# Quality Assurance

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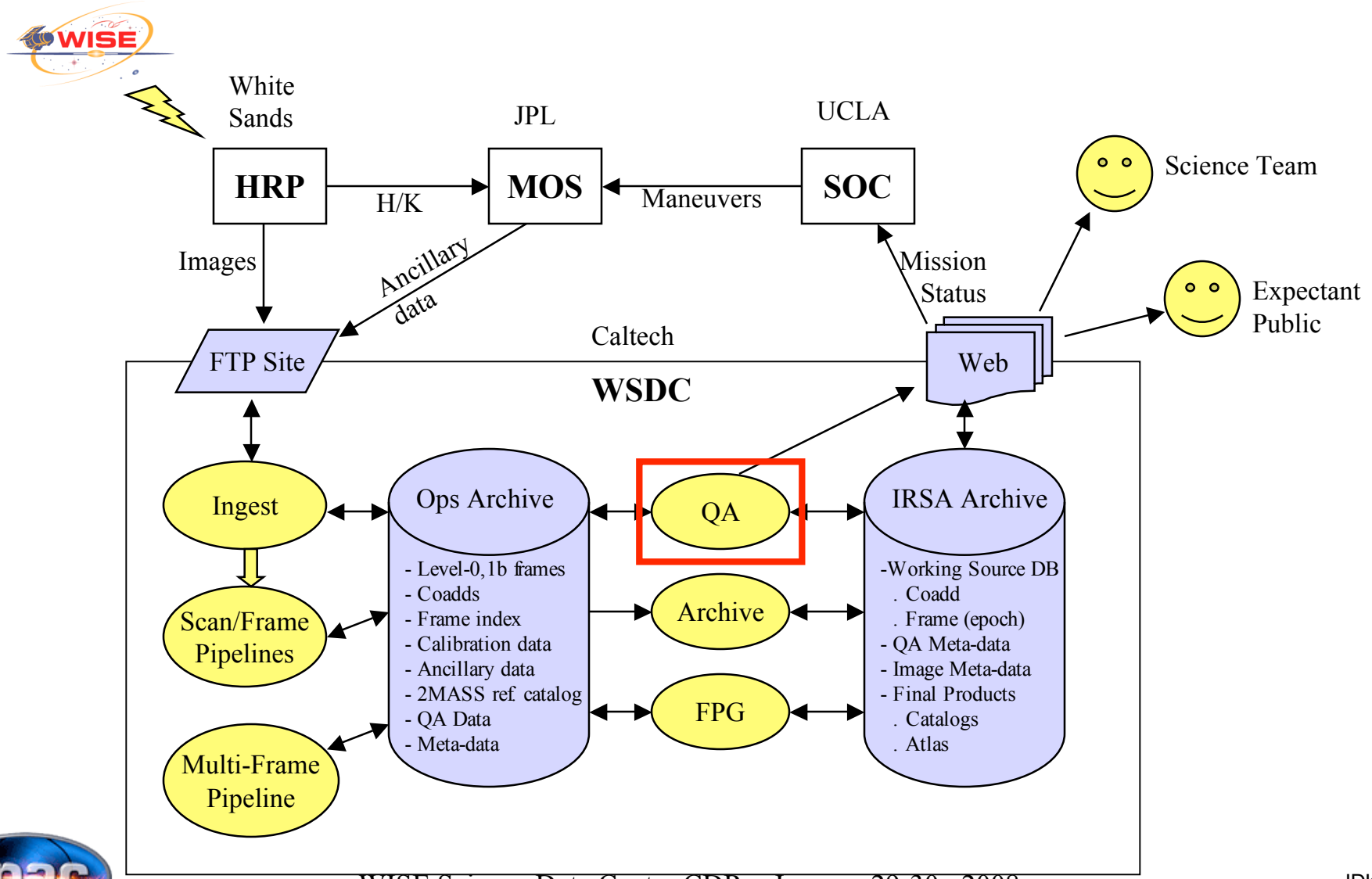
# WSDC Functional Block Diagram

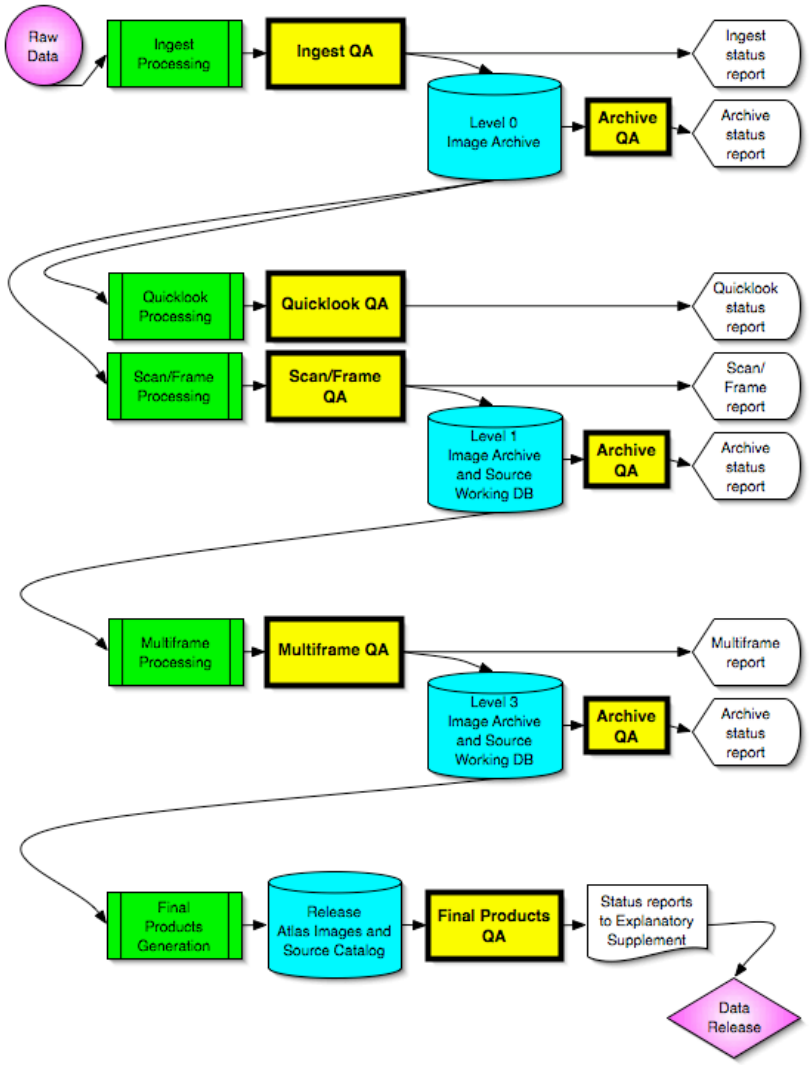




# QA Block Diagram



- Quality Assurance (QA) is injected into the data processing flow at many points to monitor data quality.
- QA subsystems are shown in yellow in the WSDC flow diagram at right. These are referred to as -
  - Ingest QA
  - Quicklook QA
  - Scan/Frame QA
  - Multiframe QA
  - Archive QA
  - Final Products QA



# WISE QA Philosophy



- Given large data volume and short timescale, quick and efficient QA is vital to success.
- The QA system
  - assesses data through each stage of processing,
  - identifies/flags data that may not meet WISE science requirements, and
  - alerts SOC, MOS, and WISE Science Team of these cases.
- The system must be as automated as possible, allowing the final arbiter of quality (the human reviewing the data)
  - to quickly assess and bless data meeting the specs and
  - to concentrate most of his/her time on the small fraction of data needing detailed scrutiny.
- The QA system collects summary reports from each data processing subsystem and compiles them into a single, concise report. Summaries include
  - software completion status reports,
  - statistical analyses, and
  - tabular and graphical material for use by the QA scientist.
- The goal of the QA system is
  - to compare collected parameters to metrics tied to mission science requirements and
  - to present overall results in a web-based form.

# Driving Requirements



- *GENERAL QA* (L4WSDC-062): The WSDC shall perform quality analysis of all WISE science data and make reports available on a regular basis.

- *PRODUCT VALIDATION* (L4WSDC-063): The WSDC shall work with the WISE Science Team to validate that, prior to their release, the Image Atlas and Source Catalog satisfy WISE science requirements.

- *PRODUCT CHARACTERIZATION* (L4WSDC-064): The WSDC shall work with the WISE Science Team to characterize and document the overall data product relative to the mission requirements. This document shall be included in the WISE data product explanatory supplement.

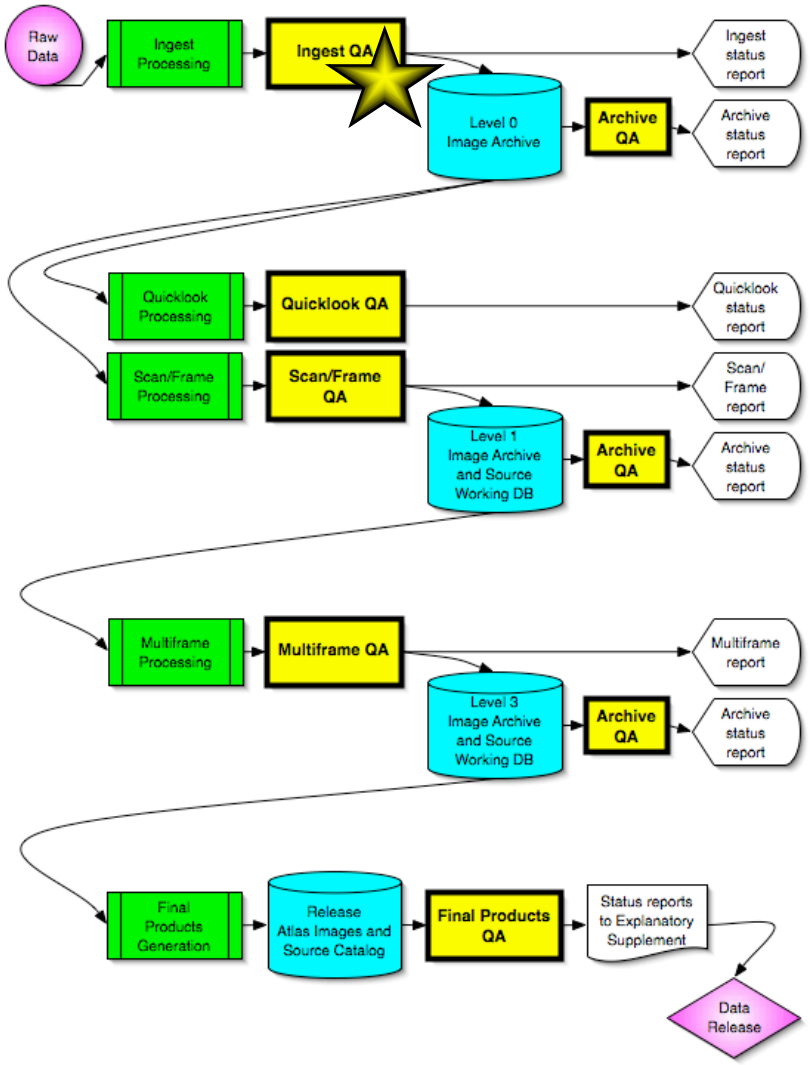
- *QUICKLOOK QA* (L4WSDC-065): A sample of 3% of the science imaging data returned to the ground each day shall be processed in an expedited way to produce a Quicklook report that monitors the routine performance of the flight system as can be determined from the science data, and identifies problems that may require prompt action by WISE Science or Mission Operations.

