Charge Injection System (CIS) Update

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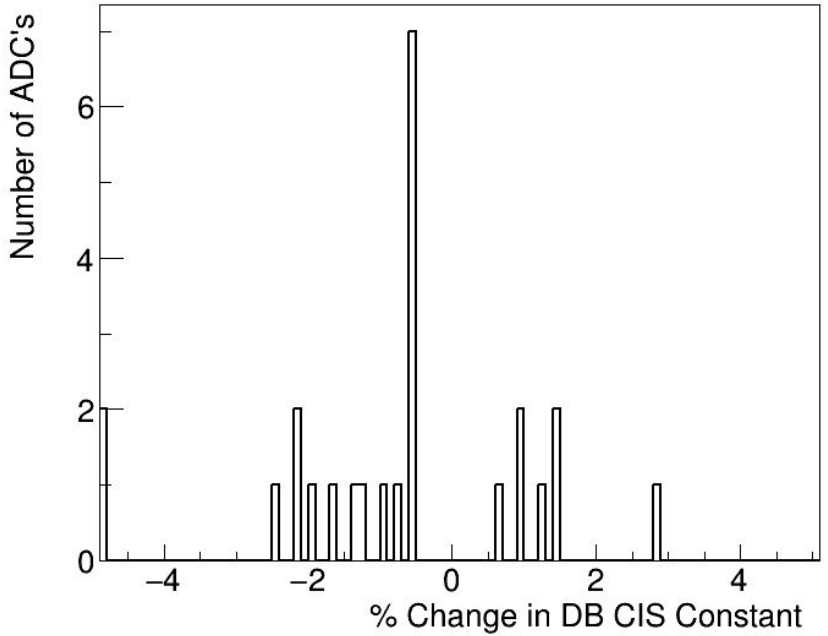
August 10, 2022

Summary

- CIS runs from July 14 - August 8
  - Database will be updated August 12
- 25 channels in update
  - 7 Good
  - 2 >5% change
- 8 Masked
- 10 Affected

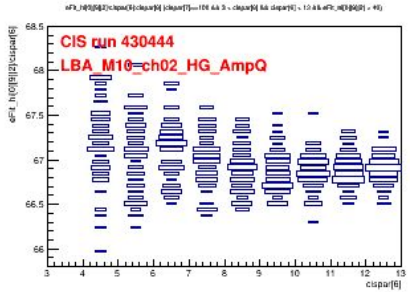


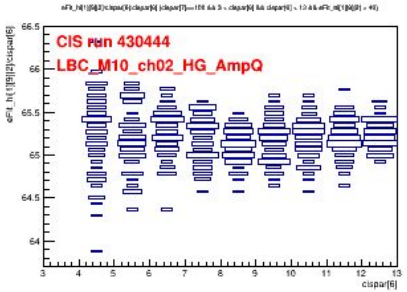
Run Selection

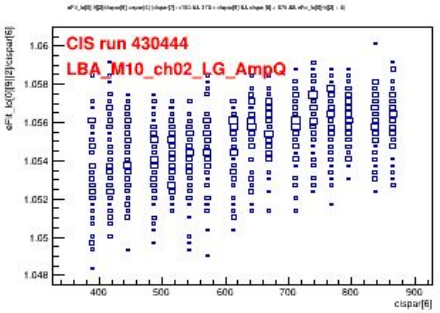
- **Date range:** July 14 - August 8, 2022
- **Runs excluded:** None
- **Runs used:** 428271, 428437, 428535, 428588, 428791, 429095, 429224, 429253, 429493, 429511, 429799, 429890, 429948, 430406, 430444

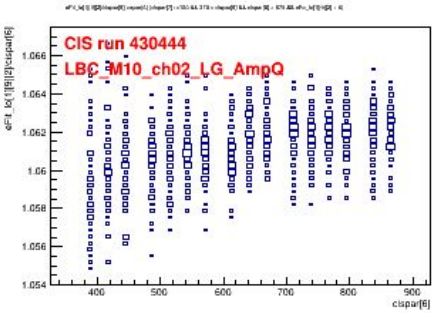
- No observed problems with Amplitude-Charge ratios (relatively flat with small scatter)
- Timing plots are consistent by module and run rumbers

