Software developments in Gemini

Contact *Victoria.Marshall@stfc.ac.uk*

VA Marshall
Central Laser Facility, STFC Rutherford Appleton Laboratory
Harwell Science and Innovation Campus, Didcot OX11 0QX

Introduction

The Gemini laser system software consists of a network of distributed applications used to control sections of the laser and monitor parameters both on-shot and continuously. The facility-wide use of EPICS[1] has enabled us to add a selection of controls measures and a significant upgrade to *penguin*, the system monitoring software. These upgrades are described below.

Diverters, Pickoffs and Attenuators

For some Gemini experiments, the measurement of compressor throughput is particularly important, so two large diverter mirrors were installed, one per compressor. The diverter mirrors can be driven into and out of the beam using a specialised motion control system and can be monitored and controlled by the main Control System via EPICS PVs (Process Variables). These PVs enable the main Control System to monitor the position of the mirrors, and to automatically move them out of the pulsed beam if the operator has forgotten to do so. The main Control System will also block attempts to take shots if it has lost contact with the mirror control system, thus avoiding any potential damage to downstream optics.

The daily measurement of pulse length used to require the operators to manually position a pickoff mirror, take some characterising shots then remove the pickoff before giving control of the beam to the users. This was a fiddly process, and it was all too easy to forget to remove the mirror… until the next few shots. Again, a motion control system and PVs were used to enable the operators to move the pickoffs into the beam when required, and to automatically move them out of the way for higher energy shots.

It is usual for attenuators to be used when aligning the beam, but they (and the alignment crosswires) are normally moved out before shots are taken. These requirements have been in place for years and have already been automated. Every experiment is different however, and occasionally there is a need for users to be able to take shots with attenuators in place so this has been added as a configurable over-ride option to the main Control System, and as an item to the pre-experiment check list.

Penguin and facility monitoring

The use of EPICS PVs has enabled us to expand considerably the number of facility-wide parameters made available. Each application makes a set of PVs available containing information about the version of that software and its various EPICS libraries. A separate application (*GEVA* – the Gemini Ecat Version Archiver) monitors these PVs and creates an XML web page listing them together with information about whether that PV is connected (ie. the corresponding application is running).

The main Control System already produces an XML web page of internal parameters so latest shot numbers and timestamps for the various target areas were added in addition to status information about the diverter mirrors and pickoffs. This provides us with a quick look-up of the latest shot numbers and timestamps – an important consideration as the day progresses, the number of shots increases, and so retrieval of data from the ICAT database can slow to the point at which it has not been fully retrieved before the next call to the database is made.

The main facility monitoring application – *penguin* – has been restructured and rewritten to take advantage of these new features.

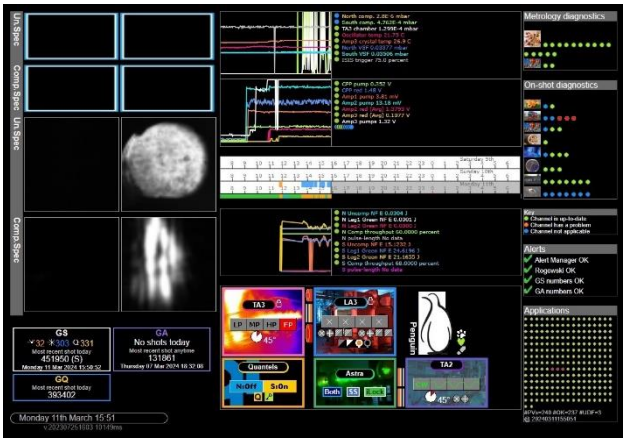

Figure 1. Screenshot of *penguin* web page.

This is a screenshot of the penguin web page taken at about 4pm. The *GS* section indicates that there have been more than 300 experiment shots so far today and the users are using only the south Quantel system, letting-up the target chamber at frequent intervals (white-coloured spikes). There was a glitch in the south uncompressed near-field energy around 2pm (tan-coloured downwards spike), and the south compressed far-field image has been deliberately de-tuned. The dots in the *Applications* section are a representation of GEVA data and indicate that all laser diagnostics are up and running except for one application on a PC which has been switched off (three red dots amongst a sea of green ones). In the *On-shot diagnostics* section, seven of the eight diagnostic PCs are up to date with their (south system) data. (The blue dots indicate north data so are inapplicable here.) We are having trouble with the spectrometer – red dots and two missing trace images. The *Metrology diagnostics* section indicates that everything is up to date on the two PCs taking that data. It took just over 10 seconds processing time to parse the various XML web pages, retrieve the data from the ICAT database and for the server to compose this web page from them.

References

[1] https://epics.anl.gov/index.php