VO diffusion for CTA

The Cherenkov Telescope Array

Mathieu Servillat

Cyril Chauvin, Renaud Savalle

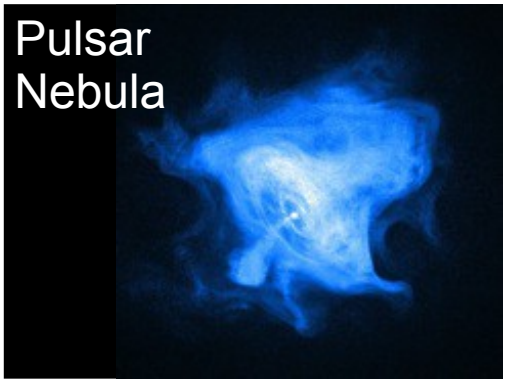
Catherine Boisson, Pierre Le Sidaner, Régis Haigron

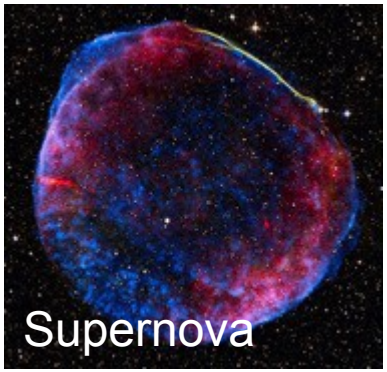
Observatoire de Paris

Laboratoire Univers et Théories

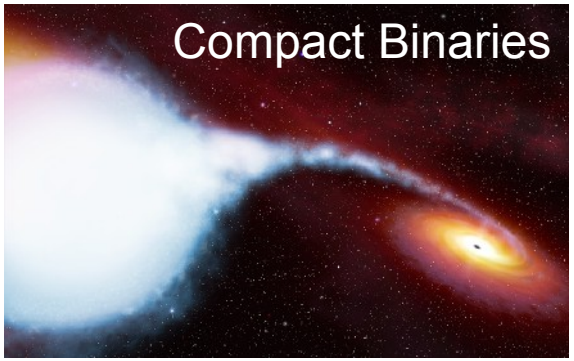
VO-Paris Data Center

High Energy Astrophysics

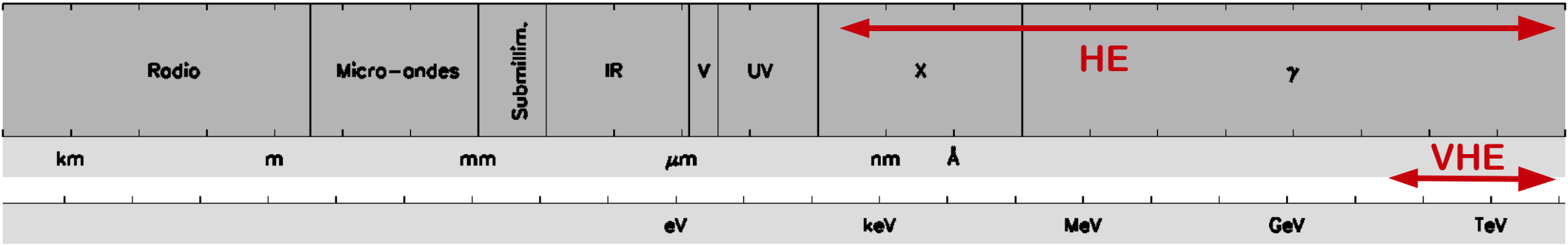




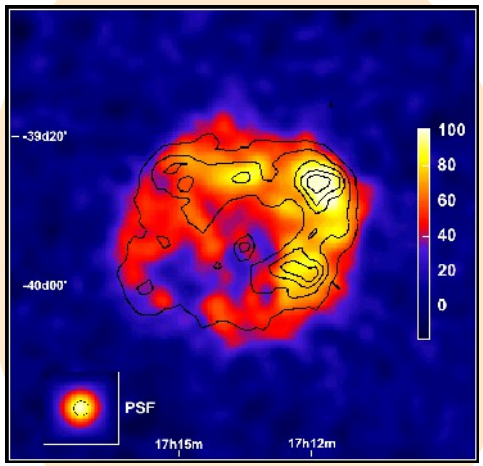
- Violent, transient, non-thermal phenomena
- Matter under extreme conditions
- Particle Acceleration
- Fundamental Physics
- Role of Black Holes in the structuration of the Universe



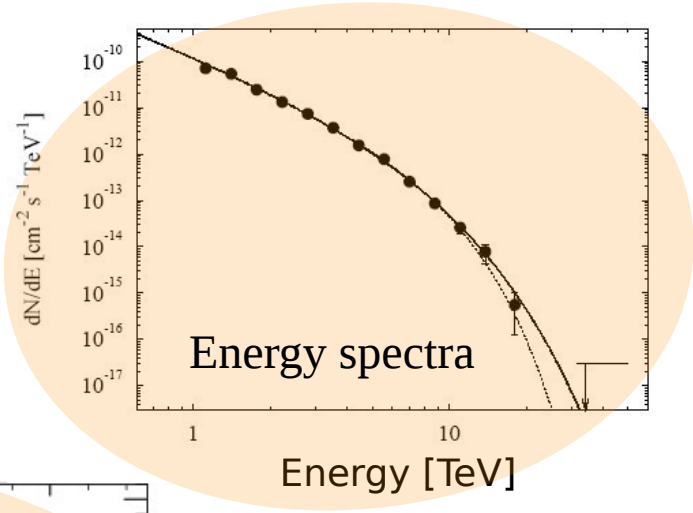
Very high energy data

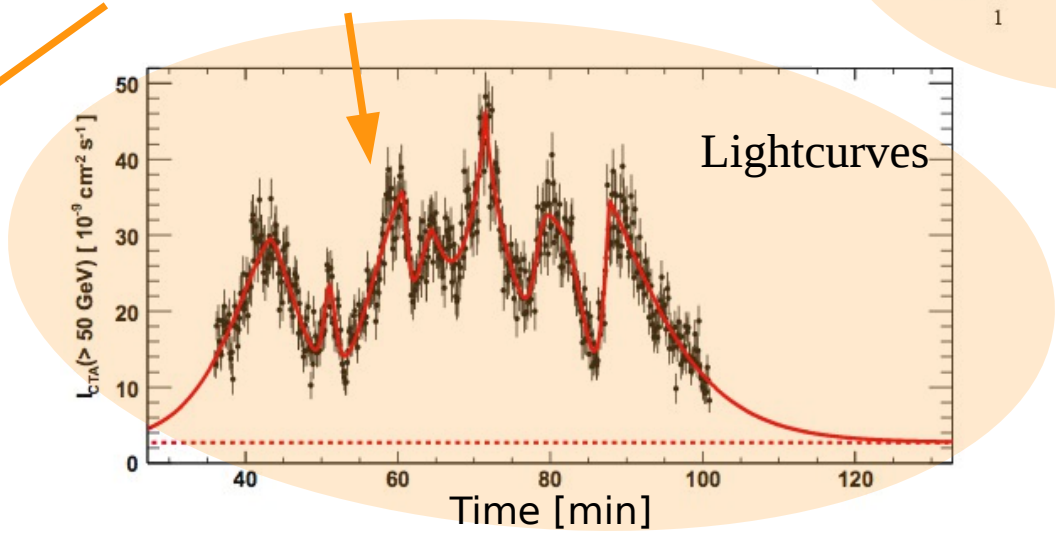


- Several orders of magnitude
- Photon counting
- Low count statistics, high background
- **Event lists**
  (coordinates, time, energy)



