Software for Proposal Preparation

Ravi Sankrit

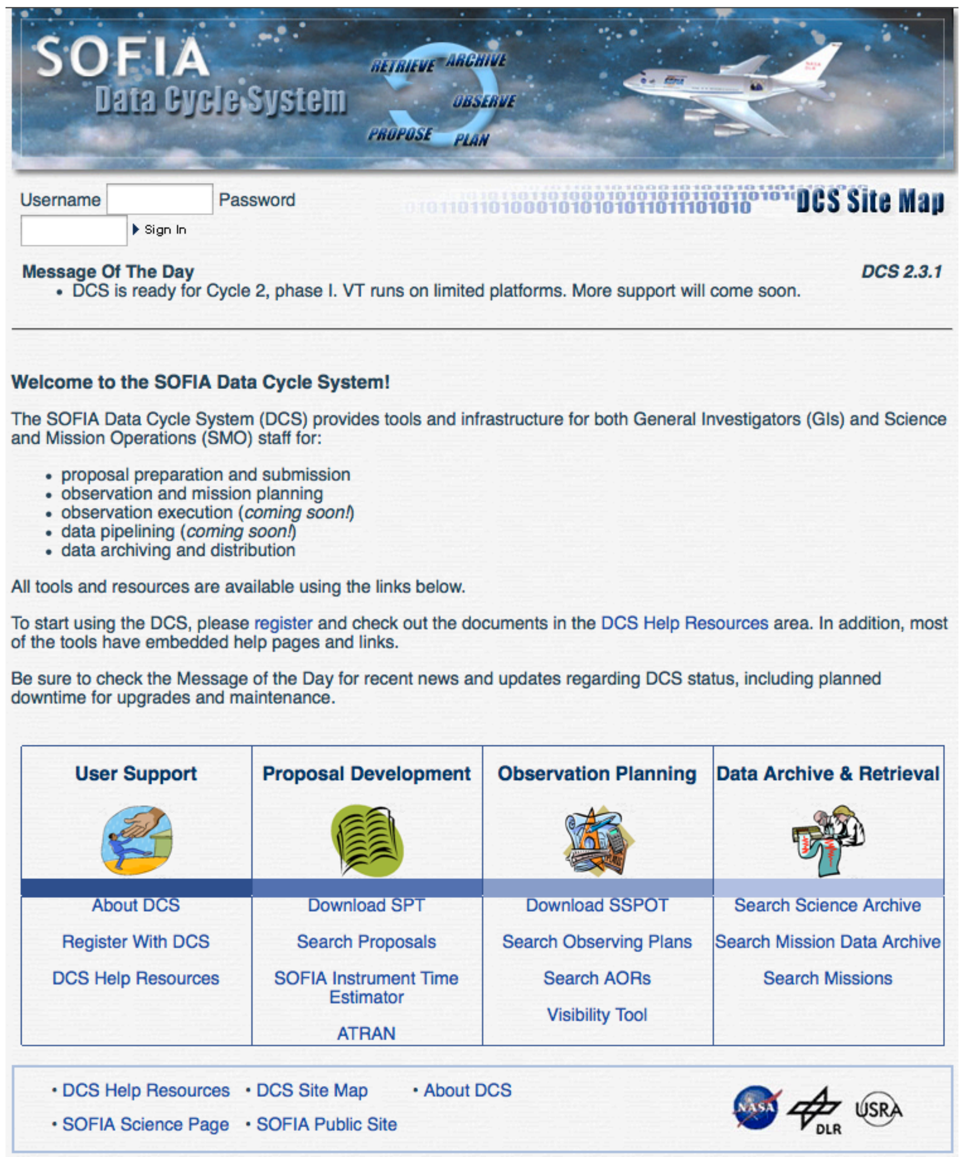
(SOFIA Science Center / USRA)

Data Cycle System & Science Operations

Lan Lin
Li Sun
Bill Vacca

Sean Colgan
Bob Krzaczek
Thomas Lau*
Kaori Nishikida
Robert Perez

Ralph Shuping
Elizabeth Moore



https://dcs.sofia.usra.edu

http://www.sofia.usra.edu/Science

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B-G Andersson
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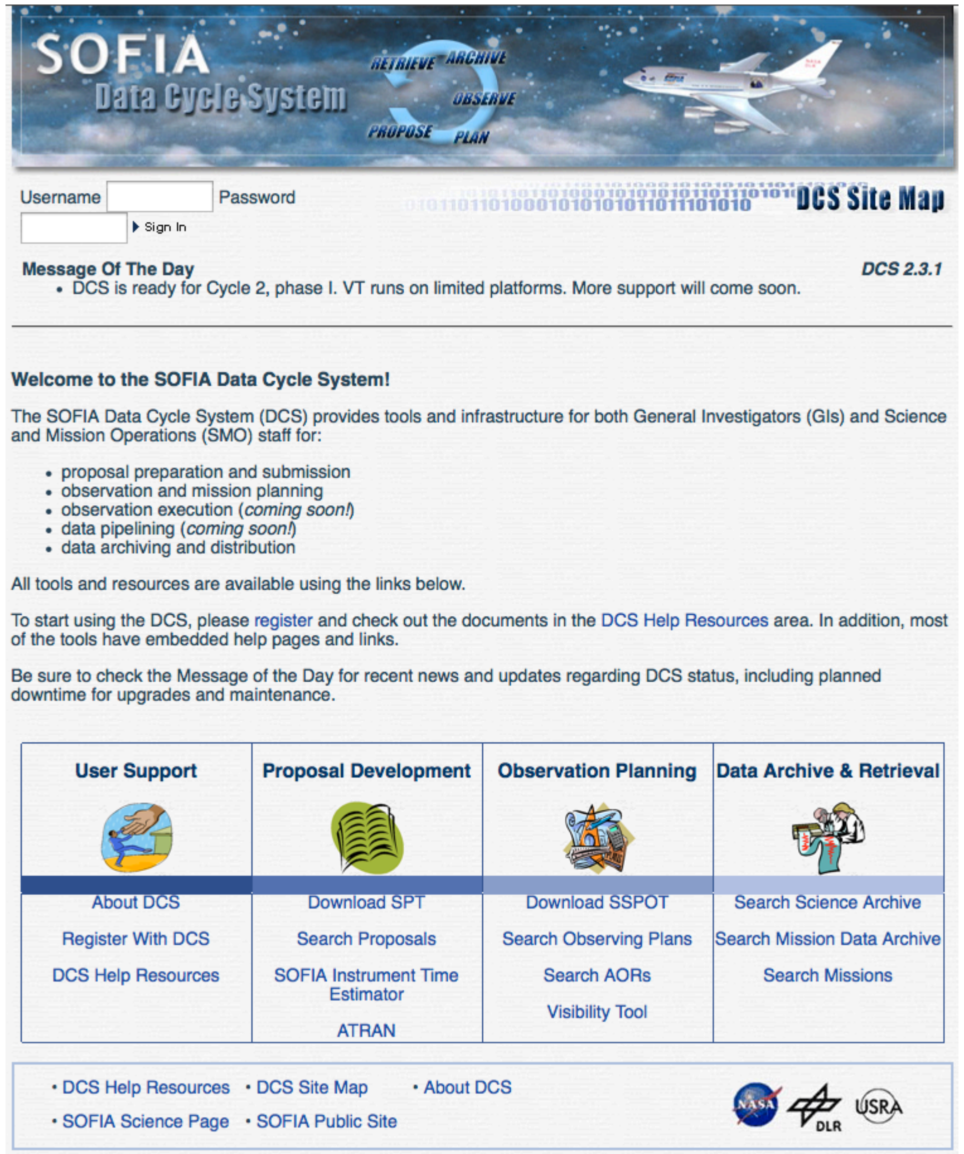

