Gemini Program Platform

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NSF's NOIRLab

Gemini: twin 8-meter telescopes with coverage of both hemispheres

Gemini North/West

CA: FP
18%

US: FP
67%

KR: FP
5%
Subaru: EX

HI: host
CFHT: EX

Gemini South/East

BR: FP
7%

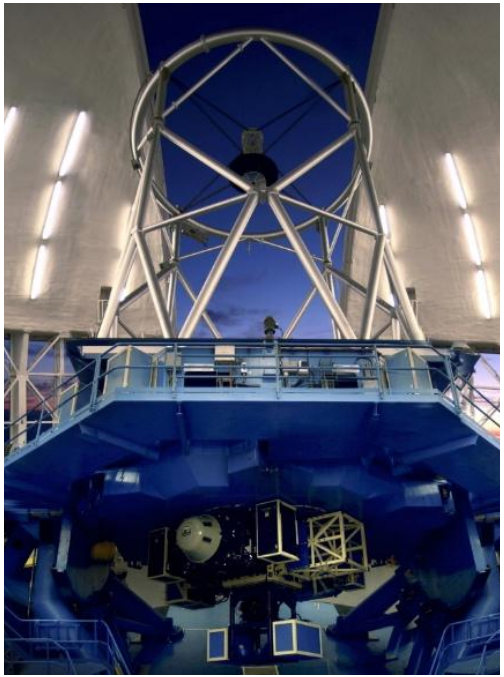
AR: FP
3%

CL:
host

FP: Full Participant (NGO)
Host: Access to local site (NGO)
EX: Exchange Partner

Gemini supports four facility instruments + AO at each site. Up to three + AO at a time in *queue*.

	Gemini North	Gemini South
Optical	GMOS-N	GMOS-S
	GNIRS	FLAMINGOS-2
Near-IR	NIFS	GSAOI
	NIRI	
AO	ALTAIR NGS & LGS	GeMS (MCAO) LGS (5)



Visitor instruments
`Alopeke/Zorro, IGRINS, MAROON-X

Proposal idea? We accept all sizes on a variety of timescales.

Director's Time: *any time*
- Chief scientist/Director approval
- For short, urgent projects

<5%

Poor Weather: *any time*
- Head of Science Operations approval
- For the worst conditions, bright targets

Fast Turnaround: *once per month*
- Peer reviewed, no fixed TAC
- For short, immediate, trial, and/or follow-up proposals
- (oversubscription: ~2)

10%

Semester Process: *once per semester*
- Through the National Time Allocation Committees (NTACs)
- For regular proposals
- (oversubscription: ~2)

~70%

Large & Long Programs: *once per year*
- Through the Large Program TAC
- For large and/or long **ambitious** proposals (up to 6 sem)
- (oversubscription: >5)

20%

Gemini offers a variety of observing modes

Queue mode: (time domain, special conditions)

95%

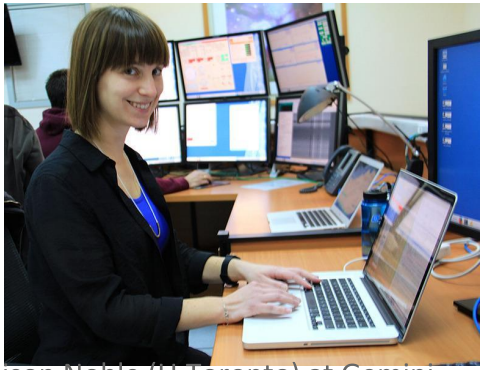
You submit your observations, we observe for you

You can look over our shoulders by *Eavesdropping*!

Classical/Visitor mode: (special configurations, real-time decisions)

5%

You visit the observatory and conduct your observations



Allison Noble (U.Toronto) at Gemini South

Priority Visitor Observing:

Come during a block, pick & choose the best time for your observations! Queue backup

Base Facility Operations:

Most observing is from the sea level facilities.

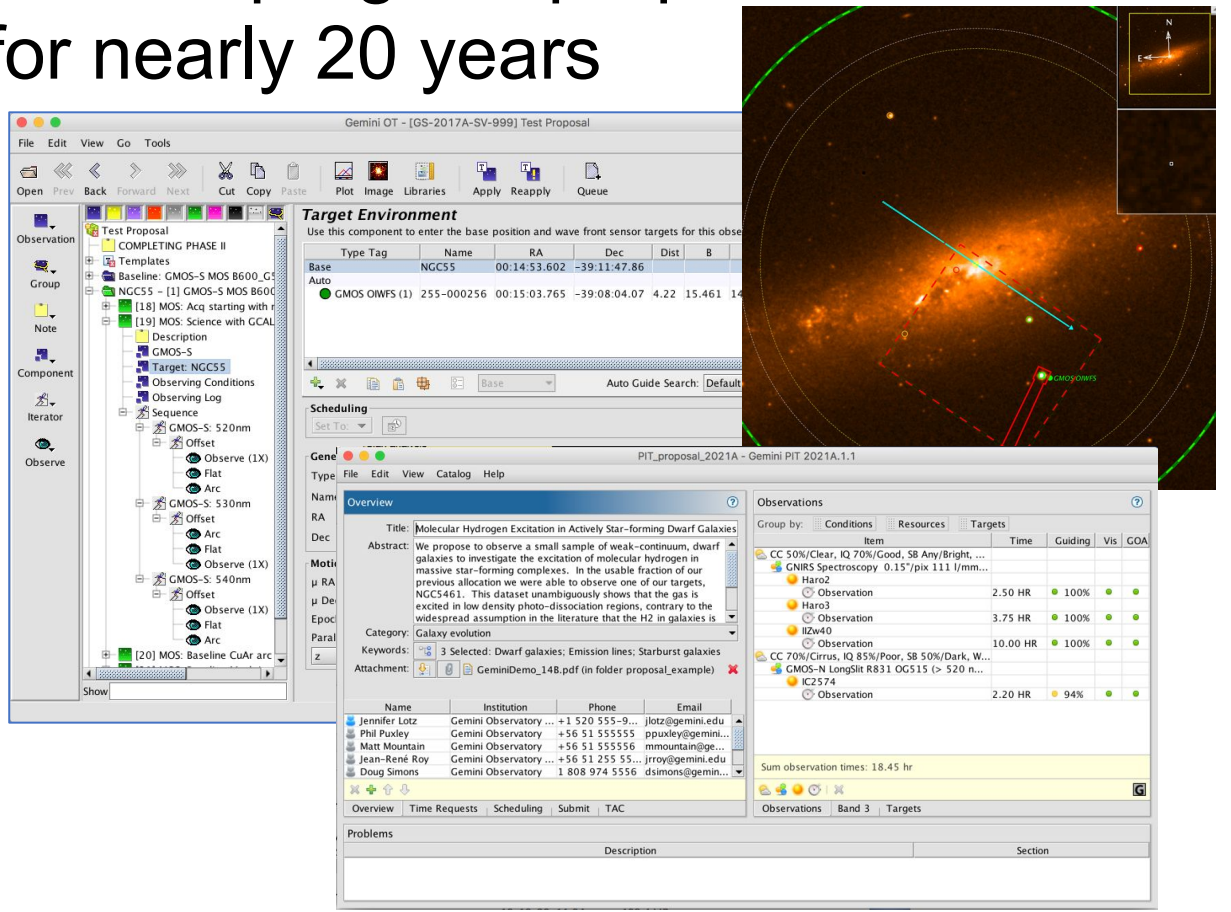
Remote observing by PIs is not currently offered.

