

dE/dx & PID study for new ILD detector models

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02/07/2018

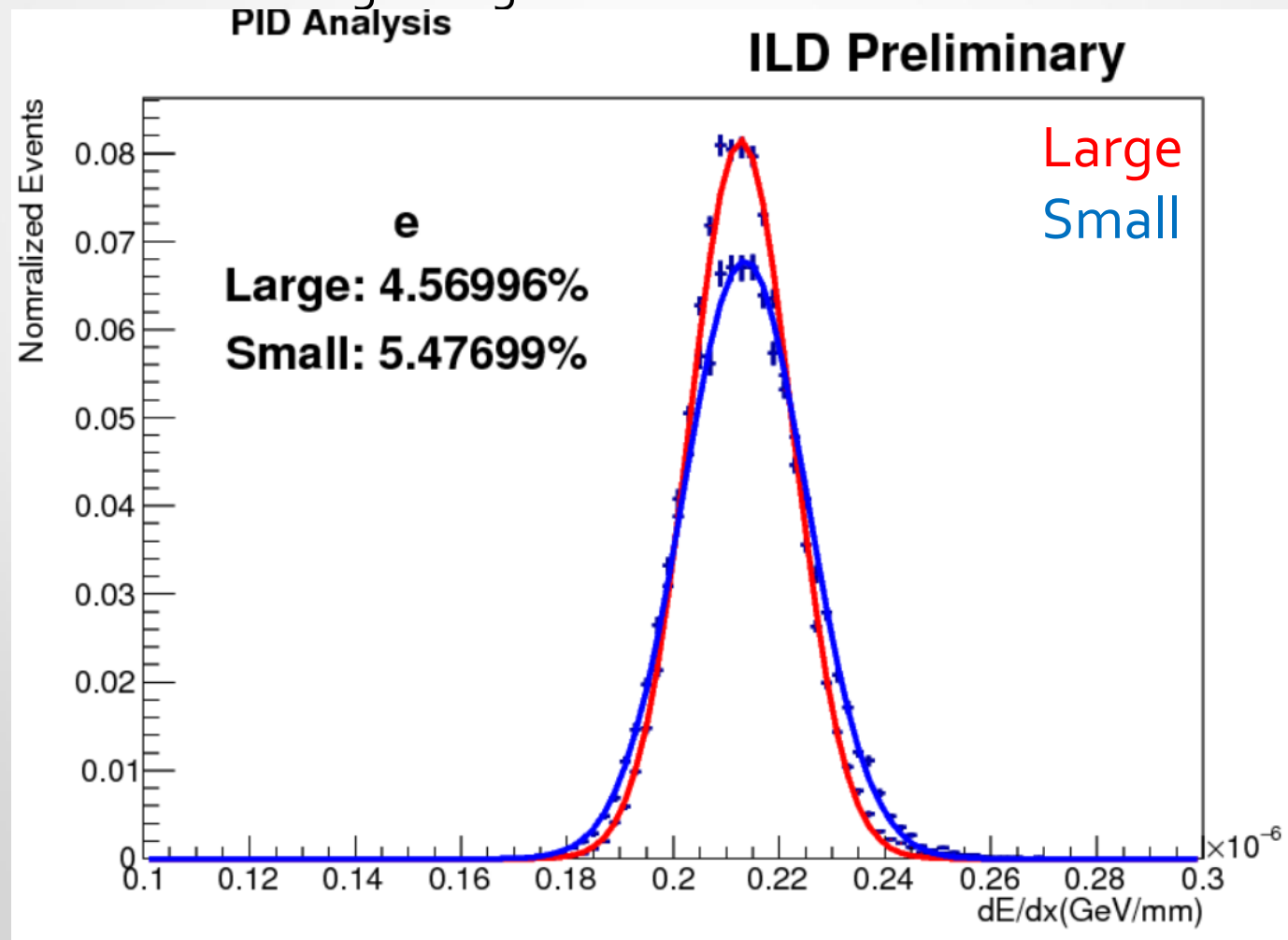
Introduction

- 2nd round to check dE/dx
 - Comparison between ilcsoft versions
 - Comparison between detector models
- Check PID which includes the correction from v01-19-04
- Use test samples
 - Both signed fundamental particles(e, mu, pi, K, p)
 - Energy 0-100GeV & Angle uniform

Today, first show plots and after that mention about some points

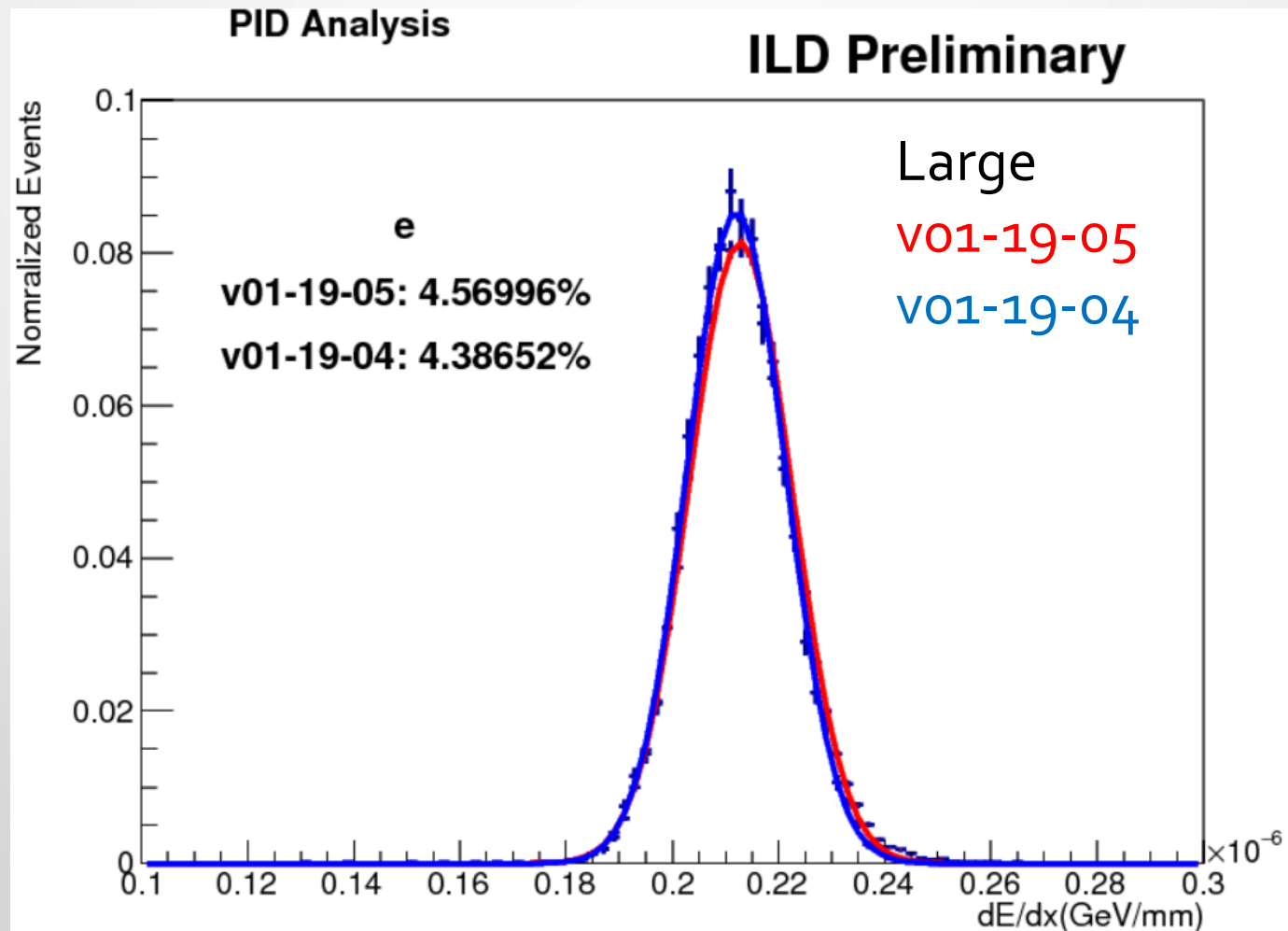
dE/dx distribution

- Truncation method
 - Upper 30% lower 8% discarded
- With additional smearing
- $N_{\text{hit}} \geq 30$, whole momentum & angle range



