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P3.026 Achievements of the ELISE test facility in view of the ITER NBI

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Neutral Beam Injection (NBI) for ITER shall deliver in total 33 MW heating power to the plasma with two injectors at a beam energy of 1 MV. Taking neutralisation efficiency and all losses along the beam path into account a negative ion current density of 329 A/m2 (H- for 1000s) and 286 A/m2 (D- for 3600s) has to be extracted from each ion source (size 1 × 2 m2) with a beam non-uniformity below 10%. For the development of the radio frequency driven (RF) ion source and the extraction system the ELISE test facility has been set up at IPP as a first step with a source size of 1 × 1 m2.
Since its start in 2013 continuous progress was achieved hardening the system technically for long pulse operation at high power (300 kW) as well as approaching ITER´s physics requirements. 90% of the required current density could be demonstrated for short pulses (10 s) and almost 70% for long pulses, both in hydrogen and deuterium. The main limitation is given by the amount and temporal instability of the co-extracted electron current, in particular in deuterium, which has to remain below the negative ion current to prevent thermal overloading of the grid system.
Shaping the magnetic field topology and controlling the electric fields inside the source together with an improved caesium conditioning procedure and a plasma grid temperature above 150°C have been identified as possible tools to increase the source performance. Experiments in 2018 concentrate on optimising these parameters for long pulses, mainly in hydrogen. Furthermore emphasis is also laid on how to improve beam divergence and homogeneity.
The paper presents the recent results of ELISE and discusses the latest results and possible modifications which might be required for the ITER source.

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