GSP Live User Manual

Release 1.0.0

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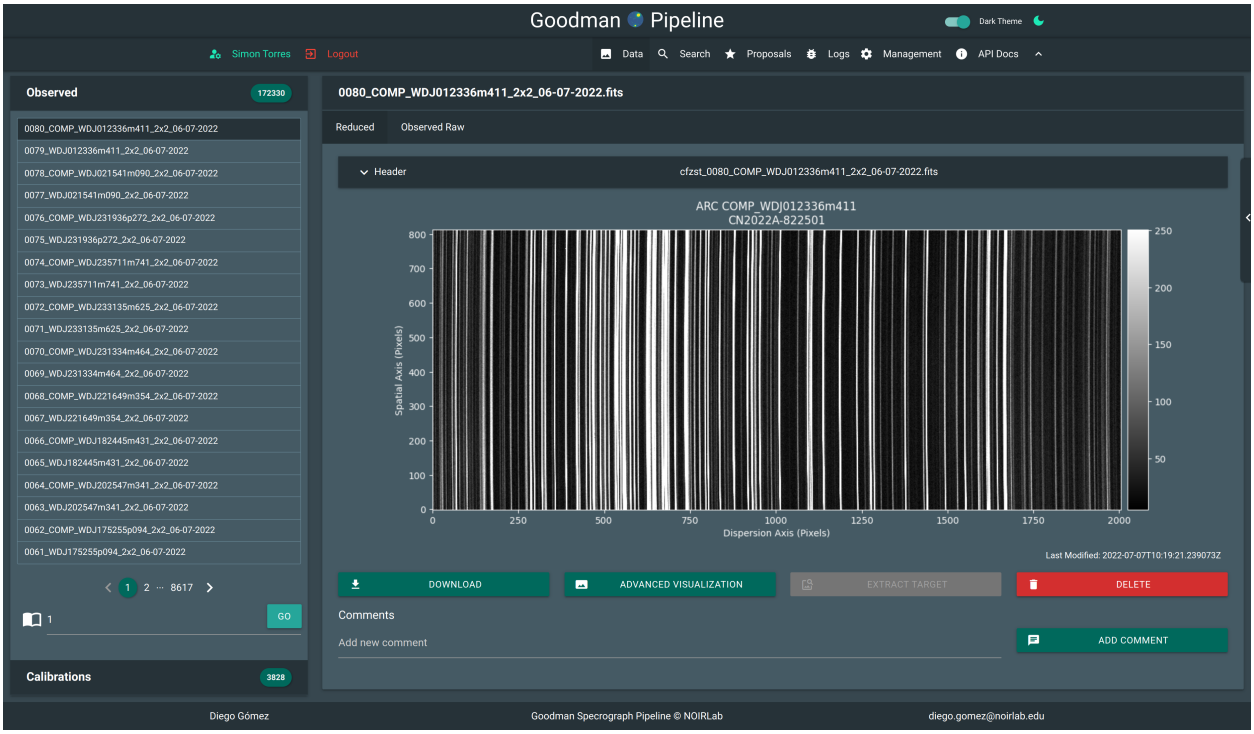
The Goodman Spectroscopic Pipeline Live is a web implementation of the Goodman Spectroscopic Pipeline package. In summary the reduction process has been broken in several parts that might include more than one step of the full process. Each of these parts has a correspondent web API end point.

All this is nicely presented to the user as a web page where the user can visualize fully reduced spectra just seconds after it was obtained. Also the user has the option of manually triggering certain process blocks.

Note: The user get access permission by proposal association. We ask our users not to share their credentials. We aim to make it very easy for PIs to add new collaborators.



CHAPTER

ONE

OVERVIEW

We use Django and Django Rest Framework for build our backend API.

The *goodman-pipeline* package processes are very *granulated* as it should be. But for a web application such as ours we found out that the best option was to group many of the processes in blocks as described below. But in an observing run there are many types of files. We have *calibration* and *science* files.

1.1 File Types

Calibration files:
Calibration files are `BIAS` and `FLAT` files. They need to be combined into *master BIAS* and *master FLATs*. Each proposal has also associated a dedicated *data reduction settings* and there can be defined, among other things, what are the minimum number of calibration files required to trigger a combination of a *master BIAS* or *FLAT*.

Science files:
Science files are `EXPOSE SPECTRUM` and `ARC` though one can argue that `ARC` are calibration files, in a general sense they are treated as science files in this case.

1.2 Process Blocks

Reduce
Identifies suitable master flats and master bias and applies the *basic* data reduction process. For spectroscopic data it also trims the non-illuminated areas which produce artifacts. In general the process looks like this:

An `EXPOSE` files, which is the type given to *imaging data* can have the following process.

Image Trim Bias Subtract Flatfielding Cosmic Ray Removal

An `SPECTRUM` file will have the following:

Image Trim Slit Trim Bias Subtract Flatfielding Cosmic Ray Removal

Extract
Identifies targets in a `SPECTRUM` file and finds a suitable and compatible `ARC` lamps and performs fractional pixel extractions.

Identify Trace Extract

Wavelength Calibration
Using the extracted lamps it performs the wavelength calibration process using a template lamp from a library and series of cross correlations, then fits a mathematical model, resamples the spectrum to a linear dispersion axis and saves the file.

Flux Calibration
This is not implemented yet but it will.

Astrometric Solution
This functionality is under development.

CHAPTER

TWO

GETTING ACCESS

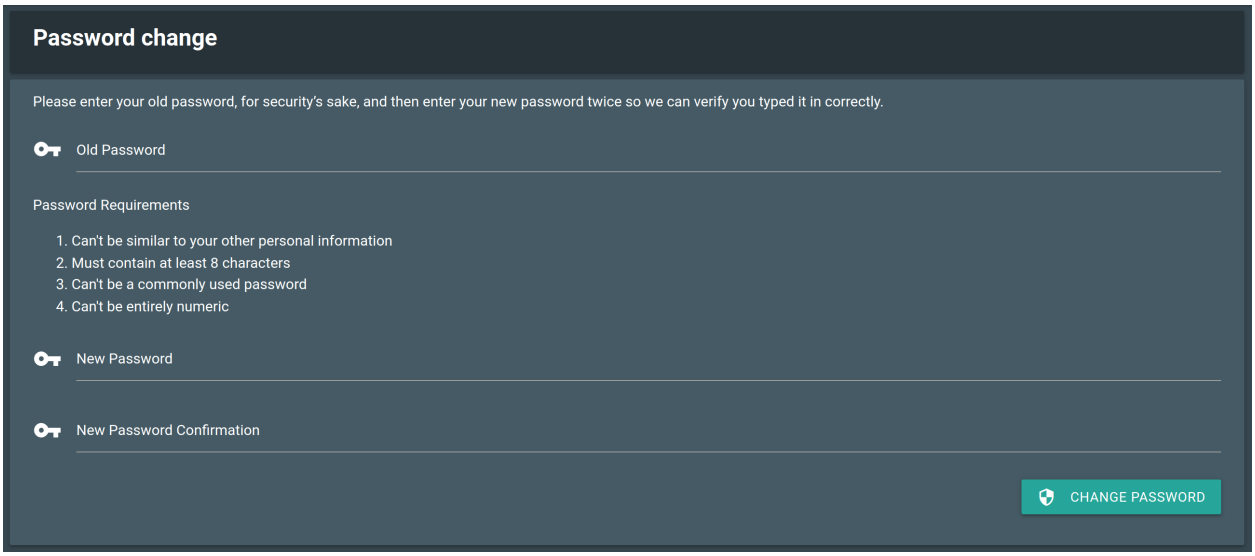
Warning: We allow everyone to have an account. Please don't share your credentials with anyone.

Any astronomer with an observing proposal can have access. Principal Investigators (PIs) can also create users to be added as collaborators to their respective proposals.

The server is protected under a VPN connection that you can get from your Instrument Scientist or by any trusted contact you have at SOAR Telescope.

At the beginning of the semester all PIs are registered with their respective proposals. And they will receive an email that contains a link to set a safe password. Our backend does not allow simple or too common password. In fact you will get the following messages.

- Your password can't be too similar to your other personal information.
- Your password must contain at least 8 characters.
- Your password can't be a commonly used password.
- Your password can't be entirely numeric.



CHAPTER

THREE

DATA VISUALIZATION

One of the greatest benefits from having a web user interface (UI) is the great flexibility it provides without having to install any special software and the data is downloaded through channels we use in our everyday life.

3.1 Understanding the UI

We will go into details later but for now this is what you see most of the time. It is meant to be simple to understand but we will go into explaining every part.

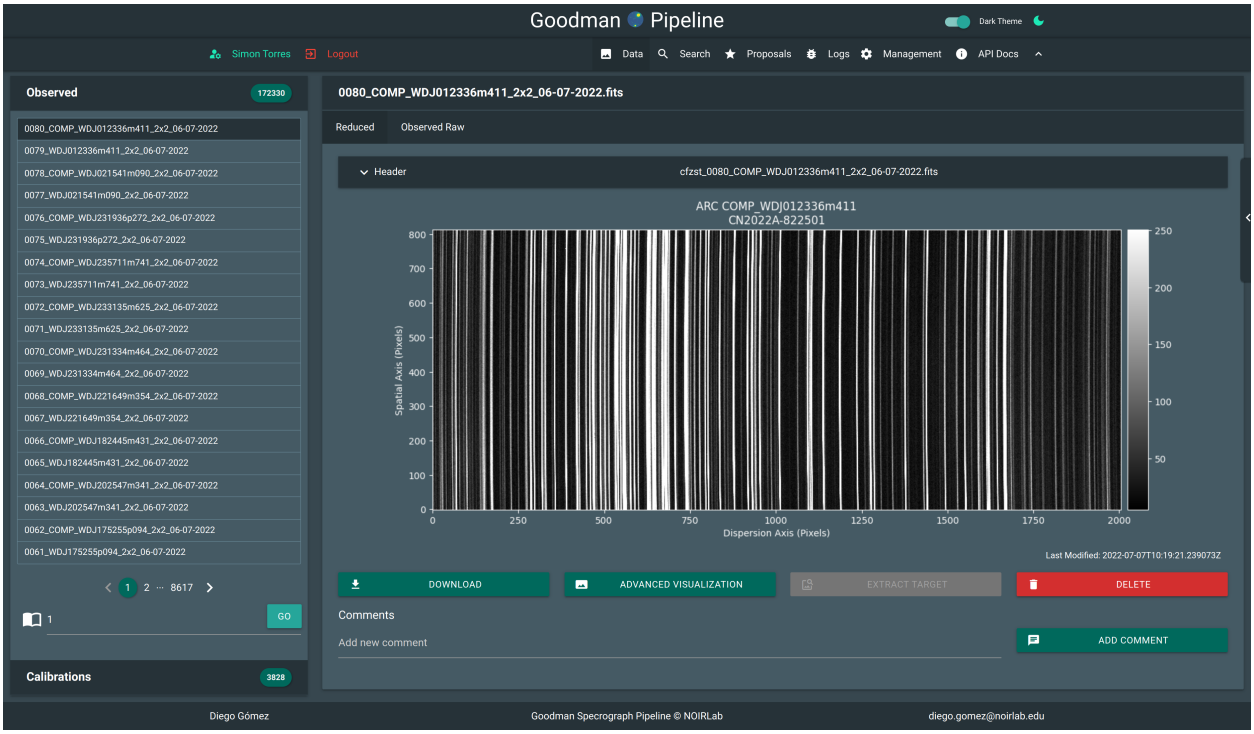


Fig. 1: Data detailed view.

For a detailed exploration we will divide the view in several subsections, for their global position please consider the following image.