- *SCAN SYNCHRONIZATION* (L4WSDC-066): The WSDC shall provide a monitor of the synchronization between flight-system and scan mirror rates to achieve and maintain required image quality as part of Quicklook QA.

# Functionality: Ingest QA



- Purpose
  - To check compliance with the FITS standard.
  - To verify that all Level 0 images have been created.
  - To compare the input manifest from White Sands to the actual data received.
- Timescale:
  - Following each data transfer (up to 4 times per day).
- Action:
  - WSDC to inform MOS/EOS and SOC of status and anomalies.



# Design: Ingest QA

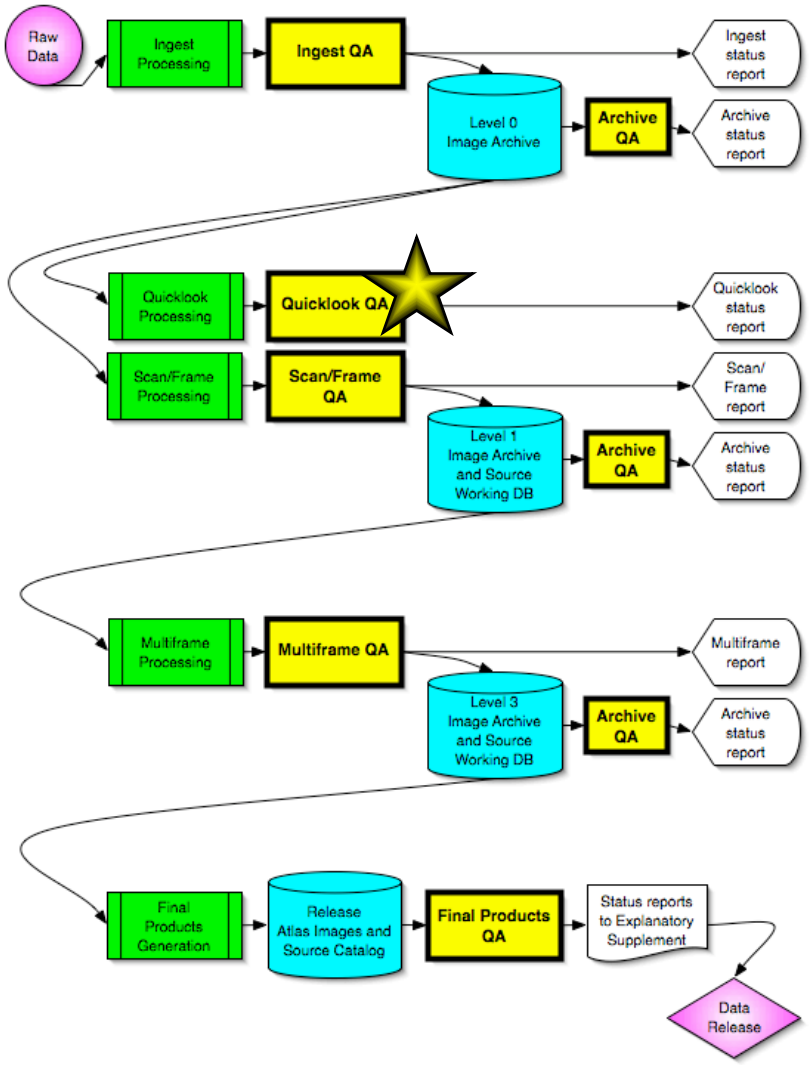


- Check that assembled images meet the FITS standard.
- Compare input manifest to resulting output to check for completeness.
- Verify that all Level 0 images were successfully created.
- Verify that housekeeping telemetry data and PEF (Predicted Events File) were successfully mated with the correct images.
- Summarize QA findings for MOS and SOC.

# Functionality: Quicklook QA



- Purpose:
  - To check key system performance parameters (on 3% of data) for each downlink via an abbreviated processing pipeline.
- Timescale:
  - Within 24 hours of end of data transfer to WSDC.
- Action:
  - WSDC to post report to web page; SOC to review report.
  - Text based summary report e-mailed to MOS.



# Design: Quicklook QA (1)



- Scan synchronization and image quality
  - Generate matrix of composite star images detected on each frame in each band, where each element is the average star image formed by combining the images of all stars in the corresponding region of the frame.
  - Measure image second moment ratios and position angles for each composite star image in the matrix.
  - Generate table and plot showing the means of these values for all frames in a half-orbit.
  - Trigger warning messages when image elongation has exceeded a predetermined threshold related to the Level 1.5 specifications for image quality. Threshold values are to be determined prior to launch using simulated image data.
- Photometric zero point and system throughput (needs ecliptic polar data for primary and secondary standard star checks.)
  - Tabulate the mean and RMS differences between a priori "true" and measured instrumental magnitudes for standard stars observed in the polar frames.
  - Generate a table and plot showing the mean and RMS of these values for each orbit.
  - Trigger a warning message if the zero point offset in any band falls outside a threshold range. The threshold range will be derived pre-launch and updated during IOC.

# Design: Quicklook QA (2)

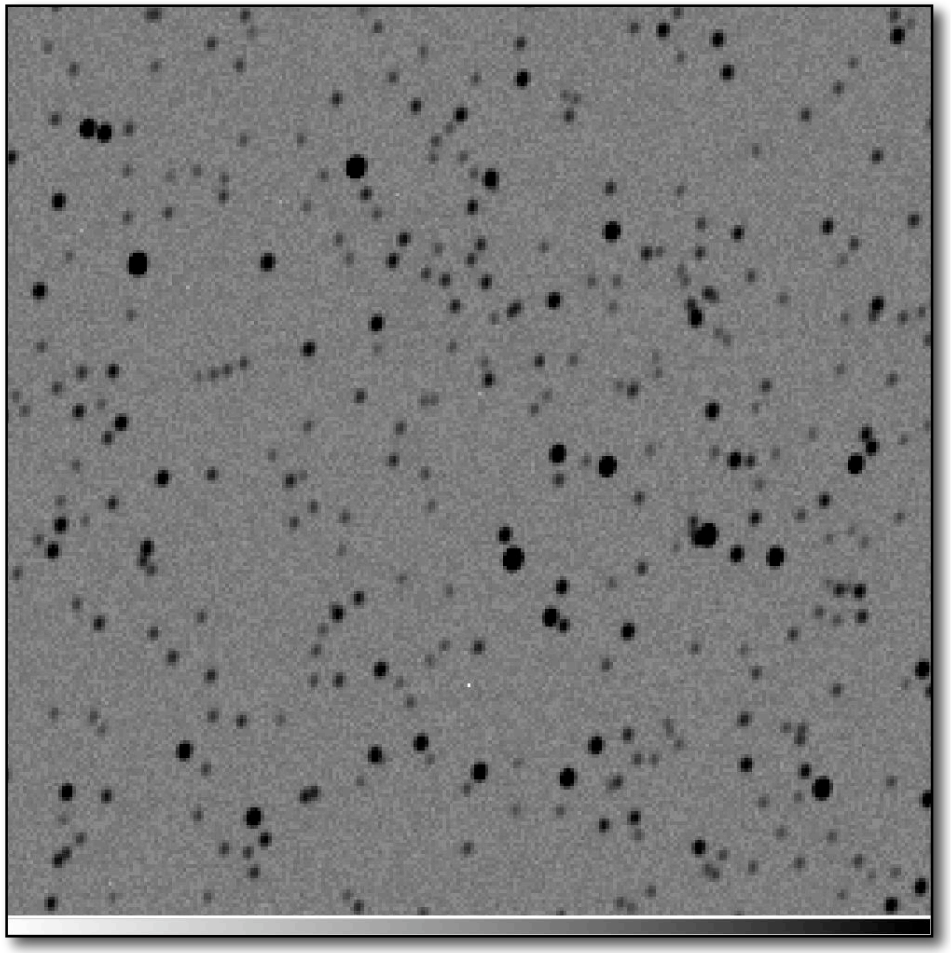


- Image backgrounds and noise (requires polar data to use as bellwethers of background level)
  - Compute the mean pixel values along with total and point-source-filtered noise values for each frame.
  - Generate a table and plot of mean pixel values and noise levels for each frame in a half-orbit and for each quadrant (for Si:As arrays) or stripe (for HgCdTe arrays).
  - Compare the measured mean pixel values and noise values in each frame to threshold values, band by band.
  - Trigger a warning message if the mean pixel values and noise values exceed predefined thresholds. These thresholds will be determined pre-launch and updated during IOC.
- Visual checks
  - Generate jpegs of a few frames in each band and check by eye. Purpose is to look for unexpected fixed pattern artifacts, odd noise signatures, and other oddities not predicted a priori.
  - Generate three-color jpegs of a few registered framesets (if possible) and check by eye.

# Demo of Scan Synchronization Monitor (1)



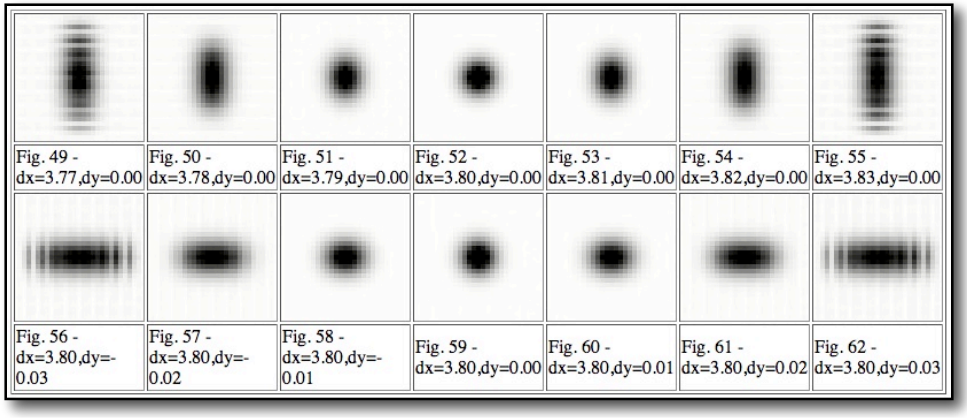
- Image quality (via PRF) will be monitored as part of standard scan/frame QA.
- Same tool will be used to support IOC task to synchronize spacecraft/scan mirror rates.
- Simulated IOC image data (with scan rate adjustments provided by Ned Wright) used to demonstrate tool.