Images

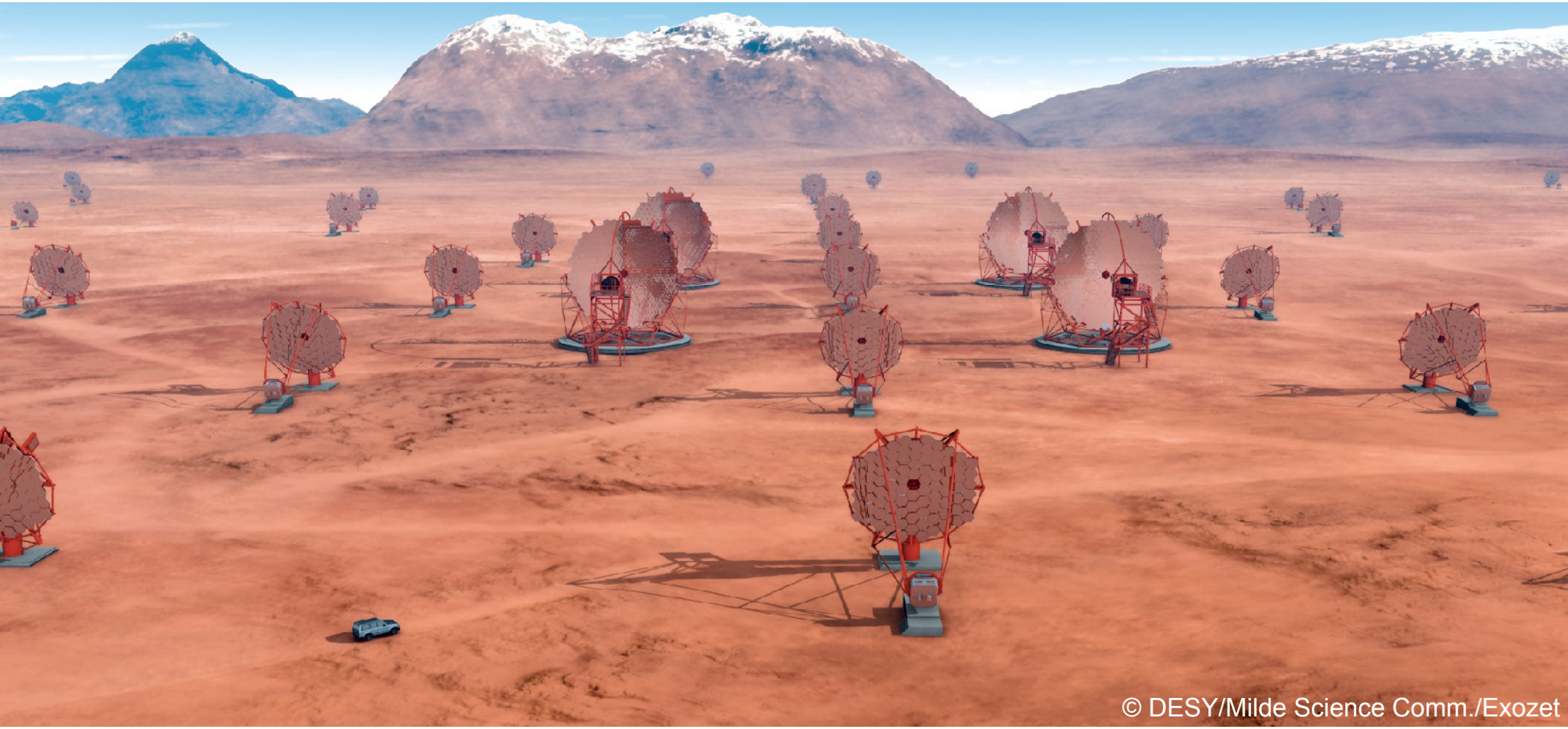




cherenkov telescope array

Observatory

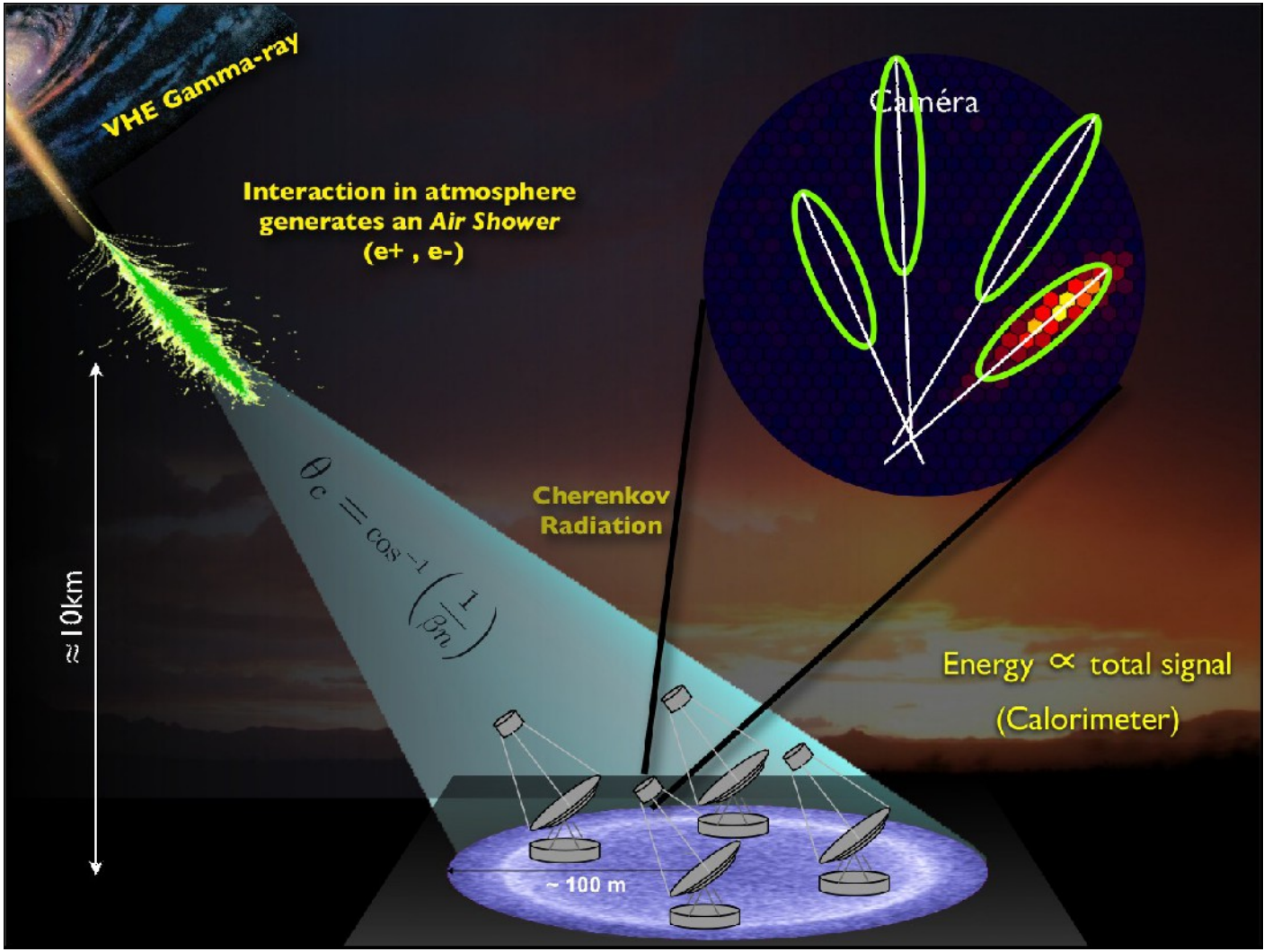
- Two arrays of **100 (South)** et **20 (North)** Cherenkov telescopes (4, 12 et 24 m in diametre)
- End of 2015: Site Selection, Namibia or Chile (under negociations)
- 2016: Construction
- Current experiments: H.E.S.S., MAGIC, VERITAS
  H.E.S.S.: experiment with 5 telescopes (4 x 12 m + 1 x 28 m)