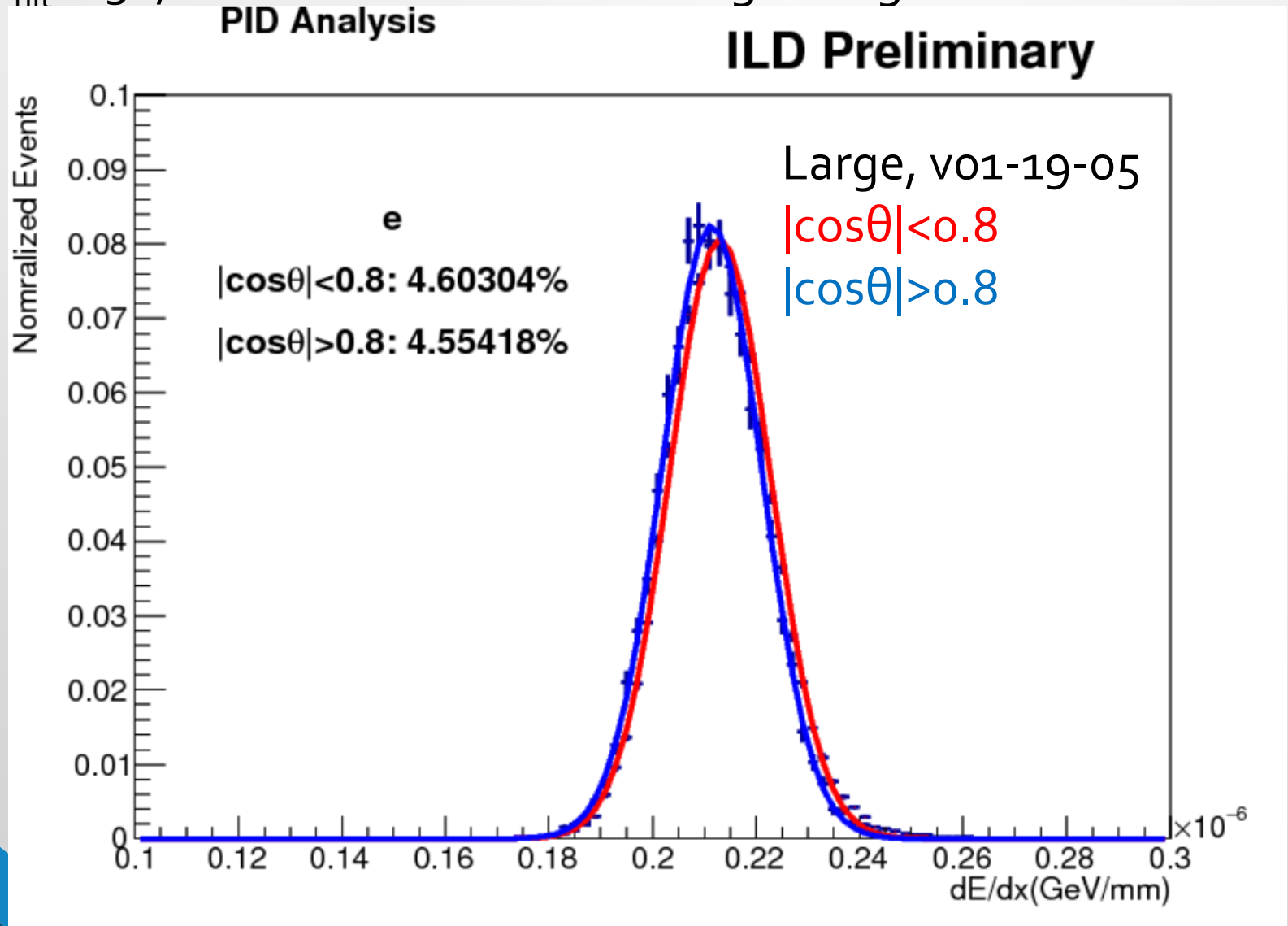
Comparison between ilcsoft versions

- $N_{\text{hit}} \geq 30$
- v01-19-04: $p \geq 1 \text{ GeV}/c$ (due to mono-energy samples)
- v01-19-05: whole momentum & angle range



Angle check

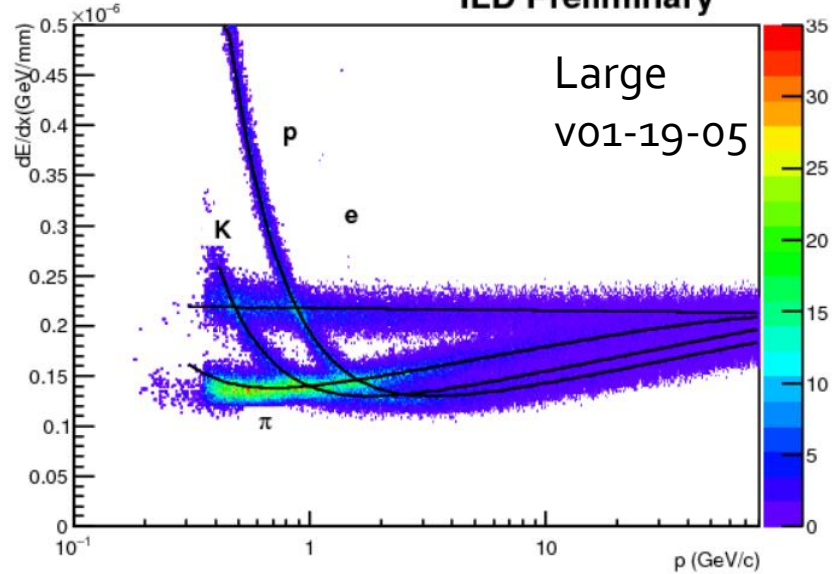
- $N_{\text{hit}} \geq 30$, whole momentum and angle range



