

AOC VCSEL studies
An Update
SCT Meeting in ID week October 2013.

Steve McMahon

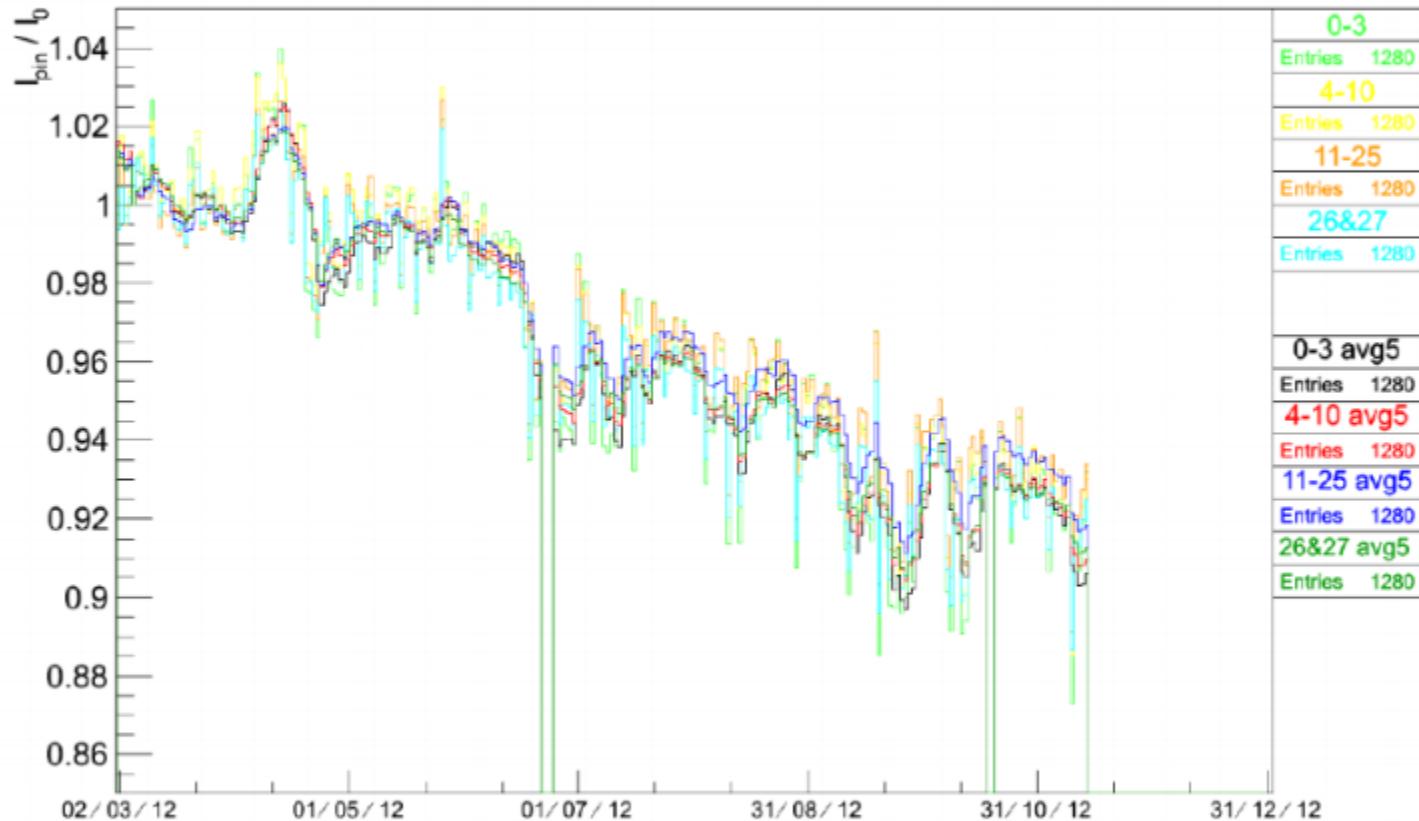
RAL

An Update

- This is an update of a talk I gave on 13th August on VCSEL lifetime studies
- <https://indico.cern.ch/getFile.py/access?contribId=3&sessionId=0&resId=0&materialId=slides&confId=267265>
- I will include a few old slides to put into context and a few new ones.
- The new slides bring us up to October 20th 2013

