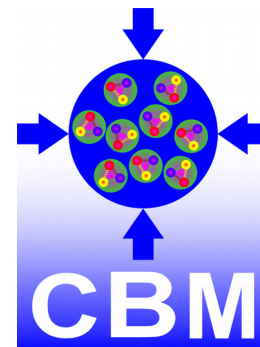


J/ Ψ reconstruction at 29 GeV p+Au collisions using muon setup

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Motivation

- J/Ψ or Charmonium suppression due to Debye color screening is a classical signature of QGP
- Identification of J/Ψ suppression due to hot QGP medium requires a precise estimation of J/Ψ dissociation in cold nuclear matter in p+A collisions
- So far, reconstruction of J/Ψ in 30 GeV p+Au collisions with: Pluto event generator to model phase space distribution of decay muons
- **Issues with Pluto:**
 - Thermal fireball model
 - Generates particles with thermal m_T and Gaussian rapidity distribution with T_{kin} and σ_y as input parameters
 - J/Ψ in low energy p+A collisions are unlikely to be thermalized
 - May be produced due to non-thermal processes
 - PYTHIA, nonthermal event generator for production of J/Ψ
 - Different (y, p_T) distributions might effect the pair reconstruction efficiency throuh CBM setup.

J/ Ψ simulation using PYTHIA event generator

- In PYTHIA J/ Ψ mesons are produced via fragmentation of stretched strings following LUND's string fragmentation model
- J/ Ψ mesons generated in 30 GeV p+p collisions in PYTHIA
- In low energy p+A collisions, J/ Ψ can be produced only in first inelastic p-N collisions: minimal effect of asymmetric collision system
- J/ Ψ mesons are decayed to dimuon channel using TGenPhaseSpace class
- Decayed J/ Ψ muons are transported through the CBM set up

CBM muon setup

CBMROOT framework

Geometry – much_v22a (with 1m thick iron absorber)

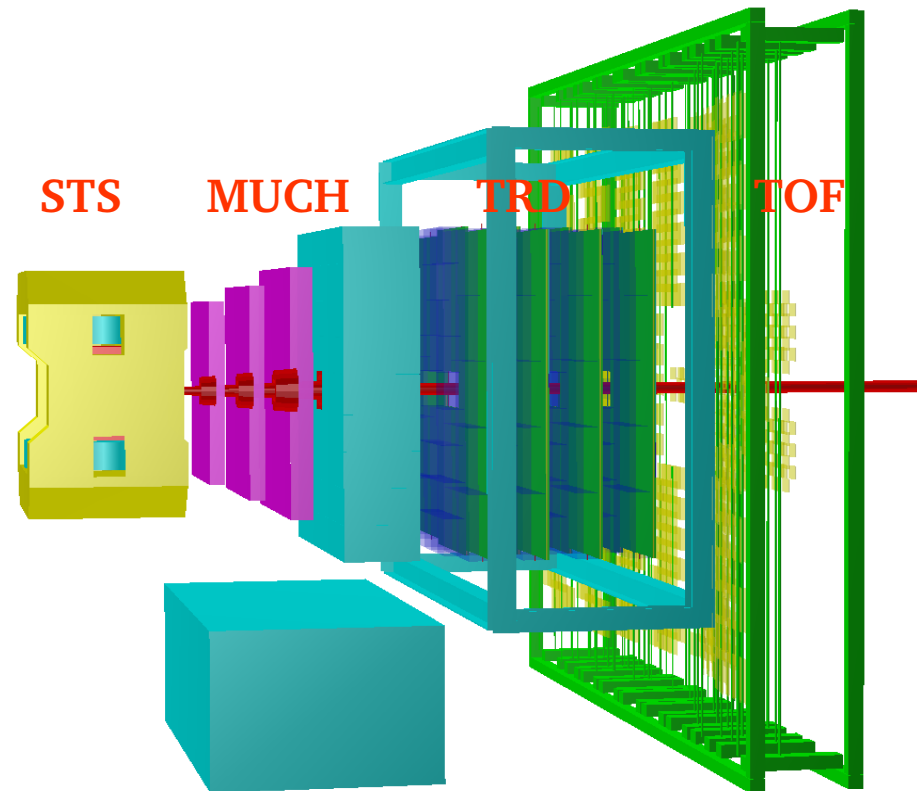
Signal input : $J/\Psi \rightarrow \mu^+\mu^-$
from PYTHIA 8.3/PLUTO

