

## Progress on Thomson Scattering in the Pegasus Toroidal Experiment

D. J. Schlossberg<sup>\*</sup>, R.J. Fonck, N.L. Schoenbeck, G.R. Winz

*Dept. of Engineering Physics, University of Wisconsin–Madison, Madison, WI 53706, USA*

A novel Thomson scattering system has been implemented on the Pegasus Toroidal Experiment. The system leverages technological advances in high-energy pulsed lasers, volume phase holographic (VPH) diffraction gratings, and gated image intensified CCD (ICCD) cameras to provide a relatively low-maintenance, economical, robust diagnostic system. Scattering is induced by a frequency-doubled, Q-switched Nd:YAG laser (2 J at 532 nm, 7 ns FWHM pulse) directed to the plasma over a  $< 7$  m long beam path, and focused to  $\leq 3$  mm throughout the collection region. Inter-shot beam alignment is adjustable with  $< 0.01$  mm spatial resolution in the collection region. A custom lens system collects scattered photons from  $15 \text{ cm} < R_{\text{maj}} < 85$  cm at  $\sim F/6$  with 14 mm radial resolution. The initial configuration provides scattering measurements at 12 spatial locations and 12 simultaneous background measurements at adjacent locations. If plasma background subtraction is insignificant, these background channels will be used as viewing channels. Spectrometers support 8 spatial channels and can provide  $> 8$  spectral bins each. The spectrometers use high-efficiency VPH transmission gratings ( $\text{eff} > 80\%$ ) and fast-gated ICCDs (gate  $> 2$  ns, Gen III intensifier) with high-throughput ( $F/1.8$ ), achromatic lensing. Installation of a stray light mitigation facility is in progress and is the final step before calibration and plasma operations. This includes a multi-aperture optical baffle array and a simple beam dump. The expected number of detected photons is  $\sim 4 \times 10^3$  for plasma densities of  $10^{19} \text{ m}^{-3}$ . Typical plasmas measured will range from densities of mid- $10^{18}$  to mid- $10^{19} \text{ m}^{-3}$  with electron temperatures from 10 to 1000 eV.

<sup>\*</sup>Presenting author: [schlossberg@wisc.edu](mailto:schlossberg@wisc.edu)