E/p performance 2019/2021

PF

07/05/2024

Introduction

- Check the current alignment performance on trident datasets using E/p
- Streamline hps-java monitoring plots for E/p monitoring and possibly use it as constraint
- Compare 2019 to 2021 and to 2019 MC

Data / MC and Selection

- 2019 Dataset:
  - Run 10031 - removed Ly7 top from reconstruction (it dies after this run)
  - HPS_ShimShoSurvey_M1M2tu_TZFix_iter26

- 2021 Dataset:
  - Run 14770 - nominal and removed Ly7 top reconstruction (to compare with 2019)
  - HPS_Run2021Pass1_v5
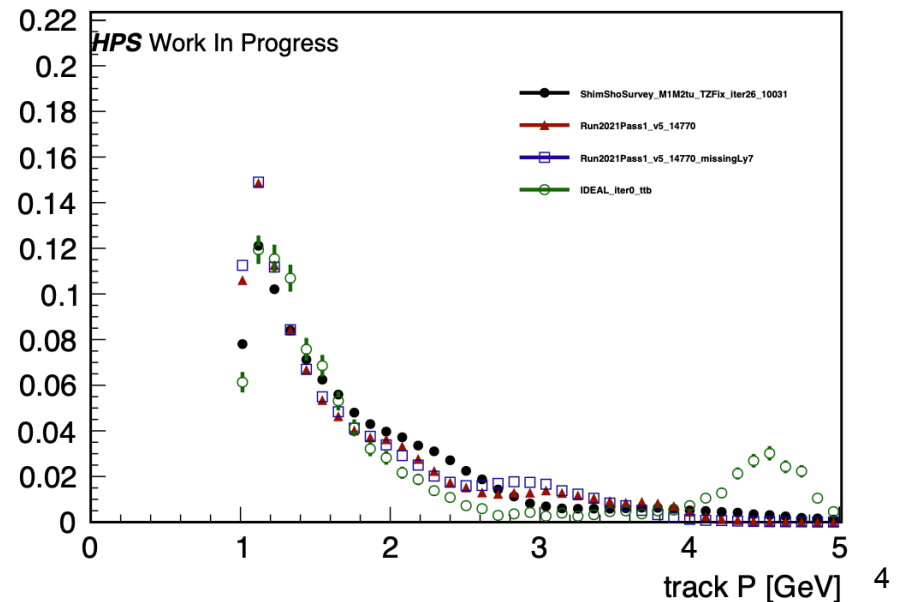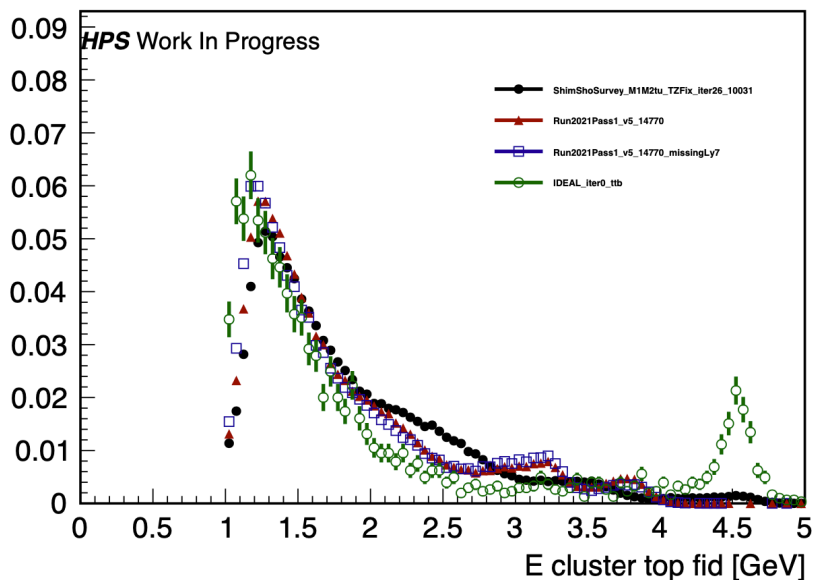- 2019 Dataset:
  - Jeopardy24 tri-trig + beam
  - HPS_IDEAL_iter0

All datasets locations are documented here:
https://hackmd.io/D6e8NfwfSm-c6wQM7S_q5Q
Should be moved to a confluence page

Data / MC and Selection

- Particles:
  - P > 1 GeV, Cluster E > 1 GeV, nHits >= 6
- I reconstructed 2021 dataset with and without Ly7 to check the effect of last layer on biases and resolution
- Today will discuss studies for the top volume only.

