TCPD
a Hybrid Cherenkov Detector

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Outline

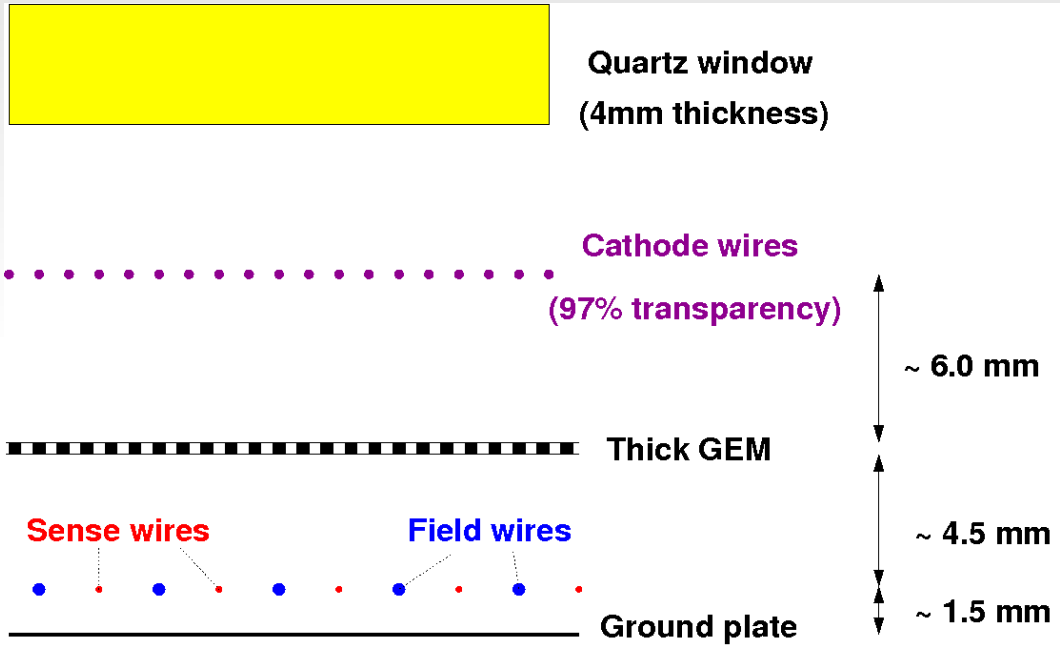
- TCPD outline
- Reminder pages from the last TCPD presentaion
- Beam test in 2012.
- Applied gains
- Cluster size
- MIP Suppression
- Photon Yield
- Summary

TGEM, CCC

- **MWPC for photon detection**
  - (+) Full surface
  - (-) Ion backflow
  - (-) Feed-back photons
- **ThickGEM based photon detection**
  - (+) Ion backflow
  - (+) Feed-back photons
  - (-) Multi-layers (2-3) raise cost
- **Close Cathode Chamber (CCC)** [NIM A 648 (2011) 163]
  - (+) Mechanical tolerance, simple construction
  - (+) Low material budget

TCPD Outline
(ThickGEM+CCC Photon Detector)

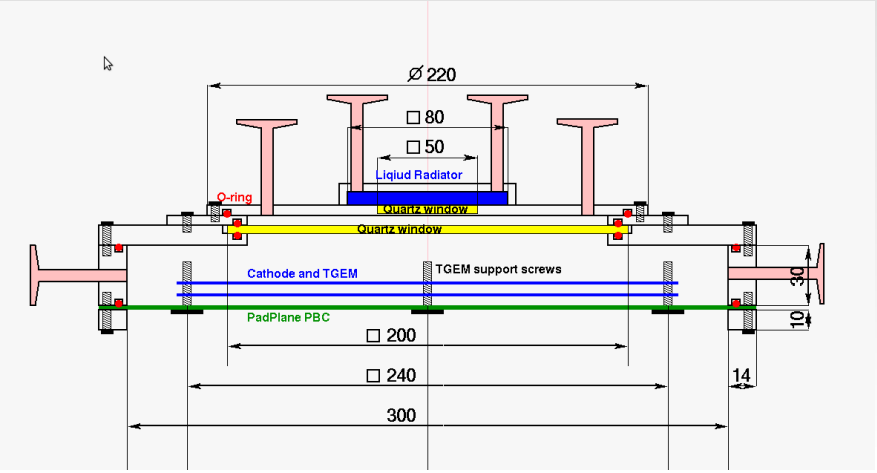
- A known configuration applied for photon detection
- UV-transparent
  quartz window
- Wire plane for cathode
- ThickGEM, upper surface
  could be coated with CsI
- Standard CCC wire layout
- Padplane on ground

