Paper proposal:

Collision energy and system size dependence of longitudinal flow de-correlation at RHIC

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Jun. 19, 2024

General information

- Title: Collision energy and system size dependence of longitudinal flow de-correlation at RHIC
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- Traget Journal: Phys. Rev. Lett.
- Webpage:

  https://drupal.star.bnl.gov/STAR/blog/gyan/Paper_proposal_LDeCorr_energy_system
- Analysis note: in preparation
- Paper draft: in preparation

Figure 1: Collision energy dependence

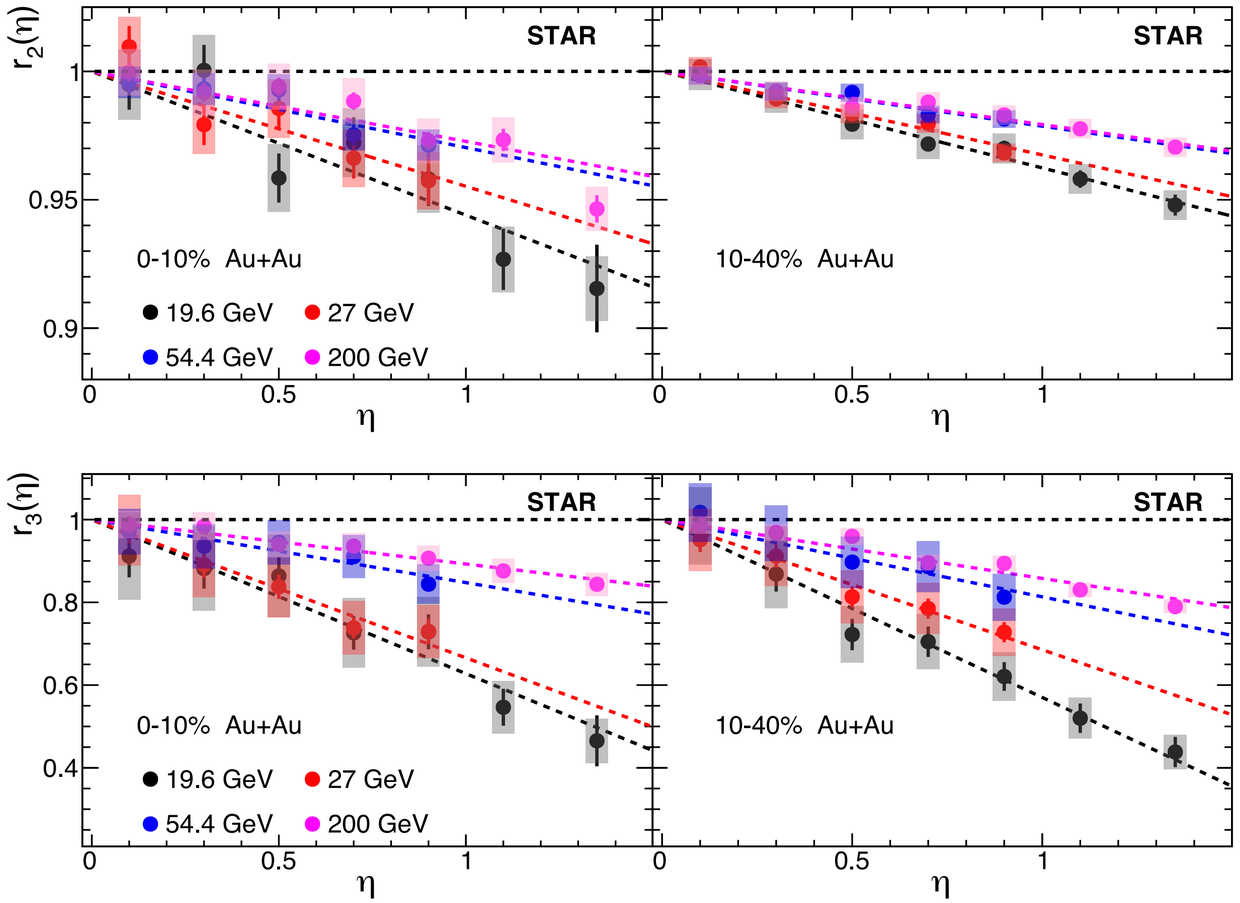


Fig.1: The $r_n(\eta)$(n=2,3) compared between the Au+Au collisions at $\sqrt{s_{NN}}$ = 19.6 (black), 27 (red), 54.4 (blue) and 200 (pink) GeV in centrality bins: 0-10% and 10-40%. For $r_2(\eta)$ (top panels), $3.1 < |\eta_{ref}| < 5.1$ $(3.1 < \eta_{ref} < 4.0)$ is selected in 19.6, 27 and 200 GeV (54.4GeV). For $r_3(\eta)$ (bottom panels), $2.1 < |\eta_{ref}| < 5.1$ $(2.5 < \eta_{ref} < 4.0)$ is selected in 19.6, 27 and 200 GeV (54.4GeV). The error bars and shaded boxes are statistical and systematic uncertainties, respectively.

