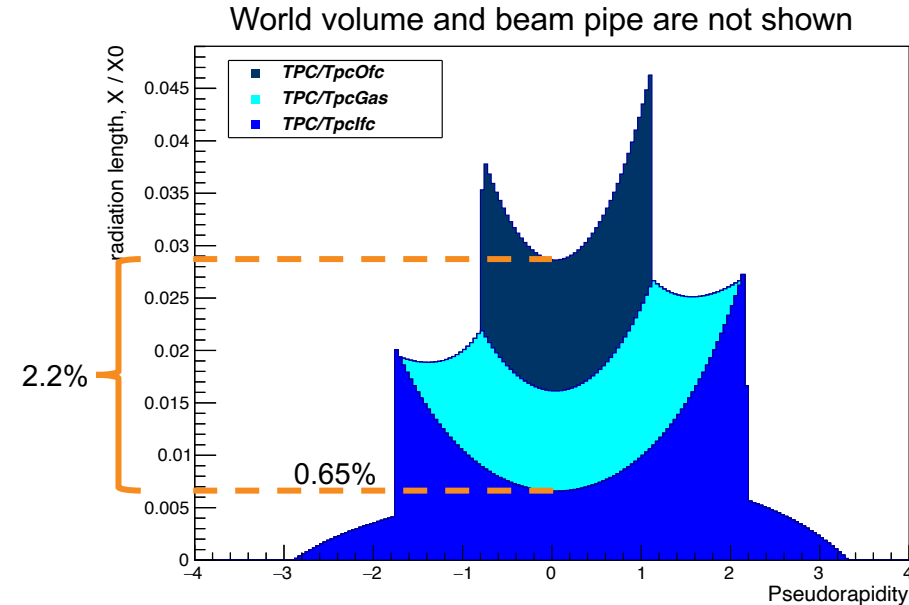
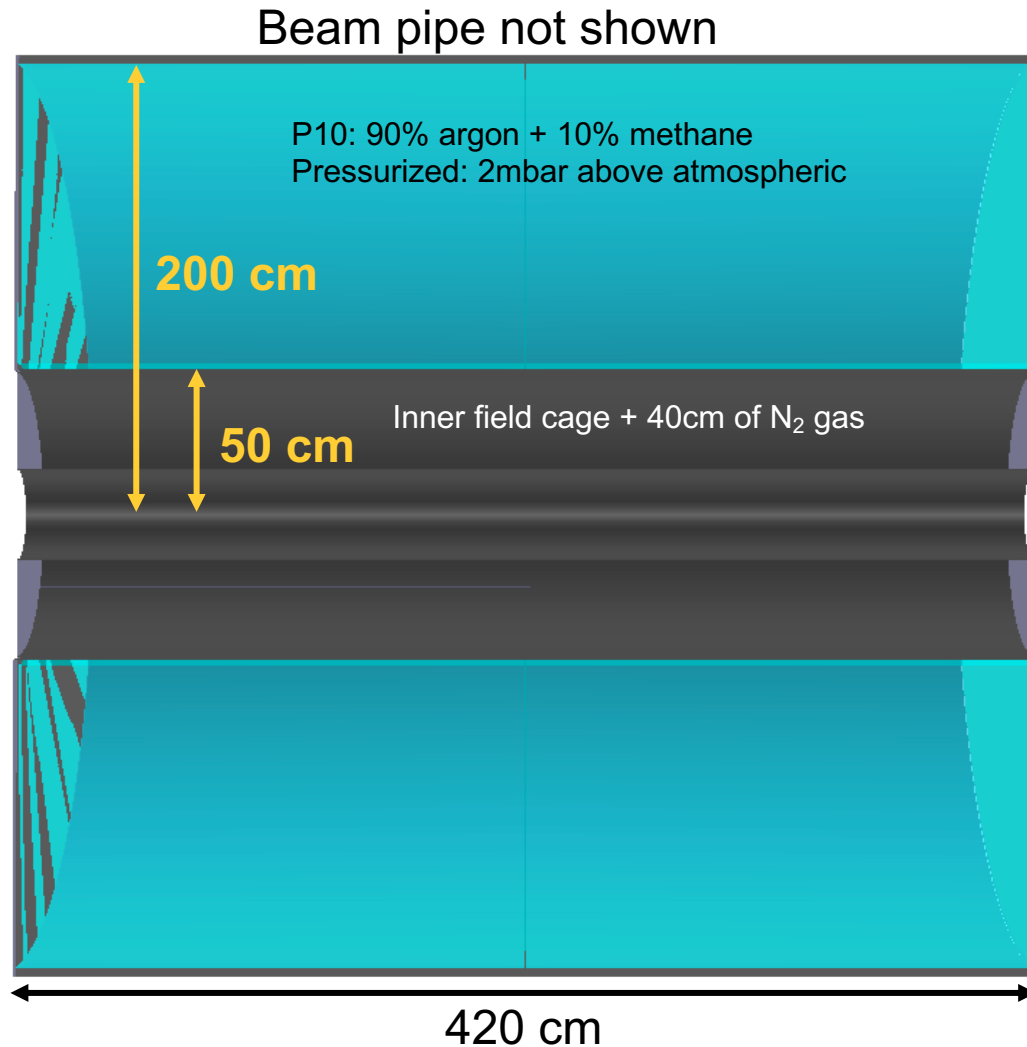


TPC Simulation in ElCroot

Cheuk-Ping Wong

01-13-2024

STAR TPC in EicRoot



- Drift velocity 5.45 cm/us
- Transverse diffusion 230 $\mu\text{m}/\sqrt{\text{cm}}$
- Longitudinal diffusion 360 $\mu\text{m}/\sqrt{\text{cm}}$
- Inner pad row=13, outer pad row=32
 $\rightarrow$ avg vertical pad size = $(200-50)/(13+32)=3.33$ cm

