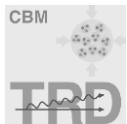


# Full-size MWPC prototypes for the CBM-TRD

## Construction and test results

DPG-Frühjahrstagung Münster 2017

31. März 2017 | Susanne Gläsel



# Overview

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CBM-TRD development and design 2015 / 2016  
in Frankfurt and Münster

Small full-size prototypes: Test beam results 2015

Large full-size prototypes: Construction and test beam  
performance 2016

# The CBM experiment and the TRD

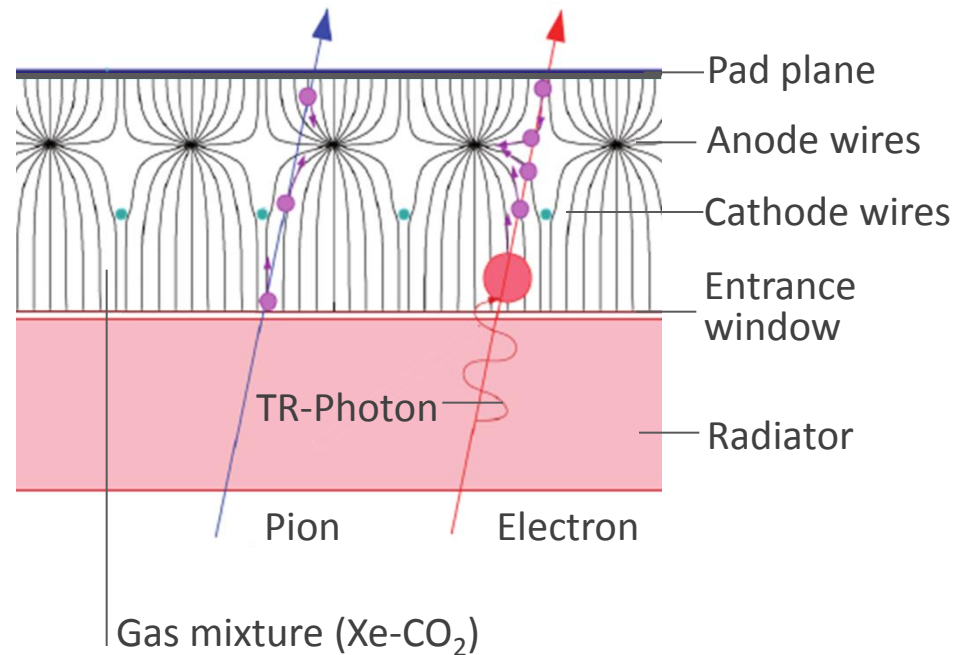
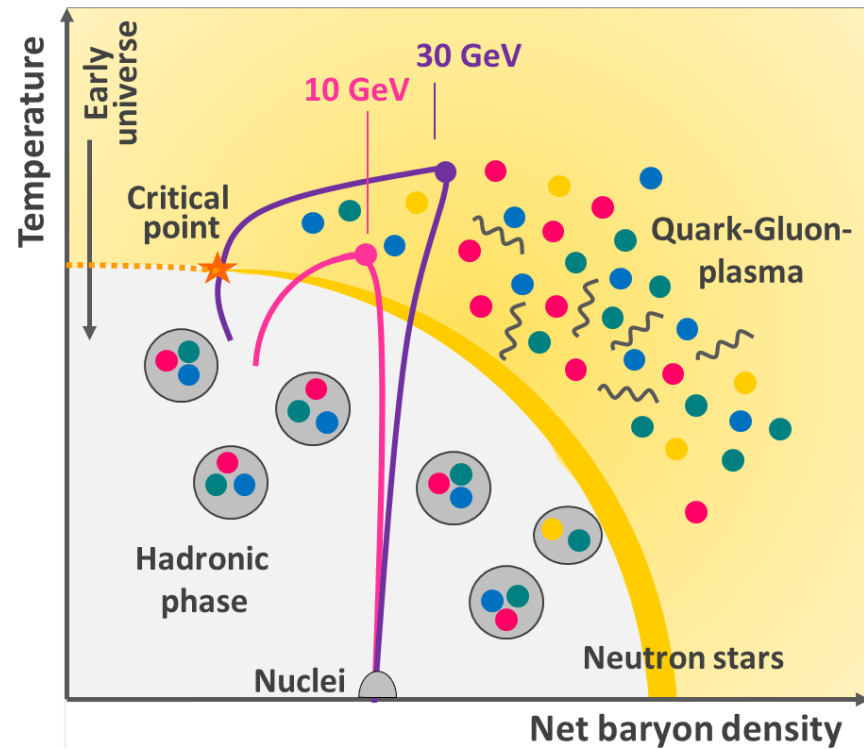
## Compressed baryonic matter experiment

QCD phase diagram at high net baryon densities

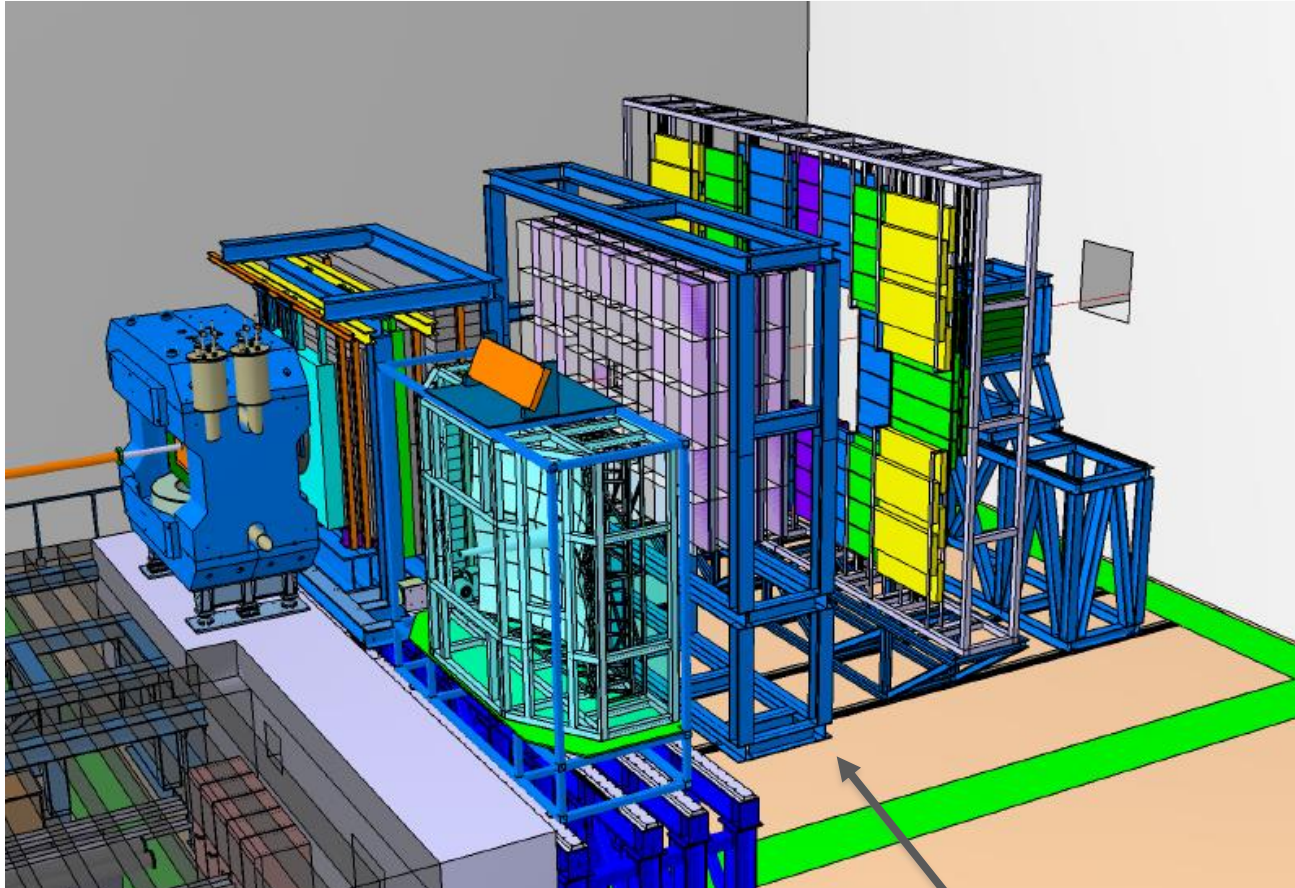
high event rates →

## Transition radiation detector

- electron pion separation at high momenta
- identification of charged hadrons (fragments)

