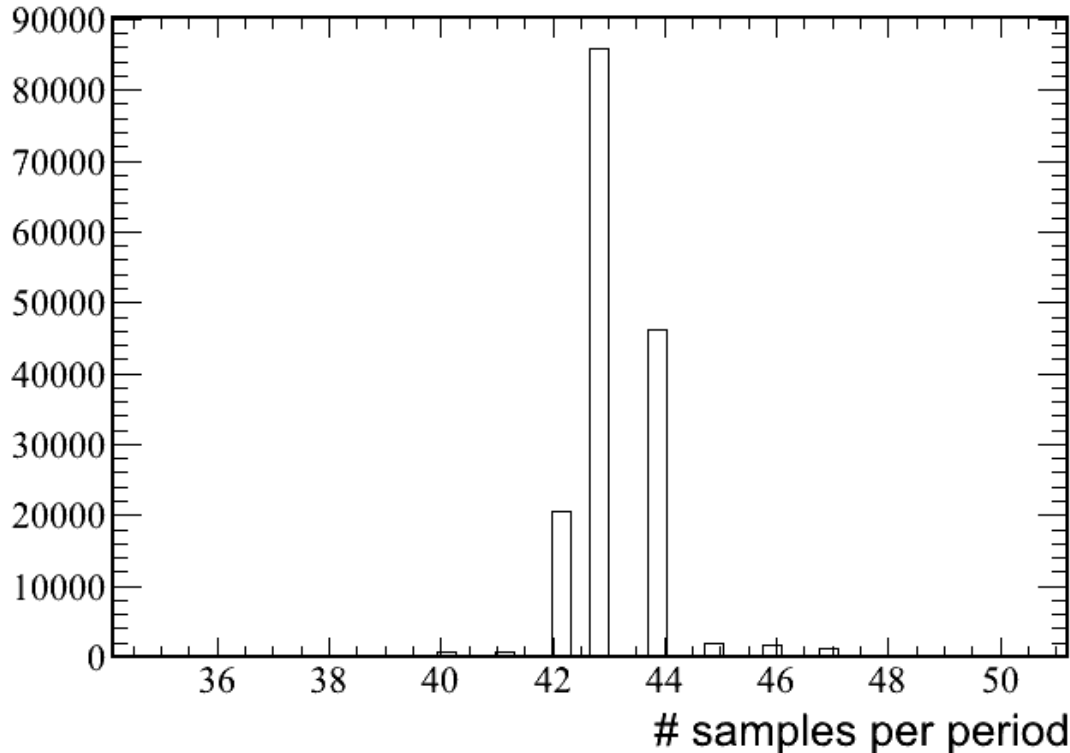


PSEC4 Timing - Current Data Sample

- Mostly same as last week: [\[previous slides\]](#)
- Data provided by Eric in December:
 - 10.24 GSa/s
 - 240 MHz sine wave input
 - 20,000 events for CH3
 - 20,000 events for CH5
- Timing calibration with “zero-crossing” analysis.
 1. Reorder waveform
 2. Pedestal (re-)correction
 3. Zero crossings:
 - a) **Updated procedure: Measure period of waveform (in number of samples) to get average sampling rate.**
 - b) Measure occupancy of zero crossings between each sample pair to get Δt for each sampling interval.

(Prev.) Step 3a – Calculate Average Δt

- Histogram number of cells between periods:



Uses full period intervals
(rising-to-rising or falling-to-falling).

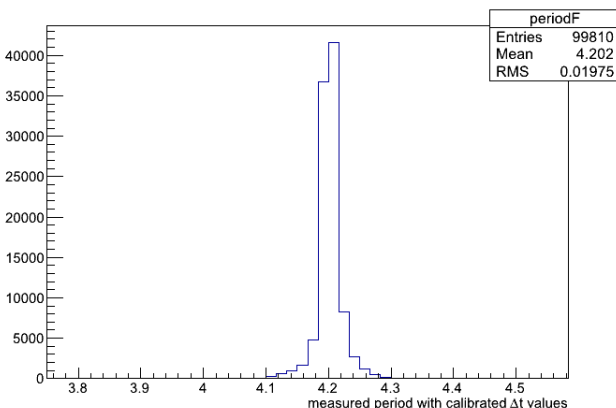
Separately calculated for
samples 0-82, 83-255 to
avoid systematic offsets
from sampling “gap.”

