ALI EREN SIMSEK

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PROFESSIONAL RESPONSIBILITIES & OUTREACH

CMS NPS (SUS/SUSY) L3 MC&I,T Convener — Trigger
TFPX Assembly Huddle Convener — CMS Inner Tracker
CERN SPS H2 & H4 Beamline — Simulation Expert and Key Contact
2025 DC Trip Organization for HEP Advocacy (Co-Organizer) — UAEC Government Relations
Government Relations (Co-Chair) — Users and Associates Executive Committee (UAEC) at Fermilab
Science Mission, Ad hoc (Co-Chair) — Users and Associates Executive Committee (UAEC) at Fermilab
QuarkNet Program — Ph.D. Physicist & Faculty Member
Fermilab CMS Data Analysis School (DAS) — Facilitator/Educator
Fermilab PURSUE Program — Final Reviewer

PROFESSIONAL EXPERIENCE

Postdoctoral Research Assoc. — Catholic University Of America, USA
Graduate Researcher — Fermilab, USA
Graduate Researcher — CERN, Switzerland
Mathematics Teacher — Ministry of Education, Turkiye
Software Developer — 2 Adam Software & Technology, Turkiye

FELLOWSHIPS, GRANTS & AWARDS

Turkish Energy, Nuclear and Mining Research C. [TENMAK] Fellowship - CERN
TUBITAK Fellowship - Fermilab
CMS HGCAL Group Fellowship - CERN
Turkish Atomic Energy Authority [TAEK] Fellowship - CERN
Turkish Atomic Energy Authority [TAEK] Fellowship - CERN

SELECTED SEMINARS, COLLOQUIUMS, & TALKS

Phenomenology Symposium at University of Pittsburgh (USA) *19-21 May 2025*
Probing new physics with dedicated data streams at CMS

Physics Colloquium at Catholic University of America (USA) *11 Oct 2023*
CERN CMS Experiment: Revealing Exotic Physics through Dijet Resonance Search

Seminar at the University Of Alabama (USA) *31 Mar 2022*
Dijet Resonance Searches & CMS Phase-II Upgrades

Seminar at the University Of Virginia (USA) *06 Jan 2021*
Dijet Resonance Searches & CMS Phase-II Upgrades

APS April 2021 Meeting *18 Apr 2021*
Dijet Resonance Search with Calo-Scouting technique

8th Beam Telescopes and Test Beams Workshop Georgia (co-author) *27-31 Jan 2020*
SPS H2 Beam Line Simulation: Energy Loss and Material Impact at HGCAL Test Beam

SELECTED PUBLICATIONS

[1] "Search for dijet resonances with data scouting in proton-proton collisions at $\sqrt{s} = 13$ TeV," CERN, Geneva, Tech. Rep., 2025. [Online]. Available: https://cds.cern.ch/record/2928059.

[2] "Timing performance of the cms high granularity calorimeter prototype," *Journal of Instrumentation*, vol. 19, no. 04, P04015, Apr. 2024, ISSN: 1748-0221. DOI: 10.1088/1748-0221/19/04/p04015. [Online]. Available: https://arxiv.org/abs/2312.14622.

[3] "Performance of the cms high granularity calorimeter prototype to charged pion beams of 20-300 gev/c," 2023. DOI: 10.1088/1748-0221/18/08/P08014. arXiv: 2211.04740 [physics.ins-det]. [Online]. Available: https://arxiv.org/abs/2211.04740.

[4] "Response of a cms hgcal silicon-pad electromagnetic calorimeter prototype to 20–300 gev positrons," *Journal of Instrumentation*, vol. 17, no. 05, P05022, May 2022, ISSN: 1748-0221. DOI: 10.1088/1748-0221/17/05/p05022. [Online]. Available: http://dx.doi.org/10.1088/1748-0221/17/05/P05022.

[5] "The daq system of the 12,000 channel cms high granularity calorimeter prototype," *Journal of Instrumentation*, vol. 16, no. 04, T04001, Apr. 2021, ISSN: 1748-0221. DOI: 10.1088/1748-0221/16/04/t04001. [Online]. Available: http://dx.doi.org/10.1088/1748-0221/16/04/T04001.

[6] "Construction and commissioning of cms ce prototype silicon modules," *Journal of Instrumentation*, 2020. arXiv: 2012.06336. [Online]. Available: https://arxiv.org/abs/2012.06336.

[7] "Search for dijet resonances using events with three jets in proton-proton collisions at $\sqrt{s} = 13$ tev," *Physics Letters B*, vol. 805, p. 135 448, Jun. 2020, ISSN: 0370-2693. DOI: 10.1016/j.physletb.2020.135448. [Online]. Available: http://dx.doi.org/10.1016/j.physletb.2020.135448.

