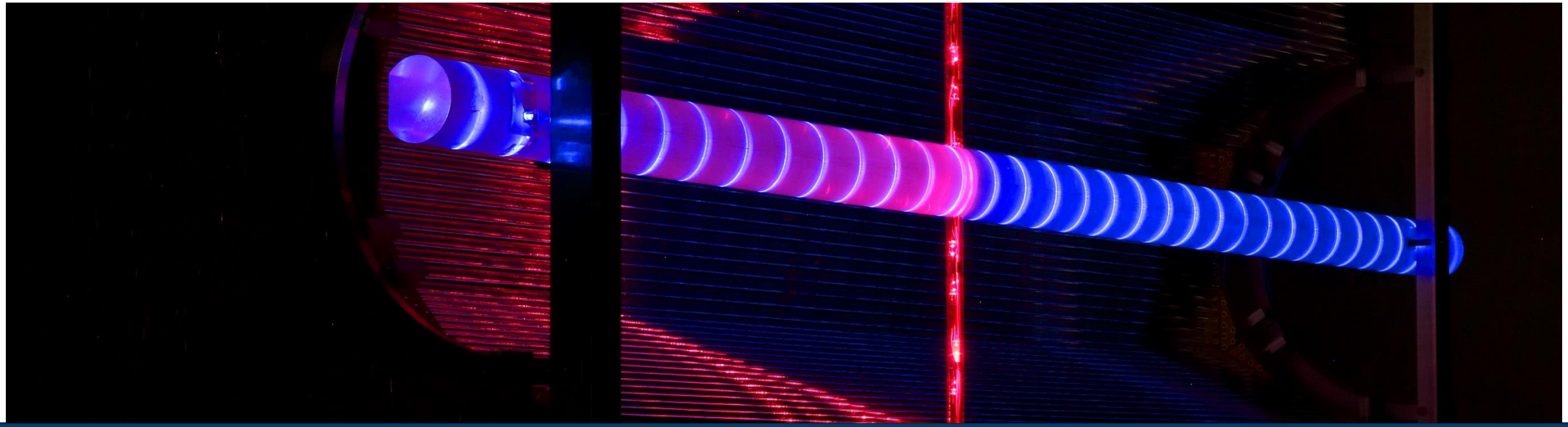


STT & STS1 NEWS

Peter Wintz (IKP, FZ Jülich) for the STT group

Status Outline

STT News

- ASIC/FEB Readout → *Aleksandra Molendra (AGH Krakow)*
- TRB3 DAQ → *Pawel Kulessa(FZ Jülich)*
- Mech. Prototyping → *Artur Derichs (FZ Jülich) in Mech. Session*

STS1@HADES

- System Overview
- Pre-commissioning
- Status & Timeline

→ *STT Status Report by Gabriela Perez (FZJ) on Friday*

STT News

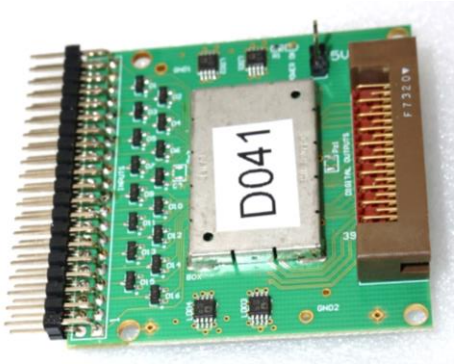
PASTTREC-ASIC

ASICs ordered, final number + spares for PANDA FT & STT

- Contact person and more information: Marek Idzik (AGH Krakow)

PASTTRECv1 properties verified

- In-beam with high rates and large dE/dx range by PANDA STT / FT tests @ COSY
- For large straw systems (STS1+2 setups with 704 + 1040 channels)
- Set up methods established (e.g. indiv. BL tuning)
- Further investigation of boards with failures



FEBv3 with two ASICs (under metal shield)

Congratulation to AGH / JU Krakow team ..

