J/Ψ measurement with the PHENIX muon arms in d-Au interactions at $\sqrt{s_{NN}} = 200$ GeV

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Outline

Physics Motivation

- J/Ψ production, gluon shadowing.

PHENIX Muon Arms

- acceptance, performance.

State of the analysis

- a first look at J/Ψ->$\mu^+\mu^-$ for dAu at RHIC

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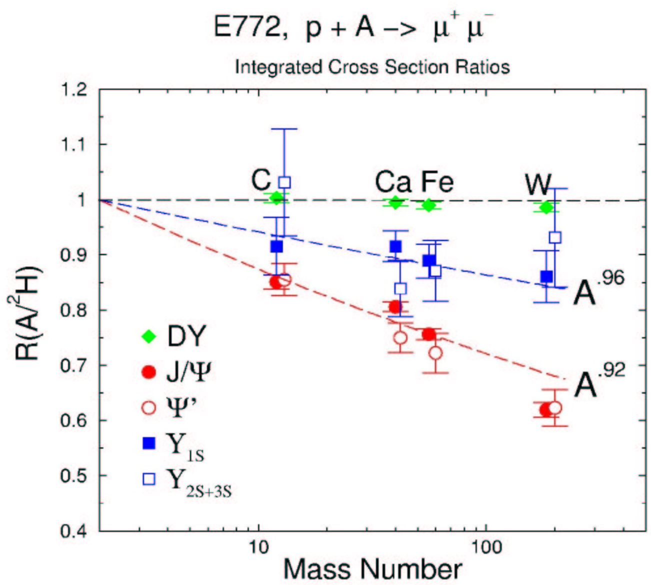
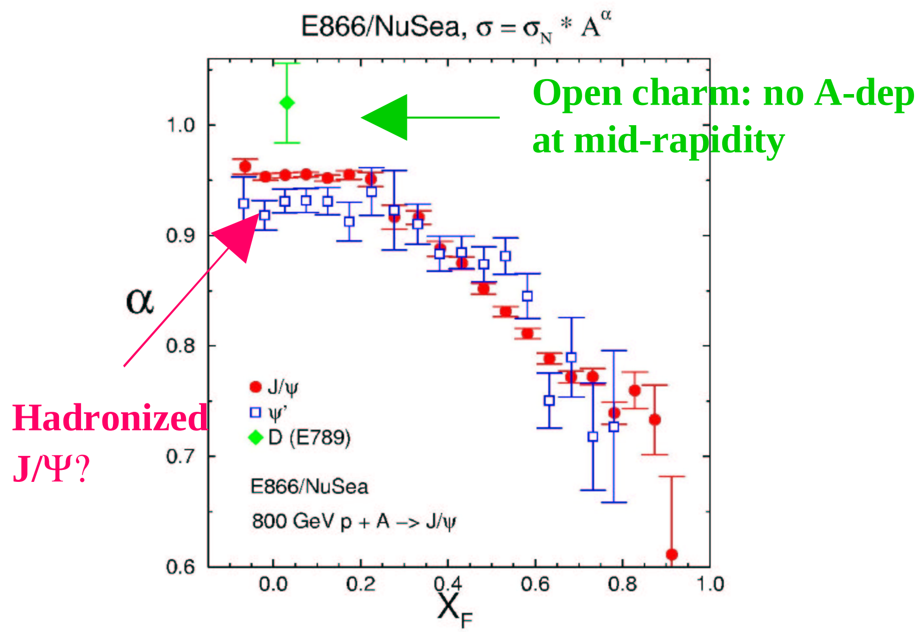
J/Ψ Suppression





[J/Ψ suppression – an effective signature of Quark-Gluon Plasma (QGP) formation?]()

Color screening in a QGP would destroy $c\bar{c}$ pairs before they can hadronize into charmonium

