

Sagar Vidya Addepalli

PARTICLE PHYSICS · ATLAS · FAST ML

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Work History & Education

SLAC National Accelerator Lab / Stanford University

RESEARCH ASSOCIATE - ATLAS

Menlo Park, USA

Jul 2024 - Present

Personal Leave

India

Jun 2024

Brandeis University

PH.D. IN PHYSICS

Waltham, USA

Aug 2021 - May 2024

Thesis: [A Search for Long-Lived Heavy Neutral Leptons in Events with Displaced Vertices Using the ATLAS Experiment](#)

MASTER OF SCIENCE IN PHYSICS

Aug 2020 - Jul 2021

POST-BACCALAUREATE

Aug 2019 - Jul 2020

Based at Brookhaven National Lab, USA

Indian Institute of Technology - Bombay

Mumbai, India

BACHELOR OF TECHNOLOGY IN ENGINEERING PHYSICS WITH DEPARTMENTAL HONORS

Aug 2015 - May 2019

Research Experience

Edge Machine Learning

GELATO: ANOMALY DETECTION TRIGGER FOR ATLAS

Aug 2024 - Present

GELATO is the first anomaly detection trigger chain implemented in the ATLAS trigger system. Trained unsupervised, it adds sensitivity to a wide range of new physics signatures and opens up the possibility to capture unexpected phenomena. Leading the integration of the hardware emulation into the ATLAS software framework and the validation of the trigger performance on Run-3 data liaising with trigger coordination. Designing the trigger calibration strategy using additional support trigger chains.

Searches for long-lived particles

Publications - [\[1\]](#) [\[4\]](#)

LONG-LIVED DARK PHOTONS

Aug 2024 - Present

Analysis contact and internal note editor for the search of long-lived dark photons decaying into displaced electron pairs in the ATLAS inner detector or calorimeter. Supervising three Ph.D. students working on different aspects of the analysis, the track-based di-electron vertexing, the neural network-based calorimeter vertexing, and a model general anomaly detection strategy.

LONG-LIVED HEAVY NEUTRAL LEPTONS

Feb 2022 - May 2025

Lead analyzer and internal note editor for the search for low mass heavy neutrinos with displaced dilepton vertices using Run-2 data with improved reconstruction. Maintainer of the derivation data format used across Long-Lived Particle searches.

Spearheading analysis optimization and sensitivity estimation to add more decay channels to expand exclusion space. Liaising with the Combined Performance groups to ensure timely and robust support for specially reconstructed large- d_0 leptons.

Reconstruction performance for long-lived particles

Publications - [\[2\]](#) [\[3\]](#) [\[5\]](#)

DISPLACED VERTEX RECONSTRUCTION

Sep 2024 - Present

Analysis contact and paper editor for the reconstruction performance of displaced vertices with the ATLAS inner detector. Led the optimization of the algorithm on long-lived particle decays. Evaluating performance on Run-3 data using $K_S \rightarrow \pi^+ \pi^-$ decays.

DISPLACED MUON IDENTIFICATION PERFORMANCE

May 2022 - May 2025

Leading the identification (working point) and reconstruction efficiency activity for large- d_0 muons within the Muon Combined Performance working group. Introducing unique methods to calibrate the efficiencies of such muons. Developed a novel overlap removal strategy between prompt and displaced muons which share Muon Spectrometer tracks. Delivering ATLAS-wide systematics recommendations for these muons used across Long-Lived Particle searches.

$H \rightarrow VV$ precision measurements

Pubs. - [6] [7] [8] [9]

$H \rightarrow ZZ^* \rightarrow 4l$ FIDUCIAL CROSS SECTION

Nov 2022 - Feb 2023

Contributed to the development of the Loose muon identification selection in Run-3, a working point designed for clean multi-lepton signatures used in the $H \rightarrow ZZ^* \rightarrow 4l$ fiducial cross section measurement, the first public 13.6 TeV ATLAS result.

