Highlights from Physics 2017 Dec 08

General notes

- **Productive "Physics Week" last month**. 71 attendees. Workshop / "Hack days" style meeting
- WGs continue to be guided by **TDR timeline**, with some notable milestones of
  - Jan 2018: iterating on WG strategies
  - May 2018: checkpoint for high level scientific goals
  - Sep 2018: supplemental internal documentation ready for review
  - Jan 2019: analyses frozen
- A lot of recent progress on **calibration needs** *(see Kendall and Sowjanya's talk)*
- Always looking to get **new people** involved. Many tasks (from beginner to expert) ready for someone to plug into

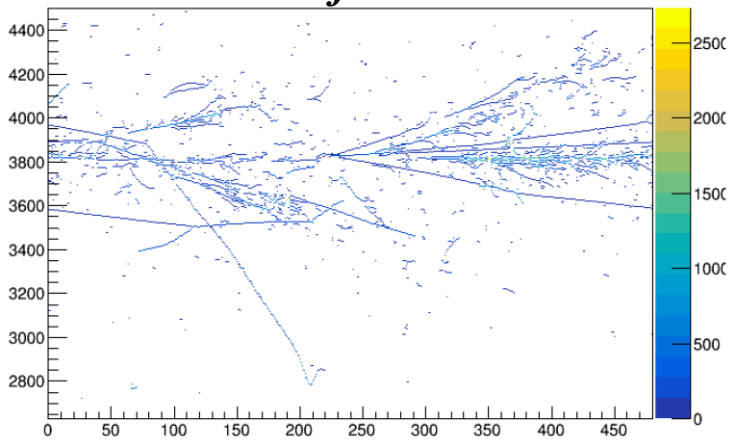
Long baseline WG

- Chewing through **necessary "chores"**, *e.g.* getting analysis pieces fully integrated into main line of production (MVASelect, CVN, CAFMaker.) Largely complete. *Next up:* rationalizing end-user file formats (exploratory work underway).
- New effort on **cross section systematic uncertainties** and getting these integrated into the main analysis pipeline. Strategy for this and the implementation "boundary conditions" established at Physics Week. Work now underway.

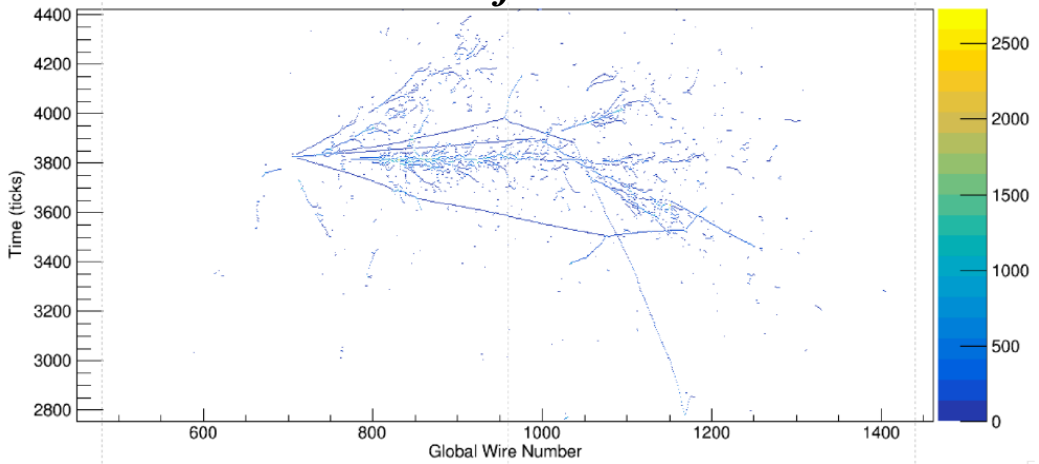
Long baseline WG (cont'd)

- **CVN ν_e selection:** improved image pre-processing (*e.g.*, global wire numbers), new sensitivities imminent. *Also*: starting dual-phase implementation.

