



Task 12.5: Particle Flow Reconstruction

John Back



on behalf of the Task 12.5 institutes

26th August 2021

Research Projects

- Dual Readout Calorimeters simulation & digitisation:
 - I. Vivarelli (Sussex), B. Di Micco (INFN Roma-3), S. Vallecorsa (CERN)
 - No news to report
- ILC Calorimeter simulation & reconstruction:
 - G. Grenier (CNRS-IP2I), V. Boudry (CNRS-LLR)
- DUNE Near Detector simulation & reconstruction:
 - J. Marshall & J. Back (Warwick), M. Uchida (Cambridge)

APRIL (Algorithm for Particle Reconstruction @ ILC)

G. Grenier (CNRS-IP2I), V. Boudry (CNRS-LLR)

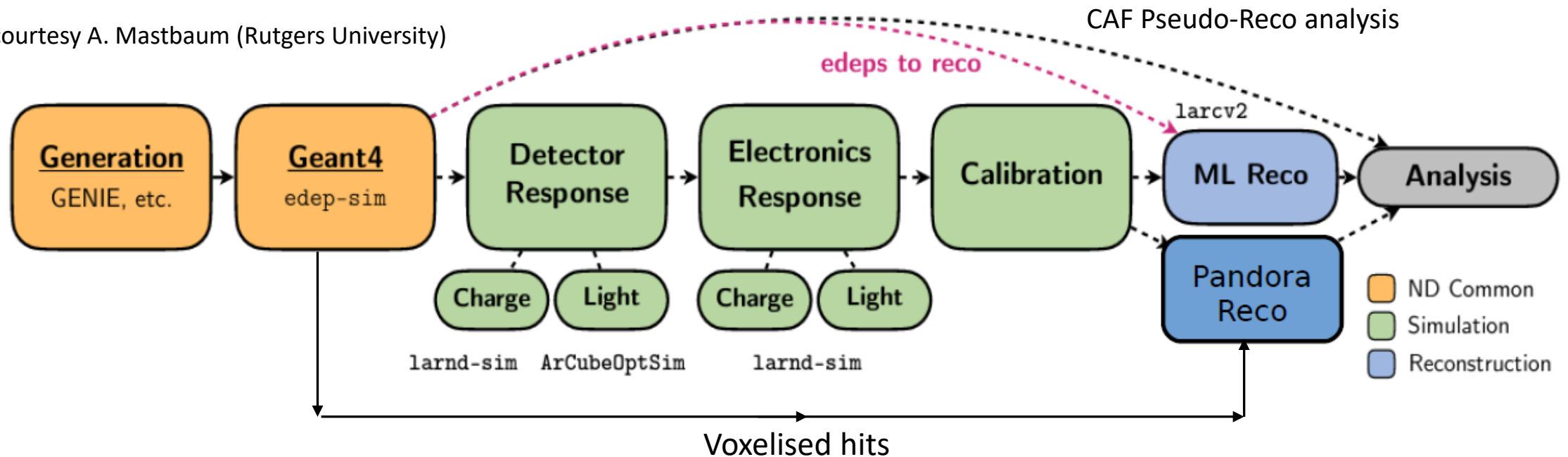
- Have first version of potentially working algorithm to **split clusters**
 - Tested on simulated **pairs of showers** using **LCIO** format (github.com/iLCSoft/LCIO)
- Results are encouraging
- However, project student working on this has **finished internship**
 - Activity will slow down for the near future
- Some code cleaning is still needed

Reconstruction for DUNE Near Detector (ND)

