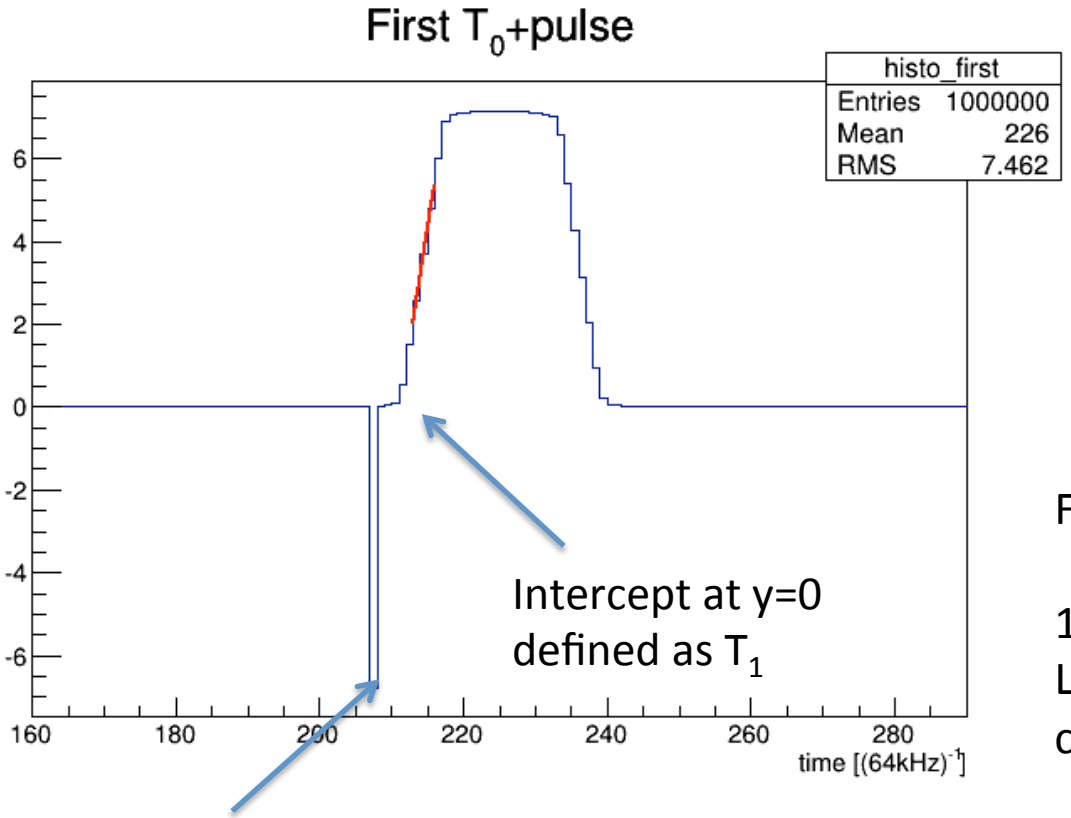
Synchronization tests with new ACQ1002 modules

test signal and the algorithm



Our high precision pulse generator simultaneously generates 60 Hz trigger signal (for the ADC "trigger" input) and synchronized to it RC shaped square pulse with the following parameters:

- Leading/Trailing edge = 100 µs
- WIDTH (incl. Le. edge) = 320 µs

For every pulse:

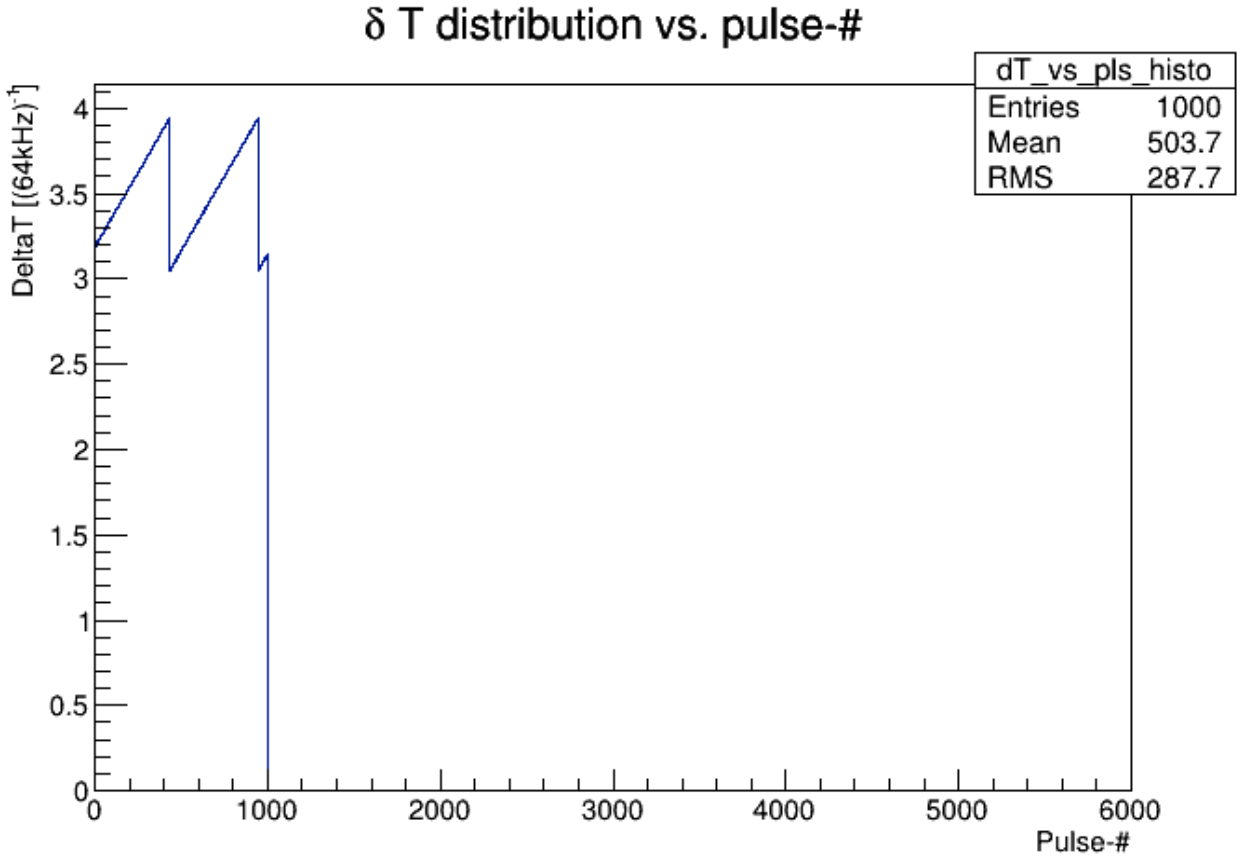
1.) We fit middle part (3 bins) of the Leading edge by a straight line and calculate the y=0 intercept

2.) We calculate $\Delta T = T_1 - T_0$ for every pulse

We looked first at 1000 pulses and then at total of 6000 pulses

§ Units on X (time) axis throughout the talk are in 1/64kHz ≈ 15.6 µsec

Individual ΔT vs. pulse number (SYNC)

