Update on EM Jet A_N with FMS and EEMC

Using Run 15 Dataset

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November 18, 2020

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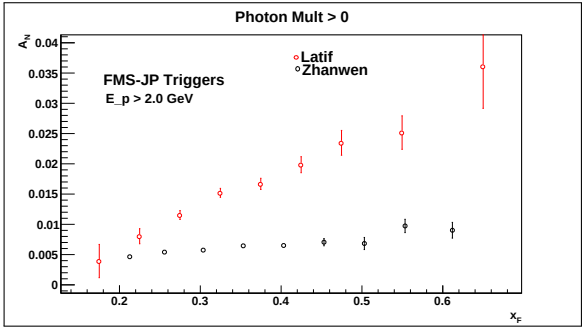
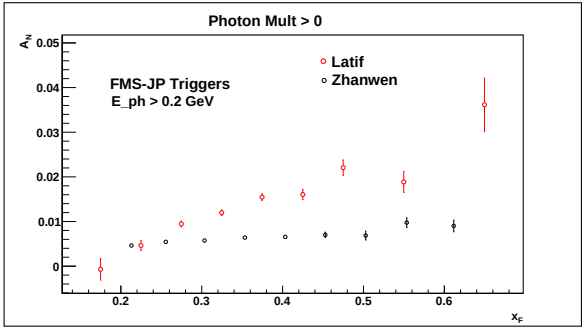
Outline

- Follow-up from last presentation
- Further consistency checks for FMS EM-Jet A_N Extraction

Comparing With Zhanwen's Results





- Used only FMS-JP triggers for the comparison
- Multiple major issues reported with Zhanwen's result
- Zhanwen's results currently going through a revision
- Revised results are likely to have a good comparison between them

EM Jet A_N Calculations

- Use Cross-ratio formula to calculate A_N.

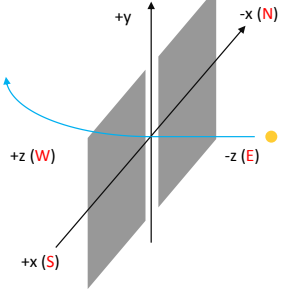
$$\epsilon = A_N \times P \times \cos(\phi) \Rightarrow \epsilon = p0 \times \cos(\phi) + p1$$

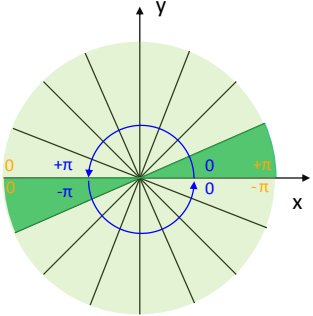
$$\epsilon \approx \frac{\sqrt{N_{\phi}^{\uparrow} N_{\phi+\pi}^{\downarrow}} - \sqrt{N_{\phi+\pi}^{\uparrow} N_{\phi}^{\downarrow}}}{\sqrt{N_{\phi}^{\uparrow} N_{\phi+\pi}^{\downarrow}} + \sqrt{N_{\phi+\pi}^{\uparrow} N_{\phi}^{\downarrow}}}$$

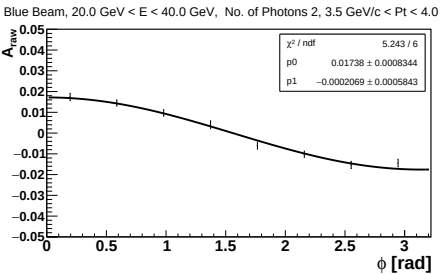
For yellow beam:

$\phi_y = \pi - \phi$ $(if \phi >= 0)$

$\phi_y = -\pi - \phi$ $(if \phi < 0)$

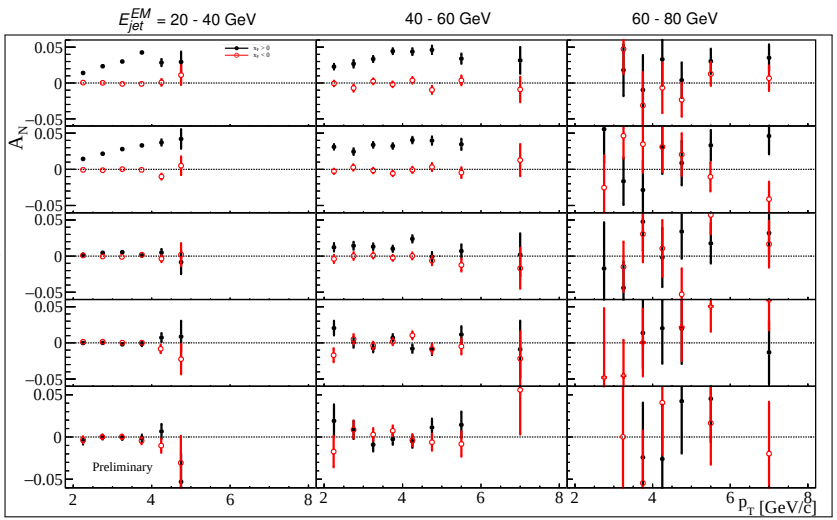






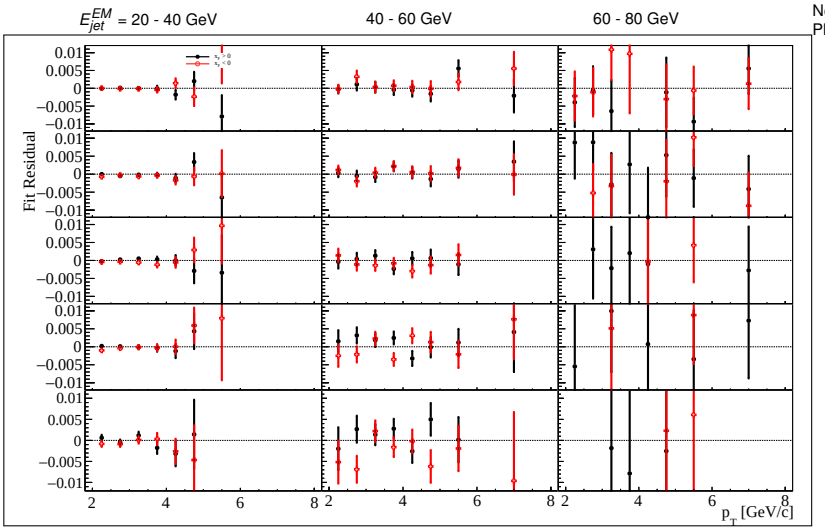
FMS EM-Jet A_N

- Small BS, Large BS and FMS-JP Triggers except Small BS3
- Anti-k_T with R = 0.7
- $E_\gamma > 2.0$ GeV
- Jet $p_T > 2.0$ GeV/c
- Trigger dependent p_T cut
- Error bars statistical only

