Multiple Scattering Measurement with Field Off

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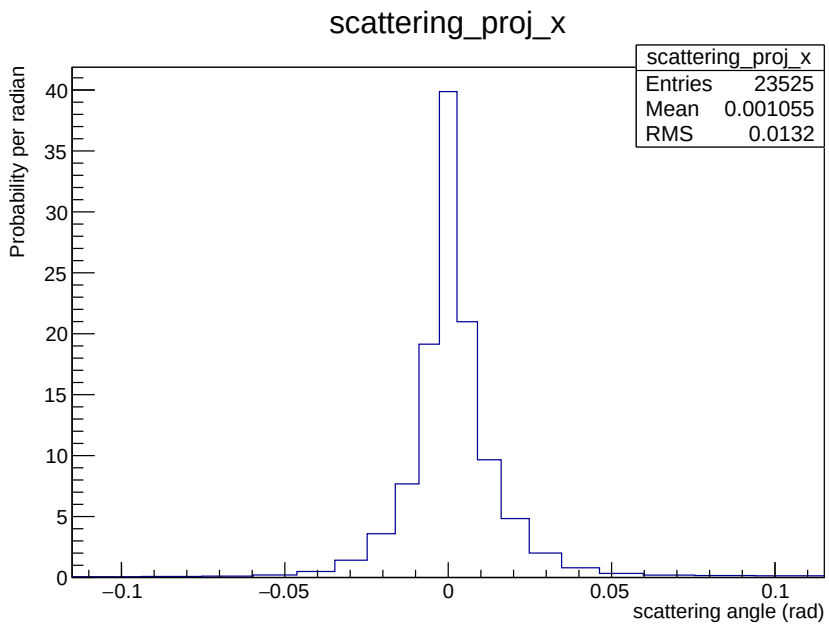
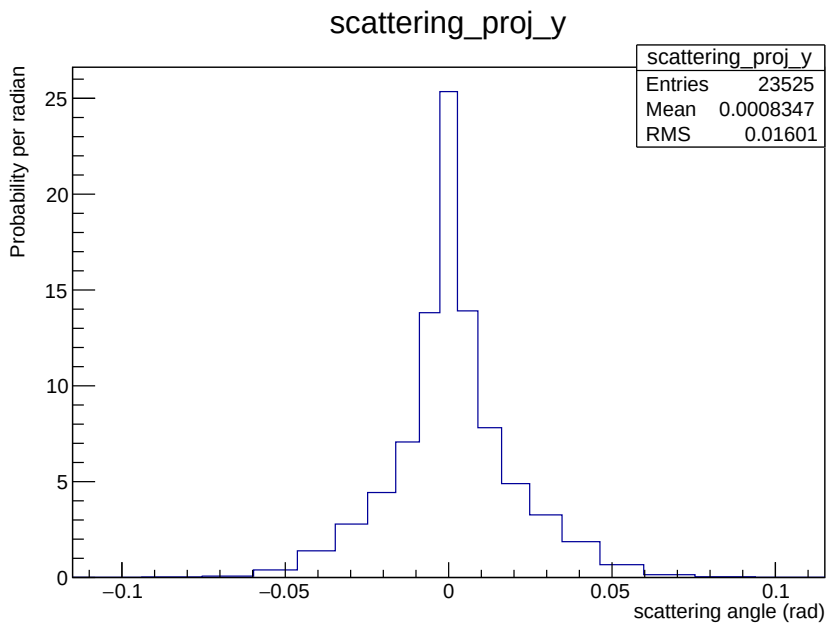
1/3/2016

Multiple Scattering with Field Off

- Particles follow straight tracks through the spectrometers, scattering off absorber material in AFC
- Use TOFs to measure momentum, EMR & CKOVs for PID
- Measure multiple scattering as a function of momentum
- Recon done with data (3,240), MAUS 1.3.2, geometry 72

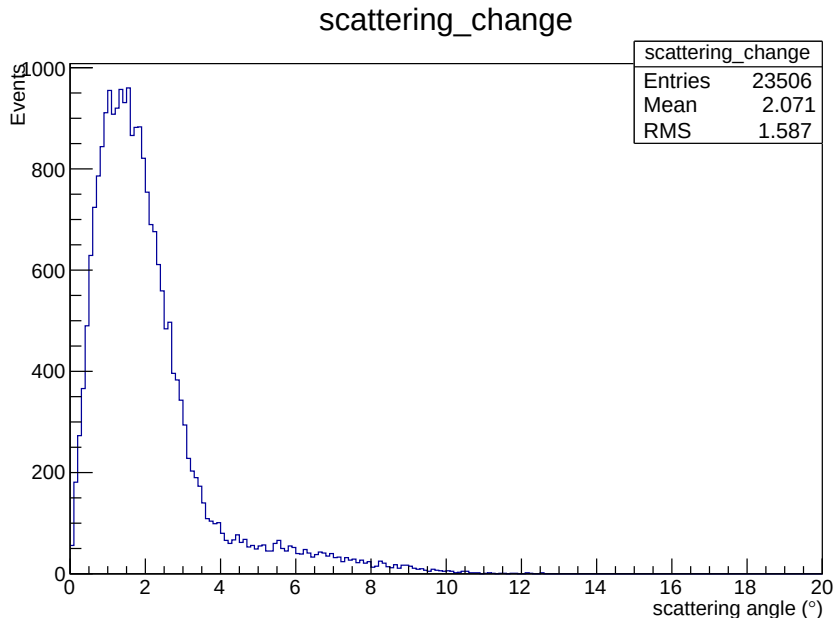
Scattering Distribution





- Pattern recognition provides straight tracks & angles in each tracker
- projection angle - $\text{proj}_x = \text{atan}(\frac{dx}{dz})_{US} - \text{atan}(\frac{dx}{dz})_{DS}$
- cuts $\rightarrow$ TOF10 27 - 28 ns, $>$ 6 trk sp

