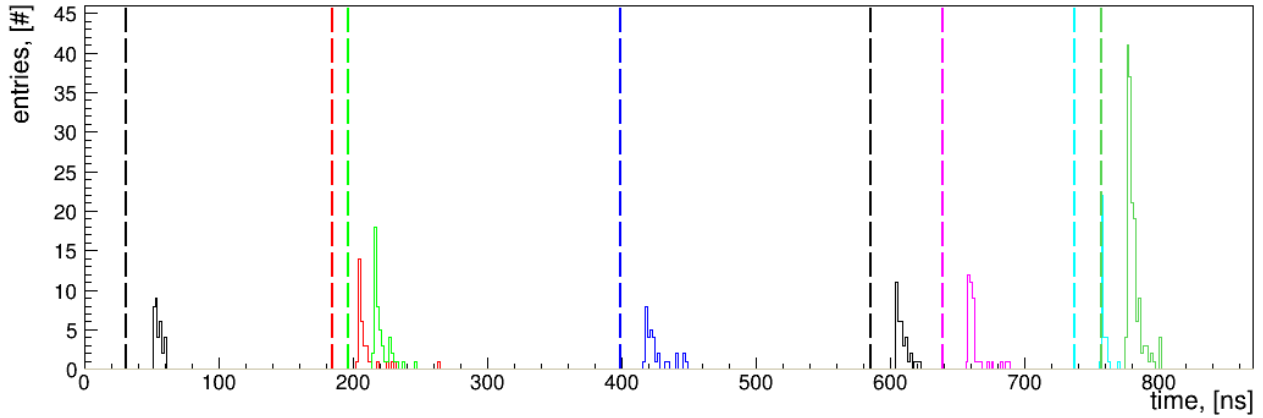
Status of the Barrel-DIRC at GSI

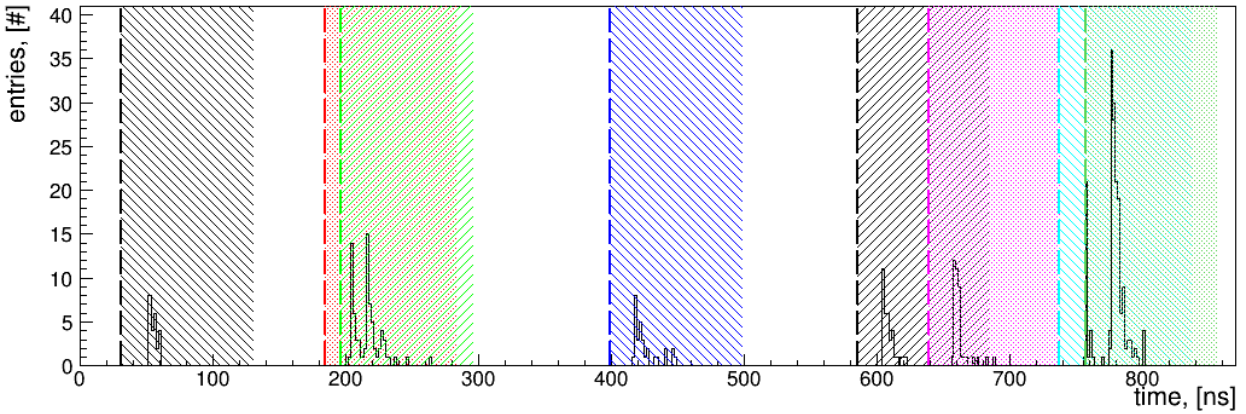
- Time based simulation
- QA quartz radiator
  - optical
  - mechanical
- Electronic developments

Time based simulations (Roman Dzhygadlo)

- Start with event-based simulations.
- Assigning time stamp to Barrel DIRC hits (@20 MHz):



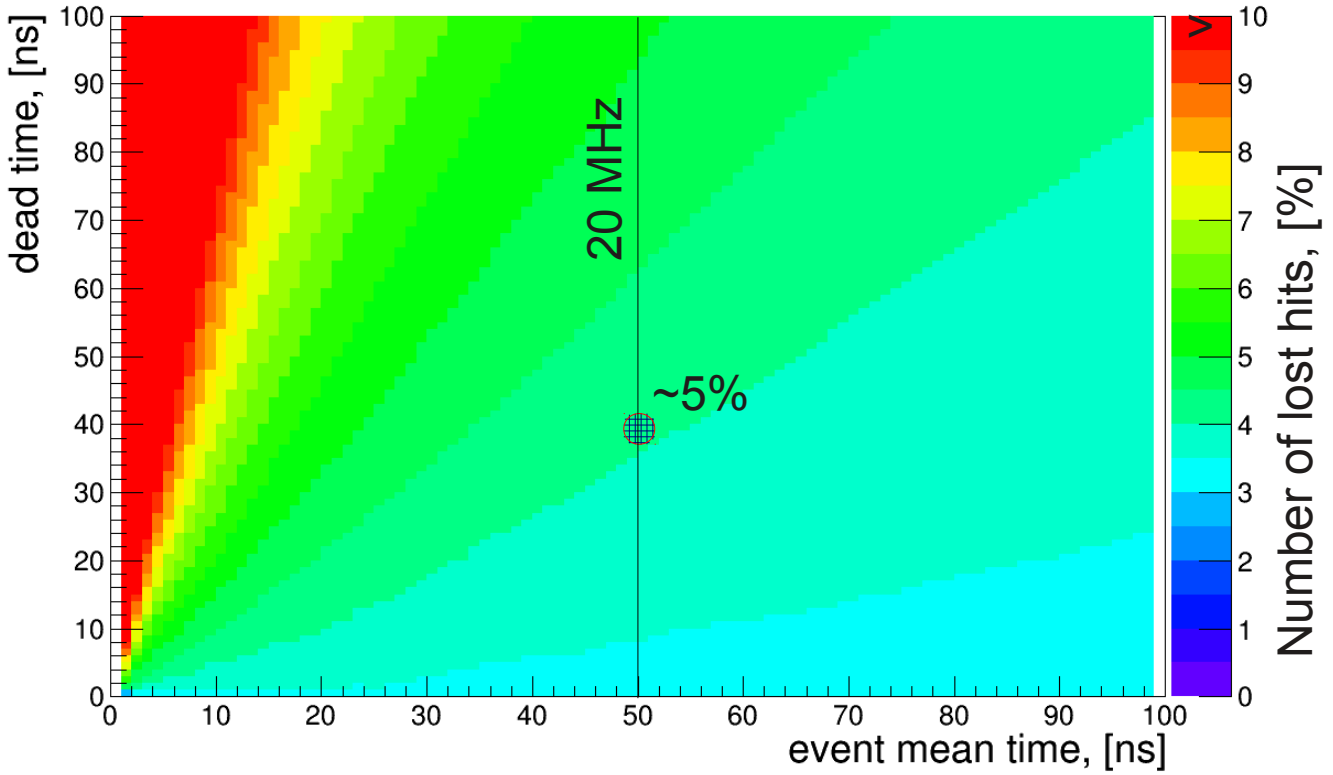
- Events-hits relationship after hit finder:



- Two bad things happens during time-based simulations:
  - Lost hits due to pile-up
  - Ambiguous assignment of hits to their tracks/events

