

YUN-TSE TSAI

Curriculum Vitae

SLAC National Accelerator Laboratory
2575 Sand Hill Road
Menlo Park, CA 94025, USA
☎ +1 (650) 926 2918
✉ yuntse@slac.stanford.edu

Summary

Experimental physicist with extensive experience in hadron colliders and in neutrino experiments based on the liquid-argon time-projection chamber (LArTPC). Led the project of a LArTPC R&D setup at SLAC, the commissioning of the data acquisition (DAQ) system of the MicroBooNE experiment, physics analyses in astroparticle and exotic physics in MicroBooNE and DUNE, and measurement of electroweak top quark production cross section at DØ.

University Education

- 2006 – 2013 **Ph.D. Physics**, *University of Rochester*, NY
Dissertation: Measurement of Electroweak Top Quark Production at DØ
Supervisor: Prof. Aran Garcia-Bellido
- 2005 – 2006 **M.S. Physics**, *National Taiwan University*, Taipei, Taiwan
Thesis: Search for Two-Body Baryonic B Decays at BELLE
Supervisor: Prof. Paoti Chang
- 2000 – 2005 **B.S. Physics and Mathematics**, *National Taiwan University*, Taipei, Taiwan
Double major in Physics and Mathematics, minor in Chinese Literature

Honors and Awards

- October 2021 The SLAC Laboratory Directed Research and Development (LDRD) Program
Aiming to enable discoveries that will create new or enrich existing research directions aligned with the Lab's core capabilities and the DOE mission. (Grant included.)
- November 2018 The Fermilab Neutrino Physics Center Fellow
Awarded to outstanding experimentalists working on Fermilab neutrino experiments and neutrino theorists. (Grant included.)
- January 2015 The Fermilab Intensity Frontier Fellow
Awarded to outstanding researchers in the areas of neutrino physics, muon physics, and other topics in the Intensity Frontier. (Grant included.)
- February 2013 The Frederick Lobkowitz Thesis Prize, the University of Rochester
Awarded in recognition of an exceptional Ph.D. dissertation in experimental astroparticle, high-energy nuclear or particle physics. (Award money included.)
- February 2010 The APS DPF Travel Grant
Travel grant included.
- June 2005 The Dean's Award, National Taiwan University
Awarded to the graduates whose grades and/or research ability are within top 10% of their class.
- January 2005 The Presidential Award, National Taiwan University
Awarded to the students ranking with the top 5% of their class. (Award money included.)
- June 2004 The Presidential Award, National Taiwan University

Academic Positions

- 2023 – present Staff Scientist, SLAC National Accelerator Laboratory
2017 – 2023 Associate Staff Scientist, SLAC National Accelerator Laboratory
2014 – 2017 Postdoctoral Research Associate, SLAC National Accelerator Laboratory
2013 Postdoctoral Research Associate, University of Rochester
2007 – 2013 Graduate Research Assistant, University of Rochester
2006 – 2007 Teaching Assistant, University of Rochester
2004 – 2006 Research Assistant, National Taiwan University, Taipei, Taiwan

Collaboration Membership

- 2021 – present COHERENT
2017 – present ICARUS
2017 – present ArgonCube, PixLAr
2014 – present MicroBooNE
2014 – present DUNE, and its 35-ton prototype detector
2008 – 2014 DØ
2004 – 2006 BELLE

Leadership Roles and Highlighted Accomplishments

- 2022 – present **COHERENT LArTPC Coordinator**
 - Led the studies for a LArTPC-based detector at the First and Second Target Stations of the Spallation Neutron Source at Oak Ridge National Laboratory (ongoing, paper in preparation).
- 2020 – present **Project Lead of the First LArTPC R&D setup at SLAC**
 - Led the design, installation, review processes, and commissioning of the first LArTPC (SLACube), with the dimension of $30 \times 30 \times 30 \text{ cm}^3$, and its cryogenic system (SLArchetto) at SLAC, aiming to operate and validate the novel field structures for the DUNE Near Detector.
 - Started cosmic ray data taking in December 2021.
 - Delivered the fully functional LArTPC in July 2022 (paper in preparation).
 - Led the upgrade of the system (ongoing).
- 2020 – 2022 **Lead Editor of a Snowmass White Paper in the Neutrino Physics Frontier**
 - Lead editor of the white paper, “Cosmogenic Dark Matter and Exotic Particle Searches in Neutrino Experiments.”
 - Delivered the white paper as part of the Snowmass 2021 contribution (journal submission in preparation).
- 2020 – 2021 **SLACmass Neutrino Group Co-convener**
 - Coordinated discussion and letter of interests about the ongoing and prospect neutrino experiments SLAC scientists are involved or would be interested in.
 - Delivered summary and topical talks to the Fundamental Physics Directorate.
- 2019 – present **DUNE High Energy Physics Group Co-convener**
 - Coordinated search for nucleon decays, boosted dark matter, and measurements of atmospheric neutrinos (ongoing).