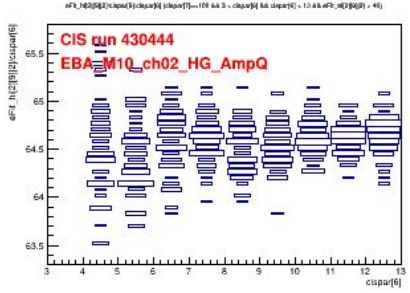
Representative Plots: Amp/Q: 430444

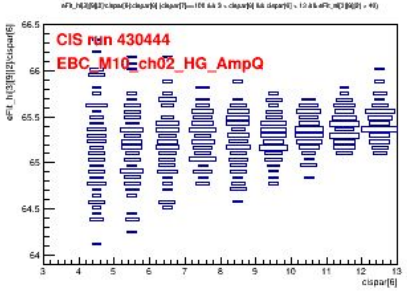


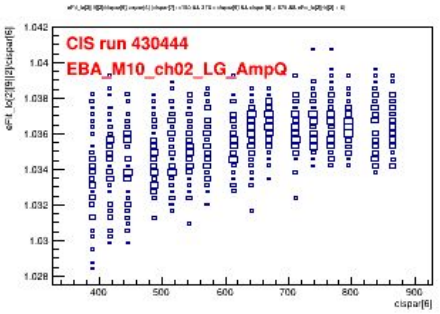


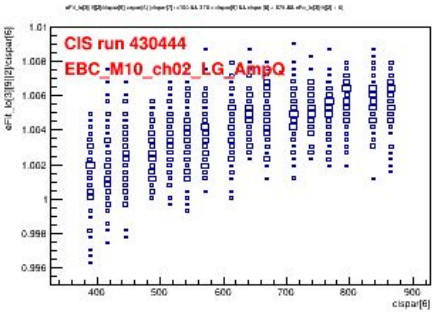








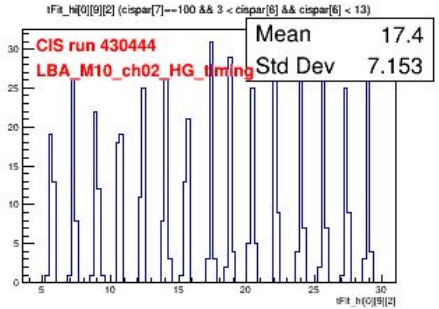


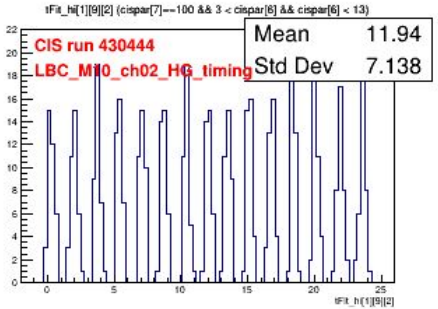


