CTA Web Client

The Cherenkov Telescope Array

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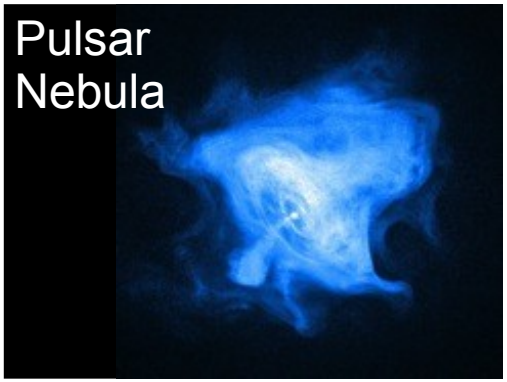
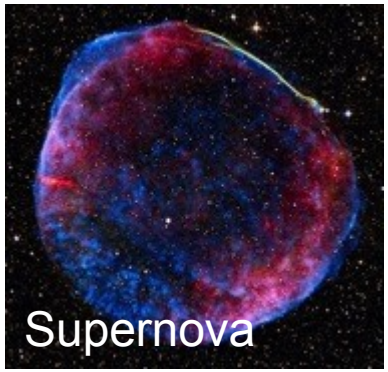
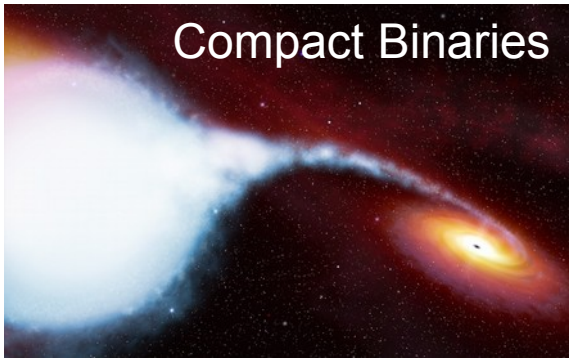
High Energy Astrophysics



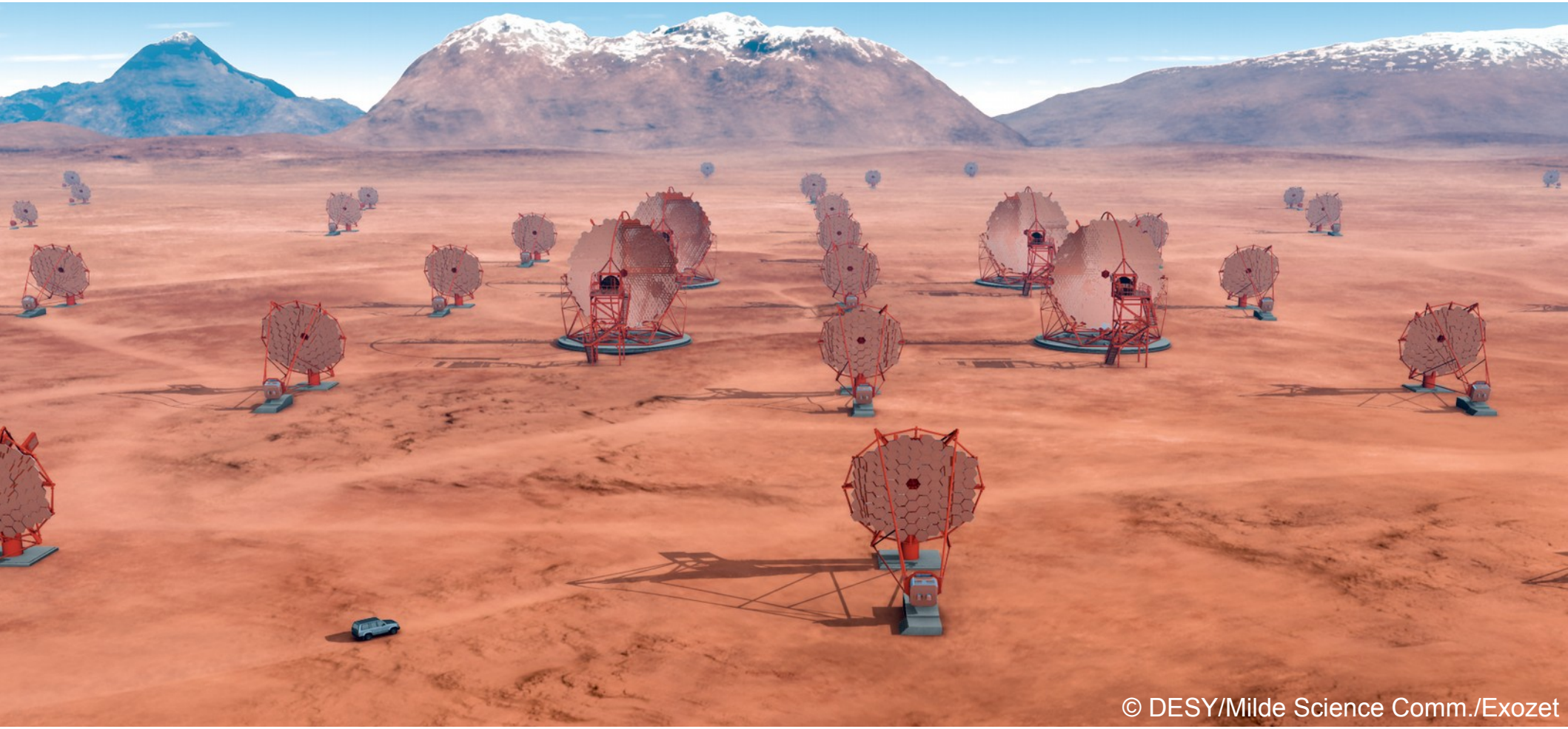
- Violent, transient, non-thermal phenomena
- Matter under extreme conditions
- Particle Acceleration
- Fundamental Physics
- Role of Black Holes in the structuration of the Universe





