Occupancy and Rates

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ePIC BHCal Meeting

March 5th, 2025

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- Data Samples:
  - 2026.02 Campaign: DIS NC Events
  - Beam energies: 10x100, 18x275, 5x41, 5x100, 10x275
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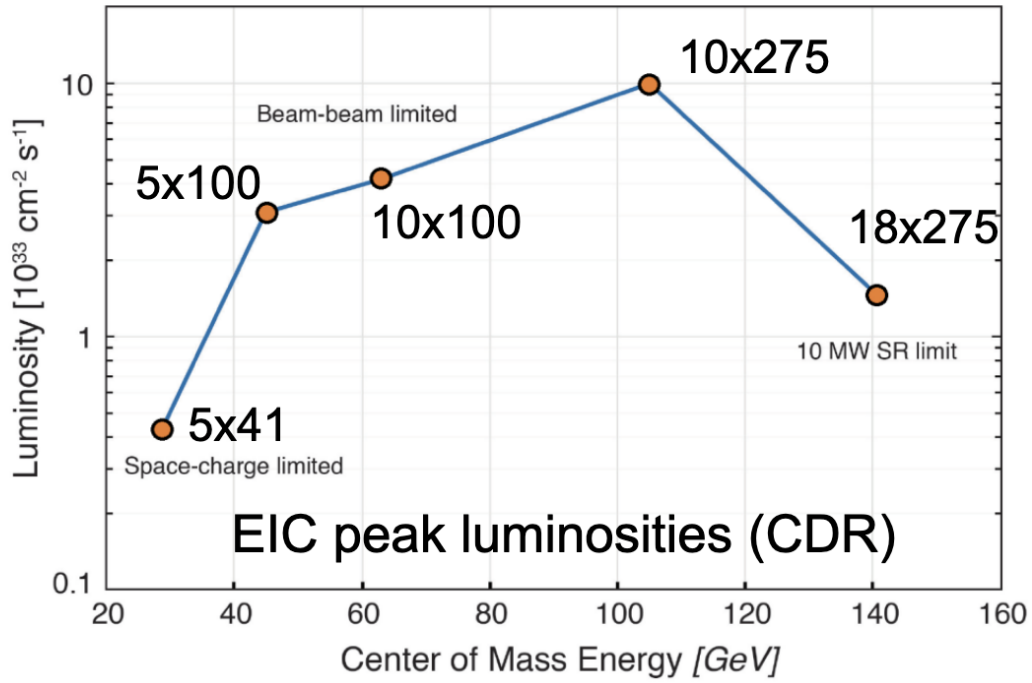
- Using branch HcalBarrelRecHits

Luminosities

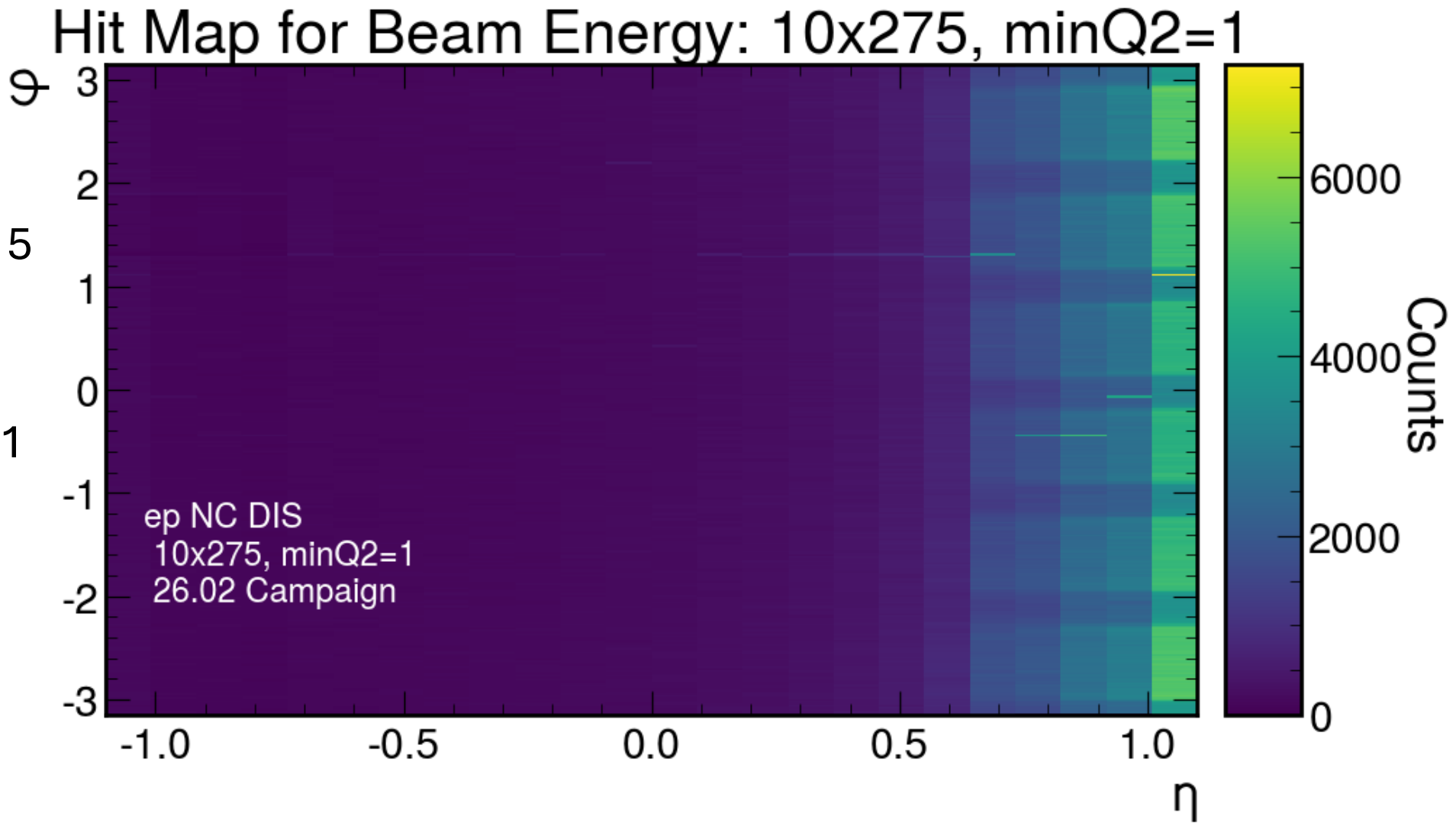
- Taken from Sergei Nagaitsev's COOL25 talk
- Need to find the original source
- Cross sections are read from HEPMC files in EVGEN

