JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

GCS GIESSEN COSMIC STATION

ATLAS PANDA HERMES AG Düren

GCS Status Update

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Online PANDA Meeting

June 15, 2021

Measurements with the Prototype in the GCS

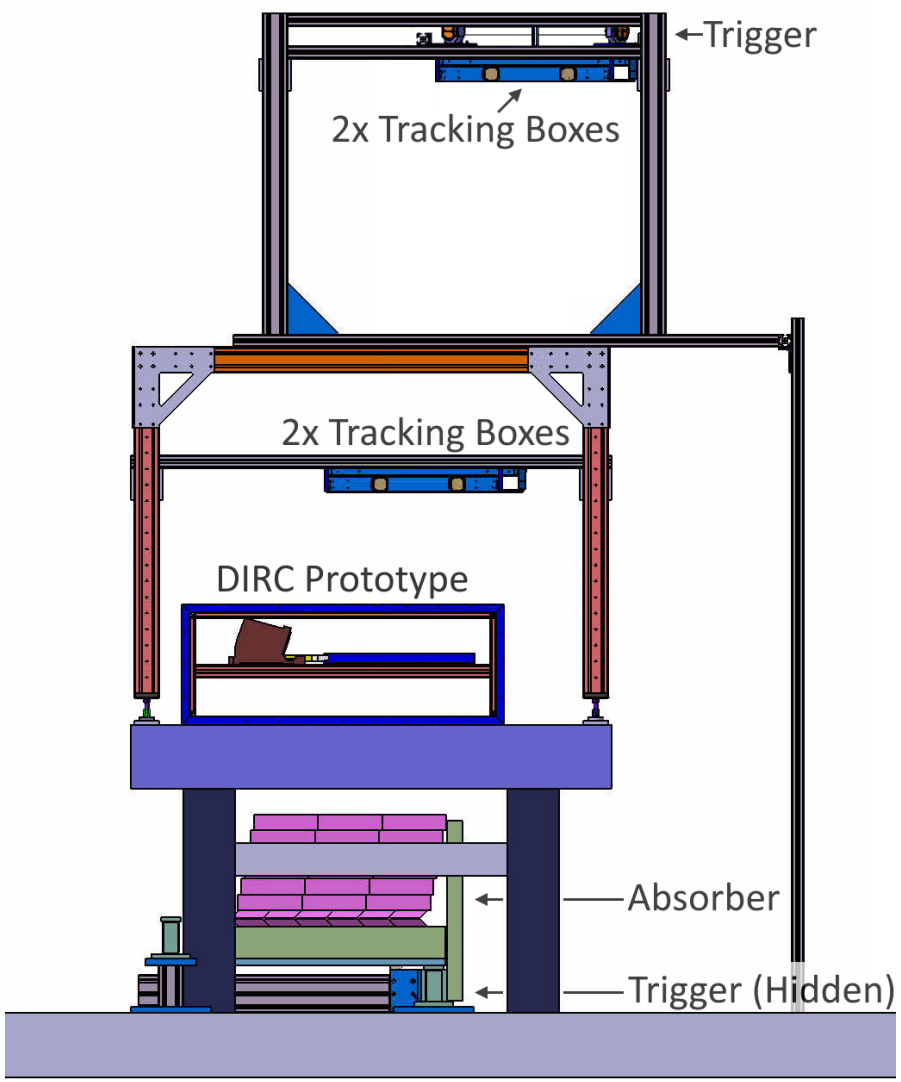

Figure: Overview of the GCS with prototype setup.