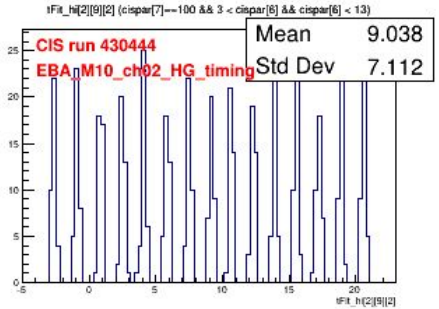
High gain

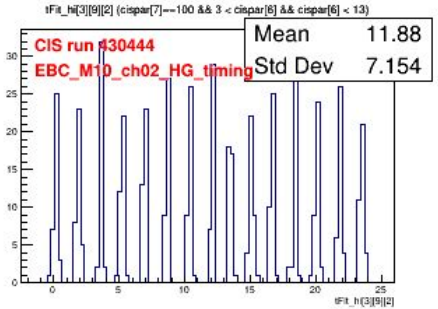
Low gain

Representative Plots: Timing: 430444

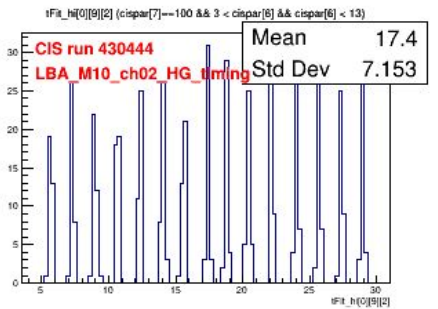


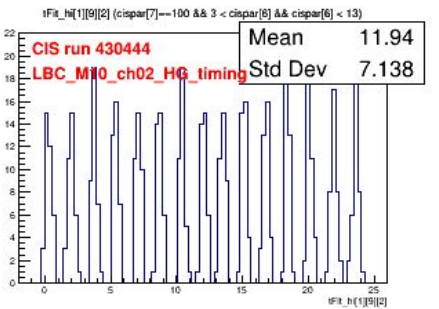


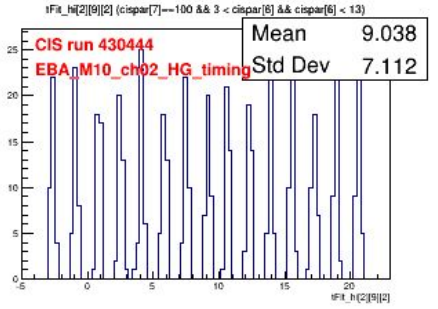


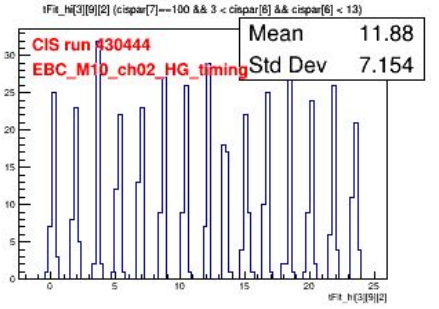


High gain



