STScI | SPACE TELESCOPE SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

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 unexpectedly 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*)

NGC 6681 stars:
SBC Photometry (X-axis) vs.
STIS Spectroscopy (Y-axis)
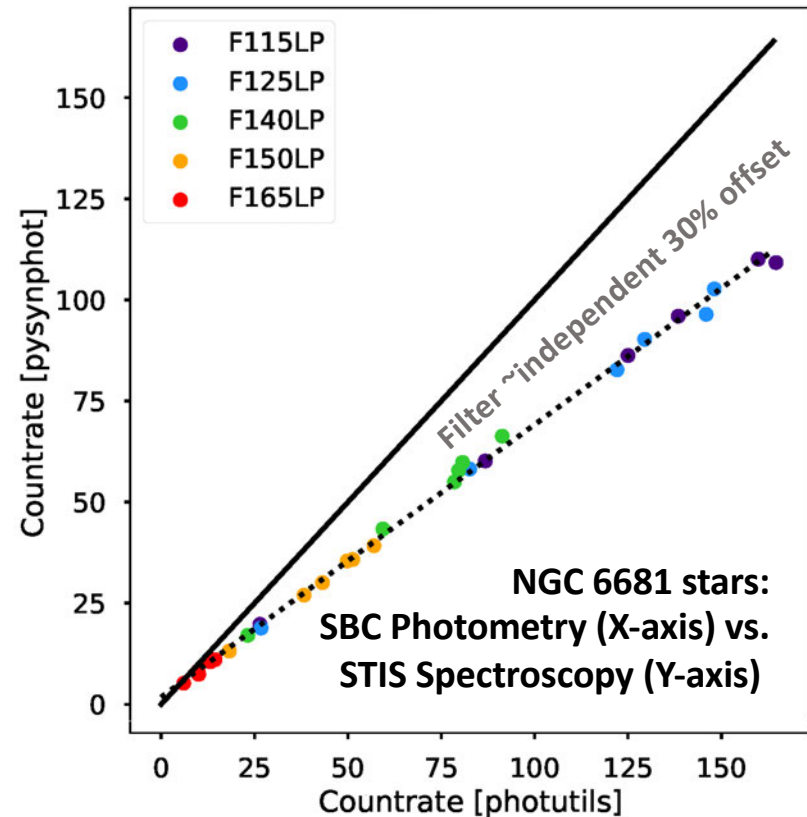
Fixing a 30% Flux Calibration Error for ACS/SBC: *Correction*

- 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
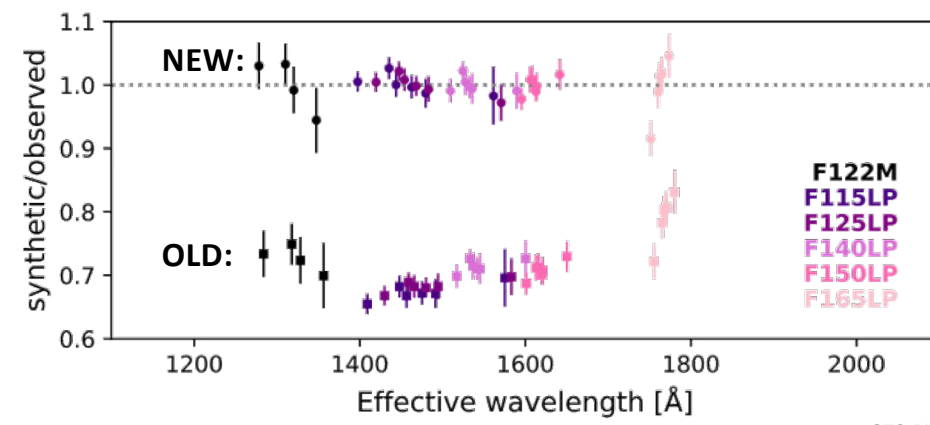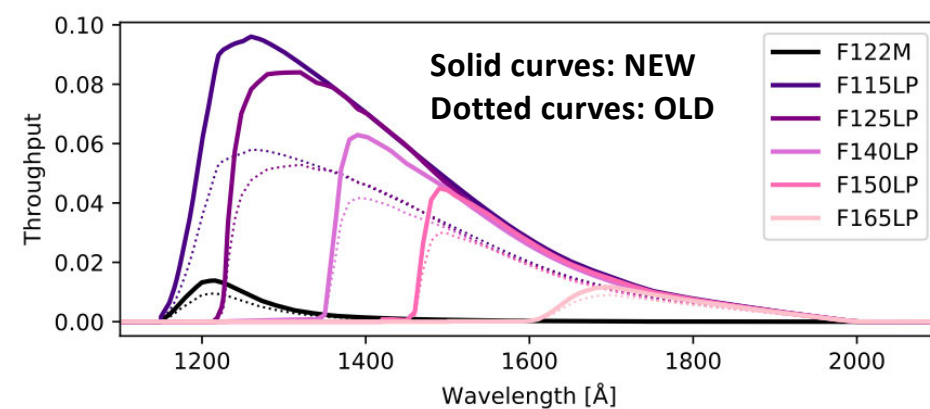
ACS Post-flash LED Intensity Rectification

