



# ToO Triggering on AEON/Gemini

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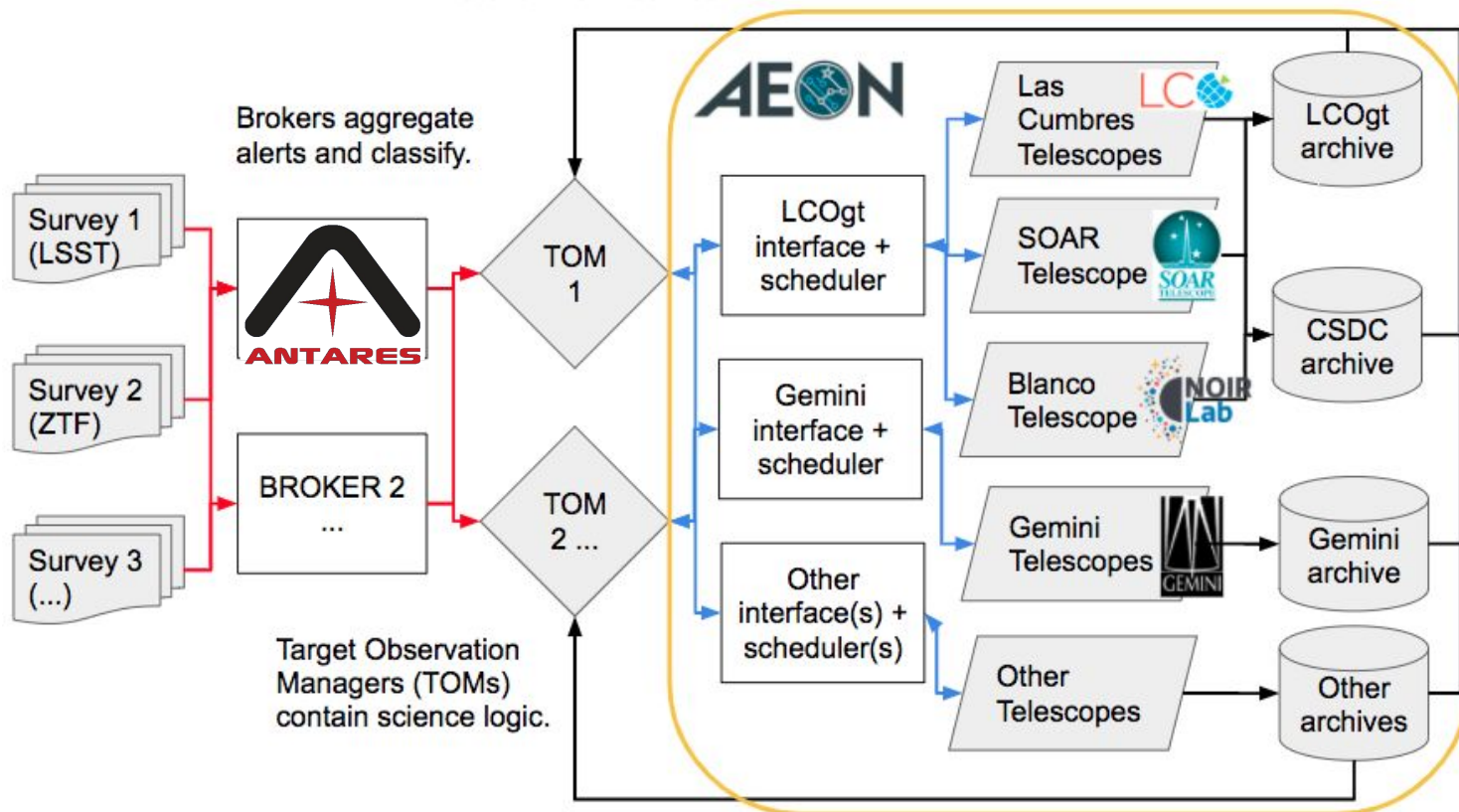
# Having a target of interest from ANTARES, we need to get it observed.

*"Here is an event"*

*"Request everything  
matching these criteria"  
"Here is what I learned"*

*"Observe X with parameters Y"  
"Tell me status of X"*

*"Send me data of X"*



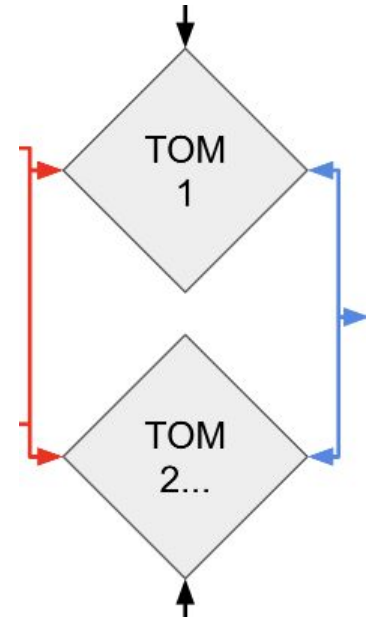
# Target Observation Managers match targets with telescopes, coordinate observations, and manage data.

