

Wire-Cell Noise Filtering Paper: Discussion & Outline

Jay Hyun Jo

May 13, 2026
BNL ProtoDUNE Meeting

Motivation

- thanks to Xin and Xuyang, we are now finalizing infrastructure of noise filtering (NF) and Signal Processing (SP) for multiple detectors: PDHD, PDVD (BDE, TDE)
- we originally planned to write technical paper that encapsulate multiple Wire-Cell chains, but then thought we could separate these
 - Noise Filtering Collaboration paper
 - Signal Processing Collaboration paper
 - DNN ROI technical paper
- Noise filtering & signal processing paper will require “data”, so it will need to go through collaboration approval process
- DNN ROI paper can be more about technical description of architecture and memory/time control; with or without data, we can push it to be limited-author technical paper

Noise filtering paper

- we already have general description of baseline noise filtering algorithms in MicroBooNE NF paper
- there are also some portion of PDHD CE paper that touches on this part
- in this new paper, there are few aspects that can be differentiated with other papers
 - this is the first time we apply the algorithms to multiple detectors, with different electronics and geometries
 - there are special treatments we implemented, such as FEMB saturation noise (aka ground shake noise), shielding plane noise, etc
 - FEMB saturation noise is described in PDHD CE paper (Sec. 7.2), but not exactly on filtering
 - we not only describe algorithms but also show performances (that may include longer-term operation, such as time dependence, certain features in different detectors, etc.)

5 Identification and filtering of MicroBooNE TPC excess noise

- 5.1 Low frequency noise from voltage regulator
- 5.2 The HV power supply noise
- 5.3 900 kHz burst noise
- 5.4 Impact of noise filtering on TPC signal

7 Electronics Performance in ProtoDUNE-HD

- 7.1 Pulser-Based Calibration
- 7.2 Noise Performance
- 7.3 Saturation Behavior

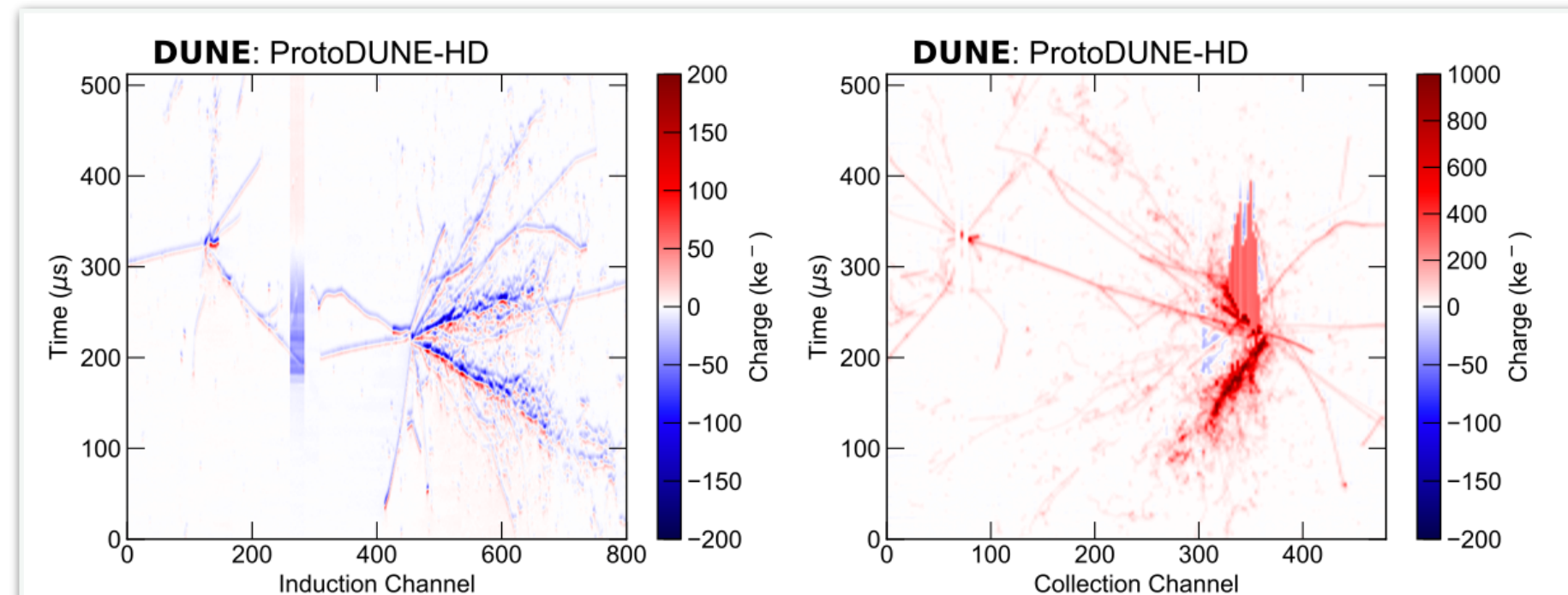


Figure 32: Example of an event showing anomalous behavior coinciding with highly saturated channels, for one of the induction views (**left**) and the collection view (**right**). In the induction view, several channels disconnected from the main interaction point suddenly experience simultaneous negative polarity pulses, coinciding in time with highly saturating signals appearing on collection channels that share the same power rail. Note that the two views use different color scales, and note that collection channels at the maximum of the color scale have been saturated.

1. Introduction
2. ProtoDUNE detectors and readout electronics
3. Electronics response
4. Identification and filtering of noise (intrinsic noise, coherent noise, detector/APA/CRP-specific cases)
5. Performance (residual noise levels)
6. Conclusion and outlook

Task list

- (understand +/-3 wires shift for CNR & FEMB noise removal)
- with completed NF infrastructure, scan/evaluate NF with (small) ProtoDUNE data
- list of dead/bad channels for all detectors
- PD data production with updated/finalized NF
- NF performance evaluation & temporal scan
- get in touch with TDE team for information/co-editing