Charge Injection System (CIS) Update

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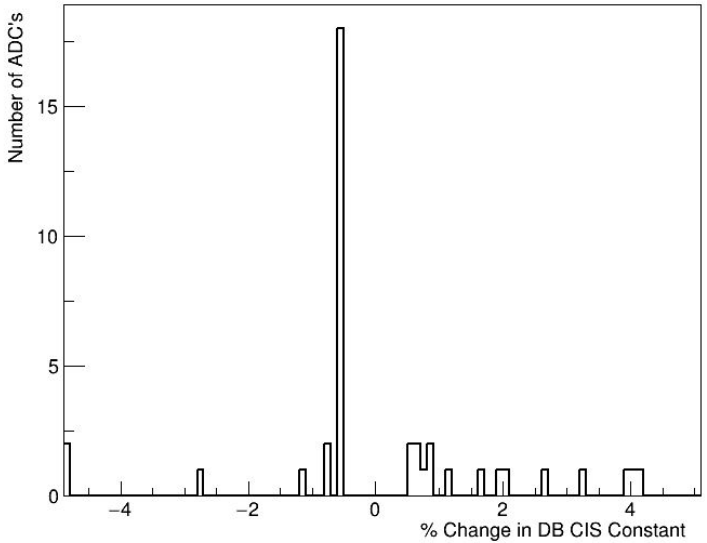
Overview

1. **Run selection:** Excluded on bad AmpQ Plot and runs from missing CIS pulse tests
2. **Global performance:** Little change in constants throughout Run 3 so far
3. **General Comments**: This is our last monthly update before reprocessing in December

Summary

- CIS runs from October 1 - November 1
  - Database will be updated November 7/8
- 40 channels in update
- 21 Good (>1 successful calibration)
- 2 >5% change
- 8 Masked
- 11 Affected



Run Selection

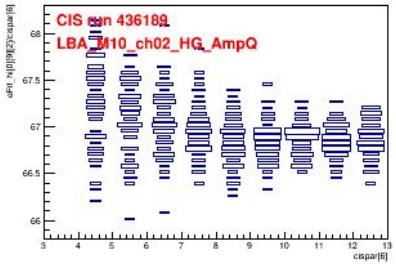
Runs:

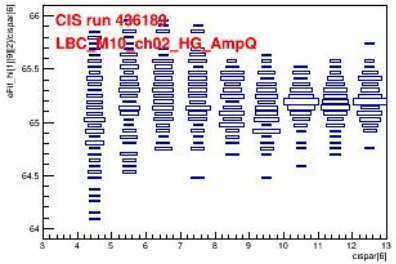
- **Date range:** October 1 - November 1, 2022
- **Runs excluded (1+TestRuns):** 436189
- **Runs used (9):** 435886 436536 436813 436852 437309 437563 437792 438209 438370

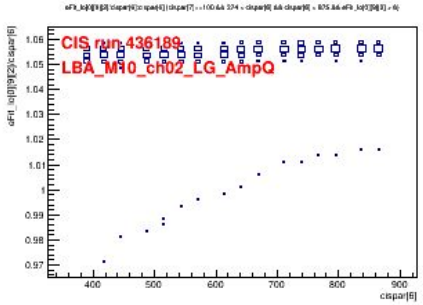
Reasons:

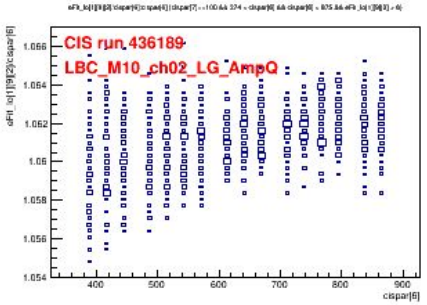
- Excluded all runs on October 18, 21, 26 (these were test runs by Andrey and Humphrey to determine reason for missing CIS pulses)
- Excluded run 436189 due to bad Amplitude-Charge ratio in LBA