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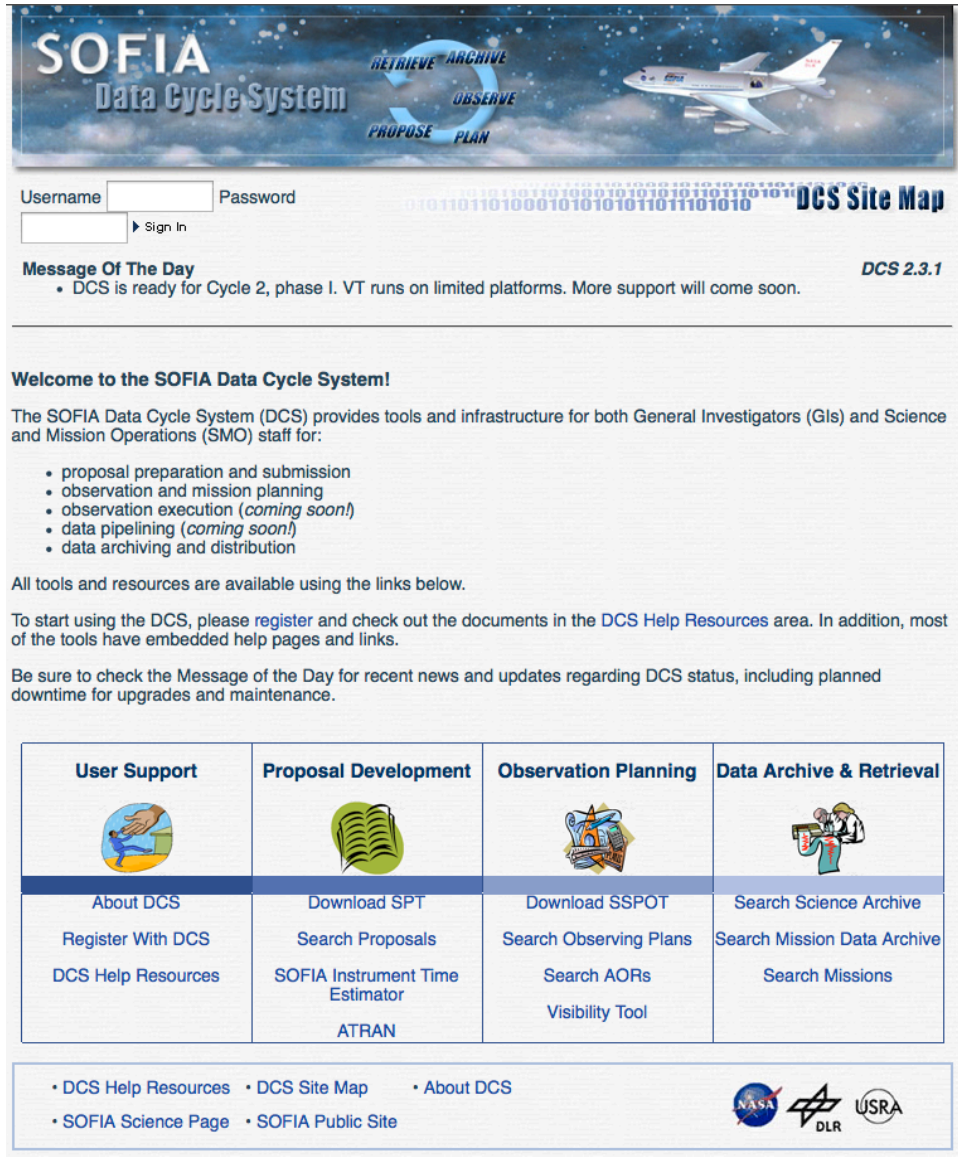

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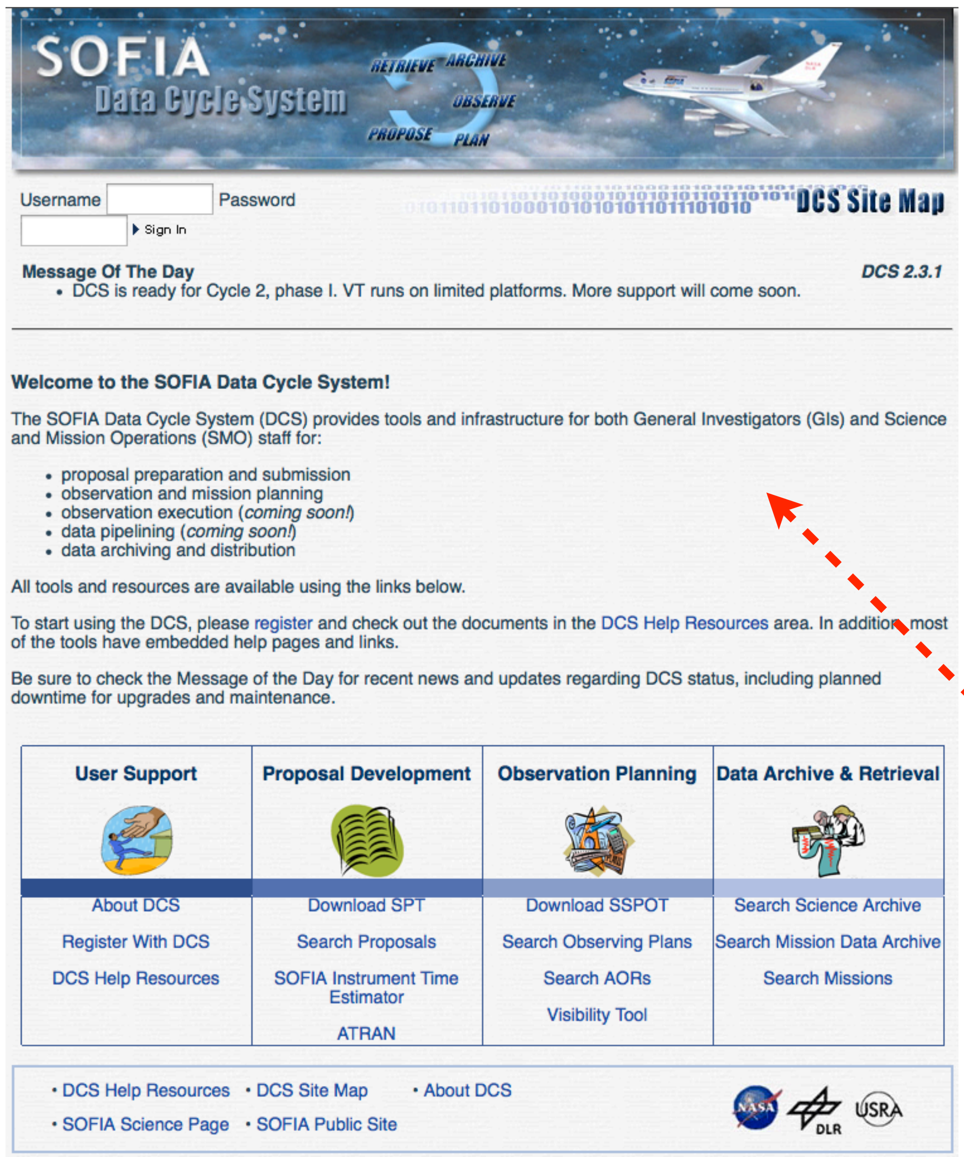

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Two Stage Proposal Process

Phase I:
Preparation and submission of a scientific justification, a high level description of targets and observing modes, and a feasibility analysis for the proposed program.

