



Abstract

- **Motivation:** Recent improvements in volume phase holographic (VPH) gratings and image intensified CCD (ICCD) cameras.
- **High efficiency visible wavelength system:** F/2 optics, optical fiber bundles with packing fractions of ~ 0.70 couple to the spectrometer, VPH gratings with $>70\%$ efficiency
 - Measurements of $T_e < 100$ eV are achieved by a 2971 l/mm grating
 - Measurements $T_e > 100$ eV are achieved by a 2072 l/mm grating
- **Detector:** Fast-gated (~ 2 ns) ICCD camera
 - Fast Gate captures 9ns laser pulse
 - Gen III image intensifier provides $>40\%$ quantum efficiency in the visible region
 - P43 phosphor screen requires a minimum integration time of 2 ms.
 - Dark noise, dominated by read noise, can be reduced to ~ 7 counts/pixel by digitizing at 31 kHz and can be further reduced by on-chip binning of the CCD.