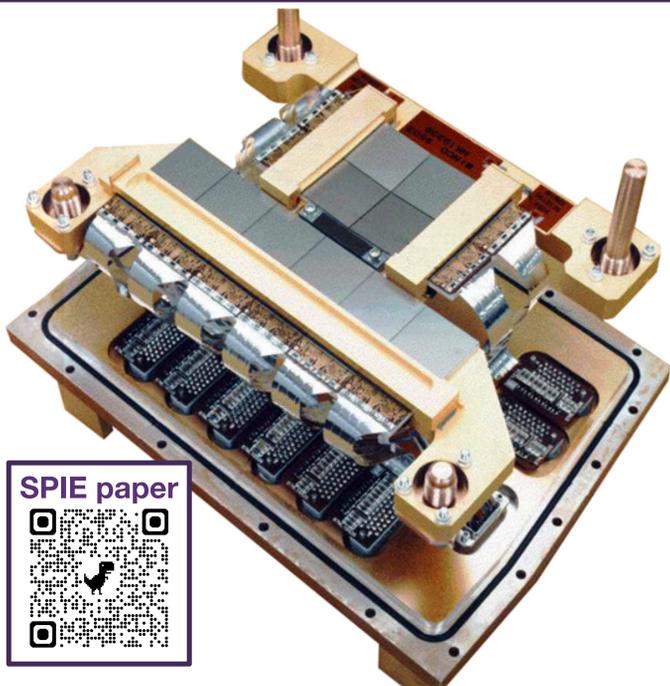


TWENTY-FIVE YEARS OF ACIS: On-orbit Operations Status

Catherine Grant, for the ACIS Instrument Team
MIT Kavli Institute, Center for Astrophysics



SPIE paper

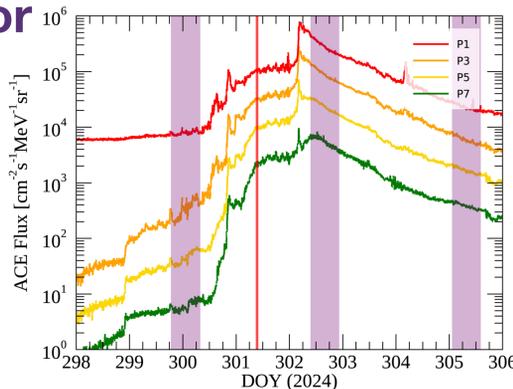


ACIS status is good!

- ACIS is performing well; no limitations on lifetime
- All 10 CCDs and 40 readout chains are fully functional; system read noise close to launch values, 2-3 e- RMS
- No evidence for light leaks or damage due to micrometeoroid impacts
- Electronics are nominal, operating on primary units. Redundant units available.
- No corruption to the EEPROM with the ACIS boot code
- Flight software patches have fixed bugs, improved on-board processing, and added enhancements; most recently in September 2023
- Some loss of low energy effective area due to molecular contaminant accumulation
- Warmer and variable focal plane temperatures require careful calibration; maintained within limits depending on science objectives of observation

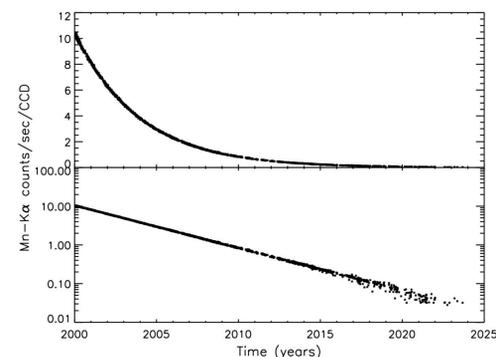
ACIS is Chandra's radiation monitor

- In 2012 a flight software patch enabled ACIS to act as a radiation monitor
- Since 2020, ACIS is the only active on-board radiation monitor
- ACIS flight software detects high particle rates due to solar storms; signals the spacecraft to stow ACIS and power down HRC to protect both from damage
- Solar cycle 25 has been stronger than early predictions; 8 ACIS triggered shutdowns since 2021
- Parameters of ACIS radiation monitor updated frequently to match changing quiescent particle background



