A glass plate for particle identification

"Beam Telescopes and Testbeams for Detector R&D"
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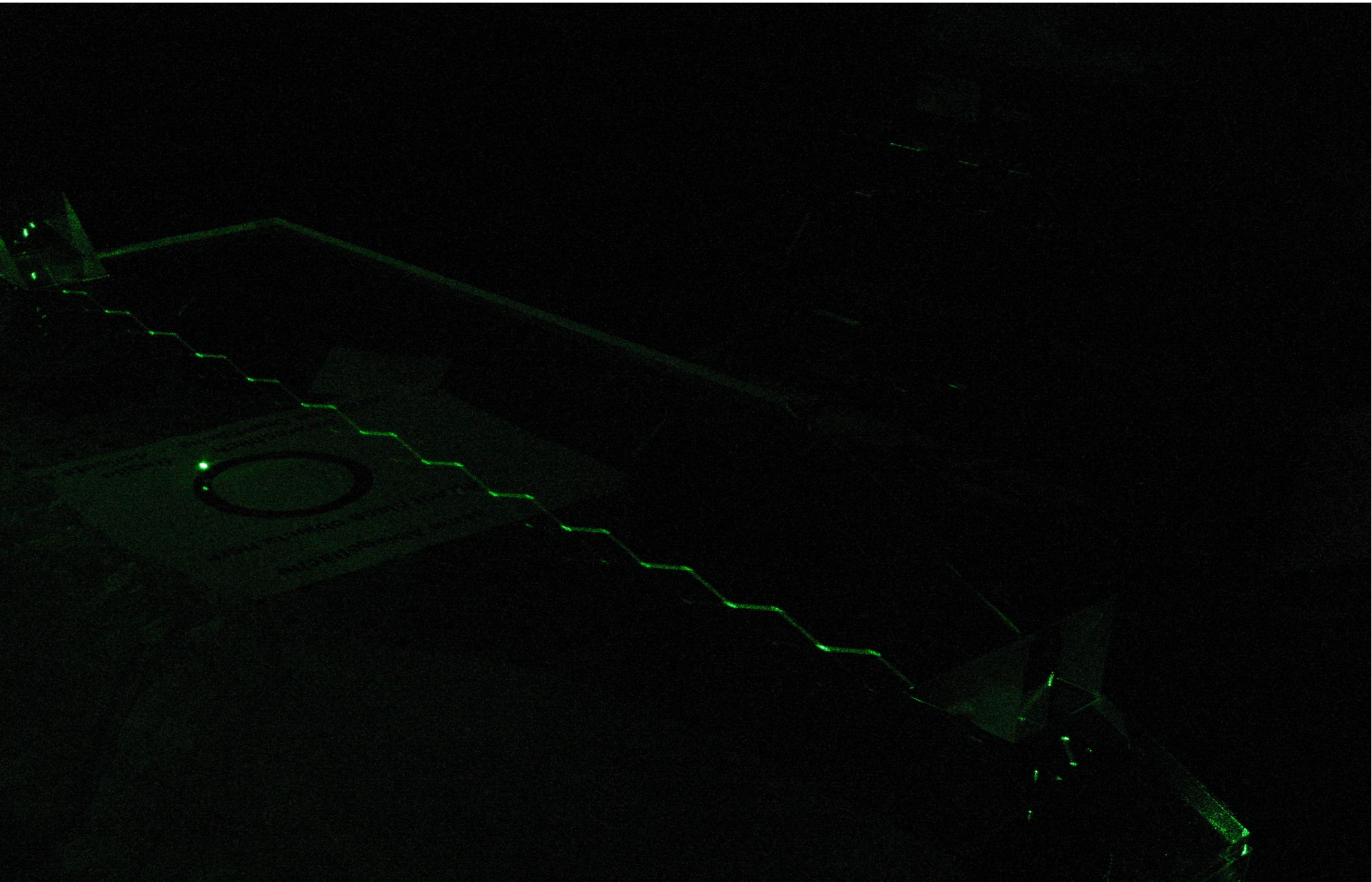
Outline

