The Advanced Camera for Surveys: Status Report

Norman Grogin and the ACS Team

STUC Meeting, 12 November 2019
Recently Completed ACS Work

- Discovering/Correcting a Long-standing ≈30% Flux Calibration Error for ACS/SBC
- Rectifying the LED “Superflash” Calibration Reference File
- Curing ACS Post-anneal Lock-ups via “Reduced Operate Mode” Annealing
Fixing a 30% Flux Calibration Error for ACS/SBC: Discovery

• Early 2019: GO CAL program reports unusually large offset in Lyα (1216Å) sensitivity

• Literature search: rare mentions of ≈30% discrepancy (>200 SBC papers)
  – Tao et al., 2012
  – Östlin et al., 2014
  – Bhattacharyya et al., 2017
  – Peacock et al., 2018

• Comparison of NGC 6681 STIS synthetic photometry vs. SBC broadband photometry clearly confirms 30% offset (right)
Fixing a 30% Flux Calibration Error for ACS/SBC: Correction

- Comprehensive checks to rule out:
  - IRAF synphot vs. pysynphot
  - AstroDrizzle vs. native (‘FLT’)
  - Photometry code dependence (DAOPHOT vs. PHOTUTILS)
  - SBC Red-leak

- Roughly 30% increase to SBC throughput curves (top) bring STIS synthetic and SBC observed counts into agreement (bottom)

- Rapid & repeated notifications: email to SBC GOs; June’19 AAS presentation; ACS ISR; ACS STAN; and MAST Newsletter
• Regular 0.5sec DARKs with 4.6sec FLASH show high-frequency LED intensity variations at ±1-2% level (*blue dots, at right*)

• Annual long-duration FLASH reference exposures sample this variation as well (*green triangles*)

• Long-term trending in LED intensity (*red*) now renormalizes the reference files (*yellow stars*) to enable more accurate FLASHCORR
ACS Reduced Operate Anneal Mode: *Motivation & Implementation*

- Ongoing radiation damage steadily increases ACS CCD warm/hot pixel counts
- CCD damage is mitigated by regularly ‘annealing’ (heating) CCDs — every 4wks
- Standard procedure: all power routed to heaters; electronics powered off (& cool)
- Winter/Spring 2019: ACS *fails to boot* after CCD anneals, until electronics warmer
- “Reduced Operate Anneal”: New plan to anneal w/ electronics in low-power state
- 1st Reduced Operate Anneal executes on 17 October 2019
ACS Reduced Operate Anneal Mode: Reassuring Early Diagnostics

- WFC CCD temperature profile during 1st ROA closely matches prior anneals
- At Left: Hot & warm pixel incidence after 1st ROA is indistinguishable from before
- At Right: Nominal reduction in WFC global dark current observed after 1st ROA

<table>
<thead>
<tr>
<th>ROA Mode</th>
<th>Date</th>
<th>% Hot</th>
<th>% Warm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>18 Oct’19</td>
<td>1.813</td>
<td>2.240</td>
</tr>
<tr>
<td></td>
<td>21 Oct’19</td>
<td>1.823</td>
<td>2.258</td>
</tr>
<tr>
<td></td>
<td>23 Oct’19</td>
<td>1.827</td>
<td>2.299</td>
</tr>
<tr>
<td>Anneal</td>
<td></td>
<td>&gt;0.14e−/s</td>
<td>0.06-0.14 e−/s</td>
</tr>
<tr>
<td>Post</td>
<td>23 Sep’19</td>
<td>1.808</td>
<td>2.269</td>
</tr>
<tr>
<td></td>
<td>25 Sep’19</td>
<td>1.824</td>
<td>2.312</td>
</tr>
<tr>
<td></td>
<td>27 Sep’19</td>
<td>1.832</td>
<td>2.347</td>
</tr>
</tbody>
</table>
ACS Ongoing & Planned Work

• “High Dynamic Range” WFC Superdark
  – Selectively merging the 1000.5 sec and 0.5 sec calibration DARKs
  – Eliminates superdark saturated pixels and pixel-blooms
  – Large majority of WFC exposures taken by GOs are ≪1000 seconds
  – Also improves fidelity of WFC simulated exposures using pixCTE ‘forward model’

• Major improvements to DARKCORR in CALACS
  – More robust DARKTIME calculation and usage (from empirically-derived overheads)
  – Combine HDR superdark with CCD full-well/bloom model for dark-saturated pixels

• New Cyc27+ ACS CAL: pixCTE monitoring/refinement at low background levels

• New Cyc27+ ACS CAL: ω Cen astrom./photom. cross-calibration with WFC3/UVIS
ACS Documentation Updates

• ACS Instrument Science Reports since the previous STUC: (May’19 – Nov’19)
  – 2019-03 : “Assessing the Accuracy of Relative Photometry on Saturated Sources with ACS/WFC”
  – 2019-05 (& STAN): “SBC Absolute Flux Calibration”
  – 2019-06 : “Post-SM4 ACS/WFC Bias II: Temporal Structure in the Prescan Bias Level”

• “HDox” conversion of ACS Instrument Handbook (Jun’19) and Data Handbook (Nov’19)

• Updated ACS Instrument Handbook for Cycle 28 (Ryon et al.)