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# LFHCal background rates 2

Aiden Wu

ORNL (NGSI), Farragut High School



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# Data source

10x275 minbias sample with background, 10k events

- epic:/FULL/26.07.1/epic\_craterlake/Bkg\_Exact1S\_2us/GoldCt/10um/SIDIS/pythia6-eic/1.0.0/10x275/q2\_0to1/pythia\_ep\_noradcor\_10x275\_q2\_0.0000000001\_1.0\_run10.ab.0015.edm4hep.root

Hit rates are dominated by DIS, with small pBeamGas contributions and negligible contributions from other backgrounds.

# Channel Rates and Chip Rates

- Each channel combines energy deposits within a  $\sim 2 \mu\text{s}$  event and counts as fired when the sum exceeds the threshold.
- The p95/p99 values indicate rates below which 95%/99% of observed channels or chips fall.

| Threshold | Channel p95 | Channel p99 | Chip p95 | Chip p99 |
|-----------|-------------|-------------|----------|----------|
| 0.1 MIP * | 2.09 kHz    | 5.56 kHz    | 17.7 kHz | 56.7 kHz |
| 0.3 MIP   | 1.58 kHz    | 3.93 kHz    | 10.4 kHz | 34.1 kHz |
| 0.5 MIP   | 1.33 kHz    | 3.11 kHz    | 7.96 kHz | 25.6 kHz |

\* 0.1 MIP = LFHCAL default threshold, detailed study:

[https://indico.bnl.gov/event/33601/contributions/127190/attachments/71725/122937/lfhcal\\_n\\_insert.pdf](https://indico.bnl.gov/event/33601/contributions/127190/attachments/71725/122937/lfhcal_n_insert.pdf)

# Data rates

- Data per active channel per event:  $4 \times 32 = 128$  bits.
- Data per active chip per event:  $4 \times (32 \times \text{number of active channels on chip} + 128)$  bits.
- The p95/p99 values indicate rates below which 95%/99% of observed channels or chips fall.

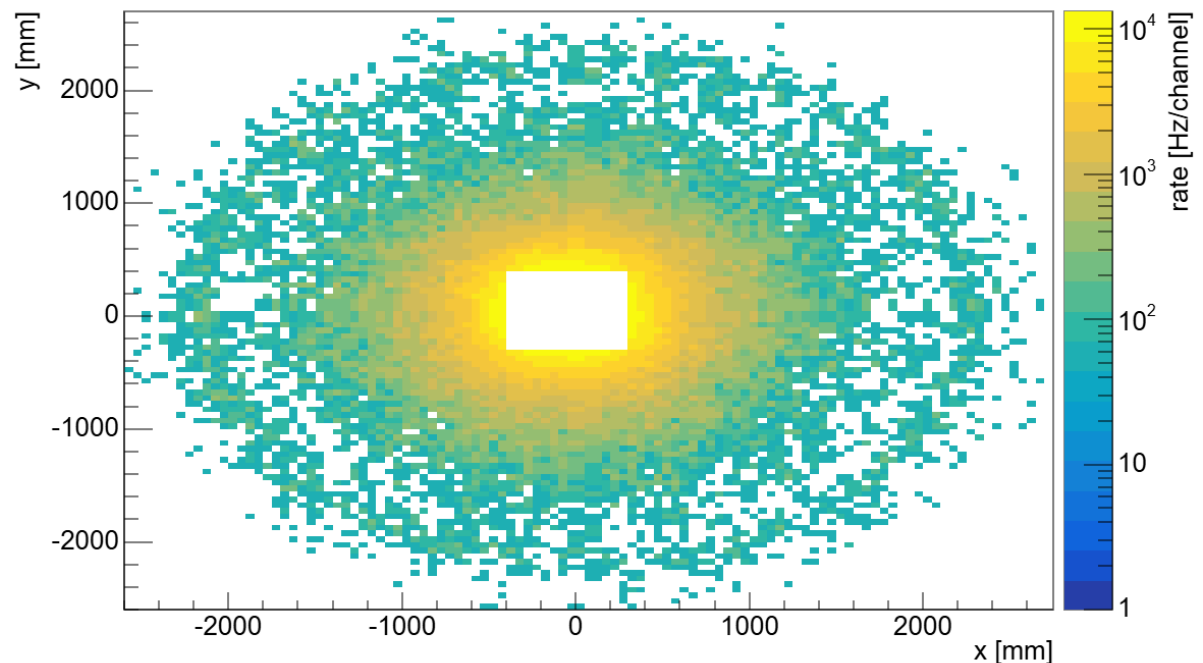
| Threshold | Channel p95 | Channel p99 | Chip p95  | Chip p99  | LFHCAL Total |
|-----------|-------------|-------------|-----------|-----------|--------------|
| 0.1 MIP * | 0.268 Mb/s  | 0.712 Mb/s  | 12.6 Mb/s | 43.3 Mb/s | 5.37 Gb/s    |
| 0.3 MIP   | 0.202Mb/s   | 0.503 Mb/s  | 7.40 Mb/s | 25.9 Mb/s | 3.06 Gb/s    |
| 0.5 MIP   | 0.170 Mb/s  | 0.398 Mb/s  | 5.73 Mb/s | 19.2 Mb/s | 2.21 Gb/s    |

