Single and Dimuon Reconstruction Performance

of the

PHENIX

South Muon Arm

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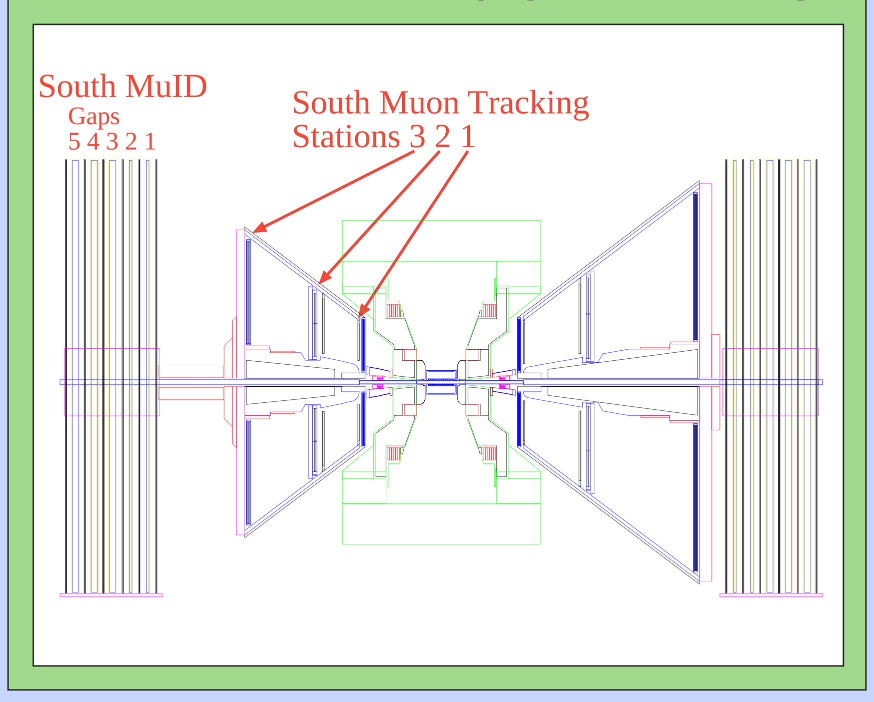
for the PHENIX Collaboration

