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ATLAS PANDA HERMES AG Düren

Construction of a Cosmic Test Stand for Particle Detectors

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Outline

Introduction

Idea

- Using cosmic particles (esp. muons) for tests of the DIRC-detector

Requirements

- PID-algorithm requires position and direction of the particles
- Selection of muons with a minimum energy (> 750 MeV)
- Acceptance for slightly angled tracks (about $12°$)

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Overview

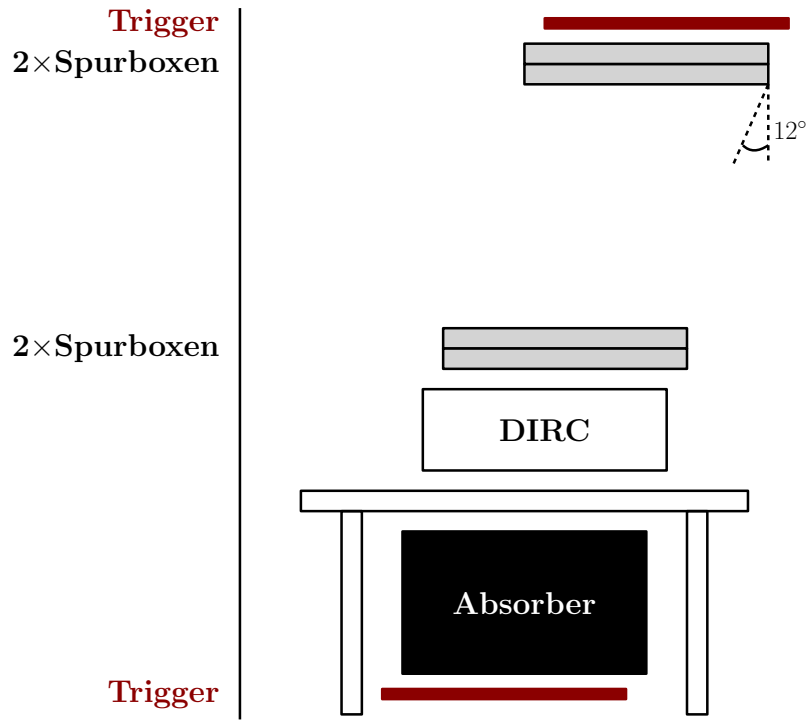
Track reconstruction

- 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

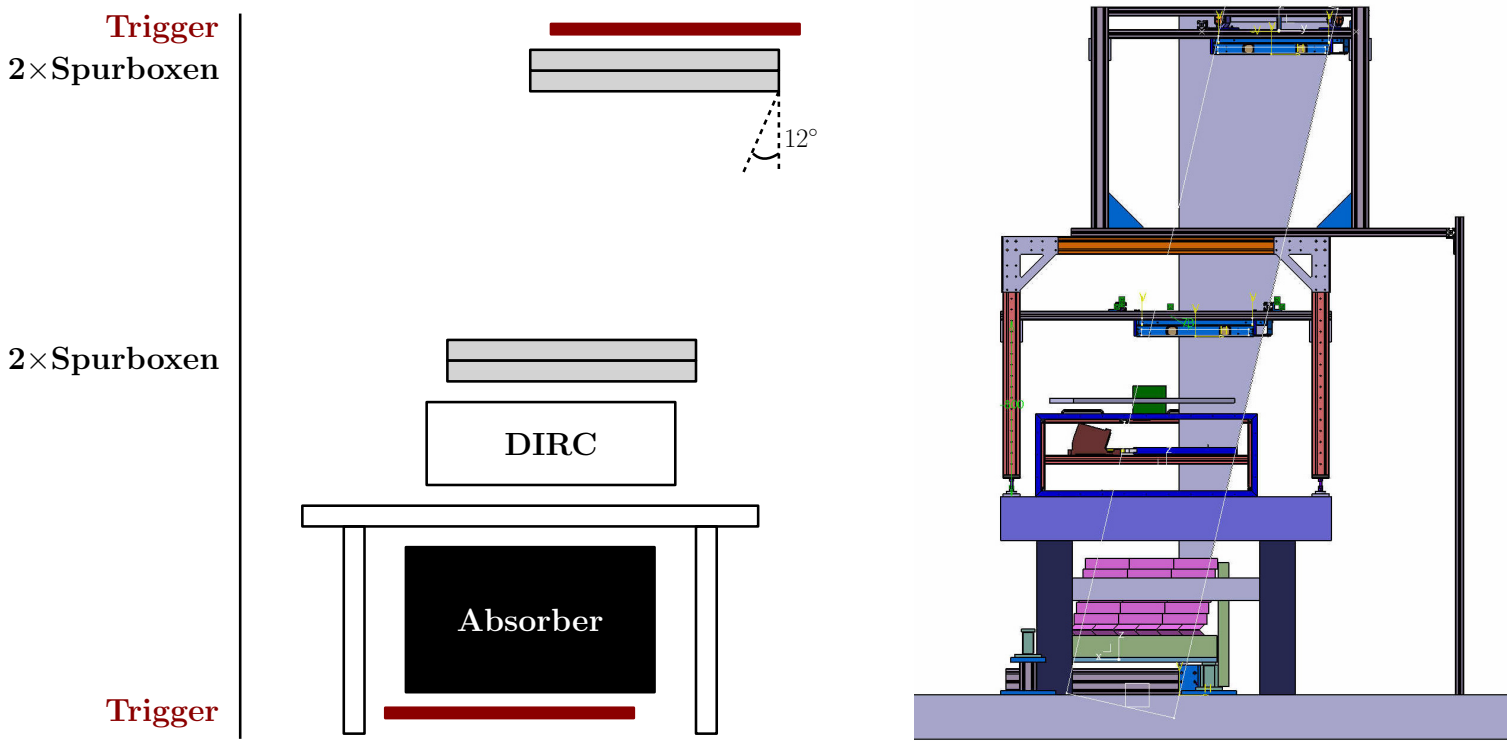


Abbildung: Schematic overview and CAD drawing.

Simulation

Expected resolution

- Polar angle: 3,2 mrad
- Azimuthal angle: 20,4 mrad
- spatial resolution: 4,5 mm