[8] "Search for high mass dijet resonances with a new background prediction method in proton-proton collisions at $\sqrt{s} = 13$ tev," *Journal of High Energy Physics*, vol. 2020, no. 5, May 2020, ISSN: 1029-8479. DOI: 10.1007/jhep05(2020)033. [Online]. Available: http://dx.doi.org/10.1007/JHEP05(2020)033.

Full Publication List & Citation: *link to Inspire-HEP*

INTERNAL PAPER REVIEWS (CMS ARC/IRC)

EXO-24-039 (ARC):	Search for paired dijets with b-jets in the final state
SUS-23-016 (IRC):	Search for new physics in the monophoton final state
EXO-22-026 (IRC):	Searching for new physics detecting anomalies in jets

EDUCATION

Ph.D. in Applied High-Energy and Particle Physics — Cukurova University, Turkiye
M.Sc. in Applied High-Energy and Particle Physics — Cukurova University, Turkiye
B.Sc. in Physics — Cukurova University, Turkiye
Associate Degree in Finance — Anadolu University, Turkiye
Youth Software Engineering Program (4-years) — Nurten Yetimoglu, Turkiye

RESEARCH EXPERIENCE

L3 Convener of the NPS MC&I,T Group

*As the L3 Trigger Convener for the **N**ew **P**hysics with **S**tandard Objects (NPS) group, I lead the design, optimization, and validation of trigger strategies to support a wide range of new physics searches. I work in close coordination with analysis teams to ensure trigger coverage aligns with physics goals and detector constraints. I also developed a robust, scalable trigger monitoring system—applicable across CMS groups (e.g., EXO, NPS, HIG) — The final goal is to run autonomously using effective ML techniques for real-time performance evaluation.*

CMS Inner Tracker Silicon Module Production for CMS Phase II Upgrades
I serve as one of the conveners of the TFPX Assembly Meetings, facilitating the assembly activities across five universities: Catholic University of America (CUA), Purdue, University of Nebraska-Lincoln (UNL), Boston University, and Vanderbilt University. At the state-of-the-art Clean Room Facility (ISO-8 Level) at CUA, one of only four such assembly factories in the U.S. for the TFPX module production, I play a pivotal role in producing silicon sensor modules for the Inner Tracker Forward Pixel detector, a crucial component of the CMS Phase II upgrades. These upgrades significantly enhance the detection capabilities of the Compact Muon Solenoid experiment at CERN. I oversee a multidisciplinary team, including a lab technician, two graduate students, and various undergraduate interns.

Advancement in CMS Tracker Monitoring Tool
I served for the advancements in the Tracker Data and Performance Monitoring tool. My responsibilities include enhancing the existing functionalities of this tool, ensuring optimized monitoring of the CMS tracker's performance and data. As the key contact for this task, I coordinate and manage the troubleshooting and development processes, ensuring the tool remains a reliable and effective resource for our data analysis needs.

Search for High-Mass Dijet Resonances in Proton-Proton Collisions at $\sqrt{s} = 13.6$ TeV
In this project, I serve as a mentor of a graduate student undertaking a comprehensive investigation into dijet resonance in proton-proton collision data collected from CERN's Compact Muon Solenoid (CMS) Detector operating at a collision energy of $\sqrt{s} = 13.6$ TeV. My role involves providing guidance from the initial phases of research design through to the eventual publication, ensuring rigorous data analysis and interpretation within the high-energy physics domain.

Dijet Resonance Search With The Calo-Scouting Technique Using 117 fb^{-1} Of Run-2 Data at $\sqrt{s} = 13$ TeV
Conducted a search for new resonances potentially linked to phenomena such as Dark Matter, Grand Unified Theories, and Extra Dimensions, utilizing the calo-scouting technique. This analysis set the most stringent limits to date on the universal coupling g'_q between a leptophobic Z' boson and quarks. The results were presented at major international conferences, including Moriond and Pheno, published within the CMS collaboration, and are currently being prepared for submission to JHEP.

Cosmic Ray Detector for Educational Outreach and Muon Lifetime Studies
I designed and constructed a cosmic ray detector utilizing four photomultiplier tubes (PMTs) to identify and measure the lifetime of cosmic muons. This project served a dual purpose: to conduct high-precision measurements of muon decay and to engage high school and undergraduate students in hands-on research within high-energy physics, fostering a deeper interest in the field and cultivating the next generation of physicists.

Development of a Basic Particle Detector with Visual Tracking for Educational Outreach
I developed a detector system combining the principles of Geiger tubes and a cloud chamber to detect and visually track alpha, beta, and gamma particles simultaneously. This innovative approach enables high school and undergraduate students to both observe the movement of these particles with the naked eye and collect meaningful data for further analysis. The project's educational focus provides a unique opportunity for students to engage directly with particle physics phenomena, fostering a deeper understanding of radiation and particle interactions through real-time observation and data collection.