- 2018 – 2023 **Electromagnetic Shower Reconstruction Group Co-convenor of Short Baseline Neutrino Program (SBN)**
- Coordinated the development of the electromagnetic shower reconstruction algorithms in both the ICARUS and SBND experiments in the SBN program.
- 2018 – 2020 **ICARUS Data Acquisition (DAQ) Working Group Convener**
- Integrated the readout systems of the TPC, light collection, and cosmic ray tagger sub-systems.
 - Coordinated the readout, DAQ software, online monitoring, trigger, and data management systems.
 - Developed the DAQ software interfacing with the TPC readout.
- 2015 – 2019 **MicroBooNE Astroparticle and Exotic Physics Group Co-Convener**
- Led and published the first analysis of search for heavy neutral lepton in MicroBooNE.
 - Established a working group across theorists and MicroBooNE experimentalists exploring interesting topics.
 - Convened measurements of supernova neutrinos, searches for rare processes with baryon number violation, dark matter, etc., and precise measurements of cosmogenic background.
 - Coordinated the reconstruction and analysis tool developments with other physics working groups.
 - Developed offline processing for zero-suppressed data from the first continuous DAQ stream in LArTPC.
- 2015 – 2018 **MicroBooNE Data Acquisition Lead**
- Delivered an online DAQ system and achieved an average of 97% of uptime since the beginning of MicroBooNE operation.
 - Coordinated online components: readout, DAQ, online monitoring, slow monitoring, and data management.
 - Delivered the first continuous data stream for large LArTPC detectors and coordinated the related online components.
 - Delivered the online self-triggering system in MicroBooNE DAQ software.
 - Delivered an automated data processing mechanism for MicroBooNE data management.
- 2015 – present **Main Developer of Electromagnetic Shower Reconstruction in LArTPC (MicroBooNE and SBN)**
- Improved automated shower reconstruction algorithms for LArTPC data, in particular for the ICARUS and MicroBooNE experiments (ongoing).
 - Developed one of the first automated shower reconstruction algorithms for LArTPC data (MicroBooNE).
 - Demonstrated the shower reconstruction in a π^0 mass measurement using data taken from the LArTPC (MicroBooNE).
- 2014 – 2015 **MicroBooNE Monte Carlo Simulation Production Co-Coordinator**
- Coordinated the development of offline processing and developed the automated offline data processing scheme.
 - Integrated Open Scientific Grid computing resources across Fermilab, SLAC, and other institutes.
- 2011 – 2013 **Lead Analyzer of Measurement of Electroweak Top Quark Production Cross Section at DØ**
- Obtained and published the first evidence of the s -channel electroweak top-quark production, as well as the measurement of the t -channel production cross section.
 - In charge of event selection, background modeling, signal-background discrimination, development of a multivariate analysis based on the Matrix Element Method, and cross section extraction.
- 2010 – 2011 **DØ Data Acquisition System on-call expert and on-site principal contact**
- Maintained DAQ and Level 3 triggers and tested single board computers.

- 2009 – 2013 **Analyzer of Jet Energy Scale Determination at DØ**
 ○ Measured and published the absolute detector response of the DØ calorimeters.
- 2008 – 2011 **Analyzer of Measurement of Electroweak Top Quark Production Cross Section at DØ**
 ○ Measured and published the cross section of the t -channel electroweak top-quark production.
 ○ Optimized selection criteria, determined background modeling, evaluated systematic uncertainties, and developed analysis tools.
- 2004 – 2006 **Main Analyzer of Two-Body Baryonic Decay at Belle**
 ○ Obtained and published upper limits of the branching fractions of $B^0 \rightarrow p\bar{p}, \Lambda\bar{\Lambda}$, and $B^+ \rightarrow p\bar{\Lambda}$. In charge of event selection, background modeling, signal-background discrimination, and upper limit evaluation.