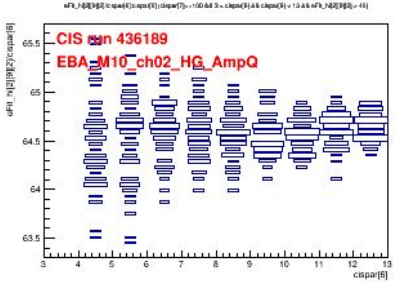
Excluded Run AmpQ: 436189

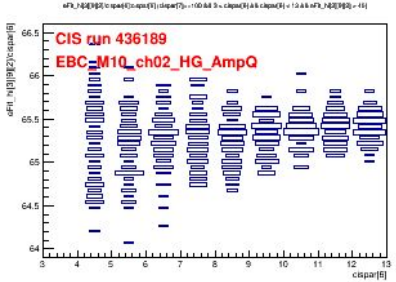


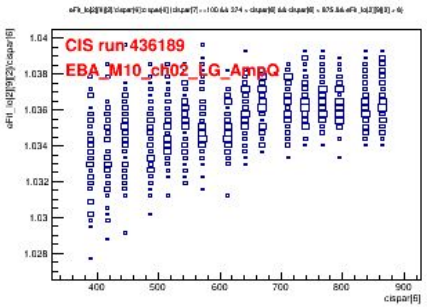


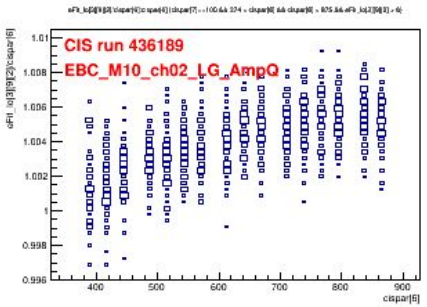








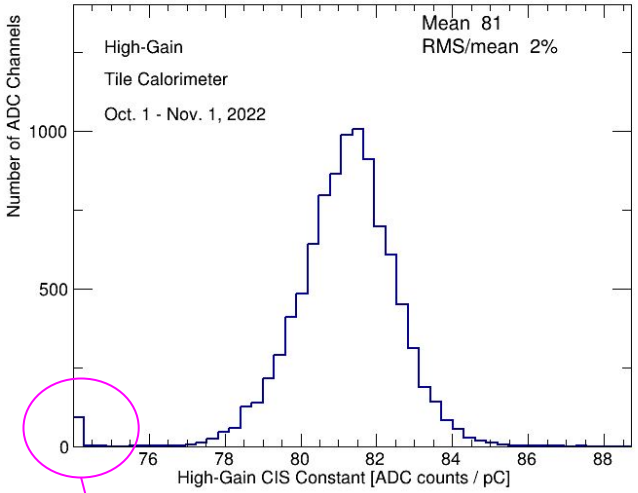


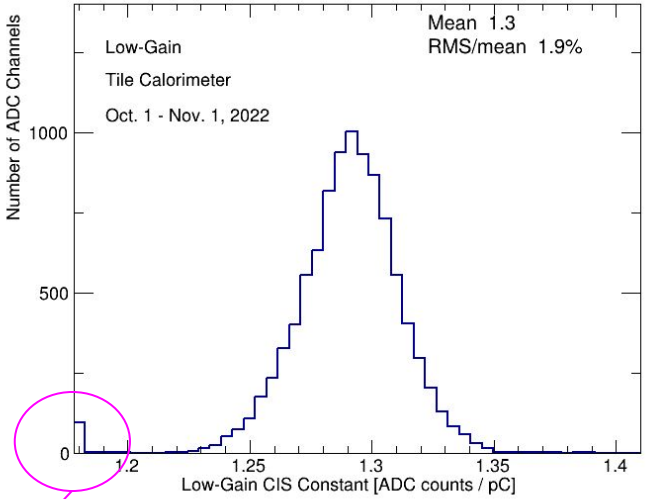


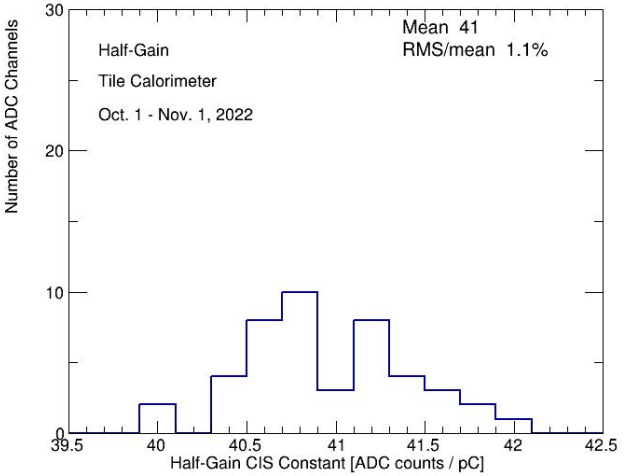
High gain

Low gain

CIS Constant Distributions



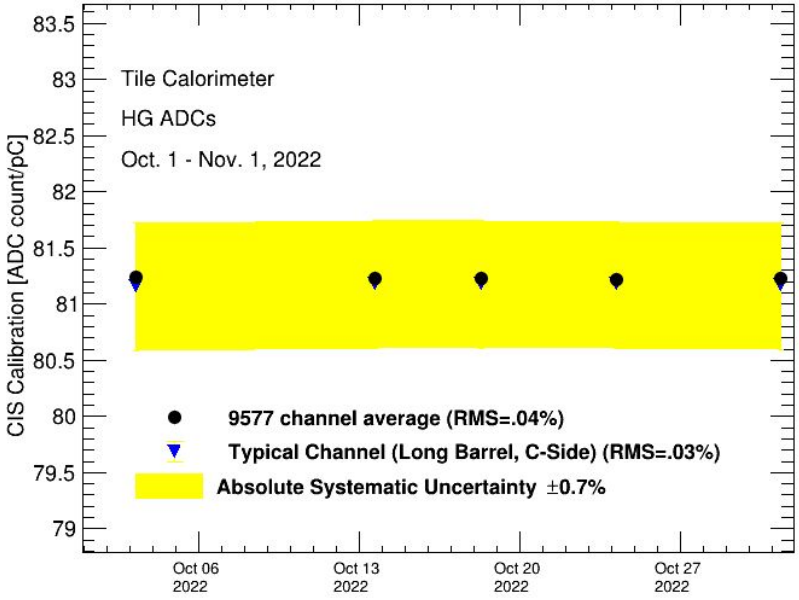


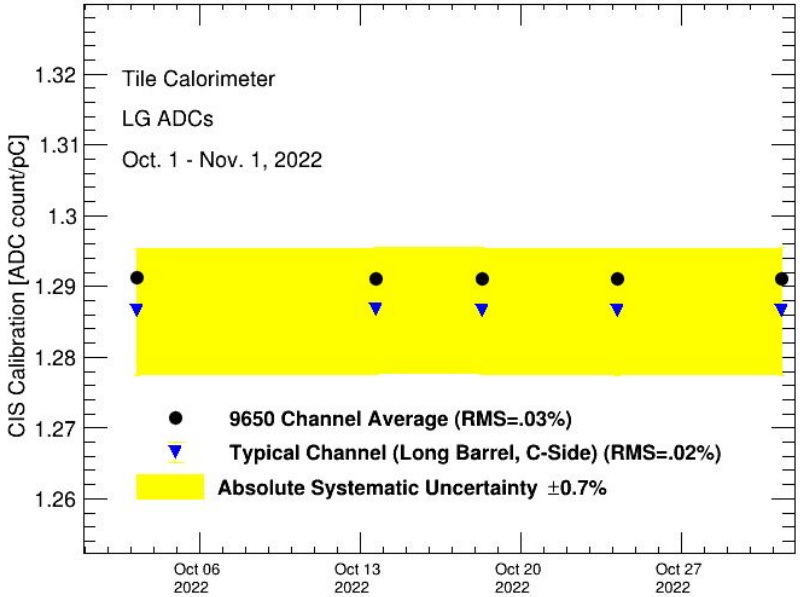


These overflows come from LBA 28, 63. They were masked near the end of October, so CIS constant gets calculated as zero for those runs. The value is not updated in the database though.

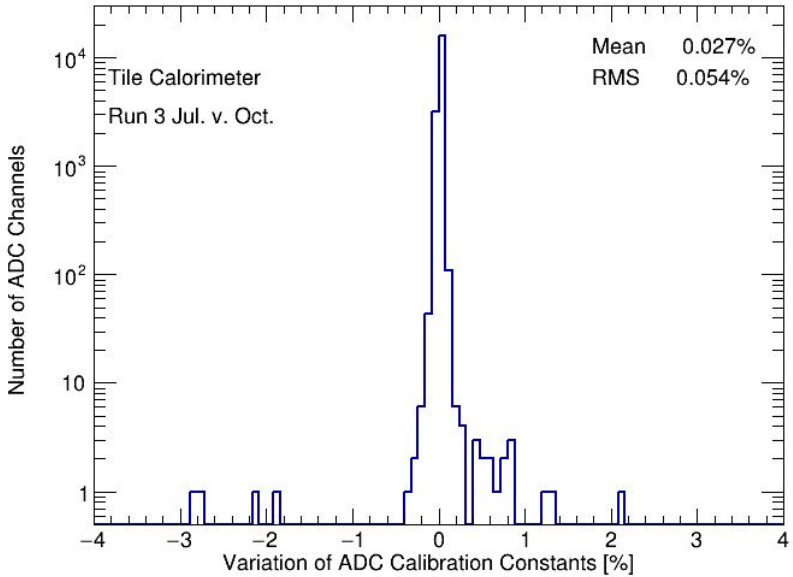
Demonstrator now separated from usual HG/LG