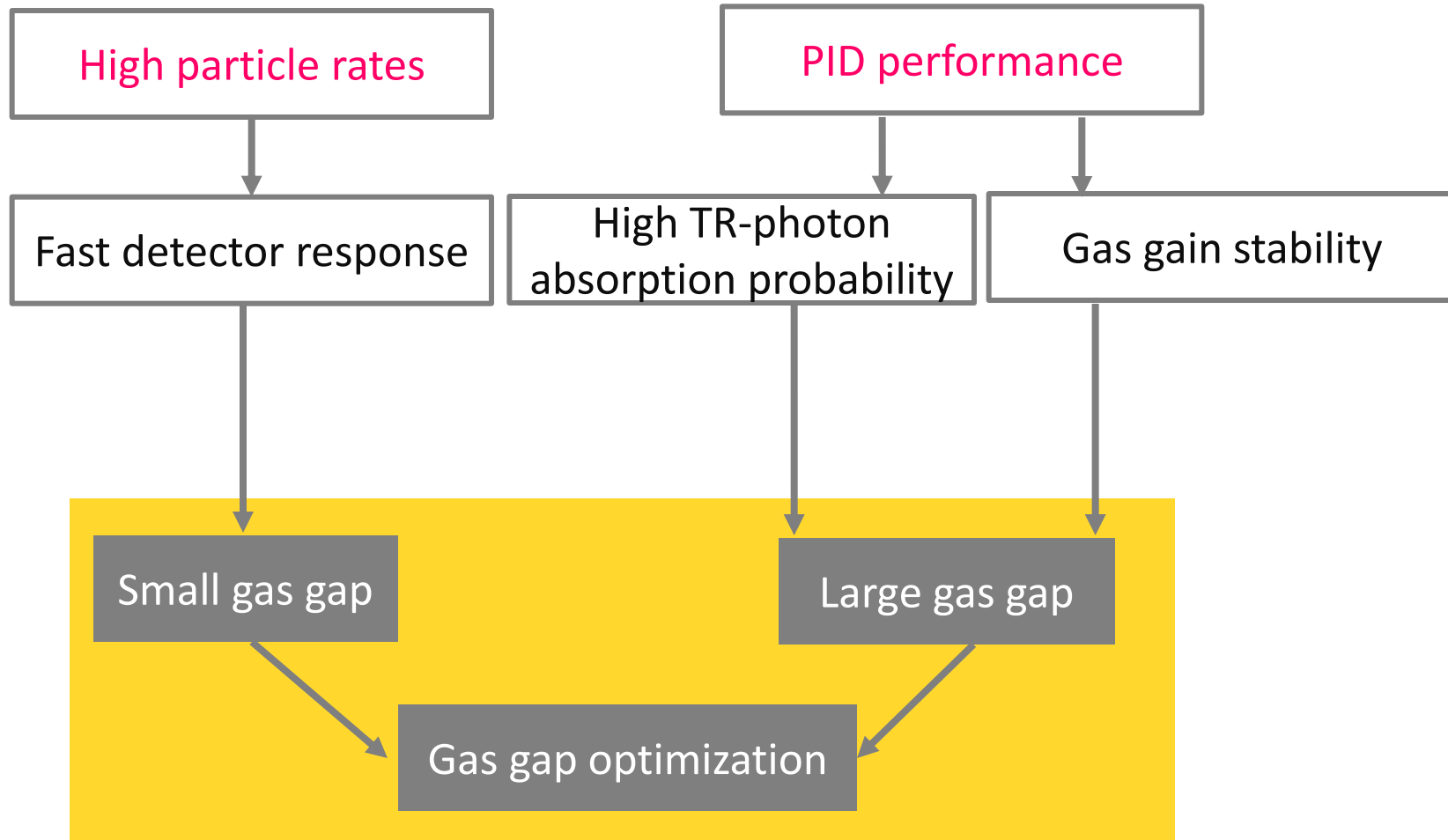


# The CBM detector system

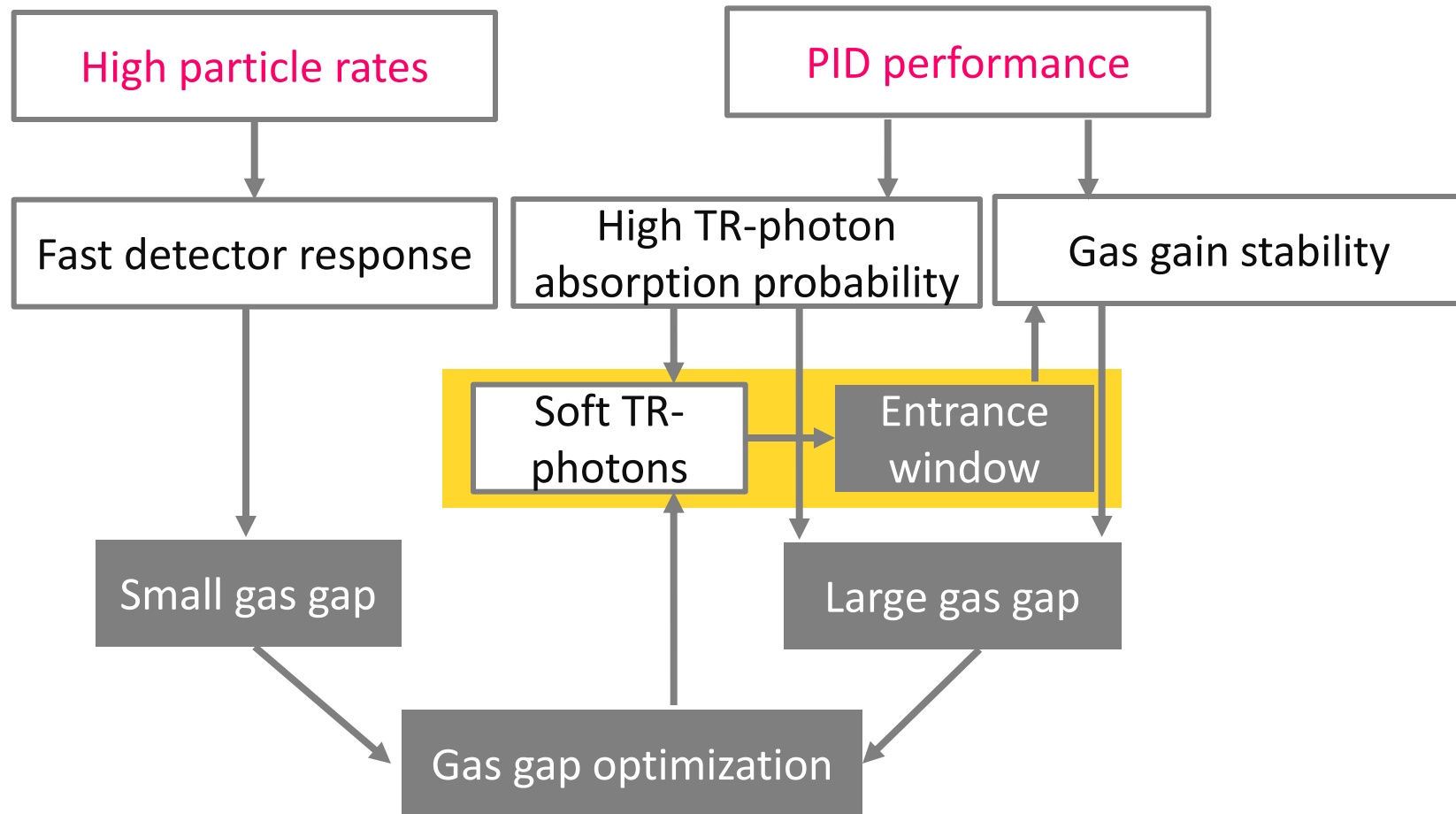


TRD: 4 layers

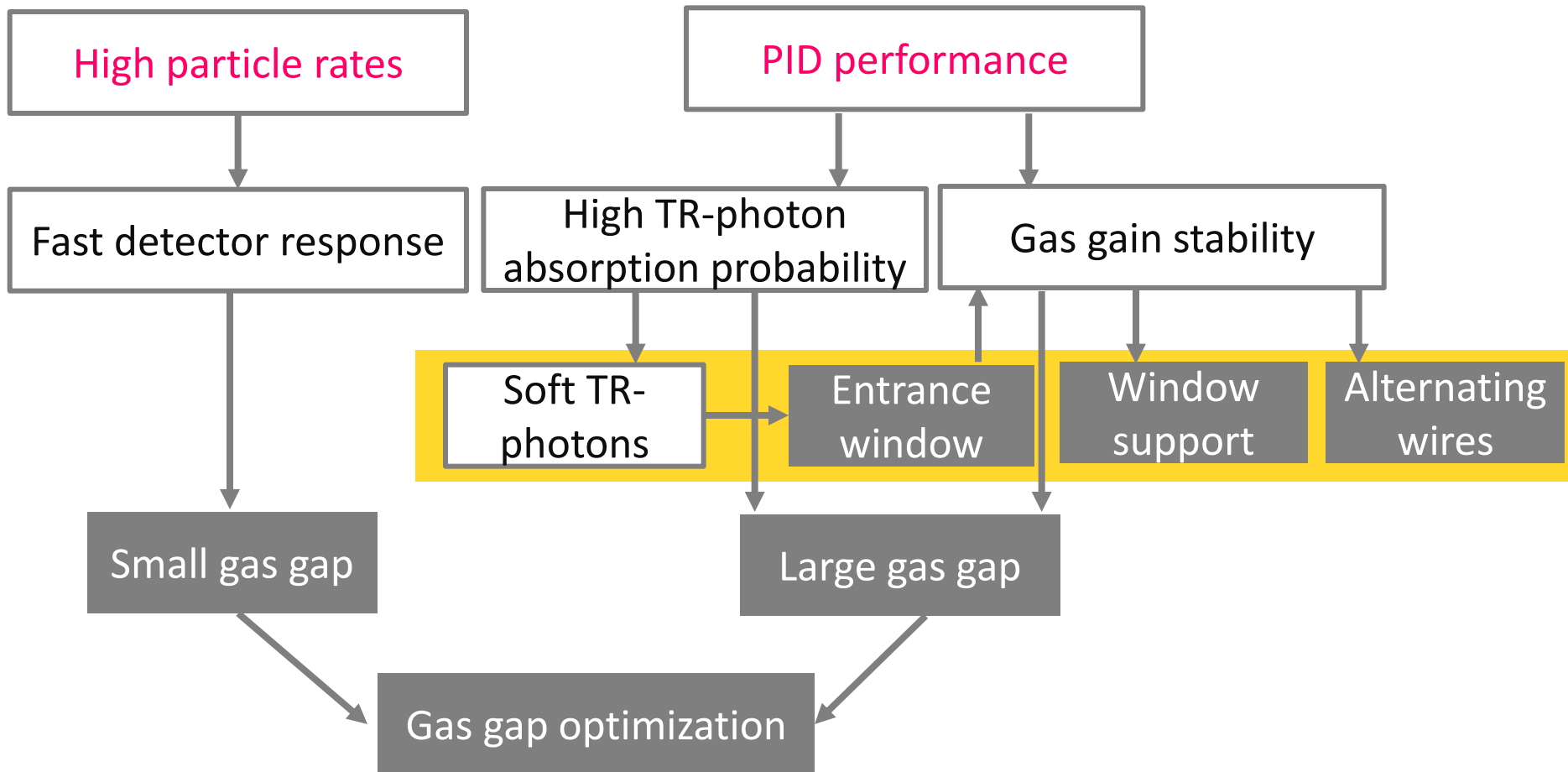
