ePIC Performance on Coherent J/ψ Diffractive Pattern

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Tracking Resolutions

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Last Update

- Tracking resolution barely improves from reducing the thickness of the silicon wafer
  →Suspect that the service parts dominate the material budget and highly affect the tracking resolution
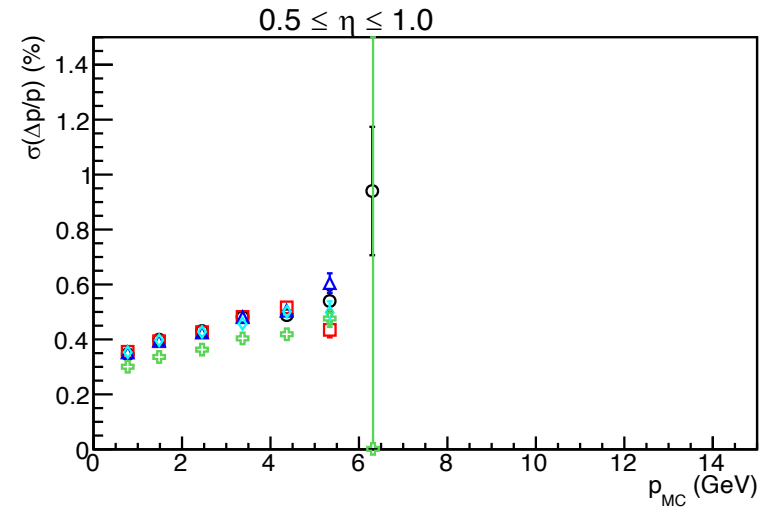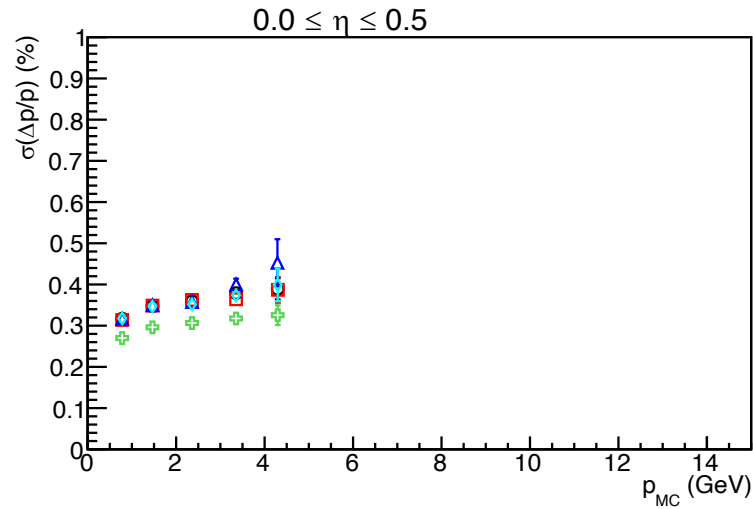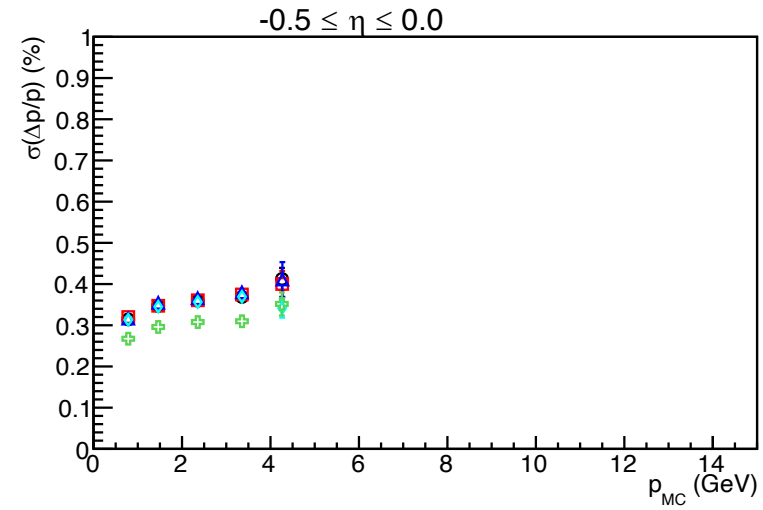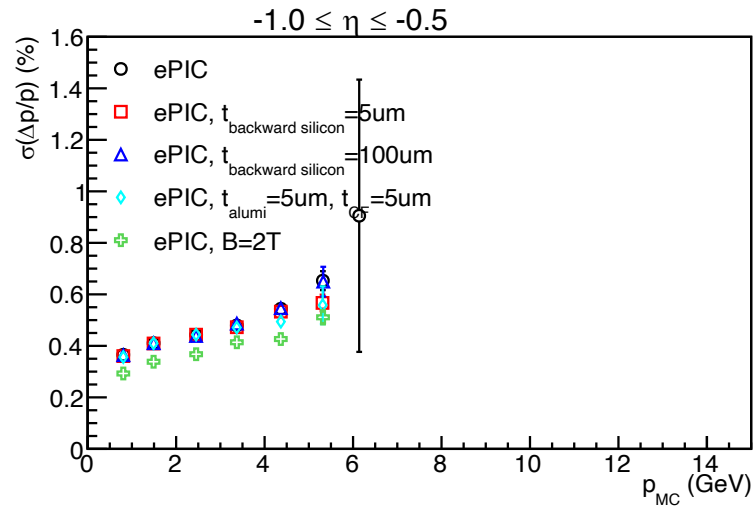
- Service/support parts of the forward and backward disks include aluminum and carbon fiber (CF), with thicknesses of 150um and 120um, respectively
