Diffractive EM Jet A_N at FMS with run 15 data updates and preliminary request

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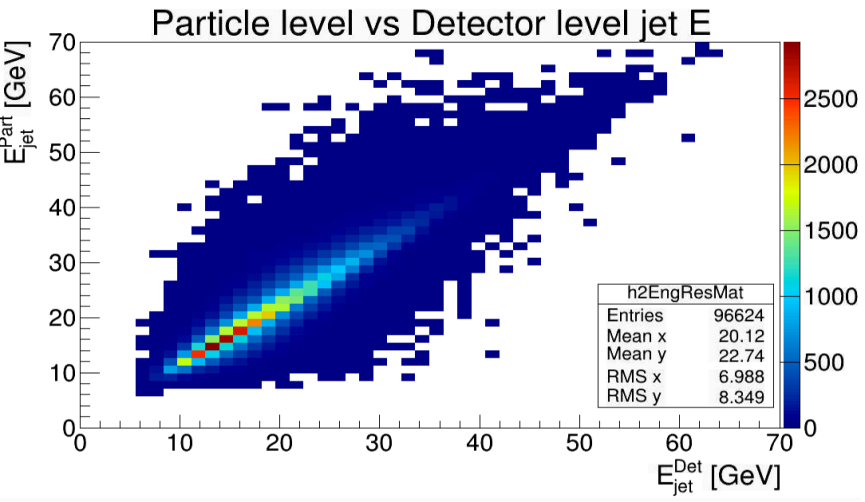
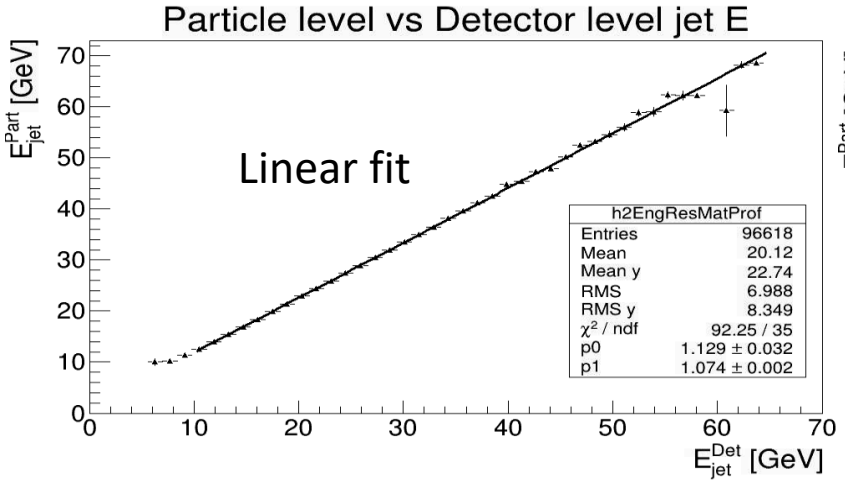
Outline

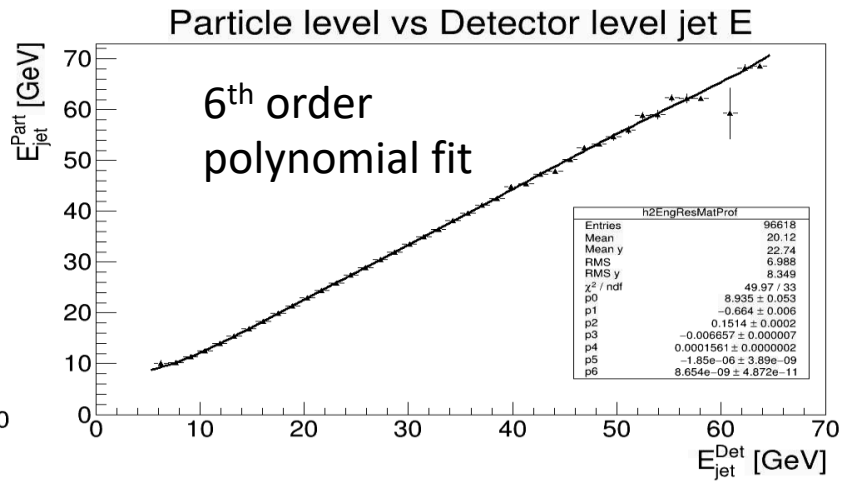
- Systematic uncertainty study
- Preliminary request

