Analysis of Dual Laser Thomson scattering signals on W7-X

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Dual-laser Thomson scattering (DLTS) is an advanced diagnostic technique in which two laser pulses of different wavelengths are sent to the plasma with a very short time delay and the two scattered signals are separately and independently measured with the same set of polychromators [1,2]. Owing to the dependence of the TS spectrum on the input laser wavelength, the two sets of signals correspond to two different spectra, both related to the same T_e and n_e. The pair of scattering signals collected in this way from each spectral channel was initially intended to correct systematic errors in the calibration of spectral channels, but it is now also aimed to extending the accuracy of the T_e and n_e measurements in the high T_e range. These features are of interest for the next generation of fusion experiments where the electron temperature in the core reaches values that are difficult to precisely measure with a single laser Thomson scattering, and where inaccessible optical elements are subject to deterioration of their spectral characteristics. Recently, a dual laser Thomson scattering has been developed at W7-X [3]: a unique system employing, in combination with a 1064 nm laser, a 1319 nm Nd:YAG laser. For the first time during OP2.1, a dual laser Thomson scattering system was operated stably during the entire experimental campaign. In this work, the dual-wavelength signals recorded in several W7-X discharges are analyzed and the electron temperature profiles and the experimental errors are discussed, with the aim of identifying the capabilities of this diagnostics.

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