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Summary of caesium evaporation and deposition during SPIDER's first campaign

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SPIDER (Source for the Production of Ions of Deuterium Extracted from a Radio frequency plasma) is currently in a major shutdown period dedicated to the upgrade of several components in order to enhance its performances and guarantee their agreement with the ITER requirements. During this phase, an indepth inspection of beam source components has been fundamental to understand SPIDER's behaviour during the previous experimental campaigns, and in particular caesium evaporation inside the source by means of Cs ovens. Caesium evaporation and its deposition on the plasma grid (PG) is fundamental to minimize the work function of PG surface and to optimize the generation and extraction of negative ions. This work presents the analysis of the caesium ovens'performances and their status after removal. The experimental data obtained via chemical analysis using environmental sampling with Inductively Coupled Plasma Mass Spectrometry (ICPMS) are compared to previously developed numerical models for the caesium evaporation and deposition, to the results of a chemical surface analysis performed in strategical locations of the source walls and extraction grid, and to the Laser Absorption Spectroscopy (LAS) measurements. This study helps understanding the nonuniformity of the negative ion beam extraction observed during SPIDER experimental campaigns. In addition, the future implementation of permanent magnets in the back plate of the source is analysed in terms of caesium deposition efficiency on the source walls.

Primary author: FADONE, Michele

Co-authors: DUTEIL, Basile Pouradier (Consorzio RFX (CNR, ENEA, INFN, Università di Padova, Acciaierie Venete SpA)); GASPARRINI, Claudia; BARBISAN, Marco (Consorzio RFX); Dr RIZZOLO, Andrea (Consorzio RFX)

Presenter: FADONE, Michele

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