B0 Tracking Performance with ACTS in DD4HEP

Alex Jentsch

August 21st, 2023

Preliminaries

- **<u>Current baseline B0 performance (standalone EICROOT sim) based on the following:</u>**
  - Fully AC-LGAD system with 20um spatial resolution.
  - 5% material budget per layer.
  - 27cm detector plane spacing.
  - GenFit with smeared truth seeding (truth-seeded MC momentum smeared to make the reconstruction more-realistic).

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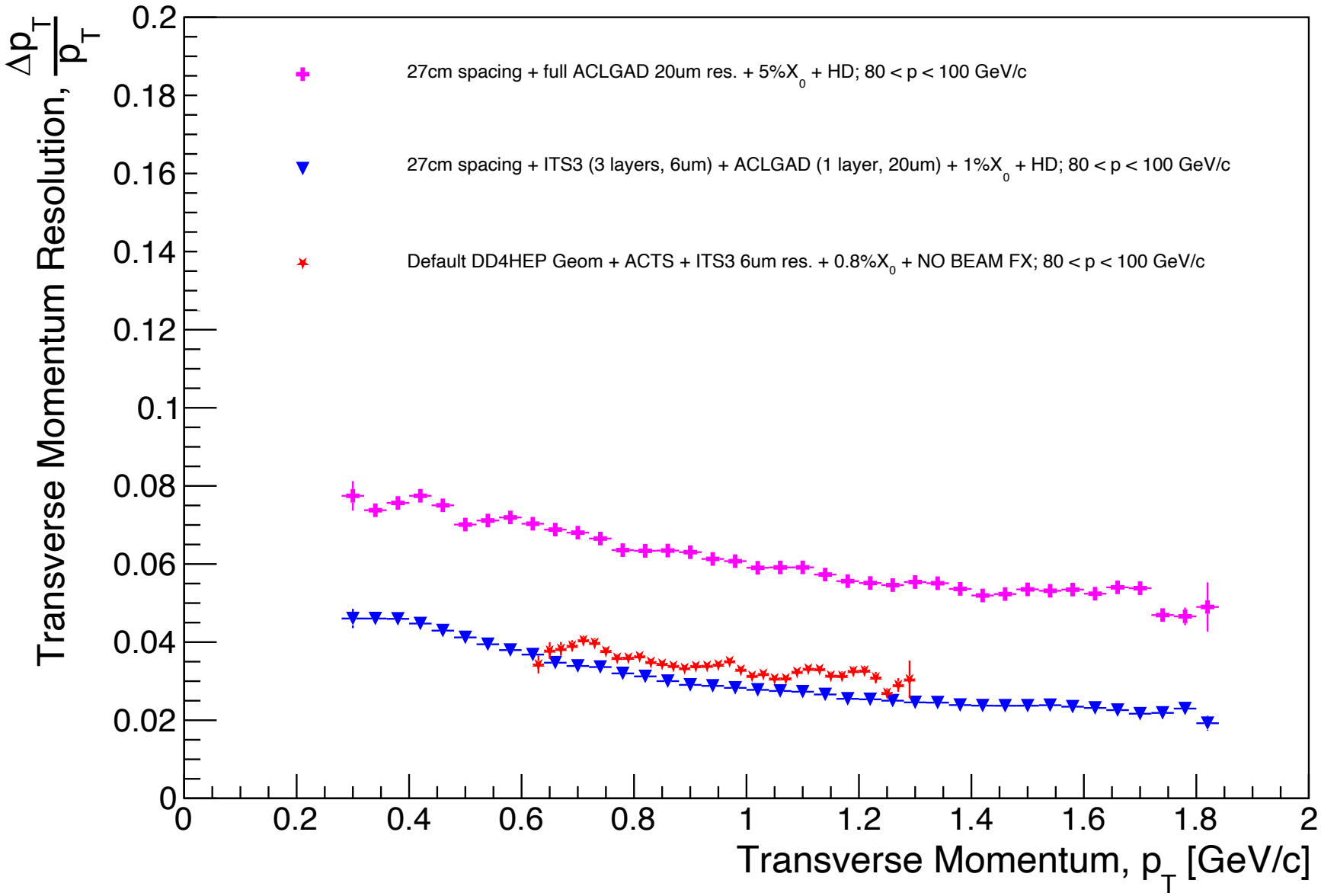
- **ACTS tracking in DD4HEP assumes the following:**
  - 20um pixels (segmentation) in geometry (~6um spatial resolution).
  - 20cm detector plane spacing (very old assumption).
  - < 1% material budget per layer.
  - ACTS tracking with truth-seeding.
  - Using epic_ip6.xml geometry (only FF + FB systems).

