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Deuterium Results at ELISE

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The ITER neutral beam system will be equipped with large RF driven negative ion sources, with a cross section of 0.9 m x 1.9 m which have to deliver a D^- current of 40 A accelerated to 1 MeV. The negative ions are produced by surface conversion of hydrogen atoms and ions on caesium layers. These giant sources will be tested from 2018 onwards at the neutral beam test facilities SPIDER and MITICA at RFX in Padua.

A source of half of this size is being operational since 2013 on the test facility ELISE (Extraction from a large Ion Source Experiment) at the Max-Planck-Institut für Plasmaphysik (IPP). The source plasma is generated in four (eight for ITER) "drivers", which are currently supplied by two 150 kW/1 MHz solid state RF generators.

Main goals of the experiments with this source are to demonstrate a high operational reliability and to achieve the extracted current densities required for ITER (33 mA/cm^2 for H^- for 1000 s and 28.6 mA/cm^2 for D^- for one hour). Changes on the source needed to meet these requirements will be implemented in the design of the ITER sources.

This paper will describe the optimization of the set-up of source and RF power supply which enable long pulse, high power operation as well as the experiments concerning variations of the filter field and the caesium dynamics in order to achieve time-stable ion and electron currents. The emphasis is laid on the experiments in deuterium in which considerable progress has been made in pulses up one hour.

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