FERNANDA PSIHAS

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EDUCATION

Ph.D. in Physics — 2018
Indiana University

M.S. in Physics — 2013
University of Minnesota Duluth

B.S. in Engineering Physics — 2011
Universidad Iberoamericana
Mexico City, Mexico

WORK HISTORY

Research Associate — 2019 - present
Fermi National Accelerator Laboratory, Batavia, IL

Postdoctoral Fellow — 2018 - 2019
The University of Texas at Austin

Postdoctoral Fellow — 2017 - 2019
The University of Texas at Arlington

Research Assistant — 2013 - 2017
Indiana University, Bloomington, IN

Research Assistant — 2011 - 2013
University of Minnesota, Duluth, MN

EXPERIMENTAL COLLABORATIONS

SBN — 2020 - present
Short-Baseline Neutrino Program

SBND — 2020 - present
Short-Baseline Near Detector

DUNE — 2018 - present
Deep Underground Neutrino Experiment

NOvA — 2011 - 2020
NUMI Off-Axis Electron Neutrino Appearance Experiment

NEXT — 2018 - 2020
Neutrino Experiment with a Xenon TPC

HONORS & AWARDS

$ Fermilab Employee Reward & Recognition Award — 2020
For the successful development and execution of an online platform for the poster session of The XXIX International Conference on Neutrino Physics and Astrophysics.

Fermilab Physics Slam Winner — 2019
For "High Energy Failure", a presentation relating the road to discovery with the struggles of learning disabilities. The Fermilab physics slam is the most popular event in the annual Fermilab Arts and Lecture Series.

$ ConTex Bi-National Postdoctoral Fellowship — 2017, 2018
Twice-recipient of a proposal-based fellowship from the ConTex collaboration between the University of Texas System and Mexico's National Council of Science and Technology for postdoctoral work.

Indiana University Outstanding Graduate Research — 2017

43rd SLAC Summer Institute Best Project — 2015

$ Indiana University Physics Outstanding Candidate Award — 2013

ELECTED POSITIONS

Division of Particles and Fields Executive Committee, American Physical Society — 2019–2020
Early career member. Launched the 2021 Snowmass Early Career organization. The Snowmass organizations are planning forums for the priorities of particle physics in the United States for the coming decade.

Fermilab Users Executive Committee (UEC) — 2017–2019
Spearheaded the creation of a Climate and Environment Committee, a joint committee with the Fermilab Graduate Student and Postdoc Association for safe and respectful environments.

Chair, Government Relations Subcommittee, Fermilab UEC — 2017–2018
Organized the annual HEP advocacy trip to Washington, D.C. to meet with members of Congress and funding agencies. Led the most successful advocacy trip to date, visiting all 535 congressional offices for the first time. Trained and managed the efforts of 50+ colleagues. Designed an implemented an online scheduling and optimization platform for this trip.

President, Young NOvA — 2016–2017
Young NOvA is the organization that represents the needs and perspectives of the graduate students and post-doctoral researchers to the collaboration leadership. As President, I organized workshops, social events, and team-building activities. I also led the first effort on NOvA to educate young scientists in the experiment about harassment and abuse policies and prevention.

OTHER COMMUNITY SERVICE

Organizing Committee for The XXIX International Conference on Neutrino Physics and Astrophysics — 2019–2020

Fermilab Climate and Environment Committee, Fermilab Users Executive Committee — 2019

Employee Concerns Task Force, Fermilab — 2019

Deputy Chair, Government Relations Subcommittee, Fermilab Users Executive Committee — 2017–2018

Indiana University Physics Bridge Program Team — 2014–2017

Young NOvA Representative, NOvA Collaboration Institutional Board — 2014–2015

Indiana University Research Affairs Committee — 2015

SKILLS

Languages

Spanish
English
French
Russian
Japanese

Professional Skills

Initiative | Problem-Solving | Integrity | Logical Reasoning | Resilience | Divergent Thinking | Trainability | Visual Communication | Independence | Team-building | Fact-based Decision-making | Empathy | People Management | Mentoring | Project Management | Delegation | Public Speaking | Innovation | Persistence | Human Factors Engineering | Analysis

