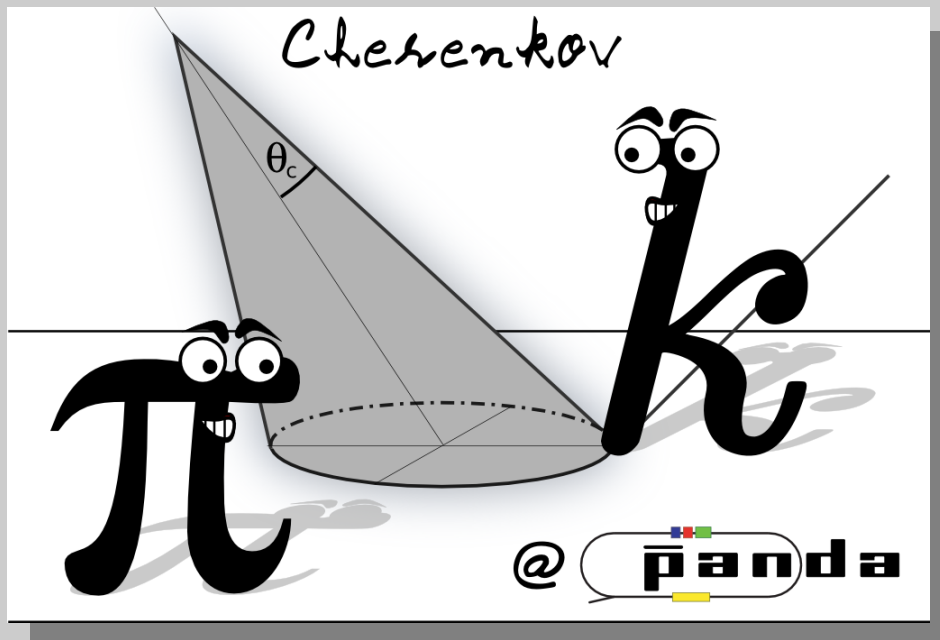


A 3D-Disc DIRC for \bar{P} ANDA

~ Evolution of the ToP-design ~



JUSTUS-LIEBIG-

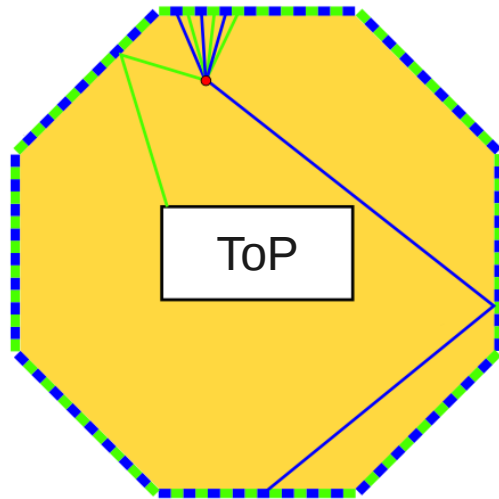
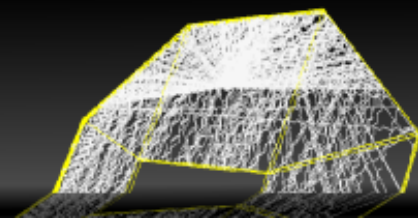


UNIVERSITÄT
GIESSEN

GEFÖRDERT VOM



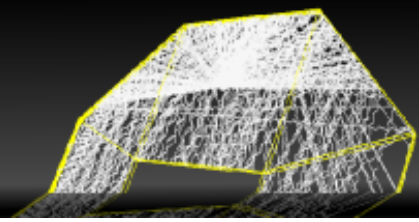
Bundesministerium
für Bildung
und Forschung



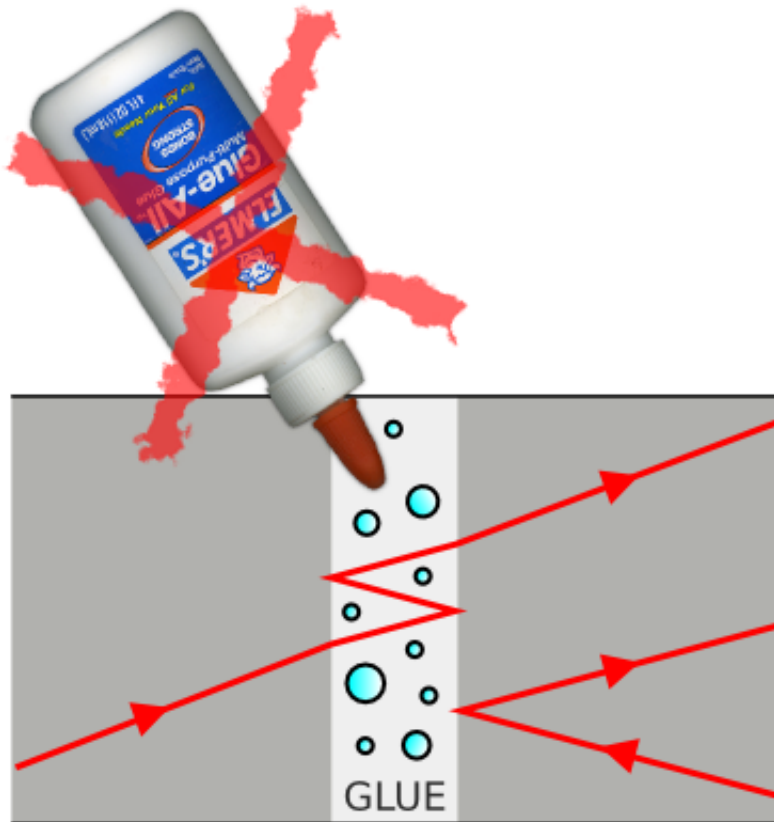
First results (Geant4 + modified reconstruction)

Misidentification [%]	up to p [GeV/c]	ϑ [°]
< 1.0 (*)	3.5	15
≤ 2.3	3.0	20

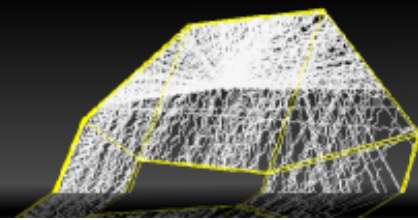
(*) reconstruction including 1 coincident particle



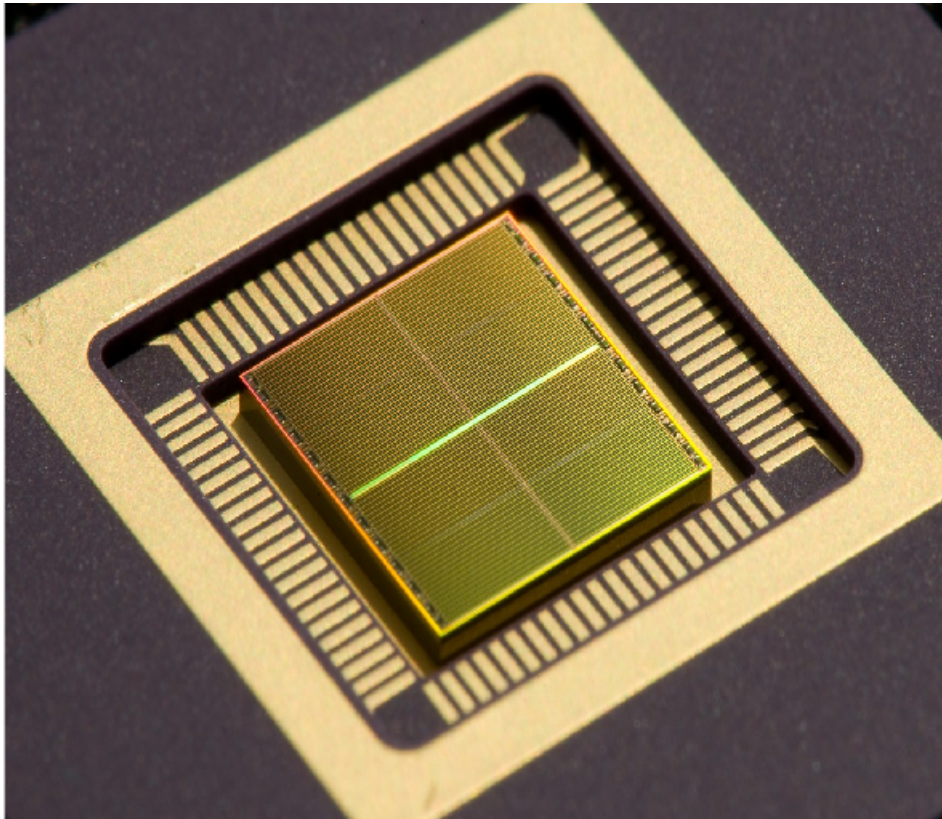
No radiator gluing ...



... the radiator can be manufactured in one single piece.



