

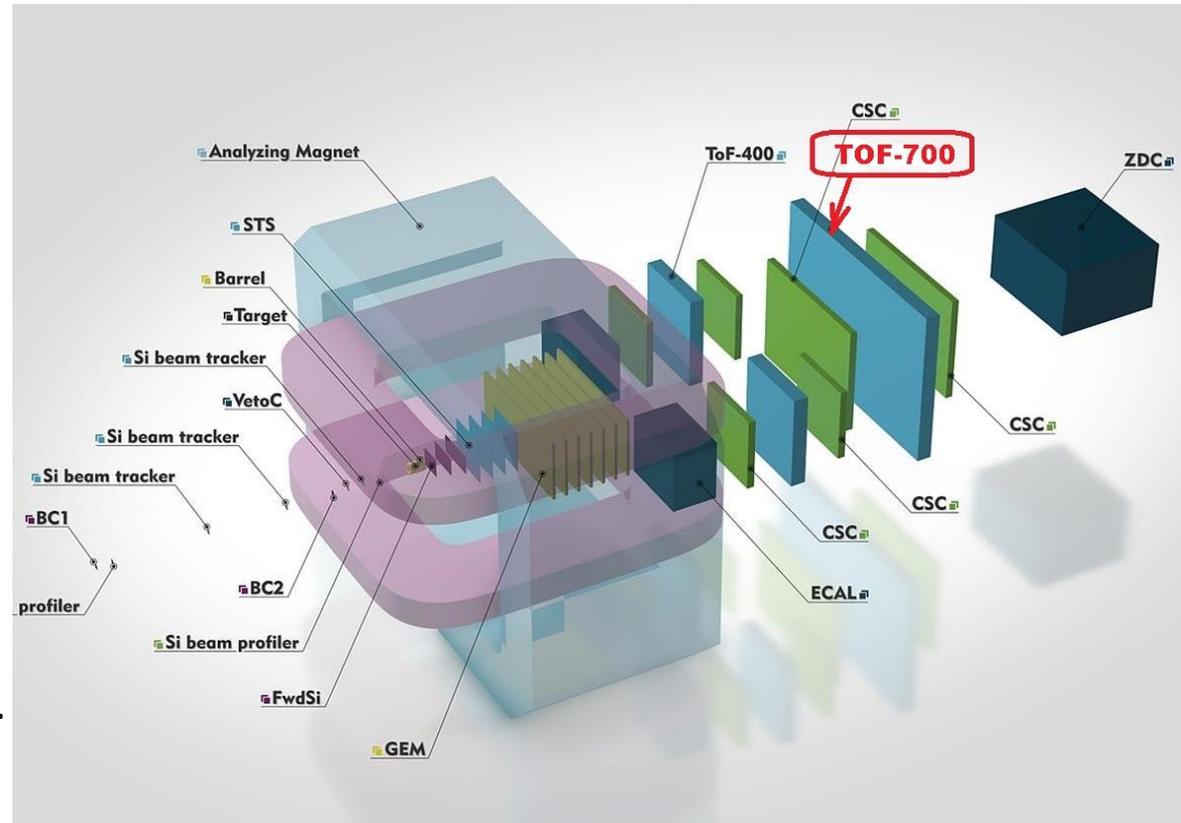
# FEE for RPC TOF for BM&N experiment JINR, Dubna, Russia.

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Dubna, Russia.

# BM&N experiment - Baryonic Matter at the Nuclotron.

## TOF-700.

- 700 cm from interaction point
- two X and Y walls 4x5m,
- 4096 channels,
- 6-gape RPC detector,
- central chambers - warm RPC,
- two side strip readout,
- 30 and 50 cm strips length,
- 17 mm and 25 mm strip width.



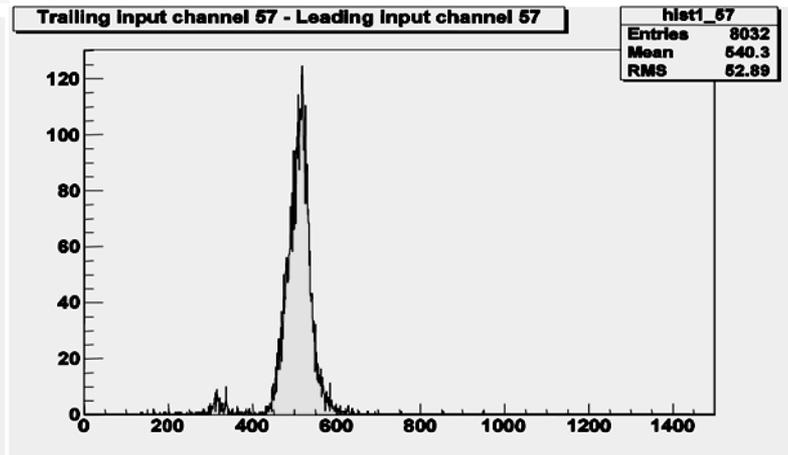
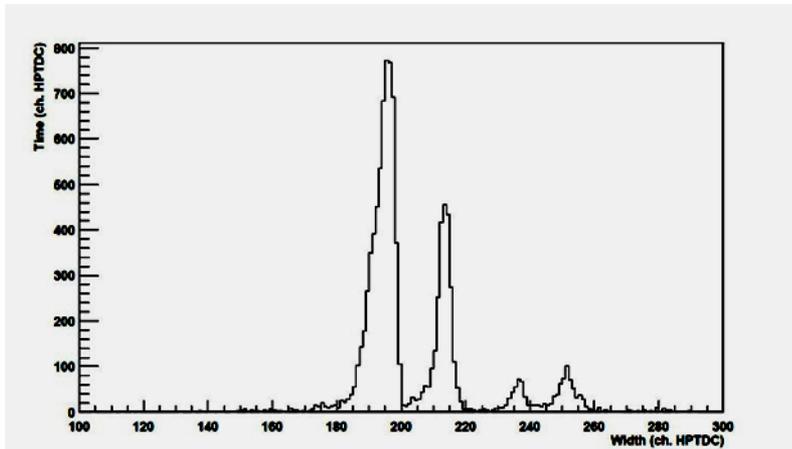
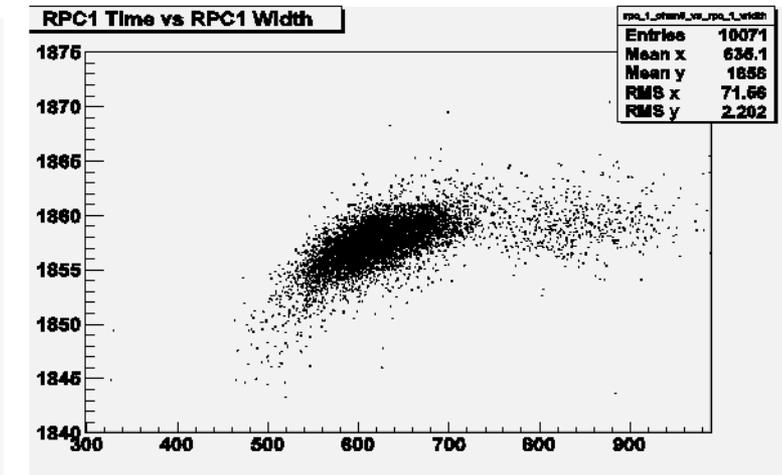
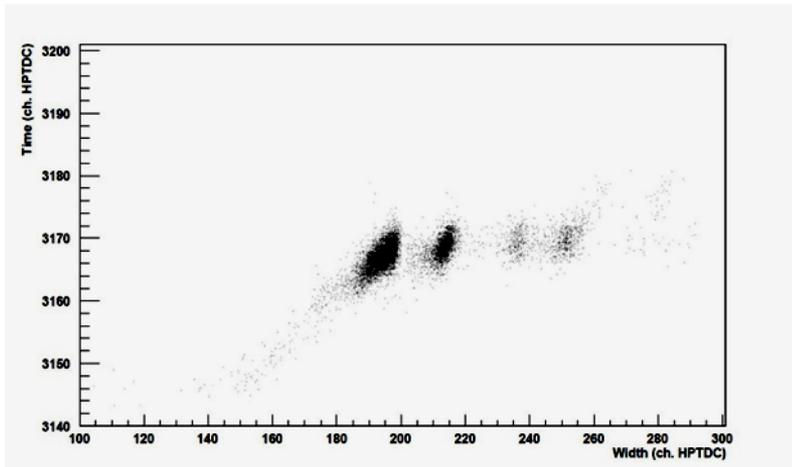
# Time Over Threshold method introduction.

