

Data Processing Status

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SOFIA Data Products

Defined in the Data Processing Plan for SOFIA SIs :

Level 1: raw SI data in standardized format (FITS)

Level 2: corrected for instrument artifacts (e.g., flats, darks, bad pixels)

Level 3: flux calibrated (using FITS keywords; Jy/pix)

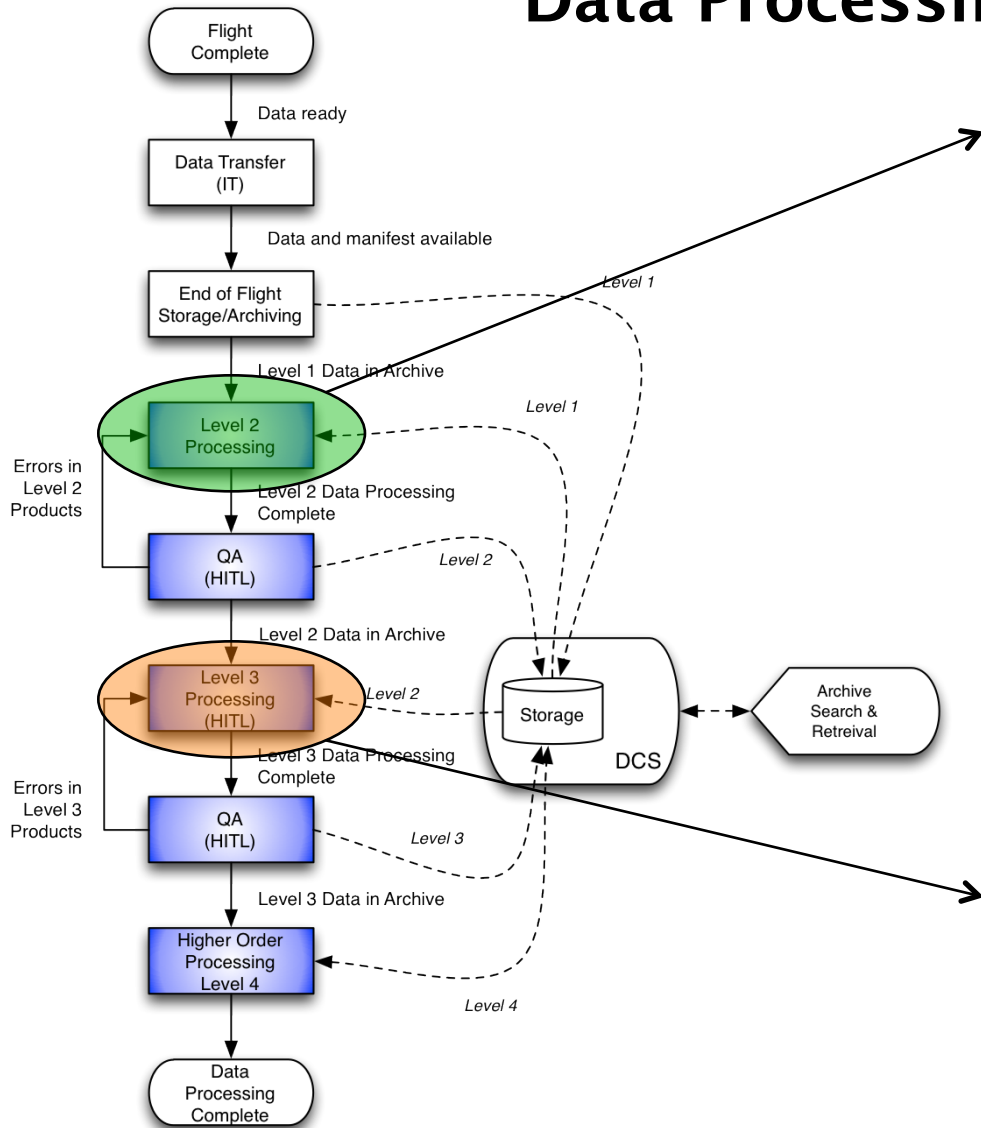
Level 4: high-order products possibly combining multiple observations

(e.g. mosaics, spectral cubes)

