



SOFIA Proposals and Tools

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On behalf of B.-G. Andersson and Science
Operation Team

SOFIA Science Center, October 4, 2010



Early Science and Observatory commissioning



Early Science flights occur while some onboard mission systems are still in development and instruments are still commissioning.

- ◆ *a shared-risk activity*
- ◆ *the science community gains earlier access to SOFIA*
- ◆ *early tests of SOFIA science capability*

Early science

♪ **Short Science - White papers, 2008**

- Galactic Center with FORCAST: M. Morris
- High mass star-forming regions with FORCAST: P. Harvey
- Chemistry of warm interstellar gas with GREAT: D. Neufeld

♪ **Basic Science - Proposal call, July, 2010**

Observatory commissioning

Instruments will be commissioned during 2012



TWO EARLY SCIENCE INSTRUMENTS

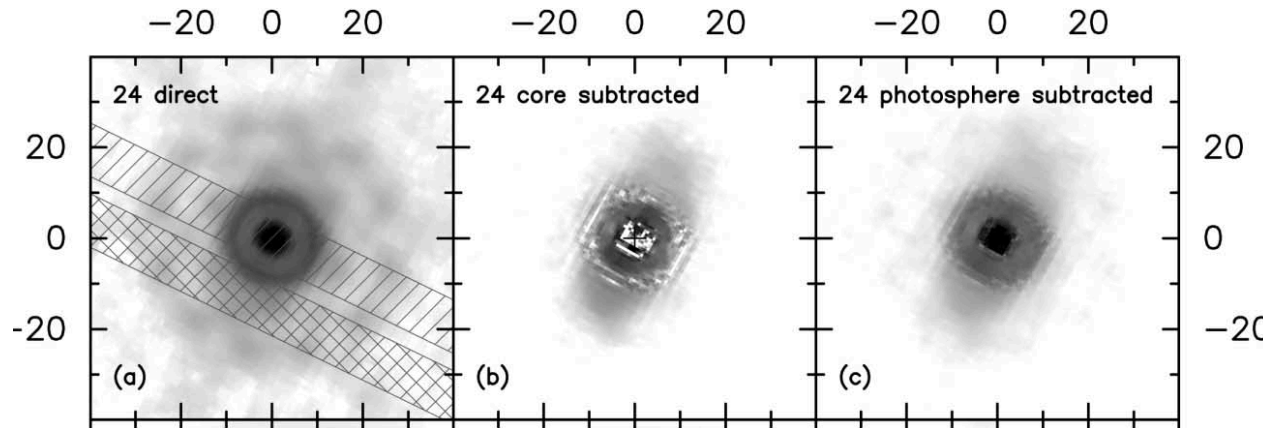


SOFIA Stratospheric Observatory for Infrared Astronomy

SOFIA

FORCAST (Faint Object InfraRed Camera for the SOFIA Telescope)

- Facility instrument
- Mid IR, two-channel camera for simultaneous imaging
- Sets of filters in 4-8 μm , 16-40 μm regimes
- 3.2x3.2 arcmin field-of-view
- ~2-3 arcsec angular resolution (0.75"/pixel)



Spitzer MIPS 24 μm
Fomalhaut
(Stapelfeldt et al.)

Searching for Disks and Exoplanets:

- FORCAST can resolve a factor of 2-3 better.
- Central star: less saturated
- Broad SED from 4 to 40 μm for different parts of disks



TWO EARLY SCIENCE INSTRUMENTS



GREAT

German Receiver for Astronomy at Terahertz frequencies

- Principal Investigator instrument
- Heterodyne spectrometer
- Dual-channel, 3 frequency windows
 - ♦ L1 200-240 μ m (1.25-1.5 THz) ♦ L2 156-167 μ m (1.8–1.92 THz)
 - ♦ M 111-125 μ m (2.4-2.7 THz) in development
 - ♦ H 63.8 μ m (4.7 THz) → future
- HD: probing molecular hydrogen in disks
- Astro-chemistry in disks and exoplanets:
Proto-planetary disk
- Chlorine and molecule (OH, CO) chemistry in planets



Basic Science Proposal Call



SOFIA Stratospheric Observatory for Infrared Astronomy

SOFIA

- ◆ Proposal due was July 30, 2010
- ◆ 75 hours of flight time
- ◆ FORCAST and GREAT
- ◆ Observing period: Mar 1- Aug 31, 2011
- ◆ Observations selected through open peer review process: Instrument PI will be assigned as co-PI of selected programs
- ◆ Proposal statistics
 - Oversubscription: 3.4
 - Number of proposals: 59
- ◆ Results will be announced soon: Nov 2010