Figure 2: Collision energy dependence by scaling

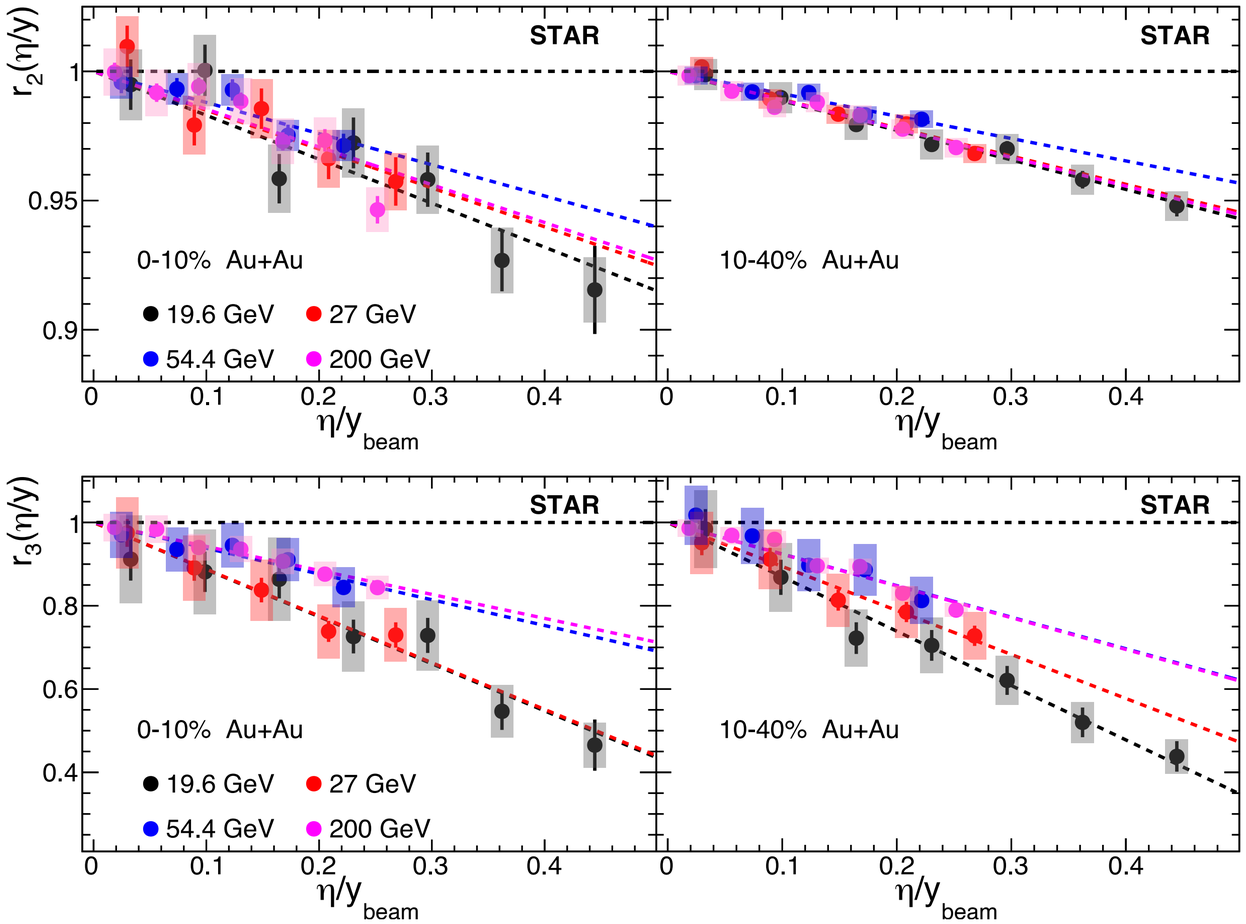


Fig.2: The $r_n(\eta/y_{beam})$ (n=2,3) compared between in Au+Au collisions at $\sqrt{s_{NN}}$ = 19.6 (black), 27 (red), 54.4 (blue) and 200 (pink) GeV in centrality bins: 0-10% and 10-40%. For $r_2(\eta)$ (top panels), $3.1 < |\eta_{ref}| < 5.1$ $(3.1 < \eta_{ref} < 4.0)$ is selected in 19.6, 27 and 200 GeV (54.4GeV). For $r_3(\eta)$ (bottom panels), $2.1 < |\eta_{ref}| < 5.1$ $(2.5 < \eta_{ref} < 4.0)$ is selected in 19.6, 27 and 200 GeV (54.4GeV). The error bars and shaded boxes are statistical and systematic uncertainties, respectively.

