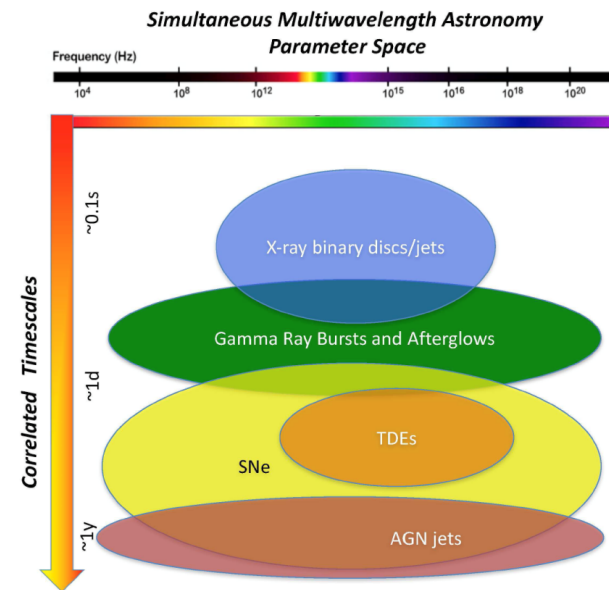


Supporting observatory coordination with new standards: current status

*Aitor Ibarra¹
on behalf of VOVISObs group
Special thanks to Karl Forster (NuSTAR)*

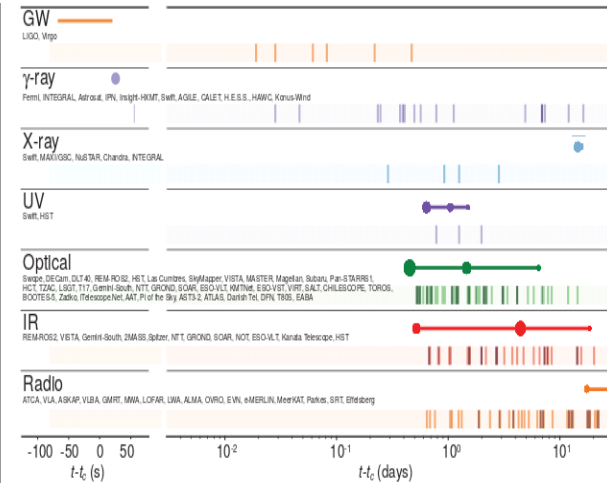
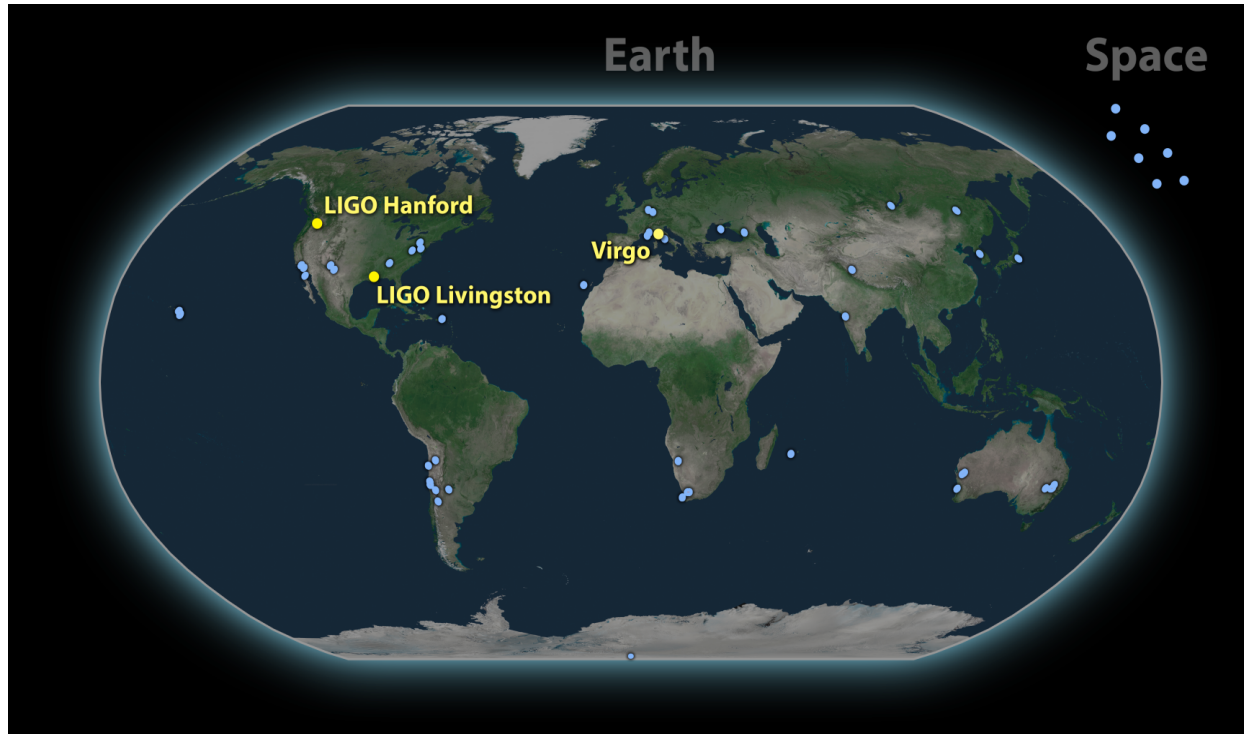
1 Quasar Science Resources for ESA

