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Observation of Short Time-scale Spectral Emissions at Millimeter Wavelengths with the New CTS Diagnostic on the FTU Tokamak

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The Collective Thomson Scattering (CTS) diagnostic on FTU tokamak was renewed [1] for investigations on the excitation of Parametric Decay Instabilities (PDI) by Electron Cyclotron (EC) beams in presence of magnetic islands and their effects on the EC absorption.
Experiments were performed with a gyrotron probe (140 GHz, 400 kW) launched in symmetric and asymmetric configurations with respect to the equatorial plane, in different conditions of plasma density and magnetic field (with or without the EC resonance in the plasma), and with magnetic islands generated by Neon injection. The acquisition with a fast digitizer allowed observing spectral features with very high time and frequency resolution [2]. In the shots performed at 7.2 T, with the fundamental EC resonance out of the plasma region, a sequence of faint lines emitted with a fast temporal evolution have been observed in a range 0.5-1.1 GHz from the gyrotron frequency (Fig.1) while at 4.7 T, with the resonance on the high field side of the plasma column, asynchronous “bursts” of continuous emissions were observed at a microsecond time scale.
In 2015 experiments were performed at 4.7 and 3.6 T, in this last case with the plasma between the first and the second EC harmonics. Different types of spectral features with a fast evolution were observed. Their correlation with magnetic probes and fast signals from the plasma has been investigated, to characterize the observations and exclude parasitic effects, as well as breakdown phenomena in front of the antennas. The variation in the stray radiation distribution in the vessel has been studied with the aid of a diffusive model, to characterize variations on the probe beam absorption associated to the observed phenomena. Further improvements of the diagnostic both in frequency band (up to ±4.2 GHz from the probe) and with the addition of a second radiometer, will allow a clearer interpretation of the emissions.

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[1] W. Bin et al., Fusion Eng. Des. 96-97 (2015) 733-737
[2] A. Bruschi et al., Proc. 42nd EPS Conference on Plasma Physics (2015)

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