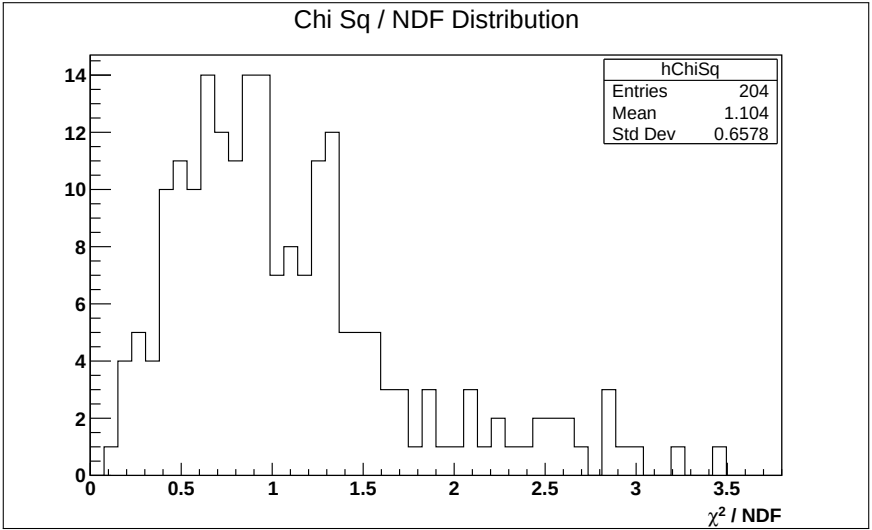


FMS EM-Jet Fit Residual

- p1 (fit residual) from the fit
  $\epsilon = p0 \times \cos(\phi) + p1$
- Small BS, Large BS and FMS-JP Triggers except Small BS3



χ^2/NDF distribution from the fit $\epsilon = p0 \times \cos(\phi) + p1$



A_N Using Usual Asymmetry Formula

$$N^{\uparrow} = I_0^{\uparrow}\epsilon(1 + PA_N \cos\phi)$$

$$N^{\downarrow} = I_0^{\downarrow}\epsilon(1 - PA_N \cos\phi)$$

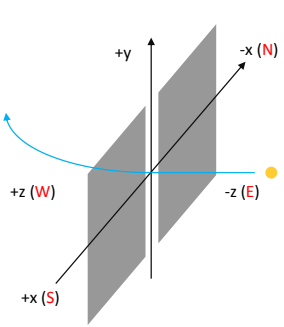
$$A(\phi) = \frac{N^{\uparrow} - N^{\downarrow}}{N^{\uparrow} + N^{\downarrow}} \approx PA_N \cos\phi + \frac{I_0^{\uparrow} - I_0^{\downarrow}}{I_0^{\uparrow} + I_0^{\downarrow}}$$

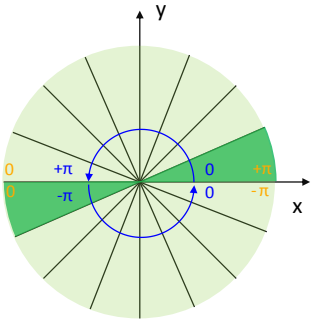
$$A(\phi) + A(\phi + \pi) \approx 2\frac{I_0^{\uparrow} - I_0^{\downarrow}}{I_0^{\uparrow} + I_0^{\downarrow}}$$

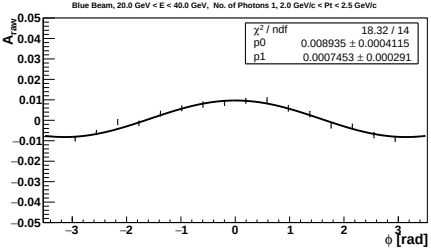
EM Jet A_N Calculations Using Usual Asymmetry Formal

- Use usual asymmetry formula to calculate A_N.

$$A(\phi) = \frac{N^{\uparrow}(\phi) - N^{\downarrow}(\phi)}{N^{\uparrow}(\phi) + N^{\downarrow}(\phi)} = p_1 + PA_N \times \cos(\phi)$$







