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Effect of plasma grid and bias plate biasing on the SPIDER negative ion beam

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Biased plasma electrodes in negative ion sources can be used for reducing the amount of co-extracted electrons, together with the magnetic filter field. In SPIDER, both the plasma grid (PG) and the bias plate can be independently polarized with respect to the source body, and this work characterises their effect on the plasma in the expansion region and on the accelerated beam. By increasing the polarization voltages, the extracted electron current decreases, but the spatial non-uniformities of the plasma in front of the PG are enhanced. This non-uniformity in the plasma reflects also upon the accelerated ion beam: at large polarization voltages, the bottom region of the beam exhibits a lower accelerated current with respect to the top region, which may also result in increasing the local divergence.

The characterization of both the beam and the plasma is carried out with different diagnostics that allow spectroscopic, calorimetric and electrical measurements, in order to clarify the different effects of biased electrodes in SPIDER.

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