Status and general updates

Mattia Fanì (Los Alamos National Laboratory)

Bi-207 Update Meeting - Sept 21, 2023

DEEP UNDERGROUND NEUTRINO EXPERIMENT

Overview

- Prototype status and ongoing activities
- Simulation
- Analysis
- Source location in ProtoDUNE-HD
- Goals & next steps

Prototype status and ongoing activities

- First data taking of 2023 (2 sources, SBND-like electronics as in 2022) ended in late July
- ProtoDUNE electronics was installed
  - System currently acquiring in the new format (ethernet continuous data streaming, trigger primitives)
- Current activities:
  - Drift measurements with non-uniform electric field (2 sources on the cathode)
    - A few profiles replaced with insulators
  - Next: exposure of a Mini Arapuca to source photons

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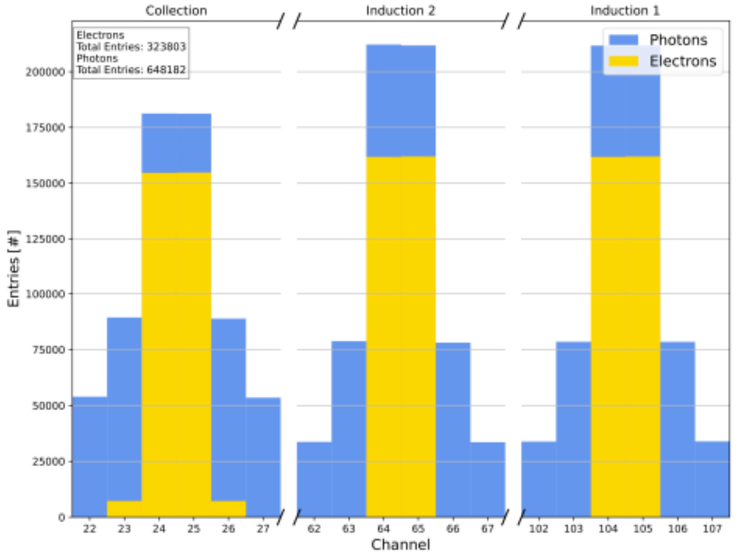
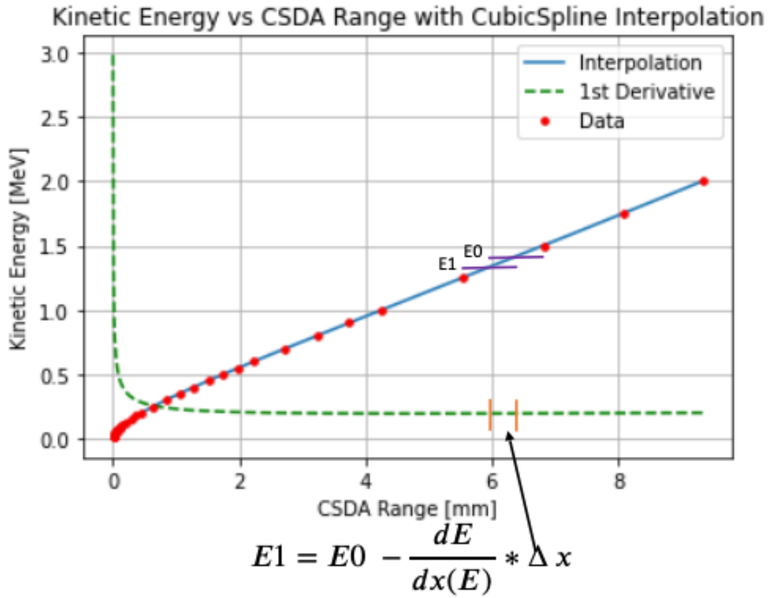
Simulation status

