The Second Wire-Cell Reconstruction Summit

Hosted by Brookhaven National Laboratory
The workshop will held as a hybrid event on April 10–12, 2024

Wire-Cell Event Reconstruction

Wire-Cell

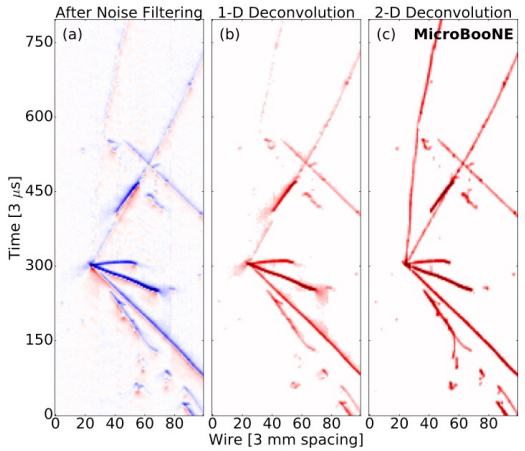
- TPC simulation
- noise filtering
- signal processing

- 3D imaging
- clustering
- charge-light matching

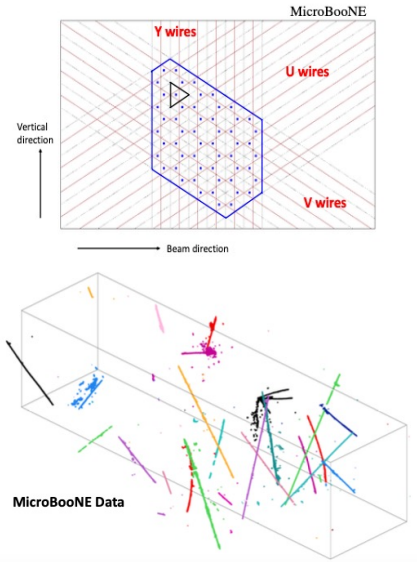
- 3D trajectory & dQ/dx fitting
- cosmic muon tagger

- multi-track fitting
- DL-3D ν-vertex ID
- particle identification
- Energy estimator
- ν-flavor ID

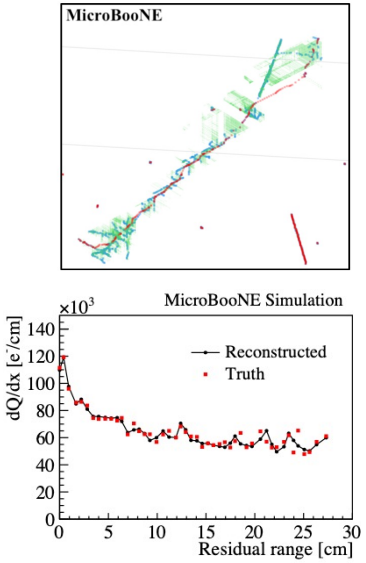
- Model validation
- Statistics
- Data Analysis



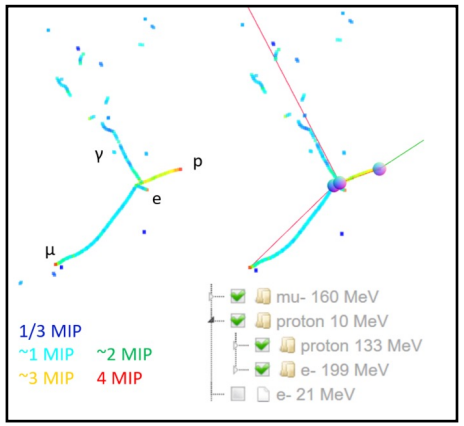
JINST 12 P08003 (2017)
JINST 13 P07006 (2018)
JINST 13 P07007 (2018)
JINST 16 P01036 (2020)



