Jannicke Pearkes

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Education

Stanford University **Dec 2022 (expected)**

Ph.D. Candidate in Experimental Particle Physics

University of British Columbia **2017**

B.A.Sc. Engineering Physics – Electrical Specialization

Research Experience

SLAC National Accelerator Laboratory **Sept 2017 – Present**

ATLAS Experiment – PhD Candidate (with C. Vernieri and S. Dong) Menlo Park, USA

Searches for Di-Higgs to $bb\gamma\gamma$ - Key analyzer and internal note editor:

- Prepared and validated Monte Carlo requests for updated HH signal models
- Developed and implemented new calibration method for b-jets using deep neural network regression
- Designed and produced the data/Monte Carlo comparisons plots
- Identified, debugged and characterized different aspects of our analysis
- Optimized analysis selection for sensitivity to Higgs self-coupling (κ_λ) via parameterized neural networks
- Contributed to analysis framework in python and C++ with version control via git
- Actively participates in group meetings and promotes collaboration between institutes and individuals

Di-Higgs Combination - Key analyzer and internal note editor:

- Performed non-resonant κ_λ scan and produced final limit and efficiency plots
- Prepared datasets for overlap studies between analysis channels to ensure statistical independence
- Co-editor of the ATLAS Physics Briefing for the general public

Di-Higgs HL-LHC Prospects Combination - Key editor of the conference note

- Collaborated with the $bb\tau\tau$ and $bb\gamma\gamma$ projections teams to produce the combined projections for Snowmass

Inner Tracker Upgrade (ITk) - Qualification Task:

- Assembled test stands for electrical quality control testing of RD53As with RCE and YARR
- Performed electrical quality control tests of FE-I4 pixel modules used in the CERN Outer Tracker prototype
- Developed the ITk production database and produced tutorials used by ∼100 people

Stanford University **June 2017 – Aug 2017**

ATLAS Experiment – CERN Summer Student (with L. Tompkins) Meyrin, Switzerland

- Assisted in the commissioning of the Data Formatter (DF) for the ATLAS Fast Tracker (FTk)
- Assembled, programmed, installed, tested and debugged hardware in the DF system
- Performed bit error rate and data rate tests with pseudodata with the commissioned ATCA racks

University of British Columbia **Sept 2015 – May 2017**

ATLAS Experiment – NSERC USRA (with W. Fedorko, A. Lister and C. Gay) Vancouver, BC, Canada

Boosted Top Quark Tagging:

- Designed deep neural networks for boosted top tagging in ATLAS
- Produced the first results applying deep learning to jet images using ATLAS full simulation
- Tagger was used to perform the first tests of a constituent level deep neural network on ATLAS data
- Four papers originated from this project, our first author paper has been cited 80 times to date

Z' to Di-lepton Analysis:
- Performed signal injection tests with the BumpHunter algorithm
- Optimized input parameters to the BumpHunter for increased sensitivity to Z' signal models

University of Victoria **May 2015 – Aug 2015**
ATLAS Experiment – NSERC USRA (with R. Kowalewski) Victoria, BC, Canada
- Designed deep convolutional neural networks for classification of ATLAS calorimeter images for the ATLAS Missing Transverse Energy trigger

TRIUMF **Jan 2015 – April 2015**
DAQ Group – Senior Design Project (with T. Lindner and F. Retiere) Vancouver, BC, Canada
- Created a simulation of shaping and read-out electronics with LTSpice for the Hyper Kamiokande Experiment

TRIUMF **Sept 2014 – Dec 2014**
EMMA Co-op Student (with B. Davids) Vancouver, BC, Canada
- Prepared surfaces of ultra-high voltage electrodes and simulated surface defects with ANSYS FEA software

Deutsches Elektronen Synchrotron (DESY) **July 2014 – Sept 2014**
CMS Summer Student - μTCA Group (with U. Behrens and I. Melzer-Pellmann) Hamburg, Germany
- Programmed FPGAs in VHDL and tested performance of high speed electronics for the CMS HCAL

TRIUMF **Jan 2013 – Apr 2013**
TITAN Co-op Student (with B. Schultz and J. Dilling) Vancouver, BC, Canada
- Simulated ion beams, created an ultra-high vacuum monitoring system with LabView, experimental data analysis

Publications

1. Measurement Prospects of Higgs boson pair production combining the $b\bar{b}\gamma\gamma$ and $b\bar{b}\tau^+\tau^-$ final states with the ATLAS detector at the HL-LHC, *ATLAS Collaboration*, ATL-PHYS-PUB-2022-005. http://cdsweb.cern.ch/record/2802127
2. Combination of searches for non-resonant and resonant Higgs boson pair production in the $b\bar{b}\gamma\gamma$, $b\bar{b}\tau^+\tau^-$ and $b\bar{b}b\bar{b}$ decay channels using pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector, *ATLAS Collaboration*, ATLAS-CONF-2021-052. http://cdsweb.cern.ch/record/2786865
3. Search for Higgs boson pair production in the two bottom quarks plus two photons final state in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector, *ATLAS Collaboration*, ATLAS-CONF-2021-016. (2021) https://cds.cern.ch/record/2759683
4. The Machine Learning Landscape of Top Taggers. *Butter, A. et al.*, SciPost Phys. 7.1.014, (2019). https://arxiv.org/abs/1902.09914