SI Pipeline Readiness

SI Pipeline	Status
FORCAST Imaging	Automatic pipeline in operation.
FORCAST Grism	Automatic pipeline in operation.
FLITECAM Imaging	Ready; auto operation pending IT&V w DPS.
FLITECAM Grism	Ready; auto operation pending IT&V w DPS.
GREAT	Manual scripts in operation; Level 3 only.
EXES	alpha version complete and under test.
FIFI-LS	Preliminary pipeline received; alpha version complete; <i>bug-fixes and algorithm updates underway.</i>
HAWC+	Preliminary pipeline for HAWC received; will need additional development for HAWC+.
HIPO	N/A

Data Processing Flow



Two modes of Level 2 Processing:

- **Manual:** operator runs established version of pipeline interactively in stand-alone environment (workstation) on a single observation.
- **“Automatic”:** pipeline is run automatically on data for a whole mission. Some provision for user-interaction will be made.

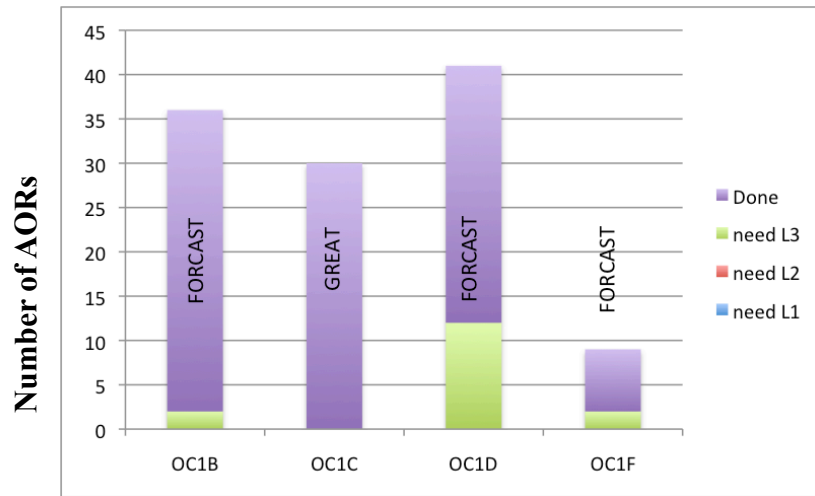
Level 3 Processing will be highly user interactive, utilizing both COTS and custom tools/pipelines.

Since last SUG (April 2014)

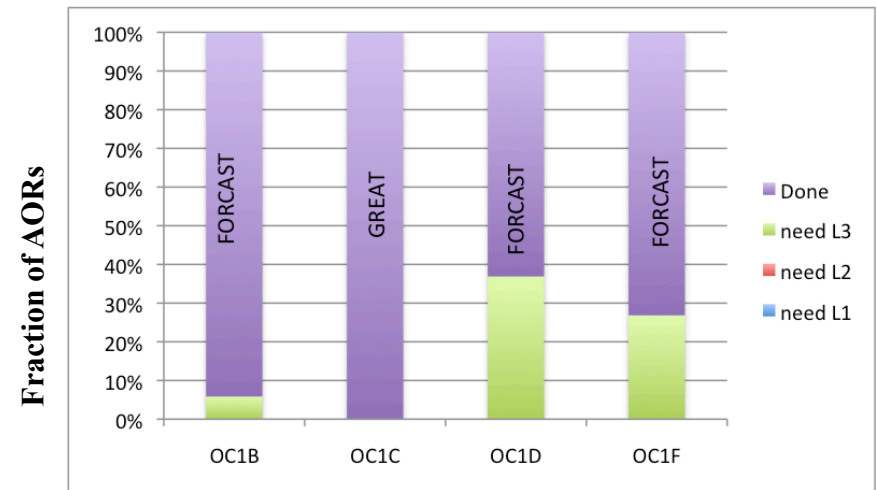
- Completed all Level 2 processing for OC2.
- Completed all Level 3 processing for OC2 *imaging*.
 - Accuracy of <5% for both FORCAST and FLITECAM
- Development team won Ames Honor Award
- Lost Miguel Charcos-Llorens, pipeline scientist/engineer (currently seeking replacement).
- Presented 3 poster papers at ADASS 24 (Calgary)
- Completed FORCAST “browse quality” calibration procedure (see Vacca’s talk)

Data processing team has produced 220 GB L2/3 data (>56000 files) for OC1 and 2.