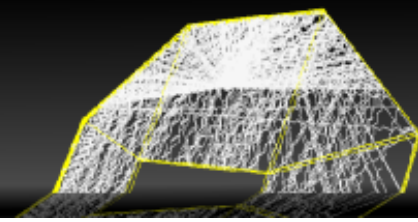
Digitization at detection & no MCP-like lifetime issues



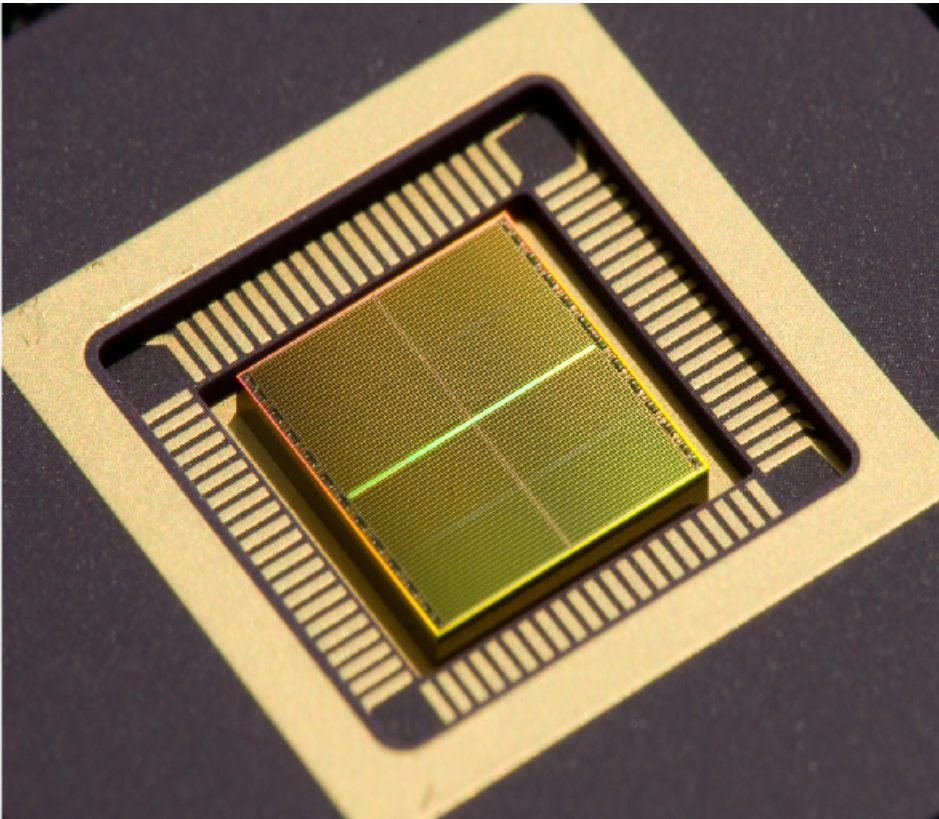
- Digital Silicon Photomultiplier
- Chip-size: $\sim 7 \times 8 \text{ mm}^2$
- On-chip TDC
- Time res.: 60 ps rms, 10 ps LSB
- Spatial res.: 2x2 pixel
>2000 APD micro-cells per pixel
- Disc-DIRC readout modification:
50 lines instead of 4 large pixel.

Source: Presentation by Thomas Frach @ 2009 IEEE Nuclear Science Symposium

... due to newest Philips SiPM technology.

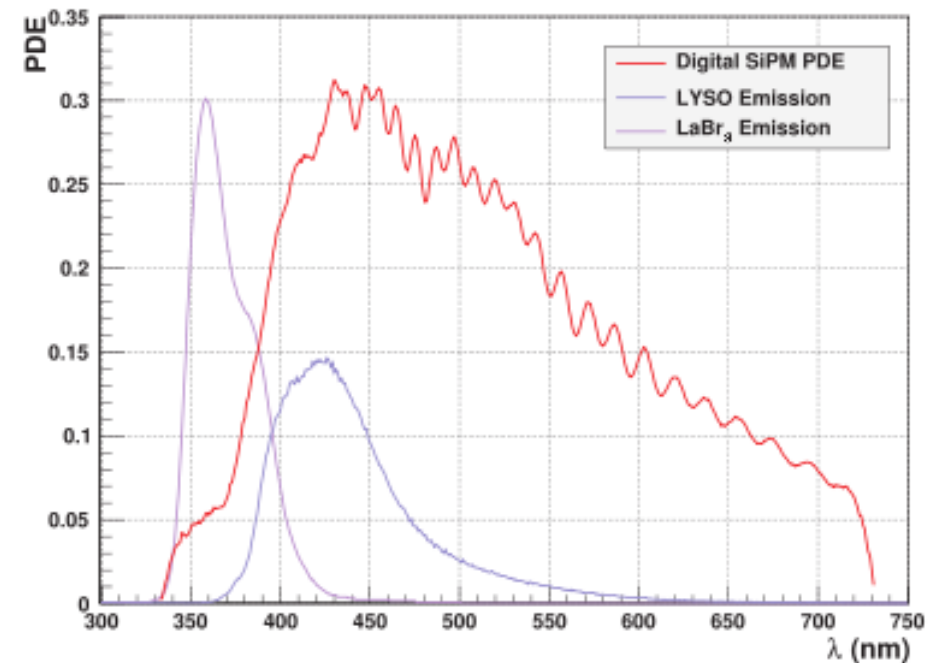


Digitization at detection & no MCP-like lifetime issues



Source: Presentation by Thomas Frach @ 2009 IEEE Nuclear Science Symposium

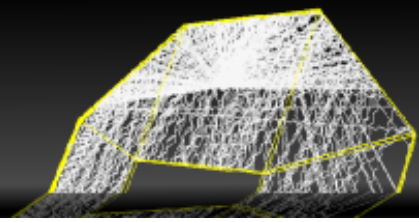
Photon Detection Efficiency



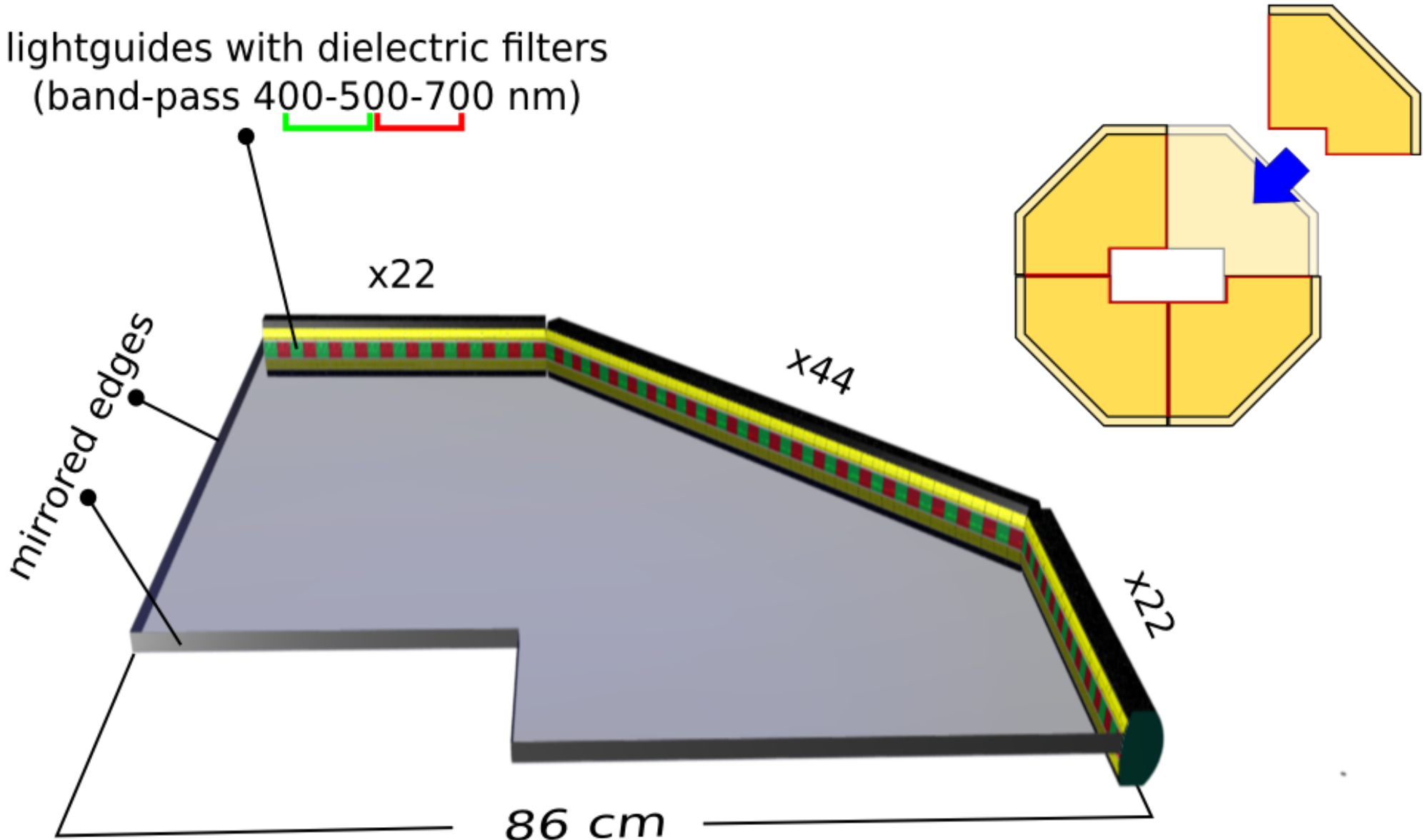
... due to newest Philips SiPM technology.

Detector design

A 3d Disc DIRC
for \overline{PANDA}

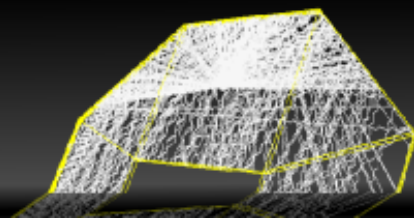


lightguides with dielectric filters
(band-pass 400-500-700 nm)

