

Data Analysis with ISOCAM Interactive Analysis System — Preparing for the Future

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Abstract.

This paper presents the latest developments in ISOCAM data analysis with the Interactive Analysis System for ISOCAM (CIA).¹⁰ The main use of the system is now to improve the calibration of ISOCAM, the infrared camera on board the Infrared Space Observatory (ISO) and to perform its astronomical data processing.

We review the algorithms currently implemented in CIA and present some examples. We will also outline foreseen changes to accommodate future improvements for these algorithms.

¹⁰CIA is a joint development by the ESA Astrophysics Division and the ISOCAM Consortium. The ISOCAM Consortium is led by the ISOCAM PI, C. Cesarsky, Direction des Sciences de la Matière, C.E.A., France.

1. Introduction

ESA's Infrared Space Observatory (ISO) was successfully launched on November 17th, 1995.¹¹ ISO is an astronomical, three-axis-stabilized satellite with a 60-cm diameter primary mirror (Kessler et al. 1996). Its four instruments (a camera, ISOCAM, an imaging photo-polarimeter and two spectrometers) operate at wavelengths between 2.5-240 microns at temperatures of 2-8 K.

ISOCAM takes images of the sky in the wavelength range 2.5 to 18 microns (Cesarsky et al. 1996). It features two independent 32 x 32 pixel detectors: the short-wavelength channel (2.5 to 5.5 microns), and the long-wavelength channel (4 to 18 microns). A multitude of filters and lenses enable the observer to perform measurements at different wavelengths, with different fields of view or with polarizers.

The development of CIA was started in 1994, its main goals being to calibrate ISOCAM, to provide the means to perform any sort of investigation requested for problem diagnostics, to assess the quality of ISOCAM pipeline data products, to debug, validate and refine the ISOCAM pipeline and to perform astronomical data-processing of ISOCAM data. The overall system now represents an effort of 20 man-years and comprises over 1300 IDL and 350 FORTRAN, C, and C++ modules and 30 MB of calibration data.

At the moment CIA is distributed to experienced users upon approval; currently it is used at 30 authorized sites. However, this policy will change with the end of ISO operations in summer 1998. Thereafter CIA V3.0 will be made generally available for the astronomical community.

2. Steps for ISOCAM Data Processing

At the moment, the following steps for astronomical ISOCAM data processing are generally performed:

1. data preparation (slicing, generation of CIA prepared data structures)
2. cross-talk correction (for the short-wave detector only)
3. deglitching (removal of cosmic ray hits)
4. dark current subtraction
5. transient correction (compensation for flux-dependent, short timescale variation of the detector response)
6. flat-fielding
7. averaging
8. configuration dependent processing
 - (a) raster observations: mosaic generation
 - (b) CVF observations: spectra selection and display
 - (c) staring and beam-switch observations: image generation
 - (d) polarization observations: generation of mosaics for polarizers and hole
9. interfacing with non-ISO data products

¹¹ISO is an ESA project with instruments funded by ESA member states (especially the PI countries: France, Germany, the Netherlands and the United Kingdom) and with the participation of ISAS and NASA.

3. Review of Selected Steps for ISOCAM Data Processing

3.1. Deglitching and Transient Correction

CIA contains various algorithms for deglitching and transient correction. Multiresolution median and temporal median filtering algorithms are most commonly used for deglitching. Similarly the most commonly used algorithms for transient correction are the inversion-method and exponential fitting. The resulting quality depends on the amount of data available. Therefore we will try in the future to treat a whole revolution instead of single observations.