# CBM-TRD design requirements



# CBM-TRD design requirements



# CBM-TRD design requirements



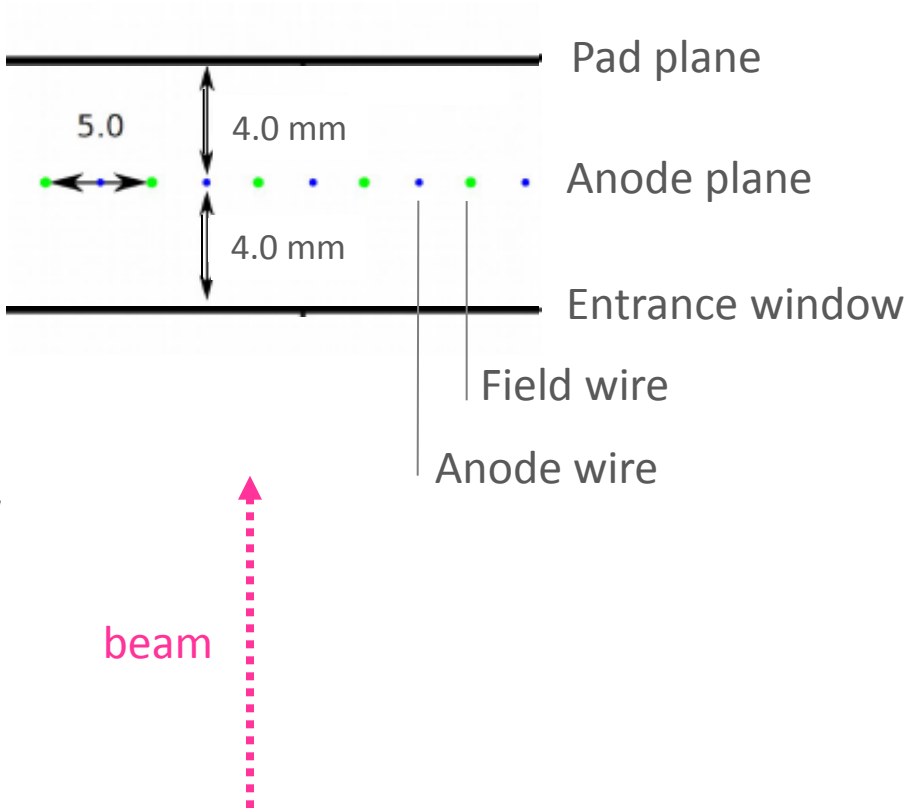
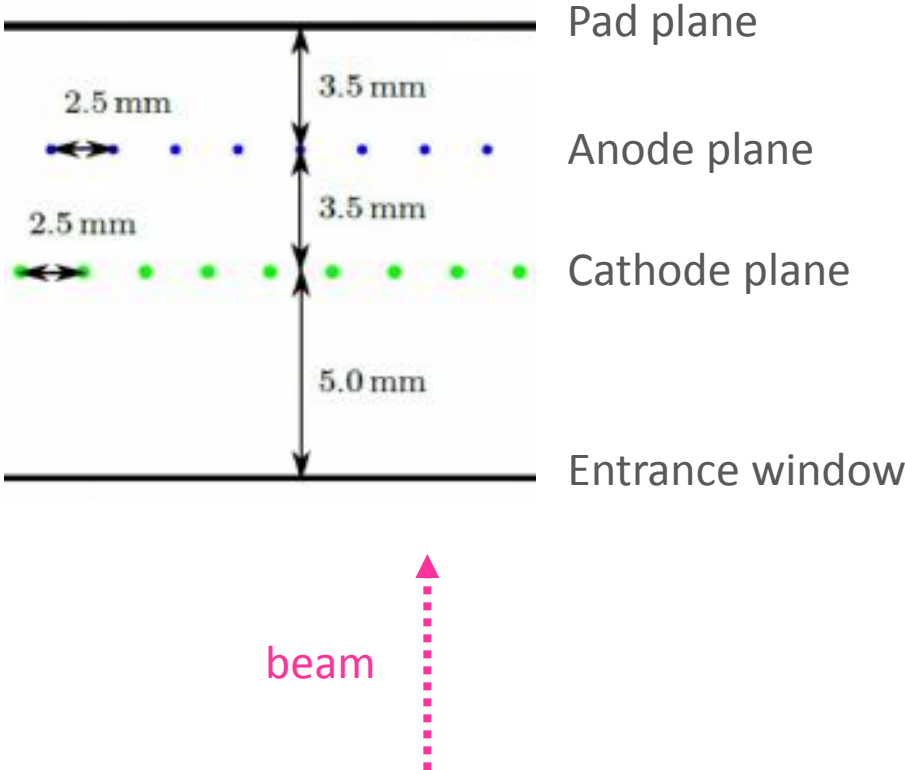
# Chamber geometry alternatives