Hard Skills

Data Analytics | Machine Learning | Data Visualization | Programming | Particle Physics | Particle Detector Technology

MENTORING

Graduate Students

Elise Chavez, DUNE R&D
Now at University of Wisconsin, Madison

Micah Groh, NOvA Experiment
Now at Colorado State University

Ryan Murphy, NOvA Experiment
Now at West Monroe

Teresa Lackey, NOvA Experiment
Now at Indiana University

Biswaranjan Behera, NOvA Experiment
Now at Colorado State University

Under-graduate Students

Emily Tsai, NOvA Experiment

Denise Huerta, NEXT Experiment

Mayank Modi, Google Summer of Code

Mentor, Google Summer of Code 2017, 2018

LEADERSHIP EXPERIENCE

Convener, SBN Analysis Framework Group 2021–present
Manager of 5-10 graduate students and postdoctoral researchers. Designed and supervised the implementation of cross-experiment analysis frameworks.Spearheaded the implementation of multi-experiment analysis frameworks that will enable all physics analyses in the Short-Baseline Neutrino program.

Convener, NOvA Reconstruction and Deep Learning Group 2018–2019
Manager of 10-15 graduate students and postdoctoral researchers. Spearheaded, designed, and supervised the creation of a Python-HDF5 analysis infrastructure to enable the utilization of parallel computing for NOvA analyses as well as the application of machine learning algorithms with industry-standard frameworks. Supervised new implementations of deep learning techniques for reconstruction of NOvA data, including the development of two new algorithms for energy estimation, single particle classification, and full event reconstruction leading to publication.

Coordinator, Fermilab Machine Learning Group 2016–2017
Founding member. Spearheaded the creation of an inter-experimental grassroots community for knowledge transfer and collaboration on machine learning applications in particle physics.

Leader, NOvA Watchdog Group 2015–2018
Manager of 5-10 students, postdoctoral researchers, and technicians. Responsible for the adaptation of monitoring procedures based of human factors. Led a group of operations experts monitoring the data quality and developing the tools used to assess and optimize NOvA detector performance.

Leader, NOvA Near Detector Maintenance 2015
Manager of 5 graduate student colleagues. Responsible for designing procedures and performing risk assessments for maintenance of underground facilities. Led a group of graduate students charged with the maintenance of the NOvA near detector electronics at Fermi National Accelerator Laboratory during the 2015 NuMI shutdown.

TEACHING EXPERIENCE

NOvA Experiment Workshops 2016, 2017, 2018
Organizer for the 2016 and 2017 workshops for new collaborators. Presenter for 2016-2018 workshops on the topics of NOvA software, deep learning, and poster presentations.

Teaching Assistant, Indiana University, Bloomington, IN 2013
Teaching assistant for algebra based physics laboratory.

Teaching Assistant University of Minnesota, Duluth, MN 2011–2012
Teaching assistant for algebra based physics laboratory.

OUTREACH

Experience communicating complex physics concepts and experimental findings to Congressional offices, Congresspeople, and the general public according to their interests and level of understanding to advance the scientific priorities of my organization.

Fermilab Physics Slam 2019

High Energy Physics Congressional Advocacy Trip Participant 2018, 2020

Fermilab Ask A Scientist 2017

Trained guide of the Fermilab NuMI underground area 2015–Present

Astronomy Day Talk, MW Alworth Observatory, Duluth, MN 2012

Outreach Talk, Science Friday, Woodland Middle School 2012

Public Seminar, Universidad Iberoamericana Observatory 2010

Exhibit Guide, Einstein: Gravity, Energy and Special Relativity, Papalote Museo del Niño, Mexico City, Mexico 2009

RESEARCH EXPERIENCE

Short-Baseline Neutrino Program
Implemented the first SBN common framework essential to enable analysis. Assembled and led an SBND-ICARUS collaborative team of four students and postdocs to work on the analysis files and framework. Designed the inner clean tent for the SBND assembly transportat frame, a critical system for the assembly of the SBND detector. Assembled and led a team of four students and postdocs to prepare and install the clean tent.

