Status of barrel DIRC test beam analysis

Roland Hohler
for the GSI PANDA barrel DIRC Group

GSI, Darmstadt
Goethe University Frankfurt

PANDA Collaboration Meeting
September 5-9, 2011
at GSI

Outline

Beam time

GSI (June 14-22, 2011)

CERN (July 9-21, 2011)

Prototype setup

Goals

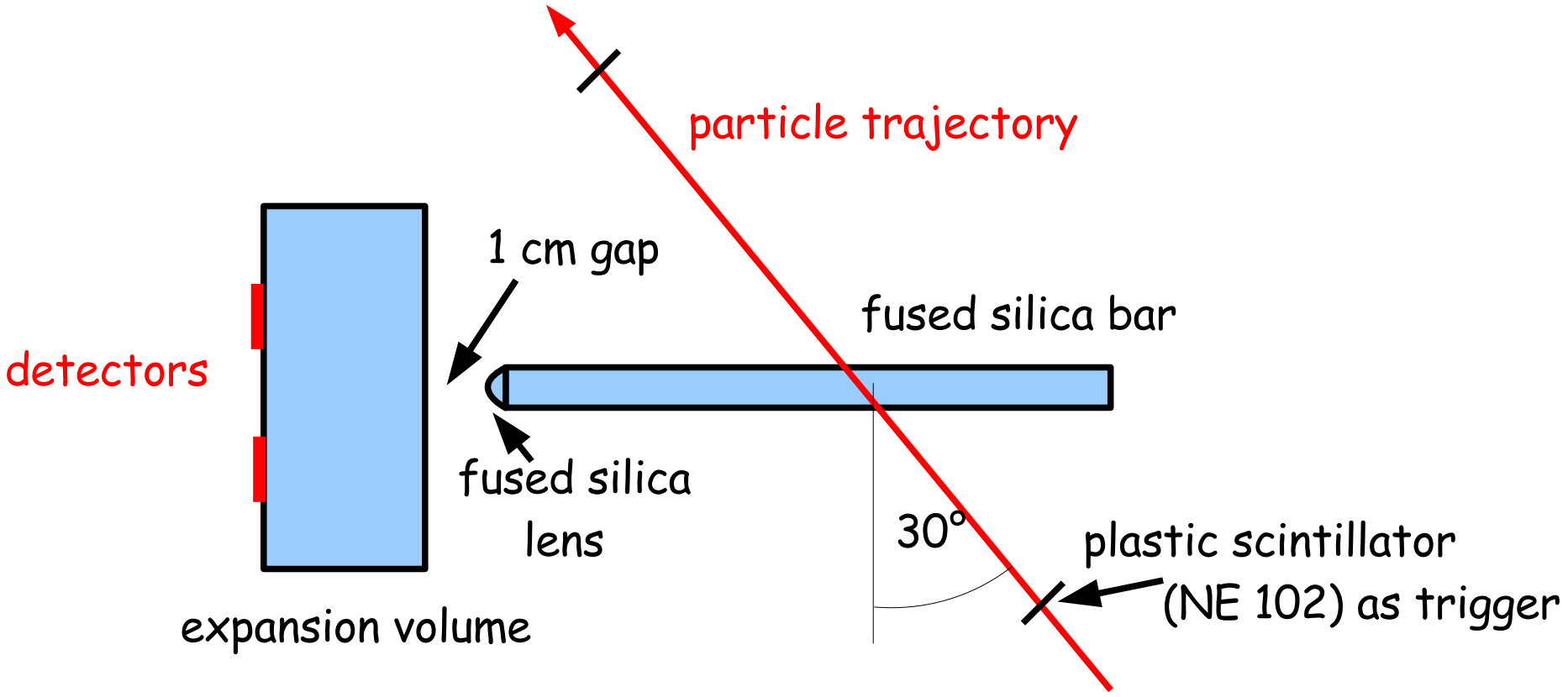
Data analysis status

Cherenkov angle reconstruction
via look up tables

GSI beam time

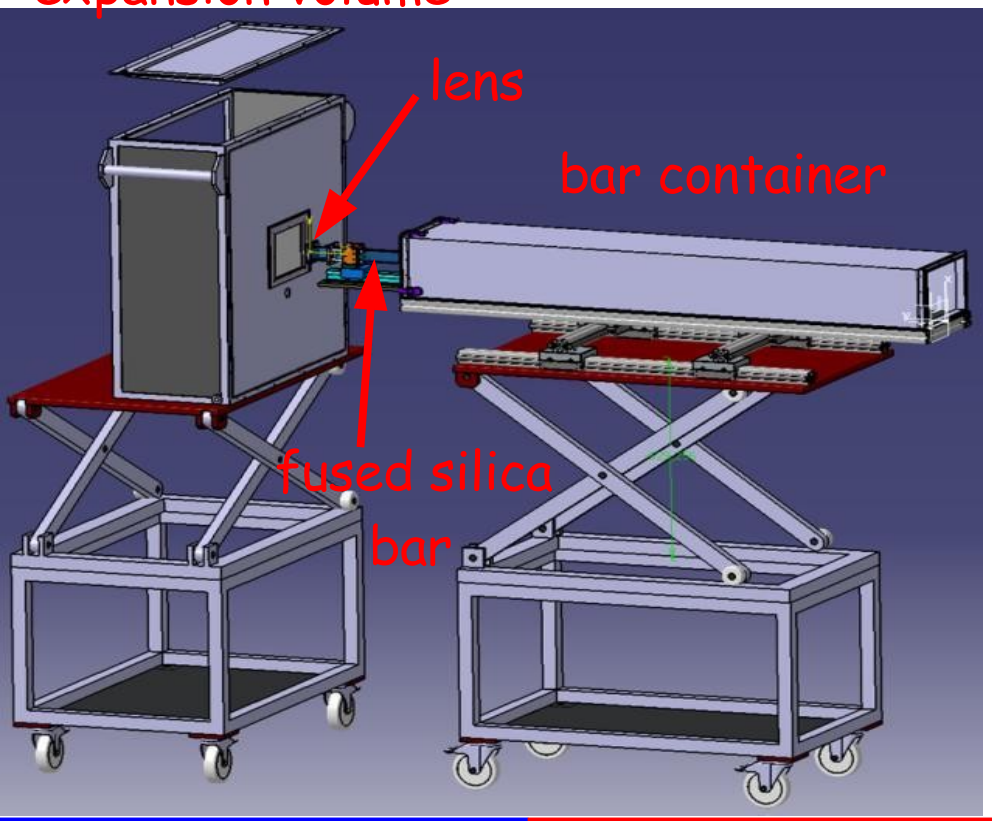
June 14-22, 2011

