



Observing the Sky with Purpose

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Project Client: The Navy Precision Optical Interferometer

Motivation

Our Client, The navy precision optical interferometer (NPOI) team approached NAU after the software that they used to schedule their observations of stellar bodies failed. The NPOI is the largest baseline interferometer in the world and it's unique observations of binary stars are valued as such. The impairment to the efficiency and capacity for observations is both costly and unfortunate for the scientific community.

Obsprep

Target table where specified stars get displayed with their astronomical values

Program selection for the observers to choose what kind of information gets returned to them

Calibrator table where calibrations, according to the observer's observation information, gets displayed

Target add box where the observers insert the star name they want to observe

Main observation specification area. This is where the observers select their observation information

Button menu for saving and loading files, displaying star graphs, help options and exiting application

Name	Spec	V	RA	Dec	D	1	2	3	4	5	6	Sep	Name	Spec	V	D	RA	Dec	Targets
FKV0257	A0	-1.4	6.8	-16.7	6.2	X	X					1.9	BSC2498	A1	5.3	0.4	6.8	-14.8	FKV0257(1.9deg)
FKV0745	A7	0.8	19.8	8.9	3.4	X	X					2.3	BSC2504	B8	5.3	0.3	6.8	-14.4	FKV0257(2.3deg)
FKV0616	M1	1.1	16.5	-26.4	41.3	X	X					2.6	BSC2596	B3	4.4	0.4	6.9	-17.1	FKV0257(2.6deg)
												4.0	FKV2532	B1	4.8	0.2	6.9	-20.2	FKV0257(4.0deg)
												4.2	BSC2590	F2	4.7	0.6	6.9	-20.1	FKV0257(4.2deg)
												4.6	FKV0271	B8	4.1	0.4	7.1	-15.6	FKV0257(4.6deg)
												5.5	FKV0243	B1	2.0	0.8	6.4	-18.0	FKV0257(5.5deg)
												6.7	FKV0249	A0	4.5	0.4	6.6	-23.0	FKV0257(6.7deg)
												6.7	BSC2595	B2	5.3	0.2	6.9	-22.9	FKV0257(6.7deg)
												7.4	BSC2387	B1	4.3	0.3	6.5	-23.4	FKV0257(7.4deg)

Graphical Outputs

Binary Visibility: Plot of visibility vs. separation (mas) for FKV0257. Shows a curve for E3-E6 (26.0 m) with $\theta = 6.21$ mas.

Star Plot: Plot of δ (deg) vs. α (hr) for FKV0257. Shows selected and potential calibrators.

Uptime Plot: Plot of Star Uptime vs. UT (hrs) for FKV0257. Shows target and calibrator uptime.

Disk Visibility: Plot of δ (deg) vs. α (hr) for FKV0257. Shows disk visibility.