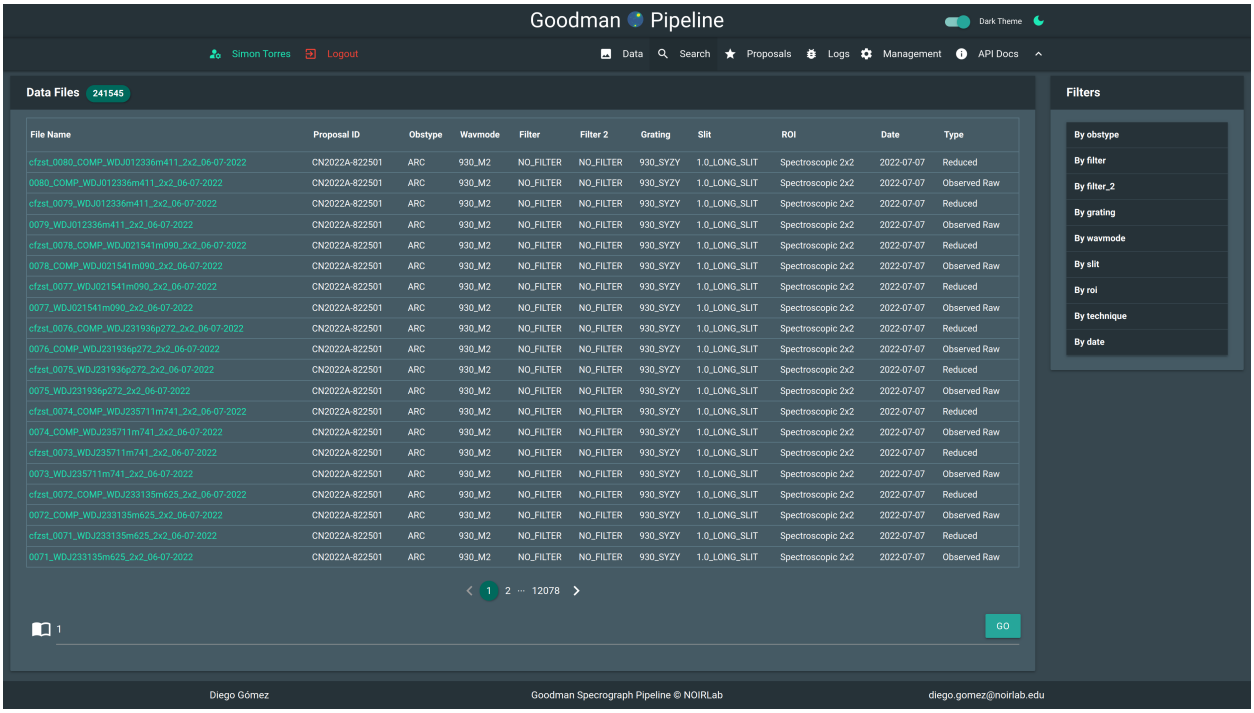
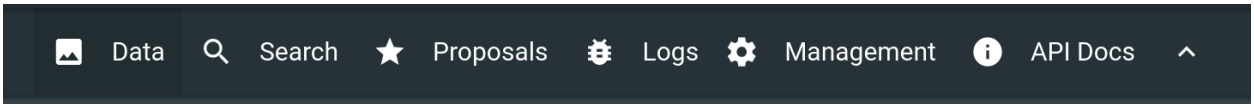


Fig. 2: Search view, implements some filtering functions.

Fig. 3: Detail: 1. Access to user controls and information. 2. Main navigation bar. 3. Quick access to files. 4. Related or child files. 5. Toggle header view. 6. Visualization area. 7. Visualization options. 8. Contextual actions. 9. Comments.

3.1.1 Main Navigation Bar



An always present navigation bar allows you to access:

Data Visualization
: The view were you can visualize data as it arrives as well as trigger actions.

Search
: Changes to Search view and implements filters.

Proposals
: Where you can see the proposals details, such as *Title*, *Abstract*, *Principal Investigator* and *Collaborators*. Also you can add or delete collaborators and edit the *Data Reduction Settings*.

Logs
: Important log messages, not very detailed but the most relevants.

Management Menu
: This is for staff users only and will be explained in the staff chapter.

API Docs
: Contains the documentation of the Public API in case you want to develop your own tools.

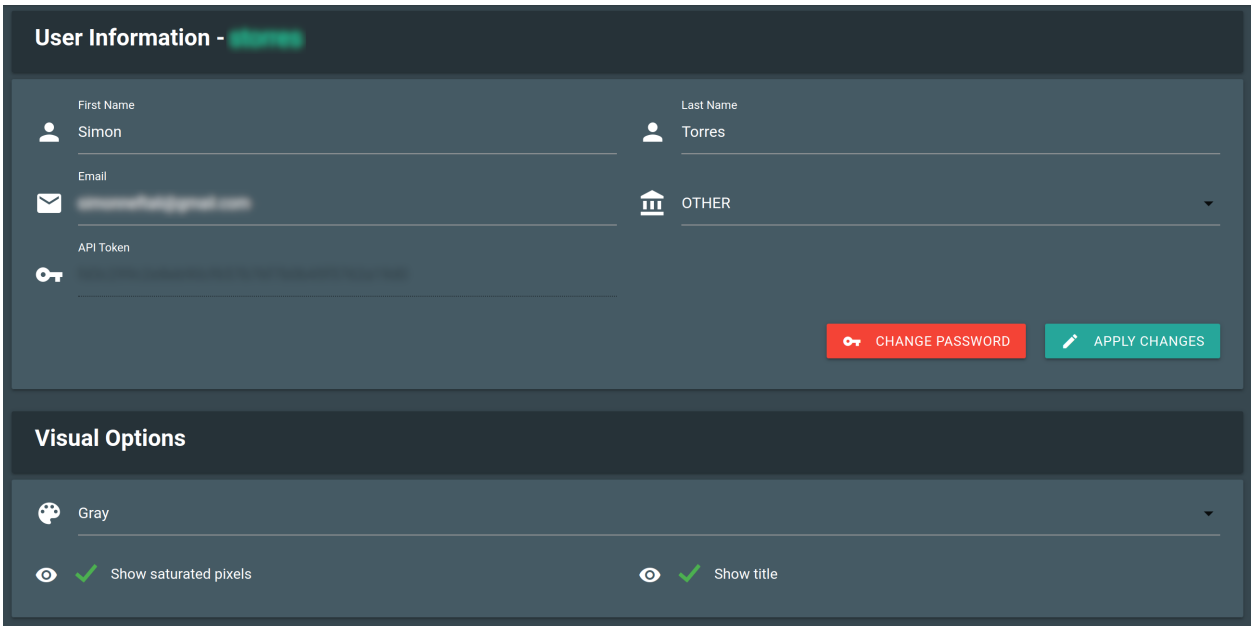
3.1.2 User Controls

By clicking the username button you get access to some user details and settings. Also you can change some preferences.

3.1.3 File Index

This area allows you to navigate the files, they are ordered from newest to oldest, if you want to filter the data you should go to **Search**.

In this area you can also see only combined calibration files such as, master `BIAS` and master `FLAT`, those are visible to everyone.



3.1.4 Related Files

All files are indexed by its raw parent file. Every file that was derived from that parent it is treated as child and are listed along this section. The buttons are tab handles.

3.1.5 Header

Will make the header visible in a searchable table.

3.1.6 Visualization Choices

Allows to select a different color map for images, show or not saturated pixels and an image title.

3.1.7 Contextual Actions

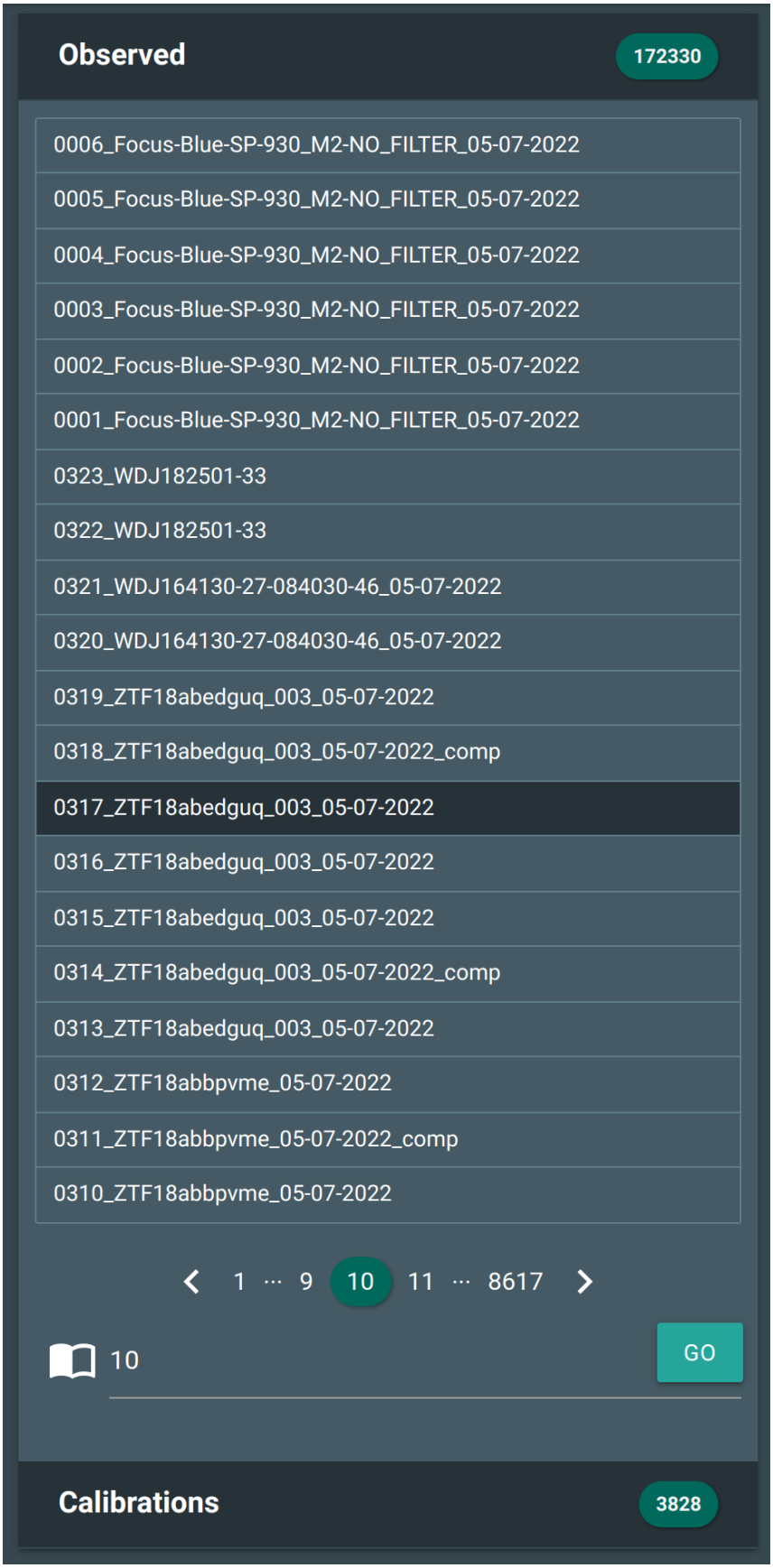
This area is where you can trigger actions.

Download
: For download the FITS file.

Advanced Visualization
: Takes you to another view where you can adjust the sampling limits for images. Or change the color map.

Calibrate Flux
: It's an action that changes according the type of file that is on display. For instance for a raw file will be **Reduce Raw File**.