→ PROPER geometry in DD4HEP, but not yet merged (results in next slides): https://github.com/eic/epic/pull/502

pT Resolution



- **DD4HEP/ACTS particle sample:**
  - Protons
  - $80 < p < 100$ GeV
  - $6 < \theta < 13$mrad (to maximize particle acceptance)
  - Beam effects **not** included in ACTS simulations (but **are** included in GenFit studies).

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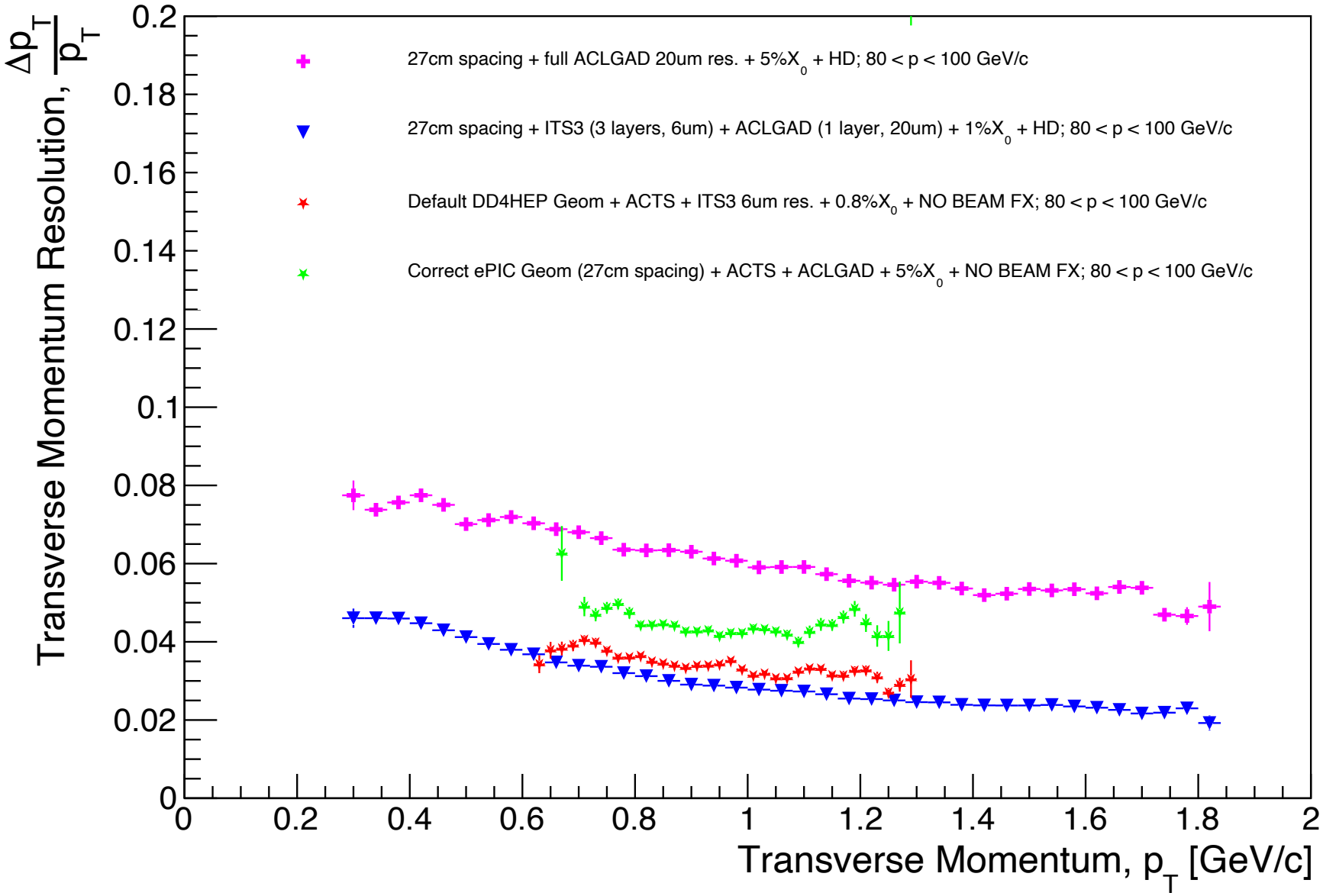

