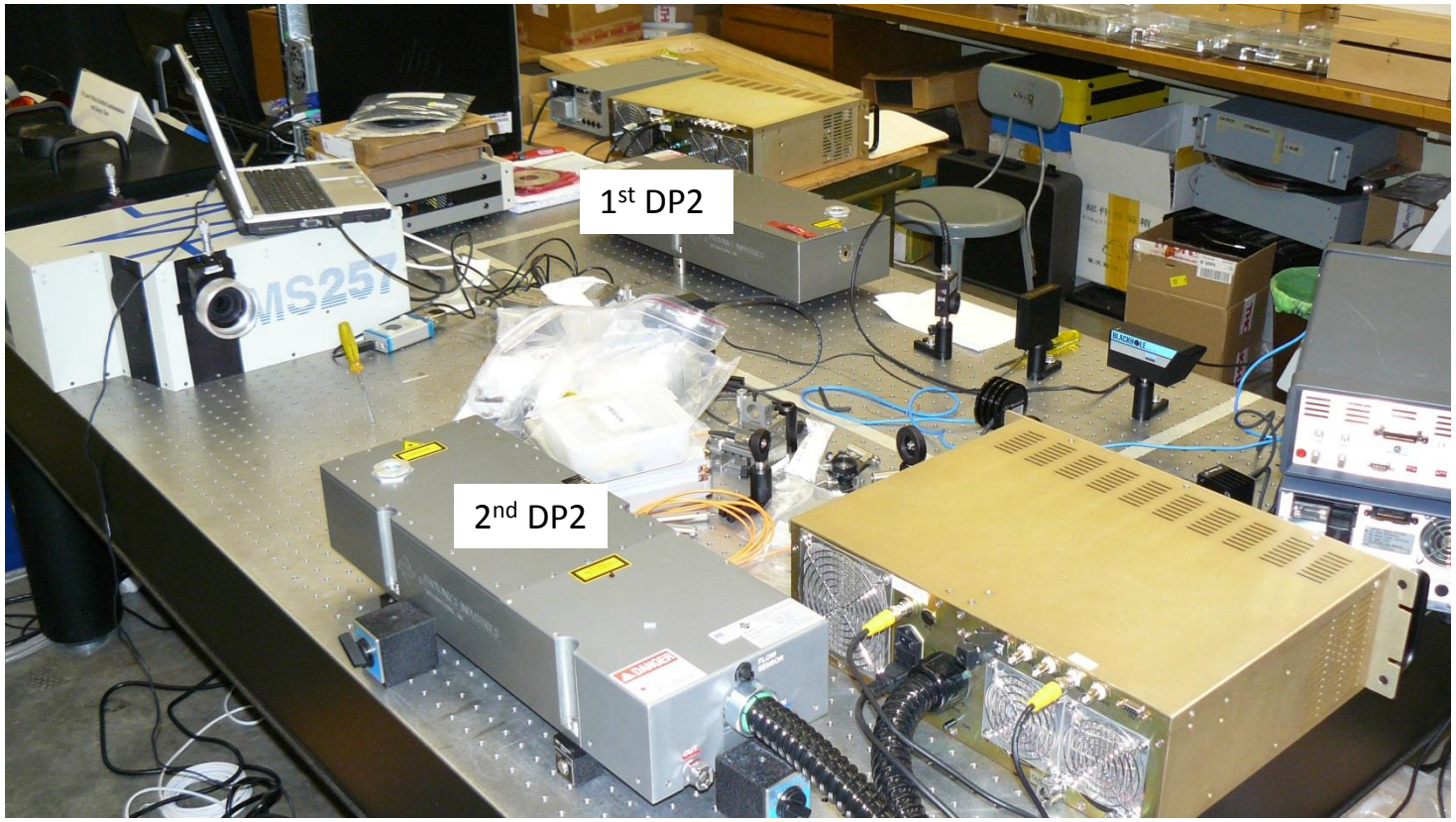
Status of DP2 Lasers at Caltech

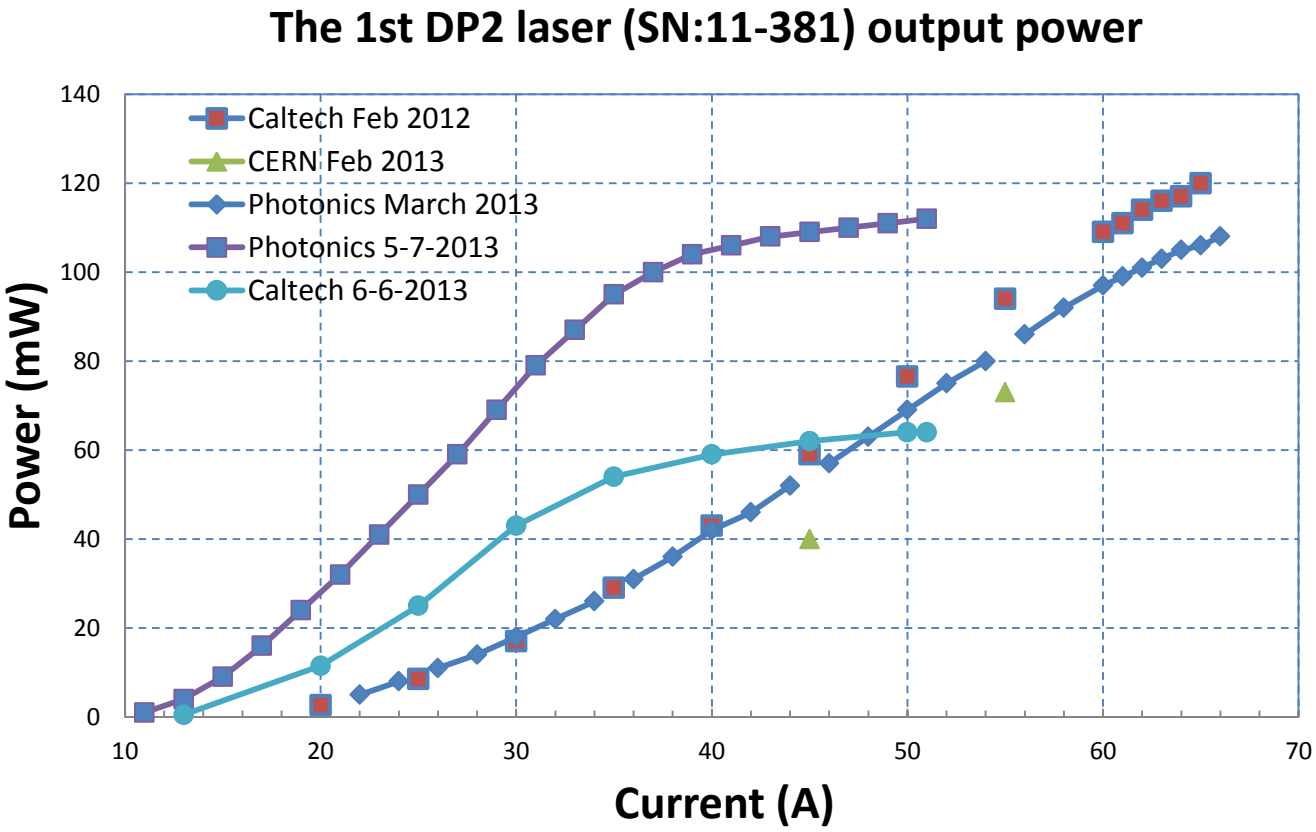
July 3, 2013



David Bailleux, on behalf of the Caltech laser group

1st Photonics DP2-447 (s/n 11-381)

After installing new diodes (the same as that in the 2nd DP2), the power of the 1st DP2 measured at Photonics was consistent with the 2nd DP2. Its power measured at Caltech on Jun 6 after delivery, however, was found about a factor of 2 lower.



1st DP2-447 (s/n 11-381)

Following Photonics advices the following diagnostics were carried out without success.

- The chiller (or diode) temperature was fine tuned.
- The THG temperature was fine tuned.
- The SHG temperature was fine tuned. .
- The output powers of the two pump diodes were measured.
- The 447 nm TEM mode was checked, and found no problem.