- main motivation and first problems,
- TOT method first step – NINO chip for ALICE TOF,
- two discriminators structure for TOF applications,
- expanded TOT method for large dynamic range,
- discrete results, beam tests,
- conclusions.

# Direct TOT Q-W conversion. What in the problem?

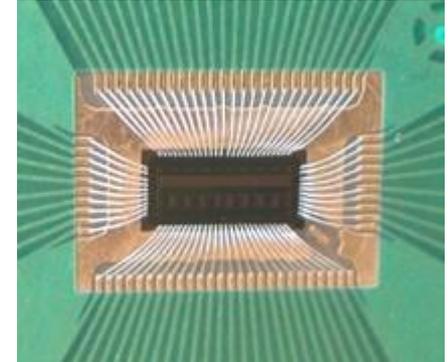
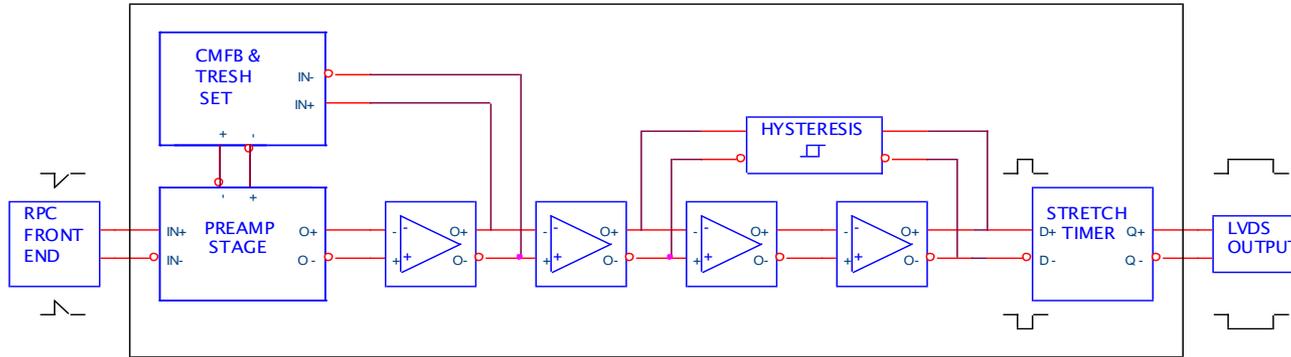
Direct TOT method – ALICE TOF NINO  
chip discriminator.

Modified TOT method – monopulser  
with 30ns shaping time



# NINO ASIC for ALICE TOF specifications.

NINO ASIC is a first special design for TOF application and TOT method

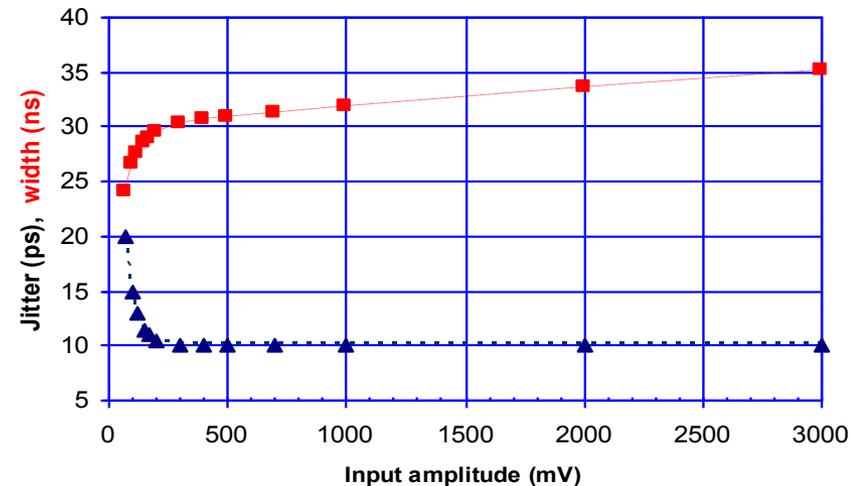


## NINO ASIC electronic channel main specs:

- <math><1\text{ns}</math> peaking time ( $\sim 500\text{ MHz}$  BandWidth)
- $\sim 6\text{ ps}$  time jitter
- 1-6ns TOT width deviation
- CMFB for input offset reduction
- diff input resistance matching from 40 to 75 Ohm
- stretch time expanding
- differential input-output structure
- hysteresis 1-12%

## Jitter & width of NINO-chip vs. Input amplitude

Setup:  $U_{thr}=70\text{mV}$ ,  $U_{hys}=0\text{V}$ ,  $U_{str}=0.95\text{V}$ ,  $R_{ext}=25\text{ Ohm}$ .



