

Diffractive $\pi^0 A_N$ with FMS and EEMC

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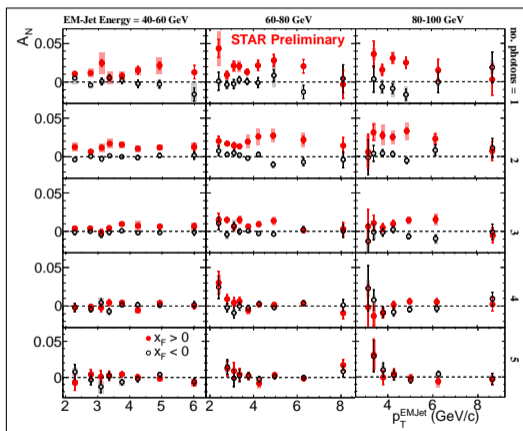
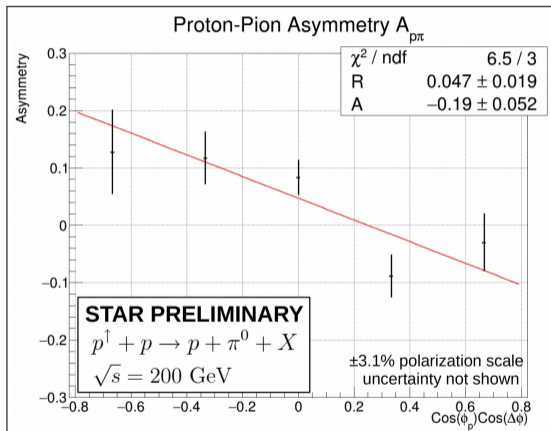
December 9, 2019



Outline

- 1 Diffractive π^0 and EM-Jet analysis
- 2 Diffractive $\pi^0 A_N$ using FMS and EEMC
- 3 FMS-RP event selections and correlations
- 4 EEMC-RP event selections and correlations

Previous Work at STAR

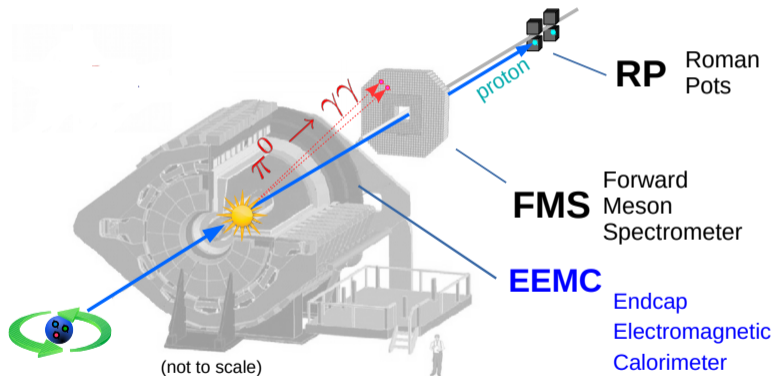


- Work presented at DIS 2019 by Chris Dilks
- Used run#15 FMS + RP data

- Work presented at DIS 2014 by Mriganka
- Used run#11 FMS data

This Analysis

- $p^\uparrow + p \rightarrow p + \pi^0 + X$
- $p^\uparrow + p \rightarrow p + \text{EM-jet} + X \Rightarrow \text{Chong}$
- Dataset:
 - Run 15(200 GeV pp trans)
 - Run 17(500 GeV pp trans).
- Take advantage of EEMC, FMS and RP.
 - Proton in RP
 - Pion/EM-jet in FMS or EEMC
- Extract A_N

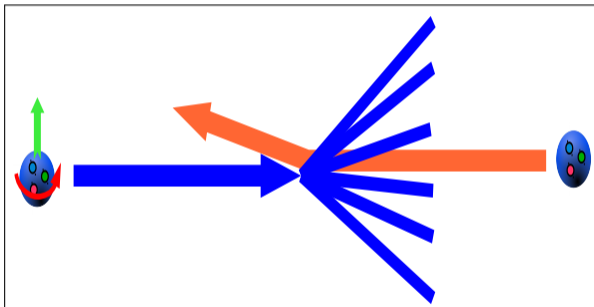


*image from C. Dilks

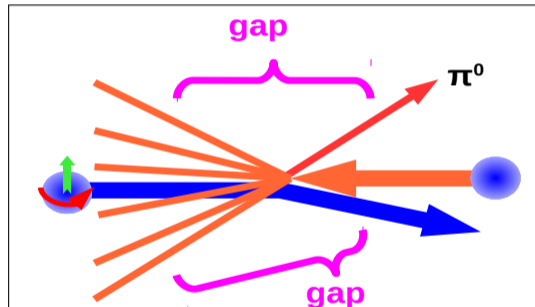
Diffractive $\pi^0 A_N$ using FMS and EEMC