Background : UrQMD @p+Au

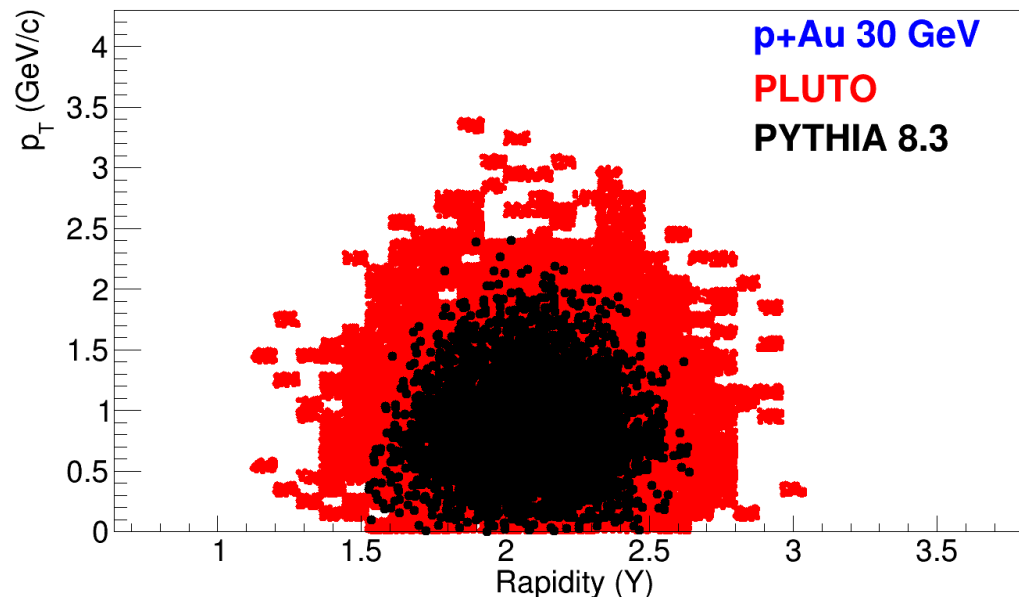
