



Prompt Processing Overview

Mike Kirby (BNL)

10 Apr 2024 - 2nd Wire-Cell Reconstruction Summit



For some things, timing is everything...



VS



After traveling for 10+ hours, arrived inside of band of totality with 25 minutes to spare.

Photos by Eric Vaandering

For some things, timing is everything...



VS



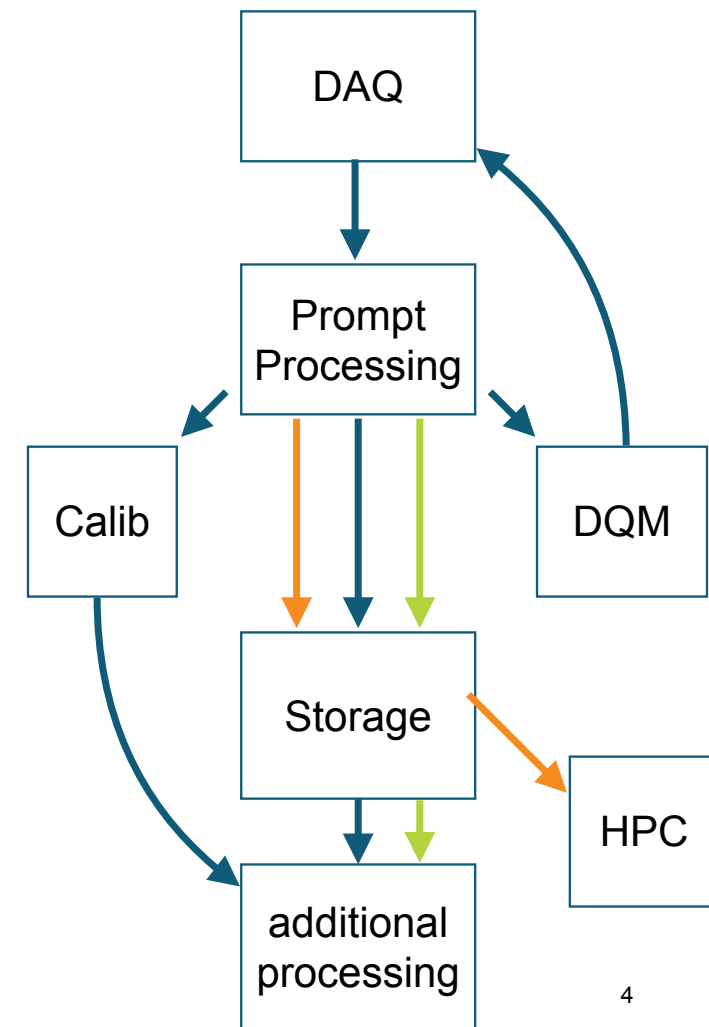
But you also have to do it properly!!!

Photo by Mike Kirby

Photo by Eric Vaandering

A limited perspective on prompt processing...

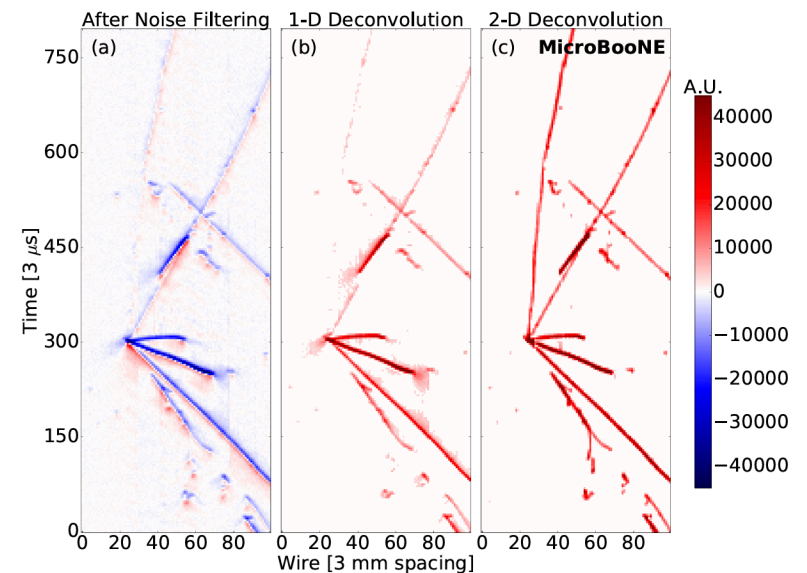
- each experiment has a unique approach to data taking and different requirements on prompt processing
 - scope of tasks (DQM, skimming, merging, etc)
 - timescale for the results of different tasks in prompt processing
 - resources available locally and distributed
- but there are some commonalities between LAr TPC neutrino experiments
 - “large” trigger readout data volumes
 - dominated by TPC data (as opposed to light readout)
 - very sparse information density within that data
 - multi-stage offline processing for reconstruction