- The Principle
- Prototypes
- Testbeams
- A few Results
- A wish for T21-24

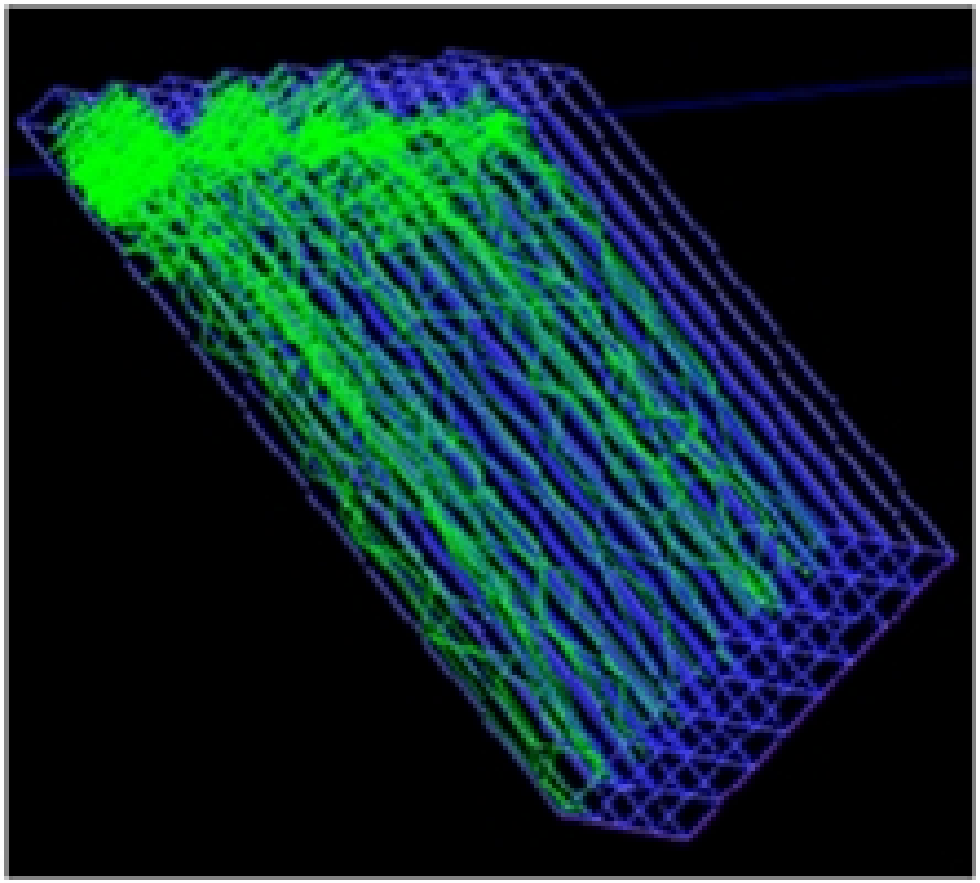
The working principle

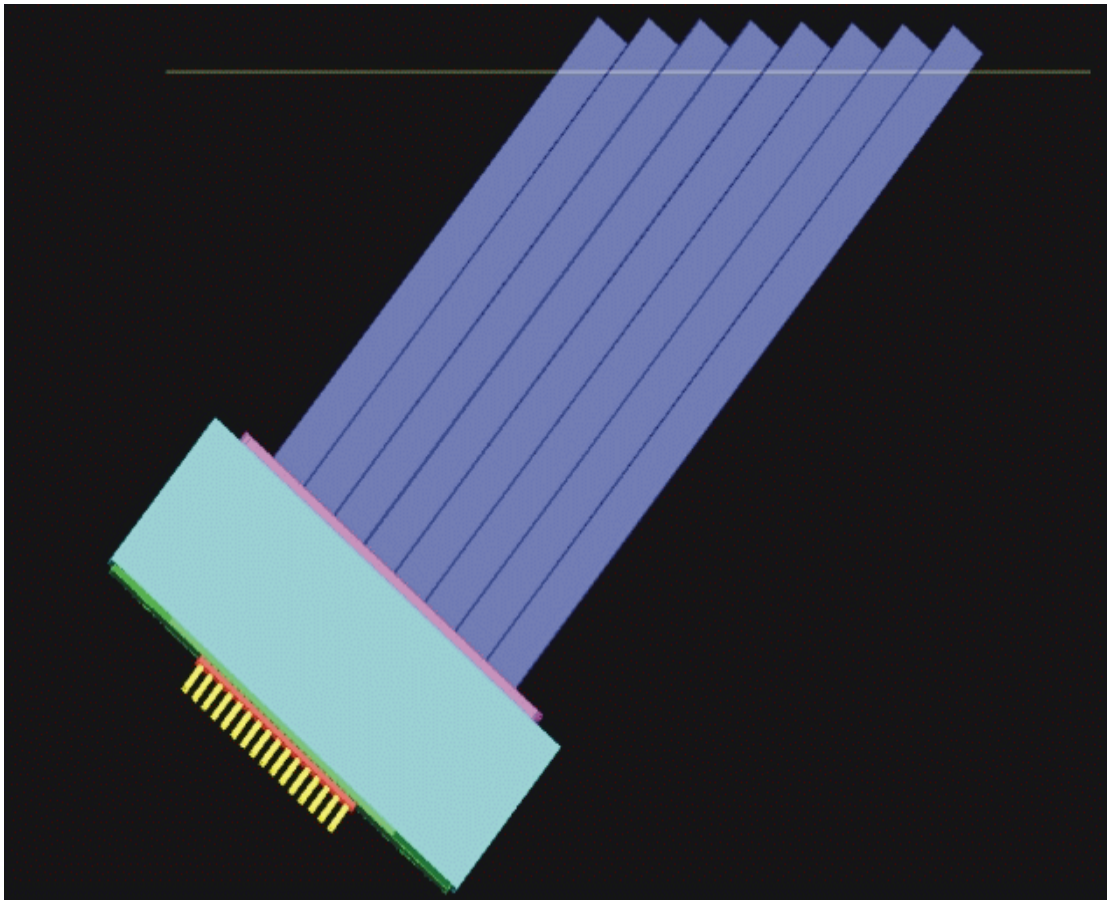


Projects that require precise timing

AFP (ATLAS Forward Physics)

