Fluctuations measurements in TEM and ITG dominated negative triangularity plasmas

M. Fontana[1], L. Porte[1], O. Sauter[1], S. Coda[1], Ajay C. K.[1],
S. Brunner[1], G. Merlo[2], A. Fasoli[1] and the TCV team
[1]*Swiss Plasma Center-EPFL, Lausanne, 1015, Switzerland*
[2]*University of Texas at Austin, Austin, TX 78712, United States*

Past experiments on TCV have shown that fluctuations in negative triangularity discharges are suppressed with respect to positive triangularity plasmas with comparable profiles and heating [1][2]. These past observations had been only conducted in ohmic or EC heated discharges where $T_e/T_i > 1$. Gyrokinetic simulations show these plasmas to be dominated by electron driven turbulence, especially Trapped Electon Modes (TEM) [3]. If such confinement improvements were retained also in low T_e/T_i plasmas, where Ion Temperature Gradient (ITG) driven turbulence is dominant, it would be particularly interesting for the design of negative triangularity DEMO-like machines.

For this reason, recent experiments have exploited the versatile heating system of TCV to investigate the effects of triangularity on transport and fluctuations in plasmas with $T_e/T_i \leq 1$. Discharges with symmetric positive and negative triangularity, characterized by comparable density and temperature profiles, have been obtained using different levels of Neutral Beam Injector (NBI) power. The CECE diagnostic has been used to measure temperature fluctuations in the region $0.7 < \rho < 0.85$. These measurements show reduced relative fluctuations in negative triangularity plasmas, compared to positive triangularity discharges, also in cases where NBI is the dominant source of heating. Linear gyrokinetic simulations, performed with the GENE code, suggest that turbulence, in these plasmas, is dominated by ITG modes.

Non-linear gyrokinetic simulations will be employed to investigate the effects of T_e/T_i on the dominant instability regime. The foreseen fluctuations levels, calculated with the use of a synthetic diagnostic, will be compared with the experimentally measured ones.

References

[1] Zhouji Huang. *Experimental study of plasma turbulence in the TCV tokamak*. PhD thesis, 2017.

[2] M. Fontana, L. Porte, S. Coda, O. Sauter, and The TCV Team. The effect of triangularity on fluctuations in a tokamak plasma. *Nuclear Fusion*, 58(2):024002, 2018.

[3] Gabriele Merlo. *Flux-tube and global grid-based gyrokinetic simulations of plasma microturbulence and comparisons with experimental TCV measurements*. PhD thesis, EPFL, 2016.