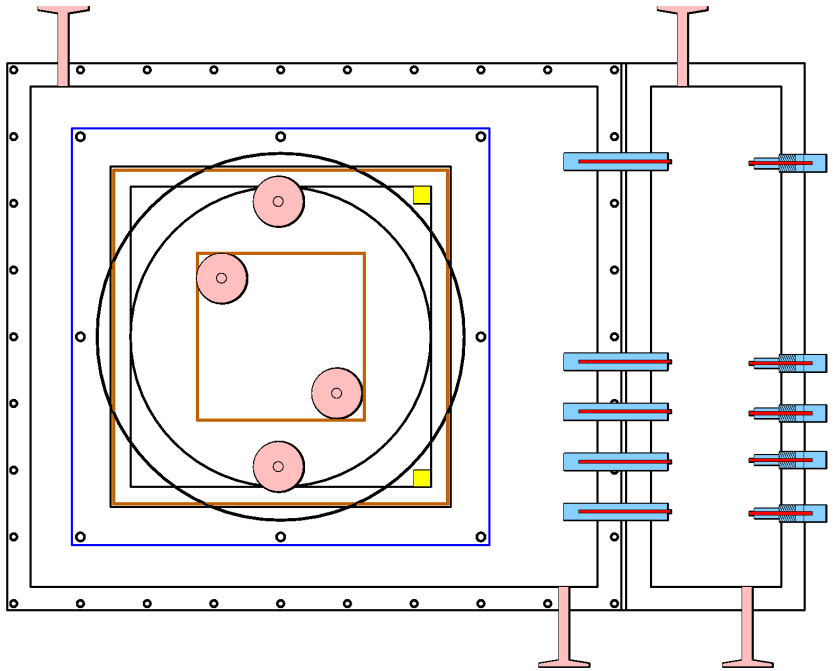


Combines msot of the advantages of both technologies

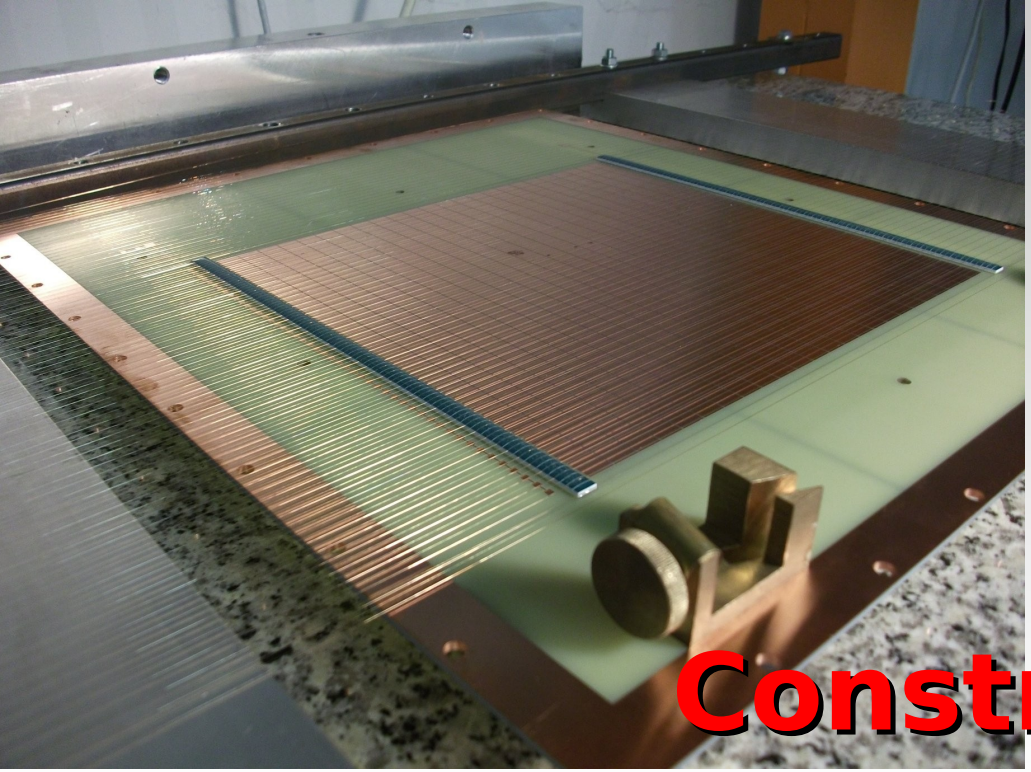
TCPD-2 Chamber for Cherenkov photons

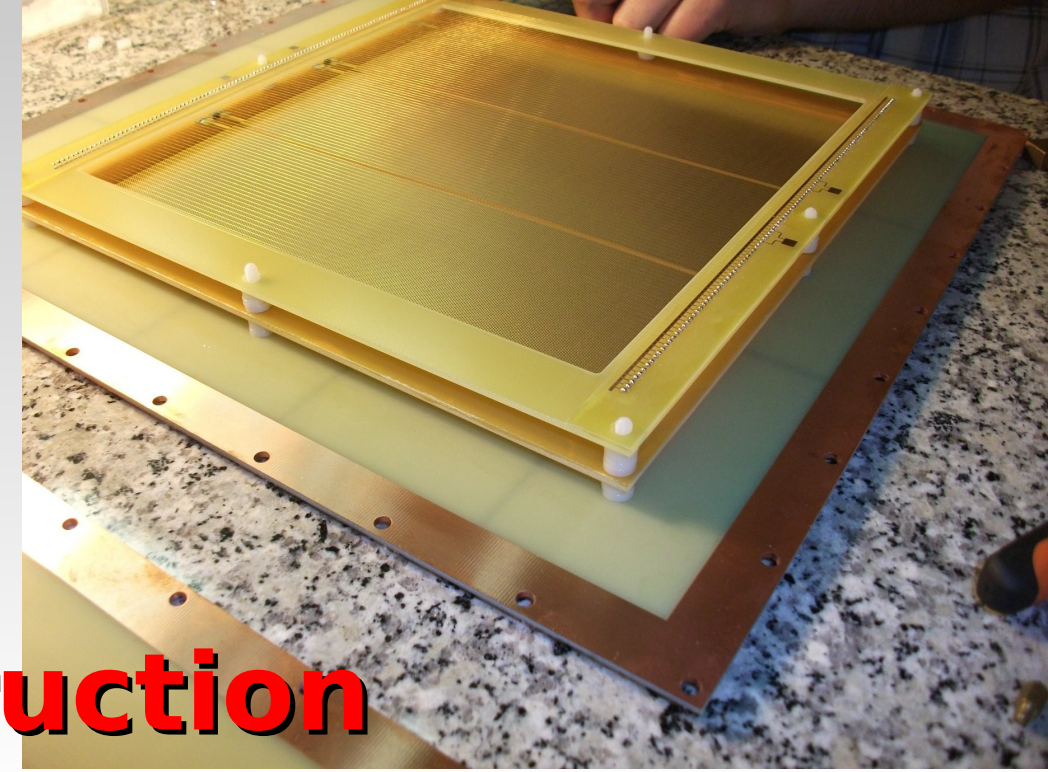
- TGEM 20x20 cm^2 active area (CERN, R.Oliveira, 2011)
- CsI cover (CERN, 2011)
- Humidity-free gas volume for the HV connection
- Large quartz window (20x20cm^2)
- Small monitoring window
- Detachable frame for the liquid radiator
- Pad structure : HMPID-like (8x8, 4x8, 4x4 mm^2)