- Multi-messenger astronomy is here:
 - Scientists require, more and more, coordinated multi-wavelength observations.
 - Increasing interest to simultaneously observe the same target at different wavelengths. Example use cases:
 - X-ray binary ToOs
 - Gaia transients
 - Optical & radio transients
 - TDEs
 - GW & neutrino follow-up



Middelton et al. 2017

Worse: 3676 scientists working together...



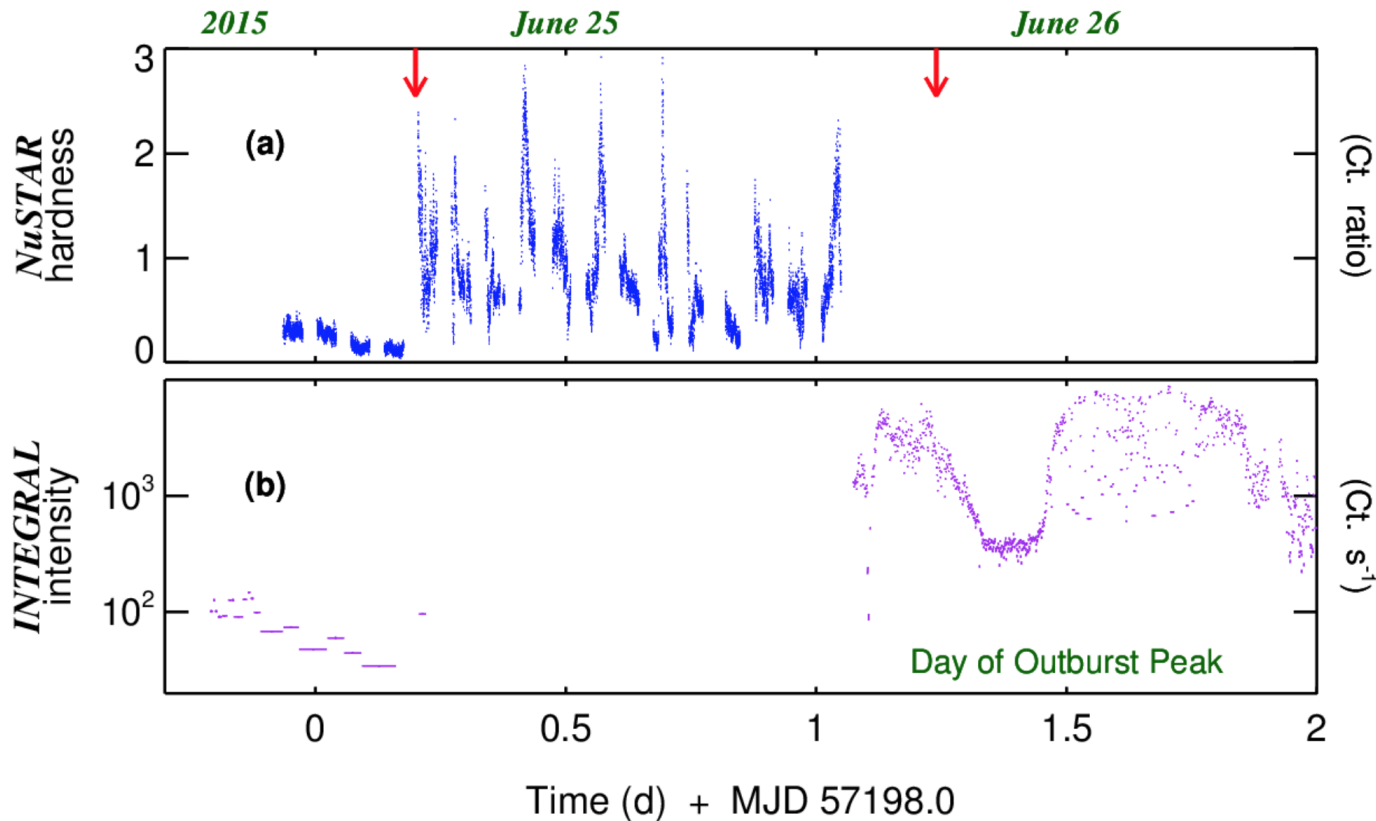
□ [2017ApJ...848L..12A](#)

