Mitigation of CTE Losses in ACS/WFC: Observed Sky Backgrounds

Josh Sokol, Jay Anderson, Linda Smith and the ACS Team
Space Telescope Science Institute, Baltimore MD

ABSTRACT

Over time, exposure to the harsh radiation environment of space has diminished the charge transfer efficiencies (CTE) of the ACS CCDs. While post-processing techniques can combat this loss of charge, it is also possible to ameliorate CTE losses in advance: by observing with a natural background high enough (~20 e−) to "pave over" charge traps. HST observers can use the estimates provided here to anticipate the natural background that should be present in their exposures, and can then determine whether they want to supplement that background to improve CTE by lengthening their exposures or through using a post-flash.

ANALYSIS

All external full-frame ACS/WFC images taken during Cycle 18 were extracted from the Mikulski Archive for Space Telescopes (MAST). The resulting dataset contained 8227 images. Table 1 breaks down these data further to show the distribution of images by filter. The sky background in each image was calculated by a FORTRAN routine and averaged between the four amplifiers.

For each filter studied, the HST Exposure Time Calculator (ETC) was queried three times to roughly span the range of background value predictions. Varying zodiacal light, earth shine, and air glow (respectively), we tested permutations of “low-average-low,” “average-average-average”, and “high-high-high” over 1000-second exposures. The resulting simulated sky backgrounds, together with the ETC’s estimate of dark current, produce a cumulative background commensurate to the background levels measured from actual raw images.

REFERENCES