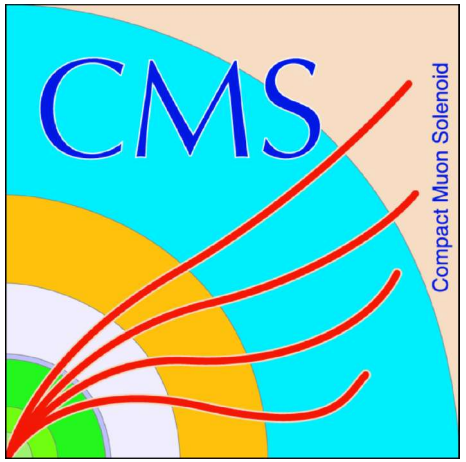

Muon Testbeam May 2003 Drift Time Spectra

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CMS Week – March 2004

Overview

- Test Beam Setup
- Distorted Drift Time Spectra
  - 40/80 MHz Pattern
  - Broadened Spectra
- Summary

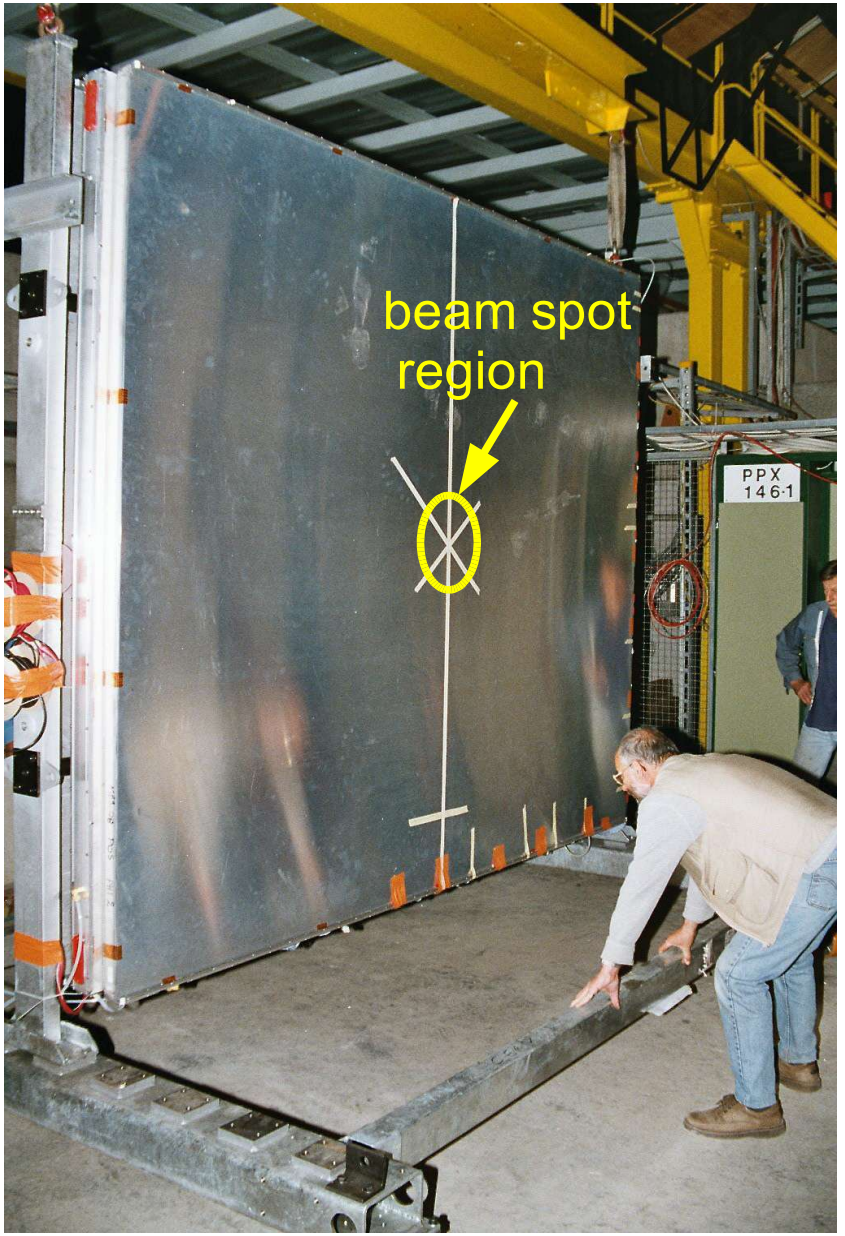
Test Beam Setup

Beam Setup

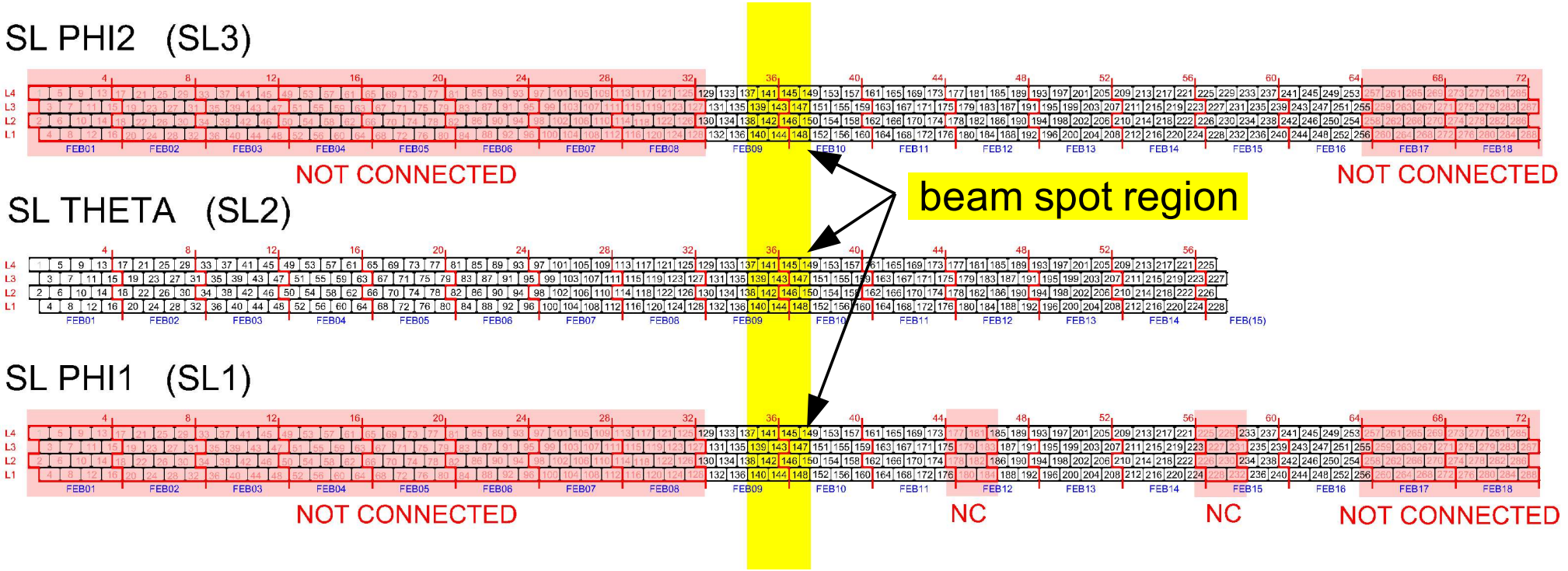
- 120 GeV μ-beam
- train of 48 bunches with 25 ns bunch separation
- 10 x 10 cm² scintillator beam trigger @ 4 m (upstream) from chamber used as external trigger device for readout.

