PERFORMANCES OF A MARTIN-PUPLETT INTERFEROMETER FOR ECE MEASUREMENTS

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** See the Appendix of F. Romanelli et al., Proc. 22nd Int. FEC Geneva, IAEA (2008)*

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A multichannel Oblique Electron Cyclotron Emission diagnostics (ObECE) has been recently installed at JET [1]. The diagnostics has been designed to investigate features in the ECE spectra taken at the different angles, related with the deviations of the electron velocity distribution from the Maxwellian behavior, both in the near-thermal [2] and in the superthermal energy range [3].
This diagnostics allows simultaneous analysis of the ECE spectra along three lines of sight (at 0º, ~10º, ~22º, to the poloidal plane) and 2 linear polarizations (mostly X-mode, mostly O-mode) for each oblique line of sight. The spectra are analyzed with a multichannel (5+1) Martin-Puplett interferometer (MPI), based on a confocal design with elliptical mirrors. The movable arm is a rotating wheel-shaped spiral rooftop reflector [4], allowing a time resolution up to ~5 ms per interferogram, with 7.5 GHz as single line equivalent best spectral resolution. The band of interest (75-800 GHz) is well covered.
The ObECE system has been providing calibrated data since the 2008 campaign and, while giving good quality data in the plasma measurements [5], being cross-calibrated with another single–channel instrument [6], suffered from sensitivity problems when used on very low temperature spectra (77-900 K) such as those used for calibration.
The signal to noise (S/N) ratio has been improved after a different arrangement of the reference rooftop mirrors and with a new set of mirrors allowing an easier optical alignment. From a preliminary analysis the sensitivity - depending on the channel and excluding the transmission line – is increased by 4 to 27 times with the new arrangement and, after a fine re-alignment, by 11 to 44 times.
Instrumental accuracy has been evaluated from live system measurements, made with thermal sources at different temperatures. The expected S/N in case of in-vessel calibration has been estimated as well as the error bars, using also estimates of attenuation of the transmission lines, performed at discrete frequencies in the 110-170 GHz band.
In the ex-vessel calibration the thermal sources are positioned near the instrument and connected to it with ~3m of waveguide (low attenuation); the signal is acquired usually with 5000-50000 number of averages. For the in-vessel calibration the signal goes through ~50m of waveguide (attenuation of ~20dB) before reaching the interferometer.
This paper discusses the ex-vessel calibration and the instrument performance in preparation of the in-vessel spectral calibration of the whole system scheduled in May-June 2010.

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