JUSTUS-LIEBIG-
UNIVERSITÄT
GIESSEN

ATLAS
PANDA
HERMES AG Düren

Commissioning of the Gießen Cosmic Station

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Introduction

Idea

- ▶ Using cosmic particles (esp. muons) for tests of particle detectors

Requirements

- ▶ Position and direction of the particles
- ▶ Selection of muons with a minimum energy (> 750 MeV)
- ▶ Acceptance for slightly angled tracks (about $13°$)

Current Status

- ▶ Fully operational!

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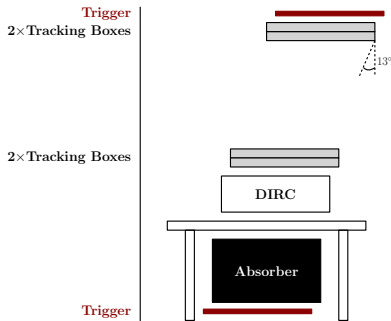
Current Status

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Overview

Track Reconstruction

▶ Track reconstruction via position measurment in two planes

Components

The test stand consists of

▶ Two scintillating plates defining a trigger

▶ Four layers of scintillating bars (track reconstruction)

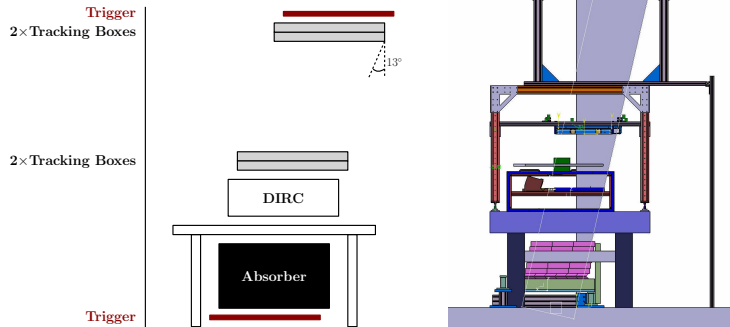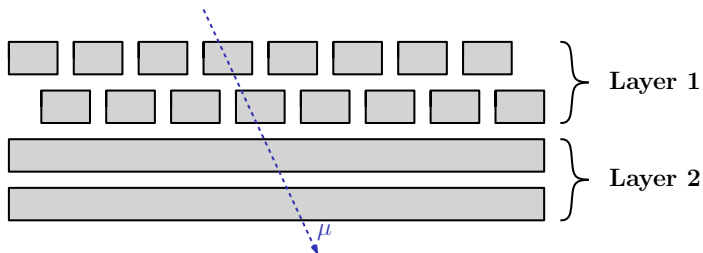▶ About 45 cm of lead in between the trigger plates (energy selection)

Overview

Figure: Schematic overview and CAD drawing.
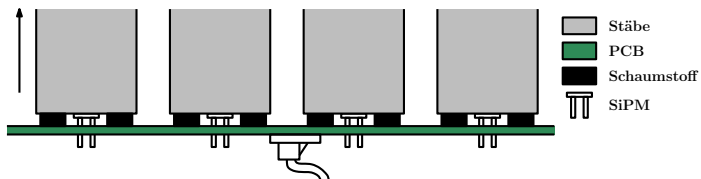
Tracking Boxes

Geometry of the bars

▶ 48 bars ($15 \times 10 \times 500$ mm) in two half-layers shifted against each other

