Status of the Laser System

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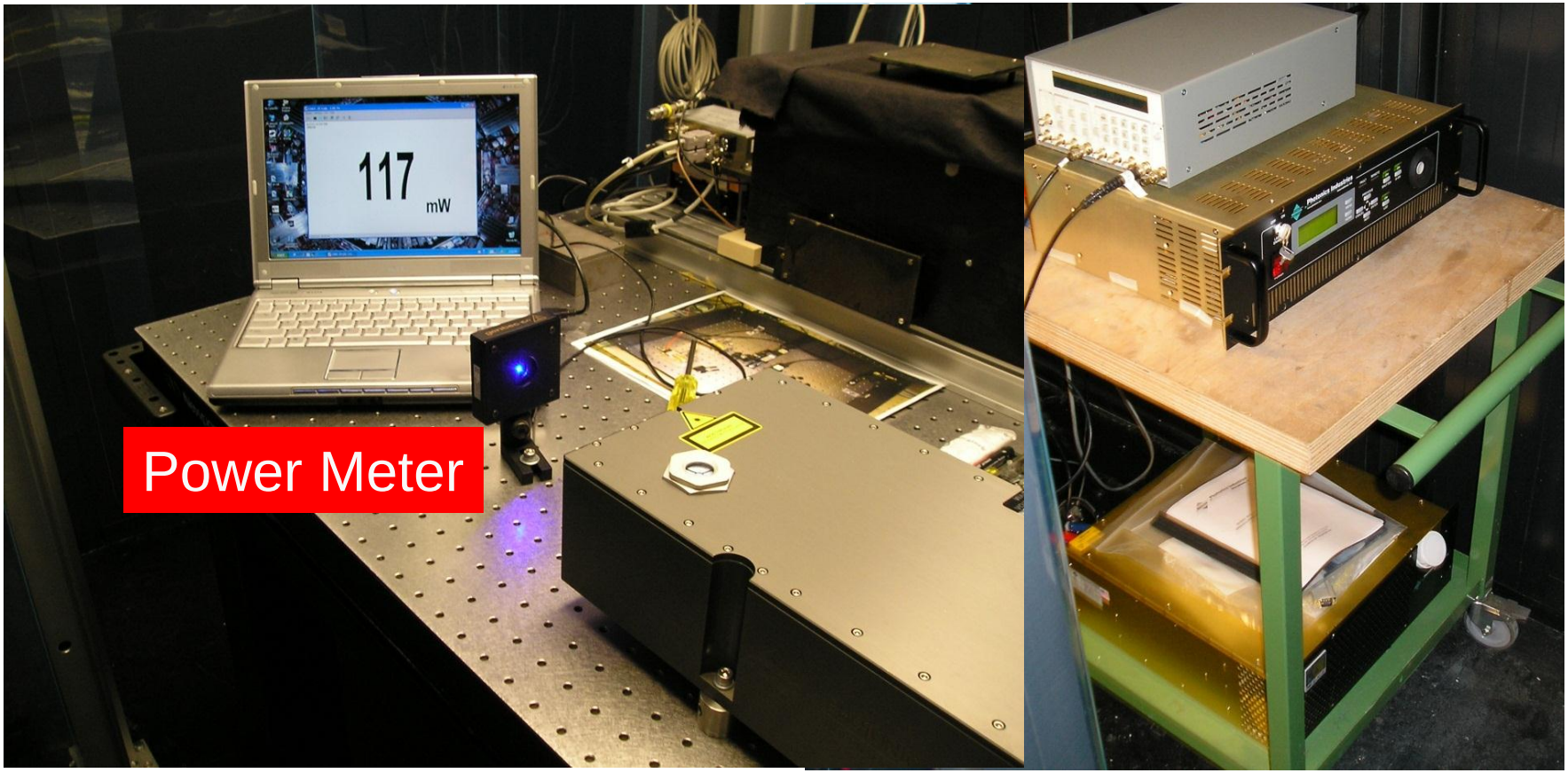
(For the laser team)