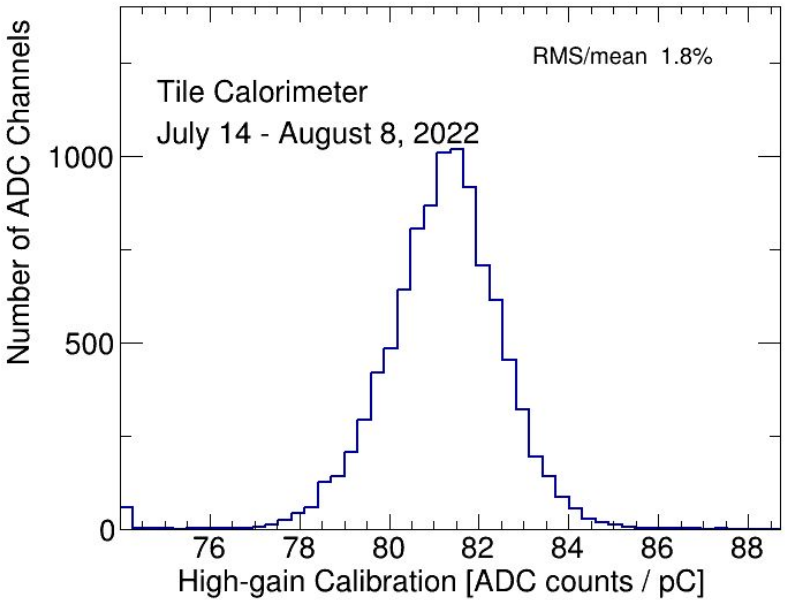


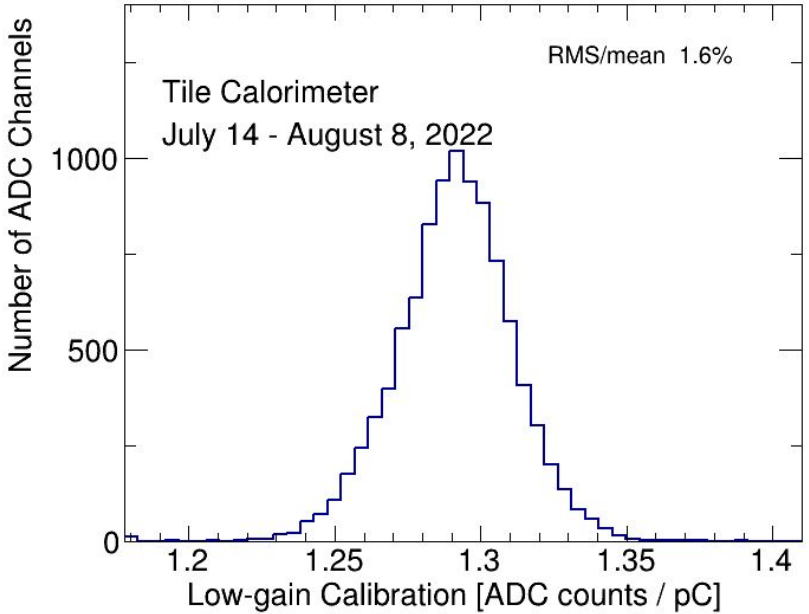




Low gain

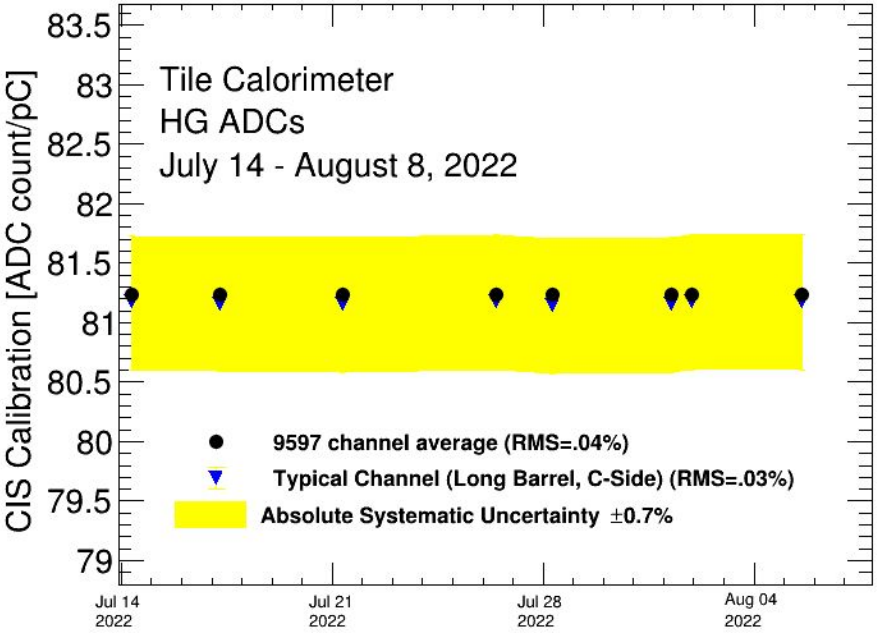
CIS Constant Distributions

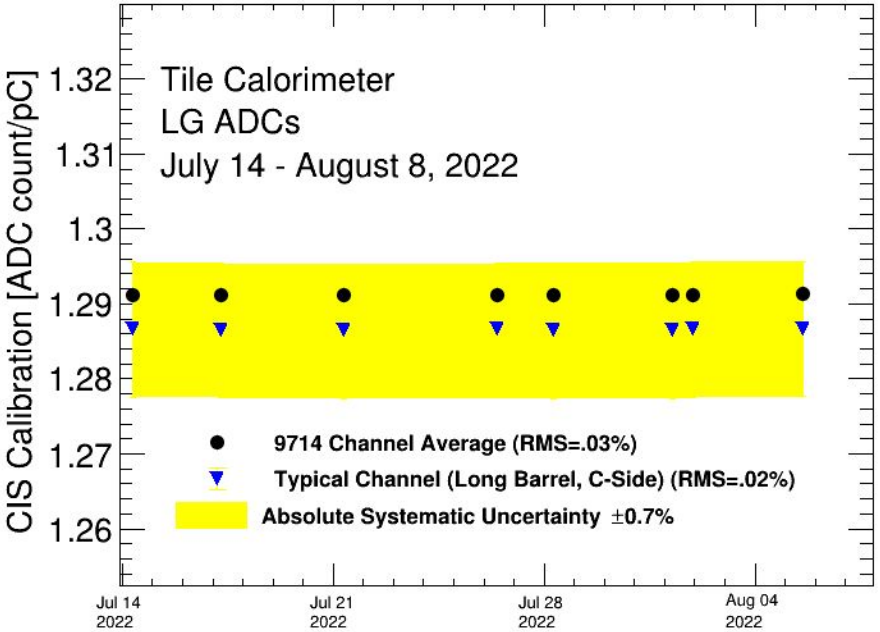




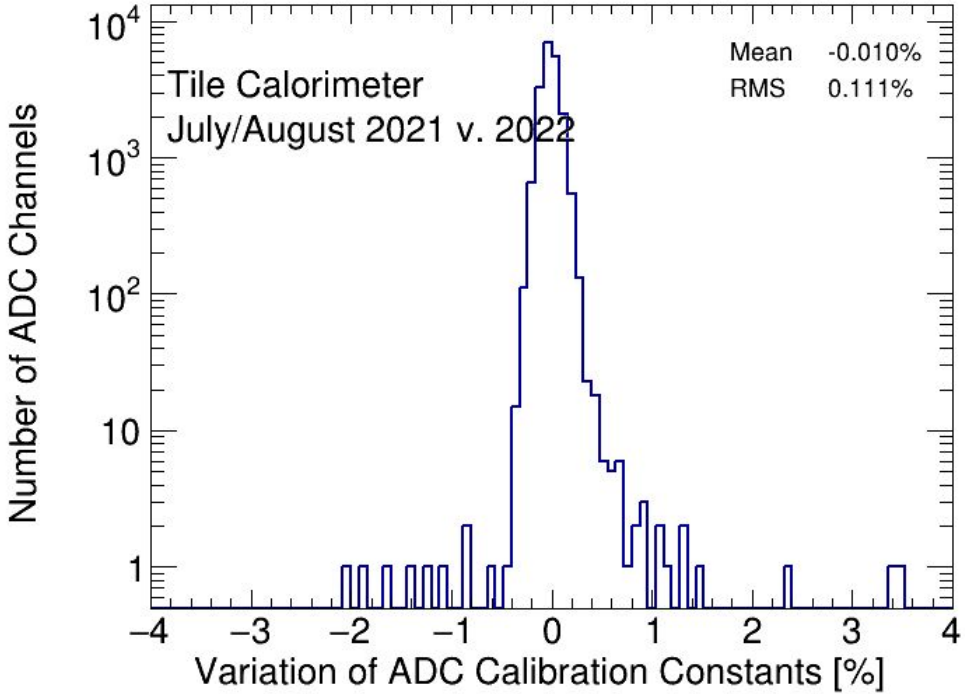
Bump on HG distribution comes from demonstrator.