Delete
: Only possible for processed files. Raw files can't be deleted.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0004_Focus-Blue-SP-930_M2-NO_FILTER_05-07-2022
0003_Focus-Blue-SP-930_M2-NO_FILTER_05-07-2022
0002_Focus-Blue-SP-930_M2-NO_FILTER_05-07-2022
0001_Focus-Blue-SP-930_M2-NO_FILTER_05-07-2022
0323_WDJ182501-33
0322_WDJ182501-33
0321_WDJ164130-27-084030-46_05-07-2022
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0318_ZTF18abedguq_003_05-07-2022_comp
0317_ZTF18abedguq_003_05-07-2022
0316_ZTF18abedguq_003_05-07-2022
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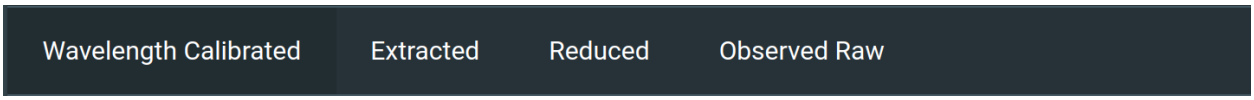
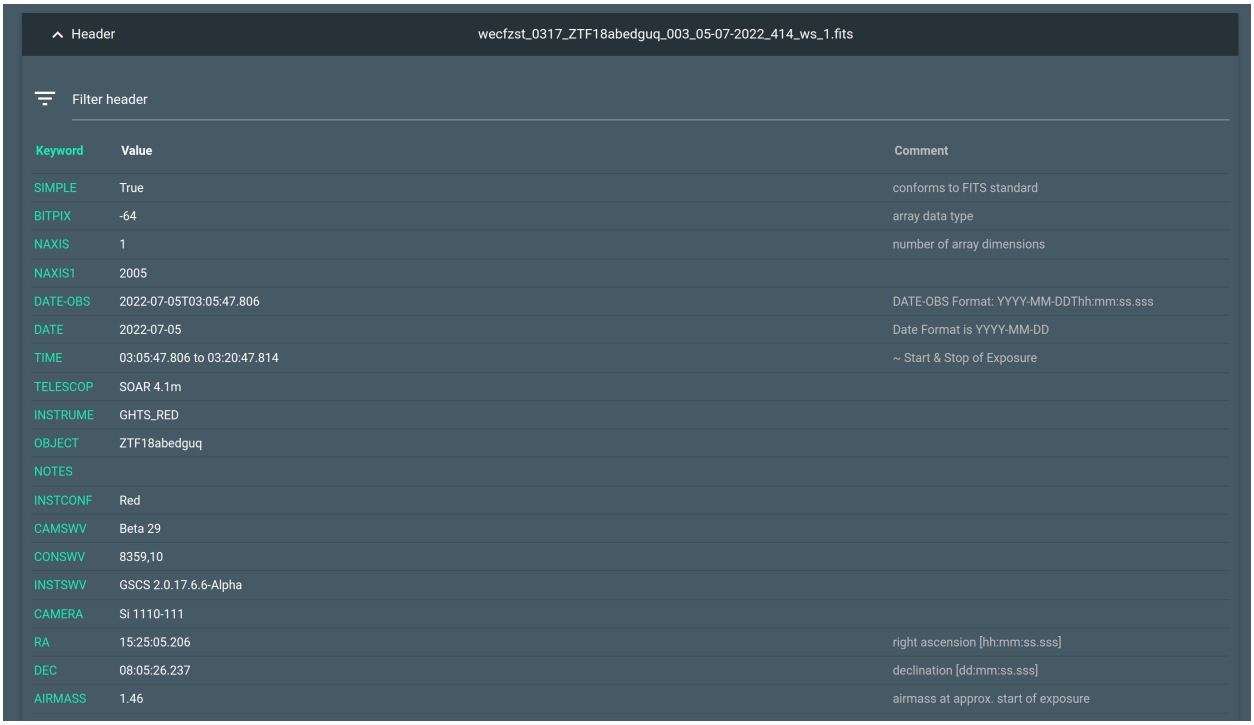
3828


Wavelength Calibrated
Extracted
Reduced
Observed Raw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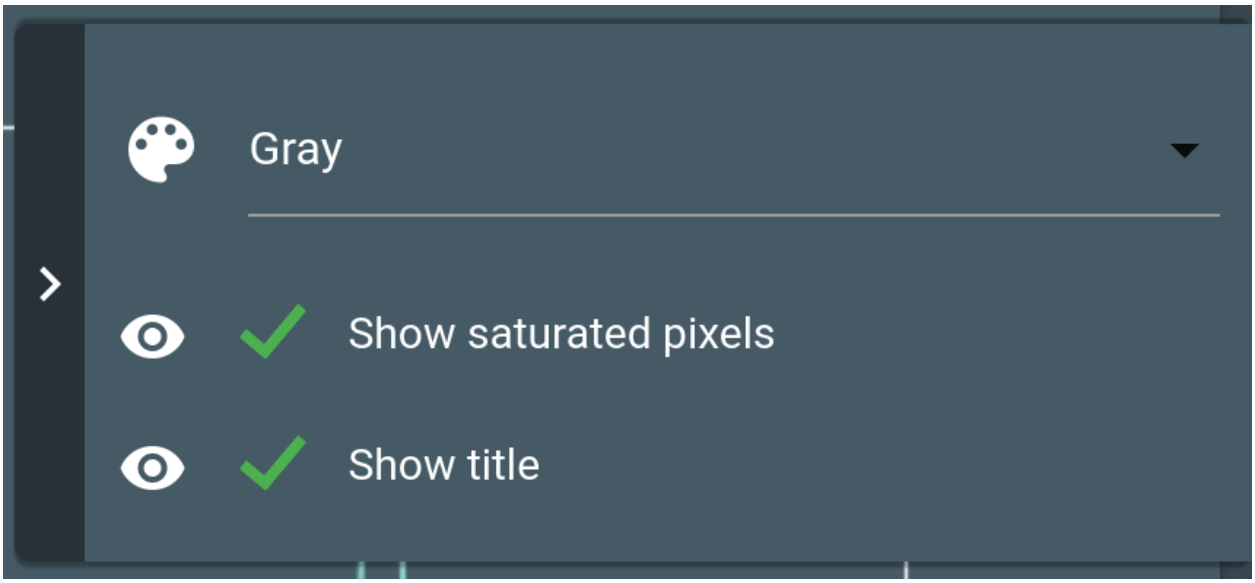
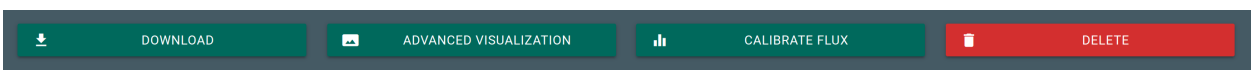
wecfzst_0317_ZTF18abedguq_003_05-07-2022_414_ws_1.fits
Filter header
Keyword Value Comment
SIMPLE True conforms to FITS standard
BITPIX -64 array data type
NAXIS 1 number of array dimensions
NAXIS1 2005
DATE-OBS 2022-07-05T03:05:47.806 DATE-OBS Format: YYYY-MM-DDThh:mm:ss.sss
DATE 2022-07-05 Date Format is YYYY-MM-DD
TIME 03:05:47.806 to 03:20:47.814 ~ Start & Stop of Exposure
TELESCOP SOAR 4.1m
INSTRUME GHTS_RED
OBJECT ZTF18abedguq
NOTES
INSTCONF Red
CAMSWV Beta 29
CONSWV 8359,10
INSTSWV GSCS 2.0.17.6.6-Alpha
CAMERA Si 1110-111
RA 15:25:05.206 right ascension [hh:mm:ss.sss]
DEC 08:05:26.237 declination [dd:mm:ss.sss]
AIRMASS 1.46 airmass at approx. start of exposure


Gray
Show saturated pixels
Show title


DOWNLOAD
ADVANCED VISUALIZATION
CALIBRATE FLUX
DELETE

3.1.8 Visualization Area

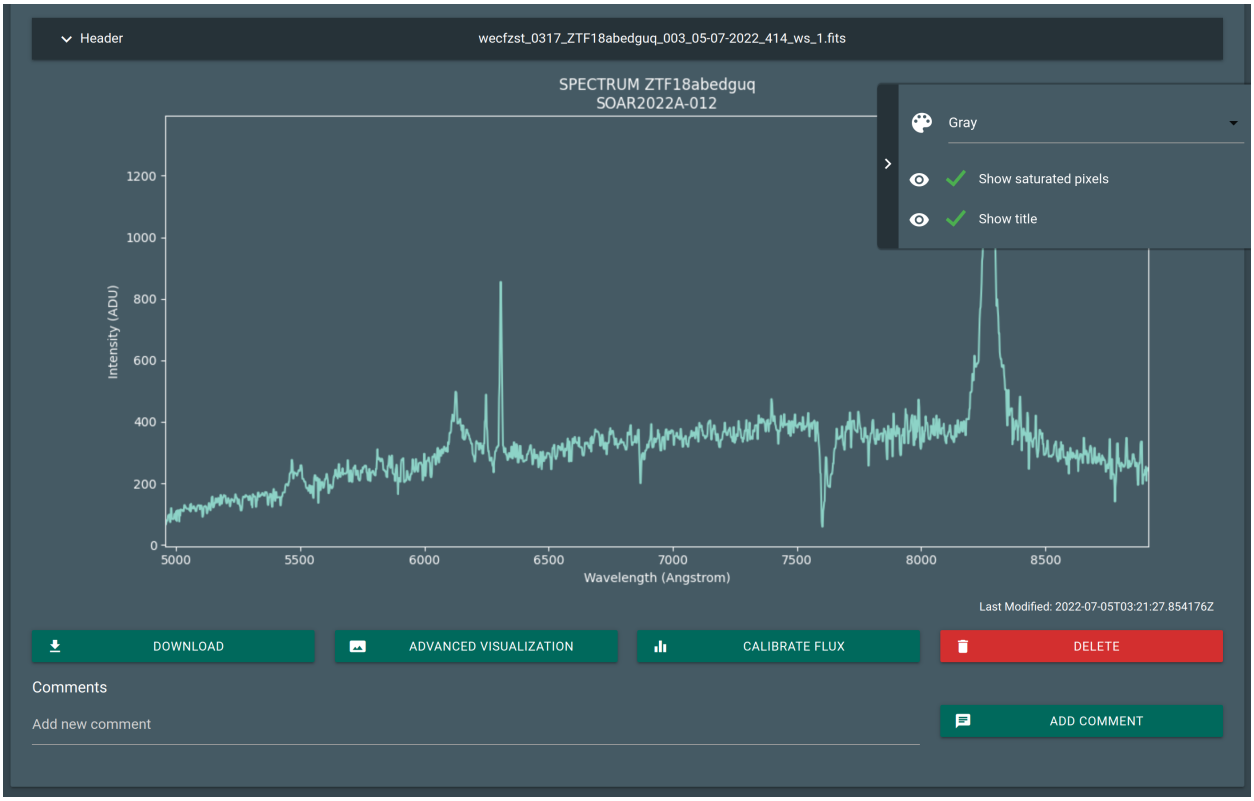


Fig. 4: Example of a static data visualization.

In this area you see the plots or the images. There is an interactive way that uses Bokeh but is slower. and for now it only allows you to zoom in or out.

