Mainz Report Status

Matteo Cardinali, on behalf of Mainz Group

Panda Collaboration Meeting, Darmstadt
11/03/2014

JOHANNES GUTENBERG UNIVERSITÄT MAINZ

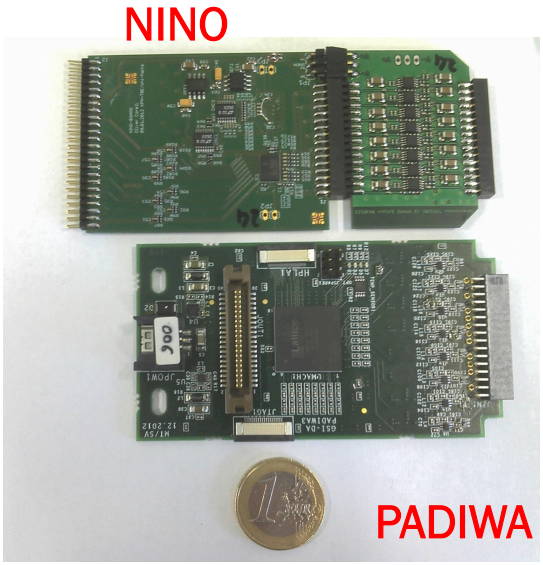
HGS-HIRe for FAIR
Helmholtz Graduate School for Hadron and Ion Research

HELMHOLTZ GEMEINSCHAFT
Helmholtz-Institut Mainz

Index

- PADIWA Laser Test:
  - MCP + PADIWA + TRBv3;
  - timing resolution and walk correction;
- Optimising time walk in the test experiment;
- Conclusions & Outlook.

PADIWA test

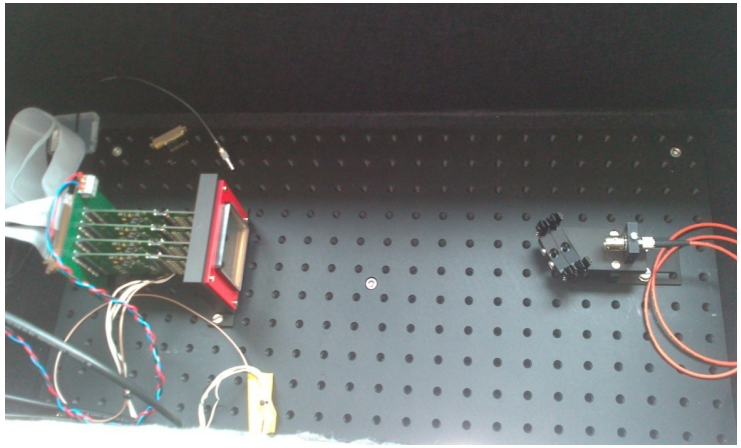


The same studies performed with NINO have been repeated for PADIWA.

	PADIWA	NINO
preamplifier	10	10 (x100)
discriminator	FPGA (reprog.)	NINO ASIC

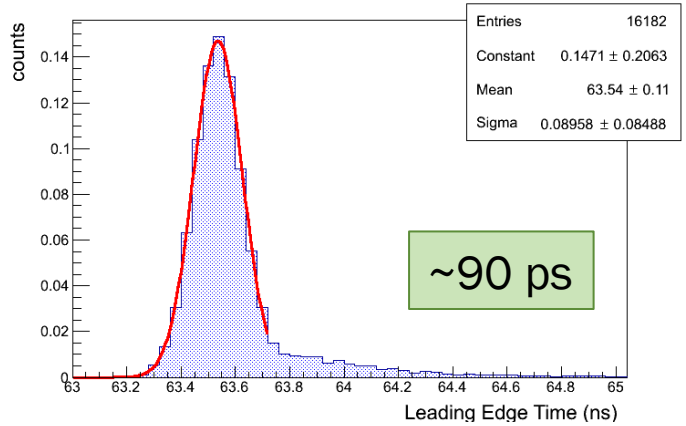
Experimental setup:

- laser pulser (35 ps FWHM, 633 nm, 0.3 γ/event);
- MCP PMT (gain 10^6) + PADIWA + TRB3.