# Demo of Scan Synchronization Monitor (2)



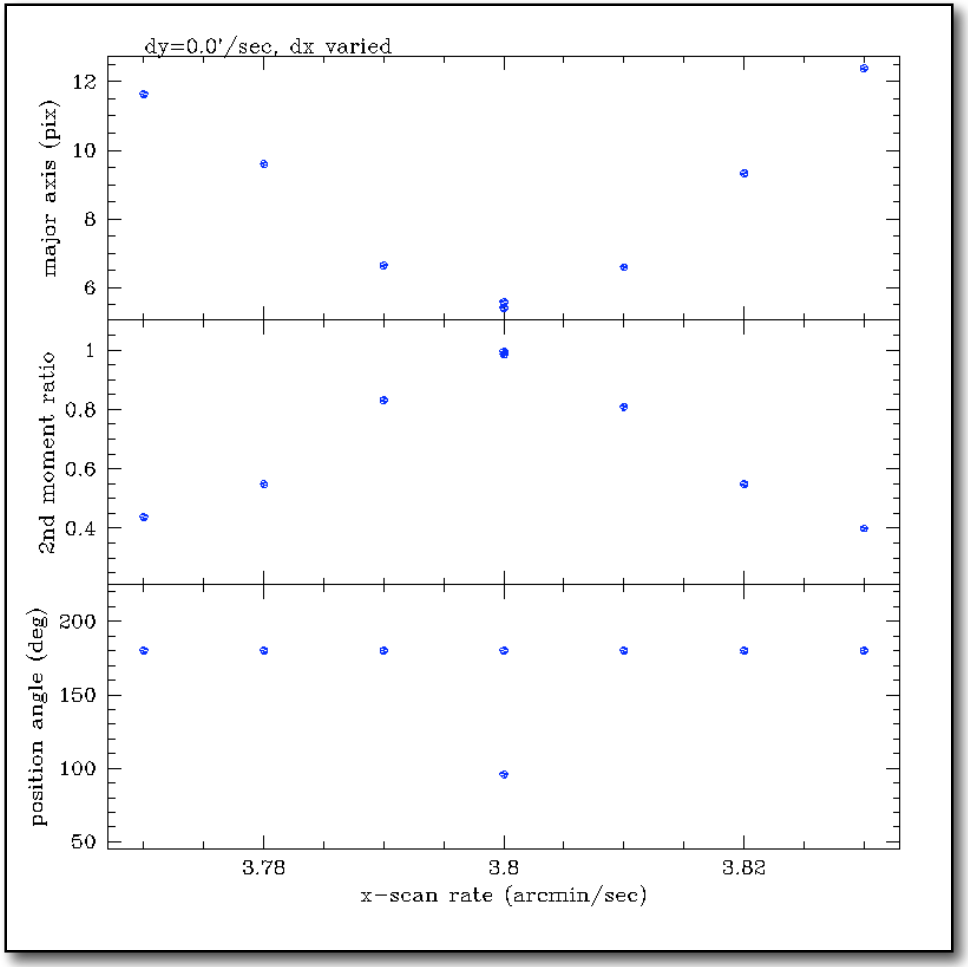
- Composite PRF generated by "stacking" high SNR point sources detected on one or more images.



# Demo of Scan Synchronization Monitor (3)



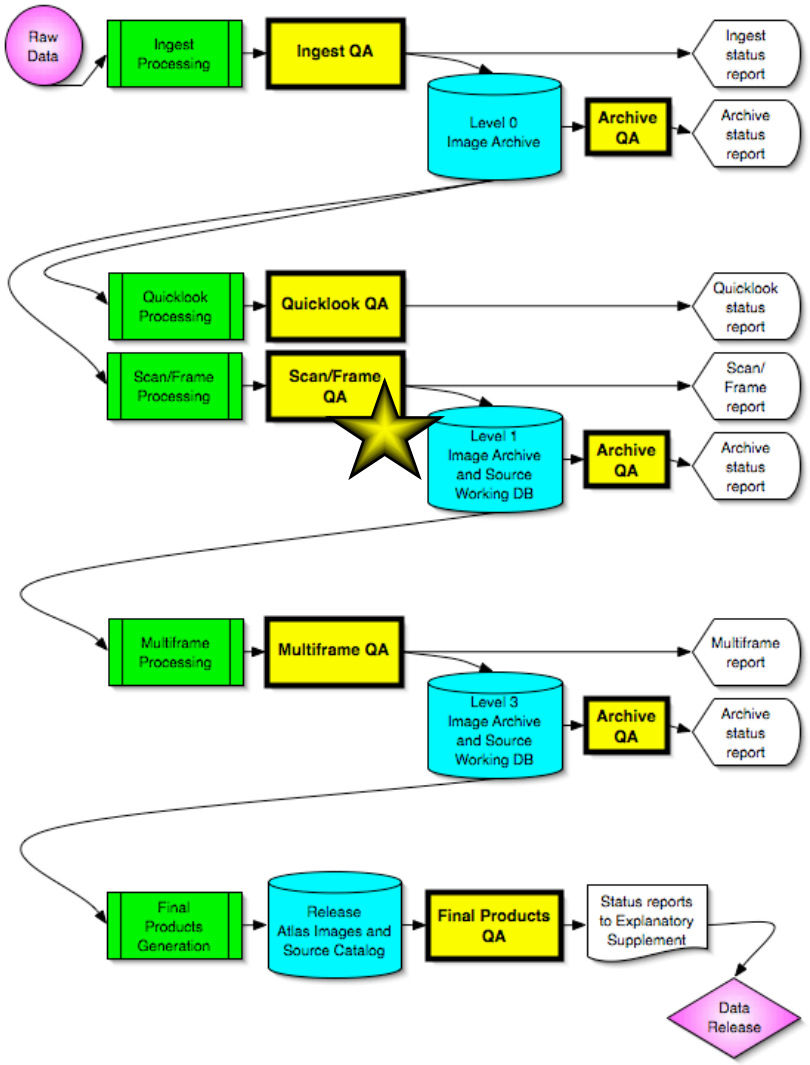
- PRF "shape" characterized and plotted as a function of frame, scan rate, etc.
- Optimal image shape occurs when scan rates are matched.
- Tool will be extended to incorporate noise pixel metric.



# Functionality: Scan/Frame QA



- Purpose:
  - To check for successful completion of Scan/Frame pipeline processing.
  - To scrutinize output of processing pipeline.
  - To compare achieved performance to science metrics tied to mission science requirements.
- Timescale:
  - Within 6 days of receipt of data at IPAC.
- Action:
  - WSDC to assign quality scores to each scan and produce QA report; PI or his designee responsible for signing off.



# Design: Scan/Frame QA (1)



- Summary of input data
  - Report log file and results of ingestion QA.
  - Report QA results for quicklook processing.
- Instrumental image calibration
  - If new flat fields computed, compare flat-fields to fiducials.
  - Compare sky-offsets to fiducials.
  - Monitor hot pixel masks – changes in masks, # of pixels masked.
  - Flag outlying noisy frames; plot noise histograms.
  - Flag outlying point-source-filtered noisy frames; plot histograms.
- Scan synchronization
  - Monitor point source shape, scan mirror synchronization.
- Band detection statistics
  - Monitor percentage of sources seen in all bands vs. single-band missing sources, two-band missing, etc.

# Design: Scan/Frame QA (2)



- Astrometric calibration
  - Plot histograms of astrometric deltas between WISE-computed and 2MASS All-Sky PSC positions; scrutinize outliers.
  - Modulo solar system object identifications, tabulate and follow up -
    - » sources (at least in W1 and W2) with no 2MASS match.
    - » 2MASS sources lacking a WISE counterpart.
- Photometric calibration, accuracy, and sensitivity
  - Monitor mean aperture photometry curves-of-growth.
  - Tabulate/plot mean/RMS differences between truth and derived photometry for standard stars in the orbit.
  - Tabulate/plot mean/RMS differences between stars in this orbit and those observed in previous overlapping orbits (trending via other Level 1 data).
  - Tabulate/plot mean photometric offsets from in-scan overlaps.
  - Plot number of objects with noted source confusion as function of galactic latitude; spot check image data for selected clean and confused sources.
  - Plot saturated star mag/flux estimates against ramp saturation flag.
  - Compare color-color diagrams for objects saturated in any band and compare against fiducial color loci to check saturated mag estimates.

# Design: Scan/Frame QA (3)



- Completeness and Reliability
  - Determine fraction vs. magnitude of "truth" sources in ecliptic polar fields.
- Artifact identification -- Perform semi-automated visual spot checks of a few examples of each of the following:
  - Latents.
  - Dichroic/filter glints.
  - Diffraction spikes.
  - Bright star halo contamination.
  - Optical ghosts.
  - Electronic ghosts.
  - Non-uniform stray light.
  - Scattered light patches from bright objects.
  - Radiation hits (?).
- Frame statistics
  - Plot log(N)-log(S) and check against mean frame noise level.
  - Plot counts vs. ecliptic latitude as check for cosmic ray hits.
  - Measure frame-to-frame overlap to assure overlap is sufficient.

# Design: Scan/Frame QA (4)



- Astrophysical checks
  - Plot color-color and color-mag diagrams of "good" sources.
- Solar system object identification
  - Plot number of solar system objects vs. ecliptic latitude.
  - Perform checks to make sure that identifications include asteroids, comets, planets, and planetary satellites.
  - Inspect color-color plots of identified objects.
  - Check detection fraction vs. visual magnitude?
- QA summary
  - Report successful/unsuccessful processing completion.
  - Provide web-accessible page with tables and plots listed above.
  - Generate auto-filled QA report along with quality scores as starting point for human review.
  - Review by QA scientists to finalize report.