Observatory

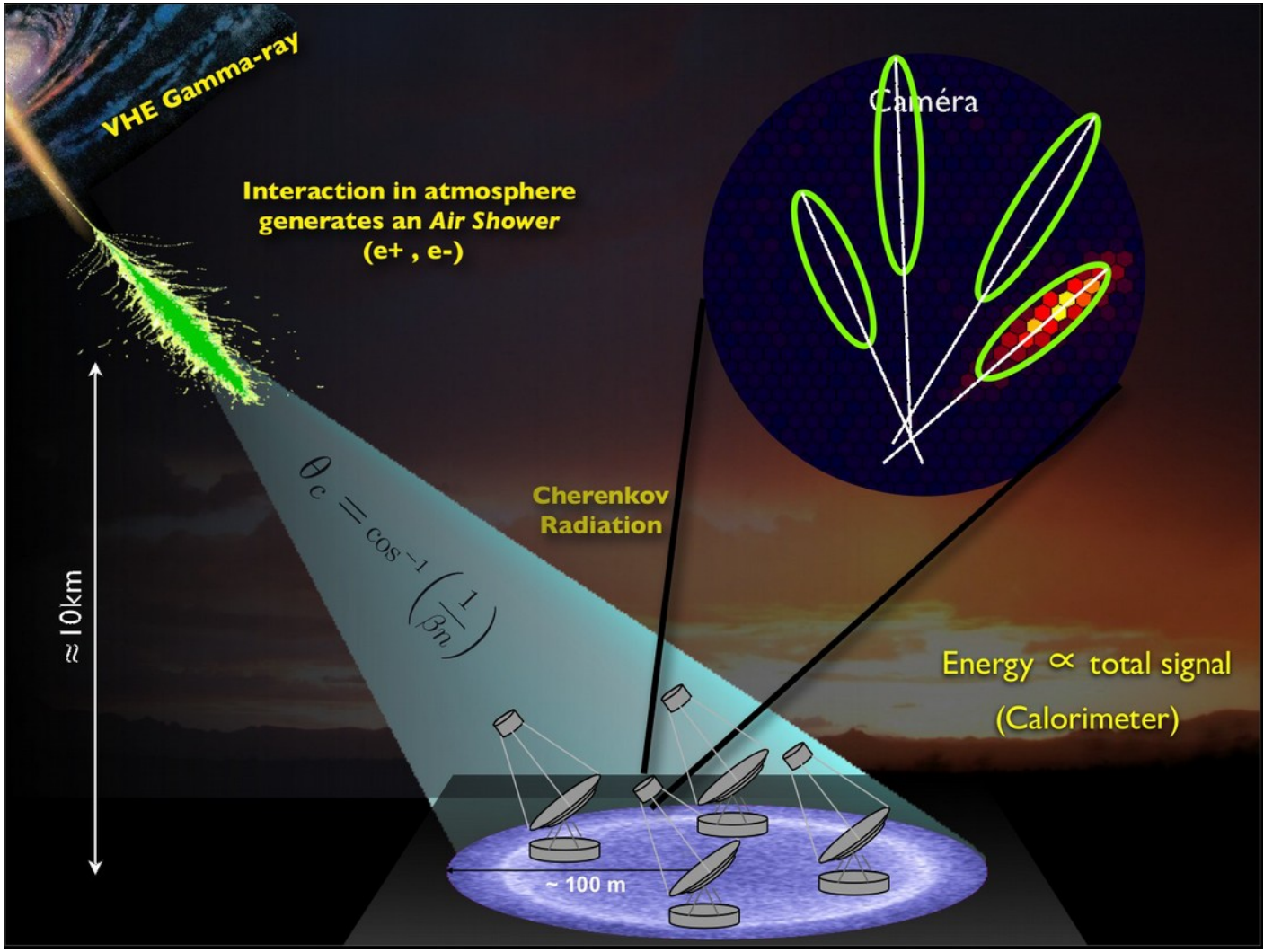
- Two arrays of **100 (South)** et **20 (North)** Cherenkov telescopes (4, 12 et 24 m in diametre)
- July 2015: Site Selection, Chile (ESO) and La Palma
- 2016: Construction phase
- Current experiments: H.E.S.S., MAGIC, VERITAS
  H.E.S.S.: experiment with 4+1 telescopes (4 x 12 m + 1 x 28 m)