Some previous prompt processing workflows

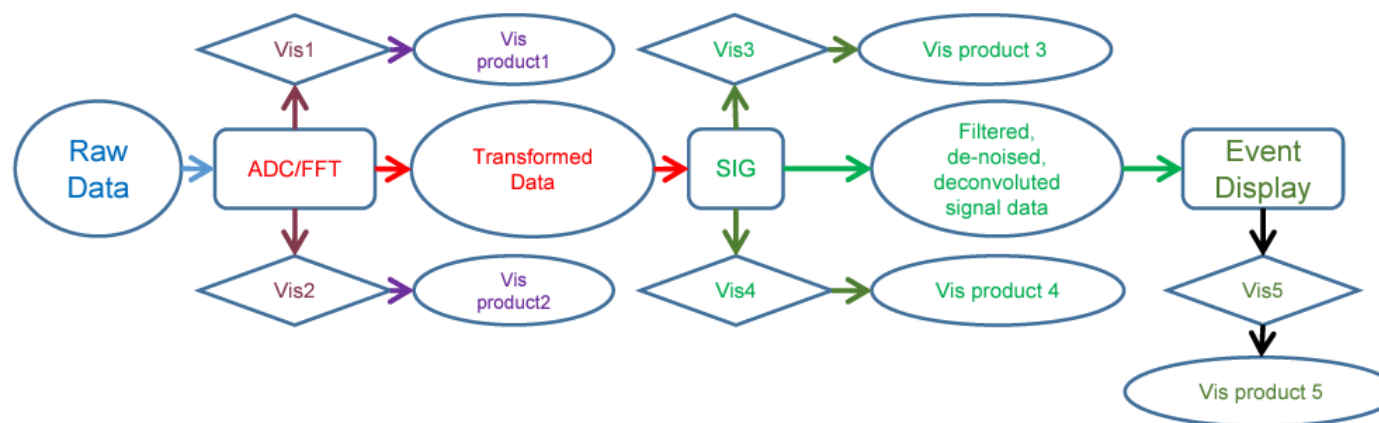
MicroBooNE Offline Processing

- multiple stages of processing
 - swizzling (translate from custom raw binary format to artroot)
 - Cosmic Ray Tagger merging
 - reco1 (signal processing*, hit finding, etc)
 - reco2 (complete event reconstruction (Pandora, WireCell, ML))
- note that very little data skimming or slimming was performed in the processing chain
- DQM was a separate processing
- keep up processing ran continuously, and reco1 followed shortly after that
- final reco2 campaigns processed after several iterations of algorithmic improvements and data studies



JINST 13 P07006 (2018)

ProtoDUNE Single Phase Prompt Processing for DQM

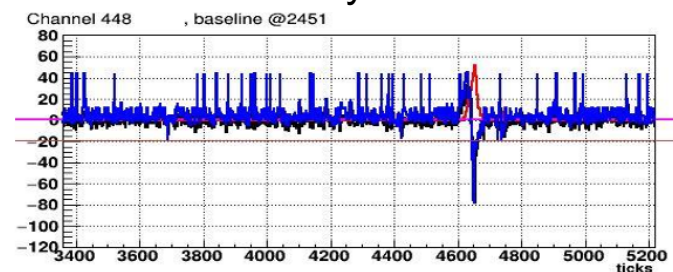


- complimentary to ProtoDUNE online DQM
- utilize reconstruction module outputs
 - signal processing, hit finding, tracking
 - purity monitoring
- deployed on local hardware at EHN1
- separate from the downstream offline keep-up processing
 - the output did not become input to further processing

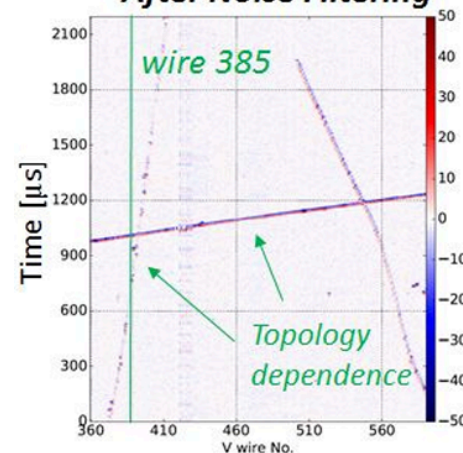
ProtoDUNE SP Signal Processing in offline Keep-Up (reco1)

- Noise removal
 - harmonic noise
 - coherent noise
 - sticky bits (is that “noise?”)
- Signal processing
 - 2D deconvolution
- spatial distortions, hit finding and other algorithms
- input fed into reco2 without skimming or slimming