Photonics issued a RMA for 1st DP2 on 6/17. The desiccator insert was found to be in contact with the end mirror mount after removing the cover of the laser head at Photonics, which seems caused by the shipment. Photonics claimed that this is the first such failure. The end mirror mount was moved a few mm to provide clearance. After a QC procedure the 1st DP2 will be shipped to CERN directly next week.

Default Settings of 1st DP2:

Coming back from Photonics, we see that the trigger input for the generator DG535 should be HighZ and no more 50ohm for the pulse stability.

Tchiller = 27.5 deg

Ta(shg) = 50.7 deg

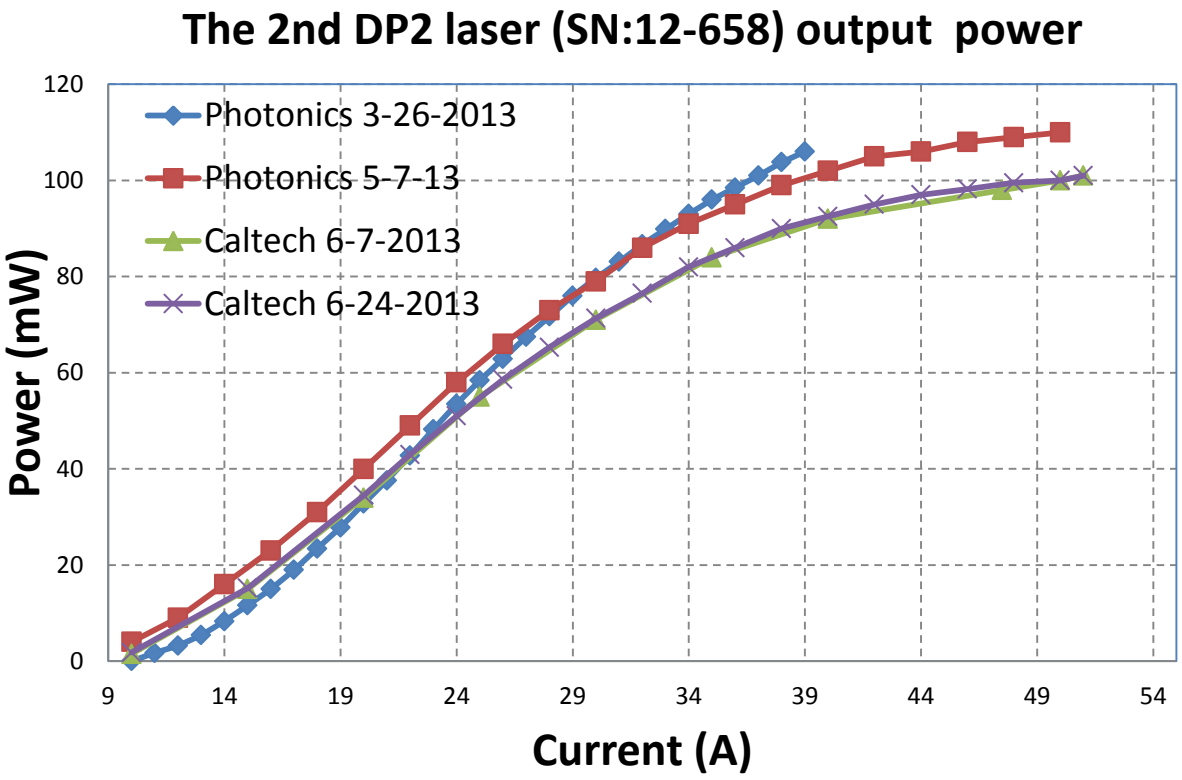
Ta(thg) = 51.0 deg

FWHM@50A = 18-18.5ns

2nd Photonics DP2-447 (s/n 12-658)

