The Helicity Injected Torus (HIT-II) multi-point Thomson scattering diagnostic (MPTS) has been designed and built to determine electron temperature and density at 11 radial positions at one time during the plasma discharge. The system includes collection optics and a Littrow mount spectrometer on loan from Princeton, and a 1 GW laser and multi-anode microchannel plate detector (MCP) from the University of Texas. The MPTS is currently operational at 8 spatial positions, indicating electron temperatures greater than 100 eV in transformer driven plasmas. The remaining 5 spatial positions are overloaded by stray laser light. Due to space constraints, the MPTS laser beam dump is required to be compact and mounted directly onto the vacuum vessel where the laser beam diameter is small, eliminating the possibility of a Brewster window in this application. Light reemerging from the beam dump is the primary suspect for stray light. A new beam dump has been fabricated in an effort to reduce the stray light and increase the number of operational channels. Further, the MCP instrument function is excessively broad in frequency response due to edge effects on the microchannel plate. A new diffraction grating has been constructed to increase the dispersion of the spectrometer to counteract the excessively broad frequency response of the MCP. Plans for MPTS operation include the characterization of density and temperature evolution across reconnection events in CHI driven plasmas, as well as temperature and density characterizations of optimized CHI and transformer driven plasmas in the HIT-II device.

**TS Accomplishments this year on HIT-II**

- Absolute calibration of the diagnostic via Rayleigh scattering, enabling density measurements.
- New detector mask fabricated and installed, allowing preliminary CHI measurements.
- New relative calibration and instrument functions measured with the new mask installed.
- New beam dump fabricated and installed on the vacuum vessel.
- Entrance for the laser beam deformed from 4.0 to 3.0 in.
- Maximum fluence on the dump surfaces reduced.
- Rigidly mounted to HIT-II facilitating alignment.
- Three laser flash lamps replaced.
- Laser cooling system flushed.
- Three laser flash lamps replaced.
- Laser cooling system flushed.

**TS Diagnostic Photon Statistics**

- Photon statistical error (50 counts):
  - Worst Rayleigh error (44 counts): $\sigma = 0.18 \text{ sr}$
  - $\eta = 0.97 \text{ %}$
- New first surface: a razor-blade first surface.
- Further reduce the stray light by installation of the razor-blade first surface.
- Re-mask the detector to allow 5 more spatial positions.
- Install new baffles at laser beam entrance.
- Increase the number of frequency channels by installing a new-diffraction grating, reducing the bandwidth of each channel.
- Characterize the density and temperature evolution across reconnection events in CHI driven plasmas.
- Optimize CHI and transformer driven plasmas for temperature in the HIT-II device.

**Future Work**

- Install new baffles at laser beam entrance.
- Increase the number of frequency channels by installing a new-diffraction grating, reducing the bandwidth of each channel.
- Characterize the density and temperature evolution across reconnection events in CHI driven plasmas.
- Optimize CHI and transformer driven plasmas for temperature in the HIT-II device.

**Values of temperature and density are calculated at all possible combinations of the measured value, maximum, and minimum error bars on the three data points. The maximum and minimum temperatures and density values calculated then become the limits of the error bars on their respective plots.**