Real-Time Multiple Networked Viewer Capability of the DIII-D EC Data Acquisition System*

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A data acquisition system (DAS) which permits real-time viewing by multiple locally networked operators is being implemented for the electron cyclotron (EC) heating and current drive system at DIII-D. The DAS is expected to demonstrate performance equivalent to standalone oscilloscopes. Participation by remote viewers, including throughout the greater DIII-D facility, can also be incorporated.

The EC system at DIII-D consists of five 1 MW class gyrotrons. Operational performance is monitored by collecting beam voltage and current, generated rf, and tube pressure waveforms, among other signals. These are currently disseminated in three ways. First, operators can view a subset of the available signals on traditional oscilloscopes. Second, legacy CAMAC digitizers are used to capture the signals and download them to the DIII-D DAS between DIII-D shots. Third, operators can view signals as they are acquired using compact PXI based digitizers. This last set of digitizers is used in the real-time system.

The real-time system uses 1 computer controlled DAS per gyrotron. Each computer acquires 8 channels simultaneously sampled at up to 70 kHz per channel. Additionally, the computer acquires and buffers 4 channels of fault signals simultaneously sampled at 15 MHz and 16 channels of coolant temperature and flow used for calorimetry. All signals can be viewed on the acquiring computer.

The 8 real-time channels per system will be distributed to multiple remote viewers. Each DAS computer sends its data to a central data server using individual and dedicated 100 Mbps fully duplexed Ethernet connections. The server has a dedicated 10,000 rpm hard drive for each gyrotron DAS. Selected channels can then be reprocessed and distributed to viewers over a standard local area network (LAN). They can also be bridged from the LAN to the internet. Calculations indicate that the hardware will support real-time writing of each channel at full resolution to the server hard drives. The data will be re-sampled for distribution to multiple viewers over the LAN in real-time. Hard drives will hold about a weeks worth of data. Archives will be kept on DIII-D servers and locally on a terabyte DVD/CD changer.

The hardware for this system is in place. The software is under development. This paper will present the design details and up-to-date performance metrics of the system.