Chamber Setup

- MB3 Chamber with MB1 Minicrate
- nominal operating conditions

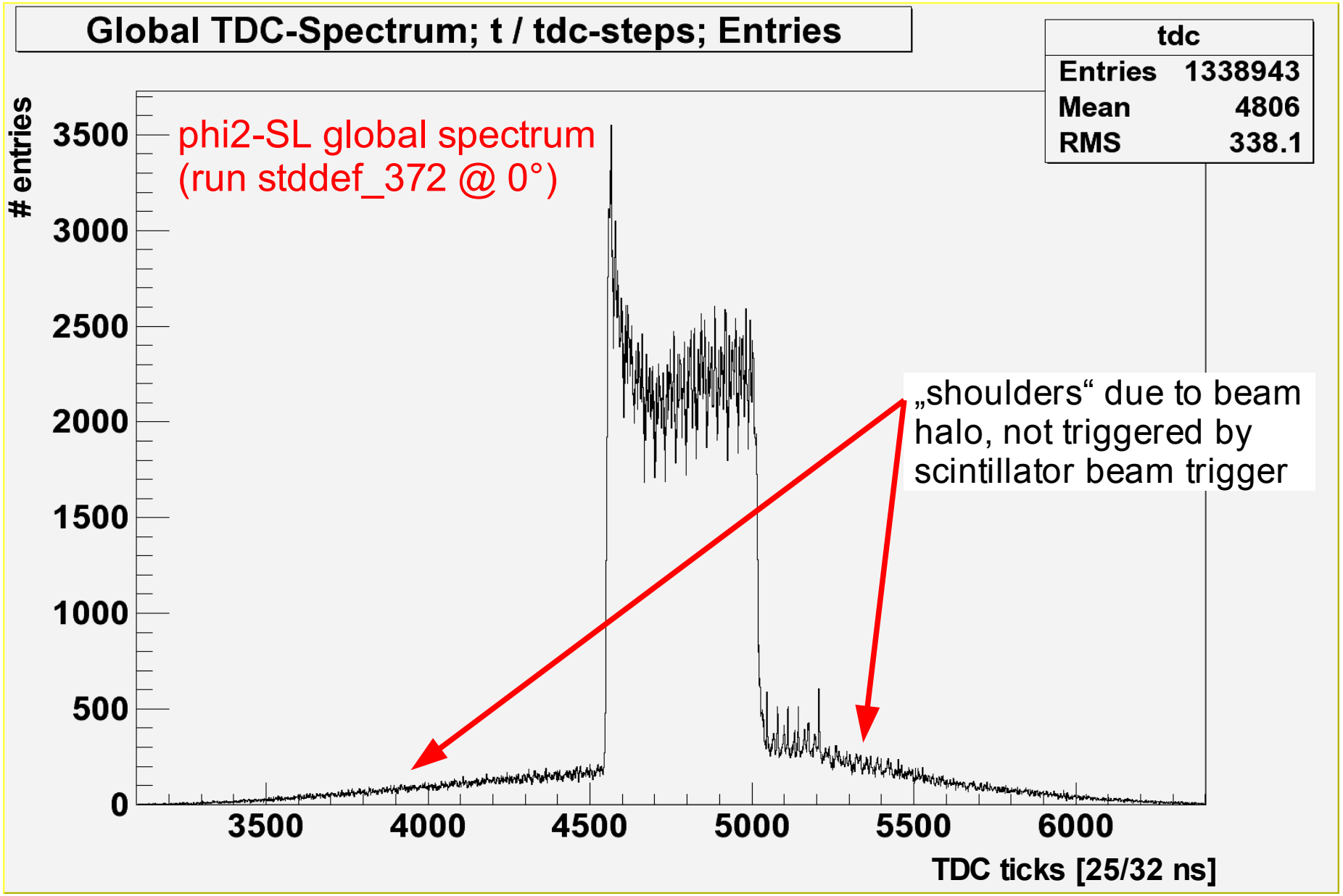


Readout Map

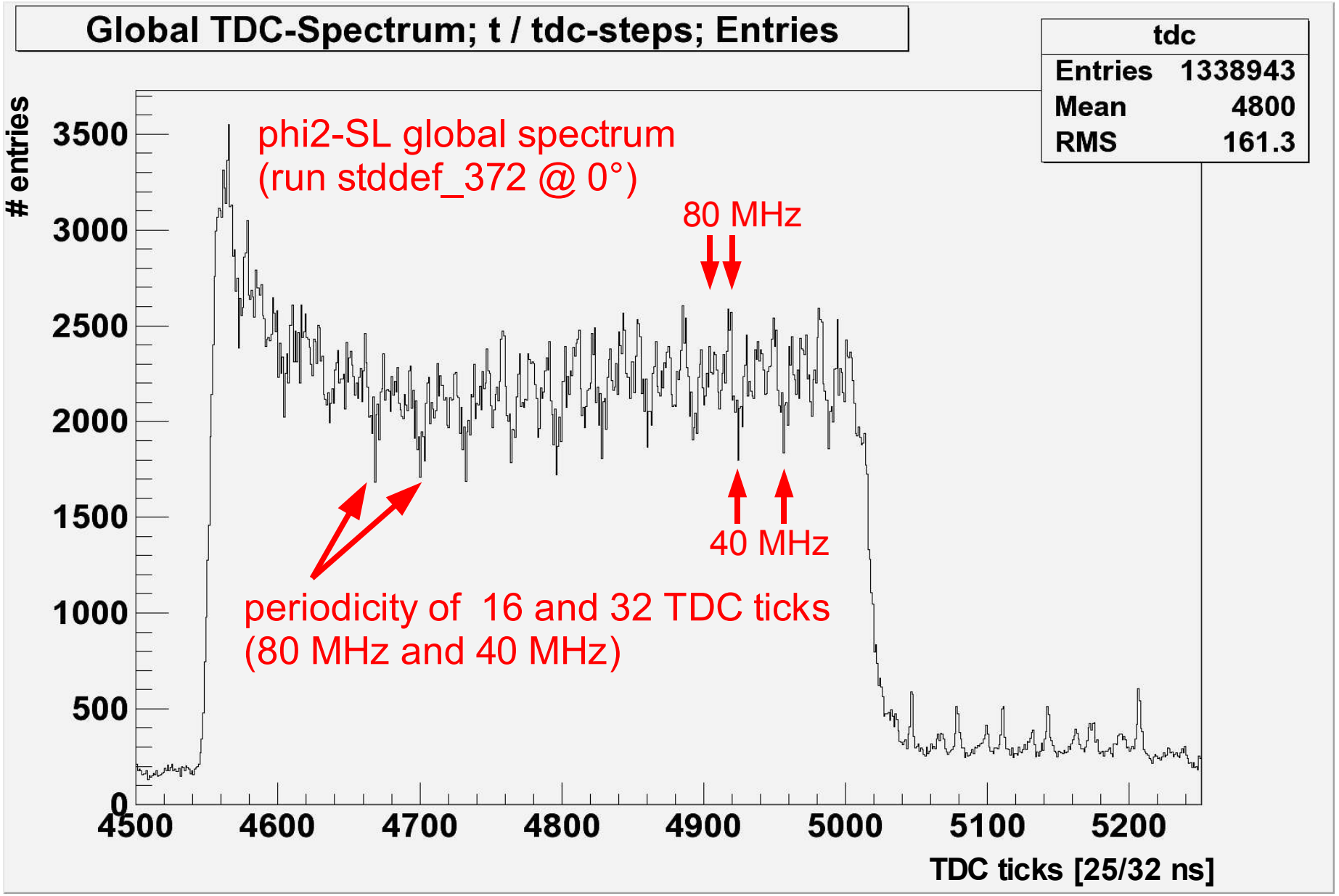


- less than ½ of cells in phi-SLs connected to DAQ
- full readout for theta-SL

Global Drift Time Spectrum



40/80 MHz Pattern



40/80 MHz Pattern

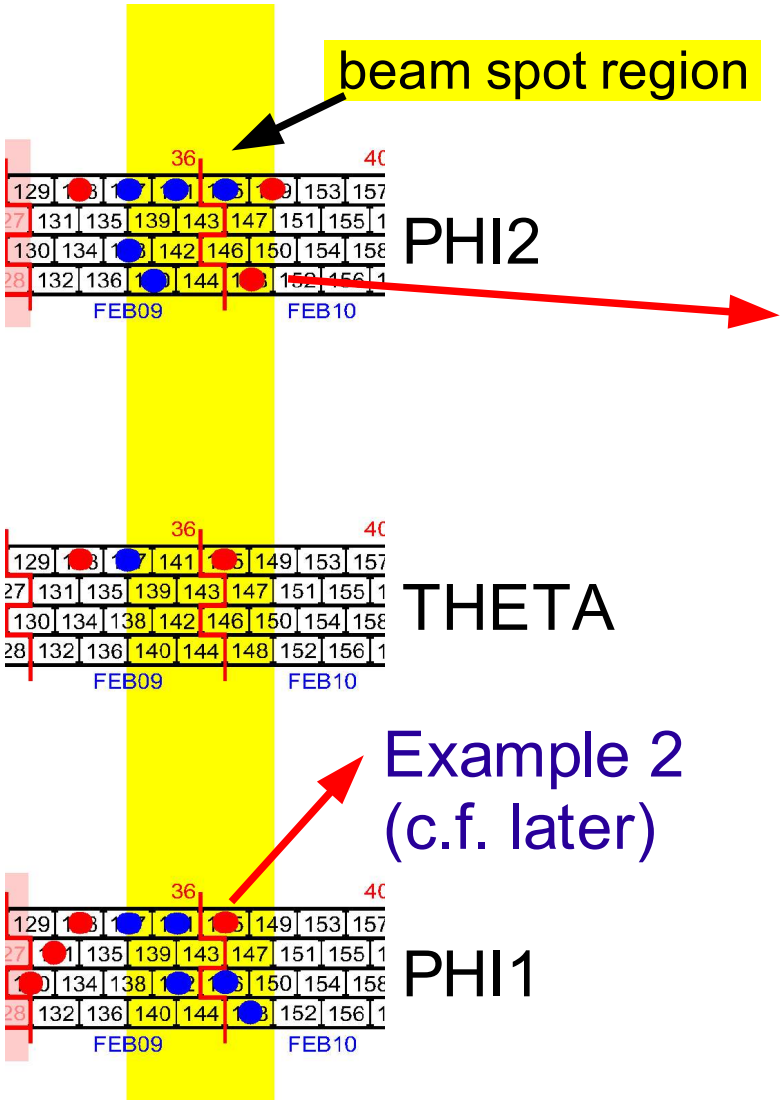
Summary

- all cells affected (visible if enough statistics available)
