Di-jet Analysis Status

Beomgon Kim (Korea University),
Yongsun Kim,
Samuel Steed Boren, Daniel Tapia Takaki (University of Kansas)

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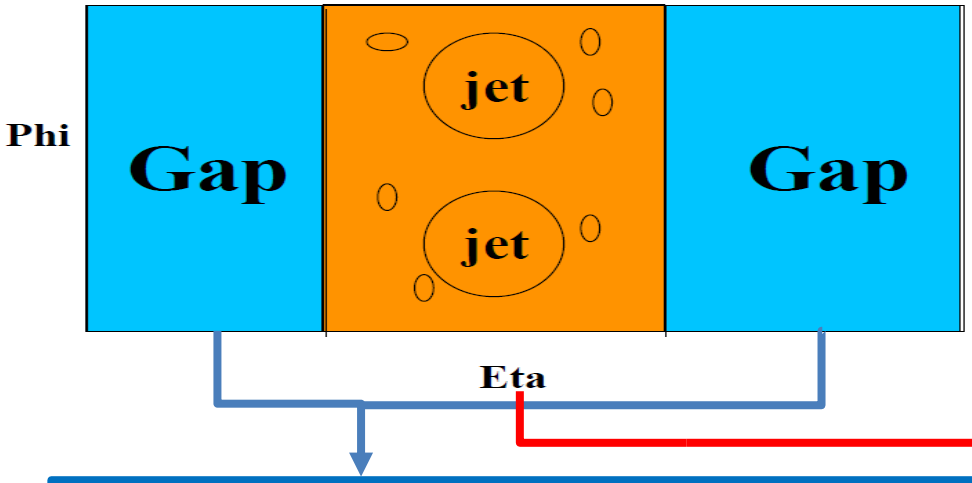
Event Selection(reminder)

❖ **HLTrigger selection**
- HLT_HIUPCSingleEG5NotHF2Pixel_SingleTrack_v1

❖ **HF selection**
- Energy deposit on both HF < 5 GeV

❖ **Track Selection**
- Only the tracks which satisfy Standardized Analysis Cuts are considered.



❖ **Di-jet Event Selection for mid-η**
1) ak4PF is used for jets
2) Have at least two jets
3) Both of 1st and 2nd highest p_T jets are in the mid-η($|\eta_{jet}| < 1.5$) region
4) Both of 1st and 2nd hightet p_T jets have $p_{T,jet} > 20$ GeV/c

❖ **Event Selection with tower energy deposit which was used for ρ analysis(FSQ-16-007)**
- ➢(Max. energy in HF towers) < 3 GeV
- ➢(Max. energy in HE towers) < 1.95 GeV
- ➢(Max, energy in HB towers) < 1.18 GeV

pp reco Vs. PbPb reco

- **Event Selection for pp reco without Hcal tower selection**
  - HLTrigger
  - (Energy deposit on both HF) < 5 GeV
  - No Hcal Selection
  - Standardized analysis cuts for tracks
  - Di-jet event selection
  - No tracks in forward($1.5 < |\eta_{track}| < 2.5$)
  - ($\Delta\phi$ btw 1st & 2nd highest p_T jet) > 2
- The number of events passed all event selections : 1978

- **Event Selection for PbPb reco**
  - HLTrigger
  - (Energy deposit on both HF) < 5 GeV
  - No rechit information in PbPb reco
  - Standardized analysis cuts for tracks
  - Di-jet event selection
  - No tracks in forward($1.5 < |\eta_{track}| < 2.5$)
  - ($\Delta\phi$ btw 1st & 2nd highest p_T jet) > 2
- The number of events passed all event selections : 202

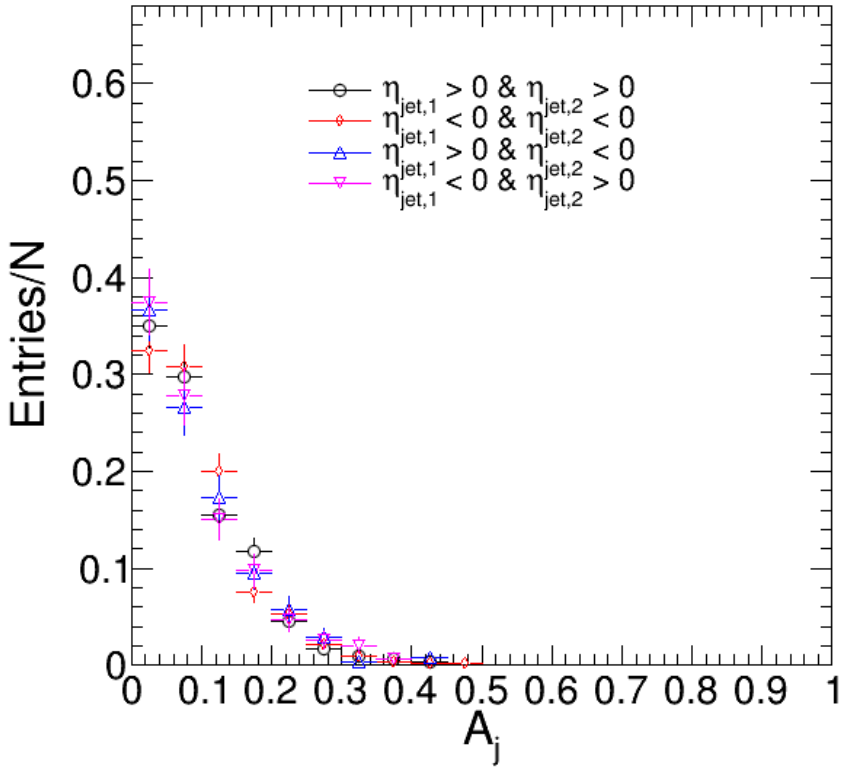
Event Selection Steps

- **Event Selection Steps for both pp reco(without Hcal tower selection) & PbPb reco**
  - Step1: HLTrigger
  - Step2: (Energy deposit on both HF) < 5 GeV
  - Step3: Di-jet event selection
  - Step4: ($\Delta\phi$ btw 1st & 2nd highest p_T jet) > 2
  - Step5: No tracks in forward($1.5 < |\eta_{track}| < 2.5$)
    - ✓ After selection of tracks which passed standardized analysis cuts for tracks

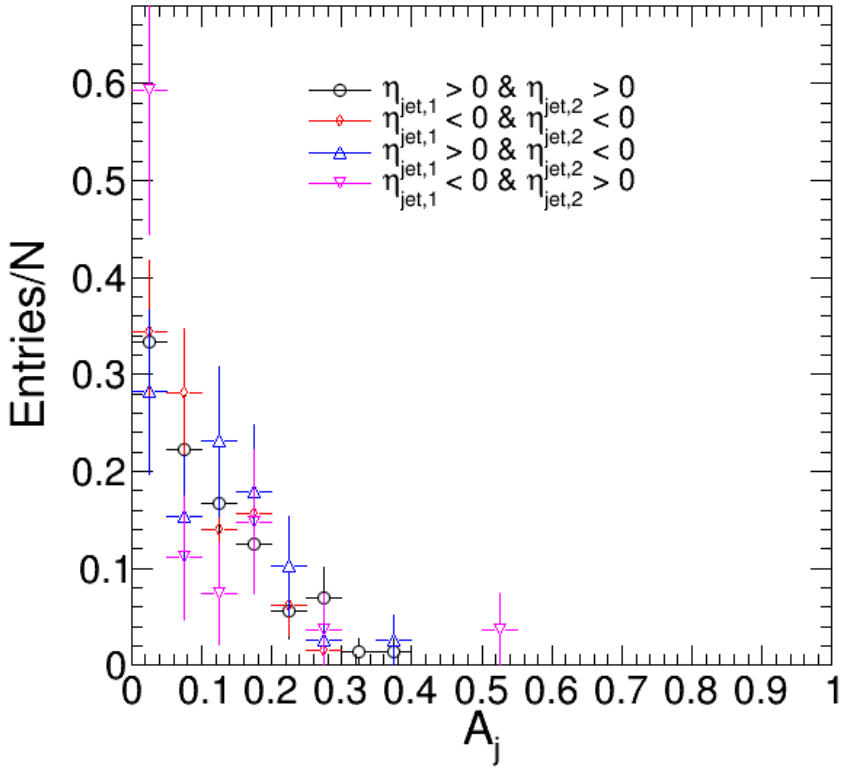
	pp reco	Rate (%)	PbPb reco	Rate (%)
Step1	1653257	100	130763	100
Step2	426515	26	34254	26
Step3	5461	0.33	442	0.34
Step4	5316	0.32	427	0.33
Step5	1978	0.12	202	0.15

