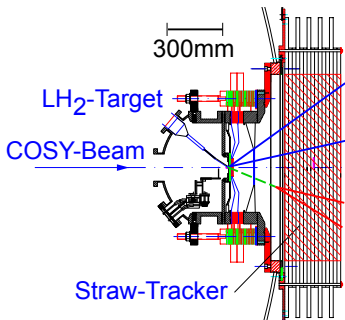# News from the COSY-TOF Straw Tube Tracker
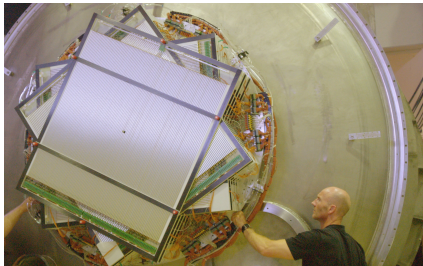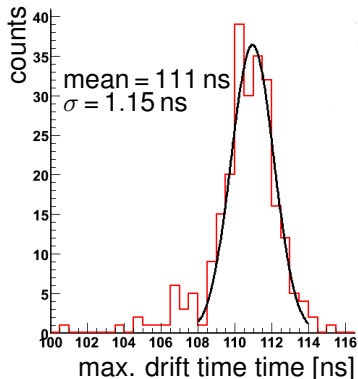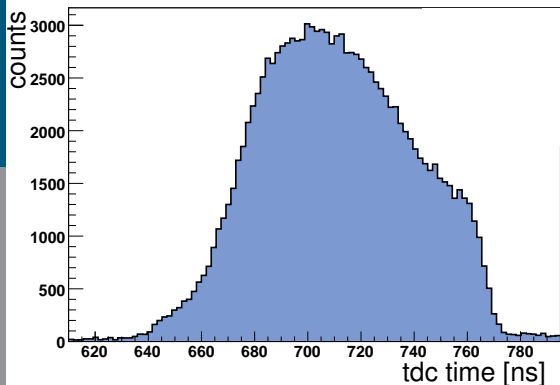
## XXX. Panda Meeting

September 8, 2009 | Matthias Röder

# Straw Tube Tracker



- 2740 drift tubes ($\ell$=1m, $\oslash$=1cm)
  - Arranged in 26 layers
  - 3 orientations for tracking
- Drift time information used to measure track to wire distance
- Ar:$CO_2$ 9:1 at 1.2 bar pressure
- Operated in Vacuum $\leq 5 \cdot 10^{-3}$ mbar
  $\Rightarrow$ Gas leakage on permeation level
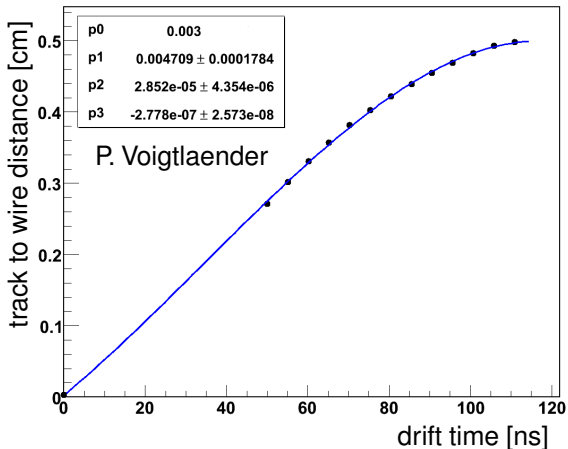
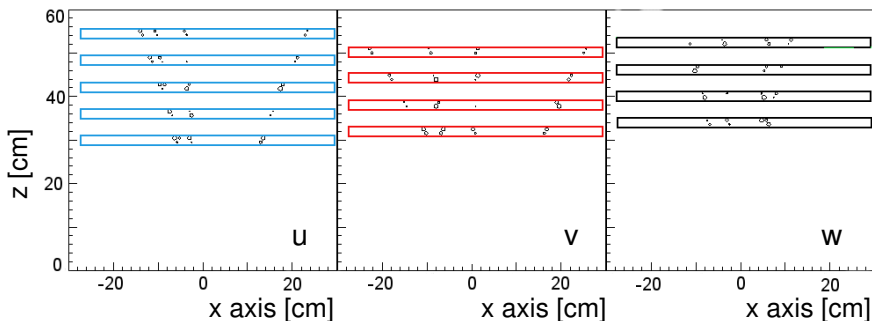# Sum TDC Spectra for All Channels



- Same drift time spectra for all straws
  e.g. 1% spread in max. drifttime
⇒ Common calibration for the whole STT

# Calibration from Drift time Spectrum



- Straw Tube Tracker drift time to track-wire distance calibration from spectrum analysis

## TOF Tracking Strategy



1. Split hits into 3 orientations (u, v, w)
2. Find all 2D tracks in each orientation
3. Combine 2D tracks to 3D tracks
4. Perform a linear regression with hits ssociated to the 3D track

# Track Finding I: Hough Transformation
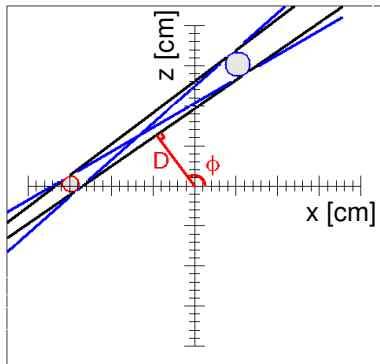


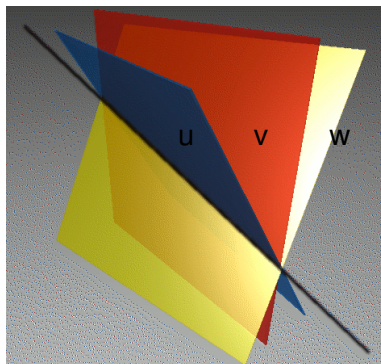- Calculate D and $\phi$ parameters
  - For all four common tangents
  - Of all hit pairs in the same layer orientation