Abbott, B. P.; Abbott, R.; Abbott, T. D.;
 Acernese, F.; Ackley, K.; Adams, C.; Adams, T.;
 Addesso, P.; Adhikari, R. X.; Adya, V. B.; and 3666
 coauthors

➤ ~70 ground- and space-based observatories

What if you do not it correctly....

X-ray evolution of V404 Cygni leading to outburst peak.



Uh-oh...

Gandhi *et al.* 2017, Nature Astronomy

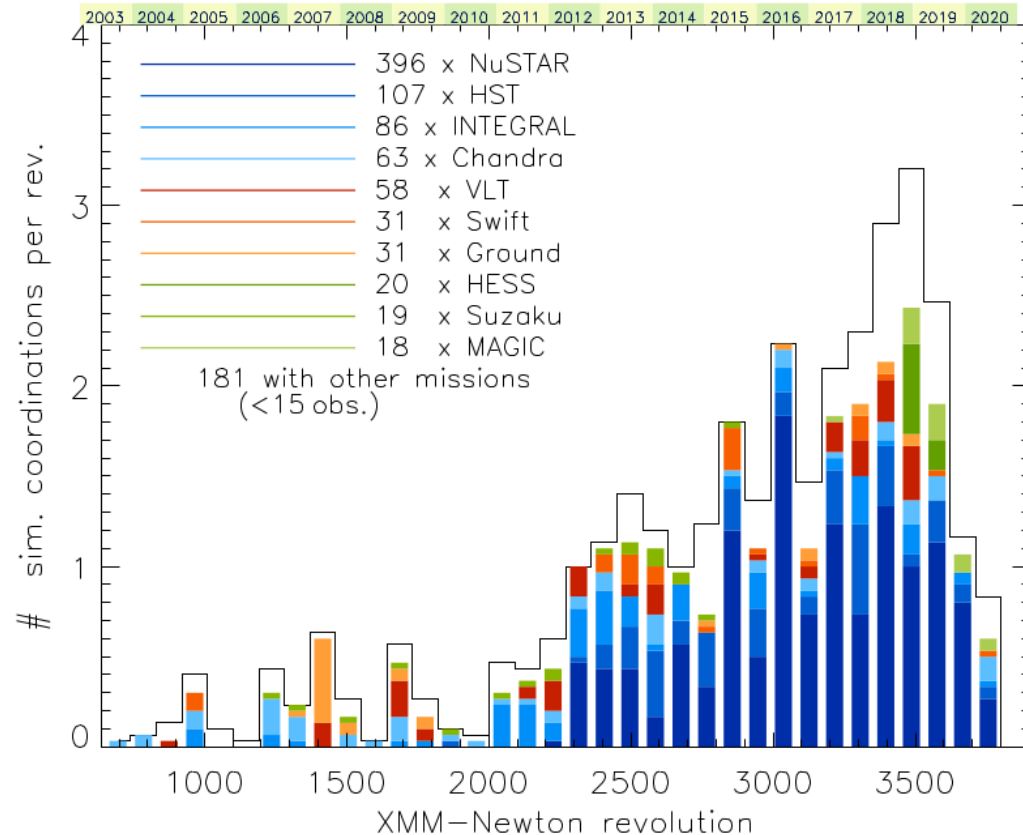
XMM-Newton coordinated observations



- Demand for coordinated observations is increasing...