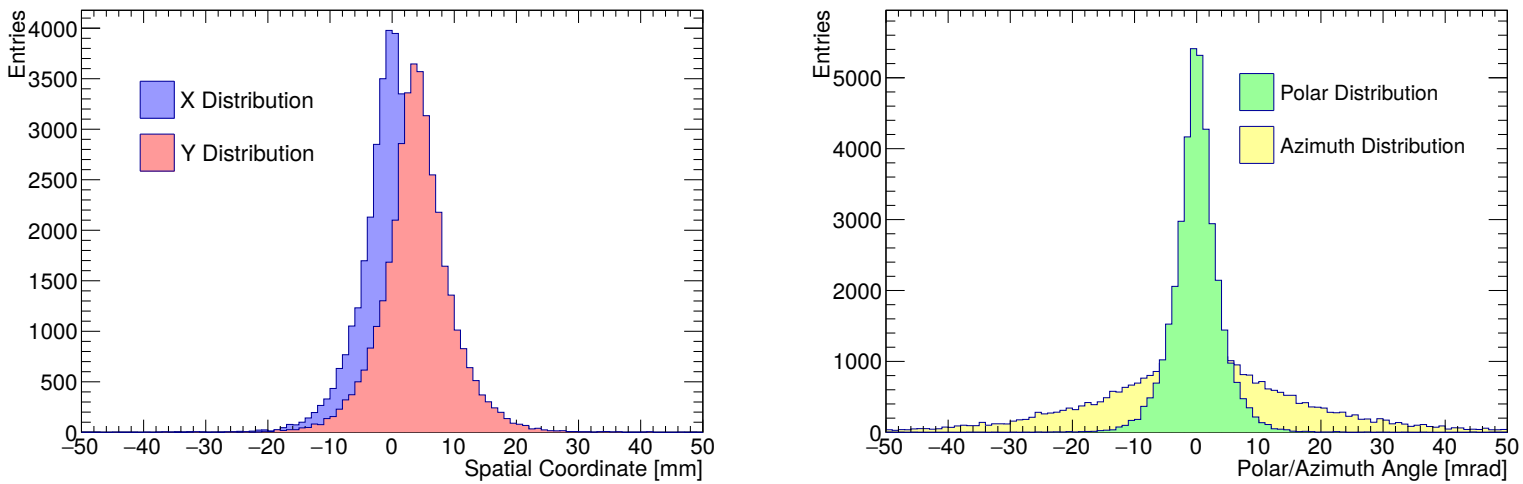
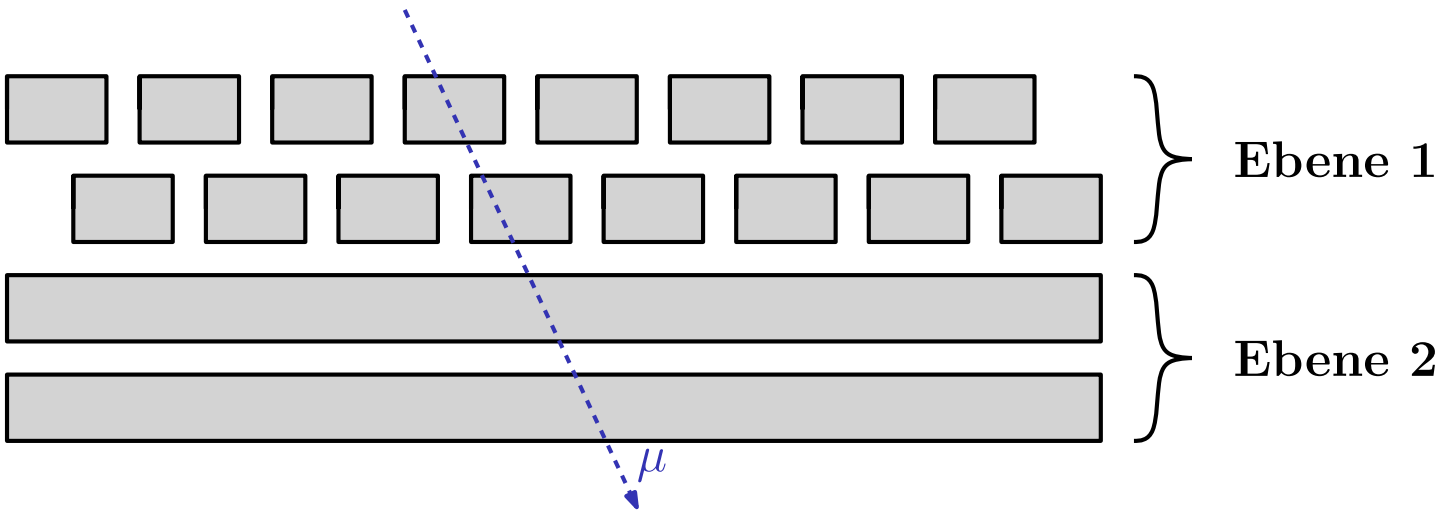


Abbildung: Expected resolution for position (left) and angle (right).

Tracking boxes

Geometry of the bars

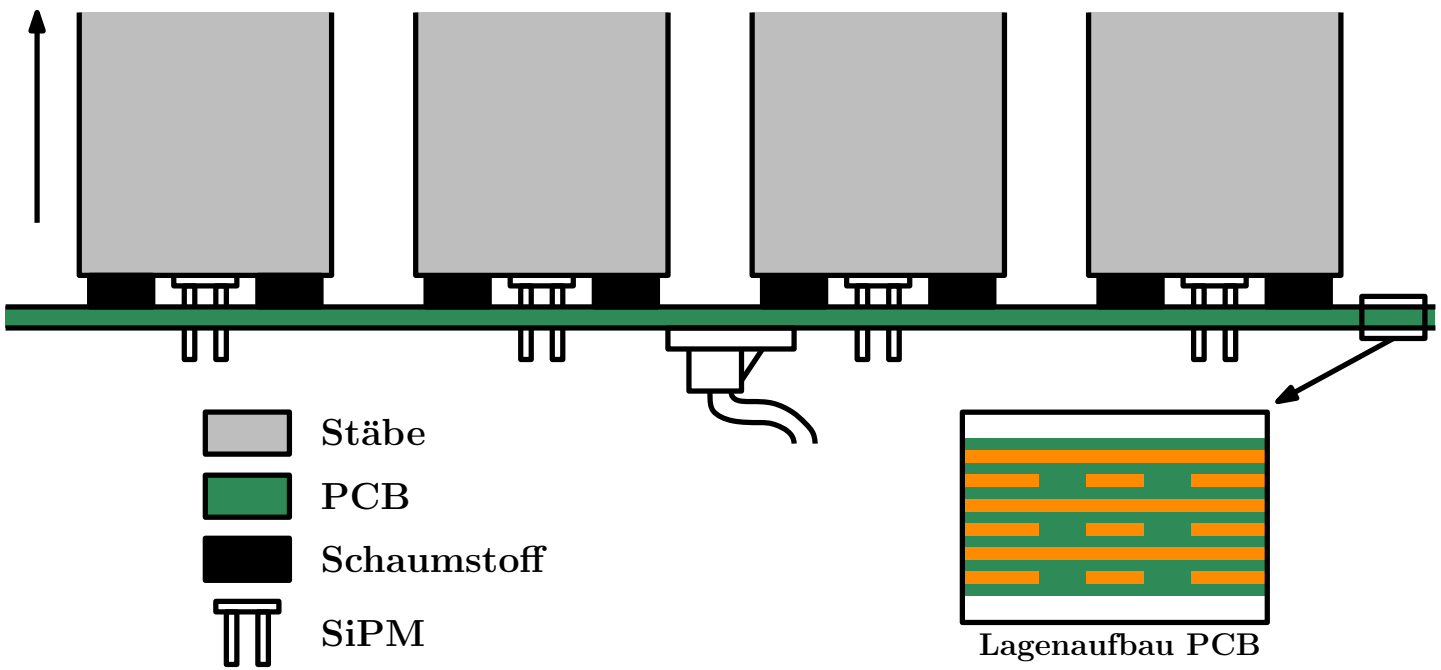
- 48 bars ($15 \times 10 \times 500$ mm) in two half-layers shifted against each other
- Second layer rotated by 90° for position resolution along the other axis
- Every layer in a separate light-proof box