E/p structures in MC vs TanL

- One thing we noticed in the E/p distribution vs tanL are regular structures at symmetric tanL locations
  - Present in 2019 / 2021 datasets : unlikely to be alignment related
  - Possible ECAL row edge effects? No MC stat to study those properly

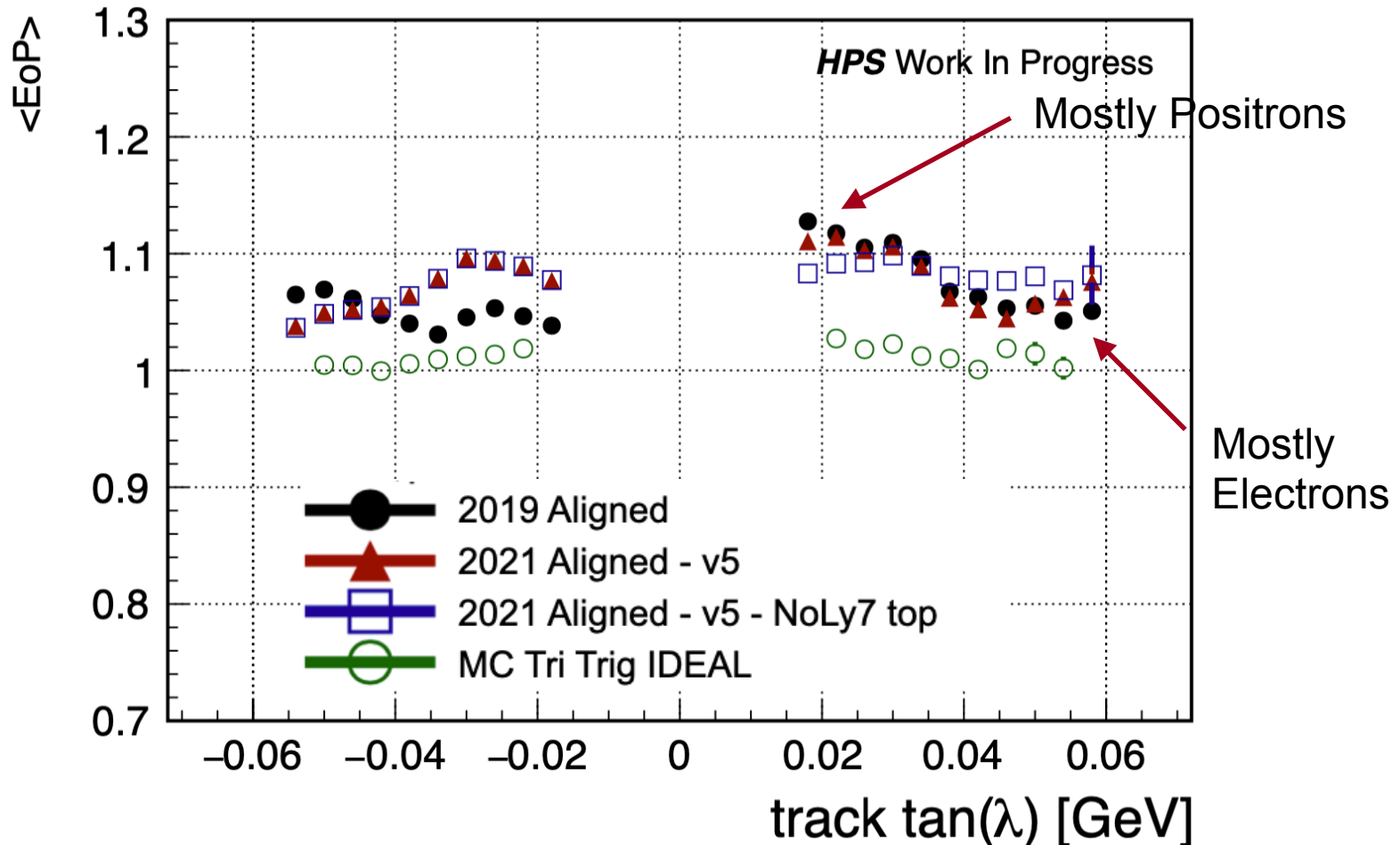- Can energy of Ecal cluster be corrected for these effects?
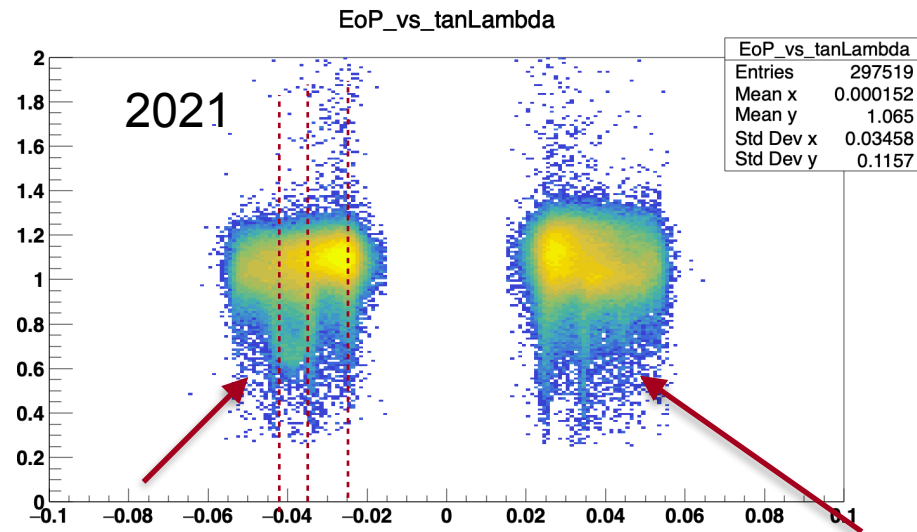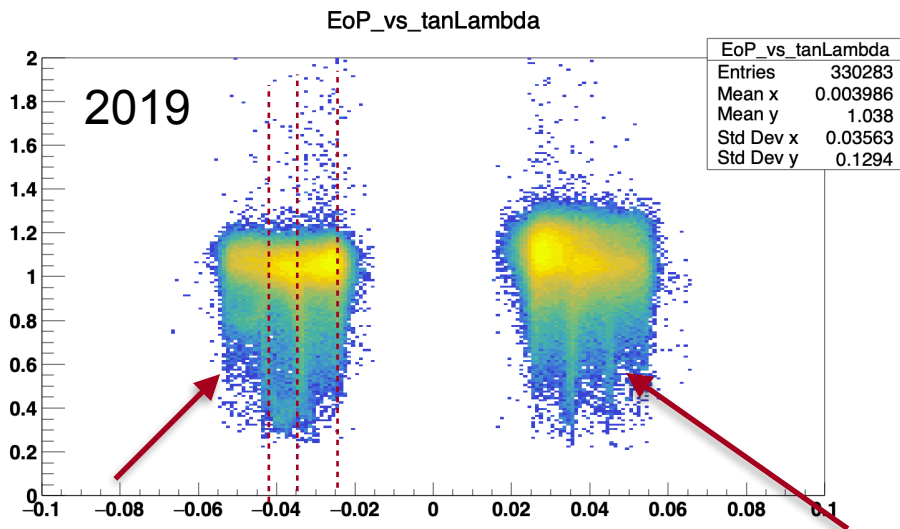
E/p vs TanL