Figure 3: System size dependence

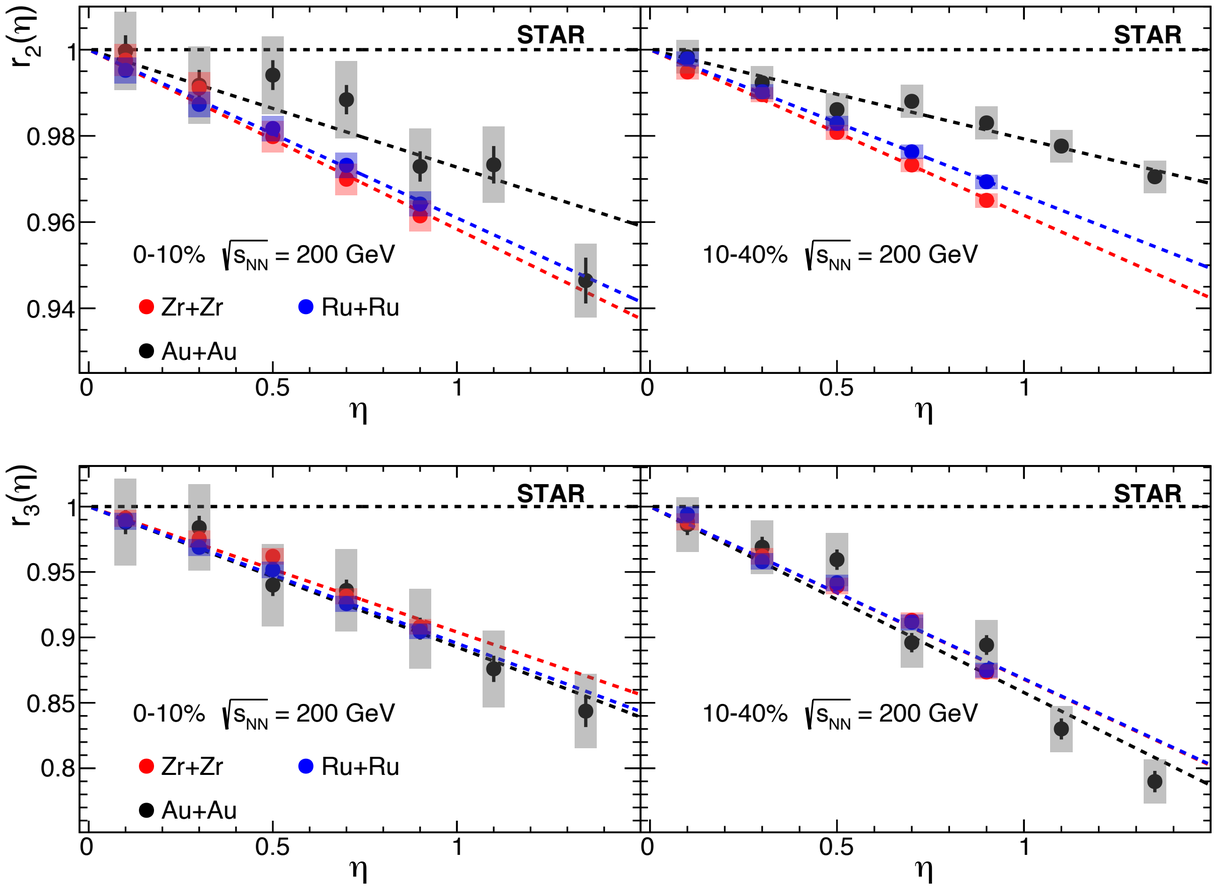


Fig.3: The $r_n(\eta)$(n=2,3) compared between the Zr+Zr (red), Ru+Ru (blue) and Au+Au (black) collisions at $\sqrt{s_{NN}}$ = 200 GeV in centrality bins: 0-10% and 10-40%. For $r_2(\eta)$ (top panels), $3.1 < |\eta_{ref}| < 5.1$ is selected. For $r_3(\eta)$ (bottom panels), $2.1 < |\eta_{ref}| < 5.1$ is selected. The error bars and shaded boxes are statistical and systematic uncertainties, respectively.

Systematic uncertainty for $r_n(\eta)$

Systematic uncertainty

- For each cut variable (vertex z, nhits, charge), we choose the maximum ratio between default value and assume these sources are uncorrelated.

Relative error: $\sigma = \dfrac{r_n(\eta)}{r_n(\eta)^{default}}$ Total systematic uncertainty: $\sqrt{\sigma_{vtxz}^2 + \sigma_{nhits}^2 + \sigma_{charge}^2} * r_n(\eta)^{default}$

- Zr+Zr collisions at 200 GeV

cuts	default	var1	var2	0-10%		10-40%	
				$r_2(\eta)$	$r_3(\eta)$	$r_2(\eta)$	$r_3(\eta)$
vertex Z	(-35,25)	<10cm	>10cm	0.001	0.003	0.001	0.003
nhits	>15	>25		0.003	0.005	0.001	0.005
charge	All	<0	>0	0.002	0.003	0.001	0.003

- Ru+Ru collisions at 200 GeV

cuts	default	var1	var2	0-10%		10-40%	
				$r_2(\eta)$	$r_3(\eta)$	$r_2(\eta)$	$r_3(\eta)$
vertex Z	(-35,25)	<10cm	>10cm	0.001	0.003	0.001	0.003
nhits	>15	>25		0.002	0.005	0.001	0.005
charge	All	<0	>0	0.002	0.003	0.001	0.003

Systematic uncertainty

- Au+Au collisions at 200 GeV

cuts	default	var1	var2	0-10%		10-40%	
				$r_2(\eta)$	$r_3(\eta)$	$r_2(\eta)$	$r_3(\eta)$
vertex Z	<100cm	<20cm	>20cm	0.005	0.010	0.002	0.010
nhits	>15	>25		0.002	0.010	0.001	0.010
charge	All	<0	>0	0.007	0.030	0.003	0.015
nMip	$(0.3,2\sigma)$	$(0.3,\sigma)$		0.002	0.005	0.001	0.005

- Au+Au collisions at 54.4 GeV

cuts	default	var1	var2	0-10%		10-40%	
				$r_2(\eta)$	$r_3(\eta)$	$r_2(\eta)$	$r_3(\eta)$
vertex Z	<40cm	<20cm	>20cm	0.005	0.020	0.002	0.040
nhits	>15	>25		0.002	0.035	0.002	0.045
charge	All	<0	>0	0.003	0.040	0.002	0.035

Systematic uncertainty

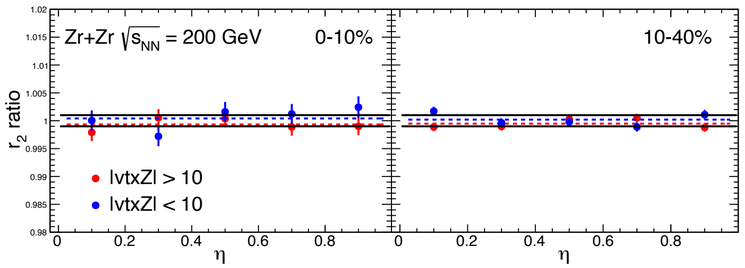
- Au+Au collisions at 27 GeV

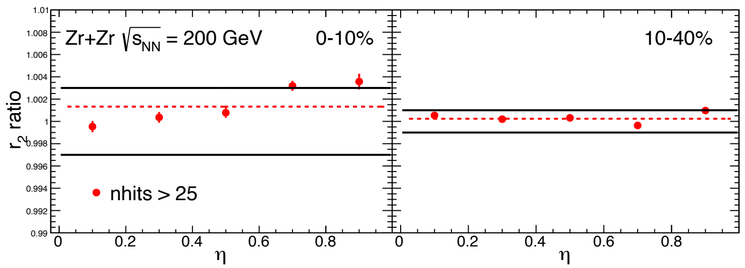
cuts	default	var1	var2	0-10%		10-40%	
				$r_2(\eta)$	$r_3(\eta)$	$r_2(\eta)$	$r_3(\eta)$
vertex Z	<60cm	<20cm	>20cm	0.010	0.060	0.001	0.070
nhits	>15	>25		0.003	0.040	0.002	0.020
charge	All	<0	>0	0.005	0.050	0.003	0.030

