

Kazuhiro Terao

Contact Information	240 Waverley Street Apt. 3 Menlo Park, CA 94025	Phone: +1 (914) 325 7908 E-mail: kterao@stanford.edu Website: www.codingkazu.com
Research Interest	Neutrino oscillation physics, neutrino phenomenology, future neutrino detector R&D, trigger/readout electronics, large scale data production, analysis framework development, deep neural networks and machine learning techniques R&D.	
Research Positions	Associate Staff Scientist , <i>Stanford University</i> Elementary Particle Physics Group, SLAC National Laboratory	Jul. 2017 - Present
	Postdoctoral Research Scientist , <i>Columbia University</i> Nevis Laboratories, Columbia University Supervisor: Dr. Michael Shaevitz	Apr. 2013 - Jul. 2017
	Research Assistant , Lawrence Berkeley National Lab. Weak Interaction Group, Lawrence Berkeley National Laboratory Supervisor: Dr. Stuart Freedman	Jan. 2007 - Aug. 2008
Education	Massachusetts Institute of Technology , Cambridge, MA Ph.D Physics Adviser: Dr. Janet Conrad Thesis: "Measurement of $\sin^2 2\theta_{13}$ Using Delayed Neutron Capture on Hydrogen in Double Chooz"	2008 - 2013
	University of California, Berkeley , Berkeley, CA B.A. Physics	2005 - 2007
Awards and Honors	Early Career Award, <i>U.S. Department of Energy</i> Intensity Frontier Fellowship, <i>Fermilab</i> University Research Association Visiting Scholar Award, <i>Fermilab</i> Chateaubriand Fellowship, <i>French Embassy in U.S.</i> Thomas Frank Fellowship, <i>MIT</i> Pomerantz Scholarship, <i>UC Berkeley</i>	2018 2017 2016 2010 2008 2007
Workshop and Seminar Talks	EDG Particle Physics Seminar at BNL, <i>Brookhaven National Lab.</i> Quantum Computing Workshop, <i>TRIUMF</i> Neutrino Seminar Series, <i>Fermilab</i> Neutrino Physics Seminar, <i>Virginia Tech</i> Deep Learning on DUNE, <i>Fermilab</i> A.I. at SLAC Seminar Series, <i>SLAC National Lab.</i> Computational and Data Science School for High Energy Physics, <i>Princeton University</i> Machine Learning at Fermilab, <i>Fermilab</i>	2018 Data Science and 2018 2018 2018 2017 2017 2017 2017
Conference Talks	Weak Interactions and Neutrinos, <i>UC Irvine</i> Neutrino Factories and Future Neutrino Facilities, <i>Centro Brasileiro de Pesquisas Fisicas</i> The 2nd International Symposium on Science at J-PARC, <i>Tsukuba, Japan</i> Rencontres de Moriond	2017 2015 2014 2013

Selected Publications
(or [full list link](#))

- A Deep Neural Network for Pixel-Level Electromagnetic Particle Identification in the MicroBooNE Liquid Argon Time Projection Chamber.*
MicroBooNE Collaboration.
Final collaboration review stage, to be submitted to Physical Review D.
- Machine Learning at The Energy and Intensity Frontiers of Particle Physics.*
A. Radovic¹, M. Williams, D. Rousseau, M. Kagan, D. Bonacorsi, A. Himmel, A. Aurisano, K. Terao, T. Wongjirad.
Nature volume 560, pages 41–48 (2018).
- Convolutional Neural Networks Applied to Neutrino Events in a Liquid Argon Time Projection Chamber.*
MicroBooNE Collaboration.
Journal of Instrumentation 12 P03011 (2017)
- First Measurement of θ_{13} from Delayed Neutron Capture on Hydrogen*
Double Chooz Collaboration.
Phys. Lett. B 723 66-70 (2013)
- Reactor $\bar{\nu}_e$ Disappearance in Double Chooz Experiment*
Double Chooz Collaboration.
Phys. Rev. D 86 052008 (2012)
- A prototype detector for directional measurement of the cosmogenic neutron flux*
J. Lopez, K. Terao, J.M. Conrad, D. Dujmic, L. Winslow.
NIM A 673, 22-31 (2012)
- Indication of Reactor $\bar{\nu}_e$ Disappearance in the Double Chooz*
Double Chooz Collaboration.
Phys. Rev. Lett. 108, 131801 (2011)