- Some observatory numbers:

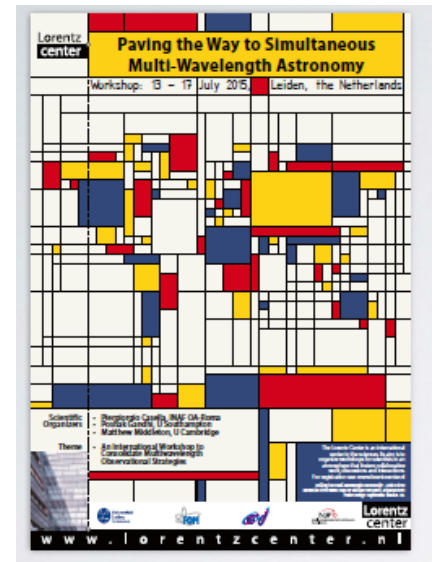
- **NuSTAR:** 30% of the observations are coordinated with other observatories.
- **XMM-Newton:** ~12% coordinated observations (NuSTAR, HST, Chandra, VLT, Swift).
- **INTEGRAL:** ~10% of the observations are coordinated with other observatories.



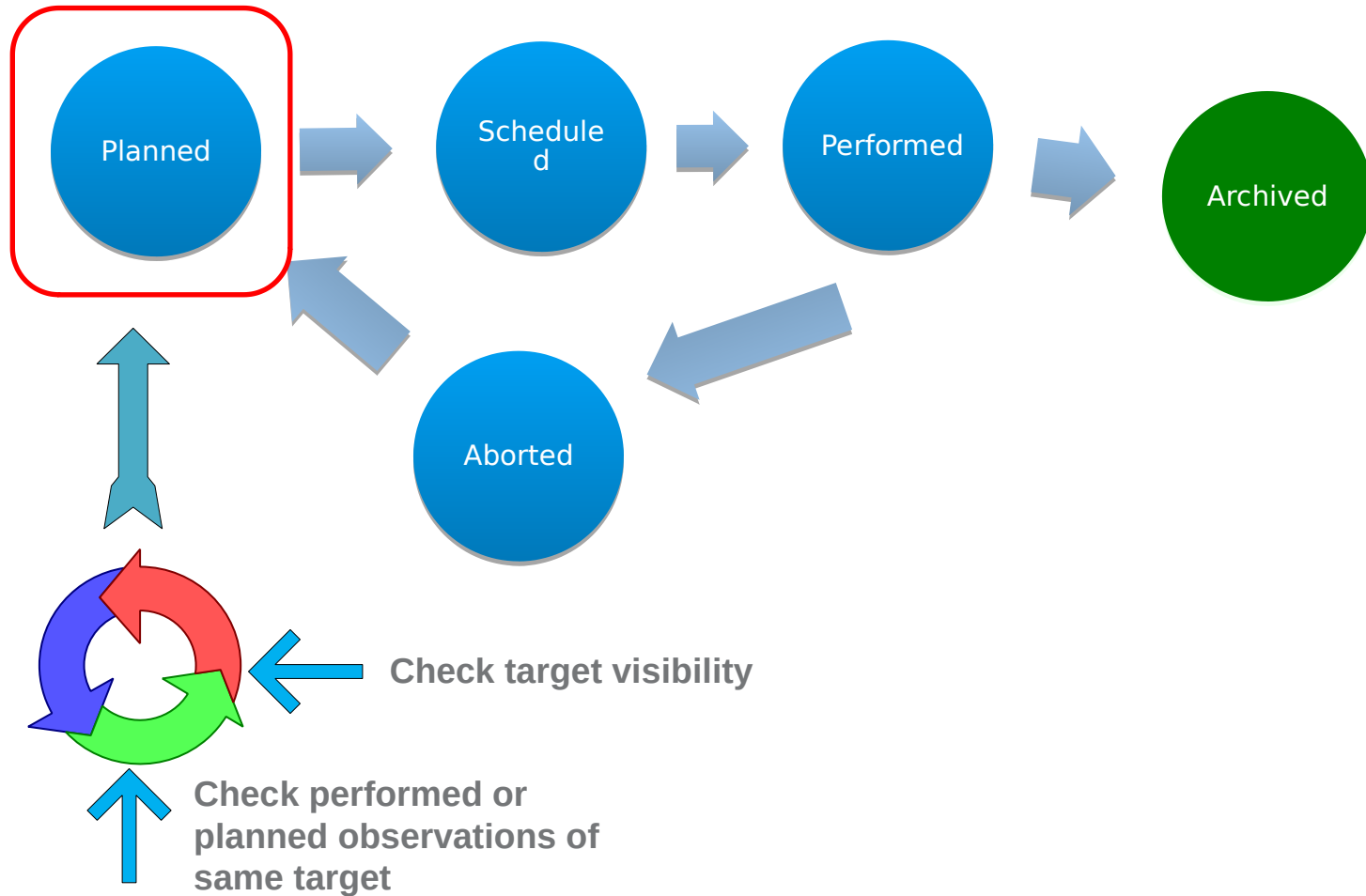
Courtesy J.-U. Ness

Need For Improved Methods

- Recent workshops have discussed this issue:
 - Paving the Way to Simultaneous Multi-Wavelength Astronomy (Leiden: July 13, 2015)**
 - White paper: (arXiv/1709.03520v3)
 - Astrophysics Mission Synergy Workshop (Caltech: March 31, 2017)**