Committees

- 2023 DOE proposal review panelist
- 2022 – present Member of the steering group of the workshop series, New Opportunities at the Next Generation Neutrino Experiment Workshop
- 2022 – 2023 Lead organizer of the third New Opportunities at the Next Generation Neutrino Experiment Workshop at SLAC, Menlo Park, California, USA
- 2022 Dissertation committee member at College of William & Mary, Williamsburg, Virginia, USA (virtual)
- 2022 SLAC LDRD review panelist, Menlo Park, California, USA (virtual)
- 2022 NSF proposal review panelist (virtual)
- 2021 Session chair of APS April Meeting (virtual)
- 2019 Co-organizer of New Opportunities at the Next Generation Neutrino Experiment Workshop at the University of Texas, Arlington, Texas, USA
- 2018 NorCal HEP-EXchange co-organizer
- 2014 – 2015 Experimental seminar organizer for the elementary particle physics division at SLAC

Refereed Publications

As Main Editor:

Prospects for Detecting Boosted Dark Matter in DUNE through Hadronic Interactions, Phys. Rev. D **103**, 095012 (2021)

New opportunities at the next-generation neutrino experiments I: BSM neutrino physics and dark matter, Rep. Prog. Phys. 2020 Nov 21;83(12):124201

Search for heavy neutral leptons decaying into muon-pion pairs in the MicroBooNE detector, Phys. Rev. D **101**, 052001 (2020)

MicroBooNE and its Cross Section Measurement, Proceedings of NuPhys2016: Prospects in Neutrino Physics, London, 2016, edited by F. Di Lodovico, S. Pascoli, and P. Ballett, eConf C1612121 (2016)

Evidence for s-channel single top quark production in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV, Phys. Lett. B **726** (2013) 656 – 664

Measurement of Single Top-Quark Production Cross Section at DØ, Proceedings of La Thuile 2013. *Nuovo Cim. C* **036**, no. 06, 161 (2013)

Search for $B^0 \rightarrow p\bar{p}, \Lambda\bar{\Lambda}$ and $B^+ \rightarrow p\bar{\Lambda}$ at Belle, *Phys. Rev. D* **75**, 111101 (2007)

As co-Author:

Search for an Excess of Electron Neutrino Interactions in MicroBooNE Using Multiple Final-State Topologies, *Phys. Rev. Lett.* **128**, 241801 (2022)

Prospects for beyond the Standard Model physics searches at the Deep Underground Neutrino Experiment, *Eur. Phys. J. C* **81**, 322 (2021)

The continuous readout stream of the MicroBooNE liquid argon time projection chamber for detection of supernova burst neutrinos, *JINST* **16** P02008 (2021)

Overhaul and installation of the ICARUS-T600 liquid argon TPC electronics for the FNAL Short Baseline Neutrino program, *JINST* **16** P01037 (2021)

Calibration of the charge and energy loss per unit length of the MicroBooNE liquid argon time projection chamber using muons and protons, *JINST* **15** P03022 (2020)

Tevatron combination of single top-quark cross sections and determination of the magnitude of the Cabibbo-Kobayashi-Maskawa matrix element V_{tb} , *Phys. Rev. Lett.* **115**, 152003 (2015)

Observation of s-channel production of single top quarks at the Tevatron, *Phys. Rev. Lett.* **112**, 231803 (2014)

Jet energy scale determination in the D0 experiment, *Nucl. Inst. A* **763**, 442 (2014)

Search for anomalous Wtb couplings in single top quark production in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV, *Phys. Lett. B* **708** (2012) 21 – 26

An improved determination of the width of the top quark, *Phys. Rev. D* **85**, 091104 (2012)

Model-independent measurement of t -channel single top quark production in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV, *Phys. Lett. B* **705** (2011) 313 – 319

Measurements of single top quark production cross sections and $|V_{tb}|$ in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV, *Phys. Rev. D* **84**, 112001 (2011)

Presentations at Conferences

June 2023 **Short-baseline Neutrino Experiments**, *PPC 2023: XVI International Conference on Interactions between Particle Physics and Cosmology*, Institute for Basic Science, Daejeon, Korea

Invited talk.

