

# "Freight Train" production model and efforts at Argonne Leadership Computing Facility

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## The NOvA Experiment

- Long-Baseline
  - Beam travels 810km from Fermilab to MN
- High-energy
  - 700kW beam on graphite target
- Off-axis
  - Beam aimed 14 mrad off center to maximize neutrino appearance

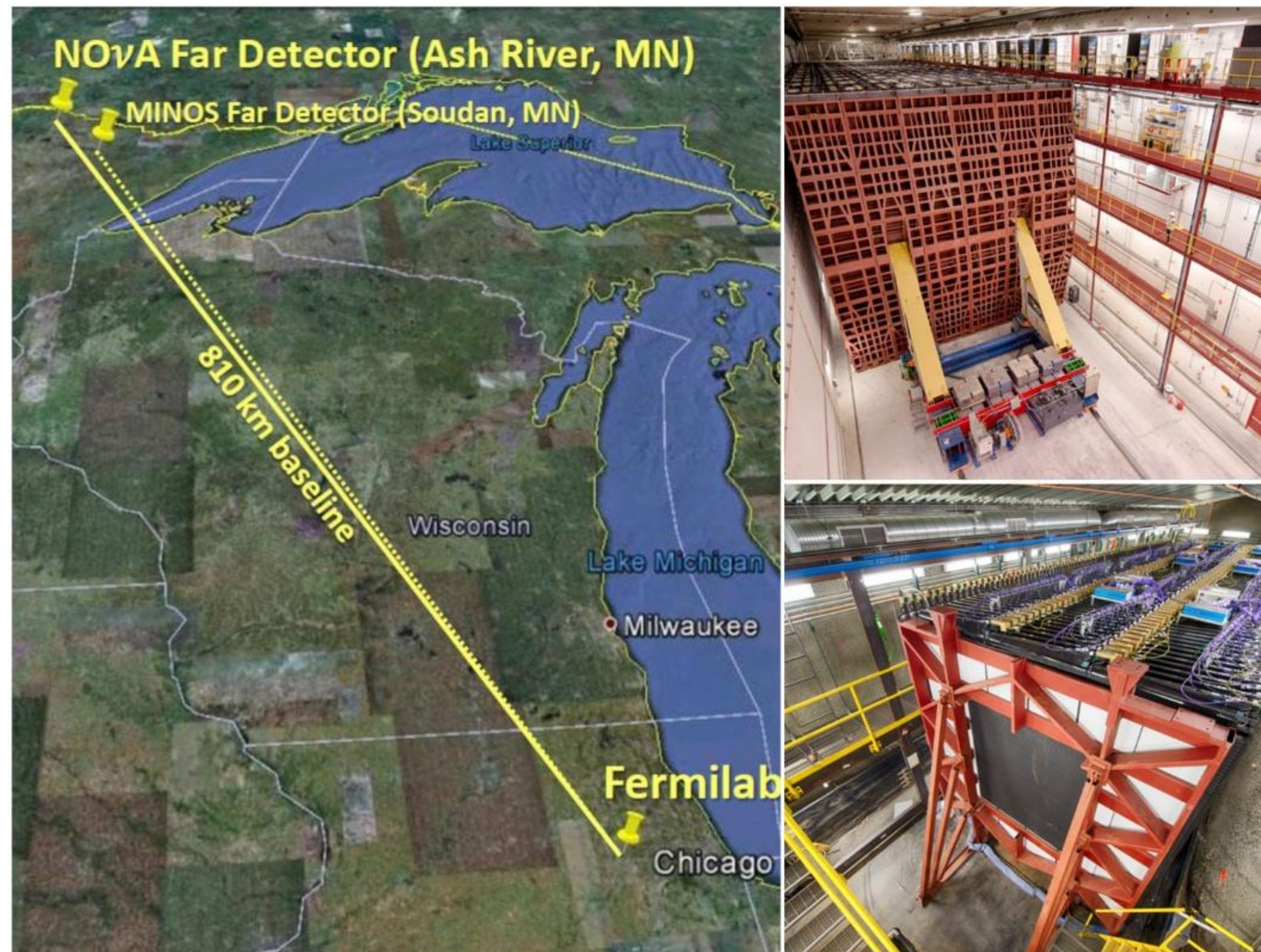


Figure 1. The NOvA Far Detector (top-right), located in Ash River, MN, 810 km away from the Near Detector (bottom-right), which is located at Fermilab