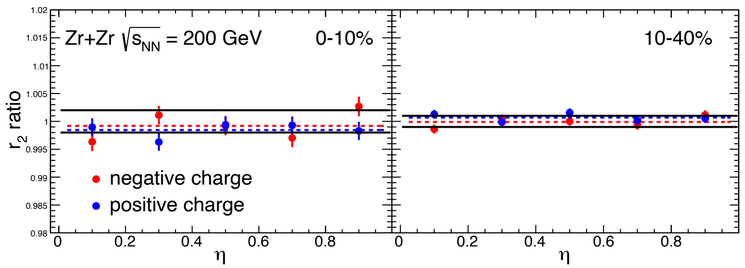
- Au+Au collisions at 19.6 GeV

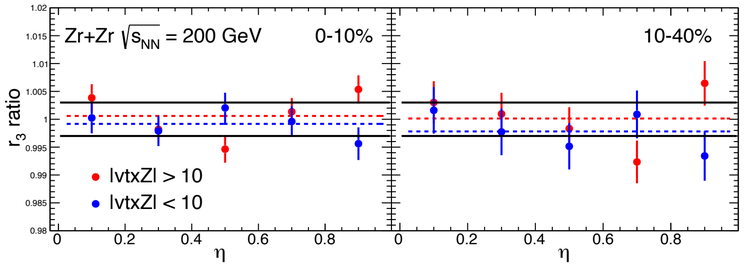
cuts	default	var1	var2	0-10%		10-40%	
				$r_2(\eta)$	$r_3(\eta)$	$r_2(\eta)$	$r_3(\eta)$
vertex Z	<145cm	<20cm	>20cm	0.005	0.100	0.040	0.080
nhits	>15	>25		0.010	0.030	0.020	0.010
charge	All	<0	>0	0.008	0.050	0.040	0.050