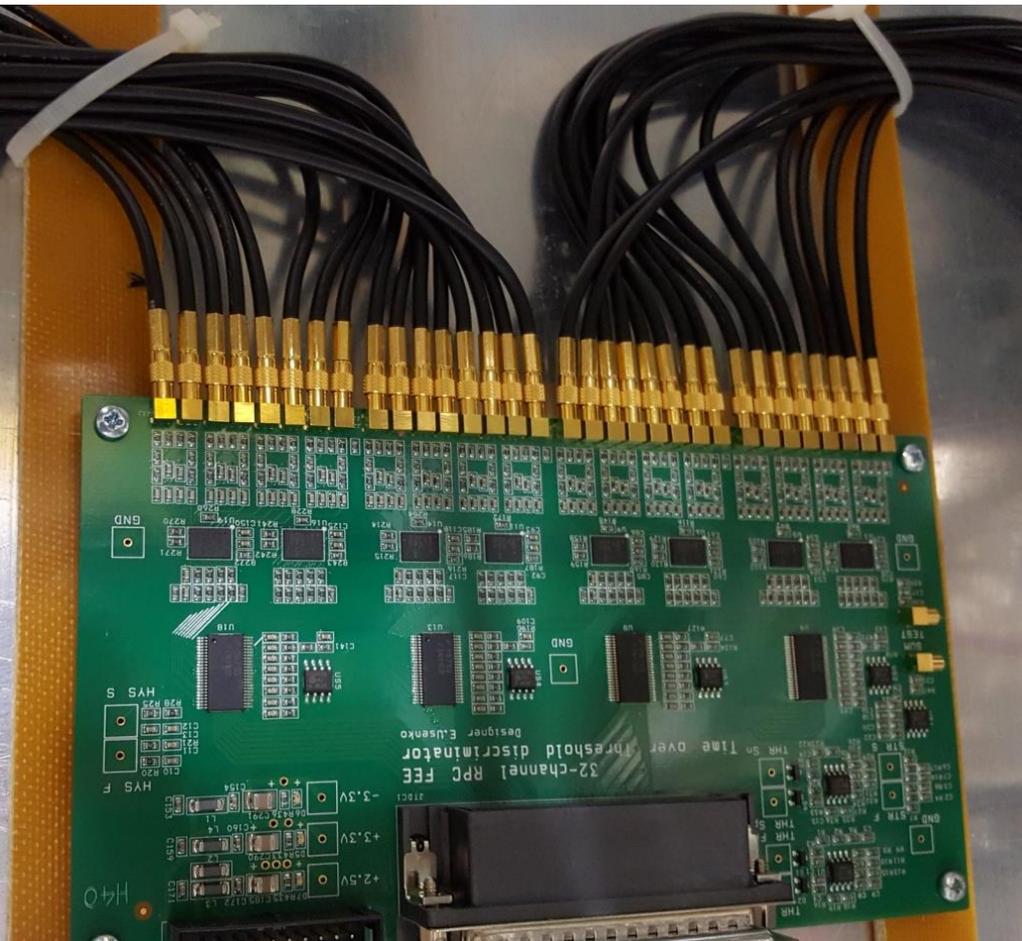
# JINR BM&N experience.

