

Centre de Calcul
de l'Institut National de Physique Nucléaire
et de Physique des Particules

La plateforme informatique pour l'Observatoire Vera C. Rubin

Rubin-LSST France

Gabriele Mainetti

28 Novembre 2022



La plateforme
informatique



QSERV



RSP



Conclusions

La plateforme informatique

- Deux composant majeures:
 - **Qserv** : la base des données du catalog astronomique
 - **Rubin Science Platform** (RSP) : la plateforme pour l'analyse interactive

- **Kubernetes**, Helm , Argo Workflow/CD
- Développement open source : <https://github.com/lsst-sqre>
- Documentation détaillée : <https://www.lsst.io/>
- Gestion de projet/suivi de bug via Confluence et Jira

Le cluster dédié

- K8S est déployé sur un cluster physique dédié, utilisé par Qserv et RSP :
 - 25 workernodes
 - 5 DELL PowerEdge R440, 20 DELL PowerEdge R540
 - 3 noeuds master K8S
 - 17 noeuds réservés à Qserv

- RSP noeuds :
 - 5 server DELL PowerEdge R540, CPUs: 40 Intel Xeon Silver 4210 CPU @ 2.20GHz
 - RAM: 256 GB
 - Local storage: 50 TB

- Merci Christelle E. et Fabien W.

Qserv

2

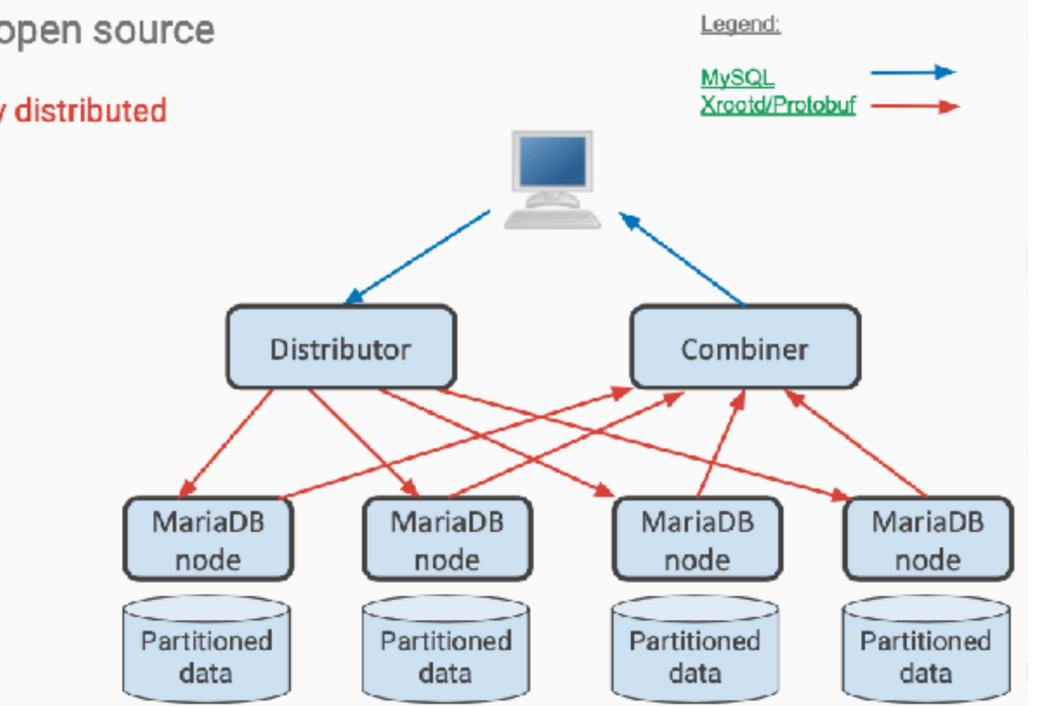
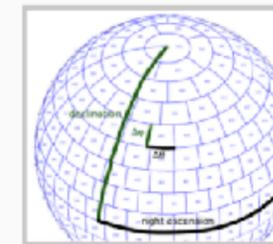
- Database Relationnel
- Contribution IN2P3
- MariaDB, XRootD
- Shared-nothing MPP
- Partitionnement sphérique avec overlap, sciSQL (UDF)
- Shared scans (concurrent query load)
- Replicated data (Résilience)
- 100 % Open Source
- Déployable sur le Cloud ou sur cluster physique

• Qserv ingest :

- utilisé pour charger les données
- Développé par F. James (LPC - IN2P3)

Qserv design <https://github.com/lsst/qserv-operator>

Relational database, 100% open source
Spatially-sharded with overlaps
Map/reduce-like processing, highly distributed



