

Qualification Task Updates

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Weekly Analysis Meeting
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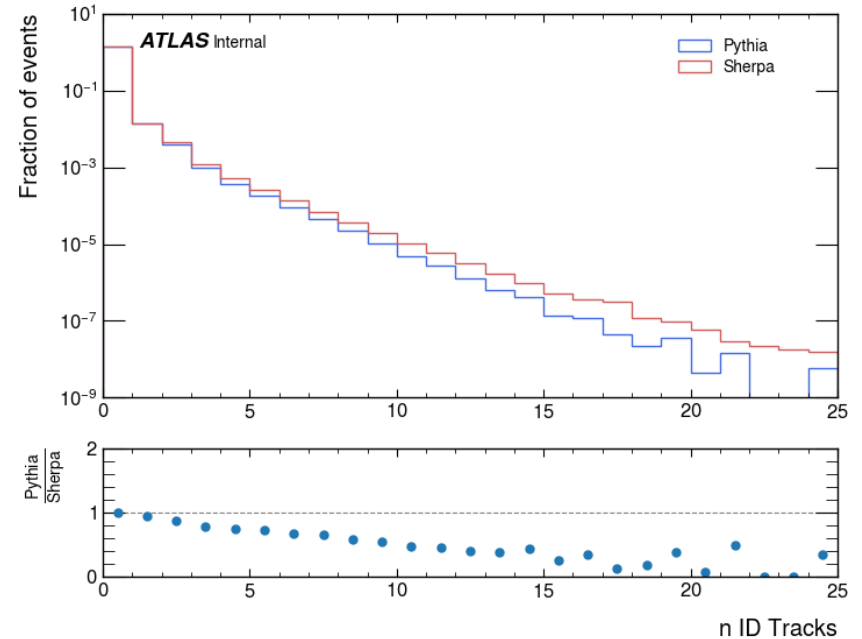


Introduction

- Investigating isolation efficiency dependence on shower generators by comparing datasets generated with pythia and sherpa ($Z \rightarrow \mu\mu$)
- Isolation variables in ATLAS use charged tracks (p_T^{cone}) and neutral particles (E_T^{neflow}):
$$p_T^{\text{cone}} + 0.4 * E_T^{\text{neflow}} < \text{threshold} * p_T$$
- Event selection details:
 - Only look at muons originating from Z bosons
 - Cut on $80 \text{ GeV} < m_{\mu\mu} < 100 \text{ GeV}$ for clean muon selection
 - Restrict events to include only events with exactly 2 muons with opposite charge

Number of Inner Detector Tracks Around Muons

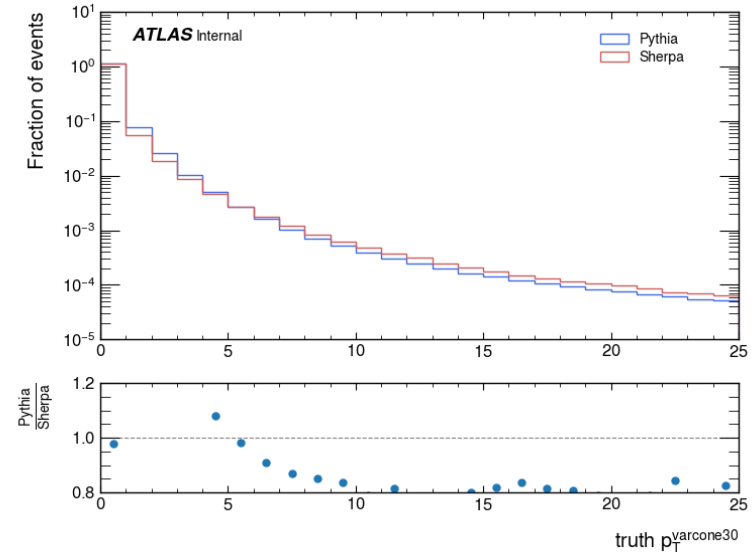
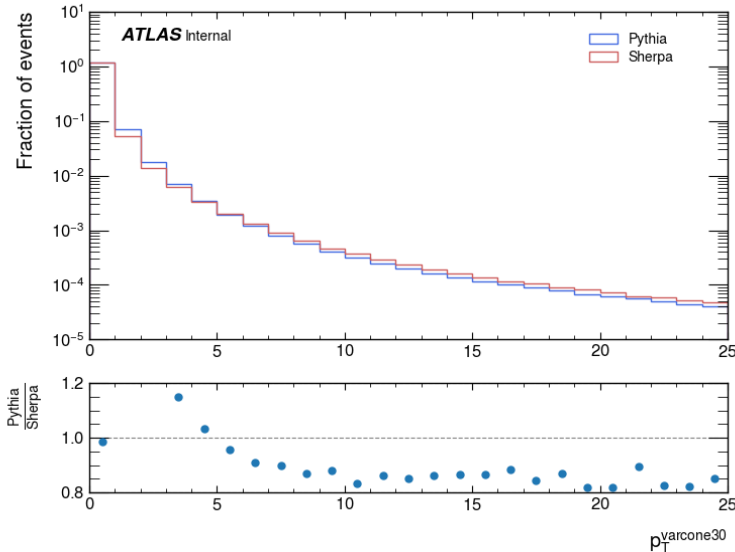
- Check for differences in soft gluon contributions between generators
- Count number of tracks around muon track in inner detector
- Used $\Delta R = 0.3$ to define cone around muon track to check for tracks
- Clearly more activity in sherpa samples