## 32-channel TOF RPC discriminator

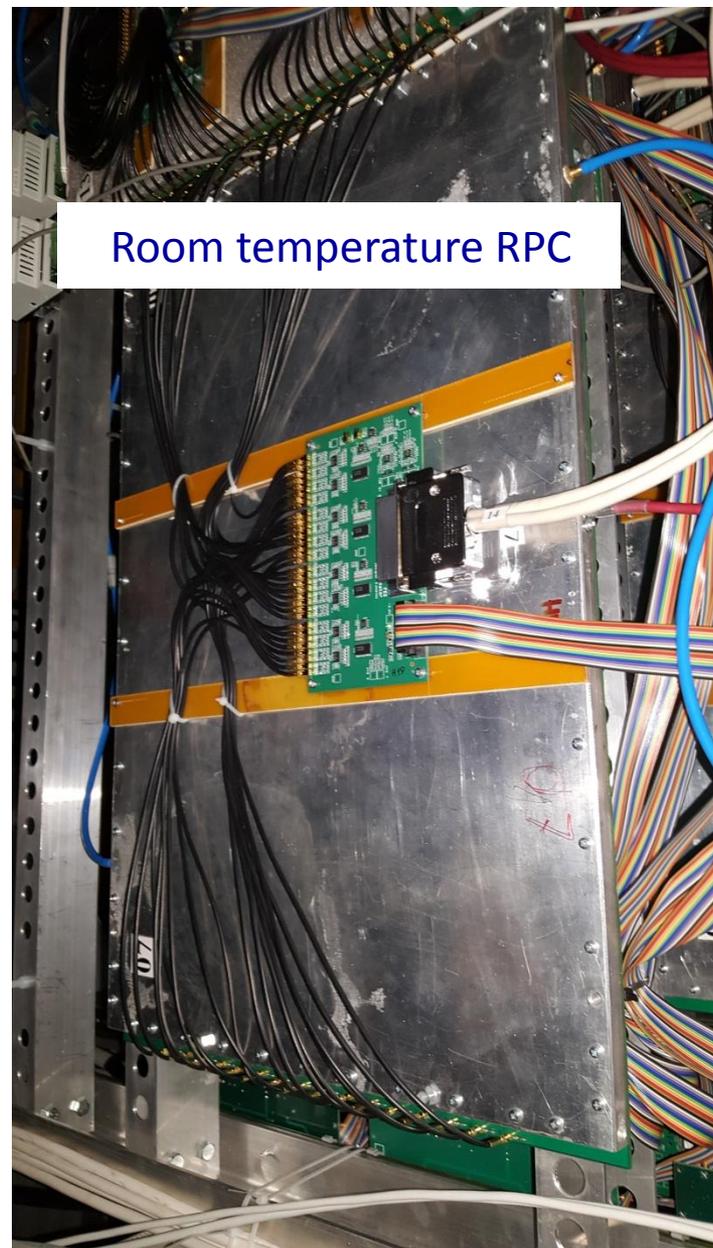
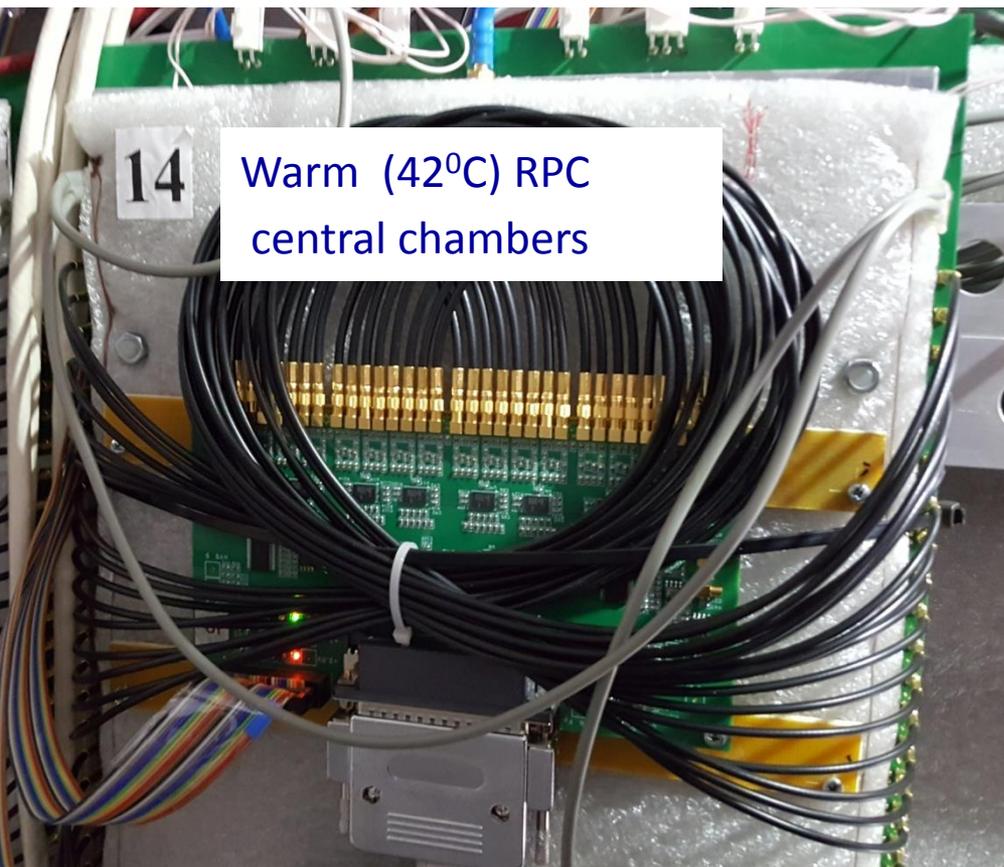
32-channel FEE TOF card +TOT function