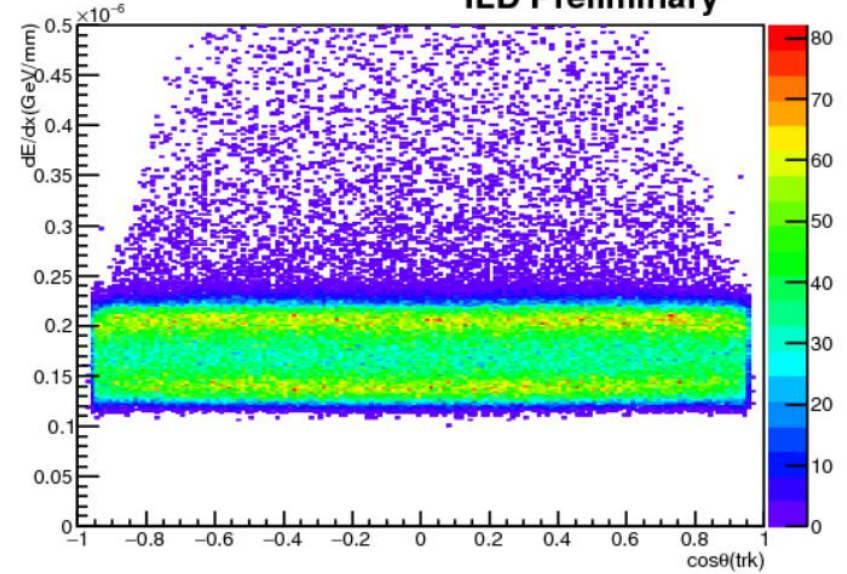
Momentum & angular dependence

- $N_{hit} \geq 30$

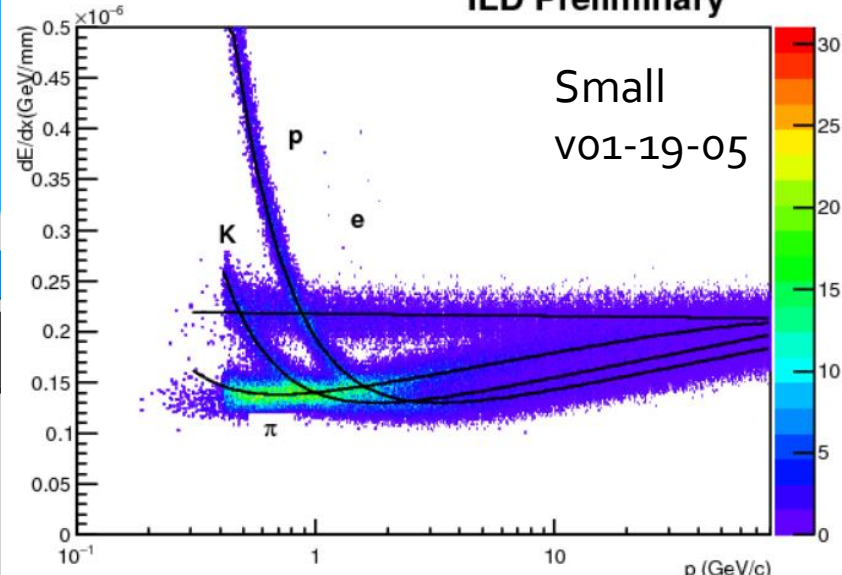
ILD Preliminary



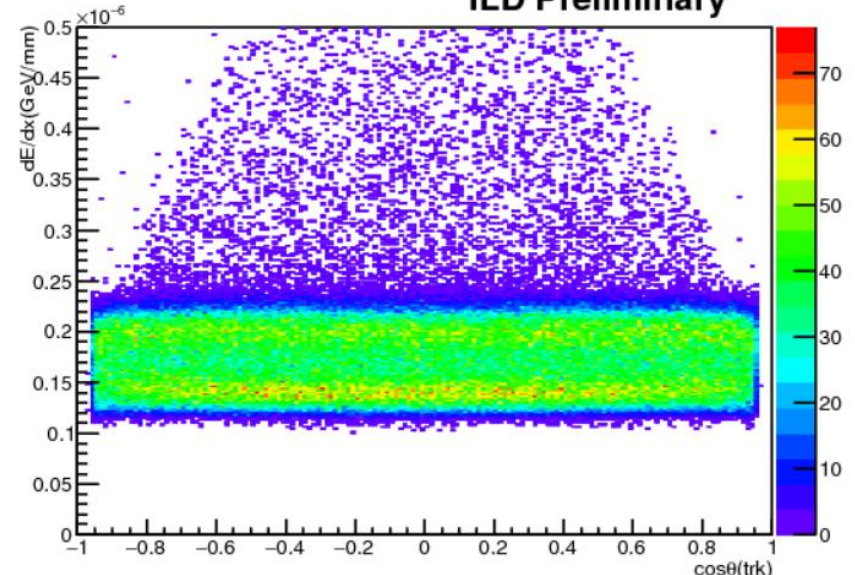
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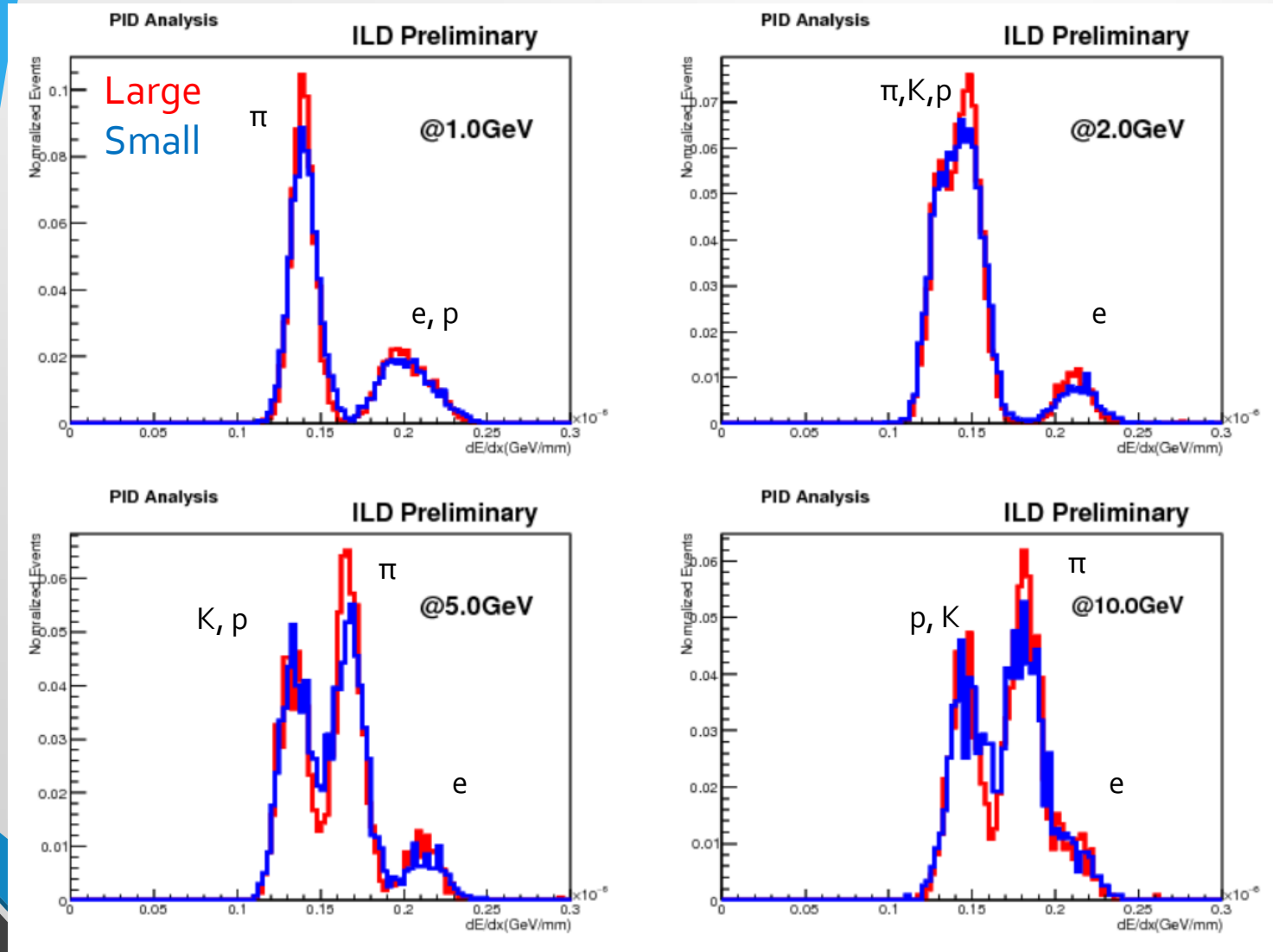
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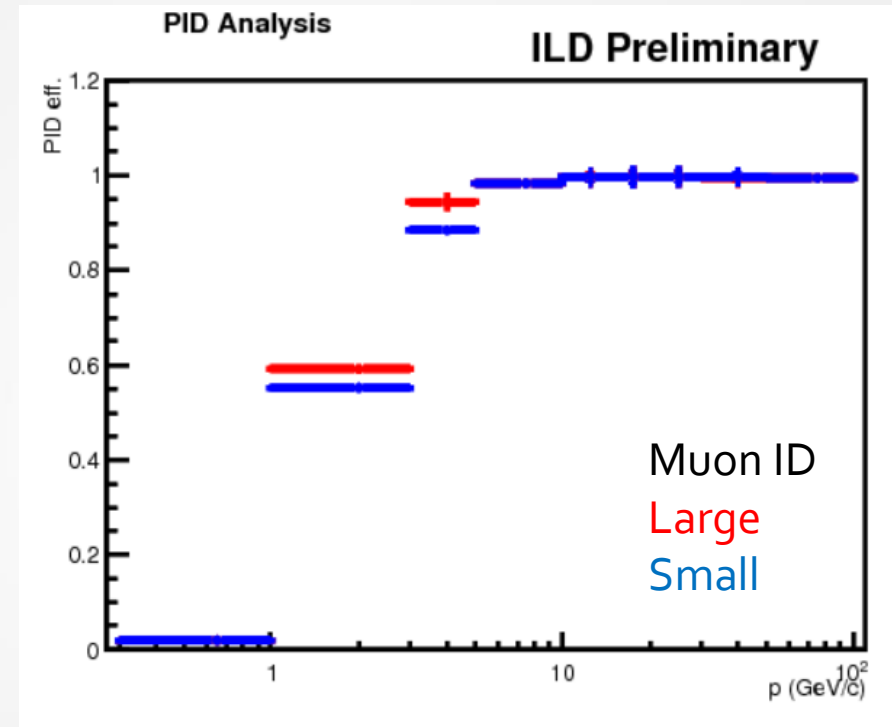
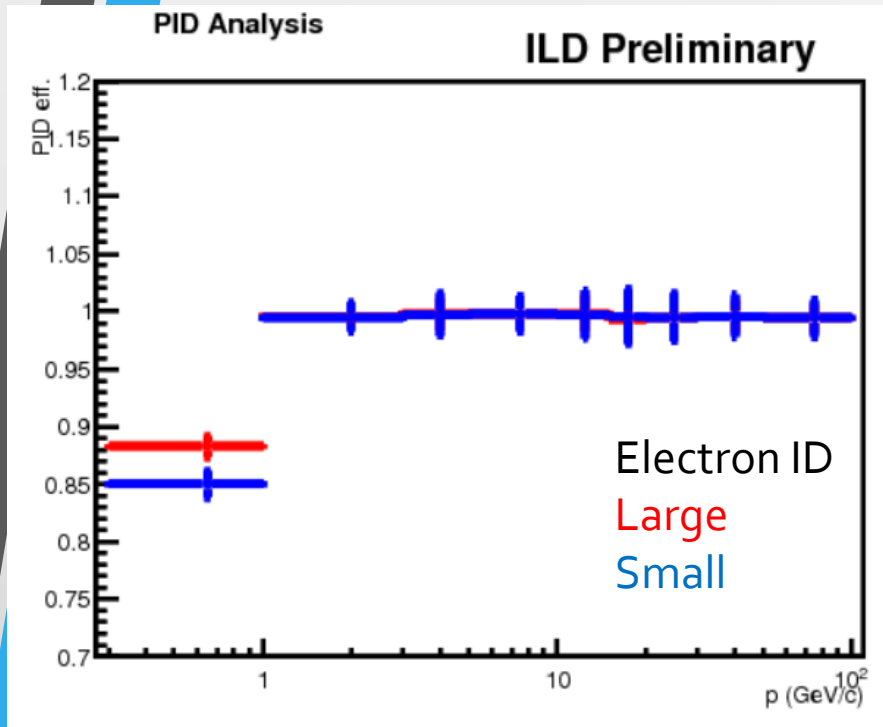
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Comparison between detector models

