Performance of silicon strip detectors in direct contact with absorbers for the secondary target at PANDA

Sebastian Bleser

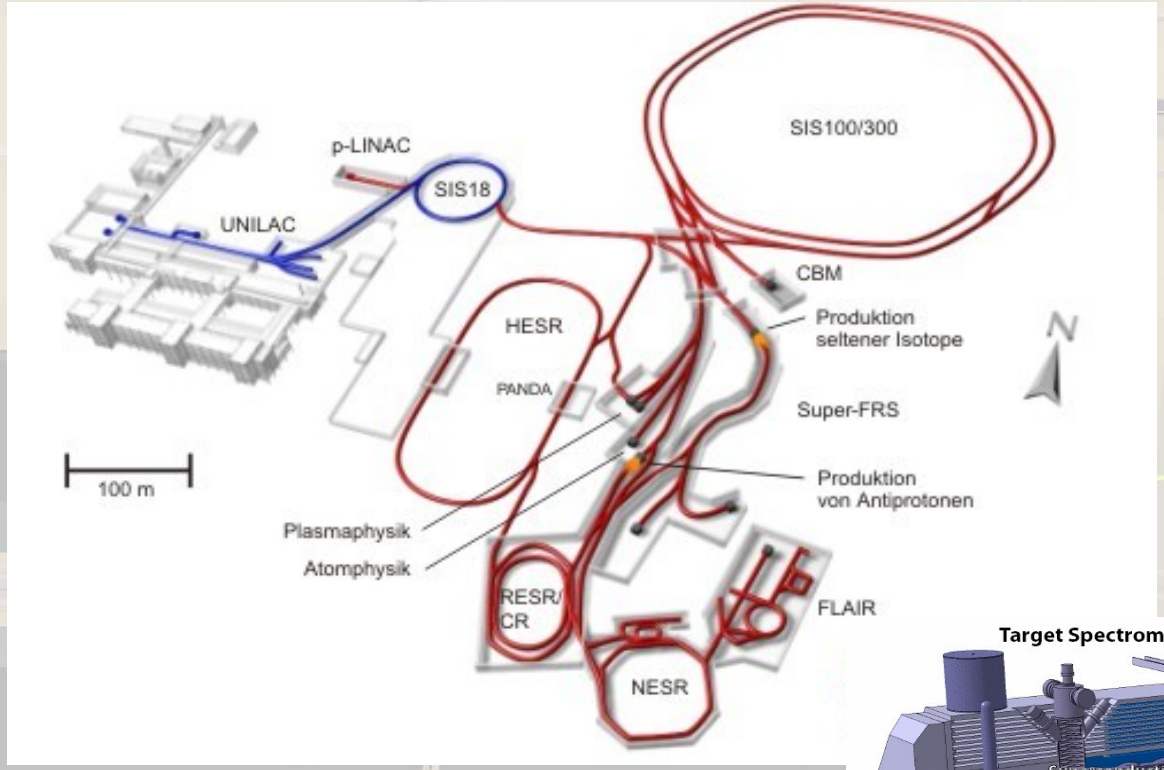
Institute of Nuclear Physics
Johannes Gutenberg-Universität Mainz