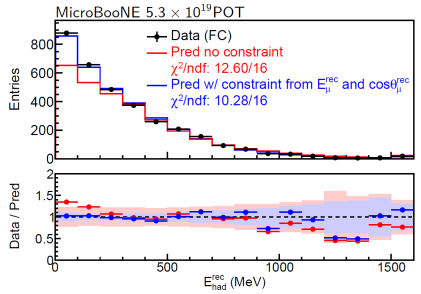
JINST 13 P05032 (2018)
JINST 16 P06043 (2021)



PRApplied 15 064071 (2021)

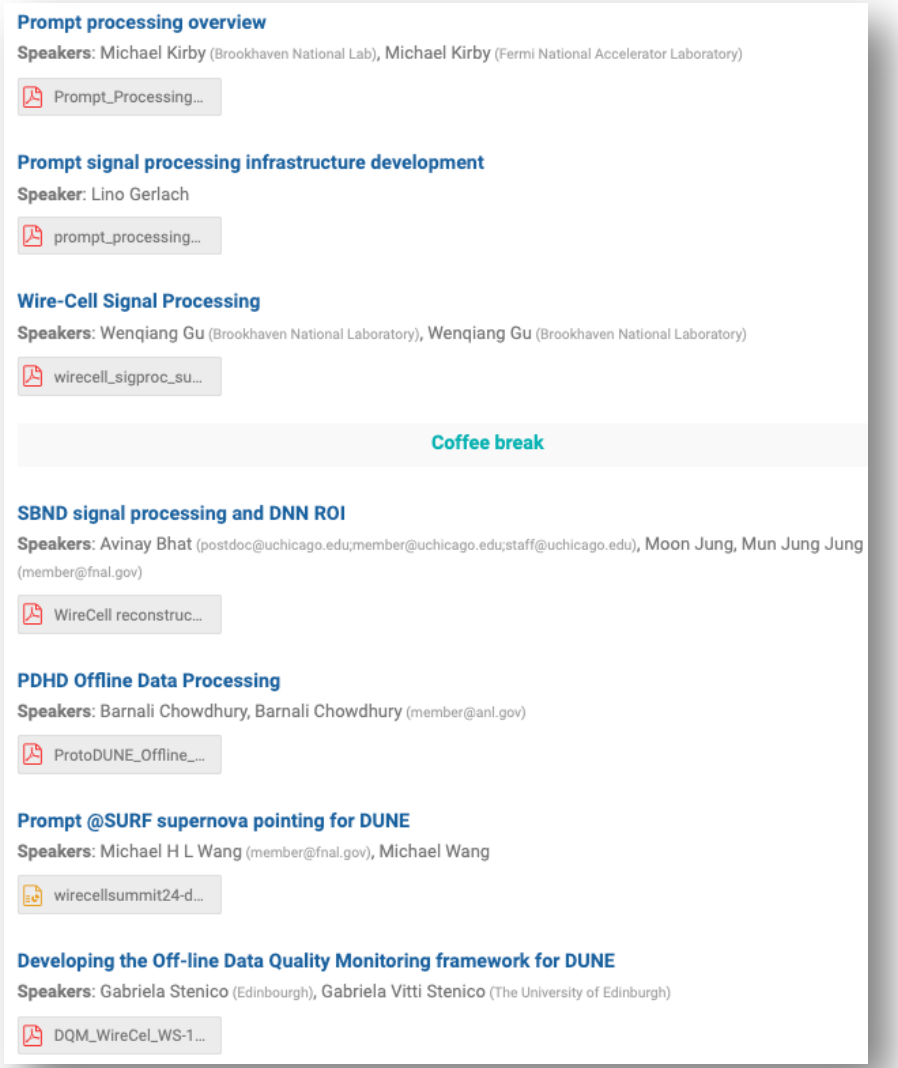


JINST 17 P01037 (2022)



PRD 105, 112005 (2022)
PRL 128, 151801 (2022)

Prompt Processing



Prompt processing overview
Speakers: Michael Kirby (Brookhaven National Lab), Michael Kirby (Fermi National Accelerator Laboratory)
Prompt_Processing...

Prompt signal processing infrastructure development
Speaker: Lino Gerlach
prompt_processing...

