

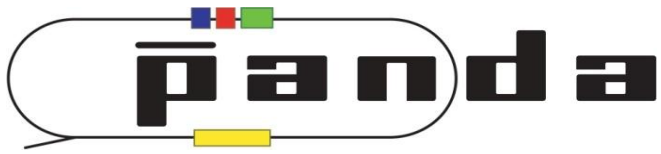
# Tracking Session at CM XLV

chaired by Peter Wintz (FZ Juelich) , Paola Gianotti (INFN)

Tuesday 25 June 2013 from **09:00** to **12:40** (Europe/Berlin)  
at Universe ( ASR )

## Tuesday 25 June 2013

- |               |  |
|---------------|--|
| 09:00 - 09:20 | Status report about activities in Juelich 20'<br>Speaker: Peter Wintz (FZ Juelich)   |
| 09:20 - 09:40 | recent ToT & spatial resolution study 20'<br>Speaker: Jacek Biernat (Jagellonian University Krakow)                                |
| 09:40 - 10:00 | Thermal studies for STT electronics 20'<br>Speaker: Vincenzo Lucherini (LNF)   |
| 10:00 - 10:20 | Status of the offline Pattern Recognition 20'<br>Speaker: Gianluigi Boca (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)) |
| 10:20 - 11:00 | coffee break   |
| 11:00 - 11:20 | Status of Cracow ASIC 20'<br>Speaker: Grzegorz Korcyl (Jagiellonian University)  |
| 11:20 - 11:40 | STT online tracking algorithm 20'<br>Speaker: Yutie Liang (Giessen University)   |
| 11:40 - 12:00 | Progress of STT online tracking based on GPU 20'<br>Speaker: Hua Ye (leaf3@mail.ustc.edu.cn)                                       |
| 12:00 - 12:20 | Status of the PANDA GEM-Tracker subsystem 20'<br>Speaker: Bernd Voss (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))     |
| 12:20 - 12:40 | Cellular Automaton tracking in STT and MVD 20'<br>Speaker: Ivan Kisel (Frankfurt University)                                       |



# Status Report About Activities In Juelich

Peter Wintz (IKP - FZ Jülich)

**XLV – PANDA Collaboration Meeting, June-25, 2013**

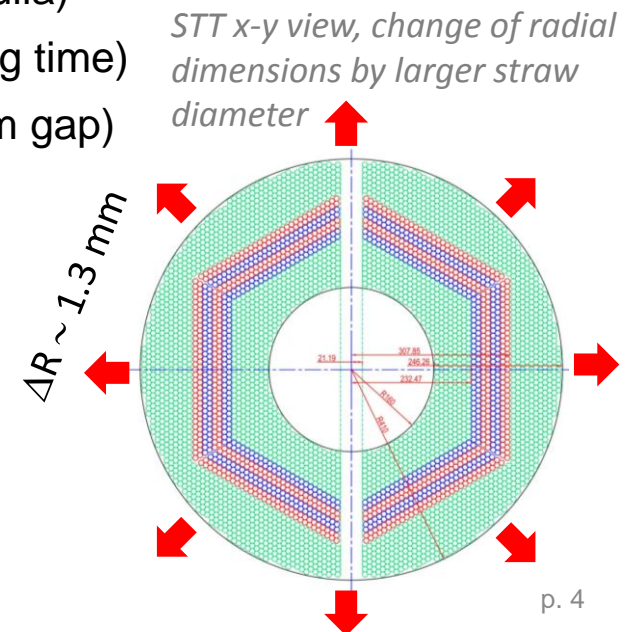
# Outline Juelich Activities

- STT layout
  - Geometry update / gas distribution
- Online tracking (→ Marius)
- STT construction (WPs)
  - Straw mass production
  - Hexagon sector setup
  - Readout electronics (→ Jacek/Greg)
- COSY-beam tests

*New to the group: Artur Cebulla, [a.cebulla@fz-juelich.de](mailto:a.cebulla@fz-juelich.de)*

