Charge Injection System (CIS) Update

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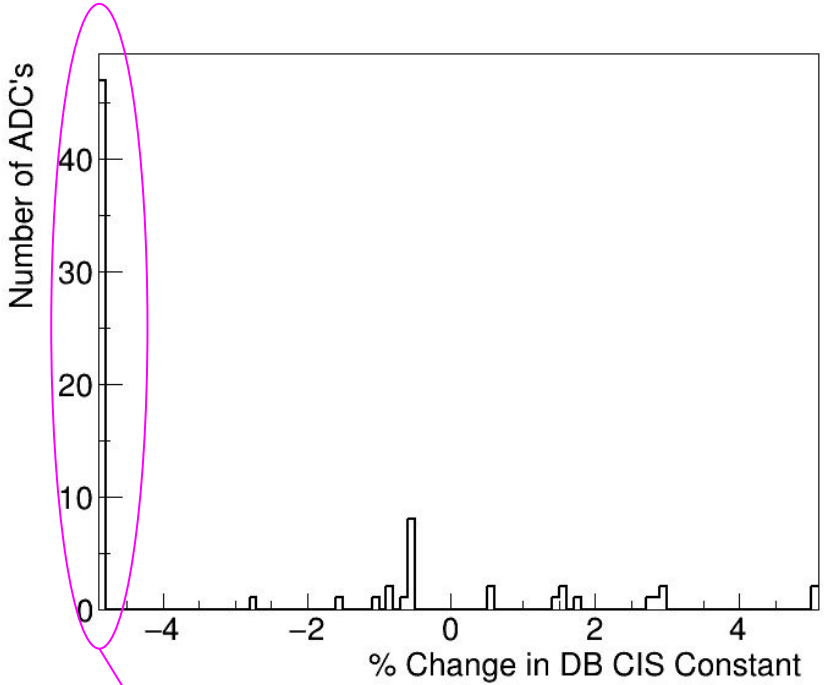
September 12, 2022

Overview

1. Run selection:
2. Global performance:
3. Specific Channels:

Summary

- CIS runs from August 9 - Septmber 1
  - Database will be updated September 13
- 73 channels in update (>0.5% change)
- 54 Good (>1 successful calibration)
- 49 >5% change (4 not LBC52)
- 10 Masked
- 9 Affected



Half-gain in LBC52 Low Gain Channel

Run Selection

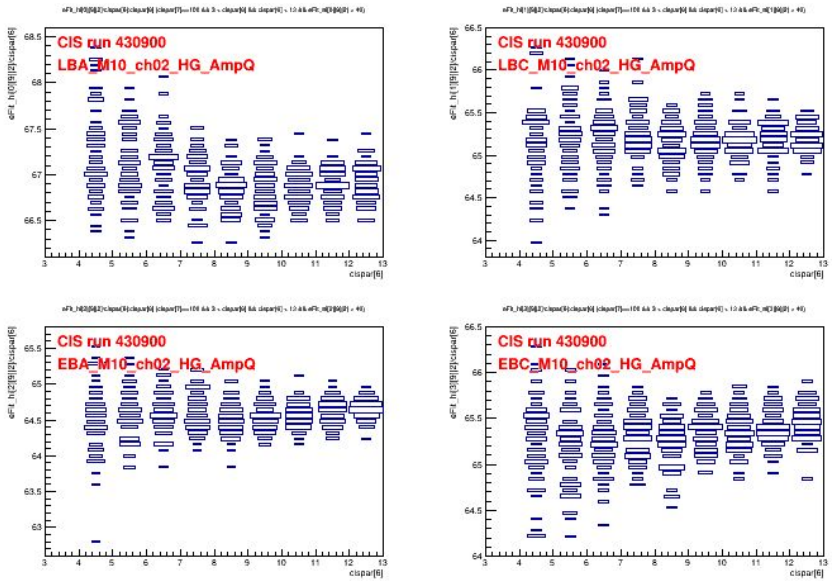
Runs:

- **Date range:** August 9 - September 1, 2022
- **Runs excluded (1):** 430900
- **Runs used (7):**, 431285, 431304, 431313, 431374, 431570, 431991, 432218

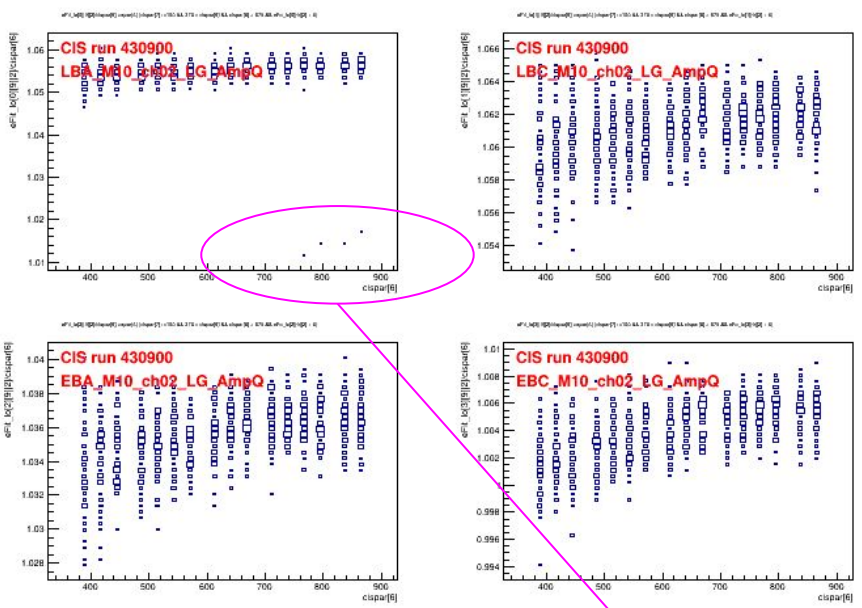
Reasons:

- Amplitude-Charge ratios for run 430900 had outliers (see next slide)
- Timing plots are consistent by module and run rumbers
- No other systemic issues visible in the channel plots warranting exclusion of runs

