Angular Resolutions at the DIRC Update

Matt Posik
Temple University

Outline

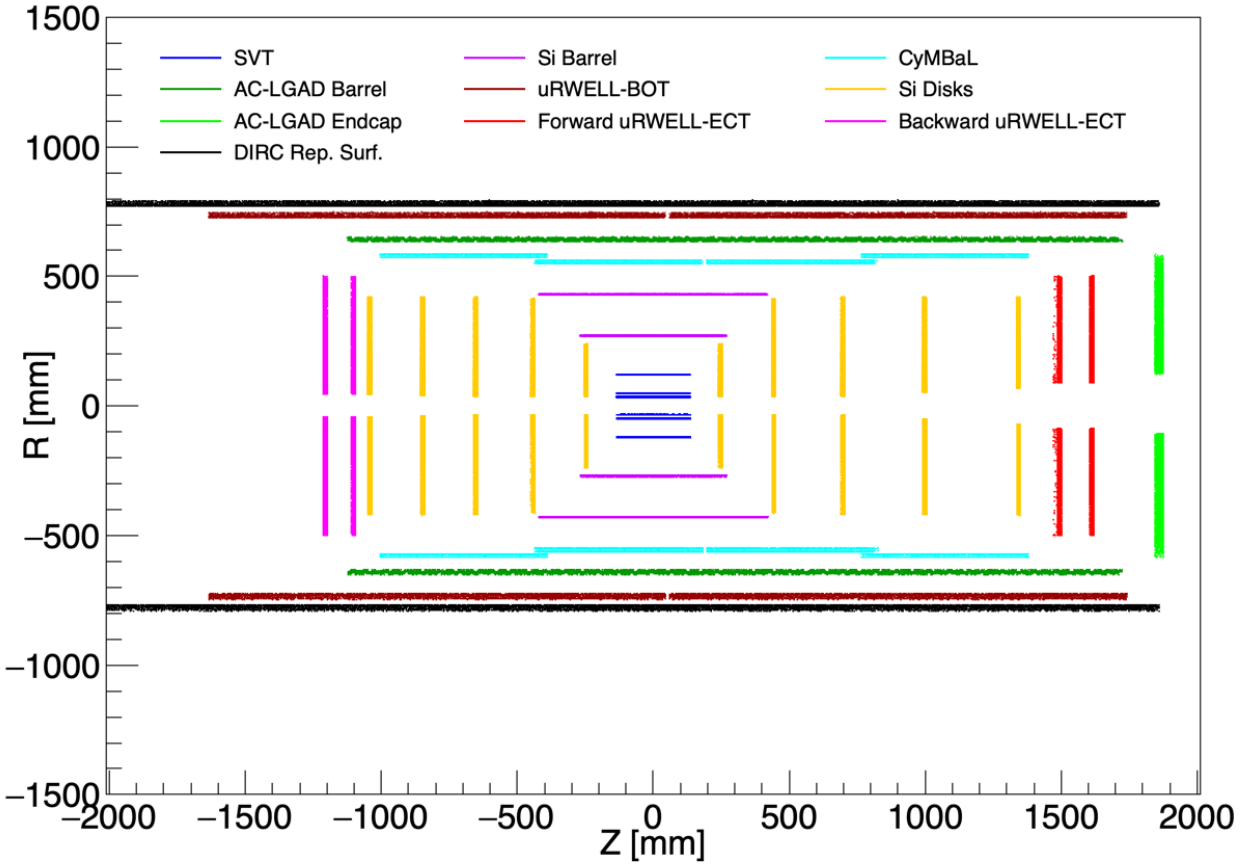
- Update on covariant error structure
- Material impact on angular resolutions
- Next Steps

Simulation Details

- ePIC: 25.04.1
- EICrecon: v1.24.0
- π^- single particle
- Fixed momenta values
- $\Delta\theta = 2^o,\ \Delta\phi = 360^o$
- Results shown for $\eta = -0.05$
- DIRC Reference Surface

