

Di-muon simulations: status & plans

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Ongoing studies

Studying (physics) performance of new much geometry: v23a

Testing the effect of realistic digitization parameters of dimuon reconstruction

Dimuon reconstruction with Machine Learning (ML) algorithms

Jpsi simulation with non-thermal input distribution

Target:

Contributions in cbm progress report 2023

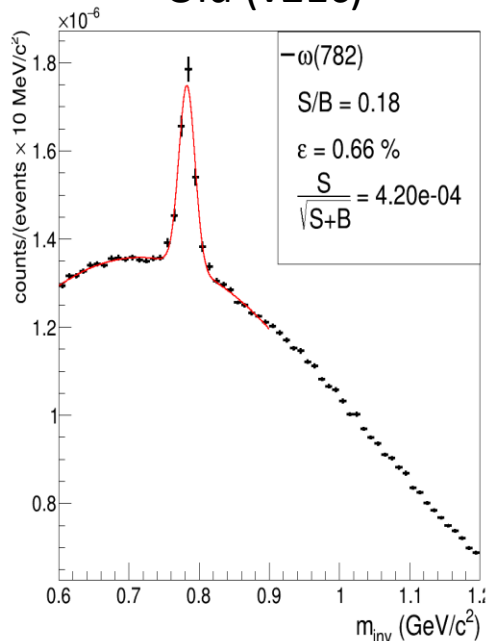
Comprehensive results before upcoming collaboration meeting (March, 2024)

Testing new (realistic) MuCh geometry

100k 8A GeV central Au+Au collisions

Pawan K. Sharma

Old (v21c)



Cuts:

N of STS hits ≥ 7

N of MUCH hits ≥ 11

N of TRD hits ≥ 1

N of Tof hits ≥ 1

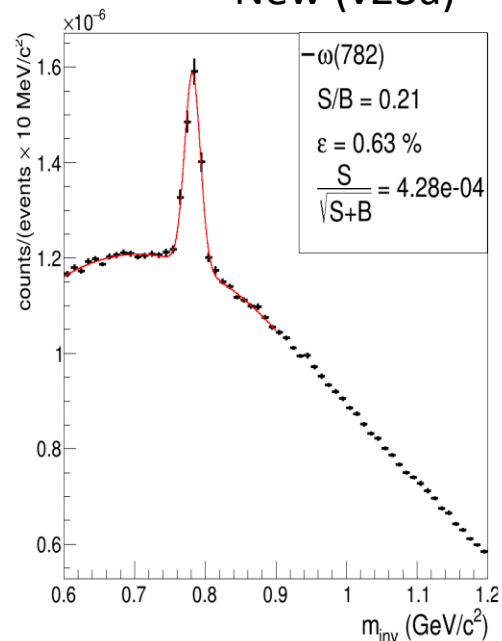
$\chi^2_{vertex} \leq 3.0$

$\chi^2_{STS} \leq 2.0$

$\chi^2_{MUCH} \leq 3.0$

2 σ cut in TOF

New (v23a)



Cuts:

N of STS hits ≥ 7

N of MUCH hits ≥ 11

N of TRD hits ≥ 1

N of Tof hits ≥ 1

$\chi^2_{vertex} \leq 3.0$

$\chi^2_{STS} \leq 2.0$

$\chi^2_{MUCH} \leq 3.0$

2 σ cut in TOF

Comparable performance both MuCh geometries

Effect of realistic digitization

Simulations with v23a much geometry

Increased charge threshold for GEM and reduced threshold for RPC

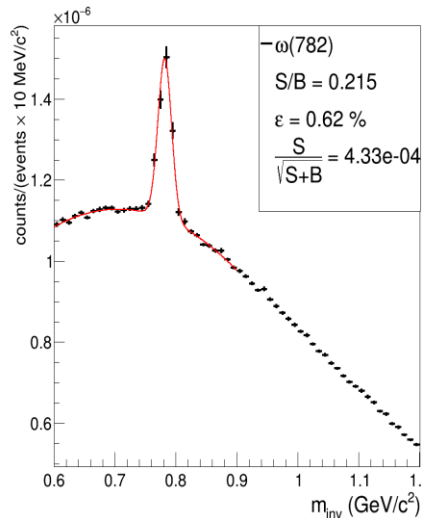
Larger spot radius for RPC

Abhishek K. Sharma

Di-muon reconstruction with ML

Pawan K. Sharma

Manual cuts



Cuts:

N of STS hits ≥ 7

N of MUCH hits ≥ 11

N of TRD hits ≥ 1

N of Tof hits ≥ 1

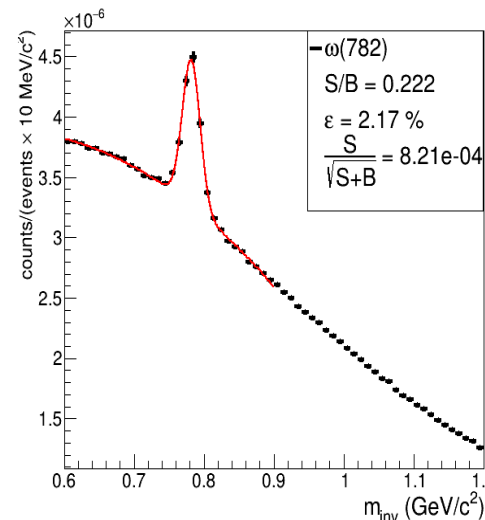
$\chi^2_{vertex} \leq 2.5$

$\chi^2_{STS} \leq 2.0$

$\chi^2_{MUCH} \leq 3.0$

2σ cut in TOF

TMVA:BDTG-1



Cuts:

N of STS hits ≥ 4

N of MUCH hits ≥ 8

N of TRD hits ≥ 1

N of TOF hits ≥ 1

$\chi^2_{vertex} \leq 20.0$

$\chi^2_{STS} \leq 20.0$

$\chi^2_{MUCH} \leq 20.0$

2σ cut in TOF

BDTG-1ML Model with cut 0.7

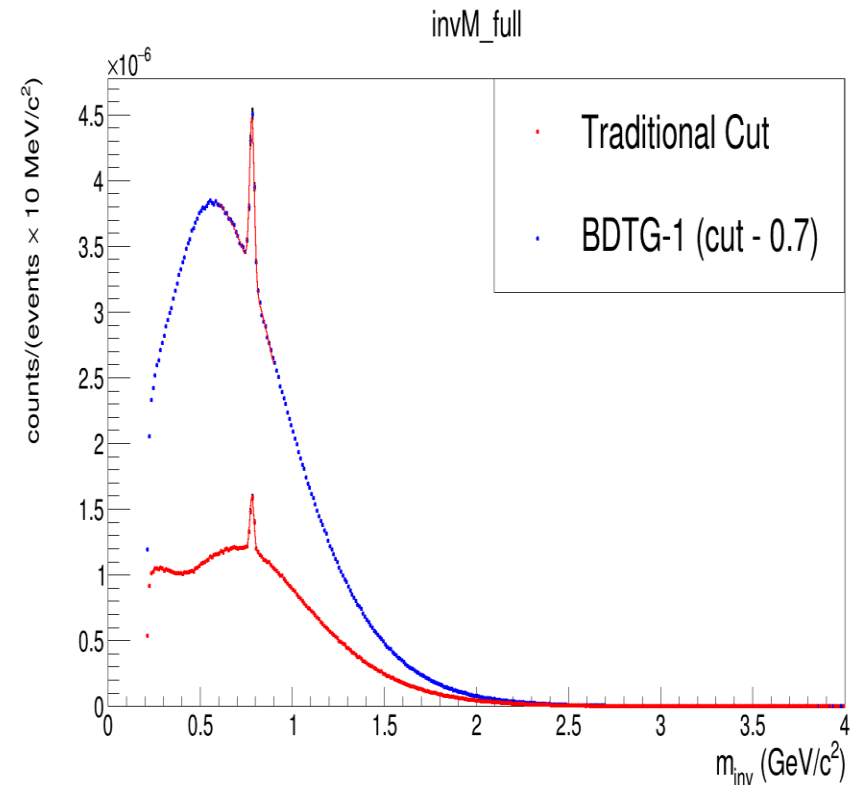
For similar S/B, factor of 3 improvement in pair efficiency

