Christopher J. Meyer

Curriculum Vitae

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Education

2013 **Doctor of Philosophy** in Physics
The University of Chicago
Advised by Prof. Mark Oreglia

2008 **Bachelor of Science** in Physics, Highest Honors
The University of California, Santa Cruz
Advised by Prof. Bruce Schumm

2008 **Bachelor of Arts** in Mathematics, Honors
The University of California, Santa Cruz

Professional Experience

Assistant Professor
Indiana University Bloomington, ATLAS experiment
Aug 2018 – present

Postdoctoral Fellow
University of Pennsylvania, ATLAS experiment
May 2014 – July 2018

Postdoctoral Scholar
The University of Chicago, ATLAS experiment
January 2014 – April 2014

Selected Publications

ATLAS Collaboration, *Measurements of Higgs boson properties in the diphoton decay channel with 36 fb^{-1} of pp collision data at $\sqrt{s} = 13$ TeV with the ATLAS detector*, Phys. Rev. **D98** (2018) no. 5, 052005, arXiv:1802.04146 [hep-ex].

- Organized analysis of first Run-2 data at 13 TeV.
- Checks of data-quality, including shower shapes in calorimeters, photon isolation, kinematic corrections of vertex choice.
- Studies of different unfolding methods and experimental uncertainty on correction factors.
- Tests of background model, mentored student studying background model description of data and signal model uncertainties.
- Developed software framework for selecting, calibrating, and analyzing data, as well as producing input files used for signal extraction.

ATLAS Collaboration, *Search for new phenomena in high-mass diphoton final states using 37 fb^{-1} of proton–proton collisions collected at $\sqrt{s} = 13$ TeV with the ATLAS detector*, Phys. Lett. **B775** (2017) 105–125, arXiv:1707.04147 [hep-ex].

- Acceptance factors and experimental uncertainties used for limit setting.
- Studied which photon isolation criteria minimizes model dependence.
- Developed software framework for selecting, calibrating, and analyzing data, as well as producing input files used for signal extraction.

ATLAS Collaboration, *Measurement of the inclusive jet cross-sections in proton-proton collisions at $\sqrt{s} = 8$ TeV with the ATLAS detector*, JHEP **09** (2017) 020, arXiv:1706.03192 [hep-ex].

- Supported unfolding studies and measurement of statistical correlation.

ATLAS Collaboration, *Studies of $Z\gamma$ production in association with a high-mass dijet system in pp collisions at $\sqrt{s} = 8$ TeV with the ATLAS detector*, JHEP **07** (2017) 107, arXiv:1705.01966 [hep-ex].

- Studied signal extraction, and the use of a control region to constrain background in the signal region.
- Experimental uncertainties on signal and background templates.

LHC Higgs Cross Section Working Group Collaboration, D. de Florian et al., *Handbook of LHC Higgs Cross Sections: 4. Deciphering the Nature of the Higgs Sector*, arXiv:1610.07922 [hep-ph].

- Contributed to section on combination of Higgs boson cross-section measurements.

ATLAS Collaboration, *Search for resonances in diphoton events at $\sqrt{s}$=13 TeV with the ATLAS detector*, JHEP **09** (2016) 001, arXiv:1606.03833 [hep-ex].

- Acceptance factors and experimental uncertainties used for limit setting.
- Studied which photon isolation criteria minimizes model dependence.
- Developed software framework for selecting, calibrating, and analyzing data, as well as producing input files used for signal extraction.

ATLAS Collaboration, *Measurement of the inclusive jet cross-section in proton-proton collisions at $\sqrt{s} = 7$ TeV using 4.5 fb^1 of data with the ATLAS detector*, JHEP **02** (2015) 153, arXiv:1410.8857 [hep-ex]. [Erratum: JHEP09,141(2015)].

- Organized analysis of full 7 TeV dataset.
- Measured trigger efficiency and studied pileup dependence and uncertainty.
- Standardized bootstrap tool for ATLAS use in measuring statistical correlations.