The current proposal and program preparation tools have been in use for nearly 20 years

While many improvements have been made, e.g.

- Automatic guide star selection
- smartGCAL
- Phase 2 templates
- ITC integration

many changes that we want/need cannot be done with the current software.



The Gemini Program Platform (GPP) is the core project of the OCS Upgrades Program that will replace the Phase I Tool (PIT) and Observing Tool (OT).

It will consist of several web applications connecting to a central database:

Dashboard: access to all of a user's proposals & programs; notifications, telescope status; possibly a communications center.

Explore: Proposal/observation preparation and nighttime observing

Chronicle: Nightlog, Obslog, Quality Assessment, Time Accounting

Observe: Updated web seqexec (main observer tool, executes observations)

Browse: Advanced program browser

Schedule: Web interface to the automated queue scheduler

OCS Upgrades/GPP address the current limitations

Main Limitations	**Solutions**
Phase 2 is difficult - large learning curve	Automatically create full, executable observations
ITC not well integrated	ITC fully integrated
Calibrations disjoint from science	Calibrations created automatically based on science
Cannot easily move observations between sites	Single ODB, programs can contain observations for GN and GS
Heavy staff workloads - Phase 2 checking and queue planning	No checking needed for automatically-generated sequences
Limited efficiency if lots of changes during the night (e.g. ToOs, unstable weather, faults)	Automatic real-time scheduling
Limited programmatic access (APIs)	More capable suite of APIs, AEON compatible
Difficult to make changes, fix bugs, slow release cycle	Continuous integration and deployment, common database infrastructure (PostgreSQL)
Limited by existing libraries, need to produce desktop apps	Web-based apps, independent of user OS

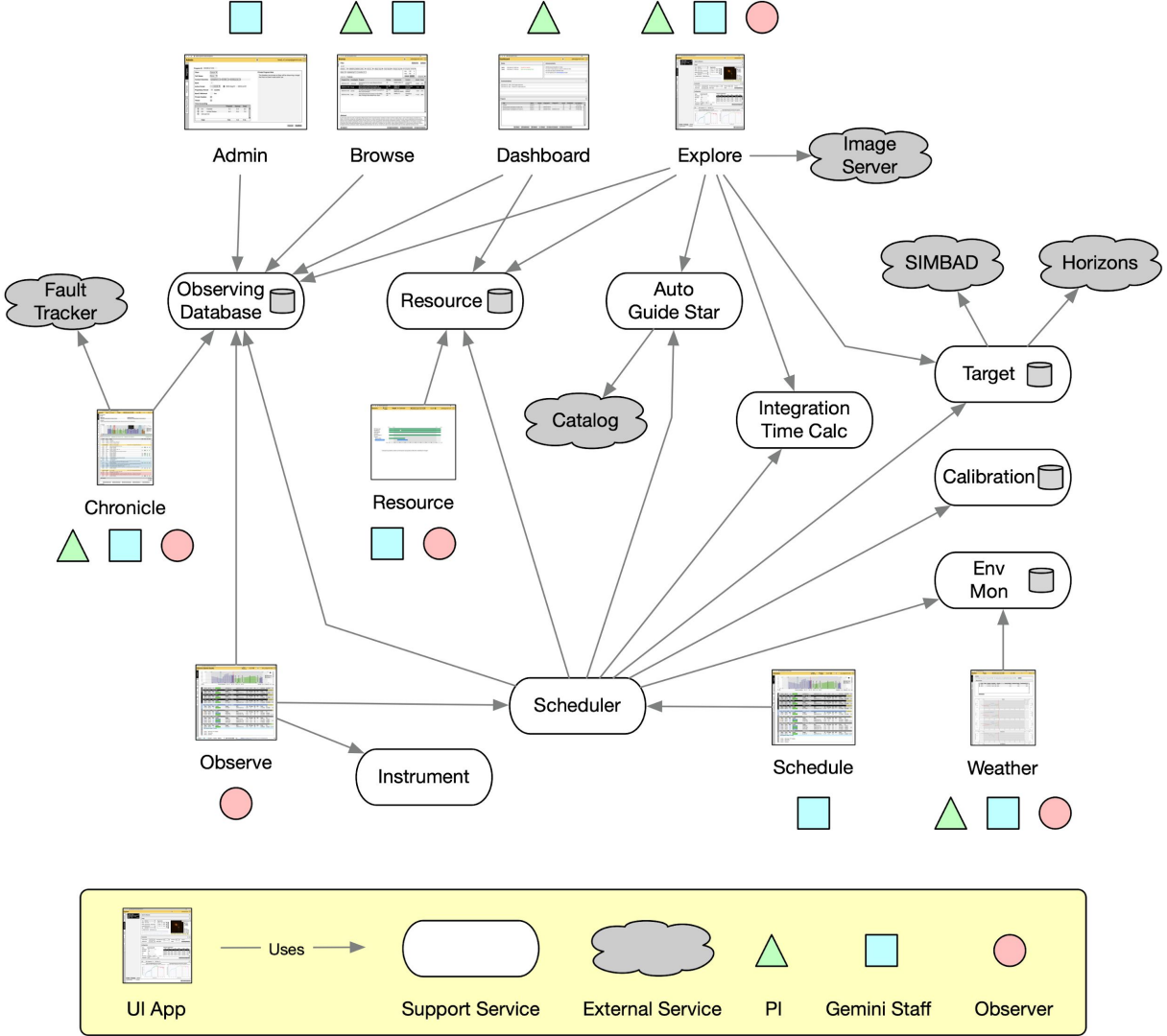
User Interfaces

External:

- Explore
- Dashboard
- Browse
- Chronicle
- Weather

Internal:

- Observe
- Resource
- Schedule
- Admin



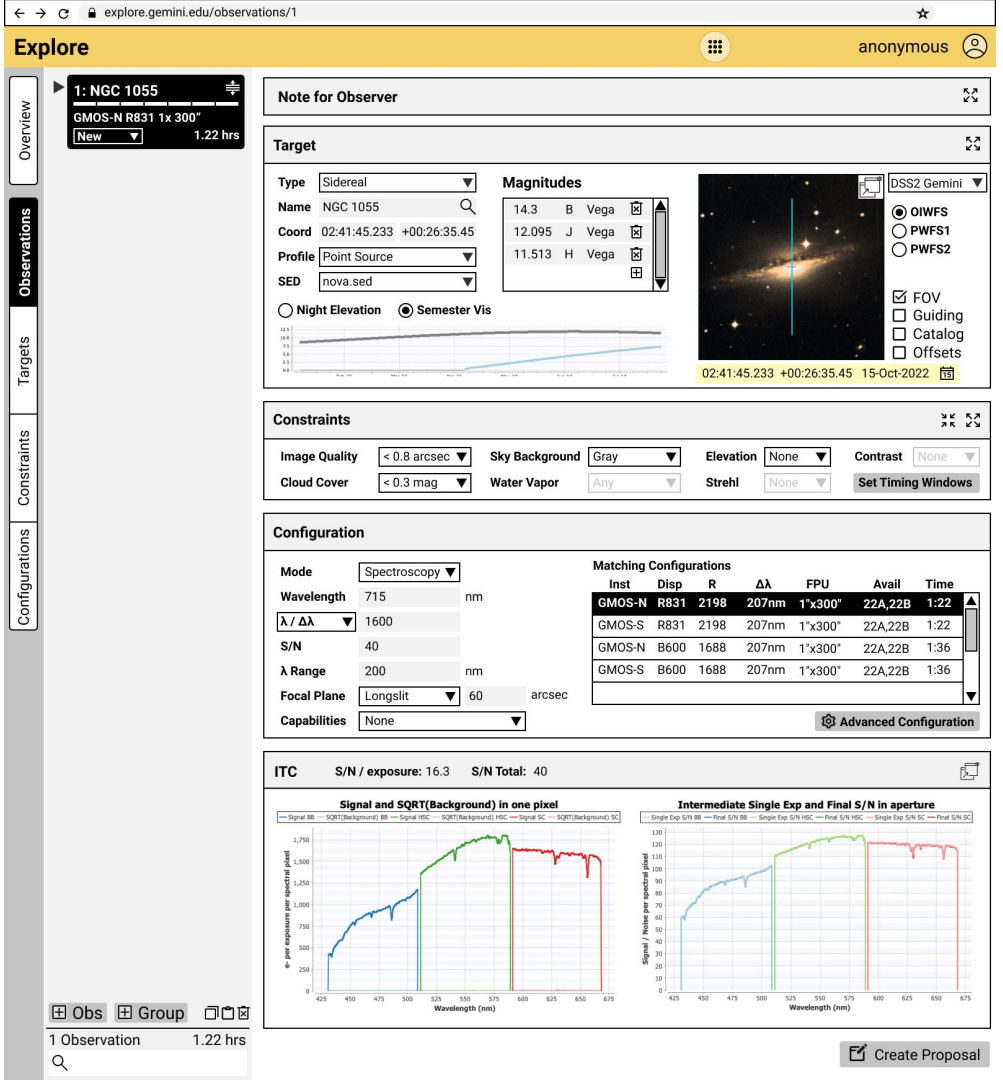
Observations View

Lists each observation

Shows important info about each

Create an observation:

1. Enter target
2. Enter (delivered) constraints
3. Enter configuration
4. Select a matching configuration
5. Done!



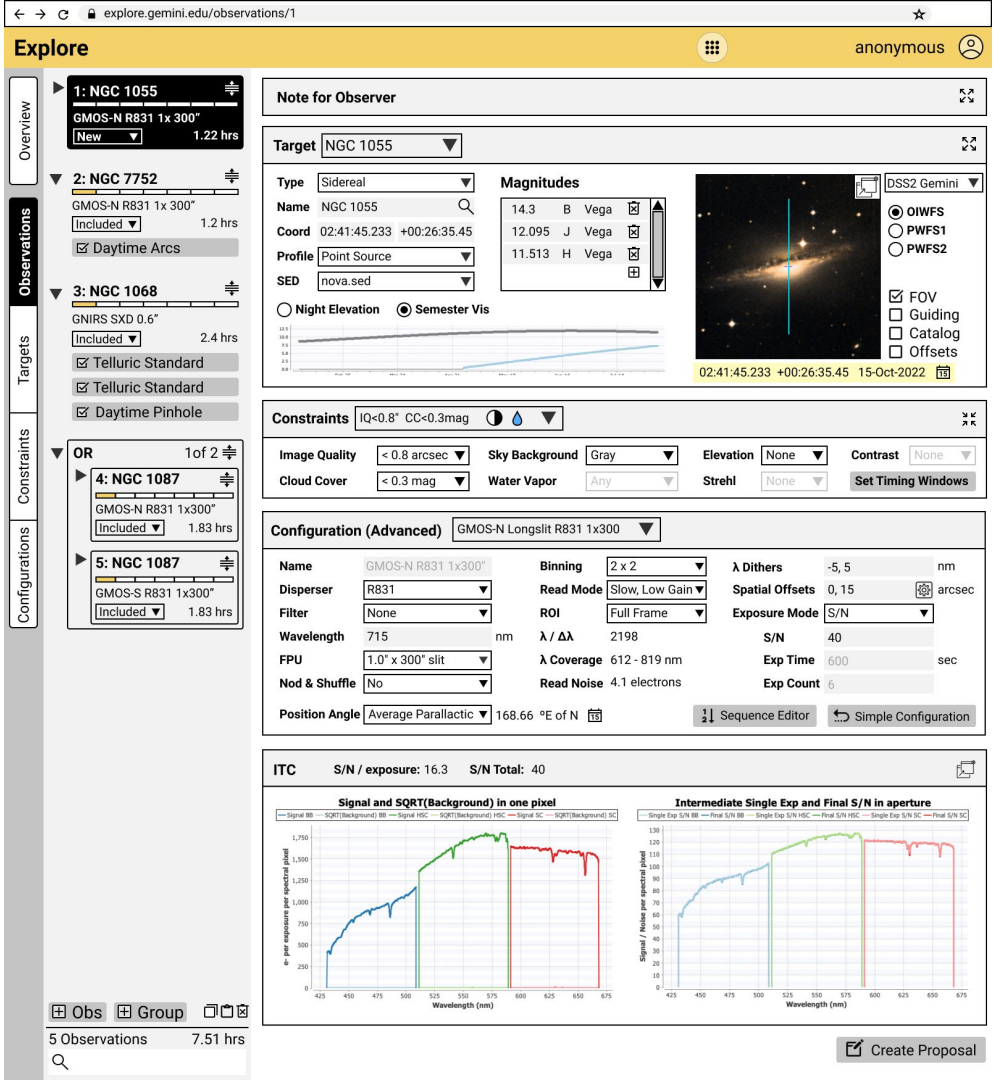
Observations View

We have now defined several observations.

Each includes their calibrations.

