SHIVARAJ MULLERIA BABU

(+41) 797616696 ⋄ shivarajmb1996@gmail.com ⋄ shivaraj.mulleriababu@unibe.ch

EDUCATION

University of Bern, Switzerland *March 2021- Present*
Laboratory for High Energy Physics (**LHEP**)
PhD Experimental Neutrino Physics

Self Directed Skill Development During COVID-19 Pandemic *2019- 2021*

Central University of Karnataka *July 2017 - May 2019*
MSc Physics
Department of Physics
Aggregate 82.4%

Government College Kasaragod *July 2014 - April 2017*
Kannur University
BSc Physics
Aggregate 85.4 %

During COVID-19 Pandemic (2019 - 2021)
Skill Enhancement and Independent Research

- Advanced proficiency in scientific programming and data analysis tools (Python, ROOT) essential for Experimental Neutrino Physics.
- Conducted independent literature reviews on neutrino physics and calibration systems to prepare for my PhD project.

CARRIER OBJECTIVE

Curious and challenge-driven, my path from applied physics to theoretical physics, and finally to experimental neutrino physics, has shaped me into a versatile scientist. I excel in dynamic, interdisciplinary settings where I can leverage my diverse skills, learn continuously, and embrace new challenges. I'm eager to contribute to cutting-edge fields and seek opportunities that drive innovation while supporting my personal and career growth.

TECHNICAL STRENGTHS

Programming Languages	Python, C++, Java*, HTML5*, CSS*, SQL*
Frameworks & Libraries	TensorFlow, Pandas, Tkinter
Version Control	Git, GitHub
Scientific Computing Tools	ROOT, PyROOT, Geant4*, Fluka-Flair
Software for Documentation & Design	LaTeX, Adobe Photoshop, Clip Studio Paint, Microsoft Office Suite
Operating Systems	Linux, Windows
Hardware & Instrumentation	- Class 4 UV Laser operation, Laser test stands. - Hands on Experience with High-voltage and Low-voltage equipments(2V to 100kV) - Cryogenic systems (Liquid Argon and Nitrogen) - MForce Mcode/TCP for motor control and automation - Scintillating and wavelength shifting materials - Trigger modules, Trigger signal processing - Temperature, Photon and Proximity Sensors/Switches - Particle Detector technology and Calibration systems - Resistive Plate Chambers (RPCs)

** Basic working Knowledge*

LANGUAGE SKILLS

Kannada	Native language
English	Fluent
Malayalam	Fluent
Other Known Languages	Thamil(Conversational Level) German (A level)

EXPERIENCE

University of Bern April 2021- Present

Development and Production of UV Laser Calibration System

- Developed, produced, and assembled the *UV Laser Electric Field Calibration system* for the Short Baseline Near Detector (SBND) at Fermilab to measure and Calibrate Electric Field inside the Liquid Argon Time Projection Chamber (LArTPC).
- Utilized MForce Mcode/TCP to develop an automated motor control system for vacuum-sealed feedthrough. This involved writing custom scripts and optimizing motor performance for calibration task.
- Implemented software and interface for controlling the calibration system units remotely.
- Worked on system integration and testing to ensure proper functionality of the calibration system.
- Participated in the Assembly, test and operation of 2X2 modules a prototype of Deep Underground Neutrino Detector(DUNE)- Near Detector.
- Worked on Machine Learning project, *Identifying Muons in LArTPC using ML techniques* focused on identifying muon tracks within a Liquid Argon Time Projection Chamber (LArTPC) using Tensorflow with simulated data.

· Managing the argoncube website on behalf of University of Bern for the ArgonCube Collaboration.

Fermi National Accelerator Laboratory - FNAL April 2023 - October 2024
Detector Hardware Installation, Testing, Software Development, and Data Analysis

· Led the production, procurement, operation and assembly of the UV Laser calibration system at the University of Bern, and managed its installation and electrical setup at FNAL.
· Worked with complex hardware systems including cryogenic systems (Liquid Argon), high-voltage and low-voltage equipment (ranging from $2V$ to $100kV$), Class 4 UV lasers, sensors, and trigger modules with processing.
· Conducted system testing and the initial calibration run to optimize the performance of detector subsystems and ensure accurate measurement of the electric field inside the Liquid Argon Time Projection Chamber (LArTPC) for neutrino detection.
· Developed automation scripts and interfaces to operate the subsystem via a remote server, streamlining operations for the calibration system.
· Performed in-depth data analysis on *Neutrino Interactions in Liquid Argon in the Charged Current (CC1p0) channel*, analyzing MicroBooNE detector data from Runs 1-5 ($2015 - 2020$) to extract neutrino interaction cross-sections.
· Demonstrated proficiency in managing large datasets, applying advanced statistical techniques, optimizing event selection, and visualizing data to derive meaningful insights into neutrino interactions and cross-section measurements.