Drop in Light from AOC since installation

Mean I_{pin} by TX install date, 03.12 - 11.12, scaled

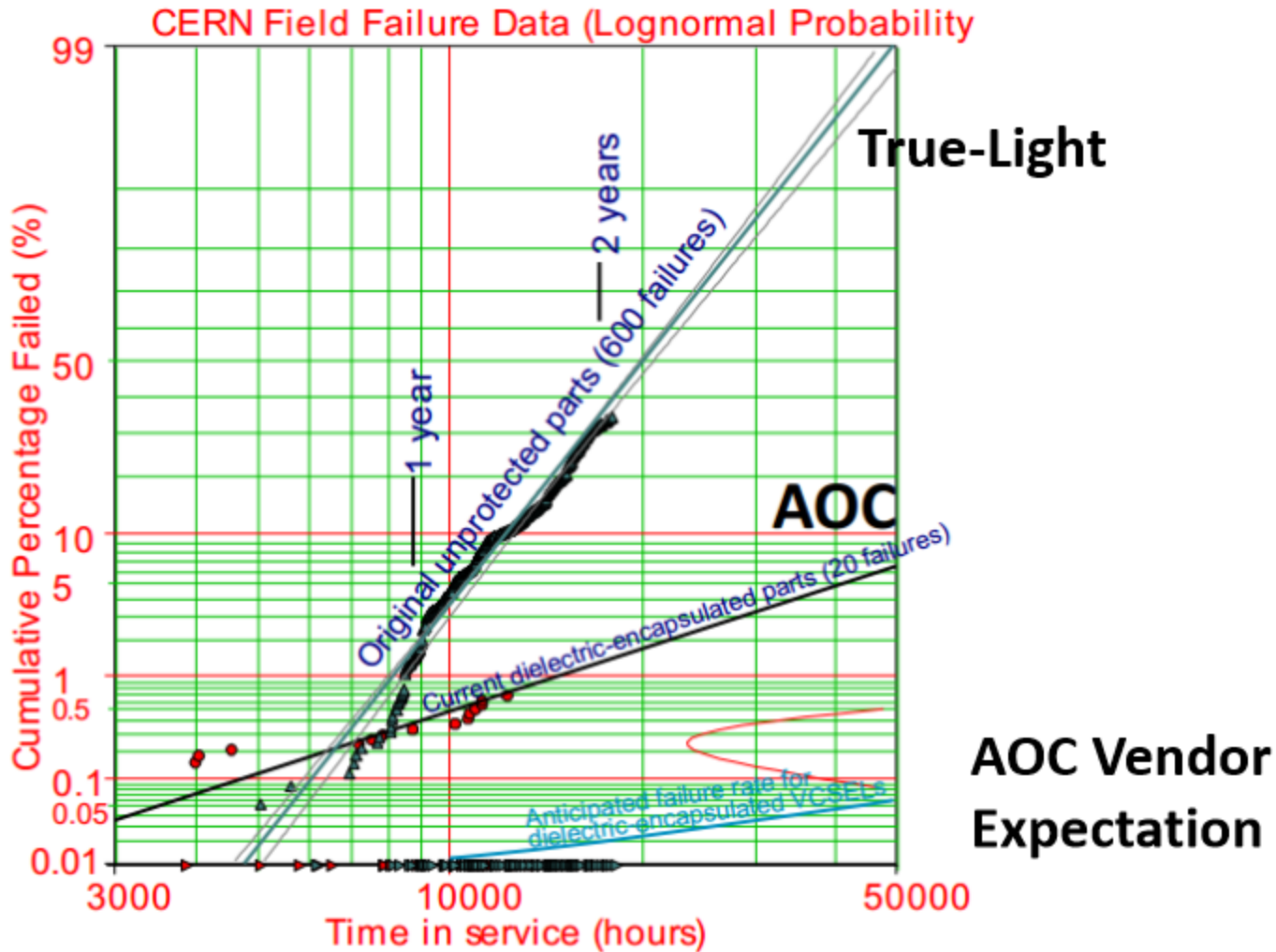


Measured by SCT confirmed by PIX

Vendor Expectation is less than 2%, we measure ~10%/year

Expert opinion, the light drop will increase and they will die

AOC - VCSEL Failures

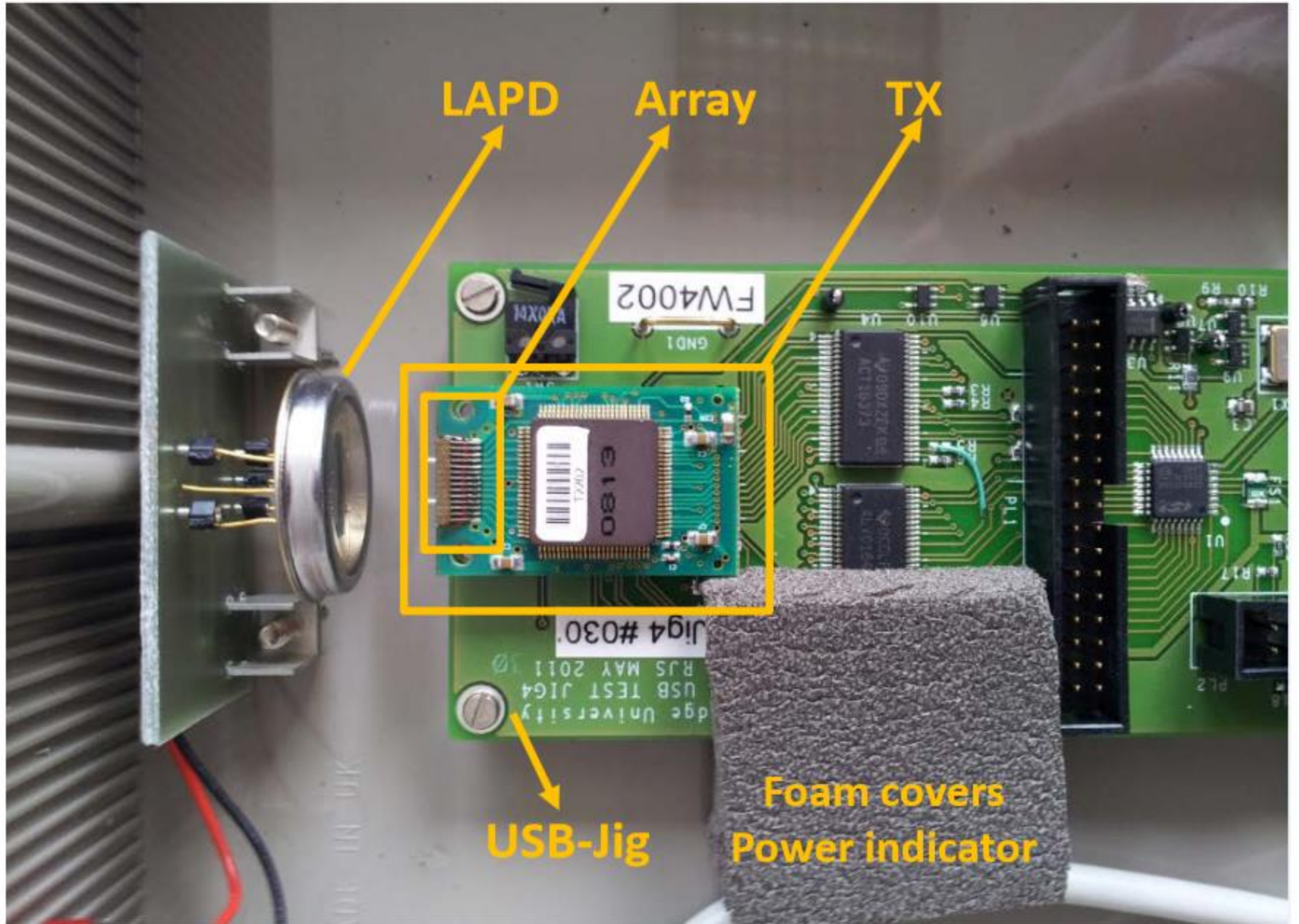


Goals of these Test

- Measure the rates of change of light output and compare with what we measured in USA15.
- Compare the rates of decrease at two different temperatures to see if there is an acceleration factor.
- Define next set of investigative tests

