Md Forhad Hossain

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Overview

Visiting Graduate Research Assistant at Fermi National Accelerator Laboratory, collaborating on Experiments E906/SeaQuest and E1039/SpinQuest. SeaQuest focuses on nucleon quark and antiquark structure, while E1039/SpinQuest studies nucleon spin physics. I am responsible for data analysis and the maintenance of trigger detectors. This involves using NIM electronics for detector optimization and debugging FPGA triggers. I have previously served as an FSPA officer, representing young physicists at Fermilab.

Research Experience

• ***Leading the trigger-detector effort for the SpinQuest Experiment at Fermilab*** (May 2018 - Present) Advisor: Dr. Stephan Pate, Dr. Vassili Papavassiliou, New Mexico State University, Las Cruces, NM

Summary: I have conducted data analysis and performed hardware installation and systems testing of the trigger hodoscopes for the SpinQuest proton-proton/neutron scattering experiment at Fermilab. Additionally, I developed software to optimize high-voltage PMTs and set up triggers using NIM electronics. These tasks involved collaboration with scientists from various DOE-funded US national labs and universities.

• ***Analyzing SeaQuest Experimental Data*** (Feb 2022 - Present) Advisor: Dr. Stephen Pate, New Mexico State University, NM

Summary: Quarks, which combine to form composite particles like the proton, may or may not have alignment within the proton. My work is to measure this alignment. To accurately understand the alignment, it is necessary to ensure that the measuring tool is unbiased. I have developed a novel Iterative Unfolding technique that can correct any errors in measuring this alignment. In addition to data unfolding, I use a machine learning model called 'Reweighting with Boosted Decision Trees' to adjust the Monte Carlo data to match the experimental data.

Education

Ph.D. in Physics, New Mexico State University, Las Cruces, NM, USA — 2016 - Ongoing
Supervisor: Dr. Stephen Pate

M.Sc. in Physics, New Mexico State University, Las Cruces, NM, USA — May 2021
GPA: **3.64/4.0**, *Supervisor:* Dr. Stephen Pate

M.Sc. in Physics, Jagannath University, Dhaka, Bangladesh — 2012 - 2014
Grade: **3.74 out of 4.00**

B.Sc. in Physics, Jagannath University, Dhaka, Bangladesh — 2006 - 2012
Grade: **3.75 out of 4.00**

Journal Publications

• Lists of SeaQuest and SpinQuest collaboration papers and conference talks are available on my Google Scholar profile at:
https://scholar.google.com/citations?user=KOygUhMAAAAJ&hl=en.

Collaborations

- ***SpinQuest***
- ***SeaQuest***

Professional Memberships

- ***American Physical Society (APS)***

Technical Skills

- ***Software and Programming Language***: bash, C++, Python, ROOT.
- ***Operating system***: Windows, Linux, Mac
- ***Version Control System***: GitHub, CVS
- ***Special Courses and certifications***: 1) U.S. Particle Accelerator School (USPAS) 2) DANCE/CoDaS computational and data science software training 3) The 2023 National Nuclear Physics Summer School (NNPSS)

Scientific Meetings

- ***Invited Talks***:

1) New Perspective 2020(2.0), August 24-25, 2020: Systematic Study of Spectrometer-Induced Azimuthal Asymmetries for SpinQuest
2) 2020 Winter SpinQuest Collaboration Meeting, March 05-06, 2020: NIM Trigger and Hodoscope Update
3) Fall SpinQuest Collaboration Meeting, October 24-25, 2019: Hodoscope & NIM Trigger Update

- ***Presentations***:

1) 2023 Fall Meeting of APS DNP and JPS : Angular Distribution of Dimuons from Drell-Yan Production in p+Fe Interactions at 120 GeV Beam Energy
2) New Perspectives, 26-27 June 27 2023, Fermi National Accelerator Laboratory, Illinois, Chicago, USA: Iterative Unfolding of the Angular Distribution of Drell–Yan Production in p+Fe Interactions at 120 GeV Beam Energy
3) Fall 2022 Meeting of the APS Division of Nuclear Physics, October 27-30 2022: Measurement of the Angular Distribution of Drell-Yan Production in p+Fe Interactions at 120 GeV Beam Energy
4) New Perspectives, 16-19 August 2021, Fermi National Accelerator Laboratory, Illinois, Chicago, USA: Measurement of the Angular Distribution of Drell-Yan Production in p+Fe Interactions at 120 GeV Beam Energy
5) 2020 Fall Meeting of the APS Division of Nuclear Physics, October 29-November 1, 2020: Systematic Study of Potential False Azimuthal Asymmetries in SpinQuest
6) Summer 2019 USPAS Session: 350 MHz Single Spoke Resonator design and optimization for β =0.45 7) 52nd Fermilab Users Organization Annual Meeting, Batavia, IL, USA: Commissioning Trigger for the SpinQuest/E1039 Experiment (**Poster**).

Job Experience

Graduate Research Assistant May 2018 - Present (5 years +)
New Mexico State University, Las Cruces, NM

- Conducted simulation tasks and developed the analysis framework for my thesis project.
- Served as an expert on the trigger detector system in the ***SpinQuest Experiment.***

Graduate Teaching Assistant Aug 2016 - May 2018 (1 year 10 months)
New Mexico State University, Las Cruces, NM

- Instructed introductory physics laboratory classes and provided tutoring as a Graduate Teaching Assistant.
- Played a role in networking and system administration.

Leadership Roles

- Judge at the Southwestern New Mexico Regional Science and Engineering Fair March 2017
- FSPA Officer at the Fermilab Student and Postdoc Association (FSPA) Oct 2021, Oct 2022
- Managed the schedule for the Users' Executive Committee visits to Congress in Washington, D.C. March 2021

Honors and awards

2022-2023	$4000 Merit-based Enhancement Fellowships.
2021-2022	$1600 Scholarship for outstanding work as Ph.D. student.
2021-2022	$2962 IA HEERF PHYS LEADS 2025.
2020-2021	$1600 Scholarship for outstanding work as Ph.D. student.

Media Appearance

- NMSU continues research on particle physics with renewed DOE grant July 09, 2022
- NMSU physics department awarded $1.26 million DOE grant June 23, 2018