Booster BLM calibration measurements.

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FNAL Proton Source.

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Outline

Motivation and set-up.

Results

Conclusions.

Motivation.

- Find a method to determine measureable calibration constants for the transistor based log integrator hardware.
- Use these constants to provide similarity of ACNET readbacks between the analog and digital systems.

Set-up.

- Charge source capable of delivering $\approx 1.2\ \mu$C of charge.
- Inject charge into the log integrator and digitize the output voltage.

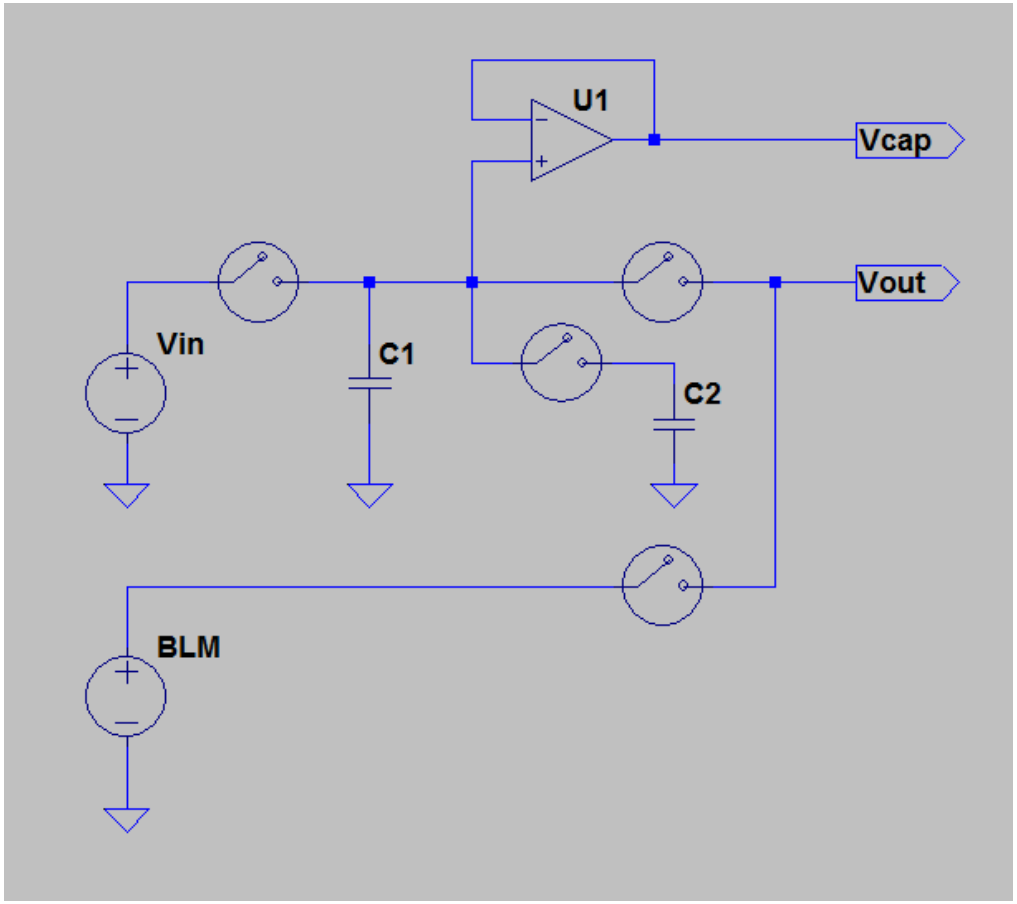


Figure: Layout.

I/O.

- Digitized capacitor and integrator output voltages via usb DAQ: sample freq $\approx$ 40 kHz, data window $\approx$ 60 msec.