TOMs are one of the components of the science layer:

- Collect and prioritize targets from alert streams (e.g. brokers)
- Manage available resources (telescopes, programs)
- Request observations
- Collect, reduce, and display data
- Manage data access for members
- Share information between interested parties

In use by SNe, exoplanet, NEO, AGN, and microlensing teams.

*“Request everything matching these criteria”*  
*“Here is what I learned”*





# Las Cumbres Observatory is developing a “toolkit” to make these easier to create.

<https://tom-toolkit.readthedocs.io>



## TOM Toolkit

The TOM Toolkit is a framework for building software for the next generation of astronomy.

Python + Django.  
Easy installation and  
configuration  
Under active development

See “Time Domain Ecosystem”  
splinter session from Tuesday

## Target and Observation Manager

The TOM Toolkit project was started in early 2018 with the goal of simplifying the development of next generation software for the rapidly evolving field of astronomy. Read more [about TOMs](#) and the motivation for them.

Are you looking to run a TOM of your own? The [documentation](#) is a good place to get started. The source code for the project is also available on Github.

## Workshop: Managing Follow-up Observations in the Era of ZTF and LSST

LSST Corporation and Las Cumbres Observatory will be hosting a workshop from September 30 to October 4, 2019, with a strong focus on interactive TOM Toolkit development and instruction. The workshop will culminate in a call for proposals that will be awarded with mini-grants and telescope time on LCO's global telescope network. If you have an interest in developing a TOM for your science case, you can apply, get more information, or subscribe to the mailing list on the [workshop homepage](#).

- [JPL Scout Support](#) » 17 Jan 2019
- [\[Video\] Triggering Target of Opportunity Observations with Gemini Observatory.](#) » 11 Jan 2019
- [TOM Toolkit at the AAS](#) » 19 Dec 2018
- [MARS Alert Broker Support](#) » 23 Aug 2018
- [TOM Toolkit Development Started](#) » 22 May 2018

<https://github.com/TOMToolkit> - Powered by Jekyll.

This project is managed by Las Cumbres Observatory, with generous financial support from the Zegar Family Foundation and the Heising-Simons Foundation.



# NOIRLab (Gemini/SOAR/MSO) and Las Cumbres are working to dynamically schedule observations on SOAR, Gemini, Las Cumbres, ...

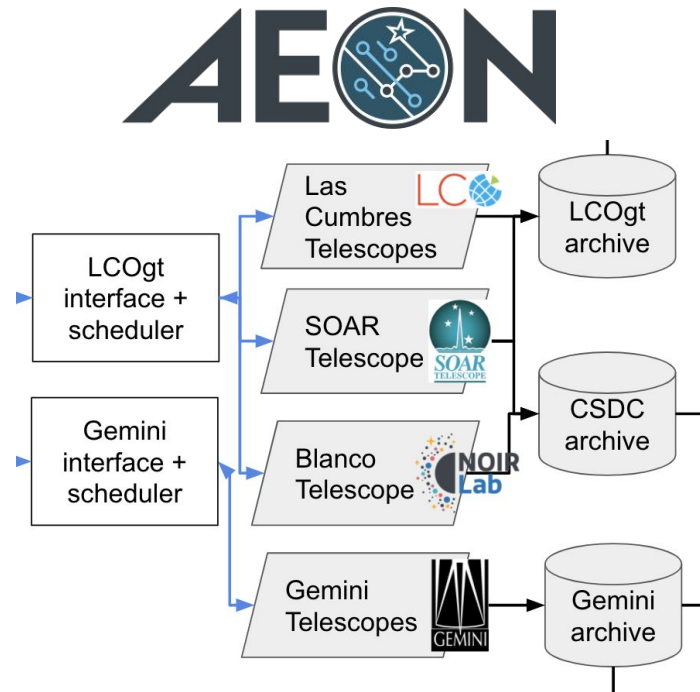


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Joanna Thomas-Osip (NOIRLab/Gemini)



