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First hydrogen operation of NIO1: characterization of the source plasma by means of an optical emission spectroscopy diagnostic

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NIO1 is a compact and flexible radiofrequency H⁻ ion source, developed by Consorzio RFX and INFN-LNL. Aim of the experimentation on NIO1 is the optimization of both the production of negative ions and their extraction and beam optics. The source will be also a test bed for the instrumentation to be installed on the ITER neutral beam test facility. In the initial phase of its commissioning, NIO1 was operated with nitrogen [1], but now the source is regularly operated also with hydrogen. Filling pressure and RF power scans have been done to characterize the source with both gases. To evaluate the source performances an optical emission spectroscopy diagnostic was installed. The system includes a low resolution spectrometer in the spectral range of 300-800 nm and a high resolution (50 pm) one, to study respectively the atomic and the molecular emissions in the visible range. The plasma is observed along lines of sight longitudinal with respect to the source or parallel and close to the plasma grid. The spectroscopic data have been interpreted also by means of a collisional-radiative model developed at IPP Garching [2]. Besides the diagnostic hardware and the data analysis methods, the paper presents the measures of the source plasma parameters as a function of the radiofrequency power and of the internal gas pressure. In particular, the correlation between the E-H transition, the operative conditions and the plasma properties are investigated.

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References

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