Detector Time Stability

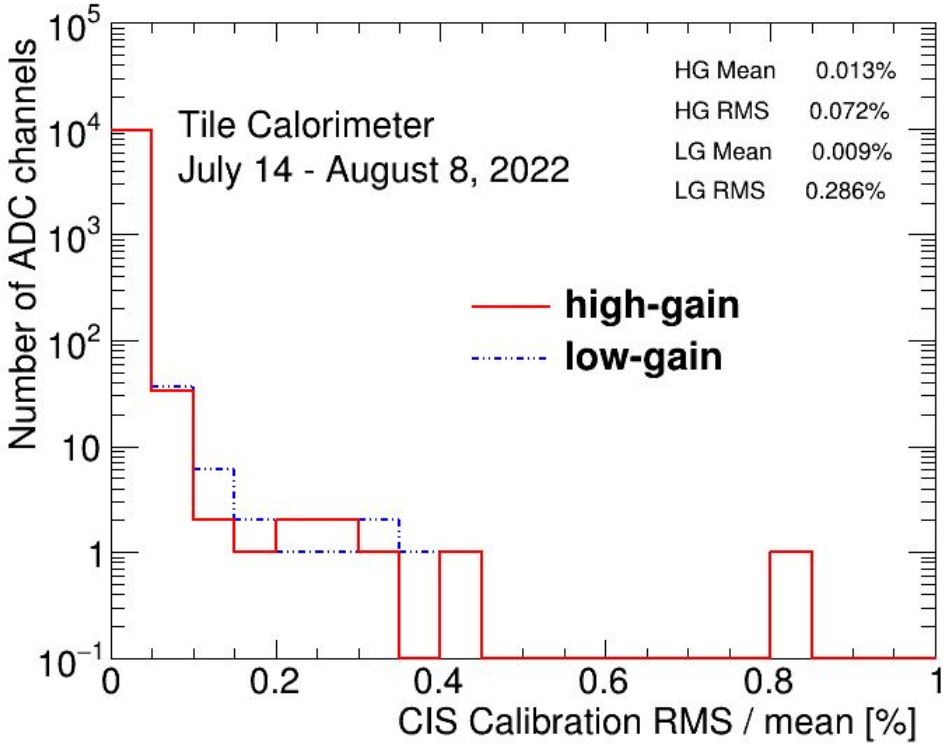




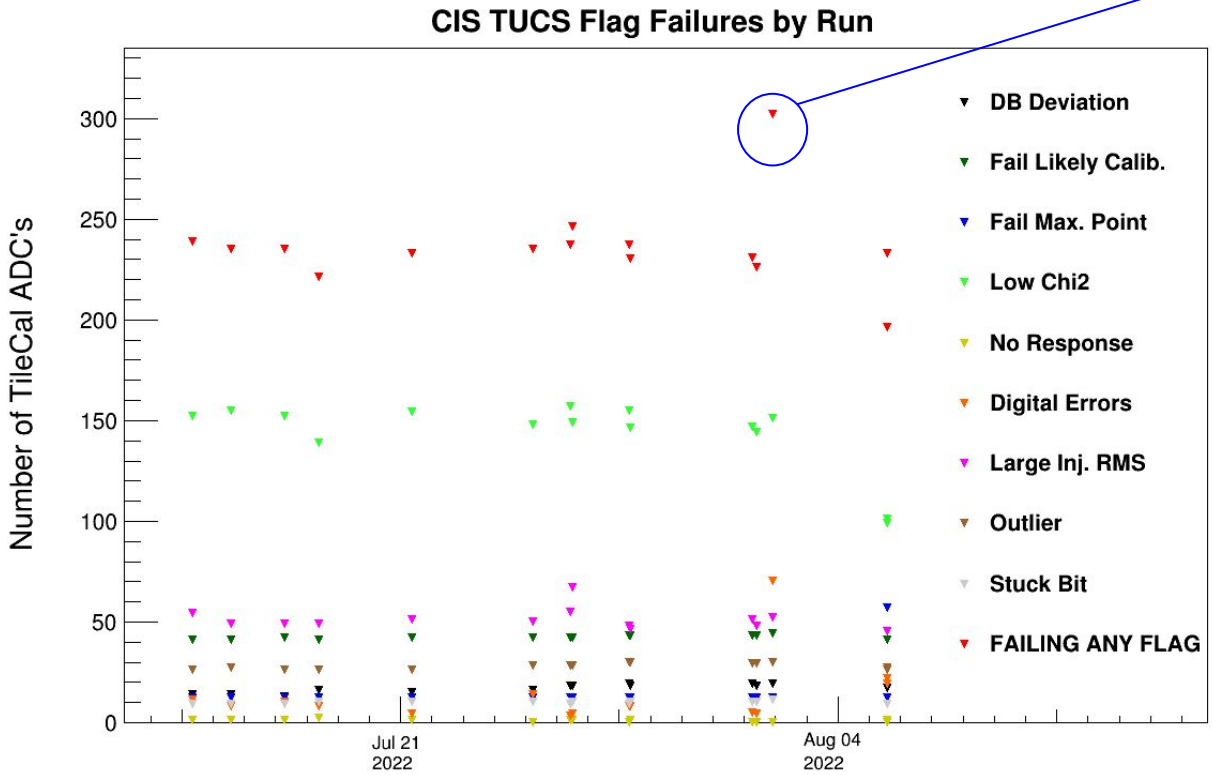
CIS Constant Long-Term Stability: 2021 vs 2022



