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. Here we outline some of the changes and upgrades to the software that have taken place this year.

ESP300 control on the Split & Delay table

In the past, there has been little call to adjust the timing between the North and South beams in Gemini, because only one beam was in use at any one time. Over the last few years, however, an increasing number of experiments have required both beams, and users have asked for finer control over their relative timing. The timing is adjusted immediately after the split into the North and South beams, using a Newport delay stage driven by an ESP300 controller. The initial software implementation used RPC (Remote Procedure Calls), but this method was restricted to a single connection, and the device would crash if any attempt was made to set up a second connection to drive it from another location.

The RPC mechanism was stripped out and replaced with direct communication over RS232 to the ESP300 controller, using a Python *cgi-bin* which effectively web-enabled the stage.

Figure 1: ESP300 control application

Using the new application, users can keep track of the position of the stage, and adjust it as needed. This has proved a far more reliable method of control, with the added advantage that the current position of the stage (and hence a reference to the relative delay between the beams) is recorded on-shot.

Filter wheel diagnostics and monitoring

Gemini uses 15 ThorLabs FW102C filter wheels which can be configured to attenuate the beam by differing amounts according to the energy level. As part of the on-going Control System work, an application was developed to continue the usual automatic control via the main Control System, but which also enabled the operators to control the filter wheels "by hand." (See Figure 2.)

Figure 2: Filter wheel control application

Positions are now verified so the operator can be alerted if a filter wheel "gets stuck" or has been disconnected for some reason. It is also possible to query the filter wheel firmware version, which has enabled us to identify which devices are up-to-date, which are obsolete or broken, and which can be upgraded.

Environmental temperature monitoring

Gemini was exhibiting variations in performance on what appeared to be a few-minute cycle, and this was suspected to be due to the air conditioning system in the laser area. Several Geist Watchdog temperature monitors were set up around Laser Area 3 to take readings once per minute in an attempt to establish whether this was a factor. (See Figure 3.)

Figure 3: Temperature logging application

The monitoring showed that most of the effect was indeed due to the air-conditioning. The mode of operation of the air-conditioning was changed to reduce the temperature variations in the cycle, and this resulted in a more stable performance of the laser.

Better beam characterization reports

On each operational day the Gemini operators generate a beam characterization report detailing pump, uncompressed and compressed energies and pulse length over a series of shots. Pulse length is measured at reduced energy, with a slide-in pick-off mirror [1] taking a sample of the beam to feed the Grenouille diagnostic. To avoid damaging this mirror, it has to be removed from the beam before full-power shots are fired, so the software was modified to distinguish between the two types of shots. (See Figure 4.)

As with the previous version, these reports can be emailed to operators and users to provide a record of the beam characteristics that day.

References

1. C J Hooker *et al*, CLF Annual Report 2016-17, p 27

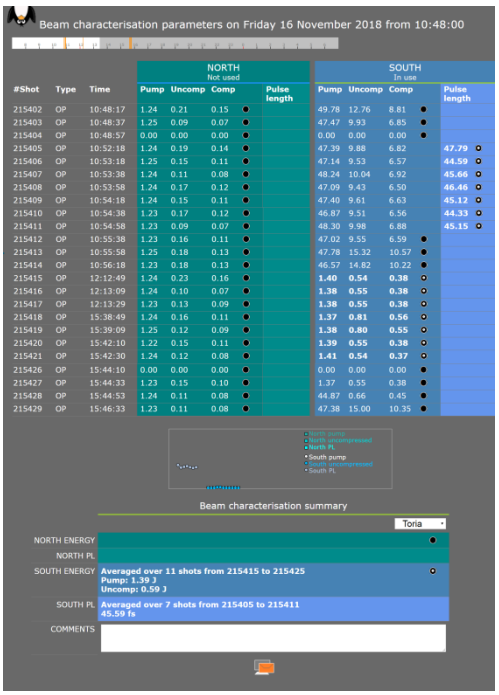

Figure 4. Beam characterization report generation