STT Activities in Jülich

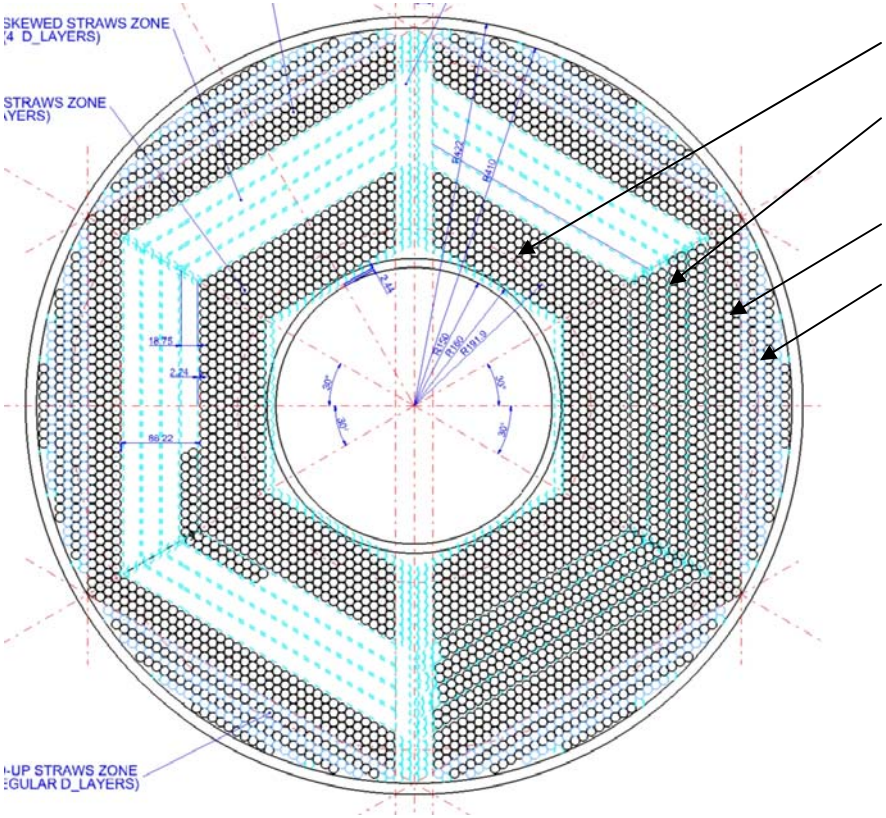
JÜLICH FORSCHUNGSZENTRUM

Outline

- Design optimisation
- Prototype construction
- Status STT @ COSY

PANDA-STT Layout

Cross section view



CAD drawing by Dario Orecchini

From inner to outer radius..

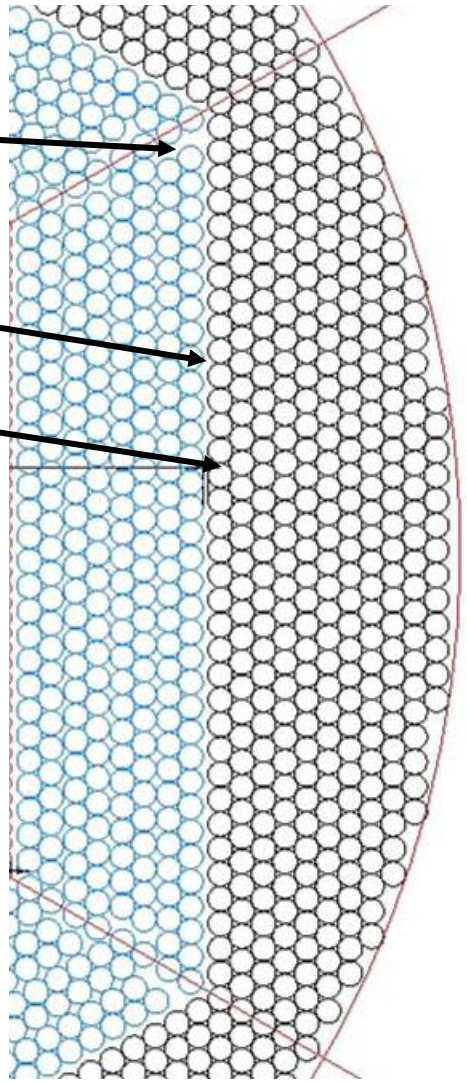
- **axial straw layers**
- **skewed straw layers**
- **axial straw layers including filling layers**

Prototype setup

STT Design Update

Optimisation of skewed layers ..