Scattering Distribution



- Calculate the change in angle between US and DS trackers
- Top plot: dot product of direction vectors of upstream and downstrean tracks
- Bottom plot: P against scattering angle

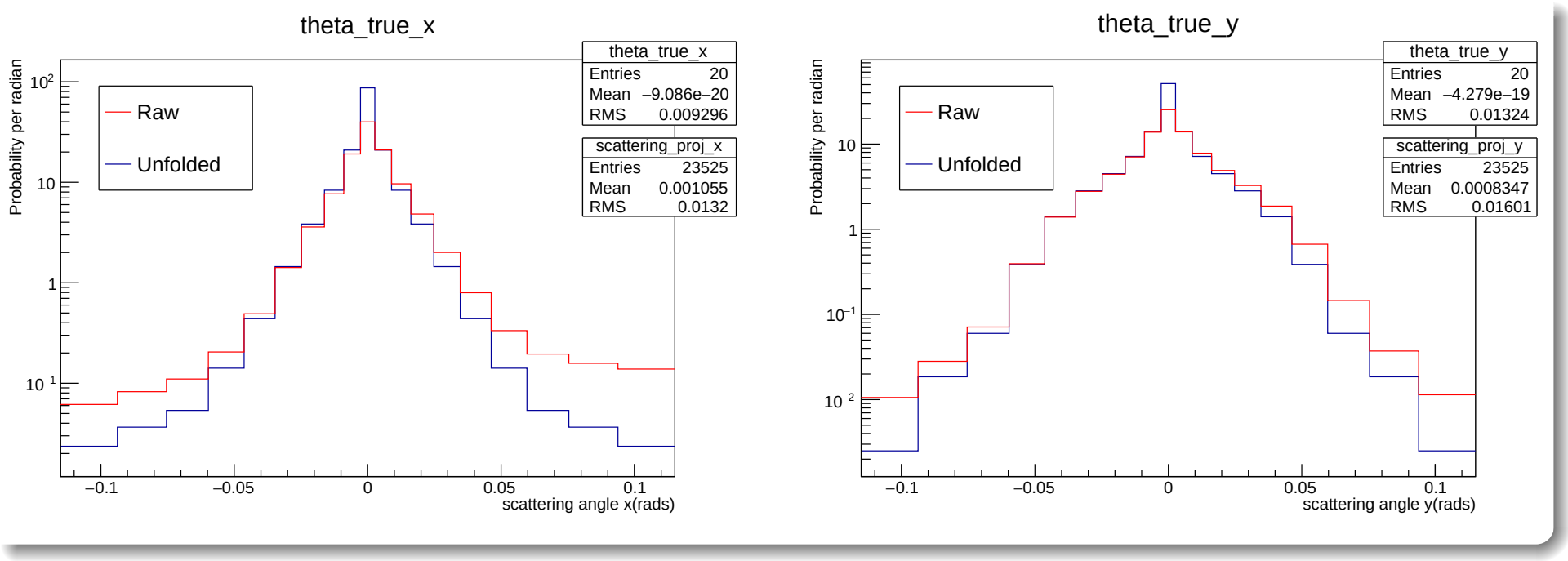
Tracker Unpacking

- MuScat unpacking uses expression : $D_j = B_j + R_{ij}\epsilon_{ij}\theta_i$
- $D_j \rightarrow$ vector of no. of counts per position bin
- $B_j \rightarrow$ vector of no. of counts per position bin PID != 13, primarily electron contamination
- $R_{ij} \rightarrow$ matrix of no. of counts per position bin for angular bin normalised by row
- $\epsilon_{ij} \rightarrow$ matrix is
  - $\frac{\text{No. of counts angular bin recon}}{\text{No. of counts angular bin truth}}$
- $\theta_i \rightarrow$ vector of no. of counts per angular bin of true scattering angle

Tracker Unpacking

- Use Minuit to minimise χ^2 expression
- Migrad tool varies θ_i entries for each iteration tests the gradient at each point until maximum is found
- distance $= \sum \frac{(D_{measured} - D_{calculated})^2}{D_{measured}}$
- distace calculated for every D_{true} entry and minimised globally

Scattering Distribution



- Raw scattering distributions plotted over distributions from unfolding
- Unfolded distros are symmetric around 0 - required by Minuit for fit to converge
- As expected unfolded distros are narrower than raw

Summary

- Data taking effort was a success
- First scattering plots with data from MICE
- Unfolding now included in analysis

Next Steps

- MC analysis coming now we have a new MAUS release
- Information from tracker alignment still to be added
- Ryan investigating Bayesian deconvolution - waiting for more MC statistics
- Scattering with P
- Draft 0 of paper in preparation