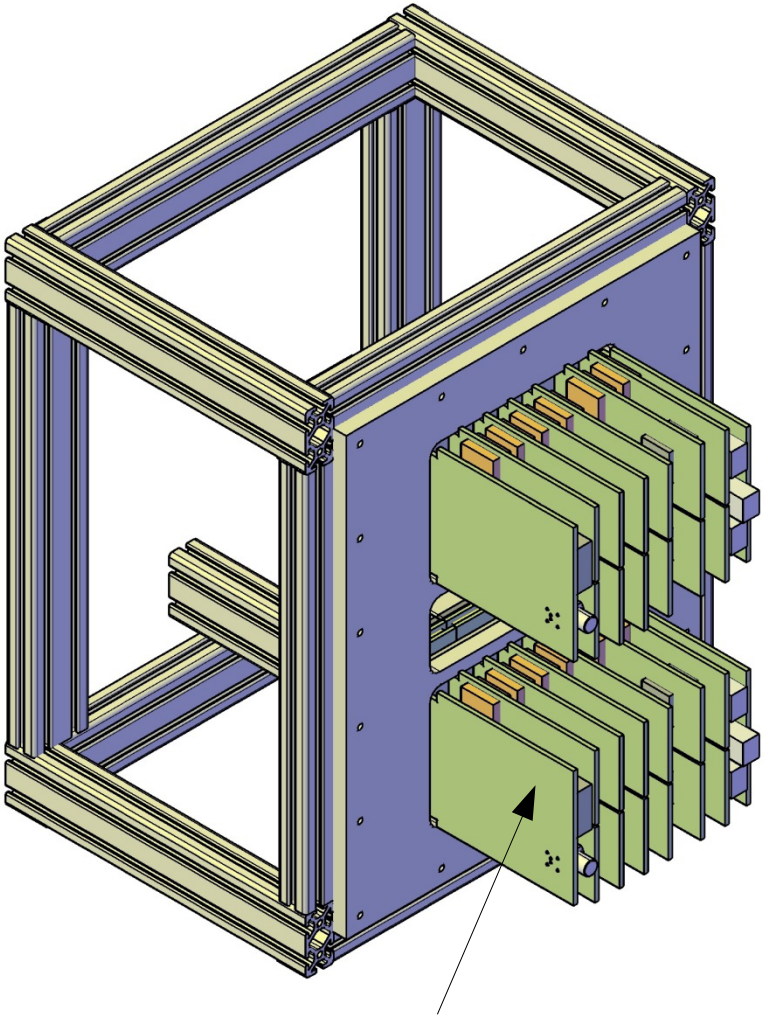
Beamtest prototype with glass lense

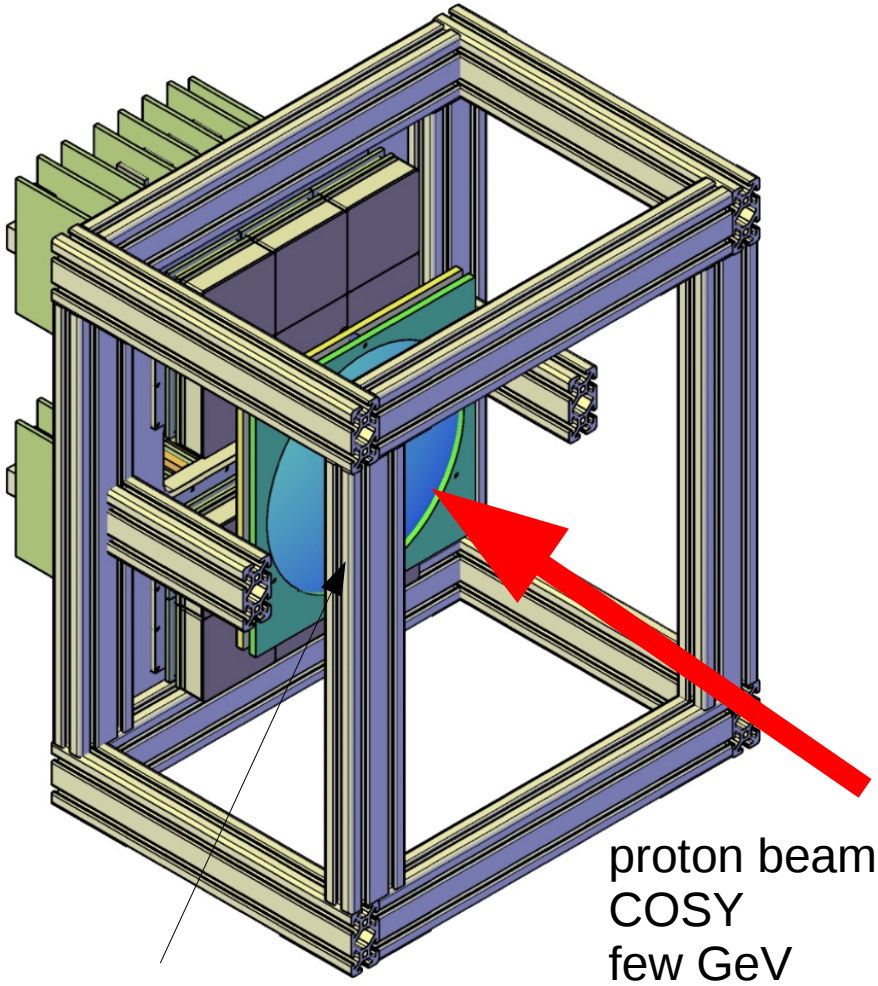
Basic idea and goals:

- Build a small and handy prototype for beam teststs
- Join the regular CBM COSY beam tests
- Main aim: tests of new electronic readout chain and DAQ integration
- Solid radiator for simplicity (and size !)
- Use rgular 3x2 MAPMT modules, as used for HADES and later for RICH

Beamtest prototype with glass lense



2x MAPMT readout modules
up to 12 MAPMTs
up to 24 DiRICH+Combiner+Power



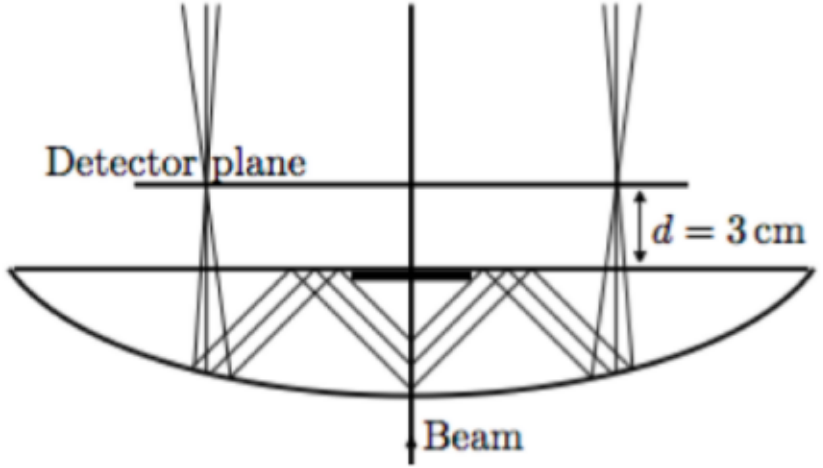
proton beam
COSY
few GeV

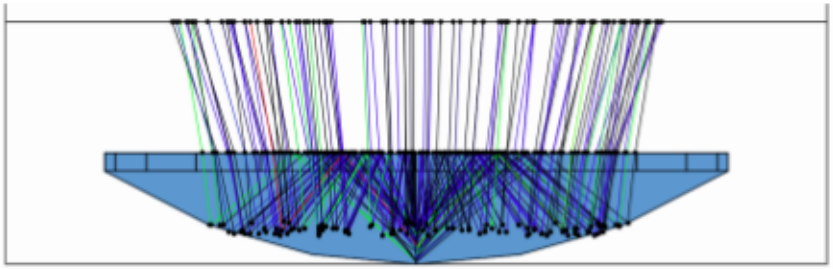
Spherical focussing lense, mirror coated
Borosilicate glas (no UV light)

design:
D. Pfeiffer, BUW
to be built together with U Giessen

Idea (and this slide) borrowed from LHCb...