.. for the successful chip design & testing (PASTTRECv1 = final)

STT News

Front-End Boards

New chip housing on FEB tested & decided

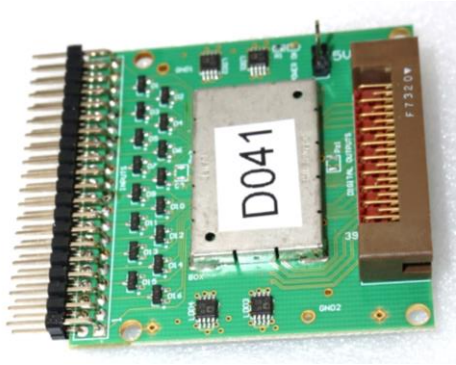
- No direct chip bonding (FEBv3 with QA issues)

Open issues for STT

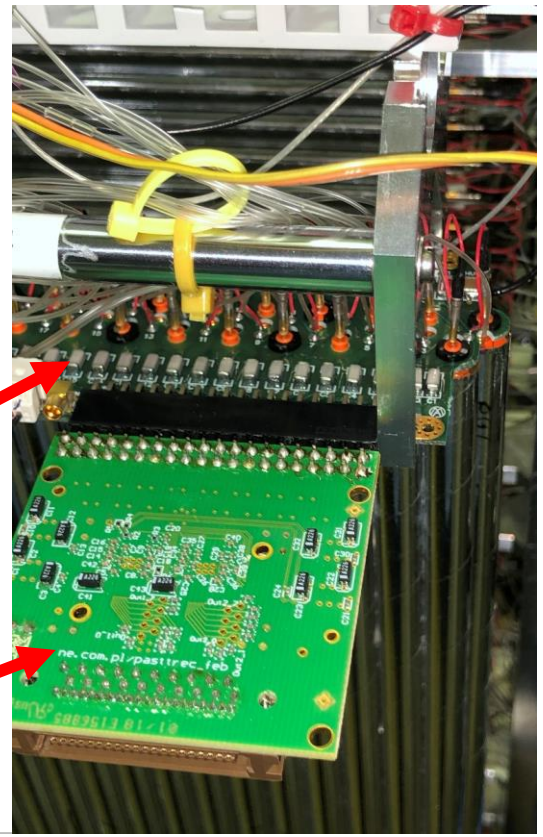
- Power consumption/heat production in closed FEE volume
  - 220 Watt for 270 boards at nom. 5V
  - 175 Watt by LV reduction (→ 4V) decided
  - Further reduction difficult, new designs necc.
  - Temperature environment very critical for STT system (materials, drift gas, ..)
- Straw contacting & HV decoupling boards
  - Same STS/FT design not possible for STT
  - Minimal space available for FEE, only longitudinal

Further issues in discussion

- Temperature sensor, chip ID, ..
- But no increase of power consumption mandatory for STT



FEBv3 (left) and connected to HV decoupling board at the STS1 (bottom)



