

Joseph Zennamo

University of Chicago, Enrico Fermi Institute

Curriculum Vitae

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Employment

- Postdoctoral Scholar, University of Chicago, Enrico Fermi Institute (Nov. 2013-present)
Supervisor: Asst. Prof. David W. Schmitz

Education

- Ph.D. in Experimental High Energy Physics, State University of New York at Buffalo (2010-2013)
Ph.D. Thesis Title: *Studies of Z boson production in association with heavy quark jets at $D\bar{0}$*
Advisor: Prof. Avto Kharchilava
- M.Sc. in Experimental High Energy Physics, State University of New York at Buffalo (2008-2009)
M.Sc. Thesis Title: *Validation of the CMS event generators*
Advisor: Prof. Avto Kharchilava
Awarded Om & Saraswati Bahethi Scholarship

Postdoctoral Research Experience

- **Enhancing MicroBooNE Physics Program** : (Nov. 2015 - present)
As MicroBooNE Technical Coordinator I oversee all efforts related to the upgrade of the detector. These upgrades are driven by providing enhancements to the physics program of the experiment, including the flagship search for the MiniBooNE low energy excess. My responsibilities include the formation and coordination of five groups focused on upgrading aspects of the detector, working with the laboratory to allocate resources, and working with the MicroBooNE Operations group. This work will culminate in the installation, during the summer 2016 accelerator shutdown, of a new cosmic ray tagging system, new cosmic shielding, upgrades to the current DAQ system, improved high voltage monitoring tools, and mitigating the sources of electronics noise. Addressing all of these will improve the sensitivity of the MicroBooNE flagship analysis and expand the scope of the experiment.
- **MicroBooNE Low Energy Excess Analyses** : (Jan. 2015 - present)
As MicroBooNE Oscillations Group Convener I lead the group performing the flagship MicroBooNE analysis aimed at studying the source of the MiniBooNE low energy excess. This involves organizing a large group of researchers to search for excesses in either electron neutrino events or neutral current single photon events. These analyses require finalizing the first fully automated event and object reconstruction in a liquid argon time projection chamber, a carefully tuned event selection, and full systematic uncertainty estimation. This is a multi-year effort that will culminate at the end of MicroBooNE data taking.
- **Short-Baseline Neutrino Program Proposal** : (Jan. 2014 - Jan. 2015)
Organized the efforts of three collaborations, the Short-Baseline Neutrino Program, to define the

Program's sensitivity to sterile neutrino oscillations. Estimating this sensitivity required careful consideration of all possible backgrounds and systematic uncertainties for two possible channels: $\nu_\mu \rightarrow \nu_e$ appearance and ν_μ disappearance. These studies directly impacted the design of the experimental program. The resulting proposal was presented to the Fermilab Physics Advisory Committee, which recommended approval of the SBN Program. The Fermilab Directorate granted Stage 1 approval in February 2015 and construction began in July 2015.

- **Liquid Argon Time Projection Chamber R&D** : (Feb. 2014 - June 2014)

Led the research effort to eliminate the threat of electric breakdowns damaging delicate components in cryogenic TPCs. Specifically investigating how surge arrestors performed in cryogenic environments. This involved repeatedly clamping the devices with high energy and high voltage pulses as would be expected inside a LArTPC during catastrophic over-voltage conditions. This work led to the installation of surge-protectors inside MicroBooNE and LArIAT, and the proposed deployment in future LArTPCs including SBND, ProtoDUNE, and DUNE. This work was published in the Journal of Instrumentation.

- **Preliminary Short-Baseline Near Detector Design** : (Nov. 2013 - Jan. 2014)

Worked to finalize the conceptual design of the Short-Baseline Near Detector (SBND) including defining the final dimensions of the detector, and studying the usefulness of a muon-range stack or the magnetization of the inner volume. In addition, performed a preliminary muon neutrino disappearance sensitivity analysis utilizing SBND and MicroBooNE. This included the full event selection and modeling energy resolution effects for contained and exiting muon tracks. This detector design was proposed to the Fermilab Physics Advisory Committee in January 2014, and went on to become part of the SBN Program.

Leadership Positions

- Technical Coordinator, MicroBooNE Upgrade Program (Nov. 2015 - present)
- Co-convener, MicroBooNE Oscillation Group (Jan. 2015 - present)
- Co-convener, SBND Physics Analysis Group (Aug. 2014 - present)
- Convener, DØ b -quark Jet Identification Group (June 2013 - present)

Publications

Co-author of 91 publications by the DØ Collaboration and 18 publications by the CMS Collaboration. (Full list: <https://inspirehep.net/search?p=exactauthor%3AJ.Zennamo.1>)

Publications with the most significant contributions:

- **“A Proposal for a Three Detector Short-Baseline Neutrino Oscillation Program in the Fermilab Booster Neutrino Beam”**
M. Antonello *et al.* [MicroBooNE, LAr1-ND, and ICARUS-WA104 Collaborations], arXiv:1503.01520 [physics.ins-det].
- **“Testing of High Voltage Surge Protection Devices for Use in Liquid Argon TPC Detectors”**
J. Asaadi, J. M. Conrad, S. Gollapinni, B. J. P. Jones, H. Jostlein, J. M. St. John, T. Strauss, S. Wolbers, and J. Zennamo, JINST **9**, P09002 (2014).
- **“Improved b quark jet identification at the D0 experiment”**
V. M. Abazov *et al.* [D0 Collaboration], Nucl. Instrum. Meth. A **763**, 290 (2014).

