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P4.1016 Plasma Edge Turbulence Characterization Using Gas Puff Imaging on the TCV Tokamak

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Understanding turbulence and anomalous transport in tokamaks remains an important open issue in plasma physics for fusion devices. A prominent feature of turbulence in the Scrape Off Layer (SOL) region are blobs, coherent filamentary plasma structures that drift across the magnetic field lines at high velocities (~km/s) and interact with the vessel wall. Besides providing cross-field transport of particles and energy, blobs are a concern for future fusion reactors since they pose a potential threat to plasma-facing components. The mechanisms dominating blob propagation in the SOL, and thus the level of plasma-wall interaction, are sensitive to a number of conditions and parameters such as plasma collisionality and magnetic configuration, and are not yet fully understood. The Tokamak à Configuration Variable (TCV) at EPFL, with its unique flexibility in plasma shaping, is a powerful tool to disentangle the different mechanisms at play. In 2018, to study blob dynamics with adequate temporal and spatial resolution, we built and commissioned a Gas Puff Imaging (GPI) diagnostic at TCV. The GPI is situated at the outer midplane, where it collects emission from a neutral gas cloud (helium or deuterium) tangentially to the local magnetic field. We acquire data from a field of view of 50x42 mm, covered by a 12x10 optical fiber array with a spot size of about 4mm on the image plane. The light is acquired with an avalanche photo-diode array at 2MHz, such that we can resolve structures with the diameter of the order of a cm with velocities of the order of km/s. In December 2018, we collected first data in attached and detached L-mode plasmas, and we were able to detect blobs being formed near the LCFS and drifting through the SOL. We will present the first analysis of the data, in which we will describe size and velocity distribution of the blobs, and compare them to previous, more indirect measurements deduced from reciprocating Langmuir probes. We will further analyze the differences in transport in attached and detached plasma conditions and the connection between divertor and upstream turbulence.

a: See the author list of S. Coda et al, 2017 Nucl. Fusion 57 102011

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