Straw contacting and HV supply & decoupling board

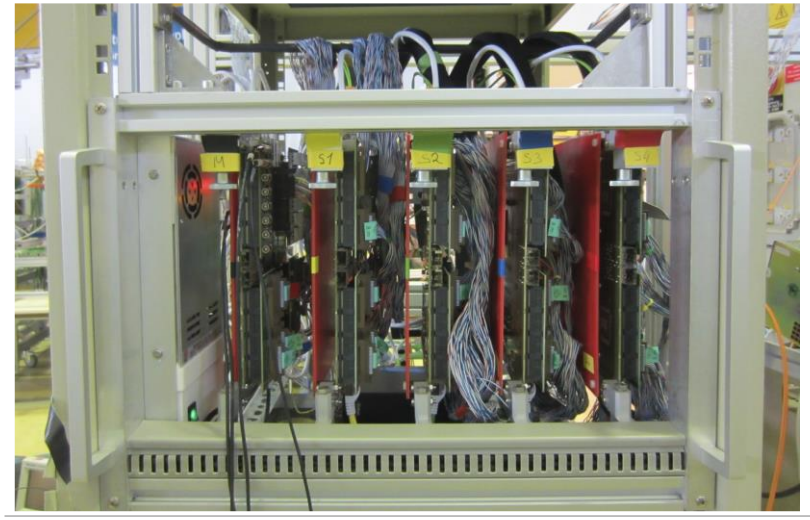
FEBv3 bottom side

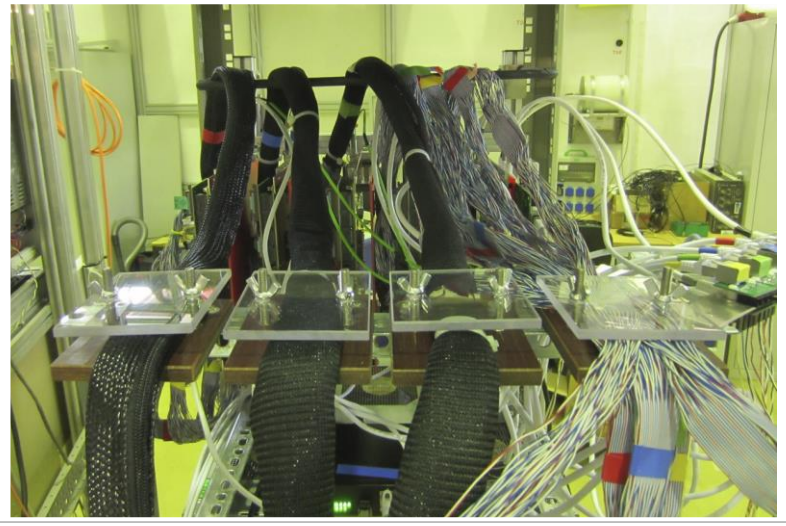
STT News

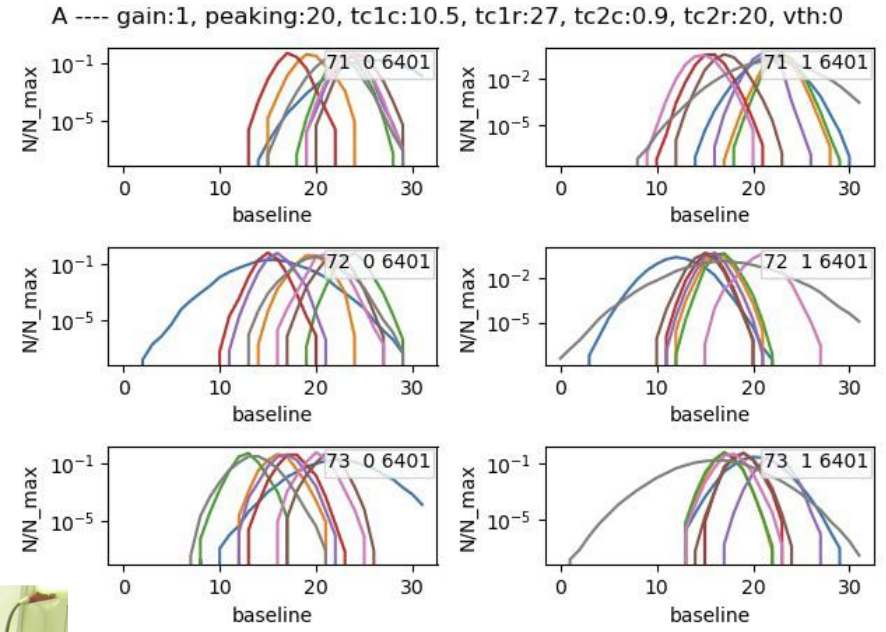
DAQ Setup in Julich

- TRB3 DAQ set up for readout & STS1 system tests
- TRB3 architecture in crate, protection cover added, cable routing
- Firmware updated
- TRB3 (self-)trigger modes studied (e.g. multiplicity, ..)