128-channel Service Boards

- Power, Control, Multiplicity cluster

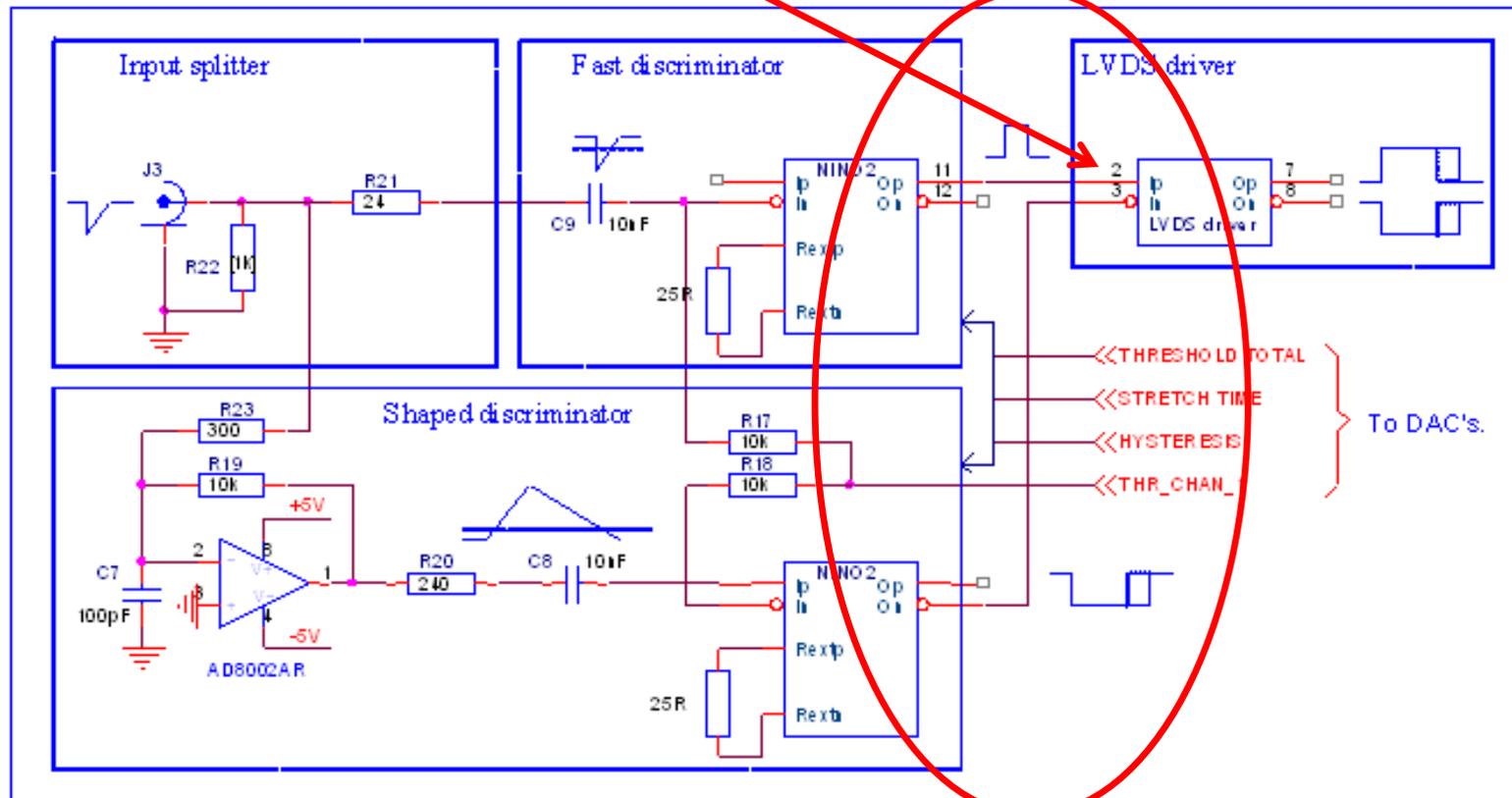


# JINR BM&N experience. 32-channel RPC warm and room temperature chambers



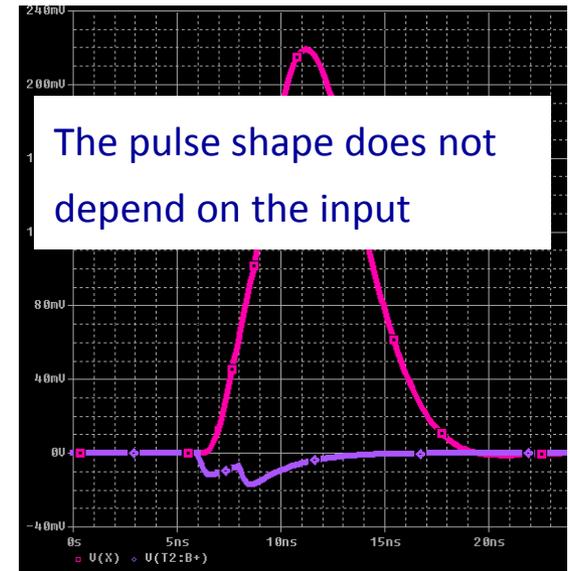
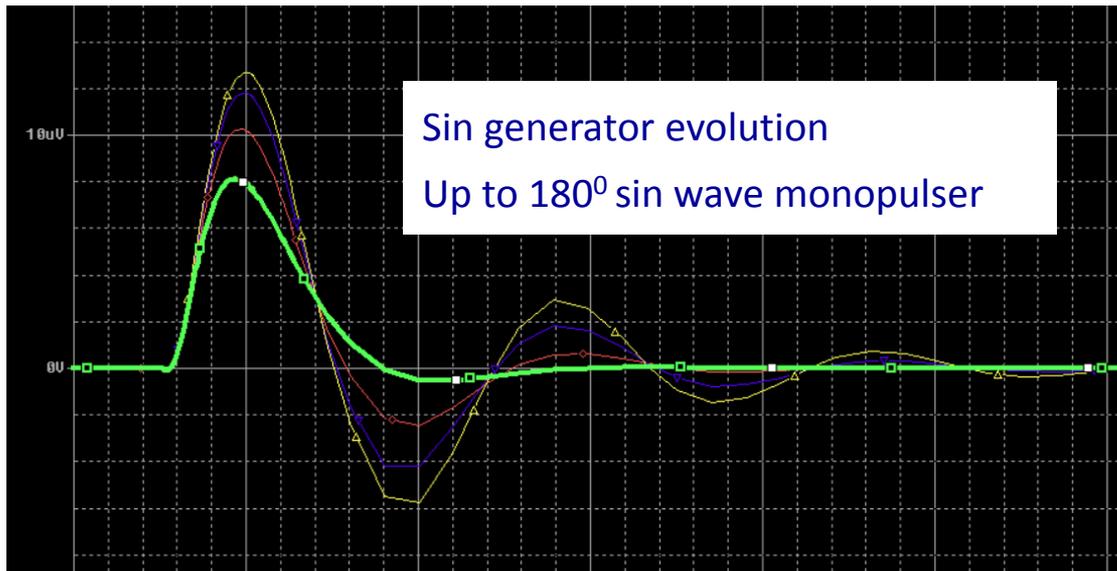
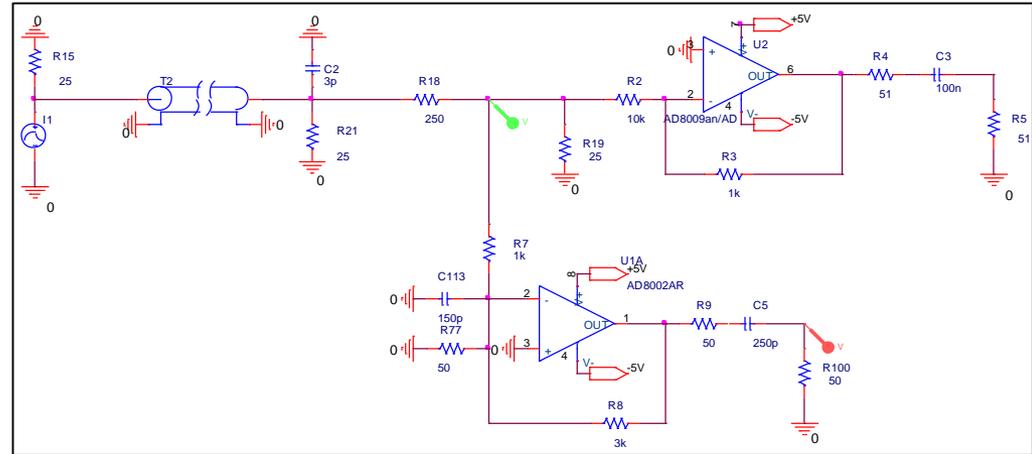
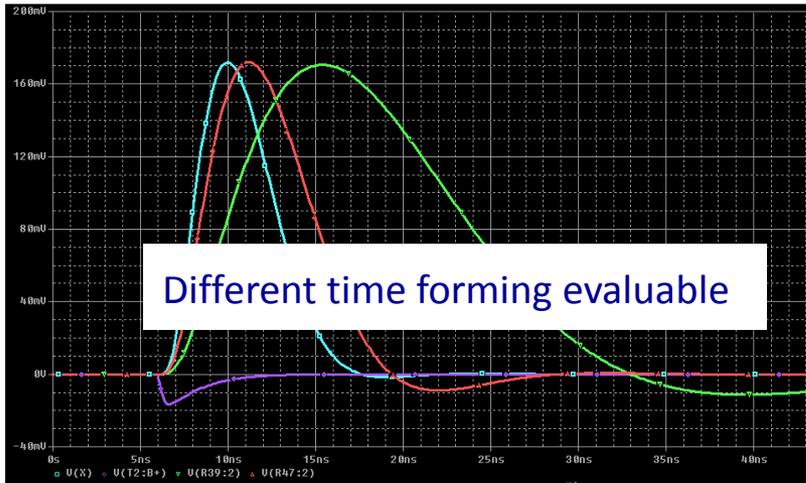
# TOT two channel structure.