Two Possible Channels for Single Diffractive Pion Production

$$p^\uparrow + p \rightarrow p + \pi^0 + X$$



- Polarized proton breaks up.
- One of the decay products is pion.
- Challenges: Background



- Unpolarized proton breaks up.
- Energy conservation resolves background issue.

◀ ▶ ◀ ▶ *cartoon by C. Dilks

FMS-RP event selections and correlations

FMS-RP Correlation: Triggers and Data

Trigger Definition for FMS-sm-bs1 (480841:853-845): (sample run = 16090039)

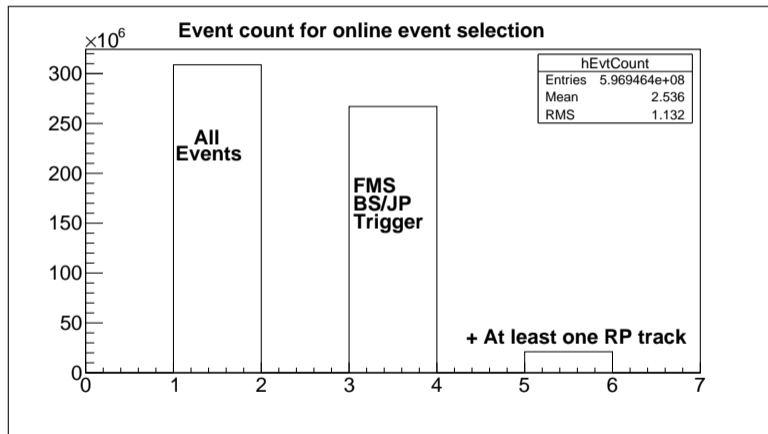
[Show History](#)

		Detector bits (detector live / detector fired)														Condition 1					or	Condition 2					or	Condition 3					or	Condition 4					L2
		SST	pp2pp	ETOW	BTOW	BSMD	TOF	ESMD	TPX	PXL	IST	unknown	unknown	unknown	unknown	GMT	MTD						or						or										
FMS-sm-bs1	0/-	0/-	+/+	+/+	0/-	+/+	+/+	0/-	0/-	0/-	0/-	0/-	0/-	0/-	0/-	0/-	0/-	FMSsmall-BS1(82)	+																Accept				
																		Laser-protection(96)	-																				

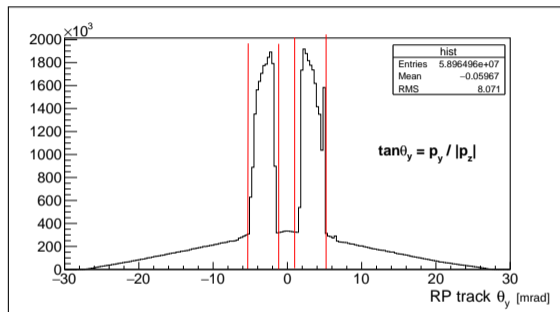
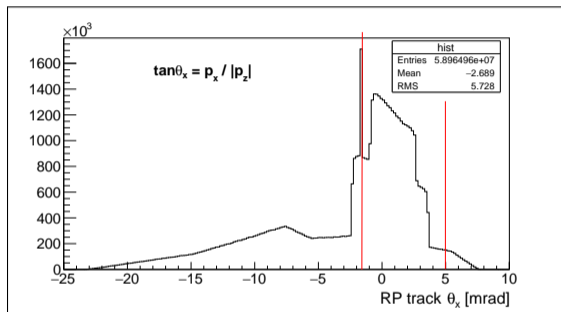
L1 algorithm: Accept

- **Triggers:** OR of FMS-small-BS, FMS-large-BS and FMS-JP triggers
- pp2pp status is actually "0/+" in the above table → Need to consider implications of RP dead time
- **Data-stream:** FMS-stream and **Calibration:** UCR (By Chong)