TRB3 readout crate for STS1 (left: front view , right: view from back)







Baseline scan (x-axis, range: 0-32 DAC) and measured noise scaler rate (y-axis) for six ASICs (boards 71, 71, 73). Results by P. Kulessa (FZJ).

STS1 System Overview

Specifications Reminder

704 straws in 4 double-layers

- Orientation: φ = 90°, 0°, 0°, 90°
- Z-distances: 118.6 mm, 281.4 mm, 118.6 mm (d-layer middle z posi.)
- 20 modules, 16 straws each (PANDA-FT layout & dimensions)
- Beamhole by split straws (2x8 straws per d-layer)

Straw specs

- 27µm Al-mylar film, $Ø_{ID}$=10.00 mm, 766mm length
- Straw pitch: 10.14mm, z-pitch in d-layer: 8.78 mm
- Ar/CO2 at 2 bar (abs.)

Electronics:

- 704 readout channels, 44x FEBv3, 88x PASTTRECv1
- 4x TRB3, 1x RO crate

STS1 Station

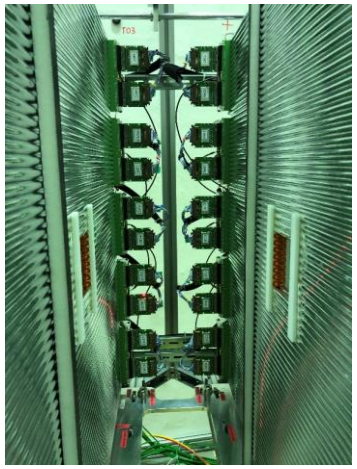
STS1 System Overview

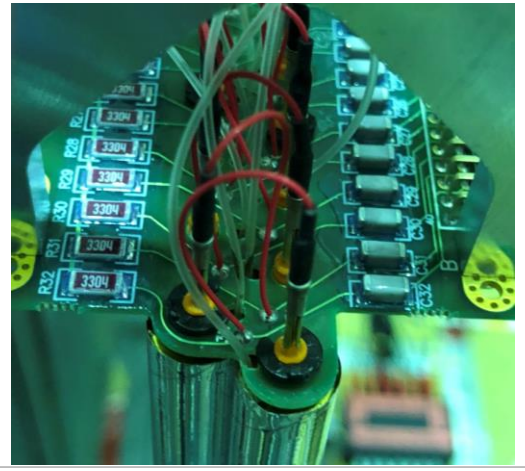
Preparations and Pre-Commissioning in Julich

Full system test with ^{90}Sr source signals (β-tracks)

- All 704 straws tested incl. ASIC-FEBs, cables and TRB3
- Drift time & time-over-threshold measurement, efficiency check
- Tube bending & wire displacement ("2nd leg")