Apply energy correlation from simulation

- Detector level to particle level EM jet energy correlation from simulation.
  - Use 6th order polynomial to fit range [5,65] GeV, but apply [5, 10] GeV into correction.
  - Use linear fit for range [10, 65] GeV, but apply [10, 65] GeV into correction

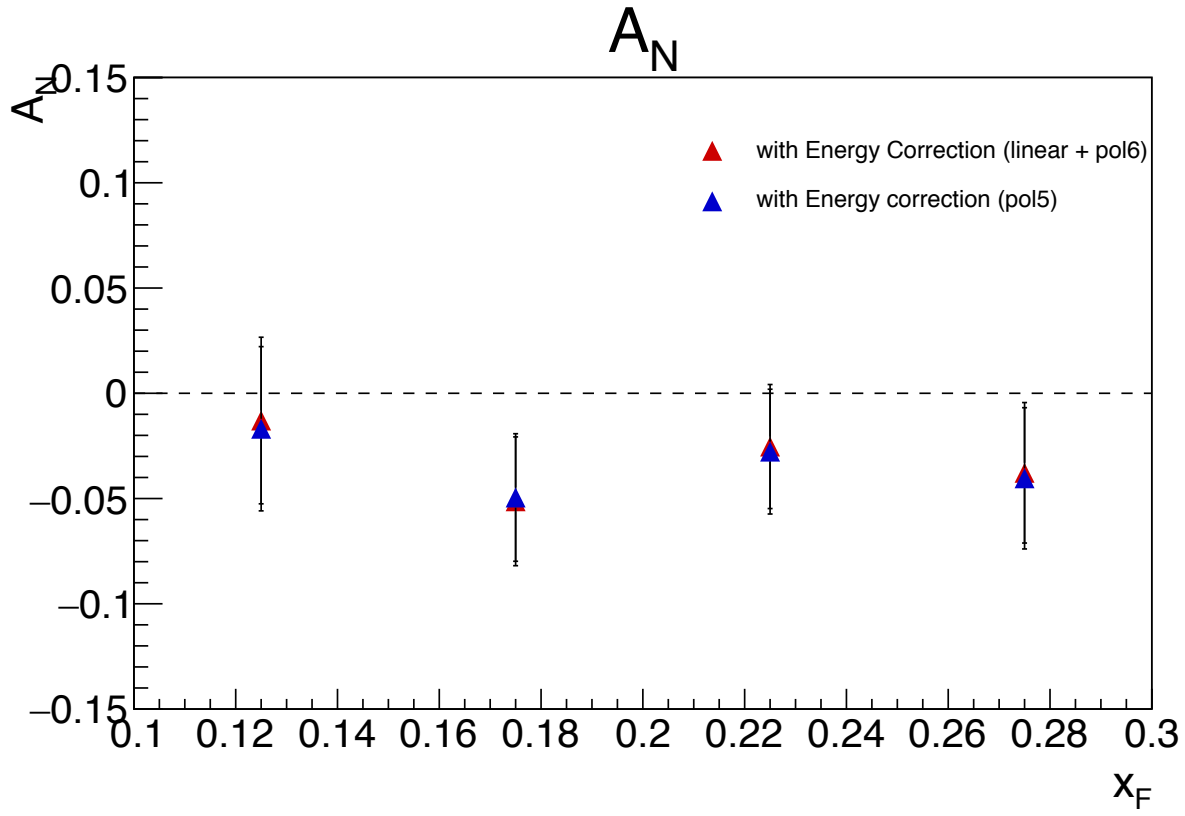






Energy correction uncertainty study

- Change energy correction function to 5th order polynomial for systematic uncertainty study for this time.