Excluded Run Amp/Q: 430900



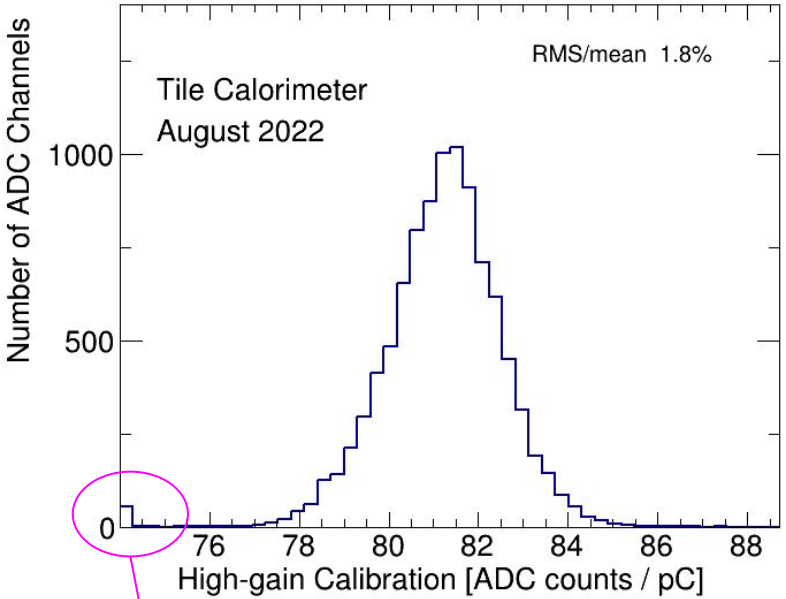
High gain



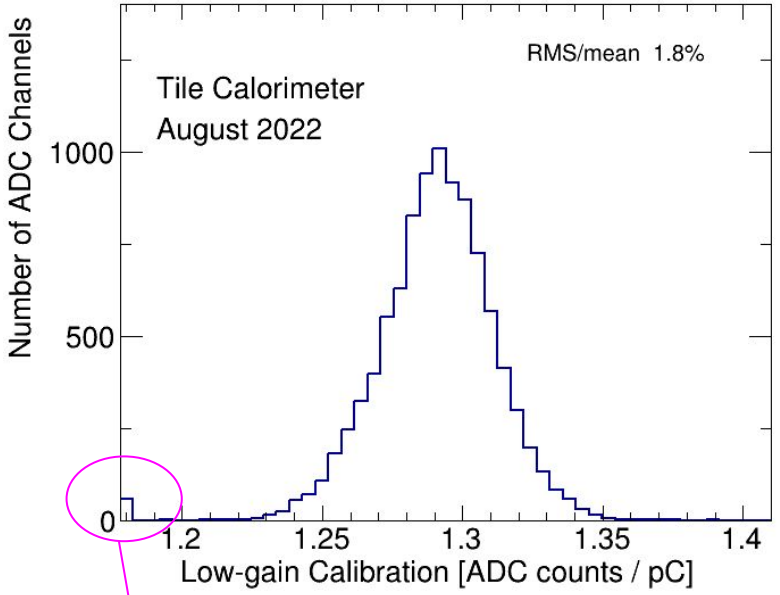
Low gain

Outliers: Injected charge not accurate for this run

CIS Constant Distributions

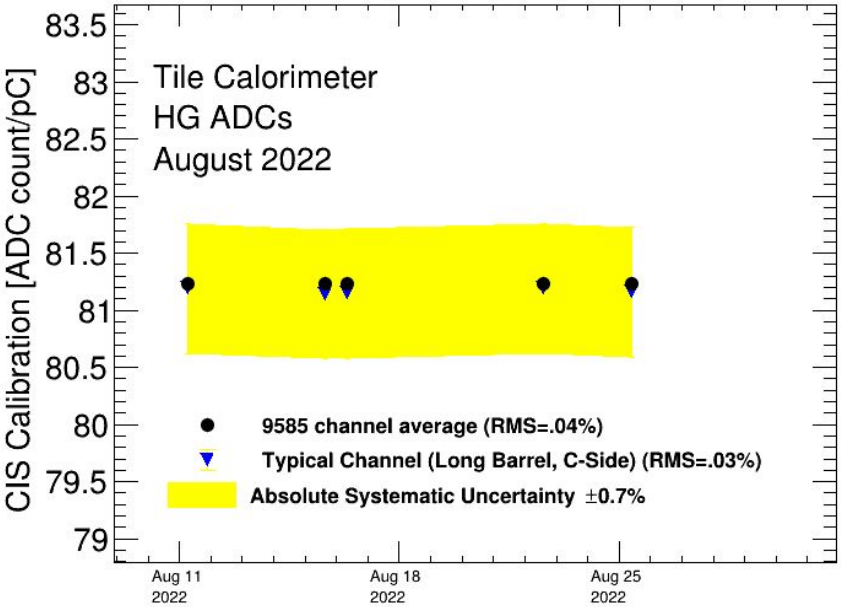


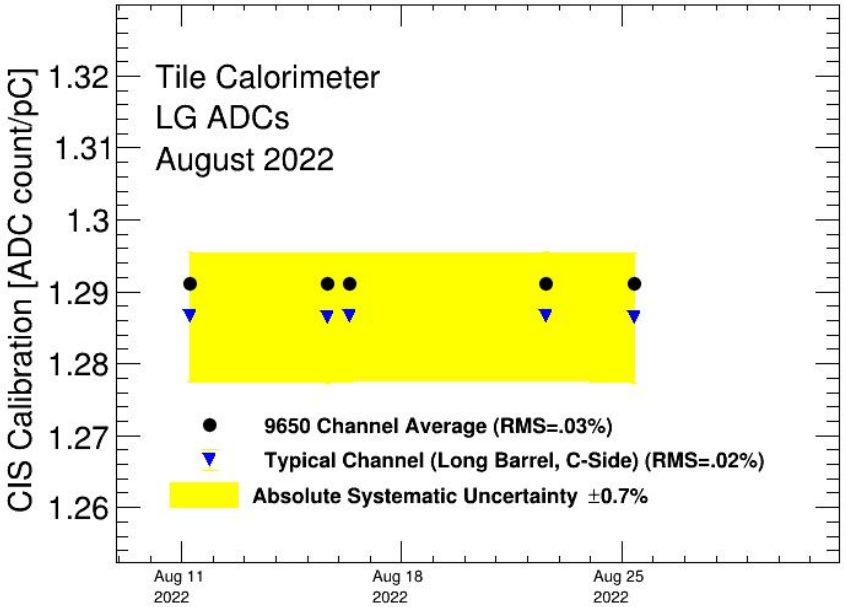
From LBC14 (demonstrator)



