

Observation Locator TAP -ObsLocTAP

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1 Quasar for ESA 2 TPZ-VEGA for ESA 3 ATG for ESA 4 ESA 5 NuSTAR

European Space Agency



Use Case

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Observations Life cycle





Planned Observations Services





Schedule for revolution 1872

(this list is also available in csv-format, click here to download)

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		2017.289	01:40:00	02:09:22	14518F0	Golimowski	F0-001	BIAS	ACS/WFC	ACCUM	WFC	F502N	0.00	FO O	1 01	
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			Scheduli Begin UT	ng Unit End UT	SU Id	Principal Investigat	Exp #	Target	Science Instrume	Mode	Apertures	Spectral Elements	Exposure Time(sec)	OB J	T EX	
		2017.289	02:38:56	03:08:18	14518F2	Golimowski	F2-001	BIAS	ACS/WFC	ACCUM	WFC	F502N F660N	0.00	F2 0	1 01	
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Observing schedules

tion Notes

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Short Range Observatory Schedule Download

This is the confirmed schedule of NuSTAR observations. This sequence of observations has been uploaded to the spacecraft and will execute autonomously unless interrupted by a new schedule, Target of Opportunity, or instrument and spacecraft anomalies. This schedule will cover various time ranges depending on the exposure time goal of the observations, but will usually be for a period of at least one week.

The times reported here are the start and end of the on-target period (day of year UTC). The estimated exposure time takes into account Earth occultation and the SAA passage time where detector background is increased. The end time of the observation is the start of the siew to the next target. Please examine the NuSTAR As-Room Timeline (AFT) for the log of past observations.

Table Header Explanations

obs_start	obs_end	sequenceID	Name	J2000_RA	J2000_Dec	Exp	Notes
2017:281:19:05:02	2017:283:00:30:00	90201021006	Kepler	262.671620	-21.491957	60.6	DDT
2017:283:01:11:23	2017:283:02:40:00	90311211001	Sol_17282_AR2683_POS11	195.15715	-6.38520	3.4	ToO
2017:283:02:40:32	2017:283:04:20:00	90311212001	Sol_17282_AR2683_PO512	195.21879	-6.41062	3.4	ToO
2017:283:04:20:32	2017:283:05:50:00	90311213001	Sol_17282_AR2683_POS13	195.28046	-6.43604	3.4	ToO
2017:283:06:55:11	2017:284:09:20:00	60376001002	2MASXJ19301380p3410495	292.557500	34.180500	55.3	Extragalactic Legacy Survey
2017:284:09:45:09	2017:284:20:35:00	60360008002	SDSSJ152132d21p391206d9	230.3874232	39.2007671	22.0	Extragalactic Legacy Survey
2017:284:21:10:03	2017:285:21:00:00	90301320002	NGC_6440	267.218083	-20.358944	49.5	ToO
2017:285:21:20:06	2017:286:08:20:00	30302020004	GRS_1915p105	288.79813	10.94578	21.9	(2/4) coordinated with XMM and VLT
2017:286:08:35:06	2017:286:19:30:00	60160701002	2MASXJ18560128p1538059	284.00210000	15.63200000	23.3	BAT AGN
2017:286:20:05:11	2017:287: <mark>1</mark> 5:05:00	60376007002	UGC06728	176.316800	79.681500	61.4	Extragalactic Legacy Survey
2017:287:15:50:11	2017:288:03:20:00	60368001002	NGC_1144	43.80083	-0.18361	22.0	
2017:288:04:05:09	2017:288:23:00:00	60301004002	ESO_103m35	279.58458	-65.4275	50.3	
2017:288:23:30:08	2017:290:05:45:00	30301026002	AX_J1841d0m0536	280.25179	-5.59625	59.7	phase constrained
2017:290:06:00:04	2017:290:17:00:00	60160670002	2E1739d1m1210	265.47600000	-12.19700000	23.5	BAT AGN
2017:290:17:15:01	2017:291:04:20:00	30363001002	GX_3p1	266.98333	-26.56361	21.8	

Long Range Observatory Schedule Download

This is the latest NuSTAR long-term schedule. Observations have been sorted into one-week intervals, taking into account Sun, Moon, required exposure time, and other constraints. So the date is the Monday of the week in which the observation is scheduled to begin.