  → Change the thicknesses of aluminum and CF to 5um
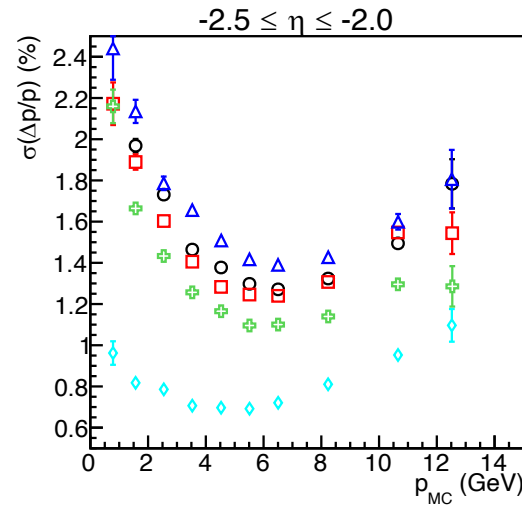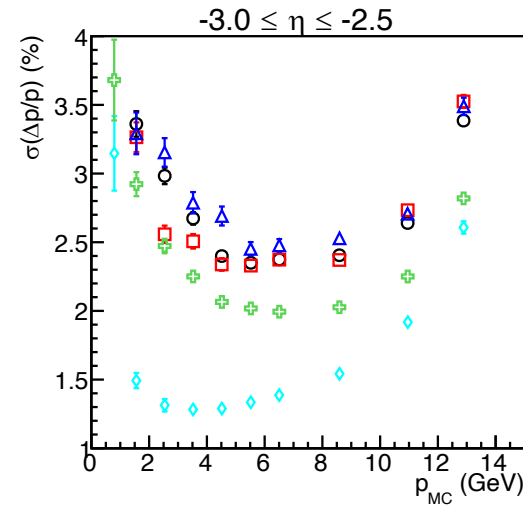
Forward
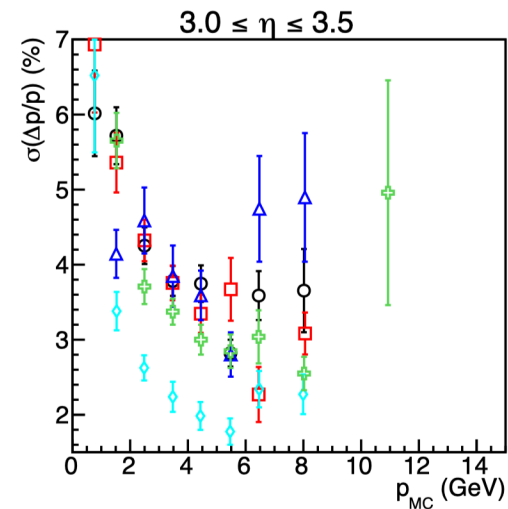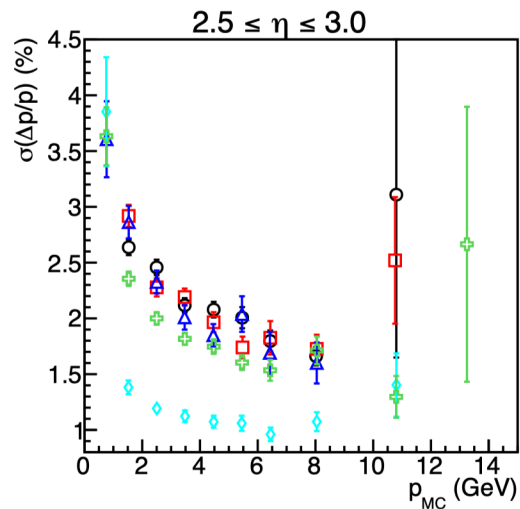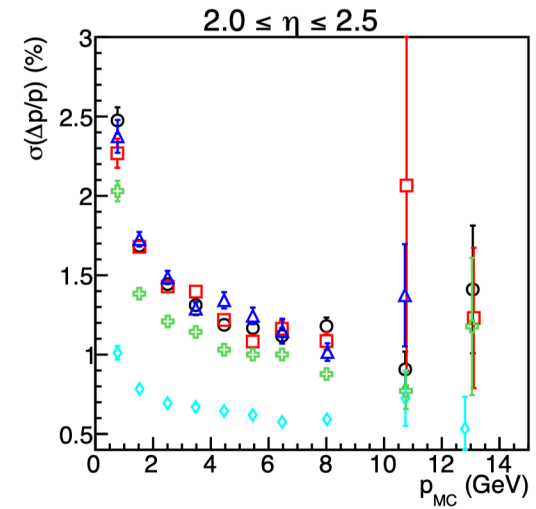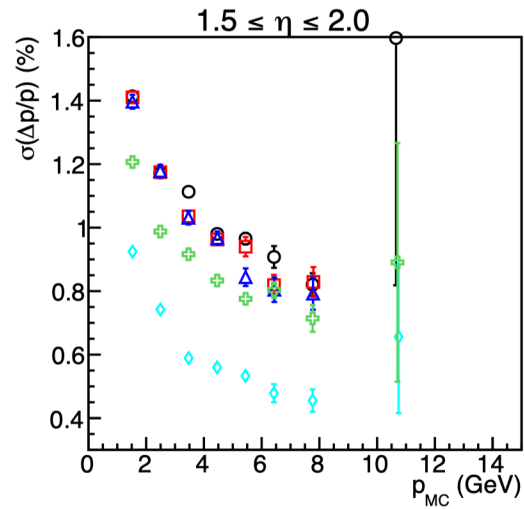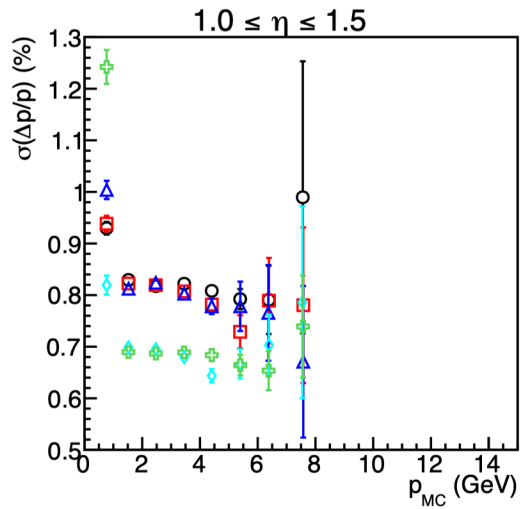
Barrel