Fast prototype with small drift region

TR-absorption  $\oplus$

Gas gain stability  $\oplus$

Very fast prototype with no drift region and alternating wires





# Overview full-size prototypes 2015 / 2016

**Fast prototype**

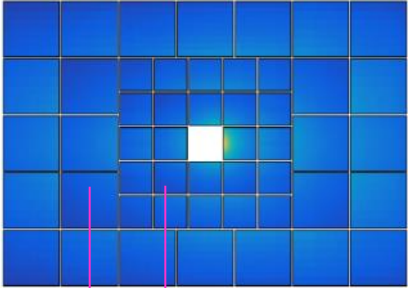
High rates

**MWPC with drift**  
**3.5mm + 3.5mm + 5mm**

**Very fast prototype**

Very high rates

**MWPC without drift**  
**4.0 mm + 4.0 mm**



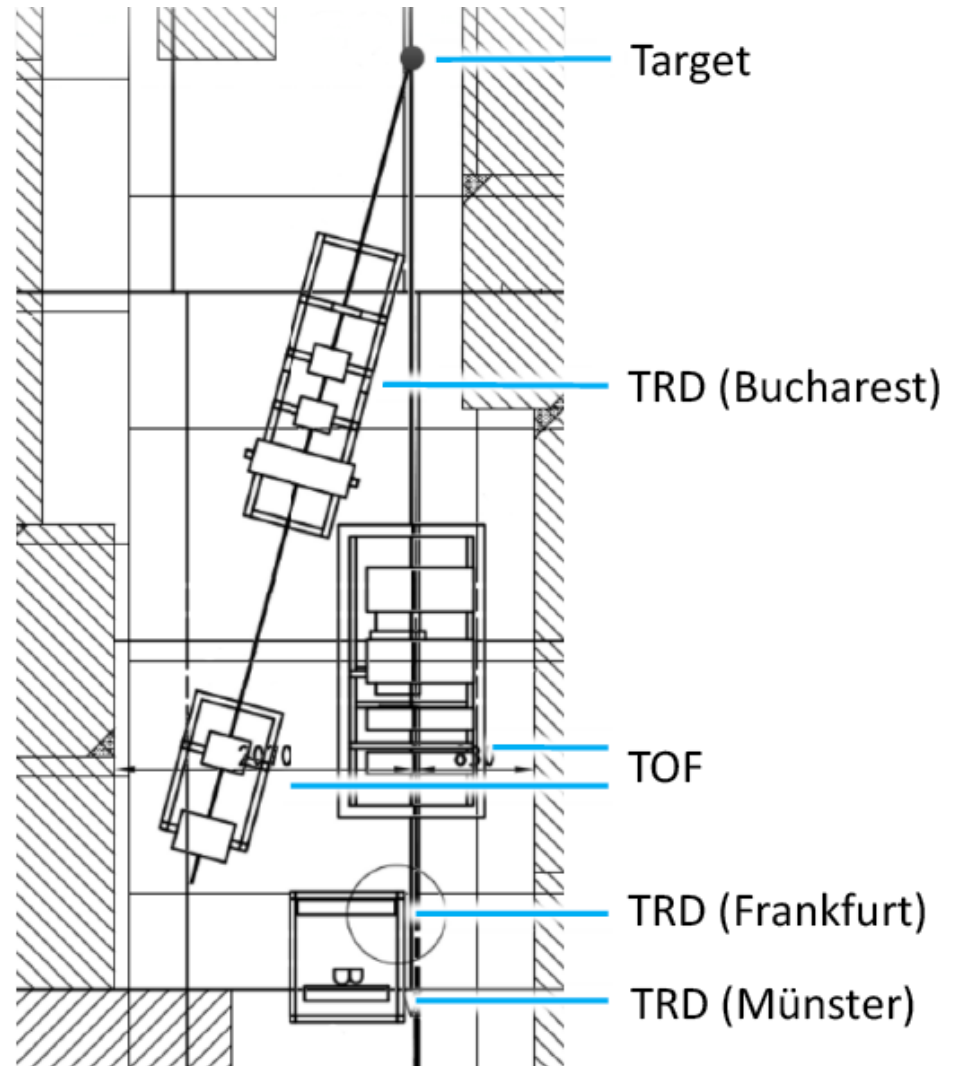
95x95 cm<sup>2</sup> | 59 x 59 cm<sup>2</sup>

<p>57 x 57 cm<sup>2</sup> (Münster)</p>	<p>57 x 57 cm<sup>2</sup> (Frankfurt)</p>	<p>Test beam 2015                  Results</p> <ul style="list-style-type: none"> <li>- Rate capability</li> <li>- Chamber correlations</li> </ul>
<p>4 x 95x95 cm<sup>2</sup> for the outer detector area (Frankfurt &amp; Münster)</p>	<p>---</p>	<p>Test beam 2016                  Construction and test                  beam performance</p>

# Testbeam 2015

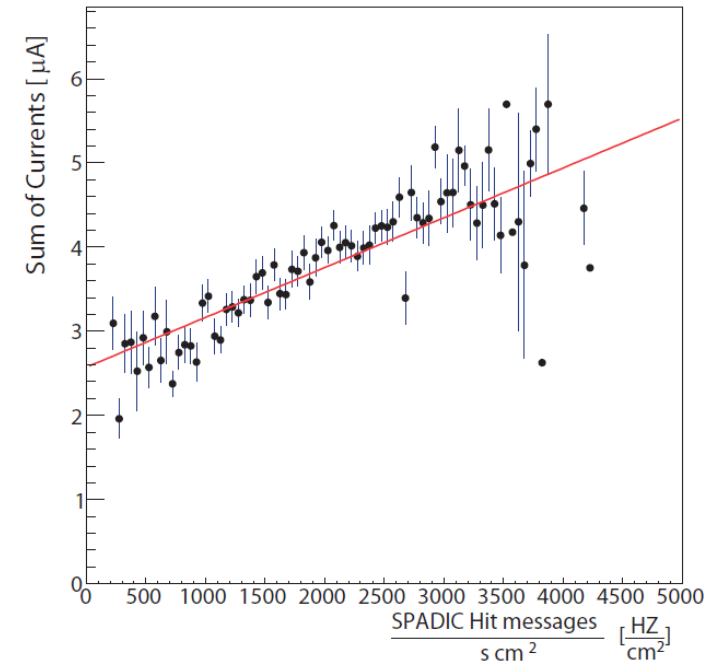
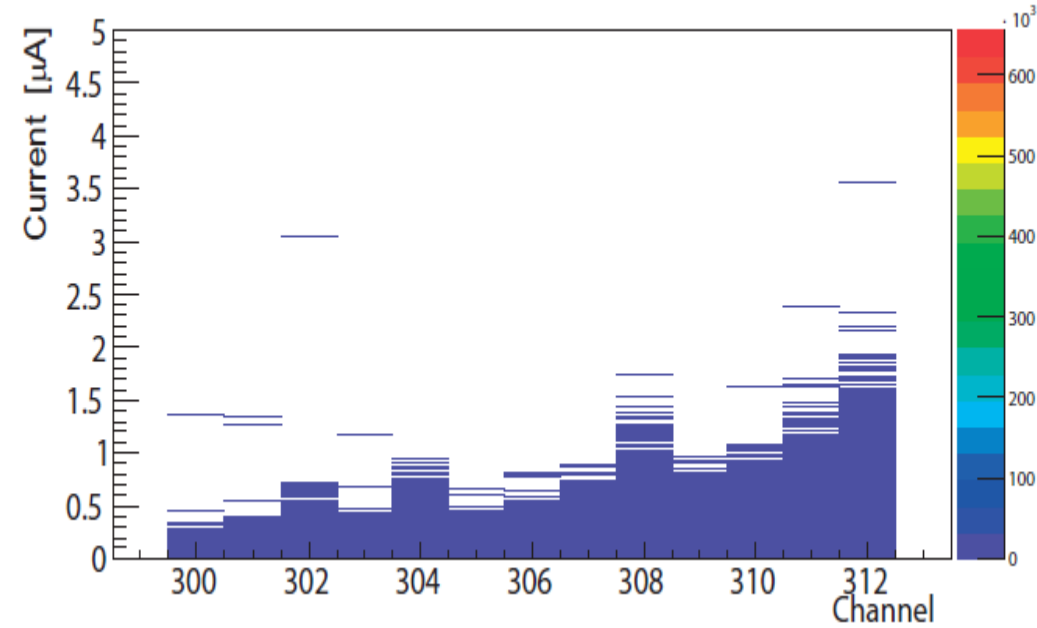
CERN SPS

Lead beam + Lead target  
57 x 57 cm<sup>2</sup> chambers from  
Frankfurt and Münster



