Commissioning of the edge Thomson scattering diagnostic system on Versatile Experiment Spherical Torus

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An edge Thomson scattering (TS) diagnostic system has been developed on the Versatile Experiment Spherical Torus (VEST) in response to the need for electron temperature and density profiles in the edge plasma and scrape-off layer (SOL) of VEST. VEST is a spherical tokamak with a major radius of 0.4 m and a minor radius of 0.3 m. The existing TS system is capable of measuring the core plasma region, covering the normalized minor radius range with $\rho < 0.6$. A new vacuum window and a collecting lens optimized for the low-field side edge region of $0.6 < \rho < 1$ were required. The collecting lens for edge region consists of four lenses to maximize the collection of scattered light from the VEST plasma, while minimizing optical aberrations. The system shares a burst-mode laser delivering 10 sub-pulses at 1 kHz with a burst repetition rate of 0.5 Hz with the existing TS system [2-4]. Such a fast repetition rate is expected to allow observations of fast transient events in the edge region, such as internal reconnection events and edge-localized modes. Since, the expected plasma temperature and density at the target region are low (temperature of under 30 eV and density of less than 10^{18} m^{-3}[5]), the combination of five ultra-narrow bandpass filters equipped in each polychromator has been newly designed to effectively determine the plasma temperature. The spectral calibration and the absolute calibration of the system have been performed as in the same manner as the core TS system.

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