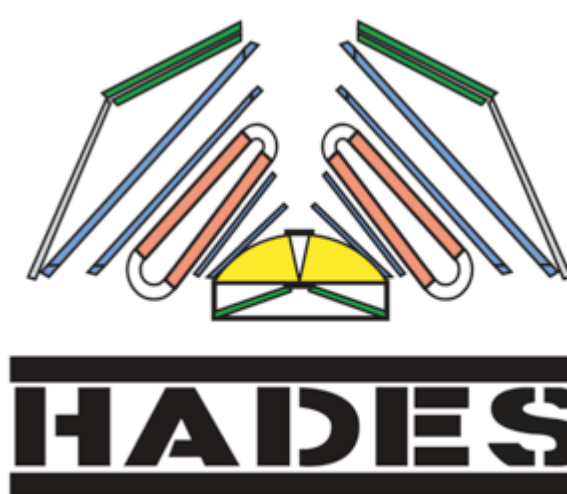


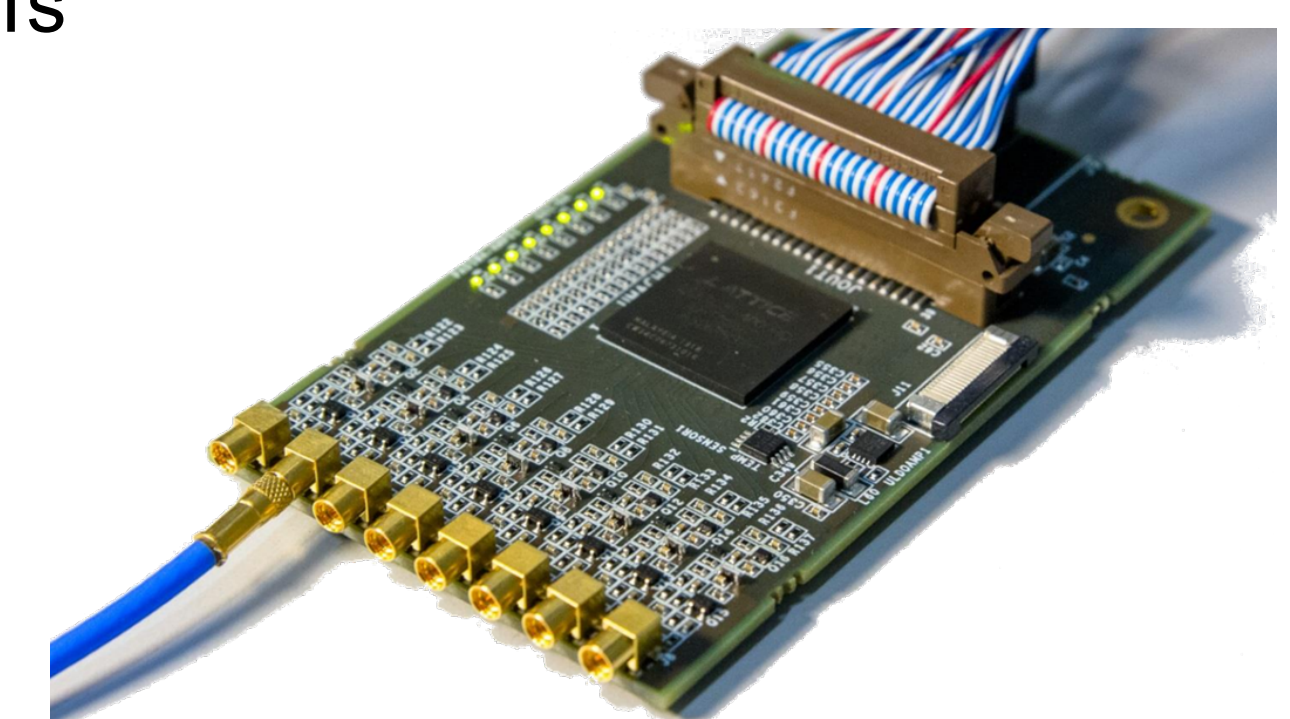