- Near Detector
  - Located at Fermilab
  - 105m underground
  - 20k detection channels
- Far Detector
  - Located in Ash River, MN (810km away)
  - 344k detection channels

## Freight Train Production Model

- Detectors collect large amounts of data
  - Order of 10s of petabytes
- Data is stored on tapes at Fermilab
- The process of retrieving this data in the past:
  - Create definition containing list of related files
  - Go through definition, pull tape holding file
  - Finish definition, move to next definition
- Past process inefficient
  - A significant bottleneck to production
- Freight train model alleviates this bottleneck
  - Get list of all definitions
  - Go through tapes sequentially
  - Get every file for every definition off the tape
  - Move to next tape
- Increases time for a definition to complete
  - Vastly outweighed by throughput gained

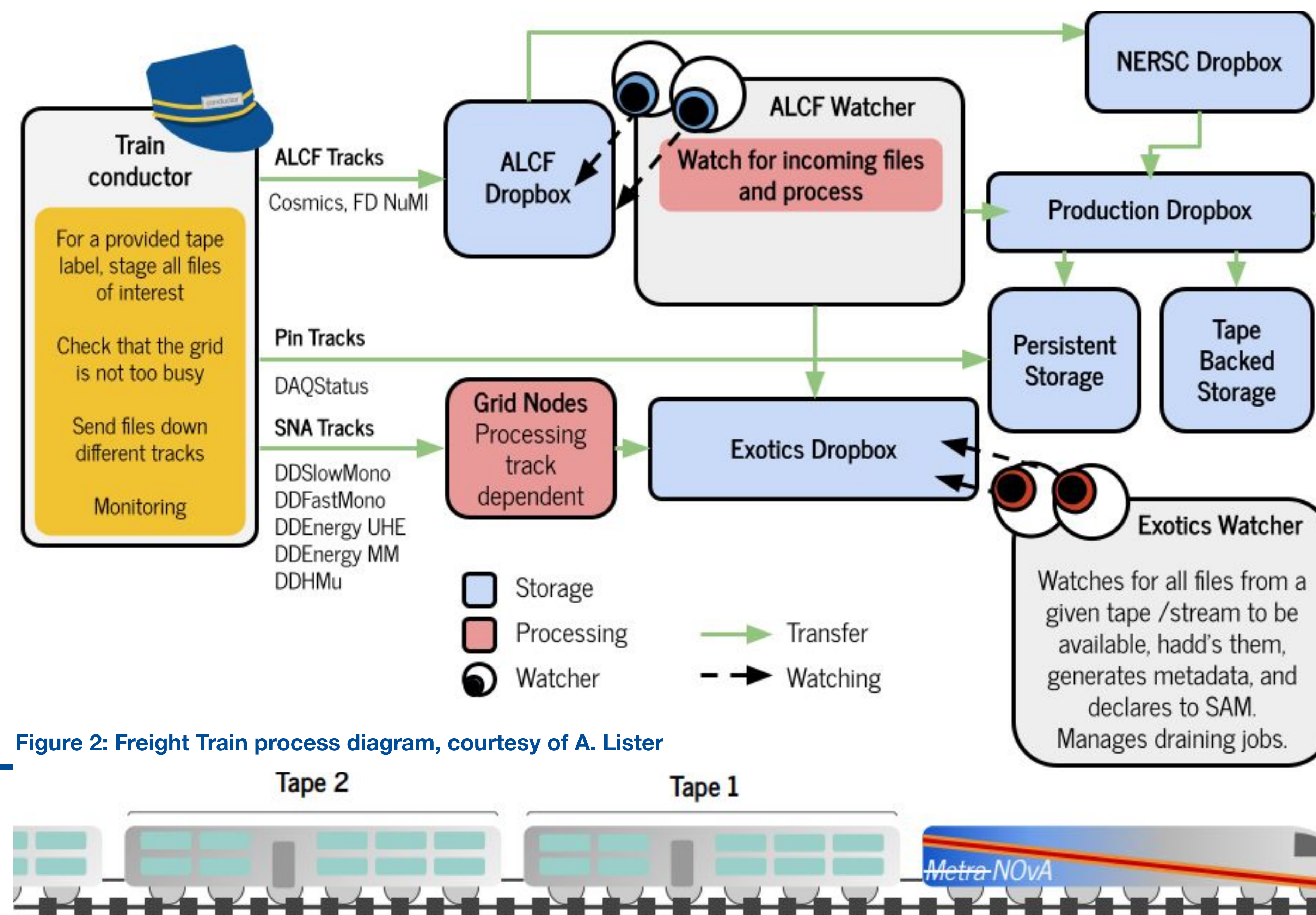


Figure 2: Freight Train process diagram, courtesy of A. Lister

## Efforts at ALCF - Cosmic Filtering

- Far Detector files require cosmic filtering
- Process to filter cosmic background is not trivial
  - Incredibly expensive computationally
    - Require  $\sim 10^6$  rejection power
  - Benefits greatly from parallelization
- ALCF's ThetaGPU farm provides resources
  - NVIDIA A100 GPU's
  - Utilize GPU to simultaneously run many jobs

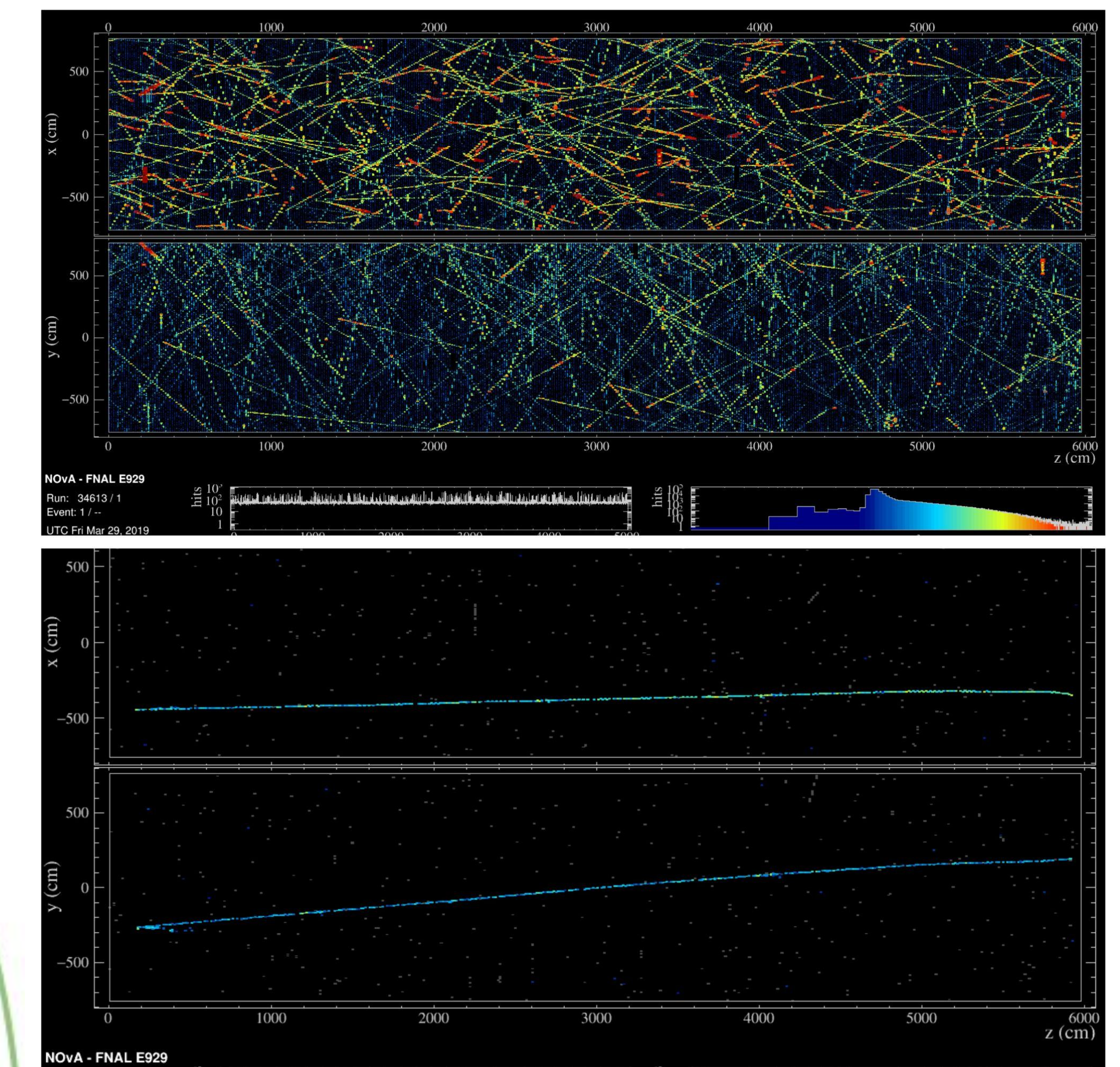


Figure 3 - Top: Unfiltered event display of a far detector event  
Bottom: Post filtering event display, that's a lot of rejection!

