In this document we present a power law fit for backscatter ratio as a function of loss cone filling derived from ELFIN data. The data we are fitting to is shown in Figure 1 (reproduced from manuscript). For this fit, we will only consider the case with low precipitating fluxes excluded in the right panel.
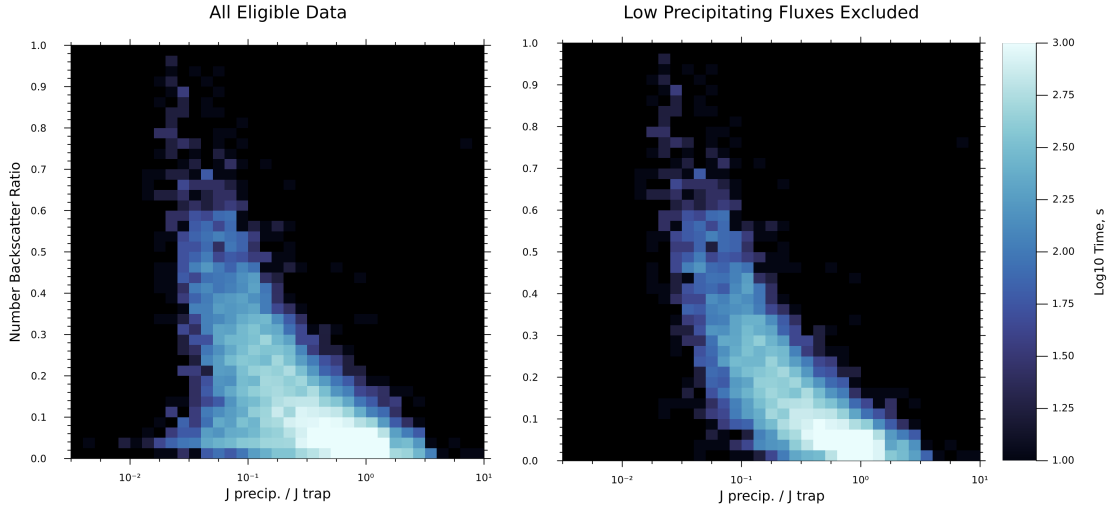

Figure 1: Number backscatter ratio vs. loss cone filling strength derived from 26 hours (33, 366 spacecraft spins) of ELFIN data. Any measurement of backscatter ratio with absolute uncertainty greater than $\sigma \approx 0.025$ was discarded. Left: Results all eligible ELFIN data (see manuscript). Right: Measurements with precipitating flux less than $10^{3.5}$ electrons-cm^{-2}-s^{-1} removed. Energy backscatter ratio has a similar pattern to number backscatter ratio and is not shown for brevity.

First we find the median backscatter ratio for every $J_{\text{precip}}/J_{\text{trap}}$ bin. This series, along with the 25th and 75th percentile of the r_N distribution for each $J_{\text{precip}}/J_{\text{trap}}$ bin, is shown in Figure 2 below.
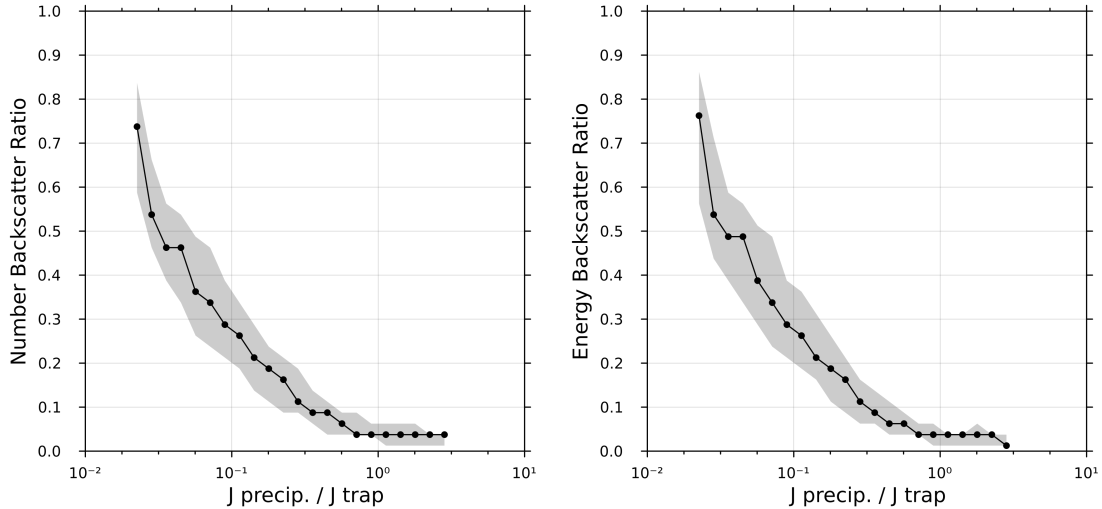