Mean: 43.22 samples

Corresponds to:

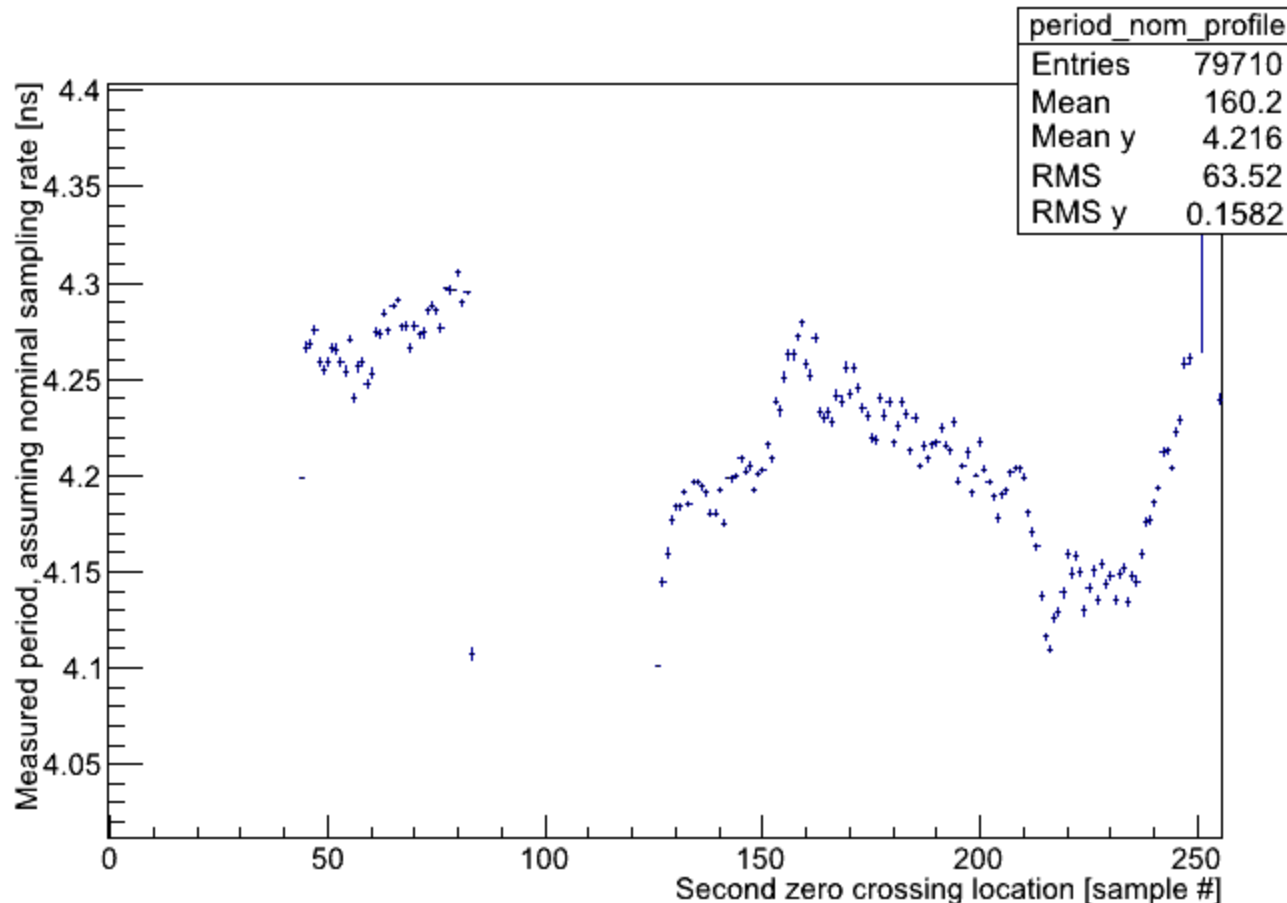
$\langle \Delta t \rangle = 96.4 \text{ ps}$

$\langle f_{\text{samp}} \rangle = 10.37 \text{ GSa/s}$



(Left) Measured period after calibration from
last time indicated an overall scale offset.
Measured 4.2 ns but expected 4.17 ns.

