

## **Abstract**

The Q-weak experiment at Jefferson Laboratories is a multi-collegiate effort to determine weak charges of quarks through precision measurement of parity-violating electron scattering. The Q-weak apparatus itself contains many sensors that provide crucial information such as position, time of flight, etc. of scattered particles. The Region 1 detector of the Q-weak experiment is the first detector encountered by scattered particles and is used to determine cylindrical position of charged particles using a Gas Electron Multiplication (GEM) technique via Micro-Pattern Gas Detector (MPGD) technology. The multiplied charge from these very precise detectors is discriminated from thin, individual, parallel conductive lines, processed, and collected into serialized packets using customized integrated circuits, e.g. VFAT2, created and used by CERN for the TOTEM experiment. This serialized data is then transferred to permanent data files. Once in this form, these files can then later be parsed to determine cylindrical position of particles passing through the detector.

The focus of this thesis is on the process of querying the VFAT2 ICs on the GEM detectors, collecting all of the simultaneous data packets from the VFATs into one large data file using an FPGA (Field Programmable Gate Array), and then transferring this large data file to a Linux-based computer for future parsing.