

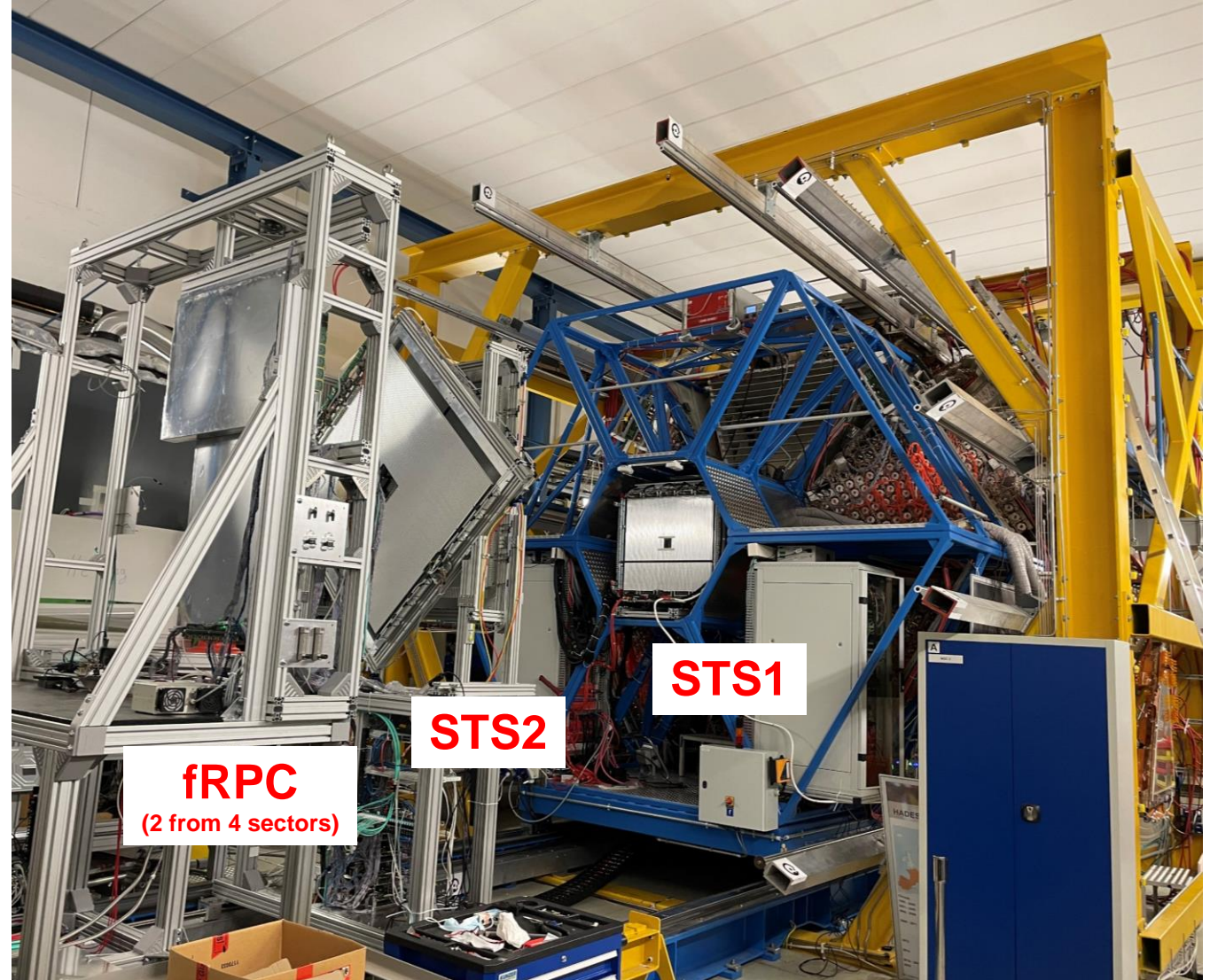
STATUS UPDATE – STS1 - STT

Peter Wintz (IKP, FZ Jülich)

Status Outline

- STS Phase-0 @ HADES
 - Status and Timelines
 - Readout test and calibration for STS1/2:
~2000 straw channels in total
- Implications for PANDA-STT
 - PASTTREC settings
 - Space-time calibration

