

# ProtoDUNE Physics Week

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Links to sim/data samples, descriptions and example codes:

<https://web.fnal.gov/collaboration/DUNE/SitePages/Topics%20for%20work%20during%20the%20Physics%20Week.aspx>

Slack channels: pdune-hackdays-\*

<https://dunescience.slack.com>

Tutorial slides, whole session, and:

Photon Detectors:

<https://indico.fnal.gov/event/15181/session/0/contribution/3/material/slides/1.pdf>

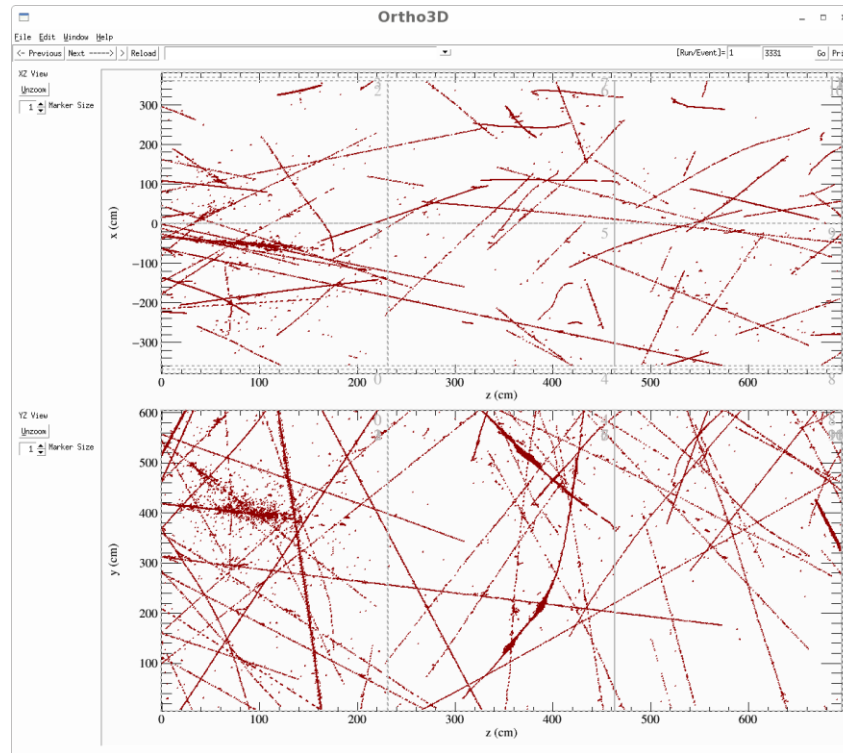
Software, algorithms, data products:

<https://indico.fnal.gov/event/15181/session/0/contribution/3/material/slides/3.pdf>

- Joint session with FD sim/reco this morning:
  - a. SpacePointSolver for ProtoDUNE SP/DP and 3x1x1
  - b. PMA interfaces for new information from upstream algorithms: TrajCluster and SpacePointSolver
- Introduction and tasks – now
  - a. „rejection” of  $\pi^0$ : gap detection, dE/dx, tests of purity/efficiency of required selections
  - b. noise: simulation, removal and related issues
  - c. cosmic tracks: CRT/TPC, PD/TPC matching
  - d. choice of small but useful tasks to get familiar with the code
- Michel selection and BI related tasks – in the next talks