Fast and slow (shaped) discriminators based on NINO ASIC  
LVDS driver is combine fast and slow pulses to one output pulse



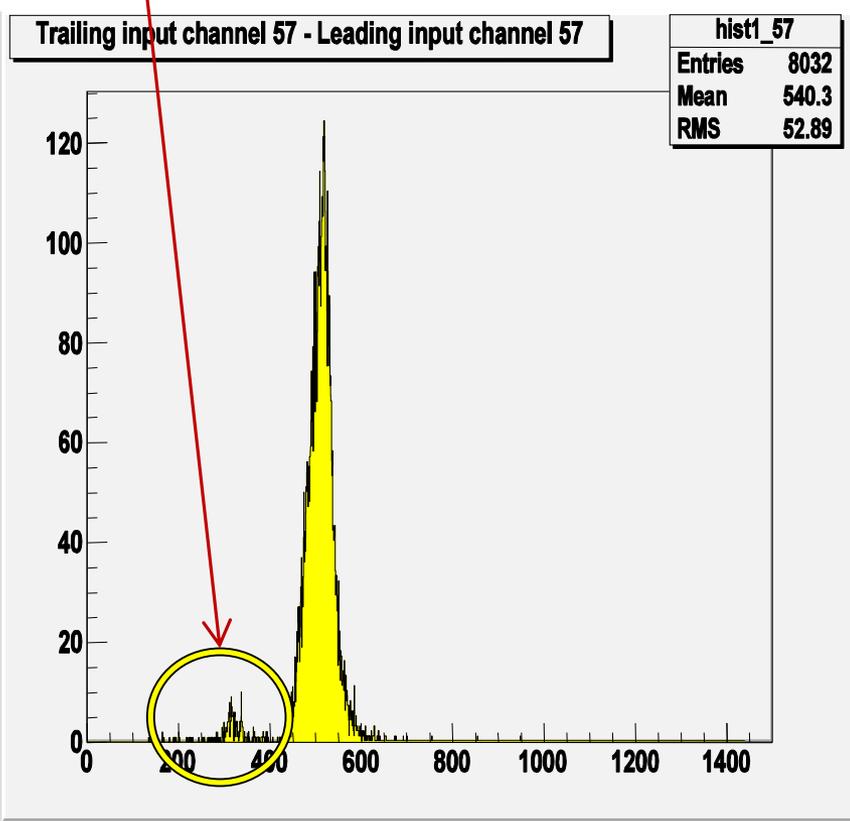
# Analogue monopulser (shaper) for TOT method.

*PSPICE simulation.*

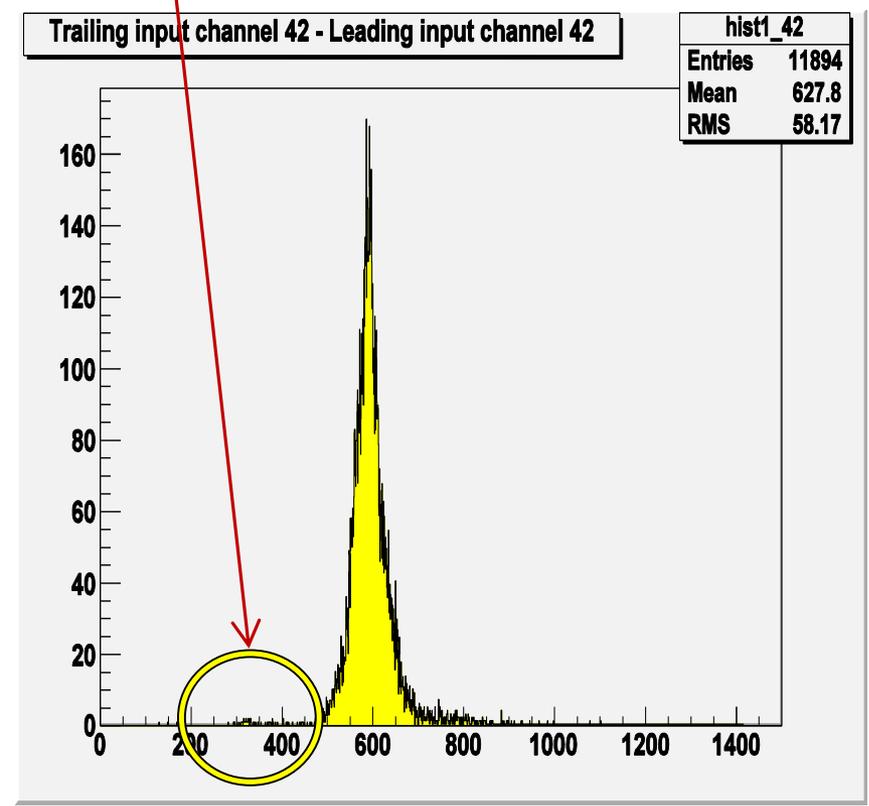


# Two discriminators TOT structure adjustment.

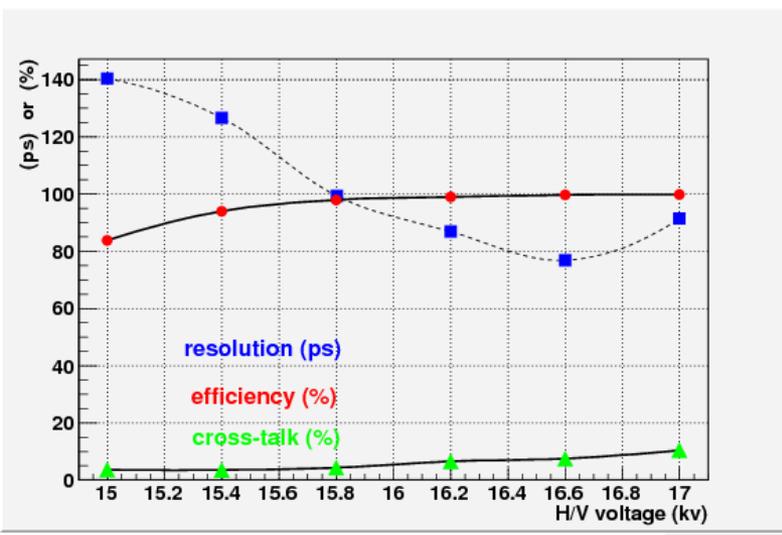
Threshold artifact on TOT spectrum  
close to 95% efficiency