▶ Second layer rotated by $90°$ for position resolution along the other axis

▶ Every layer in a separate light-proof box

Tracking Boxes

Readout of the bars

▶ Readout via one SiPM at the top of each bar

▶ 24 SiPMs are grouped together on one PCB

▶ Passing the signals to the readout system via micro-coaxial-cables
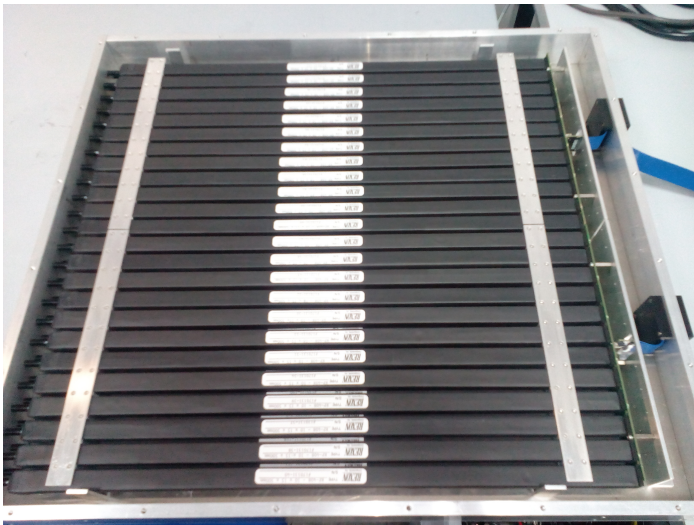
▶ Shielding of reflected light via foam

Stäbe
PCB
Schaumstoff
SiPM

Figure: One of the tracking boxes without lid.

Trigger Plates

Trigger plates

- ▶ 50×50 cm homogeneous scintillating plate with cut off corners
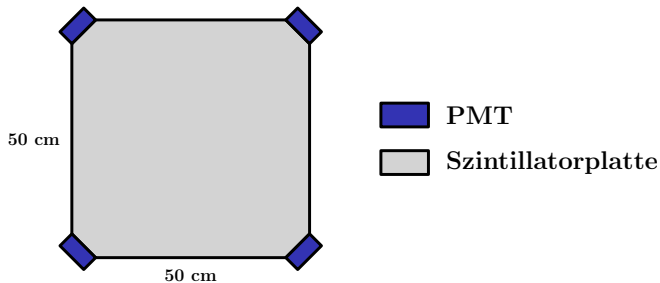- ▶ Readout via four PMTs in each of the corners

■ PMT
■ Szintillatorplatte
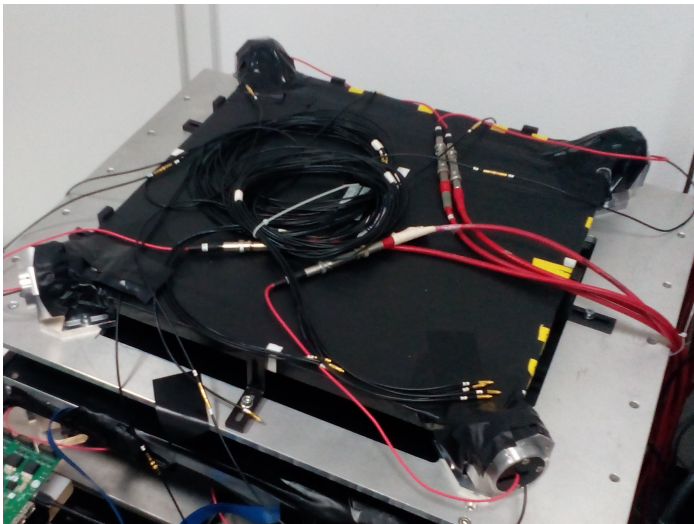
Figure: Schematic drawing of one of trigger plates.

Figure: One of the trigger plates.

Finger Counters

Detector to test . . .

- ▶ Cross of two small scintillating bars
- ▶ Readout via PMTs
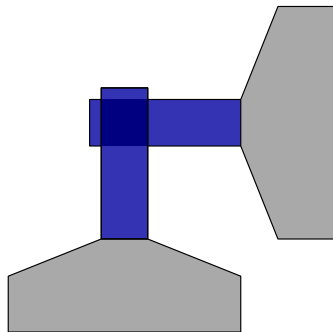- ▶ Overlapping area of approx. $1,8 \times 1,8$ cm

Figure: Schematic drawing of the finger counters.

Finger Counters

Figure: Overview and detailed image of the finger counters.

Readout and Slow-ontrol

Readout

- ▶ All 202 channels readout with the same ASIC-based system
- ▶ Trigger and finger signals are inverted
- ▶ Off-line analysis and event selection

Additional monitoring of . . .

