

Services to users

Goal:

facilitate GO experience from proposal to publication for users coming from a wide range of backgrounds (support/enable/accelerate)

The Science Outreach Team:

- Randolph Klein (lead)
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+ matrixed support from scientists across the SOFIA Science Center

User support tools and documents

- 'For Researchers' section of the website: envisioned as the '**one-stop-shop**' for users

The screenshot displays the SOFIA Science Center website interface. At the top, the SOFIA logo (Stratospheric Observatory for Infrared Astronomy) is on the left, and navigation links for Home, For Researchers (highlighted), and Multimedia are on the right. Below this is a secondary navigation bar with links for SOFIA Overview, Proposing, Observing, & Data, Instrument Call, Instruments, Publications, Meetings and Events, Announcements, and Contact. The main content area features a left sidebar with 'Announcements' (including 'Fee Waived for 2019 Winter AAS Workshop', 'Speakers Announced for 2019 Winter AAS Special Session', and 'First Cookbook Recipes Released') and 'Upcoming Events' (listing a 'Teletalk' by Judy Pipher on 11/14). The central content area shows a breadcrumb trail 'Home » Welcome to the SOFIA Science Center', followed by the title 'Welcome to the SOFIA Science Center' and a featured article 'Fee Waived for FORCAST and HAWC+ Data Analysis Workshop at the 2019 Winter AAS'. Below the article title is a color-coded astronomical image labeled '154 microns'. The right sidebar contains a search box, a 'Search' button, and links for 'Sign up for the electronic newsletter', 'Quick Guide', 'Data Cycle System', and 'Science Data Archives'. At the bottom of the right sidebar is a dark blue button with the text '<<November>>'. The footer of the page includes the SOFIA logo on the left and logos for NASA, DLR, USRA, and DSI on the right.

- SOFIA Help-Desk: ticket-based system (RT), tickets opened by email to sofia_help@sofia.usra.edu

7498 Combining data with previous HAWC+ observations	resolved 8 weeks ago	Inbox 8 weeks ago	amoulet (Arielle Moullet) 8 weeks ago	0
7504 Amateur Radio Operations on SOFIA	resolved 7 weeks ago	Inbox 6 weeks ago	amoulet (Arielle Moullet) 6 weeks ago	0
7505 SOFIA poster at AAS special session?	resolved 7 weeks ago	Inbox 6 weeks ago	amoulet (Arielle Moullet) 6 weeks ago	0
7506 OC6-J data?	resolved 6 weeks ago	Inbox 6 weeks ago	amoulet (Arielle Moullet) 6 weeks ago	0
7507 Jupiter Printing Problems	resolved 6 weeks ago	Inbox 6 weeks ago	Nobody in particular 6 weeks ago	0
7511 sample report	resolved 5 weeks ago	Inbox 5 weeks ago	amoulet (Arielle Moullet) 5 weeks ago	0
7513 problems with dcs	resolved 5 weeks ago	Inbox 5 weeks ago	amoulet (Arielle Moullet) 5 weeks ago	0
7514 FW: SOFIA Events at January AAS Meeting	resolved 5 weeks ago	Inbox 4 weeks ago	amoulet (Arielle Moullet) 4 weeks ago	0
7515 Your 30Dor SOFIA HAWC+ results (fwd)	resolved 5 weeks ago	Inbox	amoulet (Arielle Moullet) 4 weeks ago	0

- archive contents and applied calibration steps
- difficulties w software, DCS
- telescope/instrument performance
- timelines (grants, observation scheduling, product delivery)
- events