http://arxiv.org/pdf/1302.0623v1

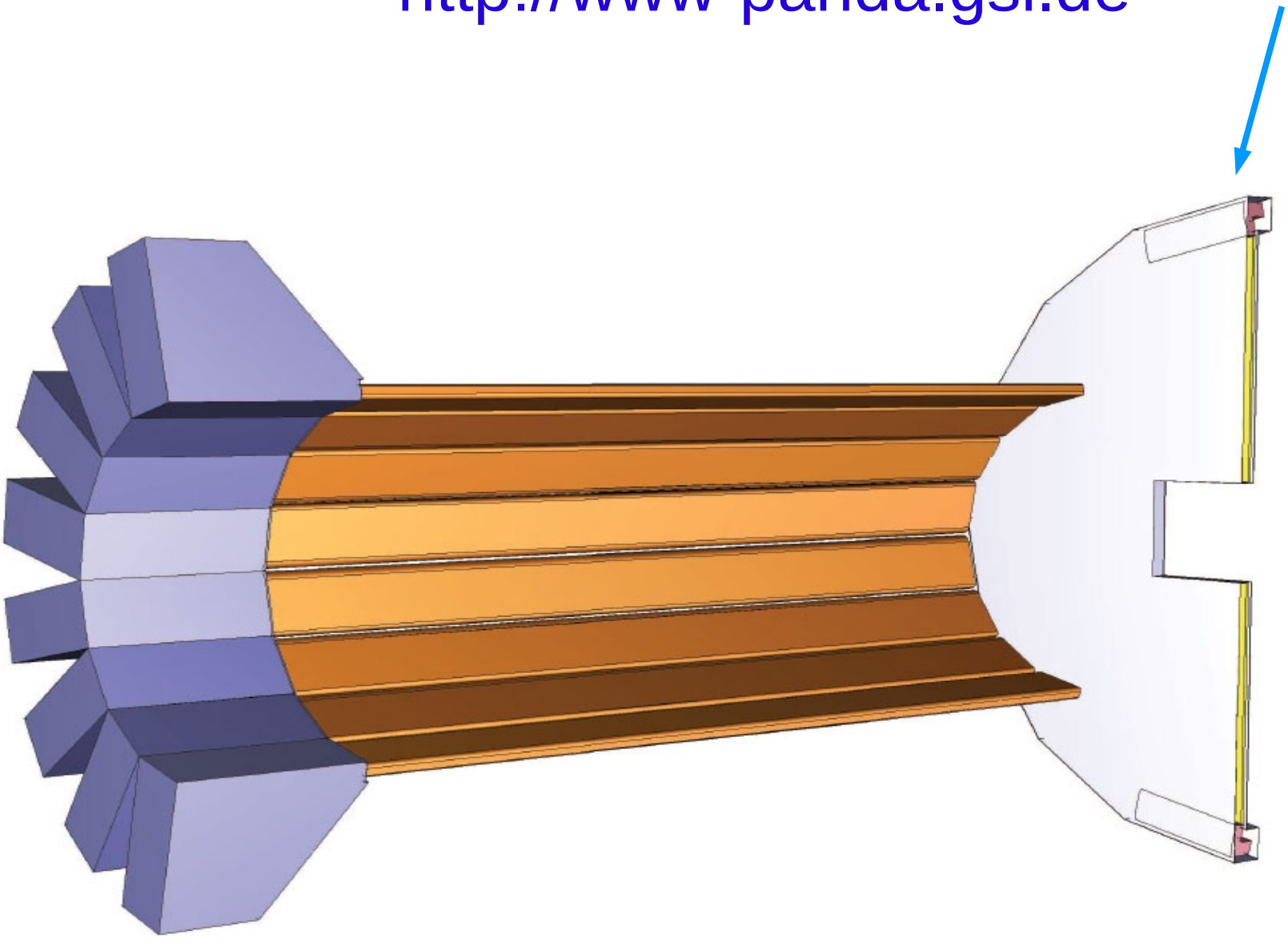




Projects that require precise timing and Coordinate measurement

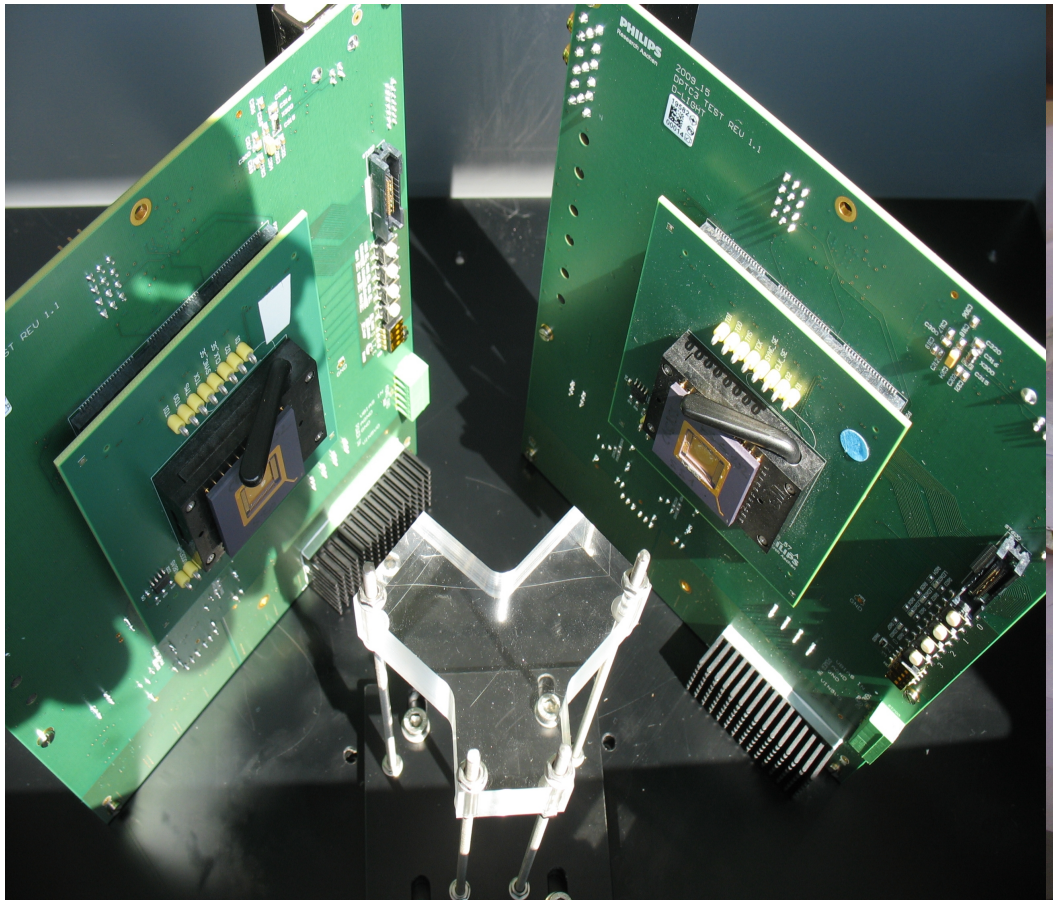
PANDA DIRC's, EDD(Endcap Disc DIRC)

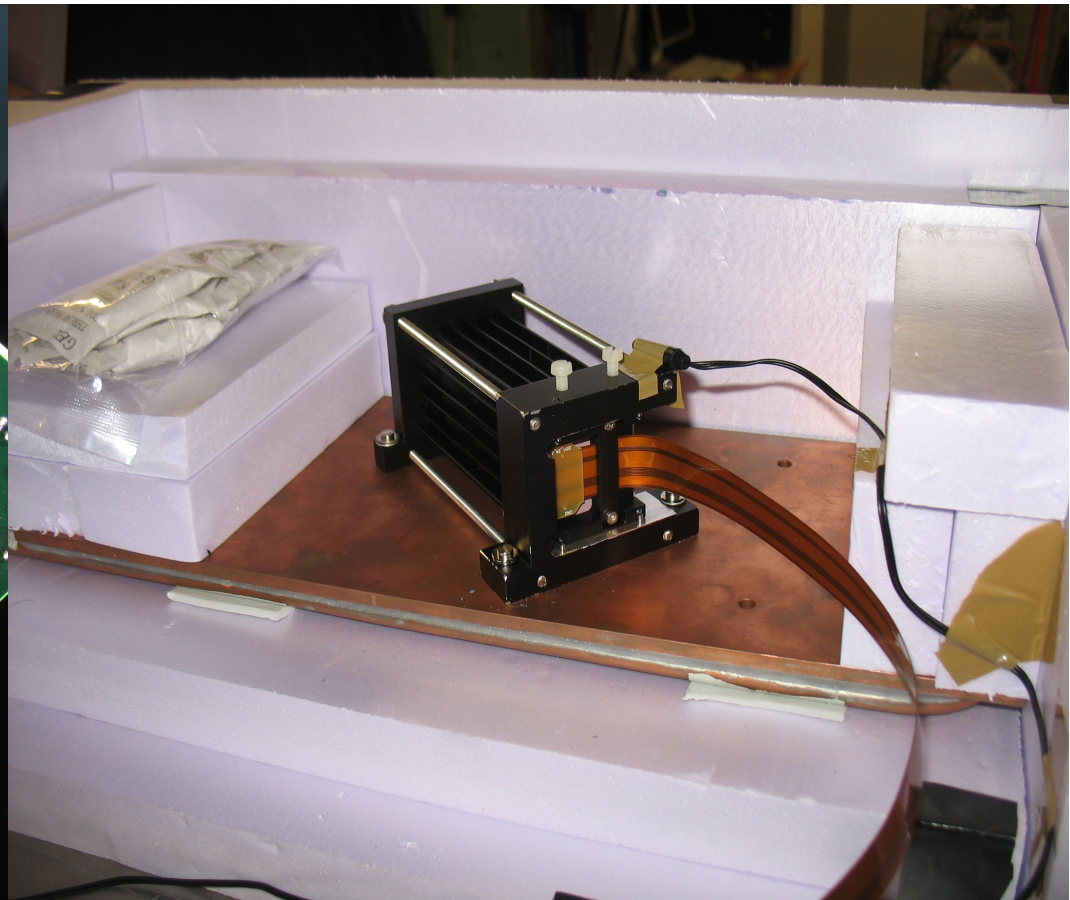
http://www-panda.gsi.de



Prototypes we build to measure Cherenkov photons fast timing and coordinate with Philips dSiPM