Joint SPHERE and JSPS Meeting 2010, Prague, September 4-6

Outline

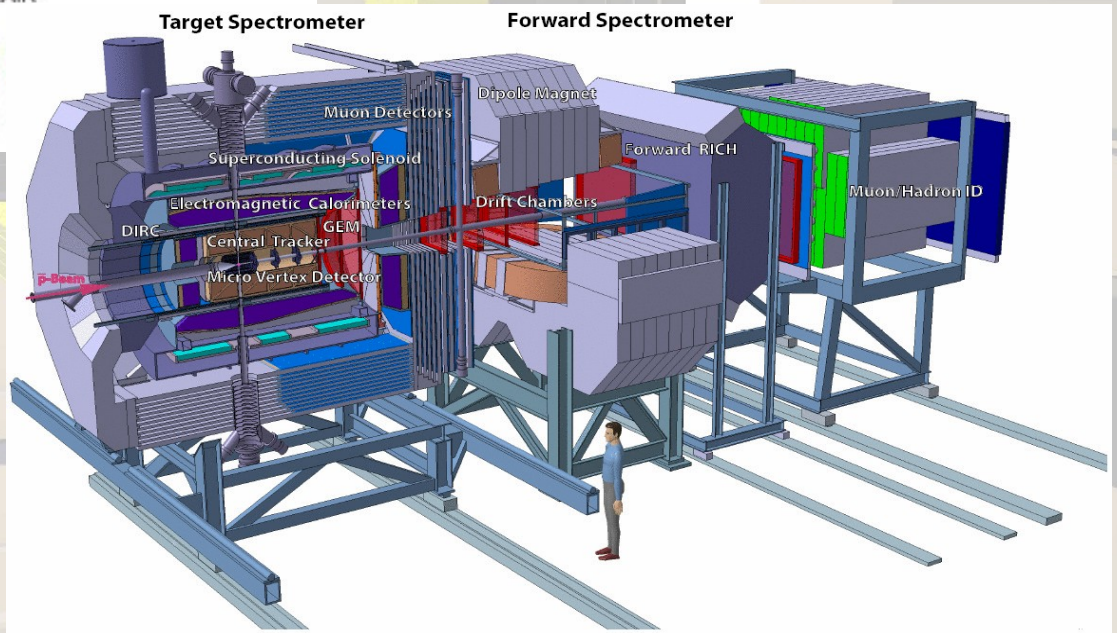
- Motivation
- Setup of the test station
- Measurements and Results
- Summary and Outlook

Motivation



FAIR:
Facility for Antiproton and Ion Research

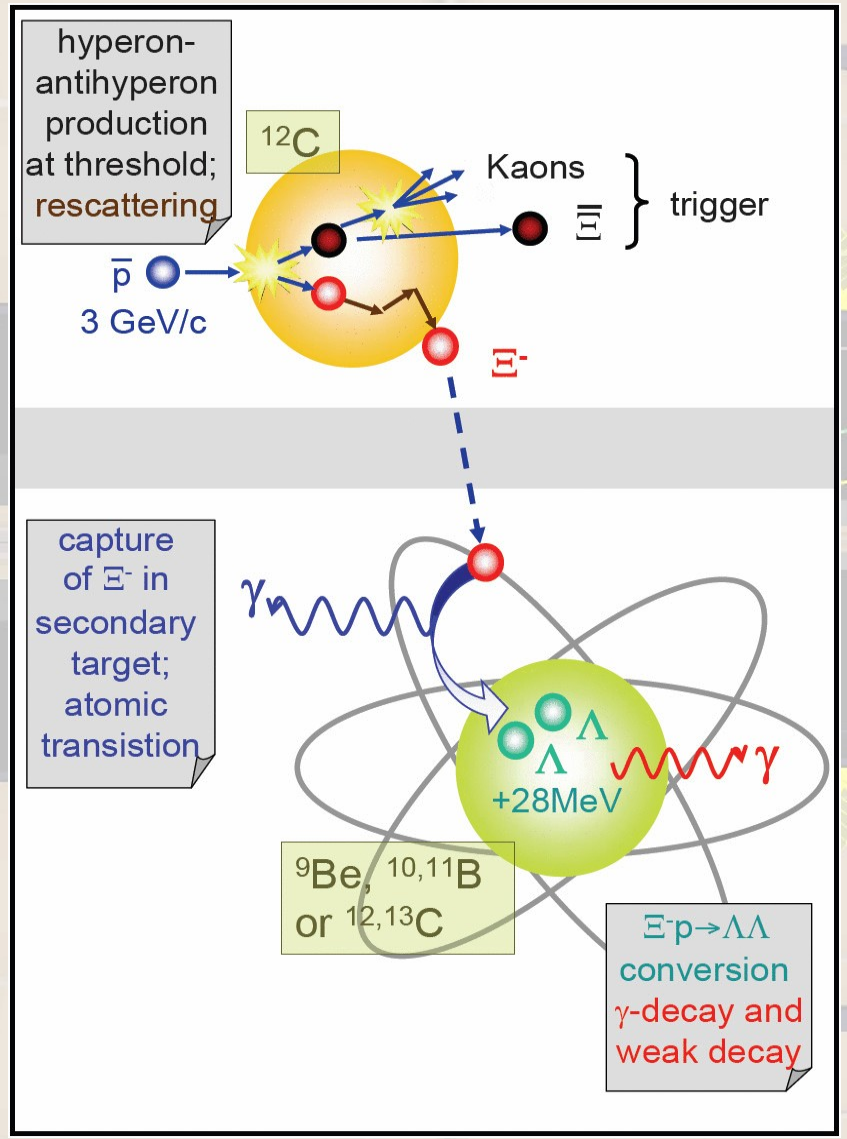
double ring accelerator at GSI
in Darmstadt
momenta of antiprotons in HESR
1.5 – 15 GeV/c