J. Marshall & J. Back (Warwick), M. Uchida & A. Moor (Cambridge)

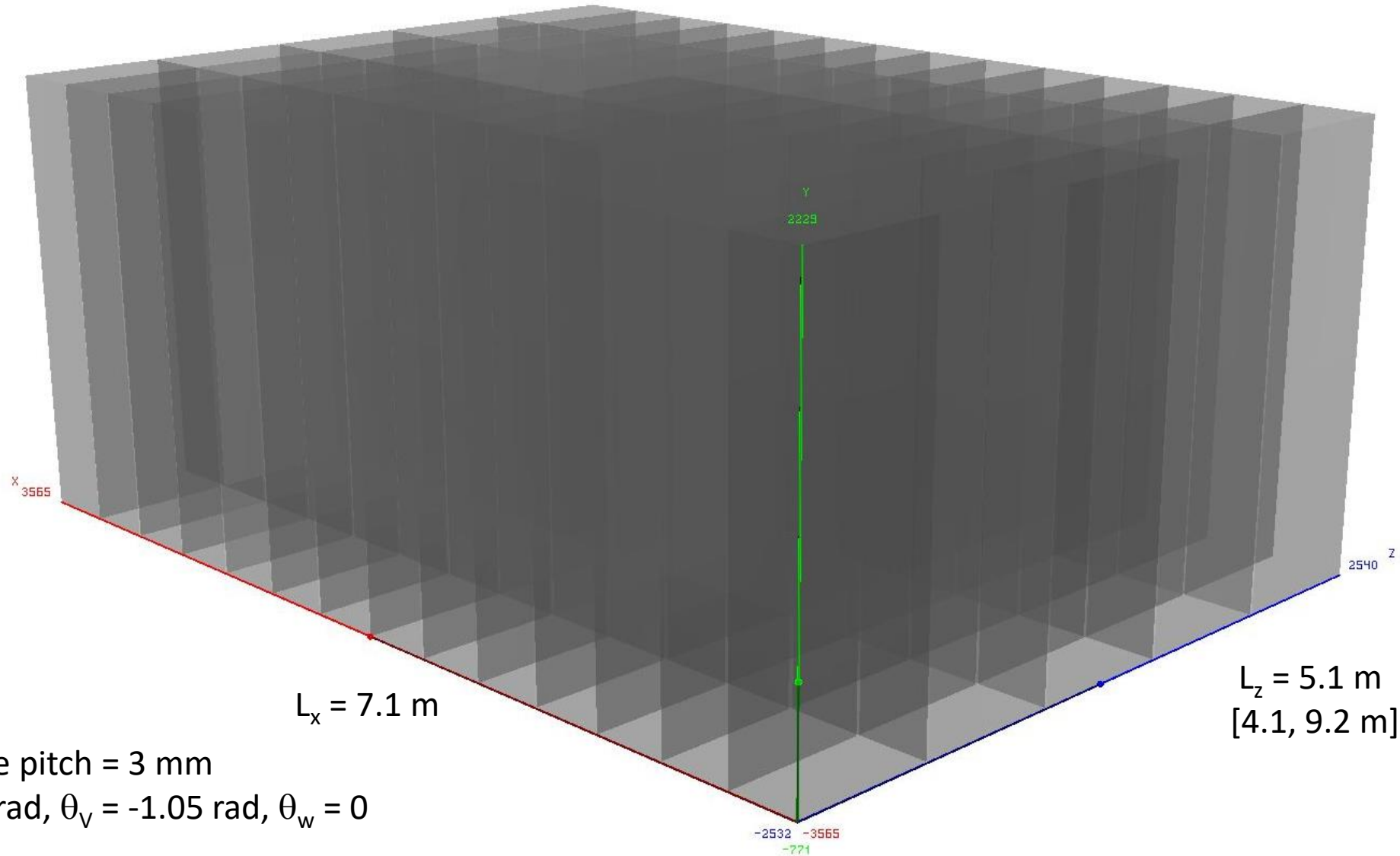
- Using and adapting [Pandora](#) software: **LArReco** [feature/edep-reco](#) git branch
- ND design assuming **LArTPC ArgonCube** geometry
- Simulated ND analysis chain
 - Mimic detector response using $0.4 \times 0.4 \times 0.4$ cm³ voxels for Geant4 [edep-sim](#) hits

Image courtesy A. Mastbaum (Rutgers University)



