Collective Thomson scattering diagnostic at Wendelstein 7-X
A Collective Thomson Scattering (CTS) diagnostic is installed at Wendelstein 7-X for ion temperature measurements in the plasma core. The diagnostic utilizes 140 GHz gyrotrons usually used for electron cyclotron resonance heating (ECRH) as a source of probing radiation. The CTS diagnostic uses a quasi-optical transmission line covering a distance of over 40 m. The transmission line is shared between the ECRH system and the CTS diagnostic. Here we elaborate on the design, installation, and alignment of the CTS diagnostic and present the first measurements at Wendelstein 7-X.
Electron-cyclotron-resonance heating in Wendelstein 7-X: A versatile heating and current-drive method and a tool for in-depth physics studies: Paper

For stellarators, which need no or only small amounts of current drive, electron-cyclotron-resonance heating (ECRH) is a promising heating method even for the envisaged application in a fusion power plant. Wendelstein 7-X (W7-X) is equipped with a steady-state capable ECRH system, operating at 140 GHz, which corresponds to the 2nd cyclotron harmonic of the electrons at a magnetic field of 2.5 T. Ten gyrotrons are operational and already delivered 7 MW to W7-X plasmas. Combined with pellet injection, the highest triple product (0.68 × 10^{20} keV m^{-3} s^{-1}) observed up to now in stellarators, was achieved (Sunn Pedersen et al 2018 Plasma Phys. Control. Fusion 61 014035). For the first time, W7-X plasmas were sustained by 2nd harmonic O-mode heating, approaching the collisionality regime for which W7-X was optimized. Power deposition scans did not show any indication of electron temperature profile resilience. In low-density, low-power plasmas a compensation of the bootstrap current with electron-cyclotron current drive (ECCD) was demonstrated. Sufficiently strong ECCD close to the plasma centre produced periodic internal plasma-crash events, which coincide with the appearance of low order rationals of the rotational transform.

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Contributors: Wendelstein 7-X Team, Stejner, M.
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Web of Science (2016): Impact factor 2.392
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BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.453 SNIP 1.201
Web of Science (2012): Impact factor 2.369
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Alpha-particle velocity-space diagnostic in ITER

We discuss α-particle velocity-space diagnostic in ITER based on the planned collective Thomson scattering (CTS) and γ-ray spectrometry (GRS) systems as well as ASCOT simulations of the α-particle distribution function. GRS is sensitive to α-particles with energies MeV at all pitches p, and CTS for MeV and . The remaining velocity space is not observed. GRS and CTS view the plasma (almost) perpendicularly to the magnetic field. Hence we cannot determine the sign of the pitch of the α-particles and cannot distinguish co- and counter-going α-particles with the currently planned α-particle diagnostics. Therefore we can only infer the sign-insensitive 2D distribution function by velocity-space tomography for MeV. This is a serious limitation, since co- and counter-going α-particle populations are expected to have different birth rates and neoclassical transport as well as different anomalous transport due to interaction with modes such as Alfvén eigenmodes. We propose the installation of an oblique GRS system on ITER to allow us to diagnostically track such anisotropy effects and to infer the full, sign-sensitive for MeV. α-particles with MeV are diagnosed by CTS only, which does not allow velocity-space tomography on its own. Nevertheless, we show that measurements of the α-particle energy spectrum, which is an ITER measurement requirement, are now feasible for MeV using a velocity-space tomography formalism assuming isotropy in velocity space.

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Organisations: Department of Physics, Plasma Physics and Fusion Energy, Department of Applied Mathematics and Computer Science, Scientific Computing, Center for Nuclear Technologies, Radiation Physics, University of Milan - Bicocca, ITER Cadarache, Max-Planck-Institut fur Plasmaphysik, Culham Science Centre, University of California at Irvine
Bayesian Integrated Data Analysis of Fast-Ion Measurements by Velocity-Space Tomography

Bayesian integrated data analysis combines measurements from different diagnostics to jointly measure plasma parameters of interest such as temperatures, densities, and drift velocities. Integrated data analysis of fast-ion measurements has long been hampered by the complexity of the strongly non-Maxwellian fast-ion distribution functions. This has recently been overcome by velocity-space tomography. In this method two-dimensional images of the velocity distribution functions consisting of a few hundreds or thousands of pixels are reconstructed using the available fast-ion measurements. Here we present an overview and current status of this emerging technique at the ASDEX Upgrade tokamak and the JET tokamak based on fast-ion D-alpha spectroscopy, collective Thomson scattering, gamma-ray and neutron emission spectrometry, and neutral particle analyzers. We discuss Tikhonov regularization within the Bayesian framework. The implementation for different types of diagnostics as well as the uncertainties are discussed, and we highlight the importance of integrated data analysis of all available detectors.

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Neutronics analysis of the ITER Collective Thomson Scattering system

The Collective Thomson Scattering (CTS) will be the ITER diagnostic responsible for measuring the alpha-particle velocity distribution. Using mirrors, a powerful microwave beam is directed into the plasma via an opening in the plasma-facing wall. The microwaves will scatter off fluctuations in the plasma, and the scattered signal is recorded after transmission through a series of mirrors and waveguides. Several components of the CTS system will be directly exposed to neutron radiation from the plasma which can change the properties of the components and reduce their lifetime. In this paper, a neutronics analysis is presented for the CTS system. A study on the influence of different materials on the nuclear heat loads in the launcher mirror is also presented, along with the design of a simple cooling system. All the studies were conducted using the Monte Carlo program MCNP6. The outputs, in particular the nuclear heat loads, will be used to perform the thermal analysis of the system.

General information

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BFI (2016): BFI-level 1
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Web of Science (2016): Impact factor 1.319
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.41 SJR 0.682 SNIP 1.493
Web of Science (2015): Impact factor 1.301
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BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.2 SJR 0.704 SNIP 1.215
Web of Science (2014): Impact factor 1.152
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.35 SJR 0.614 SNIP 1.421
Web of Science (2013): Impact factor 1.149
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.99 SJR 0.626 SNIP 1.106
Web of Science (2012): Impact factor 0.842
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.4 SJR 0.674 SNIP 1.771
Web of Science (2011): Impact factor 1.49
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.44 SNIP 1.121
Web of Science (2010): Impact factor 1.143
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.647 SNIP 1.282
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.547 SNIP 0.965
Scopus rating (2007): SJR 0.678 SNIP 1.263
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.382 SNIP 0.809
Scopus rating (2005): SJR 0.491 SNIP 1.361
Scopus rating (2004): SJR 0.97 SNIP 0.609
Scopus rating (2003): SJR 0.554 SNIP 0.989
Scopus rating (2002): SJR 1.158 SNIP 0.957
Scopus rating (2001): SJR 0.406 SNIP 1.072
Web of Science (2001): Indexed yes
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Scopus rating (1999): SJR 0.353 SNIP 0.482
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Main-ion temperature and plasma rotation measurements based on scattering of electron cyclotron heating waves in ASDEX Upgrade: Paper

We demonstrate measurements of spectra of O-mode electron cyclotron resonance heating (ECRH) waves scattered collectively from microscopic plasma fluctuations in ASDEX Upgrade discharges with an ITER-like ECRH scenario. The measured spectra are shown to allow determination of the main ion temperature and plasma rotation velocity. This demonstrates that ECRH systems can be exploited for diagnostic purposes alongside their primary heating purpose in a reactor relevant scenario.

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Web of Science (2018): Indexed yes
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Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.453 SNIP 1.201
Web of Science (2012): Impact factor 2.369
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
MeV-range velocity-space tomography from gamma-ray and neutron emission spectrometry measurements at JET

We demonstrate the measurement of a 2D MeV-range ion velocity distribution function by velocity-space tomography at JET. Deuterium ions were accelerated into the MeV-range by third harmonic ion cyclotron resonance heating. We made measurements with three neutron emission spectrometers and a high-resolution γ-ray spectrometer detecting the γ-rays released in two reactions. The tomographic inversion based on these five spectra is in excellent agreement with numerical simulations with the ASCOT–RFOF and the SPOT–RFOF codes. The length of the measured fast-ion tail corroborates the prediction that very few particles are accelerated above 2 MeV due to the weak wave-particle interaction at higher energies.

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Publication date: 2017
Mobilizing industry for 'big science'

Small- and medium-sized enterprises make good partners for neutron sources and other major research facilities, yet the barriers to entering this market can be high. Nikolaj Zangenberg and Søren Bang Korsholm offer advice on how to overcome them.

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Organisations: Department of Physics, Plasma Physics and Fusion Energy, Danish Technological Institute
Contributors: Zangenberg, N., Korsholm, S. B.
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Observation of short time-scale spectral emissions at millimeter wavelengths with the new CTS diagnostic on the FTU tokamak: Paper

On the FTU tokamak, the collective Thomson scattering (CTS) diagnostic was renewed for investigating the possible excitation of parametric decay instabilities (PDI) by electron cyclotron (EC) or CTS probe beams in presence of magnetic islands and measure their effects on the EC power absorption. The experiments were performed launching a gyrotron probe beam (140 GHz, 400 kW) and observing the scattered radiation in symmetric and asymmetric directions (with respect to the equatorial plane) in different conditions of plasma density and magnetic field (with or without the EC resonance in the plasma), and with magnetic islands generated by Neon injection. The acquisition with a fast digitizer allowed observing spectral features with very high time and frequency resolution. Shots were performed at 7.2 T, with the fundamental EC resonance out of the plasma region, at 4.7 T, with the resonance on the high field side of the plasma column, and at 3.6 T, in this last case with the plasma between the first and the second EC harmonics both lying outside the plasma volume. Several types of spectral features characterized by their frequency and their fast time evolution were identified in the observed signal after a proper treatment. The paper reports the observations in the different experimental cases and the correlation of the features with the existence of MHD modes as witnessed by magnetic probes signals and with macroscopic plasma parameters.

General information
State: Published
Overview of progress in European medium sized tokamaks towards an integrated plasma-edge/wall solution

Integrating the plasma core performance with an edge and scrape-off layer (SOL) that leads to tolerable heat and particle loads on the wall is a major challenge. The new European medium size tokamak task force (EU-MST) coordinates research on ASDEX Upgrade (AUG), MAST and TCV. This multi-machine approach within EU-MST, covering a wide parameter range, is instrumental to progress in the field, as ITER and DEMO core/pedestal and SOL parameters are not achievable simultaneously in present day devices. A two prong approach is adopted. On the one hand, scenarios with tolerable transient heat and particle loads, including active edge localised mode (ELM) control are developed. On the other hand, divertor solutions including advanced magnetic configurations are studied. Considerable progress has been made on both approaches, in particular in the fields of: ELM control with resonant magnetic perturbations (RMP), small ELM regimes, detachment onset and control, as well as filamentary scrape-off-layer transport. For example full ELM suppression has now been achieved on AUG at low collisionality with n=2 RMP maintaining good confinement $H_{\parallel}(98,y2) \approx 0.95$. Advances have been made with respect to detachment onset and control. Studies in advanced divertor configurations (Snowflake, Super-X and X-point target divertor) shed new light on SOL physics. Cross field filamentary transport has been characterised in a wide parameter regime on AUG, MAST and TCV progressing the theoretical and experimental understanding crucial for predicting first wall loads in ITER and DEMO. Conditions in the SOL also play a crucial role for ELM stability and access to small ELM regimes.

General information

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Scopus rating (2017): CiteScore 2.13 SJR 0.759 SNIP 1.424
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 1.284 SNIP 1.416
Web of Science (2016): Impact factor 3.307
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.88 SJR 1.51 SNIP 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.2 SJR 1.907 SNIP 1.667
Web of Science (2014): Impact factor 3.062
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.83 SJR 1.366 SNIP 1.516
Web of Science (2013): Impact factor 3.243
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.81 SJR 1.441 SNIP 1.448
Web of Science (2012): Impact factor 2.734
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.78 SJR 2.043 SNIP 2.433
Web of Science (2011): Impact factor 4.09
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.268 SNIP 1.927
Web of Science (2010): Impact factor 3.303
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.993 SNIP 2.441
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.031 SNIP 1.736
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.005 SNIP 1.987
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.062 SNIP 1.937
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.885 SNIP 1.932
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.647 SNIP 1.673
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.215 SNIP 1.673
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 3.275 SNIP 1.409
Scopus rating (2001): SJR 2.159 SNIP 2.173
Web of Science (2001): Indexed yes
RAMI analysis of the ITER LFS CTS system

This paper describes an initial RAMI analysis for the ITER Low Field Side Collective Thomson Scattering system (LFS CTS) based on its preliminary architecture at system design level. The benefits and challenges involved in this analysis since an early phase of the design are discussed together with the methodology pursued. The Functional Analysis, developed both at system and sub-system level, are the major inputs for the RAMI analysis. A systematic approach has been used, and significant design assumptions have been made due to the lack of knowledge and definition inherent to preliminary design stages. This study includes the Failure Mode, Effects and Criticality Analysis and the Reliability Block Diagram of the system. The results obtained for the system Availability and Reliability are presented and discussed, and criticality charts are developed to highlight the risk levels of the failure modes, regarding to their likelihood and effects on the Availability of the ITER machine. Mitigation actions are proposed to reduce these risk levels in case of impact on the ITER operation.

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Web of Science (2018): Indexed yes
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Web of Science (2017): Impact factor 1.437
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.14 SJR 0.579 SNIP 1.054
Web of Science (2016): Impact factor 1.319
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.41 SJR 0.682 SNIP 1.493
Web of Science (2015): Impact factor 1.301
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.2 SJR 0.704 SNIP 1.215
Web of Science (2014): Impact factor 1.152
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Recent development of collective Thomson scattering for magnetically confined fusion plasmas

Here we review recent experimental developments within the field of collective Thomson scattering with a focus on the progress made on the devices TEXTOR and ASDEX Upgrade. We discuss recently discovered possibilities and limitations of the diagnostic technique. Diagnostic applications with respect to ion measurements are demonstrated. Examples include measurements of the ion temperature, energetic ion distribution function, and the ion composition.

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Benchmark and combined velocity-space tomography of fast-ion D-alpha spectroscopy and collective Thomson scattering measurements

We demonstrate the combination of fast-ion D-alpha spectroscopy (FIDA) and collective Thomson scattering (CTS) measurements to determine a common best estimate of the fastion velocity distribution function by velocity-space tomography. We further demonstrate a benchmark of FIDA tomography and CTS measurements without using a numerical simulation as common reference. Combined velocity-space tomographies from FIDA and CTS measurements confirm that sawtooth crashes reduce the fast-ion phase-space densities in the plasma center and affect ions with pitches close to one more strongly than those with pitches close to zero.

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Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute for Plasma Physics
Contributors: Jacobsen, A. S., Salewski, M., Geiger, B., Korsholm, S. B., Leipold, F., Nielsen, S. K., Rasmussen, J., Pedersen, M. S., Weiland, M.
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Article number: 042002
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.453 SNIP 1.201
Web of Science (2012): Impact factor 2.369
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.69 SJR 1.496 SNIP 1.591
Web of Science (2011): Impact factor 2.731
Collective Thomson scattering measurements of fast-ion transport due to sawtooth crashes in ASDEX Upgrade

Sawtooth instabilities can modify heating and current-drive profiles and potentially increase fast-ion losses. Understanding how sawteeth redistribute fast ions as a function of sawtooth parameters and of fast-ion energy and pitch is hence a subject of particular interest for future fusion devices. Here we present the first collective Thomson scattering (CTS) measurements of sawtooth-induced redistribution of fast ions at ASDEX Upgrade. These also represent the first localized fast-ion measurements on the high-field side of this device. The results indicate fast-ion losses in the phase-space measurement volume of about 50% across sawtooth crashes, in good agreement with values predicted with the Kadomtsev sawtooth model implemented in TRANSP and with the sawtooth model in the EBdyna_go code. In contrast to the case of sawteeth, we observe no fast-ion redistribution in the presence of fishbone modes. We highlight how CTS measurements can discriminate between different sawtooth models, in particular when aided by multi-diagnostic velocity-space tomography, and briefly discuss our results in light of existing measurements from other fast-ion diagnostics.

General information

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Organisations: Department of Physics, Plasma Physics and Fusion Energy, University of Seville, Max-Planck-Institut fur Plasmaphysik, FOM Dutch Institute for Fundamental Energy Research, Budapest University of Technology and Economics
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Design of the Collective Thomson Scattering diagnostic for the next-generation fusion experiment ITER

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Source: PublicationPreSubmission
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Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Developing diagnostic systems for ITER – the next step fusion energy experiment

Fusion energy research is moving to the next stage with the well progressed construction of one of the largest research infrastructures ever – ITER. The goal of ITER is to produce 500 MW of fusion power while heating the fuel –deuterium/tritium plasma – by 50 MW. This will confirm fusion energy to be a viable energy source. Fusion energy power plants will be safe and can be operated to supply the baseload of an energy system. The fuel resources are inexhaustible, and can be derived from sea water. Fusion energy is based on the nuclear reaction fusing hydrogen isotopes into helium – like in the Sun – and thus no CO₂ is released in the energy production. The waste of the energy production is the irradiated steel of the core of the reactor, but this radioactivity will only last for about 100 years and no long-term radioactive waste storage is needed.

While the promise of safe, clean and abundant energy is the ultimate goal of fusion energy, the path towards this is challenging. A fusion plasma has a temperature of 200 mio. degrees (15 times that of the core of the Sun), and this is confined by a magnetic field generated by powerful superconducting magnets in a vacuum chamber of 1000 m³. Operating diagnostic systems in the environment of ITER is a challenge for many technologies, but due to robustness, microwave diagnostics will play an increasingly important role in burning plasma fusion energy experiments like ITER and beyond. The Collective Thomson Scattering (CTS) diagnostic to be installed at ITER is an example of such a diagnostic with great potential in present and future experiments. The ITER CTS diagnostic will inject a 1 MW 60 GHz beam of electromagnetic radiation from a gyrotron into the ITER plasma and observe the scattering off fluctuations in the plasma – to monitor the dynamics of the fast ions generated in the fusion reactions. This will provide important physics understanding of the behavior of the fusion plasma that can be used for optimizing future fusion power plants. A research team at DTU (DTU Physics and DTU Nutech) has been tasked by Fusion for Energy (the European
coordinator for supplies to ITER) to develop the ITER CTS diagnostic in collaboration with Instituto Superior Técnico in Portugal. It is a 5 year effort of more than 50 man year total effort. This presentation will outline the prospects and the status of the development of fusion energy research and the CTS diagnostic system for ITER.

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Publication date: 2016
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**Bibliographical note**
Sustain Abstract E-12
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016

**Exploiting the energy source of the stars: Fusion energy research at DTU**
With increasing energy demands and a limited supply of fossil fuels, the need for efficient, clean, and sustainable energy sources grows ever more pressing. Nuclear fusion – the process from which stars like the Sun derive their energy – holds the potential to help address this challenge. To mimic this process on earth, experimental fusion devices seek to confine and heat gas to millions of degrees (creating a fusion plasma). Learning how such plasmas behave is a crucial step towards realizing fusion as a sustainable energy source. At the Plasma Physics and Fusion Energy (PPFE) section at DTU Physics, we are exploring this issue, focusing on three areas of high priority on the way towards a working fusion power plant.

**General information**
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy
Number of pages: 1
Publication date: 2016
Peer-reviewed: Yes

**Fast-ion energy resolution by one-step reaction gamma-ray spectrometry**
The spectral broadening of γ-rays from fusion plasmas can be measured in high-resolution gamma-ray spectrometry (GRS). We derive weight functions that determine the observable velocity space and quantify the velocity-space sensitivity of one-step reaction high-resolution GRS measurements in magnetized fusion plasmas. The weight functions suggest that GRS resolves the energies of fast ions directly without the need for tomographic inversion for selected one-step reactions at moderate plasma temperatures. The D(p,γ)3He reaction allows the best direct fast-ion energy resolution. We illustrate our general formalism using reactions with and without intrinsic broadening of the γ-rays for the GRS diagnostic at JET.

**General information**
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, University of Milan - Bicocca, Culham Science Centre, Max Planck Institute for Plasma Physics, CNR
Number of pages: 11
Publication date: 2016
Peer-reviewed: Yes
High-definition velocity-space tomography of fast-ion dynamics

Velocity-space tomography of the fast-ion distribution function in a fusion plasma is usually a photon-starved tomography method due to limited optical access and signal-to-noise ratio of fast-ion Dα (FIDA) spectroscopy as well as the strive for high-resolution images. In high-definition tomography, prior information makes up for this lack of data. We restrict the target velocity space through the measured absence of FIDA light, impose phase-space densities to be non-negative, and encode the known geometry of neutral beam injection (NBI) sources. We further use a numerical simulation as prior information to reconstruct where in velocity space the measurements and the simulation disagree. This alternative approach is demonstrated for four-view as well as for two-view FIDA measurements. The high-definition tomography tools allow us to study fast ions in sawtoothing plasmas and the formation of NBI peaks at full, half and one-third energy by time-resolved tomographic movies.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Department of Applied Mathematics and Computer Science, Scientific Computing, Max-Planck-Institut für Plasmaphysik, University of California at Irvine, University of Milan - Bicocca
Number of pages: 15
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Peer-reviewed: Yes

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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CitScore 2.13 SJR 0.759 SNIP 1.424
Web of Science (2017): Impact factor 4.057
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 1.284 SNIP 1.416
Web of Science (2016): Impact factor 3.307
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.88 SJR 1.51 SNIP 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.2 SJR 1.907 SNIP 1.667
Web of Science (2014): Impact factor 3.062
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.83 SJR 1.366 SNIP 1.516
Web of Science (2013): Impact factor 3.243
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.81 SJR 1.441 SNIP 1.448
Web of Science (2012): Impact factor 2.734
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.78 SJR 2.043 SNIP 2.433
Web of Science (2011): Impact factor 4.09
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.268 SNIP 1.927
Web of Science (2010): Impact factor 3.303
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.993 SNIP 2.441
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.031 SNIP 1.736
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.005 SNIP 1.987
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.062 SNIP 1.937
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.885 SNIP 1.932
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.647 SNIP 1.673
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.215 SNIP 1.673
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 3.275 SNIP 1.409
Scopus rating (2001): SJR 2.159 SNIP 2.173
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.843 SNIP 1.104
Scopus rating (1999): SJR 1.99 SNIP 1.496
Original language: English
High power microwave diagnostic for the fusion energy experiment ITER

Microwave diagnostics will play an increasingly important role in burning plasma fusion energy experiments like ITER and beyond. The Collective Thomson Scattering (CTS) diagnostic to be installed at ITER is an example of such a diagnostic with great potential in present and future experiments. The ITER CTS diagnostic will inject a 1 MW 60 GHz gyrotron beam into the ITER plasma and observe the scattering off fluctuations in the plasma — to monitor the dynamics of the fast ions generated in the fusion reactions.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Center for Nuclear Technologies, Radiation Physics, University of Lisbon, Eindhoven University of Technology, Fusion For Energy
Number of pages: 2
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Publisher: IEEE
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( International Conference on Infrared, Millimeter and Terahertz Waves).
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DOIs:
10.1109/IRMMW-THz.2016.7758537
Source: FindIt
Source-ID: 2349436767
Research output: Research - peer-review › Article in proceedings – Annual report year: 2016

High Power Microwave Diagnostic for the Fusion Energy Experiment ITER

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Center for Nuclear Technologies, Radiation Physics, University of Lisbon, Eindhoven University of Technology, Fusion For Energy
Publication date: 2016
Peer-reviewed: Yes
Event: Poster session presented at 41st International Conference on Infrared, Millimeter and Terahertz Waves, Copenhagen, Denmark.
Electronic versions:
Korsholm_IRMMWTHz.pdf
Source: PublicationPreSubmission
Source-ID: 127089775
Research output: Research - peer-review › Poster – Annual report year: 2016

Inversion methods for fast-ion velocity-space tomography in fusion plasmas

Velocity-space tomography has been used to infer 2D fast-ion velocity distribution functions. Here we compare the performance of five different tomographic inversion methods: truncated singular value decomposition, maximum entropy, minimum Fisher information and zeroth and first-order Tikhonov regularization. The inversion methods are applied to fast-ion Dα measurements taken just before and just after a sawtooth crash in the ASDEX Upgrade tokamak as well as to
synthetic measurements from different test distributions. We find that the methods regularizing by penalizing steep gradients or maximizing entropy perform best. We assess the uncertainty of the calculated inversions taking into account photon noise, uncertainties in the forward model as well as uncertainties introduced by the regularization which allows us to distinguish regions of high and low confidence in the tomographies. In high confidence regions, all methods agree that ions with pitch values close to zero, as well as ions with large pitch values, are ejected from the plasma center by the sawtooth crash, and that this ejection depletes the ion population with large pitch values more strongly.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute for Plasma Physics, University of California at Irvine
Number of pages: 16
Publication date: 2016
Peer-reviewed: Yes

Publication information
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.453 SNIP 1.201
Web of Science (2012): Impact factor 2.369
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.69 SJR 1.496 SNIP 1.591
Web of Science (2011): Impact factor 2.731
ISI indexed (2011): ISI indexed yes
We demonstrate that collective Thomson scattering of millimeter wave electron cyclotron resonance heating radiation can be used for measurements of the main-ion temperature in the ASDEX Upgrade tokamak.

