Abstract Submitted
for the APR17 Meeting of
The American Physical Society

An FPGA-based data acquisition system for directional dark matter detection[1] CHEN YANG, Boston University, CATHERINE NICOLOFF, Wellesley College, AHMED SANAULLAH, ARVIND SRIDHAR, MARTIN HERBORDT, Boston University, JAMES BATTAT, Wellesley College, BATTAT LAB AT WELLESLEY COLLEGE TEAM, CAAD LAB AT BOSTON UNIVERSITY TEAM — Directional dark matter detection is a powerful tool in the search for dark matter. Low-pressure gas TPCs are commonly used for directional detection, and dark-matter-induced recoils are ∼mm long. These tracks can be reconstructed by micropatterned readouts. Because large detector volumes are needed, a cost-effective data acquisition system capable of scaling to large channel counts (10^5 or 10^6) is required. The Directional Recoil Identification From Tracks (DRIFT) collaboration has pioneered the use of TPCs for directional detection. We employ a negative ion gas with drift speed comparable to the electron drift speed in liquid argon (LAr). We aim to use electronics developed for million-channel readouts in large LAr neutrino detectors. We have built a prototype Micromegas-based directional detector with 10^3 channels. A FPGA-based back-end system (BE) receives a 12 Gbps data stream from eight ASIC-based front-end boards (FE), each with 128 detector channels. The BE buffers 3μs of pretrigger data for all channels in DRAM, and streams triggered data to a host PC. We will describe the system architecture and present preliminary measurements from the DAQ.

[1]We acknowledge the support of the Research Corporation for Science Advancement, the NSF and the Massachusetts Space Grant Consortium.

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Date submitted: 30 Sep 2016 Electronic form version 1.4