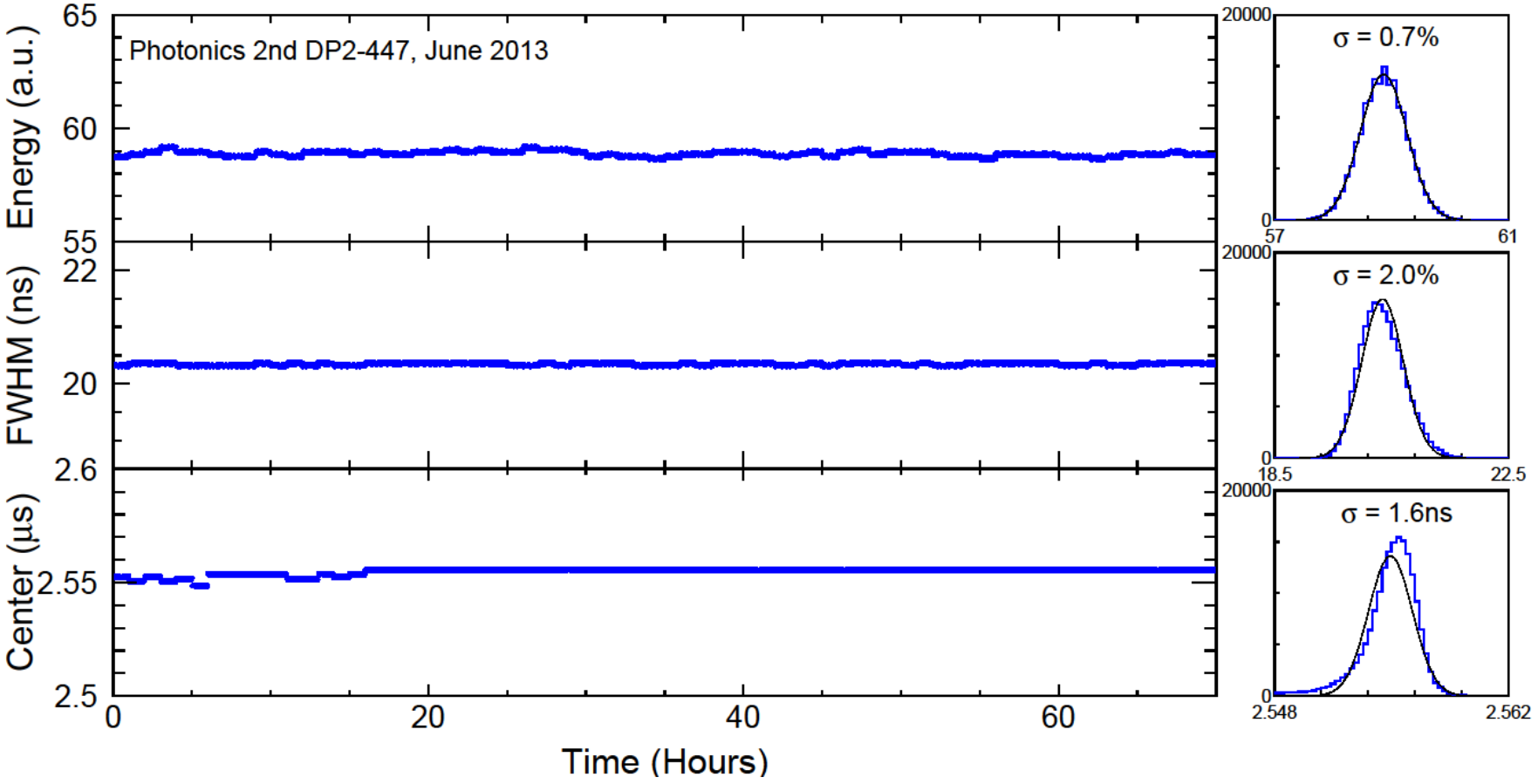
The calibration of the 2nd DP2 at Caltech is more or less consistent with that measured at Photonics. The small discrepancy could be due to different detectors. After fine tuning the THG temperature, the power is over 100 mW at 50 A.

