VISFLAT Channel Monitoring
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ABSTRACT
The whole data set of VISFLAT exposures in F555W is re-analysed and found to confirm the continuing degradation of the VISFLAT lamp. The new data indicate that the lamp degradation is perhaps more a function of cumulative lamp on-time than number of lamp cycles.

1. Introduction
The degradation of the throughput of the WFPC2 VISFLAT channel was discussed in some detail in the WFPC2 ISR 96-01. The VISFLAT channel is based on two Carley bulbs and one high-temperature Welch Allyn bulb. We attributed the observed overall intensity decrease to the Welch Allyn bulb. One of the major conclusions was that the degradation appeared to be quadratic in the number of cycles, although at the time it was hard to disentangle the number of cycles effect from that of the cumulative lamp on-time. As a consequence of this finding it was decided to drastically decrease the number of VISFLAT exposures taken and to compress those that were deemed necessary in as small a number of lamp cycles as possible.

After about one year enough additional data have been collected to revisit the issue. Indeed, the lamp degradation continues according to the extrapolated trend with some evidence for both an increasing rate and a more significant dependence on the cumulative exposure.

Our analysis is described in Section 2 and our results in Section 3. Section 4 sums up.

2. Data Analysis
We have reanalyzed all VISFLAT data available in F555W. For each frame we have obtained the exposure date in JD, the mean flux as given by the DATAMEAN header keyword, and the exposure time. The latter is necessary since in the early days of WFPC2 several values of the exposure time were used before we stabilised on 1.6 seconds for the F555W filter. These mean flux data have to been combined with engineering data on the number of cycles and cumulative on-time kindly provided by J. Balleza.
3. The Results

Figure 1 through 3 show the relative intensity for each WFPC2 camera as a function of the cumulative number of cycles, of the cumulative on-time in hours, and of the elapsed time in Julian Days, respectively.

The parabolic fit to the data in Figure 1 was obtained in July 1996, when the first evidence of a steepening compared to a parabolic trend became available. Clearly the new data confirm that the intensity is not a simple parabolic function of the cumulative number of cycles. Luckily, as shown in Figure 2, the trend with the cumulative on-time still appears to be parabolic, arguing that perhaps this quantity is the most significant. The curve plotted in Figure 2 is the same for all chips and has been obtained by averaging the coefficients for all single chip measurements. The scatter in the coefficients for each single chip is very small. Note how the last measured point remains lower than the curve for 3 out of the 4 cameras.

Various other fits have also been attempted, however the quadratic fit to cumulative lamp on-time time remains the best one. High order fits or bivariate fits where the throughput is taken to be a function of both the cumulative exposure time and the number of cycles do not provide significant improvements.

4. Conclusions

The major conclusions can be summarised as follows:

1. there is evidence that the VISLAMP degradation can be described by a second order polynomial in the cumulative on-time
2. there is some preliminary indication that the time dependence of the degradation may be steepening
3. the VIS channel usage reduction taken so far appear to be adequate to keep the degradation linear with elapsed time.
4. INTFLATs taken at the same time as VISFLATs during the last 6 months can be used to cover most of the VISFLAT functionality.
**Figure 1**: Relative intensity for the four WFPC2 cameras as a function of the cumulative number of lamp cycles. The fit was obtained in July 1996 and shows how the degradation has become more serious.
Figure 2: Relative intensity for the four WFPC2 cameras as a function of the cumulative lamp on-time. The fit has been obtained by combining all data for all cameras. There is some evidence for a steepening of the trend as the most recent points tend to fall below the curve.
Figure 3: Relative VISFLAT channel intensity as a function of the Julian Date. This plot shows how the measure to reduce the channel usage have been adequate to keep the degradation linear with time.