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First Operations with Caesium of the Negative Ion Source SPIDER

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The negative-ion beam source SPIDER, which is the full-scale prototype source for the ITER neutral beam injector, recently started the operation with caesium.

This experimental phase follows three years of volume operation, devoted to the commissioning of the plants and to the integrated test of the ion source and accelerator. The ion source, composed of eight RF drivers connected to a large plasma chamber from which the negative ions are extracted, was operated up to a RF power of 400kW, and beam energy up to 50kV, and plasma discharges limited to less than one minute

This contribution will describe the main results of the first campaign with caesium in SPIDER. The repetition of short plasma and beam extraction blips with different injection rates was applied, to study the effect on plasma and beam parameters. The caesiation procedure adopted in SPIDER will be described (caesium injection rate, duty cycle of plasma-on, RF power, source gas pressure) together with the effects of the source parameters on the extracted beam and its uniformity. Even though the use of a much reduced number of beamlets was a strong limitation in terms of total accelerated current (a mask at the plasma grid covered 1252 apertures over 1280 to limit the gas load to the vacuum pumps), it provided advantages in the study of the caesium effect on the beam, such as the introduction of dedicated diagnostics for the single beamlets, and the identification of the beamlet current and optics.

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