E.g. An observation with a date 2017-12-18 in this table is scheduled to have the observation starting sometime between 2017-12-18 0000Z and 2017-12-25 0000Z.

Currently the schedule is driven by the large number of observations coordinated with other observatories and the need to complete the NuSTAR Guest Observer programs. The exposure goal for targets allotted within one week may appear to fill more then the available NuSTAR exposure time in that week (average is 330 ks per week) but many observations start in one week and complete in the following week.

Targets of opportunity and any instrument or spacecraft anomalies may also cause the observing times of targets to shift. This long-term schedule is our present estimate of the future order of observations. Please be aware of the uncertainties.

 ToO = Target of Opportunity
 DDT = Directors Discretionary Time
 N03 = NuSTAR GO cycle-3
 I15 = INTEGRAL GO cycle-15

 X16 = XMM-Newton GO cycle-16
 C18 = Chandra GO cycle-18
 ELS/GLS = Extragalactic/Galactic legacy surveys

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 Guido



- Understand the role of all elements needed to implement an ObsLocTAP server
- Explain how to follow the implementation guide: <u>https://www.cosmos.esa.int/web/vovisobs_protocols/implementation-guides</u>
- Identify difficult steps into the implementation
- Get feedback from the different partners to understand the status and possible support



Use Case

Architecture

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ObsLocTAP architecture





http://cdsportal.u-strasbg.fr/taptuto/

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Why TAP?

- **tocol)** is a standard defined
- TAP (Tabular Access Protocol) is a standard defined by the IVOA (International Virtual Observatory Alliance) to query astronomical databases
- It allows synchronous and asynchronous queries
- Used for many astronomical data providers (ESA, CDS, Heasarc, LSST...)
- A lot of client applications, including User Interfaces (e.g. TopCat) and command line interfaces (e.g. python astropy/pyvo)
- It is powerful and allows users (and applications) to create many complex exploration queries
- It allows the use of **ADQL**

Why ADQL?

- **ADQL** (Astronomical Data Query Language) is a SQL based query language designed for Astronomical Data Bases
 - No limitations on WHERE conditions
 - No restrictions on columns for SELECT
 - Spatial support based on coordinates
 - CONTAINS/INTERSECTS
 - CIRCLE, POLYGON, POINT
 - Enables temporary tables uploaded from users (persistent tables for TAP+)
 - Due to security restrictions, it does not support procedures and functions to modify alter database contents

ADQL Examples



Gaia Archive

```
SELECT DISTANCE(
    POINT('ICRS', ra, dec),
    POINT('ICRS', 266.41683, -29.00781)) AS dist, *
FROM gaiadr2.gaia_source
WHERE 1=CONTAINS(
    POINT('ICRS', ra, dec),
    CIRCLE('ICRS', 266.41683, -29.00781, 0.08333333))
ORDER BY dist ASC
```

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ObsLocTAP Query

SELECT * FROM

ivoa.obsplan

WHERE

```
t planning > 58500 AND t max < 58502
```

AND 1=INTERSECTS (s region, CIRCLE ('ICRS', 114.8251,

1.6179, 0.016666))

where we are checking whether there are any newly planned observations from 58500 (17/01/2019) on the next two days (58502 or 19/01/2019) around the target PKS 0736+017, with a radius of 1 arcmin