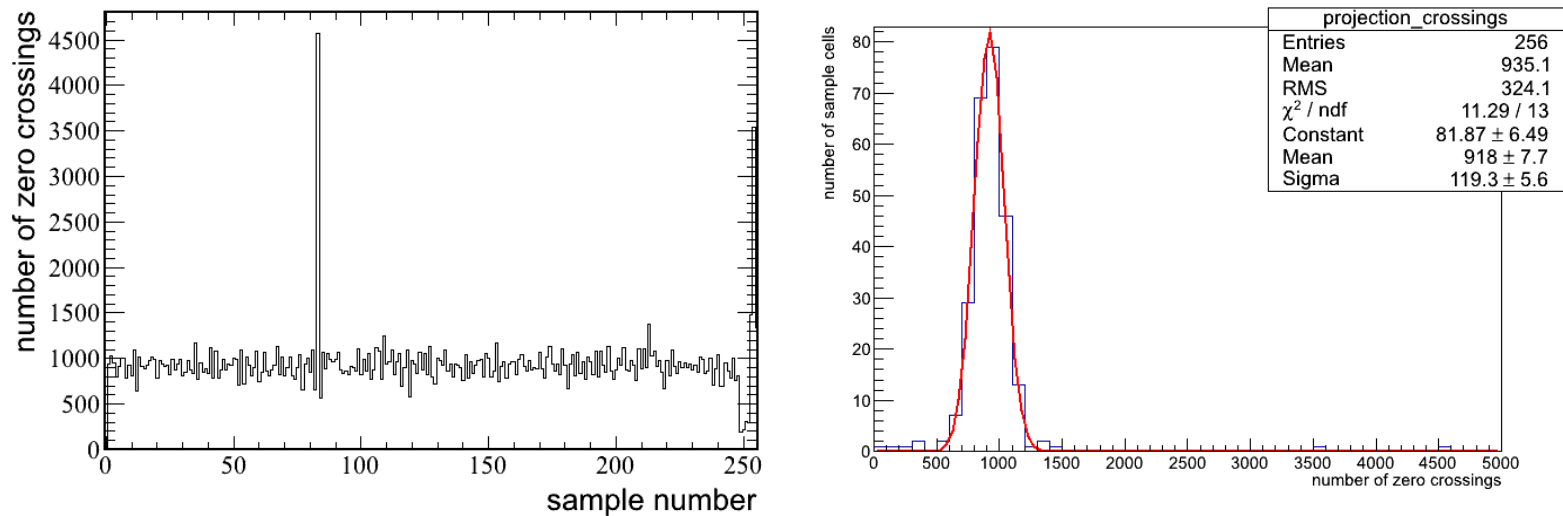
“Nominal” Period vs. Cell



- This structure biases the mean Δt .

New Method to Calculate Average Δt

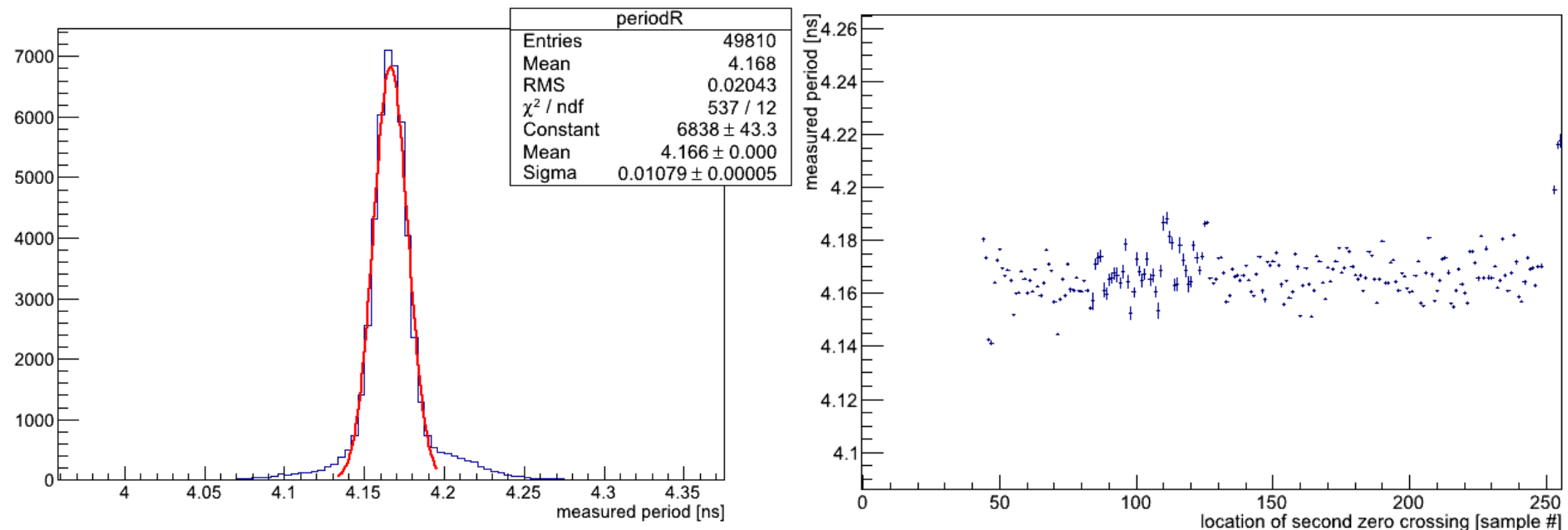
- Measure average number of zero crossings per cell (already done as part of procedure):