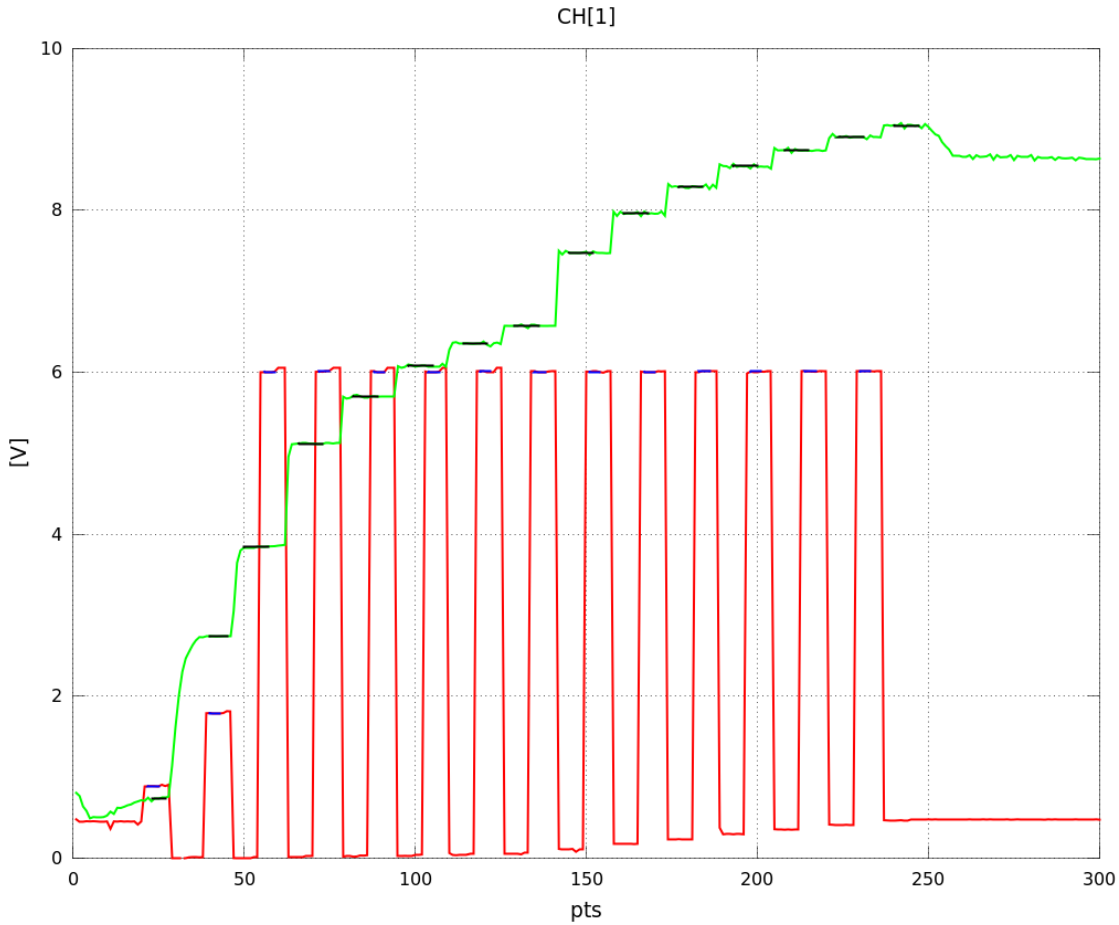


Figure: Vcap and Int out.

Data Fitting.

- The integrator output voltage is fit using least squares to the following equation:

$$V_{int} = C_1 * \text{Log}(Q_{tot}) + C_2.$$

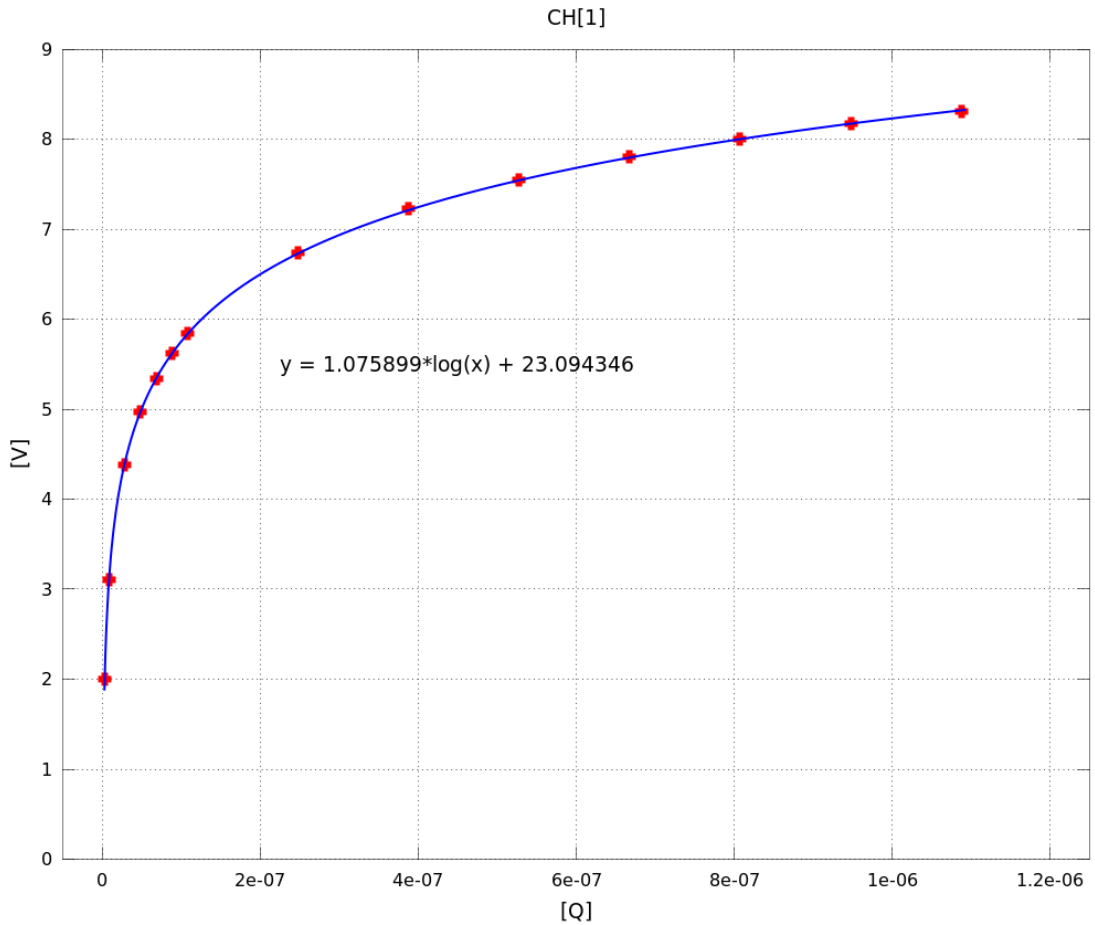
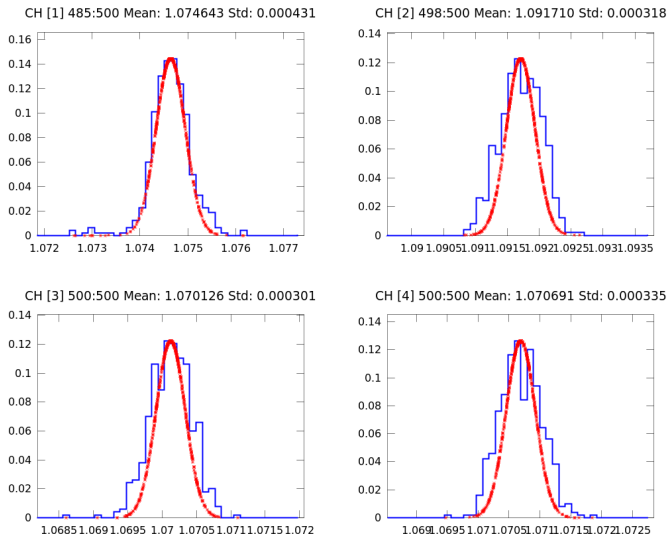


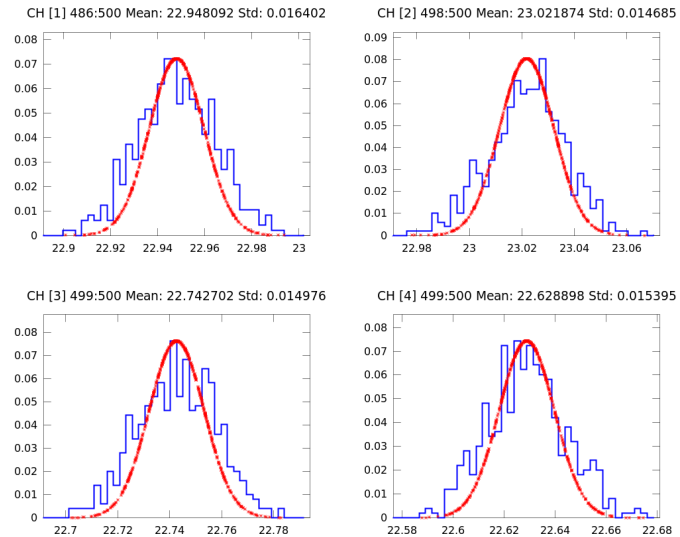
Figure: Fit of V_{int}.