FMS EM-Jet A_N Using Usual Asymmetry Formula

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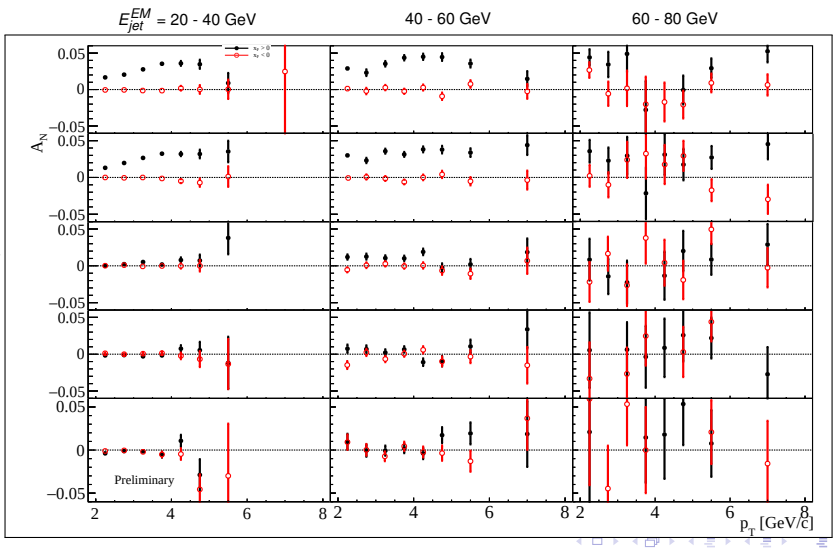
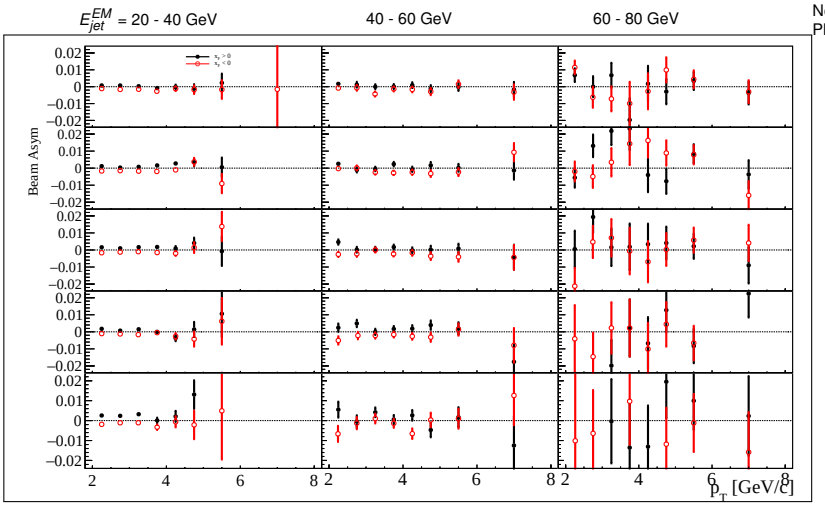


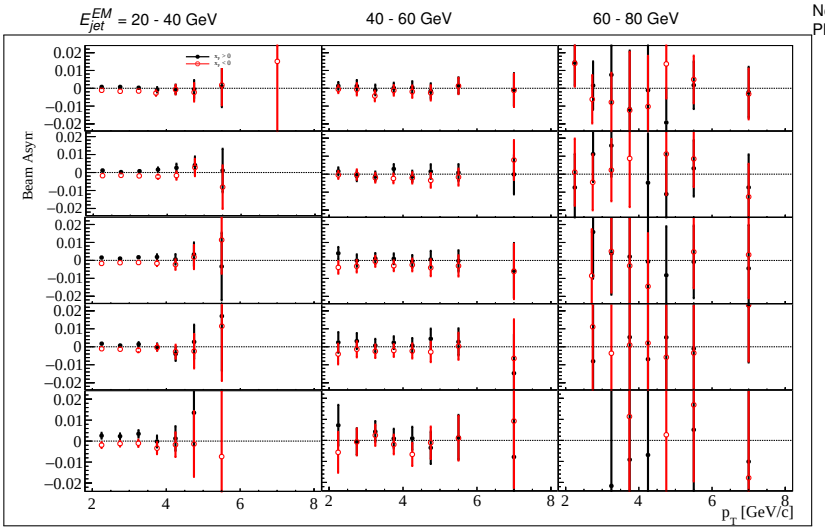
Beam Asymmetry

- p1 (beam asymmetry) from the fit $\epsilon = p0 \times \cos(\phi) + p1$
- Small BS, Large BS and FMS-JP Triggers except Small BS3