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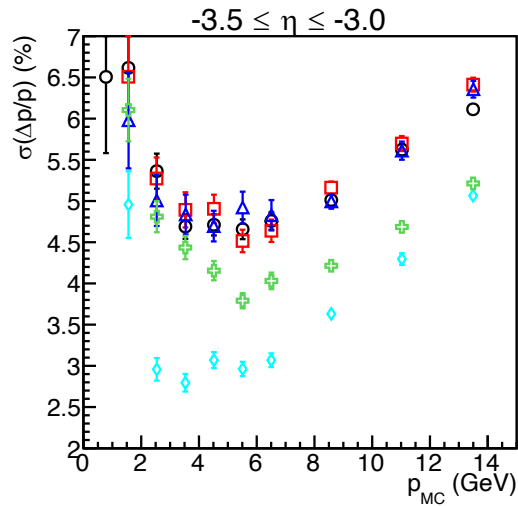
Backward
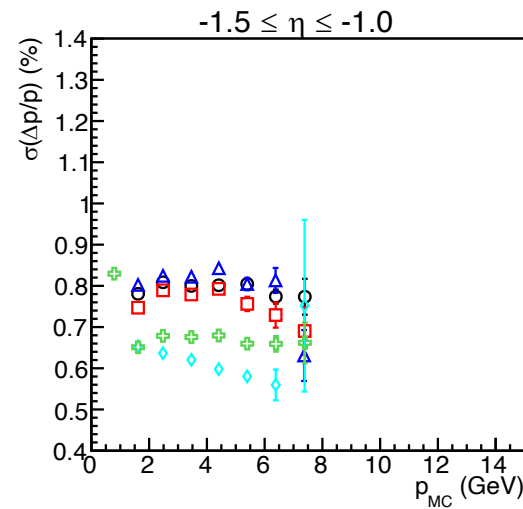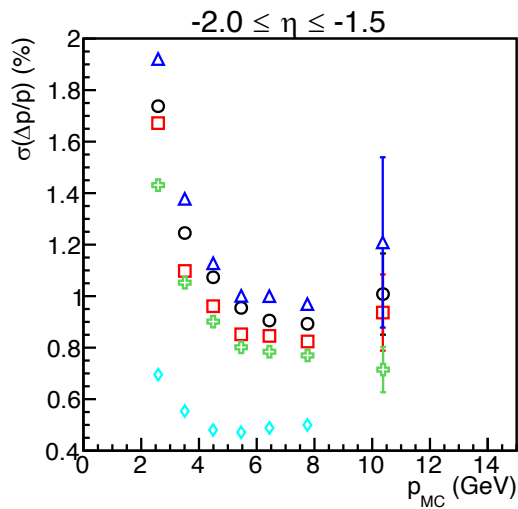
- The service parts dominate the material budget for the tracking detector
- Reducing the material budget of the service parts improves the momentum resolution, but it is still not good enough