ArgonCube Geometry

$L_y = 3 \text{ m}$



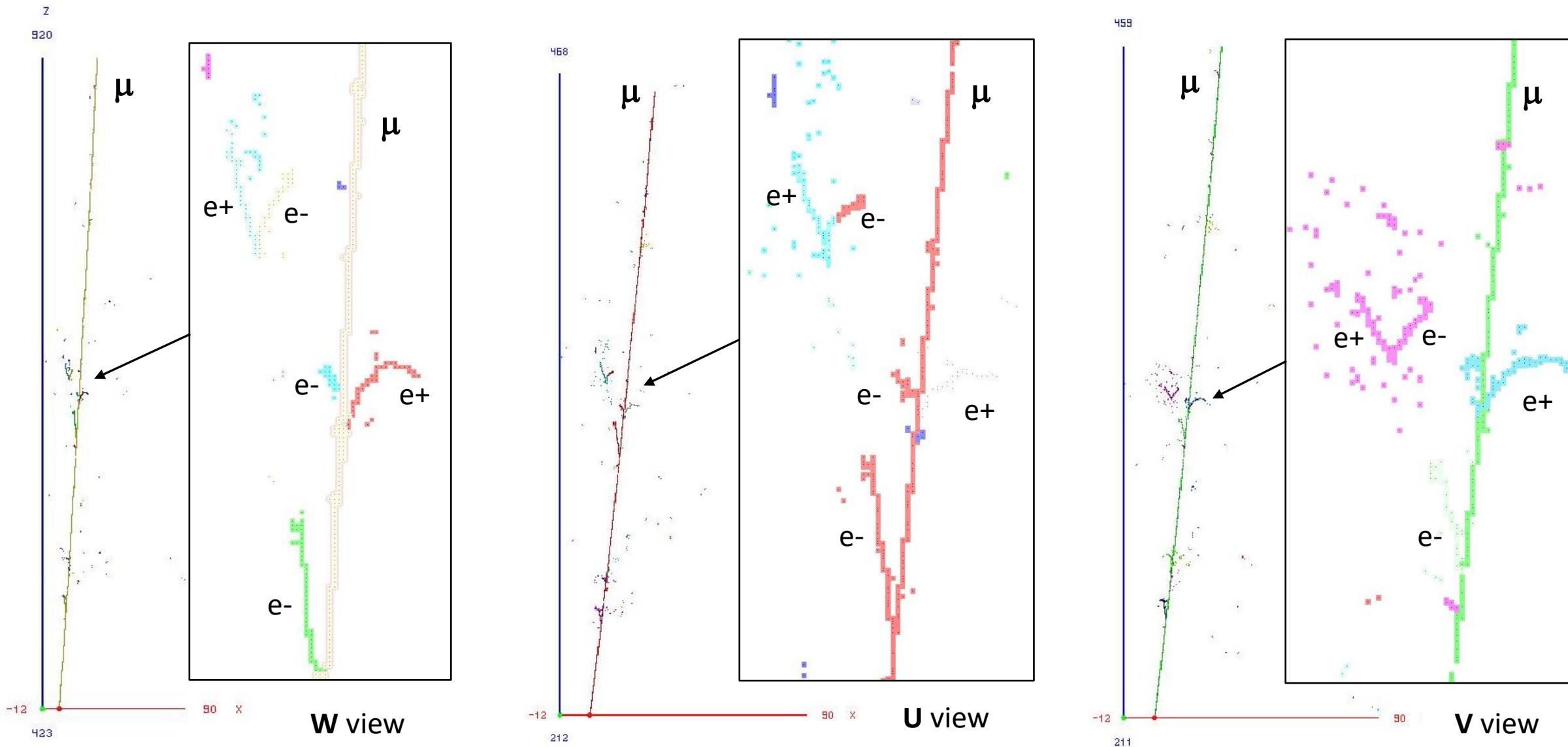
$L_x = 7.1 \text{ m}$

$L_z = 5.1 \text{ m}$
[4.1, 9.2 m]

U,V,W wire pitch = 3 mm

$\theta_U = 1.05 \text{ rad}$, $\theta_V = -1.05 \text{ rad}$, $\theta_W = 0$

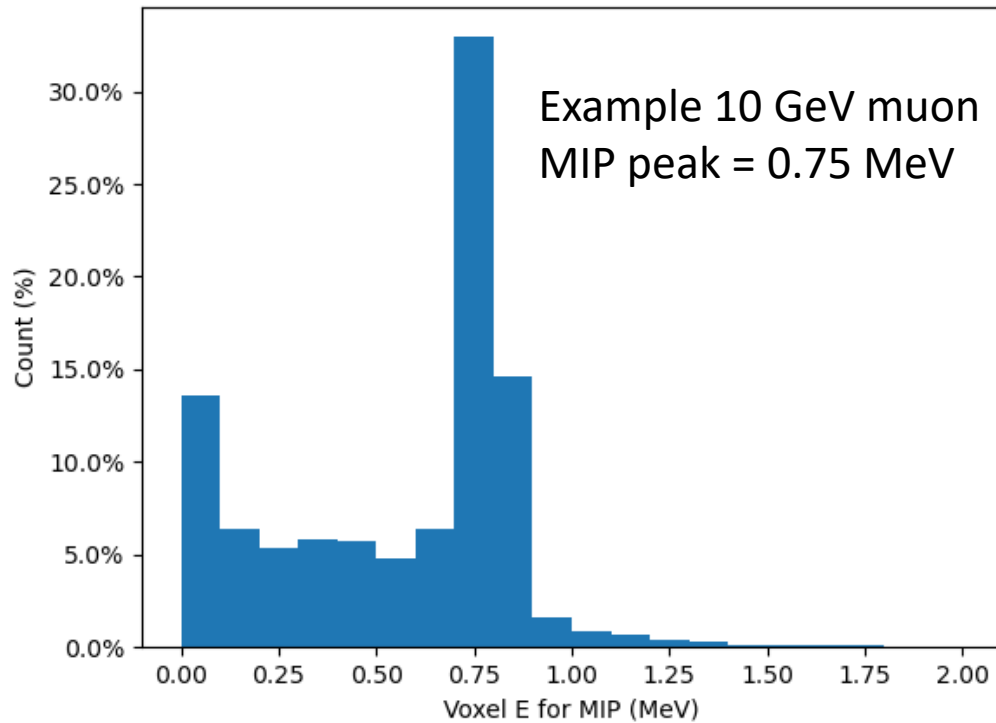
Single 10 GeV muon: 1st reco pass for voxelised hits