$\bar{\text{P}}$ANDA:
Anti-Proton Annihilation at Darmstadt

modular detector in the HESR

Motivation



Production of Λ-Λ-hypernuclei at $\bar{P}$ANDA

Primary Target:

- formation of Ξ^--particles in $\bar{p}$ + N – reactions

Secondary Target:

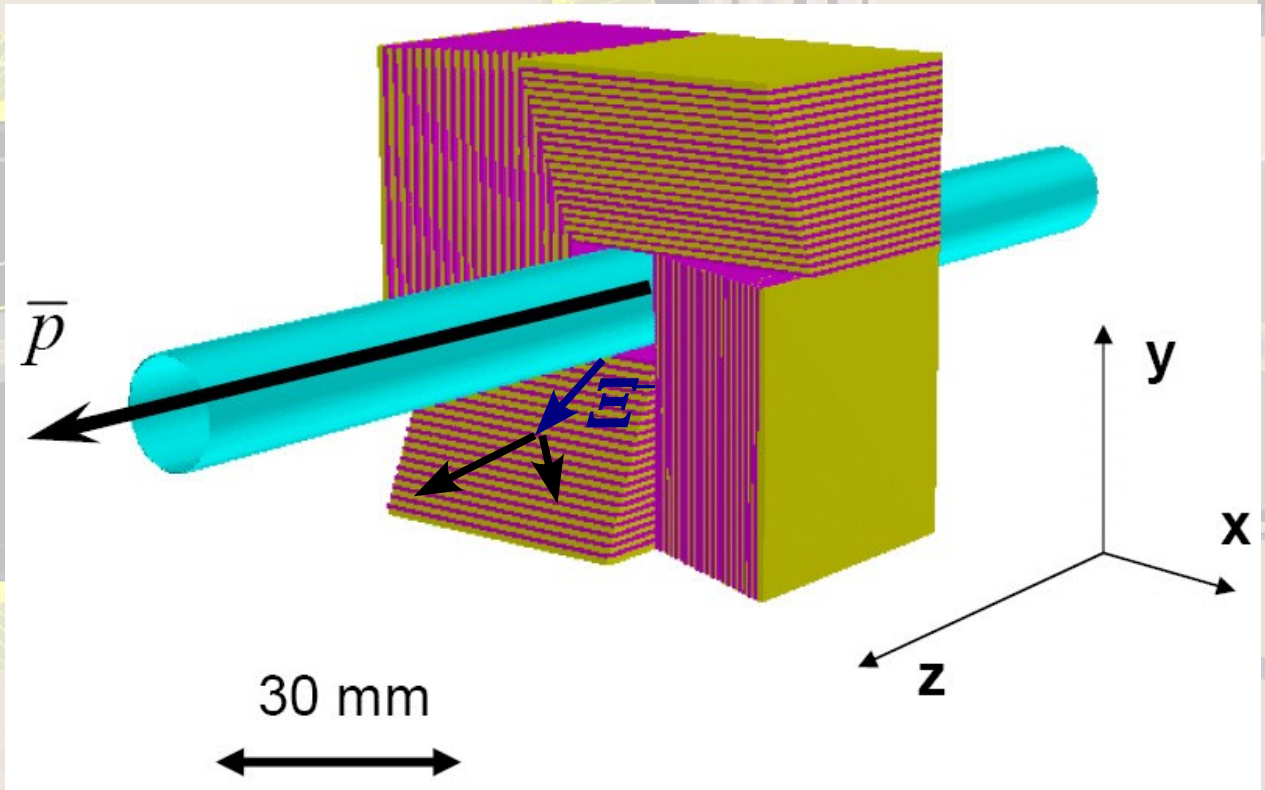
- deceleration of Ξ^--particles
- integration in the atomic shell of absorber atoms
- capture of Ξ^- by nucleus
- formation of Λ-Λ-hypernuclei by conversion
- detection of weak decay products

Motivation

Requirements for the secondary target

- alternating layers of Si strip detectors and absorber material
- adjusted to stop time and life time of Ξ^- as well as geometry
- tracking of Ξ^- and the decay products of Λ-Λ-hypernuclei