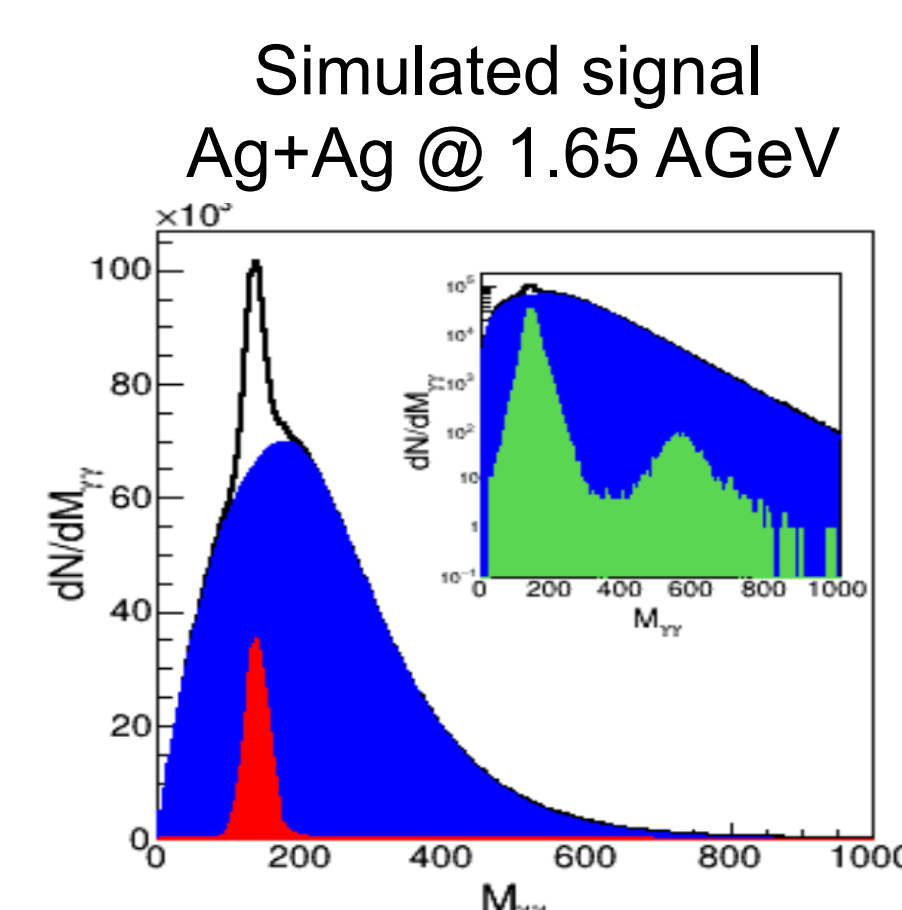
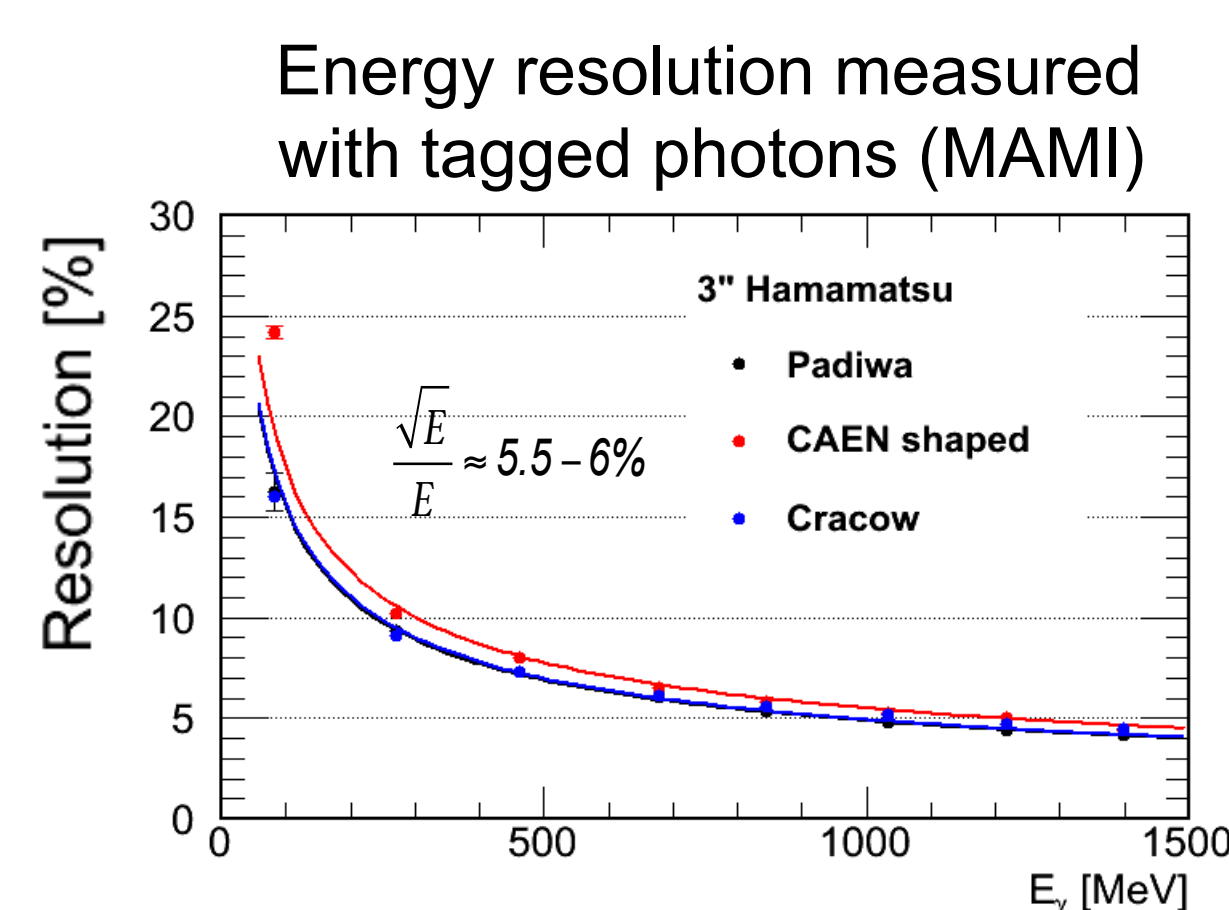
# Towards FAIR: HADES Upgrade