FMS-RP Data: Primary Event Selection



Event Selection for FMS-RP Data

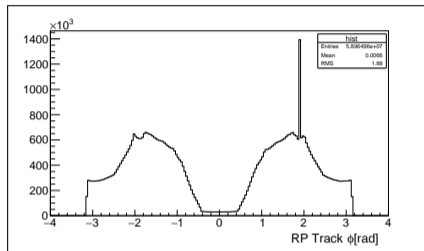
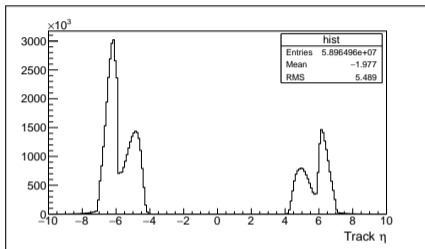


- Acceptance cut using polar angles:
 $-1.5 < \theta_x < 5.0$ mrad
 $1.0 < \theta_y < 5.5$ mrad

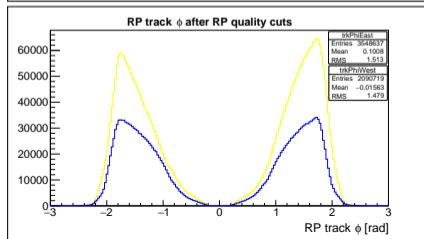
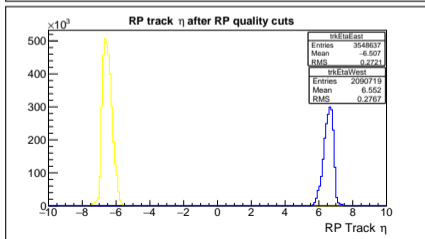
Event Selection for FMS-RP Data: Track Quality Cut

- 2 track points in a single branch: Global track.
- Planes cut: At least 7 SSD planes hits

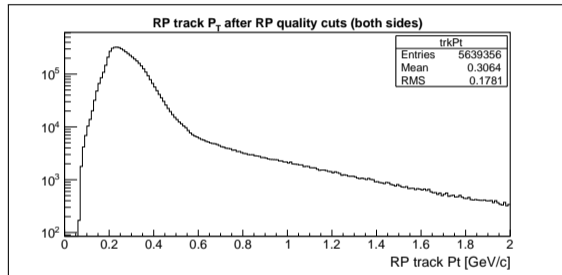
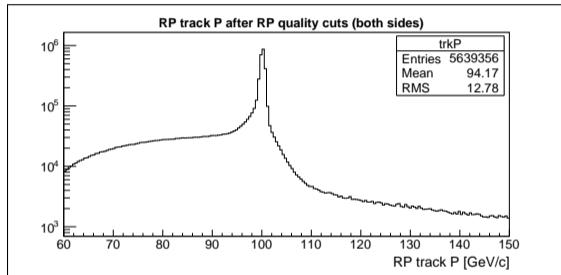
Before
RP cut \Rightarrow



After
RP cut \Rightarrow



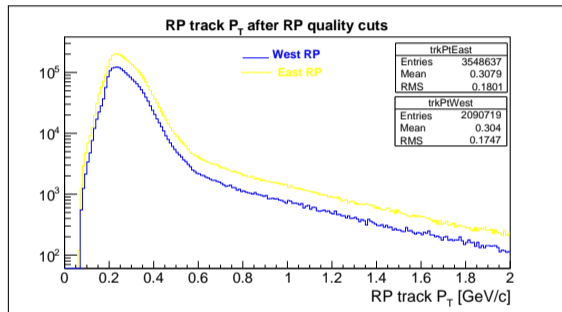
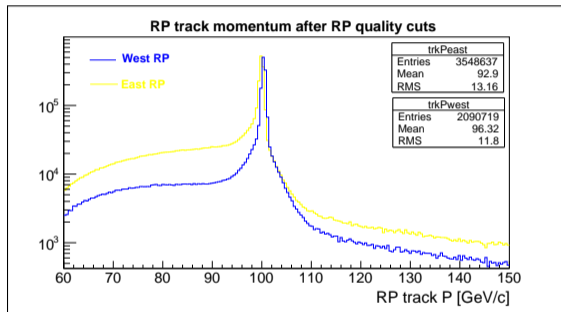
FMS-RP Data: After RP Cut



Cuts Applied:

- RP Cut

FMS-RP Data: After RP Cut

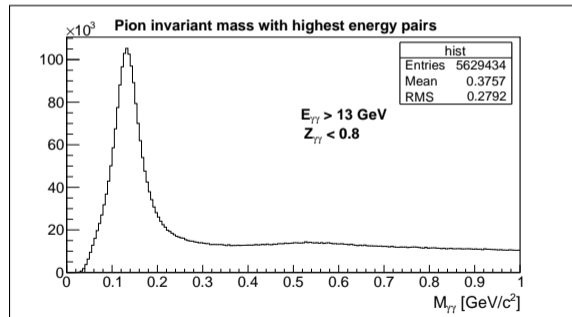
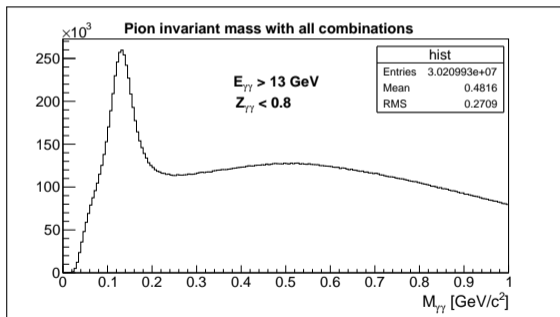


Cuts Applied:

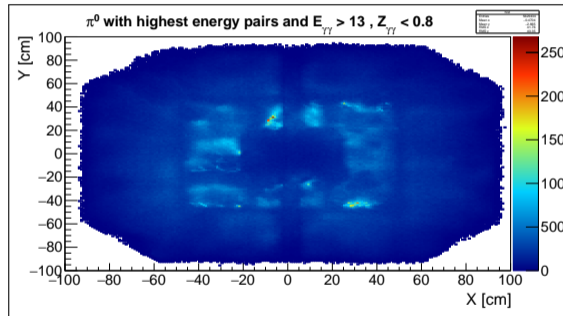
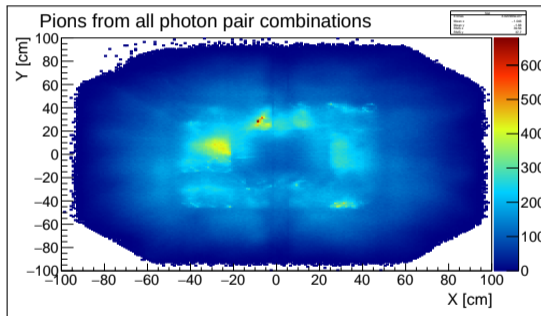
- RP track quality cuts

Event Selection for FMS-RP Data: FMS Cut

- $13 < E_{\gamma\gamma} < 70$ GeV and $Z_{\gamma\gamma} < 0.8$
- Highest energy photon pairs

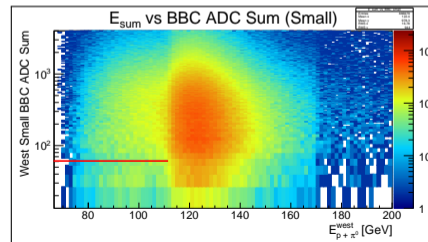
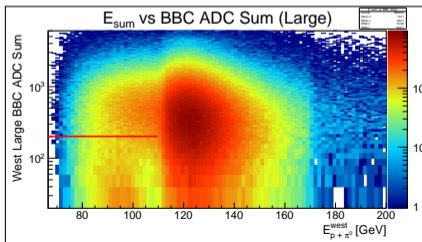
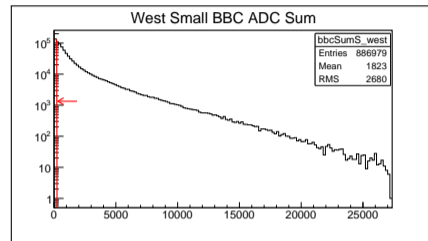
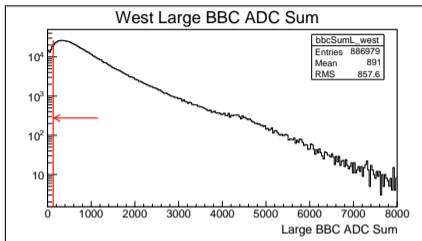