 - Planning ESO observations of future gravitational wave events (Garching: January 31 2018)**
 - Kavli-IAU Workshop: International co-ordination of multi-messenger transient observations in the 2020s and beyond**
 - International Coordination of Multi-Messenger Transient Observations in the 2020s and Beyond: Kavli-IAU White Paper



Observations Life cycle



The information is out there



All information needed to plan an observation (via AO or ToO) is currently in facilities own web pages.

Target Visibility
Constraints

BUT

Observations
info

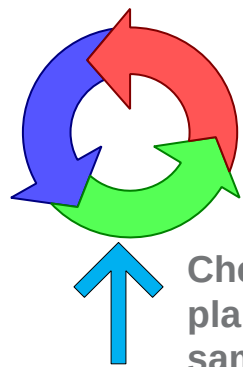
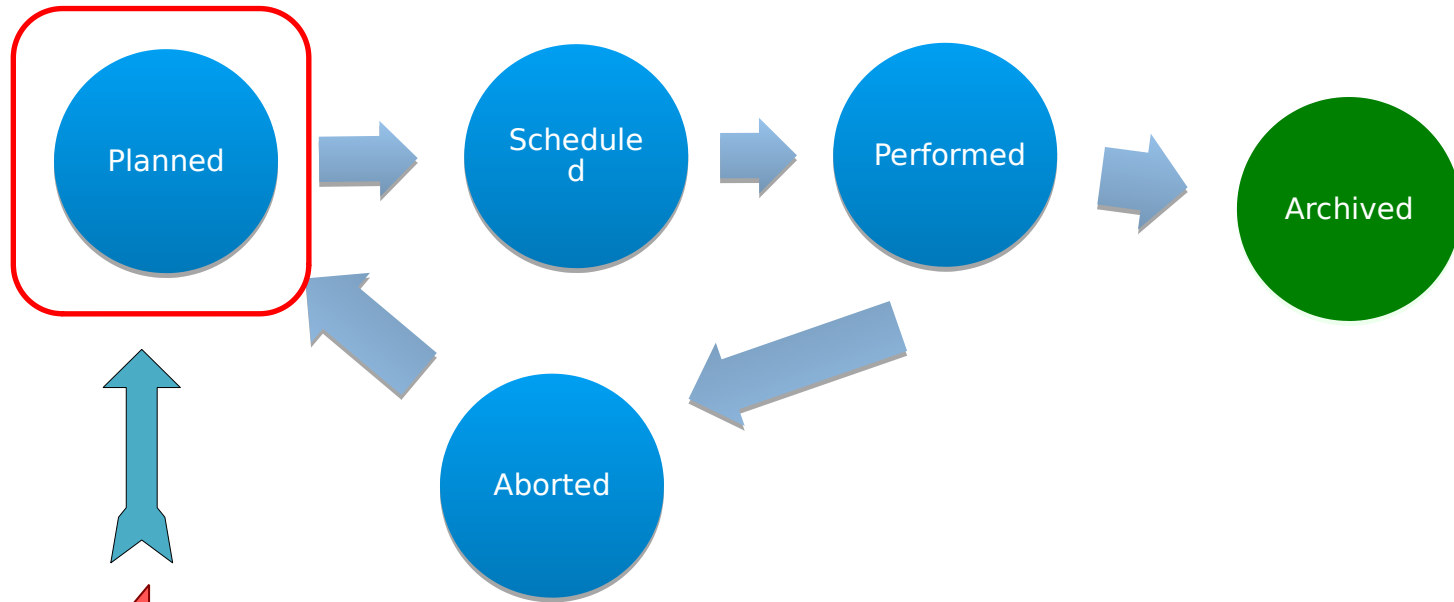
Instrument
info

