STScI | SPACE TELESCOPE SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

HST Mission Office Report

Tom Brown

STUC – 7 Oct 2021

We are working to maximize Hubble's science output through the 2020s

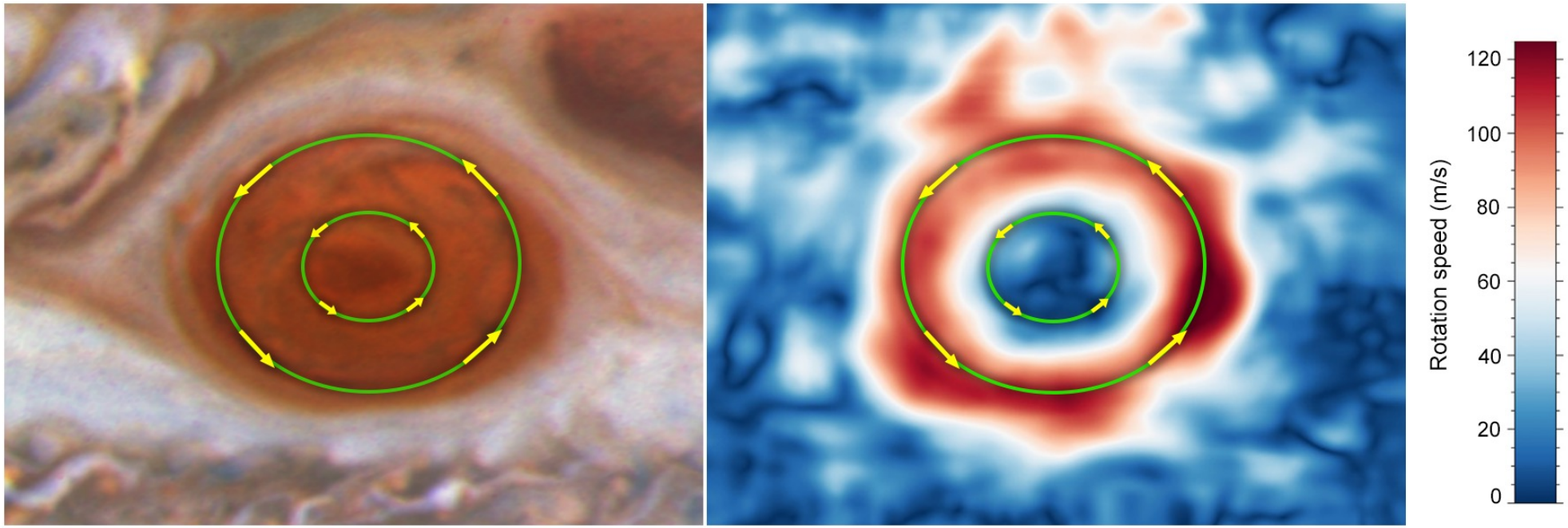
Summary

- Mitigating hardware challenges
- Looking ahead to era of Hubble and Webb synergy
- Negotiating next Hubble science operations contract
- Developing Hubble Senior Review proposal
- Long-range plan
- Instrument support

Winds in Jupiter's Great Red Spot Hubblesite: 2021-055

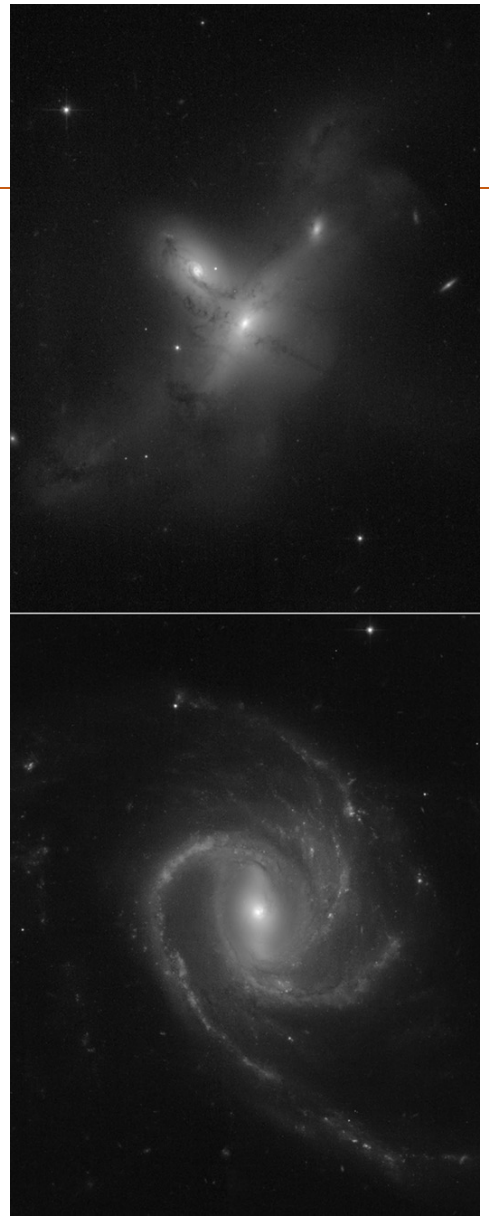
Analysis of long baseline HST data (2009-2020) shows increasing wind speeds in outer storm and decreasing wind speeds in innermost region.

PI: Simon (Program 15929), Wong et al. (2021, GRL)
Left: WFC3 F395N F502N F631N
Right: velocity map



Hubble hardware highlights

- Hardware challenges since last STUC meeting (more in GSFC presentation)
  - Space Telescope Imaging Spectrograph (May 12)
    - STIS suspended while HST was deep inside South Atlantic Anomaly
    - Strong geomagnetic storm due to coronal mass ejection
    - Attributed to single event upset, instrument rapidly recovered
  - Science Instrument Command & Data Handler Side B (June 13)
    - Failed handshake with 486 computer
    - Methodical troubleshooting traced problem to Power Control Unit
    - Operations successfully switched to SIC&DH-A on July 16
    - Work underway to restore SIC&DH redundancy (i.e., Side B capability)
  - Cosmic Origins Spectrograph (September 26)
    - COS suspended while HST was deep inside South Atlantic Anomaly
    - Attributed to single event upset, instrument rapidly recovered
    - Implementation of Lifetime Position 5 on October 1 (Cycle 29) went well
    - Lifetime Position 6 advance work proceeding for Cycle 30
  - Pointing Control System
    - Gyroscope 3 continues to exhibit erratic changes in rate bias
    - Fine Guidance Sensors also exhibiting periods of erratic behavior
    - Both issues have contributed to periods of higher acquisition failure rate
    - Pointing now relatively stable, with acquisition failure rate close to 5%

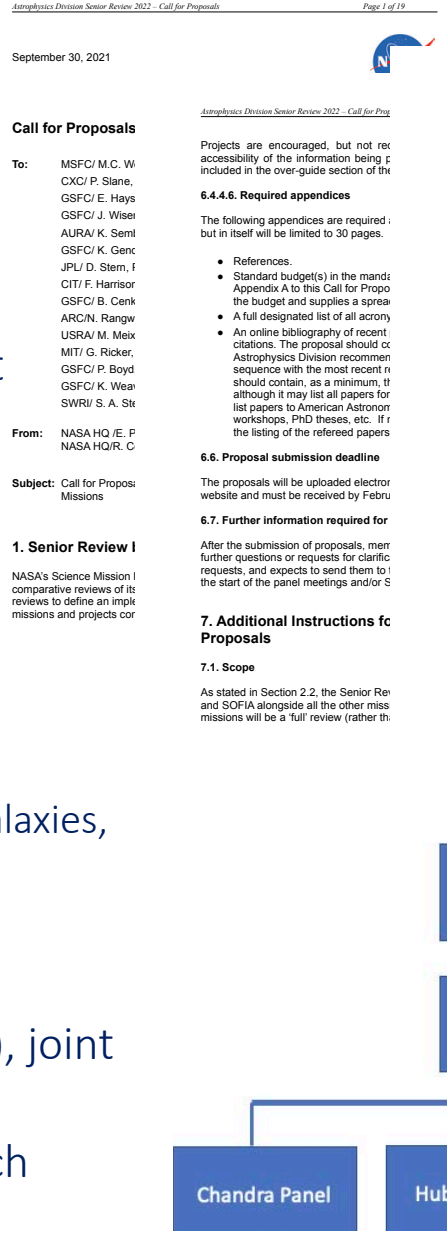


PI: Dalcanton
Program 15446
(gap program)

First Images from Rebooted Hubble: Astronomers Peer at Oddball Galaxies
hubblesite.org 2021-045

Hubble Programmatic Highlights

- HST contract extension for July 2021 – June 2026
  - Currently funded month to month while negotiating next contract
- HST Senior Review 2022
  - Call for Proposals released on October 1
  - Proposals due February 1, site visit March 14-18
  - As in 2019, using science contributions from staff & community
    - Requesting a few paragraphs in a few weeks in an area of expertise
    - Science subsections for each TAC panel (Solar System, exoplanets, galaxies, large-scale structure, etc.)
    - Providing highlights over past few years, broad context, look ahead
    - Response has been extremely supportive and helpful
  - Science subsections also cover initiatives (ULLYSES, HST-TESS, etc.), joint programs, mission support, productivity & impact, archive
  - Need to stress continuing importance of Hubble after Webb launch
  - Need to place Hubble in context of Astro2020
  - Will highlight power of Hubble's long time baseline
  - As with 2019, we request STUC feedback



Astrophysics Division Senior Review 2022 – Call for Proposals *Page 1 of 19*

September 30, 2021

Call for Proposals

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From: NASA HQ /E. P
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Subject: Call for Propos
Missions

1. Senior Review I

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Astrophysics Division Senior Review 2022 – Call for Prog

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As stated in Section 2.2, the Senior Re
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Hubble and Chandra in 2016). The review panels will fully assess the scientific merit and productivity of Chandra, Hubble, and SOFIA and will also place additional emphasis on the operations, efficiency, and the science productivity given the costs for these missions.

7.2 Required elements

Proposers should fully follow all aspects of Section 6 when preparing their proposals, taking note of the following adjustments:

1. An additional section, entitled "Project's Perspective on Operations and Efficiency" must be included. This section shall include:
   a. An assessment of the current efficiency of science and mission operations with appropriate metrics and associated justification of the metrics, where appropriate.
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   d. A description and justification of the management and decision processes that the project uses to apply the funding it receives to maximize science quality, observational efficiency, and return on investment, in an inclusive environment, nurturing a diverse community within and outside the project.
2. The combined proposal should not exceed 40 pages (including figures, figure captions, tables, and other graphics). Not included in the page limit are the appendices (see Section 6.3).

