



# Barrel time-of-flight detector for the PANDA experiment at FAIR



L. Gruber for the PANDA TOF Group

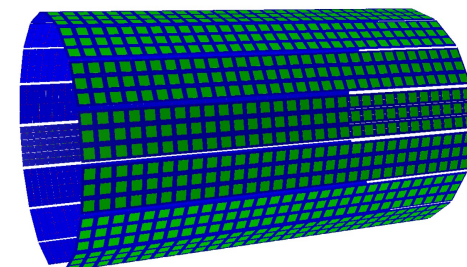
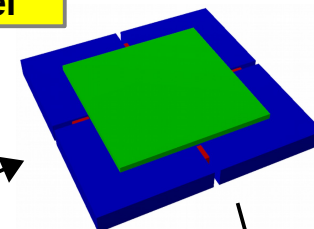
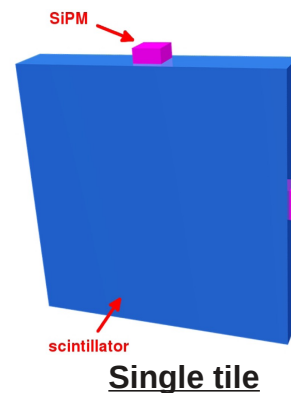


## PANDA:

- One of the major experiments at the Facility for Antiproton and Ion Research (FAIR)
- PANDA stands for Antiproton Annihilations in Darmstadt
- It will study interactions between  $\bar{p}$  (1.5 – 15 GeV/c) and fixed target protons and nuclei

## Barrel TOF detector:

- Requirements:
  - Minimum material (2 cm radial thickness)
  - Good time resolution ( $\sigma \sim 100$  ps)
- Layout:
  - Small plastic scintillator tiles ( $\sim 30 \times 30 \times 5$  mm<sup>3</sup>)
  - Silicon Photomultipliers (SiPMs) as photodetectors
  - In total 5760 tiles  $\rightarrow 5.2$  m<sup>2</sup>

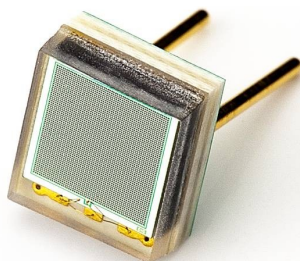


## Silicon Photomultipliers:

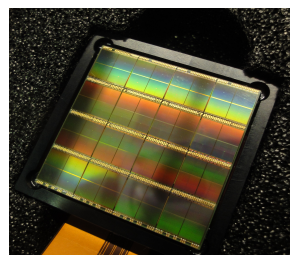
- We consider analog as well as digital SiPMs
- One of the first studies to apply the Digital Photon Counter for a large scale experiment in HEP

## Detector optimization:

- Massive R&D work has been done to optimize the detector design: scintillator, SiPMs, electronics
- Latest results from test beam experiment using 2.7 GeV/c protons:
  - $\sigma = 82$  ps with analog SiPMs
  - $\sigma = 32$  ps with digital SiPMs



KETEK SiPM



Philips Digital Photon Counter (DPC)

Time resolution well below 100 ps (sigma) could be achieved with an optimized detector fulfilling the PANDA requirements.