Solid radiator with focusing geometry [CERN, Genova and RAL]





Lens with $n \sim 1.5$

- $\theta_{\mathrm{Ckv}} = \arccos \frac{1}{n\beta} = 48.2°$

- Light is totally internal reflected at the plane edge
- Reflective layer on the spherical surface
- Absorber layer to choose the photons created in $1\,\mathrm{cm}$ of material

The focusing lens for the RICH Testbox

First try to get a reflective layer on the Lens

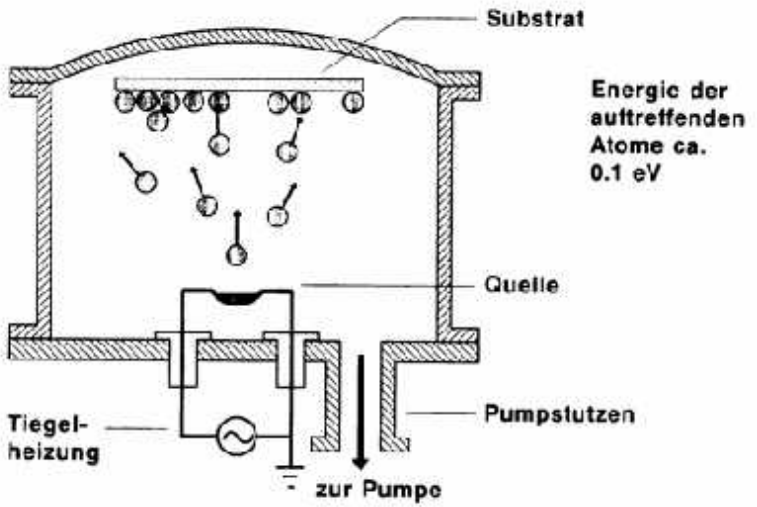
Protective layer (Magnesium fluoride)
Reflective layer (Aluminium)
Lens (Borosilicate glass)

Coating process

Coating on the curved side of the lens
Processing in a high vacuum
Chamber at 10^{-6} mbar
Specified process parameters

Reflective layer
Material : Aluminium
Layer thickness : ca. 100 nm
Specified growth rate: 4.5 Å/s

Protective layer
Material : Magnesium fluoride
Layer thickness : ca. 380 nm



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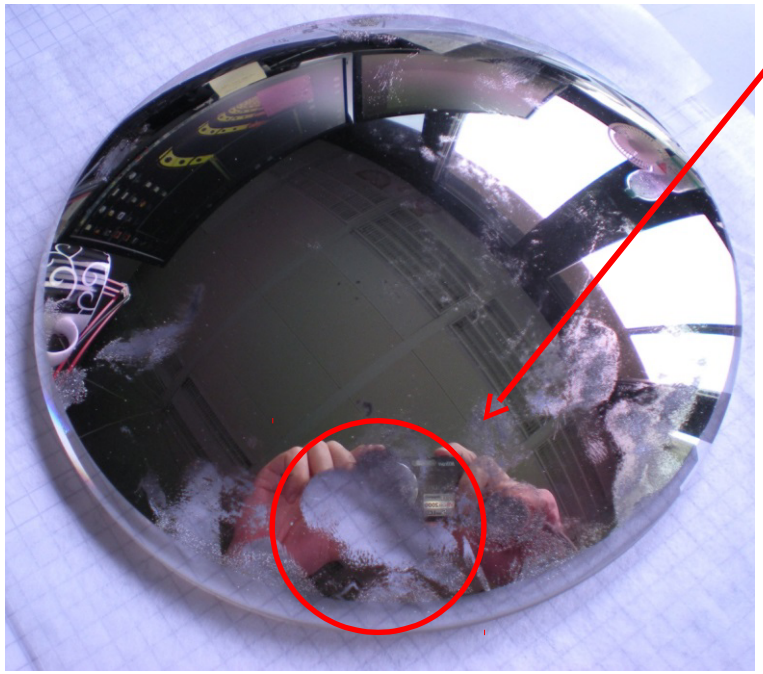
The focusing lens for the RICH Testbox



The result of the first try:

The coating has very bad areas

The problem:

Contaminations on the lens after the cleaning process

For the next try:

- Buy a new lens
- Find a reliable way to get rid of the contaminations on the lens