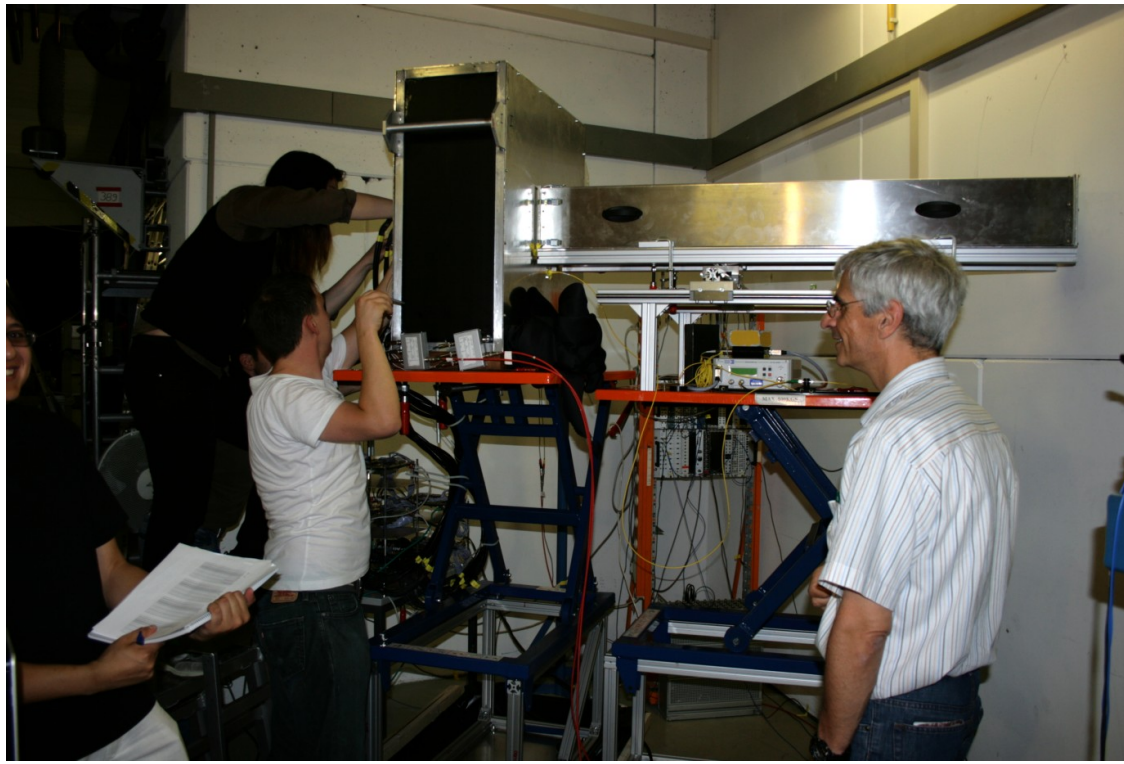
- 2h beam per day
- Pion beam with p = 1.7 GeV/c
- 4000 particles per spill (5s)



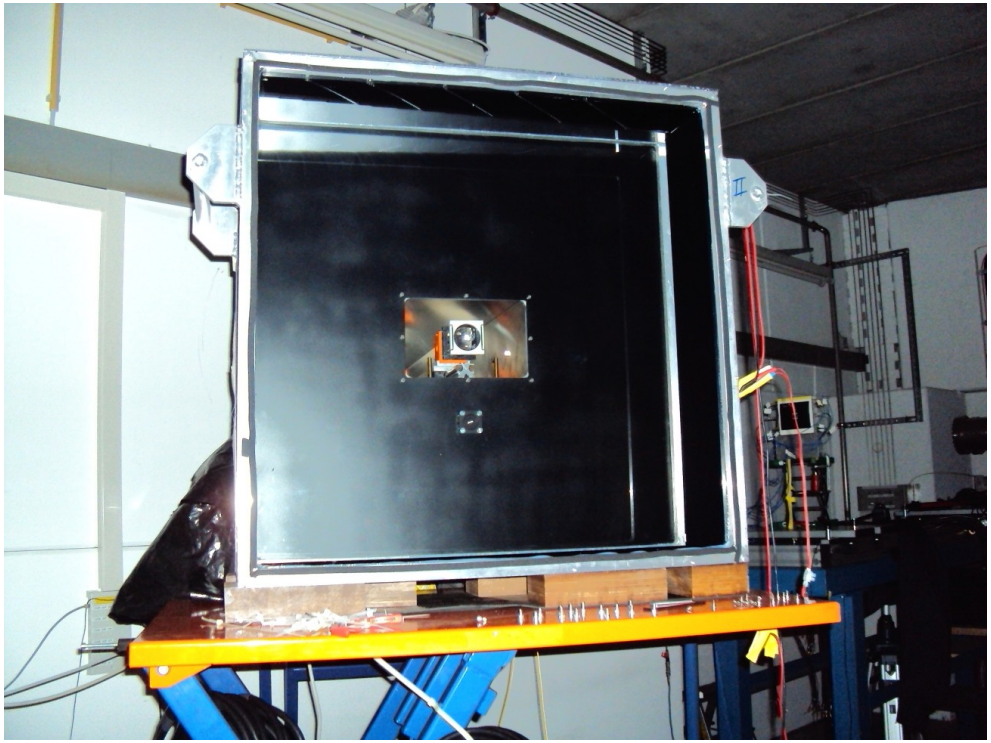
Prototype layout (i)

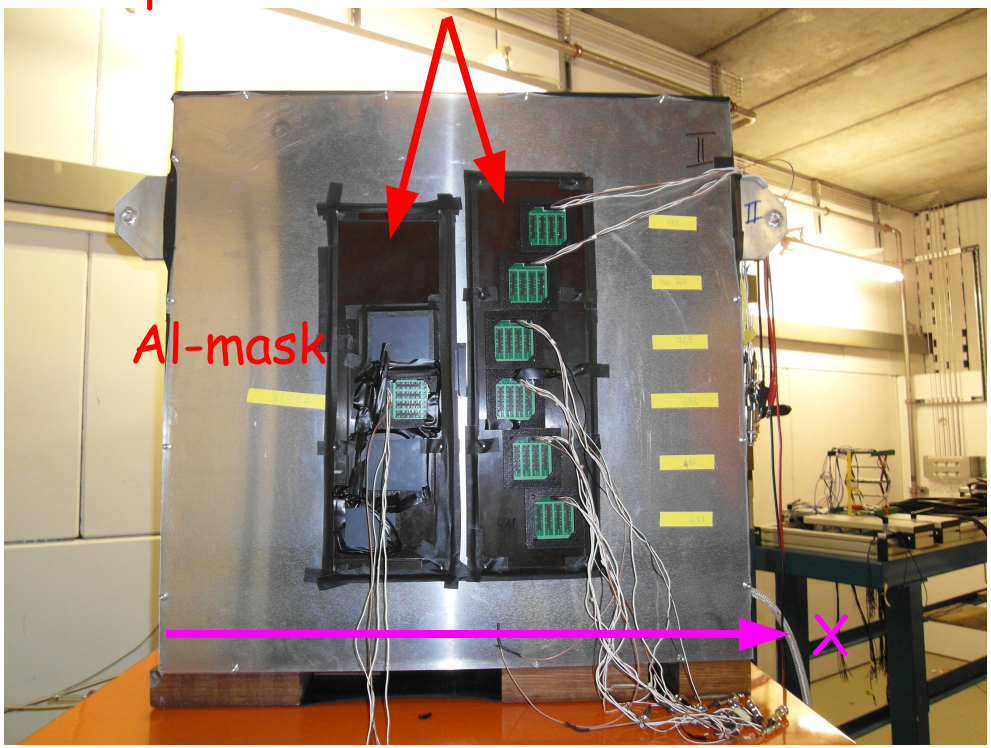
- Bar container (aluminum, 200x300x1500 mm)
- Fused silica bar (35x17x800 mm, Lithotec)
- Fused silica lens (f = 250 mm)
- Expansion volume (aluminum, 800x800x300 mm); filled with 190 liter Marcol 82 oil; 2 windows (float glass)





Prototype layout (ii)

