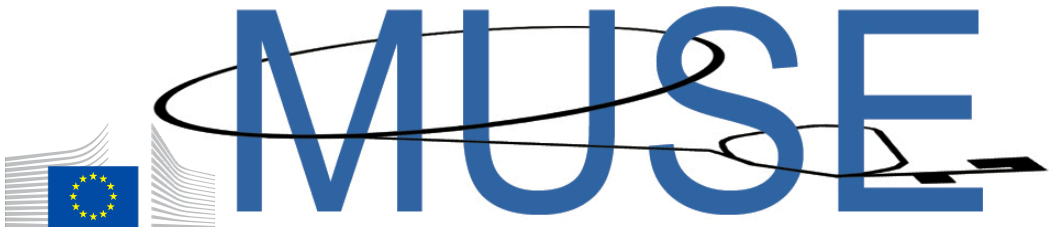


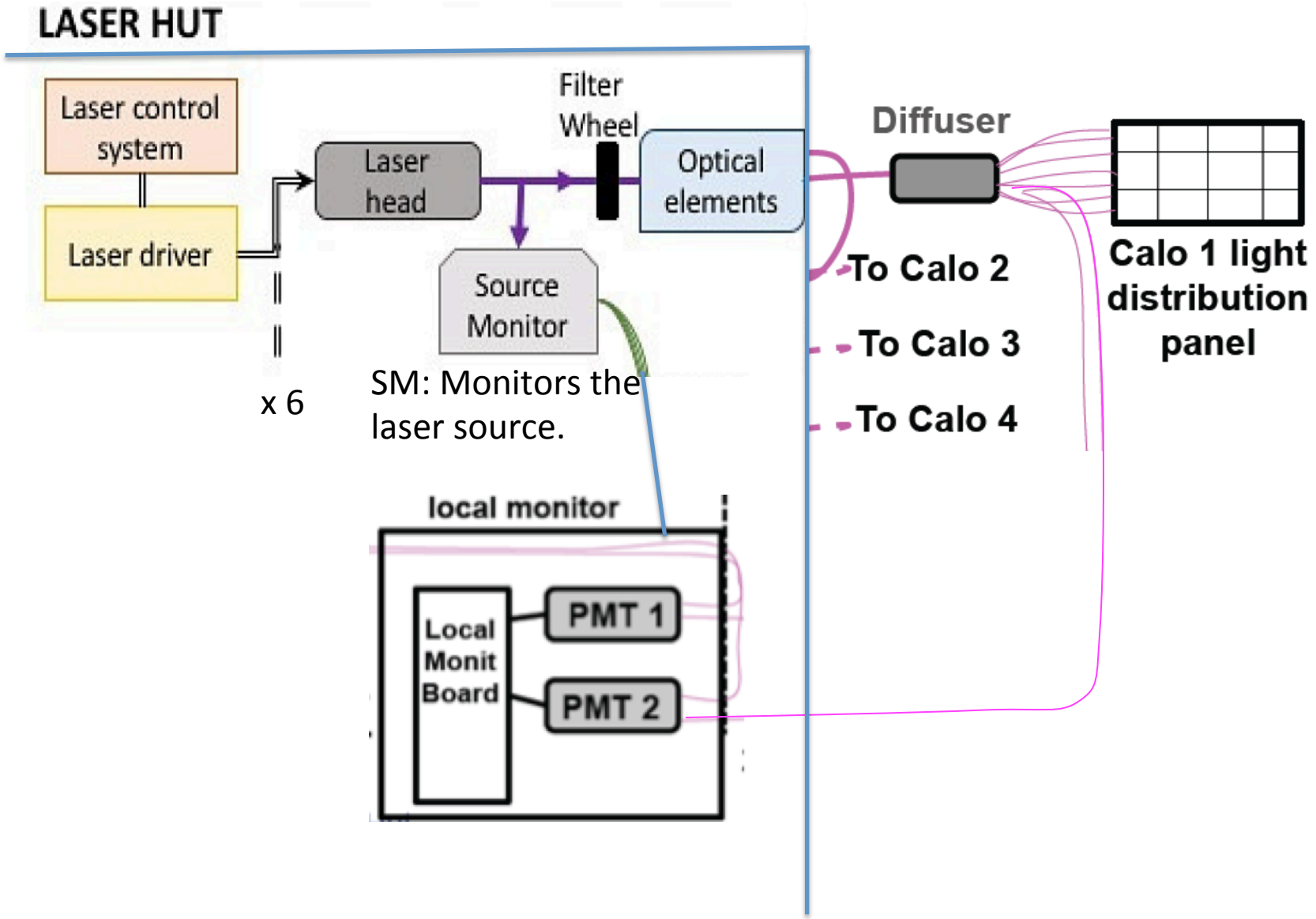
H2020-MSCA-RISE-2015 — Grant Agreement N° 690835

Analysis of Local Monitor Signals

Muse Collaboration Meeting, October 23, 2018

Nandita Raha, INFN Pisa

Laser System - Basics



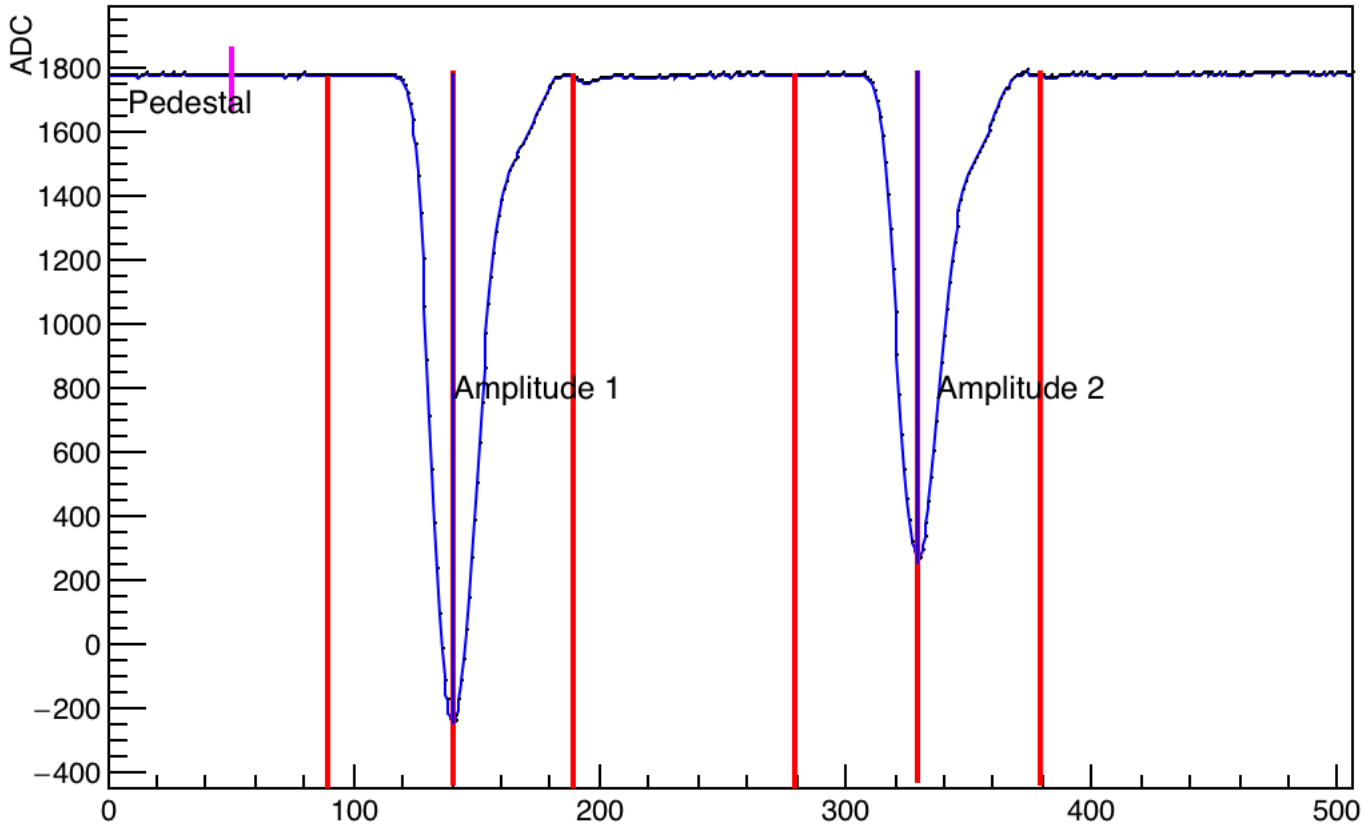
Old and New PMTs

Calorimeter	Old PMT	New PMT
11	25	5
12	26	0
13	27	6
18	28	8
20	29	4

Looking at calo 20 in detail − overall behaviour of all channels in back up. Since the amplitude is free from jitter of the pedestals, I used the amplitude instead of area for this presentation (though area plots are the same). Details of amplitude of first pulse here, as it will have the effect of temperature of the PMT alone.