D. Pfeifer, BuW

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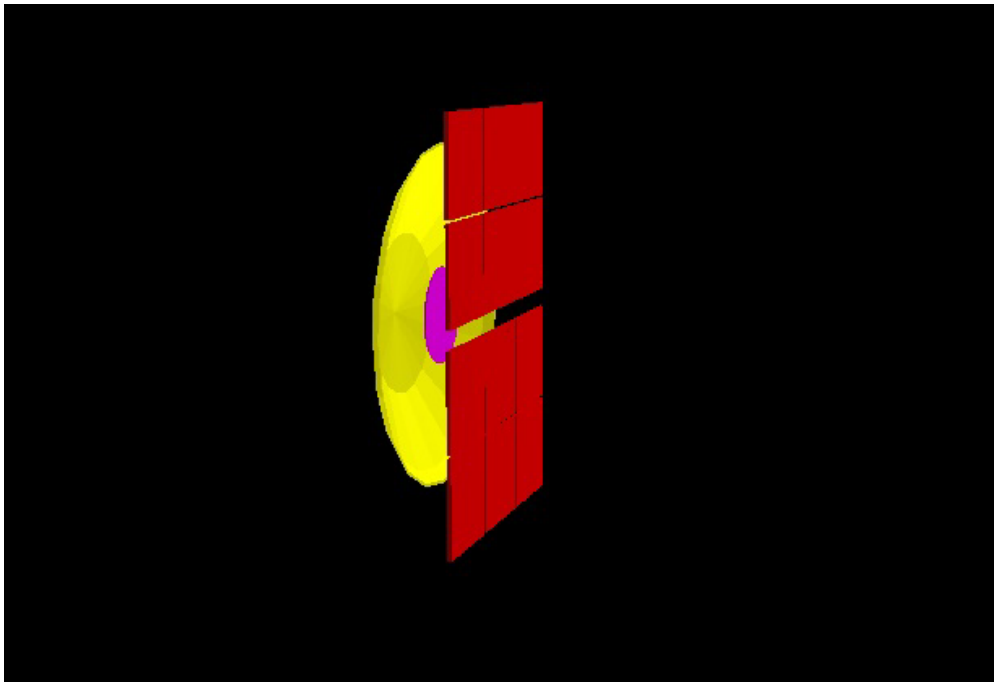
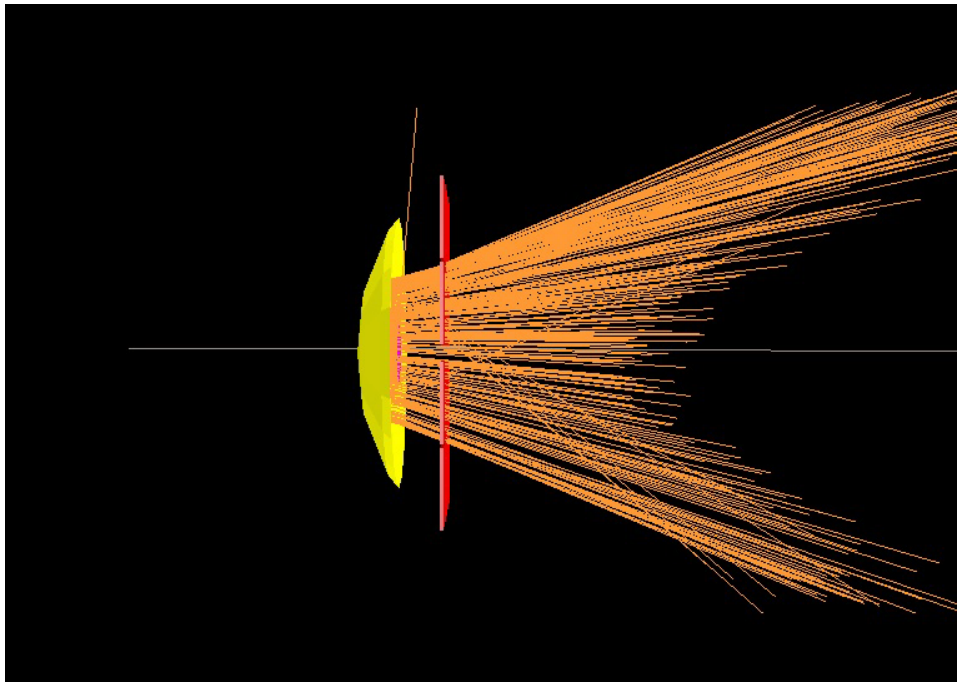
Simulation of Testbox

- Testbox implemented in CbmRoot
  - **Lense** from Edmund specifications (absorption length), Al coating similar as for CBM-RICH mirrors
  - **Absorber** (black silicon, for better focussing, reduction of Cherenkov photons)
  - **PMTs**: H12700 MAPMTs implmented on pixel level
- Run single protons (2 GeV) through setup (left to right)
  → generation of **Cherenkov photons**, focussing on PMT plane





