Alignment Validation

F2F Tracking Meeting in Pisa

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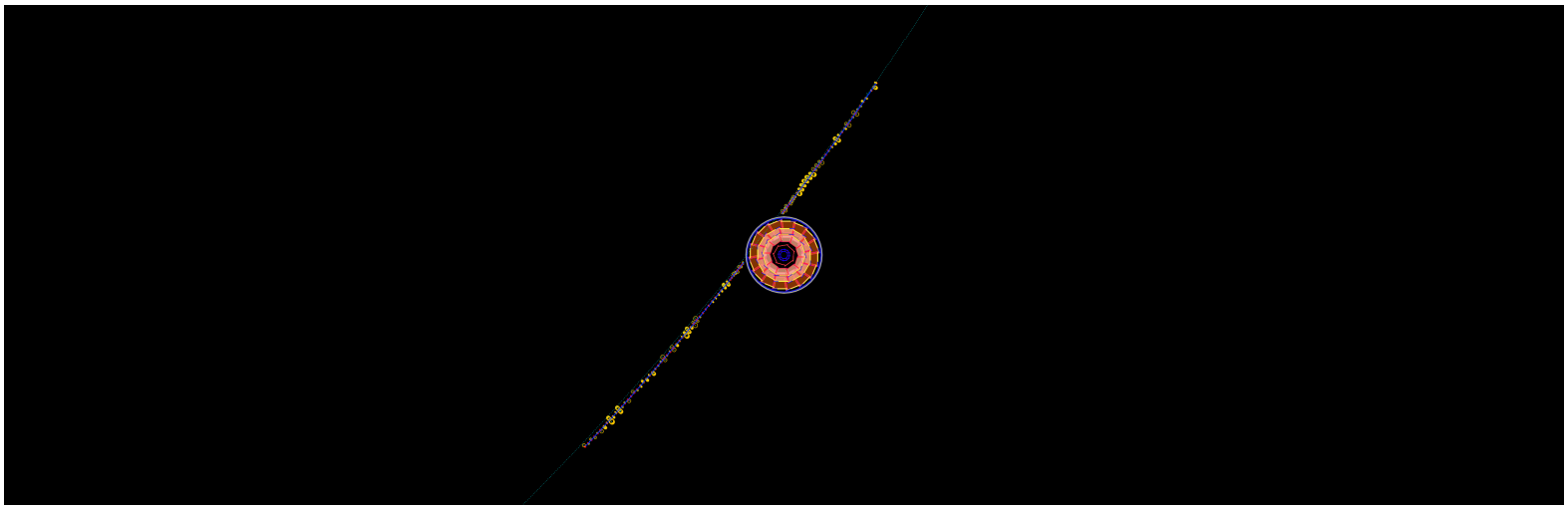
May 13, 2014

Introduction

Features

- Tool for crosschecks after alignment is performed
- Monitor vertex resolution with cosmics (and J/Ψ events)
- Check for helix parameter correlations with cosmics events
- Monitor tracking and alignment performance in D-decays

