JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

GCS GIESSEN COSMIC STATION

ATLAS PANDA HERMES AG Düren

DIRC and GCS Status Update

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Online PANDA Meeting

October 26, 2021

Readout Electronics

Readoutboard

- First prototype received
- Optical connection with DAQ-Card
- Fully compatible with existing System (GCS)

Components

- 5 ASICs (TOFPET 2)
- FPGA (Kintex-7)
- Optical Transceiver (Versatile Link+)
- Misc. (Voltage Regulators, etc. . . .)

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Readout Electronics

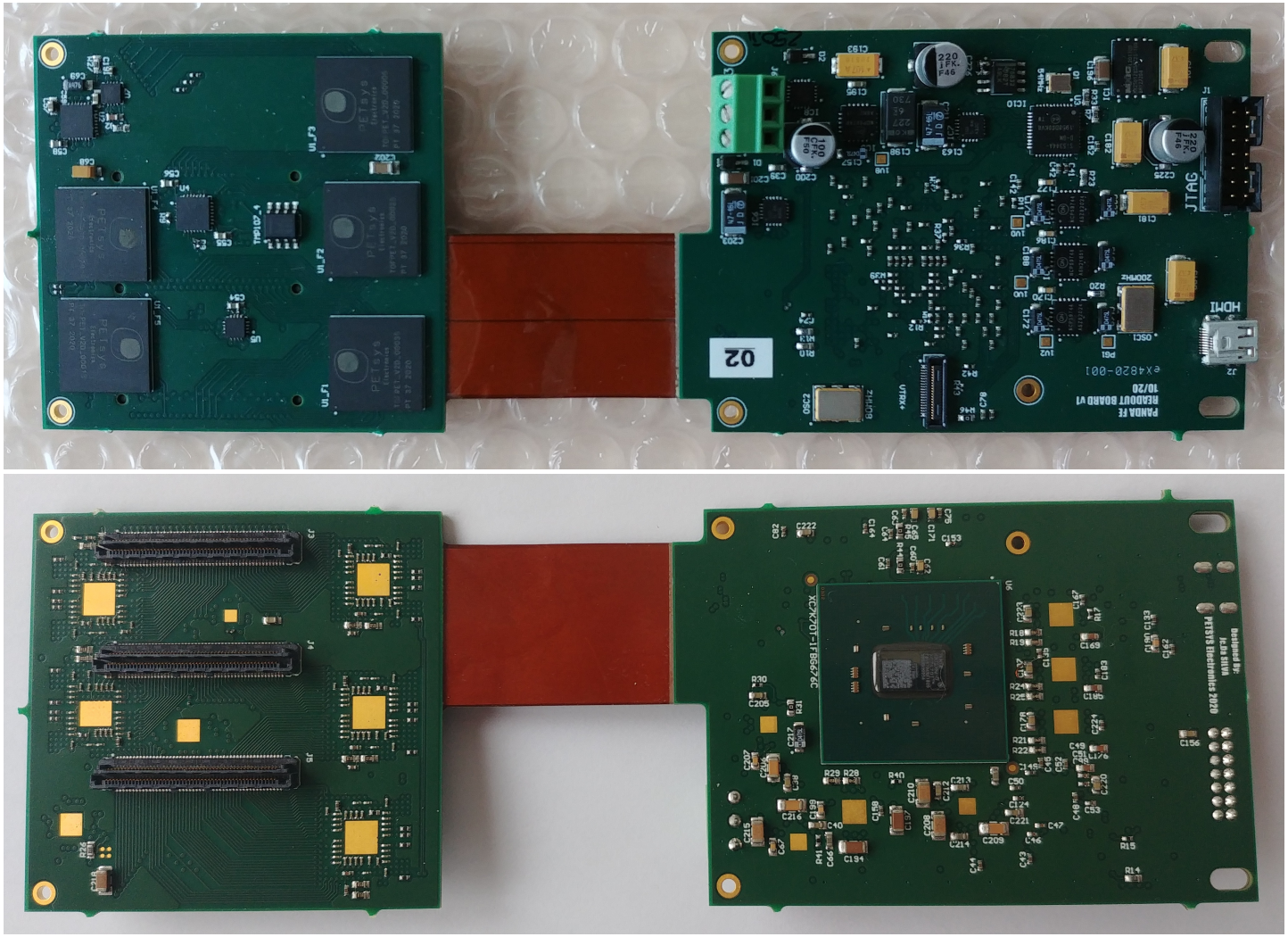


Figure: Prototype board with 5 ASICs.