- “**Measurement of associated production of Z bosons with charm quark jets in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV**”
V. M. Abazov *et al.* [D0 Collaboration],
Phys. Rev. Lett. **112**, 042001 (2014).
- “**LAr1-ND: Testing Neutrino Anomalies with Multiple LArTPC Detectors at Fermilab**”
C. Adams *et al.* [LAr1-ND Collaboration],
arXiv:1309.7987 [physics.ins-det].
- “**Measurement of the ratio of differential cross sections $\sigma(p\bar{p} \rightarrow Z + b \text{ jet})/\sigma(p\bar{p} \rightarrow Z + \text{jet})$ in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV**”
V. M. Abazov *et al.* [D0 Collaboration],
Phys. Rev. D **87**, 092010 (2013).

Conference Proceedings and Public Notes

- “Neutrino Interactions Systematic Uncertainties and the Fermilab Short-Baseline Neutrino Program”
J. Zennamo, subm. to Proceedings of 10th International Workshop on Neutrino-Nucleus Interactions in Few-GeV Region (2015).
- “Measurement of the Average Drift Velocity Utilizing UV Laser Data”
MicroBooNE Collaboration, **MicroBooNE Public Note 1009 (2016)**.
- “Demonstration of 3D Shower Reconstruction on MicroBooNE Data”
MicroBooNE Collaboration, **MicroBooNE Public Note 1012 (2016)**.

Seminars and Colloquia

- “Discovering the Undetectable: (Sterile) Neutrino Oscillations”, **Colloquium**,
Physics Department Colloquium, Northern Illinois University, DeKalb, Illinois (April 15, 2016).
- “Short-Baseline Neutrino Physics”, **Colloquium**,
Physics Department Colloquium, Illinois Institute of Technology, Chicago, Illinois (March 24, 2016).
- “Searching for Sterile Neutrinos with the Fermilab Short-Baseline Neutrino Program”,
LPC Physics Forum Lecture Series, LPC at Fermilab, Batavia, Illinois (Dec. 3, 2015).
- “Searching for Sterile Neutrinos with the Fermilab Short-Baseline Neutrino Program”,
HEP Seminar, Indiana University, Bloomington, Indiana (October 26, 2015).
- “Discovering the Undetectable: Sterile Neutrinos and the Fermilab Short-Baseline Program”,
Physics Dept. Seminar, State University of New York at Buffalo, Buffalo, New York (Sept. 29, 2015).
- “Searching for Sterile Neutrinos with the Fermilab Short-Baseline Neutrino Program”,
HEP Division Lunch Seminar, Argonne National Laboratory, Lemont, Illinois (April 14, 2015).
- “Searching for Sterile Neutrinos with the Fermilab Short-Baseline Neutrino Program”,
High Energy Physics Lunch Seminar Series, University of Chicago, Chicago, Illinois (Feb. 9, 2015).
- “Searching for Sterile Neutrinos with the Fermilab Short-Baseline Neutrino Program”,
Weak Interaction Discussion Group, Yale University, New Haven, Connecticut (Dec. 9, 2014).

Conference Talks and Posters

- “Sterile Neutrino Oscillation Search Utilizing a Stopped Kaon Source and the SBN Program”, **Poster**,
XXVII International Conference on Neutrino Physics and Astrophysics (Neutrino2016),
London, UK (July 4 - July 9 2014).