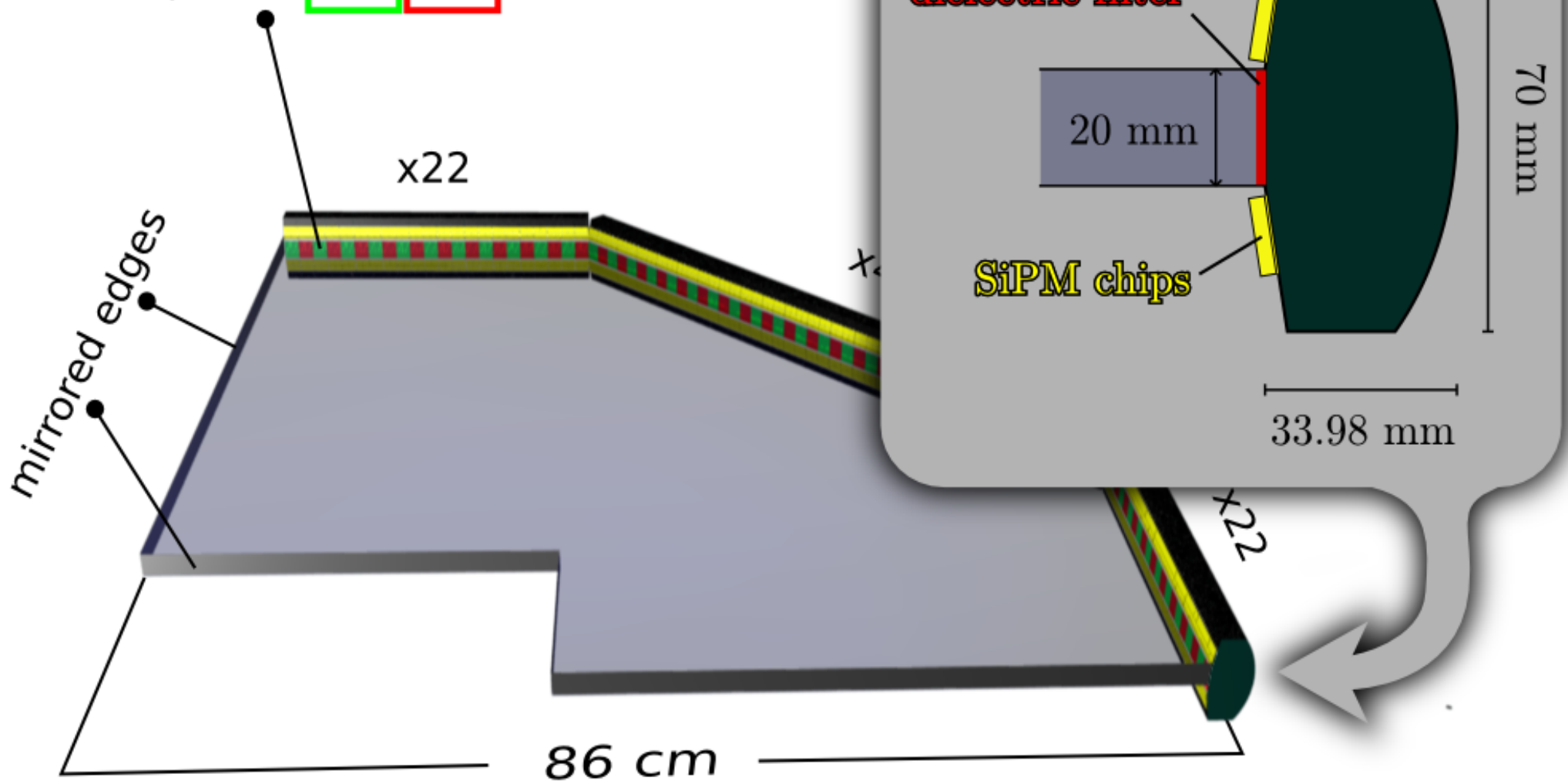


Detector design

A 3d Disc DIRC
for PANDA

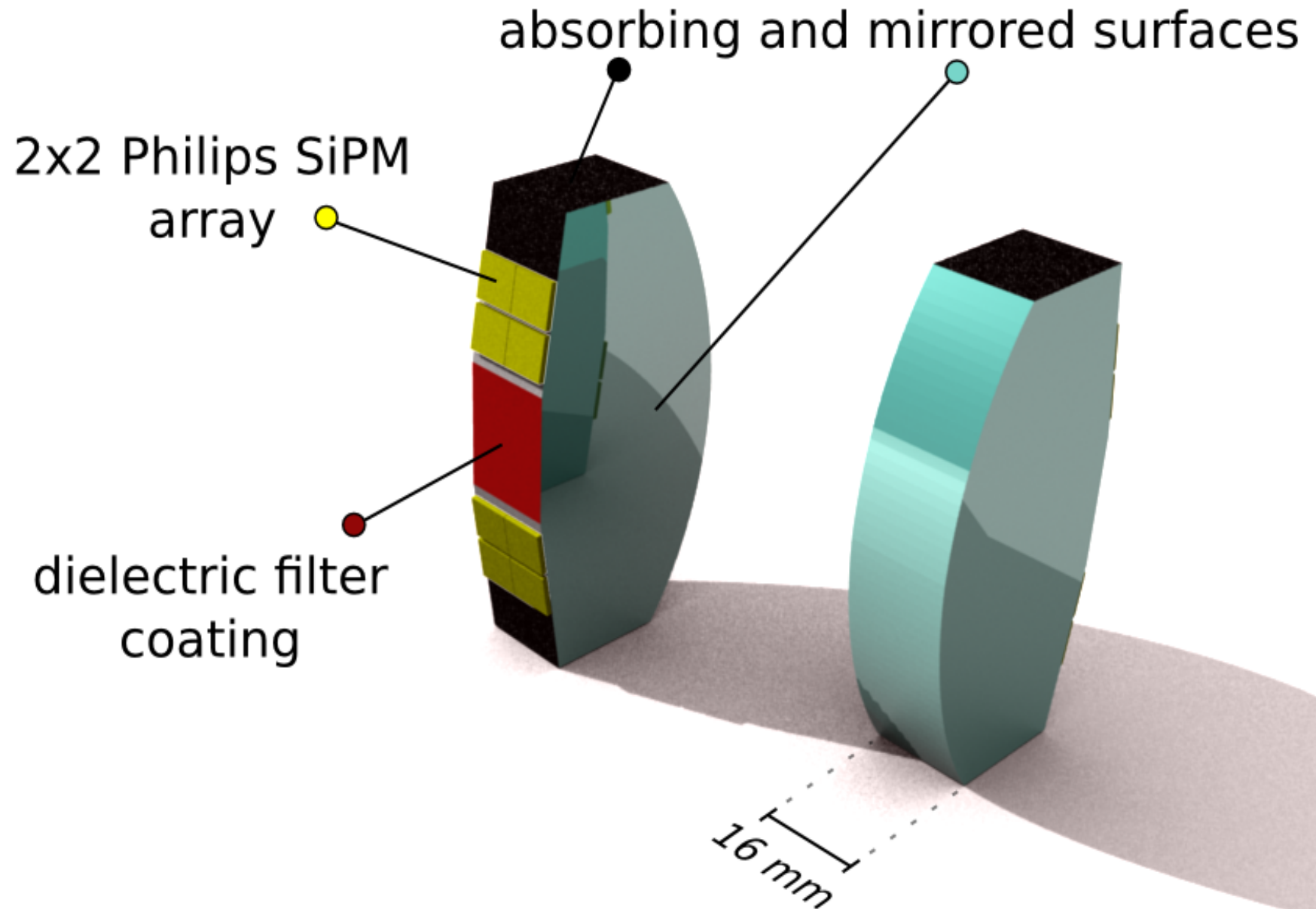
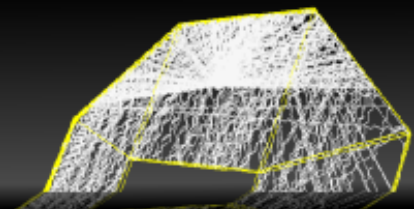


lightguides with dielectric filters
(band-pass 400-500-700 nm)



