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Networks of High-Repetition-Rate Proton Spectrometers via Low-Level Hardware Development SCOTT FEISTER, California State University, Channel Islands, JOHN T. MORRISON, Innovative Scientific Solutions, Inc., GREGORY K. NGIRMANG, National Academies of Sciences, JOSEPH SNYDER, Miami University of Ohio, Hamilton Campus, ENAM A. CHOWDHURY, The Ohio State University — Ultra-intense laser technology has the potential to serve as a compact source of energetic proton/ion beams (> MeV) for applications in science, medicine, defense, and industry. High scientific data-rates could accelerate our understanding and enable use of "big data" statistical techniques and machine learning. Currently, there is a need for high quality, single-shot proton spectra from the most-compact, highest-repetition rate laser-plasma accelerator systems (1 Hz, 10 Hz, kHz). We explore whether low-level hardware development by our own scientists may meet the needs of our field. We have prototyped a network of inexpensive, compact magnetic proton spectrometers with digital proton detection by scintillator-coupled line CCDs driven by STM32 Cortex-M7 microcontrollers. Our system is designed to scale to large numbers of simultaneous proton spectrometer diagnostics and to meet the needs of high data-rate experiments in laser-driven proton acceleration, e.g. (1) experiments capturing the correlation between single-shot proton spectra at multiple locations within the experimental chamber, (2) identifying and filtering results in real-time based on "rare" spectra due to shot-to-shot fluctuations, and (3) real-time integration with active feedback systems.

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