CoM Energy (GeV)	Average Lumi ($x10^{33}$ $cm^{-2}s^{-1}$) (per 4-hour store)
105	3
63	1.2
45	1
140	0.44
29	0.13



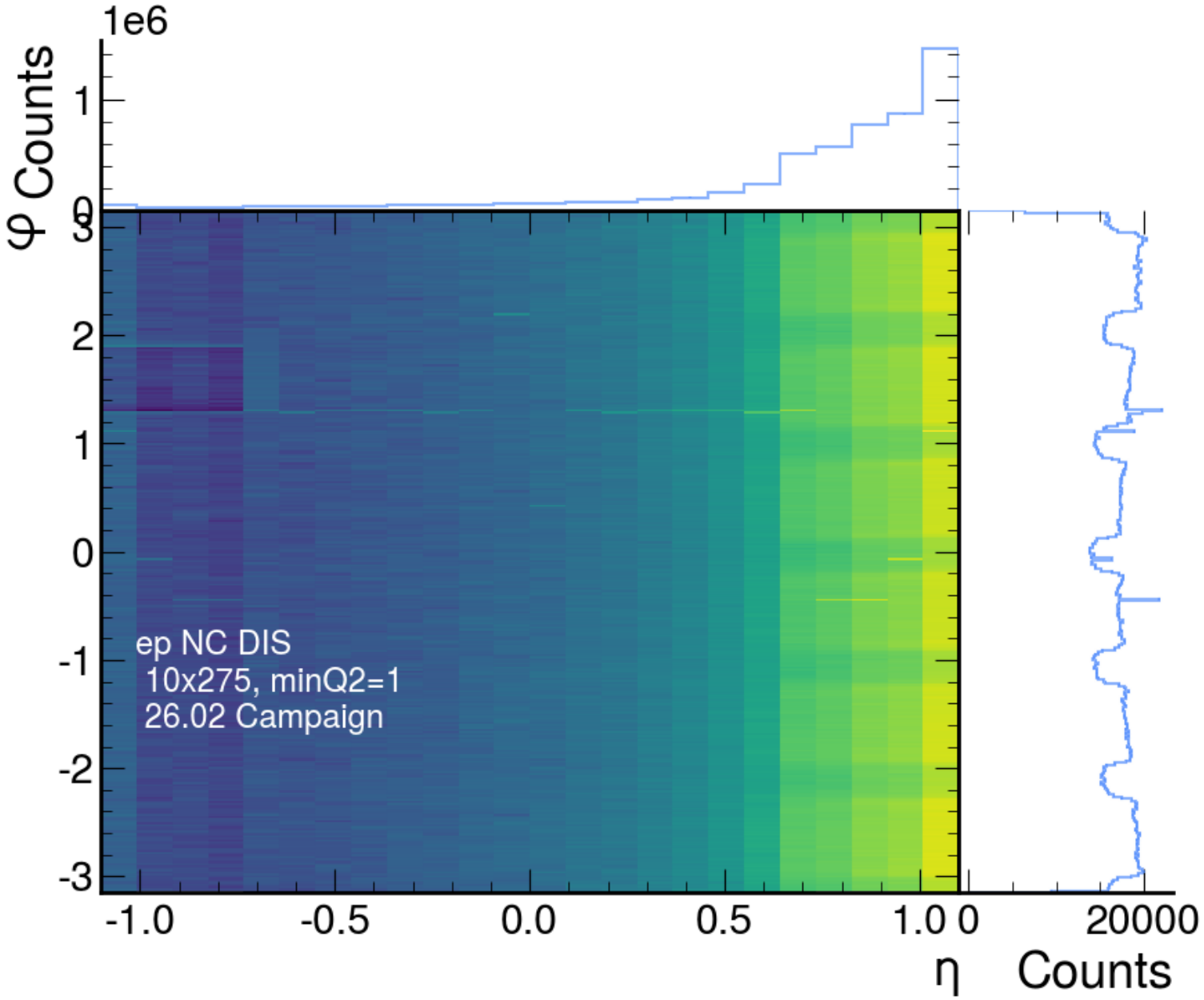
Counts

- φ bins:
  - 320 bins from -3.15 to 3.15
- η bins:
  - 24 bins from -1 to 1
- Several strange features



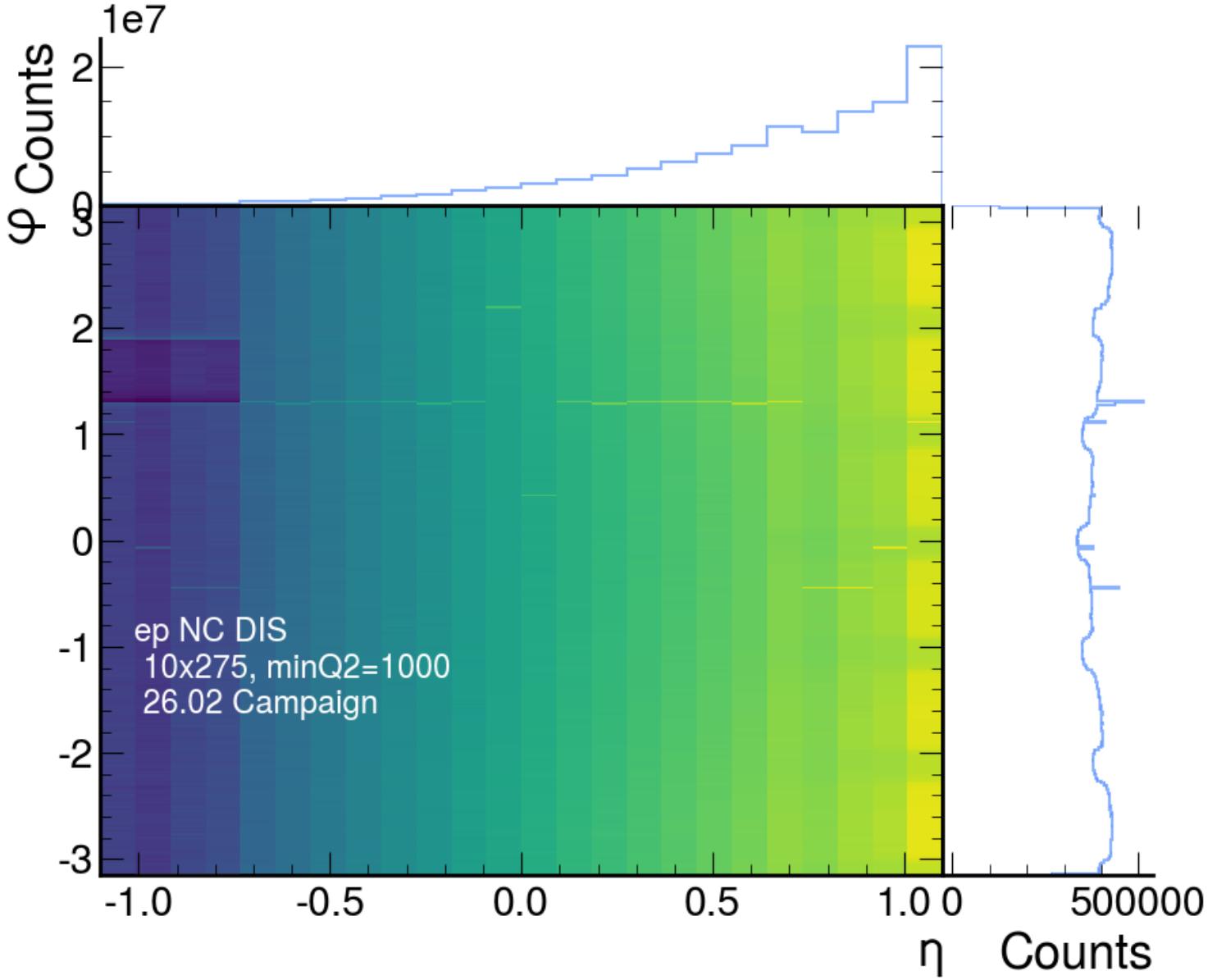
Counts

- z-axis (color) is now log scale
- Projections shown on top and right
- Are these features real? Something in front of HCal? Or bugs?