- **Timeline**

FORCAST short science: Nov-Dec 2010

GREAT Short science: Feb-April 2011



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Basic Science Proposing Basics



- Proposals shall be generated/submitted using the SOFIA Proposal Tool (SPT)
 - ◆ *Similar to, and based on, the STScI APT*
- Exposure time calculator available for FORCAST (SITE)
- Exposure time tutorial available for GREAT
- Transmission calculator (ATRAN)
- Visibility tool available on-line
 - ◆ *No flight plans required/expected*
- Lists of Reserved Observations for FORCAST and GREAT were published.



Early Science, tools (I)



Archival Searches

- ◆ *Search process similar to other archives.*
Searches can target:
 - Project ID or observer name
 - Target name or coordinates
 - Instrument, wavelength, or observation mode
 - Observations date
 - A combination of parameters.
- ◆ *Summary data are returned for matching data products, with enough detail to determine what datasets are relevant to a project.*
- ◆ *Science Archive located at SSC (Ames)*

SOFIA DCS: Archive Search

http://plerion.sofia.usra.edu//dataRetrieval/searchArchive

Admin Astro Ames Daily SOFIA Recreation DCS Portals Research Media Torrents

SOFIA
Data Cycle System

RETRIEVE ARCHIVE
OBSERVE
PROPOSE PLAN

Username Password Sign In

Data Retrieval

Archive Search

Message: No matching records

Instrument: ALL

All Records With Time Constraints

From: 1 / 1 / 1998
Month Day Year

To: 12 / 31 / 2030
Month Day Year

Object: (%=wildcard)

Observer: (%=wildcard)

Wavelength Range (mic.): -

RA (dec deg): 83.82246

Dec (dec deg): -5.39072

Search Radius (arcsec): 900

• DCS Site Map
• DCS Help Resources
• SOFIA Public Site

NASA DLR USRA



Early Science, tools (II)



SOFIA Proposal Tool

– Developed from the HST APT

– Form Driven

- Interactive syntax and content checker
- Proposal Summary form (title, abstract, etc.)
- Proposer information
- Instrument and mode selection
- Exposure time and scheduling requests

– Science Justification attached via .pdf files

– Pre-submission review through returned .pdf

– Submission acknowledgement and update capability



Early Science, tools (III)



- Exposure Time Calculators
 - SOFIA Instrument Time Estimator (SITE)
- Integrated tool for all SOFIA instruments
 - New instruments & modes added as needed
- Accounts for Observing conditions
 - Telescope Elevation
 - $\tau(\text{H}_2\text{O})$

The screenshot shows the SOFIA Instrument Time Estimator (SITE) web application. The browser title is "SOFIA DCS: Instrument Time Estimator (SITE)" and the URL is "http://plerion.sofia.usra.edu/proposalDevelopment/SITE/index". The page features a navigation menu with items like Admin, Astro, Ames, Daily, SOFIA, Recreation, DCS, Portals, Research, Media, and Torrents. A central banner displays "SOFIA Data Cycle System" with a circular flow diagram containing the steps: RETRIEVE, ARCHIVE, OBSERVE, PLAN, and PROPOSE. Below the banner, there is a "Welcome, rshuping. (View Profile) (Logout)" message and a "Proposal Development" link. The main heading is "Instrument Time Estimator (SITE)" followed by "SOFIA Instrument Time Estimator (SITE)". The instructions state: "In the four sections of this form, select the appropriate instrument, astronomical source, telescope, observing condition constraints and calculation method. Click on the Calculate button to submit the parameters from all the sections to the server. The results are reported in a separate web page that can be resized and printed." The form includes an "Instrument" dropdown menu set to "FORECAST" and a "Calculate" button. Under "Instrument properties", there is a "Filter" section with two dropdown menus set to "8.6 um" and "30.7 um". The "Calculation Method" section has a "Calculation method" dropdown and a note: "Select imaging or spectroscopy and the calculation method (note: second method is not available for spectroscopy)". Two radio buttons are present: "Total S/N ratio resulting from a total time of 900 secs" (selected) and "Total integration time to achieve a S/N ratio of 4". The "Astronomical Source Definition" section has a "Spatial profile and continuum brightness" dropdown set to "Point source (nominal spatial profile) with spatially integrated brightness". It includes input fields for "Spatially integrated brightness for the long wavelength filter" (4.110E-2 Jy), "Surface brightness for the long wavelength filter" (1.250E-1 Jy), and "Surface brightness for the long wavelength filter" (4.479E-3 Jy/sq arcsec). There is also an "Emission line" checkbox and a note: "In addition to the above continuum. The output SNR or observing time will be for the sum of continuum plus line."