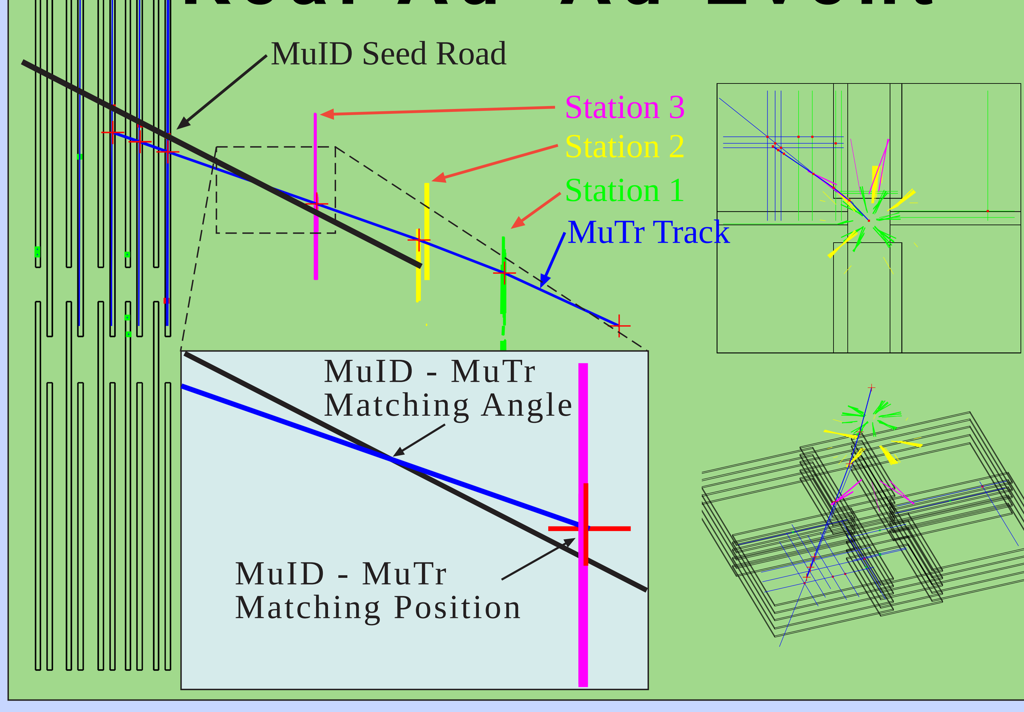
PHENIX Muon Arms



Reconstruction Overview

The PHENIX South Muon Arm was commissioned and operating for the Au+Au and the p+p runs of year 2 at RHIC. The south muon arm consists of two distinct detectors. The Muon Tracker determines the particle momentum using three tracking stations. The Muon Identifier provides particle identification using five layers of absorber and detector. Analysis of these first muon data from PHENIX will utilize software to iteratively reconstruct tracks using these two detectors. Muon Tracks are reconstructed in two stages. First, straight-line projections from the vertex seed the road-finding in the Muon Identifier (MuID). These roads are then projected to the outermost Muon Tracker (MuTr) station to seed track-finding. Tracking stubs are formed within each station and then projected toward the vertex to the next station. These tracks are then fitted and corrected for multiple scattering and energy loss that occurs in the absorber.