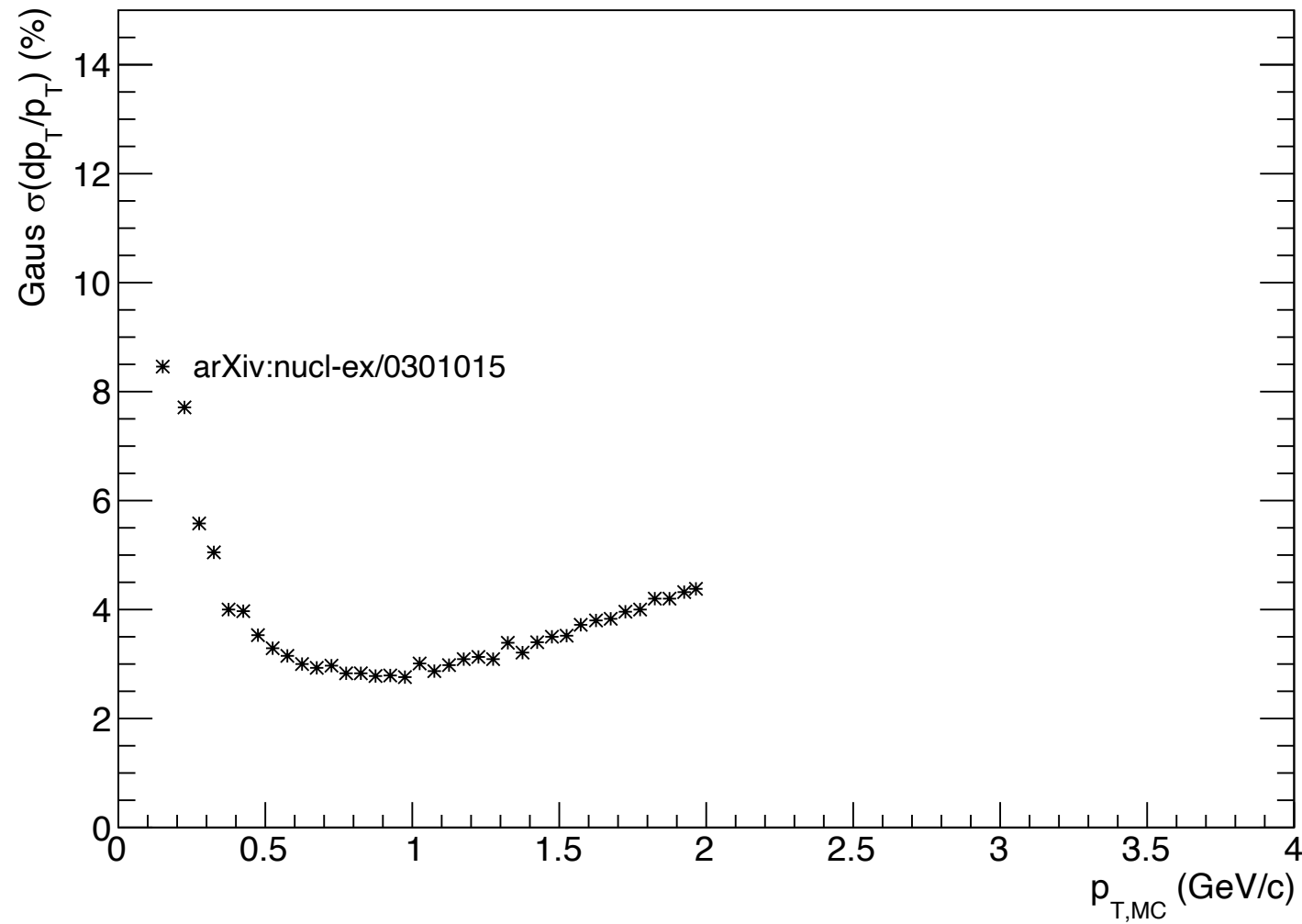
Digitization Setup

	Perfect-ish
Trans. dispersion	1 $\mu\text{m}/\sqrt{\text{cm}}$
Long. dispersion	1 $\mu\text{m}/\sqrt{\text{cm}}$
Trans. intrinsic res.	1 μm
Long. intrinsic res.	1 μm
Radial intrinsic res.	0 μm
GEM vertical pad size	0.1 cm

