PANDA XLIX. Collaboration Meeting

FEE readout status

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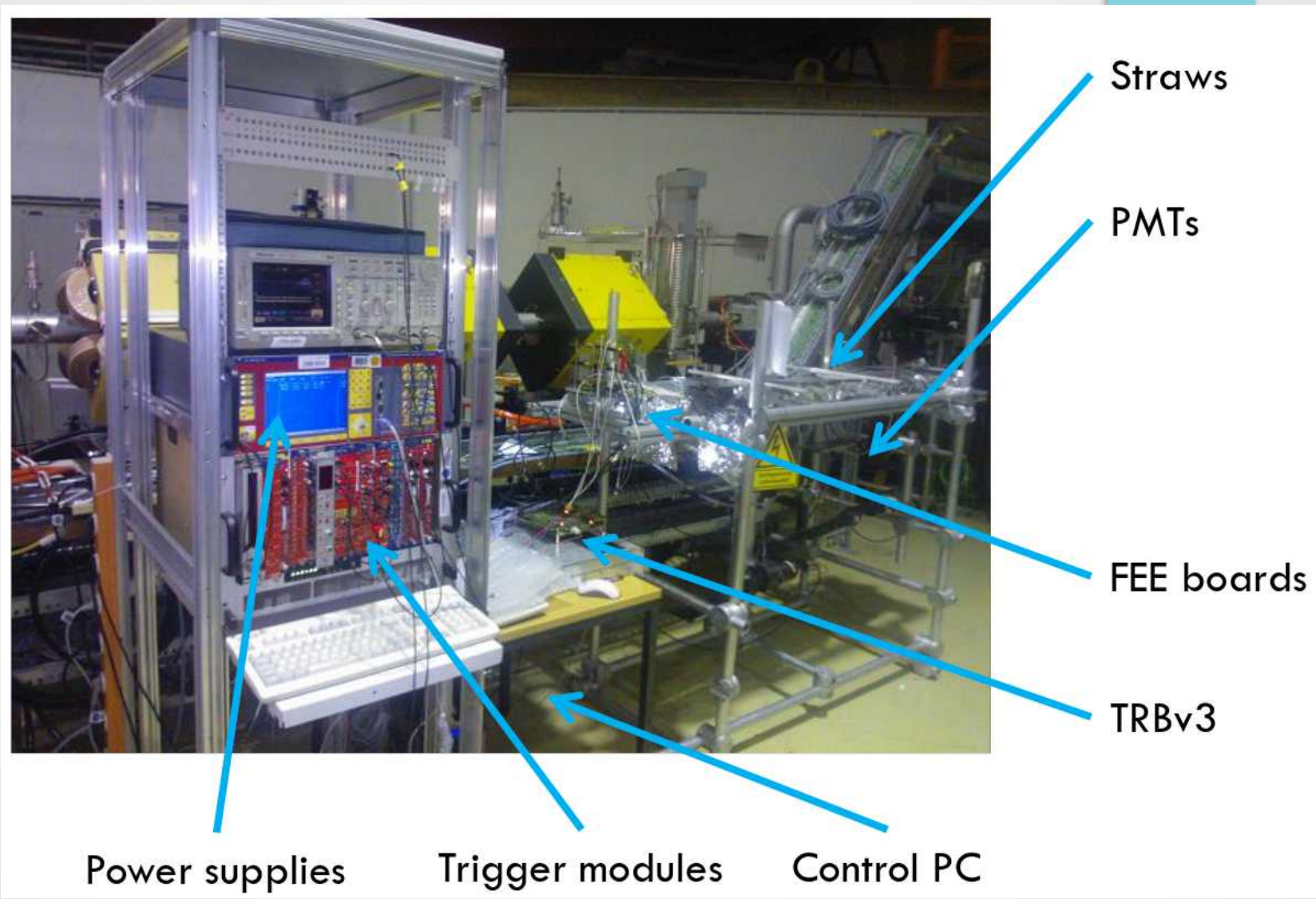
Krakow

10 June 2014

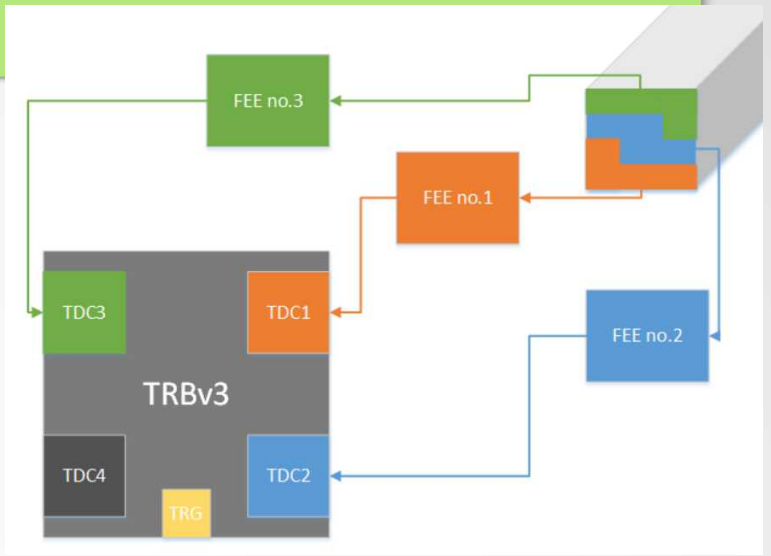
Setup at Juelich



Grzegorz Korcyl talk at PANDA XLVII. Collaboration Meeting (December 2013)

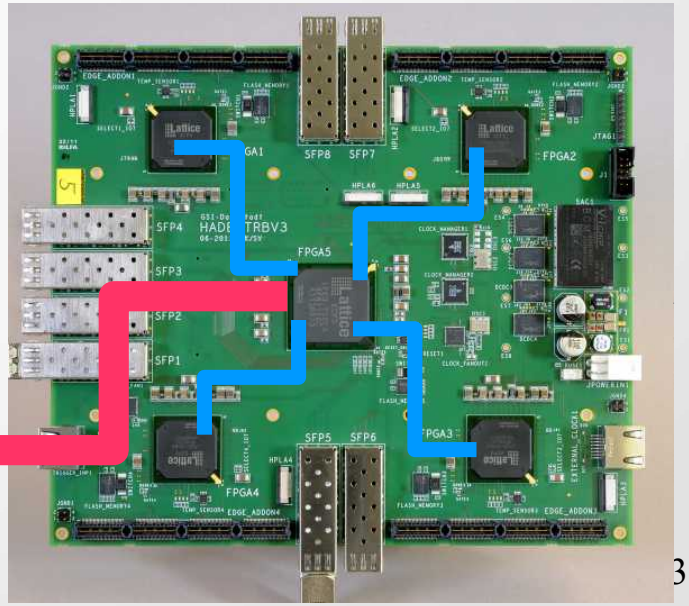
TRB3

- Channels connection:

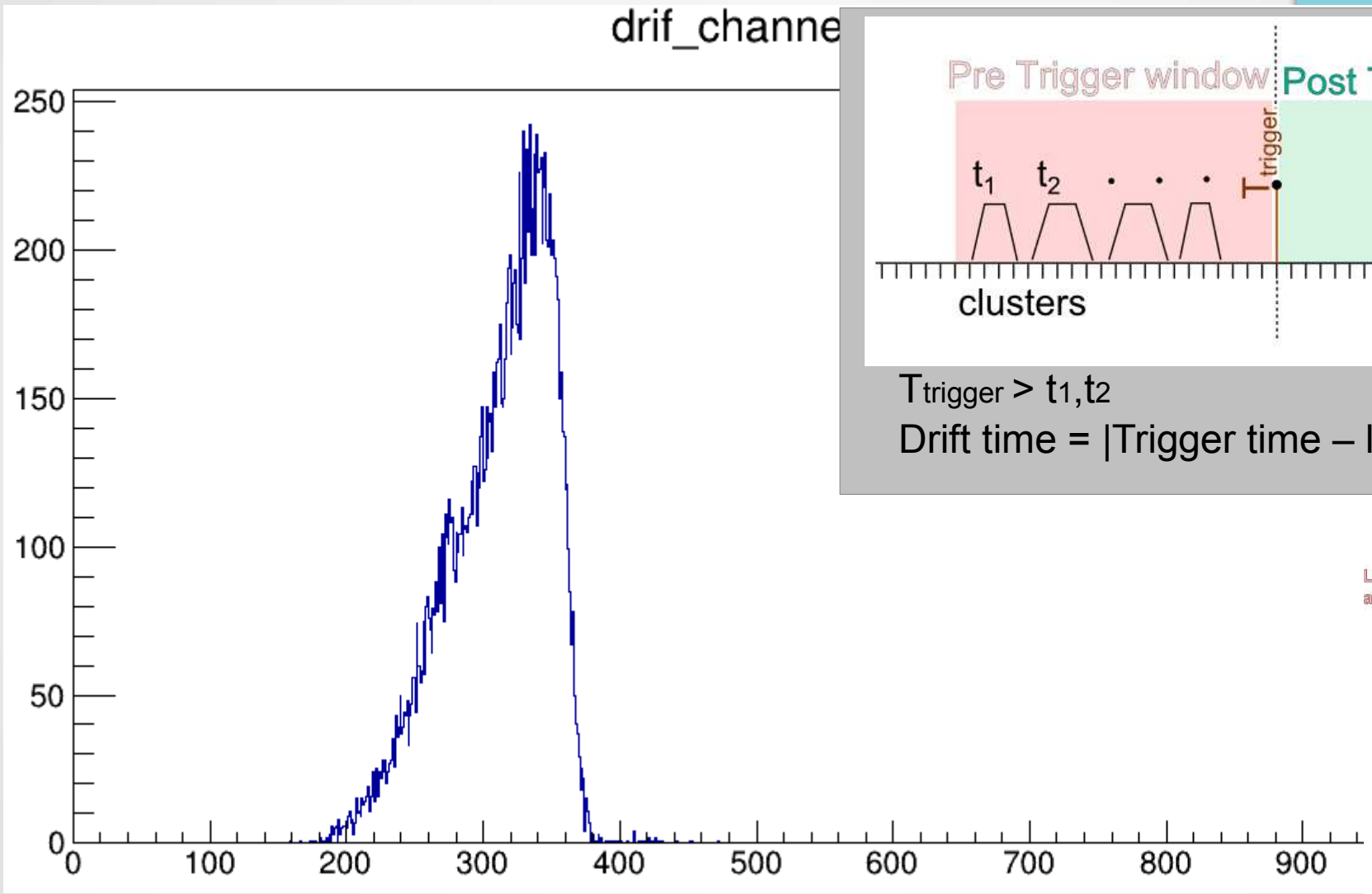


- Reference time distribution:

Trigger signal is processed by central FPGA and then distributed to 4 peripheral FPGA (TDC). Each TDC receives the reference signal on its 0 channel. Redistributed reference signal (blue) is processed with 100 MHz clock.