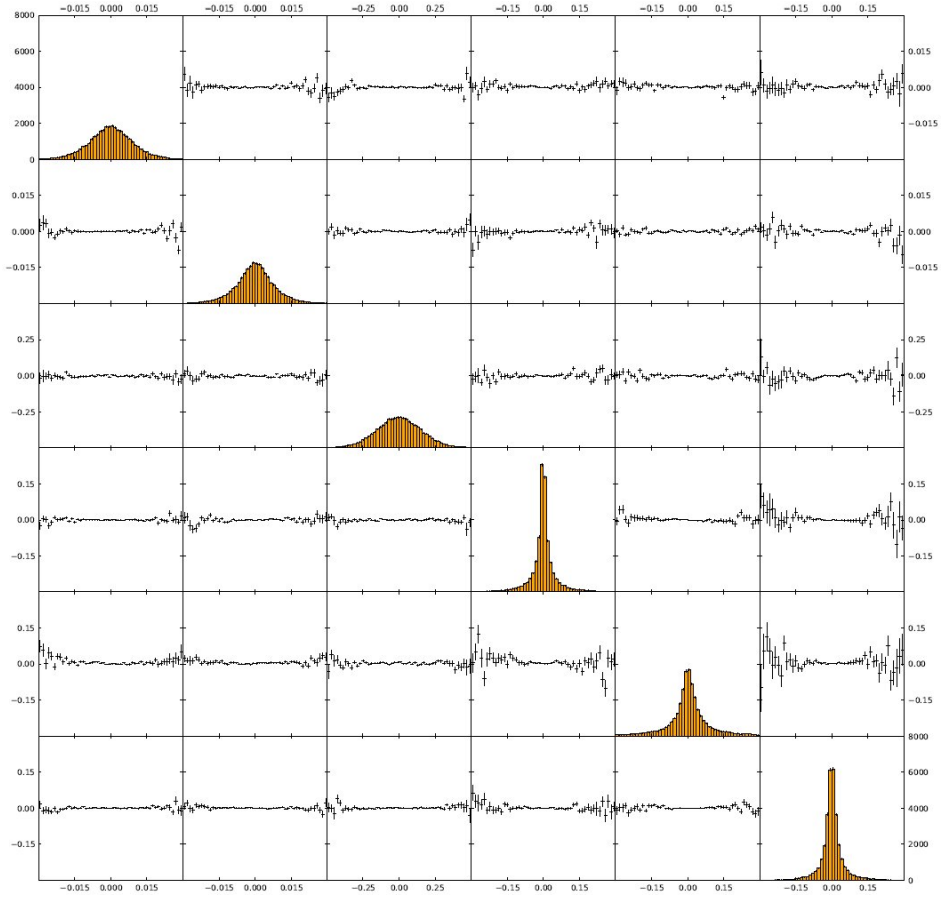
Helix parameter correlation



- Fit one cosmic track as two tracks from IP region
- Look at differences in helix parameter (e.g. $\Delta z_0, \Delta\omega$)
- Look at correlations between helix parameters (should be uncorrelated)

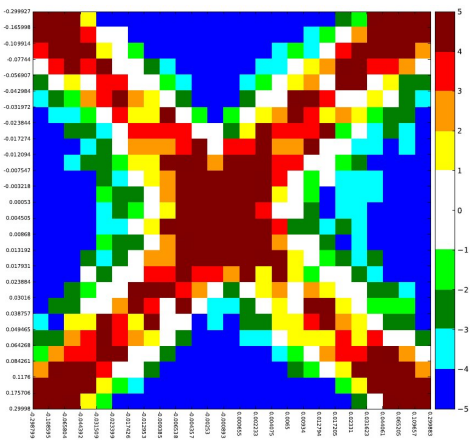
Impact parameter correlation of one cosmic muon track

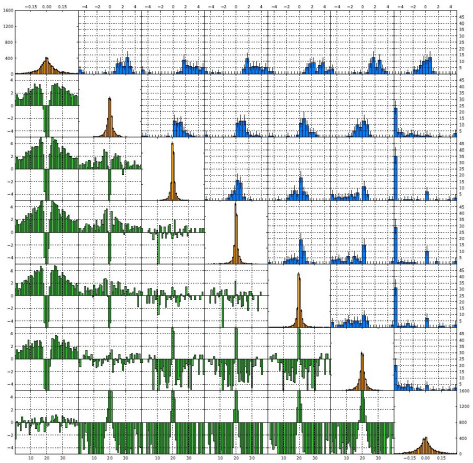
- Δx
- Δy
- Δz
- Δp_x
- Δp_y
- Δp_z

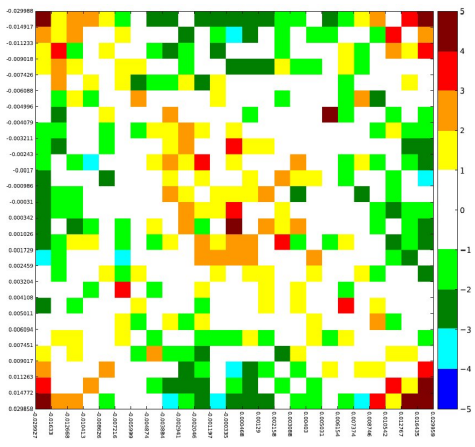


Impact parameter correlation

- Differences in momenta are stronger correlated compared to vertex positions
- But: Correlation coefficients just around 0.03