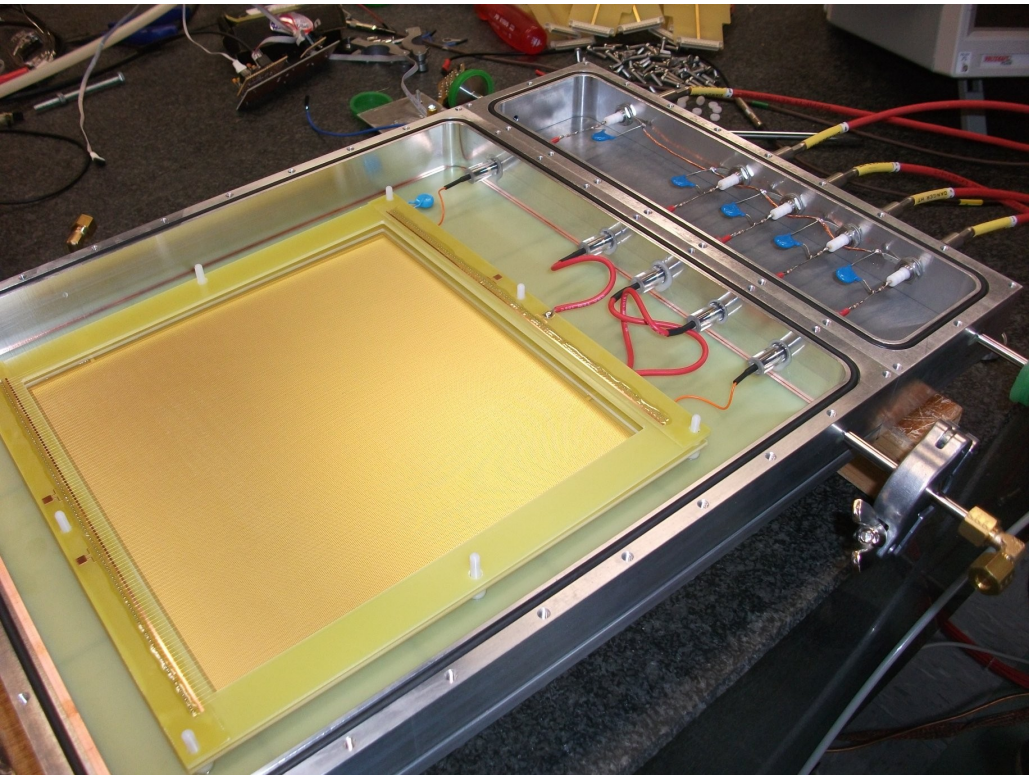


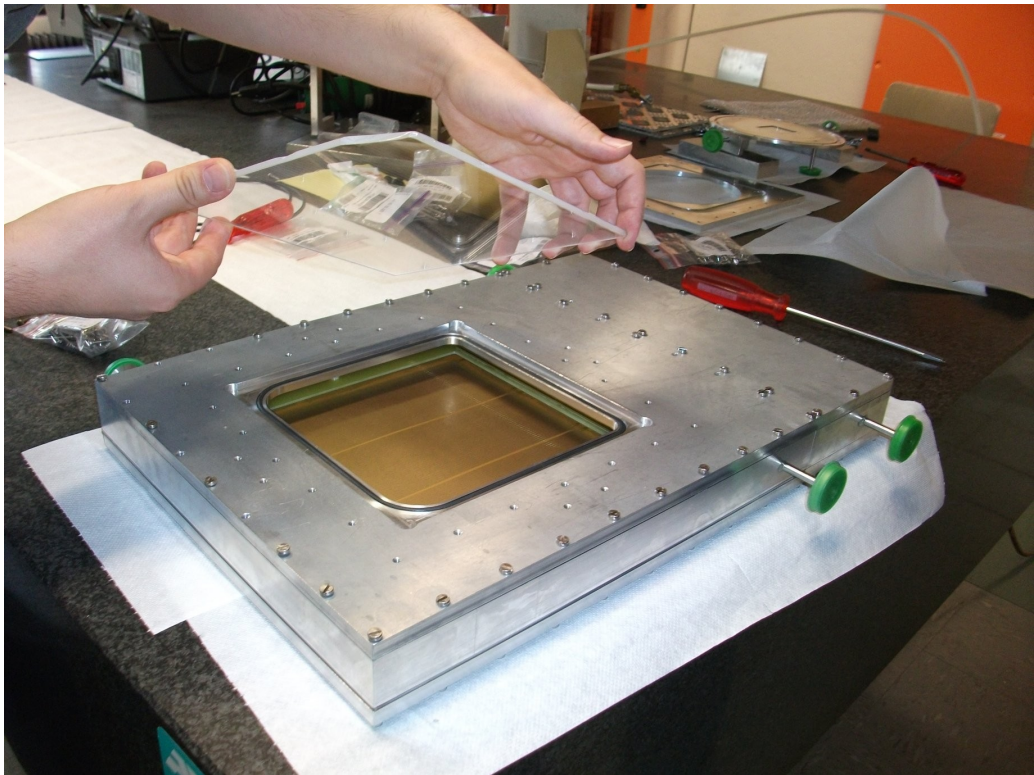


Construction

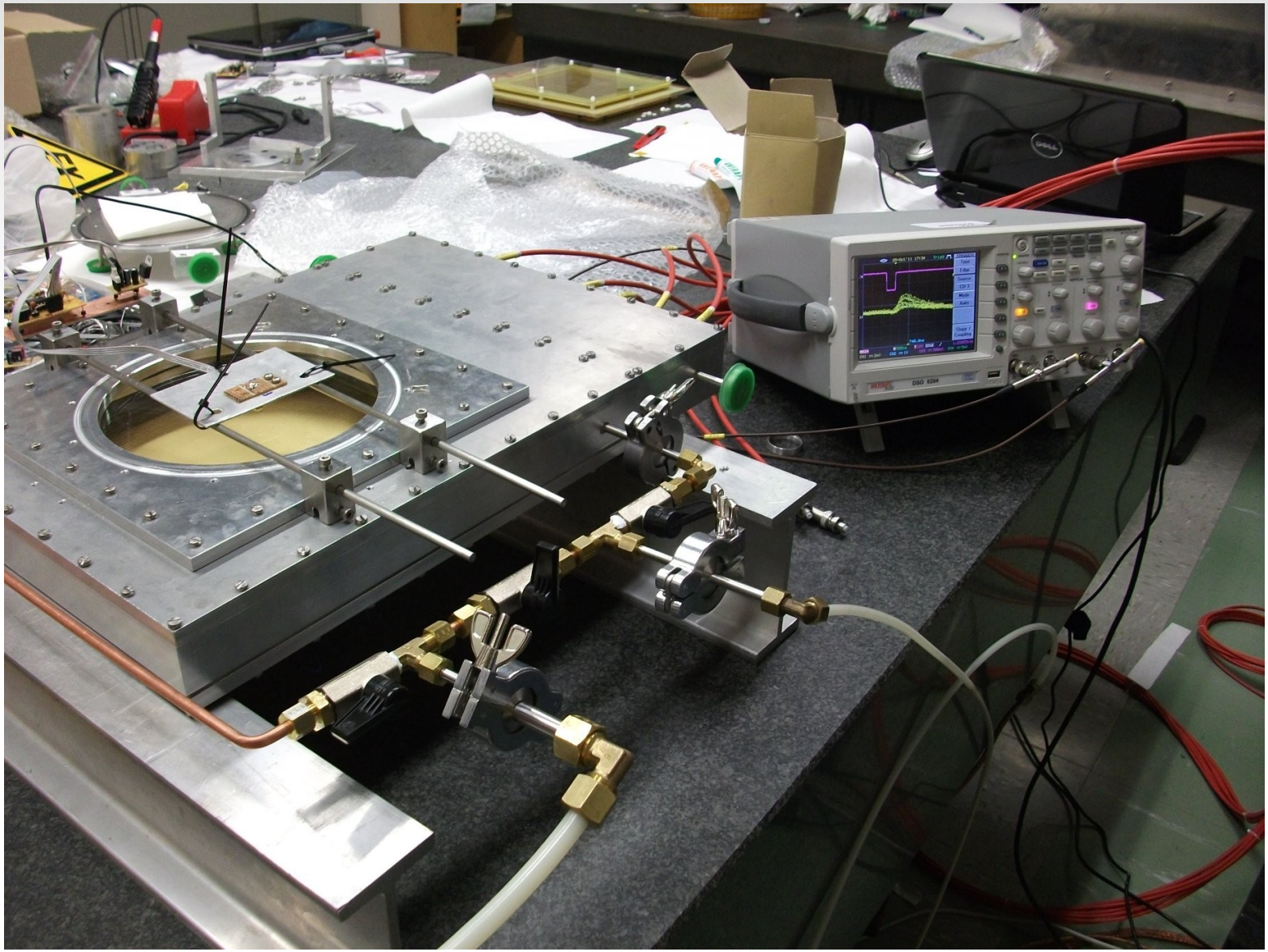






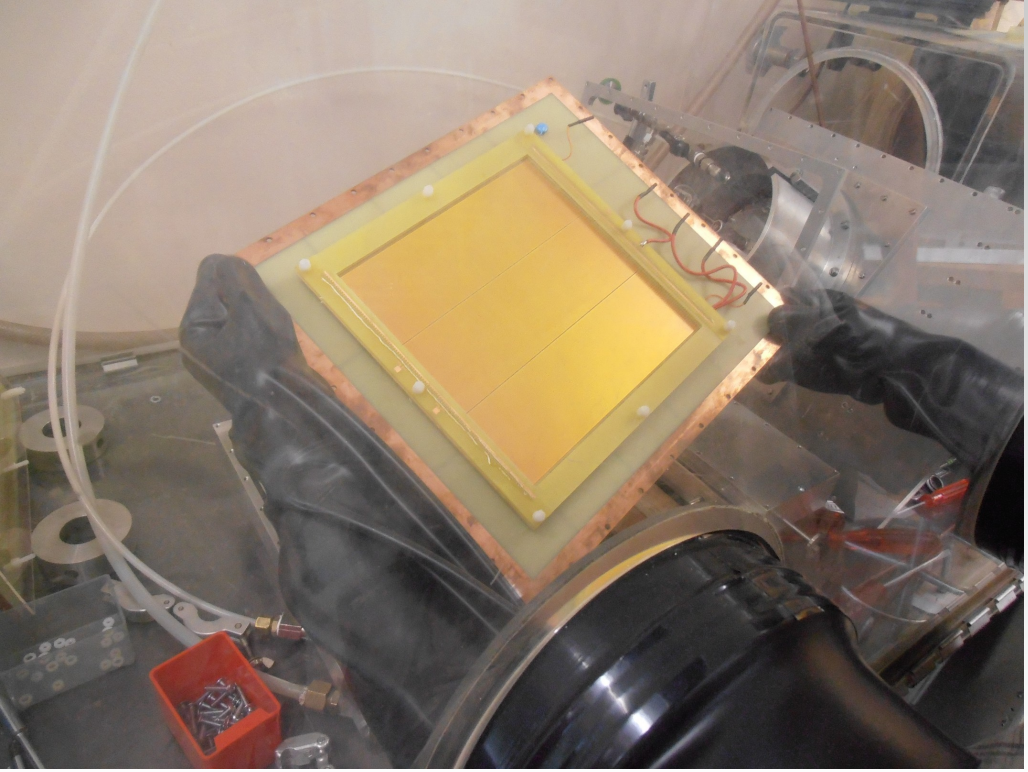


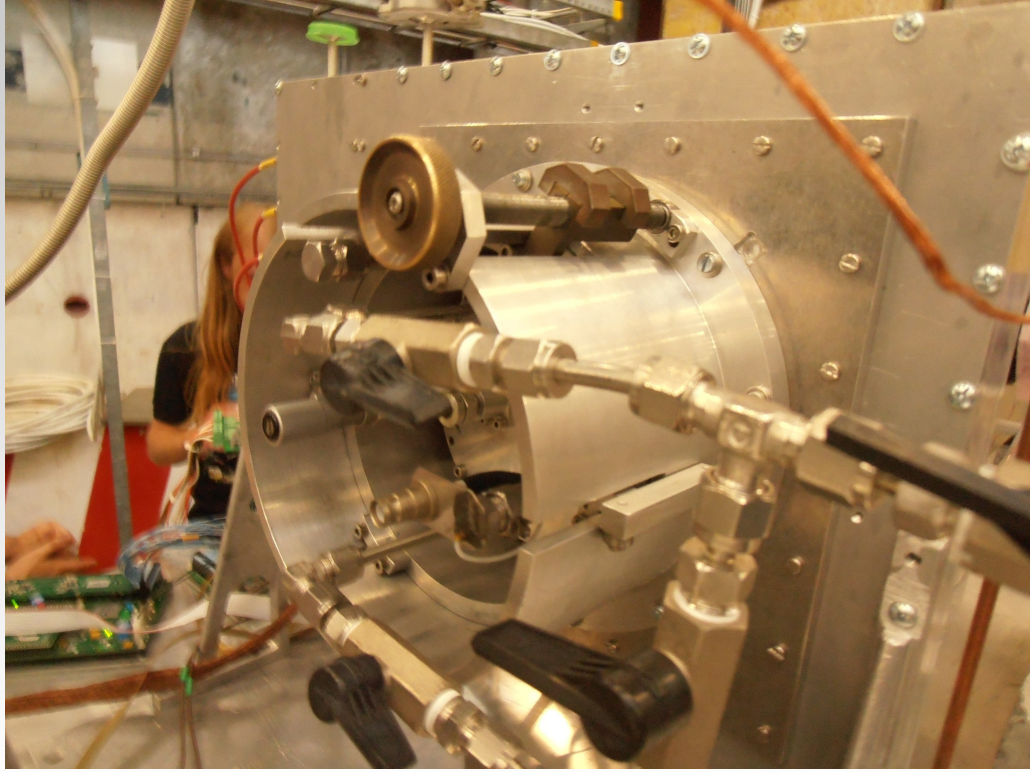
First Photons with the 20cm Chamber

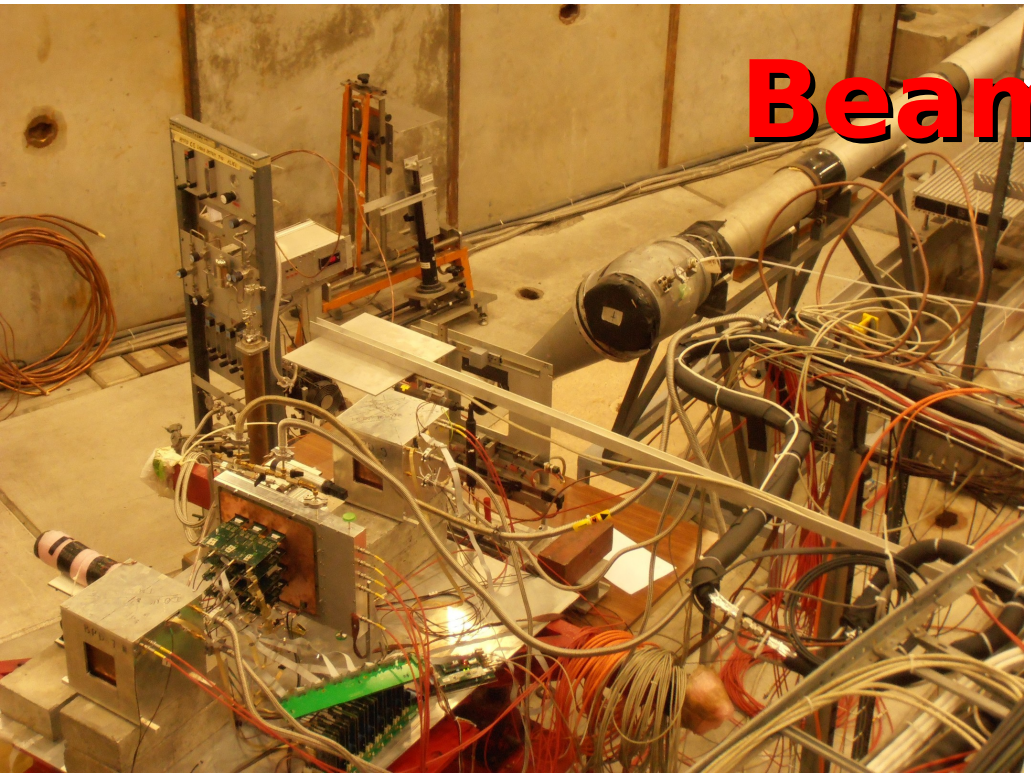


Beam Test Setup

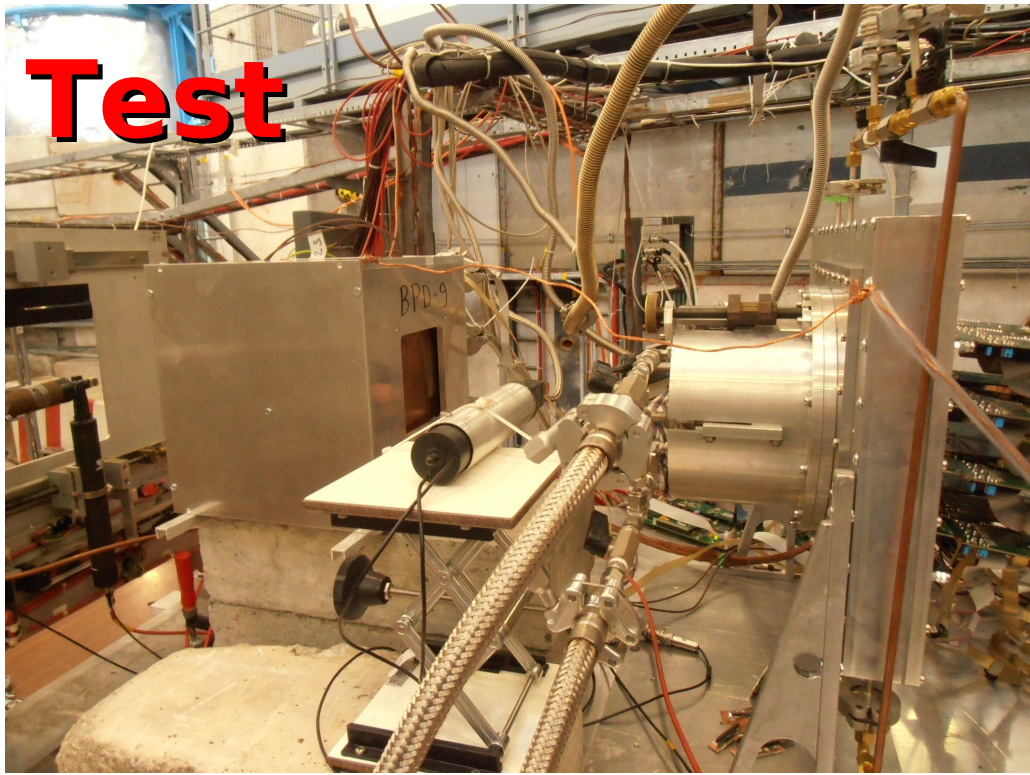
- In the former beam test problem with the window :(
- New beam test in September 2012. at CERN PS **T10**
- Four small scintillators to define a nice beam spot,
  Two large scintillators for beam and for muons
- Additional 2+2 BeamPositionChambers (**BPD**)
  read out by the same DAQ system
- TCPD:pad readout DAQ,FEE : ALICE HMPID/VHMPID type
- Connected wires read out for scope monitoring
  and/or for simple data taking with CamacADC
- Radiator : C_6F_{14} (standard HMPID),
  adjustable eff. thichness and changeable distance from TGEM
- Base gas for operation : **CH_4**
  + few days with Ar-CO_2 to compare with former lab results
- Study of pad-size dependance as well
  two padplanes: standard 8x8; and a mix with 4x4,4x8,8x8.



