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AM Reflectometry Measurements in the Stellarator TJ-II

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An Amplitude Modulation reflectometry system is in operation at the TJ-II stellarator [1] ($B_0 < 1.2$ T, R = 1.5 m and a ≤ 0.22 m). Electron density profiles have been obtained in different experimental conditions during the last experimental campaign [2]. The agreement with profiles measured by Thomson scattering and Lithium beam diagnostics is good.
In order to measure density profiles from the plasma edge, the extraordinary mode of polarisation is used. An HTO (Hyper-abrupt Varactor-Tuned Oscillator) used in combination with active multipliers generate two frequency segments: 25 - 36 and 36 - 50 GHz sharing a unique common wave-guide system (Ka band). The signal is amplitude modulated at 200 MHz and the phase demodulation is done at lower intermediate frequency. In its present configuration the reflectometer can probe densities up to $n_{max} \approx 10^{13}$ cm^{-3} for the typical magnetic field of TJ-II.
The time evolution of the electron density profile has been measured under different experimental conditions. During the transition to an improved confinement regime the measurements show a noticeable change in the density profile with a continuous increase in the density gradient and a broadening of the profile. In the most external part of the plasma the electron density remains almost constant.
The time evolution of the density profiles measured during cold pulse propagation experiments, provides the first experimental estimates of the particle diffusion coefficient at the plasma interior of TJ-II.
A notable property of TJ-II is its considerable flexibility with regard to the magnetic configuration. The rotational transform can be varied over a wide range by changing the current fed into the coil structure. Extensive scans in magnetic configuration have been carried out in TJ-II. Reflectometry measurements show a modification in the shape of the density profile when a low order rational surface is moved from the scrape-off layer into the plasma confinement region. Modifications in the density profile associated with changes in the magnetic configuration will be reported.

[1] C. Alejaldre et al., Plasma Phys. Control. Fusion **41** (1999) A539
[2] T. Estrada et al., Submitted to Plasma Phys. Control. Fusion

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