<u>SHARP Transmission Analysis</u>

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This transmission study was carried out to determine if the SHARP system has degraded over time as a result of dust on the surface of mirrors or whatever may cause the loss of signal received. Pointing targets from the SHARP runs were used in the analysis. Data was picked upon achieving a set focus and for low tau only. The data was then processed in zamin using the "sharcsolve" command. It's rather long and it goes as

~sharp/bin/sharcsolve temp.list rgm.dat -al -sb -fi 5.0 -n 10 -i 10 -g 0 -o 1 4 -de 0 -p 3 -fw 4 -ra 8 -rz 8 -t 0.00 -w 0.1 -l 101 -z 0

where "temp.list" contains the name of the raw file you wish to process, and the "rgm.dat" corresponds to the particular run. Afterward, once the output "solve.fits" file has been renamed to a distinct filename, the "fitgauss" command allows you obtain certain properties of the target from the processed file. For example, if the file was renamed to "36236.fits", the command would be

~sharp/bin/fitgauss 36236.fits

Of interest was the FWHM [as], "peak signal" (**PS**), and "integrated signal" (**IS**). The latter two quantities are given in arbitrary units. From the PS or IS, one can calculate the "calibration constant", C. If the relationship of measured and true intensity is

$I_{meas} = C * I_{true} * \exp(-25 * tau_{225} * \sec(z))$

then "C" is simply

$C = [I_{meas} / I_{true}] * \exp(25 * tau_{225} * \sec(z))$

where z is the zenith angle. Both PS and IS have their advantages, but it turned out that the PS worked out better since the true flux of each calibration object given from the SHARC II webpage was obtained from peak flux signals (http://www.submm.caltech.edu/~sharc/ then go to "Observing Manual" and "SHARC II measurements of 350 micron secondary calibrators"). IS would work rather well, except that comparing integrated flux to a true peak flux is not ideal. A problematic feature of using the PS is that it might vary, depending on the focus.

After throwing out several bad values, 97 values remained for 9 calibration objects using the PS.

In the case of IS, 74 values remained for 6 targets after excluding those with a FWHM > 10 as.

Now, for each run and for each target in that run, the average value of "C" as well as the standard deviation and the error in the mean, σ_C, were calculated. Furthermore, the average value of σ_C was calculated, and for all values of σ_C less than this mean, σ_C was replaced with the mean value. This was done because certain targets only had a few measurements per run; some of these had very small σ_C, so the weight associated would likely give a misleading fit.

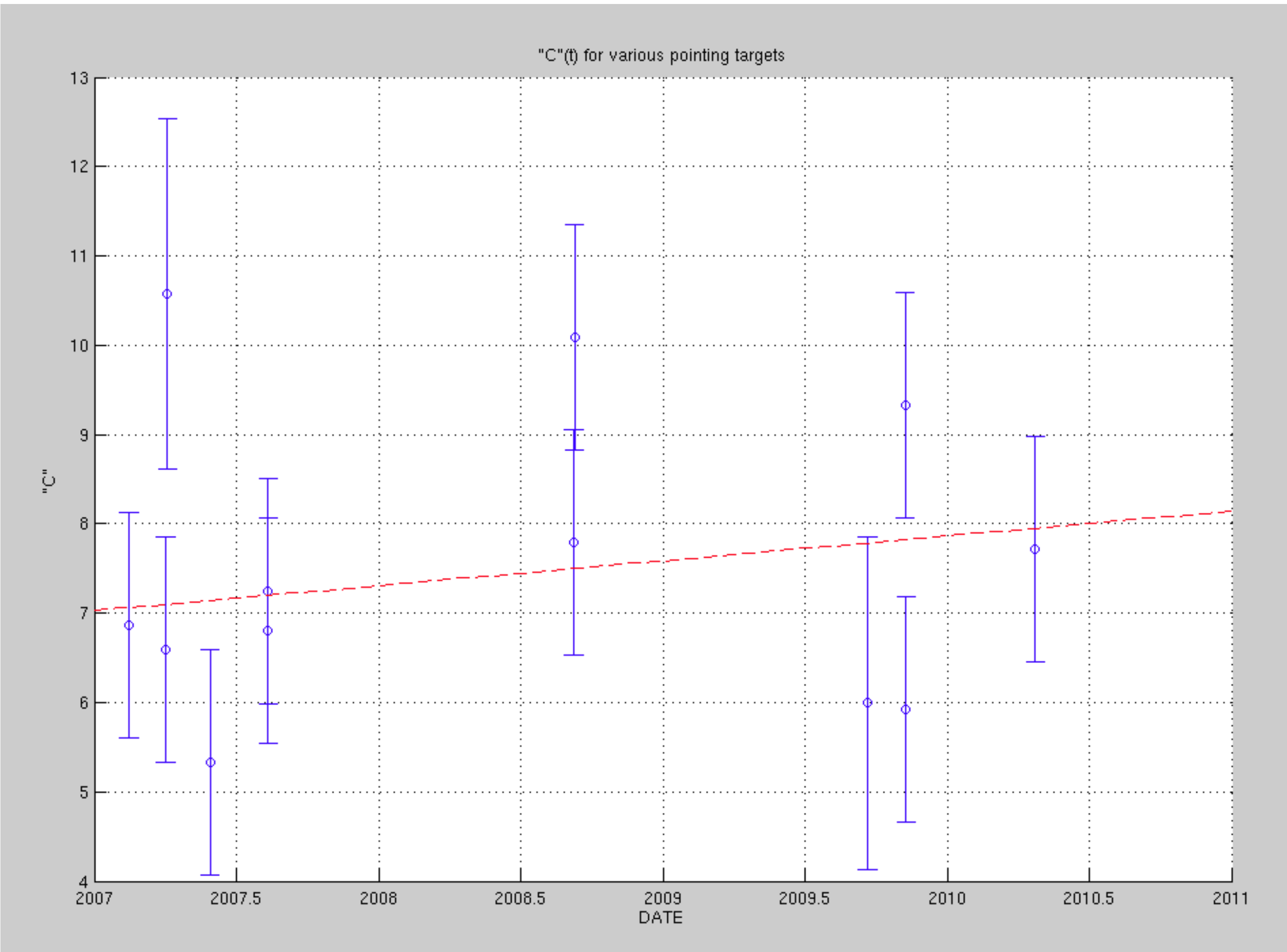
Matlab was used for the final plots with errors and a linear fit, which implies that the signal received is, in fact, not decreasing but may have increased.