5. Performance of top-quark and W-boson tagging with ATLAS in Run 2 of the LHC, *ATLAS Collaboration* Eur. Phys. J., (2019). https://arxiv.org/abs/1808.07858
6. Long Short-Term Memory (LSTM) networks with jet constituents for boosted top tagging at the LHC, *S. Egan, W. Fedorko, A. Lister, J. Pearkes, C. Gay*, (2017). https://arxiv.org/abs/1711.09059
7. Jet Constituents for Deep Neural Network Based Top Quark Tagging, *J . Pearkes, W. Fedorko, A. Lister, and C. Gay*, (2017). https://arxiv.org/abs/1704.02124
8. Search for high-mass new phenomena in the dilepton final state using proton-proton collisions at $\sqrt{s}$=13 TeV with the ATLAS detector, *ATLAS Collaboration*, Phys. Lett. B 761 (2016). https://arxiv.org/abs/1607.03669
9. Mass measurements of neutron-rich Rb and Sr isotopes, *TITAN Experiment*, Phys. Rev. C 93, 045807 (2016). https://arxiv.org/abs/1512.07105
10. First direct mass measurement of the neutron-deficient nucleus ^{24}Al, *TITAN Experiment*, Phys. Rev. C 92, 045803 (2015). https://doi.org/10.1103/PhysRevC.92.045803

Conferences

International Conference on High Energy Physics – Virtual **Apr 2022**
Poster: *ATLAS Di-Higgs Combination Results*
APS April Meeting – New York, NY **Apr 2022**
Talk: *ATLAS Di-Higgs Combination Results*
New Methods and Ideas in Particle Physics – Aspen, Colorado **Mar 2022**
Talk: *HH Searches with ATLAS*
Higgs 2021 – Virtual, Stony Brook **Aug 2021**
Plenary YSF Talk: *Search for non-resonant di-Higgs production in the bb$\gamma\gamma$ final state at 13 TeV with ATLAS*
Machine Learning for Jets – New York, NY **Jan 2020**
Hadronic Calibration Workshop – Heidelberg, Germany **Sept 2018**
Machine Learning for Jets – Berkeley, CA **Nov 2017**
Inter-Experimental Machine Learning Workshop – CERN, Switzerland **Mar 2017**
Talk: *Top Tagging with Deep Neural Networks*
APS Northwest Meeting – Penticton, BC , Canada **May 2016**
Talk: *Using Neural Networks to Separate Signal from Background with Real Missing Transverse Energy*

Notable ATLAS Internal Presentations

ATLAS Upgrade Meeting – CERN, Switzerland **Jan 2022**
Talk: Di-Higgs Prospects - Latest and Upcoming Results
ATLAS HH Workshop – CERN, Switzerland **Oct 2021**
Talk: Current Combination Results
Physics Approval Meeting – CERN, Switzerland **Oct 2021**
Talk: HH Combination Results
Di-Higgs Subgroup Meeting – CERN, Switzerland **Aug 2021**
Talk: HH Combination Status Report
Di-Higgs Subgroup Meeting – CERN, Switzerland **Apr 2021**
Talk: VBF HH Herwig 7 Signal Request
Di-Higgs Subgroup Meeting – CERN, Switzerland **Apr 2021**
Talk: ggF HH bb$\gamma\gamma$ Signal Request
ITk Pre-PDR Meeting – CERN, Switzerland **Jul 2019**
Talk: ITk Production Database Tutorial
ATLAS HDBS Workshop – CERN, Switzerland **Nov 2018**
Talk: B-Jet Energy Regression for Di-Higgs Searches

ITk Pixel Module WG – CERN, Switzerland **Mar 2019**
Talk: ITk Module Building Survey
Di-Higgs Kickoff Workshop – CERN, Switzerland **Feb 2019**
Talk: B-Jet Energy Corrections and Improvements to the m_{bb} Resolution
ITk QA/QC Workshop – CERN, Switzerland **Mar 2019**
Talk: Pixel Module Technical Specifications
ITk Pixel Module WG – CERN, Switzerland **Oct 2018**
Talk: Status of Database for Modules
FTk Meeting – CERN, Switzerland **Aug 2017**
Talk: Data Formatter Rate Studies
ATLAS ML Forum – CERN, Switzerland **Nov 2016**
Talk: Deep Neural Networks for Jet Tagging