EM jet energy uncertainty

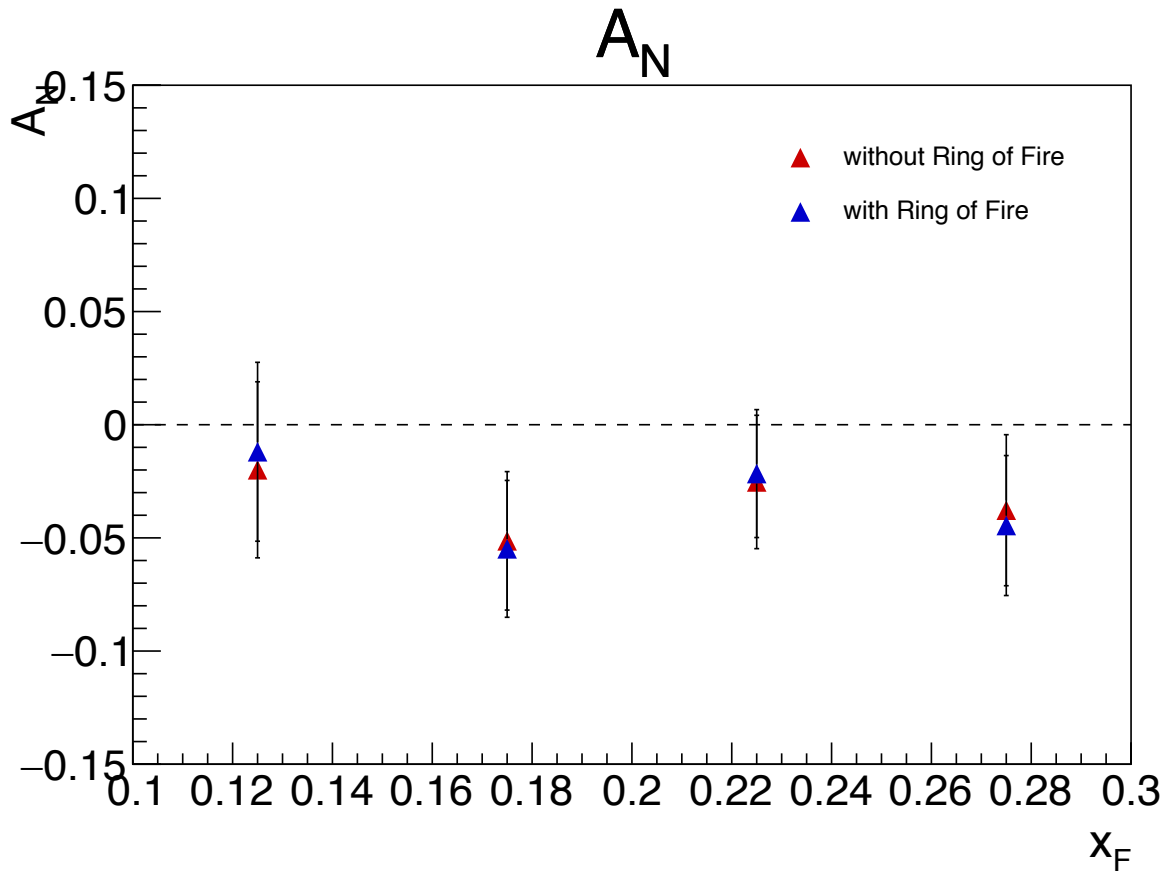
- $\sigma_E = C \oplus R \oplus E$
  - C: Calibration uncertainty (2.5%)[1]
  - R: Radiation damage and non-linear response uncertainty (0.5%)[1]
  - E: Energy resolution and correction uncertainty (separate by different x_F bins)