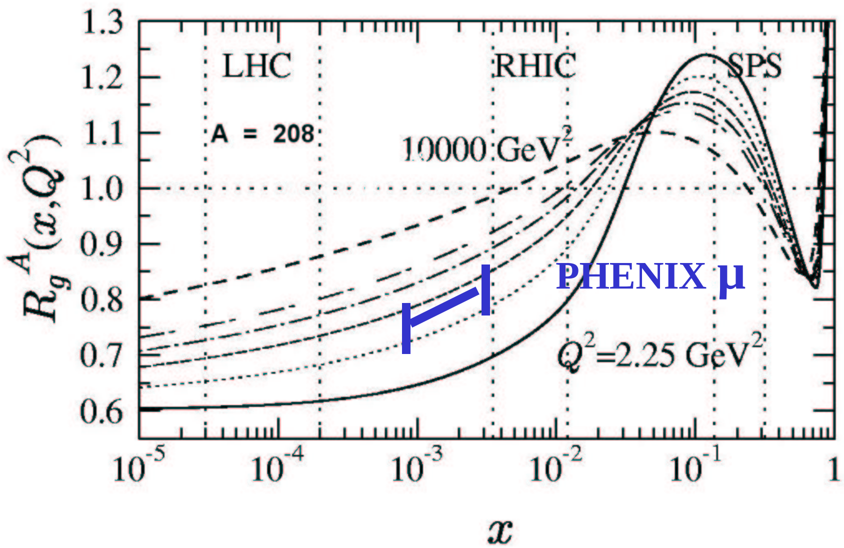
But ordinary nuclear effects also absorb or modify J/Ψ's

We need a comprehensive understanding of open charm and charmonium production

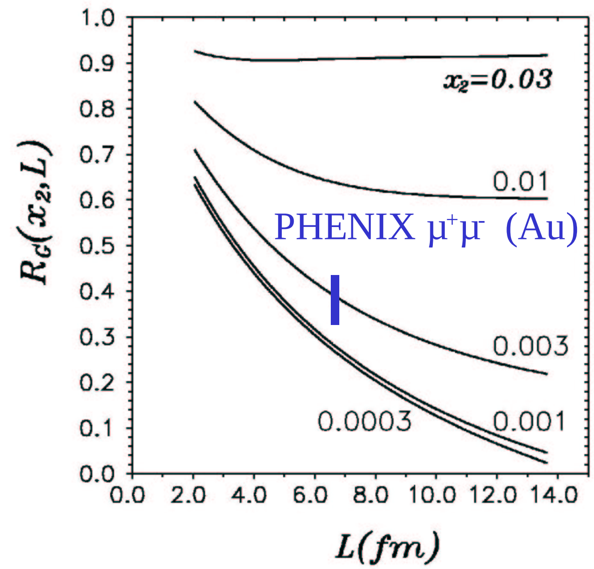
Gluon Shadowing

$R(x,Q^2,A) \equiv f_i^A(x,Q^2) \,/\, [A\, f_i^N(x,Q^2)] < 1$ ➔
Shadowing (partons recombining) resulting in e.g. lower J/Ψ yields..