Source: F. Muller, Rubin Observatory

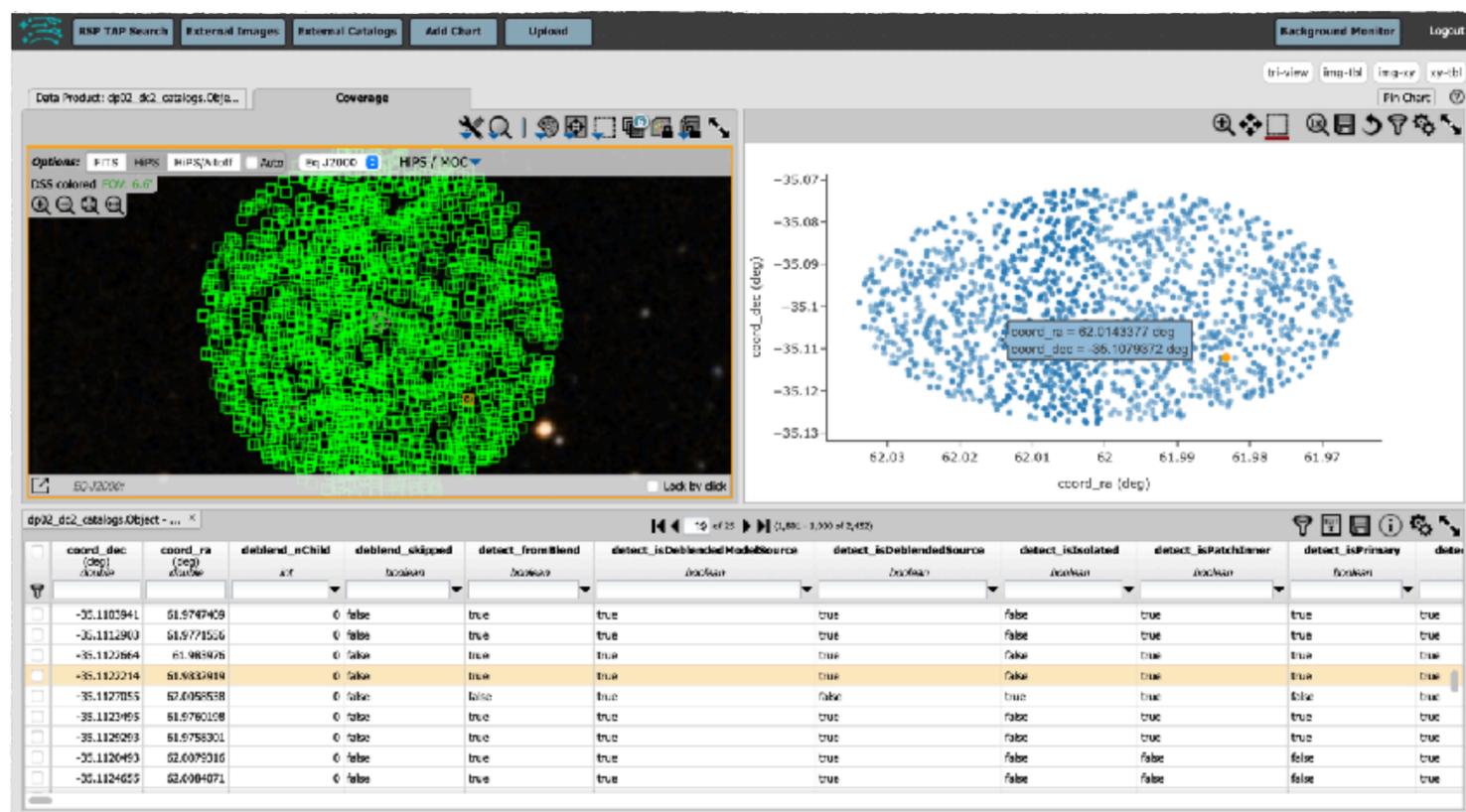
• Pre-réquis :

- Données partitionnés (CSV)
- Schema DB et partitionnement

Catalog	Taille (To)	# Lignes (Milliards)
<u>idf-dp0.2-catalog</u>	36.6	139
dp01_dc2_catalogs	1.1	1.7
skysim5000_v1.1.1	13.6	20.5
cosmoDC2_v1.1.4	3.7	5.5