Readout Electronics

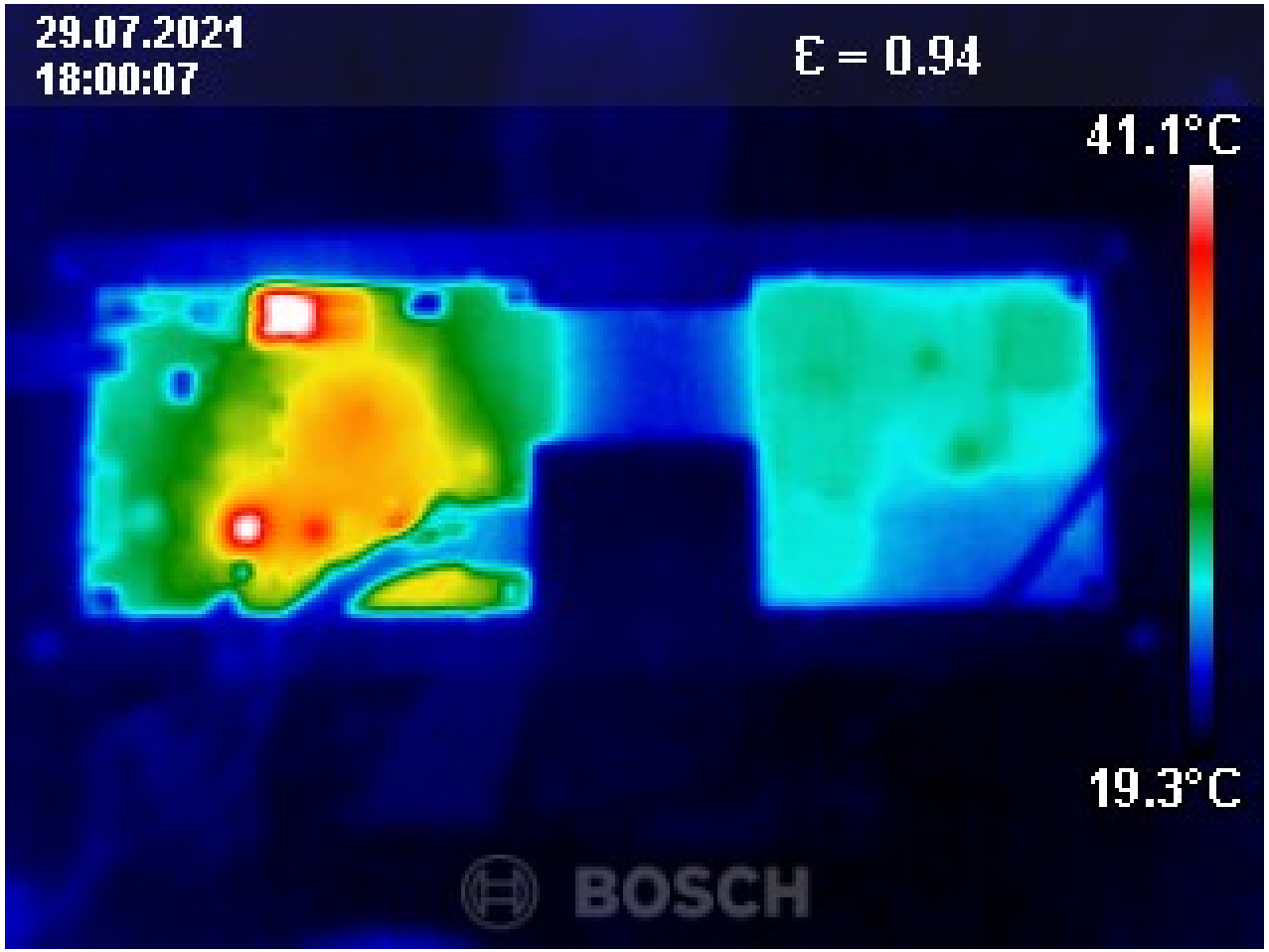
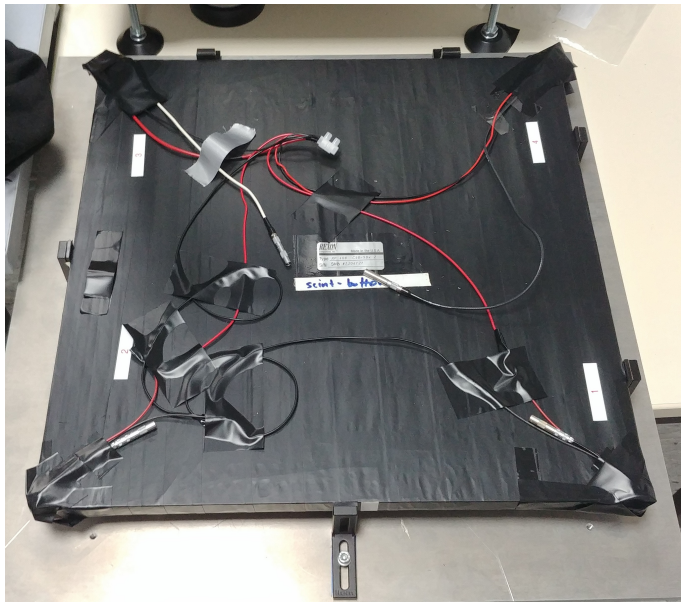