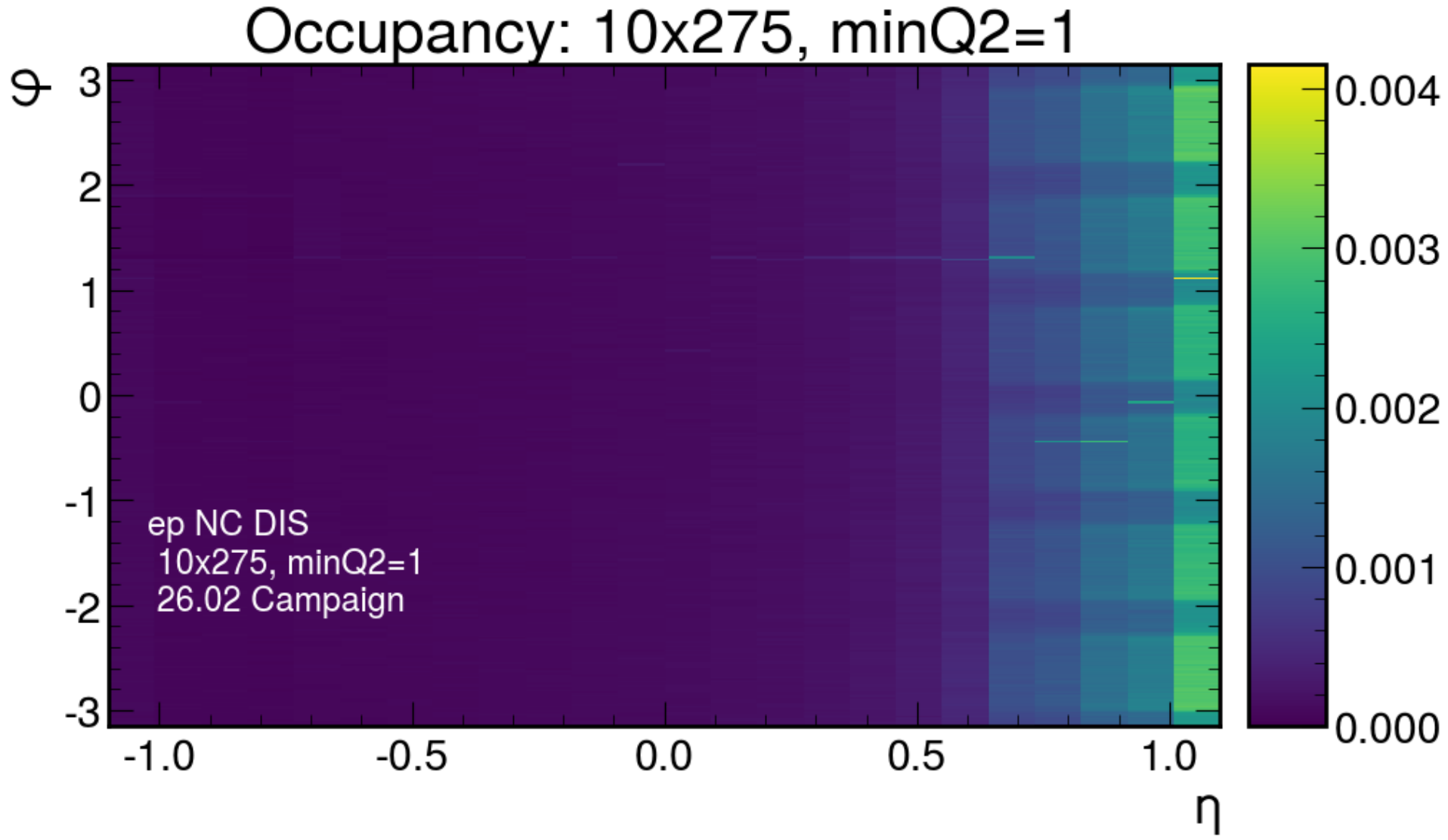
Q2 Dependence?

- Dips less pronounced at high Q2
- Possibly because stripes are only in positive eta region
  - Entire plane is more populated for higher Q2