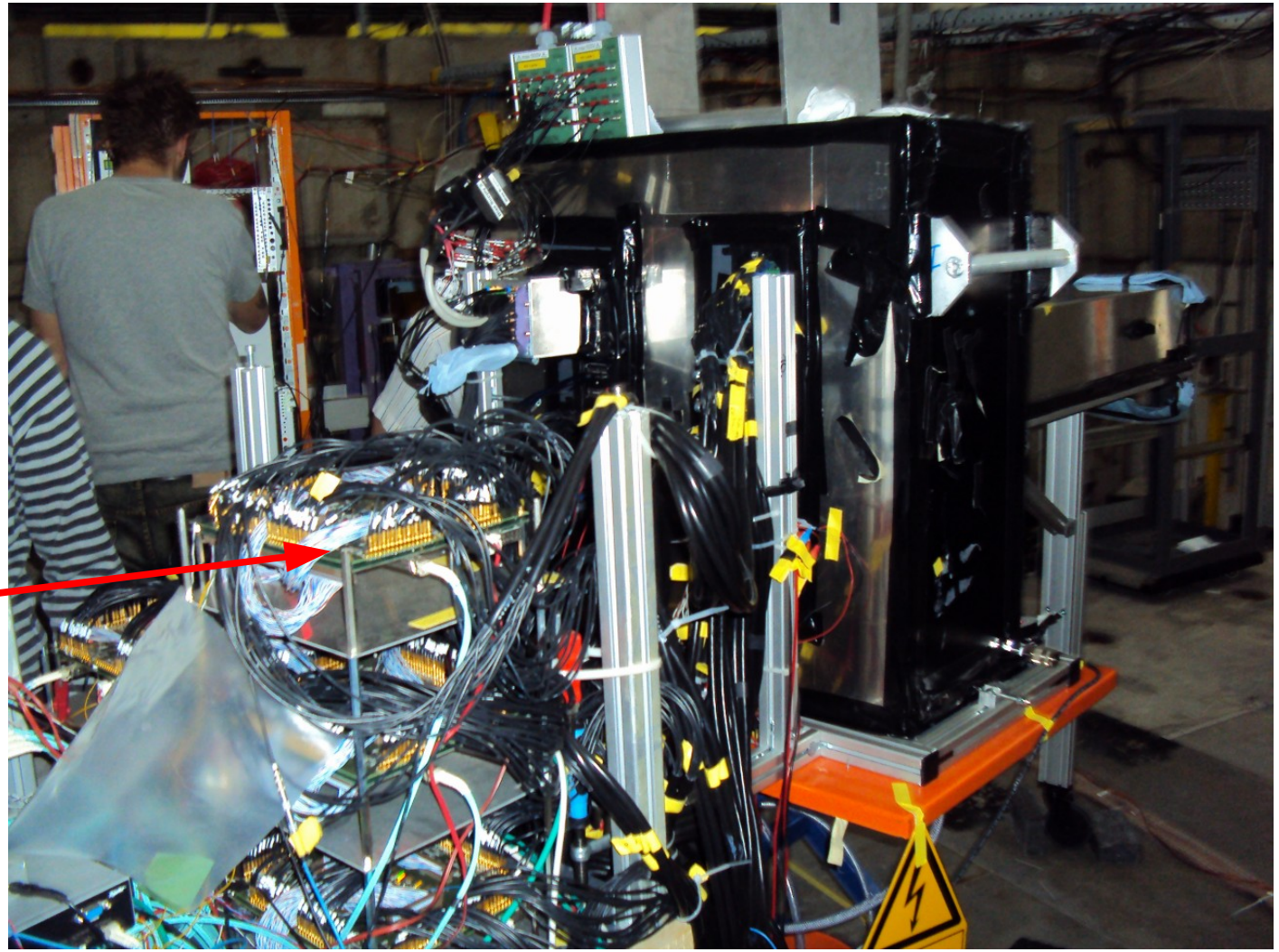




- 2 plastic masks for the detector (up to 10 mm movable in X)
- Aluminum mask for a specific incidence angle of the particle (30°)
- 9 different PMTs tested
  - 7x Photonis XP85012 (MCP-PMT)
  - 1x Hamamatsu H8500 (MA-PMT)
  - 1x Hamamatsu SL10 (MCP-PMT)

Read-out electronics

- 5 Hades trigger & readout boards (TRB) with TOF-addon (NINO)
  - Each TRB with 4 HPTDCs (32 channels, multi-hit capable)
  - Total 640 channels



Goals

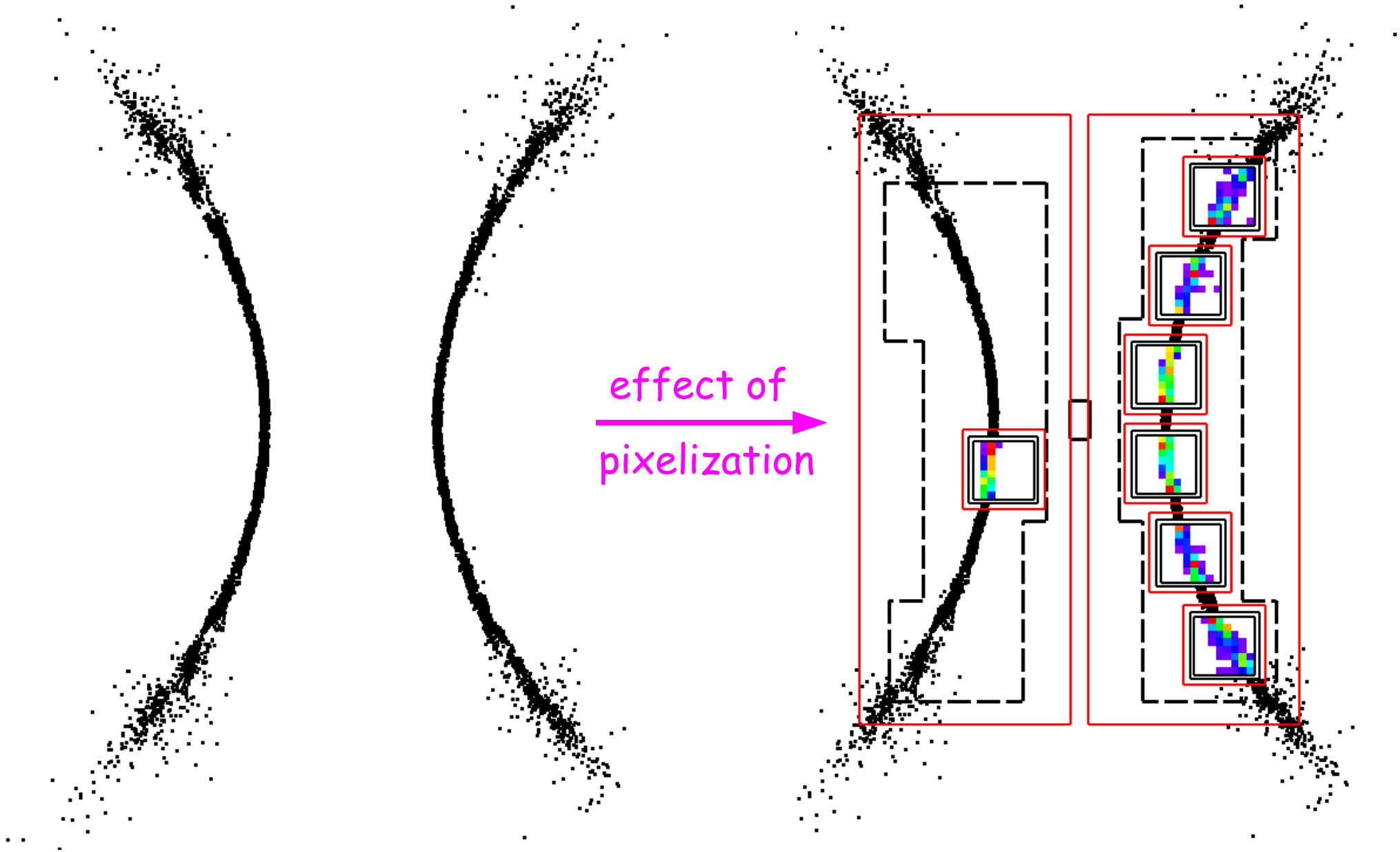
Test for the CERN beam time

- Are the masks accurate?