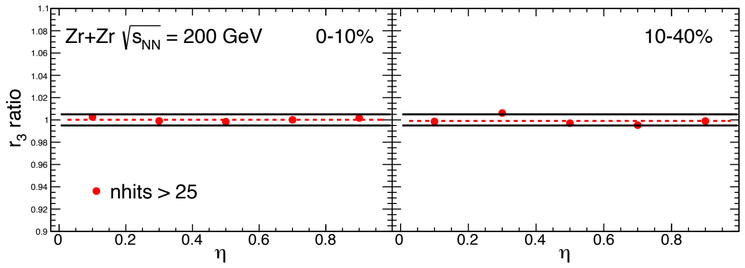
Systematic uncertainty

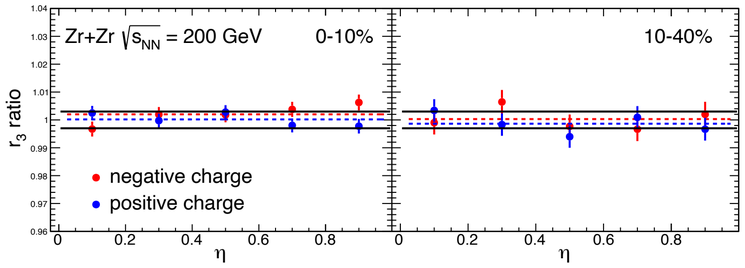


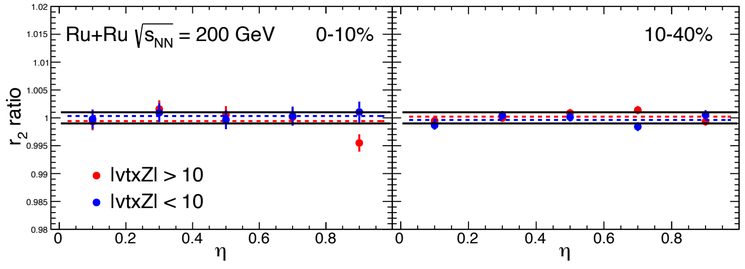


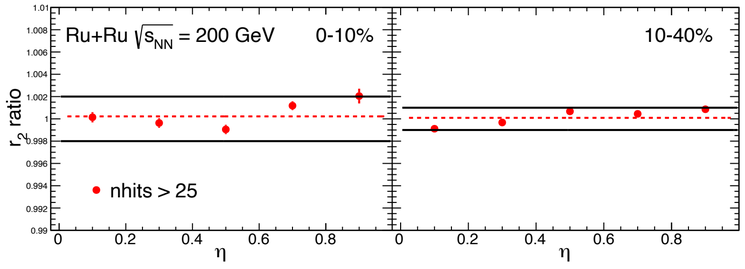


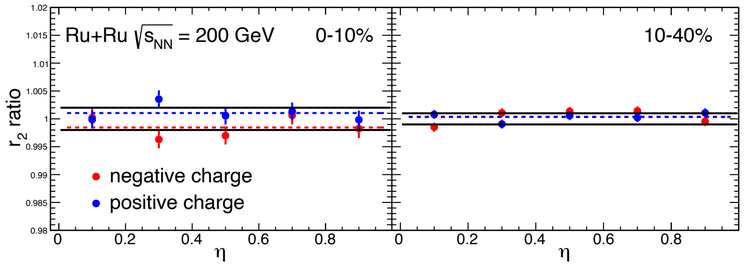


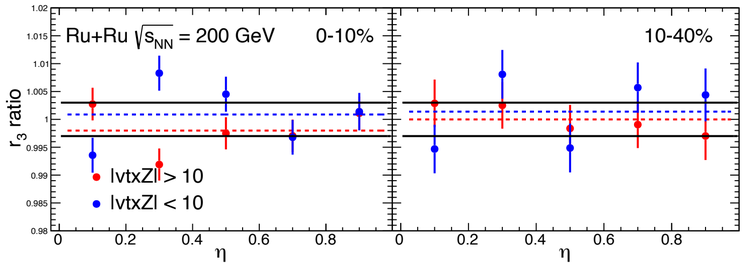


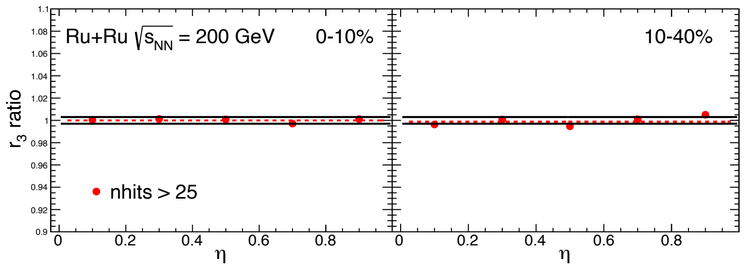


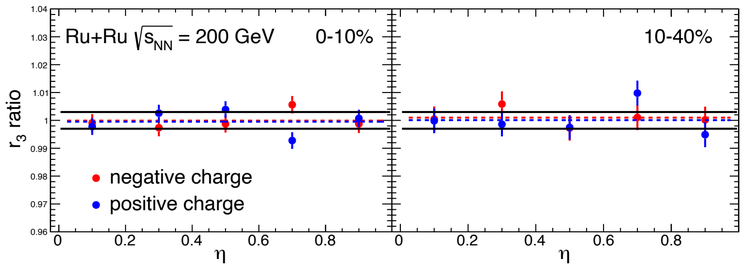




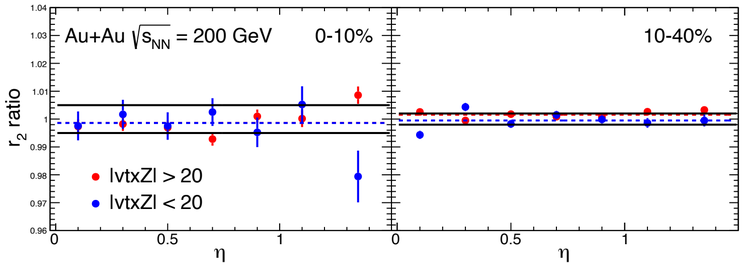


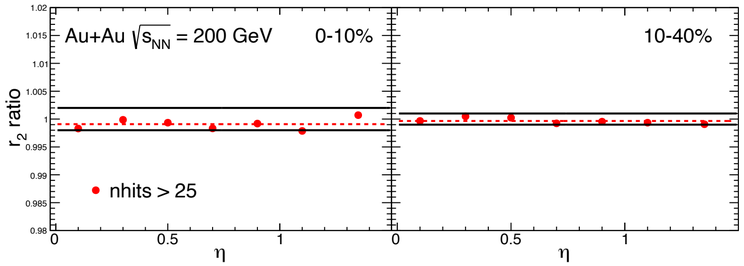


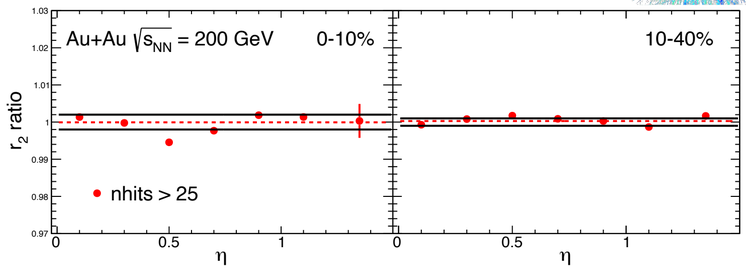


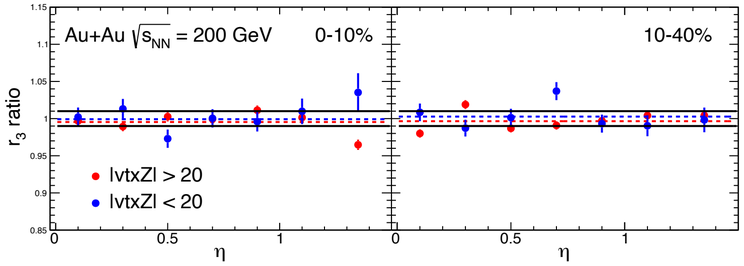


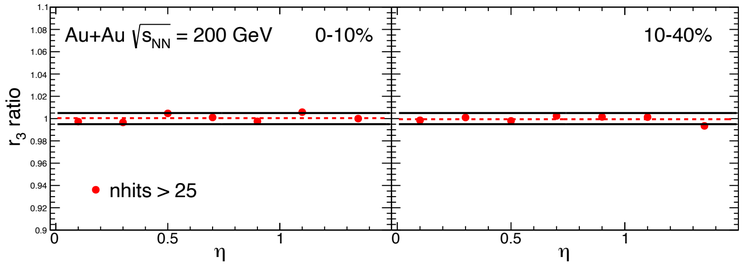
