The need for miniaturized plasma spectrometers to measure low-energy ion and electron fluxes in the near-Earth space environment is critical and virtually ubiquitous in a wide array of Heliophysics missions. The ranges of fluxes and energies to be covered are extremely wide, in view of the wide variety of plasma conditions across the Heliophysics realm. Low-energy plasma measurements in the near-Earth space environment is extremely challenging since low-energy ⇔ small-physical–spectrometer–dimensions. The Heliophysics Division of the Goddard Space Flight Center enjoys a long and distinguished tradition of developing and flying plasma spectrometers and is well placed to provide future leadership in the area of plasma spectrometer miniaturization. The time to focus on resource minimization for workhorse plasma instruments… is now!

Our goals throughout the previous two years of development have been to modernize/update our initial miniaturized designs of the basic electrostatic analyzer (ESA) and extend this miniaturization philosophy to the instrument electronics — namely the detector and the control and data handling (C&DH) subsystems. The modernization/update of the ESA has focused on making the electro-mechanical design of the sensor more robust in order to insure that the instrument survives the rigorous launch environments encountered with CubeSat implementations. Our target design requirements for the new electronics are that the DLD and C&DH are CubeSat compatible and that the overall power dissipation of the instrument lies within 0.5-W ≤ P ≤ 1.0-W range or less and that the prototype electronics design have the option to replace the FPGA and other critical parts with high reliability and/or radiation tolerant counterparts when flight opportunities arise.

Our results to date include the completion of an updated and improved mechanical design for the miniaturized, 35-mm film canister-sized ESA and the design of a new, miniaturized 32-discrete anode delay-line detector (DLD) subsystem. Laboratory testing of a concept DLD board — where the DLD is subjected to MCP-generated injection pulse height distributions as a result of exposure of an integrated MCP-DLD system to an electron gun under vacuum conditions — is underway. Testing of a new C&DH evaluation FPGA-based board will commence by the end of November 2017.