

## Sarah E. Lockwitz

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CONTACT INFORMATION	Fermilab - M.S. 309 P.O. Box 500 Batavia, IL 60510 USA	<i>Office:</i> (630) 840-3644 <i>E-mail:</i> lockwitz@fnal.gov
CITIZENSHIP	USA	
EDUCATION	<b>Yale University</b> , New Haven, Connecticut USA Ph.D., Department of Physics, May 2012 <ul style="list-style-type: none"><li>• Dissertation Topic: <i>A Search for the Standard Model Higgs Boson in CDF II Data</i></li><li>• Adviser: Professor Paul L. Tipton</li></ul> M.Ph., Department of Physics, May 2009 <ul style="list-style-type: none"><li>• Prospectus Topic: <i>Testing LHC Data for Consistency with the Standard Model</i></li><li>• ATL-COM-PHYS-2009-048</li><li>• Adviser: Professor Paul L. Tipton</li></ul> <b>Michigan State University</b> , East Lansing, Michigan USA B.S., Department of Physics and Astronomy, May 2005 <ul style="list-style-type: none"><li>• Bruce VerWest Award (outstanding junior), 2004</li><li>• Lawrence W. Hantel Fellowship, Fall 2003 - Spring 2005</li><li>• National Merit Scholarship (through Michigan State University), 2001-2005</li><li>• Kiwanis Foundation Scholarship, 2001-2005</li><li>• Michigan Bass Federation Scholarship, 2002</li></ul>	
RESEARCH EXPERIENCE	<b>Fermilab</b> <i>Research Associate</i>	<b>March 2012 to Present</b> <ul style="list-style-type: none"><li>○ Breakdown in Liquid Argon Cryostat for High Voltage Experiments (Blanche)<ul style="list-style-type: none"><li>• Principal Investigator on a Lab Directed Research and Development (LDRD) grant awarded in 2014 to study high voltage in liquid argon. One of seven awardees in the first year of the program.</li><li>• This is a \$415,000 grant to support advanced studies of high voltage performance in liquid argon through FY2015.</li></ul></li><li>○ MicroBooNE<ul style="list-style-type: none"><li>• Level 3 manager for the high voltage feedthrough. Led feedthrough development and testing. Studied the effect of insulator grooves, electric field shielding cups, and performed basic liquid argon breakdown studies in an open dewar.</li><li>• Central in the design, construction, and data collection and analysis of liquid argon dielectric strength tests during Phase I cryogenic operations at the liquid argon test facility. Extended measurements in distance to the centimeter scale with different cathode sizes. Measurements were further conducted over a range of liquid argon purities from a few ppm to 100s ppt oxygen equivalent contamination. Confirmed that the dielectric strength of liquid argon is much less than the often-quoted MV/cm value. Demonstrated for the first time in liquid argon a size-scaling trend between the maximum electric field and stressed area. Delivered results to the LArTPC R&amp;D Workshop at Fermilab in July 2014.</li></ul></li></ul>

- Additional work included:
  - Member of the TPC wire installation team
  - Part of a team that spent five weeks at Brookhaven National Lab performing quality control on ASICs to ensure the delivery of TPC electronics stayed on schedule
  - Developed the first algorithm for cosmic removal using TPC information in LArSoft
  - Tested resistors for use in the field cage. Identified resistors most likely to suffer degradation and identified those which could withstand high electrical stress in the event of an electric discharge within the cryostat.
- The Liquid Argon Purity Demonstrator (LAPD) & Long Bo
  - Responsible for the testing and operation of the high voltage system for the Long Bo TPC that operated in LAPD from January through September 2013. Developed a test with a summer teacher and student to determine if TPC high voltage trips were correlated with energetic cosmic showers.
  - Participated in DAQ shifts during Long Bo's run. Added and calibrated trigger counters to the top and bottom of LAPD to aid in data collection. Performed a data analysis showing that an event's  $t_0$  could be determined from TPC wire signals.
  - Designed and set up a stand-alone test to create electric breakdowns at a fixed distance for a large statistic study.