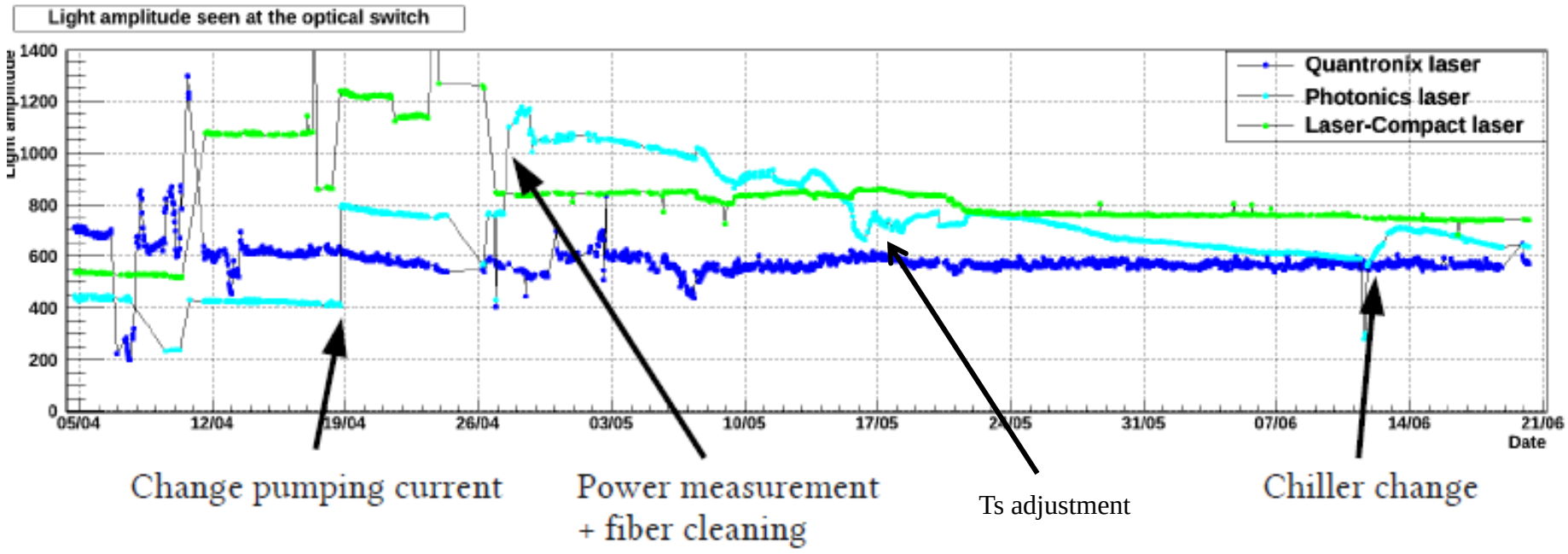
Installation at CERN

Laser system arrived CERN on 3/20/12, and was installed at CMS carven at P5 on 3/21/12 with output power consisting with what measured at Caltech, indicating no B field effect.



MATACQ Laser Intensity History

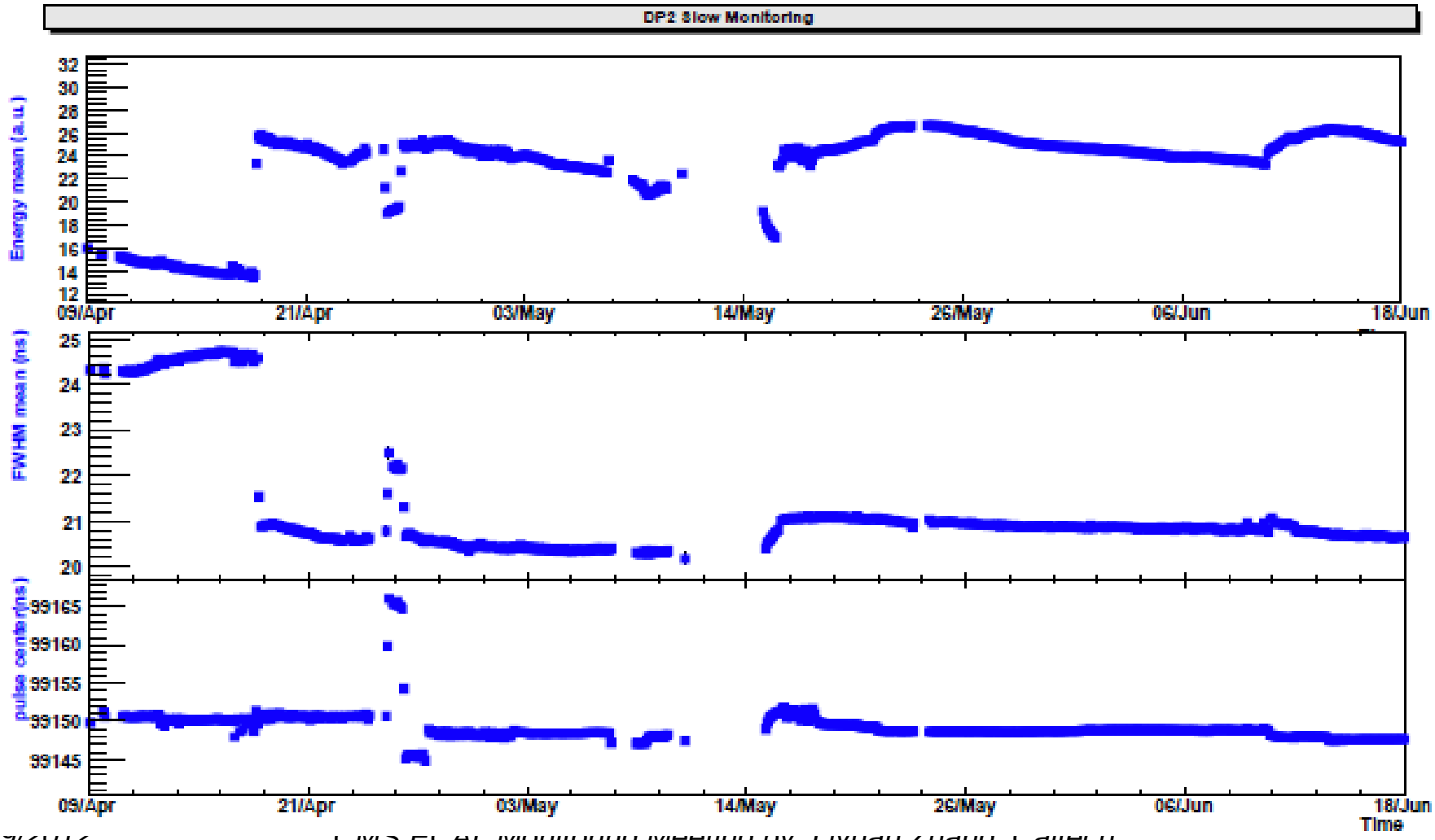
- Amplitude



Possible causes of this slow drifting at 40%: (1) broken optics; (2) variations of the room and chiller temperature and/or (3) B field effect.

