MCS Spot Photometry

Method

- Using the aperture photometry of the sep (sextractor base) python package
- spot positions from centroiding
- Standard background subtraction
- circular aperture optimized for minimum fluxerr
- background annulus optimized for minimum fluxerr
- Calculate the fluxes and flux error using sep.sum_circle, with the error set to the background bkg.globalrms from the background subtraction.
- mask spots under dots for the calculations
- Using the last iteration as the reference frame, divide by the reference frame fluxes

General Notes

- Flat field frames were not available
- Subtracting a median of the background columns from each row had a negligible effect on the result.
- At 4.8 s the peak value is typically 18000 above the background
- For 4.8 s exposures, the calculated flux error is on the order of 0.21 percent (see Figure 1)
- The RMS of the differences between fluxes compared to the last frame is on order of 1-3% of the flux between the last and second to last iterations, which is consistent with the values in seen in two 4.8s exposures at the same cobra positions (see Figure 2)
- The RMS of the differences increases with increasing separation in iteration. The patterns seen in the plots of the difference as a function of position indicate that the RMS is dominated by seeing (see Figure 3)
- In the 0.8 / 4.8 / 8 s. sequence the median flux error scales as expected for the difference in exposure time. The 4.8 s values are similar to those of the last two iterations in a 4.8 s convergence sequence.

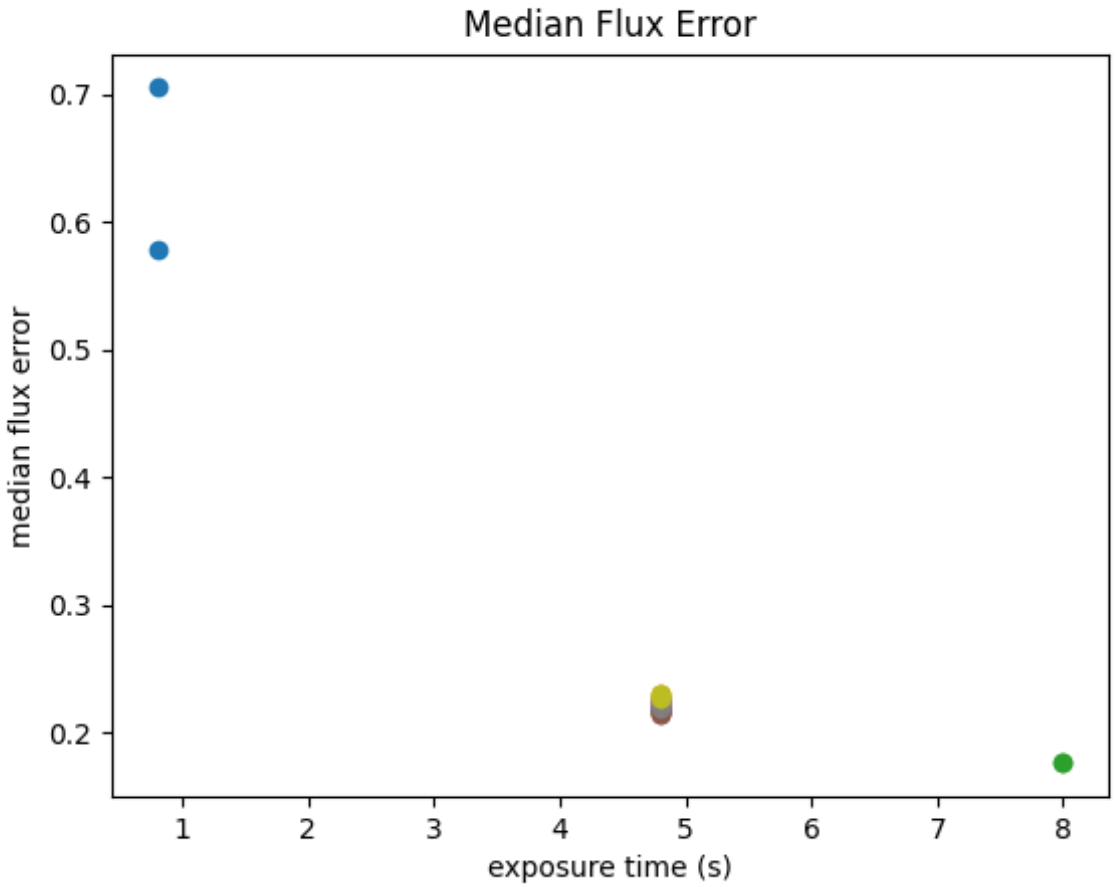


Figure 1: Median flux error as a function of exposure time, separated by visit_id.