Database	Data [GB]																									
	in unique chunks												in all replicas													
	#chunks		chunks			overlaps			regular			Σ			chunks			overlaps			regular			Σ		
	unique	replicas	data	index	Σ	data	index	Σ	data	index	Σ	Σ	data	index	Σ	data	index	Σ	data	index	Σ	Σ				
cosmoDC2_v1_1_4_image	1730	1744	3569.4	69.4	3638.7	41.9	<0.1	41.9	0.0	0.0	0.0	3680.7	3569.4	69.4	3638.7	41.9	<0.1	41.9	0.0	0.0	0.0	3680.7				
dp01_dc2_catalogs	1398	1412	915.3	58.9	974.2	114.3	<0.1	114.3	0.0	0.0	0.0	1088.5	915.3	58.9	974.2	114.3	<0.1	114.3	0.0	0.0	0.0	1088.5				
dp02_dc2_catalogs	1478	1492	31746.3	2737.4	34483.7	2138.3	<0.1	2138.3	0.0	0.0	0.0	36622.0	31746.3	2737.4	34483.7	2138.3	<0.1	2138.3	0.0	0.0	0.0	36622.0				
skysim5000_v1_1_1_parquet	18738	18752	13171.2	261.5	13432.7	157.9	<0.1	158.0	0.0	0.0	0.0	13590.7	13171.2	261.5	13432.7	157.9	<0.1	158.0	0.0	0.0	0.0	13590.7				
Total [TB for data]	23344	23400	49.4	3.1	52.5	2.5	<0.1	2.5	0.0	0.0	0.0	55.0	49.4	3.1	52.5	2.5	<0.1	2.5	0.0	0.0	0.0	55.0				

- Environnement web pour l'exploitation interactive des données
- Access aux données Qserv via UI ou via script (service TAP)
- Visualisation des images, creation des graphiques, exploitation des tables
- Execution des notebooks (API Python)
- Porte d'entrée à Qserv pour les outils "VO"



```

[2]: results = service.search("SELECT schema_name, description FROM TAP_SCHEMA.schemas")
    results.to_table().show_in_notebook()

[2]: Table length=5

```

idx	schema_name	description
0	dp01_de2_catalogs	Data Preview 0.1 includes five tables based on the DESC's Data Challenge 2 simulation of 800 square degrees of the wide-fast-deep LSST survey region after 5 years. All tables contain objects detected in coadded images.
1	dp02_de2_catalogs	Data Preview 0.2 contains the image and catalog products of the Rubin Science Pipelines v23 processing of the DESC Data Challenge 2 simulation, which covered 900 square degrees of the wide-fast-deep LSST survey region over 5 years.
2	ivce	ObsCore v1.1 attributes in ObsTAP realization
3	tap_schema	A TAP-standard-mandated schema to describe tablesets in a TAP 1.1 service
4	uws	UWS Metadata

```

[3]: results = service.search("SELECT * FROM TAP_SCHEMA.schemas")
    results.to_table().show_in_notebook()

[3]: Table length=5

```

idx	description	schema_index	schema_name	utype
0	Data Preview 0.1 includes five tables based on the DESC's Data Challenge 2 simulation of 800 square			

VERA C. RUBIN OBSERVATORY

Portal Notebooks APIs Documentation Support Community

Login

Rubin Science Platform

Portal

Discover data in the browser

Learn more about the portal.

Notebooks

Process and analyze LSST data with Jupyter notebooks in the cloud

Learn more about notebooks.

APIs

Learn how to programmatically access data with Virtual Observatory interfaces

Learn more about APIs.

[Acceptable use policy](#)

Rubin Observatory is a joint initiative of the National Science Foundation (NSF) and the Department of Energy (DOE). Its primary mission is to carry out the Legacy Survey of Space and Time, providing an unprecedented data set for scientific research supported by both agencies. Rubin is operated jointly by NSF (NOIRLab) and SLAC National Accelerator Laboratory (SLAC). NOIRLab is supported for NSF by the Association of Universities for Research in Astronomy (AURA) and SLAC is operated for DOE by Stanford University.

<https://data-dev.lsst.eu>

- Log-in via KeyCloak CC
- Accès autorisé aux membre du group LSST

APIs pour le service TAP : comment accéder aux données avec vos outils

Portal : accès aux données (Qserv et externe)

Notebooks : accès à la plateforme de notebook intégrée

RSP - PORTAL

Sélection du service TAP (default Qserv)

1. Select TAP Service

2. Select Query type

3. Select Table

4. Enter Constraints

Spatial Temporal

Longitude Column:

Latitude Column:

Shape Type:

Coordinates or Object Name:

Examples: `RA, -37 10.4 -15.1 4h11m50s -37m51m50s eqj J2000 738.2 -47.5 gal`
`'NGC 1532' (NB: DC2 is a simulated sky, so names are not useful)`

Radius:

Valid range between: 1" and 10000"

column_name	constraints	unit	ucd
coord_dec		deg	pos.eq.dec;meta.main
coord_ra		deg	pos.eq.ra;meta.main
deblend_nChild			Fiducial ICRS Declination of centroid used for c
deblend_skipped			Fiducial ICRS Right Ascension of centroid used
detect_fromBlend			Number of children this object has (defaults to
detect_isDeblendedModelSource			Deblender skipped this source
detect_isDeblendedSource			This source is deblended from a parent with m
detect_isolated			True if source has no children and is in the in
detect_isPatchInner			True if source is not a part of a blend.
detect_isPrimary			True if source is in the inner region of a coad
detect_isTractInner			True if source has no children and is in the in
footprintArea		pixel	True if source is in the inner region of a coad
g_ap03Flux		n/y	Number of pixels in the sources detection footp
g_ap03Flux_flag			Flux within 3.0-pixel aperture. Forced on g-ban
g_ap03FluxErr		n/y	General Failure Flag. Forced on g-band.
g_ap06Flux		n/y	Flux uncertainty within 3.0-pixel aperture. For
g_ap06Flux_flag			Flux within 6.0-pixel aperture. Forced on g-ban
g_ap06FluxErr		n/y	General Failure Flag. Forced on g-band.
g_ap09Flux		n/y	Flux uncertainty within 5.0-pixel aperture. For
g_ap09Flux_flag			Flux within 9.0-pixel aperture. Forced on g-ban
g_ap09FluxErr		n/y	General Failure Flag. Forced on g-band.
g_ap12Flux		n/y	Flux uncertainty within 9.0-pixel aperture. For
g_ap12Flux_flag			Flux within 12.0-pixel aperture. Forced on g-ba
g_ap12FluxErr		n/y	General Failure Flag. Forced on g-band.
g_ap17Flux		n/y	Flux uncertainty within 12.0-pixel aperture. For
g_ap17Flux_flag			Flux within 17.0-pixel aperture. Forced on g-ba
g_ap17FluxErr		n/y	General Failure Flag. Forced on g-band.
g_ap25Flux		n/y	Flux uncertainty within 17.0-pixel aperture. For
			Flux within 25.0-pixel aperture. Forced on g-ba

Using LSST RSP <https://data-dev.lsst.eu/api/tap> - Replace...

- LSST RSP <https://data-dev.lsst.eu/api/tap>
- IRSA <https://irsa.ipac.caltech.edu/TAP>
- Gaia <https://gea.esac.esa.int/tap-server/tap>
- CADC <https://ws.cadc-ccda.hia-ihp.nrc-cnrc.gc.ca/argus/>
- MAST Images <https://vao.stsci.edu/CAOMTAP/TapService.aspx>
- GAVO <http://dc.g-vo.org/tap>
- HSA <https://archives.esac.esa.int/hsa/whsa-tap-server/tap>
- NED <https://ned.ipac.caltech.edu/tap/>
- NASA Exoplanet Archive <https://exoplanetarchive.ipac.caltech.edu/TAP/>

Sélection du type de requêtes

TAP Searches

1. Select TAP Service

2. Select Query Type Single Table (UI assisted) Edit ADQL (advanced) Image Search (ObsTAP)

3. Select Table Table: **dp02_dc2_catalogs.Object**
Properties of the astronomical objects detected and measured on the deep coadded images.

4. Enter Constraints Spatial Temporal

Spatial *empty entry*

Longitude Column:

Latitude Column:

Shape Type:

Coordinates or Object Name:

Examples: `RA, -37 10.4 -15.1 14h11m50s -37m51m50s eqj J2000 1738.2 -47.5 gal`
`'NGC 1532' (NB: DC2 is a simulated sky, so names are not useful)`

Radius:

Valid range between: 1" and 10000"