## Precise Photon Measurement: Electromagnetic Calorimeter

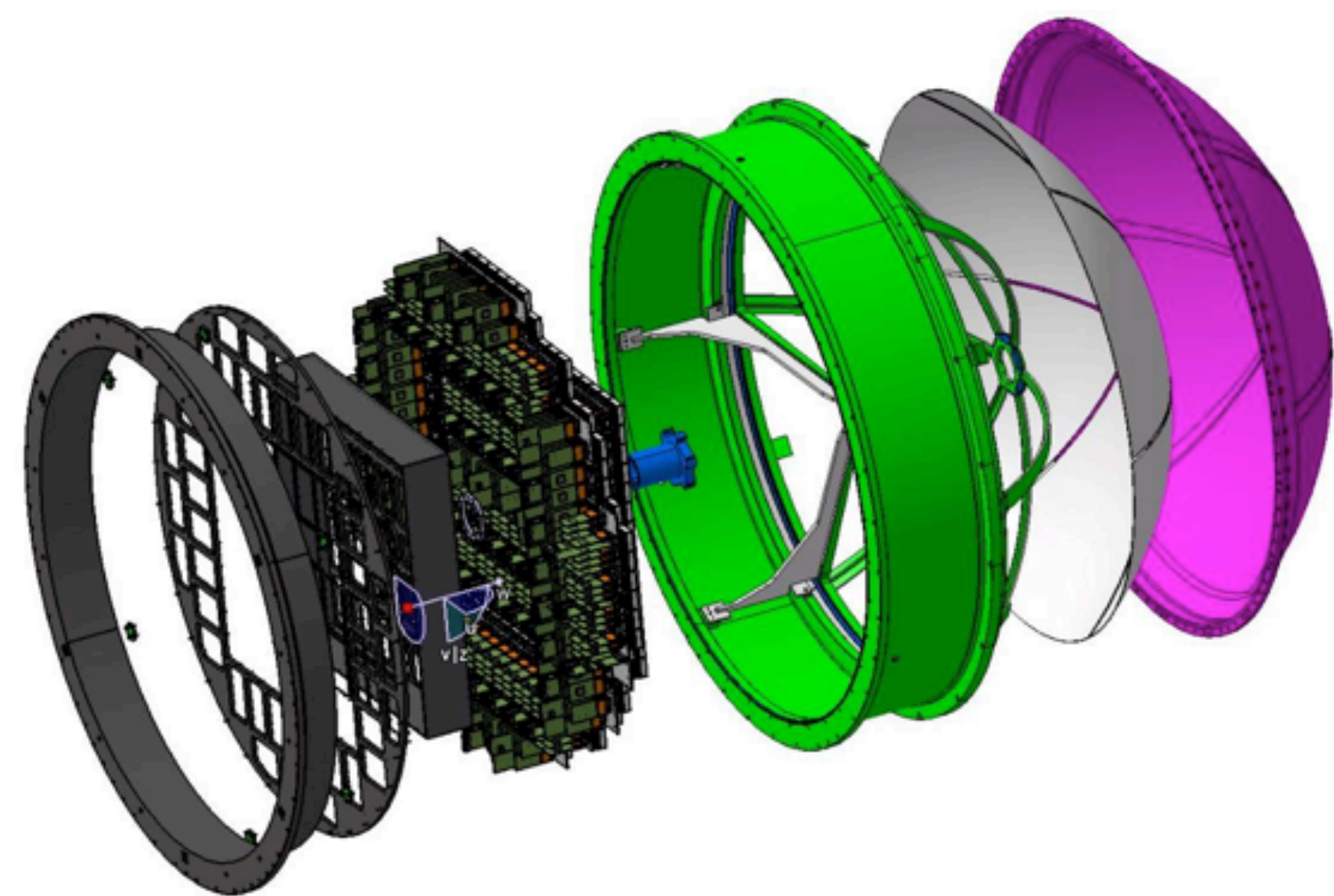


- $\pi^0$  and  $\eta$  decays into  $\gamma\gamma$  channel + Electromagnetic decays of baryonic resonances
- Improved  $e/\pi$  separation: important for di-electron spectroscopy