Early Science, tools (I)

Get Selected Data

Download	Observation ID	Mission ID	Processing	AOR	Target	RA - Dec (J2000)	Obs Date (UTC)	Start - End (UTC)	Exp. Time (sec)	Instrument	Filters/Gratings	Wavelength (mic.)	Release Date (UTC)
<input type="checkbox"/>	100520_000_00FO001_001	LP01	LEVEL_0	b01LP_0001 Get Data Products View Observation Detail	?	09:00:0.00 - +81:00:0.00	2010-05-20	03:45:18 - 03:45:23	5.111800193786621	FORCAST	UNKNOWN	24.24	2010-05-20 17:49:00
<input type="checkbox"/>	100520_000_00FO001_005	LP01	LEVEL_0	b01LP_0005 Get Data Products View Observation Detail	?	09:00:0.00 - +81:00:0.00	2010-05-20	04:22:08 - 04:22:13	5.229800224304199	FORCAST	UNKNOWN	8.61	2010-05-20 17:49:00
<input type="checkbox"/>	100520_000_00FO002_006	LP01	LEVEL_0	b01LP_0006 Get Data Products View Observation Detail	?	09:00:0.00 - +81:00:0.00	2010-05-20	04:22:45 - 04:22:51	5.229800224304199	FORCAST	UNKNOWN	8.61	2010-05-20 17:49:00