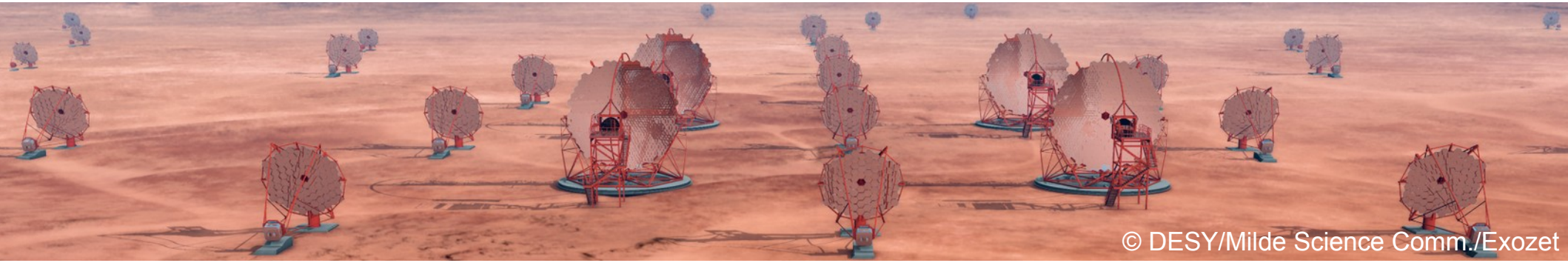


cherenkov telescope array

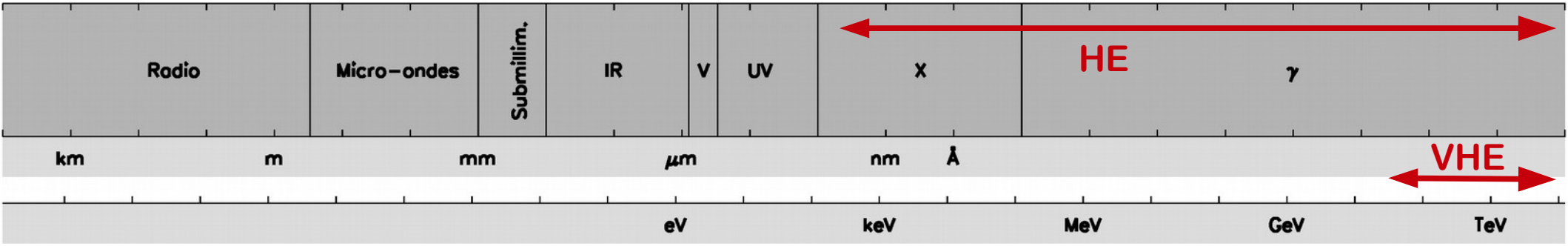
Observatory

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

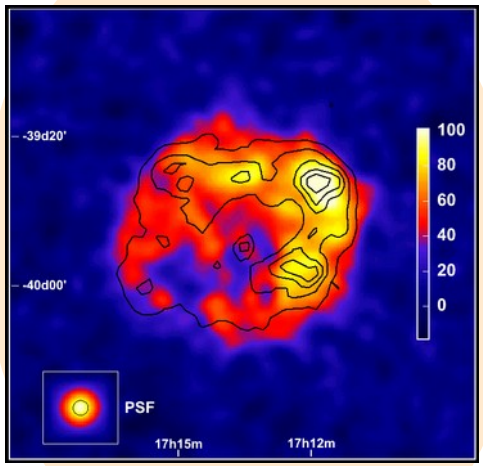




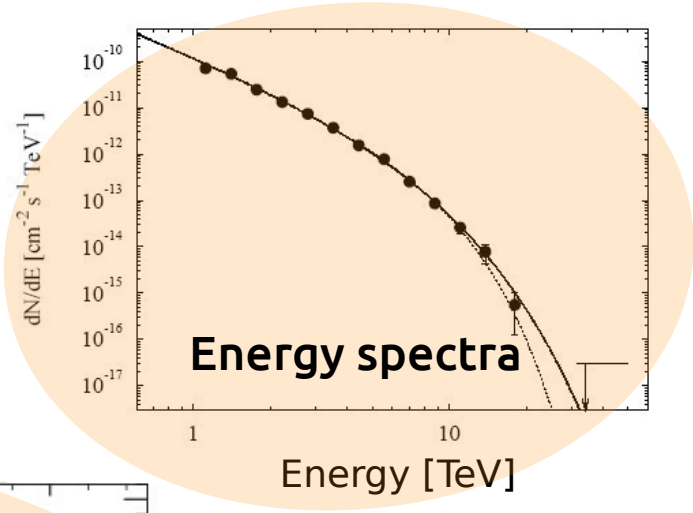
Very high energy data

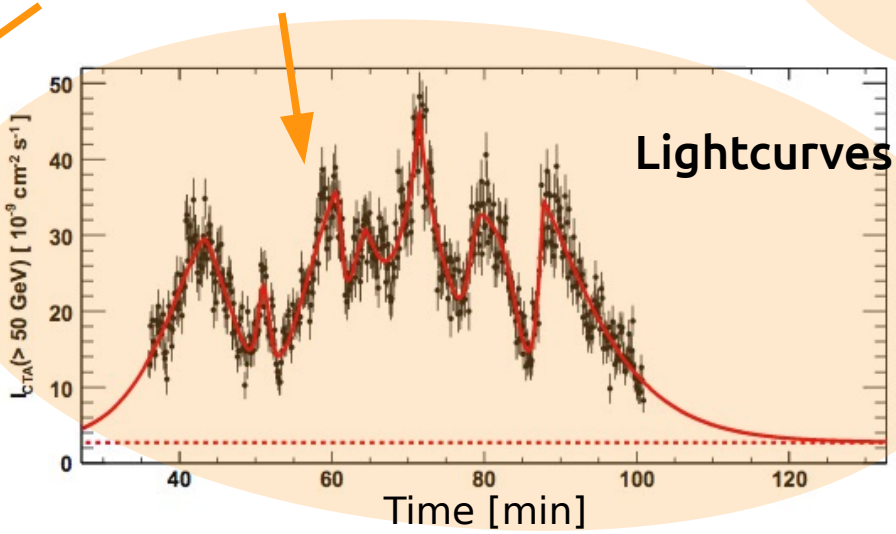


- Several orders of magnitude
