

Synchronization tests with new ACQ1002 modules

Kabir, Irakli, Vince

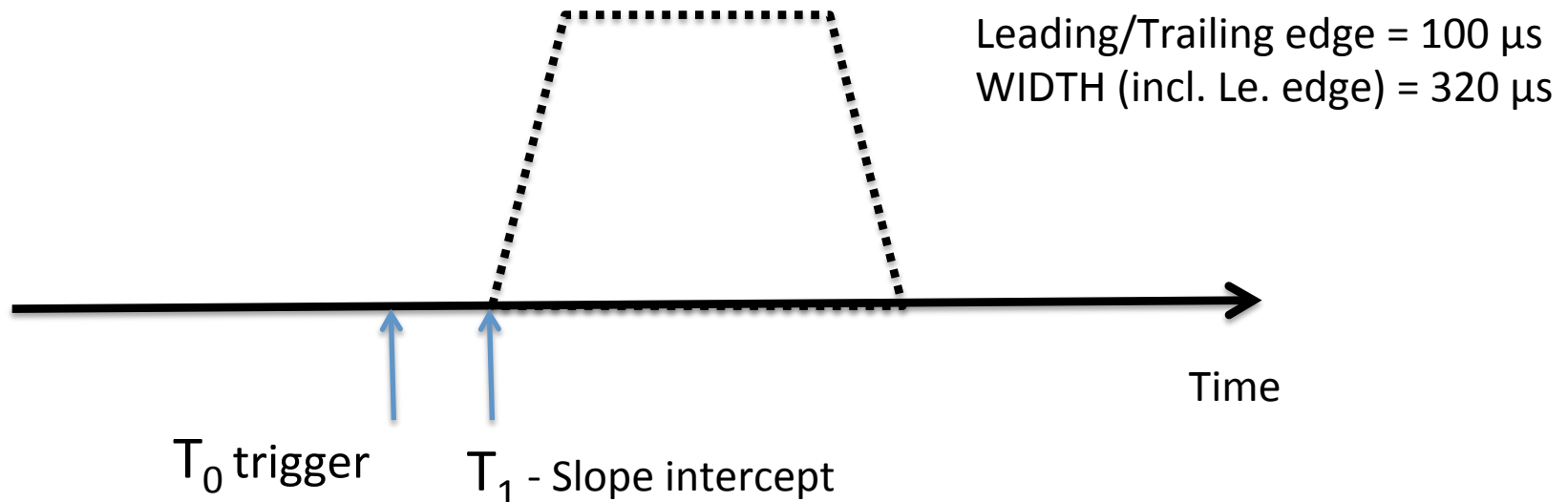
Introduction

Trying to measure synchronization between Master Clock at 32 MHz and the ACQ435 module clock w/ sampling rate 64kHz

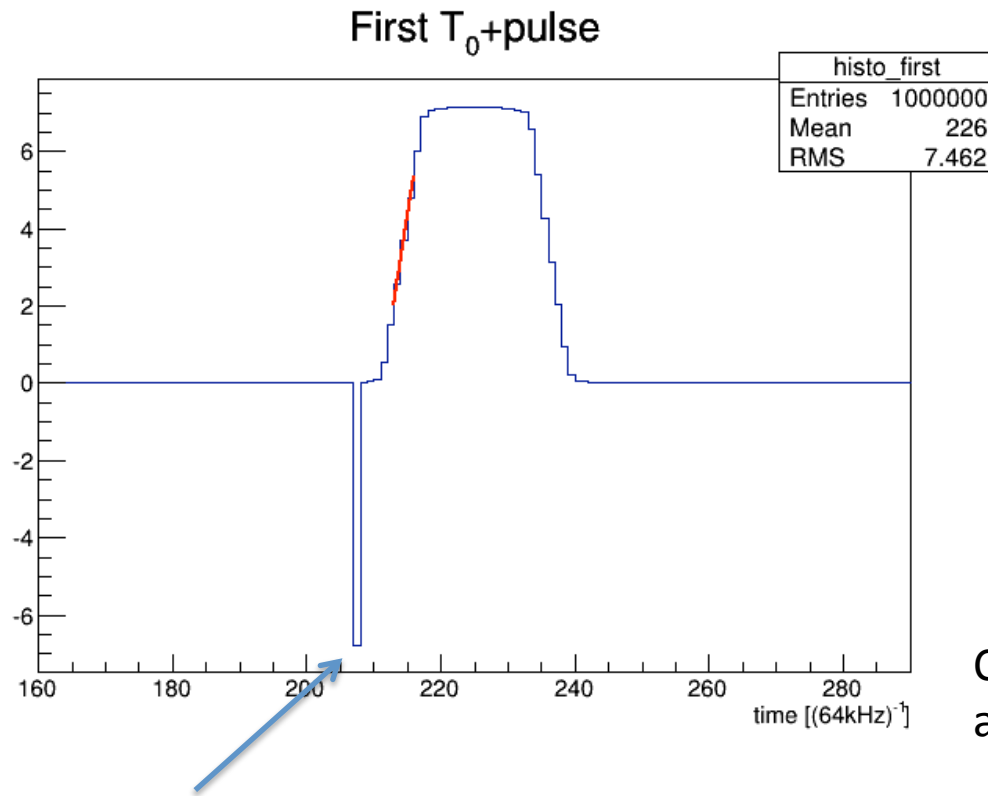
Testing or trying to confirm that in “synchronized mode” jitter between T_0 and First sampled point is from 0 - 32 MHz