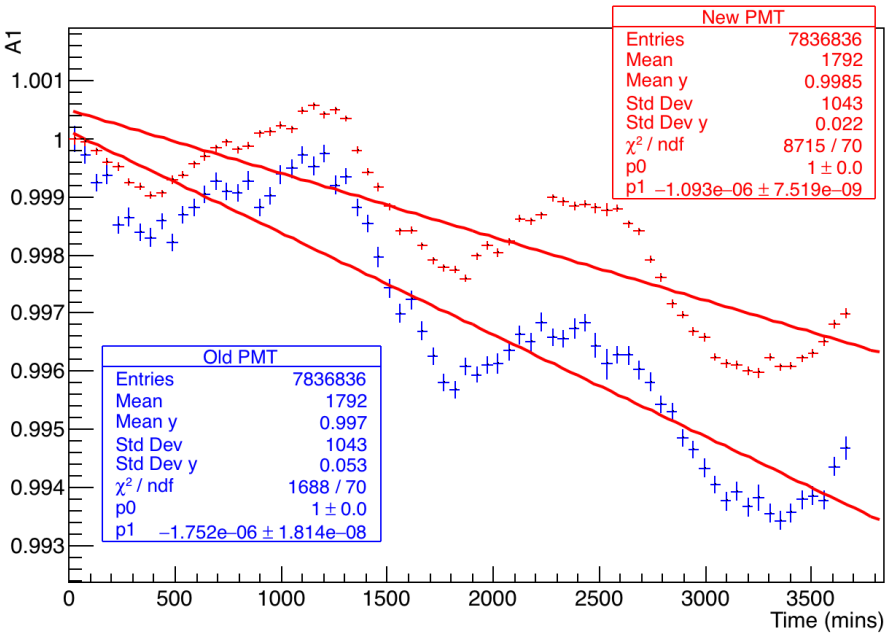
Parameter Definitions

- Pedestal: Average first 50 samples
- Amplitude: Pedestal subtracted peak sample
- Area window: ± 50 samples from peak.



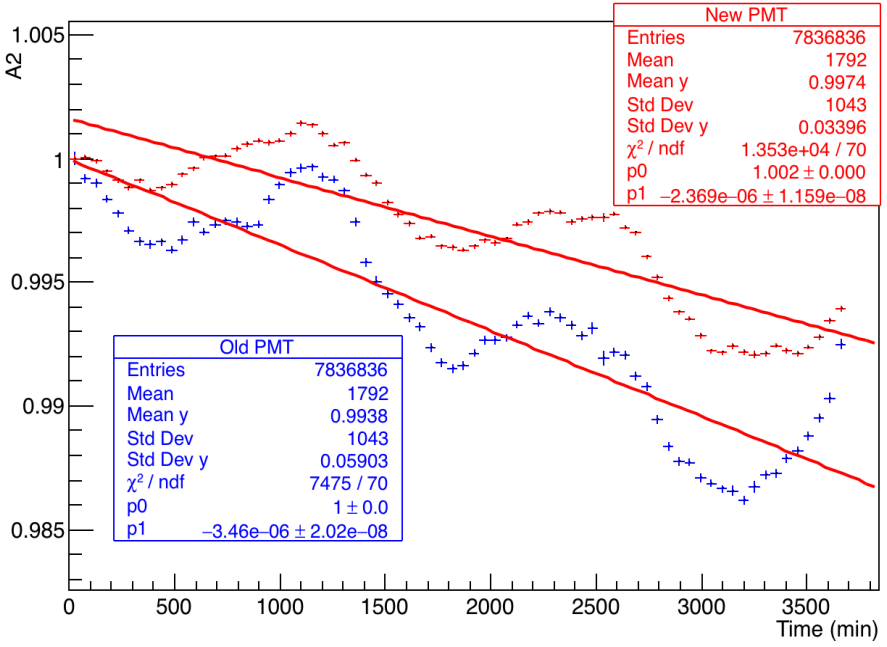
Comparison of old and new PMTs for Calo 20

Normalized area first pulse



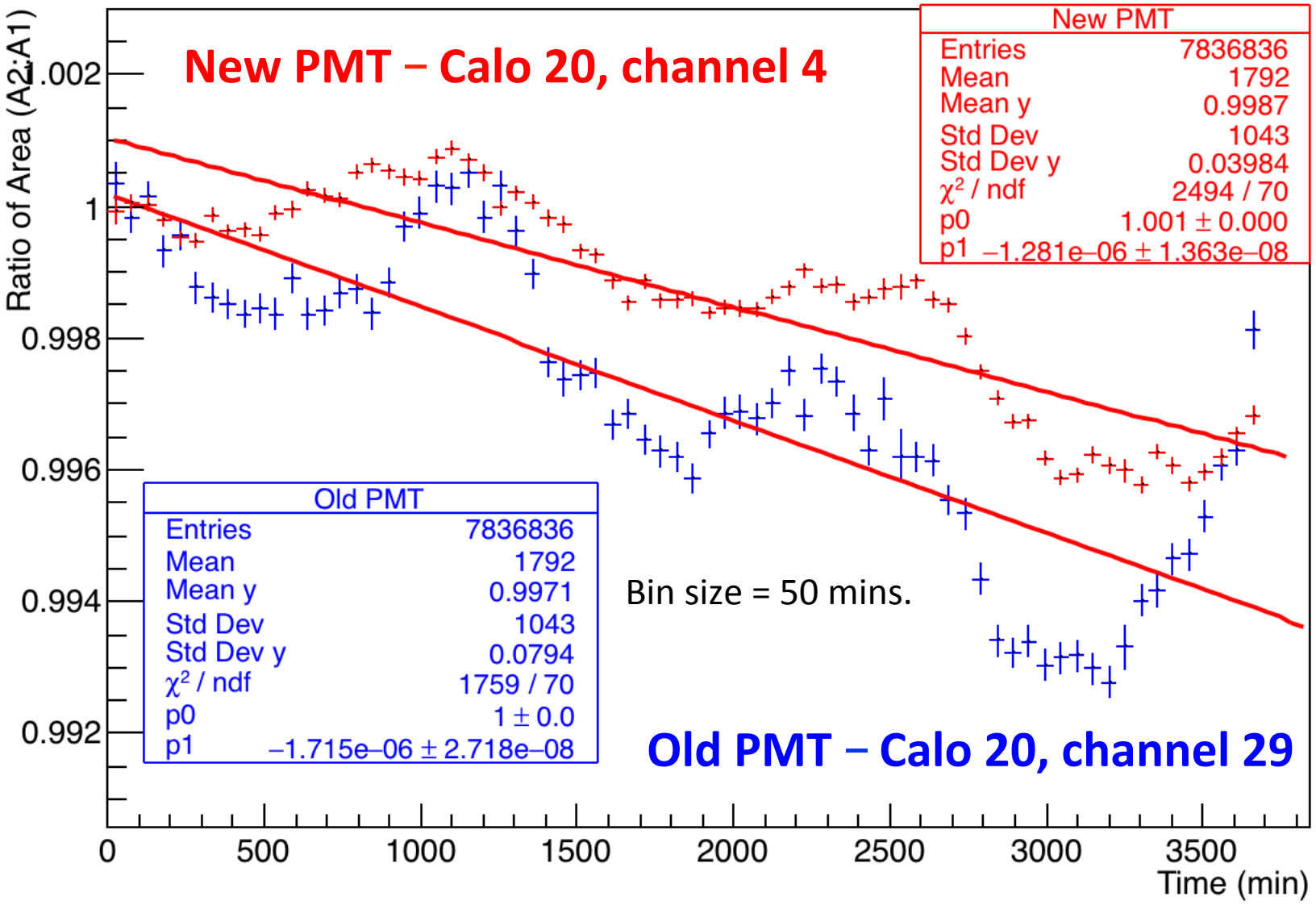
Analysis based on 60 hour dataset

Normalized area second pulse

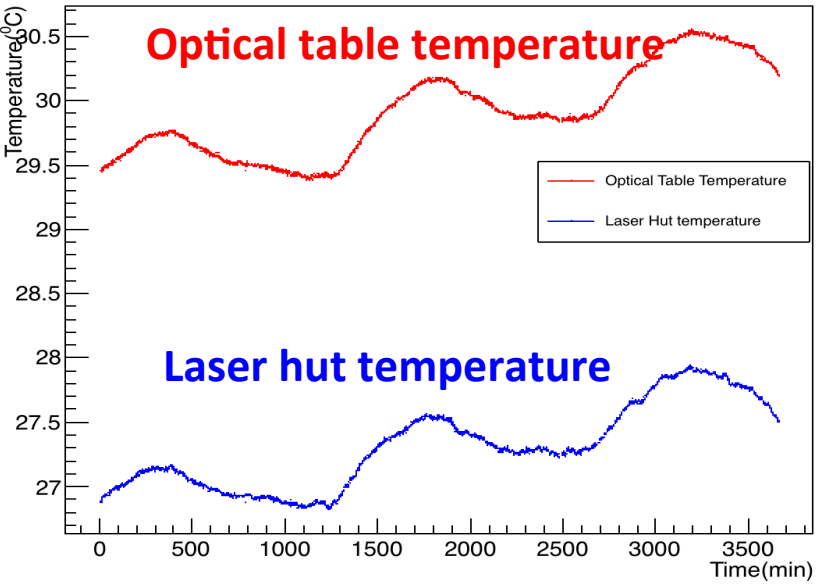


Old PMTs about 1.5 times greater drop than new ones

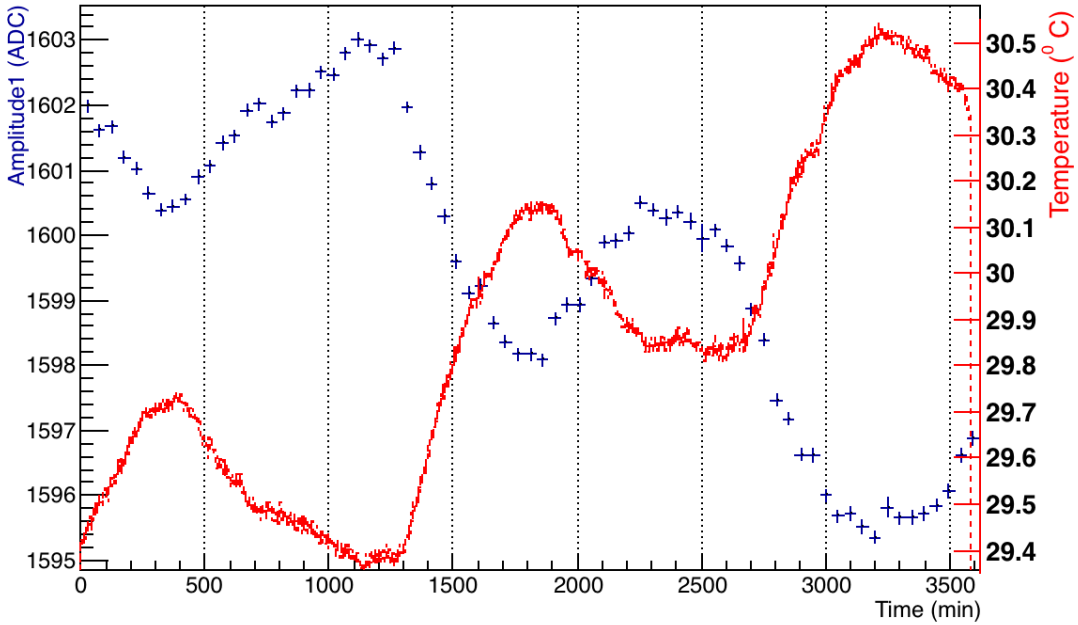
Comparison of old and new PMTs for Calo 20