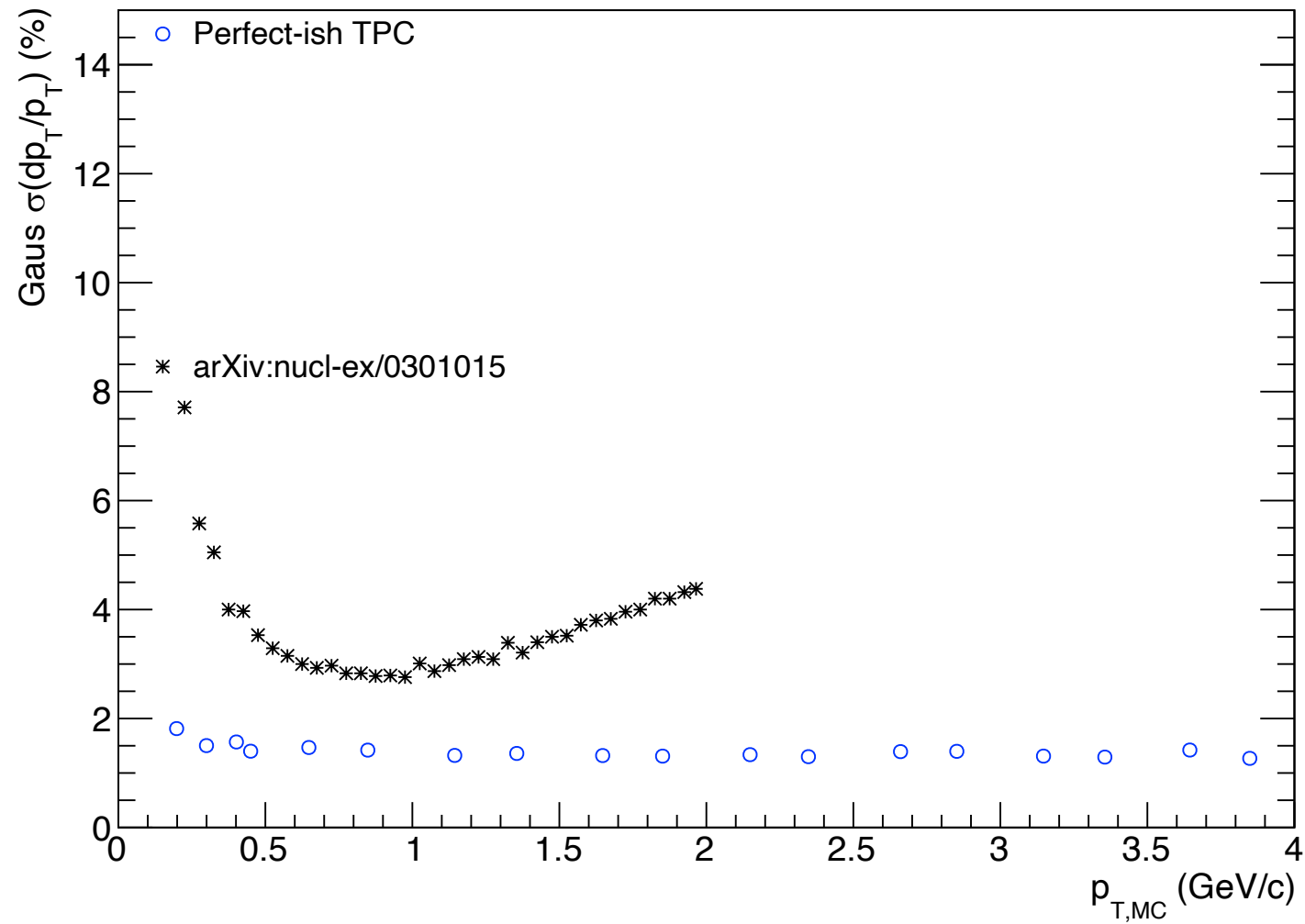
Digitization Setup

	Perfect-ish	Large intrinsic res.	Large long. dispersion	Large tran. dispersion	Large rad. intrinsic res	Large GEM vertical pad size
Trans. dispersion	1 $\mu\text{m}/\sqrt{\text{cm}}$	1 $\mu\text{m}/\sqrt{\text{cm}}$	1 $\mu\text{m}/\sqrt{\text{cm}}$	230 $\mu\text{m}/\sqrt{\text{cm}}$	1 $\mu\text{m}/\sqrt{\text{cm}}$	1 $\mu\text{m}/\sqrt{\text{cm}}$
Long. dispersion	1 $\mu\text{m}/\sqrt{\text{cm}}$	1 $\mu\text{m}/\sqrt{\text{cm}}$	1000 μm	1 $\mu\text{m}/\sqrt{\text{cm}}$	1 $\mu\text{m}/\sqrt{\text{cm}}$	1 $\mu\text{m}/\sqrt{\text{cm}}$
Trans. intrinsic res.	1 μm	1000 μm	1 μm	1 μm	1 μm	1 μm
Long. intrinsic res.	1 μm	1000 μm	1 μm	1 μm	1 μm	1 μm
Radial intrinsic res.	0 μm	0 μm	0 μm	0 μm	1000 μm	0 μm
GEM vertical pad size	0.1 cm	0.1 cm	0.1 cm	0.1 cm	0.1 cm	3.33