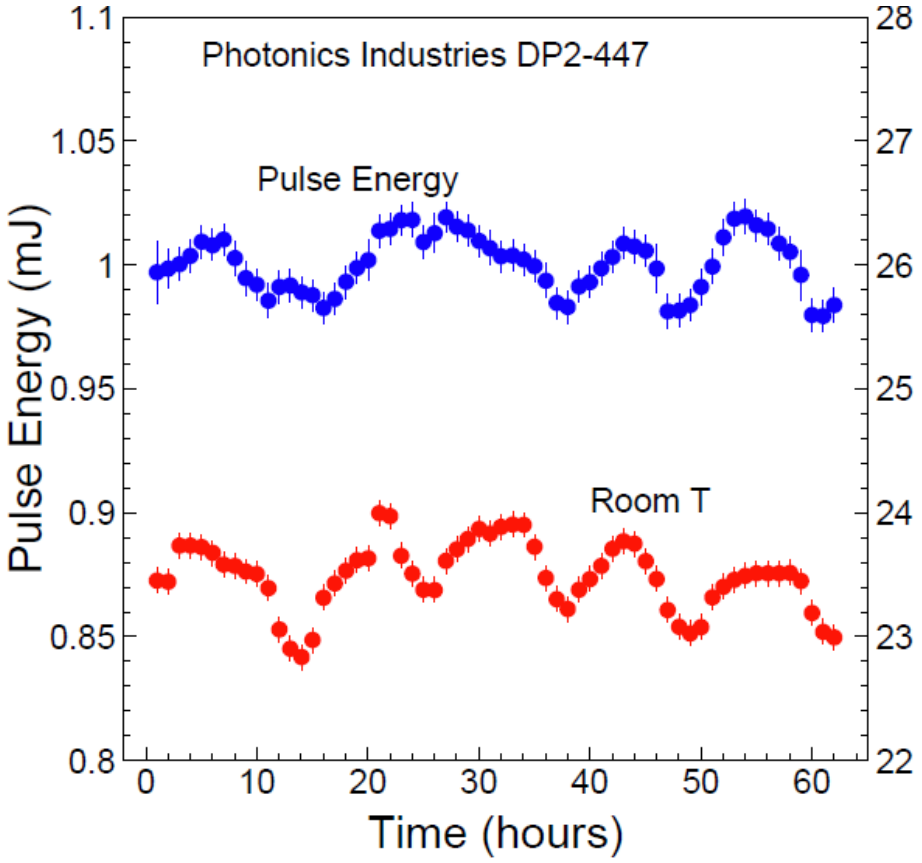
Slow Monitor History

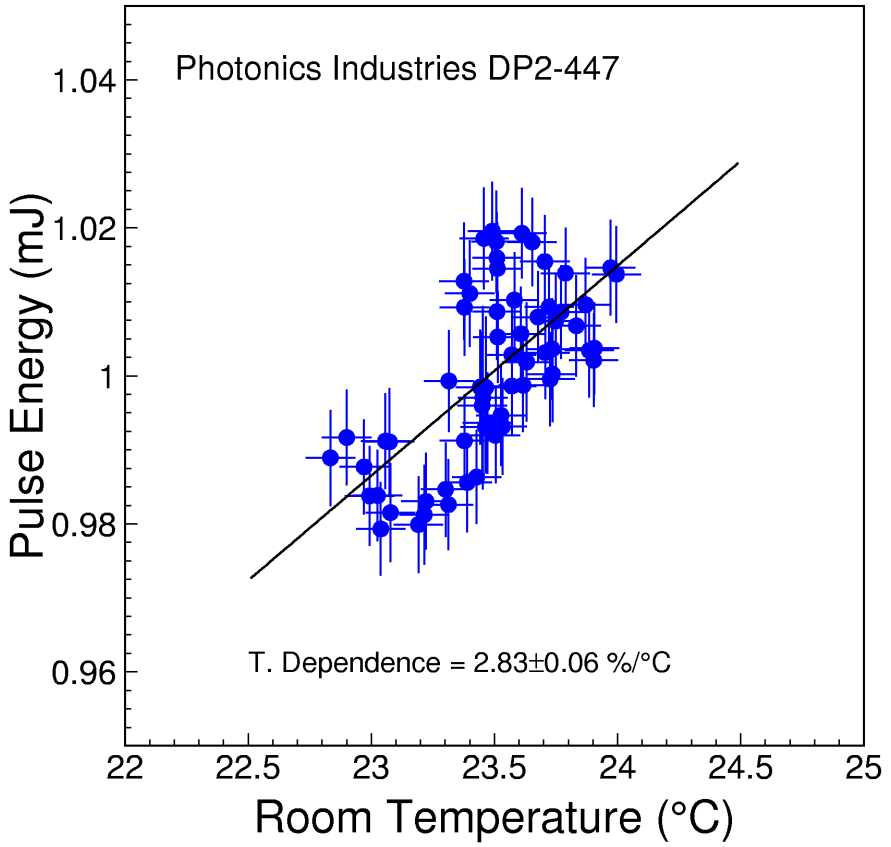
Slow drifting with much less amplitude and the same DP2 power point to temperature/B effect



Pulse Intensity versus Temperature

Room temperature needs to be stabilized to 1°C to maintain pulse energy stability at a level of 3%