OR group

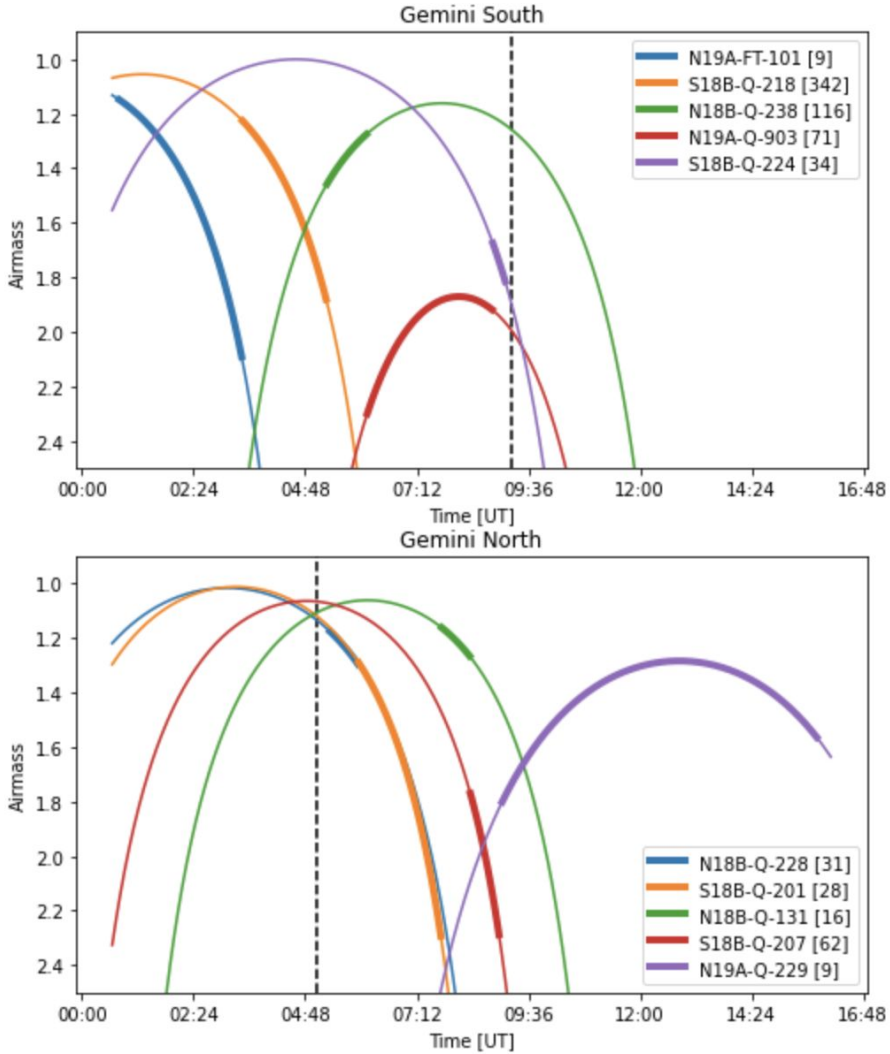
Advanced Configuration



The scheduler creates a new plan when the rToO is finished.

The new plan is displayed in the observer's tool.

Right: An example of GN and GS plans created together with a prototype scheduler using historical observations.



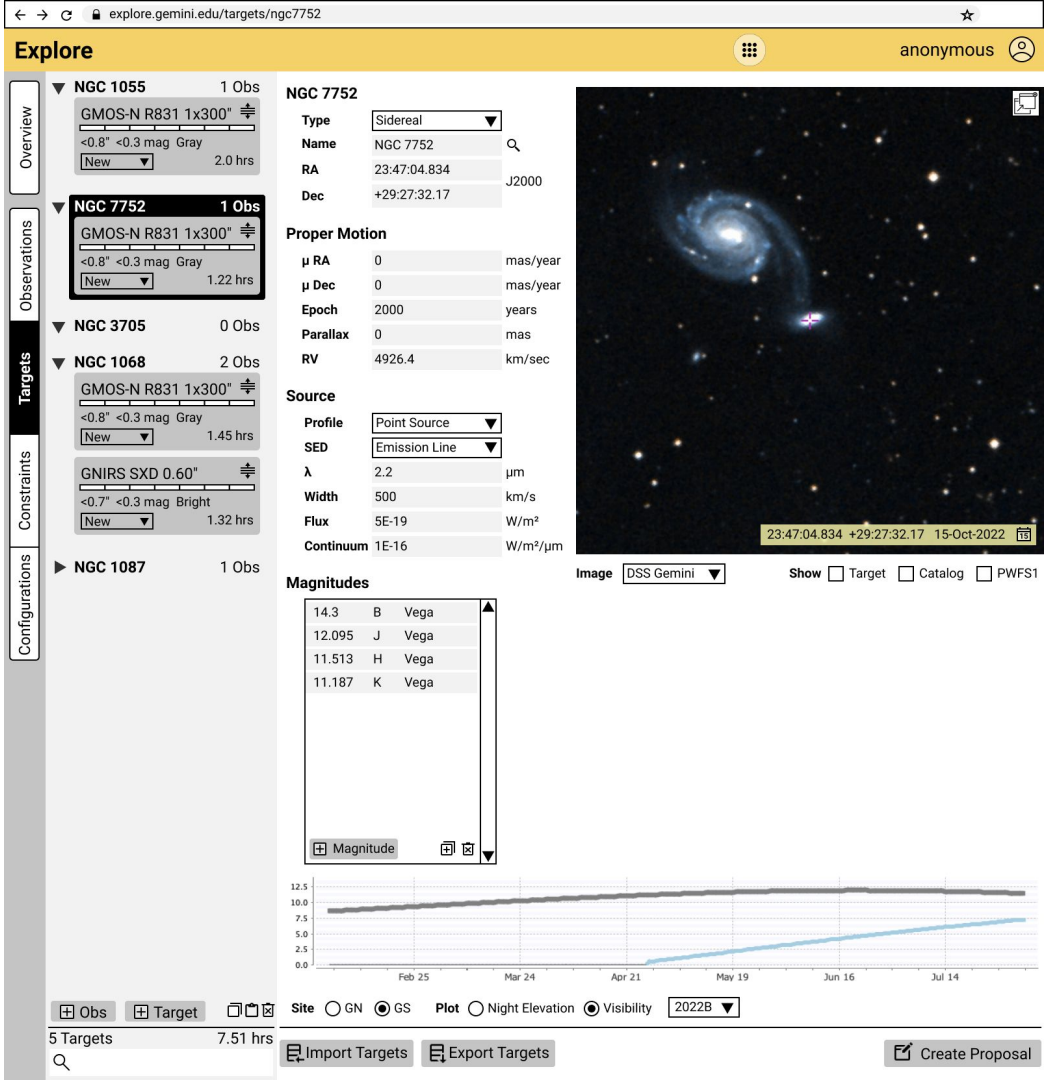
Targets View

Shows observations grouped by target.

Import target lists.

Copy observations.

Drag & drop of observations between targets.