t Resolutions
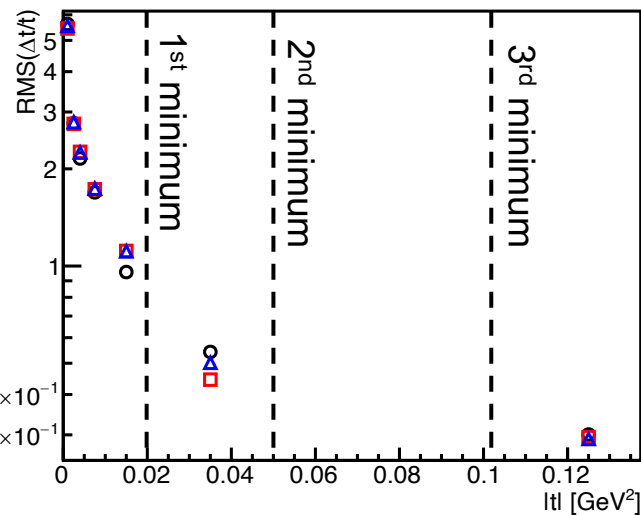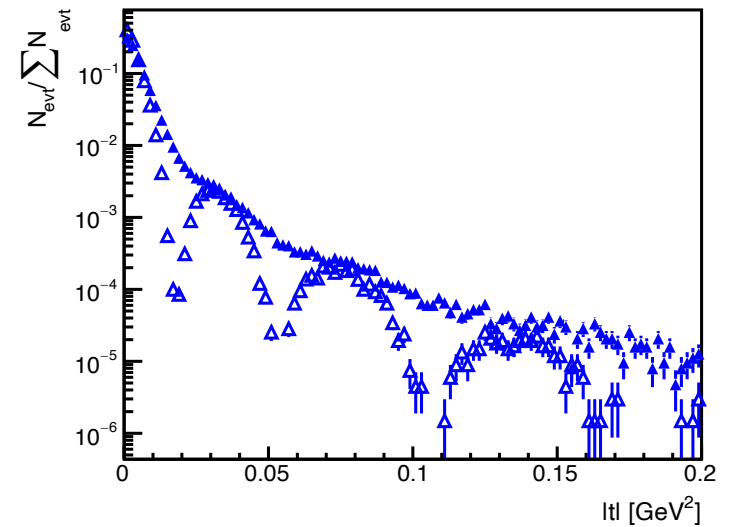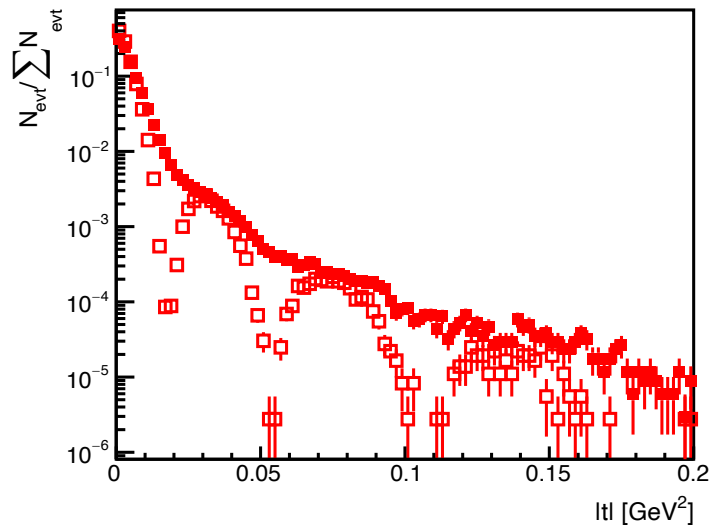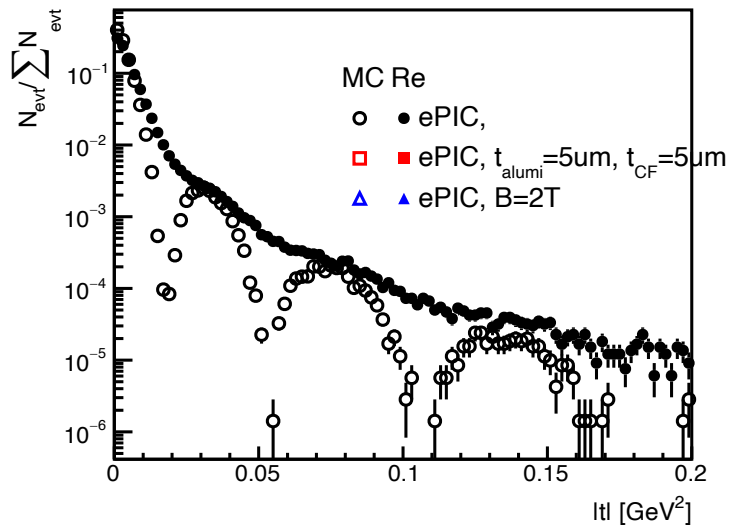
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Ways to Improve Tracking Resolution