Reminder: Phase-0 as test of PANDA systems under experiment conditions



Phase 0: Status and Timelines 2021/22

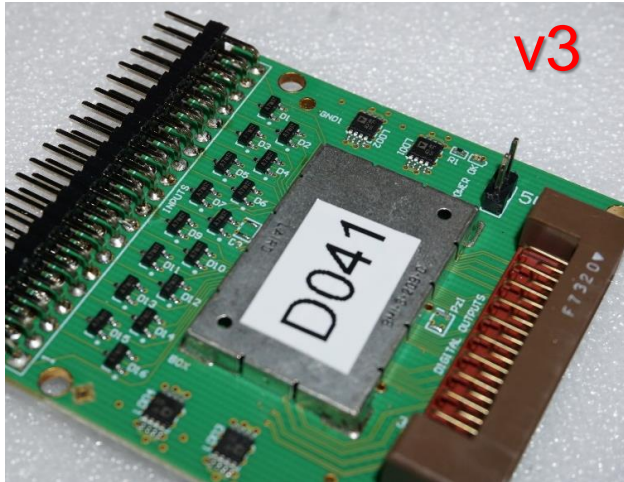


- Feb. 2021 Commiss. beamtime, one week, proton on IH2-target, 2.5 and 4.2 GeV kin. beam energy
 - STS1/2 in operation and included in HADES-DAQ, no STS operation failures (also highest intensity)
 - Data-takings for different ASIC settings and beam intensity (up to 10^5 s^{-1} per straw)
 - Set up calibration and tracking algorithms in HYDRA-SW
 - fRPC (ToF) two from four sectors set up
- Summer New PASTTREC boards (packed ASICs) delivered, QA developed and tested (in AGH Krakow)
- Sep. STS1/STS2 maintenance (FEE-boards exchange, new BL tune, ..), **STS ready for operation**
- Oct.- HADES running up has started, test stability and completeness of all systems in HADES-DAQ
 - All detector systems in (HV-) operation, check all RO-HW
- Nov/Dec. Installation completion of fRPC (sectors 3+4) and iTOF (new)
- **Feb/Mar 2022 Experiment beamtime**, four weeks, proton beam (4.5 GeV) on IH2-target
 - High intensity proton beam and optimized focus on target

PASTTREC Settings for PANDA-STT

Reminder: PASTTREC-ASIC (= amplifier, shaper, discriminator chip)

- Amp. factors: 0.67 mV/fC, 1 mV/fC, 2 mV/fC, 4 mV/fC
 - Lowest noise at 4 mV/fC (circuitry design, remark by Marek Idzik)
 - Different gain factors require diff. TC shaping parameters (> 6000 combinations poss, SW controlled)
- Feb.21 in-beam data used to test different ampl. settings and data quality
 - Higher momentum protons (> 3 GeV/c and MIP) in forward STS



PASTTREC board (v3) with bonded ASICs (left) and new board (v4) with packed ASICs (middle). Exchange of faulty boards at STS1 by new boards (right).

PASTTREC Setting for PANDA-STT

Data quality check for different ASIC settings (by Gabriela P.)

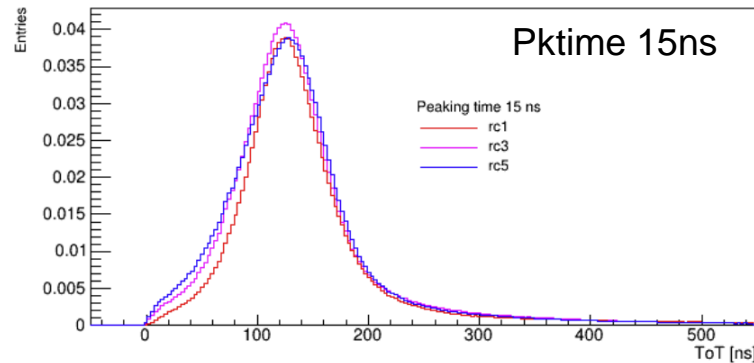
- Different ASIC settings include gain factor, peaking time, tail cancel. shaping
- HV was adjusted to get same ToT for same peaking times
- Drift time spectra checked, ~ 10-15ns longer time range explained by lower drift velocity at 1650 V (Garfield simulation)