  R = 770.5 mm

➢ All resolutions presented are with respect to R = 770.5mm surface



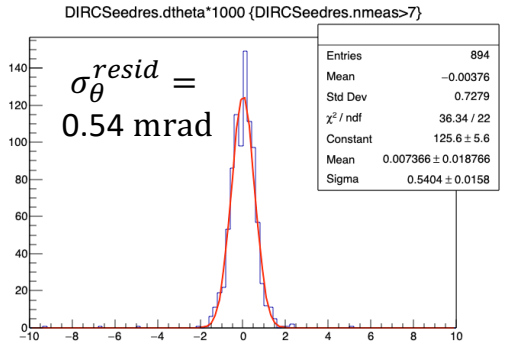
❖ Follow up from previous presentation

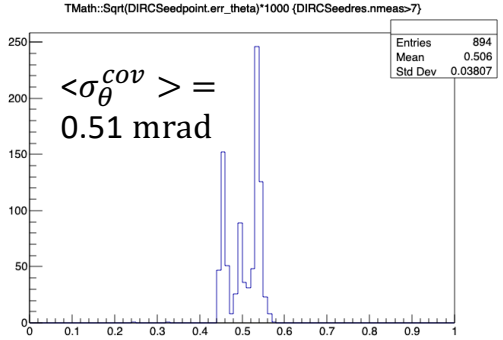
Resolution: µRWELL-BOT Hits

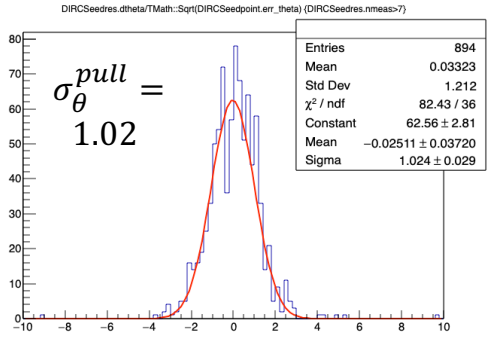
- Removing µRWELL-BOT hit collection from tracking.cc (hits not used in CKF, but material is there) removes peak structure
- Small change in residuals, but large change in covariance errors (?)