	Default settings from Photonics	New value for max. power
Ta (chiller)	27.5	27.5
Tshg	49.9	49.8
Tthg	50	49.8



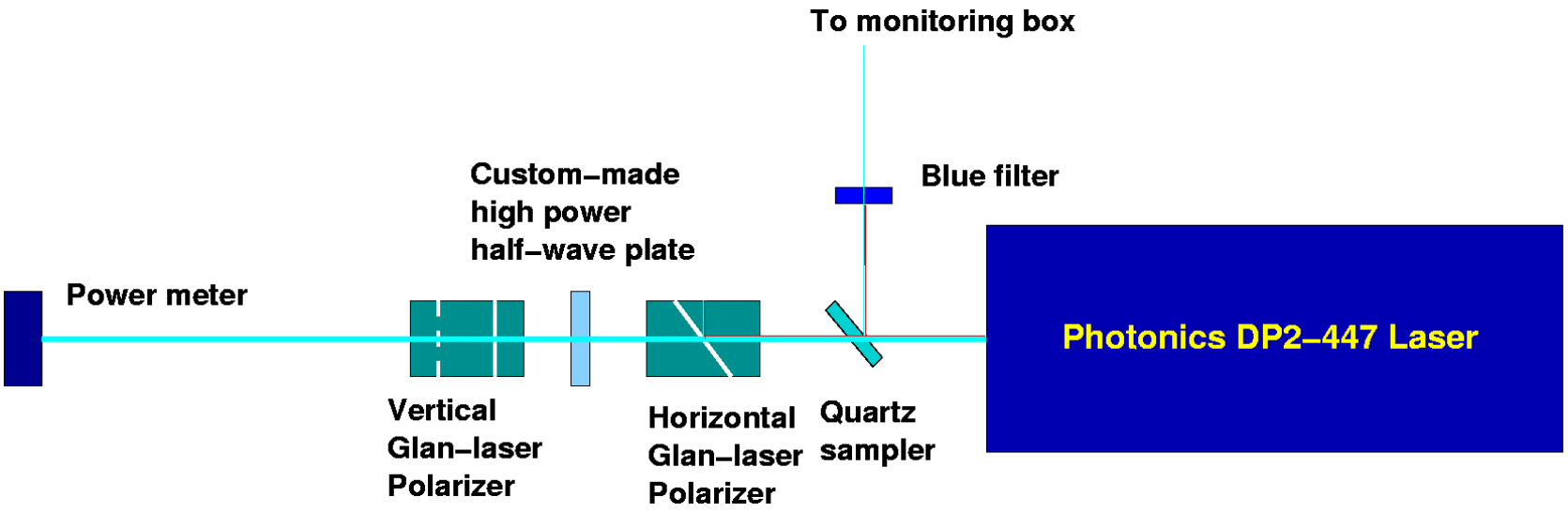
A Long Term Test for the 2nd DP2

A long term test of 70 h shows that the stabilities (rms) of pulse energy (0.7%), FWHM (2%) and jitter (1.6 ns) are well within the specifications of 3%, 5% and 3 ns respectively



