

STT Activities in Jülich

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and IKP, ZAT, ZEL at FZJ

STT @ COSY-TOF

- **Test System for PANDA-STT**
- **Beam time in May 2009 (2w)**
- **Calibration ➔ talk by M. Roeder**

PANDA - STT

- **Design issues**
- **Straw material order status**
- **Straw production**

STT@COSY as Test System for PANDA-STT

| | COSY-STT | PANDA-STT |
|---------------------------|--------------------------------------|---|
| Straw materials | same (most) | |
| Straw layers | close-packed | close-packed |
| Geometry | stack of planar double-layers | hexagon sectors of planar double-layers |
| Straw length | 1050mm | 1200mm |
| Straw number | 2700 | 4200 |
| Gas mixture | Ar / CO ₂ (10-20%) | Ar / CO ₂ (10-20%) |
| Gas pressure | p=1.25 bar | p=2.0 bar |
| Environment | in vacuum | in atmosphere |
| Readout | preamps + discr. + TDCs | new dedicated readout |
| Spatial resolution | $\sigma_{r\phi} \sim 150\mu\text{m}$ | $\sigma_{r\phi} \sim 150\mu\text{m},$ $\sigma_z \sim 2 \text{ mm}$ |

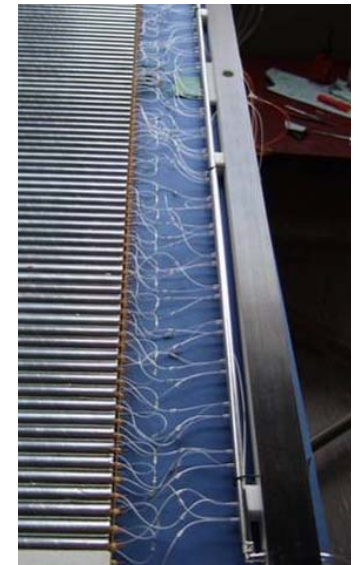
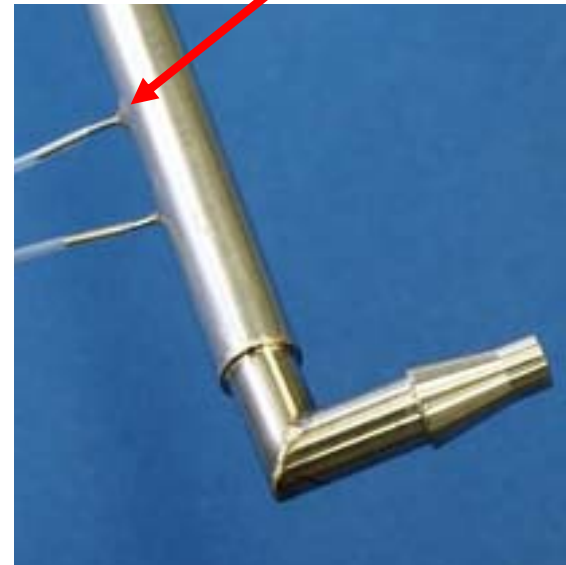
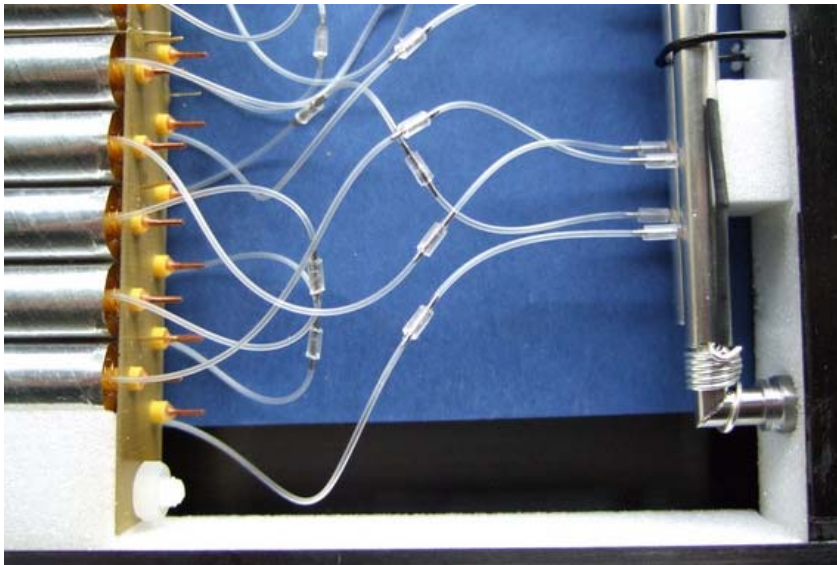
STT @ COSY