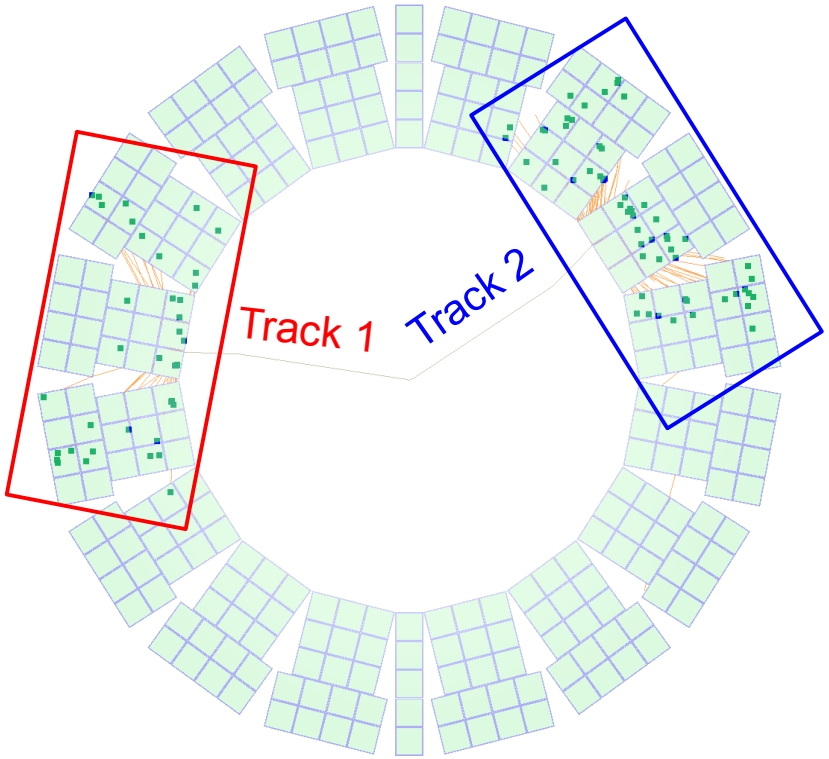
Pileup behavior

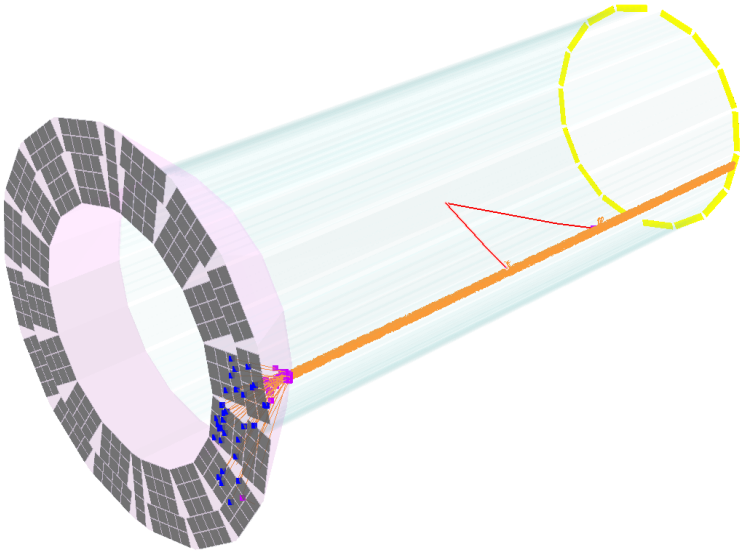
- 5 charged tracks in each event
- p = [1,3] GeV/c θ = [22, 140]° φ = [0, 180]°

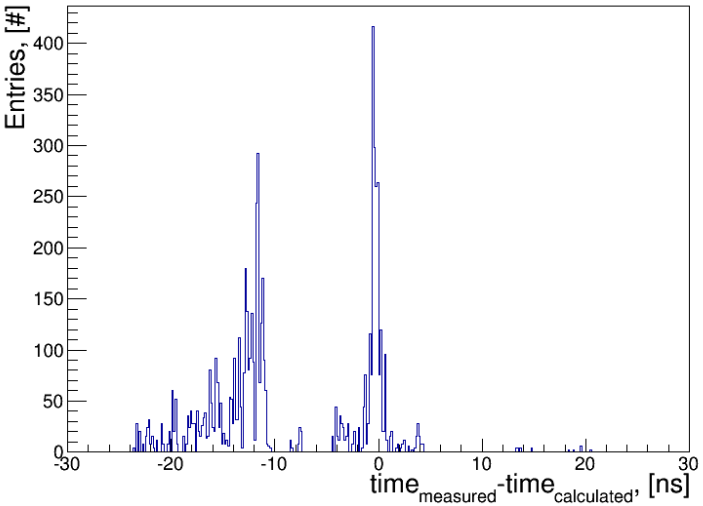


- ~5 % of photons are lost due to pileup
  (@ 20MHz and 40 ns dead time)

Hits separation







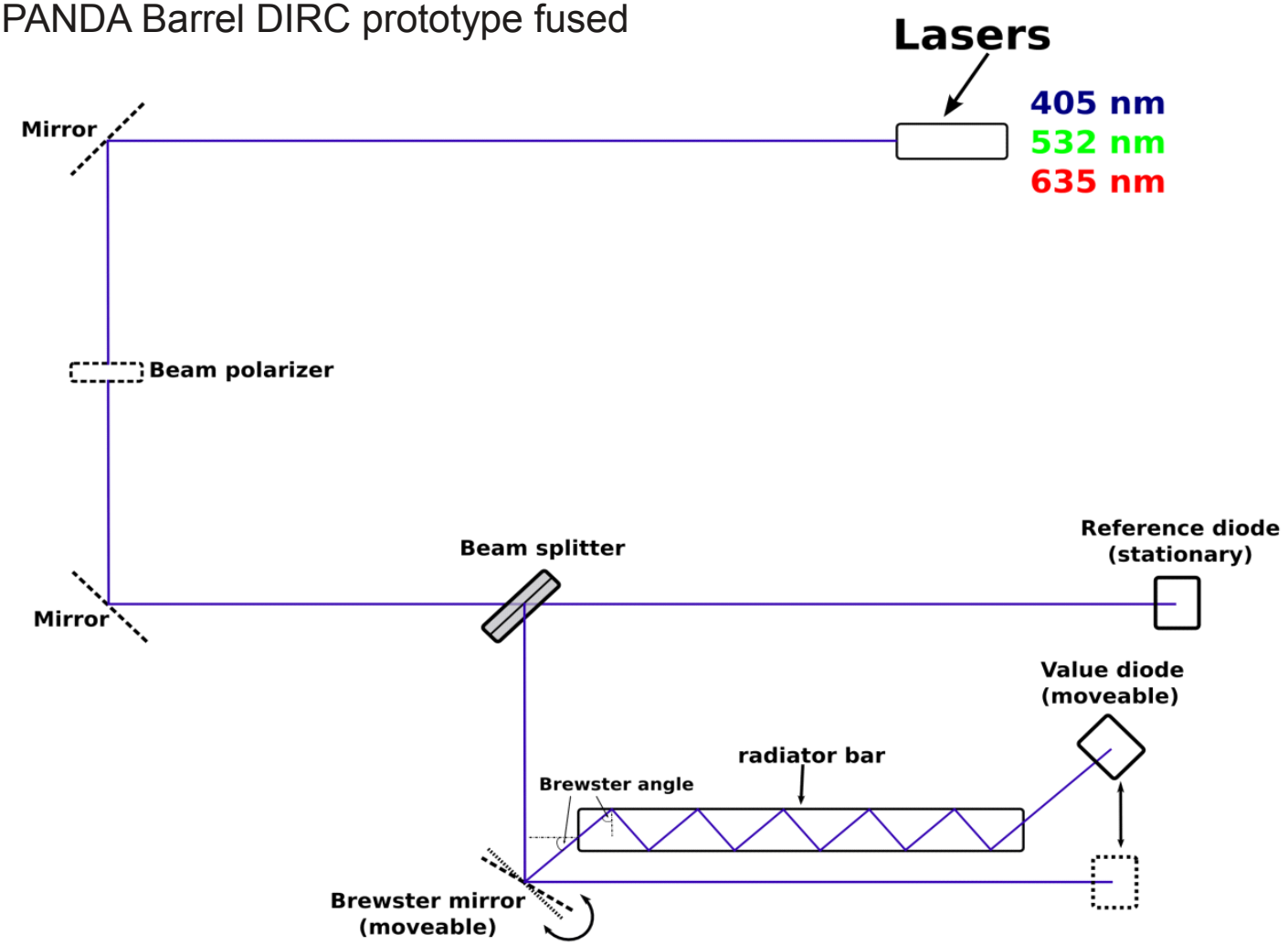
- good separation in space
- ~4 % of tracks are hit same bar box (using DPM)

