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A systematic search for the optimal baffle closure at the TCV tokamak

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** *See the author list of "Progress on an exhaust solution for a reactor using EUROfusion multi-machines capabilities" by E. Joffrin et al. to be published in Nuclear Fusion Special Issue: Overview and Summary Papers from the 29th Fusion Energy Conference (London, UK, 16-21 October 2023).*

Quantitative imaging is rapidly gaining interest within the fusion research community. Multispectral imaging systems such as MANTIS can simultaneously provide integrated emission line intensity along half a million chords through the plasma for up to ten narrow spectral bands [1]. This wealth of information allows for simultaneous hydrogen and helium spectroscopic analyses, providing unprecedented insight into the edge tokamak plasmas. This work uses two camera systems in a stereoscopic tomographic inversion process to obtain the poloidal emissivity profiles covering the main chamber and the divertor. The resulting emissivity profiles are then used in an integrated data analysis combining the latest plasma emission models accounting for the atomic and relevant molecular processes for hydrogen and an excitation emission of helium [2,3,4]. Together, those models provide an inference of the 2D maps of the electron density, temperature and atomic densities of helium and hydrogen in the SOL. The inferred plasma parameters provide a 2D map of the ionisation rate, which, in this work, is used to quantify the effect of plasma baffling on its poloidal distribution and magnitude. This study separates the plasma into regions above and below the baffle or between the high-field and low-field radial regions. This separation allows us to quantitatively describe the location and magnitude of the ionisation at the plasma edge. Our findings indicate where the neutral gas enters the plasma core region in the X-point position scan experiments, indicating the optimal baffle clearance in L-mode discharges for attached and detached conditions.

References
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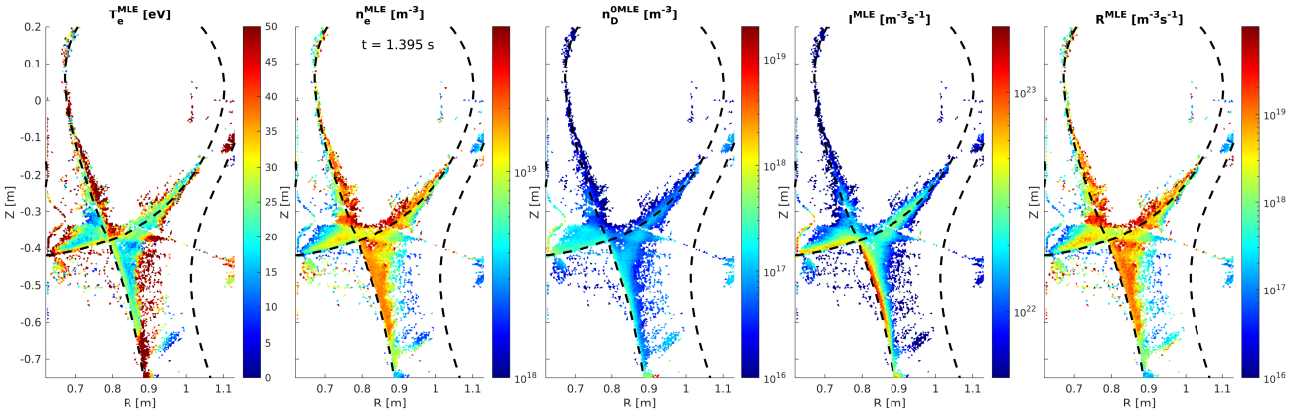

Figure 1. Poloidal profiles of plasma parameters inferred from simultaneous measurements of six emission lines of hydrogen and helium imaged by MANTIS in the TCV tokamak.