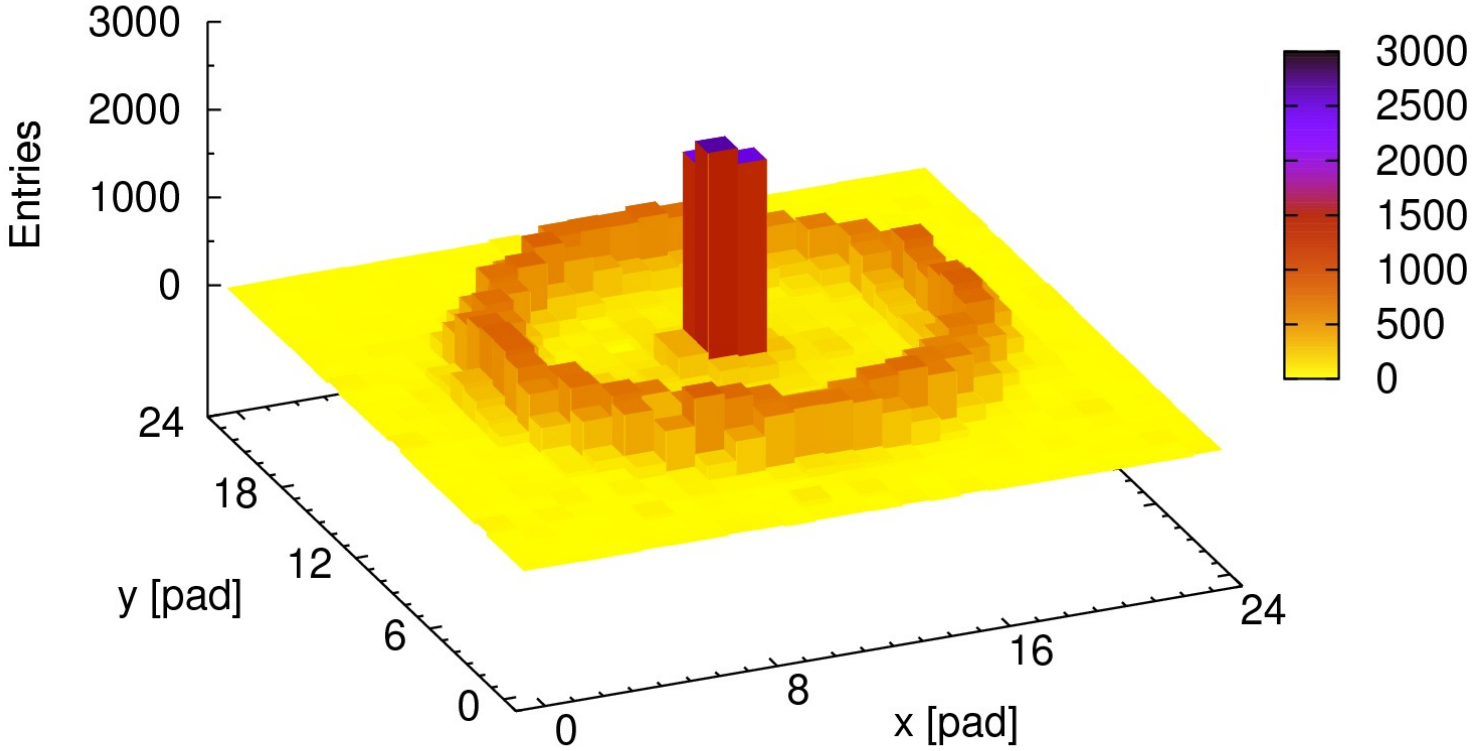




Beam Test

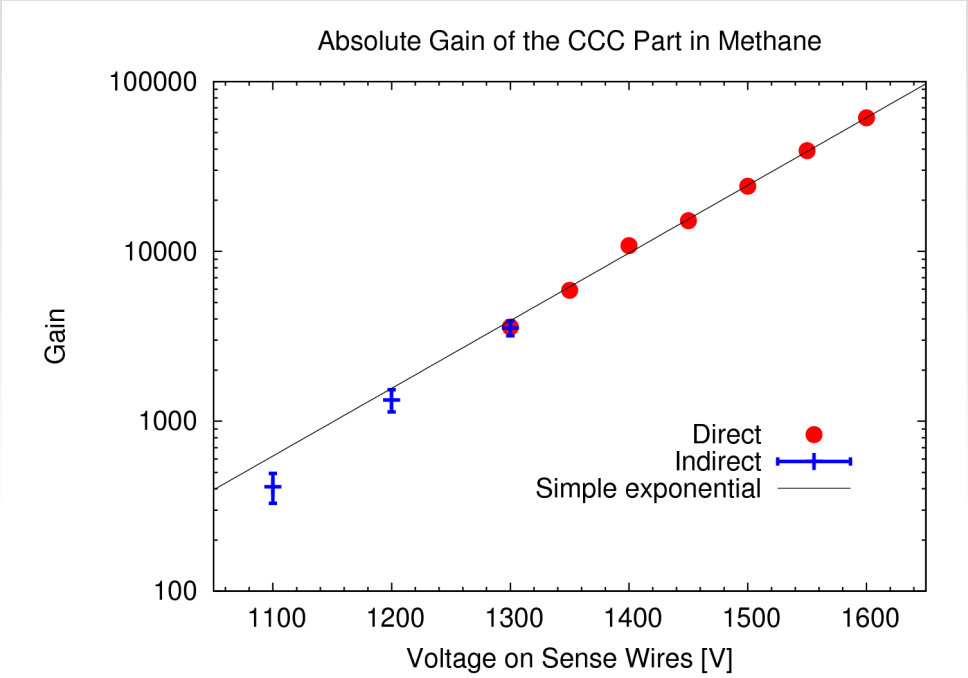


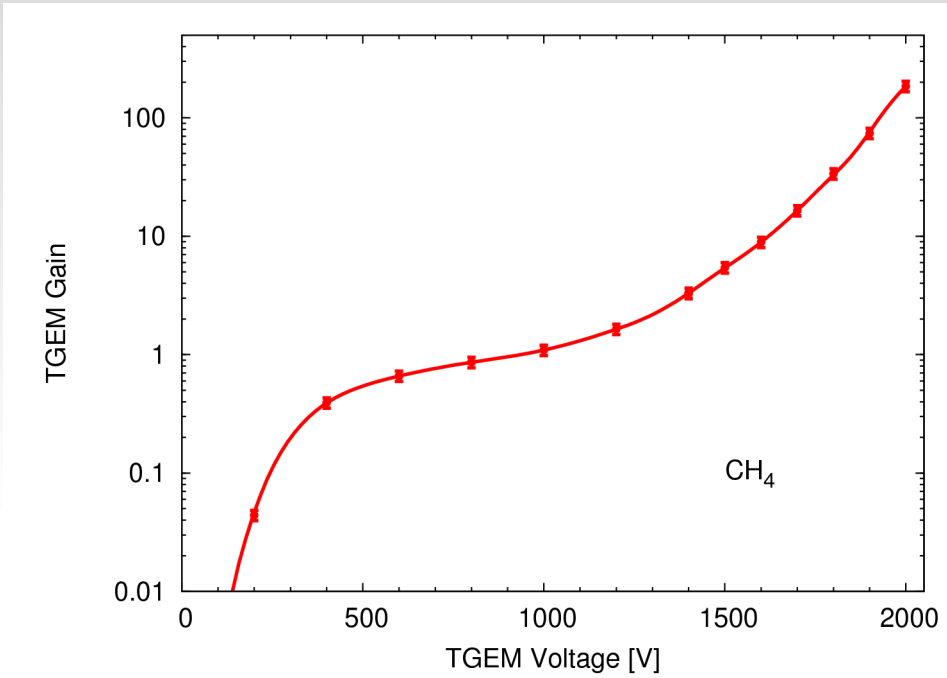
It works !



