

Spectral Line Monitors With High Frequency Response, High Dynamic Range and Long Data Record Capability Relevant to Long Pulse Devices*

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Abstract. A photomultiplier (PMT)-based diagnostic system for monitoring spectral lines along multiple viewchords, named the “Filterscope” [1], is currently in use at DIII-D, NSTX, CDXU, and has been installed at KSTAR. This diagnostic has recently been upgraded for application to long pulse devices, such as KSTAR, EAST, and ITER. Modifications include changes to the data acquisition hardware, the control software and the detector modules. A new PXI-based data acquisition system with embedded Windows computer stores data on the computer’s hard disk. This system can simultaneously record up to 64 channels at 100 kHz sampling rates for plasma periods lasting up to 20 minutes. Based on the average signal level during an adjustable time interval (100 ms in the present DIII-D implementation), the computer digitally controls the voltage of the Cockcroft-Walton power supplies encapsulated in each PMT. This raises or lowers the dynode voltage on each PMT, thereby keeping the anode output signals at a level where they are neither saturated nor dominated by digitizer noise. Feedback control of the PMT gain within the course of a discharge enlarges the effective overall dynamic range by approximately four orders of magnitude. The new system’s ability to accommodate large variations in source strength (discharge to discharge and within a single discharge) has proved particularly valuable during DIII-D operations, since changes between top, bottom and double null divertor magnetic configurations lead to large temporal variations in signal brightness.

[1] R.J. Colchin, et al., Rev. Sci. Instrum. **74** (2003) 2068.

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