Alan Wilson

Experimental Physics (HEP)

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Education

2010	**Ph.D. Physics**, *University of Michigan*, Ann Arbor.
2003	**M.S. Mathematics**, *University of Michigan*, Ann Arbor.
1999	**B.S. Mathematical Sciences (Physics)**, *University of Washington*, Seattle.
1999	**B.S. Computer Engineering**, *University of Washington*, Seattle.

Ph.D. thesis

title — *Search for a Supersymmetry Signature with the $Z\gamma$ plus Missing Transverse Energy Final State Using the DØ Detector*

supervisor — Prof. Bing Zhou

description — Over the last four years the DØ detector at Fermilab's Tevatron Collider has collected 6.2 fb^{-1} of 1.96 TeV proton-antiproton collisions. Using this data I searched for a supersymmetry signature: a high-p_T photon, a pair of electrons or muons from a Z boson decay, and large missing transverse energy produced by undetected particles. Certain gauge mediated supersymmetry breaking (GMSB) models would produce $Z\gamma$ events with large transverse missing energy, but this is the first time that this signature has been searched for in a hadron collider experiment. The dominate background is from standard model $Z\gamma$ production, these events are used as a control sample for data-Monte Carlo (MC) consistency checks. Background estimates are accomplished using data-driven methods and MC simulations. The observed data is consistent with standard model predictions. No evidence for a supersymmetric signal is found. Using the extra signal discrimination obtained with boosted decision trees (a trained multivariate selection technique) and combining the analysis results from both electron and muon channels we exclude our GMSB model at the 95% confidence level for $70 < \Lambda < 117.5$ TeV. This corresponds to neutralino (the next-to-lightest superparticle) masses of $111 < \tilde{\chi}_1^0 < 222$ GeV.

Experience

Research & Hardware Experience

2009–present — **Graduate Student Research Assistant**, *DØ Experiment*.
- Searched for supersymmetry with the $Z\gamma$+missing E_T signature.
- Collaborating on standard model $Z\gamma$ cross section and anomalous couplings.
- Managing Monte Carlo production for the new phenomena group.
- Control rooms shifts for data acquisition (DAQ).

2005–2008 — **Graduate Student Research Assistant**, *ATLAS Experiment*.
- Primary contributor to diboson physics: prepared for cross-section measurement and estimated sensitivity to anomalous couplings.
  - *Contributed entire WZ analysis and substantial portions of WW and ZZ.*
  - *Worked with MC@NLO and BosoMC for event generation, cross-section systematics, and modeling of anomalous couplings.*
  - *Developed calculation of the confidence region for couplings.*
- Constructed the gas monitor chamber for the monitored drift tube (MDT) system:
  - *Working with an engineer and an undergraduate, assembled a complete table-top (6 layers of 16 tubes) drift tube detector from scratch including scintillator triggers and gas system.*
  - *Used to monitor the gas mixture flowing in and out of the ATLAS MDT system via features of the drift-time spectra from cosmic ray muon tracks.*
- Contributions to the $H \to WW$ analysis work.
- Applying boosted decision trees to electron identification and b-tagging.
  - *Testing of algorithm and integration into ATLAS software.*

2004–2005	**Research Assistant**, *ATLAS Experiment*, Univ. of Michigan, Geneva, Switzerland.

- Phase 1 commissioning of MDT detectors (for the muon precision measurement).
  - *Setup lab space from scratch: trained to operate cranes, supervised chamber movements, expert in the gas mixing and distribution system*
  - *Lead a team of undergraduates (as many of as five) finishing chamber assembly, leak checking, commissioning with cosmic rays, and working out repairs on the fly*
- Validating muon reconstruction software
  - *Compared muon reconstruction algorithms for resolution and efficiency in MC*

1994–1999	**Research Assistant**, *Space Sciences, Geophysics*, Univ. of Washington, Seattle.

- Assembled DAQ hardware and developed software for balloon and satellite experiment commissioning.
- Research and simulations exploring coded aperture imaging using X-rays.

Teaching

1999–2003	**Graduate Student Instructor**, *Mathematics*, University of Michigan, Ann Arbor.
	Courses: precalculus, calculus, and differential equations
1998–1999	**Teaching Assistant**, *Computer Science and Engineering*, Univ. of Washington, Seattle.
	Courses: Discrete Structures, Introduction to Computer Graphics, and Digital System Design

Conference Talks and Publications

D0 note	"Search for supersymmetry with the $Z\gamma$ plus missing transverse energy signature", in preparation
publication	"The ATLAS Experiment at the CERN Large Hadron Collider." *JINST* 3 S08003 (2008)
publication	"Expected Performance of the ATLAS Experiment - Detector, Trigger and Physics." CERN-OPEN-2008-020 (2009), arXiv:0901.0512
ATLAS note	"Diboson physics studies with the ATLAS detector", ATL-PHYS-PUB-2009-038 *Expanded version of "Expected Performance...."*
proceedings	"Diboson Physics in ATLAS", ATL-PHYS-PROC-2008-051
talk	"Direct and Indirect Searches for New Physics with Diboson Final States ," LHC New Physics Signatures Workshop, University of Michigan, January 2008.
publication	"Drift time spectrum and gas monitoring in the ATLAS Muon Spectrometer precision chambers." Nucl. Instrum. Methods A **588**, 347 (2008).
proceedings	"Streamlined Calibration of the ATLAS Muon Spectrometer Precision Chambers", D. Levin for the ATLAS Collaboration, Nuclear Science Symposium Conf. Record, 2009 IEEE, 1040–1044
proceedings	"Gas performance of the ATLAS MDT precision chambers", Nuclear Science Symposium Conference Record, 2008. NSS '08. IEEE, 19-25 Oct. 2008, 3213
publication	"A Multivariate Training Technique with Event Reweighting." The ATLAS Collaboration, JINST3:P04004,2008
ATLAS note	"B-tagging Based on Boosted Decision Trees and Performance Comparisons of ATLAS B-taggers", ATL-PHYS-INT-2009-072
ATLAS note	"Performance of Electron Identification Based on Boosted Decision Trees", ATL-COM-PHYS-2009-160
ATLAS note	"Study of the SM Higgs Discovery Potential through W-pair Leptonic Decay Modes with Boosted Decision Trees", ATL-PHYS-INT-2009-052
talk	"$Z \to \mu\mu$ performance", ATLAS Physics Workshop, Rome, June 2005.

ATLAS general

publication	"Charged-particle multiplicities in pp interactions at $\sqrt{s} = 900$ GeV measured with the ATLAS detector at the LHC", ATLAS Collaboration, Phys. Lett. B 688, issue 1, 21 (2010).
publication	"Search for New Particles in Two-jet Final States in 7 TeV Proton-Proton Collisions with the ATLAS Detector at the LHC", ATLAS Collaboration, Phys. Ref. Lett. 105, 161801 (2010)
publication	"Measurement of the $W \to l\nu$ and $Z/\gamma^* \to \ell\ell$ production cross sections in proton-proton collisions at $\sqrt{s} = 7$ TeV with the ATLAS Detector", ATLAS Collaboration, accepted by JHEP (2010).
publication	"Observation of a centrality-dependent dijet asymmetry in lead-lead collisions at $\sqrt{s_{NN}} = 2.76$ TeV with the ATLAS detector at the LHC", ATLAS Collaboration, Phys. Ref. Lett. 105, 252303 (2010).