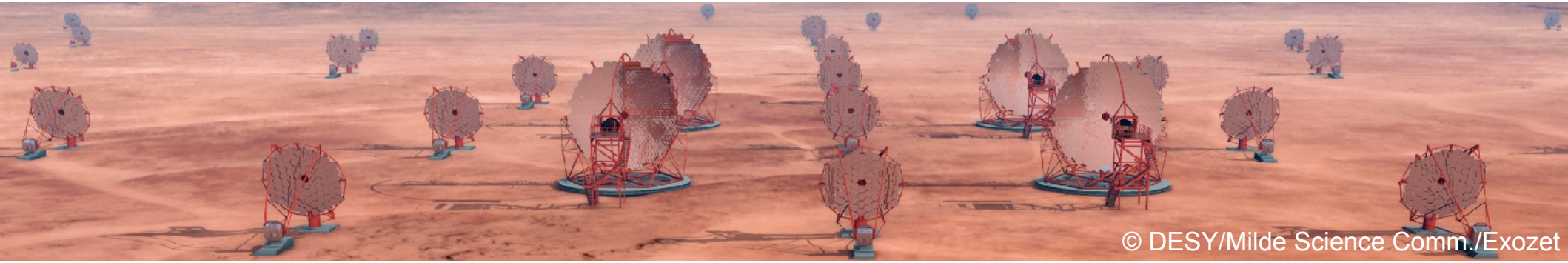


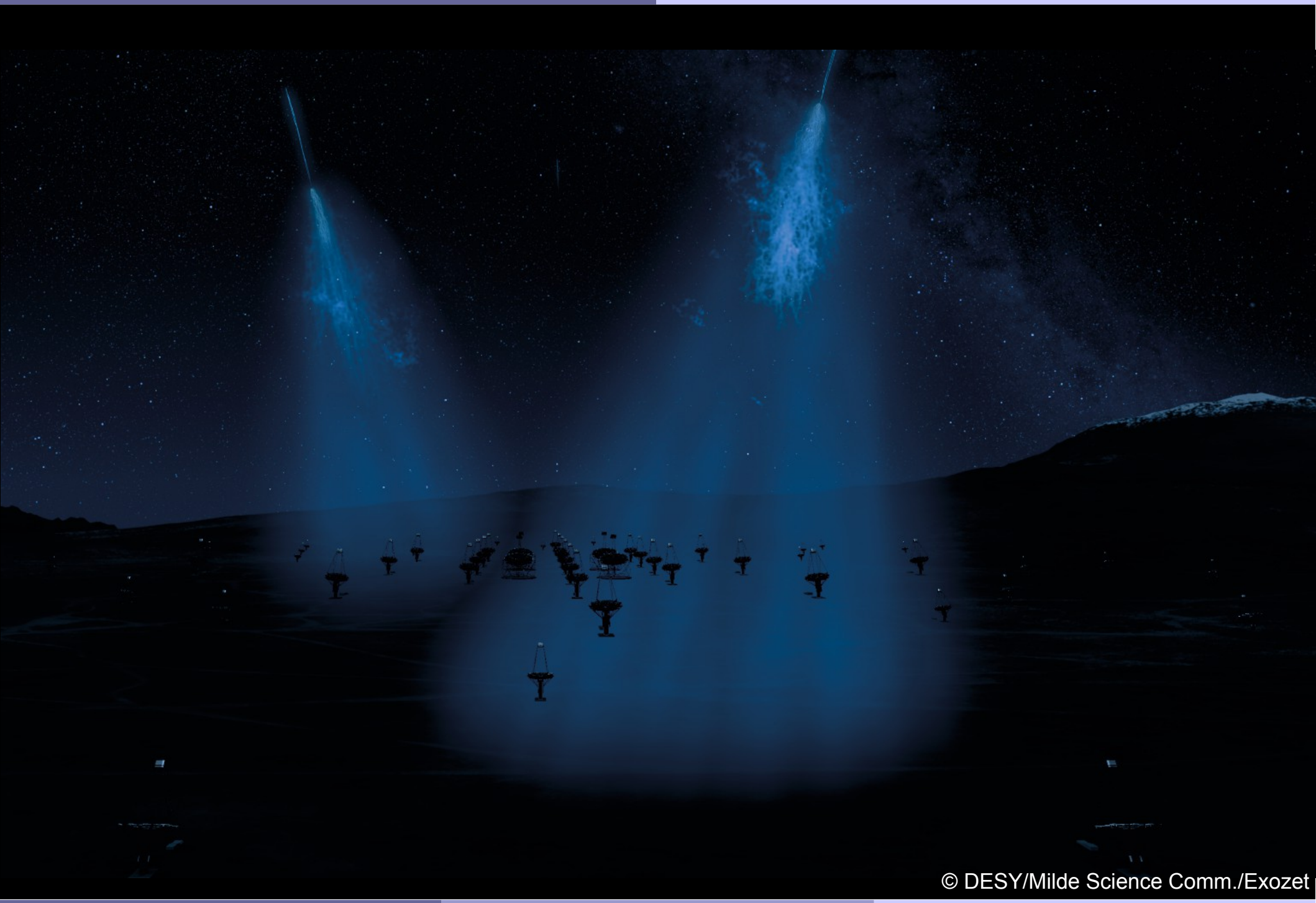
cherenkov telescope array

Observatory

- Event Reconstruction: photon, particle shower, Cherenkov light (faint, few nanoseconds)
- Atmosphere = calorimetre Simulations, assumptions
- Complex Metada, need to be structured







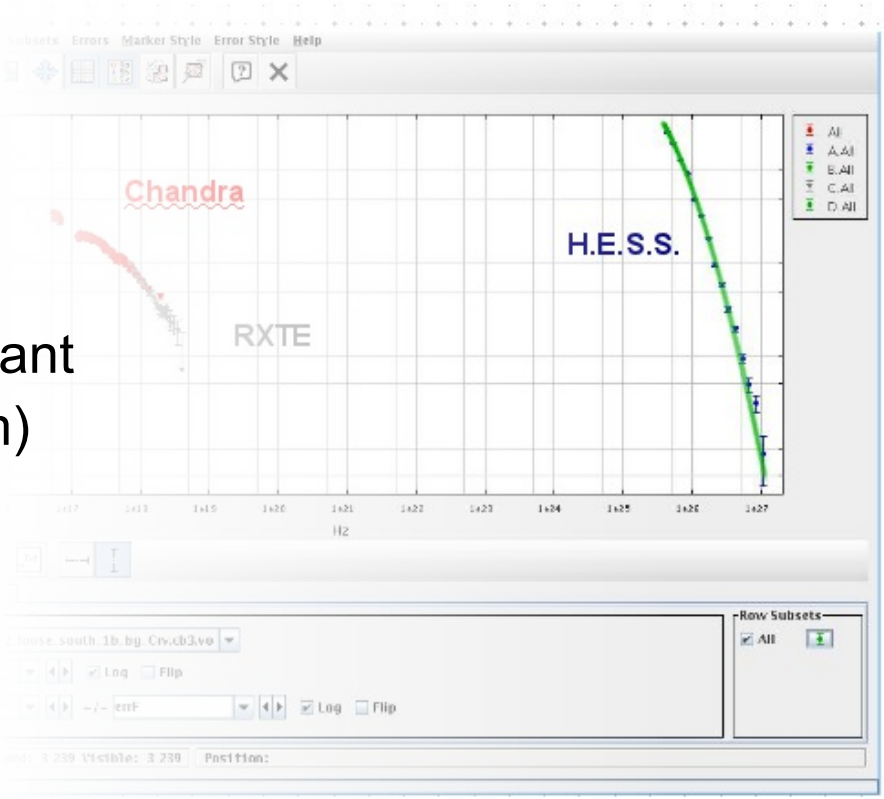
Observatoire de Paris and CTA

Knowledge in high energies and VO

- H.E.S.S. experiment
- High level data access prototype

  http://hess.obspm.fr/ ivo://vopdc.obspm/luth/hess

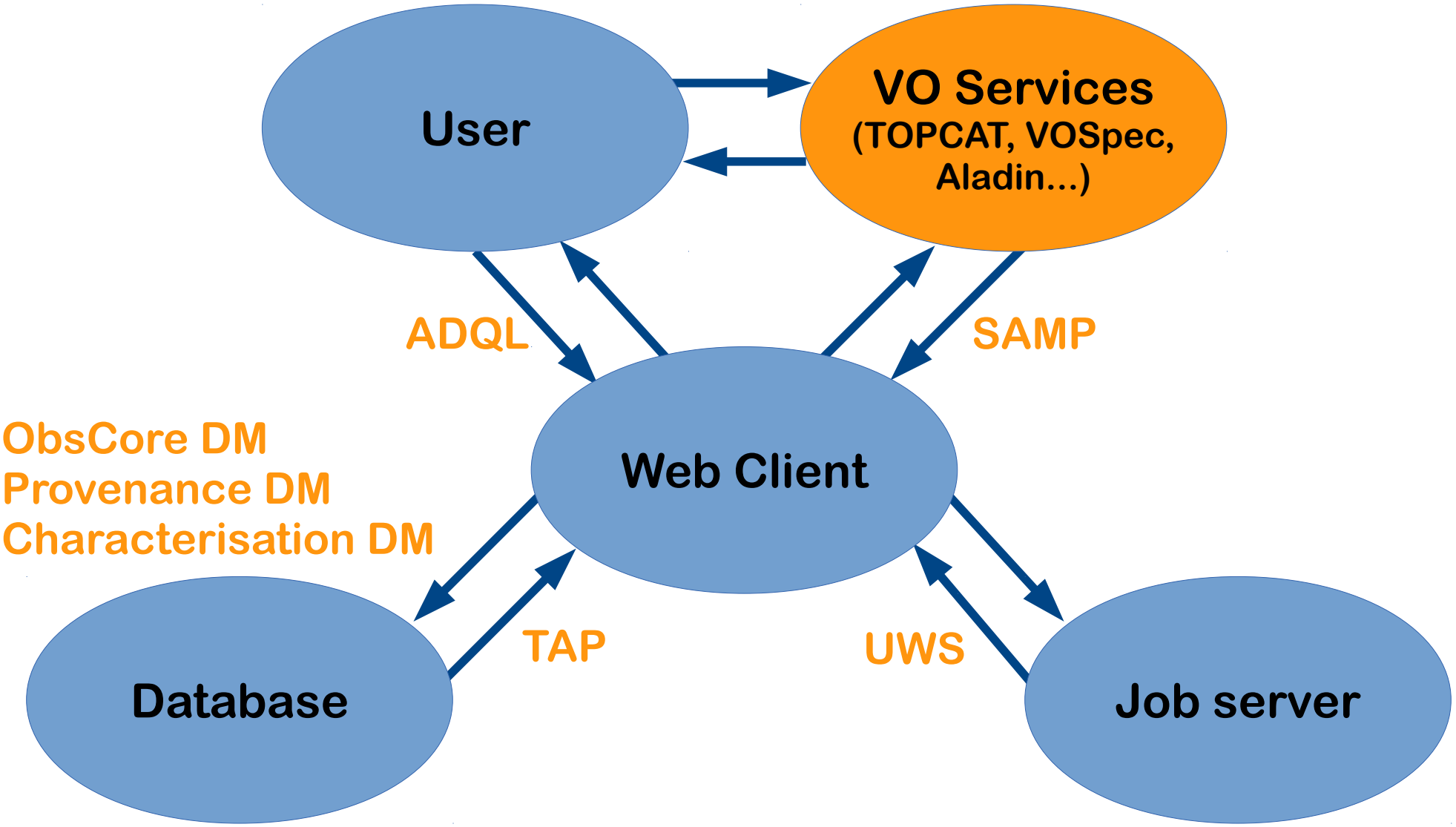
- Need to adapt VO standards
  - Complex hierarchy of related products
  - Complex metadata for Provenance
  - Queryable Metadata ?
  - Field of view / PSF are energy dependant
  - Units and precision (e.g. from TeV to m)