8. Panel Instructions

8.1 Review criteria

All proposals will be assessed against the following criteria:

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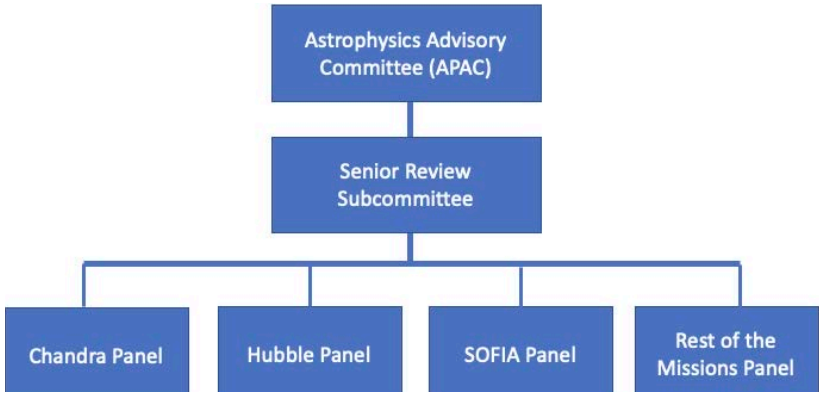
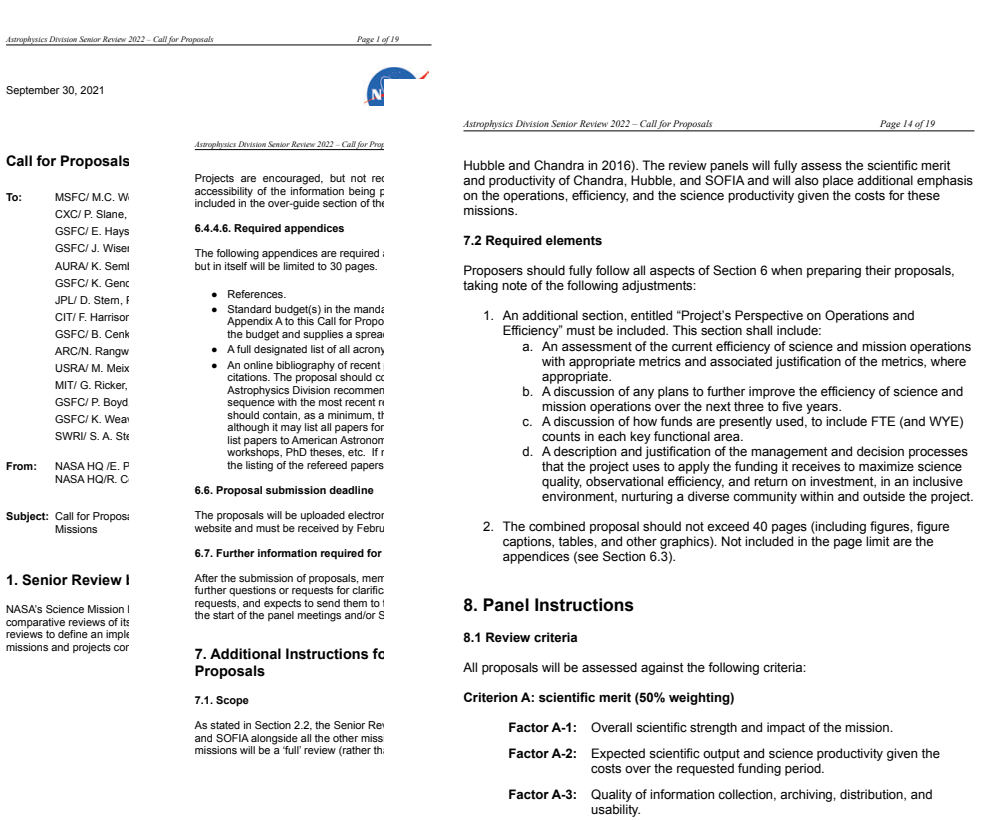


Panel structure for 2022 review

Hubble Senior Review 2022

We welcome STUC feedback on mission objectives

- Reminder of Prioritized Mission Objectives in 2019
  - Programmatic:
    - **P1:** Keep Hubble's instruments and subsystems healthy and safe so that great science can continue out to 2025 or beyond.
    - **P2:** Mitigate known instrument or system degradation in a manner consistent with maximizing science.
    - **P3:** Identify and, if practical, implement operational efficiencies that reduce costs without compromising science, or enable new science within the current cost profile.
  - Scientific:
    - **S1:** Support high-profile community-driven science as established through peer scientific review.
    - **S2:** Enhance scientific discoveries through improved archive interfaces and experiences.
    - **S3:** Optimize the unique UV scientific capabilities of Hubble.
    - **S4:** Enable pathfinding science for JWST by utilizing Hubble's unique resources.



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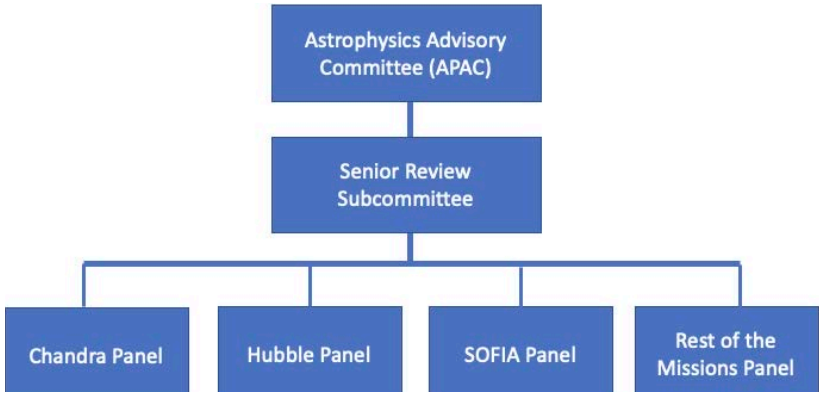
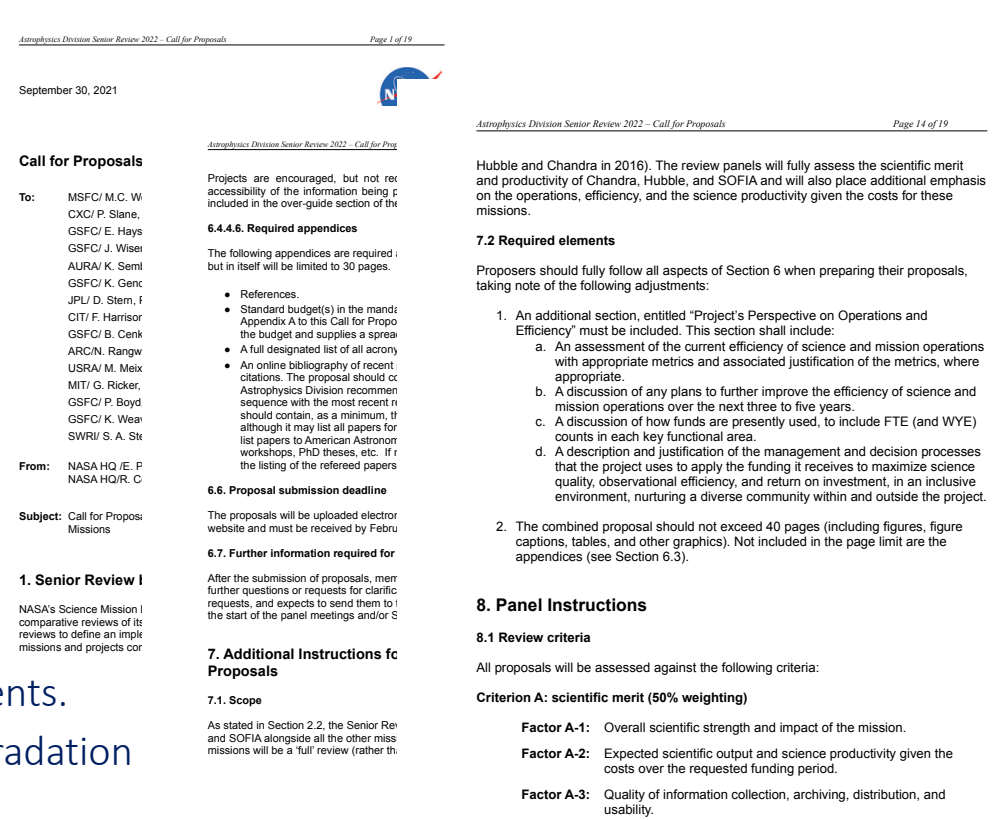


Panel structure for 2022 review

Hubble Senior Review 2022

We welcome STUC feedback on mission objectives

- Draft Prioritized Mission Objectives for 2022
  - Programmatic:
    - **P1:** Maximize the long-term scientific productivity and impact of Hubble over the coming decade by pursuing operational improvements.
    - **P2:** Extend Hubble's operational lifetime by mitigating risks and degradation associated with the observatory, subsystems, and instruments.
    - **P3:** Explore innovations that convey operational efficiencies, lifetime extension, and new scientific capabilities.
  - Scientific:
    - **S1:** Enable a diverse high-impact science program that evolves with the field over the coming decade.
    - **S2:** Expand and enhance the scientific potential of Hubble's archive, with a recognition of its heterogeneous holdings, broad wavelength coverage, and long time baseline.
    - **S3:** In consultation with the community, guide the strategic use of Hubble's unique capabilities in the context of new observatories on the ground and in space.



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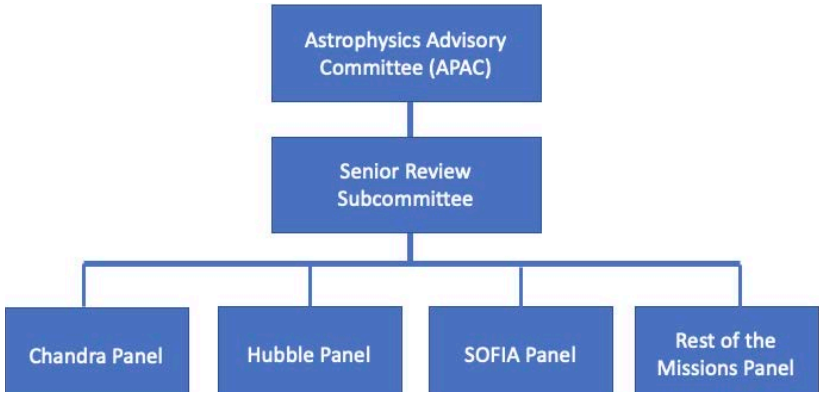
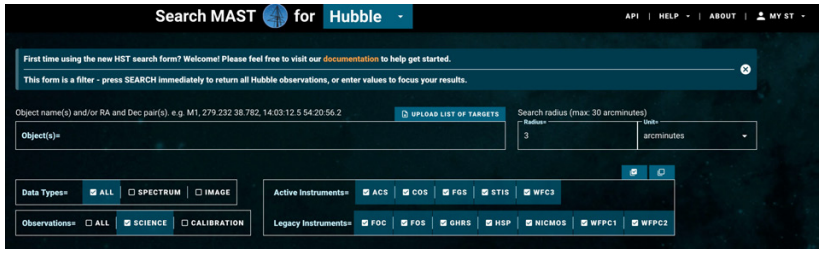