- Photon counting
- Low count statistics, high background
- **Event lists**
  (coordinates, time, energy)



Images



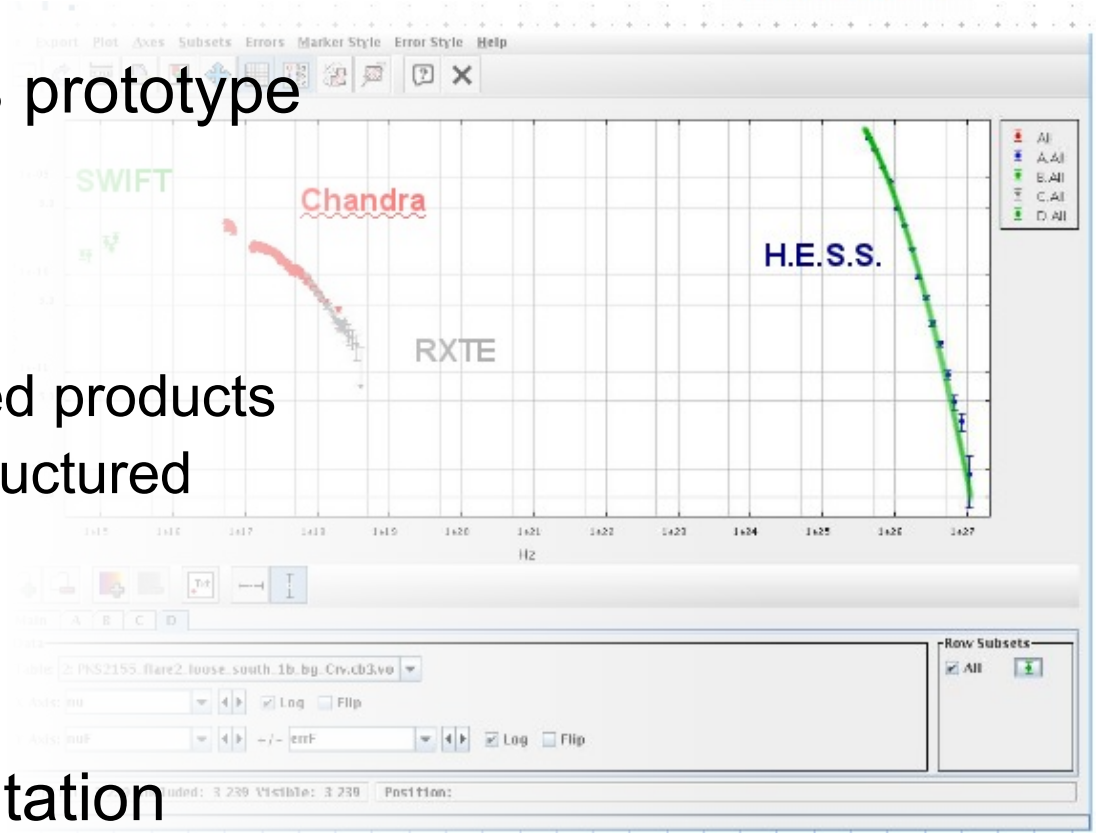


CTA Data Access at Observatoire de Paris

Knowledge in Very High Energies and VO

- H.E.S.S. experiment
- High level **VO data access** prototype
  http://hess.obspm.fr/