# Scan/Frame QA Report Design (1)



Online | Ready for Review | Being Reviewed
Submitted | Ready for Cleanup | Pending Queries
Northern Nights | Southern Nights | All Nights

## 2MASS Final Processing QA Review Status

| Night | Rev | Prod Status | Reviewer | Review Status | Other Notes |
|---|---|---|---|---|---|
| 980925s | QA | archived 010926 | raymond 010924 | approved 011001 | |
| 980926n | QA | archived 011030 | davy 011029 | approved 011102 | |
| 980927n | QA | archived 020206 | raymond 020206 | approved ------ | orig rev davy ------ |
| 980927s | QA | archived 010926 | hurt 010926 | approved 010928 | position reconstruction problems i |
| 980928s | QA | archived 020204 | nelson 020204 | approved 011001 | orig rev raymond 010926 |
| 980929n | QA | archived 011031 | nelson 011031 | approved 011102 | |
| 980929s | QA | archived 010927 | davy 010926 | approved 011001 | |
| 980930n | QA | archived 011101 | hurt 011101 | approved 011105 | |
| 980930s | QA | archived 020207 | nelson 020206 | approved 011001 | orig rev davy 010928 |
| 981001n | QA | archived 011030 | cxu 011029 | approved 011101 | |
| 981001s | QA | archived 010927 | davy 010926 | approved 011001 | |
| 981002n | QA | archived 011031 | cxu 011029 | approved 011101 | |
| 981002s | QA | archived 010927 | davy 010926 | approved 011001 | |
| 981003n | QA | archived 011031 | cxu 011030 | approved 011101 | |
| 981003s | QA | archived 010927 | cxu 010926 | approved 011002 | |
| 981004n | QA | archived 011030 | cxu 011029 | approved 011105 | priority |
| 981004s | QA | archived 010929 | vandyk 010927 | approved 011002 | |
| 981005n | QA | archived 011031 | cxu 011030 | approved 011105 | |
| 981005s | QA | archived 010927 | vandyk 010926 | approved 011002 | |
| 981006n | QA | archived 011031 | davy 011030 | approved 011105 | priority |
| 981006s | QA | archived 020206 | nelson 020206 | approved 011002 | orig rev davy 010928 |
| 981007n | QA | archived 011031 | nelson 011030 | approved 011105 | |
| 981007s | QA | archived 011011 | raymond 010927 | approved 011015 | |
| 981008n | QA | archived 011031 | cxu 011030 | approved 011106 | |
| 981008s | QA | archived 020206 | nelson 020206 | approved 011002 | orig rev raymond 010928 |
| 981009n | QA | archived 011031 | cxu 011031 | approved 011106 | |
| 981009s | QA | archived 020206 | nelson 020206 | approved 011002 | orig rev davy 010928 |
| 981010n | QA | archived 011101 | nelson 011031 | approved 011106 | |
| 981010s | QA | archived 010928 | cxu 010927 | approved 010928 | priority |
| 981011n | QA | archived 011106 | raymond 011102 | approved 011106 | |
| 981011s | QA | archived 011002 | hurt 011001 | approved 011002 | |
| 981012n | QA | archived 011102 | hurt 011101 | approved 011106 | priority |
| 981012s | QA | archived 011002 | hurt 011002 | approved 011002 | |
| 981013n | QA | archived 011101 | nelson 011031 | approved 011106 | |
| 981014n | QA | archived 011102 | hurt 011101 | approved 011107 | |
| 981014s | QA | archived 011001 | hurt 010927 | approved 011003 | |
| 981015n | QA | archived 011105 | nelson 011104 | approved 011107 | rerun after dropping scan 098 from |
| 981015s | QA | archived 011003 | davy 011002 | approved 011003 | |
| 981016n | QA | archived 011106 | nelson 011104 | approved 011106 | priority |
| 981016s | QA | archived 011002 | vandyk 010928 | approved 011004 | |
| 981017s | QA | archived 010929 | davy 010928 | approved 011004 | |
| 981018s | QA | archived 011003 | cxu 011002 | approved 011004 | |
| 981019n | QA | archived 011102 | hurt 011102 | approved 011107 | priority |
| 981019s | QA | archived 011002 | raymond 010928 | approved 011004 | |
| 981020n | QA | archived 011102 | nelson 011102 | approved 011107 | |
| 981020s | QA | archived 011001 | cxu 011001 | approved 011004 | |
| 981021s | QA | archived 011003 | davy 011003 | approved 011004 | |
| 981022s | QA | archived 011002 | cxu 011001 | approved 011004 | |
| 981023n | QA | archived 011105 | hurt 011105 | approved 011107 | priority |
| 981023s | QA | archived 011003 | davy 011002 | approved 011004 | priority |
| 981024s | QA | archived 011003 | hurt 011001 | approved 011002 | priority |
| 981025s | QA | archived 011002 | cxu 011001 | approved 011008 | |
| 981026s | QA | archived 011003 | hurt 011002 | approved 011008 | |
| 981027n | QA | archived 011106 | nelson 011105 | approved 011106 | |
| 981027s | QA | archived 011003 | davy 011003 | approved 011015 | |
| 981028n | QA | archived 020205 | hurt 020204 | approved ------ | orig rev nelson ------ |
| 981028s | QA | archived 011017 | hurt 011003 | approved 011018 | some star halo meteor blanking art |
| 981029n | QA | archived 011103 | hurt 011102 | approved 011107 | |
| 981029s | QA | archived 011004 | davy 011003 | approved 011009 | |
| 981030s | QA | archived 011002 | hurt 011001 | approved 011009 | |
| 981031s | QA | archived 011001 | cxu 011001 | approved 011002 | |
| 981101n | QA | archived 011106 | hurt 011105 | approved 011106 | |
| 981101s | QA | archived 011003 | raymond 011001 | approved 011015 | |
| 981102n | QA | archived 011106 | hurt 011105 | approved 011106 | |

- Modeled closely on 2MASS Nightly QA.
- Concise web-based summary with drill-down capability.

## 2MASS Pipeline 3 QA Report
## QA Web Index
## 981017s

| | | |
|---|---|---|
| Scan Grading | Astrometry | Log File |
| Photometricity | Tracking/Stepping | Observers Log |
| Bkg/Seeing/Focus | Jumps/Airglow | V2 QA Web Pages |
| Galaxies | Nightly Overview | V2 QA Review |

### Diagnostic Plots

| | | | | | |
|---|---|---|---|---|---|
| Zero Point Default | Seeing Shape & Ratio | Pos Reconst. Qual | Chisq/Sig Plots | Hess Plots | Galaxy Monitor |
| Overlaps Summary | Meteor Blanking | R1:R2 Diff Monitor | PSF/Ap Mags | In/Cross Scan Color | V2 Deltas |
| Sensitivity | Astrom Wander | Distortion Monitor | R1:R2 Satur Phot | Saturated Color-mags | Plot Info |

### Error summary

| filename | line # | error type | error message |
|---|---|---|---|
| input.c | 2169 | scan number not in list | data in updatesit for unknown scan#75 v2 grade=0 |
| input.c | 2169 | scan number not in list | data in updatesit for unknown scan#76 v2 grade=0 |

Return to Main Index

Last run: Wed Oct 31 15:38:25 2001

Version 010829 (3.1); more info is at SCANSCI Notes

Mail comments/bug reports to hurt@ipac.caltech.edu

# Scan/Frame QA Report Design (2)



## 2MASS Pipeline 3 QA Report
## QA Web Index
## 981017s

| | | |
|---|---|---|
| Scan Grading | Astrometry | Log File |
| Photometricity | Tracking/Stepping | Observers Log |
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| filename | line # | error type | error message |
|---|---|---|---|
| input.c | 2169 | scan number not in list | data in updatesit for unknown scan#75 v2 grade=0 |
| input.c | 2169 | scan number not in list | data in updatesit for unknown scan#76 v2 grade=0 |

Return to Main Index

Last run: Wed Oct 31 15:38:25 2001

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## 2MASS Pipeline 3 QA Report
## Quad Jump/Airglow/Planet Hazard
## 981017s

### Quadrant Jump/Banding Summary

| Scan# | Type | Jump counter J | Jump counter H | Jump counter Ks | Planet hzrds | Cnoise 3sig J | Cnoise 3sig H | Cnoise 3sig Ks | Cnoise(4) J | Cnoise(4) H | Cnoise(4) Ks | J Banding L hi | J Banding R hi | J Banding L lo | J Banding R lo | H Banding L hi | H Banding R hi | H Banding L lo | H Banding R lo | Ks Banding L hi | Ks Banding R hi | Ks Banding L lo | Ks Banding R lo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 007 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 008 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 009 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 010 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 011 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 012 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 |
| 013 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.500 | 0.200 | 0.400 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 1 |
| 014 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.600 | 0.200 | 0.400 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 0 |
| 015 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.800 | 0.300 | 0.300 | 1 | 0 | 3 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 2 | 1 |
| 016 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.600 | 0.300 | 0.500 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 5 |
| 017 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.600 | 0.100 | 0.500 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 4 |
| 018 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.500 | 0.200 | 0.400 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 1 |
| 019 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.600 | 0.100 | 0.300 | 0 | 0 | 0 | 5 | 0 | 3 | 3 | 10 | 0 | 0 | 0 | 6 |
| 020 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.600 | 0.200 | 0.300 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 |
| 021 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 |
| 022 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 023 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 1 | 0 | 3 | 0 | 2 | 1 | 4 | 0 | 0 | 1 | 3 |
| 024 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 1 | 1 | 1 | 0 | 1 | 2 | 2 | 0 | 1 | 1 | 1 |
| 025 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 |
| 026 | CAL | 0 | 0 | 0 | 0 | undf | undf | undf | undf | undf | undf | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 1 |
| 027 | SUR | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0.500 | 0.200 | 0.300 | 0 | 1 | 0 | 6 | 0 | 2 | 3 | 8 | 0 | 2 | 0 | 5 |
| 028 | SUR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.500 | 0.200 | 0.400 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |

# Scan/Frame QA Report Design (3)



## 2MASS Pipeline 3 QA Report
## QA Web Index
## 981017s

| | | |
|---|---|---|
| Scan Grading | Astrometry | Log File |
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**Diagnostic Plots**

| | | | | | |
|---|---|---|---|---|---|
| Zero Point Default | Seeing Shape & Ratio | Pos Reconst. Qual | Chisq/Sig Plots | Hess Plots | Galaxy Monitor |
| Overlaps Summary | Meteor Blanking | R1:R2 Diff Monitor | PSF/Ap Mags | In/Cross Scan Color | V2 Deltas |
| Sensitivity | Astrom Wander | Distortion Monitor | R1:R2 Satur Phot | Saturated Color-mags | Plot Info |

**Error summary**

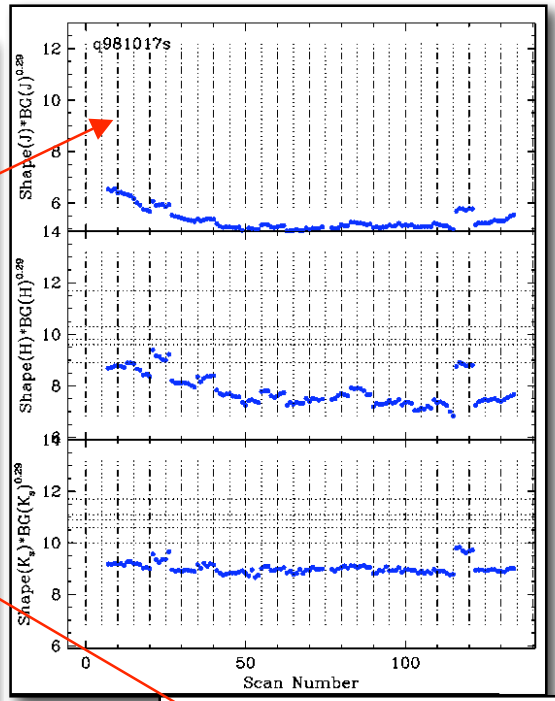
| filename | line # | error type | error message |
|---|---|---|---|
| input.c | 2169 | scan number not in list | data in updatesit for unknown scan#75 v2 grade=0 |
| input.c | 2169 | scan number not in list | data in updatesit for unknown scan#76 v2 grade=0 |