Figure: The prototype board has a power consumption of 10 W.

GCS Trigger Efficiency

Problem: Low trigger efficiency

- Single SiPM in each corner
- Small signal amplitudes
  - Ineffective light collection
  - Non-reflective area around SiPM
  - Small active area (3×3 mm^2)



GCS Trigger Efficiency

Tested Hardware Changes

- Variant A: Revert to PMTs
  - Larger active area than SiPMs
  - Requires inverter circuit
    - Old ASICs incompatible with neg. polarity
    - Changes pulse shape significantly
- Variant B: Modified SiPM Readout
  - Add optical grease
  - Add reflective material around SiPM
  - Put a second SiPM in parallel
  - Optimize ASIC parameters
- Both variants perform well (A slightly better)

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Other Measurements

- Laser setup for single photon tests
  - CCD to measure spot width
  - SiPM at low light intensities
  - High and low temperature runs

- Detection of Cherenkov Light
  - 2 cm aerogel radiator
  - SiPM arrays mounted within a few cm
  - High and low temperature runs
  - Readout with the current system inside the GCS

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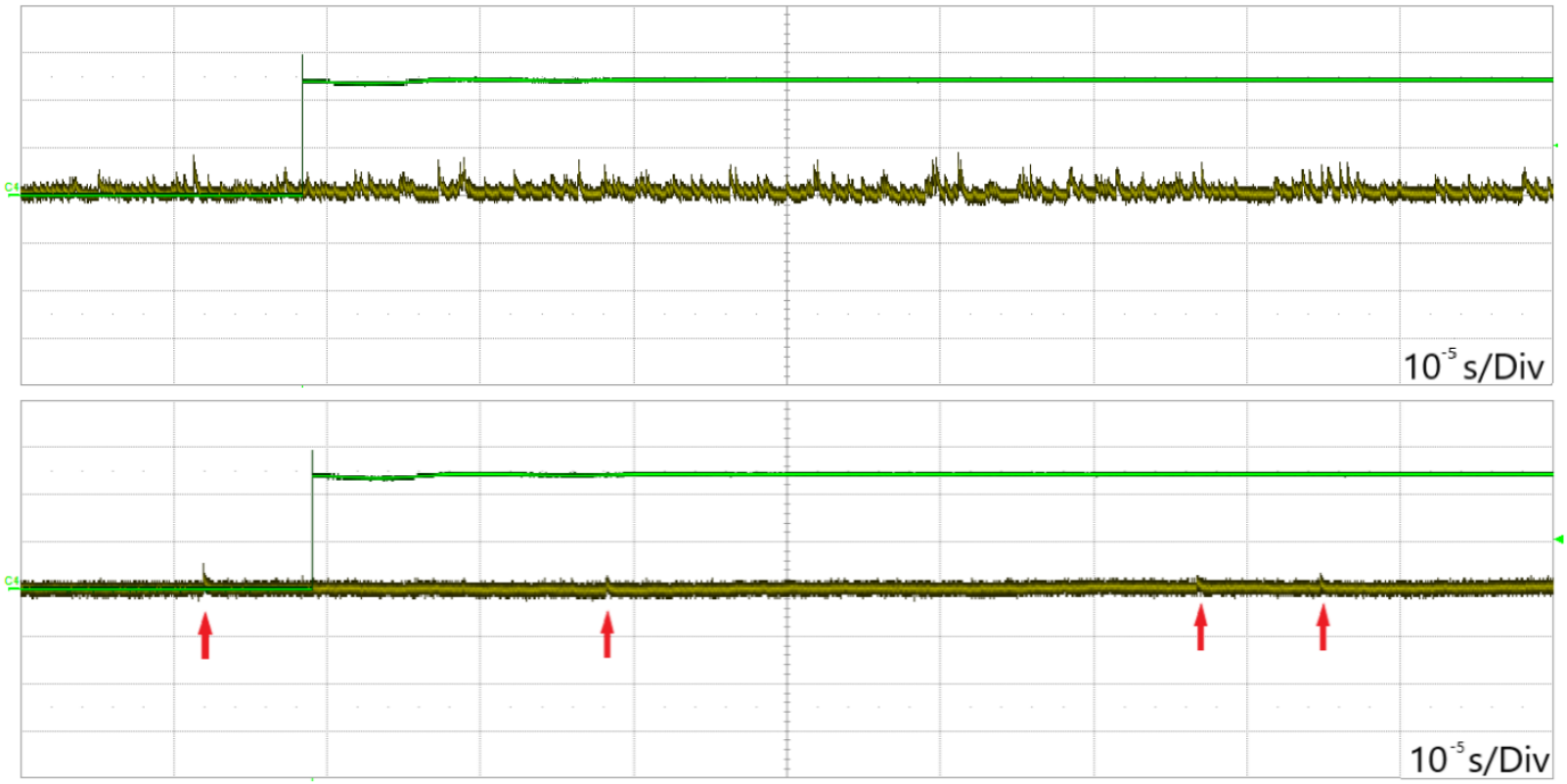

Figure: Recorded waveforms of a PM3350 SiPM at 26 C° room temperature (top) and cooled with dry ice (bottom).