Current Setup

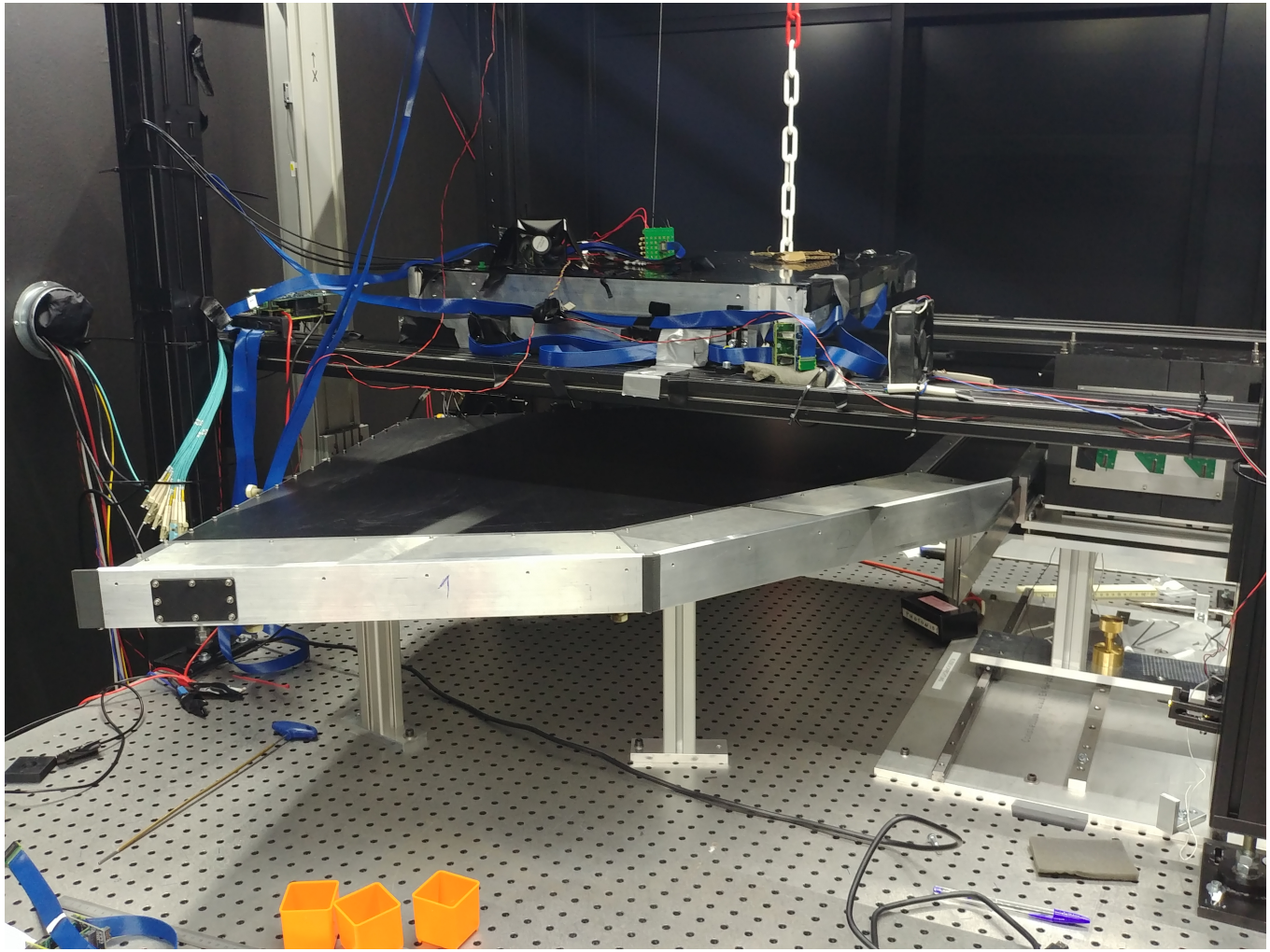

Figure: Fully light-tight radiator box.