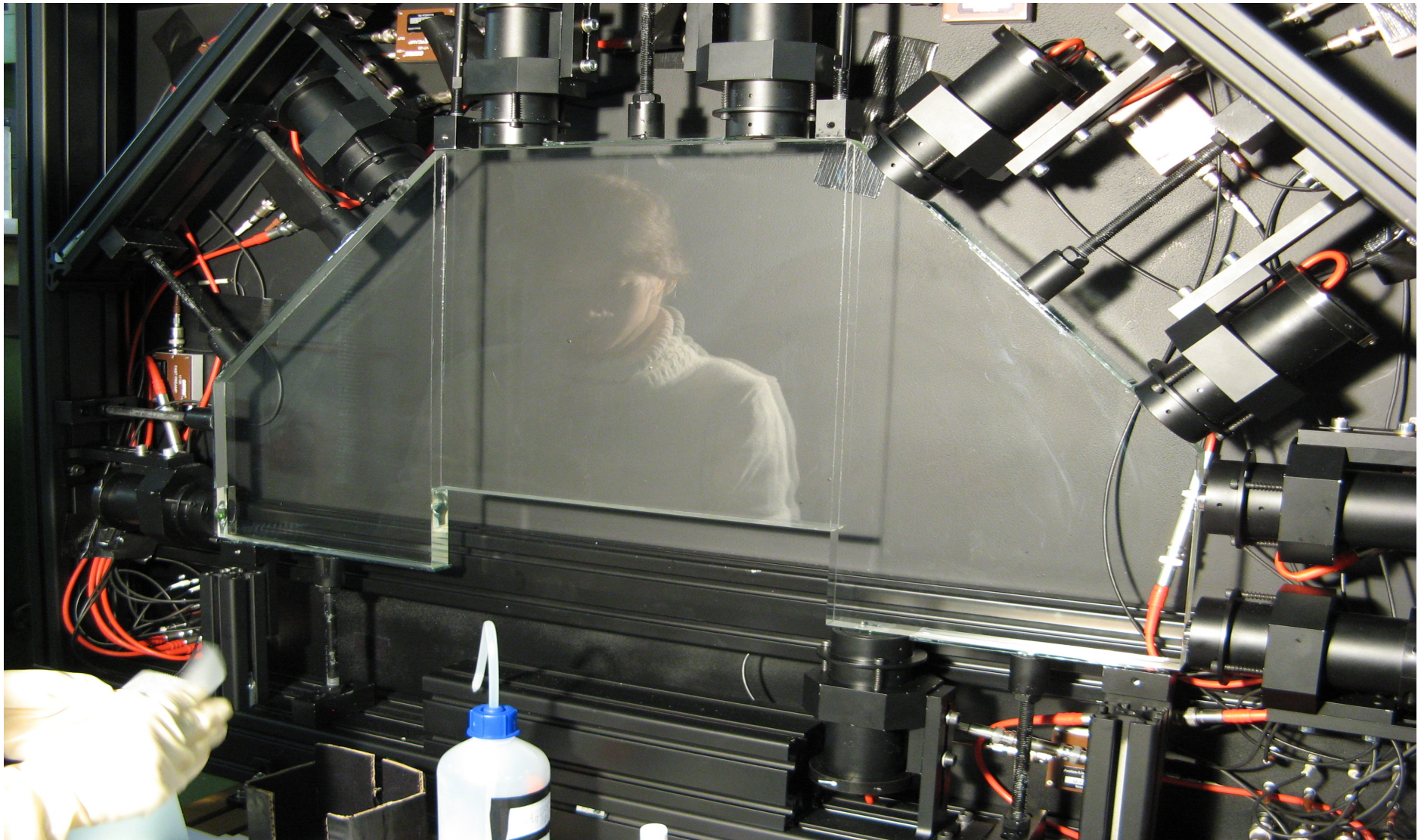
http://www.research.philips.com/initiatives/digitalphotonco unting/index.html