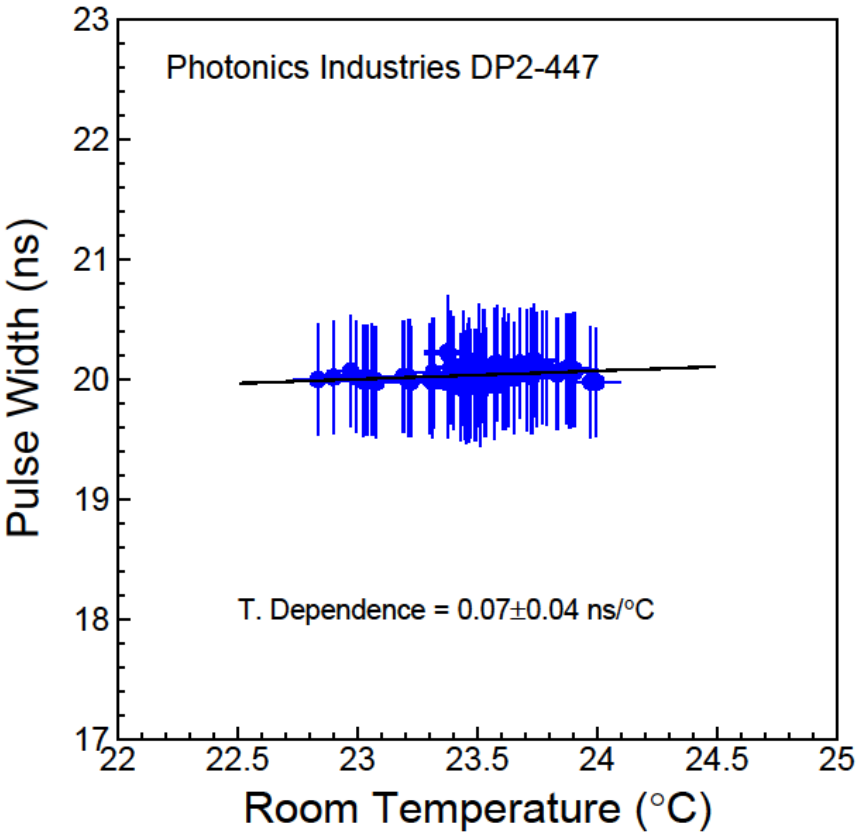


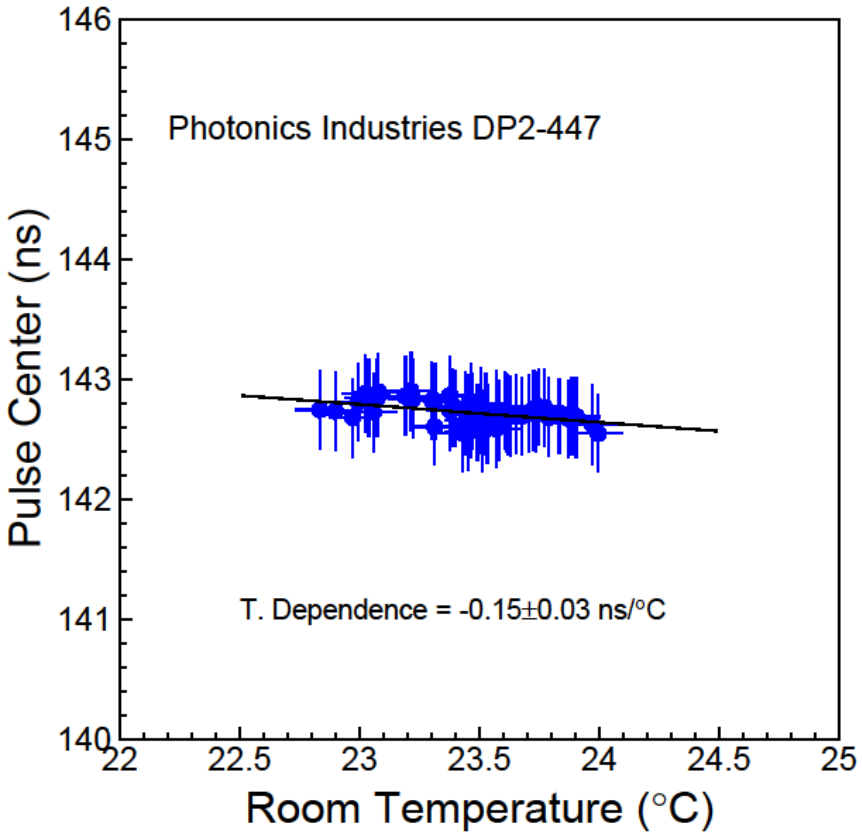


Photonics chiller has no heater so room T raised to 23°C

Pulse Width and Center vs. Temp.