Deep Learning
Adapted convolutional neural networks for the use in neutrino experiments as well as further improvements to the event identification algorithm for anti-neutrino events for NOvA. Developed a single-particle identification algorithm based on deep convolutional networks and led a team of three students and postdocs to take it to publication. Developed an energy estimation technique using deep learning algorithms for single particle selection.

NOvA Oscillation Analyses
Developed a framework for the calculation of systematic uncertainties for the main oscillations analyses. Developed an algorithm for energy reconstruction of electron neutrino charged current events and prepared final results and figures for release at conferences and in publications. Developed the selection of signal events for the 2018 analysis. Developed the first technique for muon energy estimation in the NOvA detectors using multiple scattering information.

NOvA Detector Operations and Data Quality
My work on detector operations was instrumental to NOvA's $>$95% detector uptime. I led the creation of procedures for the official NOvA shifter training and developed an automated system which uses live data to monitor specific hardware issues. As a system monitoring expert, I was responsible for maintaining and providing on-call technical support of the real-time monitoring tools employed by shifters and system experts for detector diagnostics. As an expert in the NOvA DAQ hardware and software, I provided on-call DAQ support for the experiment.
For the NOvA near detector, I developed maintenance procedures in consultation with senior detector experts and technicians, conducted safety assessments and implemented new safety procedures for work in the underground detector facilities, which included training new experts on maintenance and safety procedures for working in the underground facilities.

Neutrino-less Double-beta Decay
Developed energy resolution studies for a novel detection concept for neutrino-less double beta decay using a SeF6 ion Time-Projection Chamber (TPC), which led to a publication. Led the development of open source electron transport and ion mobility simulation, leading to a publication. Designed studies for mechanical properties and absorption properties of polymers in high pressure gasses relevant to the design of the NEXT-100 detector, leading to a publication.

Barium Tagging for NEXT
Tagging of single ^{136}Ba ions in the double-beta decay of ^{136}Xe is an exciting technology which could enable background-free searches for neutrino-less double-beta decay. I developed the conceptual design and constructed the first test-stand for an Single Molecule Fluorescence Imaging sensor which can operate in high pressure xenon gas. I also developed a methodology for and conducted extensive studies of commercial molecular dyes for single-molecule imaging.

INVITED PRESENTATIONS

Departmental Colloquium — Syracuse University, Syracuse, NY — Feb. 2021
Deep Learning Applications to Neutrino Physics.

Particle Physics Seminar — Universidad del Atlantico, Barranquilla, Colombia — Sep. 2020
Successes and Perspectives of Deep Learning Applications to Neutrino Physics.

Physics and Astronomy Colloquium — Rice University — Oct. 2019
Successes and Perspectives of Deep Learning Applications to Neutrino Physics.

DANCE 2019: Workshop on Dark Matter and Neutrino Computation Explored — Rice University — Oct. 2019
Plenary Talk: *Machine Learning and NOvA.*

Particle Physics Seminar — Rice University — Aug. 2019
Deep Learning for Neutrino Physics: Successes and Lessons.

At the Crossroad of Physics and Machine Learning — KITP UC Santa Barbara — Feb. 2019
Invited Plenary Talk: *Successes and Perspectives of Deep Learning Applications to Neutrino Physics.*

Department of Physics Colloquium — University of Minnesota Duluth — Nov. 2018
Neutrino Physics with Deep Learning.

Physics Seminar — Southern Methodist University — Nov. 2018
Neutrino Physics with Deep Learning. Techniques and applications on NOvA.