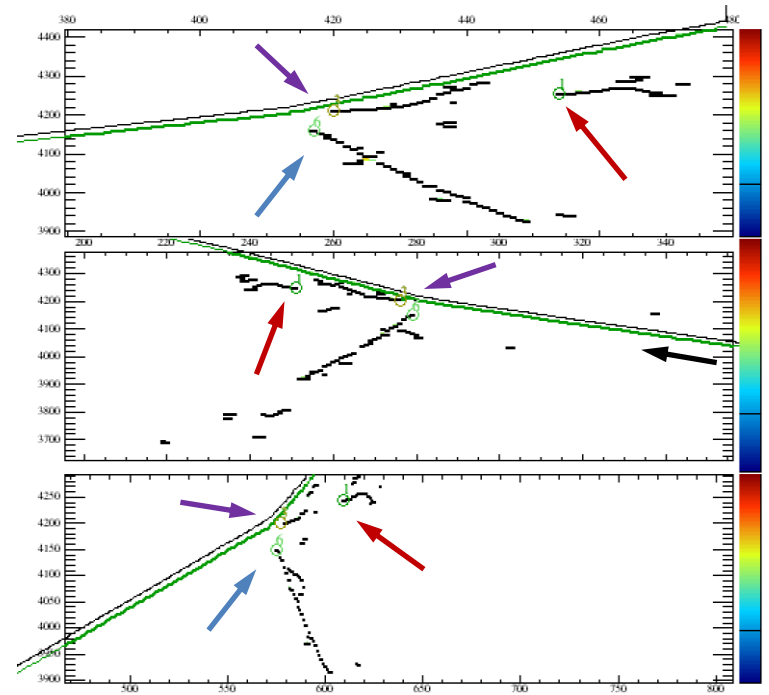
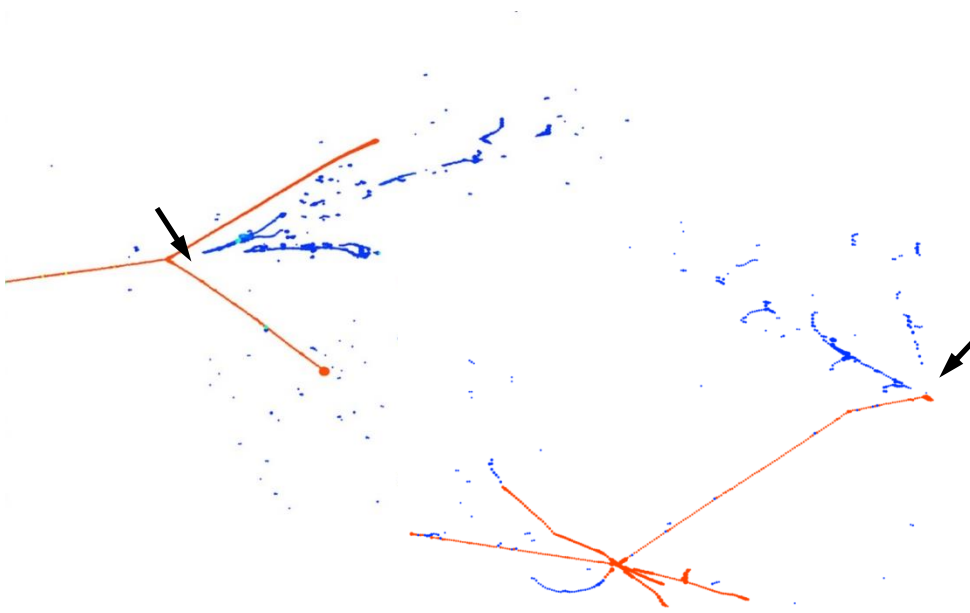
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- Working sessions: parallel work on tasks
    - a. until evening today
    - b. full Thursday
    - c. Friday until lunch
  - Summary session on Friday 1:30pm

## FD sim/reco - ProtoDUNE joint tasks



- a. SpacePointSolver already running for ProtoDUNE SP, DP sim and 3x1x1 data – ongoing
  - really fast, 3-4 s / full event
  - plan to try deriving from it: hit disambiguation and/or 2D cluster associations between views
- b. PMA interfaces – ongoing

# $\pi^0$ rejection



## Target:

- distribution of 3D distance from  $\pi^0$  vertex to conversion point
  - expected exponential
  - the minimum detectable/reconstructable threshold is most interesting
- distribution of  $dE/dx$  in the initial part of the EM shower
  - easier once vertex and shower are ready, but more issues on calibration side

## $\pi^0$ rejection

- Look at all possible inputs
  - Vertex reconstructed in the hadronic system, with EM activity in vicinity
  - EM activity selected with CNN, on the 2D cluster level
  - EM shower vertex reconstructed
  - Pandora clusters, blurredcluster, ...
- Verify if there are potential problems
  - Efficiency of detecting pi0 vertex if EM activity is required in vicinity
  - Purity of the selection: how often accidental shower is causing vertex selection, should we focus on checking the shower-vertex compatibility?
- We work with the group at CERN

## noise simulation / removal

- Single Phase:
  - noise model introduced by Jingbo, Mike configured gauss filter for deconvolution
    - seem to work up to hit finding
    - urgent: clustering and hit charge calibration needs work
  - coherent noise simulation and removal – can start from DP works
- Dual Phase
  - noise model for FD and 6x6x6: Andrea Scarpelli extrapolating 3x1x1 noise (after coherent and low freq components removal) to a long drift window
  - configure and run overlay module for 3x1x1 real noise and simulated tracks

## light analysis / cosmic muons

- PD reconstruction in ProtoDUNE geometry is up and running
  - need volunteers for analysis
  - need PD expert for consultations
- access t0 information in TPC tracks, find compatible light flashes
- CRT response is not yet parameterized, we are looking for volunteers to start this task



## easy start tasks

- service/tool producing job metadata for DQM
  - basic information such as run / event number written in json format
  - nice example to start with the art/LArSoft framework, no algorithmic problems
- „event selection”: select beam particles entering TPC without interaction in beam pipe/plug
  - angle w.r.t. the beam direction, no other particles entering in vicinity
  - use MC truth trajectories, check fraction of surviving events
  - good to warm up to analysis work