Eskola, Kolhinen, Vogt hep-ph/0104124



Kopeliovich, Tarasov, & Hufner hep-ph/0104256

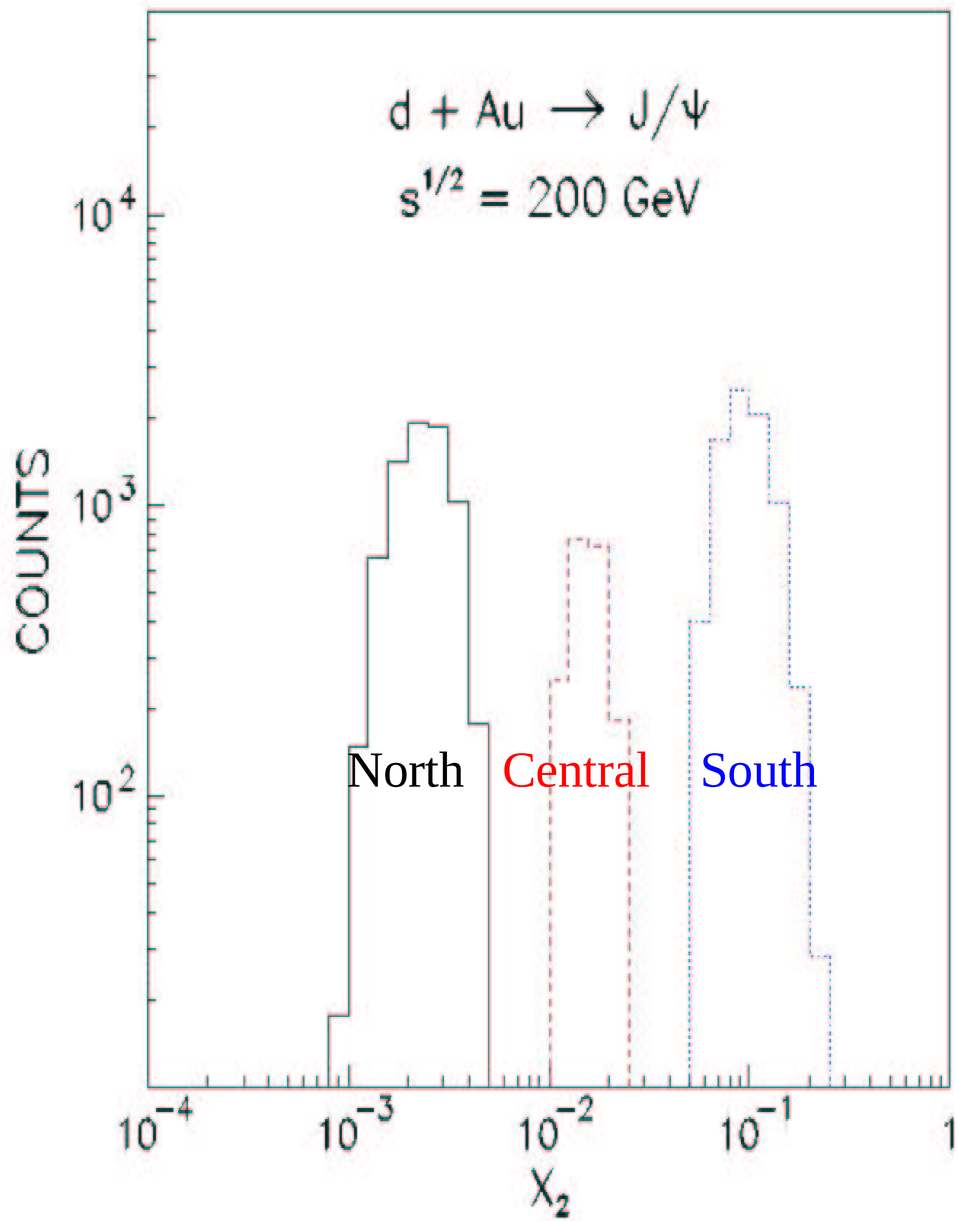


Gluon shadowing effects for nuclei, for the relevant x and Q^2 regions for the PHENIX muon arms, have large uncertainties. Kopeliovich et al., predict approx. a factor of 2 lower R_g values than Eskola et al.

Kinematics