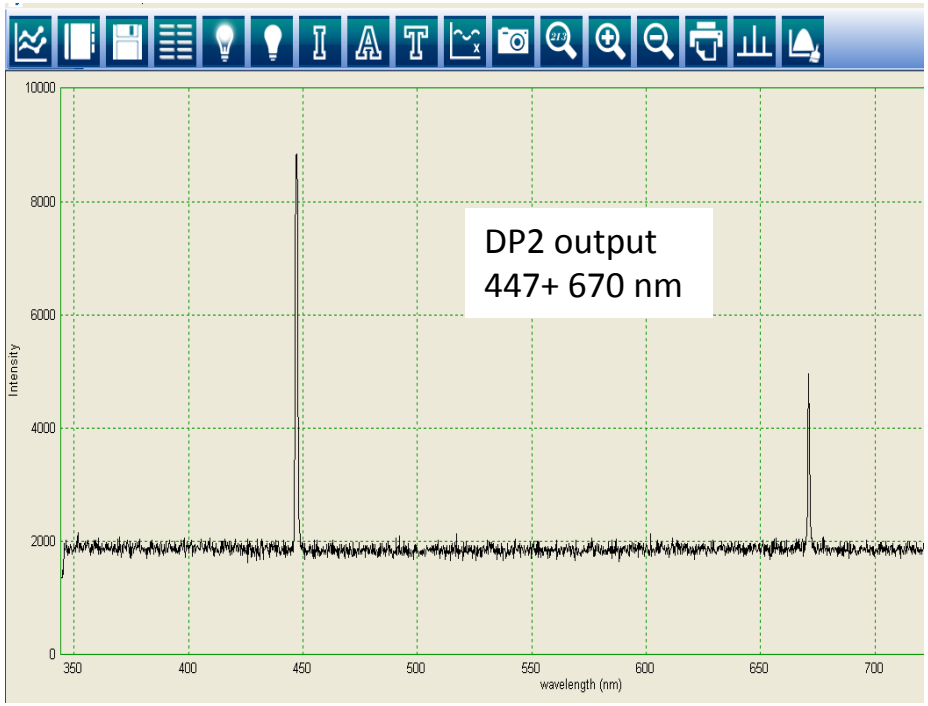
Design of the New Attenuator

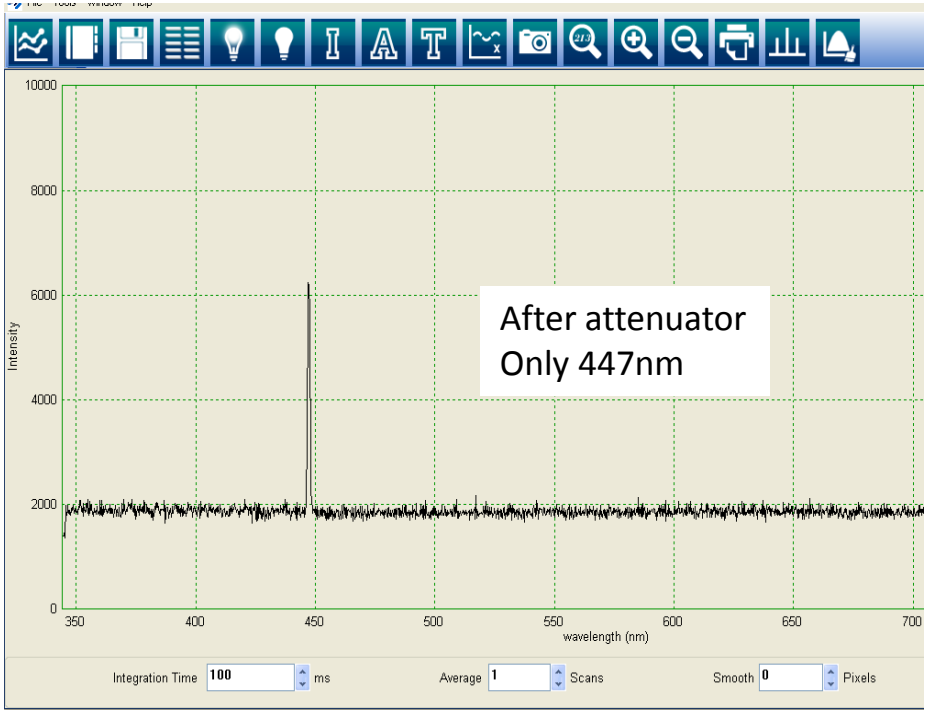
The metal film variable attenuator was found damaged last year at P5. A new attenuator based on a custom made high power half-wave plate (OptoSigma) and two commercial Glan-laser polarizers (Thorlabs) are tested at Caltech with full power. The 2nd harmonic (670 nm) background is now removed by the 1st polarizer since its polarization is perpendicular to that of the third harmonic (447 nm). This move eliminates the need for a blue filter in the main beam line. The total insertion loss of the new attenuator is **about 15%,** which is lower than that of the previous design. This new attenuator will be installed by David at P5 for the 1st DP2 laser system.