Detector Time Stability



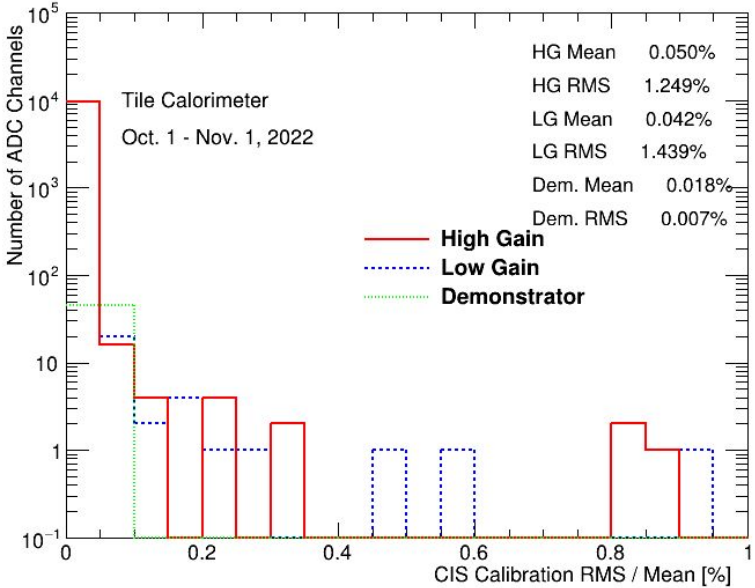


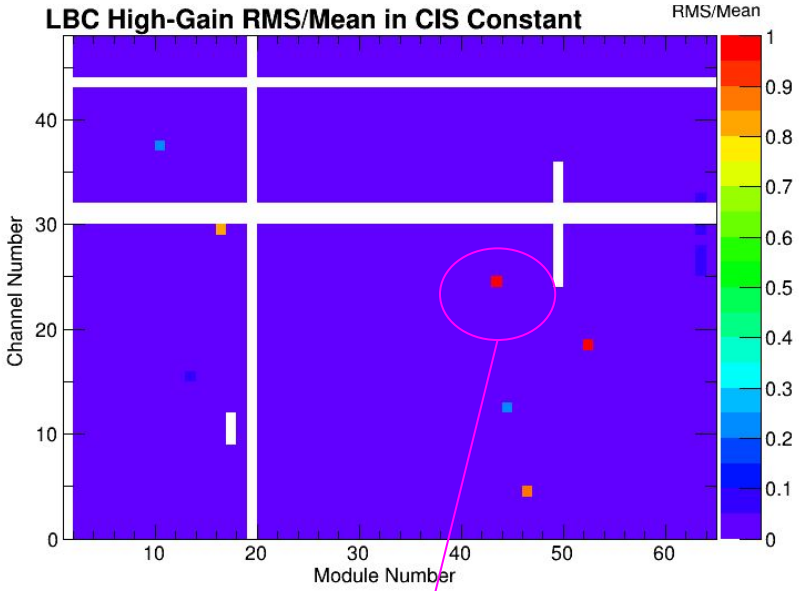
CIS Constant Long-Term Stability in Run 3



Module (with >1% change)	Change (%)
EBC_m30_c11_highgain/lowgain	-2.80/-2.80
LBA_m02_c06_highgain/lowgain	-2.15/-1.87
LBA_m51_c12_highgain	+1.29
LBA_m35_c08_highgain	+1.29
LBC_m57_c06_highgain	+1.28

CIS Constant RMS/Mean





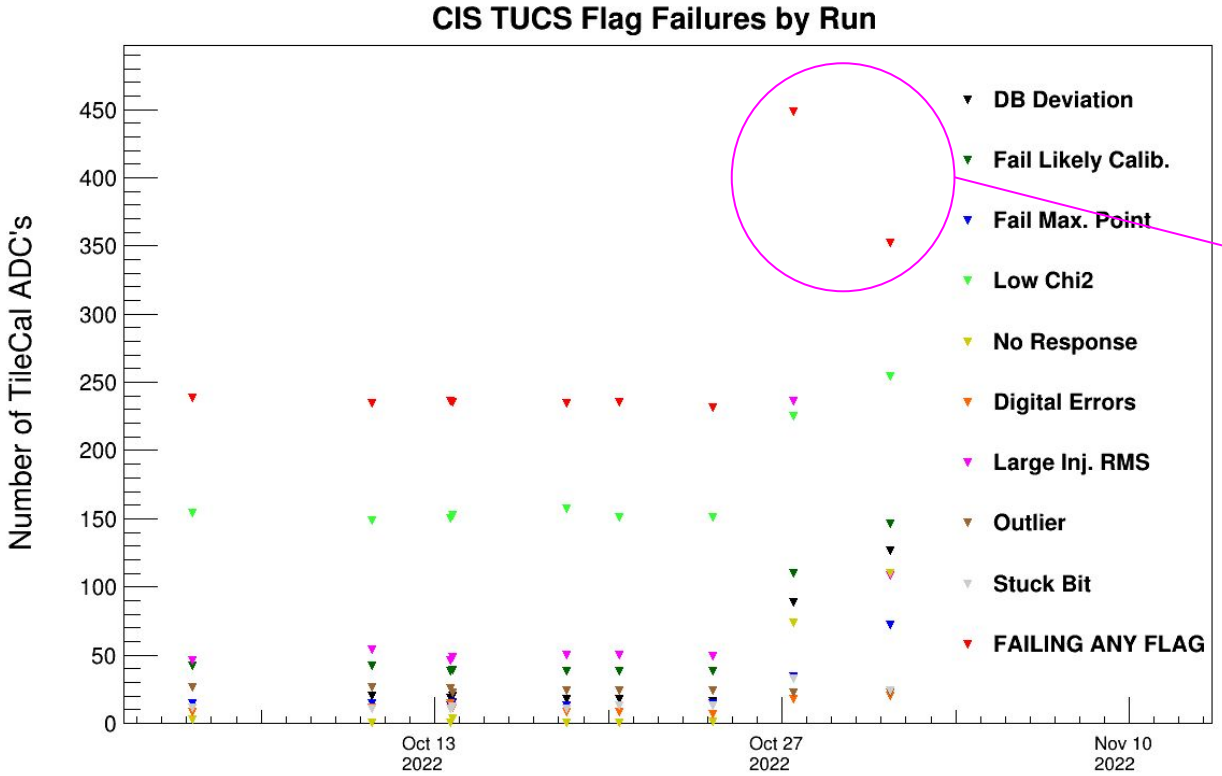
List of high RMS/mean channels identified given on next slide

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

CIS Constant RMS/Mean

High	Moderate
EBC_m22_c16_lowgain	EBA_m49_c00_highgain
EBC_m26_c01_lowgain	LBC_m46_c04_highgain
LBA_m62_c26_highgain	LBC_m18_c29_highgain
LBA_m63_*	LBC_m29_c04_lowgain
LBC_m44_c24_highgain	
LBC_m53_c23_highgain	
LBC_m23_c21_lowgain	
LBC_m49_c34_lowgain	

CIS TUCS Quality Flags

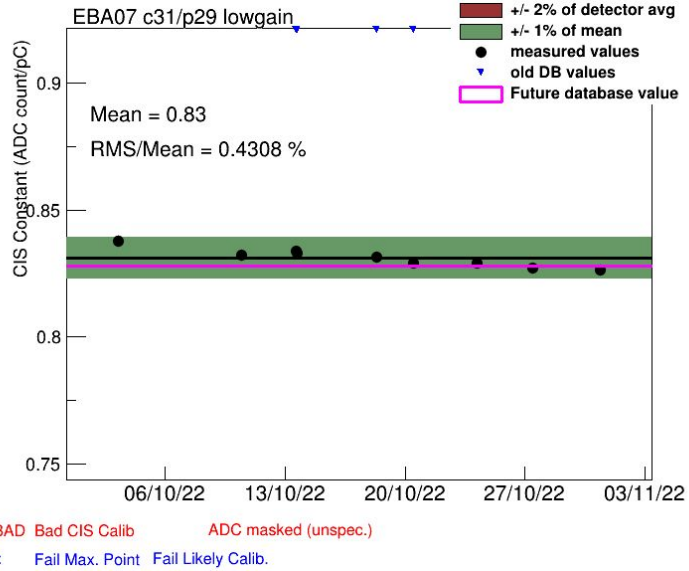


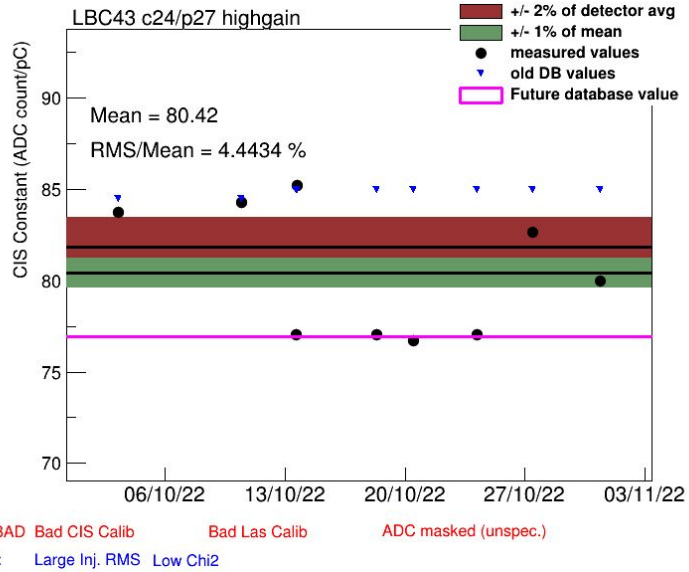
High number of failing flags (not from LBA 28,63 as per our channel-by-channel plots, but we are cross-checking by hand). No significant ERS messages from these calibration runs either.