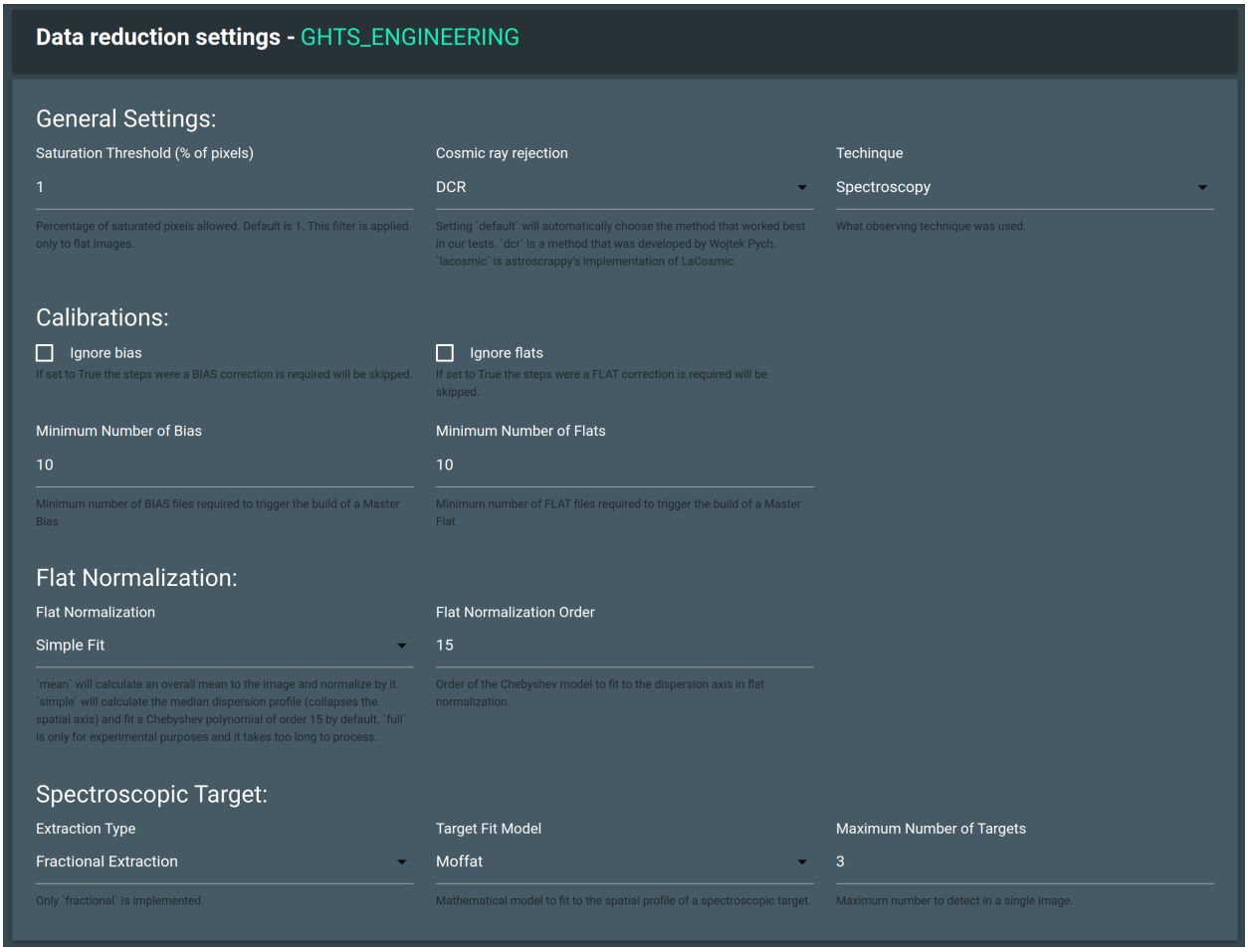
CHAPTER

FOUR

DATA REDUCTION SETTINGS

In your navigation bar click in **Proposals** then the cogs icon.

Now you can change the settings that will be used for this particular proposal in all reduction steps and in every new file.



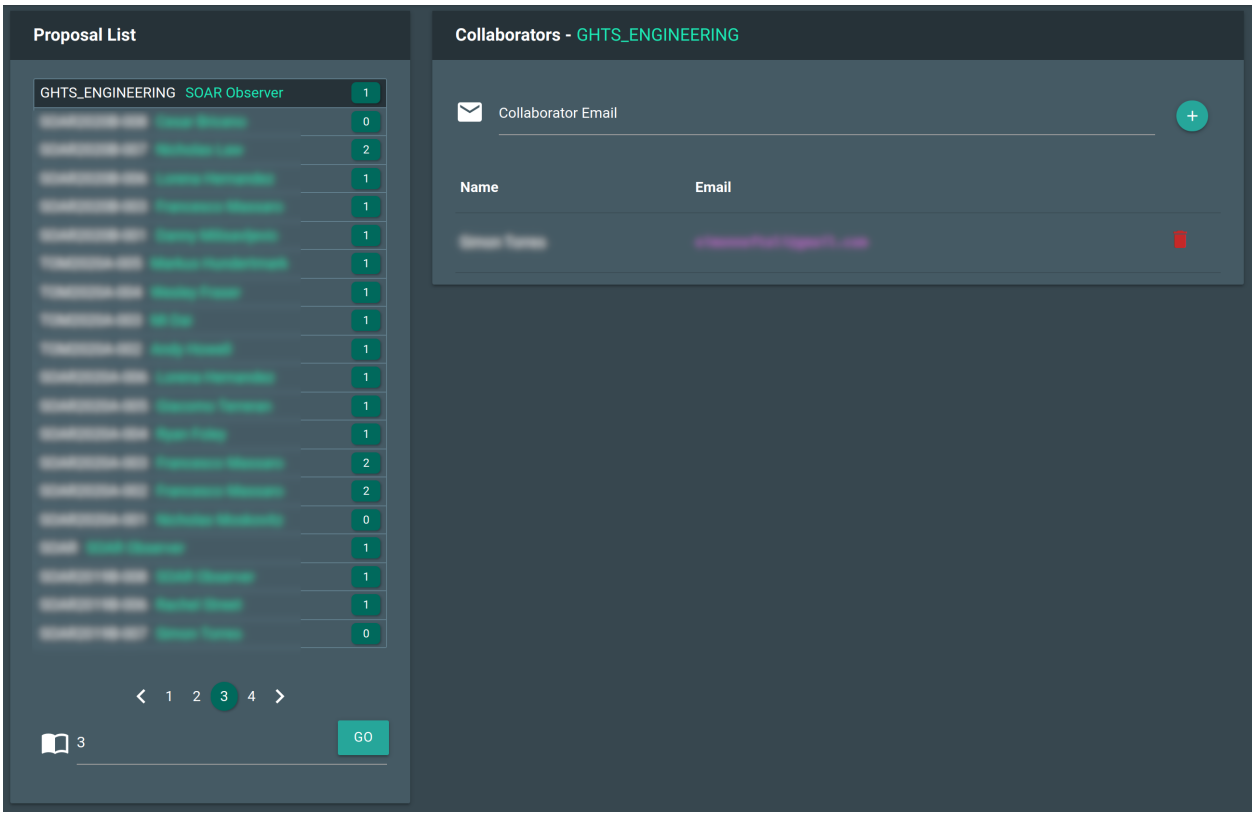
CHAPTER

FIVE

COLLABORATORS

Click in **Proposals** and then the *Person* + icon.

Now you can add or remove collaborators for all the proposals you have permissions to do so. If you are a collaborator you can't add or remove other collaborators.



CHAPTER

SIX

API DOCUMENTATION

More on this can be found on *Developer's Guide* chapter. You can get here from clicking **API Docs** in the navigation bar.

In this section you can even try the API if you are authenticated.

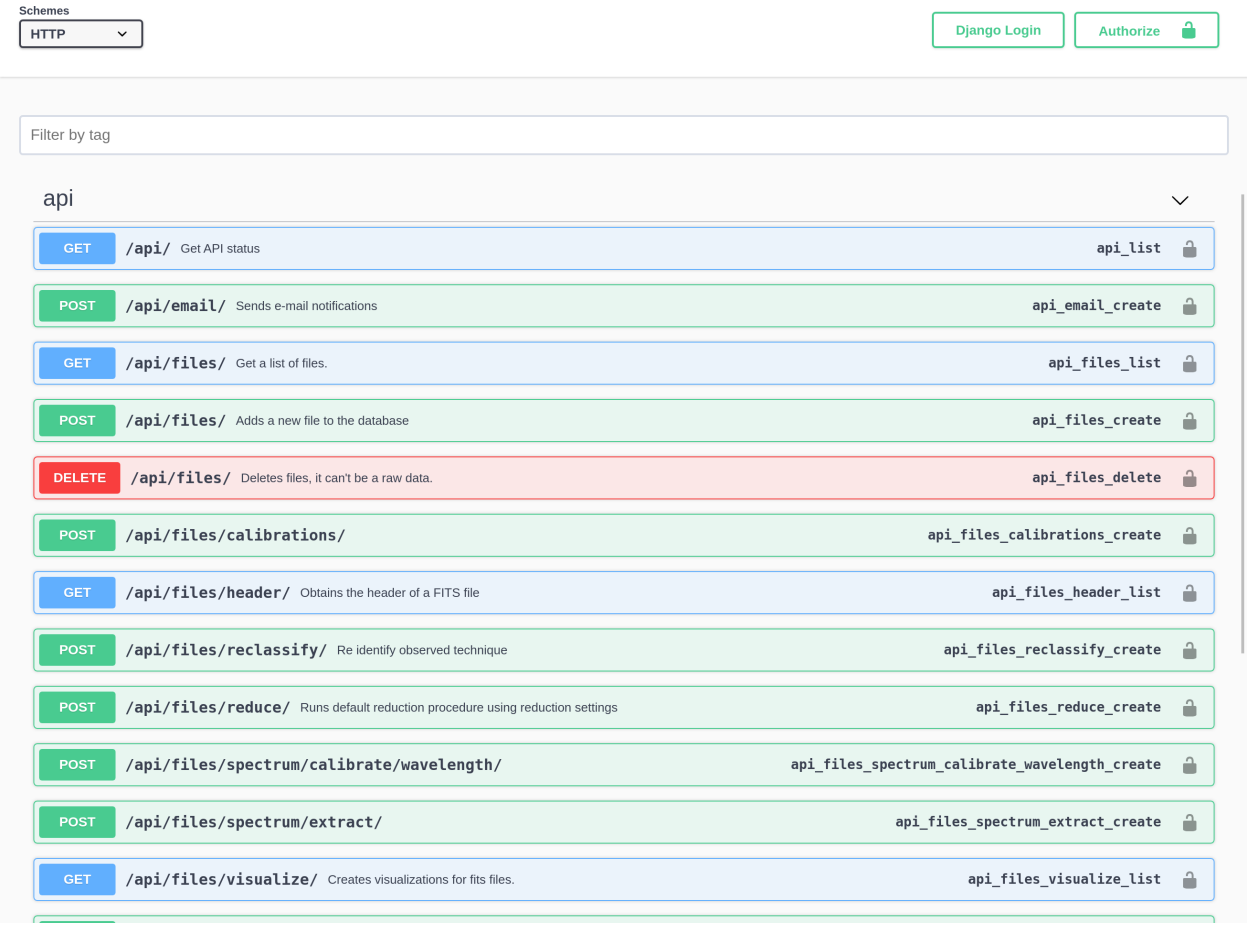
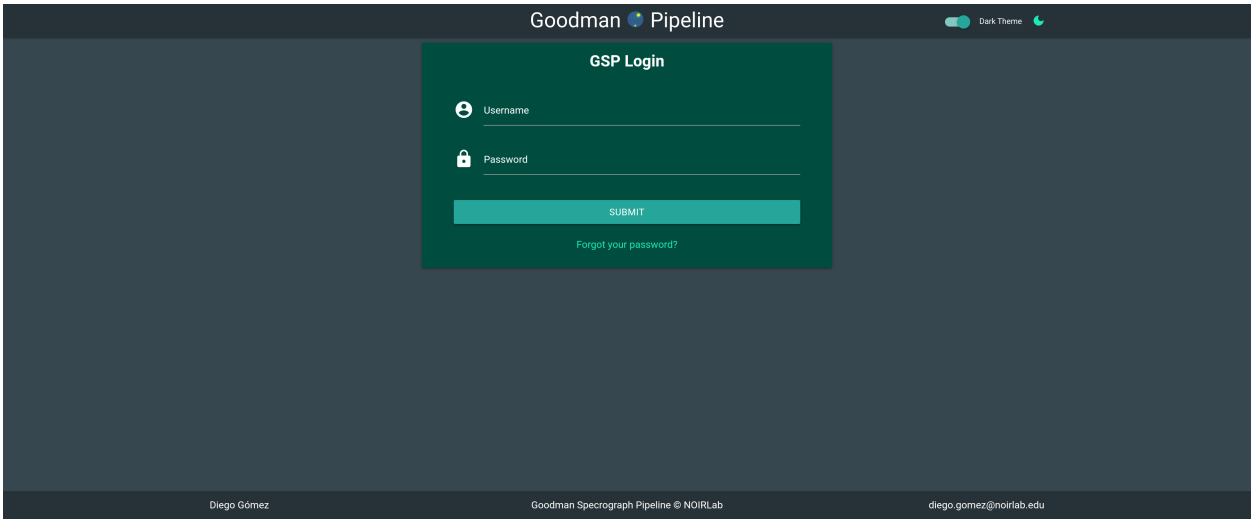