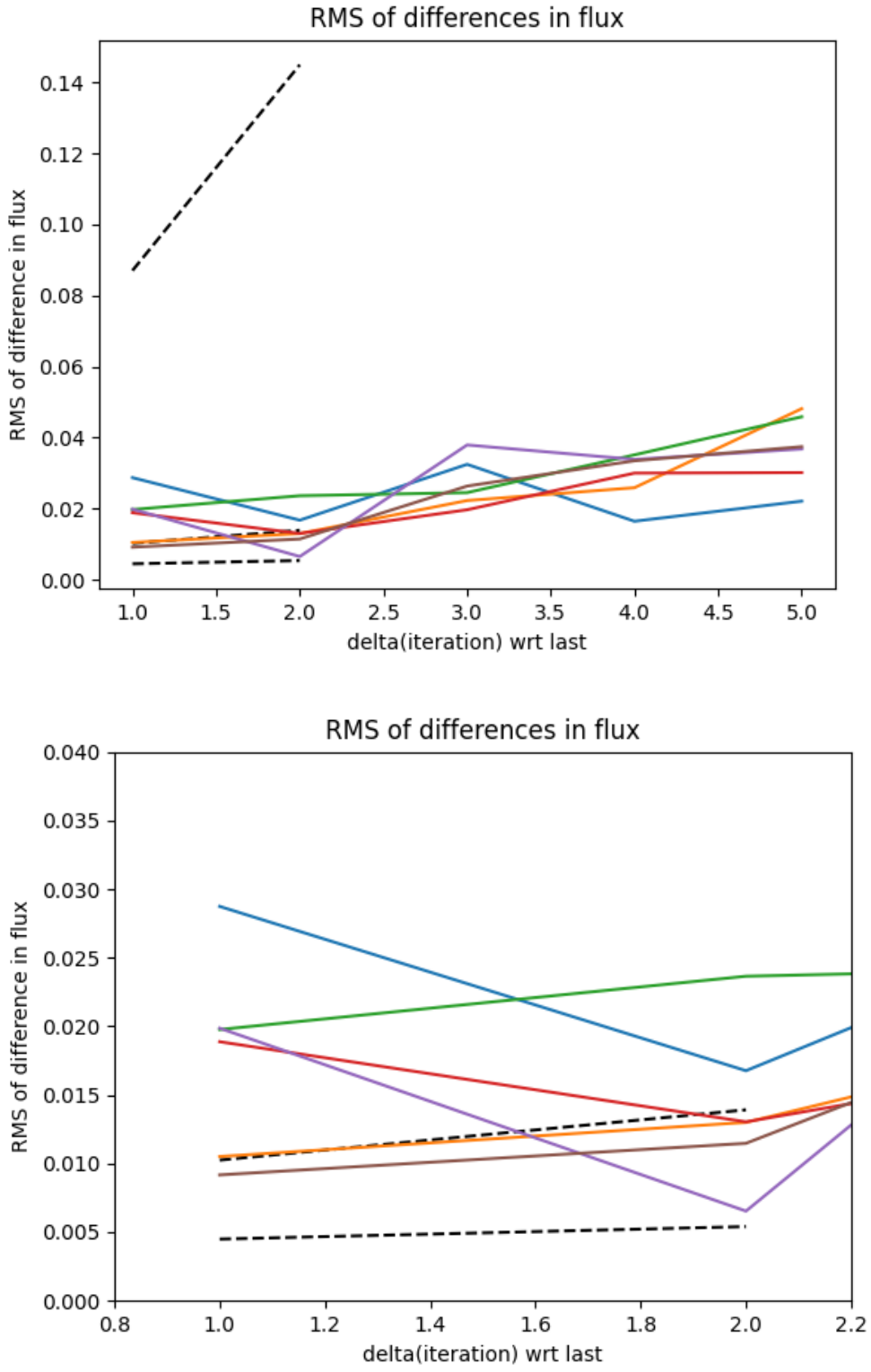
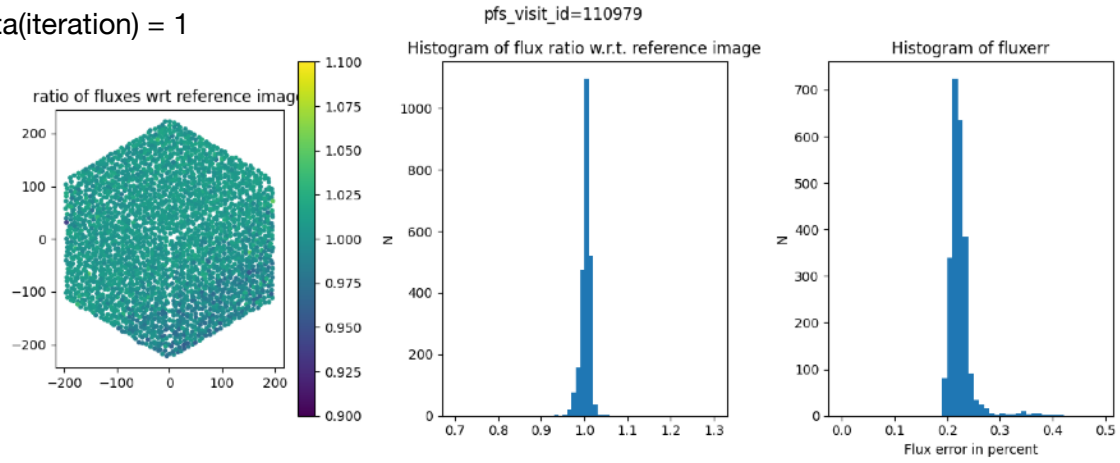