- weak 40 MHz pattern found also in recorded beam trigger signals (0.09% of recorded triggers)

Possible explanations

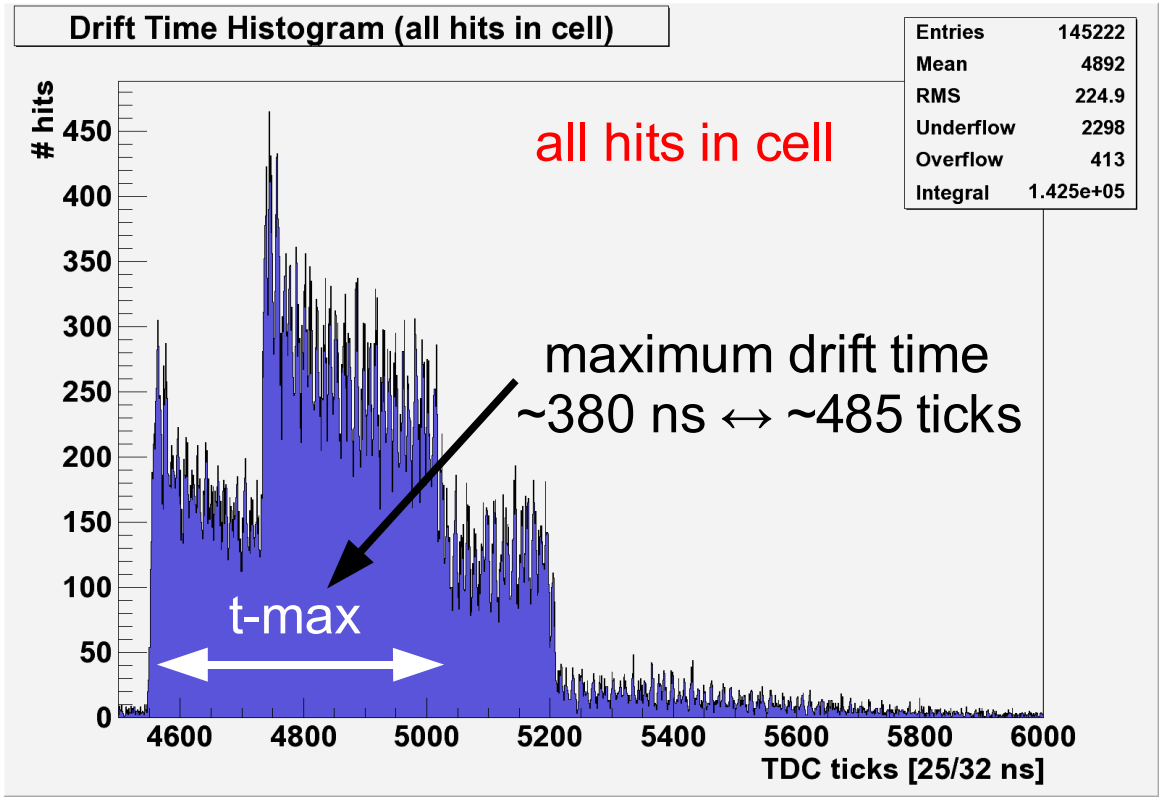
- crosstalk between clock and data (Matteo investigates this)
  - inside Minicrate
  - grounding
  - cable layout
- feedback from BTIs into TDCs
  - could explain 40 MHz and 80 MHz pattern
  - all cells are connected to BTIs → pattern in all cells