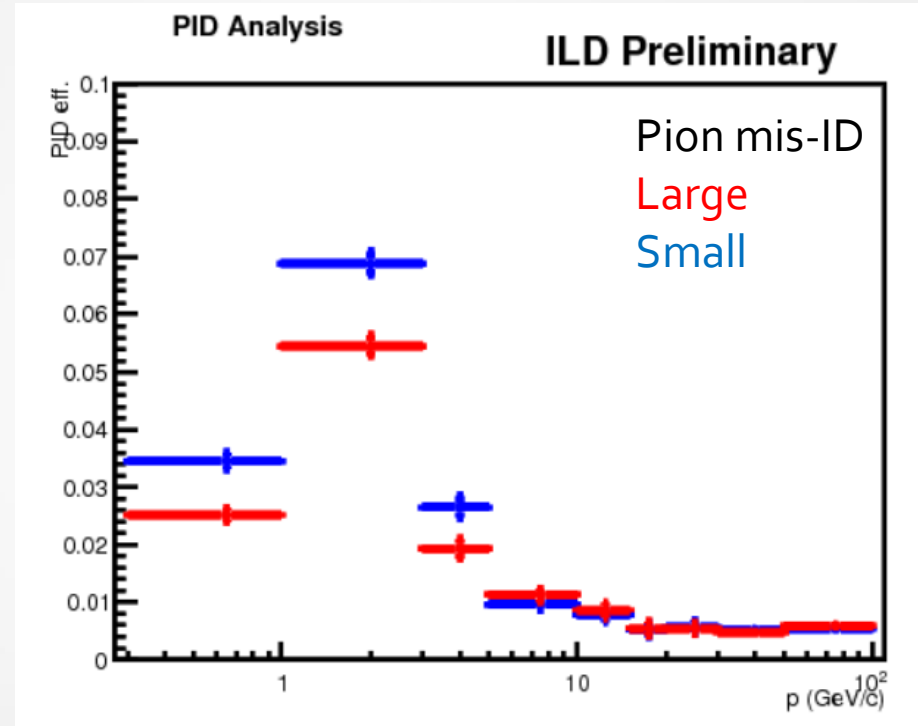
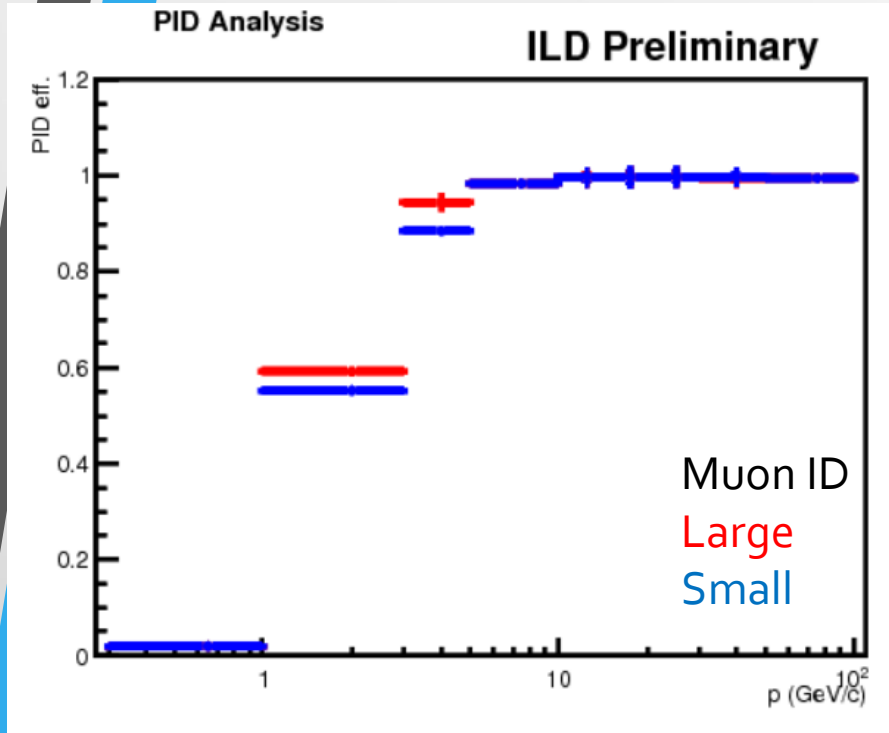


