

# Curriculum Vitae

## Yongbin Feng

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### PROFESSIONAL POSITIONS

- **Fermi National Accelerator Laboratory**, Batavia, Illinois, USA  
*Postdoctoral Research Associate*, Nov. 2020 - Present

### EDUCATION

- **University of Maryland, College Park**, College Park, Maryland, USA  
*Ph.D. in Physics*, Aug. 2015 - Oct. 2020
- **University of Science and Technology of China**, Hefei, Anhui, China  
*B.S. in Physics*, Aug. 2011 - Jun. 2015

### PROFESSIONAL EXPERIENCE

- Sep. 2023 - Present, CMS Standard Model Group Vector Boson (SMP-V) L3 Convener
- Feb. 2022 - Sep. 2023, CMS Machine Learning Production Group L3 Convener

### SELECTED PUBLICATIONS

**Publications with leading contributions in the idea proposal, technical study, paper writing, and review response**

- CMS Collaboration, “Portable Acceleration of CMS Production Workflow with Coprocessors as a Service”, CMS Physics Analysis Summary CMS-PAS-MLG-23-001, CERN, Geneva, 2023. (Analysis Contact.) To be submitted to Computing and Software for Big Science
- CMS Collaboration, “Measurement of W and Z boson inclusive cross sections in pp collisions at 5.02 and 13 TeV”, CMS Physics Analysis Summary CMS-PAS-SMP-20-004, CERN, Geneva, 2023. (Analysis Contact.) To be submitted to Journal of High Energy Physics
- T. Li et al., “Semi-supervised graph neural networks for pileup noise removal”, *Eur. Phys. J. C* **83** (2023) 99, doi: 10.1140/epjc/s10052-022-11083-5, [arXiv:2203.15823](#)
- A. Apyan et al., “DarkQuest: A dark sector upgrade to SpinQuest at the 120 GeV Fermilab Main Injector”, March, 2022. [arXiv:2203.08322](#)
- Y. Feng, “A New Deep-Neural-Network-Based Missing Transverse Momentum Estimator, and its Application to W Recoil”. Doctoral dissertation, University of Maryland, 2020
- CMS Collaboration, “Search for new particles decaying to a jet and an emerging jet”, *JHEP* **02** (2019) 179, doi: 10.1007/JHEP02(2019)179, [arXiv:1810.10069](#)

**Publications with involvement in the idea proposal, technical study, paper writing, and review response**

- H. Zhao et al., “Graph Neural Network-based Tracking as a Service”, 2, 2024. [arXiv:2402.09633](#)
- CMS Collaboration, “Measurement of the inclusive cross section of Z boson production in pp collisions at  $\sqrt{s} = 13.6$  TeV”, CMS Physics Analysis Summary CMS-PAS-SMP-22-017, CERN, Geneva, 2023
- M. Agarwal et al., “Applications of Deep Learning to physics workflows”, June, 2023. [arXiv:2306.08106](#)

- S. Liu et al., “Structural Re-weighting Improves Graph Domain Adaptation”, in *Proceedings of the 40th International Conference on Machine Learning (ICML)*, volume 202 of *Proceedings of Machine Learning Research*, p. 21778. July, 2023
- P. Harris et al., “Physics Community Needs, Tools, and Resources for Machine Learning”, in *2022 Snowmass Summer Study*. March, 2022. [arXiv:2203.16255](#)
- C. Papageorgakis et al., “Dose rate effects in radiation-induced changes to phenyl-based polymeric scintillators”, *Nucl. Instrum. Meth. A* **1042** (2022) 167445, doi: 10.1016/J.NIMA.2022.167445, [arXiv:2203.15923](#)

## RESEARCH EXPERIENCE

### Postdoctoral research

- Dec. 2020 - Present

#### **DarkQuest: probing the light dark matter with proton-fixed target experiment**

- Leading the developments and maintenance of the simulation framework and analysis chain. Guiding graduate and undergraduate students on DarkQuest research. Preparing the analysis using the data from the predecessor experiment SeaQuest
- Collaborating with the SpinQuest collaboration; studying and improving the displaced track and vertex reconstruction algorithm and performance
- Integrated the Electromagnetic calorimeter (EMCal) modules in the simulation package and verified the performance. Planning for test beam studies in Spring 2024

- Jan. 2022 - Present

#### **Measurements of differential W boson production cross sections**

- Co-leading the measurement of differential W boson production cross section with respect to W boson  $p_T$ . Analysis in progress. Expected to be released by fall 2024.
- Working in the CMS W mass measurement team, researching the use of machine-learning-based (ML-based) W recoil estimations and calibrations for W mass measurements, as well as exploring potential improvements to the W mass result from W  $p_T$  measurement.