Broadened Spectra



- 15 out of 42 cells (35.7%) in the beam spot area with broadened spectra
- 4 of them with severe distortions (●)

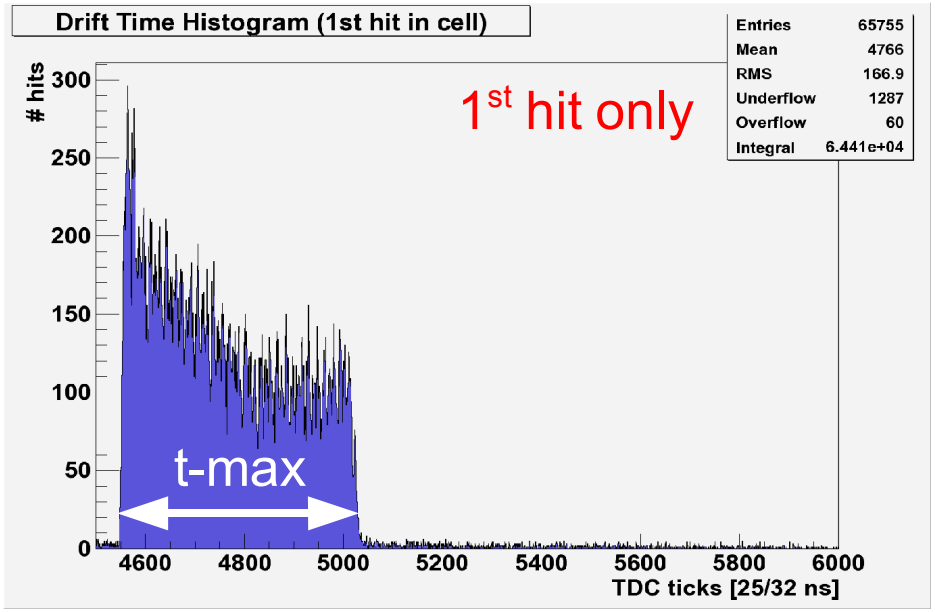
Example 1
SL Phi2 L1 cell 37 (run stddef_372)



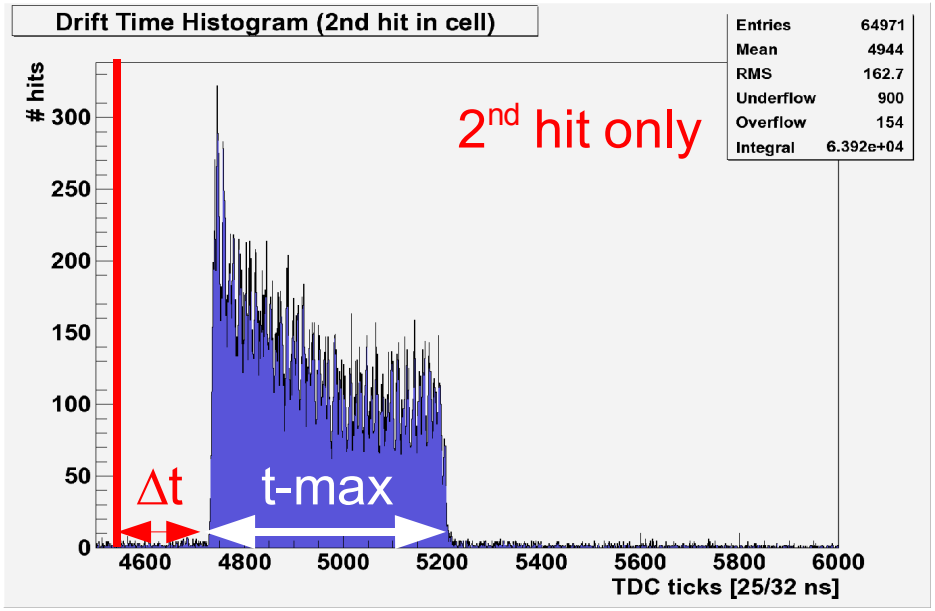
Example 2
(c.f. later)

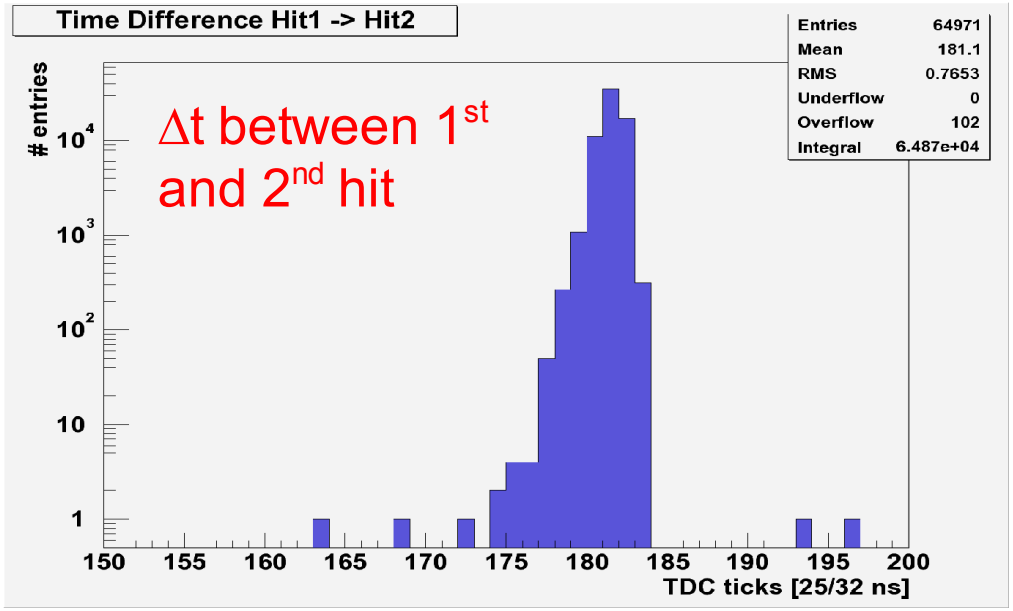
- severely distorted
- slightly distorted