Short-term
schedule

Long-term
schedule

This information is usually shown in a web page statically and is only accessible through forms that have to be manually filled in.

Observations Life cycle



Check target visibility

Check performed or planned observations of same target

Services common terminology?



Minimum common information



- Object Visibility periods
 - **Object Visibility protocol:**
 - **ObjVisSAP** to standardize the retrieval of the well known visibility periods that all facilities have.
- Observation Locator
 - **Observation Locator Protocol:**
 - **ObsLocTAP** to simplify the acquisition of previous and planned observations.

IVOA Working Draft

International Virtual Observatory Alliance



IVOA Documents

Object Visibility Simple Access Protocol Version 1.0

IVOA Working Draft 14 May 2020

InterestWorking Group:

<http://www.ivoa.net/html/bibliography/IVOA/ivoaDA/>

Author(s):
Aitor Ibarra, Richard Saxton, Jesús Salgado, Matthias Ehle, Janet Evans, Carlos Gabriel, James Dempsey, Maria Diaz Trigo, Yue Huang, Jaime Kennea, Mark Kettinis, Peter Kretschmar, Erik Kuulkers, Uwe Lammert, Giorgio Matt, Bruno Merin, Marco Molinaro, Jan-Uwe Ness, Julian Osborne, Emma de Ona Wilhelmi, Edward J. Salbol, Emilio Salazar, Celia Sánchez, Gregory Sivakoff, Lian Tao, Aaron Tohuvaovu, Bill Workman

Editor(s):
Aitor Ibarra, Richard Saxton, Jesús Salgado

Abstract

The Object Visibility Simple Access Protocol (ObjVisSAP) is an IVOA Data Access protocol which defines the standard for retrieving object constraint-free visibility time intervals through a uniform interface within the VO framework for given object coordinates to be observed by a given Astronomical Observatory. The ObjVisSAP services can be registered in an IVOA Registry of Resources using the VO Resource (Pante, Benson, et al. 2018). Extension standard, having a unique ResourceIdentifier (Demleitner, y otros 2016) in the registry. The ObjVisSAP interface is meant to be reasonably simple to be implemented by service providers. A basic query will be done introducing a set of sky coordinates and a given time period (optional). The service returns a list of constraint-free visibility time intervals formatted as VOTable. Thus, an implementation of the service may support additional search parameters (some of which may be custom to that particular service) to more finely control the selection of the visibility periods. The specification also describes how the search on extra parameters has to be done.

Status of this document

This is an IVOA Working Draft for review by IVOA members and other interested parties. It is a draft document and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use IVOA Working Drafts as reference materials or to cite them as other than "work in progress".