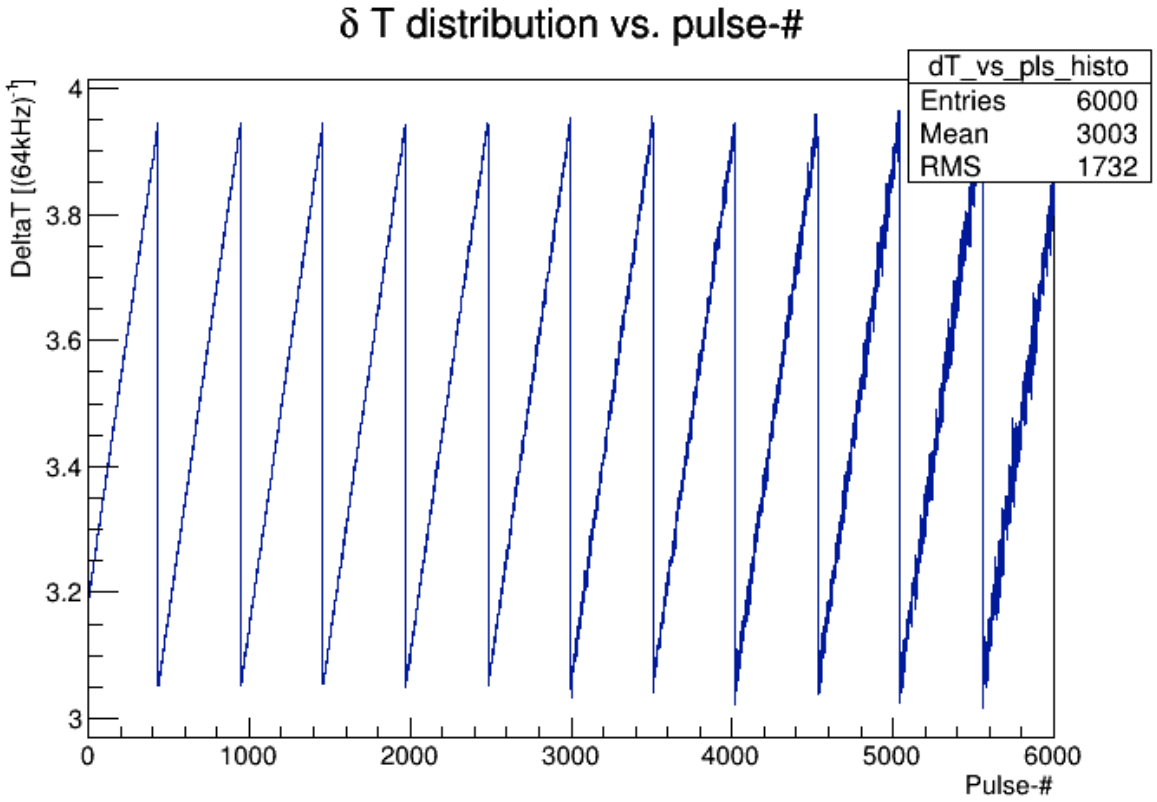


As can be seen in sync case ΔT distribution "drifts" systematically in one direction. After roughly a cycle of 500 triggers it "resets" back and does the same thing all over again.

Our initial guess was that the "drift per pulse" was only 1 time tick, i.e. 1/32MHz.

