

# RELATIVE GAIN VALUES AMONG THE FOUR WFC AMPLIFIERS

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## ABSTRACT

*The relative gain ratios among the four WFC amplifiers are determined from flat field observations for each of the four allowed gain settings. Our method relies on the average absolute gain measurements of the four amplifiers but provides a more accurate determination of their relative gains.*

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## 1. INTRODUCTION

The absolute gain values for the four ACS WFC amplifiers (A, B, C, & D) have been measured by Martel, Hartig, & Sirianni (2001, MHS) with a typical accuracy of 0.6%. The relative gain between the pair of amplifiers on the same CCD chip can be derived from flat fields to better than 0.1%. Therefore, the average gain values from MHS are re-partitioned between the amp pairs. The A/B and C/D gain ratios should now be accurate to ~0.1%.

The flat fields also provide a more precise determination of the gain ratio between the two WFC chips. However, the chip1/chip2 sensitivity ratio is wavelength dependent with a variation comparable to the absolute gain uncertainties. The chip1/chip2 relative gains are reconciled using the G=1,2,4,8 internal flats at F625W.

## 2. ANALYSIS

The average gain values for each WFC gain setting in column 2 of Table 1 are from the MHS Table 1 for G=1,2,4 and from the MHS Table 2 for G=8. The MHS uncertainties for

the average gains are 0.3% for G=1,2,4 and 0.4% for G=8. The relative gains are measured along eight pixel wide strips at adjacent edges of the amplifier pairs on each chip and at the adjacent edges of the butt crack between the two chips using the program gainrat.pro. While our relative A/B and C/D gains measured from the relative response at the adjacent edges of the AB and CD amp pairs are accurate to 0.1%, relative values between the chips depends on the assumption of equal sensitivities at F625W. The average chip1/chip2 response varies with wavelength by <0.5% from F475W to F850LP and by ~0.7% at F435W.

Table 1. Average Absolute Gains and New Individual Gain Values

Nominal Gain	Average	Amp A	Amp B	Amp C	Amp D
1	1.0002	0.9999	0.9721	1.0107	1.0180
2	2.008	2.018	1.960	2.044	2.010
4	3.990	4.005	3.897	4.068	3.990
8	7.96	7.974	7.735	8.023	8.107

### 3. REPEATABILITY AND UNCERTAINTIES

Our repartitioned gains in Table 1 agree with the absolute MHS gain measurements within the quoted uncertainties. The largest difference is ~2% or 3-sigma for the amp C gain value of 4.068. The earlier measurement at the component level is 4.045, while the MHS Table 2 value is 4.01, both higher than their Table 1 value of 3.98. However, more of our Table 1 values are closer to MHS than to the bench data for the individual amps. The biggest difference between the MHS average values and the bench averages is 1.5% at gain 2, which suggest that the one-sigma uncertainty of 0.3% quoted by MHS is better than the uncertainty in the bench values, despite the extra digit of precision that is attached to the bench gain values. A discontinuity in the flat fields is caused by using the unreconciled bench gain values, as illustrated in Figures 3-4 of Bohlin, Hartig, and Martel (2001). The same flats re-made with the Table 1 gain values show no discontinuity between the quadrants that are read by the four amplifiers.

### REFERENCES

Martel, A., Hartig, G., & Sirianni, M. 2001, [http://acs.pha.jhu.edu/instrument/calibration/results/by\\_item/detector/wfc/build4/gain/](http://acs.pha.jhu.edu/instrument/calibration/results/by_item/detector/wfc/build4/gain/), (MHS)

R. C., Hartig, G. & Martel, A. 2001, Instrument Science Report, ACS 01-11, (Baltimore:STScI) Instrument Science Report ACS 2000-00