x_F is defined as $x_F = 2*p_z/\mathrm{sqrt}(s)$.
With the help of $\tau = m^2/s$,
we can obtain x_1 and x_2:
$x_1 = 1/2*(x_F+\mathrm{sqrt}(x_F^{\ 2}+4*\tau))$;
$x_2 = x_1 - x_F$

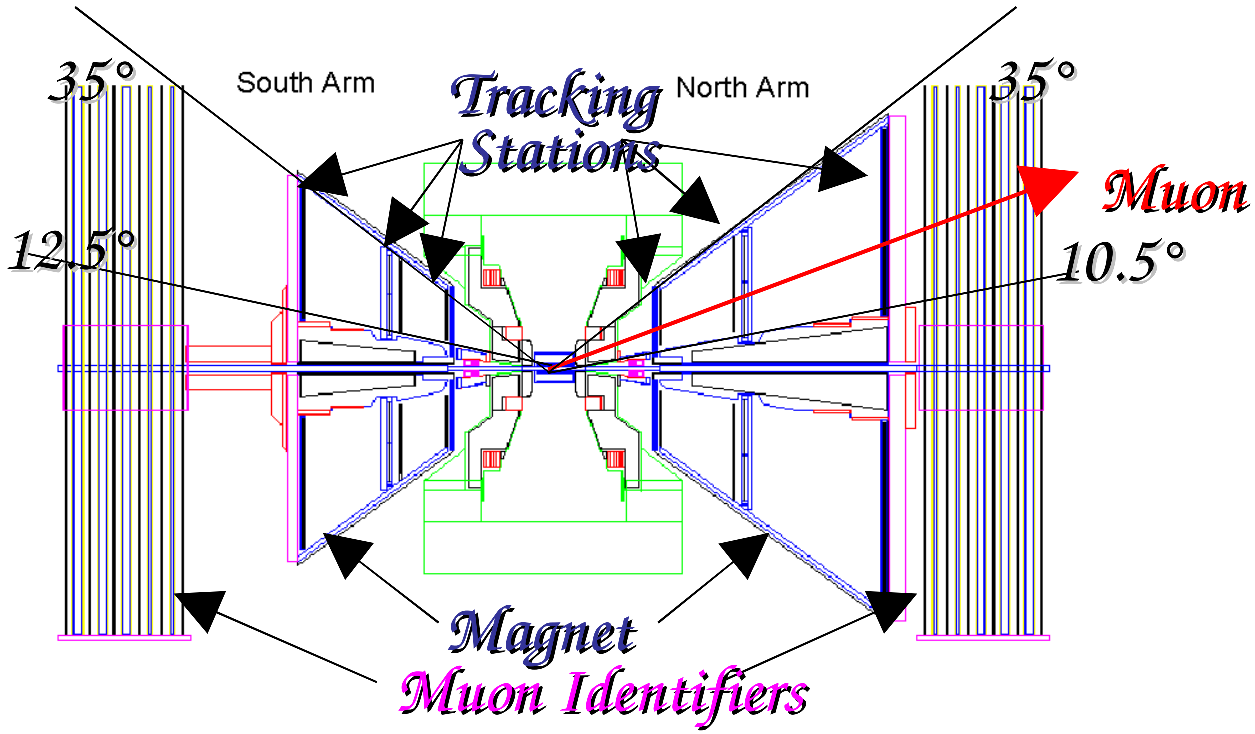
At the large s value of RHIC, τ is small, as is therefore also x_2. The x_2 distributions are plotted for simulated J/Ψ's.