First Biennial Workshop on Gas Phase, Ton-Scale $0\nu\beta\beta$ Decay Searches — Lawrence Berkeley National Laboratory, Berkeley, CA — Jun. 2018
Plenary Talk: *Ion Transport in SeF6 for Neutrinoless Double-beta Decay.*

Aspen Winter Conference: The Particle Frontier — Aspen, CO — Mar. 2018
Invited Participant: *Panel on Machine Learning.*

Department of Physics Colloquium — UT Dallas — Jan. 2018
Neutrino Oscillations and Recent Results from the NOvA Experiment.

Department of Physics Colloquium — UT Arlington — Jan. 2018
Neutrino Oscillations and Recent Results from the NOvA Experiment.

XVI Mexican Workshop on Particles and Fields — Puerto Vallarta, Mexico — Oct. 2017
Plenary Talk: *Status of Machine Learning Applications at Fermilab Experiments.*

HEP Software Foundation Workshop — Annecy, France — Jun. 2017
Plenary Talks: *Status and Summary of the Career Advancement and Training Working Group.*

XXXI Annual Meeting of the Mexican Physics Society Particles and Fields Division — Mexico City, Mexico — May 2017
Invited Plenary Talk: *Status of Long Baseline Experiments at Fermilab.*

S2I2 HEP/CS workshop (Invited Participant) — Princeton, NJ — May 2017
Plenary Talk: *Summary of the Session on Intensive Data Analysis and Visualization.*
Talk: *Optimizing Neural Networks for Physics Metrics.*

First Inter-experimental Machine Learning Workshop — CERN, Geneva, Switzerland — Mar. 2017
Deep Convolutional Networks for Event Reconstruction and Particle Tagging on NOvA and DUNE.

OTHER TALKS AND PRESENTATIONS

American Physical Society April meeting — Virtual — Apr. 2021
DUNE-beta: DUNE as a platform for neurtino-less double-beta decay searches.

XXIX International Conference on Neutrino Physics and Astrophysics — Fermilab, Batavia, IL — Jun. 2020
Poster: *DUNE-beta: Can we expand DUNE's physics program to search for neurtino-less double beta decay?*

16th International Conference on Topics in Astroparticle and Underground Physics — Toyama, Japan — Sep. 2019
Talk: *Results and prospects from the NOvA Experiment.*

American Physical Society April meeting — Denver, Colorado — Apr. 2019
Talk: *Successes and Lessons of Deep Learning Applications to the NOvA experiment.*

NuFact 2018, 20th International Workshop on Neutrinos from Accelerators — Virginia Tech — Aug. 2018
Talk: *Single Ion Barium Tagging for Neutrino-less Double-Beta Decay. A multi-disciplinary technique for NEXT.*
Poster: *Neutrino physics with deep learning. Techniques and applications on NOvA.*

Workshop on Single Atom Ba Tagging. — Donostia International Physics Center, San Sebastian, Spain — Jul. 2018
Plenary talk: Ba++ Microscopy in Gas at UTA

XXVIII International Conference on Neutrino Physics and Astrophysics — Heidelberg, Germany — Jun. 2018
Poster: Neutrino physics with deep learning. Techniques and applications on NOvA.
Poster: Barium daughter tagging using single molecule fluorescence imaging.

2017 Meeting of the APS Division of Particles and Fields — Fermilab, Batavia IL — Aug. 2017
Talk: Deep Learning on NOvA.
Talk: Energy Reconstruction for Signal Neutrino Events on NOvA.

Fermilab New Perspectives — Fermilab, Batavia IL — Jun. 2017
Plenary Talk: Machine Learning at Fermilab.

Data Science and High Energy Physics — Fermilab, Batavia IL — May 2017
Plenary Talk: Community Efforts in Machine Learning.

