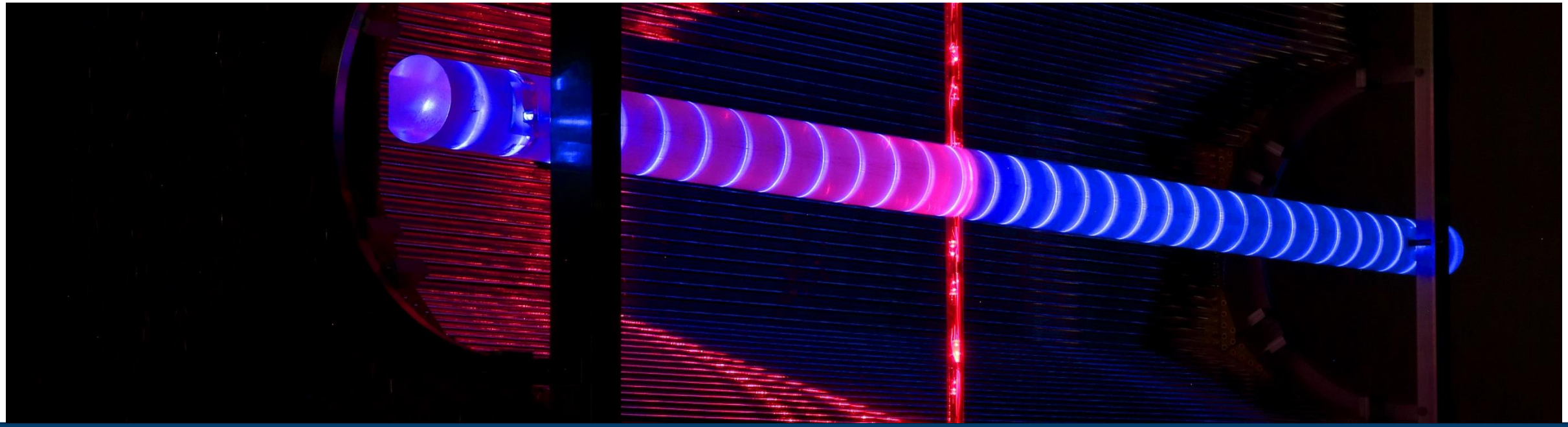

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STT & STS1 NEWS

Pre-Installation Straw System QA

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

Outline

- STT News
  - Readout System (→ STT / FT readout report in FEE session, M. Idzik & A. Maligne)
  - PANDA Infrastructure & Risk Assessment
  - STT Hit Efficiency In-Beam ($\varepsilon(r) > 98\%$) (→ talk by G. Perez)
- STS1 Status
  - Operation Status and Timelines
  - TRB-DAQ and ASIC Tests (→ talk by P. Kulessa)
- Straw Systems QA
  - ASIC/FE-Board Teststand
  - Pre-Installation Full Functionality Test (STS1)

STT Readout News

STT/FT Readout System

- PASTTRECv1 ASIC order in preparation, contact person: Marek Idzik (AGH Krakow)
- Chip housing option promising, study together with HADES-MDC group

- ASIC technical specifications:
  - Baseline level (BL) dispersion ~ 7 mV (σ), BL trimming range ±30 mV (2 mV DAC steps), noise level NL ~ 2-5 mV
  - Common discriminator threshold per chip (2mV DAC steps)
  - Observation: up to few 10 mV BL differences channel-to-channel

- Channel-individual BL tuning for each ASIC mandatory (→ BL lookup table)
  - Krakow: BL detection method and auto script using noise rates, check with ^{55}Fe (X-ray) and time-over-threshold alignment
  - Julich: BL tuning off-detector (testpulse & NL), on-detector check with ^{90}Sr (β-tracks) and time & time-ovr-threshold alignment
  - Results: off-detector BL = on-detector BL, independent on gain factor and shaper parameters

PANDA Experiment Infrastructure

Technical Design Report & Risk Assessment

- Technical Design Report paper by TCs et al. (L. Schmitt, A. Belias et al.), 109 p.
  - PANDA installation with sub-systems coordination, installation scheme and timelines
  - Infrastructure and resource requirements

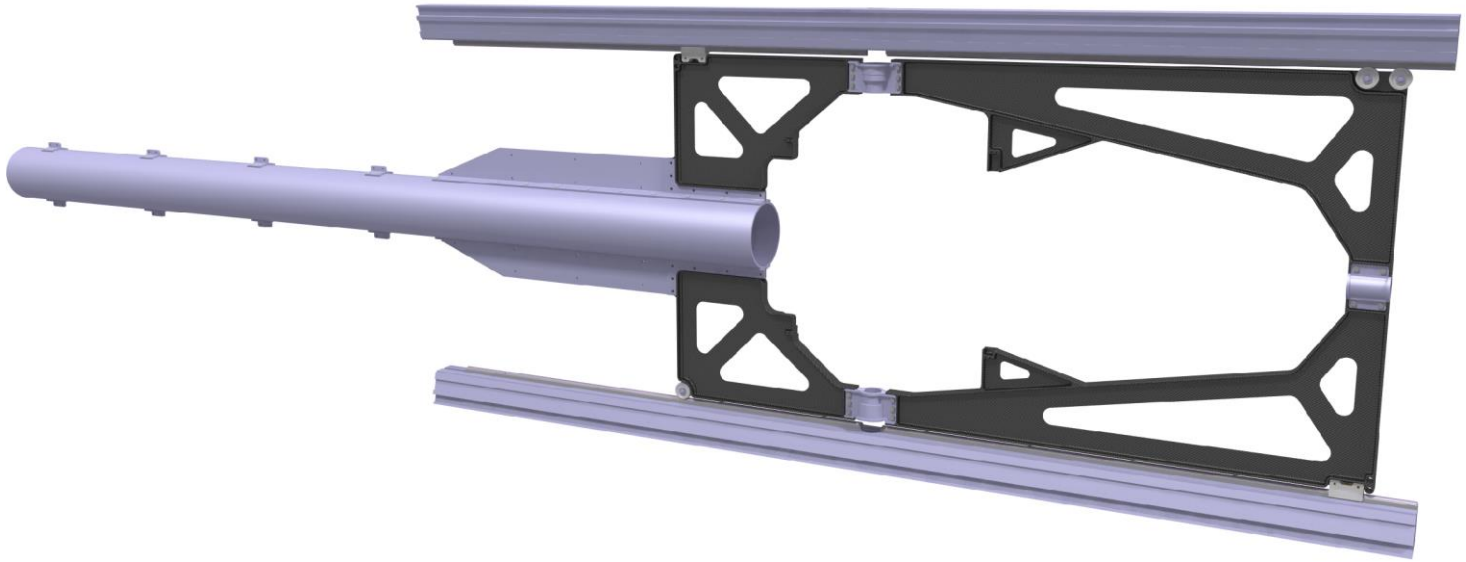
- STT specific issues (next slides)
  - Central systems frame in TS
  - TS mounting platform w/ clean room close-by
  - Gas supply infrastructure