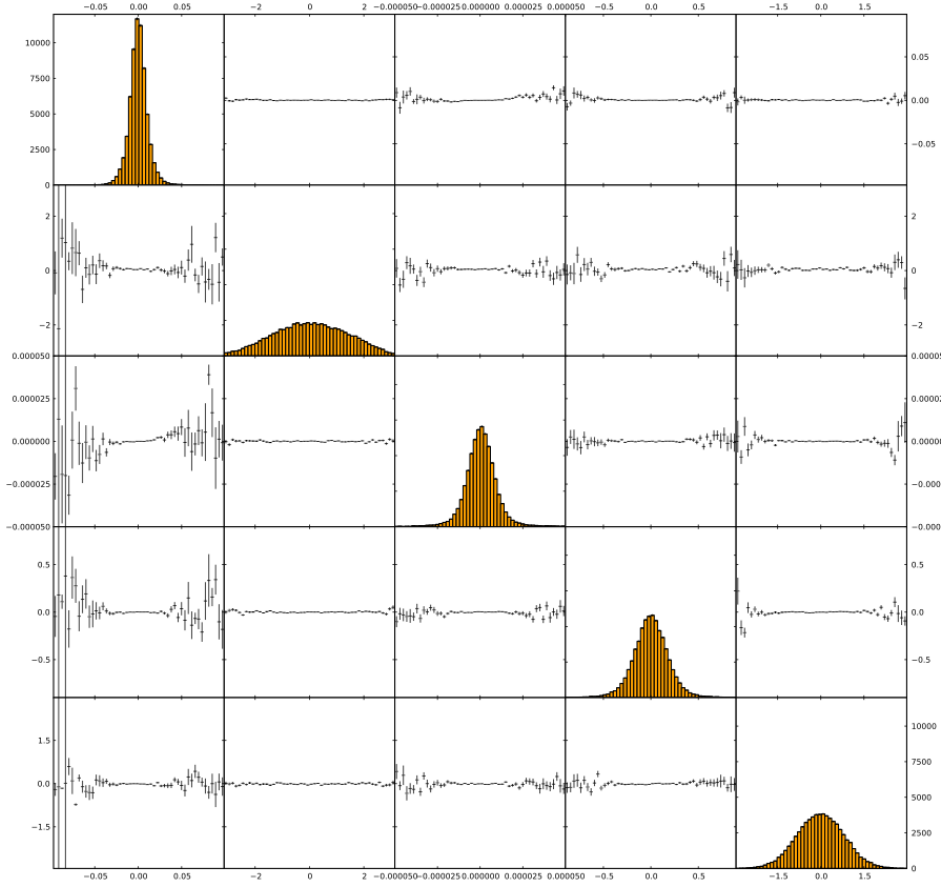




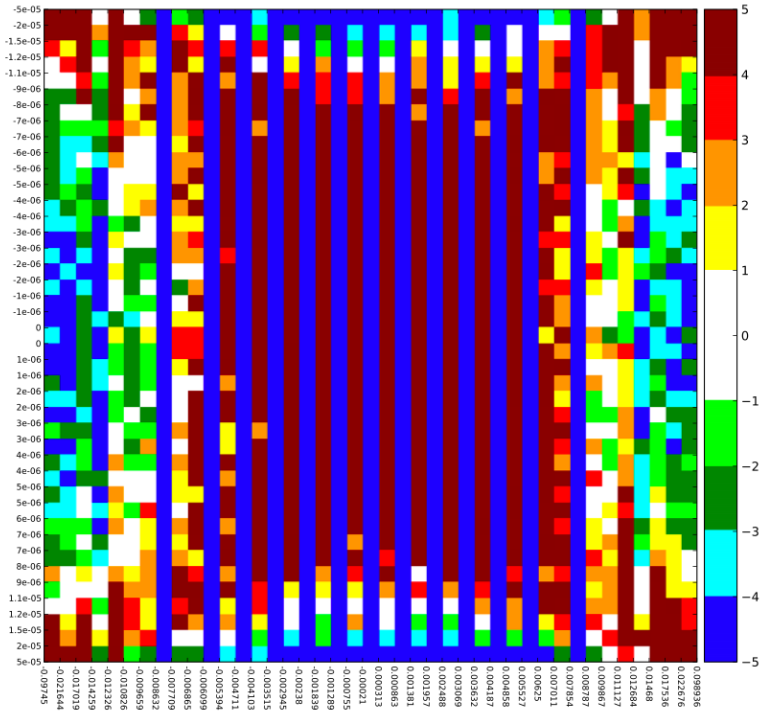


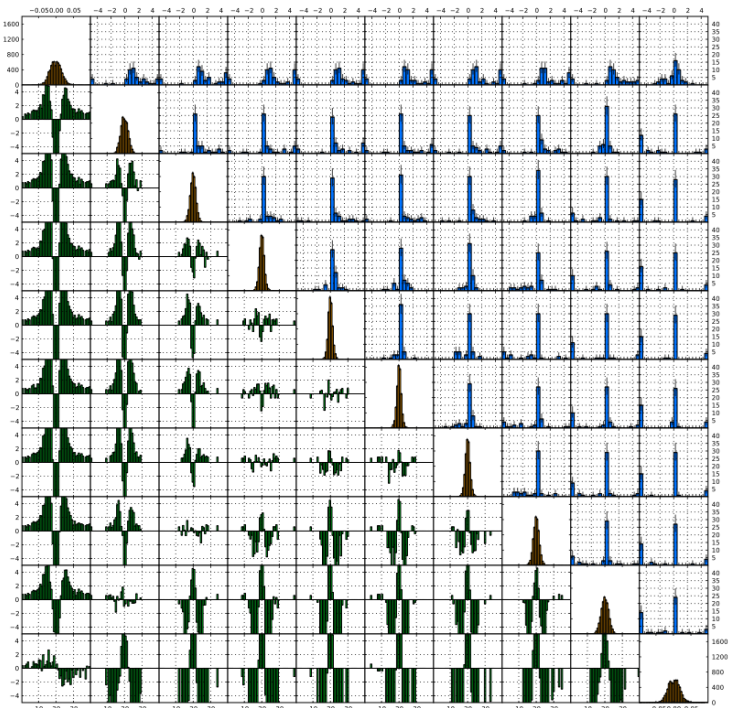
Helix parameter correlation of one cosmic muon track