CIS Constant RMS/mean



CIS TUCS Quality Flags

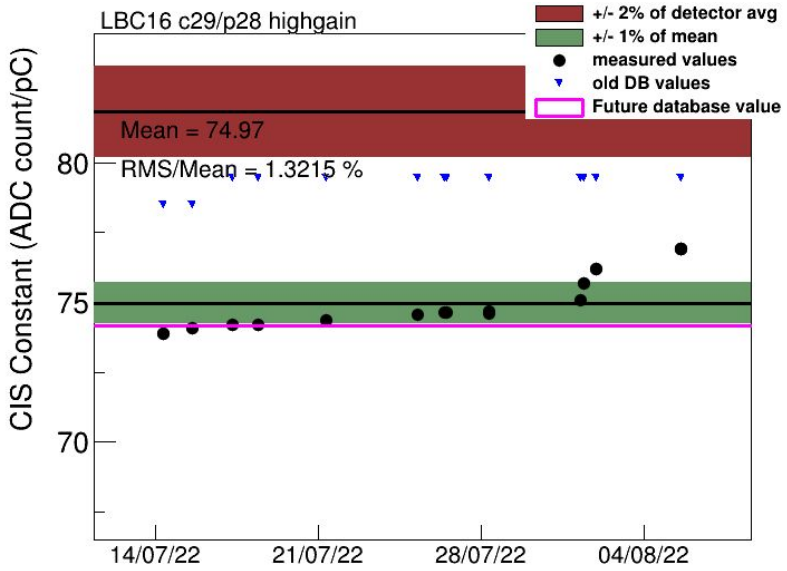


Investigating why there are more flags for this run
Run Number: 429948
Start Time: '2022-08-01 23:58:32

Interesting Channel Behaviour

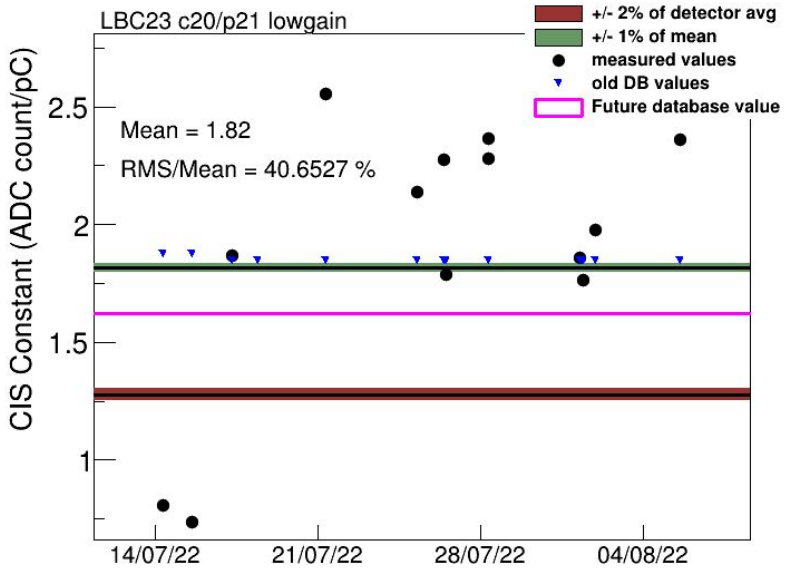
High Deviation from DB Mean (2)

	OLD	NEW	CHANGE
• LBC_m16_c29_highgain	79.44	74.15	-6.7%
• LBC_m23_c20_lowgain	1.84	1.62	-12.1%



ADC AFFECTED Bad CIS Calib

qflags: Fail Likely Calib.

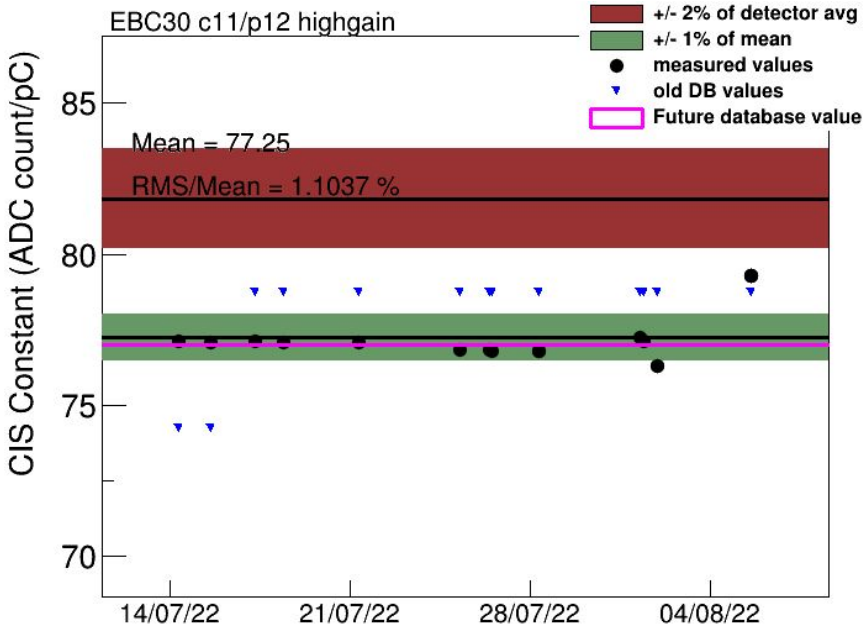


ADC BAD Bad Las Calib Bad CIS Calib ADC masked (unspec.)