Measuring main-ion temperatures in ASDEX upgrade using scattering of ECRH radiation

We demonstrate that collective Thomson scattering of millimeter wave electron cyclotron resonance heating radiation can be used for measurements of the main-ion temperature in the ASDEX Upgrade tokamak.
Millimeter-wave receiver design for plasma diagnostics
Scattered millimeter waves entering from the collective Thomson scattering diagnostic at ASDEX Upgrade fusion device are generally elliptically polarized. In order to convert the millimeter waves to linearly polarized waves (required for the detector), birefringent window assemblies (sapphire) have been developed to replace grooved metal mirrors. This allows a significantly more compact receiver design which is less susceptible to misalignment. The setup has been tested and implemented at ASDEX Upgrade.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Technical University of Denmark
Number of pages: 2
Publication date: 2016

Host publication information
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Publisher: IEEE
ISBN (Print): 978-1-4673-8486-5
ISBN (Electronic): 978-1-4673-8485-8
( International Conference on Infrared, Millimeter and Terahertz Waves).
DOIs: 10.1109/IRMMW-THz.2016.7758533
Source: FindIt
Source-ID: 2349436911
Research output: Research - peer-review › Article in proceedings – Annual report year: 2016

Three-wave interaction during electron cyclotron resonance heating and current drive
Non-linear wave-wave interactions in fusion plasmas, such as the parametric decay instability (PDI) of gyrotron radiation, can potentially hamper the use of microwave diagnostics. Here we report on anomalous scattering in the ASDEX Upgrade tokamak during electron cyclotron resonance heating experiments. The observations can be linked to parametric decay of the gyrotron radiation at the second harmonic upper hybrid resonance layer.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Technical University of Denmark, Max-Planck-Institut fur Plasmaphysik
Number of pages: 2
Publication date: 2016

Host publication information
Title of host publication: 2016 41st International Conference on Infrared, Millimeter, and Terahertz waves
Publisher: IEEE
ISBN (Print): 978-1-4673-8486-5
ISBN (Electronic): 978-1-4673-8485-8
( International Conference on Infrared, Millimeter and Terahertz Waves).
DOIs: 10.1109/IRMMW-THz.2016.7758400
Source: FindIt
Source-ID: 2349437031
Research output: Research - peer-review › Article in proceedings – Annual report year: 2016

Velocity-space tomography of fusion plasmas by collective Thomson scattering of gyrotron radiation
We propose a diagnostic capable of measuring 2D fast-ion velocity distribution functions in the MeV-range in magnetized fusion plasmas. Today velocity-space tomography based on fast-ion Dα spectroscopy is regularly used to measure fast ions for ion energies below 100 keV. Unfortunately, the signal-to-noise ratio becomes fairly low for MeV-range ions. Ions at any energy can be detected well by collective Thomson scattering of mm-wave radiation from a high-power gyrotron. We demonstrate how collective Thomson scattering can be used to measure fast ions in the MeV-range in reactor relevant plasmas such as in the tokamaks ITER or DEMO.

General information
Consistency between real and synthetic fast-ion measurements at ASDEX Upgrade

Internally consistent characterization of the properties of the fast-ion distribution from multiple diagnostics is a prerequisite for obtaining a full understanding of fast-ion behavior in tokamak plasmas. Here we benchmark several absolutely-calibrated core fast-ion diagnostics at ASDEX Upgrade by comparing fast-ion measurements from collective Thomson scattering, fast-ion spectroscopy, and neutron rate detectors with numerical predictions from the TRANSP/NUBEAM transport code. We also study the sensitivity of the theoretical predictions to uncertainties in the plasma kinetic profiles. We find that theory and measurements generally agree within these uncertainties for all three diagnostics during heating phases with either one or two neutral beam injection sources. This suggests that the measurements can be described by the same model assuming classical slowing down of fast ions. Since the three diagnostics in the adopted configurations probe partially overlapping regions in fast-ion velocity space, this is also consistent with good internal agreement among the measurements themselves. Hence, our results support the feasibility of combining multiple diagnostics at ASDEX Upgrade to reconstruct the fast-ion distribution function in 2D velocity space.
Determining fast-ion velocity-space distribution functions using velocity-space tomography
Doppler tomography in fusion plasmas and astrophysics

Doppler tomography is a well-known method in astrophysics to image the accretion flow, often in the shape of thin discs, in compact binary stars. As accretion discs rotate, all emitted line radiation is Doppler-shifted. In fast-ion Dα (FIDA) spectroscopy measurements in magnetically confined plasma, the Dα-photons are likewise Doppler-shifted ultimately due to gyration of the fast ions. In either case, spectra of Doppler-shifted line emission are sensitive to the velocity distribution of the emitters. Astrophysical Doppler tomography has lead to images of accretion discs of binaries revealing bright spots, spiral structures and flow patterns. Fusion plasma Doppler tomography has led to an image of the fast-ion velocity distribution function in the tokamak ASDEX Upgrade. This image matched numerical simulations very well. Here we discuss achievements of the Doppler tomography approach, its promise and limits, analogies and differences in astrophysical and fusion plasma Doppler tomography and what can be learned by comparison of these applications.
First operations with the new Collective Thomson Scattering diagnostic on the Frascati Tokamak Upgrade device

Anomalous emissions were found over the last few years in spectra of Collective Thomson Scattering (CTS) diagnostics in tokamak devices such as TEXTOR, ASDEX and FTU, in addition to real CTS signals. The signal frequency, down-shifted with respect to the probing one, suggested a possible origin in Parametric Decay Instability (PDI) processes correlated

Original language: English
Keywords: Tomography, Fast ions, Accretion discs, Spectroscopy, Fast ion D-alpha spectroscopy, Tomamak
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salewski2015ppcf.pdf
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Source: FindIt
Source-ID: 272865086
Research output: Research - peer-review › Journal article – Annual report year: 2015
with the presence of magnetic islands and occurring for pumping wave power levels well below the threshold predicted by conventional models. A threshold below or close to the Electron Cyclotron Resonance Heating (ECRH) power levels could limit, under certain circumstances, the use of the ECRH in fusion devices. An accurate characterization of the conditions for the occurrence of this phenomenon and of its consequences is thus of primary importance. Exploiting the front-steering configuration available with the real-time launcher, the implementation of a new CTS setup now allows studying these anomalous emission phenomena in FTU under conditions of density and wave injection geometry that are more similar to those envisaged for CTS in ITER. The upgrades of the diagnostic are presented as well as a few preliminary spectra detected with the new system during the very first operations in 2014.

**General information**

State: Published

Organisations: Department of Physics, Plasma Physics and Fusion Energy, Consiglio Nazionale delle Ricerche, EURATOM-ENEA sulla Fusione, Swiss Federal Institute of Technology Lausanne


Publication date: 2015

Peer-reviewed: Yes

**Publication information**

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Article number: P10007

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- Web of Science (2019): Indexed yes
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 1.23 SJR 0.642 SNIP 1.04
- Web of Science (2017): Impact factor 1.258
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 1.22 SJR 0.903 SNIP 1.164
- Web of Science (2016): Impact factor 1.22
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): CiteScore 0.96 SJR 0.833 SNIP 0.966
- Web of Science (2015): Impact factor 1.31
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): CiteScore 1.08 SJR 0.683 SNIP 1.062
- Web of Science (2014): Impact factor 1.399
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): CiteScore 1.23 SJR 0.791 SNIP 1.089
- Web of Science (2013): Impact factor 1.526
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): CiteScore 1.14 SJR 0.477 SNIP 1.361
- Web of Science (2012): Impact factor 1.656
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): CiteScore 1.93 SJR 1.126 SNIP 2.578
Measurements of the fast-ion distribution function at ASDEX upgrade by collective Thomson scattering (CTS) using active and passive views

Collective Thomson scattering (CTS) can provide measurements of the confined fast-ion distribution function resolved in space, time and 1D velocity space. On ASDEX Upgrade, the measured spectra include an additional signal which previously has hampered data interpretation. A new set-up using two independent heterodyne receiver systems enables subtraction of the additional part from the total spectrum, revealing the resulting CTS spectrum. Here we present CTS measurements from the plasma centre obtained in L-mode and H-mode plasmas with and without neutral beam injection (NBI). For the first time, the measured spectra agree quantitatively with the synthetic spectra in periods with and without NBI heating. For the discharges investigated, the central velocity distribution of neutral beam ions can be described by classical slowing down. These results will have a major impact on ITER physics exploration, since CTS is presently the only diagnostic to measure the confined alpha particles produced by the fusion reactions.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute for Plasma Physics, FOM Dutch Institute for Fundamental Energy Research
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Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Plasma rotation and ion temperature measurements by collective Thomson scattering at ASDEX Upgrade

We present the first deuterium ion temperature and rotation measurements by collective Thomson scattering at ASDEX Upgrade. The results are in general agreement with boron-based charge exchange recombination spectroscopy measurements and consistent with neoclassical simulations for the plasma scenario studied here. This demonstration opens the prospect for direct non-perturbative measurements of the properties of the main ion species in the plasma core with applications in plasma transport and confinement studies.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max-Planck-Institut fur Plasmaphysik
Number of pages: 1
Pages: 062001
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Volume: 57
Issue number: 6
ISSN (Print): 0741-3335
Ratings:
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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.453 SNIP 1.201
Web of Science (2012): Impact factor 2.369
ISI indexed (2012): ISI indexed yes
Velocity-space observation regions of high-resolution two-step reaction gamma-ray spectroscopy

High-resolution γ-ray spectroscopy (GRS) measurements resolve spectral shapes of Dopplerbroadened γ-rays. We calculate weight functions describing velocity-space sensitivities of any two-step reaction GRS measurements in magnetized plasmas using the resonant nuclear reaction $^{9}\text{Be}(\alpha, n\gamma)^{12}\text{C}$ as an example. The energy-dependent cross sections of this reaction suggest that GRS is sensitive to alpha particles above about 1.7 MeV and highly sensitive to alpha particles at the resonance energies of the reaction. Here we demonstrate that high-resolution two-step reaction GRS measurements are not only selective in energy but also in pitch angle. They can be highly sensitive in particular pitch angle ranges and completely insensitive in others. Moreover, GRS weight functions allow rapid calculation of γ-ray energy spectra from fast-ion distribution functions, additionally revealing how many photons any given alpha-particle velocity-space region contributes to the measurements in each γ-ray energy bin.

General information

State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, University of Milan - Bicocca, Culham Science Centre, Max Planck Institute for Plasma Physics, Consiglio Nazionale delle Ricerche
Number of pages: 15
Pages: 093029
Publication date: 2015
Velocity-space sensitivity of neutron spectrometry measurements

Neutron emission spectrometry (NES) measures the energies of neutrons produced in fusion reactions. Here we present velocity-space weight functions for NES and neutron yield measurements. Weight functions show the sensitivity as well as the accessible regions in velocity space for a given range of the neutron energy spectrum. Combined with a calculated fast-ion distribution function, they determine the part of the distribution function producing detectable neutrons in a given neutron energy range. Furthermore, we construct a forward model based on weight functions capable of rapidly calculating neutron energy spectra. This forward model can be inverted and could thereby be used to directly measure the fast-ion phase-space distribution functions, possibly in combination with other fast-ion diagnostics. The presented methods and results can be applied to neutron energy spectra measured by any kind of neutron spectrometer and to any neutron yield measurement.

General information
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Peer-reviewed: Yes

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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.13 SJR 0.759 SNIP 1.424
Web of Science (2017): Impact factor 4.057
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 1.284 SNIP 1.416
Web of Science (2016): Impact factor 3.307
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.88 SJR 1.51 SNIP 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.2 SJR 1.907 SNIP 1.667
Web of Science (2014): Impact factor 3.062
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.83 SJR 1.366 SNIP 1.516
Web of Science (2013): Impact factor 3.243
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.81 SJR 1.441 SNIP 1.448
Web of Science (2012): Impact factor 2.734
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.78 SJR 2.043 SNIP 2.433
Web of Science (2011): Impact factor 4.09
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.268 SNIP 1.927
Web of Science (2010): Impact factor 3.303
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.993 SNIP 2.441
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.031 SNIP 1.736
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.005 SNIP 1.987
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.062 SNIP 1.937
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.885 SNIP 1.932
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.647 SNIP 1.673
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.215 SNIP 1.673
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 3.275 SNIP 1.409
Scopus rating (2001): SJR 2.159 SNIP 2.173
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.843 SNIP 1.104
Scopus rating (1999): SJR 1.99 SNIP 1.496
Original language: English
Keywords: Neutron emission spectrometry, Velocity-space sensitivity, Fast ions, Energetic particles, Plasma diagnostics
DOI: 10.1088/0029-5515/55/5/053013
Association Euratom - DTU, Technical University of Denmark, Department of Physics - Annual Progress Report 2013

The programme of the Research Unit of the Fusion Association Euratom – DTU, Technical University of Denmark covers work in fusion plasma physics and in fusion technology. The fusion plasma physics research focuses on turbulence and transport, and its interaction with the plasma equilibrium and particles. The effort includes both first principles based modelling, and experimental observations of turbulence and of fast ion dynamics by collective Thomson scattering. Within fusion technology there are activities on fusion materials research (Tungsten and ODSFS). Other activities are system analysis, initiative to involve Danish industry in ITER contracts and public information. A summary is presented of the results obtained in the Research Unit during 2013.

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Organisations: Department of Physics, Plasma Physics and Fusion Energy
Publication date: 2014

Publication Information
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Original language: English
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Source-ID: 100182563
Research output: Research › Report – Annual report year: 2014

Improved Collective Thomson Scattering measurements of fast ions at ASDEX Upgrade

Understanding the behaviour of the confined fast ions is important in both current and future fusion experiments. These ions play a key role in heating the plasma and will be crucial for achieving conditions for burning plasma in next-step fusion devices. Microwave-based Collective Thomson Scattering (CTS) is well suited for reactor conditions and offers such an opportunity by providing measurements of the confined fast-ion distribution function resolved in space, time and 1D velocity space. We currently operate a CTS system at ASDEX Upgrade using a gyrotron which generates probing radiation at 105 GHz. A new setup using two independent receiver systems has enabled improved subtraction of the background signal, and hence the first accurate characterization of fast-ion properties. Here we review this new dual-receiver CTS setup and present results on fast-ion measurements based on the improved background characterization. These results have been obtained both with and without NBI heating, and with the measurement volume located close to the centre of the plasma. The measurements agree quantitatively with predictions of numerical simulations. Hence, CTS studies of fast-ion dynamics at ASDEX Upgrade are now feasible. The new background subtraction technique could be important for the design of CTS systems in other fusion experiments.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, FOM Dutch Institute for Fundamental Energy Research, Max Planck Institute
Number of pages: 4
Pages: 117-120
Publication date: 2014
Peer-reviewed: Yes

Publication Information
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Volume: 1612
ISSN (Print): 0094-243X
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.26 SJR 0.165 SNIP 0.3
We present the first measurement of a local fast-ion 2D velocity distribution function $f(v_\parallel, v_\perp)$. To this end, we heated a plasma in ASDEX Upgrade by neutral beam injection and measured spectra of fast-ion Dα (FIDA) light from the plasma centre in three views simultaneously. The measured spectra agree very well with synthetic spectra calculated from a TRANSP/NUBEAM simulation. Based on the measured FIDA spectra alone, we infer $f(v_\parallel, v_\perp)$ by tomographic inversion. Salient features of our measurement of $f(v_\parallel, v_\perp)$ agree reasonably well with the simulation: the measured as well as the simulated $f(v_\parallel, v_\perp)$ are lopsided towards negative velocities parallel to the magnetic field, and they have similar shapes. Further, the peaks in the simulation of $f(v_\parallel, v_\perp)$ at full and half injection energies of the neutral beam also appear in the measurement at similar velocity-space locations. We expect that we can measure spectra in up to seven views simultaneously in the next ASDEX Upgrade campaign which would further improve measurements of $f(v_\parallel, v_\perp)$ by tomographic inversion.

**Measurement of a 2D fast-ion velocity distribution function by tomographic inversion of fast-ion D-alpha spectra**

We present the first measurement of a local fast-ion 2D velocity distribution function $f(v_\parallel, v_\perp)$. To this end, we heated a plasma in ASDEX Upgrade by neutral beam injection and measured spectra of fast-ion Dα (FIDA) light from the plasma centre in three views simultaneously. The measured spectra agree very well with synthetic spectra calculated from a TRANSP/NUBEAM simulation. Based on the measured FIDA spectra alone, we infer $f(v_\parallel, v_\perp)$ by tomographic inversion. Salient features of our measurement of $f(v_\parallel, v_\perp)$ agree reasonably well with the simulation: the measured as well as the simulated $f(v_\parallel, v_\perp)$ are lopsided towards negative velocities parallel to the magnetic field, and they have similar shapes. Further, the peaks in the simulation of $f(v_\parallel, v_\perp)$ at full and half injection energies of the neutral beam also appear in the measurement at similar velocity-space locations. We expect that we can measure spectra in up to seven views simultaneously in the next ASDEX Upgrade campaign which would further improve measurements of $f(v_\parallel, v_\perp)$ by tomographic inversion.

**General information**

State: Published

Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute, University of Seville, University of California

On velocity-space sensitivity of fast-ion D-alpha spectroscopy

The velocity-space observation regions and sensitivities in fast-ion Dα (FIDA) spectroscopy measurements are often described by so-called weight functions. Here we derive expressions for FIDA weight functions accounting for the Doppler shift, Stark splitting, and the charge-exchange reaction and electron transition probabilities. Our approach yields an efficient way to calculate correctly scaled FIDA weight functions and implies simple analytic expressions for their boundaries that separate the triangular observable regions in (v‖, v⊥)-space from the unobservable regions. These boundaries are determined by the Doppler shift and Stark splitting and could until now only be found by numeric simulation.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute, University of California at Irvine
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Peer-reviewed: Yes

Publication information
Journal: Plasma Physics and Controlled Fusion
Volume: 56
Issue number: 10
ISSN (Print): 0741-3335
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
Original language: English
Keywords: Fast-Ion D-alpha spectroscopy, FIDA, Charge-exchange recombination spectroscopy, Fast ions, Velocity space
Resolving the bulk ion region of millimeter-wave collective Thomson scattering spectra at ASDEX Upgrade

Collective Thomson scattering (CTS) measurements provide information about the composition and velocity distribution of confined ion populations in fusion plasmas. The bulk ion part of the CTS spectrum is dominated by scattering off fluctuations driven by the motion of thermalized ion populations. It thus contains information about the ion temperature, rotation velocity, and plasma composition. To resolve the bulk ion region and access this information, we installed a fast acquisition system capable of sampling rates up to 12.5 GS/s in the CTS system at ASDEX Upgrade. CTS spectra with frequency resolution in the range of 1 MHz are then obtained through direct digitization and Fourier analysis of the CTS signal. We here describe the design, calibration, and operation of the fast receiver system and give examples of measured bulk ion CTS spectra showing the effects of changing ion temperature, rotation velocity, and plasma composition.
Spectrum response and analysis of 77 GHz band collective Thomson scattering diagnostic for bulk and fast ions in LHD plasmas: Paper

A collective Thomson scattering (CTS) diagnostic was developed and used to measure the bulk and fast ions originating from 180 keV neutral beams in the Large Helical Device (LHD). Electromagnetic waves from a gyrotron at 77 GHz with 1 MW power output function as both the probe and electron cyclotron heating beam. To clarify the diagnostic applicability of the gyrotron in the 77 GHz frequency band, we investigated the dependence of the probe and receiver beam trajectories in plasmas with high electron densities of (4–5) × 10¹⁹ m⁻³ and low electron densities of (1–2) × 10¹⁹ m⁻³. At high density, a stray radiation component was observed in the CTS spectrum whereas it was negligibly small at low density. The CTS spectrum was measured and analysed after the in situ beam alignment using a beam scan. Qualitatively, the CTS spectrogram shows consistent response to ion temperatures of 1–2 keV for electron densities of (1–2) × 10¹⁹ m⁻³ and electron temperatures of 2–4 keV. The measured CTS spectrum shows an asymmetric shape at the foot of the bulk-ion region during the injection of 180 keV fast ions. This shape is explained by the fast-ion distribution in the velocity space.
based on Monte Carlo simulation results. The analysis method of the CTS spectra is used to evaluate the ion temperature and fast-ion velocity distribution from the measured CTS data.
Strong scattering of mm-waves in tokamaks

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, FOM Dutch Institute for Fundamental Energy Research, Max Planck Institute
Number of pages: 2
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the 9th International Workshop "Strong Microwaves and Terahertz Waves: Sources and Applications"
Electronic versions: Nielsen_SMTW.pdf
Source: PublicationPreSubmission
Source-ID: 99593238
Research output: Research - peer-review » Conference abstract in proceedings – Annual report year: 2014

The perspectives of fusion energy: The roadmap towards energy production and fusion energy in a distributed energy system

Controlled thermonuclear fusion has the potential of providing an environmentally friendly and inexhaustible energy source for mankind. Fusion energy, which powers our sun and the stars, is released when light elements, such as the hydrogen isotopes deuterium and tritium, fuse together. This occurs at very high temperature where all matter is in the plasma state as the involved energies are orders of magnitude higher than typical chemical binding energies. It is one of the great science and engineering challenges to construct a viable power plant based on fusion energy. Fusion research is a worldwide international collaboration and is in a crucial new phase with the construction of the international fusion experimental reactor, ITER, in Cadarache, France, which will be largest energy experiment in the world, and a milestone on the way to fusion energy. The recently adopted European Roadmap to fusion energy aims at feeding the first energy into nets by
Towards fusion energy as a sustainable energy source: Activities at DTU Physics

Nuclear fusion – the process from which the Sun derives its energy – holds the potential to become a clean, safe, highly efficient, and virtually inexhaustible energy source for the future. To mimic this process on earth, experimental fusion devices seek to heat gas to millions of degrees (creating a fusion plasma) and to confine it within magnetic fields. Learning how such plasmas behave and can be controlled is a crucial step towards realizing fusion as a sustainable energy source. At the Plasma Physics and Fusion Energy (PPFE) section at DTU Physics, we are exploring these issues, focusing on areas of high priority on the way towards a working fusion power plant. On the theoretical front, we are simulating plasma turbulence and transport of heat and particles in fusion plasmas (Fig. 1a). These issues play a key role in determining how the plasma behaves globally and how well it remains confined in the magnetic field of the fusion device. Understanding this is important for optimizing plasma performance and for controlling the heat load onto the walls of the confining vessel. Experimentally, we operate equipment to measure key plasma properties in experimental fusion devices such as ASDEX Upgrade in Germany (Fig. 1b+c). Using a technique called collective Thomson scattering (CTS), we can infer the plasma composition and the dynamics of energetic ions in the plasma. Control of these parameters is vital for achieving a high fusion yield in future power plants. We are also designing CTS equipment for the next-step fusion device ITER (Fig. 1d), in which plasma temperatures will exceed 200 million C. This machine is currently being built in France in a large international effort to experimentally demonstrate fusion as a viable energy source and pave the way for the first fusion power plant.

