



Overview of FD Simulation and Reconstruction

Tingjun Yang (FNAL) and Xin Qian (BNL)

Sep 28, 2015

- FD Detector Simulation and Reconstruction Group: convened by Xin Qian and Tingjun Yang.
- We meet on Monday, 10:00 a.m. CT in physics weeks.
- Our mailing list is dune-reco@fnal.gov.

Outline

- Overview of current tools for FD simulation and reconstruction.
- Tasks and collaboration with other working groups.
- Useful links.

Generators

- GENIE is integrated in LArSoft, current version is v2_8_6.
 - We produced beam neutrino samples using histogram flux.
 - Dom Brailsford is converting the flux ntuples Laura Fields generated to a format that can be used by LArSoft with help from Robert Hatcher.
 - There is an atmospheric neutrino mode in LArSoft/GENIE, which has not been tested.
 - Low energy neutrinos produced in supernova group.
- Other neutrino generators (e.g. NuWro) can be used in LArSoft through TextFileGen.
- Cosmogenic generators: underground - MUSUN (Vitaly/Karl), surface - CRY.
- Single particles.

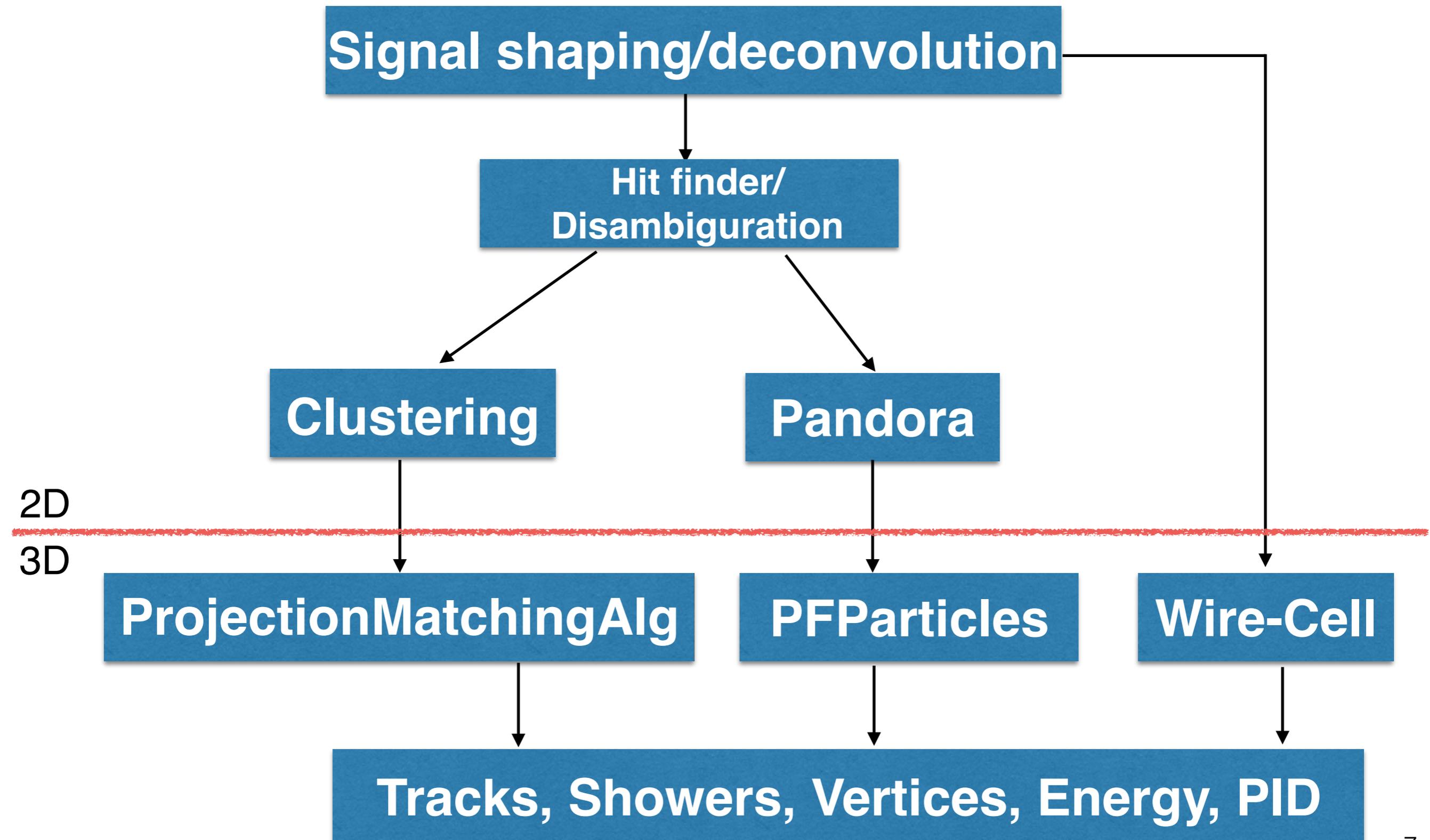
GEANT4 Simulation

- Track particles in LAr using GEANT.
- Recombination - Birks (ICARUS) or Modified Box (Bruce Baller) model.
- Signal attenuation (electron lifetime).
- Diffusion (both transverse and longitudinal).
- Photon propagation.

Detector Simulation

- TPC readout simulation (field response, electronics response) - Leon Rochester, Xin Qian.
- Photon detector simulation - Alex Himmel, Gleb Sinev.
- Scintillator counter simulation.

Reconstruction Chain



Reconstruction Status

- Signal shaping/deconvolution - Xin Qian, Jyoti Joshi.
- Hit reconstruction - Jonathan Asaadi, Bruce Baller, Michelle Stancari.
- Disambiguation - Tom Junk, Tingjun Yang.
- Pandora reconstruction - Andy Blake, John Marshall, Mark Thomson.
 - Works on FD geometry now.
- Track reconstruction (PMA) - Robert Sulej, Dorota Stephan.