ATLAS Collaboration, *Jet energy measurement and its systematic uncertainty in proton-proton collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector*, Eur. Phys. J. **C75** (2015) 17, arXiv:1406.0076 [hep-ex].

- Extended previous results to reduce the uncertainty due to close-by jets. Previously, unphysical behavior was seen when comparing the jet energy response between samples of jets with and without another jet close by. By redefining the distance criteria for isolated jets, a more physical result was obtained.

ATLAS Collaboration, *Measurement of dijet cross sections in pp collisions at 7 TeV centre-of-mass energy using the ATLAS detector*, JHEP **05** (2014) 059, arXiv:1312.3524 [hep-ex].

- Co-author of paper, as well as main contributor to measurement portion. Wrote sections of the backup note, as well as editing the full document and responding to editorial comments. Presented the SM approval talk, as well as introduction during ATLAS weekly meeting when circulated to collaboration.
- Specifically, I was responsible for trigger efficiency, pileup studies, unfolding, systematic uncertainties, theoretical predictions and uncertainties, and presentation. Of particular note, worked through the necessary steps for combining multiple prescaled triggers to look at spectra as a function of pileup (μ) conditions. Used new Bootstrap tool, standardized for ATLAS use by myself, to include statistical errors on the jet energy calibration uncertainties. Considered pileup reweighting for different $p_{\mathrm{T}}^{\mathrm{jet}}$ ranges corresponding to different triggers in data, and showed it reduced the MC simulation statistics dramatically.
- Provided inputs and discussion for statistical comparison of data measurements and theory predictions. Part of the discussion interpreting the resulting agreement and disagreement for the NLOJet++ predictions with data, using various PDF sets.

ATLAS Collaboration, *Measurement of inclusive jet and dijet production in pp collisions at $\sqrt{s} = 7$ TeV using the ATLAS detector*, Phys. Rev. **D86** (2012) 014022, arXiv:1112.6297 [hep-ex].

- Studies of the trigger efficiency, and systematic uncertainties. Helped to validate the two-jet trigger strategy, and the systematic uncertainty due to inefficiency in the crack between barrel and endcap LAr calorimeters.
- Provided final propagation of the systematic uncertainties, and the transfer matrix for unfolding. These were used in the final unfolding procedure, which yielded the results presented in the paper.

M. K. Petterson, R. F. Hurley, K. Arya, C. Betancourt, M. Bruzzi, B. Colby, M. Gerling, C. Meyer, J. Pixley, T. Rice, H. F. W. Sadrozinski, J. Bernardini, L. Borrello, F. Fiori, and A. Messineo, *Determination of the charge collection efficiency in neutron irradiated silicon detectors*, .

- Collected and analyzed data.
- Developed electronic system for measuring multiple strips on test bench.

Author on ∼550 ATLAS Collaboration peer-reviewed publications since October 2011.

Selected Conference Proceedings

C. J. Meyer, *Measurements of photon and jet production properties with ATLAS*, arXiv:1610.04220 [hep-ex].

- Proceeding for LHCP 2016: 4th Conference on Large Hadron Collider Physics, Lund, Sweden, 13-18 June 2016. Talk given during parallel session.

C. Meyer, *Recent QCD Results from ATLAS*, arXiv:1409.4399 [hep-ex].

- Proceeding for LHCP 2014: Second Annual Conference on Large Hadron Collider Physics, New York, United States, 2-7 June 2014. Talk given during parallel session.

C. Meyer, *Recent QCD Results From ATLAS*, arXiv:1310.2944 [hep-ex].

- Proceeding for LHCP 2013: First Large Hadron Collider Physics Conference, Barcelona, Spain, 13-18 May 2013. Poster prepared for conference.

C. Meyer, *The ATLAS Tile Calorimeter Calibration and Performance*, arXiv:1310.2945 [hep-ex].

- Proceeding for LHCP 2013: First Large Hadron Collider Physics Conference, Barcelona, Spain, 13-18 May 2013. Poster prepared for conference.