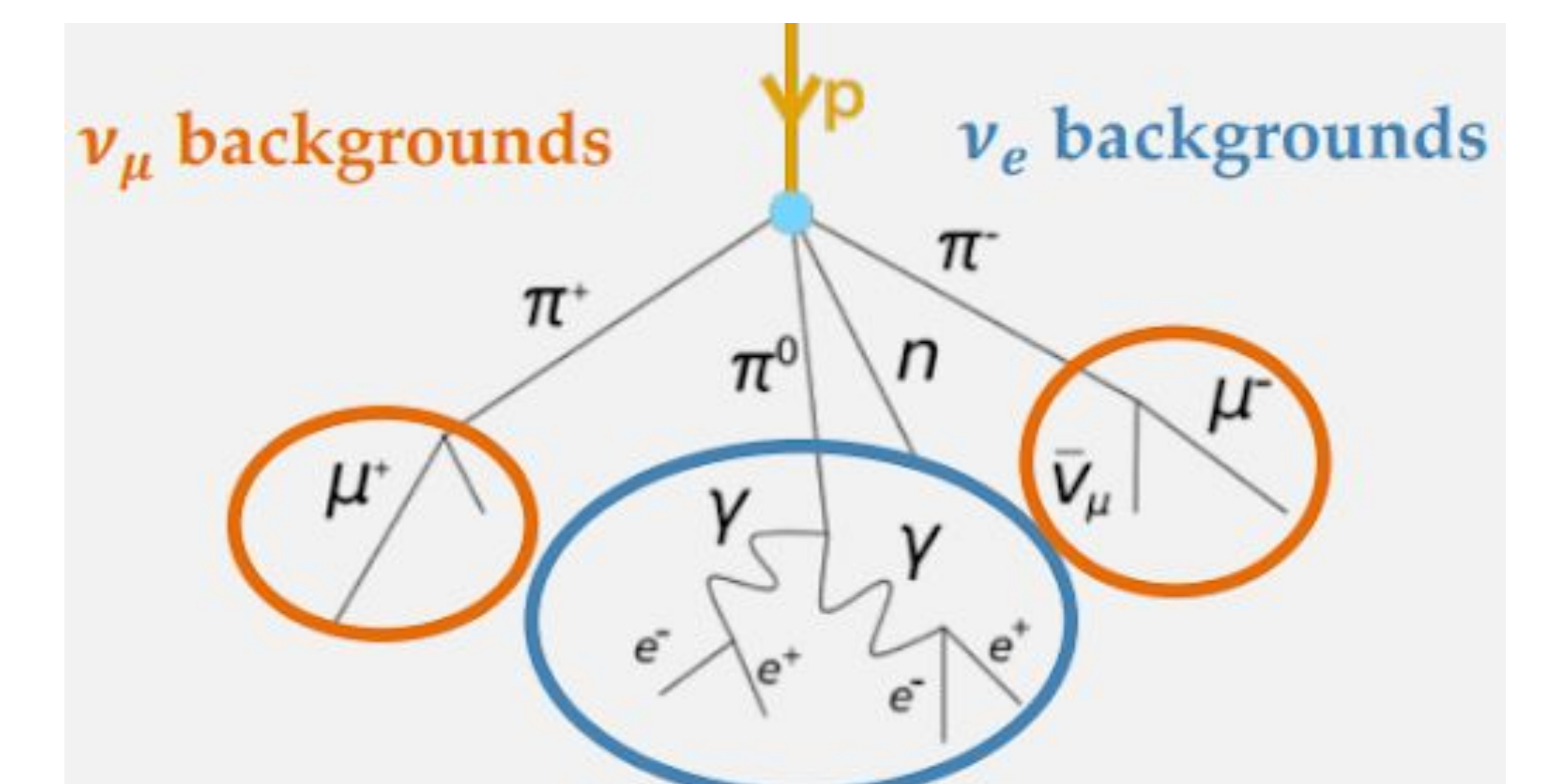


Figure 4: Cosmic neutrino events

