Data Quality with the One-Gyro Control System

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On March 6 of this year, the *IUE* satellite suffered another gyro failure after the ground computer sent a corrupted command to the spacecraft. Attempts to revive the dead gyro failed and a decision to switch to the one-gyro spacecraft control system was made. Spacecraft attitude was recovered several days later using the one-gyro mode and operations were resumed. This analysis tests the effect of the one-gyro mode on *IUE* low-dispersion fluxes. Since all observations must now be obtained while tracking on a guide star, the effect is expected to be negligible.

Several LWP and SWP spectra (low-dispersion large-aperture) of the primary white-dwarf standard CD-38° 10980 were taken in April of 1996 using the one-gyro control mode. These observations were then compared with data taken in August of 1994 under the two-gyro mode. The images were processed using NEWSIPS software and corrected for time- and temperature-induced sensitivity degradation effects. The two sets of observations were taken close in time and had similar camera temperatures (THDA). As a result, any errors associated with the degradation correction algorithms are reduced. A list of images used in this analysis is shown in Table 1. Details on the various corrections applied to NEWSIPS data can be found in the NEWSIPS Information Manual (Nichols *et al.* 1993).

The analysis results are illustrated in Figures 1–3 for the LWP and Figures 4–6 for the SWP. The figures plot flux difference, expressed as a percent (%), versus wavelength. The flux differences were computed in the following manner:

$$Percent\ Difference = ((F2 - F1)/((F2 + F1)/2)) \times 100$$

where $F2$ and $F1$ are the spectral fluxes obtained under the two-gyro and one-gyro control modes, respectively. The percent differences that have been annotated to each plot were averaged over the same wavelength ranges used in the NEWSIPS low-dispersion repeatability analysis (Garhart 1995). The results in each case are always positive which means that the two-gyro fluxes are higher than the one-gyro fluxes. This could indicate a systematic degradation in data quality for spectra taken under the one-gyro system. However, LWP repeatability is 3.3% over the range of 2000–3000Å and SWP repeatability is 2.2% from 1250–1950Å. In addition, the one-sigma errors seen in standard sensitivity degradation analysis (Garhart 1994) are

also on the order of 2–3% for the SWP and 3–4% for the LWP. Therefore, the difference between one- and two-gyro data is indistinguishable from the repeatability or sensitivity degradation errors.

References

Garhart, M.P. 1994, IUE NASA Newsletter, No. 54, 10

Garhart, M.P. 1995, IUE NASA Newsletter, No. 55, 39

Nichols, J.S., Garhart, M.P., De La Peña, M.D., and Levay, K.L., *IUE New Spectral Image Processing System Information Manual: Low-Dispersion Data, Version 1.0*, Computer Sciences Corporation, CSC/SD-93/6062, December 1993

