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Three-dimensional calculations of the inductive coupling between radio-frequency waves and plasma in the drivers of the SPIDER device

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This work documents the initial 3D calculations to simulate the coupling between RF waves and plasma in the plasma sources of the SPIDER device. Axisymmetric 3D calculations in the plasma domain alone compare well against equivalent 2D cases, yielding the expected axi-symmetry with coincident fields and Joule power coupled to the plasma. A model of SPIDER driver, the cylindrical chamber where the plasma is heated by the RF drive, is then defined including the metallic parts of the Faraday shield, insulator and vacuum layer up to the RF winding (not included in the calculation domain). First estimates of the power share in the different parts are shown based on experimental conditions. The results are sensitive to the particular geometry of the driver and the temperature of the Faraday shield

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