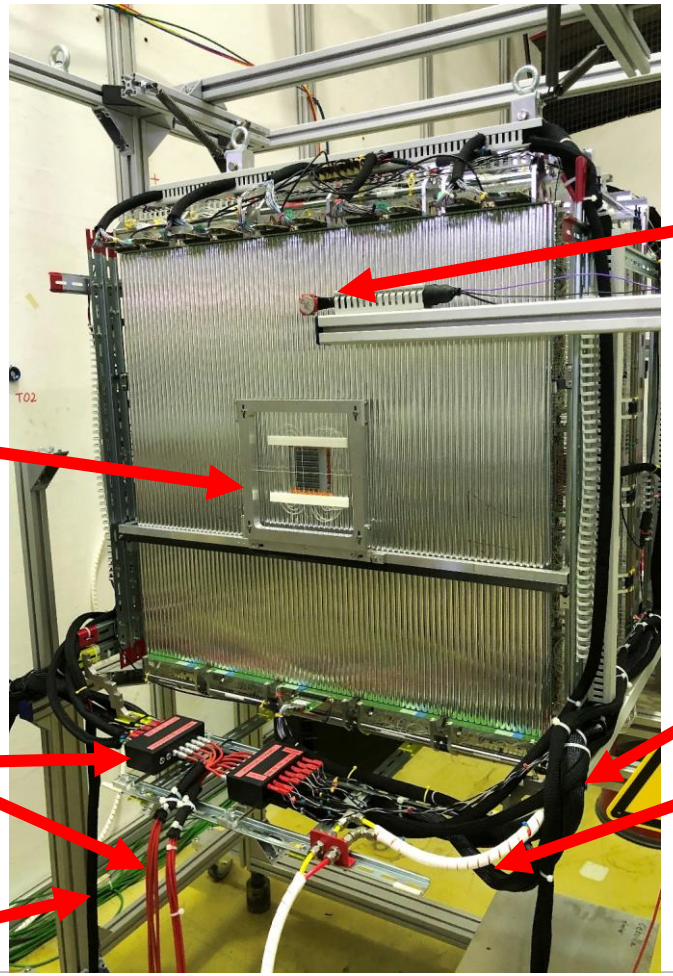
- 1st tune of all ASIC baselines (by noise scaler rate)
- 2nd BL-tune done by ToT measurement & alignment





Inner horizontal layers and FEE coupling boards (JU Krakow design)

STS1 Station



^{90}Sr&scint. for tests

Center cross (remove later)

