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10.8 Two-pass upgrade to the Thomson Scattering diagnostic on the Prototype Material Plasma Exposure eXperiment (Proto-MPEX)

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The Thomson scattering (TS) diagnostic on the Proto-MPEX at ORNL has been upgraded to simultaneously measure electron temperature (T_e) and density (n_e) at two axial locations. After the first pass through the vacuum vessel, the existing laser beamline is re-collimated in atmosphere and rerouted into the vacuum vessel for the second pass. The upgrade will help diagnose axial T_e and n_e gradients between the 'central chamber' and the target region, which are located 1m and 2.5m downstream from the helicon RF source. TS measurements have given $T_e \approx 4-15\text{eV}$ and $n_e \approx 1-4 \times 10^{19}/\text{m}^3$ at the central chamber, and $T_e \approx 1-2\text{eV}$ and $n_e \approx 1-3 \times 10^{19}/\text{m}^3$ at the target. The upgrade also increases the number of sampling points at the target from one fiber to 5 fibers, measuring 3cm radially across the plasma column, and 25 fibers in the central chamber radially spanning 8cm. The intensified CCD camera is double triggered for each laser pulse: 1) to measure the TS and laser stray light, and 2) to measure the plasma background light, which contains nuisance emission lines and bremsstrahlung. Subtracting the background light from the TS photons improves the temperature and density measurements. Details of the diagnostic setup, axial and radial measurements, and areas for further optimization will be discussed.

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