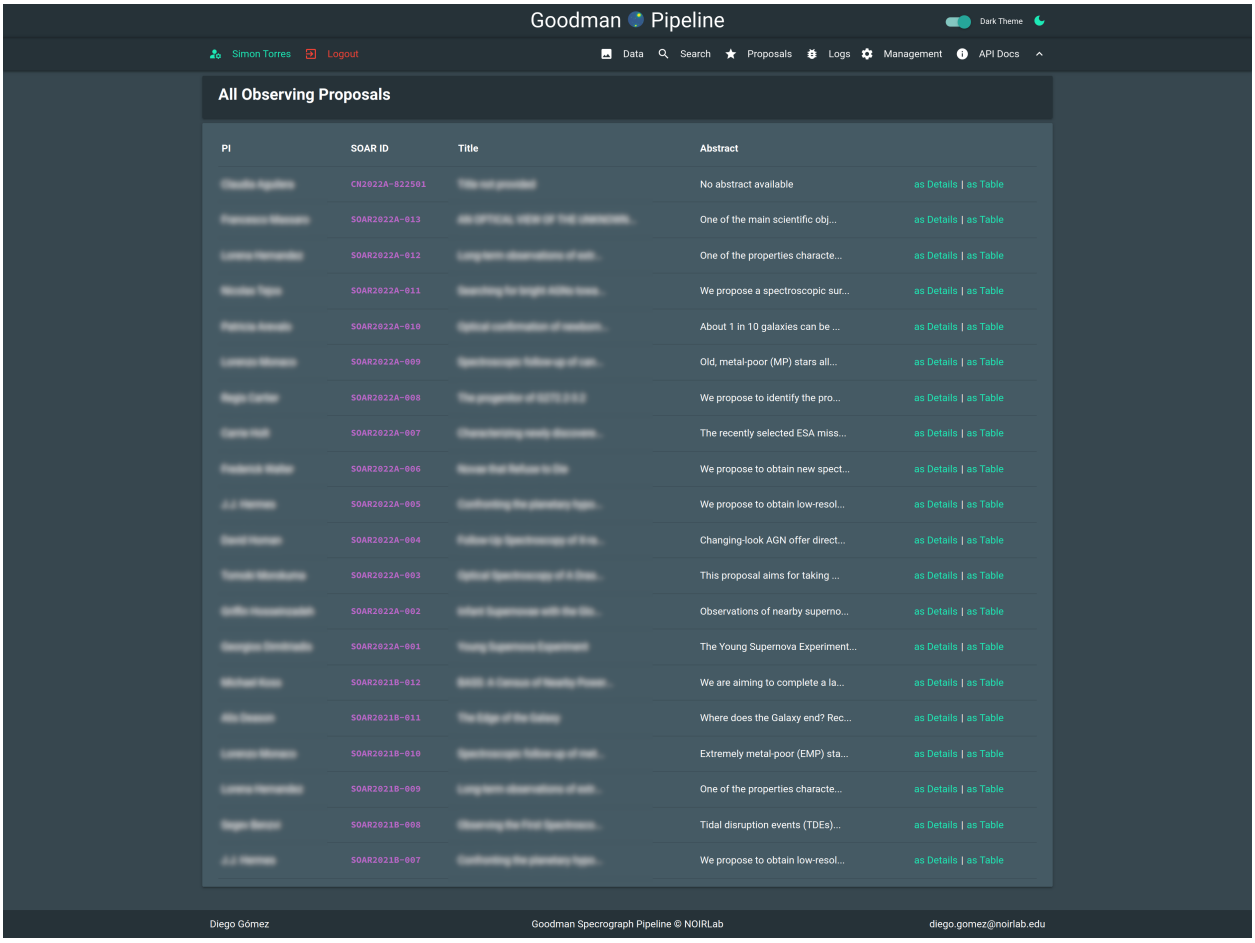
Fig. 1: Public API documentation.

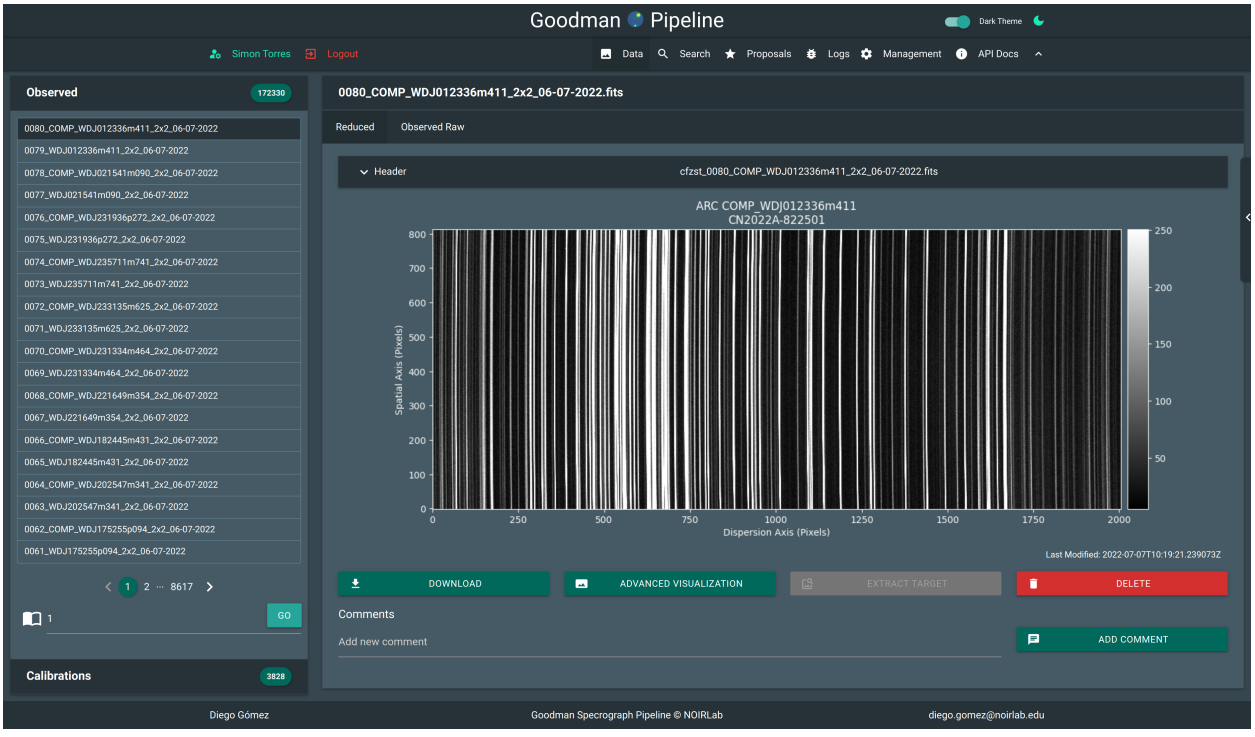
CHAPTER

SEVEN

SCREENSHOTS




Goodman Pipeline
Dark Theme
Simon Torres
Logout
Data
Search
Proposals
Logs
Management
API Docs
All Observing Proposals
PI
SOAR ID
Title
Abstract
No abstract available
One of the main scientific obj...
One of the properties characte...
We propose a spectroscopic sur...
About 1 in 10 galaxies can be ...
Old, metal-poor (MP) stars all...
We propose to identify the pro...
The recently selected ESA miss...
We propose to obtain new spect...
We propose to obtain low-resol...
Changing-look AGN offer direct...
This proposal aims for taking ...
Observations of nearby superno...
The Young Supernova Experiment...
We are aiming to complete a la...
Where does the Galaxy end? Rec...
Extremely metal-poor (EMP) sta...
Tidal disruption events (TDEs)...
as Details | as Table
Diego Gómez
Goodman Specrograph Pipeline © NOIRLab
diego.gomez@noirlab.edu