- $\Delta|d_0|$
- $\Delta\phi_0$
- $\Delta Q/R$
- Δz_0
- $\Delta \cot(\theta)$

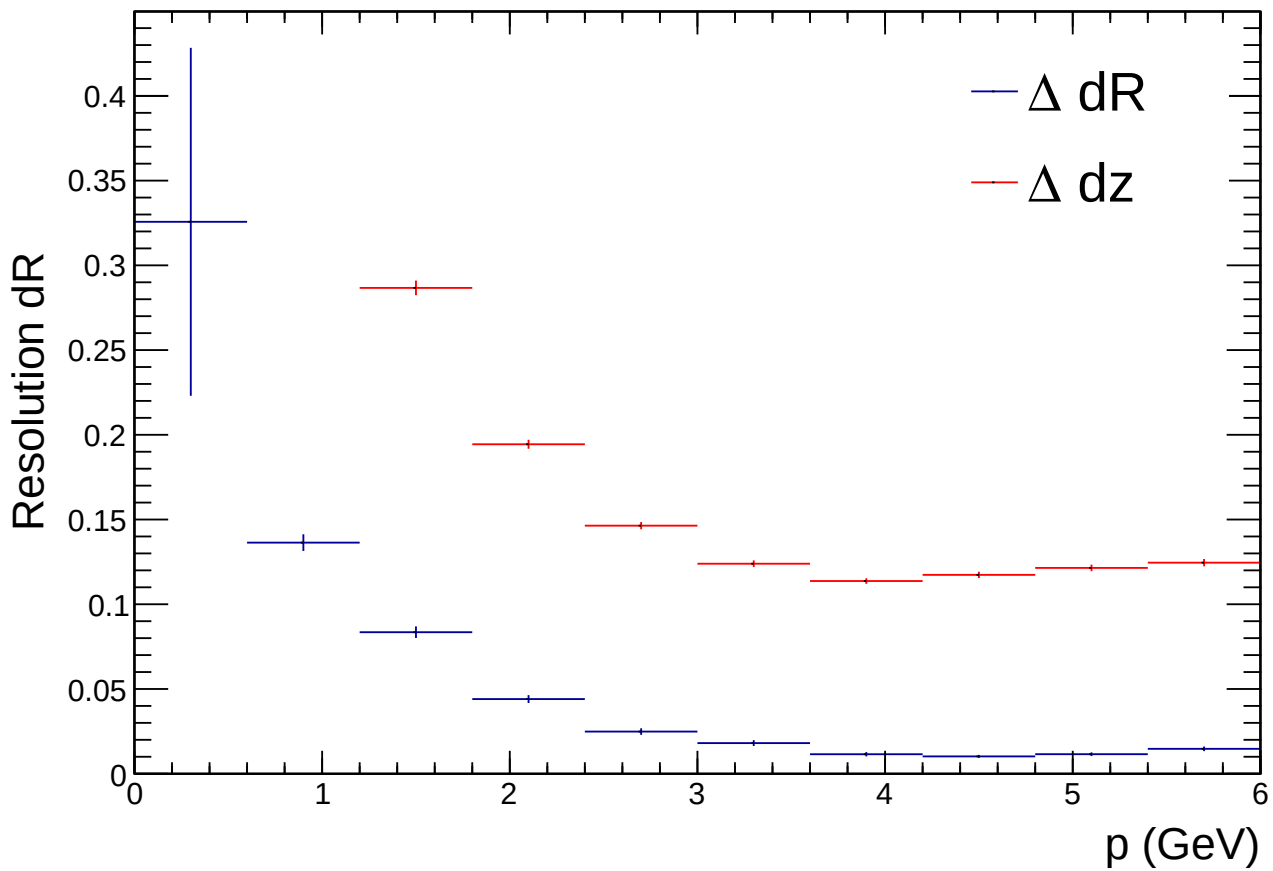


Helix parameter correlation $\Delta|d_0|$ vs $\Delta\omega$

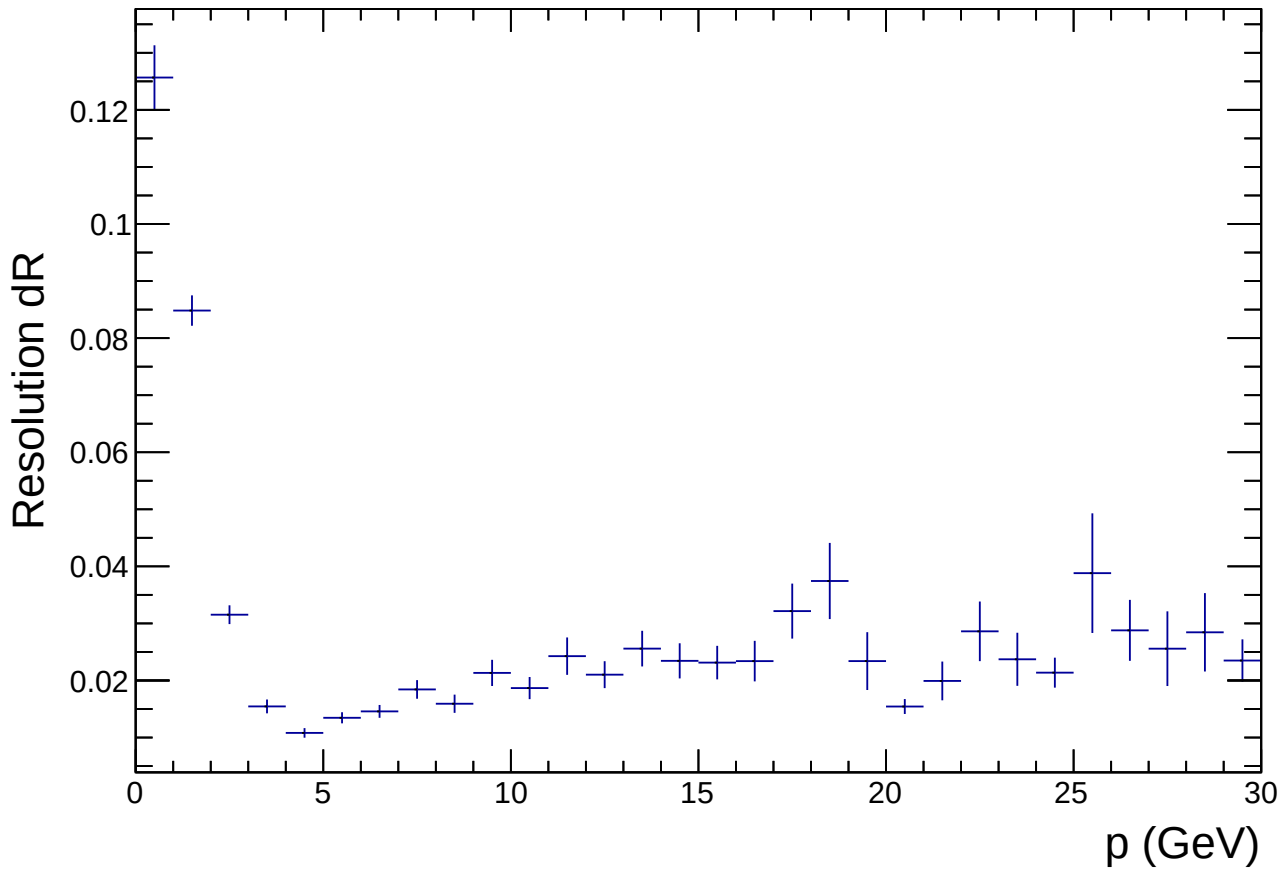




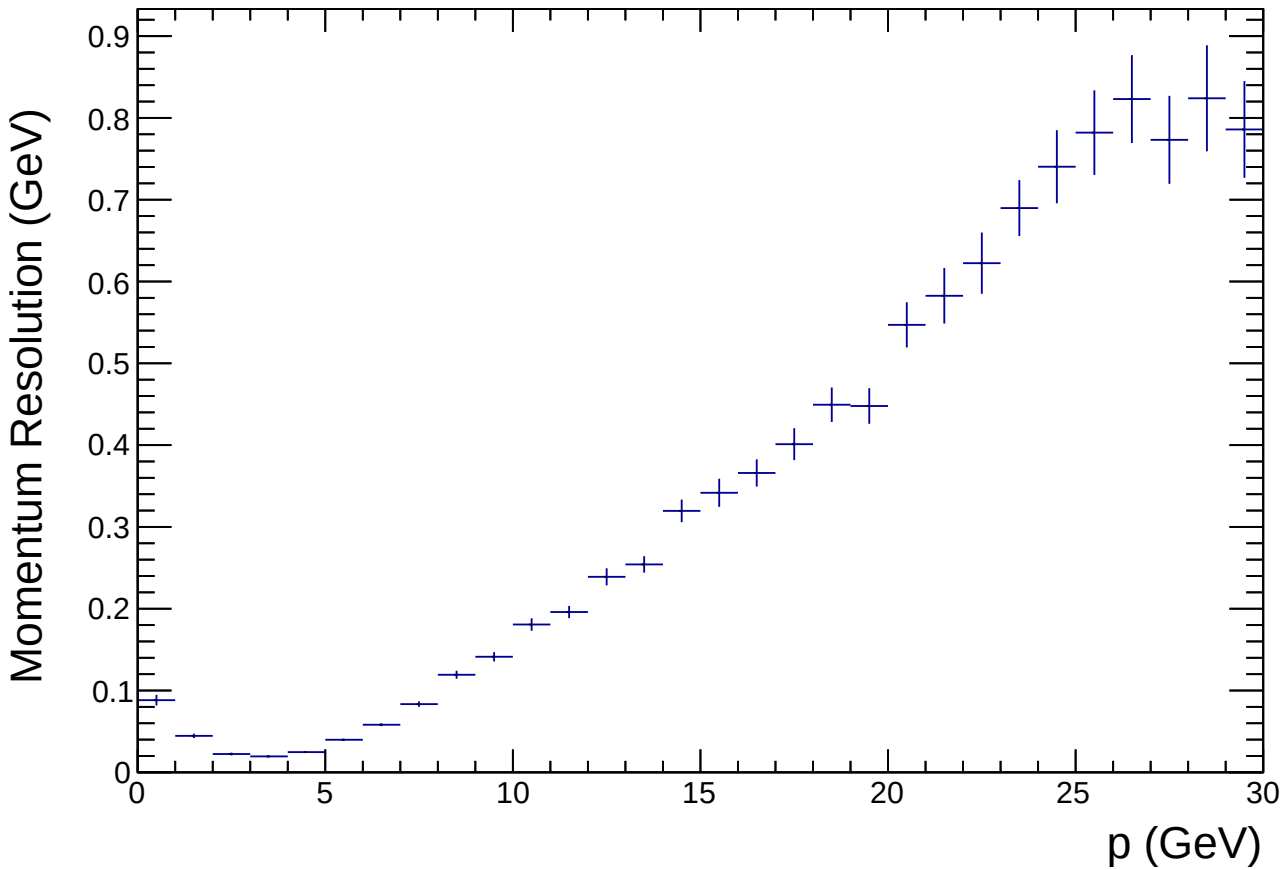
Cosmic track vertex resolution (CDC)