Figure 2: Median backscatter (black line) as well as the 25th and 75 percentile (grey ribbon below and above, respectively) as a function of precipitation strength. Left panel shows the number backscatter ratio r_N, right panel shows the energy backscatter r_E.

We then fit a power law to each curve using a least-squares regression. The formulae for these fits and their coefficient of determination R^2 are given below.

$$r_N = 0.049846675 \cdot \left(\frac{J_{\text{precip}}}{J_{\text{trap}}}\right)^{-0.69318138} \qquad\qquad R^2 = 0.9764$$

$$r_E = 0.042889591 \cdot \left(\frac{J_{\text{precip}}}{J_{\text{trap}}}\right)^{-0.76185648} \qquad\qquad R^2 = 0.9842$$

These fits are plotted over the data in Figure 3 below.
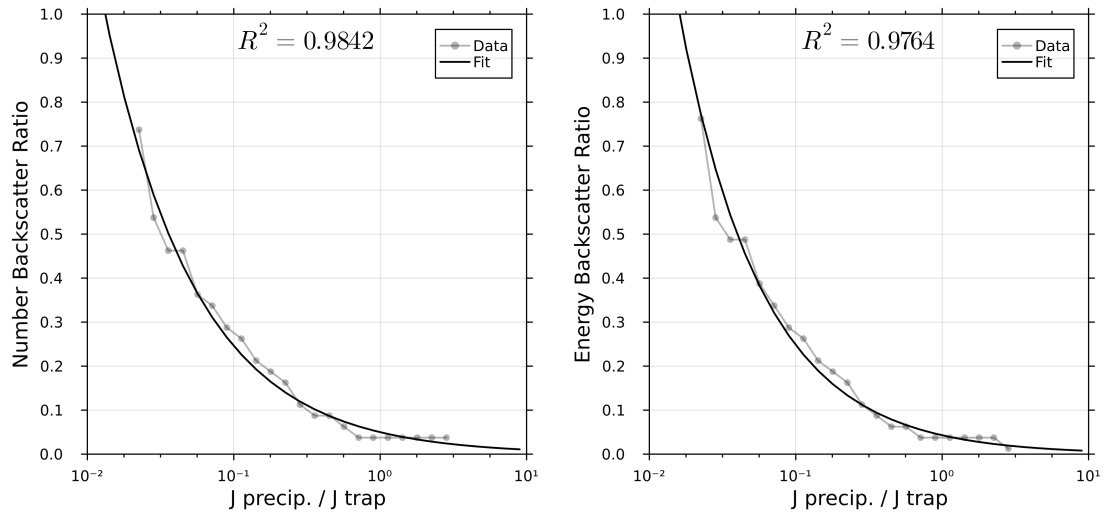

Figure 3: Median backscatter rates (grey line with dots) at a variety of loss cone filling levels with a power law curvefit (black line) overlaid. Left: Number backscatter ratio as a function of loss cone filling. Right: Energy backscatter ratio as a fucntion of loss cone filling.