Recent Leadership

- DeepLearnPhysics Founder/Organizer 2017 - Present
First application of deep learning in LArTPC published as the first MicroBooNE paper.
Co-led ν_e oscillation analysis using deep learning.
Organized shared GPU resources across institutions for R&D work.
- MicroBooNE Deep Learning Analysis Group Convener (retired) 2016 - 2018
First application of deep learning in LArTPC published as the first MicroBooNE paper.
Co-led ν_e oscillation analysis using deep learning.
Organized shared GPU resources across institutions for R&D work.
- MicroBooNE Readout/Trigger Electronics Team Leader 2015 - Present
Development of PMT and TPC readout and trigger electronics firmware.
Installation and commissioning of hardware, integration with DAQ software.
Organizing a team of operation experts for data taking.
- MicroBooNE Data Management Group Convener 2015 - 2016
Foundation of the first online/offline data processing framework (PUBS).
Organized group effort for PUBS code development.
Commissioned the whole automated data process chain (DAQ to offline reconstruction) .
Organized operations team for data taking.
- MicroBooNE Simulation Group Convener 2014 - 2016
Organized group effort to improve physics and detector simulation software.
Delivered software releases with requested features for three large scale simulation production.
Introduced the readout electronics simulation software that mimic FPGA firmware logic.

Double Chooz Hydrogen Analysis Group Leader 2012 - 2013

Enabled the new signal detection channel for θ_{13} measurement in the field.
Organized a group of graduate students and post-docs to establish the whole analysis scheme.
Published the result as the first measurement of θ_{13} using neutron capture on hydrogen.

Double Chooz Data Production Group Leader 2011 - 2013

Delivered a large scale data production software for simulation, data reconstruction and analysis.
Operated several large scale simulation and reconstruction productions.
Interfaced with administrators of Lyon Tier1 cluster (France) for optimized resource usage.

Programming Skills

Languages

C, C++, Python, Perl, SQL, PHP, XML, JSON, Bash

Software

GDB/LLDB, Valgrind, GNC/LLVM compilers, Cython, MySQL, Postgres, ROOT, Geant4, caffe, TensorFlow, PyTorch, MXNet, Python packages including numpy, scipy, scikit, PyTable, pandas

Software Experience

Developed number of software critical for operating the experiment in C++, Python, SQL, and PHP languages. Please see [this document](#) for the list of software I developed with brief descriptions.

Highlights for operations software include a large scale data production software, online and offline SQL database software for configuration, file storage, and detector calibration management.

Experienced in software framework development in C++ using known design patterns. Developed several frameworks for analysis and reconstruction purpose in MicroBooNE.

Hardware Experience

MicroBooNE

Installation and commissioning of the TPC and optical detector readout electronics, trigger electronics, and hosting electronics racks with low voltage power supplies. Helped interface to the firmware on DAQ. Maintained a separate readout electronics test-stand for testing and R&D work at Fermilab.

Double Chooz

Installation and commissioning of the Double Chooz far detector, in particular the initial PMT calibration, electronics firmware debugging, first calibration system deployment, and installation of DCTPC neutron tracking detector.

KamLAND

Helped with construction of MWPC (Multiwire Proportional Chamber) and scintillator based trigger system. Cleaned the system for shipping and deployment. Responsible for testing and repairing custom readout electronics boards. Participated in installation and commissioning task at Kamioka, Japan.