Wire-Cell Signal Processing
Speakers: Wenqiang Gu (Brookhaven National Laboratory), Wenqiang Gu (Brookhaven National Laboratory)
wirecell_sigproc_su...

Coffee break

SBND signal processing and DNN ROI
Speakers: Avinay Bhat (postdoc@uchicago.edu;member@uchicago.edu;staff@uchicago.edu), Moon Jung, Mun Jung Jung (member@fnal.gov)
WireCell reconstruc...

PDHD Offline Data Processing
Speakers: Barnali Chowdhury, Barnali Chowdhury (member@anl.gov)
ProtoDUNE_Offline_...

Prompt @SURF supernova pointing for DUNE
Speakers: Michael H L Wang (member@fnal.gov), Michael Wang
wirecellsummit24-d...

Developing the Off-line Data Quality Monitoring framework for DUNE
Speakers: Gabriela Stenico (Edinbourgh), Gabriela Vitti Stenico (The University of Edinburgh)
DQM_WireCel_WS-1...

Purpose:

- Timely physics results and efficient processing [M. Kirby, G. Stenico]
- Higher level of DQM [M. Kirby, G. Stenico]
- Supernova pointing [M. Wang]

Requirement/Development:

- Robust infrastructure [L. Gerlach, M. Wang]
- Robust NF and SigProc [W. Gu, B. Chowdhury]
- AI/ML [M. Wang, A. Bhat, M. Jung]

Takeaway:

- **Usefulness of prompt processing relies on “robustness”**
- **Software design should be coupled with hardware infrastructure design**

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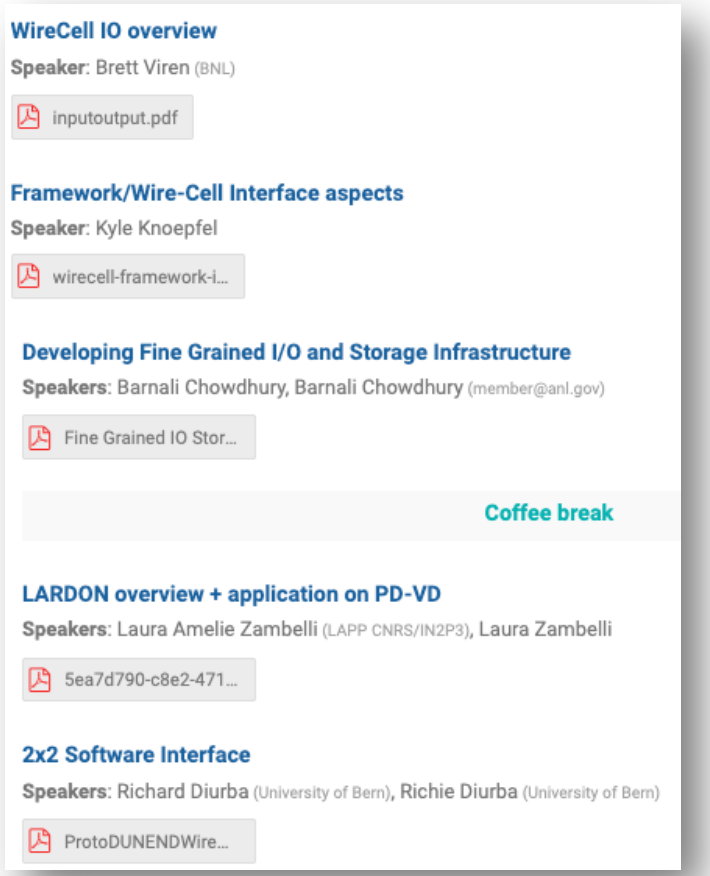
Framework and IO



Purpose:

- Framework: robust production and minimize boilerplate [B. Viren, K. Knoepfel]
- IO: interface between software/people [B. Viren, K. Knoepfel, B. Chowdhury]

Development:

- Wire-Cell Toolkit [B. Viren]
- Meld and related [K. Knoepfel, B. Chowdhury]
- LARDON [L. Zambelli]
- ND-LAr 2x2, larnd-sim [R. Diurba]

