Improved Collective Thomson Scattering measurements of fast ions at ASDEX Upgrade - DTU Orbit (14/04/2019)

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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
Publication status: 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
Journal: A I P Conference Proceedings Series
Volume: 1612
ISSN (Print): 0094-243X
Ratings:
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.17 SJR 0.171 SNIP 0.202
Original language: English
Electronic versions:
1310.2406v1_1.pdf
Source: dtu
Source-ID: n:oai:DTIC-ART:arxiv/409238545::37865
Research output: Contribution to journal → Conference article – Annual report year: 2014 → Research → peer-review