The Advanced CCD Imaging Spectrometer (ACIS) is Chandra’s premier science instrument, most often regarded as an observatory’s eyes. For the current operation of our radiation mitigations strategies to minimize the proton damage in the ACIS CCD detectors and the importance of real-time data sources that are used to protect the ACIS detector system from space weather events.

Overview

- The most often requested science instrument onboard Chandra (OCS) cannot be operated in high flux, soft proton environment within the magnetosphere and solar particle events due to a CO damage mechanism from ~100-200 keV protons.
- The ACE EPAM instrument monitors the only data source available for directly measuring the soft protons in interplanetary space that damage ACIS CO's.
- No other users of ACE EPAM RTSW data have been identified to date, it appears that Chandra is the only program using the EPAM data for these purposes.
- Current NOAA plans to discontinue ACE RTSW data starting late 2014 or early 2015 when the Deep Space Climate Observatory (DISCOVER) spacecraft becomes the primary NOAA space weather data source from Sun-Earth L1 Lagrange point, and DISCOVER does not have instrumentation onboard to monitor the proton energy range required to protect the ACIS detector.

The loss of this real-time data stream could cause a significant impact to the science lifetime and data quality for this Great Observatory.

Current COX ACE EPAM Data Requirements

- Chandra requires real-time ACE EPAM data for monitoring and implementing manual interruptions of Chandra science operations if necessary, ACE Science Center Level 2 (verified) and Browse (unverified) science products are not updated often enough to be useful for operational support.
- Access to 5-minute average ACE EPAM RTSW data product (status quo) is the preferred option for Chandra since it allows continuous monitoring of our radiation mitigations software tools.
- However, data rates are negligible as ACE radiation damage is a fluence issue, with long exposure periods to soft proton flux required for significant damage to CO's.
- Lower real-time data rates are acceptable as long as sufficient information is available to estimate soft proton fluence, ACE EPAM RTSW data rates at periods up to once per hour can be used by Chandra to monitor soft proton environment.

The Future of ACIS Real-time Data

The ACE/EPAM RTSW records are the only real-time data currently available for detecting soft ~100-200 keV proton events in interplanetary space that impact the ACIS instrument.

NOAA plans to replace ACE with Deep Space Climate Observer (DISCOVER) in late 2014
- DISCOVER will become the primary NOAA-space weather plasma data source
- ACE RTSW coverage will be discontinued
- DISCOVER carries a MAG/SWEPAM type cold solar wind and magnetic field instrument

No replacement for non-thermal EPAM, 63 energetic particle instruments on DISCOVER

Discovered is planned as an interim solution for an ACE replacement with release of an RFP for a full replacement after DISCOVER's release.

- Full ACE replacement satellites could have a more complete set of cold plasma, energetic particle instruments including an EPAM replacement, but a gap in service for a few years for the real-time energetic particle data.
- None of this has been authorized by Congress so it is all uncertain at best
- The gap could be many years

Loss of ACE/EPAM soft proton data will impact CXO operations.

Are there other spacecraft or space weather users that require the RTSW ACE/EPAM data for operations that will be similarly impacted?

The CXO Program would like to know...

Joseph P. Minow

nasa.gov