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## Poloidal 2D scans to investigate potential and density profiles in the TJ-II stellarator using Heavy ion beam probe diagnostic

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Recent simulations have shown that in the plasma regime where the length scale of the turbulence is very small compared to the equilibrium scale set by the variation of the magnetic field, the largest fluctuations of density and plasma potential form narrow bandlike structures on the magnetic surfaces [1]. In addition, flux-surface variations of electrostatic potential can have a significant impact on high-Z impurities radial fluxes [2]. Heavy Ion Beam Probe (HIBP) set up has been used to experimentally characterize these 2-D structures of plasma fluctuations in the TJ-II stellarator mapped by varying the energy of the Cs<sup>+</sup> probing beam. Experiments were carried out in low-density ( $0.4 \times 10^{19} \text{ m}^{-3}$ ) ECRH plasmas characterized by peaked and hollow electron temperature and density profiles respectively. This unique experiment allows the investigation of 2D poloidal contour map for plasma potential and the RMS fluctuation in potential and density from high to low field side for the plasma volume under examination [Fig. 1]. The 2D poloidal scan indicates the local maximum of potential (fig1 left) to be slightly shifted upwards from the center of vacuum magnetic flux surface, which coincides with the local maximum in RMS potential (fig1 Right). Also, there is a visible up-down poloidal asymmetry of RMS potential fluctuations for both LFS and HFS in the range of 5-10 V. Similar contour plots were also investigated for RMS fluctuation in density. It should be noted that there exist an uncertainty in the HIBP measurements for  $\rho > \pm 0.8$  due to low plasma density in periphery. The 2-D characterization of plasma potential and fluctuations covering the whole TJ-II plasma cross-section will be performed in the near future.

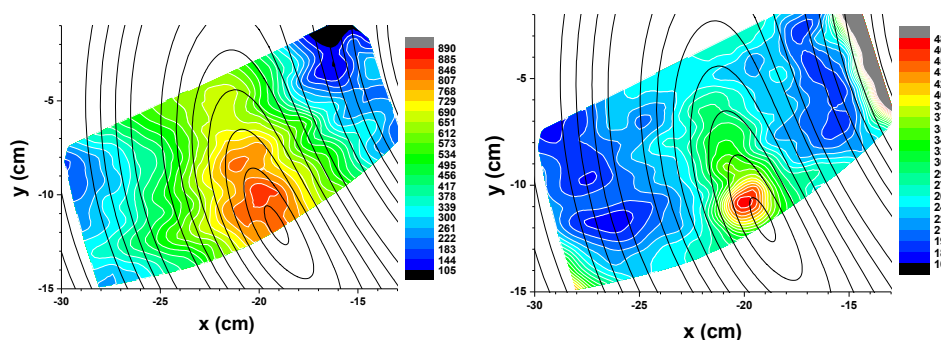


Fig1: The 2D poloidal mapping of mean potential (left) and RMS potential fluctuations (right) for the plasma volume scanned (units in volts)

[1] P. Xanthopoulos et al., Physical Review X 6 (2016) 021033

[2] J.M. García-Regaña, et al., Nucl. Fusion 57 (2017) 056004

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