From LBC52 Low Gain at Half-Gain Configuration for August

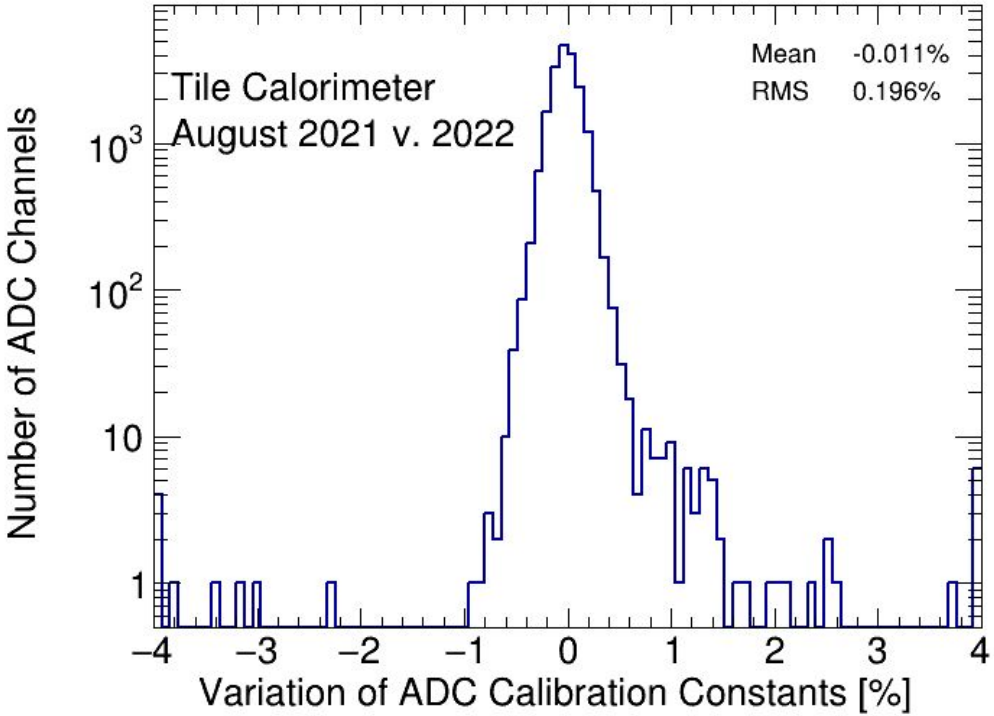
Detector Time Stability





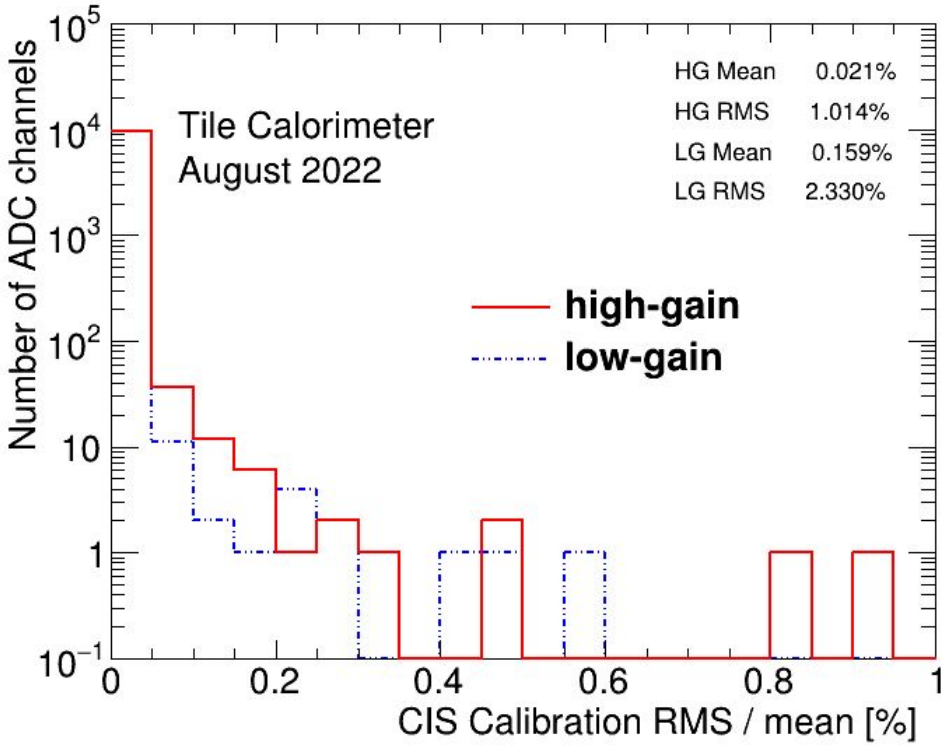
Note: First run of this period was excluded due to bad Amp/Q characteristics. There were 7 runs until September 1, some on the same day (in fact, no runs from August 25 to September 5). Runs should be taken at least once or twice per week. We should remind shifters to do this.

CIS Constant Long-Term Stability: 2021 vs 2022

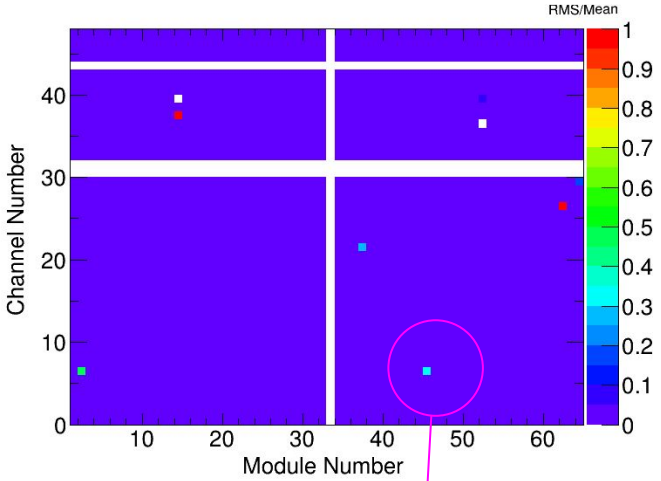


Module	Change (%)
EBC_m16_c24_highgain	+5.60
EBC_m46_c07_lowgain	+5.06
LBC_m59_c24_highgain	-6.55
LBC_m59_c25_lowgain	-5.62
LBC_m59_c26_highgain	-9.10
LBC_m59_c27_highgain	-4.82
LBC_m59_c29_lowgain	+4.36