LeptonID



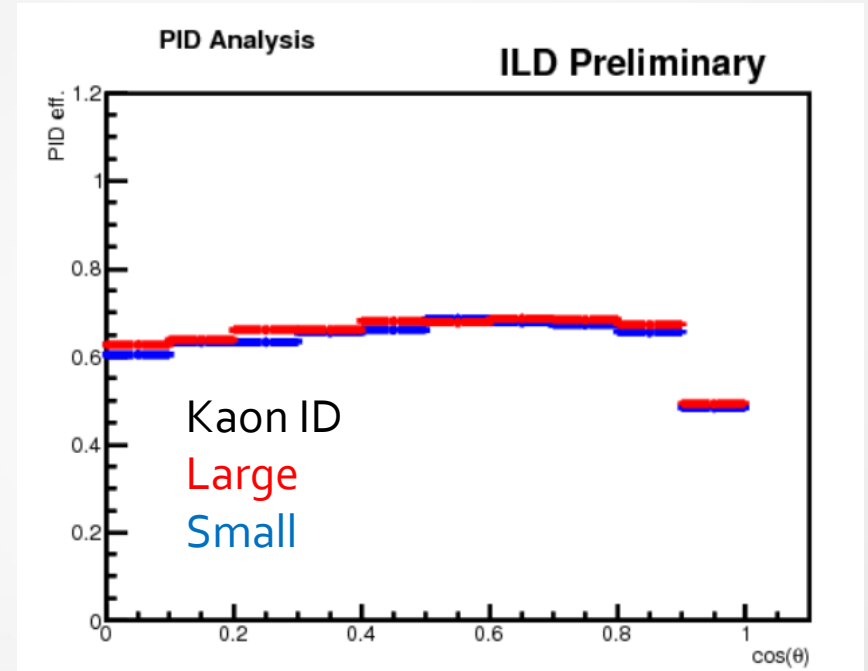
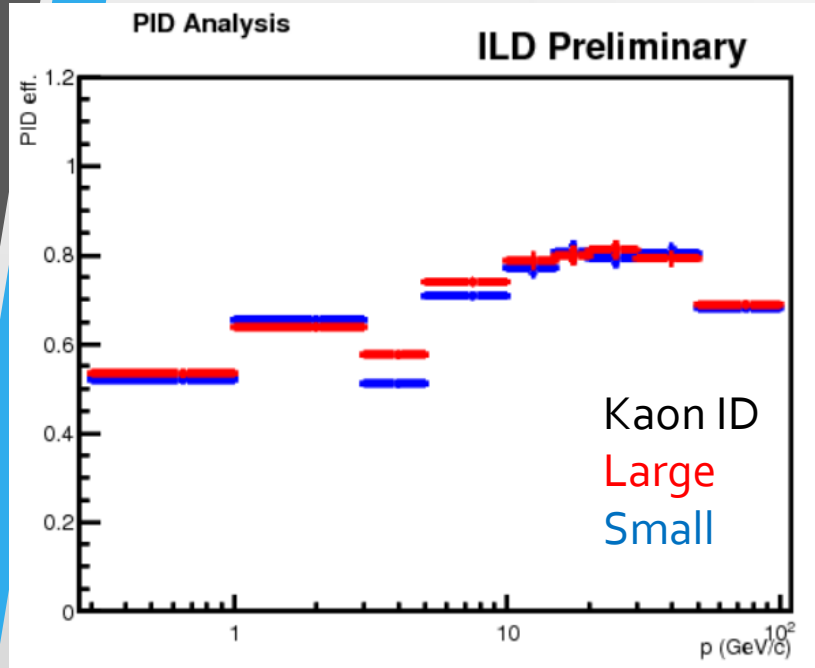
- Both leptons can be identified well with both detectors
 - Small detector has low efficiency especially low momentum region

μ/π separation



- Better Pion mis-ID efficiency suppress with large detector

Charged hadrons(Kaon ID)



- In single track case, performance is almost same
 - Large seems slightly better than small

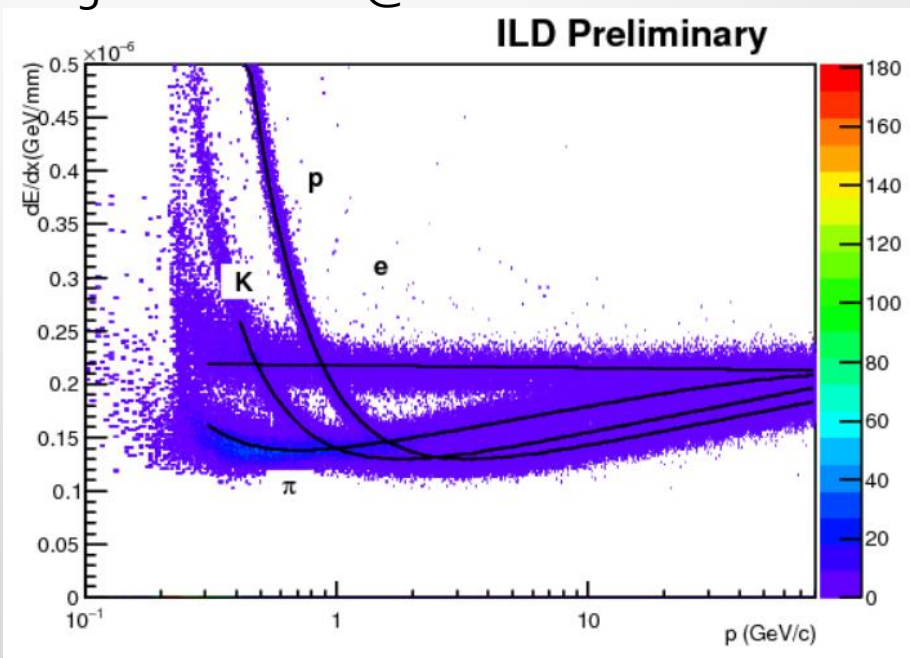
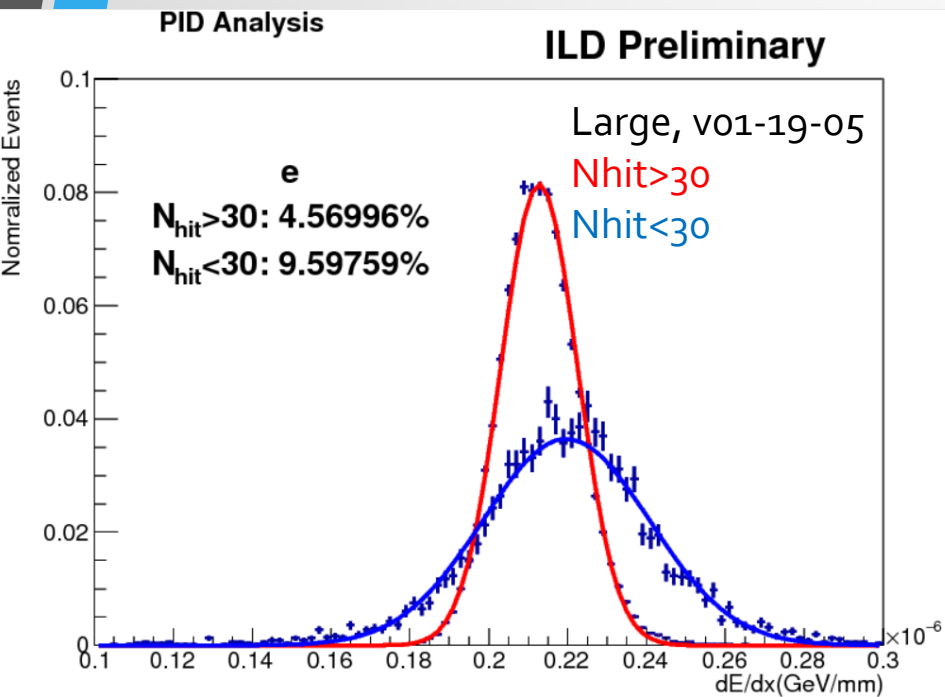
Momentum & angle dependence look weak except very forward