- Under the assumption that Energy is well calibrated and measured, <E/p> is expected to be ~1 across the tanL range
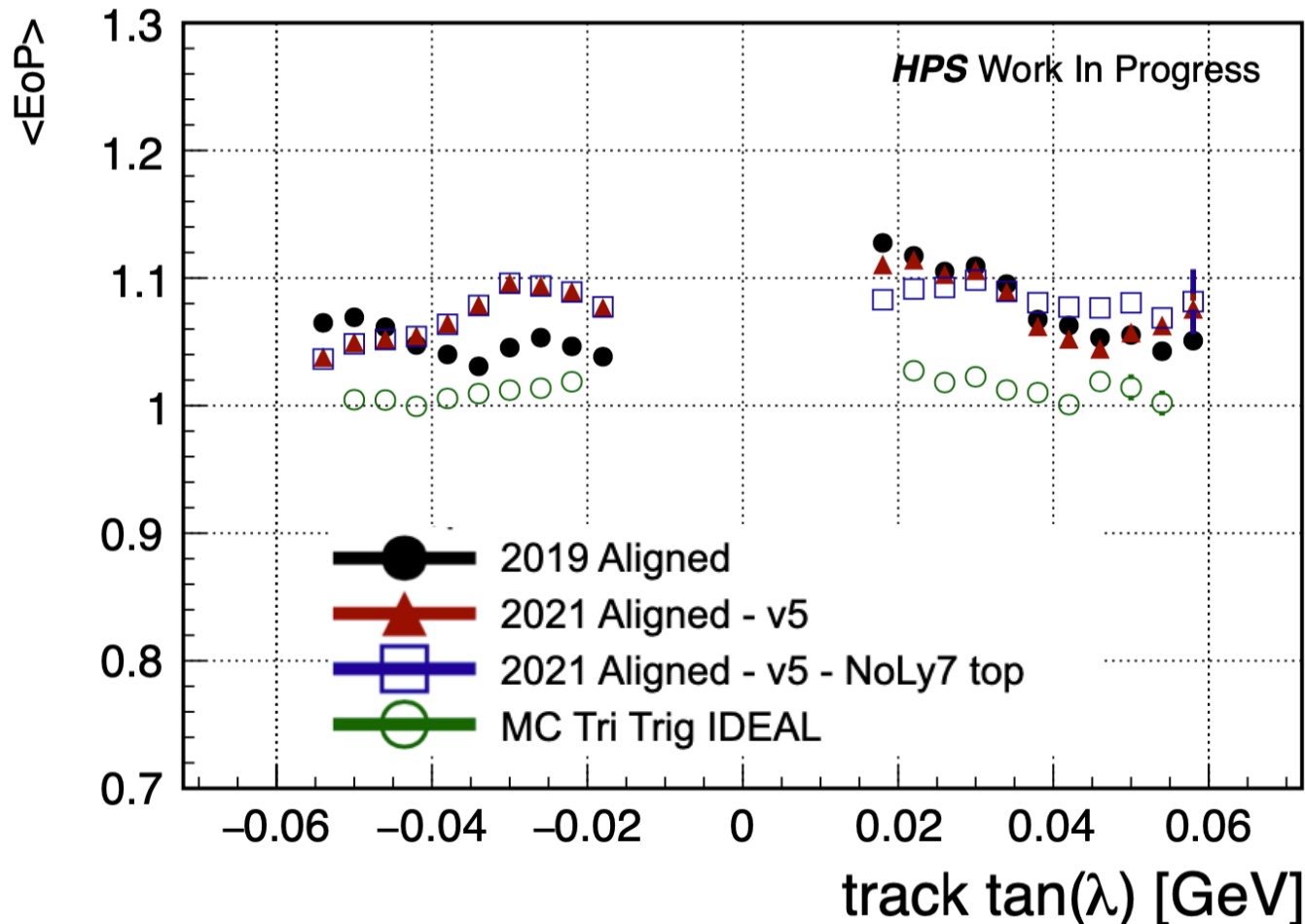
E/p vs TanL