TAP Clients

http://www.star.bris.ac.uk/~mbt/topcat/sun253/TapTableLoadDialog.html

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Table Access Protocol (TAP) Query			<u></u>		
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Select Service Use Service Resume Job	a Running Jobs				
[Metadata	ant and				
Find: califa hipparcos	Schema Schema	e	actrony:docs	actro DV IZ Jaday Madulas Page	
🗹 Name 🗹 Descrip 🛛 👘 Name	Type Unit	Indexed Descrit	astropy.docs		1
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Query Language: ADQL-2.0 V Max Rows	s: 2000 (default)	Uploads: 20Mb		If you need to access data which is not available via the Virtual Observatory standards, try the astropy affiliated package astroquery (and, of course, ask the data providers to do the right thing and use the proper standards for their publication).	
Mode: Synchronous 🔻	444	🎟 🧷 🦘 🍻 Ier Ios 🛕 🦠		Installation	
nnmyl_1 nnmyl_2 califa 5				PyVO is installable via pip.	
SELECT TOP 10000		1		pip install pyvo	
o.target_name, o.raj2000, o.dej2000	, o.magg, o.magz,				
h.hipno, h.raj2000, h.dej2000, h.pm	ra, h.pmde			Source Installation	
TOTN arihin main AS h				ait along http://aithub.com/muristabs/mura	1
ON 1=CONTAINS(POINT('ICRS', o.raj3000 CIRCLE('ICRS', h.raj200	<mark>0</mark> , o.dej2000), 00, h.dej2000, 5./3	600.))		cd pyvo python setup.py install	Ø v: latest ▼
Examples		Info 🗳			
) <u></u>	Run Query		<u>http</u>	s://pyvo.readthedocs.io/en/lates	<u>st/</u>

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ObsLocTAP implementation: Database

- Install a PostgreSQL DB: Recommended 9.6
 - Commonly used in Astronomy
 - Geometrical indexing support
 - IVOA Toolkits compatible with PosgreSQL

https://www.postgresql.org/download/

- **Install pgSphere:** PostgreSQL modules which adds spherical data types.
 - containing, overlapping, and other operators
 - point, circle, polygon
 - indexing of spherical data types

https://pgsphere.github.io/

• There are some shortcuts for some operating systems like:

https://zoomadmin.com/HowToInstall/UbuntuPackage/postgresgl-pgsphere

but it is usually better to install both packages sequentially





ObsLocTAP implementation: TAP

- IVOA offers different toolkits
 - DACHS from GAVO:
 - http://soft.g-vo.org/dachs https://dachs-doc.readthedocs.io/tutorial.html
 - SAADA:
 - http://saada.unistra.fr/saada/
 - TAPTuto:
 - http://cdsportal.u-strasbg.fr/taptuto/

http://cdsportal.u-strasbg.fr/taptuto/

- Very well documented
- Clear instructions
- Always updated to latest version (e.g. ADQL)
- Note: It makes use of a Tomcat web server (if not available, it needs to be installed too)







TAP Library v2.3

This Java library is a framework aiming to build quickly and easily a TAP service.

Getting started !

Download 🛓

What is TAP ?

<u>TAP</u> is a protocol defined by the <u>IVOA</u> in the Recommendation of 27 March 2010 (Version 1.0) which lets access table data.

The standards <u>ADQL</u> and <u>UWS</u> are used in this protocol.

Remind me! 4

Why this library?

In order to help Java developpers to quickly build a TAP service with as less code writing as possible. A service built using this framework will be conform to the IVOA definition of the protocol TAP.

Functionalities:

- <u>Configuration file</u>: a TAP service can be created with just a simple keyvalue configuration file...nothing else.
- <u>Metadata management:</u> a TAP service let querying a database whose some tables and columns are accessible. All information (name, ucd utype type description)

How to use it ?

- Getting started: to start with this library.
- Migration help: to migrate from v1.0 to v2.0.
- Documentation: to have more details about all provided functionnalities.

(9) The documentation is not yet complete. Content will be added piece by piece.