Interesting Channel Behaviour

High Deviation from DB Mean (2)

	OLD	NEW	CHANGE
• EBA_m07_c31_lowgain	0.92	0.83	-10%
• LBC_m43_c24_highgain	84.95	76.96	-9.4%

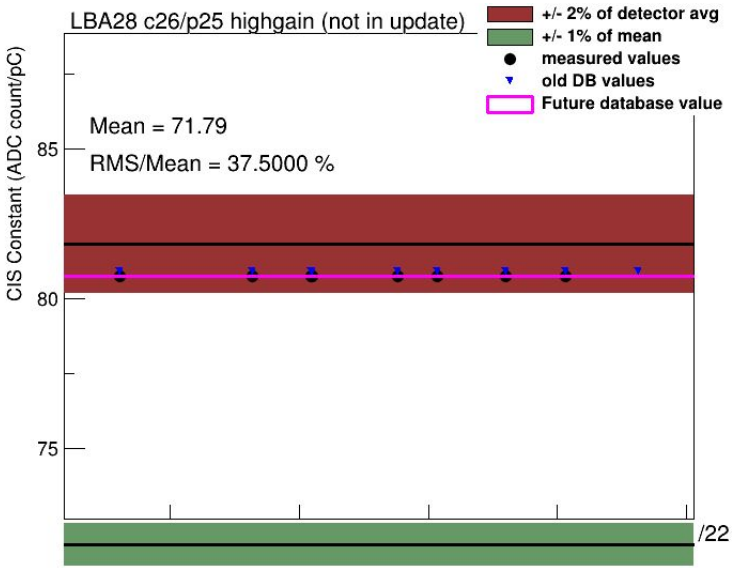




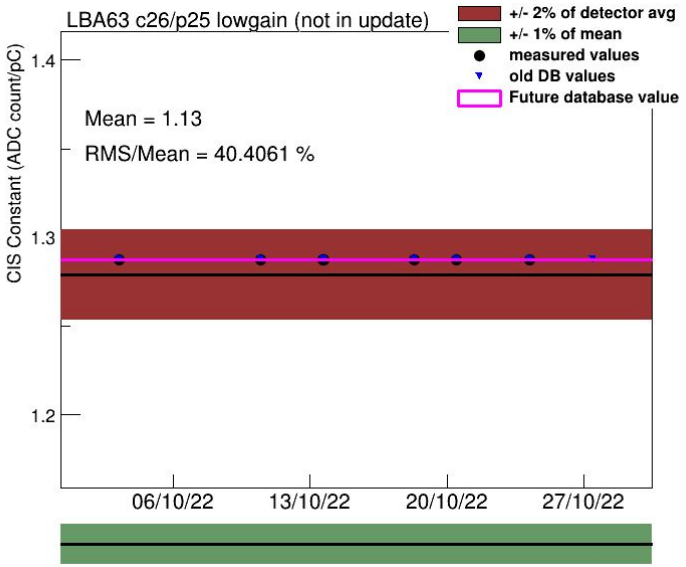
All channels listed above are “ADC masked” anyways

No Response in LBA 28,63 Channels

- Database values will not change
- Masked for data quality reasons



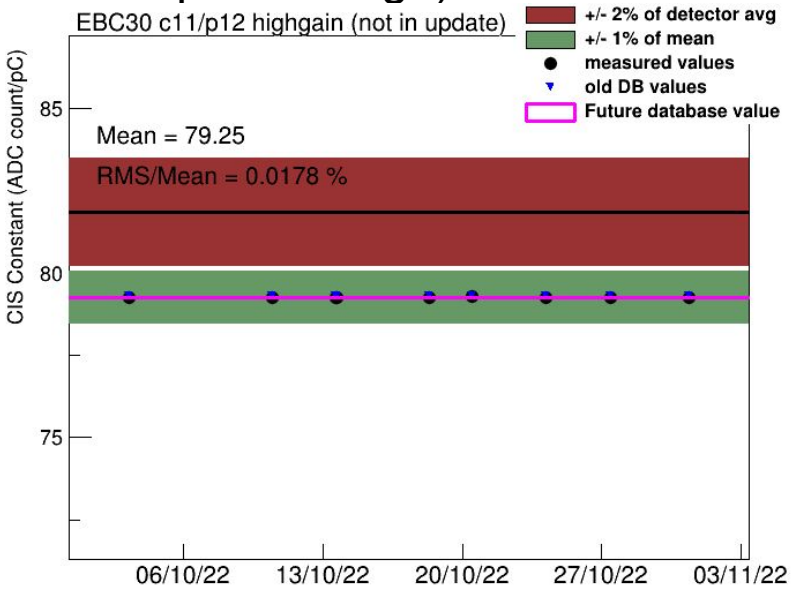
qflags:



qflags:

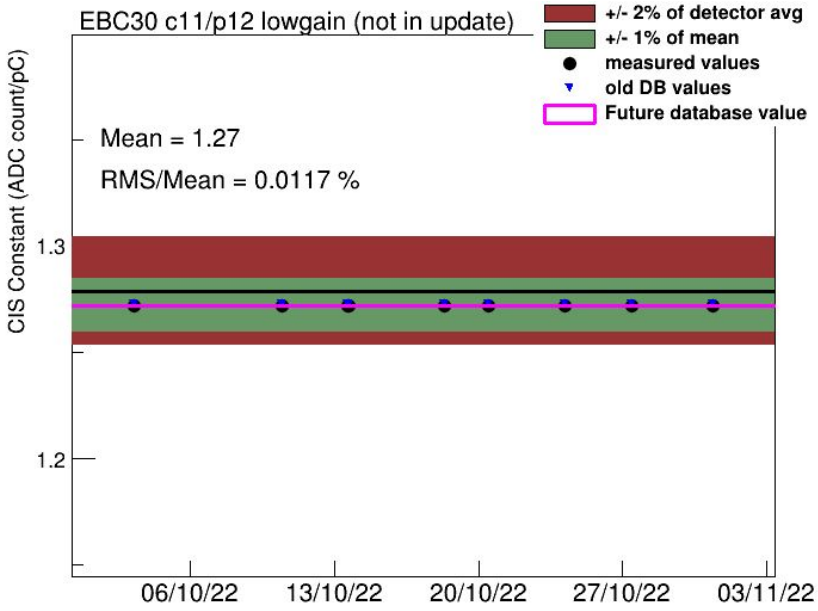
EBC 30 Channel 11

- CIS constant value seems to be stable now (it had deviated from its starting value at the beginning of Run 3)
- Remove Bad CIS and monitor for next month (or address ony in reprocessing?)