Truth Level Analysis

- Goal: Find truth types of tracks and reproduce isolation variable with truth information
- Match inner detector track to its truth particle using link (ignore non valid links)
- Retrieve pdg ids from truth particle to determine type
- Isolation variable in question: $p_T^{\text{varcone30}}$
 - Uses variable radius $\min(0.3, 10\text{GeV}/p_T)$, depends on muon p_T
 - Check if truth particle is in radius of muon and add up p_T of those that are
- Compare results with the plots obtained in earlier studies

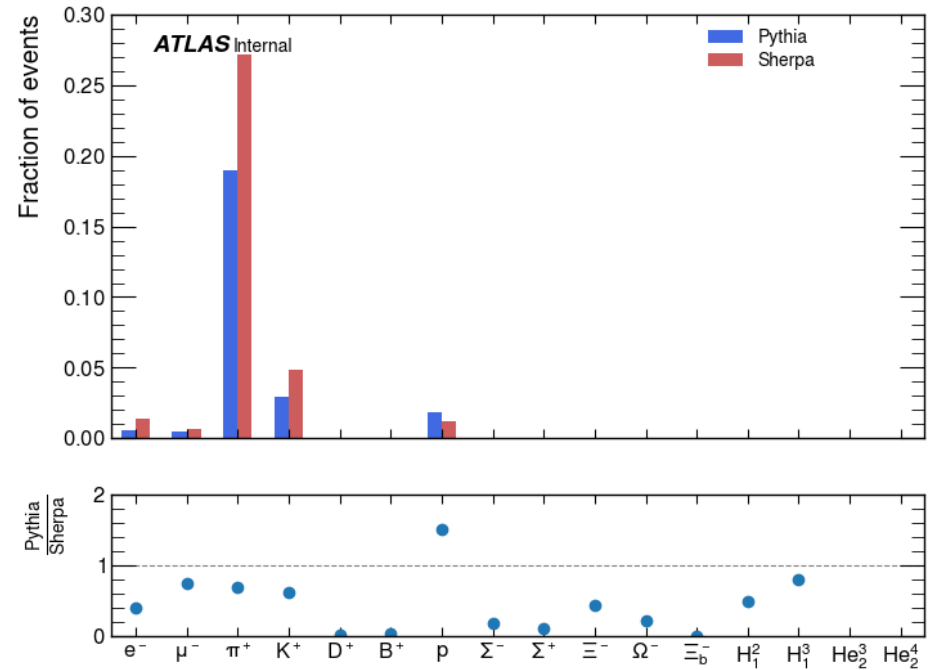
Reco vs Truth ptvarcone30



- Plots and generator differences look very similar in both cases
 - ▶ Issue seems to be present even on truth level

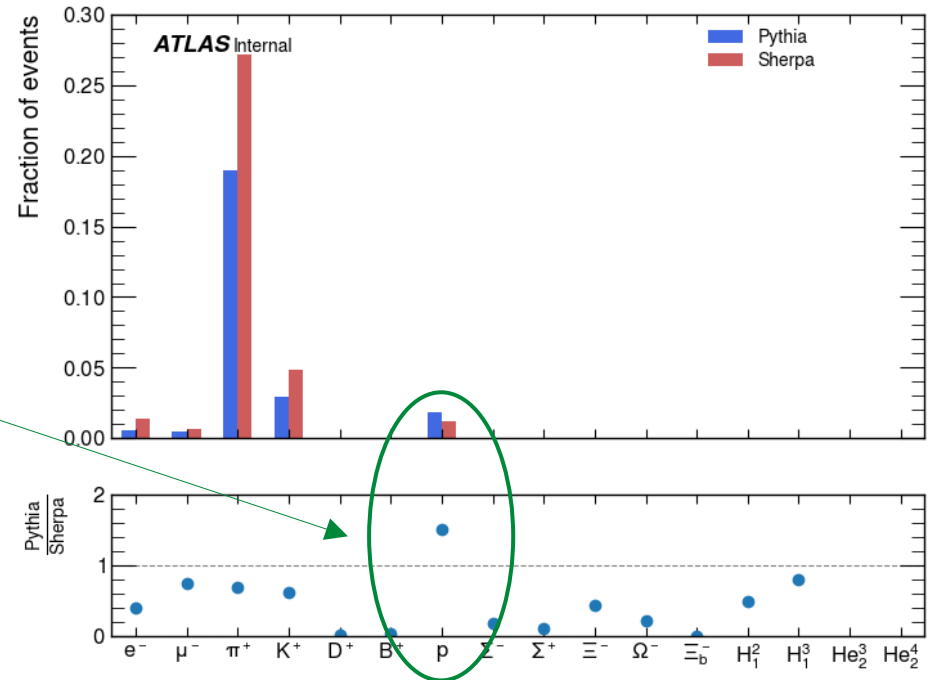
Types of Particles Close to Muons

- Collect pdg ids from truth track particles inside of the isolation cone
- Sherpa has more id tracks so more entries
- Most rare particles seem to be even rarer in pythia



Types of Particles Close to Muons

- Collect pdg ids from truth track particles inside of the isolation cone
- Sherpa has more id tracks so more entries
- Most rare particles seem to be even rarer in pythia
- Protons are significantly more common in pythia despite the lower number of tracks



Conclusions

- Problem exists on truth level
- Expert input from outside of the group is needed

Next Steps:

- Contact PMG and ask for input
 - ▶ Will have to prepare a summary presentation for this