Example 1 - „Double Hits“

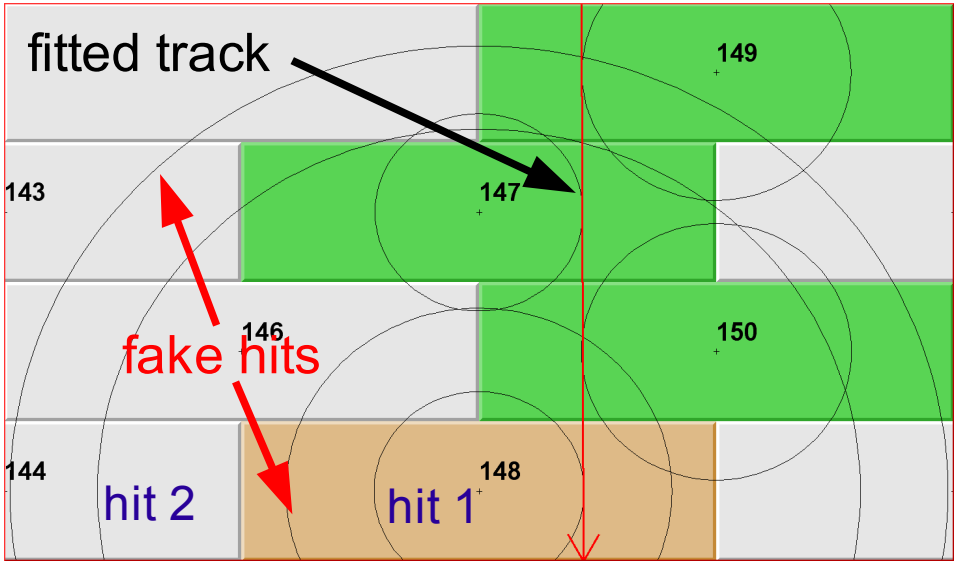


- distortion caused by „double hits“
- probability of „double hits“ > 99%
- $\Delta t = 181 \pm 1$ TDC ticks
  → FEB output pulse length
- 2nd (fake) hit generated by electronic (not related to driftcell)