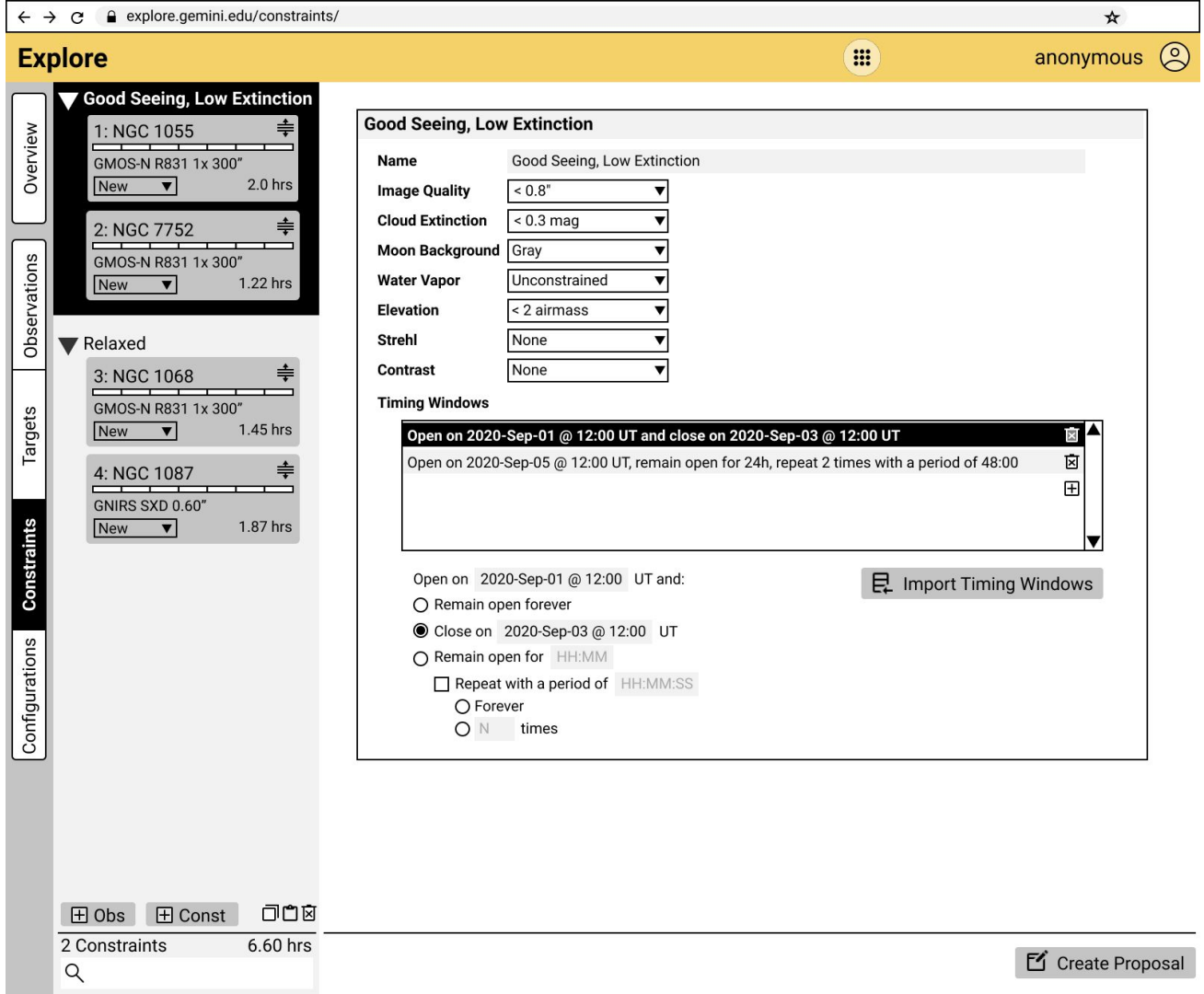
Constraints View

Shows observations grouped by constraints.

Import timing windows.

Copy observations.

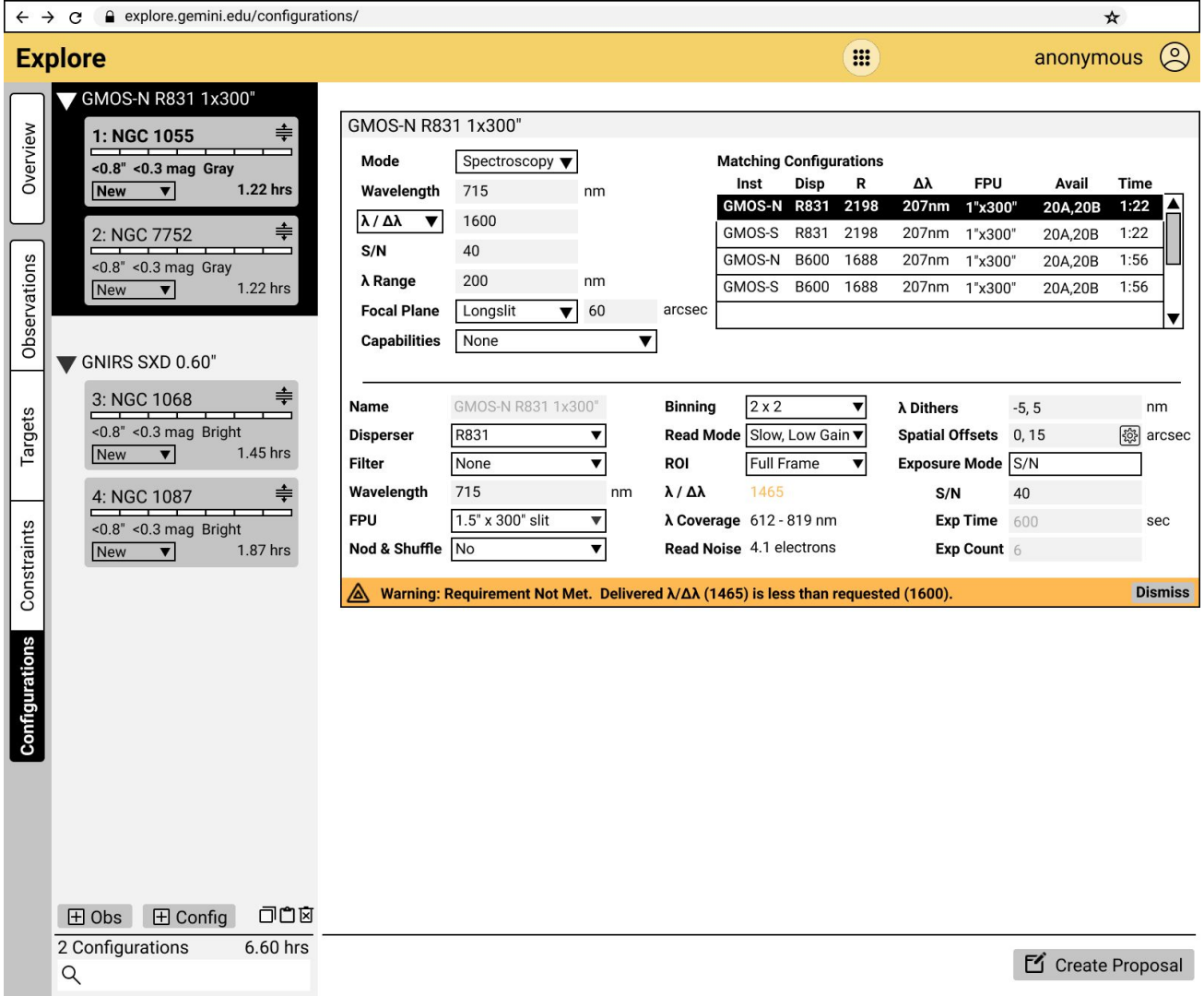
Drag & drop observations between constraints.



Configurations View

Make bulk configuration changes.

Drag & Drop observations between configurations.



Proposal View

Add investigator details.

Enter abstract.