Table 1: One-Gyro Test Images

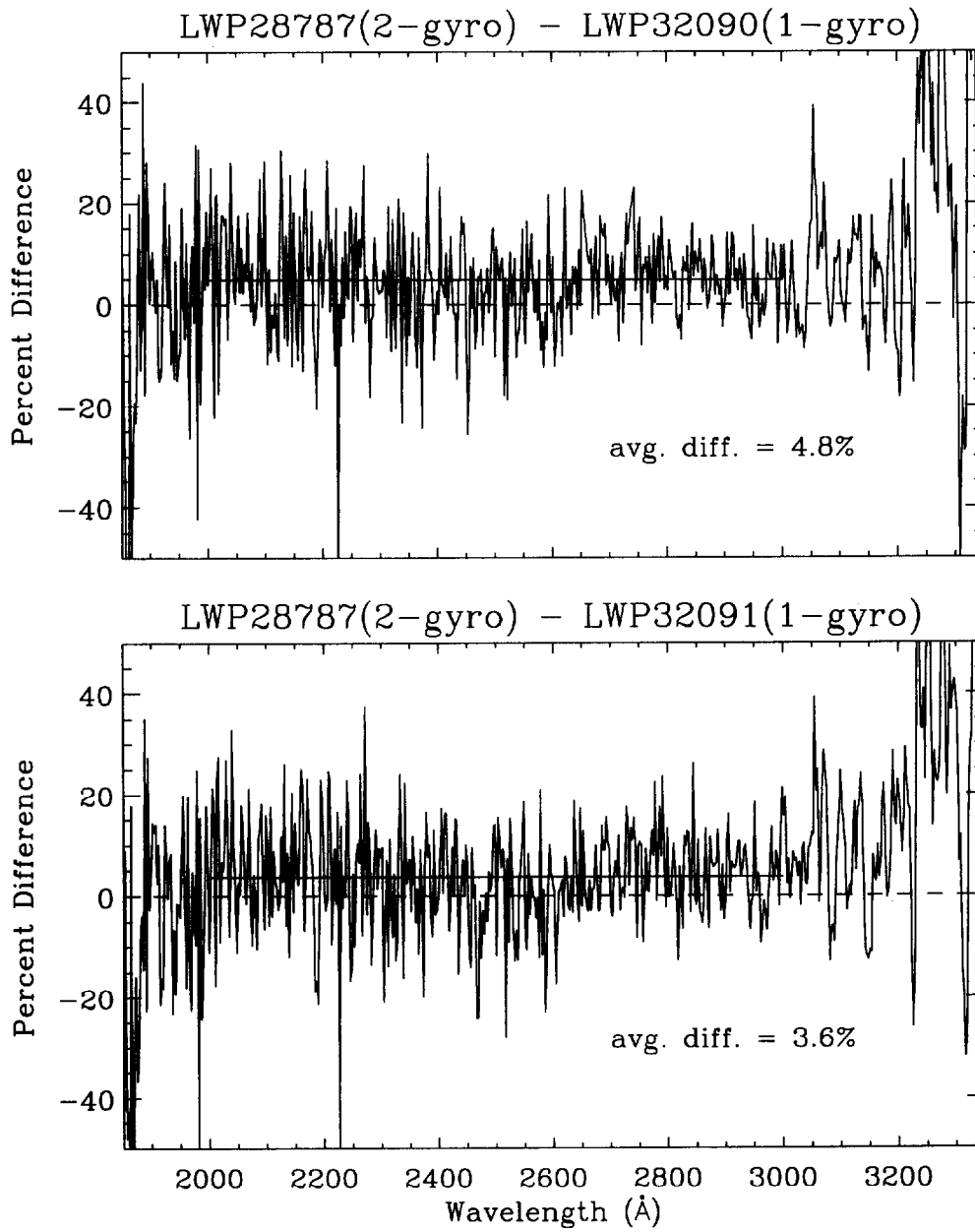| Camera	Image Number	Date (Yr/Day)	THDA	Gyro Mode
LWP	28787	94/213	5.8	Two-Gyro
	32090	96/092	6.1	One-Gyro
	32091		6.5	
	32092		6.1	
	32093		6.1	
	32094		6.1	