CIS Constant RMS/Mean



(Note: There is some overflow beyond RMS/mean = 1)

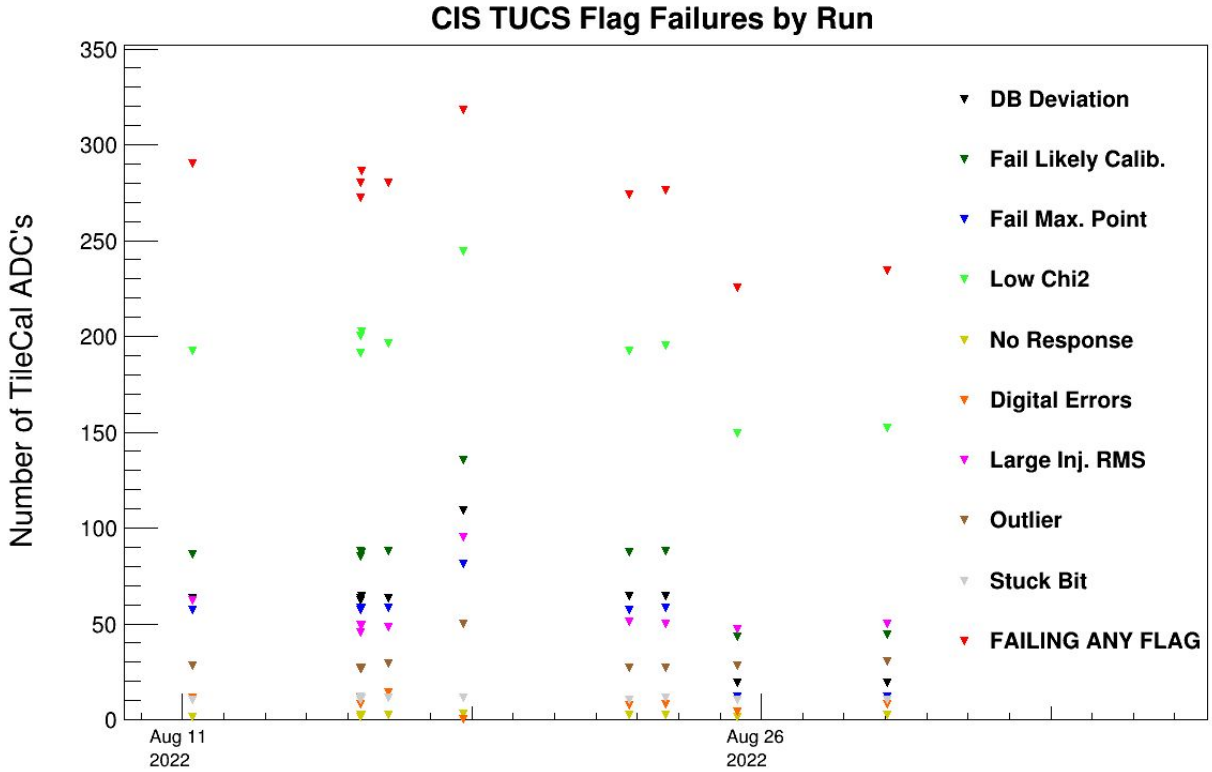


List of high RMS/mean channels identified given on next slide

CIS Constant RMS/Mean

Very High	High	Moderate
EBC_m22_c16_lowgain	LBC_m44_c13_highgain	EBC_m13_c03_lowgain
LBA_m14_c37_highgain		LBA_m02_c06_highgain
LBA_m62_c36_highgain		LBA_m02_c06_lowgain
LBA_m14_c39_lowgain		LBC_m46_c04_highgain
LBC_m43_c24_highgain		
LBC_m52_c18_highgain		
LBC_m23_c20_lowgain		
LBC_m52_c**_lowgain		

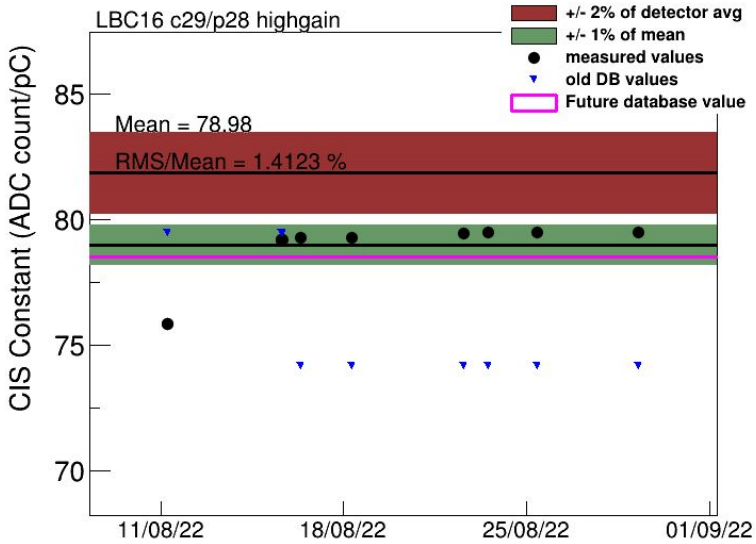
CIS TUCS Quality Flags



Interesting Channel Behaviour

High Deviation from DB Mean (4+45) [

	OLD	NEW	CHANGE
• LBC_m52_c18_highgain	103.50	95.28	-7.94%
• LBC_m43_c24_highgain	77.54	84.48	+8.96%
• LBC_m23_c20_lowgain	74.15	78.52	-12.6%
• LBC_m16_c29_highgain	74.15	78.52	+5.90%