Other Measurements

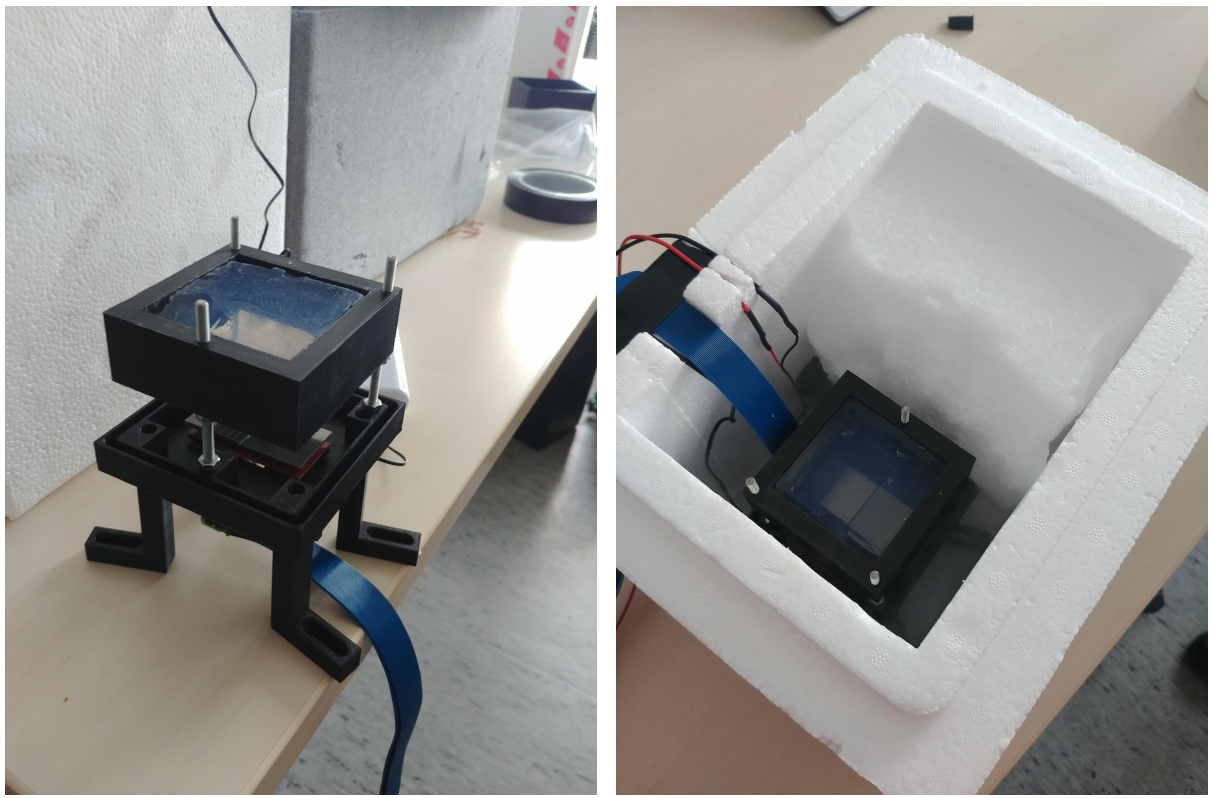

Figure: The aerogel setup with the Hamamatsu and