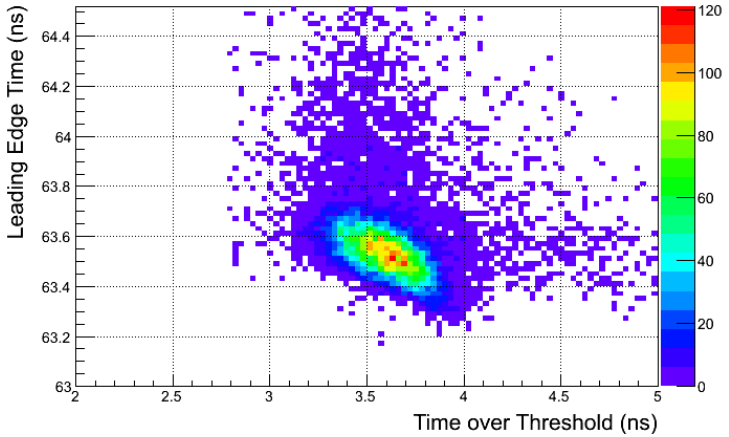


NB: all the problems with thresholds settings now have been solved.

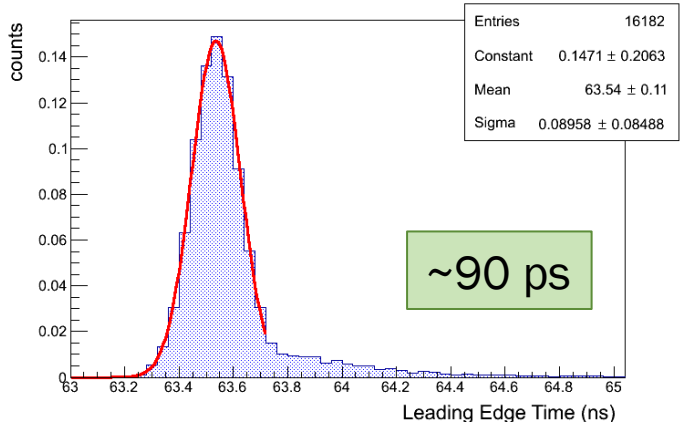
PADIWA test

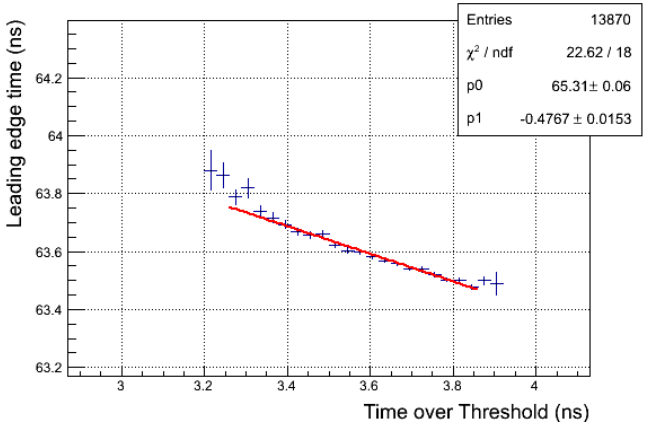


- Time walk correction?