Panel structure for 2022 review

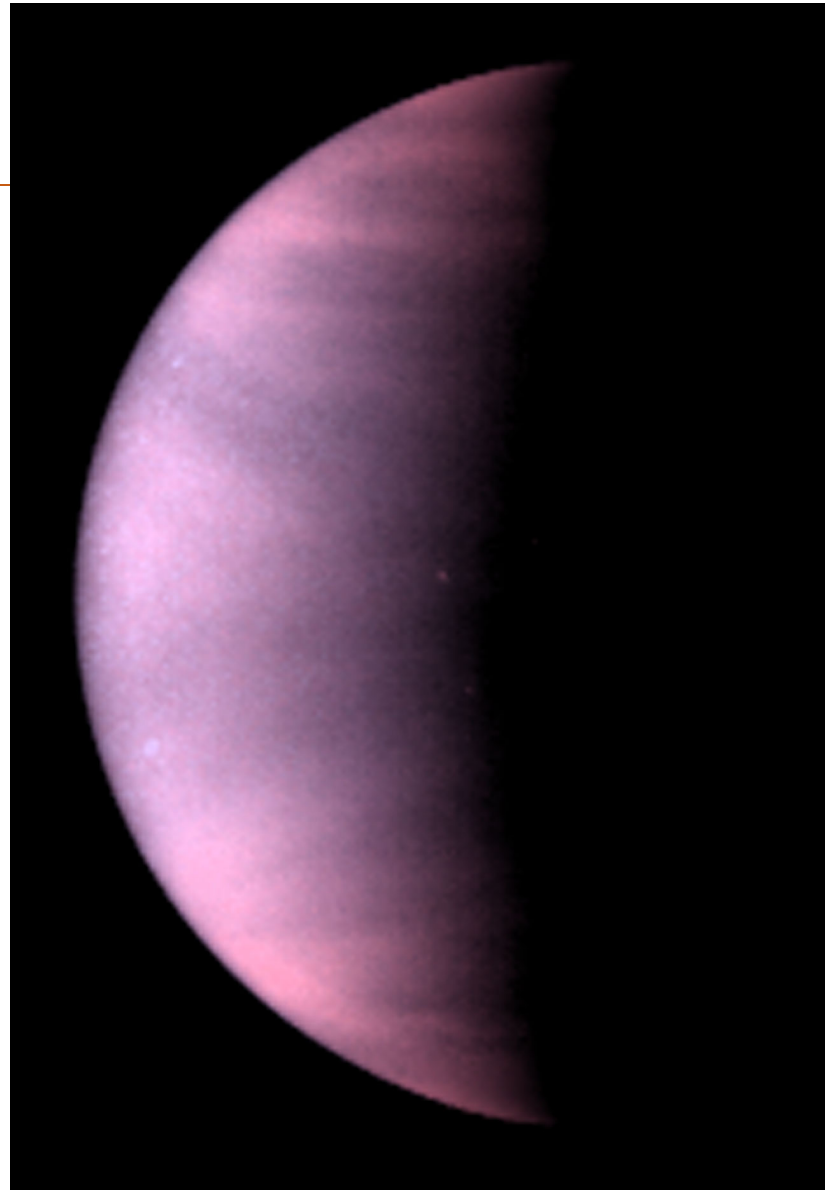
Other items

- New MAST search released Aug 31: https://mast.stsci.edu/search/hst/
  (see Fleming presentation to April meeting)



- Venus
  - In Oct 2016 STUC meeting, discussed change in Venus programs
    - No longer part of standard TAC
    - Could be proposed for DD with high bar for acceptance
    - See Reid presentation covering Venus proposal and publication history
  - In 2018, we received a request for DD observations of Venus
    - Declined due to pointing control system performance and risk
  - For Cycle 30, we will no longer accept any Venus proposals (GO or DD)
    - Pointing control system is still a concern today
    - We should not encourage proposals that will not be accepted

- Cycle 30 Annual Call will increase orbit pool to 3000 orbits
  - Would have been higher if not for the one-month setback from SIC&DH
- ULLYSES Data Release 3 on August 31



PI: Esposito (Cycle 4, GO-5783)
WFPC2 UV image of Venus
F218W + F255W

Long Range Plan Status

Prepared by Dave Adler

Long Range Plan

Cycle 29 update

- The HST Cycle 29 LRP was released on September 1, 2021 and began on October 1

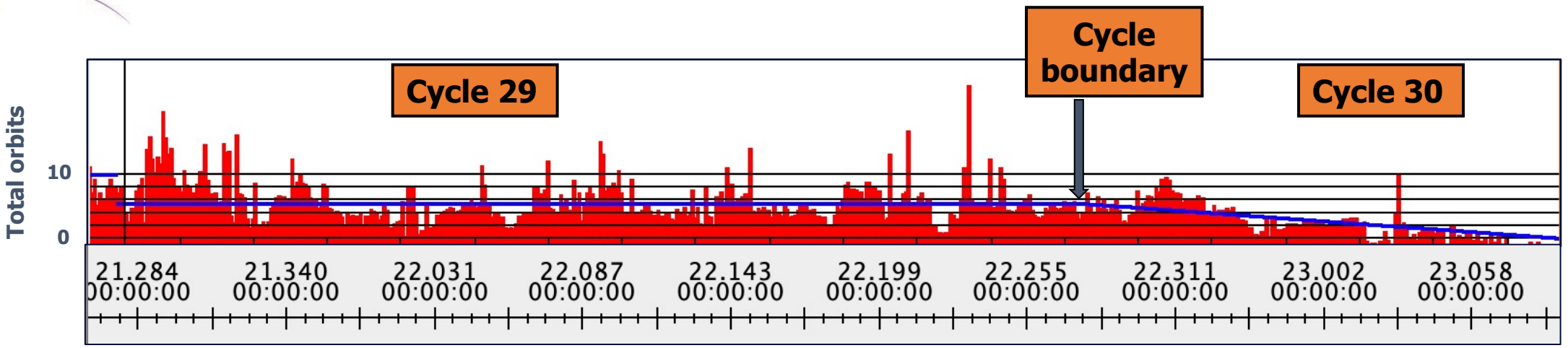
Cycle 28 execution lower than previous cycles

- **Cycle 28** averaged 75.1 orbits/week over 52 weeks
  - five-week down-time before the SIC&DH side switch in July, plus downtime in for instruments suspending
- **Cycle 27**: 85 orbits/week
- **Cycle 26**: 80 orbits/week
  - Three weeks downtime due to Gyro 2 failure
- **Cycle 17-25**: 84 orbits/week

Previous Cycle Completeness

- **Cycle 25**: 9 orbits remain
  - 8 orbits from two 4-orbit visits from TRAPPIST exoplanet program **15304** (de Wit) to be observed by late October
  - 1 orbit ToO follow-up from SUSHI program **15363** (Suzuki) planned for November
- **Cycle 26**: complete, but some HOPRs from astrometry program 15491 (Bedin) are expected
- **Cycle 27**: 133 orbits left, some as late as spring 2022

Long Range Plan



Cycle 29 LRP features

- Cycle 28 programs fill the start of the LRP until late October
- Current subscription levels drop off in November 2021 to save room for
  - First set of Cycle 29 mid-cycle programs
  - Large number of unschedulables/not ready visits (as of mid-September).
  - ~350 orbits of not-yet-submitted ULLYSES programs
  - Usual number of ToOs, Director's Discretionary, HOPRs, etc.
- In late September, programs moved up from end of cycle to fill subscription, as needed
  - Gives adequate time for CS reviews to set visits flight-ready

Exoplanet Programs

- For exoplanets with tight period/phase constraints, planning windows outside the definitive ephemeris (10 weeks) are not reliable

Cycle 25-28

- 15 programs/165 orbits remain, including
  - Collecting the Puzzle Pieces: Completing HST's UV+NIR Survey of the TRAPPIST-1 System ahead of JWST (**deWit , Cycle 25, 114-orbits)** 2 visits/8 orbits planned for Oct 2021
  - Seeing in 3D: Unlocking the dynamical properties of a canonical exoplanet (**Mikal-Evans, Cycle 27, 60 orbits**) 29 consecutive-1-orbit visit string, one 9-orbit string remain for Nov 2021

Cycle 29

- 19 programs and 379 orbits allocated
- **Highlights:**
  - Essential Ultraviolet Stellar Characterization for Cycle 1 JWST Transiting Planet Targets (**Youngblood, 110 orbits)**
  - Cloudy mornings and clear afternoons: mapping atmospheric dynamics at the limbs of an exceptional hot Saturn (**Rustamkulov, 23 orbits**)
  - A comparative study of atmospheric escape in the brightest system of super-earths straddling the evaporation valley (**Ehrenreich, 35 orbits**)

Solar System Programs

Previous cycles:

- Cycle 28 has 9 orbits of moving target currently in the operational plan
- Some are not yet plannable

C29 Solar System : 12 programs and 216 orbits

- **Highlights**:
  - A combined HST and JWST study of the composition of the faintest trans-Neptunian objects: Testing hypotheses for the formation of the Solar System (**Trilling, 99 orbits**)
  - OPAL: Outer Planet Atmospheres Legacy (**Simon, 41 orbits**)
  - Observing Jupiter's FUV auroras during the Juno Extended Mission (**Nichols, 18 orbits**)
  - Characterization and Temporal Evolution of the Ejecta Created by the DART Impact on Dimorphos (**Li, 19 orbits**)
  - Are the surfaces of the large moons of Uranus modified by charged particle bombardment? (**Cartwright, 16 orbits**)

Other programs of note

- **Two large M31 programs**
  - Connecting the Smoke to the Fire: Mapping Andromeda's Inner Circumgalactic Medium **(Lehner, 137 orbits),**
  - The Panchromatic Hubble Andromeda Southern Treasury (PHAST) **(Williams, 195 orbits)**

- **Reverberation program**
  - Shedding light on light echoes: mapping the accretion disk and broad line region in Mrk 279 (**Chelouche, 50 orbits)**
    - PI requested all visits in a 40-day period, with a visit every 0.7-0.9 days
    - STIS MAMAs can only schedule in SAA-free times
    - PC is working with PI to find a workable solution

ULLYSES

HST UV Legacy Library of Young Stars as Essential Standards (ULLYSES)

- **Cycle 27** material mostly done
- **Cycle 28** programs with some remaining
- **Cycle 29** – not all submitted; numbers are as of 9/22/21

Program(s)	alloc	progs	Exec/sched by 10/3/21	Planned before 10/1/22	Planned after 10/2/22	comment
C27 Dwarf Galaxy	6	1	4	2	0	
C27 LMC	75	8	71	0	0	4 not in plan
C27 SMC	69	6	69	0	0	complete
C28 Galactic low-mass stars	106	7	93	12	0	1 not in plan
C28 LMC	64	6	27	26	0	11 not in plan
C28 SMC	100	6	28	69	0	3 not in plan
C28 T-Tauri	106	7	96	0	0	11 not in plan
C29 LMC	87	16	0	0	0	
C29 SMC	48	8	0	0	0	
C29 T-Tauri	136	11	0	0	0	