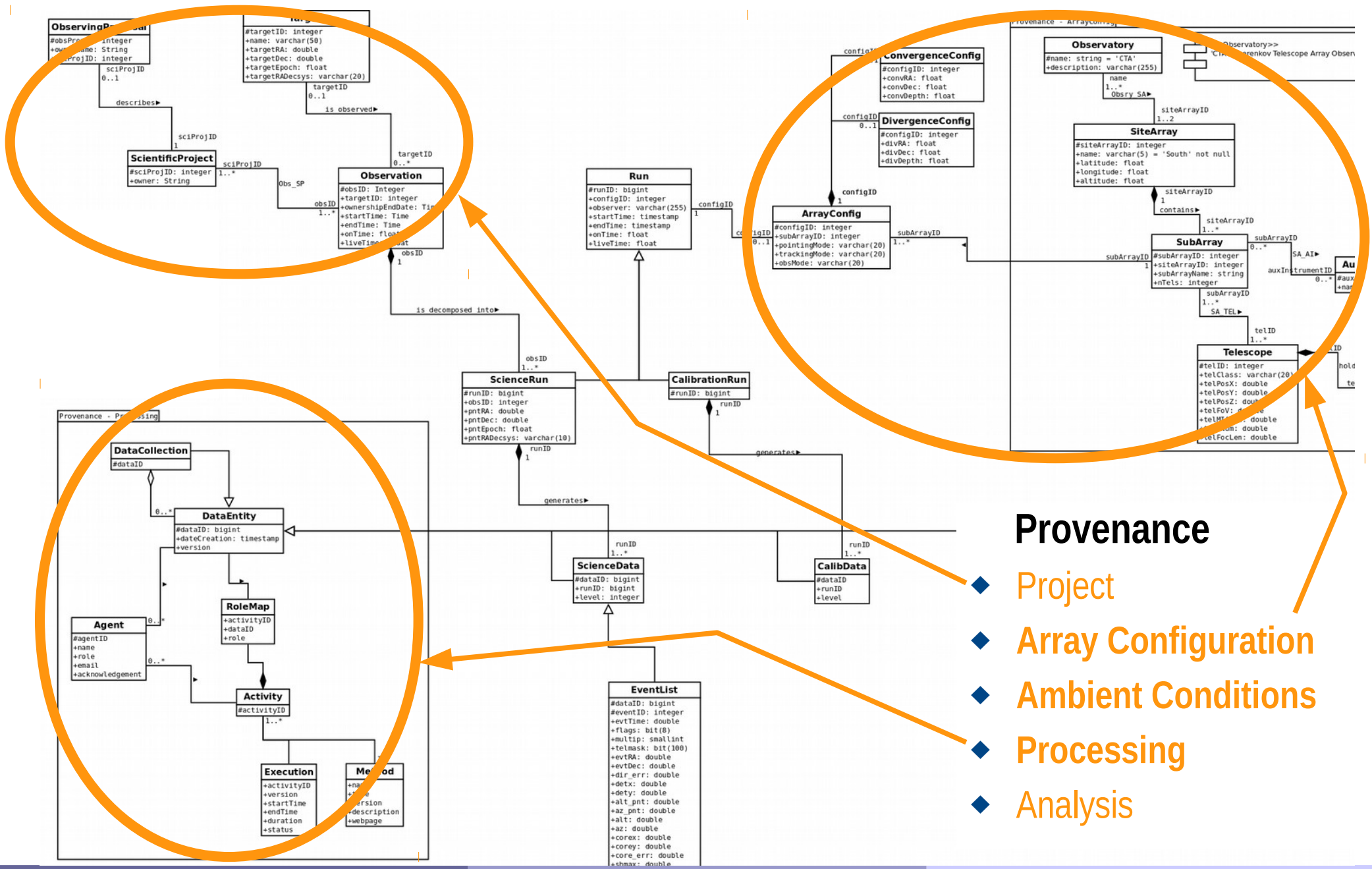
- VO standards vs VHE?
  - Complex **hierarchy** of related products
  - Complex **metadata** to be structured
  - **Queryable** metadata ?



CTA data access prototype

- CTA **data model** implementation
- Test VO compliance
  http://voparis-cta-client.obspm.fr