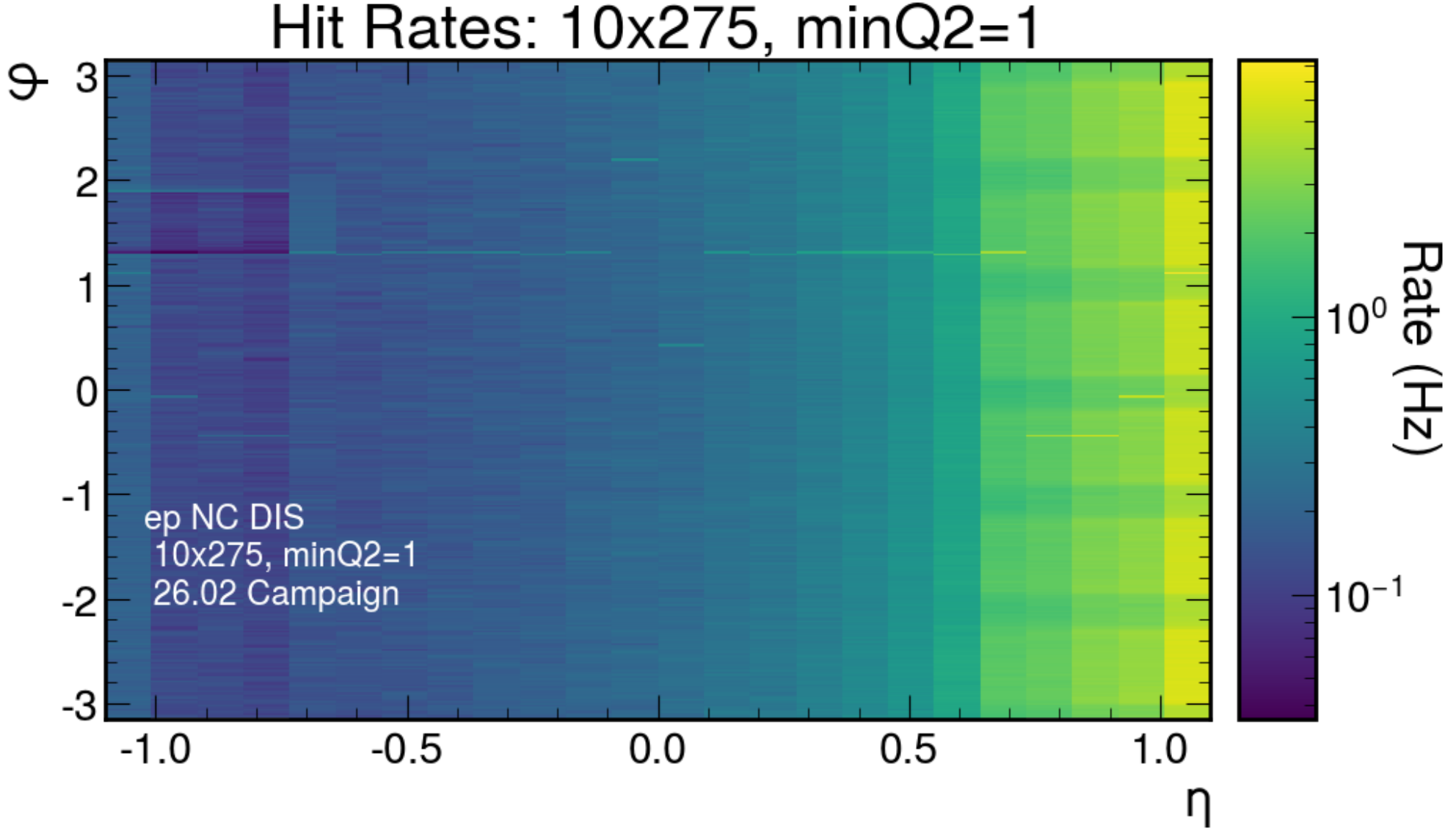
Occupancy

- Counts per tile per event
- Previous Q2=1 distribution normalized by number of events