A_j Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection

- pp reco without hcal selection

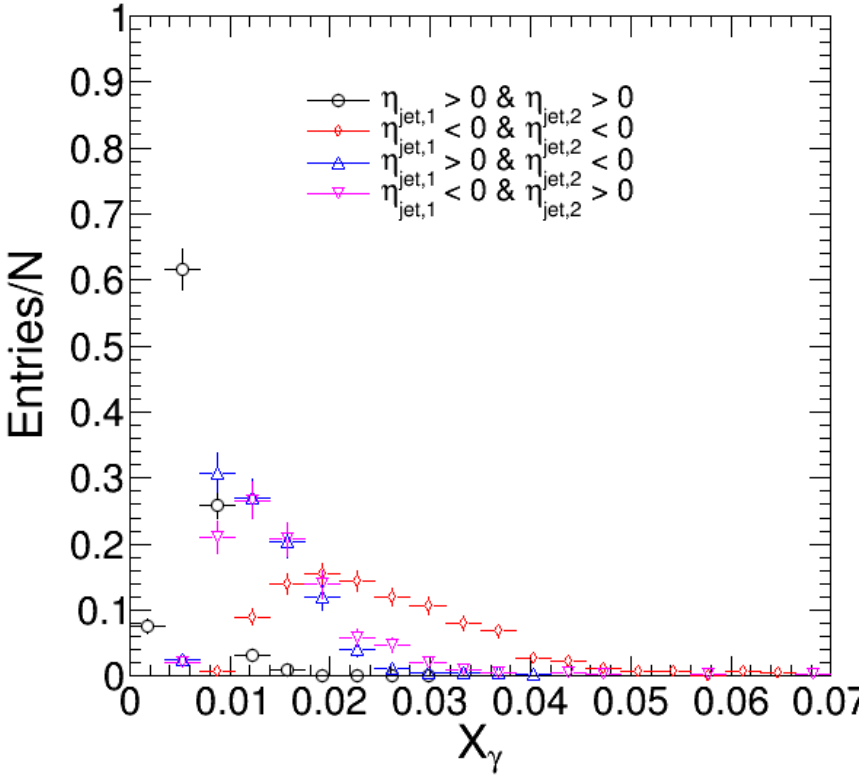


- PbPb reco without hcal selection

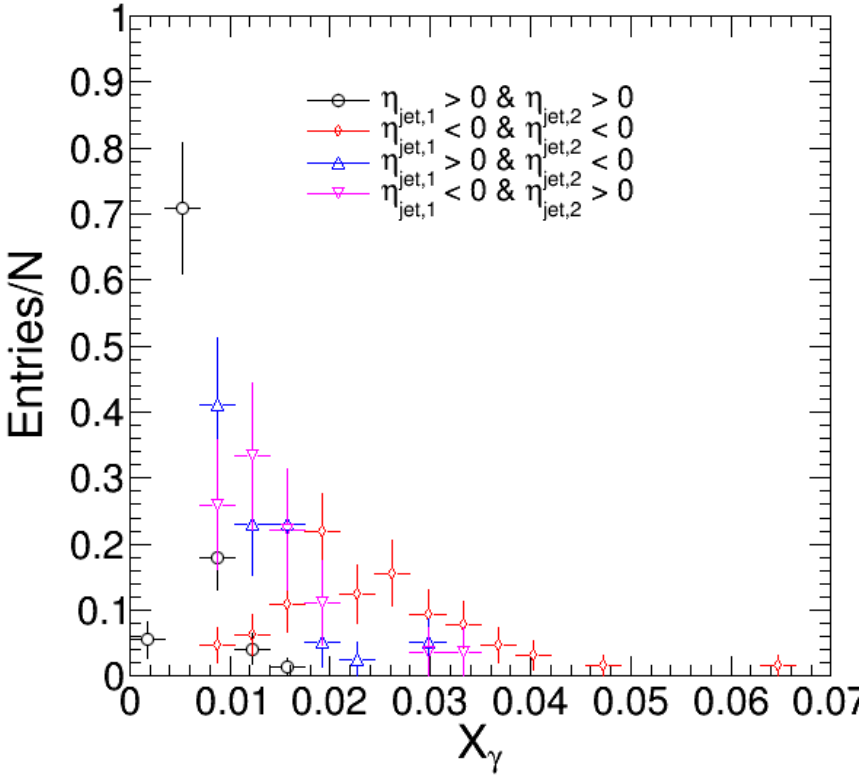


X_γ Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection

- pp reco without hcal selection



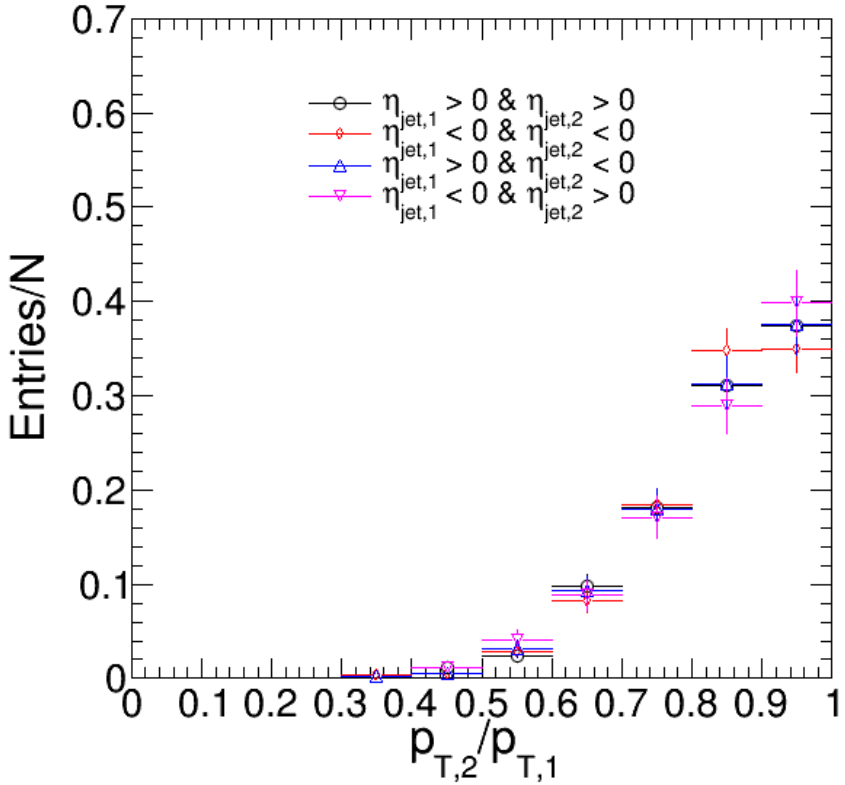
- PbPb reco without hcal selection



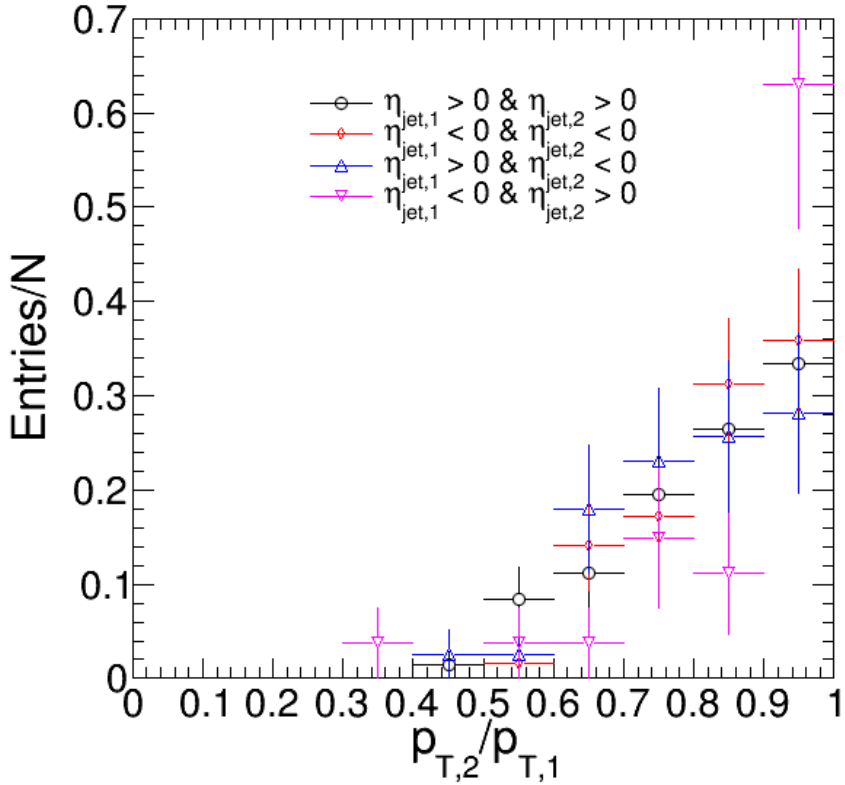
- $X_\gamma = (M_{JJ}/\sqrt{S_{NN}})\mathrm{Exp}(-y)$
  - y : Di-jet rapidity
  - M_{JJ} : Di-jet invariant mass