- Jan. 2021 - Aug. 2023

#### **Measurements of inclusive W and Z boson production cross sections**

- Led the measurements of the inclusive W and Z boson production cross sections and their ratios at 13 TeV and 5.02 TeV. Achieved the world’s best precision on the cross section ratios between  $W^+$  and  $W^-$  and between  $W^\pm$  and Z. Analysis contact; CMS-PAS-SMP-20-004 released in August 2023; paper to be submitted to Journal of High Energy Physics.
- Collaborating with the Karlsruhe Institute of Technology team and working on the first measurement of the inclusive W and Z boson production cross sections at 13.6 TeV. CMS-PAS-SMP-22-017 released for the measurement of Z boson production cross section in  $Z \rightarrow \mu\mu$  channel. The measurement of W boson production cross section in progress.

- Dec. 2020 - Present

#### **SONIC: Service for Optimized Network Inference with Coprocessors**

- Co-leading the study using coprocessors, such as GPUs, FPGAs, and Intelligent Processing Units (IPUs), etc to accelerate ML inference in CMS computing, with the focus on the inference as-a-Service approach
- Co-led the study testing different commercial computing clusters, such as Google Cloud and Amazon Web Services computing clusters, and High Performance Computing centers to accelerate remote CMS production jobs using as-a-Service

- Collaborating with NVIDIA and Graphcore software developers on testing and improving the software for ML inference on GPUs and IPUs
- Analysis contact of CMS paper MLG-23-001. The first joint paper between the ML group and the offline and computing group to systematically study the performance of ML computing. CMS-PAS-MLG-23-001 released in September 2023; paper to be submitted to Computing and Software for Big Science.
- Led the study on porting classical domain (non-ML) algorithms into as-a-service. Successfully demonstrated that this approach can run on the GPUs for the high-level trigger, and potentially save the GPU resources by more than 40%
- Collaborating with ATLAS colleagues and working on porting ML and non-ML-based track reconstruction algorithms to as-a-service, to accelerate event reconstruction
- Prepared SONIC tutorials; providing technical support for new postdocs and students

- Jan. 2021 - Present

**Semi-supervised graph neural network for pileup mitigation**

- Collaborating with computer scientists and leading the study on developing semi-supervised graph-neural-network models to train on charged particles for pileup mitigation, which allows the training on real collision data directly, without dependence on simulation
- Methodology demonstration paper published in Eur. Phys. J. C 83 (2023). Currently leading the algorithm integration into CMS software and performance benchmark in full simulations and real data
- Collaborated with computer scientists to develop domain adaptation algorithms on graphs and study the performances on the HEP dataset. Paper accepted by ICML

## PhD research

- Apr. 2019 - Sep. 2019

**Installation of the CMS Hadronic Calorimeter (HCAL) Barrel Upgrade**

- Test and installation of the read-out modules and electronics for the barrel upgrade of the HCAL subdetector.

- Oct. 2018 - Nov. 2020

**DeepMET development and  $W$  recoil studies**

- Development and calibration of the deep-learning-based missing transverse momentum estimator (DeepMET). It achieves the best MET performance, with 10-20% better resolutions than PF and Puppi MET, and more robustness against pileup.
- Standalone technical paper in preparation. Also part of the CMS Full Run-2 MET paper (JME-22-001) currently under review.
- Application of DeepMET in the recoil measurement of the  $W$  boson, to reduce the uncertainties of the  $W$  mass measurement from the  $W$  transverse momentum spectra.

- Jan. 2018 - Ongoing

**Search for new particles in the  $W\gamma$  final state**

- Search for new particles in the  $W\gamma$  final state, where  $W$  decays leptonically, using full Run-II data collected by CMS.
- Work on the parametric modelings of signal and backgrounds, systematic uncertainty evaluations, and limit settings.
- Analysis CADI EXO-21-017. Pre-approved and currently under ARC review.