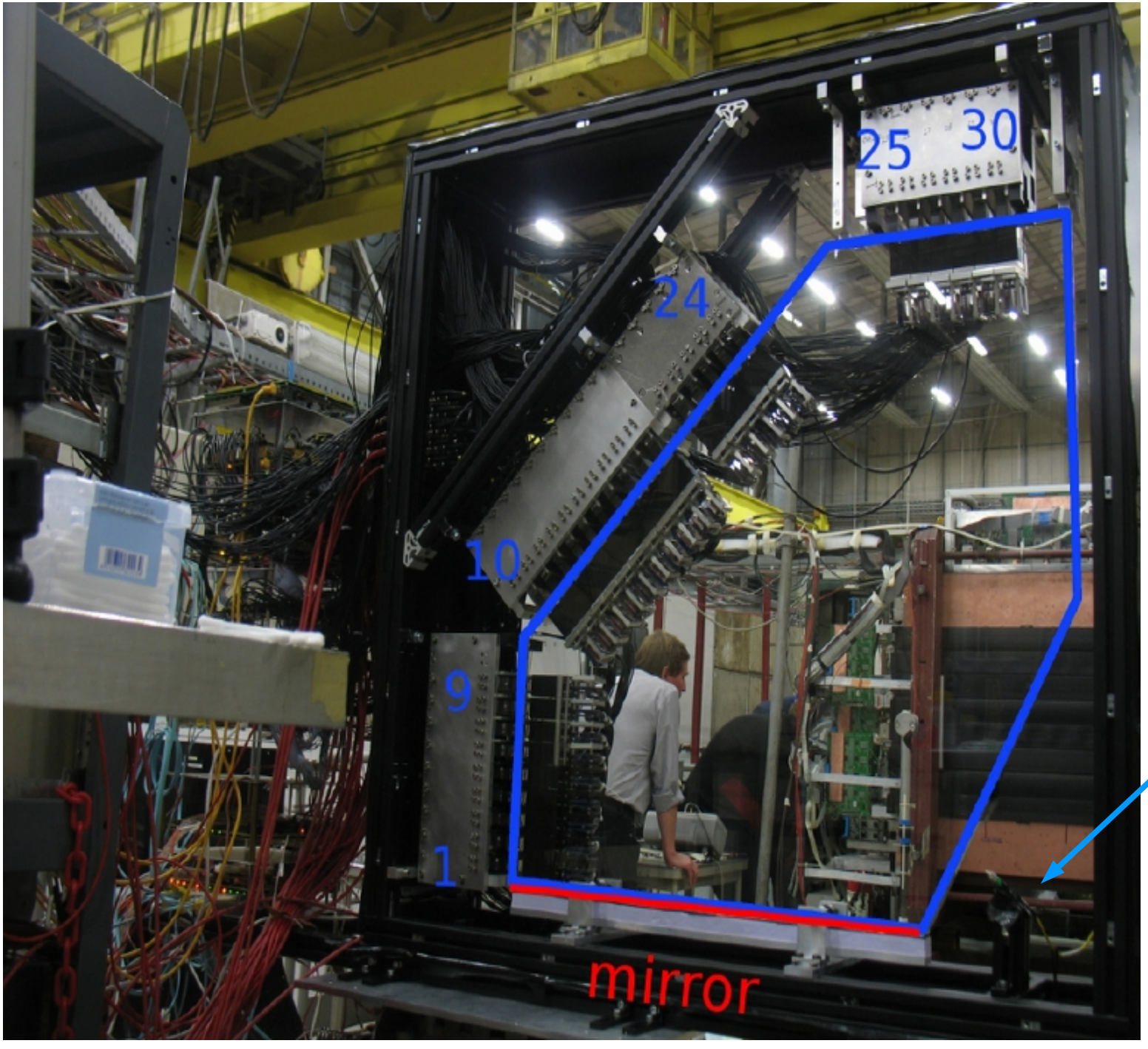


First Prototype of half size half disc

viewed by BINP MCP PMT



PANDA EDD actual design, 1 quadrant as a Prototype

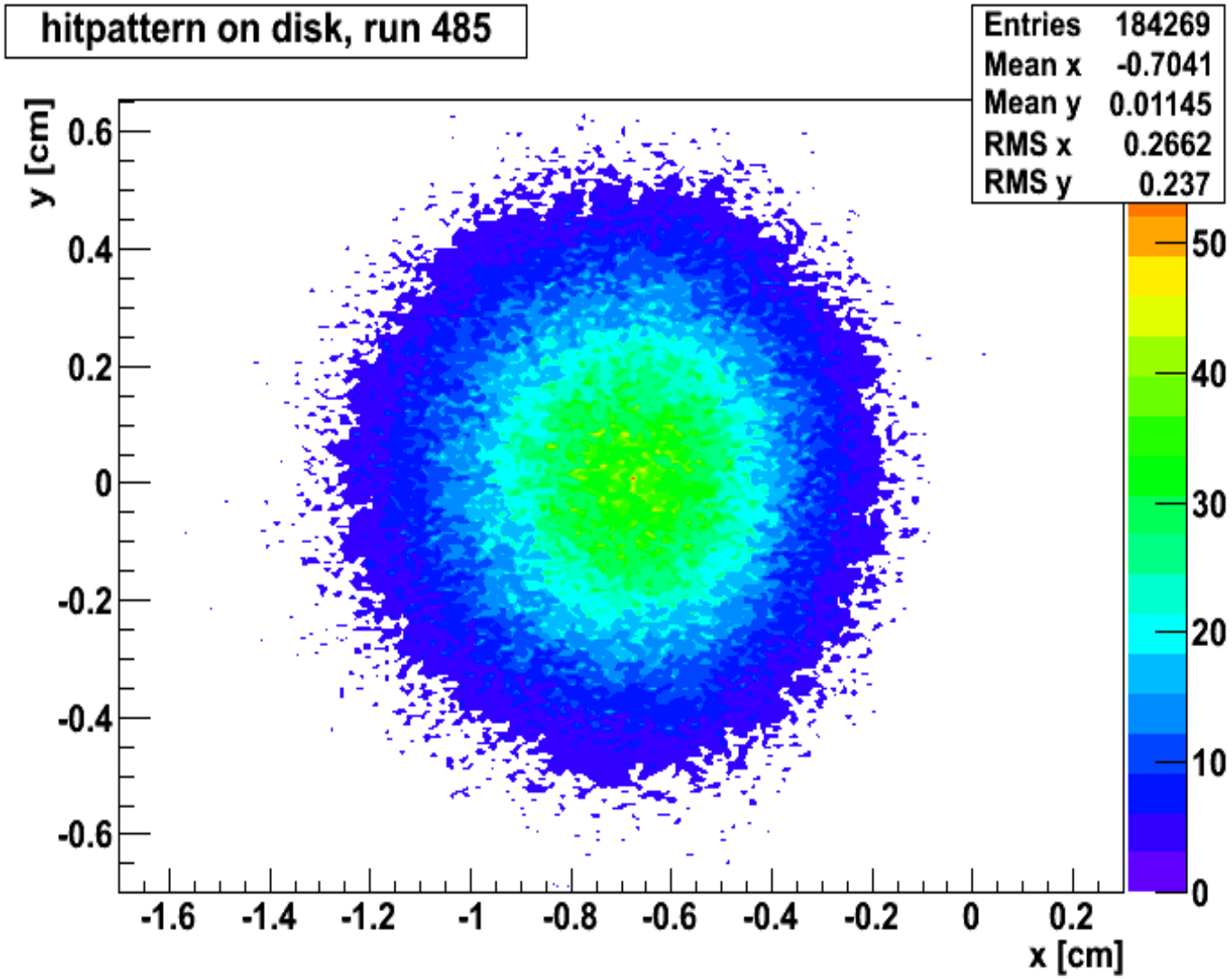


Viewed by 30 Hamamatsu 16 channel PMTs

On bottom side mirror is attached to enhance hits collection

From rim side laser pulse is shinning to Check detector functionality

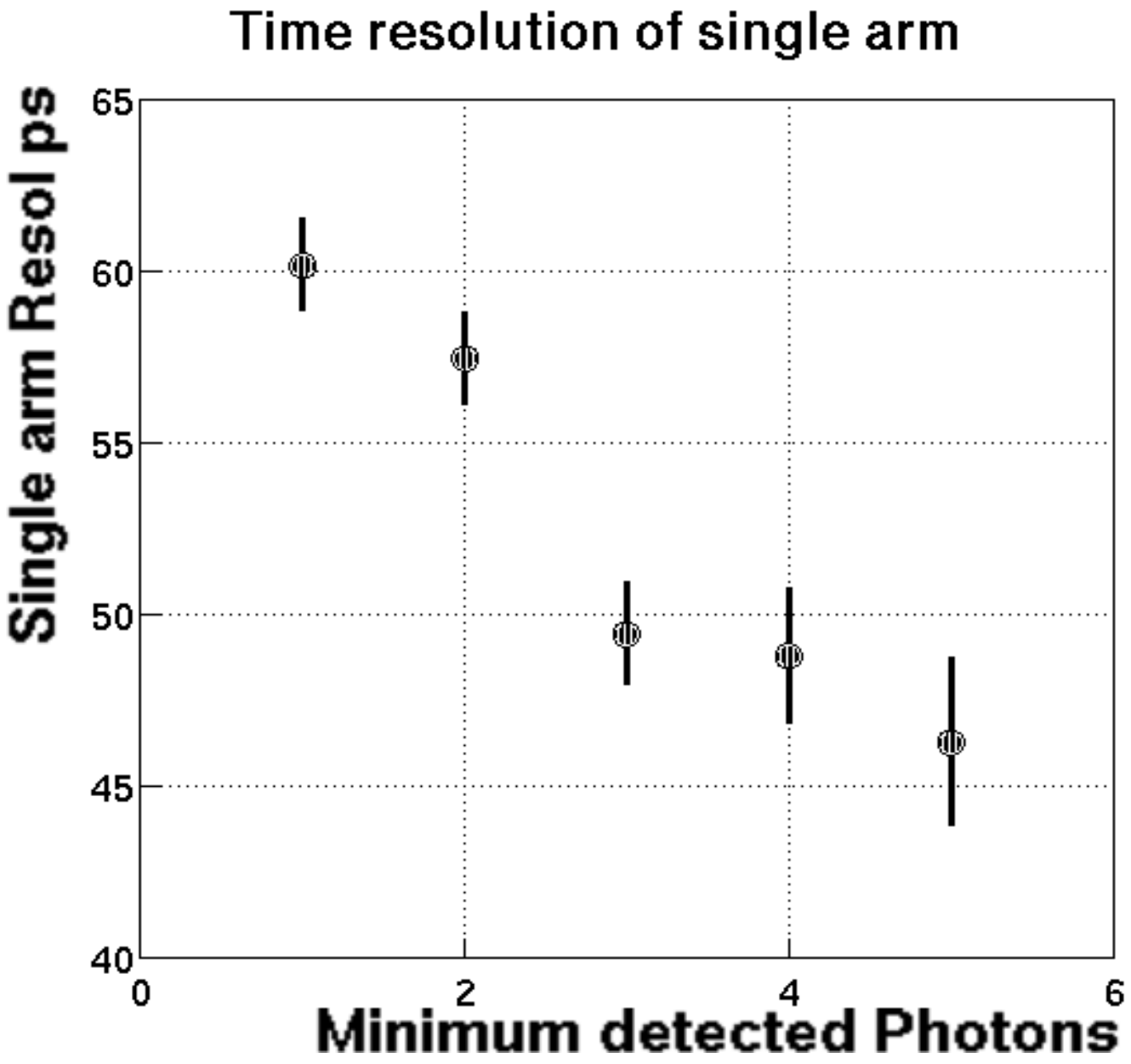