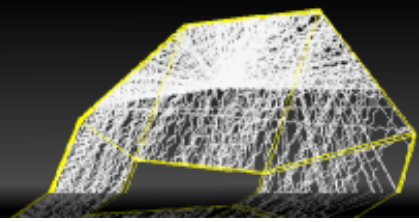
Detector design

A 3d Disc DIRC
for $\overline{\text{PANDA}}$



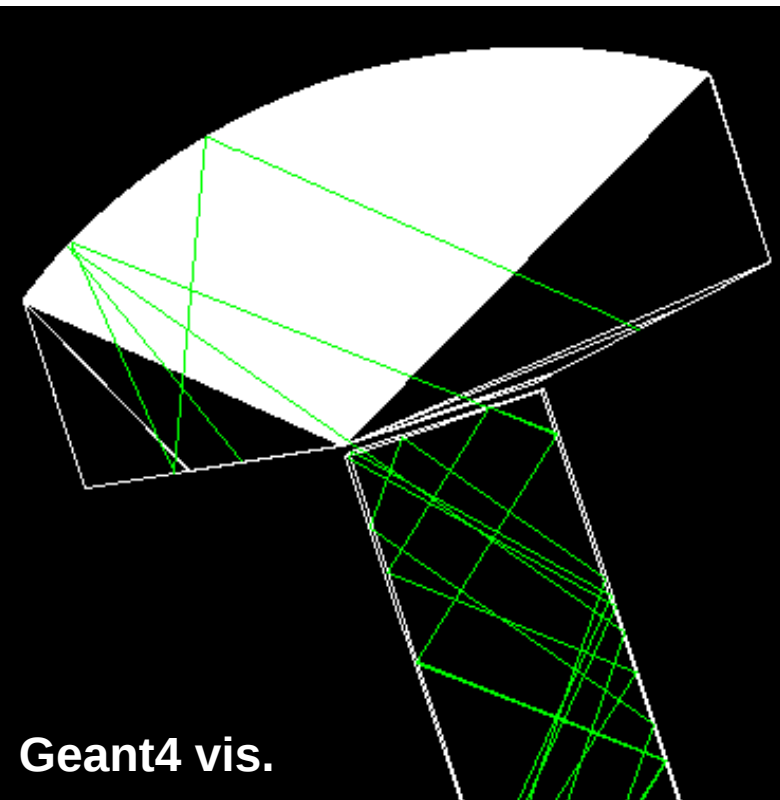
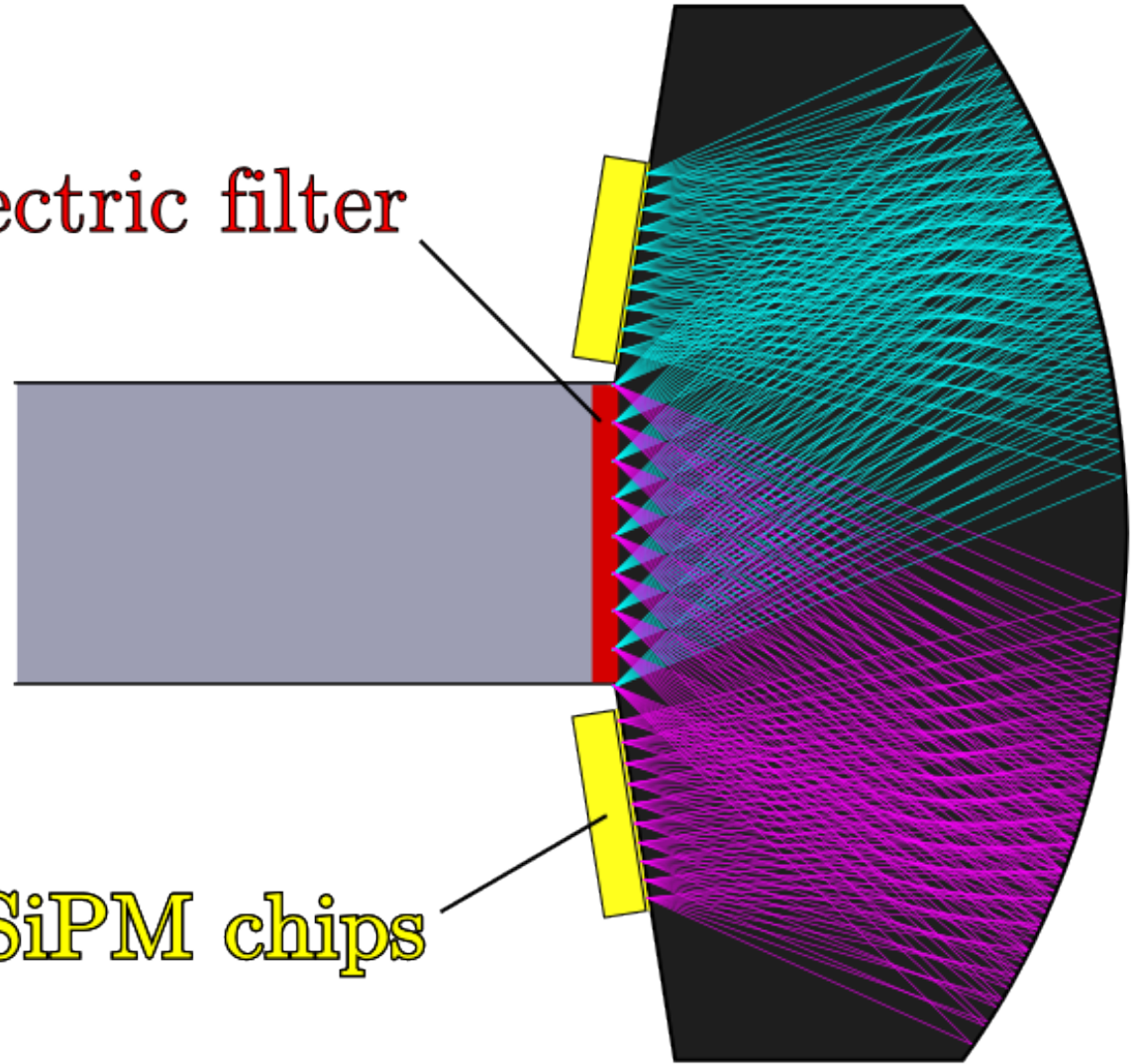
Lightguide imaging

A 3d Disc DIRC
for \overline{PANDA}



dielectric filter

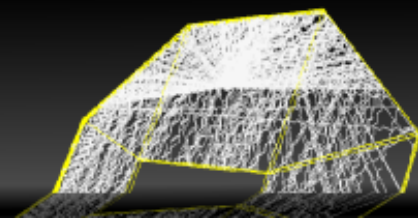
SiPM chips



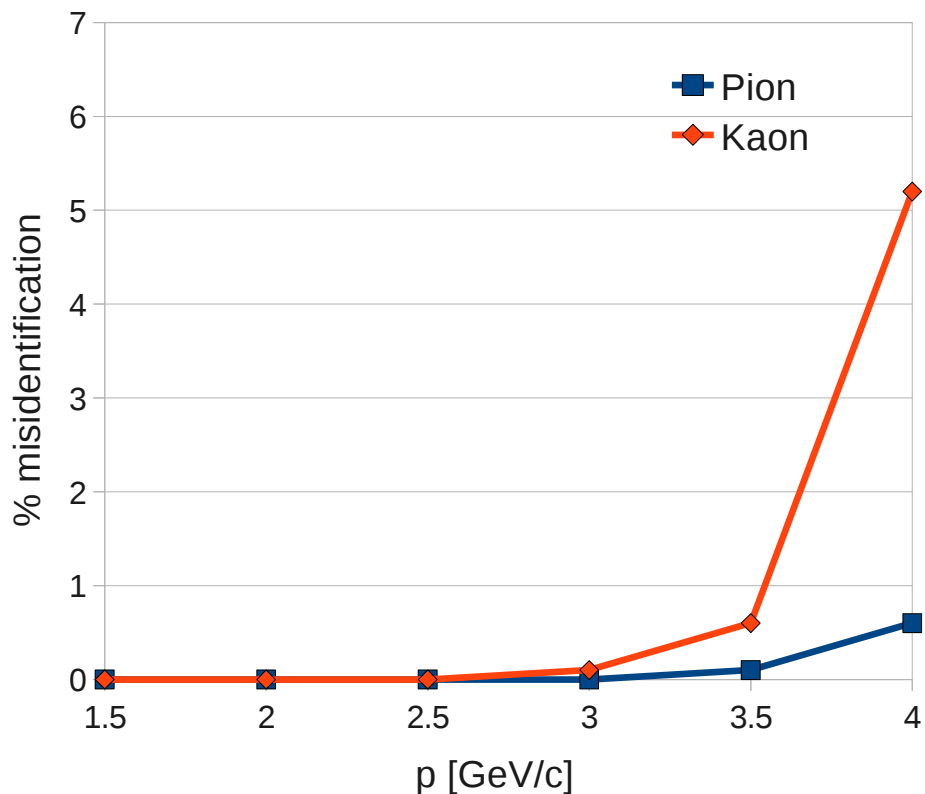
Geant4 vis.

First preliminary results

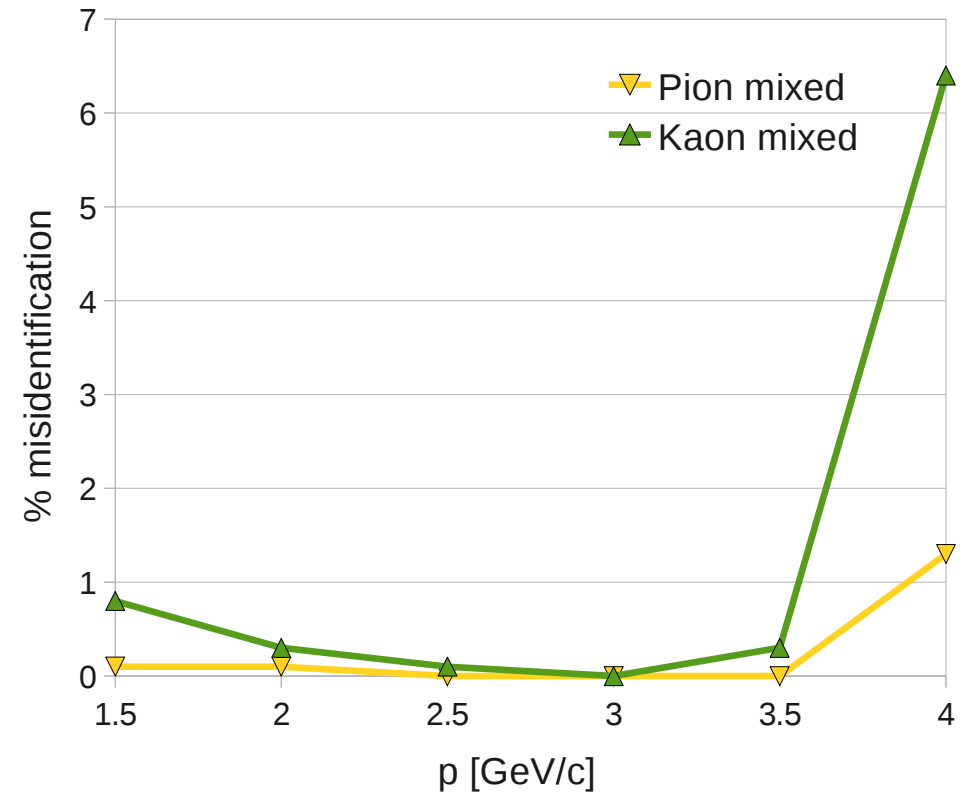
A 3d Disc DIRC
for $\bar{P}ANDA$



Small quarter (2x44 LG) - theta=15°; phi=45°
1000 tracks / marker

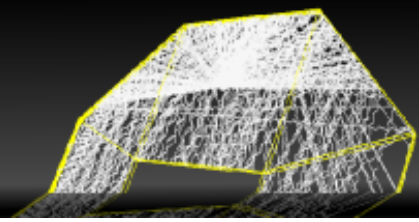


Small quarter (2x44 LG) - theta=15°; phi=45° - mixed tracks
1000 tracks / marker - 1 background track