Velocity-space interrogation regions of neutron spectrometers

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Department of Applied Mathematics and Computer Science, Mathematics
Number of pages: 4
Publication date: 2014

Host publication information
Title of host publication: Abstract Book - DTU Sustain Conference 2014
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2014
Velocity-space sensitivity of the time-of-flight neutron spectrometer at JET

The velocity-space sensitivities of fast-ion diagnostics are often described by so-called weight functions. Recently, we formulated weight functions showing the velocity-space sensitivity of the often dominant beam-target part of neutron energy spectra. These weight functions for neutron emission spectrometry (NES) are independent of the particular NES diagnostic. Here we apply these NES weight functions to the time-of-flight spectrometer TOFOR at JET. By taking the instrumental response function of TOFOR into account, we calculate time-of-flight NES weight functions that enable us to directly determine the velocity-space sensitivity of a given part of a measured time-of-flight spectrum from TOFOR.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Uppsala University
Number of pages: 3
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Review of Scientific Instruments
Volume: 85
Article number: 11E103
ISSN (Print): 0034-6748
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Web of Science (2014): Impact factor 1.614
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.28 SJR 0.9 SNIP 1.099
Web of Science (2013): Impact factor 1.584
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.45 SJR 1.017 SNIP 1.277
Web of Science (2012): Impact factor 1.602
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
The programme of the Research Unit of the Fusion Association Euratom – DTU, Technical University of Denmark covers work in fusion plasma physics and in fusion technology. The fusion plasma physics research focuses on turbulence and transport, and its interaction with the plasma equilibrium and particles. The effort includes both first principles based modelling, and experimental observations of turbulence and of fast ion dynamics by collective Thomson scattering. Within fusion technology there are activities on fusion materials research (Tungsten and ODSFS). Other activities are system analysis, initiative to involve Danish industry in ITER contracts and public information. A summary is presented of the results obtained in the Research Unit during 2012.
Combination of fast-ion diagnostics in velocity-space tomographies: Paper

Fast-ion Dα (FIDA) and collective Thomson scattering (CTS) diagnostics provide indirect measurements of fast-ion velocity distribution functions in magnetically confined plasmas. Here we present the first prescription for velocity-space tomographic inversion of CTS and FIDA measurements that can use CTS and FIDA measurements together and that takes uncertainties in such measurements into account. Our prescription is general and could be applied to other diagnostics. We demonstrate tomographic reconstructions of an ASDEX Upgrade beam ion velocity distribution function. First, we compute synthetic measurements from two CTS views and two FIDA views using a TRANSP/NUBEAM simulation, and then we compute joint tomographic inversions in velocity-space from these. The overall shape of the 2D velocity distribution function and the location of the maxima at full and half beam injection energy are well reproduced in velocity-space tomographic inversions, if the noise level in the measurements is below 10%. Our results suggest that 2D fast-ion velocity distribution functions can be directly inferred from fast-ion measurements and their uncertainties, even if the measurements are taken with different diagnostic methods.

General information

State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute, Aarhus University, University of California at Irvine
Pages: 063019
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Nuclear Fusion
Volume: 53
Issue number: 6
ISSN (Print): 0029-5515
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.13 SJR 0.759 SNIP 1.424
Web of Science (2017): Impact factor 4.057
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 1.284 SNIP 1.416
Web of Science (2016): Impact factor 3.307
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.88 SJR 1.51 SNIP 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.2 SJR 1.907 SNIP 1.667
Web of Science (2014): Impact factor 3.062
Web of Science (2014): Indexed yes
This is the final report for Socio Economic Research on Fusion (SERF), EFDA Technology Work programme 2012. The report summarises the experience from several presentations during 2012, and it schedules two proposals for articles in peer reviewed mainstream energy journal, which will require further documentation and analysis of model assumptions and results before submission.

It also contains presentations for promotion of fusion as a future element in the electricity generation mix and presentations for the modelling community concerning model development and model documentation – in particular for
Experimental characterization of anomalous strong scattering of mm-waves in TEXTOR plasmas with rotating islands

Anomalous scattering of high power millimetre waves from gyrotrons at 140 and 110 GHz is investigated for plasma with rotating islands at TEXTOR. The magnetic field and plasma density influence the spectral content of the scattered waves and their power levels significantly. Anomalous strong scattering occurs in two density regimes, one at low densities and one at high densities, that also depend on the magnetic field. The two regimes are separated by a quiescent regime without anomalous scattering. Investigations suggest that scattering in the high-density regime is generated at the low-field side intersection of the gyrotron beam and the island position. The transition from the quiescent regime to the high-density regime occurs when the gyrotron frequency is twice the upper hybrid frequency at this position. There is some evidence that the scattering in the low-density regime is generated near the plasma centre. Under this assumption all the observed scattering is generated when the gyrotron frequency is near or below twice the upper hybrid frequency.

General information
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Organisations: Department of Physics, Plasma Physics and Fusion Energy, FOM Dutch Institute for Fundamental Energy Research, Eindhoven University of Technology
Number of pages: 11
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Plasma Physics and Controlled Fusion
Volume: 55
Issue number: 11
Article number: 115003
ISSN (Print): 0741-3335
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.453 SNIP 1.201
Web of Science (2012): Impact factor 2.369
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.69 SJR 1.496 SNIP 1.591
Web of Science (2011): Impact factor 2.731
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.468 SNIP 1.408
Web of Science (2010): Impact factor 2.466
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.589 SNIP 1.324
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.845 SNIP 1.569
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.927 SNIP 1.374
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.844 SNIP 1.556
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.756 SNIP 1.54
Scopus rating (2004): SJR 2.246 SNIP 1.382
Scopus rating (2003): SJR 2.135 SNIP 1.253
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.668 SNIP 1.058
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.679 SNIP 1.233
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.974 SNIP 1.097
Scopus rating (1999): SJR 2.001 SNIP 1.471
Original language: English
Electronic versions:
Experimental_characterization_postprint.pdf
DOIs:
10.1088/0741-3335/55/11/115003

Bibliographical note
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FOM and FZJ, was carried out within the framework of the European Fusion Programme. The contribution of Egbert
Westerhof and Waldo Bongers has been performed in the framework of the NWO-RFBR Centre of Excellence on Fusion
Physics and Technology (grant 047.018.002).
How to compute velocity-space tomographies using several fast-ion diagnostics

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute, University of Seville, University of California
Number of pages: 4
Publication date: 2013

Host publication information
Title of host publication: Europhysics conference abstracts
Volume: 37D
ISBN (Print): 2-914771-84-3
Electronic versions: How to compute velocity-space tomographies using several fast-ion diagnostics.pdf

Bibliographical note
O6.512
Source: dtu
Source-ID: u::8873
Research output: Research - peer-review › Article in proceedings – Annual report year: 2013

Measurements of ion temperature and plasma hydrogenic composition by collective Thomson scattering in neutral beam heated discharges at TEXTOR

A method is developed to perform plasma composition and ion temperature measurements across the plasma minor radius in TEXTOR based on ion cyclotron structures in collective Thomson scattering spectra. By gradually moving the scattering volume, we obtain measurements across the outer midplane of the plasma. Results for the ion temperature are compared with ion temperatures measured by active charge-exchange recombination spectroscopy.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Aarhus University, FOM Dutch Institute for Fundamental Energy Research, Forschungszentrum Jülich GmbH
Contributors: Stejner Pedersen, M., Salewski, M., Korsholm, S. B., Bindslev, H., Delabie, E., Leipold, F., Meo, F., Michelsen, P., Moseev, D., Nielsen, S. K., Bürger, A., de Baar, M.
Number of pages: 9
Publication date: 2013
Peer-reviewed: Yes

Publication information
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Volume: 55
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Ratings:
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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Polarizer design for millimeter-wave plasma diagnostics
Radiation from magnetized plasmas is in general elliptically polarized. In order to convert the elliptical polarization to linear polarization, mirrors with grooved surfaces are currently employed in our collective Thomson scattering diagnostic at ASDEX Upgrade. If these mirrors can be substituted by birefringent windows, the microwave receivers can be designed to be more compact at lower cost. Sapphire windows (α-cut) as well as grooved high density polyethylene windows can serve this purpose. The sapphire window can be designed such that the calculated transmission of the wave energy is better than 99%, and that of the high density polyethylene can be better than 97%.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy
Pages: 084701
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Review of Scientific Instruments
Volume: 84
Issue number: 8
ISSN (Print): 0034-6748
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Web of Science (2014): Impact factor 1.614
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.28 SJR 0.9 SNIP 1.099
Web of Science (2013): Impact factor 1.584
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.45 SJR 1.017 SNIP 1.277
Web of Science (2012): Impact factor 1.602
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.43 SJR 0.868 SNIP 1.108
Velocity-space tomography of the fast-ion distribution function

Fast ions play an important role in heating the plasma in a magnetic confinement fusion device. Fast-ion $D_{\alpha}$ (FIDA) spectroscopy diagnoses fast ions in small measurement volumes. Spectra measured by a FIDA diagnostic can be related to the 2D fast-ion velocity distribution function. A single FIDA view probes certain regions in velocity-space, determined by the geometry of the set-up. Exploiting this, the fast-ion distribution function can be inferred using a velocity-space tomography method. This poster contains a tomography calculated from measured spectra from three different FIDA views at ASDEX Upgrade. The quality of the tomography improves with the number of FIDA views simultaneously measuring the same volume. To investigate the potential benefits of including additional views (up to 18), tomographies are inferred from synthetic spectra calculated from a simulated distribution function. The number of experimentally available views can be increased by combining different types of diagnostics in a joint velocity-space tomography. Using this, up to 7 views are available at ASDEX Upgrade from 2014.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute, University of Seville, University of California at Irvine
Velocity-space tomography using many-view CTS or FIDA systems

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute, University of Seville, University of California
Number of pages: 4
Pages: 1358-1361
Publication date: 2013

Host publication information
Title of host publication: Europhysics conference abstracts
Volume: 37D
ISBN (Print): 2-914771-84-3
Electronic versions:
Velocity-space tomography using many-view CTS or FIDA systems.pdf
URLs:

Bibliographical note
P5.130
Source: dtu
Source-ID: u::8872
Research output: Research - peer-review › Conference abstract in journal – Annual report year: 2013

Algebraic and iterative tomography of fast-ion velocity-space distributions from synthetic fast-ion diagnostics

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Max Planck Institute, Aarhus University, University of California
Number of pages: 4
Publication date: 2012

Host publication information
Title of host publication: Proceedings
Publisher: European Physical Society
ISBN (Print): 2-914771-79-7
(Europhysics Conference Abstracts; No. 36F).
Keywords: Fusion energy
Electronic versions:
Algebraic_and_iterative_tomography.pdf
Research output: Research › Article in proceedings – Annual report year: 2012
The programme of the Research Unit of the Fusion Association Euratom – DTU, Technical University of Denmark (until 31-12-2011: Association Euratom – Risø DTU) covers work in fusion plasma physics and in fusion technology. The fusion plasma physics research focuses on turbulence and transport, and its interaction with the plasma equilibrium and particles. The effort includes both first principles based modelling, and experimental observations of turbulence and of fast ion dynamics by collective Thomson scattering. Within fusion technology there are activities related to development of high temperature superconductors. Other activities are system analysis, initiative to involve Danish industry in ITER contracts and public information. A summary is presented of the results obtained in the Research Unit during 2011.

**Design and performance of the collective Thomson scattering receiver at ASDEX Upgrade.**

Here we present the design of the fast-ion collective Thomson scattering receiver for millimeter wave radiation installed at ASDEX Upgrade, a tokamak for fusion plasma experiments. The receiver can detect spectral power densities of a few eV against the electron cyclotron emission background on the order of 100 eV under presence of gyrotron stray radiation that is several orders of magnitude stronger than the signal to be detected. The receiver down converts the frequencies of scattered radiation (100-110 GHz) to intermediate frequencies (IF) (4.5-14.5 GHz) by heterodyning. The IF signal is divided into 50 IF channels tightly spaced in frequency space. The channels are terminated by square-law detector diodes that convert the signal power into DC voltages. We present measurements of the transmission characteristics and performance of the main receiver components operating at mm-wave frequencies (notch, bandpass, and lowpass filters, a voltage-controlled variable attenuator, and an isolator), the down-converter unit, and the IF components (amplifiers, bandpass filters, and detector diodes). Furthermore, we determine the performance of the receiver as a unit through spectral response measurements and find reasonable agreement with the expectation based on the individual component measurements.

**General information**

State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Electromagnetic Systems, Department of Electrical Engineering
Pages: 013507
Publication date: 2012
Peer-reviewed: Yes

**Publication information**

Journal: Review of Scientific Instruments
Volume: 83
Issue number: 1
ISSN (Print): 0034-6748
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Web of Science (2014): Impact factor 1.614
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.28 SJR 0.9 SNIP 1.099
Web of Science (2013): Impact factor 1.584
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.45 SJR 1.017 SNIP 1.277
Web of Science (2012): Impact factor 1.602
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.43 SJR 0.868 SNIP 1.108
Web of Science (2011): Impact factor 1.367
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.218 SNIP 1.405
Web of Science (2010): Impact factor 1.601
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.001 SNIP 1.061
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.274 SNIP 1.344
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.922 SNIP 1.023
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.153 SNIP 1.297
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.883 SNIP 1.044
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Scopus rating (2004): SJR 1.13 SNIP 1.393
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.994 SNIP 1.301
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.02 SNIP 1.015
Scopus rating (2001): SJR 1.13 SNIP 1.301
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.022 SNIP 1.051
Web of Science (2000): Indexed yes
Diagnosis of energetic ions and ion composition in fusion plasmas by collective Thomson scattering of mm-waves

In fusion plasmas, the dominant heating source will be fusion generated energetic ions slowing down in the plasma. The same ions can also drive waves and instabilities in the plasma. Their distribution in velocity and in space has major impact on plasma dynamics, and plasma dynamics in turn affects the energetic ion distributions. The dynamics of energetic ions is thus important to measure in order to understand fusion plasmas, and important to monitor as part of input to plasma control. The collective Thomson scattering of millimeter waves has proven to be a valuable means of diagnosing energetic ion distributions in fusion plasmas. A beam of mm-waves with a diameter of 5–10 cm and a power of 150–600 kW is sent through the plasma, and radiation scattered from this probe beam by the microscopic fluctuations in the plasma is detected. These microscopic fluctuations are in part induced by the ion motion and the fluctuations and hence the scattered radiation is thus sensitive to the ion distribution. This permits the fast ion distribution to be inferred from the detected scattered radiation. Dynamics of the fast ions is measured, and phenomena related to plasma instabilities observed.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Aarhus University
Contributors: Bindslev, H., Korsholm, S. B., Leipold, F., Meo, F., Michelsen, P., Nielsen, S. K., Salewski, M., Stejner Pedersen, M.
Pages: 7C-10
Publication date: 2012
ISSN (Print): 0034-6748

Ratings:

BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
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BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Web of Science (2014): Impact factor 1.614
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BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.28 SJR 0.9 SNIP 1.099
Web of Science (2013): Impact factor 1.584
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.45 SJR 1.017 SNIP 1.277
Web of Science (2012): Impact factor 1.602
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.43 SJR 0.868 SNIP 1.108
Web of Science (2011): Impact factor 1.367
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.218 SNIP 1.405
Web of Science (2010): Impact factor 1.601
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.001 SNIP 1.061
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Scopus rating (2008): SJR 1.274 SNIP 1.344
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Scopus rating (2007): SJR 0.922 SNIP 1.023
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.153 SNIP 1.297
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.883 SNIP 1.044
Web of Science (2005): Indexed yes
Experimental and simulated fast ion velocity distributions on collective Thomson scattering diagnostic in the Large Helical Device

We have developed a collective Thomson scattering diagnostic system in the LHD. The CTS spectrum spread is observed in the frequency region corresponding to the bulk and fast ions during NB injection. The NB originated fast ions are evaluated by the MORH code for understanding the measured CTS spectra. We found that tangentially injected particles affect the CTS spectrum in the fast ion region from the simulated 1D velocity distribution for fast ions. This is consistent with the measured CTS spectrum in the frequency shift at less than -0.7 GHz and more than 0.7 GHz. As the next step, the CTS spectrum would be evaluated using the simulated 1D velocity distribution.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, National Institute for Fusion Science, Kyoto University
Number of pages: 4
Pages: 373-376
Publication date: 2012

Host publication information
Volume: 1
ISBN (Print): 9781622769810
Electronic versions:
Experimental_and_simulated_fast_ion_velocity.pdf
Research output: Research - peer-review › Conference article – Annual report year: 2012

Measurements of plasma composition in the TEXTOR tokamak by collective Thomson scattering

We demonstrate the use of collective Thomson scattering (CTS) for spatially localized measurements of the isotopic composition of magnetically confined fusion plasmas. The experiments were conducted in the TEXTOR tokamak by scattering millimeter-wave probe radiation off plasma fluctuations with wave vector components nearly perpendicular to the magnetic field. Under such conditions the sensitivity of the CTS spectrum to plasma composition is enhanced by the spectral signatures of the ion cyclotron motion and of weakly damped ion Bernstein waves. Recent experiments on TEXTOR demonstrated the ability to resolve these signatures in the CTS spectrum as well as their sensitivity to the ion species mix in the plasma. This paper shows that the plasma composition can be inferred from the measurements through forward modeling of the CTS spectrum. We demonstrate that spectra measured in plasmas consisting of hydrogen, deuterium and 3He can be accurately reproduced by theory and yield inferred plasma compositions consistent with expectations. The potential to use CTS for measurements of plasma composition is of significant interest since CTS is well suited for reactor environments and since there is at present no established method to measure the fuel ion density ratio in the core of a burning fusion plasma.

General information
State: Published
Modification of the collective Thomson scattering radiometer in the search for parametric decay on TEXTOR

Strong scattering of high-power millimeter waves at 140 GHz has been shown to take place in heating and current-drive experiments at TEXTOR when a tearing mode is present in the plasma. The scattering signal is at present supposed to be generated by the parametric decay instability. Here we describe the heterodyne detection system used to characterize the newly discovered signal measured at TEXTOR, and we present spectral shapes in which the signal can appear under different conditions. The radiation is collected by the receiver through a quasi-optical transmission line that is independent of the electron cyclotron resonance heating transmission line, and so the scattering geometry is variable. The signal is detected with 42 frequency channels ranging from 136 to 142 GHz. We demonstrate that the large signal does not originate from gyrotron spurious radiation. The measured signal agrees well with independent backscattering radiometer data.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, FOM Dutch Institute for Fundamental Energy Research, Eindhoven University of Technology
Contributors: Nielsen, S. K., Salewski, M., Bongers, W., Korsholm, S. B., Leipold, F., Meo, F., Michelsen, P., Moseev, D., Oosterbeek, J. W., Stejner Pedersen, M., Westerhof, E.
Number of pages: 5
Pages: 113508
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Review of Scientific Instruments
Volume: 83
Issue number: 11
ISSN (Print): 0034-6748
Ratings:
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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
Performance measurements of the collective Thomson scattering receiver at ASDEX Upgrade

The fast-ion collective Thomson scattering (CTS) receiver at ASDEX Upgrade can detect spectral power densities of a few eV in the millimeter-wave range against the electron cyclotron emission (ECE) background on the order of 100 eV under presence of gyrotron stray radiation that is several orders of magnitude stronger than the signal to be detected. The receiver heterodynes the frequencies of scattered radiation (100–110 GHz) to intermediate frequencies (IF) (4.5–14.5 GHz). The IF signal is divided into 50 IF channels tightly spaced in frequency space which are terminated by square-law Schottky detector diodes. The performance of the entire receiver is determined by the main receiver components operating at mm-wave frequencies (notch-, bandpass- and lowpass filters, a voltage-controlled variable attenuator, and an isolator), a mixer, and the IF components (amplifiers, band-pass filters, and detector diodes). We discuss here the design of the entire receiver, focussing on its performance as a unit. The receiver has been disassembled, and the performance of its individual components has been characterized. Based on these individual component measurements we predict the spectral response of the receiver assembled as a unit. The measured spectral response of the assembled receiver is in reasonable agreement with this prediction.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Electromagnetic Systems, Department of Electrical Engineering
Number of pages: 8
Pages: C02039
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Journal of Instrumentation
Volume: 7
Issue number: 02
ISSN (Print): 1748-0221
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.23 SJR 0.642 SNIP 1.04
Web of Science (2017): Impact factor 1.258
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.22 SJR 0.903 SNIP 1.164
Web of Science (2016): Impact factor 1.22
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.96 SJR 0.833 SNIP 0.966
Web of Science (2015): Impact factor 1.31
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.08 SJR 0.683 SNIP 1.062
Web of Science (2014): Impact factor 1.399
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Temporally resolved plasma composition measurements by collective Thomson scattering in TEXTOR

Fusion plasma composition measurements by collective Thomson scattering (CTS) were demonstrated in recent proof-of-principle measurements in TEXTOR [S. B. Korsholm et al., Phys. Rev. Lett. 106, 165004 (2011)]. Such measurements rely on the ability to resolve and interpret ion cyclotron structure in CTS spectra. Here, we extend these techniques to enable temporally resolved plasma composition measurements by CTS in TEXTOR, and we discuss the prospect for such measurements with newly installed hardware upgrades for the CTS system on ASDEX Upgrade.

