SOFIA Stratospheric Observatory for Infrared Astronomy

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

SOFIA Stratospheric Observatory for Infrared Astronomy

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 comissioning

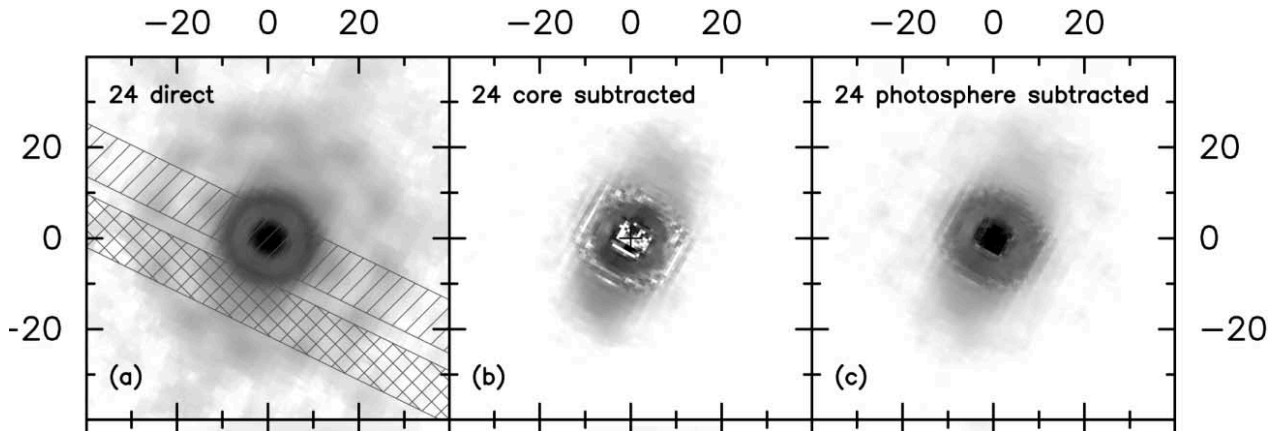
Instruments will be commissioned during 2012

TWO EARLY SCIENCE INSTRUMENTS

SOFIA Stratospheric Observatory for Infrared Astronomy

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

SOFIA Stratospheric Observatory for Infrared Astronomy

GREAT

German Receiver for Astronomy at Terahertz frequencies

- Principal Investigator instrument
- Heterodyne spectrometer
- Dual-channel, 3 frequency windows
  - L1 200-240μm (1.25-1.5 THz) ◆ L2 156-167μm (1.8–1.92 THz)
  - M 111-125μm (2.4-2.7 THz) in development
  - H 63.8μm (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