	32095		5.8	
SWP	51679	94/213	4.8	Two-Gyro
	56908	96/092	5.8	One-Gyro
	56909		6.1	
	56910		6.8	
	56911		6.5	
	56912		6.1	
	56913		6.1	

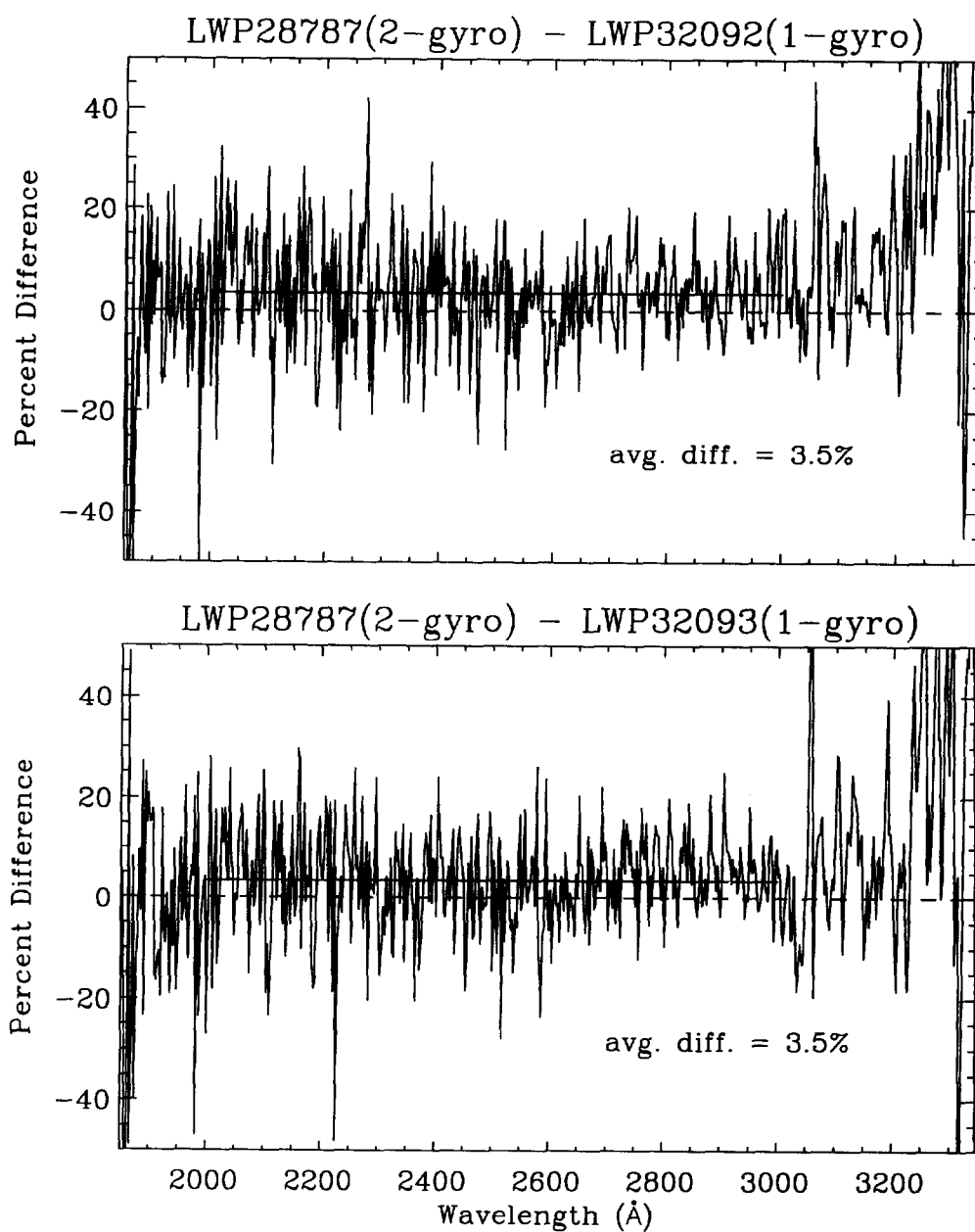Figure 1: Comparison of 2-gyro to 1-gyro data for the LWP camera.