Goodman Pipeline
Dark Theme
Simon Torres
Logout
Data
Search
Proposals
Logs
Management
API Docs
Observed
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1 2 ··· 8617
GO
Calibrations
3828
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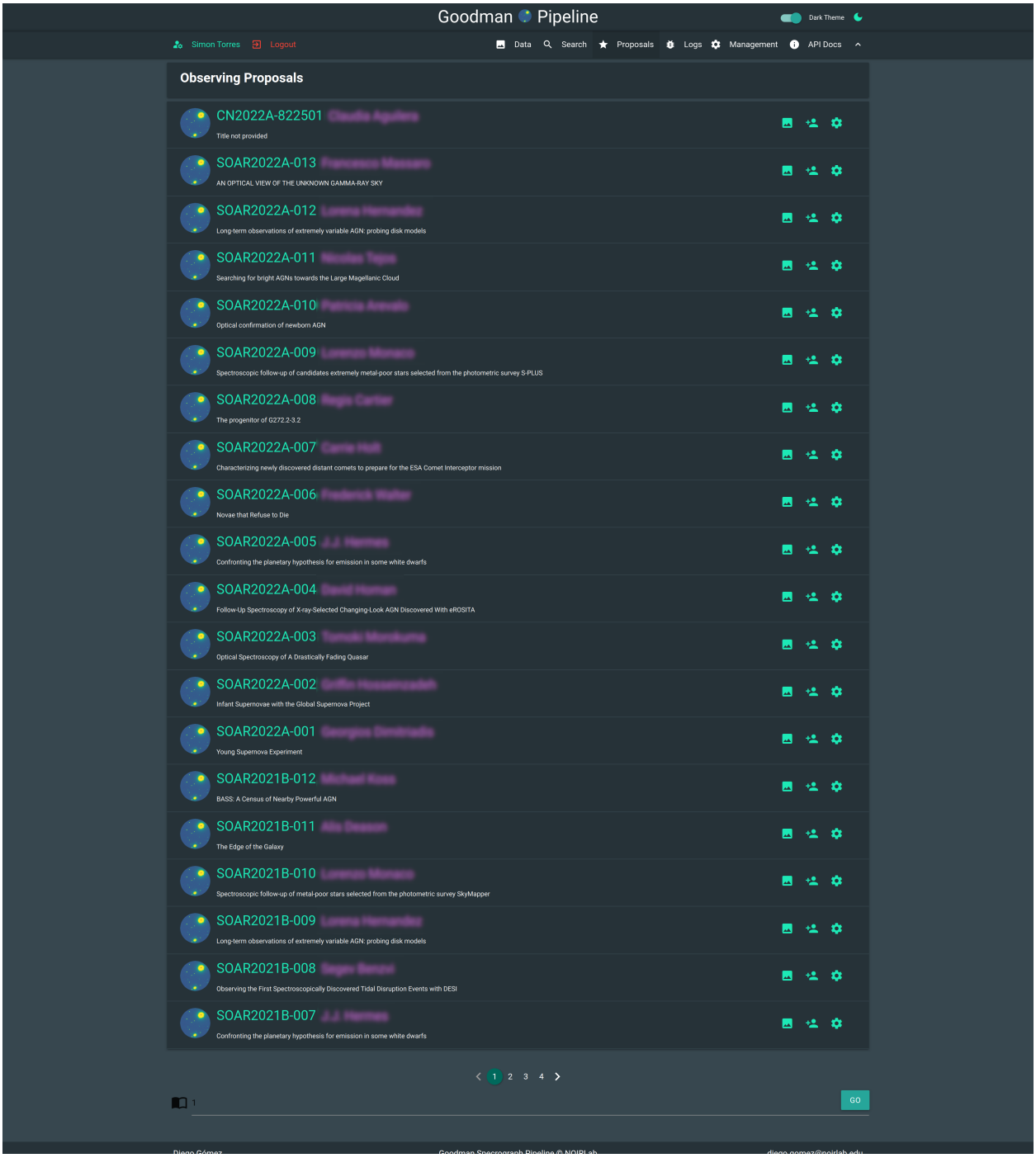
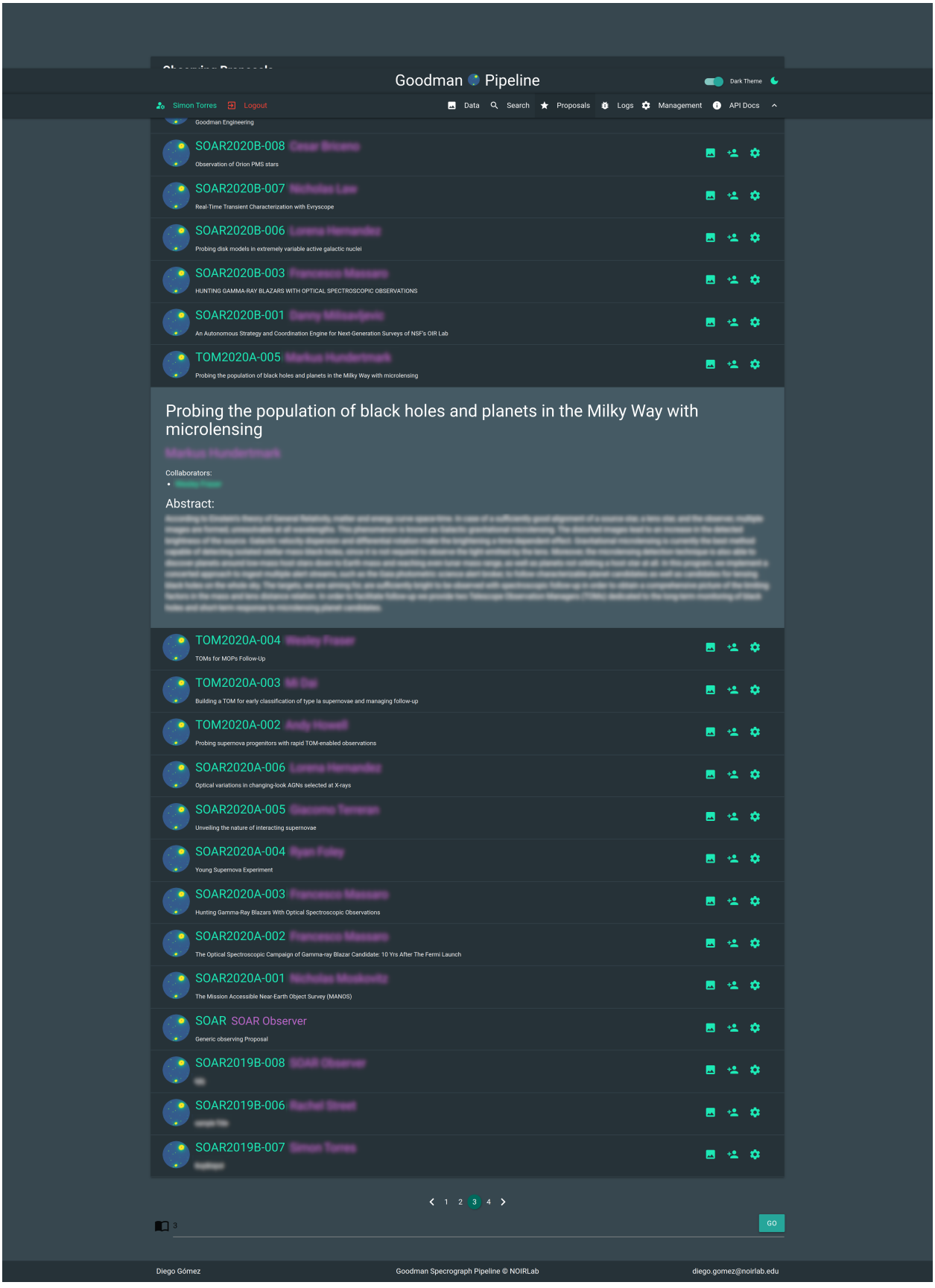
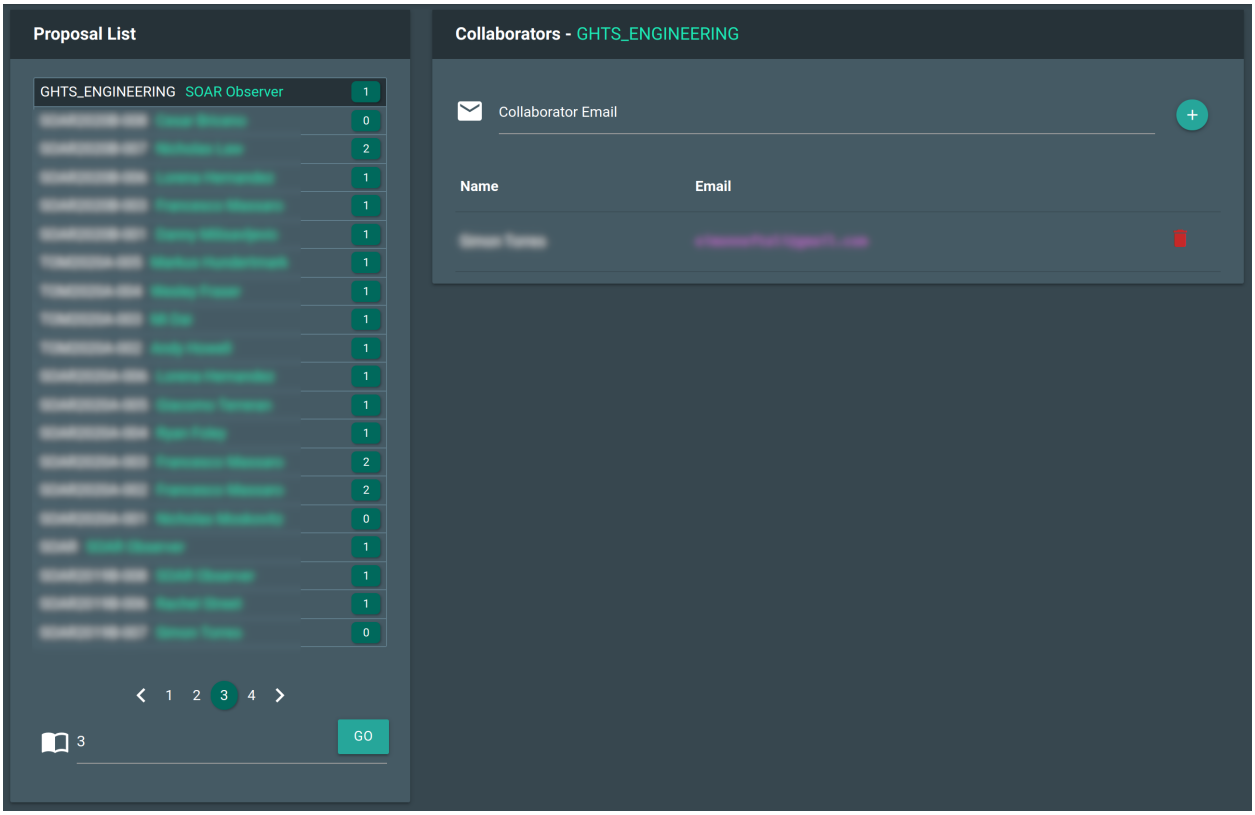
Reduced
Observed Raw
Header
cfzst_0080_COMP_WDJ012336m411_2x2_06-07-2022.fits
ARC COMP_WDJ012336m411
CN2022A-822501
Spatial Axis (Pixels)
Dispersion Axis (Pixels)
Last Modified: 2022-07-07T10:19:21.239073Z
DOWNLOAD
ADVANCED VISUALIZATION
EXTRACT TARGET
DELETE
Comments
Add new comment
ADD COMMENT
Diego Gómez
Goodman Specrograph Pipeline © NOIRLab
diego.gomez@noirlab.edu


Goodman Pipeline
Dark Theme
Simon Torres
Logout
Data
Search
Proposals
Logs
Management
API Docs
Observing Proposals
CN2022A-822501
Title not provided
SOAR2022A-013
AN OPTICAL VIEW OF THE UNKNOWN GAMMA-RAY SKY
SOAR2022A-012
Long-term observations of extremely variable AGN: probing disk models
SOAR2022A-011
Searching for bright AGNs towards the Large Magellanic Cloud
SOAR2022A-010
Optical confirmation of newborn AGN
SOAR2022A-009
Spectroscopic follow-up of candidates extremely metal-poor stars selected from the photometric survey S-PLUS
SOAR2022A-008
The progenitor of G272.2-3.2
SOAR2022A-007
Characterizing newly discovered distant comets to prepare for the ESA Comet Interceptor mission
SOAR2022A-006
Novae that Refuse to Die
SOAR2022A-005
Confronting the planetary hypothesis for emission in some white dwarfs
SOAR2022A-004
Follow-Up Spectroscopy of X-ray-Selected Changing-Look AGN Discovered With eROSITA
SOAR2022A-003
Optical Spectroscopy of A Drastically Fading Quasar
SOAR2022A-002
Infant Supernovae with the Global Supernova Project
SOAR2022A-001
Young Supernova Experiment
SOAR2021B-012
BASS: A Census of Nearby Powerful AGN
SOAR2021B-011
The Edge of the Galaxy
SOAR2021B-010
Spectroscopic follow-up of metal-poor stars selected from the photometric survey SkyMapper
SOAR2021B-009
Long-term observations of extremely variable AGN: probing disk models
SOAR2021B-008
Observing the First Spectroscopically Discovered Tidal Disruption Events with DESI
SOAR2021B-007
Confronting the planetary hypothesis for emission in some white dwarfs
1 2 3 4
GO


Goodman Pipeline
Dark Theme
Simon Torres
Logout
Data
Search
Proposals
Logs
Management
API Docs
Goodman Engineering
SOAR2020B-008
Observation of Orion PMS stars
SOAR2020B-007
Real-Time Transient Characterization with Evryscope
SOAR2020B-006
Probing disk models in extremely variable active galactic nuclei
SOAR2020B-003
HUNTING GAMMA-RAY BLAZARS WITH OPTICAL SPECTROSCOPIC OBSERVATIONS
SOAR2020B-001
An Autonomous Strategy and Coordination Engine for Next-Generation Surveys of NSF's OIR Lab
TOM2020A-005
Probing the population of black holes and planets in the Milky Way with microlensing
Probing the population of black holes and planets in the Milky Way with microlensing
Collaborators:
Abstract:
TOM2020A-004
TOMs for MOPs Follow-Up
TOM2020A-003
Building a TOM for early classification of type Ia supernovae and managing follow-up
TOM2020A-002
Probing supernova progenitors with rapid TOM-enabled observations
SOAR2020A-006
Optical variations in changing-look AGNs selected at X-rays
SOAR2020A-005
Unveiling the nature of interacting supernovae
SOAR2020A-004
Young Supernova Experiment
SOAR2020A-003
Hunting Gamma-Ray Blazars With Optical Spectroscopic Observations
SOAR2020A-002
The Optical Spectroscopic Campaign of Gamma-ray Blazar Candidate: 10 Yrs After The Fermi Launch
SOAR2020A-001
The Mission Accessible Near-Earth Object Survey (MANOS)
SOAR SOAR Observer
Generic observing Proposal
SOAR2019B-008
SOAR2019B-006
SOAR2019B-007
1 2 3 4
3
GO
Diego Gómez
Goodman Specrograph Pipeline © NOIRLab
diego.gomez@noirlab.edu