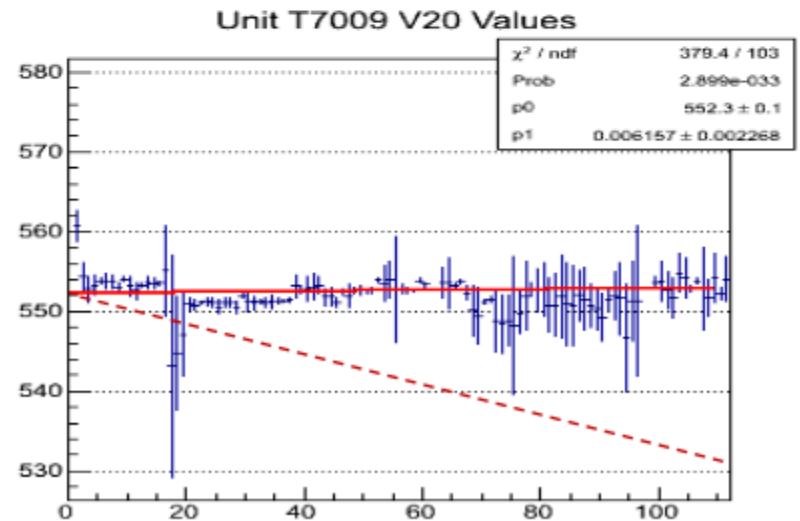
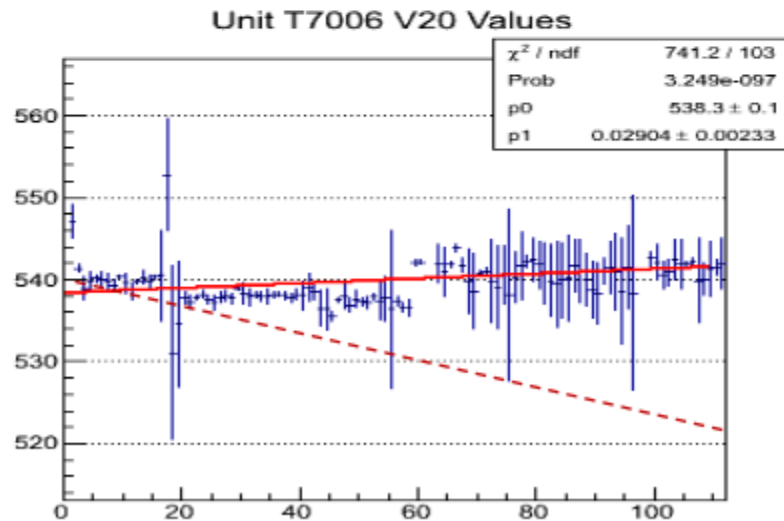
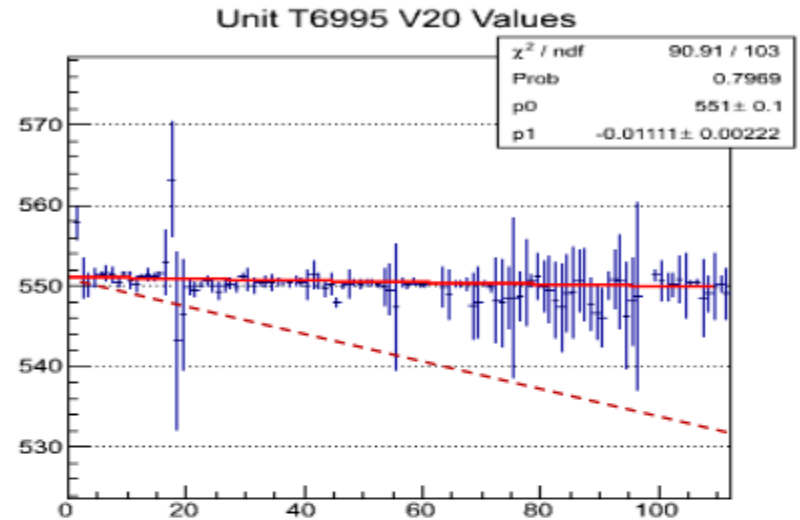
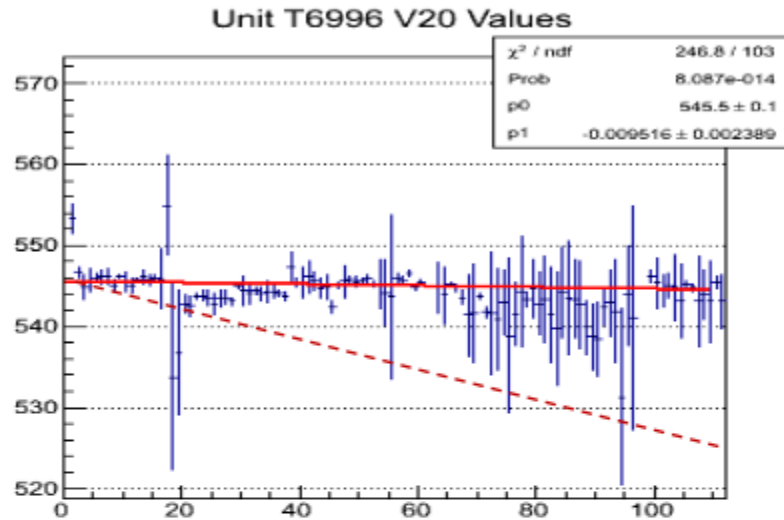
Set up and key dates

- Tests started on **April 16th**
- 6 TX units (12 way arrays) mounted in 6 light tight boxes.
- Each unit has its own power supply
- Each box its own temperature sensor
- 4 units at ambient temperature
- 2 units at 40°C (*after May 2nd*)
- Because the LO of the device depends on temperature for units at ambient need to do a V-T calibration each day.
- For units held at 40°C no calibration required.
- Motivation for different T is to see if process is accelerated (Arrhenius type process)
- Update today to **20th October**
- *After September 10th start power cycle trials on two units one at 40°C and one ambient. Power on off every hour*
- *Number of days between October 20 and May 2nd = 171 = 0.47 Yrs*
- *Number of days between October 20 and April 16th = 187 = 0.51 Yrs*
- *Also note (for reference) file format changes on 17.6*
- *Some data removed when DAQ gets “stuck” (amounts to a few (5 or 6) days) but sample remains operational.*



VT20 value by day (dashed line shows 3% change)