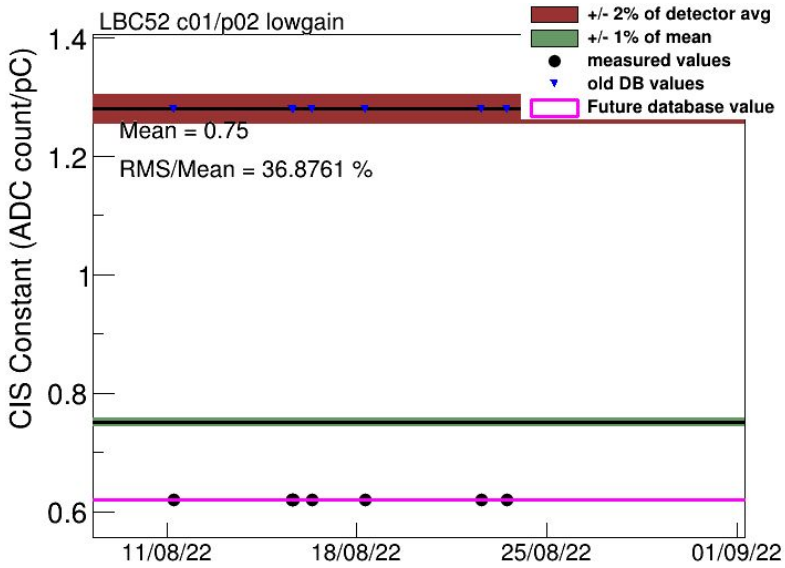
All channels listed above besides are “ADC masked” anyways

ADC AFFECTED Bad CIS Calib

qflags:

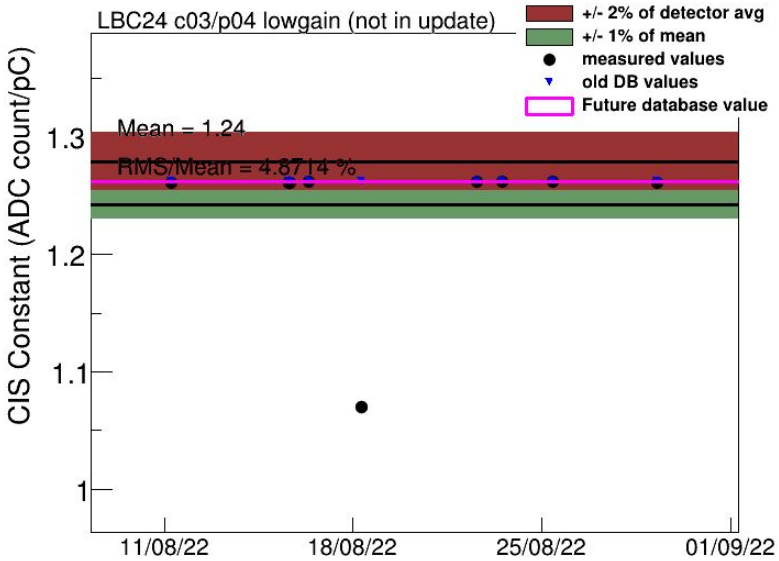
Half-Gain in LBC52 Low Gain

- For most of August, LBC52 Low Gain channels were kept at half gain (reason?)
- Last two CIS runs show that it is back at normal gain settings
- Recalibrate the channels using just the last runs of the month



Outlier in LBC24

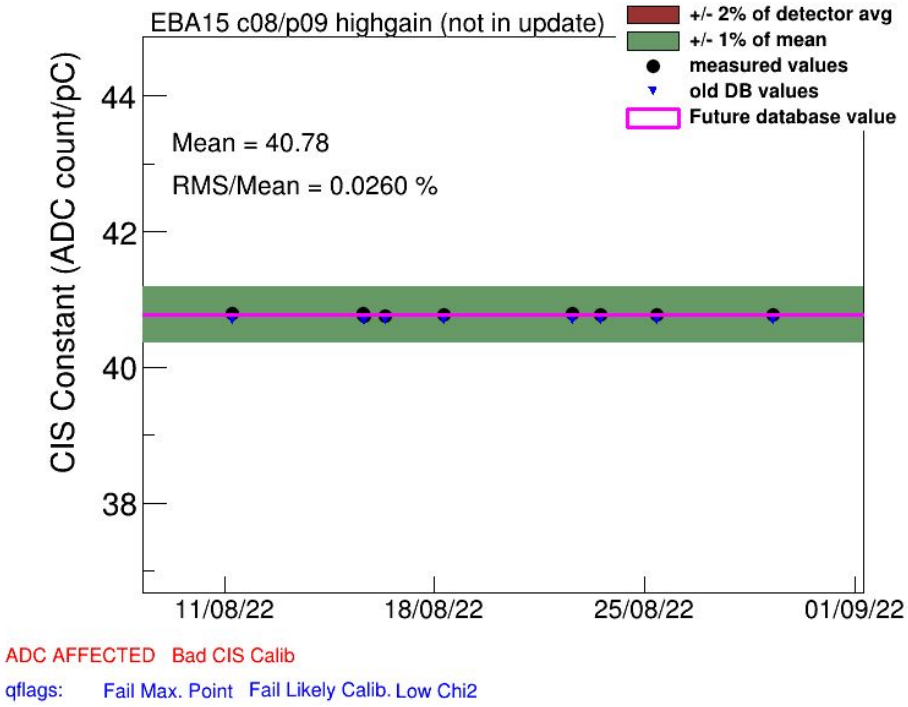
- For run 431570 on August 18, all runs in LBC24 low gain show a consistent low outlier.
- No elogs or DQ posts found about this issue
- Not in update, so it should not matter



qflags:

Half Gain Channels

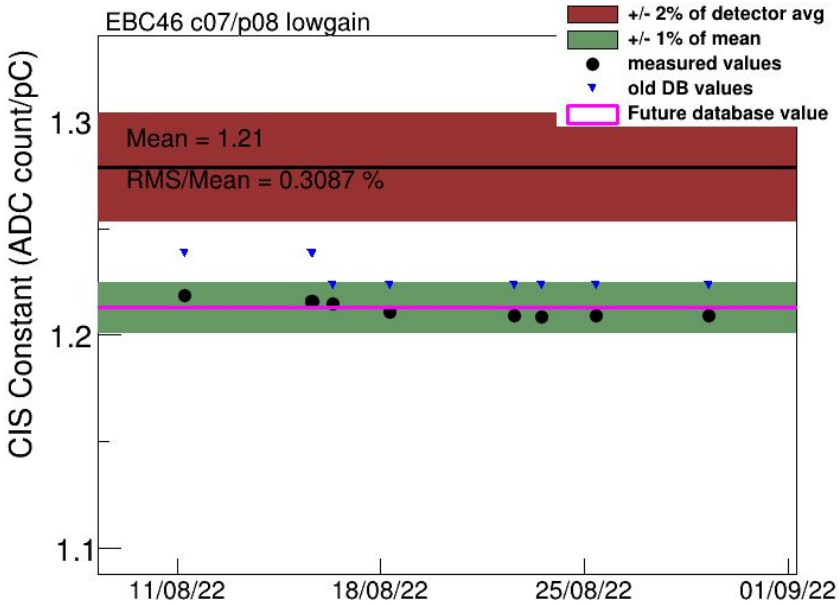
- EBA_m15_c08_highgain
- EBA_m16_c00_highgain
- EBA_m36_c15_highgain
- EBA_m48_c31_lowgain
- EBA_m64_c03_highgain
- EBC_m09_c40_highgain
- EBC_m21_c36_lowgain
- LBA_m37_c19_highgain
- LBC_m08_c03_lowgain
- LBC_m19_c22_lowgain



Affected
Masked
Not included (compared to last update)

Channels to Recalibrate

- EBC_m46_c07_lowgain (from 23/08) – ADC Affected not masked
- LBC_m24_c**_lowgain (from 22/08)
- LBC_m52_c**_lowgain (except c18 ADC masked) (from 25/08)



COOL Flag Updates

Remove BadCIS (2)

NONE

Add BadCIS (2)

NONE:

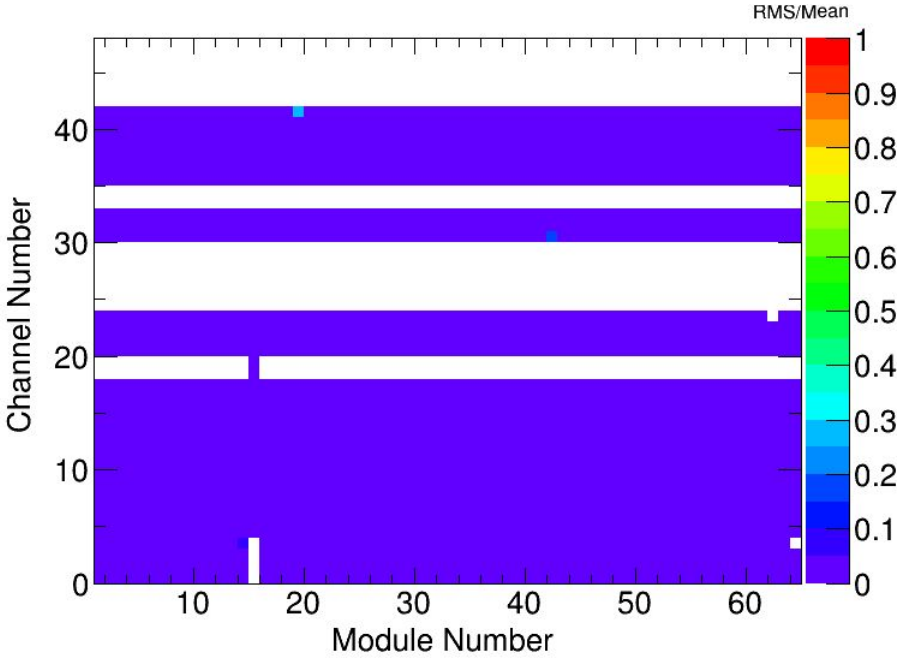
(either they are not in the update or they have a masked ADC anyways)

Other Issues

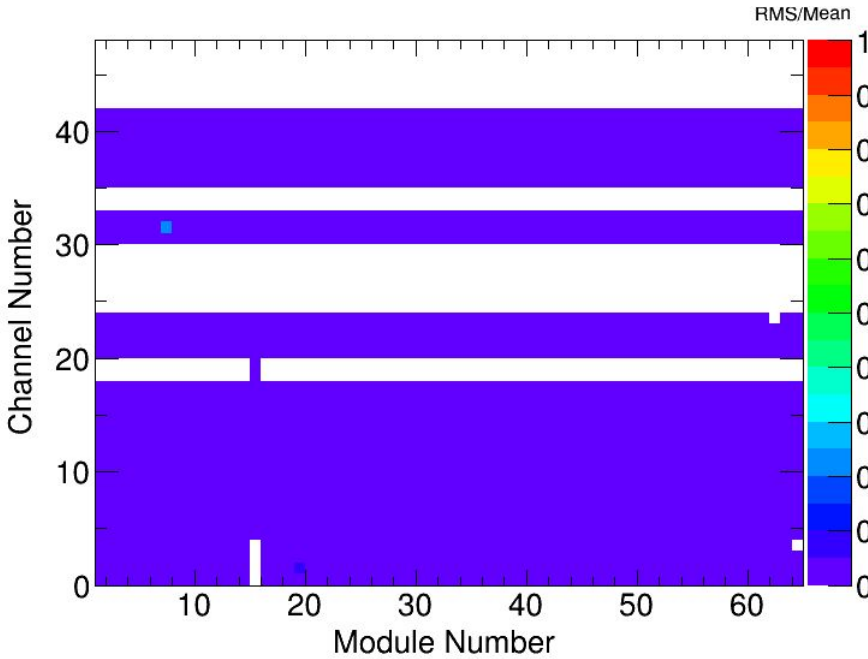
- LBC_m49_c27_lowgain
  - No valid data, and it was not filtered out automatically by the calibration scripts (patched for now)
  - See Xuanhong's DQ report from August 29 (https://indico.cern.ch/event/1178308/)
  - Affected Tucs scripts: SetLowCISThreshold.py, SQLOutput.py

Appendices

RMS/Mean Channel Maps (EBA)