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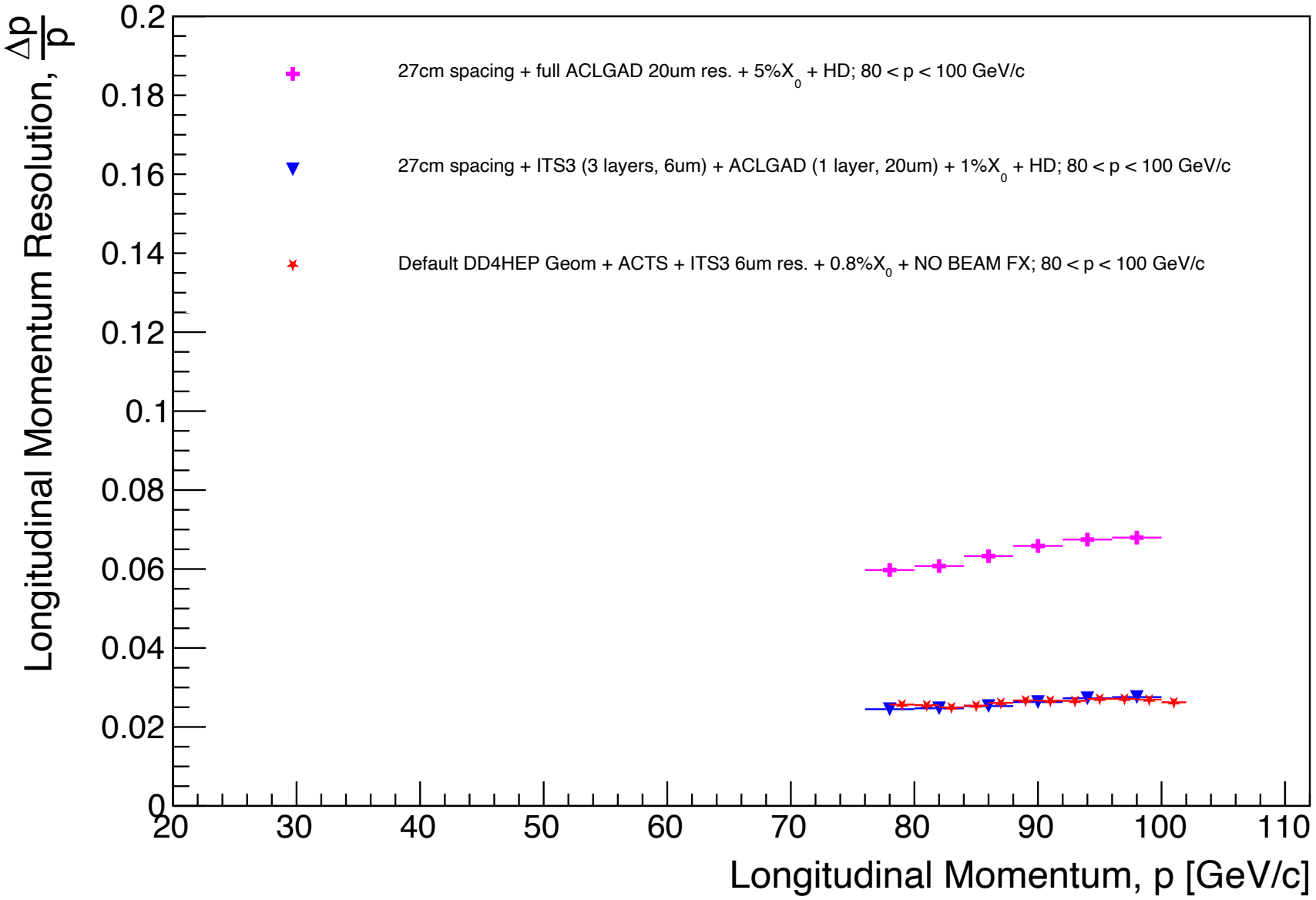
Three-Momentum Resolution