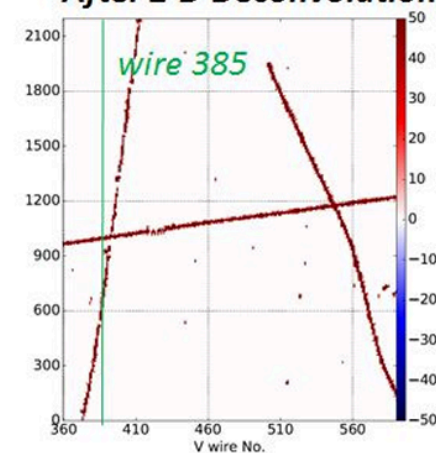
sticky bits



After Noise Filtering



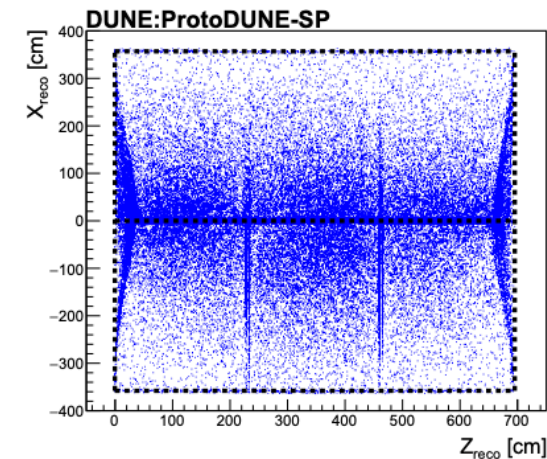
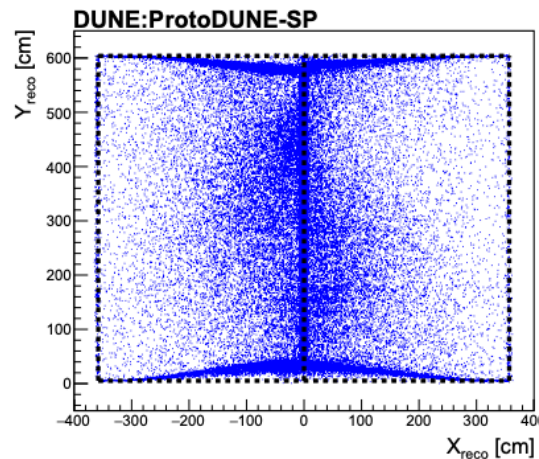
After 2-D Deconvolution



ProtoDUNE Single Phase Signal Processing in offline Keep-Up (reco1)

2020 JINST 15 P12004

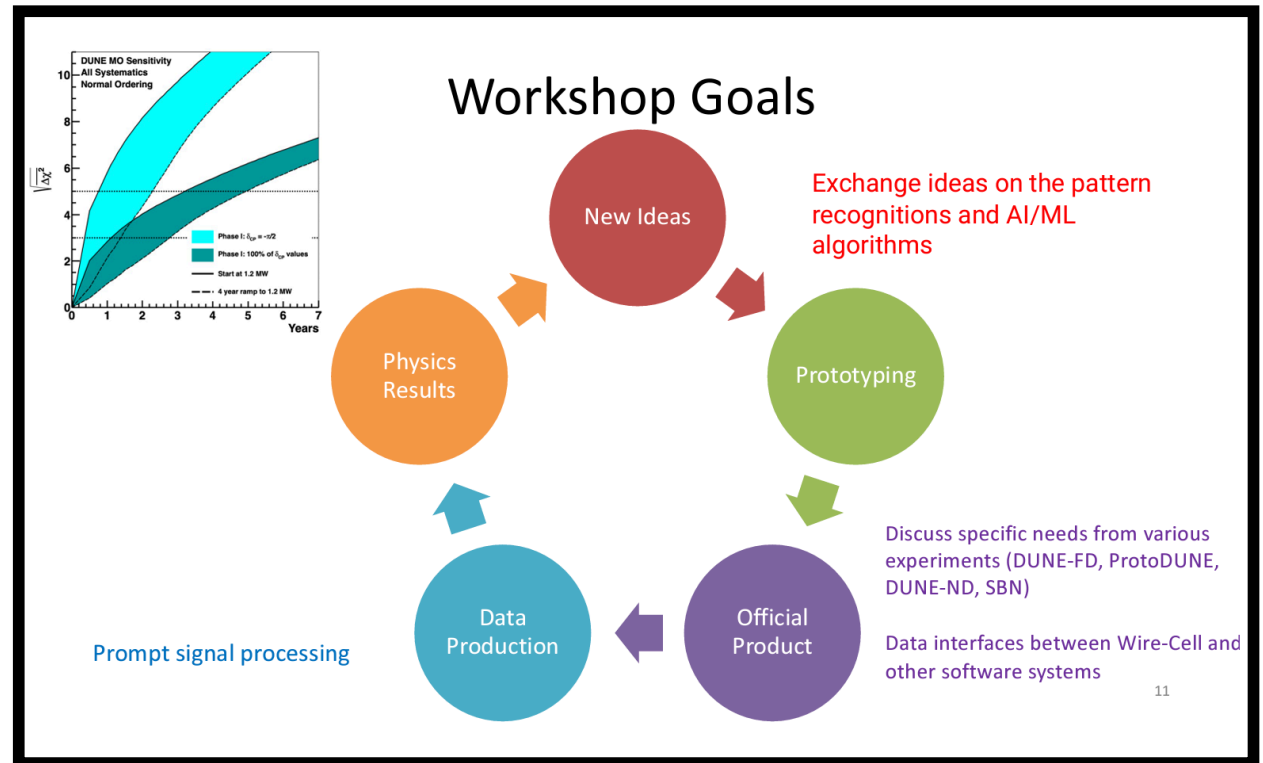
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Space Charge Effects seen in the cosmic muon track end points