Problem Statement

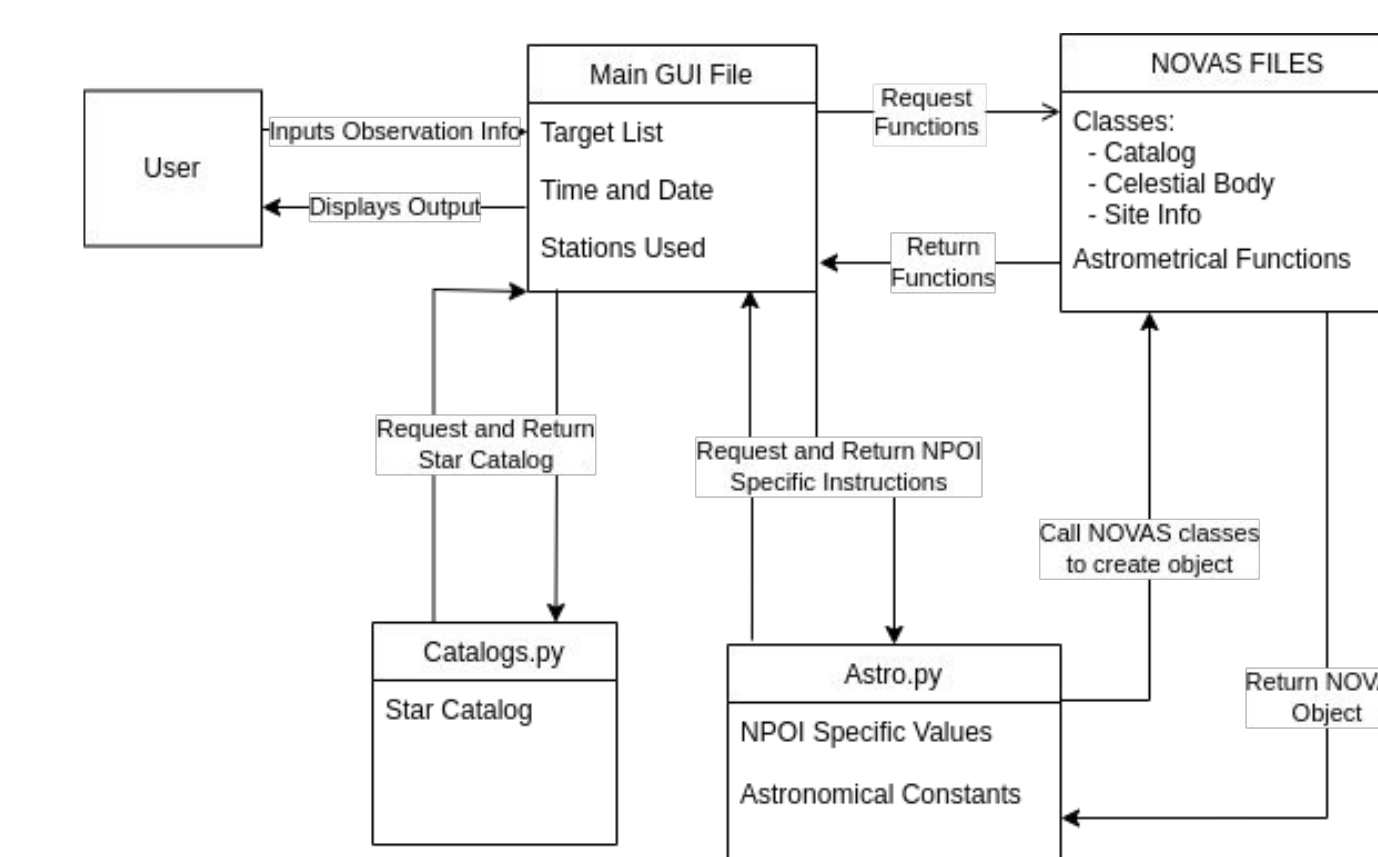
The NPOI has hired Team Dark Sky to rebuild and update obsprep to meet modern software standards. Obsprep 2.0 implements a straightforward GUI (Graphical User Interface) that still reflects the basic organization of the original software that NPOI staff are already familiar with. It allows users to input a wide range of observation specifications and generates accurate outputs in both text and graphical formats. Finally, this new version of obsprep is simple to install, use, and maintain.

Technologies

- Swig
- Tkinter
- Numpy
- Matplotlib
- Python
- C



Architecture



Challenges

- Working with pre-existing code
 - Updating outdated/deprecated software
 - Updating from Python 2 to Python 3
- Deep program comprehension
 - Reviewing code line-by-line to understand the logic/data flow
- Hard to understand behavior
 - This involved learning how the program is supposed to work

Our Solution

Overview:
We resolved numerous syntax, data management, library access, and module integration errors. Enhanced obsprep's installation compatibility and simplicity allowing for resumed use of the program at the NPOI. Obsprep accurately returns the relevant information about a star and its calibrators viewing angle from each of the stations at the NPOI.

Key Features:

- Structured Tkinter Frames and widgets to provide an intuitive user interface
- Input from user, Vizier database, and ephemeris files.
- Output To the screen and local file output
- File navigation and loading for discontinuous observation planning
- Astronomical accuracy

Testing and Deployment:

Testing

- Unit Testing
The first phase of testing runs concurrently with our integration testing. Most important section for ensuring accuracy of our calculations.
- Integration Testing
Testing each modules interactions with each other
- User Testing
Hands on feedback from the end user. Final check for any errors.

Deployment

- Package organization for our client
- Github repo with documentation for follow-up development and maintenance
- Feedback from user testing to ensure smooth acceptance of the product
- Quantitative and qualitative acceptance feedback from our client