Temperature Variation – Channel 4



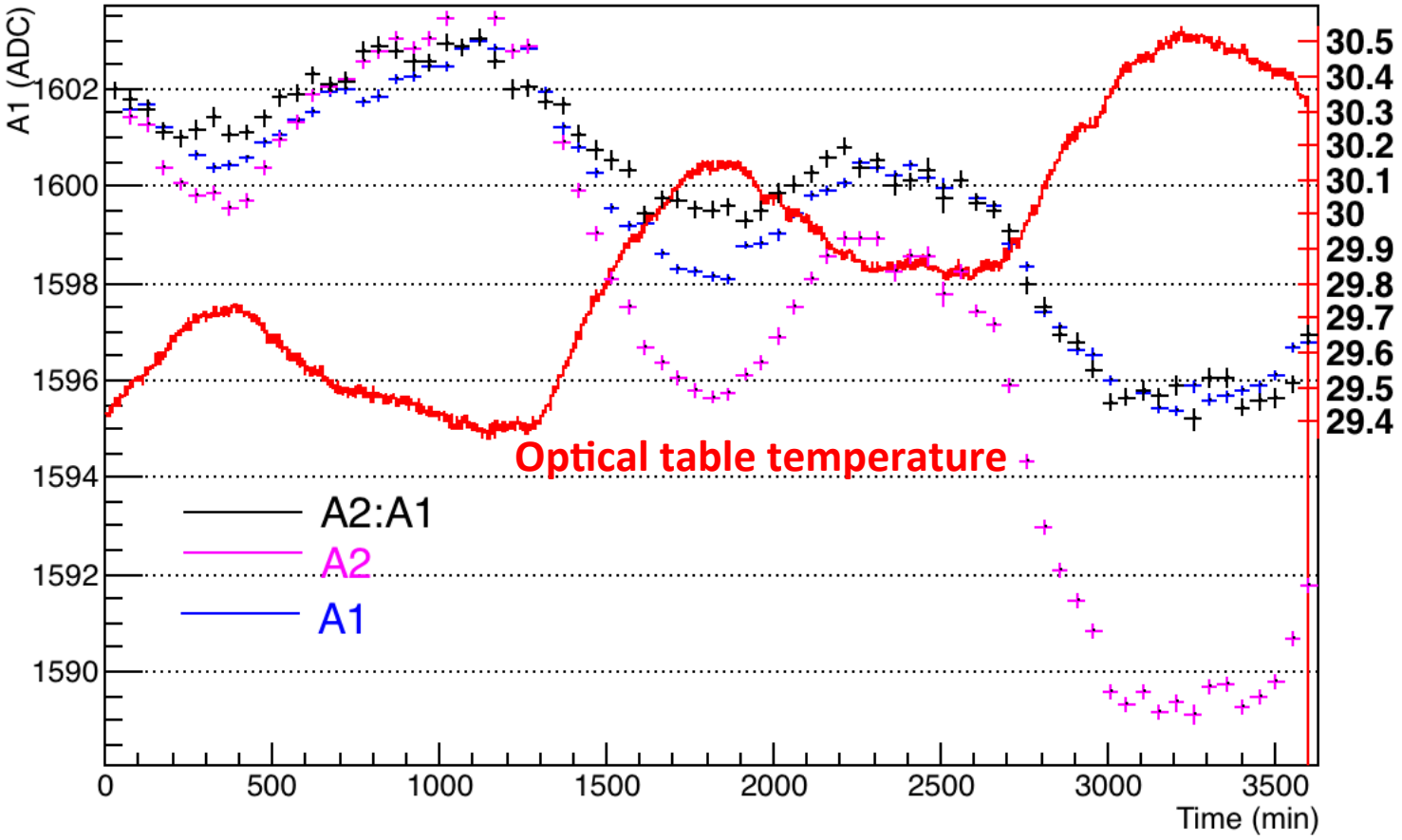
Overlaid temperature and A1 on the same plot



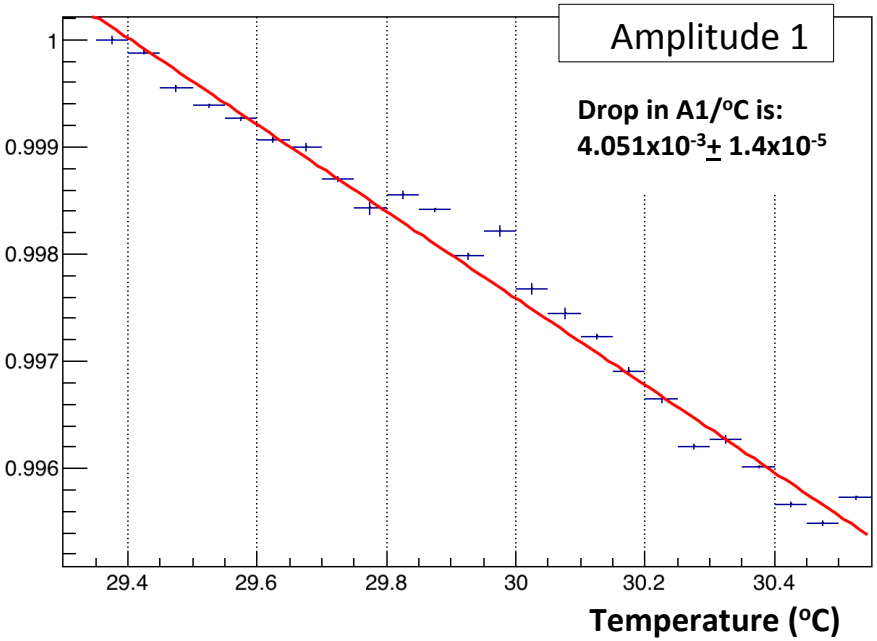
Note: Bottom plot clearly shows a negative temp coefficient

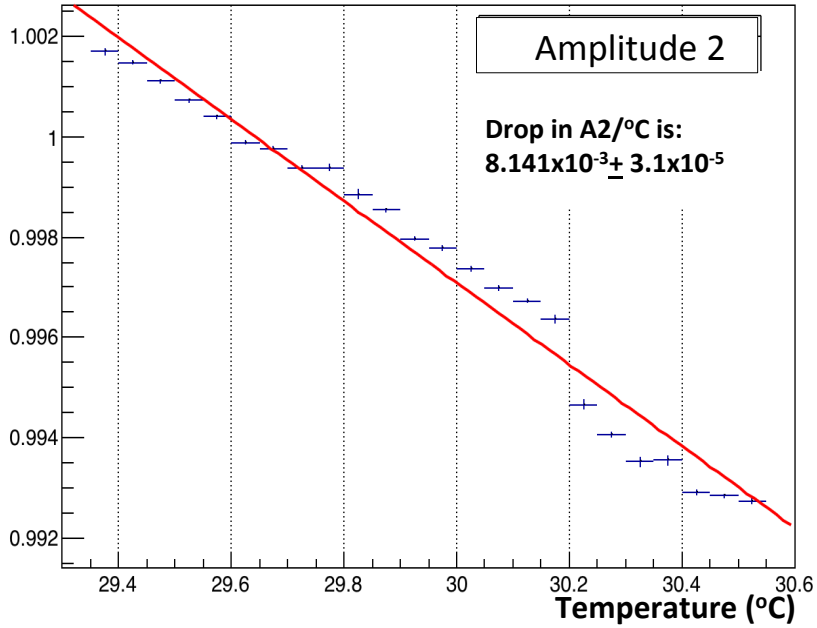
Temperature Variation – Channel 4

Overlaid temperature and A1, A2 and A2:A1 on the same plot, after normalizing all to A1 for consistency