Cosmic track vertex resolution at high momentum

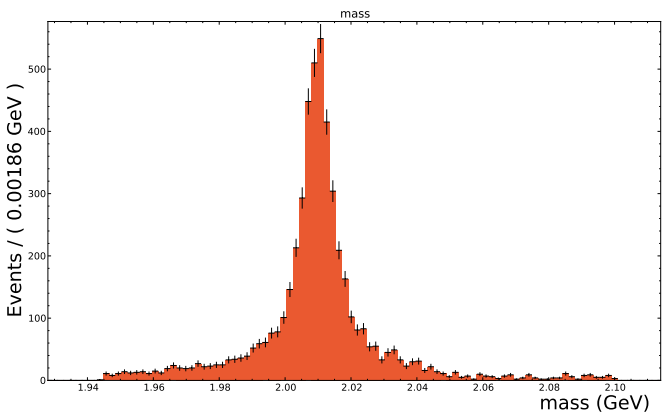


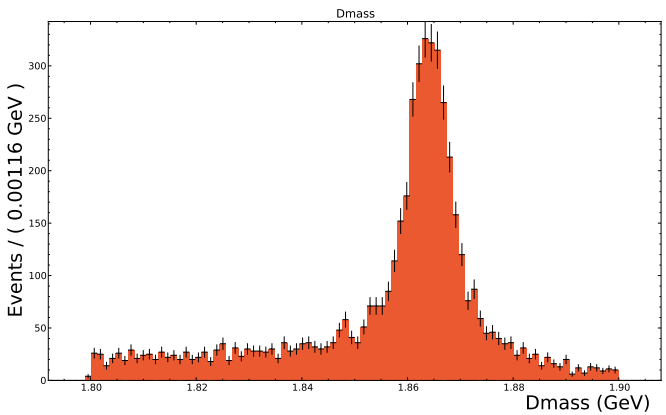
Cosmic track momentum resolution



$D^0 \to K3\pi$

- Monitor vertexing and tracking performance in D decays
- Two vertex fits are done: (K^+, π^-) and (π^+, π^-)
- The differences in the fit is taken as resolution
- $D^{(*)0}$ mass and width can be monitored