In “Non-sync mode” jitter is expected to be from 0 – 64 kHz

Using hp 8161A Pulse Generator borrowed from nEDM (Vince) we have triggering at 60Hz and “modified square pulse” synchronized with the generated trigger



test signal from ADC and algorithm



Header – serving as T_0

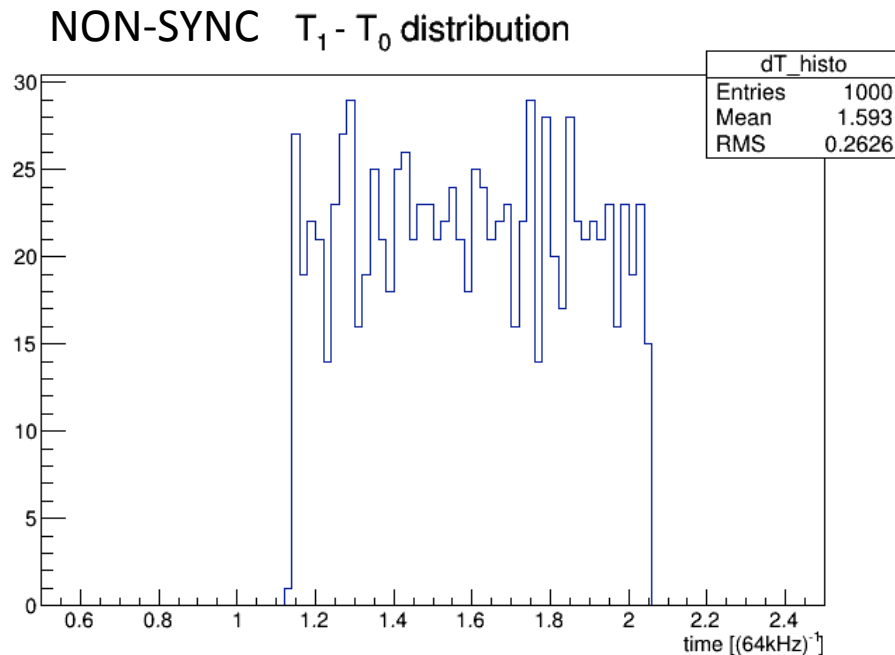
Because RC delay from generator
Leading edge starts $\sim 40 \mu\text{s}$ from T_0

Fitting middle (3 bins) of the Leading edge
by pol1 and calculating the $y=0$ intercept

Calculating $\Delta T = T_1 - T_0$ for every pulse

Comparing ΔT distributions between “sync”
and “non-sync” modes

ΔT distribution

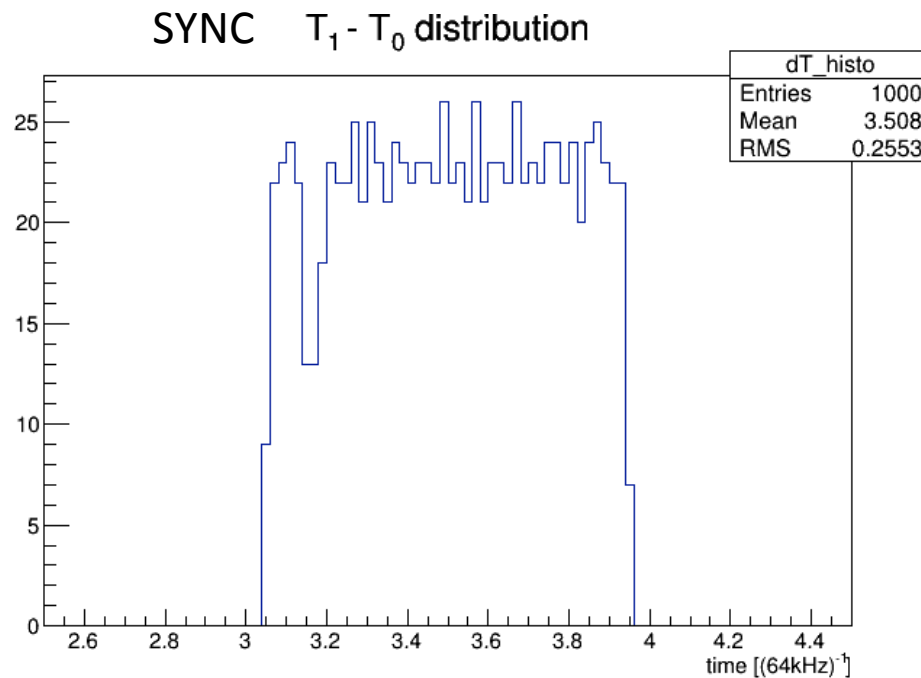


X-axis in units of $1/64\text{kHz}$

Expected spread:

$\sim 1/64\text{kHz}$ for NON-sync

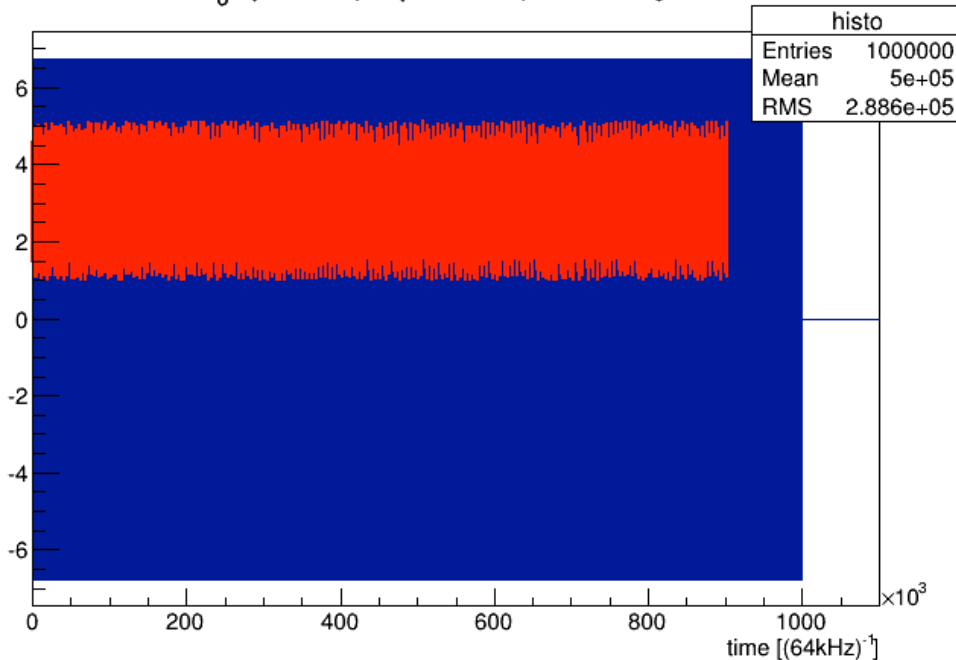
$\sim 1/32\text{MHz}$ for SYNC, i.e.
much smaller



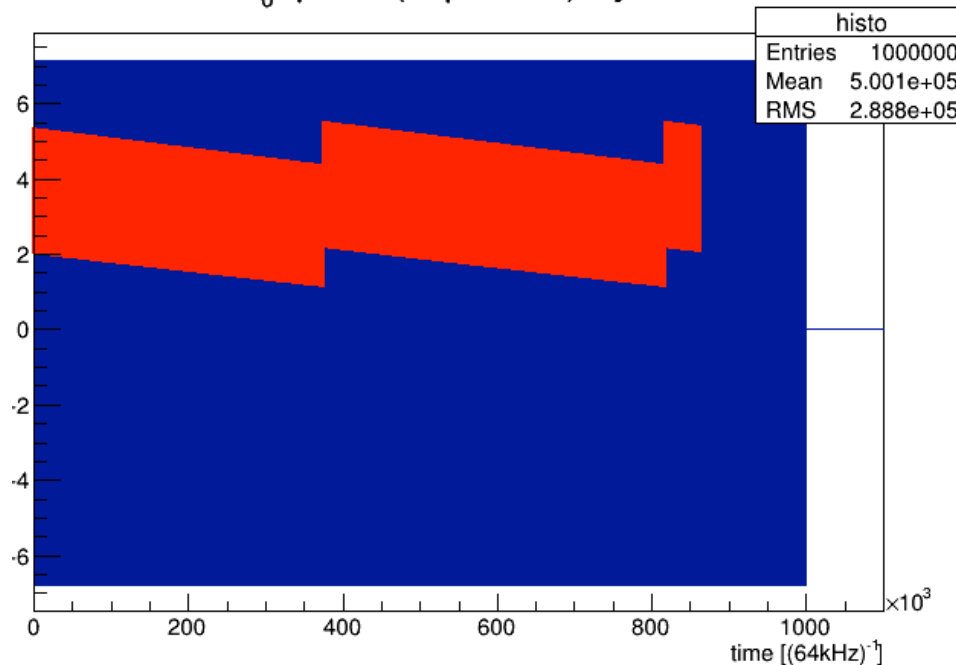
But both appear to be of the
same size $\sim 64\text{kHz}$

No synchronization ?