Event Selection for FMS-RP Data

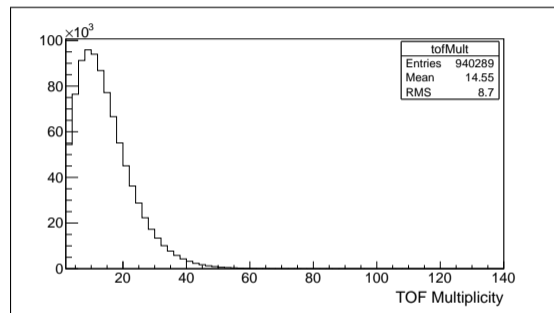
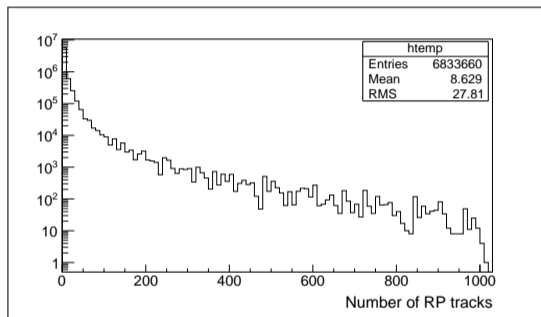


Additional Cuts: BBC and TOF

- West Large BBC ADC Sum < 110
- West Small BBC ADC Sum < 60
- Veto on east RP track



Event Selection for FMS-RP Data



- Only one RP track per event is considered (after RP quality cuts).
- TOF multiplicity > 0

FMS-RP Data: All Cuts

RP Cut

- Global RP track
- Polar angle cut:
 $-1.5 < \theta_x < 5.0$ mrad
 $1.0 < \theta_y < 5.5$ mrad
- Planes cut: At least 7 SSD planes hits
- Multiplicity cut: 1 track in an event
- p_t cut (Not implemented yet)

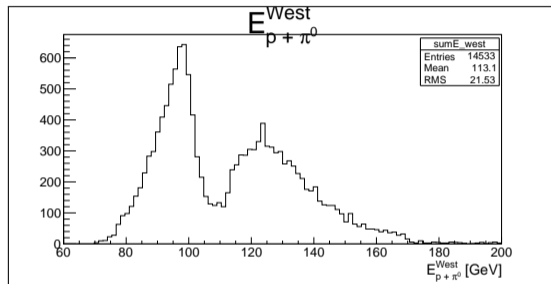
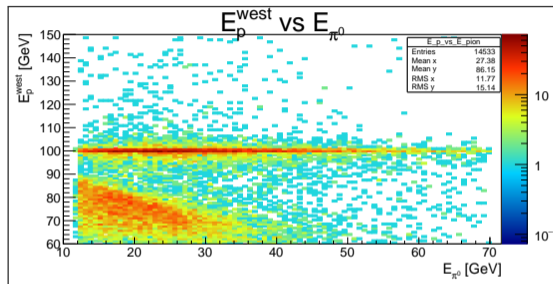
FMS Cut

- $13 < E_{\gamma\gamma} < 70$ GeV
- $Z_{\gamma\gamma} < 0.8$
- Highest energy photon pairs

BBC and TOF

- TOF multiplicity > 0
- East BBC ADC Sum > 0
- West Large BBC ADC Sum < 110
- West Small BBC ADC Sum < 60

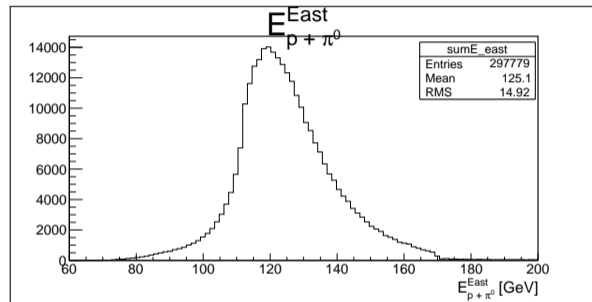
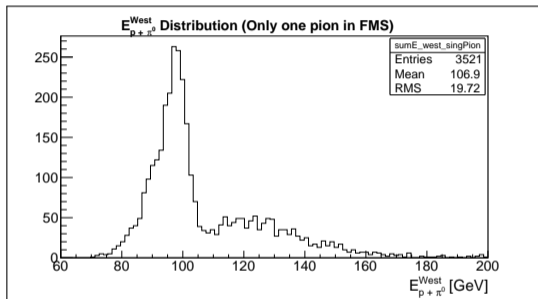
FMS-RP Correlations After Cuts



Cuts Applied:

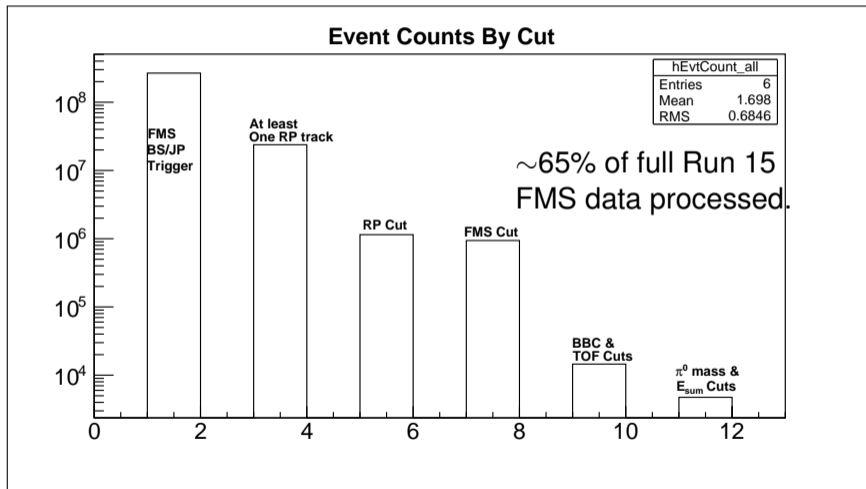
- RP Cut
- FMS Cut
- TOF and BBC Cuts

FMS-RP Correlations



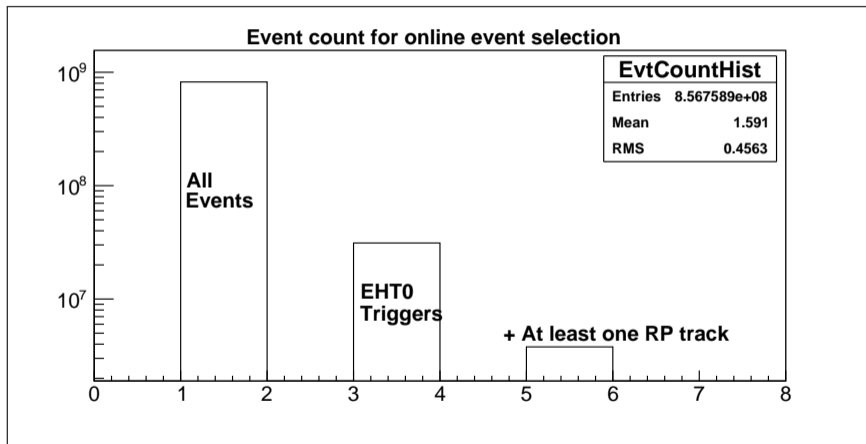
- (top left) $E_{\rho+\pi^0}^{\text{West}}$ with only one pion in FMS.
- (top right) $E_{\rho+\pi^0}^{\text{East}}$ for East RP with similar cut on East BBC.

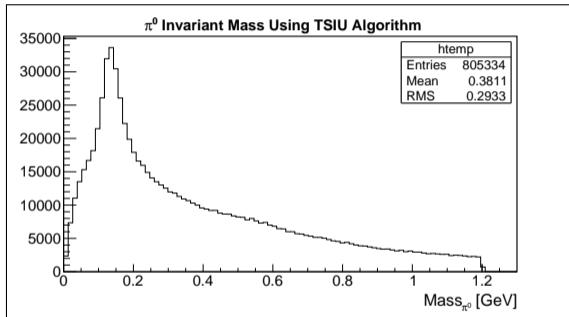
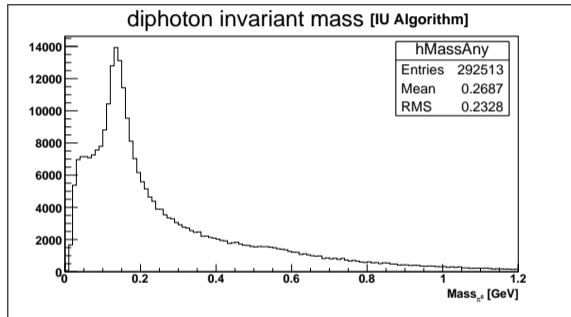
FMS-RP Data: Event Counts By Cut



EEMC-RP event selections and correlations

EEMC-RP Data: Primary Event Selection



π^0 Reconstruction in EEMC (IU vs TSIU)

- Decided to use TSIU algorithm for π^0 reconstruction in EEMC.