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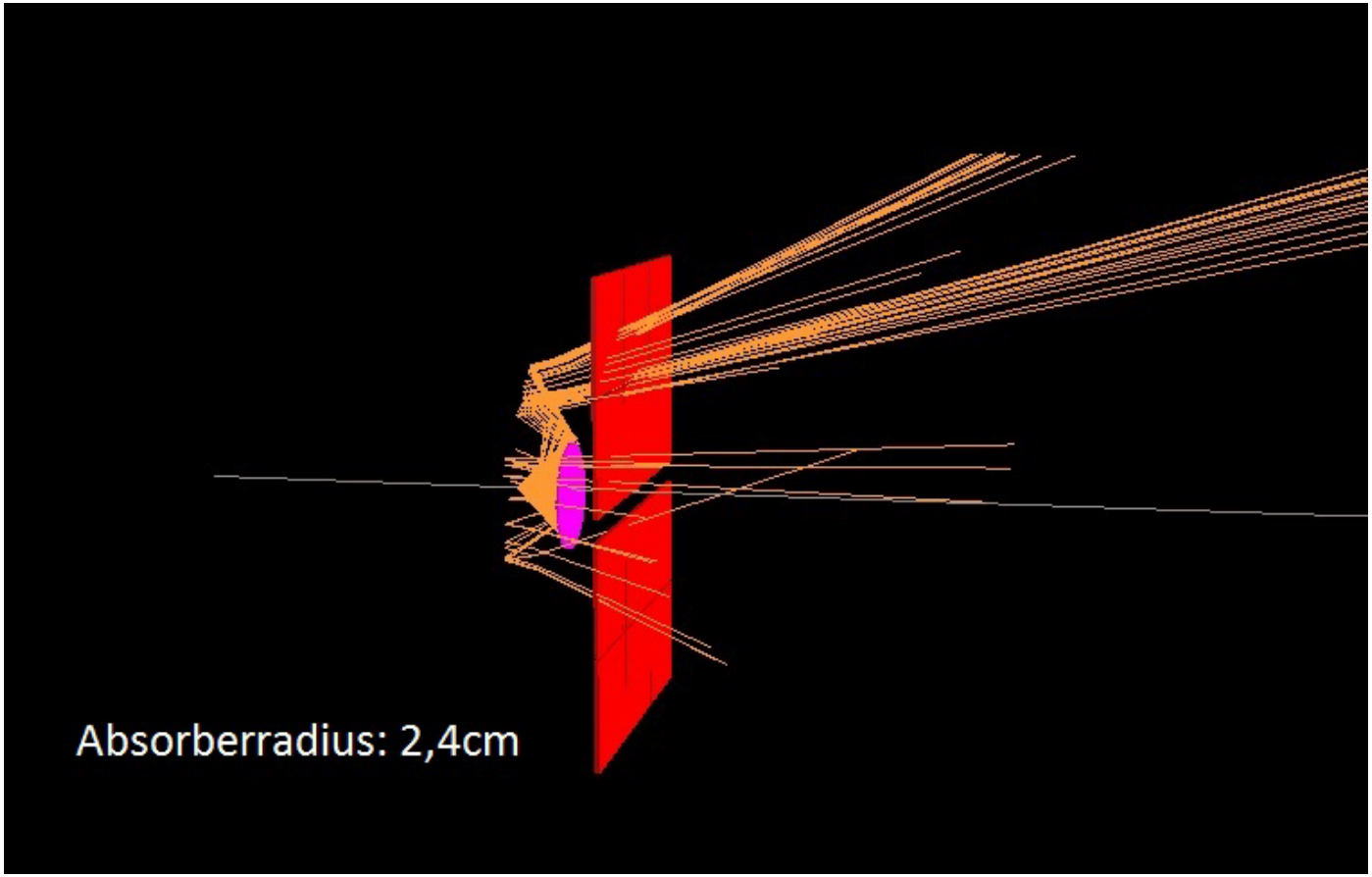
Simulations of Testbox

- For better visibility of Cherenkov photons lense is invisible here, absorber radius increased
- generated Cherenkov cone visible
- total internal reflection (and absorption) on planar side of lense
- reflection on curved side, focussing on PMT plane



