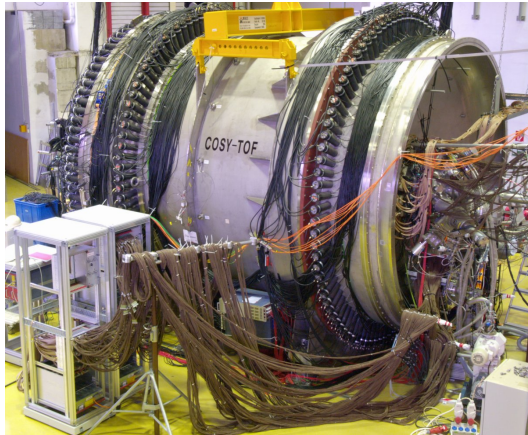


Status of the COSY-TOF Straw Tube Tracker

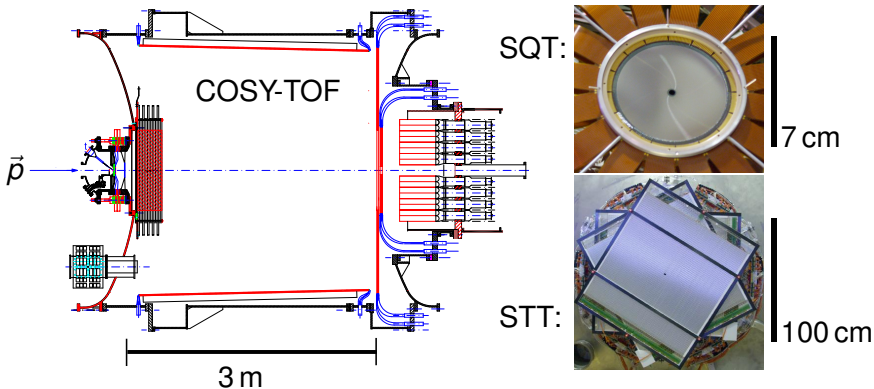
XXXIII. PANDA Collaboration Meeting – June, 15th 2010 | Matthias Röder

COSY-TOF Detector Overview I



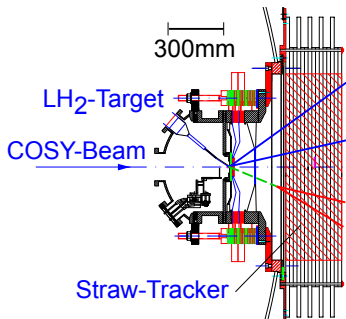
- 4π detector e.g. for $pK\Lambda$ reactions
- Vacuum barrel ($\leq 0^{-3}$ mbar) to reduce multiple scattering
- Specialised on event geometry thus no magnetic field
- Time Of Flight for momentum measurement


COSY-TOF Detector Overview II



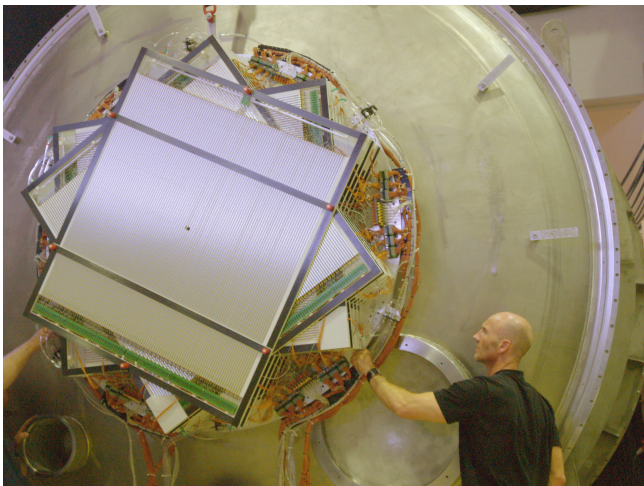
- Improved COSY-TOF Detector:
 - With the new Silicon Quirl Telescope (SQT)
 - an new Straw Tube Tracker (STT)

COSY-TOF Straw Tube Tracker



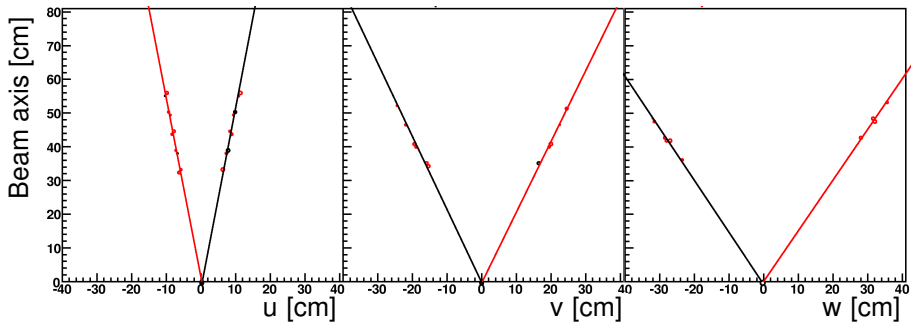
- 2740 straws ($l=1\text{m}$, $\varnothing=1\text{cm}$)
 - Arranged in 26 layers 
 - 3 orientations for 3D tracking
 - ⇒ Panda prototype with **similar system size**
- Ar:CO₂ 9:1 at 1.2 bar pressure
- Operated in **vacuum** at $\leq 10^{-3}$ mbar
 - ⇒ Harder conditions as for PANDA
- Material between target and STT:
 - Start: 2×1 mm scintillator
 - SQT: 2×500 μm silicon
 - Fibre hodoscope: 3×2 mm fibre

