

Final Calibration and Reprocessing of the FUSE Archive

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FUSE Pipeline Improvements

As FUSE has been taken offline, we have undertaken a series of software enhancements to the CALFUSE pipeline, including

- Addressing archived data sets with zero exposure times in the calibrated data products;
- Fixing a bug that occasionally inserted random numbers into the flux arrays of the NVO files.

We have also generated a final set of calibration files including effective area and background files appropriate for data taken during the last two years of the mission.

Observations with Zero Exposure Times

- CalFUSE v3.0 was introduced in August of 2004 and was a total redesign and rewrite of the pipeline software.
- This version produced observations where all of the raw data were flagged as bad, resulting in calibration data with 0.0 sec exposure times.
- These observations have created issues for MAST, so we have been working to find ways to change these observations.

Solutions for the Zero Exposure Times

1. A bug in the program to create our jitter files resulted in the occasional rare miscalculation of the spacecraft orientation, causing the jitter routines to incorrectly flag the target as out of the aperture. This was corrected.
2. Combining exposures to make observation level files was throwing away imperfect **histogram** files that were worth saving.
 - If the spectrum for an exposure is too faint to perform the normal cross-correlation but the target is still in the aperture then the spectra are combined with a shift of zero.
 - If an histogram suffers a limb-angle or SAA violation, the exposure is now included anyway. This assumes that any target observed in HIST mode is bright enough that any additional background flux is not a problem.

CaIFUSE

1. CaIFUSE 3.2.1 was installed on the operational processing cluster on May 21, 2007. Everything archived after that date was processed with CaIFUSE v3.2.1
2. CaIFUSE 3.2.2 was installed on the operational cluster on March 17, 2008.
 - FUSE 3.2.2 included a couple minor fixes that applied to specific observations and the final calibration files that needed to be applied to the final two years of data.
 - Every observation taken after January 1, 2005 has been reprocessed with CaIFUSE version 3.2.2

Reprocessing Status

- Bulk reprocessing and re-archiving of the FUSE observations was completed the first week of July 2008.
- We are currently comparing our lists of observations against MAST's list of observations to make sure that we can document the status of every observation.
- We are examining the histogram exposures to determine if any others will benefit from the corrections made for the zero time exposures.
- We are examining the air glow observations to determine if they should be processed differently.
- MAST is examining the data catalog for any data that raises questions (We found observations with no object category defined or obvious bad categories defined).
- Reprocessing should be completely finished by the end of September 2008.



Archive Statistics

5866 FUSE observations
have been archived.

- 3433 reprocessed with CalFUSE 3.2.1
- 2432 reprocessed with CalFUSE 3.2.2

41,290 Science Exposures
Containing over
65,000,000 seconds of
calibrated data

- 2566 - GI Program
(A – H)
- 1071 - PI Program
(P, Q & X)
- 1568 - Instrument
Programs (I, M & S)
- 661 - U and Z
Programs

MAST to host FUSE web based documentation

- The URL fuse.pha.jhu.edu will remain as an active website, but support for the website will eventually not have any financial backing.
- So much of the instrument and data documentation will be **moved** to a MAST website to insure long term availability.
- Meetings are currently underway and the current websites are being evaluated to determine what should be moved.
- One example is the FUSE Mission Planning Schedule (MPS) files are being moved and linked into the observation quick look pages.

Updated Documentation

New Archive versions are being written of:

- FUSE Data Handbook
- FUSE Instrument Handbook

The design is to have these written as topical interfaces with short explanations of each topic and then links to more detailed explanations from instrument or data viewpoints.

Both documents are being written from the perspective of a totally new user – like new graduate students 5 or 10 years from now.

Getting the Word Out

- Information about the final reprocessing will be included in the next FUSE newsletter.
- MAST will host web pages sharing any FUSE documentation that will help a user with data analysis.
- The current fuse.pha.jhu.edu website will be updated with links to the documents and updates hosted by MAST.