- Proven technology: lead glass modules read out with Hamamatsu PMTs
- Readout: PADIWA-AMPS + TRB3 platform



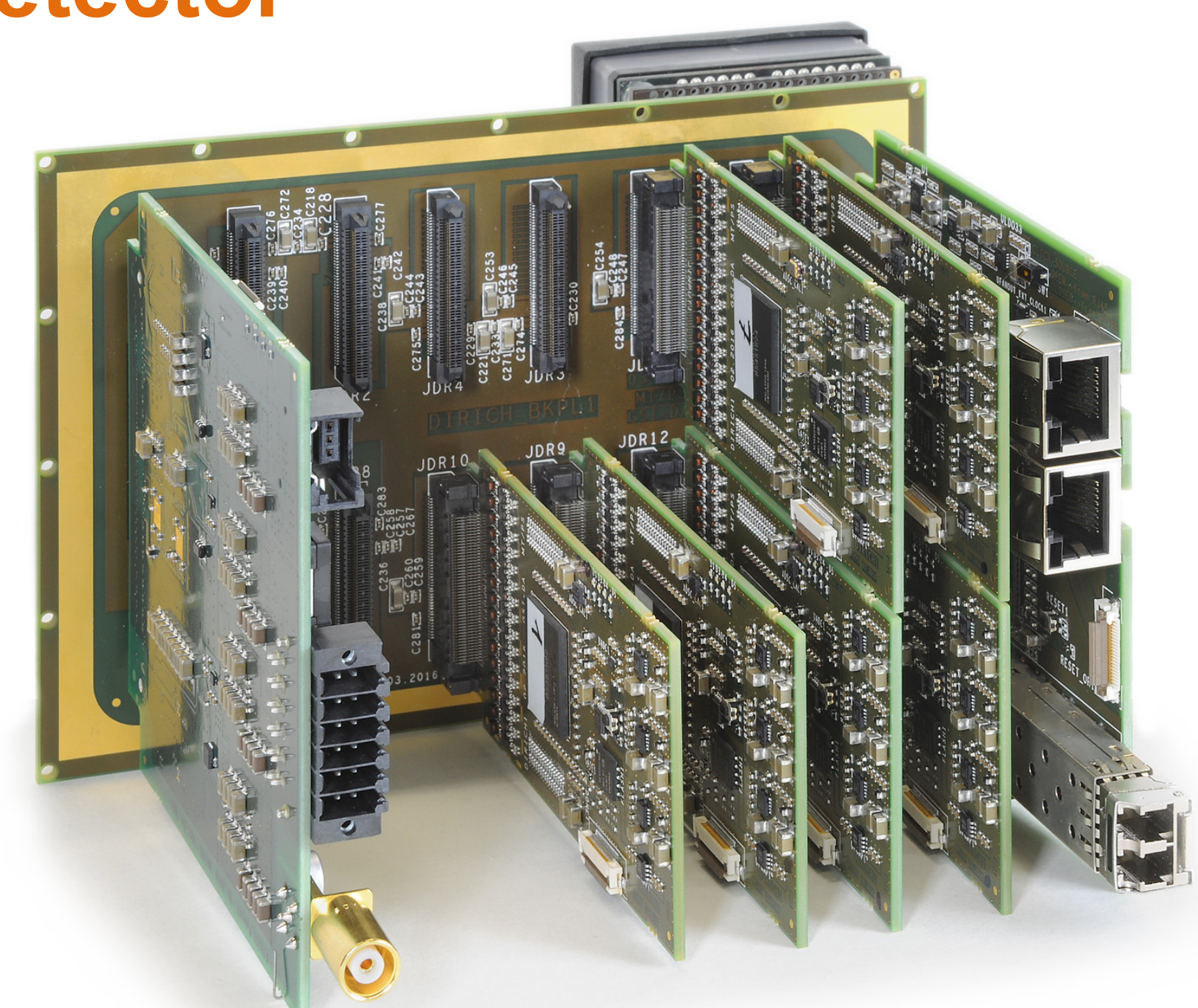
- PADIWA-AMPS board (GSI/TU Darmstadt)**
- 8 channel FPGA-discriminator board
  - Time precision  $\sim 20$  ps
  - Charge measurement