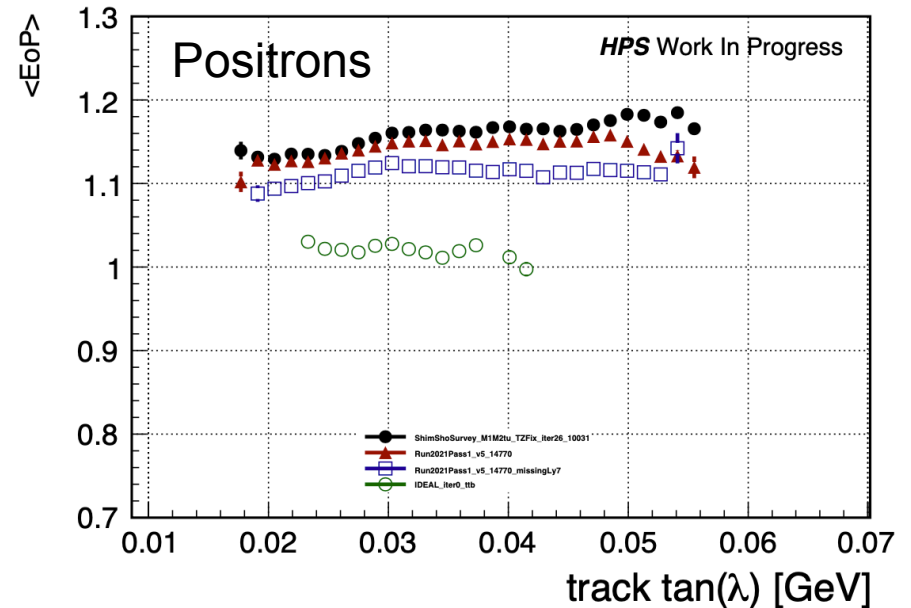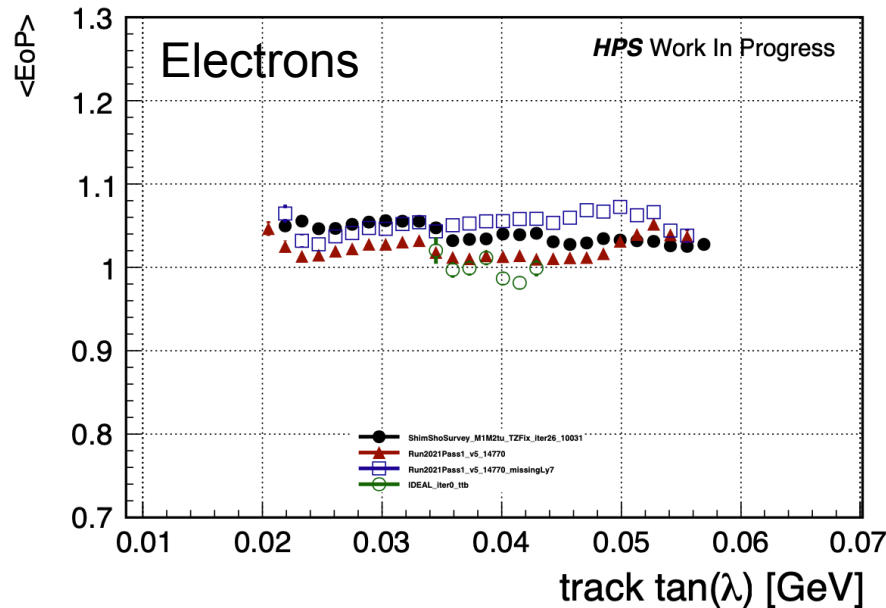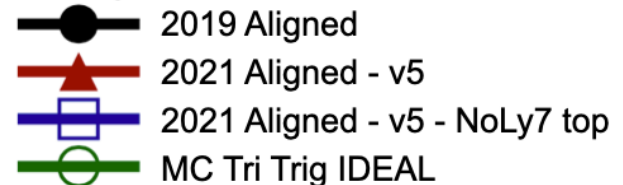- Under the assumption that Energy is well calibrated and measured, <E/p> is expected to be ~1 across the tanL range