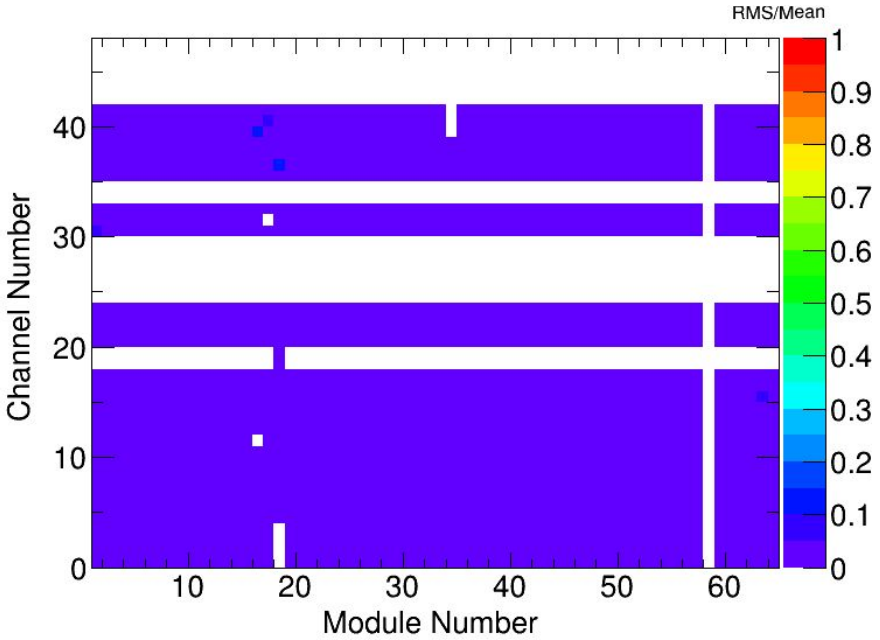


High gain

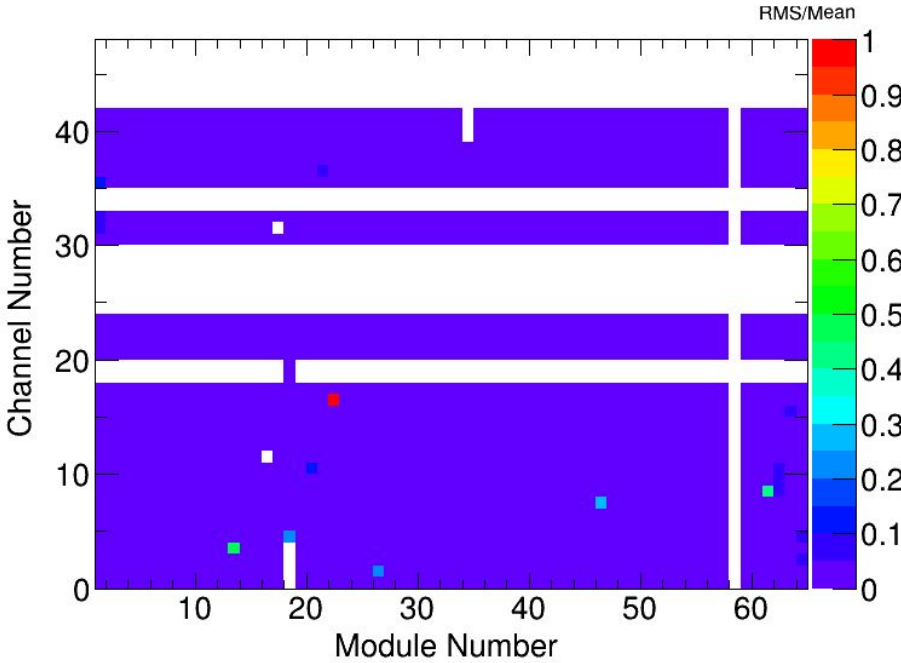


Low gain

RMS/Mean Channel Maps (EBC)

