

Statement of Research Activity

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Research Overview The top priority of all particle physicists is to seek the fundamental building blocks of matter, and further understand the interaction between them. Right now, the smallest building blocks of our world are known as quarks and leptons; however, the answer to the question: *How do quarks interact inside of proton and neutrons?*

remains a mystery. The standard method to research this subject is to use electron scattering, i.e. to accelerate electrons at high momenta and collide with a hydrogen target then look at the products after the interaction.

The Thomas Jefferson National Accelerating Facility (JLab), located in Newport News, Virginia, is the world leading electron accelerating facility. It has been used by scientists around the world for research in subatomic and medical physics. In 2008, JLab was approved by the U.S. Department of Energy for a U.S.\$310 million upgrade to increase the maximum electron beam energy from 6 GeV to 12 GeV and build new experimental facilities. This upgrade is in progress with a projected completion date of 2015.

Personal Research Role The JLab 12 GeV upgrade calls for new set of experimental equipment to detect produced particles at higher momenta. In Experimental Hall C of JLab, the Super High Momentum Spectrometer (SHMS) will be installed as part of the upgrade. The essential role of the SHMS is to allow scientists to distinguish different particle types and precisely measure their momenta and angles of emission. A part of the SHMS instrumentation known as the Heavy Gas Cerenkov Detector used for particle identification is being constructed at the University of Regina with funds provided by the Government of Canada. My supervisor at the University of Regina, Dr. Garth Huber, has over 20 years of research experience at JLab, and his work on the *Charged Pion Form Factor* is one of the signature results to come from the Hall C Group at JLab. My work is to assist Dr. Garth Huber with the construction of the Heavy Gas Cerenkov Detector, and to perform experiments to test and the calibrate detectors at the early running stage.