**Yale University**, New Haven, Connecticut USA

*Graduate Researcher*

**May 2007 to February 2012**

- Collider Detector at Fermilab (CDF), Fall 2009 to February 2012
  - Performed research with the Higgs Discovery Group on the  $ZH \rightarrow \ell b \bar{b}$  channel specializing on improving the  $ZH \rightarrow e b \bar{b}$  final state channels
    - Developed a neural-network-based electron identification scheme to accept as much signal as possible without increasing backgrounds significantly.
    - The combination of all analysis improvements led to a  $\sim 20\%$  improvement in sensitivity at the  $120 \text{ GeV}/c^2$  mass point due to technique alone (when combined with the muon channel)
    - Employed multivariate techniques to set confidence level intervals on excluding upper limits on the standard model Higgs boson cross section.
  - CDF analyses completed
    - *A Search for the Standard Model Higgs Boson in the Process  $ZH \rightarrow e b \bar{b}$  Using  $7.5 \text{ fb}^{-1}$  of CDF II Data* (CDF Note 10593). Upper limit on production cross section times branching ratio of 5.8 times the standard model for the  $115 \text{ GeV}/c^2$  mass point
    - *Search for  $ZH \rightarrow \ell b \bar{b}$  in  $5.7 \text{ fb}^{-1}$  of CDF II Data* (CDF Note 10235). Upper limit on production cross section times branching ratio of 5.99 times the standard model for the  $115 \text{ GeV}/c^2$  mass point
- A Toroidal LHC Apparatus (ATLAS) Experiment at CERN, Summer 2008 to Summer 2009
  - Developed a model-independent framework using Kolmogorov-Smirnov test to study the statistical significance of anomalous dilepton plus missing transverse energy events as evidence of physics beyond the standard model.
  - Documented the methods in an ATLAS internal note (ATL-COM-PHYS-2009-048) and through three talks with the Lepton+X Exotics group.
  - Full Monte-Carlo-based analysis estimated sensitivity to SUSY (SU3) at the 80% confidence level with as little as  $10 \text{ pb}^{-1}$
  - Helped commission the Transition Radiation Tracker (TRT) during shift work with cosmics

- ATLAS Experiment at CERN, Summer 2007
  - Helped install an inner detector cooling control system in the main cavern at ATLAS.

**University of Rochester**, Rochester, New York USA

*Graduate Researcher*

**May to August 2006**

- **Compact Muon Solenoid (CMS)**
  - Performed quality control tests on precision silicon detectors for the CMS experiment at CERN for quick installation.

TEACHING  
EXPERIENCE

**Yale University**, New Haven, Connecticut USA

*Teaching Assistant*

**September 2006 to May 2008**

- Laboratory Teaching Assistant, Spring 2008
  - Conducted a weekly three hour introductory laboratory section for undergraduates. Ensured that the labs were completed in a timely fashion and objectives were understood.
  - Responsible for assessing the students.
- Introduction to Physics Teaching Assistant, Fall 2007 and Fall 2008
  - Held weekly office hours for an introductory physics class. Focused on one-on-one communication of ideas with physics majors.
  - Responsible for promptly grading homework and tests.
- Introduction to Modern Physics Teaching Assistant, Fall 2006 through Spring 2007
  - Led a weekly review section for physics for non-science majors and graded course work.
  - Communicated physics concepts to those with a non-science background.

**University of Rochester**, Rochester, New York USA

*Teaching Assistant*

**January to May 2006**

- Mechanics for Science Majors
  - Led three recitation sections per week of up to 15 students each. Prepared problems for the students to solve and provided guidance where needed.