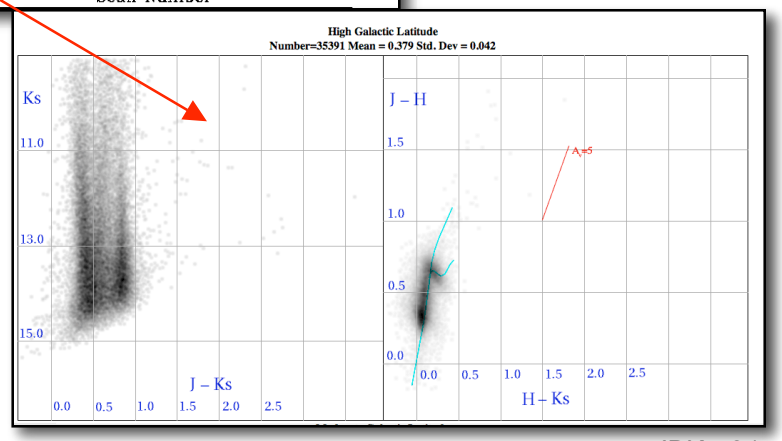
Return to Main Index

Last run: Wed Oct 31 15:38:25 2001

Version 010829 (3.1); more info is at SCANSCI Notes

Mail comments/bug reports to hurt@ipac.caltech.edu



# Scan/Frame QA Report Design (4)



Online | Ready for Review | Being Reviewed
Submitted | Ready for Cleanup | Pending Queries
Northern Nights | Southern Nights | All Nights

## 2MASS Final Processing QA Review Status

| Night | Rev | | Prod Status | Reviewer | Review Status | Other Notes |
|---|---|---|---|---|---|---|
| 980925s | QA | archived | 010926 | raymond 010924 | approved 011001 | |
| 980926n | QA | archived | 011030 | davy 011029 | approved 011102 | |
| 980927n | QA | archived | 020206 | raymond 020206 | approved ------ | orig rev davy ------ |
| 980927s | QA | archived | 010926 | hurt 010926 | approved 010928 | position reconstruction problems i |
| 980928s | QA | archived | 020204 | nelson 020204 | approved 011001 | orig rev raymond 010926 |
| 980929n | QA | archived | 011031 | nelson 011031 | approved 011102 | |
| 980929s | QA | archived | 010927 | davy 010926 | approved 011001 | |
| 980930n | QA | archived | 011101 | hurt 011101 | approved 011105 | |
| 980930s | QA | archived | 020207 | nelson 020206 | approved 011001 | orig rev davy 010928 |
| 981001n | QA | archived | 011030 | cxu 011029 | approved 011101 | |
| 981001s | QA | archived | 010927 | davy 010926 | approved 011001 | |
| 981002n | QA | archived | 011031 | cxu 011029 | approved 011101 | |
| 981002s | QA | archived | 010927 | davy 010926 | approved 011001 | |
| 981003n | QA | archived | 011031 | cxu 011030 | approved 011101 | |
| 981003s | QA | archived | 010927 | cxu 010926 | approved 011002 | |
| 981004n | QA | archived | 011030 | cxu 011029 | approved 011105 | priority |
| 981004s | QA | archived | 010929 | vandyk 010927 | approved 011002 | |
| 981005n | QA | archived | 011031 | cxu 011030 | approved 011105 | |
| 981005s | QA | archived | 010927 | vandyk 010926 | approved 011002 | |
| 981006n | QA | archived | 011031 | davy 011030 | approved 011105 | priority |
| 981006s | QA | archived | 020206 | nelson 020206 | approved 011002 | orig rev davy 010928 |
| 981007n | QA | archived | 011031 | nelson 011030 | approved 011105 | |
| 981007s | QA | archived | 011011 | raymond 010927 | approved 011015 | |
| 981008n | QA | archived | 011031 | cxu 011030 | approved 011106 | |
| 981008s | QA | archived | 020206 | nelson 020206 | approved 011002 | orig rev raymond 010928 |
| 981009n | QA | archived | 011031 | cxu 011031 | approved 011106 | |
| 981009s | QA | archived | 020206 | nelson 020206 | approved 011002 | orig rev davy 010928 |
| 981010n | QA | archived | 011101 | nelson 011031 | approved 011106 | |
| 981010s | QA | archived | 010928 | cxu 010927 | approved 010928 | priority |
| 981011n | QA | archived | 011106 | raymond 011102 | approved 011106 | |
| 981011s | QA | archived | 011002 | hurt 011001 | approved 011002 | |
| 981012n | QA | archived | 011102 | hurt 011101 | approved 011106 | priority |
| 981012s | QA | archived | 011002 | hurt 011002 | approved 011002 | |
| 981013n | QA | archived | 011101 | nelson 011031 | approved 011106 | |
| 981014n | QA | archived | 011102 | hurt 011101 | approved 011107 | |
| 981014s | QA | archived | 011001 | hurt 010927 | approved 011003 | |
| 981015n | QA | archived | 011105 | nelson 011104 | approved 011107 | rerun after dropping scan 098 from |
| 981015s | QA | archived | 011003 | davy 011002 | approved 011003 | |
| 981016n | QA | archived | 011106 | nelson 011104 | approved 011106 | priority |
| 981016s | QA | archived | 011002 | vandyk 010928 | approved 011004 | |
| 981017n | QA | archived | 010929 | davy 010928 | approved 011004 | |
| 981018s | QA | archived | 011003 | cxu 011002 | approved 011004 | |
| 981019n | QA | archived | 011102 | hurt 011102 | approved 011107 | priority |
| 981019s | QA | archived | 011002 | raymond 010928 | approved 011004 | |
| 981020n | QA | archived | 011102 | nelson 011102 | approved 011107 | |
| 981020s | QA | archived | 011001 | cxu 011001 | approved 011004 | |
| 981021s | QA | archived | 011003 | davy 011003 | approved 011004 | |
| 981022s | QA | archived | 011002 | cxu 011001 | approved 011004 | |
| 981023n | QA | archived | 011105 | hurt 011105 | approved 011107 | priority |
| 981023s | QA | archived | 011003 | davy 011002 | approved 011004 | priority |
| 981024s | QA | archived | 011003 | hurt 011001 | approved 011002 | priority |
| 981025s | QA | archived | 011002 | cxu 011001 | approved 011008 | |
| 981026s | QA | archived | 011003 | hurt 011002 | approved 011008 | |
| 981027n | QA | archived | 011106 | nelson 011105 | approved 011106 | |
| 981027s | QA | archived | 011003 | davy 011003 | approved 011015 | |
| 981028n | QA | archived | 020205 | hurt 020204 | approved ------ | orig rev nelson ------ |
| 981028s | QA | archived | 011017 | hurt 011003 | approved 011018 | some star halo meteor blanking art |
| 981029n | QA | archived | 011103 | hurt 011102 | approved 011107 | |
| 981029s | QA | archived | 011004 | davy 011003 | approved 011009 | |
| 981030s | QA | archived | 011002 | hurt 011001 | approved 011009 | |
| 981031s | QA | archived | 011001 | cxu 011001 | approved 011002 | |
| 981101n | QA | archived | 011106 | hurt 011105 | approved 011106 | |
| 981101s | QA | archived | 011003 | raymond 011001 | approved 011015 | |
| 981102n | QA | archived | 011106 | hurt 011105 | approved 011106 | |

```
981017s [v3]

This night has two scans that will need to be flagged to assure that their
noted astrometric problems are factored into their final astrometric errors.


http://2massqa.ipac.caltech.edu:9000/data/2mass/1gos_v3/qa981017s/


Processing notes:
-----------------

Scans failing processing: None.

Minor planet ID's: Two low-numbered asteroids predicted and both found --

|scn|psID    |Name              |RA          |Dec       |
 014    8521 (238)       Hypatia  329.664377   -6.891632
 033    5658 (212)         Medea  331.222679   -8.601501


Photometricity:
---------------

Calibration strategy: New

CALMON overrides: None.

CALMON passes entire night with a solution in all three bands that approximates
a constant fit.

Overlaps plots: Scatter is low in all sci blocks. Biases are near zero at J
and H but are positive, though only at the 0.01 mag level, at Ks.

In summary,

      Scans      Phot. quality factor
      -------    --------------------
      013-020      1.0
      027-034      1.0
      041-048      1.0
      055-062      1.0
      069-074      1.0
      083-089      1.0
      096-102      1.0
      109-115      1.0
      122-128      1.0


Backgrounds/Coadds:
-------------------

Background plots: These all look very stable. (I love southern data!)

Meteor blanking: Scan 015 (fr 126) contains a meteor with three parallel
trails, and these were all cleaned successfully. A partial-frame meteor
in scan 016 (fr 39) is also cleaned out completely. Scan 017 (fr 124) has
two parallel meteors, only one of which is caught; the one missed is so
faint that it does not create any false sources. Scan 018 (fr 144), scan
061 (fr 243), and scan 113 (fr 253)  contain partial-frame meteors which are
successfully cleaned.

Jump Counters:  All OK

Airglow/Coadd Noise:  All OK

Marginal Airglow/Coadd Noise:  All OK


Seeing Diagnostics:
-------------------

Extensive Untracked Seeing:  All OK

Marginal Seetracker Scores:  All OK

Bad 2nd image moment ratios:  All OK


Astrometry Diagnostics:
-----------------------

Astrometric wander [blue]: The dec.dpos file for 014 vs 015 shows that RA is
displaced by 0.3" for the entire run of Decs. Interestingly, the dec.dpos files
for the two pairs on either side of this (013 vs 014 and 015 vs 016) show
delta RA's which sit perfectly on zero. Howard has looked at comparisons with
UCACr7, and it appears that both scans (014 and 015) are discrepant by about
the same amount. Both of these scans will need to be flagged so that their
final astrometric errors reflect this. This is by far the largest wander
seen on this night; all others look fine.
```