- 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

SOFIA Stratospheric Observatory for Infrared Astronomy

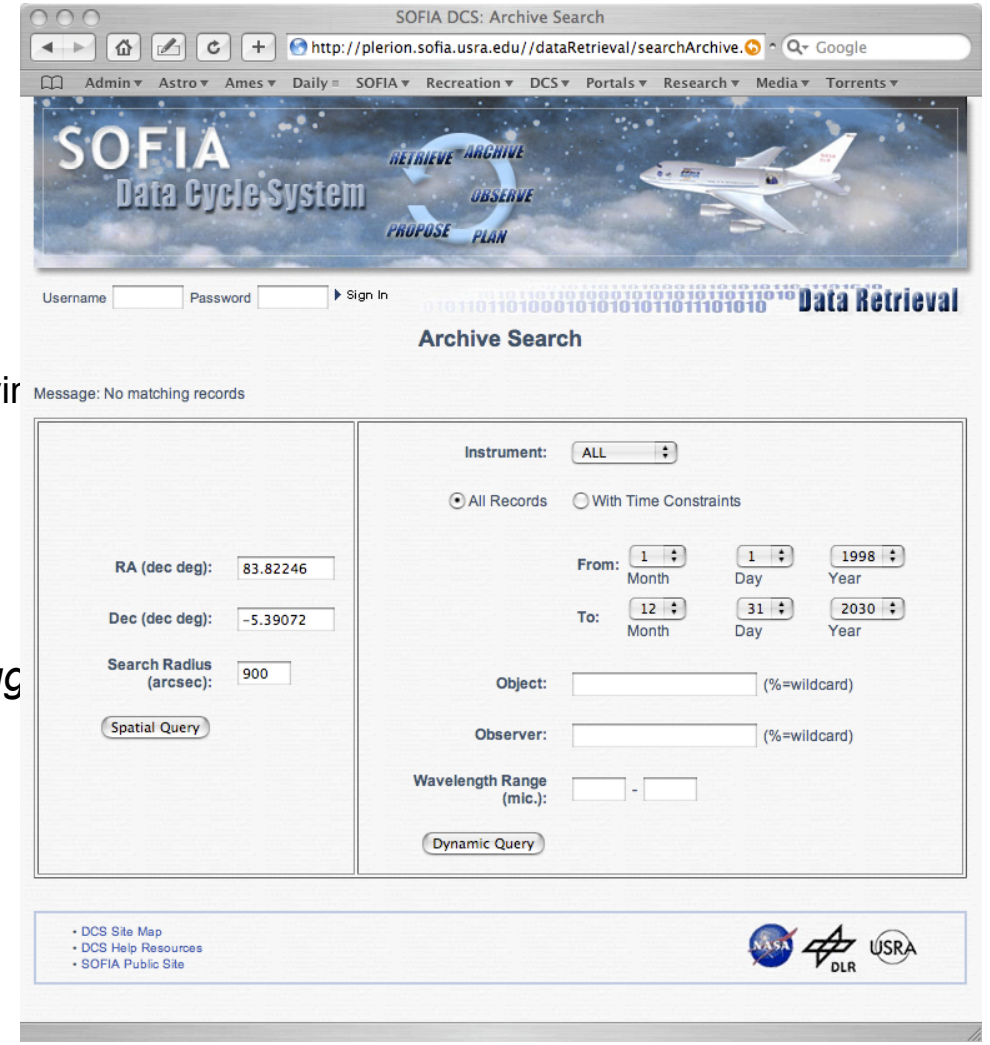
- Proposals shall be generated/submitted using the SOFIA Proposal Tool (SPT)
  - *Similar to, and based on, the STScI APT*
- Exposure time calculator available for FORCAST (SITE)
- Exposure time tutorial available for GREAT
- Transmission calculator (ATRAN)
- Visibility tool available on-line
  - *No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

Early Science, tools (I)

SOFIA Stratospheric Observatory for Infrared Astronomy

Archival Searches

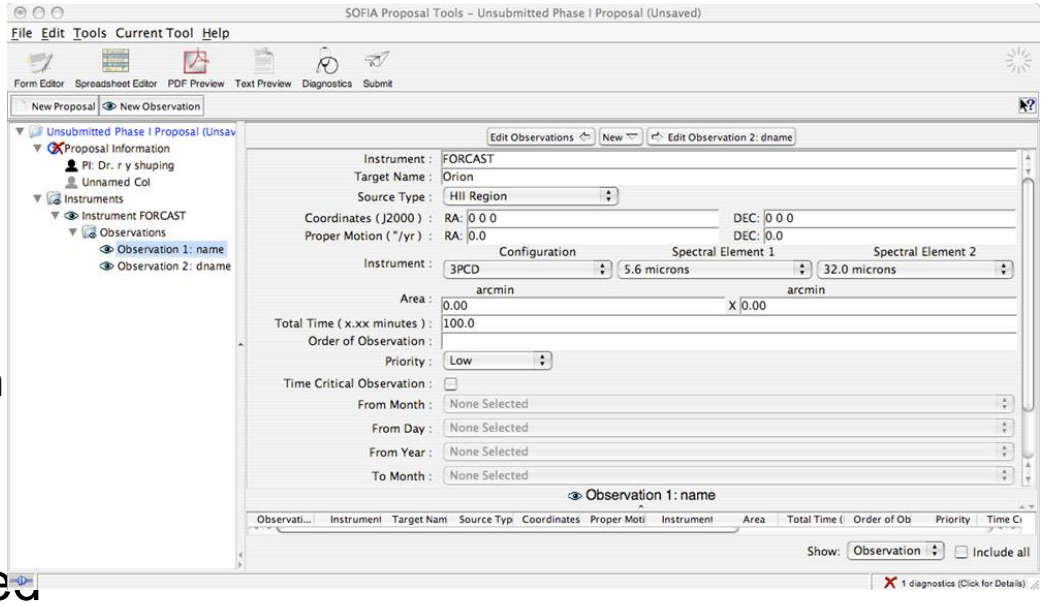
- *Search process similar to other archives.*
  Searches can target:
  - Project ID or observer name
  - Target name or coordinates
  - Instrument, wavelength, or observir mode
  - Observations date
  - A combination of parameters.
- *Summary data are returned for matching data products, with enoug detail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