E/p vs TanL

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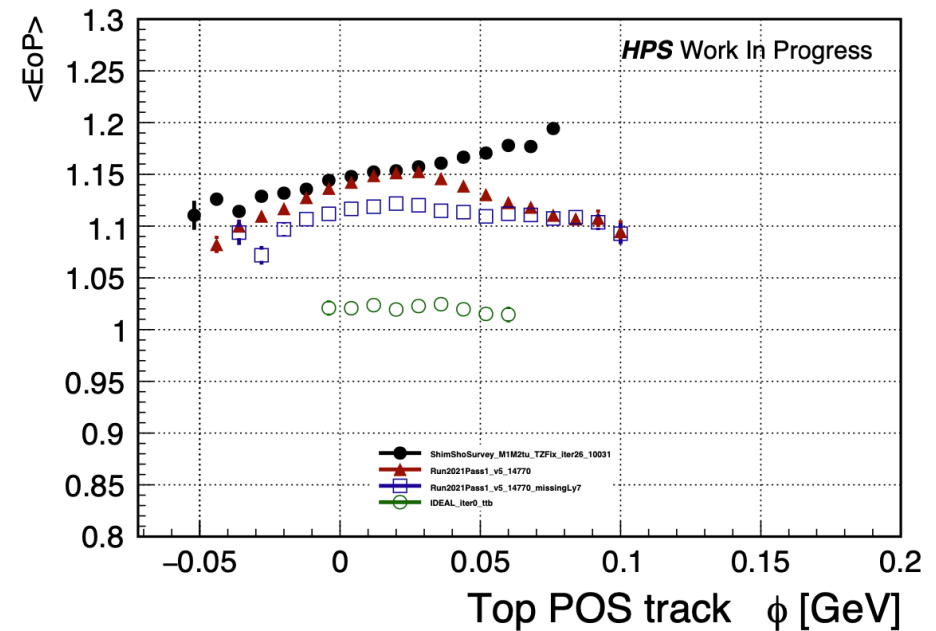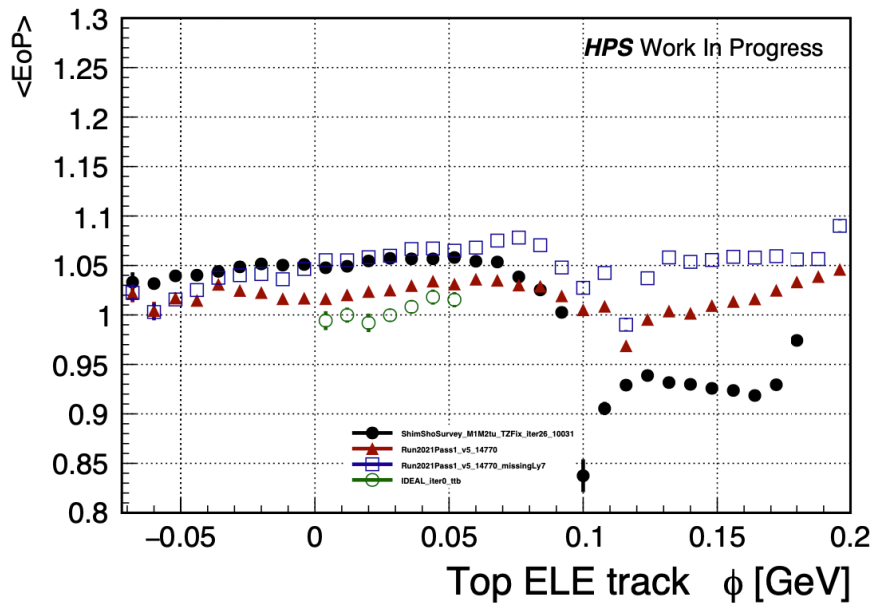

- Momentum scale bit larger in 2019
  - Seems very similar to 2021 with missing Ly7
- Scale >10% large across the two datasets
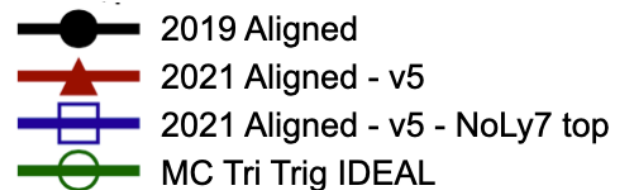 - 2% larger in MC positrons.

E/p vs Phi Top

- Under the assumption that Energy is well calibrated and measured, <E/p> is expected to be ~1 across the tanL range
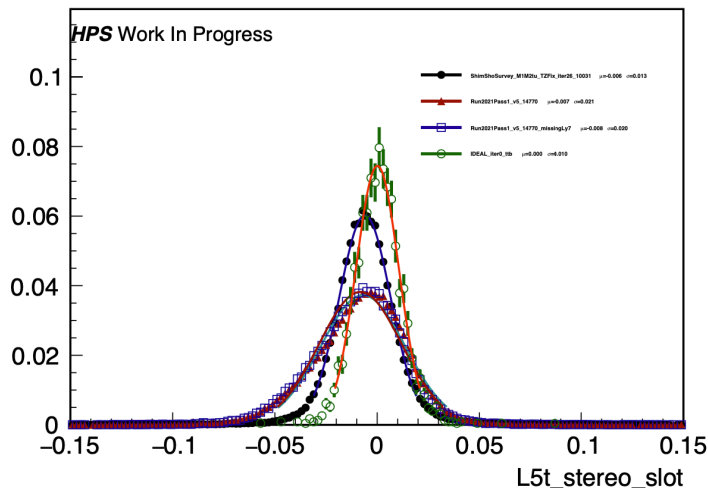