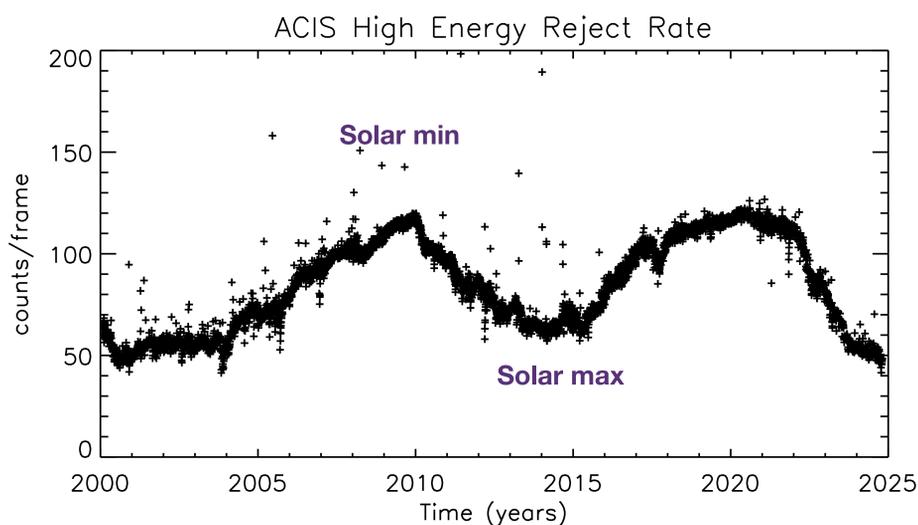
Elevated low energy proton flux (< 1 MeV) during a solar storm in October 2024. The vertical red line is the time of the ACIS triggered radiation shutdown. (Jack Steiner, SAO)

Fe-55 radioactive decay



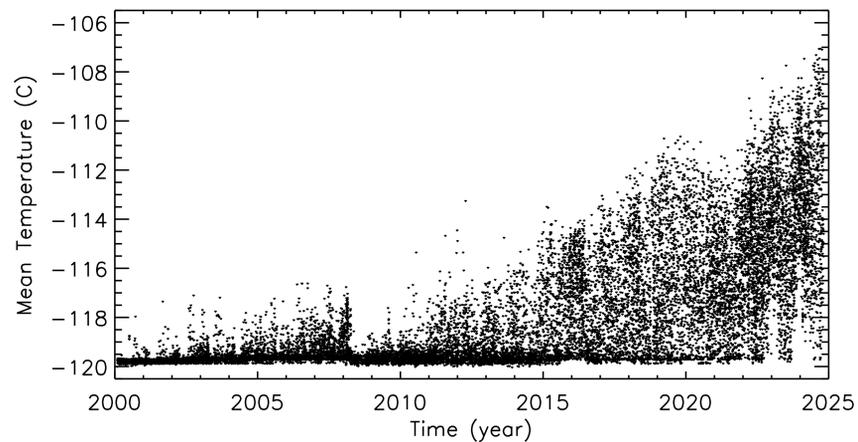
- Used for calibration and performance monitoring
- Fully illuminates all CCDs; multiple line energies
- Half-life = 2.740 ± 0.005 yr (ACIS)
 2.737 ± 0.011 yr (literature)

Particle background is variable



- Quiescent background is primarily Galactic Cosmic Ray protons
- Modulated by the solar cycle and solar activity
- Many timescales of variability (days to decades)
- Each solar cycle is unique

Focal plane temperature is variable



- Heater set point $\sim -120^\circ\text{C}$
- Temperature is primarily driven by spacecraft pitch
- Maintained within limits by careful mission planning
- Requires calibration of CTI temperature dependence; included in standard processing pipeline since 2010