IVOA Proposed Recommendation

International Virtual Observatory Alliance



IVOA Documents

Observation Locator Table Access Protocol Version 1.0

IVOA Proposed Recommendation 07 October 2020

InterestWorking Group:

<http://www.ivoa.net/html/bibliography/IVOA/ivoaDataModel/>

Author(s):
Aitor Ibarra, Jesús Salgado, Matthias Ehle, Carlos Gabriel, James Dempsey, Markus Demleitner, Maria Diaz Trigo, Karl Foster, Jaime Kennea, Mark Kettinis, Peter Kretschmar, Erik Kuulkers, Giorgio Matt, Bruno Merin, Marco Molinaro, Jan-Uwe Ness, Julian Osborne, Emma de Ona Wilhelmi, Edward J. Salbol, Emilio Salazar, Celia Sánchez, Richard Saxton, Gregory Sivakoff, Lian Tao, Aaron Tohuvaovu, Bill Workman

Editor(s):
Jesús Salgado, Aitor Ibarra

Abstract

The Observation Locator Table Access Protocol (ObsLocTAP) defines a data model for scheduled observations and a method to run queries over compliant data using several Virtual Observatory technologies. The data model builds on the ObsCore data model, removing elements associated to datasets access, not present during the planning phase. In this way, present standard is focused on the access to metadata related to the planning of a certain observatory, more than in the access to the scientific data products. Also, the data model will be focused on observation planning discovery, what is very useful information for multiwavelength coordination observations, re-planning information propagation, follow-up of targets of Opportunity alerts, preparation of proposals, etc. As with ObsCore, a serialisation into a relational table is defined, which allows users to run complex queries using the IVOA Table Access Protocol. The document also prescribes how to register and discover ObsLocTAP services.

Status of this document

This is an IVOA Proposed Recommendation made available for public review. It is appropriate to reference this document only as a recommended standard that is under review and which may be changed before it is accepted as a full recommendation.



- Observatory protocols workshop @ ESAC/ESA (21st September 2018)
 - More than 50 participants
 - More than 40 observatories represented
 - Comments and suggestions implemented in the IVOA documents
- Several facilities implements the current version of the protocols:
 - XMM-Newton, Integral, Gaia, Chandra, **NuSTAR**
- Demonstrator workshop @ Videocon (18th & 28th September 2020)
 - Two sessions with more than 20 participants each
 - Goal:
 - To report about the status of the VO protocols and to receive feedback on the proposed standards
 - To report about the implementation of these two protocols carried out by NuSTAR mission.

- **Karl Foster** (NuSTAR) reported during the demonstrator workshop his experience during the **ObjVisSAP** and the **ObsLocTAP** implementation.
 - Both protocols were implemented following the implementation guides from:
https://www.cosmos.esa.int/web/vovisobs_protocols/home
- Summary:

“It is complex but not complicated”
- **Peter Sorensen** (Nordic Optical Telescope) implemented the **ObjVisSAP** protocol right after the first session of the demonstrator workshop!!

- **Object Visibility Service**

- **Emilio Salazar** has developed a basic ObjVisSAP web service (REST) compliant using python+Django that can be downloaded from the following github repository

<https://github.com/emiliosalazardonate/visibility-service/blob/master/README.md>

- **Observation Locator Service**

- Detailed instructions of how to install a TAP (Table Access Protocol) server and configure it.
- In case you are familiar with Docker technologies, **Jesus Salgado** has created a dockerized instance with two Docker containers: One with a PostgreSQL/pgsphere with the ivoa.obsplan table and a second one with TAP server. They can be downloaded from:

<https://hub.docker.com/r/jsalgadodocker/postgres9.5-pgsphere-obsplan>

<https://hub.docker.com/r/jsalgadodocker/tapserver>

- The workshop was focused on the importance of international coordination in the multi-messenger area.
- The outcome of this workshop was a **White Paper** with a summary of the discussions that took place and the resulting recommendations for how to fulfil the full scientific potential in the 2020s and beyond.
- In particular, in section **Telescope Coordination** says:
 - Telescope Coordination Recommendation 1:

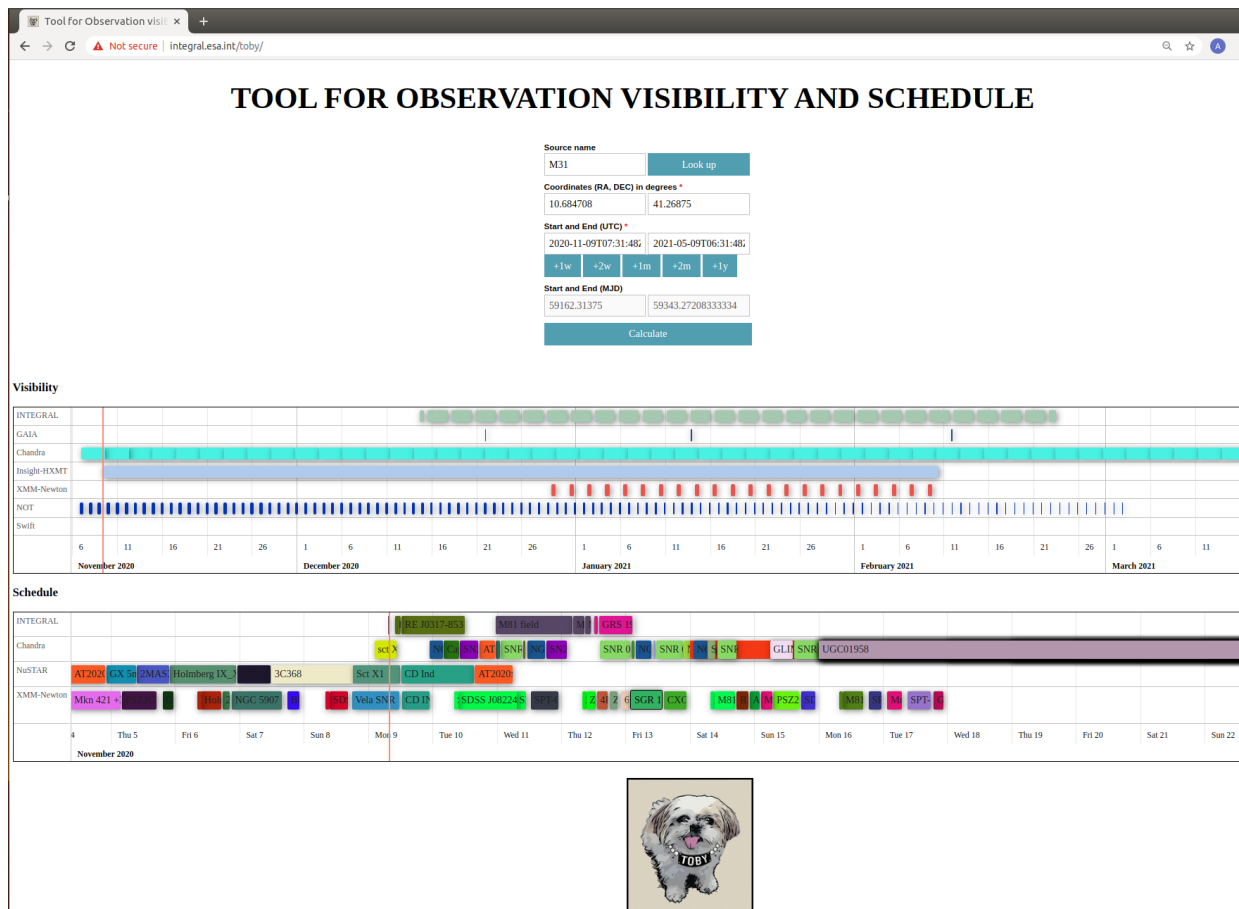
*We recommend the IAU endorse a common format for all observatories to report previous and planned observations, namely the standard developed by the IVOA (**ObsLocTAP**)*

Client implementation example



- ESAC (**Emilio Salazar**) has developed a web application where we can visualize all the astronomy facilities that currently implements the **ObjVisSAP** and **ObsLocTAP** protocols.

<http://integral.esa.int/toby/>



- **ObsLocTAP** has been proposed for recommendation to the IVOA
- **ObjVisSAP** is in working draft state and it will be proposed for recommendation to the IVOA soon.
- Implementation guides and code examples can be found at:
https://www.cosmos.esa.int/web/vovisobs_protocols/implementation-guides

Do not hesitate to contact me (aibarra@sciops.esa.int) or Jan-Uwe Ness (juness@sciops.esa.int) if you have any question or doubt about the protocols.