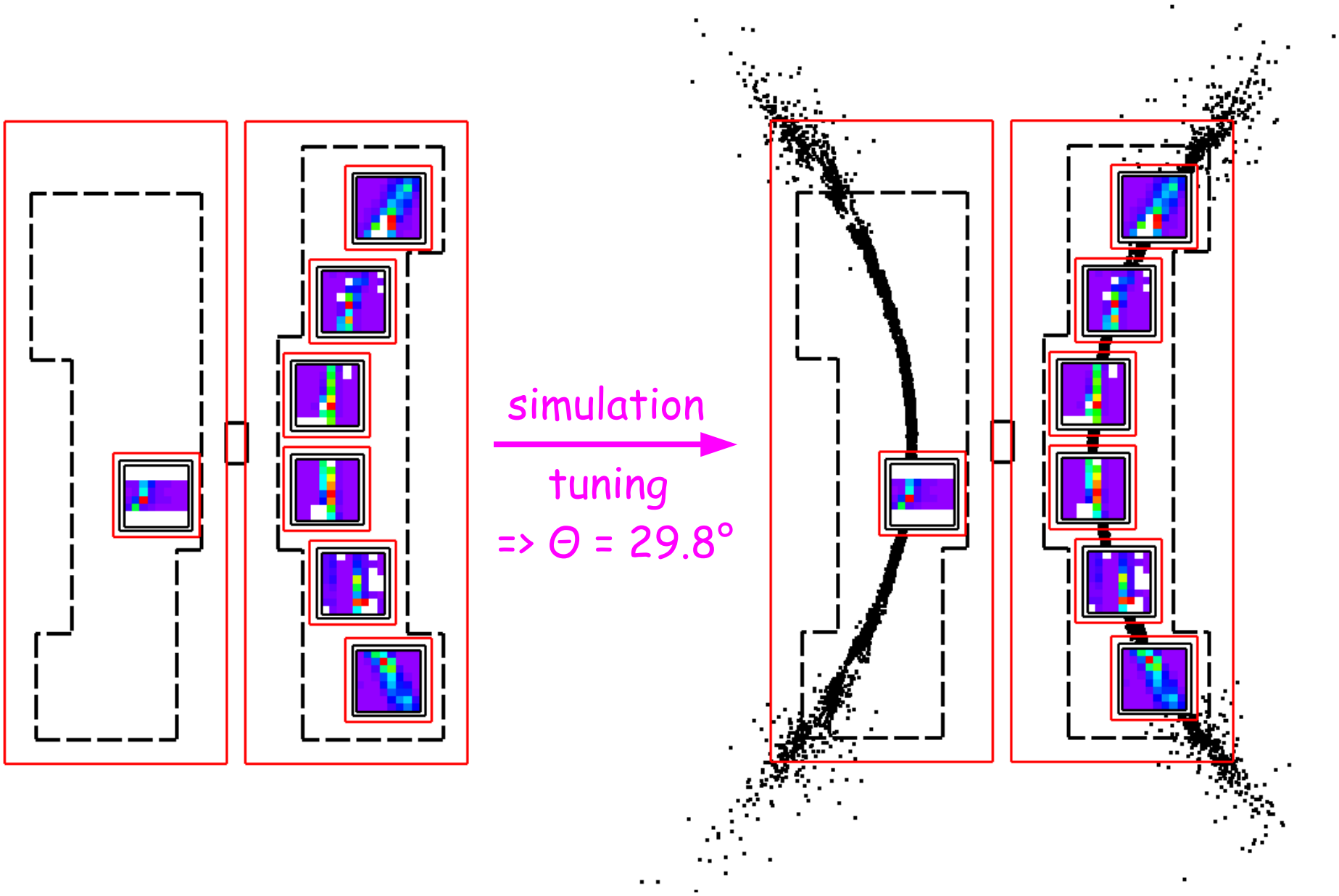
- Does the electronics works?

- Gain experience with new prototype
  (alignment, light leaks, etc.)

Simulation (drcprop)



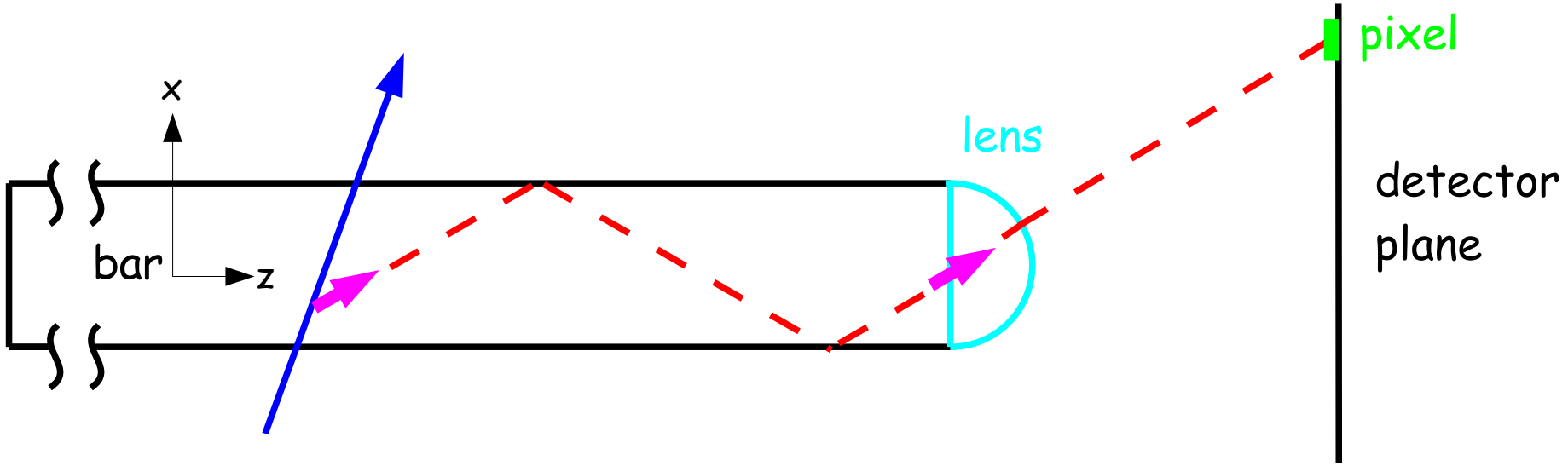
Data (example run, preliminary)



Cherenkov angle reconstruction method

- Pixel information (position)
- Look up table (kBar-map; kBar: photon direction at bar end)
- Particle track