$p_{T,2}/p_{T,1}$ Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection

- pp reco without hcal selection

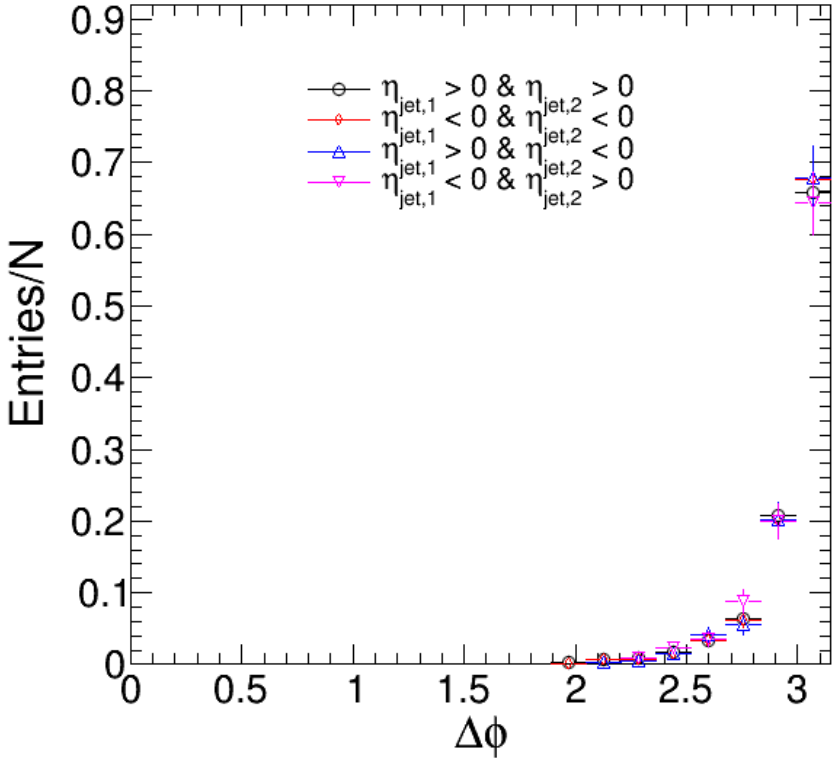


- PbPb reco without hcal selection

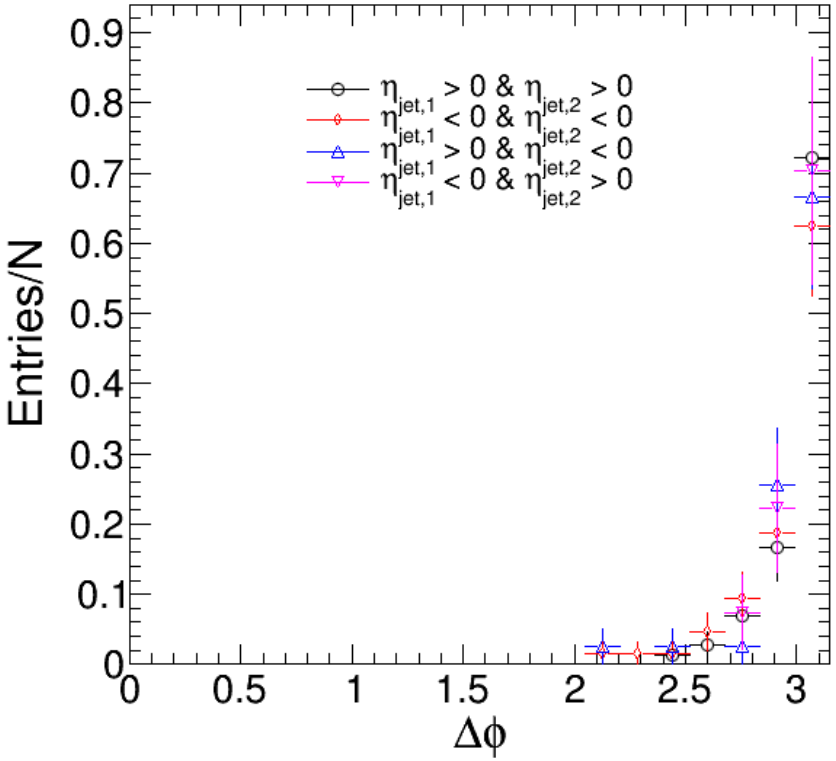


$\Delta\phi$ Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection

- pp reco without hcal selection

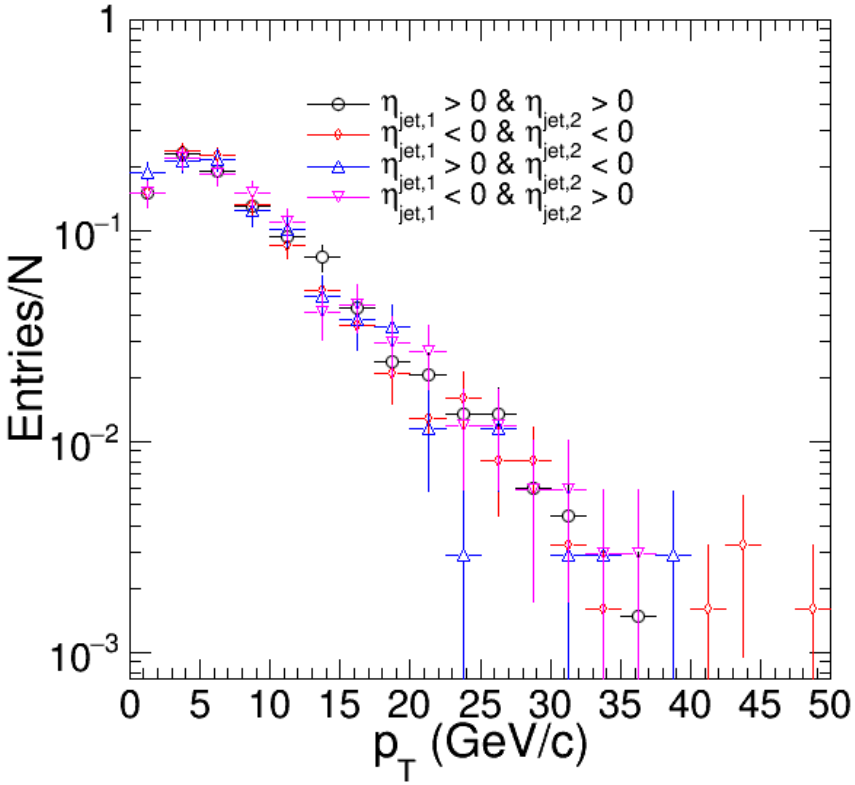


- PbPb reco without hcal selection

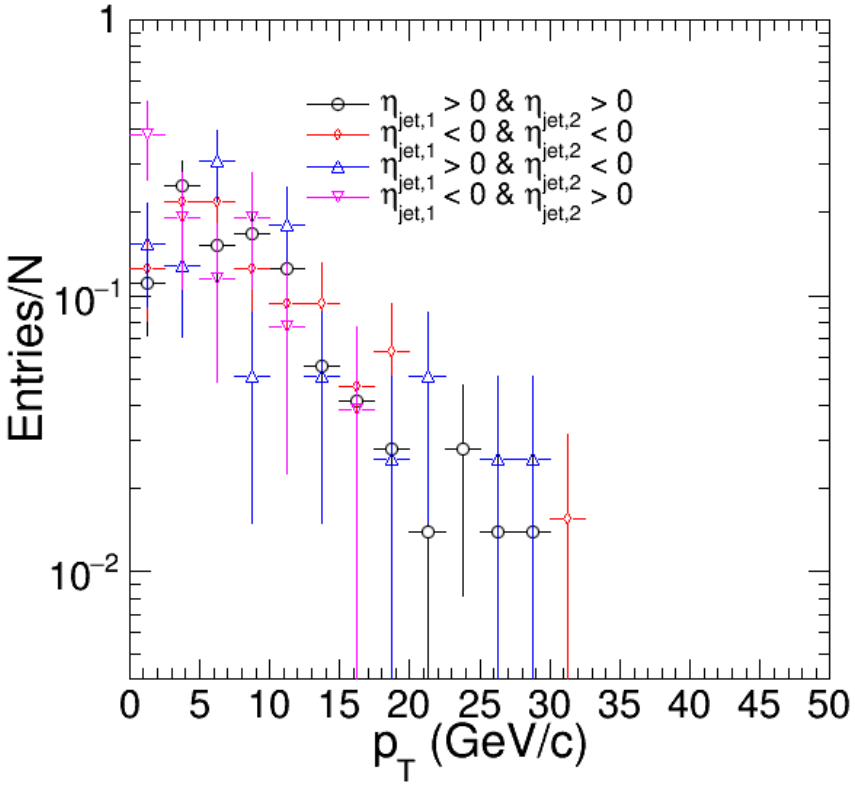


Di-jet p_T Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection

- pp reco without hcal selection



- PbPb reco without hcal selection



The Tasks in Parallel

- **MC Status(by Samuel)**
  - There has been much progress in UPC di-jet MC.
  - It is almost finished, and now comparing with data.

- **ZDC with pp reco(by James and Quan)**
  - ZDC information exist in PbPb reco data, but not in pp reco data.
  - Merging the ZDC information into pp reco is making progress.

- Checking Hcal distributions for most suitable Hcal selections for UPC di-jet analysis
  - Need to discuss more about them

Back Up

Standardized Analysis Cuts for Fall 2015 Data (For Single Track Triggers)

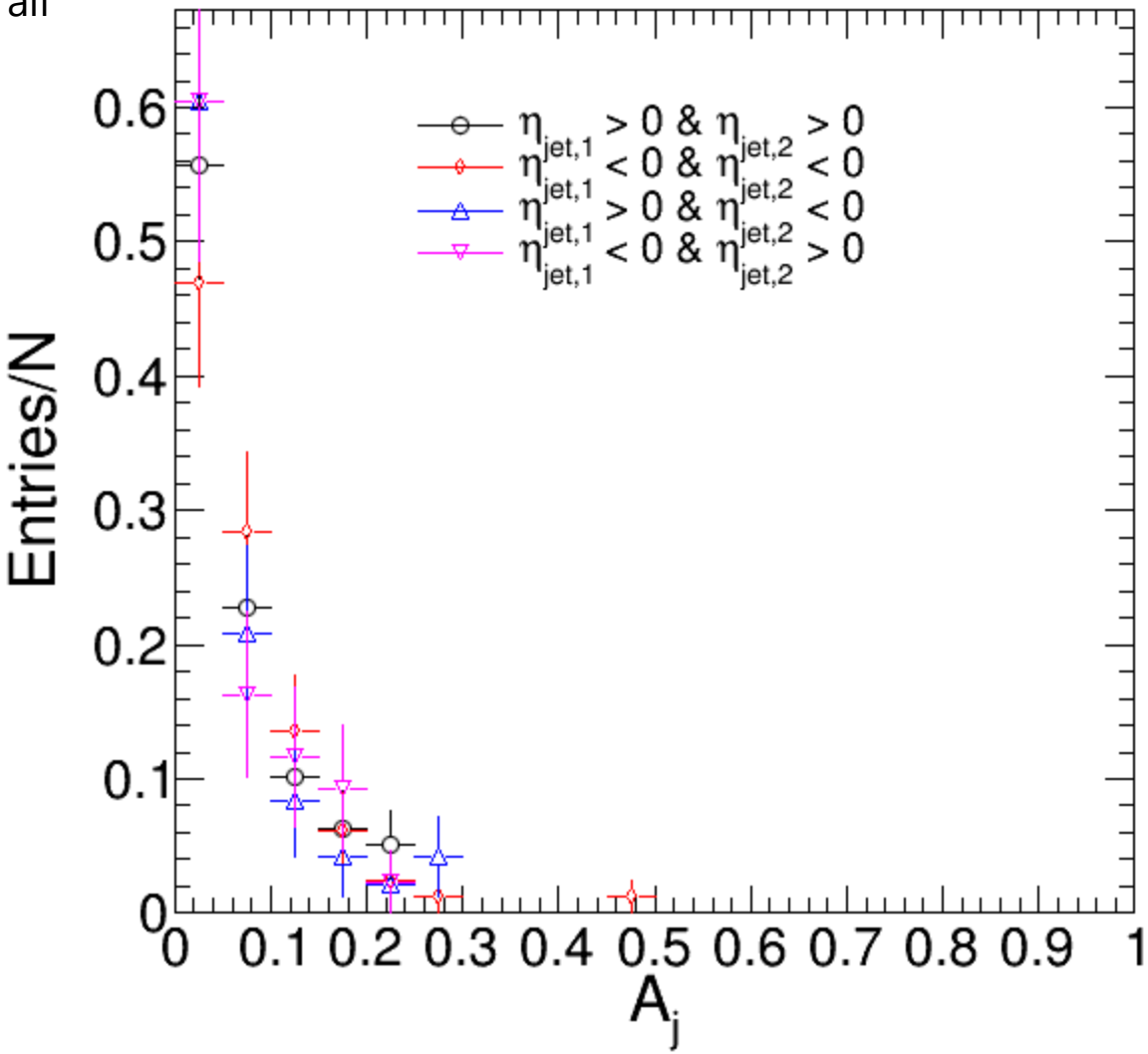
❖ https://twiki.cern.ch/twiki/bin/viewauth/CMS/HiTrackingDocumentation

- highPurity
- trkPt > 0.2 GeV
- trkPtError/trkPt < 0.1
- fabs(trkDz/trkDzError) < 3
- fabs(trkDxy/trkDxyError) < 3
- fabs(eta) < 2.5
- trkNHits >= 11
- trkChi2/trkNdof/trkNlayers < 0.15

A_j Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection

- The number of events passed all event selections : **251**

- **4 selection of $\eta_{jet,1}$ & $\eta_{jet,2}$**
  - $\eta_{jet,1} > 0$ & $\eta_{jet,2} > 0$: 79
  - $\eta_{jet,1} < 0$ & $\eta_{jet,2} < 0$: 81
  - $\eta_{jet,1} > 0$ & $\eta_{jet,2} < 0$: 48
  - $\eta_{jet,1} < 0$ & $\eta_{jet,2} > 0$: 43