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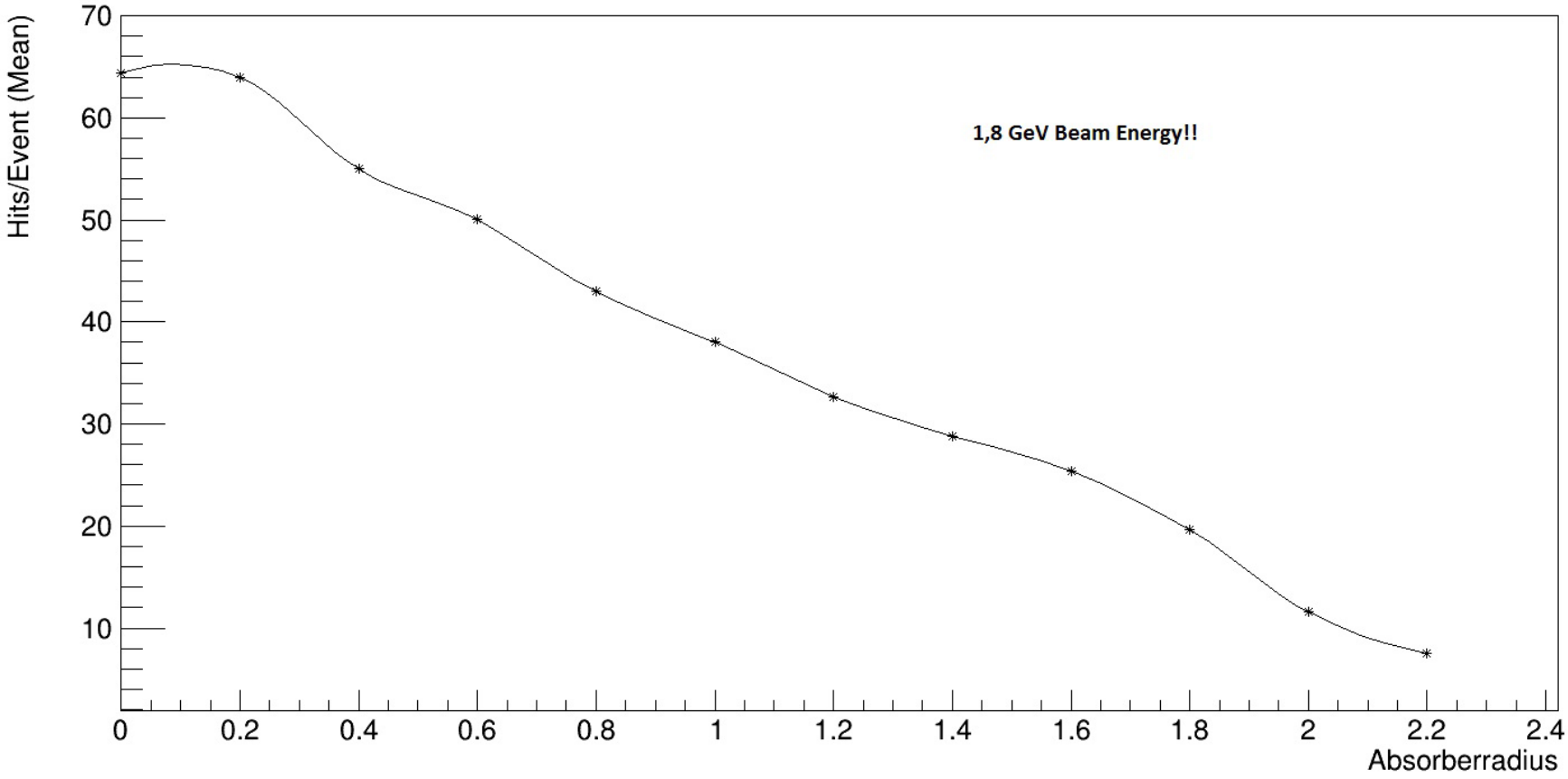
Simulations of Testbox

- Choose absorber radius to get the desired number of hits/ring
  25 hits/ring with 1.6 cm absorber radius