Output Column Selection and Constraints

<input type="checkbox"/>	column_name <i>char</i>	constraints <i>char</i>	unit <i>char</i>	ucd <i>char</i>	description <i>char</i>	datatype <i>char</i>	arraysize <i>char</i>	itype <i>char</i>	xtype <i>char</i>	principal <i>int</i>	size <i>int</i>	column_index <i>int</i>	index <i>int</i>
<input type="checkbox"/>	coord_dec		deg	pos.eq.dec;meta.main	Fiducial ICRS Declination of centroid used for c	double				0			
<input type="checkbox"/>	coord_ra		deg	pos.eq.ra;meta.main	Fiducial ICRS Right Ascension of centroid used	double				0			
<input type="checkbox"/>	deblend_nChild				Number of children this object has (defaults to	int				0			
<input type="checkbox"/>	deblend_skipped				Deblender skipped this source	boolean				0			
<input type="checkbox"/>	detect_fromBlend				This source is cblended from a parent with m	boolean				0			
<input type="checkbox"/>	detect_isDeblendedModelSource				True if source has no children and is in the in	boolean				0			
<input type="checkbox"/>	detect_isDeblendedSource				True if source has no children and is in the in	boolean				0			
<input type="checkbox"/>	detect_isolated				This source is not a part of a blend.	boolean				0			
<input type="checkbox"/>	detect_isPatcherInner				True if source is in the inner region of a coad	boolean				0			
<input type="checkbox"/>	detect_isPrimary				True if source has no children and is in the in	boolean				0			
<input type="checkbox"/>	detect_isTractorInner				True if source is in the inner region of a coad	boolean				0			
<input type="checkbox"/>	footprintArea		pixel		Number of pixels in the sources detection footp	int				0			
<input type="checkbox"/>	g_ap03Flux		ny		Flux within 3.0-pixel aperture. Forced on g-ban	double				0			
<input type="checkbox"/>	g_ap03Flux_flag				General Failure Flag. Forced on g-band.	boolean				0			
<input type="checkbox"/>	g_ap03FluxErr		ny		Flux uncertainty within 3.0-pixel aperture. For	double				0			
<input type="checkbox"/>	g_ap06Flux		ny		Flux within 6.0-pixel aperture. Forced on g-ban	double				0			
<input type="checkbox"/>	g_ap06Flux_flag				General Failure Flag. Forced on g-band.	boolean				0			
<input type="checkbox"/>	g_ap06FluxErr		ny		Flux uncertainty within 6.0-pixel aperture. For	double				0			
<input type="checkbox"/>	g_ap09Flux		ny		Flux within 9.0-pixel aperture. Forced on g-ban	double				0			
<input type="checkbox"/>	g_ap09Flux_flag				General Failure Flag. Forced on g-band.	boolean				0			
<input type="checkbox"/>	g_ap09FluxErr		ny		Flux uncertainty within 9.0-pixel aperture. For	double				0			
<input type="checkbox"/>	g_ap12Flux		ny		Flux within 12.0-pixel aperture. Forced on g-ba	double				0			
<input type="checkbox"/>	g_ap12Flux_flag				General Failure Flag. Forced on g-band.	boolean				0			
<input type="checkbox"/>	g_ap12FluxErr		ny		Flux uncertainty within 12.0-pixel aperture. For	double				0			
<input type="checkbox"/>	g_ap17Flux		ny		Flux within 17.0-pixel aperture. Forced on g-ba	double				0			
<input type="checkbox"/>	g_ap17Flux_flag				General Failure Flag. Forced on g-band.	boolean				0			
<input type="checkbox"/>	g_ap17FluxErr		ny		Flux uncertainty within 17.0-pixel aperture. For	double				0			
<input type="checkbox"/>	g_ap25Flux		ny		Flux within 25.0-pixel aperture. Forced on g-ba	double				0			

Query Types disponibles

- Single Table, avec UI, facilité
- Par script ADQL
- Images (pas encore disponible)

RSP - PORTAL - SINGLE TABLE QUERY

Sélection de la base des données et de la table

TAP Searches

1. Select TAP Service: Using LSST RSP <https://data-dev.stsci.edu/ap/tap> - Replace...

2. Select Query Type: Single Table (UI assisted) Edit ADQL (advanced) Image Search (ObsTAP)

3. Select Table: Table Collection (Schema): **dp02_dc2_catalogs** (Data Preview 0.2 contains the image and catalog products of the Rubin Science Pipelines v23 processing of the DESC Data Challenge 2 simul...)
Table: **dp02_dc2_catalogs.Object** (Properties of the astronomical objects detected and measured on the deep coadded images.)

4. Enter Constraints

Spatial *empty entry*

Longitude Column:

Latitude Column:

Shape Type:

Coordinates or Object Name:

Examples: `62, -37 163.4 -35.11 14h11m59s -33d51m59s eqj J2000 738.2 -47.5 gal 'NGC 1532' (NB: DC2 is a simulated sky, so names are not useful)`

Radius:
Valid range between: 1" and 36000"