Large/Treasury programs

Remaining Cycle 25-28 Large Programs

C25-28 Program	alloc	Exec/sched by 10/3/21	Planned before 10/1/22	Planned after 10/1/22	comment
deWit	114	105	8	0	Exoplanet; 1 not planned
Weisz	244	239	0	0	HOPRs; 5 not planned
Kelly (c27-c28)	192	112	64	16	12 sets of 16-consecutive orbits
Jones	110	85	15	8	2 not in plan
Momcheva	259	139	107	1	3D-DASH; 12 not in plan
Peterson	198	148	44	0	Reverberation; 6 not in plan
Sabbi	84	48	35	0	GULP; 1 not in plan

Large/Treasury programs

Remaining Cycle 29 Large Programs

C29 Program	alloc	Exec/sched by 10/3/21	Planned before 10/1/22	Planned after 10/1/22	comment
Pala	118	0	0	0	22 orbits of ToO
Levan	22	0	0	0	ToO
Youngblood	110	0	0	0	exoplanets
Trilling	99	0	0	0	TNOs; JWST-coord
Lehner	137	0	0	0	M31
Williams	195	0	0	0	M31-PHAST

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ACS Update

Norman Grogin, Roberto Avila, and ACS Team

ACS Developments since the Apr'21 STUC Meeting

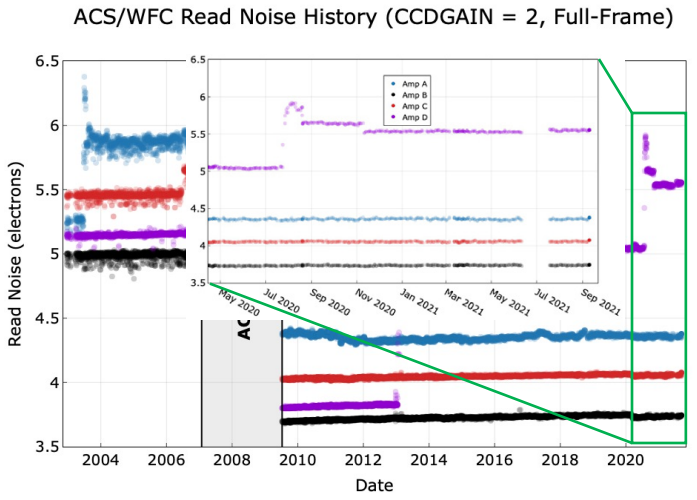
- ✓ ACS continues to operate nominally.

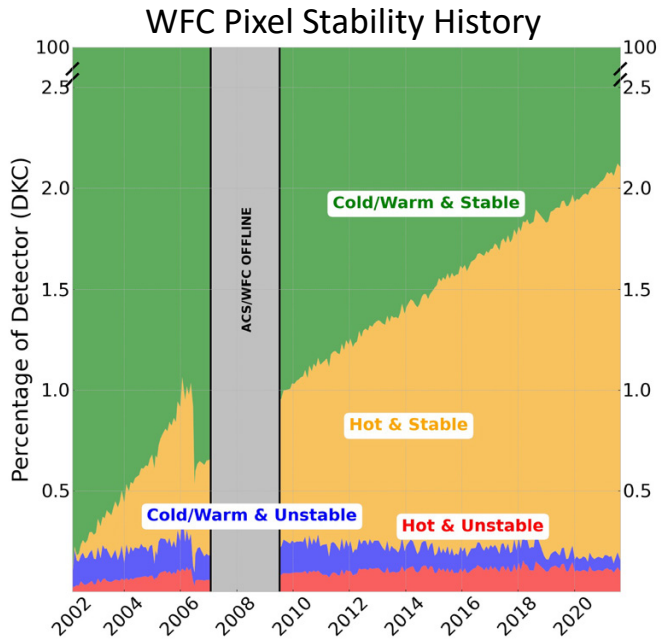
- Continued stable WFC readnoise after Jul'20 AmpD glitch (*upper left*); slow trending of WFC dark current & CTE

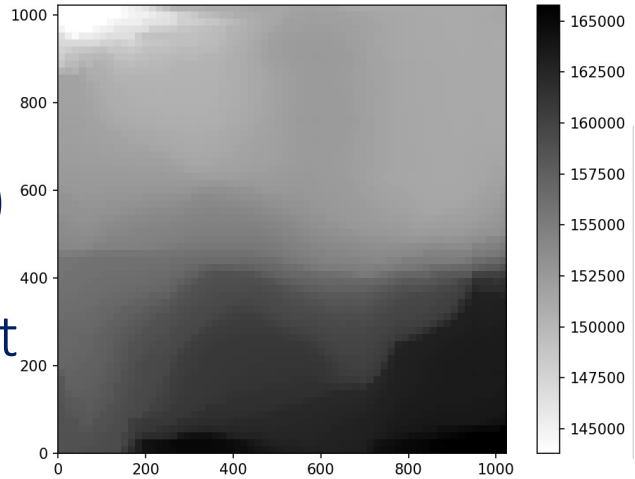
- WFC pixel stability monitoring (*upper right*) shows steady 99.8% usability

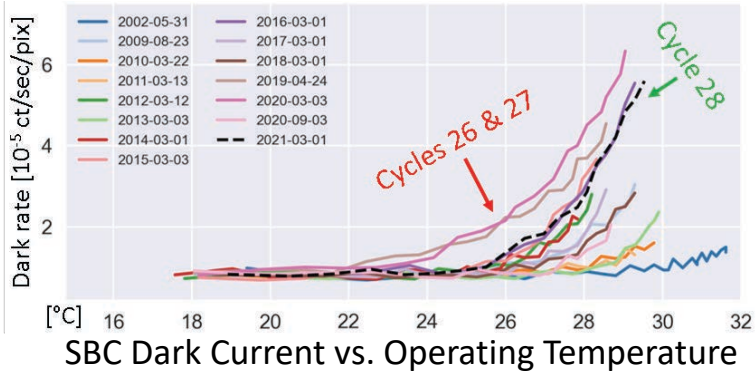
- CALACS updated to DQ-flag spatially variable HRC CCD saturation (*lower left*)

- Early onset of elevated SBC dark current seen in Cycles 26 & 27 has reverted back to long-standing behavior (*lower right*)









Highlights of ACS Recent & Ongoing Work

- Spatially-dependent CCD saturation flagging in CALACS
  - ACS/WFC shows ±10% variation; CALACS implementation in 1Q21 (reported at Apr'21 STUC)
  - ACS/HRC (legacy) shows ±6% variation; CALACS implementation in 3Q21 (≈1Q ahead of schedule)
- Planned improvements to DARKCORR in CALACS
  - DARKCORR update to better correct "fading" hotpix recently discovered (ISR ACS 2021-03)
  - Revised DARKTIME overheads estimate, from improved short-/long-exp hotpix flux ratios
- Continued refinement of WFC geometric distortion solution
  - Cycle 28 non-routine CAL program confirms post-2016 shallowing of coefficients' trending
  - Gaia eDR3 validates existing (DR2) solution, with ≈2× more precise proper motions for 47 Tuc
- Commissioning underway for new ACS observing mode: WFC spectropolarimetry
  - Crossing the WFC grism filter (G800L) with the polarizer filters (POL0V; POL60V; POL120V)
  - Goal is to advertise Opt/NIR (6000-9500Å) grism spectropolarimetry capability in upcoming observing opportunity

New ACS Documentation since the Apr'21 STUC Meeting

- ISR ACS 2021-01 : "Systematic Effects of Pixel-based CTE Correction on the Accuracy of ACS/WFC Point Source Polarimetry" (Desjardins et al.)
- ISR ACS 2021-02 : "Long-term Monitoring of the ACS Tungsten Lamp Brightness" (Cohen & Grogin)
- ISR ACS 2021-03 : "Fading Hot Pixels in ACS/WFC" (Ryon et al., in press)
- ISR ACS 2021-04 : "One-Pass HST Photometry with `hst1pass`" (Anderson et al., in press)
- TIR ACS 2021-01 : "An Exploration of Reduced Exposure Time and Post-Flash Duration of ACS/WFC Calibration Darks" (Ryon et al.)
- TIR ACS 2021-02 : "Python Build of the IDC Table Generator for ACS/WFC" (Hoffmann et al., in press)

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EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

COS Update

Marc Rafelski, Bethan James, and COS team

COS General Updates

- COS is Operating Nominally
  - Time Dependent Sensitivity trends remain constant
  - FUV dark rate decreased back to nominal value, NUV dark rate remains constant
  - New hot spot in the background region of LP4, being investigated
- New reference files supporting FUV LP5 & LP3, FUV LP4 (calibration) and NUV
- Documentation: 3 STANS, 5 ISRs, COS DHB, and new Jupyter notebooks

Authors	Title	ISR #
E. Frazer et al.	Summary of COS Cycle 27 Calibration Plan	2021-04
D. Dashtamirova et al.	Cycle 26 COS NUV Detector Dark Monitor	2021-05
D. Dashtamirova et al.	Cycle 27 COS NUV Detector Dark Monitor	2021-06
T. Fischer et al.	Focusing on New COS FUV Lifetime Positions: G130M/1291 at LP5 G140L/800 at LP3	2021-07
K. Rowlands et al.	The Time-Dependent Sensitivity Correction of the COS/FUV Cenwaves G130M/1055 and G130M/1096	2021-08

The COS2030 Plan

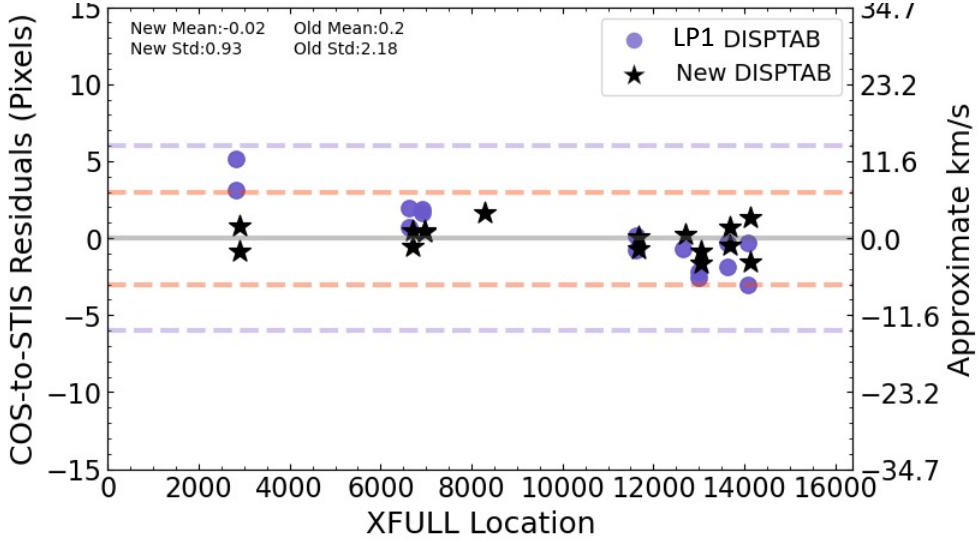
- New ideas and methods now enable us to use the detector area above LP5
  - Increased overheads due to split-wavecals that avoid light leak
- New hybrid-LP mode of operating, along with LP6, will enable COS operations to 2030

	Grating/Cenwave Lifetime Position					
Date	**Blue Modes**	**G130M-1222**	**G130M-1291 + 1300s**	**G160M-short**	**G160M-long**	**G140L**
In the past	2	4	4	4	4	4
Oct. 2021	2	4	4→5	4	4	4→3
Oct. 2022	2	4	5	4	4→6	3
Late 2024	2	4	5	4	6	3→2
Late 2025	2→?	4	5	4	6	2
Late 2026	?	4	5	4	6	2→?
Late 2028	?	4→6	5	4→6	6	?
Mid-2030	?	6→?	5→?	6→?	6→?	?

