

NuSTEC Outreach Working Group Update



T.Katori (King's College London)

A.Papadopoulou (ANL)

Outreach Working Group

Conveners: [Teppei Katori](#) and [Afroditi Papadopoulou](#)

The outreach group focuses on enhancing NuSTEC's and community-wide neutrino interaction physics activities' outreach to and engagement with the broader neutrino and scientific community as well as with science enthusiasts.

To Follow NuSTEC activities:

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PA Papadopoulou, Afroditi
 To: NuSTEC new mailing list <nustec-news@listserv.fnal.gov>
 Cc: Papadopoulou, Afroditi

Wed 12/11/2024 1:48 AM

Dear all!

We hope this email finds you well!

We would like to bring your attention to a new manuscript ([arXiv:2412.07466](https://arxiv.org/abs/2412.07466)) on the "Implementation and investigation of electron-nucleus scattering in NEUT neutrino event generator".

Abstract

Understanding nuclear effects is essential for improving the sensitivity of neutrino oscillation measurements. Validating nuclear models solely through neutrino scattering data is challenging due to limited statistics and the broad energy spectrum of neutrinos. In contrast, electron scattering experiments provide abundant high-precision data with various monochromatic energies and angles. Since both neutrinos and electrons interact via electroweak interactions, the same nuclear models can be applied to simulate both interactions. Thus, high-precision electron scattering data is essential for validating the nuclear models used in neutrino experiments. To enable this, the author has newly implemented electron scattering in the `NEUT` neutrino event generator, covering two interaction modes: quasielastic (QE) and single pion production. `NEUT` predictions of QE agree well with numerical calculations, supporting the validity of this implementation. From comparisons with `NEUT` predictions and inclusive electron scattering data, the momentum-dependent binding energy correction is derived, corresponding to effects beyond the plane wave impulse approximation. The impact of this correction on neutrino interactions is also evaluated. Significant differences in charged lepton kinematics are observed, with approximately 20 MeV of peak shift in the reconstructed neutrino energy distribution, which is important for accurately measuring neutrino oscillation parameters. It is expected to serve as a foundation for future discussions on electron scattering using NEUT.

<https://arxiv.org/abs/2412.07466>

Cheers!

• Listserv: NuSTEC-News (~600 subscribers)

- Advertise nuxsec workshops/schools/conferences
- Advertise NuSTEC WG activities
- Recent results

NuSTEC CEWG seminar: OmniFold, Machine Learning-Assisted Unfolding

PA owner-nustec_cewg@listserv.fnal.gov on behalf of Papadopoulou, Afroditi <00001d139ad34210-dmarc-request@LISTSERV.FNAL.GOV>
 To: NuSTEC new mailing list <nustec-news@listserv.fnal.gov>; nustec_cewg <nustec_cewg@listserv.fnal.gov>; nustec_ctgw <nustec_ctgw@listserv.fnal.gov>
 Cc: Daniel David Cheradack <dcheradack@uh.edu>; andrew.cudd@colorado.edu <Andrew.Cudd@colorado.edu>; Vishwas Pandey <vpandey@fnal.gov>

Wed 12/4/2024 9:13 AM

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[EXTERNAL] – This message is from an external sender
 Dear NuSTEC colleagues,

This is a reminder that we will have our next NuSTEC Cross Experiment Working Group (CEWG) Seminar on **Thursday, December 5 at 10:00 am US Central Time**.

Speaker: Andrew Cudd

Topic: OmniFold: Machine Learning-Assisted Unfolding

Abstract: The choice of unfolding method for a cross-section measurement is tightly coupled to the model dependence of the efficiency correction and the overall impact of cross-section modeling uncertainties in the analysis. A key issue is the dimensionality used, as the kinematics of all outgoing particles in an event typically affects the reconstruction performance in a neutrino detector. OmniFold is an unfolding method that iteratively reweights a simulated dataset using machine learning to utilize arbitrarily high-dimensional information that has previously been applied to collider and cosmology datasets. Here, we demonstrate its use for neutrino physics using a public T2K near detector simulated dataset, and show its performance is comparable to or better than traditional approaches using a series of mock data sets.

Resources:

OmniFold Paper: <https://doi.org/10.1103/PhysRevLett.124.182001>

Neural network weighting: <https://journals.aps.org/prd/abstract/10.1103/PhysRevD.101.091901>

Indico page: <https://indico.fnal.gov/event/67192/>

Zoom link: <https://fnal.zoom.us/j/95572357669?pwd=Z0LmstVP2juQjZlbnR6Qm9McS2kxL1>

Meeting ID: 955 7235 7669

Passcode: 999143

For those at Fermilab, we have reserved the **Refuge Chamber (WH135W)**

You can find slides and recordings of our past seminars, and a list of upcoming seminars on our webpage: <https://nustec.fnal.gov/cross-experiment-working-group-cewg/>