- **STT was installed in COSY-TOF vacuum barrel in summer 2008**
 - **Only single days with beam, no experiment beam time**
 - **Vacuum operation of ~ 6 months**
 - **Micro gas leaks showed up, probably at gas manifolds**
 - **not seen before in surrounding atmosphere after years**
 - **but after months in surrounding vacuum (by low humidity)**
 - **Decision to develop new gas manifolds and replace all**
- ➡ Complete dismantling of STT necessary**

New Gas Manifolds for COSY-STT

- Old design (glued PP-profiles) with micro leaks after months in vacuum
- New design: steel pipes ($\varnothing=6\text{mm}$, $d=100\mu\text{m}$)
 - 37 gram per double-layer of 204 straws
 - $X/X_0 \sim 1.2\%$ per double-layer (2 pipes for in-/outlet)
 - STT leakage at permeation level, measured: ~ 5 litre/day (Ar/CO₂ 10%)

gas pins (52×30) fixed by
laser welding (FZJ-ZAT)



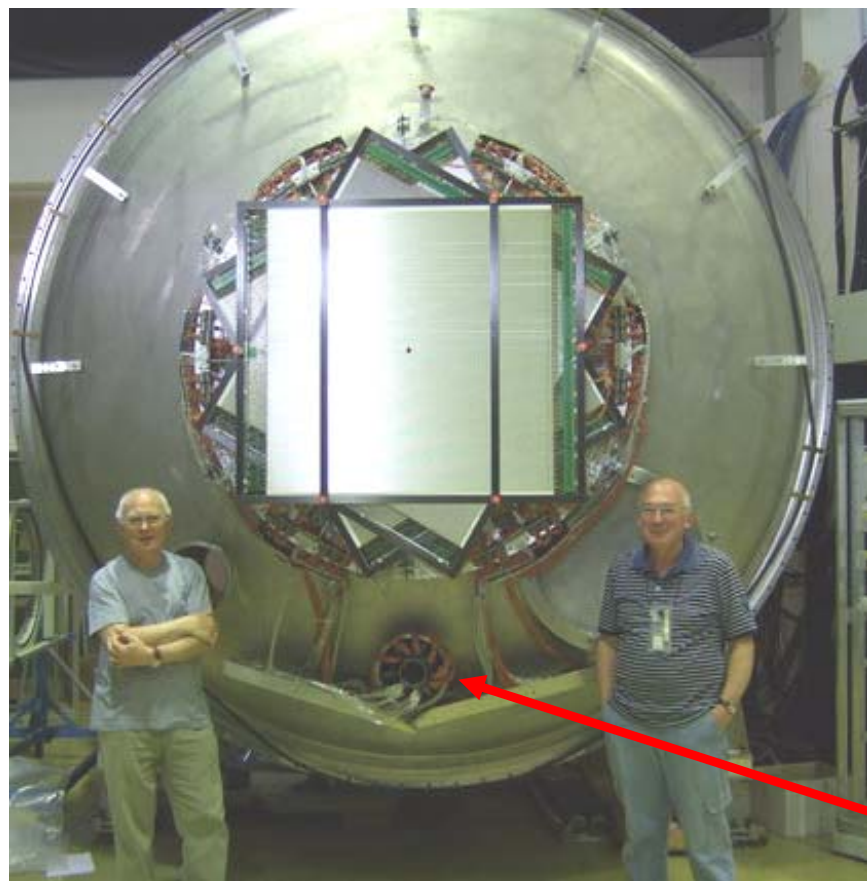
STT @ COSY-TOF Upgrade (1)