✓ Material budgets

❑ Pixel pitch/size

❑ Disk placements

❑ More disks

✓ Magnetic field

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Muon ID

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Strategy for muon ID smearing

- What is the minimum muon momentum to reach beyond the EMCal?

- Muon ID efficiency

- Muon ID fake rate

BELLE2 KLM Performance

$0.82 \leq \theta < 1.16$ rad, muonID > 0.9
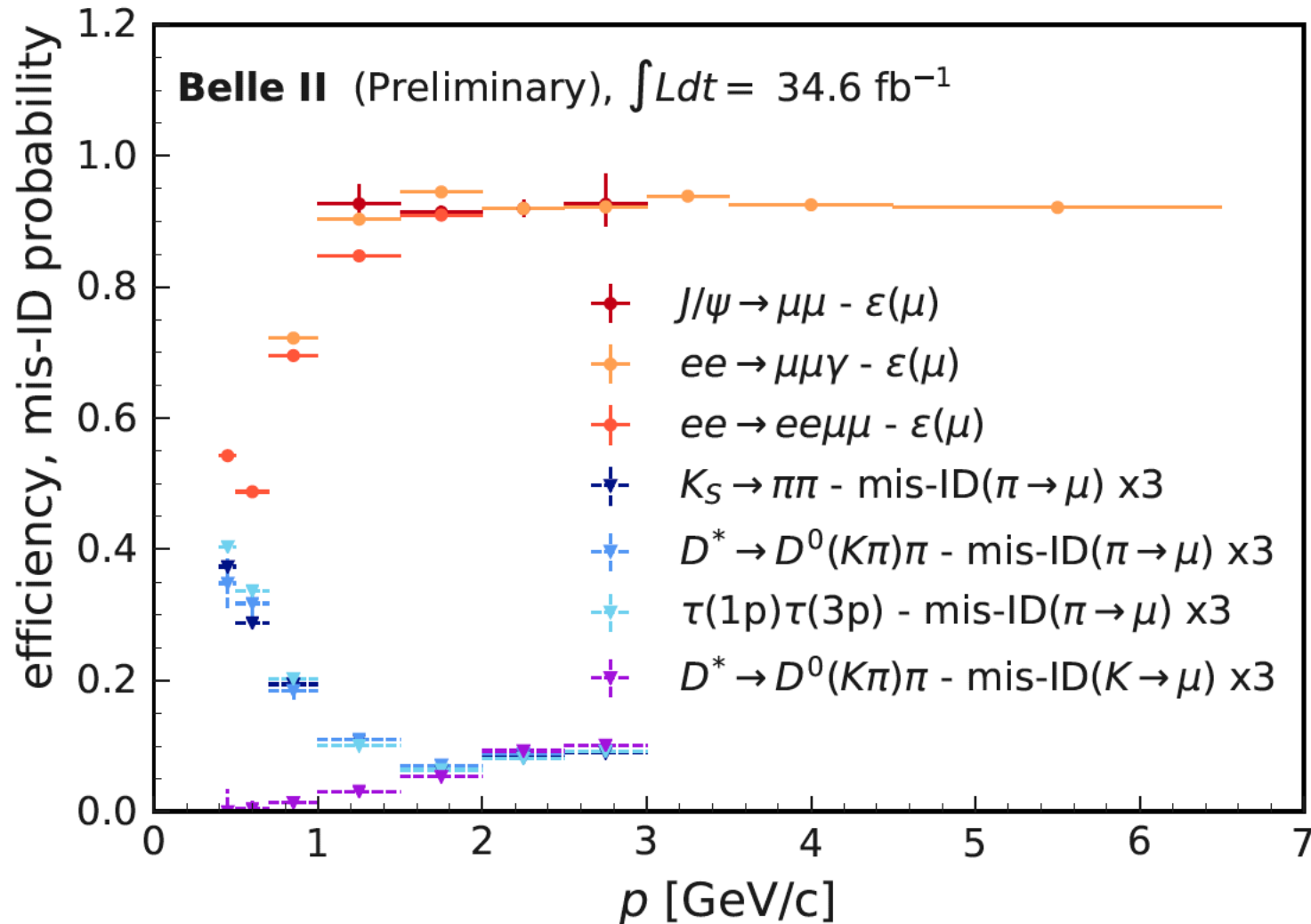
- min μ p=0.6 GeV
- Efficiency = 89% for p≥1GeV
- Fake rate 1.3% for p≥ 0.7GeV
- Fake rate ≤3.8% for p≤ 0.7GeV

https://docs.belle2.org/record/2895/files/Lepton_identification_Moriond_2022__v2.pdf

