Software developments in Gemini

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Introduction

The Gemini laser system software consists of a network of distributed applications which are used to control elements of the laser, and monitor a large number of parameters both on-shot and continuously.

Over the last year, the most significant upgrade to this software has been the introduction of the Experimental Physics and Industrial Control System (EPICS), originally developed at Los Alamos National Laboratory. Below we illustrate some of the software developed for Gemini using this system.

Main Control System

The main Gemini Control System exports nearly 80 EPICS Process Variables (PVs) detailing the state of the Laser and Target Areas. (See figure 1.)

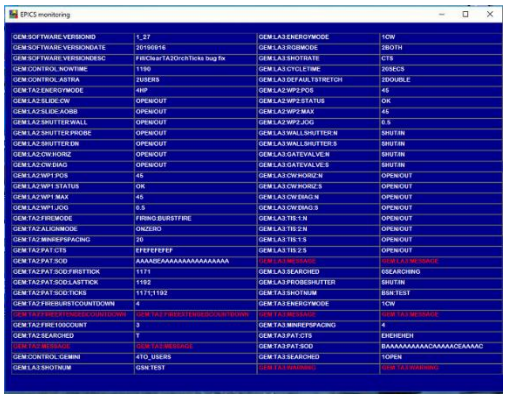

Figure 1. Part of the EPICS window for the Gemini Control System

Amongst these PVs is the system tick count `GEM:CONTROL:NOWTIME` used to orchestrate the various devices in the beamline, `GEM:CONTROL:{ASTRA|GEMINI}` indicating who has control of the front-end or main beamline, `GEM:TA{2|3}:ENERGYMODE`, the positions of shutters, cross-wires and wave-plate stages, and the Continuous (CTS) and Shot-On-Demand (SOD) trigger patterns `GEM:TA{2|3}:PAT:{CTS|SOD}`. Not seen in this screen capture are parameters associated with the Quantels, including energy settings and the 20-second shot schedule.

The learning curve for implementing a soft Input/Output Controller (IOC) for EPICS is steep, but the amount of information then available to applications and users is considerable. Users can watch progress as the system is brought-up in the morning to gauge when the beam might be available to them. They can also monitor energy mode and trigger patterns to arm/disarm devices as required.

TA2 Control System

The user interface to the TA2 Control System has been upgraded from VB6 to .NET, and redesigned to display more clearly the state of the system using about 30 EPICS PVs. (See figure 2.)

Figure 2. TA2 Control System main window

"Fire once," "Burst fire" and "Extended fire" modes have been added to support 5Hz operation where appropriate.

TA3 Control System

The user interface to the TA3 Control System has also been upgraded and redesigned, using about 40 PVs. (See figure 3.)

Figure 3. Part of the TA3 Control System main window

The old Timelines application has been replaced by an in-window timeline showing the orchestration of Quantel shots, Quantel energy update points, command send points, and the current tick. This simple display has already proved useful visualising the sequence of events in the system.

Cross-network gateway servers for Target Areas

A perennial issue for both Target Areas has been the difficulty of managing data across multiple networks: a network of "foreign" (from the point-of-view of site) PCs from the various user institutes, the camera network, the laser network, and the main site network, all of which have slightly different security concerns.

This issue has been eased by the introduction of two carefully configured servers acting as Gateways between the networks. These allow users to manage their own data acquisition systems whilst also permitting visibility of Gemini PVs and diagnostic data.