# Test beam SPS 2015: Current measurements

U=1400V



- Chamber without drift, with alternating wires
- Anode wires: 13 segments
- Correlation between anode current and distance to beam

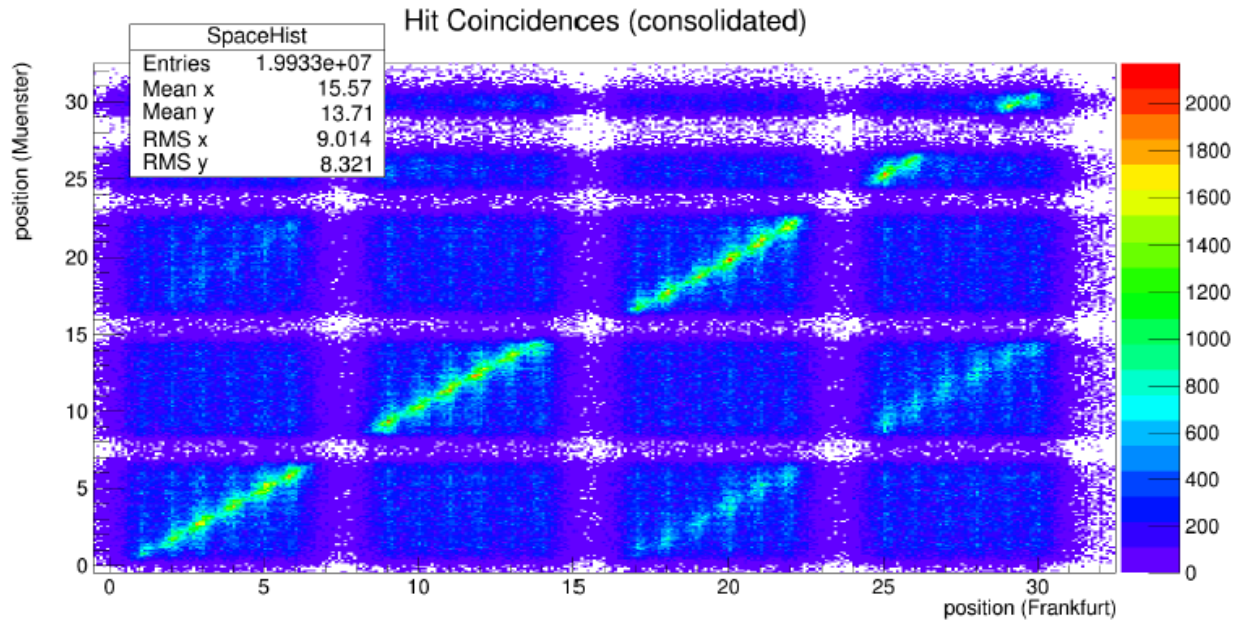
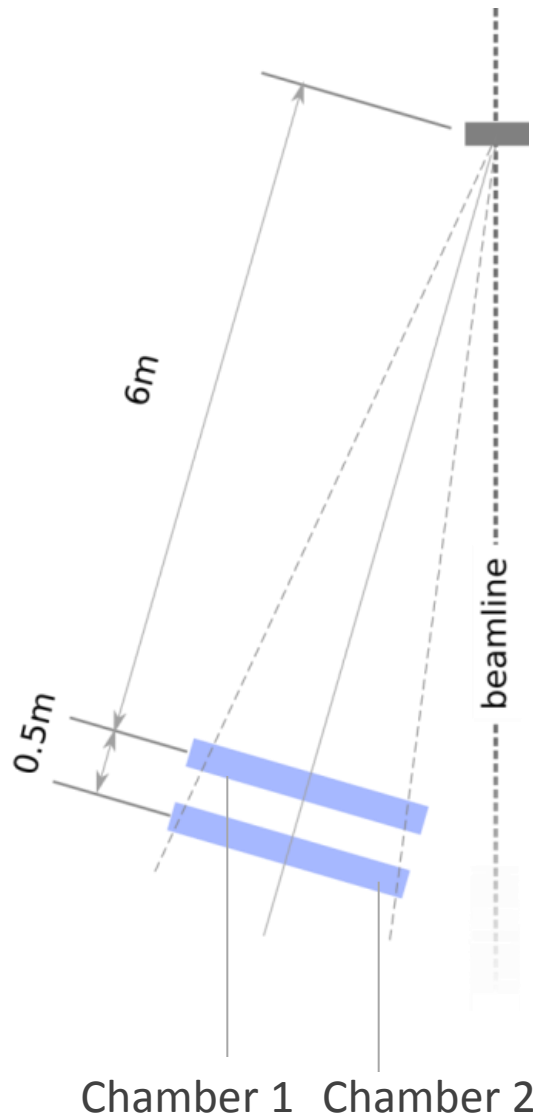
beam ↑

→ Detector performs at moderate rates

- Linear correlation of anode current and SPADIC hit messages per sec and cm<sup>2</sup>