Transverse Momentum Resolutions

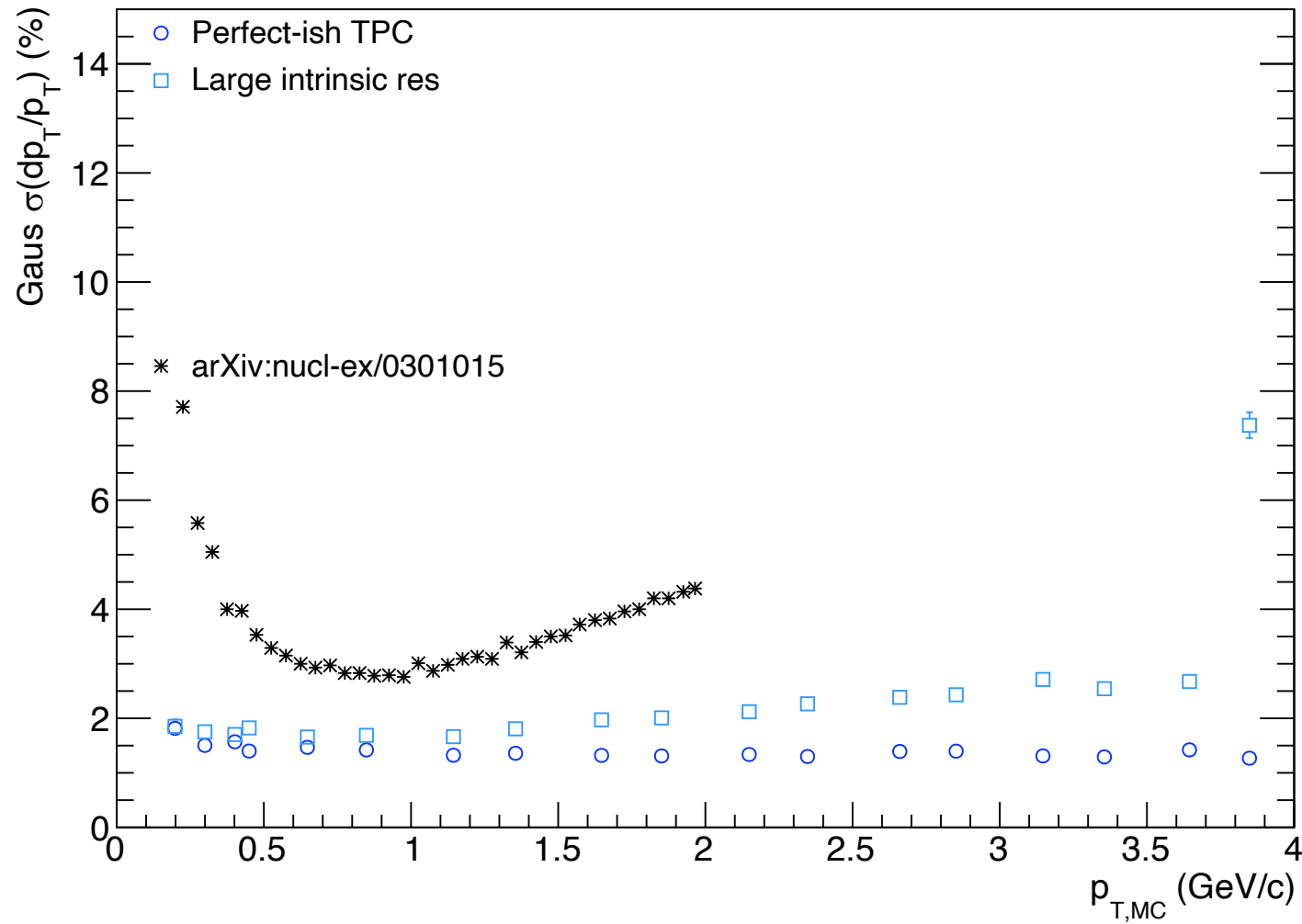


Transverse Momentum Resolutions



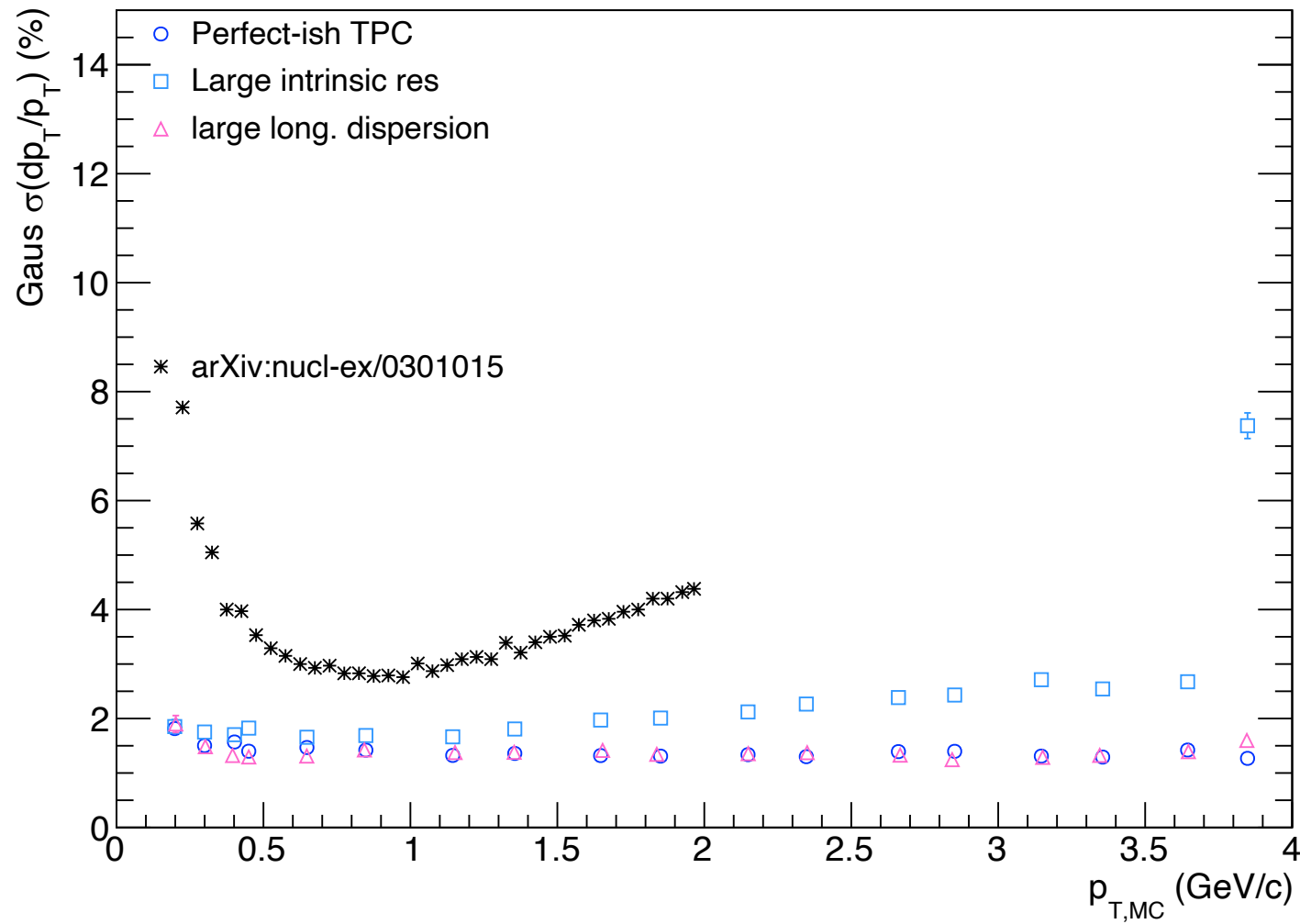
Transverse Momentum Resolutions

Transverse and
longitudinal intrinsic