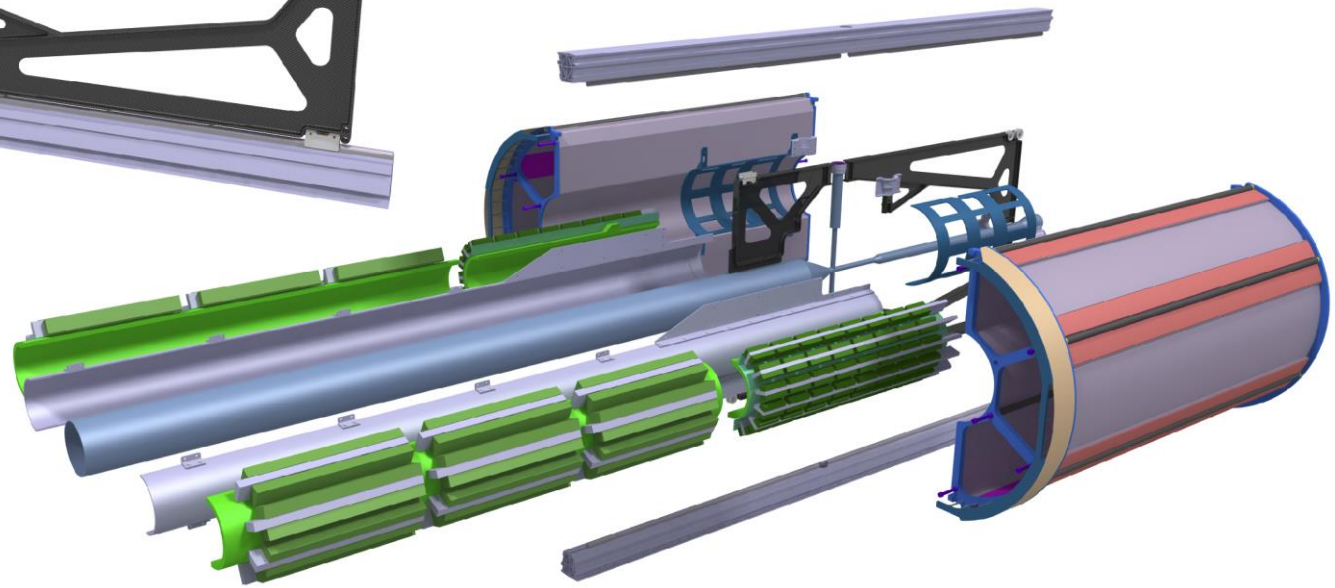
- Workplace safety & risk assessment by FAIR upcoming
- STT risk assessment document in preparation

Central Systems Frame

Taken over by GSI/Part of Experiment Infrastructure

- Carbon-Fiber structure on insertion rails



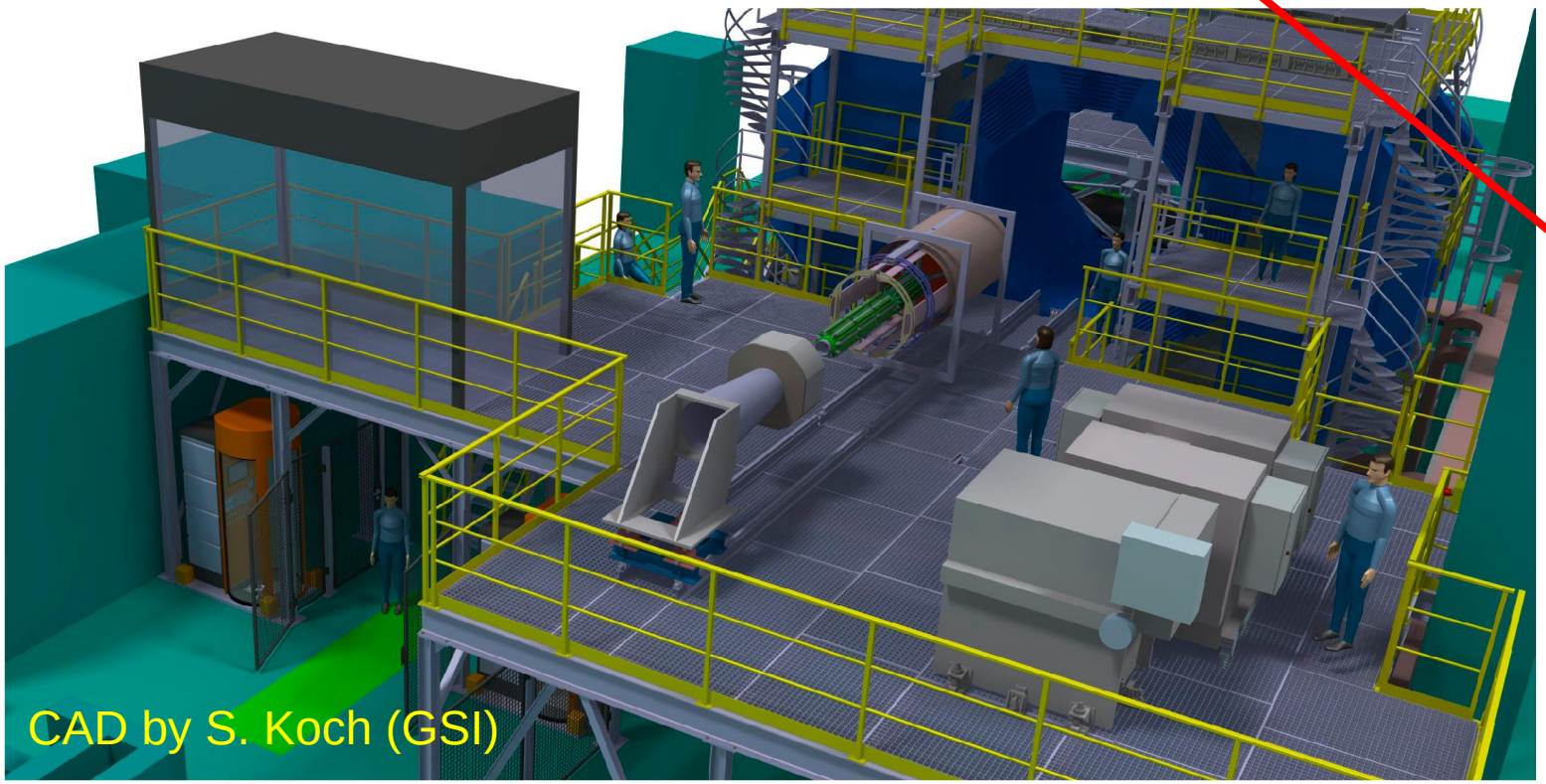


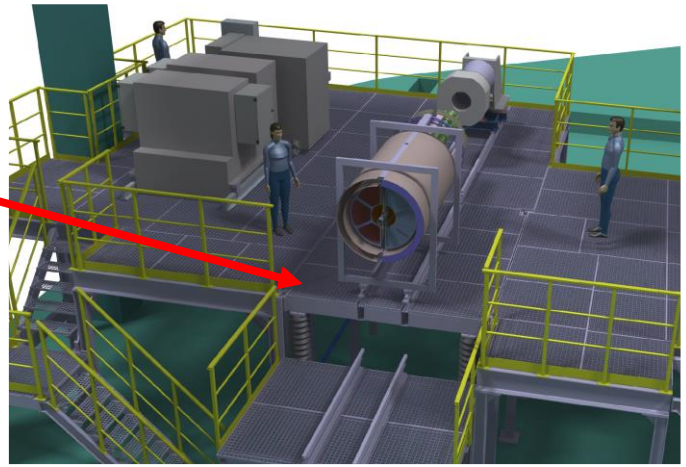
- Support for beam pipe, MVD, STT semi barrels
- Separate support for MVD upstream routing
  (no load on thin beam pipe)
- CAD design by S. Koch (GSI)