Cherenkov Measurement Results

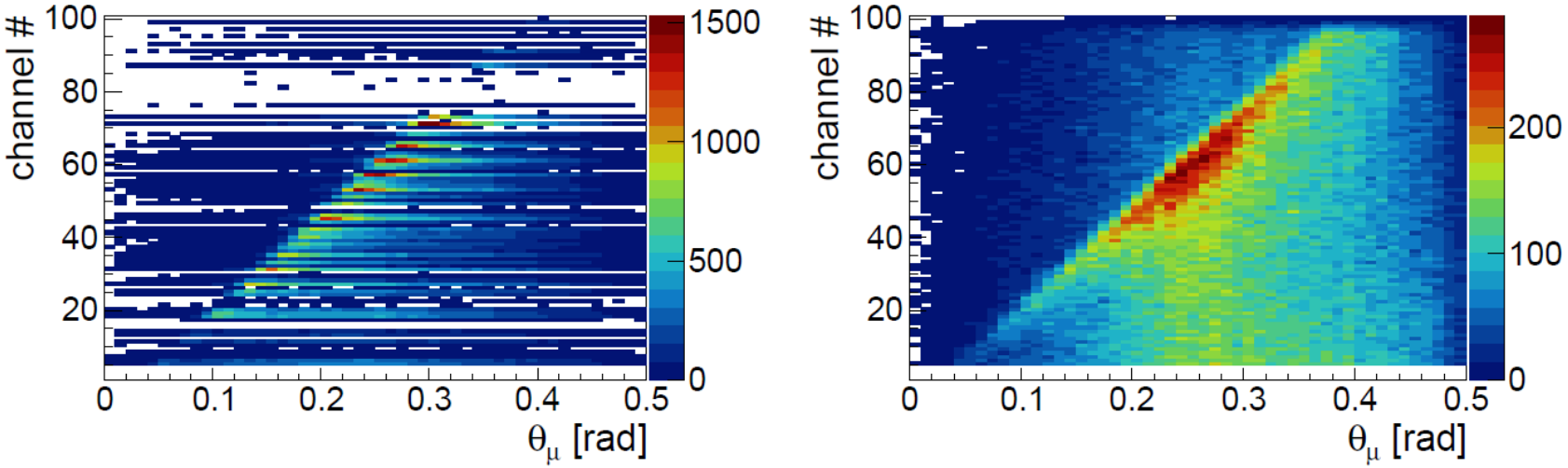

Figure: Hit MCP channels as a function of the polar angle for reconstructed tracks with $\varphi < 0.5$ rad.

İlknur Köseoğlu Sari, "Development of a fast readout system for the DISC DIRC prototype of PANDA", 2021

Cherenkov Measurement Results

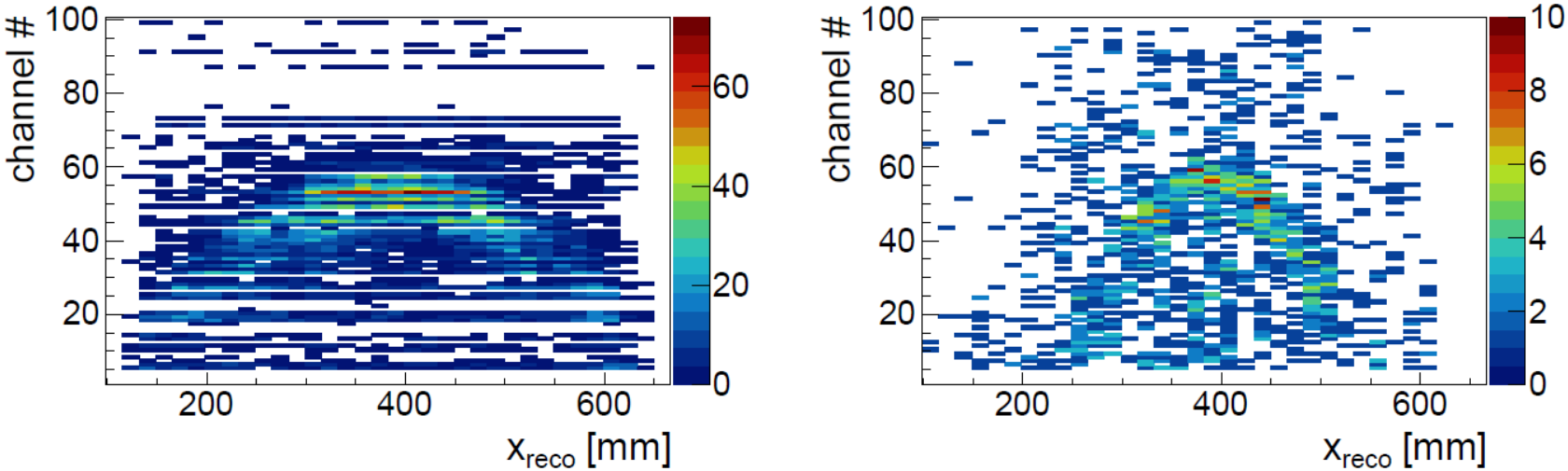

Figure: Hit MCP channels as a function of the x-position for reconstructed tracks with $12° < \theta < 14°$ and $\varphi < 0.4$ rad.