Systematic uncertainty

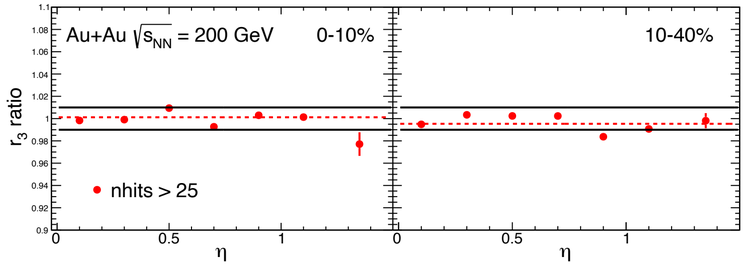


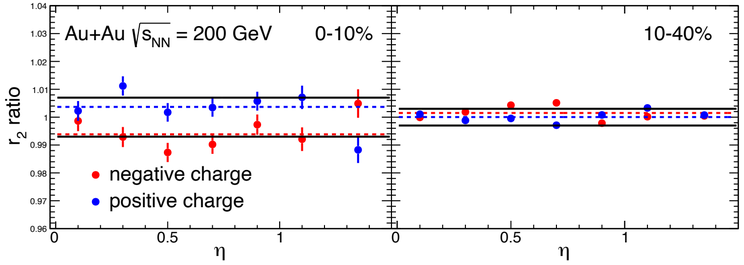


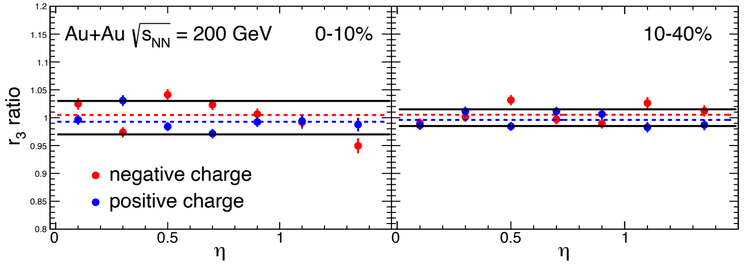




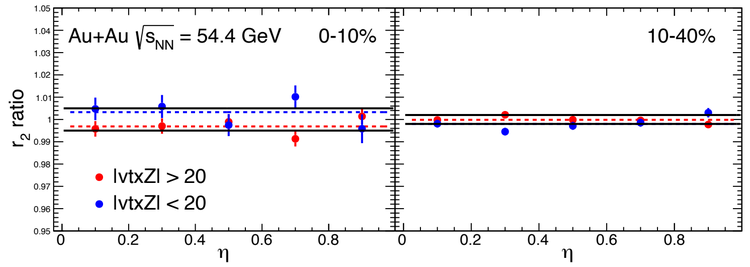


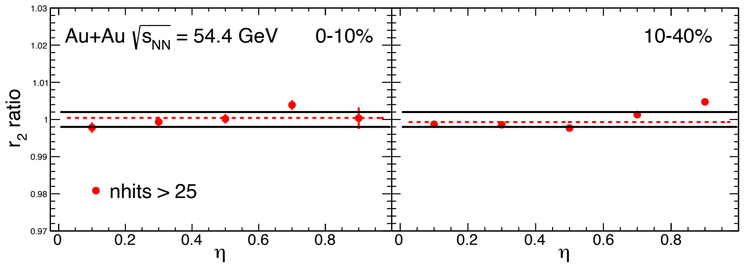


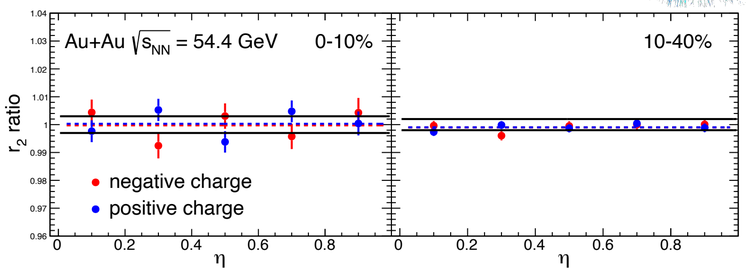


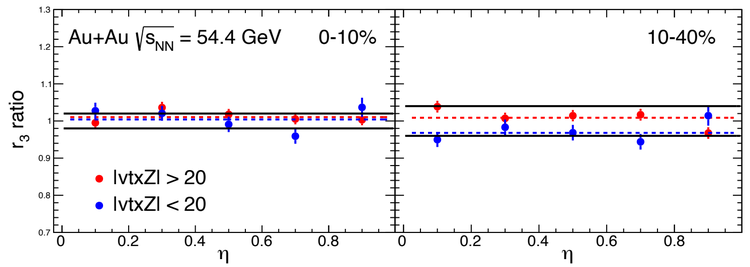


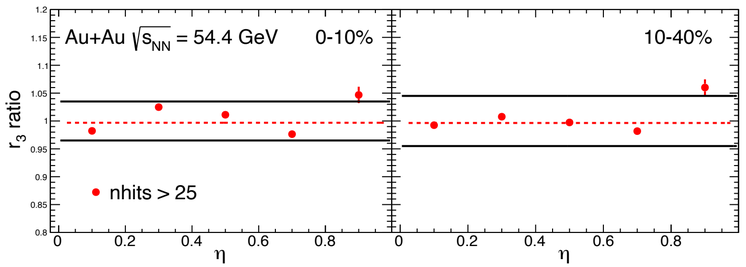
Systematic uncertainty

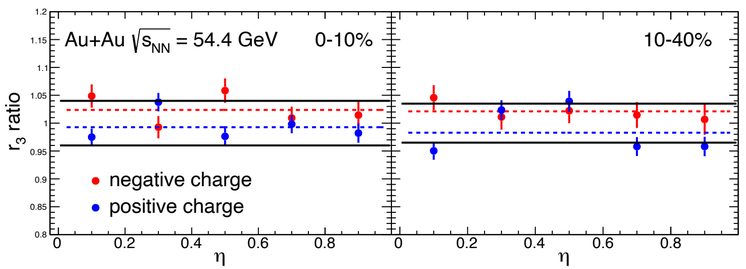


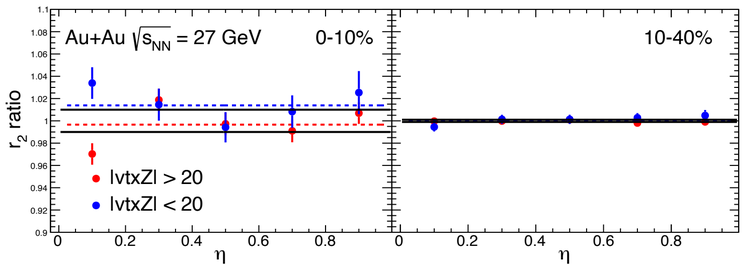


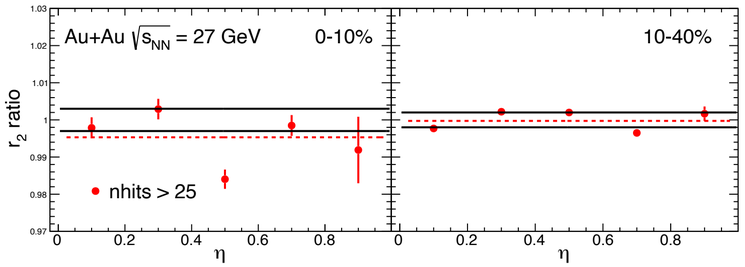


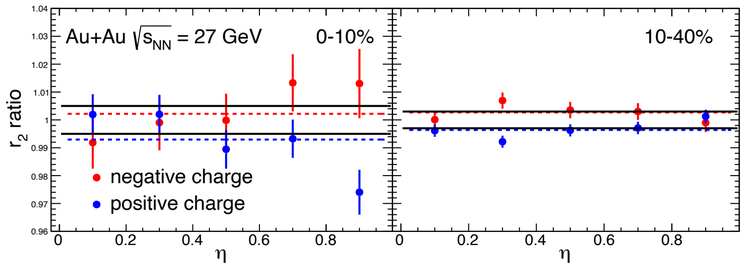


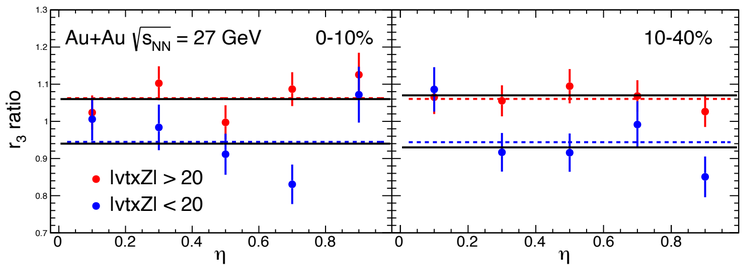