Measurement of the Second Harmonic

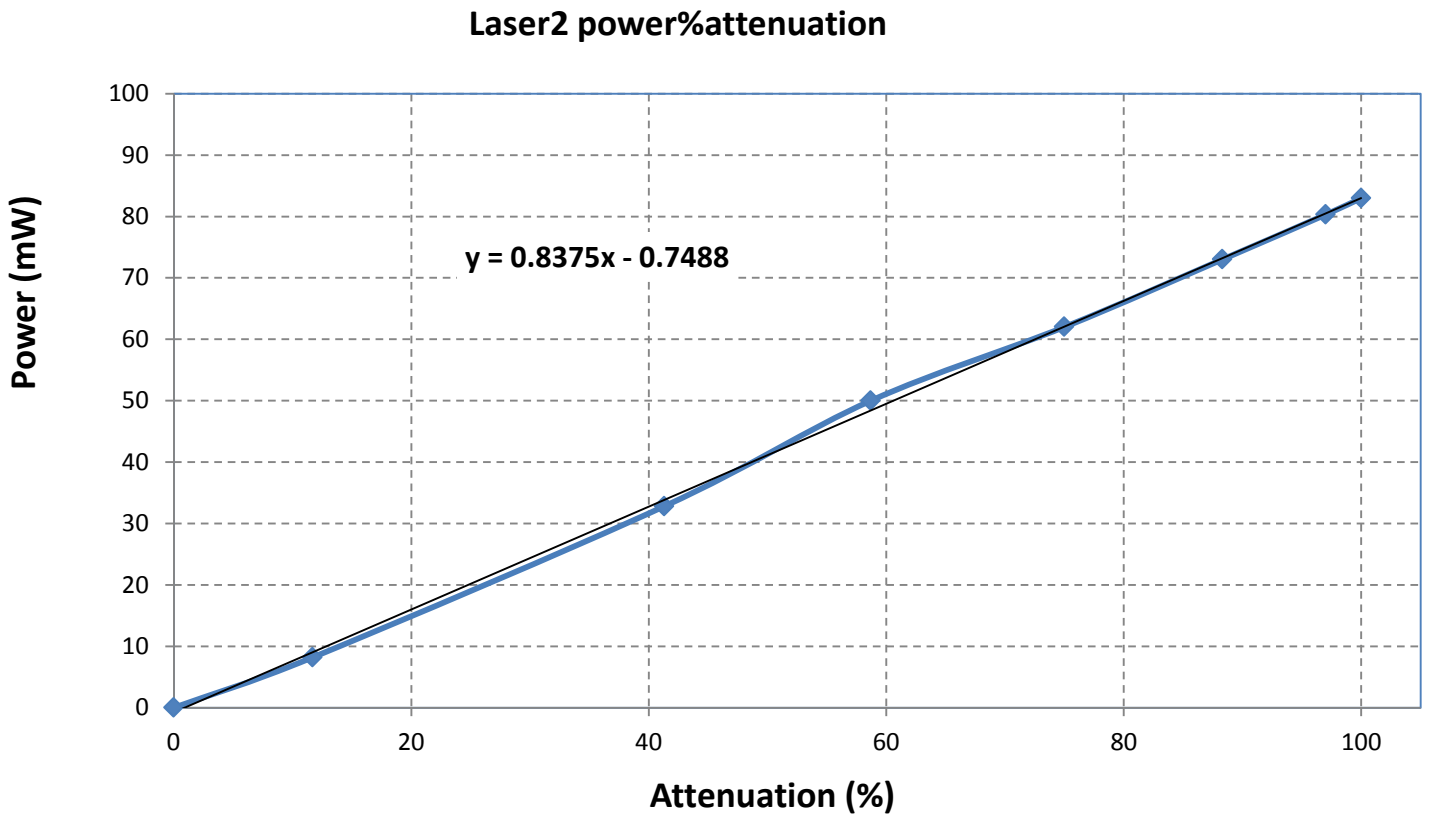
The 2nd harmonic (670 nm) background is removed by the 1st polarizer