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



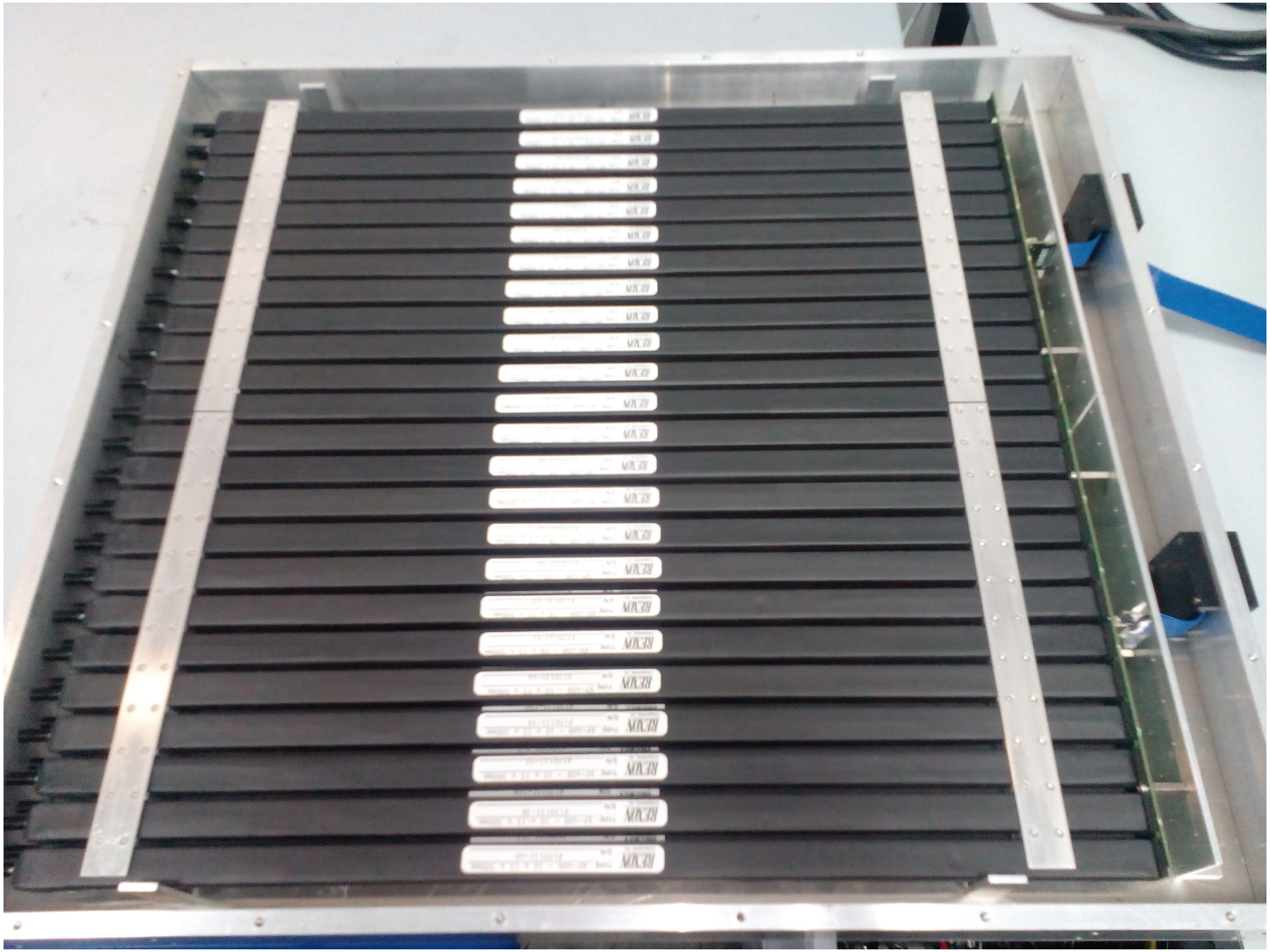


Abbildung: One of the tracking boxes without lid.

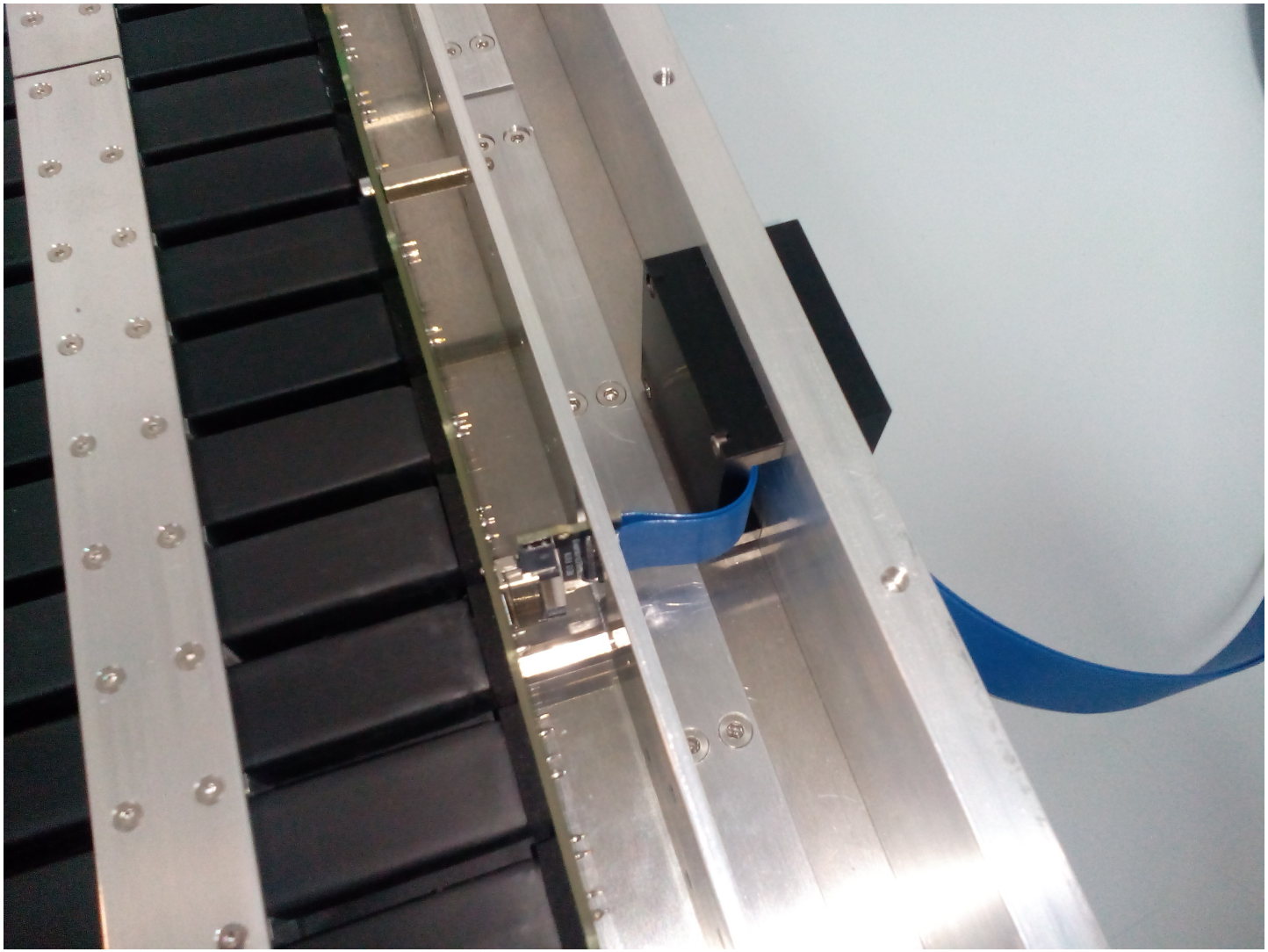


Abbildung: Image of the readout of the bars and the feed-though of the cable.

Abbildung: Each bar is pressed against the SiPM via spring loaded pins.

Trigger plates

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

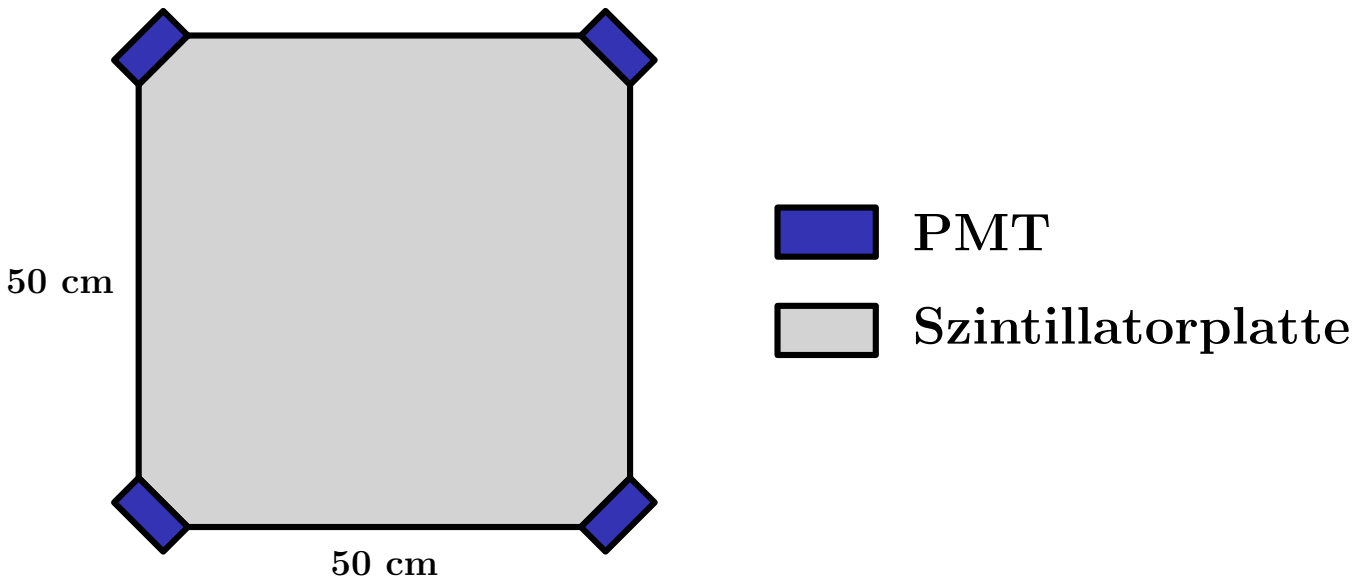


Abbildung: Schematic drawing of one of trigger plates.