- good separation in time
- 90% of 2 tracks in same barbox still could be separated using delta timing.

Optics lab status (Mavin Krebs)

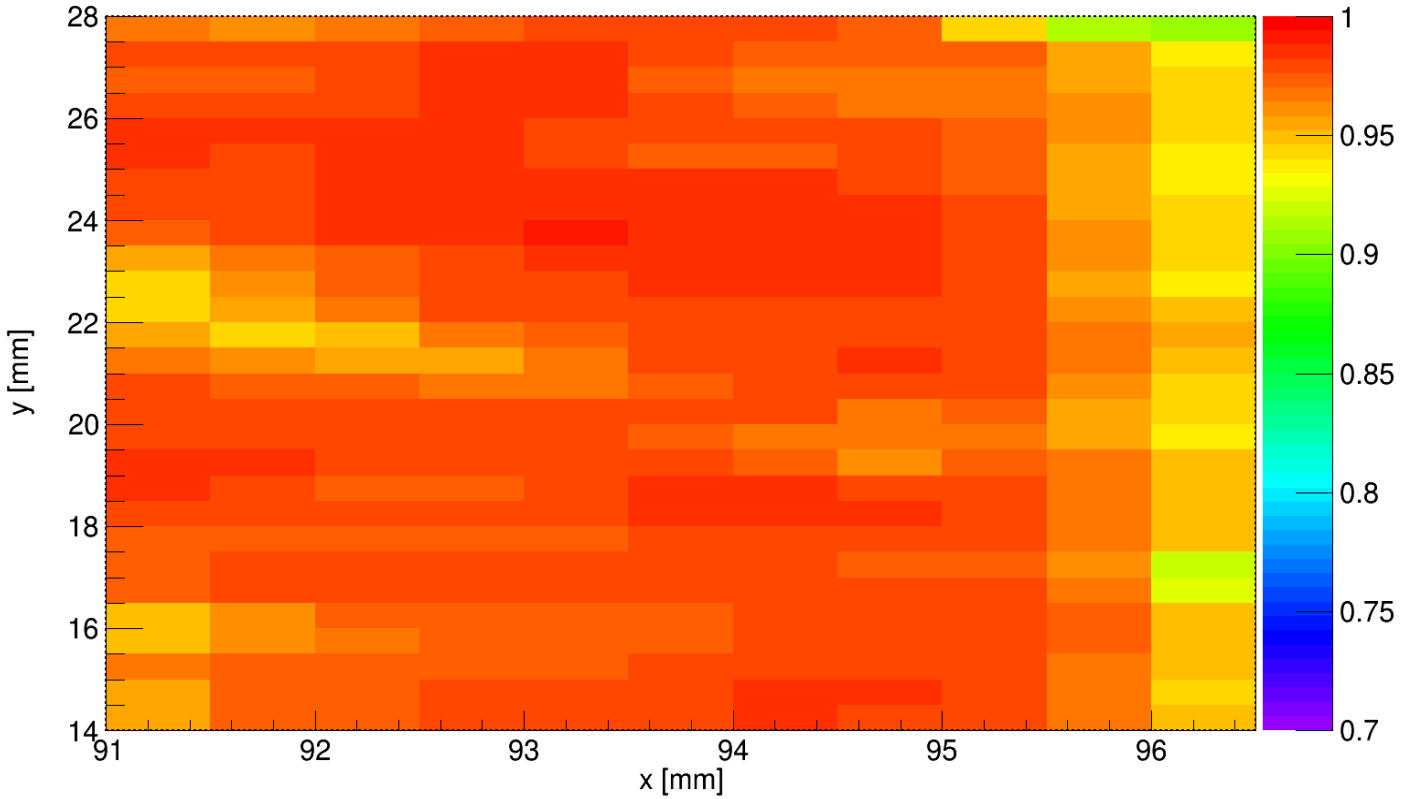
QA measurements for current PANDA Barrel DIRC prototype fused silica radiator bars

Current setup in opticslab (for internal reflection measurements)



- Obtaining transmission values indirectly, by measuring laser intensity ratios
- Double ratio of measured intensities by value- and reference diode
  - for cases: laser going through radiator and laser going through air

Transmission matrix for one prototype bar made by Schott Lithotec (L1)

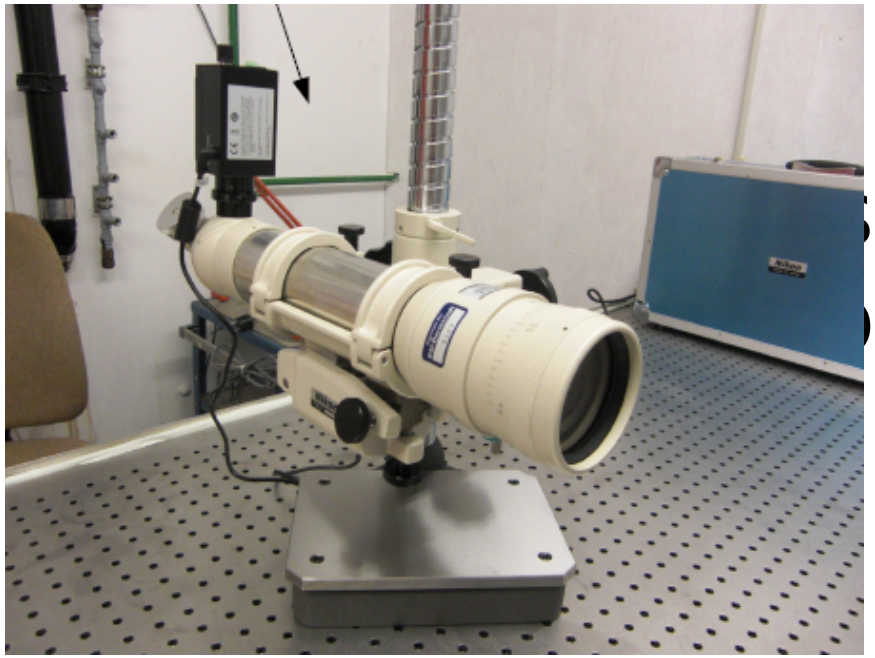


Transmission (31reflections):
T = 0.975 ± 0.005

- Crucial values like reflectivity and absorption length are measured with this setup
  - Surface roughness (H) will be calculated later on with $R = 1 - \left(\frac{4\pi \cdot H \cdot \cos(\theta) \cdot n}{\lambda}\right)^2$
- Setup is ready for measuring bars from different vendors, to see if they match the specs, e.g. H ≤ 10 A