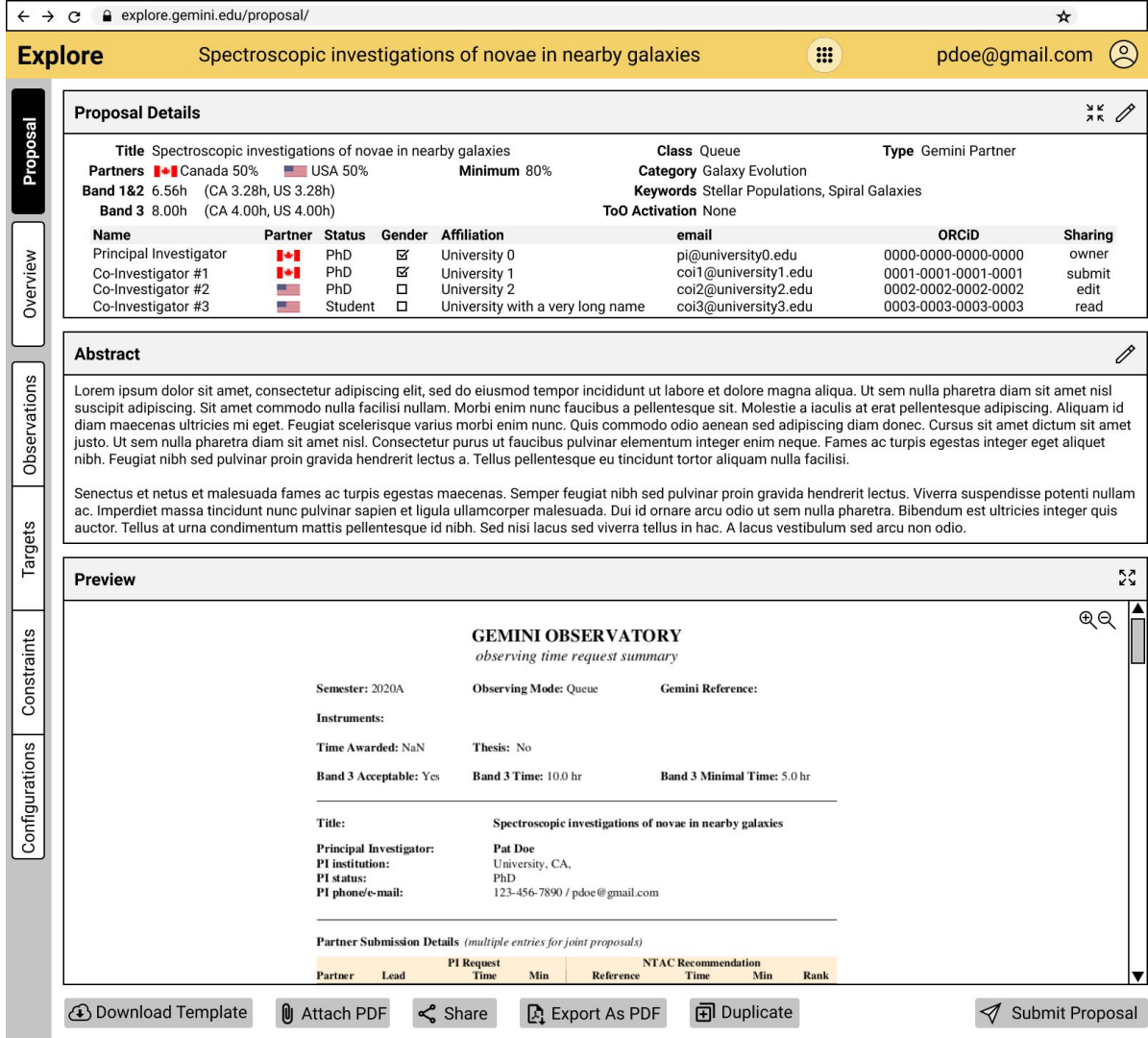
Attach PDF template.

Share and Collaborate.

Export PDF.

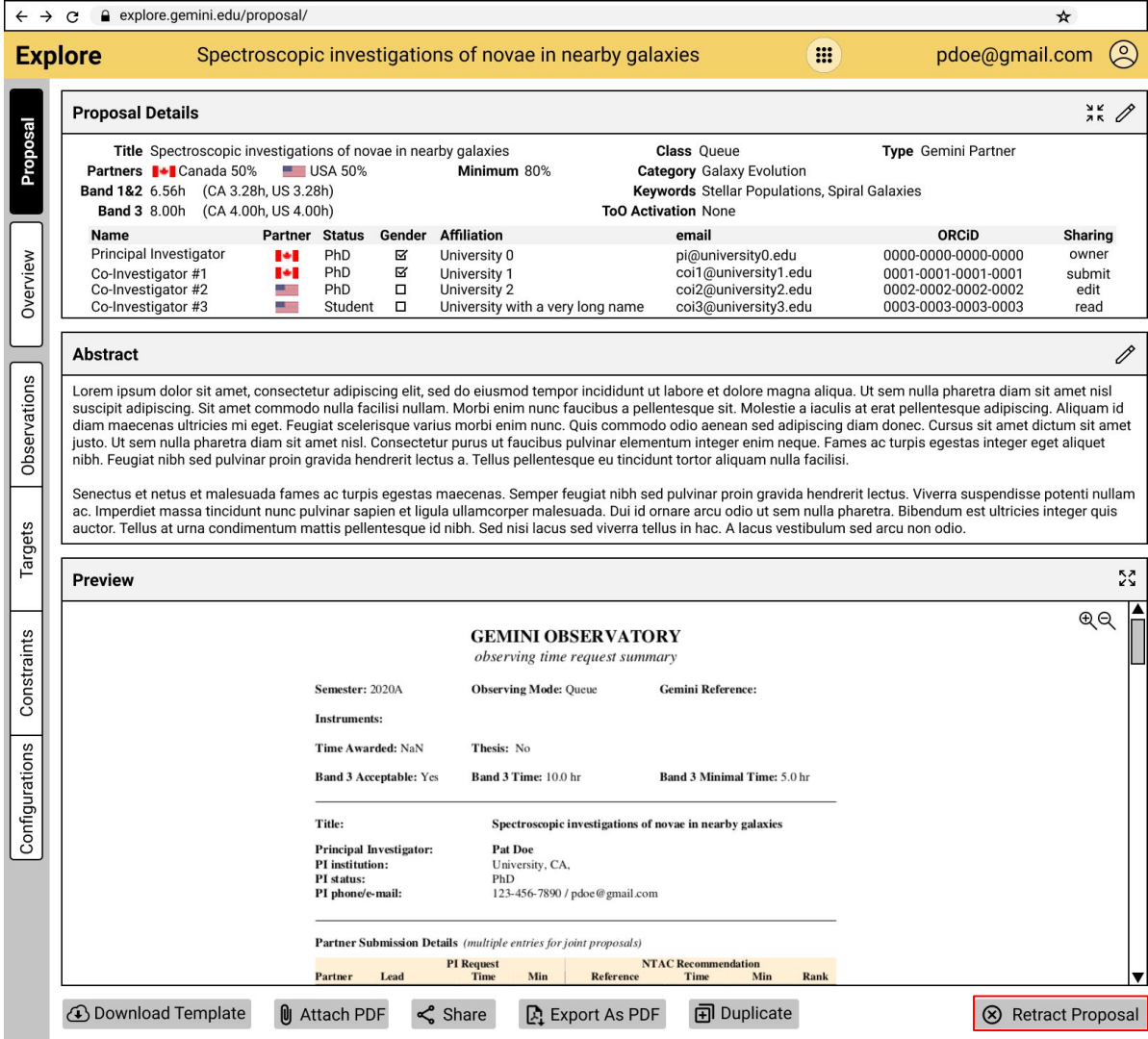
Duplicate proposal.