- minimal gaps at corners
- skewed double-layer close-packed
- 1.98mm space to outer axial layer
- one more axial straw layer



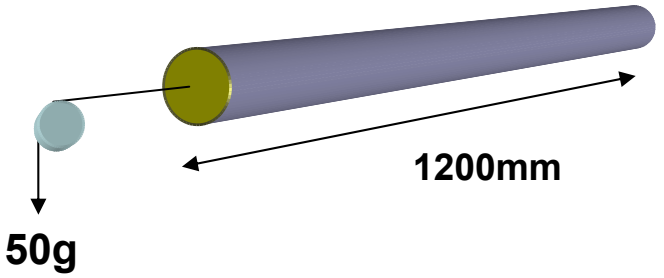
- **4400 straws**
- ~ 85% active volume (full cylinder vol. = 100%)
- **21-27 straw layers in radial direction**
  - 8 inner axial layers
  - **8 skewed layers (±2.89°)**
  - 5-11 outer axial layers

Straw Wire Crimping

Assembly of straw wire

- wire is stretched by 50gram
- centred and fixed by crimping in both end plugs
- copper crimp pins, gold-plated, 1mm outer diameter
- 0.1mm crimp bore hole
- 20µm (∅) W/Re wire, gold-plated

straw parts



Straw Wire Crimping Methods

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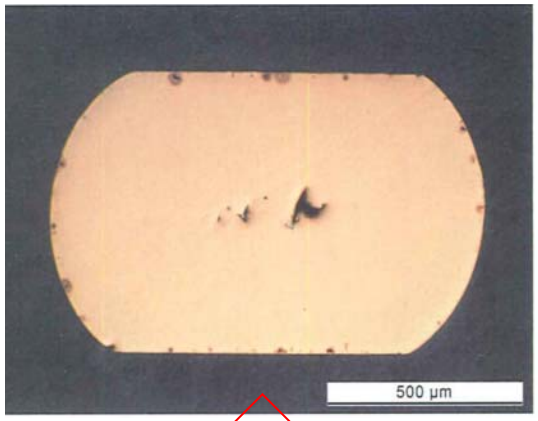
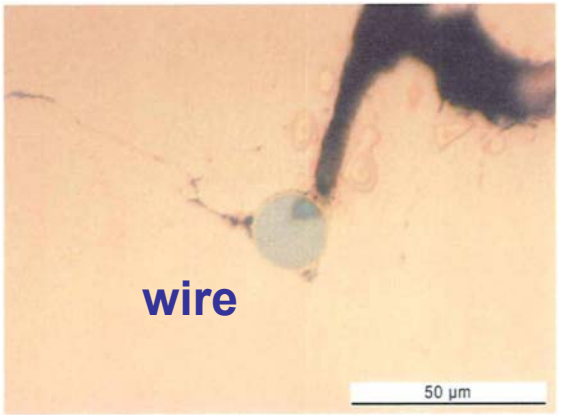
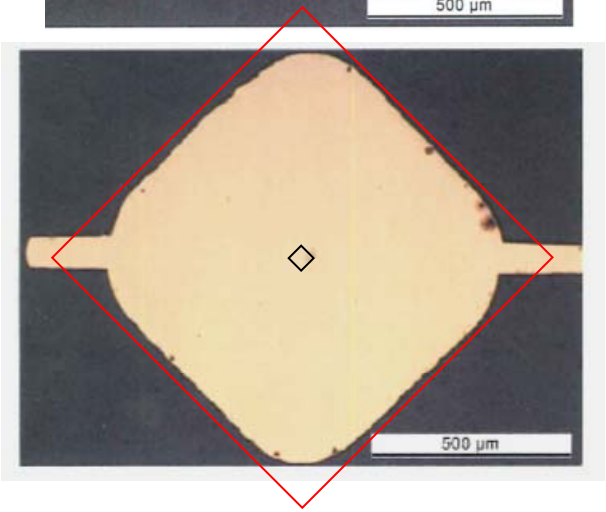
Cut through crimp pin:

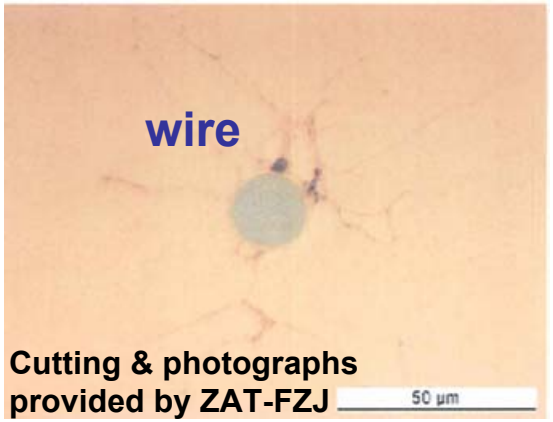
crimping in 1 direction





crimping in 2 directions

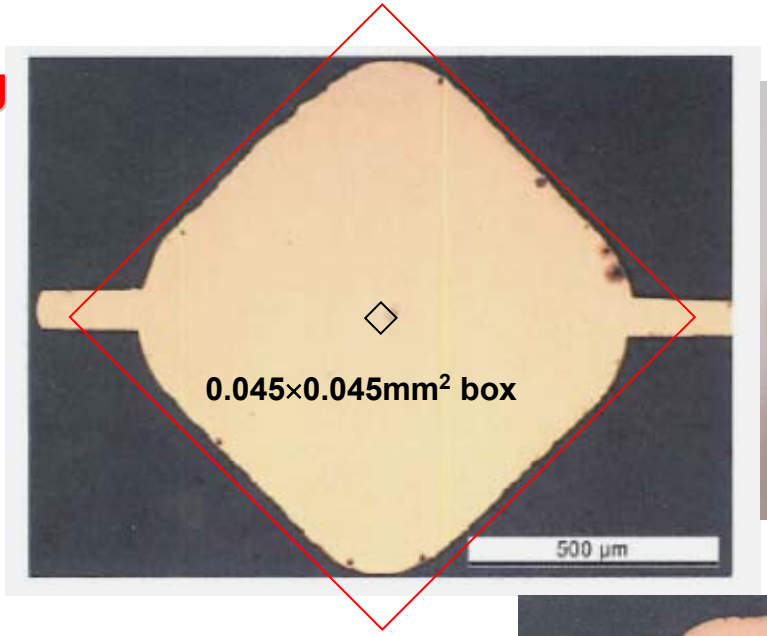




- **Difficult to fix straw wire position perpendicular to crimp direction**
- **Crimp hole diameter 0.1mm**
- **1-directional crimping: $\Delta x = \pm 40\mu m$ wire position uncertainty**
- **2-directional crimping better**

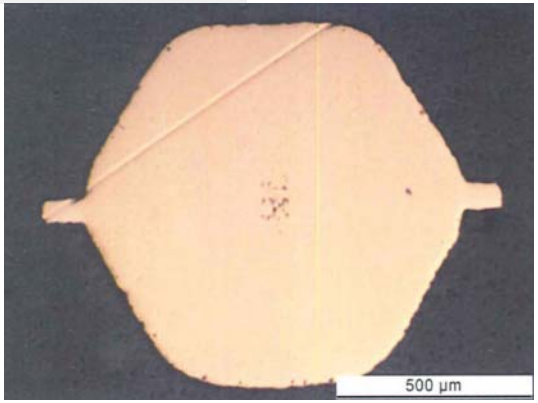
New Wire Crimping Method

- 2-directional crimping leaving
- Space for excess material
- Homogenous crimping
- σ_r ~ 20µm precision