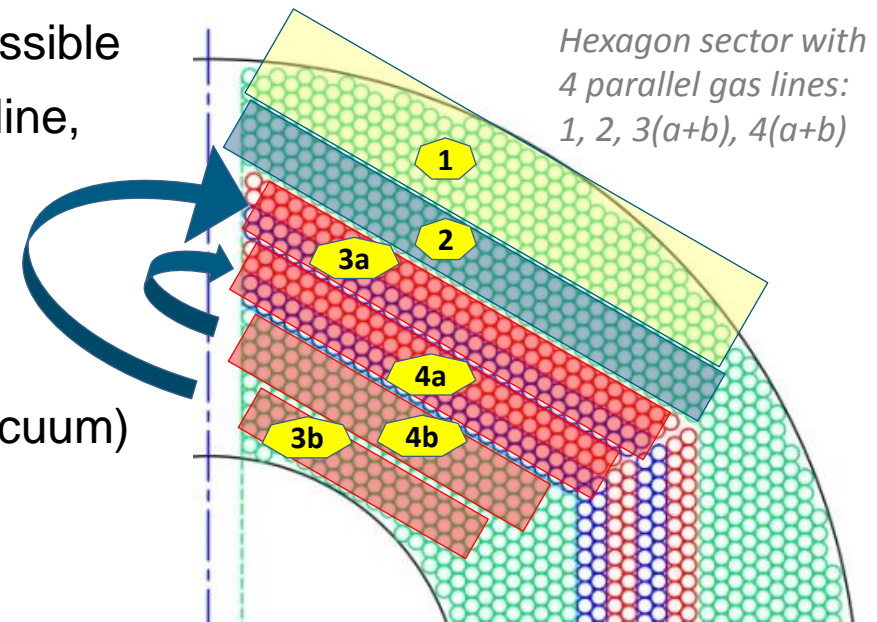
# STT Geometry Update

- **Reminder: straws are close-packed with  $\sim 20\mu\text{m}$  gaps**
- **Pressurized straw diameter defines layout dimensions**
  - Depends on strip winding / glue layer, slight differences each delivery (LAMINA)
- **Precise diameter measurement** neccess. for final new tubes, results this Sep.
  - Method approved,  **$\sim 1\text{-}2\mu\text{m}$  precision** (by Artur Cebulla)
  - Measure diam. vs **overpressure & long-term** (setting time)
  - Change (prelim.):  $10.10 \rightarrow 10.14(5)$  mm (incl.  $20\mu\text{m}$  gap)
- **Small change in radial STT dimension ( $\sim 1.3\text{mm}$ )**
  - Few mm safety margin in layout still left
- **Re-calculation of all straw positions (in Sep./Oct.)**
  - CAD & text file for MC input (Artur/Peter)
  - Mechanical frame adaption



# STT Gas Distribution Lines

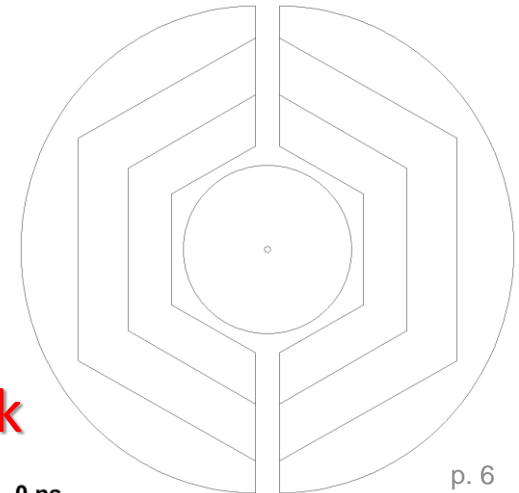
- Per semi-barrel: 12× gas supply lines, 2×12 gas pipes (in-/outlet)
- Optimisation of gas distribution scheme, parallel lines access. from outside
- Arrangement of 4 parallel gas lines per hexagon sector, if one failures
  - still 3d tracking possible with momentum reso. in each sector
  - still 3d-online track recognition possible
  - similar number of straws per gas line, #205, 196, 190, 142
  - different gas flows possible
- No hints for serious gas failures (leakage) from COSY-STT (4yrs in vacuum)
- Proposal! open for discussions



# STT Online Reconstruction

- **STT layout must fulfill** PANDA specific **reco requirements**
  - 😊 offline: full simulation & analysis of benchmark channels done
  - 😊 online: track & event reconstruction in continuous data stream
- **Online:** proof by **time-distributed event simulation (DPM)**
  - STT stand-alone tracking, based on axial zones
  - STT hits w/o external timing ( $t_0$ )
  - hit triplets method seems to work
    - **hit triplet: ~1mm precision** (cms-x,y)
    - single straw: ~3mm
    - **isochrone: ~ 150 $\mu$ m, only with  $t_0$**

*Time-distributed event simulation (DPM) and track reco based on hit triplets*



→ Marius' talk

## STT Construction WPs

- Straw mass production and layer modules
- Electronic readout system
- Mechanical frame system: STT (+ central support frame)
- Hexagon sector setup (pre-comissioning)
- Gas system
- HV system
- Slow control system (DCS)
- STT final setup and comissioning
- Partners in **Germany, Italy, Poland, Romania, ..**