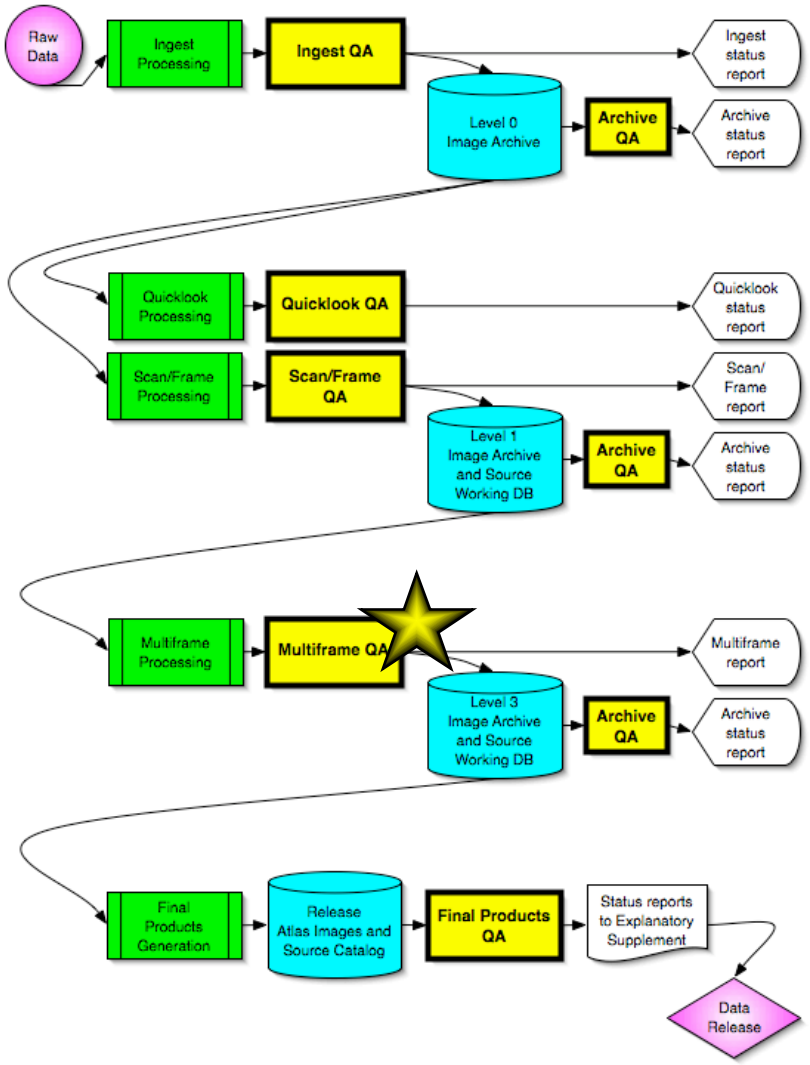
```
Global astrometry [blue]: These look fine.

Scan tracking warnings: NONE


Science Diagnostics:
--------------------

Photometric diagnostics [yellow]: Photometric sigmas show the usual families.
Chi-squared values sit very close to 1.0 for all mags. Photometric linearity
look very good except for the ~0.02 mag bias at the eastern edge of the array
for faint Ks sources. All other plots look fine.

Galaxy diagnostics [orange]: These look fine.


Quality Recommendation:
-----------------------

Sci scans:  (max score = 10; using min of fct's)

                      fct1 fct2 fct3 fct4 fct5
      Scans    Grade  phot sens see  untr airg
      -------  -----  ---------------------
      013-020   10     1.0  1.0  1.0  1.0  1.0
      027-034   10     1.0  1.0  1.0  1.0  1.0
      041-048   10     1.0  1.0  1.0  1.0  1.0
      055-062   10     1.0  1.0  1.0  1.0  1.0
      069-074   10     1.0  1.0  1.0  1.0  1.0
      083-089   10     1.0  1.0  1.0  1.0  1.0
      096-102   10     1.0  1.0  1.0  1.0  1.0
      109-115   10     1.0  1.0  1.0  1.0  1.0
      122-128   10     1.0  1.0  1.0  1.0  1.0


Cal scans:  (non-photometric = 0, photometric = 10)

      Scans    Grade  Notes
      -------  -----  -----
      007-012   10
      021-026   10
      035-040   10
      049-054   10
      063-068   10
      077-082   10
      090-095   10
      103-108   10
      116-121   10
      129-134   10


Untracked Seeing Overrides: NONE


Missing Scans:

      Scans      Notes
      -------    -----
      075-076    v2 Q=0


Version 2 Differences:
----------------------

Delta Plots [red]: Zero-points show only expected changes. PSP values show
almost no change at all. Source counts change by up to 60% but are as usual
anti-correlated with source density.

Degraded scores: NONE

Improved scores: NONE


Special Notes:
--------------

None.

SCANSCI Version 010829 (3.1) last run on Fri Sep 28 06:33:13 2001
```

Final QA grades

# Functionality: Multiframe QA



- Purpose:
  - To check for successful completion of Multiframe pipeline processing.
  - To scrutinize output of processing pipeline.
  - To compare achieved performance to science metrics tied to mission science requirements.
- Timescale:
  - Within 15 days for multi-orbit pipeline with >18 coverages.
- Action:
  - For ultimate (not intermediate) coadds, WSDC to assign quality scores to each coadd and produce QA report; PI or his designee responsible for signing off.



# Design: Multiframe QA



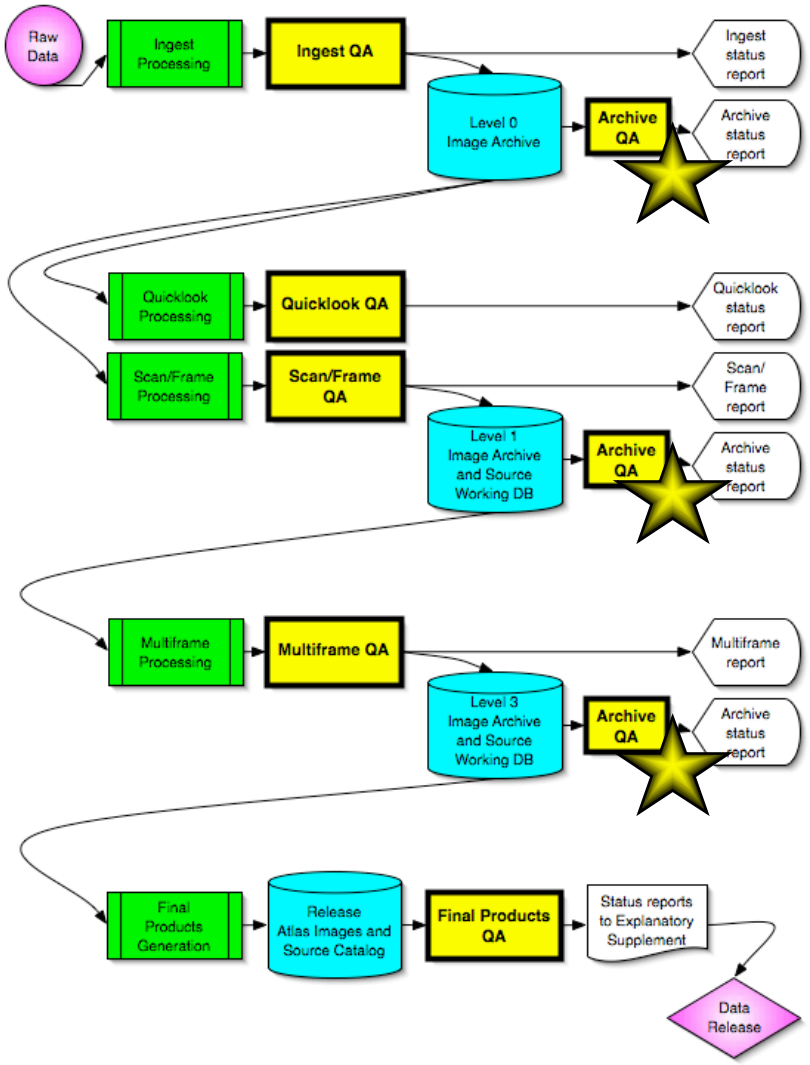
Same as the Scan/Frame QA design, with the following additions/deletions:

- Summary of input data
  - Summarize QA grades for each scan considered for image stacking.
- Source characterization
  - Perform semi-automated visual checks of registered coadds.
- Astrometric calibration
  - Plot deltas with respect to 2MASS and individual scan astrometry; scrutinize sources with large deltas.
  - Plot astrometric error per axis as function of source SNR.
- Photometric calibration
  - Tabulate/plot zero-point differences for scan-to-scan overlaps.
  - Plot Level-1 photometry vs. deep coadd photometry to check for photometric self-consistency and depth of extractions.
- Artifact identification
  - Check additional artifact flagging from extra-scan info.
- No solar system object checks needed

# Functionality: Archive QA



- Purpose:
  - To validate accuracy of source/metadata database loadings.
  - To verify integrity of database tables and images (using, e.g, checksums and RTB queries).
- Timescale:
  - After each database load (roughly once per week).
  - Run periodically on static tables.
- Action:
  - WSDC reports status of checks and responds to problems (in concert with IRSA, where applicable).



# Design: Archive QA

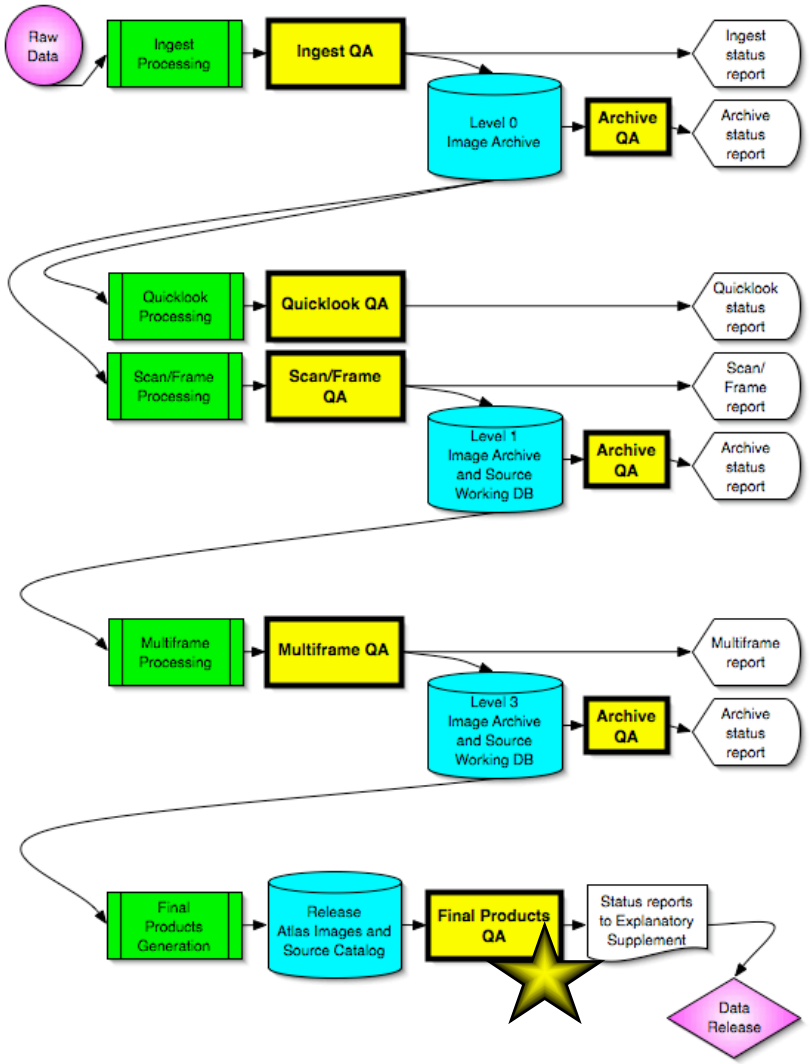


- Perform checksums on the following:
  - Working databases.
  - Source catalogs.
  - Image archives.
  - Image metadata.
  - Any ancillary archives such as QA score archive or calibration archive.
- Perform range checking of the same databases, catalogs, and archives.
- QA summary
  - Report status of each check.
  - Provide web-accessible page with summarized results.