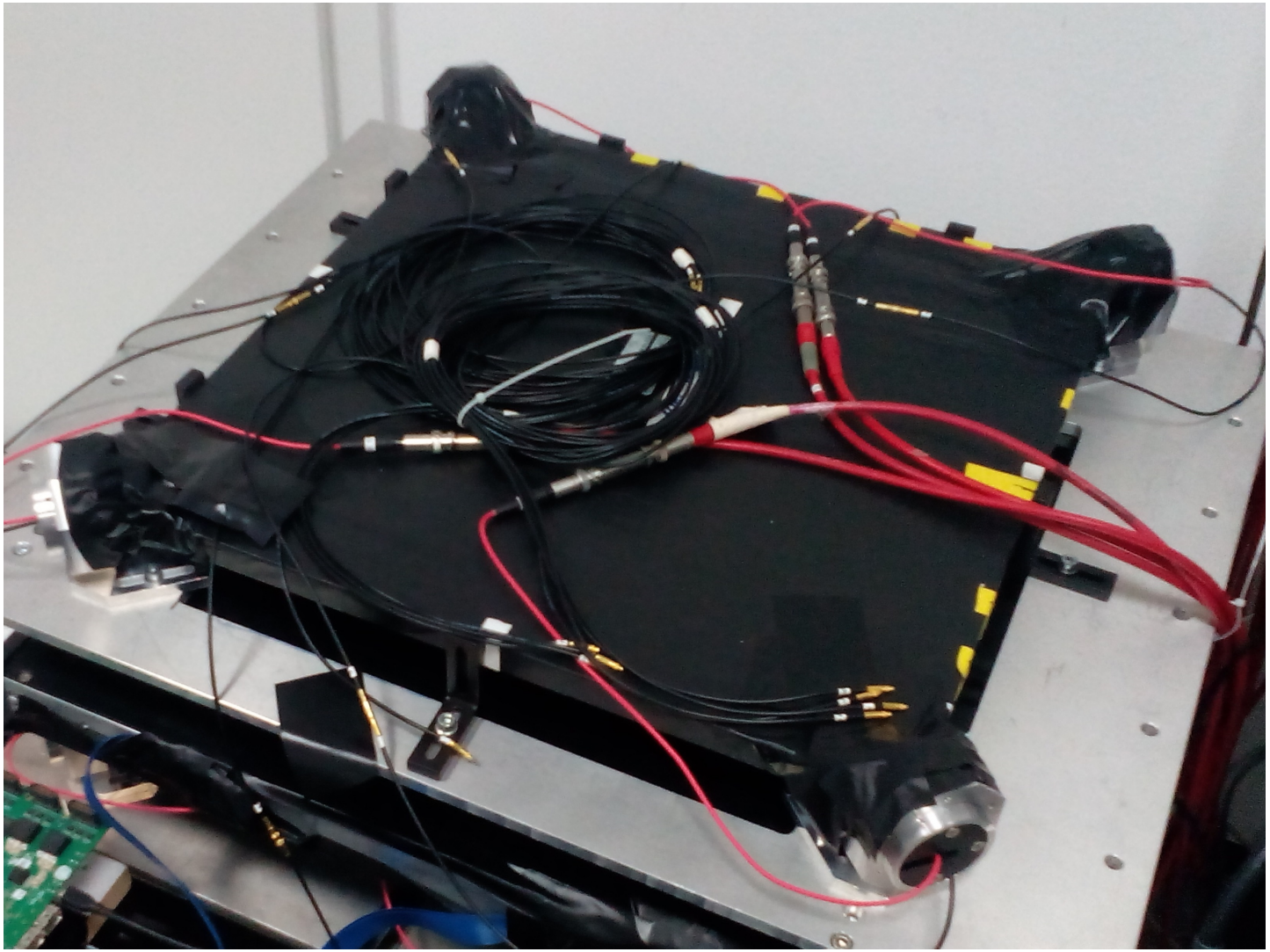


Abbildung: One of the trigger plates.

Readout system

Readout system

- ASIC based Readout (TOFPET)
- Detector and test stand is read out with the same system
- Definition of trigger and reconstruction will be done off-line

Channel distribution

- 64 channels per ASIC and two ASICs per board
- For short analogue paths one board is placed near each pair of tracking boxes

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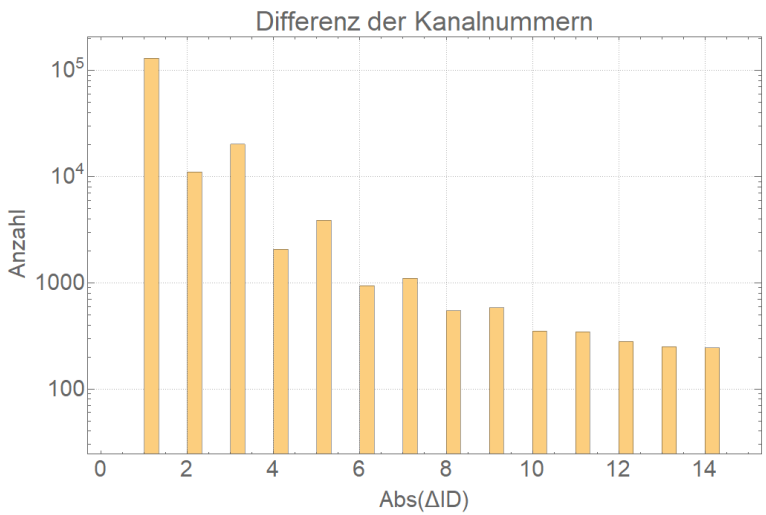
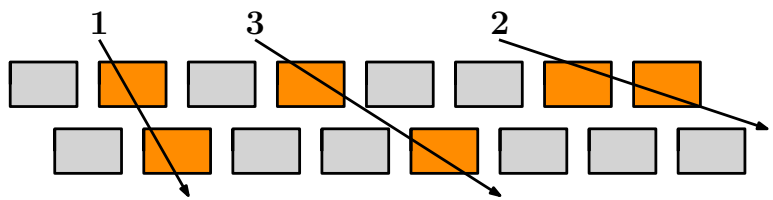
Coincidence measurements

Channel ID differences

- Histogram of the absolute difference of channel numbers (position) for coincidences with a multiplicity of two
- Events between bars inside one half-layer (even differences) are suppressed