# Straw Production Status

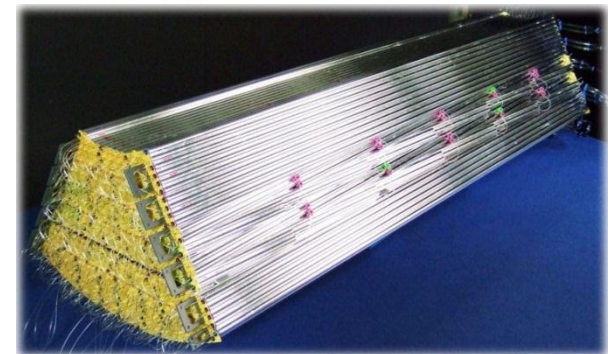
- Straw productions in Juelich (100% WP)
- **Pilot mass production run done** at end 2012/13
  - Unexpected leakage → tests, new specific. of film tubes (winding/glue)
  - Replacement order (LAMINA), first 5000 straws delivered this June
  - Re-definition of production quality criteria, assurance tests, ..
- **Final straw mass production starts this Sep.**
  - **Preps done:** all materials, mounting tools & techniques
  - **Needs 3-4 years**, including >> 50% spare straws
  - **First task: precise measure** of pressurized (p=2 bar) **straw diameter**
    - No change of inner tube diameter, same end plugs
    - New CAD drawings for straw modules (skew angle, side bands, ..)
    - Pending: new reference (groove) plate for straw layer gluing



# STT Hexagon Sector Setup

- **Ideal pre-commissioning of full STT design (mechanics & electronics)**
- **Mechanical setup** issues
  - Precision measurement of straw positions (3d-gauge)
  - Alignment structures (connecting tubes, frame-straw module connect.)
  - Mechanical frame adaption, final mounting scheme
- **Electronic readout** system
  - 800 straw channels
  - Final mounting scheme, cooling
- **Ready in 2014/ 2015**, beam tests in 2015
- In addition: existing straw prototype detector setups for ongoing beam tests

*STT hexagon sector, 1.5m length*



# STT Readout

**2 Concepts** to measure drift time + signal amplitude (for dE/dx)

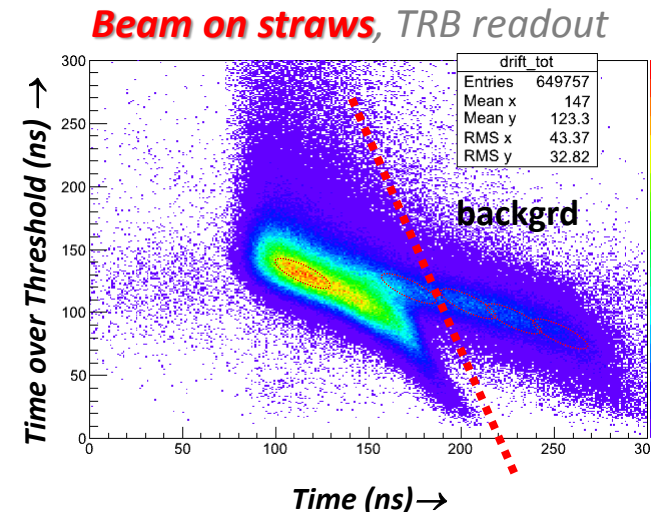
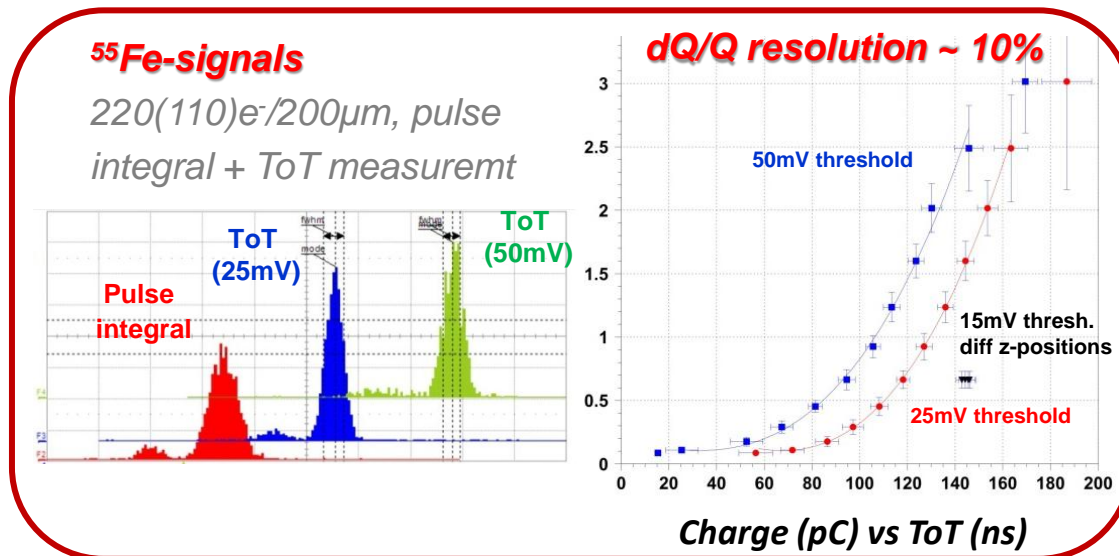
TDR fully approved, ECE evaluation & recommendation: “.. following both electronics options is a wise approach ..“