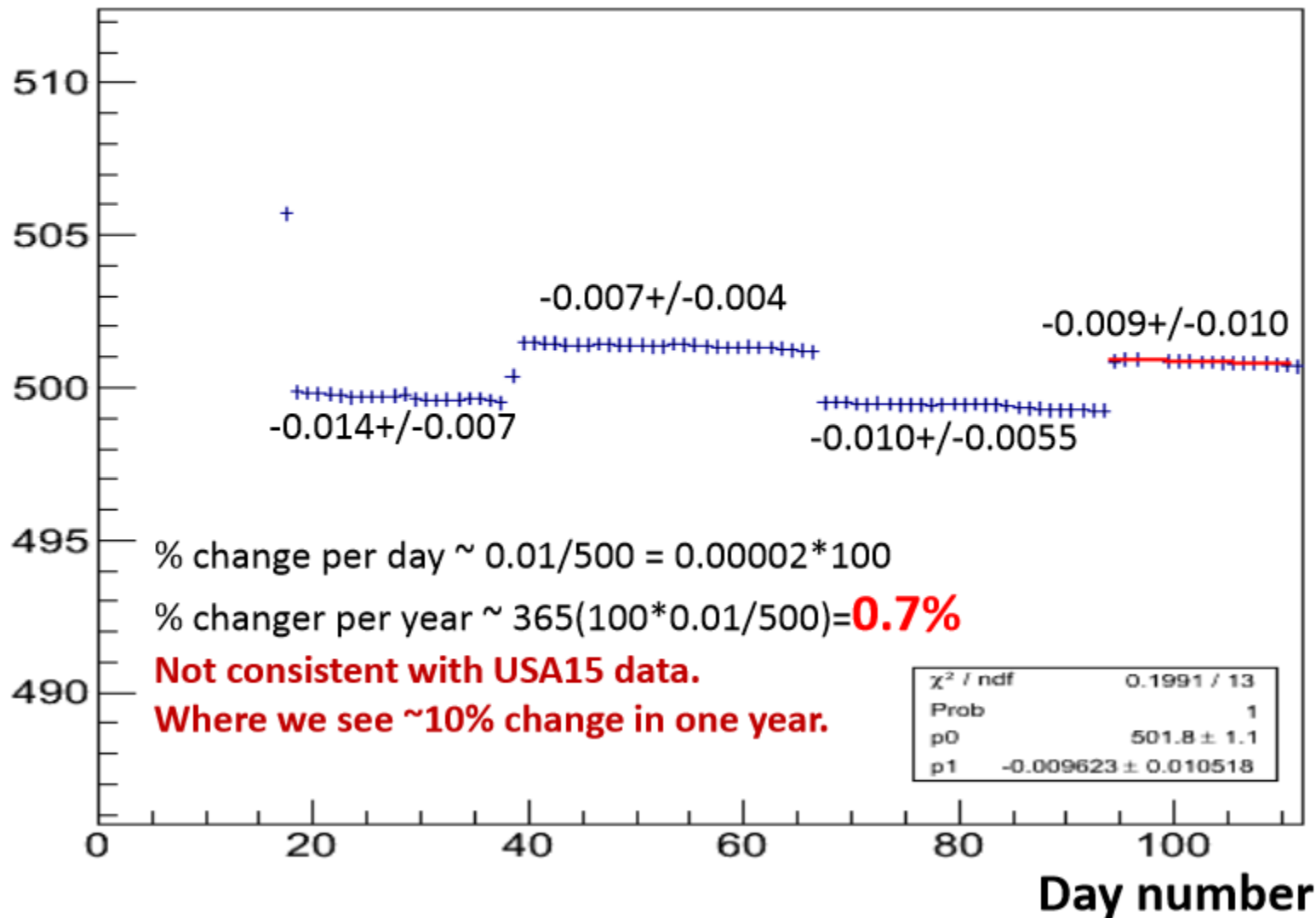
Note the error increases in days when the dT is small as the error on VT increases