Problem?: momentum & number of hits

- Low momentum & small number of hits tracks have strange dE/dx value
 - Cannot erase Landau effect
 - Tried different patterns of truncation method
 - e.g.) upper 30, 40, 50% discarded – cannot be changed...
 - Electron type track has large effect: multiple scattering?
- Correlation seems small about $\cos\theta$

$N_{hit} \neq 0$

Large fluctuation @ low momentum

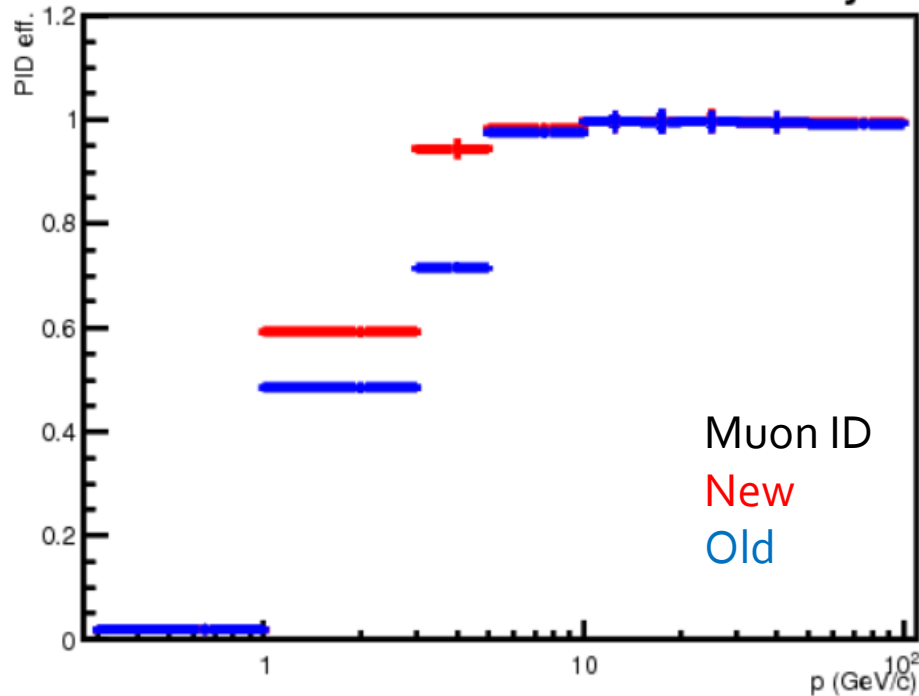


Update on PID

- Rearrange input variables for PID
 - Especially relatively low momentum mu/pi separation
 - Focus on $2.0\text{GeV}/c < p < 7.0\text{GeV}/c$ range
 - Others seems to be unchanged or slightly better