before



after



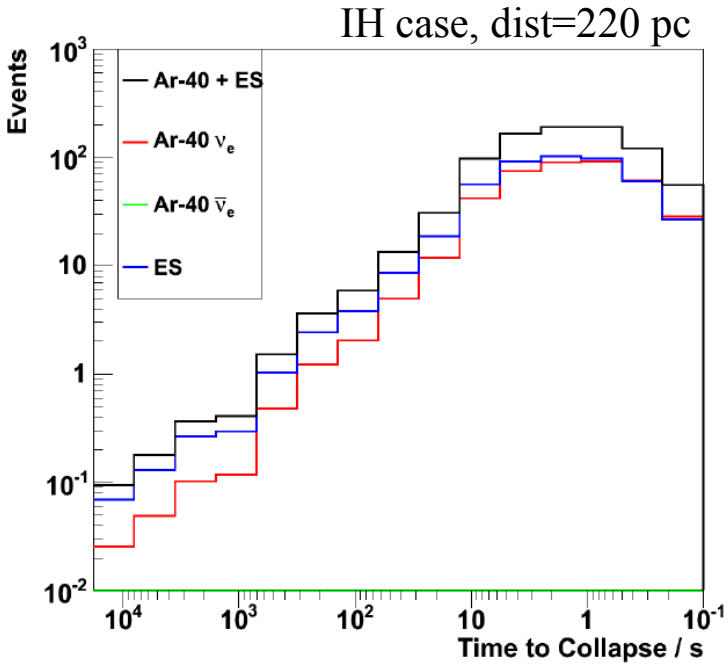
- Revisiting **energy scale requirements** with latest tools. (Older studies led to some counterintuitive results.)
- Also, **detector variations**: prioritized short list of first effects to study (not just for LBL physics)
- LBL WG will hold its next **Hack Days** in spring, with date/location TBD

Nucleon decay / High-E WG

- At Physics Week, many discussions of avenues for **improving $p \to K\bar{\nu}$** signal-to-noise (*e.g.*, kinematic variables to identify atmospheric CC events; applying event-level CNN tools)
- First attempt at using n-nbar's **CNN architecture** for $p \to K\bar{\nu}$: not a silver bullet *(though some caveats here)*
- **Want to get involved?** *Q*: How reasonable are our current FSI models for kaons?
- Also at Physics Week: effort started on **$p \to K^0 l^+$** channel
- Atmospherics: fixes to the atmos ν **flux driver**. Also: event **vertexing** updates
- **n-nbar**: working on detector syst. studies

Supernova / Low-E WG

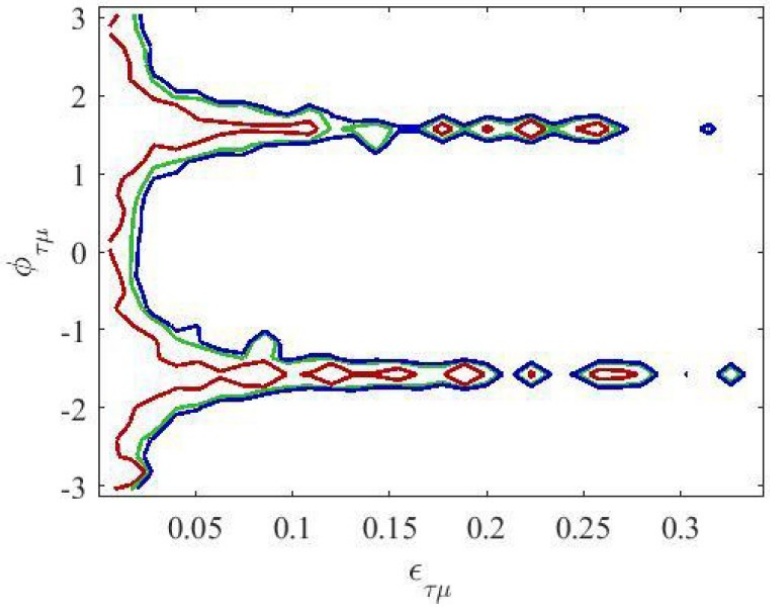
- Recent developments include early looks at sensitivity to **SASI oscillations** in supernovae and **pre-collapse neutrino signals** *(plot at right)*
- Continuing **joint work with DAQ group**. (SNB is the design driver for most aspects.)