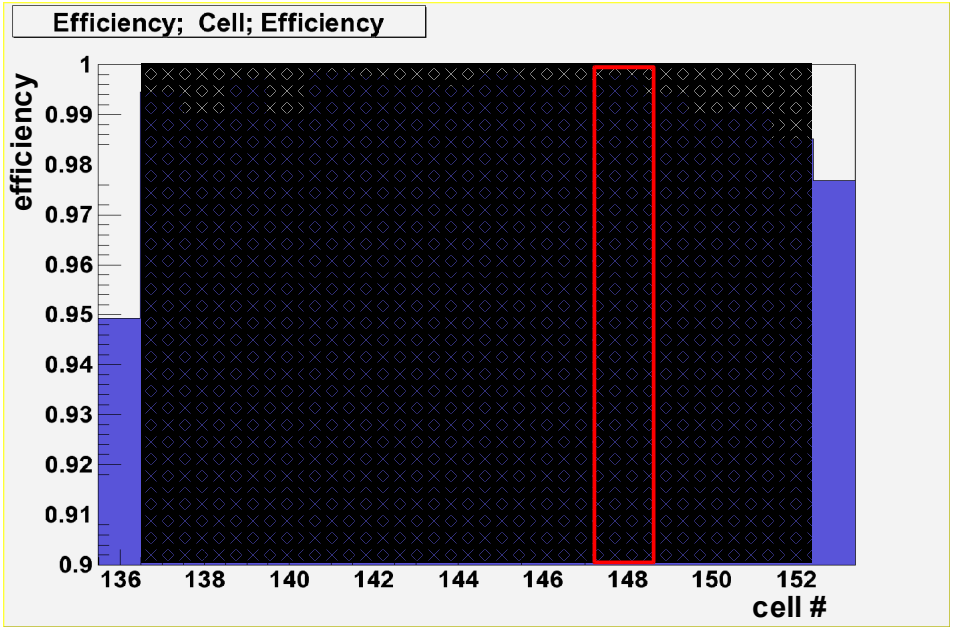


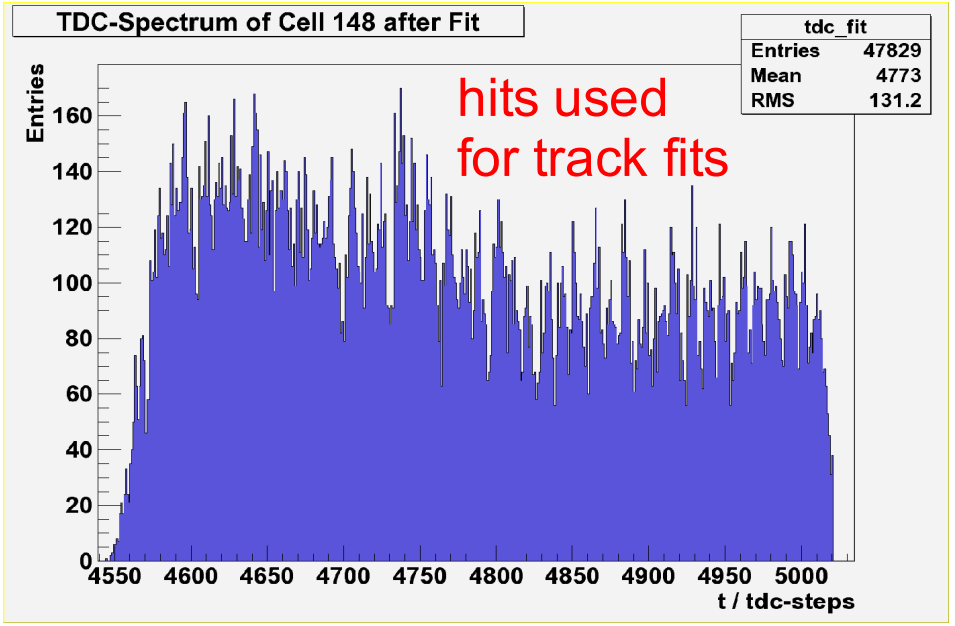


Example 1 - Track Fits



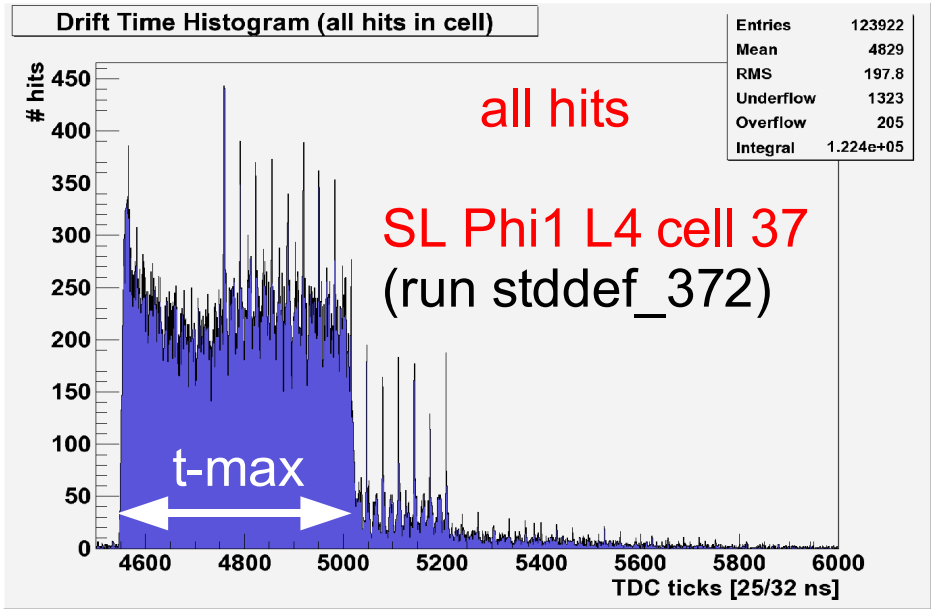
- „double hits“ do not influence track fits and efficiency of cell
- 40/80 MHz pattern may affect the resolution of cell (c.f. still visible spike pattern in spectrum of used hits for track fits)

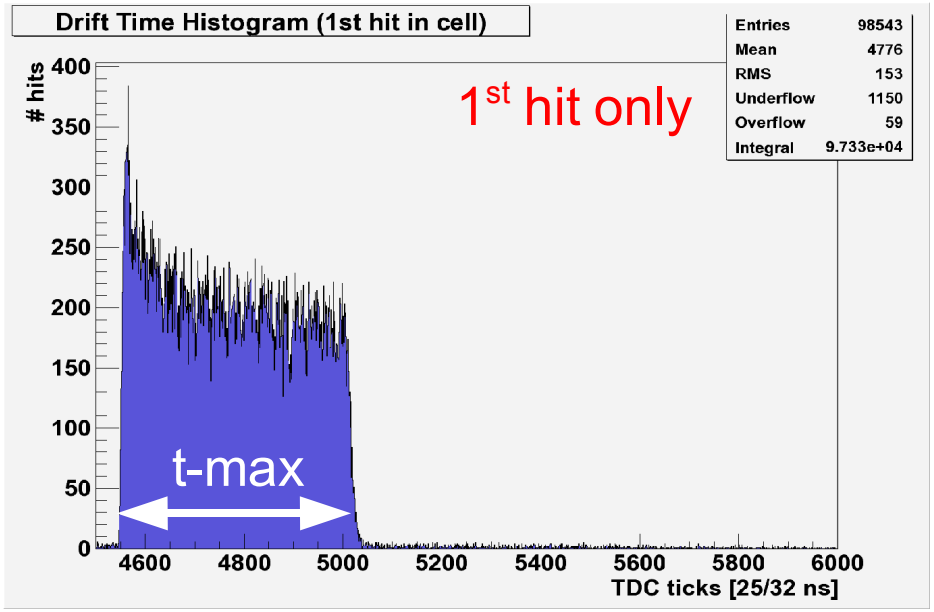




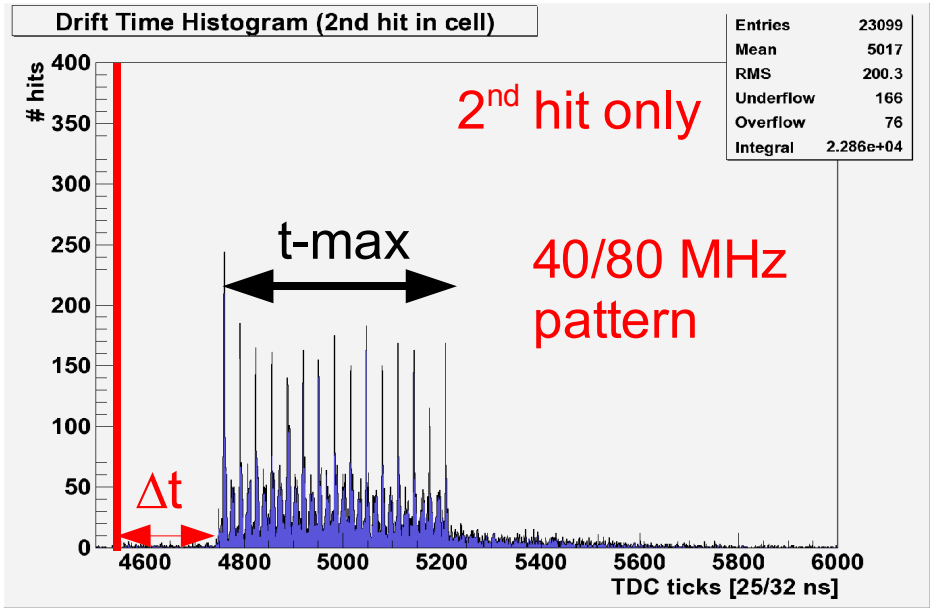
(Efficiencies and event display calculated by Raphael Mameghani's track fitter)

