Wide Field Planetary Camera II Status Update
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Abstract
We review the status of the Wide Field and Planetary Camera II (WFPC2) onboard the Hubble Space Telescope, as well as recent enhancements to calibration and user support. The photometric, flat field, and PSF stabilities continue to be excellent, and they do not appear to have been affected by the recent servicing mission. Charge Transfer Efficiency (CTE) in the CCDs remains a concern; we discuss the latest results from on-going monitor programs, as well as the latest correction procedures. We also discuss a readalvis of the "long-vs-short" anomaly, which suggests that the effect is primarily relevant for very crowded fields (several thousand stars per CCD). The entire set of flat fields for the standard filters redward of F390W has been updated. Plans are underway for Cycle 11 calibration programs, and some of the highlights are discussed. A new edition of the WFPC2 Data Analysis Tutorial is available. The WFPC2 Instrument Handbook has been updated for Cycle 12, and a new edition of the HST Data Handbook is also available. Efforts have been made to update the WFPC2 website to make it easier for people to find desired documents. The Service Mission SM3b occurred in March 2002, and we summarize the WFPC2 SM3b results. These and other issues will be discussed.

WFPC2 Instrument Science Reports. New ISRs since the last AAS Meeting:
• 2002-01: "WFPC2 Clocks-ON Close Out", Schultz et al.
• 2002-03: "Charge Transfer Efficiency for Very Faint Objects and a Reexamination of the Long-vs-Short Problem for the WFPC2", Whitmore and Heyer.

The ISRs can be accessed on the web at http://www.stsci.edu/instruments/wfpc2/wfpc2_doc.html#Inst

Other WFPC2 Documents. Other new documents since the last AAS Meeting
• The WFPC2 Instrument Handbook has been updated for Cycle 12.
• A new edition of the HST Data Handbook is available.

Charge Transfer Efficiency for Very Faint Objects and a Reexamination of the Long-vs-Short Problem for the WFPC2.
An analysis of WFPC2 observations of the Omega Centauri and a number of NGC 104 leads to the following results.
1. The correction formula developed by Whitmore, Heyer, and Casertano (1999; hereafter WHC99) does a reasonable job of correcting for CTE loss down to extremely low count levels (i.e., so faint you cannot actually see the object but only know of its existence from longer exposures). There is no sharp cutoff to the detection threshold for very faint stars.
2. A comparison of the WHC99 formula with the Dolphin (2000b; hereafter DOL00) formula shows reasonable agreement for bright and moderately bright stars, with some differences for fainter stars. However, at very faint levels, the DOL00 formula overestimates, and the WHC99 formula underestimates, the correction by tens of percent. Our current recommendation is to use the DOL00 formula for CTE loss correction.
3. A reexamination of the long-vs-short nonlinearity shows that the effect is very small (a few percent) or nonexistent for uncrowded fields, with less than 1000 stars per chip. However, for crowded fields, with ~10,000 stars per chip, apparent nonlinearities of tens of percent are possible. A possible explanation is that this is due to an overestimation of the sky measurement in the short exposure, which is probably due to the presence of scattered light around bright stars and the subsequent improvement in CTE loss in these regions. No correction formula has been derived since the effect is dependent on the analysis parameters (aperture size) and possibly also on the photometry package (psf-fitting, apertures, photometry).

Preflashing may be a useful method of reducing the effects of CTE loss for certain observations (moderately bright objects on very faint backgrounds), by throwing stars across the aperture and thereby reducing the CTE problem at these low levels.

5. Detection thresholds for typical broad band observations have been reduced by ~0.1 - 0.2 mag in the ~7 years since WFPC2 was launched. For worst-case observations (F336W) the effect is currently ~0.4 magnitudes. The figure below shows the ratio of counts between a 14 sec and 100 sec exposure for objects in Omega Cen vs. the Y position for stars on all three WF chips. The raw values (filled circles) fall below a ratio of 0.14 due to CTE loss. The different panels are for different target brightness, as selected on the 100 sec exposure and described by the labels. The filled squares show the values corrected using the Whitmore, Heyer & Casertano (1998) formula while the filled triangles show the values corrected using the Dolphin (2001) formula. Note that neither of the two correction formulas is very good for the faintest stars (~5 DN on the short exposure). Also note that the extrapolation of the raw data to Y=0 (the sloped line) is consistent with the predicted value of the throughput ratio based on the exposure times, hence the long-vs-short anomaly is not a problem for this data set (from Dolphin 2002).

WFPC2 SMOV3B UV Monitoring and Throughput Check. A critical aspect of the initial cool-down and activation of WFPC2 after SM3b involved a period of intensive monitoring and verification of the throughput of the instrument at UV wavelengths, in order to ensure that the camera throughput was not permanently degraded by contamination deposited on the cold (~88 C) CCD windows. In particular, the throughput in the F170W filter needed to be monitored to verify that the decrease in flux due to contamination never exceeded the safe limit of a 30% drop in total throughput, which corresponds to the maximum level that is known to be removed by the routine decontamination procedures.
The UV contamination monitoring plan for WFPC2 was based on observations of the WFPC2 primary standard star GRW+70S5824 through the F170W filter, in all 4 cameras of the instrument. The first, intensive phase began with a set of observations immediately after cool-down, and repeated at 3, 6, 12, 18, 24, 36 hours, and 2, 3, 4, 5, 6 days after cooldown. At each epoch, the two observations for each chip consisted of a dither-pair where the second exposure was offset by 0.25" along both the x and y axes in a simple DITHER-LINE pattern. All exposures were 40s in length and obtained using GAIN=15. Subsequent monitoring observations were obtained before and after each of the decontamination procedures at 7, 14 and 28 days after cooldown.
The data were calibrated using the normal WFPC2 pipeline, after which cosmic rays were removed from the images and photometry was carried out using standard photometry procedures. Only about 10% of the images had cosmic rays sufficiently close to the star, and of sufficient intensity, that editing was necessary.
From our photometry, we have verified the following: At no point did the contamination on any of the CCD windows exceed a 15% drop in throughput, which is well above the safety limit of a 30% drop in throughput. While the contamination rate was measured to be slightly higher than our normal rate in each of the cameras (up to a factor of 2), the rates were still well below those observed during the previous servicing mission. This is likely due to a combination of factors, including not cooling down the camera until 12 days after cool-down (allowing extra time for contaminants to escape), as well as possibly a reduced level of contaminants from the new instruments compared to previous servicing missions.
The decontamination procedures carried out during SM3b demonstrated that the UV throughput in the F170W filter was successfully recovered to its nominal value (within our measurement errors and systematic uncertainties of 0.2-0.3%). Moreover, the contamination rates for each camera now appear to have returned to their nominal values.
Thus we conclude that our program of delayed cooldown, pro-active UV monitoring, and frequent decontaminations during SM3b were successful in fully retaining the UV throughput capabilities of WFPC2 as measured in the F170W filter.