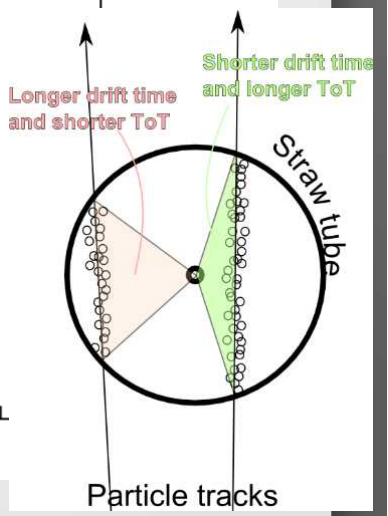


Drift time



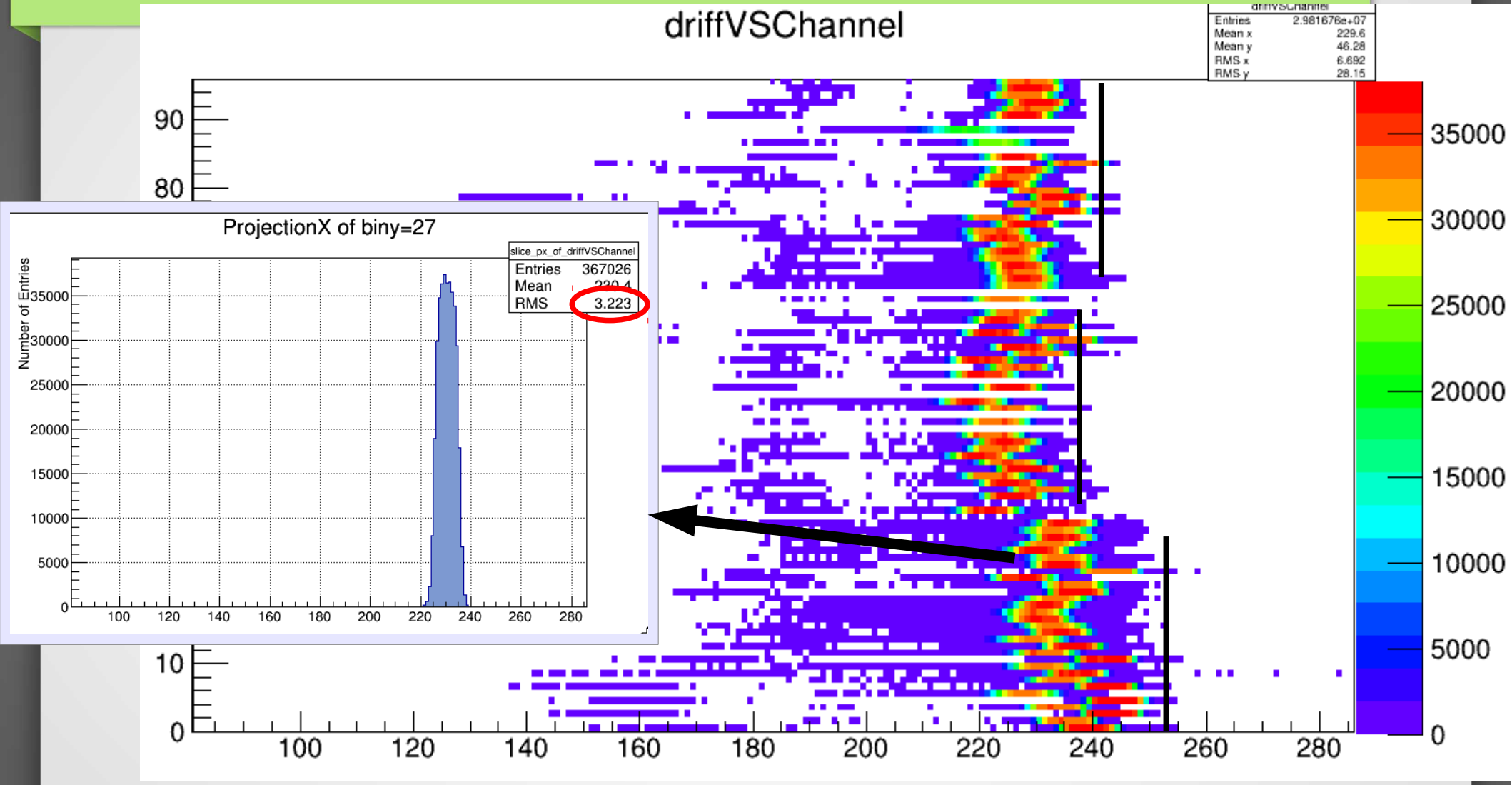
$T_{trigger} > t_1, t_2$

Drift time = |Trigger time – lead time|



Width of the drift time (150 ns) corresponds to 5 mm (straw radius), it means that to obtain 100um of spatial resolution the time must be measured with precision no worse than 3ns.