CTA : data access prototype

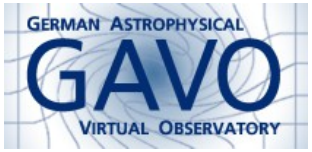
- CTA data model implemetation
- Test VO compliance

VO data access prototype



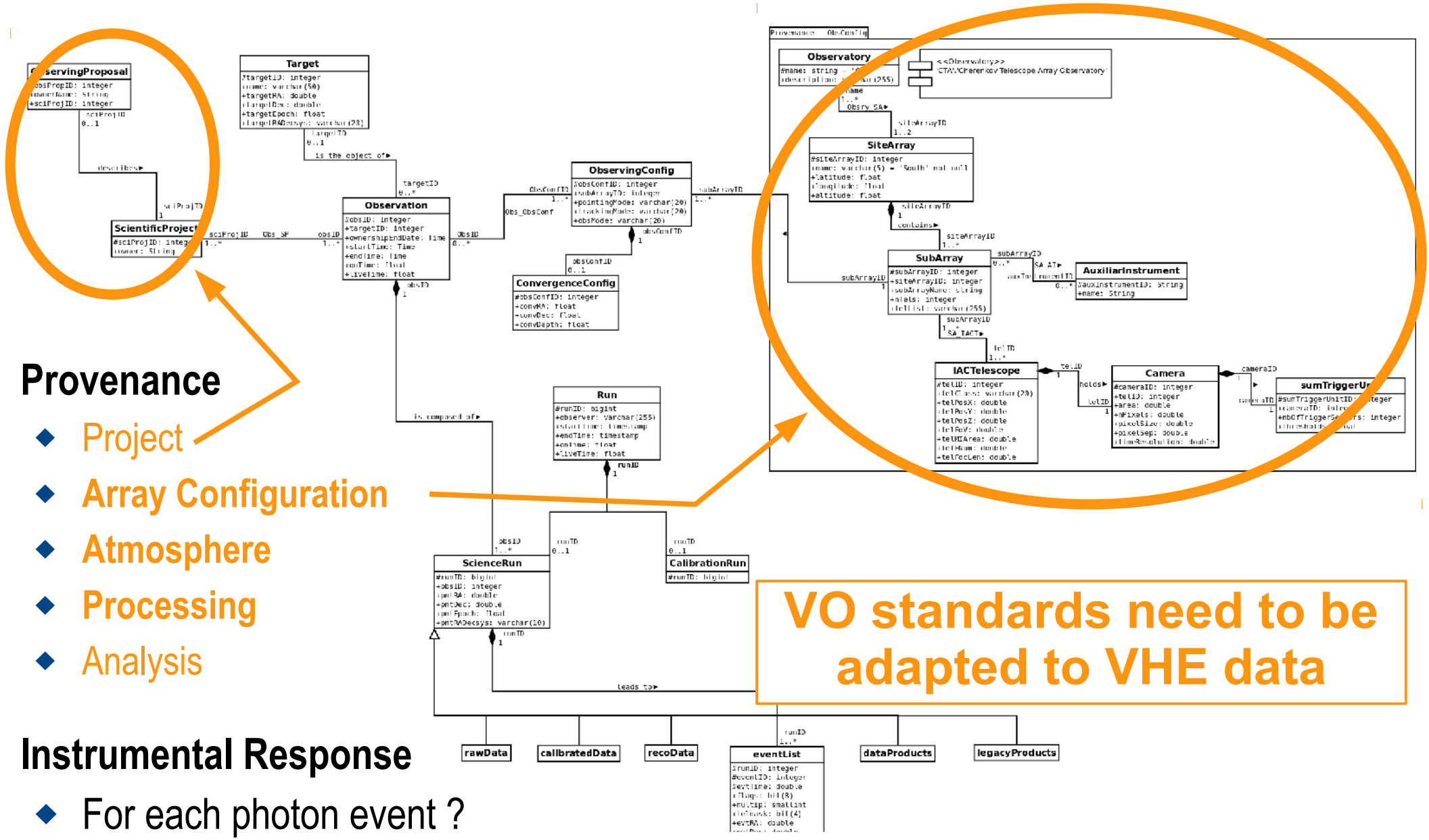
VO data access prototype

- **CTA Data Model**
  - **Automatic** Conversion UML to SQL
  - Relational database implemented (PostgreSQL)
- **Data Ingestion**: CTA 1DC data/metadata
- **VO Compliance**
  - IVOA ObsCore Data Model
  - GAVO DaCHS server: TAP, ADQL
- **Web Client** (Django, jQuery, BootStrap)
- **Online Analysis**: UWS, SAMP
- **Single Sign On** with SAML2/Shibboleth



► Complete solution based on VO standards/protocols

CTA Data Model



Provenance

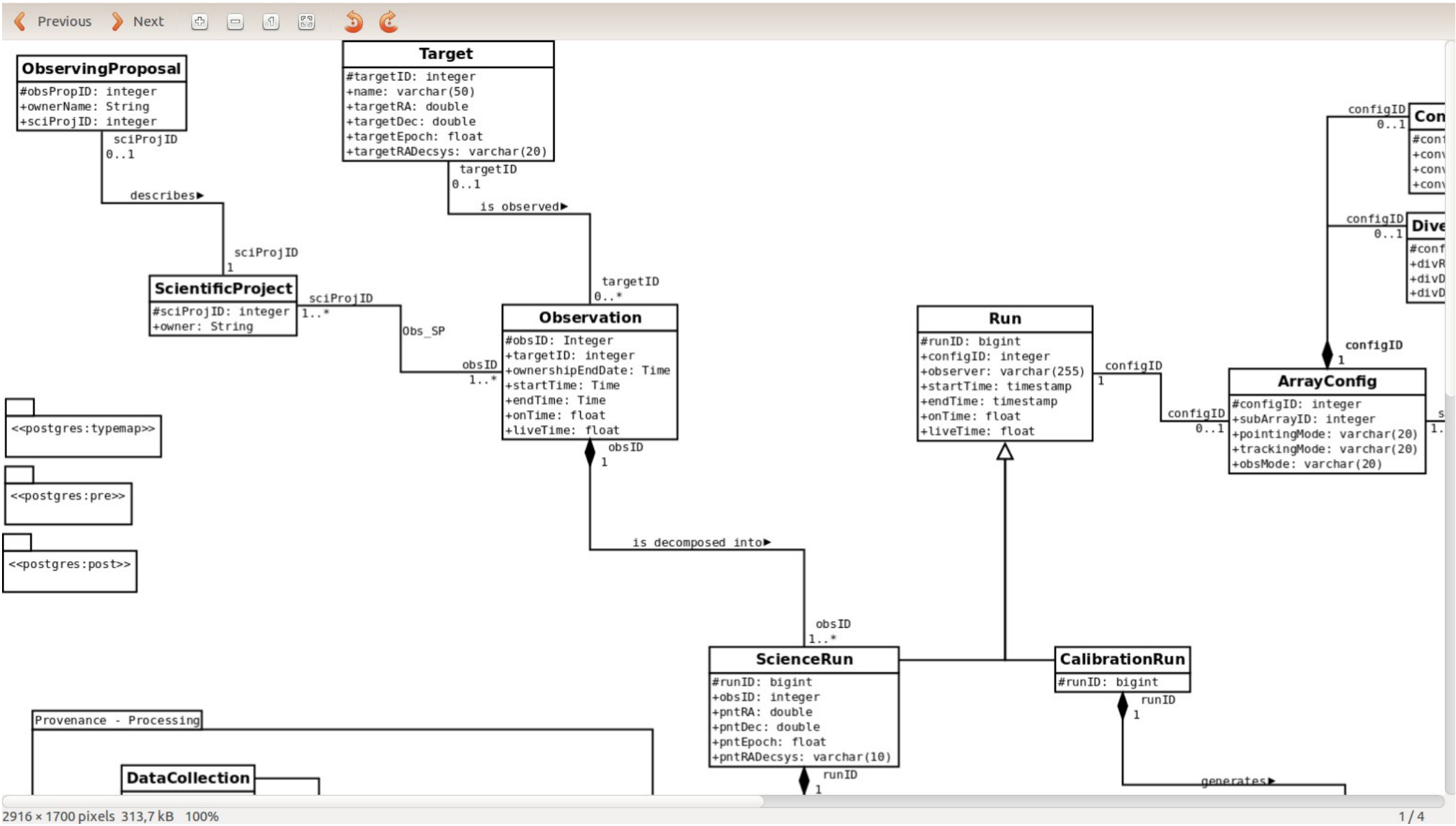
- Project
- Array Configuration
- Atmosphere
- Processing
- Analysis