General information
State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy, Aarhus University, FOM Dutch Institute for Fundamental Energy Research, Forschungszentrum Jülich GmbH, Russian Academy of Sciences
Contributors: Stejner Pedersen, M., Korsholm, S. B., Nielsen, S. K., Salewski, M., Bindslev, H., Leipold, F., Michelsen, P., Meo, F., Moseev, D., Bürger, A., Kantor, M., de Baar, M.
Number of pages: 7
Pages: 10E307
Publication date: 2012
Peer-reviewed: Yes
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The prospect for fuel ion ratio measurements in ITER by collective Thomson scattering

We show that collective Thomson scattering (CTS) holds the potential to become a new diagnostic principle for measurements of the fuel ion ratio, nT/nD, in ITER. Fuel ion ratio measurements will be important for plasma control and machine protection in ITER. Measurements of ion cyclotron structures in CTS spectra have been suggested as the basis for a new fuel ion ratio diagnostic which would be well suited for reactor environments and capable of providing spatially resolved measurements in the plasma core. Such measurements were demonstrated in recent experiments in the TEXTOR tokamak. Here we conduct a sensitivity study to investigate the potential measurement accuracy of a CTS fuel ion ratio diagnostic on ITER. The study identifies regions of parameter space in which CTS can be expected to provide useful information on plasma composition, and we find that a CTS fuel ion ratio diagnostic could meet the ITER measurement requirements for a standard ELMy H-mode discharge.
Tomography of 2D Velocity-space Distributions from Combined Synthetic Fast-ion Diagnostics at ASDEX Upgrade

General Information
State: Published
Organisations: Department of Physics, Max Planck Institute, Aarhus University, University of California, FOM Dutch Institute for Fundamental Energy Research
Pages: 315
Publication date: 2012

Original language: English
Keywords: Plasma physics, Nuclear physics, Instrumentation and measurement

DOIs:
10.1088/0029-5515/52/2/023011

Source: orbit
Source-ID: 317533
Research output: Research - peer-review › Journal article – Annual report year: 2012
Tomography of fast-ion velocity-space distributions from synthetic CTS and FIDA measurements

We compute tomographies of 2D fast-ion velocity distribution functions from synthetic collective Thomson scattering (CTS) and fast-ion D (FIDA) 1D measurements using a new reconstruction prescription. Contradicting conventional wisdom we demonstrate that one single 1D CTS or FIDA view suffices to compute accurate tomographies of arbitrary 2D functions under idealized conditions. Under simulated experimental conditions, single-view tomographies do not resemble the original fast-ion velocity distribution functions but nevertheless show their coarsest features. For CTS or FIDA systems with many simultaneous views on the same measurement volume, the resemblance improves with the number of available views, even if the resolution in each view is varied inversely proportional to the number of views, so that the total number of measurements in all views is the same. With a realistic four-view system, tomographies of a beam ion velocity distribution function at ASDEX Upgrade reproduce the general shape of the function and the location of the maxima at full and half injection energy of the beam ions. By applying our method to real many-view CTS or FIDA measurements, one could determine tomographies of 2D fast-ion velocity distribution functions experimentally.
Fast Ion Dynamics in ASDEX Upgrade and TEXTOR Measured by Collective Thomson Scattering

Fast ions are an essential ingredient in burning nuclear fusion plasmas: they are responsible for heating the bulk plasma, carry a significant amount of plasma current and moreover interact with various magnetohydrodynamic (MHD) instabilities. The collective Thomson scattering (CTS) diagnostic is sensitive to the projection of fast ion velocity distribution function. This thesis is mainly devoted to investigations of fast ion physics in tokamak plasmas by means of CTS.
Dynamics of fast ions during sawtooth oscillations in the TEXTOR tokamak measured by collective Thomson scattering

Experimental investigations of sawtooth interaction with fast ions measured by collective Thomson scattering on TEXTOR are presented. Time-resolved measurements of localized 1D fast-ion distribution functions allow us to study fast-ion dynamics during several sawtooth cycles. Sawtooth oscillations interact strongly with the fast-ion population in a wide range of plasma parameters. Part of the ion phase space density oscillates out of phase with the sawtooth oscillation during hydrogen neutral beam injection (NBI). These oscillations most likely originate from fast hydrogen ions with energies close to the full injection energy. At lower energies passing fast ions in the plasma centre are strongly redistributed at the time of sawtooth collapse but no redistribution of trapped fast ions is observed. The redistribution of fast ions from deuterium NBI in the plasma centre is found to vary throughout velocity space. The reduction is most pronounced for passing ions. We find no evidence of inverted sawteeth outside the sawtooth inversion surface in the fast-ion distribution function.
105 GHz Notch Filter Design for Collective Thomson Scattering

A millimeter-wave notch filter with 105-GHz center frequency, >20-GHz passband coverage, and 1-GHz rejection bandwidth has been constructed. The design is based on a fundamental rectangular waveguide with cylindrical cavities coupled by narrow iris gaps, i.e., small elongated holes of negligible thickness. We use numerical simulations to study the sensitivity of the notch filter performance to changes in geometry and in material conductivity within a bandwidth of ±10 GHz. The constructed filter is tested successfully using a vector network analyzer monitoring a total bandwidth of 20 GHz. The typical insertion loss in the passband is

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Furtula, V., Michelsen, P., Leipold, F., Johansen, T., Korsholm, S. B., Meo, F., Moseev, D., Nielsen, S. K., Salewski, M., Stejner Pedersen, M.
Pages: 670-677
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Fusion Science and Technology
Volume: 59
Issue number: 4
ISSN (Print): 1536-1055
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.96 SJR 0.383 SNIP 0.982
Web of Science (2017): Impact factor 0.991
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.57 SJR 0.423 SNIP 0.728
Web of Science (2016): Impact factor 0.578
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.65 SJR 0.411 SNIP 0.759
Web of Science (2015): Impact factor 0.799
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.46 SJR 0.357 SNIP 0.536
Web of Science (2014): Impact factor 0.486
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.56 SJR 0.382 SNIP 0.582
Web of Science (2013): Impact factor 0.591
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.54 SJR 0.448 SNIP 0.704
Web of Science (2012): Impact factor 0.517
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.93 SJR 0.617 SNIP 1.195
Web of Science (2011): Impact factor 1.12
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.357 SNIP 0.54
Web of Science (2010): Impact factor 0.658
BFI (2009): BFI-level 1
The programme of the Research Unit of the Fusion Association Euratom - Risø National Laboratory for Sustainable Energy, Technical University of Denmark, covers work in fusion plasma physics and in fusion technology. The fusion plasma physics research focuses on turbulence and transport, and its interaction with the plasma equilibrium and particles. The effort includes both first principles based modelling, and experimental observations of turbulence and of fast ion dynamics by collective Thomson scattering. Within fusion technology there are activities related to development of high temperature superconductors. Other activities are system analysis, initiative to involve Danish industry in ITER contracts and public information. A summary is presented of the results obtained in the Research Unit during 2010.

Collective Thomson scattering by using a 77GHz gyrotron for bulk and fast ion measurements in LHD

General information
State: Published
Organisations: Rise National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme, National Institute for Fusion Science, University of Fukui, Nagoya University
Comparison of measured and simulated fast ion velocity distributions in the TEXTOR tokamak

Here we demonstrate a comprehensive comparison of collective Thomson scattering (CTS) measurements with steady-state Monte Carlo simulations performed with the ASCOT and VENUS codes. The measurements were taken at a location on the magnetic axis as well as at an off-axis location, using two projection directions at each location. The simulations agree with the measurements on-axis, but for the off-axis geometries discrepancies are observed for both projection directions. For the near perpendicular projection direction with respect to the magnetic field, the discrepancies between measurement and simulations can be explained by uncertainty in plasma parameters. However, the discrepancies between measurement and simulations for the more parallel projection direction cannot be explained solely by uncertainties in plasma parameters. Here anomalous fast ion transport is a possible explanation for the discrepancy.
CTS observations of NBI-induced instabilities in TEXTOR plasmas

General information
State: Published

Original language: English
Keywords: Fusion energy
DOIs: 10.1088/0741-3335/53/10/105004
Source: orbit
Source-ID: 282224
Research output: Research - peer-review › Journal article – Annual report year: 2011
Long-term modelling of Carbon Capture and Storage, Nuclear Fusion, and large-scale District Heating

Among the technologies for mitigating greenhouse gasses, carbon capture and storage (CCS) and nuclear fusion are interesting in the long term. In several studies with time horizon 2050 CCS has been identified as an important technology, while nuclear fusion cannot become commercially available before 2050. The modelling tools developed by the International Energy Agency (IEA) Implementing Agreement ETSAP include both multi-regional global and long-term energy models till 2100, as well as national or regional models with shorter time horizons. Examples are the EFDA-TIMES model, focusing on nuclear fusion and the Pan European TIMES model, respectively. In the next decades CCS can be a driver for the development and expansion of large-scale district heating systems, which are currently widespread in Europe, Korea and China, and with large potentials in North America. If fusion will replace fossil fuel power plants with CCS in the second half of the century, the same infrastructure for heat distribution can be used which will support the penetration of both technologies. This paper will address the issue of infrastructure development and the use of CCS and fusion technologies using the available models among the ETSAP tools.

General information
State: Published
Organisations: Energy Systems Analysis, Systems Analysis Division, Rise National Laboratory for Sustainable Energy, UNEP Risoe Centre on Energy, Climate and Sustainable Development (URC), Plasma Physics and Technology Programme, DTU Climate Centre
Contributors: Grohnheit, P. E., Korsholm, S. B., Lüthje, M.
Number of pages: 420
Pages: 56-65
Publication date: 2011
Measurements of Intrinsic Ion Bernstein Waves in a Tokamak by Collective Thomson Scattering

In this Letter we report measurements of collective Thomson scattering (CTS) spectra with clear signatures of ion Bernstein waves and ion cyclotron motion in tokamak plasmas. The measured spectra are in accordance with theoretical predictions and show clear sensitivity to variation in the density ratio of the main ion species in the plasma. Measurements with this novel diagnostic demonstrate that CTS can be used as a fuel ion ratio diagnostic in burning fusion plasma devices.

General information
State: Published
Contributors: Korsholm, S. B., Stejner Pedersen, M., Bindslev, H., Furtula, V., Leipold, F., Meo, F., Michelsen, P., Moseev, D., Nielsen, S. K., Salewski, M., de Baar, M., Delabie, E., Kantor, M., Bürger, A.
Pages: 165004
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Physical Review Letters
Volume: 106
Issue number: 16
ISSN (Print): 0031-9007
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.58 SJR 3.622 SNIP 2.464
Web of Science (2017): Impact factor 8.839
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.33 SJR 4.196 SNIP 2.61
Web of Science (2016): Impact factor 8.462
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.76 SJR 4.656 SNIP 2.538
Web of Science (2015): Impact factor 7.645
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.62 SJR 5.232 SNIP 2.71
Web of Science (2014): Impact factor 7.512
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 7.46 SJR 5.675 SNIP 2.781
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 7.19 SJR 6.292 SNIP 2.867
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 7.02 SJR 6.314 SNIP 2.905
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Observation of fast ion velocity distribution and driven waves by collective Thomson scattering diagnostic in the Large Helical Device

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, National Institute for Fusion Science, University of Fukui, Kyoto University
Pages: O2.101
Publication date: 2011

Host publication information
Title of host publication: Proceedings
Keywords: Fusion energy
Electronic versions:
Observation of fast ion velocity_paper.pdf
Source: orbit
Source-ID: 276538
Research output: Research › Article in proceedings – Annual report year: 2011

On velocity space interrogation regions of fast-ion collective Thomson scattering at ITER
The collective Thomson scattering (CTS) diagnostic proposed for ITER is designed to measure projected 1D fast-ion velocity distribution functions at several spatial locations simultaneously. The frequency shift of scattered radiation and the
scattering geometry place fast ions that caused the collective scattering in well-defined regions in velocity space, here dubbed interrogation regions. Since the CTS instrument measures entire spectra of scattered radiation, many different interrogation regions are probed simultaneously. We here give analytic expressions for weight functions describing the interrogation regions, and we show typical interrogation regions of the proposed ITER CTS system. The backscattering system with receivers on the low-field side is sensitive to fast ions with pitch |p| = |v/v| <0.5–0.9 depending on the ion energy and the frequency shift of the scattered radiation. A forward scattering system with receivers on the high-field side would be sensitive to co- and counter-passing fast ions in narrow interrogation regions with pitch |p| > 0.6–0.8. Additionally, we use weight functions to reconstruct 2D fast-ion distribution functions, given two projected 1D velocity distribution functions from simulated simultaneous measurements with the back- and forward scattering systems.
Principles of fuel ion ratio measurements in fusion plasmas by collective Thomson scattering

For certain scattering geometries collective Thomson scattering (CTS) measurements are sensitive to the composition of magnetically confined fusion plasmas. CTS therefore holds the potential to become a new diagnostic for measurements of the fuel ion ratio—i.e. the tritium to deuterium density ratio. Measurements of the fuel ion ratio will be important for plasma control and machine protection in future experiments with burning fusion plasmas. Here we examine the theoretical basis for fuel ion ratio measurements by CTS. We show that the sensitivity to plasma composition is enhanced by the signatures of ion cyclotron motion and ion Bernstein waves which appear for scattering geometries with resolved wave vectors near perpendicular to the magnetic field. We investigate the origin and properties of these features in CTS spectra and give estimates of their relative importance for fuel ion ratio measurements.
Collective Thomson scattering capabilities to diagnose fusion plasmas

Collective Thomson scattering (CTS) is a versatile technique for diagnosing fusion plasmas. In particular, experiments on diagnosing the ion temperature and fast ion velocity distribution have been executed on a number of fusion devices. In this article the main aim is to describe the technique, focusing on the measurements of fast ion dynamics in the tokamaks TEXTOR and ASDEX Upgrade. Other potential applications such as measurements of bulk ion temperature, bulk ion rotation, and fuel ion ratio measurements will be mentioned.

General information

State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Contributors: Korsholm, S. B., Bindslev, H., Furtula, V., Leipold, F., Meo, F., Michelsen, P., Moseev, D., Nielsen, S. K., Salewski, M., Stejner Pedersen, M.
Pages: 677-680
Publication date: 11 Nov 2010
Peer-reviewed: Yes

Publication information

Journal: Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment
Volume: 623
Issue number: 2
ISSN (Print): 0168-9002
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.48 SJR 0.814 SNIP 1.333
Web of Science (2017): Impact factor 1.336
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.44 SJR 0.866 SNIP 1.354
Web of Science (2016): Impact factor 1.362
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.21 SJR 0.965 SNIP 1.284
Web of Science (2015): Impact factor 1.2
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.24 SJR 0.852 SNIP 1.265
Web of Science (2014): Impact factor 1.216
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.48 SJR 0.946 SNIP 1.446
Web of Science (2013): Impact factor 1.316
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.19 SJR 0.832 SNIP 1.36
Web of Science (2012): Impact factor 1.142
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.29 SJR 0.956 SNIP 1.414
Web of Science (2011): Impact factor 1.207
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.894 SNIP 1.11
Web of Science (2010): Impact factor 1.142
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.759 SNIP 1.372
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.755 SNIP 1.077
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.728 SNIP 1.384
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.84 SNIP 1.213
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.858 SNIP 1.135
Scopus rating (2004): SJR 0.902 SNIP 1.471
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.747 SNIP 1.254
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.724 SNIP 1.139
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.751 SNIP 1.125
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.817 SNIP 0.982
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.762 SNIP 0.998
Original language: English
Keywords: Fusion energy, Microwave, Fast ions
DOIs:
10.1016/j.nima.2010.05.003
Source: orbit
Source-ID: 265053
The programme of the Research Unit of the Fusion Association Euratom - Risø National Laboratory for Sustainable Energy, Technical University of Denmark, covers work in fusion plasma physics and in fusion technology. The fusion plasma physics research focuses on turbulence and transport, and its interaction with the plasma equilibrium and particles. The effort includes both first principles based modelling, and experimental observations of turbulence and of fast ion dynamics by collective Thomson scattering. New activities in technology related to development of high temperature superconductors have been initiated in 2008. Minor activities are system analysis, initiative to involve Danish industry in ITER contracts and public information. A summary is presented of the results obtained in the Research Unit during 2008.

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Juul Rasmussen, J., Westergaard, C. M.
Number of pages: 67
Publication date: 2010

Publication information
Place of publication: Roskilde
Publisher: Danmarks Tekniske Universitet, Risø Nationallaboratoriet for Bæredygtig Energi
ISBN (Print): 978-87-550-3738-0
Original language: English
Keywords: Fusion energy, Risø-R-1684
Electronic versions:
ris-r-1684.pdf
Source: orbit
Source-ID: 267767
Research output: Research › Report – Annual report year: 2010

The programme of the Research Unit of the Fusion Association Euratom - Risø National Laboratory for Sustainable Energy, Technical University of Denmark, covers work in fusion plasma physics and in fusion technology. The fusion plasma physics research focuses on turbulence and transport, and its interaction with the plasma equilibrium and particles. The effort includes both first principles based modelling, and experimental observations of turbulence and of fast ion dynamics by collective Thomson scattering. Within fusion technology there are activities related to development of high temperature superconductors. Minor activities are system analysis, initiative to involve Danish industry in ITER contracts and public information. A summary is presented of the results obtained in the Research Unit during 2009.

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Juul Rasmussen, J., Westergaard, C. M.
Number of pages: 68
Publication date: 2010

Publication information
Place of publication: Roskilde
Publisher: Danmarks Tekniske Universitet, Risø Nationallaboratoriet for Bæredygtig Energi
ISBN (Print): 978-87-550-3807-3
Original language: English
Keywords: Fusion energy, Risø-R-1725
Electronic versions:
ris-r-1725.pdf
Source: orbit
Source-ID: 267768
Research output: Research › Report – Annual report year: 2010
Broadband mm-Wave Notch Filter for ECE Applications

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Publication date: 2010
Peer-reviewed: No
Event: Poster session presented at 16th Joint Workshop on Electron Cyclotron Emission and Electron Cyclotron Resonance Heating, Sanya (CN), 12-15 Apr,.
Keywords: Fusion energy
Source: orbit
Source-ID: 265187
Research output: Research › Poster – Annual report year: 2010

Broadband notch filter design for millimeter-wave plasma diagnostics
Notch filters are integrated in plasma diagnostic systems to protect millimeter-wave receivers from intensive stray radiation. Here we present a design of a notch filter with a center frequency of 140 GHz, a rejection bandwidth of ~ 900 MHz, and a typical insertion loss below 2 dB in the passband of ±9 GHz. The design is based on a fundamental rectangular waveguide with eight cylindrical cavities coupled by T-junction apertures formed as thin slits. Parameters that affect the notch performance such as physical lengths and conductor materials are discussed. The excited resonance mode in the cylindrical cavities is the fundamental TE11. The performance of the constructed filter is measured using a vector network analyzer monitoring a total bandwidth of 30 GHz. We compare the measurements with numerical simulations. © 2010 EURATOM

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Electromagnetic Systems, Department of Electrical Engineering
Pages: 10D913 (5 pages)
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Review of Scientific Instruments
Volume: 81
Issue number: 10
ISSN (Print): 0034-6748
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Web of Science (2014): Impact factor 1.614
Collective Thomson scattering measurements with high frequency resolution at TEXTOR

We discuss the development and first results of a receiver system for the collective Thomson scattering (CTS) diagnostic at TEXTOR with frequency resolution in the megahertz range or better. The improved frequency resolution expands the diagnostic range and utility of CTS measurements in general and is a prerequisite for measurements of ion Bernstein...
wave signatures in CTS spectra. The first results from the new acquisition system are shown to be consistent with theory and with simultaneous measurements by the standard receiver system. © 2010 EURATOM

**General information**

**State:** Published

**Organisations:** Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management, Forschungszentrum Jülich GmbH, FOM, Russian Academy of Sciences

**Contributors:** Stejner Pedersen, M., Nielsen, S. K., Korsholm, S. B., Salewski, M., Bindslev, H., Furtula, V., Leipold, F., Meo, F., Michelsen, P., Moseev, D., Bürger, A., Kantor, M., de Baar, M.

**Pages:** 10D515

**Publication date:** 2010

**Peer-reviewed:** Yes

**Publication information**

**Journal:** Review of Scientific Instruments

**Volume:** 81

**Issue number:** 10

**ISSN (Print):** 0034-6748

**Ratings:**

- BFI (2019): BFI-level 1
- Web of Science (2019): Indexed yes
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
- Web of Science (2017): Impact factor 1.428
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
- Web of Science (2016): Impact factor 1.515
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
- Web of Science (2014): Impact factor 1.614
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): CiteScore 1.28 SJR 0.9 SNIP 1.099
- Web of Science (2013): Impact factor 1.584
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): CiteScore 1.45 SJR 1.017 SNIP 1.277
- Web of Science (2012): Impact factor 1.602
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): CiteScore 1.43 SJR 0.868 SNIP 1.108
- Web of Science (2011): Impact factor 1.367
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.218 SNIP 1.405
- Web of Science (2010): Impact factor 1.601
Collective Thomson scattering of a high power electron cyclotron resonance heating beam in LHD

Collective Thomson scattering (CTS) system has been constructed at LHD making use of the high power ECRH system in LHD. The necessary features for CTS, high power probing beams and receiving beams, both with well defined Gaussian profile and with the fine controllability, are endowed in the ECRH system. The 32 channel radiometer with sharp notch filter at the front end is attached to the ECRH system transmission line as a CTS receiver. The validation of the CTS signal is performed by scanning the scattering volume. A new method to separate the CTS signal from background ECE is developed and applied to derive the bulk and high energy ion components for several combinations of NBI heated plasmas.
Comparison of Central Fast Ion Distributions between Plasmas with on-Axis and o-Axis NBI Current Drive on ASDEX Upgrade

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management, Max Planck Institute
Number of pages: 637
Pages: 244-245
Publication date: 2010

Host publication information
Title of host publication: Book of abstracts
Publisher: International Atomic Energy Agency
Keywords: Fusion energy
URLs:
Source: orbit
Source-ID: 268164
Research output: Research → Conference abstract in proceedings – Annual report year: 2010

Comparison of fast ion collective Thomson scattering measurements at ASDEX Upgrade with numerical simulations
Collective Thomson scattering (CTS) experiments were carried out at ASDEX Upgrade to measure the one-dimensional velocity distribution functions of fast ion populations. These measurements are compared with simulations using the codes TRANSP/NUBEAM and ASCOT for two different neutral beam injection (NBI) configurations: two NBI sources and only one NBI source. The measured CTS spectra as well as the inferred one-dimensional fast ion velocity distribution functions are clearly asymmetric as a consequence of the anisotropy of the beam ion populations and the selected geometry of the experiment. As expected, the one-beam configuration can clearly be distinguished from the two-beam configuration. The fast ion population is smaller and the asymmetry is less pronounced for the one-beam configuration. Salient features of the numerical simulation results agree with the CTS measurements while quantitative discrepancies in absolute values and gradients are found.

