MONITORING CHANDRA PERFORMANCE AND SUPPORTING OBSERVERS

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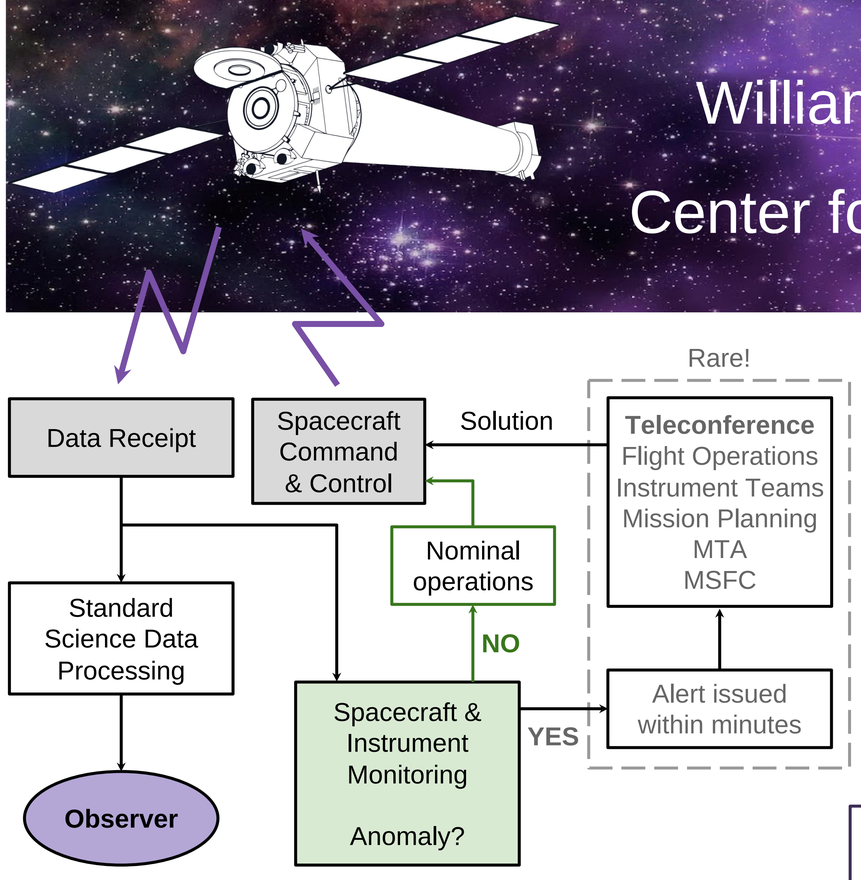


Monitoring and Trend Analysis

The MTA team, a part of the Chandra Operations and Science Support group, is focused on maximizing Chandra's scientific output by monitoring the quality of **Chandra's engineering and science data**, and by providing critical data evaluations to support the Flight Operations, Mission Planning, Calibration, and Instrumentation teams.

Examples of MTA activities include:

A – Monitoring the **real-time** engineering data stream and alerting the operations teams of anomalies which require immediate attention.

B – Monitoring **space weather conditions** to ensure Chandra's radiation safety.

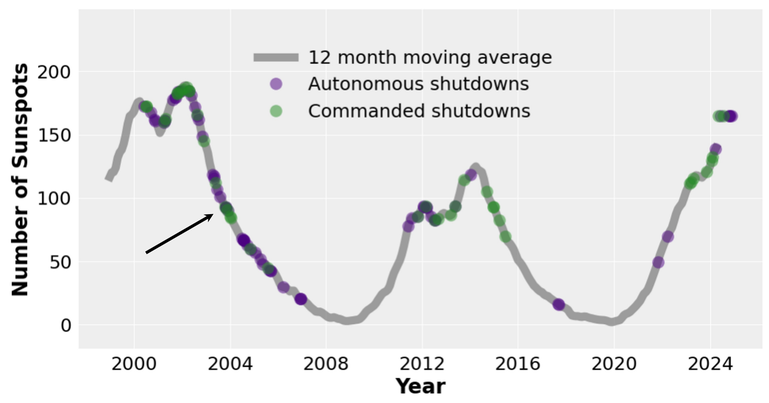
C – Long-term data **trending and forecasting** to track changes across all Chandra subsystems.

A.State of Health

- At each Deep Space Network contact (~ 3 times per day), MTA tracks **1200+** parameters describing the status of main Chandra subsystems, e.g., Science Instrument Module (SIM), Electrical Power Subsystem (EPS), Transmission Gratings mechanisms.
- Values outside the nominal ranges may trigger alerts which are received by the CXC team members within minutes.
- MTA processes also the back-orbit engineering data and tracks any planning limit violations.

