Improvement to the TAP nanosecond contrast diagnostic

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Introduction

In this report we describe recent modifications to the nanosecond contrast measuring capability for the Vulcan Petawatt facility. We have installed a new beamline to increase the dynamic range available for the measurement and automated the recording and archiving of this data.

TAP contrast diagnostic

In previous reports we have presented the measurements taken of the nanosecond contrast of the pulses in the Vulcan petawatt area [1]. These measurements demonstrated that the nanosecond contrast is principally due to the parasitic parametric fluorescence generated in the OPCPA pre-amplifier.

Since those measurements were taken the nanosecond contrast has been monitored in the Petawatt target area using a photo-diode and an oscilloscope. The photo-diode was installed on a leakage of one of the beamlines used for the autocorrelators and as such had a dynamic range of 10^7 the modifications reported here have increased that dynamic range to 10^8. This has been achieved by relaying the beam out of the compressor chamber that would normally be blocked by a beam dump. This energy is dumped to prevent damage to the petawatt diagnostic suite.

A Labview VI has been developed to record and save the data. The oscilloscope that is attached to the diode is in the diagnostics area of the Petawatt target area, the VI is located on one of the computers in the

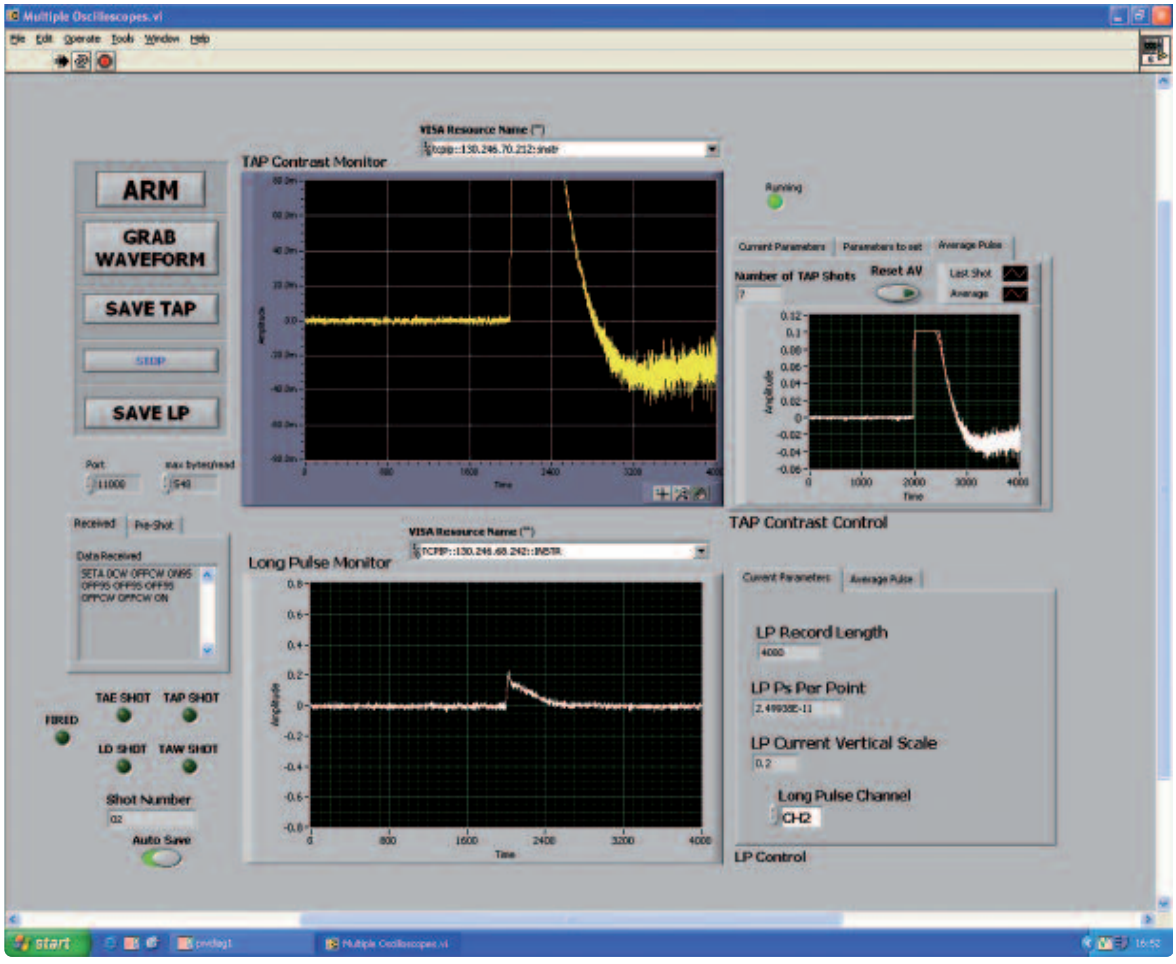

Figure 1. Front Panel of the TAP contrast monitor.

Vulcan laser main control room and the trace is extracted from the oscilloscope using TCP communication. The VI is also in communications with the Vulcan diagnostic server and receives commands as to what the next shot type is and to which area. The VI is also able to measure the average waveform for a number of shots and figure 1 demonstrates its front panel. The same VI is also connected to another oscilloscope which is placed to monitor the output of the main 6 of Vulcan.

The system is currently configured so that the contrast data is recorded on every shot automatically and stored on the Vulcan Data server.

A typical trace for a single shot and the average of 15 shots is shown in figure 2.

Conclusions

In conclusion we have demonstrated an increase in the dynamic range of the contrast monitoring in the petawatt diagnostics area and developed software to capture this data automatically on the shot. The VI is being developed to enable on the shot analysis of the contrast and to compare single shot to the average of a number of shots. This work will be further extended by including the measurements of a contrast monitor system that has been developed for Target Area West [2].

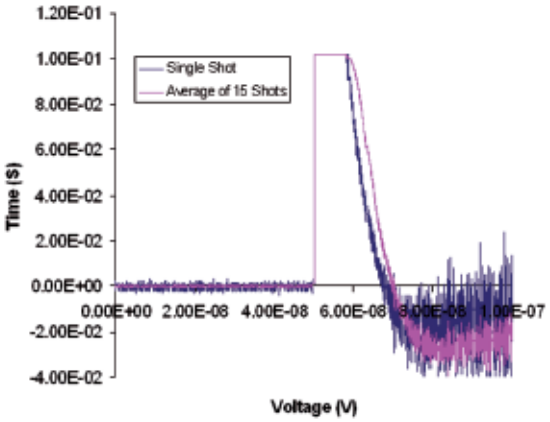

Figure 2. Single shot trace (blue) and average of 15 shots (pink).

References

1. I. O. Musgrave *et al.*, *'Nanosecond contrast measurements of the Vulcan Petawatt Facility'* CLF Annual Report 2004-2005.
2. T. Boudenne *et al.*, *'A Contrast Monitor for TAW'* CLF Annual Report 2008-2009.