Data Processing Status

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SOFIA Users Group Meeting
Nov. 2015

Improvements to existing pipelines

- EXES
  - non-linearity correction
- FLITECAM
  - bad pixel identification
  - star masking in flat and sky generation
  - Incorporate calibration procedure
- FORCAST
  - wavelength calibration for XG063 mode
  - 2-D rectification of grism data
  - slit response function for long-slit grism data
  - improved grism response functions
  - Incorporate calibration procedure
- FIFI-LS
  - Vers 1.0.0 of pipeline about to be released; used extensively on OC3-K flights for quick-look reduction and analysis
- GREAT
  - Now store L3 CLASS and FITS files plus auxiliary files in tar format
- HAWC
  - Received alpha-version of pipeline and initial drafts of manuals from SI team

Redux Interface for FIFI-LS Pipeline

25 spatial pixels (spaxels)

16 spectral pixels

FIFI-LS Pipeline example: GC @ 145 microns

FORCAST Observations of the CNR
(Lau et al. 2013)

SOFIA/FORCAST
(20, 32, 37 µm)

CNR

1 pc

1a
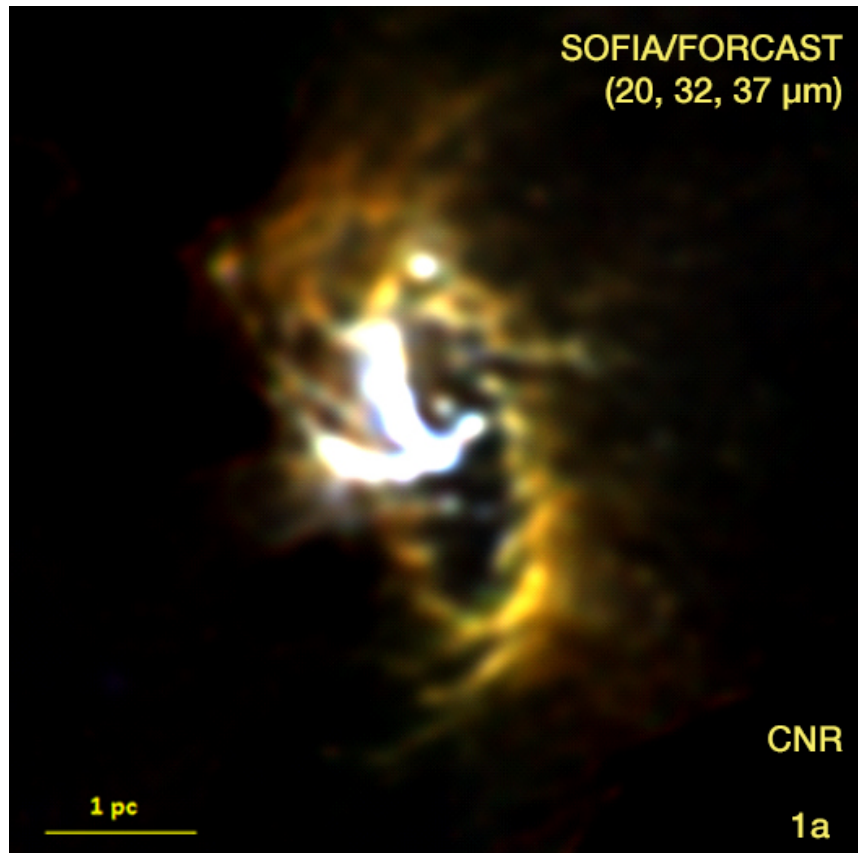
Proprietary data redacted

© FIFI-LS Team, unpublished data

FIFI–LS Pipeline example: Mars spectrum

Program 03_0151 (Blake)

Proprietary data redacted…
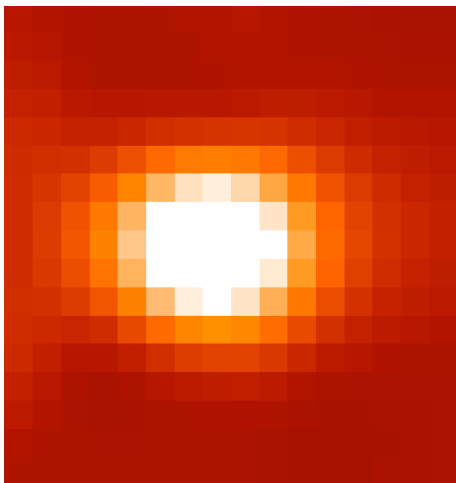
SOFIA Pipeline Products

