Collective Thomson Scattering in FTU: first comparison between numerical predictions and experimental observations

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The Collective Thomson Scattering (CTS) diagnostic allows the investigation of ion populations in fusion plasma devices, studying the characteristic emissions, stimulated by the injection of a powerful microwave probing beam. From the shape of the emitted spectrum, plasma parameters such as ion temperature, drift velocity and ion composition can be inferred [1, 2]. The availability in FTU of a CTS diagnostic system at 140 GHz and the possibility of "non-resonant" plasma scenarios, i.e. scenarios in which the Electron Cyclotron (EC) layer (and harmonics) resonant with the probe frequency are out of the plasma region, allow to carry out studies on ions characteristics. In fact, in presence of EC resonances, the Electron Cyclotron Emission (ECE) background (at probing frequency) can significantly overwhelm the signals due to thermal CTS. In recent experiments, focused on the investigation of the effects of Parametric Decay Instabilities (PDI) in plasma with magnetic islands stimulated by neon injection [3], a few shots were performed in non-resonant plasmas at 3.6 T, plasma current of 350 kA and densities ranging from $5*10^{19}$ to $1.2*10^{20}$ m^{-3}. The scattered signal of the 140 GHz, 350 kW probe beam has been detected by the upgraded CTS system [4] and further analysed with the Thermal Collective Scattering code (TCS) [5]. The TCS has been developed for the analysis of thermal ions spectral functions and recently upgraded with tool providing absolute calibrated spectra (in eV). The CTS emission predicted by the code was compared with the new calibrated spectra collected during the non-resonant discharges. The fitting of these spectra allows an estimate of ion temperature and of the fraction of neon impurities (injected to stimulate magnetic island) whose characteristic emissions have been also simulated by the code.

References

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