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ITR/P5-30: Status of Thomson Scattering in ITER Divertor

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Detailed measurements of electron parameters in the ITER divertor will be an important part of the experimental program and will be used to study the divertor's ability to adequately deal with plasma position during disturbances and adequately screen impurities released by intense plasma-surface interaction. The divertor Thomson scattering (TS) system is well suited for this purpose. Although TS for ITER will be nominally similar to those used on previous devices, its implementation will be quite different. The large scale of the ITER vacuum vessel and the long distance from the vacuum boundary to plasma boundary (5-10 m) necessitates including in-vessel diagnostic components in the ITER design. The in-vessel diagnostic component design has to take into account the nuclear nature of the ITER device as well as the presence of intensive erosion and redeposition. In addition, the in-vessel diagnostic components have to withstand possible mechanical deformations, displacements during cooling/heating procedures as well as powerful electromagnetic forces generated by the interaction between eddy currents induced during disruptions and the strong magnetic field (~5 T). The main difficulties and challenges for the divertor TS and many other ITER diagnostics are the operability of the components located close to the first wall. The diagnostics has to provide reliable data on the electron parameters near the ionization front characterized by very steep gradients of n_e and T_e: n_e in the range of 10^{19} –10^{21} m^{-3} and T_e from several ten's of eV to extra-low values around 1 eV. Additional challenges include a limited diagnostic access to the plasma and a weak laser scattering signal to be detected against intense background radiation.

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