- **Amplitude sampling: LE-Time + Q**
  - Frontend amplifier + FADC (240MHz)
  - Status:  $\sigma_{r\phi} \sim 150 \mu\text{m}$ ,  $\sigma(\text{dE/dx}) < 10\%$  measured,  $\sim 7\%$  feasible at PANDA
  - Pending: High-rate FPGA pulse analysis and readout, final amplifiers
- **Amplitude by time-over-threshold\*: LE-Time + ToT(Q)**
  - Frontend ASIC chip + Time-Readout-Boards
  - Status: first in-beam tests successful, analysis ongoing (→Jacek)
  - Pending: full ToT  $\leftrightarrow$  dE/dx calibration, analysis, >4 beam momenta, larger straw setups equipped with RO (few 100 straws, inclined to beam)

*\*ToT used for PID at ATLAS-TRT & HADES-MDC*

# Time-Over-Threshold Method

- ASiC testversion with analog out, first in-beam test 2012 (→ Jacek)
- Next ASiC version in production: 100 chips× 8 ch, few param. optimisations
- Calibration of ToT ↔ dE/dx with  $^{55}\text{Fe}$ -source and beam protons
  - need >4 different beam momenta to get ToT ↔ dE/dx relation and resolution

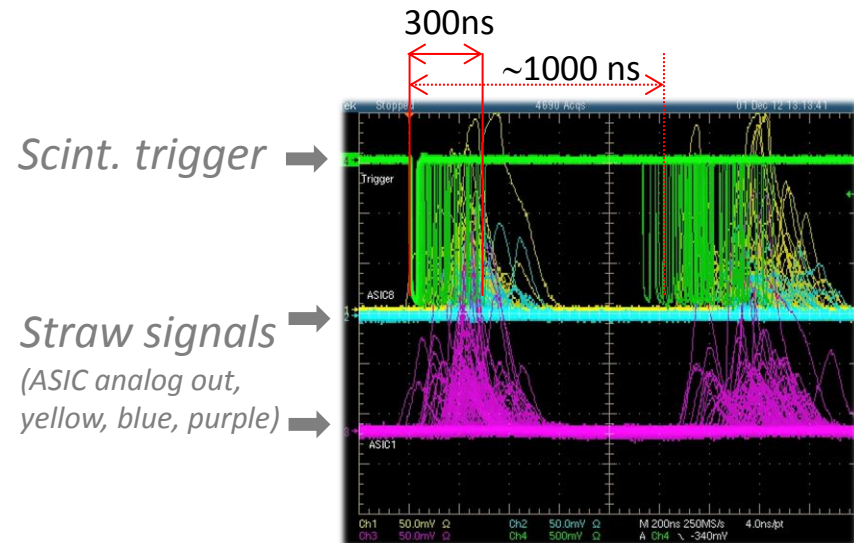


# COSY Beam Tests

- Accessible dE/dx-range:  $\sim 10 \times$  mips with proton/deuteron beams  $\sim 0.6-3$  GeV/c
- Straw prototype setups for readout tests in COSY beam area (Big Karl)
- Pileups (trigger + straws) during last beam test (Dec-12)
  - multiple beam/triggers within 300ns, delayed straw hit times possible
  - next time: cleaner setup (multiplicity veto, lower intensities for checks, ..)



2 Straw setups, beam coming from the back (Big Karl area)



## Summary

- Well prepared to start straw production in Sep. this year
- Beam straw tests at COSY ongoing for high-rate measurements
- Hexagon sector setup ideal for pre-commissioning (mechanics/electr.)
- Followed by dedicated beam tests at COSY in 2015