Data sets.

- Collected 500 waveforms for each channel, 4 channels at a time.



(a) C1



(b) C2

Locations.

Chassis	G02-RR1-3	G01-RR6-1	G20-RR1	G17-RR2	G11-RR6-1
Channel	071	L24	L18	L12	L06
	072	S24	S18	S12	S06
	062	L01	L19	L13	L07
	061	S01	S19	S13	S07
	052	L02	L20	L14	L08
	051	S02	S20	S14	S08
	026	L03	L21	L15	L09
	025	S03	S21	S15	S09
	024	L04	L22	L16	L10
	023	S04	S22	S16	S10
	011	L05	L23	L17	L11
	021	S05	S23	S17	S11

The data.

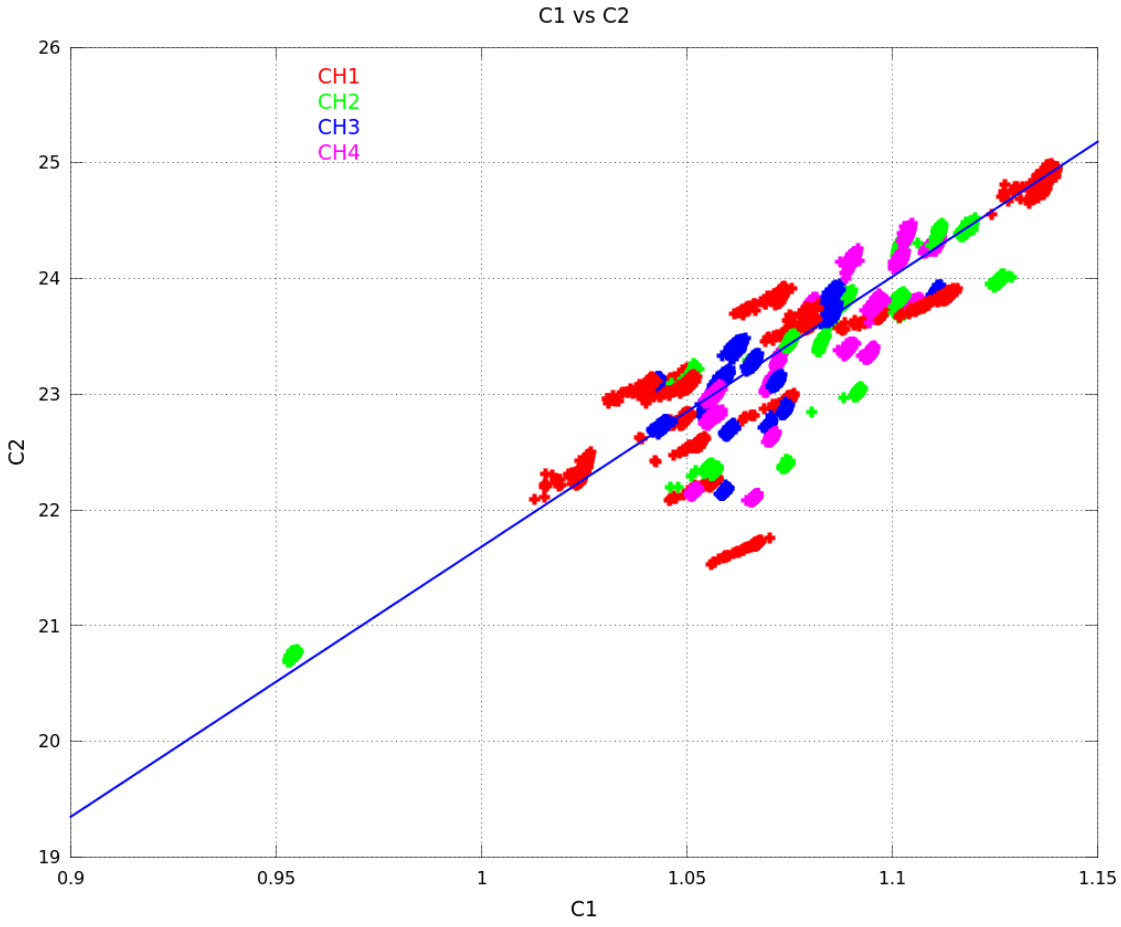


Figure: C2:C1

Median.