Technical review of proposals by SMO staff, independent peer-review, and selection of proposals by SMO Director.

Phase II:
Preparation and submission of detailed specifications for each observation in a selected program.

Software, and Online Tools

Proposal/Observation Preparation:

SOFIA Proposal Tool (SPT) ; Phase I
SOFIA Spot (SSpot) ; Phase II

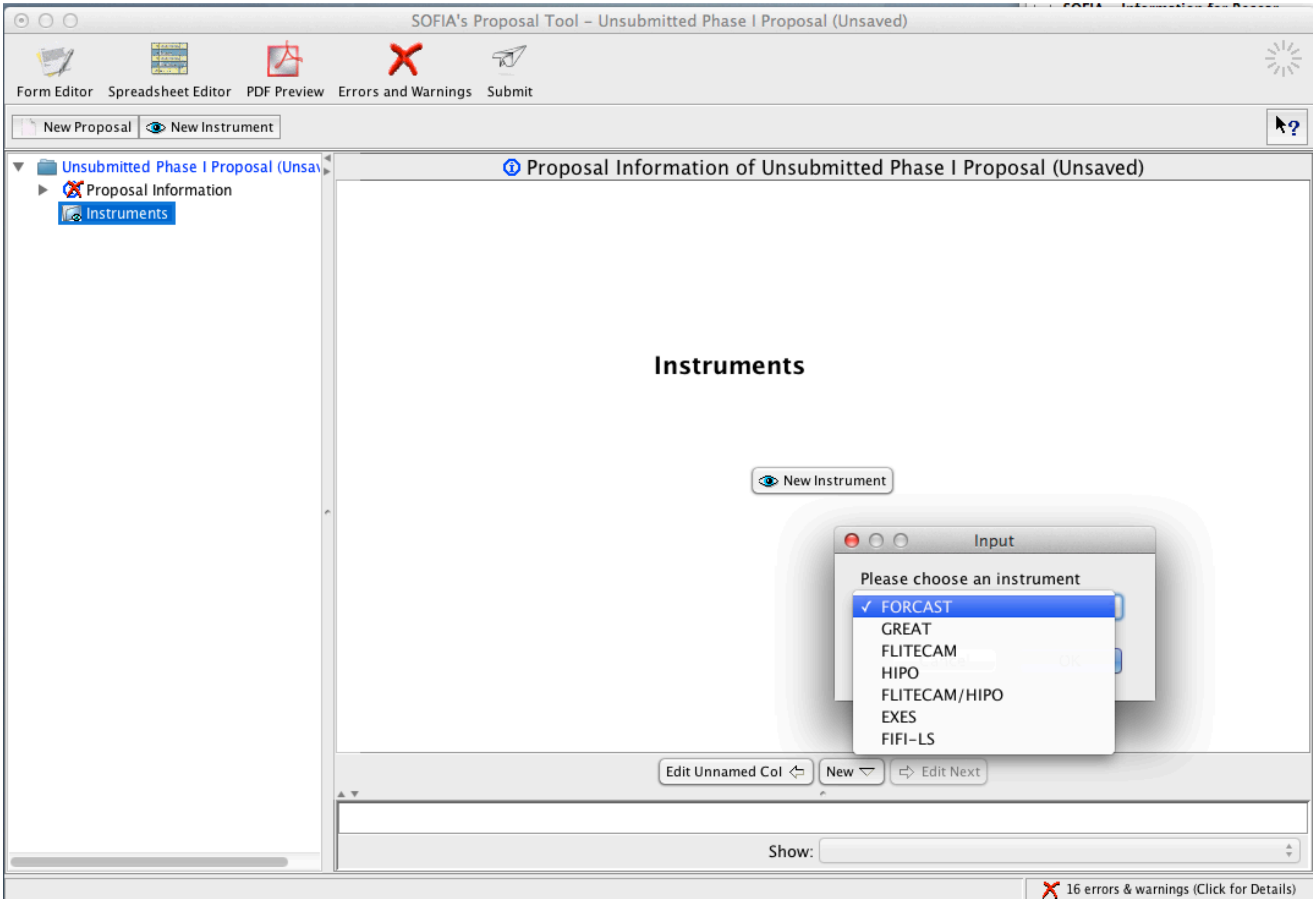
Exposure time estimation:

SOFIA Instrument Time Estimator (SITE)
FLITECAM Grism Observation Calculator
FORCAST Grism Observation Calculator
GREAT Time Estimator

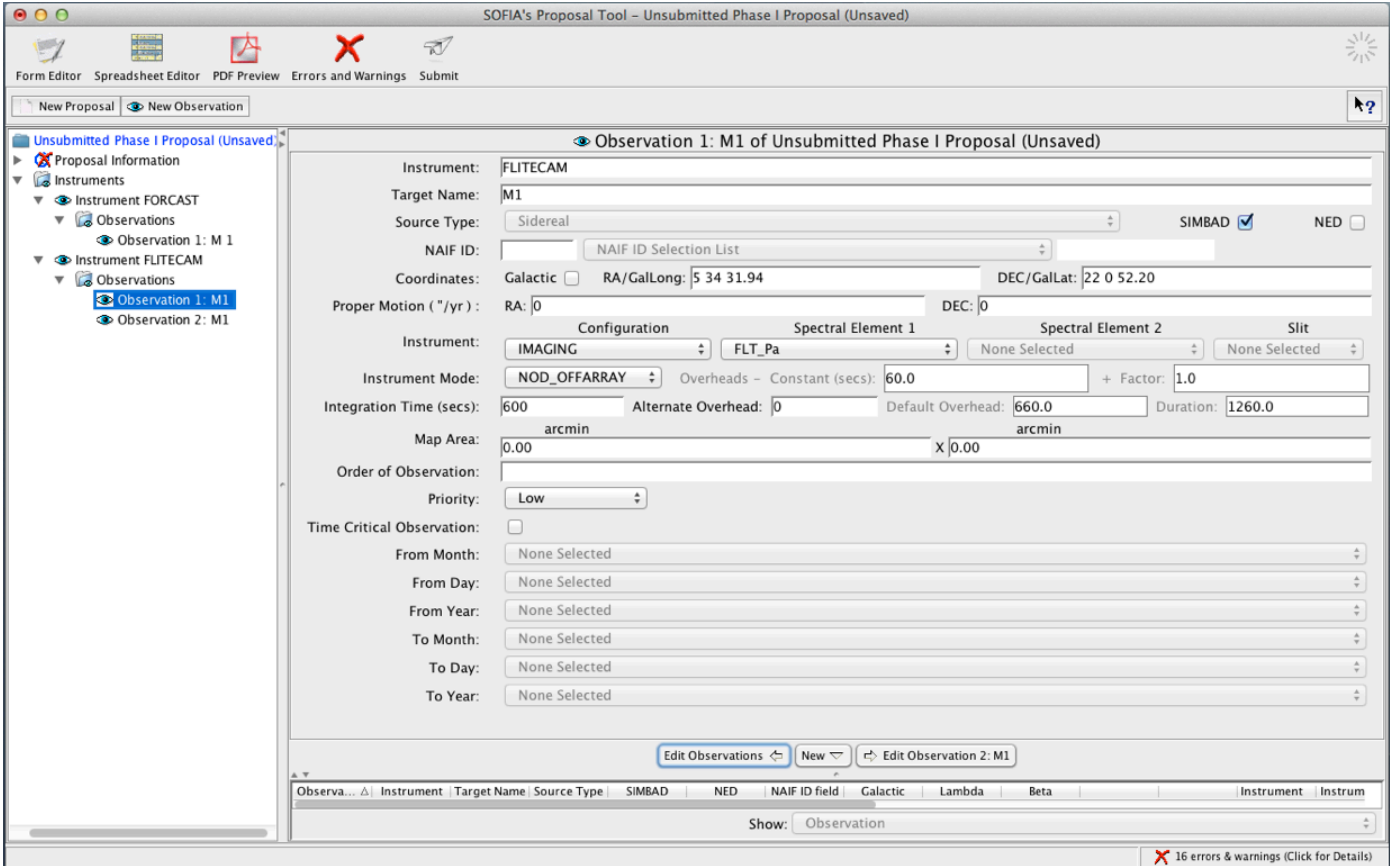
Other resources:

Atmospheric Transmission Models (ATRAN)
Visibility Tool (VT)
AOR Search Page (for duplication checks)

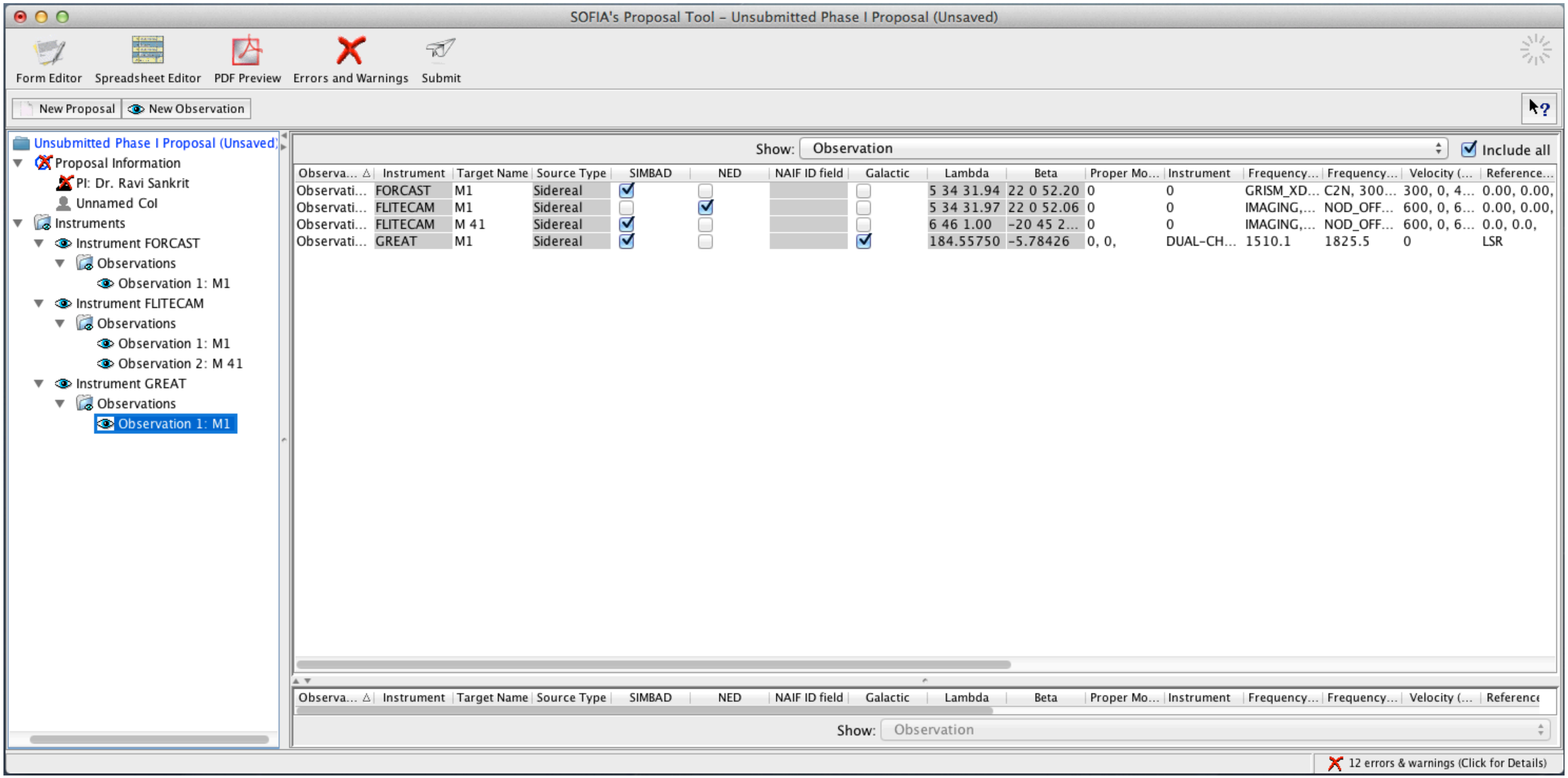
SOFIA Proposal Tool (SPT) ; https://dcs.sofia.usra.edu/proposalDevelopment/installSPT/index.jsp