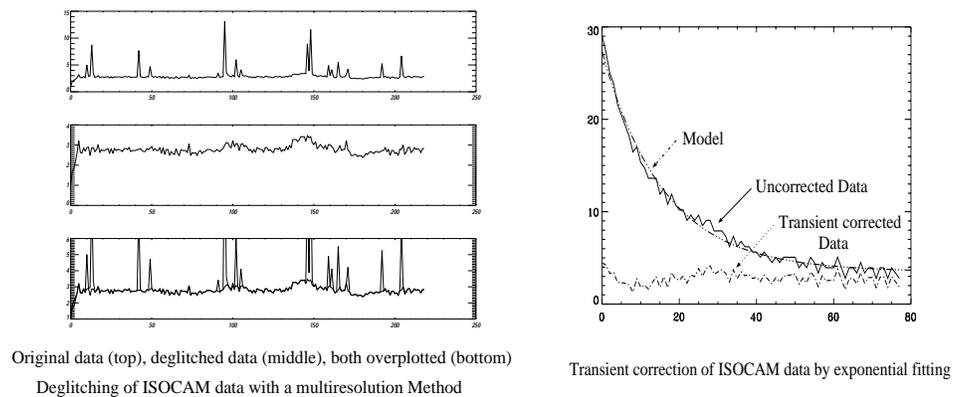


Figure 1. Effects of deglitching and transient correction

3.2. Flat-Fielding

Flat-fielding with library-flats and automatic flat-fielding using the raster observation being analysed are both implemented in CIA. However, the lens wheel does not always come to exactly the same position. When the wheel position for the observation differs from the wheel position reached when the flat-field was obtained, this affects the quality of the final image. Therefore we hope to implement a correction for this effect (lens-wheel jitter) in the flat-field algorithm.

3.3. Dark Current Subtraction

Various algorithms can be used for the dark current subtraction. Currently implemented are the dark correction with library or user supplied darks (e.g., handover darks) as well as a second order dark correction. Studies have shown that the dark can be better predicted as a function of the observation time or by scaling with a reference dark. It is planned to implement these new dark corrections in near future.

3.4. CVF Observations: Spectra Selection and Display

CIA users can play with a 2 dimensional spectrum. From the displayed image a pixel can be selected : the spectrum of this pixel will be displayed. From the

spectrum a wavelength can be selected and the image will be displayed at this wavelength.

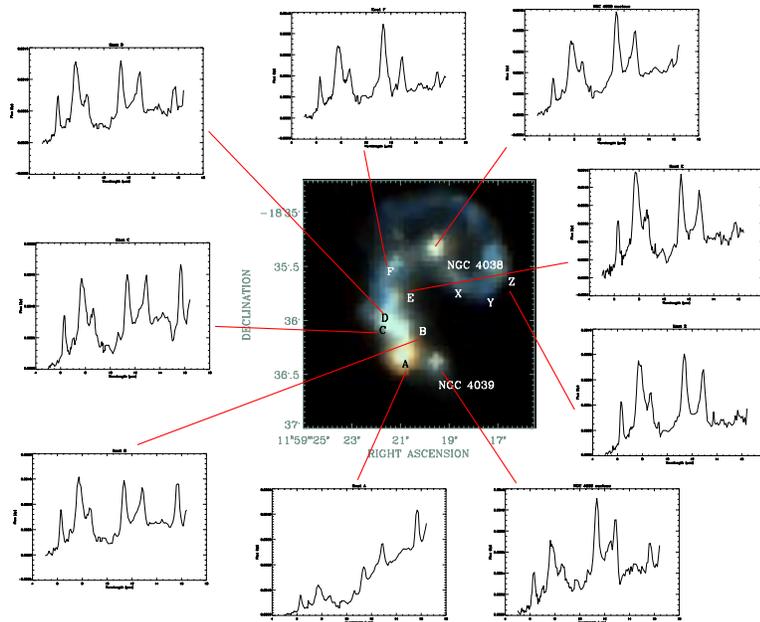


Figure 2. CVF observations: spectra selection and display

3.5. Interfacing with Non-ISO Data Products

CIA users can overlay a contour plot of one image on a colour display of another. The two input images can come from different instruments, have different size and resolution — the only requirement is that there is astrometry information associated with each image and that they overlap spatially. The images can be shifted and annotated.

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