# The AURA/LCOGT follow-up effort is called the **Astronomical Event Observatory Network (AEON)**:

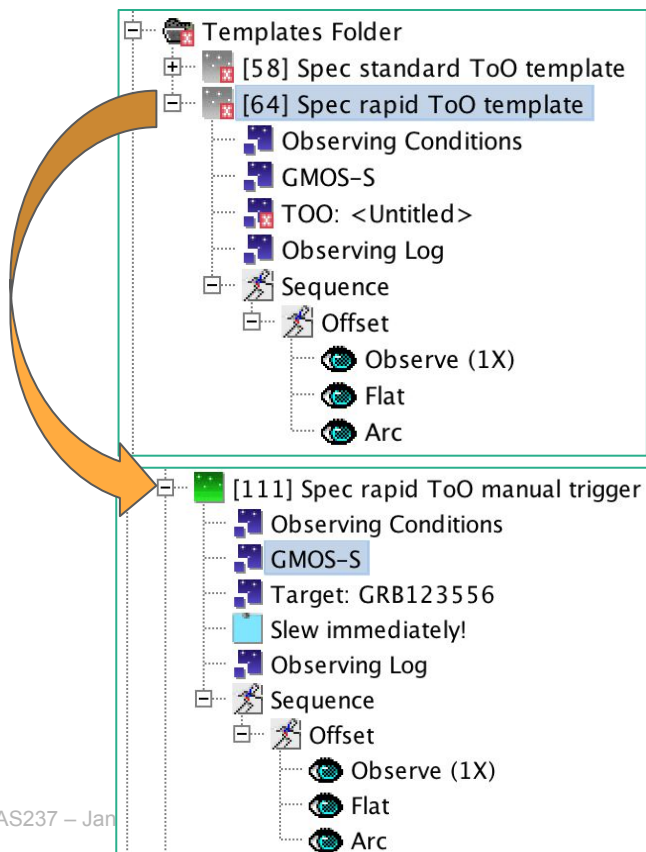
1. Develop interfaces (APIs)
2. Incorporate SOAR with the LCOgt scheduler, execute observations on dedicated nights
3. Coordinate data pipelining and archiving efforts
4. Incorporate Gemini, more capable APIs and an automated queue scheduler
5. Be ready to incorporate other facilities (Blanco, etc)



<https://lco.global/aeon/>

<https://noirlab.edu/public/projects/aeon/>

# Understanding Gemini triggers: template observations must be defined using the Observing Tool (OT).



Contact scientists help the PIs define template observations, set to “On Hold”.

Trigger sequence:

- Copy/paste template
- Fill in target-specific information
- Put special instructions in a note
- Set observation status to “Prepared”
- Sync (upload to Gemini, “trigger”)
- Upload finding chart

This can be done manually using the OT.

# Triggers may also be made programmatically via a URL API.

The details of the trigger are formatted as an URL string which can be submitted to Gemini using any browser or URL tool such as wget. The following parameters are available.

prog	- program id
email	- email address for user key
password	- password for user key associated with email, site specific
obsnum	- id of the template observation to clone and update, must be 'On hold'
target	- name of the target
ra	- target RA (J2000), format 'HH:MM:SS.SS'
dec	- target Dec(J2000), format 'DD:MM:SS.SSS'
mags	- target magnitude information (optional)
note	- text to include in a "Finding Chart" note (optional)

The Observing Database takes care of the copy/paste/trigger actions.

Full API documentation and example scripts, including guide star selection, at <https://github.com/bryanmiller/gselect>



<https://tomtoolkit.github.io>

This API is used by the  
TOM Toolkit Gemini plugin.

Observations can be  
submitted manually with the  
form, for example  
[https://youtu.be/PC\\_5kmSdZBU](https://youtu.be/PC_5kmSdZBU)

or programmatically, e.g. via  
jupyter notebooks, via the  
TOM API.

## Submit an observation to GEM

[Gemini Observation](#)

### Observation Parameters

Obsid\*

S19AT001[1] Std: GMOS B600 1.0arcsec  
S19AT001[2] Rap: GMOS B400 1.0arcsec  
S19AT001[9] GMOS Acq 1.0arcsec  
N19AT001[1] Std: GMOS B600 1.0arcsec

Ready\*

Yes

Group

NGC300 Group

Position Angle in degrees [0-360]

90

Exptime [sec]. If multiple, comma separate

900,30

Note

Link for finder chart

Target brightness

22.7

Brightness band

r

Brightness system

AB

Airmass/Hour Angle Constraint

Airmass

Min Airmass/HA

1.0

Max Airmass/HA

1.6

UT Timing Window Start [Date Time]

2019-10-03 01:30:00

Timing Window Duration [hr]

48

Optional Guide Star Parameters: If any one of Name/RA/Dec is given, then all must be.