Straw Tube Tracker Installation



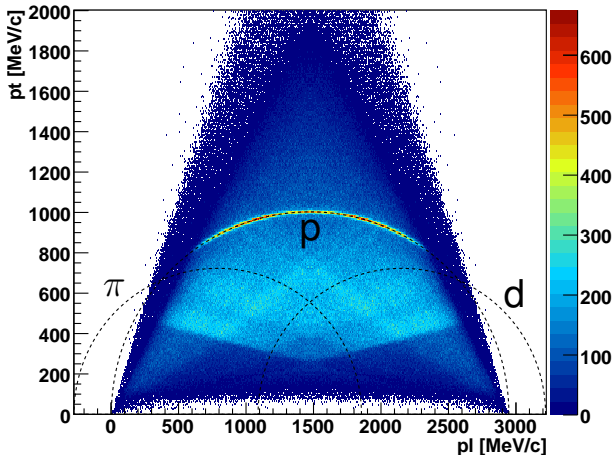
- The Straw Tube Tracker installation

Vertex Reconstruction I (only STT)



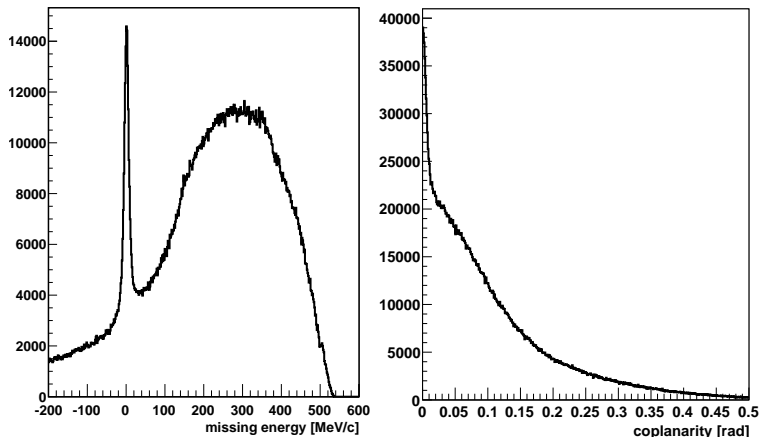
- Combination of 2 close skewed tracks
 - Common fit of track directions and vertex point
- ⇒ 7 parameter “orthogonal line fit” with the STT

Vertex Reconstruction II (only STT)



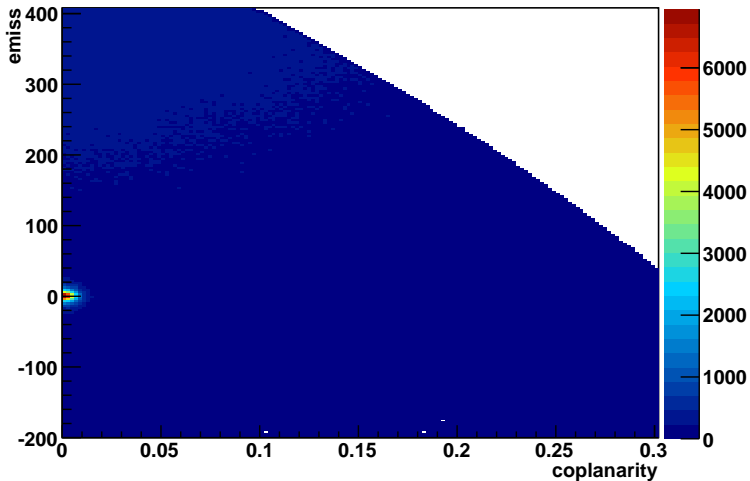
- 1 vertex events without cuts and ($p p \rightarrow 1 2$) hypothesis:
 - Distinct peak on pp ellipsis
 - Deuteron and pion ellipses drown in background