Real Au+Au Event



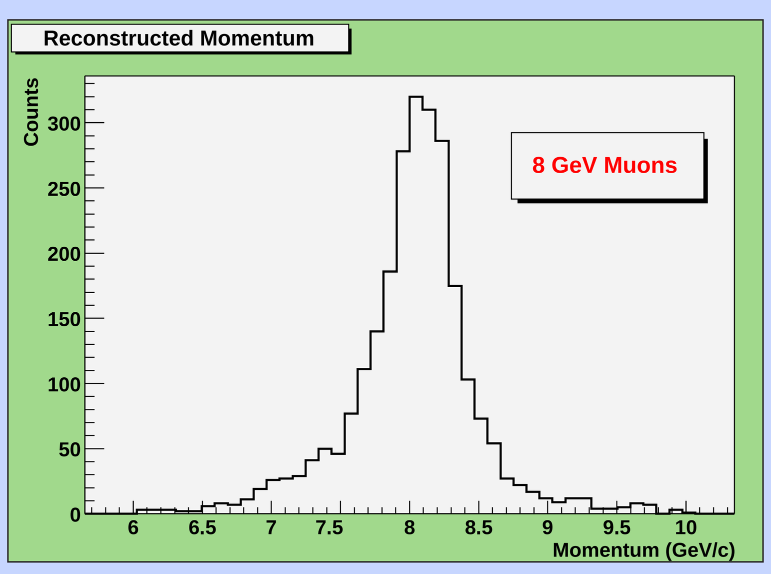
Single Muon Simulated Performance

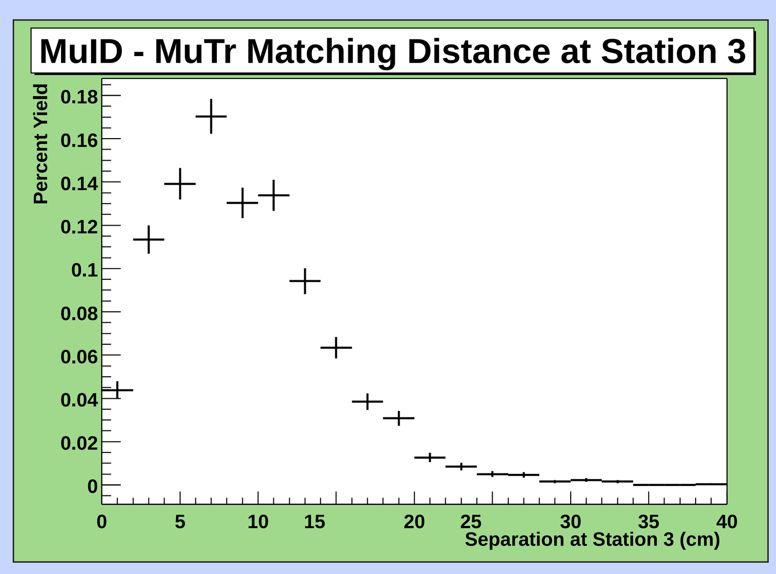
Analysis Summary

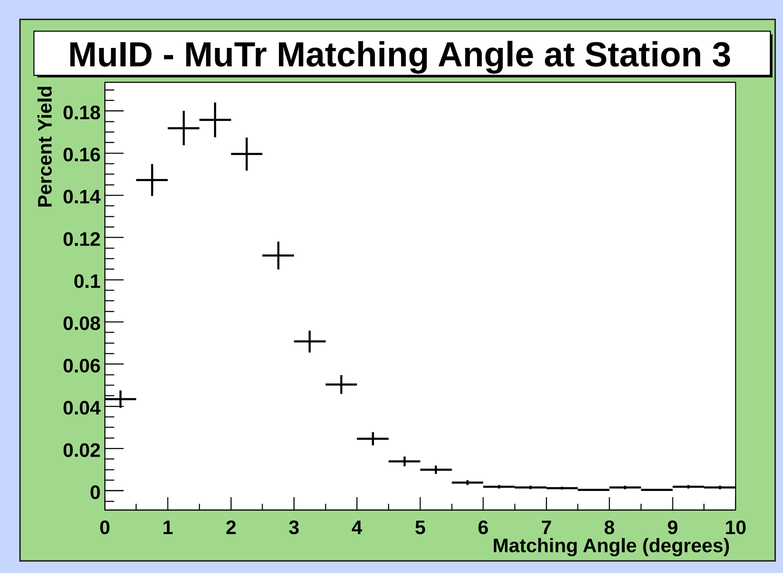
The single muon reconstruction efficiencies for the south arm are estimated by using simulations with measured detector efficiencies for both a typical Au+Au run and a typical p+p run. Each is then compared to a perfect detector. See the poster by Ken Read on muon arm hardware performance.

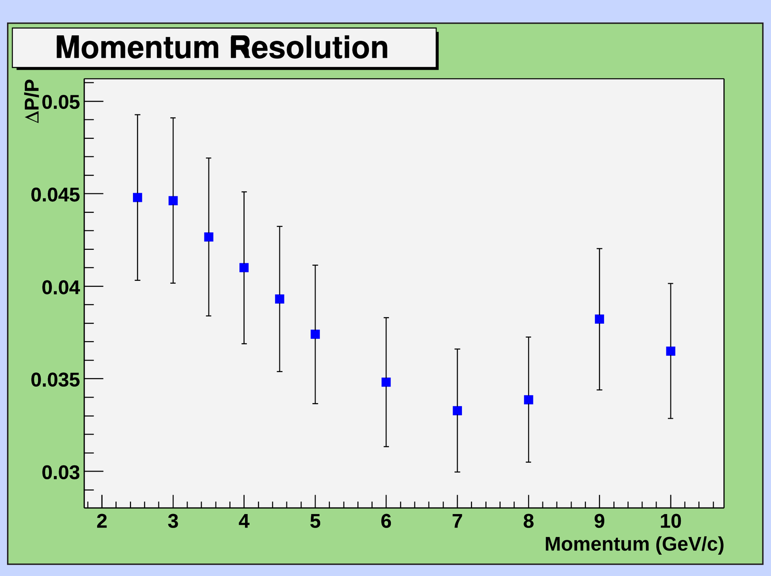
The effective momentum reconstruction is shown for simulated 8 GeV muons but will differ with momentum. As momentum increases, the resolution improves due to less multiple scattering. However, with increasing momentum the bending of the charged particle, due to the magnetic field, decreases relative to the position resolution of the detector. The simulated momentum resolution demonstrates these competing effects.