Quality Control: Autocollimator (Georg Schepers)

First preparation of Quality Assurance measurements (Acceptance tests) for squareness and parallelism of the quartz bars



Nikon 6D Autocollimator:
Accuracy 0.002 mrad

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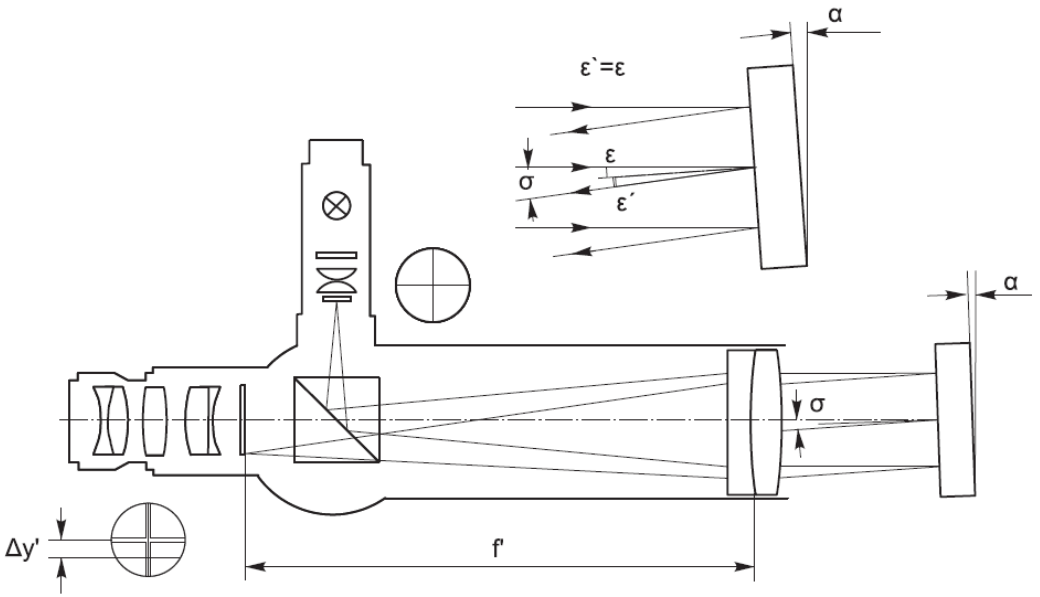
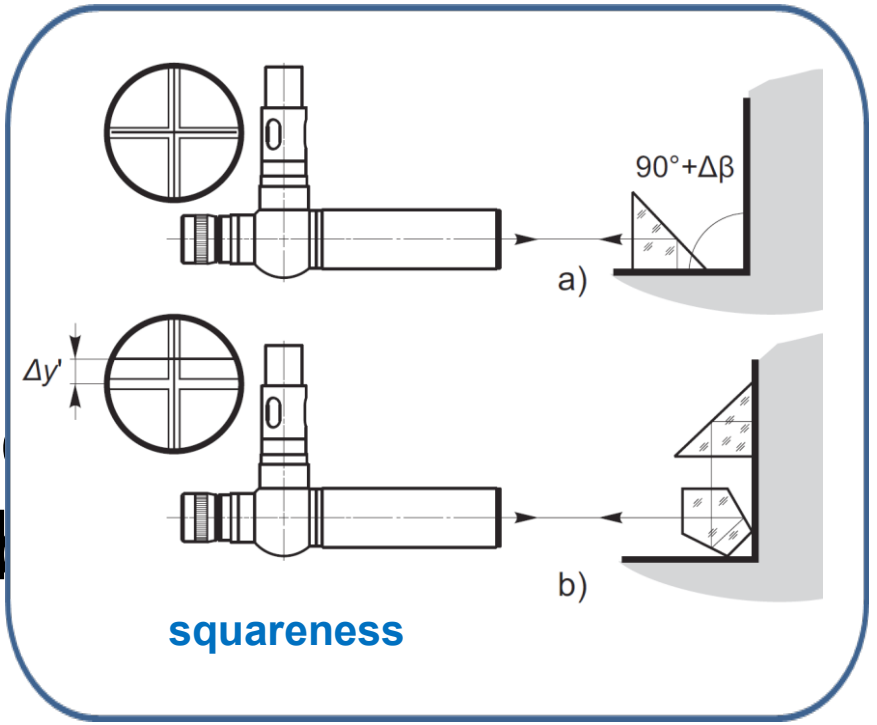
Accuracy specified for PANDA:
0,25 mrad
Accuracy needed:
0,1 mrad