ADC AFFECTED Bad CIS Calib

qflags:

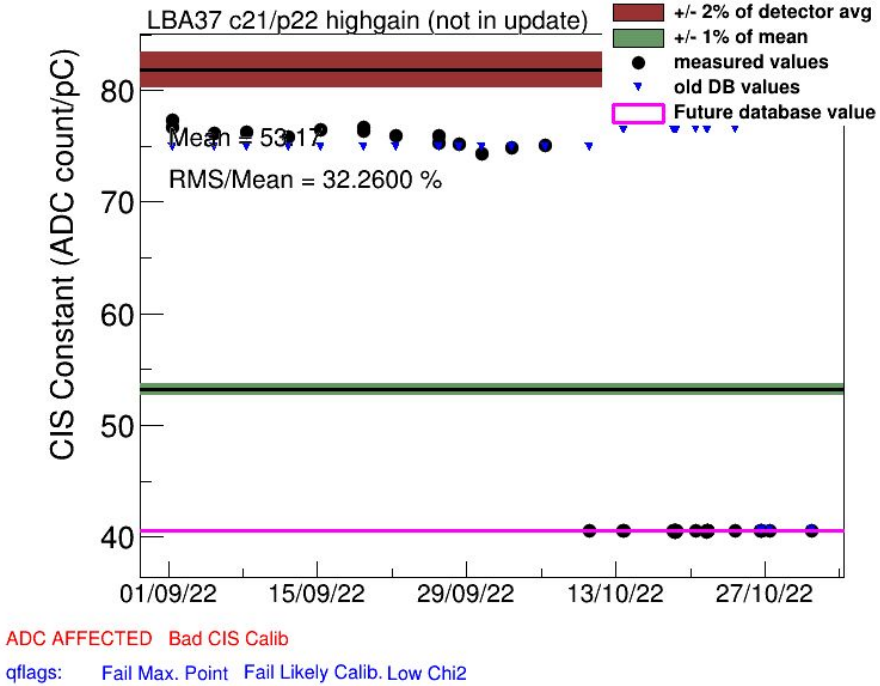


ADC AFFECTED Bad CIS Calib

qflags:

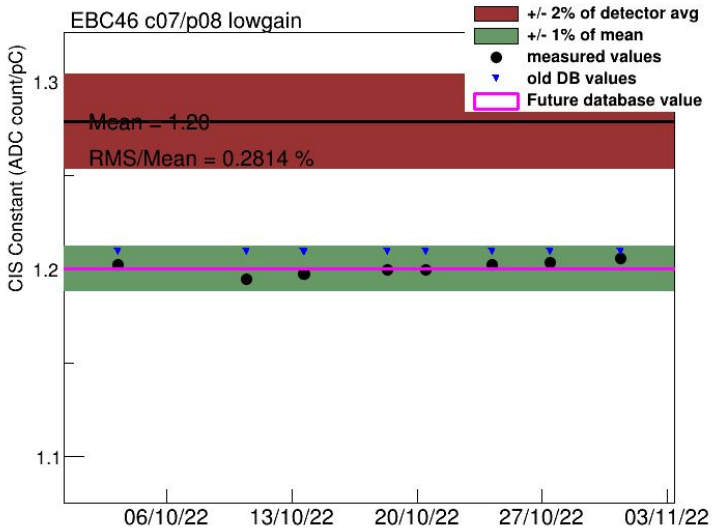
LBA 37 Channel 21 HG

- Updated by Pawel last week in the database due to noticing shift in Laser constant



Channels with High Scatter/Drift

- EBC_m46_c07_lowgain: Bad runs at the beginning of the month shift the constant (but not far enough away from the database value to be marked as bad)

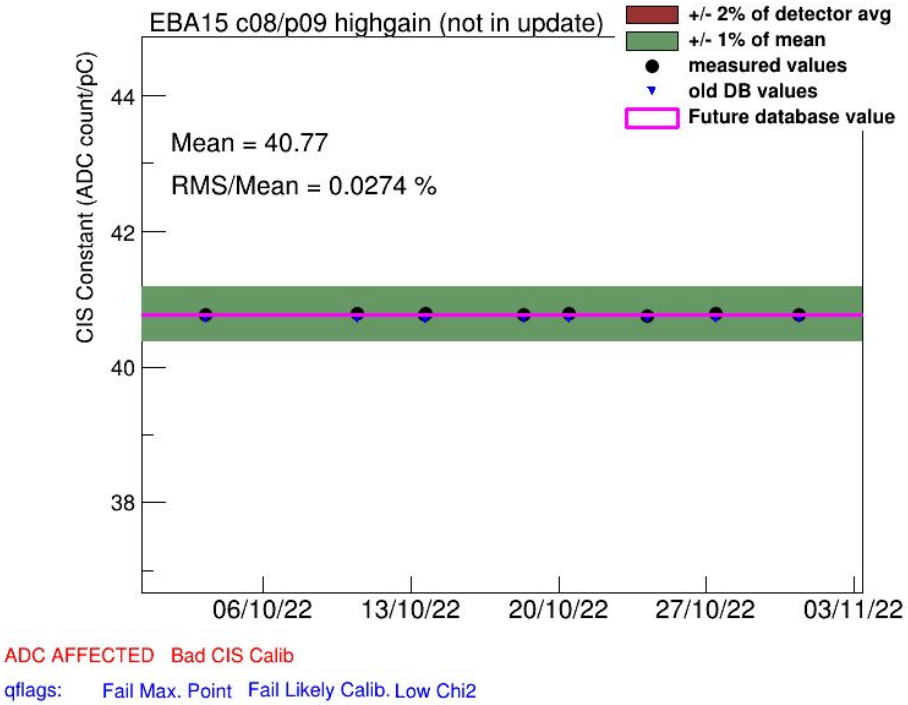


ADC AFFECTED Bad CIS Calib

qflags: Fail Likely Calib.

Half Gain Channels

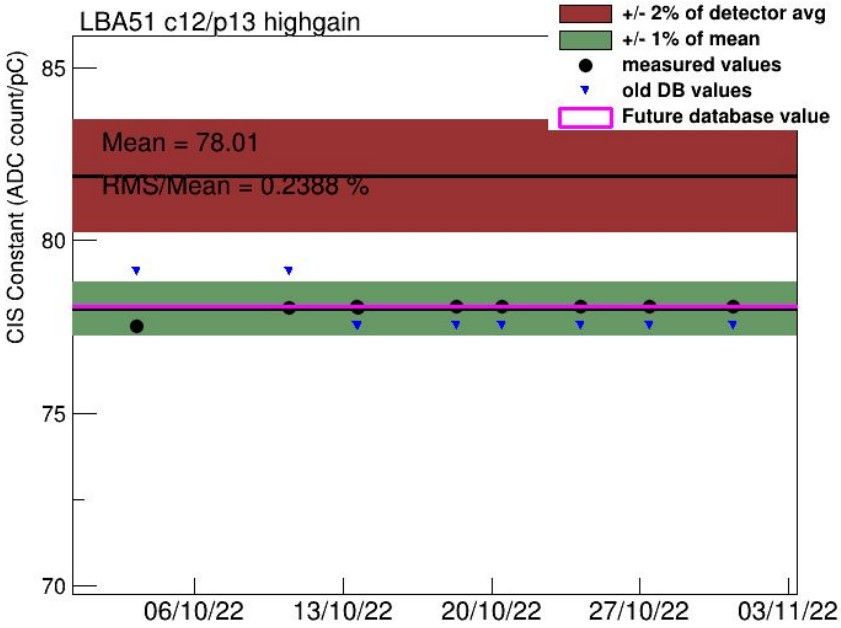
- EBA_m15_c08_highgain
- EBA_m16_c00_highgain
- EBA_m36_c15_highgain
- EBA_m42_c30_highgain
- EBA_m48_c31_lowgain
- EBC_m09_c40_highgain
- EBC_m21_c36_lowgain
- LBC_m08_c03_lowgain
- LBC_m19_c22_lowgain