qflags: Fail Likely Calib. Large Inj. RMS

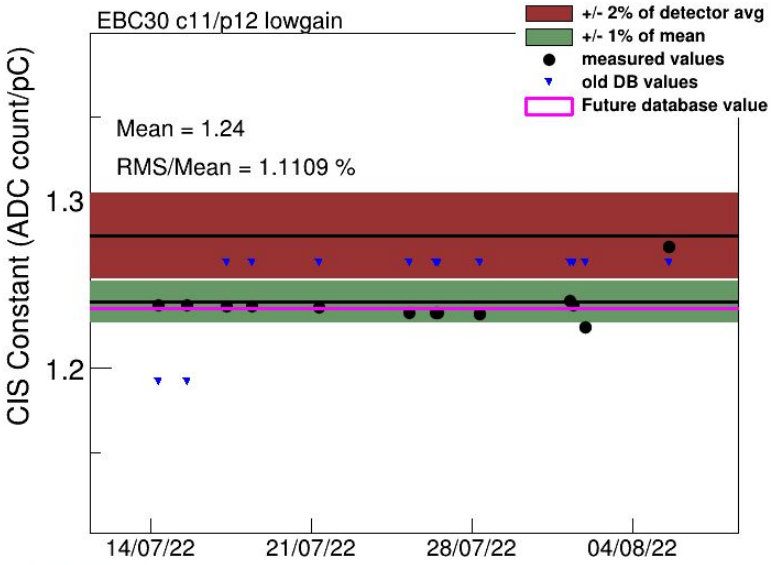
High Scatter Channels

- EBC_m30_c11_highgain
- LBC_m30_c11_lowgain



ADC AFFECTED Bad CIS Calib

qflags:



ADC AFFECTED Bad CIS Calib

qflags:

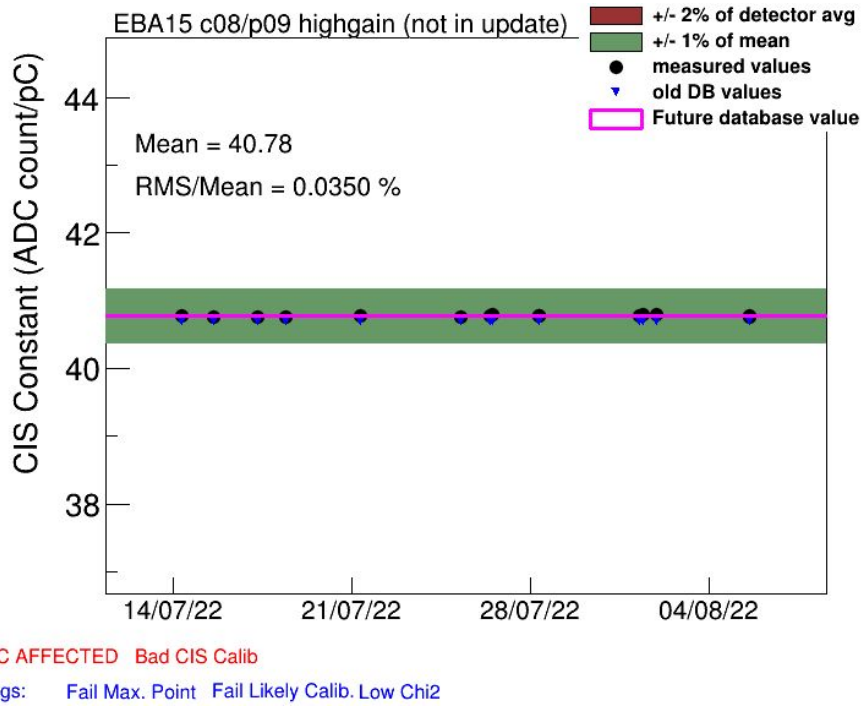
Half Gain Channels

- 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

(No changes from last update)