Takeaway:

- **Portable file exchange IO becoming more favorable**
  - development of computing hardware
  - sparsified LArTPC data is not so large
    - sim-sigproc could still be data-heavy
- **Traditional "framework" is still good at**
  - **CPU and data heavy production**
  - **robust data provenance**

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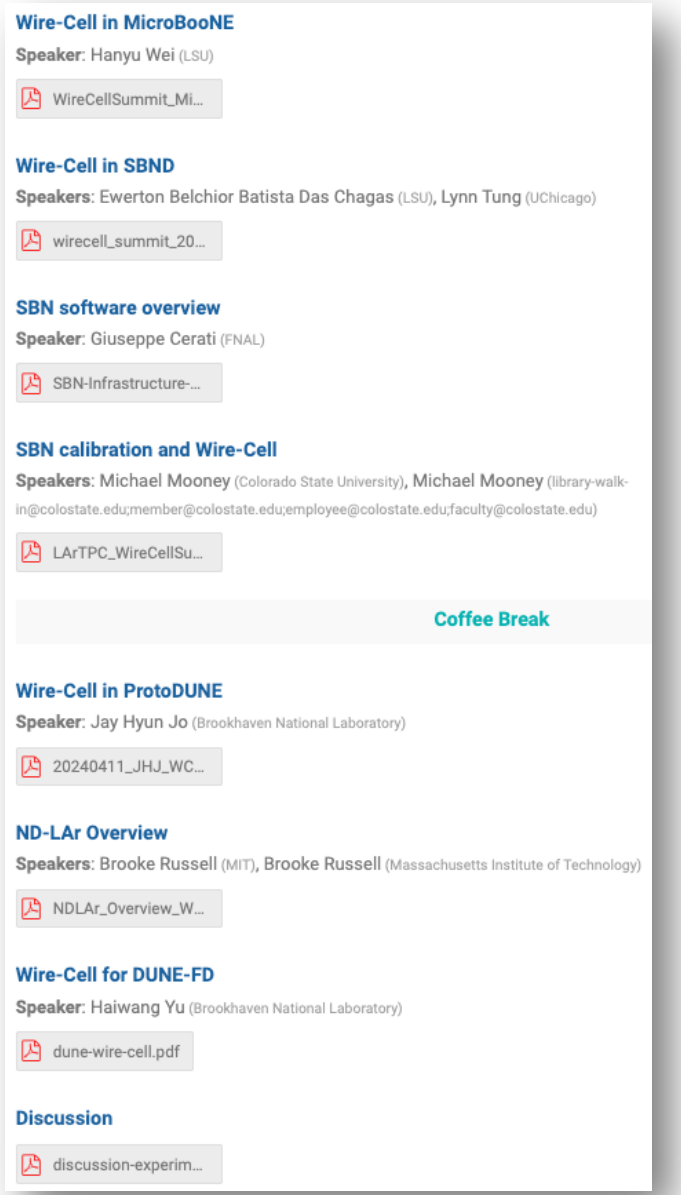
Experiment needs



Purpose:

- Gather experiment needs to guide our future dev.

Request/development:

- Porting: uboone alg. (WCP) → other LArTPC (WCT) [H. Wei]
- SBN/ProtoDUNEs/DUNE-ND/FD [E. Belchior, L. Tung, G. Cerati, M. Mooney, J. Jo, B. Russel, H. Yu]

Takeaway:

- **We will prepare a note to document the requests and our initial thoughts**
- **We need to make it easier to contribute to WCT**