CTA Data Model

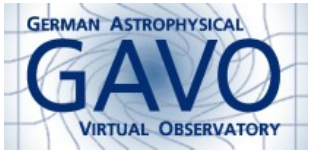


Provenance

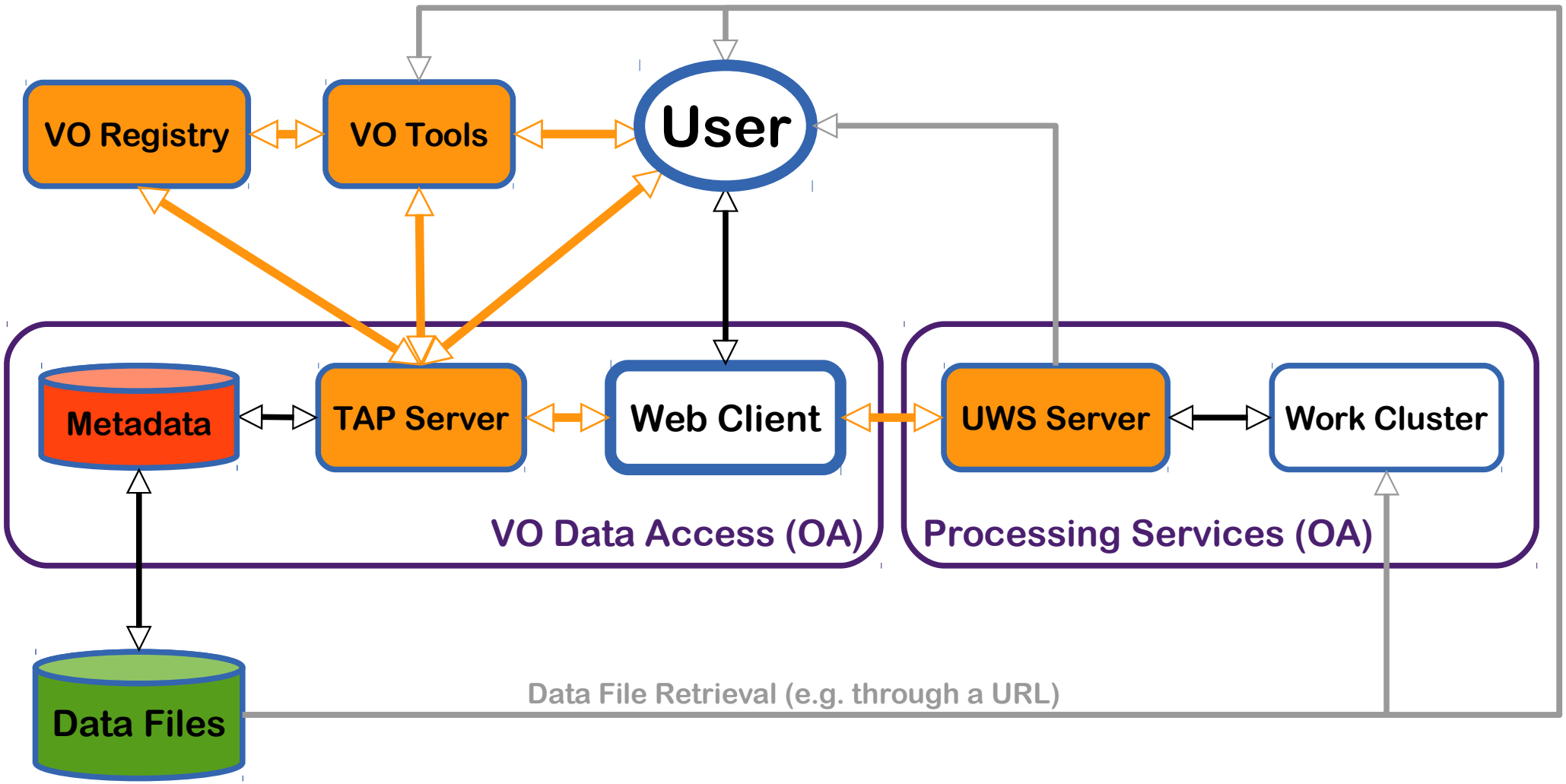
- Project
- Array Configuration
- Ambient Conditions
- Processing
- Analysis

CTA VO data access prototype

- **CTA Data Model** (not complete, still evolving)
  - **Automatic** Conversion UML to SQL
  - Relational database implemented (PostgreSQL)
- **Data Ingestion**: CTA 1DC data/metadata
- **VO Compliance**
  - 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


VO Registry
VO Tools
User
Metadata
TAP Server
Web Client
UWS Server
Work Cluster
VO Data Access (OA)
Processing Services (OA)
Data Files
Data File Retrieval (e.g. through a URL)
VO compliant Service
VO protocol
Database
CTA Data Model
CTA Archive
OA CTA Observer Access

TAP Server with DaCHS

```
<resource schema="cta">
   <meta name="title">CTA</meta>
   <meta name="creationDate">2014-04-25T10:00:00Z</meta>
   <meta name="description" format="plain">fill in</meta>
   <meta name="copyright">The CTA Consortium</meta>
   <meta name="creator.name">Mathieu Servillat</meta>
   <meta name="subject">CTA runs</meta>

   <table id="vo_obscore" onDisk="True" adql="True">
      <meta name="description">CTA run obscore</meta>
      <meta name="referenceURL">TBD</meta>

      <column name="dataproduct_type" type="text" ucd="meta.id;class"
         description="product type: spectrum or timeseries ..."/>
      <column name="calib_level" type="integer" ucd="meta.id"
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         <values nullLiteral="-32768"/>
      </column>
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         description="dataset identifier given by the publisher"/>
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      <column name="access_url_local" type="text" ucd="meta.ref.url"
         description="URL used to access dataset on localhost"/>
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         description="file content format"/>
      <column name="access_estsize" type="integer" unit="kbyte" ucd="phys.size;meta.file"
         description="estimated size of dataset">
```
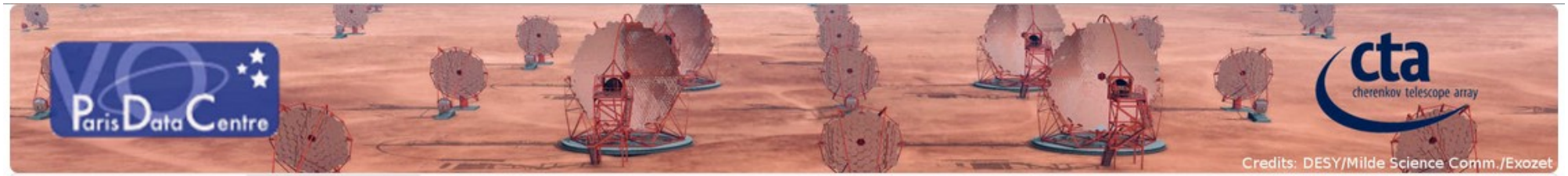