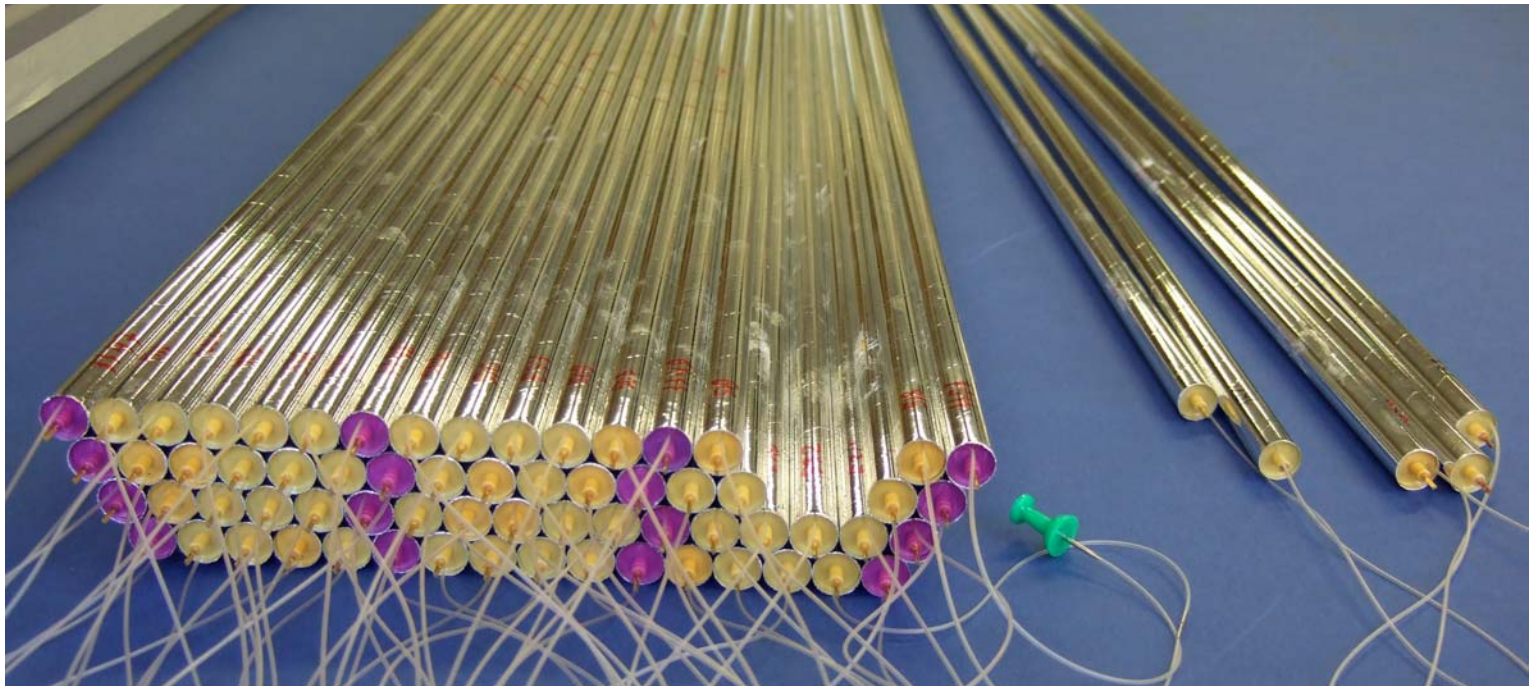
- No further improvement
  by 3-directional crimping

- Tolerance pin in endplug in tube: σ_r ~ 30µm
- Wire sag by gravitation: ΔY^{max} ~ 23µm (1.2m length)