- 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
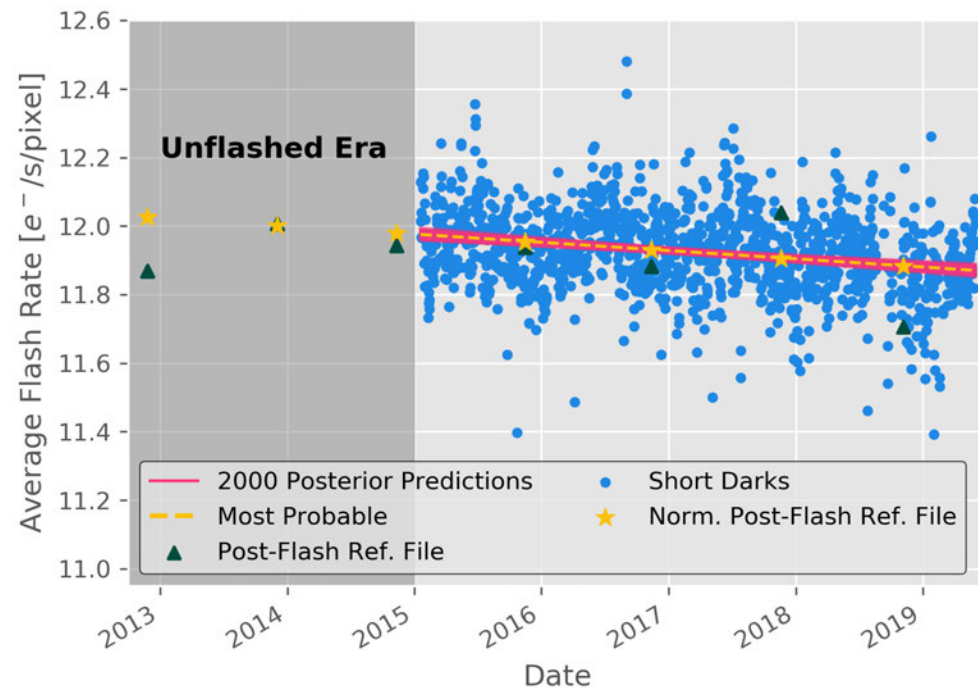
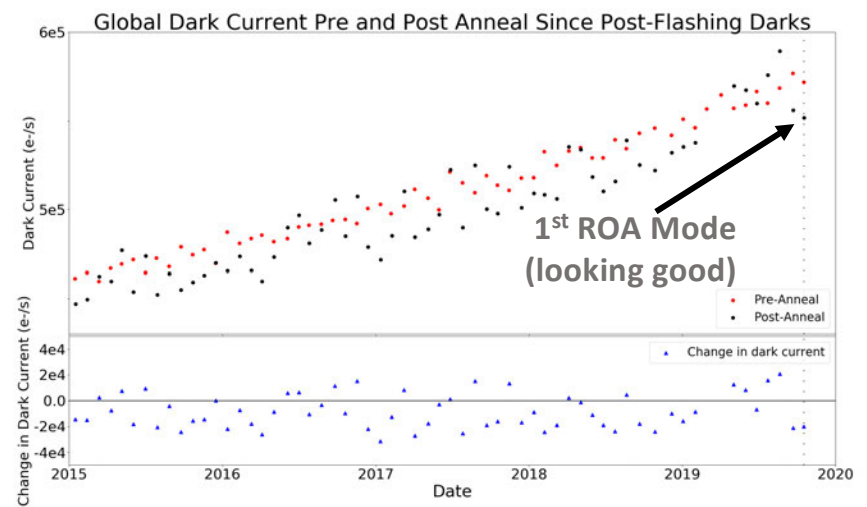## ACS Reduced Operate Anneal Mode: *Motivation & Implementation*

- 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

	Date	% Hot	% Warm
Post 10/17/19 Anneal (ROA Mode)	18 Oct'19	1.813	2.240
	21 Oct'19	1.823	2.258
	23 Oct'19	1.827	2.299
		>0.14e⁻/s	*0.06-0.14 e⁻/s*
Post 09/21/19 Anneal (Prior)	23 Sep'19	1.808	2.269
	25 Sep'19	1.824	2.312
	27 Sep'19	1.832	2.347

Global Dark Current Pre and Post Anneal Since Post-Flashing Darks

1st ROA Mode (looking good)

Pre-Anneal
Post-Anneal
Change in dark current

- "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"

  - 2019-04 : "SBC Time-Dependent Sensitivity and L-flats"

  - 2019-05 (& STAN): "SBC Absolute Flux Calibration"

  - 2019-06 : "Post-SM4 ACS/WFC Bias II: Temporal Structure in the Prescan Bias Level"

  - 2019-08 : "Temporal Stability of the ACS/WFC OD-800W LED"

- "HDox" conversion of ACS Instrument Handbook (Jun'19) and Data Handbook (Nov'19)

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