- User-facing documentation: Observers' Handbook, Quick-guide, USPOT manual, announcements
- Cookbook recipes: easy to follow instructions to perform basic **inspection/plotting/analysis** on Level 3 / 4 products, and background information on applied **calibration/error estimation**. Either in pdf or notebook format, and cover a variety of software options (SOSPEX, CLASS, python/matplotlib plotting, ATV, APT...)
 - Published: GREAT spectra (Reach), FORCAST imaging (Shuping), FIFI-LS mapping (Fadda), HAWC+ polarization mapping (Lopez-Rodriguez/Gordon)
 - Coming up: FORCAST-grism for point sources, GREAT mapping
 - Future: EXES, FORCAST-grism for extended sources, HAWC+ photometry,

Plotting Polarization Fraction

We can also plot the polarization fraction p to better visualize the structure of 30 Doradus. We plot the same contours from total intensity I in the background.

```
In [8]: fig = FITSFigure(p)

# Show image
fig.show_colorscale(cmap=cmap)

# Plot contours
ncontours = 30
fig.show_contour(stokes_i, colors='gray', levels=ncontours,
                smooth=1, kernel='box', linewidths=0.3)

# Add colorbar
fig.add_colorbar()
fig.colorbar.set_axis_label_text('$p^\prime$ (%)')
```

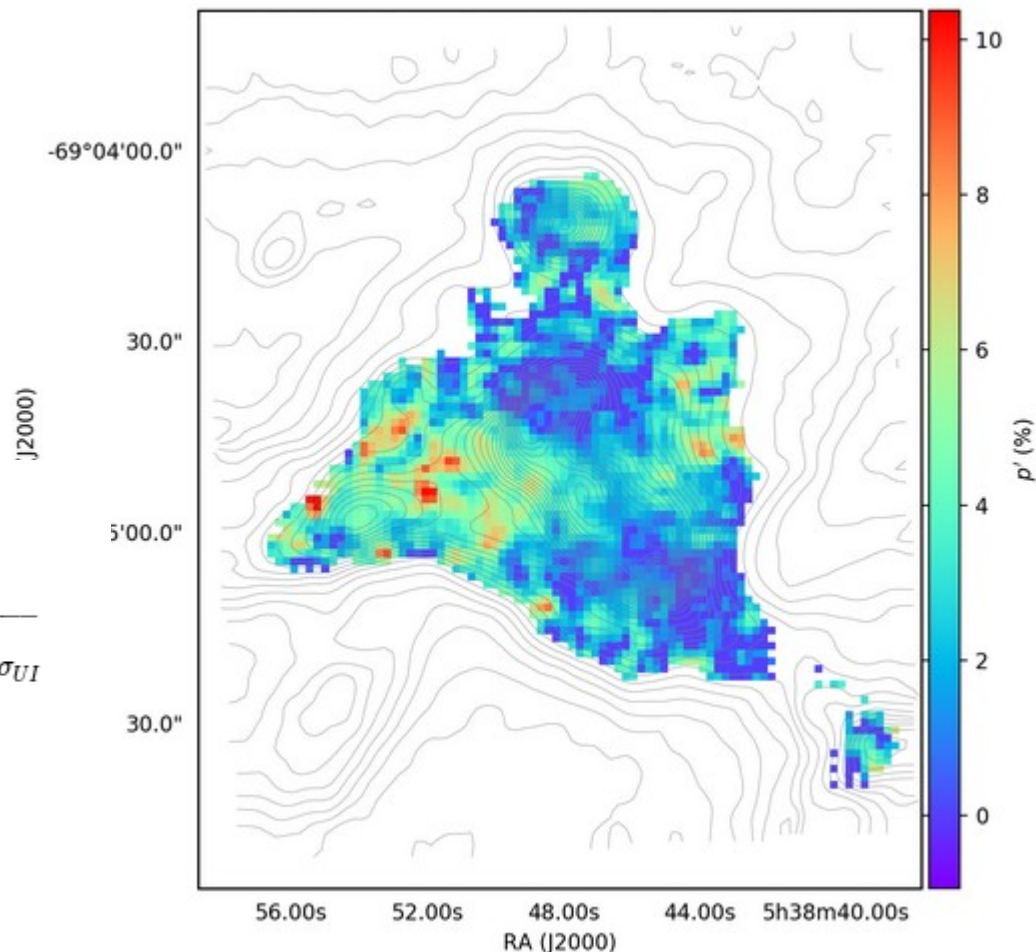
Percent polarization (p) and error (σ_p) are calculated as:

$$p = 100 \sqrt{\left(\frac{Q}{I}\right)^2 + \left(\frac{U}{I}\right)^2}$$

$$\sigma_p = \frac{100}{I} \sqrt{\frac{1}{(Q^2 + U^2)} [(Q \sigma_Q)^2 + (U \sigma_U)^2 + 2QU \sigma_{QU}] + \left[\left(\frac{Q}{I}\right)^2 + \left(\frac{U}{I}\right)^2\right] \sigma_I^2 - 2\frac{Q}{I} \sigma_{QI} - 2\frac{U}{I} \sigma_{UI}}$$

Note that p here represents the **percent** polarization as opposed to the more typical convention for p as the **fractional** polarization.

Maps of these data are found in extensions 7 (PERCENT POL) and 9 (ERROR PERCENT POL).



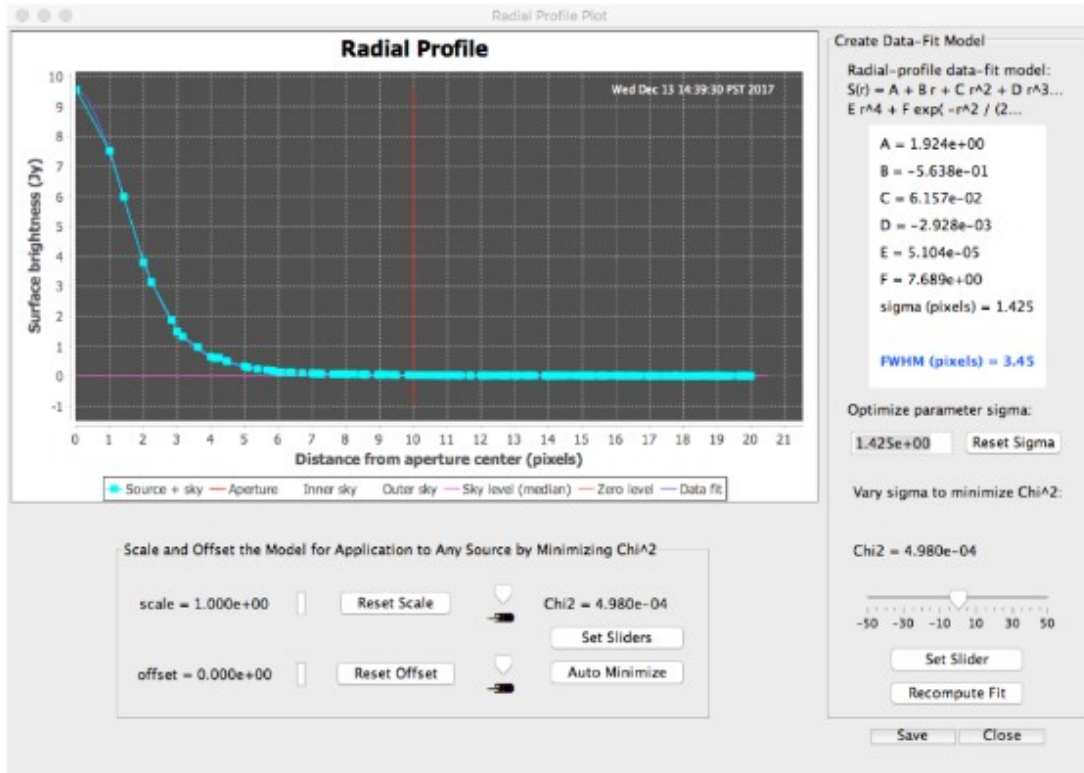


Figure 2. Radial profile measurement using APT.