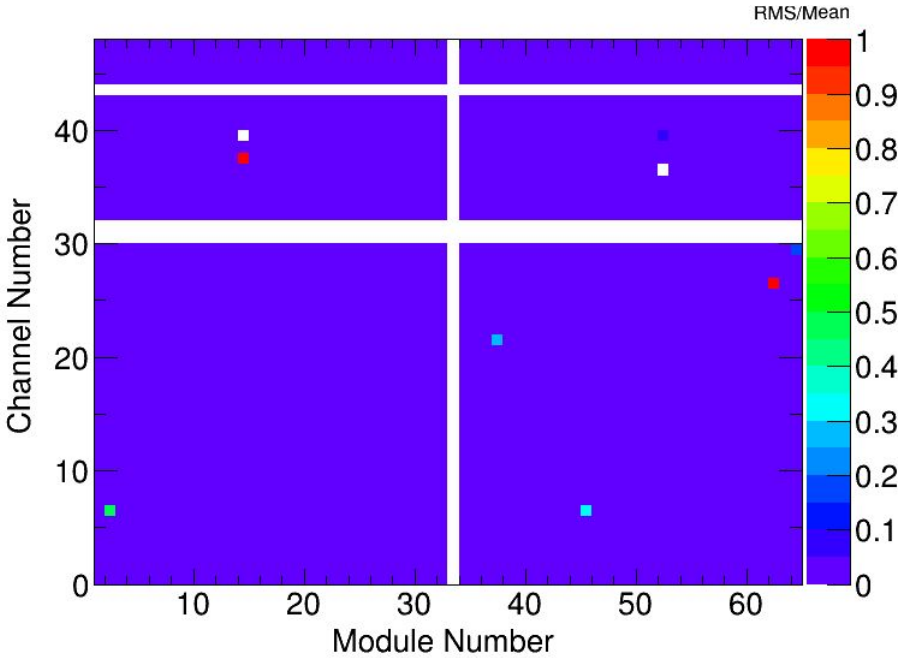


High gain

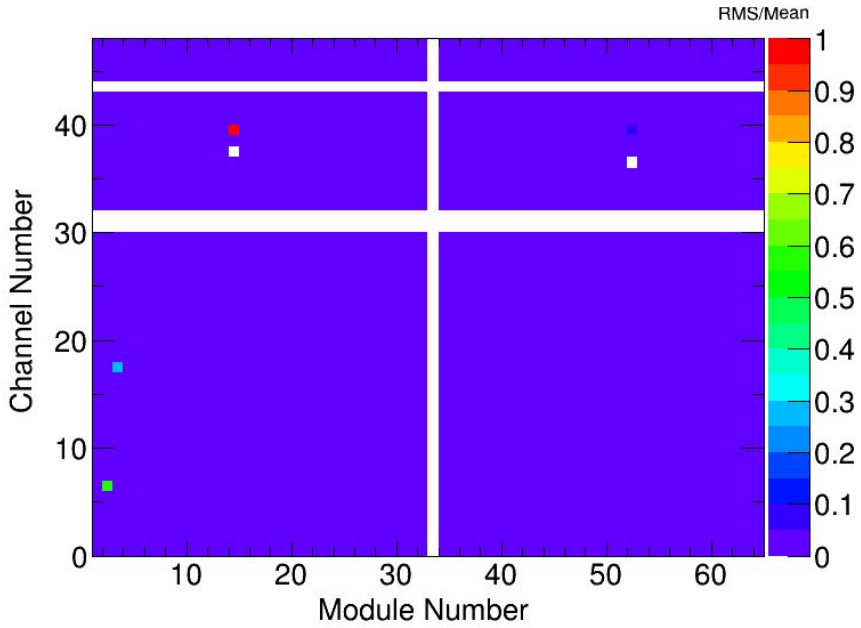


Low gain

RMS/Mean Channel Maps (LBA)

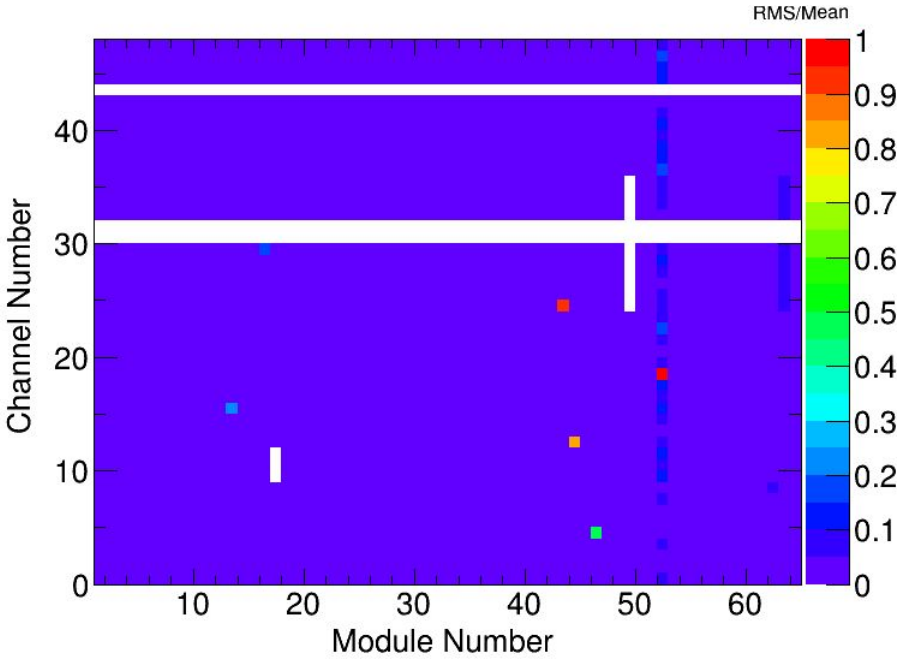


High gain

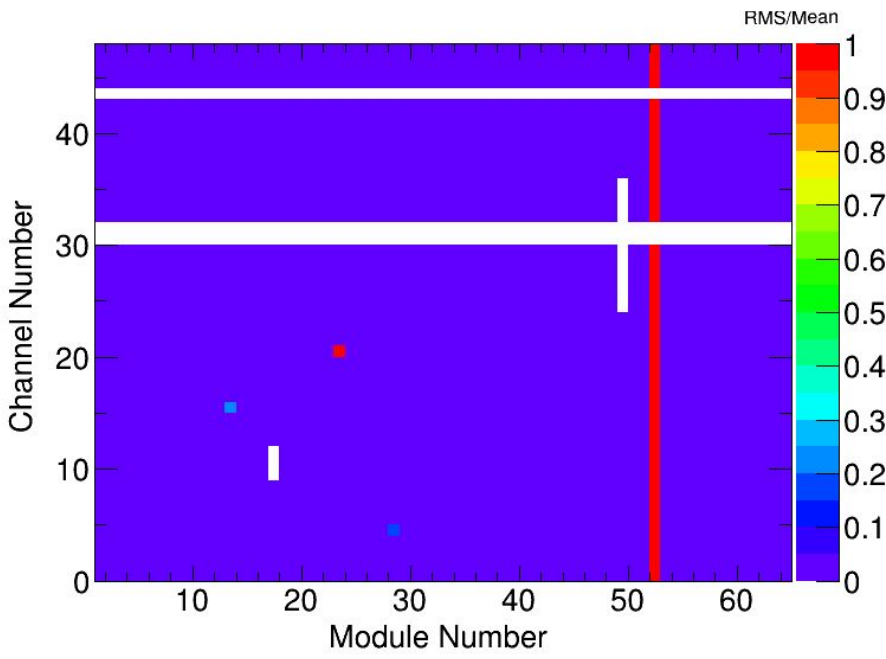


Low gain

RMS/Mean Channel Maps (LBC)



High gain



Low gain

Figure 19: Descriptions of each CIS TUCS quality flag

Flag	Location	Passed If...
No Response	qflag bit 1	At least one successful injection readout
Fail Likely Calib.	qflag bit 3	CIS constant within 6.23% of detector-wide mean
Fail Max. Point	qflag bit 4	≥ 1 point in fit range > 600 ADC counts
Large Injection RMS	qflag bit 5	RMS of all fixed-charge injections in fit range < 5
Digital Errors	qflag bit 6	All digital error checks passed
Low Chi2	qflag bit 7	Linear fit $\chi^2 > 2 \times 10^{-6}$
Edge Sample	qflag bit 8	No events in fit range w/ 1st or 7th sample as max
Next to Edge Sample	qflag bit 9	No events in fit range w/ 2nd or 6th sample as max
Stuck Bit	qflag bit 10	No stuck bits in readout chain detected
Unstable	TUCS	ADC CIS const. RMS/Mean < 0.39%
Mean Deviation	TUCS	CIS constant within 5% of ADC time period avg.
Default Calibration	TUCS	Default CIS constant not used in database
Outlier	TUCS	CIS const. < 6 and > 15% away from det. avg.
DB Deviation	TUCS	Measured and database const. differ by < 1%