Design of Thomson scattering diagnostics for the Divertor Tokamak Test (DTT) facility

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Abstract:

In the Divertor Tokamak Test (DTT) facility two Thomson scattering (TS) systems are under design for the measurements of Te and ne in the core plasma region and in the divertor respectively. The divertor TS system under study is a conventional TS system based on a Nd:YAG laser source, a fiber optic based light collection system and a set of filter polychromators equipped with Si APD detectors. The laser beam and the collection optics share an aperture between adjacent cassettes of the lower divertor and the scattering signal is collected from a set of scattering volumes close to one of the divertor legs by a collection optics system located under the divertor dome and is carried to the polychromators by fiber optic bundles. The filter polychromators are designed to measure Te as low as 1 eV . Measurements with a spatial resolution of 10 mm are possible, with accuracy limited by the plasma ne and the background light. For the core TS system, two options are under consideration: a conventional system, similar to that designed for the ITER core TS, in which Te and ne are measured along a large fraction of a laser beam crossing the plasma near the equatorial plane and the detection system is again based on fiber optic coupled filter polychromators. The spatial resolution is 5 cm in the central region and 1 cm at the plasma edge. Alternatively a TS system based on the LIDAR concept, previously implemented in JET, is under consideration. Recent advancements in laser and detector technology allow achieving a spatial resolution similar to that of a conventional system, but with a simpler and reliable experimental set-up and possibly at a lower cost.