Threshold artifact on TOT spectrum  
close to 100% efficiency



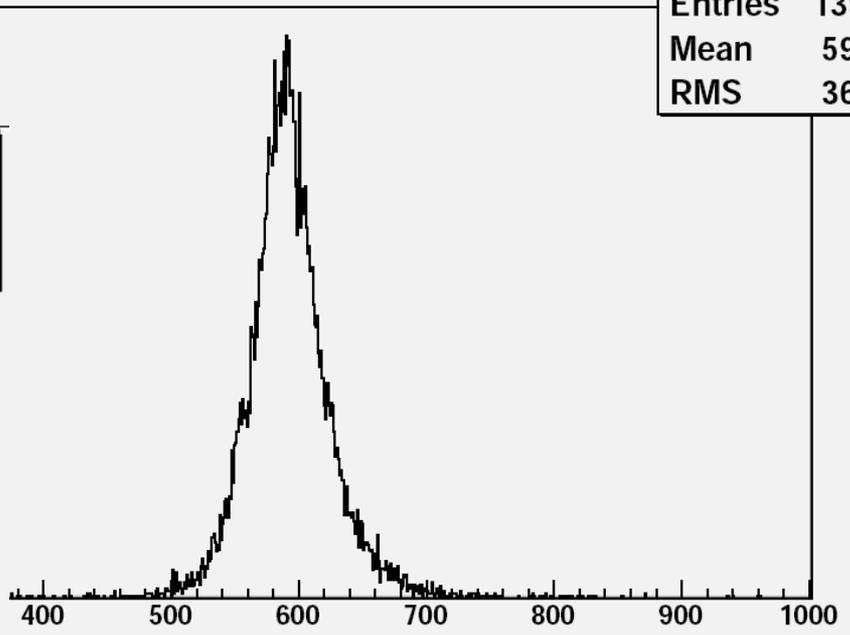
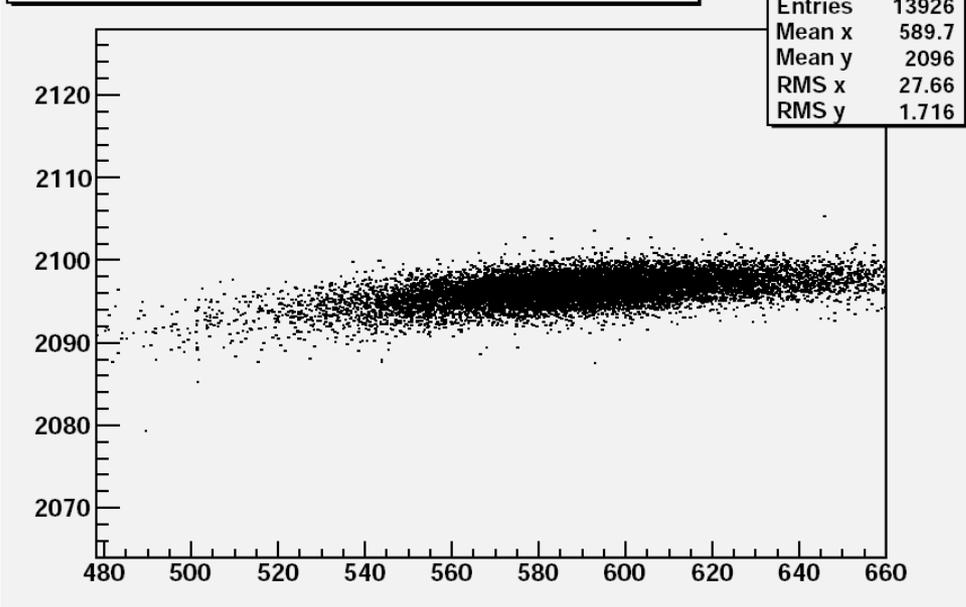
# Time resolution, efficiency and cross talk vs. HV. TOT width spectrums.



ailing input channel 51 - Leading input channel 51

hist1_51	
Entries	13926
Mean	592.3
RMS	36.36

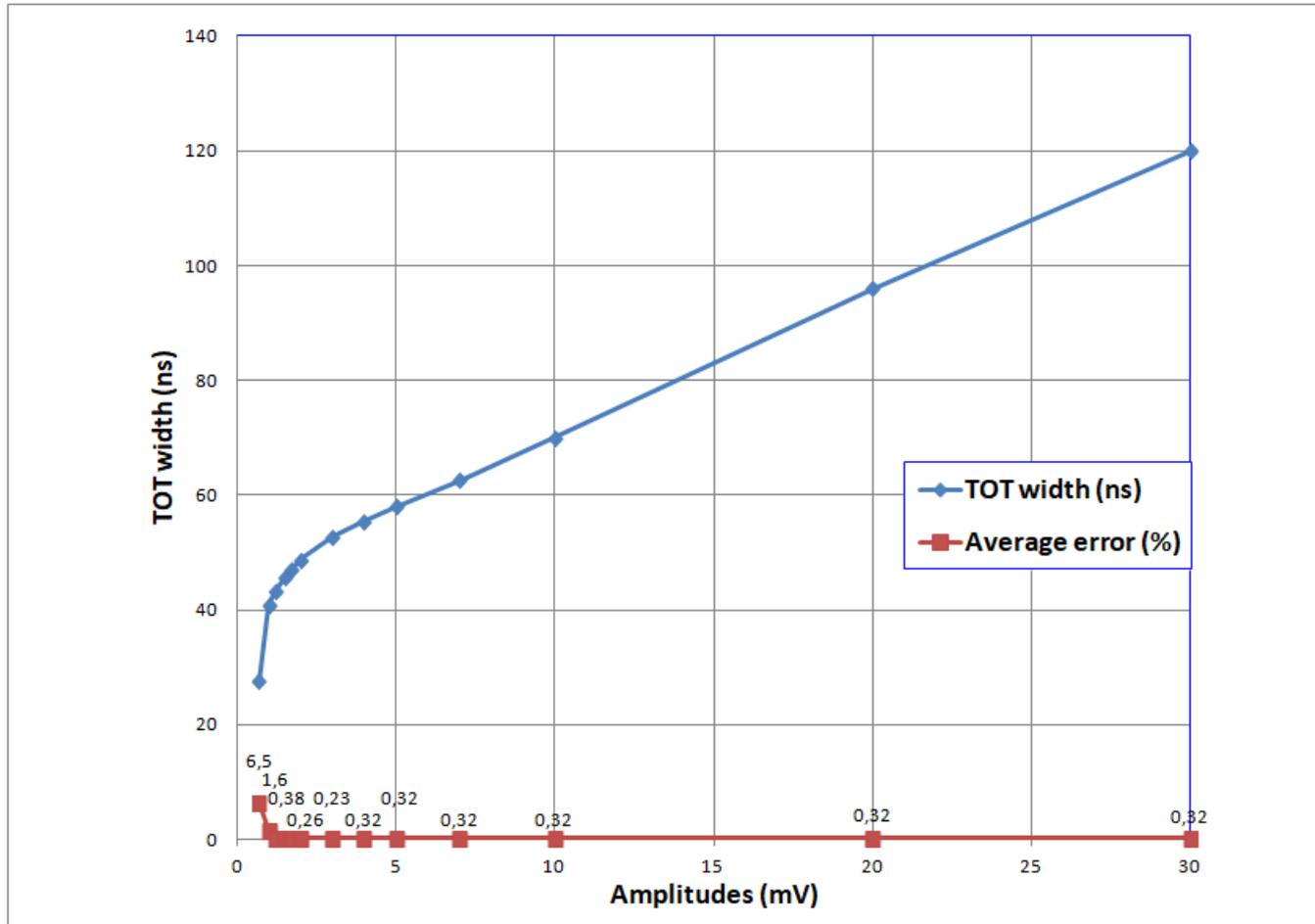
RPC1 Time vs RPC1 Width (pre-defined area), T0 from channel 24