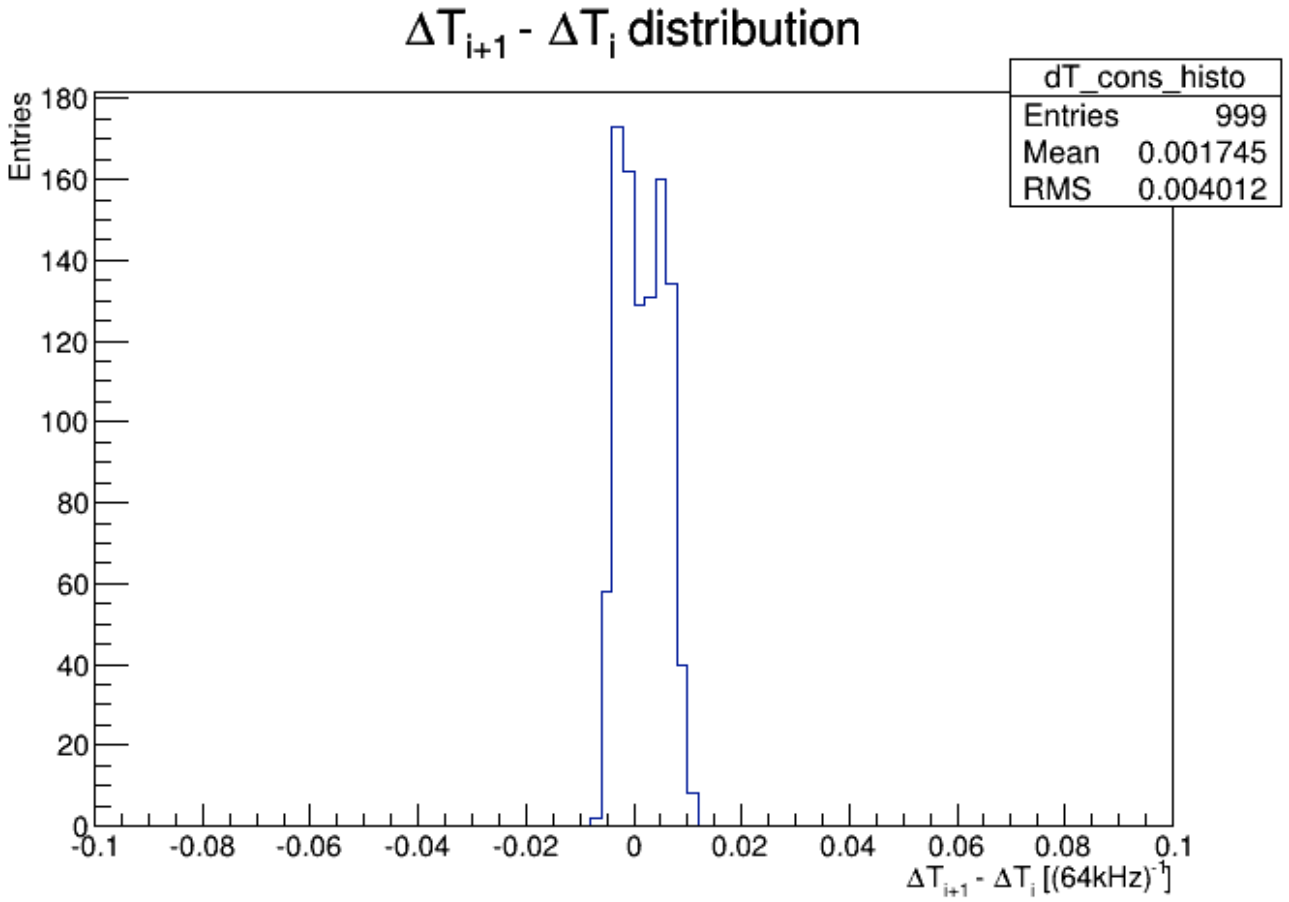
However upon further inspection we noticed that it is not quite true. The shift can be up to 2-3 ticks in both directions (up or down) as demonstrated on the next slide

Looking at more data: 6000 pulses



Last night we actually looked at more data and noticed that fluctuation of “the drift” from pulse to pulse gets larger.

ΔT between two consecutive pulses (SYNC)