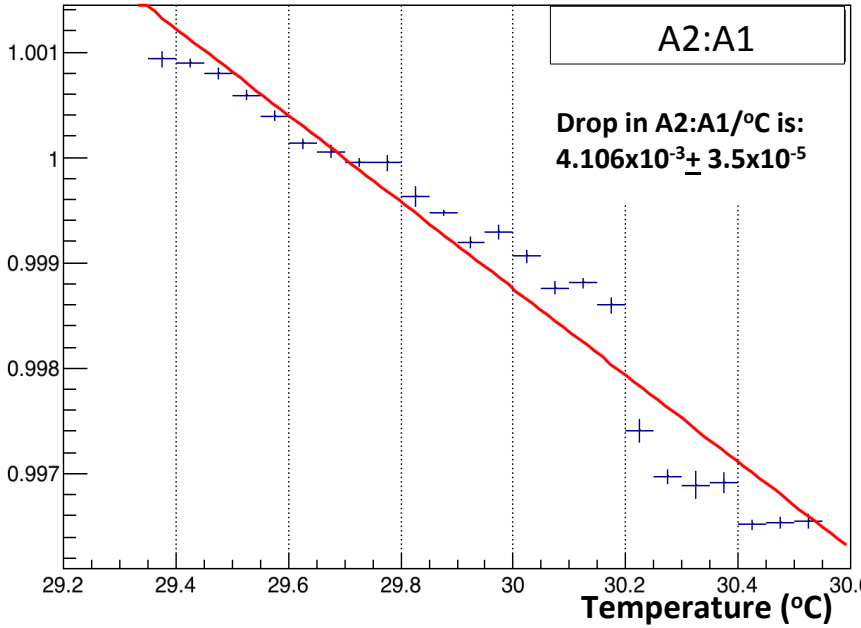


Amplitude Vs. Temp – Channel 4

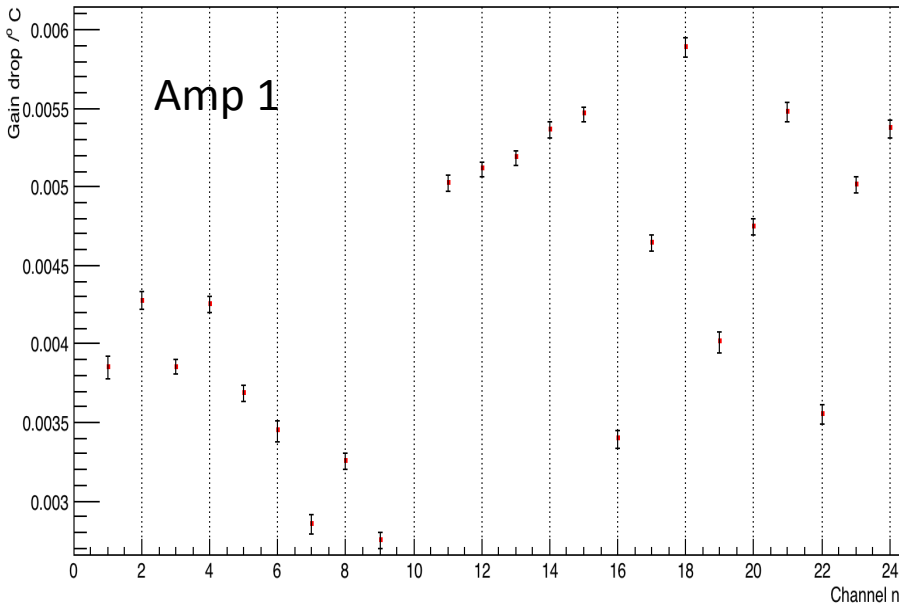


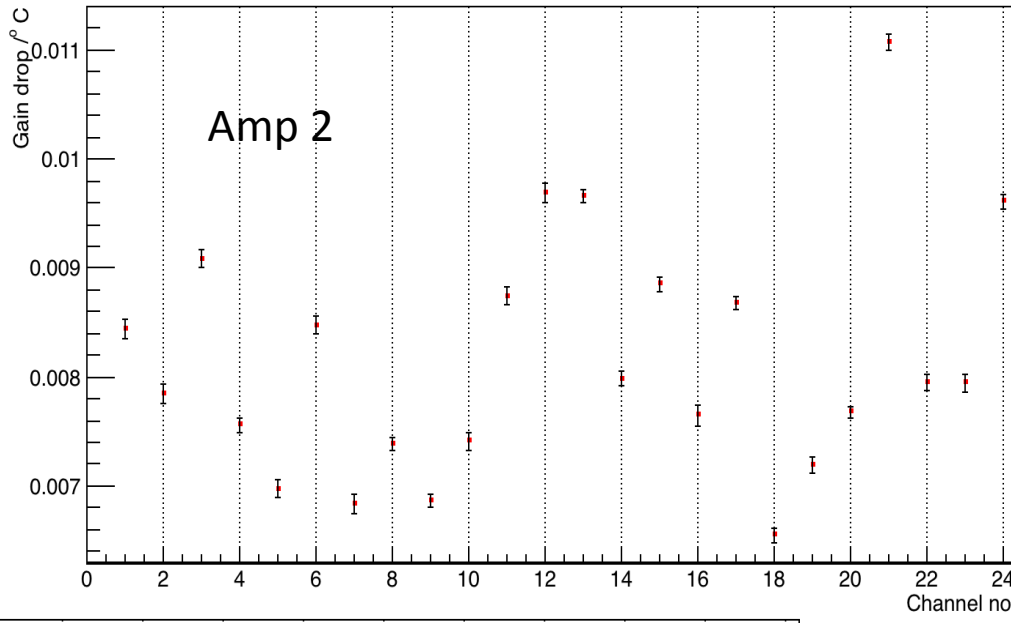


A linear fit on the temperature Vs. amplitude plots – gives the approx. gain drop / °C