İlknur Köseoğlu Sari, "Development of a fast readout system for the DISC DIRC prototype of PANDA", 2021

Cherenkov Measurement Results

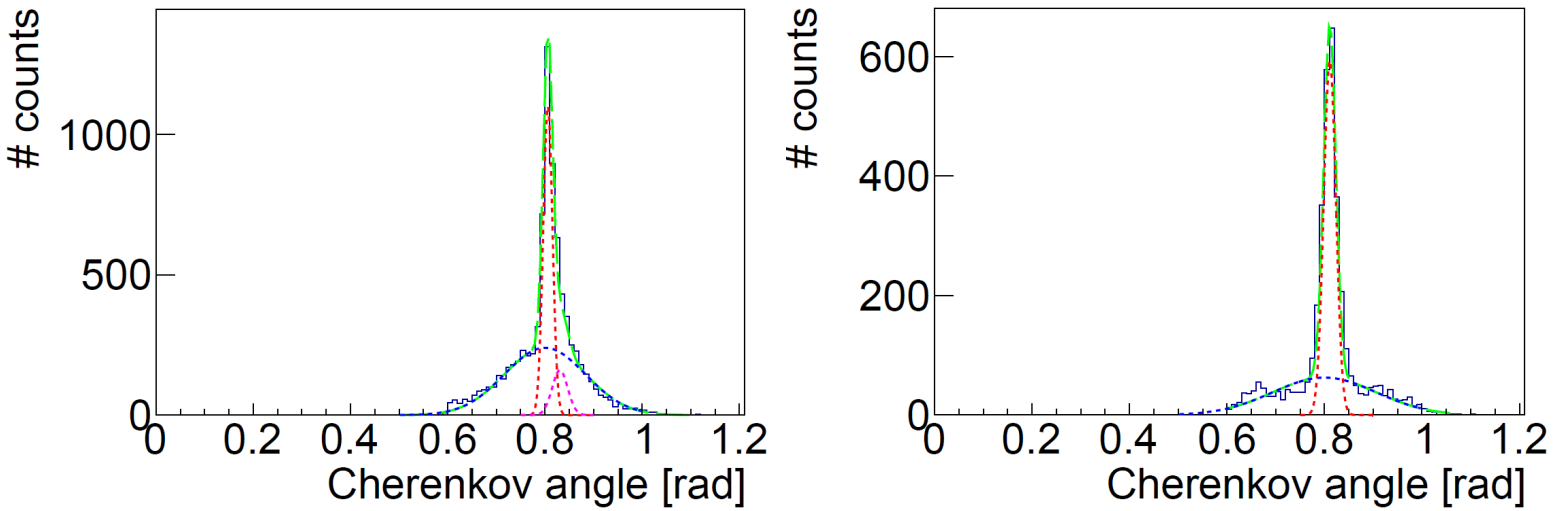

Figure: Reconstructed cherenkov angle for data (left) and simulation (right). Tracking cuts are applied. Single photon resolution estimated to be around 10 mrad.

İlknur Köseoğlu Sari, "Development of a fast readout system for the DISC DIRC prototype of PANDA", 2021

Improved Reconstruction Algorithm

Naive Reconstruction

- Average bar positions in each plane
- Linear extrapolation to measurement plane
- Method has systematic position error

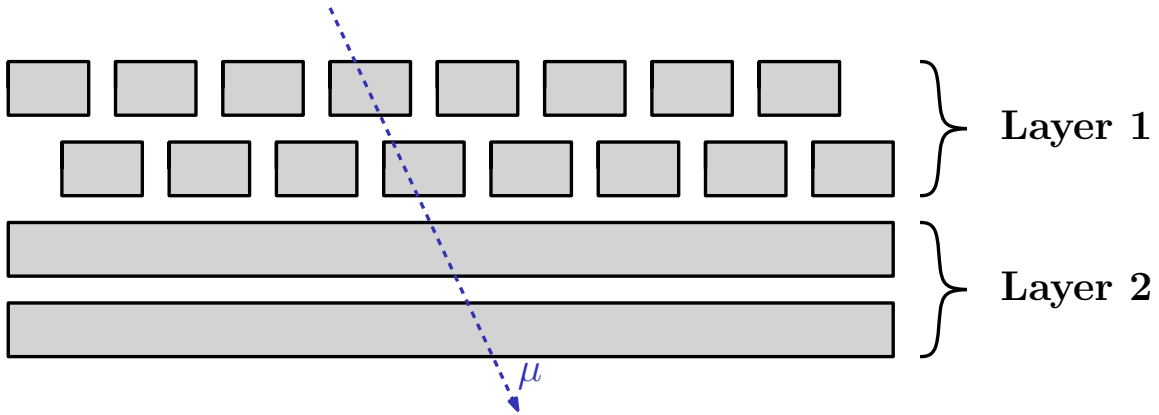

Figure: Schematic drawing of the bar geometry.