June 2023 **Prospects of detecting boosted dark matter in DUNE through hadronic interactions**, *The 1st workshop on Boosted Dark Matter*, Institute for Basic Science, Daejeon, Korea

Invited talk.

- May 2023 **LArTPC technology**, *Physics Opportunities at Beam Dump Facility in PIP-II and Beyond*, Fermi National Accelerator Laboratory, Batavia, Illinois, USA
Invited talk.
- March 2023 **Future Physics Opportunities at the Oak Ridge National Laboratory Spallation Neutron Source**, *P5 Town Hall at Fermilab and Argonne*, Argonne National Laboratory, Lemont, Illinois, USA
- March 2023 **Opportunities at COHERENT: LArTPC**, *Workshop on Neutrino Interaction Measurements for Supernova Neutrino Detection*, Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA
Invited talk.
- December 2022 **BSM Searches at Short Baseline LArTPCs**, *PITT PACC Workshop: Nu Tools for BSM at Neutrino Beam Facilities*, University of Pittsburgh, Pittsburgh, Pennsylvania, USA
Invited talk.
- July 2022 **Dark Matter from Neutrino Frontier**, *Seattle Snowmass Summer Meeting*, University of Washington, Seattle, Washington, USA
- May 2022 **Liquid-Argon Time-Projection Chambers DIY**, *The Mitchell Conference on Collider, Dark Matter, and Neutrino Physics 2022*, The Mitchell Institute, Texas A&M University, College Station, Texas, USA
Invited talk.
- February 2022 **NF03 Subtopical Group Report 5 – Cosmogenic Dark Matter and Exotic Particle Searches**, *Snowmass Joint Workshop on New Physics Opportunities with Neutrino Experiments: Theoretical & Experimental Perspectives*, Virtual
Invited talk.
- December 2021 **Boosted Dark Matter Event Generation at SBN**, *Mini SBN-Theory Workshop*, Virtual
Invited talk.
- November 2021 **Measuring Low Energy Cross Sections**, *Neutrinos at ORNL Workshop*, Virtual
Invited talk.
- April 2019 **Beyond standard model searches with LArTPCs**, *New Opportunities at the Next Generation Neutrino Experiments*, University of Texas, Arlington, Texas, USA
Invited talk.
- December 2018 **Search for heavy neutral lepton at MicroBooNE**, *Physics Opportunities in the Near DUNE Detector Hall*, Fermilab, Batavia, Illinois, USA
Invited talk.
- November 2018 **Search for boosted dark matter in DUNE**, *NuTheories: Beyond the 3×3 Paradigm at Current and Near-Future Facilities*, University of Pittsburgh, Pittsburgh, Pennsylvania, USA
Invited talk.
- August 2018 **Sterile neutrino searches with the ICARUS detector**, *NuFact 2018, 20th Workshop on Neutrinos from Accelerators*, Virginia Tech, Blacksburg, Virginia, USA

- May 2017 **MicroBooNE and its results**, *The Twelfth Particle Physics Phenomenology Workshop*, National Chiao Tung University, Hsinchu, Taiwan
Invited talk.
- March 2017 **Recording supernova neutrinos in LArTPC**, *Precision Investigations of the Neutrino Sector (PINS 2017)*, SLAC National Accelerator Laboratory, Menlo Park, California, USA
Invited talk.
- December 2016 **The latest updates on neutrino cross sections in MicroBooNE**, *NuPhys2016: Prospects in Neutrino Physics*, London, UK
- October 2015 **Triggering and charge readout of Liquid Argon TPCs from MeV to multi-GeV**, *International Workshop for the Next Generation Nucleon Decay and Neutrino Detector (NNN15)*, Stony Brook University, Stony Brook, New York, USA
Invited talk.
- February 2013 **Single top production cross section measurement at DØ**, *La Thuile 2013: Les Rencontres de Physique de la Vallée d'Aoste*, La Thuile, Aosta Valley, Italy
- February 2012 **Single top production cross section measurement at DØ**, *Lake Louise Winter Institute 2012*, Calgary, Canada
- August 2011 **Anomalous top quark couplings at DØ**, *Supersymmetry 2011: The 19th International Conference on Supersymmetry and Unification of Fundamental Interactions*, Fermilab, Batavia, Illinois, USA
- May 2011 **Measurement of the single top quark production cross section and —Vtb— at DØ**, *Phenomenology 2011 Symposium*, Madison, Wisconsin, USA
- February 2010 **Beyond the standard model searches in single top events**, *APS April Meeting 2010*, Washington, DC, USA
- April 2008 **Trends in thermostatic properties of excited finite nuclei**, *APS April Meeting 2008*, St. Louis, MO, USA