Thus the autocollimator measurement is about 50 times that accurate

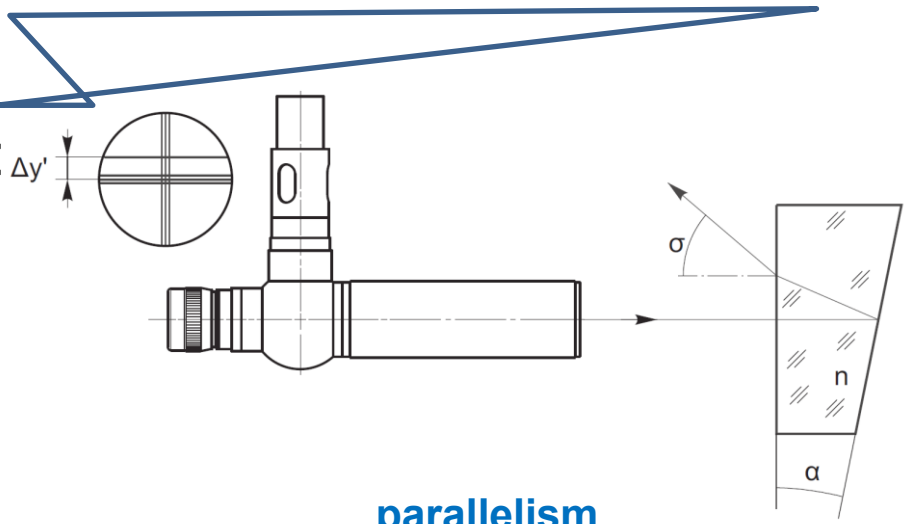
Figures from MÖLLER-WEDEL OPTICAL GmbH

Quality Control: Autocollimator

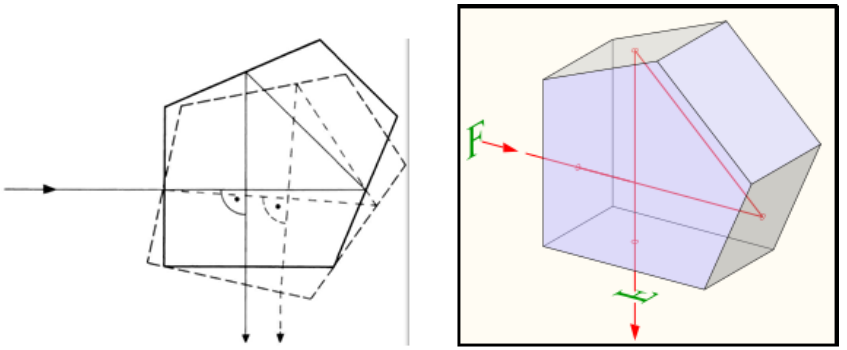




squareness



parallelism



flatness

Figures from MÖLLER-WEDEL OPTICAL

Reading the surface reflection of the Bar-Sides through the Pentaprism

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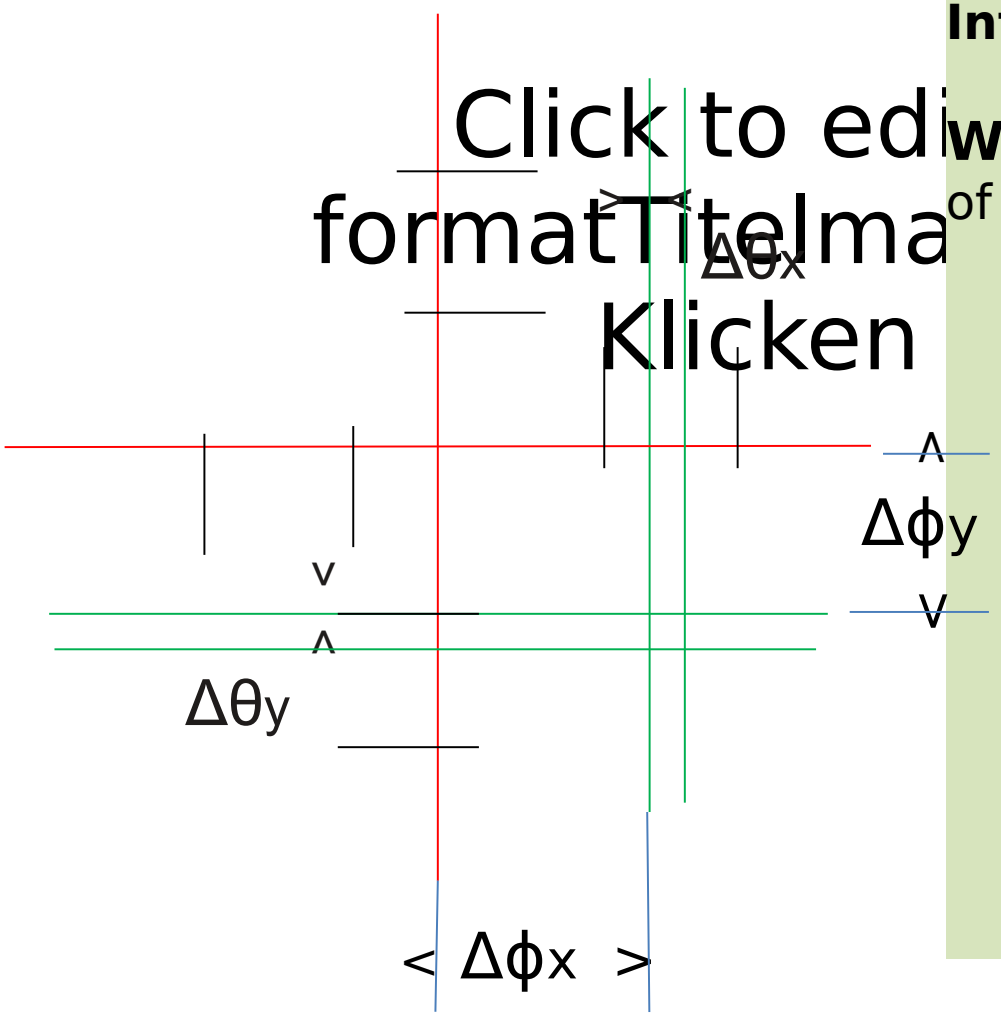


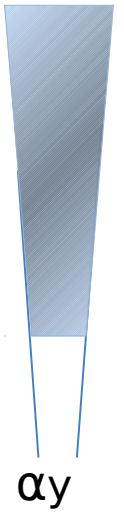
Information:

Wedge-angle (Parallelism) of the Quartz Bar

$$\alpha_{xs} = \frac{\Delta\theta_x}{n} = \frac{\sigma_x}{2n}$$

Squareness

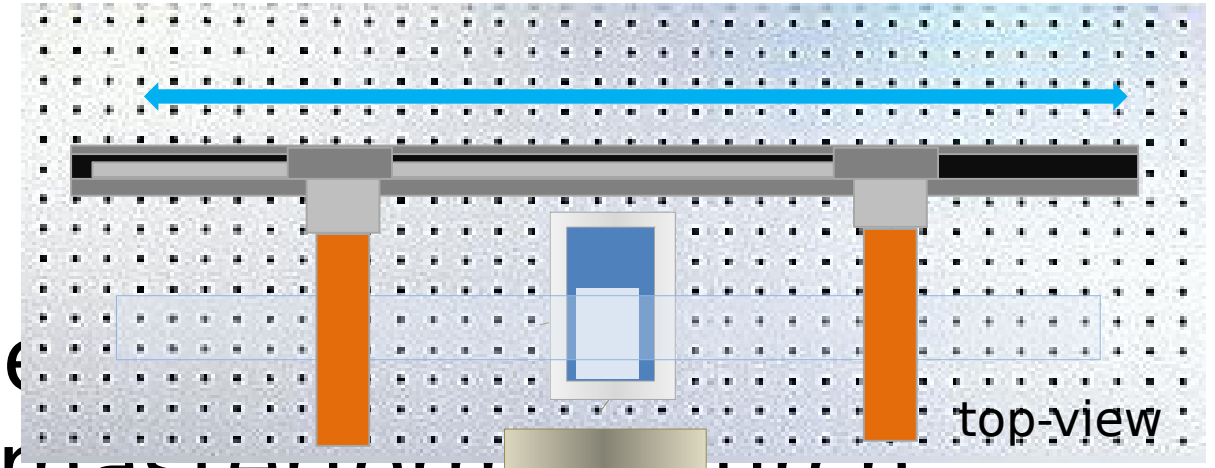
$$\beta_y = \Delta\phi_y$$



Pentaprism underneeth the bar

Orthogonality of Face and Down-side

- **Prism table**
  - 3D-movable **high** accuracy
- **Barholder**
  - x-y-movable, **normal** accuracy
  - Bar held on two points
  - in preparation