- ▶ ASIC temperature
- ▶ Inverter current and HV channels
- ▶ Ambient pressure, temperature and humidity
- ▶ Light level

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Testruns

Measurment

- ▶ Running nonstop for approx. 64 days
- ▶ Acquisition performed in 30 minute runs (2922 in total)
- ▶ A total of approx. $6.7 \cdot 10^6$ events with "clean" tracking information collected ($600 \cdot 10^3$ trigger hits)
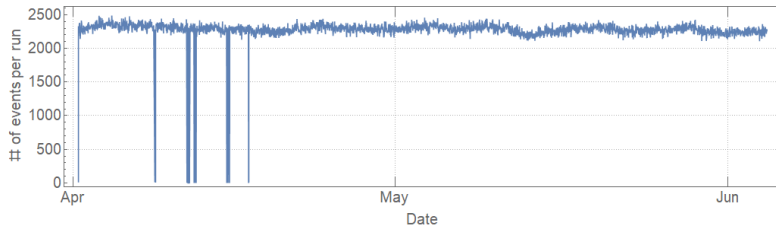

Figure: Number of "clean" tracking events per run.

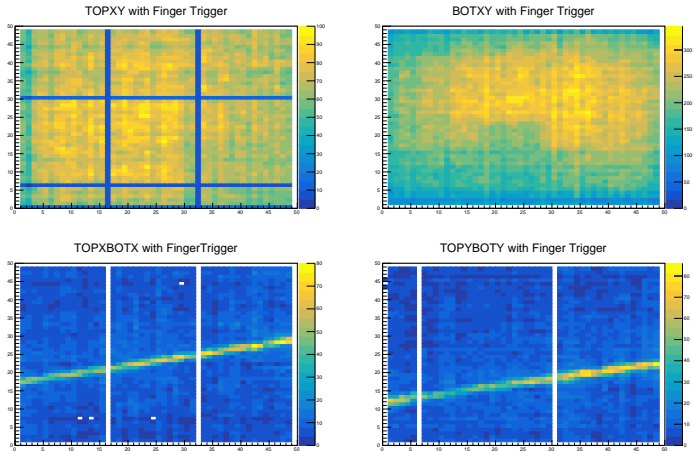# Finger Counters - Coordinate correlation

Figure: 2D-Histogram of the coordinate combinations (X_{top}, Y_{top}), (X_{bot}, Y_{bot}), (X_{top}, X_{bot}) and (Y_{top}, Y_{bot}) for events in coincidence with the finger counters.
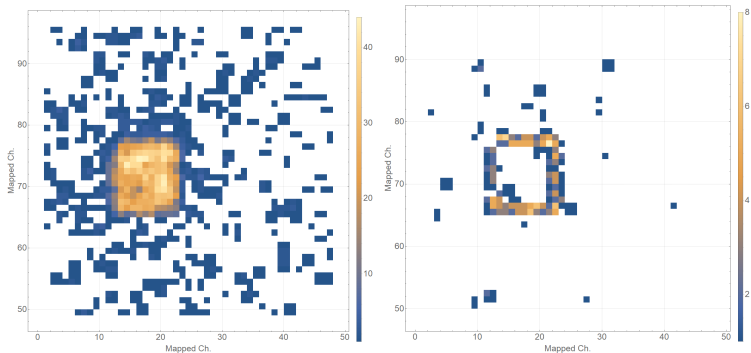
Finger Counters - Image of the top tracking boxes

Figure: 2D-Histogram of the coordinate combinations (X_{bot}, Y_{bot}) for events in coincidence with the finger counters and the top tracking ensemble.
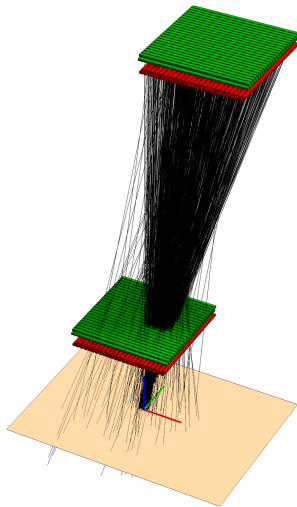
Finger Counters - Track Reconstruction

Figure: 3D visualization of the reconstructed tracks.