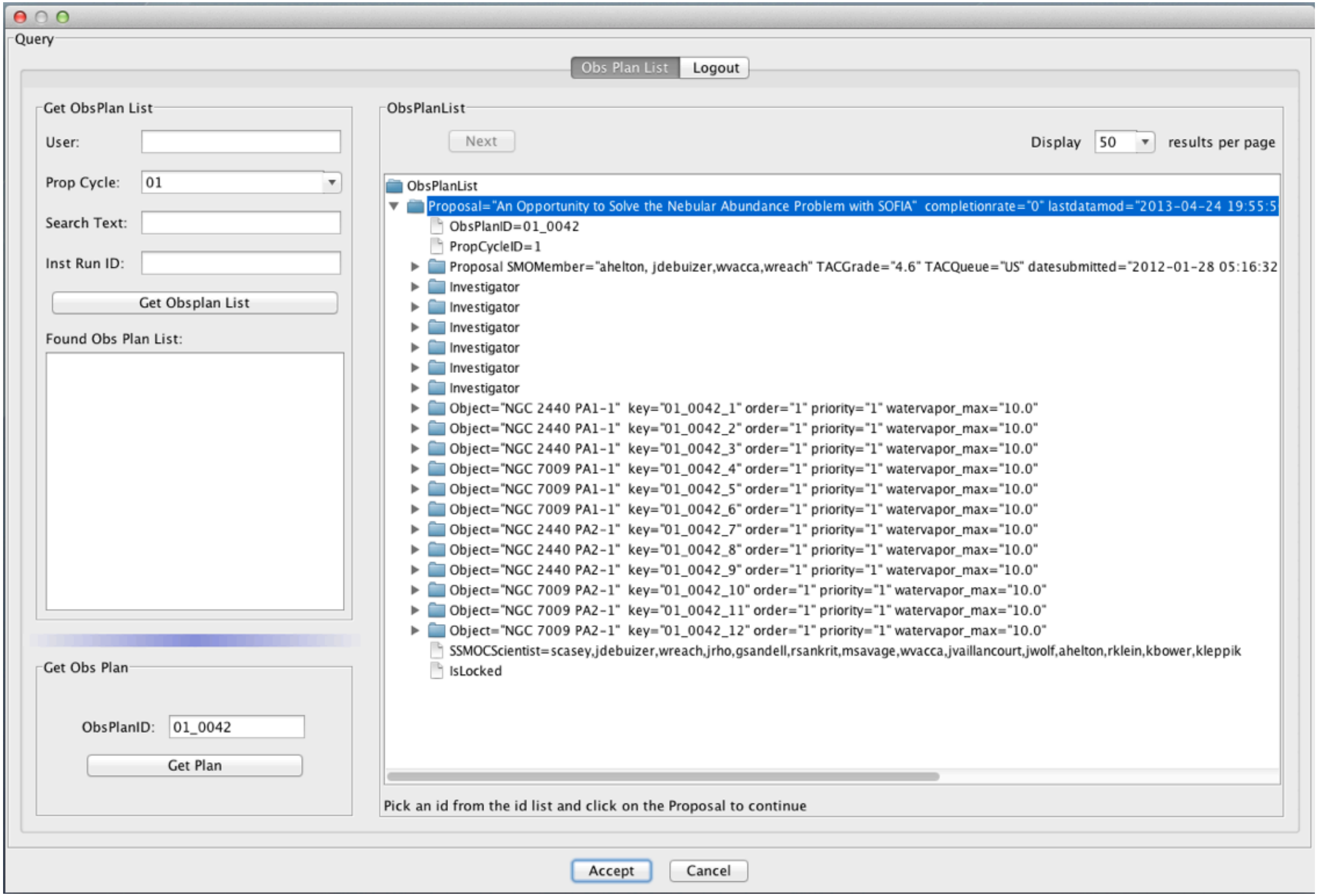
SOFIA Proposal Tool - Form Editor



SOFIA Proposal Tool - Spreadsheet Editor

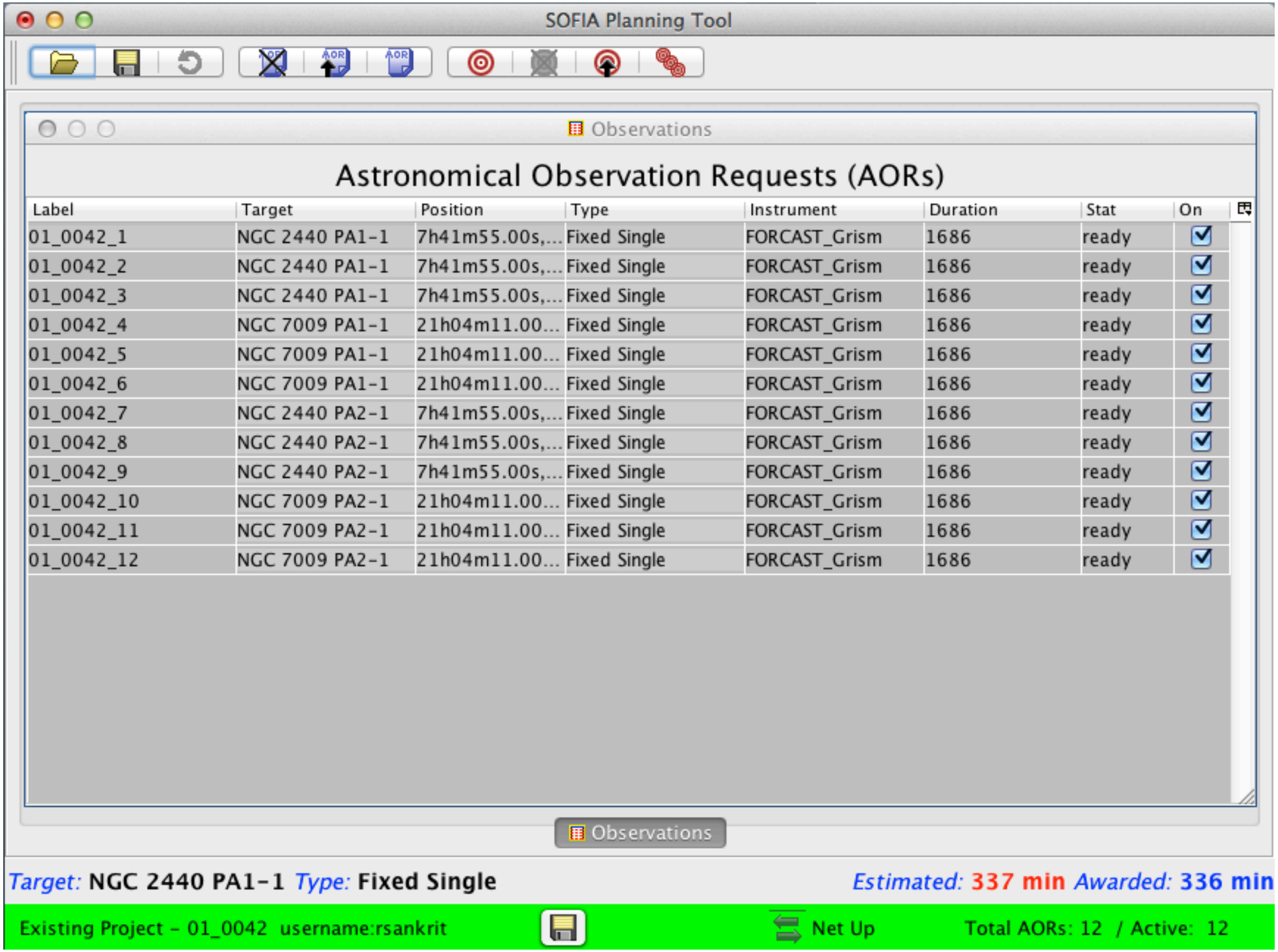


SOFIA Spot ; https://dcs.sofia.usra.edu/observationPlanning/installSSPOT/sspotDownload.jsp