\* 0.1 MIP = LFHCAL default threshold, detailed study:

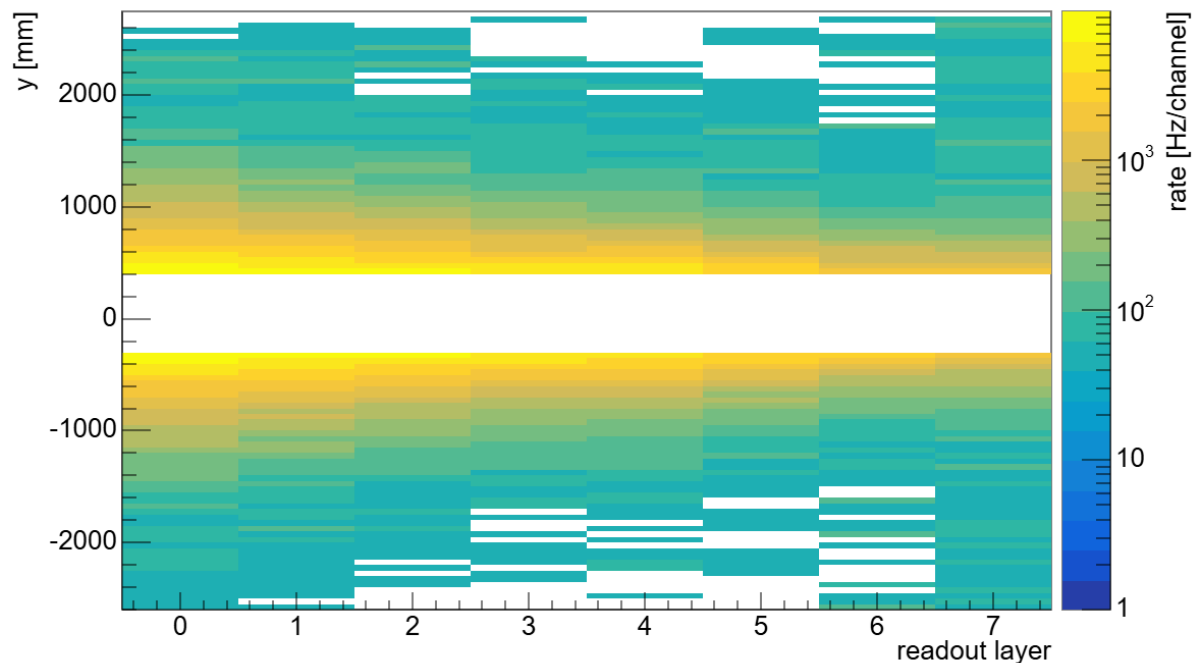
[https://indico.bnl.gov/event/33601/contributions/127190/attachments/71725/122937/lfhcal\\_n\\_insert.pdf](https://indico.bnl.gov/event/33601/contributions/127190/attachments/71725/122937/lfhcal_n_insert.pdf)