4 APERTURE PHOTOMETRY

Procedure

1. Open the Level 3 FITS file in your image analysis tool, and select the *first* plane.
2. Check the image for any spurious artifacts or large non-astronomical background variations.
3. Check the photometry settings: in particular, some tools (e.g. ATV) give a choice to compute photometry in *magnitudes* or *counts*. For FORCAST you should choose *counts*; since the images are already flux calibrated (Jy/pixel), *counts* = *Janskys*.

Estimating uncertainty

Relative uncertainty in the flux measurement (η) for the source can be estimated from the component relative errors, summed in quadrature:

$$\eta^2 = (\eta_m)^2 + (\eta_{\text{flux}})^2 + (\eta_{\text{model}})^2$$

where η_m is the relative error in the photometry measurement (σ_m / F_0); η_{flux} is the relative error in the flux calibration; and η_{model} is the relative uncertainty in the flux calibration model at the given wavelength, which is typically 5% (Dehaes et al. 2011). The relative flux calibration error (η_{flux}) is simply $\text{ERRCALF}/\text{CALFCTR}$ and can range from 1% -- 10% depending on the filter used (typically higher for longer wavelengths).

Support at proposal preparation stage

- wide advertisement/information effort at the opening of Call For Proposals
 - to current /interested users (e-mail list including all GIs and co-Is, community day participants)
 - to wider outlets to reach out to new potential users (AAS, SMD, national communities)
 - topic/instrument-based mailing lists (Herschel, OST, astrochemistry)
 - targeted advertisement to individuals

Possible future developments:

- directly contacting grad schools
- identify more international information channels (outside US/DE)
- more contacts with future/current IR missions (BLAST, instruments on planetary spacecrafts)

- continuous support through the HelpDesk, to address issues and questions:

- DCS login
- time estimates
- documentation clarification
- submission issues
- 'I have a last minute idea do you think it is worth it'

- live collection of feedback from users:
allows for minor corrections and improvement
of tools and docs up to the deadline

7473	HAWC+ NMC vs OTF Map
7474	SOFIA-GREAT
7475	Help with FORECAST grism
7476	proposal validation error - DCS username
7477	Change in HAWC+ Band E MiPF since 30 July
7478	problem with USPOT for SOFIA Cycle 7 proposal submission
7479	Cannot submit proposal because cannot recognize DCS name
7480	not recognizing DCS account
7481	Re: not recognizing DCS account
7482	Re: not recognizing DCS account
7483	USPOT submission problem
7484	trouble saving AORs and proposal submission
7485	Proposal submission
7487	Re: Proposal 07_0177 received
7488	Fwd: Double proposal submission?