$D^0 \to K3\pi$ reconstruction

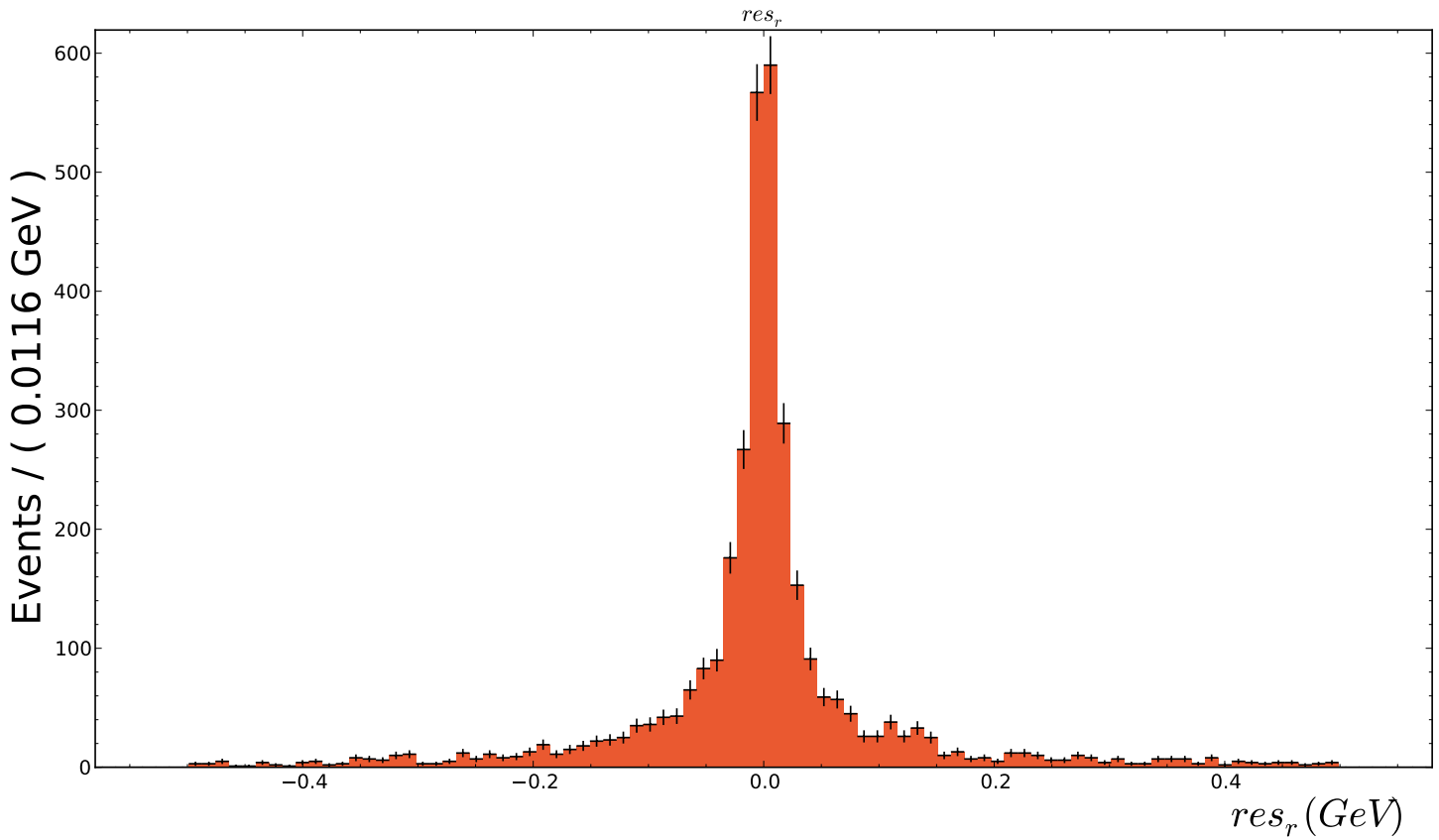
The decay is reconstructed in the decay chain:

$$e^+e^- \to c\bar{c} \to XD^{*+},$$
$$D^{*+} \to pi^+_{\text{slow}} D^0,$$
$$D^0 \to K3\pi$$

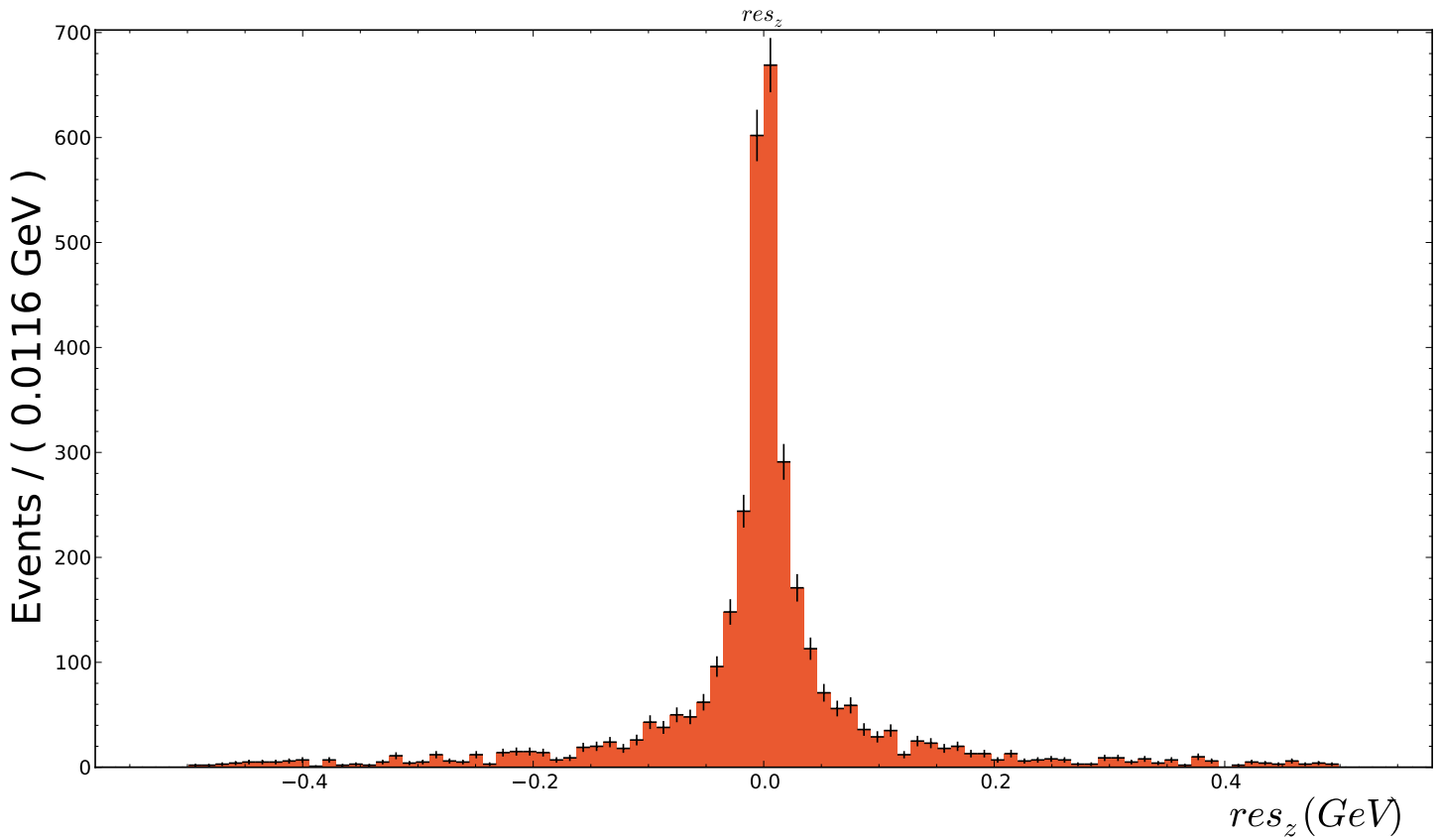
Track quality requirements:

- # hits in SVD
- # firing wires in the CDC
- Transverse momentum $P_t > 70\text{MeV}/c$
- IP cuts

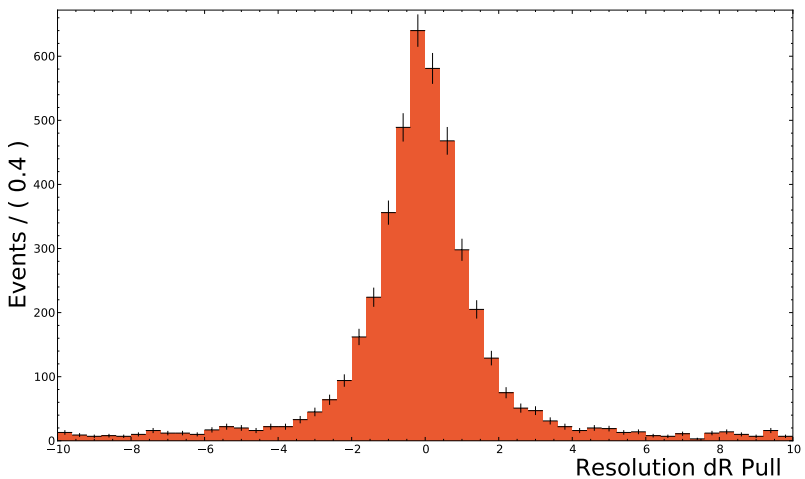
$D^0 \to K3\pi$ Vertex Resolution

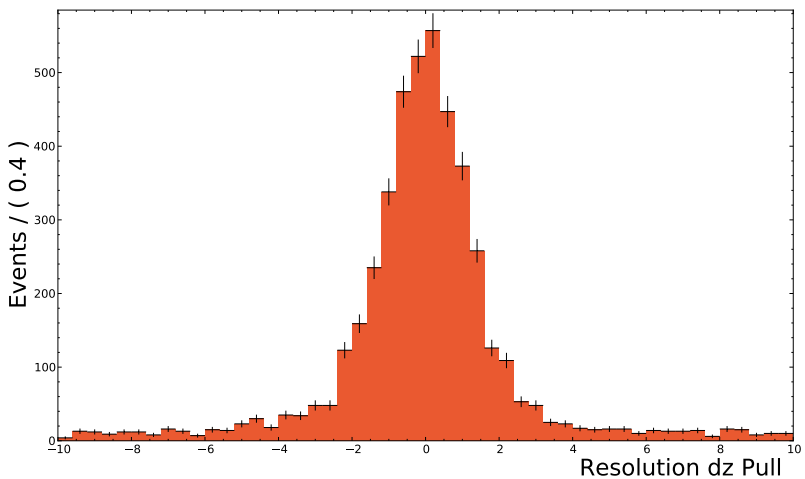


$D^0 \to K3\pi$ Vertex Resolution



$D^0 \to K3\pi$ Vertex Resolution Pull





Pull

- Mean: -0.075 ± 0.019
- Sigma: 1.202 ± 0.021

Pull

- Mean: -0.013 ± 0.020
- Sigma: 1.283 ± 0.021

Future/Ideas

- Improving the $D \to K3\pi$ analysis (better selection)
- Choosing general track selection criteria
- Looking at artificial miss alignment