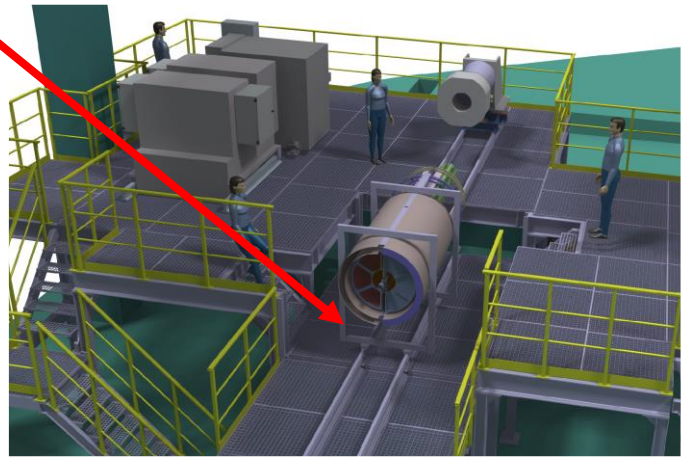
TS Mounting Platform Layout

Central Systems Requirements

- Extended platform with more surrounding space for assemblies, target system devices and clean room
- Central systems on elevated installation platform
- Platform will be lowered to exact insertion height





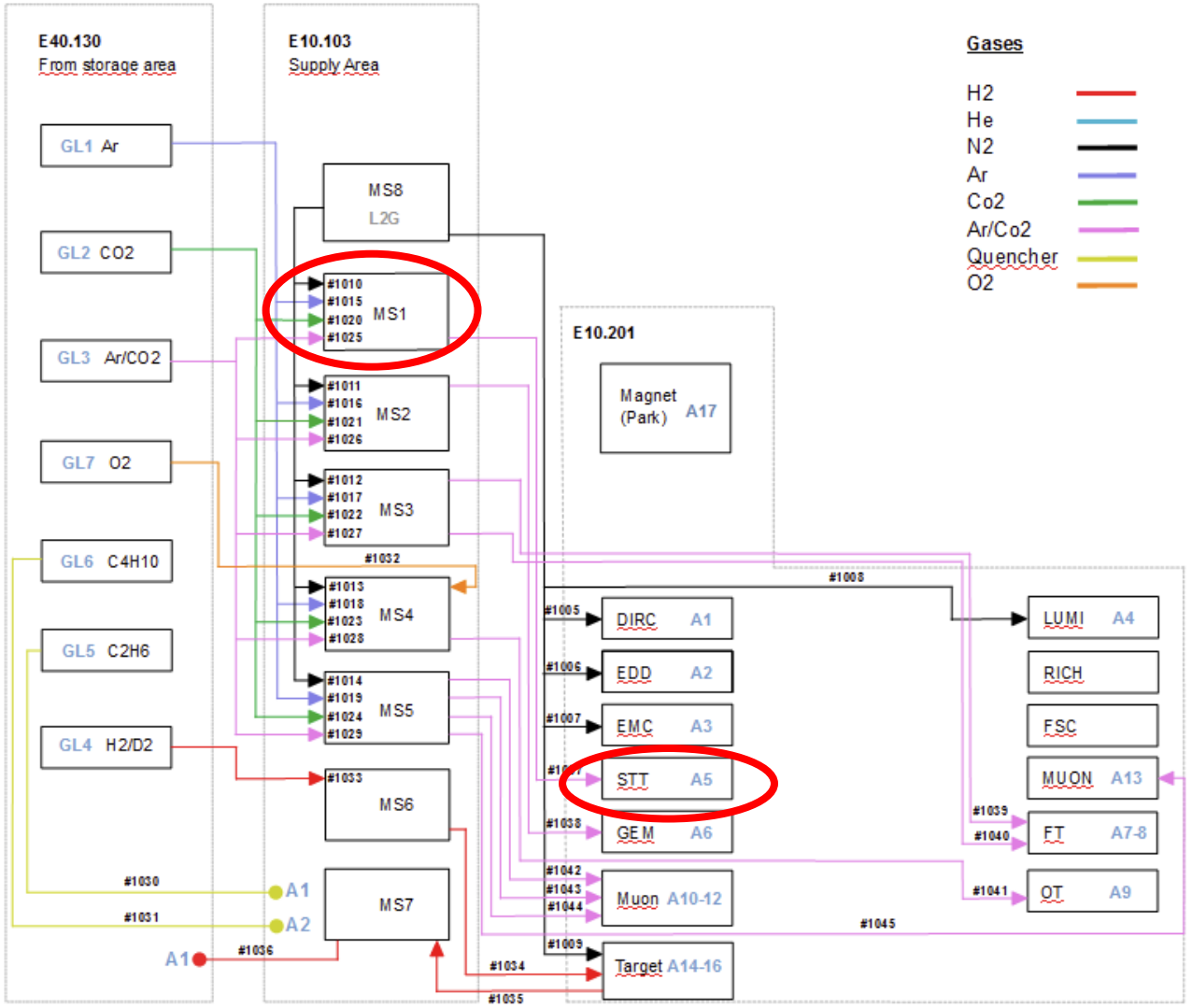


Gas Supply Infrastructure

Gas Supply & Mixing Sections for Detector Subsystems

- Gas bottle storage area
- Gas supply area with mixing stations
- Gas distribution to detectors

- STT gas system:
  - Mixing station MS1
  - Driftgases: Ar, CO_2, (Ar/CO_2)
  - N2 (Flushing)
  - Optional: addit. quencher: C_2H_6, $i\text{-}C_4H_{10}$
  - Pressure controlled gas supply lines (up to 24)
  - Gas flow / pressure controls and alarm modes
  - Generic test system (EPICS) set up by IFIN Bucharest

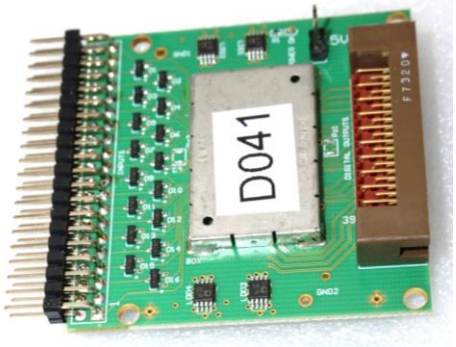


Reminder: STS1 System For Phase-0

PANDA-FT3/4 Layout & Dimensions

- 4 Straw 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 w/ 16 straws each
  - Beamhole by split straws (2x8 straws per d-layer)
  - Module perp alignment by Rohacell/CF bars (2x0.3 mm CF tapes)
- 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 w/ 88x PASTTRECv1 (a 8 ch)
  - 4x TRB3, 1x RO crate

