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On Filamentary Transport in the TCV Tokamak: Addressing the Role of the Parallel Connection Length

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Addressing the role of Scrape Off Layer filamentary transport is presently a subject of intense studies in fusion science. Indeed, the broadening of the Scrape Off Layer profiles in high density discharges has been observed in a number of devices. The broadening has been attributed to an increase of the convective contribution to the perpendicular transport [LaBombard, B et al. Phys. Plasmas 8, 2107 (2001)]. Recent observations in AUG and JET L-mode plasma [Carralero, D et al. Phys. Rev. Let. 115, 215002 (2015)] provide support to the idea that the profile broadening is caused by the transition of the filamentary dynamics from sheath-limited to inertial regime. The transition is then due to an increase of effective collisionality [Myra, J. R. et al. Physics of Plasmas 13, 112502 (2006)] and a consequenttial disconnection of the plasma filaments from the target. The experimental results from AUG and JET are not fully supported by observations on devices as MAST and DIII-D. In this context experiments have been performed on the TCV tokamak [Coda, S et al. Nucl. Fus. 53, 104011 (2013)], where the high flexibility in plasma shaping has been used to test the profile broadening against the dependence on the parallel connection length. In a set of L-Mode discharges the flux surface expansion at the outer target was progressively increased between shots, leading to an increase of the parallel connection length from the midplane to the outer target plates by almost a factor of two. In these shots identical density ramps were performed. A clear modification of the target profiles and a modest modification of upstream profiles have been observed. The investigation of profiles and turbulence, as observed from various diagnostics, is presented and correlated with the divertor conditions in terms of detachment and effective collisionality. The data obtained is compared with ASDEX-Upgrade results in terms of effective collisionality and dimensionless parameters.

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