$$\langle \Delta t \rangle = T_{\text{input}} * \langle N_{\text{zero}} \rangle / (2 * N_{\text{events}})$$

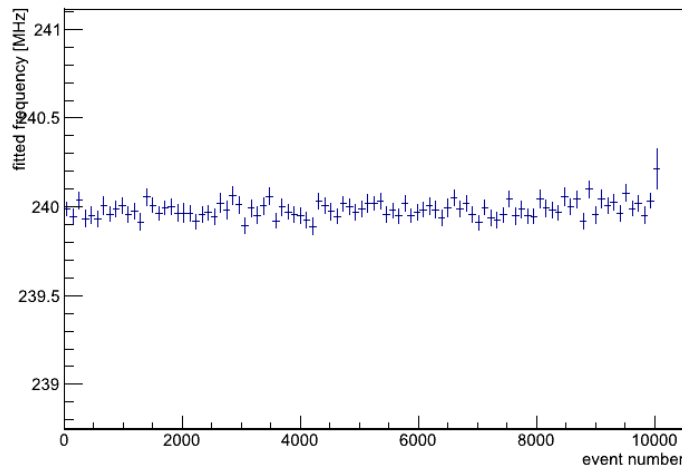
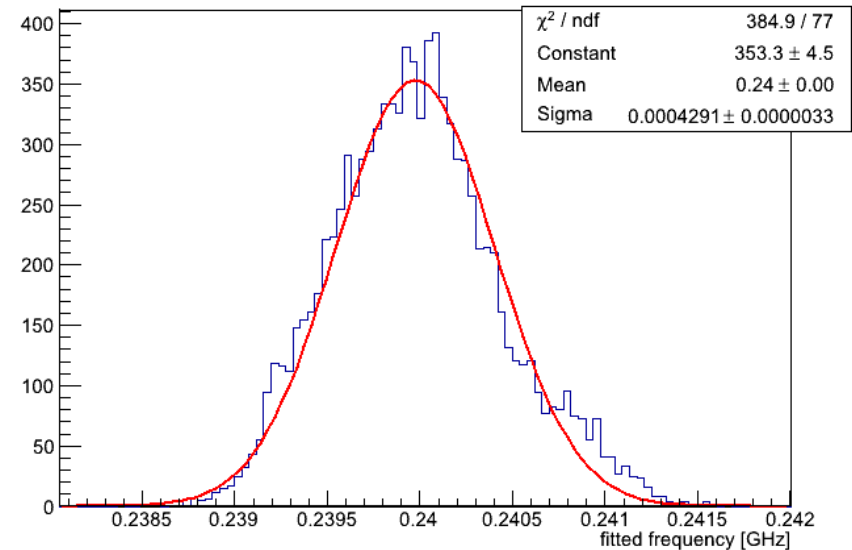
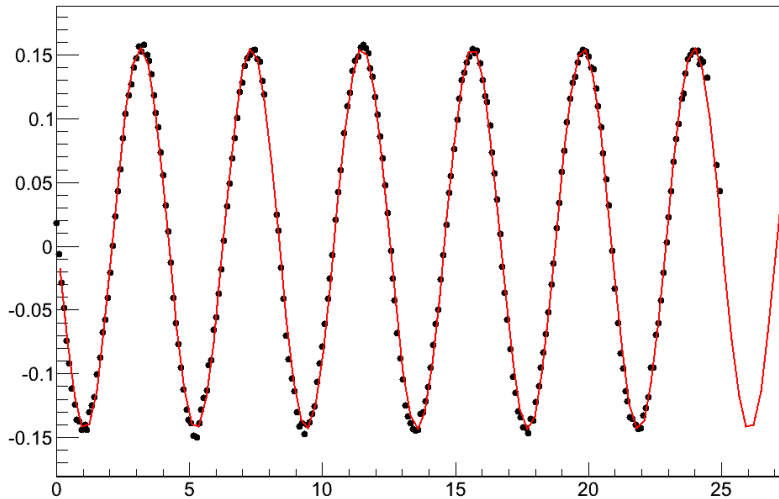
Cross-checks (1)