T_0 +pulse (expanded) NON-sync.



T_0 +pulse (expanded) Sync.



All pulses w/ fits

In Non-sync mode samples appears to be randomly distributed after T_0 with width $\sim 1/64$ kHz... as expected

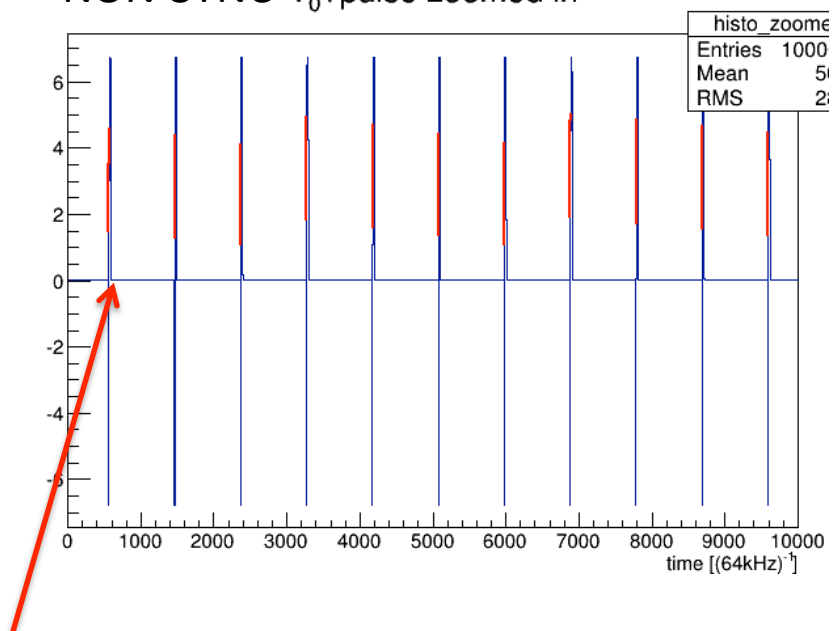
In Sync mode it is systematically shifting and then “resetting” back and shifting again...resulting in the similar width

But if truly synchronized shouldn't we see also random distribution of samples with respect to T_0 with width of 32 MHz ?

Last night Vince pointed out that “drifting cycle” is suspiciously close to 500 counts. ($500 \times 64\text{kHz} = 32\text{ MHz}$)

Could it be that every T_0 trigger samples are drifting away from it by single Master clock tick ($1/32\text{MHz}$) and then resetting????

NON-SYNC T_0 +pulse zoomed in

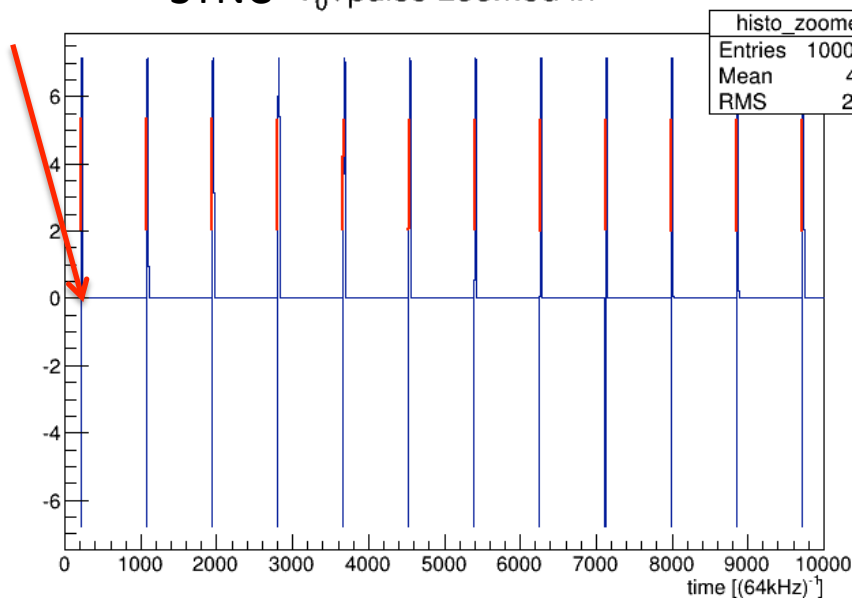


Just another note: First few pulses

After “START” data sampling starts before First T_0 trigger.

This is sometimes the case even for “SYNC mode” as shown (lower plot)

SYNC T_0 +pulse zoomed in



Kabir noticed that sometimes data sampling does start with the first T_0 trigger for SYNC mode ... but only sometimes!