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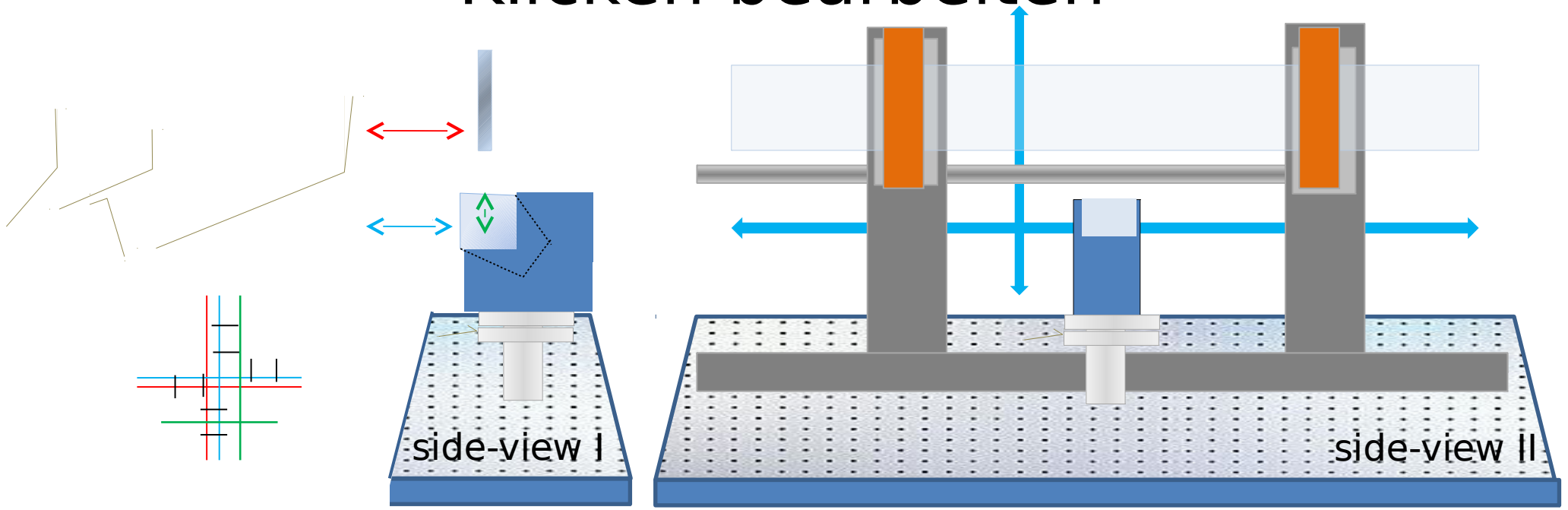
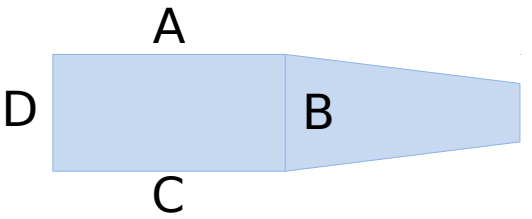


Autocollimator setup in Preparation

First Measurements: Squareness
Quartz bar with large deviation from spezifications

Bar Sides	Δβ [mrad]	Bar Sides	Δβ [mrad]
A-D	4,029	D-A	4,014
D-C	-3,757	C-D	-3,747
C-B	3,844	B-C	3,837
B-A	-4,072	A-B	-4,060
Sum	0,044	Sum	0,044



Error:
Autocollimator 0.002 mrad
Penta prism 0.008 mrad (x2)

Thus measurement error 0.011 mrad

Reproducibility within error, however, systematic error to be found

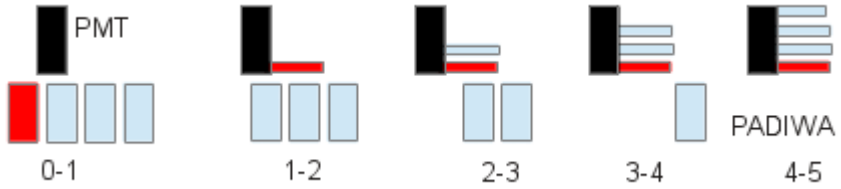
Electronics: PADIWA discriminator research (C.S)

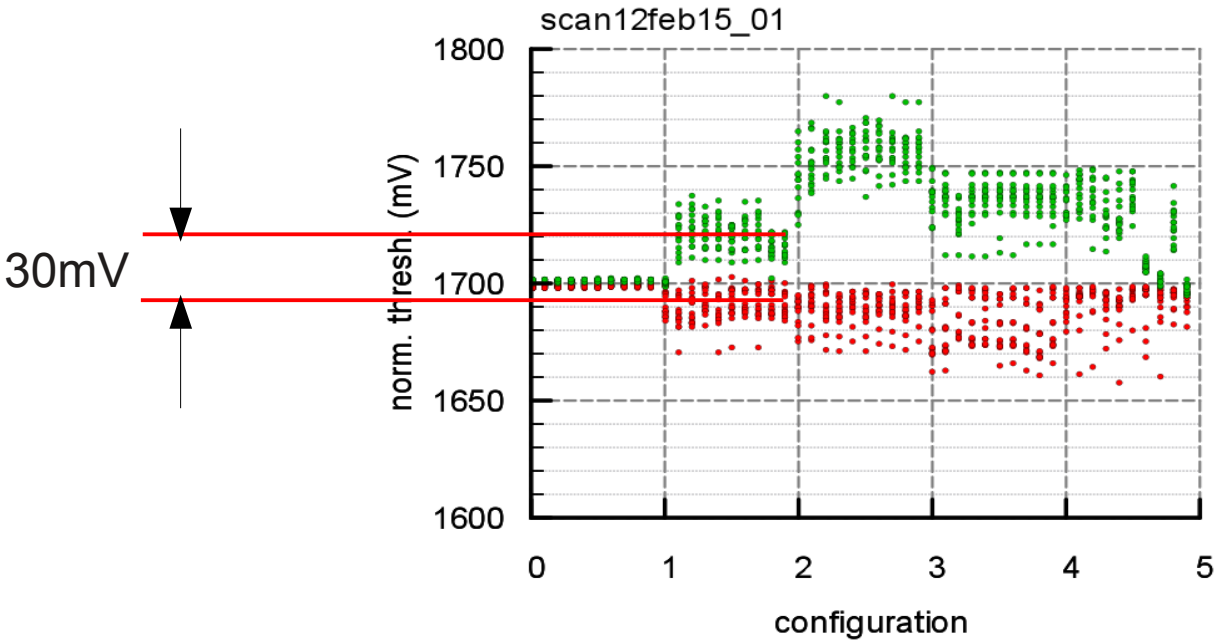
Single PADIWA works fine.

Last beamtime at GSI 2014: there is an issue with many PADIWA plugged on MCP-PMT

The automatic threshold search program finds to large thresholds → low signals are cut.

Suspicion: noise on the input pins.