ASIC cables

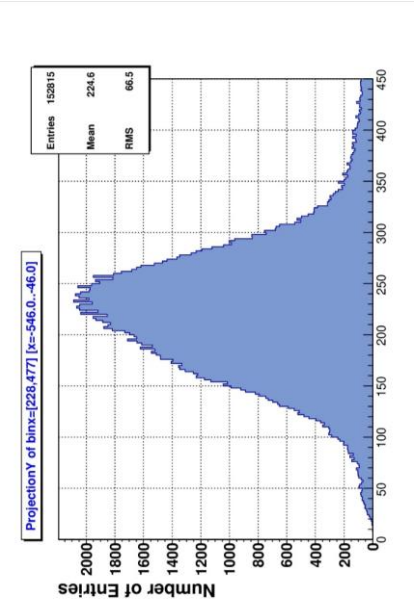
HV boxes & cables

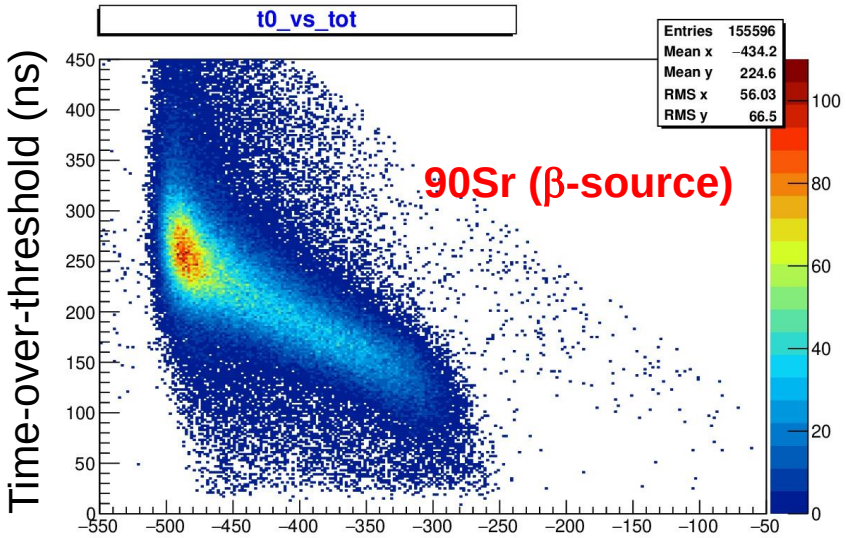
Gas lines

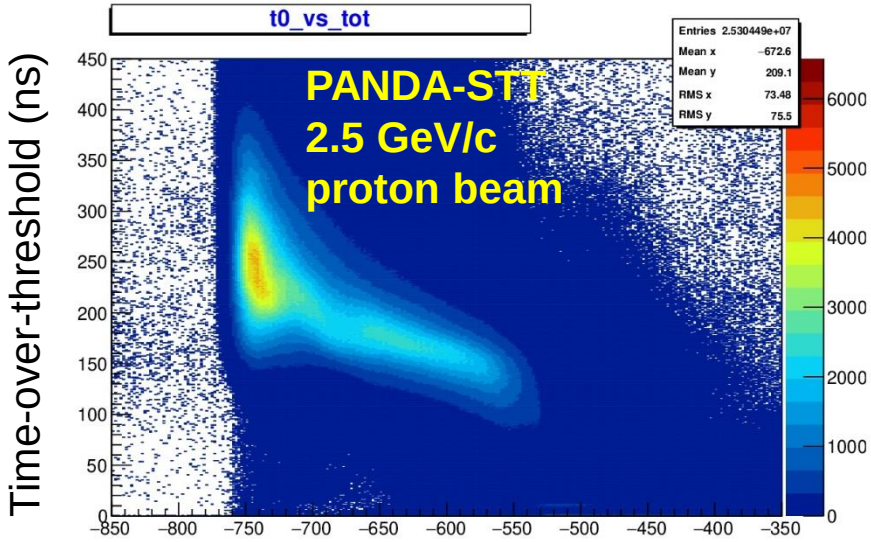
LV cables

STS1 Test with 90Sr Source

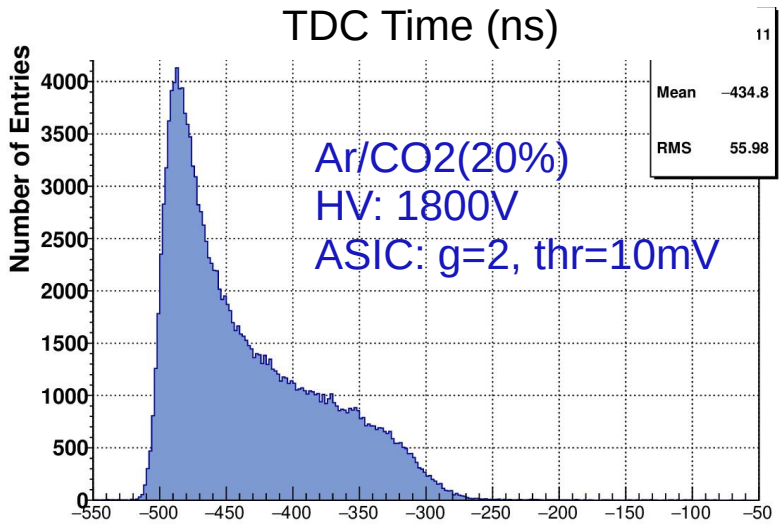
Drift Time & Time-over-Threshold Measurement