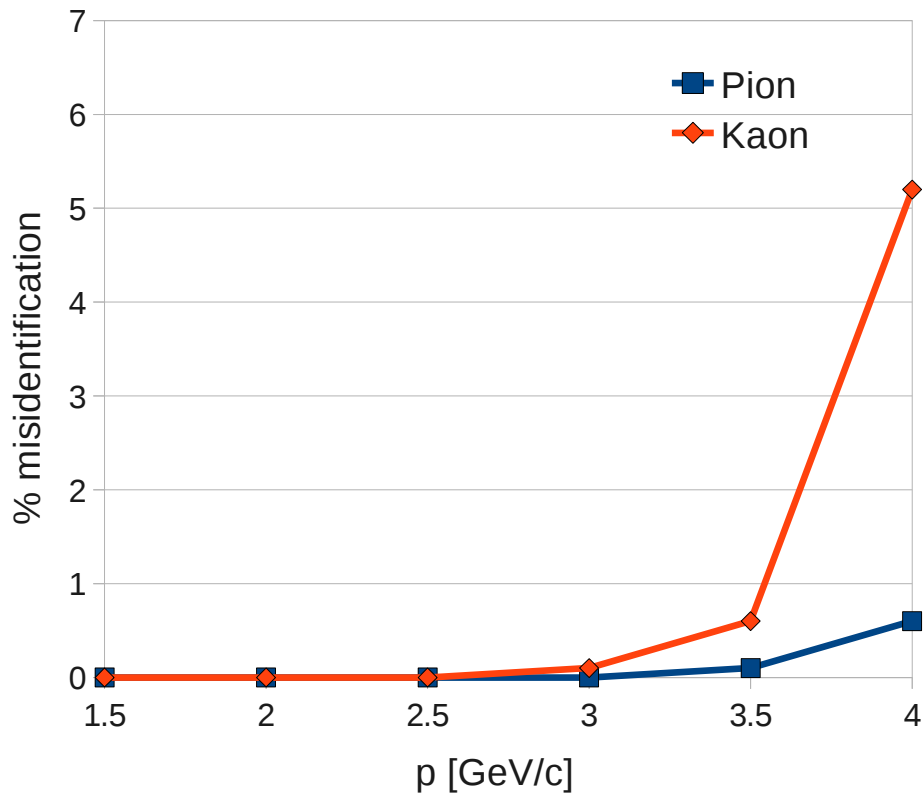


First preliminary results

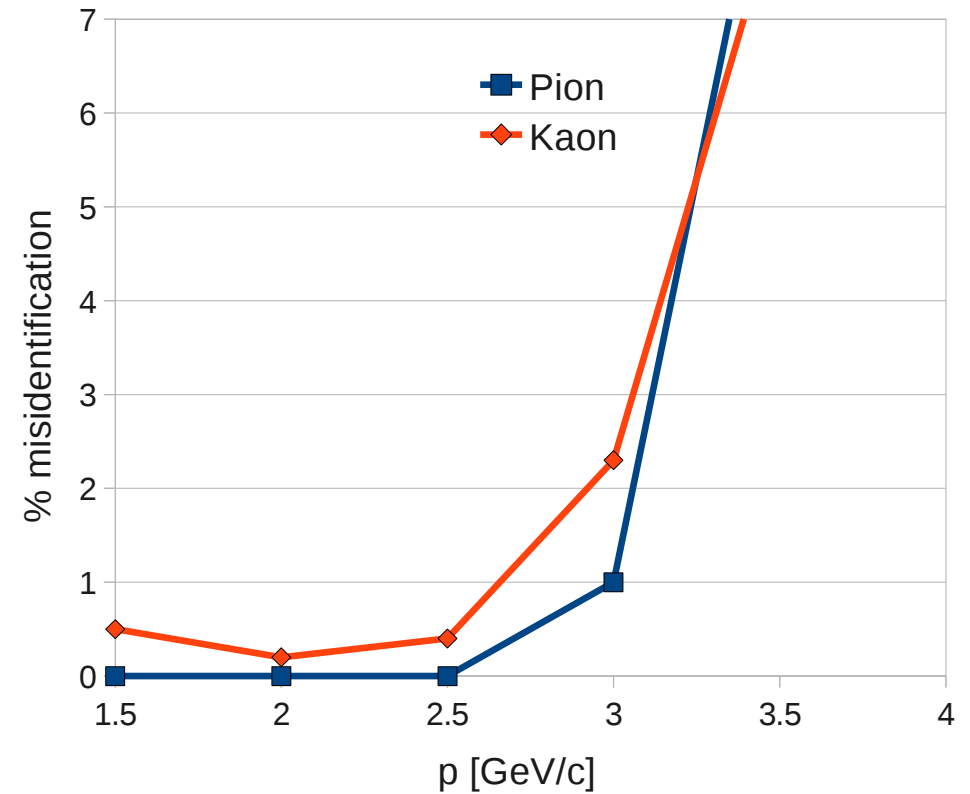
A 3d Disc DIRC
for $\bar{P}ANDA$



Small quarter (2x44 LG) - theta=15°; phi=45°
1000 tracks / marker

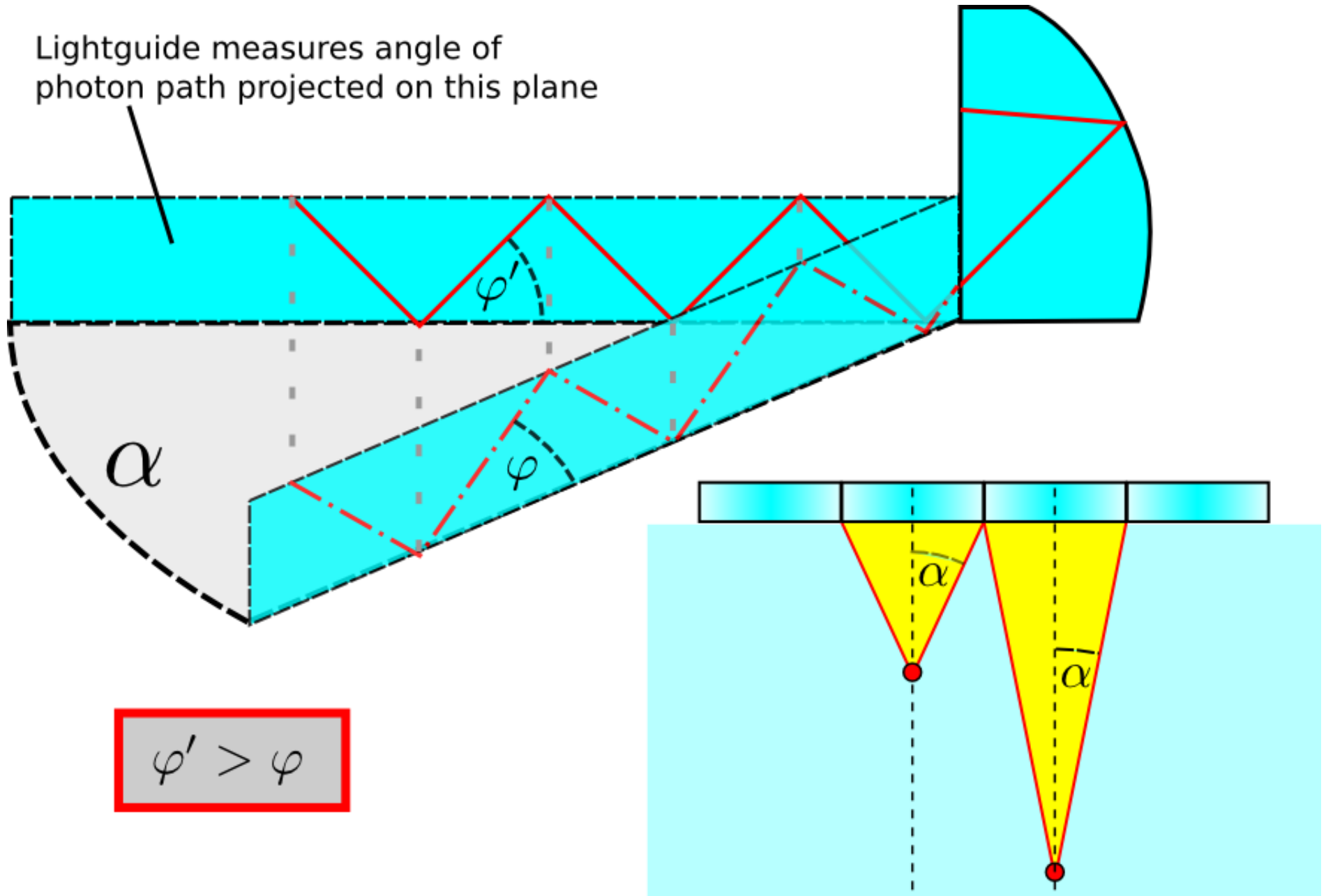
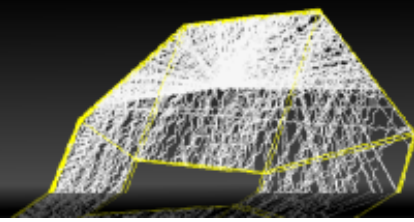