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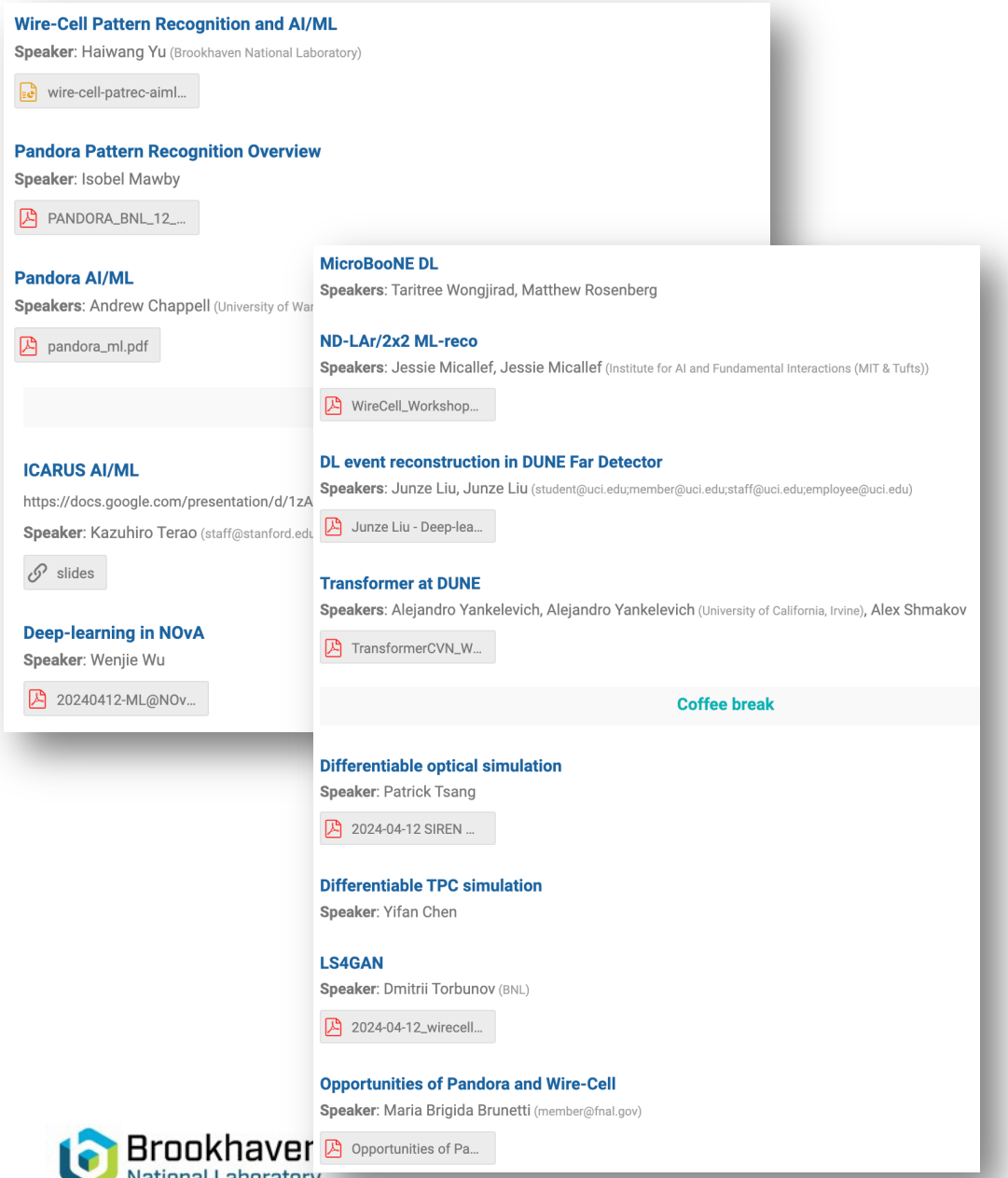
PatRec & AI/ML



Purpose: Exchange ideas

Development:

- Wire-Cell [H. Yu]
- Pandora [I. Mawby, A. Chappel, M. B. Brunetti]
- AI/ML [K. Terao]
- Experience for experiments [W. Wu, T. Wongjirad, J. Micallef, J. Liu, A. Yankelevich]
- Simulation improvement [P. Tsang, Y. Chen, D. Torbunov]

Takeaway for us:

- Data format
- Suitable NN/architecture
- Truth labeling
- data-sim diff, calibration, validation

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