- Shower reconstruction - Mike Wallbank, Dorota Stephan, Robert Sulej.
- Calorimetry reconstruction - Karl Warburton, Tingjun Yang
- WellCell reconstruction - Xin Qian, Chao Zhang, Brett Viren
- PD reconstruction - Alex Himmel, Gleb Sinev.

Work Plans

- We encourage new ideas and developments
 - Mike Wallbank brought T2K cluster reconstruction to LArSoft.
 - Dorota Stephan and Robert Sulej brought the software they developed for ICARUS to LArSoft and continue development.
 - Karl Warburton brought MUSUN to LArSoft.
- We would like to work closely with other WGs and TFs on simulation and reconstruction.
- We have been doing Monte Carlo Challenges (current version 4). We will continue to do that to test simulation and reconstruction chain.

Inputs from LBPWG

- Studies of single particle (e, mu, pi, p, n) detection efficiency and resolution as a function of energy.
- Studies of neutrino reconstruction efficiency.
- Particle ID, e/gamma separation.
- Understanding the effect of reconstructing particles across multiple TPCs and the effect of fiducial volume cuts.

Detector Optimization

- We will work on detector optimization in coordination with other working groups and task forces.
- We are producing MC samples with different configurations.
 - Wire spacing: 5 mm vs 3 mm
 - Wire angle: 36 degree vs 45 degree
 - Different beam angles w.r.t. the wire planes

Useful Links

- Working group web page:
 - <https://web.fnal.gov/collaboration/DUNE/SitePages/Far%20Detector%20Reconstruction%20Working%20Group.aspx>
- David Adams' wiki on LArSoft releases:
 - https://lbne.bnl.gov/wiki/DUNE_LAr_Software_Releases
 - Instructions on how to download LArSoft to your laptop (SL6 or Mac).
- LArSoft wiki:
 - <https://cdcvs.fnal.gov/redmine/projects/larsoft/wiki>
- dunetpc wiki:
 - <https://cdcvs.fnal.gov/redmine/projects/dunetpc/wiki>