C. Meyer, *Results on QCD jet production at ATLAS and CMS*, arXiv:1310.2946 [hep-ex].

- Proceeding for Blois 2012: 24th Rencontres de Blois on "Particle Physics and Cosmology", Blois, Loire Valley, France, 27 May - 1 Jun 2012. Talk given during parallel session.

C. Meyer, T. Rice, L. Stevens, and B. A. Schumm, *Simulation of an All-Silicon Tracker*, arXiv:0709.0758 [hep-ex].

- Proceeding for the 2007 International Linear Collider Workshop, DESY, Hamburg, Germany, 30 May - 3 June, 2007.

Notable Presentations

Lecture **Measuring the Higgs: two photon edition**
Graduate HEP course, 2016, Bonn

Talk **Looking for bumps in diphoton events**
Particle Physics Seminar, 2016, Bonn

Talk **Searching for new physics in diphoton events**
Fermilab Joint Experimental–Theoretical Physics Seminar, 2016, Chicago

Talk **Measurements of photon and jet production properties with ATLAS**
Large Hadron Collider Physics, 2016, Lund

Talk **Recent QCD results from ATLAS**
Large Hadron Collider Physics, 2014, New York

Talk **Summary of Tile Calorimeter operations**
ATLAS Week, February 2014, CERN

Talk **Summary of photon, jet, and soft QCD physics results from ATLAS**
ATLAS Week, 2013, Marrakech

Poster **Recent QCD results from ATLAS**
Large Hadron Collider Physics, 2013, Barcelona.

Poster **The ATLAS Tile Calorimeter calibration and performance at the LHC**
Large Hadron Collider Physics, 2013, Barcelona.

Talk **Introduction to jet calibration and in situ calibration**
Hadronic Calibration Workshop, 2012, Grenoble

Talk **Dijet cross sections & Tile Calorimeter studies**
Presentations to the NSF and DOE LHC Research Program Managers, 2012, CERN

Poster **Standard Model jet measurements using the ATLAS detector**
109th Meeting of the LHCC, 2012, Geneva

Talk **Results on QCD jet production at ATLAS and CMS**
24th Rencontres de Blois, 2012, Blois

Leadership Roles

Convener of $H \to \gamma\gamma$ sub-group
April 2017 – present

- Responsible for organization of all ATLAS analyses (~ 10) with a Higgs-like boson decaying to two photons. This includes chairing the weekly sub-group meeting.
- Help analyses prepare results and navigate approval procedure.
- Provide necessary inputs (data, MC simulation, common tools) so that analyses can efficiently publish results.

Coordinator of data acquisition for transition radiation tracker
January 2016 – April 2017

- Coordinate software and hardware upgrades necessary to cope with increased data-flow, as well as general maintenance.
- Testing and replacement campaign of all optical readout boards resulting in 25% improvement in output bandwidth.
- Organize expert on-call shifts to ensure high-quality data acquisition.

Analysis contact for $H \to \gamma\gamma$ cross-section measurement
May 2015 – April 2017

- Co-contact and organizer of LHC Run-2 measurements of Higgs boson production cross-sections at 13 TeV.

Run Coordinator of Tile Calorimeter
January 2014 – April 2014

- Organization and coordination of the ATLAS Tile Calorimeter consolidation effort during long shutdown 1 (2013-2014). This includes chairing the weekly Tile Calorimeter operations meeting.
- Interface between data-quality results and maintenance team, helping prioritize which modules to work on first.
- Coordinate operations at point 1 (ATLAS control room). This involves responsibility for the Tile Calorimeter during combined ATLAS test runs in early 2014, as well as the shifters.

Deputy Run Coordinator of Tile Calorimeter
September 2013 – December 2013

- Responsible for assisting the run coordinator.