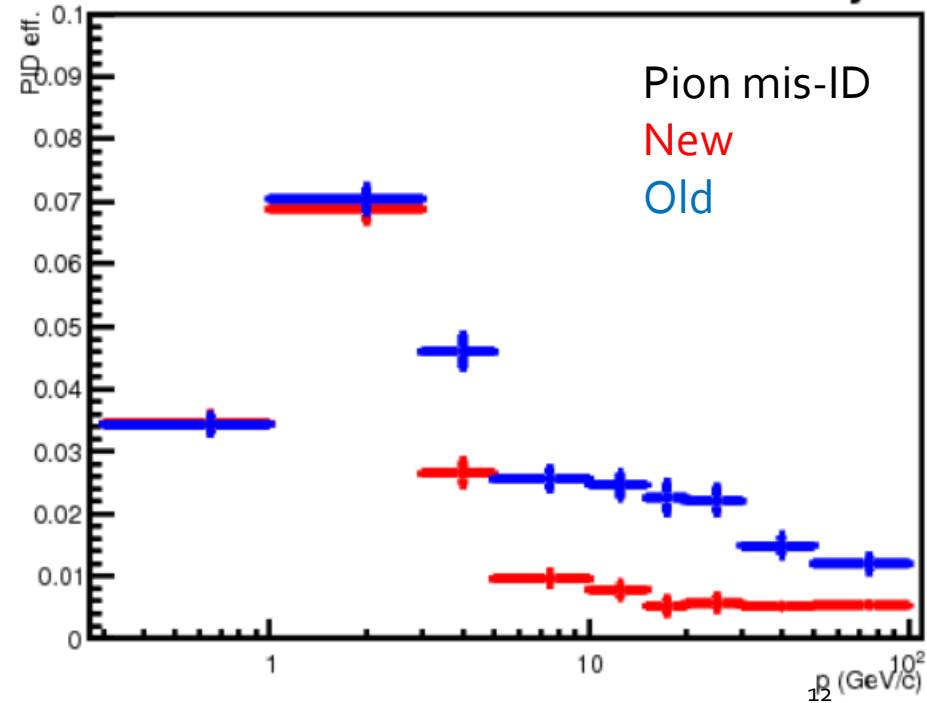
PID Analysis

ILD Preliminary



PID Analysis

ILD Preliminary



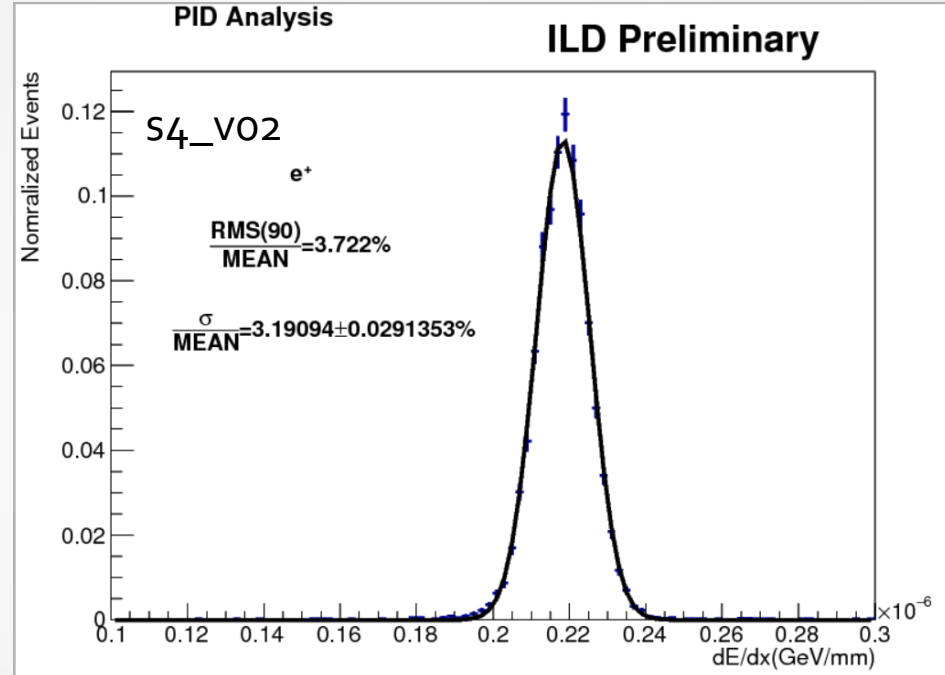
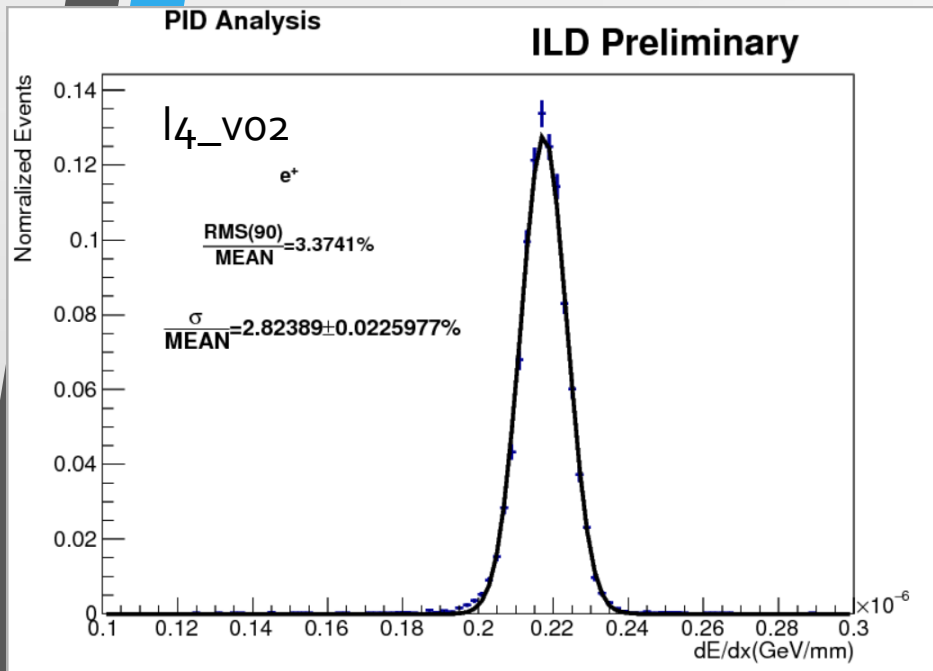
Summary & Plan

- No strange behavior on dE/dx and PID
 - Correction from v01-19-04 is OK
- Will be done within this week:
 - Introduce some changes to ilcsoft
 - Rearranged variables used for PID
 - Backward compatibility included
 - Correct parameters on steering file
 - For large & small detectors
 - Upload template files for PID



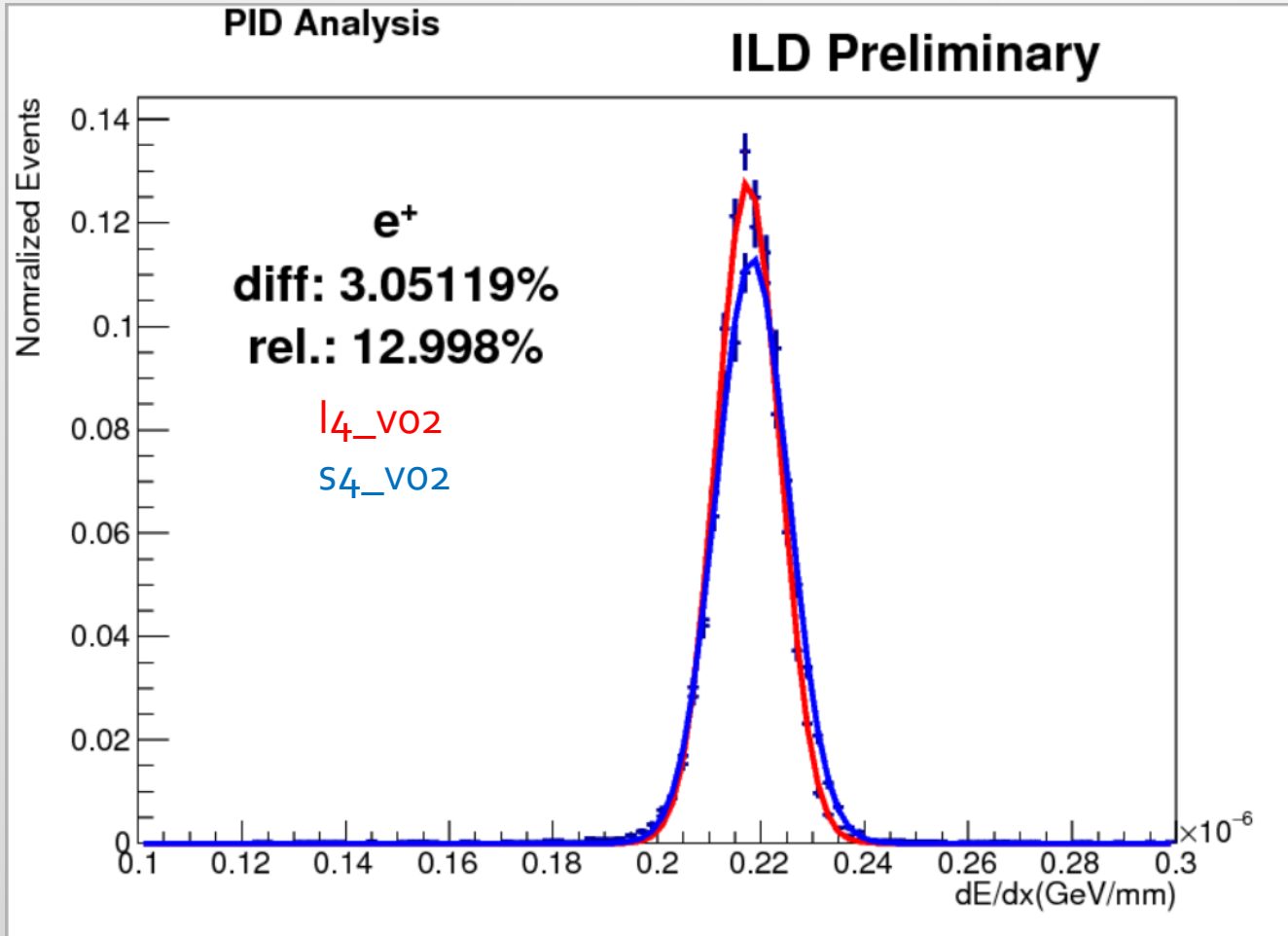
backups

New detector models



- Fluctuation difference(σ/MEAN): $\sim 3\%$ (abs.) $\sim 13\%$ (relative)
 - Natural result
- Fluctuation too small?
 - Do not add any additional smearing now
e.g.) 4.61 \sim 4.70% fluctuation for Asian GEM electron beam test result
- Need to check using other MIP particles