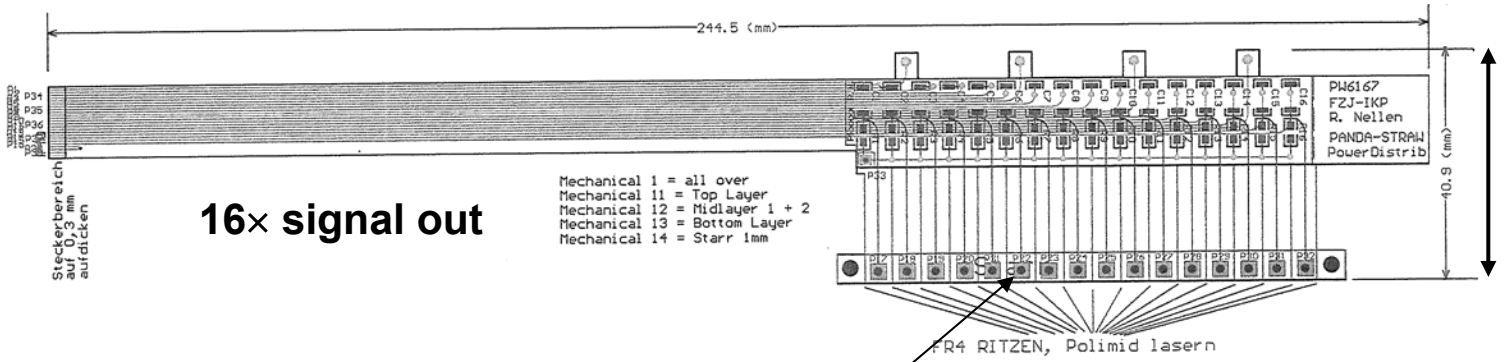
➡ Expected wire centring precision: σ_{center} ~ 40µm
(to be verified by data)

Quad-Layer Modules



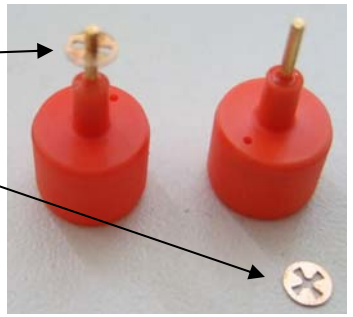
- **Straw module consists of 4 close-packed layers, glued together**
- **Increased rigidity compared to double-layer**
- **Replacement of single, faulty straws possible**
- **Even number of straws and gas lines per module**

Straw Electric Coupling Layout

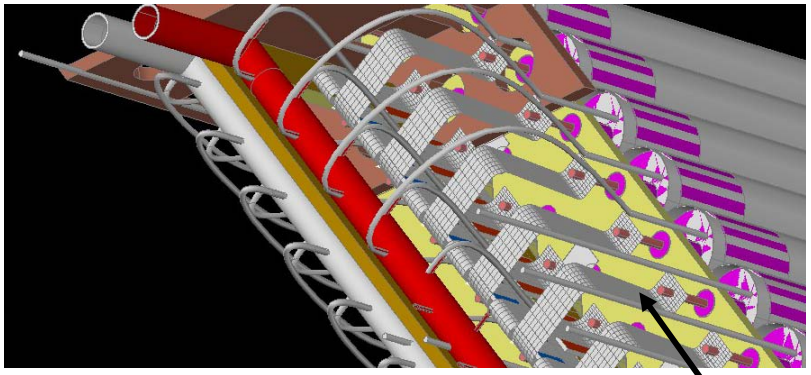


Kapton film strip containing..

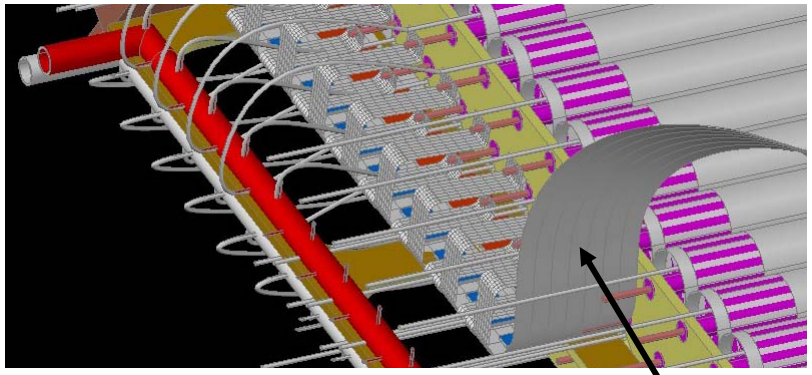
- crimp pin contact rings
- grounding spots
- HV resistor + capacitor
- option: (transimpedance) preamplifier
- 16 channel connector to readout board
- only ~ 2-3 cm longitudinal space required