Early Science, tools (II)

SOFIA Stratospheric Observatory for Infrared Astronomy

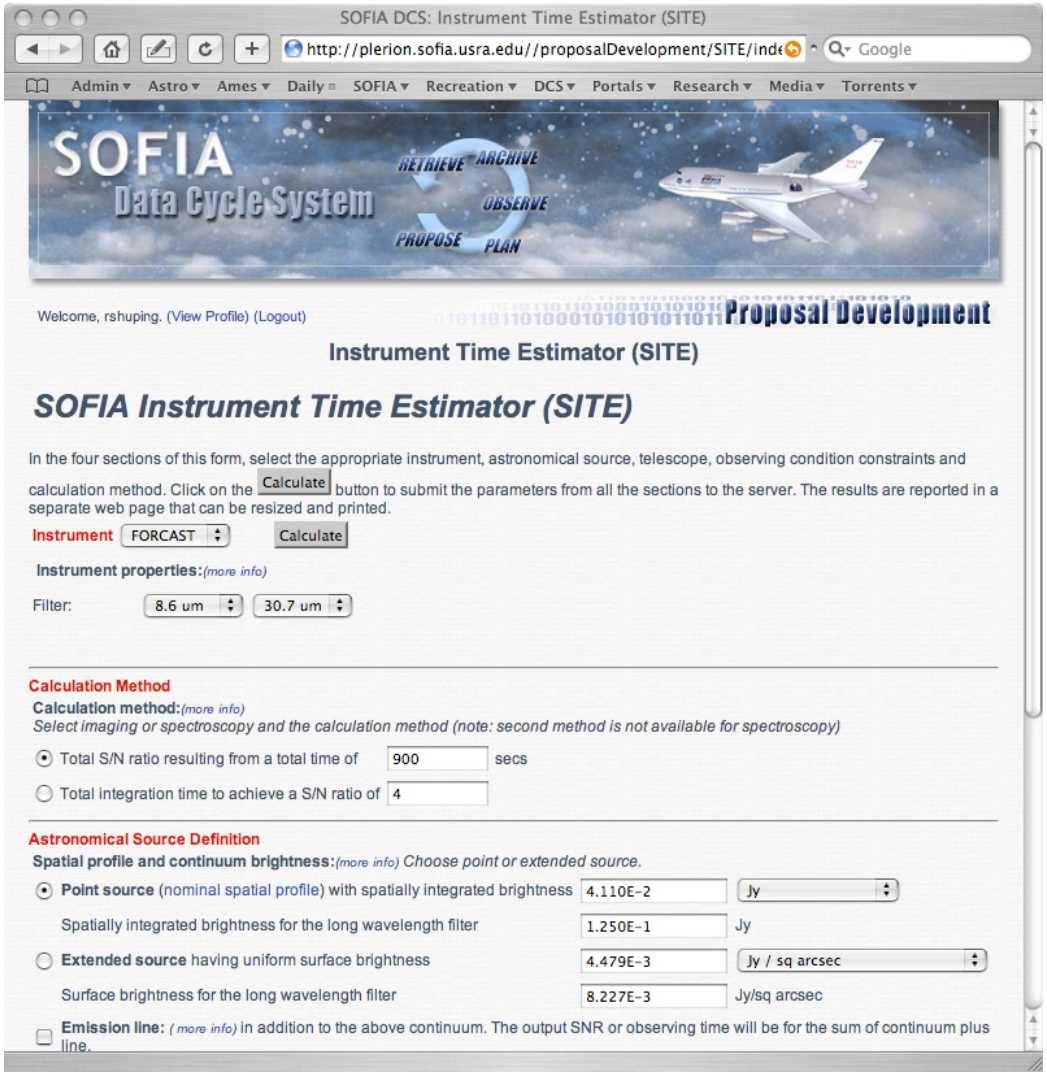
- SOFIA Proposal Tool
  - Developed from the HST APT
  - Form Driven
    - Interactive syntax and content checker
    - Proposal Summary form (title, abstract, etc.)
    - Proposer information
    - Instrument and mode selection
    - Exposure time and scheduling requests
  - Science Justification attached via .pdf files
  - Pre-submission review through returned .pdf
  - Submission acknowledgement and update capability