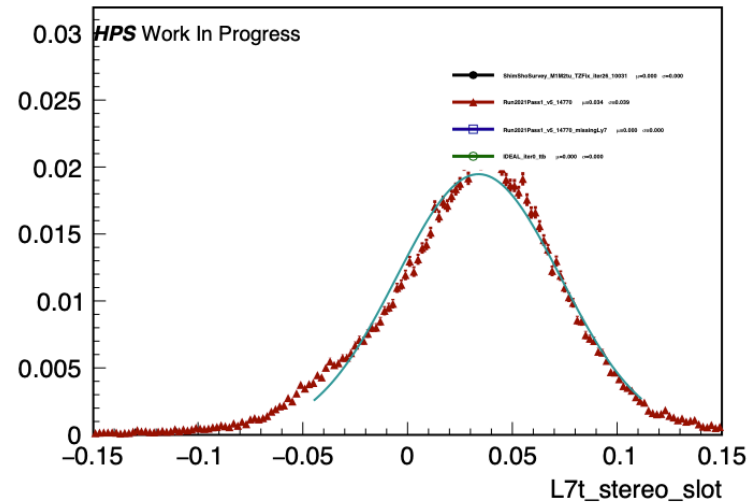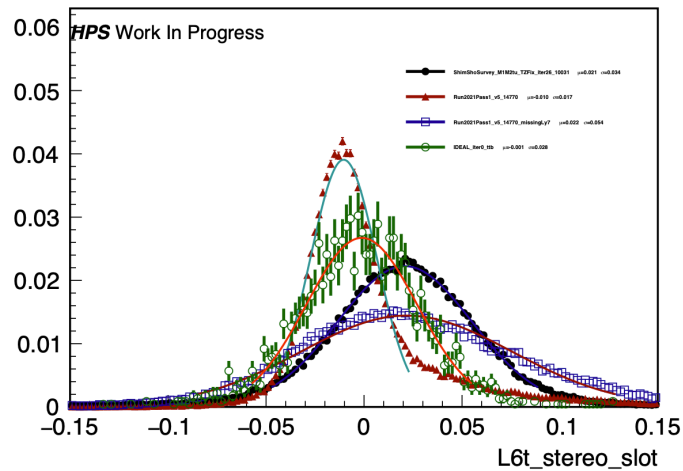- 2019 - Slot side problem (ly5-ly6 Stereo Slot sensors)
- 2021 - No Ly7 seems better behaved wrt full detector
  - Flatter distributions

2019 Aligned
2021 Aligned - v5
2021 Aligned - v5 - NoLy7 top
MC Tri Trig IDEAL

Ly5-Ly6-Ly7 SLOT Stereo Uresiduals

- Took a dedicated look to stereo slot unbiased residuals
  - Axial follow specular distributions
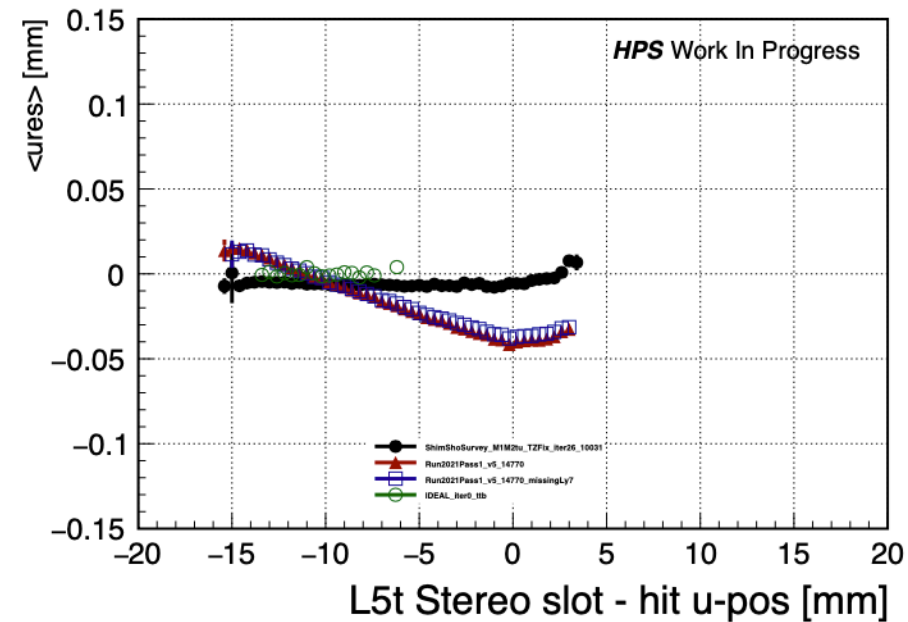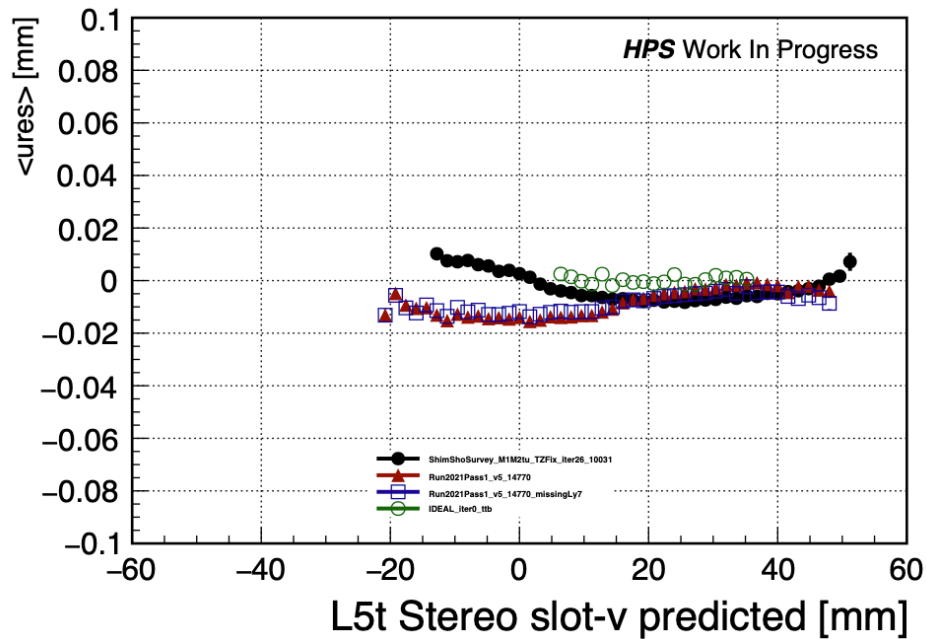