Improved Reconstruction Algorithm

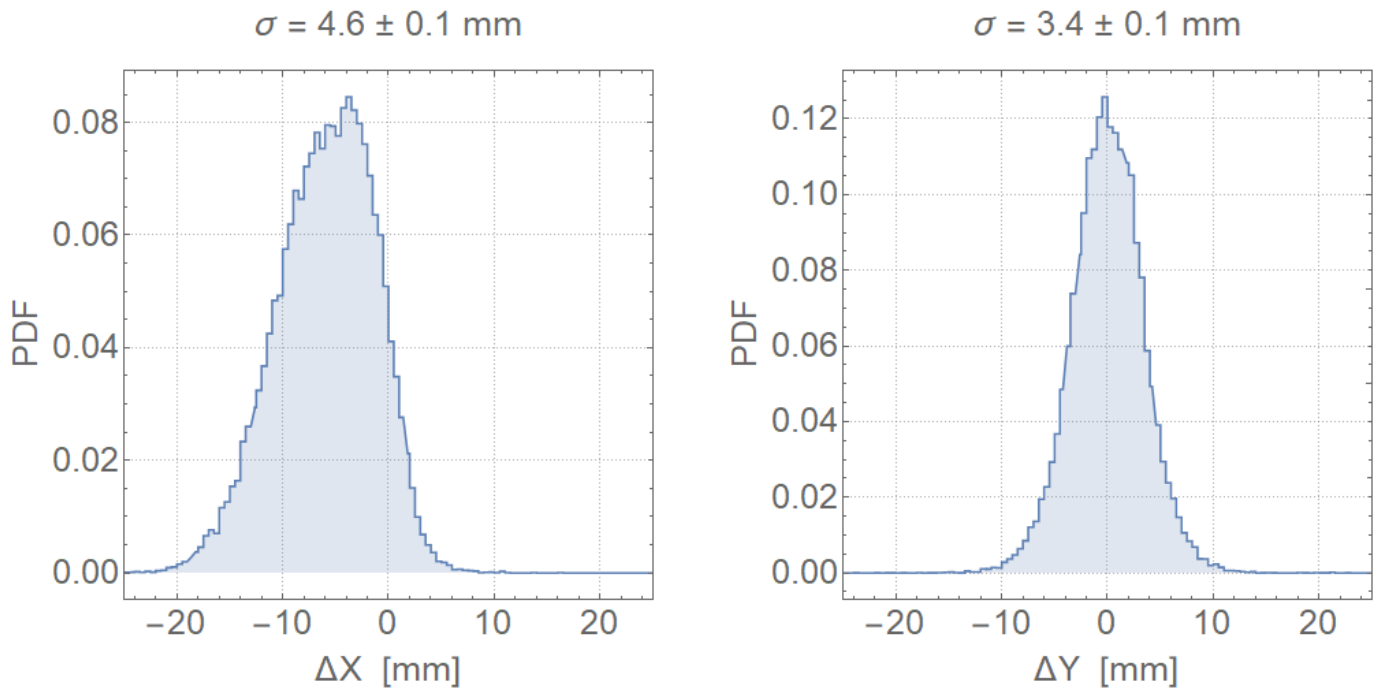

Figure: Reconstruction error obtained from simulation.