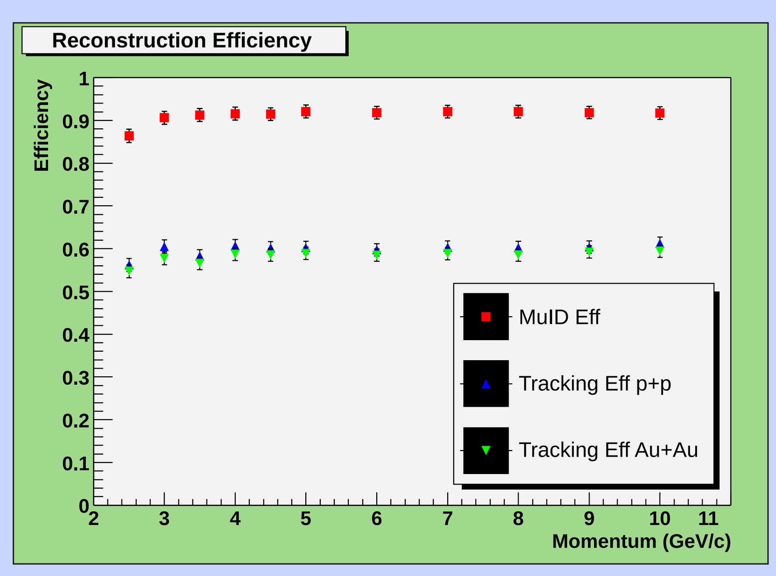
The high occupancy of Au+Au collisions presents very different challenges to the reconstruction software than the clean p+p environment. There is a decrease in efficiency with higher occupancy as it becomes more likely that an uncorrelated hit will be associated with a track. The effects of this higher occupancy in Au+Au on reconstruction efficiency is calculated by embedding simulated single particles into the corresponding real data.