- Decision for upgrade in Jan-09
- Next allocated beam time was in May-09
- Tough schedule
 - **Dismount all 30 straw layers**
 - **Identify μ -leaks** ➔ located at gas manifolds
 - Exchange by **30 new gas manifolds** made of steel
 - Produced at ZAT-FZJ
 - **Replace few single straws** with broken wires
 - **Mount STT in COSY-TOF** vacuum tank, reduction to 26 layers

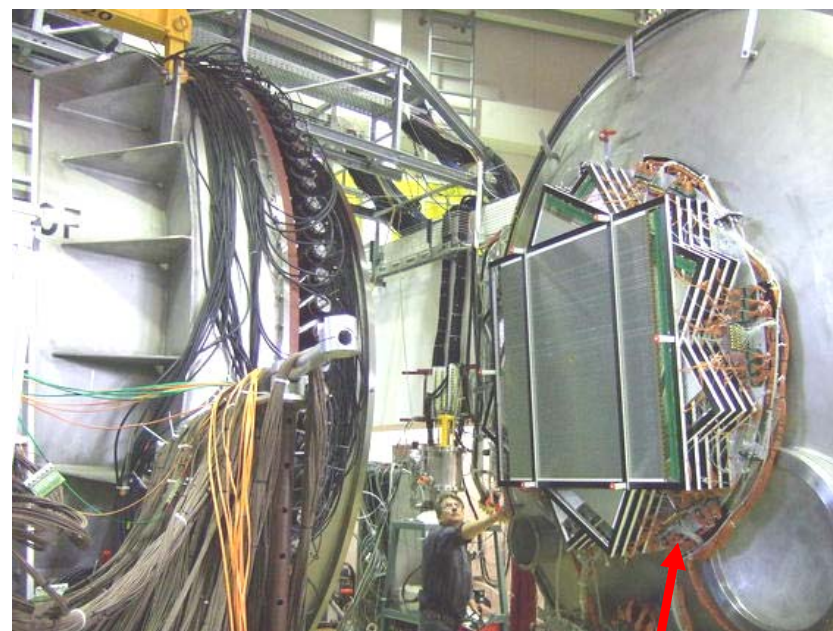
➔ **All done within 3 months**

STT @ COSY-TOF Upgrade (2)

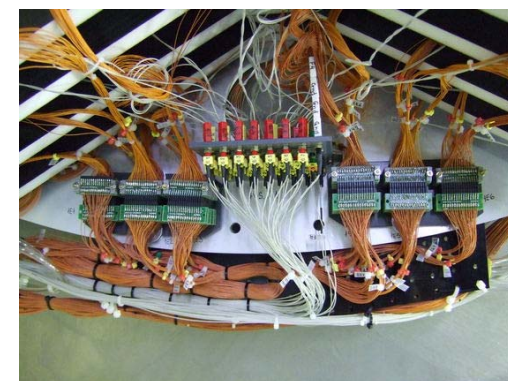
Upgraded STT mounted at the COSY-TOF front cap



