Wide-field Infrared Survey Explorer (WISE)

WISE Science Data Center
Simulated Data Request

Version 1.0

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WSDC D-I001

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Revision History

Date	Version	Author	Description
4/13/2006	1.0	R.M.C.	Initial Draft

Assumptions:

1. WISE science data will be supplied by the WISE Science Operations group at UCLA.

2. The fidelity of simulation will evolve with time as improved detector and optical ground test data become available.

3. Data Level definitions:

> **Level 0** - Raw FITS images. Instrumental dark and flat-field signatures in images.
> **Level 1** - FITS images with instrumental flat-field and dark signatures removed, but with
poisson noise and distortion present. Four bands registered.

4. Metadata and Truth tables will be supplied with simulated image data:

a. For each simulated data set provided, metadata describing the date and version of the simulation, parameters that were used in the simulation will also be provided to enable unambiguous tracking and test provenance.
b. For images, the "true" field centers, rotation angles, plate scales, distortion model will be provided for processing validation.   Ideally, these will be in the headers of the simulated images, but they may be provided in separate meta-data tables.
c. Source truth tables, giving the a priori input values of source pixel and equatorial positions and fluxes in the four WISE bands will be provided for each simulated image or set of images to enable processing validation. This information may be provided on a case-by-case basis, or if preferred, in the form of a sky model database from which sources are drawn to create the simulations.
d. Solar system object lists, giving the *a priori* input values of equatorial positions and fluxes in the four WISE bands will be provided for any simulated images or source lists in which they are incorporated, for the purpose of validating the solar system object identification system.
e. The WSDC may request that various features in simulations be toggled on/off to aid in the debugging of processes. For example, with/without spatial distortions (III, IV) (i.e. only projection), with/without transient hot pixels (IV), with/without extended sources (V

I. Scan Synchronization Test

Description: Sample calibrated (L1) frame data simulating loss of scan synchronization. These will be used to test the scan synchronization monitor for the Quicklook QA systems.

A total of 90 simulated image frames. Nine sets of image frames for a range of alignment angle differences between the scan mirror and spacecraft scan directions from -20 deg to +20 deg at intervals of 5 deg. For each alignment angle, ten frames each simulating band 1 (W1) images that show scan rate synchronization errors ranging from zero to TBD deg/sec. For simplicity, the frames may show the same scene on the sky.

Source positions and PSFs may be altered by distortion. Realistic PSF should be used to model simulated sources. Frame backgrounds levels and source brightnesses should include poisson noise.

Input truth table of artificial sources giving pixel coordinates on frame. Equatorial positions and fluxes not required for truth table.

Need by:

      1.   8 May 2007 - Ten images corresponding to a single position angle with scan rate offsets ranging from zero to max value.

      2.   24 July 2007 - Full set of 90 images.

II. Pipeline Data Handling and Data Flow Testing

Description: Level 0 frame data for 30 orbits adjacent in time. Four bands. 2MASS reference stars in images. Approximate WCS information in image headers or provided in table. Simulated faint sources not required.

Source positions and PSFs may be altered by distortion. Realistic PSFs should be used to model simulated sources. Frame backgrounds levels and source brightnesses should include poisson noise. Variable backgrounds optional.

Input truth table of source equatorial positions and fluxes for validation.

Need by: 30 May 2007

III. Position Reconstruction Prototype Testing

Description: Table of source positions in frame pixel coordinates simulating extractions from Level 1 frame data. Positions may be affected bydistortion model and degraded by photometric noise.

Input truth table of source equatorial positions to validate processing results.

This data set may be derived from the input data described used to produce the data set described in II.

Need by: 6 June 2007

IV. Source Detection and Photometry Testing

Description: Level 0 frame data for 30 orbits adjacent on sky. Four bands. 2MASS reference stars along with faint simulated WISE-only sources in images. Approximate WCS information in image headers or provided in tables to simulate ADCS housekeeping telemetry. Ten different versions of the the 30 orbit simulations to enable repeatability testing for completeness, reliability and stability.

Source positions and PSFs may be altered by distortion. Realistic PSF should be used to model simulated source images. Frame backgrounds levels and source brightnesses should include poisson noise. Simulated frames should represent a range of source density environments from high galactic latitudes to the galactic plane *(|glon|<90)*.

Input truth table of source equatorial positions and fluxes to validate processing results.

Need by:

    1. 1 August 2007 - Version 1 - First set of 30 orbits. Best available instrumental signatures and PSFs.

    2. 24 October 2007 - Version 2 - Remaining 9 sets of 30 orbits. Improved instrumental signatures and PSFs from ground test.

    3. 16 April 2008 - Version 3 - Update version of 10x30 orbit simulations with improved instrumental signatures and PSFs. Include intermittent hot/noisy pixels.

V. Complex Scene Source Detection and Photometry Testing

Description: Repeat of the the Level 0 frame data described in IV, including scenes that contain complex backgrounds and/or sources. Background structure to include a large galaxy that fills large fraction of a single FOV (e.g. M31), nebulosity such as will be seen in galactic plane fields or cirrus complexes, strong gradients and linear features such as may be seen in the vicinity of the zodiacal dust bands. A complex source field that contains small, extended sources such as a nearby galaxy cluster (e.g. Virgo), or a star formation region (e.g. rho Ophiuchus).

Point and extended source positions and PSFs may be altered by distortion. Realistic PSFs should be used to model simulated point source images. Frame backgrounds levels and source brightnesses should include poisson noise. Complex background and foreground scenes are needed for frames over only a small range of ecliptic latitude in each orbit.

Input truth table of point and compact extended source equatorial positions and fluxes to validate processing results.

These simulations may be incorporated into the basic data sets described in IV.

Need by:

1. 9 June 2008 - Complex background simulation.

2. 8 July 2008 - Small extended source simulation.

3. 5 August 2008 - Zodiacal structure simulation.

VI. Known Asteroid Detection Testing

Description: Level 0 frame data for 30 orbits adjacent on sky.   Four bands. 2MASS reference stars along with faint simulated WISE-only sources in images. Approximate WCS information in image headers or provided in tables. Simulated images of known asteroids at positions consistent with observation time of the simulated images.

Source positions and PSFs may be altered by distortion. Realistic PSFs should be used to model simulated source images. Frame backgrounds levels and source brightnesses should include poisson noise. Simulated frames should represent a range of source density environments from near galactic poles to galactic plane *(|glon|<90)*.

Input truth table of source equatorial positions and fluxes to validate processing results. Input truth table of known asteroid positions and flux values in the four WISE bands at the time of the simulated observations. Specification of the orbital elements used to compute asteroid positions, including osculation date and origin.

The known solar system object simulations may be incorporated into any of the basic data sets described in IV.

Need by: 16 May 2008