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Spider plasma emission between 300 nm and 900 nm in different operative conditions

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SPIDER is the prototype source for ITER negative ion beams in operation at Padova PRIMA test facility since 2018. SPIDER mission is to produce an extracted negative ion beam of section 1.5x0.6 m2 and a current density of 355 A/m2 (H-) or 285 A/m2 (D-) while keeping the fraction of co-extracted electrons below 0.5 (H)/1 (D). During the experimental campaigns in SPIDER, the operating conditions and many hardware components underwent several modifications. The former includes change of gas (hydrogen or deuterium), cesium injection, and variation of the main discharge parameters: pressure, RF power, source and grid bias, extraction and acceleration voltages, etc. Other modifications arose from the need to better understand the experimental findings: introduction of gas dopants, changes in the oscillator electric circuits (capacitance, connections), functioning with a reduced set of RF generators, reversal of the magnetic filter field, etc. In some cases these changes were the only way to make the plasma operation possible, such as the masking of the plasma-facing grid, or the redesign of the electric circuit for the generation of the magnetic filter field in the plasma. In a situation of continuously changing the experimental conditions it is fundamental to trace them out and to compare the experimental results with the previous ones. In SPIDER the optical emission spectroscopy diagnostic, providing real time measurements of plasma emission, demonstrated to be a reliable non invasive tool to monitor the plasma conditions in the source. This work shows the dependence of plasma optical emissions on the modifications of SPIDER experimental conditions and offers possible interpretations of their influence on plasma emission.

Author: ZANIOL, Barbara (Consorzio RFX)

Co-authors: TALIERCIO, Cesare (Consiglio Nazionale Delle Ricerche); BRUNO, Domenico (ISTP - CNR); Dr SERIANNI, Gianluigi (Consorzio RFX); MARIO, Isabella; DELOGU, Rita Sabrina (Consorzio RFX); PASQUALOTTO, Roberto (Consorzio RFX); SARTORI, emanuele (unipd)

Presenter: ZANIOL, Barbara (Consorzio RFX)

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