Scan the QR-code to check if Chandra is in contact with DSN

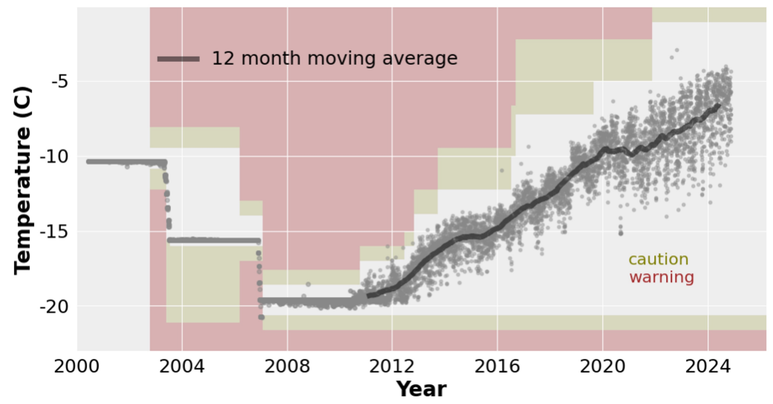
B. Space Weather



Solar Cycle Progression and Chandra high radiation events. Chandra is experiencing its 3rd Solar cycle. The 2003 Halloween Storm was one of the most impactful storms weathered by Chandra

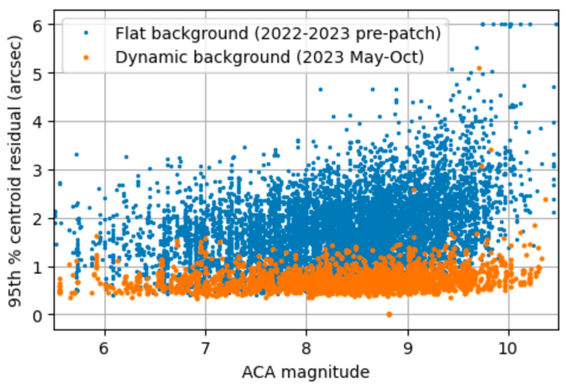
- Chandra has autonomously executed 67 shutdowns in response to high radiation events detected on-board.
- Ground commands to execute 40 additional radiation shutdowns were sent following a consensus of instrument teams and MTA.

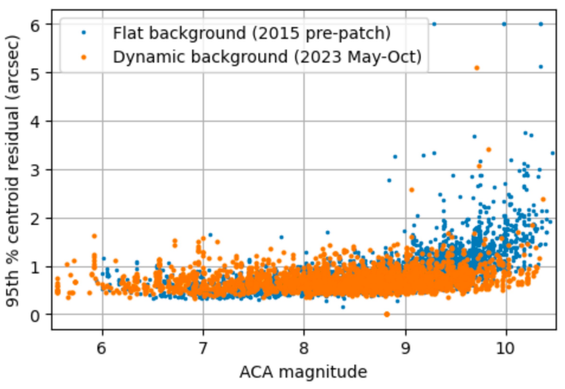
C1. Aspect Camera Assembly



The aspect optical camera long-term CCD temperature trend.

- Temperatures of Chandra subsystems evolve with time, and can be predicted with thermal models used by Mission Planning to achieve very accurate absolute pointing.
- Temperature trends tracked by MTA inform planning limits.



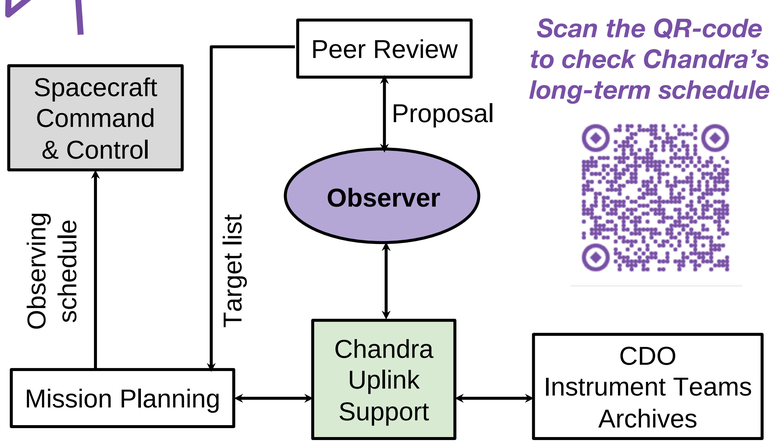


Improvement in ACA "vision" with the dynamic background PEA patch, which can be compared to a time machine able to reverse 8 years of ACA CCD degradation.

