Doppler reflectometer system in the stellarator TJ-II

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Recently, the antenna system of the *conventional* reflectometer [1] of TJ-II has been replaced to allow for Doppler backscattering measurements. The new system [2] consists of a choked-corrugated antenna [3] in combination with a steerable ellipsoidal mirror. Both elements have been exclusively designed to meet the requirements of TJ-II and the system has been adapted (position, toroidal inclination) to the three-dimensional geometry. The combination of antenna and ellipsoidal mirror allows for Gaussian microwave beams with well-defined beam waist radii near the cutoff layer in the plasma, which is an indispensable condition to obtain a good spectral resolution of the measurements in TJ-II [4]. The electrical backbone is a frequency hopping system [5] which operates in the Q-Band (33 – 50 GHz) with switching times less than 1 ms. The X-mode wave probes plasma cutoff densities ranging from 0.3 to 1.5×10^{19} m^{-3} and the available tilt angle range enables wavenumber scans between 3 and 15 cm^{-1}. Two channels permit the calculation of velocity shear profiles and radial correlation lengths. Estimation of the perpendicular wavenumber and the radial position of scattering as well as their uncertainties is done using the 3D ray/beam tracing code TRUBA [6].

Perpendicular plasma velocity profiles for ECRH and NBI discharges will be shown. In ECRH plasmas, the deduced radial electric fields change from about +5 to -3 kV/m as the density increases above the threshold value for the formation of the edge velocity shear layer [7, 8]. Close to the threshold density the perpendicular velocity profiles show an inversion at the radial position of maximum density gradient. The effect of ECRH heating power modulation on the turbulence will be presented. Stronger negative radial electric fields of up to -8 kV/m are observed in NBI plasmas. Their dependence on plasma density and temperature will be discussed.

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