$H \rightarrow WW^* \rightarrow e\nu\mu\nu$ FIDUCIAL CROSS SECTIONS

Feb 2020 - Mar 2023

Measured the differential fiducial cross section of the Vector Boson Fusion produced Higgs bosons in the $H \rightarrow WW^* \rightarrow e\nu\mu\nu$ channel. Key contributor to the analysis optimization and the data-driven signal extraction methods, including the ML strategy, detector and physics-related uncertainty evaluation, and multidimensional fits. Developed the statistical framework (bootstrapping mechanism) to evaluate correlations between unfolded observables. Served as a point of contact for responses to the journal.

Tracking detector construction and characterization

Publications - [10]

SILICON STRIP DETECTOR ASSEMBLY FOR THE ITK

Aug 2019 - Jul 2021

Key member of the assembly and testing team for the silicon inner tracker planned for the Phase-II upgrade of ATLAS. Lead developer and operator of the mechanical system assembling electrical modules on carbon fiber structures with 50 μm accuracy. Built the final design review prototype. Lead student for the design of the quality control criteria of the assembled detectors. Developed a new metrology system that combined a camera and a laser to yield their first 3D mapping.

UNDERGRADUATE RESEARCH

Indian Institute of Technology - Bombay

Mumbai, India

SENIOR THESIS: $H \rightarrow \mu\mu$, CMS

2018 - 2019

Collaborated with the Klute group at MIT to investigate a statistical tool to replace the choice of fitting an arbitrary function to background with a discrete nuisance parameter.

Osaka University

Osaka, Japan

SUMMER INTERNSHIP: PHASE-II PRODUCTION TARGET OPTIMISATION, COMET

May 2018 - July 2018

Simulated events on Geant4 with modified production target designs for increased signal sensitivity. Perfected the designed geometries in the material map and explored novel beam shaping targets.

School of Physics, University of Bristol

Bristol, UK

SUMMER INTERNSHIP: TORCH DETECTOR, LHCb

May 2017 - July 2017

Built an automated calibration system for the TORCH readout electronics using locally designed components, and wrote the control software for amplifier boards integrated into an automated GUI.

Community & Organizational Involvement

EDITORIAL ROLES

- 2025 **Editor - Quantum Algorithms**, Organizing contributions for the quantum algorithms and processors segment of the community white paper on hardware-based ML for particle physics. *ML for Front End*
- 2025 **Author - ECR Input**, Analyzed and circulated the results of the early career researcher survey on the European Strategy for Particle Physics Update in a **community white paper**. *European Strategy*
- 2024 **Expert Reviewer**, Pre-submission critical review of the documentation and analysis techniques for the **ATLAS emerging jets search**. *ATLAS*
- 2024 **Session Chair**, Curated the list of topics and invited speakers for the long-lived particles session in the ATLAS Exotics Workshop. *EXOT Workshop*

TEACHING & FORMAL SUPERVISION

- 2025 **CERN Summer Student Program**, Supervised an undergraduate **CERN summer student** on the development of the calibration chain for the ATLAS anomaly detection trigger response. *CERN*
- 2020-21 **Martin A. Fisher School of Physics**, TA for undergraduate laboratory courses in mechanics and electricity & magnetism. Awarded the David L. Falkoff prize for excellence in teaching. *Brandeis University*
- 2018 **Department of Physics**, TA for undergraduate Quantum Mechanics, Statistics and Data Analysis. *IIT Bombay*

UNIVERSITY LEADERSHIP

- 2021 **Graduate Department Representative, Physics**, Worked with university deans to resolve student issues centrally. Facilitated regular curriculum revision, set up a peer mentorship program, and led the formalization of student teaching and pay structure. *Brandeis University*
- 2018-19 **General Secretary, Department of Physics**, Set up committees to modify the undergraduate course structure, allow a simpler transition to an integrated masters program, and introduced doctoral level courses for rising undergraduates. *IIT Bombay*
- 2017-19 **Mentor, Department Academic Mentorship Program**, Mentored six students helping them cope up with academic and non-academic challenges. Organised various events to develop student-faculty interaction and promote undergraduate research. *IIT Bombay*