- Exposure to ionizing radiation in space and increasing ACA CCD temperature contribute to increased ACA CCD dark current, which affects the ACA ability to track stars and navigate in space
- This issue was mitigated by the development of a novel ACA **dynamic background subtraction algorithm,** extensive testing, and uplink of a patch to the Processing Electronics Assembly (PEA) code.
- MTA supported this effort by developing a high fidelity ACA simulator for initial tests of the dynamic background algorithm.

Scan the QR-code to read more in 2023 Fall Chandra Newsletter

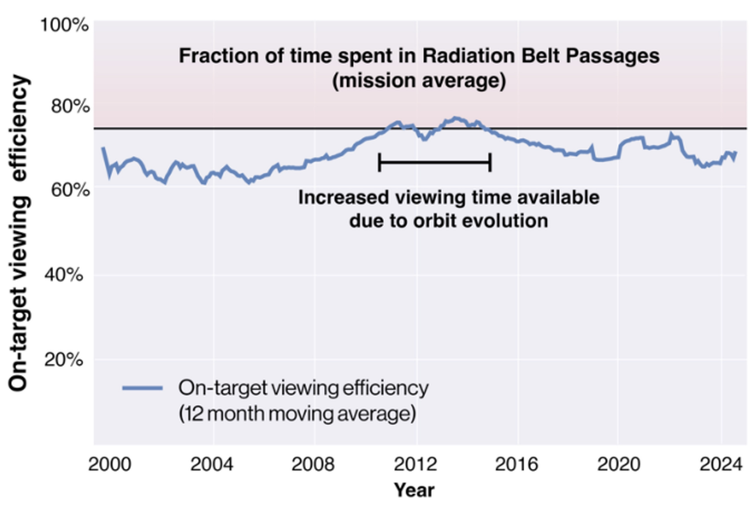
Chandra Uplink Support



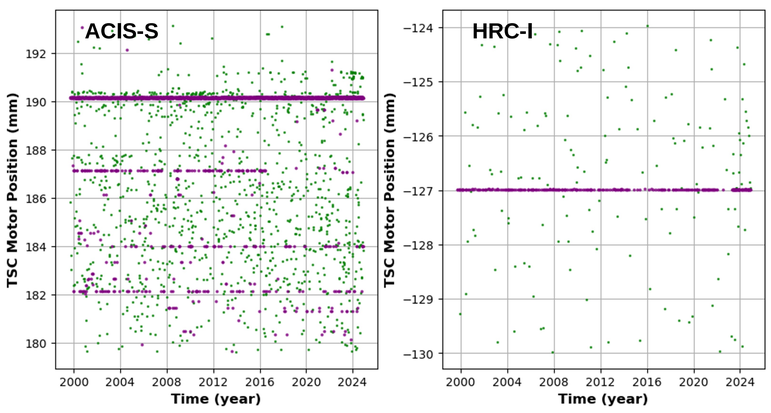
Scan the QR-code to check Chandra's long-term schedule

The CUS team is responsible for contacting observers for each approved target, including Targets Of Opportunity (TOO), to ensure instrument configuration which maximizes science return.

- So far, CUS has provided support to **1400+** observers who solicited **30,000+** observations.
- Chandra plays a **substantial role in the time-domain science,** and has observed TOOs within < 2 days from the trigger.
- Chandra has been maintaining **high orbit efficiency.**

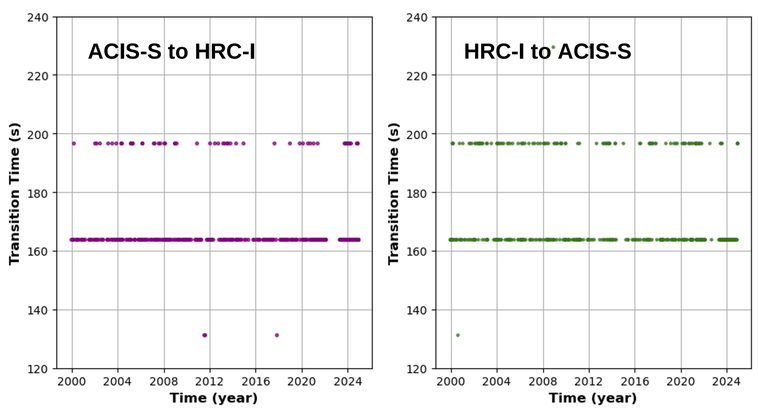


C2. Science Instrument Module



Optical axis translation of example SIM focal detectors ***in position, in transit***

- The SIM contains a translation table to alter the telescope focal length and position both ACIS and HRC along the optical axis.
- Over twenty five years, the SIM position reliably achieves a consistent aim-point positioning.



Transitions between detectors continue to be completed in consistent time intervals.