Affected
Masked

Channels to Recalibrate

- LBA_m51_c12_highgain
- LBA_m62_c08_highgain



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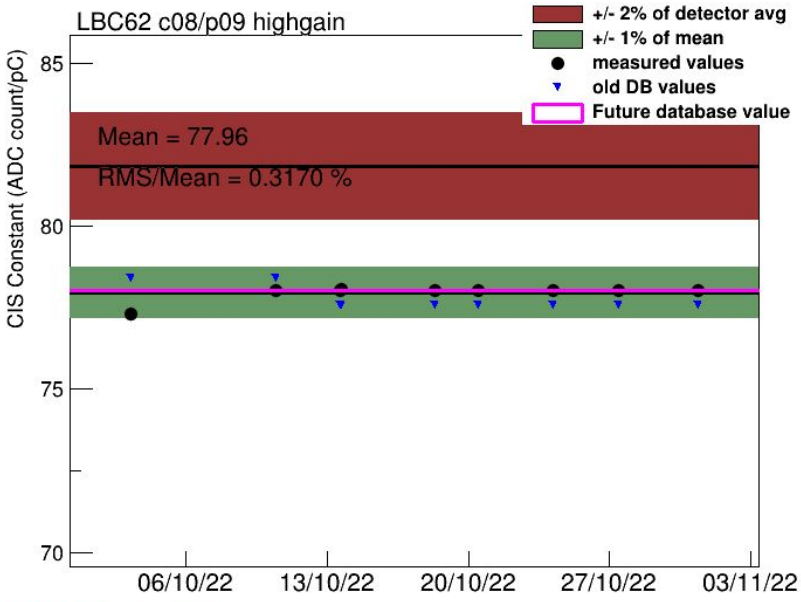
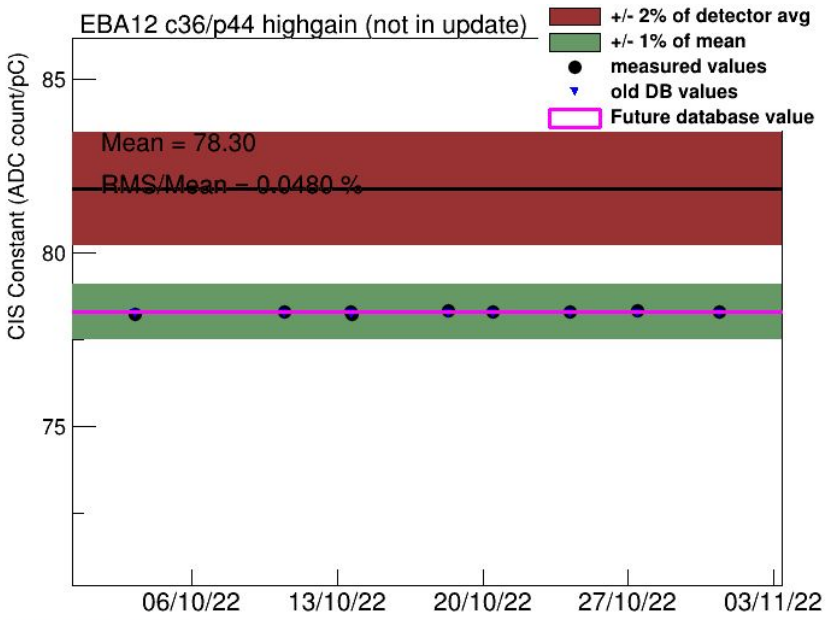


ADC AFFECTED Bad Las Calib

qflags:

Remove Bad CIS



ADC AFFECTED Bad CIS Calib

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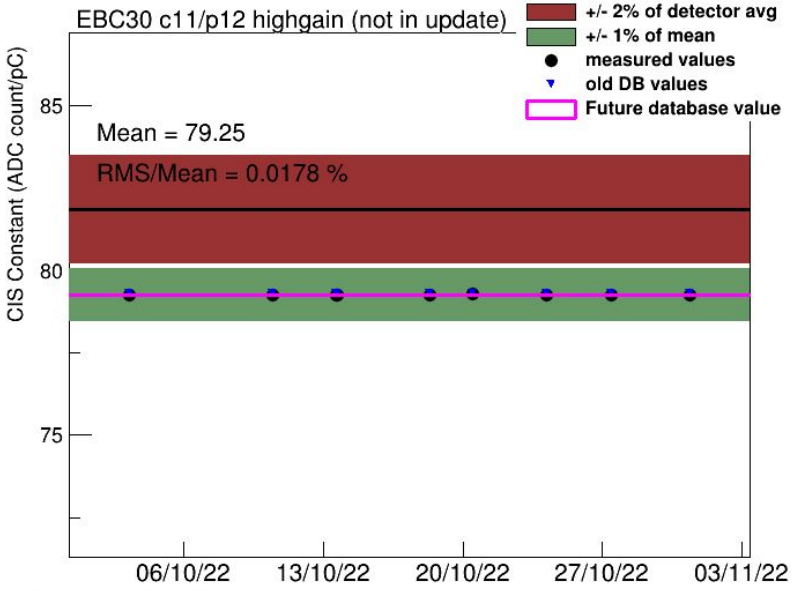


ADC AFFECTED Bad CIS Calib

qflags:

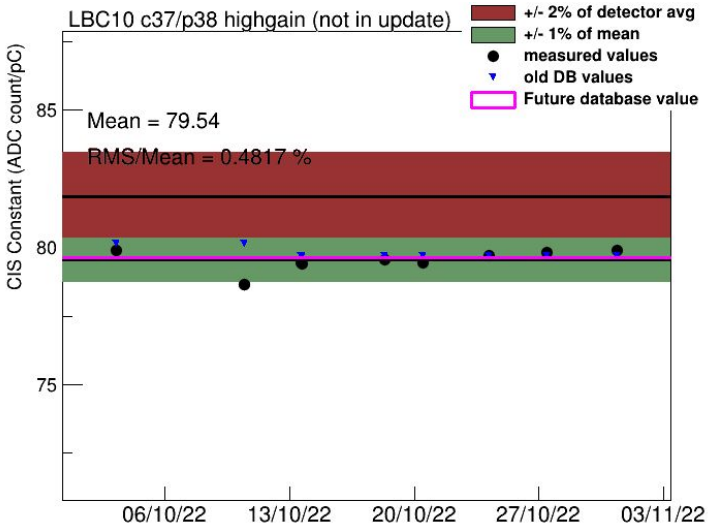
COOL Flag Updates

Remove BadCIS (3)

EBA_m12_c36_highgain
EBC_m30_c11_highgain
EBC_m30_c11_lowgain

Add BadCIS (1)

LBC_m10_c37_highgain

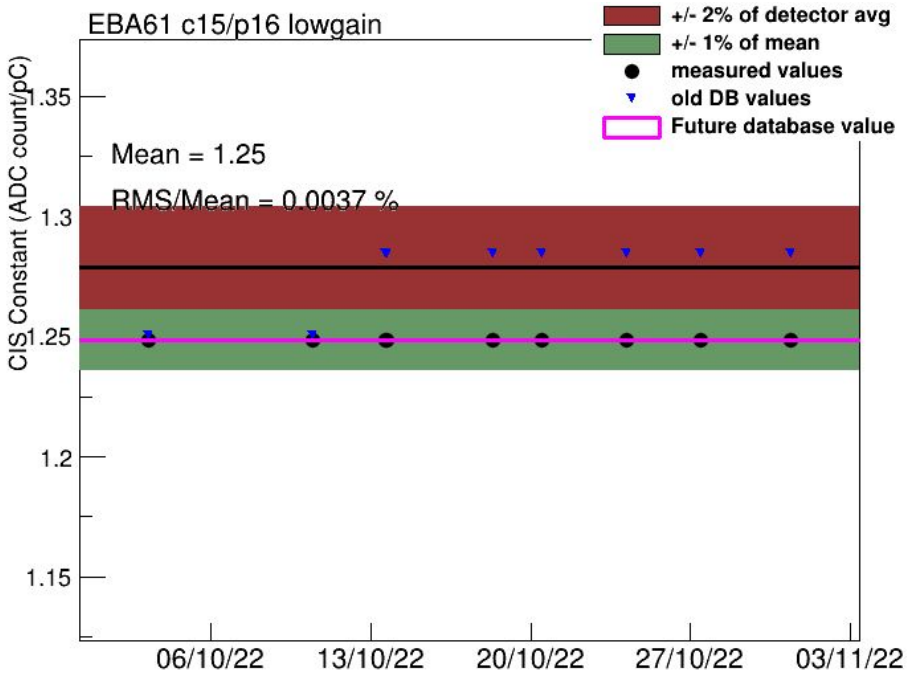


ADC AFFECTED Bad Las Calib

qflags:

Follow-up From Last Month …

- EBA_m61_c15_lowgain: Previous month's recalibration is remaining stable



qflags:

Appendices

Current Status of ADC Masked/Affected Channels

Affected channels: 11

LBC01 c25/p26 highgain

LBC46 c04/p05 highgain

LBC16 c29/p28 highgain

LBC62 c08/p09 highgain

EBC01 c21/p22 highgain

EBC46 c07/p08 lowgain

EBC13 c03/p04 lowgain

LBA64 c29/p28 highgain

EBA42 c30/p33 highgain

EBA49 c00/p01 highgain

EBA50 c20/p21 highgain

Masked channels: 8

LBC28 c04/p05 lowgain

LBC43 c24/p27 highgain

LBC52 c18/p19 highgain

EBC22 c16/p17 lowgain

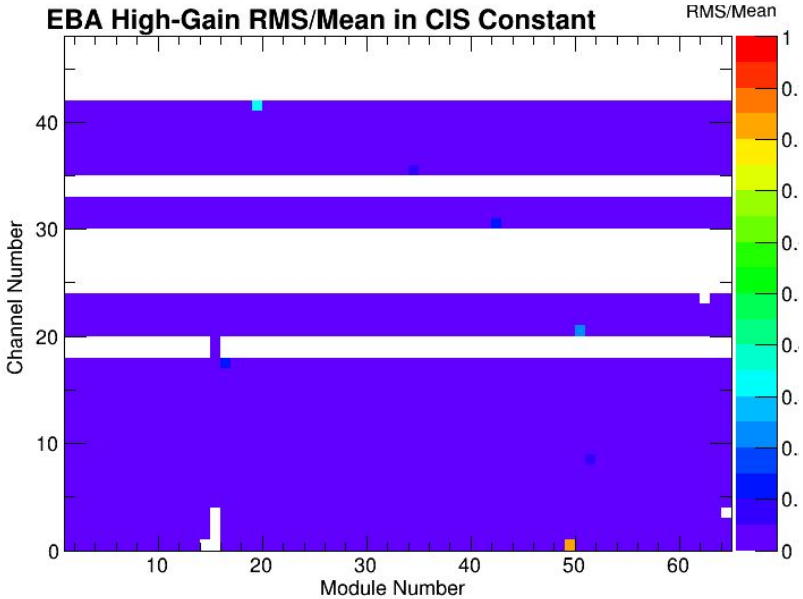
EBC56 c41/p41 lowgain

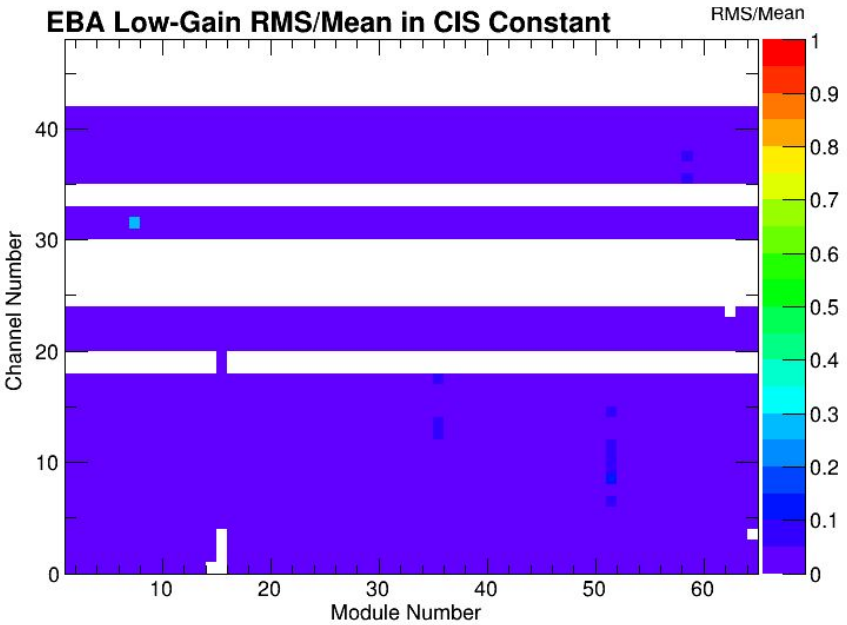
LBA02 c06/p07 lowgain

LBA02 c06/p07 highgain

EBA07 c31/p29 lowgain

RMS/Mean Channel Maps (EBA)

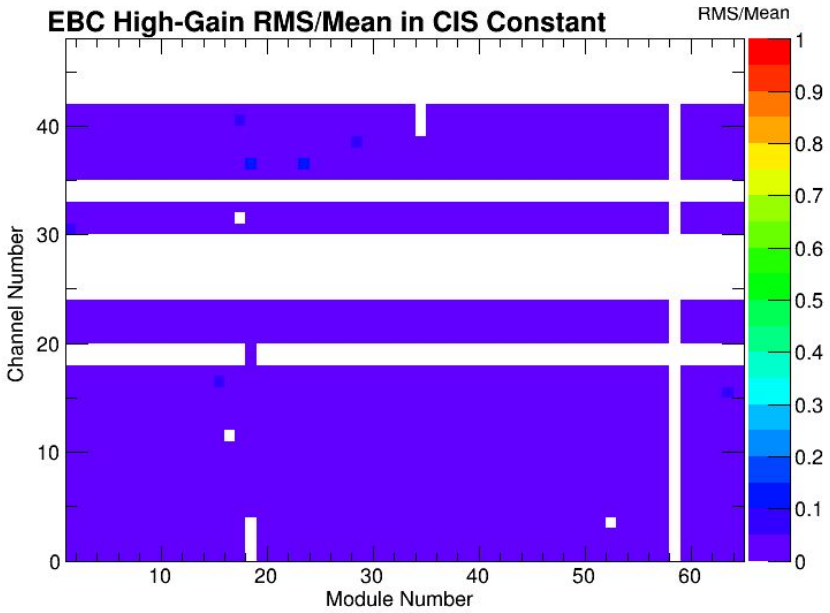


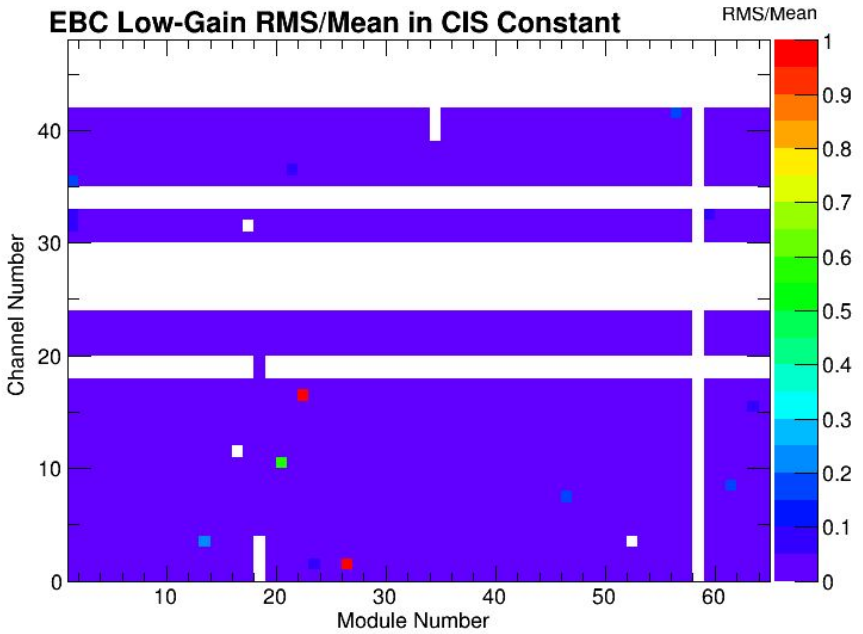


High gain

Low gain

RMS/Mean Channel Maps (EBC)