Example 2 – „Double Hits“ and Spikes

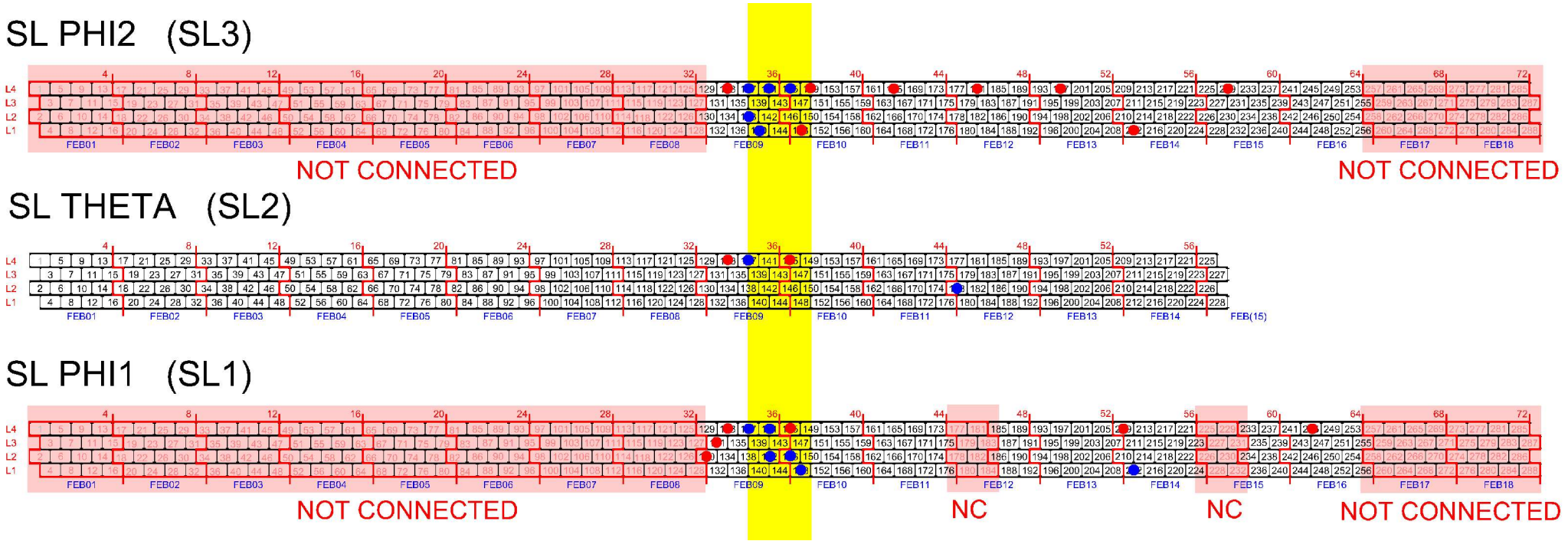




- „double hit“ probability here ~ 23%
- Δt = 198 ± 1 TDC ticks → FEB output pulse length
- 2nd hits show 40/80 MHz spike pattern very strongly



Map of Distorted Cells



- severely distorted
- slightly distorted

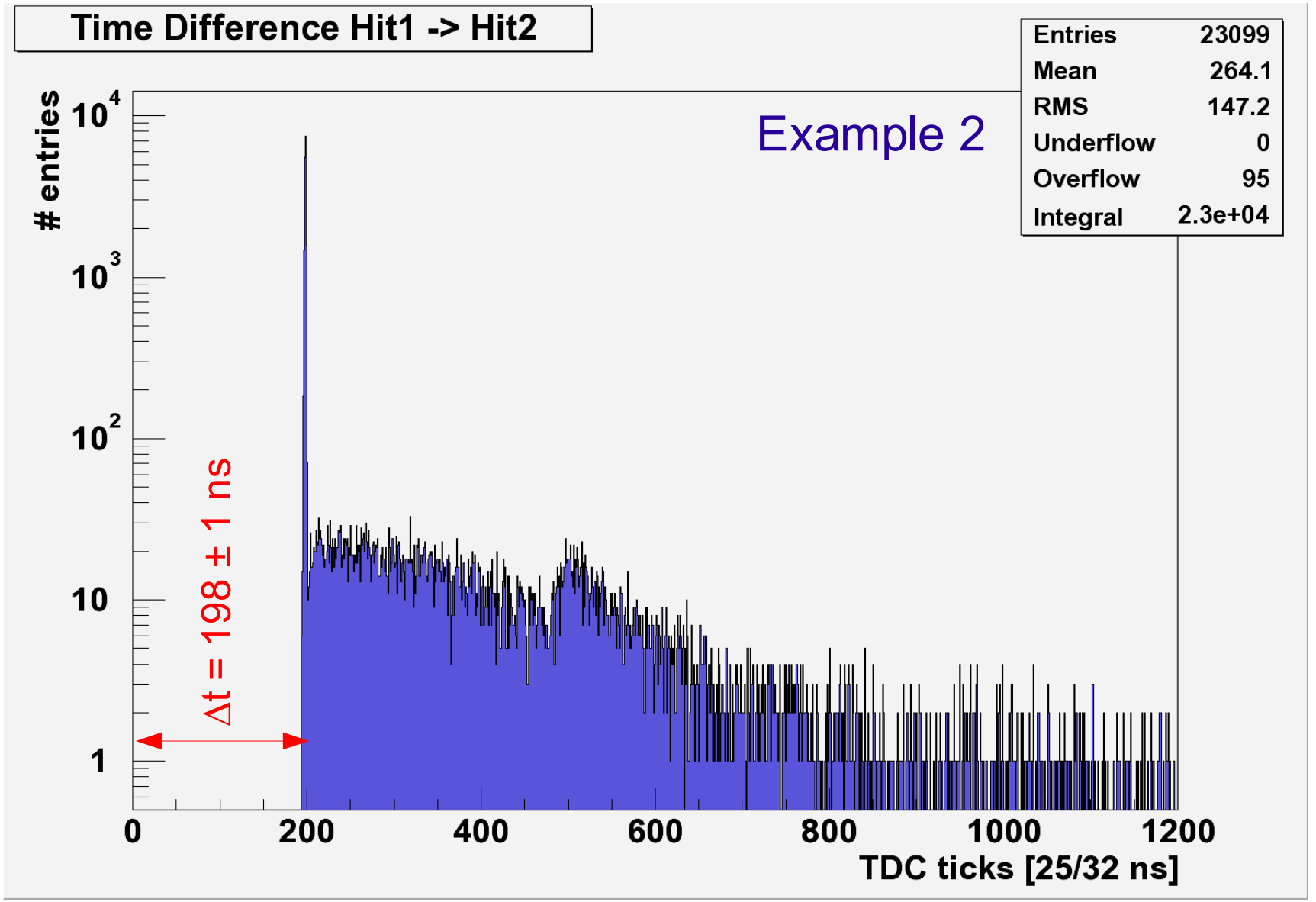
Summary

- 40/80 MHz pattern seen in the drift time histograms of all cells. Its origin is unknown.
- Several cells have distorted drift time spectra due to „double hits“.
- Both effects do not seem to affect the offline track reconstruction.

But ...

