EFTSOMP2008 - 11th Workshop on Electric Fields, Turbulence and Self-Organisation in Magnetized Plasmas
Satellite meeting of the 35th EPS Plasma Physics Conference, Crete, 2008

Fast temperature fluctuation measurements in SOL of tokamak TCV

J. Horacek[1], A.H. Nielsen[2], R. A. Pitts[3], J. Zajac[1], J. Seidl[1], O.E. Garcia[4], B. Gulejova[3]

1 *Institute of Plasma Physics AS CR, v.v.i., Association EURATOM/IPP.CR, Za Slovankou 1782/3, 182 00, Prague 8, Czech Republic*

2 *Association EURATOM–Risø National Laboratory, Technical University of Denmark, OPL-128 Risø, PO Box 49, DK-4000 Roskilde, Denmark*

3 *École Polytechnique Fédérale de Lausanne (EPFL), Centre de Recherches en Physique des Plasmas, Association Euratom – Confédération Suisse, 1015 Lausanne, Switzerland*

4 *Department of Physics and Technology, University of Tromsø, N-9037 Tromsø, Norway*

A fast scanning assembly has been widely used on the TCV tokamak to insert a probe head equipped with an array of single Langmuir probe tips up to the separatrix at the plasma midplane. Using fast voltage sweeping, we obtain IV-characteristics every 8 μs, allowing an estimate of the electron temperature, T_e on this timescale. Since this temporal resolution corresponds to typical T_e autocorrelation times [1][2], it is just fast enough to resolve the temperature of individual turbulent structures (blobs).
Since at this voltage sweep frequency (~60 kHz) hysteresis is observed in the IV-characteristics, some effort is required to demonstrate the credibility of the T_e derived from the characteristics. Following the methodology proposed in [3], we use both numerical (*5spice* code) and lab simulations of the equivalent probe circuit, together with a simplified plasma circuit to study the capacitative coupling both across the plasma sheath and in the probe circuit itself. Comparisons are also made between the results from higher frequency sweeping and the standard values derived from a slower sweep to show that the fast measurement is reliable.
Considerable effort has been expended in recent years to compare the statistical character of turbulence in the SOL particle flux on TCV with results from the 2D fluid electrostatic model ESEL [2][4]. Using results from the fast sweeping, similar comparisons can now be made with the fluctuating T_e and will be described in this contribution. We also present basic statistics derived from the T_e time series obtained at different radii in the SOL plasma and show, in particular, that the relationship between higher moments of the probability distribution function from both experimental and simulated T_e's may be well described by the Beta probability distribution function, introduced for SOL turbulence in [5]. The fast T_e capability also allows the SOL response to Edge Localised Modes (ELMs) to be studied and new results will be presented for the far SOL T_e response during Type III ELMs.

References

[1] J. Boedo, Phys. Plasmas, 10 (2003) 1670

[2] J. Horacek, PhD-thesis, 2006, CRPP EPFL Switzerland

[3] Philippe Verplancke, PhD-thesis, 1996, IPP 4/275 Garching, Germany

[4] O.E. Garcia *etal*., Nucl. Fusion 47 (2007) 667–676

[5] B. Labit *etal*., Plasma Phys. Contr. Fusion 49 (2007) 12B 281