PHENIX Preliminary Data Request Plenary Presentation

- Name: Haiwang Yu, Cesar, Jin, Ming, Xiaorong, Melynda PWG: HHJ
- What Observable:
- track multiplicity dependence of the J/psi yield
- System, Energy, Run: p+p 510GeV run13
- Last PWG Presentation Date: May 1st
- Last PWG Presentation Link:

https://www.phenix.bnl.gov/cdsagenda/askArchive.php?base=agenda&categ=a14109&id=a14109s1t3/moreinfo

- Analysis Note #: 1180
- Analysis Note Web Link:

http://www.phenix.bnl.gov/phenix/WWW/p/info/an/1180/AnaNote_main.pdf



What plots are requested preliminary?



https://www.phenix.bnl.gov/phenix/WWW/p/plots/show_plot.php?editkey=p1306



Basic Information

Data set : run13 510 GeV

- Pro build 97, using picoDST_object (offline/AnaTrain/picoDST_object) and ana module (offline/analysis/jpsi_multiplicity)
- 1007 runs, 7400 Billion events, integrated luminosity 228 pb⁻¹
- Removed 94 runs because of FVTX readout issues
- FVTX track selection used to count multiplicity:
 - Chi²/NDF<4
 - DCA_Z<1 cm from the closest vertex
- Muon track selection:
 - Evt_vtxchi2<2, Evt_vtxoor<1, DG0<15, DDG0<10, ntrhits>9, nidhits>5, lastgap>2, dca_r (using MuTr only)<5, pT<10, 2<pZ<100. NO FVTX matching is required.

Vertex selection: more than 2 crossing tracks, |Z|<10 cm.

• J/psi are selected as dimuons in 2.6<M<3.6 GeV after like-sign subtraction. Both dimuon tracks should match the same vertex.





What's the observable

- We measure the FVTX track multiplicity dependence of the J/psi->dimuon yield.
- A scaling of the J/psi yield with charged particle multiplicity may indicate multi-parton interactions
- Scaling is observed in ALICE 7 TeV p+p data, can this happen at lower energy?
- J/psi yield and track multiplicity are normalized by their corresponding averages to be compared with ALICE result and models



Analysis Issues

Any dependence with Z vertex? An

No up to |Z|<10cm where J/psi acceptance and FVTX track acceptance/rapidity is the same. Sys. Error assigned. Any luminosity rate bias? Checked with low (BBC<2MHz) and high (BBC>3.5MHz) luminosity rate runs. Sys. Error assigned.





Analysis Issues

Is BBC bias different between MB events and J/psi events as a function of track multiplicity ? Needs a correction in the relative J/psi yield to account for different bias compared to MB. Also assigned a sys. Error to cover the possibility of no bias.

J/psi reconstruction efficiency change with Nch? Not seen it. Assigned a sys. error of 5%





Analysis Issues

Bias from fake/missing vertexes?

After several checks, assigned a sys. Error from the result difference btw. events with 1(>1) vertex per event.





Relation to Previous Analyses





Plots Requested for PHENIX Preliminary



Physics Knowledge Gained

PYTHIA in single parton interaction mode. (plot from ALICE paper)



ALICE and PHENIX results deviate from a regular behavior expected from single parton interaction in p+p.

Still processing raw MC result.

arXiv:1308.3638.pdf 10 $\sqrt{s}=7 \text{ TeV}$ • |y| < 0.9• 2.5 < y < 4Energy independent 2.5 0 0 5/5/2014 2 3 4

J/Ψ in high-multiplicity pp collisions: lessons from pA

B. Z. Kopeliovich¹, H. J. Pirner², I. K. Potashnikova¹, K. Reygers³, and Iván Schmidt¹ ¹Departamento de Física, Universidad Técnica Federico Santa María; and Centro Científico-Tecnológico de Valparaíso; Casilla 110-V, Valparaíso, Chile ²Institute for Theoretical Physics, University of Heidelberg, Germany ³Physikalisches Institut, University of Heidelberg, Germany

Gluons at small x in high-energy nuclei overlap in the longitudinal direction, so the nucleus acts as a single source of gluons, like higher Fock components in a single nucleon, which contribute to inelastic collisions with a high multiplicity of produced hadrons. This similarity helps to make a link between nuclear effects in pA and high-multiplicity pp collisions. Such a relation is well confirmed by data for the J/Ψ production rate in high-multiplicity pp events measured recently in the ALICE experiment. Broadening of J/Ψ transverse momentum is predicted for high-multiplicity pp collisions.



The Path to Final Results

Have a better understanding of the small effects from luminosity rate in the FVTX track multiplicity.

Check J/psi p_T broadening as suggested by Kopeliovich.

Idea is to keep the focus on this analysis after QM and make a paper release in the next two months.



BACKUP SLIDES



Summary of Systematic Errors

Systematic Errors Summary



The total is just summation. Not the combined systematic err.



Table of Systematic Errors

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
luminosity	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.5%	3.0%	4.0%	4.5%	5.0%
mult-vertex	4.0%	4.0%	4.0%	4.0%	3.7%	3.3%	3.0%	2.7%	2.3%	2.0%	1.7%	1.3%	1.0%	0.7%	0.3%	0.0%
z-vertex	12.0%	4.0%	2.0%	1.5%	1.3%	1.0%	1.0%	1.3%	1.7%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%
jpsi reco	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
BBC eff.	15.6%	12.2%	9.5%	7.3%	5.6%	4.2%	3.2%	2.4%	1.8%	1.3%	0.9%	0.6%	0.4%	0.3%	0.2%	0.1%



FVTX track DCA_Z distribution

DAC (tracklet to associated FVTX vertex)



Now counting multiplicity only for FVTX tracks with DCA_Z< 1cm



Muon track FVTX vertex DCA_Z distribution



We are using MuTr only track parameters for the association



Relative BBC bias



Coverage map for the FVTX tracks



Pure geometry coverage, no efficiency involved in this plot. Extended Z range is possible, but J/psi and FVTX tracks will have a different rapidity coverage.



Beyond |Z|<10 cm

 J/ψ Yield vs. FVTX multiplicity (Normalized to MB)



Not for this preliminary request. Difference at large |Z| may come from different rapidity acceptance btw. J/psi and FVTX tracks, to be confirmed.



Vertex(es) determination



Are J/psi associated with the right vertex?







Vertex Multiplicity vs. luminosity rate





FVTX track Multiplicity vs. luminosity rate



J/psi matched vertexes

Minimum Bias



FVTX track Multiplicity vs. luminosity rate

>1 vertex in the event



dimuon matched vertexes

Minimum Bias



Muon FVTX DCAz vs. BBC rate

track0

track1



We are using MuTr only track parameters for the association



raw ratio mstp81 on





raw ratio mstp81 off