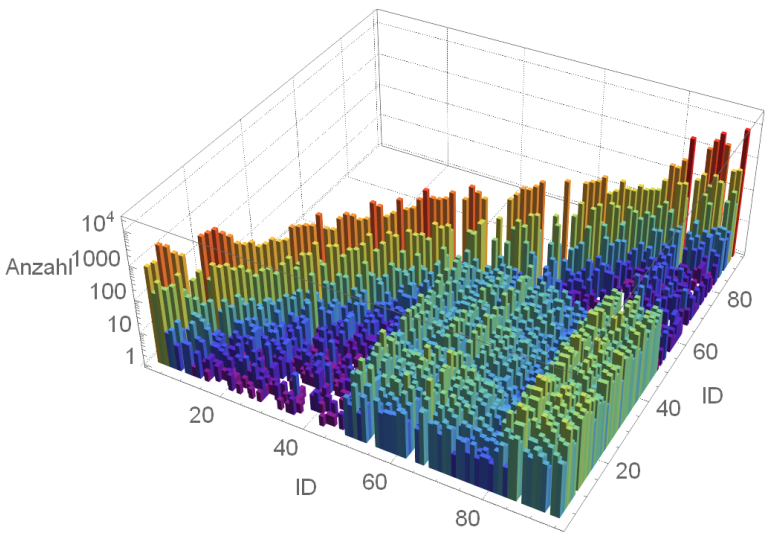


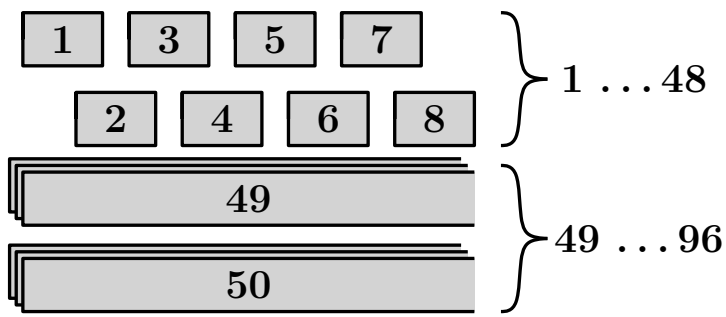


Coincidence measurements

Channel ID combinations

- 3D-histogram of the coincidences (multiplicity 2) for two boxes
- Dominant diagonal contains neighboured bars
- Plateau in the lower right corner contains coincidences in-between the boxes





Current status and outlook

Current status

- Both triggerplates are ready for use
- 2 of the 4 tracking boxes are ready for use
- First measurements with TOFPET (and TOFPET2 eval.-Kit) have been performed
- The mechanic with the lead absorber has been installed

In the near future

- Optimization of the readout
- Completion of the remaining components
- Operation!

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Thank you for your attention!

Zusätzliche Folien

Akzeptanz des Detektors

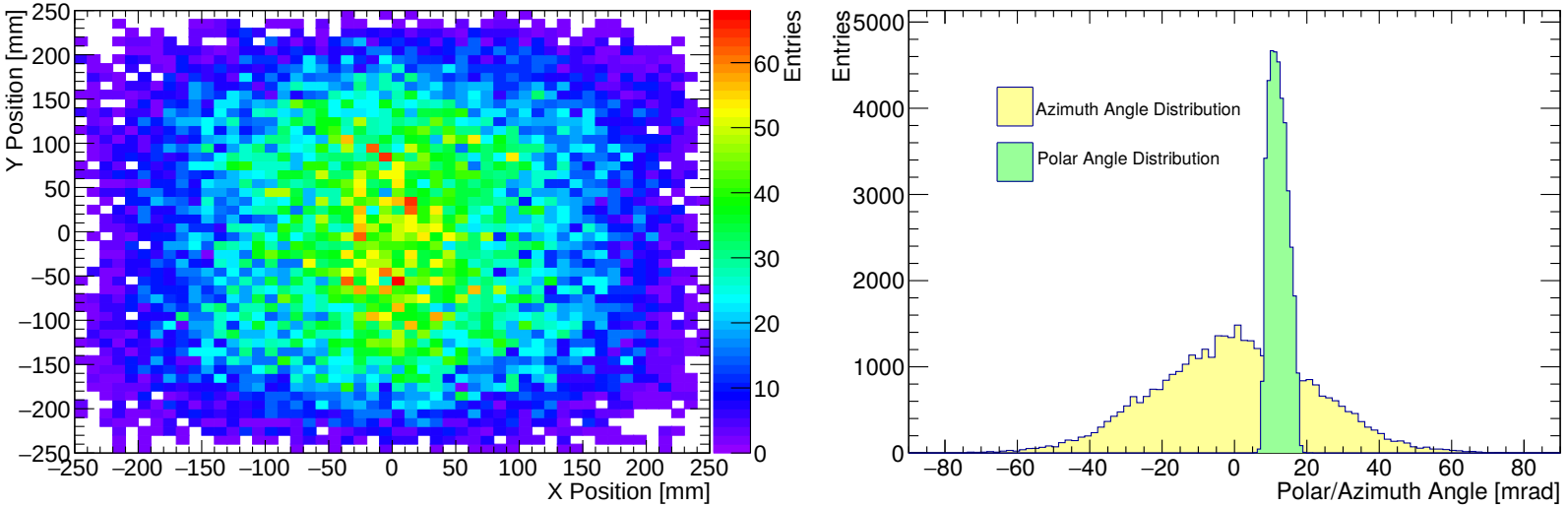

Abbildung: Akzeptanz für Position (links) und Winkel (rechts).

Anschluss des Auslesesystems

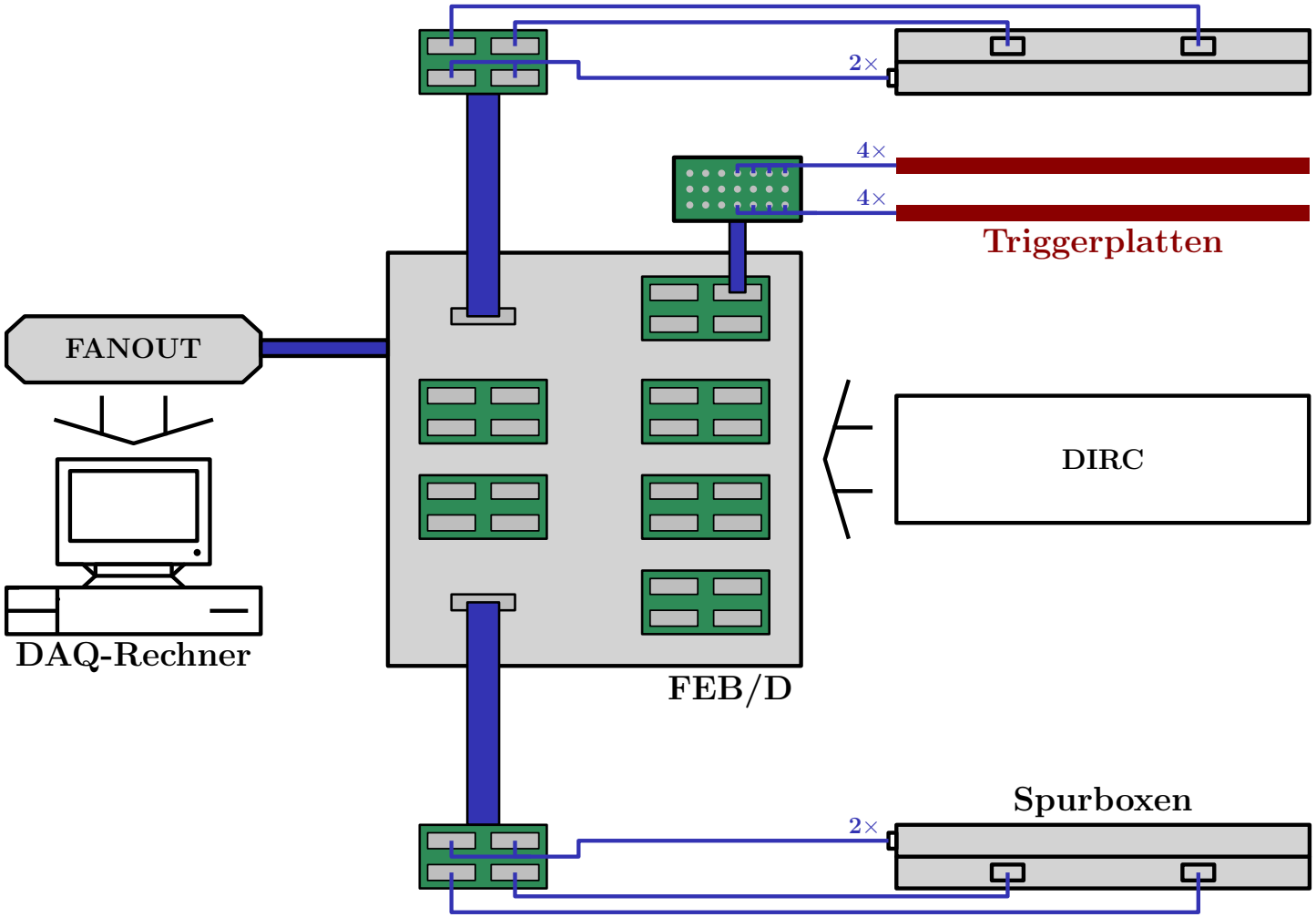

Abbildung: Schematische Darstellung der Anbindung des Auslesesystems an den Teststand.