Instrumental Response

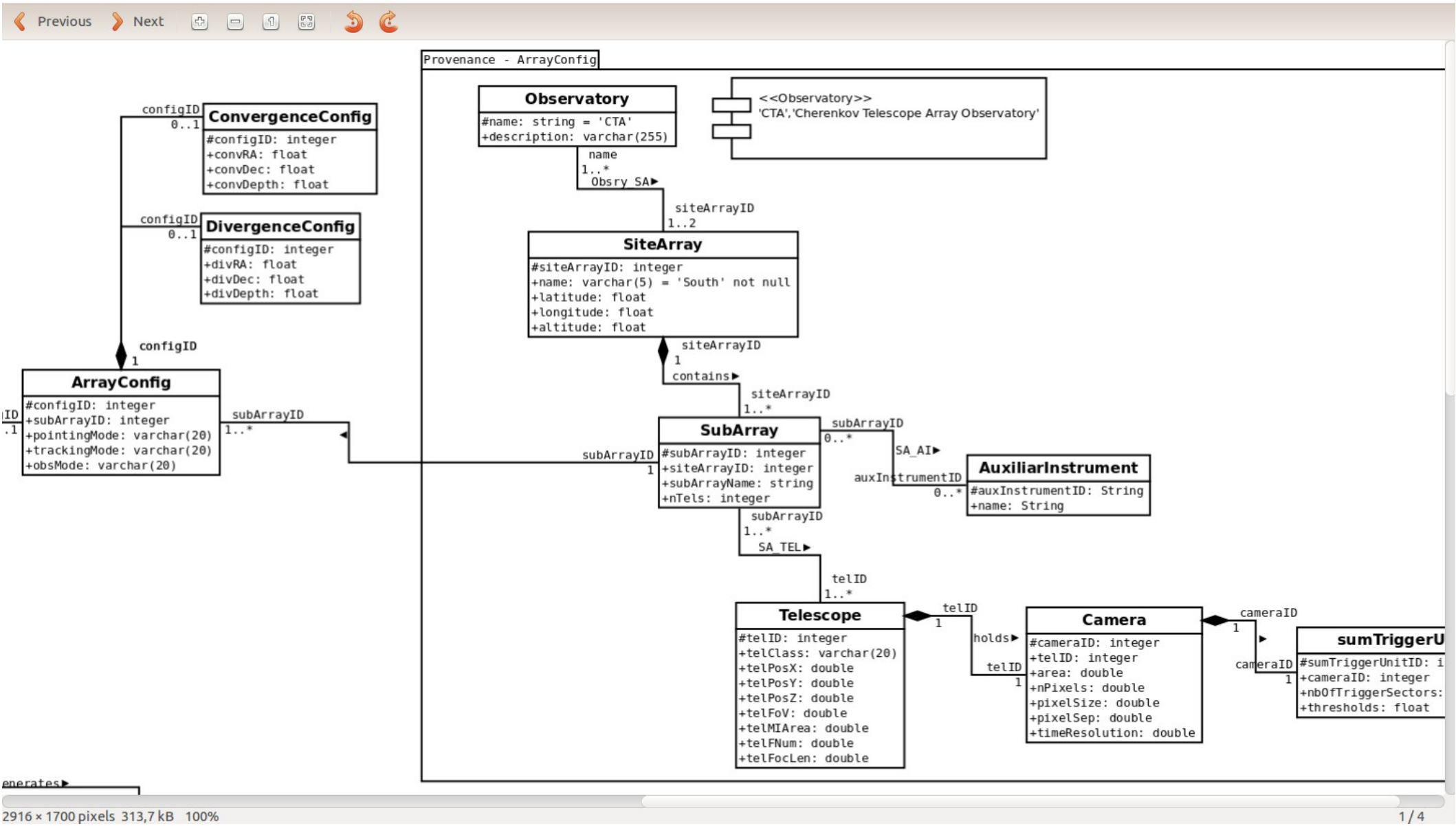
- For each photon event ?