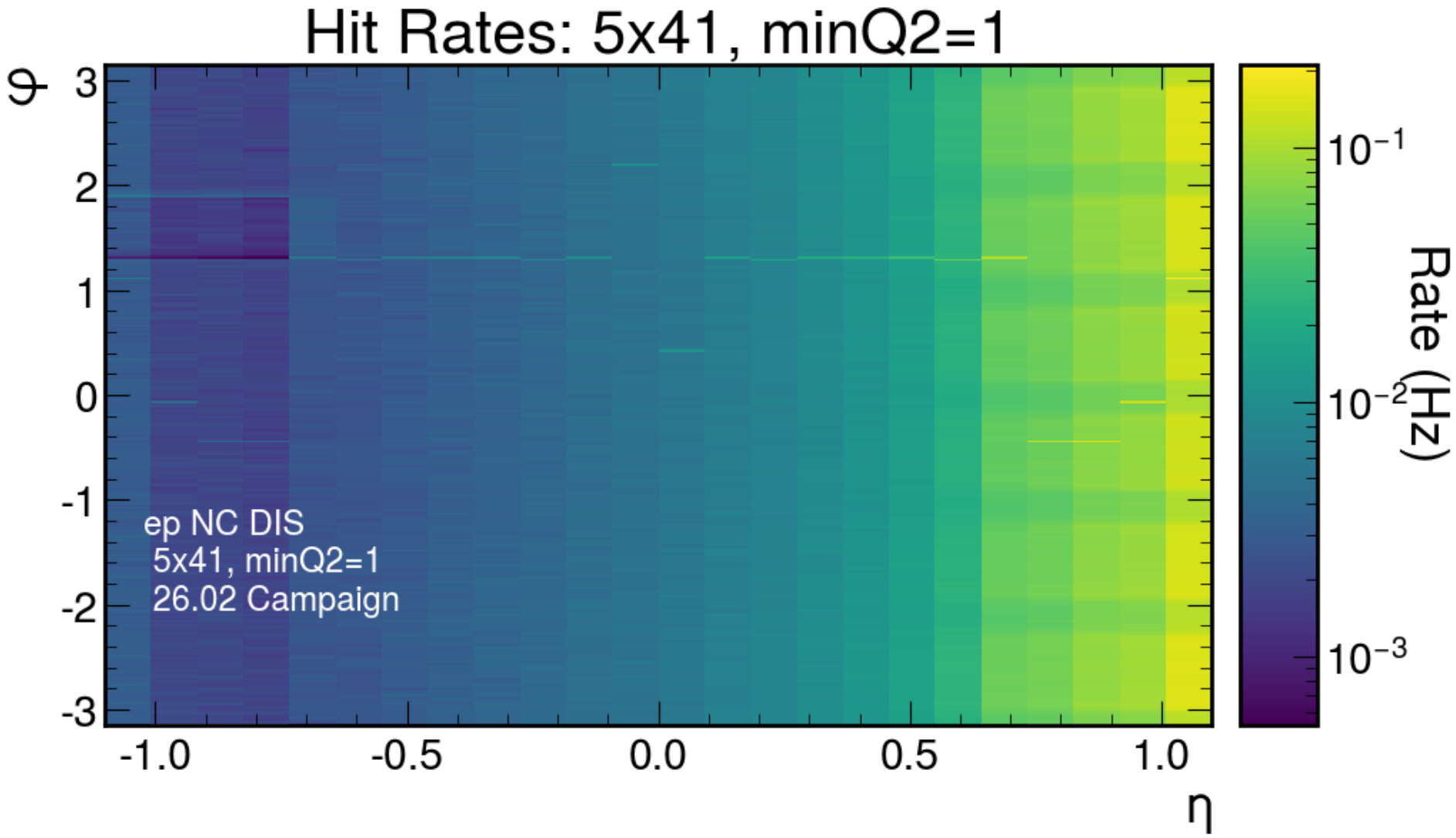
Rates: Highest Lumi

- Now, scale by cross-section and lumi
- Maximum rate is ~7 Hz
- Log scale reveals depleted region



Rates: Another Example

- Lower due to smaller cross section and lumi



Next Steps

- Determine origins of strange features in hit maps
  - Periodic depletion in azimuthal angle
  - Hot tiles
  - Depleted tiles
- Pin down correct luminosity values
- Stitch together Q2 bins
- Make code and cross-sections (stored in json) public

Backup

RUCIO Queries for Datasets

- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/10x100/minQ2=1
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/18x275/minQ2=10
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/5x41/minQ2=100
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/5x41/minQ2=10
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/5x100/minQ2=10
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/5x100/minQ2=1000
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/5x100/minQ2=1
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/10x100/minQ2=10
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/10x100/minQ2=1000