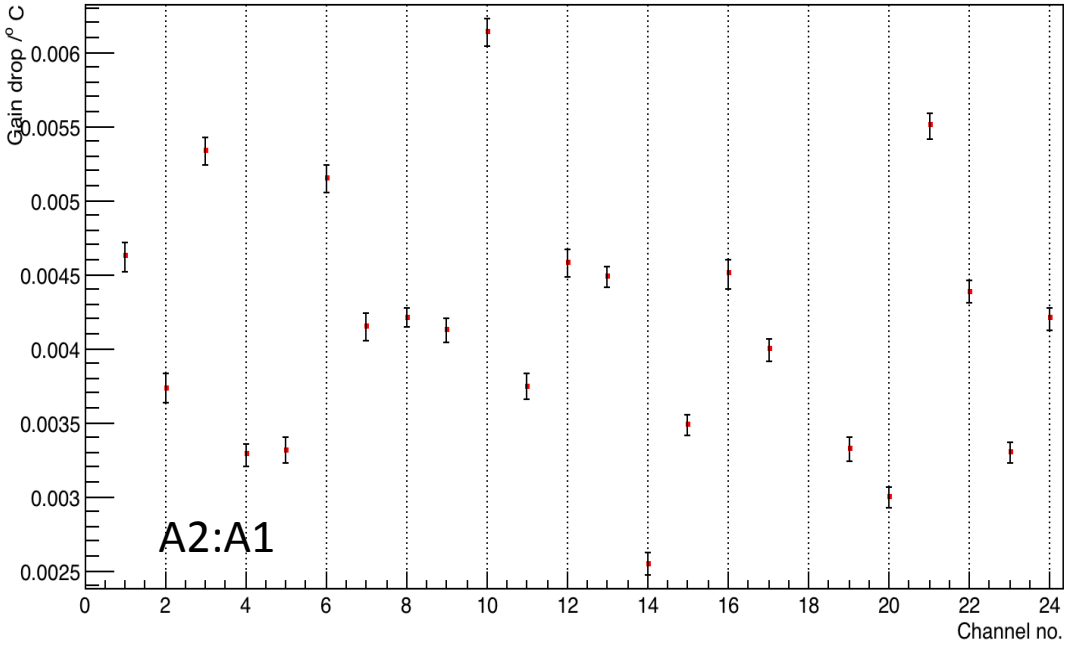


Amplitude Vs. Temp – all channels

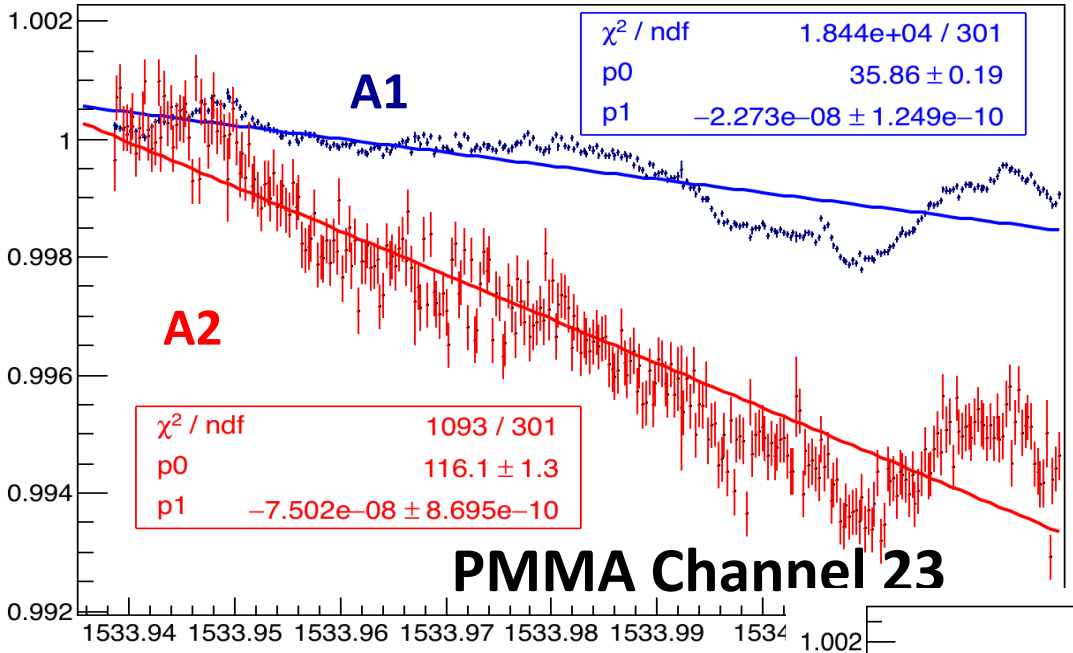


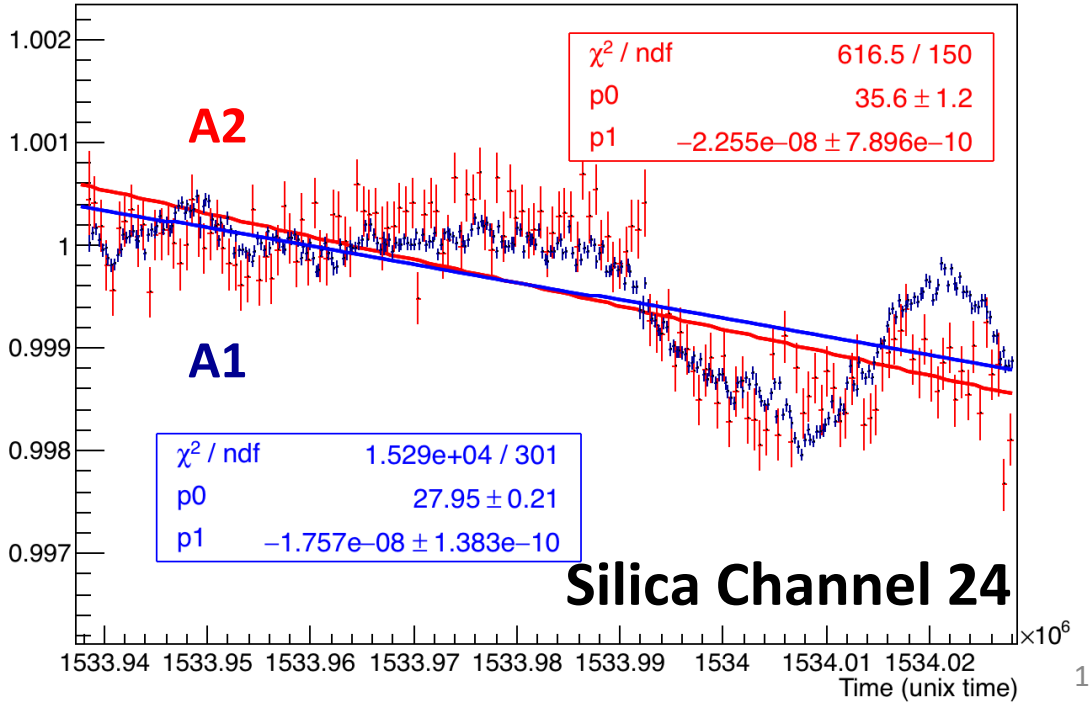


A linear fit on the temperature Vs. amplitude plots – gives the approx. gain drop / ^{o}C for every channel (or calorimeter)



Comparing A1 and A2 – a special run 18413





Run 18413 – 24 hours

Normalized by the mean of first 5 bins

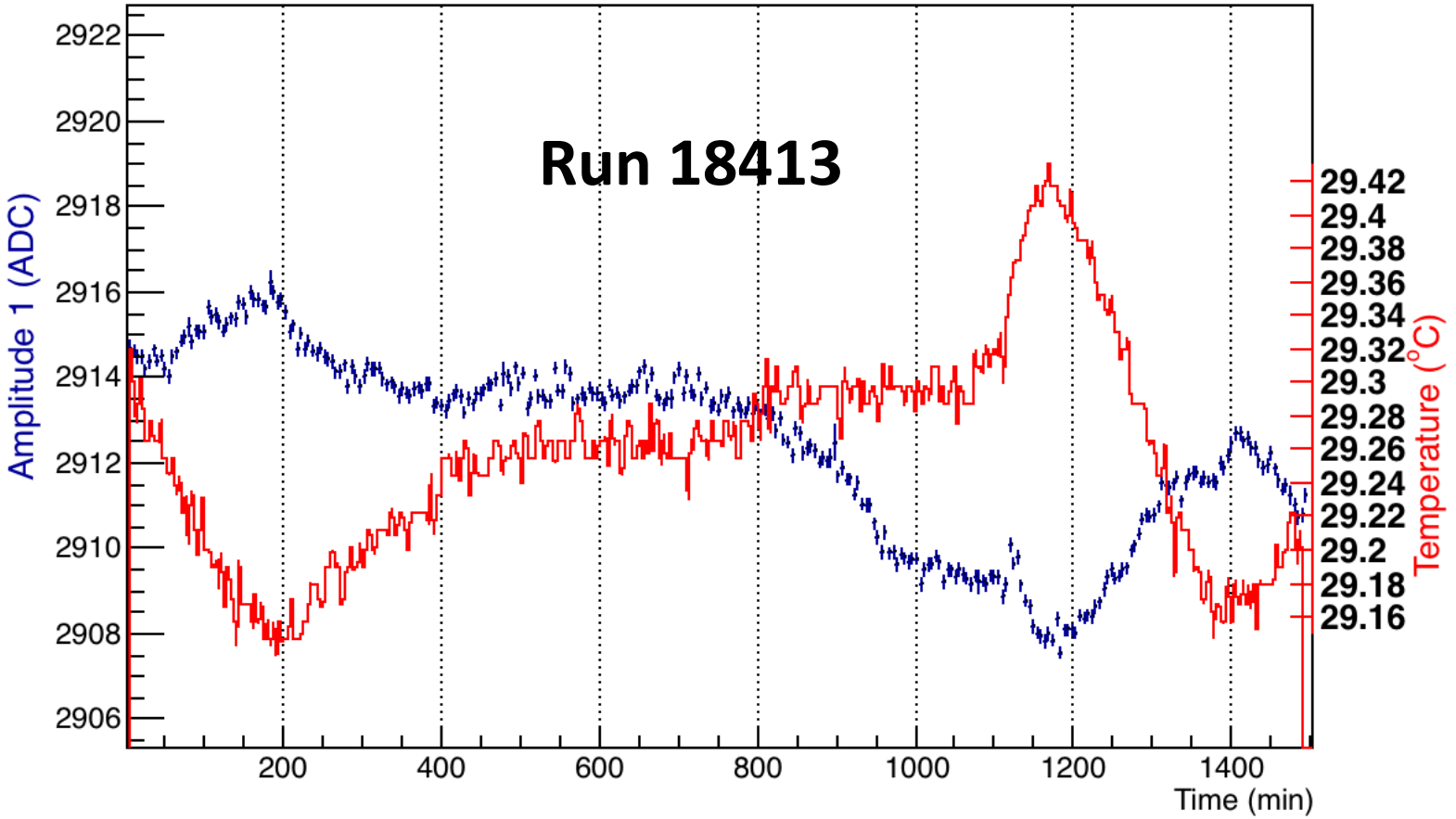
Conclusions

- A1 primarily indicates the gain fluctuation of the PMT, as it is directly connected to the PMT from SM. As expected we have a negative correlation with temperature (PMT gain). A1 is similar for channels 23 and 24 does not depend on the type of fiber used.
- A2 can have additional effects in fluctuation due to forward and reverse fibers to and from the calorimeters respectively.
  - For silica no visible effects on A2.
  - For PMMA "strange" and significant drop behind Gain variation − maybe attributed due to heating effect of temperature.
- In any case LM correction is not necessary − the long term out of fill effects due to environmental factors do not effect the short term in fill SiPM gain function.