EEMC-RP Data: Event Selection

RP Cut

- Polar angle cut:
 $-1.5 < \theta_x < 5.0$ mrad
 $1.0 < \theta_y < 5.5$ mrad
- Planes cut: At least 7 SSD planes hits
- Global RP track
- Multiplicity cut: 1 track in an event
- p_t cut (Not implemented yet)

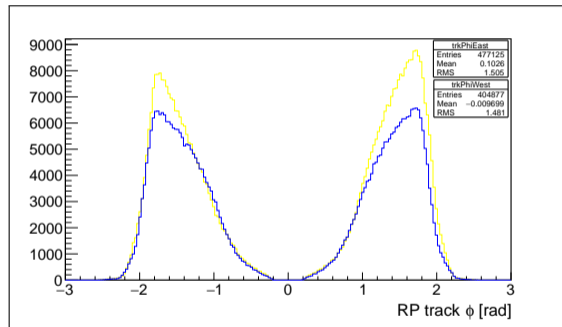
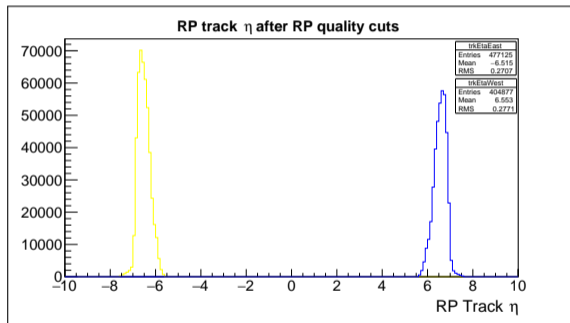
EEMC Cut

- $5 < E_{\gamma\gamma} < 70$ GeV
- $Z_{\gamma\gamma} < 0.8$
- Highest energy photon pairs

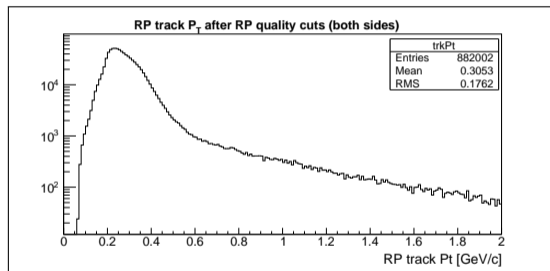
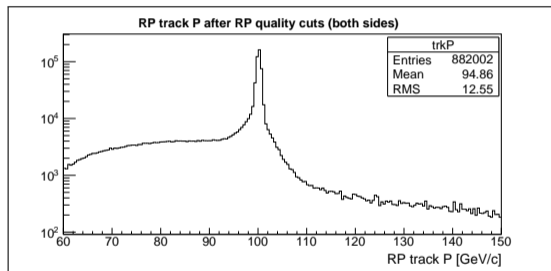
BBC and TOF

- TOF multiplicity > 0
- West Large BBC ADC Sum < 110
- West Small BBC ADC Sum < 60

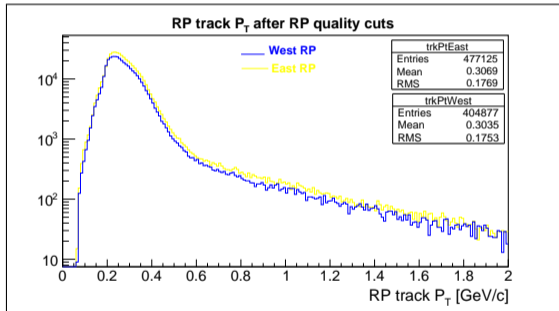
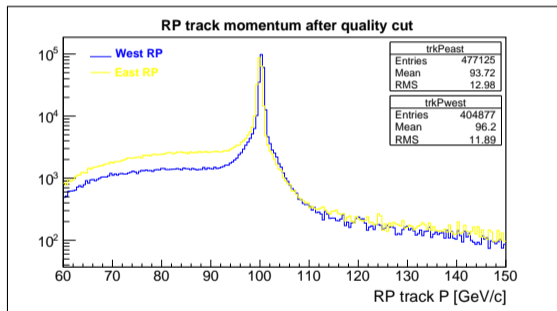
EEMC-RP Data After Cuts