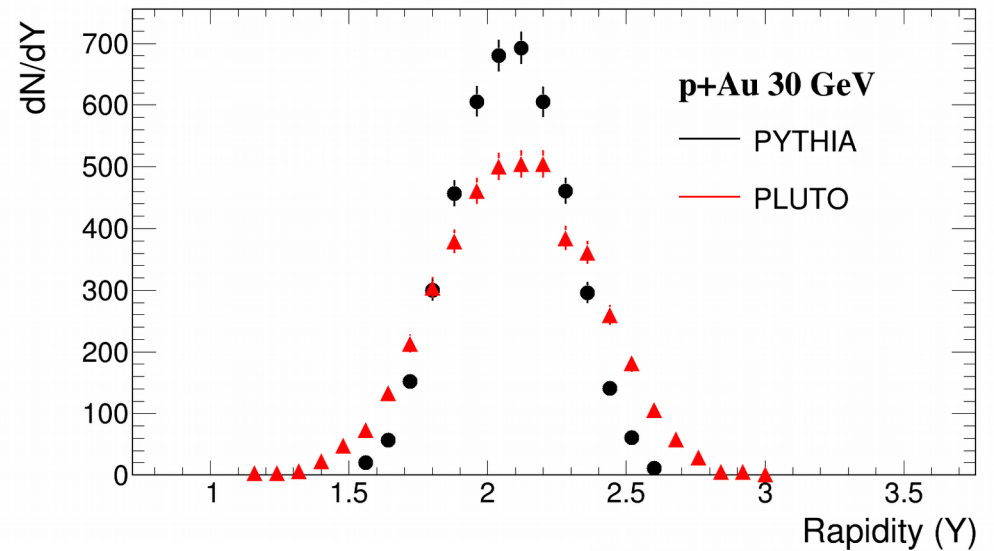
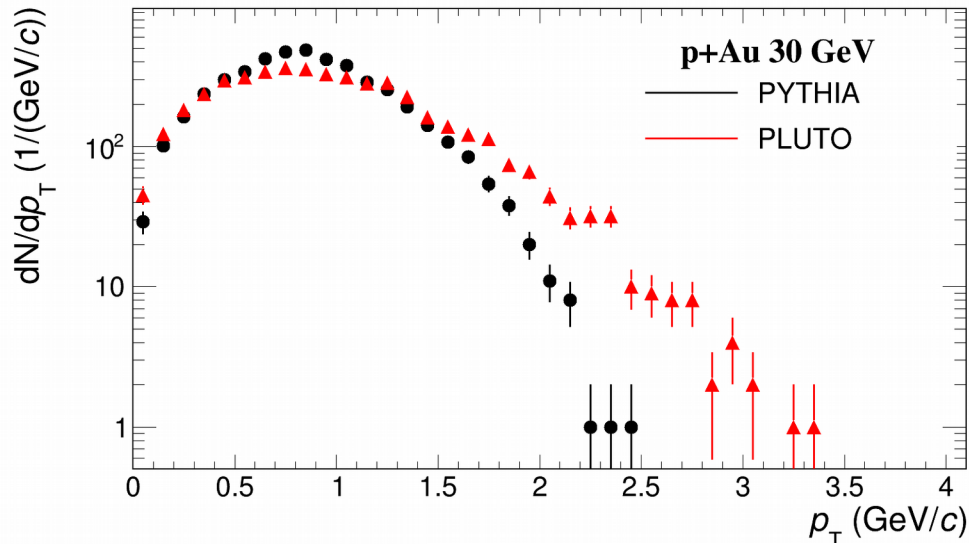
System p+Au @ 30 GeV