- Cumulated Cherenkov rings from the firsts runs in Sept. 2012.

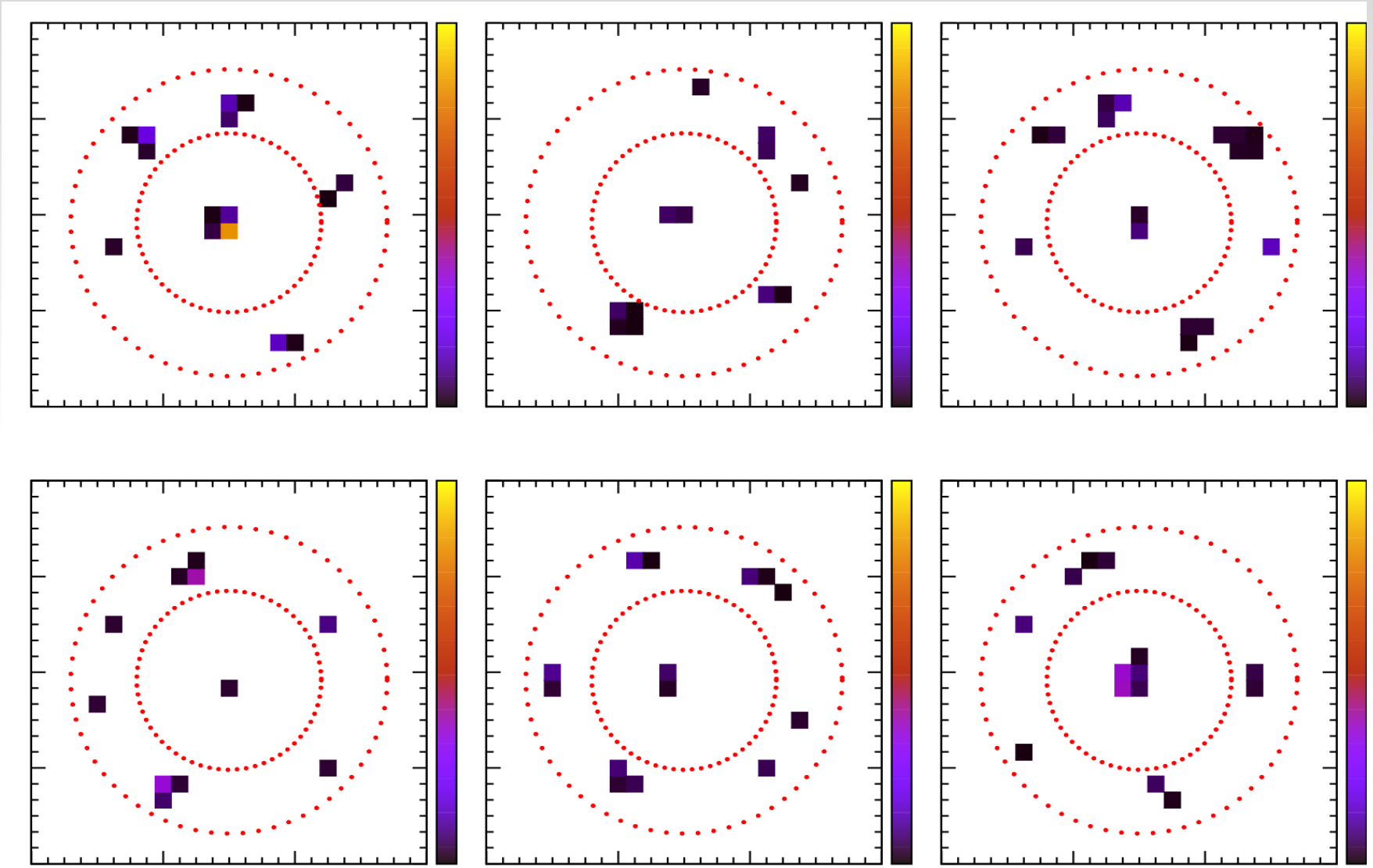
Applied Gains





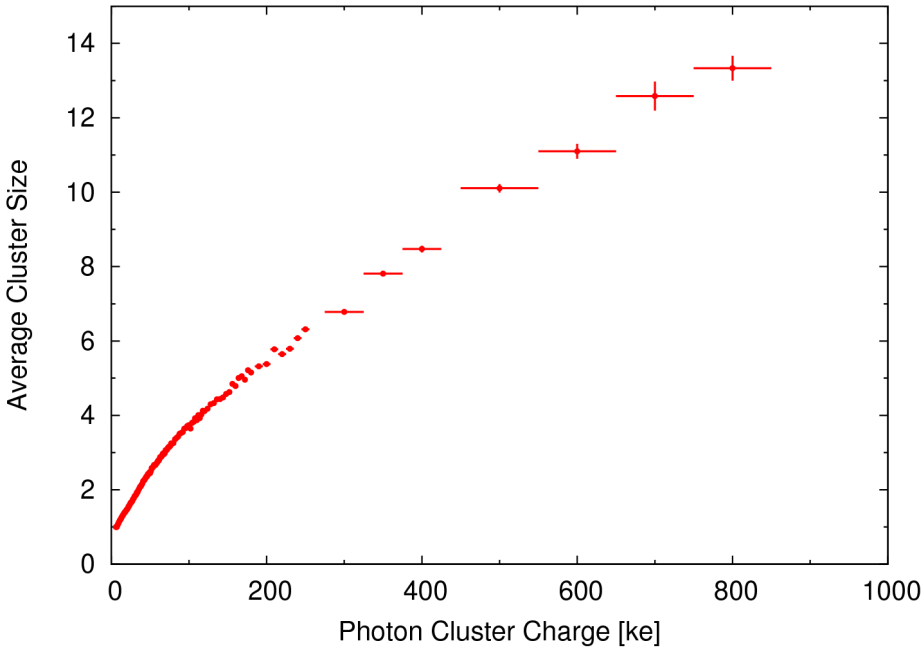
- CCC and TGEM gains were measured independently
- Typical gains : TGEM : 10 - 100; Overall gain : 10^4 - 10^5
- No need for high gain on TGEM ensured stable operation
- Even with gain $3x10^5$ no sparks have been observed

