Feasibility of a Collective Thomson Scattering diagnostic for DEMO

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The harsh environment around the DEMO plasma, and the space restrictions and need to maximize the first-wall area used for T breeding, set limitations on the number and type of diagnostics to be installed. This will also focus the efforts on diagnostics needed for control of the DEMO plasma. The robustness and versatility [1] of a microwave-based Collective Thomson Scattering (CTS) diagnostic make it worthwhile to investigate the potential of a DEMO CTS diagnostic.

The CTS diagnostic for ITER, based on a dedicated 1 MW 60 GHz (sub-EC fundamental resonance) gyrotron has recently passed the Final Design Review [2]. The ITER CTS diagnostic will focus on measurements of fast ion dynamics in the burning ITER plasma [3]. The development was founded on experience from both TEXTOR and ASDEX Upgrade, and on the latter it was previously demonstrated that bulk ion dynamics, such as rotation velocity and temperature, could be measured using an ECRH heating beam [4].

The feasibility study for a CTS diagnostic for DEMO is in the initial phase and builds on the experience of the past experiments and the development of the ITER CTS system. The target is to be able to use an ECRH gyrotron beam as the probing source beam, while the receiving quasi-optical system may be a dedicated CTS setup. Nevertheless, the physical impact on the DEMO first wall and port space will be minimised with the (full or partial) use of ECRH quasi-optics. The target for the feasibility study is to investigate how such a CTS diagnostic can be integrated and to give a first estimate on which parameters that can be determined – with particular focus on bulk ion rotation velocity and temperature.

References