Regards,
 Afroditi, Dan, and Vishwas
 for the NuSTEC CEWG

NUSTEC-News

1.1K likes • 1.2K followers




- Highlight nu-xsec related activities
- Community engagement

NUSTEC-News
 Published by Afroditi Papadopoulou
 - 6 days ago

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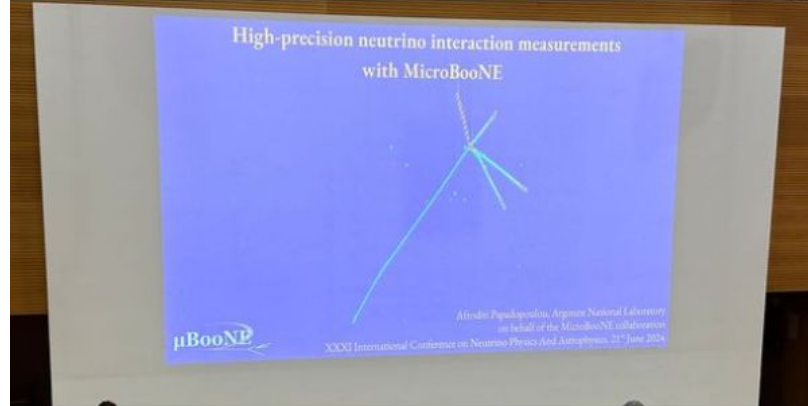
Abstract
 Understanding nuclear effects is essential for improving the sensitivity of neutrino oscillation measurements. Validating nuclear models solely through neutrino scattering data is challenging due to limited statistics and the broad energy spectrum of neutrinos. In contrast, electron s... [See more](#)



ARXIV.ORG 

Implementation and Investigation of electron-nucleus scattering in NEUT neutrino event generator

Second neutrino interaction session at Neutrino2024 with talks from MicroBooNE, ENUBET, e4ν, CEvNS, and COHERENT!
<https://agenda.infn.it/event/37867/timetable/...>



- Experiment slack (e.g. CEWG seminars)



Afroditi Papadopoulou 8:27 AM

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Regards,

Home

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Workshops, Conferences and
Schools Working Group

Cross Experiment Working
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Cross Theory and Generators
Working Group

Long-term Community
Planning Working Group

Outreach Working Group

Publications Working Group

Resources

Cross Experiment Working Group

Conveners: Dan Cherdack, Vishvas Pandey, and Afroditi Papadopoulou

Members: Luca Doria, Josephine Paton, and Prabhjot Singh

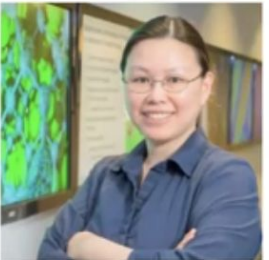

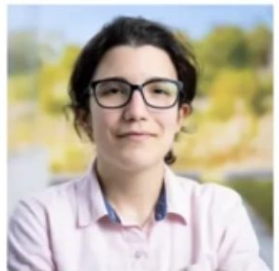
The goal of the NuSTEC CEWG is to provide a service to the neutrino-nucleus interaction community by aiding communication between experiments, and building consensus on how to best perform and report cross section measurements.


2024

- December 5, 2024: "OmniFold: Machine Learning-Assisted Unfolding", Andrew Cudd (University of Colorado Boulder)
- November 7, 2024: "Data-driven Model Validation For Neutrino Cross Section Measurements", Lee Hagaman (University of Chicago)
- October 17, 2024: Joint CEWG + CTGWG Event
"2p2h from the Valencia Model Revisited", Joanna Sobczyk (Johannes Gutenberg University Mainz)
"Measurement of double differential charged current muon neutrino scattering in three-momentum transfer and available energy using the NOvA Near Detector", Travis Olson (University of Houston)
- October 3, 2024: "Current Status of Achilles Event Generator", Joshua Isaacson (Fermilab)
- September 12, 2024: "New proton transparency data with electron probe and its relationship to neutrino experiments", Steven Dytman (University of Pittsburgh)
- August 15, 2024: "Neutrino-nucleus interaction systematic uncertainties and baseline model for DUNE analyses", Laura Munteanu (CERN)
- June 13, 2024: "Measurement of double-differential cross sections for mesonless charged-current muon neutrino interactions on argon with final-state protons using the MicroBooNE detector", Steven Gardiner (Fermilab)
- March 7, 2024: "Measurement of Transverse/Generalized Kinematic Imbalance Variables in MicroBooNE", Andrew Furmanski (University of Minnesota), Afroditi Papadopoulou (Argonne National Laboratory)
- January 18, 2024: "NuHepMC: A Standardized Event Record Format for Neutrino Event Generators", Steven Gardiner (Fermilab), Joshua Isaacson (Fermilab), Luke Pickering (STFC, Rutherford Appleton Laboratory)

Targeting candidate SULI students. A number of them reached out and expressed interest in cross section & generator projects at FNAL and ANL in the summer

ARGONNE RESEARCHER PANEL

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| <p>Maria Chan</p>  <p>Title: Scientist, Nanoscience Division: Nanoscience and Technology Degree: PhD, Physics</p> | <p>Ed O'Loughlin</p>  <p>Title: Senior Biogeochemist Division: Biosciences Degree: PhD, Environmental Chemistry</p> | <p>Afroditi Papadopoulou</p>  <p>Title: Maria Goepfert Mayer Fellow Division: High Energy Physics Degree: PhD, Experimental Particle Physics</p> |
|--|--|--|



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Thank you!