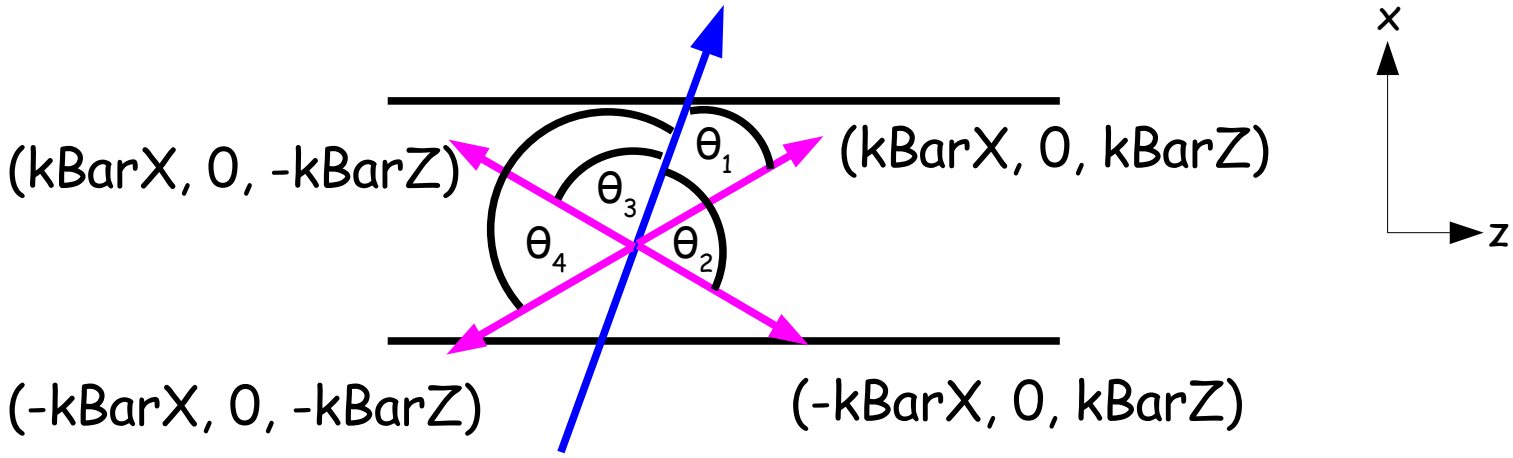
=> Θ_C (including ambiguities)



Ambiguities (solutions)

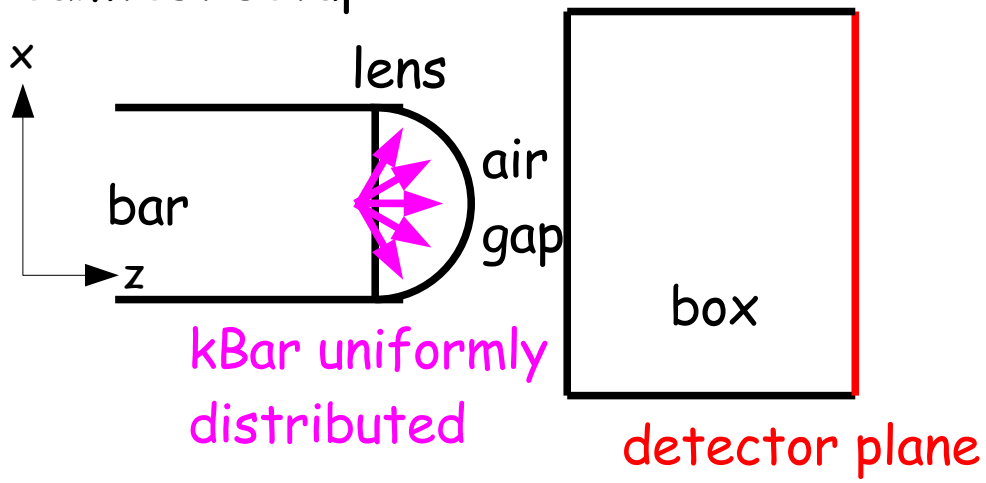
pixel hit => possible ambiguities => more than 1 solution

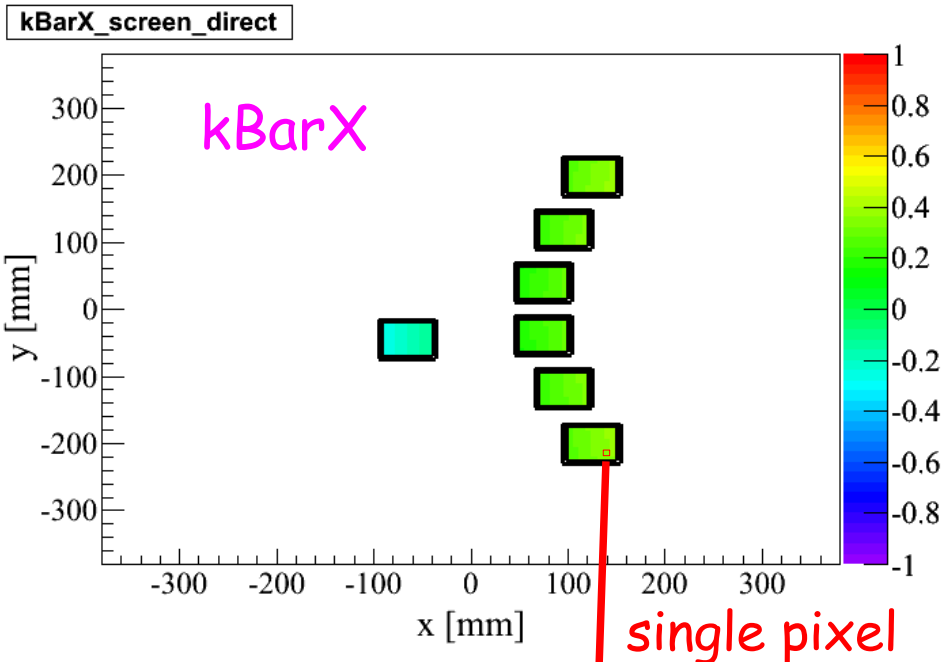
Example: pixel: (kBarX, 0, kBarZ) from kBar map
left/right, back/forward = > 2*2 = 4 solutions