Early Science, tools (III)

SOFIA Stratospheric Observatory for Infrared Astronomy

- 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
      - $\tau(H_2O)$



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.)	Rele Da (UT
☐	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- 17:49:
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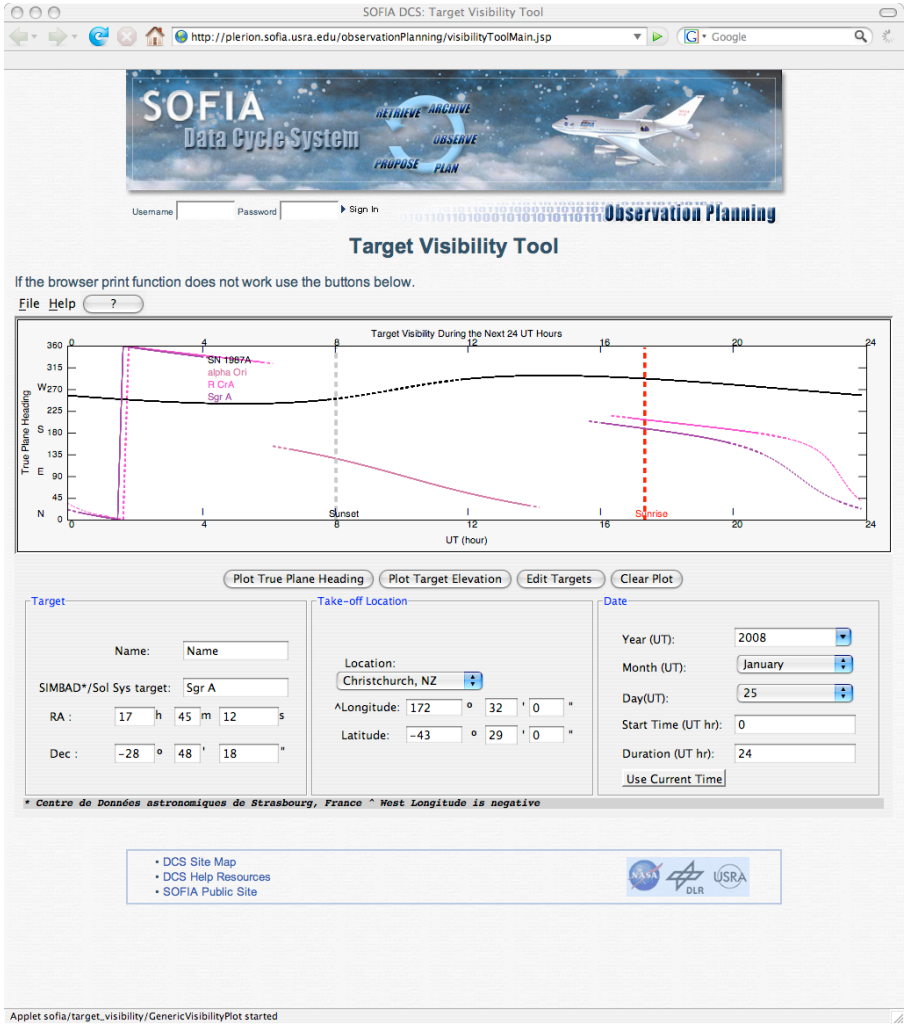
☐	100520_000_00FO002_006	LP01	LEVEL_0	b01LP_0006 Get Data Products View Observation Detail	?	09:00:0.00 - +81:00:0.00	2010-05-20	04:22:45 - 04:22:51	5.229800224304199	FORCAST	UNKNOWN	8.61	2010- 17:49:

Real SOFIA data

Visibility Tool

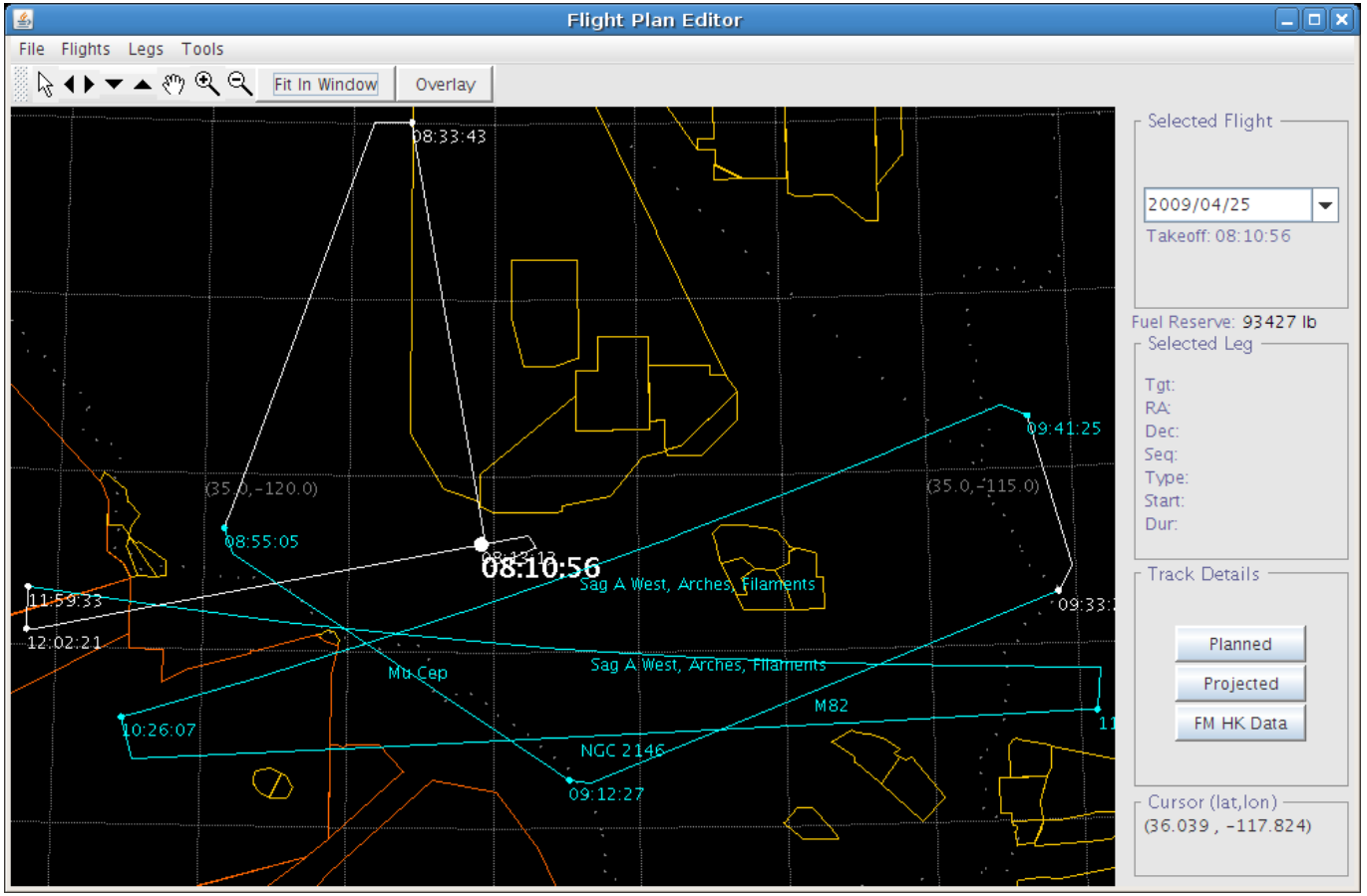
SOFIA Stratospheric Observatory for Infrared Astronomy