After Energy correction x_F range	EM jet Energy uncertainty (%)	x_F uncertainty
0.1- 0.15	15.64%	0.0196
0.15 - 0.2	4.34%	0.0076
0.2- 0.25	9.89%	0.0223
0.25 - 0.3	7.41%	0.0204

[1] Z. Zhu , Measurement of Transverse Single Spin Asymmetry for pi0 at Forward Direction in 200 and 500 GeV Polarized Proton-Proton Collisions at RHIC-STAR

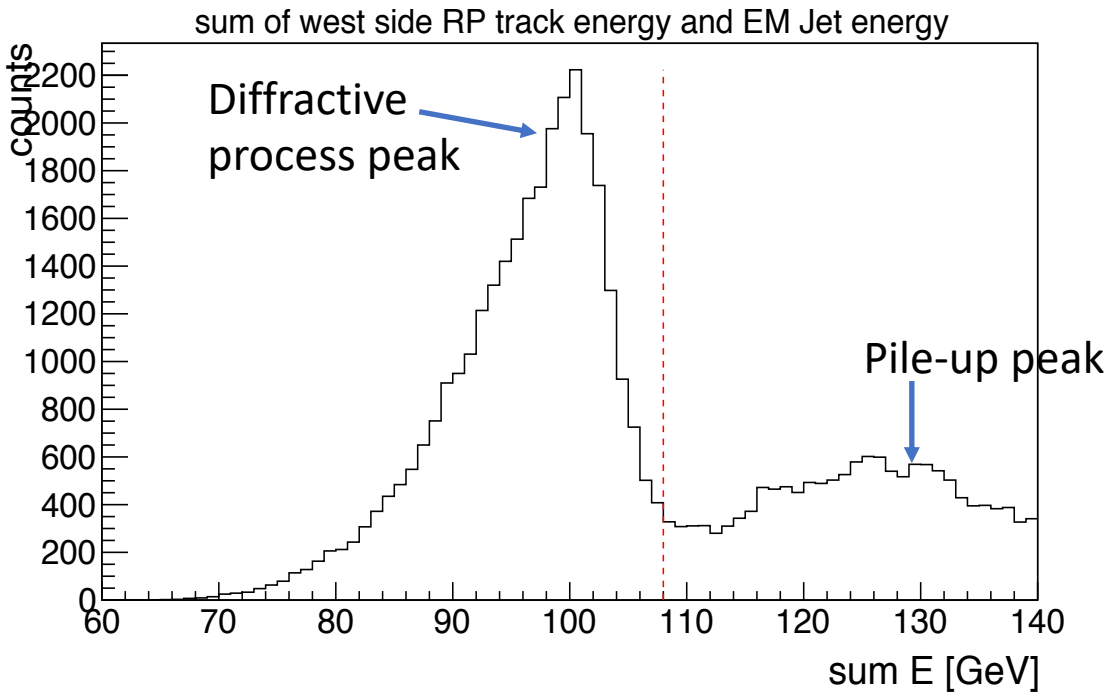
Systematic uncertainty (Ring of fire)