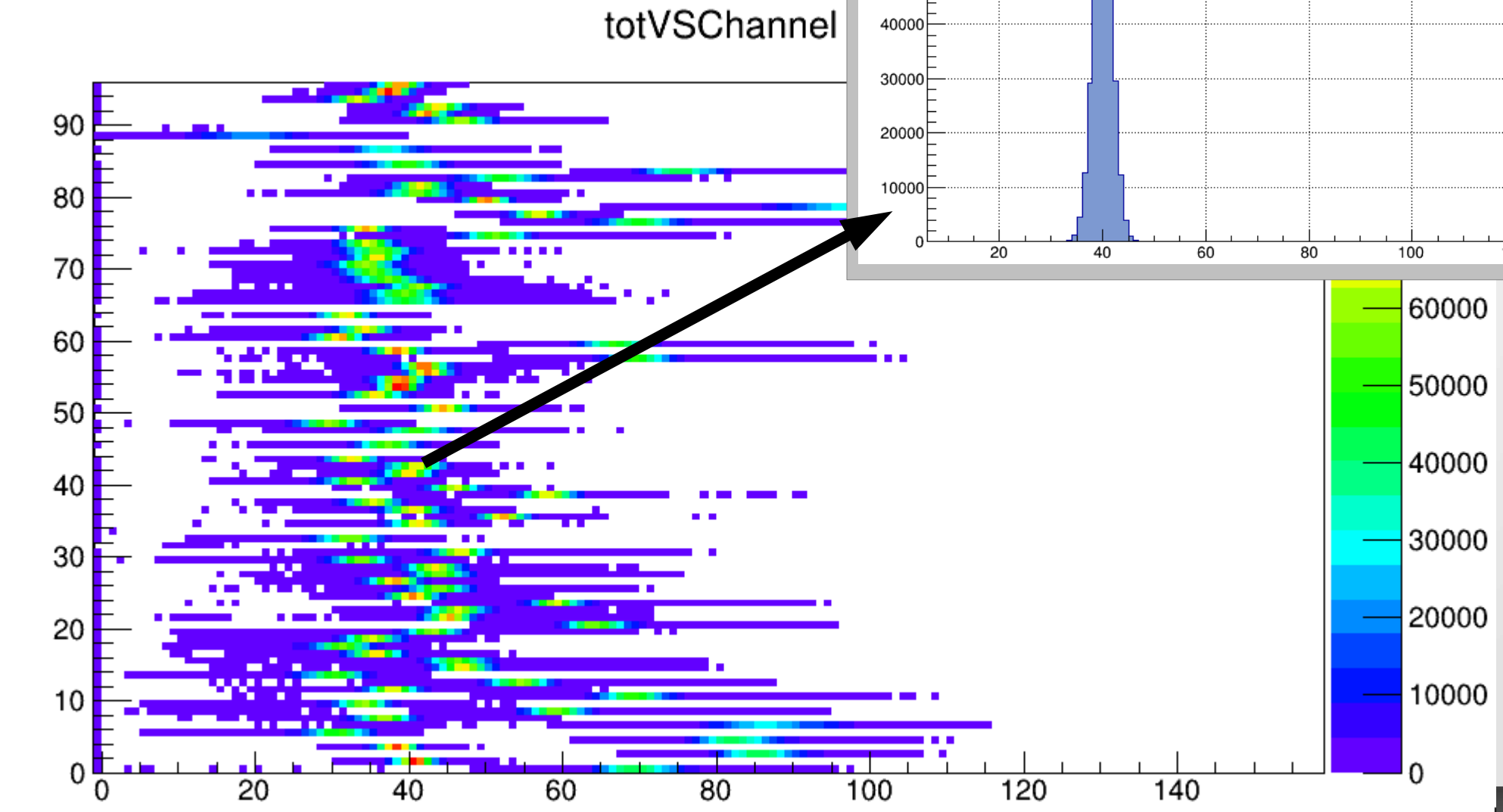
Pulser measurements

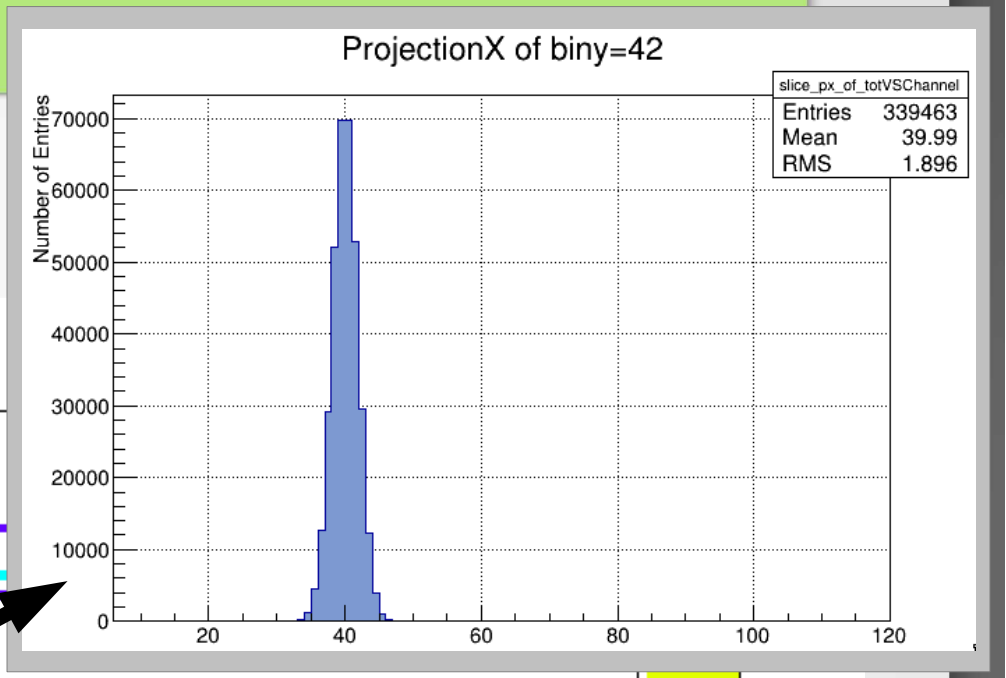


Data taken with pulser shows that each group of 32 channels is shifted (32 ch. = 1 TDC).

Pulser measurements

ToT RMS consists of electronics and noise contribution (straws plugged in during pulser measurements).





Improvements

- TDC calibration and its non linearity corrections (special approach to reference channels of the TDCs)
- Unpacking precise reference time form CTS (central FPGA of the TRB3)
- Using coarse reference time form first channel of each TDC to make TDC alignment
- Change trigger method (trigger mode → trigger less mode)

Non linear correction of TDC

Central Trigger System

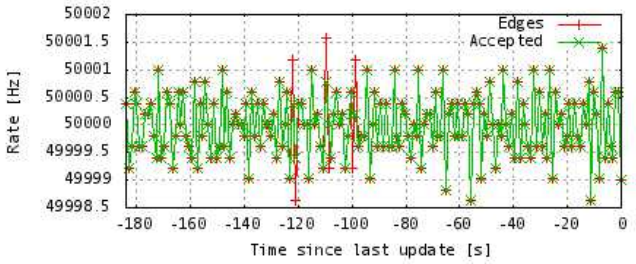
- Status overview

Counter	Counts	Rate
Trigger asserted	431136872 clks.	50.00 Kcnt/s
Trigger rising edges	431136872 edges	50.00 KHz
Trigger accepted	430482935 events	50.00 KHz
Last Idle Time	8150 ns	
Last Dead Time	11850 ns	84.39 KHz

Throttle — Limit Trigger Rate to 1 KHz

Full Stop — Ignore all events

Export CTS Configuration — as TrbCmd script — as shell script



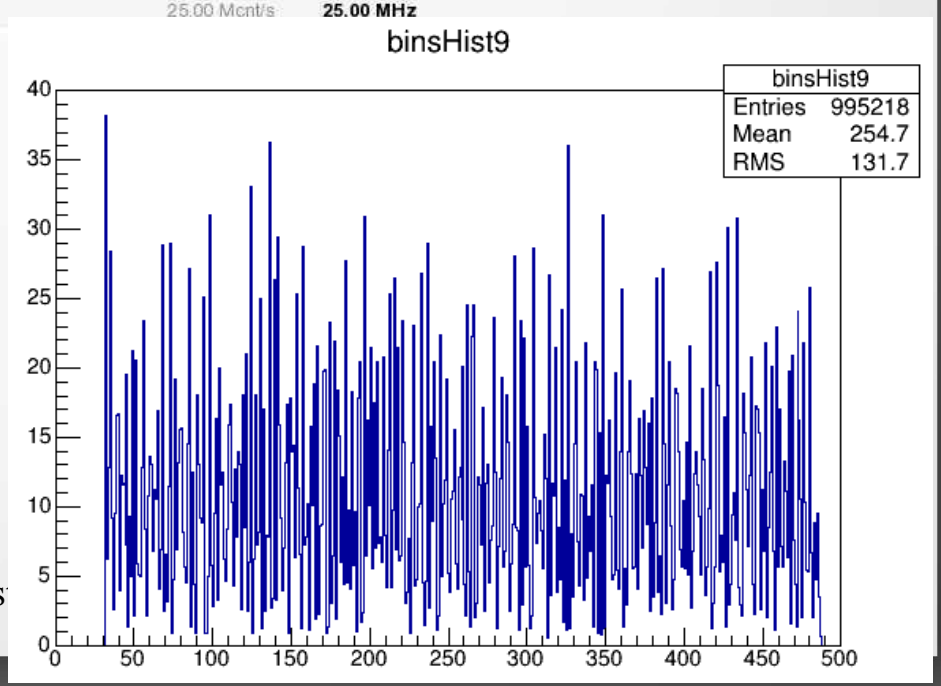
Click on the image to switch between short and long plotting intervals