PHENIX Muon Arms

2 Muon Trackers =
2x3 stations

2 Muon Identifiers
= 2x5 planes



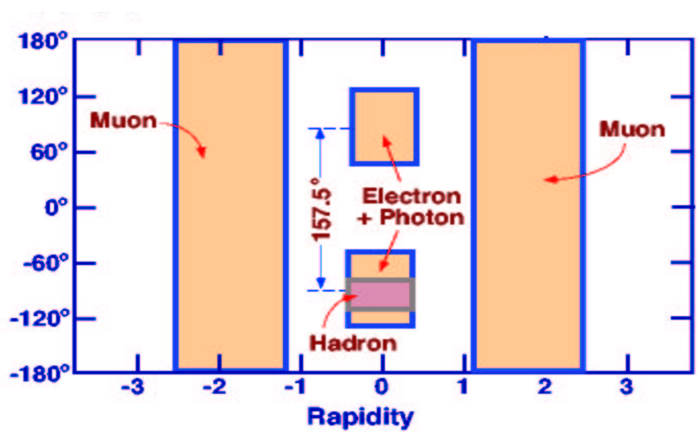
South Arm:
Began operations
in 2001-2002 run.

North Arm:
Installed in 2002.

Acceptance : $1.2 < |\eta| < 2.4$

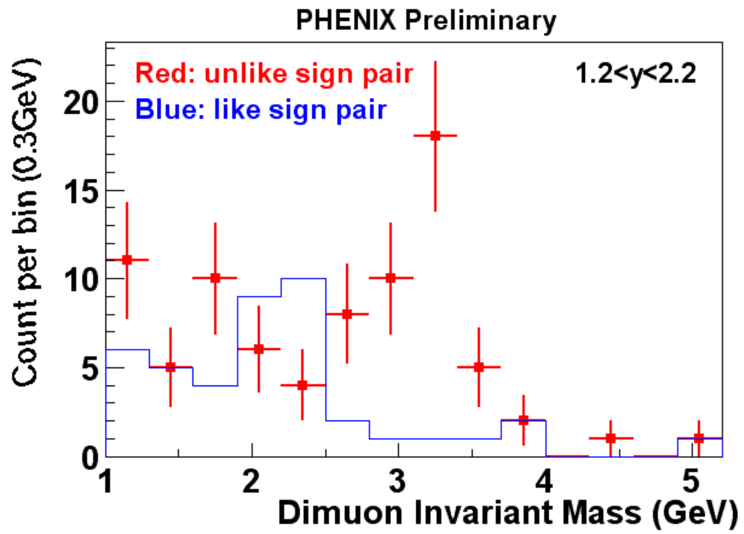
$\Delta\Phi = 2\pi$

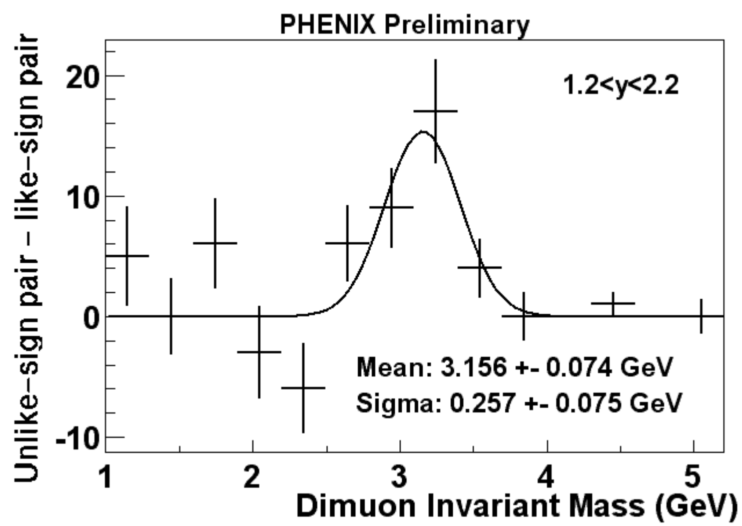
Muon minimum momentum ~ 2 GeV/c



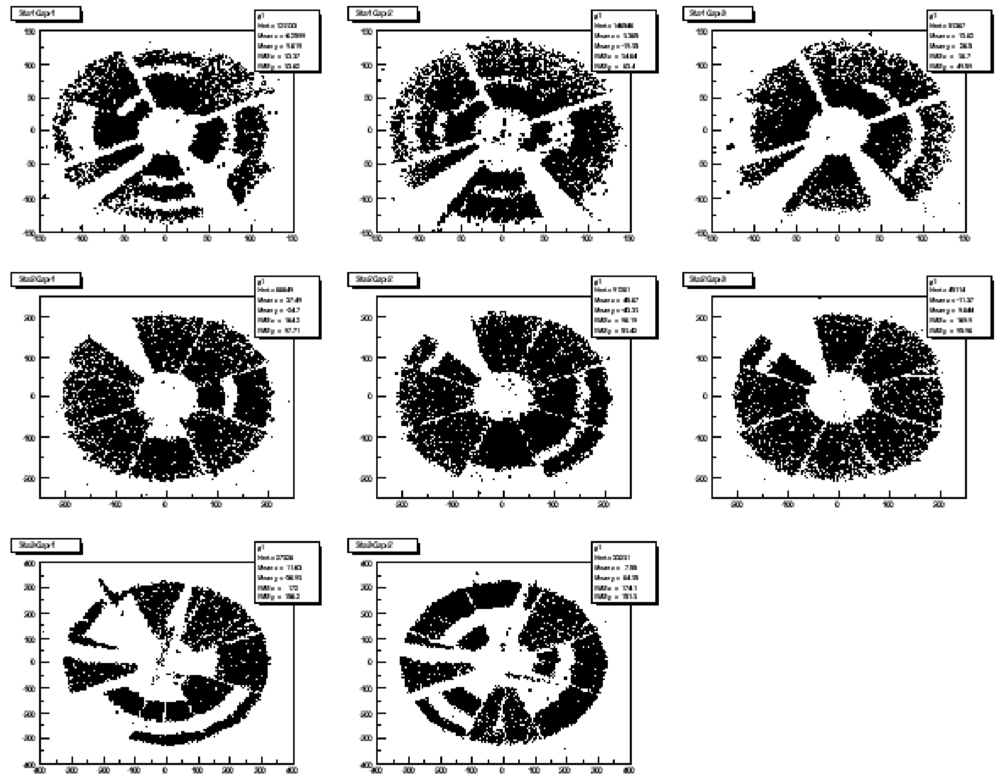
Run-2 pp

Preliminary results:





South MUTR radiograph:



Significant improvements in hardware and software and machine performance since then.