Guide Star Name

Guide Star RA

Guide Star Dec

Guide Star Brightness

Guide Star Brightness Band

Guide Star Brightness System

Guide Probe

OIWFS

Submit

295 lines (295 sloc) 517 KB



## Triggering an observation from an ANTARES locus object with TOM

This notebook requires the installation of ANTARES client (<https://noao.gitlab.io/antares/client/>) and TOM Toolkit ([https://tom-toolkit.readthedocs.io/en/latest/introduction/getting\\_started.html#installing-the-tom-toolkit-and-django](https://tom-toolkit.readthedocs.io/en/latest/introduction/getting_started.html#installing-the-tom-toolkit-and-django)). For more detail on programmatic access of TOM Toolkit, please see (<https://tom-toolkit.readthedocs.io/en/stable/common/scripts.html>).

We can arrange follow up observations of intriguing ANTARES locus/alert using the facilities within the Astronomical Event Observatory Network (AEON). This can be conveniently done with the TOM Toolkit as follows.

The first step is to define the target information (name, ra, dec, etc.)

```
In [1]: from antares_client.search import get_by_id, get_by_ztf_object_id
        #get locus by ANTARES ID
        locus = get_by_id("ANT2020bj3s4")
```

```
In [2]: print(locus.locus_id, locus.ra, locus.dec)
        print(locus.lightcurve['ant_mag'].iloc[-1], locus.lightcurve['ant_passband'].iloc[-1])
```

```
ANT2020bj3s4 227.58436649043028 66.99700788920126
19.123262405395508 R
```

# Configuring your TOM to use the Gemini plugin

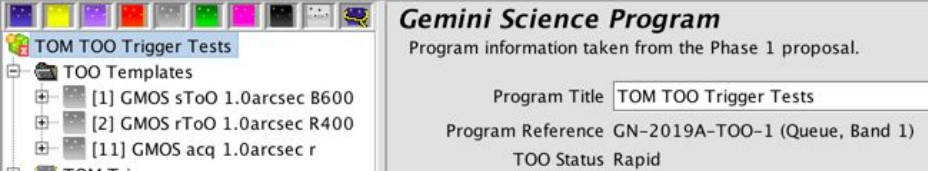
Customize the FACILITIES section of settings.py

```
'GEM': {  
    'portal_url': {  
        'GS': 'https://gsoddbtest.gemini.edu:8443',  
        'GN': 'https://gnoddbtest.gemini.edu:8443',  
    },  
    'api_key': {  
        'GS': '402483',  
        'GN': '866761',  
    },  
    'user_email': 'bmiller@gemini.edu',  
    'programs': {  
        'GS-2019A-T00-1': {  
            '1': 'Std: GMOS B600 1.0arcsec',  
            '2': 'Rap: GMOS B400 1.0arcsec',  
            '9': 'GMOS Acq 1.0arcsec',  
        },  
        'GN-2019A-T00-1': {  
            '1': 'Std: GMOS B600 1.0arcsec',  
            '2': 'Rap: GMOS B400 1.0arcsec',  
            '11': 'GMOS Acq 1.0arcsec',  
        },  
    },  
},
```

Server URLs (for testing)  
Use gsodb/gnodb for production

“User key” password associated with  
user\_email, request using OT, see  
<https://www.gemini.edu/node/12109>

Program id and template observation ids



The screenshot shows the Gemini Science Program interface. On the left, a list of observation templates is displayed under the heading 'TOM TOO Trigger Tests'. The templates are:

- [1] GMOS sToO 1.0arcsec B600
- [2] GMOS rToO 1.0arcsec R400
- [11] GMOS acq 1.0arcsec r

On the right, a box titled 'Gemini Science Program' contains the following information:

- Program information taken from the Phase 1 proposal.
- Program Title: TOM TOO Trigger Tests
- Program Reference: GN-2019A-T00-1 (Queue, Band 1)
- TOO Status: Rapid

We can configure test programs.

