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P2.045 Upgrade of Thomson scattering system on VEST

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Upgrade of the Thomson scattering (TS) system in Versatile Experiment Spherical Torus (VEST) is planned for measuring the electron temperature and density with higher reliability and higher time resolution. The existing TS system has difficulties on measuring single plasma discharge, since it uses a laser with energy of 0.65 J and repetition rate of 10 Hz, while the pulse duration of the plasma is ~20 ms. Recently, additional heating sources such as neutral beam injection and electron cyclotron heating are installed, thus, the upgrade of the TS system has been required to provide the time evolutions of the electron temperature and density for heating efficiency analysis. The upgrade is mainly related with two parts. First, a new laser is utilized for increasing both the signal-to-noise ratio (SNR) and the time resolution. The laser generates 10 pulses with 1 ms time interval in every 2 s, and each pulse has the energy of 2 J. And a switched capacitor type digitizer with 32 channels and 5 GS/s is newly employed for storing a number of pulse signals. Second, the optical fibers for transferring the collected TS photons are improved as well as the laser. Although the collection solid angle and the numerical aperture between the collection lens and the optical fiber are well matched each other, it uses only half of the maximum etendue of the polychromator. Therefore, the fiber bundle is designed to optimize the optical properties among the lens, fiber, and the polychromator. Compared to the current system, replacement of the laser, modification of laser injection optics, and fiber bundles are expected to improve the efficiency more than 6 times. Furthermore, in the temporal point of view, it decreases the number of required plasma discharges to be a tenth.

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