Software developments in Gemini

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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. Over the last year we have consolidated work on Gemini diagnostics including an investigation into the effects of EMP on the DTACQ2106 device and the installation of a back-reflection prevention flipper. These are described below.

EMP and the DTACQ2106

When Gemini was built in 2008, the health of the 108 lamps in the two Quantel lasers was monitored using Rogowski coils and two 64-channel ACQ196 DAQ devices from D-TACQ Solutions Ltd[1]. The devices were triggered by the main Control System either separately or together according to which Quantel(s) were switched on.

The two D-TACQ devices were upgraded to one 128-channel ACQ2106 device, and the two triggers were merged using pulse-combiner box (designed by now-retired colleague, Chris Hooker). The box was set to give a TTL-level pulse of 300 microseconds duration which was then fed to the new device.

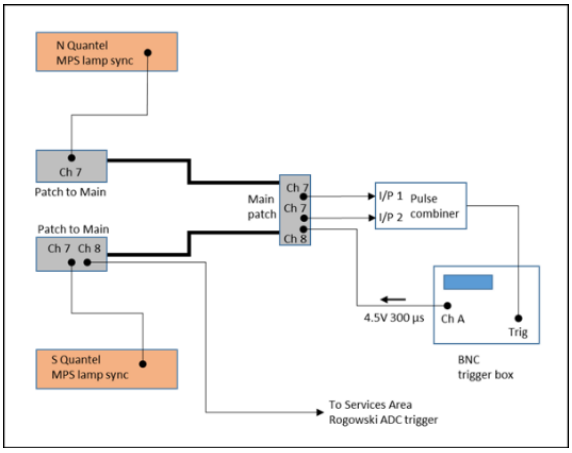

Figure 1. Circuit logic of pulse-combiner box.

However, internal counters on-board the device indicated that much of the time two triggers were being received on-shot (which is incorrect), though sometimes only one (which is correct). The pulse-combiner box came under suspicion for a while, but the problem was finally tracked down to EMP noise generated by the two capacitor banks in the Services Area – the same area in which the D-TACQ device was operating.

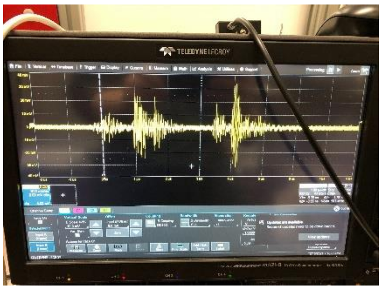

Figure 2. Two bursts of EMP captured by an oscilloscope.

The effect was to sometimes, but not always, knock out the device which subsequently required power cycling.

Various solutions were discussed with the manufacturer including the addition of a ferrite collar to try and reduce the effect of EMP. We were also asked to monitor various internal parameters to more readily identify when it had been knocked out. These measures have gone some small way to improving the reliability of the device, and our ability to identify problems when they occur.

The manufacturer is now working on a harsh environment version of the device which we plan to try once it is available. Unfortunately the current worldwide economic situation makes this a waiting game.

Back-reflection prevention flipper

Facility users were instructed to move a flipper into the alignment section of the beamline on-shot to block back-reflections from the full power section. Perhaps unsurprisingly this instruction was sometimes forgotten which caused optical problems and potential damage further back down the line.

To address the issue, a simple flipper control application was introduced which could be configured to automatically move a flipper into (or out of) the beam on-shot. The associated control systems were also modified so that the users could move the flipper in or out as required on lower-power energy modes.

Figure 3. Flipper control interface configured to move IN on-shot.

This simple application has worked well and has reduced the number of checks that need to be made (so can be forgotten) before each shot.

References

[1] https://d-tacq.com/index.shtml