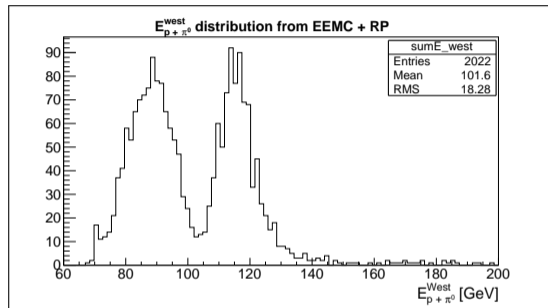
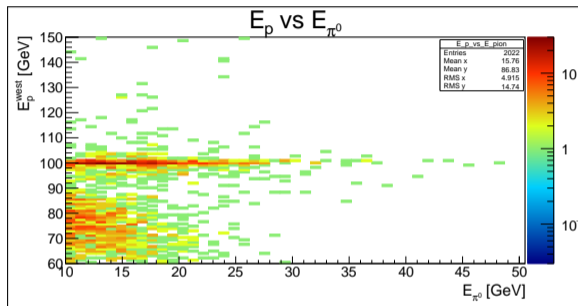
EEMC-RP Data After Cuts



EEMC-RP Data After Cuts



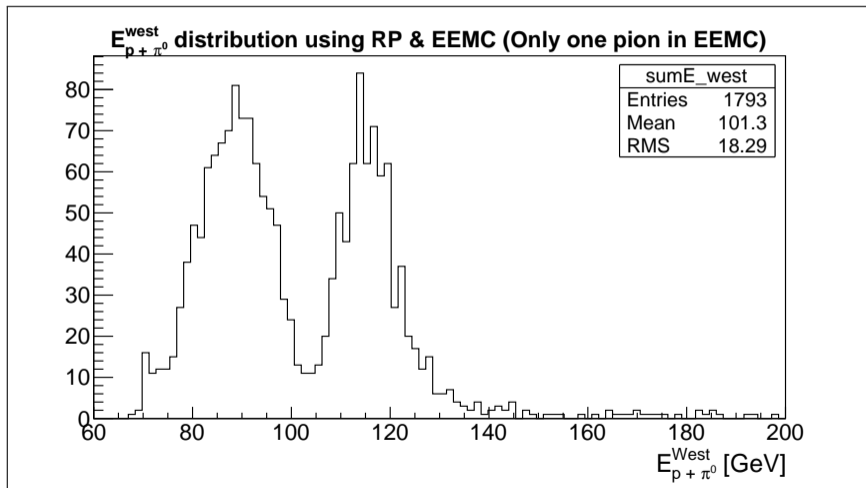
EEMC-RP Correlations After Cuts



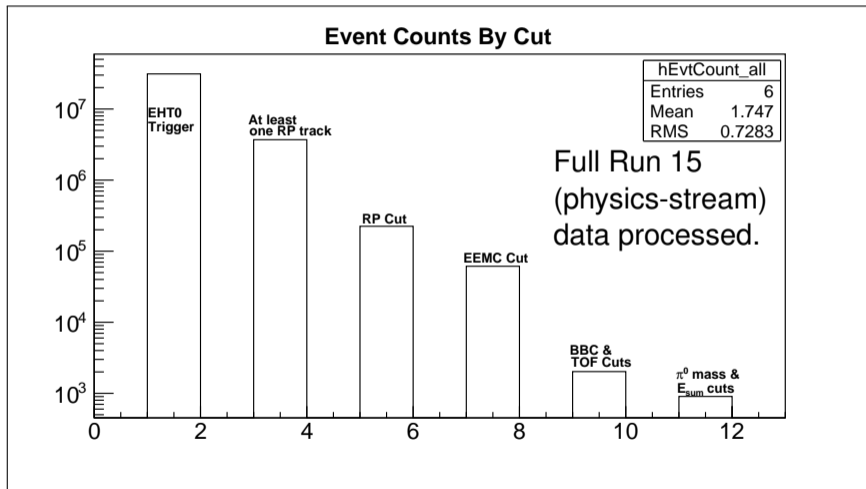
Cuts Applied:

- RP Cut
- EEMC Cut
- TOF and BBC Cuts

EEMC-RP Correlations After Extreme Cuts



EEMC-RP Data: Event Counts By Cut



Summary

- Processed Run 15 FMS + RP and EEMC + RP data.
- Applied event selection.
- Looked at basic FMS-RP and EEMC-RP correlations.

Backup Slides