22nd International Conference on Computing in High Energy and Nuclear Physics. — San Francisco, CA — Oct. 2016
Neutrino Identification With A Convolutional Neural Network in the NOvA Detectors

XXVII International Conference on Neutrino Physics and Astrophysics — Imperial College London, UK — Jul. 2016
Poster: The Convolutional Visual Network Algorithm for NOvA Event Identification and Reconstruction.
Poster: Charge Current Electron Neutrino Event Identification in the NOvA Detectors.

American Physical Society Meeting — Salt Lake City, UT — Apr. 2016
Improvements for NOvA's Second Electron Neutrino Appearance Analysis.
Poster: Monitoring the performance of the NOvA Detectors.

American Physical Society April meeting — Denver, CO — Apr. 2013
Poster: Muon energy reconstruction through the multiple scattering method.

Fermilab Users Meeting — Fermilab, Batavia, IL — Jun. 2014
Poster: Monitoring the performance of the NOvA Detectors.

SELECTED PUBLICATIONS

Xenon-Doped Large Liquid Argon TPCs as Neutrinoless Double Beta Decay Platform — Manuscript in preparation. — 2021
A. Mastbaum, F. Psihas, J. Zennamo.

A Review on Machine Learning for Neutrino Experiments — International Jounral of Modern Physics A — 2020
F. Psihas, M. Groh, C. Tunnell, and K. Warburton. **[5+ citations]** arXiv

Context-Enriched Identification of Particles with a Convolutional Network for Neutrino Events — Physical Review D. — 2019
F. Psihas, E. Niner, M. Groh, R. Murphy, A. Aurisano, A. Himmel, K. Lang, M. Messier, A. Radovic, A. Sousa. **[10+ citations]** arXiv

Neutrinoless Double Beta Decay with 82SeF6 and Direct Ion Imaging — Journal of Instrumentation — 2018
D.R. Nygren, B.J.P. Jones, N. López-March, Y. Mei, F. Psihas, J. Renner. arXiv

A Convolutional Neural Network Neutrino Event Classifier — Journal of Instrumentation — 2016
A.Aurisano, A. Radovic, D. Rocco, A. Himmel, M.D. Messier, E. Niner, G. Pawloski, F. Psihas, A. Sousa, and P. Vahle. **[160+ citations]** arXiv

SELECTED PUBLICATIONS AS A LEAD CONTRIBUTOR

First Measurement of Neutrino Oscillation Parameters using Neutrinos and Antineutrinos by NOvA — Physical Review Letters — 2019
M. Acero et al. (NOvA Collaboration) **[100+ Citations]** arXiv

New constraints on oscillation parameters from ν_e appearance and ν_μ disappearance in the NOvA experiment — Physical Review D. — 2018
M. Acero et al. (NOvA Collaboration) **[150+ citations]** arXiv

High Voltage Insulation and Gas Absorption of Polymers in High Pressure Argon and Xenon Gases — Journal of Instrumentation — 2018
L. Rogers et al. (NEXT Collaboration) **[5+ citations]** arXiv

Constraints on Oscillation Parameters from ν_e Appearance and ν_μ Disappearance in NOvA — Physical Review Letters — 2017
P. Adamson et al. (NOvA Collaboration) **[200+ citations]** arXiv

Measurement of the neutrino mixing angle θ_{23} in NOvA — Physical Review Letters — 2017
P. Adamson et al. (NOvA Collaboration) **[190+ citations]** arXiv

First measurement on muon-neutrino disappearance from the NOvA experiment — Physical Review D. — 2016
P. Adamson et al. (NOvA Collaboration) **[190+ citations]** arXiv

First measurement of electron-neutrino appearance in NOvA — Physical Review Letters — 2016
P. Adamson et al. (NOvA Collaboration) **[250+ citations]** arXiv

THESES & PROCEEDINGS

Measurement of Long Baseline Neutrino Oscillations and Improvements from Deep Learning — FERMILAB-THESIS — 2018
F.Psihas **[10+ citations]** arXiv