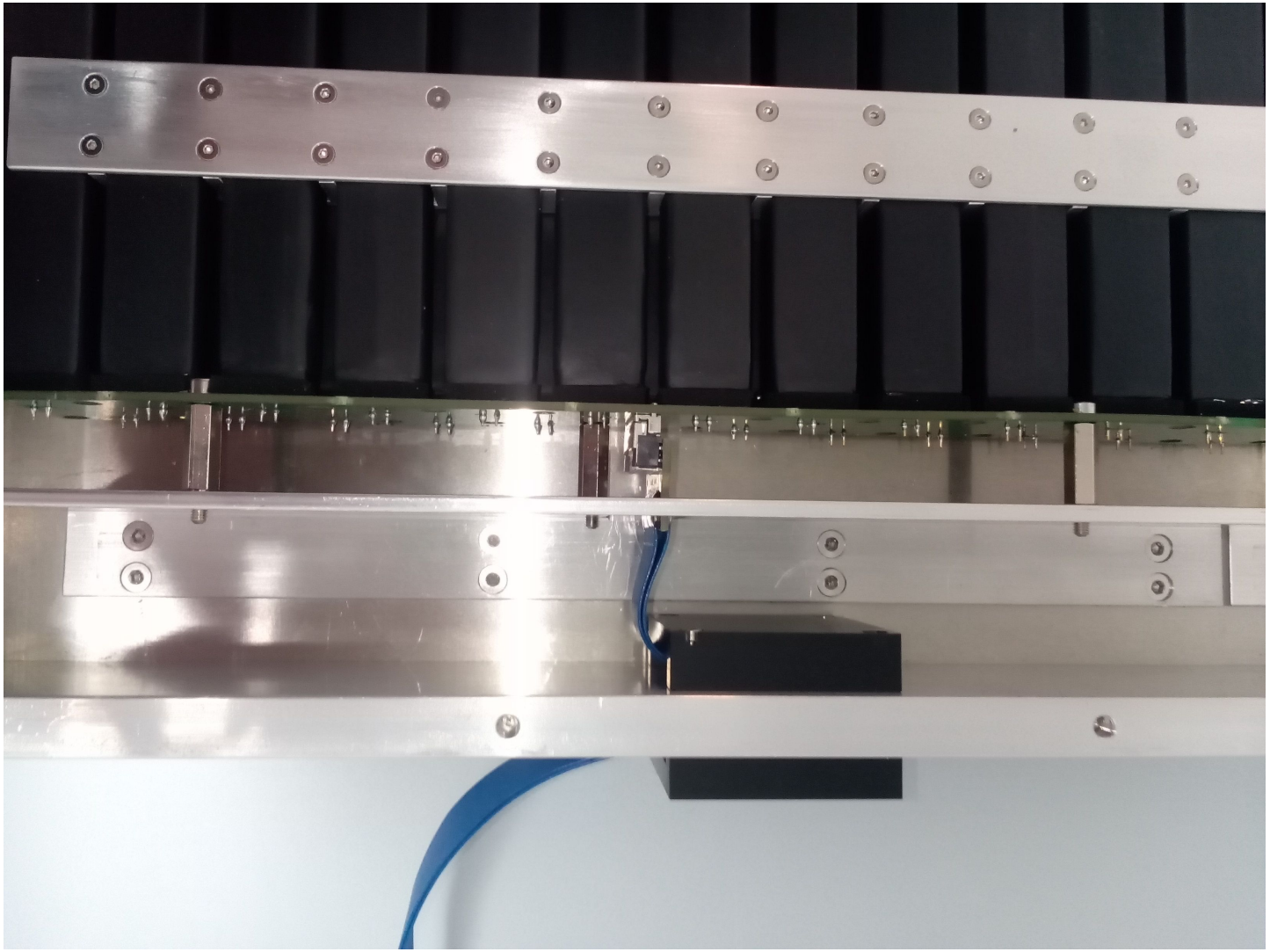

Abbildung: Umsetzung des Anschlusses von PCB und SiPMs.

Abbildung: Bild der unbestückten PCB.

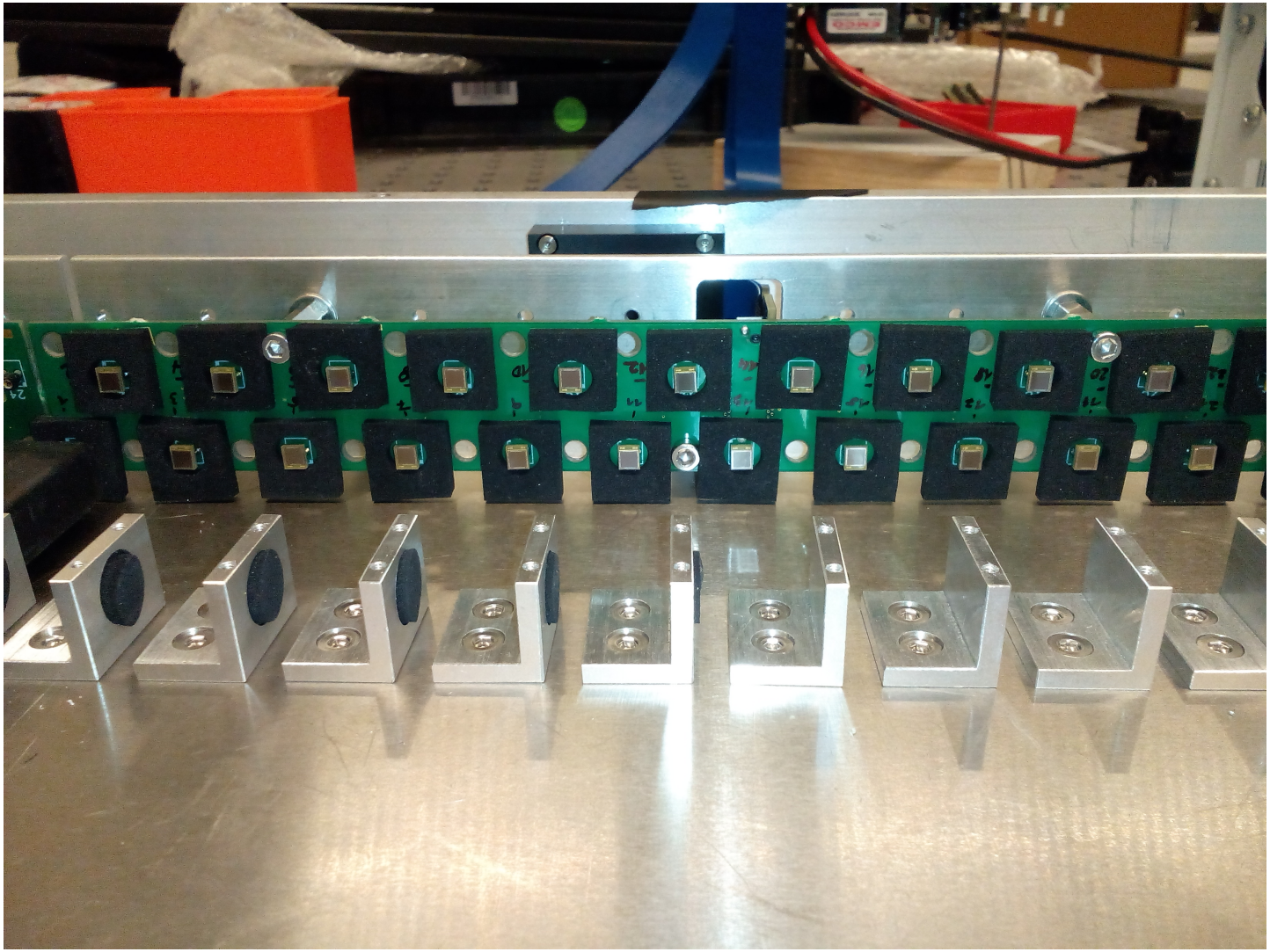

Abbildung: Bild der bestückten PCB mit Schaumstoff ohne Stäbe.