Processing Status: OC1



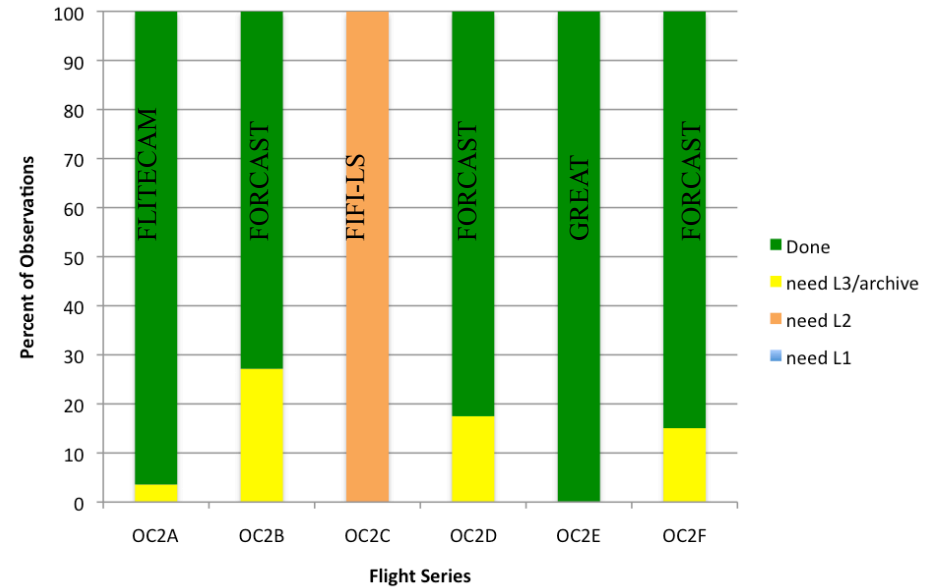
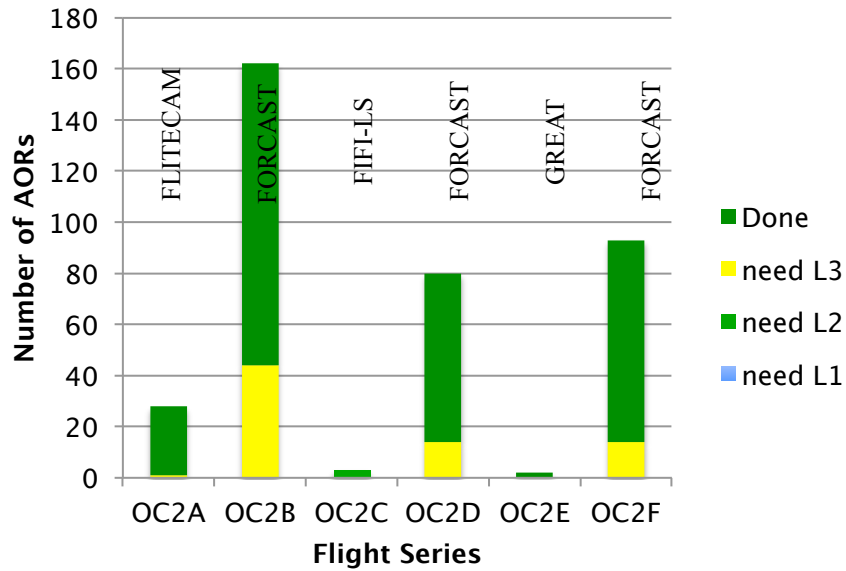
Flight Series



Flight Series

Remaining L3 products for FORCAST Grism Mode.

Processing Status: OC2



Remaining L3 products for FORCAST Grism Mode.