Submit proposal.



Proposal View

After submission receive email confirmation and may retract proposal.



Everything, and more, that can be done with the UI can be done programmatically with APIs

GraphQL query structures will be used, different from REST (e.g. URL endpoints).

GraphQL allows more flexible queries.

Planned aids for users:

- Define common queries, like endpoints, in client libraries (e.g. Python)
- Users just need to fill in the parameters
- Provide examples

```
# Filter settings using a dictionary. This is all the user has to do.
variables = {"filters":
                {"searchString": "Q-10?",
                 "instruments": ["GMOSN", "GMOSS", "GNIRS"],
                 "partners": ["CL", "US"],
                 "completionPercentage":
                     {"minPercentage": 30,
                      "maxPercentage": 80
                     }
                 }
             }

# Execute the query
result = browse_query(variables)

# Extract the programs from the result.
programs = result["data"]["programs"]

# For each program, print the pid and PI lastName
for p in programs:
  print(p["pid"] + " - " + p["pi"]["lastName"])
```

The algorithmic scheduler will create the queue plans rapidly in real-time as events occur.

Requirements:

- Fast - create a new plan in < 1 minute
- Schedules GN/GS together when appropriate (e.g. both in queue)
  - Faster completion for observations that can be done at either site (~25%)
  - Fewer programs for PIs to manage
  - Allows better coordination
- Queue plans are equivalent to human-generated, are evaluated based on a metric that encodes observatory goals, e.g.
  - Respect TAC rankings (Band)
  - Complete 100% of highest-ranked programs
  - Foster thesis programs and time-critical observations

Example use case: rapid ToO

A team studying young SNe has time on Gemini for follow-up

Their Target Observation Manager (TOM) identifies an event from LSST classified as a SNe by the ANTARES broker.

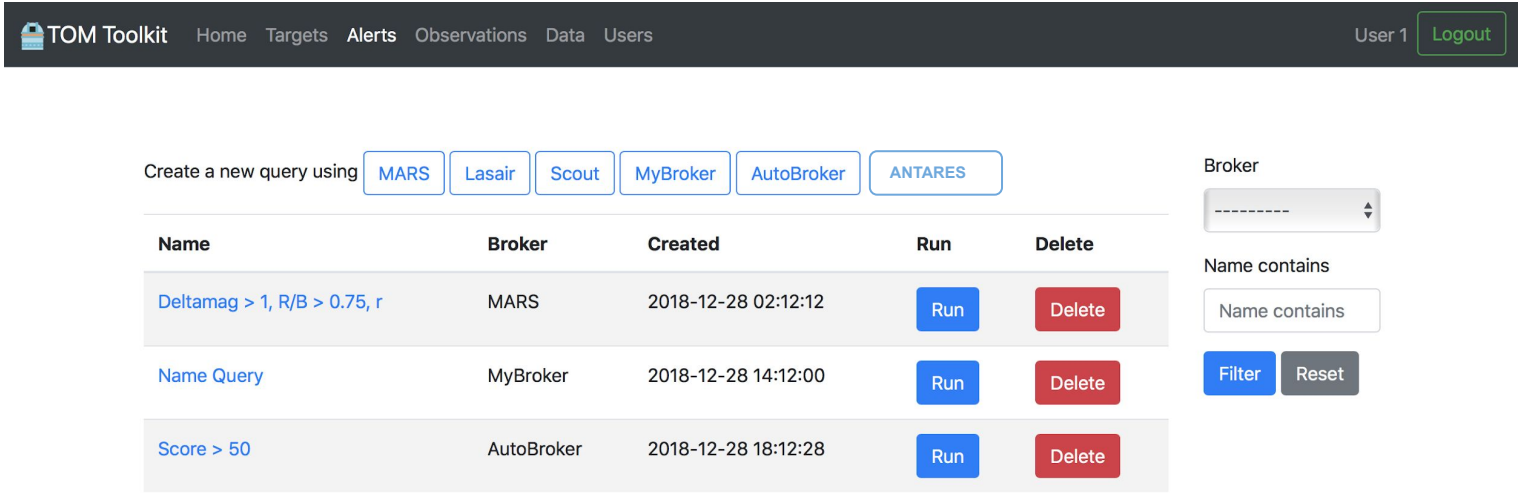
The TOM sends rToO (interrupting) observation requests to Gemini via the API for SCORPIO or GMOS-N, whatever is available.

