Design of the cold and thermal neutron moderators for the European Spallation Source

At the European Spallation Source (ESS), neutrons will be generated by spallation induced by a 2-GeV proton beam on a tungsten target. ESS will have a grid of 42 beamports available for a variety of neutron scattering experiments. Neutron moderators will provide thermal and cold neutrons to the instruments, allowing bispectral beam extraction wherever needed. The moderators were designed by adopting a holistic design approach that has considered brightness, brightness transfer and beam extraction constraints, resulting in a system with the following main features: low-dimensional moderators for enhanced brightness and maximum flux to the sample; a single moderator system placed above the spallation target; lateral shape of the moderators optimized for bispectral extraction. A moderator with a vertical extraction surface of 3 cm was chosen as result of the optimization process. With all initial instruments pointing to the top moderator, and a beamport system that allows the possibility to extract neutrons from above and below the target, the adopted configuration opens the possibility to have different types of moderators below the target, so that other neutron beams of different intensity, or spectral shape, with respect to the ones delivered by the top moderator, could be envisaged, adding additional scientific opportunities to the facility without having the need to build a second target station.

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