For the IS, the "best" value of "C" ≈ 7.58

Error in y-intercept = 664.7148
Error in slope = 0.3310
fit(x) = -552.5817 + 0.2788 x

Over 3.3 years, ΔC is
$-1.26 < \Delta C < 3.10$
with 95% confidence.

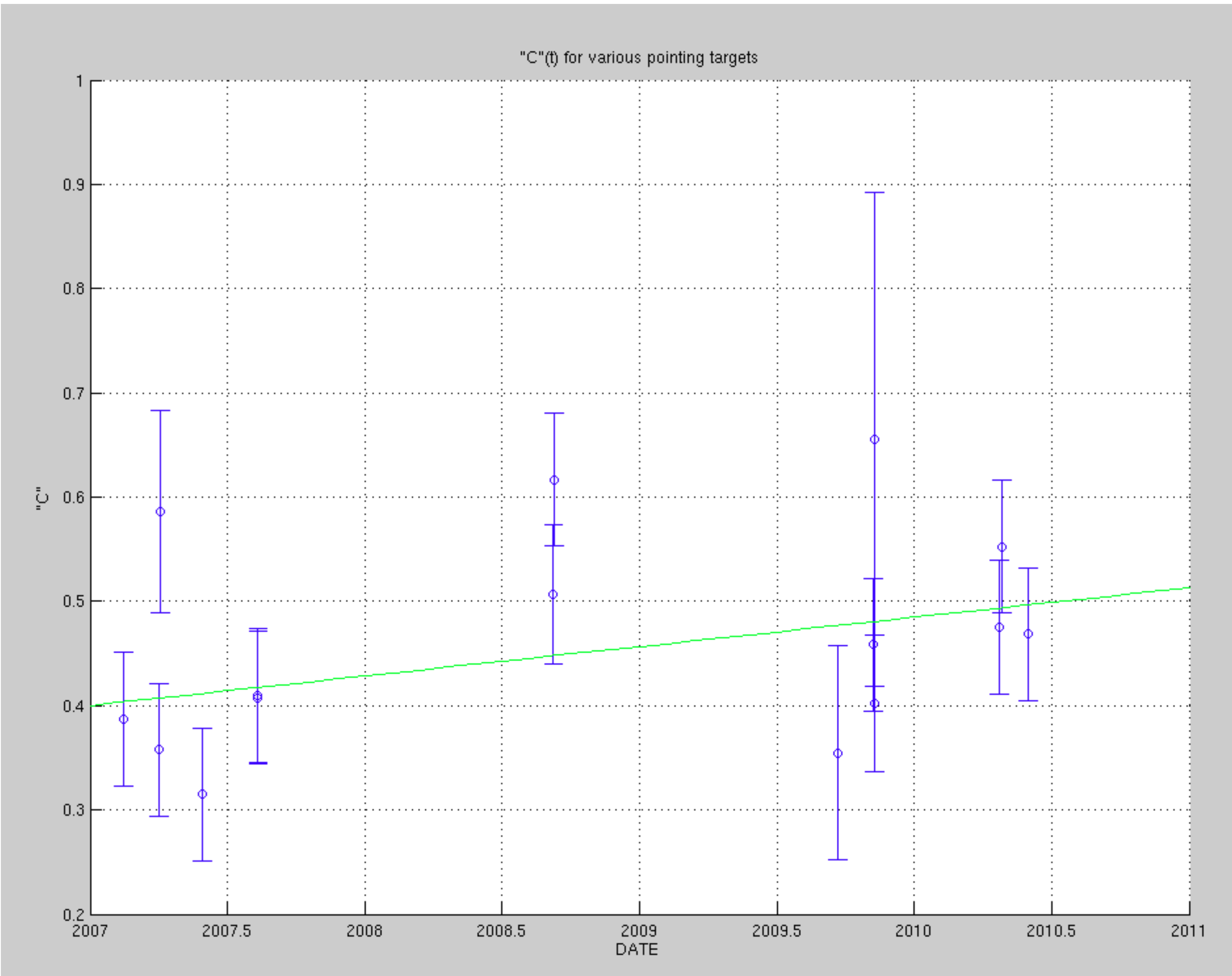
The fractional change in transmission of SHARP can be estimated from
0.834 < Relative Signal < 1.41
with 95% confidence.



For the PS, C (best) ≈ 0.455

Error in y-intercept = 28.1311
Error in slope = 0.0140
fit(x) = -56.1724 + 0.0282 x

$0 < \Delta C < 0.185$
1.0 < Relative Signal < 1.41
with 95% confidence.



Again, it seems that the plot using the PS is a better representation as it holds more targets and compares to calibrators whose true flux values are obtained from peak flux measurements.

Thanks to Giles for his guidance. Hope you all find this helpful.