L. Saunders (Boston University)

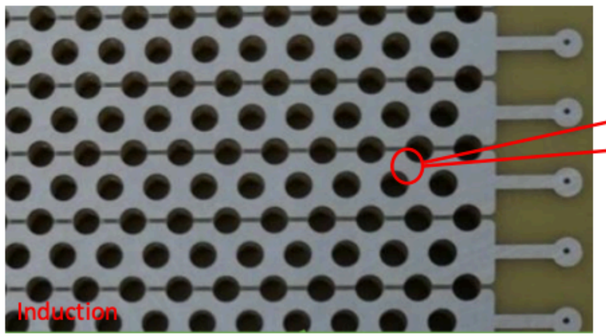
- Purpose: modeling the physics in the TPC
- Status:
  - Particle generation - OK
  - Electron decay products - OK
  - Electron energy deposition - OK
    - Includes “segmentation” modeling - OK
  - Collected energy - OK
  - Waveform reconstruction - ongoing
    - Takes into account particle trajectories in the perforated PCB
  - Light propagation - ongoing

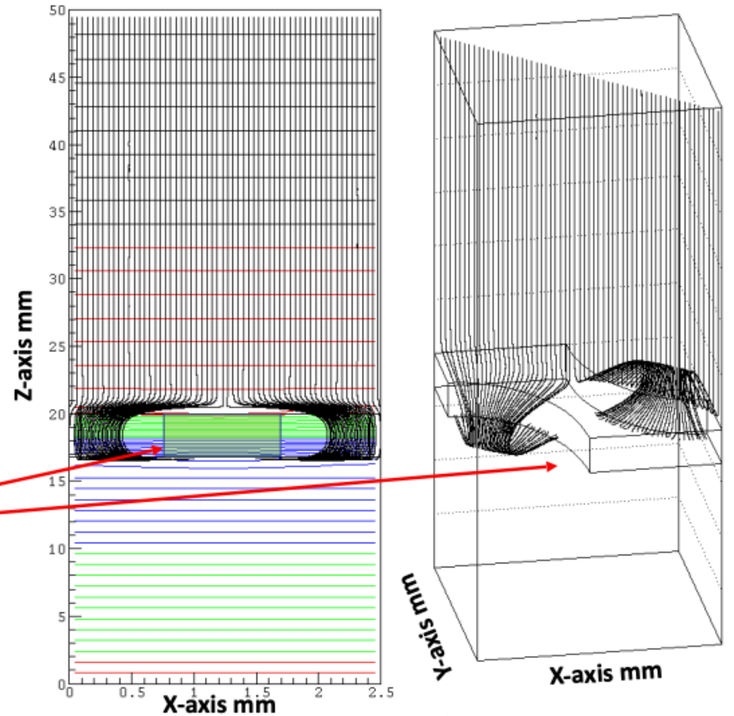




Particle Trajectories

- Once the Laplacian has been solved for the TPC volume, the particle trajectories can be determined.





[https://indico.fnal.gov/event/60500/]