- Remainder of procedure is same as before.
- Apply Δt values (from first 10,000 events) and measure period (from second 10,000 events):



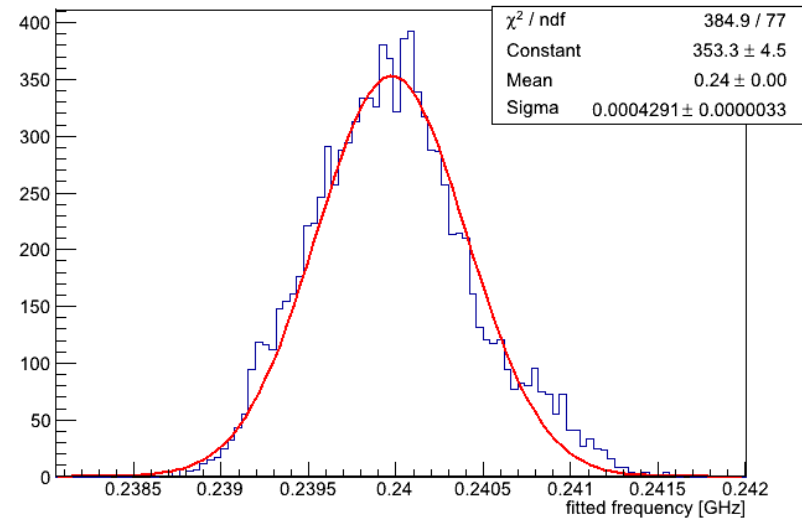
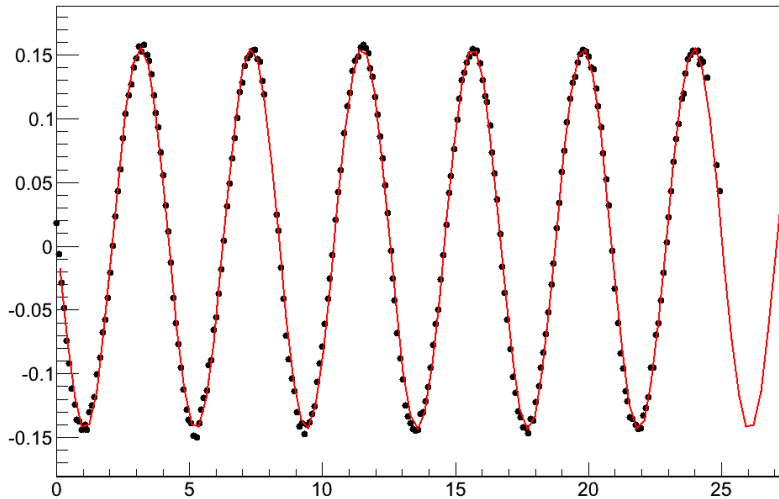
Cross-checks (2)

- Apply Δt values (from first 10,000 events) and fit sine waves (from second 10,000 events):

