Seventeen Years of HST's Advanced Camera for Surveys : Calibration Update

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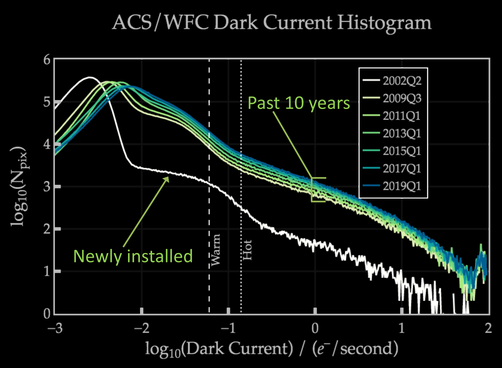
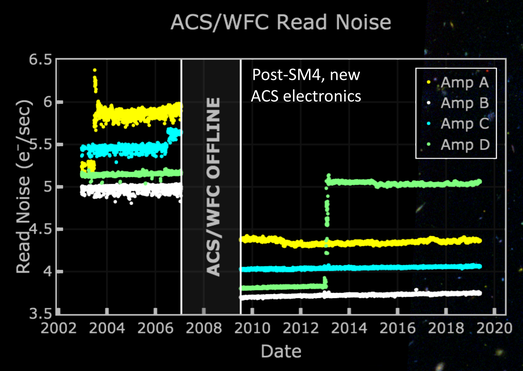
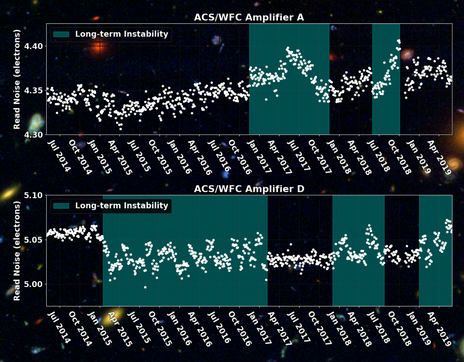
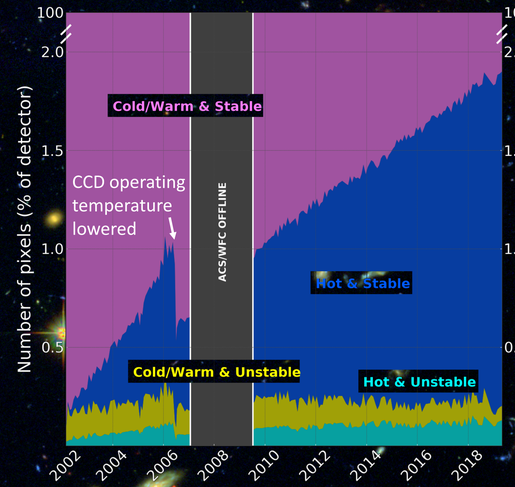
I. Long-term Monitoring to Optimize ACS Detector Calibrations

On orbit for seventeen years, the Advanced Camera for Surveys (ACS) remains a crucial workhorse imager for *HST*. The Wide Field Channel (WFC) has now been operating over twice as long (>10yrs) since its 2009 repair as before its 2007 failure. The ACS Team at STScI has been exploiting this long history to characterize instrument performance better than ever, resulting in excellent calibrations for the ACS users. Examples shown here include: full lifetime trending in WFC dark current and read noise (*left 2 panels*), and detailed stability monitoring of WFC read noise and per-pixel dark current (*right 2 panels*).



