Integrated Optimisation of instrument performance, target neutronics and target engineering at ESS

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The European Spallation Source (ESS) in Lund aims to be the world's leading neutron facility, using a linear proton accelerator to produce 5 MW of spallation neutrons from its target. It will come on-line in 2019 and reach its full suite of 22 instruments by 2028.

Recent neutronics studies [1,2] have shown that large increases in the brightness of para-H_2 moderators can be achieved by reducing their dimensionality. Large gains in brightness can be achieved firstly by reducing their height to approach a 2D geometry, and then by reducing their width to resemble 1D tubes. The performance of a suite of 24 instruments at the ESS has been evaluated as a function of moderator geometry, redesigning their guide optics to optimally take advantage of the brightness increases allowed by the change in moderator-reflector geometry.

Such significant changes to the moderator-reflector geometry require associated significant changes to many of the engineering aspects: fluid flow and access for maintenance and replacement are central to this study

An overview is given of the ESS project, as well as the current state of the iterative optimisation process, in which source brightness gains feed into instrument redesigns which feed back into source geometry and engineering considerations. The instrument redesign work has been a community effort distributed among the ESS partner countries, allowing us to confidently make a decision on the best moderator design for the ESS as a whole.

References

[1] K. Batkov, A. Takibayev, L. Zanini, F. Mezei, Nucl. Instr. Meth. A **729**, 500 (2013)

[2] F. Mezei, L. Zanini, A. Takibayev, K. Batkov, E. Klinkby, E. Pitcher, T. Schönfelft, J. Neut. Res. **17**, 101 (2014)