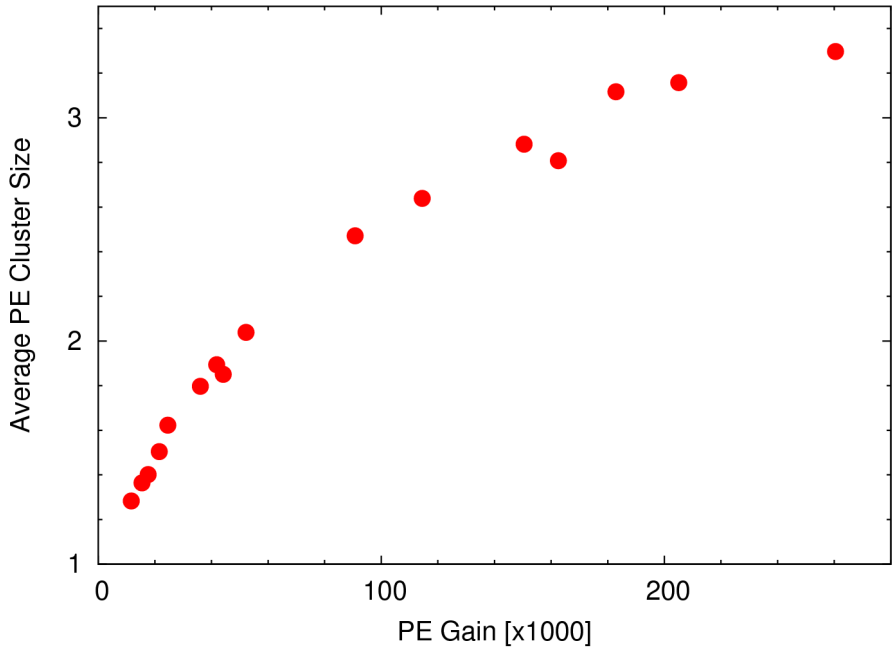
Single Events



Cluster Size Distribution

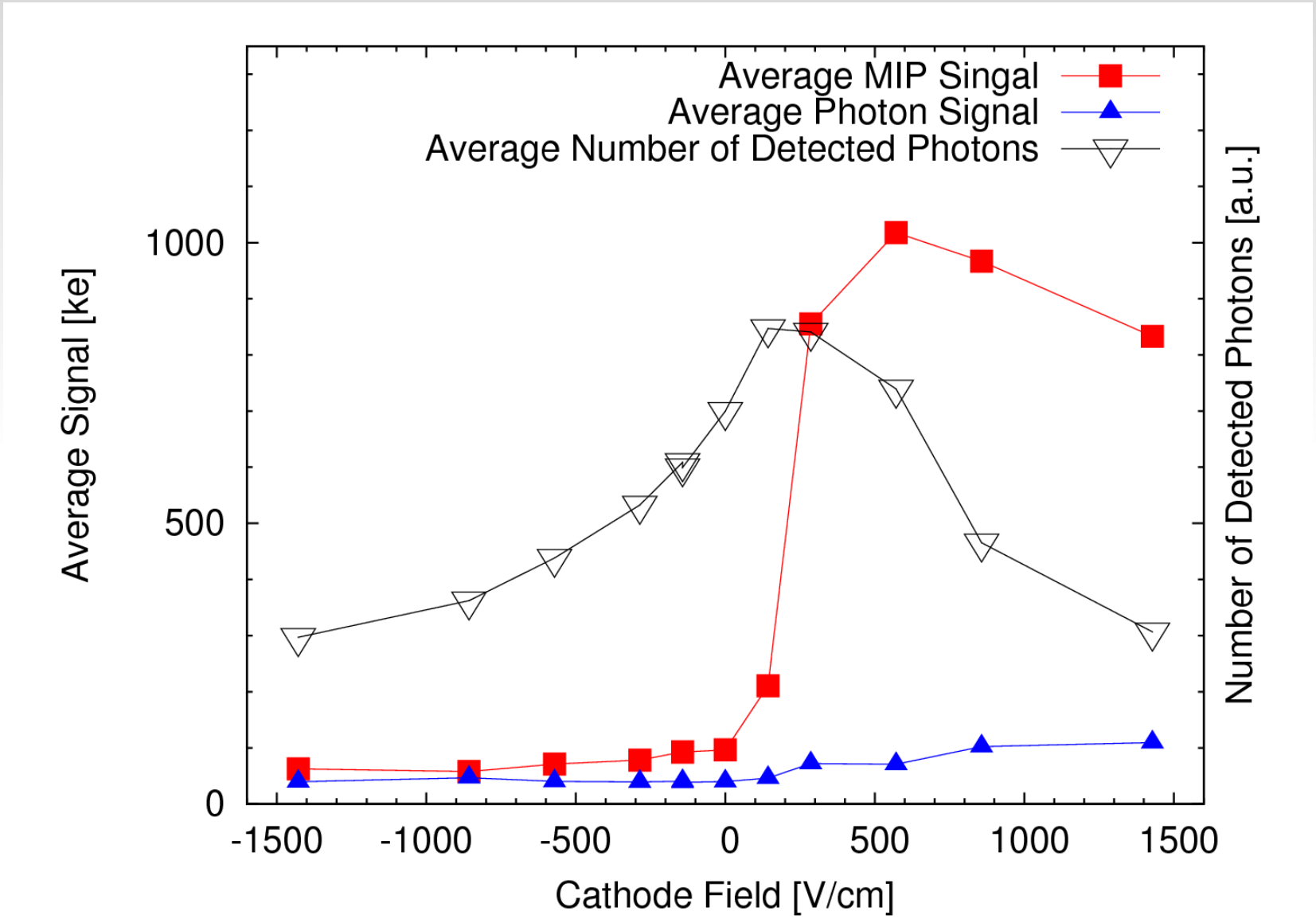
- Cluster size on the 8.0 x 8.4 mm^2 pads were measured in the ring region with photo-electron candidates
- Cluster size is crucial for padsize optimization in small diameter rings





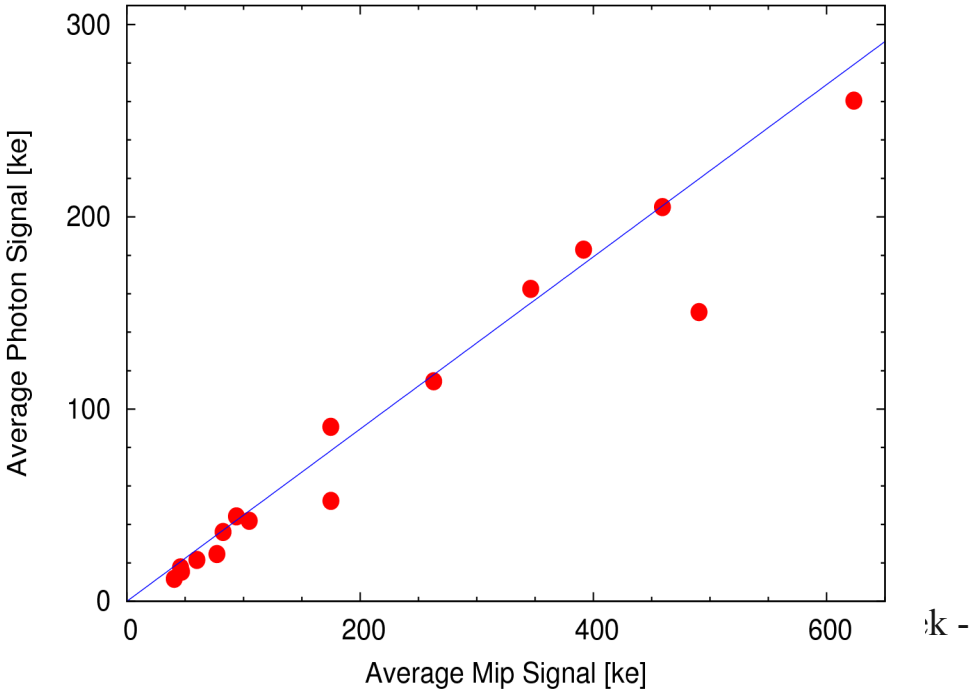
- Different gain distributions lies nearly on the same curve
- Even with gain 10^5 the average cluster size is 2.5