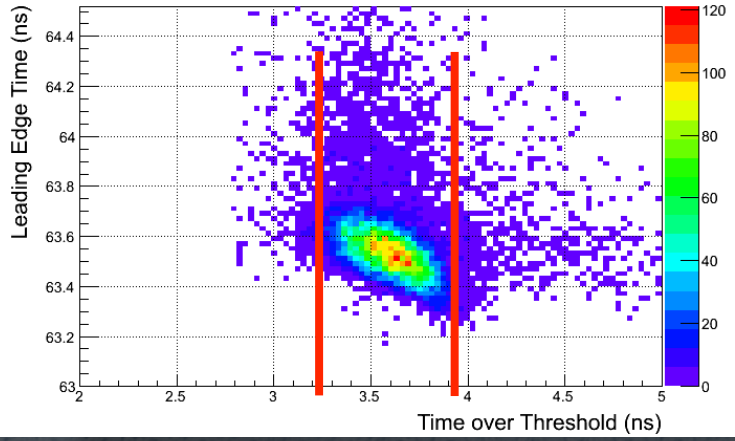
PADIWA test

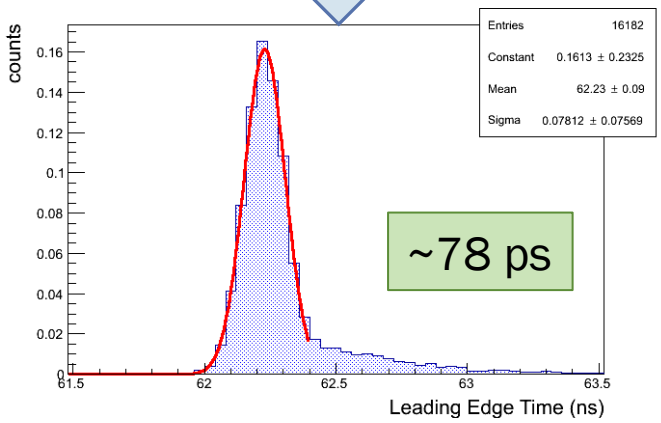




- Time walk correction?

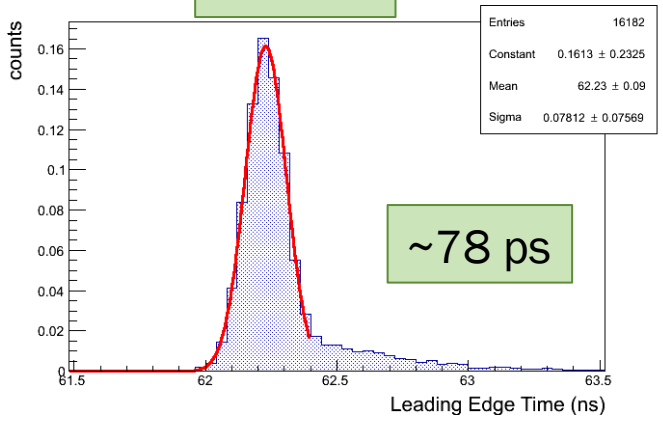
$$t_{corr} = t_{meas} - m \cdot (\mathrm{ToT}) + q$$





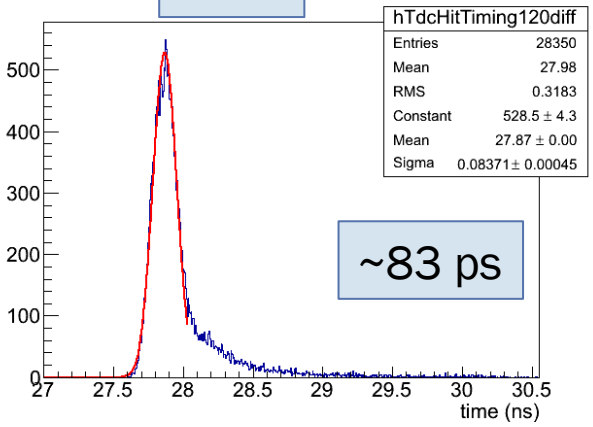
PADIWA vs NINO

PADIWA



~78 ps

NINO



~83 ps

$$\sigma_{time} = \sqrt{\sigma_{fit}^2 - \sigma_{laser}^2}$$

~70 ps

~75 ps

Both FEE cards show similar performances

Time walk optimisation

Problem: no absolute timing in July test experiment (Mainz).

Consequence: no way to extract time walk parameters from data!

We used the parameters obtained from the laser tests even if the conditions were different (e.g. HV/gain, thresholds).

Idea: $$t_{corr} = t_{meas} - m \cdot (\mathrm{ToT}) + q$$

fundamental parameter

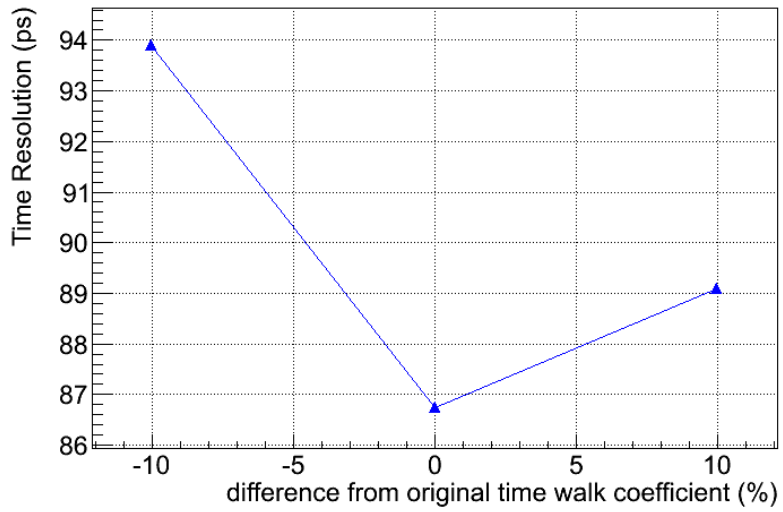
Varying m in order to find the best timing resolution

Time walk optimisation

Problem: no absolute timing in July test experiment (Mainz).