Co-convener of Inclusive Jet + Dijet Analysis Group
October 2011 – June 2013

- Organization of necessary studies for the inclusive jet and dijet cross section measurements. Determined which portions of the previous analysis should be repeated, and what new features could be added. Identified people to be responsible for analysis related tasks, and mentored/guided their activities.
- Co-chair of weekly analysis meetings, providing introductions as well as feedback to members of the analysis teams. Contacted people and encouraged them to present their work to the group. Responsible for reminding people of meeting, reserving the room, connecting to video conference system.
- Contact with Standard Model jet physics group for analysis progress and approval talks. Presented updates of analysis progress every 1-2 months at Standard Model jet/photon physics meetings, and updates at Standard Model plenary every 3 months.

Coordinator of Charge Injection System Experts
September 2009 – September 2012

- Supervisor and mentor of Chicago technical experts, through weekly meetings. Generally one hour, informal meetings to discuss what they've worked on and what to do next.
- Provide feedback on calibration work, and keep them focused on the most important aspects. Kept track of Tile Calorimeter community, so that their efforts could be directed where most needed.

Research Experience

University of Pennsylvania
Postdoctoral fellow on the ATLAS experiment, *2014 – present*

- Convener of Higgs decaying to two photons sub-group (2017 – present).
- Co-author of first Higgs to two photons production measurement with 13 TeV data, as well as combination with Higgs to two Z bosons (Fall 2015).
- Analysis contact for Higgs decaying to two photons cross-section analysis (2015 – 2017).
- Measurement of Higgs boson cross-sections and signal strengths (2014 – present). Organized group, derived unfolding factors, experimental uncertainties for the measurement. Studied data compared with background model and MC simulation. Evaluated practicality of using functionless fit method for background model studied by Exotics searches. Mentored student who quantified agreement of different backgrounds models with data and MC simulation. Wrote numerous iterations of supporting documentation and supported editorial work on upcoming paper.
- Main developer of analysis framework used for measurements of Higgs decaying to two photons in Run 2 (2015 – 2017). Desgined base framework, object and event selection tools, reduced analysis ntuple algorithm. Coordinated production of reduced analysis ntuples, which contain final calibrated objects and selected events used in signal extraction.
- Transition radiation tracker data acquisition coordinator (2015 – 2016).
- Transition radiation tracker data acquisition expert (2015 – present). Maintain high-quality data taking of sub-detector, fixing hardware and software issues that arise during running.
- Search for high-mass diphoton resonances (2014 – 2017). Derived correction and acceptance factors for limit setting, checks of Run-2 data and MC simulation, reduced limit dependance on photon isolation. Additional cross-checks of sidebands near 750 GeV diphoton mass. Mentored student performing data quality checks and calculating additional acceptance factors.
- Search for low-mass diphoton resonances (2017 – present). Mentoring student investigating novel background modeling technique, signal and background modeling strategy used for search.
- Search for LSP with 1 or 2 photons plus missing energy (2017 – present). Mentoring student performing full analysis, including signal optimization, data driven backgrounds, uncertainties, and limits.
- Invited reviewer for European Physical Journal C (Summer of 2017).
- Member of editorial board for three analyses (measurement, search, and performance).

Enrico Fermi Institute, The University of Chicago
Postdoctoral scholar on the ATLAS experiment, *2014*

- Invited reviewer for Nuclear Instruments and Methods in Physics: A (Winter of 2014).
- SM physics representative for ATLAS analysis harmonization effort (Winter of 2014).
- Run coordinator of the Tile Calorimeter at ATLAS (Winter of 2014).
- Measurement of vector-boson scattering in the $V\gamma$ final state.
- Deputy run coordinator of the Tile Calorimeter at ATLAS (Fall of 2013).