Day number

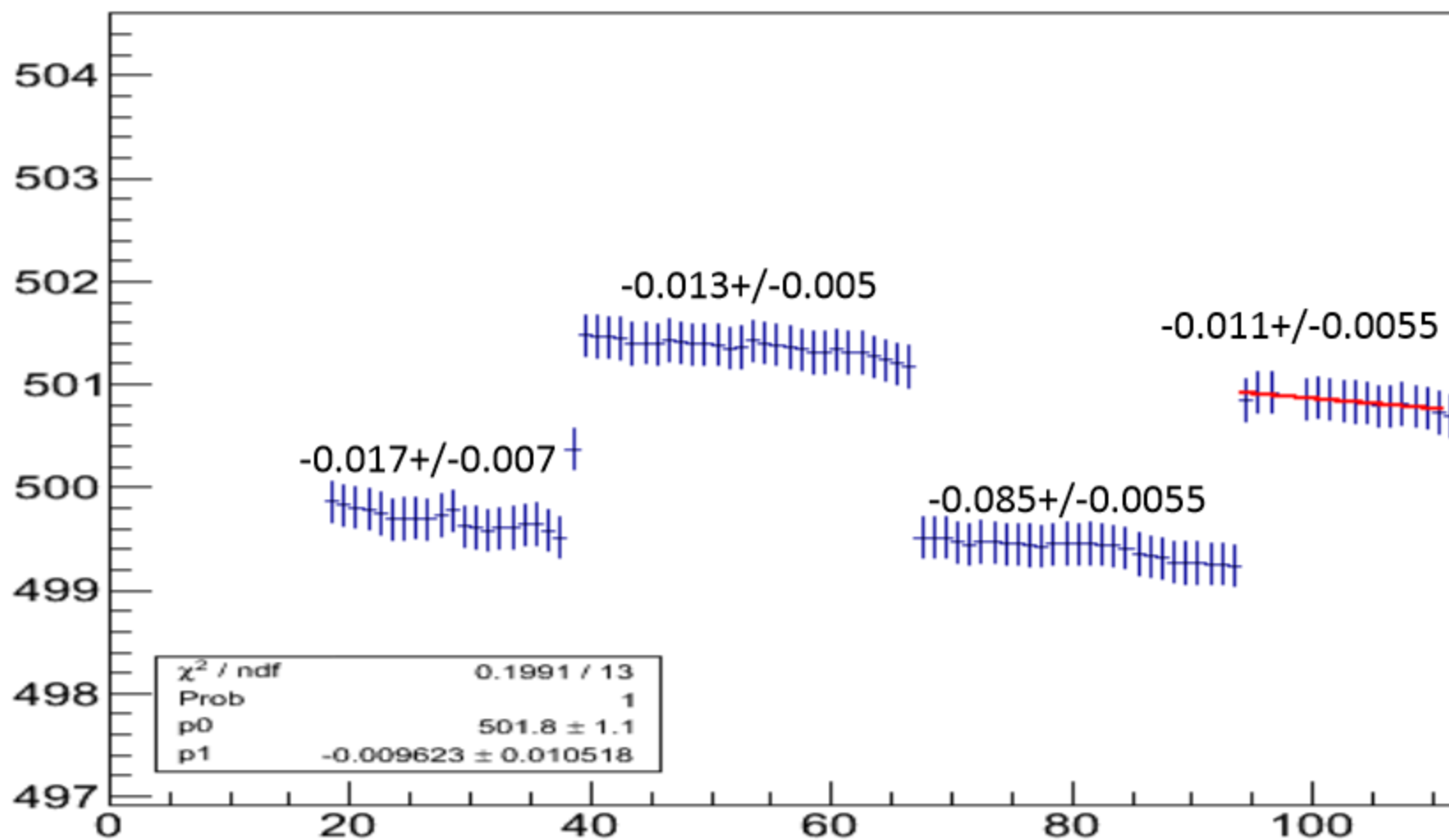
Unit T7008 held at 40°C

Fitted gradients shown



Unit T7007 held at 40°C

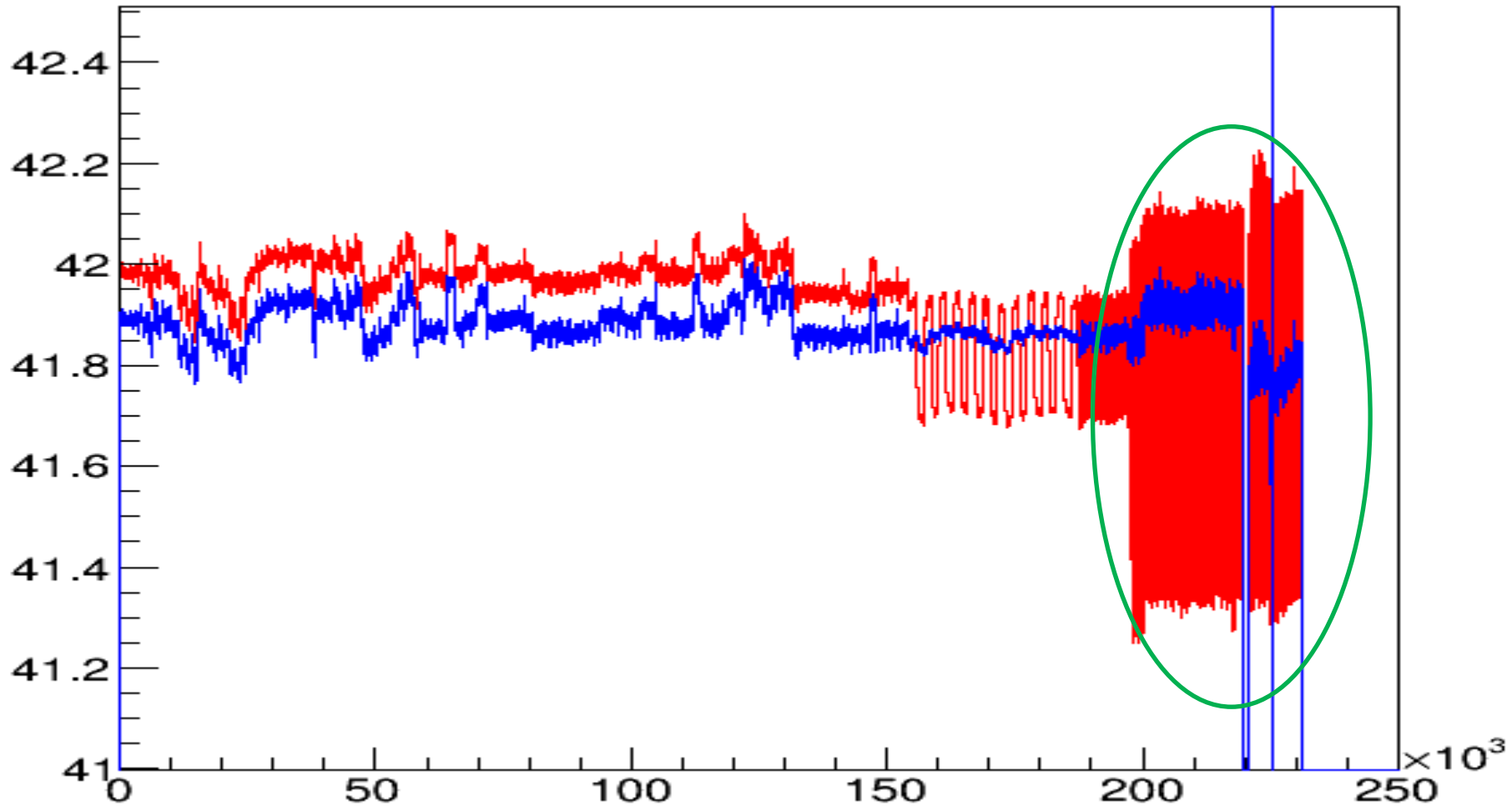
Fitted gradient shown



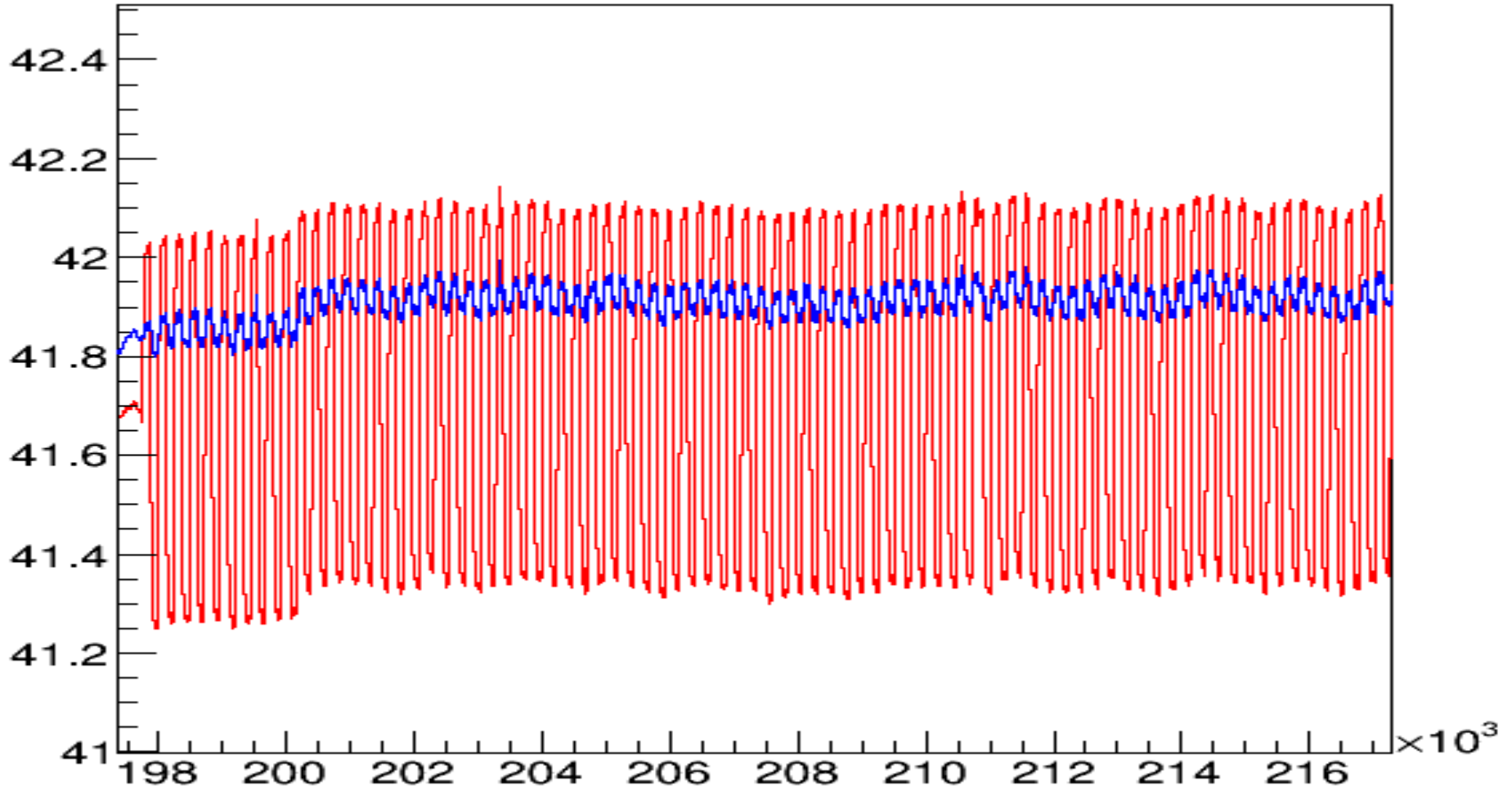
Questions raised in August

- Power cycling. Does this decrease power
- Power supply