Softer cuts leading to extended phase space coverage

Test different ML algorithms

Extend to other Imvm

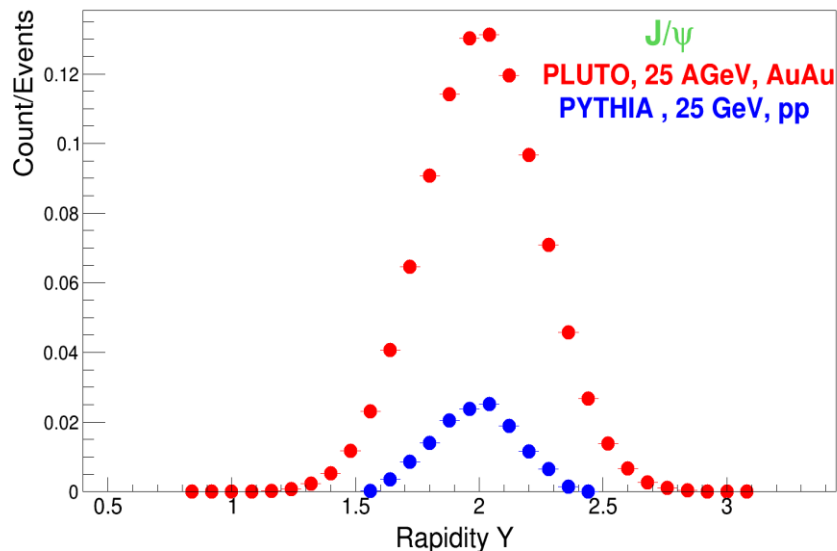
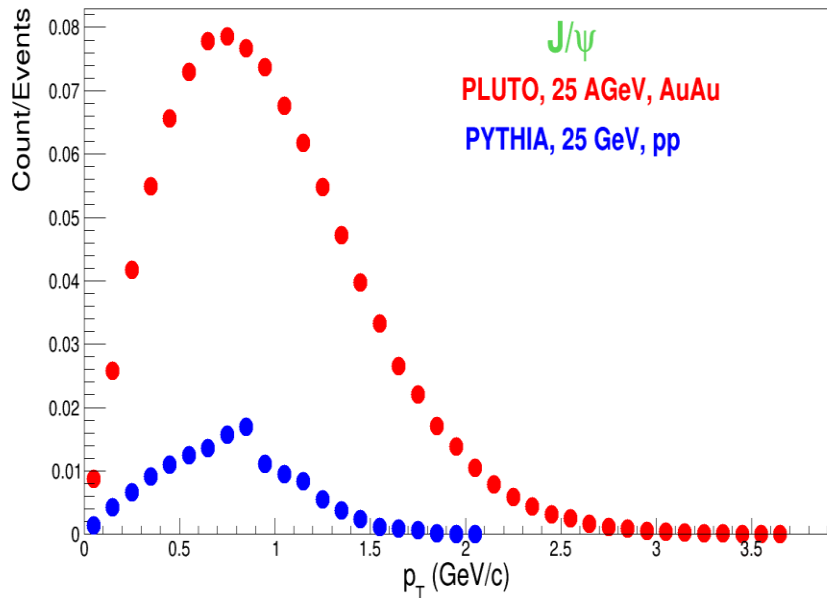
Comparison of different ML algorithms



Method	ML output variable	S/B	Efficiency	Normalized Significance
Manual Cuts		0.215	0.62	1
BDTG-1	0.7	0.222	2.17	1.89
HMatrix	0.2	0.215	0.89	1.2
KNN	0.9	0.225	1.49	1.58

J/ ψ simulations with PYTHIA

Ekata Nandy



Distinctly different (y, p_T) distribution with PYTHIA compared to PLUTO

Need to decay into dimuons and transport through cbm detector set up for full simulation