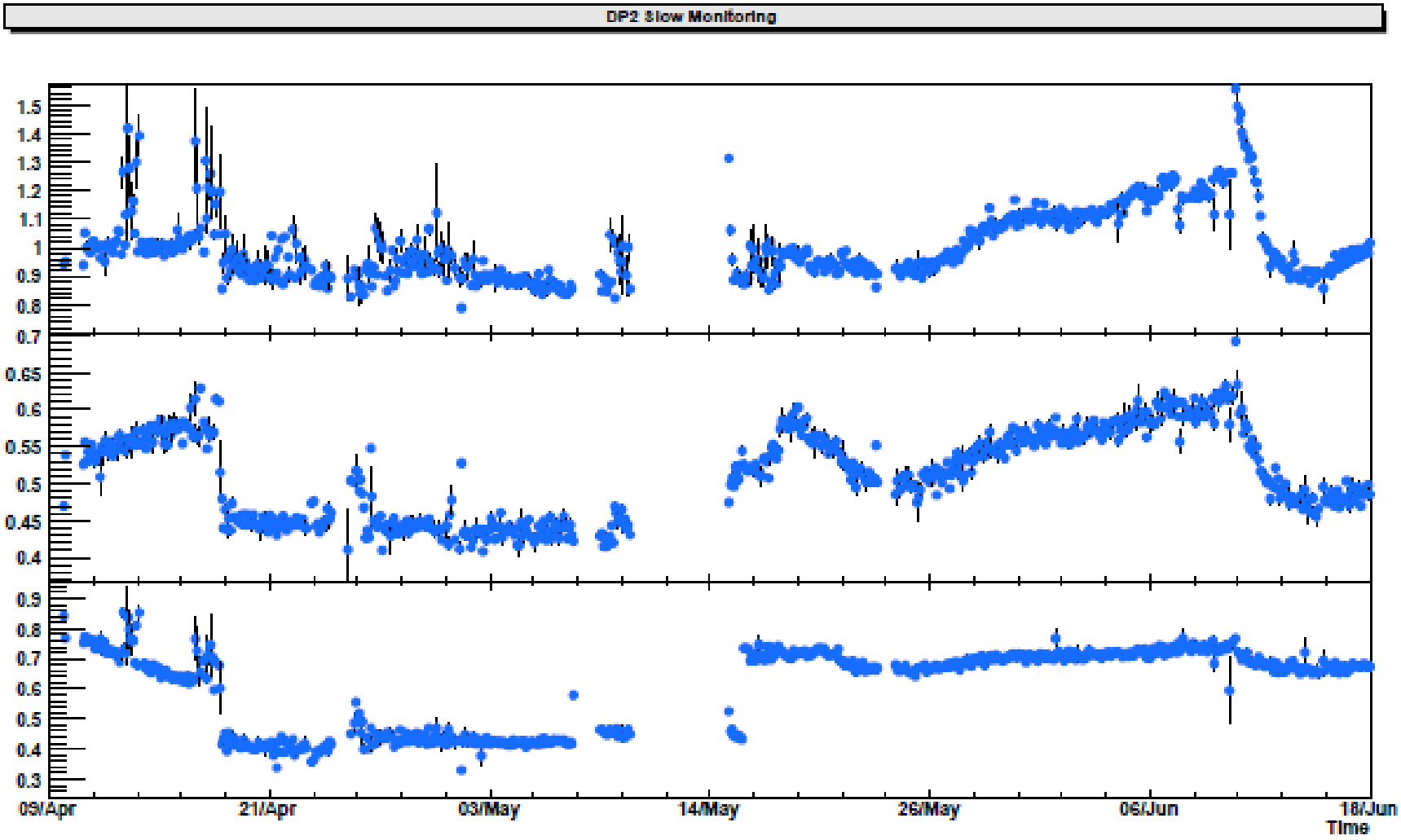
Pulse width and center are almost independent of the room temperature at 55 A pumping current





Laser Pulse Stability

Short term rms is 1%/2%/0.8 ns for intensity/width/jitter



Team Mission of this Week

Overall mission: to make sure that the entire laser system is in a good shape for the runs after the TS. The detailed tasks breakdown is as follows.

1) Check the optical chain of DP2-447 from laser exit port to the long fiber coupling, and to understand and eliminate the additional ~1.5db loss since the installation.

2) Check the fiber chain from the long fiber coupling point to the exit port of the 1 x 100 optical switch, and to understand and eliminate another additional ~1.5 dB loss. After these two steps, the original budget of ~13 dB should be reinstalled.

3) Work with Kejun, add a self-calibration function for the DP2-447 attenuator and a DP2-447 diode temperature monitoring in the laser DAQ program.

4) Work with Photonics, further check the status of the chiller.

5) Laser-1 maintenance, replacing the lamp and cleaning/replacing the filter, and fine tuning TiS-1.