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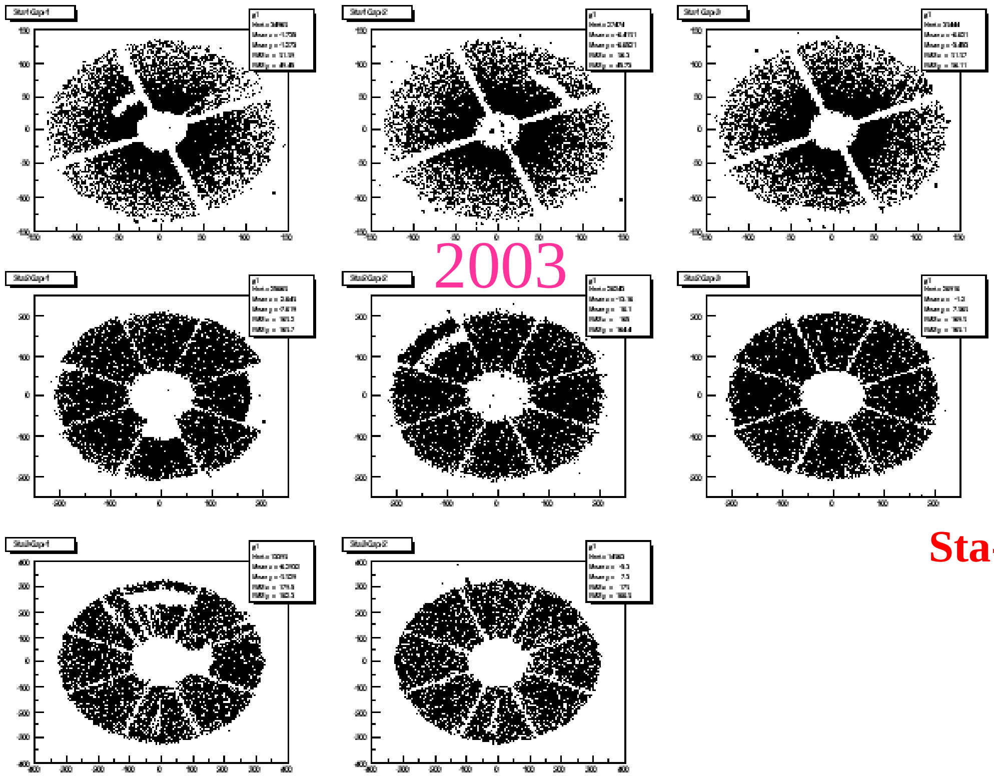
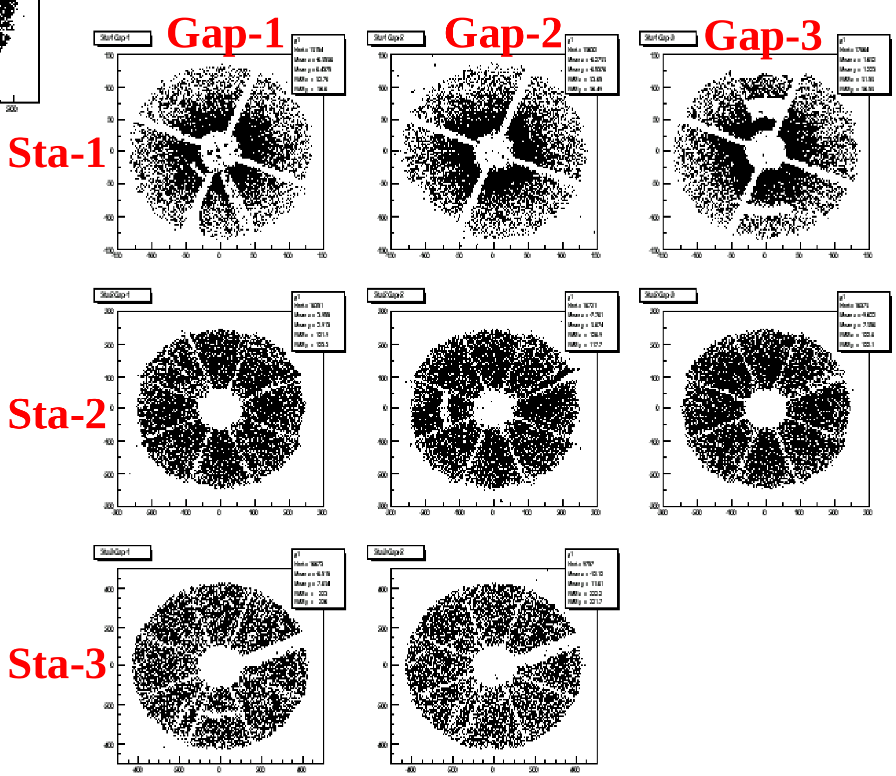
Run-3 (dAu): improved performance

South MUTR:



A new arm installed and operational !

North MUTR:



Also, significant MUID and shielding improvements!