Summer Schools

SLAC Summer Institute – Virtual, SLAC **August 2021**
Poster: Searches for Di-Higgs Decaying to $bb\gamma\gamma$ with the ATLAS Detector
Hadron Collider Physics Summer School – Virtual, Fermilab **July 2020**
SLAC Summer Institute – Menlo Park, CA **August 2019**
Poster: B-jet Energy Regression for HH Searches
CTEQ Summer School – Mayaguez, Puerto Rico **June 2018**

Awards

APS Grad Slam (APS membership for 1 year) **2022**
Martin and Beate Block Award - most promising young physicist, Aspen Center for Physics ($500) **2022**
NSERC Undergraduate Student Research Award ($4,500) **2016**
2nd Place Canadian Undergraduate Physics Conference **2015**
NSERC Undergraduate Student Research Award ($4,500) **2015**
1st Place TRIUMF Undergraduate Student Symposium **2014**
3rd Place Canadian Undergraduate Physics Conference **2014**
2nd Place TRIUMF Undergraduate Student Symposium **2013**

Research Mentoring

Everett Lee - $HH \to bb\gamma\gamma$ kinematic fit 2022
Mirella Vassilev - b-jet working point studies for VBF $HH \to bb\gamma\gamma$ analysis 2022
Brandon Zhang - $HH \to bb\gamma\gamma$ kinematic fit 2021
Jake Hofgard - HL-LHC Prospects for $HH \to bb\gamma\gamma$ analysis 2021
David Wendt - VBF sensitivity studies for $HH \to bb\gamma\gamma$ analysis 2020
Ishira Fernando, Sean Hackett, Alex Boulton-McKeehan - Dark photon prospects with Mu3e 2020
Genevieve Hayes - Tracks as inputs for boosted top tagging 2019
Shannon Egan - LSTMs for boosted top tagging 2018
Anita Mahinpei - Adversarial training for boosted top tagging 2018

Teaching Experience

Stanford University **Stanford, CA**
Advanced Physics Laboratory - Teaching Assistant April 2020 – June 2020

- Advanced undergraduate physics course in which students researched and proposed an experiment of their choice. Mentored a group of students interested in the Atomki anomaly and resonance searches with Mu3e. Student report at: https://arxiv.org/abs/2009.03540

Mechanics Laboratory - Teaching Assistant October 2019 – December 2019

- Enriched introductory physics labs covering experimental design and data analysis.
- Taught students to design research questions, collect and analyse data from pendulums and water bottle rockets, and quantitatively assess where their models fit the data.

Introduction to Laboratory Physics - Teaching Assistant March 2018 – June 2018

- Enriched introductory physics labs covering optics, heat transfer, radiation, and electronic circuits.
- Designed and ran introductory python data analysis tutorials

Byte Camp Education Society **June 2012 – August 2012**
Lead Instructor Vancouver, BC, Canada

- Taught programming, animation and video game design in Flash to summer camp students ages 11-14

Leadership Activities

SLAC Users Organization – High Energy Physics Advocacy Representative **March 2020 & 2018**

- Lead meetings with 25 congressional offices in Washington DC to advocate for High Energy Physics

UBC Snowbots – Autonomous Robotics Team **Sept 2012 – Dec 2015**
Member → Software Team Lead → Team Captain

- As software lead, developed computer vision system (filtering, lane following) with OpenCV in C++, developed LIDAR obstacle avoidance, GPS navigation algorithms, and high level AI for integrating the multiple subsystems.
- As team captain, co-ordinated growth of the team from 15 to 56 active students
- Raised over $30,000 in funding for the team and organized team travel to 3 international competitions

Outreach

Discotracker - an ATLAS Inner Tracker inspired art installation 2022
https://drive.google.com/drive/folders/1EVuN55Nu1YM3Ch_qO93ieuq21l7qaPdv?usp=sharing
ATLAS Physics Briefing - HH Combination, lead author 2021
https://atlas.cern/updates/briefing/new-milestone-di-Higgs-search
ATLAS Physics Results Explained Video for $b\bar{b}\gamma\gamma$ analysis - participant 2020
https://fb.watch/bDPw-LImca/
"What is a particle?" - York House Girls School outreach presentation 2019

Skills

Languages: English and German (bilingual), French (intermediate)
Programming Languages: Python, C++, Bash, C, VHDL, Verilog, MATLAB, LabView
Libraries: Tensorflow, Keras, Numpy, Pandas, Scikit-learn, Matplotlib, Open-CV, ROS
High Performance Computing: Slurm, condor, torque, moab
Laboratory: Ultra high voltage and ultra high vacuum cleanroom experience
Rapid Protoyping: Water-jet, laser-cutter, 3D printer, lathe, 40 hour machine shop course
Communication: Award winning public speaking skills and writing of papers/documentation
Group Culture: Regular organizer of research group dinners and social activities

Other Activities

Enjoys backpacking, hiking, skiing, climbing and listening to podcasts. AIARE 1 (avalanche safety) and wilderness first aid certified.