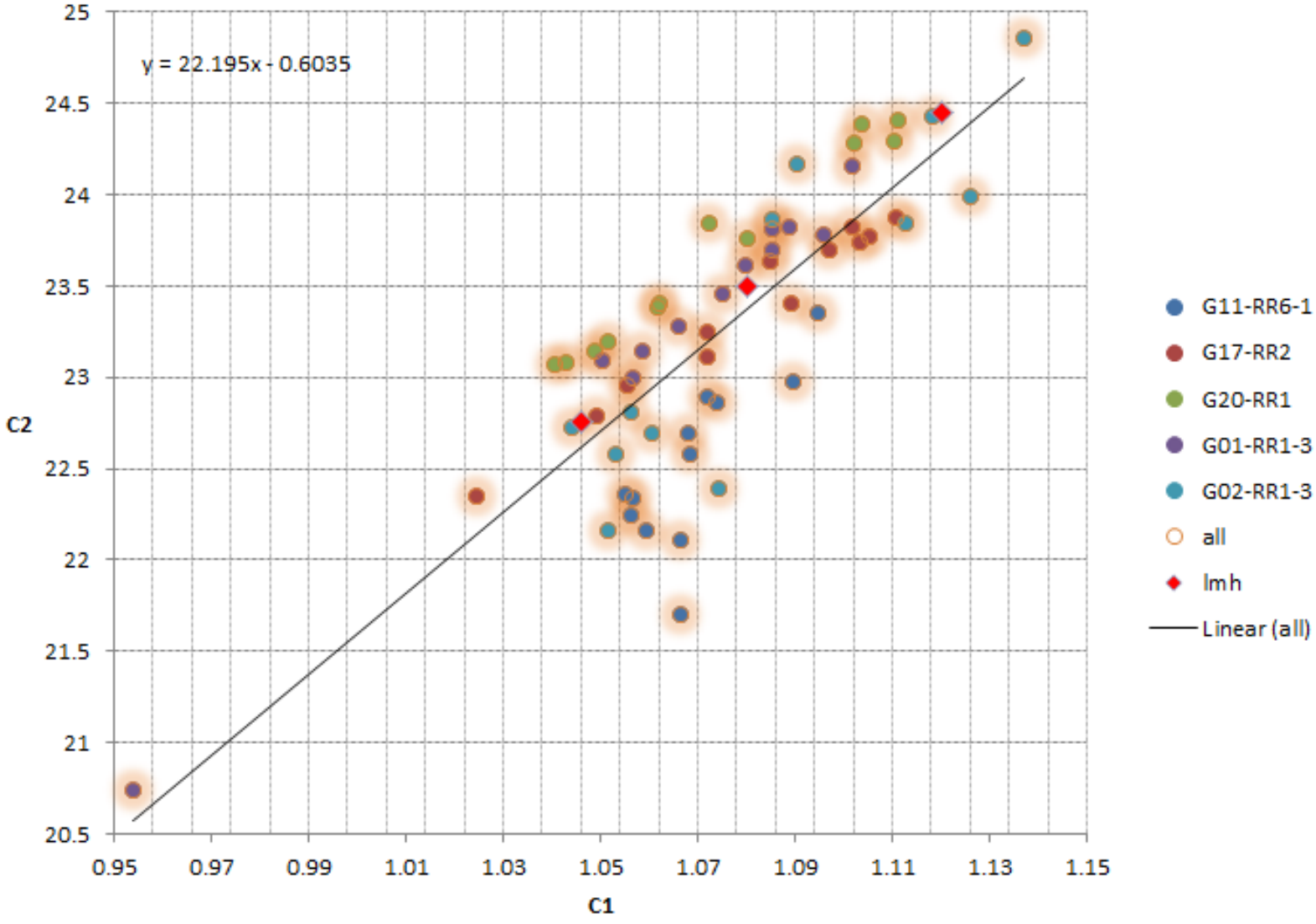


Figure: C2:C1

Compare.