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management, Aalto University, Max Planck Institute, Massachusetts Institute of Technology
Pages: 035012
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Nuclear Fusion
Volume: 50
Issue number: 3
ISSN (Print): 0029-5515
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.13 SJR 0.759 SNIP 1.424
Web of Science (2017): Impact factor 4.057
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 1.284 SNIP 1.416
Web of Science (2016): Impact factor 3.307
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.88 SJR 1.51 SNIP 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.2 SJR 1.907 SNIP 1.667
Web of Science (2014): Impact factor 3.062
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.83 SJR 1.366 SNIP 1.516
Web of Science (2013): Impact factor 3.243
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.81 SJR 1.441 SNIP 1.448
Web of Science (2012): Impact factor 2.734
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.78 SJR 2.043 SNIP 2.433
Web of Science (2011): Impact factor 4.09
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.268 SNIP 1.927
Web of Science (2010): Impact factor 3.303
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.993 SNIP 2.441
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.031 SNIP 1.736
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.005 SNIP 1.987
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.062 SNIP 1.937
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.885 SNIP 1.932
Web of Science (2005): Indexed yes
Development of novel fuel ion ratio diagnostic techniques
To overcome the challenge of measuring the fuel ion ratio in the core ($\rho$)

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management, Uppsala University, Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, FOM, Eindhoven University of Technology
Pages: 10D323 (3 pages)
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Review of Scientific Instruments
Volume: 81
Issue number: 10
ISSN (Print): 0034-6748
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Dynamics of Fast Ions during Sawtooth Oscillations in the TEXTOR Tokamak measured by Collective Thomson Scattering

General Information
State: Published

Original language: English
Keywords: Fusion energy

DOIs:
10.1063/1.3460634

Source: orbit
Source-ID: 268316
Research output: Research - peer-review › Conference article – Annual report year: 2010
Expected accuracy of fuel ion ratio measurements by collective Thomson scattering at TEXTOR

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Pages: P5.126
Publication date: 2010

Host publication information
Title of host publication: Proceedings
Keywords: Fusion energy
Electronic versions:
article1.pdf
URLs:
Source: orbit
Source-ID: 264717
Research output: Research › Article in proceedings – Annual report year: 2010

Fast-ion redistribution due to sawtooth crash in the TEXTOR tokamak measured by collective Thomson scattering

Here we present collective Thomson scattering measurements of 1D fast-ion velocity distribution functions in neutral beam heated TEXTOR plasmas with sawtooth oscillations. Up to 50% of the fast ions in the centre are redistributed as a consequence of a sawtooth crash. We resolve various directions to the magnetic field. The fast-ion distribution is found to be anisotropic as expected. For a resolved angle of 39° to the magnetic field we find a drop in the fast-ion distribution of 20–40%. For a resolved angle of 83° to the magnetic field the drop is no larger than 20%.

General information
State: Published
Pages: 092001
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Plasma Physics and Controlled Fusion
Volume: 52
Issue number: 9
ISSN (Print): 0741-3335
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.453 SNIP 1.201
Web of Science (2012): Impact factor 2.369
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.69 SJR 1.496 SNIP 1.591
Web of Science (2011): Impact factor 2.731
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.468 SNIP 1.408
Web of Science (2010): Impact factor 2.466
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.589 SNIP 1.324
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.845 SNIP 1.569
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.927 SNIP 1.374
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.844 SNIP 1.556
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.756 SNIP 1.54
Scopus rating (2004): SJR 2.246 SNIP 1.382
Scopus rating (2003): SJR 2.135 SNIP 1.253
First results and analysis of collective Thomson scattering (CTS) fast ion distribution measurements on ASDEX Upgrade

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme, Management, Max Planck Institute, Plasma Science & Fusion Center at MIT
Pages: 012010
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Peer-reviewed: Yes

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Journal: Journal of Physics: Conference Series (Online)
Volume: 227
ISSN (Print): 1742-6596
Ratings:
    BFI (2019): BFI-level 1
    BFI (2018): BFI-level 1
    BFI (2017): BFI-level 1
    Scopus rating (2017): CiteScore 0.48 SJR 0.241 SNIP 0.447
    Web of Science (2017): Indexed yes
    BFI (2016): BFI-level 1
    Scopus rating (2016): CiteScore 0.45 SJR 0.24 SNIP 0.401
    Web of Science (2016): Indexed yes
    BFI (2015): BFI-level 1
    Scopus rating (2015): CiteScore 0.35 SJR 0.252 SNIP 0.374
    Web of Science (2015): Indexed yes
    BFI (2014): BFI-level 1
    Scopus rating (2014): CiteScore 0.32 SJR 0.264 SNIP 0.352
    Web of Science (2014): Indexed yes
    BFI (2013): BFI-level 1
    Scopus rating (2013): CiteScore 0.25 SJR 0.245 SNIP 0.293
    ISI indexed (2013): ISI indexed no
    Web of Science (2013): Indexed yes
    BFI (2012): BFI-level 1
    Scopus rating (2012): CiteScore 0.33 SJR 0.293 SNIP 0.387
    ISI indexed (2012): ISI indexed no
    BFI (2011): BFI-level 1
    Scopus rating (2011): CiteScore 0.43 SJR 0.293 SNIP 0.356
    ISI indexed (2011): ISI indexed no
Localized measurements of the fast ion velocity distribution of TEXTOR plasmas using collective Thomson scattering

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy,
Management, Forschungszentrum Jülich GmbH, FOM, Ioffe Institute, Aalto University
Contributors: Moseev, D., Korsholm, S. B., Meo, F., Nielsen, S. K., Bindslev, H., Bürger, A., Delabie, E., Furtula, V.,
Kantor, M., Koskela, T., Leipold, F., Michelsen, P., Salewski, M., Schmitz, O., Stejner Pedersen, M., Uhlemann, R.,
Westerhof, E.
Pages: P5.123
Publication date: 2010

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URLs:
Source: orbit
Source-ID: 264713

Research output: Research › Article in proceedings – Annual report year: 2010

Requirements for calibration and testing of ITER microwave based diagnostic front-end components, ITER D 33ZRFR

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, IPP, ITER
Cadarache, ORNL, Troitsk Institute for Innovation and Fusion Research, University of Texas, University of California at
Los Angeles, Centro de Investigaciones Energéticas, MedioAmbientales y Tecnológicas
Contributors: Conway, G., Vayakis, G., Hanson, G., Korsholm, S. B., Udintsev, V., Petrov, V., Austin, M., Peebles, W.,
Estrada, T.
Publication date: 2010

Publication information
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Spatially resolved fast ion velocity distribution results from on-axis and off-axis NBI heated plasmas on ASDEX Upgrade using the Collective Thomson Scattering (CTS)

**General information**
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Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management, Max Planck Institute
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Research output: Research › Article in proceedings – Annual report year: 2010

Antenna design for fast ion collective Thomson scattering diagnostic for the international thermonuclear experimental reactor

Fast ion physics will play an important role for the international thermonuclear experimental reactor (ITER), where confined alpha particles will affect and be affected by plasma dynamics and thereby have impacts on the overall confinement. A fast ion collective Thomson scattering (CTS) diagnostic using gyrotrons operated at 60 GHz will meet the requirements for spatially and temporally resolved measurements of the velocity distributions of confined fast alphas in ITER by evaluating the scattered radiation (CTS signal). While a receiver antenna on the low field side of the tokamak, resolving near perpendicular (to the magnetic field) velocity components, has been enabled, an additional antenna on the high field side (HFS) would enable measurements of near parallel (to the magnetic field) velocity components. A compact design solution for the proposed mirror system on the HFS is presented. The HFS CTS antenna is located behind the blankets and views the plasma through the gap between two blanket modules. The viewing gap has been modified to dimensions 30 × 500 mm2 to optimize the CTS signal. A 1:1 mock-up of the HFS mirror system was built. Measurements of the beam characteristics for millimeter-waves at 60 GHz used in the mock-up agree well with the modeling.

**General information**
State: Published
Organisations: Plasma Physics and Technology Programme, Rise National Laboratory for Sustainable Energy, Management
Contributors: Leipold, F., Furtula, V., Salewski, M., Bindslev, H., Korsholm, S. B., Meo, F., Michelsen, P., Moseev, D., Nielsen, S. K., Stejner Pedersen, M.
Pages: 093501
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Web of Science (2017): Impact factor 1.428
second harmonic off-axis on the low field side. Effects of a minority heating scheme with He-3 are also considered. CTS
scattering functions for fast deuterons, fast tritons, fast He-3 and the fusion born alphas are presented, revealing that
fusion alphas dominate the measurable signal by an order of magnitude or more in the Doppler shift frequency ranges
typical for fast ions. Hence the observable CTS signal can mostly be attributed to the alpha population in these frequency
ranges. The exceptions are limited regions in space with some non-negligible signal due to beam ions or fast He-3 which
give rise to about 30% and 10-20% of the CTS signal, respectively. In turn, the dominance of the alpha contribution
implies that the effects of other fast ion contributions will be difficult to observe by CTS.

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Rise National Laboratory for Sustainable Energy,
Management, Aalto University, French Alternative Energies and Atomic Energy Commission
Contributors: Salewski, M., Asunta, O., Eriksson, L., Bindslev, H., Hynönen, V., Korsholm, S. B., Kurki-Suonio, T.,
Leipold, F., Meo, F., Michelsen, P., Nielsen, S. K., Pedersen, J. R.
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 1.2 SNIP 1.253
Web of Science (2013): Impact factor 2.386
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.453 SNIP 1.201
Web of Science (2012): Impact factor 2.369
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.69 SJR 1.496 SNIP 1.591
Web of Science (2011): Impact factor 2.731
ISI indexed (2011): ISI indexed yes
Confinement of fast ions during applied resonant magnetic perturbations in TEXTOR using collective Thomson scattering diagnostic

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Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Pages: P1.186
Publication date: 2009

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Title of host publication: Proceedings
Publisher: European Physical Society (Europhysics Conference Abstracts; No. 33E).
Keywords: Fusion energy
URLs:
http://epsppd.epfl.ch/Sofia/pdf/P1_186.pdf
Source: orbit
Source-ID: 253352
Research output: Research › Article in proceedings – Annual report year: 2009
EFDA Task DIAG-01-05 on Fuel ion ratio measurements

General information
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Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Publication date: 2009
Peer-reviewed: No
Event: Abstract from EFDA Meeting on reporting to the Diagnostic Topical Group, Garching (DE), 4 Nov., .
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Source: orbit
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Research output: Research › Conference abstract for conference – Annual report year: 2009

EFDA task on Fuel ion ratio measurements

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Contributors: Korsholm, S. B., Stejner Pedersen, M., Bindslev, H., Lischtschenko, O., Jaspers, R., Conroy, S., Gorini, G.
Publication date: 2009
Peer-reviewed: No
Keywords: Fusionsenergi, Fusion energy
Source: orbit
Source-ID: 254011
Research output: Research › Conference abstract for conference – Annual report year: 2009

EFDA Task TW6-TPDS-DIADEV deliverable 2: ITER Fast Ion Collective Scattering Development of diagnostic components and techniques

In 2003 the Risø CTS group finished a feasibility study and a conceptual design of an ITER fast ion collective Thomson scattering system. The purpose of the CTS diagnostic is to measure the distribution function of fast ions in the plasma with particular interest in fusion alphas. The feasibility study demonstrated that the only system, which can fully meet the ITER measurement requirements for confined fusion alphas, is a 60 GHz system. The study showed that by using two powerful microwave sources (gyrotrons) of this frequency both on the low field side, and two antenna systems, one on the low field side and one on the high field side, it is possible to resolve the distribution function of fast ions both for perpendicular and parallel velocities with good spatial and temporal resolution. The present work concerned a continuation of this work, and the following tasks were performed. 1) Optimisation of the design, considering the scattering geometries, variations in plasma profiles, magnetic equilibria etc. 2) Development of numerical codes for determination of the geometry of the antenna system on the high field side, including shapes and positions of mirrors and receiver horns. 3) A model experiment was set up in order to test and support the theoretical and numerical results. From the design studies various R&D issues critical to the viability of the CTS diagnostic on ITER were identified; the most urgent ones are addressed in the presented R&D tasks.

General information
State: Published
Organisations: Management, Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme
Contributors: Michelsen, S., Bindslev, H., Korsholm, S. B., Leipold, F., Meo, F., Michelsen, P., Nielsen, A. H., Tsakadze, E.
Number of pages: 45
Publication date: 2009

Publication information
Place of publication: Roskilde
Publisher: Danmarks Tekniske Universitet, Risø Nationallaboratoriet for Bæredygtig Energi
Original language: English
(Denmark. Forskningscenter Risoe. Risoe-R; No. 1716(EN)).
Keywords: Fusion energy, Risø-R-1716, Risø-R-1716(EN)
Engineering design of the ITER Collective Thomson Scattering diagnostic. Contract EFDA 06-1478
This report describes the work done under EFDA contract 06-1478 (EFDA Ref.: TW6-TPDS-DIASUP10). The main part of the work has been focused on: 1) An outline plan for the full development of the CTS diagnostic for ITER, including specifications for future design tasks on the system and R&D tasks on critical components. 2) An engineering design and test in a blanket mock-up of the frontend quasi-optical High Field Side (HFS) antenna system. 3) Some considerations on the waveguide mounting. 4) Neutronics and thermo-elastic calculations on nuclear and radiative heating of the first mirror required to provide input to the engineering design. 5) An engineering design of the front-end quasi-optical components for the Low Field Side (LFS) system in the port plug. 6) A discussion on possible calibration methods.

Fast ion collective Thomson scattering - present results and plans for ITER
Moving towards the era of burning fusion plasmas, a better knowledge of the physics of highly energetic particles, such as the 3.5 MeV fusion born alpha particles, becomes necessary. Diagnosing the fast ions in a fusion plasma is a challenging task, but the technique of collective Thomson scattering (CTS) provides the possibility of revealing the velocity distribution of the confined fast ions along a given direction – resolved both in time and space. Recently, the ITER baseline design has been expanded to include a fast ion CTS diagnostic. The design of this diagnostic was provided by the CTS group at Risø DTU building on the experiences and expertise gained from the group’s construction and current operation of the CTS diagnostic systems on the tokamaks TEXTOR and ASDEX Upgrade. This contribution will introduce the technique of CTS, give an overview of the current diagnostic systems and results, and present the expectations for the ITER CTS diagnostic.

Fast ion distribution results of NB1 heated plasmas on ASDEX Upgrade using the Collective Thomson Scattering (CTS) diagnostic
Fast ion measurements by collective Thomson scattering in TEXTOR and ASDEX Upgrade and proposal for the ITER CTS system

Moving towards the era of burning fusion plasmas, a better knowledge of the physics of highly energetic particles, such as fusion born alpha particles, becomes essential. Diagnosing the fast ions in a fusion plasma is a challenging task, but the technique of collective Thomson scattering (CTS) provides the possibility of revealing the velocity distribution of the confined fast ions along a given direction – resolved both in time and space. Recently, the ITER baseline design has been expanded to include the enabling of the front end of a fast ion CTS diagnostic system resolving dynamics perpendicular to the magnetic field. The feasibility study and conceptual design of this diagnostic was provided by the CTS group at Risø DTU. The development of the ITER CTS diagnostic builds on the experiences and expertise gained from the construction and current operation of the CTS diagnostic systems on TEXTOR and ASDEX Upgrade. This contribution will briefly introduce the technique of CTS, give an overview of the results of the current diagnostic systems at TEXTOR and ASDEX Upgrade, and present the chosen solution and the status of the design of the ITER CTS diagnostic system.

First measurement of the ion Bernstein wave spectrum by means of Collective Thomson Scattering

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Contributors: Stejner Pedersen, M., Korsholm, S. B., Bindslev, H., Furtula, V., Leipold, F., Meo, F., Michelsen, P., Moseev, D., Nielsen, S. K., Salewski, M.
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Fuel ion ration measurements

**General information**

State: Published  
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management  
Contributors: Korsholm, S. B., Bindslev, H., Stejner Pedersen, M., Lischttschenko, O., Jaspers, R., Conroy, S., Gorini, G.  
Publication date: 2009  
Peer-reviewed: No  
Event: Abstract from EFDA Workshop on Diagnostics: Annual Meeting of the EFDA Topical Group on Diagnostics, Garching (DE), 1-2 April.  
Keywords: Fusionsenergi, Fusion energy  
Source: orbit  
Source-ID: 254006  
Research output: Research › Conference abstract for conference – Annual report year: 2009

Fuelling diagnostics for burning plasmas

**General information**

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Organisations: Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme, Management  
Contributors: Korsholm, S. B., Bindslev, H., Stejner Pedersen, M., Lischttschenko, O., Jaspers, R., Brezinsek, S., Ingesson, C.  
Publication date: 2009  
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Research output: Research › Conference abstract for conference – Annual report year: 2009

Fusion energy - an abundant energy source for the future

Fusion energy is the fundamental energy source of the Universe, as the energy of the Sun and the stars are produced by fusion of e.g. hydrogen to helium. Fusion energy research is a strongly international endeavor aiming at realizing fusion energy production in power plants on Earth. Reaching this goal, mankind will have a sustainable base load energy source with abundant resources, having no CO2 release, and with no longlived radioactive waste. This presentation will describe the basics of fusion energy production and the status and future prospects of the research. Considerations of integration into the future electricity system and socio-economic studies of fusion energy will be presented, referring to the programme of Socio-Economic Research on Fusion (SERF) under the European Fusion Energy Agreement (EFDA).

**General information**

State: Published  
Organisations: Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme  
Contributors: Korsholm, S. B.  
Publication date: 2009

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Event: Meeting at Energy Environment Agency  
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EEA_Fusion_Korsholm.pdf  
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Fusionsenergi og plasmafysik: Risø DTU plasmafysik roadshow

**General information**

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Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy  
Contributors: Stejner Pedersen, M., Korsholm, S. B., Rasmussen, F. A.
Impact of ICRH on the Measurement of Fast Ions by Collective Thomson Scattering in ITER

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Volume: TH/P3-3
Publisher: International Atomic Energy Agency (IAEA-CN-165).
Keywords: Fusion energy
Electronic versions:
Salewski_paper.pdf
Source: orbit
Source-ID: 251133
Research output: Research › Article in proceedings – Annual report year: 2009

Impact of ICRH on the measurement of fusion alphas by collective Thomson scattering in ITER
Collective Thomson scattering (CTS) has been proposed for measuring the phase space distributions of confined fast ion populations in ITER plasmas. This study determines the impact of fast ions accelerated by ion cyclotron resonance heating (ICRH) on the ability of CTS to diagnose fusion alphas in ITER. Fast ions with large perpendicular velocities, such as the populations investigated here, can be detected with the 'enabled' part of the proposed ITER CTS diagnostic. The investigated ICRH scenarios include pure second harmonic tritium heating and He-3 minority heating at a frequency of 50 MHz, corresponding to an off-axis resonance. The sensitivities of the results to the He-3 concentration (0.1-4%) and the heating power (20-40 MW) are considered. Fusion born alphas dominate the total CTS signal for large Doppler shifts of the scattered radiation. The tritons generate a negligible fraction of the total fast ion CTS signal in any of these heating scenarios. The minority species He-3, however, contributes more than 10% of the fast ion CTS signal at locations close to the resonance layer for He-3 concentrations larger than similar to 1%. In this particular region in space for resolution of near perpendicular velocities, it may be difficult to draw conclusions about the physics of alpha particles alone by CTS. With this exception, the CTS diagnostic can reveal the physics of the fusion alphas in ITER even under the presence of fast ions due to ICRH.

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Scopus rating (2017): CiteScore 2.13 SJR 0.759 SNIP 1.424
Web of Science (2017): Impact factor 4.057
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 1.284 SNIP 1.416
Web of Science (2016): Impact factor 3.307
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.88 SJR 1.51 SNIP 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.2 SJR 1.907 SNIP 1.667
Web of Science (2014): Impact factor 3.062
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.83 SJR 1.366 SNIP 1.516
Web of Science (2013): Impact factor 3.243
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.81 SJR 1.441 SNIP 1.448
Web of Science (2012): Impact factor 2.734
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.78 SJR 2.043 SNIP 2.433
Web of Science (2011): Impact factor 4.09
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.268 SNIP 1.927
Web of Science (2010): Impact factor 3.303
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.993 SNIP 2.441
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.031 SNIP 1.736
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.005 SNIP 1.987
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.062 SNIP 1.937
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.885 SNIP 1.932
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.647 SNIP 1.673
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.215 SNIP 1.673
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 3.275 SNIP 1.409
Scopus rating (2001): SJR 2.159 SNIP 2.173
Industriens netværksamarbejde om leverancer til store forskningsanlæg

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B.
Publication date: 2009
Peer-reviewed: Unknown
Event: Paper presented at Konference om European Spallation Source Scandinavia, København, Denmark.
Keywords: Fusion energy
Source: orbit
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Research output: Communication › Paper – Annual report year: 2009

Investigation of fast-ion dynamics on ASDEX-Upgrade and TEXTOR using collective Thomson scattering

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Moseev, D., Korsholm, S. B., Meo, F.
Publication date: 2009

Publication information
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Research output: Research › Working paper – Annual report year: 2009

Measurements of the ion Bernstein wave spectrum in TEXTOR by means of collective Thomson scattering

General information
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Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Contributors: Stejner Pedersen, M., Korsholm, S. B., Bindslev, H., Furtula, V., Leipold, F., Meo, F., Michelsen, P., Moseev, D., Nielsen, S. K., Salewski, M.
Publication date: 2009
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Keywords: Fusion energy
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Research output: Research › Paper – Annual report year: 2009

mm-Wave Technology for the Collective Thomson Scattering Diagnostic

General information
State: Published
**Recent results of collective Thomson scattering on TEXTOR and plans for CTS on ITER**

Moving towards the era of burning fusion plasmas, a better knowledge of the physics of highly energetic particles, such as fusion born alpha particles, becomes essential. Diagnosing the fast ions in a fusion plasma is a challenging task, but the technique of collective Thomson scattering (CTS) provides the possibility of revealing the velocity distribution of the confined fast ions along a given direction – resolved both in time and space. Recently, the ITER baseline design has been expanded to include the enabling of the front end of a fast ion CTS diagnostic system resolving dynamics perpendicular to the magnetic field. The feasibility study and conceptual design of this diagnostic was provided by the CTS group at Risø DTU. The development of the ITER CTS diagnostic builds on the experiences and expertise gained from the construction and current operation of the CTS diagnostic systems on TEXTOR and ASDEX Upgrade. This contribution will briefly introduce the technique of CTS, give an overview of the results of the current diagnostic systems at TEXTOR, and present the chosen solution and the status of the design of the ITER CTS diagnostic system.