GAVO
Data Center Helper Suite
http://docs.g-vo.org/DaCHS

Web Client

http://voparis-cta-client.obspm.fr



CTA Data Distiller | Search Form | Job List | Sign out **user**

Cone Search

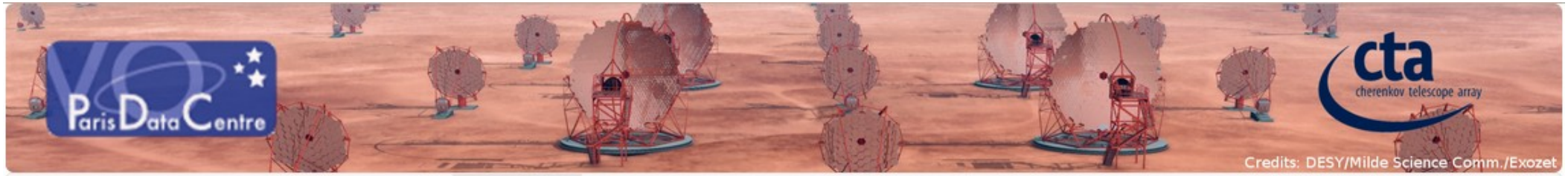
Target Name	Crab Nebula
Source RA (deg)	83.633
Source Dec (deg)	22.514
Search radius (deg)	0.001

Submit | Reset

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

ObsCore Search

proposal_id		Proposal ID
dataproduct_type	Nothing selected	Data product (file content) primary type
dataproduct_level	Nothing selected	DL0-5



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

	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

UWS

Analysis tools
- Create Count Map(s)
- Extract Spectrum

Plotting tools
- TOPCAT
- Aladin
- VOSpec
- SPLAT

Showing 1 to 5 of 10 rows 5 records per page

<< < 1 2 > >>

ObsCore fields for CTA

dataproduct_type: set to "eventlist" corresponding to the DL3 in CTA.

calib_level: 0 for raw instrumental data, 1 for instrumental data in a standard format, 2 for calibrated, science ready data with the instrument signature removed, and 3 for enhanced data products. CTA defines 5 data level, for example DL3 data are calibrated data in scientific units but still include an instrument signature, hence its calib_level would be 1.

obs_collection: group of several runs corresponding to an observation (e.g. there are 4 runs on the Crab with H.E.S.S. in the CTA 1DC data grouped with the obs_collection name "CTA1DC_1").

obs_id: unique Run ID

obs_publisher_did: "ivo://vopdc.obspm.luth/cta"

access_url: to be defined, however the CTA 1DC data should not be accessible to the public. We plan to include simulated data that will be temporarily hosted on `http://voplus.obspm.fr/cta/`. Using a private login, one could access the data through a specific view in the web client.

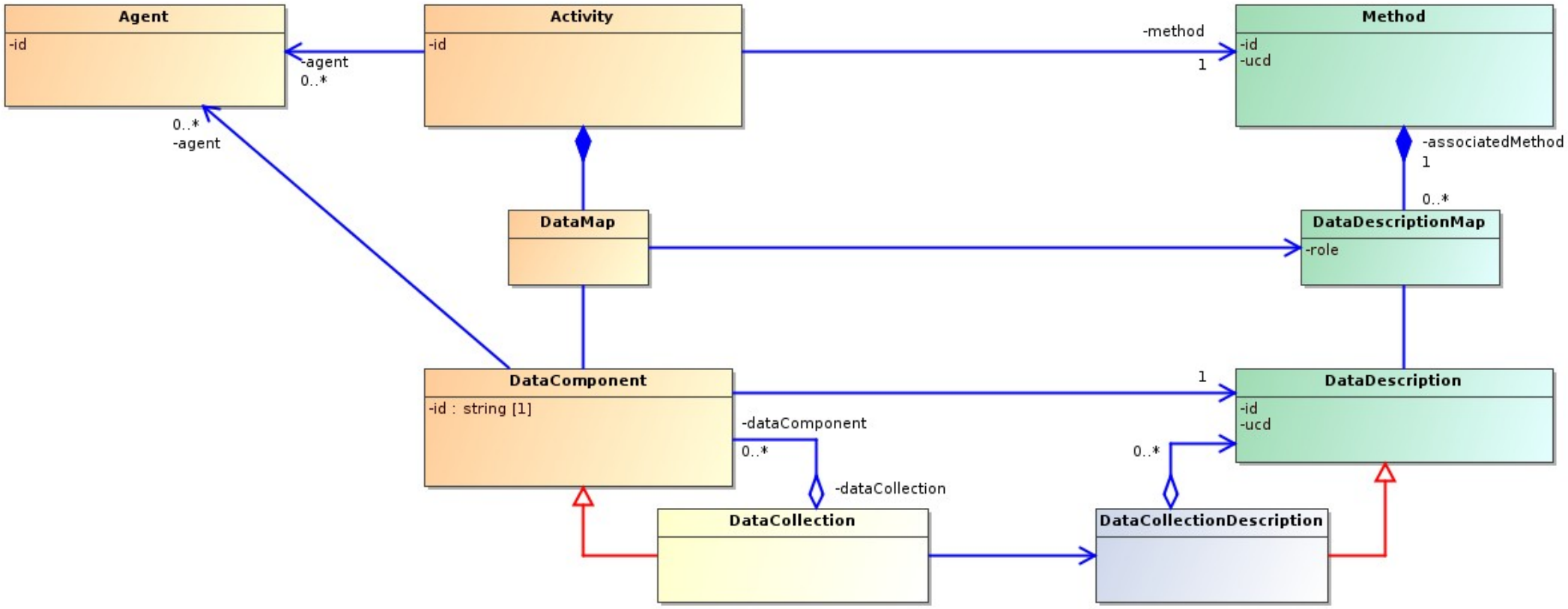
access_format: format of the data product. "application/fits" as FITS files will be provided.

access_estsize: estimated size of the data product.

s_fov: as several telescope are used, the field of view is currently the mean of all telescope fields of view used in the Observation Configuration.