resolution = 1000 μm



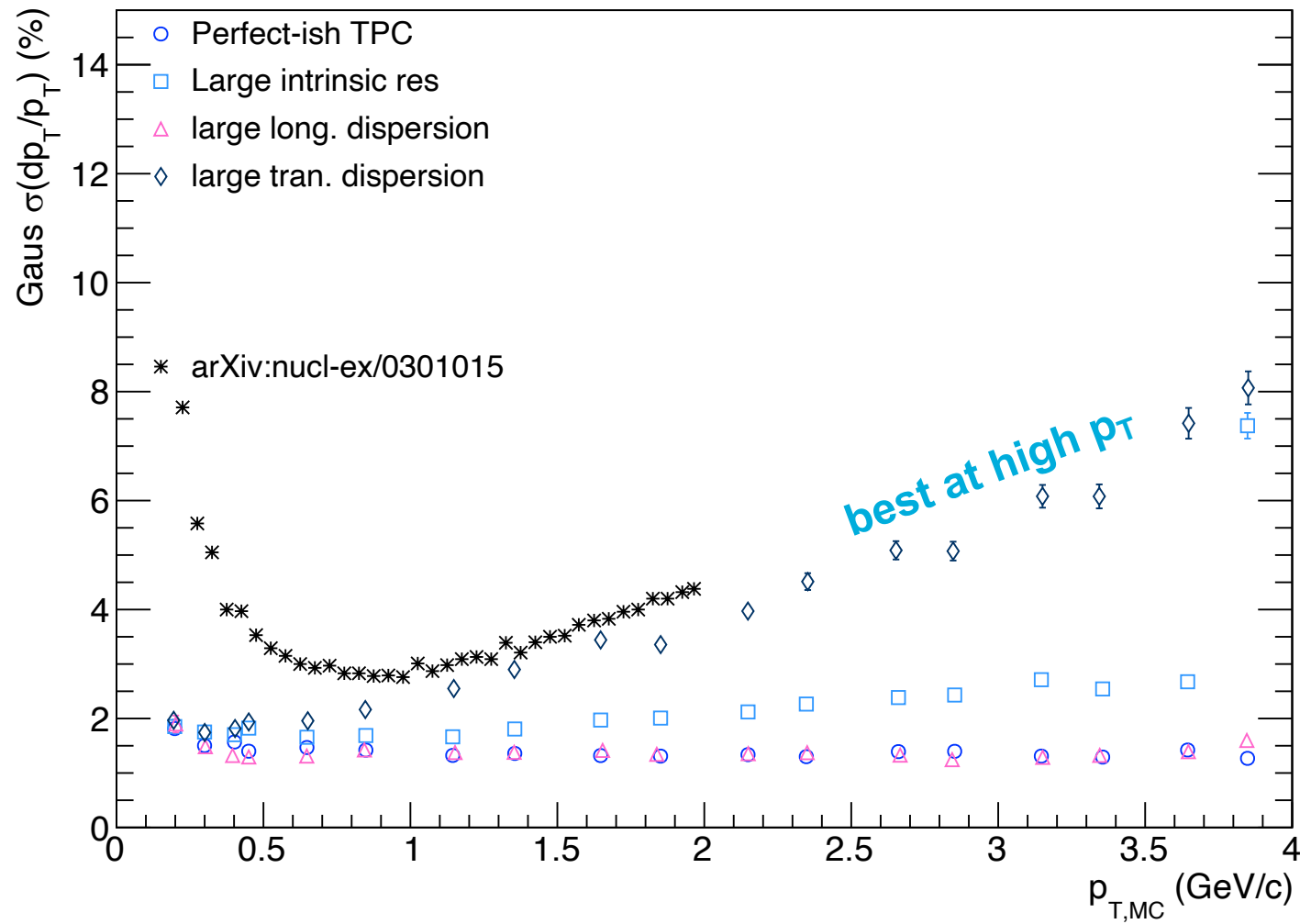
Transverse Momentum Resolutions

longitudinal
dispersion =
 $1000 \text{ um}/\sqrt{\text{cm}}$



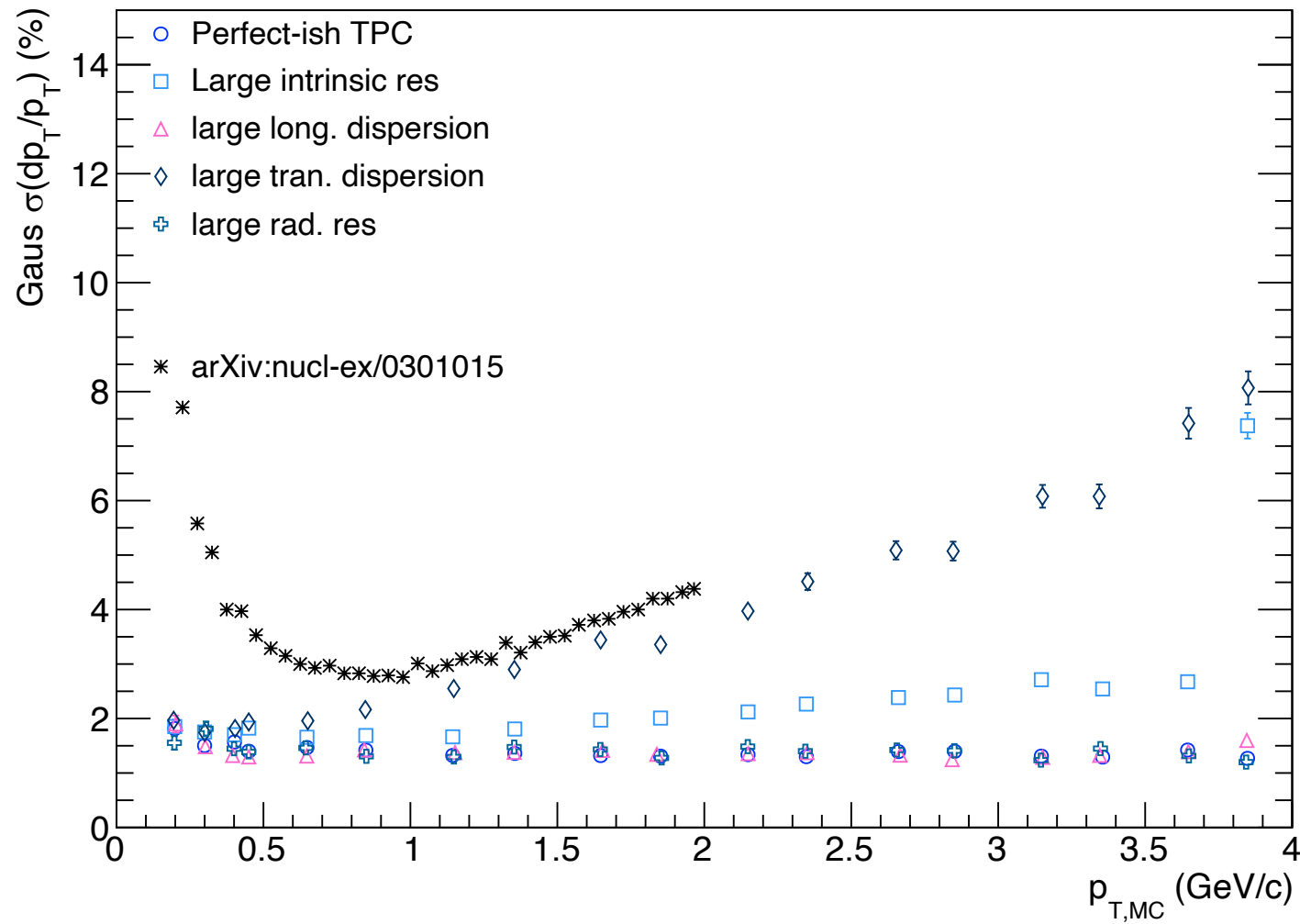
Transverse Momentum Resolutions