- Oct. 2016 - Feb. 2019

**Search for emerging jets**

- Search for the “dark QCD” model with the “emerging jet” signatures, using 2016 data collected by CMS.
- Led the study of “emerging jet” tagging variables, event selection criteria, background estimations, and systematic uncertainties.
- Jan. 2016 - Jan. 2018

#### **Radiation damage study of plastic scintillators**

- Study of scintillator light yields for different materials, using cosmic ray, radioactive sources, and spectrophotometer.
- Study of the HCAL Endcap radiation damage modeling, including total dose, dose rate, temperature dependence, and other effects during recovery.

### **SEMINARS, CONFERENCE TALKS, POSTERS**

- *Pushing the Precision Boundary of the Standard Model with Modern Tools*  
**Colloquium** of Department of Physics and Astronomy at Texas Tech University, Lubbock, Texas, USA, February 2024
- *Low Pileup fiducial measurements in CMS*  
**Talk** at the LHC electroweak precision subgroup meeting, CERN, Switzerland, November 2023
- *DarkQuest*  
**Seminar** at Karlsruhe Institute of Technology, Karlsruhe, Germany, July 2023
- *DarkQuest - Probing dark sector with a proton fixed-target experiment at Fermilab*  
**Invited talk** presented at the 2023 Aspen Conference for Physics, Aspen, Colorado, USA, March 2023
- *Introduction to Graph Neural Networks*  
**Seminar** at the Fermilab lab-wide AI meetings, Batavia, Illinois, USA, November 2022
- *Exa.TrkX inference as-a-service*  
**Talk** presented at the Fast Machine Learning Workshop, Dallas, Texas, USA, October 2022
- *DarkQuest - Probing dark sector with a proton fixed-target experiment at Fermilab*  
**Seminar** presented at the SYSU-PKU Particle Physics Forum, Virtual, May 2022.
- *Semi-supervised graph neural network for pileup noise removal*  
**Seminar** presented at the University of Washington Machine Learning Forum, Virtual, May 2022.
- *DarkQuest - Searching for light dark matter with a proton fixed-target experiment at Fermilab*  
**Talk** presented at the 2022 Phenomenology Symposium, Pittsburgh, Pennsylvania, USA, May 2022.
- *Semi-supervised machine learning for pileup per particle identification with graph neural networks*  
**Talk** presented at the 2021 BOOST workshop, Virtual, August 2021.
- *Searching for light dark matter at Fermilab’s proton-fixed target experiment: DarkQuest*  
**Talk** presented at the 2021 Particle Physics and Cosmology Workshop, Norman, Oklahoma, USA, May 2021.
- *Search for emerging jets and other long-lived states with the CMS experiment*  
**Seminar** presented at Experimental particle physics seminars of the University of Pennsylvania, Philadelphia, Pennsylvania, USA, November 2019.
- *Search for new particles decaying into a jet and an emerging jet*  
**Poster** presented at the 2019 Winter LHCC meeting Students Poster Session, CERN, Geneva, Switzerland, February 2019.

- *Search for New Physics with Emerging Jets*  
Talk presented at the 2018 APS April Meeting, Columbus, Ohio, USA, April 2018.

## TEACHING EXPERIENCE

- *Lead Facilitator*, Top mass measurement long exercise of CMS Data Analysis School (DAS) 2022, Fermilab, January 2022
- *Lead Facilitator*, Inference Hands-on session of the CMS Machine Learning Town Hall, CERN, July 2021
- *Facilitator*, Search for structures in the  $J/\psi J/\psi$  mass spectrum long exercise of CMS DAS 2024, Fermilab, January 2024
- *Facilitator*, Machine Learning Hands-on Advanced Tutorial (HATS) of the LHC Physics Center (LPC) HATS, Fermilab, July 2021
- *Facilitator*,  $HH(b\bar{b}b\bar{b})$  long exercise of CMS DAS 2021, Fermilab, January 2021
- *Lead Facilitator*, MET short exercise of CMS DAS and LPC HATS, Fermilab, January 2021, July 2021, January 2022, August 2023, January 2024
- *Teaching Assistant*, PHYS276 Electronics Lab, 3 sessions, about 40 students, Maryland, Fall 2015
- *Teaching Assistant*, Introduction to Electromagnetism (physics major), about 90 students, USTC, Spring 2015

## SCHOLARSHIPS

- National Endeavor Scholarship, USTC, 2013
- Outstanding Student Scholarship (First Class), USTC, 2013, 2014, 2015
- Industrial Responsibility Scholarship, USTC, 2012

## ORGANIZED ACTIVITIES

- Organizer, LPC Physics Forum, 2022 - Present
- Local Organizer, CERN-Fermilab Collider Physics Summer School, 2022