# Functionality: Final Products QA



- Purpose:
  - To assess properties of the Atlas Images and Source Catalogs relative to mission Level 1 and 1.5 science requirements.
  - To check integrity of the products via range checking on all parameters.
  - To give overall characterization of public data products.
- Timescale:
  - After Final Product Generation but before public release.
- Action:
  - WSDC and Science Team to provide analyses; final release approval given by PI.



# Design: Final Products QA (1)



- Source Catalog
  - Plot histogram of N-out-of-M (N/M) statistics for multiple epochs for internal checks of completeness and reliability; scrutinize cases with low N/M values.
  - Check photometric variability statistics; scrutinize outliers.
  - Check astrometric variability statistics (moving objects); scrutinize outliers.
  - Perform cross-correlations with other catalogs; scrutinize sources in each catalog that have no association in the other.
  - Perform range checking on all columns.
  - Using deeper Spitzer Space Telescope data at similar wavelengths (IRAC-ch1, IRAC-ch2, IRAC-ch4/IRS-blue-PU, and IRS-red-PU/MIPS-24um) and multi-repeat WISE scans at the ecliptic poles, determine completeness of catalog as a function of SNR and check with respect to science requirements.
  - Using the same data sets as above, determine reliability of catalog as a function of SNR and check with respect to science requirements.
  - Plot log(N)-log(S) against mean scan noise level or SNR.
  - Plot saturated star mag/flux estimates against ramp saturation flag.
  - Compare color-color diagrams for objects saturated in any band and compare against fiducial color loci to check saturated mag estimates.
  - Plot astrometric error per axis as function of source SNR.

# Design: Final Products QA (2)



- Image Atlas (data images, depth-of-coverage mags, noise maps)
  - Confirm FITS standard.
  - Confirm that photometric zero points are correct.
  - Overlay images on outside image source data (2MASS All-Sky Atlas Images) to check astrometry.
  - Perform range checking on header values; check that pixel grid is the same for all images and all wavelengths.
  - Determine areal coverage for 8+-deep coverage areas and check against science requirement. Build up survey coverage statistics.
  - Using header info, determine epoch difference between first and last observation and check against science requirement.
  - Summarize reports of QA analyses for Explanatory Supplement.

# 2MASS Heritage: Final Products Analysis



| | Category | Requirement | Performance |
|---|---|---|---|
| *Point Source Catalog* | | | |
| | Photometric sensitivity | 10-σ at **15.8, 15.1, 14.3 mag** at J, H, $K_s$ respectively for \|b\|>10° | met for full unconfused sky; exceeded for most of sky |
| | Photometric uniformity | **<4%** maximum bias in photometric zeropoint around the sky | <2% achieved |
| | Photometric precision | **<5%** 1-σ for bright stars unsaturated in the 1.3 s exposure | <3% achieved |
| | Astrometric accuracy | **<0.5″** 1-σ relative to the reference frame | <0.1″ achieved |
| | Completeness | **>0.99** at 10-σ sensitivity limits | met |
| | Reliability | **>0.9995** | 0.9997 demonstrated in test areas; no known source of unreliability in excess of specification |
| | Bright star photometry (Read_1, *rd_flg*=1) | **<2% bias** at Read_1 saturation limit ($K_s$~4.0 mag)<br>**<5% 1-σ repeatability** at Read_1 faint limit ($K_s$~8.0 mag)<br>**<10% 1-σ repeatability** at Read_1 saturation limit ($K_s$~4.0 mag) | <4% at worst<br>2% achieved<br>2% achieved |
| *Extended Source Catalog* | | | |
| | Photometric sensitivity | **10-σ at J<15.0, H<14.2, $K_s$<13.5 mag** | met |
| | Photometric precision | **<10% 1-σ repeatability** for H<13.8 mag | 7-10% achieved |
| | Photometric uniformity | **<10%** maximum bias around sky | <4% achieved |
| | Completeness | **>0.90** for \|b\|>30° | met |
| | Reliability | **>0.80** for 10°<\|b\|<20°<br>**>0.99** for \|b\|>20° | achieved 0.93-0.95<br>achieved 0.992-0.995 |
| *General Survey* | | | |
| | Sky coverage | **>95%** | 99.998% imaged; 99.5% coverage in point sources; 98% coverage in extended source |
| *Other Information* | | | |
| | Galactic Plane performance | No Requirements | |

**g. PSC Bright Source Photometric Precision**

**The Level 1 Specifications place three requirements on saturated star photometry (specifically "Read_1" photometry).**

1. **5% photometric precision for $K_s$=8.0 mag (meaning just above the "Read_2 - Read_1" 1.3 s exposure saturation threshold (designated by *rd_flg*=1)).**
2. **10% photometric precision for at $K_s$=4.0 mag (meaning just below the "Read_1" 51 ms saturation threshold (thus, also *rd_flg*=1)).**
3. **No more than 2% bias for $K_s$>4.0 mag**

**There are no Level 1 requirements associated with sources that saturated even the 51 ms "Read_1" exposure (designated by *rd_flg*=3). These sources do have large uncertainties significantly in excess of the Level 1 Specifications for fainter sources.**

i. *Bright Star Photometric Precision*

Requirements 1 and 2 are addressed in the Photometric Precision subsection (see VI.1c), which discusses uncertainties derived from repeated observation across virtually the entire flux range observed in 2MASS. The relevant diagram is reproduced in Figure 1 and shows that the uncertainty in the magnitude range 4.0<$K_s$ [mag] <8.0 is substantially better than the 10%/5% requirements in items 1 and 2 above.

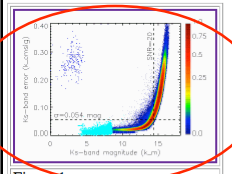


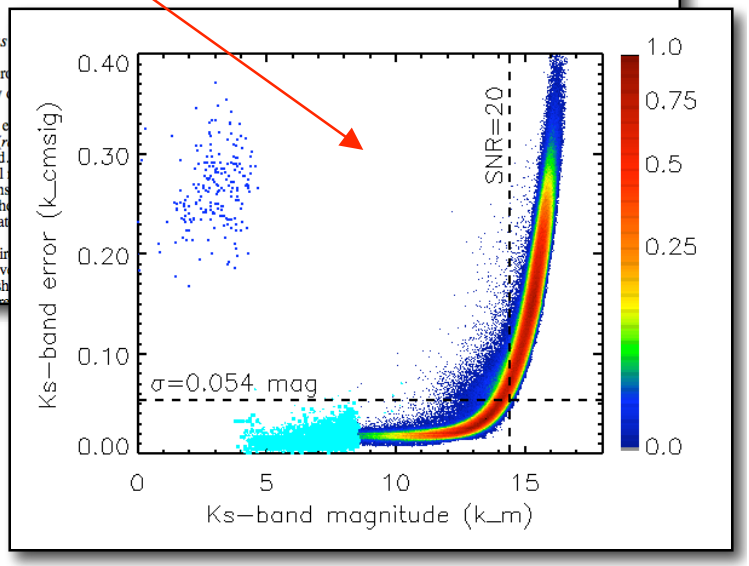
Figure 1

ii. *Bright Star Photometric Bias*

A means has not been found to rigor
mag) regime -- from internal Survey

Bias can be addressed at the "faint"
and the 51 ms Read_1 photometry (*r*
Read_2-Read_1 saturation threshold
magnitude. Figure 2 shows a typical
transition to saturated 1.3 s detections
diagrams show deviation, because th
deviation, because the singly-correlat

Although this result does not bear dir
tied to the 1.3 s frames at the crossov
linear right up to the saturation thresh



# QA V&V Matrix: Scan/Frame QA



| | Source Catalog | | | | | | | | | | | | | | Image Atlas | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Requirement→<br>QA check↓ | Completeness | Reliability | Characterization | Artifact Flagging | Flux Meas/Upper Limits | Flux Uncertainties | Flux Quality Flag | Phot. SNR=5 Limits | Phot. RMS Error | Saturated Photometry | Saturation Limit | Near-Moon Performance | Astrometric Measures | Astrometric Uncertainties | Astrom. RMS Error | Sky Coverage | Coverage Maps | Time Sampling | Common Pixel Grid | Photometric Calibration | FITS Standard | Image Quality |
| SCAN/FRAME QA | | | | | | | | | | | | X | | | | | | | | | | |
| Band detection stats | | | | | X | | | | | | | | | | | | | | | | | |
| Source confusion vs. glat | | | | | | | X | | | | | | | | | | | | | | | |
| Saturation vs ramp flag | | | | | | | | | | X | | | | | | | | | | | | |
| Color-color plots | | | | | | | | | | X | | | | | | | | | | | | |
| Artifact ID checks | | X | | X | | | X | | | | | | | | | | | | | | | |
| Log(N)-log(S) plots | X | | | | | | | | | | | | | | | | | | | | | |

# QA V&V Matrix: Multiframe QA



| | Source Catalog | | | | | | | | | | | | | | | Image Atlas | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Requirement→<br>QA check↓ | Completeness | Reliability | Characterization | Artifact Flagging | Flux Meas/Upper Limits | Flux Uncertainties | Flux Quality Flag | Phot. SNR=5 Limits | Phot. RMS Error | Saturated Photometry | Saturation Limit | Near-Moon Performance | Astrometric Measures | Astrometric Uncertainties | Astrom. RMS Error | Sky Coverage | Coverage Maps | Time Sampling | Common Pixel Grid | Photometric Calibration | FITS Standard | Image Quality |
| MULTIFRAME QA | | | | | | | | | | | | | | | | | | | | | | |
| Scan detection stats | | | | | X | | | | | | | | | | | | | | | | | |
| Astr. Error vs. SNR | | | | | | | | | | | | | | | X | | | | | | | |
| Source confusion vs. glat | | | | | | | X | | | | | | | | | | | | | | | |
| Saturation vs ramp flag | | | | | | | | | | X | | | | | | | | | | | | |
| Color-color plots | | | | | | | | | | X | | | | | | | | | | | | |
| Artifact ID checks | | X | | X | | | X | | | | | | | | | | | | | | | |
| Log(N)-log(S) plots | X | | | | | | | X | X | | X | | | | | | | | | | | |