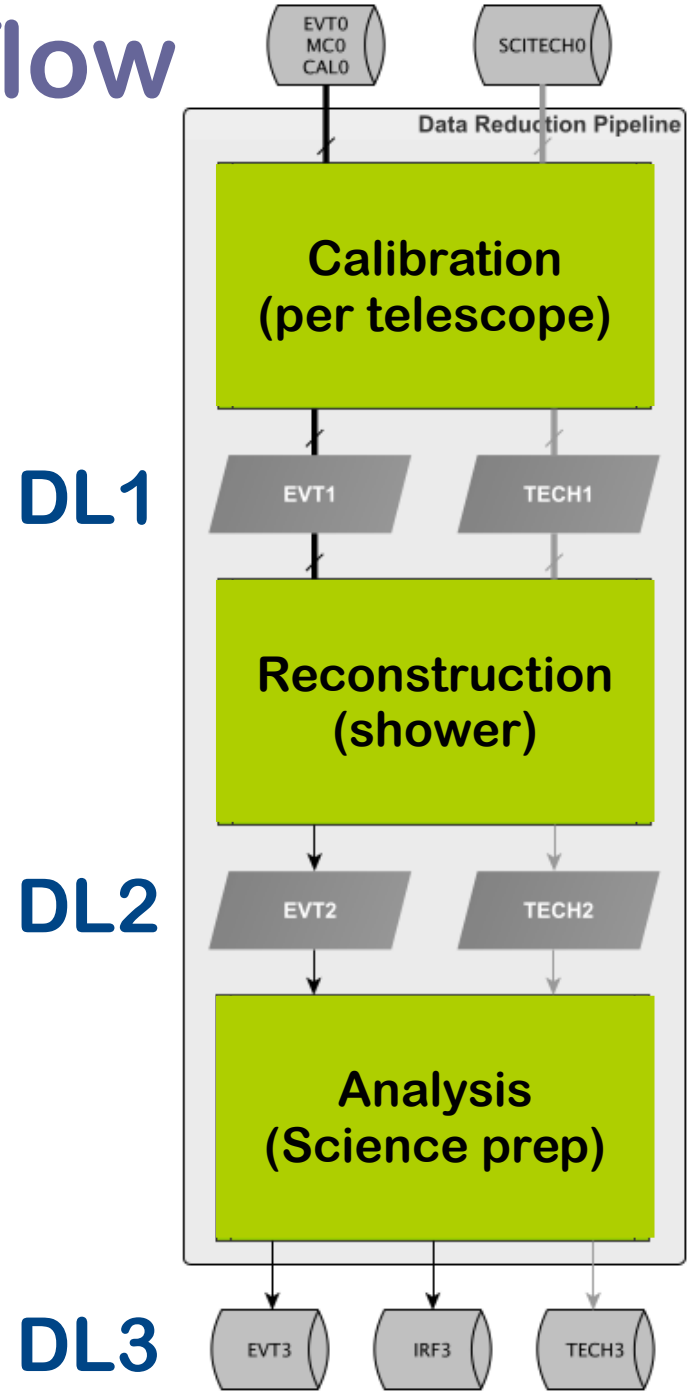
IVOA Provenance DM (based on W3C)

IVOA Provenance DM (with prototypes)



CTA data levels and workflow

Data Level	Short Name	Description
Level 0 (DL0)	DAQ-RAW	Data from the Data Acquisition hardware/software.
Level 1 (DL1)	CALIBRATED	Physical quantities measured in each separate camera: photons, arrival times, etc., and per-telescope parameters derived from those quantities.
Level 2 (DL2)	RECONSTRUCTED	Reconstructed shower parameters (per event, no longer per-telescope) such as energy, direction, particle ID, and related signal discrimination parameters.
Level 3 (DL3)	REDUCED	Sets of selected (e.g. gamma-ray-candidate) events, along with associated instrumental response characterizations and any technical data needed for science analysis.
Level 4 (DL4)	SCIENCE	High Level binned data products like spectra, sky maps, or light curves.
Level 5 (DL5)	OBSERVATORY	Legacy observatory data, such as CTA survey sky maps or the CTA source catalog.



Use Cases

- Users:
  - astronomer, quality control, database managers
- Examples :
  - Create an image (DL3 → DL4)
  - All datasets with run_id = …
  - From DL4 image, go back to DL3 and redo
  - All products using Pipeline version ...
- Questions :
  - Metadata propagation
  - Access to Provenance (Obscore fields, DataLink)