VO standards need to be adapted to VHE data

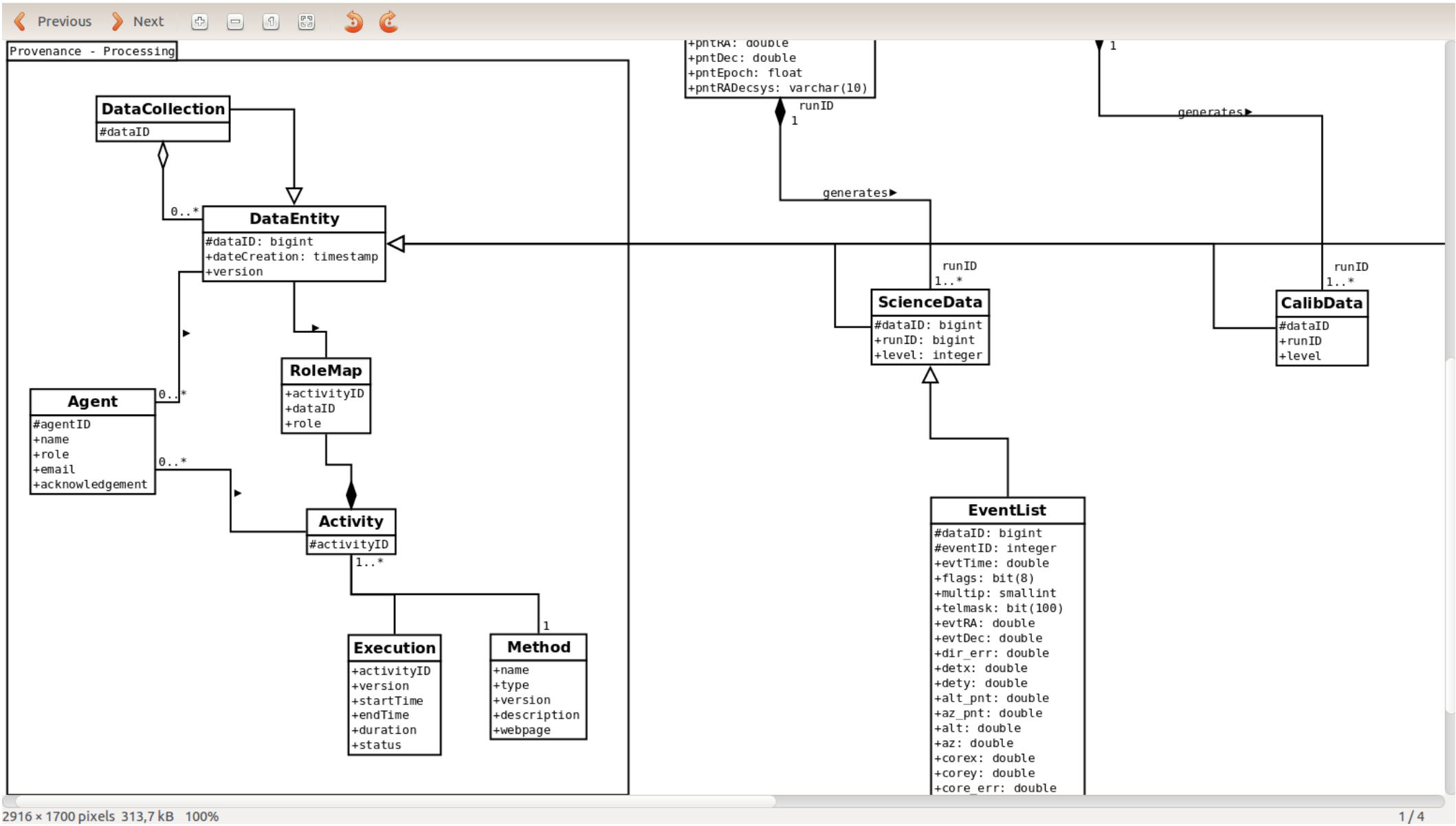
CTA DM - Observation



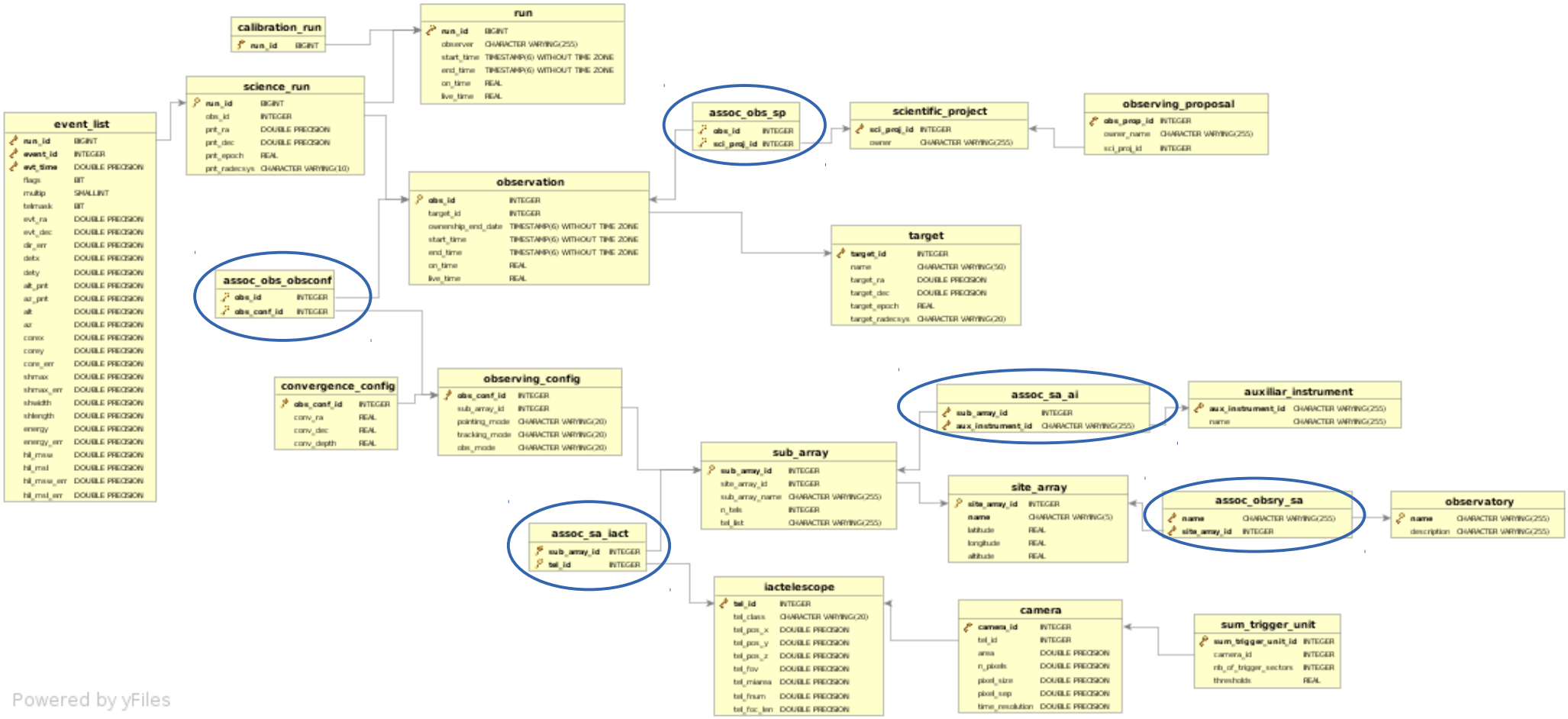
CTA DM - ArrayConfig



CTA DM - Processing



Database Structure



Automatically generated from UML diagram, with implementation choices (e.g. many-many associations become association tables, in blue)

Direct ADQL query

http://voparis-cdpp.obspm.fr/__system__/adql/query/form

- select * from cta.vo_obscore
- select * from cta.vo_obscore
  where
  intersects(
  s_region,
  circle('ICRS', 83.633, 22.514, 0.1)
) = 1

GERMAN ASTROPHYSICAL VIRTUAL OBSERVATORY

Help

Service info

Related

Tables available for ADQL

Metadata

Identifier >>

Description >>

Keywords >>

Creator >>

Created >>

Data updated >>

Reference URL >>

Try ADQL to query our data.

Please report errors and problems to the site operators. Thanks.