- Trigger Channels

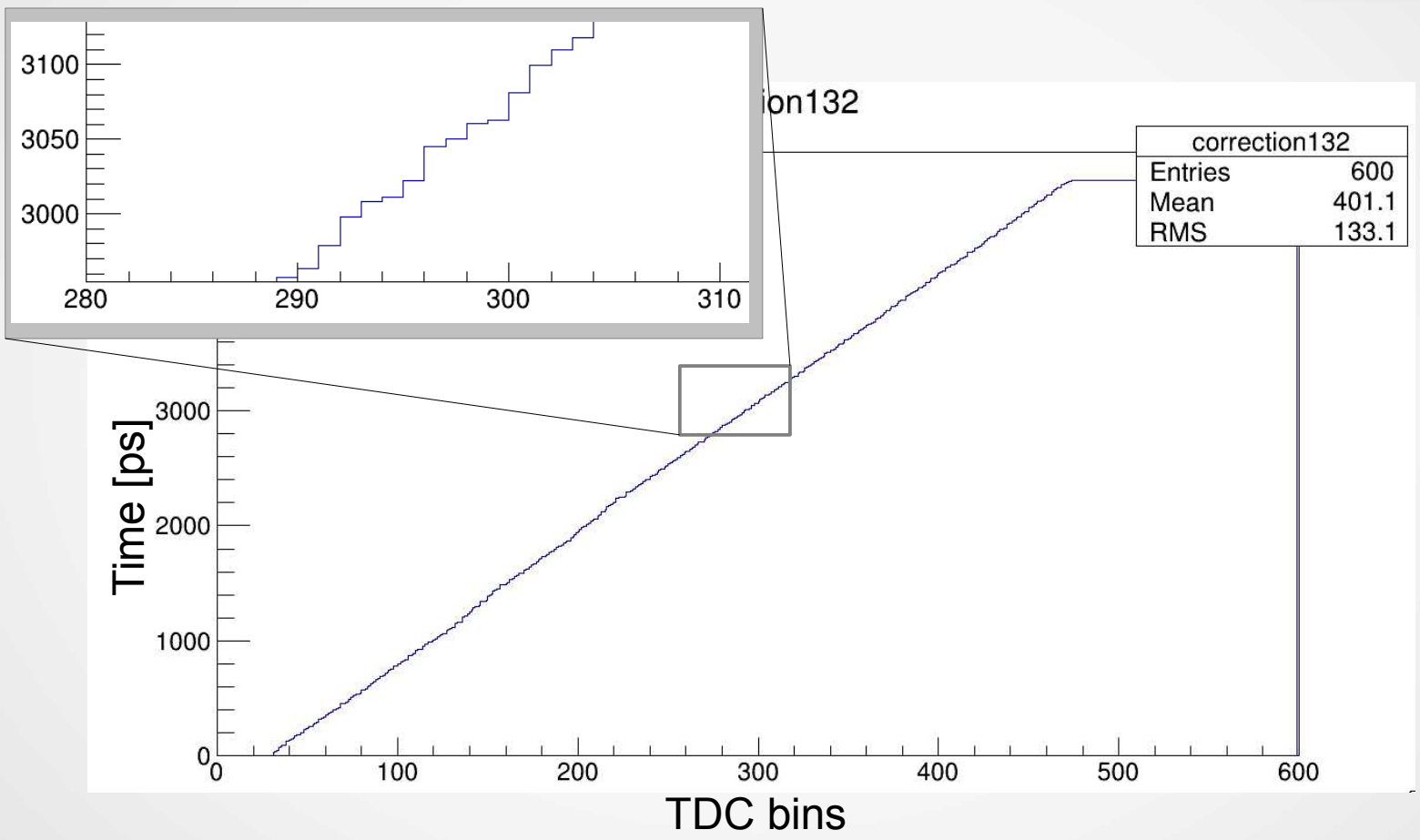
#	Enable	Trg. Cond.	Assignment	TrbNet Type	Asserted	Edges
0	☐	R. Edge	Ext. Logic - CBM	0x1_physics_trigger	0.00 cnt/s	0.00 Hz
1	☑	R. Edge	Periodical Pulser 0	0x1_physics_trigger	50.00 Kcnt/s	50.00 KHz
2	☐	R. Edge	Periodical Pulser 1	0x1_physics_trigger	25.00 Mcnt/s	25.00 MHz

Calibration mode of TDC generates many hits per channel.

TDC measure time with 3 types of counters. Epoch counter which is incremented every 10,24us, coarse time counter (5ns) and fine time counter (10,6ps). Left hand side histogram presents fine time distribution.