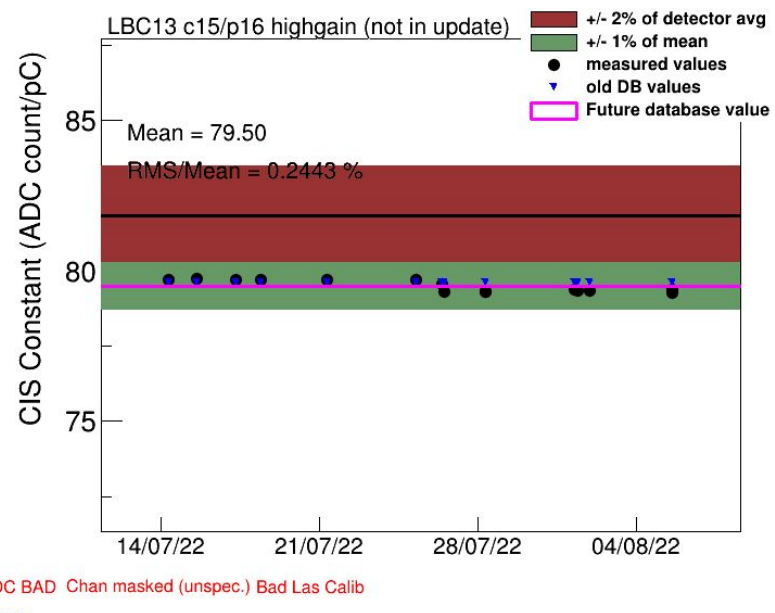
Affected

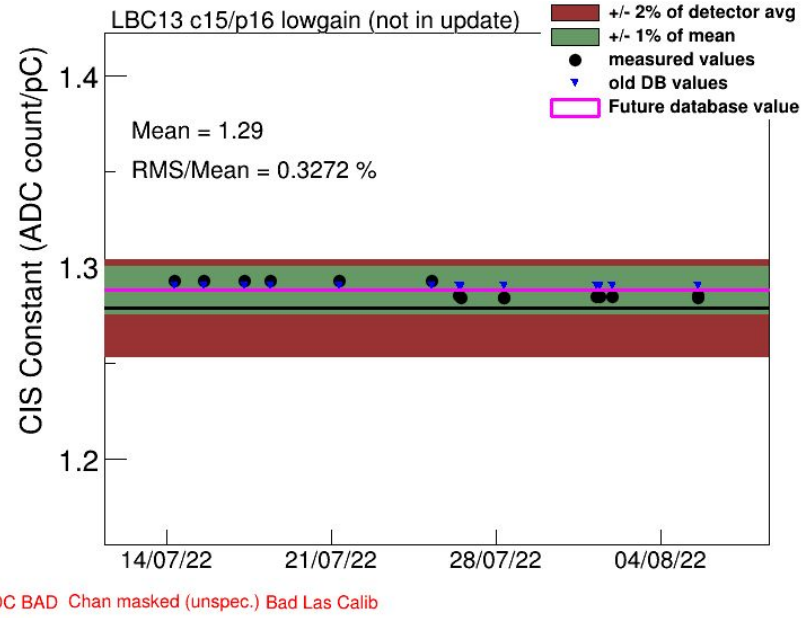
Masked



Channels to Recalibrate (3)

- `LBC_m13_c15_highgain` (from 26/07)
- `LBC_m13_c15_lowgain` (from 27/07)
- LBC_m10_c37_highgain (from 21/07)





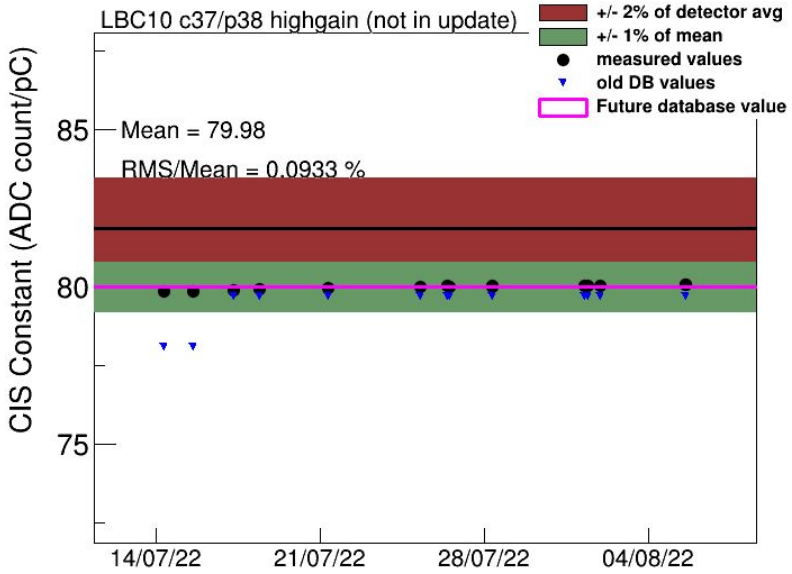
COOL Flag Updates

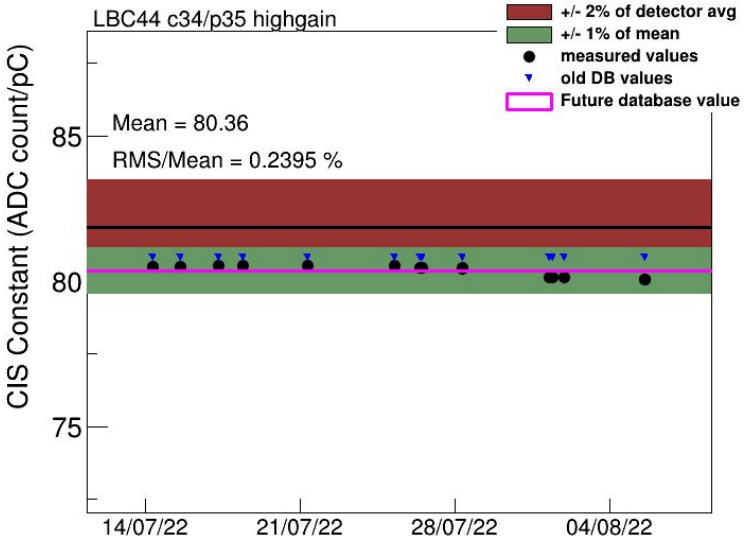
Remove BadCIS (2)

- LBC_m10_c37_highgain
- LBC_m63_c45_highgain

Add BadCIS (2)

- LBA_m52_c01_lowgain
- LBC_m44_c34_highgain





ADC AFFECTED Bad Las Calib Bad CIS Calib

qflags:

qflags:

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%