**STS1, Gain 1
HV = 1800 V**

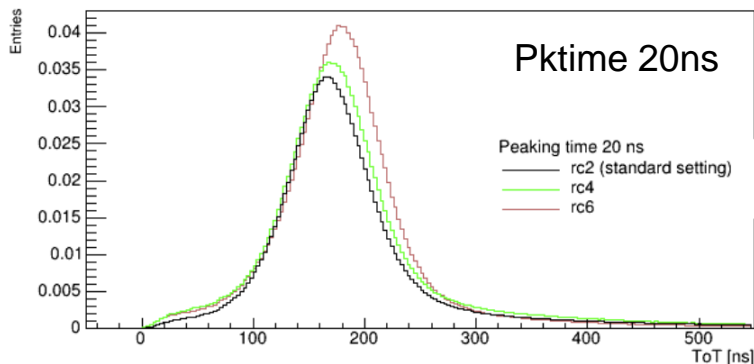
**STS1, Gain 4
HV = 1650 V**

Station.Doublelayer	Tmax [ns]
STS1.1	150
STS1.2	150
STS1.3	150
STS1.4	150

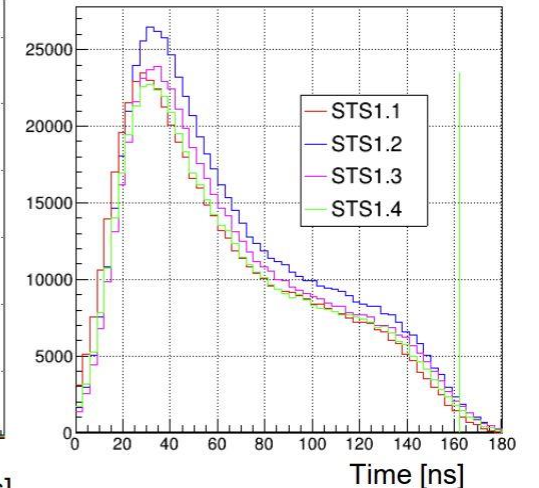
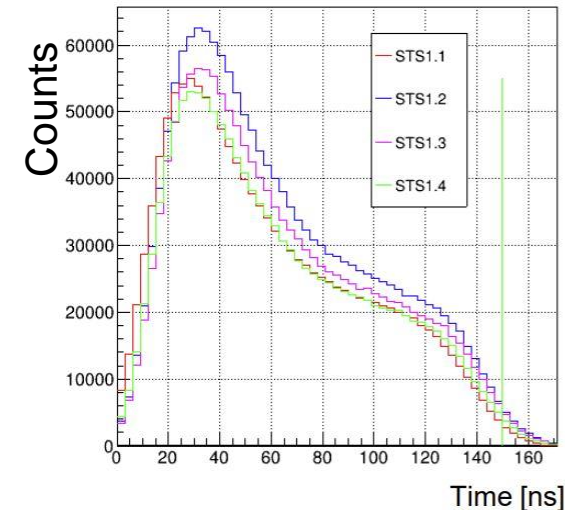
Station.Doublelayer	Tmax [ns]
STS1.1	162
STS1.2	162
STS1.3	162
STS1.4	162