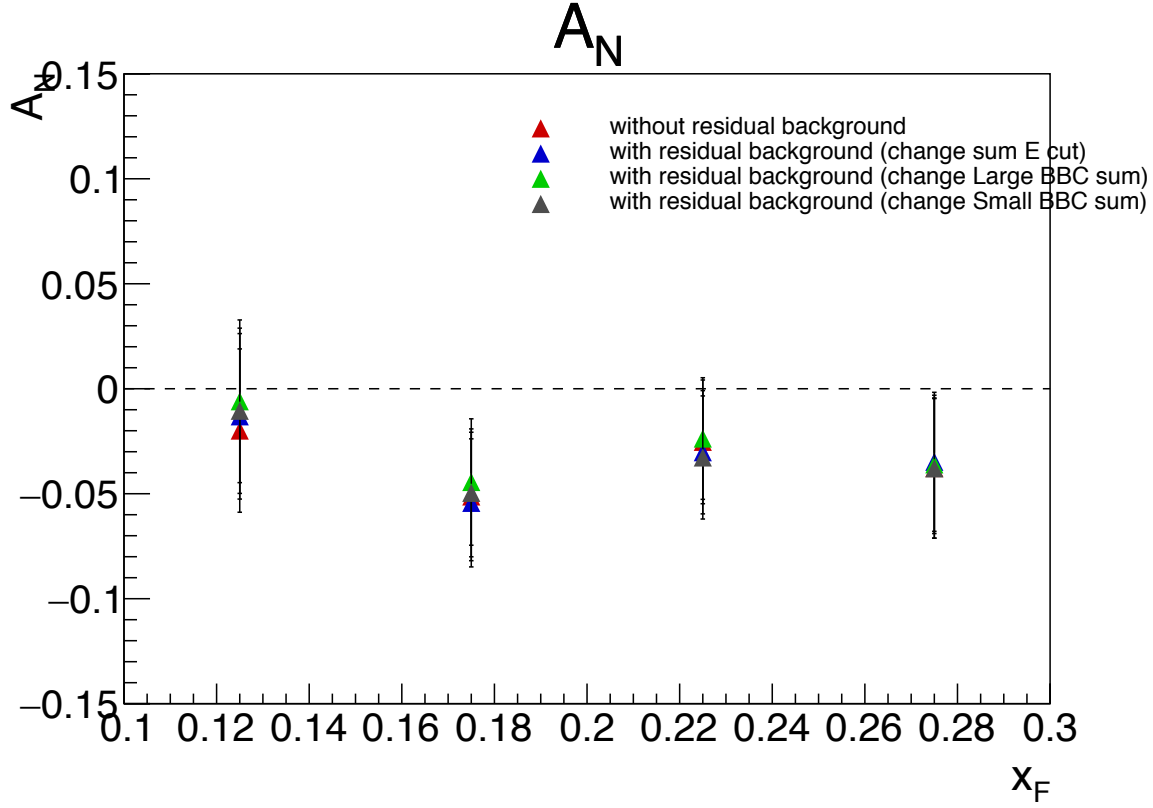
- Ring of fire
  - Trigger: fms-sm-bs3
- Compare by with and without such trigger.



Systematic uncertainty (residual background effect)

- Systematic uncertainties for residual background effect mainly come from the cut for selecting signal from background.
  - Energy sum cut: change 108 GeV to 110 GeV
  - Small BBC ADC sum cut: change 100 to 105
  - Large BBC ADC sum cut: change 60 to 65





Polarization uncertainty

- $\sigma(P_{set}) = P_{set} \cdot \frac{\sigma(scale)}{P} \oplus \sigma_{set}(fill\ to\ fill) \oplus P_{set} \cdot \frac{\sigma(profile)}{P}$
- $\frac{\sigma(scale)}{P} = 3\%$ [1]
- $\frac{\sigma(profile)}{P} = \frac{2.2\%}{\sqrt{M}} = 0.3\ \%$ [1]
- $\sigma^2{}_{set}(fill\ to\ fill) = (1 - \frac{M}{N}) \frac{\sum_{fill} {L_{fill}}^2 \sigma^2(P_{fill})}{(\sum_{fill} L_{fill})^2}$
  - $\sigma_{set}(fill\ to\ fill)$ = 0.3%
  - $\sigma(P_{fill}) = \sigma(P_0) \oplus \sigma(\frac{dP}{dt})(\frac{\sum_{run} t_{run} L_{run}}{L_{fill}} - t_0) \oplus \frac{\sigma(fill\ to\ fill)}{P} P_{fill}$ [2]