Figure 2: Comparison of 2-gyro to 1-gyro data for the LWP camera.
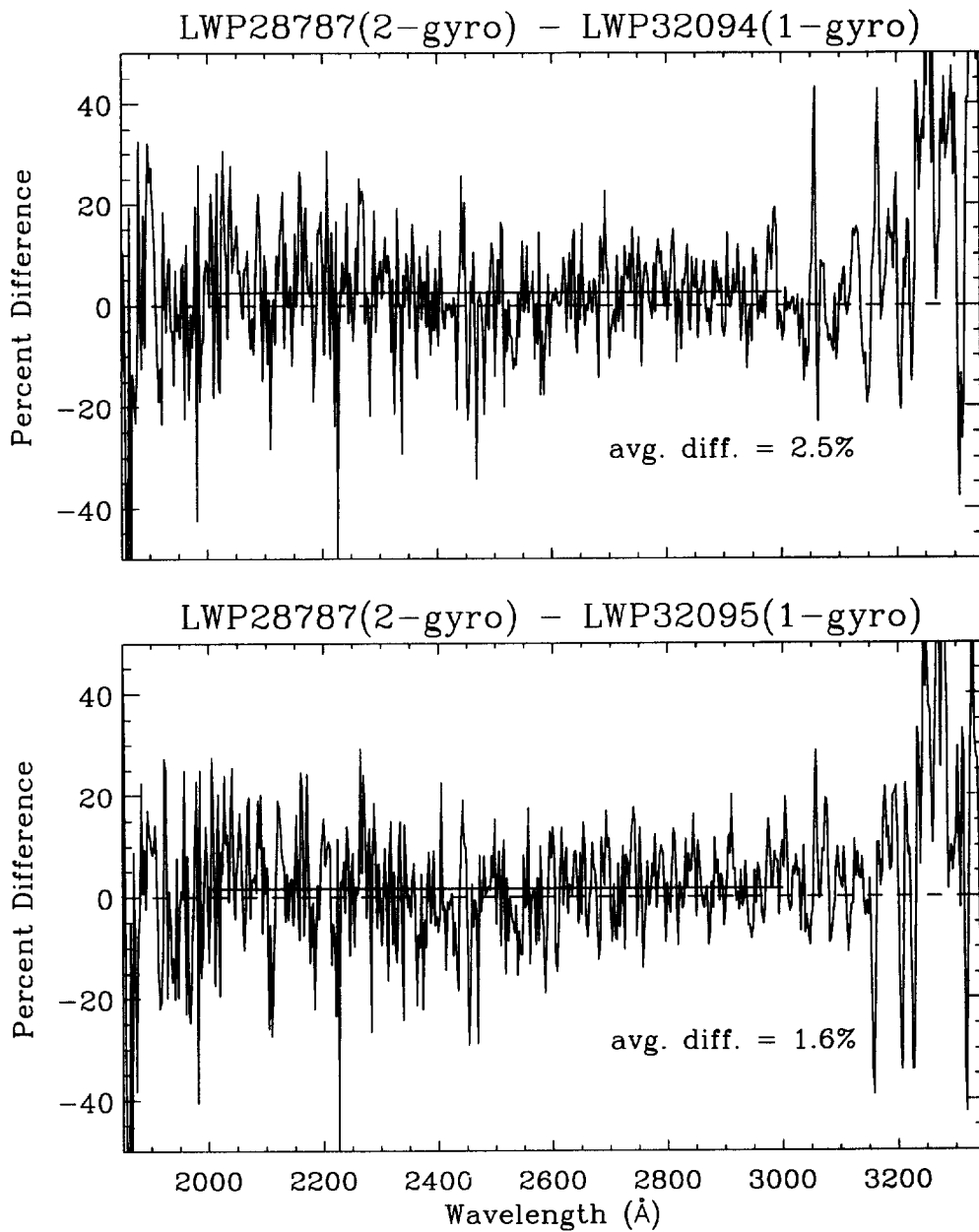
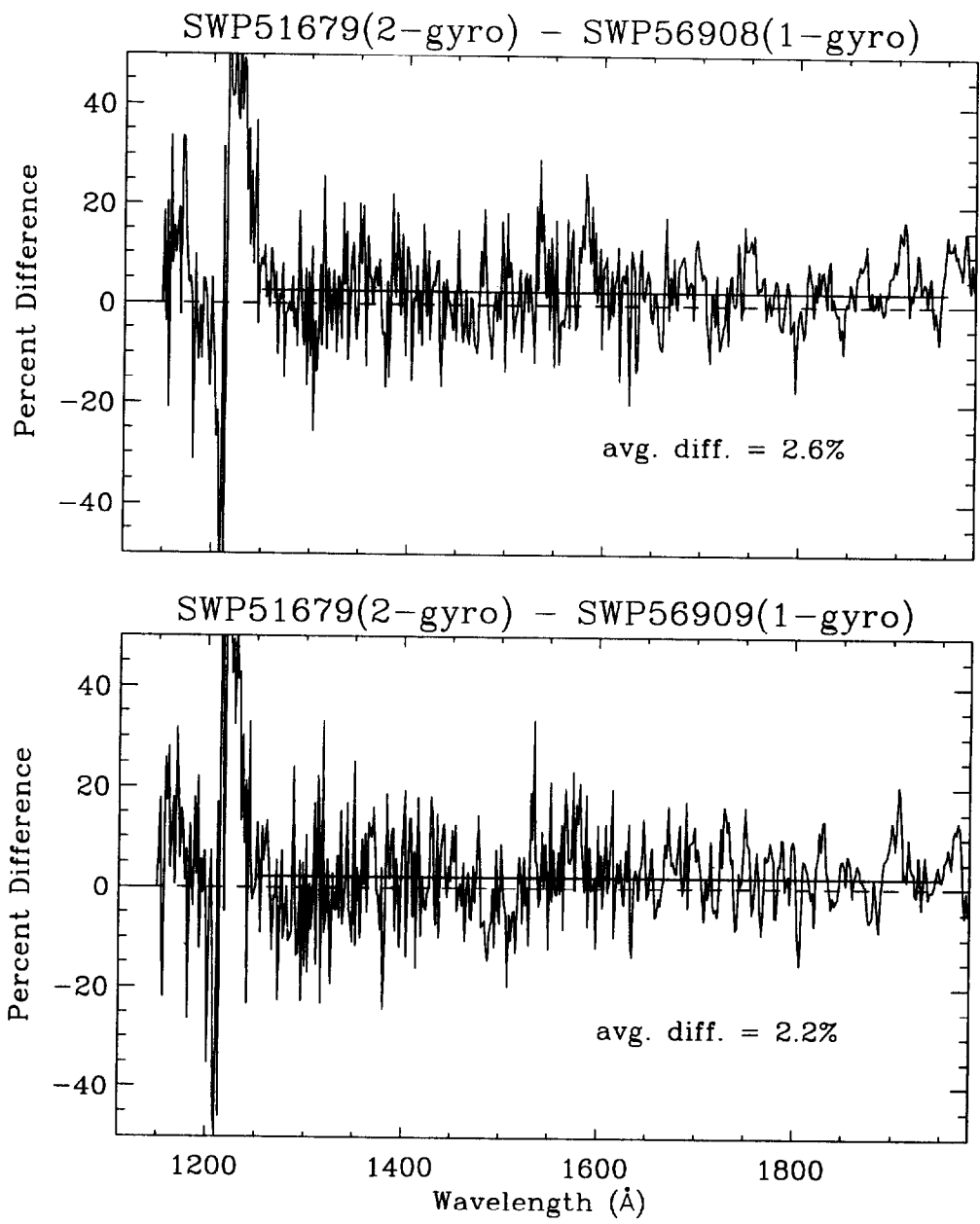Figure 3: Comparison of 2-gyro to 1-gyro data for the LWP camera.