Consequence: no way to extract time walk parameters from data!

We used the parameters obtained from the laser tests even if the conditions were different (e.g. HV/gain, thresholds).

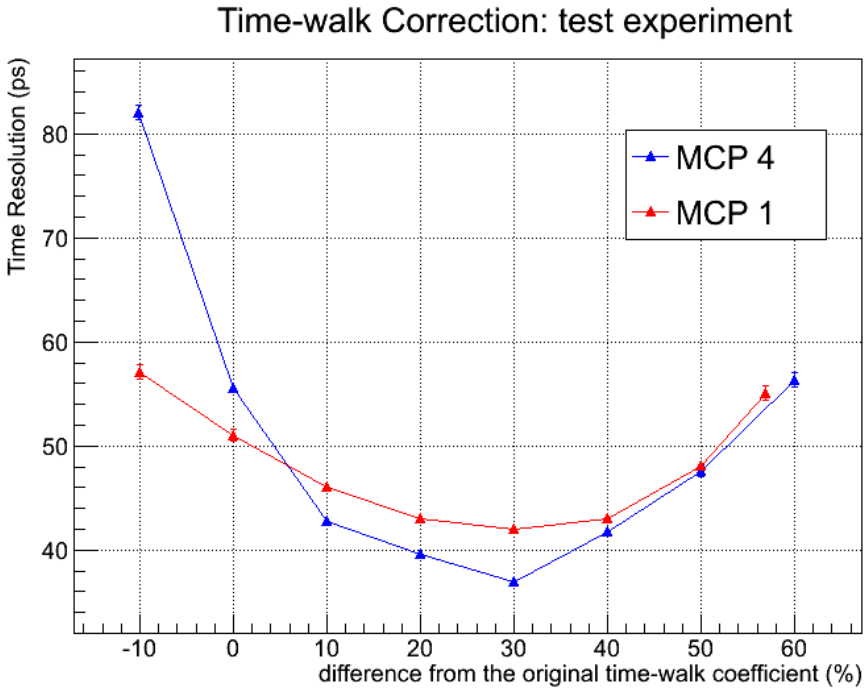


- First test with laser;
- there is a minimum.

Time walk optimisation

Beam time:

- algorithm applied to two different MCPs;
- starting point (0) = laser parameter ;

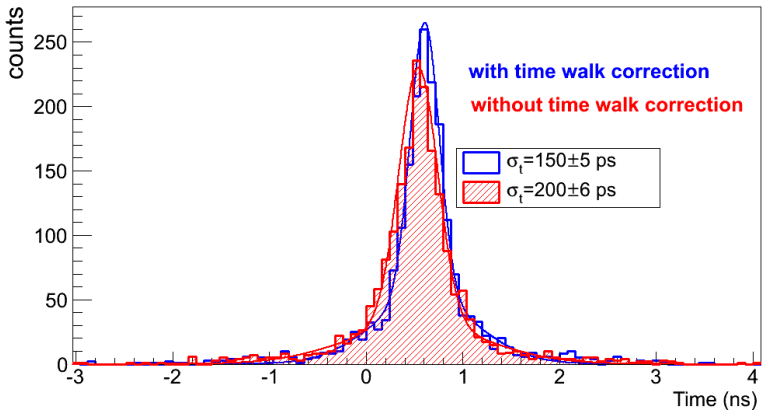


- minimum found in both cases;
- the method could be used for each pixel;
- new timing resolution "record" ***~40 ps***;
- we still need a way to "optimise" the offset.