6) Install the fast shutter in Laser-1

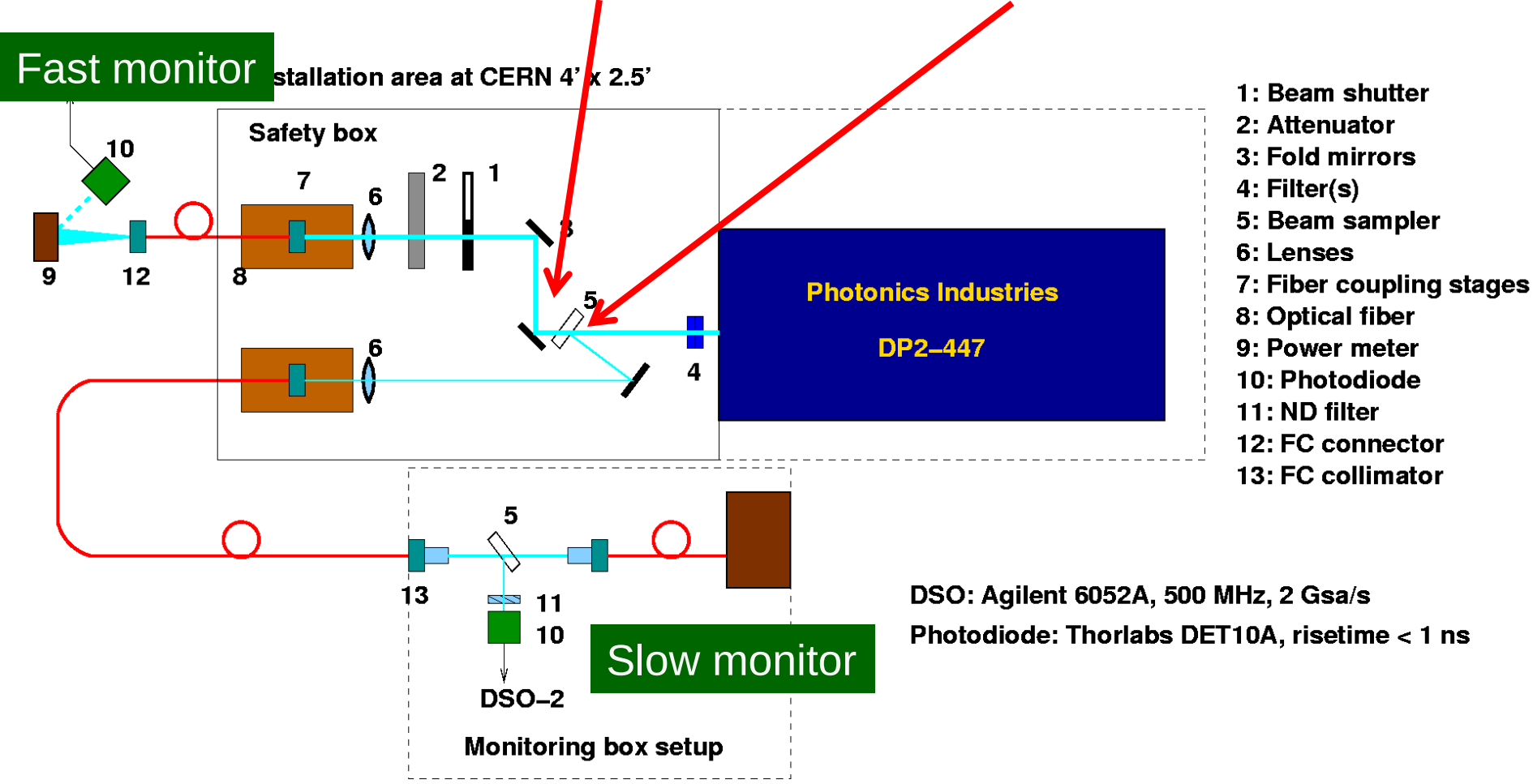
7) Improve Quantronix laser-2 system if time is available.

8) Green laser : check shutter – diffusing light problem.

9) Implement the safety interlock for DP2-447 and the green laser (TBD, do we have channel in the safety box? it looks like a trial thing, but it's not, e.g., an electrical noise may kill the DP2 power supply thus jeopardize the whole project.)

DP2 Laser Optics

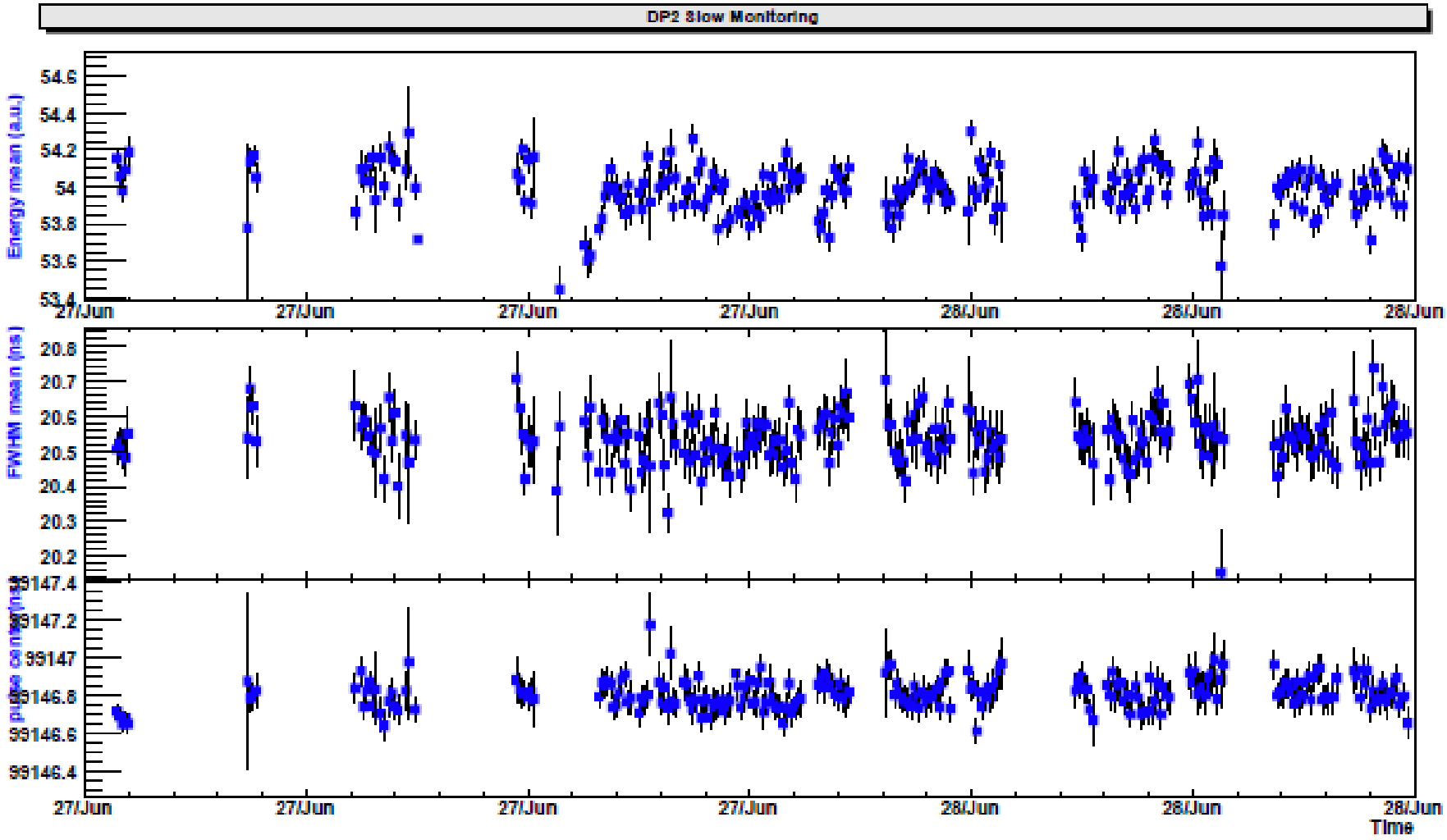
Burned beam sampler and folding mirror replaced on June 25