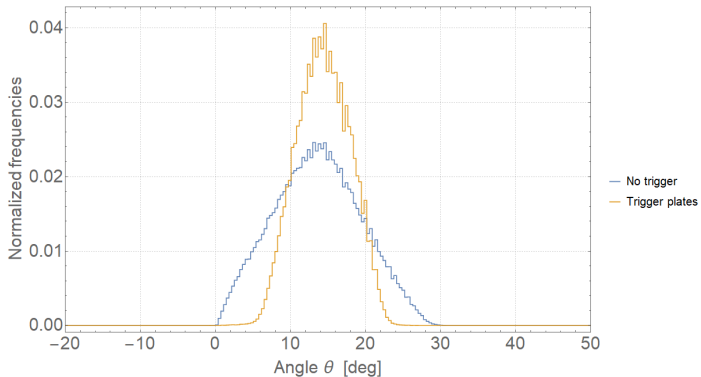# Reconstruction - Angular Distribution

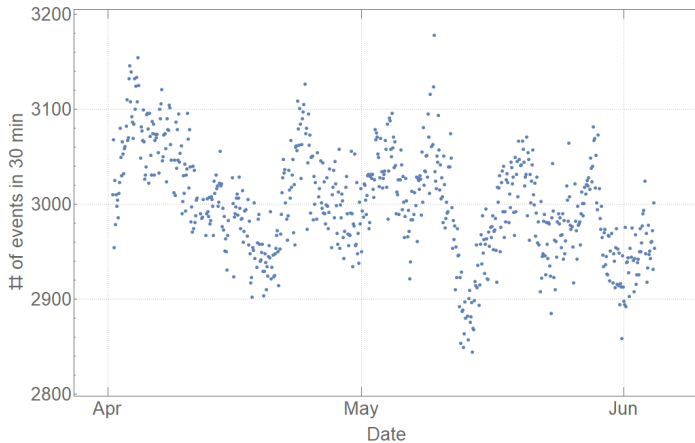Figure: Angular distribution with and without trigger plates.

Event Rate

Figure: Number of events in 30 minutes averaged over 4 runs.
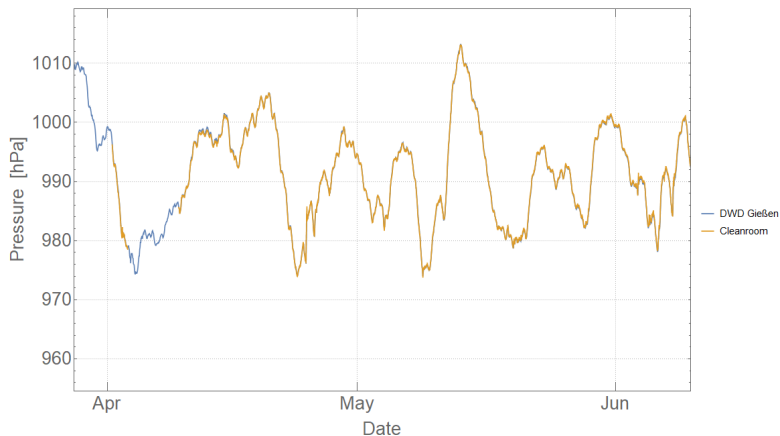
Ambient Pressure

Figure: Ambient pressure measured locally in the clean room (orange) and data provided by "'Deutscher Wetterdienst"' (blue).

Data for station 01639 (Gießen) provided by "Deutscher Wetterdienst" (Open data server). Last accessed 25.06.2019.

ftp://ftp-cdc.dwd.de/pub/CDC/observations_germany/climate/hourly/pressure/recent/stundenwerte_P0_01639_akt.zip
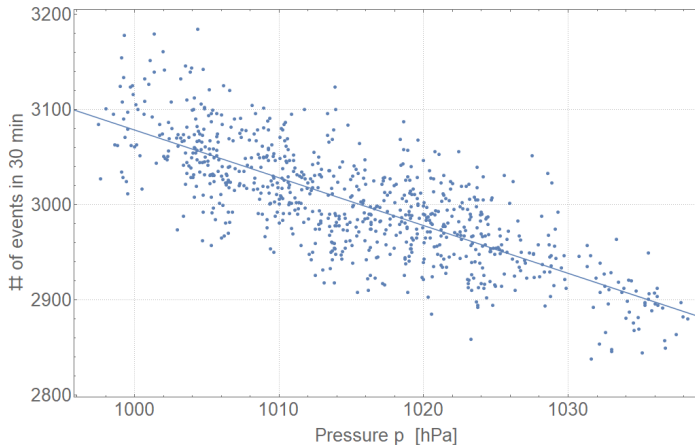
Event Rate - Pressure Correlation