transverse
dispersion =
230 $\mu\text{m}/\sqrt{\text{cm}}$



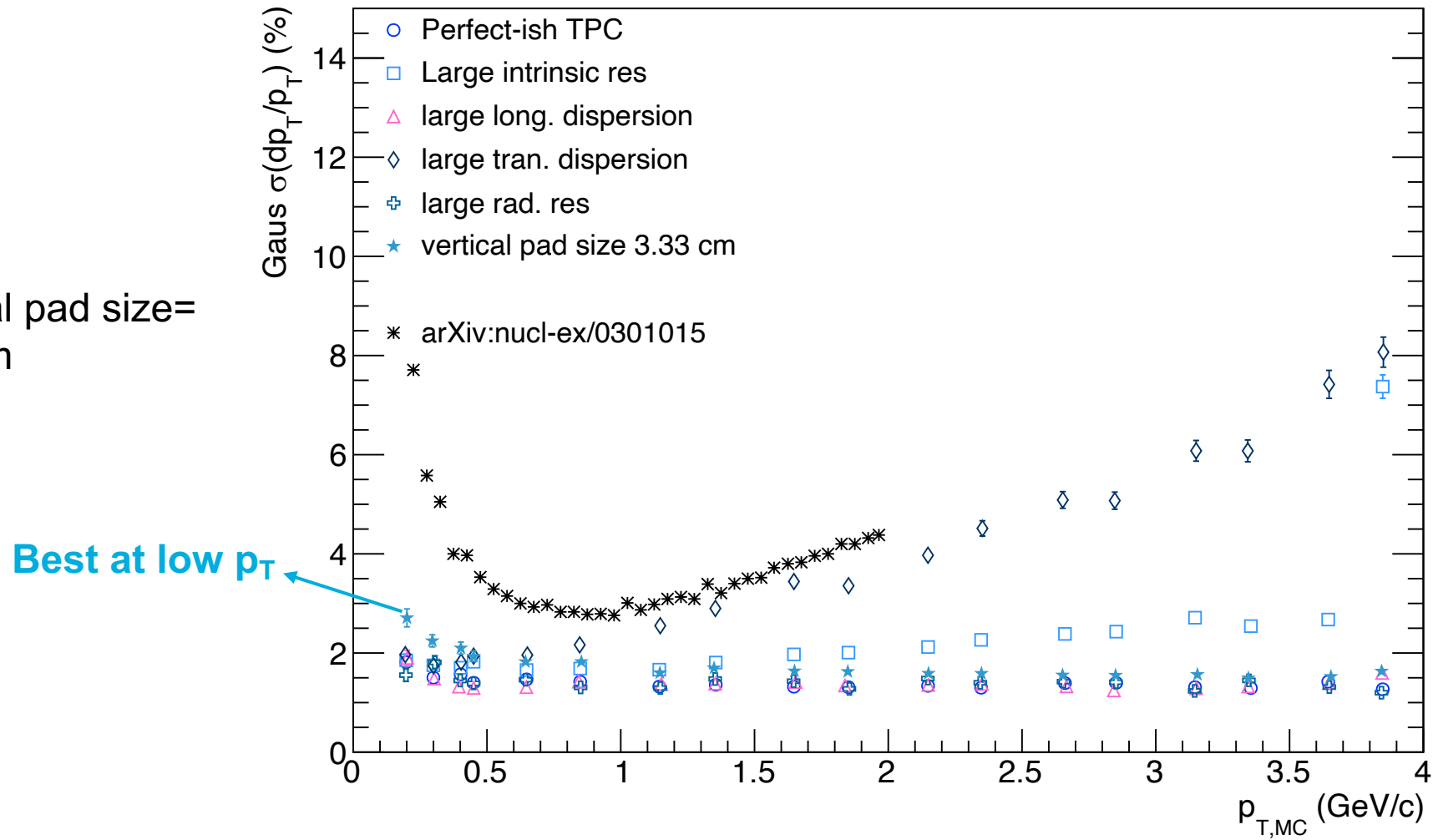
Transverse Momentum Resolutions

Radial intrinsic
resolution =
1000 μ m



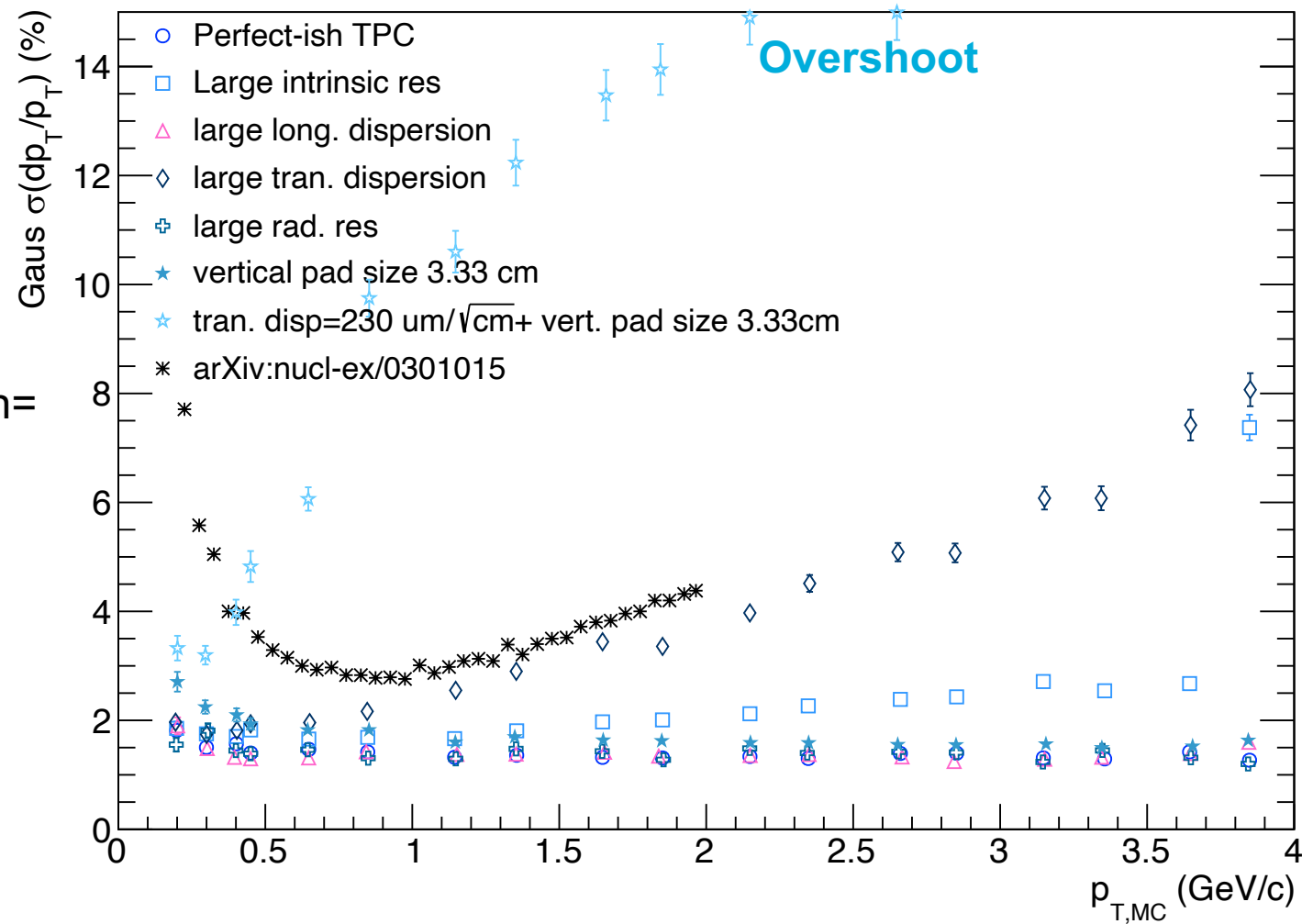