Seminars and Colloquia

- April 2023 **“Near Detector” for Supernova Neutrino Measurements in DUNE**, ASIAA/CCMS/IAMS/LeCosPA/NTU-Phys/NTNU-Phys Joint Colloquia, Department of Physics, National Taiwan University, Taipei, Taiwan
Particle Physics Seminar, Institute of Physics, Academia Sinica, Taipei, Taiwan
- September 2020 **Search for beyond Standard Model Physics in LArTPCs**, Particle Physics Seminar, Department of Physics, University of Notre Dame, Notre Dame, Indiana, USA
- January 2020 **Search for beyond Standard Model Physics in LArTPCs**, Particle Physics Seminar, Institute of Physics, National Chiao Tung University, Hsinchu, Taiwan
Particle Physics Seminar, Institute of Physics, Academia Sinica, Taipei, Taiwan
High Energy Physics Seminar, Department of Physics, National Central University, Zhongli, Taiwan
- January 2018 **Exploring ν territory: Using LArTPC technology**, Physics Colloquium, University of California, Riverside, Riverside, California, USA

- February – **Exploring ν territory: Using LArTPC technology,**
 March 2017 RPM Seminar, Lawrence Berkeley National Laboratory, Berkeley, California, USA
 Experimental Particle Physics Seminar, SLAC National Accelerator Laboratory, Menlo Park, California, USA
- January – **Exploring ν territory: Using LArTPC technology,**
 February 2017 Physics Colloquium, Colorado State University, Fort Collins, Colorado, USA
 Physics Colloquium, University of Cincinnati, Cincinnati, Ohio, USA
 Physics Colloquium, Syracuse University, Syracuse, New York, USA
- July – **MicroBooNE: ν physics and first results,**
 September 2016 Experimental Particle Physics Seminar, SLAC National Accelerator Laboratory, Menlo Park, California, USA
 Particle Physics Seminar, Institute of Physics, Academia Sinica, Taipei, Taiwan
 Particle Physics Seminar, Department of Physics, National Tsing Hua University, Hsinchu, Taiwan
 Particle Physics Seminar, Institute of Physics, National Chiao Tung University, Hsinchu, Taiwan
 Particle Physics Seminar, Department of Physics, National Taiwan University, Taipei, Taiwan
- June – **Truth and beauty together: Evidence for s-channel single top production,**
 December 2013 Particle Physics Seminar, Department of Physics, National Taiwan University, Taipei, Taiwan
 Particle Physics Seminar, Institute of Physics, Academia Sinica, Taipei, Taiwan
 Particle Physics Seminar, Physics Division, National Center for Theoretical Sciences, Hsinchu, Taiwan
 High Energy Physics Lunch Seminar, Argonne National Laboratory, Lemont, Illinois, USA
 Experimental Particle Physics Seminar, SLAC National Accelerator Laboratory, Menlo Park, California, USA
 High Energy Physics Seminar, University of Rochester, Rochester, New York, USA
 High Energy Physics Seminar, Indiana University, Bloomington, Indiana, USA
 Fermilab Joint Experimental-Theoretical Physics Seminar (Wine and Cheese Seminar), Fermilab, Batavia, Illinois, USA

Teaching Experience

- 2008 Teaching Assistant of Graduate Quantum Mechanics at the University of Rochester
 2008 Teaching Assistant of Graduate Electromagnetic Theory at the University of Rochester
- 2006 – 2007 Teaching Assistant of Undergraduate Physics Laboratory at the University of Rochester
- 2005 – 2006 Teaching Assistant of Undergraduate General Physics at National Taiwan University

Languages

- Mandarin Native
 English Fluent

Computer Skills

Operating Systems	Linux, OS X, Windows
Programming Languages	C, C++, Python, FORTRAN, UNIX shell scripting, HTML
Applications	Arduino, ROOT, LArSoft, Condor, TEX, LATEX, BIBTEX, iWork (Keynote, Pages, Numbers), Microsoft Office (Word, Excel, Powerpoint), and other common productivity packages