Assessment of the SPIDER beam features by diagnostic calorimetry and thermography

Antonio Pimazzoni, Matteo Brombin, Gloria Canocchi, Rita S. Delogu, Daniele Fasolo, Luca Franchin, Bruno Laterza, Roberto Pasqualotto, Gianluigi Serianni, and Marco Tollin

Rev. Sci. Instrum. **91**, 033301 (2020); https://doi.org/10.1063/1.5128562

Abstract:

The full-size ITER ion source prototype SPIDER (Source for the Production of Ions of Deuterium Extracted from a Radio frequency plasma)has recently started beam operation, whose objective is to produce 100 keV, 60 A hydrogen negative ions for 1 h. The source is presently operated in the volume regime, and the beam power is consequently limited. In such a configuration, the high resolution calorimeter STRIKE (Short-Time Retractable Instrumented Kalorimeter Experiment), even though uncooled, may be used instead of the SPIDER beam dump without limiting the beam-on time. STRIKE is formed by unidirectional carbon fiber–carbon matrix (CFC) composite tiles that are exposed to the beam while their temperature is recorded by using two infra-red cameras. This setup, thanks to the moderate broadening of the temperature profile guaranteed by the anisotropy of CFC, allows for the determination of detailed features of the beam current distribution(spatial resolution is about 2 mm). Furthermore, positively biasing the CFC tiles permits a direct electrical measurement of the negative ion beam current. Besides the total beam current and beam uniformity, which can be retrieved both by calorimetry and electrical measurement, beamlet divergence and deflection can be determined by infra-red thermography. This contribution describes the characterization of the SPIDER negative ion beam as a function of the source and accelerator parameters by means of the diagnostic calorimeter STRIKE in the volume regime.