Transverse Momentum Resolutions

Vertical pad size=
3.33cm

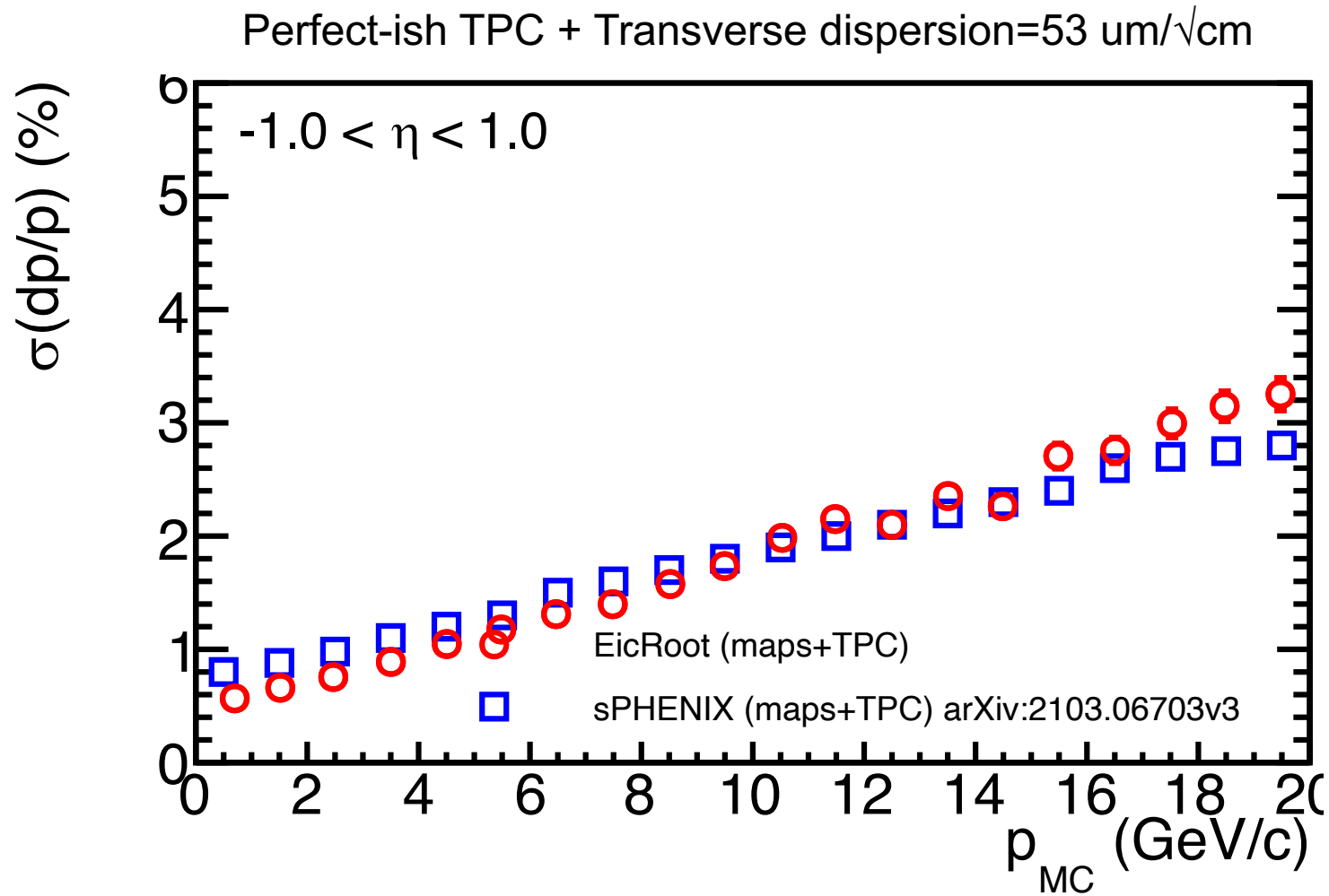


Transverse Momentum Resolutions

Transverse dispersion=
230 $\mu\text{m}/\sqrt{\text{cm}}$
Vertical pad size=
3.33cm