Improved Reconstruction Algorithm

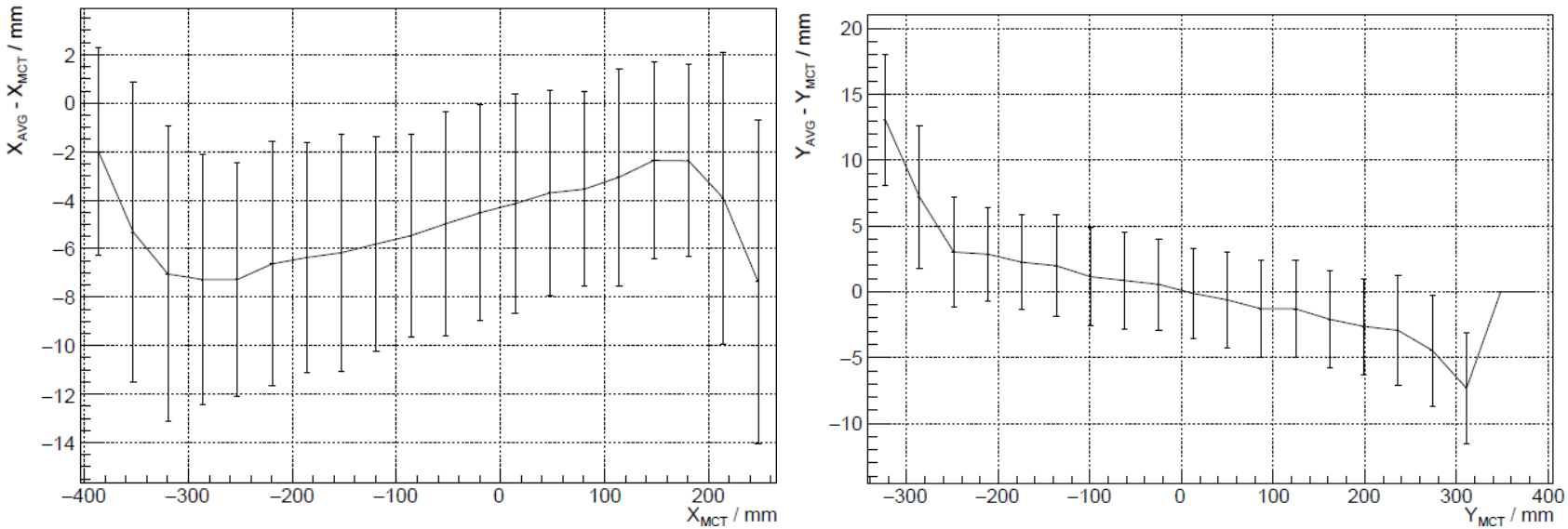

Figure: Reconstruction error (naive method) for x and y direction.

Jan Niclas Hofman, "Track Reconstruction for the Giessen Cosmic Station using a Lookup Table", 2021

Improved Reconstruction Algorithm

Lookup Table

- Finite number of valid hit patterns
- Handle x and y axis separately
- Store proper position inside a large table (Initialized using Monte Carlo)