From last meeting

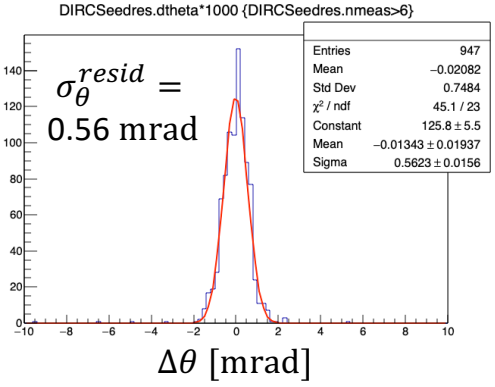
With µRWELL-BOT Hits

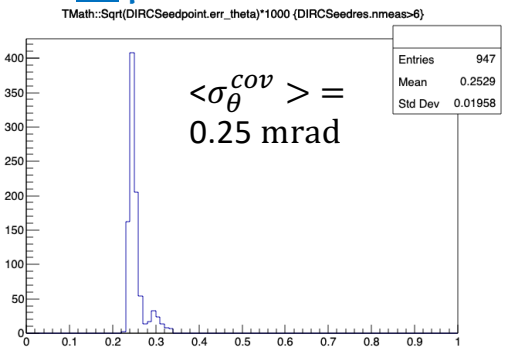


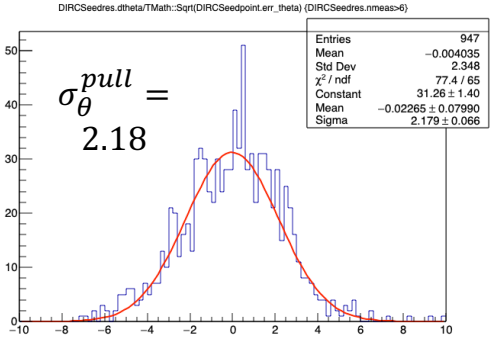




No µRWELL-BOT Hits



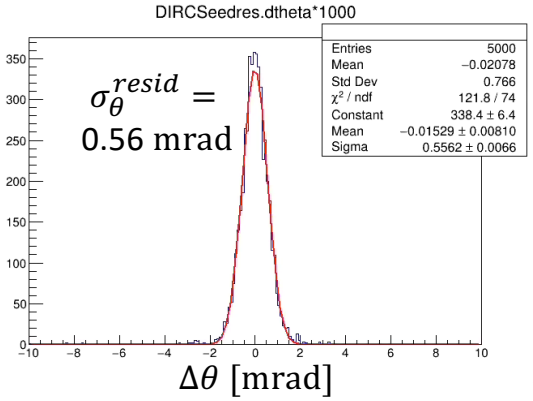


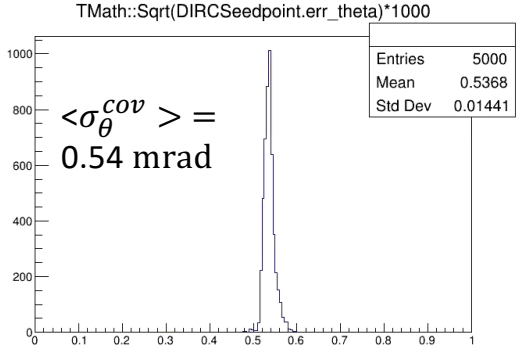


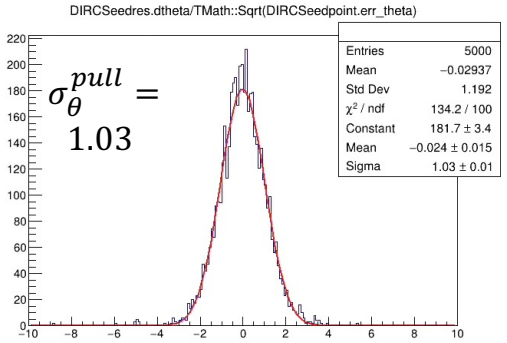
Resolution: µRWELL-BOT Hits

- Add Acts::MaterialInteractor option to propagation algo (PR #1977)
- Residuals and cov. errors are consistent