ANTARES

https://antares.noirlab.edu

TOM TOOLKIT Las Cumbres Observatory LCO

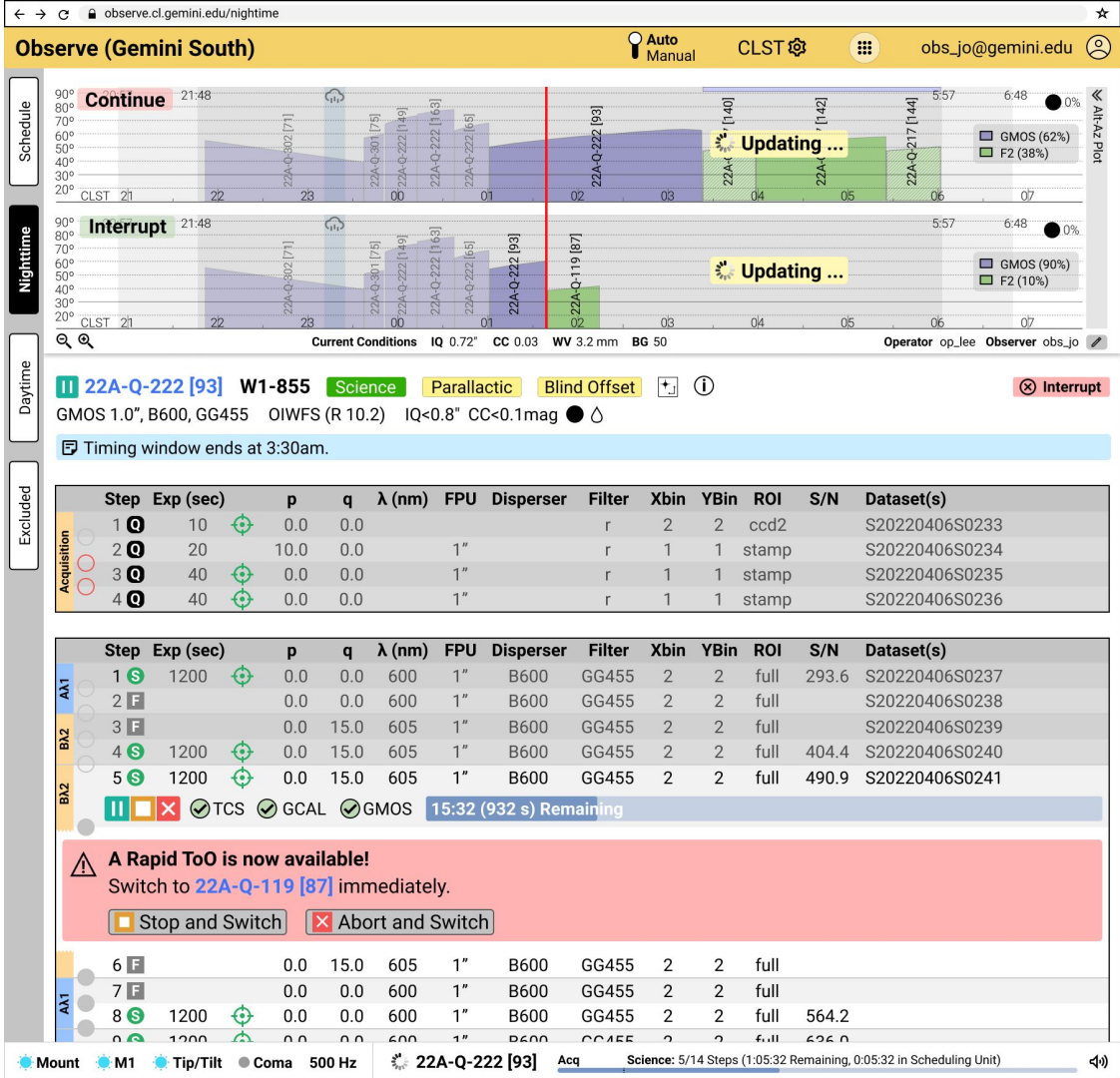
https://tomtoolkit.github.io



Observing

The scheduler determines that the best site for the ToO, based on conditions and target visibility, etc, is Gemini South.

The observer will then be notified of the ToO and respond to it.

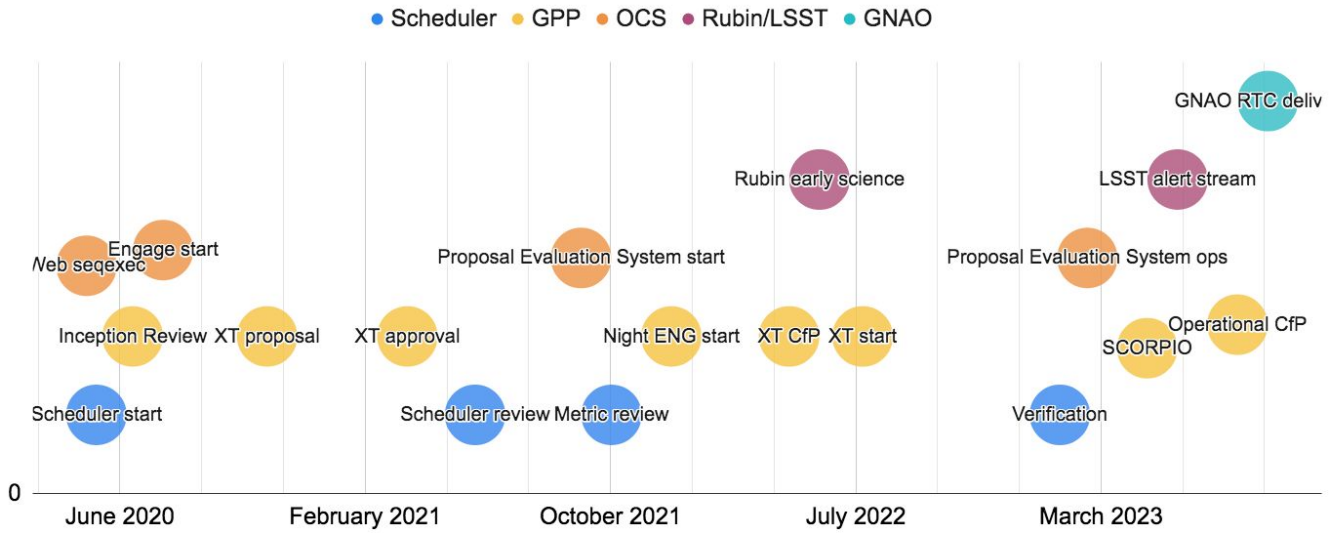


Current Status

Explore is under active development (demo)

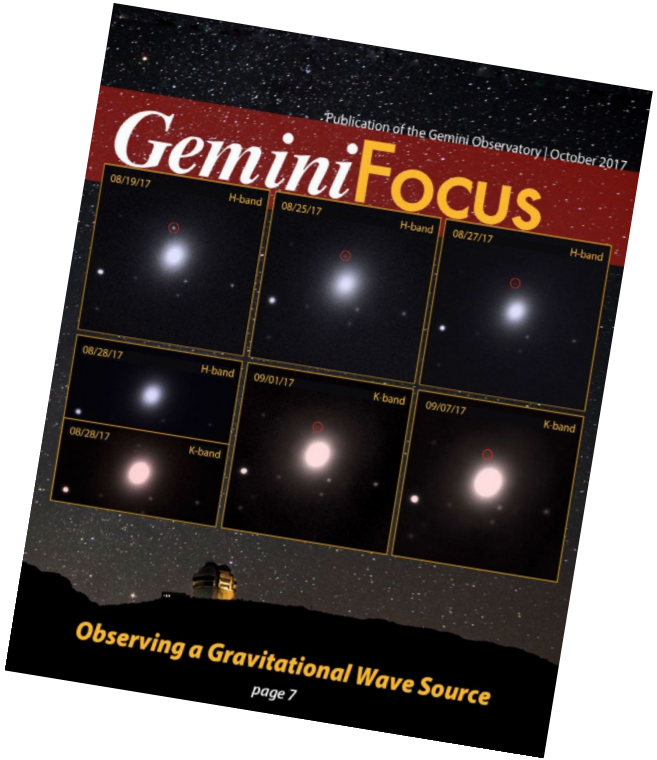
We are working towards a system that supports GMOS-N/S imaging and longslit by May 2022, when we issue a CfP for early science testing (XT).

Full operations expected for the start of 2024A.



Summary: OCS Upgrades and GPP will make the use of Gemini easier and more efficient for all users and provide a platform for the future.

- Improve usability - e.g. make Phase 2 preparation much easier
- Improve efficiency - e.g. improve flexibility and reduce staff workload with an automated scheduler
- Support Time Domain Astronomy (TDA) - e.g. provide the software framework for the GEMMA scheduler and APIs
- Support new instruments - e.g. SCORPIO and GNAO/GIRMOS
- Avoid obsolescence - e.g. make the code maintainable and scalable



See Oct 2017 Gemini Focus, pg. 20
Update in Jan 2021 NOIRLab Mirror

Resources and Feedback

Announcements are posted to the Gemini Science Software Blog

http://staff.gemini.edu/scisoft/

Project updates and documents:

https://www.gemini.edu/observing/operations-development

You may provide feedback with a suggestion form on the above page, or email bryan.miller@noirlab.edu or andrew.stephens@noirlab.edu.

Related sessions at AAS237

DRAGONS data reduction demo
Every day, 4:40–5:10 pm ET, NOIRLab Booth

Building the Follow-up Ecosystem for Science in the 2020s
Tuesday, January 12, 12:00–1:30 pm ET

224 The Data Lab Science Platform and Open-Data Ecosystem at NSF's NOIRLab
Tuesday, January 12, 4:10–5:40 pm ET

NOIRLab’s Data Services: A Practical Demo Built on Science with DES DR2
Thursday, January, 14, 4:10–5:40 pm ET

NOIRLab Town Hall
Thursday, January 14, 1:10–2:40 pm ET