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Edge Flows Studies via Doppler Backscattering on the TCV Tokamak

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A Doppler backscattering (DBS) diagnostic from LPP has been installed recently on TCV, enabling an extended characterization of the detailed edge E_r structure on this tokamak. The DBS system consists of two continuous wave, independent V-band channels. It uses a quasi-optical launcher antenna[1], shared with TCV's short-pulse reflectometry system. The polarization can be changed flexibly between O- and X-mode. The tiltable line of sight, which views the plasma diagonally from the upper low-field side, allows the top to outer mid-plane regions of the plasma cross-section to be probed. The unusual probing geometry offers some flexibility, in particular regarding access to the X-point region in upper single-null plasmas, or the study of poloidal variation of the $E_r \times B$ velocity, but also comes with technical challenges. In this contribution, we report on recent and ongoing experiments utilizing this new DBS system to address the physics of edge E_r "well" formation in L-mode and approaching the L-H transition.
A special focus of these experiments is the role of magnetic topology (favorable vs. unfavorable $B \times \nabla B$ drift) in setting the $E_r \times B$ shear[2,3]. Guided by similar experiments on TORE SUPRA[4], WEST[5,6] and ASDEX Upgrade[7,8], E_r profiles have now been measured on TCV for different topologies and plasma conditions, in Ohmic as well as auxiliary heated discharges. Further studies intended with the new DBS diagnostic include radial correlation measurements and the impact of shaping (especially negative triangularity) on E_r.

[1] P. Molina Cabrera Rev. Sc. Instruments (2018)
[2] T. N. Carlstrom et al. PPCF (2002)
[3] B. LaBombard et al. PoP (2005)
[4] P. Hennequin et al. 37th EPS Conference on Plasma Physics (2010)
[5] L. Vermare et al. Nucl. Fusion (2021)
[6] S Rienäcker et al. 27th Joint EU-US TTF Meeting, poster (2023)
[7] J. Schirmer et al. Nucl. Fusion (2006)
[8] U. Plank et al. PoP (2023)

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