Telescope track projection on DIRC



For exact definition of beam track incident angle DESY beam telescopes were used

Here tracks hit projection Is plotted extrapolated from Telescope

A few Results done at T22,T24

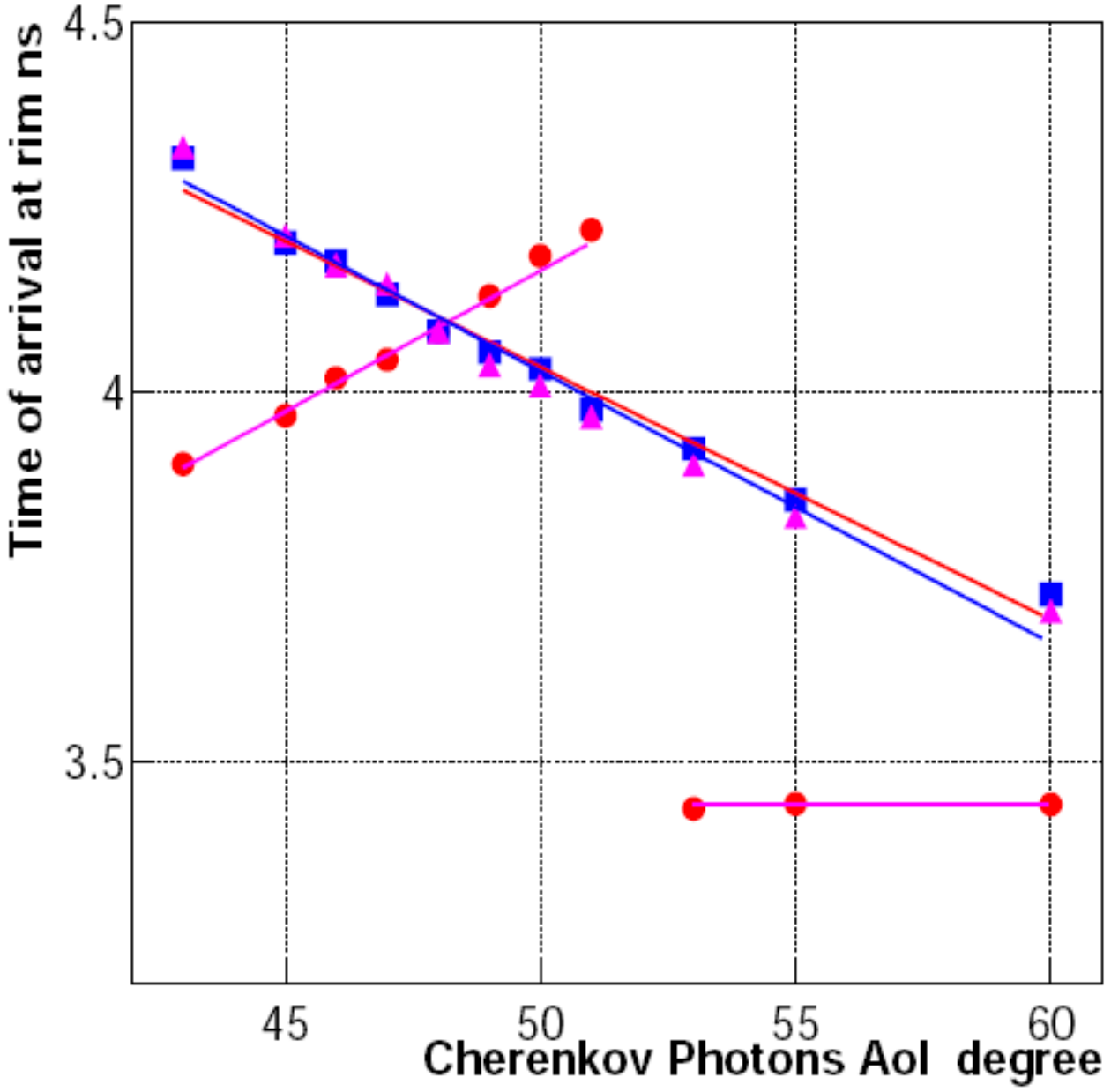


Philips dSiPM time resolution measured using cherenkov Radiation

please not that in second Iteration Philips detector reach ~48ps resolution for single photons, see here