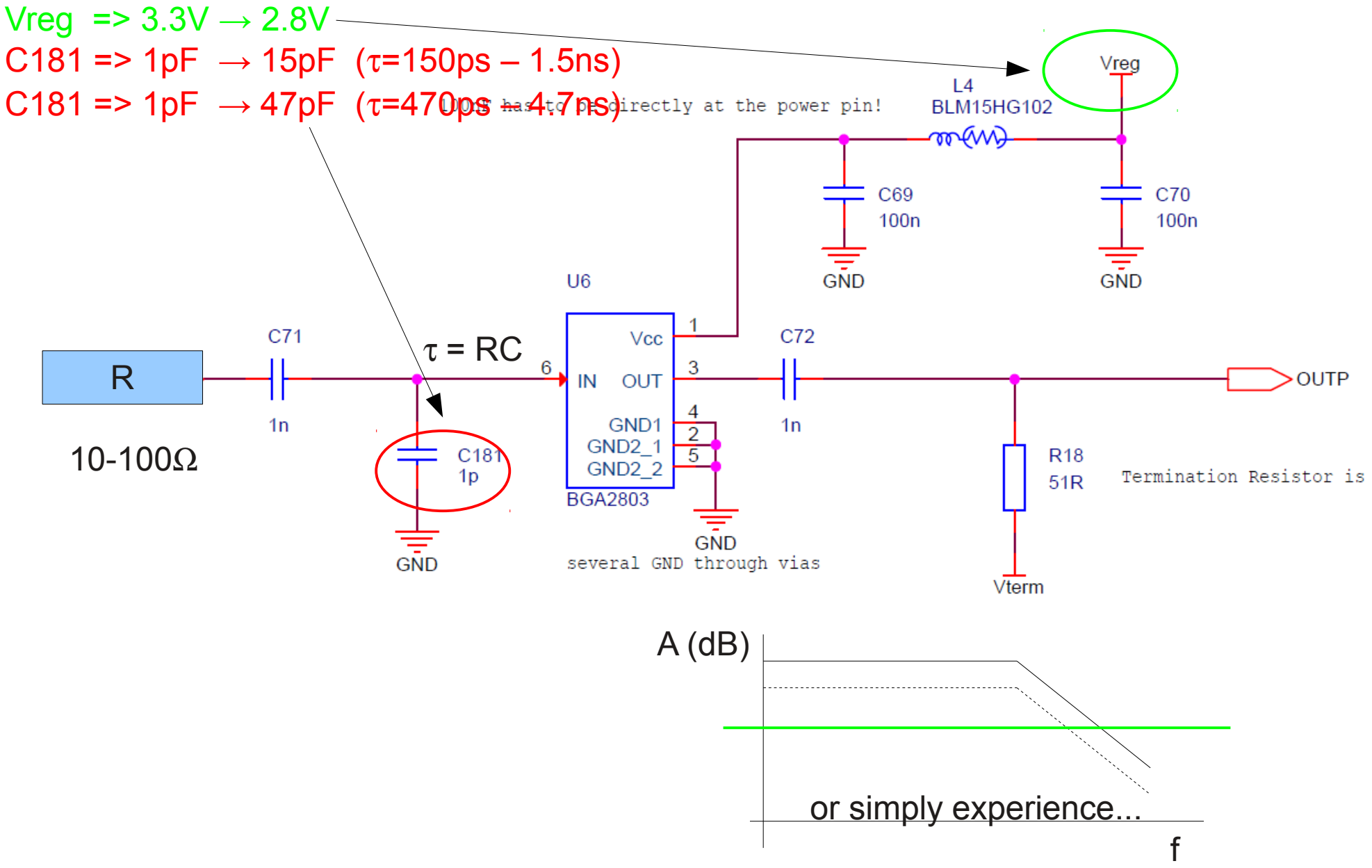


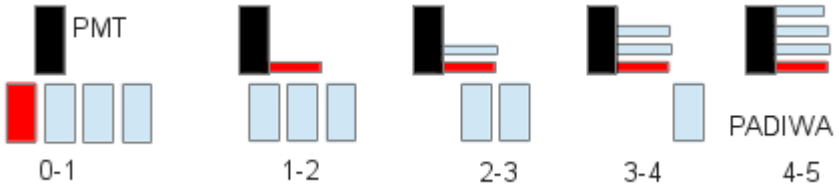


PADIWA on MCP-PMT (1-2)
30mV noise band (after amp x10)
→ 3mV at input pins

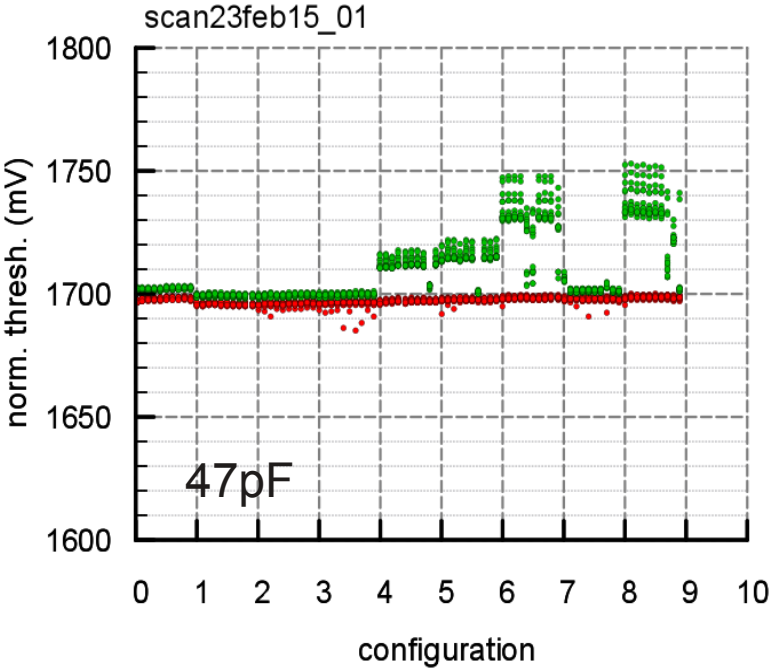
Idea: reduce bandwith of PADIWA

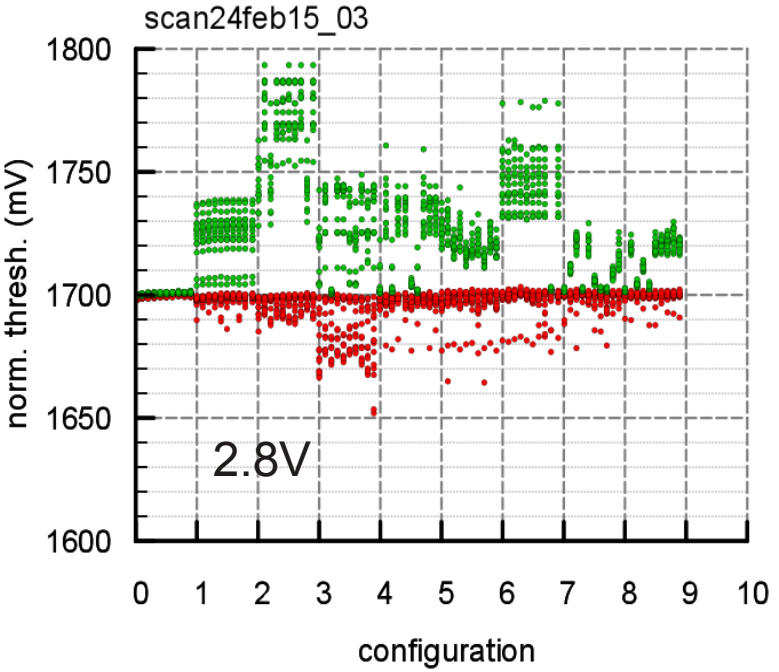
(first done by CBM RICH experiment / Christian Pauly)