**General information**

State: Published
Organisations: Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme, Management
Contributors: Korsholm, S. B., Bindslev, H., Furtula, V., Leipold, F., Meo, F., Michelsen, P., Moseev, D., Nielsen, S. K., Salewski, M., Stejner Pedersen, M.
Publication date: 2009
Peer-reviewed: No
Recent Results of the Collective Thomson Scattering Diagnostic at TEXTOR

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Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Pages: P1.185
Publication date: 2009

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Title of host publication: Proceedings
Publisher: European Physical Society
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Keywords: Fusion energy
Electronic versions:
sbko EPS 2009 abstract_Final.pdf
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Source-ID: 253351
Research output: Research › Article in proceedings – Annual report year: 2009

Strong Scattering of High Power Millimeter Waves in Tokamak Plasmas with Tearing Modes
In tokamak plasmas with a tearing mode, strong scattering of high power millimeter waves, as used for heating and noninductive current drive, is shown to occur. This new wave scattering phenomenon is shown to be related to the passage of the O point of a magnetic island through the high power heating beam. The density determines the detailed phasing of the scattered radiation relative to the O-point passage. The scattering power depends strongly nonlinearly on the heating beam power. ©2009 The American Physical Society

General information
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Peer-reviewed: Yes

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Journal: Physical Review Letters
Volume: 103
Issue number: 12
ISSN (Print): 0031-9007
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.58 SJR 3.622 SNIP 2.464
Web of Science (2017): Impact factor 8.839
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.33 SJR 4.196 SNIP 2.61
Web of Science (2016): Impact factor 8.462
A line-of-sight electron cyclotron emission receiver for electron cyclotron resonance heating feedback control of tearing modes

An electron cyclotron emission (ECE) receiver inside the electron cyclotron resonance heating (ECRH) transmission line has been brought into operation. The ECE is extracted by placing a quartz plate acting as a Fabry-Perot interferometer under an angle inside the electron cyclotron wave (ECW) beam. ECE measurements are obtained during high power ECRH operation. This demonstrates the successful operation of the diagnostic and, in particular, a sufficient suppression of the gyrotron component preventing it from interfering with ECE measurements. When integrated into a feedback system for the control of plasma instabilities this line-of-sight ECE diagnostic removes the need to localize the instabilities in absolute coordinates. (C) 2008 American Institute of Physics.
The programme of the Research Unit of the Fusion Association Euratom - Risø National Laboratory, Technical University of Denmark, covers work in fusion plasma physics and in fusion technology. The fusion plasma physics research focuses on turbulence and transport, and its interaction with the plasma equilibrium and particles. The effort includes both first principles based modelling, and experimental observations of turbulence and of fast ion dynamics by collective Thomson scattering. The activities in technology on investigations of radiation damage of fusion reactor materials have been phased out during 2007. Minor activities are system analysis, initiative to involve Danish industry in ITER contracts and public information. A summary is presented of the results obtained in the Research Unit during 2007.

Collective Thomson scattering for ITER

The collective Thomson scattering (CTS) diagnostic installed on ASDEX Upgrade uses millimeter waves generated by the newly installed 1 MW dual frequency gyrotron as probing radiation at 105 GHz. It measures backscattered radiation with a heterodyne receiver having 50 channels (between 100 and 110 GHz) to resolve the one-dimensional velocity distribution of the confined fast ions. The steerable antennas will allow different scattering geometries to fully explore the anisotropic fast ion distributions at different spatial locations. This paper covers the capabilities and operational limits of the diagnostic. It then describes the commissioning activities carried out to date. These activities include gyrotron studies, transmission line alignment, and beam pattern measurements in the vacuum vessel. Overlap experiments in near perpendicular and near parallel have confirmed the successful alignment of the system. First results in near perpendicular of scattered spectra in a neutral beam injection (NBI) and ion cyclotron resonance heating (ICRH) plasma (minority hydrogen) on ASDEX Upgrade have shown evidence of ICRH heating phase of hydrogen. ©2008 American Institute of Physics.
Fast Ion Collective Thomson Scattering Diagnostic for ITER: Progress of Design

In the era of high power and burning plasma fusion experiments with significant populations of fast particles, the diagnosis of fast ion dynamics becomes an important topic. In ITER, populations of fast ions due to ICRH and NBI, as well as fusion born alphas will carry a significant fraction of the free energy of the plasma. This may affect instabilities and transport in the plasma. A key candidate for diagnosing confined fast ions in ITER is the technique of collective Thomson scattering (CTS). A fast ion CTS system with a probing frequency of 60 GHz has been proposed for ITER. Based on diagnostic experience from particularly TEXTOR and ASDEX Upgrade, work is now progressing towards a final design of a fast ion CTS diagnostic for ITER. The biggest challenge of the diagnostic design is the HFS receiver located in the restricted space behind the blanket modules. Calculations and a series of mock-up measurements have brought the design towards a four mirror quasi-optical solution. The development as well as the present design will be presented.

Fast ion collective Thomson scattering diagnostic for ITER: Design elements

The proposed fast ion collective Thomson scattering (CTS) diagnostic system for ITER provides the unique capability of measuring the temporally and spatially resolved velocity distribution of the confined fast ions and fusion alpha particles in a burning ITER plasma. The present paper describes the status of the iteration toward the detailed design of the ITER fast ion CTS diagnostic and explains in detail a number of essential considerations and challenges. The diagnostic consists of two separate receiving systems. One system measures the fast ion velocity component in the direction near perpendicular, and the other measures the component near parallel to the magnetic field. Each system has a high-power probe beam at an operating frequency of 60 GHz and a receiver unit. In order to prevent neutron damage to moveable parts, the geometry of the probes and receivers is fixed. An array of receivers in each receiving unit ensures simultaneous measurements in multiple scattering volumes. The latter receiving system (resolving the parallel component) is located on the high field side (HFS) of the plasma, and this constitutes a significant challenge. This HFS receiving unit has been central in the studies, and new HFS receiver mock-up measurements are presented as well as neutron flux calculations of the influence of the increased slot height.
Fast ion collective Thomson scattering diagnostics on TEXTOR, ASDEX upgrade, and ITER

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B.
Publication date: 2008
Peer-reviewed: No
Keywords: Fusion energy
Source: orbit
Source-ID: 215509
Research output: Research - peer-review › Conference article – Annual report year: 2007

Fast ion CTS diagnostic for ITER - state of design

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Leipold, F., Bindslev, H., Korsholm, S. B., Meo, F., Michelsen, P., Michelsen, S., Nielsen, S. K., Salewski, M.
Publication date: 2008

Host publication information
Title of host publication: Proceedings
Place of publication: Paris
Publisher: European Physical Society
(Europhysics Conference Abstracts, Vol. 31F).
Electronic versions:
2008_14.pdf

Bibliographical note
Europhysics Conference Abstracts, vol. 31F
Pagination: P-1.159 (4 pages)
Source: orbit
Source-ID: 223095
Research output: Research › Article in proceedings – Annual report year: 2008

Fast ion CTS diagnostic for ITER - State of design

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Contributors: Leipold, F., Bindslev, H., Furtula, V., Korsholm, S. B., Meo, F., Michelsen, P., Michelsen, S., Nielsen, S. K., Salewski, M.
Pages: 1038-1041
Publication date: 2008

Host publication information
Title of host publication: Proceedings
Fast Ion Dynamics in ITER Measured by the Collective Thomson Scattering Diagnostic

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Contributors: Korsholm, S. B., Bindslev, H., Furtula, V., Leipold, F., Meo, F., Michelsen, P., Olesen, M. R. H., Salewski, M.
Publication date: 2008
Peer-reviewed: No
Event: Poster session presented at 13th EU-US TTF workshop 2008 and 1st EFDA Transport Topical Group Meeting, Copenhagen, Denmark.
Source: orbit
Research output: Research › Poster – Annual report year: 2008

Fast Ion Transport Measured by Collective Thomson Scattering

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Publication date: 2008
Peer-reviewed: No
Event: Poster session presented at 13th EU-US TTF workshop 2008 and 1st EFDA Transport Topical Group Meeting, Copenhagen, Denmark.
Source: orbit
Research output: Research › Poster – Annual report year: 2008

First results of the TEXTOR line of sight ECE system for ECRH feedback

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Publication date: 2008

Host publication information
Title of host publication: Proceedings
Place of publication: San Diego
Publisher: General Atomics
Source: orbit
Source-ID: 231623
Research output: Research › Article in proceedings – Annual report year: 2008

First scattering results of the Collective Thomson Scattering (CTS) diagnostic on ASDEX upgrade

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy, Management
Investigation of first mirror heating for the collective Thomson scattering diagnostic in ITER

Collective Thomson scattering (CTS) has the capabilities to measure phase space densities of fast ion populations in ITER resolved in configuration space, in velocity space, and in time. In the CTS system proposed for ITER, probing radiation at 60 GHz generated by two 1 MW gyrotrons is scattered in the plasma and collected by arrays of receivers. The transmission lines from the gyrotrons to the plasma and from the plasma to the receivers contain several quasioptical mirrors among other components. These are designed to produce astigmatic beam patterns in the plasma where the beam shapes will have a direct impact on the signal strength of the diagnostic, the spatial resolution, and the robustness of probe and receiver beam overlap against density excursions. The first mirror has a line of sight to the plasma and is thus exposed to severe neutron streaming. The present neutronics and thermomechanical modeling of a first mirror on the high field side indicates that the mirror curvature may warp due to heating. This may alter the beam quality, and therefore, thermal effects have to be accounted for during the design of the mirror. The modeling further demonstrates that thin mirrors are superior to thick mirrors from a thermomechanical point of view. ©2008 American Institute of Physics
Temporal evolution of confined fast-ion velocity distributions measured by collective Thomson scattering in TEXTOR

Fast ions created in the fusion processes will provide up to 70% of the heating in ITER. To optimize heating and current drive in magnetically confined plasmas insight into fast-ion dynamics is important. First measurements of such dynamics by collective Thomson scattering (CTS) were recently reported [Bindslev, Phys. Rev. Lett. 97, 205005 2006]. Here we extend the discussion of these results which were obtained at the TEXTOR tokamak. The fast ions are generated by neutral-beam injection and ion-cyclotron resonance heating. The CTS system uses 100-150 kW of 110-GHz gyrotron probing radiation which scatters off the collective plasma fluctuations driven by the fast-ion motion. The technique measures the projected one-dimensional velocity distribution of confined fast ions in the scattering volume where the probe and receiver beams cross. By shifting the scattering volume a number of scattering locations and different resolved velocity components can be measured. The temporal resolution is 4 ms while the spatial resolution is similar to 10 cm depending on the scattering geometry. Fast-ion velocity distributions in a variety of scenarios are measured, including the evolution of the velocity distribution after turnoff of the ion heating. These results are in close agreement with numerical simulations.
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.14 SJR 0.979 SNIP 0.987
Web of Science (2017): Impact factor 2.284
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 1.95 SJR 1.271 SNIP 1.018
Web of Science (2016): Impact factor 2.366
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 1.89 SJR 1.183 SNIP 1.043
Web of Science (2015): Impact factor 2.252
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 2.05 SJR 1.244 SNIP 1.135
Web of Science (2014): Indexed yes
Scopus rating (2013): CiteScore 2.28 SJR 1.307 SNIP 1.214
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 2.28 SJR 1.414 SNIP 1.205
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 2.28 SJR 1.48 SNIP 1.211
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Scopus rating (2010): SJR 1.692 SNIP 1.203
Web of Science (2010): Indexed yes
Scopus rating (2009): SJR 1.708 SNIP 1.246
Web of Science (2009): Indexed yes
Scopus rating (2008): SJR 1.972 SNIP 1.298
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.615 SNIP 1.063
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.266 SNIP 0.867
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.204 SNIP 0.795
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.194 SNIP 0.907
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.366 SNIP 1.127
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.962 SNIP 1.106
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.904 SNIP 1.637
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.84 SNIP 1.249
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.88 SNIP 1.225

Original language: English
Keywords: FLUCTUATIONS, TOROIDAL PLASMAS, EXCITATION, JET, DIAGNOSTICS, WAVES, TOKAMAK, PARTICLE ENERGY, RADIATION, TEMPERATURE

Electronic versions:
Nielsen.pdf
DOIs:
10.1103/PhysRevE.77.016407
URLs:

Bibliographical note
The TEXTOR line-of-sight ECE system for feedback controlled ECRH power deposition

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Pages: 1081-1085
Publication date: 2008

Host publication information
Title of host publication: Proceedings
Place of publication: Paris
Publisher: European Physical Society (Europhysics Conference Abstracts, Vol. 32D).

Collective Thomson Scattering diagnostics of confined fast ions

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy, Optics and Plasma Research Department, Plasma Physics and Technology, Technical University of Denmark
Publication date: 2007
Peer-reviewed: No
Event: Abstract from 12th Meeting of the ITPA Topical Group on Diagnostics, Princeton, United States.

Commissioning a microwave based Collective Thomson Scattering (CTS) diagnostic on ASDEX-upgrade

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy, Technical University of Denmark
Contributors: Meo, F., Bindslev, H., Korsholm, S., Leuterer, F., Michelsen, P., Michelsen, S., Nielsen, S., Pedersen, J., Stober, J., Woskov, P.
Publication date: 2007
Peer-reviewed: No

Danish industry and ITER

General information
Design of a dedicated ECE diagnostic for feedback control of instabilities by ECRH

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy
Pages: 232-237
Publication date: 2007
Host publication information
Title of host publication: Proceedings of the Joint workshop on electron cyclotron emission and electron cyclotron resonance heating (EC-14)
Place of publication: Athens
Publisher: Heliotopos Conferences Ltd.
Editor: Lazaros, A.
ISBN (Print): 960-89228-2-8
Source: orbit
Source-ID: 215783
Research output: Research - peer-review › Article in proceedings – Annual report year: 2007

Energy supply technologies. Fusion energy

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy
Contributors: Michelsen, P., Cardozo, N., Korsholm, S. B.
Pages: 63-66
Publication date: 2007
Host publication information
Title of host publication: Risø energy report 6. Future options for energy technologies
Publisher: Risø National Laboratory
Editors: Larsen, H., Sønderberg Petersen, L.
ISBN (Print): 978-87-550-3611-6
(Denmark. Forskningscenter Risoe. Risoe-R; No. 1612(EN)).
Keywords: Risø-R-1612(EN), Risø-R-1612
Electronic versions:
ris_r_1612.pdf
Source: orbit
Source-ID: 215901
Research output: Research - peer-review › Book chapter – Annual report year: 2007

Fast ion behaviour in TEXTOR measured by collective Thomson scattering (CTS)

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy, Technical University of Denmark
Fast ion collective Thomson scattering (CTS) diagnostic results at TEXTOR, ASDEX upgrade, and status of the CTS design at ITER

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy
Publication date: 2007
Peer-reviewed: No
Source: orbit
Source-ID: 215807
Research output: Research › Paper – Annual report year: 2007

Fast ion collective Thomson scattering diagnostic for ITER

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy
Pages: 227-231
Publication date: 2007
Peer-reviewed: No
Event: Abstract from 12th Meeting of the ITPA Topical Group on Diagnostics, Princeton, United States.
Source: orbit
Source-ID: 215784
Research output: Research › Conference abstract for conference – Annual report year: 2007

Host publication information
Title of host publication: Proceedings of the Joint workshop on electron cyclotron emission and electron cyclotron resonance heating (EC-14)
Place of publication: Athens
Publisher: Heliotopos Conferences Ltd.
Editor: Lazaros, A.
ISBN (Print): 960-89228-2-8
Source: orbit
Source-ID: 215784
Research output: Research › Article in proceedings – Annual report year: 2007

Fast Ion Collective Thomson Scattering diagnostic for ITER

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy, Optics and Plasma Research Department, Plasma Physics and Technology, Technical University of Denmark
Contributors: Korsholm, S., Bindslev, H., Leipold, F., Meo, F., Michelsen, P., Michelsen, S., Nielsen, A., Tsakadze, E., Woskov, P.
Publication date: 2007
Peer-reviewed: No
Event: Abstract from 12th Meeting of the ITPA Topical Group on Diagnostics, Princeton, United States.
URLs:
Source: orbit
Source-ID: 215602
Research output: Research › Conference abstract for conference – Annual report year: 2007
Fast ion collective Thomson scattering diagnostic for ITER - progress of design

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy, Technical University of Denmark
Contributors: Korsholm, S., Bindslev, H., Furtula, V., Leipold, F., Meo, F., Michelsen, P., Michelsen, S., Nielsen, S. K., Renby, J., Salewski, M., Tsakadze, E.
Publication date: 2007
Peer-reviewed: No
Event: Abstract from International Conference on Burning Plasma Diagnostics, Varenna, Italy.
URLs:
Source: orbit
Source-ID: 215801
Research output: Research › Conference abstract for conference – Annual report year: 2007

Fast ion CTS diagnostic for ITER - state of design

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy, Technical University of Denmark
Contributors: Leipold, F., Bindslev, H., Korsholm, S., Meo, F., Michelsen, P., Michelsen, S., Nielsen, A., Salewski, M.
Pages: 732-735
Publication date: 2007

Host publication information
Title of host publication: 34th EPS Conference on Plasma Physics- Europhysics Conference Abstracts
Volume: 31
ISBN (Print): 978-162276334-4
Source: orbit
Source-ID: 216173
Research output: Research › Conference abstract in proceedings – Annual report year: 2007

Fast ion dynamics in magnetically confined plasma measured by collective Thomson scattering

General information
State: Published
Organisations: Management, Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology, Optics and Plasma Research Department
Number of pages: 8
Pages: S1023
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Plasma Fusion Research
Volume: 2
ISSN (Print): 1880-6821
Ratings:
Web of Science (2019): Indexed yes
Scopus rating (2017): CiteScore 0.54 SJR 0.273 SNIP 0.502
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 0.42 SJR 0.44 SNIP 0.717
Scopus rating (2015): CiteScore 0.39 SJR 0.393 SNIP 0.573
Scopus rating (2014): CiteScore 0.31 SJR 0.299 SNIP 0.479
Scopus rating (2013): CiteScore 0.3 SJR 0.197 SNIP 0.29
ISI indexed (2013): ISI indexed no
Fast-ion dynamics in the TEXTOR tokamak measured by collective Thomson scattering

The dynamics of fast ion populations in the TEXTOR tokamak are measured by collective Thomson scattering of millimetre wave radiation generated by a gyrotron operated at 110 GHz and 100-150 kW. Temporal evolution of the energetic ion velocity distribution at switch on of neutral beam injection (NBI) and the slowdown after switch off of NBI are measured. The turn on phase of the NBI has, furthermore, been measured in plasmas with a range of electron densities and temperatures. All of these measurements are shown to be in good agreement with simple Fokker-Planck modelling. Bulk ion rotation velocity is also measured.

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology, Optics and Plasma Research Department
Pages: B551-B562
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Plasma Physics and Controlled Fusion
Volume: 49
Issue number: 12B
ISSN (Print): 0741-3335
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.74 SJR 0.69 SNIP 1.243
Web of Science (2017): Impact factor 3.032
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
Web of Science (2016): Impact factor 2.392
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 1.314 SNIP 1.345
Web of Science (2015): Impact factor 2.404
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.61 SJR 1.542 SNIP 1.346
Web of Science (2014): Impact factor 2.186
Fast ions in fusion plasmas measured by CTS

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy, Technical University of Denmark
Fusion - a future energy option

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy
Publication date: 2007
Peer-reviewed: No
Event: Paper presented at Internal DTU conference on future energy research at the Technical University of Denmark, Roskilde, Denmark.
Source: orbit
Source-ID: 215808
Research output: Research › Paper – Annual report year: 2007

ITER fast ion collective Thomson scattering. Conceptual design of 60 GHz system
The collective Thomson scattering diagnostic for ITER at the 60 GHz range is capable of measuring the fast ion distribution parallel and perpendicular to the magnetic field at different radial locations simultaneously. The design is robust technologically with no moveable components near the plasma. The fast ion CTS diagnostic consists of two separate systems. Each system has its own RF launcher and separate set of detectors. The first system measures the perpendicular component of the fast ion velocity distribution. It consists of radially directed RF launcher and receiver, both located in the equatorial port on the low field side (LFS). This system will be referred to by the acronym LFS-BS system referring to the location of the receiver and the fact that it measures backscattered radiation. The second part of the CTS diagnostic measures the parallel component of the fast ion distribution. It consists of an RF launcher located in the mid-plane port on the LFS and a receiver mounted on the inner vacuum vessel wall that views the plasma from between two blanket modules. This system will be referred to as HFS-FS referring to the location of the receivers and that they measure forward scattered radiation. The design of both LFS-BS and HFS-FS receivers is aimed at measuring at different spatial locations simultaneously with no moveable components near the plasma. This report is a preliminary study of the hardware design and engineering constraints for this frequency range. Section 2 conceptually describes the two systems and their main components. Section 3 clarifies the impact of design parameters such as beam widths and scattering angle on the CTS measurements. With this in hand, the ITER measurement requirements are translated into constraints on the CTS system designs. An important result in this section is that systems can be designed inside these constraints. Section 4 outlines the technical feasibility and describes in more detail the design and the engineering constraints of each system. Section 5 briefly describes an upgrade to the CTS diagnostic to permit fuel ion density ratio measurements with the same probe line and system front-end. Finally, Section 6 outlines future work needed to address issues related to the hardware and design.

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy
Contributors: Meo, F., Bindslev, H., Korsholm, S. B.
Number of pages: 40
Publication date: 2007

Publication information
Place of publication: Roskilde, Denmark
Publisher: Risø National Laboratory
ISBN (Print): 978-87-550-3587-4
Original language: English
(Denmark. Forskningscenter Risoe. Risoe-R; No. 1600(EN)).
Neutral beam start-up dynamics on TEXTOR measured by collective Thomson scattering (CTS)

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy, Technical University of Denmark
Contributors: Nielsen, S., Bindslev, H., Hoekzema, J., Korsholm, S., Leipold, F., Meo, F., Michelsen, P., Michelsen, S., Oosterbeek, H., Tsakadze, E., Westerhof, E., Woskov, P.
Publication date: 2007
Peer-reviewed: No
URLs:
Source: orbit
Source-ID: 216175
Research output: Research › Conference abstract for conference – Annual report year: 2007

Preliminary results from the Collective Thomson Scattering (CTS) diagnostic on ASDEX upgrade

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy, Technical University of Denmark
Contributors: Korsholm, S., Meo, F., Bindslev, H., Leipold, F., Leuterer, F., Manini, A., Michelsen, P., Nielsen, S., Salewski, M., Stober, J., Tsakadze, E., Wagner, D., Woskov, P.
Publication date: 2007
Peer-reviewed: No
Event: Abstract from 13. Meeting of the ITPA topical group on diagnostics, Chengdu (CN), .
URLs:
Source: orbit
Source-ID: 215604
Research output: Research › Conference abstract for conference – Annual report year: 2007

Recent fast ion measurements by collective Thomson scattering (CTS) at the TEXTOR tokamak

General information
State: Published
Organisations: Plasma Physics and Technology, Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy
Pages: 9-14
Publication date: 2007

Host publication information
Title of host publication: Proceedings
Place of publication: Toki
Publisher: National Institute for Fusion Science
Editor: Kawahatqa, K.
(NIFS-PROC-68).
Source: orbit
Source-ID: 215747
Research output: Research › Article in proceedings – Annual report year: 2007
Research issues regarding the collective Thomson scattering diagnostic for ITER

General information
State: Published
Organisations: Plasma Physics and Technology, Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Salewski, M., Bindslev, H., Furtula, V., Korsholm, S. B., Leipold, F., Meo, F., Michelsen, P.
Publication date: 2007
Peer-reviewed: No
Event: Abstract from 3rd Annual meeting Danish Physical Society, Nyborg, Denmark.
Source: orbit
Source-ID: 216258
Research output: Research › Conference abstract for conference – Annual report year: 2007

The effect of RF- and NBI-driven fast ions in ITER on various diagnostics

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology, Optics and Plasma Research Department, Technical University of Denmark
Publication date: 2007
Peer-reviewed: No
Source: orbit
Source-ID: 215603
Research output: Research › Paper – Annual report year: 2007

Current experiments on fast ion collective Thomson scattering at TEXTOR and ASDEX upgrade, and ITER plans (invited talk)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2006
Peer-reviewed: Yes
Source: orbit
Source-ID: 309853
Research output: Research › Conference abstract for conference – Annual report year: 2006

Current fast ion collective Thomson scattering diagnostics at TEXTOR and ASDEX Upgrade, and ITER plans (invited)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Pages: 10E514 (7 pages)
Publication date: 2006
Peer-reviewed: Yes
Publication information
Journal: Review of Scientific Instruments
Volume: 77
ISSN (Print): 0034-6748
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Web of Science (2014): Impact factor 1.614
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.28 SJR 0.9 SNIP 1.099
Web of Science (2013): Impact factor 1.584
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.45 SJR 1.017 SNIP 1.277
Web of Science (2012): Impact factor 1.602
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.43 SJR 0.868 SNIP 1.108
Web of Science (2011): Impact factor 1.367
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.218 SNIP 1.405
Web of Science (2010): Impact factor 1.601
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.001 SNIP 1.061
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.274 SNIP 1.344
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.922 SNIP 1.023
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.153 SNIP 1.297
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.883 SNIP 1.044
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.13 SNIP 1.393
Design of a dedicated ECE diagnostic for feedback control of instabilities by ECRH (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2006
Peer-reviewed: No
URLs:
Source: orbit
Source-ID: 309296
Research output: Research › Conference abstract for conference – Annual report year: 2006

Fast ion collective Thomson scattering diagnostic for ITER (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2006
Peer-reviewed: No
URLs:
Source: orbit
Source-ID: 309297
Research output: Research › Poster – Annual report year: 2006

Fast-ion dynamics in the TEXTOR tokamak measured by collective Thomson scattering

Here we present the first measurements by collective Thomson scattering of the evolution of fast-ion populations in a magnetically confined fusion plasma. 150 kW and 110 Ghz radiation from a gyrotron were scattered in the TEXTOR tokamak plasma with energetic ions generated by neutral beam injection and ion cyclotron resonance heating. The temporal behavior of the spatially resolved fast-ion velocity distribution is inferred from the received scattered radiation. The fast-ion dynamics at sawteeth and the slowdown after switch off of auxiliary heating is resolved in time. The latter is shown to be in close agreement with modeling results.