V. Kozlov & S. Orfanitski in front of STT



Mounting the front cap with STT to the vacuum barrel



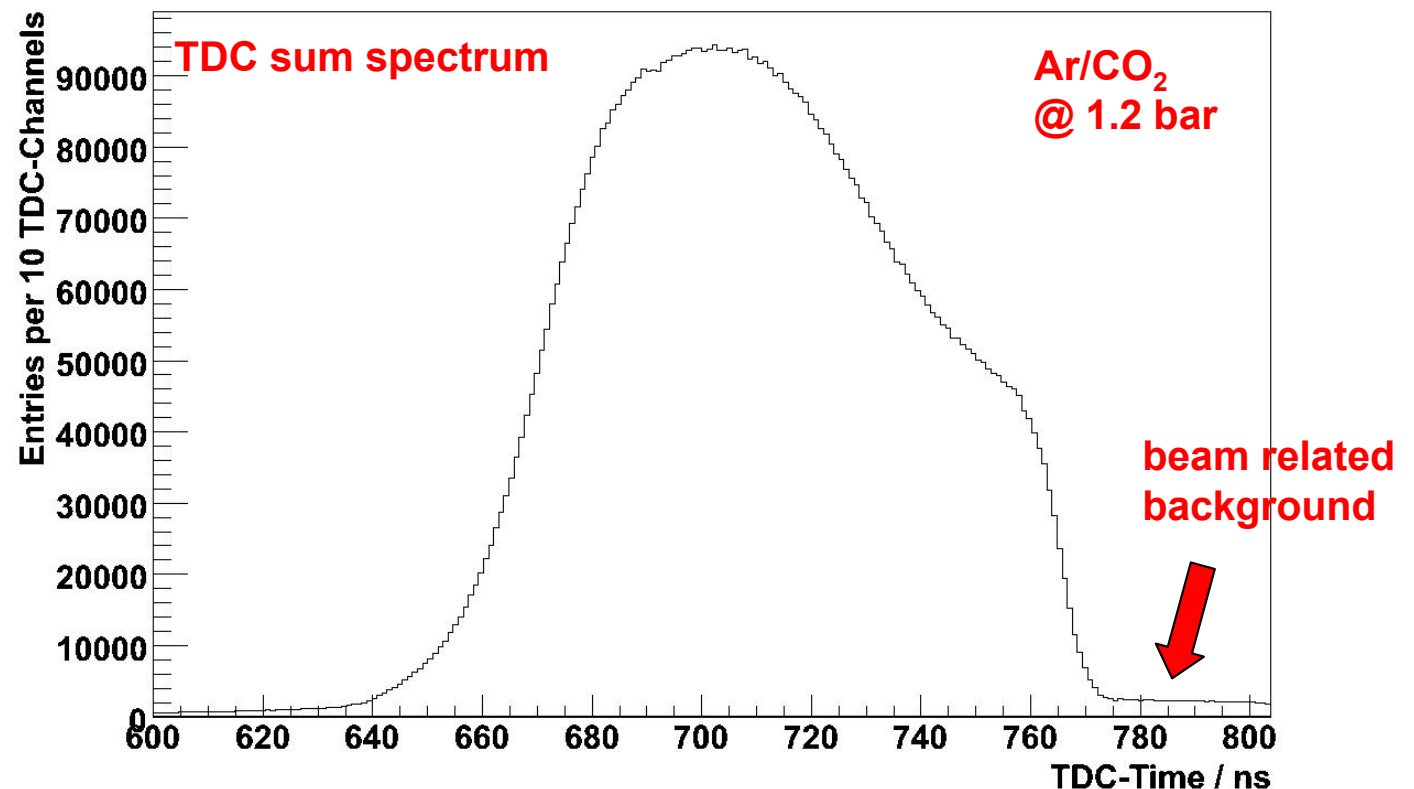
First Beam Time in May 2009

- 2 weeks for $\vec{p}p \rightarrow pK\Lambda$ at 2.95 GeV/c
- First experiment beam time with STT
- STT with 26 layers (2700 straws)
 - operated inside COSY-TOF vacuum (at $\sim 4 \times 10^{-3}$ mbar)
 - one straw with broken wire after installation (16ch HV sector off)
- Operation settings:
 - Ar/CO₂(10%) at p=1.25 bar (absolute)
 - 1600 V
- Threshold tuning ($\times 170$) of ASD8 discriminators
- **Stable operation of detector & readout**
- Implementing new STT into the COSY-TOF tracking algorithm
- Data analysis has just started ..