Events – 1 million each

A separate PYTHIA generator class has been written to make PYTHIA generated data compatible with CBM detector transportation



Input 4π distribution of J/Ψ from PLUTO & PYTHIA

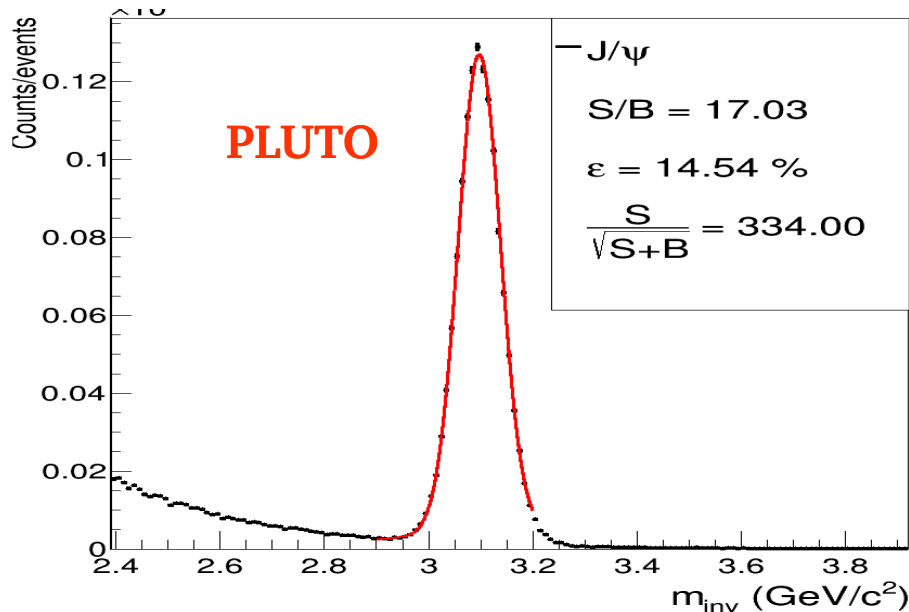
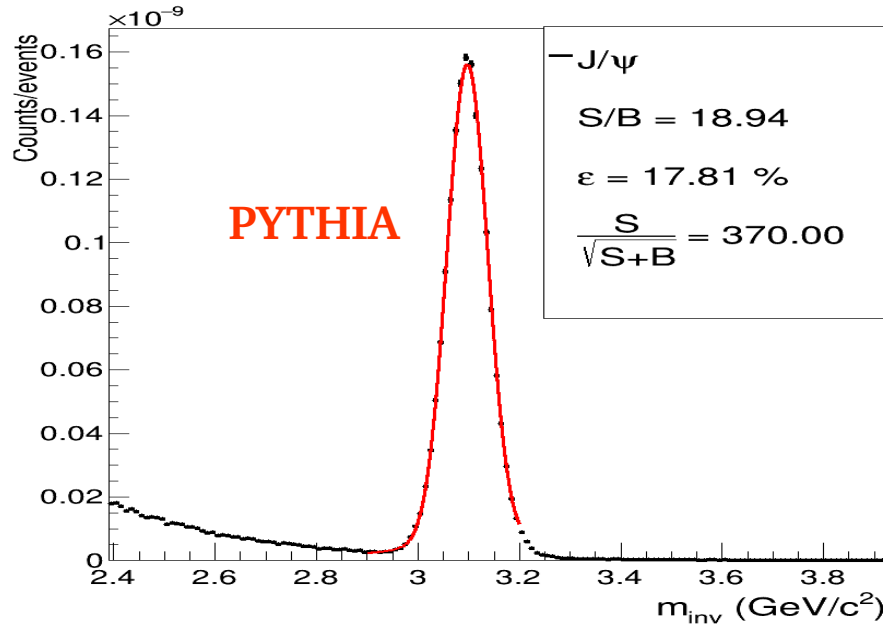


Phase space coverage
of PLUTO is wider
than PYTHIA

Reconstructed J/ψ from PYTHIA & PLUTO

J/ψ multiplicity – 8.2×10^{-9}

Ref : S. Chatterjee, P. P. Bhaduri,
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Cuts:

N of STS hits ≥ 5

N of MUCH hits ≥ 6

N of TOF hits ≥ 1

$\chi^2_{\text{vertex}} \leq 2.5$

$\chi^2_{\text{STS}} \leq 2.5$

$\chi^2_{\text{MUCH}} \leq 4.0$

Cuts:

N of STS hits ≥ 5

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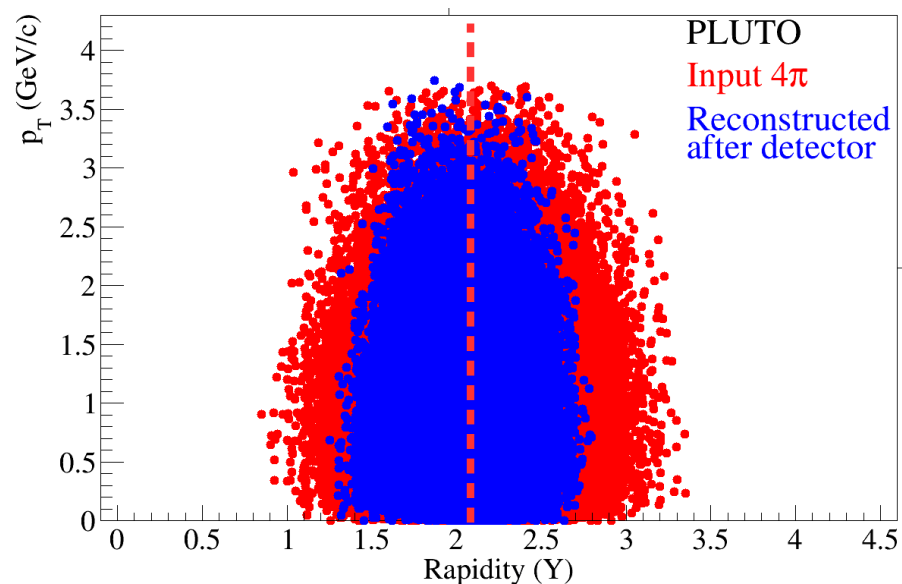
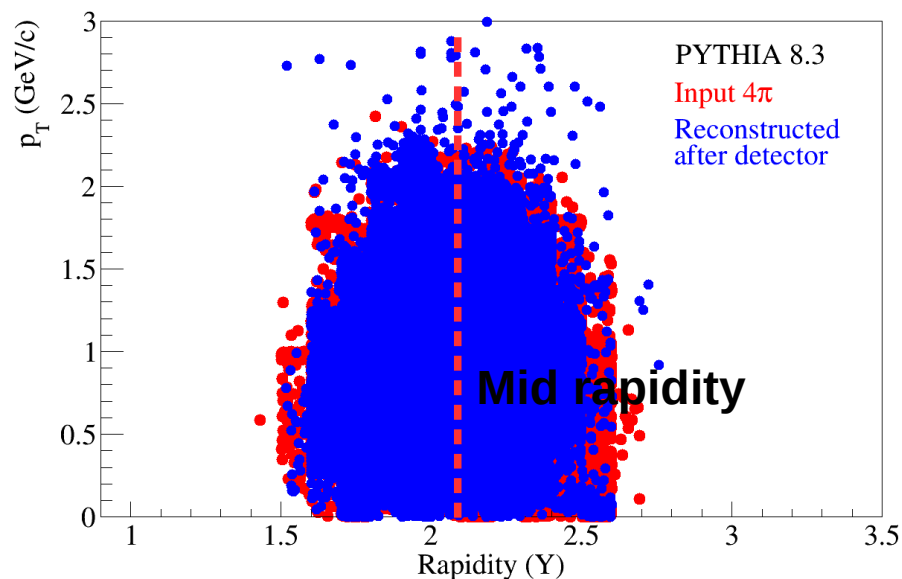
N of TOF hits ≥ 1