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Frequency measurements of the gyrotrons used for collective Thomson scattering diagnostics at TEXTOR and ASDEX Upgrade

**General information**
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Pages: 10E524 (4 pages)
Publication date: 2006
Peer-reviewed: Yes

**Publication information**
Journal: Review of Scientific Instruments
Volume: 77
ISSN (Print): 0034-6748
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Web of Science (2014): Impact factor 1.614
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.28 SJR 0.9 SNIP 1.099
Web of Science (2013): Impact factor 1.584
Isi indexed (2013): Isi indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.45 SJR 1.017 SNIP 1.277
Web of Science (2012): Impact factor 1.602
Isi indexed (2012): Isi indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.43 SJR 0.868 SNIP 1.108
Web of Science (2011): Impact factor 1.367
Isi indexed (2011): Isi indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.218 SNIP 1.405
Web of Science (2010): Impact factor 1.601
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.001 SNIP 1.061
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.274 SNIP 1.344
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.922 SNIP 1.023
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.153 SNIP 1.297
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.883 SNIP 1.044
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.13 SNIP 1.393
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.994 SNIP 1.301
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.02 SNIP 1.015
Scopus rating (2001): SJR 1.13 SNIP 1.301
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.022 SNIP 1.051
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.979 SNIP 1.043
Original language: English
DOIs:
10.1063/1.2347694
Source: orbit
Source-ID: 309687
Research output: Research - peer-review › Conference article – Annual report year: 2006

Gyrotron frequency measurements for fast ion CTS diagnostics at TEXTOR and ASDEX upgrade (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
ITER - "vejen til fremtidens uudtømmelige energikilde - fusionsenergi

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B.
Publication date: 2006
Peer-reviewed: No
Source: orbit
Source-ID: 309971
Research output: Research › Conference abstract for conference – Annual report year: 2006

Measurements of fast ions in fusion experiments

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Nielsen, S., Bindslev, H., Hoekzema, J., Korsholm, S. B., Meo, F., Michelsen, P., Michelsen, S.,
Oosterbeek, H., Tsakadze, E., Westerhof, E., Woskov, P.
Publication date: 2006
Peer-reviewed: No
Event: Abstract from Danish Physical Society Annual Meeting 2006, Nyborg, Denmark.
Source: orbit
Source-ID: 309486
Research output: Research › Conference abstract for conference – Annual report year: 2006

Progress on the fast ion millimetre wave CTS diagnostics on TEXTOR and ASDEX upgrade and status of the CTS design for ITER

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Tsakadze, E., Bindslev, H., Korsholm, S. B., Leipold, F., Meo, F., Michelsen, P., Michelsen, S., Nielsen, S.,
Woskov, P., Hoekzema, J., Oosterbeek, H., Westerhof, E., Leuterer, F.
Publication date: 2006

Host publication information
Title of host publication: Proceedings
Place of publication: Paris
Publisher: European Physical Society (Europhysics Conference Abstracts, Vol. 30I).
URLs:
Source: orbit
Source-ID: 309854
Research output: Research › Article in proceedings – Annual report year: 2006

Progress towards a fast ion collective Thomson scattering diagnostic for ITER

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2006
Peer-reviewed: No
URLs:
Source: orbit
Source-ID: 309852
Research output: Research › Conference abstract for conference – Annual report year: 2006

Fast ion behaviour measured from CTS (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2005

Host publication information
Title of host publication: Contributed papers
Place of publication: Paris
Publisher: European Physical Society
(Europhysics Conference Abstracts, Vol. 29C).
Source: orbit
Source-ID: 308700
Research output: Research › Article in proceedings – Annual report year: 2005

Fast ion collective Thomson scattering on TEXTOR and ASDEX upgrade

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2005
Peer-reviewed: No
Source: orbit
Source-ID: 308659
Research output: Research › Conference abstract for conference – Annual report year: 2005

Frequency measurements of the 110 GHz gyrotron used for fast ion CTS diagnostics at TEXTOR

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Woskov, P., Korsholm, S. B., Meo, F., Tsakadze, E., Oosterbeek, H., Jakubowska, K., Scholten, J., Tito, C.
Publication date: 2005
Peer-reviewed: No
Event: Abstract from 47th Annual Meeting of the Division of Plasma Physics, Denver, CO, United States.
URLs:
http://www.risoe.dtu.dk/rispubl/OFD/ofdpdf/opl_1_2006.pdf
Source: orbit
Source-ID: 308658
Research output: Research › Conference abstract for conference – Annual report year: 2005

Overview of core diagnostics for TEXTOR

General information
State: Published
**Preliminary results of the new fast ion CTS systems at TEXTOR and ASDEX upgrade**

**General information**
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2005
Peer-reviewed: No
Event: Abstract from 47th Annual Meeting of the Division of Plasma Physics, Denver, CO, United States.
URLs:
Source: orbit
Source-ID: 308657
Research output: Research › Conference abstract for conference – Annual report year: 2005

**Progress of the CTS diagnostics on TEXTOR and ASDEX upgrade (poster)**

**General information**
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2005

**Host publication information**
Title of host publication: Contributed papers
Place of publication: Paris
Publisher: European Physical Society (Europhysics Conference Abstracts, Vol. 29C).
Source: orbit
Source-ID: 308699
Research output: Research › Article in proceedings – Annual report year: 2005

**Design of the collective Thomson scattering diagnostic for International Thermonuclear Experimental Reactor at the 60 GHz frequency range**

**General information**
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Pages: 3585-3588
Publication date: 2004
Peer-reviewed: Yes

**Publication information**
Journal: Review of Scientific Instruments
Volume: 75
Design of the collective Thomson scattering diagnostic for ITER at the 60 GHz frequency range

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Meo, F., Bindslev, H., Korsholm, S. B., Tsakadze, E., Walker, C., Woskov, P.
Publication date: 2004
Peer-reviewed: No
Source: orbit
Source-ID: 306814
Research output: Research › Conference abstract for conference – Annual report year: 2004

Diagnosing fast ions in ITER by collective Thomson scattering (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Bindslev, H., Meo, F., Korsholm, S. B., Egedal, J., Michelsen, S., Nielsen, S., Woskov, P.
Publication date: 2004

Host publication information
Title of host publication: Contributed papers
Place of publication: Paris
Publisher: European Physical Society
(Europhysics Conference Abstracts, Vol. 28B).
Source: orbit
Source-ID: 307014
Research output: Research › Article in proceedings – Annual report year: 2004

Fast ion CTS for ITER

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Bindslev, H., Meo, F., Korsholm, S. B., Woskov, P., Egedal, J.
Publication date: 2004
Peer-reviewed: No
Source: orbit
Source-ID: 306816
Research output: Research › Conference abstract for conference – Annual report year: 2004
Collective Thomson scattering (CTS) diagnostic systems for measuring fast ions in TEXTOR and ASDEX Upgrade are described in this article. Both systems use millimeter waves generated by gyrotrons as probing radiation and the scattered radiation is detected with heterodyne receivers having 40 spectral channels at TEXTOR and 50 spectral channels at ASDEX Upgrade. The antenna patterns of probe and receiver, both steerable, determine size and location of the measuring volume, and the direction of the resolved fast ion velocity. With overmoded transmission lines, consisting of waveguides and quasioptical mirrors, the antenna patterns depend on the alignment of the entire transmission line. Alignment is aided by visible laser beams relayed by small optical mirrors, inserted in the quasioptical mirrors. (C) 2004 American Institute of Physics.
Fast ion millimeter wave CTS diagnostic installation activities on TEXTOR and ASDEX upgrade (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2004

Host publication information
Title of host publication: Book of abstracts
Publisher: American Physical Society, Division of Plasma Physics
Source: orbit
Source-ID: 307252
Research output: Research › Conference article – Annual report year: 2004

Fast ion millimeter wave CTS diagnostics on TEXTOR and ASDEX upgrade

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Fast ion millimeter wave CTS diagnostics on TEXTOR and ASDEX upgrade (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2004

Host publication information
Title of host publication: Contributed papers
Place of publication: Paris
Publisher: European Physical Society
(Europhysics Conference Abstracts, Vol. 28B).
Source: orbit
Source-ID: 307016
Research output: Research › Article in proceedings – Annual report year: 2004

Feasibility study of fast ion diagnosis in ITER by collective Thomson scattering, millimeter waves to CO₂ laser

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Bindslev, H., Meo, F., Tsakadze, E., Korsholm, S. B., Woskov, P.
Pages: 3598-3600
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Review of Scientific Instruments
Volume: 75
ISSN (Print): 0034-6748
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.32 SJR 0.585 SNIP 0.858
Web of Science (2017): Impact factor 1.428
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.11 SJR 0.686 SNIP 0.908
Web of Science (2015): Impact factor 1.336
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.45 SJR 0.972 SNIP 1.261
Feasibility study of fast ion diagnosis in ITER by collective Thomson scattering, mm-waves to CO₂ laser

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Diagnosing fast ions in ITER with collective Thomson scattering

**General information**
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2003
Peer-reviewed: No
Source: orbit
Source-ID: 306813
Research output: Research › Conference abstract for conference – Annual report year: 2004

Fast ion dynamics measured by collective Thomson scattering

**General information**
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2003
Peer-reviewed: No
Event: Abstract from 4. Meeting of the ITPA Topical Group on Diagnostics, Padova (IT), 17-21 Feb, .
Source: orbit
Source-ID: 306514
Research output: Research › Conference abstract for conference – Annual report year: 2003

Fast ion millimeter wave CTS diagnostics on TEXTOR and ASDEX (poster)

**General information**
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Pages: 84
Publication date: 2003
Peer-reviewed: Yes

**Publication information**
Volume: 47
Issue number: 9
ISSN (Print): 0003-0503
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
URLs:
http://www.aps.org/meet/DPP02/baps/abs/G400107.html
Source: orbit
Source-ID: 305242
Research output: Research - peer-review › Conference abstract in journal – Annual report year: 2003
Fast ion millimeter wave CTS diagnostics on TEXTOR and ASDEX upgrade

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B.
Publication date: 2003
Peer-reviewed: No
Event: Abstract from Seminar at ELVA-1 Millimeter Wave Division (DOK Ltd.), St. Petersburg (RU), 10 Jul,.
Source: orbit
Source-ID: 305704
Research output: Research › Conference abstract for conference – Annual report year: 2003

Fast ion millimeter wave CTS diagnostics on TEXTOR and ASDEX upgrade (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Publication date: 2003

Host publication information
Title of host publication: Contributed papers (on CD-ROM)
Place of publication: Paris
Publisher: European Physical Society
(Europhysics Conference Abstracts, Vol. 27A).
Source: orbit
Source-ID: 305701
Research output: Research › Article in proceedings – Annual report year: 2003

Implementation of fast ion millimeter wave CTS diagnostics on TEXTOR and ASDEX upgrade

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Bindslev, H., Meo, F., Korsholm, S. B.
Publication date: 2003
Peer-reviewed: No
Event: Abstract from 45th Annual Meeting of the Division of Plasma Physics, Albuquerque, NM, United States.
Source: orbit
Source-ID: 306190
Research output: Research › Conference abstract for conference – Annual report year: 2003

ITER Fast Ion Collective Thomson Scattering: Feasibility study

In this report we investigate the feasibility of diagnosing the fast ions in ITER by collective Thomson scattering (CTS), exploring and comparing the diagnostic potentials of CTS systems based on a range of different probe frequencies. In the first section we first recall the requirements for measurements of the confined fusion alpha particles in ITER set by the ITER team. Then we outline the considerations, which enter into the selection and evaluation of CTS systems. System definition includes choice of probe frequency, geometry of probe and receiver beam patterns and probe power, but ultimately covers many more details. Here we introduce terms and methods used in the more detailed system evaluations later in the report. In Sections 2 through 5 we consider four different types of CTS systems, which differ by the ranges in which their probe frequencies lie. In Section 6 we summarize and compare the diagnostic potentials uncovered in the preceding four sections. A number of more detailed discussions are placed in appendices along with supporting material.

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy, Optics and Plasma Research Department
Contributors: Bindslev, H., Meo, F., Korsholm, S. B.
Number of pages: 144
Coherent structures and transport in drift wave plasma turbulence

Fusion energy research aims at developing fusion power plants providing safe and clean energy with abundant fuels. Plasma turbulence induced transport of energy and particles is a performance limiting factor for fusion devices. Hence the understanding of plasma turbulence is important for optimization. The present work is a part of the puzzle to understand the basic physics of transport induced by drift wave turbulence in the edge region of a plasma. The basis for the study is the Hasegawa- Wakatani model. Simulation results for 3D periodic and nonperiodic geometries are presented. The Hasegawa-Wakatani model is further expanded to include ion temperature effects. Another expansion of the model is derived from the Braginskii electron temperature equation. The result is a self-consistent set of equations describing the dynamical evolution of the drift wave fluctuations of the electron density, electron temperature and the potential in the presence of density and temperature gradients. 3D simulation results of the models are presented. Finally, the construction and first results from the MAST fluctuation reflectometer is described. The results demonstrate how L- to H-mode transitions as well as edge-localized-modes can be detected by the relatively simple diagnostic system.

Analysis of determination of Reynolds stress in drift wave turbulence (poster)

General information
State: Published
Organisations: Rise National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naulin, V., Juul Rasmussen, J.
Pages: 2133-2136
Publication date: 2002
Fast-ion collective Thomson scattering diagnostic on TEXTOR Tokamak (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Porte, L., Bindslev, H., Hoekzema, F., Korsholm, S. B., Kruyt, O., Prins, R., Woskov, P.
Pages: 425-428
Publication date: 2002

Host publication information
Title of host publication: Proceedings
Place of publication: Lisboa
Publisher: Instituto Superior Técnico
Editors: Silva, C., Varandas, C., Campbell, D.
URLs:

L-H transition in the mega-Amp spherical tokamak
H-mode plasmas have been achieved on the MAST spherical tokamak at input power considerably higher than predicted by conventional threshold scalings. Following L-H transition, a clear improvement in energy confinement is obtained, exceeding recent international scalings even at densities approaching the Greenwald density limit. Transition is accompanied by an order-of-magnitude increase in edge-density gradient, a marked decrease in turbulence, the efficient conversion of internal electron Bernstein waves into free space waves, and the onset and saturation of edge poloidal rotation.

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Pages: 035002.1-035002.4
Publication date: 2002
Peer-reviewed: Yes

Publication information
Journal: Physical Review Letters
Volume: 88
Issue number: 3
ISSN (Print): 0031-9007
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.58 SJR 3.622 SNIP 2.464
Web of Science (2017): Impact factor 8.839
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.33 SJR 4.196 SNIP 2.61
Web of Science (2016): Impact factor 8.462
First results from MAST

MAST is one of the new generation of large, purpose-built spherical tokamaks (STs) now becoming operational, designed to investigate the properties of the ST in large, collisionless plasmas. The first six months of MAST operations have been remarkably successful. Operationally, both merging-compression and the more usual solenoid induction schemes have been demonstrated, the former providing over 400 kA of plasma current with no demand on solenoid flux. Good vacuum conditions and operational conditions, particularly after boronization in trimethylated boron, have provided plasma current of over 1 MA with central plasma temperatures (ohmic) of order 1 keV. The Hugill and Greenwald limits can be exceeded and H mode achieved at modest additional NBI power. Moreover, particle and energy confinement show an immediate increase at the L-H transition, unlike the case of START, where this became apparent only at the highest plasma currents. Halo currents are small, with low toroidal peaking factors, in accordance with theoretical predictions, and there is evidence of a resilience to the major disruption.

General information

State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Porte, L., Bindslev, H., Hoekzema, F., Korsholm, S. B., Kruyt, O., Prins, R., Woskov, P.
Number of pages: 124
Publication date: 2001
Peer-reviewed: No
Event: Poster session presented at 28th European Physical Society Conference on Controlled Fusion and Plasma Physics, Funchal, Portugal.
Source: orbit
Source-ID: 303364
Research output: Research › Poster – Annual report year: 2001

Publication information

Journal: Nuclear Fusion
Volume: 41
Issue number: 10
ISSN (Print): 0029-5515
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.13 SJR 0.759 SNIP 1.424
Web of Science (2017): Impact factor 4.057
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 1.284 SNIP 1.416
Web of Science (2016): Impact factor 3.307
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.88 SJR 1.51 SNIP 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.2 SJR 1.907 SNIP 1.667
Web of Science (2014): Impact factor 3.062
Web of Science (2014): Indexed yes
Flows and transport in 3D drift Alfvén turbulence (invited talk)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Naulin, V., Korsholm, S. B., Michelsen, P., Juul Rasmussen, J.
Publication date: 2001

DOI: 10.1088/0029-5515/41/10/310
Source: orbit
Source-ID: 303061
Research output: Research - peer-review | Journal article – Annual report year: 2001
Impurity radiation and transport in the MAST Tokamak (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Lehane, I., Mansfield, M., Meyer, H., Carolan, P., Arends, E., Korsholm, S. B.
Publication date: 2001
Peer-reviewed: No
Event: Poster session presented at 43rd Annual Meeting of the APS Division of Plasma Physics, Long Beach, CA, United States.
Source: orbit
Source-ID: 303359
Research output: Research › Poster – Annual report year: 2001

Reynolds stress and effects of external and self-generated shear flows (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naulin, V., Juul Rasmussen, J.
Publication date: 2001

Reynolds stress and shear flow generation
The so-called Reynolds stress may give a measure of the self-consistent flow generation in turbulent fluids and plasmas by the small-scale turbulent fluctuations. A measurement of the Reynolds stress can thus help to predict flows, e.g. shear flows in plasmas. This may assist the understanding of improved confinement scenarios such as H-mode confinement regimes. However, the determination of the Reynolds stress requires measurements of the plasma potential, a task that is difficult in general and nearly impossible in hot plasmas in large devices.

In this work we investigate an alternative method, based on density measurements, to estimate the Reynolds stress, and demonstrate the validity range of this quantity, which we term the pseudo-Reynolds stress. The advantage of such a quantity is that accurate measurements of density fluctuations are much easier to obtain experimentally. Prior to the treatment of the pseudo-Reynolds stress, we present analytical and numerical results which demonstrate that the Reynolds stress in a plasma, indeed, generates a poloidal shear flow. The numerical simulations are performed both in a drift wave turbulence regime and a resistive interchange turbulence regime. Finally, the implications of misaligned probe arrays on the determination of Reynolds stresses are investigated, and alignment is found to be important but not severe.

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Pages: 1377-1395
Publication date: 2001
Peer-reviewed: Yes
Taming driftwave turbulence: Numerical simulations and experiment (poster)

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Naulin, V., Schröder, C., Klinger, T., Blick, D., Piel, A., Bonhomme, G., Korsholm, S. B.
Number of pages: 519
Publication date: 2001

Host publication information
Title of host publication: Abstracts of invited and contributed papers
Place of publication: Funchal
Publisher: Instituto Superior Técnico
Editors: Silva, C., Varandas, C., Campbell, D.
Source: orbit
Source-ID: 303362
Research output: Research › Conference abstract in proceedings – Annual report year: 2001

Density fluctuation measurements in the mega amp spherical tokamak

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Cunningham, G., Michelsen, P., Juul Rasmussen, J.
Publication date: 2000

Host publication information
Title of host publication: Programme. Abstracts. List of participants
Place of publication: København
Publisher: HCØ Tryk
ISBN (Print): 87-7834-385-2
Source: orbit
Source-ID: 301256
Research output: Research › Conference abstract in proceedings – Annual report year: 2000

Introduction to fusion energy and fusion research

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B.
Publication date: 2000
Peer-reviewed: No
Event: Abstract from Visit from Stenhus Gymnasium at Culham Science Centre, Culham (GB), 27 Mar,
Introduction to fusion energy and fusion research

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B.
Publication date: 2000
Peer-reviewed: No
Event: Abstract from Visit from Tørring Amtsgymnasium at Culham Science Centre, Culham (GB), 12 Apr, .
Source: orbit
Research output: Research › Conference abstract for conference – Annual report year: 2000

Reflectometry measurements of turbulence in MAST

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B.
Publication date: 2000
Peer-reviewed: No
Event: Abstract from Workshop on plasma turbulence, anomalous transport, and numerical modeling, Risø, Denmark.
Source: orbit
Source-ID: 301756
Research output: Research › Conference abstract for conference – Annual report year: 2000

Reynolds stress and shear flow generation

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naullin, V., Juul Rasmussen, J.
Number of pages: 375
Publication date: 2000

Host publication information
Title of host publication: Abstracts of invited and contributed papers
Place of publication: Budapest
Publisher: KFKI-Research Institute for Particle and Nuclear Physics
Editors: Szegö, K., Todd, T., Zoletnik, S.
Source: orbit
Source-ID: 301242
Research output: Research › Conference abstract in proceedings – Annual report year: 2000

Density and temperature gradient driven drift waves

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P.
Pages: 59-552
Publication date: 1999

Host publication information
Title of host publication: Contributed papers
Place of publication: Mulhouse
Publisher: European Physical Society
Editors: Schweer, B., Oost, G. V., Vietzke, E.
Nonlinear dynamics of resistive electrostatic drift waves

The evolution of weakly nonlinear electrostatic drift waves in an externally imposed strong homogeneous magnetic field is investigated numerically in three spatial dimensions. The analysis is based on a set of coupled, nonlinear equations, which are solved for an initial condition which is perturbed by a small amplitude incoherent wave-field. The initial evolution is exponential, following the growth of perturbations predicted by linear stability theory. The fluctuations saturate at relatively high amplitudes, by forming a pair of magnetic field aligned vortex-like structures of opposite polarity, i.e. a pair of electrostatic convective cells.
Plasma transport, zonal flows and Reynolds stress in 2 and 3D models of drift wave turbulence

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Naulin, V.
Publication date: 1999
Peer-reviewed: No
Event: Abstract from Nonlinear Science Festival 2, Risø, Denmark.
Source: orbit
Source-ID: 299623
Research output: Research › Conference abstract for conference – Annual report year: 1999

Plasma transport, zonal flows, and Reynolds stress in 2 and 3D models of drift wave turbulence

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Naulin, V., Korsholm, S. B., Michelsen, P., Juul Rasmussen, J.
Publication date: 1999

Host publication information
Title of host publication: Programme and abstracts
Place of publication: Milano
Poloidal flows and transport in non-periodic 3D simulations of the Hasegawa-Wakatani model

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naulin, V., Juul Rasmussen, J.
Publication date: 1999
Peer-reviewed: No
Event: Abstract from IAEA Technical Committee Meeting on First Principle-Based Transport Theory, Monastery Seeon, Germany.
Source: orbit
Source-ID: 300296
Research output: Research › Conference abstract for conference – Annual report year: 1999

Resistive drift wave turbulence in a three-dimensional geometry
The Hasegawa-Wakatani model describing resistive drift waves is investigated analytically and numerically in a three-dimensional periodic geometry. After an initial growth of the energy the drift waves couple nonlinearly to convective cells, which eventually dominate the system completely. An approach to include more physical boundary conditions to the system is presented. This changes the results of the simulations significantly. (C) 1999 American Institute of Physics.