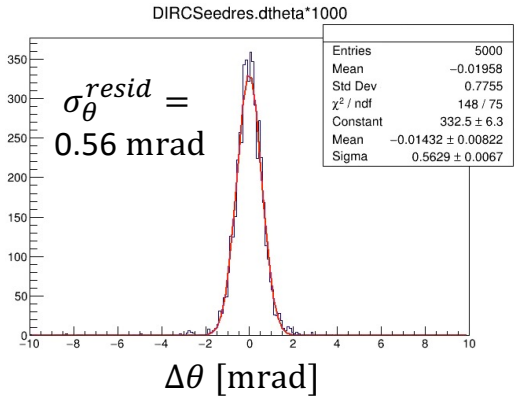
With µRWELL-BOT Hits

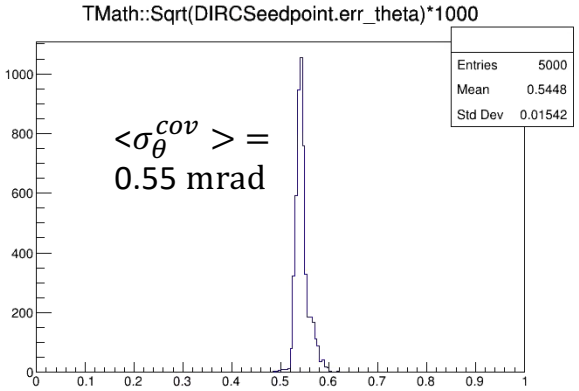


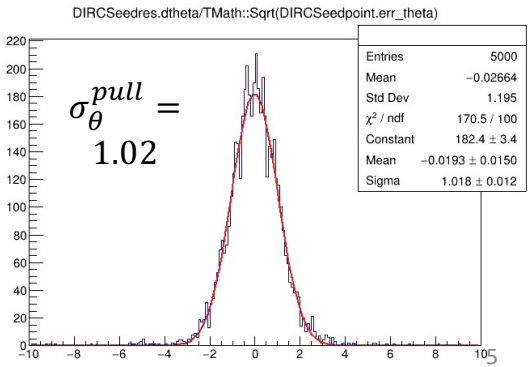




No µRWELL-BOT Hits

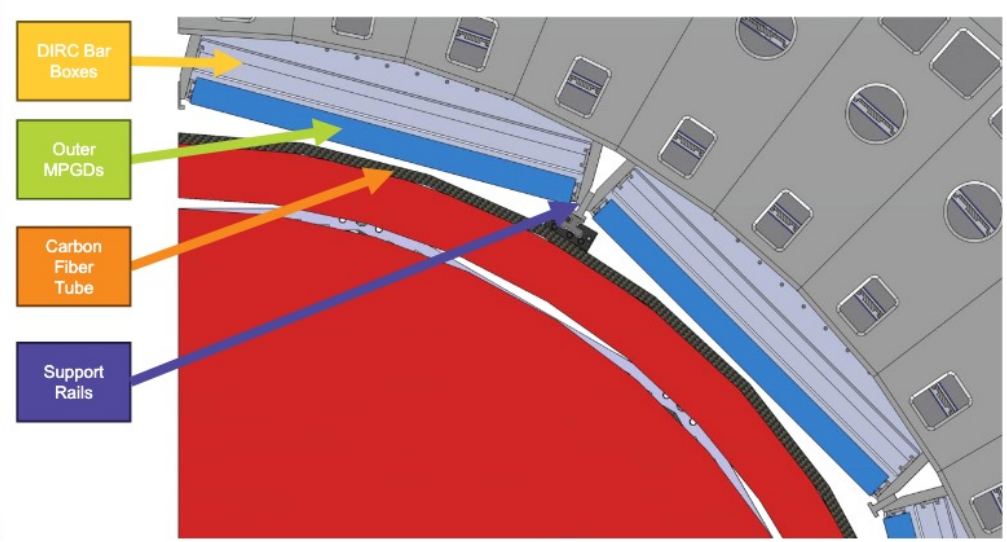






Material Impact on Angular Resolutions

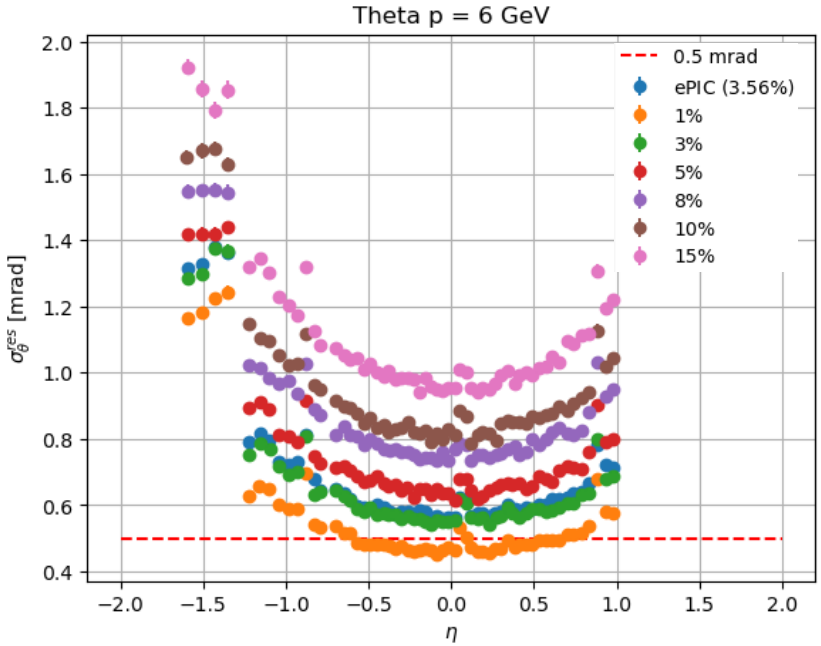
- Modify material budget of CF tube (InnerTrackingSupport_assembly, χ/χ_0 = 3.56%) to see impact on angular resolutions
- CF material changed to Cu (χ_0 = 1.436 cm) for this study to avoid overlaps when increasing material budget
- Material map generated for each material budget change