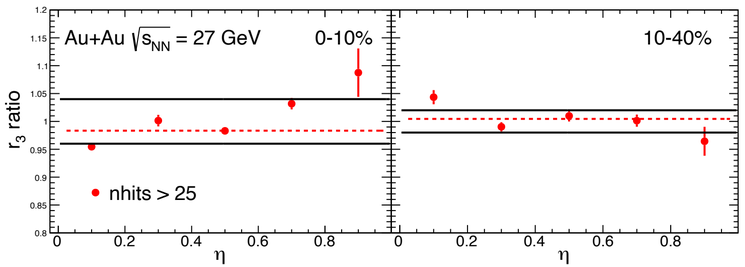


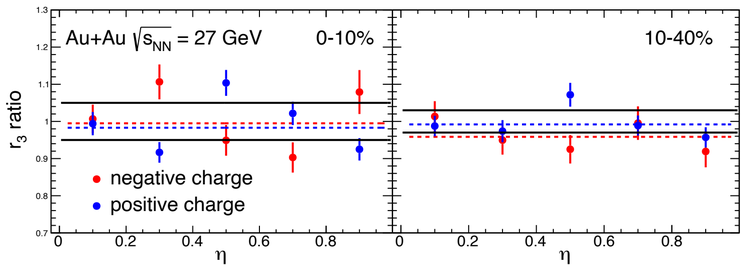




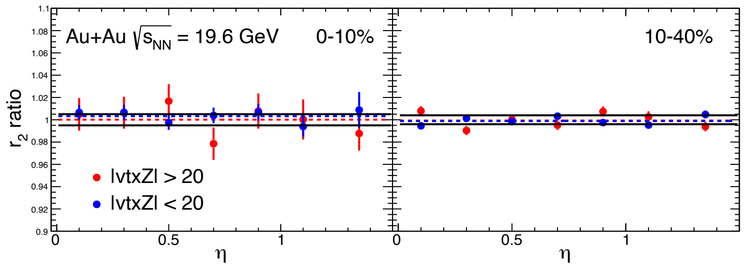


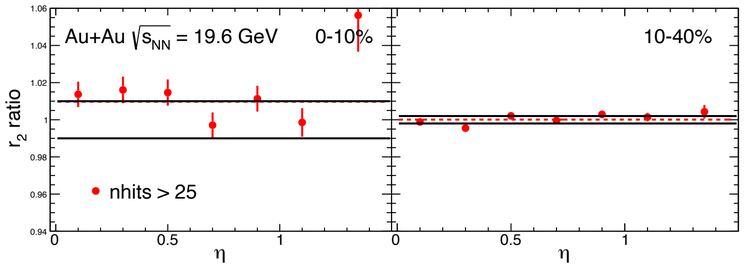


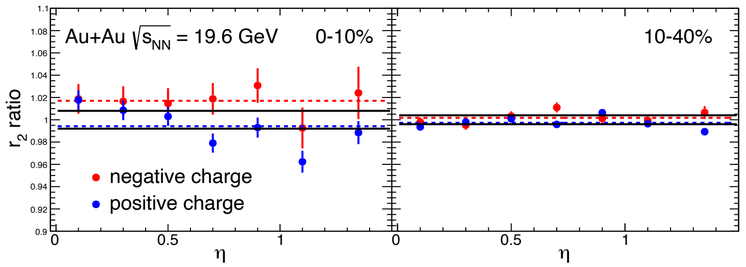


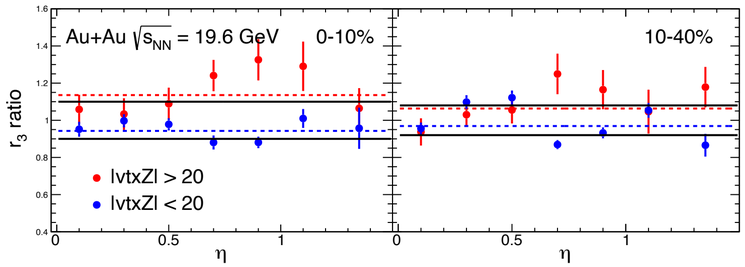


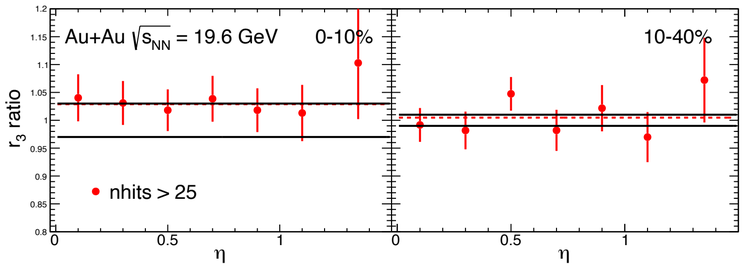
Systematic uncertainty

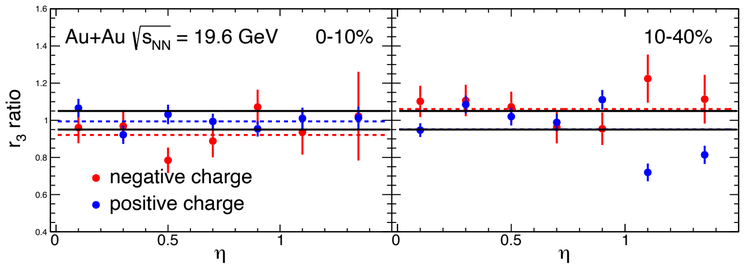












Systematic uncertainty for F_n

Systematic uncertainty

- For each cut variable (vertex z, nhits, charge), we choose the maximum ratio between default value and assume these sources are uncorrelated.