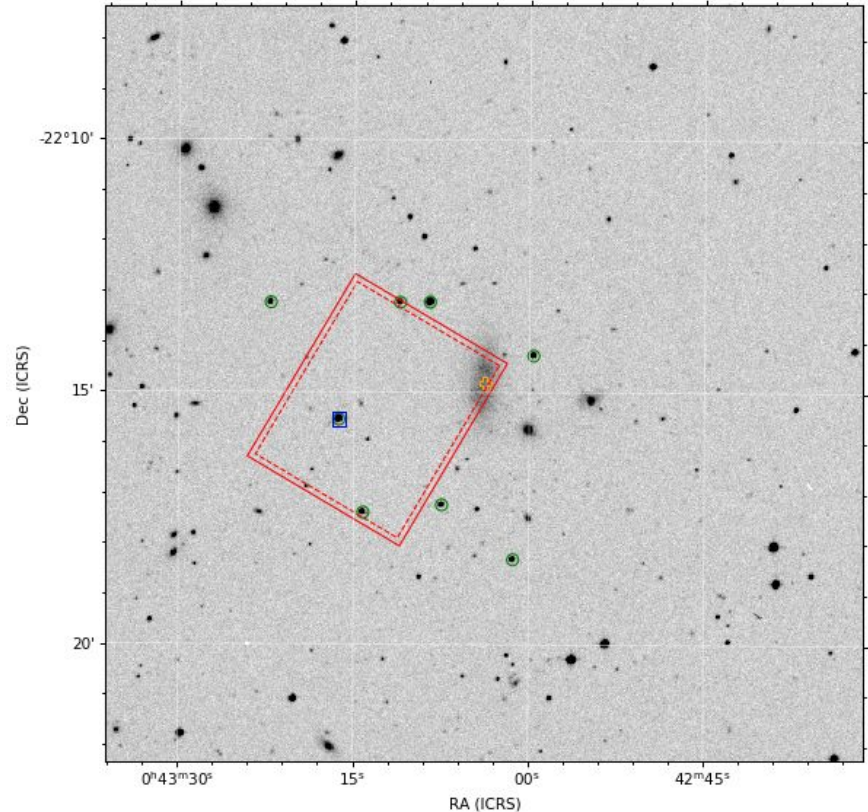
# While not required, checking for guide stars is recommended to ensure that the observation is feasible.

Guiding is needed (e.g. active optics).

Many guiders (e.g. GMOS OIWFS) have limited FoVs.

GSSELECT allows guide star selection, similar to that done by the OT

Has a 'find' PA feature never implemented in the OT. This will pick the best guide star available and set the PA so that it is reachable.





# GSSELECT is available for the TOM Toolkit in a community development version of the Gemini plugin

Not included in tom\_base to reduce dependencies

Get from:

- [https://github.com/TOMToolkit/tom\\_gemini\\_community](https://github.com/TOMToolkit/tom_gemini_community)
- `pip install tom-gemini-community`

Customize the TOM\_FACILITY\_CLASSES section of settings.py

```
TOM_FACILITY_CLASSES = [  
    'tom_observations.facilities.lco.LCOFacility',  
    'tom_observations.facilities.soar.SOARFacility',  
    'tom_gemini_community.gemini_gsselect.GEMFacility',  
]
```

# The community plugin provides controls for guide star selection

## Position Angle modes

- Fixed
- Flip180
- Find best PA
- Parallactic Angle

## Other instrument modes and conditions options

See the video at

[https://youtu.be/PC\\_5kmSdZBU](https://youtu.be/PC_5kmSdZBU)

TOM Toolkit Home Targets Alerts Observations Data Users Bryan Logout

### Submit an observation to GEM

Gemini Observation

Observation Parameters

Obsid*	Ready*	Group
S19ATOO1[1] Std: GMOS B600 1.0arcsec S19ATOO1[2] Rap: GMOS B400 1.0arcsec S19ATOO1[9] GMOS Acq 1.0arcsec N19ATOO1[1] Std: GMOS B600 1.0arcsec	Yes	Trappist 1 Group
Position Angle in degrees [0-360]	PA Mode	UT Date Time (for Parallactic PA Mode)
90	Parallactic Angle	2019-10-03 02:30:00
Target brightness	Brightness band	Brightness system
16.5	r	AB
Airmass/Hour Angle Constraint	Min Airmass/HA	Max Airmass/HA
Airmass	1.0	1.8
Note	UT Timing Window Start [Date Time]	Timing Window Duration [hr]
Parallactic angle, Finding chart URL		
Exptime [sec]. If multiple, comma separate		
400,30		
Optional Guide Star Parameters: If any one of Name/RA/Dec is given, then all must be.		
Guide Star Name	Guide Star RA	Guide Star Dec
Guide Star Brightness	Guide Star Brightness Band	Guide Star Brightness System
	UC	Vega
Instrument	Guide Probe	IFU Mode
GMOS	OIWFS	None
Image Quality	Cloud Cover	Sky Brightness
Any	Any	Any
Search for guide star if none entered?	Overwrite previous guide star query?	ISS Port
Yes	No	Side

Submit