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6.12 Dual-laser wavelength Thomson scattering at Wendelstein 7-X

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The Thomson scattering (TS) system is a main diagnostic at the Wendelstein 7-X stellarator for electron temperature (T_e) and density (n_e) profiles. The TS system includes a pulsed, high power Nd:YAG laser with $\lambda=1064$ nm, together with five interference filter polychromators for spectral analysis of the scattered light in the near infrared region between $\lambda=750-1061$ nm. The system is able to measure T_e up to approximately 10 keV within an error of $\sim 10\%$, depending on n_e and background light. The system will be equipped with an additional Nd:YAG laser with $\lambda=1319$ nm, so that the peak of the TS spectrum shifts up by $1319-1064=255$ nm. This has two advantages: First, the dual laser availability allows an in-situ spectral calibration, based on the two lasers being fired quasi-simultaneously; the two measured TS spectra, covering different wavelength regions, should yield an unchanged T_e . Secondly, higher $T_e > 10$ keV can be measured as the peak of the TS spectrum shifts to shorter wavelengths. This avoids the polychromators having to cover $\lambda < 750$ nm, where line emission and Bremsstrahlung increase strongly. The status of the 1319 nm Nd:YAG laser development and the design of optical components of the laser beam path will be shown and simulations will demonstrate the new system capabilities.

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