Geometrical $\vec{p}p \rightarrow pp$ Reconstruction I



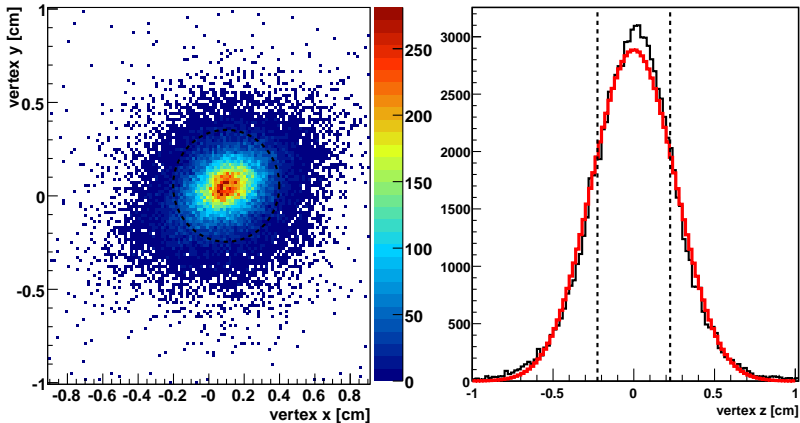
- Distinct peaks in E_x and coplanarity
- Both include too much background

Geometrical $\vec{p}p \rightarrow pp$ Reconstruction II



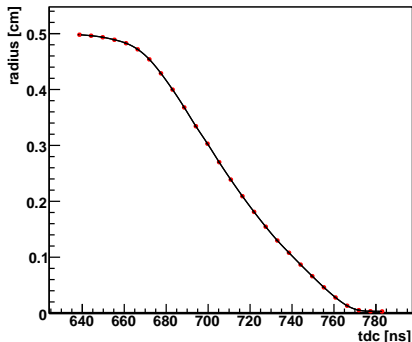
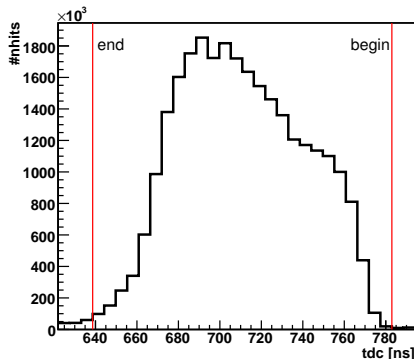
- Circular cut yields excellent S/N

$\vec{p}p \rightarrow pp$ Vertex Resolution



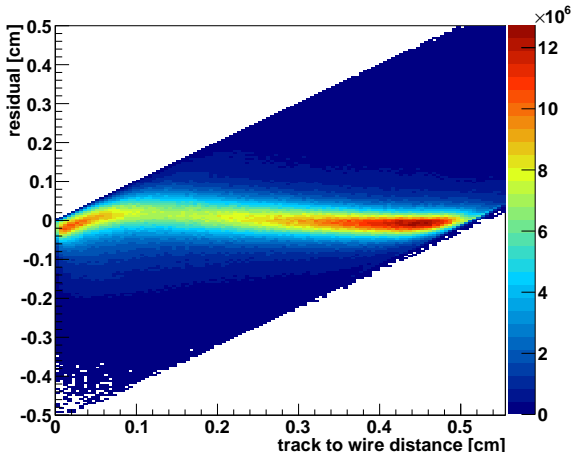
- (beam profile \times vertex resolution): $y \approx 1.1$ mm, $x \approx 1.3$ mm
 - z resolution: ≈ 2.1 mm from (Gauss \times rectangular) fit
- \Rightarrow **Very good vertex resolution** for COSY-TOF

Straw Calibration Method



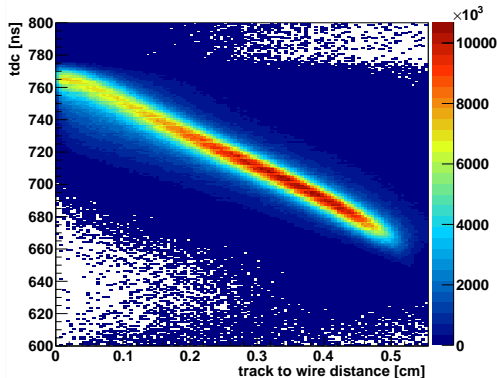
- 9:1 Ar:CO₂ @ 1 bar: linear drift time to radius relation
- ⇒ Box shaped spectrum with deviations from cluster effect
- Assume homogeneous illumination:
$$r(i_{tdc}) = \sum_{i=i_{begin}}^{i_{tdc}} (n_i) / N_{sum} \cdot R_{Straw}$$
- Calibration curve with a wide linear part but deviations at higher tdc times

Straw Calibration Improvement I



- residual = $r(\text{tdc}) - [\text{track to wire distance}]$
 - Systematic S-shaped offset from 0 for distances ≤ 0.18 cm
- ⇒ Recalibration will improve tracking performance

Straw Calibration Improvement II



- Linear relation between tdc time and most probable track to wire distance
- Work in progress: recalibration from this diagram
- Asymmetric probability distributions of distances
⇒ can only be handled by a likelihood optimisation

Conclusion and Outlook

Conclusion

- The STT implementation to COSY-TOF reconstruction software is complete
- Geometrical $\vec{p}p \rightarrow pp$ reconstruction shows that the **STT works very well**
- Recalibration and straw alignment will **further improve** the results

Outlook

- 4 weeks beam time in August with
 - Less material between target and STT
 - More CO₂ admixture possible