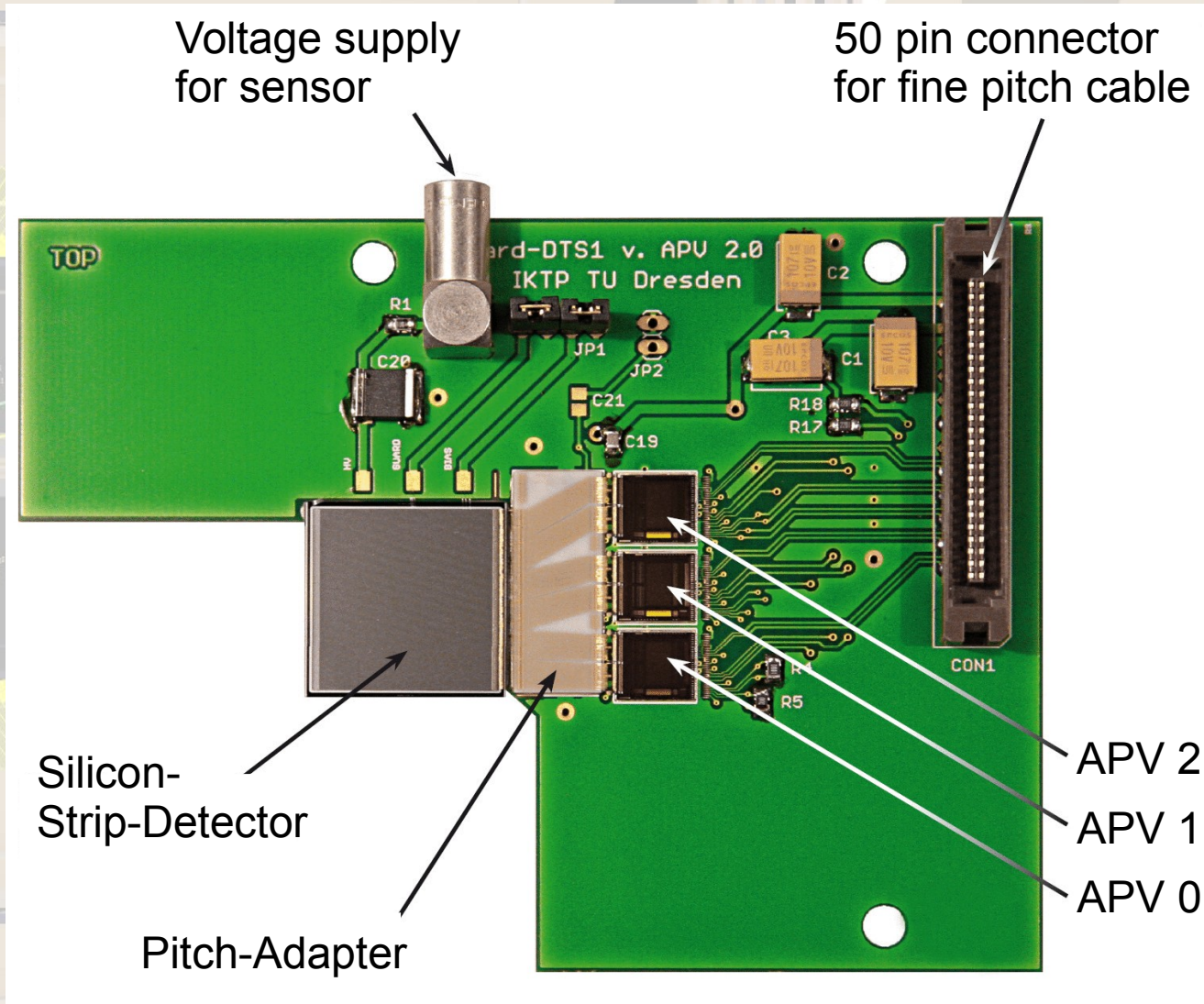
$\Rightarrow$ compact structure without gaps