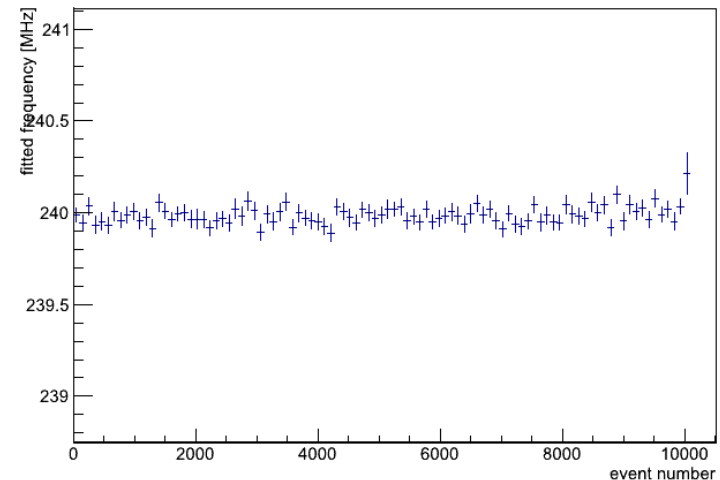


Cross-checks (3)

- Apply Δt values (from first 10,000 events) and fit sine waves (from second 10,000 events):

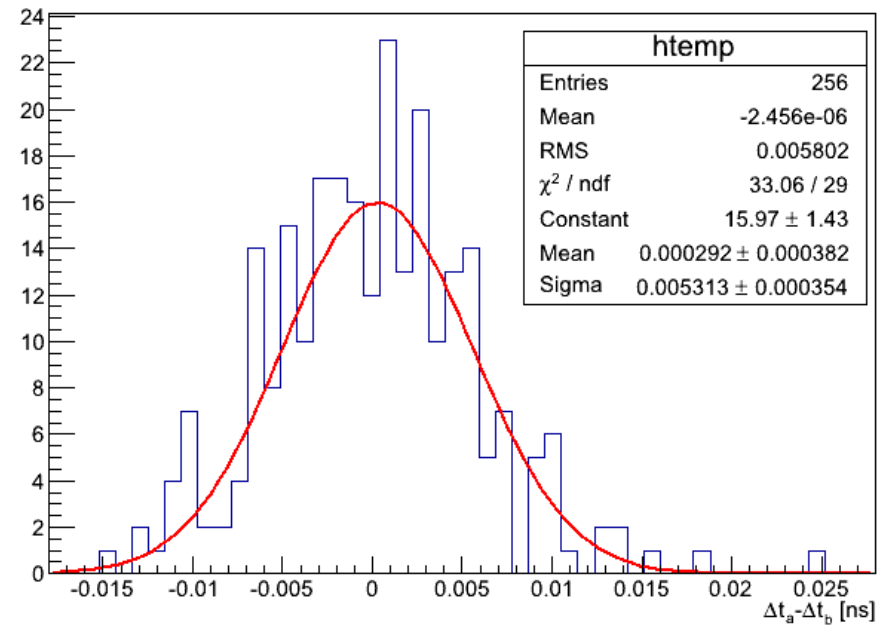
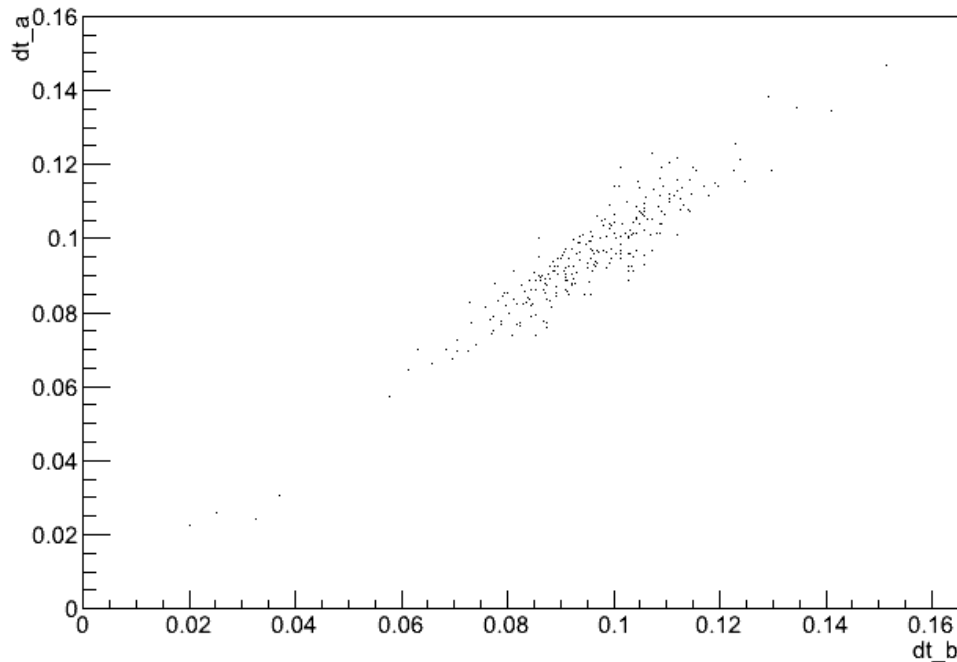