Privacy | Disclaimer

Log in

ADQL Query

Parameters

- ADQL query: select * from cta.vo_obscore

Result

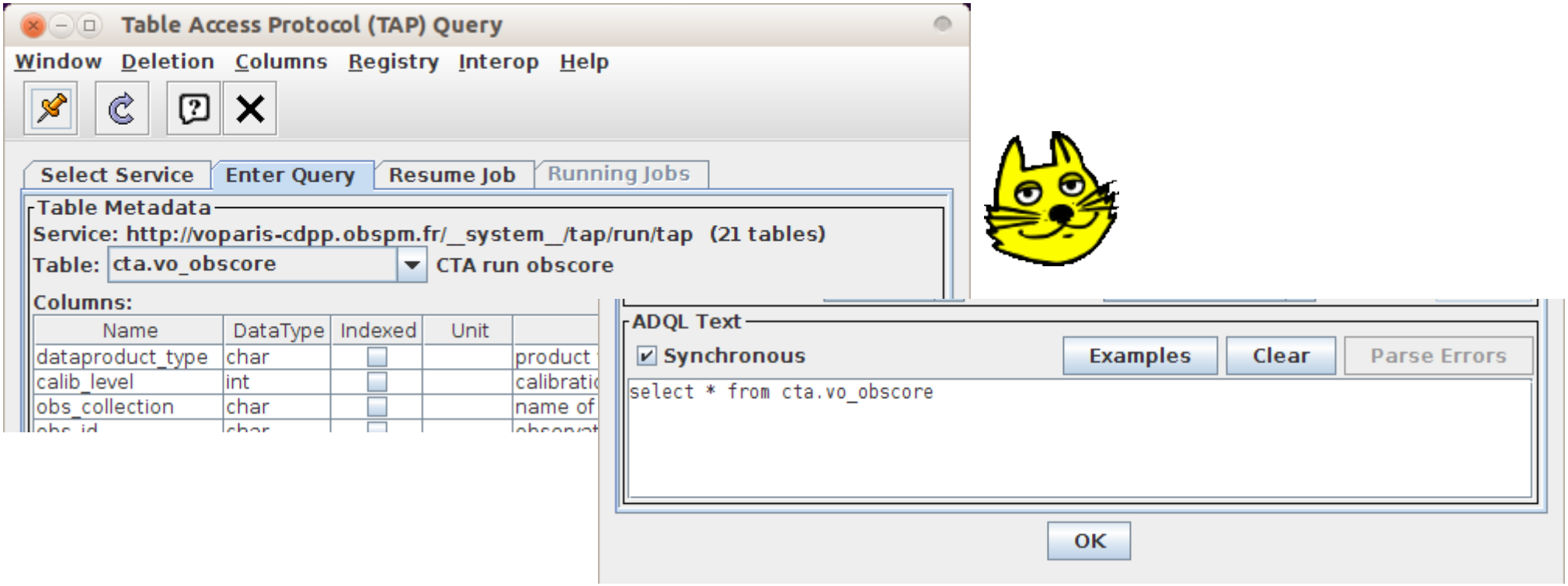
Matched: 4

Send via SAMP | Quick Plot

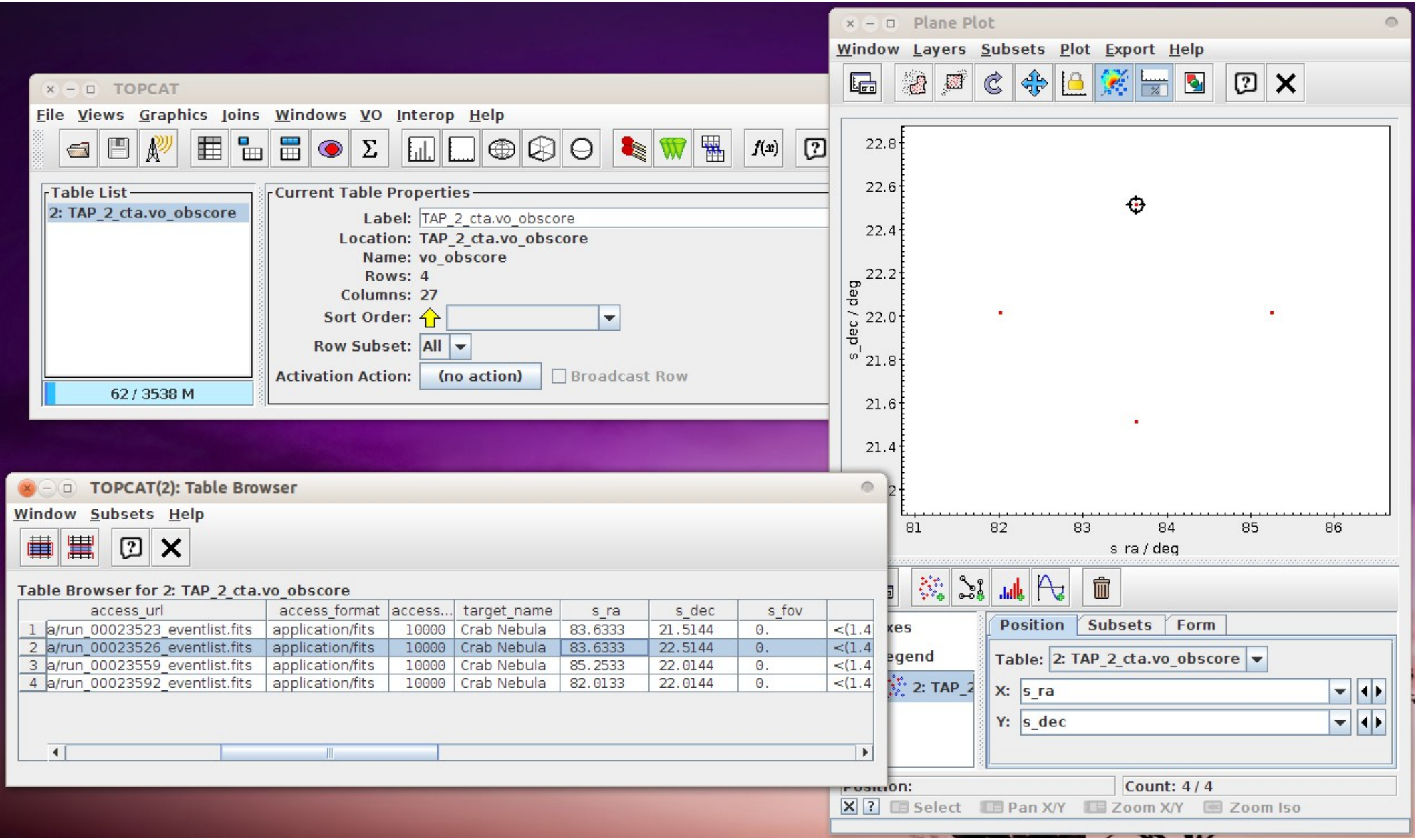
Dataproduct_type	Calib_level	Obs_collection	Obs_id	Obs_publisher_did	Access_url	Access_format	Access_estsize [kbyte]	Target_name	
eventlist	2	CTA1DC_1	23523	ivo://vopdc.obspm/cta#23523	http://cta/run_00023523_eventlist.fits	application/fits	10000	Crab Nebula	83
eventlist	2	CTA1DC_1	23526	ivo://vopdc.obspm/cta#23526	http://cta/run_00023526_eventlist.fits	application/fits	10000	Crab Nebula	83
eventlist	2	CTA1DC_1	23559	ivo://vopdc.obspm/cta#23559	http://cta/run_00023559_eventlist.fits	application/fits	10000	Crab Nebula	85
eventlist	2	CTA1DC_1	23592	ivo://vopdc.obspm/cta#23592	http://cta/run_00023592_eventlist.fits	application/fits	10000	Crab Nebula	82

ADQL query with TOPCAT

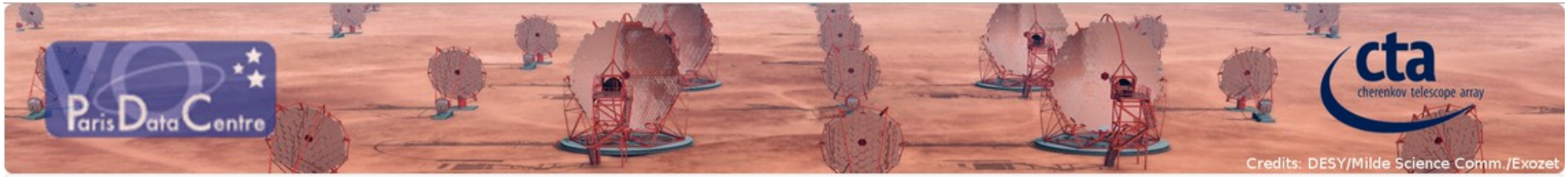
- **VO → Table Access Protocol (TAP) Query**
- In **Select Service**, enter **TAP URL** at the bottom : `http://voparis-cdpp.obspm.fr/__system__/tap/run/tap`
- Clic **Enter Query**
- Select **Table** : `cta.vo_obscore`
- Enter '**ADQL Text**' : `select * from cta.vo_obscore`, clic **OK**



ADQL query with TOPCAT



Web Client



CTA Data Distiller | Search | Help | CTA login

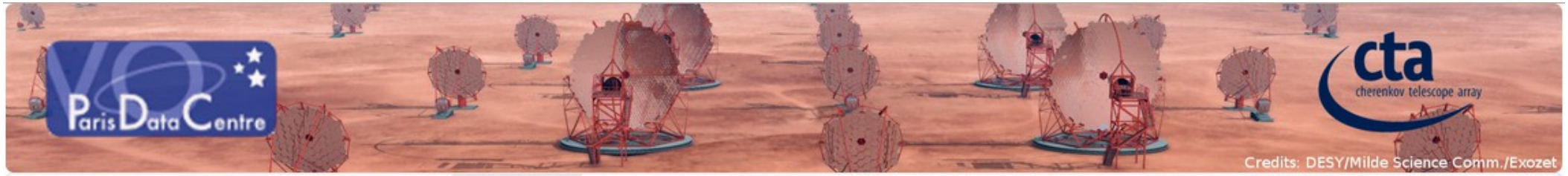
Search Datasets | Search All Tables

Search Datasets

Source name	Crab Nebula
Source RA (deg)	83.633
Source Dec (deg)	22.514
Search radius (deg)	0.001
Resource type	Event Lists

Submit Reset

- Django, jQuery, BootStrap3
- Name resolver
  Simbad through Sesame
- Builds and Sends the ADQL query



CTA Data Distiller | Search Datasets | Results | Job List | Selected Job | JS9 | Authentication: Sign out **user**

Search | Analyse | Visualisation

SAMP

Interop (SAMP)
Send Result Table
Send Selected Data

Results

show/hide query

SELECT * FROM cta.vo_obscore as o WHERE 1 = intersects(o.s_region, circle('ICRS', 83.63308333, 22.0145, 0.001))

ADQL query

Send

ObsCore fields

Search

UWS

	dataproduct_type	obs_collection	obs_id	target_name	s_ra (deg)	s_dec (deg)
☐	eventlist	1	23592	Crab Nebula	82.01333618164062	22.01444435119629
☐	eventlist	1	23559	Crab Nebula	85.25333404541016	22.01444435119629
☐	eventlist	1	23526	Crab Nebula	83.63333129882812	22.51444435119629
☐	eventlist	1	23523	Crab Nebula	83.63333129882812	21.51444435119629
☐	eventlist	3	5003499	CrabNebula	83.28087615966797	21.784133911132812

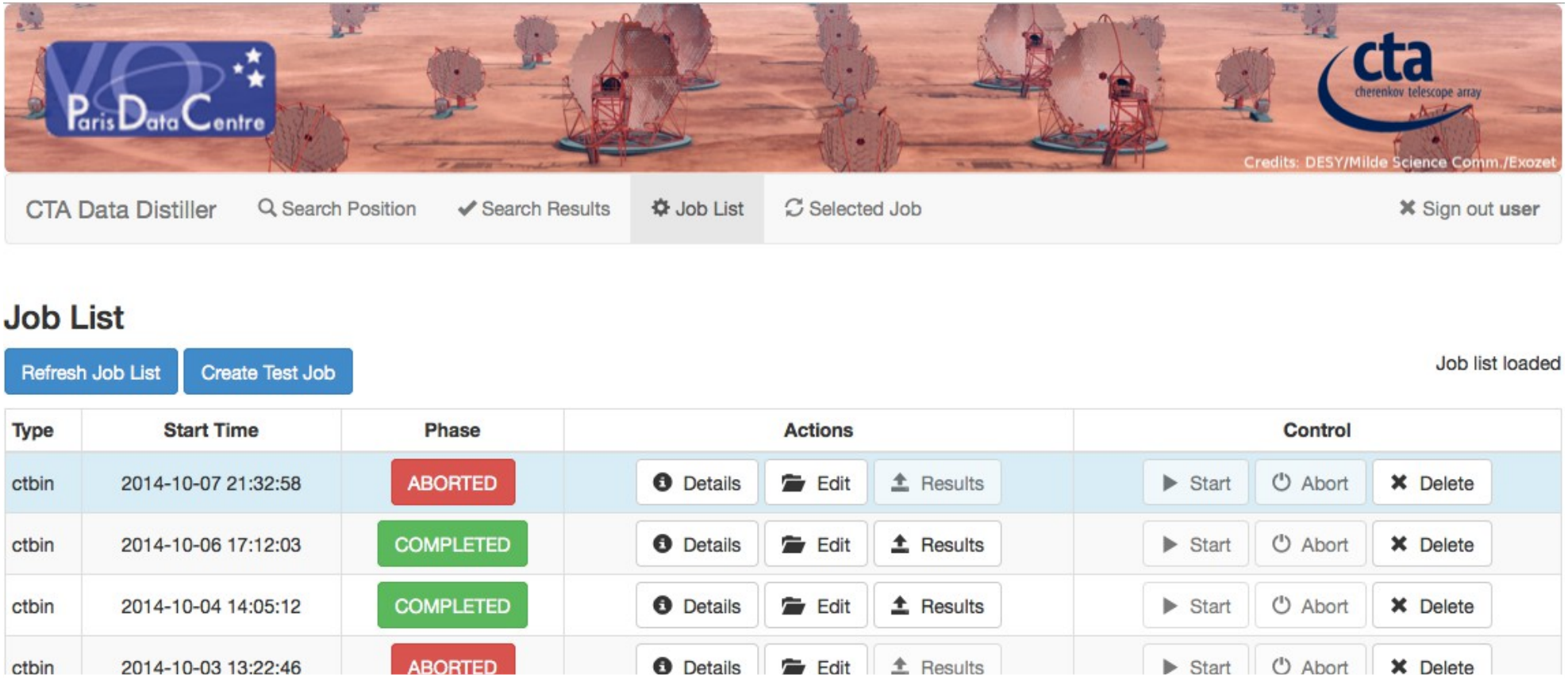
Showing 1 to 5 of 10 rows 5 records per page