X_γ Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection

- $X_\gamma = (M_{JJ}/\sqrt{S_{NN}})\mathrm{Exp}(-y)$
  - y : Di-jet rapidity
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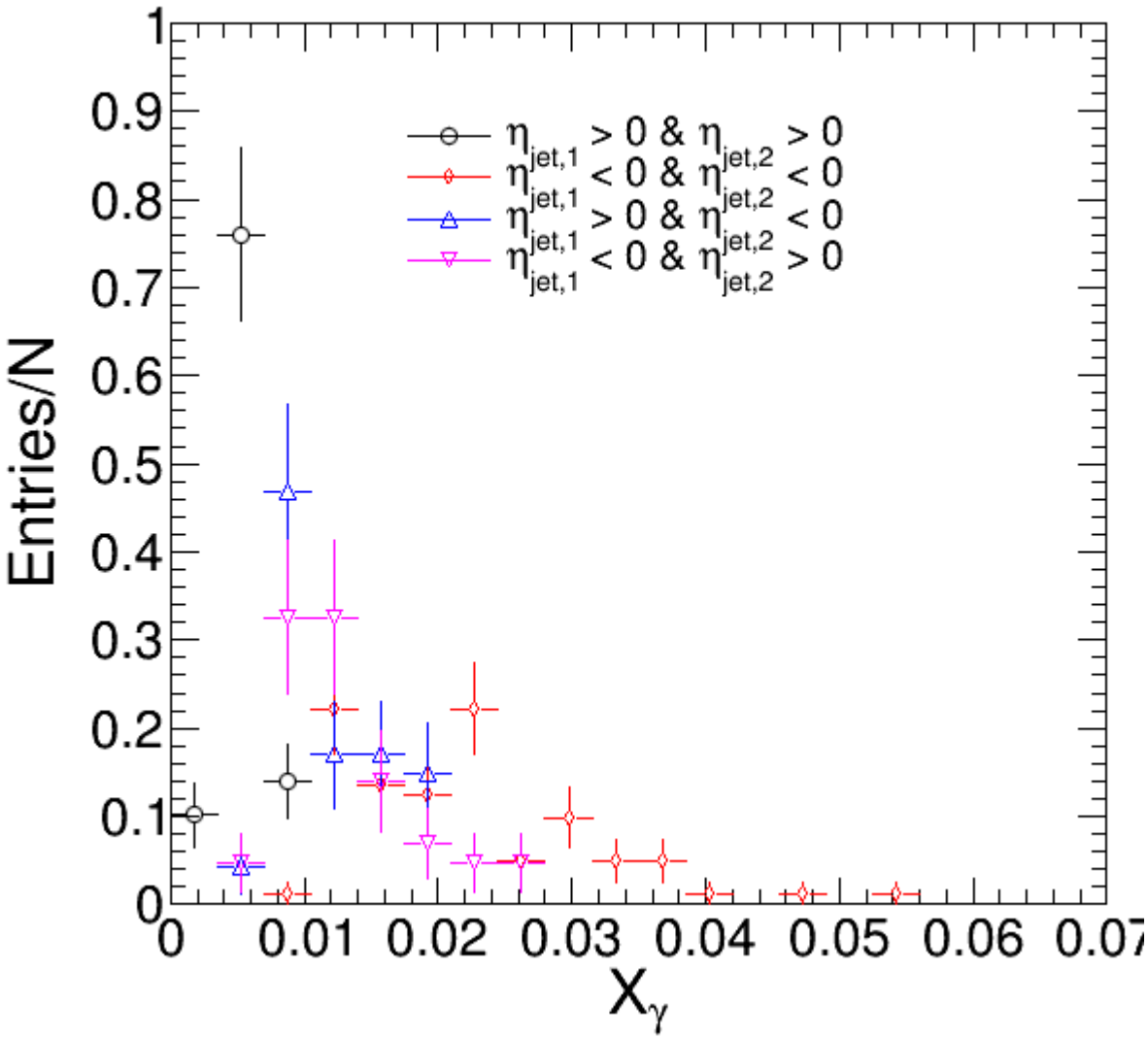
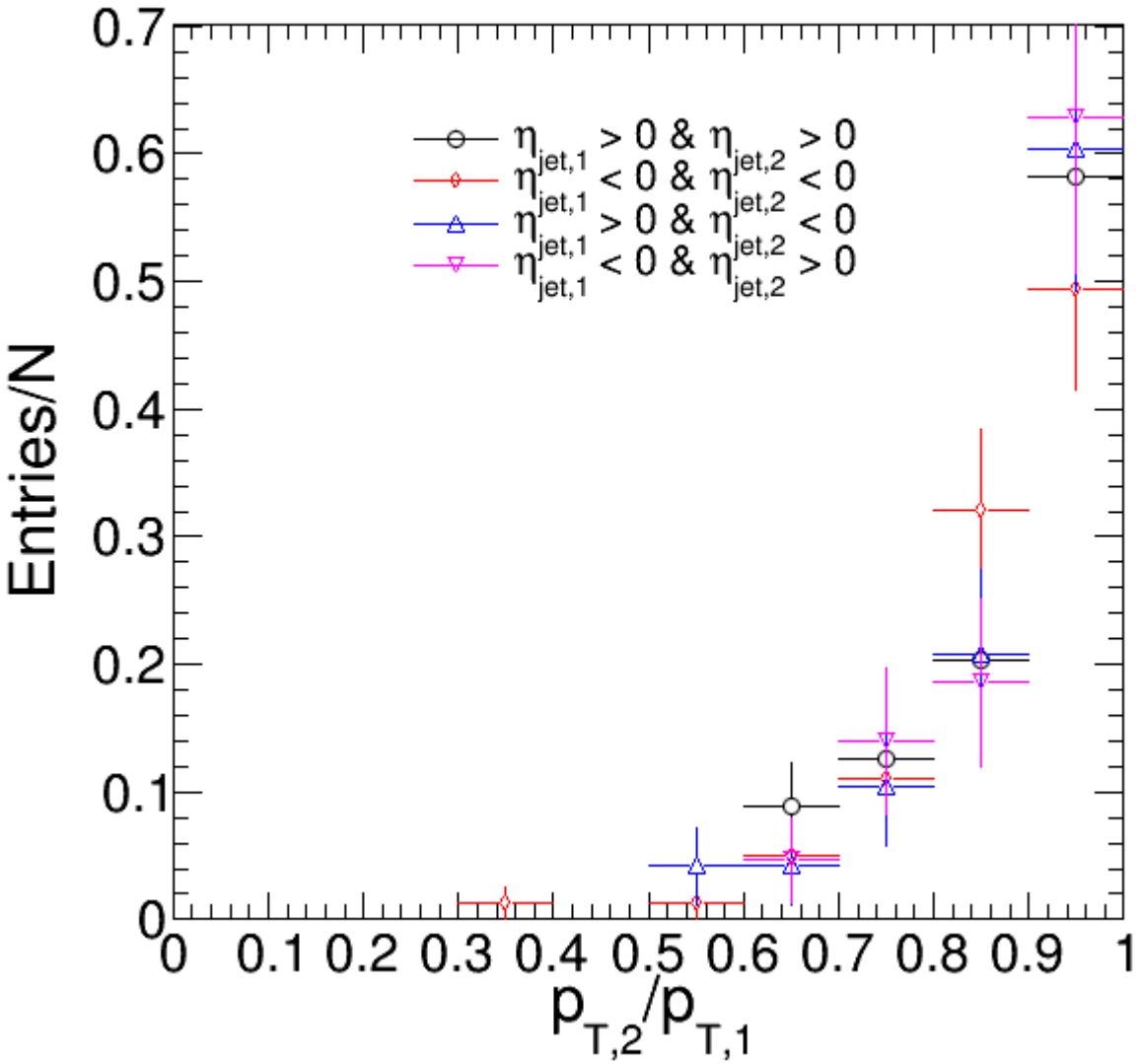
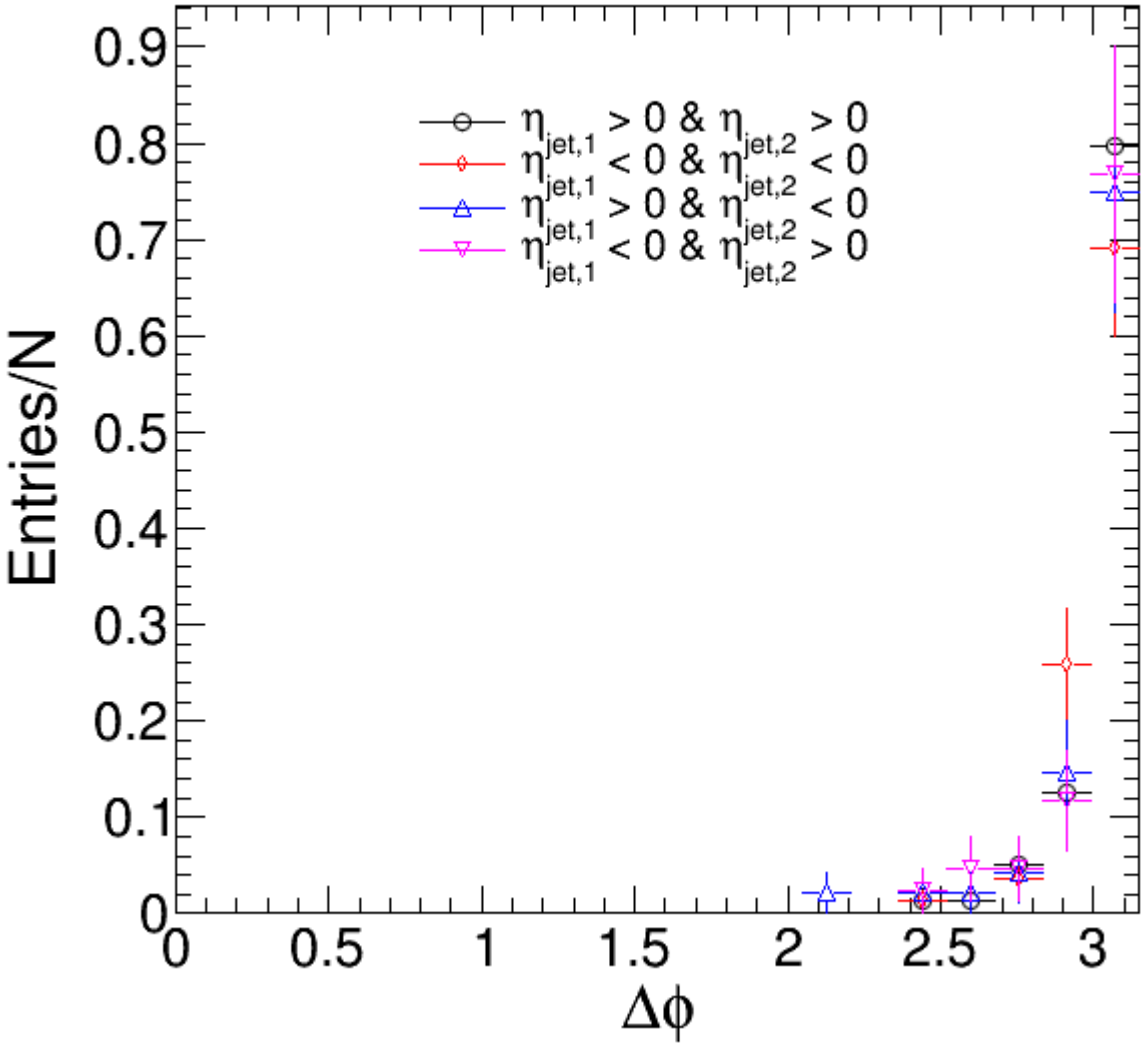


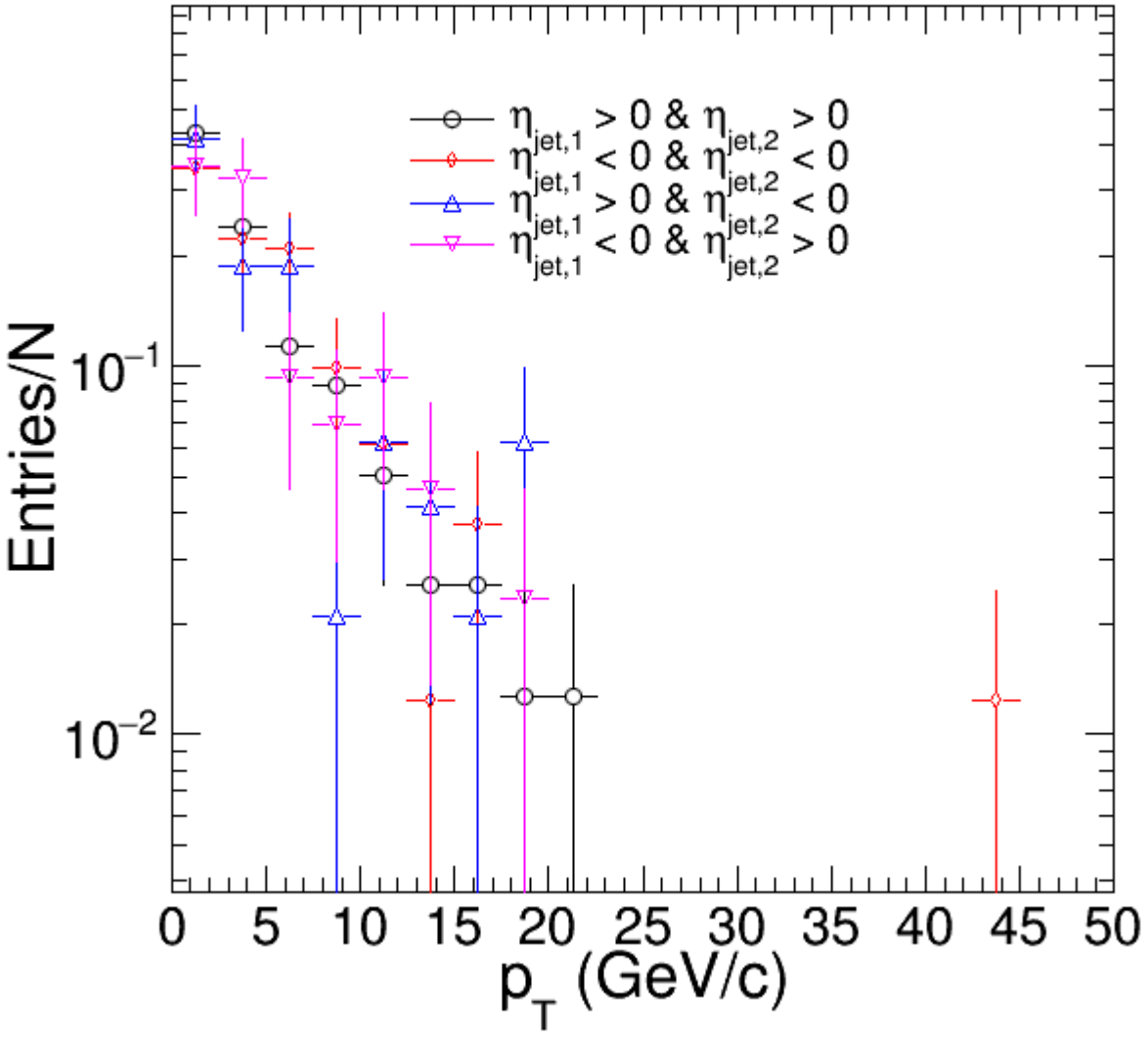
$p_{T,2}/p_{T,1}$ Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection



$\Delta\phi$ Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection

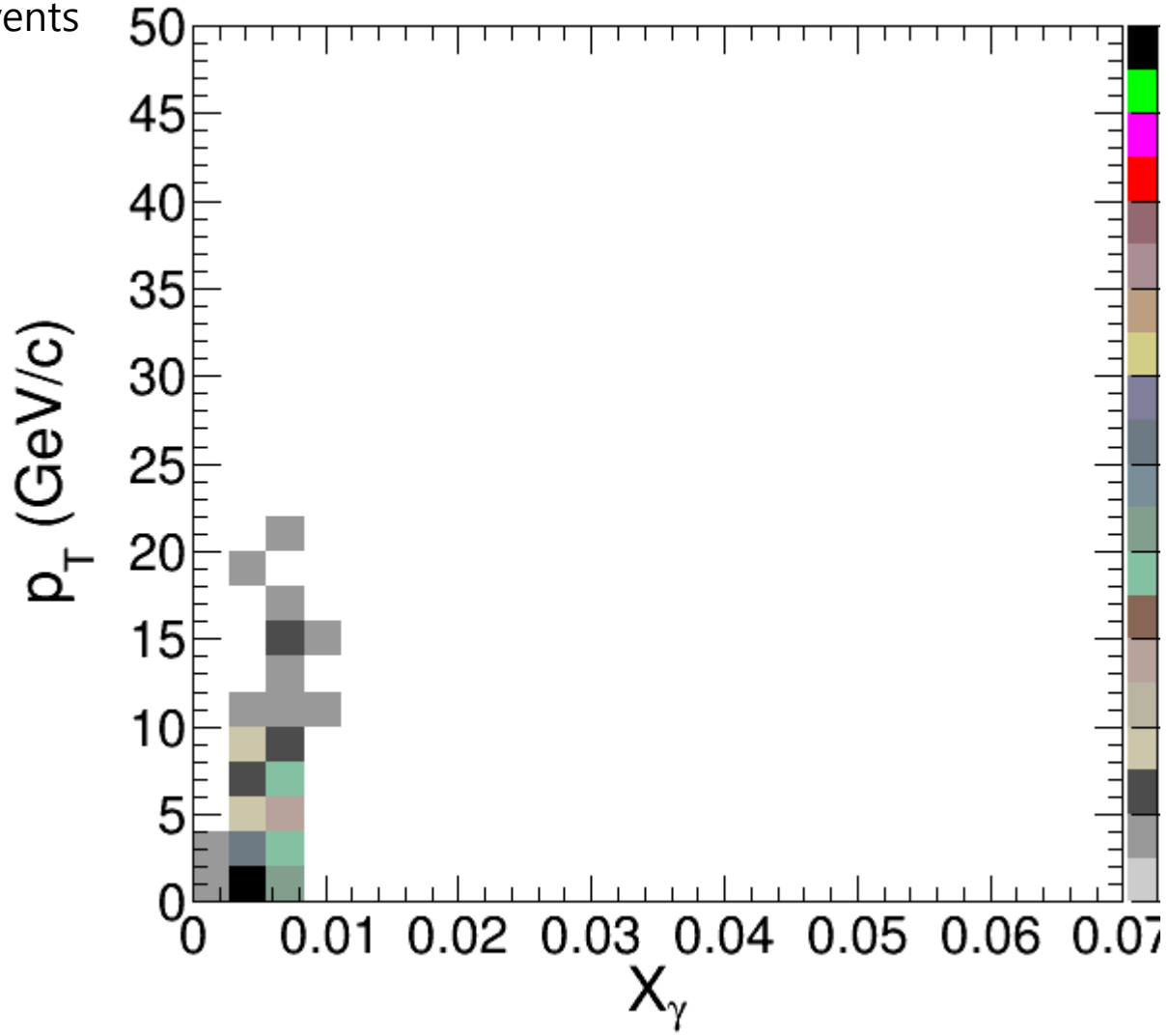


Di-jet p_T Distribution with $\eta_{jet,1}$ & $\eta_{jet,2}$ Selection



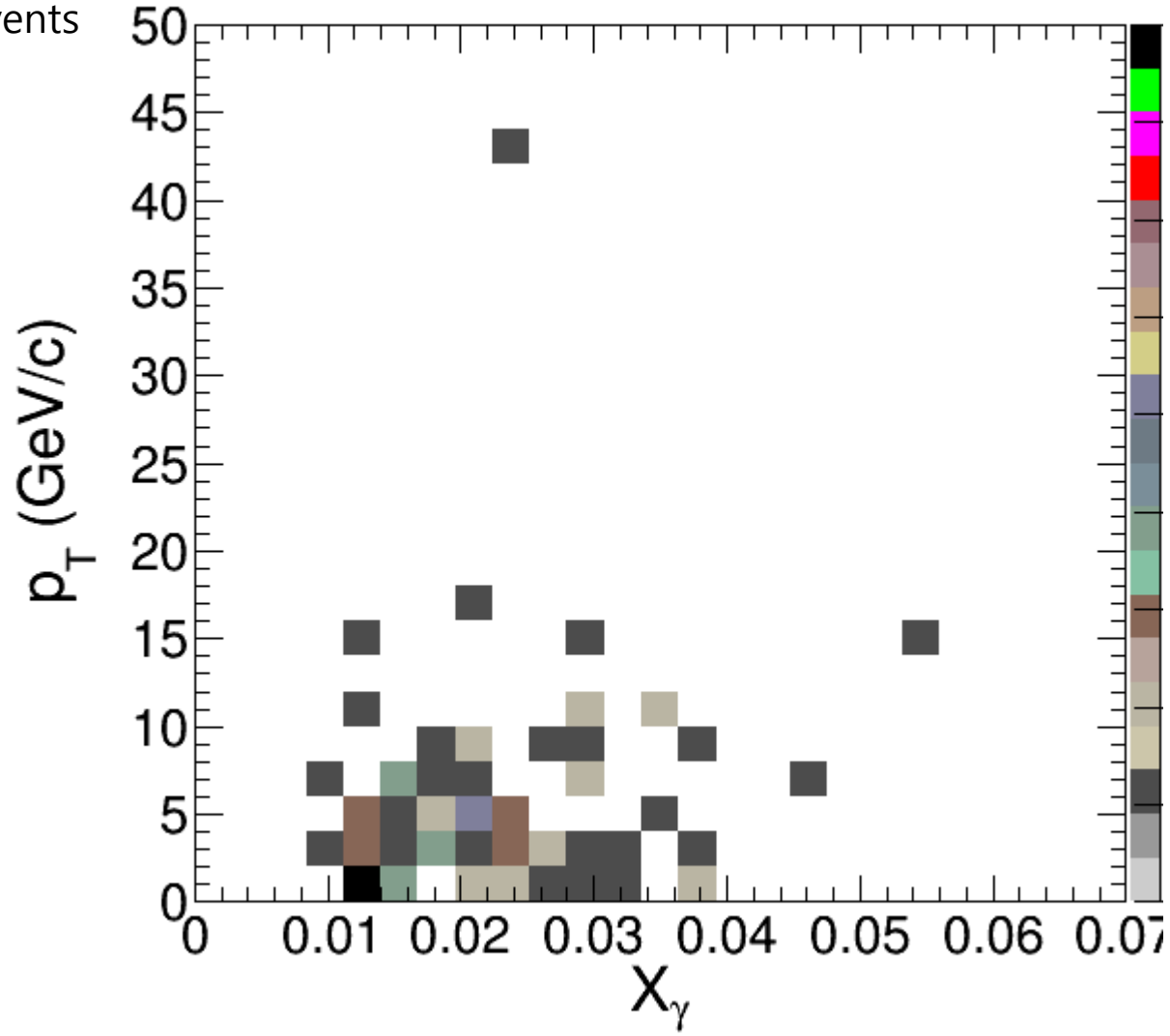
Di-jet p_T Vs. X_γ Distribution

- $\eta_{jet,1} > 0$ & $\eta_{jet,2} > 0$: 79 events



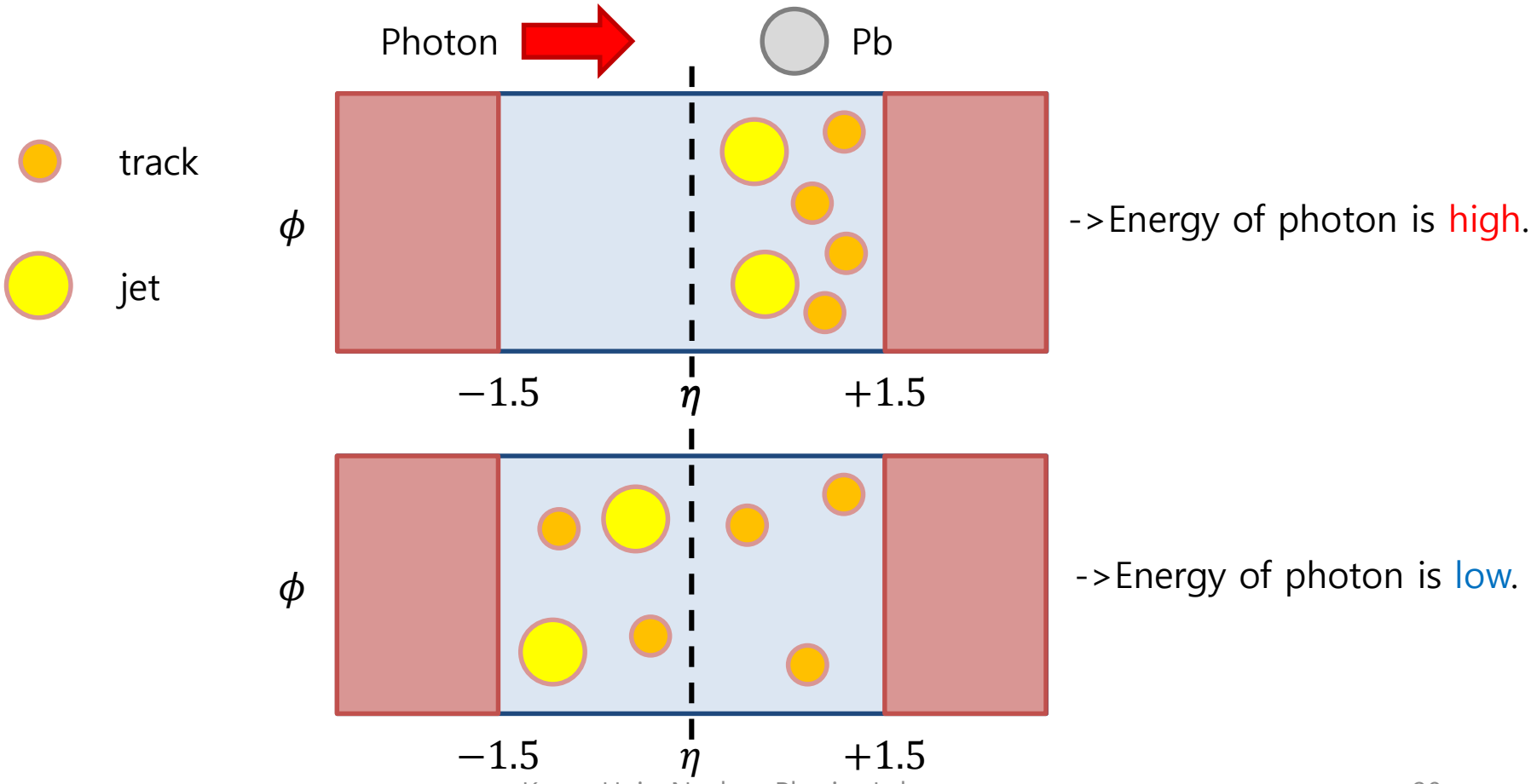
Di-jet p_T Vs. X_γ Distribution

- $\eta_{jet,1} < 0$ & $\eta_{jet,2} < 0$: 81 events



Next Step(reminder)

- Check the scatter plot of ϕ(angular distribution) Vs. η(pseudorapidity) of the jets and tracks for all events which passed the event selection
  - ➢ To distinguish and classify the events in terms of their energy