# Spatial distributions

all LFHCAL readout layer 1

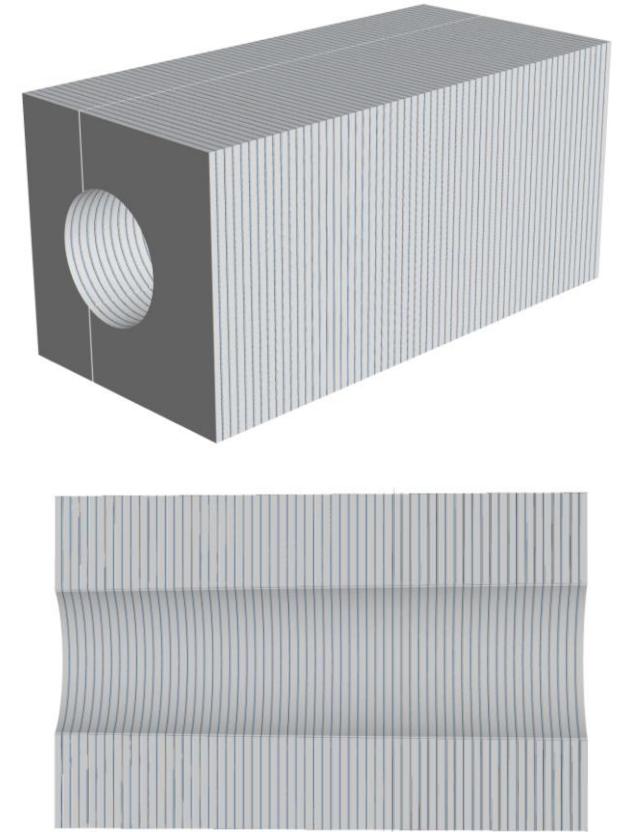


all central X slice



# Insert Calorimeter status

- Original design was unlikely to be built
  - Hexagonal tiles of multiple sizes
  - Layer-specific tile staggering
  - Nonuniform beampipe cutout
- Multiple alternative options and rate requirements have been evaluated via simulations\*
  - LFHCal-sized tiles (47 by 47 mm)
  - Full LFHCal-style readout with longitudinal summing
  - With/without innermost channels



\* Details: [https://indico.bnl.gov/event/33832/contributions/127815/attachments/72030/123342/insert\\_updates\\_20260812.pdf](https://indico.bnl.gov/event/33832/contributions/127815/attachments/72030/123342/insert_updates_20260812.pdf)

# Insert Calorimeter: preliminary rates

- Finalized design: LFHCal-sized tiles, uniform beampipe cutout, room for PCBs
- Preliminary rates significantly higher than that of LFHCal's

| Threshold | Channel p95           | Channel p99           | Chip p95              | Chip p99              | Left side total | Right side total |
|-----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------|
| 0.1 MIP   | 18.0 kHz<br>2.31 Mb/s | 29.7 kHz<br>3.80 Mb/s | 135 kHz<br>102 Mb/s   | 152 kHz<br>117 Mb/s   | 14.8 Gb/s       | 6.79 Gb/s        |
| 0.5 MIP   | 11.8 kHz<br>1.51 Mb/s | 20.0 kHz<br>2.57 Mb/s | 97.9 kHz<br>69.8 Mb/s | 116 kHz<br>84.3 Mb/s  | 9.93 Gb/s       | 4.20 Gb/s        |
| 1.5 MIP   | 7.60 kHz<br>0.97 Mb/s | 13.3 kHz<br>1.70 Mb/s | 67.4 kHz<br>47.5 Mb/s | 81.7 kHz<br>57.7 Mb/s | 6.54 Gb/s       | 2.72 Gb/s        |

# Insert Calorimeter: redesign

- The redesign has been implemented into ePIC/ElCrecon
- More realistic analysis when new simulation campaigns release