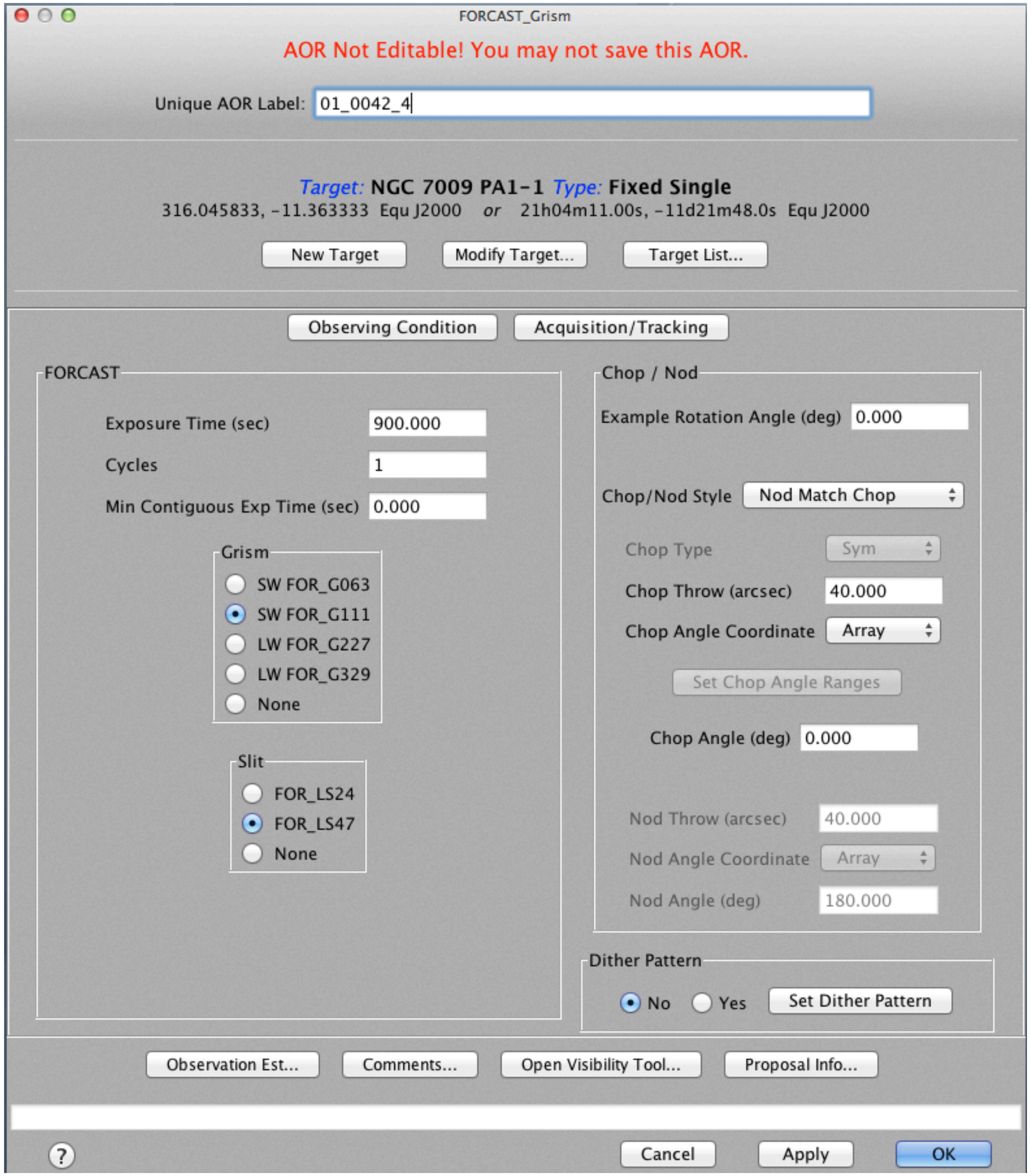
USRA NASA DLR SOFIA

SSpot - Retrieved AORs



Label	Target	Position	Type	Instrument	Duration	Stat	On
01_0042_1	NGC 2440 PA1-1	7h41m55.00s,...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_2	NGC 2440 PA1-1	7h41m55.00s,...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_3	NGC 2440 PA1-1	7h41m55.00s,...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_4	NGC 7009 PA1-1	21h04m11.00...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_5	NGC 7009 PA1-1	21h04m11.00...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_6	NGC 7009 PA1-1	21h04m11.00...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_7	NGC 2440 PA2-1	7h41m55.00s,...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_8	NGC 2440 PA2-1	7h41m55.00s,...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_9	NGC 2440 PA2-1	7h41m55.00s,...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_10	NGC 7009 PA2-1	21h04m11.00...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_11	NGC 7009 PA2-1	21h04m11.00...	Fixed Single	FORCAST_Grism	1686	ready	☑
01_0042_12	NGC 7009 PA2-1	21h04m11.00...	Fixed Single	FORCAST_Grism	1686	ready	☑

SSpot - AOR Detail and Editing



AOR Search ; https://dcs.sofia.usra.edu/observationPlanning/AORSearch.jsp

AOR Search

Get AORs for matching criteria [help]

Cycle Number All Cycles

Instrument Name: ALL | Spectral Element1: ALL | Spectral Element2: ALL | Mode: ALL

Target Type ALL

Target NGC 7009 | SIMBAD Position | NED Position

Spatial Area RA (hh:mm:ss): 21:04:10.88 | Dec (deg:mm:ss): -11:21:48.26 | Search Radius (arcsec): 60 | Equinox: 2000

Results Per Page: 50

Submit | Reset

Page 1 of 1 (1 - 10 of 10)

Save As CSV File [help]

AORID	Target	RA(J2000)	Dec(J2000)	NAIF_ID	Instrument	Spectral1	Spectral2	Freq1	Freq2	ObsMode	Exposure (minutes)
01_0042_10	NGC 7009 PA2-1	21:04:11.0	-11:21:48.0		FORCAST	FOR_G111	FOR_LS47			C2N	15
01_0042_11	NGC 7009 PA2-1	21:04:11.0	-11:21:48.0		FORCAST	FOR_G227	FOR_LS47			C2N	15
01_0042_12	NGC 7009 PA2-1	21:04:11.0	-11:21:48.0		FORCAST	FOR_G329	FOR_LS47			C2N	15
01_0042_4	NGC 7009 PA1-1	21:04:11.0	-11:21:48.0		FORCAST	FOR_G111	FOR_LS47			C2N	15
01_0042_5	NGC 7009 PA1-1	21:04:11.0	-11:21:48.0		FORCAST	FOR_G227	FOR_LS47			C2N	15
01_0042_6	NGC 7009 PA1-1	21:04:11.0	-11:21:48.0		FORCAST	FOR_G329	FOR_LS47			C2N	15
81_0029_1	NGC 7009	21:04:10.79	-11:21:47.7		FORCAST	19.7 microns	31.5 microns				30
81_0029_2	NGC 7009	21:04:10.79	-11:21:47.7		FORCAST	19.7	33.6 microns				30
81_0029_3	NGC 7009	21:04:10.79	-11:21:47.7		FORCAST	24.2 microns	34.8 microns				30
81_0029_4	NGC 7009	21:04:10.79	-11:21:47.7		FORCAST	24.2 microns	37.1 microns				30

SITE ; https://dcs.sofia.usra.edu/proposalDevelopment/SITE/index.jsp

SOFIA Instrument Time Estimator (SITE)

In the four sections of this form, select the 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. Links to related tools are here:

FORCAST GRISM Time Estimator **FLITECAM GRISM Time Estimator** **GREAT Time Estimator** **ATRAN**

Please Check 'Notes and Known Issues' Before Proceeding

Instrument [FORCAST] [Calculate]

Instrument properties: *(more info)*

Filter: [FOR_F086] [FOR_F315] *more info*

Calculation Method

Calculation method: *(more info)*
Select the calculation method

(•) S/N ratio resulting from a Total Integration Time of [900] secs

( ) Total Integration Time to achieve a S/N ratio of [4]

Astronomical Source Definition

Spatial profile and continuum brightness: *(more info) Choose point or extended source.*

(•) **Point source** (nominal spatial profile) with spatially integrated brightness [7.151E-2] [Jy]

Spatially integrated brightness for the long wavelength filter [1.698E-1] Jy

( ) **Extended source** having uniform surface brightness [1.604E-2] [Jy / sq arcsec]

Surface brightness for the long wavelength filter [2.887E-2] Jy/sq arcsec

[ ] **Emission line:** *(more info)* in addition to the above continuum. The output SNR or observing time will be for the sum of continuum plus line.

Single emission line at wavelength [8.606] microns with line flux [0.0] [W/m^2]

Emission line at longer wavelength [31.460] microns with line flux [0.0] W/m^2

Observing Condition Constraints

Note: You can read the explanatory notes for more information on the water vapor overburden.

Zenith Water Vapor Overburden in microns: ( ) 2 ( ) 5 ( ) 7 (•) 10 ( ) 13 ( ) 20 ( ) 27 ( ) 34 ( ) 40

Elevation Angle: ( ) 20^{o} (•) 40^{o} ( ) 60^{o}

[Calculate] [Reset to Defaults]

Notes and Known Issues

1) Because of uncertainties in the sensitivity for the long wavelength range of FLITECAM, not all filters listed in SITE and SPT are valid for Cycle 1 proposals. Only filters short-ward of 3.6 mic. will be supported in Cycle 1 (see SOFIA Cycle 1 Call for Proposals, Section1.3.1): J, H, K, Pa_alpha, Pa_alpha continuum, Water Ice (3.08 mic.), PAH (3.29 mic.). In addition, the order sorting filters used for grism spectroscopy (H_W, K_W, K_long, LM) will not be supported for imaging. Proposals requesting filters or grism modes other than those advertised in the CfP will be considered as non-conforming to the rules of the proposal call.