http://www.sciencedirect.com/science/article/pii/S0168900213010814

Results done at T22,T24 Prototype2

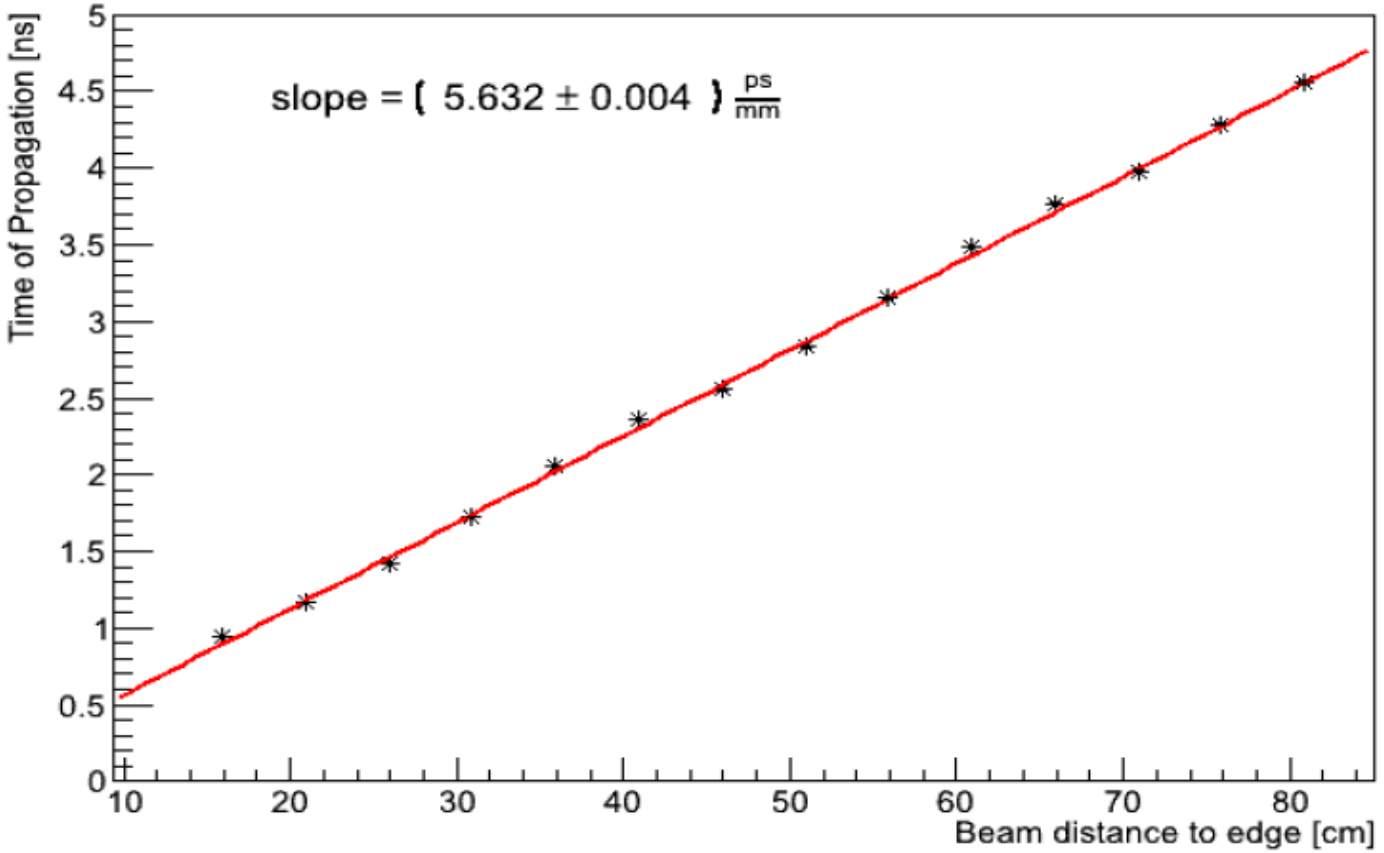


One sees that for opposite side PMT's show different time dependence because of stretching(shrinking) of photons path inside radiator

Drop in red points shows that in that direction one reach TIR (total internal reflection) limit and one sees only bremsstrahlung photons