Honors & Awards

- 2023 **Berko Prize**, Excellence in physics research by a graduate student *Brandeis University*
- 2021 **David L. Falkoff Prize**, Excellence in teaching by a physics graduate student *Brandeis University*

Selected Talks & Posters

COLLOQUIUM

- 2023 **Searching for New Physics in the Higgs Sector**, Berko Symposium, Brandeis University *Waltham, USA*

SEMINARS

- 2024 **Atypical Tracks for Long-lived pArticle Searches**, SLAC National Lab *Menlo Park, USA*
- 2023 **New differential cross section measurements in the Higgs sector**, SLAC National Lab *Menlo Park, USA*
- 2023 **New differential cross section measurements in the Higgs sector**, Northeastern University *Boston, USA*
- 2023 **New differential cross section measurements in the Higgs sector**, University of Mass. Amherst *Amherst, USA*
- 2023 **New differential cross section measurements in the Higgs sector**, Columbia University *New York, USA*
- 2023 **New differential cross section measurements in the Higgs sector**, Brookhaven National Lab *Upton, USA*
- 2023 **New differential cross section measurements in the Higgs sector**, Harvard University *Cambridge, USA*
- 2023 **New differential cross section measurements in the Higgs sector**, Brown University *Virtual*
- 2023 **New differential cross section measurements in the Higgs sector**, Brandeis University *Waltham, USA*

CONFERENCES

- 2025 **GELATO: A Generic Event-Level Anomalous Trigger Option for ATLAS**, ML4Jets *Pasadena, USA*
- 2025 **GELATO: A Generic Event-Level Anomalous Trigger Option for ATLAS**, A3D3 All-Hands Meeting *Pasadena, USA*
- 2025 **Searches for Displaced Signatures with ATLAS and CMS**, 59th Rencontres de Moriond *La Thuile, Italy*
- 2023 **Machine learning techniques for cross-section measurements for the vector-boson-fusion production of the Higgs boson in the $H \rightarrow WW^* \rightarrow e\nu\mu\nu$ decay channel with ATLAS**, 57th Rencontres de Moriond *La Thuile, Italy*
- 2022 **Higgs differential cross-sections and CP Higgs couplings results with the ATLAS experiment**, Deep Inelastic Scattering 2022 *Santiago, Spain*
- 2022 **Poster: Improved track reconstruction for prompt and long-lived particles in ATLAS for LHC Run-3**, Deep Inelastic Scattering 2022 *Santiago, Spain*
- 2021 **Optimization of the VBF $H \rightarrow WW^*$ Measurement at the ATLAS Experiment**, DPF APS Meet *Virtual*
- 2021 **Optimization of the VBF $H \rightarrow WW^*$ Measurement at the ATLAS Experiment**, APS April Meet *Virtual*

COLLABORATION MEETINGS

2025	Anomaly Detection Triggers for 2025 Data Taking , ATLAS Exotics Workshop	Virtual
2025	Tracking, τ, Jet, and γ Performance for Searches with Displaced Objects , ATLAS Week	Geneva, Suisse
2025	hls4ml in ATLAS – A Software Perspective , ATLAS Software and Computing Week	Geneva, Suisse
2024	Poster: Anomaly Detection Triggers for 2025 ATLAS Data-Taking , ATLAS Week	Geneva, Suisse
2023	Poster: Fiducial cross-section measurements of the Higgs boson production in the $H \rightarrow WW^* \rightarrow e\nu\mu\nu$ decay channel with the ATLAS detector , 156th LHCC Meeting	Geneva, Suisse
2023	EFT Interpretation: HVV - Current status and lessons learnt , ATLAS Higgs Workshop	Virtual
2021	Status of the VBF $H \rightarrow WW^*$ Differential Analysis , ATLAS HWW Workshop	Virtual

Publications

Refer to my [InspireHEP](#) page for a full list of publications. Below are the papers in referee-assessed international journals where my contributions were significant.