FEBv3 with two ASICs



STS1 Station

STS1 Operation Status

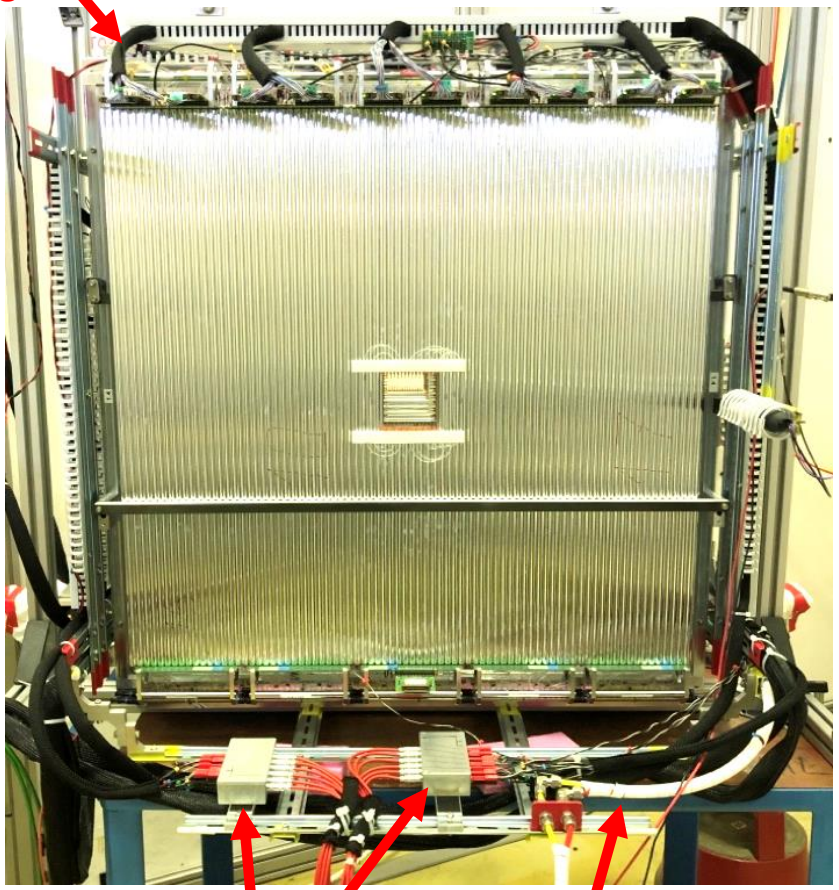
System Set-Up in Julich

- Detector gas tightness on permeation level since 3 months — OK
- Detector fully cabled, FE-boards mounted — OK
- All FE-boards tested & tuned off-detector — OK (but no spares!)
- High voltage operation — (OK)
- EMI/noise level seems rather low (~ 2mV) — OK

- Final system QA with 90Sr and test of all channels — (ongoing)

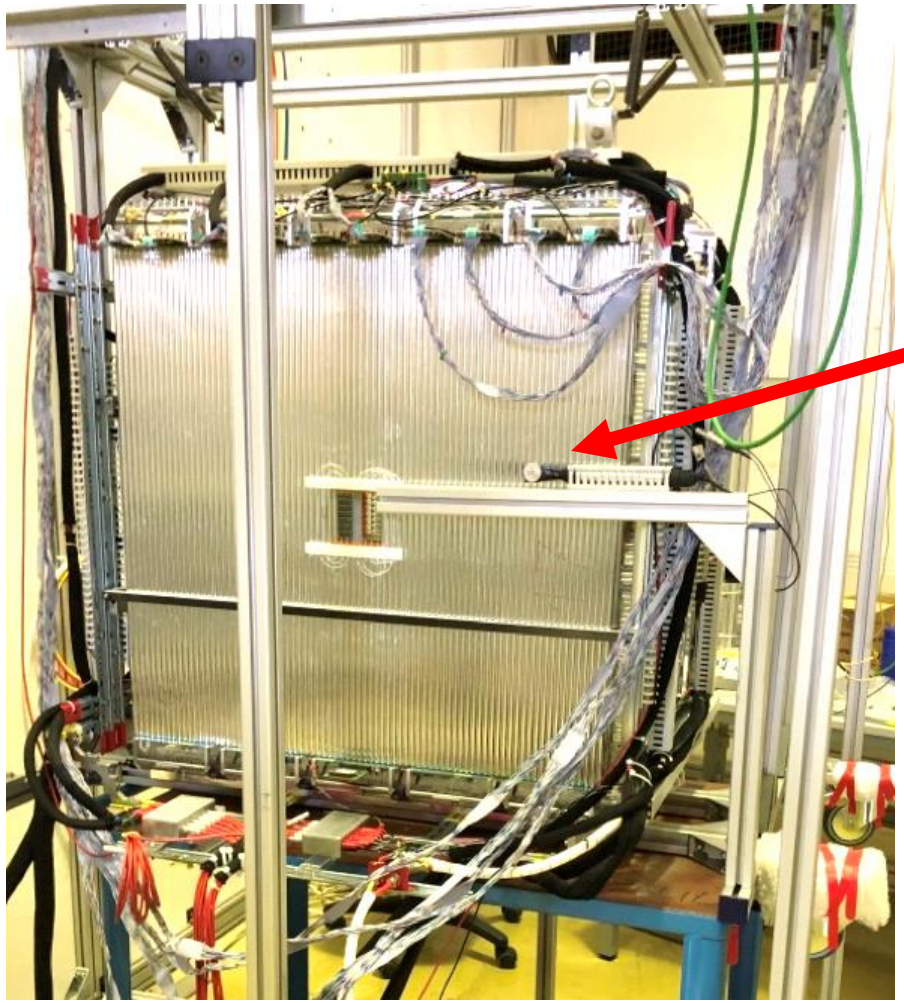
- Old DAQ (single TRB3) running, Root-based data format & analysis SW
- New DAQ (multi TRB3, new firmware) prepared
  - TRB multiplicity trigger in preparation by Pawel (support by Jan Michel, GSI)
  - Cosmic data-taking started

- STS1 Installation in HADES in 2nd half 2020

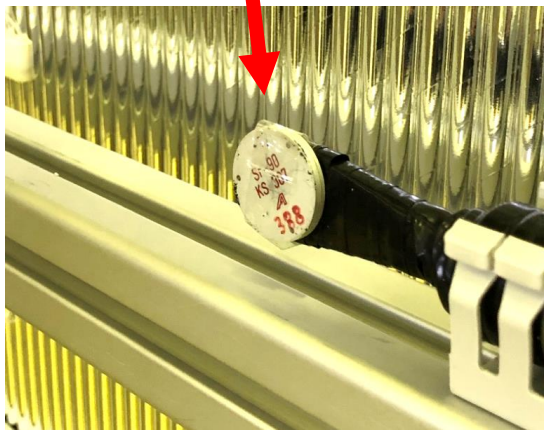


STS1 System QA

90Sr Detector Scan



^{90}Sr source movable with finger scintillator (trigger)