ϕ Vs. η Scatter Plot

- **Event Selection**
  - HLTrigger
  - (Energy deposit on both HF) < 5 GeV
  - Hcal tower energy selection
    - ✓ (Max. energy in HF towers) < 3 GeV
    - ✓ (Max. energy in HE towers) < 1.95 GeV
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  - Standardized analysis cuts for tracks
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  - No tracks in forward($1.5 < |\eta_{track}| < 2.5$)
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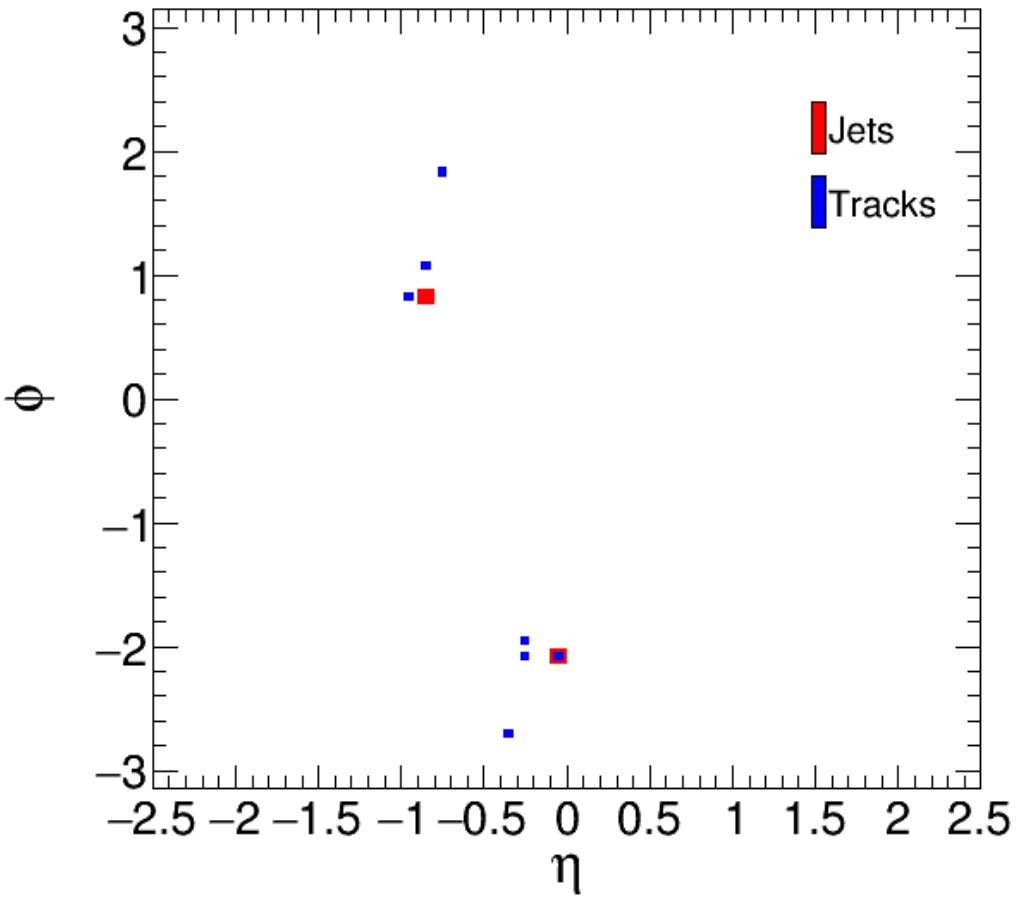
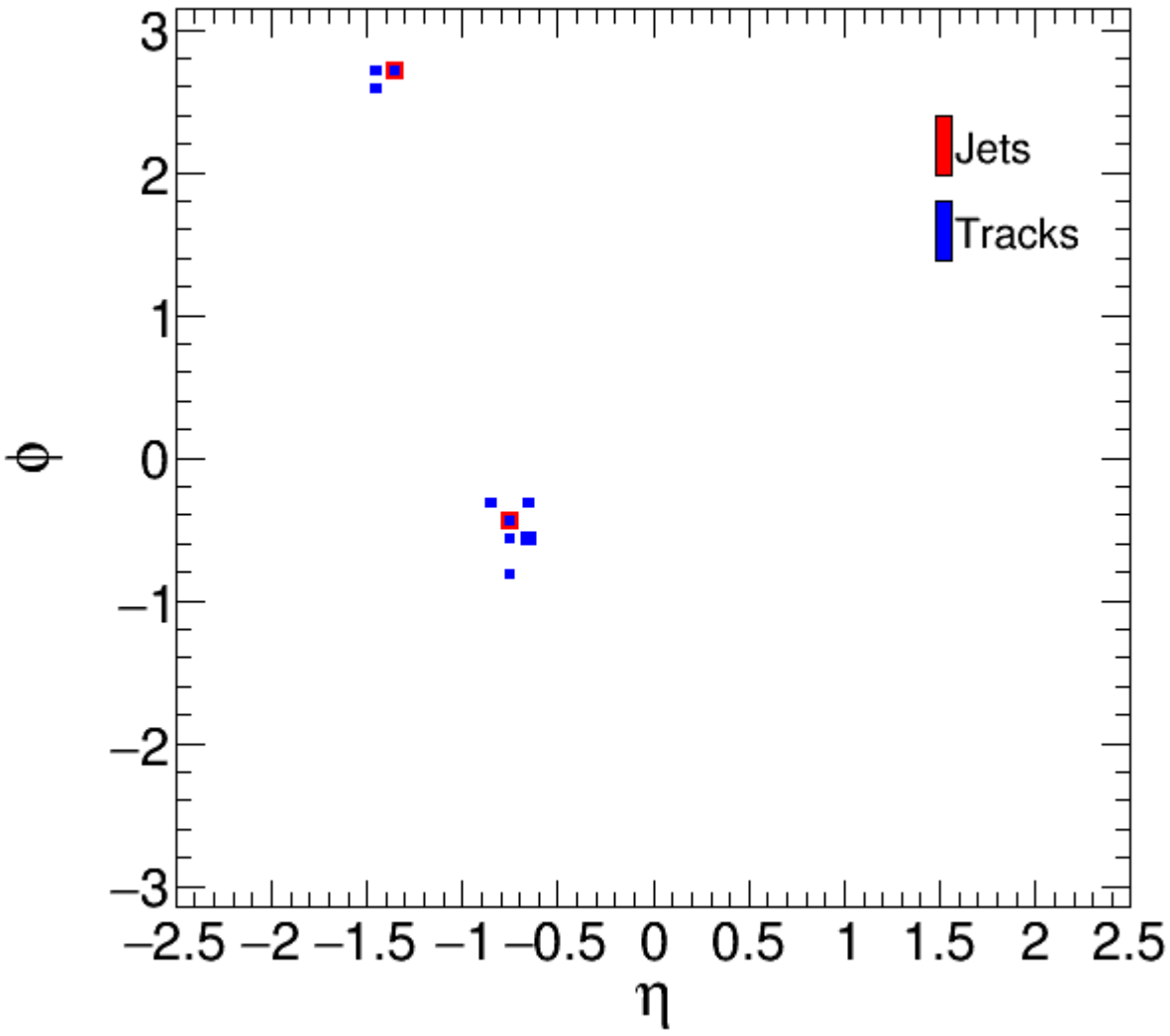
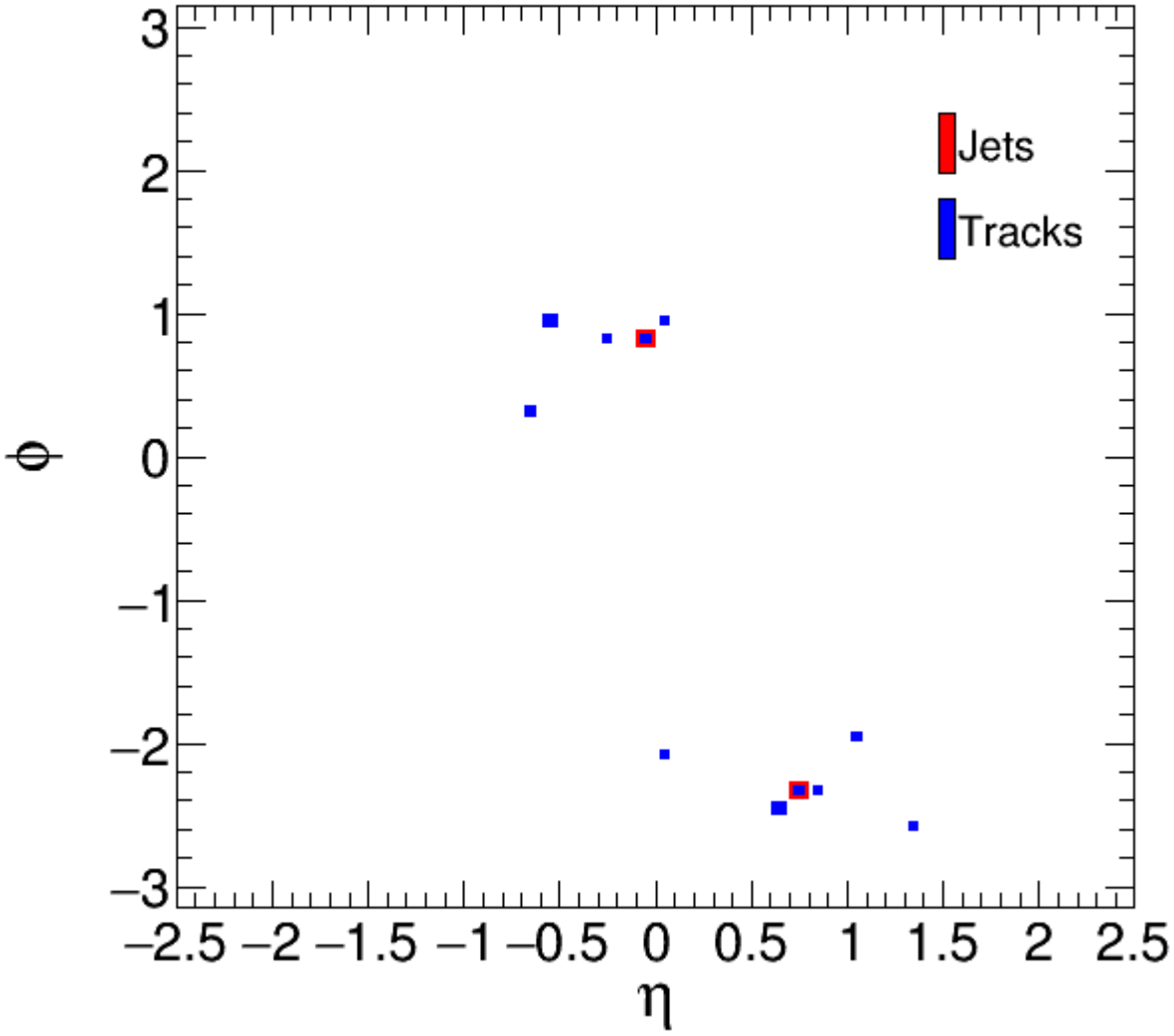
- The number of events passed all event selections : **251**