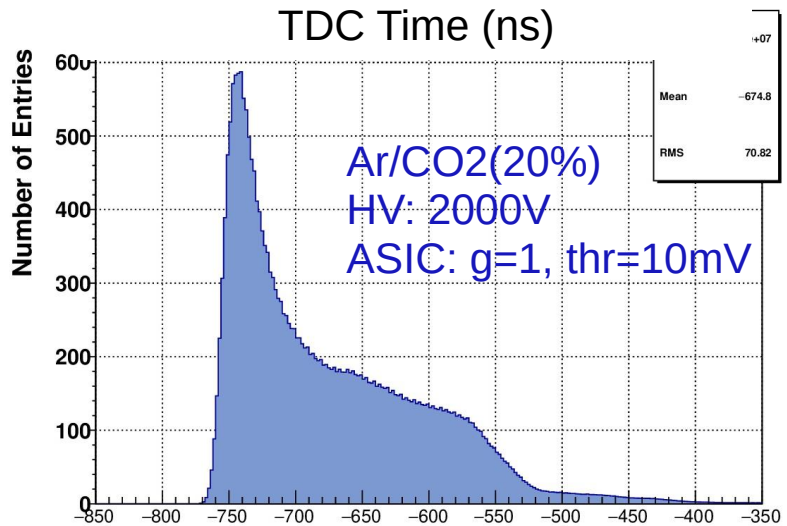






- Similar spectra for ^{90}Sr β-tracks and (mip) proton beam tracks
- No typical Bethe-Bloch dE/dx for low mass e-, ~ 40% higher dE/dx than MIPs
- ^{90}Sr ideal for full system tests, drift time and time-over-thresh. measurement (→ efficiency)