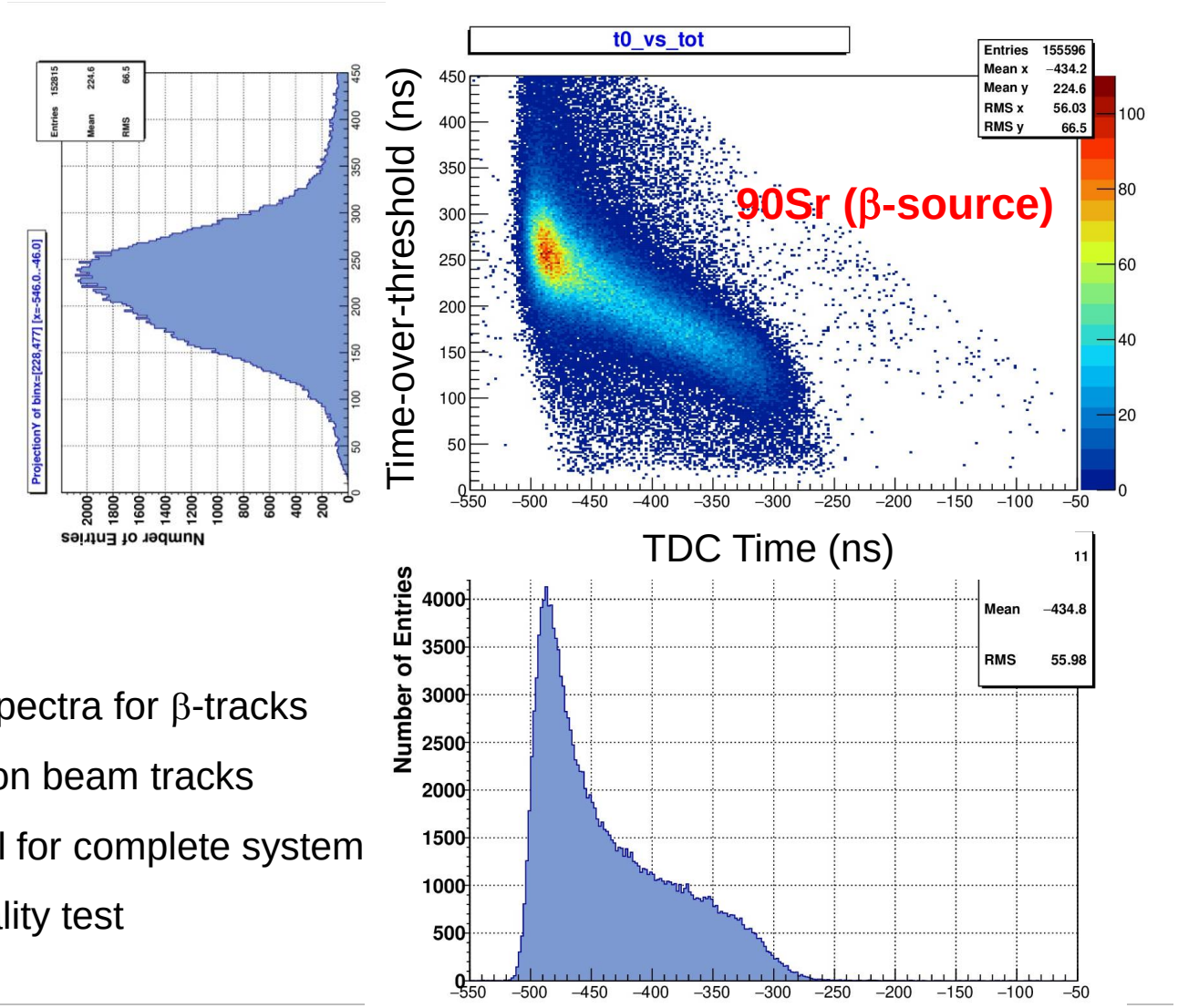
Settings:

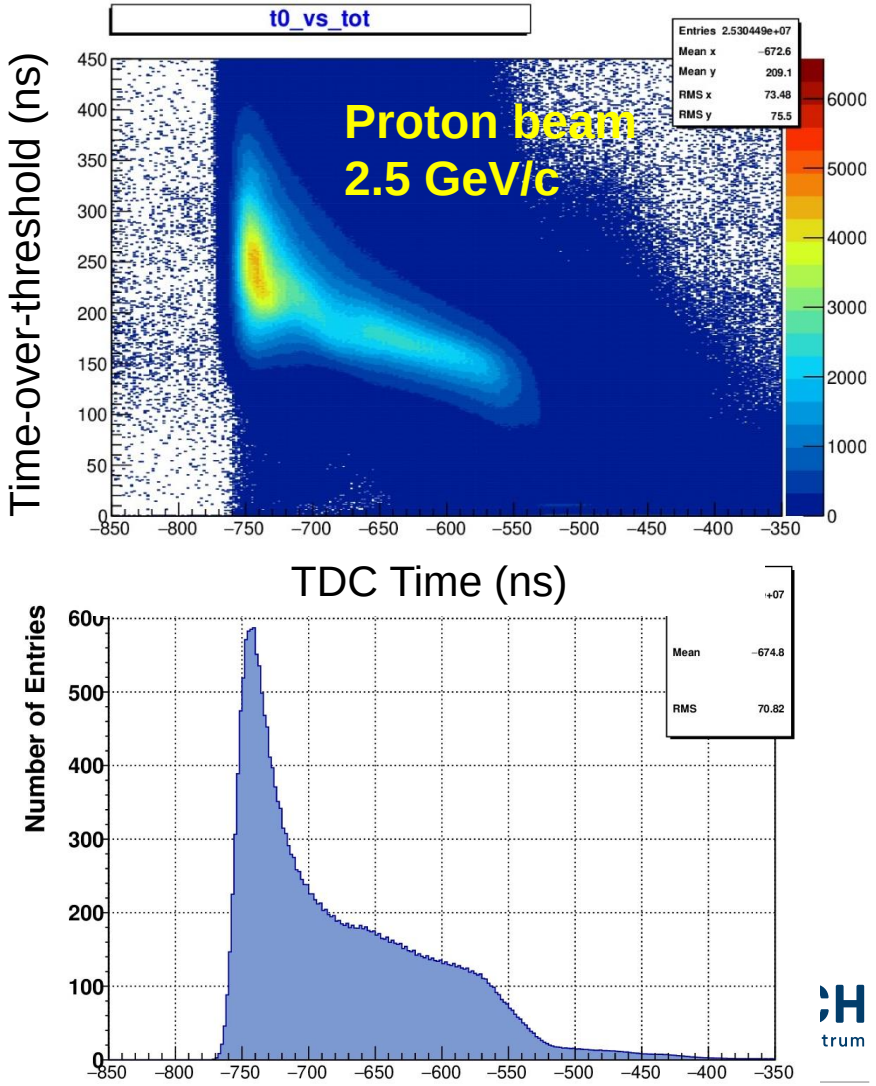
- Gas mixture: Ar/CO2 (20%)
- HV: 1750V, gas gain A ~ 1x 10^4
- ASIC: gain=2, pkt=20ns, thr=10mV
- Noise level ~ 2 mV (= DAC step size)
- ASIC BL tuned off-detector with pulser