Prompts for discussions this afternoon

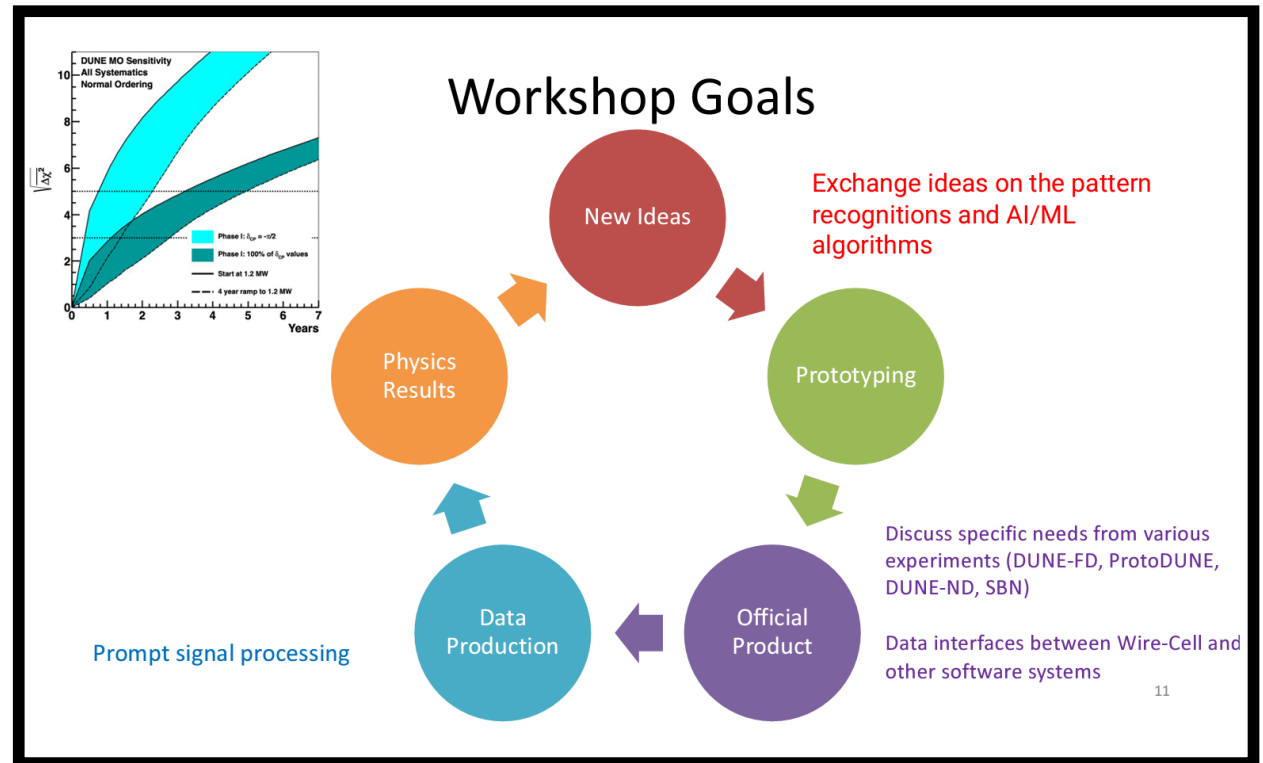
- how do we get resources and at what scale with these data volumes?
- what does signal state-of-the-art signal processing look like?
- what do active experiments plan for their signal processing tasks?
- what will prompt processing provide for DQM and operations?



Xin's talk this morning

Looking forward to future tasks

- how can experiments generate prompt SNEWS alerts?
- what new workflows and tasks can optimize and enable physics results?
- respond to different data types and incorporate faster feedback into downstream processing?
- prompt processing can maintain the features in the data while removing the detector features (alignment, calibration, noise)
- how can WireCell enable these and other tasks of prompt processing?



Xin's talk this morning