Sensitivity analysis of the off-normal conditions of the SPIDER accelerator

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In the contest of the research for the 1 MV neutral beam injector foreseen for the ITER tokamak [1], the study on the beam formation and acceleration has considerable importance. The major dedicated experiment is the SPIDER (Source for Production of Ions of Deuterium Extracted from an Rf plasma) ion source, planned to be built in Padova at Consorzio RFX, and designed to extract and accelerate a 355 A/m\textsuperscript{2} current of H\textsuperscript{-} (or 285 A/m\textsuperscript{2} D\textsuperscript{-}) up to 100 kV. Exhaustive simulations were already carried out during the accelerator optimization leading to the present design [2]. However, the difficulties to realize a real device that will meet all requirements perfectly, call for the investigation of a large set of off-normal scenarios. Some of them will be closer to the real performances of the machine, and should help in interpreting experimental results, or in identifying dangerous operating conditions.

The present contribution offers an overview of the results obtained during the investigation of off-normal condition, among which: mechanical modifications (caused by manufacturing tolerances or, with the beam on, thermal expansion or vibrations), magnetic and electric field dishomogeneities (due to voltage and magnetic field ripple, field uniformity...) and deviations from reference values of some operational parameters (gas pressure, electron to ion ratio, extracted current...).

The simulations were performed by means of commercial modeling tools (OPERA, ANSYS, COMSOL) or dedicated codes (SLACCAD, BYPO, EAMCC, PERMAG, ALIGN, EDAC, BACKSCAT) and the results compared with reference case and discussed.

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REFERENCES