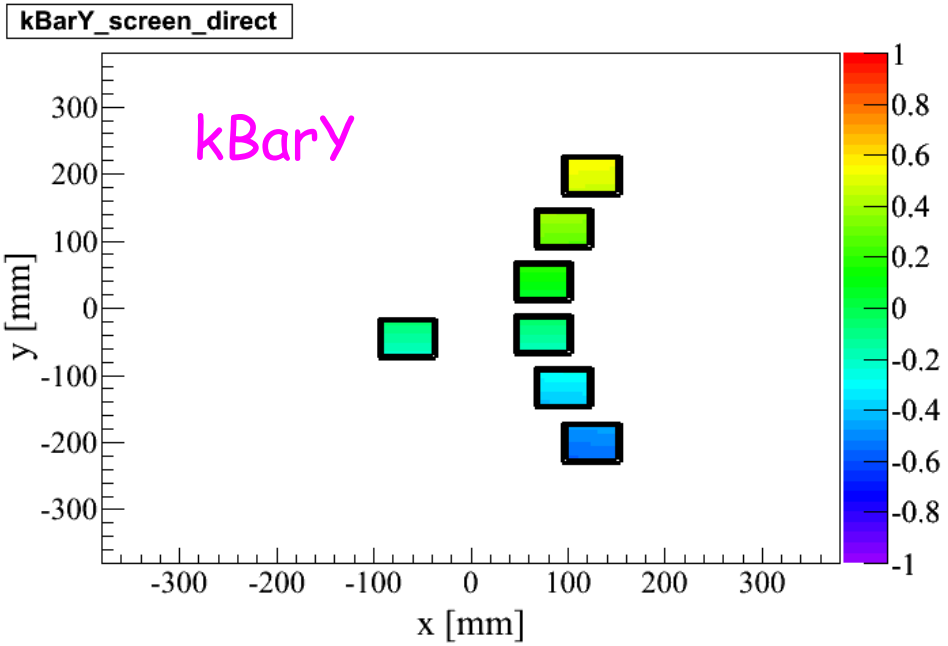
kBar map for example run

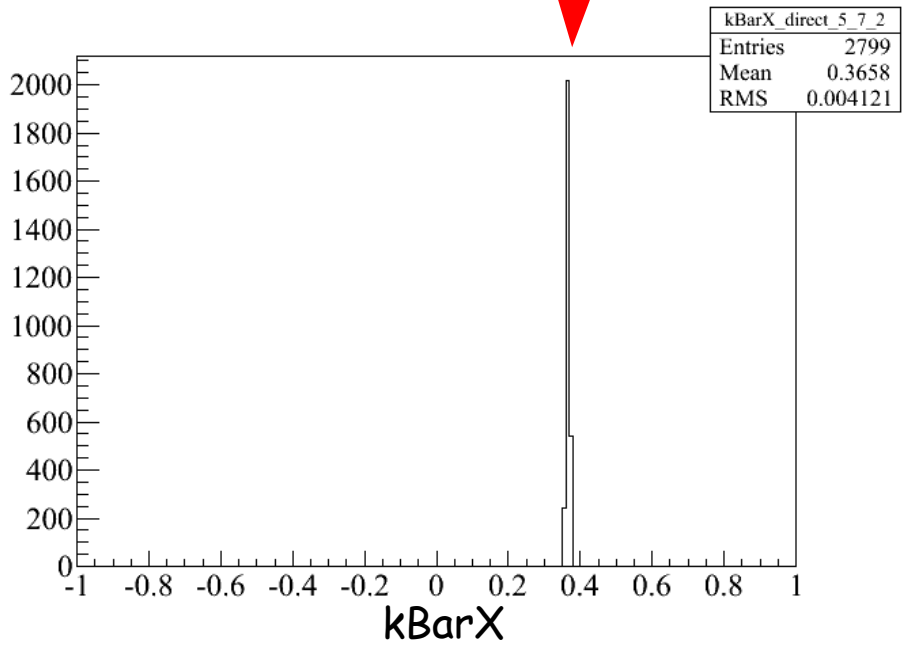
Beamtest setup:



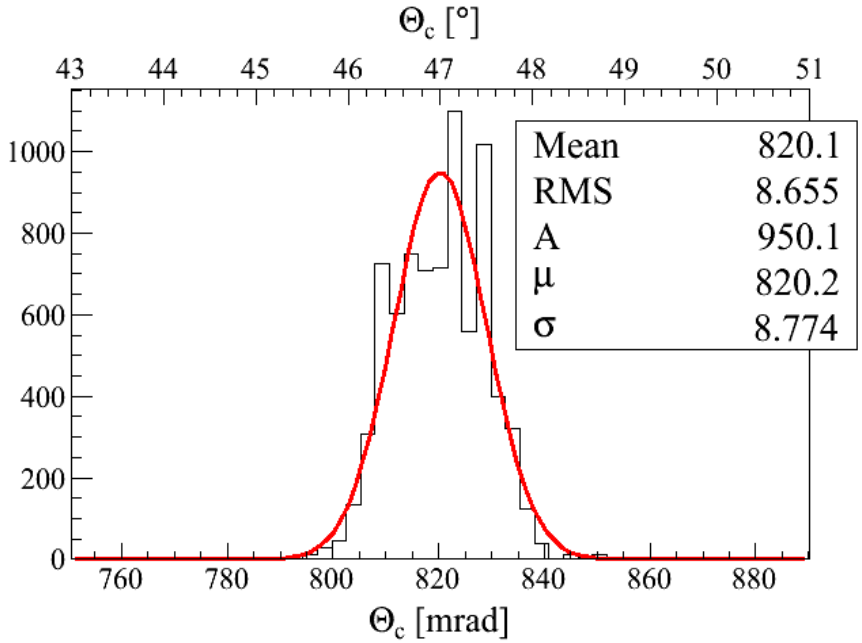


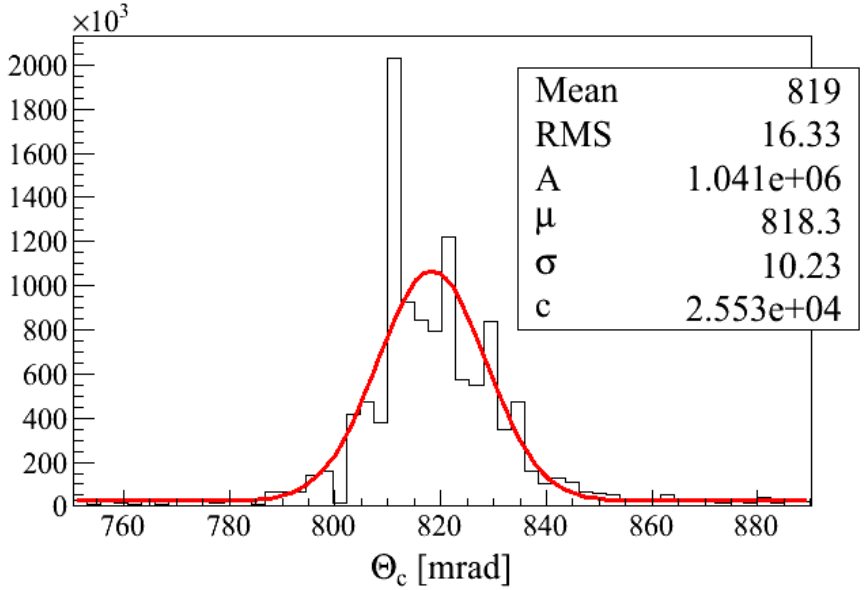
single pixel





Reconstructed Cherenkov angle (per photon)