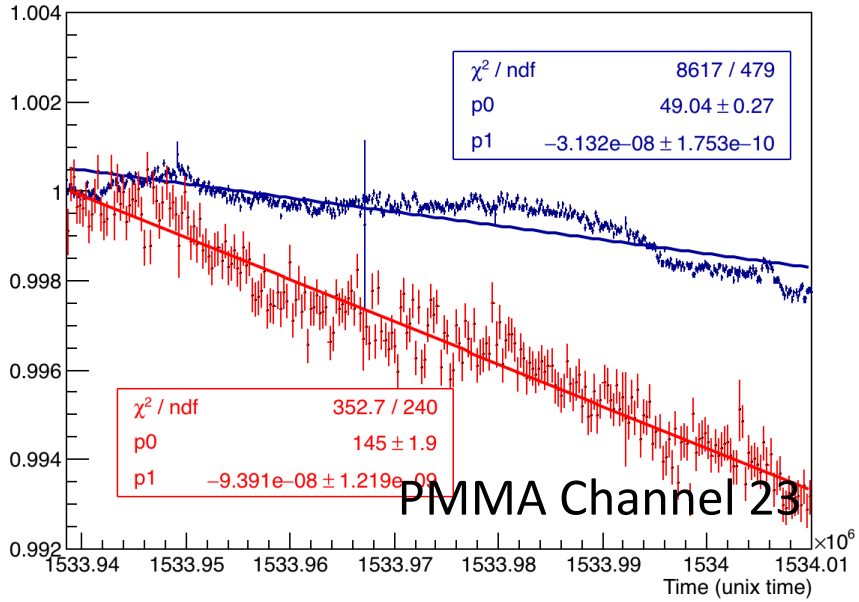
Back Up Slides

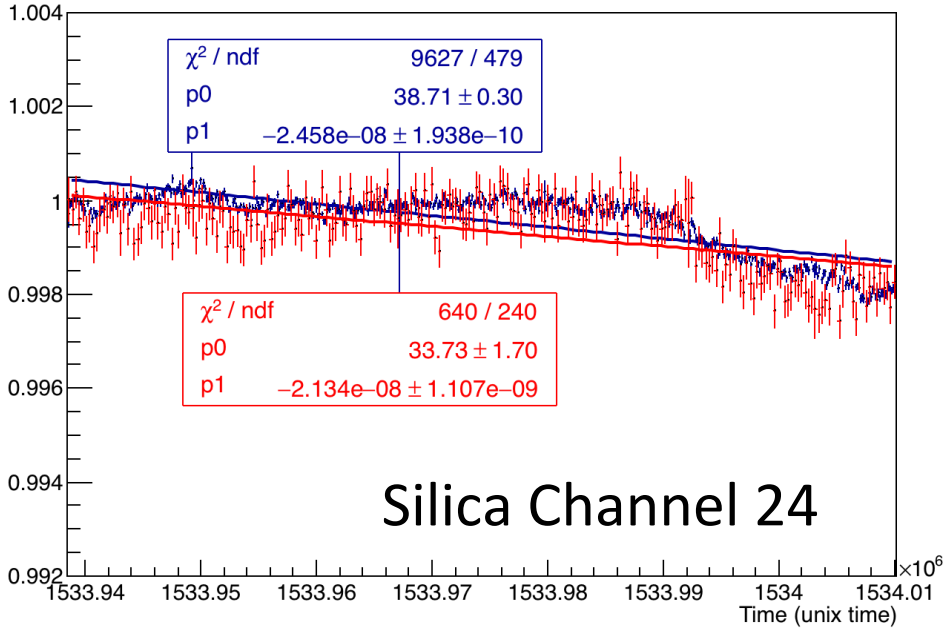
Temp dependence on A1 – Channel 23

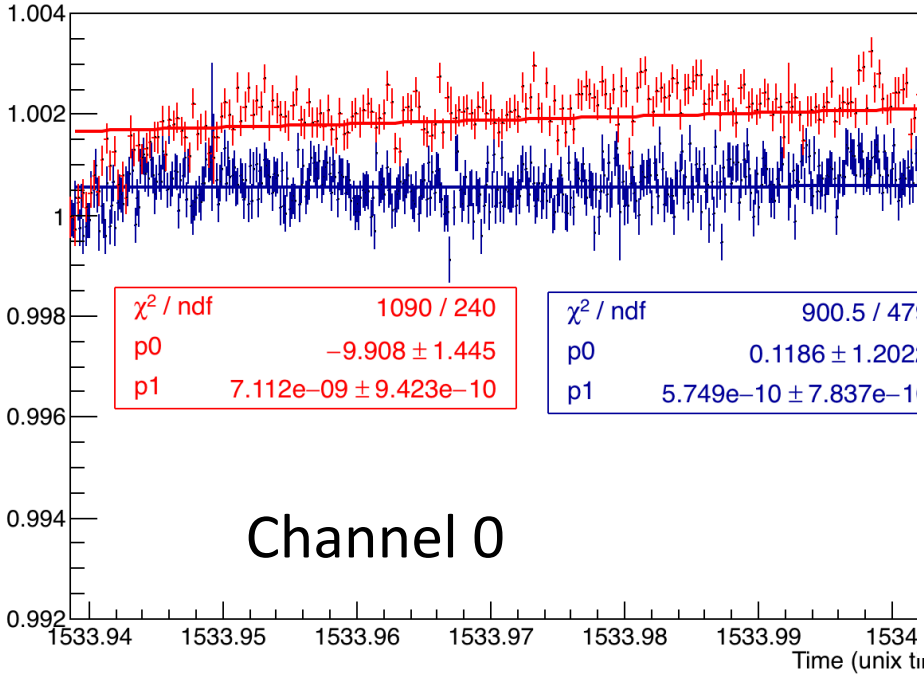
Channel 23, Amplitude 1

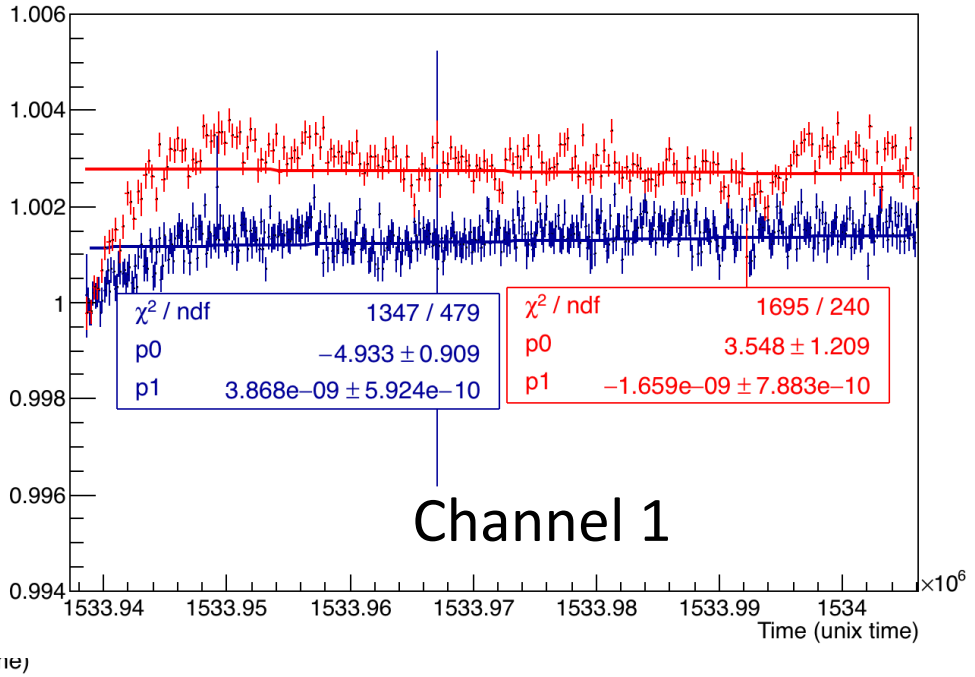


Checking all channels A1 and A2 overlaid – other run





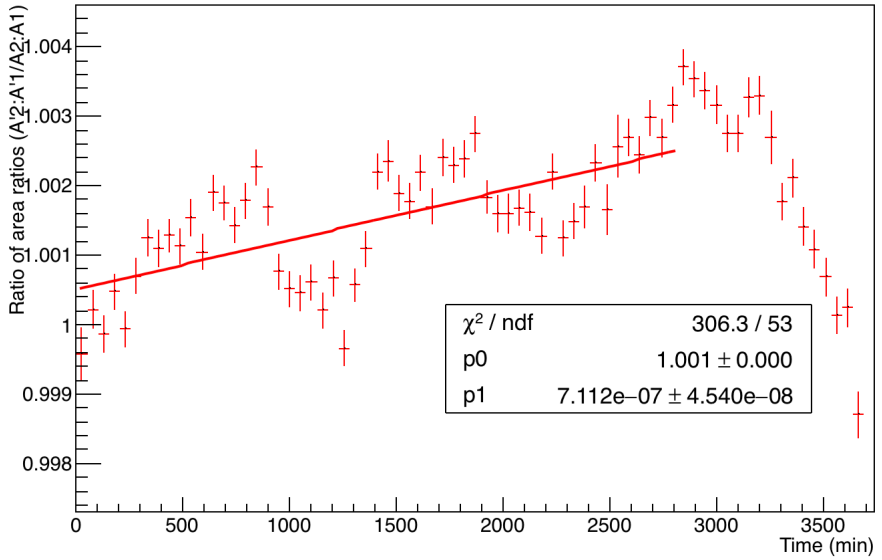




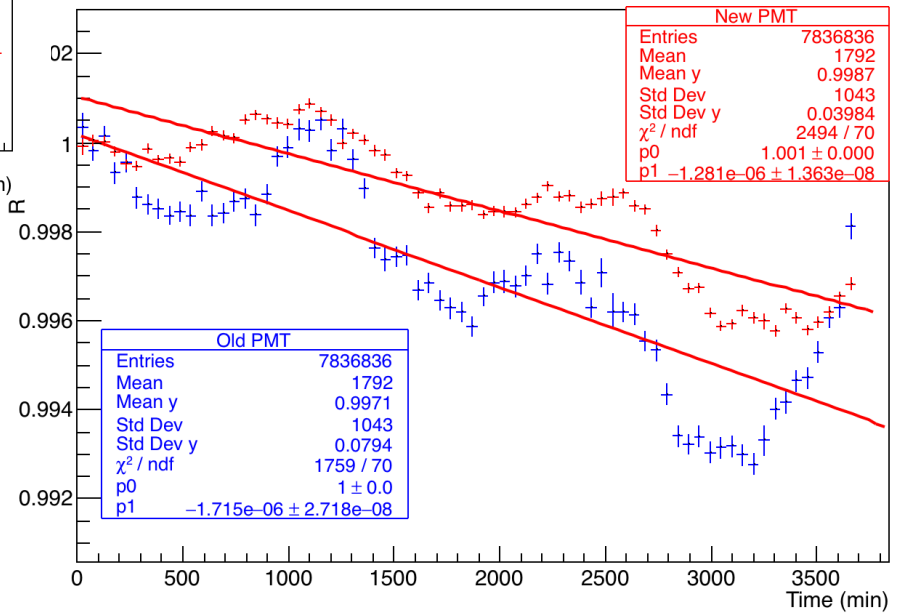
Ratio of ratios for Calo 20