STT Performance

Clean and same TDC spectra for all 2700 straws

- $\sigma (t_{\max}=115\text{ns}) \sim 1\text{ns} \rightarrow \sigma (r_{\max}=5\text{mm}) \sim 50\mu\text{m}$ (incl. wire sag)
- confirms precise straw diameter definition by pressurized film tube
- global space-time calibration for all straws \rightarrow talk by Matthias Roeder

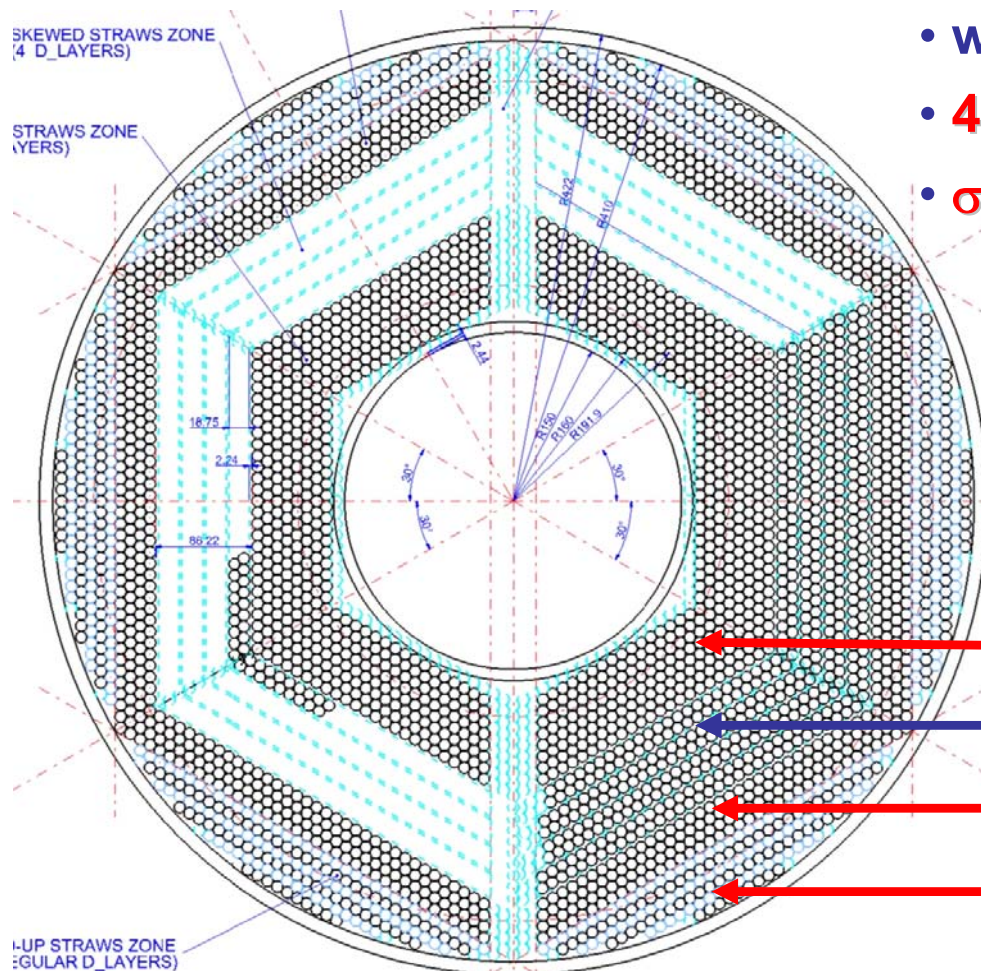


STT Gas Mixtures

- Ar/CO₂(10%) at p=1.25 bar in COSY-TOF vacuum
 - *gas gain: $A \sim 10-15 \times 10^4$ and 1570-1600 V*
 - *linear space – time relation, less critical to gas variations*
 - *small aging measured for some straws operated with 10% CO₂*
- Ar/CO₂(30%)
 - *no aging observed for all straws operated with 30% CO₂*
 - *non-linear space-time relation, but same resolution (PAVIA simul.)*
- PANDA-STT operated at p=2.0 bar
 - *higher ionisation density* ➔ *higher spatial resolution close to wire*
 - *few 100 V higher voltage, 1800 (10% CO₂) - 2200 V (30% CO₂)*
- Gas exchange $\sim 4 \times V_{\text{STT}} / \text{day}$ (open exhaust) ➔ **3300 litre/day @ PANDA**
- STT leakage measured: $\leq 1 \text{ mbar} / \text{h}$ ➔ **~ 10 litre/day @ PANDA**