Small quarter (2x44 LG) - theta=20°; phi=45°
1000 tracks / marker



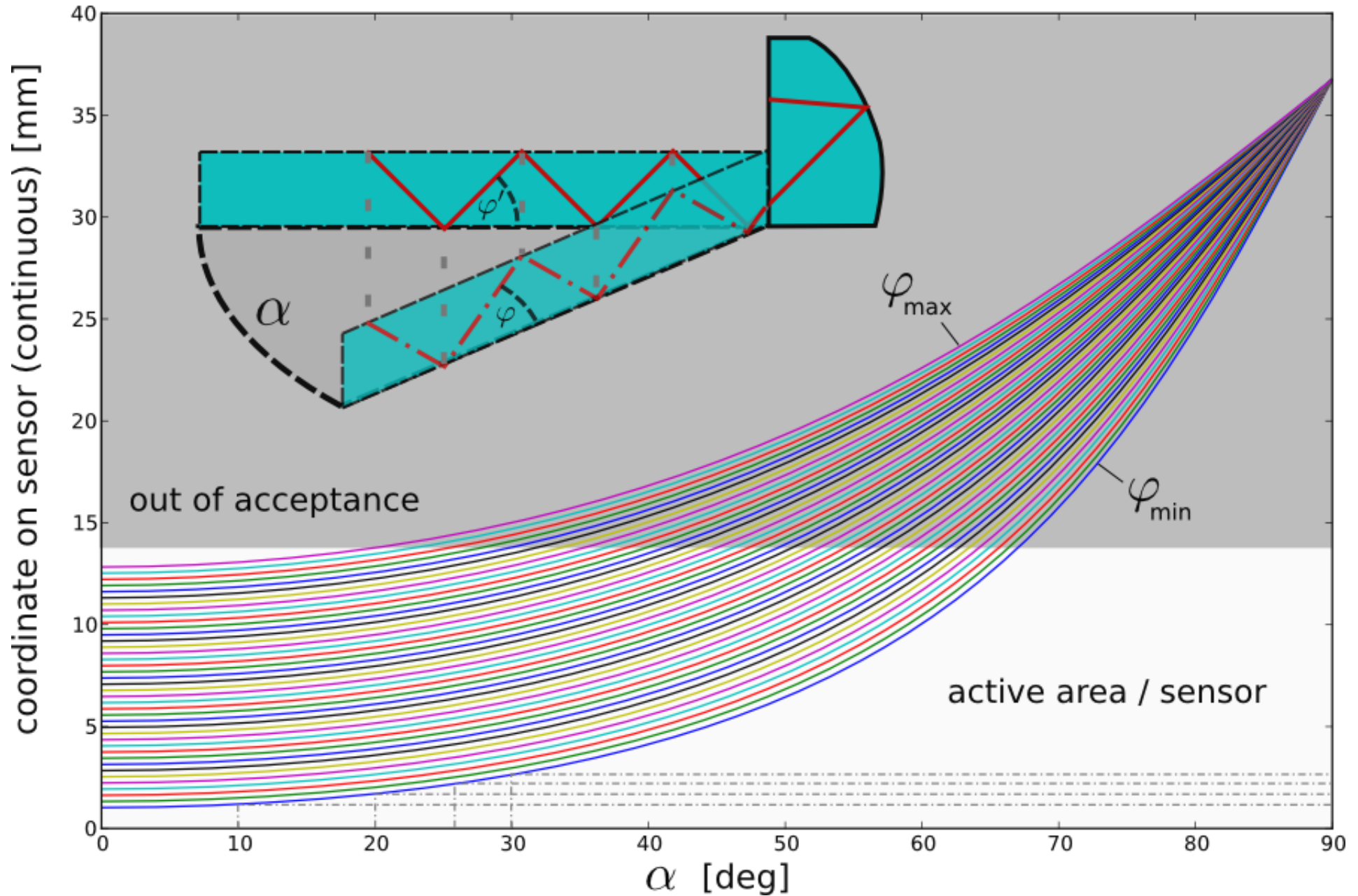
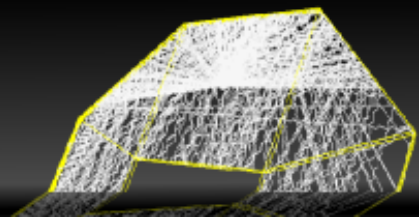
Lightguide imaging