- Pick arbitrary C's and find the difference in Rads/s.
- $V_{int}(t) = C_1 * \text{Log}(Q_{tot}) + C_2$
- $R(kT) = 0.00721196 * \text{Log}(1.057772 * V_{int}(t))$;

Lo	Mid	Hi	Q_{tot}
1.046,22.76	1.08,23.5	1.12,24.49	68 nC

Percent Diff in ACNET read back.

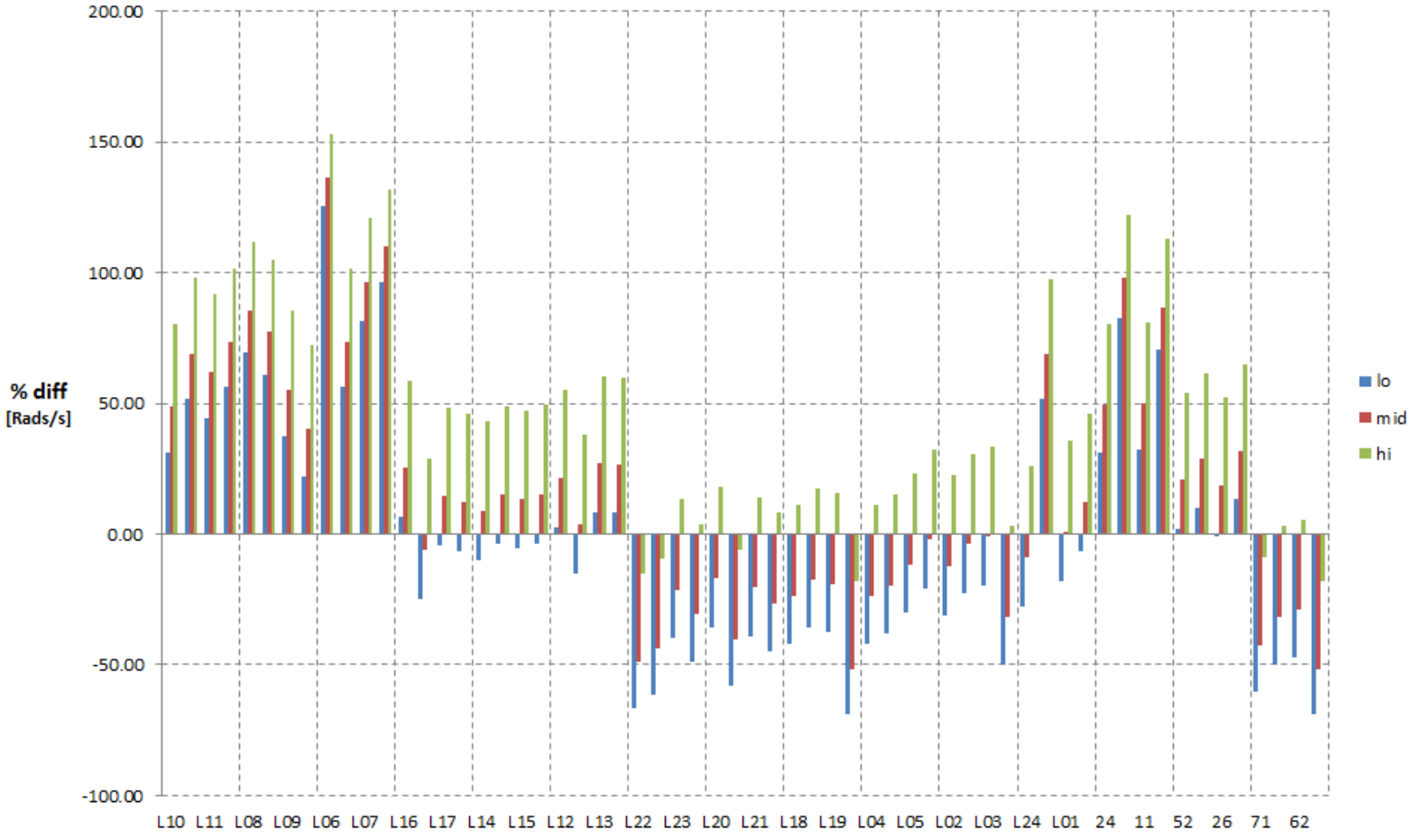


Figure: percent diff

Issues.