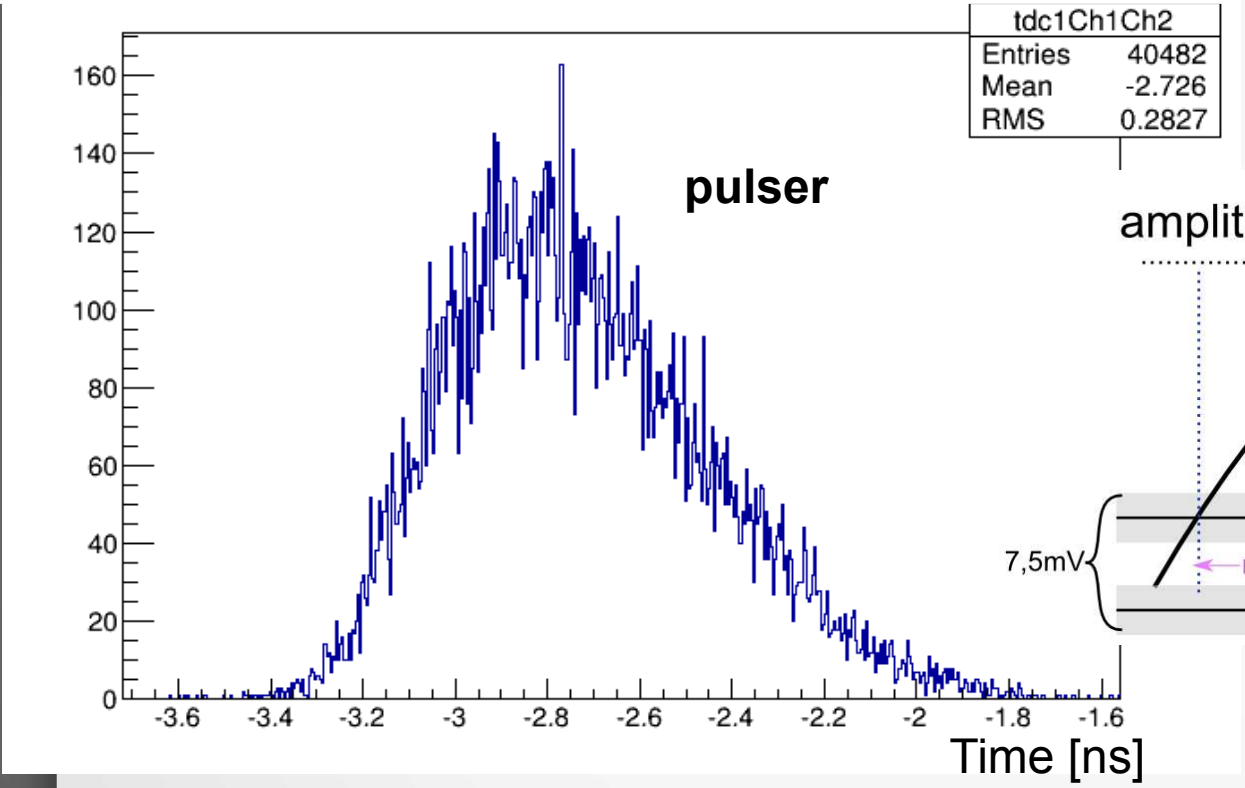
Non linear correction of TDC



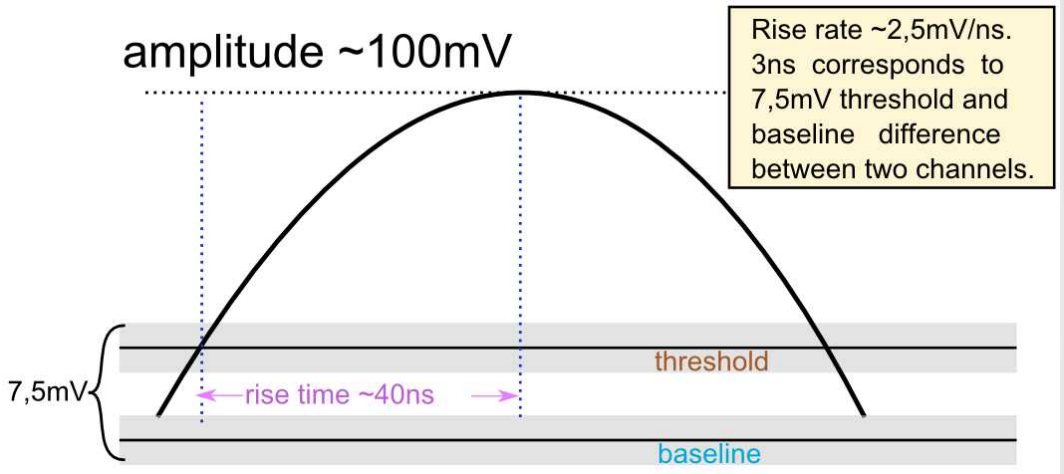
For each TDC channel the correction histogram is generated. Then it is used during data unpacking process to calibrate TDC (applying corrections for non linearity).

Improvements results

Lead time difference between two channels on one TDC.



Walk effect

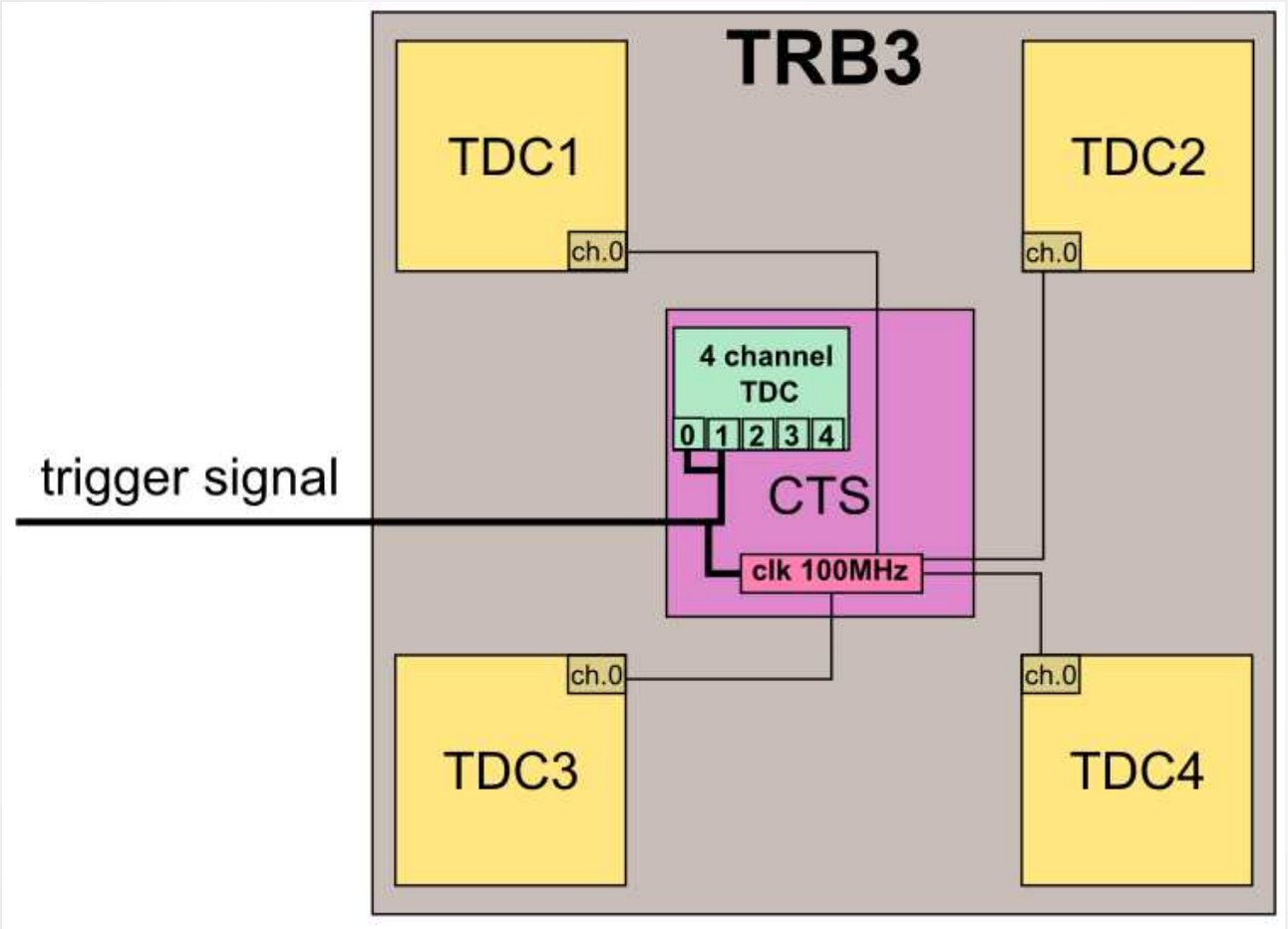


Mean value of the histogram may be result of

- the baseline and threshold difference among two channels,
- gain difference among the ASIC channels.