Defined in the Data Processing Plan for SOFIA SIs :

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

Level 2: corrected for instrumental artifacts (e.g. dark current, bad pixels, etc…)

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

Level 4: high-order products possibly combining multiple observations

(e.g. mosaics, spectral cubes)

FSI Data Processing Flow

FSI Data Processing Status (OC3)

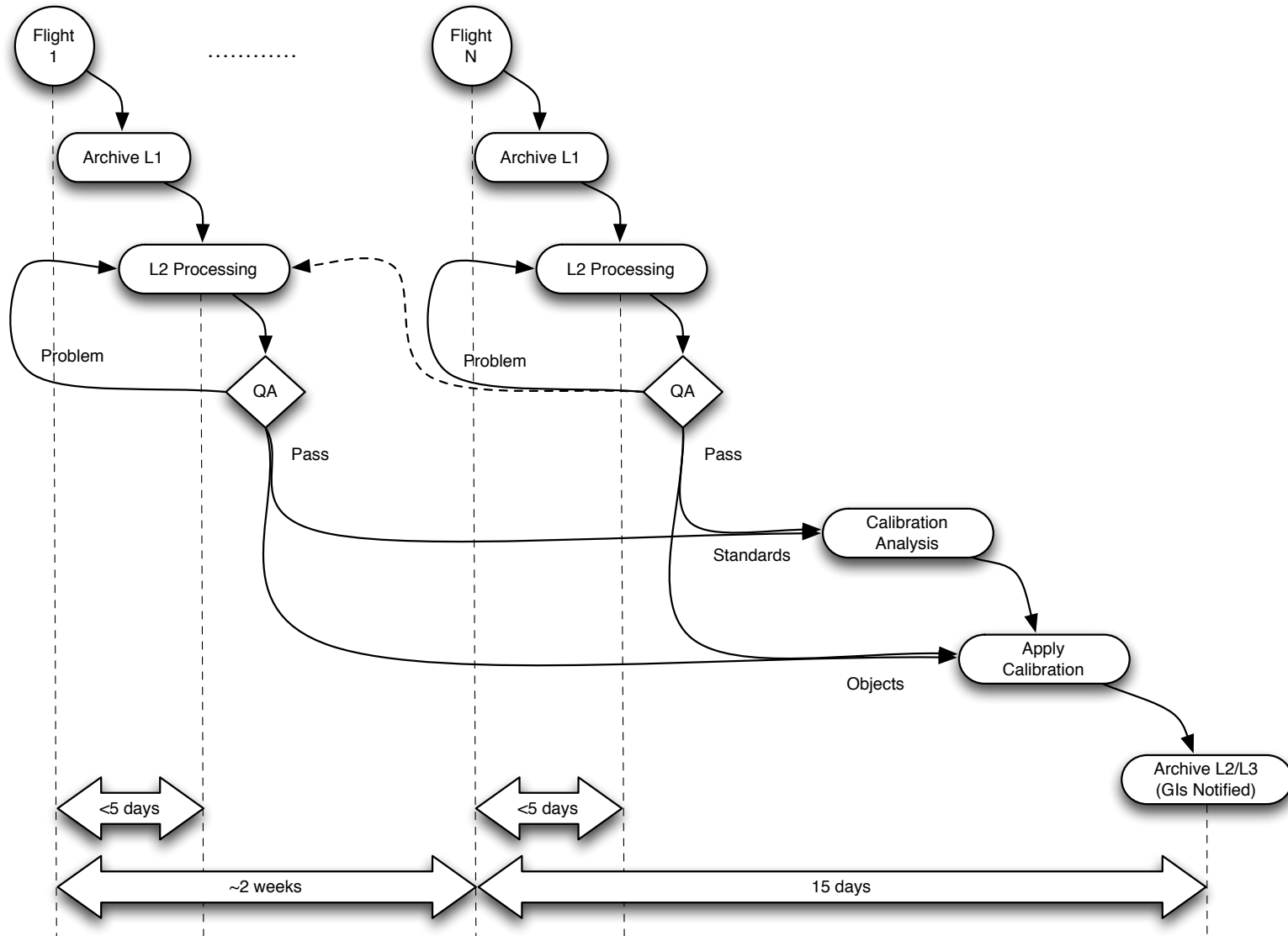| Series	Series Complete	L2/L3 Archiving (PLANNED)	L2/L3 Archiving (ACTUAL)	Notes
OC3C FORCAST	6–5–2015 6–14–2015*	6–26–2015 7–6–2015*	Grism: 6–15 Imaging: 6–25	No grism observations on ferry flight.
OC3D FORCAST/NZ	7–8–2015**	7–29–2015	Grism: 7–22 Imaging: 7–28	
OC3E FLITECAM/NZ	6–30–2015	L2: 9–7–2015	L2: 9–9–2015	Delayed due to header problems; No pipeline for transit/occultation mode; no flux cal (L3) data
OC3I FORCAST	9–22–2015	10–13–2015	10–19–2015	**L2/L3 data ready on Oct 8**; delay due to drive failure on storage array.
OC3J FLITECAM	10–6–2015	10–26–2015	L2: 10–28–2015 L3: 11–30–2015	Instrument software problems and scrubbed flight prevented acquisition of suitable photometric calibration data
OC3L FORCAST	11–20–2015 (ETC)	12–14–2015 (ETC)	TBD	Currently on-track.