Beam Asymmetry Using Sum of Asymmetries

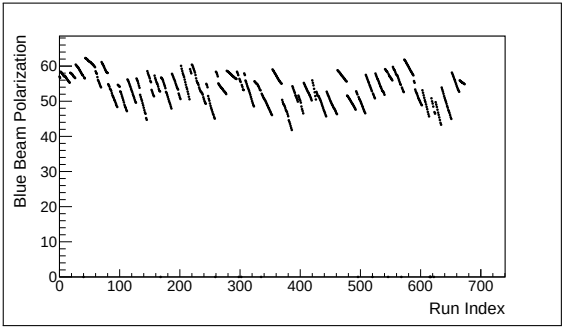
- Beam asymmetry from A(ϕ) + A($\phi + \pi$)

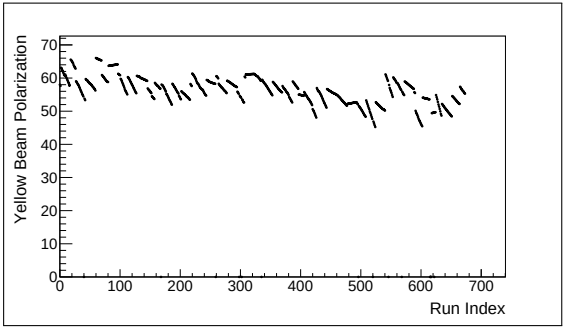


Beam Polarization Calculation

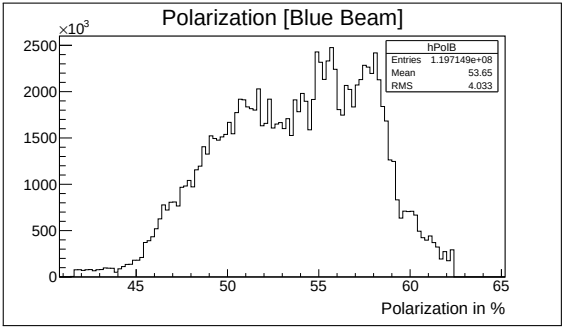
- Calculate P for an event: $P(t) = P_0 + \frac{dP}{dt}t$
  Use $t = (t_{event} - t_0)$
  t_{event} = event time from MuDST
  t_0 = start time for the fill (from spin group table).
- Calculate for every event accepted
- Take the average over the entire dataset.
- Following this approach:
  - Blue beam <P> = 53.65 %
  - Yellow beam <P> = 56.14%