- Javadoc: Java documentation of all available classes.
- What's new ?: Last modifications of the library

ObsLocTAP implementation: TAP trick I

TAP Lib. - Home TAP Reminder Getting Started Documentation - Javadoc Download What's new?

(optional) Connection pool library.

Use case

Let's supy want to publ Using this • <u>Datab</u> • <u>Datab</u> • <u>JDBC</u> • <u>File dil</u> • (<u>optior</u> Goal In both of • 4 out • <u>VIPLC</u> • Simpl • All AD • 4 com	pose we have a PostgreSQL database named NyStarCatalogues containing several astronomical data. Among all these data we lish in a TAP service only one table called SuperCat (in the database schema public). TAP library, we should first fulfil the above prerequisites: Application Server? Apache Torncat ase? a PostgreSQL database called NyStarCatalogues . diver? or postgreSQL Pitter (can be found here) rectory? file:///somewhere/TAPFiles. na) Connection pool library? the Apache Torncat embedded connection pool. The above methods, the goal will be to set a TAP service having the following specification: put formats: VOTable (binary), VOTable (TableData), FITS and CSV. XOL beling: le coordinate system verification (only ICRS coordinates must be allowed) XOL geometries (depending of your DBMS and its extension(s)) mon simple user defined functions (random, rtrim, rpad, initcap) Configuration file O Create and configure an antire TAP service with only one single text file. OR HTTP Servlet O Extend 2 simple interfaces of the library ard write an HTTP serviet to use them.	<pre>public SuperCat HarB name: varchar322) ra: float8 demagg: float magg: float </pre>	 To configure the TAP so the easiest way is to us configuration file optio No code to be writter Change MyTAP servle to your project name 				
Author: Gré Last modifie	gory Mantelet (CDS) cation: 11 April 2019						
1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	<pre><?xml version="1.0" encoding="UTF-8"?> <web-app http:="" java.sun.com="" n<="" th="" xml="" xmlns:xsi="http://www.w3.org/2001/XM xsi:schemaLocation="><th>ILSchema-instance" xmlns is/javaee http://java.su .eTAPServlet<th>="htt n.com ass></th><th>p://java.sun.com/xml/ns/javaee" //xml/ns/javaee/web-app_3_0.xsd" version="3.0"></th></th></web-app></pre>	ILSchema-instance" xmlns is/javaee http://java.su .eTAPServlet <th>="htt n.com ass></th> <th>p://java.sun.com/xml/ns/javaee" //xml/ns/javaee/web-app_3_0.xsd" version="3.0"></th>	="htt n.com ass>	p://java.sun.com/xml/ns/javaee" //xml/ns/javaee/web-app_3_0.xsd" version="3.0">			
12.							

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ObsLocTAP implementation: TAP trick II



• Connection to DB can be done by properties or JNDI

- Through properties is very simple. JNDI for better performance
- Change jdbc_url schema to your scheme (probably ivoa)

Method 1: JDBC parameters

Just 1 parameter to select the JDBC method and 4 additional parameters to configure it are required here, nothing else:

```
    database_access = jdbc
    jdbc_driver = org.postgresql.Driver
    jdbc_url = jdbc:postgresql:MyStarCatalogues
    db_username = tapuser
    db password = *****
```

• DB schema TAP SCHEMA

- TAP_SCHEMA created at DB. Scripts provided by the instructions
- Use sql translator = pgsphere
 - The translator (pgsphere instead of postgresql) is one of the few differences of the instructions

ObsLocTAP Data Model

INGEST

- obsplan table needs to be created into DB
- Table should be populated



- Defines with tables and columns are published into the TAP service
- Can be used for aliases
- Security layer. Not all the tables and columns are published