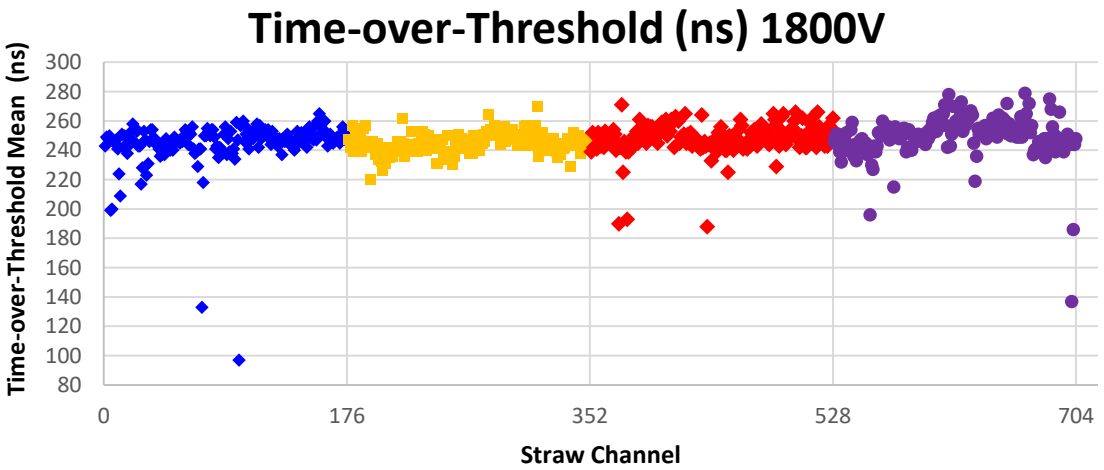


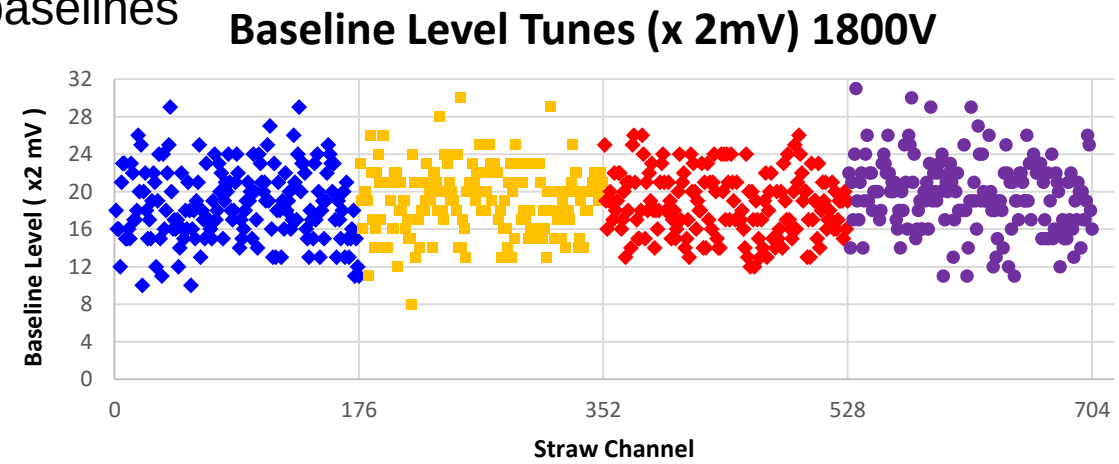


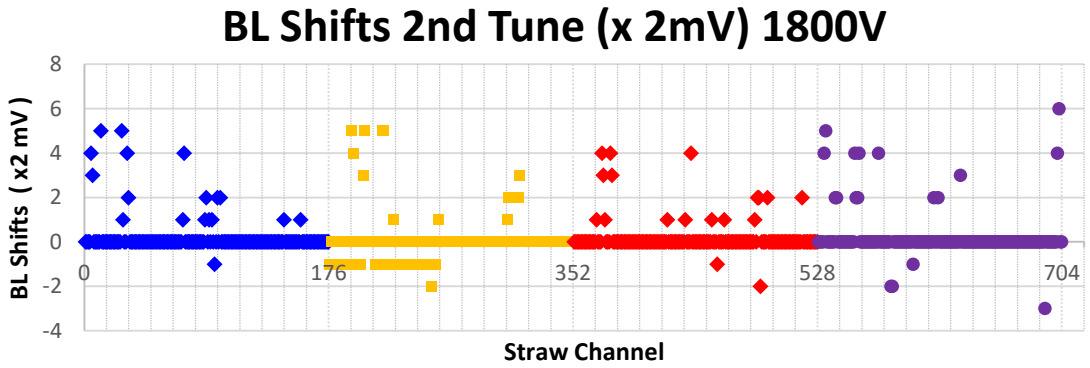
ASIC Tests and Tuning

BL Tuning with ^{90}Sr and ToT Measurement

- Reminder: common ASIC threshold, channel individual baselines
- 1st tune by using noise scaler rate (Krakow method)
- 2nd tune by signals from ^{90}Sr source
  - Measure the mean of ToT distribution for each channel
  - BL adjusting by aligning the ToT mean
- Some bad channels remain (no better tune poss.)
- ASIC setting: gain=2, pktime=20ns, thresh=10mV
- Low noise level → BL in upper half of range







STS1 Status Summary

QA Measures / Pre-Comissioning in Julich

Straw operation

- gas tightness on permeation level (~ 100 mbar/day @ 1 bar overpressure)
- all 704 straws signal tested, no failure (e.g. broken wire)
- HV stability: ~ 20-30 nA dark current (all 704 straws, at 1800V nominal)
- stable operation since months

Front-end readout cards (PASTTREC-ASICs)

- ASIC tests and precision tunes done for all channels ($\rightarrow$ Ch & BL database)
- 26 channels (from 704) with failures, replace boards when spares become available

TRB3 readout and DAQ

- TRB3 crate system set up in Julich and tested, 4 spare TRB3 boards for PANDA-STT activities in parallel

Full system tests in Julich completed

- signal tests of all straws and complete RO chain (^{90}Sr: drift time & ToT, efficiency)
- stable operation, low straw voltage and low ASIC threshold (low noise level)

Timelines STS1

• System pre-commissioning in Julich	completed
• Installation in HADES	early November
• Commissioning proton beam for HADES scheduled	February 2021
• Physics experiment with proton beam at SIS 18	Probably early 2022

.. but Covid-19 threat

.. much reduced personnel on-site for installation and detector operation

.. exploit remote control and operation

Thank you

for

your attention

and

stay healthy