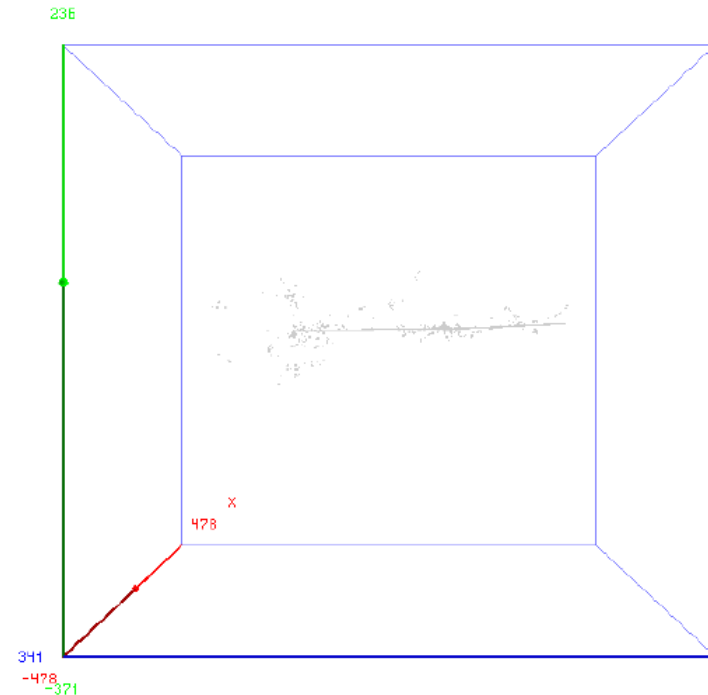
Colours: Reco'd Particle Flow Objects. Also contain matched MC truth information

Minimum Ionising Particle (MIP) calibration

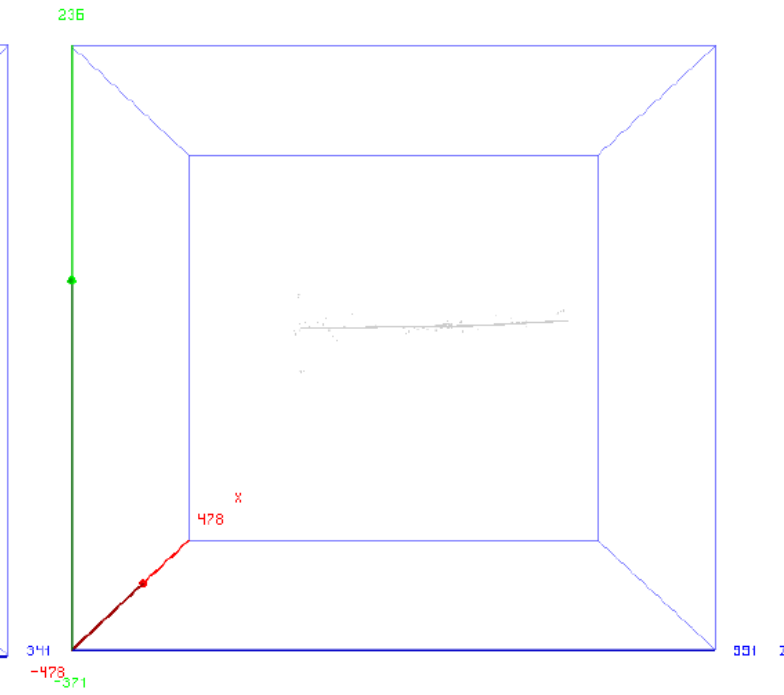
MIP Calibration Voxel Energies



Equivalent MIP E = voxel E / MIP peak



No MIP cut



$E > 0.3$ MIP (0.225 MeV)

Apply MIP cut to aid pattern recognition
Removed hits added later for full E reco