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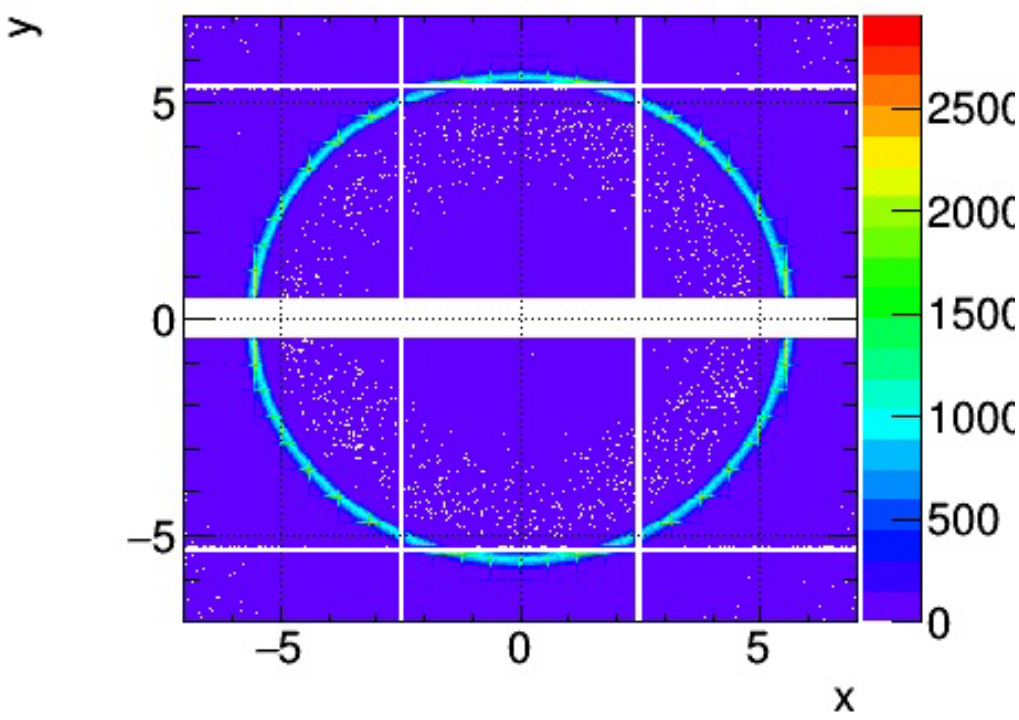
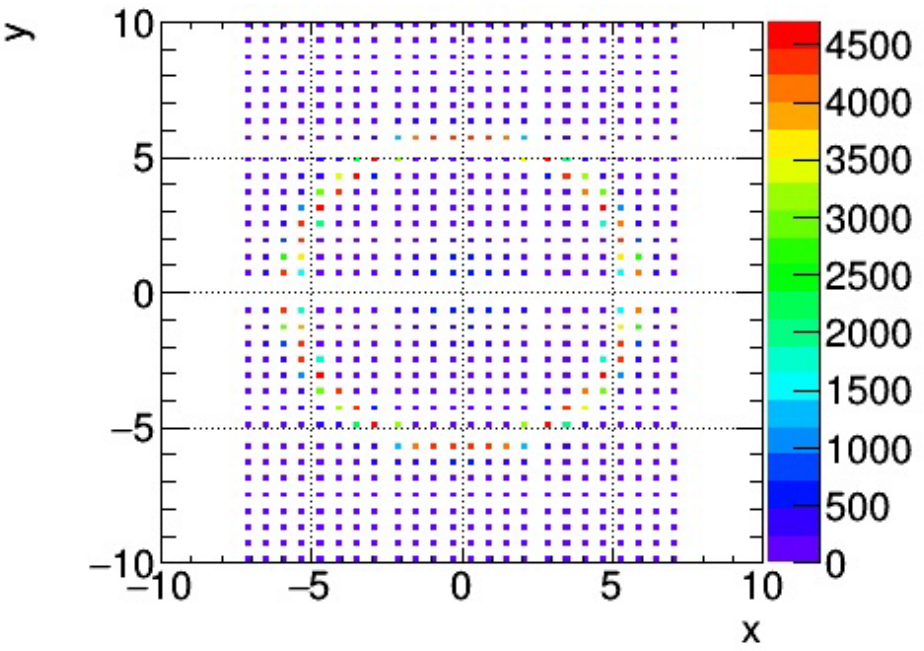
Simulations of Testbox

- Ring radius ~ 5.5 cm
- Choose absorber radius to get the desired number of hits/ring
- COSY beamspot: 3mm sigma in x and y direction need to increase the gap between PMTs
- Depending on beam intensity: investigate broad range on hit rates

Cherenkov points in PMT plane



Pixel hits in PMT plane (10000 events)



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