RUCIO Queries for Datasets Cont'd

- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/10x100/minQ2=100
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/5x100/minQ2=100
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/18x275/minQ2=100
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/10x275/minQ2=10
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/5x41/minQ2=1
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/10x275/minQ2=100
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/18x275/minQ2=1000
- epic:/RECO/26.02.0/epic_craterlake/DIS/NC/10x275/minQ2=1000
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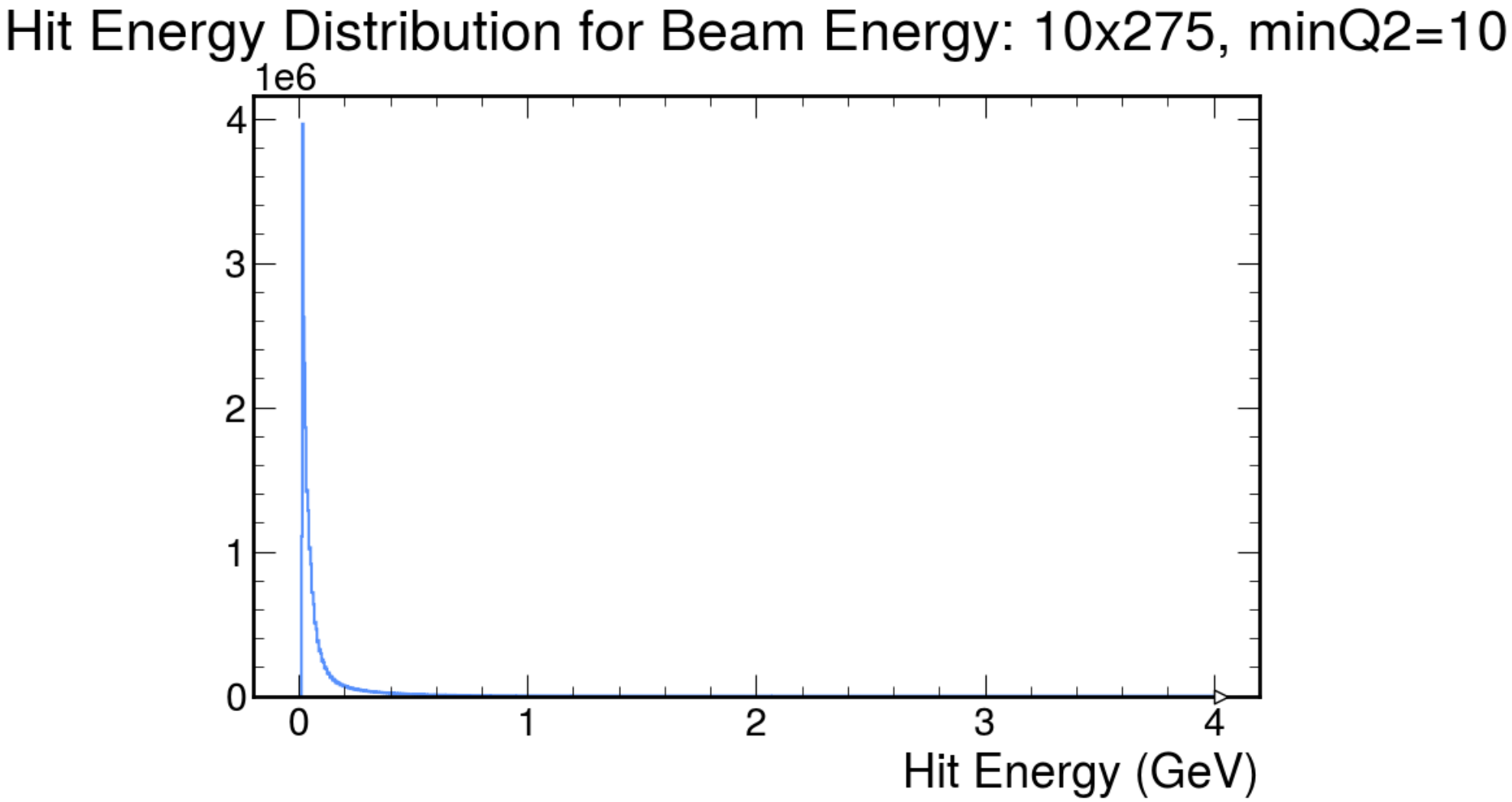
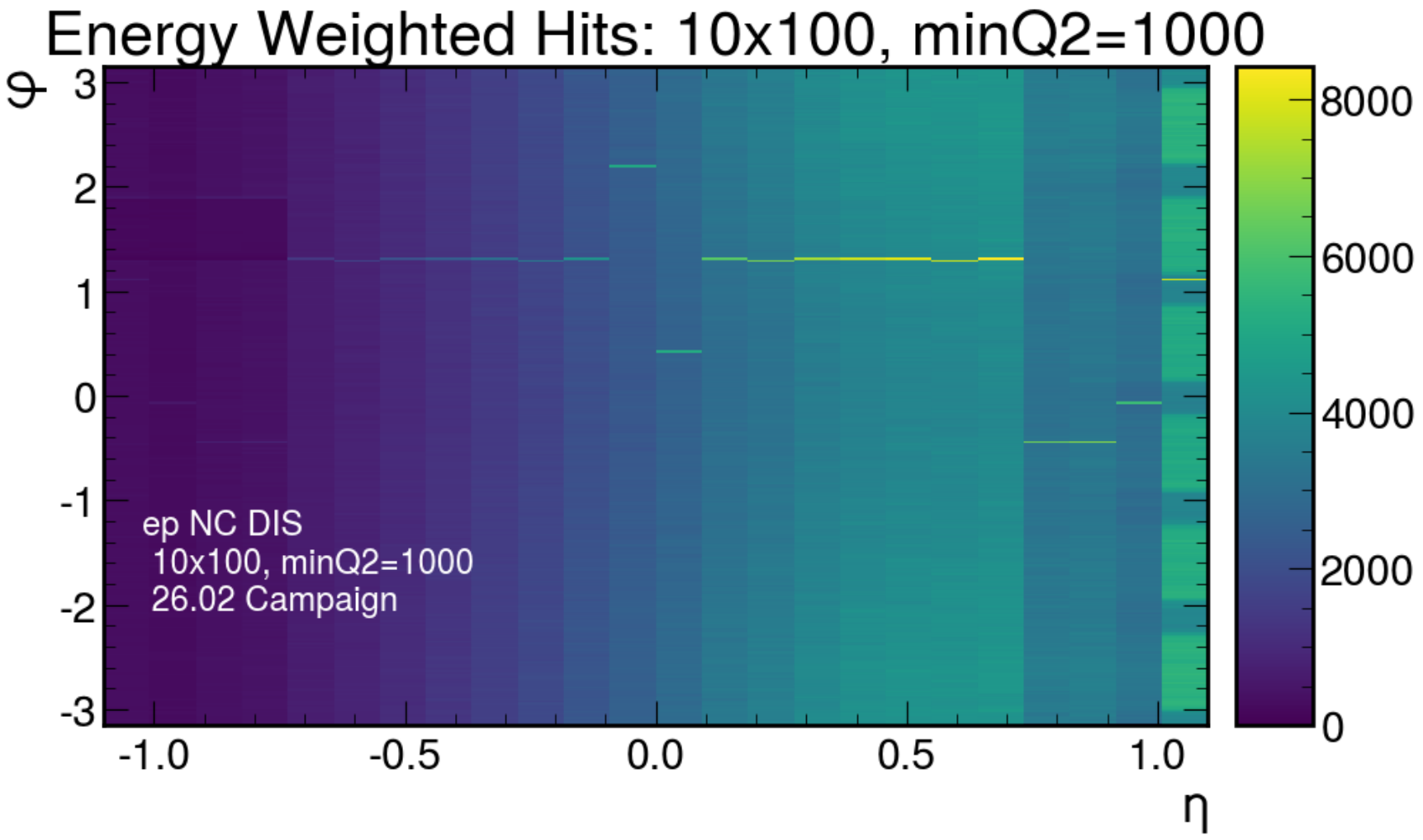
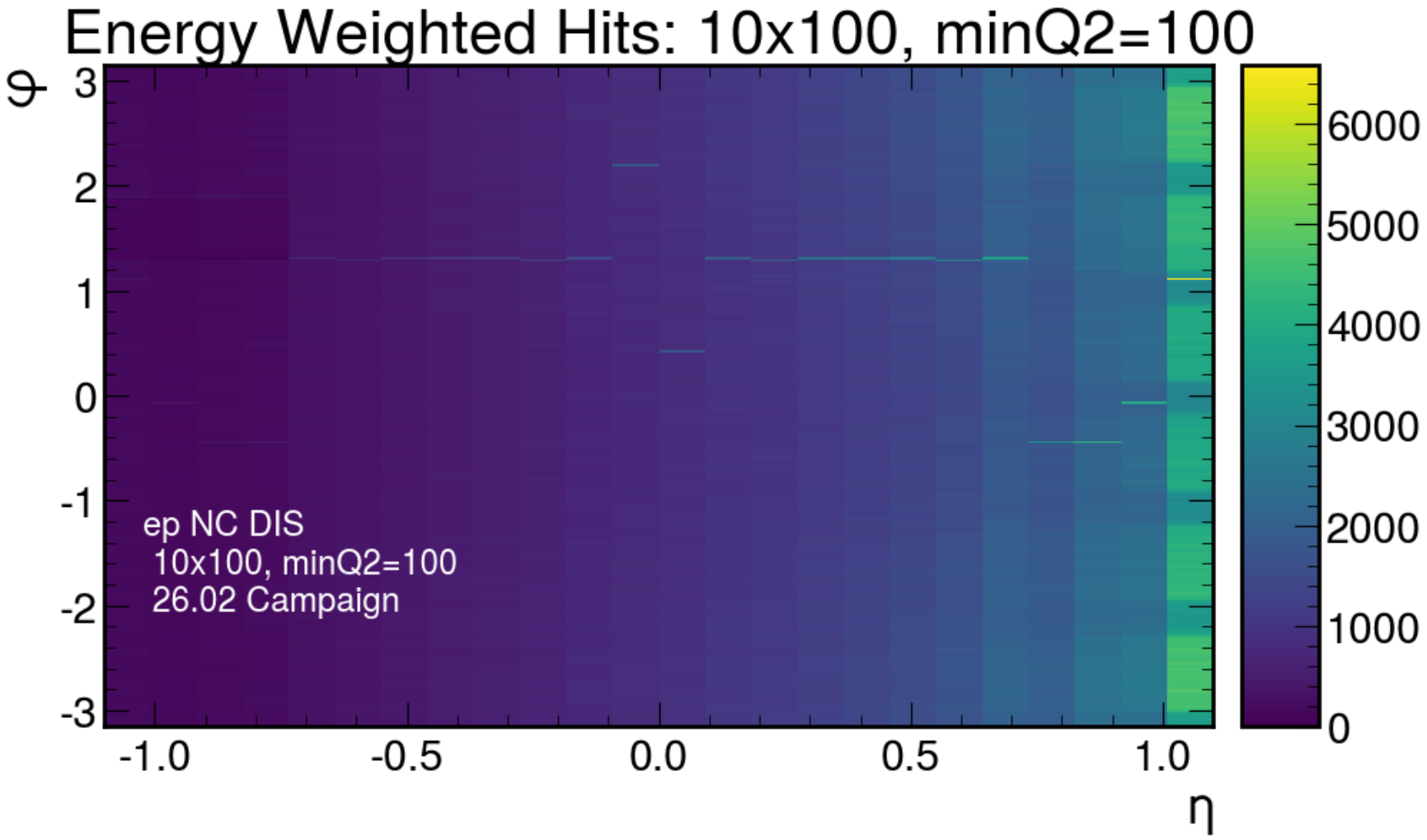
Energy Distribution



Energy Weighted Occupancy



Energy-Weighted Occupancy



Map of RecHits Has Strange Features

- Something in front of the Hcal?
- A peculiar bug?