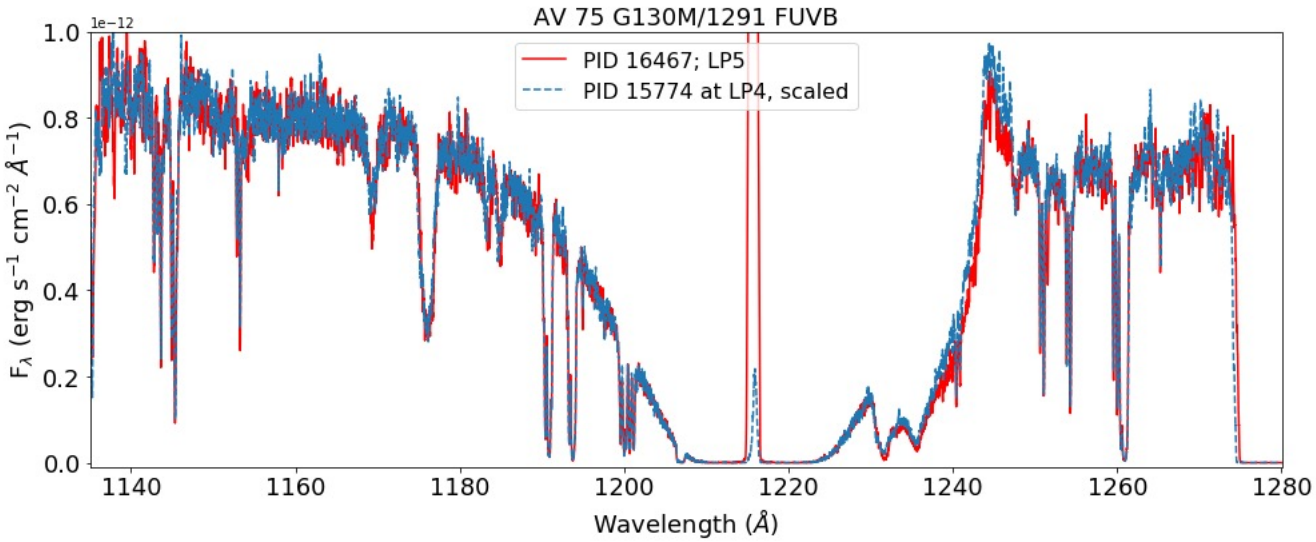
LP5 / LP3 Calibration: Operations started with Cycle 29

- G130M settings (1291, 1300, 1309, 1318, 1327) at LP5 using COS2025 rules (no BOA)
- G140L settings (800, 1105, 1280) at LP3 since mostly fall on segment A.
  - New calibrations needed only for cenwave 800.
- Reference files were delivered on Sept 10
  - Including profile extraction, wavelength calibration, and flux calibration, bad pixel table
- Resolution on segment FUVA with G130M grating ~14,000 (slightly higher than at LP4)

Wavelength Calibration Residuals in G130M/1291 FUVB within spec and small

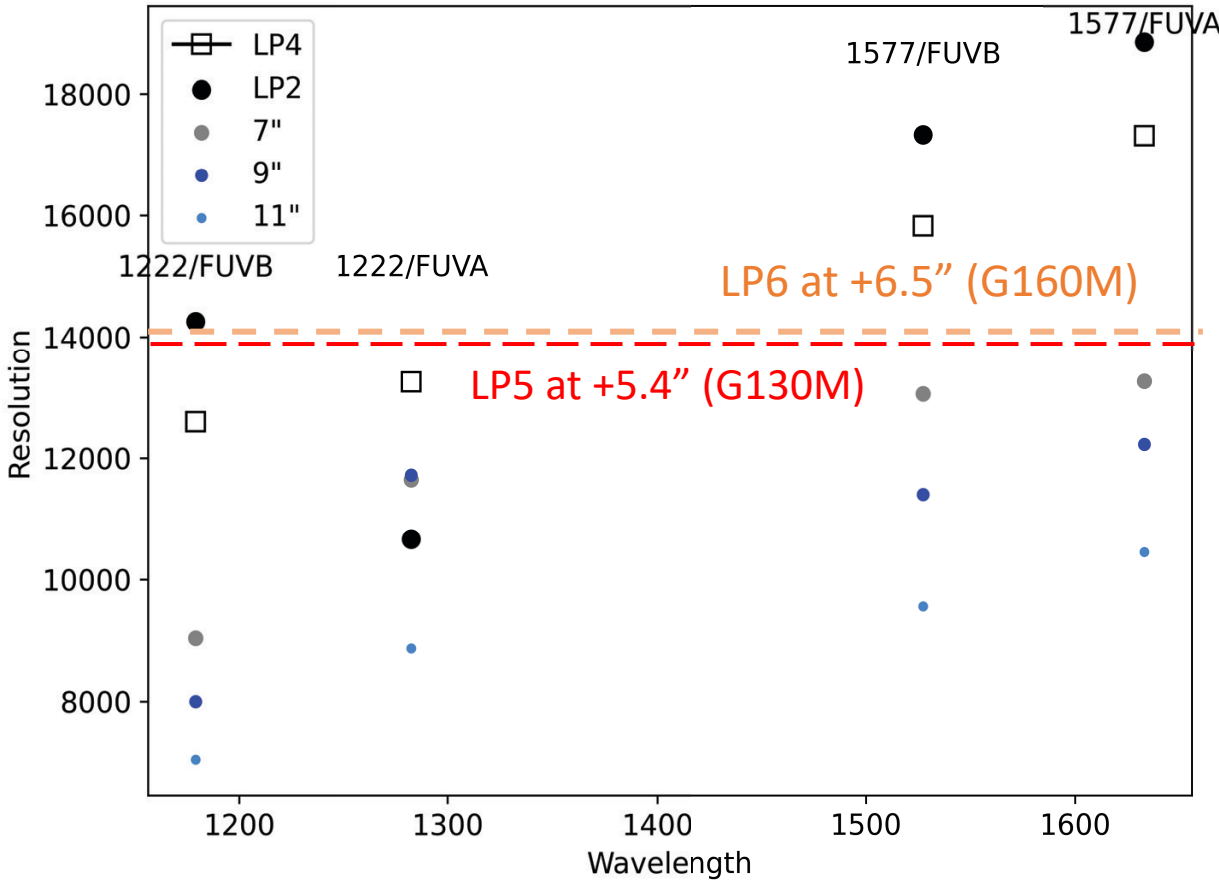


Flux Calibration: LP5 and LP4 in agreement



LP6 Update: Operations start Cycle 30

- Exploration of new area of detector to determine placement of LP6 is **now complete**
- Gain modeling shows the optimal placement of LP6 to be at +6.5”
- Allows maximum resolution (R~14,000) and sufficient upper real estate for a potential future LP with R>10,000
- LP6 at Cycle 30: G160M 1533, 1577, 1589, 1600, 1611, 1623
  - Initially long exposures only; eventually long and short exposures in 2028
  - G130M 1222 also to move to LP6 in 2028
- End of life of LP5 and LP6 expected in early 2030
- No Bright Object Aperture operations, no Flatfield Calibration Aperture, use split-wavecals for calibration lamps



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EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

STIS Update

Joleen Carlberg, Tala Monroe, and STIS Team

STIS Status

General

- STIS operating nominally
- STIS Team changes:
  - 2 departures: Matt Maclay (technical staff) & Kim Ward-Duong (STScI Fellow)
  - 2 additions: Laura Prichard (technical staff) & Leonardo dos Santos (STScI Fellow)

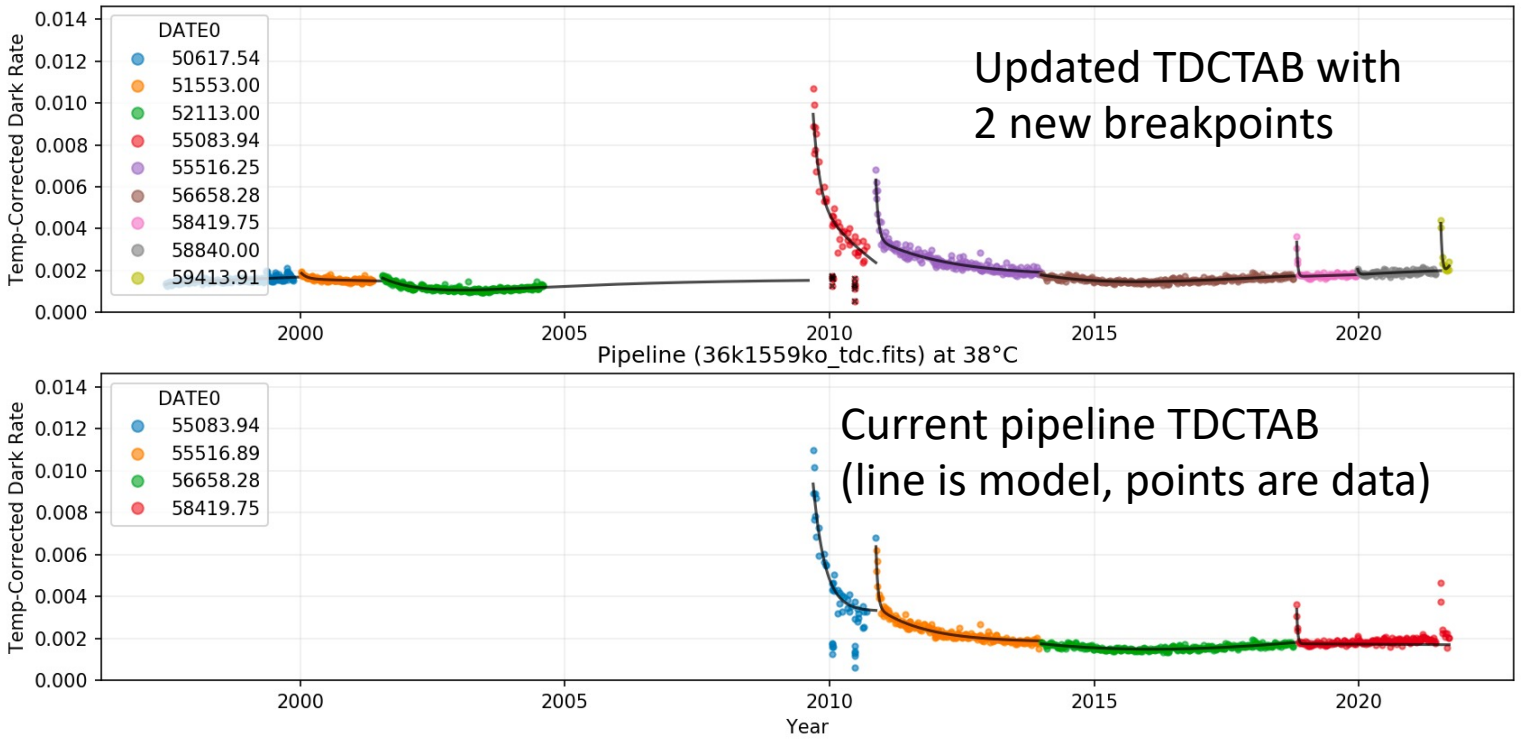
Documentation

- Input to Cycle 30 Primer, Call for Proposals
- 2 STANs published (July and August 2021)
- ISR 2021-02: **STIS MAMAs Checking for Gain Sag** (M. Maclay)
- Two ISRs currently under review:
  - *Characterization of the long-term rotational evolution of the STIS CCD flatfields* (K. Ward-Duong)
  - *Scattered Light in STIS grism G230LB* (G. Worthey, PI of CAL/GO program 16188)