Patrick Schneider → Poster HK 27.65

# Test beam SPS 2015: Chamber correlation

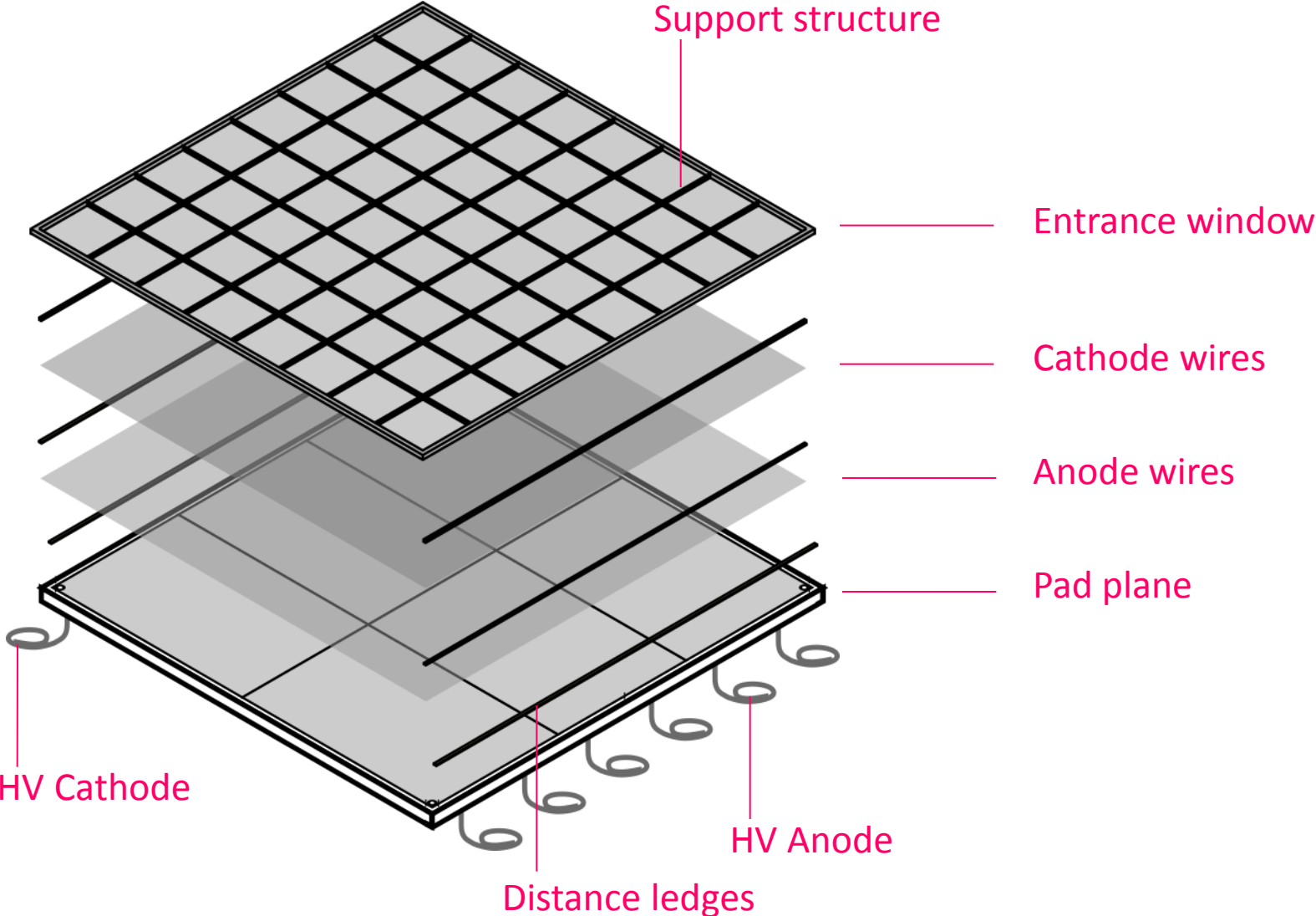


→ Clear correlation between both chambers

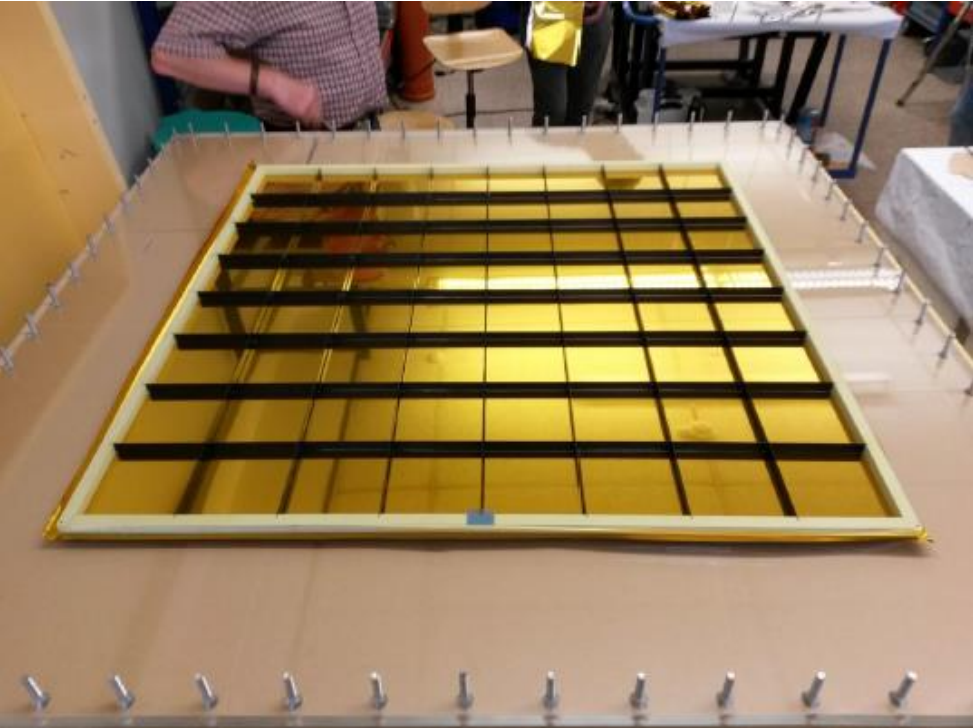
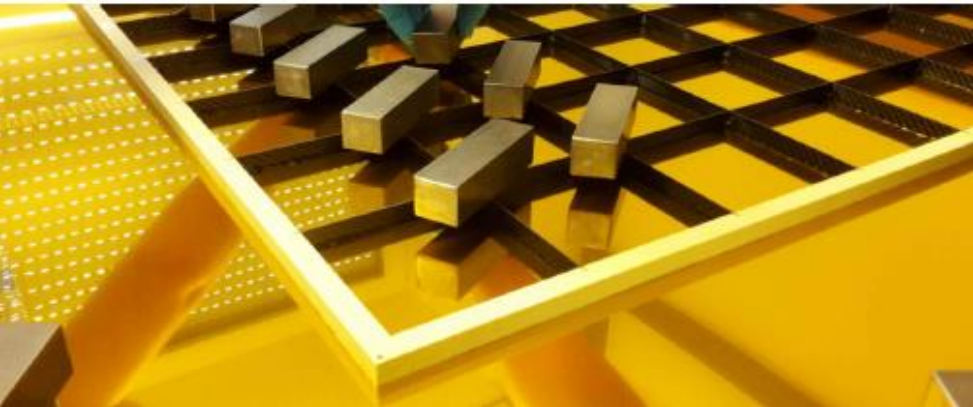
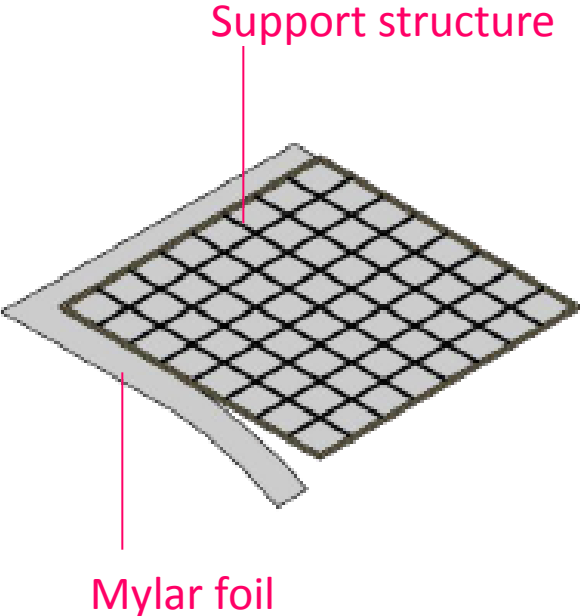
Dennis Spicker → Poster HK 27.65

# Chamber design 2016

4 x 95 x 95 cm<sup>2</sup> chambers from Frankfurt and Münster

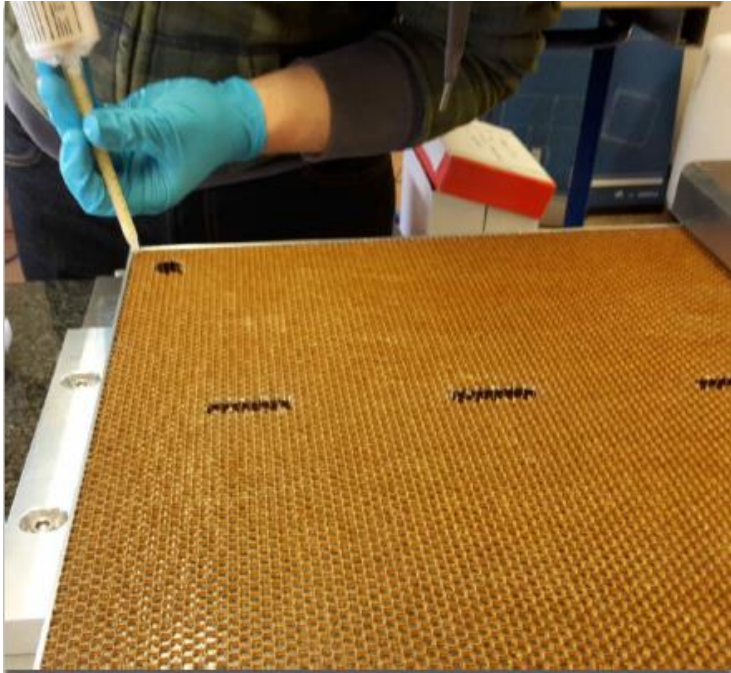
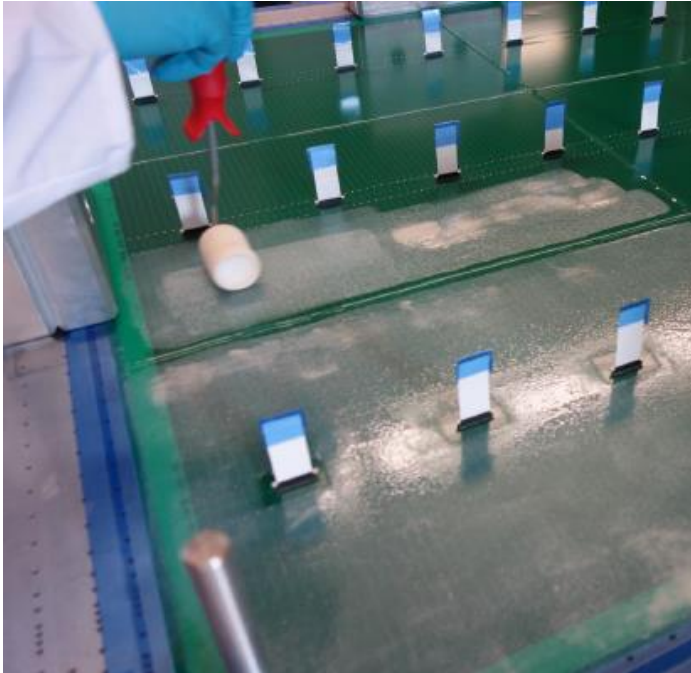
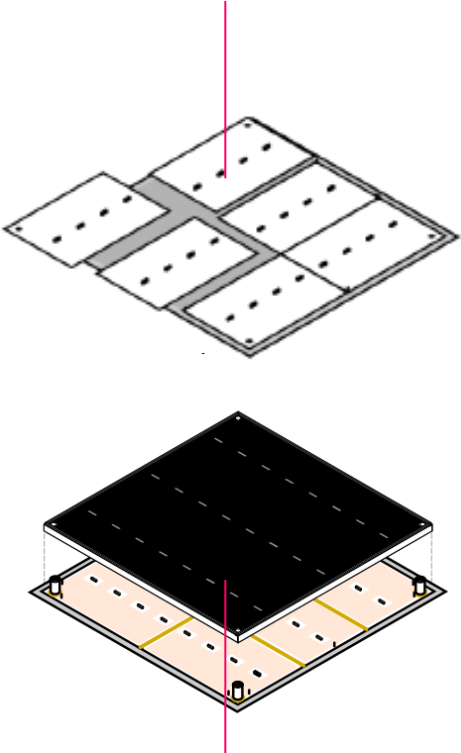