simulation

$\langle\Theta_C\rangle$ = 820.1 mrad

$\sigma_{\Theta c}$ = 8.7 mrad

data

$\langle\Theta_C\rangle$ = 819.0 mrad

$\sigma_{\Theta c}$ = 10.2 mrad

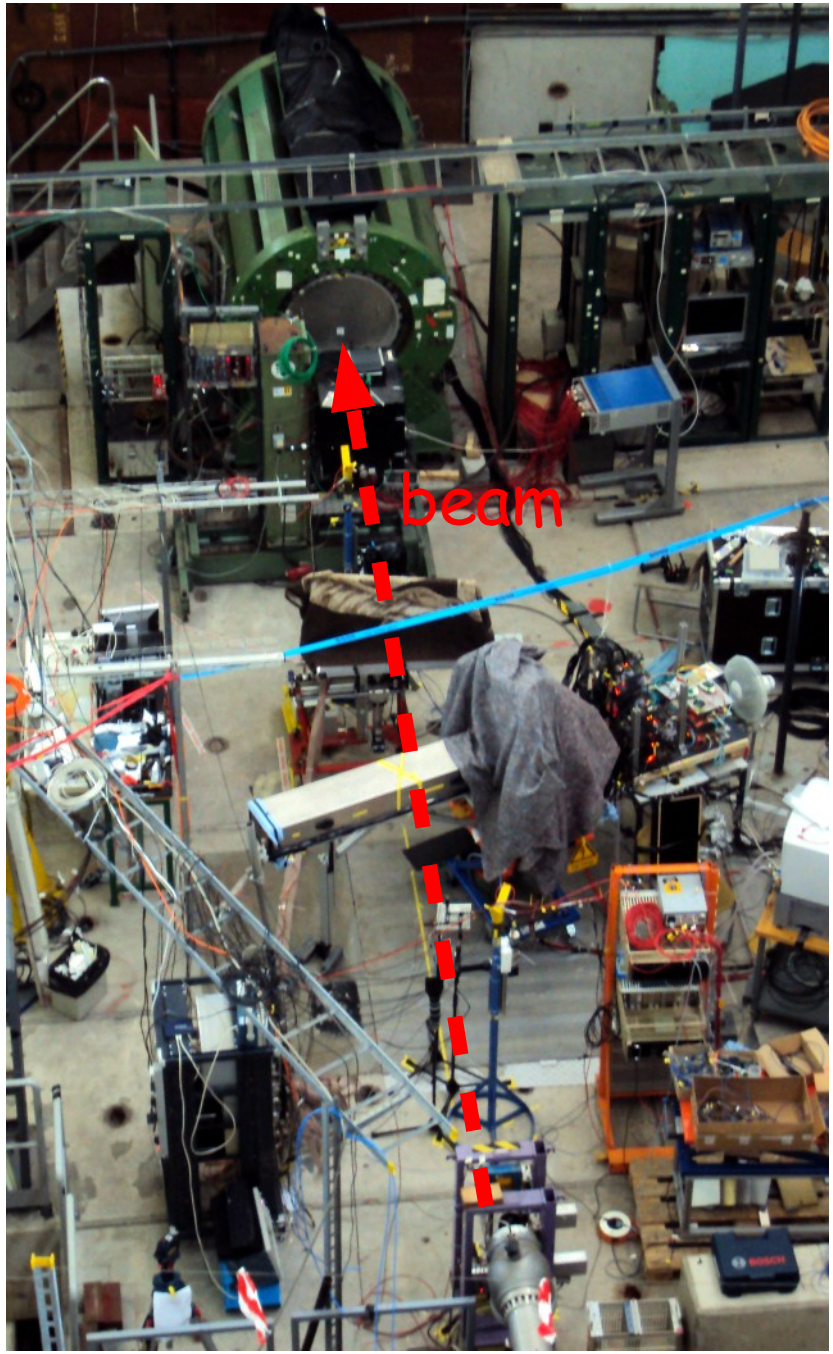
expected: Θ_C = 820.6 mrad

Known candidates for the data/simu. difference: charge sharing, optics

CERN beam time

July 9-21, 2011

- T9 test beam facility
- 24h beam
- mixed beam either electron- or pion-rich
- beam momentum changeable from 1.5 – 10 GeV/c
- beam focus adjustable

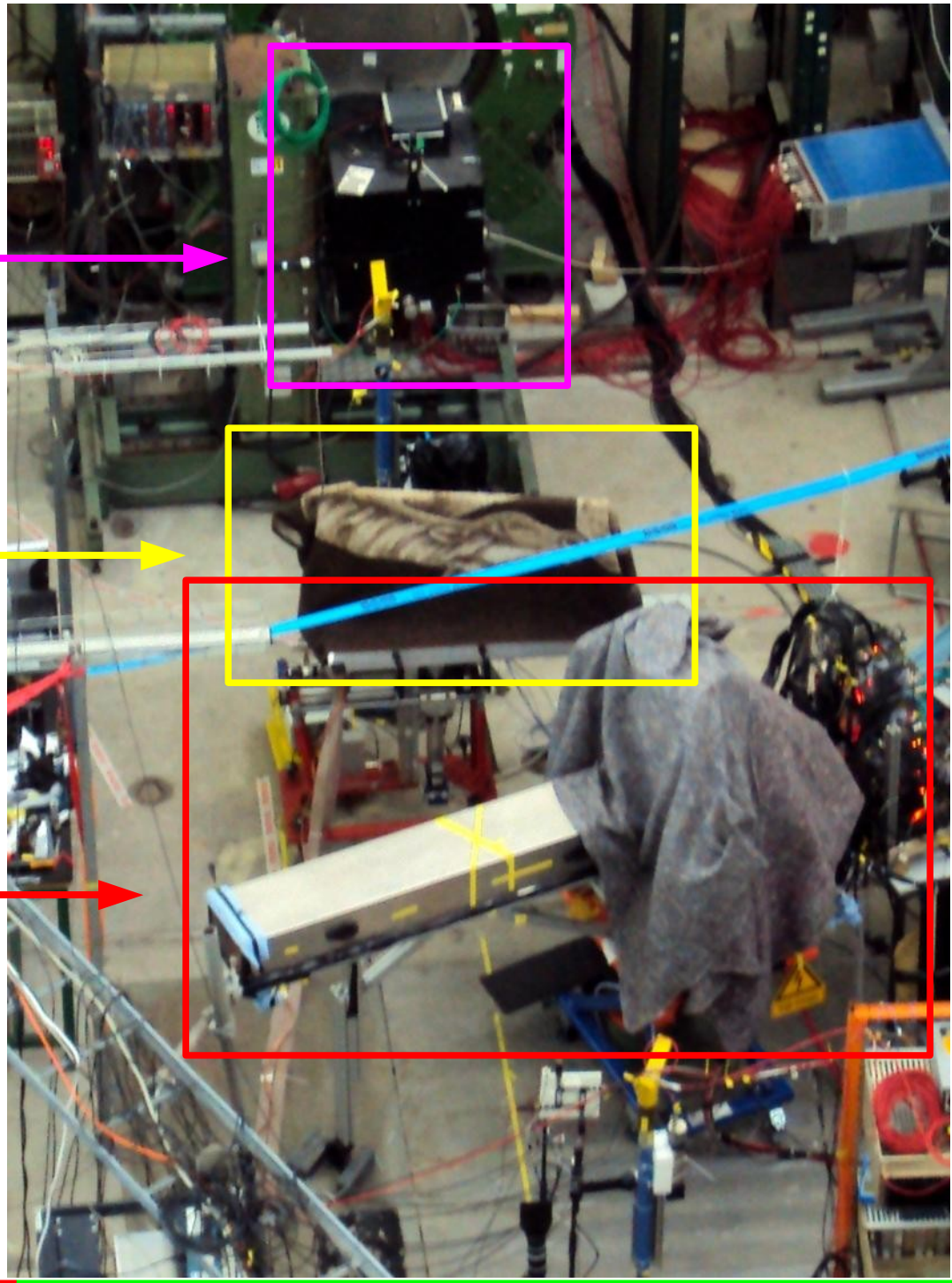


Cherenkov activities

CLAS 12 RICH Prototype (Aerogel)