2019 Aligned
2021 Aligned - v5
2021 Aligned - v5 - NoLy7 top
MC Tri Trig IDEAL

- 2019 - clear bias in L6t slot
  - Likely responsible of ele P bias in high Phi region
- 2021 - ly7 large bias
  - Might be responsible of some of the biases seen when this layer is added to reconstruction

Ly5 SLOT Stereo Uresiduals

- Took a dedicated look to stereo slot unbiased residuals
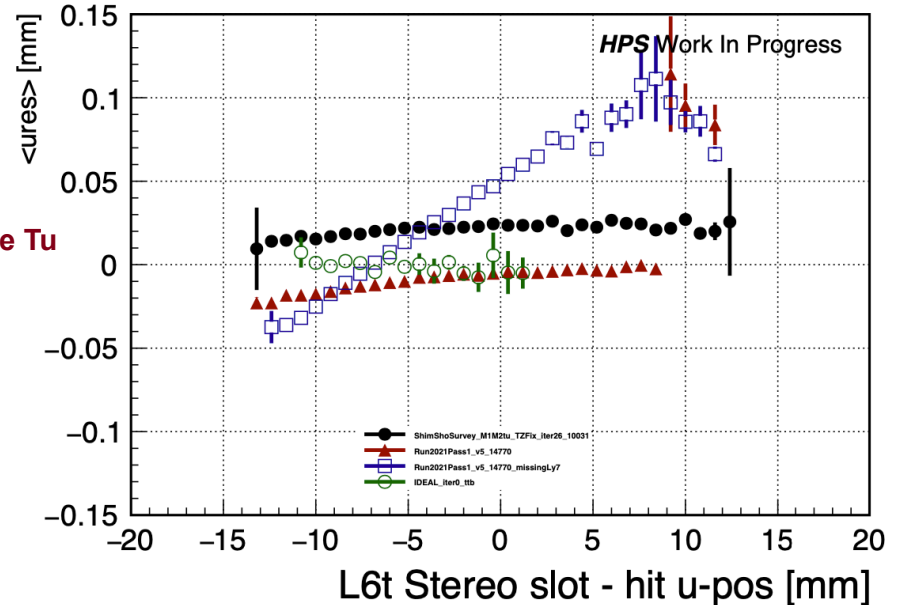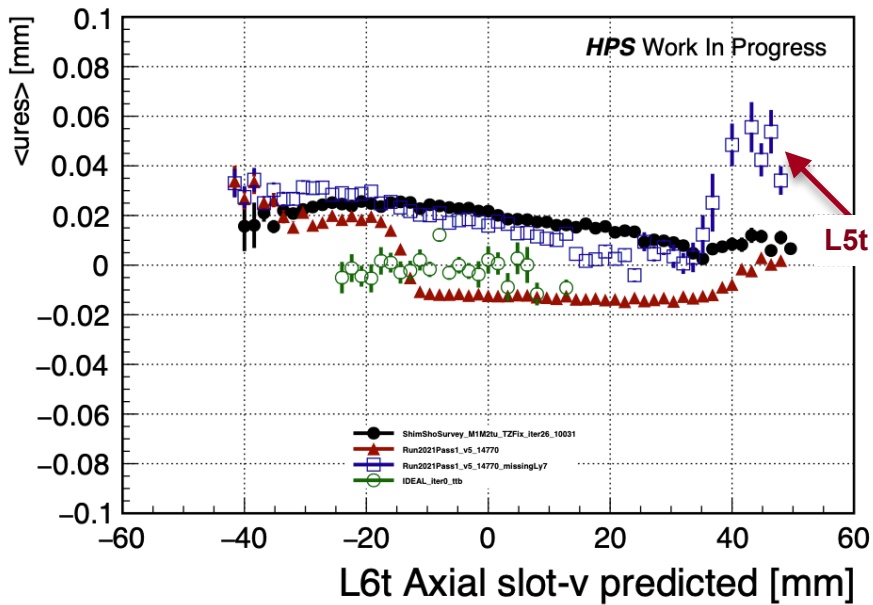 - Axial follow specular distributions

