OPTIMIZATION OF ECE DIAGNOSTIC FOR W7-X STELLARATOR

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The interpretation of diagnostic data at W7-X stellarator (under construction in Greifswald) will be supported by the concept of integrated data analysis [1,2]. This concept is demonstrated to be feasible for the Thomson scattering diagnostic on W7-AS [3]. For the ECE diagnostic, the basic idea is to fit the spectral intensity $I_{\omega\pm\Delta\omega}$ simulated by modelling the data (the antenna, the reciever, *etc*) for a T_e profile. Simulations are performed with a newly developed ray-tracing code, which includes an option to calculate the emission by electrons with an arbitrary distribution function.

The antenna for (standard) ECE measurements will be installed on low-field-side (*lfs*) near the bean-shaped plane, where ∇B is largest, without spectral overlapping of cyclotron harmonics. In order to estimate the limit of spatial resolution, which comes from relativistic broadening of the emission line [4], the calculated ECE spectrum, i.e. radiation for each frequency channel $I_{\omega\pm\Delta\omega}$, is "mapped" onto the radial coordinate. *Vice versa*, using the obtained radial uncertainties for disturbance of the T_e parametrized profiles, the sensitivity of the ECE spectrum with respect to the implemented radial T_e-profiles is checked.

In the initial stage, W7-X will operate in the $10^{19}m^{-3}$ range of densities, with strong ECR heating by X2-mode at 140 GHz. For a highly localized deposition profile, one has to expect the appearance of a suprathermal population of electrons. The question how to distinguish the thermal and non-thermal contributions in the ECE spectrum is also discussed. The attractive idea of using vertical chords with $|B| \simeq const$ as sightlines for the reconstruction of the electron distribution function will fail due to the diamagnetic effects (no way to find the chord with $|B| \simeq const$ for an appropriate range of β-values). However, a high-field-side (*hfs*) observation (especially along the same sightline as *lfs* [5]) appears to be much more promissing: despite the not so high spatial resolution of a *hfs* ECE diagnostic, the existence of suprathermal electrons can be identified by comparison of both *lfs*- and *hfs*-ECE spectra. Moreover, the energy range of the non-thermal fraction can be identified. The capability of (possible) *hfs* multichord imaging is also checked.

References

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