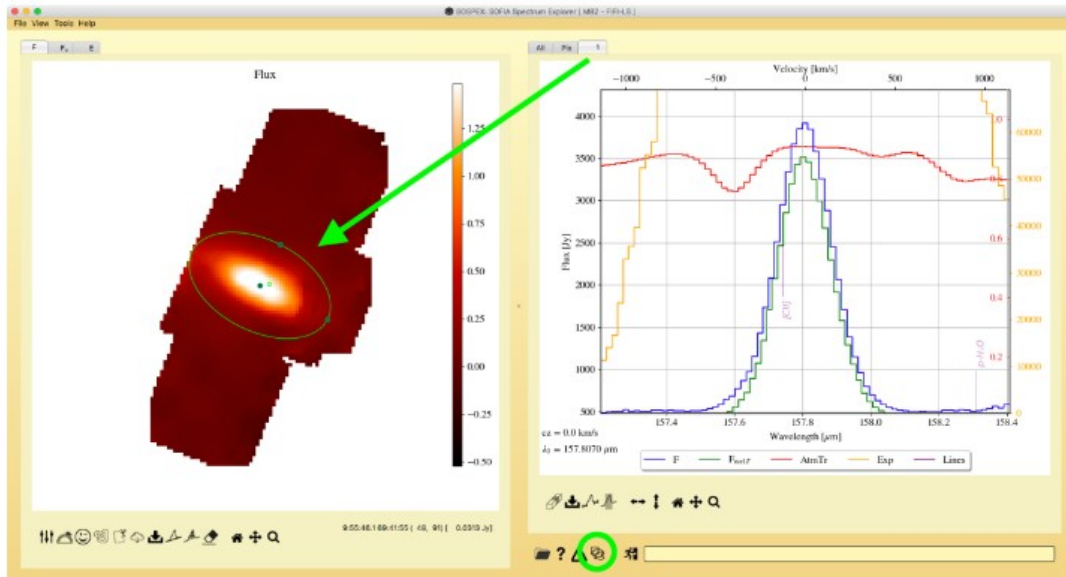
Accompanying GOs to publication

- at any time, the GO can contact the Science Center through HD, or the IS directly
- assistance for AOR preparation and acceptance (IS)
- after a series is scheduled, invitation to join flights. Monitoring of clearances approvals, scheduling
- after series completion, GOs are informed about obs. completion/quality (IS)
- regular monitoring of project completion status during cycle, triggering adequate information to GOs (expected next observing opportunities, suggestion to re-propose)

Identification of finished programs which have a good potential for publication (good completion, good perceived data quality) amongst:

- recently delivered series
- unpublished public data

Identified GOs are contacted with suggestions for possible personalized help:



- navigating archive products
- pointing to cookbooks to get started w analysis
- clarification on applied calibration steps
- phone, Skype, on-site visits for more in-depth questions

Occasionally as needed, **group data workshops** can be organized to help several users in one setting (USRA location, meeting, community day). Also helps to build community.

Example: 2019 AAS workshop

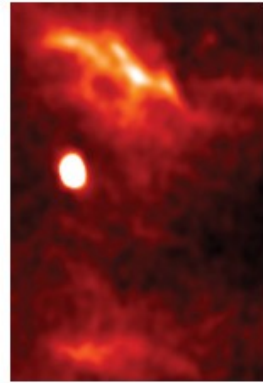
Winter AAS Workshop Fee Waived

Sunday, January 6, 2019
8:30 am-5:15 pm PST
Washington State Convention Center, Room 201
Fee: **FREE**

Agenda:
FORCAST 8:30 am-12:00 pm
HAWC+ 1:00-5:15 pm

To ensure that all interested students and scientists attending the 2019 Winter AAS have access to this opportunity, the SOFIA Science Center has waived the registration fee for the workshop. It is critical that those who are interested in joining the workshop register by **November 14, 2018** . [Register for the workshop](#) on the AAS registration page. If you are already registered for the meeting, you may revisit the registration page to add the workshop.

This interactive workshop will introduce participants to advanced analysis techniques utilizing Python to parse and visualize grism spectra with the Faint Object infraRed CAmera for the SOFIA Telescope (FORCAST) and imaging polarimetry data with the High-resolution Airborne Wideband Camera-plus (HAWC+). The guided Python exercises will be geared toward graduate students, early career astronomers, and SOFIA users in general. Participants will be able to receive direct assistance from SOFIA science staff while learning to use the fully reduced data delivered by SOFIA. This is an opportunity both for those who want help with analyzing their existing SOFIA data, and for those interested in learning about data analysis and observing techniques for future observations.