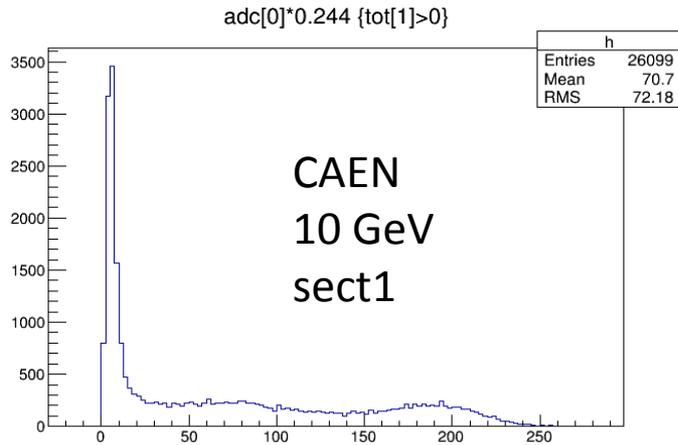
# TOT width vs. amplitude and accuracy.

Charge vs. width accuracy.

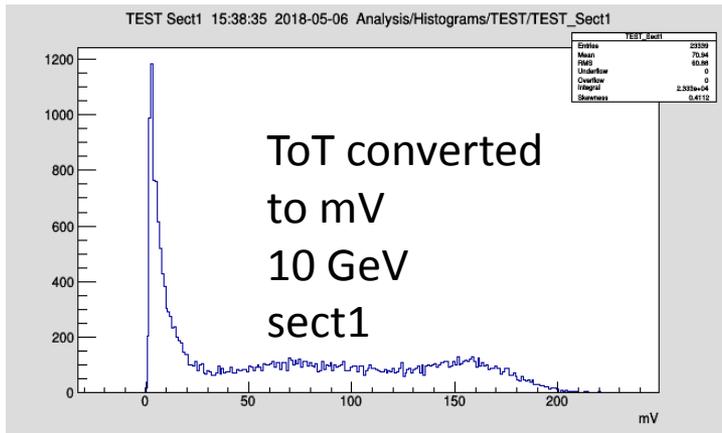
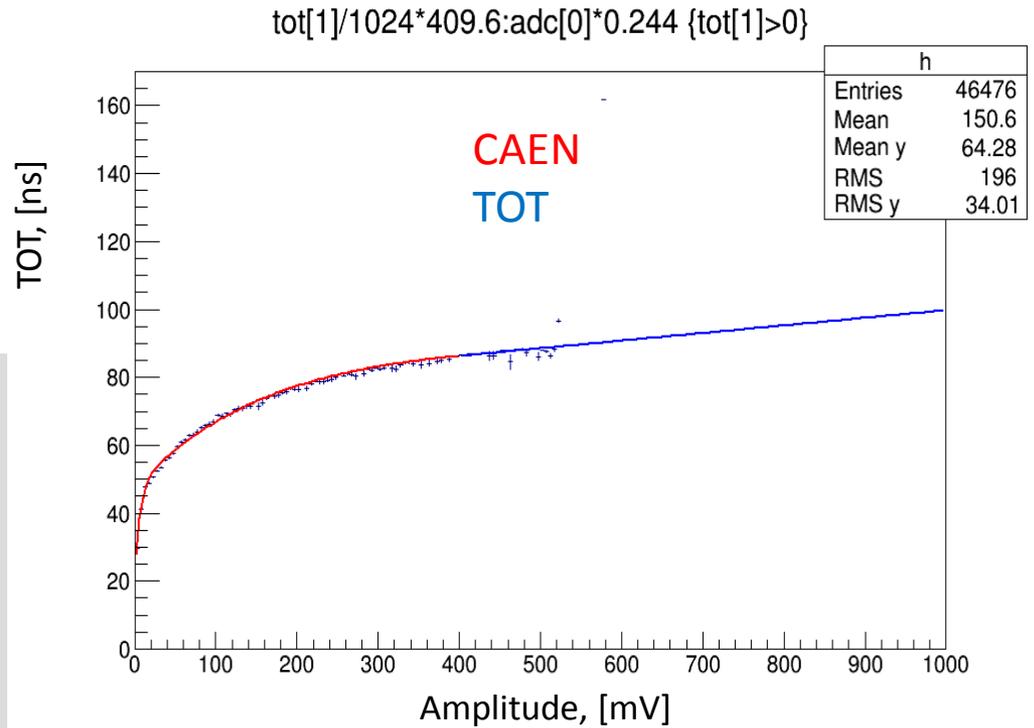
Average error is <0.4%



# TOT response for protons. CERN PS test beam 05.2018



## Time-amplitude curve 10GeV



# Conclusion.

1. New method – many misunderstanding.
2. Especial design need for each detector for different signal waveforms.
3. New configuration method.
4. Good repeatability of channel parameters.