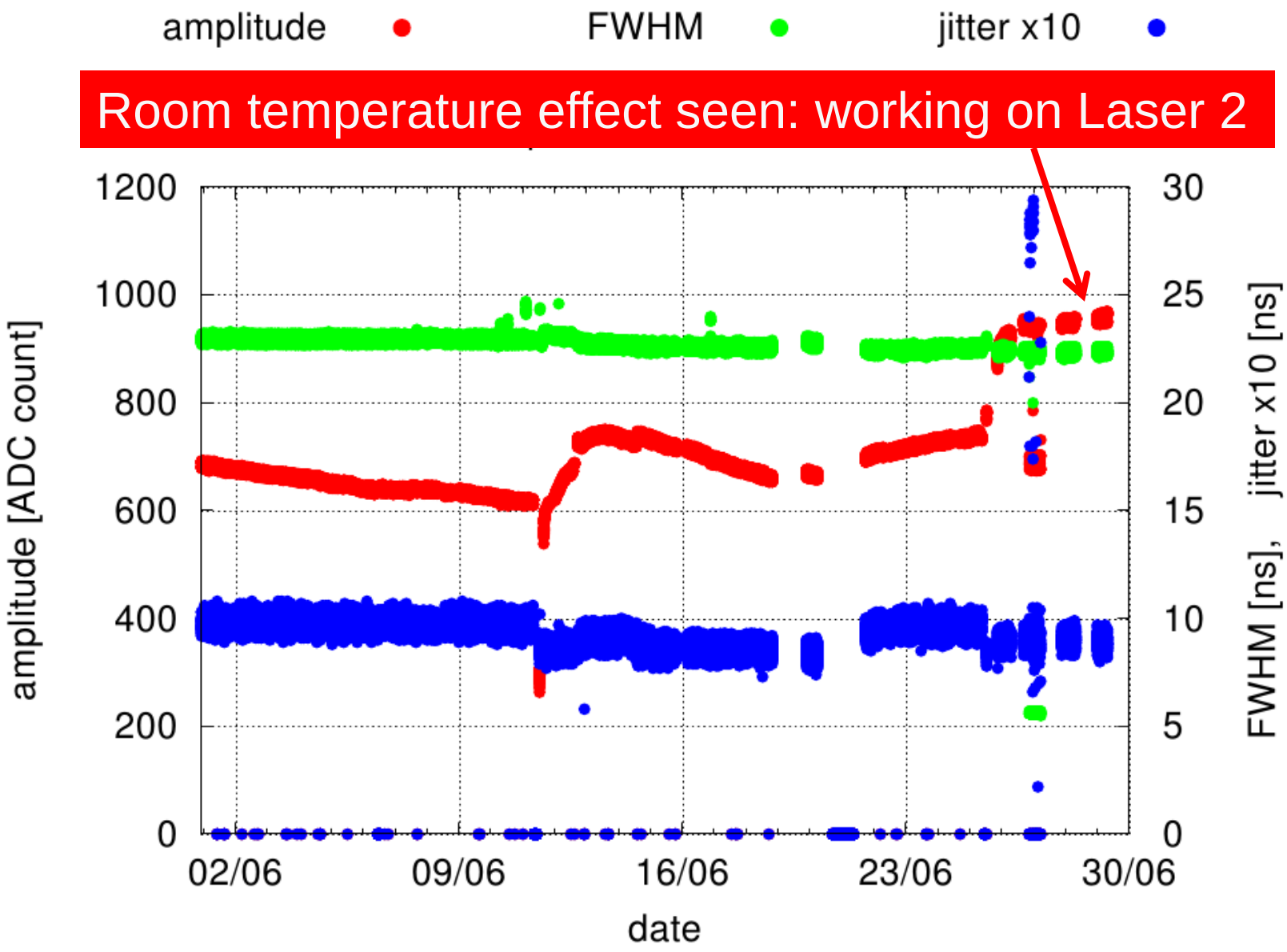
Consistent with large/small variations by fast/slow monitors