<< < 1 2 > >>

Analysis tools
Create Count Map(s)
Extract Spectrum

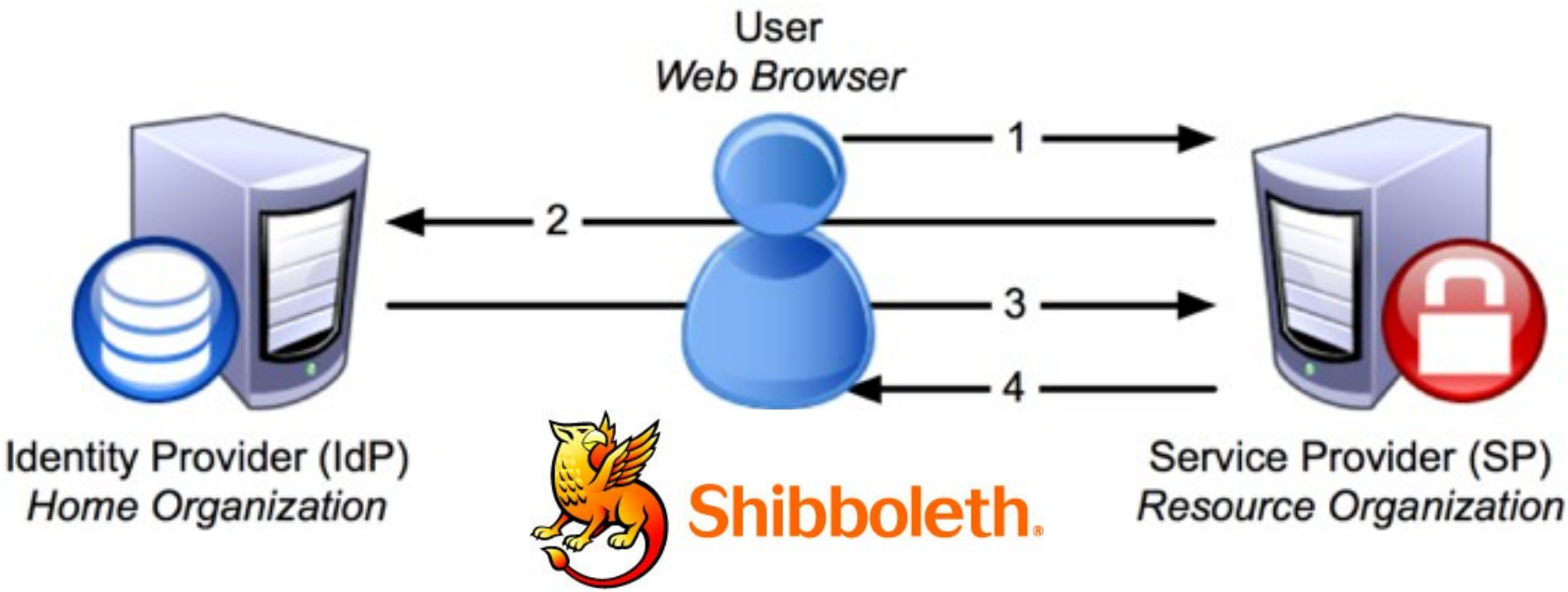
Plotting tools
TOPCAT
Aladin
VOSpec
SPLAT

Web Client – Universal Worker System



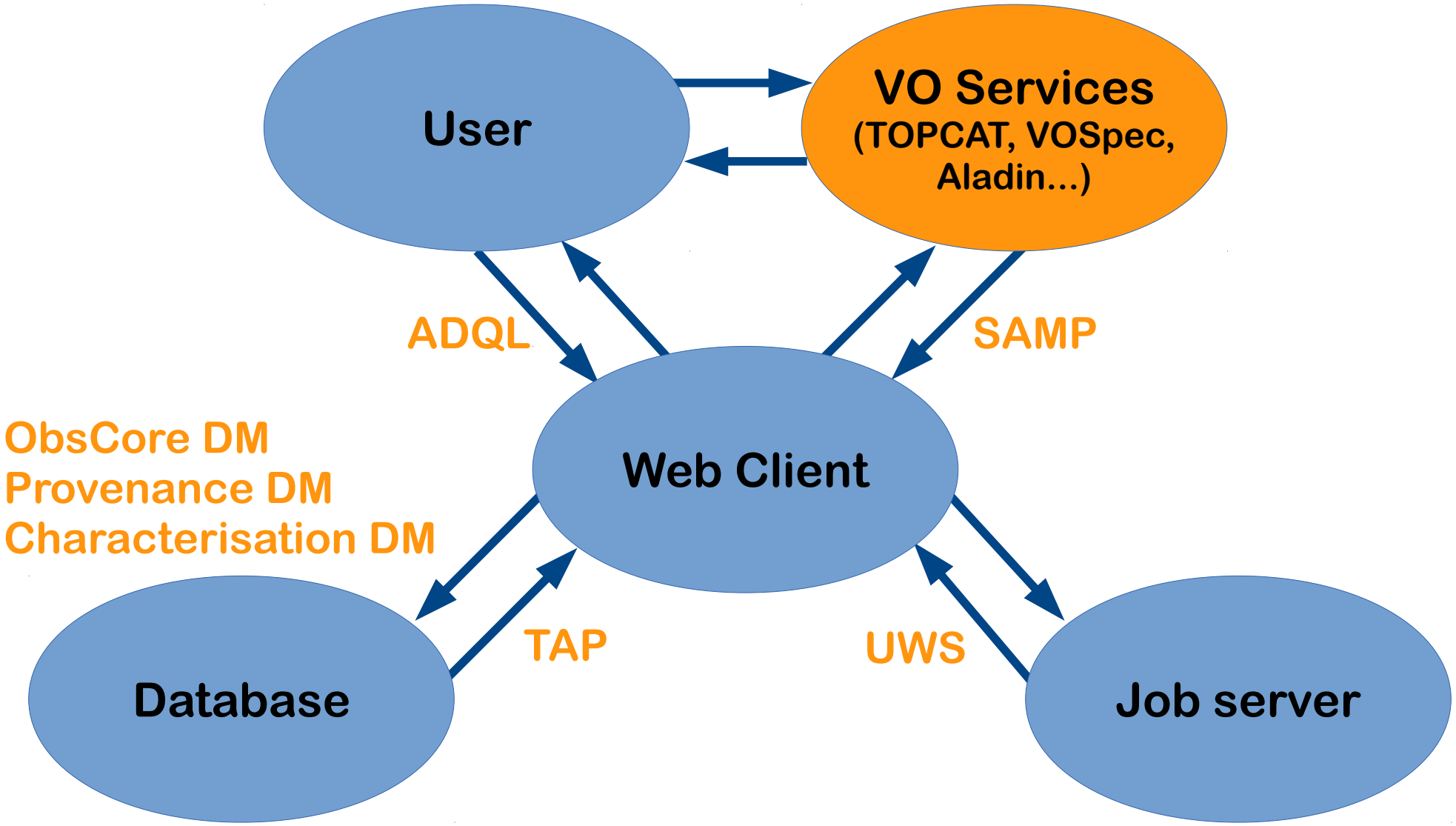
- UWS v1.0 server (voparis-uws.obspm.fr)
- JavaScript client using WADL Job Description Language
- Job sent to a generic cluster (tycho.obspm.fr)
  (using SLURM as batch queue)

Web Client – Single Sign On



- Shibboleth = implementation of SAML2 for SSO Authentication
- Tested using Apache2 / mod_shib + mod_ssl
- EduGAIN : Identity Federation (RENATER, …)
- CTA : How to handle permissions ?
  - Create a dedicated IdP ?
  - Use the current LDAP after authentication

Summary


User
VO Services
(TOPCAT, VOSpec,
Aladin…)
ADQL
SAMP
ObsCore DM
Provenance DM
Characterisation DM
Web Client
Database
TAP
UWS
Job server