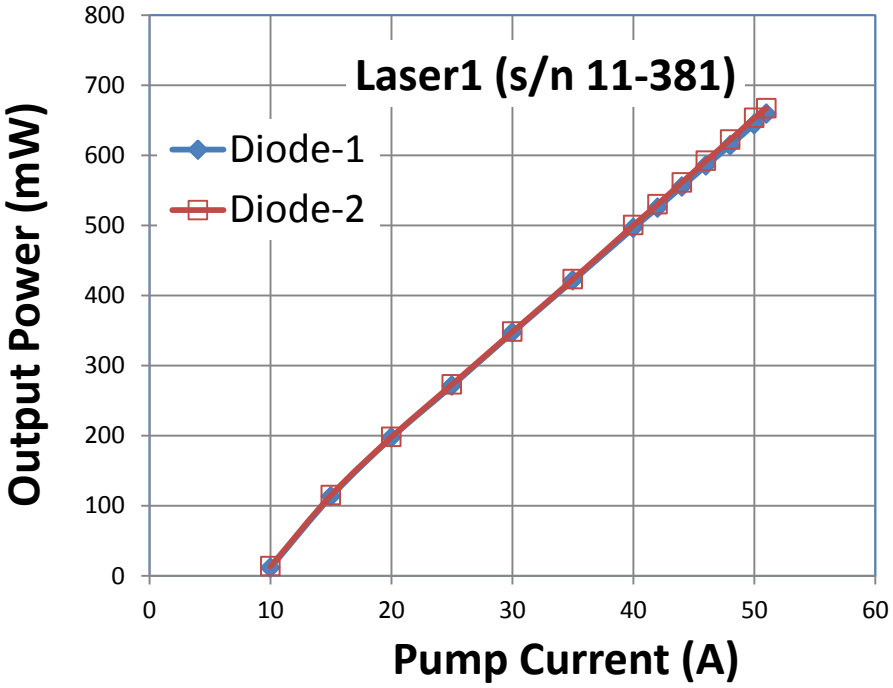
Calibration of the New Attenuator

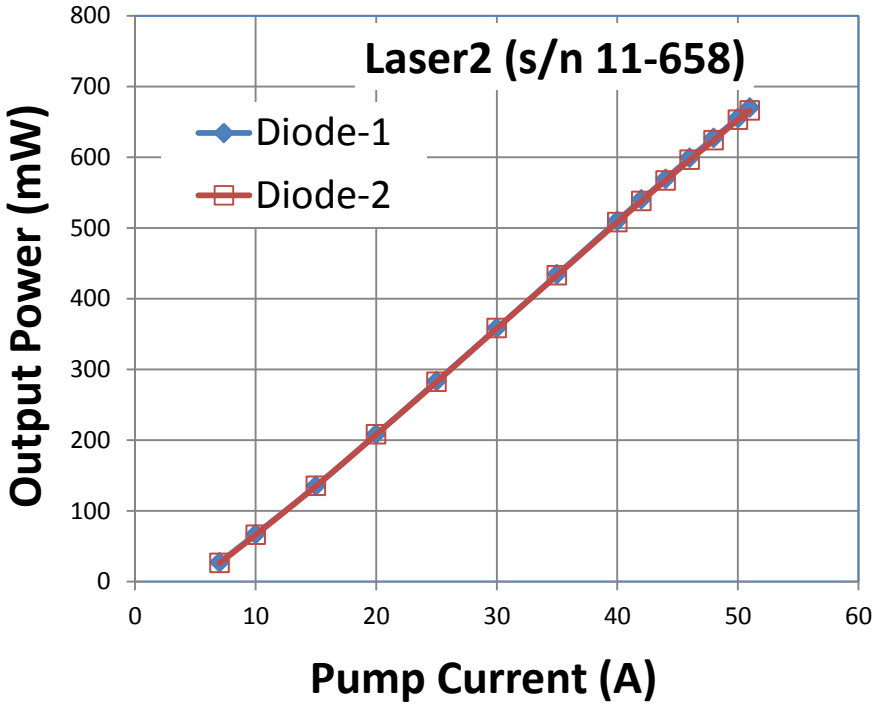
Software modification was done using this new calibration



Measurement of Diodes Output

The diode outputs of the two lasers were found consistent





Summary

- The 1st DP2 laser was shipped back to Photonics on Jun 17 because of the low power measured at Caltech. The problem was fixed at Photonics. The laser is going through a QC procedure at Photonics, and will be shipped to CERN next week.

- The performance of the 2nd DP2 was found meeting our specifications at Caltech. It will be integrated with ancillary optics and go through various stability tests at Caltech. The laser DAQ program will be modified to accommodate two DP2 lasers.

- New half-wave plate based attenuator works fine. It will be implemented at P5 for the 1st DP2 laser system.

- The power output versus the pumping current was measured for two pump diodes of both DP2 lasers. The data provide useful references for future diagnostics for the DP2 laser systems.