Indian Institute of Technology, Guwahati December 2018 - April 2019
MSc Project

· Project titled *Study of Matter-Antimatter Asymmetry through Leptogenesis*, supervised by Prof. P. Poulose.
· Theoretical studies focused on the connection between neutrino mass generation models and leptogenesis.
· Explored how the lepton asymmetry generated via leptogenesis translates into baryogenesis, offering a theoretical explanation for the matter-antimatter asymmetry in the universe.
· This study deepened my understanding of the relationship between particle physics and cosmology, particularly in the context of fundamental concepts like mass generation and the origin of the universe's matter dominance.

Manipal Centre for Natural Sciences- MAHE June 2018- August 2018
Summer Research Internship

· Conducted theoretical research on *Neutrino oscillation and quantum entanglement*, focusing on the interplay between quantum mechanics and particle physics under the guidance of Dr. Cheng Yang Lee
· Derived probability relations for Neutrino oscillation with neutrinos in an entangled state with muons, contributing to the understanding of quantum-level neutrino behaviour.
· Developed deeper insights into the quantum mechanical principles underlying particle interactions, advancing the theoretical framework for neutrino physics.
· Secured third place in the Poster Presentation competition at Manipal Academy of Higher Education.

India Based Neutrino Observatory, IICHEP- TIFR May 2018 - June 2018
Summer Research Internship

· Gained hands-on experience with the mini-ICAL detector, studying its functionality and operational procedures under the Guidance of Dr. Satyanarayana Bheesette and Dr. Deepak Samuel.
· Participated in the fabrication and installation of Resistive Plate Chambers (RPCs), contributing to the development and assembly of the detector.

· Performed data analysis using ROOT, enhancing understanding of detector performance and event reconstruction.

ACADEMIC ACHIEVEMENTS

- Recipient of European Commission's **Marie Sklodowska-Curie ITN early stage fellowship** to pursue the PhD.
- Qualified all India level **GATE 2020** exam in Physics for Research/ Higher studies in India.
- Recipient of **JN Tata endowment scholarship award for Higher education** in the year 2020.
- Recipient of **Central Sector Scholarship** awarded by MHRD, Govt. of India.
- Got third position in Poster presentation competition at Manipal Academy of Higher education.

CONFERENCES AND SCHOOLS

- Presented at MicroBooNE Collaboration Meeting **Talk: Differential cross sections in longitudinal and transverse muon & proton momenta** Fermilab, Chicago, USA, 30 Sep. 2024 to 03 Oct. 2024.
- Presented at LIDINE 2024: LIght Detection In Noble Elements Conference **Talk: The UV Laser Calibration System for measuring the Electric field in the SBND** Sao Paulo, Brazil, August 26 -28 2024.
- Presented at SBND Collaboration Meeting **Talk: UV Laser Calibration system - Assembly and Installation at SBND** Sao Paulo, Brazil, December 04 - 08, 2023.
- Presented at New Perspective 2023 Conference **Talk: The UV Laser Calibration System for measuring the electric field in the SBND detector** Fermilab, USA, June 26-27, 2023.
- Presented at SBND Collaboration Meeting **Talk: SBND TPC Calibration Laser System Status.** Univ. of Texas in Arlington, USA June 12 - 16, 2023.
- Presented at New Perspective 2022 Conference, **Talk: The Idea - UV Laser Calibration System for measuring the Electric field in the SBND-LArTPC"** held at Fermilab, USA from June 16-22, 2022.
- Participated **'Bern Winter School on Machine Learning'** at Murren, Switzerland, from January 24, 2022 to 28 January, 2022.
- Participated in the school 'Invitation to Particle Cosmology' conducted by Manipal Centre for Natural Sciences and Harish- Chandra research institute, Allahabad. at MCNS from September December 03, 2018 to December 08, 2018.

OTHER ACHIEVEMENTS

- Trained and disciplined in National Cadet Corps (NCC) at Government College Kasaragod.
- Received NCC 'C' certificate with 'A' grade in Army wing and NCC 'B' certificate with 'A ' grade.
- Attended Prestigious Republic Day Camp at New Delhi in the year 2016.
- Attended Prestigious Indian Military Academy attachment Camp at Dehradun in the year 2016.
- Won 2nd position in Kerala School sports meet district level Wrestling freestyle- 74 kg category.

REFERENCES