# Chamber construction: entrance window

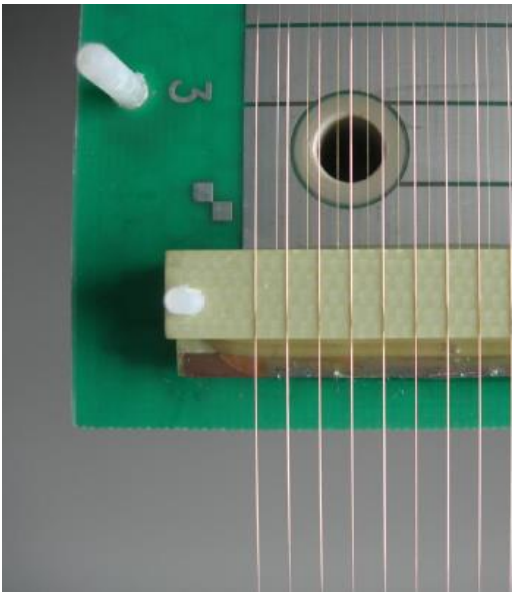
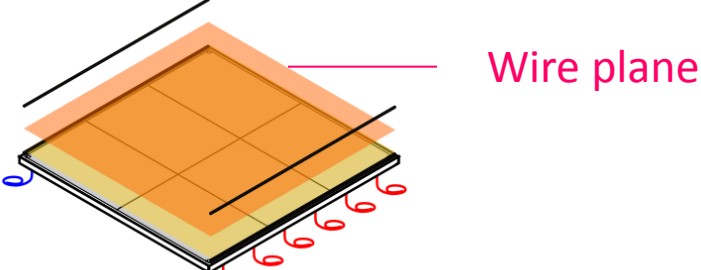
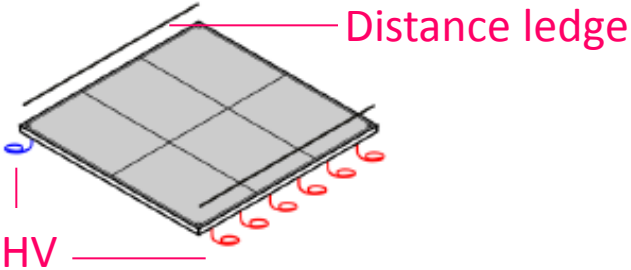


# Chamber construction: back panel

Pad plane segment



# Chamber construction: wire planes

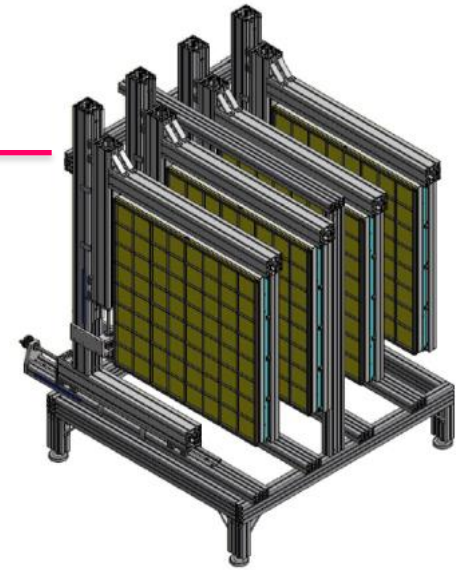
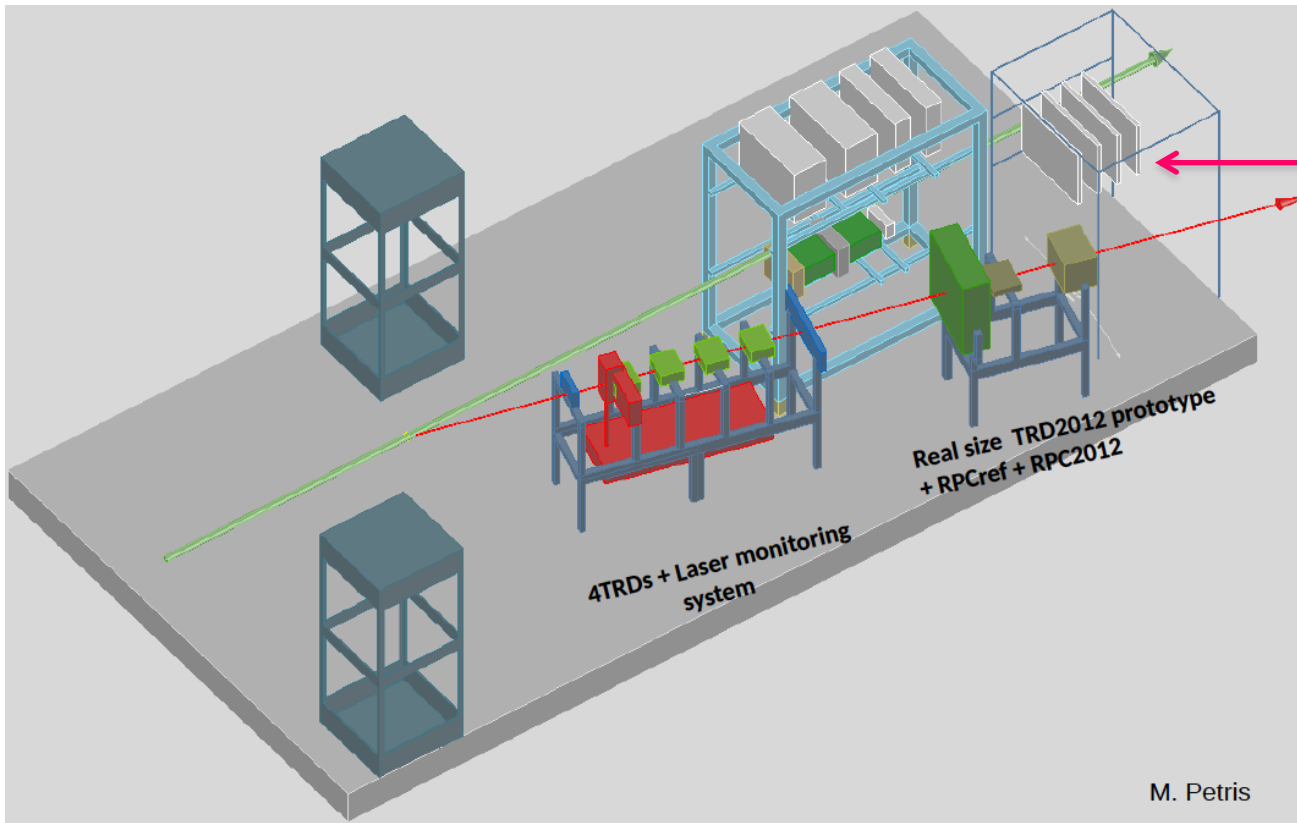