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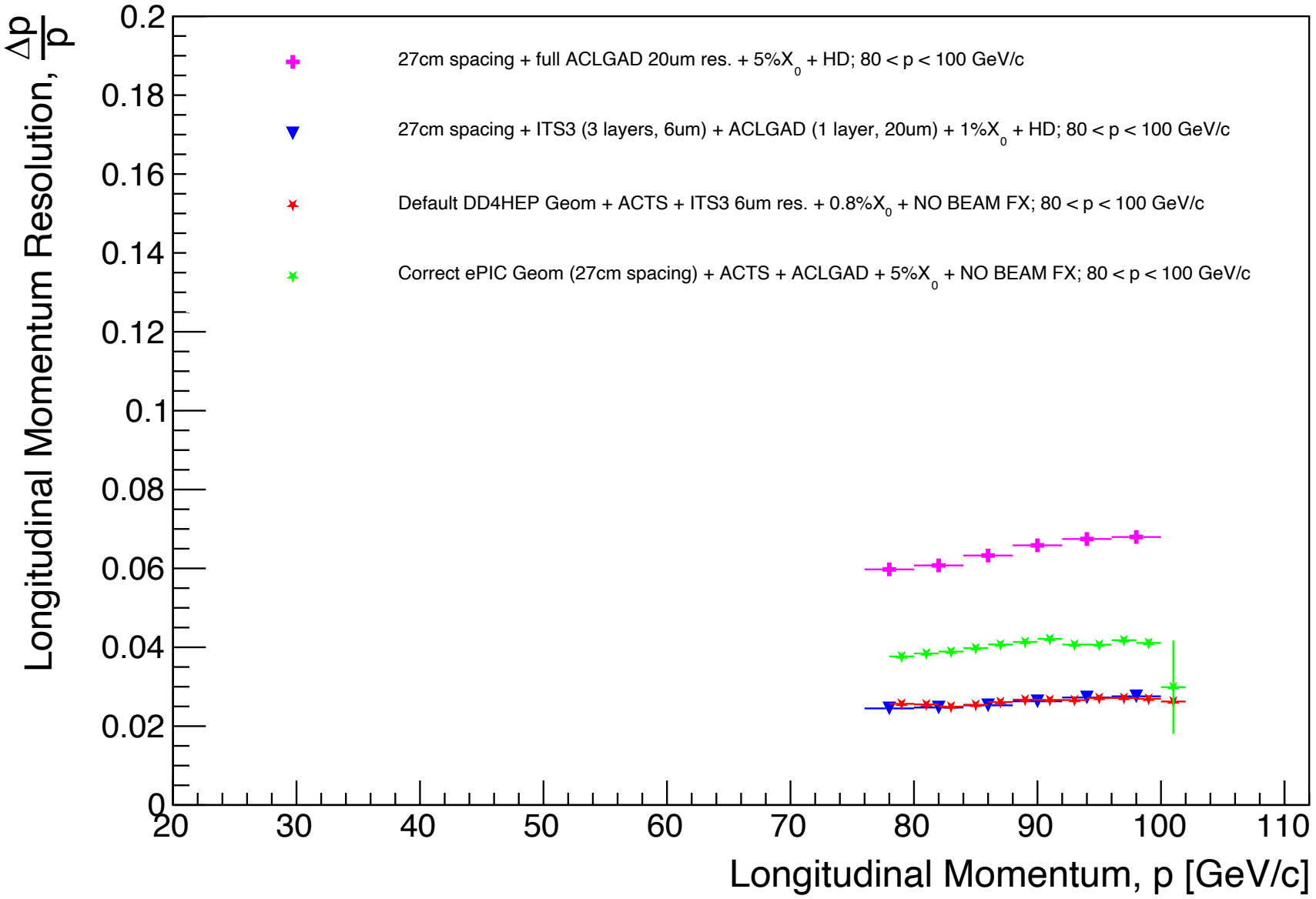

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Some Important Notes and Next Steps

- ACTS results compatible with GenFit study → YAY!
  - Special thanks to Sakib Rahman for getting this working (do we know why it magically started working?).
  - **Studies can now commence fully in DD4HEP.**
- **B0 tracking geometry is updated in DD4HEP (https://github.com/eic/epic/pull/502).**
  - Segmentation updated to AC-LGAD assumption.
  - Material budget updated to 5% per layer (for now – until we get updated concept from ASIC folks).
  - Need to use FULL ePIC geometry to include the solenoid field from ePIC! **(not done in this study!)**
- ACTS needs realistic seeding (in-progress by Nathaly).
- **Special note:**
  - Analyzers MUST remove crossing angle from both MC particle track AND reconstructed B0 track to compare the vectors! → This is different from the Roman Pots.
- **PWG members:** please run some small MC samples through DD4HEP + EICRecon and analyze the output – we really need feedback, and we got no response from the information we shared back in June.

Main analysis code: https://github.com/ajentsch/exclusive_PWG_analysis
Branch with resolution calculation: https://github.com/ajentsch/exclusive_PWG_analysis/tree/Detector-Resolution-Analysis