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P1.1073 Experiments on negative ion sources at the NIO1 installation

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Negative ion sources are a critical component of neutral beam injectors NBI (used for stellarator and tokamak heating and current drive), due to the stringent requirement current density, beam divergence and operational stability. In support to the NBI development, a relatively compact 9 beamlet H- source (named NIO1, for negative ion optimization phase 1) was developed in close collaboration between Consorzio RFX and INFN, and is operated since 2014, for studying the influence of magnetic field configuration and other conditions on extracted beam. A robust rf system (amplifier can tolerate the load mismatch at plasma onset) and strong water cooling of the ion source and accelerator allow CW operation of the beam, well over the one hour pulse length required by ITER. A dedicated Cs oven (including a hot closure valve) was verified in separated test stand, where final calibrations are in progress, for installation in NIO1. Effects of several magnetic field configurations were studied in NIO1 in pure volume production conditions, which in principle should guarantee long term stability of extracted beam; spontaneous and unexpected fluctuations of plasma regime (with time scale in the order of minutes, or tens of minutes) were sometimes observed, and partly related to several changes in operational procedures (history of pressure changes). As a general trend, the typical source perfomances improve with strength of the magnetic field filter (with collected data spanning from 1 to 12 mT), which also helps to reduce the coextracted electron current. Evolution of diagnostic and simulation development is also summarized in this contribution: the beam images taken by two orthogonal cameras and the beam optics simulation are in fair agreement. Some development of energy recovery system and related full power beam calorimeter are also noted. More detailed modelling of source plasma will benefit from data of Cavity Ring Down Spectrometer whose installation, nearly finished, is also described.

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