instrument and negative toward the bottom of the instrument. Ideally, non-normal incident particles with $E/q > (V_{RPA} / \cos^2\alpha)$ would be passed; however, the focusing properties of the SWAP RPA lead to a more complex response function. In Figure 30 of the instrument paper the normalized response of the RPA as a function of the azimuth angle is shown. Below is a formula for the RPA voltage scaled by the incident beam energy (f) as a function of the azimuth angle.

$$f = \cos^2(2\alpha), \qquad \alpha \le 4.0$$

$$f = \cos^2(3.5\alpha - \square\square) - 0.03, \qquad 4.0 < \alpha \le \square\square$$

$$(\square)$$

$$f = \cos^2(5.5\alpha - 65) - 0.085, \qquad 10 < \alpha$$

Unknown character

For SWAP non-normal incident particles with $E/q > (V_{RPA} / f(\alpha))$ are transmitted through the RPA.

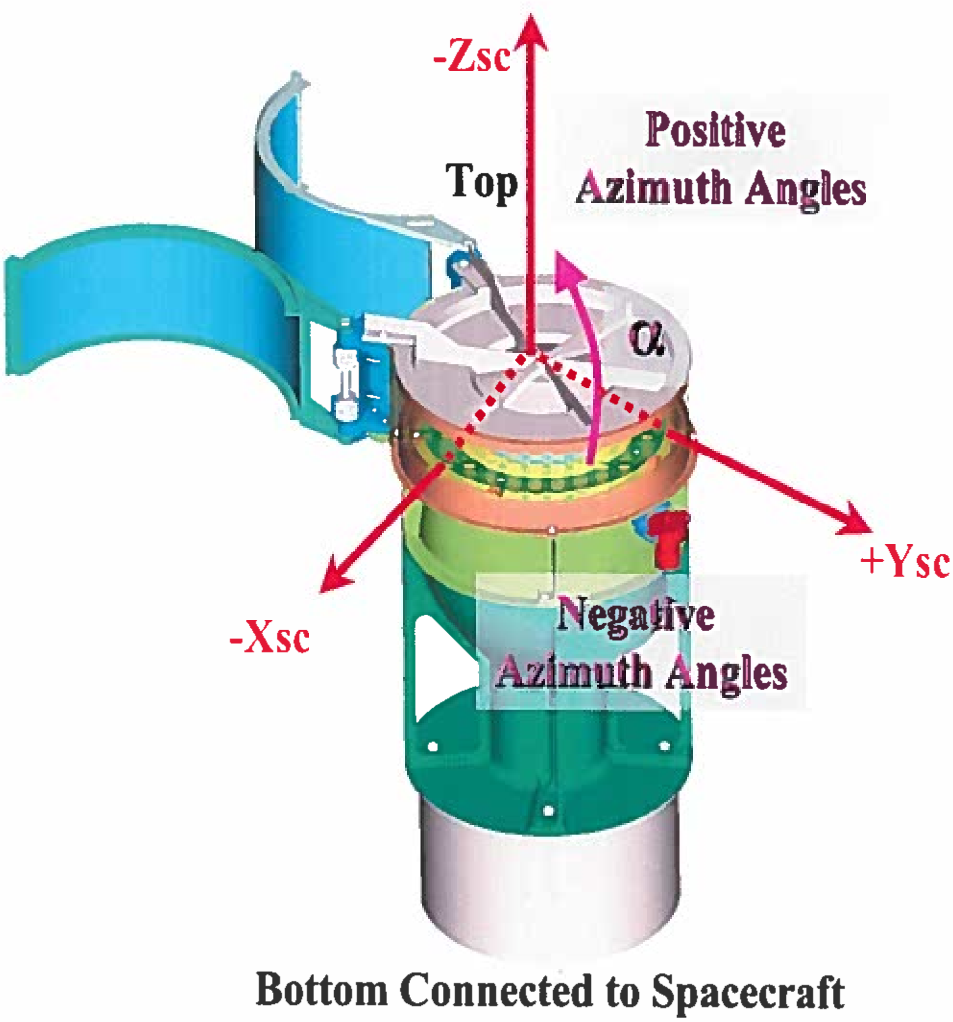

Figure 1: *Diagram defining the azimuth angle. Bottom of the instrument connects to the spacecraft.*

entering anywhere in the 10° instrument Field-Of-View (see Figure 31 of [MCCOMASETAL2008]). We then use the RPA and ESA voltage setting to calculate the center of the combined response. We have the energy of the peak response for each RPA and ESA voltage setting in the onboard voltage tables. In the calibration directory we list the filenames of the precalculated energy bin centers and the time periods over which they are valid in the list_energy_files.tab file. Each energy bin file (i.e., esa_rpa_v19_energy_binsf.csv, filename suffix extension is .tab in PDS data sets) lists the plan number, sweep, number, ESA DAC, RPA DAC, ESA voltage, RPA voltage, the crossing ratio (ratio of the RPA voltage to the ESA center energy), energy at the peak response, energy width (FWHM), minimum energy, and maximum energy. These energy tables are used to determine the energy in the spectrograms.

5) Detectors

The gain on the detectors can be adjusted by adjusting the operating voltage of the detectors. The operation voltage was determined in the lab by sweeping the voltage while illuminating the instrument with a constant intensity 1 keV proton source. Figure 32 of the instrument paper shows the lab calibration results were the response of the PCEM, SCEM, and the COIN rates are given as a function of voltage. The operation voltage was selected to be 2100 V at start of mission since at that voltage the CEM gain curves are on saturated. The instrument gain naturally degrades with age and usage, and we will perform regular gain tests to determine if the voltage needs to be adjusted. The gain also affects the geometric factor and effective area. In the table below we list the effective areas and geometric factors for the PCEM, SCEM, coincidence and a combined detection in the PCEM,SCEM, or coincidence.

Detection Signal	**Geometric Factor**	**Effective Area**
PCEM	4.1e-3 cm^2 sr eV/eV	0.058 cm^2
SCEM	8.6e-3 cm^2 sr eV/eV	0.12 cm^2
Coincidence	1.8e-3 cm^2 sr eV/eV	0.025 cm^2
Any detection	1.1e-2 cm^2 sr eV/eV	0.15 cm^2