Energy Loss and Material Impact at HGCAL Test Beam - SPS H2 Beamline Simulation
I investigated the energy loss observed in data from the October HGCAL Test Beam studies. Using on-site measurements and producing a highly realistic simulation of the SPS-H2 Beamline via the Geant4 Beamline tool. I studied the effects of both vacuum and air regions and material interactions with beam instrumentation devices like scintillators and wire chambers. This in-depth approach not only enhanced the calibration of the HGCAL detector by comparing test-beam data with more realistic Monte Carlo (MC) data, but it also prompted changes to the beamline, facilitating cleaner beam delivery by the H2 Beamline experts and technicians. Furthermore, I extended this work for the FASER detector, improving their simulation accuracy by 20%, incorporating this realistic beamline simulation into the FASER's MC simulation.

SPS H4 Full Beamline Simulation for CMS ECAL Test-Beams
I focused on extending the successful methodologies developed from the previous HGCAL test beam studies to evaluate the material effects on the H4 Beamline for the Electromagnetic Calorimeter (ECAL). In this comprehensive analysis, various factors are considered, including material effects, Bremsstrahlung phenomena, synchrotron radiation, multiple scattering, and even the impact of humidity and temperature. Using the data obtained from in-situ visits, a comprehensive and accurate simulation of the H4 Beamline was developed, resulting in the most precise Monte Carlo (MC) model of the actual physical processes taking place during the test beam.

High Granularity Calorimeter (HGCAL) Muon/MIP Calibration with Test Beam Data
The primary focus was to calibrate each channel of the HGCAL detector using the Minimum Ionizing Particle (MIP) constant. This crucial constant converts the ADC value into the energy scale of MIP, displaying the energy deposition in the calorimeter in MIP equivalents. By reducing noise contributions on ADC spectra, the calibration process effectively refines the electronic response to MIPs for each module, chip, and channel. This project also verified the possibility of performing MIP Calibration with hadronic particles like pions, offering an alternative to traditional muon-based calibration methods.

High Granularity Calorimeter (HGCAL) Test-Beam Data Analysis
HGCAL is a new CMS sub-detector for both electromagnetic and hadronic particles. I focused on identifying and isolating hadronic and electromagnetic particles captured by the detector, while also analyzing its performance. The crucial part of this work involved discerning the hadronic and electromagnetic particles by creating a beam profile of the calorimeter data, thereby separating the particles into two distinct populations. Through this study, problematic regions were identified and reported, leading to the discovery that electrical components near the detector prototype during the test beam were causing issues. Consequently, the HGCAL group decided to take measures for the affected modules, chips, and channels, enhancing the performance and accuracy of the detector.

Troubleshooting Power Module Issues in the CMS Back-End Electronics
In this task, I worked on resolving temperature-related issues that arose in the power modules of the CMS backend electronics during the proton-proton collisions at the CMS experiment. This involved using special equipment to measure the temperature of the modules and compare them to the data from the heat sensors. Various strategies were implemented to reduce the heat, and I utilized software and systems like NATview and Telnet for management and configuration. Ultimately, a special configuration was applied as the solution for these temperature problems. The solution has been remarkably successful over the past three years.

Silicon PhotoMultiplier (SiPM) Performance Analysis and Offline Data Quality Monitoring (DQM) of the CMS Hadronic End-Cap Calorimeter

In this project, I analyzed the performance of specific sensors called Silicon Photomultipliers (SiPMs) that are used in a sub-detector of the CMS Experiment at CERN. To perform this project, I used data from cosmic rays from 2017 and proton-proton collisions from 2018. Initial studies focused on a specific part of the detector, where these new sensors were first used, and I found everything to be working well. However, we encountered some minor technical issues in some eta-phi regions of the detector due to a failure in the power supply (2018). I investigated the impact of this problem on the actual physics data and found it to be minimal. Eventually, the problem is fixed by replacing the faulty equipment during the LS2.

Performance and Background Noise Analysis of Hadronic Forward (HF) Calorimeter with 2016 CMS Data

During a major maintenance and upgrade period for the CMS experiment at CERN between 2013 and 2015 (Long Shutdown 1), necessary improvements were made to acquire data at an energy level of 13 TeV. In 2016, the CMS detector began collecting data from proton-proton collisions at this enhanced energy level for the first time. This project focused on analyzing the performance and stability of a particular sub-detector of the CMS Experiment called the Hadronic Forward (HF) Calorimeter, which is crucial for detecting certain types of particles. Specifically, I assessed the efficiency of noise filters in the HF Calorimeter using the data collected from proton-proton collisions at 13 TeV in 2016.