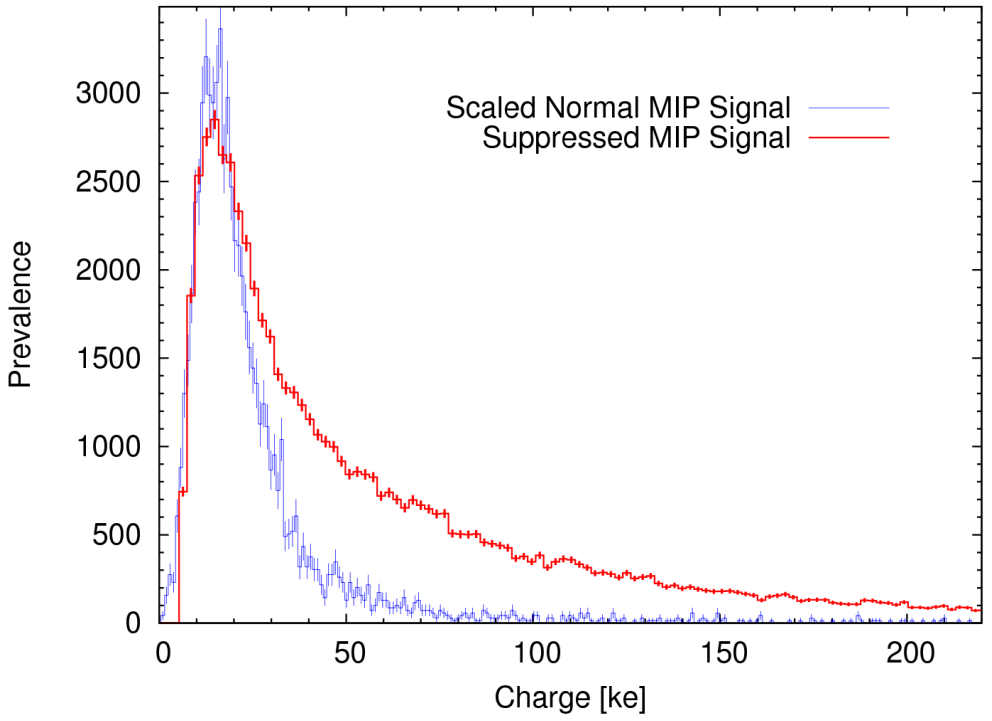
MIP Suppression



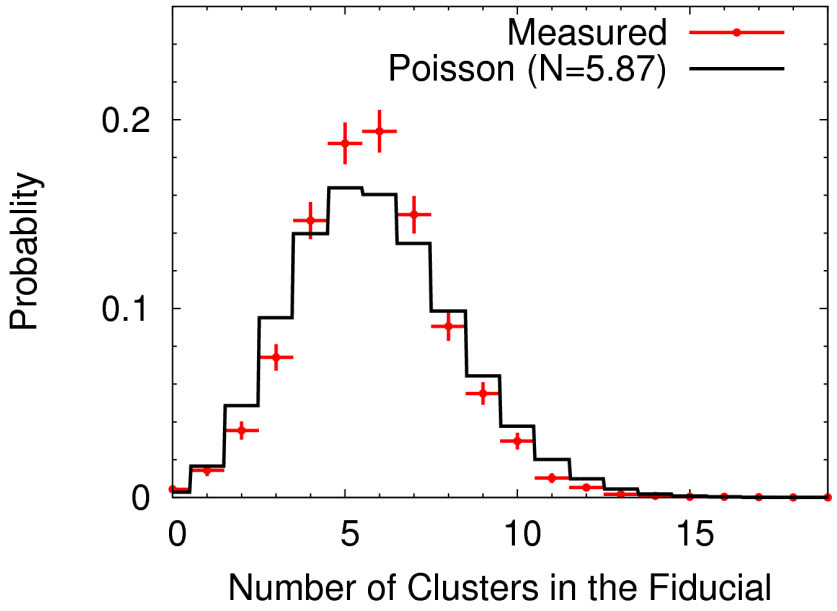
MIP Suppression

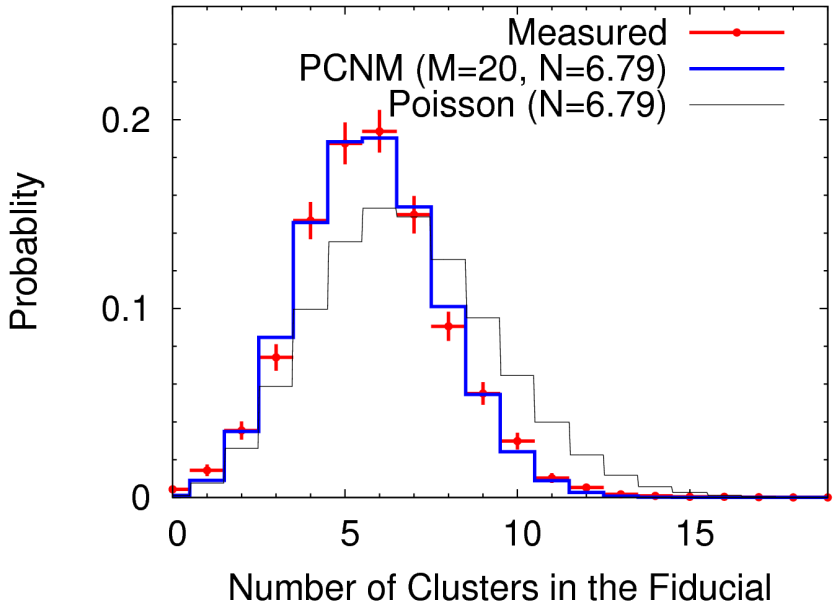
- Possibility for MIP suppression in MPGDs
- MIP signal in the order of the PE singal
- Small reversed cathode field is enough
- The cathode field approx. 0-100 V/cm is ideal for photon detection
- Suppressed MIP signal differs form the Landau curve
  due to the eventually deposited electron just above the TGEM





Photon Yield





- With TGEMs there are blind areas for photons
- Hole configuration needs to be optimized for this purpose (-> "Leopard" like studies)
- With nonoptimized setup the photon yield was approx. 60-70 % of desired
- Consistent with Leopard meas.

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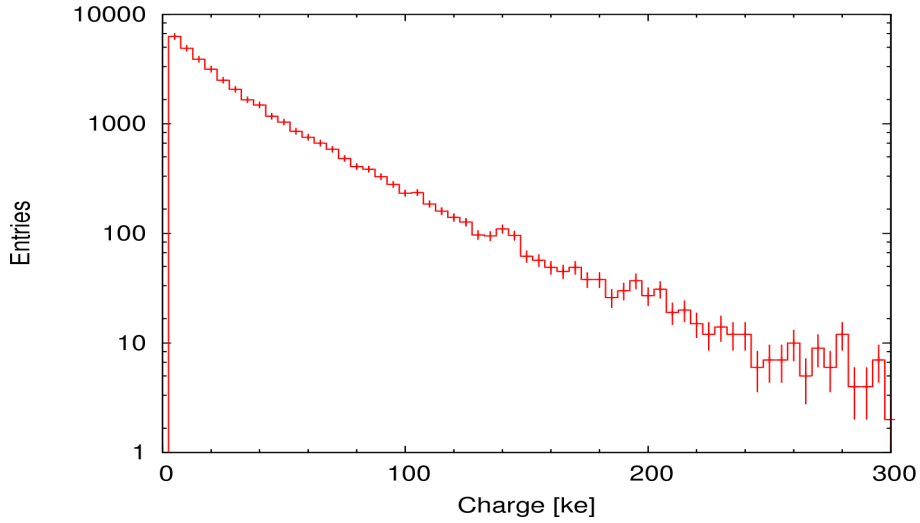

Summary

- **TCPD –** nice combination of micropattern and wire based technologies for photon detection
- **Single photo-electron** studies with a UvLed
- Real **Cherenkov applicability** was demonstrated
- Full Cherenkov ring detection with one TGEM
- Stable operation even with **high gains**
- **Moderate cluster size** without technical difficulties
- Natural **MIP suppression**

- The offline analysis is still ongoing
- Special thanks go to the test beam group
- And thanks to the Hungarian OTKA CK77719, CK77815 grants and the support of the REGARD, ALICE-Budapest and ALICE VHMPID Groups

Thank You
for Your Attention