https://arxiv.org/pdf/1011.0352.pdf

Survival Muon Selection
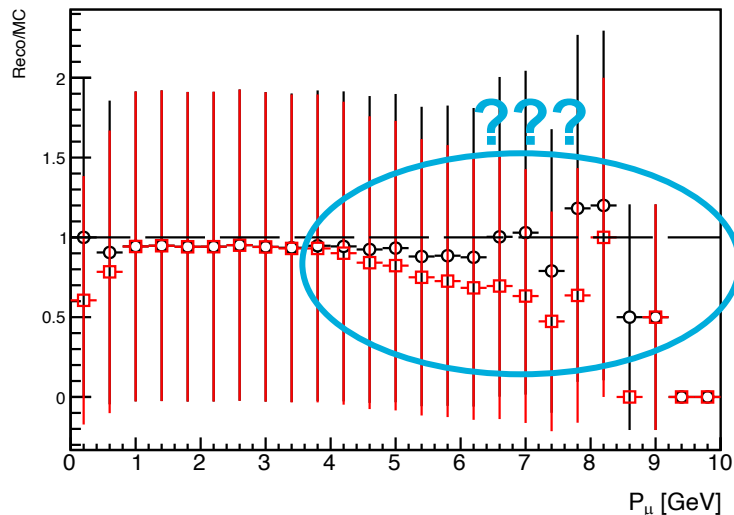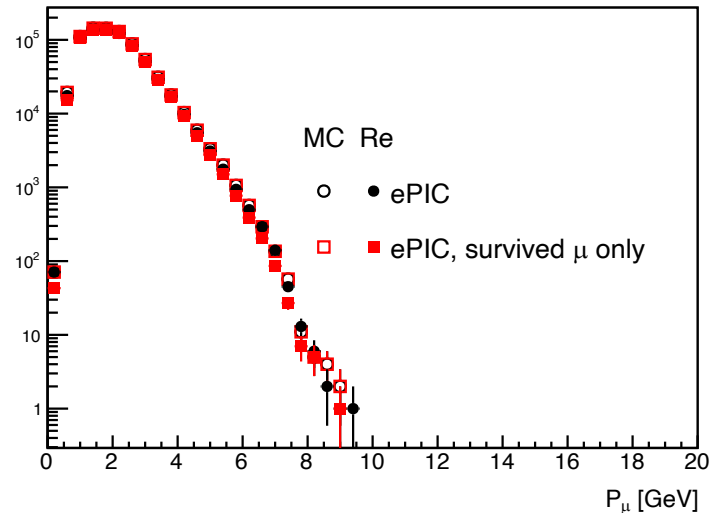
- Survival muon is defined as the muon that can reach the Hcal, where the muon ID detector is supposed to be

- If the last hit of a muon is inside the Hcal or beyond, the muon survives
  - if abs(hit.z)>=150cm, survived
  - If abs(hit.z)<150cm and r>180cm, survived

- Working progress

Summary

- The service parts dominate the material budget for the tracking detector

- Reducing the material budget of the service parts improves the momentum resolution, but it is still not good enough

- Started implementation of muon ID smearing

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Backup

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Simulation Setup

Sartre

- eAu at 18x110 GeV
- $Q^2 \geq 1$ GeV^2
- Coherent events only
- Forced $J/\psi \rightarrow l^+ l^-$
- No background

Data Selections and Reconstructions

Single electron selection

If the electron $\eta < -1.5$, use Ecal energy instead of momentum from tracking

J/ψ reconstruction
- |pid| = 11
- Opposite charges cut on dilepton pair
- If the reconstructed mass is within 2 standard deviations, the e+ and e- are labeled as "**J/ψ** decayed" dielectrons

Q^2
- Scattered electrons must be negatively charged
- "**J/ψ** decayed" electrons are excluded
- $Q^2 = -(e_{beam} - e_{scattered}).M2()$

t from method L
- Removed events with a mis-reconstructed $Q^2 < 1$ GeV^2
- Reconstructed **J/ψ** $|\eta| < 1.5$
- Require information of the proton beam
- Better t resolutions

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BELLE2 Detector