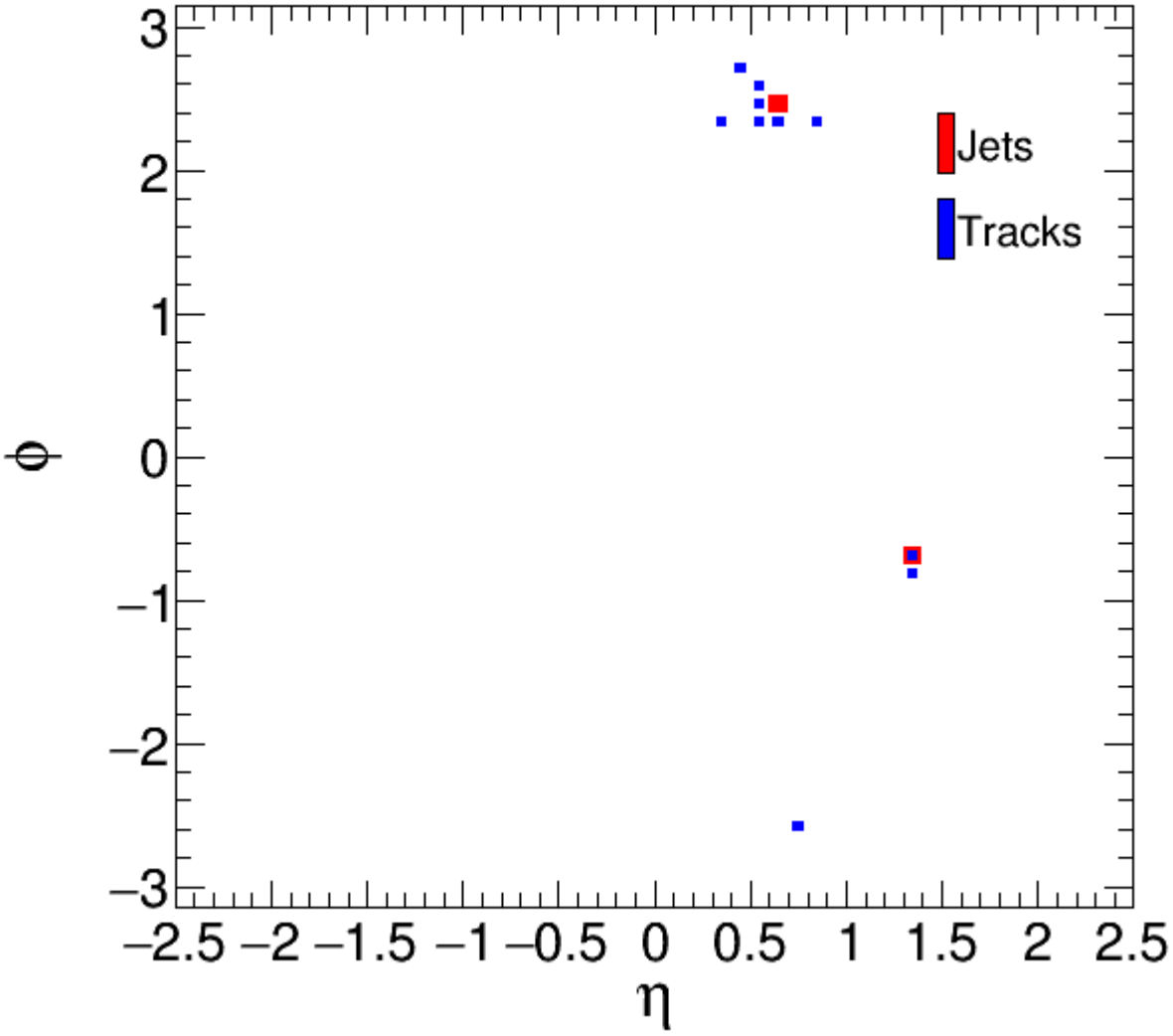
ϕ Vs. η Scatter Plot



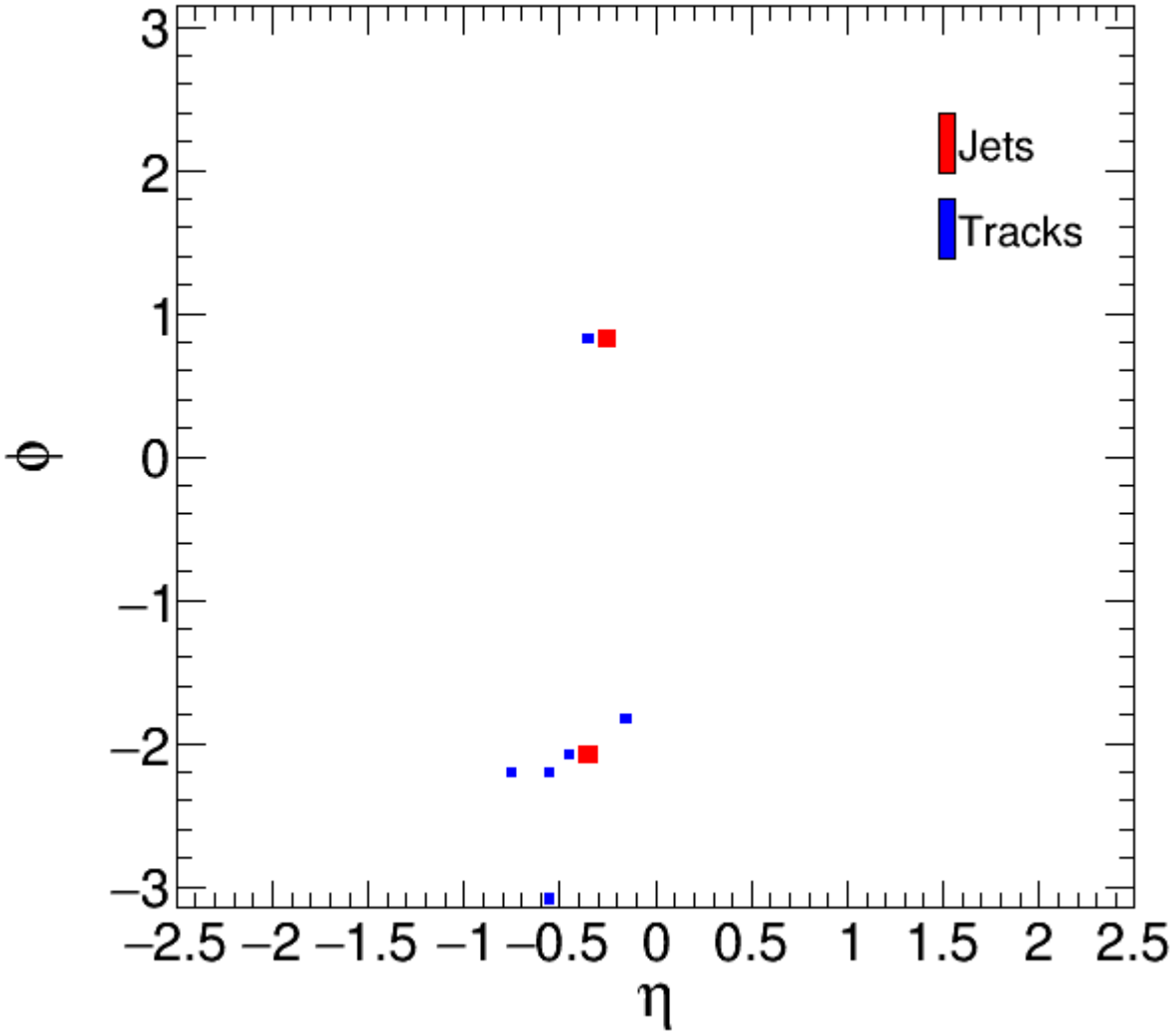
ϕ Vs. η Scatter Plot



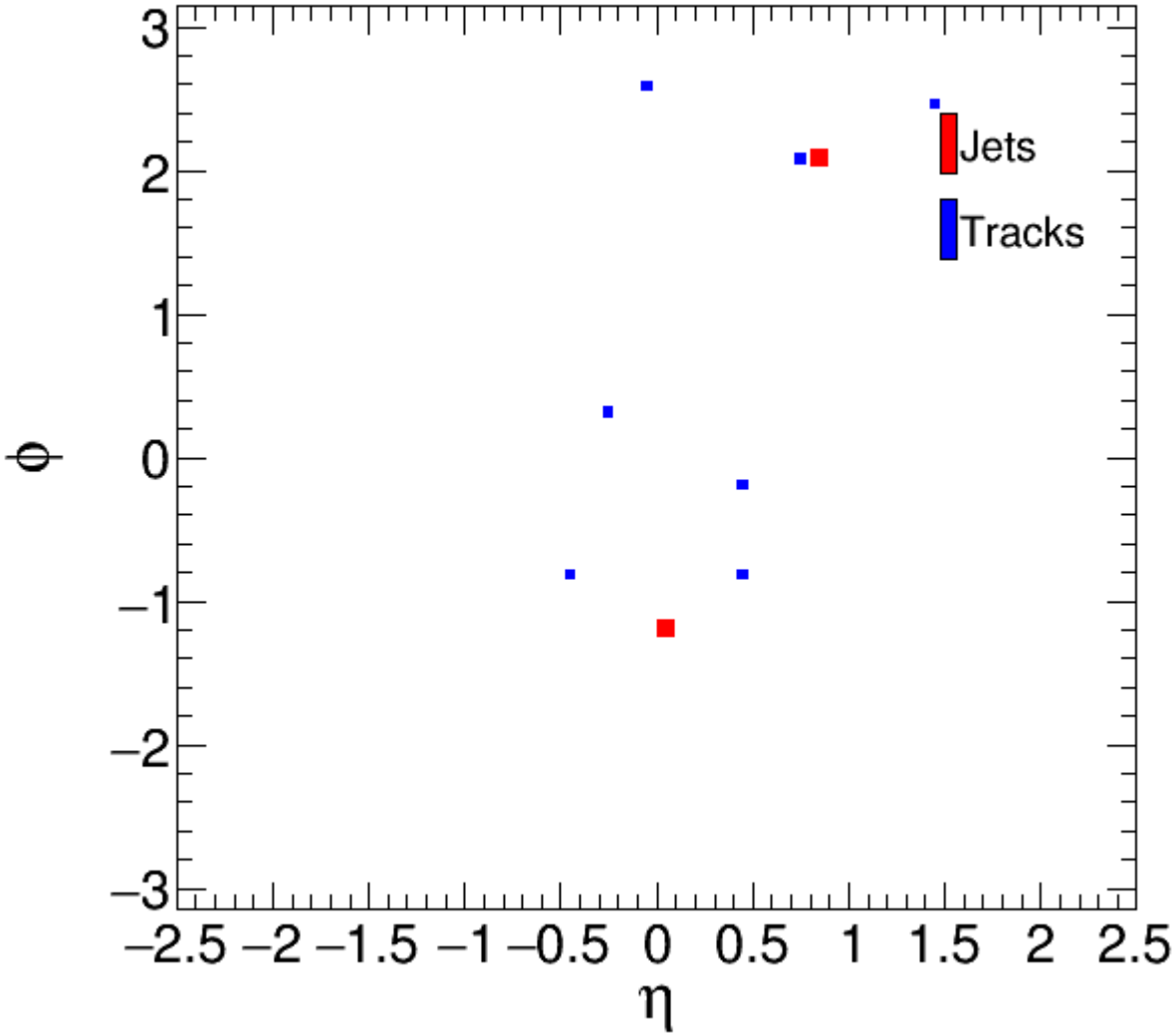
ϕ Vs. η Scatter Plot



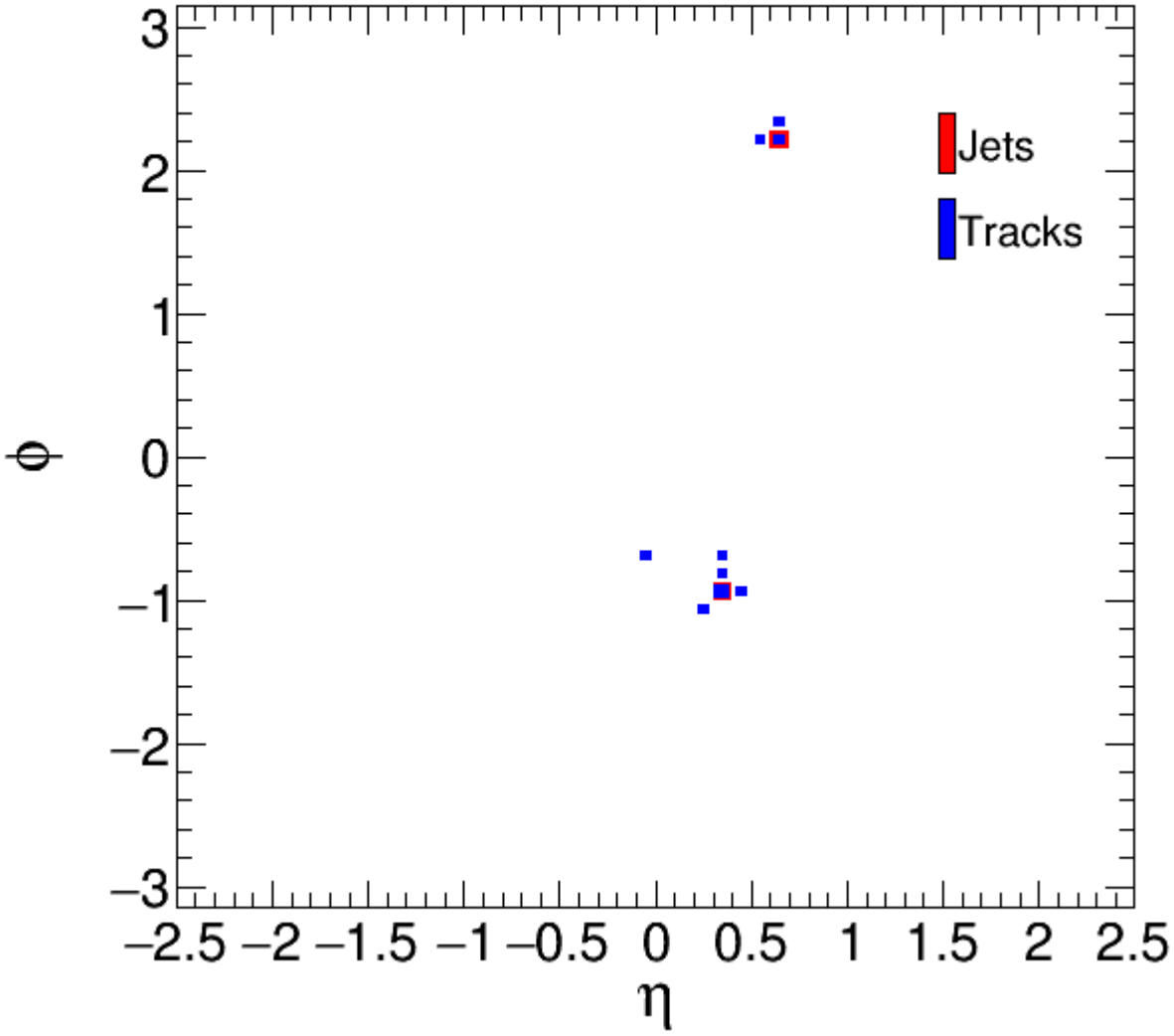
ϕ Vs. η Scatter Plot



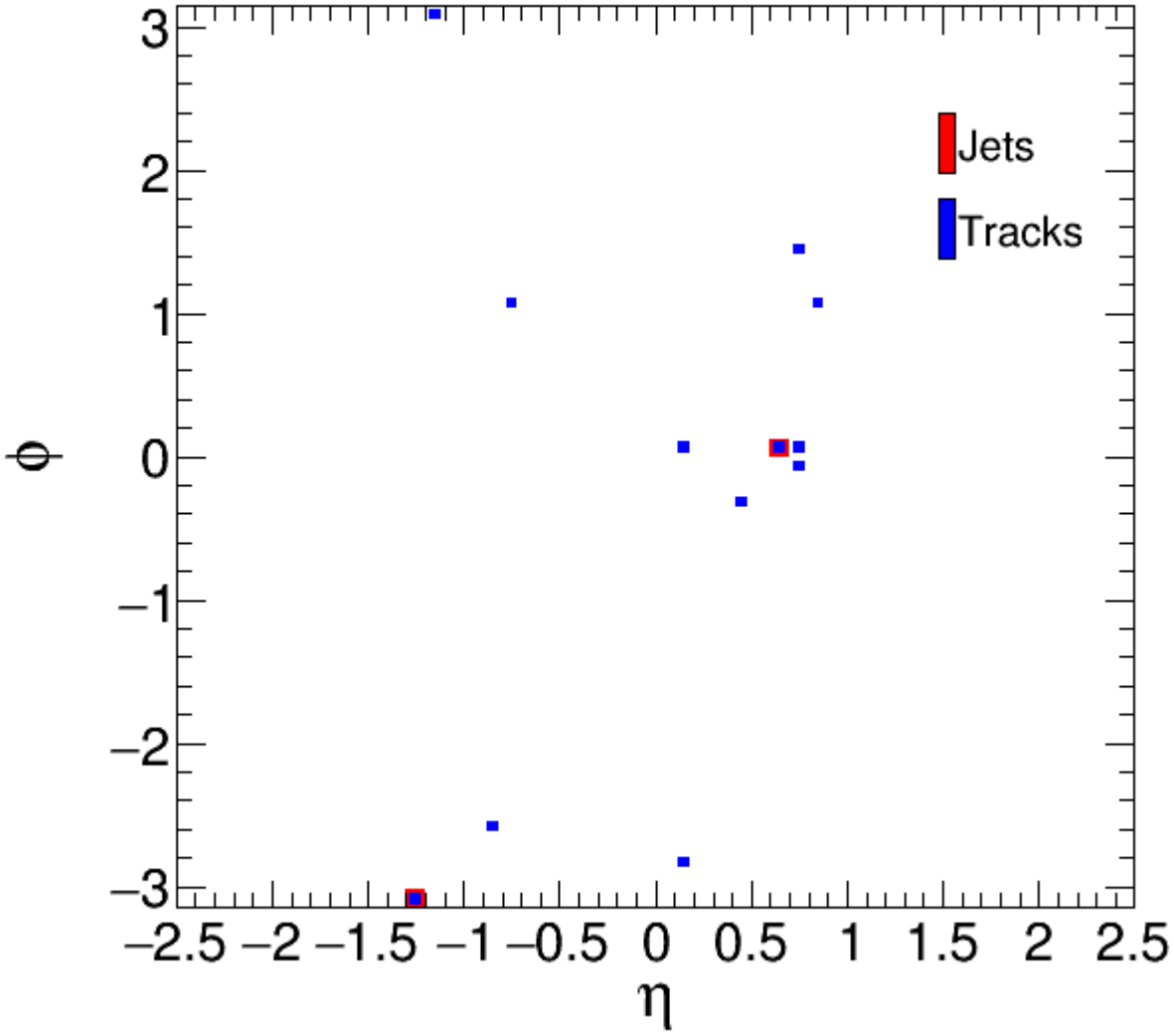
ϕ Vs. η Scatter Plot



ϕ Vs. η Scatter Plot

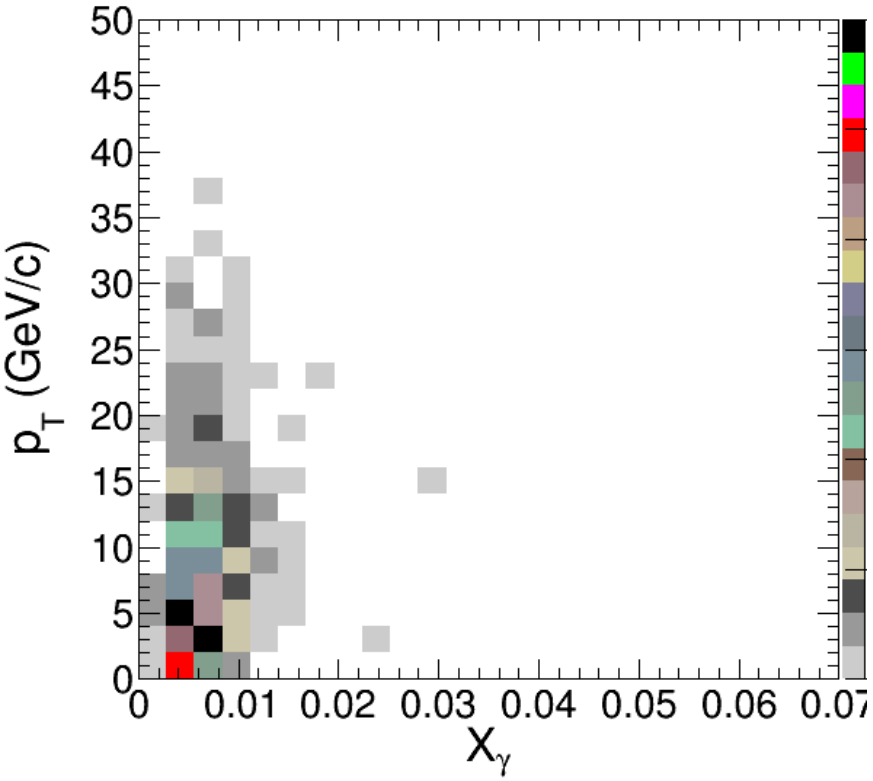


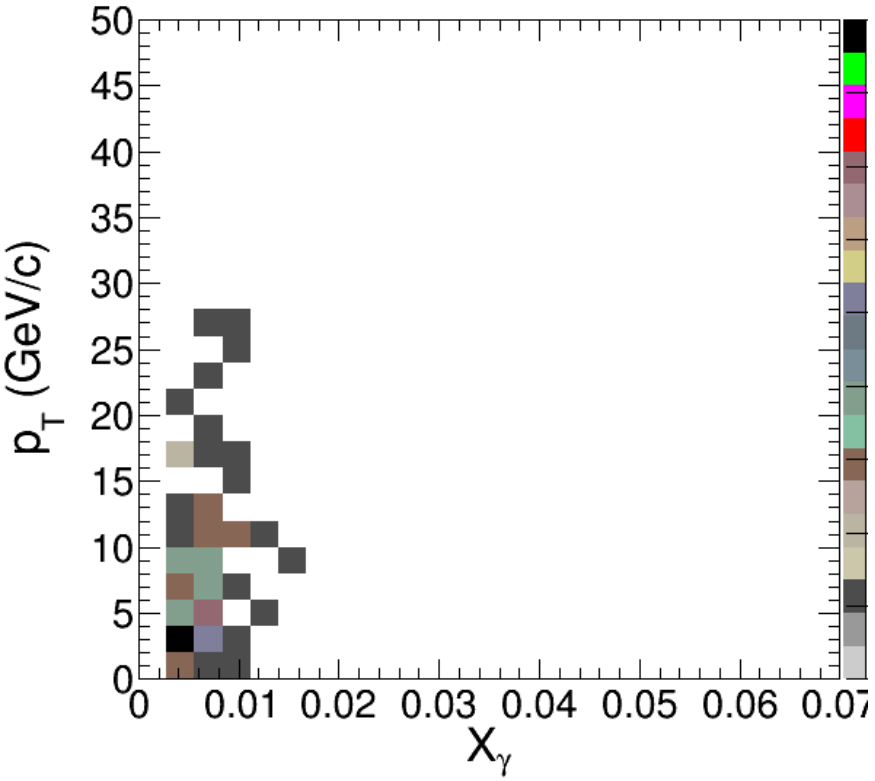
ϕ Vs. η Scatter Plot



