

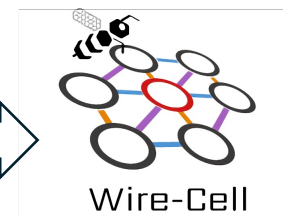
The Second Wire-Cell Reconstruction Summit

Hosted by Brookhaven National Laboratory

The workshop will held as a hybrid event on April 10–12, 2024



Wire-Cell Event Reconstruction



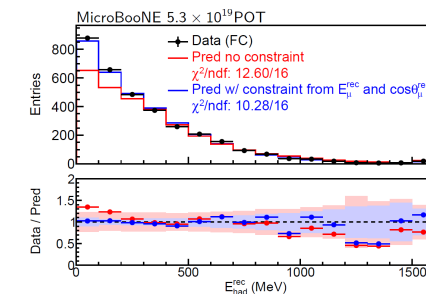
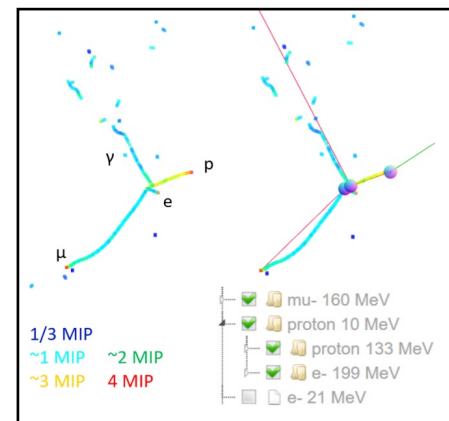
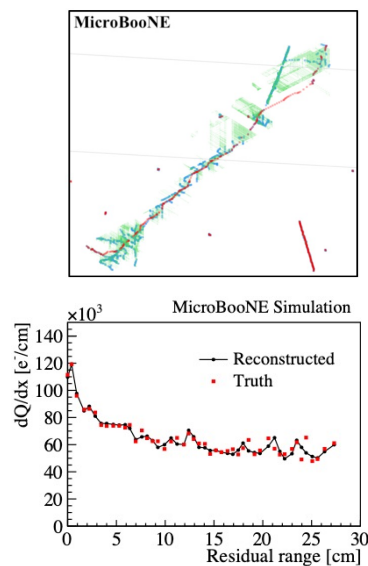
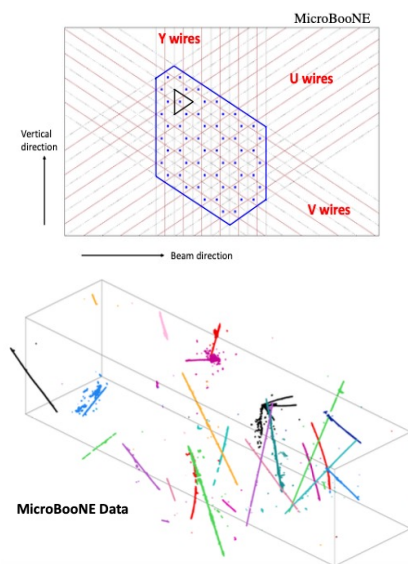
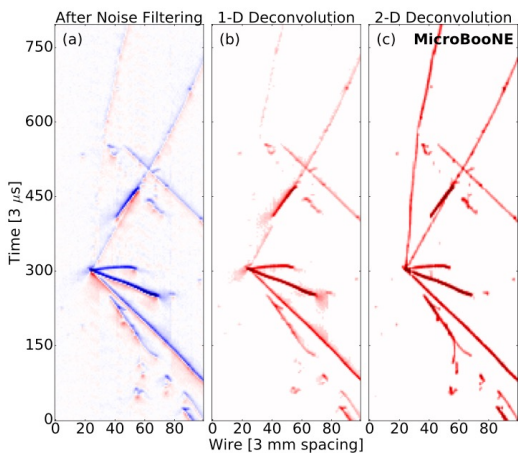
- TPC simulation
- noise filtering
- signal processing

- 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 (Edinburgh), 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**

Framework and IO

WireCell IO overview
Speaker: Brett Viren (BNL)
inputoutput.pdf

Framework/Wire-Cell Interface aspects
Speaker: Kyle Knoepfel
wirecell-framework-i...

Developing Fine Grained I/O and Storage Infrastructure
Speakers: Barnali Chowdhury, Barnali Chowdhury (member@anl.gov)
Fine Grained IO Stor...

Coffee break

LARDON overview + application on PD-VD
Speakers: Laura Amelie Zambelli (LAPP CNRS/IN2P3), Laura Zambelli
5ea7d790-c8e2-471...

2x2 Software Interface
Speakers: Richard Diurba (University of Bern), Richie Diurba (University of Bern)
ProtoDUNENDWire...

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**

Experiment needs

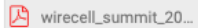
Wire-Cell in MicroBooNE

Speaker: Hanyu Wei (LSU)



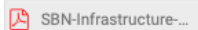
Wire-Cell in SBND

Speakers: Ewerton Belchior Batista Das Chagas (LSU), Lynn Tung (UChicago)



SBN software overview

Speaker: Giuseppe Cerati (FNAL)



SBN calibration and Wire-Cell

Speakers: Michael Mooney (Colorado State University), Michael Mooney (library-walk-in@colostate.edu;member@colostate.edu;employee@colostate.edu;faculty@colostate.edu)



Coffee Break

Wire-Cell in ProtoDUNE

Speaker: Jay Hyun Jo (Brookhaven National Laboratory)



ND-LAr Overview

Speakers: Brooke Russell (MIT), Brooke Russell (Massachusetts Institute of Technology)



Wire-Cell for DUNE-FD

Speaker: Haiwang Yu (Brookhaven National Laboratory)



Discussion



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**

PatRec & AI/ML

Wire-Cell Pattern Recognition and AI/ML

Speaker: Haiwang Yu (Brookhaven National Laboratory)

wire-cell-patrec-aiml...

Pandora Pattern Recognition Overview

Speaker: Isobel Mawby

PANDORA_BNL_12_...

Pandora AI/ML

Speakers: Andrew Chappell (University of War

pandora_ml.pdf

ICARUS AI/ML

<https://docs.google.com/presentation/d/1za>

Speaker: Kazuhiro Terao (staff@stanford.edu)

slides

Deep-learning in NOvA

Speaker: Wenjie Wu

20240412-ML@NOv...

MicroBooNE DL

Speakers: Taritree Wongjirad, Matthew Rosenberg

ND-LAr/2x2 ML-reco

Speakers: Jessie Micallef, Jessie Micallef (Institute for AI and Fundamental Interactions (MIT & Tufts))

WireCell_Workshop...

DL event reconstruction in DUNE Far Detector

Speakers: Junze Liu, Junze Liu (student@uci.edu;member@uci.edu;staff@uci.edu;employee@uci.edu)

Junze Liu - Deep-lea...

Transformer at DUNE

Speakers: Alejandro Yankelevich, Alejandro Yankelevich (University of California, Irvine), Alex Shmakov

TransformerCVN_W...

Coffee break

Differentiable optical simulation

Speaker: Patrick Tsang

2024-04-12 SIREN ...

Differentiable TPC simulation

Speaker: Yifan Chen

LS4GAN

Speaker: Dmitrii Torbunov (BNL)

2024-04-12_wirecell...

Opportunities of Pandora and Wire-Cell

Speaker: Maria Brigida Brunetti (member@fnal.gov)

Opportunities of Pa...

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