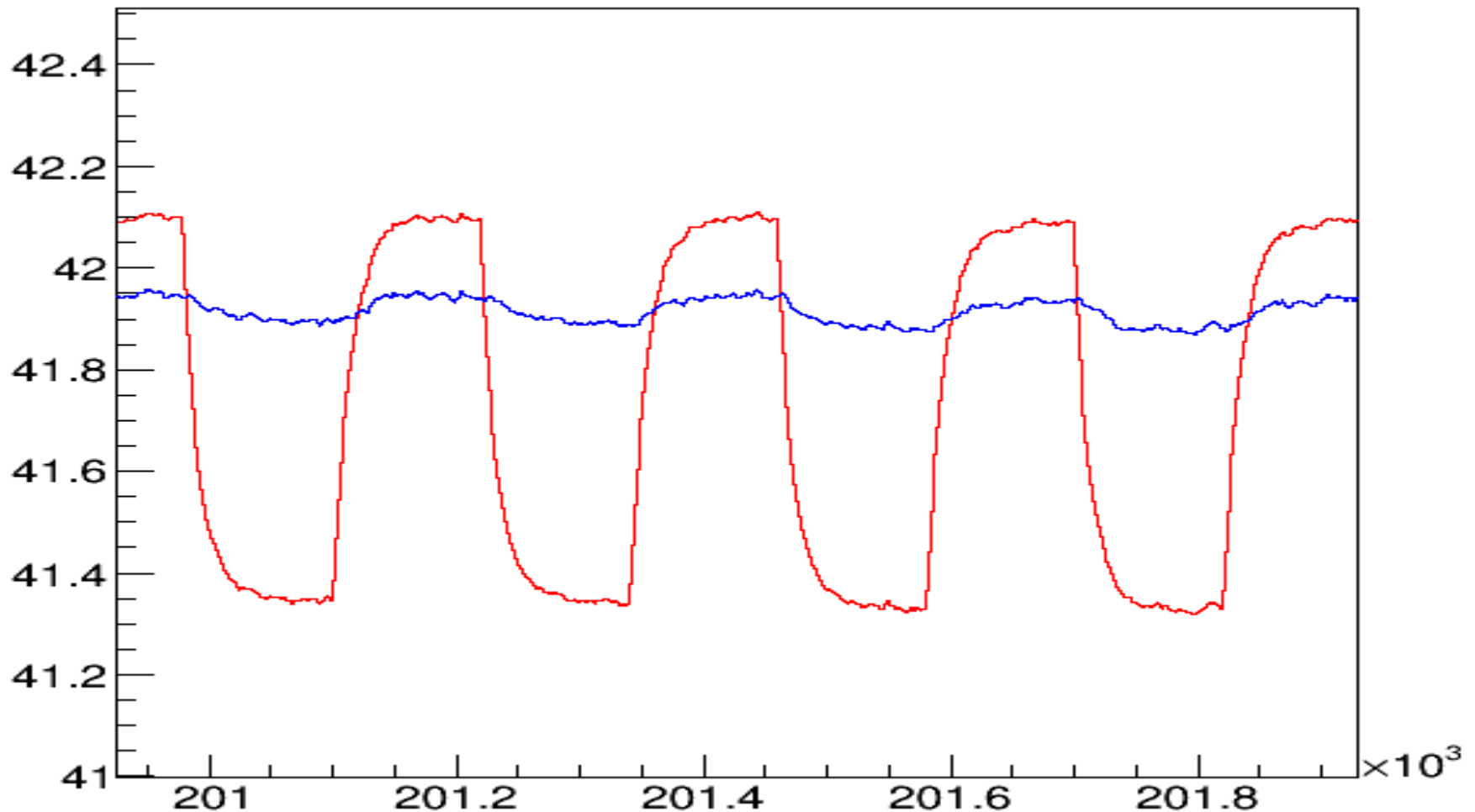
40 degree samples Temp History



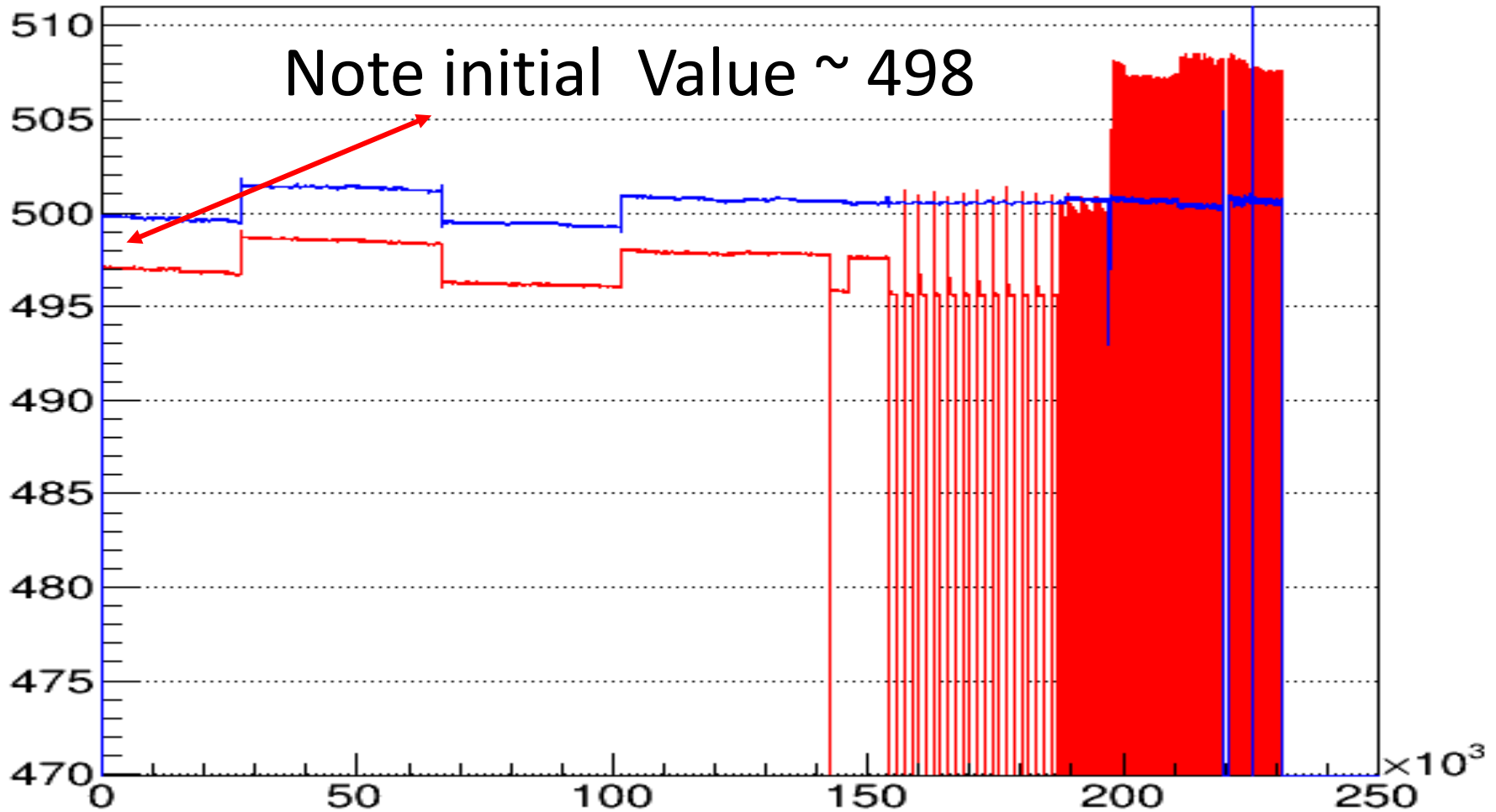
40 degree samples Temp History



Small effect seen in box where power remains on. Otherwise swing = 0.2oC

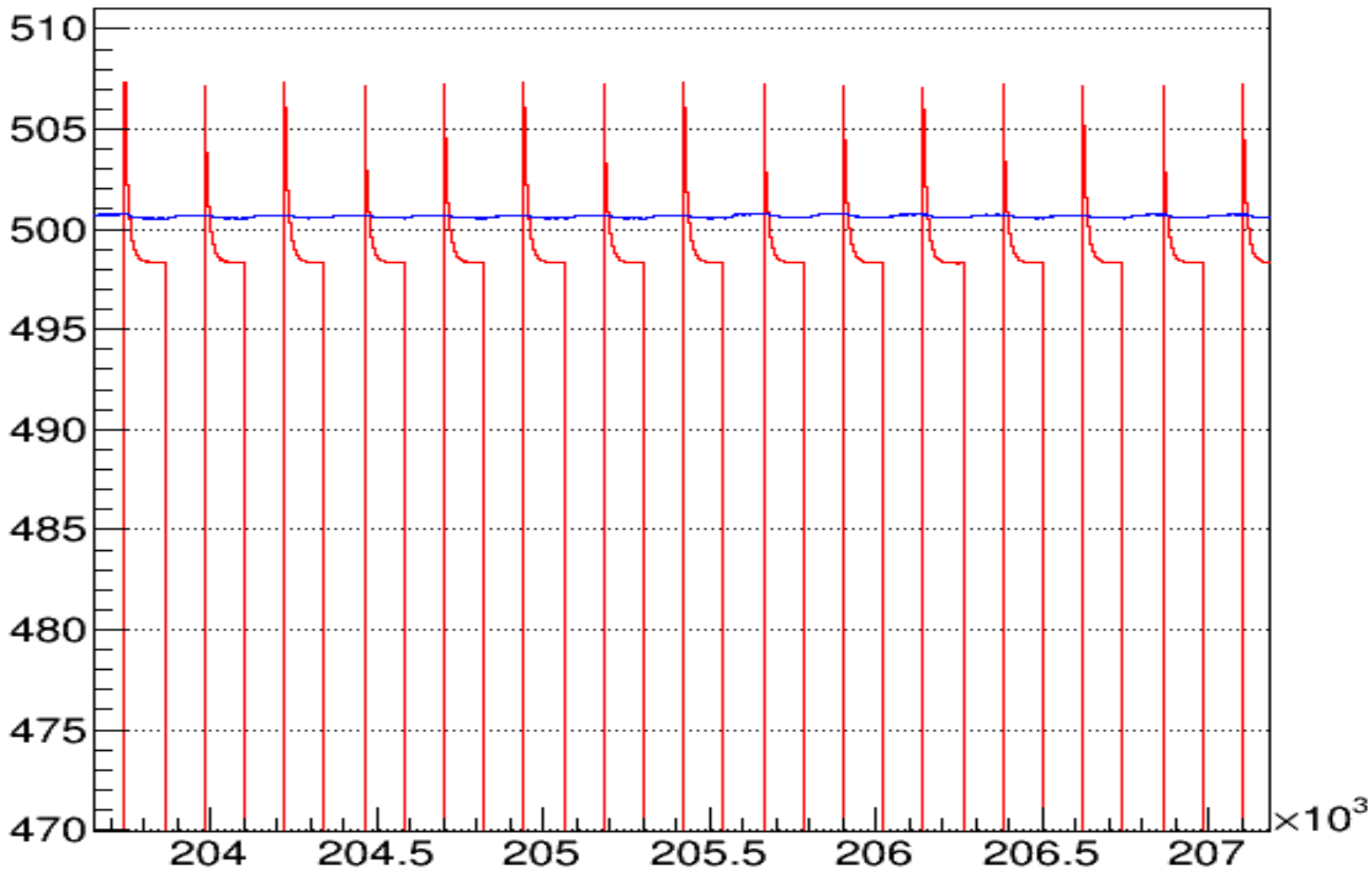


40°C Samples Light Output

