RUPESH SILWAL, PhD

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PROFESSIONAL EXPERIENCE

Senior Postdoctoral Researcher, *Massachusetts Institute of Technology, Cambridge, MA* Fall 2014-present

Postdoctoral Researcher, *Massachusetts Institute of Technology, Cambridge, MA* Fall 2012-Summer 2014

Postdoctoral Researcher, *University of Virginia, Charlottesville, VA* Summer 2012

EDUCATION

Ph.D., Experimental Particle Physics, *University of Virginia, Charlottesville, VA* May 2012

B.A., Physics, *Lawrence University, Appleton, WI* May 2006

SKILLS

- Data Acquisition and Analysis
- Simulation & Modeling
- Analytical and Numerical Techniques
- Scientific Communication

PROGRAMMING LANGUAGES

C/C++, Python, SQL, Unix Shell, HTML, Mathematica, Fortran, ROOT, Geant4, Latex

EXPERIENCES

Data Analysis

- Analyzed large data sets (terabytes) collected at Jefferson Lab to extract effects of a few parts in a million to a few parts in a billion.
- Designed, wrote and implemented software filters to clean raw data. These filters imposed appropriate quality criteria, and flagged data that did not meet these criteria.
- Quantified variations in data quality, and significant changes in the values and distributions of variables in the data collected over a long period of time.
- Validated that the analysis technique and tools generalized to the entire data set.
- Developed C++ based software to generate 'look-alike' data sets, and used them to test the data analysis software, and study various effects and biases present in the experimental data.
- Developed and implemented software to select representative data sample, perform relevant analysis, and feed the results of this analysis to a feedback system in real time in order to improve data quality.
- Performed multivariate regression analysis, and extracted coefficients to identify and quantify both random and controlled effects in the data.

Data Acquisition

- Optimized experimental configuration to minimize data contamination, and achieve homogeneity of data collected over long duration.
- Quantified the quality of data collection devices, and ensured that only devices that did not affect the data quality adversely were used for data collection.
- Incorporated various data digitization devices into the data acquisition system, and customized the data acquisition system software to store data from these devices into appropriate storage devices.
- Developed various data acquisition devices, and incorporated them to run automatically and synchronously with the existing data acquisition system during data collection.

- Ensured efficient data collection by testing and quantifying the data acquisition systems' dead-time, data transfer rate and efficiency, and the synchronization among various data acquisition sub-systems.
- Maximized experimental run-time with prompt diagnosis and resolution of intermittent issues with the data acquisition software and hardware systems during experiments.

Programming

- Augmented existing C++ based Monte Carlo simulation by writing new classes.
- Updated statistical data analysis and visualization software written in C++ and Python as needed for various experiments.
- Developed and implemented C/C++ based software to run stand-alone processes, and set them up to run on cue from the data acquisition system.
- Customized C/C++ based software to inject data from different experimental sub-systems into the data stream.
- Wrote and customized Unix shell and XML scripts to run large-scale data analysis and simulations on Jefferson Lab supercomputer cluster.
- Customized Python scripts to pull data from SQL database, summarize and extract desired parameters from data in the form of graphs and tables, and publish them on webpages accessible to the experimental collaboration.

Simulation and Modeling

- Developed Mathematica based simulation to model the propagation of laser light through electro-optic crystals and measure it using photodiode arrays.
- Customized Monte Carlo simulation in C++ for scattering of charged particles, their transport through magnetic spectrometers, and detection in various detectors.
- Developed C++ based classes to reconstruct the track of charged particles from the point of detection to the scattering vertex.

Hardware-Software Interface and Control

- Developed software to remotely control and automate the operation of particle detector test systems and perform controlled excursions of the electron beam.
- Implemented an automated feedback system that monitored the quality of the electron beam and made appropriate adjustments to improve the beam quality.
- Customized software to remotely operate optical elements on a laser table.

Communication

- Collaborative authorship of 8 peer-reviewed scientific publications, and sole author of multiple technical reports, abstracts, etc.
- Numerous technical talks presented at international conferences and seminars.
- Routinely presented technical summaries in a manner accessible to both students and people of different expertise and background in the experimental collaboration.

SELECTED PUBLICATIONS

- D. Wang et al. [PVDIS Collaboration], Measurement of parity-violating asymmetry in electron-deuteron inelastic scattering, Phys. Rev. C91, (2015) 4, 045506.
- T. Allison et al. [QWEAK Collaboration], The QWEAK Experimental Apparatus, Nucl. Instrum. Meth. A781 (2015) 105-133.

- D. Wang et al. [PVDIS Collaboration], Measurement of Parity Violation in electron-quark scattering, Nature, 506, 67 (2014).
- D. Androic et al. [QWEAK Collaboration], First Determination of the Weak Charge of the Proton, Phys. Rev. Lett. 111, 141803 (2013).
- D. Wang et al. [Jefferson Lab Hall A Collaboration], Measurement of the Parity-Violating Asymmetry in Electron-Deuteron Scattering in the Nucleon Resonance Region, Phys. Rev. Lett. 111, 082501 (2013).
- S. Abrahamyan et al. [HAPPEX and PREX Collaborations], New Measurements of the Transverse Beam Asymmetry for Elastic Scattering from Selected Nuclei, Phys. Rev. Lett. 109, 192501 (2012).
- C. J. Horowitz et al., Weak Charge Form Factor and Radius of ^{208}Pb Through Parity-Violation in Electron Scattering, Phys. Rev. C 85, 032501(R) (2012).
- S. Abrahamyan et al. [PREX Collaboration], Measurement of the Neutron Radius of ^{208}Pb Through Parity-Violation in Electron Scattering, Phys. Rev. Lett. 108, 112502 (2012).
- Z. Ahmed et al. [HAPPEX Collaboration], New Precision Limit on the Strange Vector Form Factors of the Proton, Phys. Rev. Lett. 108 102001 (2012).
- Rupesh Silwal and John R. Brandenberger, Hyperfine structure in the $4p^5 5d$ states of ^{83}Kr, Phys. Rev. A 73, 032508 (2006).

SELECTED PRESENTATIONS

- First results from QWEAK, The Sixth Workshop on Hadron Physics in China and Opportunities in the US, Lanzhou, China, July 2014.
- Probing the Strangeness content of the Proton via Precision Parity-Violating Electron Scattering, Seminar, University of Alabama-Physics, Tuscaloosa, AL, August 2012.
- Probing the Strangeness content of the Proton and the Control of Beam Systematics in Precision Parity-Violating Electron Scattering Experiments, Lunch Seminar, Laboratory for Nuclear Science - Massachusetts Institute of Technology, Cambridge, MA, August 2012.
- Measurement of Nucleon Strange Form Factors at High Q^2 by the HAPPEX-III Collaboration, 2011 Fall Meeting of the American Physical Society-Division of Nuclear Physics, East Lansing, MI, October 2011.
- HAPPEX-III Instrumentation and Systematic Errors, 2011 April-May Meeting of the American Physical Society, Anaheim, CA, May 2011.
- Measurement of Nucleon Strange Form Factors at High Q^2 by the HAPPEX-III Collaboration, Nuclear Physics Seminar, University of Virginia-Physics, Charlottesville, VA, March 2010.
- Hyperfine structure in the $4p^5 5d$ states of ^{83}Kr, The Symposium on Undergraduate Research, American Physical Society-Division of Laser Science, Tucson, AZ, October 2005.