- 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 Panner

- Flight Planner
  - Planning Function (Operation team Tool)



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Future Proposal Calls

SOFIA Stratospheric Observatory for Infrared Astronomy

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 Stratospheric Observatory for Infrared Astronomy

SOFIA Observation Planning Tool SSpot

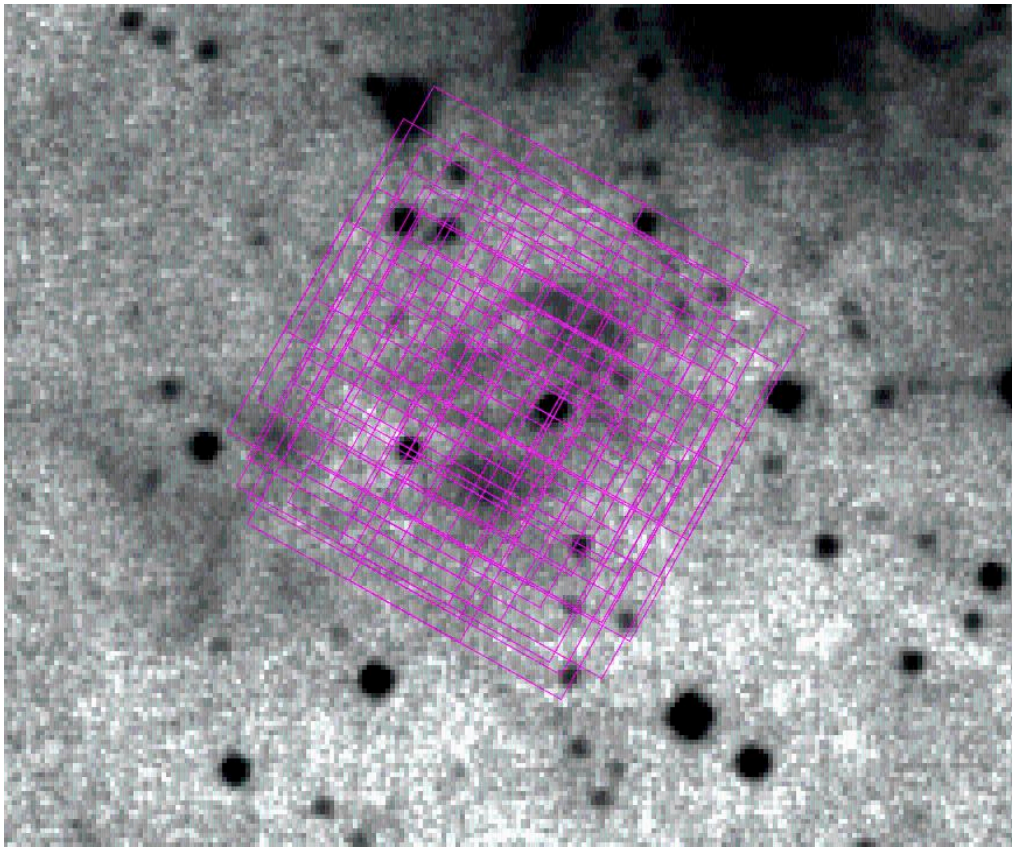
(based on Spitzer SPOT/Herschel SPOT)