Legend:
- ● 2019 Aligned
- ▲ 2021 Aligned - v5
- ☐ 2021 Aligned - v5 - NoLy7 top
- ○ MC Tri Trig IDEAL

- u-dependent trend taken out in 2019 with Tw corrections

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Ly6 SLOT Stereo Uresiduals

- Took a dedicated look to stereo slot unbiased residuals
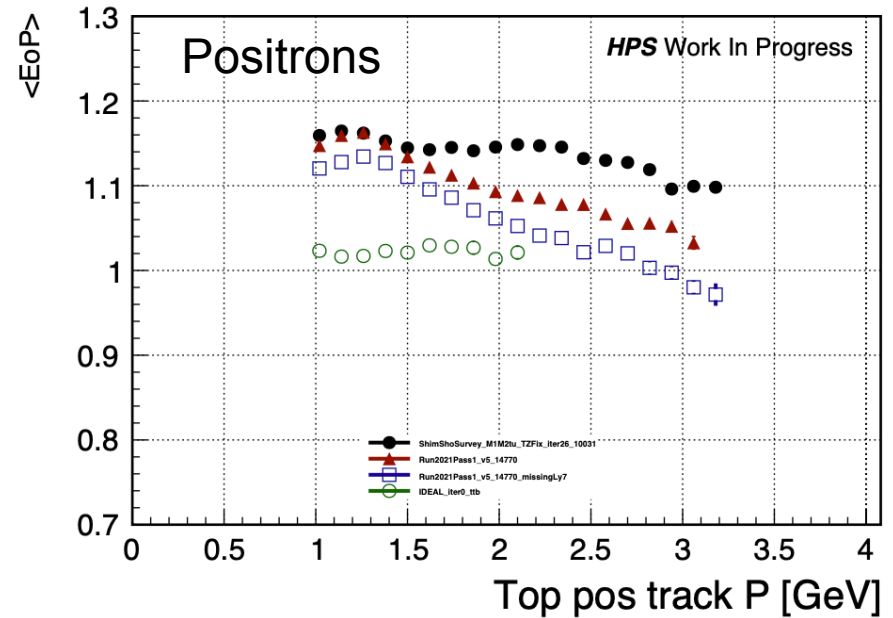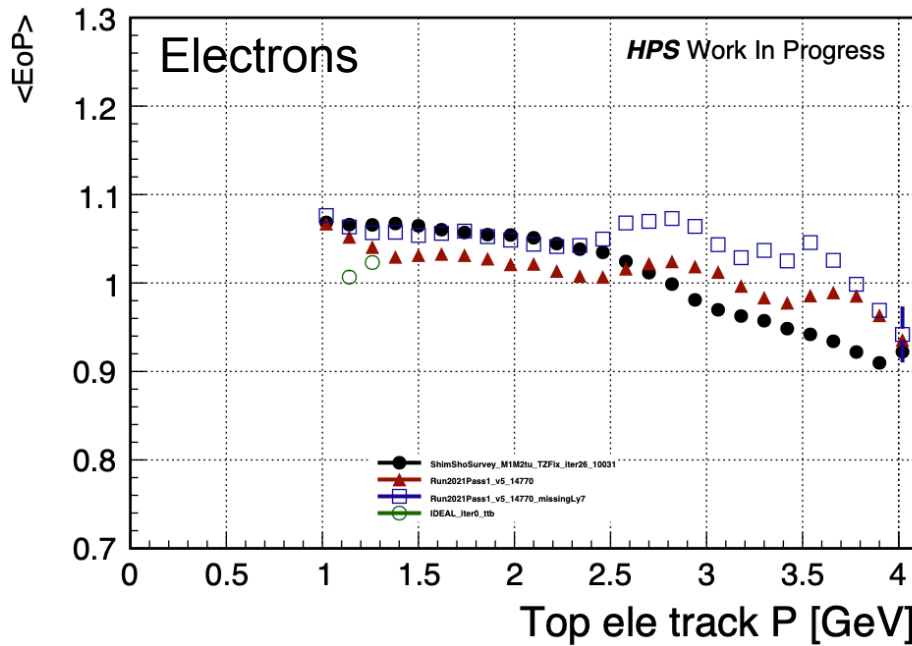 - Axial follow specular distributions

- 2021 exhibit structures in the residuals depending on presence / absence of 7th layer
- Large u-dependent trend when removing last layer.
- 2019 exhibit residual misalignments

E/p vs track p

- E/p vs P is expected to be flat vs track momentum

Legend:
- ● 2019 Aligned
- ▲ 2021 Aligned - v5
- ☐ 2021 Aligned - v5 - NoLy7 top
- ○ MC Tri Trig IDEAL

- 2021 has flatter p distribution for electrons than 2021
  - Correlated with track phi / slot side alignment for electrons

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Summary

- E/p could be a good metric to use for Alignment constraint using e+e- tracks
- FEEs do not cover the full spectrum and if there are trend as function of momentum they are hard to pin
- 2019 TOP Slot alignment need to be improved
  - Plan to take it out keeping front fixed ad axial fixed and correcting for stereo sensors
- Investigate E/p as bias corrections to improve tracker momentum scale.

BACKUP