R = A2:A1 of new PMT and R' = A'2:A'1 of old PMT. The ratio of these ratios

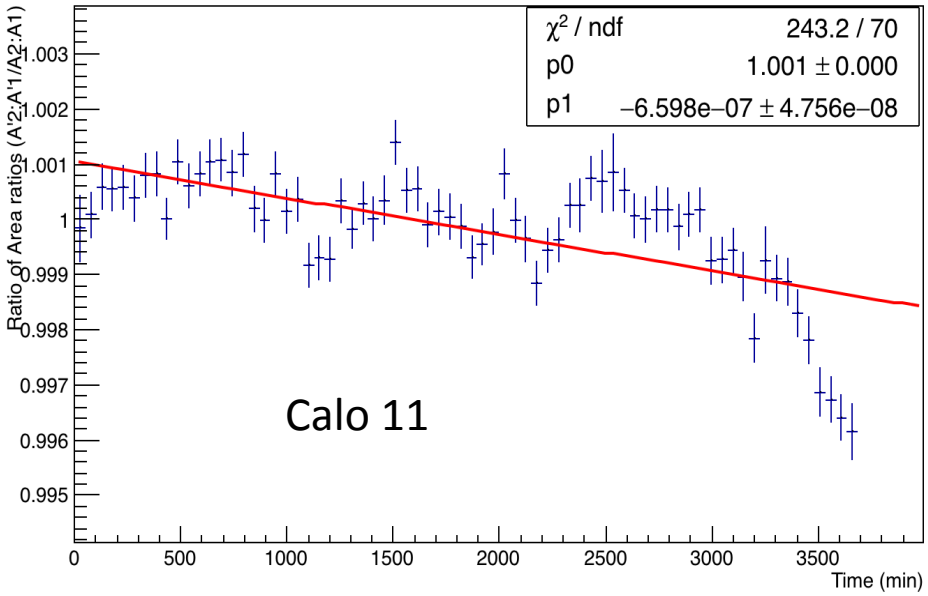
R: R' (new:old) is slightly unstable => The "return" component is not stable.

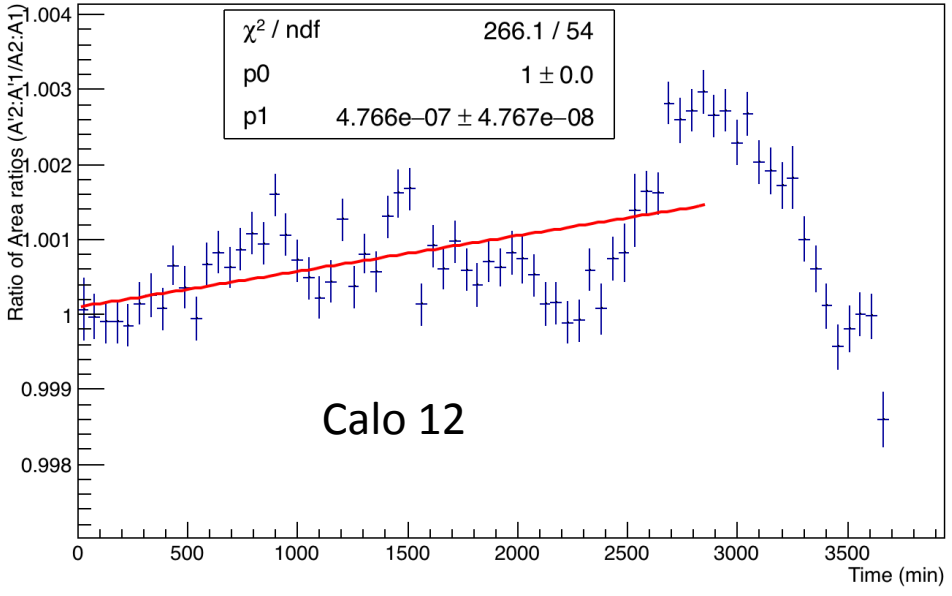


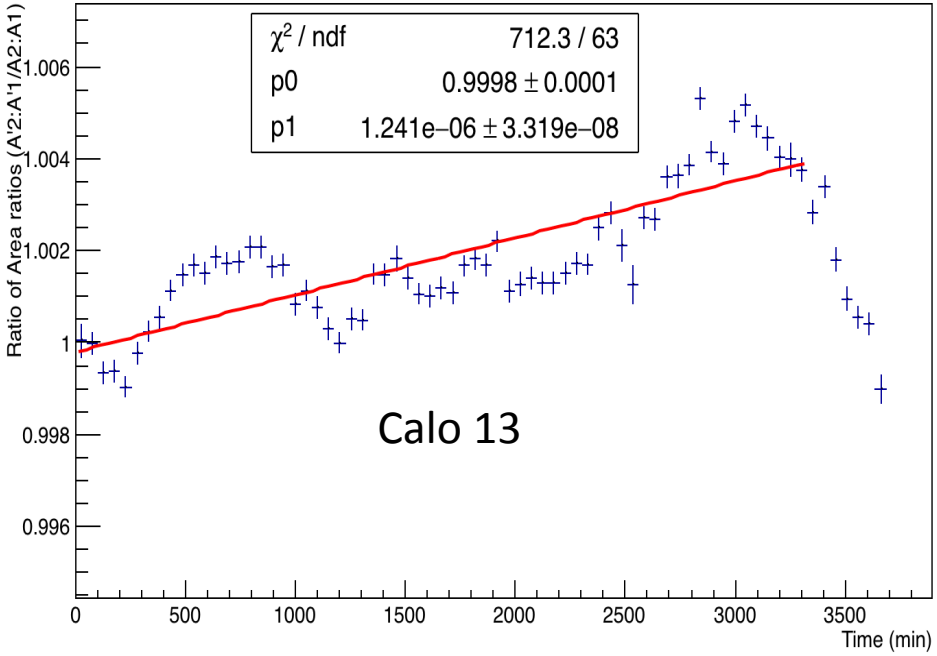
Fitted with p1 just to get a rough idea of the drop in ratio of ratio's per min. This is 7e-7/min for calo 20