- No obvious event number dependence.
- Good fit qualities.
- Period in = period fitted.



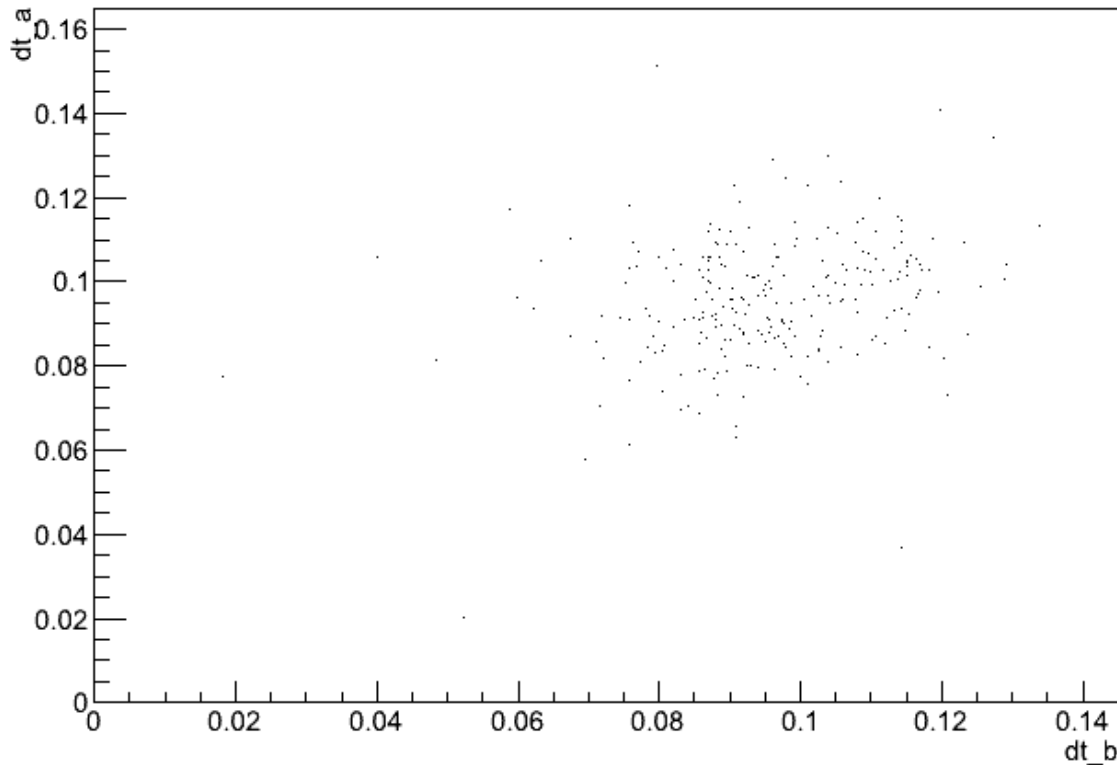
Cross-checks (4)

- Compare Δt values from first 10,000 events and second 10,000 events:



Other checks

- Compare Δt values from CH3 and CH5:



They appear uncorrelated.

“North” and “south” sides of chips
need separate calibrations?

Summary

- Δt files available (and verified) for channels 3 and 5 for Chicago PSEC4 eval card.
- Taking new data w/ Joachim in Hawaii to check:
 - Channel dependence of calibrations.
 - Effect of Wilkinson feedback.
 - Effect of statistics on Δt values.
 - Timing resolution.