Relative error: $\sigma = \frac{F_n}{F_n^{default}}$ Total systematic uncertainty: $\sqrt{\sigma_{vtxz}^2 + \sigma_{nhits}^2 + \sigma_{charge}^2} * F_n(\eta)^{default}$

- Zr+Zr collisions at 200 GeV

cuts	default	var1	var2	0-10%		10-40%	
				F_2	F_3	F_2	F_3
vertex Z	(-35,25)	<10cm	>10cm	0.04	0.02	0.02	0.02
nhits	>15	>25		0.05	0.04	0.02	0.02
charge	All	<0	>0	0.10	0.02	0.02	0.02

- Ru+Ru collisions at 200 GeV

cuts	default	var1	var2	0-10%		10-40%	
				F_2	F_3	F_2	F_3
vertex Z	(-35,25)	<10cm	>10cm	0.04	0.02	0.02	0.02
nhits	>15	>25		0.05	0.04	0.02	0.02
charge	All	<0	>0	0.05	0.02	0.02	0.02

Systematic uncertainty

- Au+Au collisions at 200 GeV

cuts	default	var1	var2	0-10%		10-40%	
				F_2	F_3	F_2	F_3
vertex Z	<100cm	<20cm	>20cm	0.08	0.05	0.08	0.02
nhits	>15	>25		0.15	0.10	0.05	0.05
charge	All	<0	>0	0.02	0.02	0.03	0.02
nMip	$(0.3,2\sigma)$	$(0.3,\sigma)$		0.04	0.01	0.04	0.01

- Au+Au collisions at 54.4 GeV

cuts	default	var1	var2	0-10%		10-40%	
				F_2	F_3	F_2	F_3
vertex Z	<40cm	<20cm	>20cm	0.15	0.10	0.05	0.10
nhits	>15	>25		0.10	0.08	0.05	0.08
charge	All	<0	>0	0.10	0.06	0.05	0.06

Systematic uncertainty

- Au+Au collisions at 27 GeV

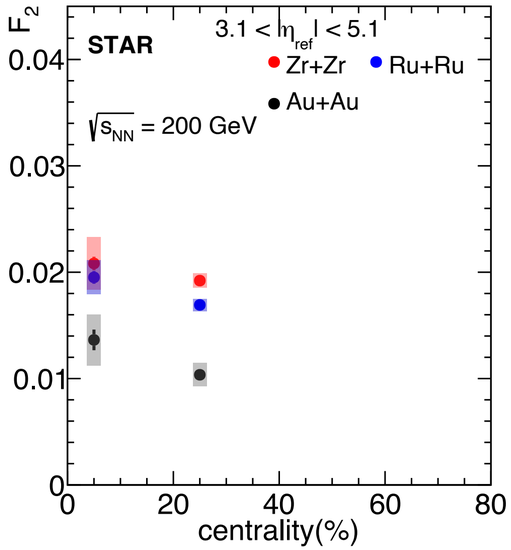
cuts	default	var1	var2	0-10%		10-40%	
				F_2	F_3	F_2	F_3
vertex Z	<60cm	<20cm	>20cm	0.20	0.20	0.05	0.20
nhits	>15	>25		0.20	0.05	0.05	0.05
charge	All	<0	>0	0.15	0.03	0.02	0.03

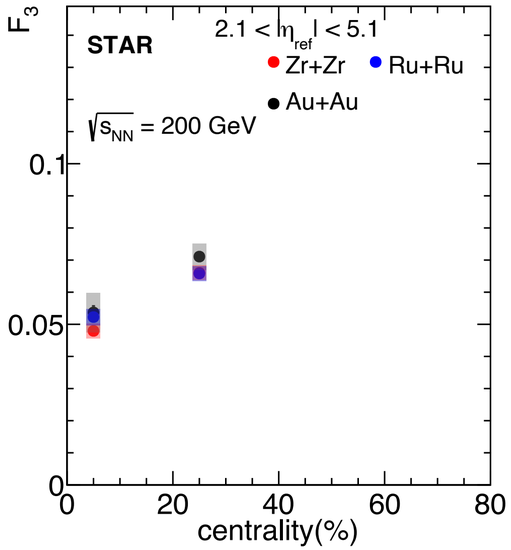
- Au+Au collisions at 19.6 GeV

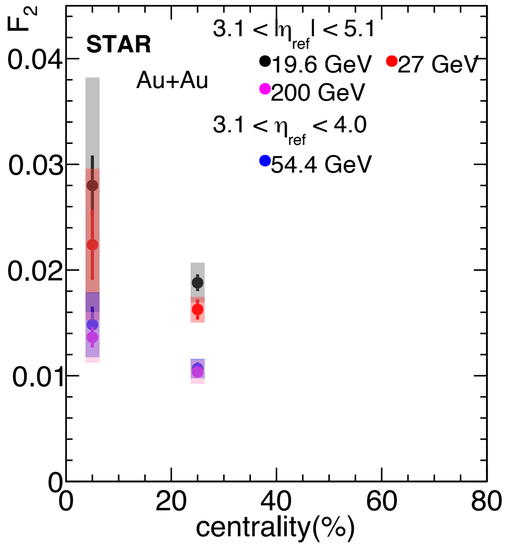
cuts	default	var1	var2	0-10%		10-40%	
				F_2	F_3	F_2	F_3
vertex Z	<145cm	<20cm	>20cm	0.05	0.20	0.03	0.10
nhits	>15	>25		0.30	0.10	0.08	0.08
charge	All	<0	>0	0.20	0.05	0.05	0.02

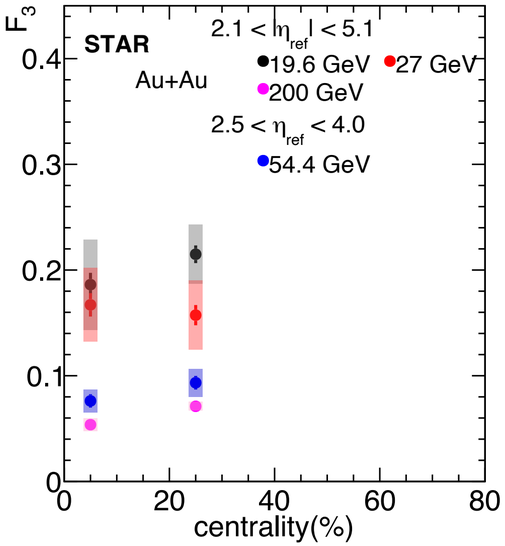
Fn

Estimating systematic error on F_n from r_n vs eta in each of cut variations









Estimating systematic error on F_n by fitting r_n vs eta with systematic errors