- “SBN Proposal Analysis, Backgrounds Estimates and Mitigation Strategies”, **Invited**, PITT PACC Short-Baseline Neutrino Physics Workshop, Pittsburgh, PA (Jan. 26 - Jan. 27, 2016).
- “Neutrino Interactions Systematics and the Fermilab Short-Baseline Neutrino Program”, **Invited**, 10th Workshop on Neutrino-Nucleus Interactions (NuInt15), Osaka, Japan (Nov. 16 - Nov. 21, 2015).
- “The Short-Baseline Neutrino Program”, **Invited**, 48th Fermilab Users’ Meeting, Batavia, Illinois (June 9 - June 11, 2015).
- “Liquid Argon TPCs as Neutrino Detectors”, **Invited**, IceCube Particle Astrophysics Symposium, Madison, Wisconsin (May 4 - May 6, 2015).
- “Muon Neutrino Disappearance with the Fermilab Short-Baseline Neutrino Program”, **Poster**, 47th Fermilab Users’ Meeting, Batavia, Illinois (June 11 - June 12, 2014).
- “Muon Neutrino Disappearance with MicroBooNE and LAr1-ND”, **Poster**, XXVI International Conference on Neutrino Physics and Astrophysics (Neutrino2014), Boston, Massachusetts (June 2 - June 7 2014).
- “Fermilab Short-Baseline Neutrino Program”, **Invited**, 52nd International School of Subnuclear Physics, Erice, Italy (June 24 - July 3, 2014). **Awarded “Best New Talent” and Bruno Zumino Scholarship.**
- “Identification of heavy flavor jets at $D\bar{0}$ ”, **Invited**, 51st International School of Subnuclear Physics, Erice, Italy, (June 24 - July 3, 2013). **Awarded “Seymour Lindenbaum Diploma”.**
- “Measurement of the ratio of differential cross sections $\sigma(Z + b)/\sigma(Z + \text{jet})$ at $D\bar{0}$ ”, **Poster**, Fermilab Users’ Meeting, Batavia, Illinois (June 12 - June 13, 2013).
- “Measurement of Z boson production in association with heavy flavor jets at $D\bar{0}$ ”, New Perspectives, Batavia, Illinois (June 10 - June 11, 2013).
- “Measurement of Z boson production in association with heavy flavor jets at $D\bar{0}$ ”, APS April Meeting, Denver, Colorado, (Apr. 13 - Apr. 16, 2013).
- “Measurements of the ratio of differential cross sections $\sigma(Z + b \text{ jets})/\sigma(Z + \text{jets})$ at $D\bar{0}$ ”, Lake Louise Winter Institute, Lake Louise, Alberta, (Feb. 17 - Feb. 23, 2013).
- “Measurement of Z boson production in association with heavy flavor jets at $D\bar{0}$ ”, APS April Meeting, Atlanta, Georgia, (Mar. 31 - Apr. 3, 2012).
- “Measurement of $\sigma(Z + b)/\sigma(Z + \text{jet})$ with $D\bar{0}$ ”, **Poster**, Fermilab Users’ Meeting, Batavia, Illinois (June 1-2, 2011).
- “Measurement of $Z + b$ jet production at $D\bar{0}$ ”, APS April Meeting, Anaheim, California, (Apr. 30 - May 3, 2011).

Awards

- **URA Visiting Scholars Award**, 2016, Universities Research Association :
Awarded salary support to lead the MicroBooNE Upgrade Program and Oscillations group.
- **“Best New Talent” Award**, 2015, 52nd International School of Subnuclear Physics :
Awarded to the top ranked student.
- **Bruno Zumino Scholarship**, 2015, 52nd International School of Subnuclear Physics :
Merit based scholarship to cover the cost of attendance.
- **“Seymour Lindenbaum Diploma”**, 2014, 51st International School of Subnuclear Physics :
Awarded for being in the top 5% of students.
- **Fermilab UEC Users’ Meeting Travel Support**, 2011, Fermilab Users Executive Committee :
Travel support to attend the 2011 Users’ Meeting at Fermilab.
- **Om & Saraswati Bahethi Scholarship**, 2009, University of Buffalo, Physics Department :
Masters Scholarship awarded through the physics department at the University at Buffalo.

Outreach

- Active tour guide for the Fermilab Remote Operations Center West, which includes meeting members of the public and teaching them about the Fermilab neutrino program including during open houses, VIP visits, and community events.
- Participated in the “2014 Fermilab Physics Slam”, presenting a public lecture entitled “The Weird and Wonderful World of Neutrinos”. Ranked second by crowd applause.
- Act as a tour guide for University groups who visit Fermilab and individuals interested in pursuing studies in high energy particle physics.
- Officer of the Fermilab Graduate Student Association (2011-2012) and organized the 2012 New Perspectives conference and Users’ Meeting poster session, setup various outreach activities for the graduate students at Fermilab, and worked with the Users’ Executive Committee and Directorate to setup the new Fermilab Student and Postdoc Association.

Mentoring

- **David Kaleko (Columbia University, Graduate), 2015 - present.**
Working on Ph.D. analysis in Oscillations group, oversee day-to-day analysis activities and advise with regard to next steps to take and interpretation of results.
- **Marina David (Ohio State University, Undergraduate), Summer 2015.**
REU summer student, built an analysis to complete over the summer, investigating reconstruction tools at MicroBooNE, and oversaw its completion.
- **Davio Cianci (University of Chicago, Undergraduate), Summer 2014.**
Summer student, built an analysis to complete over the summer, performing sterile neutrino signal injection studies, and oversaw its completion.