- ^{90}Sr β-source scan along detector
- 1mm thin scintillator for trigger
- Drift time and time-over-threshold measurement

System QA Test with 90Sr Source

Comparison Drift Time and Time-over-Threshold Measurement



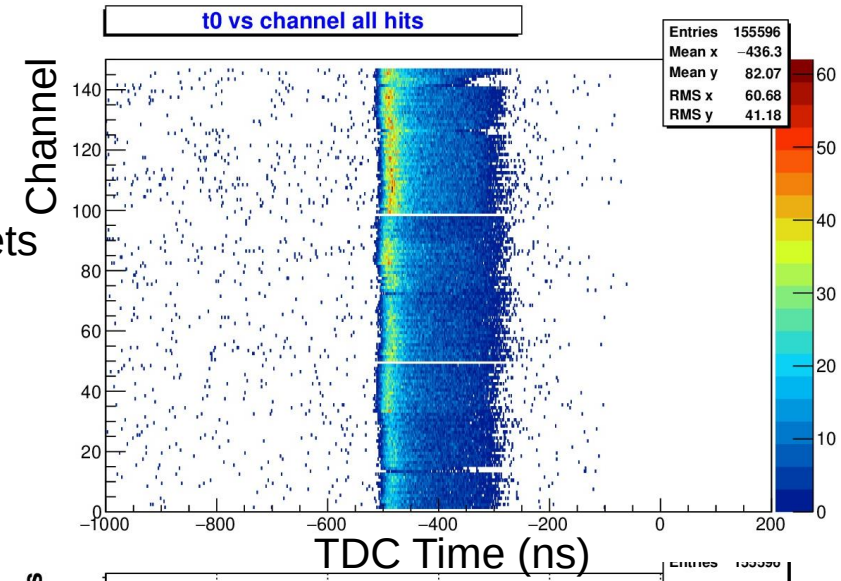


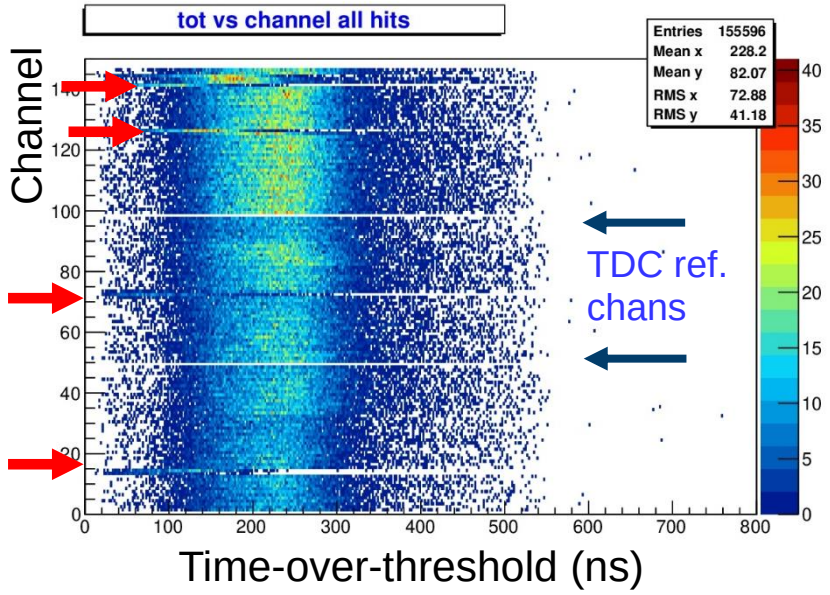
- Similar spectra for β-tracks and proton beam tracks
- ^{90}Sr ideal for complete system functionality test

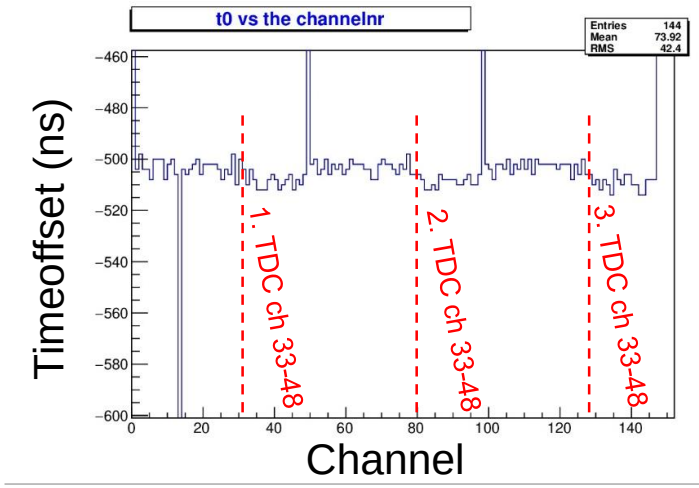
System QA Test with 90Sr Source

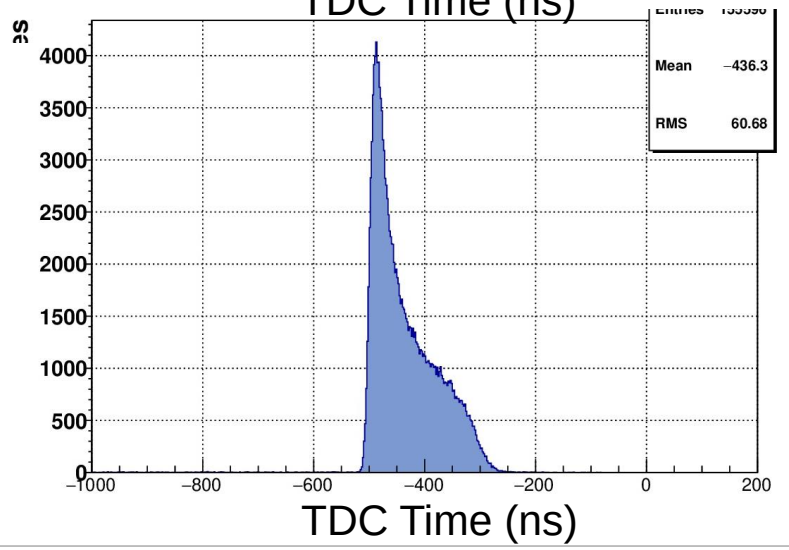
ASIC Tune Check by Drift time and Time-over-Threshold