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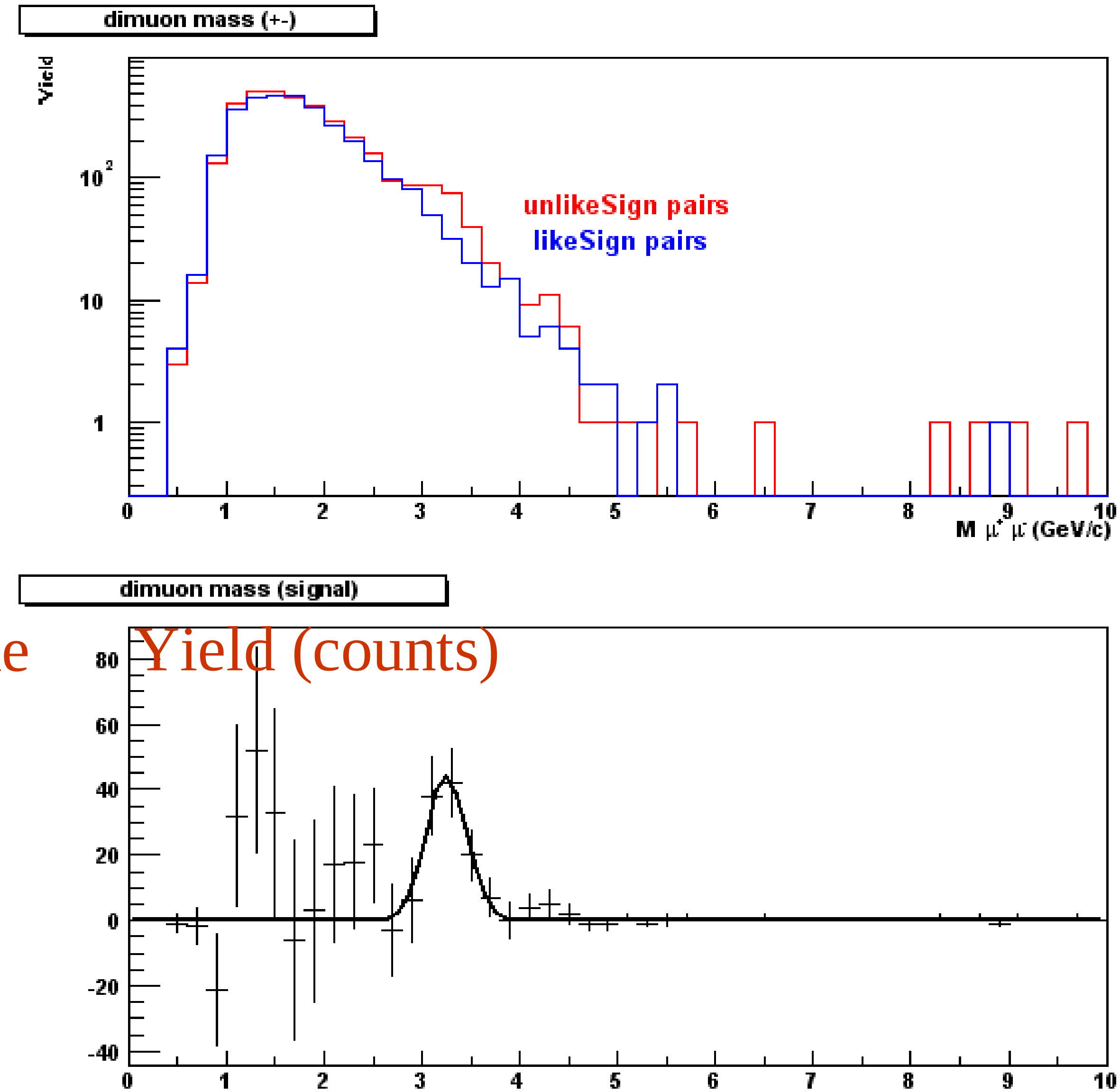
South

A subset of the data has been analyzed with online code.

An order of magnitude improvement of the statistics in the peak should be expected in the real production pass.

Trigger and detector eff. are not yet completely determined.



$M_{\mu+\mu-}$ (GeV/c)