Improved Reconstruction Algorithm

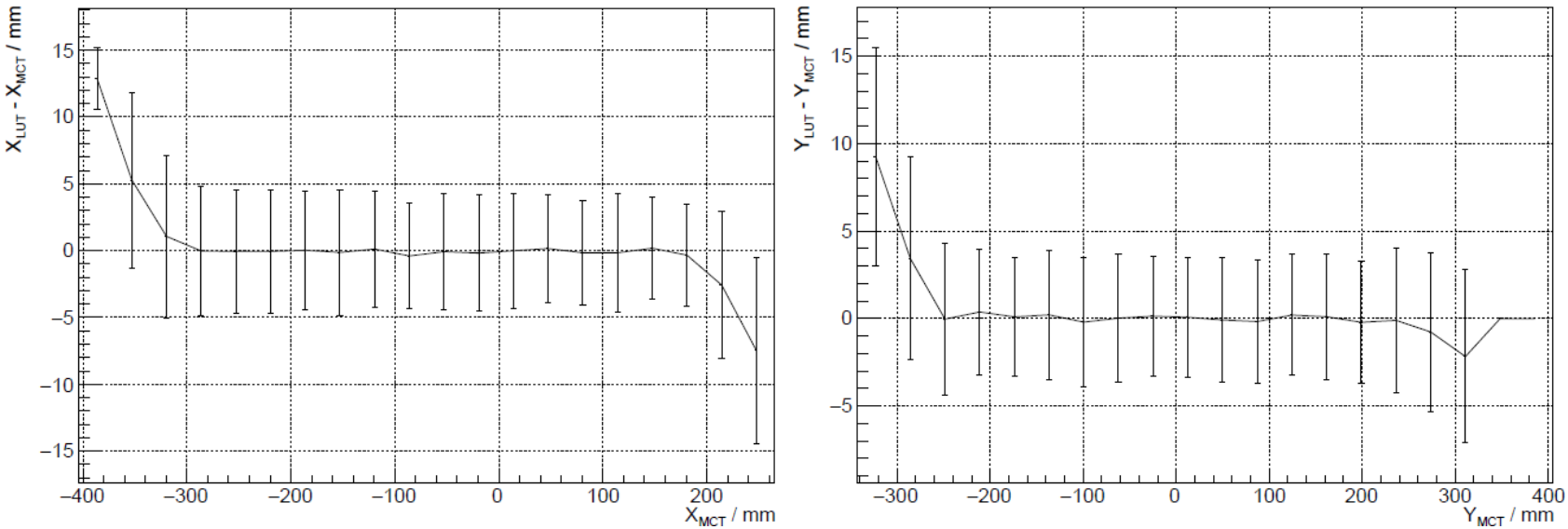

Figure: Reconstruction error (LUT) for x and y direction.

Jan Niclas Hofman, "Track Reconstruction for the Giessen Cosmic Station using a Lookup Table", 2021

Online Event Filter

Motivation

- For some runs high disk usage due to noisy channels
- Majority of the recorded hits not interesting

Software Trigger

- Online event preselection implemented
- Fixed size coincidence window (5 µs)
- Arbitrary trigger conditions (e.g. 3 out of 4 tracking boxes hit)
- Data rate capability $>$ 1 GB/s (modern CPUs are fast)

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Problems: Condensation

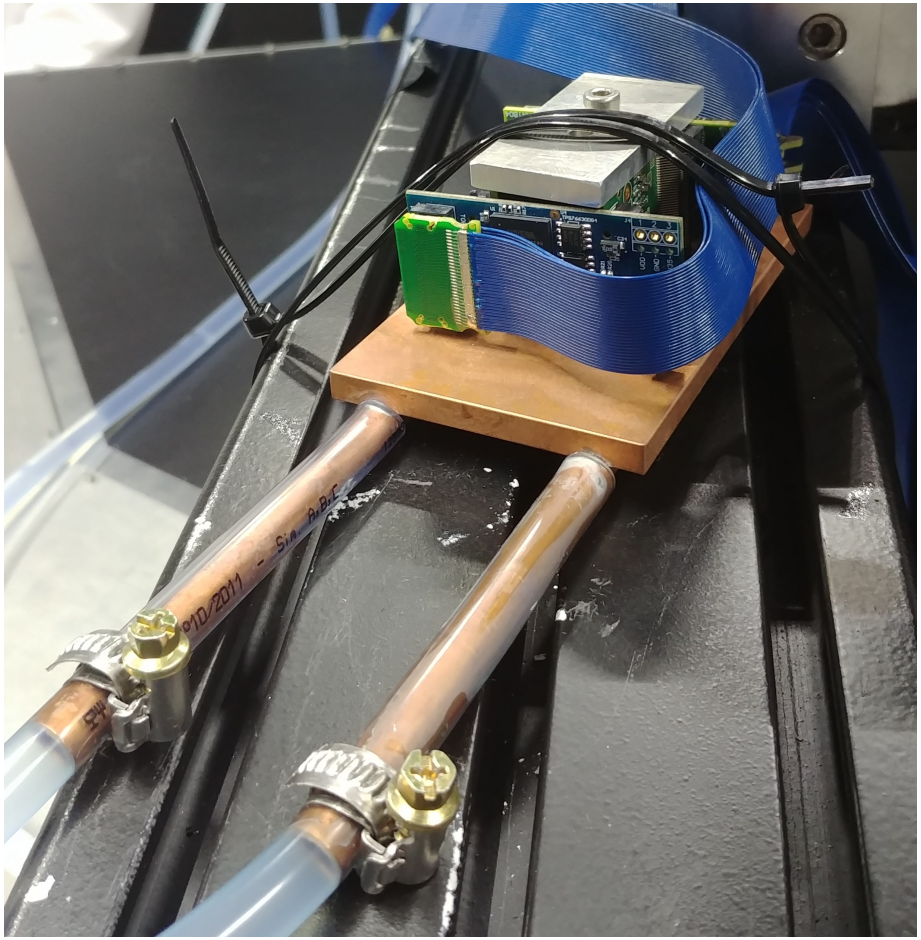

Figure: Cooling setup of the ASICs inside the cleanroom.