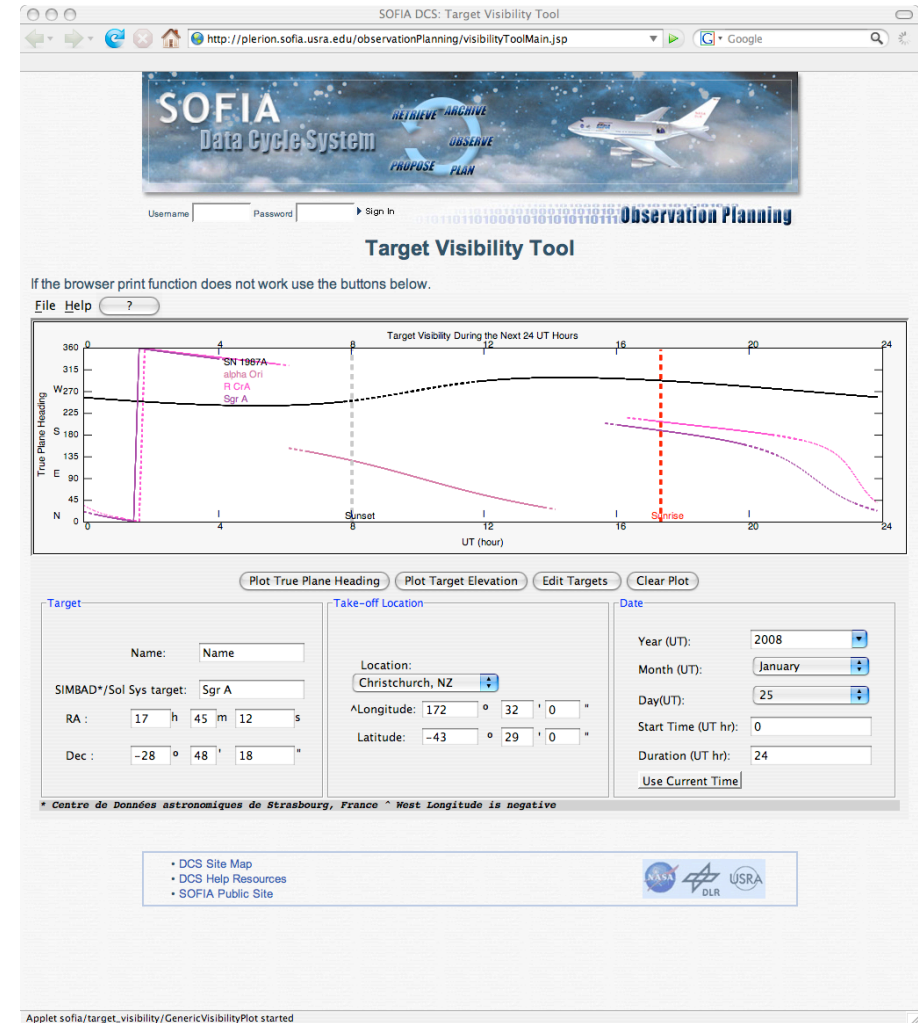
Real SOFIA data



Visibility Tool



- Java based
- *Plots telescope-assembly elevation or aircraft heading*
 - For any given day and take-off location
 - Over a 24 hour period
 - Several default airfields
 - Target selection via SIMBAD supported
 - Can display multiple target simultaneously



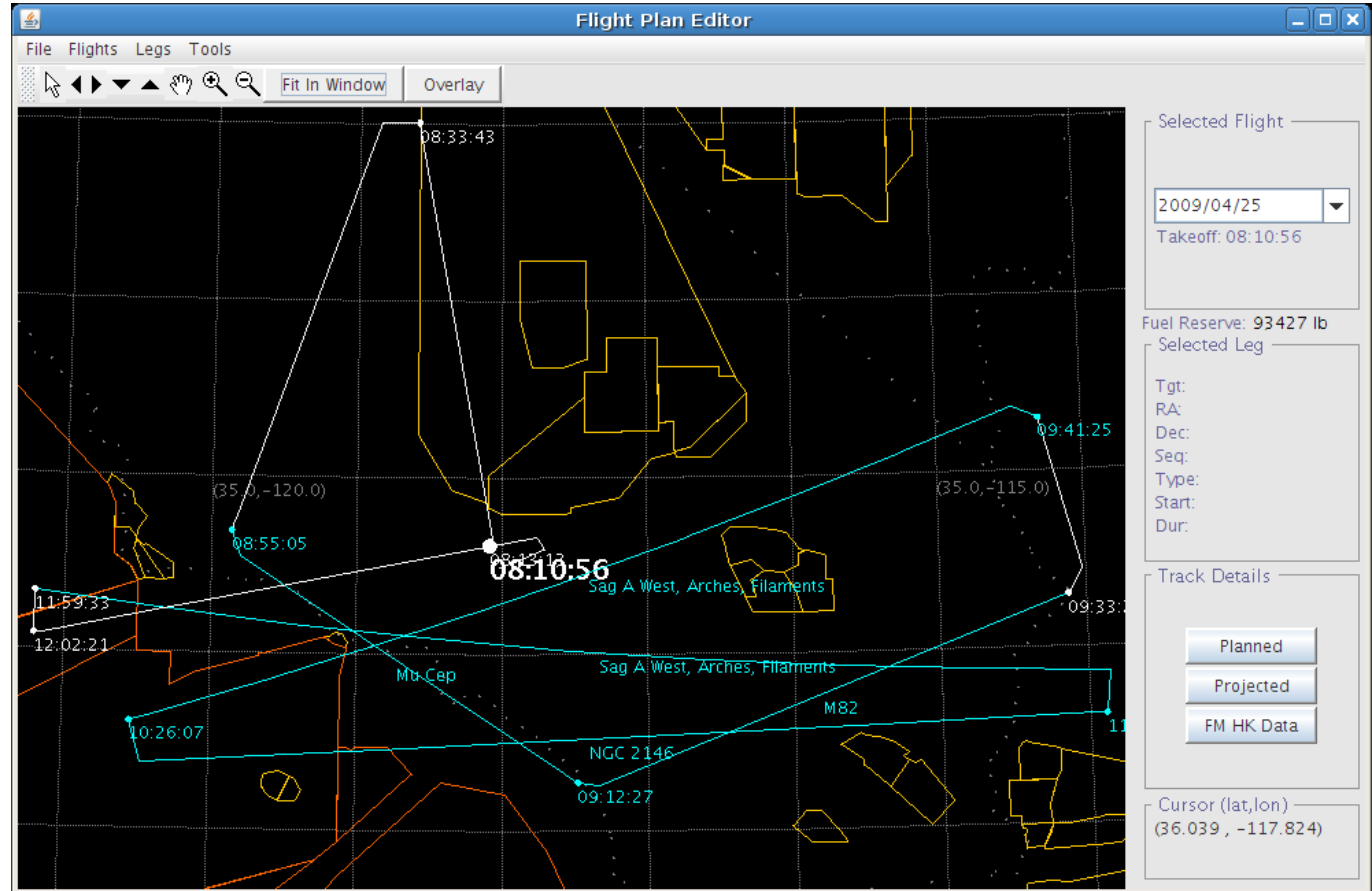


Tools: Flight Planner



- Flight Planner

– Planning Function
(Operation team Tool)