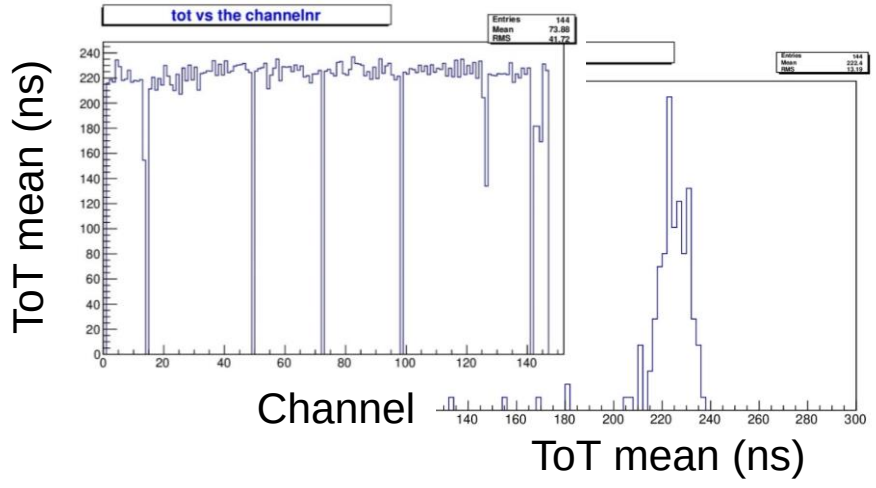
- TDC time spectra & fitted time offsets
- Time-over-threshold fit per channel
- Off-detector BL tune taken
- 6 (from 144) channels to be further checked (red arrow marked)







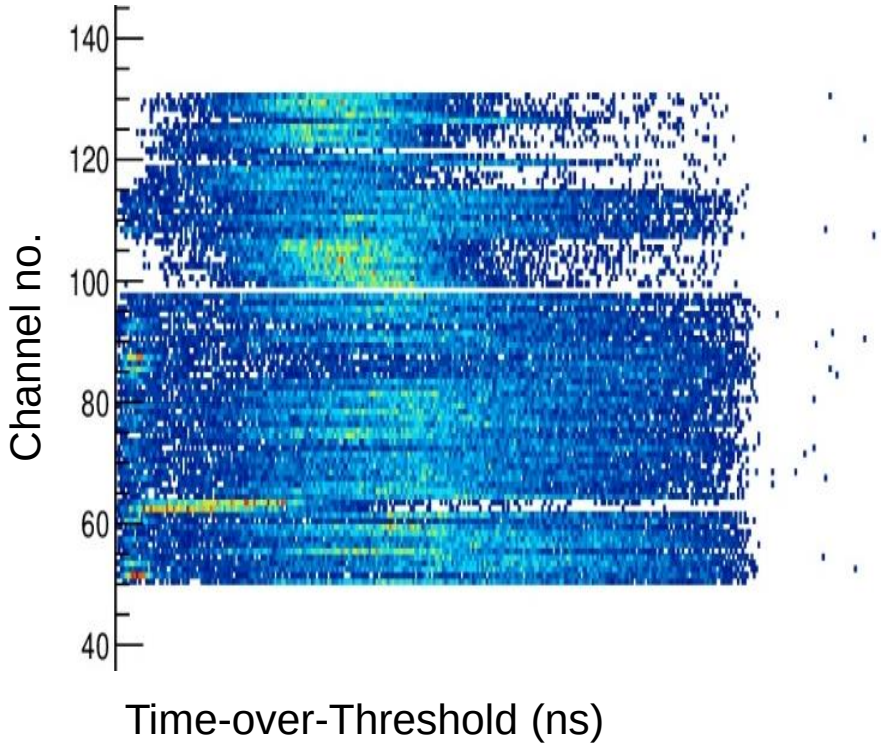




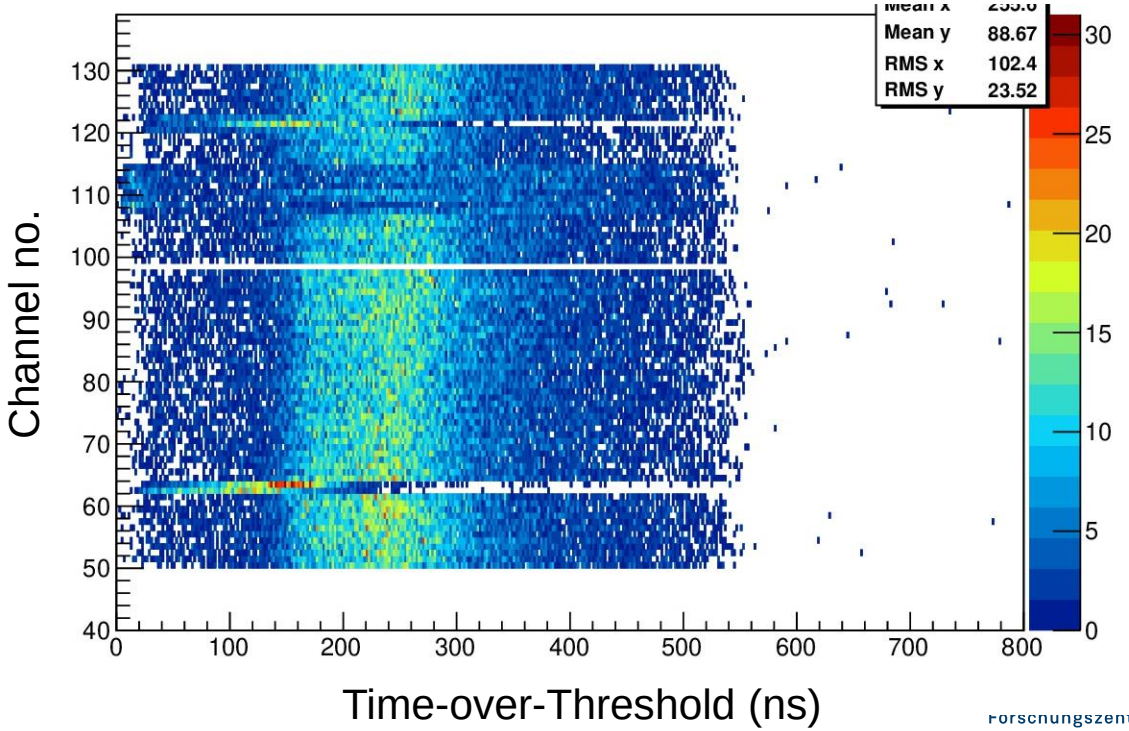
ASIC Tuning Example

TDC Time-over-Threshold before & after BL Tuning

Coarse/improper BL setting



After BL tuning



Pre-Installation Straw System QA

Proposed Procedure

- Off-detector ASIC/FE-board (teststand):
  - Single ASIC/FE-board control and failure test (no bit errors, no missing channels)
  - BL determination by noise scaler rate, BL lookup table for all FE-boards and individual channels
  - Observation so far: ASIC BL off-detector = BL on-detector, BL is gain and shaping parameters independent

- System full-functionality QA test:
  - Connect FE-boards to straw modules and to TRB readout, straw module connected to gas and HV
  - Scan of all channels with ^{90}Sr source & trigger scintillator
  - TDC time and time-over-threshold spectra and alignment check for each channel