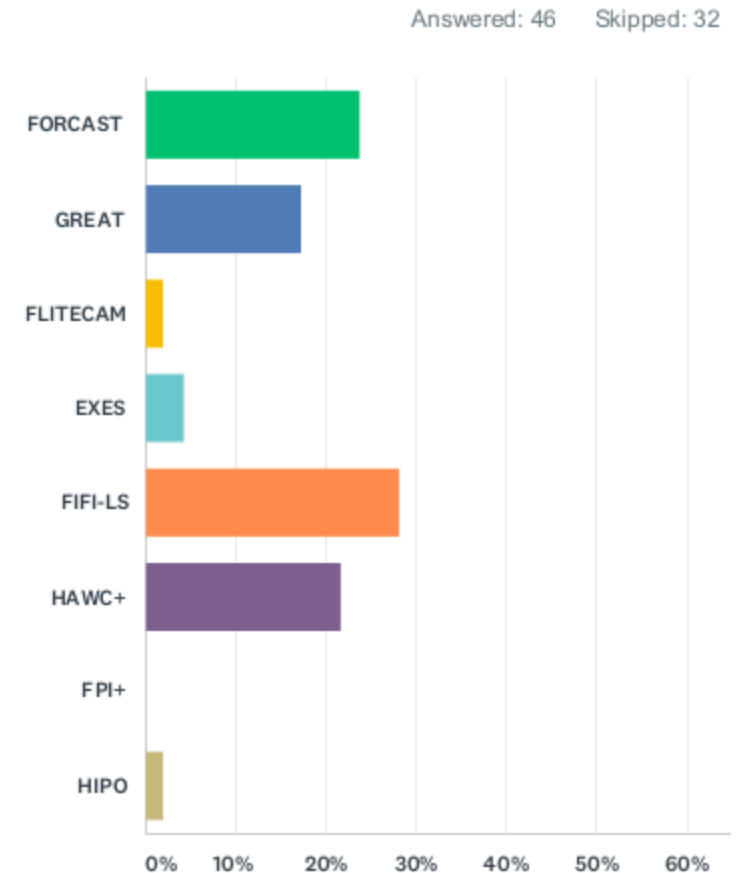


Lessons learned at that event will help us to determine best model for direct support in group setting:
use of recipes, staffing level, pre-requisites

Annual user survey

Goals: identify GO needs and obstacles towards publication, assess perceived quality/efficiency of services,

- November 2017: 17 questions to select list of SOFIA users. publication plans, quality/usability of data, services, general comments
- 2018: will send after SUG meeting to GOs who were delivered data in the last 1.5 year



Results of 2017 Survey:

- 78 responses (56% on Cycle 4 and 5 projects, rest earlier)
- Very positive feedback on the quality of **services to users**
 - Documentation and tools: > 90% rated good, very good or excellent
 - HelpDesk response: > 86% rated good, very good or excellent.
- Positive feedback on **data products quality**, but significant spread:
 - very good or excellent (34%)
 - good (37%)
 - Fair / poor (29%): often seems to be related to incomplete observations