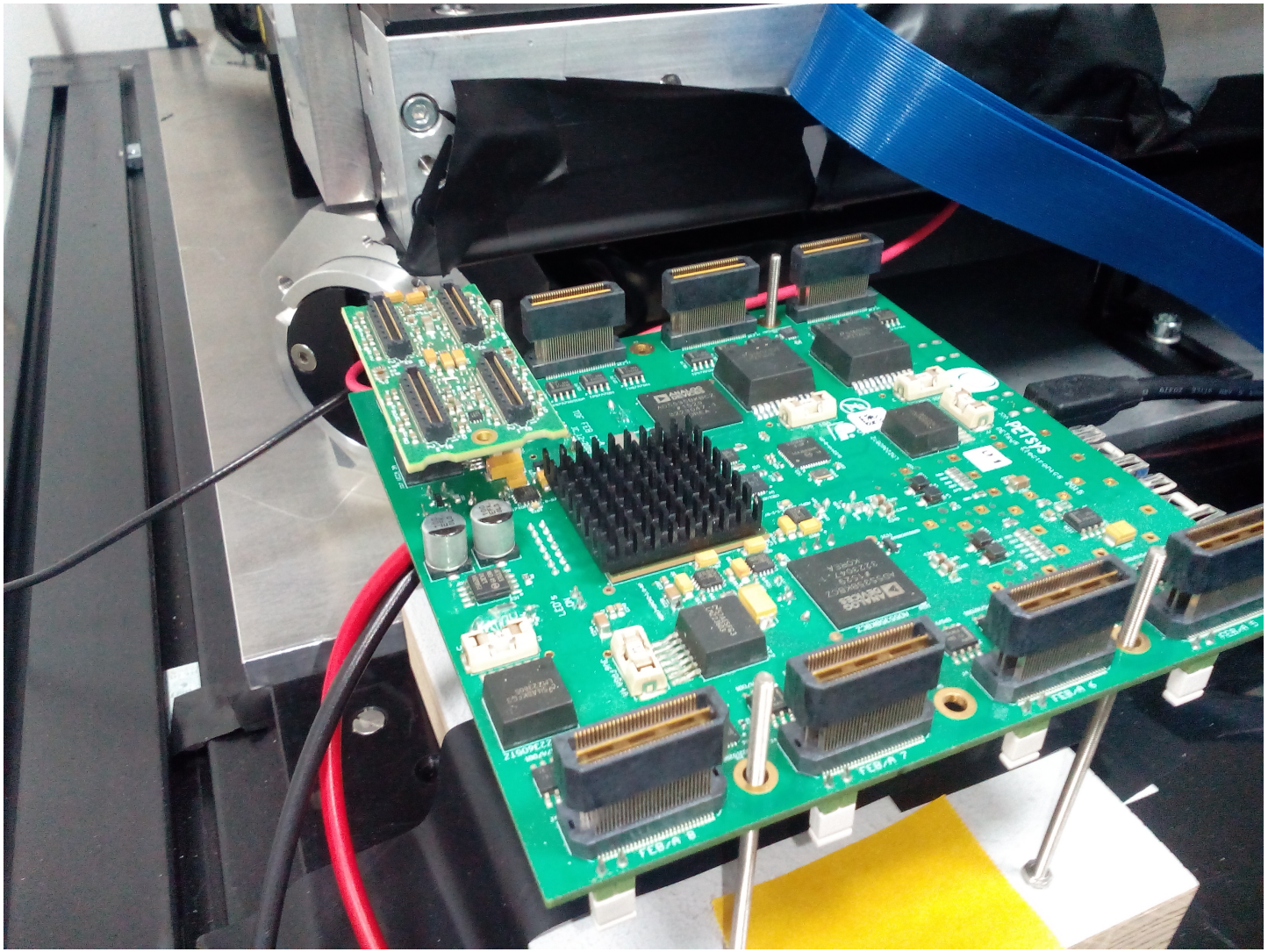

Abbildung: TOFPET Version 1 mit zwei ASICS (ein Frontend-Board) ohne angeschlossene Detektoren.

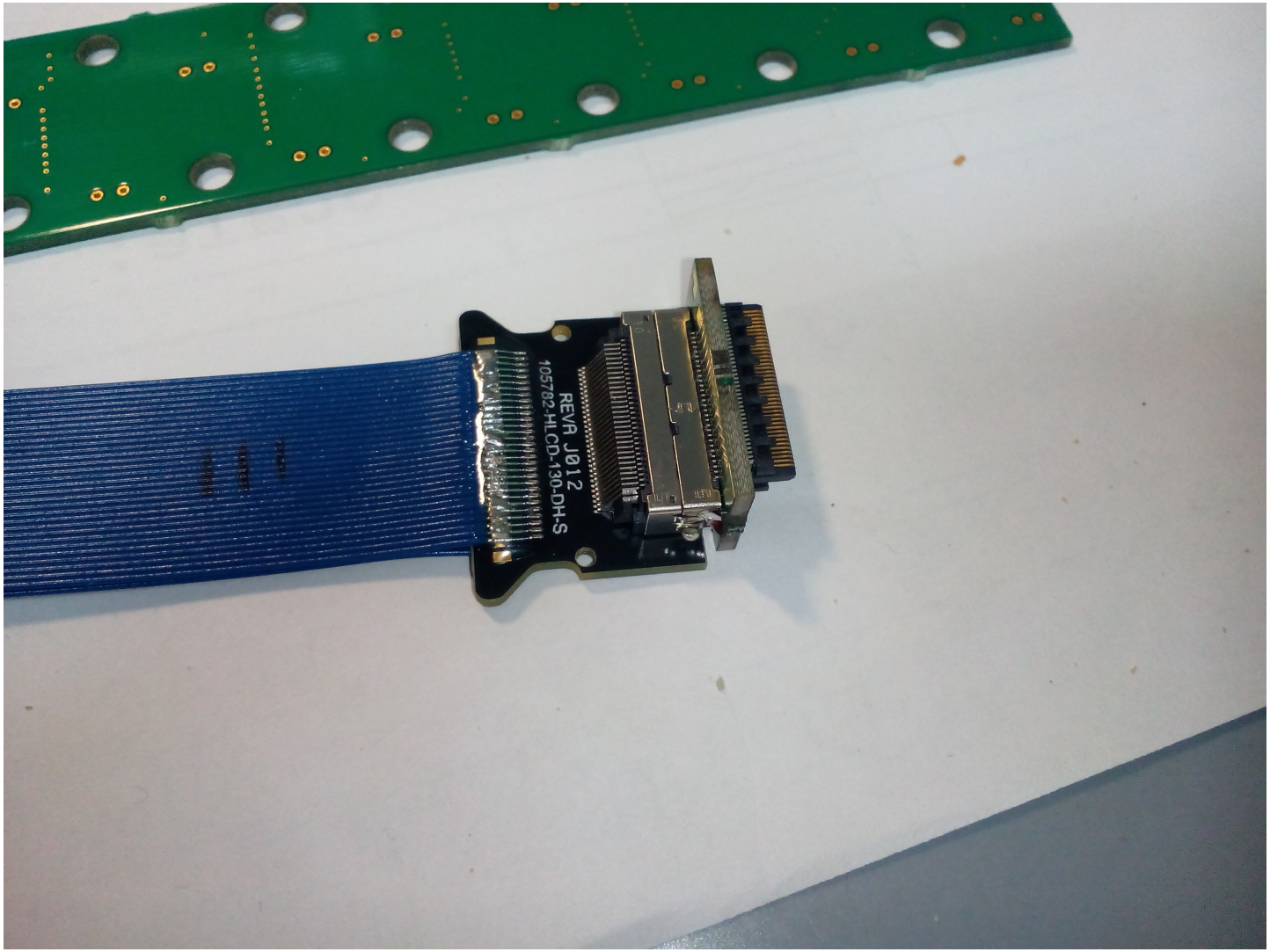

Abbildung: Kabel mit Adapterboard.