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naulin, V.
Pages: 2401-2408
Publication date: 1999
Peer-reviewed: No

Publication information
Journal: Physics of Plasmas
Volume: 6
Issue number: 6
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Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.17 SJR 0.576 SNIP 0.682
Web of Science (2017): Impact factor 1.941
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.08 SJR 0.999 SNIP 1.052
Web of Science (2016): Impact factor 2.115
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.02 SJR 0.874 SNIP 0.908
Web of Science (2015): Impact factor 2.207
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.69 SJR 1.153 SNIP 1.195
Web of Science (2014): Impact factor 2.142
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Three dimensional drift wave simulations

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naulin, V.
Publication date: 1999
Three-dimensional simulations of drift-wave turbulence

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Naulin, V., Korsholm, S. B., Michelsen, P.
Pages: 505-510
Publication date: 1999

Three dimensional studies of a modified Hasegawa-Wakatani model

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Michelsen, P., Korsholm, S. B., Pécseli, H.
Pages: 553-556
Publication date: 1999

3D simulations of drift-wave turbulence

General information
State: Published
Organisations: Plasma Physics and Technology Programme, Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B.
Publication date: 1998
Peer-reviewed: No
Event: Abstract from Workshop on coherent structures, turbulence and anomalous transport in plasmas and fluids, Risø, Denmark.
Source: orbit
Source-ID: 298071
Research output: Research › Conference abstract for conference – Annual report year: 1998

Three dimensional numerical investigations of drift wave turbulence in plasmas

General information
Three-dimensional simulations of drift-wave turbulence

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Naulin, V., Korsholm, S. B., Michelsen, P.
Publication date: 1998
Peer-reviewed: No
Event: Abstract from Theory of fusion plasmas. Joint Varenna-Lausanne international workshop, Varenna (IT), 31 Aug - 4 Sep, .
Source: orbit
Source-ID: 297912
Research output: Research › Conference abstract for conference – Annual report year: 1998

Three dimensional study of the Hasegawa-Wakatani drift-wave model

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naulin, V.
Publication date: 1998
Peer-reviewed: No
Event: Abstract from 35. Culham plasma physics summer school, Culham (GB), 6-17 Jul, .
Source: orbit
Source-ID: 297914
Research output: Research › Conference abstract for conference – Annual report year: 1998

Three dimensional study of the Hasegawa-Wakatani drift-wave model

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naulin, V.
Pages: 2378-2381
Publication date: 1998

Host publication information
Title of host publication: 1998 International congress on plasma physics combined with the 25. European Physical Society conference on controlled fusion and plasma physics. Contributed papers
Place of publication: Prague
Publisher: European Physical Society
Editor: Pavlo, P.
(Europhysics Conference Abstracts, Vol. 22C).
URLs:
http://www.ipp.cas.cz/conference/98icpp/
Source: orbit
Source-ID: 298638
Research output: Research › Article in proceedings – Annual report year: 1998
Three-dimensional study of the Hasegawa-Wakatani drift wave model

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Korsholm, S. B., Michelsen, P., Naulin, V.
Publication date: 1998

Host publication information
Title of host publication: Transport in fusion plasmas. Programme and abstracts
Place of publication: Göteborg
Publisher: Chalmers University of Technology. Center for Fusion Science
Source: orbit
Source-ID: 298143
Research output: Research › Conference abstract in proceedings – Annual report year: 1998

Projects:

Kohærente strukturer og transport i driftbølge-plasmaturbulens
Korsholm, S. B., PhD Student, Department of Physics
Mosekilde, E., Main Supervisor, Department of Physics
Michelsen, P., Supervisor, Department of Physics
Rasmussen, J. J., Supervisor, Department of Physics
Bohr, T., Examiner, Department of Physics
Lashmore-Davies, C. N., Examiner
Rypdal, K., Examiner
Forskerakademiets Samfinansier
01/05/1998 → 18/10/2002
Award relations: Kohærente strukturer og transport i driftbølge-plasmaturbulens
Project: PhD

Fast Ion Dynamics in ASDEX Upgrade Measured by Collective Thomson Scattering
Moseev, D., PhD Student
Korsholm, S. B., Main Supervisor, Department of Physics
Meo, F., Supervisor, Department of Physics
Bohr, T., Examiner, Department of Physics
Ericsson, G., Examiner
Garcia-Munoz, M., Examiner
Institut/centerfinansieret
01/11/2008 → 29/03/2012
Award relations: Fast Ion Dynamics in ASDEX Upgrade Measured by Collective Thomson Scattering
Project: PhD

Activities:

ITPA Diagnostics Topical Group (External organisation)
Period: 1 Nov 2017
Søren Bang Korsholm (Vice-chairman)
Department of Physics
Plasma Physics and Fusion Energy

Description
Microwave Working Group (MWG) of the ITPA Diagnostics Topical Group
Degree of recognition: International

Related external organisation

ITPA Diagnostics Topical Group
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar
ATV Sustain conference
Period: 30 Nov 2016
Søren Bang Korsholm (Speaker)
Department of Physics
Plasma Physics and Fusion Energy

Description
Poster and poster pitch talk: Developing diagnostic systems for ITER – the next step fusion energy experiment
Poster presentation of "Developing diagnostic systems for ITER – the next step fusion energy experiment"
Links:
http://www.sustain.dtu.dk/ (Conference website)

Related event
ATV Sustain conference
30/11/2016 → 30/11/2016
Activity: Talks and presentations › Conference presentations

Efteruddannelseskursus i plasmafysik og fusion
Period: 19 Sep 2016
Søren Bang Korsholm (Organizer)
Department of Physics
Plasma Physics and Fusion Energy

Description
Kursusplanlægger sammen med LMFK, samt oplægsholder med et fusionsroadshow
Links:
https://www.lmfk.dk/index.phtml?sek_id=11&con_id=716

Related event
Efteruddannelseskursus i plasmafysik og fusion: LMFK/DTU arrangeret kursus
19/09/2016 → 20/09/2016
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Kursus i plasmafysik og fusion
Period: 8 Sep 2016
Søren Bang Korsholm (Organizer)
Department of Physics
Plasma Physics and Fusion Energy

Description
Kursusplanlægger sammen med LMFK, samt oplægsholder med et generelt fusionsforskningsforedrag
Links:
https://www.lmfk.dk/index.phtml?sek_id=11&con_id=716

Related event
Kursus i plasmafysik og fusion: Århus: LMFK/DTU arrangeret efteruddannelse
08/09/2016 → 09/09/2016
Aarhus, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Danish Instruments for Big Science 2016
Period: 25 Jan 2016
Søren Bang Korsholm (Organizer)
Department of Physics
Plasma Physics and Fusion Energy

Description
In the central organising committee of DIBS’16

DIBS is an annually recurring conference, which gathers together universities and businesses with experience in or interest in delivering instruments for large research infrastructure, so called Big Science facilities. Taking on instruments for Big Science facilities relies on high level competence- and technology development, potentially to the benefit of both academia and businesses alike. The objective of DIBS is to strengthen the exchanges going on between these and to ensure a more efficient build up process as well as an increase of Danish deliveries of high quality instruments in the future.

Links:
http://www.nbi.ku.dk/english/calendar/activities_16/danish_instruments_big_science/tilmelding/ (Conference link)

Related event

Danish Instruments for Big Science 2016
25/01/2016 → 25/01/2016
København, Denmark
Activity: Attending an event › Participating in or organising a conference

Fusionsenergi – hvordan går det med at efterligne solen?
Period: 13 Nov 2012
Søren Bang Korsholm (Lecturer)
Department of Physics
Plasma Physics and Fusion Energy

Description
Videnskabsfolk har siden 50’erne arbejdet intensivt på at realisere fusionsenergi som en reel energikilde på jorden. Fusionsenergi er solens og stjernernes energiform, og drømmen er at efterligne solen i kraftværker på jorden. Lykkes det vil menneskeheden have en energikilde med uudtømmelige energiressourcer, der vil frigøre os af afhængighed af fossile brændsler.


Links:
http://aalborg.unf.dk/
http://aalborg.unf.dk/program.php?id=1008477&arr=Fusionsenergi+%26+hvordan+g%5E5r+med+at+efterligne+solens+3F

Related event

UNF - Ungdommens Naturvidenskabelige Forening Aalborg
13/11/2012 → …
Aalborg, Denmark
Activity: Talks and presentations › Conference presentations
Styrelsen for Forskning og Innovation (External organisation)
Period: 17 Aug 2011 → 1 Apr 2014
Søren Bang Korsholm (Participant)
Department of Physics
Plasma Physics and Fusion Energy

Description
Industrial Liaison Officer Network to the European Southern Observatory

The ESO ILO Network is the link between ESO and the industry of the member states. The ILOs assist ESO and the industry in preparation for tender actions.

As the Danish Industrial Liaison Officer (ILO) to the European Southern Observatory (ESO) the role is to be the link between ESO and Danish industry in preparation for tender actions from ESO. The ILO is part of the ESO ILO Network and participate in the ILO meetings and other ESO events. The ILO's are nominated by the national member state Council/finance committee representatives.

Body type: International organisation
Degree of recognition: International
Links:
http://www.eso.org/public/industry/cp/ILO/ILO_Contact_Details_for_web.pdf (List of ESO ILOs)

Related external organisation
Danish Agency for Science and Higher Education
Denmark
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Fusion Roadshow
Period: 15 Nov 2010 → 16 Nov 2010
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Lærerkursus Fusionsklassen, Mærsk Mc-Kinney Møller Videncenter, Sorø (DK), 15-16 Nov

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Roadshow om fusionsenergi og plasmafysik
Period: 1 Oct 2010
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Dansk Naturvidenskabsfestival, Nykøbing Katedralskole

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Roadshow om fusionsenergi og plasmafysik
Period: 30 Sep 2010
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Dansk Naturvidenskabsfestival, Roskilde Gymnasium, 30. september

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Roadshow om fusionsenergi og plasmafysik
Period: 29 Sep 2010
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Dansk Naturvidenskabsfestival, Nørresundby Gymnasium og HF, 29. september

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion Roadshow
Period: 24 Apr 2010
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

**Description**
Place: Roadshow på Forskningens Døgn, Roskilde, 24. april

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Fusion Roadshow**
Period: 24 Apr 2010
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

**Description**
Place: Roadshow på Forskningens Døgn, Roskilde, 30. april

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Fast ion measurements by collective Thomson scattering in TEXTOR and ASDEX Upgrade and proposal for the ITER CTS system**
Period: 25 Mar 2010
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme
Documents:
CTS_abstract_korsholm.doc

**Related event**

**Fast ion measurements by collective Thomson scattering in TEXTOR and ASDEX Upgrade and proposal for the ITER CTS system**
25/03/2010 → 25/03/2010
Seminar på Uppsala Universitet, 25. marts
Activity: Talks and presentations › Conference presentations

**Seminar at Uppsala University: Fast ion measurements by collective Thomson scattering in TEXTOR and ASDEX Upgrade and proposal for the ITER CTS system**
Period: 25 Mar 2010
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme
Documents:
Korsholm_seminar_abstract.doc

**Related event**

**Seminar at Uppsala University: Fast ion measurements by collective Thomson scattering in TEXTOR and ASDEX Upgrade and proposal for the ITER CTS system**
25/03/2010 → 25/03/2010
Uppsala (SE)
Activity: Talks and presentations › Conference presentations
Fusionsenergi og plasmafysik
Period: 19 Nov 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Rise DTU plasmafysik roadshow ved fysikaften på DTU-Fysik

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma road show
Period: 25 Sep 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma road show
Period: 24 Sep 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Dansk Naturvidenskabs Festival, Nyborg Gymnasium, 24 Sep.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma road show
Period: 23 Sep 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Dansk Naturvidenskabs Festival, HTX Teknisk Gymnasium Christiansbjerg, Århus, 23 Sep.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations
Fusion og plasma road show
Period: 22 Sep 2009 → 23 Sep 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow for gymnasielærere på Talentcenteret, Sorø Akademi, 23 Sep.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma road show
Period: 22 Sep 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion and plasma road show
Period: 17 Sep 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Comenius projektet - international skolekonference, Stilling skole, Skanderborg, 17 Sep.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma road show
Period: 5 Jul 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Roskilde Festival, Climate Shout Out, 5 Jul.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations
Fusion og plasma road show
Period: 25 Apr 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Forskningens Døgn, Roskilde (DK), 25 Apr.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma road show
Period: 24 Apr 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Forskningens Døgn - Forskerbyen på Frederiksberg, 24 Apr.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma road show
Period: 23 Apr 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Forskningens Døgn, Risø (DK), 23 Apr.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma road show
Period: 17 Apr 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Sciecntalenternes talentcamp Energi 2009, Sorø (DK), 17 Apr.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Fusion og plasma road show
Period: 17 Apr 2009
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Roadshow på Dansk Naturvidenskabsfestival, Esbjerg Statsskole, 21 Sep.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Risø DTUs roadshow om fusion og plasmafysik
Period: 13 Dec 2008 → …
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Marathon foredrag på Observatoriet i Brorfelde, arrangeret af Brorfeldes Vennekreds, Brorfelde (DK)

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion og plasma roadshow
Period: 9 Dec 2008 → …
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Møde i Ungdommens Naturvidenskabelige Forening, Aalborg (DK)

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

ITER - the way to fusion energy
Period: 9 Dec 2008 → …
Søren Bang Korsholm (Lecturer)
Plasma Physics and Technology Programme
Risø National Laboratory for Sustainable Energy

Related external organisation
Aalborg University
A.C. Meyers Vænge 15, 2450 Copenhagen SV, Aalborg, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities
ITER - en mulighed for dansk industri
Period: 27 Nov 2008 → …
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Møde i Ingeniørhuset i København

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusion energy, ITER and spin offs
Period: 25 Aug 2008 → …
Søren Bang Korsholm (Speaker)
Rise National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Invest in Denmark - IDK renewable energy tour 2008 , Risø (DK)

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Udvikling af danske erhvervsmuligheder i ITER
Period: 11 Jun 2008 → …
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Møde om et dansk ITER industrinetværk, Risø (DK)

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fusionsenergi og ITER
Period: 22 May 2008 → …
Søren Bang Korsholm (Speaker)
Rise National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Fremtidens energiformer, Risø (DK)

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Styrelsen for Forskning og Innovation (External organisation)
Period: 15 May 2008 → …
Søren Bang Korsholm (Member)
Department of Physics
Plasma Physics and Fusion Energy

Description
Industrial Liaison Officer Network to Fusion for Energy and ITER

The F4E ILO Network is the link between the business intelligence group of F4E and European industry in preparation for tender actions with relation to ITER.

As the Danish Industrial Liaison Officer (ILO) to Fusion for Energy (F4E) the role is to be the link between the business intelligence group of F4E and Danish industry in preparation for tender actions from F4E and ITER. The ILO is part of the F4E ILO Network and participate annually in several meetings with F4E. The ILO’s are nominated by the national Governing Board members of F4E.

Body type: European
Degree of recognition: International
Links:
http://fusionforenergy.europa.eu/procurementsgrants/ilos.aspx (List of Industrial Liaison Officers to Fusion for Energy)

Related external organisation

Danish Agency for Science and Higher Education
Denmark
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Udvikling af danske erhvervsmuligheder i ITER
Period: 31 Jan 2008 → …
Søren Bang Korsholm (Speaker)
Risø National Laboratory for Sustainable Energy
Plasma Physics and Technology Programme

Description
Place: Møde om et dansk ITER industrinetværk, Risø (DK)

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

European Fusion Development Agreement (External organisation)
Period: 1 Mar 2003 → …
Søren Bang Korsholm (Participant)
Department of Physics
Plasma Physics and Fusion Energy

Description
EFDA Public Information Network

The European Fusion Development Agreement (EFDA) has a network of Public Information Officers - one from each EURATOM Fusion Association. The network assists each other and EFDA in the dissemination of information about fusion energy research to the public.

Body type: European network
Degree of recognition: International
Links:
http://www.efda.org (EFDA website)
Related external organisation

European Fusion Development Agreement

Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Press clippings:

Artikel på DR.dk om fusionsenergi
Søren Bang Korsholm
30/01/2018
Department of Physics, Plasma Physics and Fusion Energy

Media contribution (1)

En kunstig sol og helium fra Månen: Sådan vil forskerne revolutionere energiproduktion
30/01/2018
Danmarks Radio (National), Denmark, Web
JEPPÉ KYHNE KNUDSEN, JONAS PETRI OG LASSE FROM, DR Viden
Webartikel (~2-3 A4 sider) samt video
Søren Bang Korsholm
Press/Media: Press / Media

Interview til Ren og evig energi: Kunstig intelligens skal hjælpe med at lave en sol på Jorden
Søren Bang Korsholm
30/12/2017
Department of Physics, Plasma Physics and Fusion Energy

Media contribution (1)

Ren og evig energi: Kunstig intelligens skal hjælpe med at lave en sol på Jorden
30/12/2017
Politiken (National), Denmark, Print
Mathias Glistrup, Politiken
1 full page in print and online
https://politiken.dk/viden/art6271411/Kunstig-intelligens-skal-hj%C3%A6lpe-med-at-lave-en-sol-p%C3%A5-Jorden
Søren Bang Korsholm
Press/Media: Press / Media

Interview i DR2 Dagen om fusionsenergi, CPH|DOX og Let there be light
Søren Bang Korsholm
27/03/2017
Department of Physics, Plasma Physics and Fusion Energy

Media contribution (1)

Interview i DR2 Dagen om fusionsenergi, CPH|DOX og Let there be light
27/03/2017
Danmarks Radio DR2 (National), Denmark, Television
15 minutter
http://www.dr.dk/tv/se/dr2-dagen-tv/dr2-dagen-2017-03-27#!/!
Søren Bang Korsholm
Press/Media: Press / Media

Sommertema i DR P1 Orientering
Søren Bang Korsholm
18/07/2016

Description
http://www.dr.dk/radio/ondemand/p1/orientering-2016-07-18#!/01:00:11

Søren Bang Korsholm was one of three scientists being interviewed about current and status of science.
Department of Physics, Plasma Physics and Fusion Energy
Media contribution (1)

Sommertema i DR P1 Orientering
18/07/2016
DR, Radio
Chris Lehmann
53 minutes
http://www.dr.dk/radio/ondemand/p1/orientering-2016-07-18/#!/01:00:11
Direct link to 53 minutes interview at DR P1
Søren Bang Korsholm
Department of Physics, Plasma Physics and Fusion Energy
Press/Media: Press / Media

Interview i TV2 Nyhederne med Skammelsen: TV2s 22-Nyhederne med Poul Erik Skammelsen
Søren Bang Korsholm
28/04/2016

Subject
Indslaget var indledt med en rapport fra dagens åbning af fusoren i Viborg Tekniske Gymnasium og afsluttedes med et interview i Skammelsens studie af Søren Bang Korsholm. Emnet var uddannelse og behov for teknisk- og naturvidenskabeligt interesserede unge med udgangspunkt i dagens åbningsceremoni for Viborg Tekniske Gymnasiums fusor.
Department of Physics, Plasma Physics and Fusion Energy

Media contribution (1)

Interview i TV2 Nyhederne med Skammelsen: TV2s 22-Nyhederne med Poul Erik Skammelsen
28/04/2016
TV2, Television
Michael Malling Loehr
5 minutter
Søren Bang Korsholm
Department of Physics, Plasma Physics and Fusion Energy
Press/Media: Press / Media

Interview i TV2 News - New Science - om Viborg Mercantec fusoren: Indslag i forbindelse med Viborg Tekniske Gymnasiums åbningsceremoni for deres fusor
Søren Bang Korsholm
28/04/2016

Subject
I forbindelse med Viborg Tekniske Gymnasiums åbningsceremoni for deres fusor
Department of Physics, Plasma Physics and Fusion Energy

Media contribution (1)

Interview i TV2 News - New Science - om Viborg Mercantec fusoren: Indslag i forbindelse med Viborg Tekniske Gymnasiums åbningsceremoni for deres fusor
28/04/2016
TV2 News, Television
5 minutter
Søren Bang Korsholm
Department of Physics, Plasma Physics and Fusion Energy
Press/Media: Press / Media

Fuld fart på forskningen i fusionskraft: Interview på videnskab.dk
Søren Bang Korsholm
09/12/2015

Subject
Statusartikel om fusionsforskningen.
Department of Physics, Plasma Physics and Fusion Energy
Hvilke tekniske problemstillinger skal løses, før fusionsprocessen kan indgå i energiforsyningen?
Søren Bang Korsholm
25/10/2010
Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme

Media contribution (1)

Hvilke tekniske problemstillinger skal løses, før fusionsprocessen kan indgå i energiforsyningen?
25/10/2010
Online svar på spørgsmål fra ing.dk's læsere mandag d. 25. oktober 2010, Web
Søren Bang Korsholm
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Forsker til læserne: Vi kan forvente fusionsenergi omkring år 2050
Søren Bang Korsholm
25/10/2010
Risø National Laboratory for Sustainable Energy

Media contribution (1)

Forsker til læserne: Vi kan forvente fusionsenergi omkring år 2050
25/10/2010
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Foredrag med spræl i
Søren Bang Korsholm
01/01/2010
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Fusionsenergiforskning – internationalt samarbejde mod fremtidens energikilde
Søren Bang Korsholm
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Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme
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Klimaforandringer er naturens orden
Søren Bang Korsholm
07/08/2009
Risø National Laboratory for Sustainable Energy, Plasma Physics and Technology Programme

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Solkraft kommer til en kontakt nær dig
Søren Bang Korsholm
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Hvorfor satses der ikke mere på Polywell-fusionsprojektet?
Søren Bang Korsholm
08/01/2009
Risø National Laboratory for Sustainable Energy

Media contribution (1)

Hvorfor satses der ikke mere på Polywell-fusionsprojektet?
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