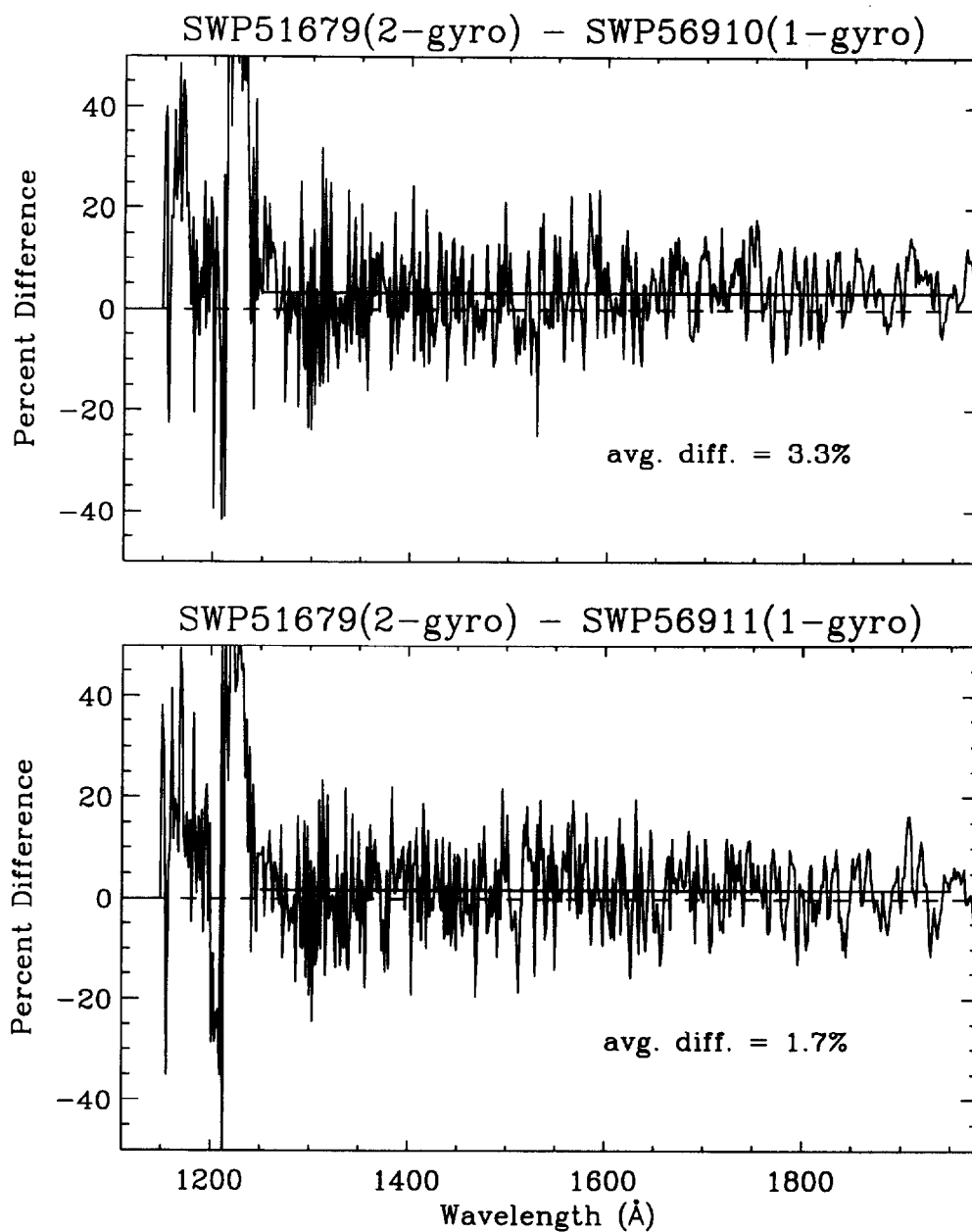Figure 4: Comparison of 2-gyro to 1-gyro data for the SWP camera.

Figure 5: Comparison of 2-gyro to 1-gyro data for the SWP camera.