Slow Monitor after June 25, 2012

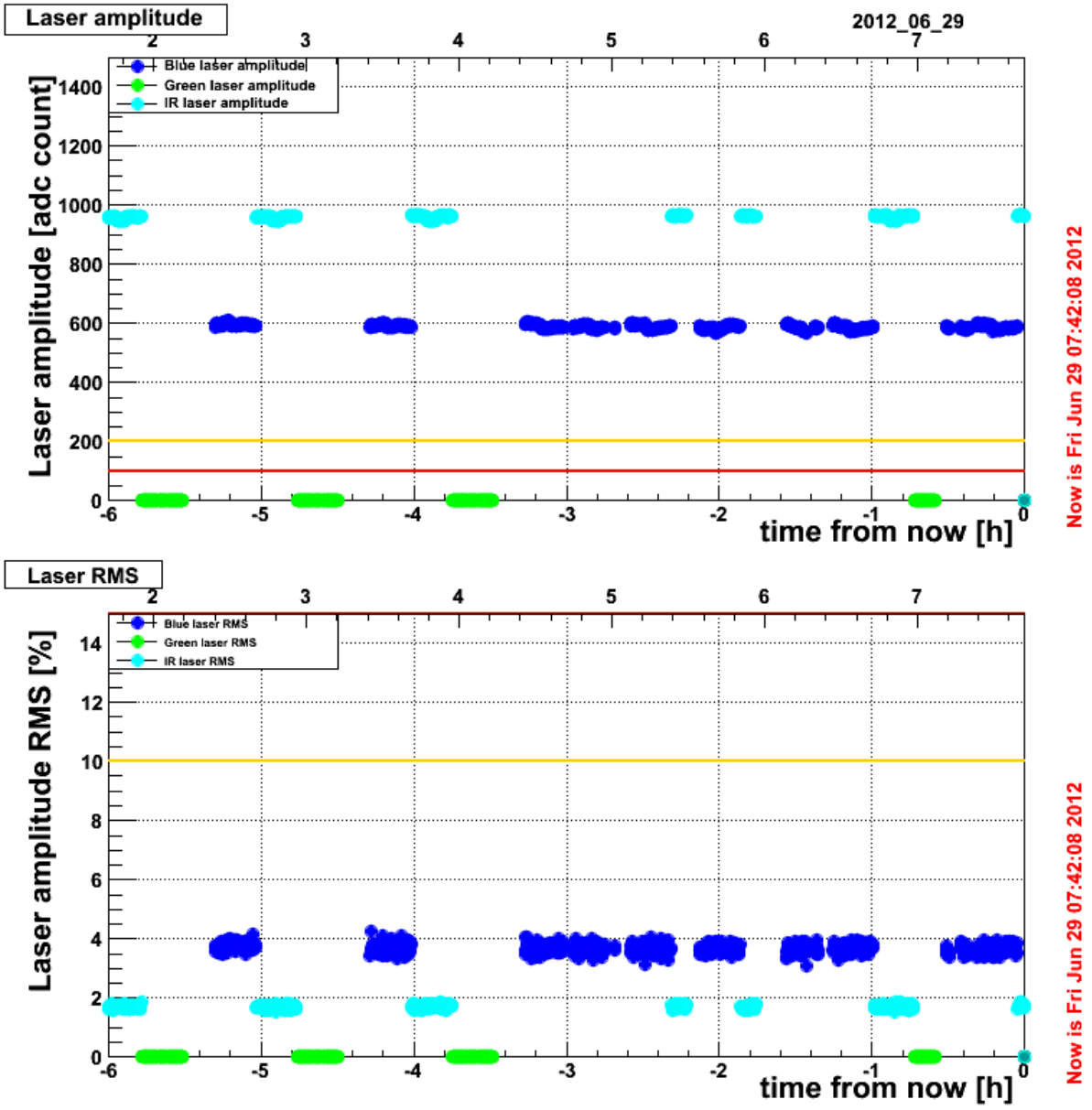
No variation observed since optics replacement



MATACQ Data for DP2 in June



No Variation under B field



Summary

After replacing the damaged optics and raising the room temperature to 23^{o}C the DP2 laser pulse intensity shows no drift. To understand the long term stability, or the B-field effect if any, three temperature readings are added into the slow monitoring for DP2-447 for (1) the pumping diode, (2) the SHG crystal and (3) the THG crystals.

Lasers 1 and 2 are serviced. While Laser-1 is in a good shape, the YLF & LBO of Laser-2 need to be replaced. Its pulse width and jitter are improved by replacing the Q-switch mount machined at Caltech.

DP2-447's fast shutter control is moved from a GPIB-RS232 box to a USB-RS232 converter.

Fast shutters are installed in both Quantronix lasers by using USB-RS232 converter. The overall switch time may now be reduced.

All three blue lasers are expected to be in a good shape for LHC data taking after the TS.

Specifications for Lasers

- **Pulse intensity:** 1 mJ/pulse at 440 nm, equivalent to 1.3 TeV in dynamic range.
- **Pulse intensity instability:** < 3%.
- **Pulse FWHM:** < 30 ns to match ECAL readout.
- **Pulse width instability:** < 5%.
- **Pulse jitter:** < 3 ns for synchronization with LHC.
- **Pulse repetition rate:** 0-100 Hz, scan of full ECAL in 20 minutes.
- **Immune to stray B field of 30 Gauss.**

DP2-447 at Caltech (2/17/2012)