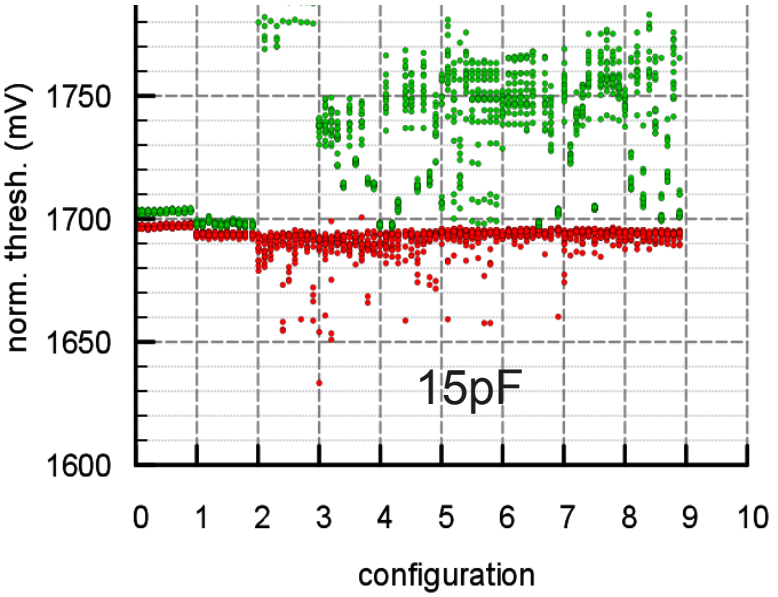


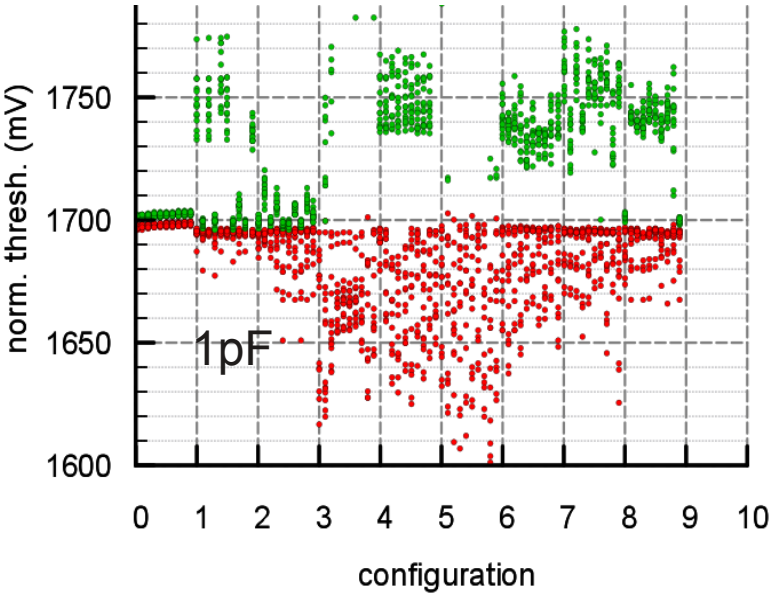


4 additional neighbours



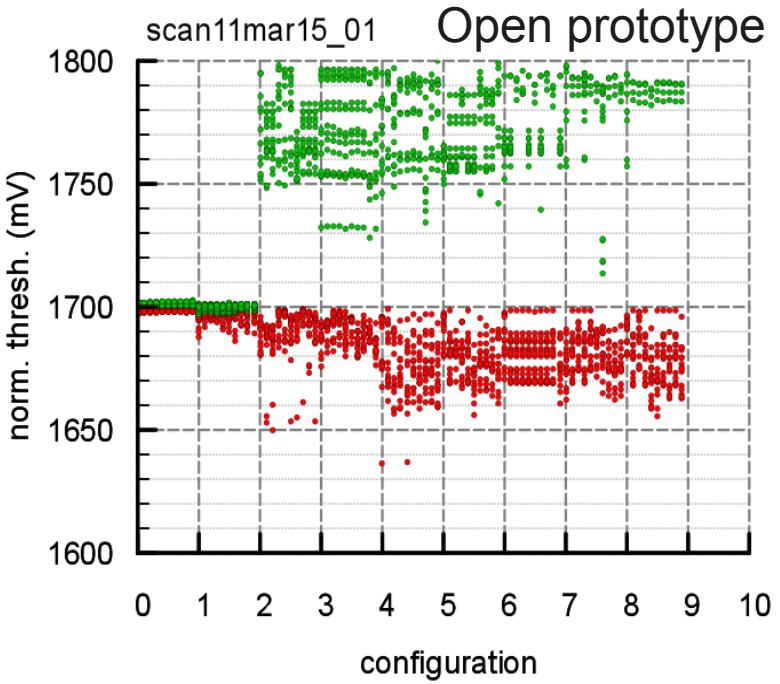


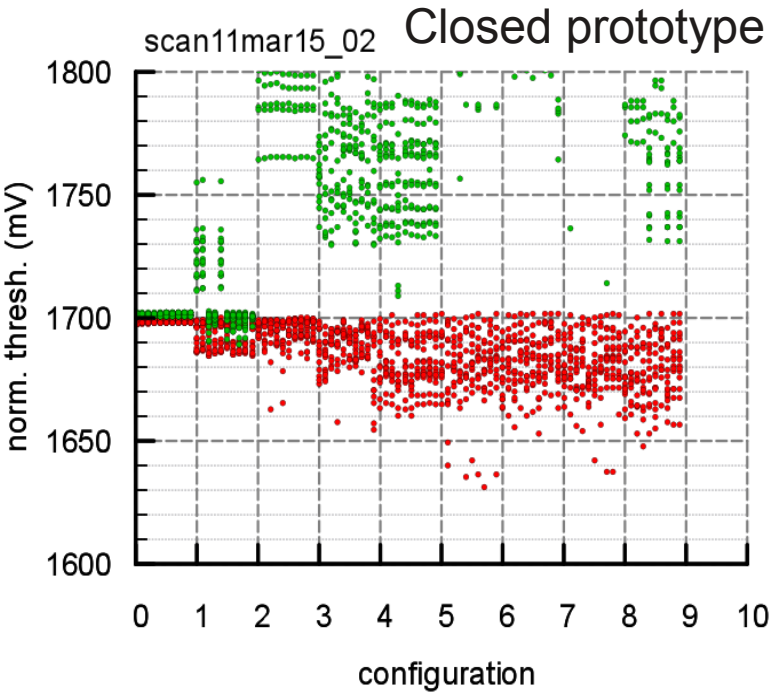


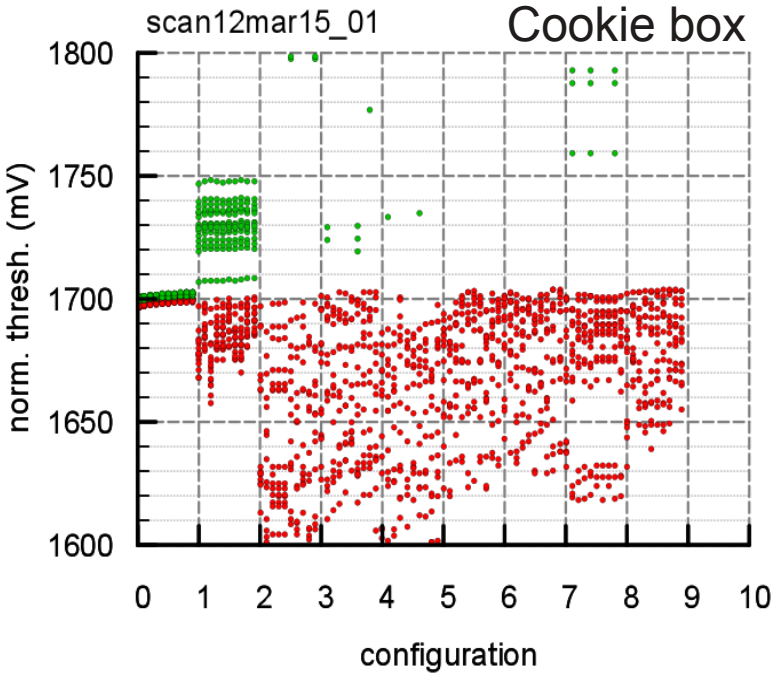


Noise pickup from outside?

Here, the neighbours are even not powered and no data cable







Noise comes **not** from outside.

Threshold search routine works on
16 channels at the same time

Feedback by crosstalk, amplified by
Neighbours cause wrong thresholds.

Only counter measure:

- Single threshold search
- Bandwdth limit

Time based simulations of Barrel DIRC have started.

Optical QA of radiator bars start to give similar results as in old lab.

Mechanical QA of radiator bars with auto colliminator promising to improve old „laser pointer“ measurements.

PADIWA issue solvable on short term by bandwidth limitation and different threshold search routine.