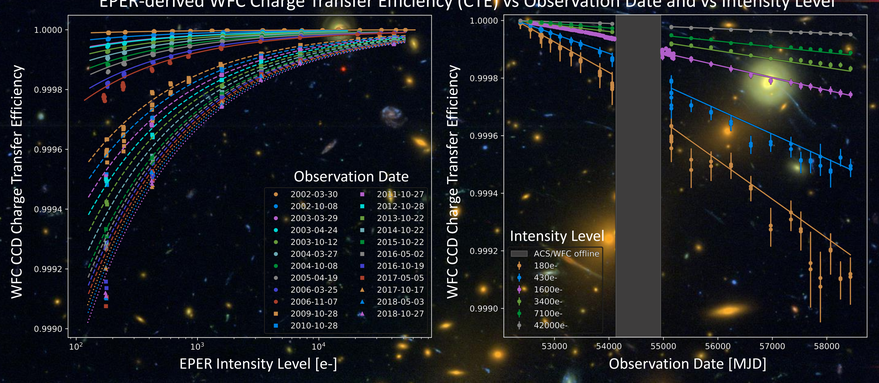


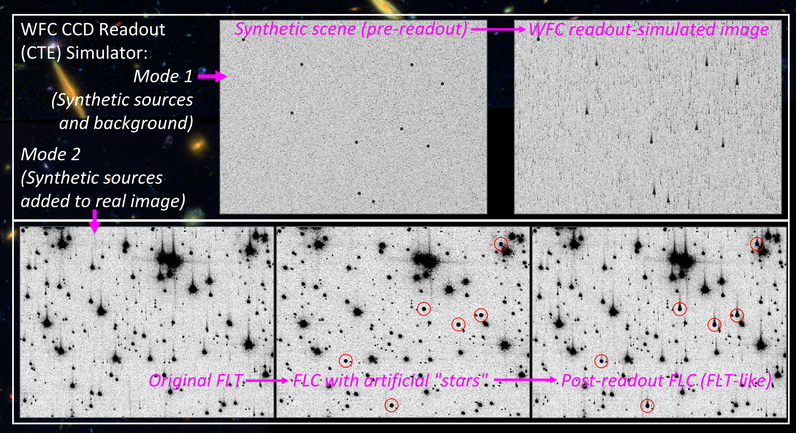


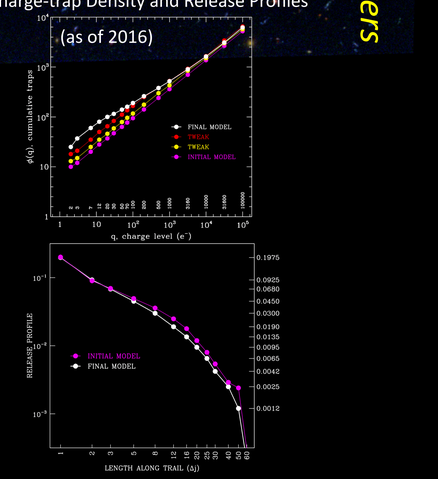


II. WFC CCD Charge Transfer Efficiency: Charting and Simulating

Cumulative radiation damage to the WFC CCDs steadily worsens their charge transfer efficiency (CTE). After seventeen years, the WFC CTE has become problematic for faint targets against low WFC backgrounds. The ACS Team provides both corrections and mitigations of this effect, including a pixel-based correction (post-readout) that was extensively updated as of the Summer 2017 update to the *CALACS* pipeline. Regular monitoring of CTE degradation with Extended Pixel-Edge Response (EPER; *left 2 panels*) data shows smooth trending as functions of both CCD age and image background level. The ACS Team has recently made available a CCD readout simulator that includes realistic charge-trapping and –release (*middle and right panels*).



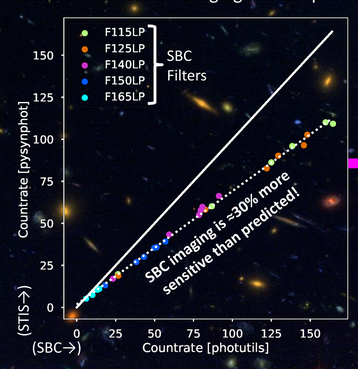




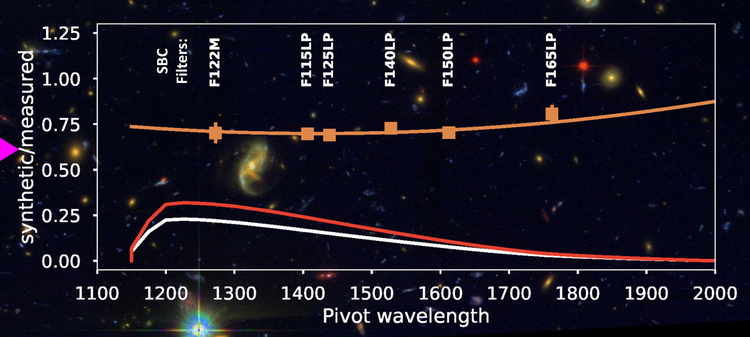
III. Coming Attractions: SBC Zeropoints; WFC Geometric Distortion

The ACS Team has recently completed a detailed cross-comparison of ACS Solar Blind Channel (SBC) FUV photometry and HST/STIS FUV spectroscopy for a variety of stars, using all the SBC imaging filters. The original estimate for the SBC's MAMA detector quantum efficiency (QE) appears to have been 30% low (*left 2 panels*). These results will be published soon in a STScI Instrument Science Report, but the revised QE curve has already been incorporated into *pysynphot* and the SBC Exposure Time Calculator. The team has recently recalculated the geometric distortion solution for all the WFC imaging filters (*right 2 panels*). The revision incorporated precise astrometry from GAIA DR2, and lowered astrometric residuals to <1mas RMS.

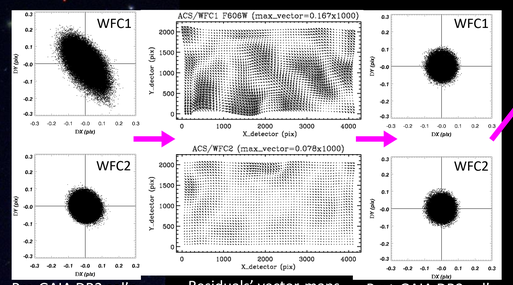
NGC 6681 stars: SBC imaging vs STIS spectra



Prior and Revised (after Correction) SBC MAMA Quantum Efficiency Curves



WFC astrometric residuals in 47 Tuc: pre- and post-GAIA DR2

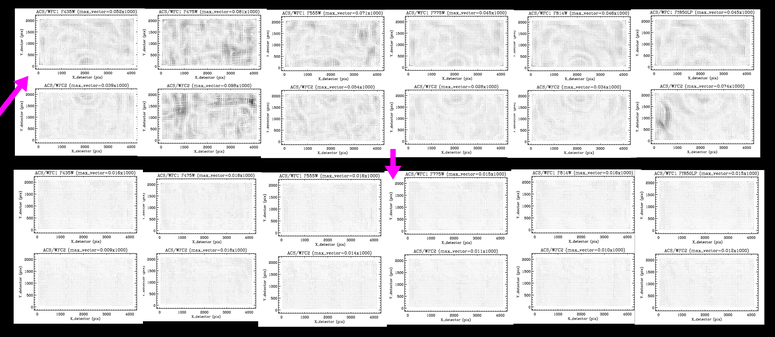


Pre-GAIA DR2 sol'n: nonGaussian >0.1pix RMS

Residuals' vector-maps

Post-GAIA DR2 sol'n: Gaussian ≪0.1pix RMS

WFC filter-dependent geometric distortions (*top*) corrected to <0.02 pixels RMS (*bottom*)



HST Frontier Field : Galaxy Cluster MACS J0416.1-2403 WFC Color Composite of Cluster Center in BVI Filters

HST Frontier Field : Galaxy Cluster Abell 2744 WFC Color Composite of Parallel Field in BVI Filters