PANDA Endcap Disc DIRC Prototype

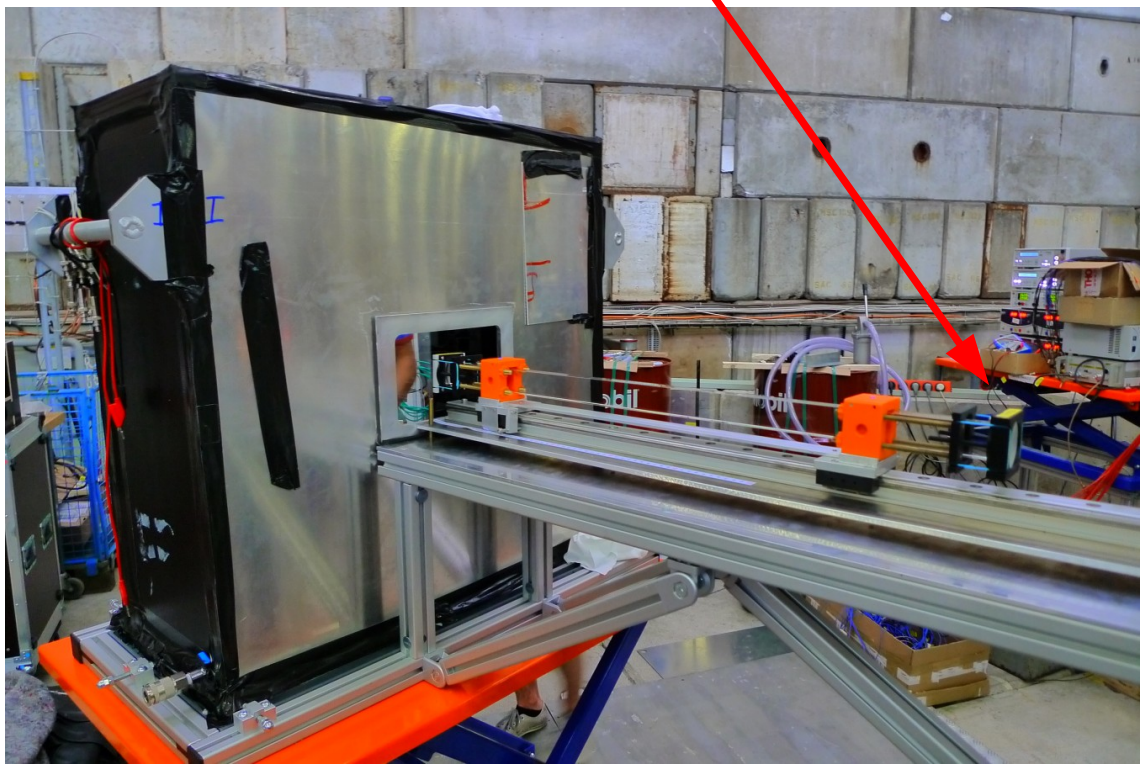
PANDA Barrel DIRC Prototype



25 participants
8 institutions

Prototype differences to GSI beam time

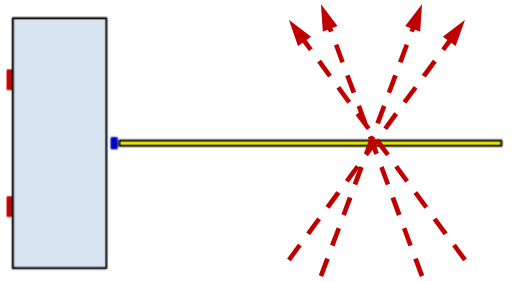
- 2 fused silica bars tested (Lithotec: 35x17x800 mm & Boeing 35x17.25x1225 mm)
- 2 lenses tested (uncoated & AR coating for 355-532 nm)
- Flat mirror (silver) at bar end



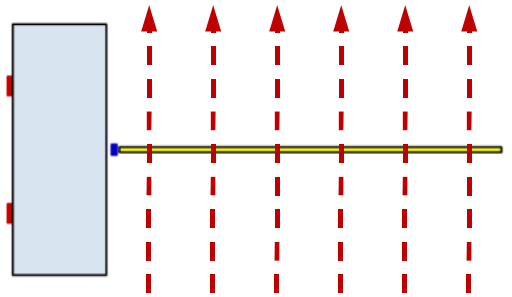
- 13 different detectors tested
  - 7x Photonis XP85012
  - 1x Photonis XP85112
  - 1x Hamamatsu H8500
  - 1x Hamamatsu H9500
  - 2x Hamamatsu SL10
  - 1x SiPM
- Coupling of detectors to the expansion volume either with air gap or with optical grease

Goals

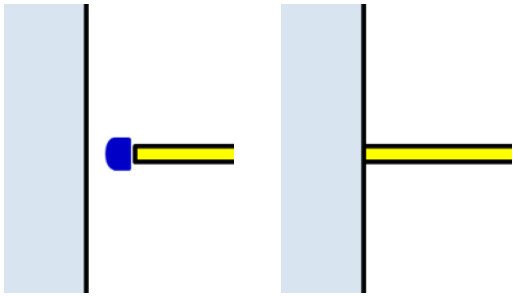
- Different incidence angles (-30°, 20°, 0°, 30°)
  - verify if pattern is Cherenkov-like
  - check timing



- Different hit position (110 mm, 183 mm, 365mm)
  - check timing



- With and without focusing
  - lens with and without anti-reflective coating



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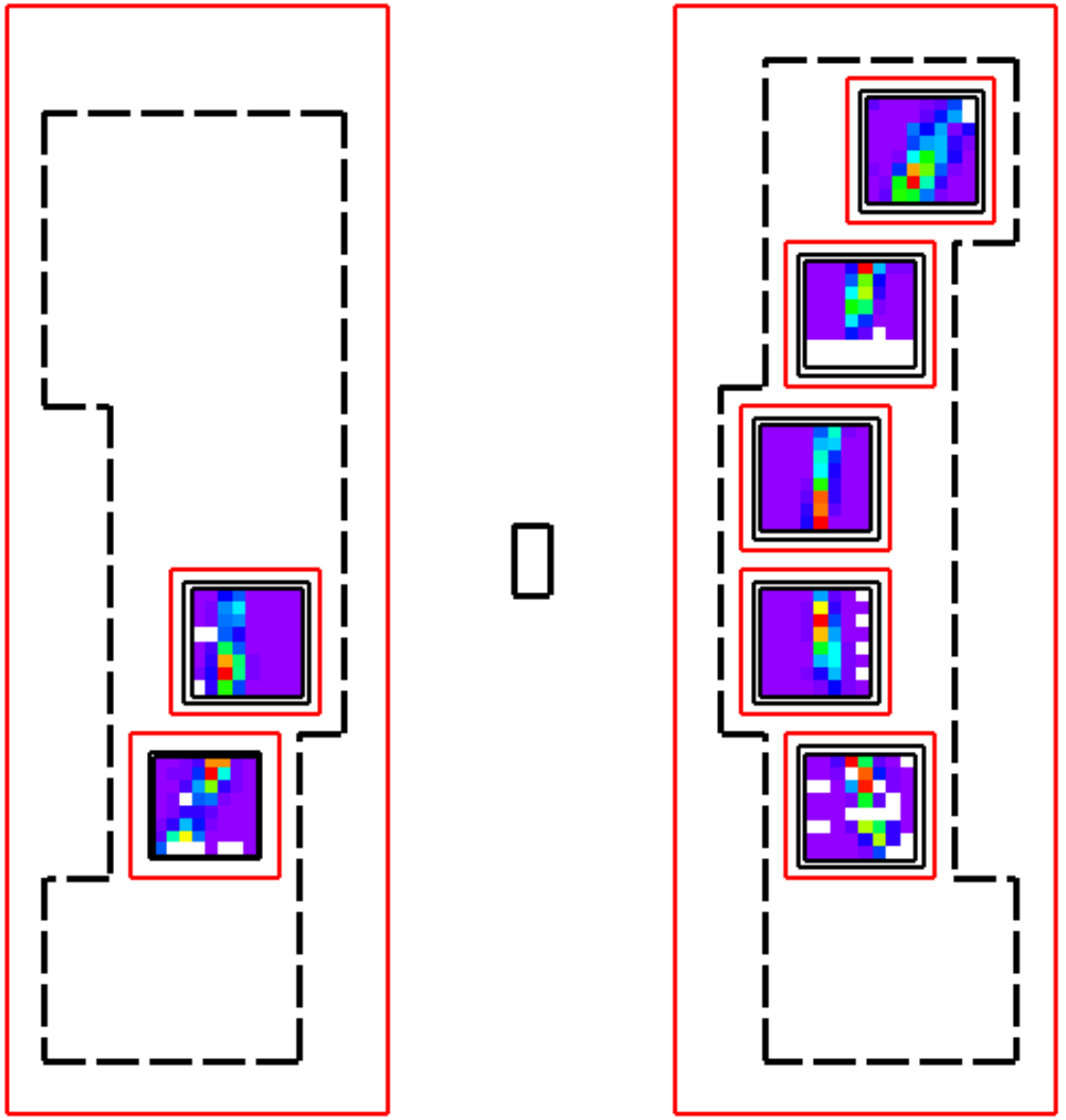

Analysis status

- Database for GSI & CERN beam time almost finished but not tested yet
  (detector positions, cable connections, files, etc.)

- Recently started with data analysis

- Tested reconstruction method

Outlook:

- Test database

- Understand timing & charge information in data

- Implement charge sharing in simulation