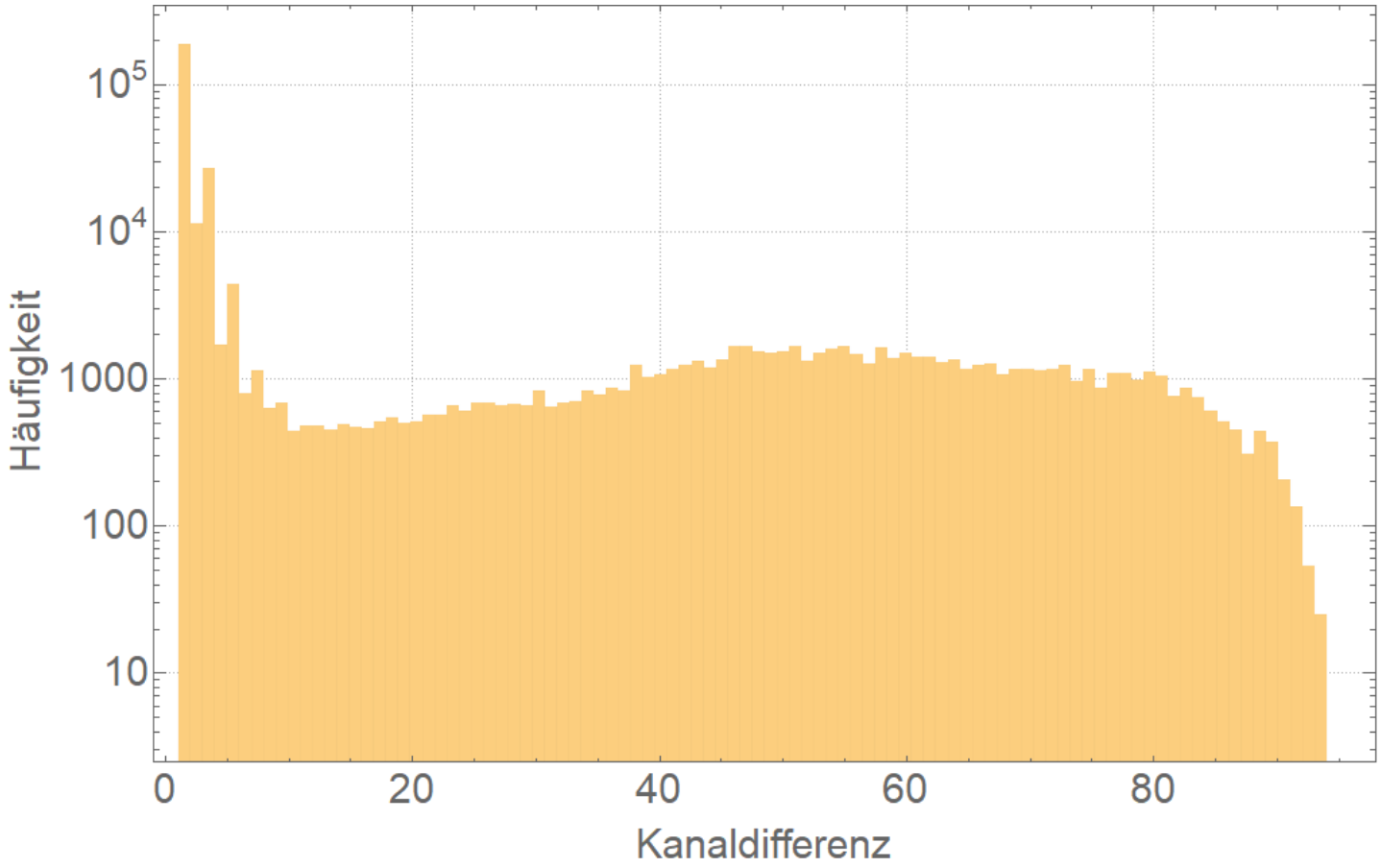

Abbildung: Kanalnummerdifferenz für zwei Spurboxen.

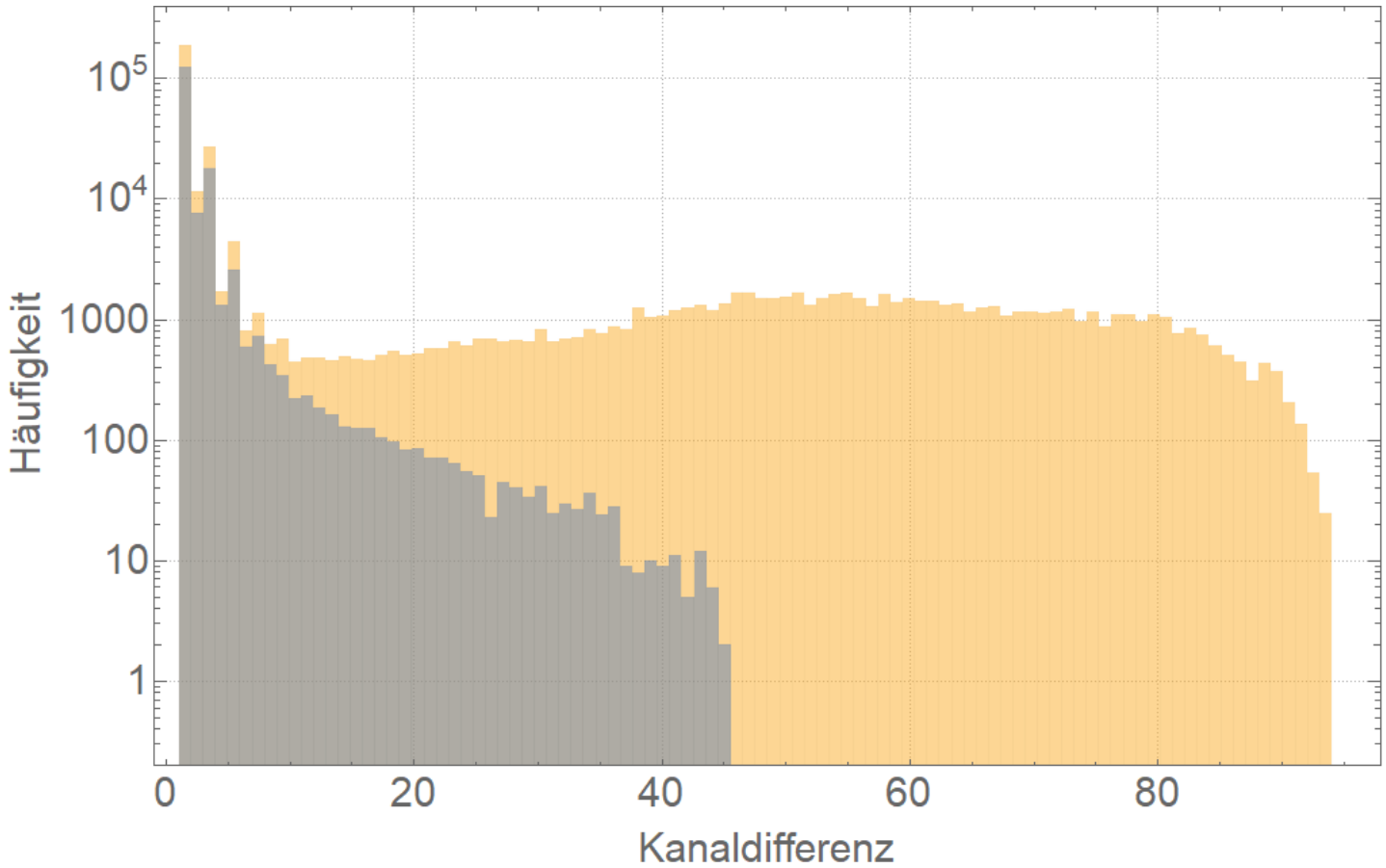

Abbildung: Kanalnummerdifferenz für eine (grau) und zwei (gelb) Spurboxen.