PANDA-STT Layout

Cross section views



Best mech. skewed layer geometry by

- 4 double-layers (+/-/+/-)
 - with $\Delta r \sim 2\text{mm}$ (rohacell) spacing
 - **4.3° skew angle** (instead of 3°)
 - $\sigma_z = 2.0\text{ mm}$ (instead of 2.9 mm)
- at $\sigma_{r\phi} = 150\mu\text{m}$

- **4×2 axial straw layers**
 - **4×2 skewed layers**
 - **2×2 axial layers**
 - **1- 6 axial rest layers**
- $\Sigma = 20-26$ straw layers**

CAD drawings by Dario Orecchini

PANDA Straw Material Order Status

Mylar film tube (ok)

- 1550mm length, ~28µm film thickness,
- aluminised inside & outside (light shielding)

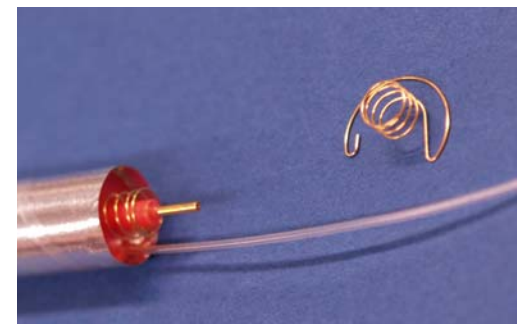
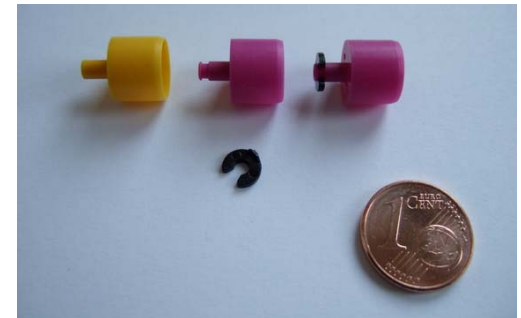
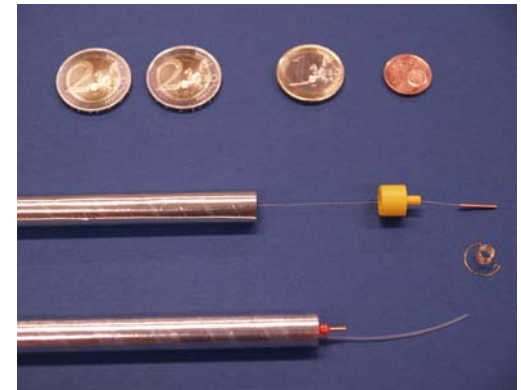
End plugs

- old design (yellow) (ok)
- new design (purple) ~~(ok)~~

Contact springs

- Cu/Be (ok)
- gold plating afterwards (in process)

Crimp pins (in process)



Crimp Pin Problem

Quality problems of copper pins ('08➡'09)

- unexpected for a repeat order at same company
- improper cutting (1.00×0.10mm OD×ID)
- cleaning by electrolytic etching possible
- but imperfect, inner hole diameters, ..

➡ stopped now



Must find new production company, maybe

- new material (steel?)
- new design
- new mass production
- new crimping test



view at pins from top

Straw Production

New straw production during past months:

- **1200mm length**
- **unwired due to lacking crimp pins**
 - check mechanical setup
 - check skewed layer setup
- to be mixed later with wired straws for tracking
- removal of single straws inside d-layer tested
 - weaker mylar films (2×windings) than before
 - similar mylar (winding) imperfections than before

... waiting for new crimp pins ...