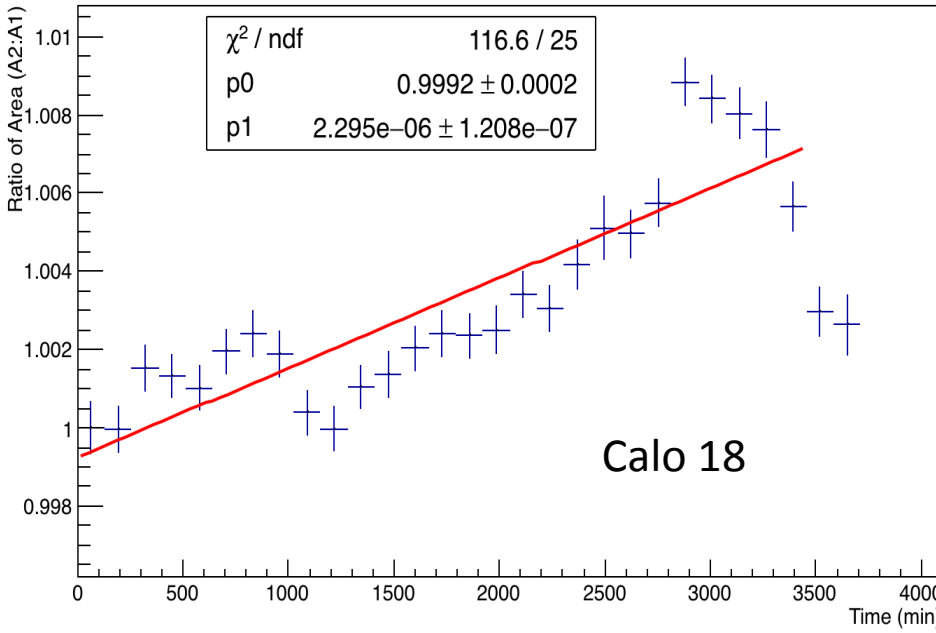


Ratio of ratios other calos

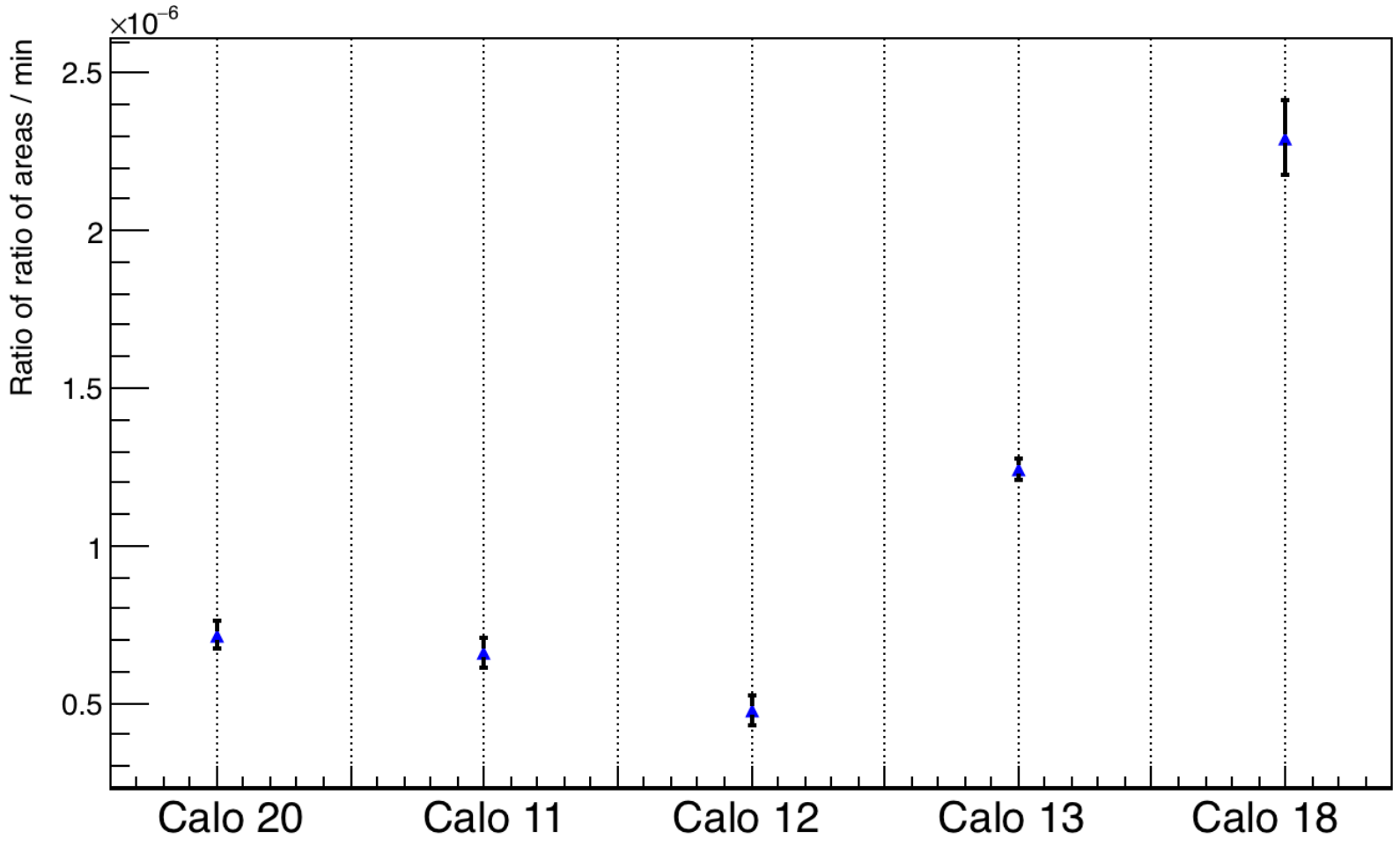








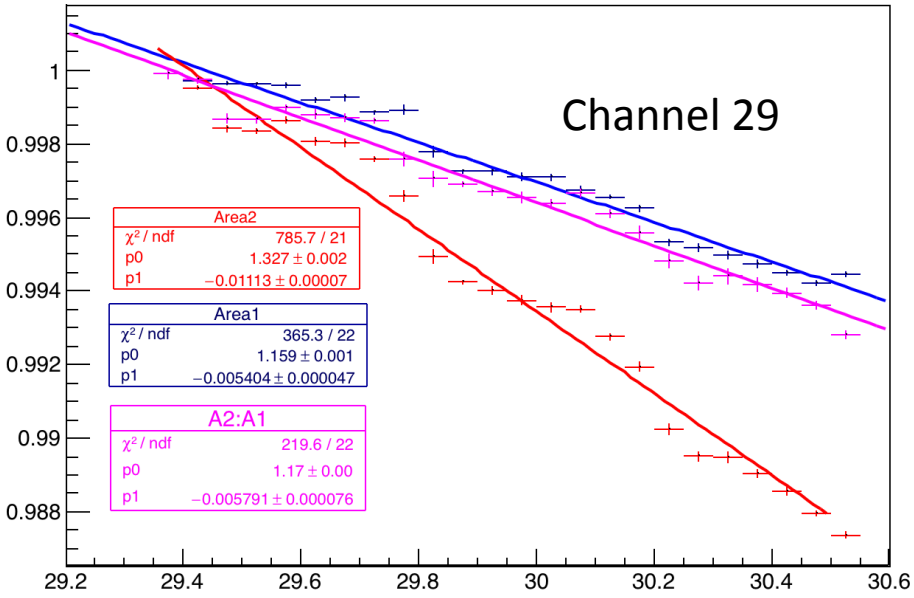
Variation Ratio of ratios/min

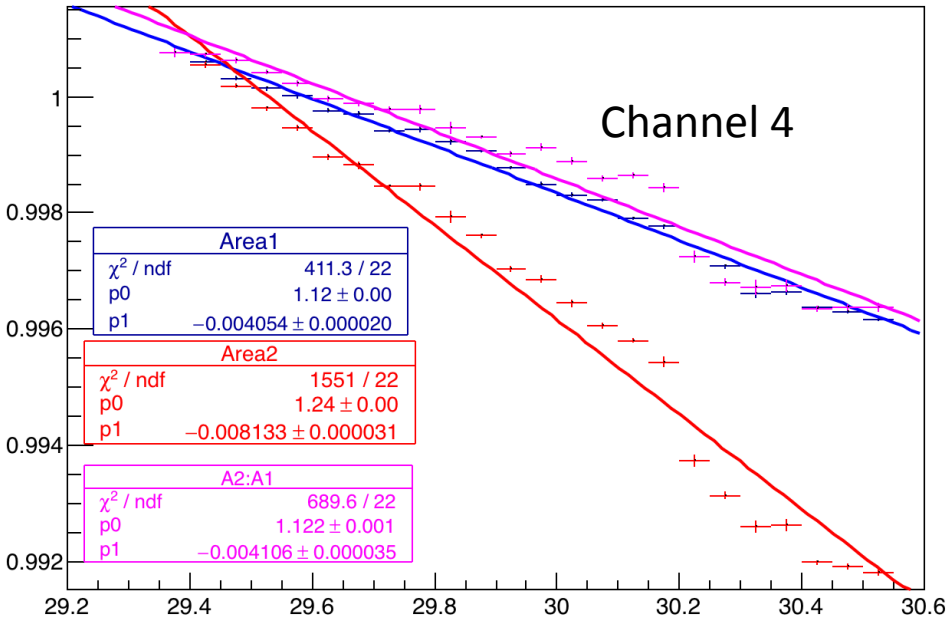


Mostly, the drop is of the order of ~10^{-7}/min

Recap - Temperature variation calo 20

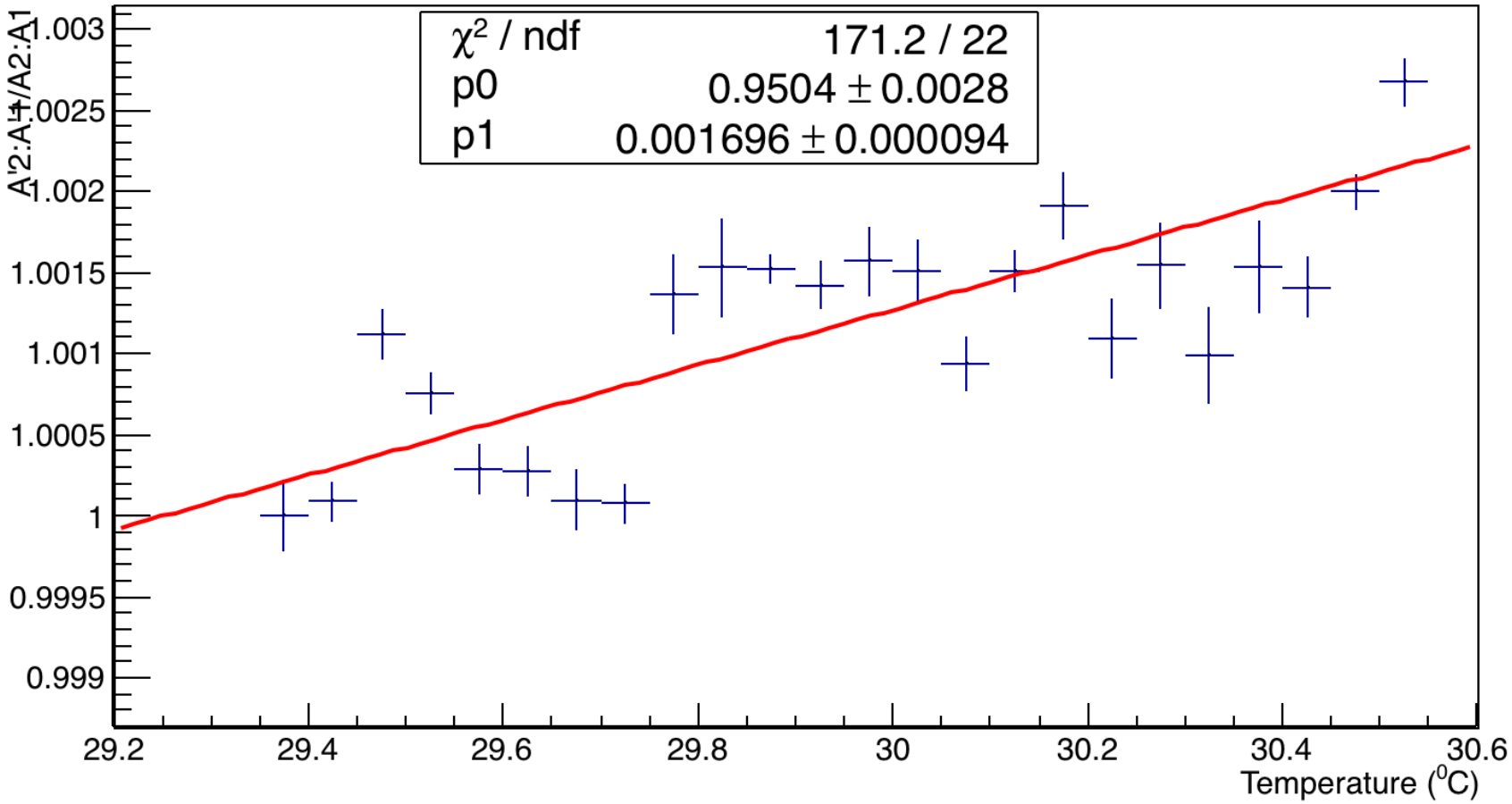
Reminding the temp variations of A1, A2 and A2:A1 for channel 29 and 4− old PMT of calo





Temperature variation of Ratio of ratios- ch 20

This is to check the variation of any drift of the return signal from the calorimeters with temperature for this dataset.
Change is 0.16% / ^{0}C



Temperature Vs. Ratio of ratios other calos