Ketek SiPM arrays.

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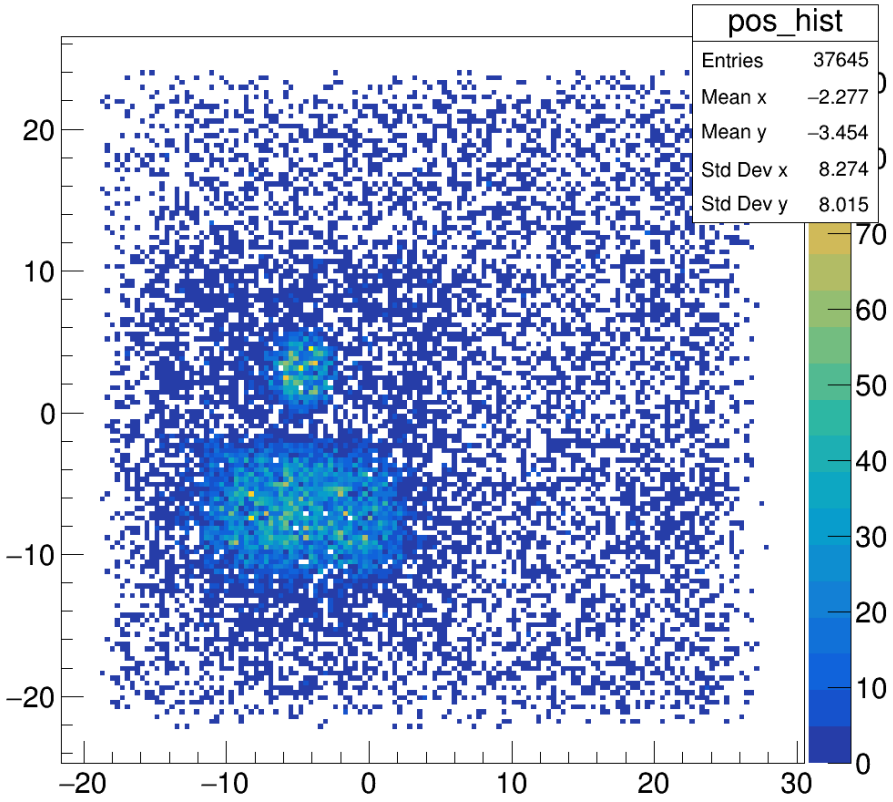