Muon Energy Reconstruction Through the Multiple Scattering Method in the NOνA Detectors — FERMILAB-MASTERS — 2013
F.Psihas arXiv

The Convolutional Visual Network for Identification and Reconstruction of NOvA Events — Journal of Physics: Conf. Series — 2017
F. Psihas

Event Reconstruction in the NOvA Experiment — FERMILAB-CONF — 2017
B. Behera, G. Davies, and F. Psihas for the NOvA collaboration **[5+ citations]** arXiv

CVN: A Convolutional Visual Network for Identication and Reconstruction of NOvA Events — Journal of Physics: Conf. Series — 2017
F. Psihas, for the NOvA collaboration

Search for Z rare decays on CDF: $Z^0 \to J/\psi\gamma$ and $Z^0 \to \Upsilon\gamma$ — Journal of Physics: Conf. Series — 2012
F.Psihas, et al. arXiv

OTHER PUBLICATIONS

Extended search for supernova-like neutrinos in NOvA coincident with LIGO/Virgo detections — Submitted to Physical Review D. — 2021
M. A. Acero, et al. (NOvA Collaboration) — arXiv

Cosmic Background Removal with Deep Neural Networks in SBND — FERMILAB-PUB — 2020
R. Acciarri, et al. (SBND Collaboration) — arXiv

Adjusting Neutrino Interaction Models and Evaluating Uncertainties using NOvA Near Detector Data — European Journal of Physics C — 2020
M. A. Acero, et al. (NOvA Collaboration) — **[5+ citations]** — arXiv

Supernova neutrino detection in NOvA — Journal of Cosmology and Astroparticle Physics — 2020
M. A. Acero, et al. (NOvA Collaboration) — **[5+ citations]** — arXiv

Search for multimessenger signals in NOvA coincident with LIGO/Virgo detections — Physical Review D. — 2020
M. A. Acero, et al. (NOvA Collaboration) — arXiv

Observation of seasonal variation of atmospheric multiple-muon events in the NOvA Near Detector — Physical Review D. — 2019
M. A. Acero, et al. (NOvA Collaboration) — **[5+ citations]** — arXiv

Measurement of Neutrino-Induced Neutral-Current Coherent π^0 Production in the NOvA Near Detector — Physical Review D — 2019
M. Acero et al. (NOvA Collaboration) — **[5+ Citations** — arXiv

Initial results on energy resolution of the NEXT-White detector — Journal of Instrumentation — 2016
J. Renner et al. (NEXT Collaboration) — **[20+ citations]** — arXiv

Search for active-sterile neutrino mixing using neutral-current interactions in NOvA — Physical Review D. — 2017
P. Adamson et al., (NOvA Collaboration) — **[80+ citations]** — arXiv

Roadmap for HEP Software and Computing R&D for the 2020s — Computing and Software for Big Science — 2017
Antonio Augusto Alves, Jr et al. — **[80+ citations]** — arXiv

Machine Learning in High Energy Physics Community White Paper — Journal of Physics Conf. Series — 2018
K. Albertsson et al. — **[80+ citations]** — arXiv

Measurement of radon-induced backgrounds in the NEXT double beta decay experiment — Journal of High Energy Physics — 2018
P. Novella et al. (NEXT Collaboration) — **[20+ citations]** — arXiv

The DUNE Far Detector Interim Design Report, Volume 3: Dual-Phase Module — FERMILAB-DESIGN — 2018
B. Abi et al. (DUNE Collaboration) — **[50+ citations]** — arXiv

The DUNE Far Detector Interim Design Report, Volume 2: Single-Phase Module — FERMILAB-DESIGN — 2018
B. Abi et al. (DUNE Collaboration) — **[50+ citations]** — arXiv

The DUNE Far Detector Interim Design Report Volume 1: Physics, Technology and Strategies — FERMILAB-DESIGN — 2018
B. Abi et al. (DUNE Collaboration) — **[160+ citations]** — arXiv