A 3d Disc DIRC
for \overline{PANDA}



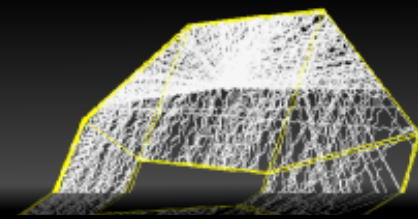
Lightguide imaging

A 3d Disc DIRC
for \overline{PANDA}

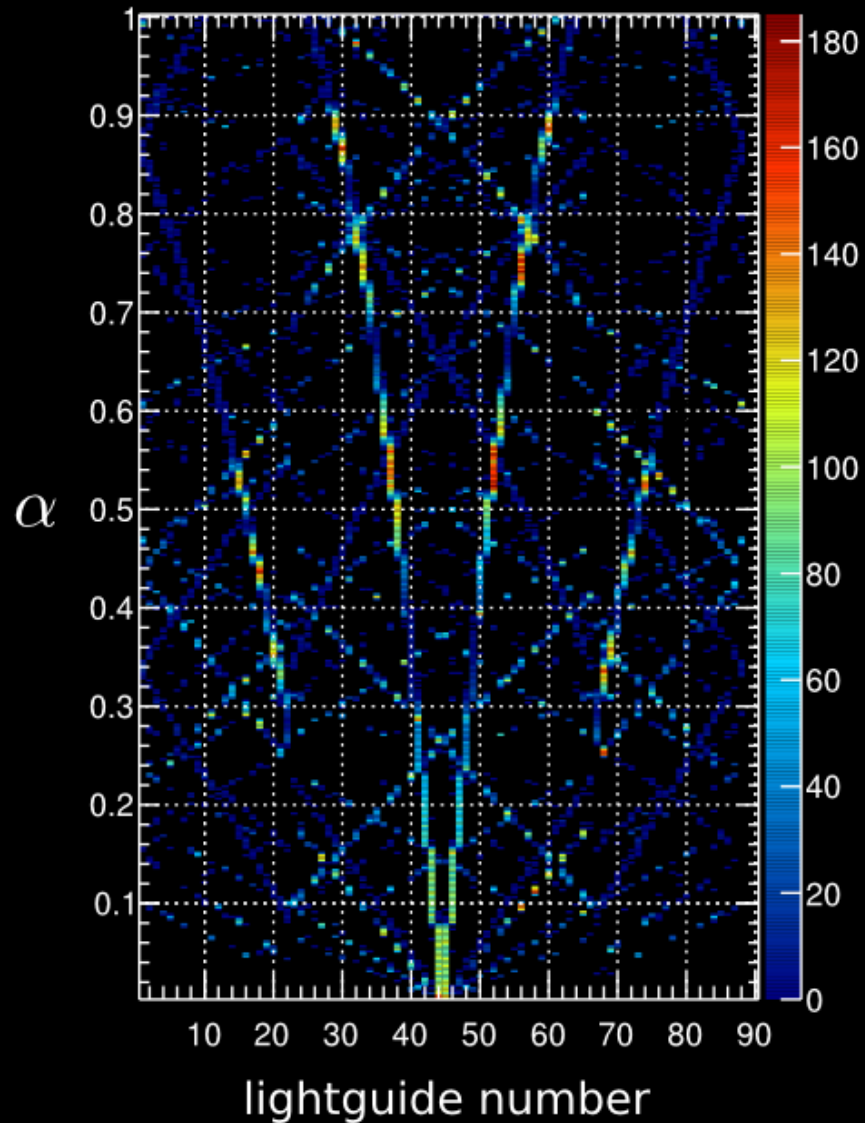


Lightguide imaging

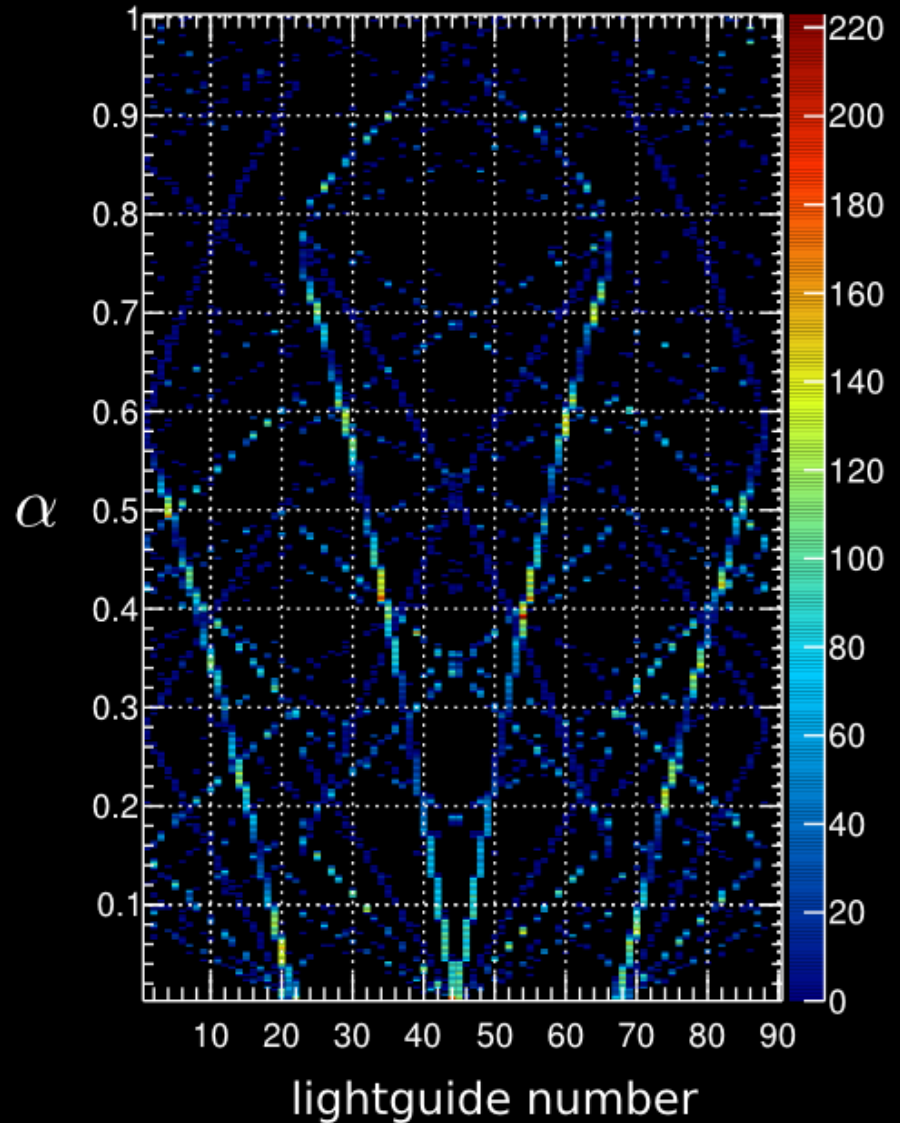
A 3d Disc DIRC
for \overline{PANDA}



theta = 20 deg | phi = 45 deg

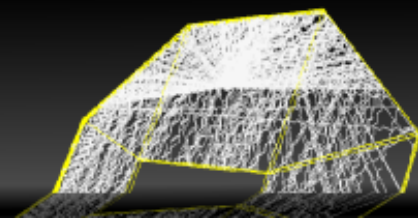


theta = 15 deg | phi = 45 deg

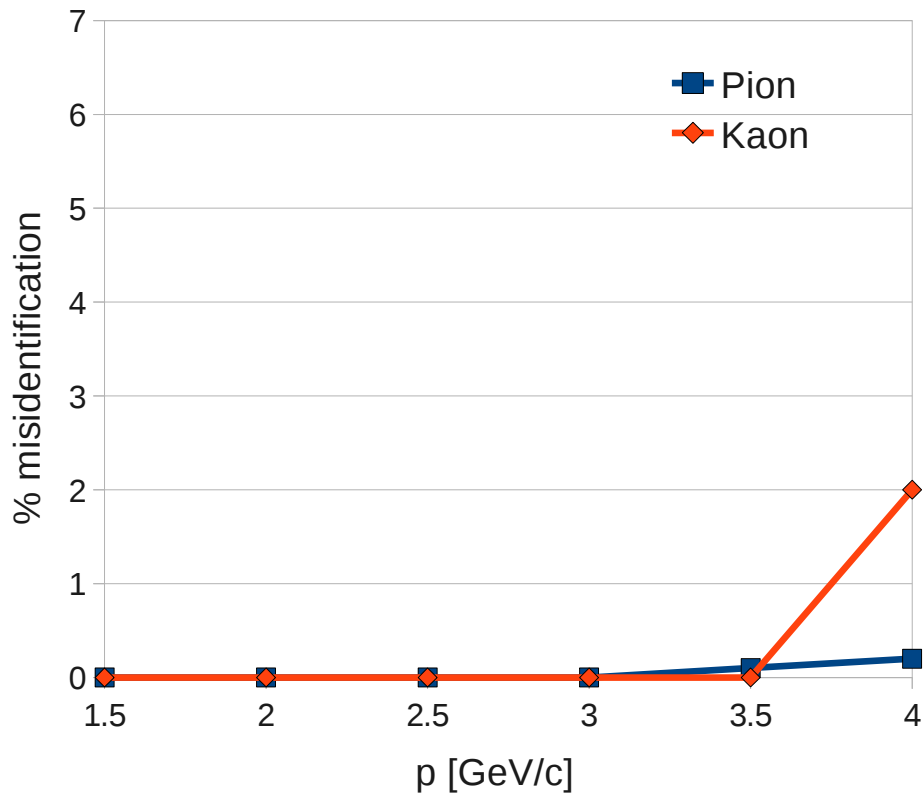


First preliminary results

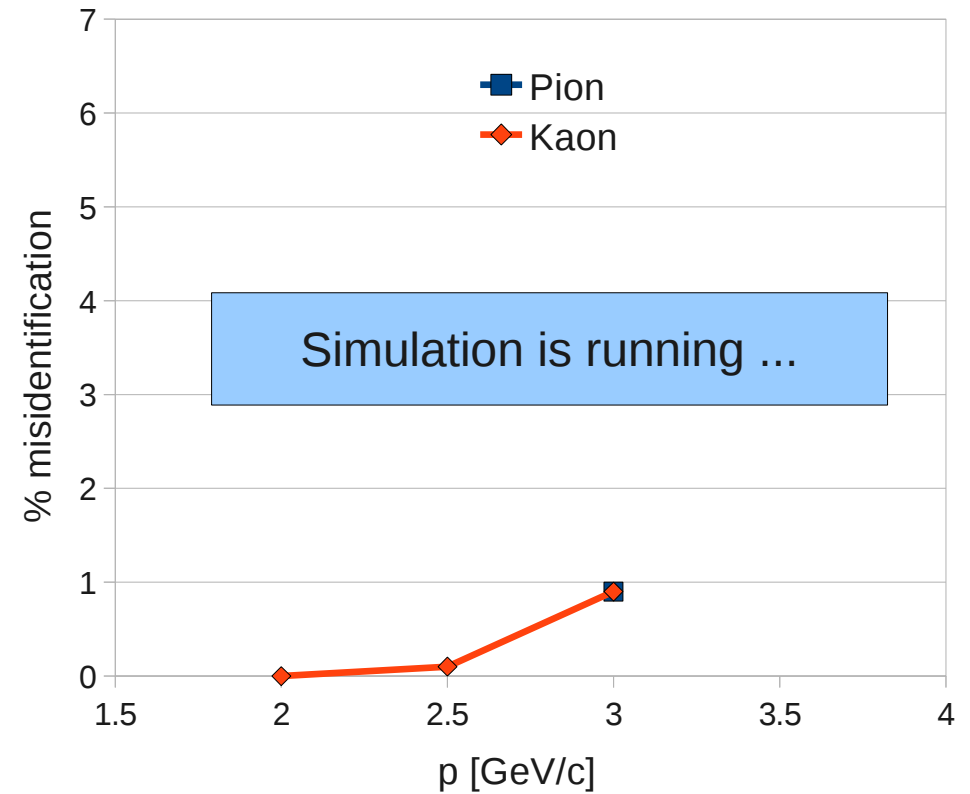
A 3d Disc DIRC
for \overline{PANDA}

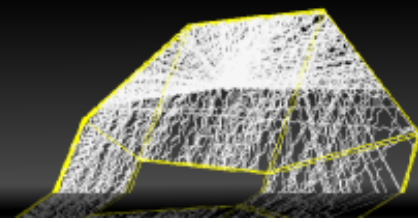


Large quarter (2x50 LG) - $\theta=15^\circ$; $\phi=45^\circ$
1000 tracks / marker

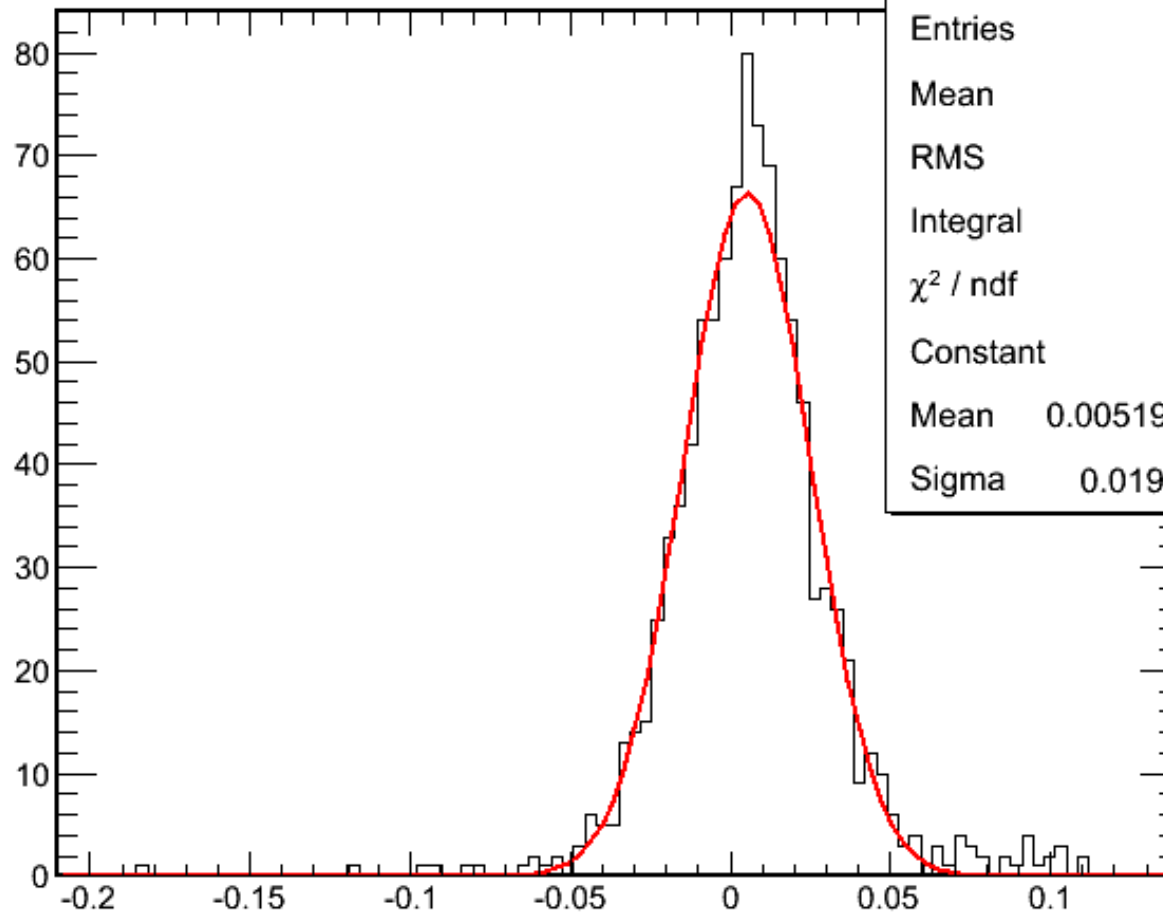


Large quarter (2x52 LG) - $\theta=22^\circ$; $\phi=45^\circ$
1000 tracks / marker





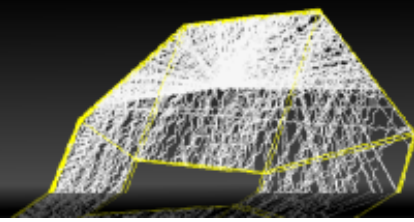
Reconstructed particle time of arrival:



htemp	
Entries	1000
Mean	0.006529
RMS	0.02573
Integral	1000
χ^2 / ndf	53.71 / 50
Constant	66.41 ± 2.90
Mean	0.005191 ± 0.000656
Sigma	0.01995 ± 0.00059