Temporal

Output Column Selection and Constraints

checkbox	column_name char	constraints char	unit char	ucd char	description char	datatype char	arraysize char	utype char	xtype char	principal int	size int	column_index int	index int
<input checked="" type="checkbox"/>	coord_dec		deg	pos.eq.dec;meta.main	Fiducial ICRS Declination of centroid used for c...	double					0		
<input type="checkbox"/>	coord_ra		deg	pos.eq.ra;meta.main	Fiducial ICRS Right Ascension of centroid used	double					0		
<input type="checkbox"/>	deblend_nChild				Number of children this object has (defaults to	int					0		
<input type="checkbox"/>	deblend_skipped				Deblender skipped this source	boolean					0		
<input type="checkbox"/>	detect_fromBlend				This source is co-blended from a parent with m...	boolean					0		
<input type="checkbox"/>	detect_isDeblendedModelSource				True if source has no children and is in the inn...	boolean					0		
<input type="checkbox"/>	detect_isDeblendedSource				True if source has no children and is in the inn...	boolean					0		
<input type="checkbox"/>	detect_isIsolated				This source is not a part of a blend.	boolean					0		
<input type="checkbox"/>	detect_isPatchInner				True if source is in the inner region of a coadd...	boolean					0		
<input type="checkbox"/>	detect_isPrimary				True if source has no children and is in the inn...	boolean					0		
<input type="checkbox"/>	detect_isTractInner				True if source is in the inner region of a coadd...	boolean					0		
<input type="checkbox"/>	footprintArea		pixel		Number of pixels in the sources detection footp...	int					0		
<input type="checkbox"/>	g_ap03Flux		ny		Flux within 3.0-pixel aperture. Forced on g-ban...	double					0		
<input type="checkbox"/>	g_ap03Flux_flag				General Failure Flag. Forced on g-band.	boolean					0		
<input type="checkbox"/>	g_ap03FluxErr		ny		Flux uncertainty within 3.0-pixel aperture. For...	double					0		
<input type="checkbox"/>	g_ap06Flux		ny		Flux within 6.0-pixel aperture. Forced on g-ban...	double					0		
<input type="checkbox"/>	g_ap06Flux_flag				General Failure Flag. Forced on g-band.	boolean					0		
<input type="checkbox"/>	g_ap06FluxErr		ny		Flux uncertainty within 6.0-pixel aperture. For...	double					0		
<input type="checkbox"/>	g_ap09Flux		ny		Flux within 9.0-pixel aperture. Forced on g-ban...	double					0		
<input type="checkbox"/>	g_ap09Flux_flag				General Failure Flag. Forced on g-band.	boolean					0		
<input type="checkbox"/>	g_ap09FluxErr		ny		Flux uncertainty within 9.0-pixel aperture. For...	double					0		
<input type="checkbox"/>	g_ap12Flux		ny		Flux within 12.0-pixel aperture. Forced on g-ba...	double					0		
<input type="checkbox"/>	g_ap12Flux_flag				General Failure Flag. Forced on g-band.	boolean					0		
<input type="checkbox"/>	g_ap12FluxErr		ny		Flux uncertainty within 12.0-pixel aperture. For...	double					0		
<input type="checkbox"/>	g_ap17Flux		ny		Flux within 17.0-pixel aperture. Forced on g-ba...	double					0		
<input type="checkbox"/>	g_ap17Flux_flag				General Failure Flag. Forced on g-band.	boolean					0		
<input type="checkbox"/>	g_ap17FluxErr		ny		Flux uncertainty within 17.0-pixel aperture. For...	double					0		
<input type="checkbox"/>	g_ap25Flux		ny		Flux within 25.0-pixel aperture. Forced on g-ba...	double					0		

Table Collection (Schema): **dp02_dc2_catalogs**
Data Preview 0.2 contains the image and catalog products of the Rubin Science Pipelines v23 processing of the DESC Data Challenge 2 simul...

5 TABLE COLLECTIONS (SCHEMAS)

dp02_dc2_catalogs
Data Preview 0.2 contains the image and catalog products of the Rubin Science Pipelines v23 processing of the DESC Data Challenge 2 simul...

ivoa
ObsCore v1.1 attributes in ObsTAP realization

dp01_dc2_catalogs
Data Preview 0.1 includes five tables based on the DESC's Data Challenge 2 simulation of 300 square degrees of the wide-fast-deep LSST su...

tap_schema
A TAP-standard-mandated schema to describe tablesets in a TAP 1.1 service

uws
UWS Metadata

DB Qserv disponible via TAP

- DP0.2
- DP0.1

Table: **dp02_dc2_catalogs.Object**
Properties of the astronomical objects detected and measured on the deep coadded images.

11 TABLES

dp02_dc2_catalogs.Object
Properties of the astronomical objects detected and measured on the deep coadded images.

dp02_dc2_catalogs.Source
Properties of detections on the single-epoch visit images, performed independently of the Object detections on coadded images.

dp02_dc2_catalogs.ForcedSource
Forced-photometry measurements on individual single-epoch visit images and difference images, based on and linked to the entries in the O...

dp02_dc2_catalogs.DiaObject
Properties of time-varying astronomical objects based on association of data from one or more spatially-related DiaSource detections on l...

dp02_dc2_catalogs.DiaSource
Properties of transient-object detections on the single-epoch difference images.

dp02_dc2_catalogs.ForcedSourceOnDiaObject
Point-source forced-photometry measurements on individual single-epoch visit images and difference images, based on and linked to the ent...