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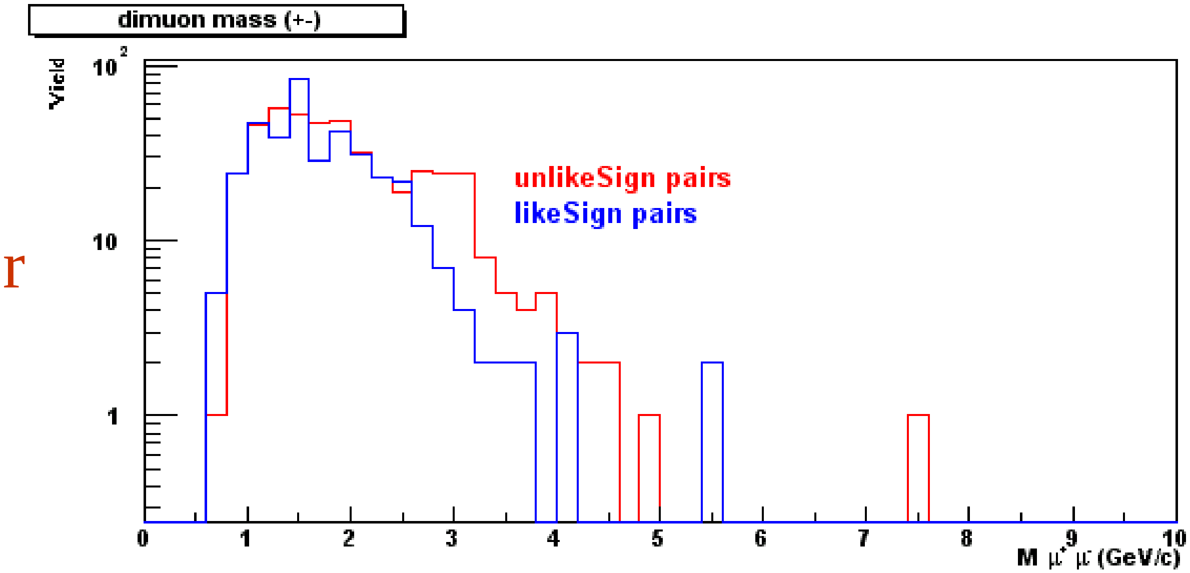
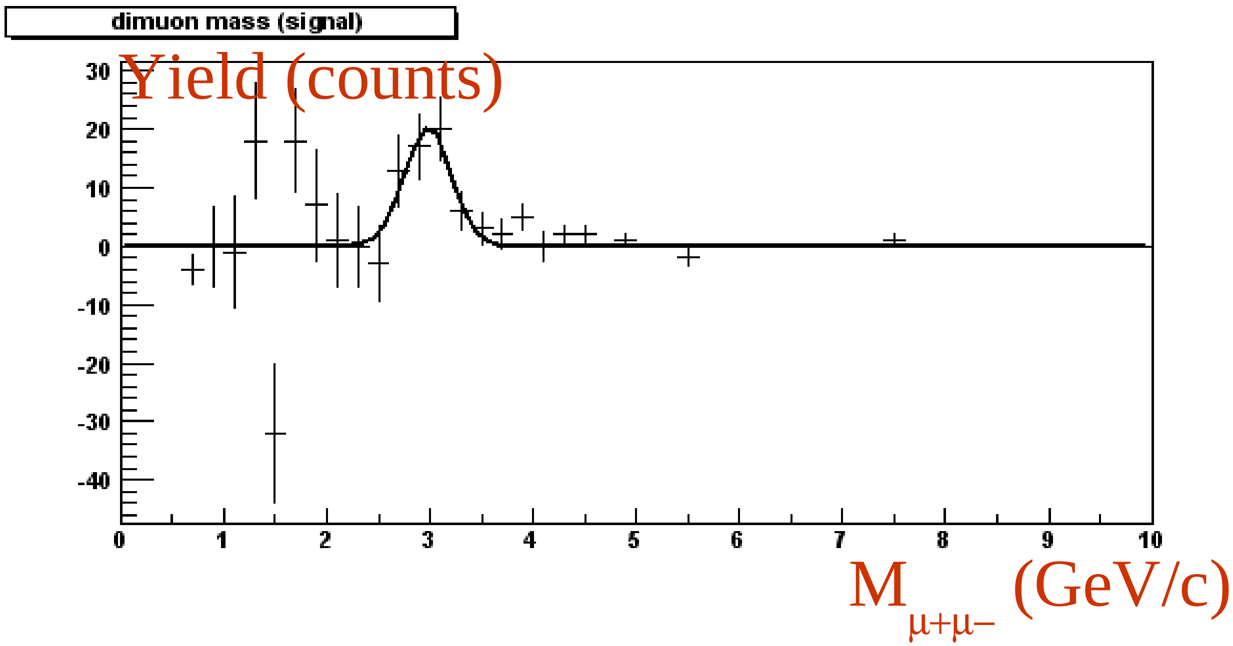
North

Note: <u>not</u> the same subset of the data as has been processed for the South arm.

Direct comparisons between the yield in the two arms are thus meaningless for now.





Summary and Outlook

J/Ψ peaks were observed for both muon arms, already while the dAu run was still going on.

Production pass to analyze all the data is to be started RSN. Approximately an order of magnitude more data than presented here should be available.

Improving our alignment will lead to improved mass resolution

Efforts are underway to determine trigger and detector efficiencies throughout the run.

Upcoming p-p run (Apr-May) will together with the dAu results also give a baseline for comparisons with the upcoming high statistics Au-Au (Nov -Jun) run.

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*as of July 2002