Transverse Momentum Resolutions with sPHENIX Tracking Setup



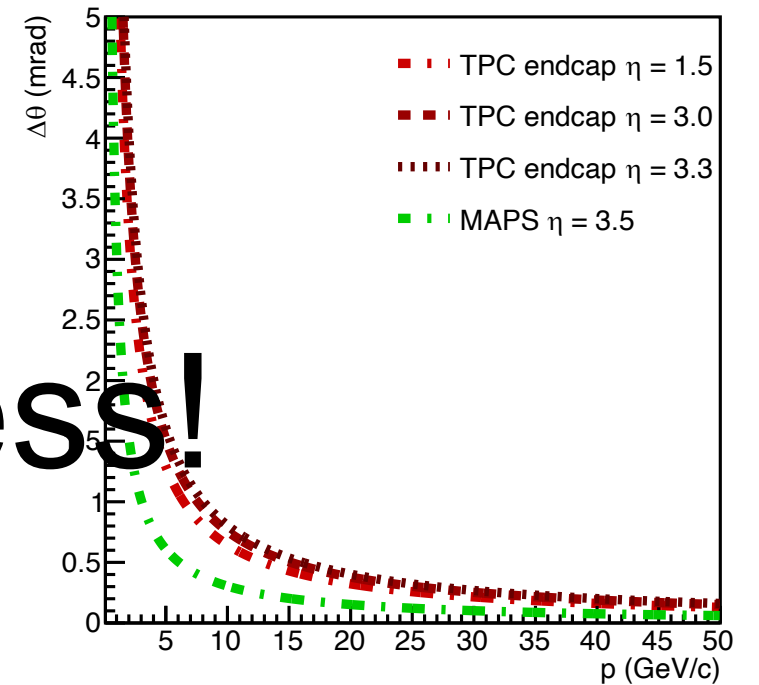
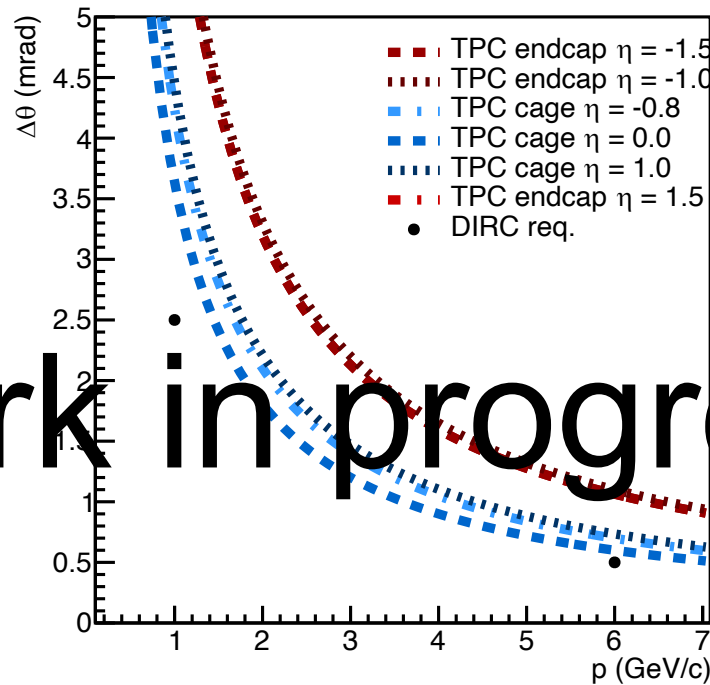
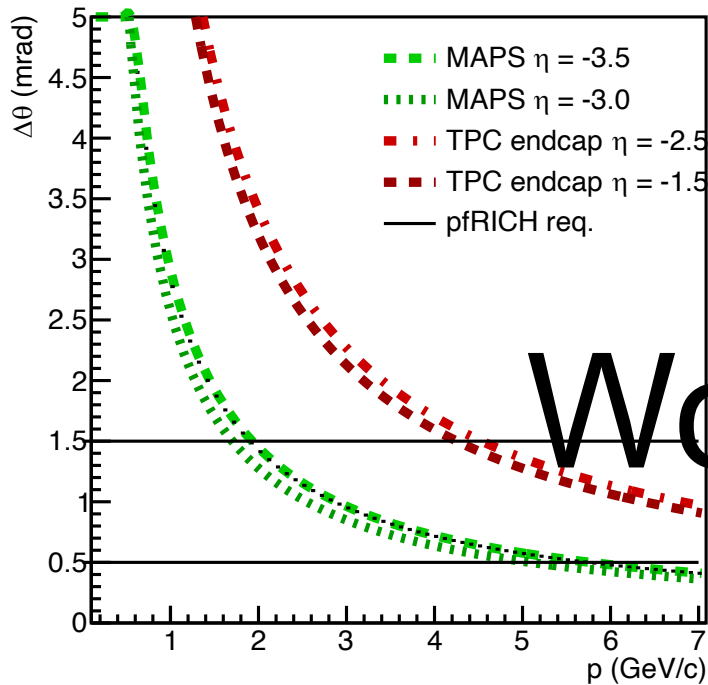
Summary

Playing around the TPC digitization parameters

- p_T resolution is sensitive to the transverse dispersion at $p_T > 1 \text{ GeV}/c$
- p_T resolution is sensitive to the vertical pad size at $p_T < 0.5 \text{ GeV}/c$

To-do List

- Update the tracking simulation notes
- Angular resolution of GradPix + inner silicon tracker
- Look up sPHENIX/STAR reference on TPC endcap materials
- Invite speaker from BELLE II on TPC R&D



Work in progress!