Paramètres de la requêtes

RSP - PORTAL - ADQL QUERY

Schéma des bases des données

The screenshot displays the TAP Search interface with the following sections:

- TAP Searches**: Includes a dropdown for "1. Select TAP Service" (Using LSST RSP) and radio buttons for "2. Select Query Type" (Single Table (UI assisted), **Edit ADQL (advanced)**, Image Search (ObsTAP)).
- 3. Advanced ADQL**: A text input field for the ADQL query, with "Reset" and "Clear" buttons. A note states: "ADQL edits below will not be reflected in Single Table view".
- Schema Browser**: A tree view on the left showing database schemas like "dp02_dc2_catalogs", "lvs", "dp01_dc2_catalogs", "tap_schema", and "lvs".
- Popular Functions**: A list of SQL functions such as TOP n, ORDER BY, POINT, CIRCLE, BOX, POLYGON, DISTANCE, and CONTAINS.
- Sample Queries**: Three example queries with their respective SQL code and descriptions.

Form pour la requête

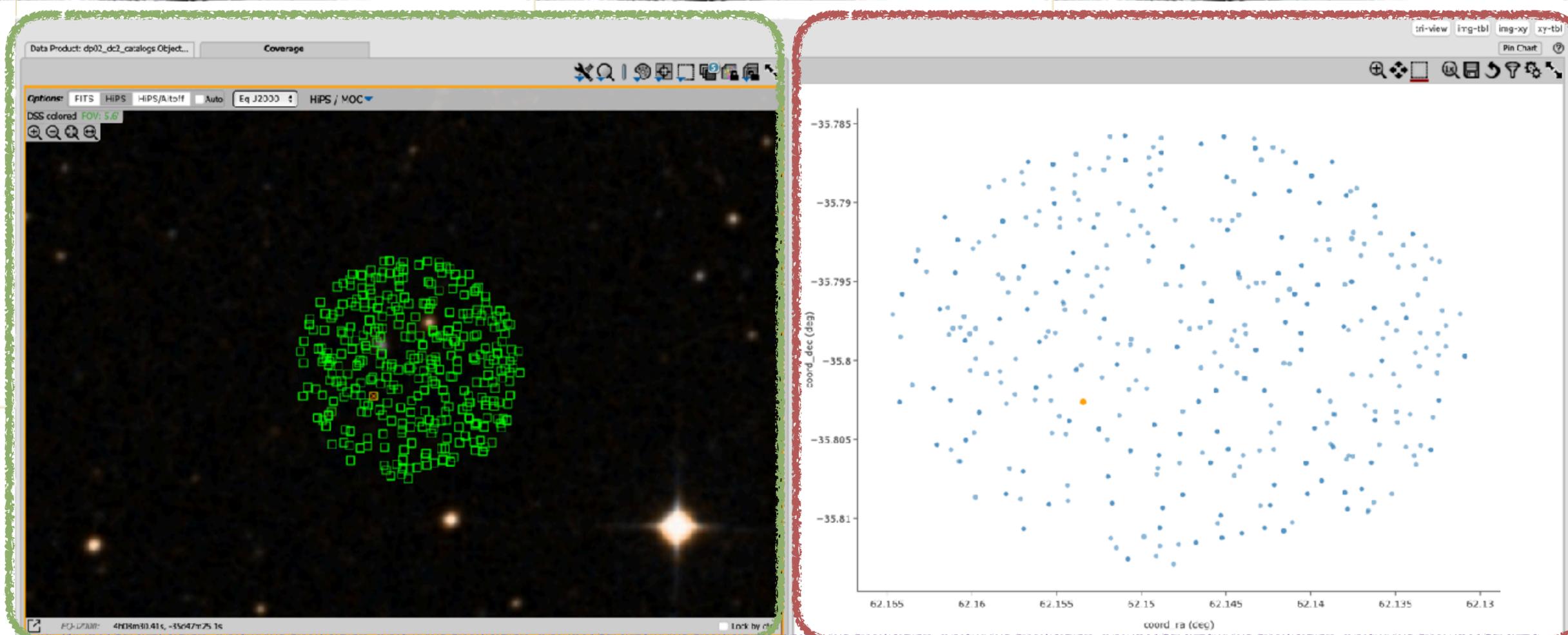
Fonctionnes Populaires

Exemples de requêtes

RSP - PORTAL

HIPS server

Plot area



- Différents layouts disponibles
- Interactive
- Synchronisation entre les différents panneaux

HIPS Server

- DSS Color
- DP0.2 en cours

Plot Area

- Plot des coordonnées
- Plot utilisateurs

Data Table

- Filtrage
- Export des données

Data Table

DataLink : protocole pour déclarer relations entre différents dataset

Exemple: Courbe de lumière

Le service TAP avec les résultats de la query renvoie une annotation

- Une UI est générée
- On sélectionne une source
- On choisit la bande photométrique
- On récupère les données

The screenshot displays the RSP Portal interface. On the left, there are two panels for configuring a query. The top panel is titled "Data Product: dp02_dc2_catalogs..." and shows fields for "table: dp02_dc2_catalogs.Forcec", "id_column: objectId", and "join_time_column: dp02_dc2_catalogs.CcdVis". Below these are dropdown menus for "band: all" and "detail: full", and a "Submit" button. The bottom panel is similar but has a dropdown menu for "band" with options "all", "u", "g", "r", "i", "z", "y".