Future Proposal Calls



Next Instrument Proposal Call

- Asilomar meeting

<http://www.sofia.usra.edu/Science/workshops/asilomar.html>

- Announce proposal call: Spring 2011

Next Science Proposal Call

- Fall of 2011
- Data Analysis funding is available for US Investigators
- FORCAST and GREAT: fully commissioned,



Future Planned Tools



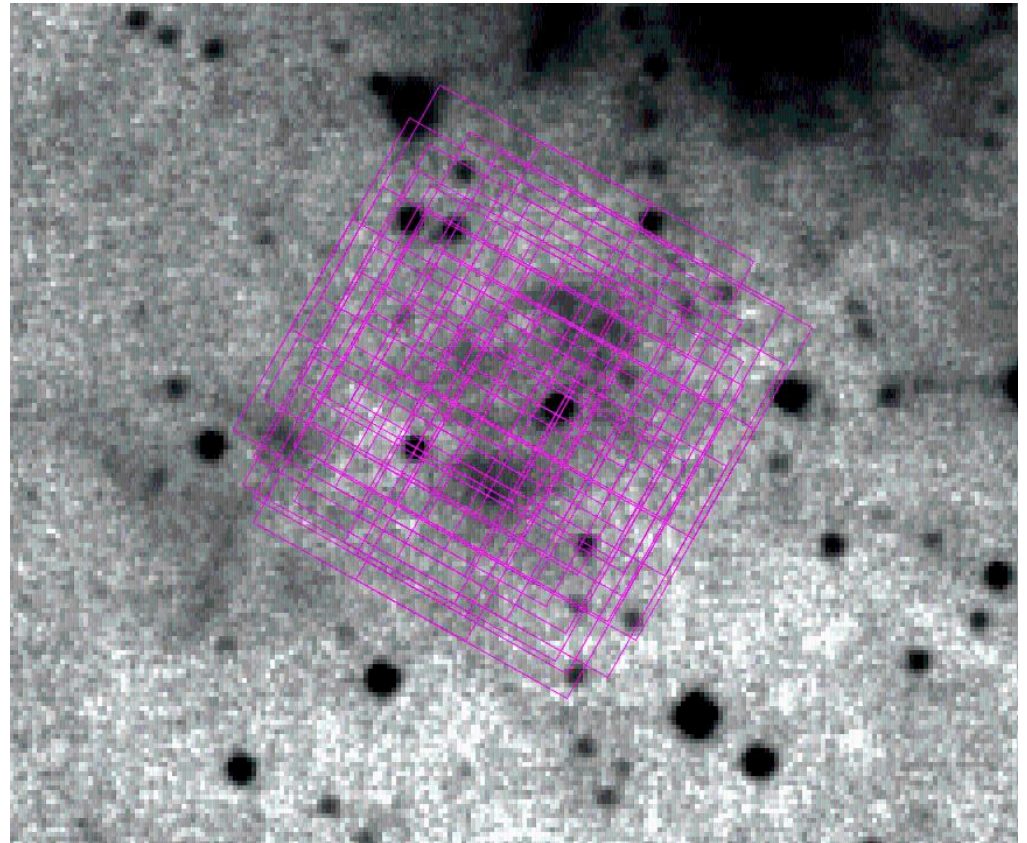
SOFIA Observation Planning Tool *SSpot*

(based on Spitzer SPOT/Herschel SPOT)

- ◆ ***Detailed observing strategy*** : *detailed AOTs including exact mapping strategy, chopping, nodding, slit selection etc.*

- ◆ ***Excellent Visualization Tool***

- Archival sky images (IRAS, MSX, 2MASS, DSS etc)
- Depth of planned observations