Results done at T22,T24

ToP for PMT 1 in x-Scan



photon speed in medium

$$c_m = \frac{c}{n} \approx 20.2 \frac{cm}{ns}$$

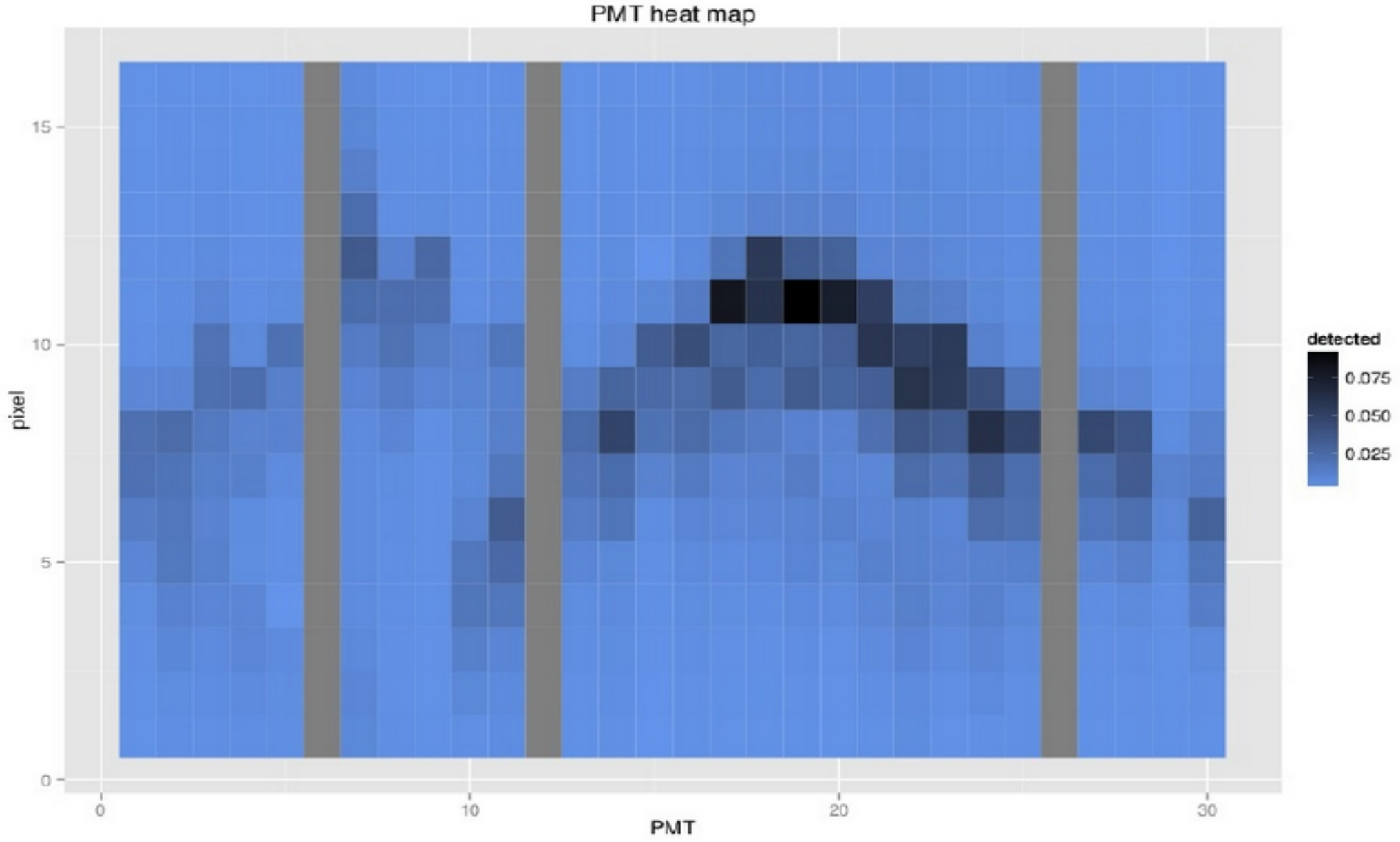
projection on radiator surface

$$c_p = \cos(31°) \cdot c_m$$

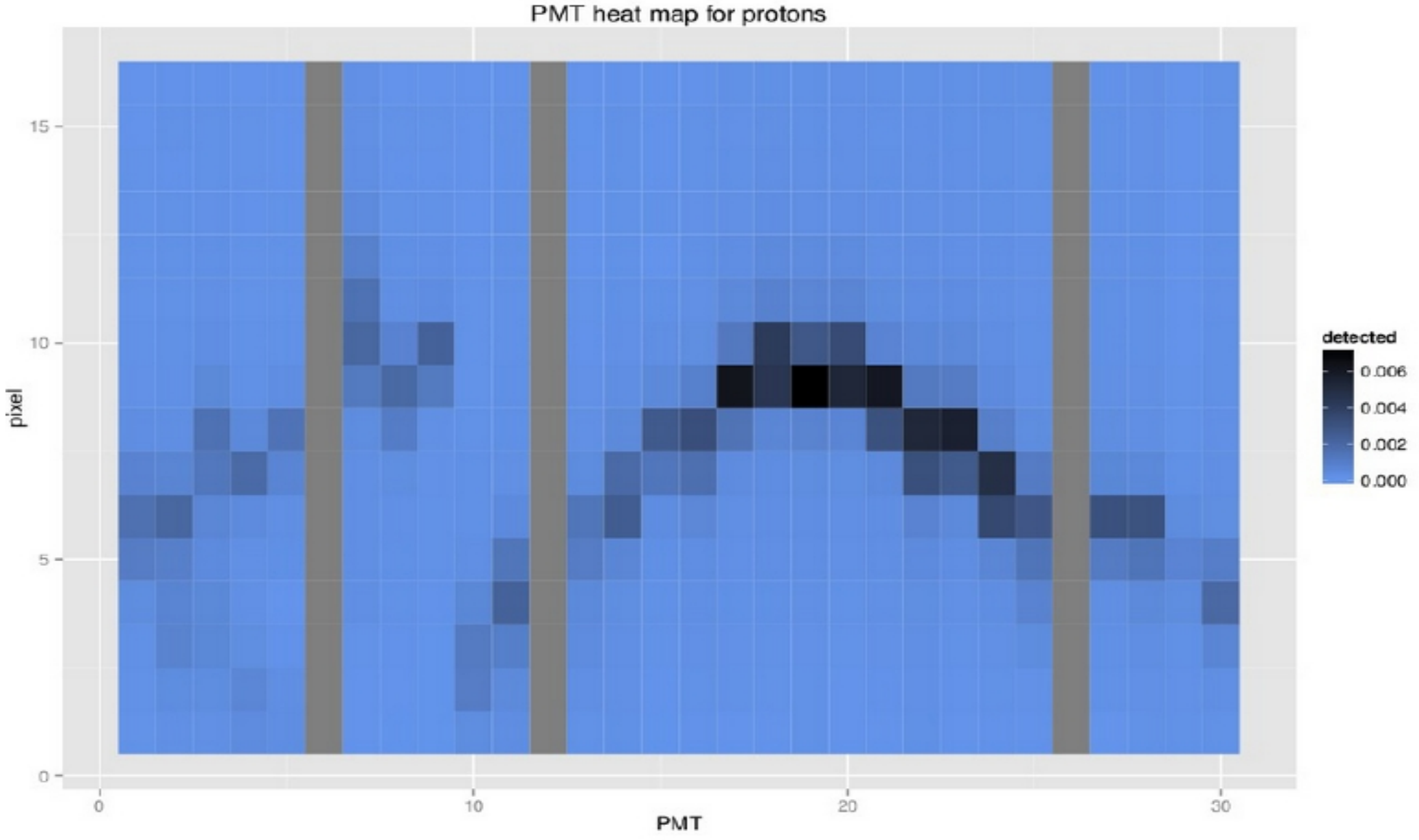
$$\approx 17.5 \frac{cm}{ns}$$

$$\frac{1}{c_p} \approx 5.716 \frac{ps}{mm}$$

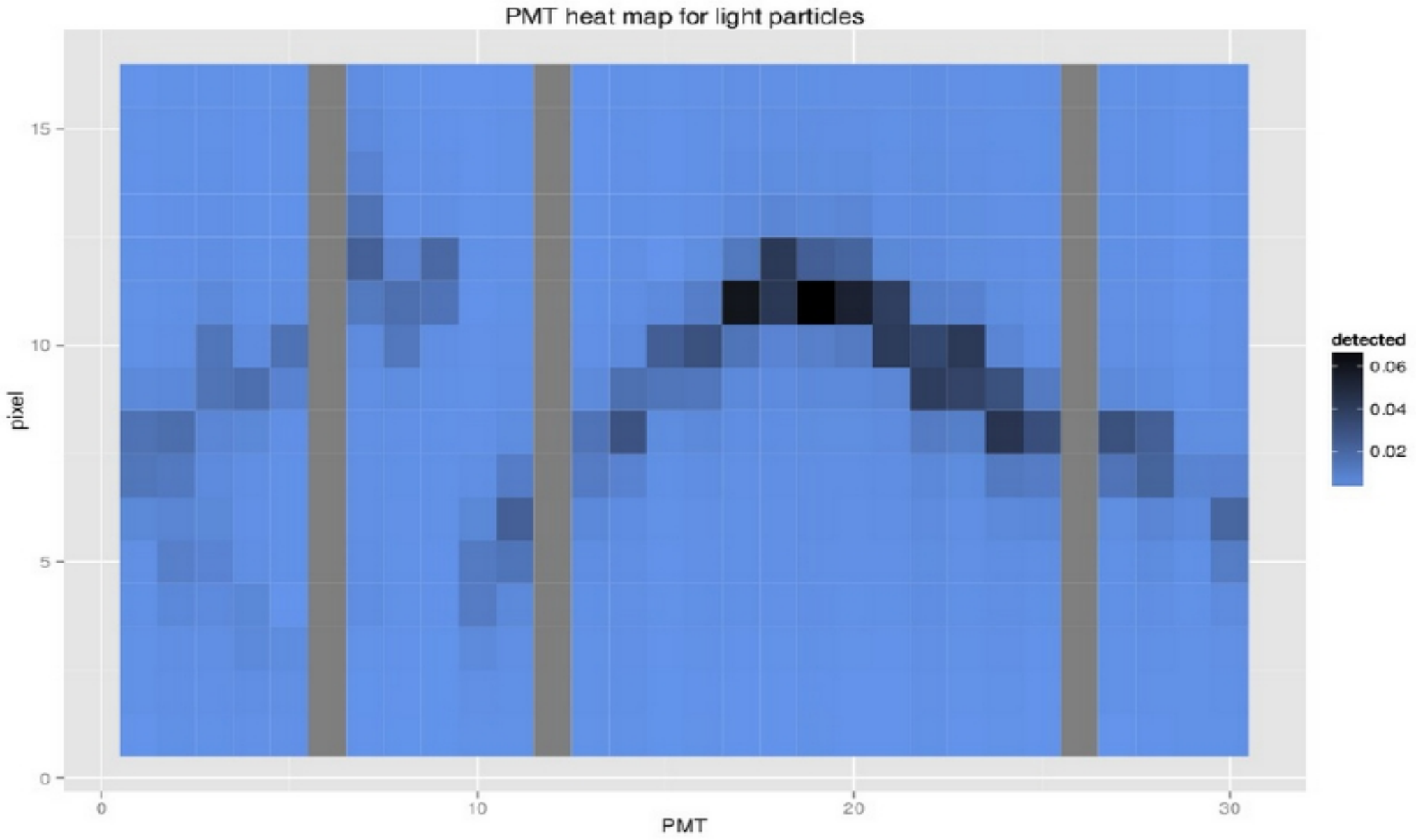
Cherenkov cone(s) from EDD prototype



Cherenkov cone from protons/CERN



Chernkov cone from β=1 particles/CERN



Polished Results from our testbeam campaigns and on EDD one gets from

- **B. Kröck Ph.D thesis, JLU Gießen in preparation**
- **O. Merle Ph.D thesis, JLU Gießen in preparation**
- **NIM articles:**

  Nucl.Inst. and Meth. A732, 2013

  Nucl. Inst. and Meth. A, 2014.

- **And DIRC Workshops(2009,2011,2013) proceedings we have organized**

  http://iopscience.iop.org/1748-0221/focus/extra.proc3

  http://iopscience.iop.org/1748-0221/focus/extra.proc14

  http://www.uni-giessen.de/cms/fbz/fb07/fachgebiete/physik/einrichtungen/2pi/ag/ag-dueren/aktuelles/resolveuid/956d0e54da1c119dc7e6cb9bd8cc8489

Thanks goes first to

- DESY/CERN Test beam Organizers/Coordinators

  and a WISH also goes there, to have on T21-24

- A complete DAQ for additional ~1000 channels of ADC&TDC readout plus EUDET telescope stationed permanently