# Large full-size prototypes 2016



# Testbeam set-up 2016



6 weeks at SPS in November / December 2016

4 large full-size chambers from Frankfurt/Münster

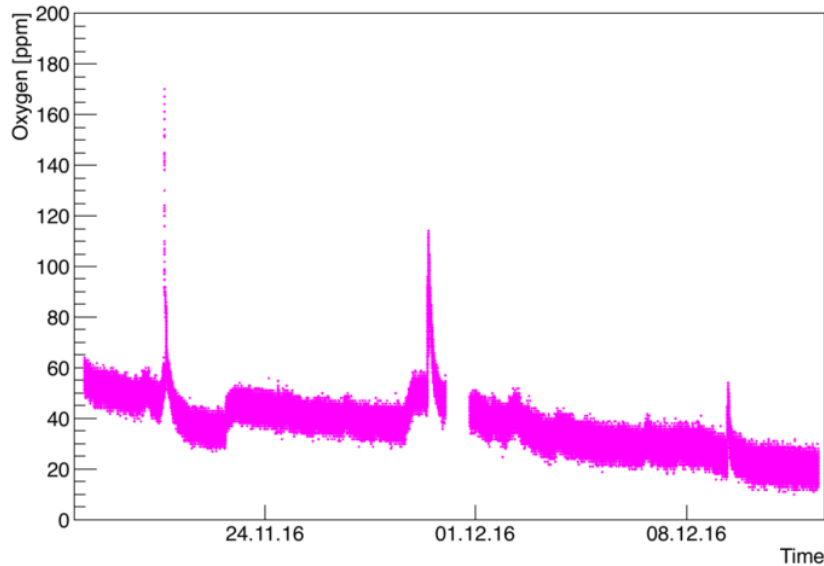
Lead beam 13, 30, 150 AGeV + Lead target

# Testbeam set-up2016

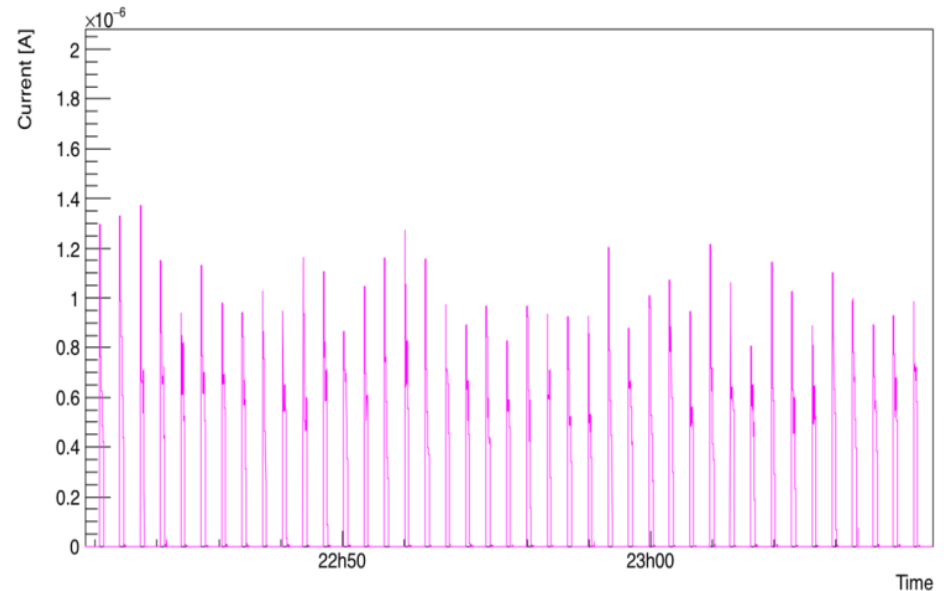


# Testbeam performance 2016

## Oxygen



## Currents



→ Stable performance over 6 weeks: Gas tightness, stable high voltage

Felix Fiodorra → HK 62.6  
Philipp Munkes → HK 62.7  
Philipp Kähler → HK 62.8

# Outlook

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## Further Analysis of test beam 2016 with 4 detector layers

- Tracking + position resolution

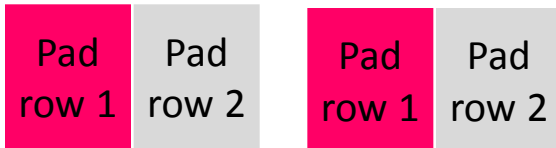
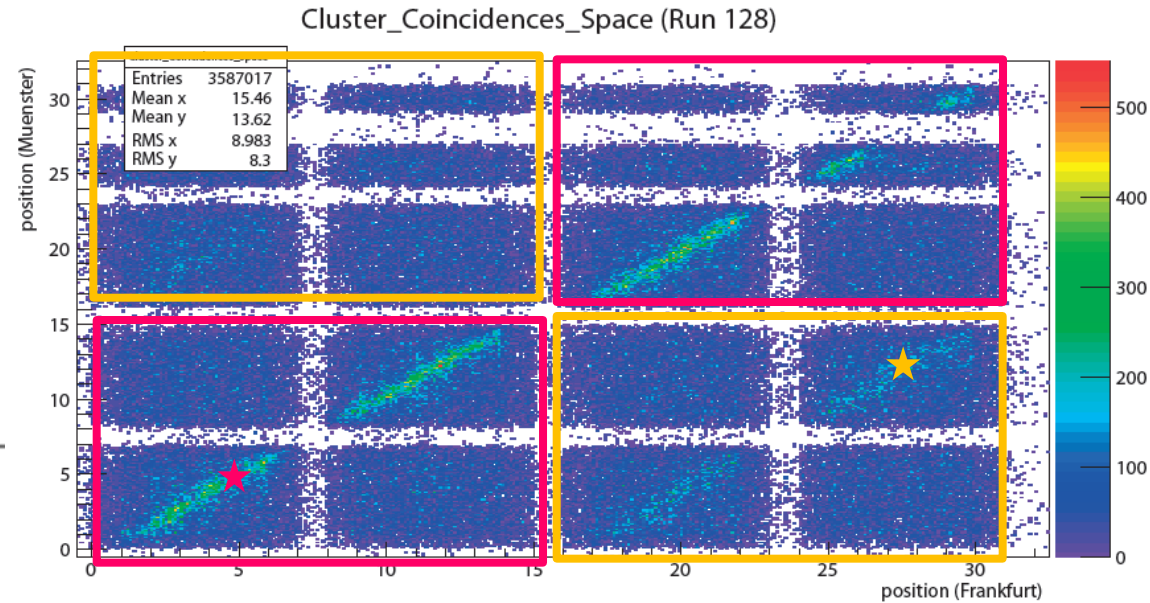
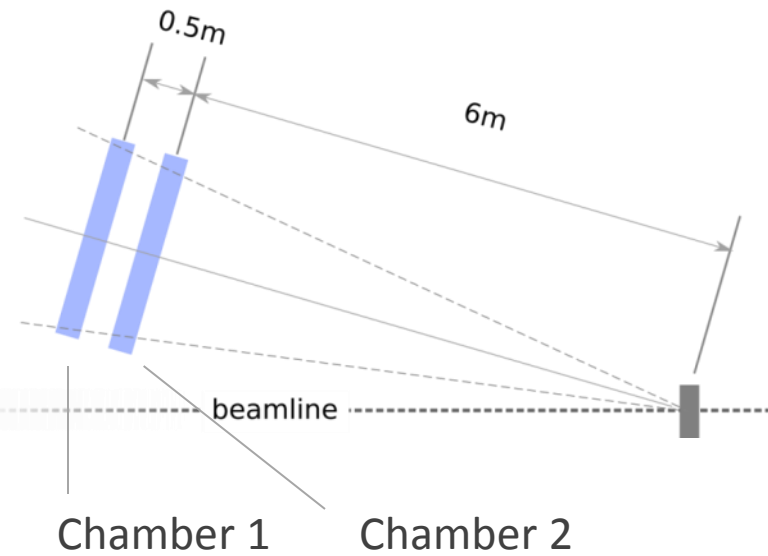
## Testing

- DESY: Pure electron beam at fixed momenta
  - Systematic characterization of module performance
  - Electron efficiency + tracking + position resolution versus momentum
- GIF++ (CERN Gamma Irradiation Facility):  $^{137}\text{Cs}$  source (13.7 TBq) +  $\mu$ -beam from SPS-H4
  - High-rate performance + Aging tests (long term)

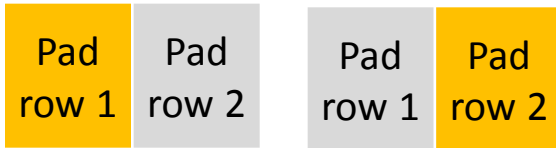
## Mini-CBM

- Set up with 4 large chambers to test system integration

# Test beam SPS 2015: Chamber correlation



→ Hit in the same pad row ★



→ Hit in the neighbour pad row ★

→ Clear correlation between both chambers

Dennis Spicker → Poster HK 27.65