Straw Modules



Kapton film strips



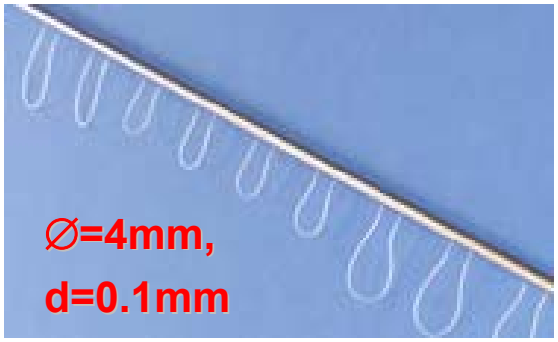
16ch signal out

Assembly method

- glue straws to a close-packed quad-layer
- add frontend supply and electric contacts
- insert module into STT frame structure

Straw module connections

- signal out (×16ch) to RO-boards
- gas manifold pipes, in series to next mod.
- HV cable to supply
- **all at backward end of STT**



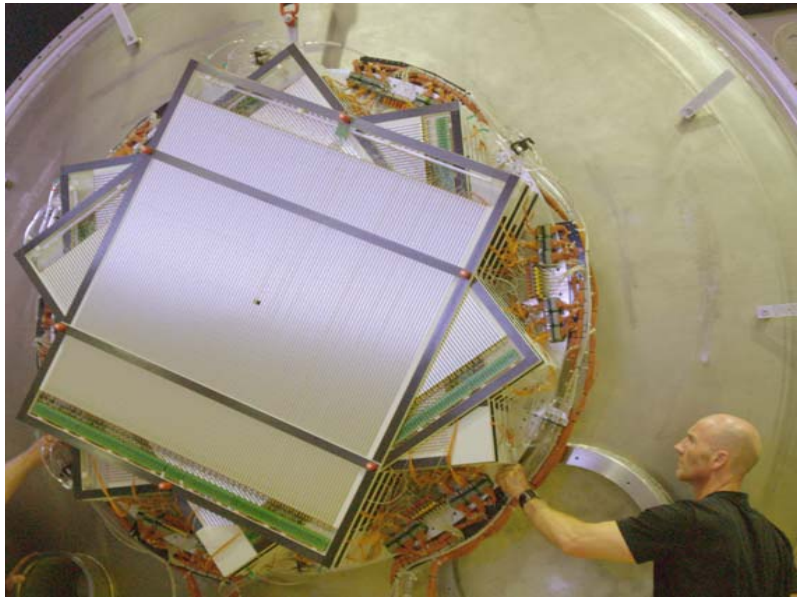
Proposed gas manifolds:

- insulated, non-magnetic steel pipes (0.1mm wall)
- 2 pipes for in-/outlet

Test System: STT @ COSY-TOF

Test system for PANDA-STT

- **2740 straws**, stack of 26 planar layers
- **same straw materials & diameter**
- operated inside vacuum at $p_{vac} < 10^{-3}$ mbar
- **Ar/CO_2 (10%) at p=1.25 bar** (abs.)
- readout: preamps in vacuum, 13m cables, discr.(ASD8) + TDC(GPX)
- **similar calibration method**: isochrone radius ↔ drift time



1st beam time in May 2009, 2 weeks
p p ➨ pKΛ at 2.95 GeV/c

- **~ 1.5 years vacuum environment (2008-2010)**
- no straw gas leakage (no material cracks, diss. glue, ..)
- upcoming beam time: 4 weeks, Jul-Aug 2010

➨ **Status report by Matthias Röder**