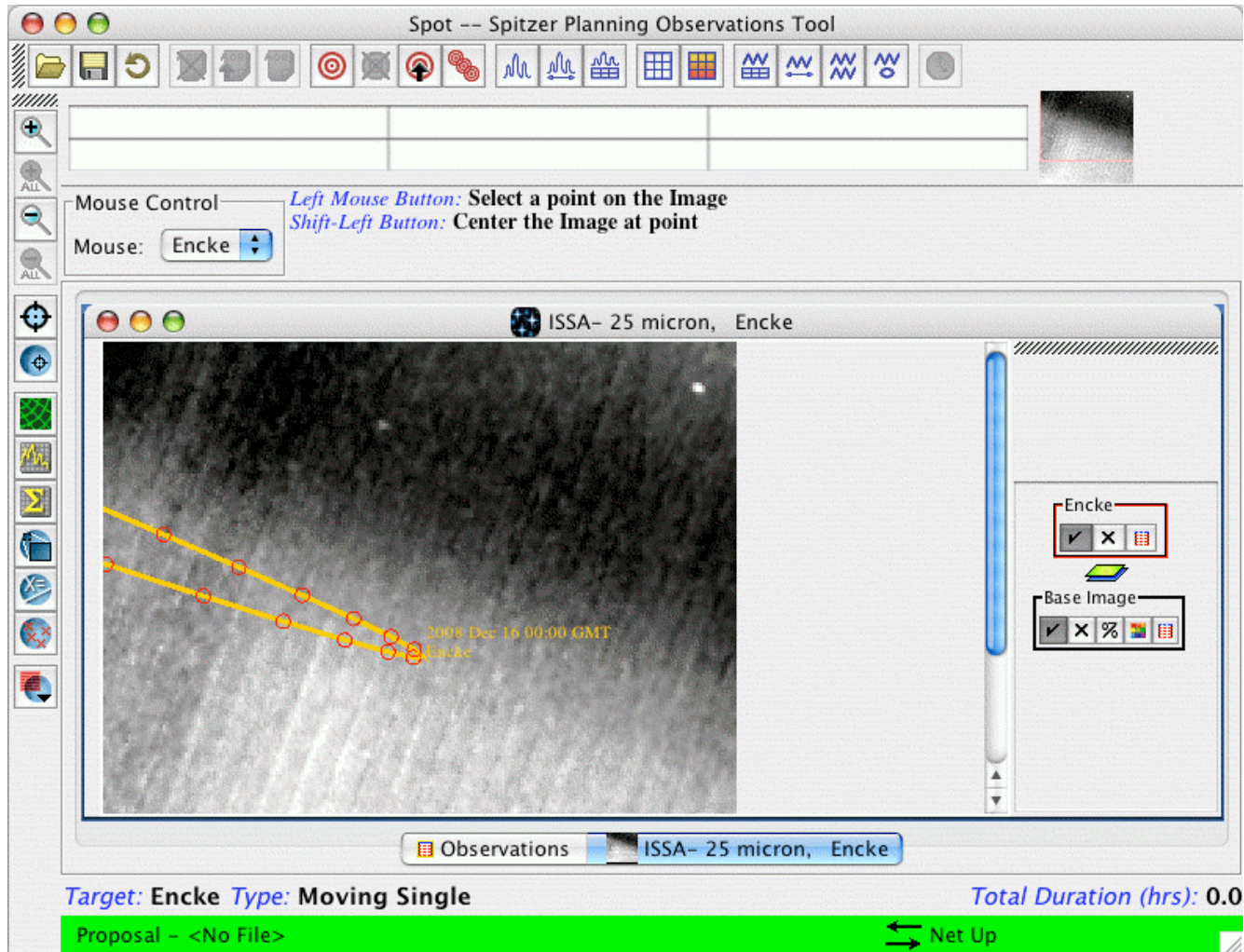


Moving Target Visualization in SSpot



Stratospheric Observatory for Infrared Astronomy

SOFIA



Path of comet Encke with symbols for each time.

Observations will be visualized on background image to determine confusion in primary and chopped field of view.

SOFIA

Stratospheric Observatory for Infrared Astronomy





Early Science, Data Rights and Availability



- Instrument teams will perform data reduction
- Only “Scientifically Valid” data to be archived in reduced form
- Proprietary Period:
 - ◆ *Short Science data - 3 months*
 - ◆ *Basic Science data – 1 year*
- Data available through the SOFIA Archive tool