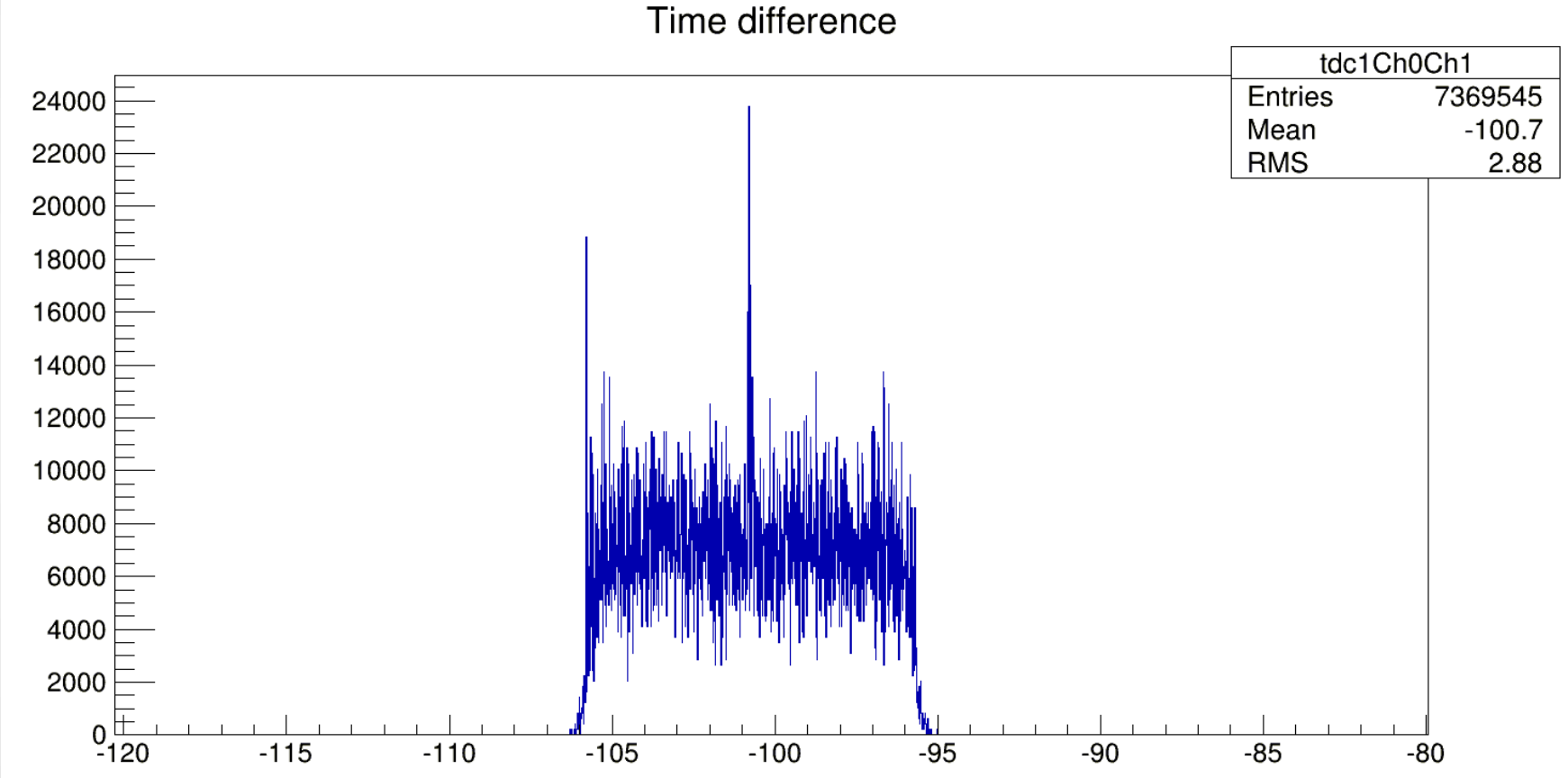
Otherwise for signal from generator we would suspect histogram position at zero.

TDC synchronization



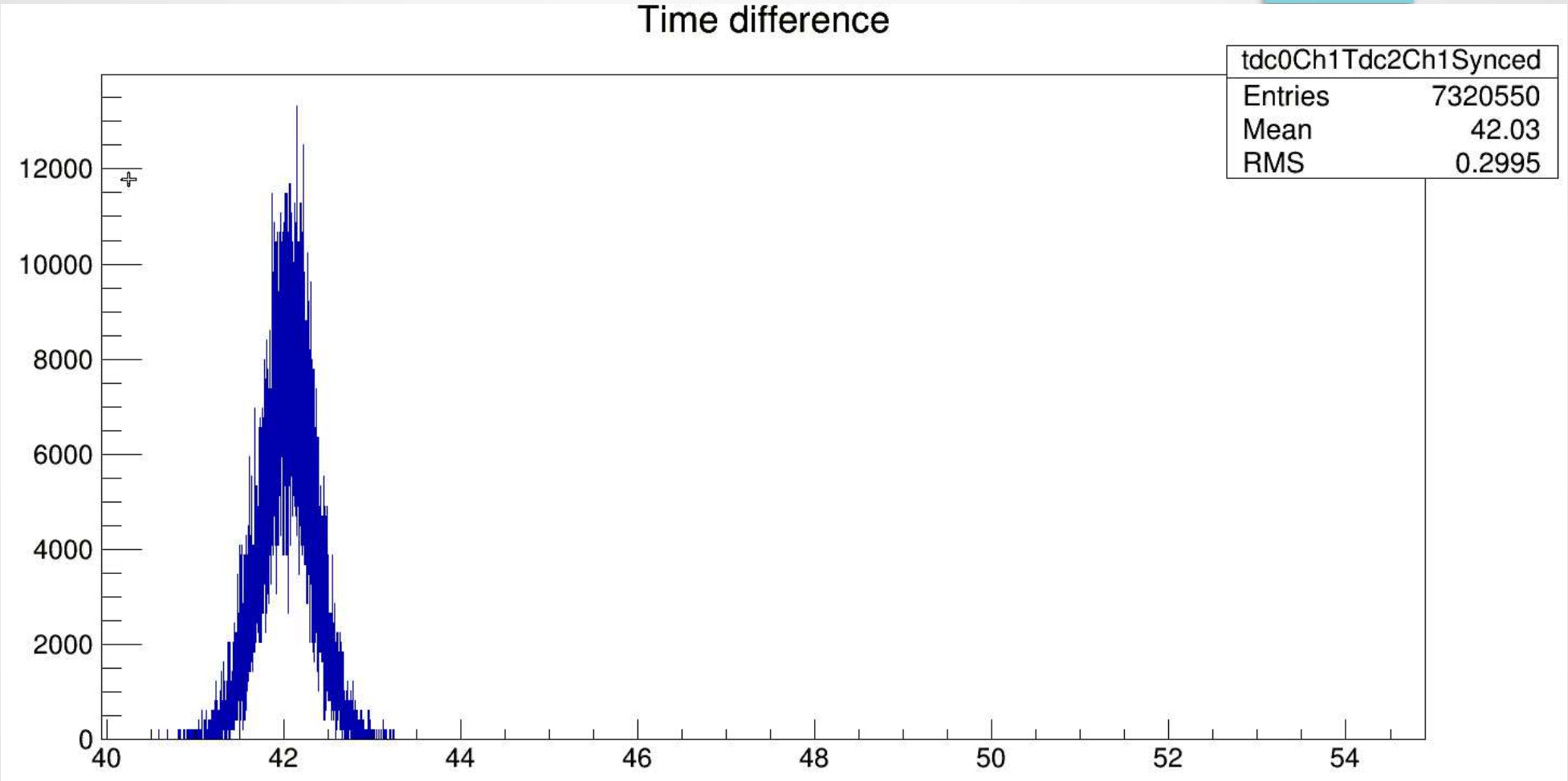
Reference time calculation: $(T_{tdc0ch1} - T_{tdc0ch0}) - (T_{tdc1ch1} - T_{tdc1ch0})$