* F217 (Ferry to NZ) was included in OC3C.

** OC3D was divided into two parts: before and after OC3E.

- Nearly all FSI observations have produced "NOMINAL" or "USABLE" L2/L3 data products.
- A small fraction have needed manual processing
- Very small number of observations have failed (usually, object not on slit)
- FORCAST photometric calibration good to ~5–10%

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PSI Data Archiving Status (OC3)

Series	Series Complete	L1 Archiving Complete	L2/L3 Archiving Complete	Notes
OC3A EXES	3-5-2015	3-5-2015	9-16-2015	Re-reduced by SI team after determination of new non-linearity corrections by DPS
OC3B FIFI-LS	3-27-2015	3-30-2015	L2: 12-30-2015 L3: 03-2016	L3: Flux calibration procedure in development
OC3G GREAT	7-21-2015	7-22-2015	10-22-2015	
OC3H EXES	9-5-2015	9-11-2015	10-21-2015	
OC3K FIFI-LS	10-29-2015	25% ETC: 12-2015	L2: 12-30-2015 L3: 03-2016	L1: Header fixes in-work. L3: Flux calibration procedure in development

Pipeline and Processing Issues/Improvements

1. **FIFI-LS:**
   - Pipeline still in development; Vers 1.0.0 will be released 19 Nov. 2015
   - Level 1 FITS headers are incomplete
   - No WCS yet
   - Need better flat fields
   - Calibration and telluric correction procedure not yet fully defined
2. **FORCAST:**
   - Level 1 FITS headers need corrections
   - WCS for C2NC2 still problematic
   - New bad pixel mask and bad pixel handling
   - Improve grism response curves
3. **FLITECAM:**
   - Level 1 FITS headers incorrect and incomplete
   - No flatfields for < 2 μm for imaging or grisms
   - Low QE region difficult to correct; for on-slit nodding, A and B beams processed and stored separately.
   - No wavelength solution for narrow slit; not yet needed
   - Manual telluric correction/flux calibration required for grisms
4. **EXES:**
   - Improve the automatic order merging algorithm

DPS Staff

- Scientists:
  - **W. Vacca** – DPS Lead, pipeline development, calibration scientist for FORCAST, FLITECAM, FIFI-LS
  - **R. Shuping** (SSI) – 80%, Ops lead
  - **J. Radomski** – QA scientist for FORCAST
  - **S. Shenoy** – QA scientist for FORCAST, FLITECAM
  - **E. Chambers** – 50%, GREAT
  - **R. Hamilton** – 10%, FLITECAM
  - New hire, primarily for processing/QA of FIFI-LS data

- Software Engineers:
  - **M. Clarke** – Redux (pipeline interface), develops/maintains all 'in-house' pipelines, header checker, QA tools, testing, documentation
  - **J. Holt** – FIFI-LS development, left Oct. 1; new hire to replace her
  - **R. Krzaczek** (RIT) – 50%, pipeline infrastructure
  - **E. Omelian** (NASA) – testing, documentation, guiding us through NASA hoops

- IT:
  - **D. Sandel** – DPS machine maintenance; pipeline operations

Summary

- DPS team maintains and continues to make improvements to FORCAST, FLITECAM, and EXES pipelines

- DPS team has successfully developed a pipeline (L2) for FIFI-LS, and has taken delivery of an initial version of the pipeline for HAWC+

- Data processing of FIFI-LS data will begin shortly

- To date, DPS team has been able to meet scheduled deadlines for reductions of all FORCAST

- Header issues and instrument problems have delayed processing of FLITECAM data

- FORCAST calibration appears to be good to ~5-10%

- We are in the process of hiring one new scientist (for FIFI-LS pipeline QA) and one new software engineer