# Track Finding II: Hough Accumulator
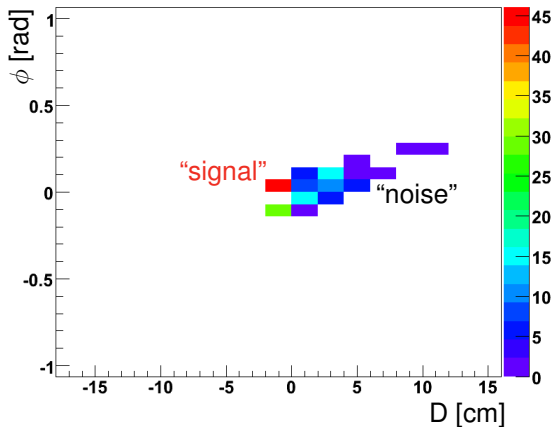
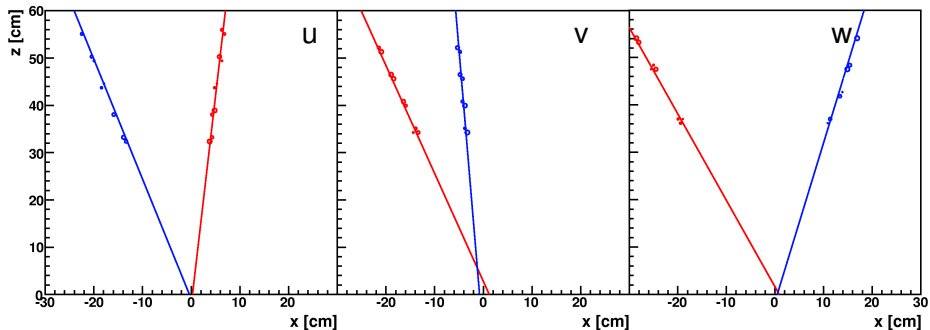

- Accumulate D, phi pairs in a 2D histogram
- Find maxima in each orientation with #hits > threshold
- ⇒ Each maximum defines a plane in 3D space

# Track Finding III: Plane Matching



- Intersect planes pair wise (uv, vw, wu) $\Rightarrow$ 3 Lines
- If 3 maxima stem from a real track these lines are close to each other $\Rightarrow$ selection criterion
- Average the 3 lines to get the track

# Track Fitting I: Method



- Average line as start values for the fit
- Hits from Hough maxima are associated to the track (if close enough to average line)
- Minimise orthogonal distances from line to isochrones (Minuit)

# Track Fitting II: pp→pp Elastic Example



u orientation
pp→pp elastic
data
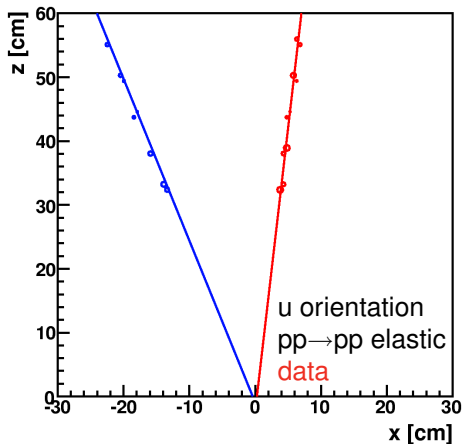
- Double layer efficiency > 90%
- Very little noise from straws
- ⇒ STT data is very good for tracking

# Transition from Monte Carlo to Data

Track fitting

- Worked from the beginning

# Transition from Monte Carlo to Data

## Track finding

- Calibration inaccuracies (alignment $*$ drift time calibration)
- $\Rightarrow$ Bad signal/noise requires large bin sizes for accumulator
- $\Rightarrow$ Plane matching inefficient

- Need working tracking to refine calibration [DONE]
- $\Rightarrow$ Improved software to handle several maxima
  - From "small enough" bin sizes
  - And "low enough" thresholds

# Low Threshold Example
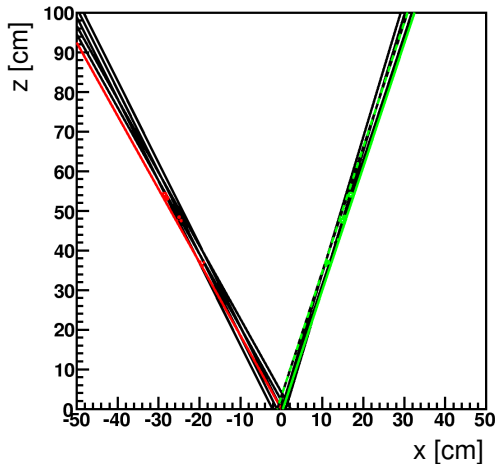


- Example of track finding under "rough" conditions

# Work in Progress

To do:

1. Analyse fit residuals
2. Refine straw positioning / drift time calibration
3. Be happy about improved spatial resolution
   and reconstruction efficiency
4. Go to 1

- Should have reliable numbers for December meeting

# **Conclusion**

## Conclusion

- COSY-TOF STT tracking is now working with data
- COSY-TOF STT data is very well usable for tracking
- Straw positioning and calibration improvement in progress