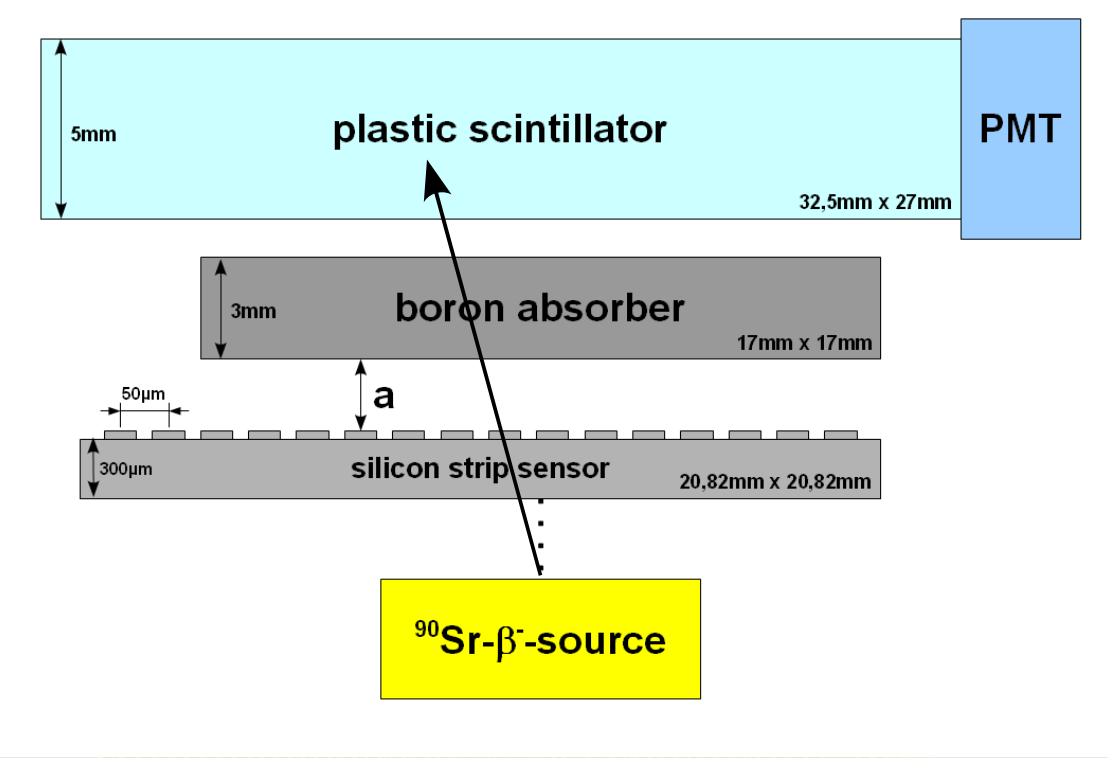
Setup of the test station

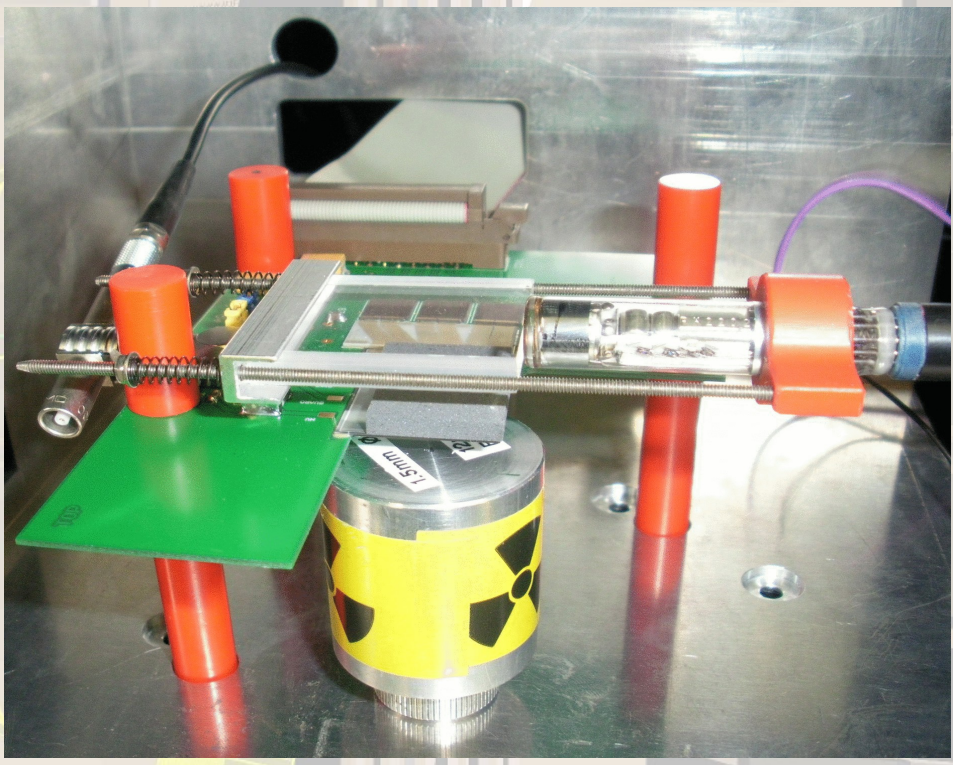
Si strip detector:

- 20 x 20 mm^2
- thickness 300 µm
- 384 strips
- pitch 50 µm
- readout of the p-side with 3 APV25-S1 chips
- sensor not radiation hard



Setup of the test station



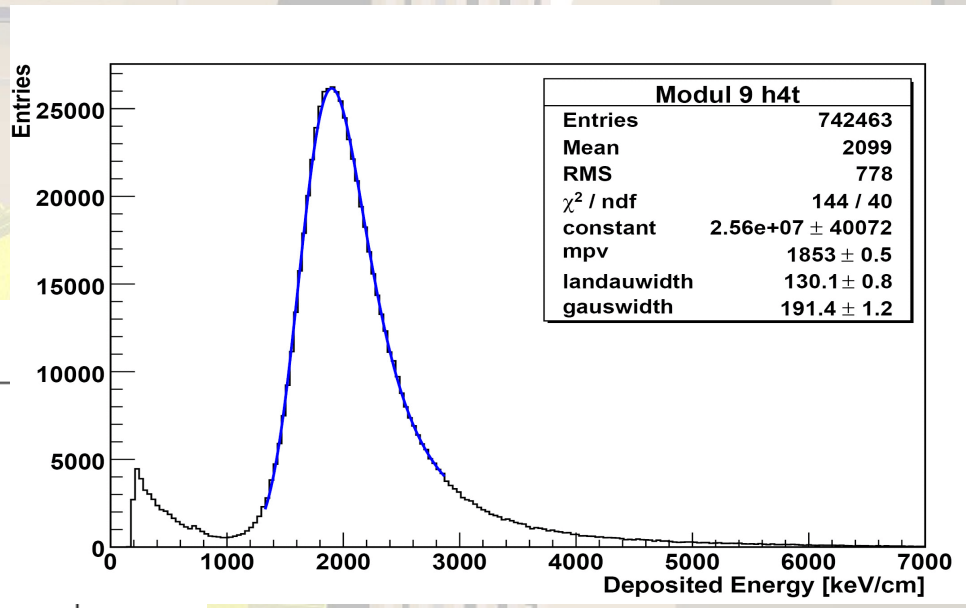


Boron disc arranged as absorber material

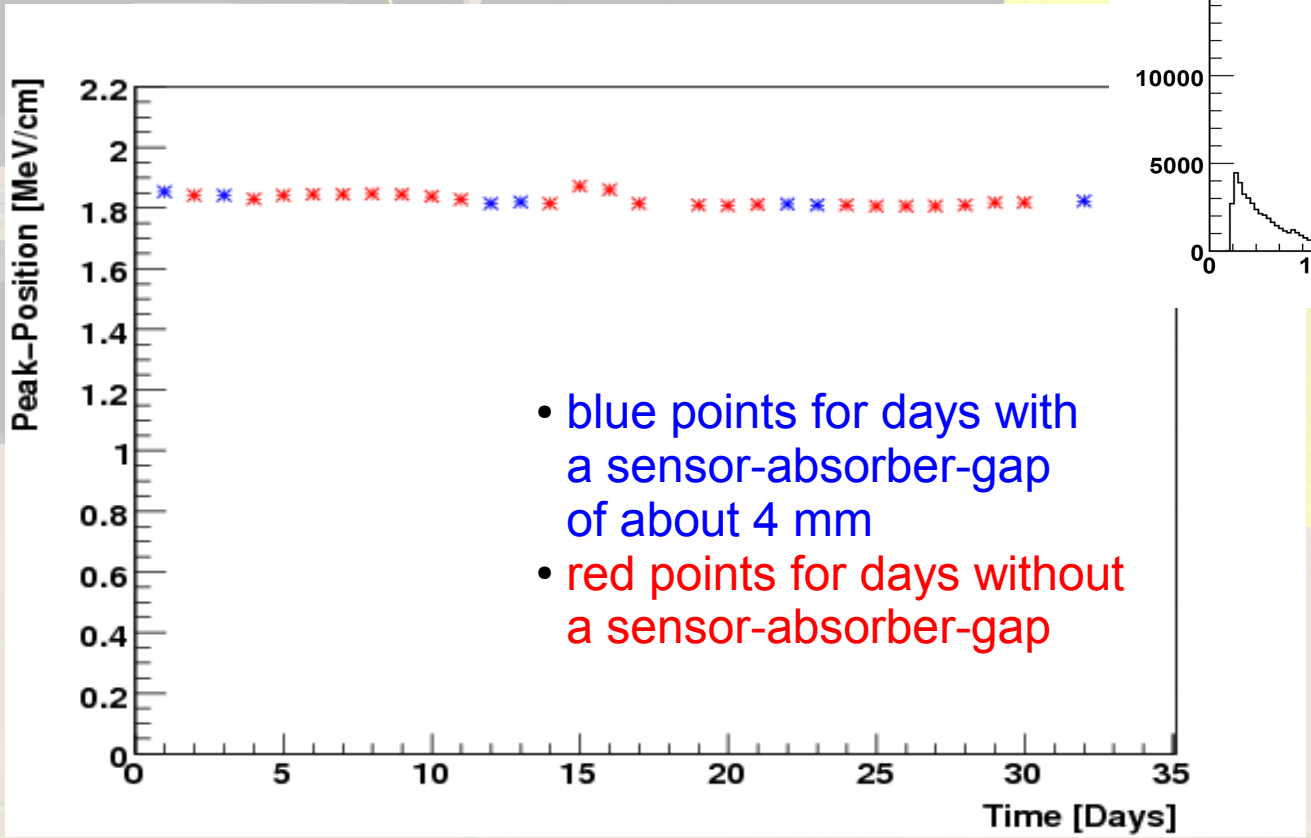
- directly on the sensor, a = 0
- with a gap, a ≈ 4 mm