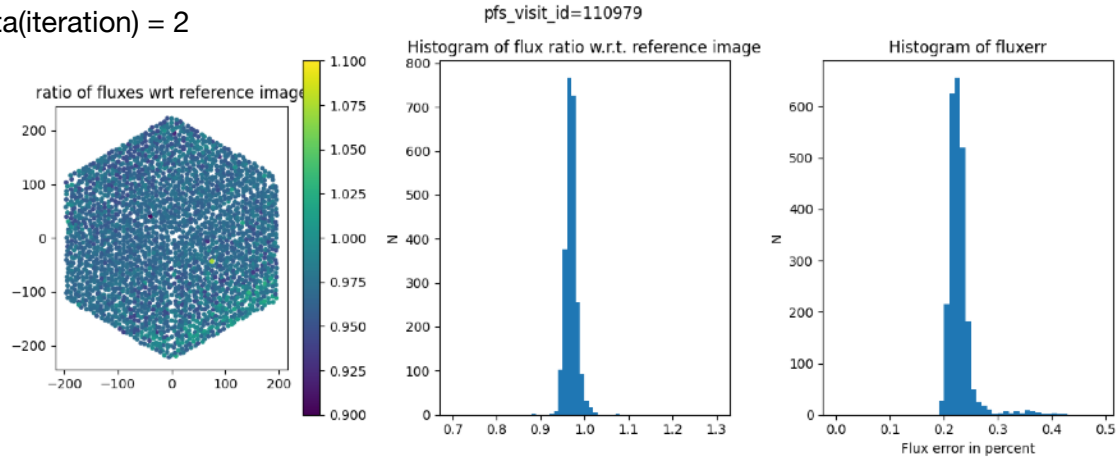
Figure 2: RMS of the difference between fluxes as a function of delta(iteration) from the final exposure for a series of convergences. Coloured lines are randomly chosen convergence sequences, limited to the 4.8s exposures. Dashed black lines show the results from sets of three consecutive exposures of 0.8, 4.8 and 8s (top to bottom), with no cobra motion. The two plots show the same data with difference axis scales.