Figure: Reconstructed positions of tracks in coincidence with the SiPM matrices. The two visible structures can be identified with the aerogel radiator and the dry ice block.

Thank you!

GCS Trigger Efficiency

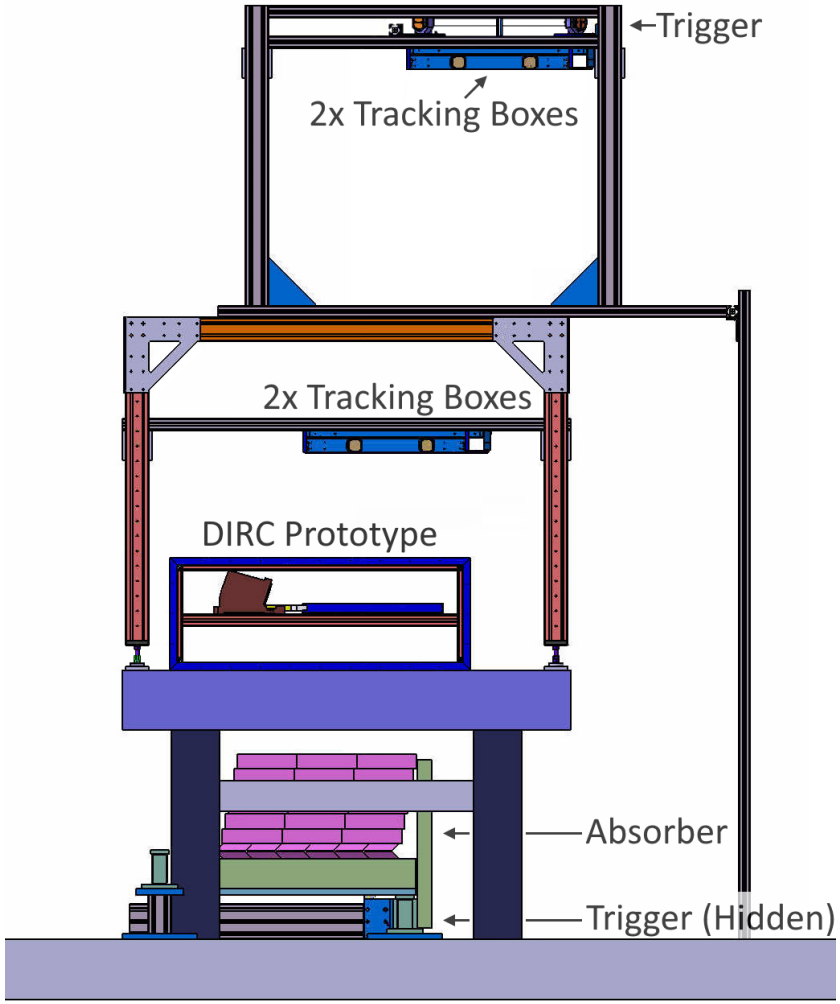

Figure: GCS uses two triggerplates (Above top tracking and below lead).