- Possible differences in chassis ref voltage, or bias current (nA).
- Channel to channel differences of test box.
- DAQ calibration.

Redux

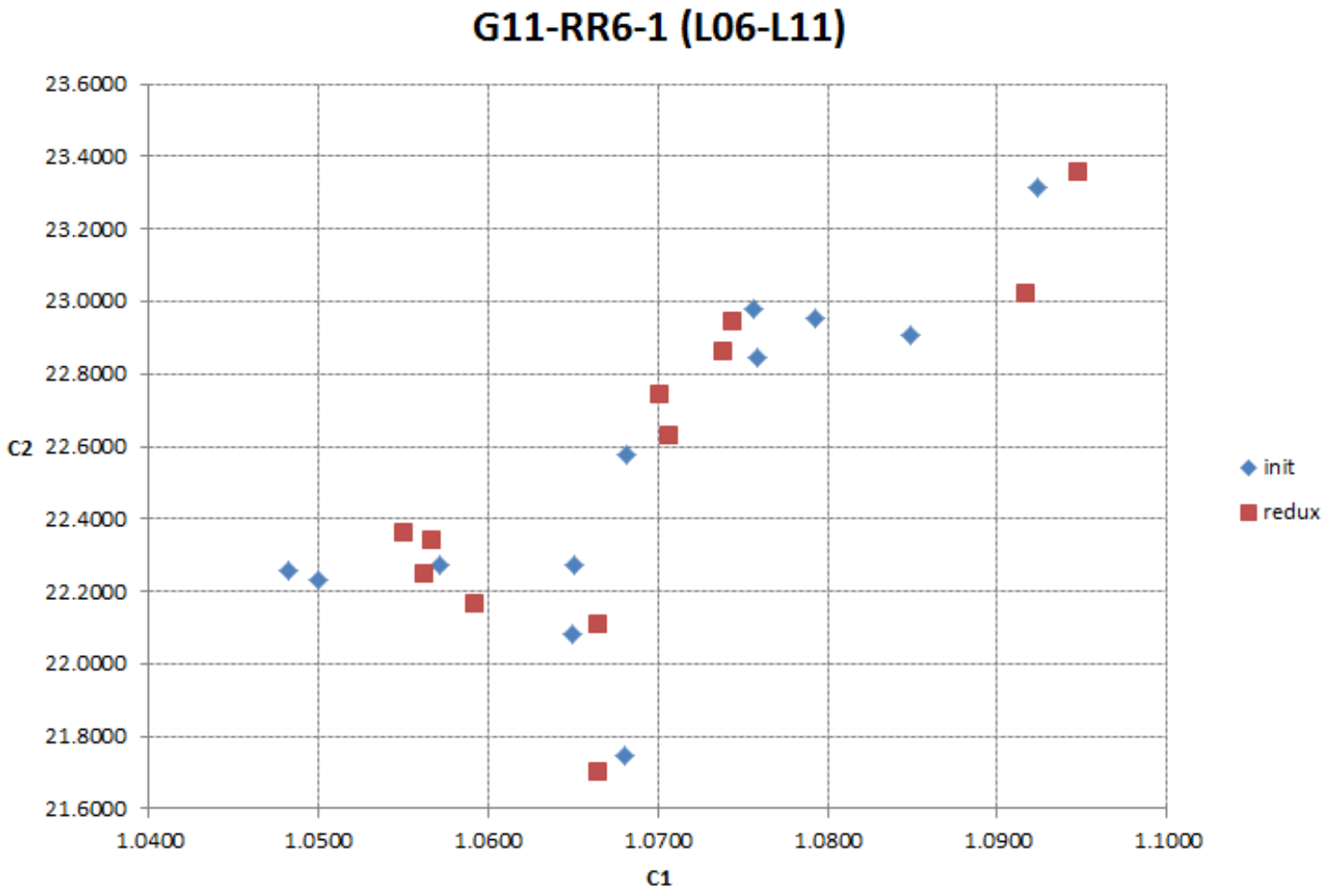


Figure: take two

Conclusions.

- C_1's & C_2's pretty spread out.
- Difference in ACNET read backs bigger than expected when compared to a global pair.
- More rigorous rad analysis.