STIS Calibration Updates – NUV Dark Rate

NUV Dark Rate Updates

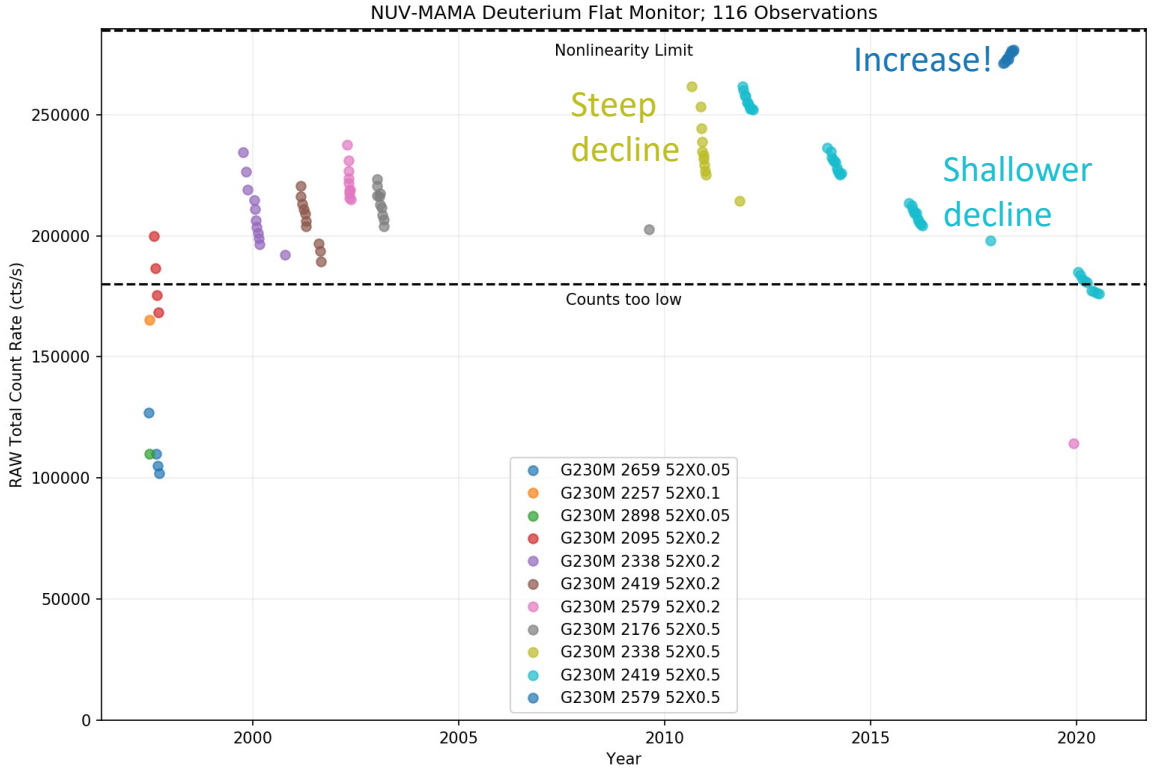
- The TDCTAB models the time variation of the NUV dark rate
- Prior to the spring HST anomaly, the NUV dark rate was beginning to show a slight increase with time
- NUV dark rate spiked (as expected) after the HST recovery
- **A new TDCTAB with 2 new breakpoints will be delivered as soon as the post-anomaly dark rate stabilizes**



STIS Calibration Updates – NUV MAMA Flats

NUV Lamp Brightness for Flat Fields

- No NUV cenwave/aperture combination currently achieves needed count rates for flat fields
- The changes in lamp intensity measured over time are highly variable with wavelength (see plot)
- A special calibration program (16517) will determine a snapshot of the NUV deuterium lamp SED across 9 cenwaves to inform Cycle 29 Flat program



Evaluating Current NUV P-flats (SASP* project)

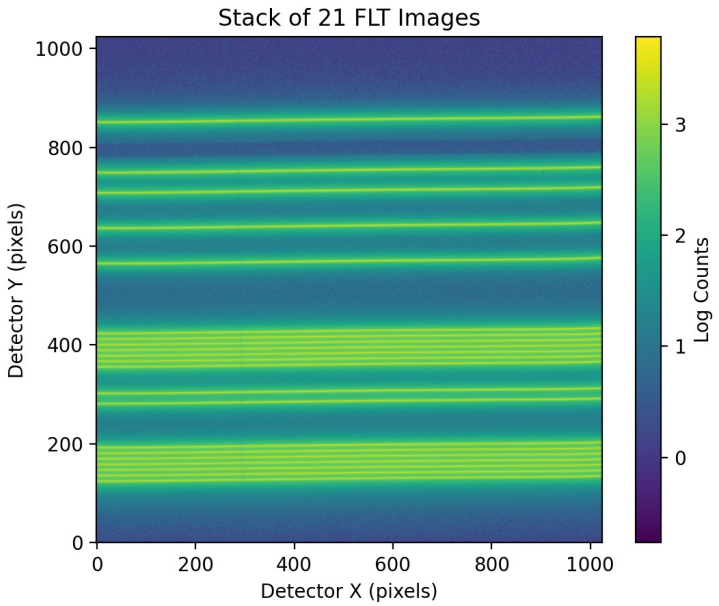
- SASP intern modernized P-flat (pixel-to-pixel flat) generation code to remove IRAF dependencies
- Generated new P-flats for all post-SM4 cycles
- RMS of new flats relative to pipeline flat (which uses pre-SM4 data) continues to grow, but may still be negligible. Further study needed to assess impact.

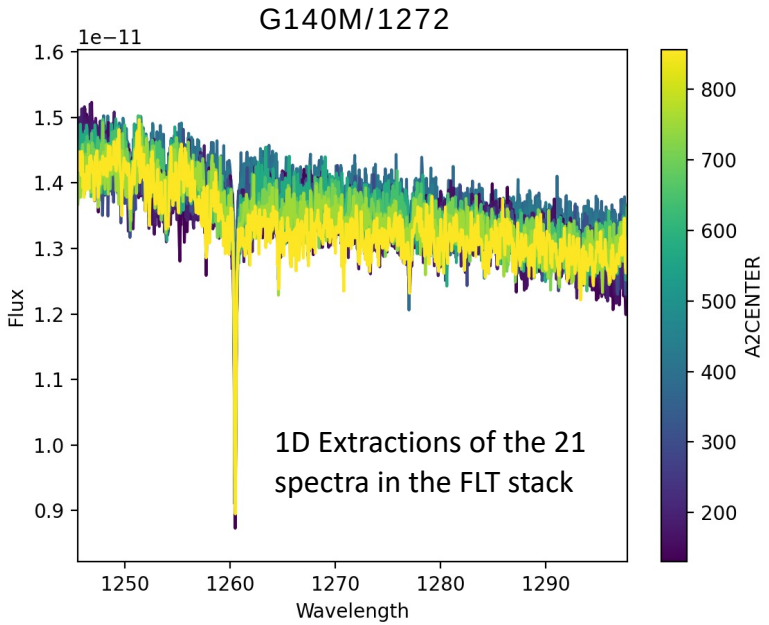
*SASP = Space Astronomy Summer Program

Future/On-going work

FUV Investigation for Uncorrected Spatial Variation

- Program 16438 is designed to identify and quantify potential uncorrected spatial variation in the FUV L-flats
- Spectra taken at 21 slit positions in 3 gratings (example below)
  - Dense coverage around nominal and D1 positions
  - Sparse coverage over remaining detector
- Analysis will begin Fall 2021





Other Updates

- New IMPHTTAB delivered to correct outdated TDS used in PHOTFLAM derivation → corrects all post-SM4 imaging datasets
- In Cycle 30:
  - PRISM will become available but unsupported (due to rare usage)
  - Users will be able to request disabling monthly MAMA offsets as an available mode (currently restricted)
- Work continues on absolute flux recalibration. Current status here: https://www.stsci.edu/hst/instrumentation/stis/flux-recalibration

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WFC3 Update

Sylvia Baggett, Annalisa Calamida, and WFC3 Team

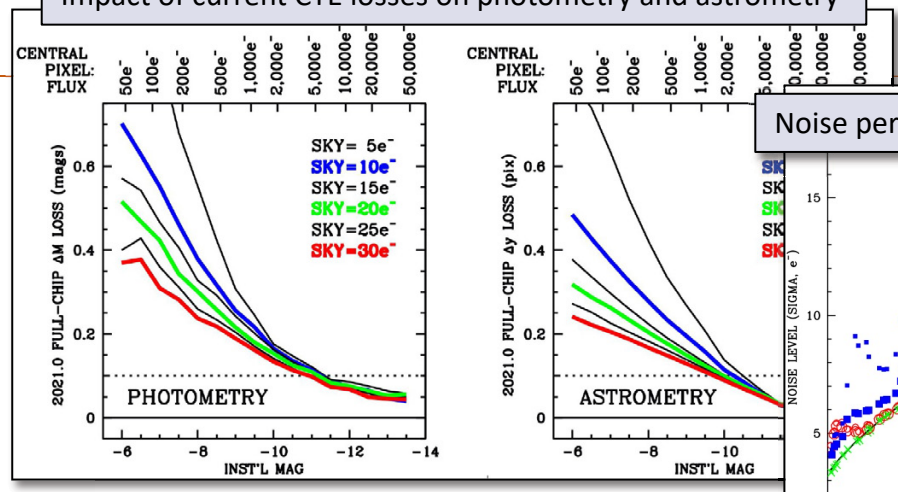
WFC3 status

General

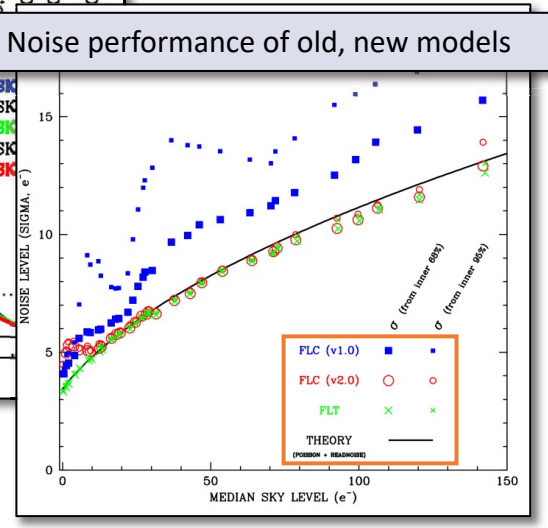
- WFC3 operating nominally
- After SIC&DH switch in July, data normal
- ~300,000 WFC3 images in MAST archive