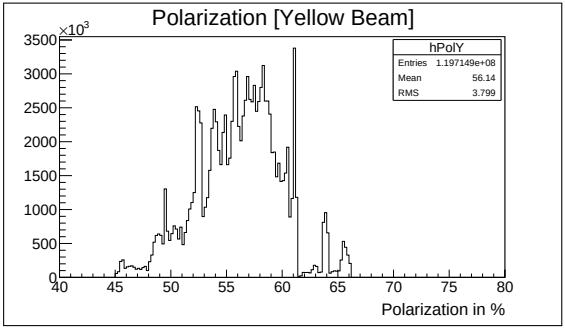
Beam Polarization By Run





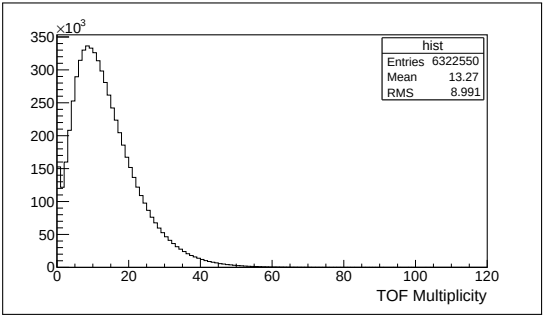
Beam Polarization For Entire Dataset

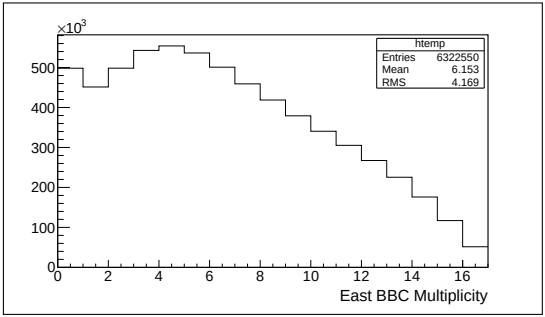




Beam background / Ring of Fire Studies

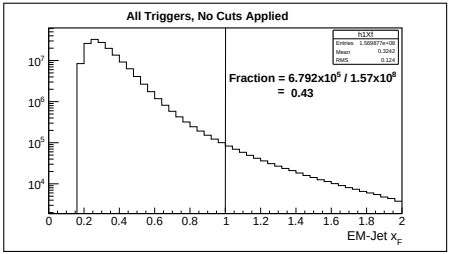
Ring of Fire Studies

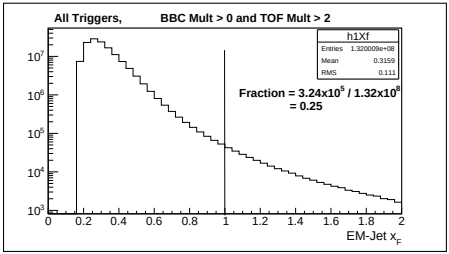


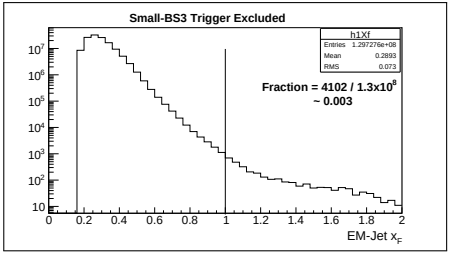


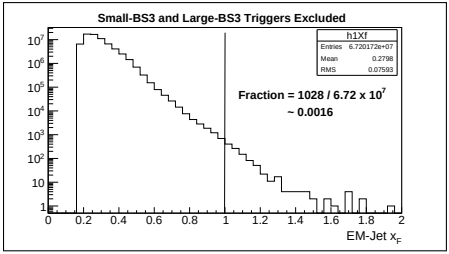
- Cuts to minimize ring of fire:
  - BBC Multiplicity > 0
  - TOF Multiplicity > 2

Effects of different cuts on ring of fire









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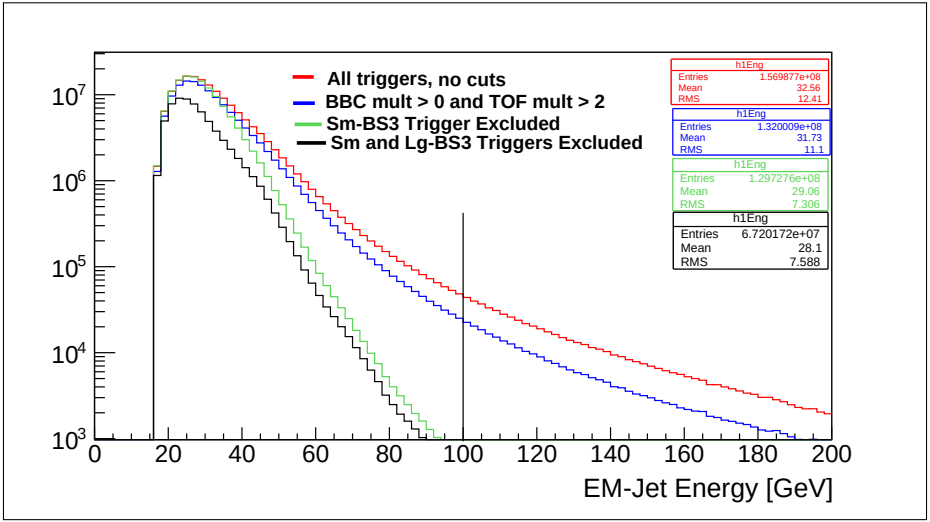

Summary

- FMS EM-Jet A_N seems consistent across different approaches
- Working to check if Small-BS3 trigger can be included
- Planning to exclude charged particle tracks from EEMC EM-Jet A_N

Backup Slides

FMS Trigger Counts For EM-Jets