$\chi^2_{\text{vertex}} \leq 2.5$

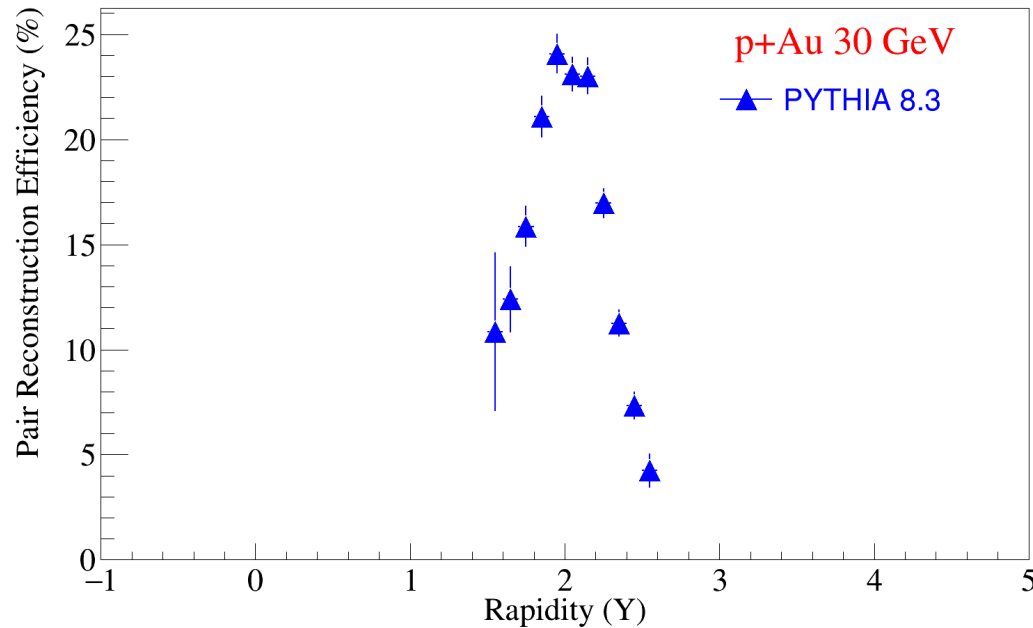
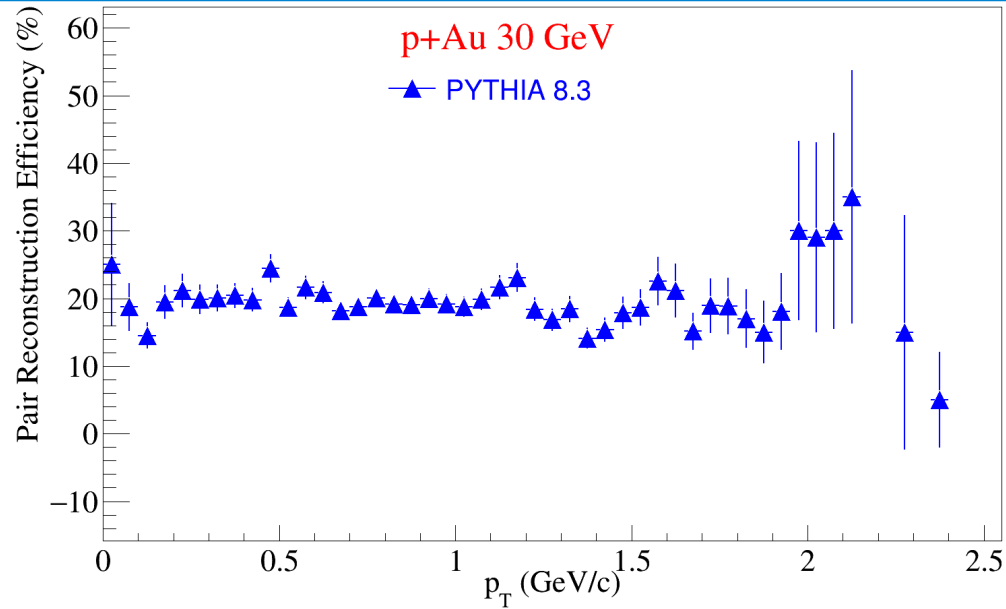
$\chi^2_{\text{STS}} \leq 2.5$