## Efficient Electron Identification: New RICH Photon Detector



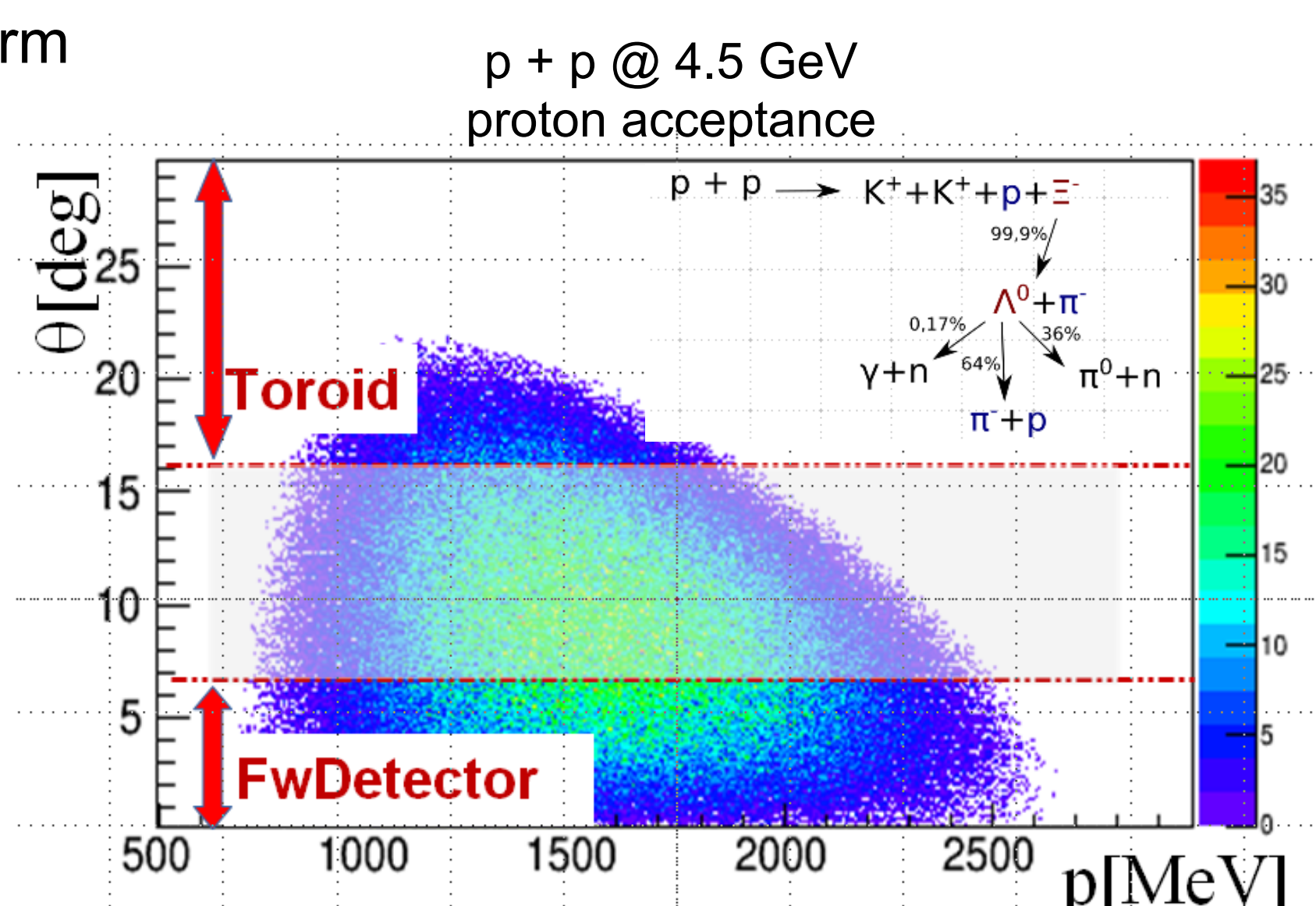
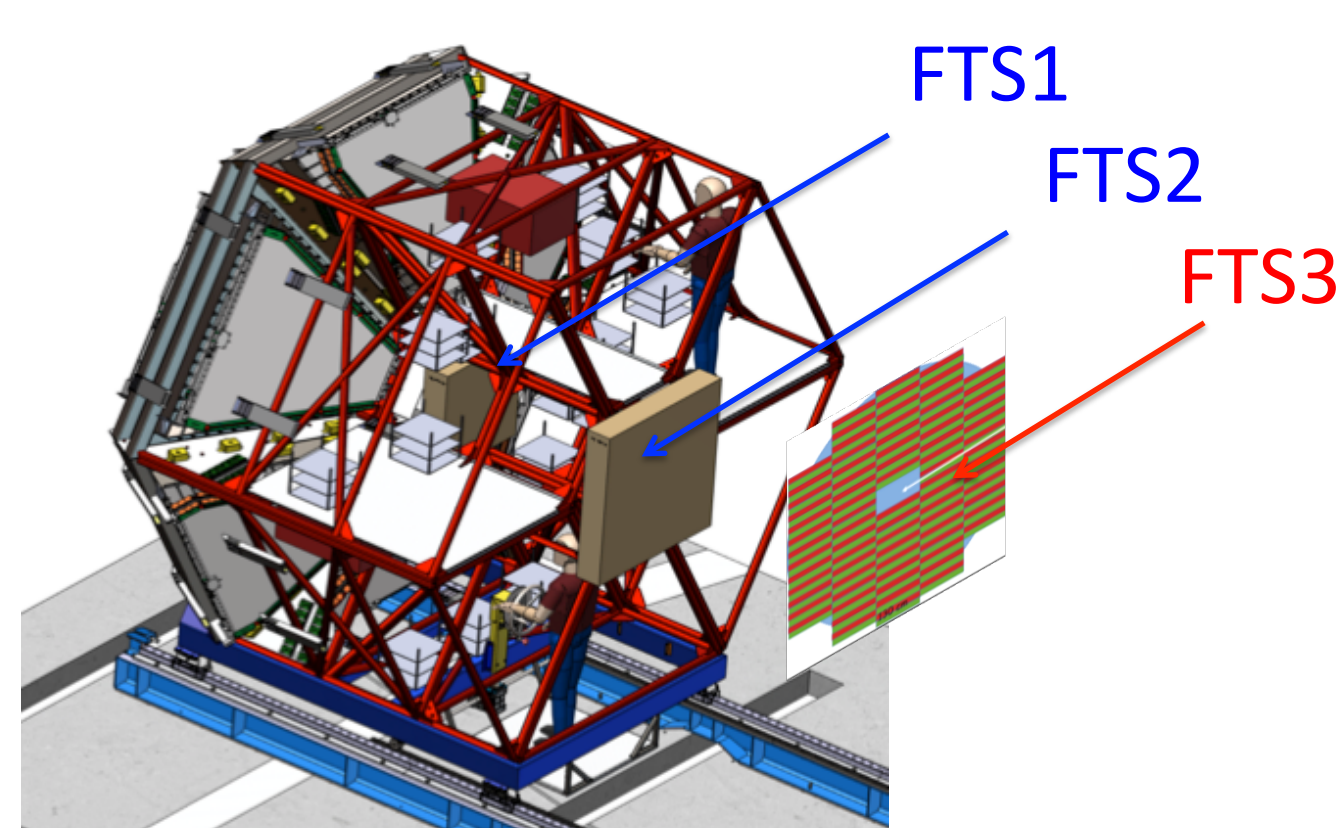
HAMAMATSU MAPMTs (Multi-anode photo multiplier) will replace 20 year old CsI photon detector:

- Gain in lepton pair detection efficiency (x 3)
- Improved background/noise rejection:
  - Better conversion pair rejection
  - Precise time information (down to 300ps precision)
- Long-term stability and high rate-capability
- Joint (CBM/PANDA/HADES) development of read-out system based on TRB3 platform.