Measurements and Results

Histogram of a 23-hours energy loss measurement, peak fittet with convoluted Landau-Gauß-distribution



Peakpositions on 32 days of measurement

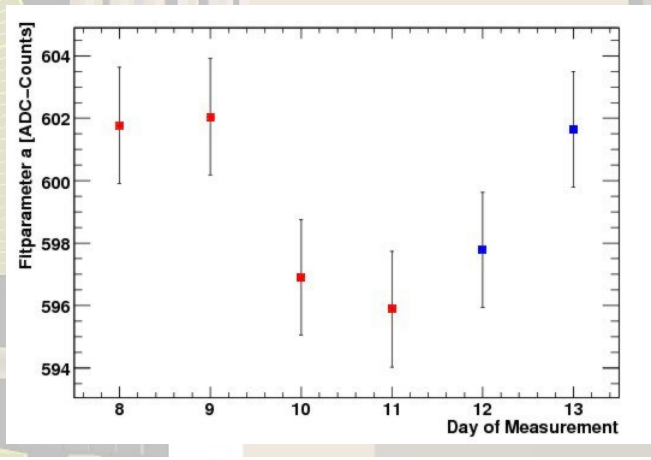


- blue points for days with a sensor-absorber-gap of about 4 mm
- red points for days without a sensor-absorber-gap