$\chi^2_{\text{MUCH}} \leq 4.0$

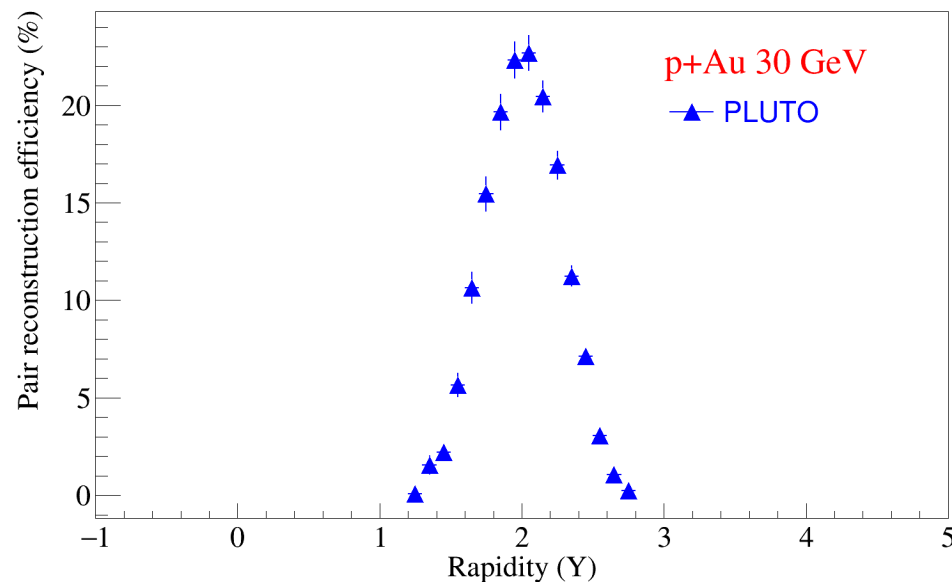
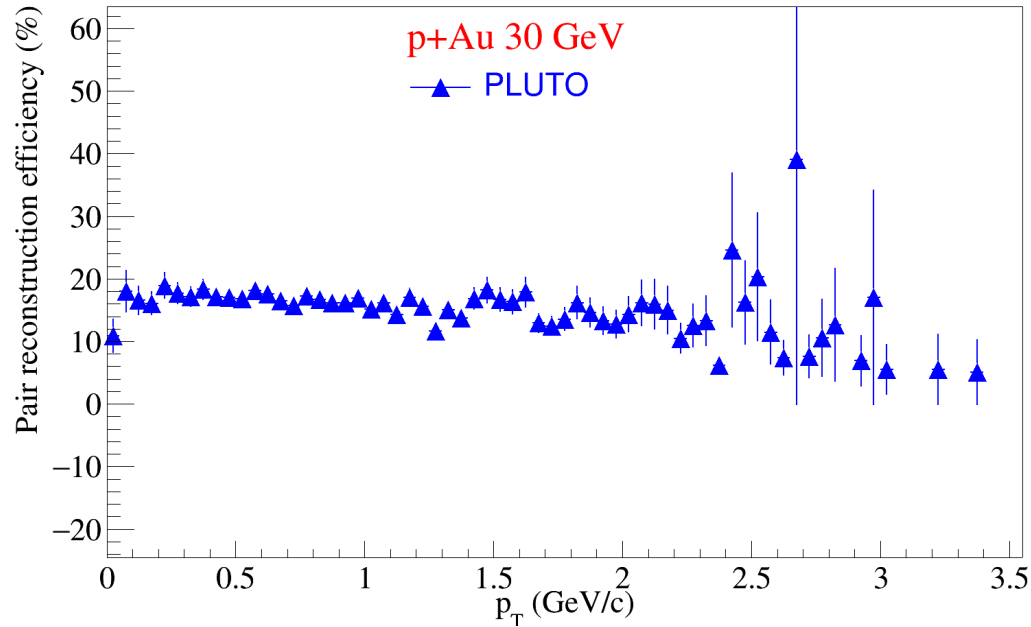
Reconstructed Y - p_T acceptance of J/Ψ from PYTHIA & PLUTO



P_T & rapidity dependence of efficiency of J/Ψ from PYTHIA



p_T & rapidity dependence of efficiency of J/Ψ from PLUTO



Summary

- J/Ψ mesons generated in 30 GeV p+Au collisions from PYTHIA & PLUTO and decayed into dimuon channels
- P_T , rapidity and (y, p_T) acceptance of J/Ψ mesons are compared from input 4π distributions from PYTHIA & PLUTO. Phase space distribution of PYTHIA is narrower than PLUTO
- Reconstructed J/Ψ efficiency & S/B from PYTHIA is higher than PLUTO
- Compared p_T & rapidity dependence of efficiency of J/Ψ from PYTHIA & PLUTO
- J/ψ detection is feasible independent of the input phase space distribution of the decay muons.

Acknowledgement

Florian Ulig - for generating background UrQMD files for p+Au collisions

Thank you