Setting	HV	Gain	Peaking time [ns]
rc1	1800	1	15
rc3	1740	2	15
rc5	1650	4	15



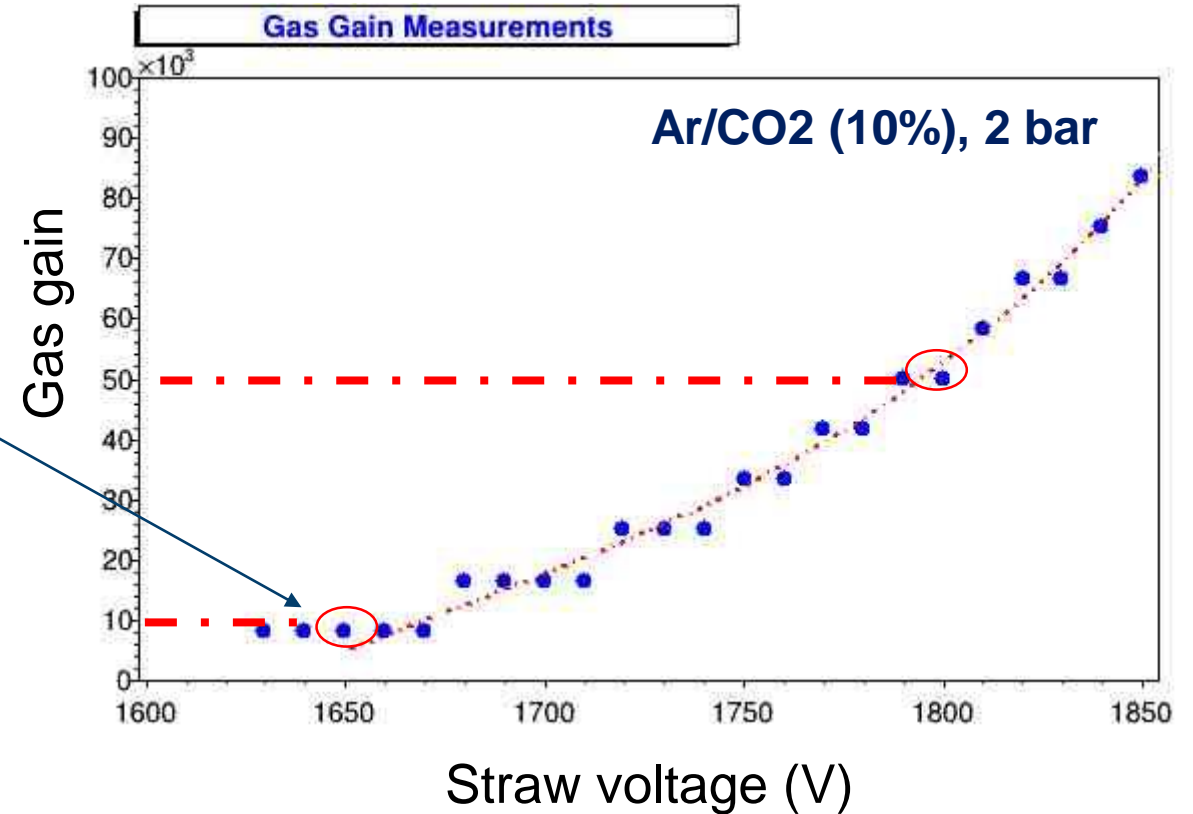
Setting	HV	Gain	Peaking time [ns]
rc2	1800	1	20
rc4	1740	2	20
rc6	1650	4	20



PASTTREC Setting for PANDA-STT

Lower gas gain and reduced charge load possible

- Choosing ASIC setting with 4mV/fC instead of 1mV/fC
- Same signal shapes for HV=1650V instead of 1800V
- Gas gain range for STT operation $A \sim 1(!) - 5 \times 10^4$
- Low noise levels allow to operate at **low $A \sim 1 \times 10^4$**
- Checked for high mom. protons (MIP) in HADES-STTS
- Tested for STS1 (75cm straw length) and STS2 (120cm straw length) with in total ~ 2000 channels



High sensitivity of PASTTREC ASIC and low noise level

⁵⁵Fe (X-ray, 5.9 keV, 2.9 keV escape), 2nA current resolution

allow to reduce charge load (aging) in straws by up to a factor 4 !

STS Calibration Procedure



- Calibration of STS1/2 data from Feb.21 commissioning beamtime ongoing
 - Time of flight correction using fRPC data → *Konrad. S (JUK)*
 - Time offsets and parametrisation of isochrone radius - drift time relation $r(t)$ → *Gabriela P. (FZJ)*
- Check if “global” calibration sufficient for multi-1000 channel straw system
 - Timeoffsets and “global” $r(t)$ calibration seems possible (simplification, robust)
 - Benefit from precise straw geometry by thin mylar wall (27 μm) and overpressure (1 bar)
- Method of channel individual PASTTREC BL-tunes verified (QA tests)
- Maybe add ToT-alignment for BL-tune in future as QA item
→ improves ToT resolution for PID, important for PANDA-STT

Summary