Enrico Fermi Institute, The University of Chicago
Graduate student research assistant on the ATLAS experiment, *2008 – 2013*

- **Ph.D. Thesis**: *Measurement of dijet cross sections in pp collisions at 7 TeV centre-of-mass energy using the ATLAS detector*. Based on the 2011 dijet cross sections paper, for which I was the main contributor for the measurement.
- Co-convener of the *Inclusive jet + dijet analysis group*.
- Main contributor and contact editor for 2011 dijet cross section paper.
- Trigger efficiency for the 2011 dijet mass exotic search paper.
- Coordinator of Chicago technical experts based at CERN.
- Contributed Standard Model prospective to Dijet Angular Task Force. Looked into a feature, eventually found to be due to the jet energy calibration, seen towards the end of 2011 data taking. Provided kinematic distributions, and cross sections measurements compared to NLOJet++ theory predictions. Contributed to discussions about the cause, and resolution, of the excess during weekly meetings.
- Online data-quality shifter for the ATLAS Tile Calorimeter. Monitor data quality plots during physics runs and quickly address issues which may later affect whether the data is usable. First responder, notifying run coordinator and other experts, when issues arise.
- Data-quality validator for the ATLAS Tile Calorimeter. Perform offline checks of data quality, which is reported to the data quality leader. Involves checking various plots showing energy and timing distributions covering the Tile Calorimeter, and summarizing the results.
- Data-quality leader for the ATLAS Tile Calorimeter. Of particular note, I developed an online interface for the fast and easy validation and reporting of detector conditions. The results of the data quality validator are interpreted, and necessary masking of channels is performed. Recommendations for possible updates to calibration constants for timing and other issues are reported at bi-weekly meetings.
- Provided the trigger efficiency, systematic uncertainty, and transfer matrix for the 2010 dijet measurement using ATLAS.
- Studied the effect of the jet energy calibration/resolution uncertainty on the 2010 W+jets measurement using ATLAS. Performed on the early 2010 data sample, using a preliminary version of the jet energy calibration uncertainty.
- Studied jet shapes in early ATLAS Monte Carlo simulation. The energy density in annulus of increasing radius was explored, where the energy density far from the jet can be interpreted as underlying event and pileup contributions.
- Noise characterization of ATLAS Tile Calorimeter read-out electronics. A study noise vs. frequency in 3-in-1 cards was performed using an electronic simulation package, as well as measured on a physical card at a test bench. An additional output filter was shown to address a resonance which appeared at certain frequencies of input noise.

Santa Cruz Institute for Particle Physics, The University of California, Santa Cruz
Undergraduate research assistant, *2006 – 2008*

- Development and analysis of charged-particle track reconstruction algorithms for the proposed International Linear Collider, under the guidance of Prof. Bruce Schumm. In particular, methods utilizing only three hits in the silicon layers and one additional point in the calorimeter are considered. This type of algorithm will be useful for discovering long-lived neutral particles which could decay outside the first few layers of the tracker.
- Characterization of silicon microstrip detectors for the high luminosity LHC upgrade in 2020, under the guidance of Prof. Hartmut Sadrozinski. I studied effects of the radiation expected due to the increased luminosity. I also developed an automated testing program, which controlled an apparatus which measured the noise on each of the 100 silicon strips per chip, then recorded the results.

Awards

2013 **ATLAS Thesis Award**
The ATLAS Collaboration, 1 of 5 recipients

2012 **Nathan Sugarman Award for Excellence in Graduate Student Research**
The University of Chicago

2010 **NSF US LHC Graduate Student Support Award**
National Science Foundation, 1 year

2009 **Robert A. Millikan Fellowship for Research and Teaching**
The University of Chicago, 2 years

2009 **Physical Sciences Teaching Award**
The University of Chicago

Outreach

HEP Outreach Program with The University of Chicago
http://hep-outreach.uchicago.edu/ (*2009 and 2010*)
- Week-long outreach program for local highschool students.
- Assisted with labs involving programming, statistics, and the scientific method.
- Chaperoned a tour of FNAL on the last day.

Balloon Fest with The University of California, Santa Cruz
http://scipp.ucsc.edu/outreach/BF/balloon.html (*2007 and 2008*)
- Day-long event, using weather balloons and TI calculators to perform experiments.
- Assisted a group in designing an experiment, performing the experiment, and analyzing the results.
- All groups present their results to the class at the end of the day.

References

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