## Forward Tracker

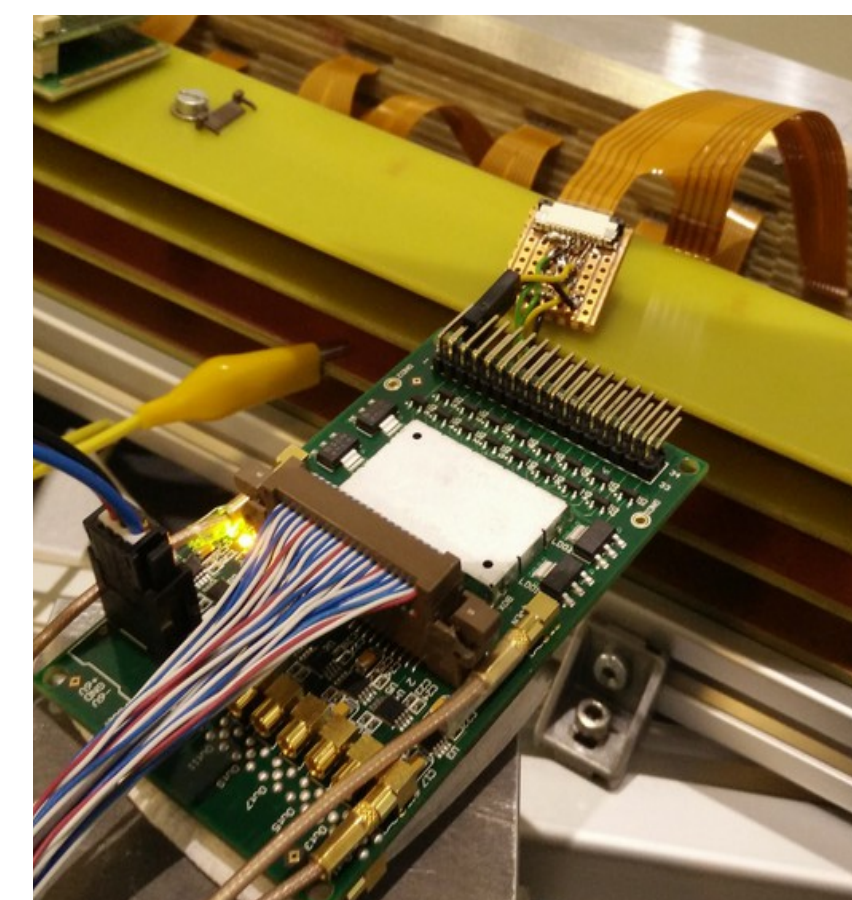
- Enhance HADES capabilities for exclusive channels
  - Hyperon production and EM decays
- Mounted on the ECAL Main Frame
- PID via TOF,  $dE/dx$ (straw tube) – no magnetic field
- Read-out based on TRB3 platform
- Joint development with PANDA



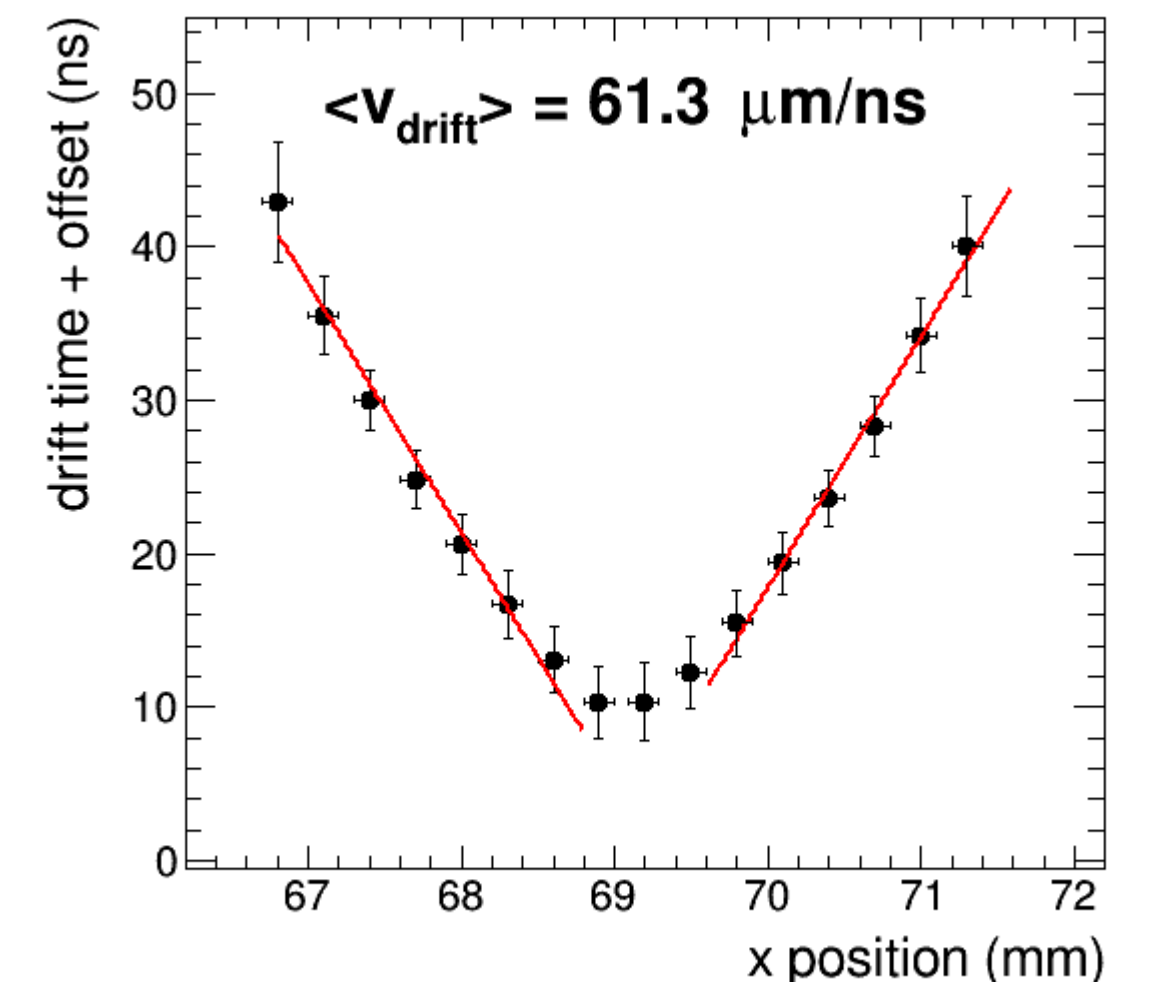
## MDC Read-out Upgrade

- Multi-hit TDC (TRB based) – essential for high rate experiments
- Read-out trigger rate increase from 50 kHz to 200 kHz
- Alternative to ASD8 chip, PANDA PASTREC chip is being evaluated as possible replacement for MDC front-end