Measurements and Results

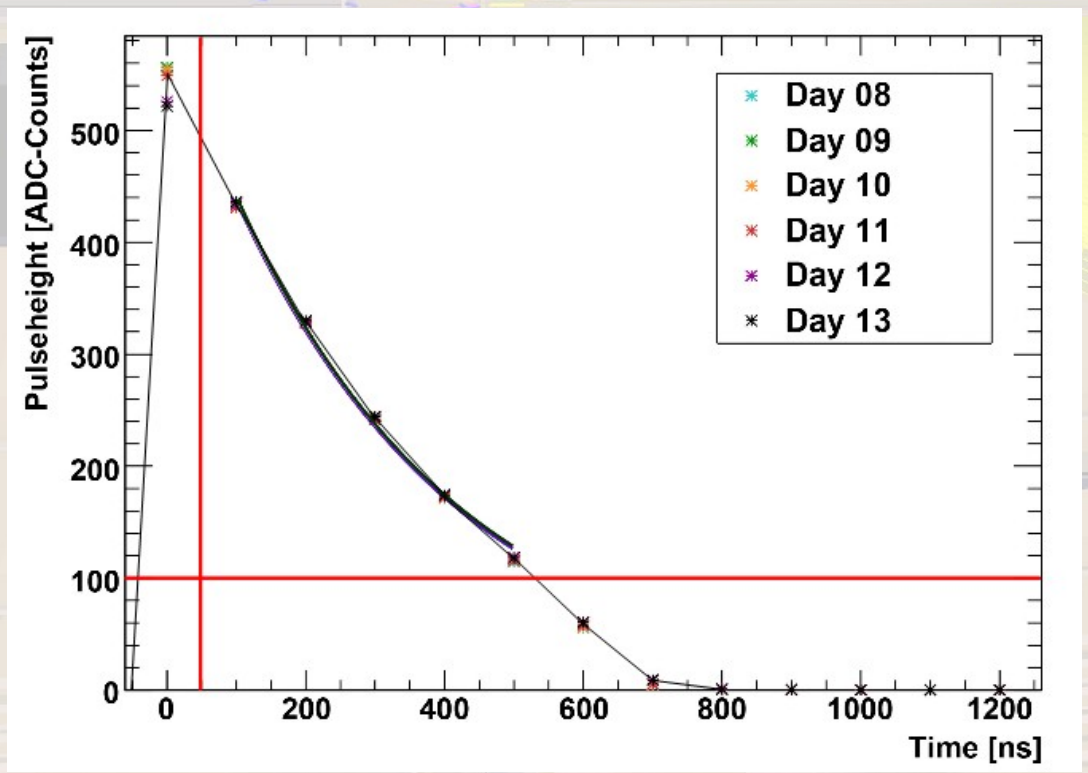
Fitparameters für exponential decay

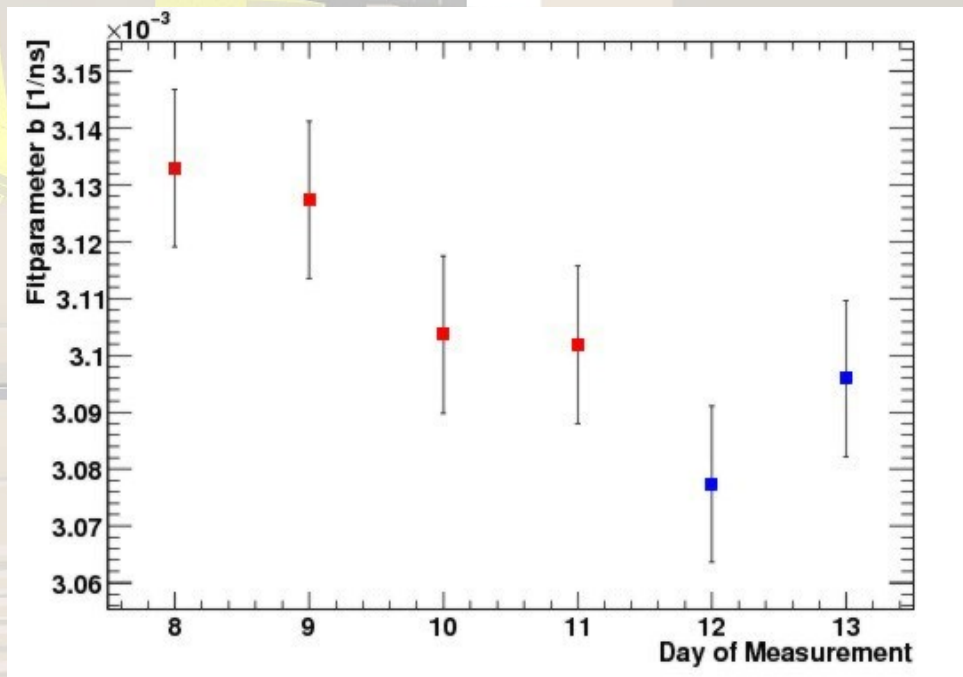
- a = amplitude
- b = decay parameter



Analysis of the pulseshape for one selected strip

- days 8 - 11 with direct sensor-absorber-contact
- days 12 and 13 with sensor-absorber-gap of 4 mm





Summary

- compact structure of detector and absorber layers essential for the secondary target at PANDA
- investigation of the performance of silicon strip detectors in direct contact with absorbers
- no systematic differences occured in present measurements with a boron disc

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Outlook

- more detailed studies of the decay time of the signal
- research of the properties of silicon strip detectors in contact with beryllium und diamond as absorber materials
- optimization of the secondary target