Close to 0

- so $\sigma(P_{set}) = 3.0\%$

[1] W. B. Schmidke, RHIC polarization for Runs 9-17

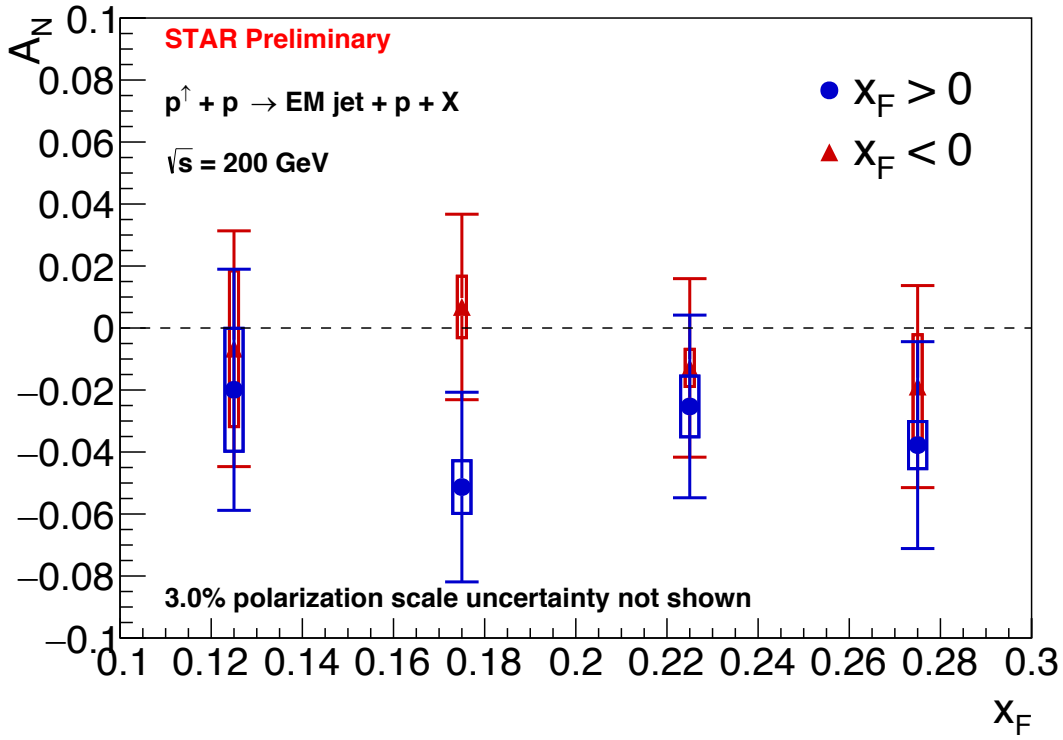
[2] Z. Chang Example calculation of fill-to-fill polarization uncertainties

Summary for systematic uncertainty

- Systematic uncertainty mainly come from energy uncertainty, Ring of fire background, residual background.
  - Analyze separately by different x_F bins.
  - Energy uncertainty is accounted into x-axis (x_F, not shown in the preliminary plot)
  - Background uncertainties are accounted into y-axis (A_N, shown in the preliminary plot)
- The underlying events correction is not considered.
- Polarization uncertainty (3.0%) seems reasonable.

Preliminary request plot

- Diffractive EM jet A_N for run 15 FMS data.
- Statistics error and systematic error (in box) uncertainty are included for polarized and unpolarized beam A_N.
- Blue beam A_N is relatively large (blue points), but with negative value. Yellow beam A_N is close to 0 (red points).



Preliminary request page

- Drupal page for preliminary request: https://drupal.star.bnl.gov/STAR/blog/liangxl/Run-15-diffractive-EM-jet-preliminary-request-0

Back up

Total uncertainty table

Types of uncertainty x_F ranges	Ring of fire	Residual background effect	Summary
x_F:[0.1, 0.15]	40.01%	91.12%	99.51%
x_F:[0.15, 0.2]	6.91%	15.06%	16.57%
x_F:[0.2, 0.25]	14.66%	35.86%	38.73%
x_F:[0.25, 0.3]	17.94%	9.13%	20.13%