Implementation of the Pegasus Multi-Point Thomson Scattering System

G.M. Bodner, D.J. Schlossberg, R.J. Fonck, J.A. Reusch, C.Rodriguez Sanchez

The Pegasus Thomson Scattering system has recently been upgraded to increase the spatial range of the diagnostic and automate the data collection process. The current system uses a frequency-doubled 2J Nd:YAG laser pulsed at 10 Hz with three multi-channel spectrometers, providing a total of 24 data channels to view the plasma volume. Each spectrometer utilizes a volume-phase holographic (VPH) grating and a gated-intensified CCD camera to maximize the observable Thomson signal. Effects from plasma background light, stray light, and image intensifier leakage have been addressed through the installation of a gated intensifier collection window and the addition of multiple fast-actuated shutters. LabVIEW programming has been used to automate the data collection process and interface with the system-wide Pegasus control code. A suite of virtual instrument panels provides the user with both at-a-glance confirmation of proper settings as well as the ability to make detailed changes at the component level. The system presently provides automation of all Thomson-collection events, including laser flashlamp, q-switch and fire commands; ICCD timing and triggering; laser energy monitoring; and heads-up data display and archival. Automation has been extended to areas outside of data collection, such as manipulation of beamline Ethernet cameras and remotely-controlled turning mirror actuators enabling intra-shot beam alignment. This capability maintains optimal laser operation and minimizes disruptions due to thermal lensing and walk-off. Modifications and automation to the Thomson system have enabled reliable measurements of unique, non-solenoidally-driven discharges that require significant collection statistics to provide novel physics insights.

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