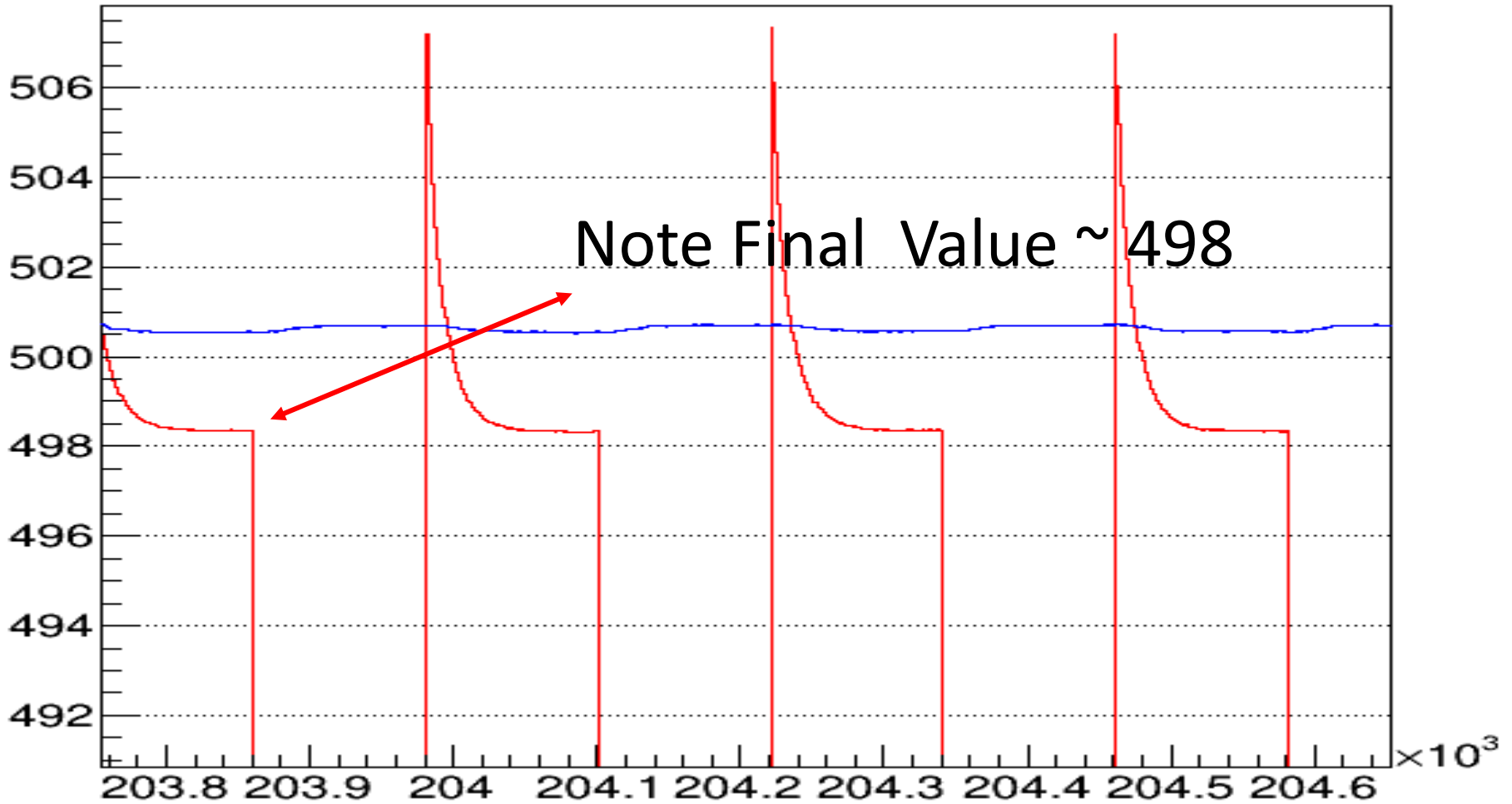


Note Non powered sample (blue) changes by less than 1 unit in 500 (0.2%) in 0.47 years

Look at 60hr period in October



Close up in 18 hr period



Conclusions

- Tests at ambient temperature and at fixed value of 40oC show no significant decrease in light output and are totally inconsistent with the observations in USA15 seen in 2012. We expect 10% we see less than 1%.
- Power cycling tests carried out over 1 month do not change the conclusions.
- Next stage is to set up new tests in USA15 with the same set-up but with power coming from the BOC and same ambient conditions as normal TX operation.