Proposal List
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3
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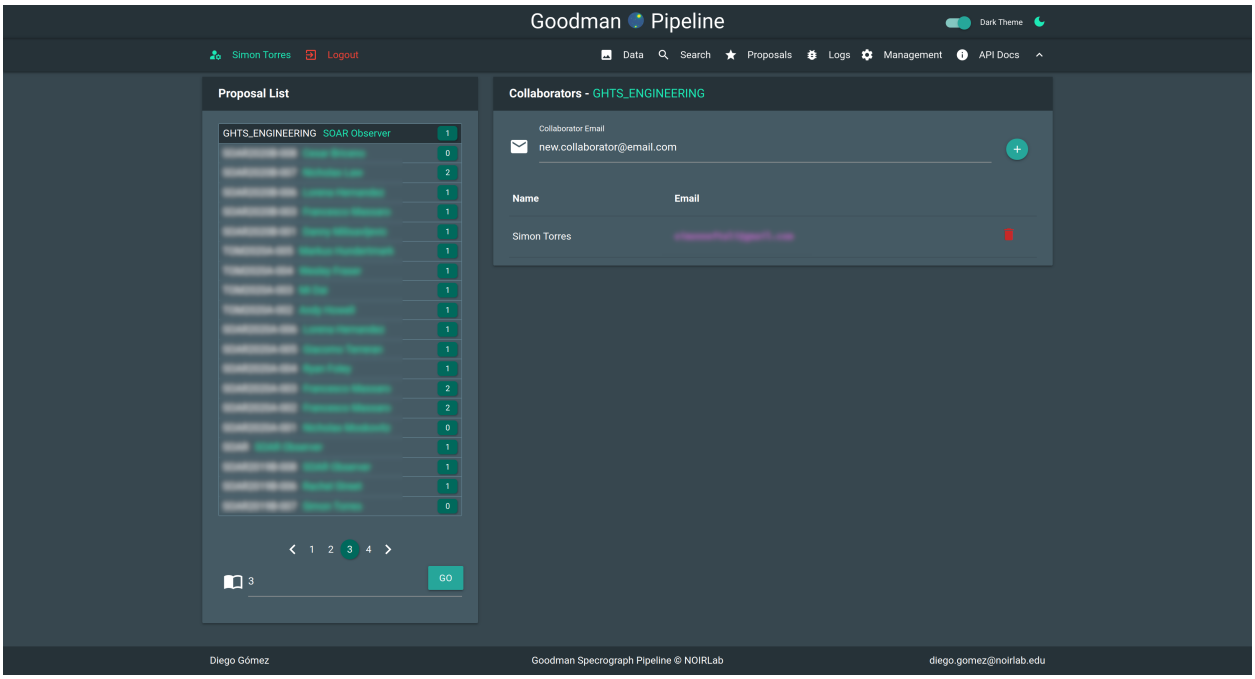
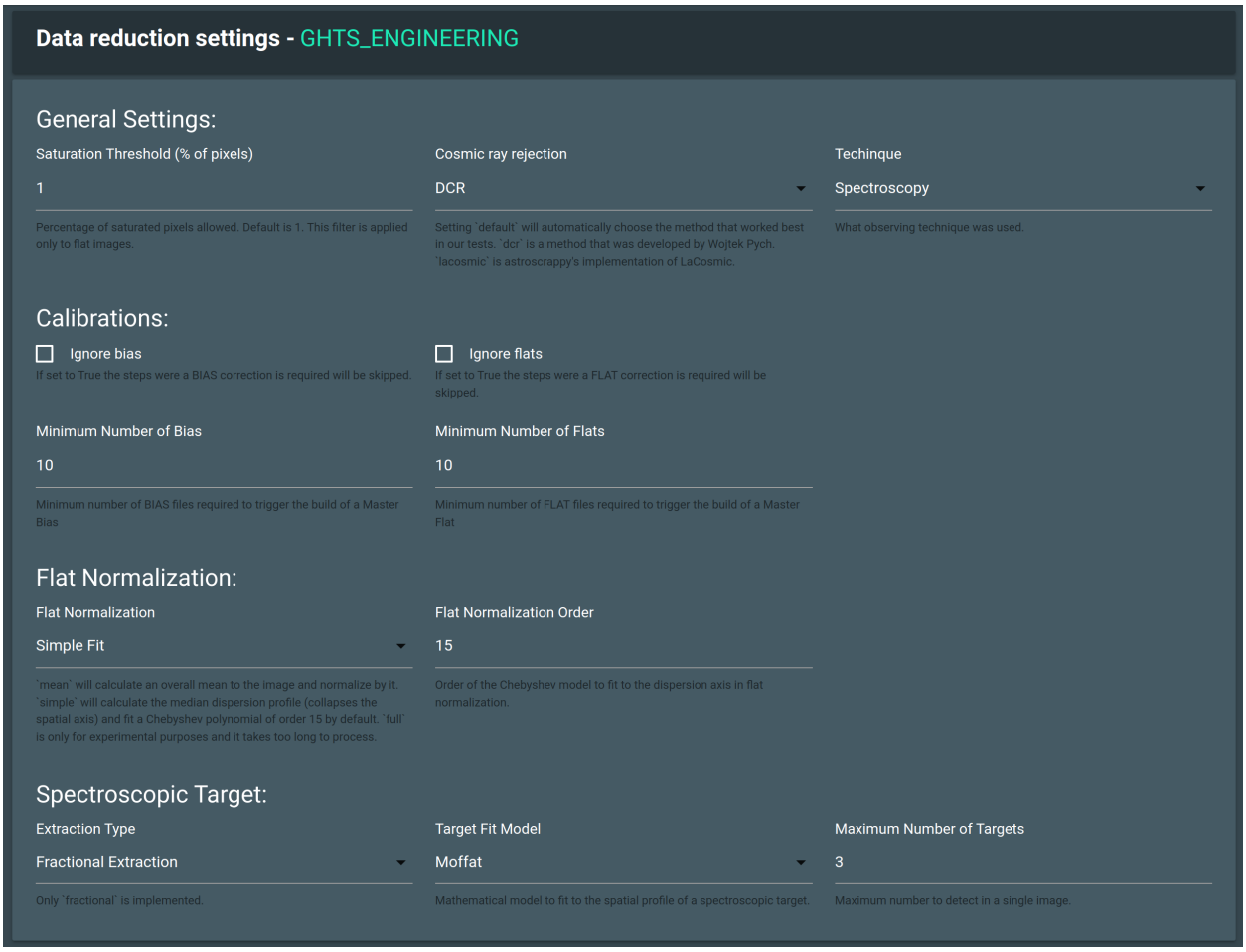
Collaborator Email
Name
Email


Goodman Pipeline
Dark Theme
Simon Torres
Logout
Data
Search
Proposals
Logs
Management
API Docs
Proposal List
GHTS_ENGINEERING SOAR Observer 1
1 2 3 4
3
GO
Collaborators - GHTS_ENGINEERING
Collaborator Email
new.collaborator@email.com
Name
Email
Simon Torres
Diego Gómez
Goodman Specrograph Pipeline © NOIRLab
diego.gomez@noirlab.edu


Data reduction settings - GHTS_ENGINEERING
General Settings:
Saturation Threshold (% of pixels)
1
Percentage of saturated pixels allowed. Default is 1. This filter is applied only to flat images.
Cosmic ray rejection
DCR
Setting `default` will automatically choose the method that worked best in our tests. `dcr` is a method that was developed by Wojtek Pych. `lacosmic` is astroscrappy's implementation of LaCosmic.
Techinque
Spectroscopy
What observing technique was used.
Calibrations:
Ignore bias
If set to True the steps were a BIAS correction is required will be skipped.
Ignore flats
If set to True the steps were a FLAT correction is required will be skipped.
Minimum Number of Bias
10
Minimum number of BIAS files required to trigger the build of a Master Bias
Minimum Number of Flats
10
Minimum number of FLAT files required to trigger the build of a Master Flat
Flat Normalization:
Flat Normalization
Simple Fit
`mean` will calculate an overall mean to the image and normalize by it. `simple` will calculate the median dispersion profile (collapses the spatial axis) and fit a Chebyshev polynomial of order 15 by default. `full` is only for experimental purposes and it takes too long to process.
Flat Normalization Order
15
Order of the Chebyshev model to fit to the dispersion axis in flat normalization.
Spectroscopic Target:
Extraction Type
Fractional Extraction
Only `fractional` is implemented.
Target Fit Model
Moffat
Mathematical model to fit to the spatial profile of a spectroscopic target.
Maximum Number of Targets
3
Maximum number to detect in a single image.

CHAPTER

EIGHT

ADDING NEW USERS

Warning: This section is meant for **staff** users only

There are several ways you can access the user creation form. The faster would be:

Management Add User

Another way that will take you to the same form is:

Management Manage Users click **Add new**

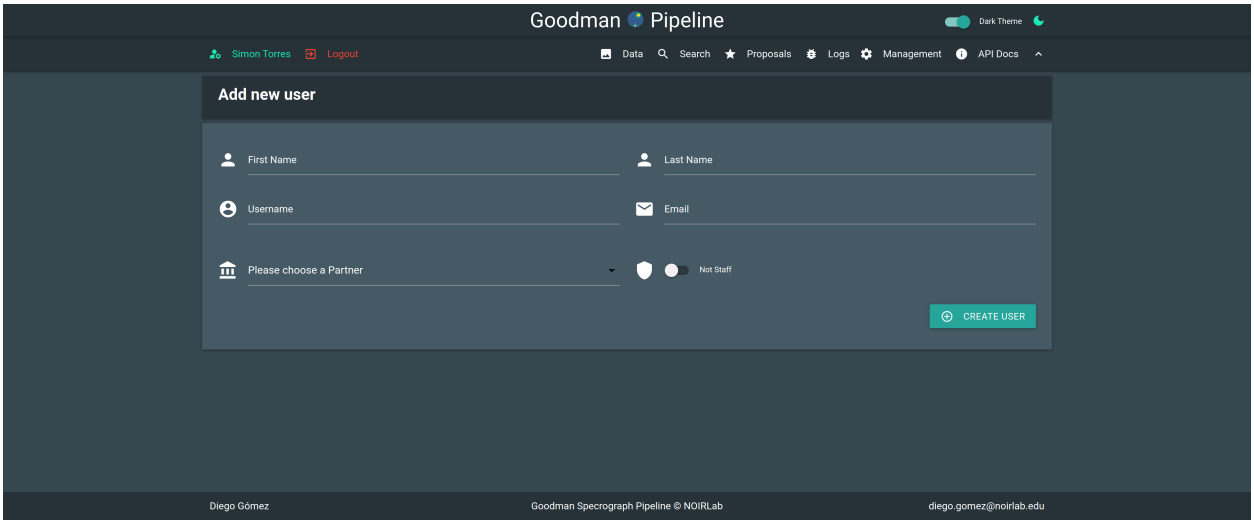


Fig. 1: Add new user form

Note: Staff users can only be added from a super user account for now.

And the last one would be through Proposals's Collaborators

CHAPTER

NINE

ADDING NEW OBSERVING PROPOSALS

Warning: This section is meant for **staff** users only

If you created a user as described in *Adding new Users* you will be redirected to the *proposal creation form* However there are other ways too.

Management Add Proposal

and

Management Manage Proposals click **Add new**

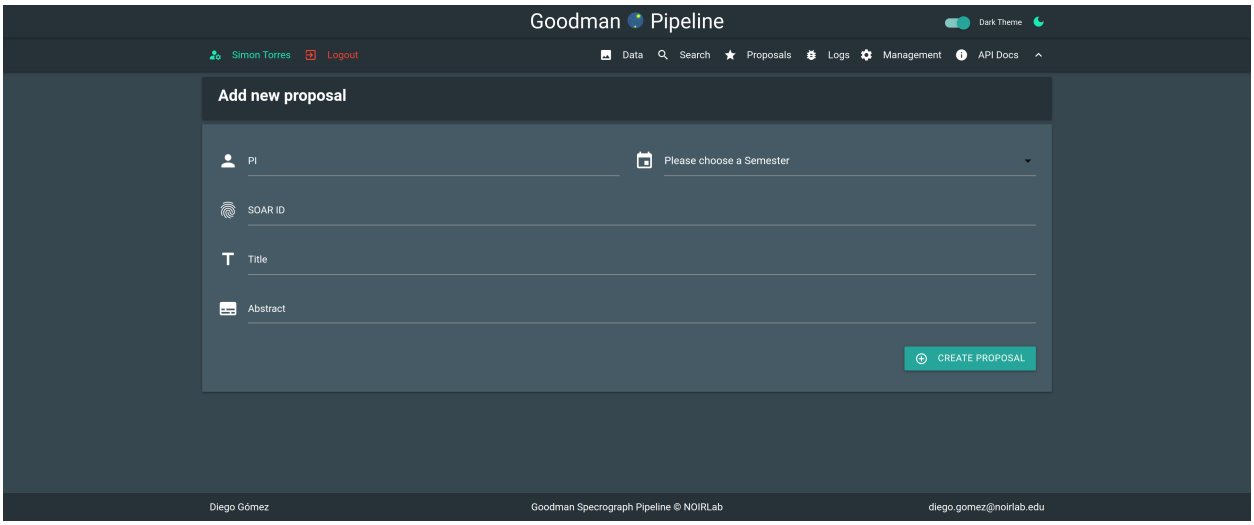


Fig. 1: Add new proposal form

Make sure the SOAR ID is correct or PI or collaborators will not be able to see their data. The *Soar id* default value is set automatically depending on current semester and count.