FLITECAM Grism Observation Calculator ; http://flitecam.sofia.usra.edu/cgi-bin/flitecam/flitecam_calc2.cgi

Web-based input form for FLITECAM Grism Observation Calculator -- beta version

This form can be used to estimate (1) the limiting fluxes of objects that can be observed with FLITECAM for a given signal-to-noise and exposure time; (2) the integration time needed to reach a requested signal-to-noise for an input source flux and temperature; or (3) the signal-to-noise resulting from an input source flux and temperature and integration time. The output data file generated by this routine (flitecam.plt...dat) can be saved to your machine from your browser window once the program has been run.

When estimating (1) the limiting flux, the user should specify the slit size, the desired signal-to-noise ratio (per resolution element), the integration time for an individual image (in sec), and the total integration time for the observation (in sec). At each wavelength point over the observed range, the limiting flux is calculated for the input parameters. Magnitude limits are given for the nominal centers of each broadband filter covered (e.g., at 2.2 microns for the K band). Saturation will occur if the single frame integration time is too long. This can be seen in the plot as a red background for those wavelengths that are saturated.

When estimating (2) the integration time needed to reach a specified signal-to-noise ratio (per resolution element), the user should specify the slit size, the desired signal-to-noise ratio, the integration time for an individual image (in sec), the source flux at 2.2 microns (K band), and the effective blackbody temperature of the source. It should be noted that 0.3 sec is the shortest frame time allowable for a full array readout. For long wavelengths single frame times of 0.3 sec are typical in order to prevent saturation, while for the mid wavelengths 3 sec is a typical value. For the shortest wavelengths, 300 sec is common. (Note that Vega has a mag of 0.03 and a flux of approximately 4.14e-10 W/m2/micron, or 655 Jy, in the K band.)

When estimating (3) the signal-to-noise ratio per resolution element, the user should specify the slit size, the the source flux at 2.2 microns (K band), the effective blackbody temperature of the source, the integration time for an individual image (in sec), and the total integration time for the observation (in sec). Saturation will occur if the single frame integration time is too long. This can be seen in the plot as a red background for those wavelengths that are saturated. (Note that Vega has a mag of 0.03 and a flux of approximately 4.14e-10 W/m2/micron, or 655 Jy, in the K band.)

The conversion between the limiting continuum flux and limiting line flux, under the assumption of a Gaussian line, is given by F_l = 1.06*lambda*F_c/R where F_l is the line flux in units of W/m2, F_c is the continuum flux in units of W/m2/micron, lambda is the wavelength of the line in microns, and R is the resolving power. Alternatively, F_l = 3.19e-15*F_c/(lambda*R) for F_c in units of mJy.

This form and the program to estimate the desired quantities was written by Bill Vacca based on the **expected** performance of FLITECAM. No guarantees regarding actual performance are claimed or implied. The program uses a model of the atmospheric transmission and emission as a function of wavelength for an altitude of 41000 ft, an elevation angle of 45 deg (airmass of 1.4), and a zenith water vapor content of 7.3 microns. The model is smoothed to the requested resolution (which depends on the slit size). The calculations assume perfect flat-fielding and telluric division, and nominal instrument behavior. Note that the plate scale for FLITECAM is 0.475 arcsec/pixel.

Questions about FLITECAM and its expected performance should be directed to the SOFIA Help Desk. If you have problems with this form, please contact the SOFIA Help desk (sofia_help@sofia.usra.edu).

Submit Form | Clear Form

Input Observing Parameters

Select the quantity to be estimated: Limiting Flux

Choose a slit size (arcsec): 1.0

Required Signal-to-Noise ratio:

Single frame integration time (sec):

Total integration time (sec):

Source Flux at 2.2 microns: W/m2/micron

Source blackbody temperature (K):

Submit Form | Clear Form

Back to the SOFIA Home Page

FLITECAM Grism Observation Calculator - Input

Input Observing Parameters

Select the quantity to be estimated:	Limiting Flux
Choose a slit size (arcsec):	1.0
Required Signal-to-Noise ratio:	5
Single frame integration time (sec):	5
Total integration time (sec):	600
Source Flux at 2.2 microns:	Jy
Source blackbody temperature (K):	6000

Submit Form | Clear Form

FLITECAM Grism Observation Calculator - Output

FLITECAM Calculator Output

Input Parameters

Mode:	Limiting Flux
Slit:	1.0 arcsec
Requested Signal-to-Noise Ratio:	5
Single frame exposure time:	5 sec
Total exposure time:	600 sec

View output data file

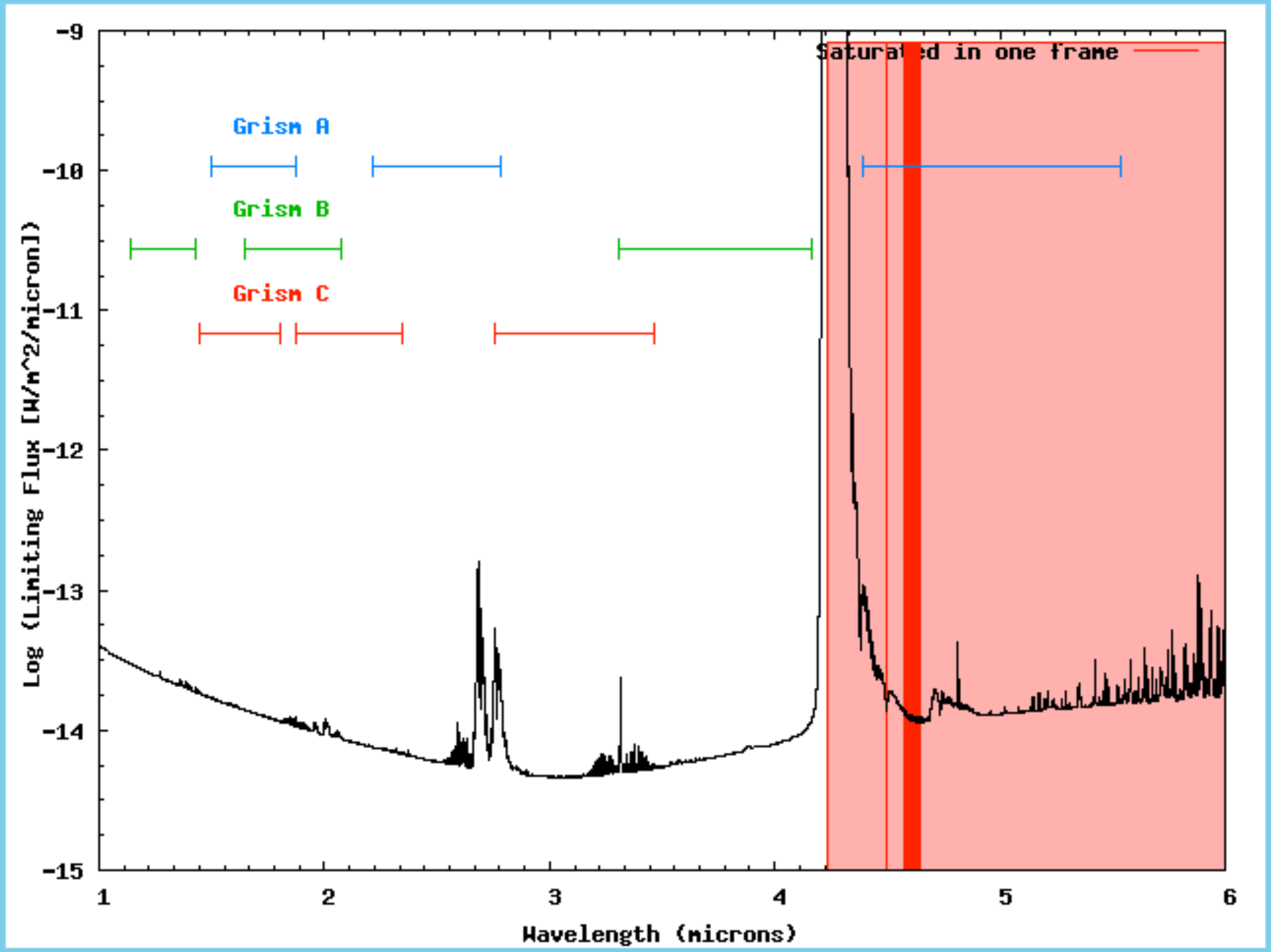
Slit size = 1.000 arcsec
Resolution = 1700.0
Single frame exposure time = 5.000 sec
Number of Coadds = 120.00000
Total Exposure Time = 600.00000 sec