Beyond the Standard Model WG

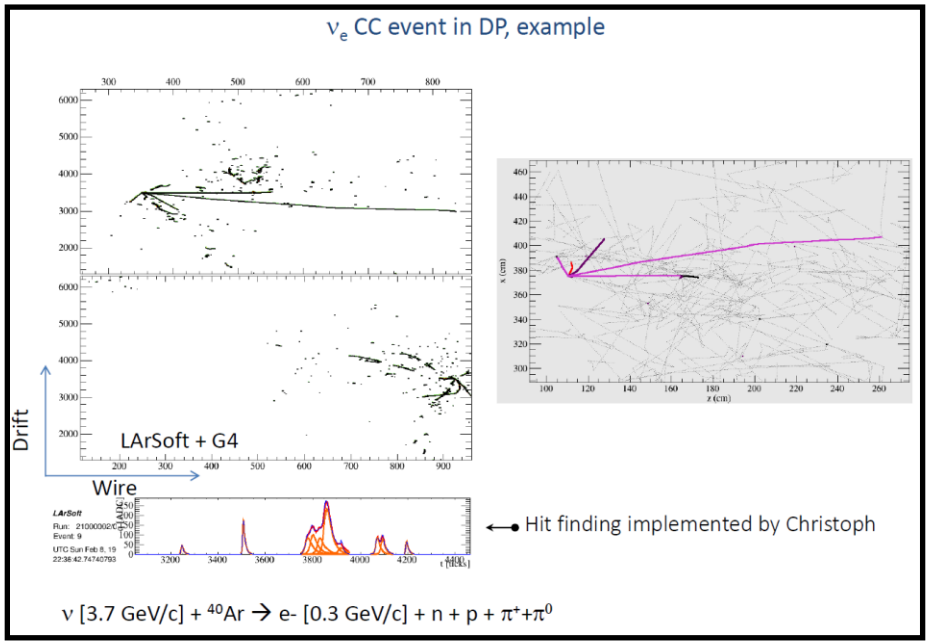
- Spawned a new **boosted dark matter** sub-group, toward a first look at DUNE capabilities by summer to consider including in the TDR.
- **Light dark matter**: analysis chain in place; focusing now on simulating large LDM samples
- At Physics Week, converged on a group-standard **description of the ND geometry** for such simulations throughout the group.
- **Sterile neutrino mixing**: just this week, able to produce draft versions of all of the sterile mixing sensitivity plots required for the TDR. *Next up*: adding realism to the systematic uncertainties assumed.
- **Non-standard interactions**: migrated to a more realistic model of the Earth's density profile. Transitioning to running sensitivities with distributed computing.
- **Neutrino tridents**: millions of events generated. Now running these through the new ND geometry

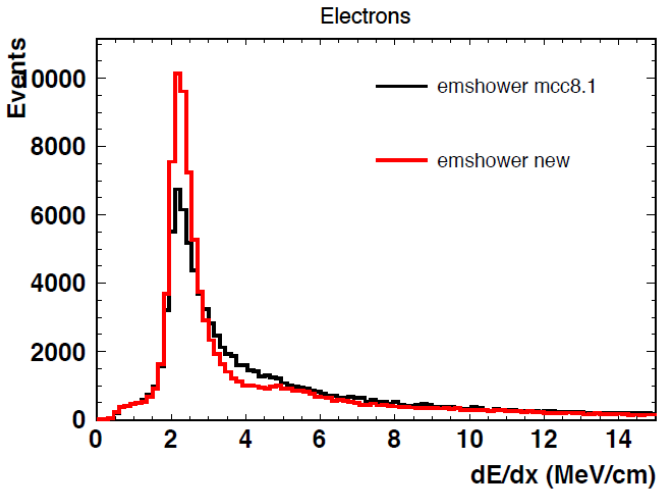
Example NSI sensitivity plot made with realistic density profile

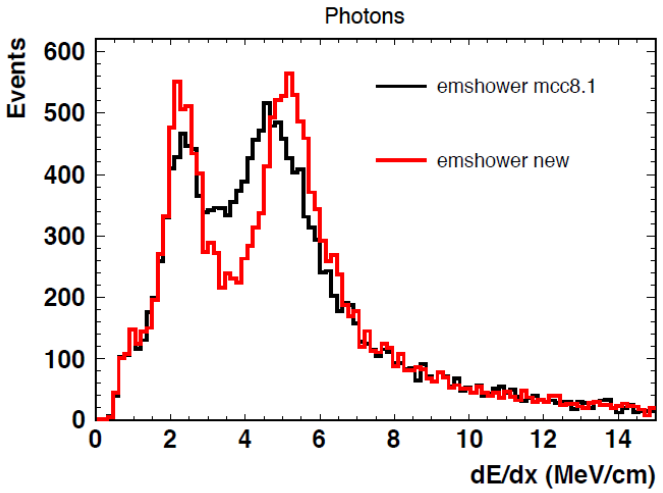


FD Sim/Reco

- **Many joint sessions** with other WGs during Physics Week for exchanges of needs and ideas
- Progress in **FD-DP simulations** ⟶
- Draft of **standardized interface for calibrations** and their uncertainties (ultimately a shared interface across experiments)
- Improved **shower *dE/dx***: ⟶