Di-jet p_T Vs. X_γ Distribution

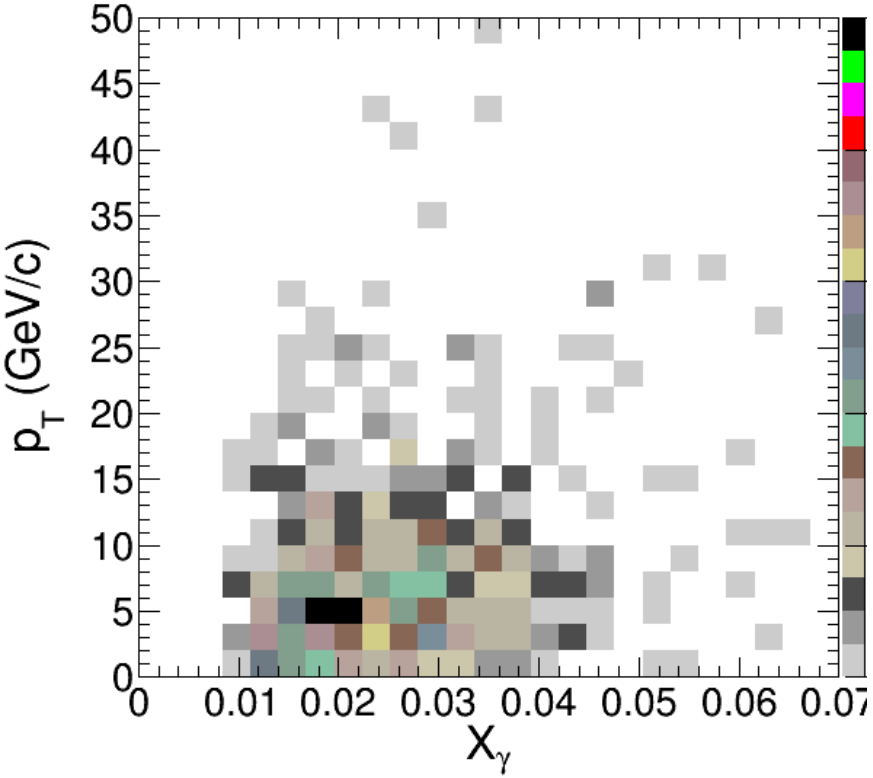
- pp reco without hcal selection
  - $\eta_{jet,1} > 0$ & $\eta_{jet,2} > 0$: 674 events
- PbPb reco without hcal selection
  - $\eta_{jet,1} > 0$ & $\eta_{jet,2} > 0$: 72 events





Di-jet p_T Vs. X_γ Distribution

- pp reco without hcal selection
  - $\eta_{jet,1} < 0$ & $\eta_{jet,2} < 0$: 619 events



- PbPb reco without hcal selection
  - $\eta_{jet,1} < 0$ & $\eta_{jet,2} < 0$: 64 events