CHAPTER

TEN

OVERVIEW

The Public API is thoroughly documented using swagger.

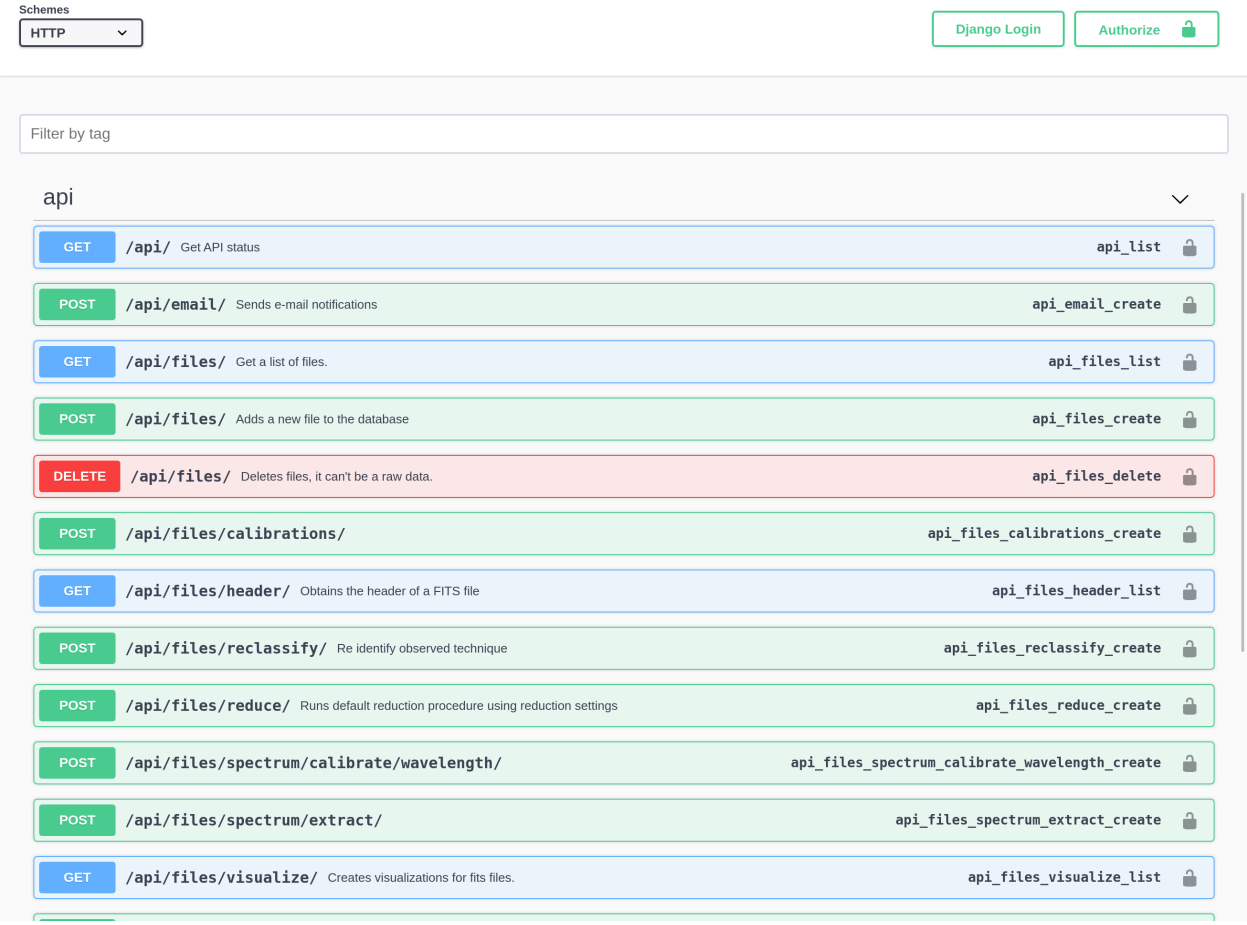


Fig. 1: Public API documentation.

CHAPTER

ELEVEN

API EXAMPLES

Warning: Always trust the API docs page instead because it is updated along the API itself.

11.1 Get the list of raw files

```
import requests

api_key = 'some-fake-api-key-that-does-not-work'

# define request headers
headers = {'Authorization': f"Token {api_key}",
           'Content-Type': 'application/json'}

#define parameters
# 0: Raw files
# 1: Calibration Files (Master flats or bias)
# 2: Reduced files
# 3: Extracted 1D spectrum
# 4: Wavelength calibrated
# 5: Flux Calibrated
parameters = {"data_type": "0"}

# remotehost should be replaced with the actual host
# also the url can be composed as http://remotehost/api/files/?data_type=0
# in that case you don't need to pass the params argument.
response = requests.get(
         url='http://remotehost/api/files/',
         params=parameters,
         headers=headers)

if response.status_code == 200:
    json_response = response.json()

# alternatively you can use response.raise_for_status() and catch any exception

from request.exceptions import HTTPError

try:
```

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```
    response.raise_for_status()
except HTTPError as http_error:
    log.exception(http_error)
```

Will produce a response like this. In this particular case the results have been truncated to just a couple of results.


```
{
    "count": 545,
    "next": "http://remothost/gsp/api/files/?data_type=0&page=2",
    "previous": null,
    "results": [
        {
            "id": 952,
            "created": "2021-02-18T10:22:10.340053-03:00",
            "last_modified": "2021-02-18T10:22:13.470928-03:00",
            "original_file": "0001_GHTS_B_400m1_2x2_18-02-2021.fits",
            "original_file_id": 952,
            "parent_file": "0001_GHTS_B_400m1_2x2_18-02-2021.fits",
            "parent_file_id": 952,
            "file_name": "0001_GHTS_B_400m1_2x2_18-02-2021.fits",
            "directory_name": "/pipeline/data/20210218/RAW",
            "full_path": "/pipeline/data/20210218/RAW/0001_GHTS_B_400m1_2x2_18-02-2021.
↪fits",
            "obstype": "LAMPFLAT",
            "object": "DFLAT",
            "filter": "NO_FILTER",
            "filter_2": "NO_FILTER",
            "grating": "400_SYZY",
            "slit": "1.0_LONG_SLIT",
            "cam_targ": "11.6",
            "grt_targ": "5.8",
            "obsra": "17:38:33.320",
            "obsdec": "-48:23:59.899",
            "gain": "1.4",
            "rdnoise": "4.74",
            "roi": "Spectroscopic 2x2",
            "wavmode": "400_M1",
            "proposal_id": "calibrate",
            "observation_id": null,
            "configuration_id": null,
            "block_id": null,
            "image_id": 1,
            "date": "2021-02-18",
            "data_type": "0",
            "normalized": false,
            "technique": "Spectroscopy",
            "saturation_value": 49928
        },
        {
            "id": 900,
            "created": "2020-11-26T21:30:52.692308-03:00",
            "last_modified": "2020-11-26T21:30:55.204647-03:00",
```


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```
            "original_file": "0354_Orion-Burst_26-11-2020_comp.fits",
            "original_file_id": 900,
            "parent_file": "0354_Orion-Burst_26-11-2020_comp.fits",
            "parent_file_id": 900,
            "file_name": "0354_Orion-Burst_26-11-2020_comp.fits",
            "directory_name": "/pipeline/data/20201126/RAW",
            "full_path": "/pipeline/data/20201126/RAW/0354_Orion-Burst_26-11-2020_comp.
↪fits",
            "obstype": "ARC",
            "object": "ZTF20actqfpc",
            "filter": "NO_FILTER",
            "filter_2": "GG455",
            "grating": "400_SYZY",
            "slit": "1.0_LONG_SLIT",
            "cam_targ": "16.1",
            "grt_targ": "7.5",
            "obsra": "05:34:22.372",
            "obsdec": "-5:24:52.448",
            "gain": "1.48",
            "rdnoise": "3.89",
            "roi": "Spectroscopic 2x2",
            "wavmode": "400_M2",
            "proposal_id": "SOAR2020B-008",
            "observation_id": 1,
            "configuration_id": 1,
            "block_id": 0,
            "image_id": 34304,
            "date": "2020-11-26",
            "data_type": "0",
            "normalized": false,
            "technique": "Spectroscopy",
            "saturation_value": 69257
        },
        {
            "id": 895,
            "created": "2020-11-26T19:37:53.519510-03:00",
            "last_modified": "2020-11-26T19:37:55.892156-03:00",
            "original_file": "0353_Orion-Burst_26-11-2020_comp.fits",
            "original_file_id": 895,
            "parent_file": "0353_Orion-Burst_26-11-2020_comp.fits",
            "parent_file_id": 895,
            "file_name": "0353_Orion-Burst_26-11-2020_comp.fits",
            "directory_name": "/pipeline/data/20201126/RAW",
            "full_path": "/pipeline/data/20201126/RAW/0353_Orion-Burst_26-11-2020_comp.
↪fits",
            "obstype": "ARC",
            "object": "ZTF20actqfpc",
            "filter": "NO_FILTER",
            "filter_2": "GG455",
            "grating": "400_SYZY",
            "slit": "1.0_LONG_SLIT",
            "cam_targ": "16.1",
```


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```
            "grt_targ": "7.5",
            "obsra": "05:34:22.372",
            "obsdec": "-5:24:52.448",
            "gain": "1.48",
            "rdnoise": "3.89",
            "roi": "Spectroscopic 2x2",
            "wavmode": "400_M2",
            "proposal_id": "SOAR2020B-008",
            "observation_id": 1,
            "configuration_id": 1,
            "block_id": 0,
            "image_id": 34304,
            "date": "2020-11-26",
            "data_type": "0",
            "normalized": false,
            "technique": "Spectroscopy",
            "saturation_value": 69257
        }
    ]
}
```


11.2 Add Collaborator to Proposal

```
import requests

api_key = 'some-fake-api-key-that-does-not-work'

# define request headers
headers = {'Authorization': f"Token {api_key}",
           'Content-Type': 'application/json'}

#define payload
payload = {
    "email": "user@server.net",
    "action": "add"
    }


# remotehost should be replaced with the actual host
response = requests.get(
         url='http://remotehost/api/proposals/collaborators/5/',
         data=payload,
         headers=headers)

if response.status_code == 200:
    json_response = response.json()
```

You get a serialized version of the proposal database instance.

```
{
    "id": 5,
    "soar_id": "calibrate",
    "semester": "2020A",
    "title": "Calibrations",
    "abstract": "How calibrations will be handled.",
    "user": {
        "id": 3,
        "username": "observer",
        "last_login": "2020-10-24T18:56:45.976000-03:00",
        "first_name": "Observer",
        "last_name": "Observer",
        "email": "observer@observatory.cl",
        "is_staff": true,
        "is_active": true,
        "date_joined": "2019-11-13T10:26:23-03:00"
    },
    "collaborators": [
        {
            "id": 41,
            "username": "user",
            "last_login": null,
            "first_name": "",
            "last_name": "",
            "email": "user@server.net",
            "is_staff": false,
            "is_active": true,
            "date_joined": "2021-03-24T15:32:23.329399-03:00"
        }
    ]
}
```


Since the user did not exists a new user was created.