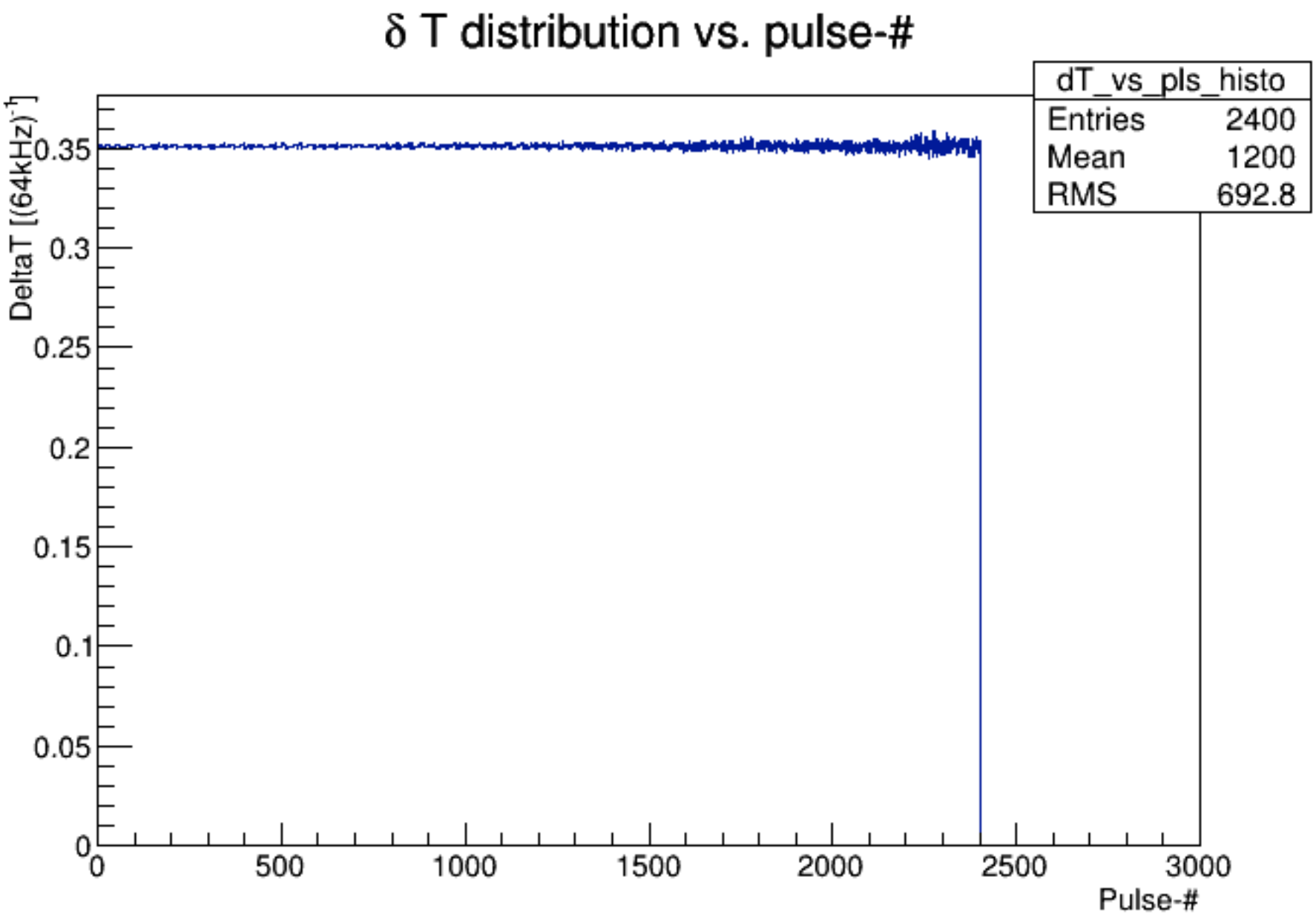


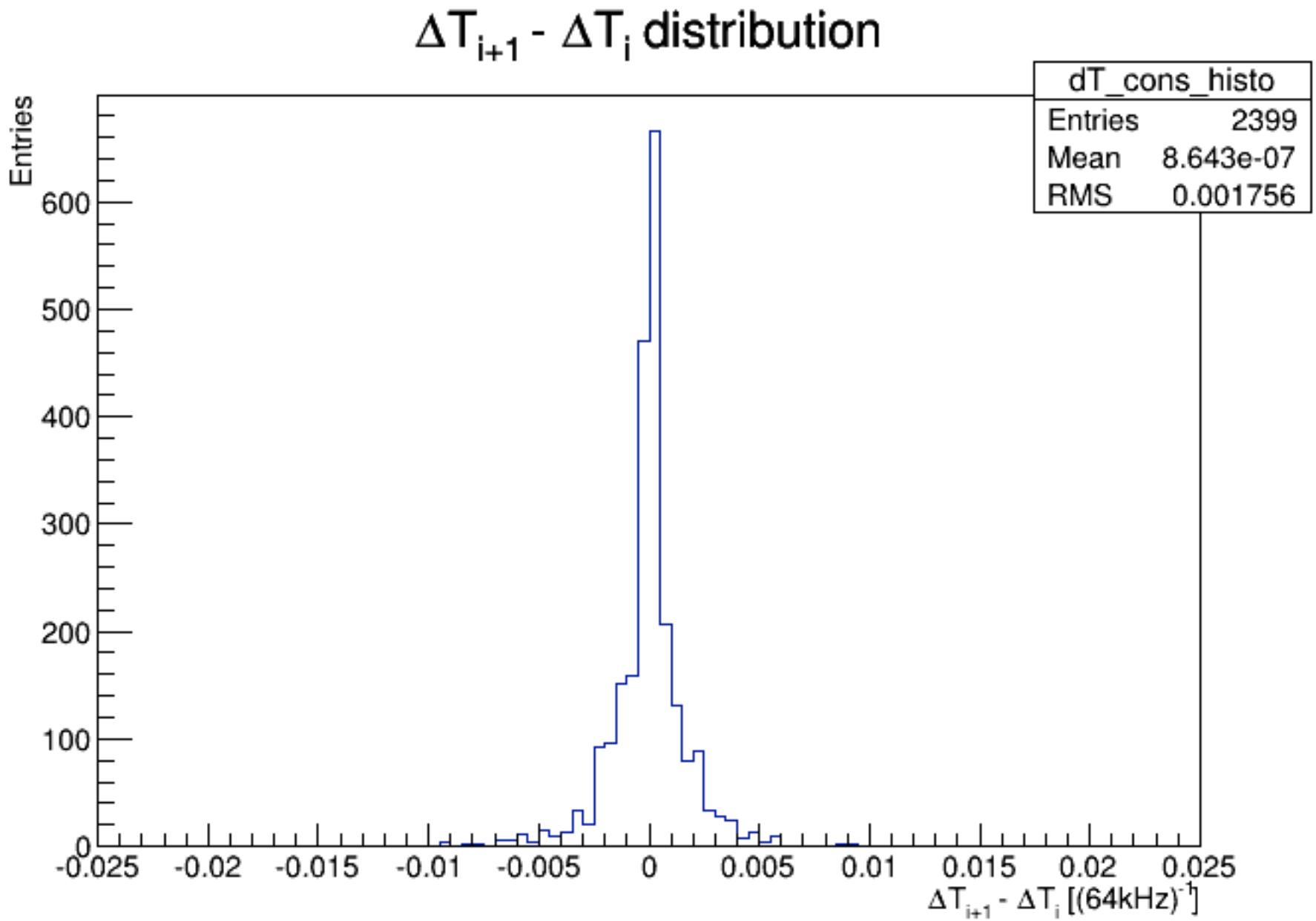
The distribution of the ΔT difference between two consecutive pulses show the overall “drift” distribution from pulse to pulse.

An negative side (down tick direction) it peaks at roughly -1.0 * 1/32MHz.

At positive side (up tick direction) it peaks at roughly about + 2.0 * 1/32 MHz

Updated Results with the fresh FPGA upgrades


δ T distribution vs. pulse-#
dT_vs_pls_histo
Entries 2400
Mean 1200
RMS 692.8
DeltaT [(64kHz)^-1]
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
500
1000
1500
2000
2500
3000
Pulse-#


ΔT_{i+1} - ΔT_i distribution
dT_cons_histo
Entries 2399
Mean 8.643e-07
RMS 0.001756
Entries
600
500
400
300
200
100
0
-0.025
-0.02
-0.015
-0.01
-0.005
0
0.005
0.01
0.015
0.02
0.025
ΔT_{i+1} - ΔT_i [(64kHz)^{-1}]