- Updated CTE model (ISR 2021-09; 2021-06)
  - Noise performance improved
    - "Do no harm" approach prevents noise amplification
    - Losses make reconstruction of faint sources near background nearly impossible
    - Observers with faint sources use empirical correction or previous CTE code (python notebook available; ISRs 2021-06, 2021-13)
    - Merging empirical CTE correction for photometry and astrometry into hst1pass software (ISR 2021-13)
    - Preliminary results promising; release expected later this year

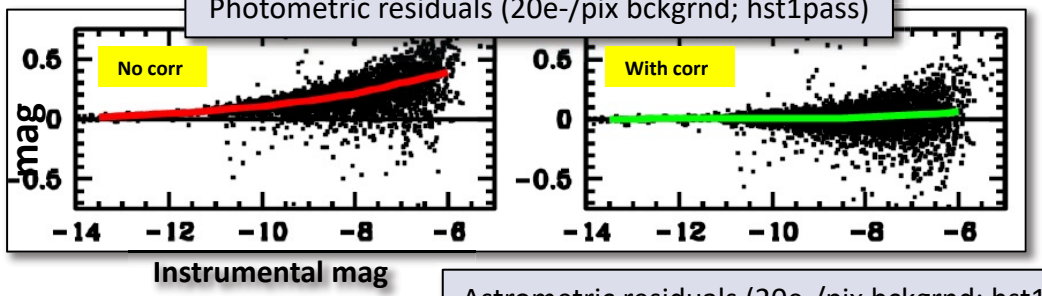
Impact of current CTE losses on photometry and astrometry



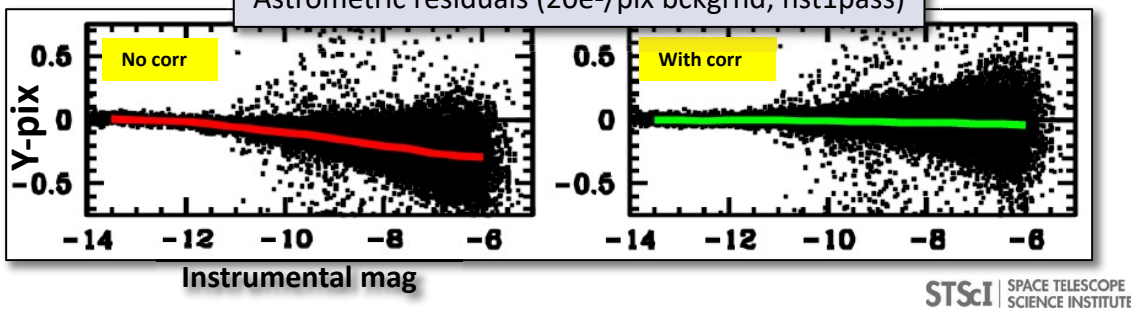
Noise performance of old, new models



Photometric residuals (20e-/pix bckgrnd; hst1pass)

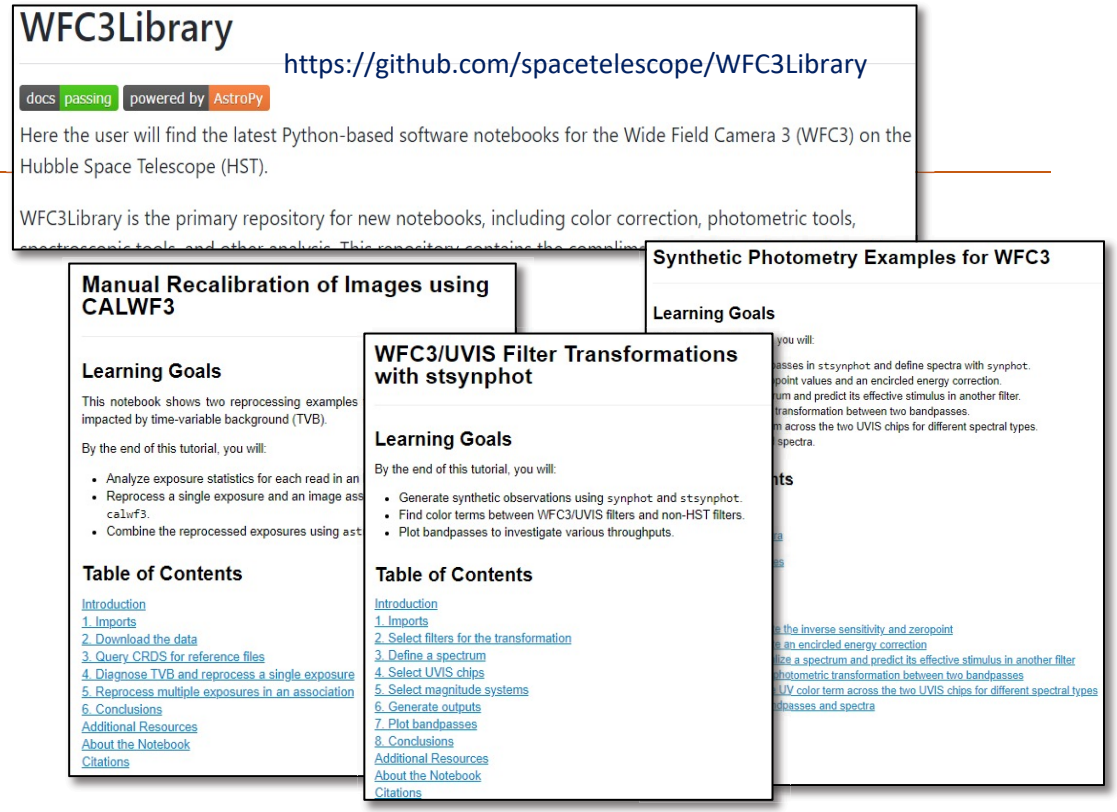


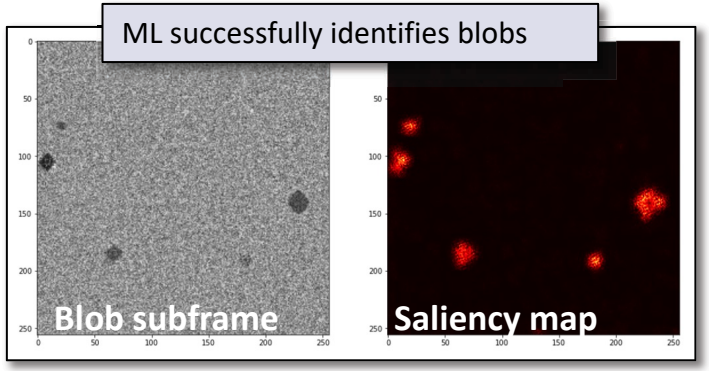
Astrometric residuals (20e-/pix bckgrnd; hst1pass)

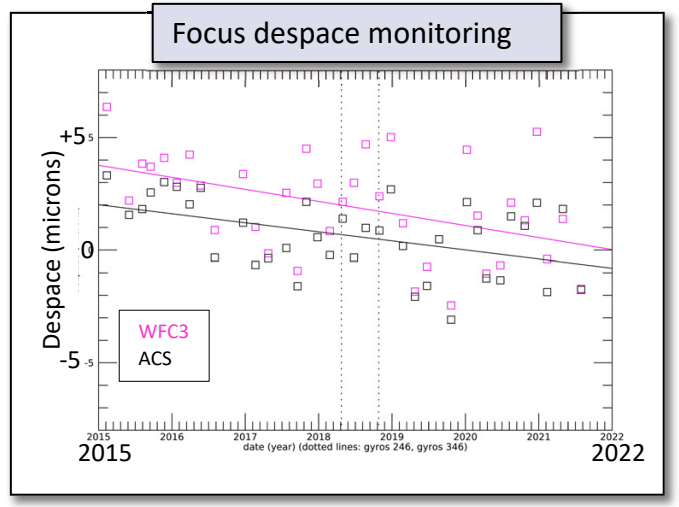


WFC3 status

- WFC3 PSF Image library in MAST (ISR 2021-08)
  - 24M UVIS and 5M IR
  - Isolated, high S/N stars, extracted on-the-fly for best calibration
  - WFPC2 PSF Image library, ~900,000 PSF images New
- WFC3 Software Library: python scripts, notebooks
  - Centralized location, sustainable release/maintenance
  - 6 Posted now: 6; additional ~20 by end of year
- IR sensitivity over time: high-precision scans (ISR 2021-05)
  - F140W, M35 (2015-2021) -0.024% /yr +/- 0.008
  - F098M, M35 (2020-2021) -0.044 %/yr +/- 0.07
- HST focus monitoring using WFC3,ACS data
  - linear fit: -0.53, -0.40 microns/year respectively
  - dispersion large but ~0 microns by ~2022
- Machine learning (ML) applied to blobs
  - correctly finds blobs 94% of time (ISR 2021-08)
  - ML monitor version now in Quicklook
  - running in parallel with manual checks
  - next: applying ML to figure-8 ghosts