- Create a basic/plain TAP_SCHEMA using TAPTUTO
 - **TAP_SCHEMA.schemas**: One row per schema where TAP tables are located
 - **TAP_SCHEMA.tables:** One row per table published on TAP
 - **TAP_SCHEMA.columns:** One row per column published on TAP
- A new schema (ivoa) a new table (obsplan) and some columns need to be added to the ObsLocTAP service TAP_SCHEMA
- These are described and an example of the SQL inserts could be found at the implementation guide:
 - <u>https://www.cosmos.esa.int/web/vovisobs_protocols/implementation-guides</u>

ivoa.obsplan creation

- Next step is the obsplan DB creation
- A script can be found at: <u>https://www.cosmos.esa.int/web/vovisobs_protocols/implementation-guides</u>
- CREATE EXTENSION pg_sphere;
- Pgsphere will be needed to create the s_region field. Two possible types:
 - Circle
 - Polygon
- Unfortunately, there is no way to express a mixture of circles and polygons in the same row
- Ingestion can be done talking directly with the database (e.g. using psql)



INSERT INTO ivoa.obsplan

(t_planning,target_name,obs_id,obs_collection,s_ra,s_dec,s_fov,s_region,s_resolution,t_min,t _max,t_exptime,t_resolution,em_min,em_max,em_res_power,o_ucd,pol_states,pol_xel,facility _name,instrument_name,obs_release_date,t_plan_exptime,category,priority,execution_status) VALUES (58809.42866,'Cas A / Tycho SNR','21710053','16200160002',4.4687083,59.9733583,12.0, <(4.4687083d, 59.9733583d),12d>, 720.0,58833.67603,58833.71689,3530.0,6.1E-5,1.241528257871965E-13,8.27685505247976 6E-11,0.00386,'photon.flux',NULL,0,'INTEGRAL','IBIS, SPI',NULL,1500000.0,'Normal',0,'Scheduled');

• Please check pgsphere notation:

<(4.4687083d , 59.9733583d),12d>

equivalent to CIRCLE('ICRS', ra, dec, radius)

- Note: If "d" is not added, values in radians.
- In case of doubt understanding a field, please also check ObsCore <u>http://www.ivoa.net/documents/ObsCore/</u>

Testing the system

• By using, e.g. TopCat, you can test your system by adding your service URL into the application.Generally, something like

http://localhost:8080/<tap_name>/tap

	TAP HOME PAGE
Available resources	
 tables sync capabilities async availability 	
ADQL query	
Query:	
SELECT * FROM TAP_SCHEMA.tables;	
Execution mode: O Asynchrono	us/Batch
Format: votable V	
Result limit: -1	rows (0 to get only metadata ; a value < 0 means 'default value')
Duration limit: -1	seconds (a value ≤ 0 means 'default value')
Execute!	
Page generated by TAPI ibrary v?	0

Try some queries, like:

SELECT * FROM ivoa.obsplan WHERE t_max < 58502 AND 1=INTERSECTS(s_region, CIRCLE('ICRS', 114.8251, 1.6179, 0.016666))

ObsLocTAP Docker short-cut

- Either to have a service to play with or to have a service without major effort, a couple of Docker instances are also provided:
 - PostgreSQL database with pgsphere installed, TAP_SCHEMA and ivoa.obsplan table with some rows
 - Tomcat server with taptuto installed
- As Docker containers are executed on a sandbox (isolated from the host machine) a network bridge is created to communicate them



ObsLocTAP by Docker start-up





docker pull jsalgadodocker/pgsphere-obsplan:latest docker pull jsalgadodocker/tapserver:latest docker network create --driver=bridge db-network docker image ls docker run -p 8080:8080 --net=db-network --name tap jsalgadodocker/tapserver:latest docker run -p 5432:5432 --net=db-network --name db jsalgadodocker/pgsphere-obsplan:latest

After successful implementation, contact E. Salazar for integration into:

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



Other clients expected: MySpaceCal (calendar for many missions), ESASky, etc

J. Salgado | Visibility protocols workshop | 18/09/2020 | Slide 26

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