COMMITTEES

- Reviewer for DOE/SC CD-1 of the Lux-Zeplin (LZ) Project, March 2015
  - One of three reviewers for the TPC and DAQ systems. Evaluated feasibility and potential issues regarding the high voltage and TPC systems.
- Fermilab Graduate Student Association, Fall 2009 to Fall 2010
  - One of five elected to represent the students to the Fermilab Users' Executive Committee (UEC).
  - Explained the importance of science funding to congressional staff members while attending the UEC's annual goodwill visit to Washington, DC.
  - Helped organize monthly activities to engage the student researchers outside of the lab.

TALKS

- Workshop on the Intermediate Neutrino Program, Brookhaven National Laboratory, February 2015: *High Voltage Generation and Breakdown*
- Fermilab Detector R&D Program Review, Fermilab, October 2014: *High Voltage Studies*

- Intensity Frontier Summer Student Lecture Series, Fermi National Accelerator Laboratory, July 2014: *Liquid Argon TPCs*
- Liquid Argon TPC R&D Workshop, Fermi National Accelerator Laboratory, July 2014: *Measurements of Dielectric Strength of Liquid Argon*
- Fermilab LAr R&D Review, Fermilab, February 2014: *High Voltage Understanding*
- Meeting of the American Physical Society (APS) Division of Particles and Fields (DPF), Santa Cruz Institute for Particle Physics (SCIPP), August 2013: *The MicroBooNE LArTPC*

#### TECHNICAL SKILLS

ROOT experience: CINT interpreter, scripting, RootJetNet, TMVA

Programming: C, C++, UNIX shell scripting, some LabView

Computer Applications: T<sub>E</sub>X (L<sup>A</sup>T<sub>E</sub>X, TikZ, PSTricks, BibTeX), most common productivity packages (for Windows, OS X, and Linux platforms), Emacs, some OPERA 2D and FREEFEM++

Operating Systems: Microsoft Windows family, Apple OS X, and Linux

Hardware experience: lathe, mill, and basic CNC machining of metals

#### OUTREACH

- Mentored TRAC teacher Anthony Cerqua during the summer of 2015. His project included designing and testing a data acquisition system for high voltage tests using a National Instruments box and LABVIEW, and testing a spark discharge monitor for high voltage cables.
- Guided a research project with TRAC teacher Michelle Morris and undergraduate Thomas Badman during the summer of 2013. The study looked for correlations between energetic cosmic showers and LArTPC high voltage trips using a DAQ with inputs from the high voltage power supply and scintillation counters.
- Mentored Illinois Math and Science Academy student Alan Yang during the summer of 2014. Arranged a study of the performance of various insulators in liquid argon under high electrical stress.
- Engaged young students on the benefits of working in the STEM fields at the Fermilab booth at the 2013 and 2014 STEM Career Expos.
- Guided eight Saturday Morning Physics tours for groups of 30 or more of various experiments at Fermilab.

#### SELECTED PUBLICATIONS

- R. Acciarri *et al.*, “Liquid argon dielectric breakdown studies with the MicroBooNE purification system,” JINST **9**, P11001, (2014) [arXiv:1408.0264 [hep-ex]]. DOI: 10.1088/1748-0221/9/11/P11001
- C. Bromberg *et al.*, “Design and operation of LongBo: a 2 m long drift liquid argon TPC,” JINST **10**, P07015, (2015) [arXiv:1504.00398 [physics.ins-det]] DOI: 10.1088/1748-0221/10/07/P07015
- R. Acciarri *et al.*, “Summary of the second workshop on liquid argon time projection chamber research and development in the United States,” JINST **10**, T07006, (2015) DOI: 10.1088/1748-0221/10/07/T07006
- T. Aaltonen *et al.* [CDF Collaboration], “Search for the standard model Higgs boson produced in association with a Z Boson in 7.9 fb<sup>-1</sup> of p anti-p collisions at  $\sqrt{s} = 1.96$  TeV,” Phys. Lett. B **715**, 98 (2012) [arXiv:1203.5815 [hep-ex]].

#### REFERENCES

Available upon request