# QA V&V Matrix: Final Products QA (1)



| | Source Catalog | | | | | | | | | | | | | | Image Atlas | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Requirement→ / QA check↓ | Completeness | Reliability | Characterization | Artifact Flagging | Flux Meas/Upper Limits | Flux Uncertainties | Flux Quality Flag | Phot. SNR=5 Limits | Phot. RMS Error | Saturated Photometry | Saturation Limit | Near-Moon Performance | Astrometric Measures | Astrometric Uncertainties | Astrom. RMS Error | Sky Coverage | Coverage Maps | Time Sampling | Common Pixel Grid | Photometric Calibration | FITS Standard | Image Quality |
| FINAL PRODUCTS QA – Source Catalog | | | | | | | | | | | | | | | | | | | | | | |
| Range checking of columns | | | | | X | X | X | | | | | | X | X | | | | | | | | |
| Completeness via truth fields | X | | X | | | | | | | | | | | | | | | | | | | |
| Reliability via truth fields | | X | X | | | | | | | | | | | | | | | | | | | |
| Log(N)-log(S) plots | | | | | | | | X | X | | X | | | | | | | | | | | |
| Saturation vs ramp flag | | | | | | | | | | X | | | | | | | | | | | | |
| Color-color plots | | | | | | | | | | X | | | | | | | | | | | | |
| Astr. Error vs SNR | | | | | | | | | | | | | | | X | | | | | | | |

# QA V&V Matrix: Final Products QA (2)

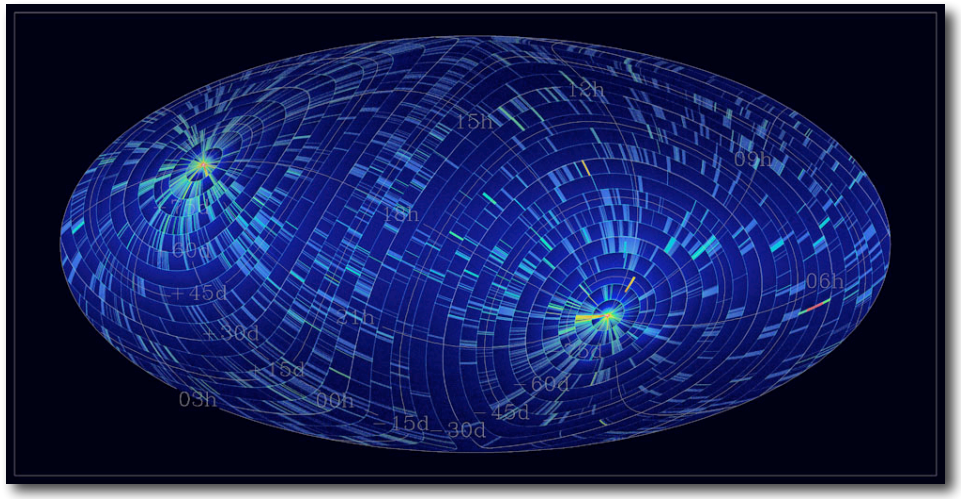


| | Source Catalog | | | | | | | | | | | | | | | Image Atlas | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Requirement→<br>QA check↓ | Completeness | Reliability | Characterization | Artifact Flagging | Flux Meas/Upper Limits | Flux Uncertainties | Flux Quality Flag | Phot. SNR=5 Limits | Phot. RMS Error | Saturated Photometry | Saturation Limit | Near-Moon Performance | Astrometric Measures | Astrometric Uncertainties | Astrom. RMS Error | Sky Coverage | Coverage Maps | Time Sampling | Common Pixel Grid | Photometric Calibration | FITS Standard | Image Quality |
| FINAL PRODUCTS QA – Image Atlas | | | | | | | | | | | | | | | | | X | | | | | |
| Confirm FITS standard | | | | | | | | | | | | | | | | | | | | | X | |
| Phot. Zero point check | | | | | | | | | | | | | | | | | | | | X | | |
| Range checking of headers; pixel grid check | | | | | | | | | | | | | | | | | | | X | | | |
| Build survey coverage stats | | | | | | | | | | | | | | | | X | | | | | | |
| Compute epoch diff via headers | | | | | | | | | | | | | | | | | | X | | | | |

# Tracking QA Results



We will maintain two tables, one for individual scans and one for coadds, that summarize QA results.




- In 2MASS we had
  - Scan Information Table for normal survey data
  - Cal Information Table for calibration data.
- These contained concise info for each scan
  - Basic scan info (e.g., ID, sky location, date)
  - Telescope telemetry (e.g., dewpoint, temperature)
  - Summarized characterizations of the data (e.g., point source shape parameters, calibration zero-points, mean source density)
  - Quality assessments and final quality scores
- Tables were useful for
  - Performing trending analyses (e.g., seeing shape vs temperature)
  - Deciding which scans to include/exclude as part of final data release.

# Anomaly Response Plan (1)



During the QA process, anomalies and problems will be detected that may need response from the EOS, MOS, SOC, WSDC, or WISE Science Team.

- Ingest QA
  - Action: WSDC to inform MOS/EOS and SOC of successful ingest or anomalies via web-accessible report.
  - Tracking: (TBD) MOS/EOS and/or SOC to acknowledge receipt of anomaly report via web form; results of subsequent analyses to be archived by WSDC and made web accessible.
  - Resolution: WSDC will note anomalies on web summary pages; issues may need to be closed with MOS/EOS and/or SOC.

- Quicklook QA
  - Action: WSDC to inform MOS/EOS and SOC of Quicklook runs and anomalies via web-accessible report.
  - Tracking: MOS/EOS and/or SOC to acknowledge receipt of anomaly report via web form; results of subsequent analyses to be archived by WSDC and made web accessible.
  - Resolution: WSDC will close the issue and note it on web summary pages once parties agree that resolution has been reached

- Scan/Frame and Multiframe QA
  - Action: WSDC to report anomalies as part of the normal assigning of scan/frame QA grades. This report will be posted on the web for review by the PI and SOC.
  - Tracking: On the web summary pages, WSDC will mark reviews having outstanding issues and add subsequent analyses by WSDC or SOC to the QA review for curation.
  - Resolution: WSDC will close the issue and note it on web summary pages once the PI or designee concurs that resolution has been reached.

# Anomaly Response Plan (2)



- Archive QA
  - Action: WSDC to report problems on web summary pages and to assign action items to internal WSDC or IRSA personnel via those project's ticket systems.
  - Tracking: Tracking will be handled by each project's existing ticket systems.
  - Resolution: WSDC will close issue and note it on web summary pages after concurrence of WSDC/IRSA personnel.

- Final Products QA
  - Action: WSDC to report anomalies to WSDC/IRSA via ticket systems or to SOC via e-mail.
  - Tracking: WSDC to note status of anomaly checking via ticket systems (for WSDC/IRSA-related issues) and via web summary pages.
  - Resolution: WSDC will close the issue and note it on web summary pages once the PI or designee concurs either that a solution has been found or that the anomaly should be characterized and documented for the Explanatory Supplement.

- Anomaly collection via other routes
  - Collect anomalies from WISE Science Team.
  - Collect anomalies from the astronomical community.

# IOC: QA Tasks w/ Cover On



Although some of the data acquired during IOC will be non-standard with respect to normal operational data, QA tasks will be needed on resultant data products as the integrity of both the data and the pipelines are tested. Such tests will be largely manual activities using custom software and analysis tools.

- Cover-on: Before the cover is released, the temperature of the inner shield of the aperture cover will be high enough that data in W3 and W4 should be saturated. Nonetheless, there are tests that can be made for W1 and W2 data:
  - Test Ingest QA pipeline.
  - Test those portions of the Scan/Frame QA Pipeline that monitor darks, hot pixel masks, and frame noise (for W1 and W2 only).
  - Test saturation pixel flagging (for W3 and W4 only).
  - Check noise characteristics in W1 and W2 for orbits with SAA passages to determine noise thresholds to use during routine QA.

# IOC: QA Tasks w/ Cover Off



Cover-off: After the cover is ejected, a series of planned tests will evaluate the performance of the instrument to actual astronomical sources. These data will allow (a) threshold checking needed for nominal QA operations, (b) collection of inputs needed for pipeline tuning, and (b) thorough testing of the scan synchronization monitor:

- Scan Synchronization monitor
  - Test fully.
  - Derive warning thresholds for QA.
- Detector calibration
  - Derive fiducial on-orbit flats.
  - Derive fiducial on-orbit masks (low-response pixels + hot pixels).
- Photometric calibration initialization
  - Monitor orbit-to-orbit pole passages to check zero-point stability of standard stars.
  - Monitor photometric stability using orbit-to-orbit overlaps.
  - Verify that each standard is still appropriate for use.
- Source detection initialization
  - Determine optimal SNR thresholds for detections to meet completeness requirements.
  - Set deblending parameters.
- Bright source artifact mapping
  - Set thresholds for flagging latents, diffraction spikes, dichroic glints, electronic ghosts, and optical ghosts.
- Annealling characterization
  - Check image statistics before and after anneals.
  - Check behavior of latents before and after anneals.
- Avoidance limits
  - Determine practical background limit for processing data near the Moon.
  - Determine SAA charge rate limits for W3 and W4.

# QA Development Schedule



- Jun 19, 2008 (version 1.0)
  - Ingest QA prototyped
  - Quicklook QA prototyped
  - Parts of Scan/Frame QA prototyped
  - Scan synch monitor in preliminary state
- Dec 17, 2009 (version 2.0)
  - v1.0 pieces matured
  - Parts of Multiframe QA prototyped
  - Archive QA prototyped
- Jul 7, 2009 (version 3.0)
  - Ingest QA, Quickook QA, Scan/Frame QA, Multiframe QA, Archive QA ready for launch
- Dec 30, 2009 (post-launch)
  - Post-launch tune-ups of the five QA subsystems above
  - Final Products QA prototyped
- Dec 20, 2010 (post-cryo)
  - Final versions of all six QA subsystems mature

# Issues/Concerns



- Who is responsible for providing calibration products and tuning parameters from IOC results?
- During IOC will we be able to respond quickly enough to in-orbit differences so that processing timescales stay on schedule?
- Coordination of the parties needed to make anomaly tracking work will need the attention of upper management.