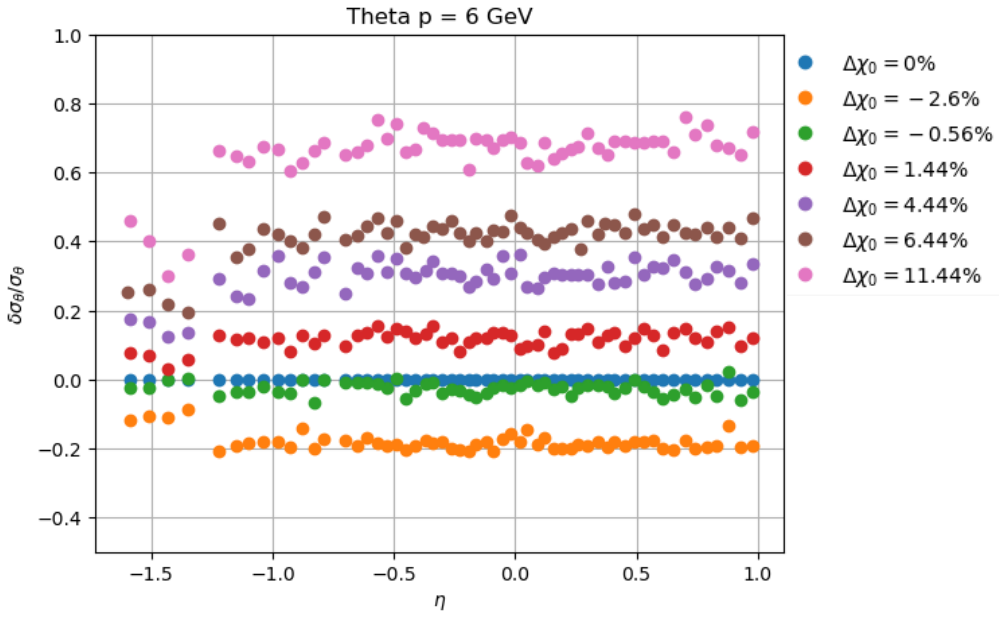


Cylinder Thickness [cm]	χ/χ_0 [%]
0.01436	1
0.04308	3
0.0718	5
0.11488	8
0.1436	10
0.2154	15

Material Impact on Angular Resolutions: Theta

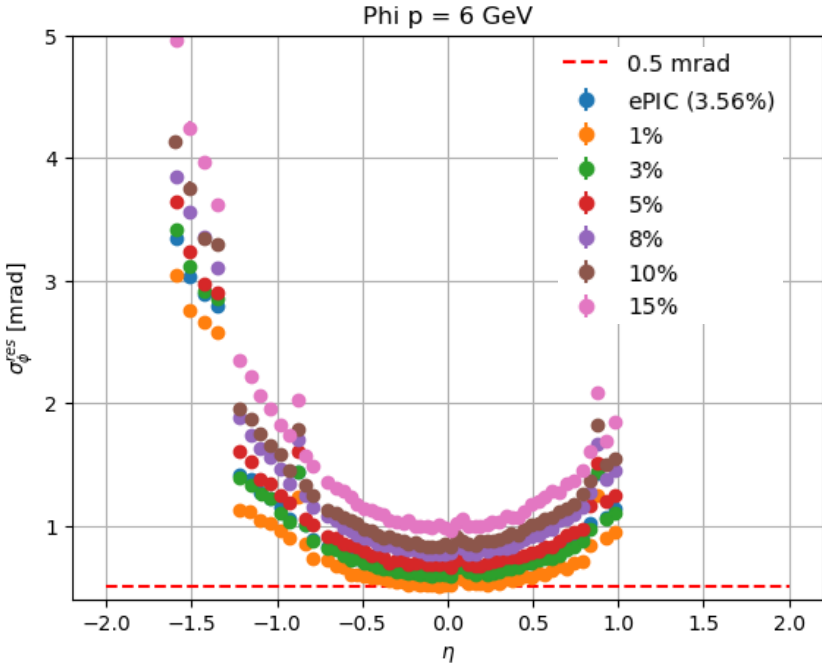
$$\frac{\delta\sigma}{\sigma_0} = \frac{\sigma_i - \sigma_0}{\sigma_0}\ ,\ \sigma_0 = \text{resolution from official ePIC detector}$$