- [1] ATLAS Collaboration. **Search for long-lived dark photons using di-electron and di-photon displaced vertices in $\sqrt{s} = 13$ TeV pp collisions with the ATLAS detector**, in preparation.
- [2] ATLAS Collaboration. **Reconstruction of displaced vertices in the ATLAS inner tracker system**, in preparation.
- [3] ATLAS Collaboration. **Muon reconstruction and identification performance using ATLAS Run 3 data**, in preparation. Contributions: Displaced muon efficiency and systematic studies, and integration of displaced muons into the standard muon workflow chain.
- [4] ATLAS Collaboration. **Search for heavy neutral leptons in decays of W bosons using leptonic and semi-leptonic displaced vertices in $\sqrt{s} = 13$ TeV pp collisions with the ATLAS detector**, *JHEP***07** (2025) 196, [arXiv:2503.16213 \[hep-ex\]](#). Contributions: Internal note editor and primary analyzer of the leptonic channel, optimization of the DV reconstruction increasing acceptance to semi-leptonic decays, background estimation techniques, displaced muon performance.
- [5] ATLAS Collaboration. **Software Performance of the ATLAS Track Reconstruction for LHC Run 3**, *Comput. Softw. Big Sci.* **8**, 9 (2024), [arXiv:2308.09471 \[hep-ex\]](#). Contributions: Integration of displaced muons and removal of MS overlaps with standard muons.
- [6] ATLAS Collaboration. **Measurement of the $H \rightarrow \gamma\gamma$ and $H \rightarrow ZZ^* \rightarrow 4\ell$ cross-sections in pp collisions at $\sqrt{s} = 13.6$ TeV with the ATLAS detector**, *Eur. Phys. J. C* **84** (2024) 78, [arXiv:2306.11379 \[hep-ex\]](#). Contributions: Muon working point efficiency studies with Run-3 geometry and reconstruction.
- [7] ATLAS Collaboration. **Integrated and differential fiducial cross-section measurements for the vector-boson-fusion production of the Higgs boson in the $H \rightarrow WW^* \rightarrow e\nu\mu\nu$ decay channel at 13 TeV with the ATLAS detector**, *Phys. Rev. D* **108**, 072003, [arXiv:2304.03053 \[hep-ex\]](#). Contributions: Event selection, BDT training and hyper-parameter optimization, systematics rankings and profile likelihood scans, physics and experimental systematics estimation, final observable binning strategy for cross-sections, correlation between measured observables, analysis framework maintenance, bootstrapping framework development, liaison to the journal.
- [8] ATLAS Collaboration. **Measurements of differential cross sections of Higgs boson production through gluon fusion in the $H \rightarrow WW^* \rightarrow e\nu\mu\nu$ final state at $\sqrt{s} = 13$ TeV with the ATLAS detector**, *Eur. Phys. J. C* **83** (2023) 774, [arXiv:2301.06822 \[hep-ex\]](#). Contributions: Coordination with the VBF channel, physics systematics evaluation.
- [9] ATLAS Collaboration. **Measurements of Higgs boson production by gluon–gluon fusion and vector-boson fusion using $H \rightarrow WW^* \rightarrow e\nu\mu\nu$ decays in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector**, *Phys. Rev. D* **108**, 032005, [arXiv:2207.00338 \[hep-ex\]](#). Contributions: Physics systematics evaluation.
- [10] ATLAS ITk Collaboration. **The ABC130 barrel module prototyping programme for the ATLAS strip tracker**, *JINST* **15** (2020) P09004, [arXiv:2009.03197 \[hep-ex\]](#). Contributions: Stave assembly and electrical testing at BNL.