ToF stop for fast charged particles with ~ 20 ps rms

t0_pion



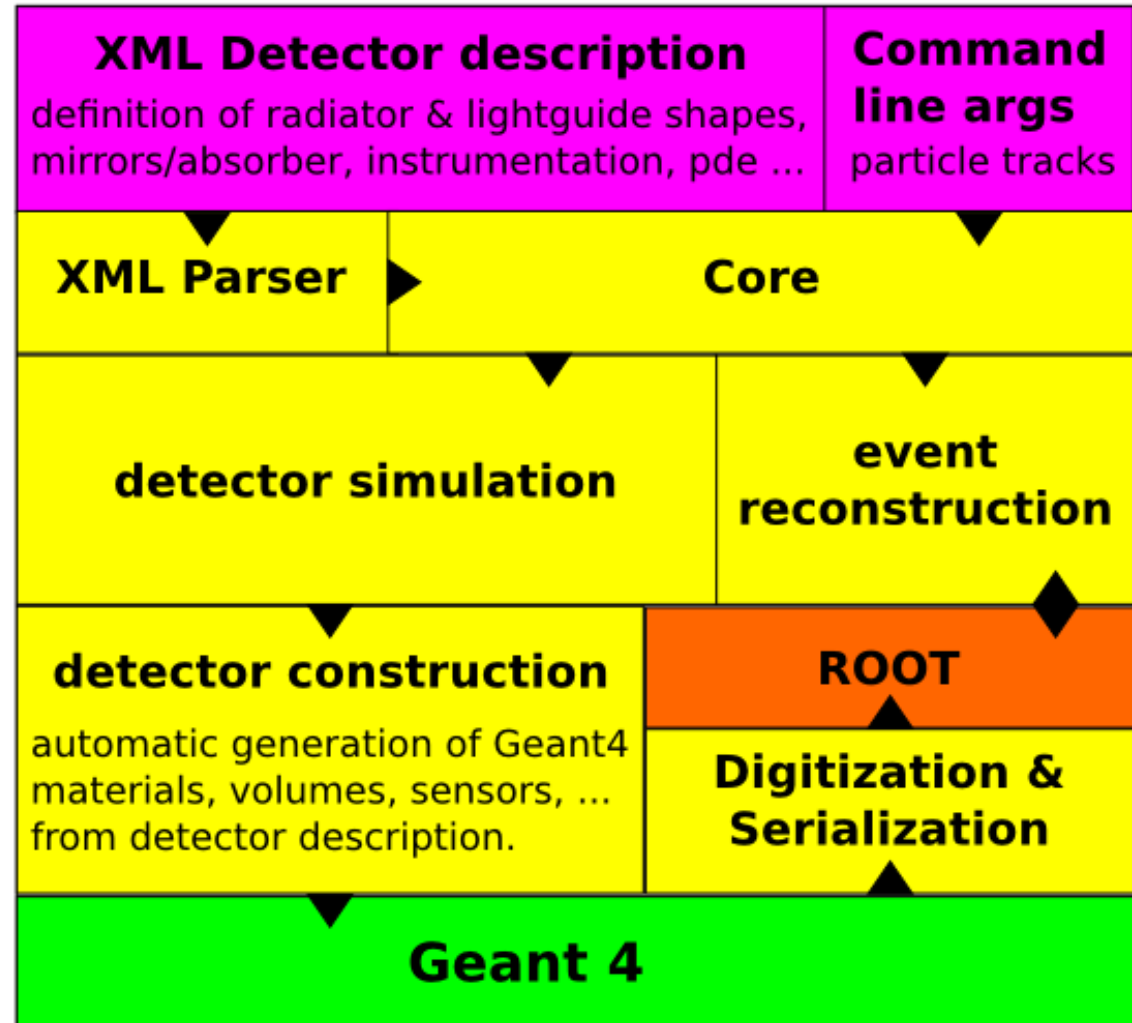
DiscDIRC toolkit

(c) Oliver Merle 2010

Will be continuously extended and improved while working on the Disc DIRC design.

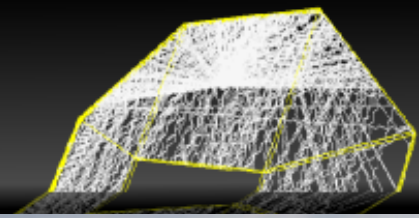
Source will be released under the DiscDIRC license, similar to the Geant4 software license.

- **user provided input**
- **Disc DIRC toolkit**
- **simulation backend**
- **serialization**

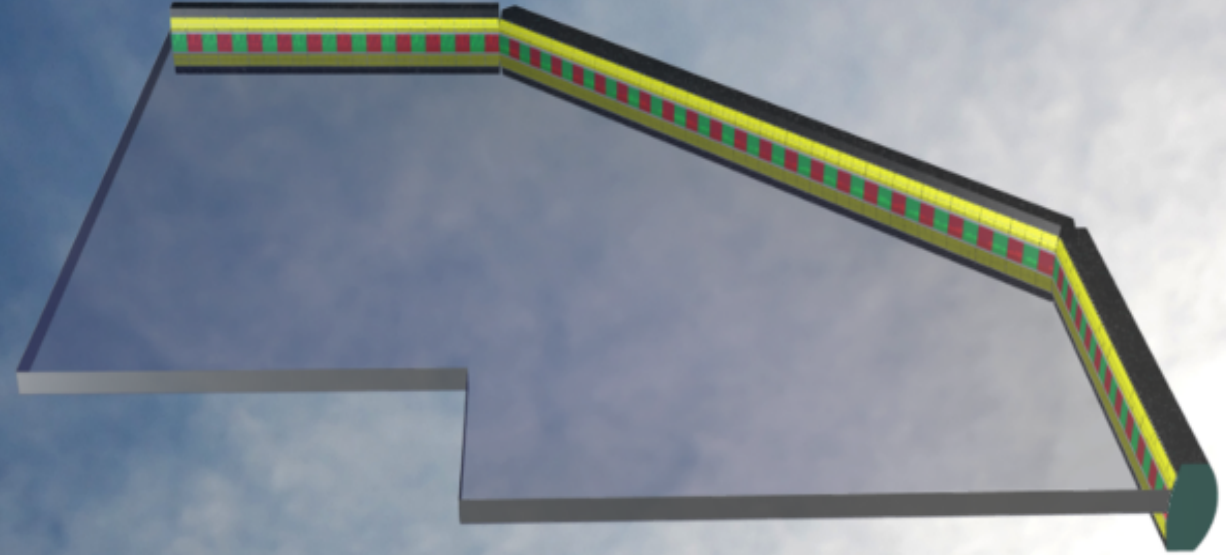


Here we are.

A 3d Disc DIRC
for \overline{PANDA}

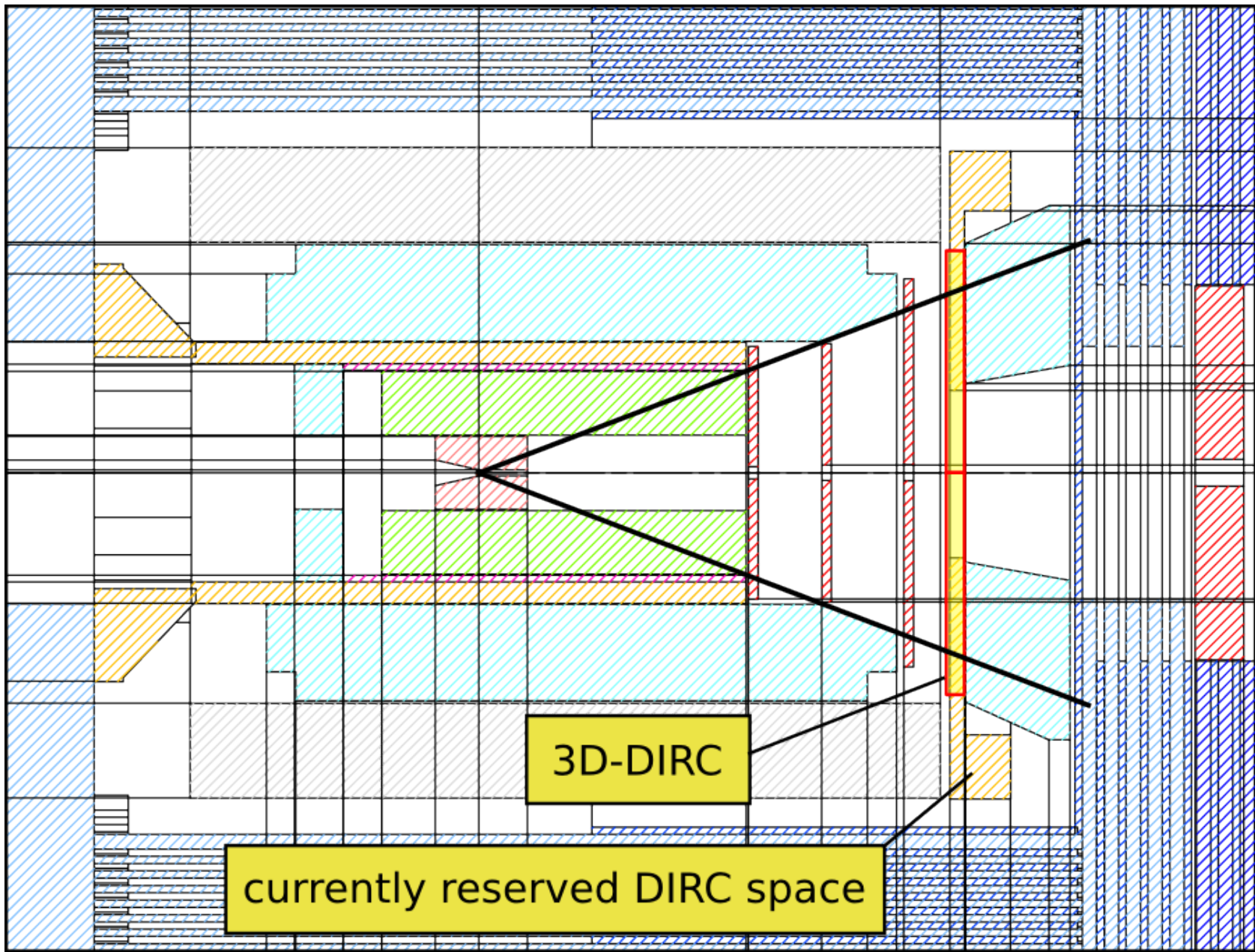
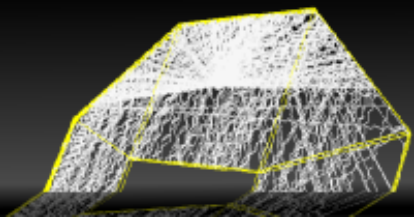


Finally, in reach



Detector integration

A 3d Disc DIRC
for \overline{PANDA}



3D-DIRC

currently reserved DIRC space