Problems: Condensation

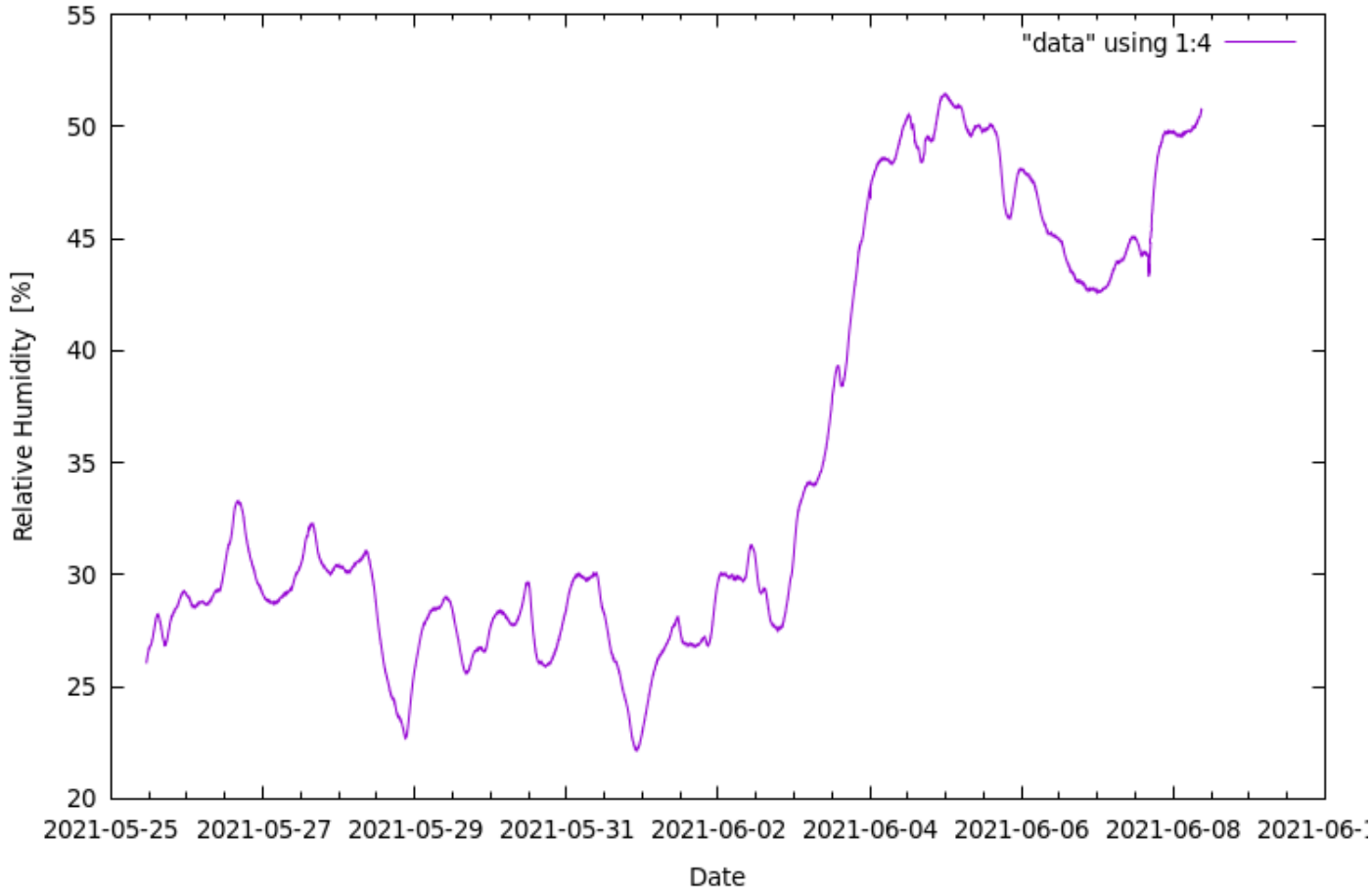

Figure: Relative humidity inside the cleanroom.

Problems: Condensation

Condensation

- Problem noticed manually (not picked up by slow control)
- Electronics were shut down manually (no damage)

Dew Point Estimation

- In principle possible using weather station inside cleanroom
- Accuracy not good enough (estimate off by at least 1 C°)

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Problems: Trigger Efficiency

Trigger Efficiencies

- Last runs had reduced trigger plate efficiency (when enforcing 4/4 coincidence)
- Switch back to older adapter set, external power supply and careful tuning helped a bit (not final)
- Requires further investigation

Thank you!