PASTREC board at MDC

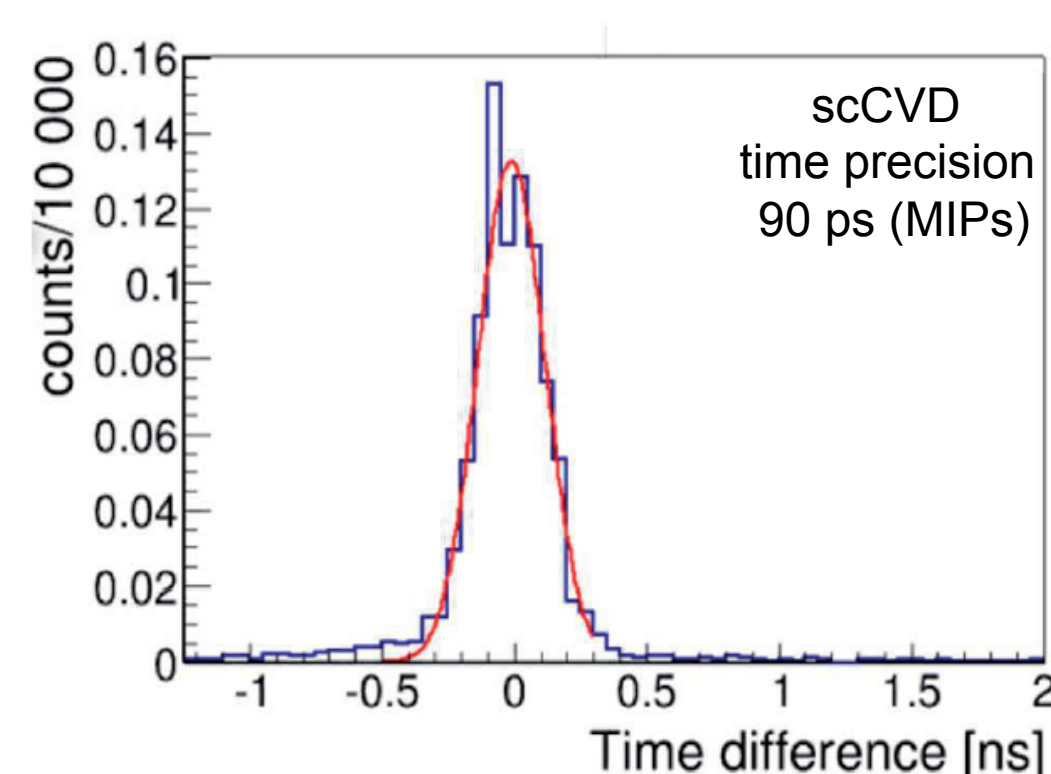


Drift velocity measured with PASTREC

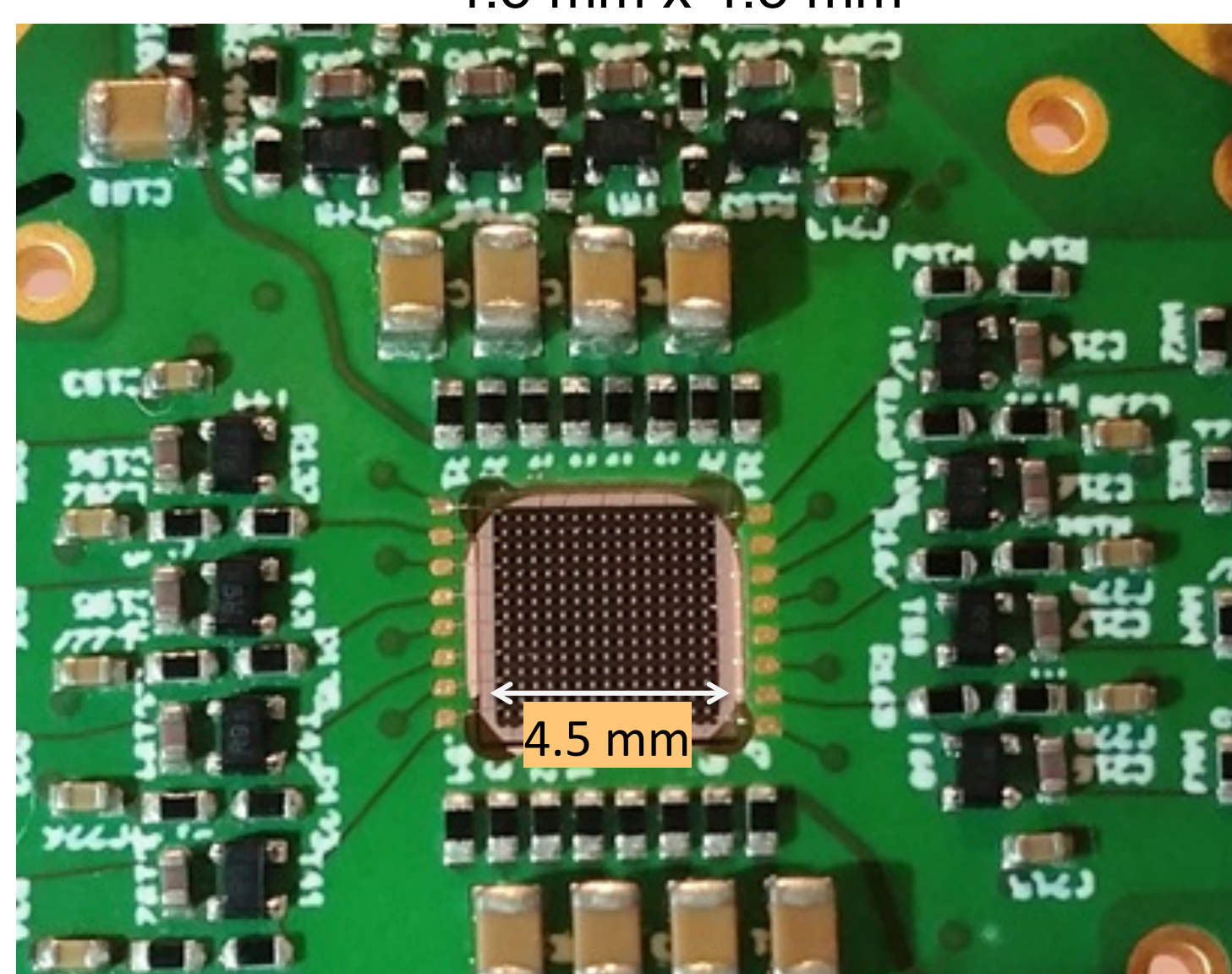


## Upgrade of Multipurpose T0-detector(s)

- T0 determination with precision  $< 100$  ps
- Precise beam profiling in X, Y directions
- Broad dynamic range, from p up to Au beams
- Sensor technologies:**
  - ScCVD diamonds
  - Ultra Fast Silicon Detectors (UFSD)



Double-sided scCVD diamond  
4.5 mm x 4.5 mm