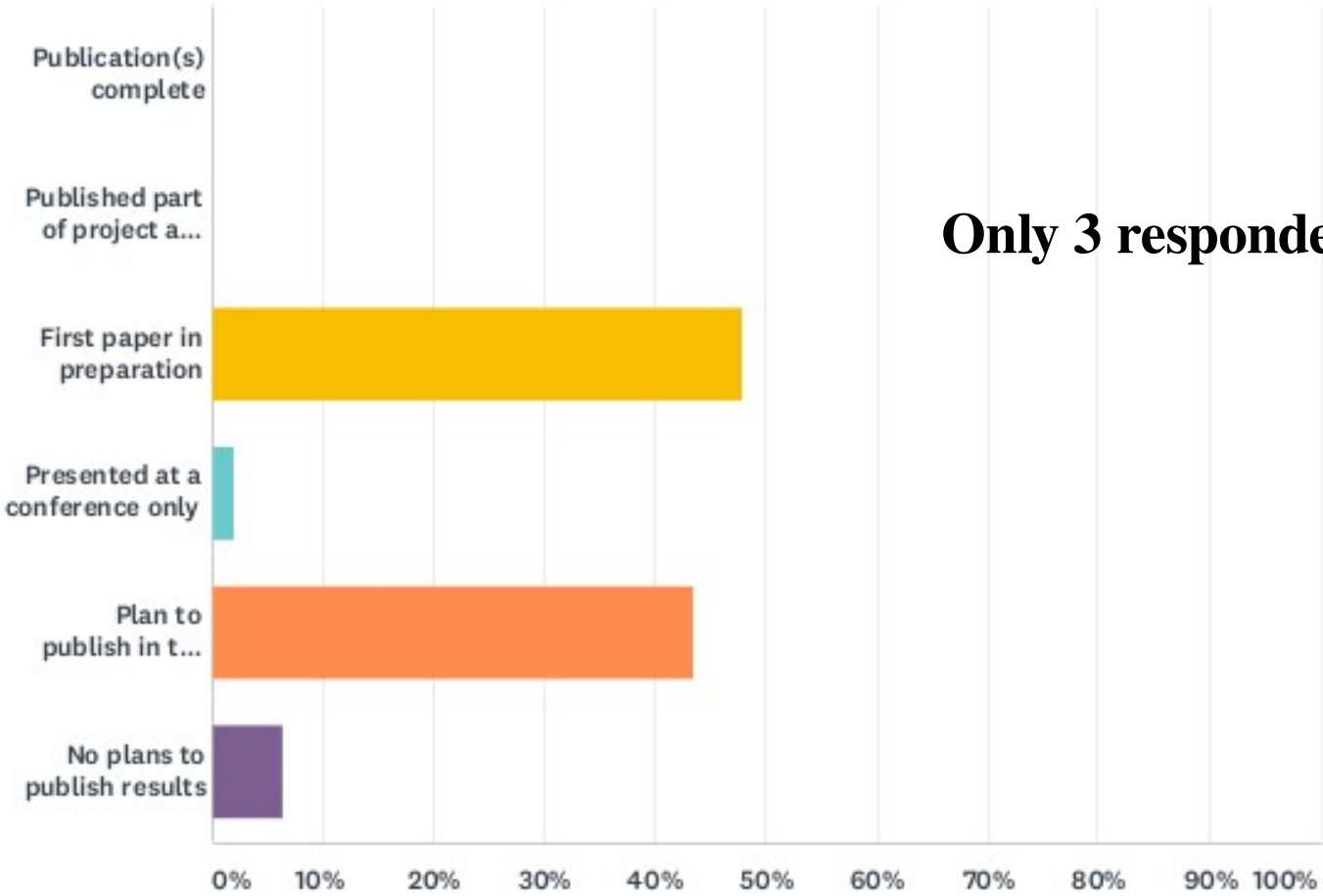
Areas for possible improvement identified and addressed:

- rapidity of **HelpDesk response**: increase of staff resources for Help Desk monitoring
- availability of **information on the flight schedule**: restructuring of scheduling information on website
- rapidity of **data delivery/data processing**: commissioning of pipeline for HAWC+

For at least 10 respondents, non-completion of projects was a identifiable source of lack of satisfaction (data quality, delivery timing, delaying publication) → improvements on scheduling efficiency, obs. prioritization

Q5 What is the publication status of this project?

Answered: 46 Skipped: 32



Only 3 respondents had no plan to publish.

Draft questions of 2018 Survey:

- What is the publication status of your project(s)?
- Please specify the reason you do not plan to publish your results
- How would you rate the TIMING of your data product deliveries?
- How would you rate the FORMAT of your data products delivered through the archive?
- How would you rate the QUALITY, including calibration, of your data products?
- Do you think some of the delivered data needed to be re-calibrated to be of sufficient quality for analysis?
- How satisfied are you with the SOFIA HelpDesk service (timing and response quality)
- How satisfied are you with assistance from the SOFIA team after data products delivery?
- How satisfied are you with the SOFIA Science Center's user TOOLS (e.g. USPOT, SITE, SOSPEX)?
- How satisfied are you with the SOFIA Science Center's DOCUMENTATION (e.g. website, Observers and Data Handbooks)?