FORCAST Grism Flux Calibration

- Support for telluric correction and flux calibration added to FSpextool for FORCAST, with 'Flux Calibrate' step added to the Redux interface.
 - *OC1 and G2xG1 response curves in work.*
- Verification: Tested on all observations of alpha Boo in OC2 – verified against model of alpha Boo.
- Release of FORCAST–Redux pipeline complete
- Readiness Review passed on Oct 17.
- OC2 processing to start immediately with OC1 processing to follow ASAP.
- Expect FORCAST Grism Level 3 data to be available to GIs (via DCS archive) by end of October.

Top 4 Data Processing Issues

1. QA is time-consuming...

- ...but trend is positive – OC2 D/F QA was very quick.
- *See Backup Slides for QA process details*

2. SI Configuration Changes

- Changes in SI often cause changes to pipelines which require formal test and release according to NASA software management plan; can impact processing schedule.
- *Mitigated by new “beta release” procedure.*

3. Processing staff (~6 FTE) matrixed into other observatory activities (e.g. flight ops).

- Short Term: Sometimes conflicts with processing schedule/ deadlines.
- Long Term: Benefits pipeline operations due to increased familiarity with SI data and observing modes/strategies.

4. FIFI-LS pipeline and calibration procedure still in-work

- *Will likely need to process initial FIFI-LS flight series manually.*

WCS Issues

- FORCAST
 - Investigation of OC2 observations is on-going (F167 and F178).
 - C2NC2 and NMC observations have large WCS discrepancies, apparently related to nodding. After correction, WCS much more accurate.
 - FORCAST control software will need update to correctly account for nodding (and other minor discrepancies).
- FLITECAM
 - WCS solution in headers appears accurate to $\sim 0.7''$ at ref pixel; $\sim 3''$ at field edge (due to coma and distortion).

Development for FY2015

Pipelines:

- FORCAST:
 - OC1 grism response curves (IN WORK)
 - New wavecals for G4 (need on-sky observations)
- FLITECAM:
 - Complete IT&V with automated system (IN WORK).
- FIFI-LS:
 - Testing/bug-fixes with commissioning data (IN WORK)
 - Algorithm updates
 - IT&V with Processing System
- EXES:
 - IT&V with Processing System
 - New observing modes (TBC)

New capabilities:

- Metadata/reporting subsystem (requirements/prototyping IN-WORK)
- Additional Re-processing Functionality (IN-WORK)

SPR maintenance/upgrades: on-going.

Backup Slides

Quality Assurance Activities

Level 1:

- Validate header keyword values against observing log
- Spot check data (based on observing logs) for anomalies
- All discrepancies/changes tracked in JIRA
- Update headers and submit to DCS archive (scripts, DCS tools)
- Updated files are stored as new “revision” in DCS; only *latest* revision is displayed in DCS archive.

Level 2:

- Inspect L2 products for issues outlined in Pipeline Users Manual (for all datasets, including commissioning/GTO) and assess overall data quality.
- Document discrepancies/issues and recommend fix for re-processing in QA log sheets.
- Update DATAQUAL keyword for all products.
- Submit to DCS for final storage/archiving.

Flux Calibration for FORCAST and FLITECAM Imaging

- Commissioned SI calibration plans are under change control.
- For OC2, a new plan for FORCAST was approved: one calibrator will be observed per flight (all filters)
 - *Effect on calibration accuracy still TBD.*
- For imaging, fluxes and wavelengths have been derived for each standard star for each filter using a comprehensive model of the instrument throughput and atmospheric transmission
- Corrections for differences in airmass, altitude, and pwv, between targets and standards have been derived from ATRAN models for each passband and incorporated into the calibration software
- Calibration parameters applied to Level 2 data to produce Level 3 products; calibration params also stored in archive for reference.
- All standards obtained in-flight are used for calibration.

Standard Star Selection

- For FORCAST, standard stars chosen from list of Herschel standards for which good models covering the FORCAST bandpass are available:
 - α Boo, α Cet, α CMa, α Tau, β And, β UMi, γ Dra, σ Lib
 - Asteroids (especially important for calibrating filter “blue leaks”)
- For FLITECAM, imaging standard stars chosen from Cohen et al. (2003) list of “Supertemplate” stars (~ 22 K–M giants with $K \sim 5\text{--}8$); grism standards are A0V’s, as used for ground–based NIR spectroscopy