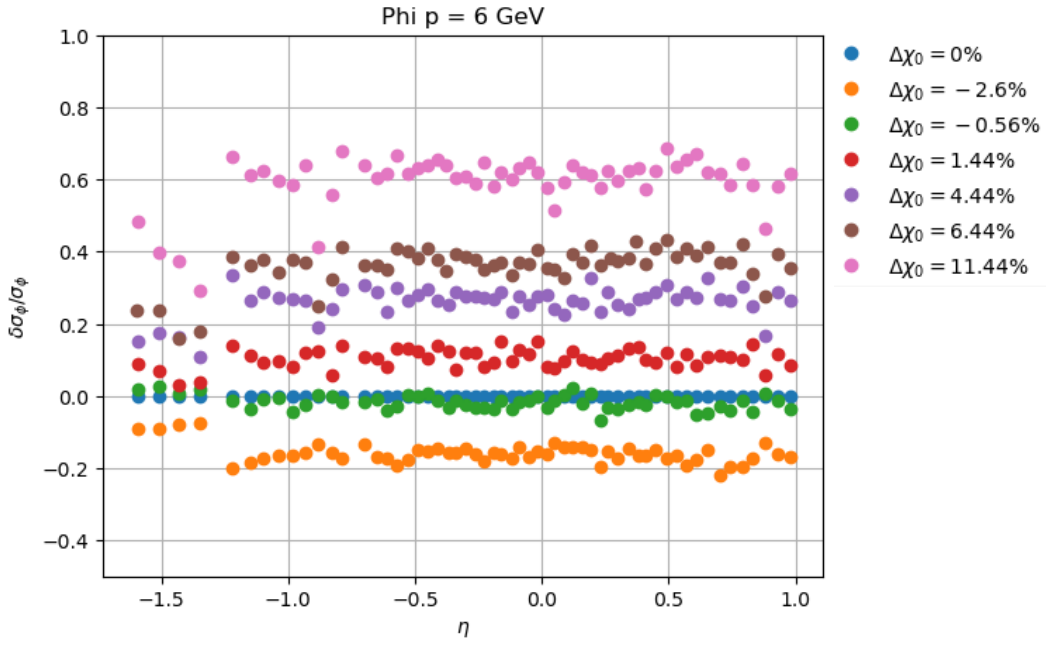




Material Impact on Angular Resolutions: Theta

$$\frac{\delta\sigma}{\sigma_0} = \frac{\sigma_i - \sigma_0}{\sigma_0}\ ,\ \sigma_0 = \text{resolution from official ePIC detector}$$





Summary

- Recent update to propagation navigator
  - Resolves the structure in the covariance errors
  - Covariance errors are now consistent with residuals
- Quantified material impact on angular resolutions at the DIRC

Next Steps

- Access impact of BIC on angular resolutions
- Add angular resolution calculation to official ePIC software stack
  - Add DIRC propagation planes into EICrecon (ala calorimeter prop. planes)
    - EICrecon working branch
  - For residual method, need true momentum vector of particle passing through DIRC:

    Make DIRC bars sensitive or add thin reference plane (?)
  - Add benchmark that computes angular resolution via residual and cov error methods

    and their pull distribution.