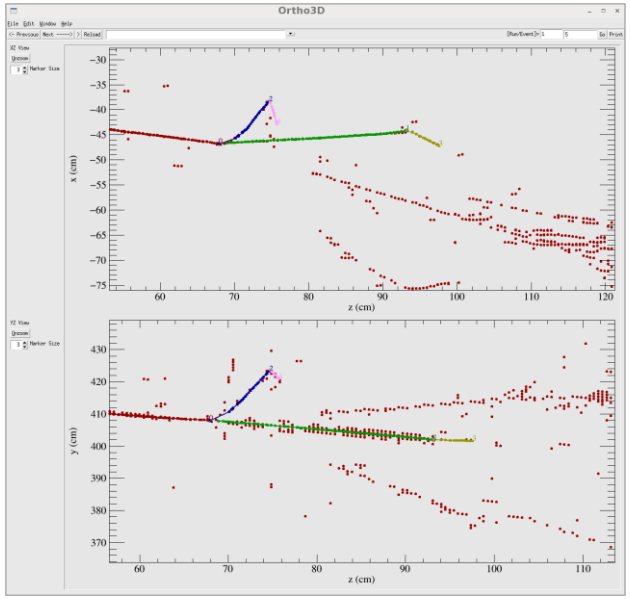




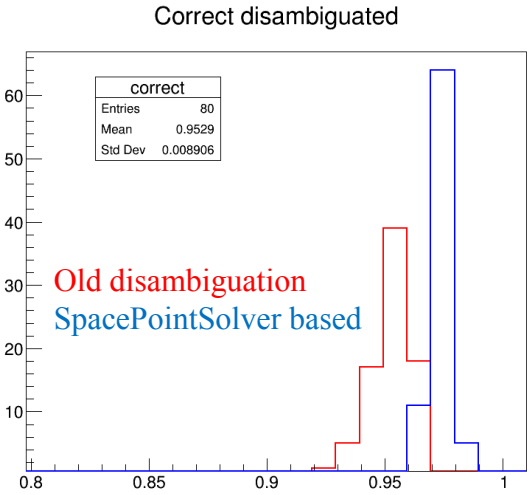
- *Other updates and/or new effort in:* continuous integration procedures, overhaul of BackTracker (reco/truth mapping facility), neutrino energy reconstruction, photon library parameterization

ProtoDUNE DRA joint with FD Sim/Reco

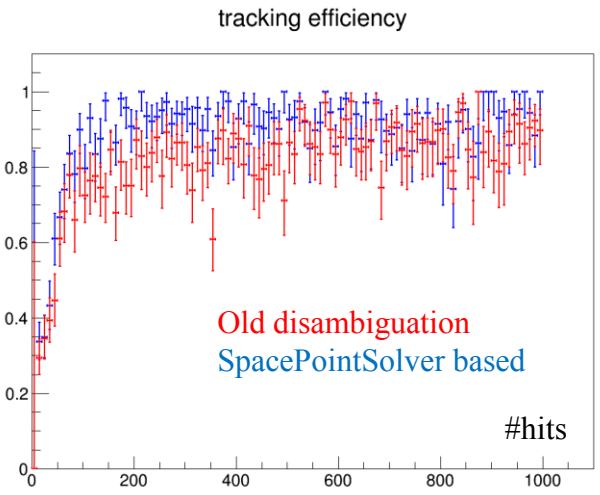
- Very busy **ProtoDUNE sessions** at Physics Week, with new and experienced members
- Michel electron analysis, noise simulation/mitigation, signal processing, beam data sim/reco, TrajCluster improvments, "global wire/drift" support in LArSoft, ProtoDUNE geometry updates, DQM support, photon detector analysis
- SpacePointSolver enabled and **new hit disambiguation** based on it. Improved efficiency of all downstream algorithms:



3D reco of beam π^+ at 2 GeV/c, secondary tracks and SpacePoints in π^0 showers



hit disambiguation efficiency



cosmic tracks reconstruction (linecluster+PMA)