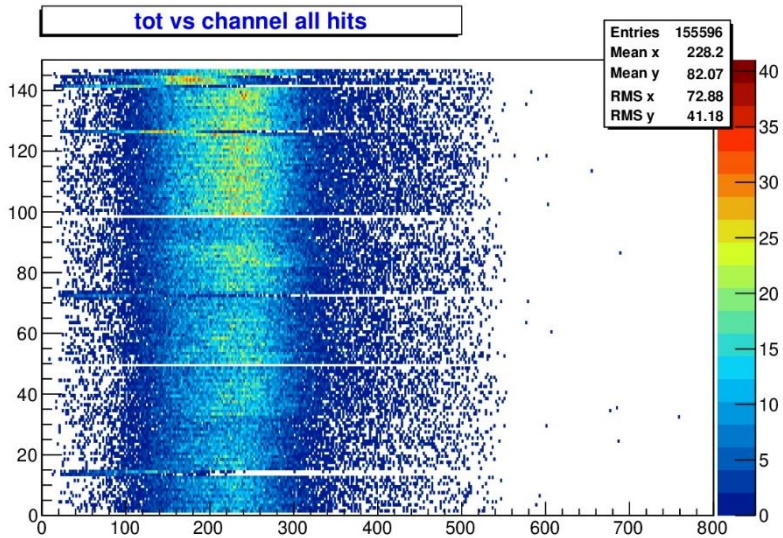
- Reminder: STT front-end space and access restricted, failure detection & component replacement difficult
- QA of STT modules (4-layer) with ^{90}Sr scan should be done before the main detector assembly

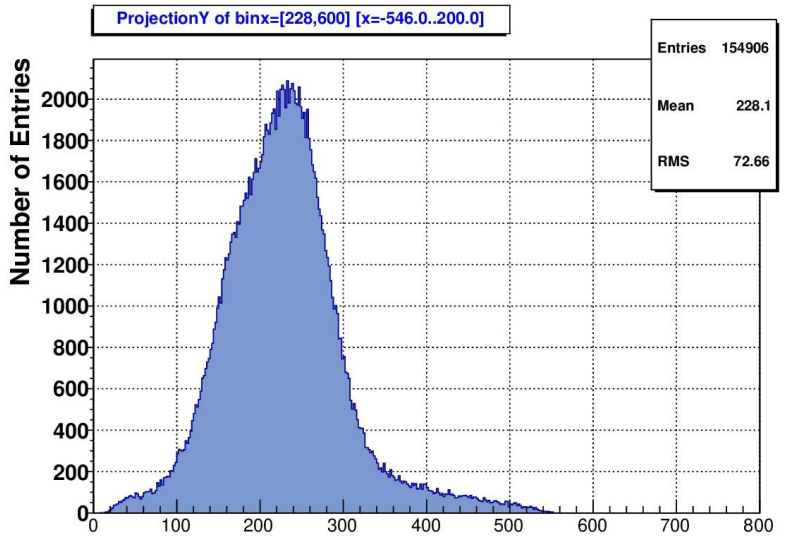
Thank you

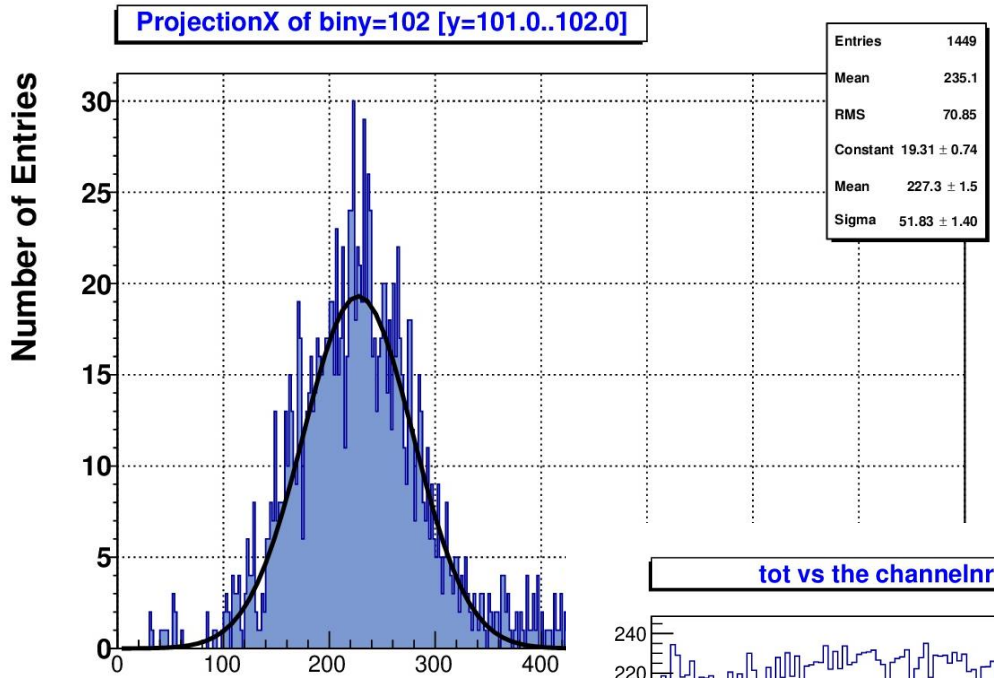
for

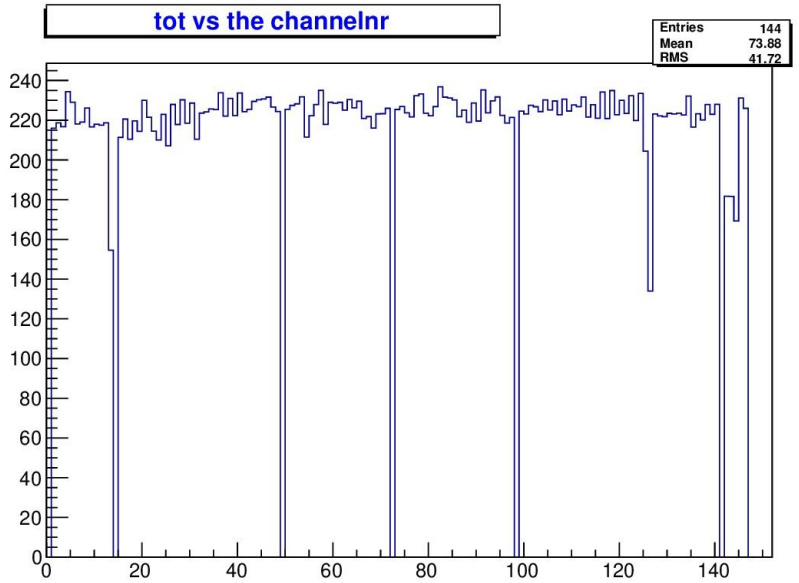
your attention

Backup


tot vs channel all hits
Entries 155596
Mean x 228.2
Mean y 82.07
RMS x 72.88
RMS y 41.18


ProjectionY of binx=[228,600] [x=-546.0..200.0]
Entries 154906
Mean 228.1
RMS 72.66
Number of Entries


ProjectionX of biny=102 [y=101.0..102.0]
Entries 1449
Mean 235.1
RMS 70.85
Constant 19.31 ± 0.74
Mean 227.3 ± 1.5
Sigma 51.83 ± 1.40
Number of Entries


tot vs the channelnr
Entries 144
Mean 73.88
RMS 41.72