New detector models

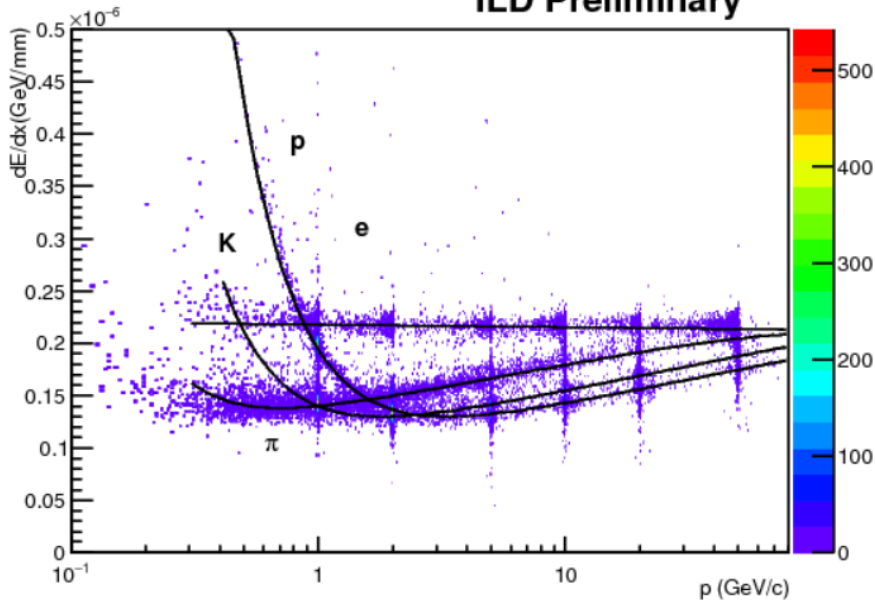


Fluctuation difference(σ /MEAN): $\sim 3\%$

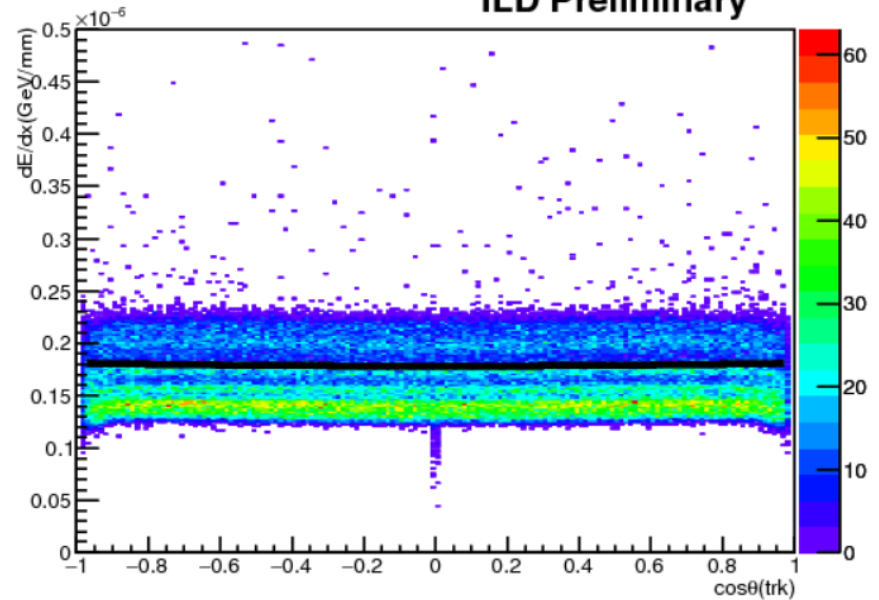
Natural result

New detector model(l4_v02)

ILD Preliminary



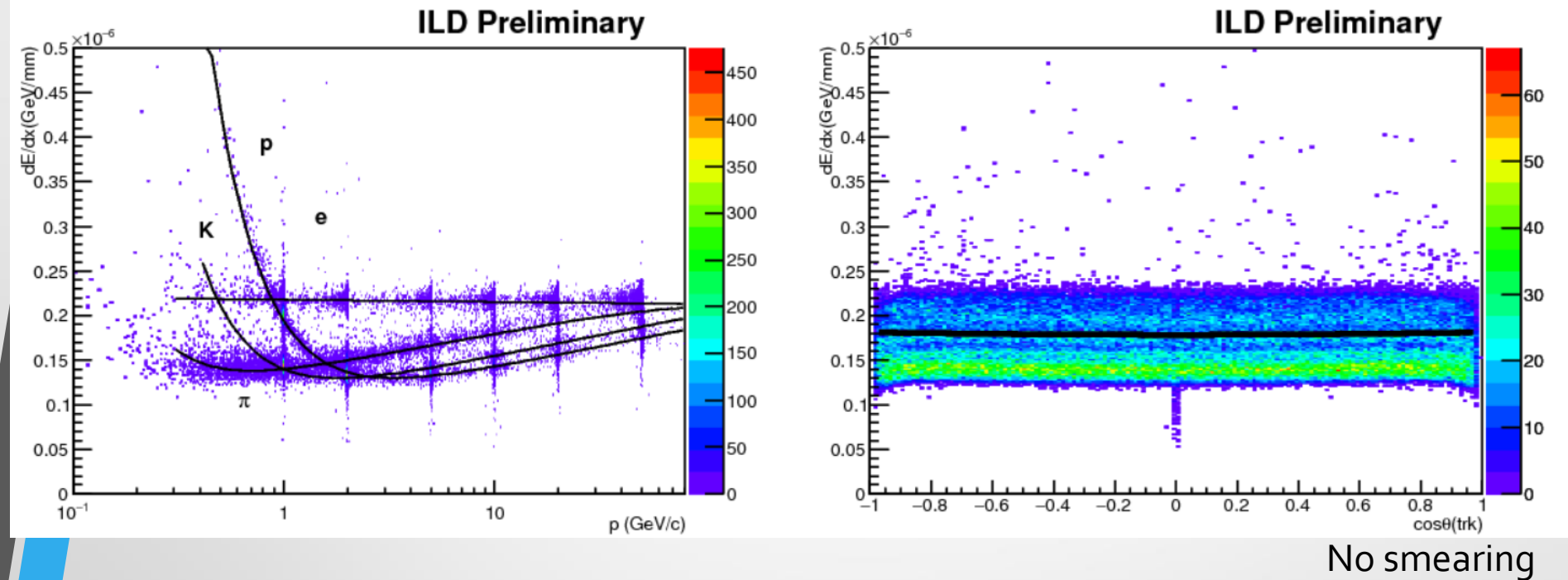
ILD Preliminary



No smearing

- Cannot do full check... but:
 - Bethe-Bloch curve looks OK. Does not change from o1_v05
→ Curve is coming from o1_v05
 - Angle correction is too much in forward region?

New detector model(s4_v02)



- Cannot do full check... but
 - Same tendency as the case of l4_v02