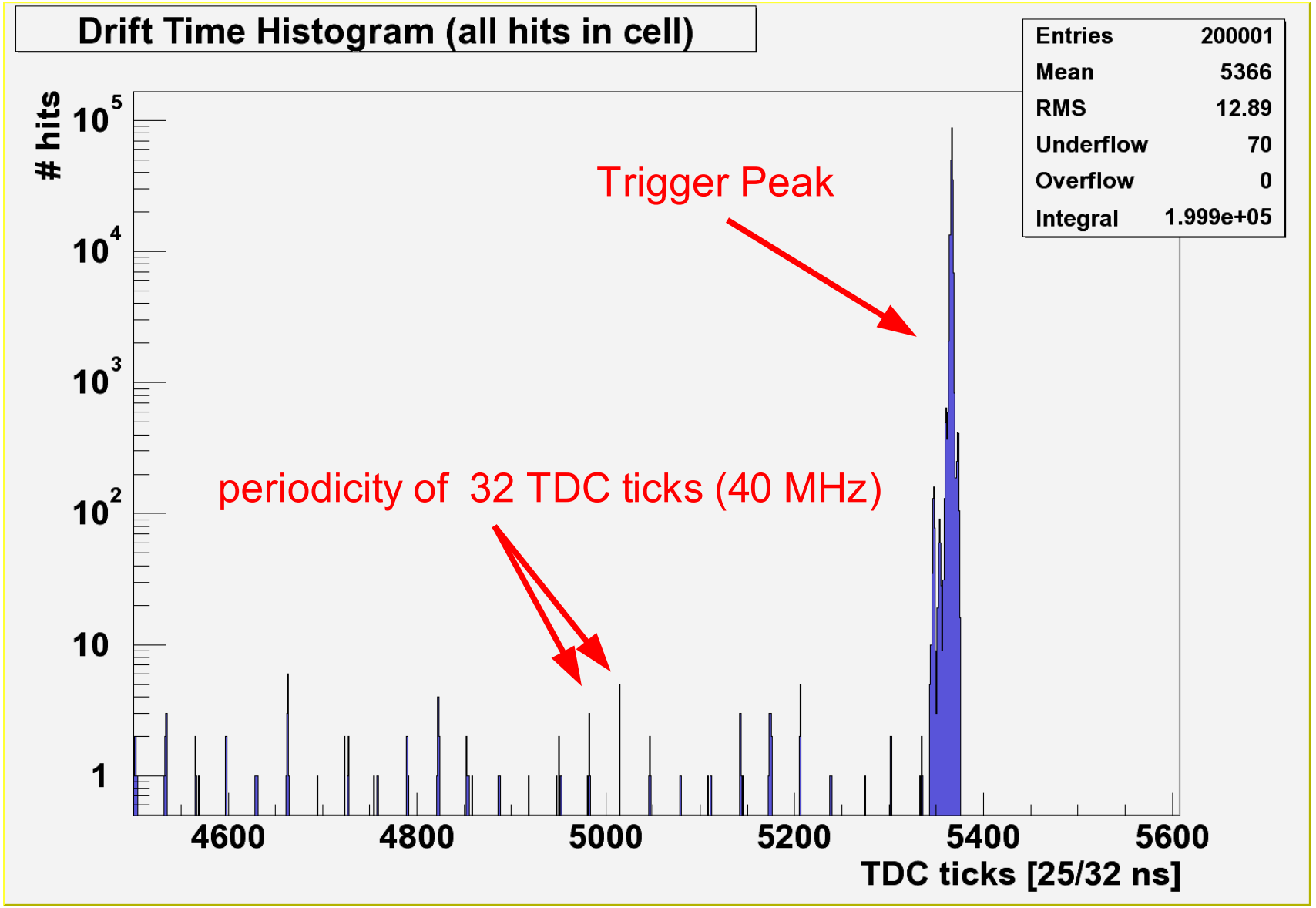
- Can these effects disturb the 1st level trigger?
  - ghost tracks and noise
  - wrong bx identfication
- What happens if two or more cells with many of such „double hits“ are very close to each other?
- Why are often the same cell numbers in different FEBs affected?

Backup (1) Example 2



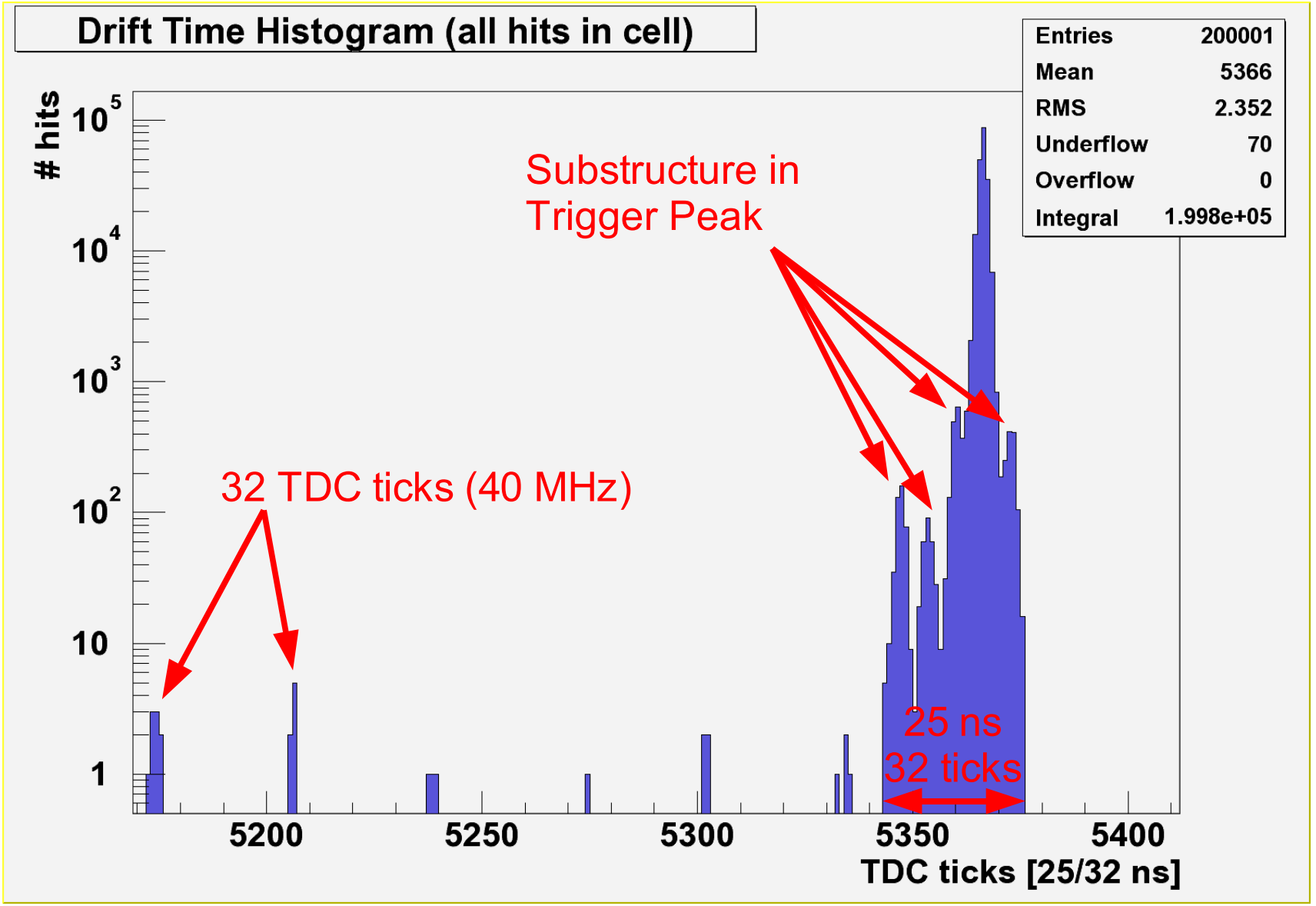
stddef_372 SL Phi1 L4 Cell 37

Backup (2) Beam Trigger Signal



stddef_372 beam trigger channel

Backup (3) Beam Trigger Signal



stddef_372 beam trigger channel

Backup (4) Test Pulses

- generation of (up to 4) fake pulses in some cells known from test pulse measurements at Aachen