- ***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

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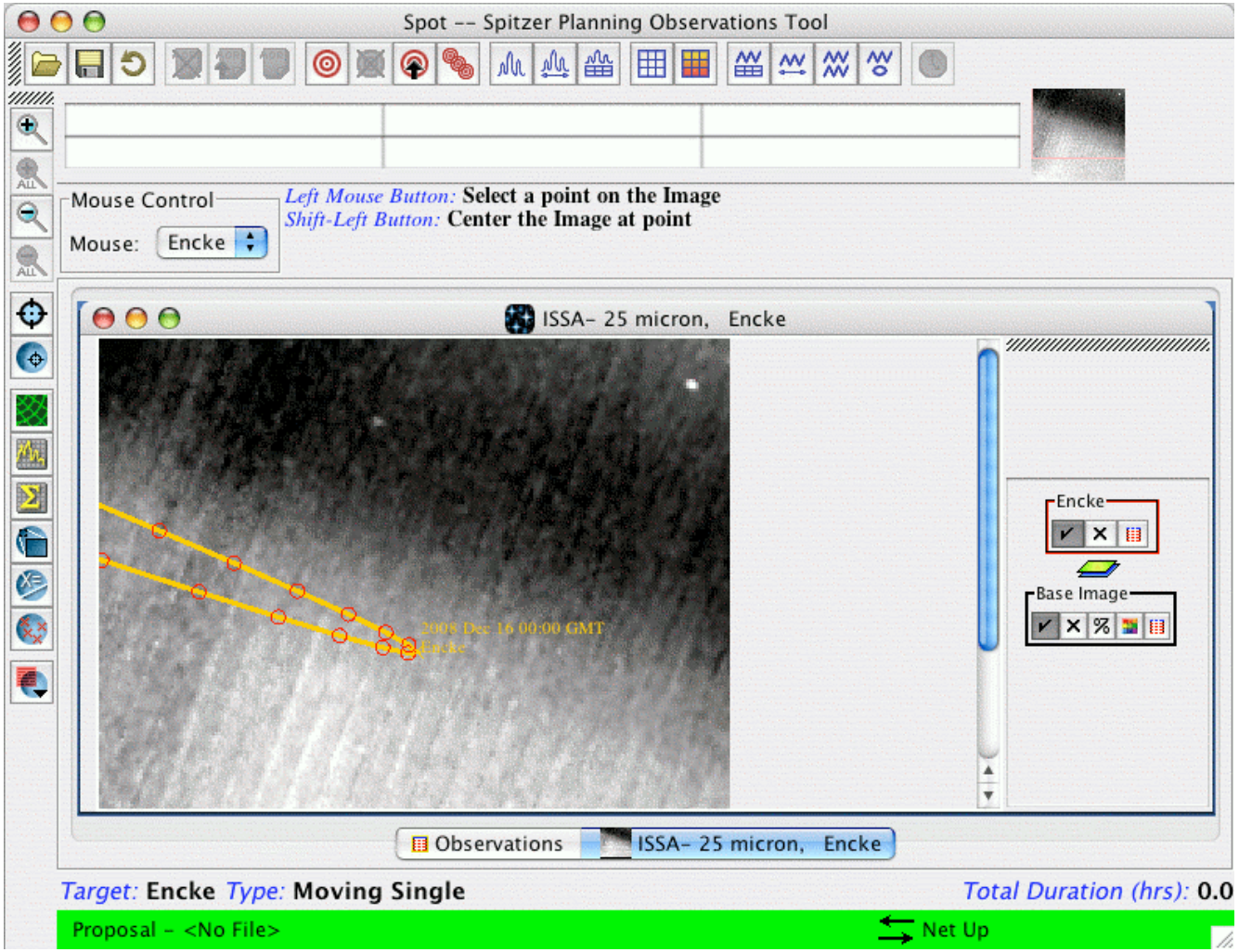

Path of comet Encke with symbols for each time.

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

Early Science, Data Rights and Availability

SOFIA Stratospheric Observatory for Infrared Astronomy

- 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