Figure: Scatter plot with fit of the pressure versus the number of events in 30 minutes. $(8096 - 5.018 \cdot p)$
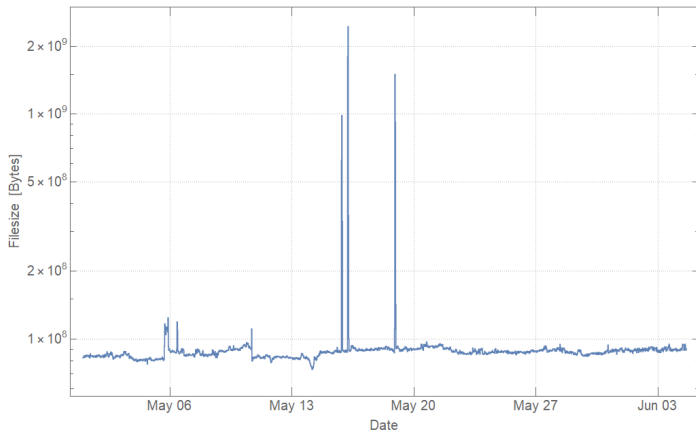
Open Questions - File Sizes

Figure: File sizes of the may runs show short spikes in data rate of the trigger and finger channels.

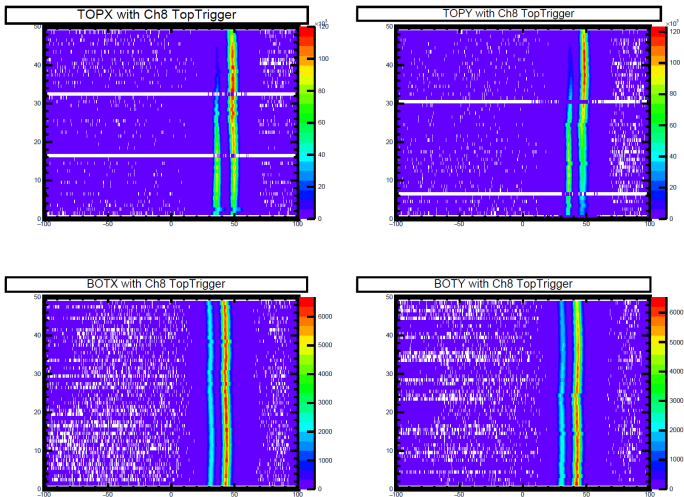# Open Questions - Time Differences

Figure: Time difference between PMT8 (top trigger) and bars (Tracking boxes).
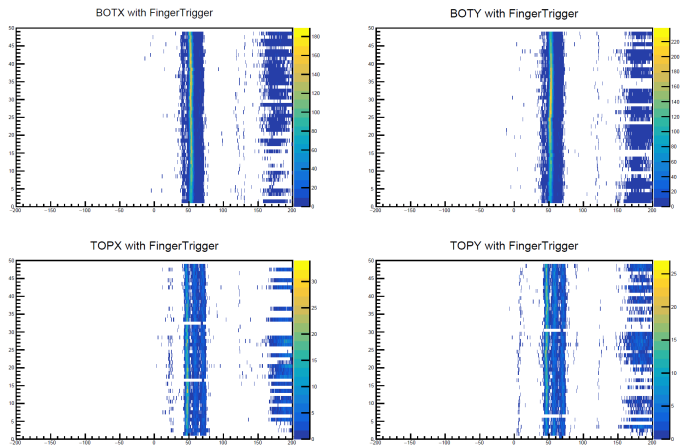
Open Questions - Time Differences

Figure: Time difference between fingers and bars (tracking boxes).

Conclusion

Summary

- ▶ Data acquisition and reconstruction working
- ▶ Successful operated for 2 months
- ▶ A few minor problems left

Current status

- ▶ Off-line but fully operational!

Thank you for your attention!