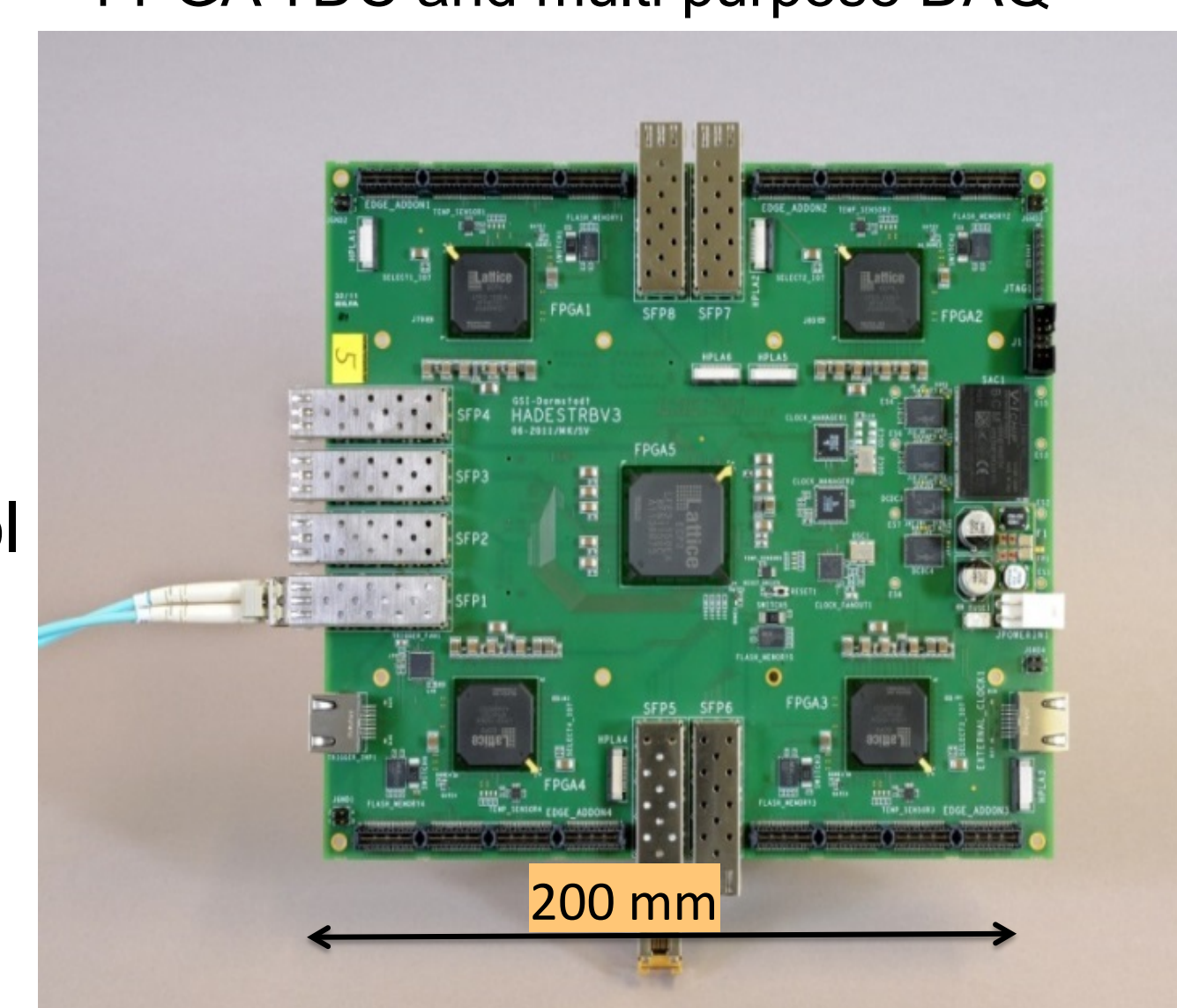


## Multipurpose Readout System Based on TRB3 Platform

- Developed by TRB collaboration  
GSI EE + many institutes and groups
- Based on FPGAs
- Time precision: 10 ps RMS
- Up to 260 TDC read-out channels, 50 MHz/ch
- Build-in internal trigger system and slow control
- Broad community: HADES, CBM, PANDA, Mainz A2 Collaboration and others



**TRB3 (TDC and read-out board v.3) platform**  
FPGA TDC and multi purpose DAQ



<http://trb.gsi.de/>