Optimisation of isolation WPs in Run3

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Outline

Qualification task

Title: Optimisation of isolation WPs in Run3

Description

- Distinguish muons from prompt sources from non-prompt and fake ones.
- Improve robustness against higher pile-up while maintaining good performance for prompt muon selection.
- explore possible dependencies on event topology such as $Z \to \mu\mu$ and $t\bar{t}$ events.

OTP task ID: 532774 sub-task ID: 556633.
Proposed beginning of qualification: 01/02/2026
https://its.cern.ch/jira/browse/ATLASMCP-295

Introduction

In this presentation, I worked on subsection 8.3, "Studies on jet modelling uncertainty: Powheg+Pythia vs. Powheg+Herwig vs. Sherpa," from the documentation: here

- $Z \to \mu^+\mu^-$

Variables

- Dimuon invariant mass $m_{\mu\mu}$
- Muon transverse momentum p_T
- Muon pseudorapidity η
- Angular distance between a muon and its closest jet $\Delta R(\text{jet}, \mu)$

Technical details

- Software : AnalysisBase,25.2.89
- MC23e, tag :r16083
- ROOT Version: 6.36.04
- DAOD_MUON1 format.
- DSID: 601190, 700789-700790-700791,513108
- Package:fastMuonChecker
- Generator:Pythia ,Sherpa

Distributions for the dimuon mass

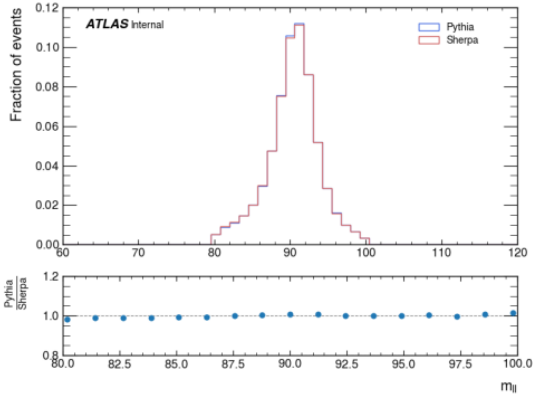

Figure: Original plot

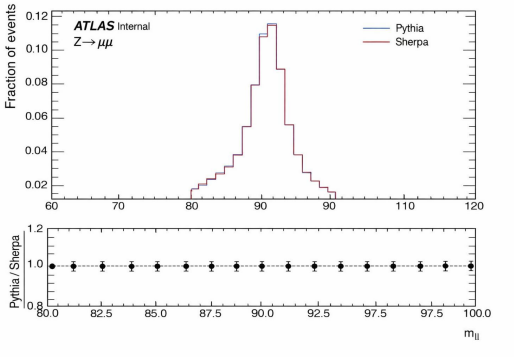

Figure: Reproduced plot

Distributions for muon transverse momentum

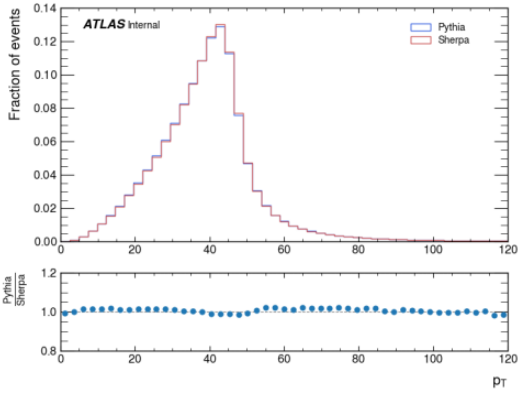

Figure: Original plot

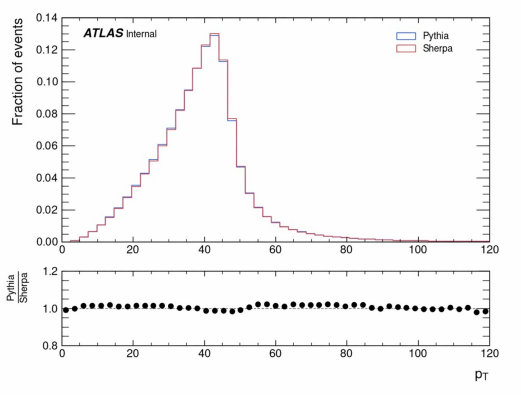

Figure: Reproduced plot

Distributions for muon pseudorapidity

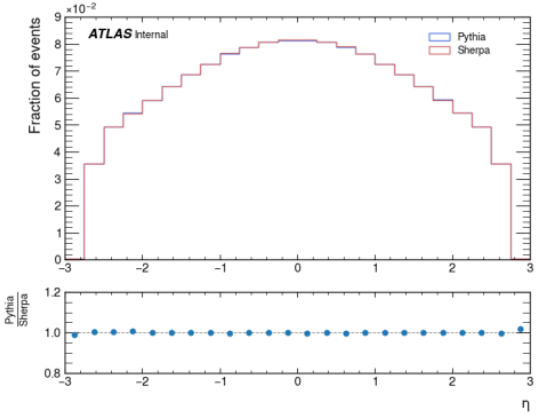

Figure: Original plot

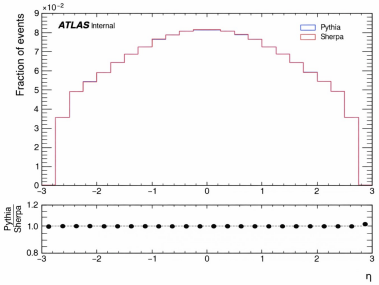

Figure: Reproduced plot

Distributions for angular distance between a muon and its closest jet

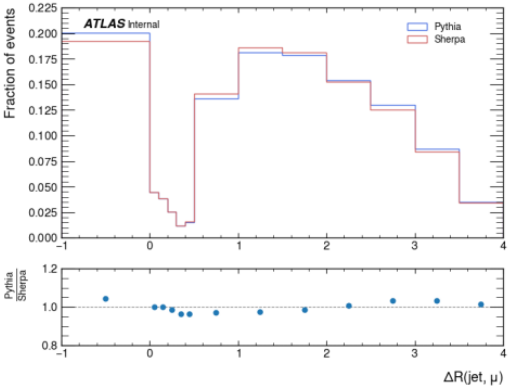

Figure: Original plot

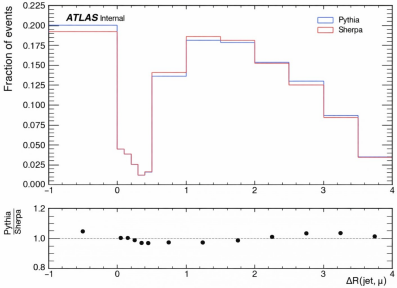

Figure: Reproduced plot

Back Up

Instructions to reproduce the results

setupATLAS
voms-proxy-init -voms atlas
lsetup pyAMI panda rucio
asetup AnalysisBase,25.2.89

Grid Submission Command (prun):

```
pathena --trf "python fastMuonCheckertruth.py -i %IN -r Run3 -m %MAXEVENTS" --inDS mc23_13p6TeV:mc23_13p6TeV
  .700791.Sh_2214_Zmumu_maxHTpTV2_CVetoBVeto.deriv.DAOD_MUON1.e8514_s4159_r15530_p7021 --outDS user.melallam.
  zmumu_Sherpa_700791_run3_r15530_t0  --nEventsPerJob 10000 --extOutFile output_tree.root.

```