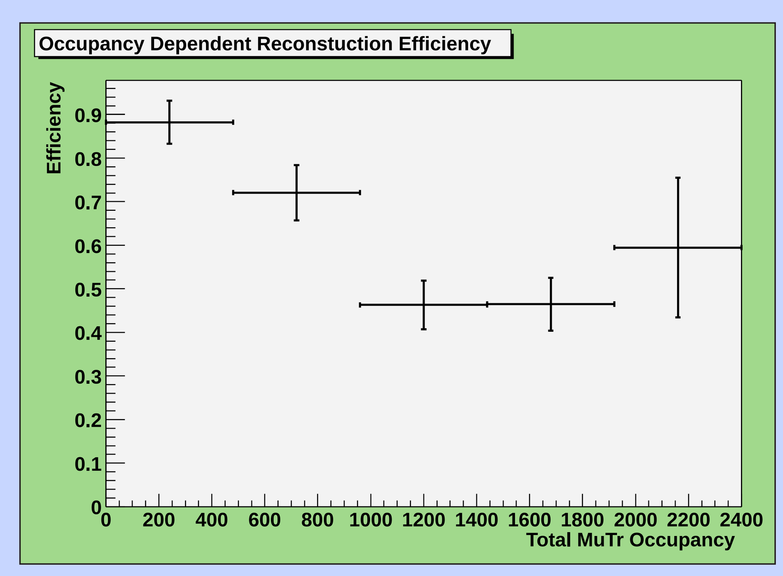












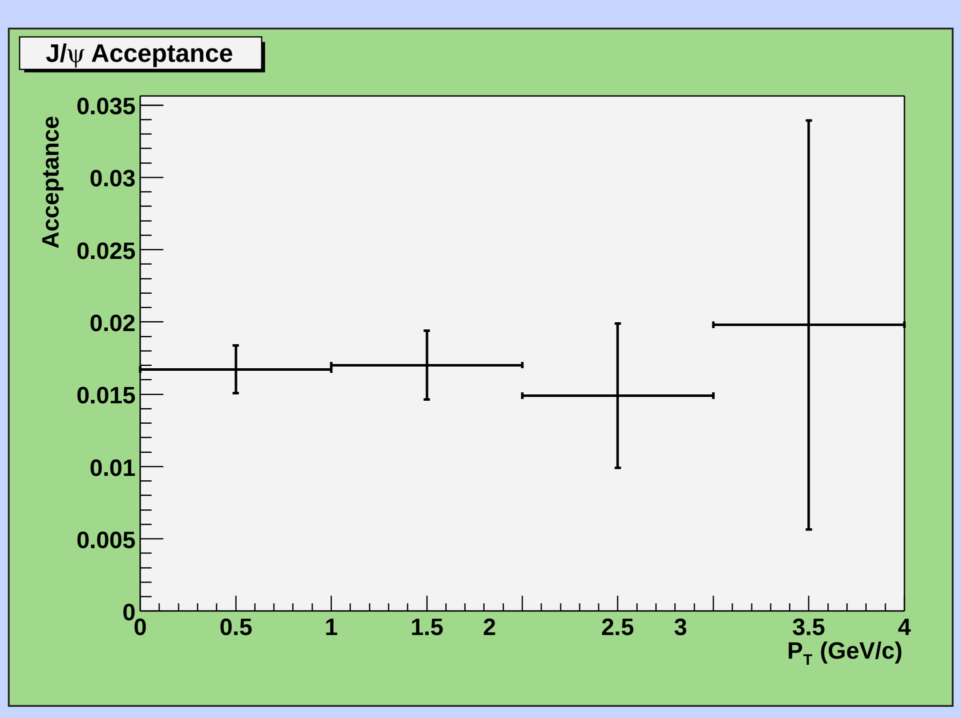
Dimuon Performance

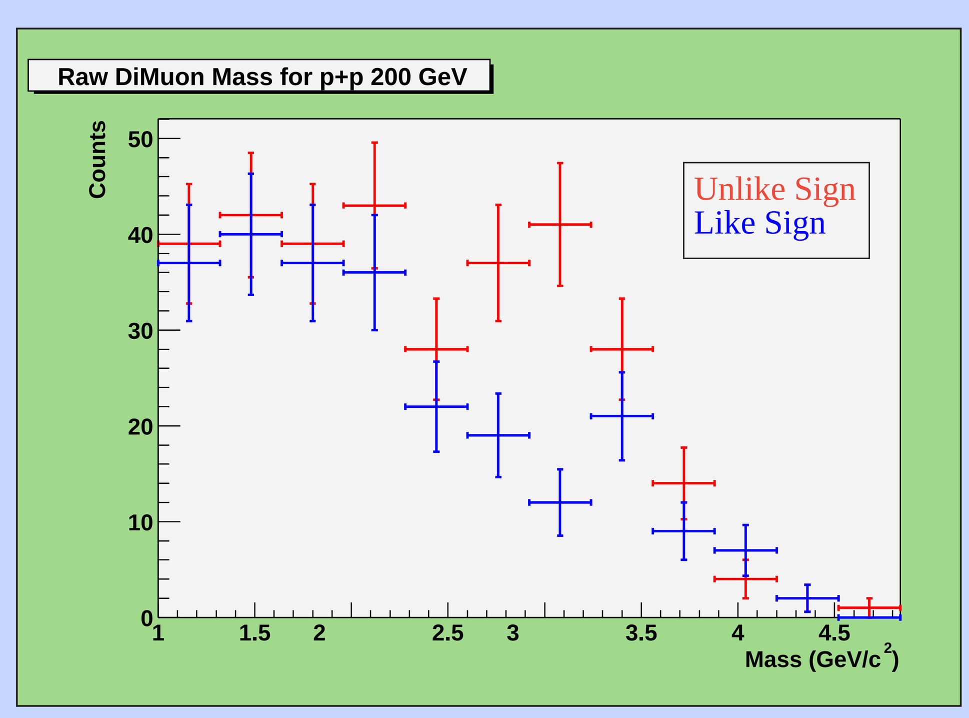
Dimuon Measurements

The muon arms are designed to measure the production of powerful probes like the ϕ, J/ψ, ψ', and Υ. The focus of the PHENIX muon arm's first year of running is the J/ψ both in p+p and Au+Au. The acceptance for the J/ψ in the south muon arm is relatively flat in transverse momentum out to 4 GeV/c as shown. The simulated mass resolution is 110 MeV/c^2 which allows it to be adequately separated from the ψ'.

The reconstruction requirements for dimuon analysis will be quite different from single muon requirements. For single muons, purity is emphasized over efficiency. However, analysis of rare processes requires a high efficiency. Selections on the matching angle and matching position shown above are effective in removing ghost tracks that dominate the background of the higher occupancy Au+Au collisions. The dimuon analysis of RHIC's year 2 p+p running will not be dominated by such background as demonstrated in the raw dimuon mass plot shown.

See presentations by Hiroki Sato and Ming Liu on J/ψ analysis for p+p and Au+Au respectively.





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