Data analysis status /1

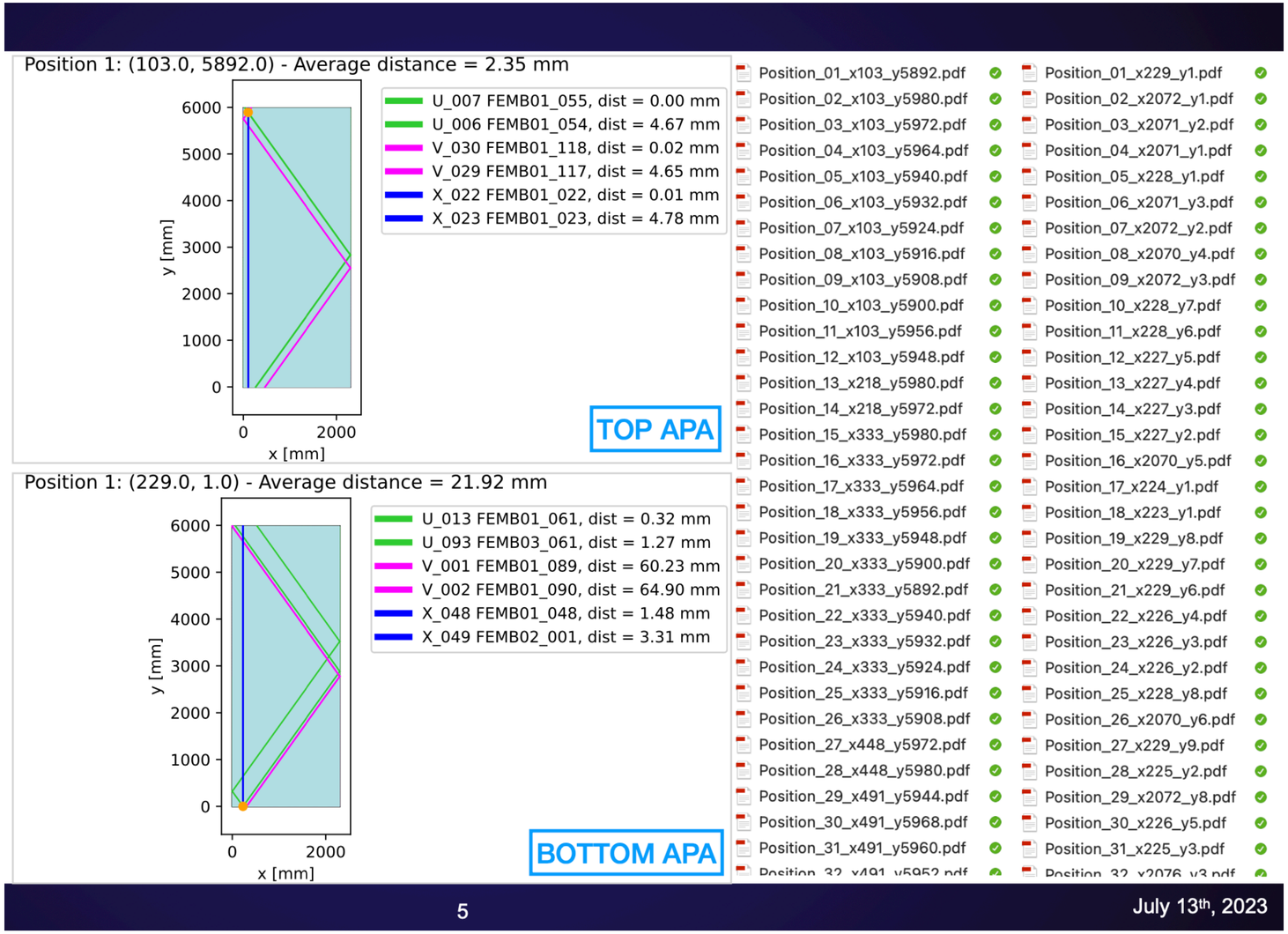
- **Set up**
  - data acquisition, storage space, code repository, service account for collaborative analysis
- **Conversion**
  - 6 channels on Induction 1 plane (strips parallel to cosmic muons) were found being at wrong positions - July 2023
  - Collection channels were in the opposite order
    - Currently being fixed
  - A new conversion will be ran starting end of this week on all 2022 and 2023 good data
    - Old conversion will be kept as a backup for a while

Data analysis status /2

- **Options** for data selection and cuts included - OK
  - Separate event selection, coherent noise removal
  - Event display, single channel display
- **Charge equalization** (L. Boistray, J. Capó)
- **Cosmic muon selection** (L. Boistray)
- Analysis of 2022 data - for validation
- **Analysis of 2023 data** - peak selection, event counting, event selection based on strips combinatorics (-> determination of source events), charge measurement, charge strip clustering (takes into account induction effects on adjacent strips)
  - preliminary results are available
- **New contributions**: J. Capó, F. Barao
  - Moving from json to ROOT
    -> more efficient data storage, data access

Updates on source location

- A tool was finalized and made available in the repository
- Discussion with DAQ team have started to understand ways to validate this study
- Apparently, there is no way to directly validate this study other than running ProtoDUNE



[https://indico.fnal.gov/event/60500/contributions/271589/attachments/168890/226496/20230713%20-%20Bi207%20update.pdf]

Goals

- Paper: Validation of the calibration method for DUNE
- Possible standalone paper: new technique for a purity monitor

To-do list

- Simulation: get to a reasonable close
  - Complete the waveform reconstruction, generation of actual decay products, include Compton scattering
- Determination of source locations in ProtoDUNE-HD
  - Reiterate talks with DAQ group
  - Get to a point where both groups agree with the source positions
  - Define data acquisition modes
- Analysis: work in progress
  - Status and next steps in the next talk