Figure 3: series of plots showing from left to right the difference in flux compared to the final iteration, the histogram of the values in the first plot, and the histogram of the calculated flux errors.

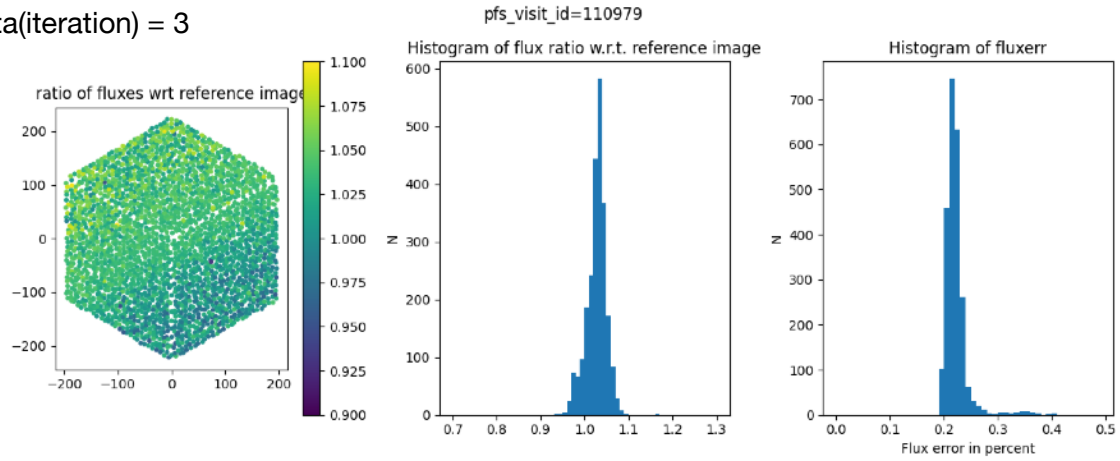
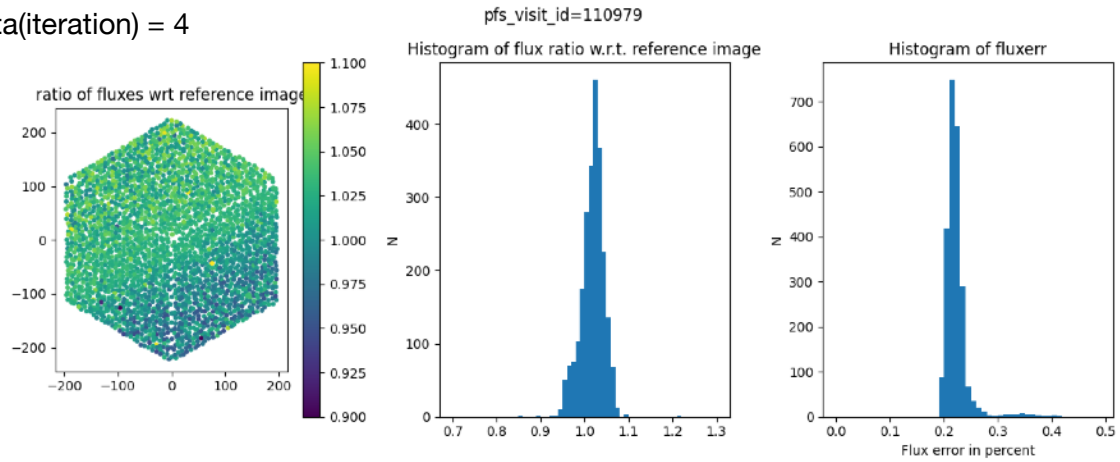
delta(iteration) = 1



delta(iteration) = 2



delta(iteration) = 3



delta(iteration) = 4