Wrong reference channel



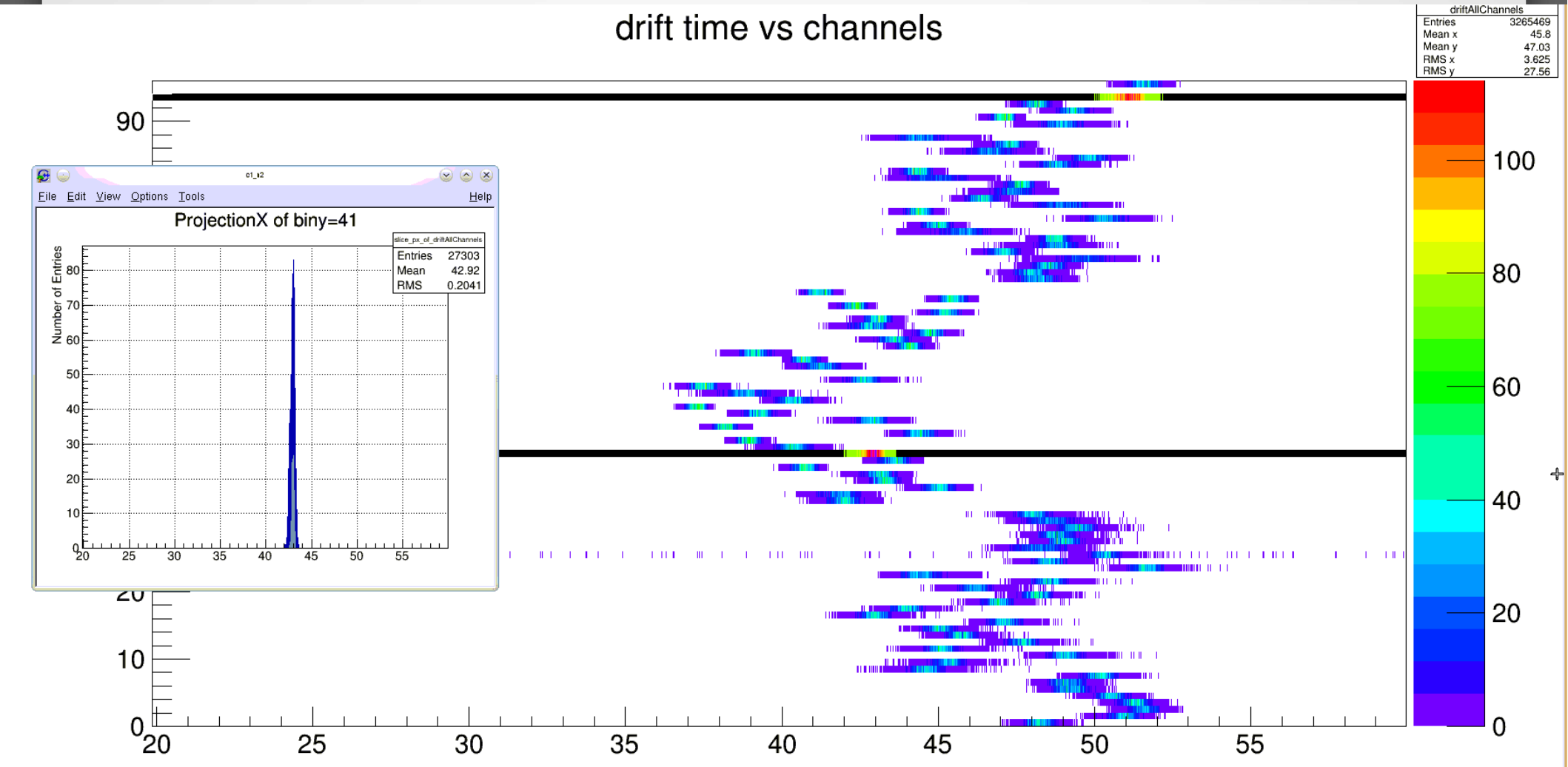
Lead time difference between channel 0 and channel 1 of one of the TDC. Width of 10 ns appears due to 100MHz clock, which process trigger signal on CTS.

TDC synchronization



Lead time difference between two channels on different TDCs. Synchronization procedure applied. Drift time is difference between lead time of trigger signal measured on CTS and and signal from FEE measured on peripheral TDC.

Drift time for all channels



Outlook

- Some minor bugs still have to be improve
- 32 channel TDC version 1.6.2 is needed (current version is 1.5)
- General purpose add-on for beam test (July 2014) – back up solution for trigger time

Thank you for your attention!

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Acknowledgments:
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