Wavelength (microns)	FWHM (arcsec)	Fractional Slit Transmission
1.250	3.64	0.25
1.650	3.58	0.25
2.200	3.52	0.26
3.550	3.49	0.26
3.760	3.49	0.26
4.750	3.50	0.26

Limiting Magnitudes	Limiting Fluxes (mJy)	Limiting Fluxes (W/m2/micron)
J = 12.791	12.819	0.2460E-13
H = 12.321	12.733	0.1402E-13
K = 11.817	12.634	0.7825E-14
L = 10.189	23.850	0.5674E-14
Lprime = 9.797	30.743	0.6519E-14
M = 7.831	121.276	0.1611E-13 -- Saturated!

FLITECAM Grism Observation Calculator - Output Plot

Plot of Limiting Flux as a function of Wavelength for S/N = 5



View output data file

USRA NASA DLR SOFIA

GREAT Time Estimator ; http://great.sofia.usra.edu/cgi-bin/great/great.cgi

Web-based input form for GREAT time estimator -- beta version

This form can be used to estimate the integration time needed to reach a requested signal-to-noise for an input source flux and temperature. The output data file generated by this routine can be saved to your machine from your browser window once the program has been run.

This form and the program to estimate the desired quantities was written by Riccardo Melchiorri based on a previous PHP code version.

Submit Form

Input Parameters

Observatory Altitude (in feet; < 60000 ft):	43000	◉ ft ○ m
Water Vapor Overburden (in microns; 0 if unknown):	0	
Telescope elevation (between 20 and 60 deg):	45	
Signal to Noise Ratio / Integration Time (s): :	5	◉ SNR ○ Total Int.Time
Rest Frequency (in THz, use 7 decimals):	1.9005369	
Velocity correction(Observer VLSR + source VLSR) in km/s:	0	
Brightness Temperature or RMS (K) :	5	
Frequency or Velocity Resolution :	1	○ MHz ◉ km/s
Comments for the plot :		

Submit Form

The time estimator calculates the time required to reach a certain rms brightness temperature , T_R^* , ($T_R^* = T_A^* / \eta_{fss}$, where η_{fss} is the forward scattering efficiency, assumed to be 0.95 for GREAT at all bands) for a line at a frequency ; by solving the standard radiometric formula

$\Delta T_A^* = (2\, T_{sys}) / \mathrm{sqrt}(t\, \Delta\nu)$

Here $\Delta\, T_A^*$ is is the antenna temperature corrected for ohmic losses and rear spillover. T_{sys} is the single sideband system temperature outside the earth atmosphere, t is the integration time (ON+OFF) and $\Delta\nu$ is the desired frequency resolution.For further details, see Guide to GREAT v3.

The calculator uses the most recent measured receiver temperatures (April 2013) and calls the atmospheric transmission program ATRAN to estimate the atmospheric transmission for a given frequency, altitude, telescope elevation and water vapor overburden. The transmission is used to calculate Tsys, assuming an ambient temperature of the atmosphere of 220 K and a telescope temperature of 230 K.

The time estimator can also compute the required integration time (ON + OFF) for a line with a given peak brightness temperature, desired signal to noise ratio (SNR) and frequency or velocity resolution. To estimate the total time needed for your observations, enter the integration times in the SOFIA Proposal Tool, or calculate them yourself. For position, beam switched observations and raster maps the overheads are currently assumed to be 100% (2 x integration time). Add 5 minutes for tuning and calibration. For on-the-fly mapping the overheads are 50% (1.5 x integration time for the map) plus 5 minutes for tuning and calibration.

If your line estimates are in main beam brightness temperature, T_{mb}, convert to radiation temperature $T_R^* = T_{mb}/\eta_{mb}$, where η_{mb} is the main beam efficiency. The Main beam efficiency has been measured from observations of Jupiter in April 2013 and found to be 0.67 for both L1 and L2.

If your desired line rest frequency falls close to or in an atmospheric absorption feature, you may still be able to observe the line if you choose the right time of the year and your source is blue or redshifted to move you out of the atmospheric feature. The time estimator therefore also allows you to put in a velocity correction. The first term in this velocity correction calculates the radial velocity of the observer with respect to your source for a given date and location (hyperlink) and then you still need to add the VLSR of your source.

The time estimator also plots the position of both sidebands (separated by +/- 3.25 GHz from the signal band). If the transmission is poor at the lower frequency but very good at the higher frequency, you would tune your line to the lower sideband. If the opposite is true you would tune your line to the upper sideband (USB). If both sidebands have poorer transmission than your signal band, your system temperature will be underestimated and your time estimate will be too optimistic, since GREAT is a dual sideband receiver and emission from both the signal and the image band contributes equally to the system temperature.

GREAT Time Estimator - Input

Input Parameters

Observatory Altitude (in feet; < 60000 ft):	43000	(•) ft ( ) m
Water Vapor Overburden (in microns; 0 if unknown):	0	
Telescope elevation (between 20 and 60 deg):	45	
Signal to Noise Ratio / Integration Time (s): :	5	(•) SNR ( ) Total Int.Time
Rest Frequency (in THz, use 7 decimals):	1.9005369	
Velocity correction(Observer VLSR + source VLSR) in km/s:	0	
Brightness Temperature or RMS (K) :	.5	
Frequency or Velocity Resolution :	1	( ) MHz (•) km/s
Comments for the plot :		

Submit Form

GREAT Time Estimator - Output

Output

Rest Frequency	1.900537	THz
Single Sideband System Temperature	2217	K
Integration Time	343.7	s
Atmospheric Transmission	0.91	-

Input Parameters

Rest Frequency	1.900537	THz
Doppler correction	0	km/s
Signal to Noise Ratio	5	-
Frequency resolution	6.3	MHz
Velocity resolution	1.0	km/s
Brightness Temperature or RMS	0.5	K
Altitude	43000	ft
Zenith water vapor overburden	default	µm
Elevation angle	45	deg

Assumed Parameters

Ambient temperature for the atmosphere	220	K
Physical Temperature of the Telescope	230	K
Telescope Efficiency incl. ohmic losses and spillover	0.92	
Double Side Band Receiver Temperature	900	K
Forward Scattering Efficiency	0.95	

GREAT Time Estimator - Output Plot