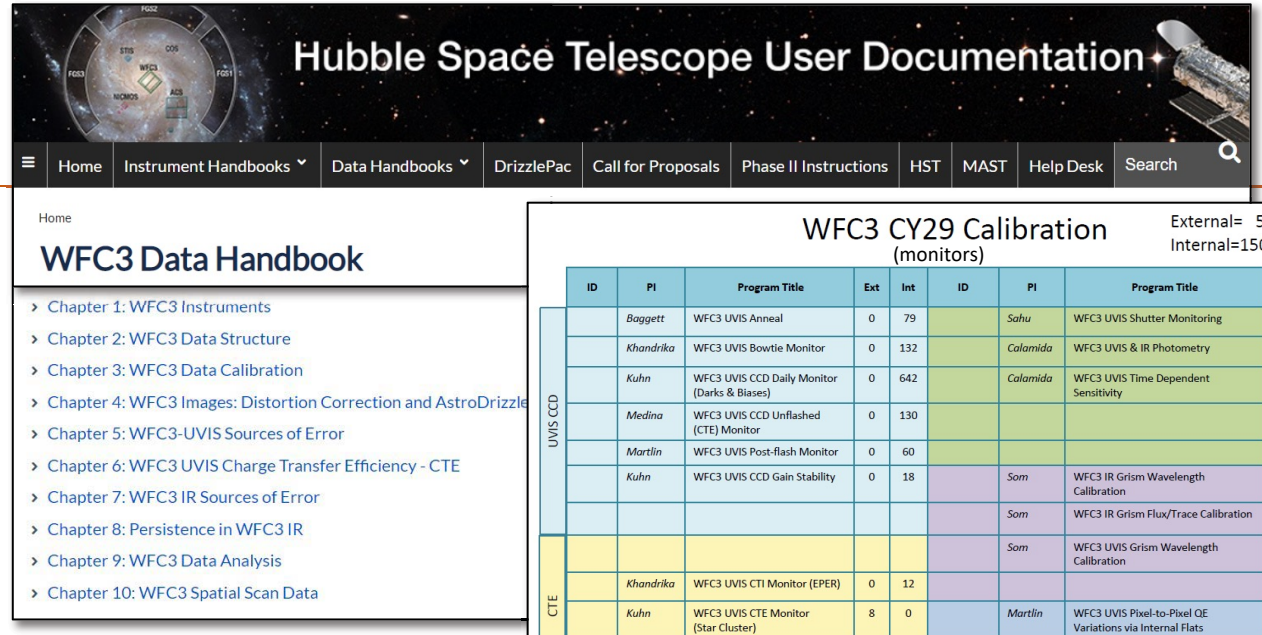






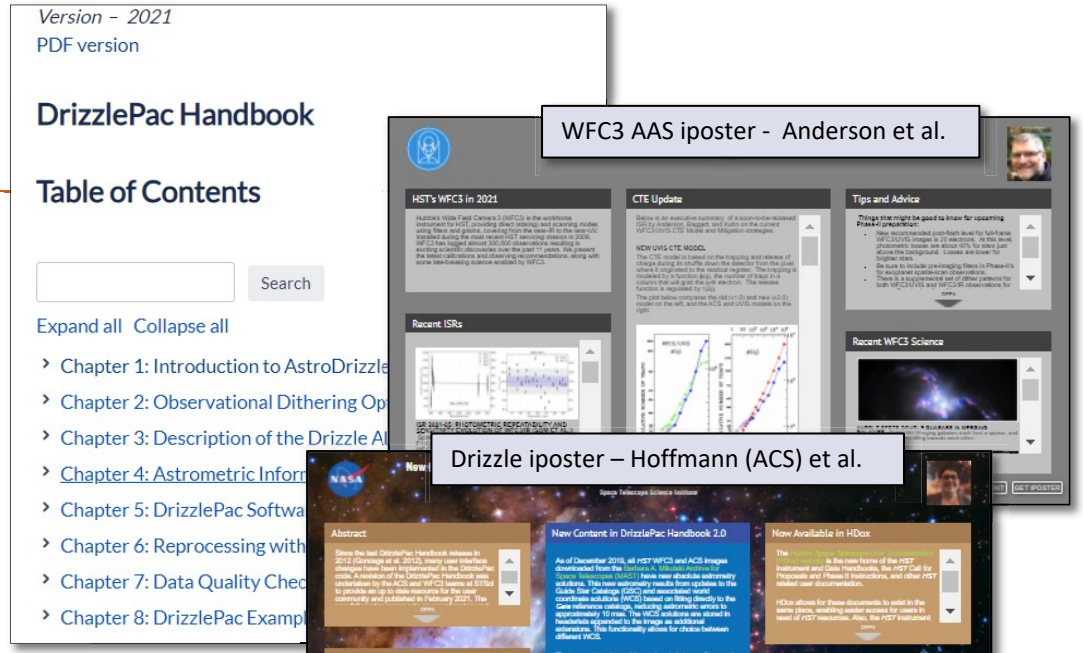
WFC3 status

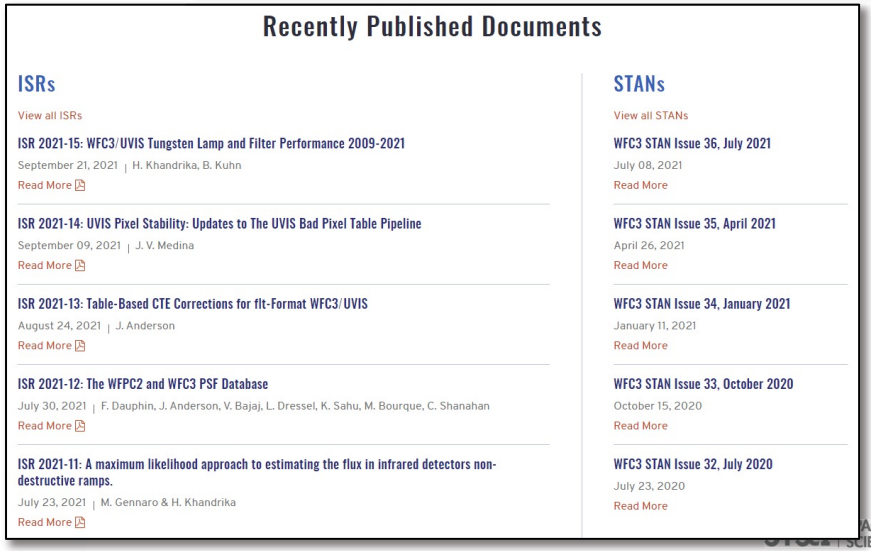
- Data Handbook Update (release Oct 2021)
  - changes include:
    - photometric calibration update
    - IR flatfields
    - blob delta flats
    - new CTE model
    - time-dependent IR darks
    - pixel stability flags
    - new python examples
    - IRAF removed
    - pointers to Jupyter notebooks for workflows
- Contact Scientist reviews
  - Cycle 29 proposals
  - Joint Chandra-HST
  - mid-Cycle 29
- Calibrations for Cycle 29
- Exoplanet Catalog (ExoCat) of transiting observations
  - target, phase start/end, scan parameters, filter/grism, etc
  - *New*: each target connects directly to ExoMAST entry
  - *Now*: adding links to WFC3 scan quality from Quicklook https://www.stsci.edu/~WFC3/exocat/exocat/exocat.html
  - ExoCat being renamed to Trexolists to avoid confusion with an extant catalog



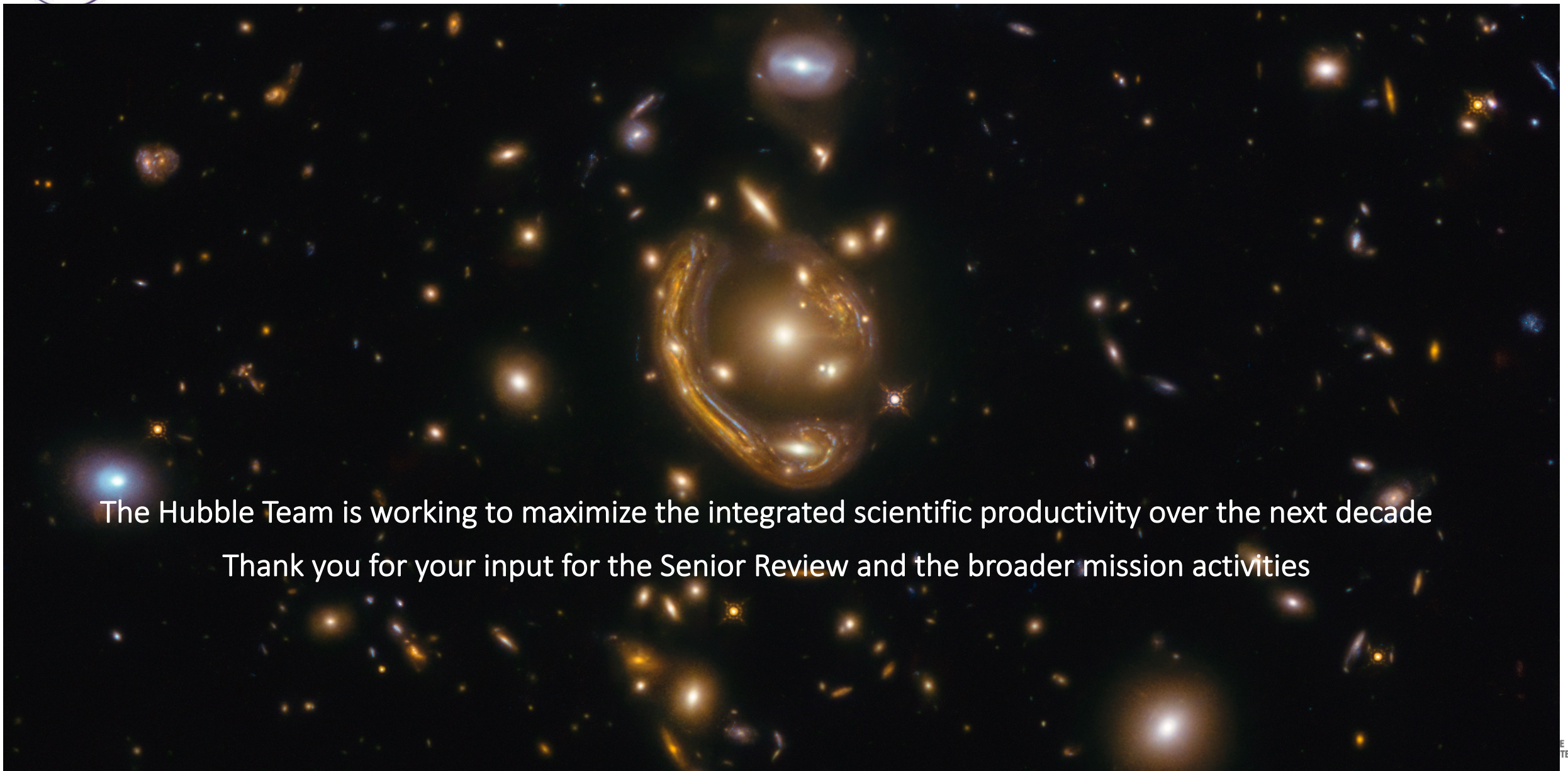
User support/documentation

- Data Handbook (Oct 2021)
- STANs (April, July, and Oct 2021)
- Helpdesk
- June 2021 AAS
  - HST's WFC3 in 2021
  - New DrizzlePac Handbook Version 2.0 Release (with ACS)
- Reports
  - 2021-05 Photometric Repeatability, Sensitivity Evolution of WFC3/IR
  - 2021-06 WFC3/UVIS: New FLC External CTE Monitoring 2009 – 2020
  - 2021-07 Accuracy of WFC3 Standard Astrometric Catalog w.r.t Gaia EDR3
  - 2021-08 WFC3 IR Blob Classification with Machine Learning
  - 2021-09 Updating the WFC3/UVIS CTE Model and Mitigation Strategies
  - 2021-10 WFC3/IR Blob Flats
  - 2021-11 Maximum Likelihood Approach to Estimating the Flux in Infrared Detectors Non-destructive Ramps
  - 2021-12 The WFPC2 and WFC3 PSF Database
  - 2021-13 Table-Based CTE Corrections for flt-Format WFC3/UVIS
  - 2021-14 UVIS Pixel Stability: Updates to The UVIS Bad Pixel Table Pipeline
  - 2021-15 WFC3/UVIS Tungsten Lamp and Filter Performance 2009-2021
- In prep
  - AJ article on UVIS zeropoints
  - WFC3/UVIS Deuterium Lamp and Filter Performance 2009-2021





Summary



The Hubble Team is working to maximize the integrated scientific productivity over the next decade

Thank you for your input for the Senior Review and the broader mission activities