Geometric Factor Calculation

Adri Jackson, Aaron Russel, Laura Peticolas, Noé Lugaz

March 22nd 2024

Provided below is Equation 4 from Johnstone et al. (1987)

$$GF = \left(eA_f \Delta v^{'} \Delta\theta \Delta\phi / I_0 T\right) \sum_b N_b S_b \tag{1}$$

Where e is the charge of an electron, A_f is the area of the anode, $\Delta v^{'}$ is the velocity of the incoming particles, $\Delta\theta$ and $\Delta\phi$ are the range of angles used, I_0 is a standard current for the energy level and flux of the electron beam, T is detection time, N_b is the number flux, and S_b is a weighting factor where $I_0/S_b = I_b$ and I_b is the current response of the instrument.

To use this equation we could combine the simulation results with the testing we did of the SHERPA. We can solve for the particle velocity from their initial energy in the simulation. We would need to know the conversion factor from the voltage output of the SHERPA to the current response, as well as how the current response differs from the "standard current" (defined above). To solve for the flux we would need to use the percentages from the simulation results to find fluxes at specific angles from the instrument centerline, summing the different flux values (multiplied by their different weighting factors) associated with the range of angles tested in the simulation. The simulations also gave percentage results for different selection screen values of the SHEPRA. Combining those percentages with the results for the different selection screen values from the SHERPA testing, we can make multiple estimates of the Geometric Factor. This would likely be easiest to do with the assistance of Python code, which I (Adri) could do.
article url: https://iopscience.iop.org/article/10.1088/0022-3735/20/6/038