of 25 degrees x 12 degrees each. Each sector has two SSDs: 3 of the sectors have one electron SSD and one ion SSD each; three sectors have two ion SSDs each. Ions entering the PEPSSI FOV generate secondary electrons as they pass through entrance and exit foils in the TOF section, providing 'start' and 'stop' signals detected by a microchannel plate (MCP).

Details

PEPSSI is a compact particle telescope with a time-of-flight (TOF) section and a solid-state detector (SSD; a.k.a. 'pixel') array. A mechanical collimator defines the acceptance angles for the incoming ions and electrons. The TOF section is axially symmetric; entrance and exit apertures are 6 mm wide with an azimuthal opening angle of 160 degrees. The entry apertures are covered by a thin polyimide/aluminum/polyimide foil. The stop foil is a polyimide/palladium//polyimide foil. The foils are mounted on high-transmittance stainless-steel grids. The foil thickness and composition is a compromise to minimize the energy threshold, secondary electron production, and scattering of particles in the foil while blocking UV from the direct Sun and Lyman-alpha background. PEPSSI measures the ion TOF using secondary electrons generated as the ion passes through the entrance and exit foils in the spectrometer. Total energy is measured by the SSD array comprising six sectors. Each six sectors comprises two SSDs; sectors 2, 4, and 5 are dedicated for ion measurement with two ion SSDs each; sectors 1, 3, and 6 each have one ion SSD and one SSD covered with ~1E-6 m Al absorber, to block low energy ions and permit measurements of electrons. The fan-like collimator together with the internal geometry defines the acceptance angles. The FOV is 160 degrees by 12 degrees with six angular sectors of 25 degrees each; the total geometric factor is ~0.15 cm**2-sr. As an ion passes through the sensor, it is first accelerated by the potential of ~3 kV on the front foil prior to contact. The ion generates secondary electrons at the foils, which are then electrostatically steered to well-defined separate regions on a single micro channel plate (MCP), providing 'start' and 'stop' signals for the TOF measurements (from 1 ns to 320 ns). The segmented MCP anode, with one start segment for each of the six angular entrance segments, allows determination of the direction of travel even for lower-energy ions that do not give an SSD signal above threshold.

The combination of measured energy and TOF provides unique particle identification by mass and particle energy in the range: for protons from 15 keV to 1 MeV; for heavy (CNO) ions from 80 keV to 1 MeV. Lower-energy (>3 keV) ion fluxes are measured by TOF and pulse-height analysis (PHA) of the signal they produce in the MCP, providing particle identification and velocity spectra at these energies as well. Molecular ions, expected from Pluto's atmosphere, will break up in the foil prior to their full detection, but will be detected as high-mass events. Internal event classification electronics determine the mass and produce an eight-point energy spectrum for each of four species for six arrival directions. Energetic electrons are measured simultaneously in the dedicated electron pixels in the range from 20 to 700 keV. Only protons with energies > 300 keV (expected to be very rare at Pluto) can penetrate the absorbers on these pixels, and even