Time walk optimisation: prototype resolution

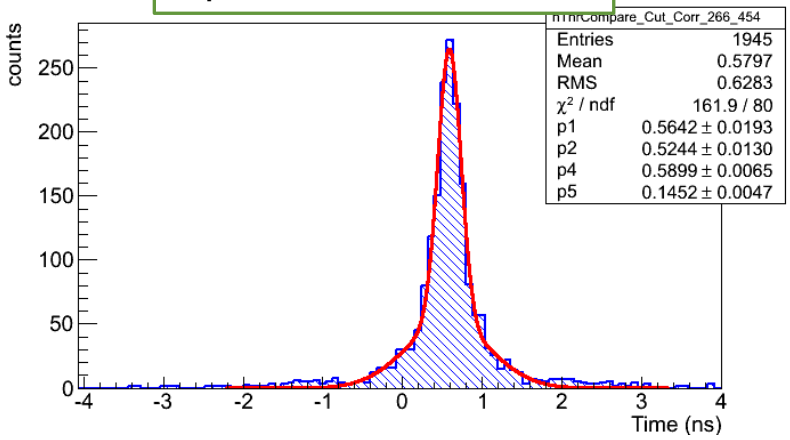
- Apply the new coefficients to each pixel;
- Look for timing resolution of two pixels sitting in different MCPs (prototype timing resolution);
- We don't expect a big change because the main contribution is due to the detector itself (~100 ps from G.Kalicy MC);

Coefficient from laser test



150 ps

Optimised coefficient



145 ps

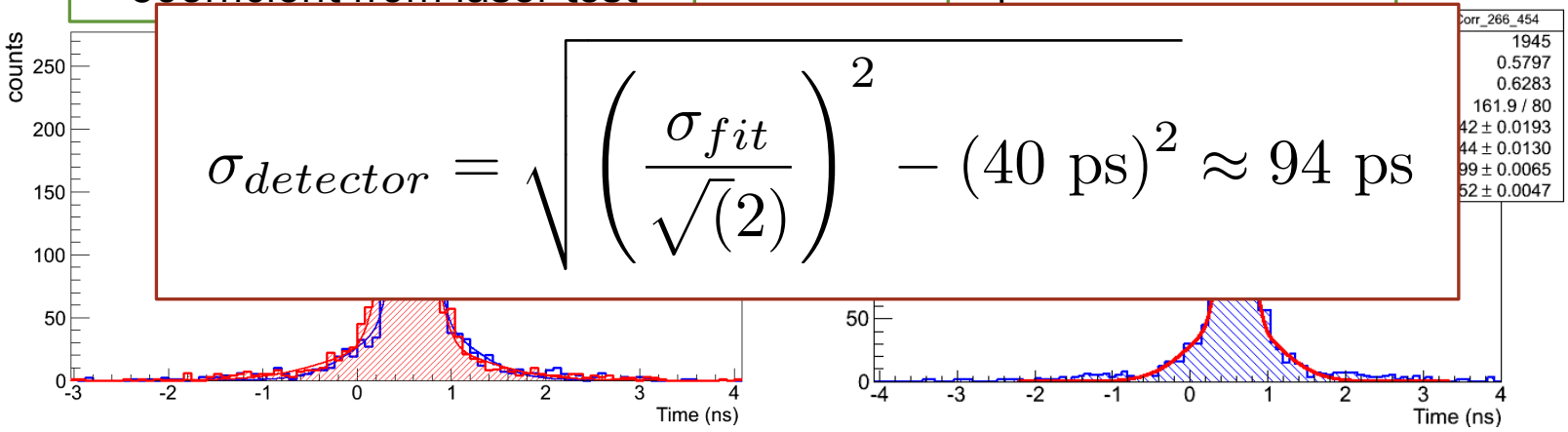
Time walk optimisation: prototype resolution

- Apply the new coefficients to each pixel;
- Look for timing resolution of two pixels sitting in different MCPs (prototype timing resolution);
- We don't expect a big change because the main contribution is due to the detector itself (~100 ps from G.Kalicy MC);

Coefficient from laser test

Optimised coefficient

$$\sigma_{detector} = \sqrt{\left(\frac{\sigma_{fit}}{\sqrt{(2)}}\right)^2 - (40\ \text{ps})^2} \approx 94\ \text{ps}$$



150 ps

145 ps

Conclusion & Outlook

- PADIWA studies:
  - ✓ full characterisation under realistic conditions;
  - ✓ good timing resolution (similar to NINO).

- Test beam analysis:
  - ✓ Time walk optimisation works fine;
  - ✓ 40 ps timing resolution achieved;
  - ✓ measured ~94 ps contribution from photon propagation in the prototype.

- Tune simulation with our setup;

- ...We are done ➡ write contribution for TDR?

Thank you