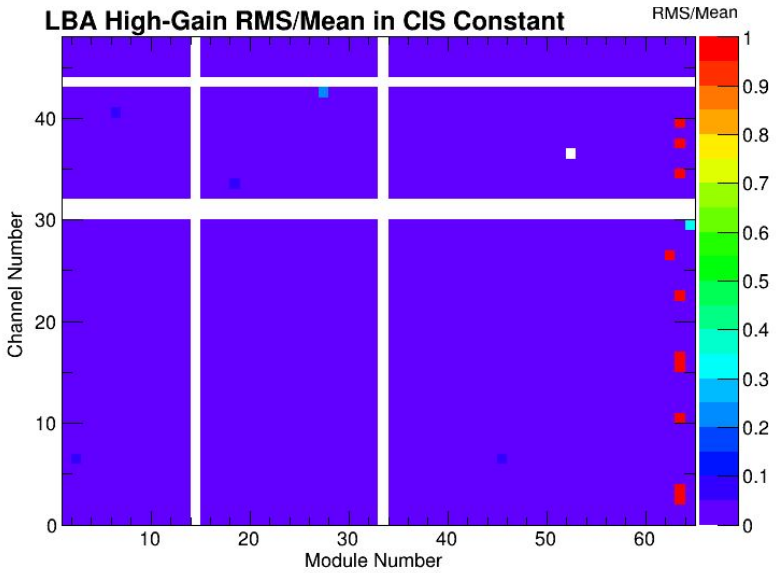


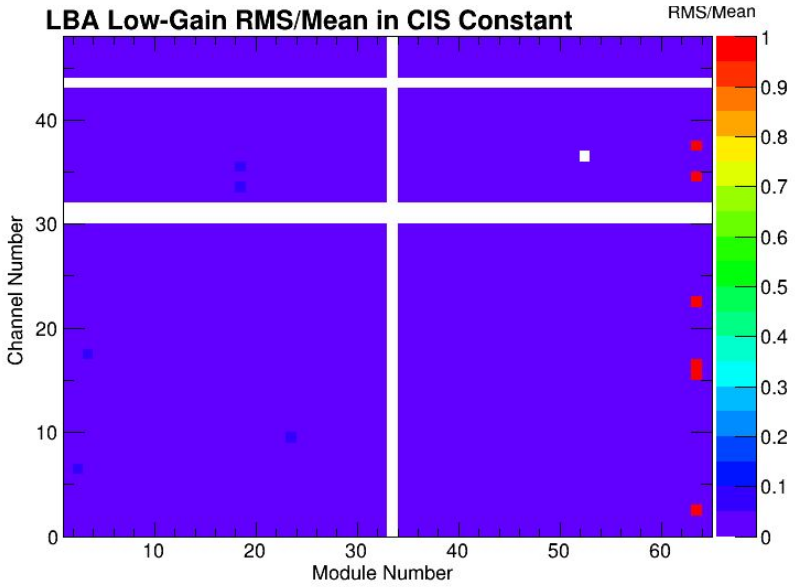


High gain

Low gain

RMS/Mean Channel Maps (LBA)

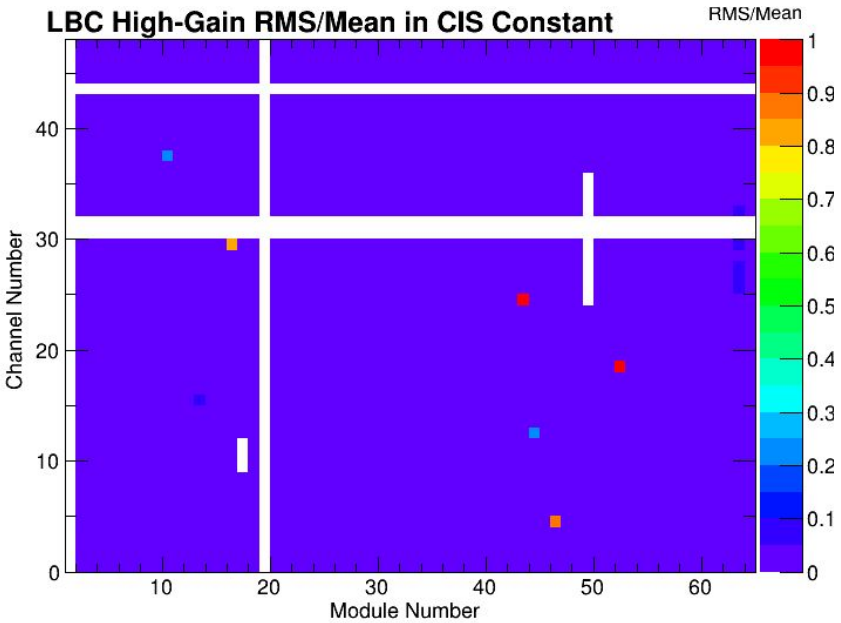


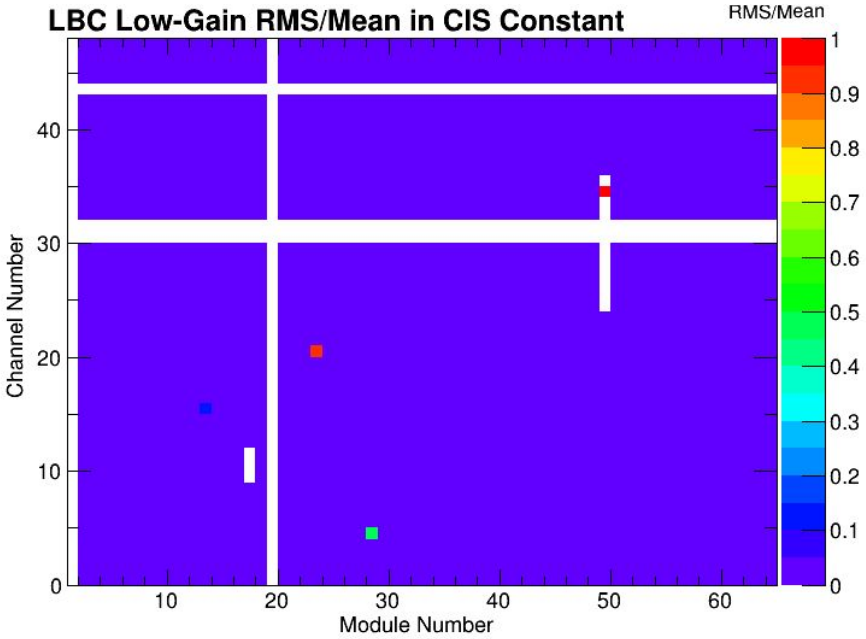


High gain

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	$\geq$ 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%