On the right, a scatter plot shows "coord_dec (deg)" on the y-axis (ranging from -35.81 to -35.785) and "coord_ra (deg)" on the x-axis (ranging from 62.13 to 62.155). The plot contains many blue points and one orange point. Below the plot is a table with 14 columns and 5 rows of data.

coord_dec (deg)	coord_ra (deg)	deblend_nChild	deblend_skipped	detect_fromblend	detect_isDeblendedModelSource	detect_isDeblendedSource	detect_isolated	detect_isPatchInner	detect_isPrimary	detect_isTractInner	footprintArea (pixel)	a_ap03Flux (nJy)	a_ap03Flux_flag	a_ap03FluxErr (nJy)
-35.8026196	62.1534271	1	false	false	false	true	true	true	true	true	276	98.4535729	false	7.39540
-35.8039909	62.1489762	4	false	false	false	false	false	true	false	true	952	421.5836031	false	7.7892003
-35.8054522	62.1459262	10	false	false	false	false	false	true	false	true	2996	307.318219	false	7.991703
-35.8073336	62.1519718	1	false	false	false	true	true	true	true	true	255	81.8336077	false	7.4892373
-35.8075867	62.1393808	1	false	false	false	true	true	true	true	true	228	51.7836549	false	7.7688295

DataLink : protocole pour déclarer relations entre différents dataset

Exemple: Courbe de lumière

Data Product: dp02_dc2_catalogs... Coverage

Table

Table (40 cols x 52 rows)

expMidptMJD (d)	band	coordDecId	coord_dec (deg) double	coord_ra (deg) double	detect_IsPatchInner boolean	detect_IsPrimary boolean	detect_IsTractInner boolean	forcedSourceId
61064.1099652	g	1019973140	-35.7982+27	62.1402298	true	false	true	5475035098
61064.0890902	g	1019932105	-35.7982+27	62.1402298	true	false	true	5475218793
60924.2566012	g	921307140	-35.7982+27	62.1402298	true	false	true	4945230044
60924.2561532	g	921306007	-35.7982+27	62.1402298	true	false	true	4945224123
60500.1674572	g	697930817	-35.7982+27	62.1402298	true	false	true	3747026733
60145.4239102	g	400461179	-35.7982+27	62.1402298	true	false	true	2149955503
60229.3197612	g	661609056	-35.7982+27	62.1402298	true	false	true	3552416204
60229.3247232	g	661721066	-35.7982+27	62.1402298	true	false	true	3552500229
60530.3520422	g	637871126	-35.7982+27	62.1402298	true	false	true	3424544692
59941.2571012	g	194862027	-35.7982+27	62.1402298	true	false	true	1045157541
60530.3586072	g	637866000	-35.7982+27	62.1402298	true	false	true	3424517540
61364.0736142	g	1225277012	-35.7982+27	62.1402298	true	false	true	6573855860
59941.2561072	g	194860176	-35.7982+27	62.1402298	true	false	true	1045147604
60924.2784002	g	921351022	-35.7982+27	62.1402298	true	false	true	4945462634
59941.3299902	g	194920110	-35.7982+27	62.1402298	true	false	true	1045465722
60530.3732912	g	637913022	-35.7982+27	62.1402298	true	false	true	3424654589
60854.2793832	g	821333142	-35.7982+27	62.1402298	true	false	true	4945477016
61268.2830602	g	1166075155	-35.7982+27	62.1402298	true	false	true	6277224645
60644.0857302	g	716591110	-35.7982+27	62.1402298	true	false	true	3863275348
60644.1004602	g	716693101	-35.7982+27	62.1402298	true	false	true	3863446758
60754.0757702	g	786702019	-35.7982+27	62.1402298	true	false	true	4212836885
59879.2024112	g	221615159	-35.7982+27	62.1402298	true	false	true	1183087335
58017.0832672	g	875990871	-35.7982+27	62.1402298	true	false	true	5239807333
59879.1830132	g	221575146	-35.7982+27	62.1402298	true	false	true	1183072875
60009.1588312	g	765493172	-35.7982+27	62.1402298	true	false	true	4180210173
60982.3056532	g	964278760	-35.7982+27	62.1402298	true	false	true	5069563935
61113.0350012	g	1043304177	-35.7982+27	62.1402298	true	false	true	5601196649
60982.2889032	g	964248066	-35.7982+27	62.1402298	true	false	true	5069932034

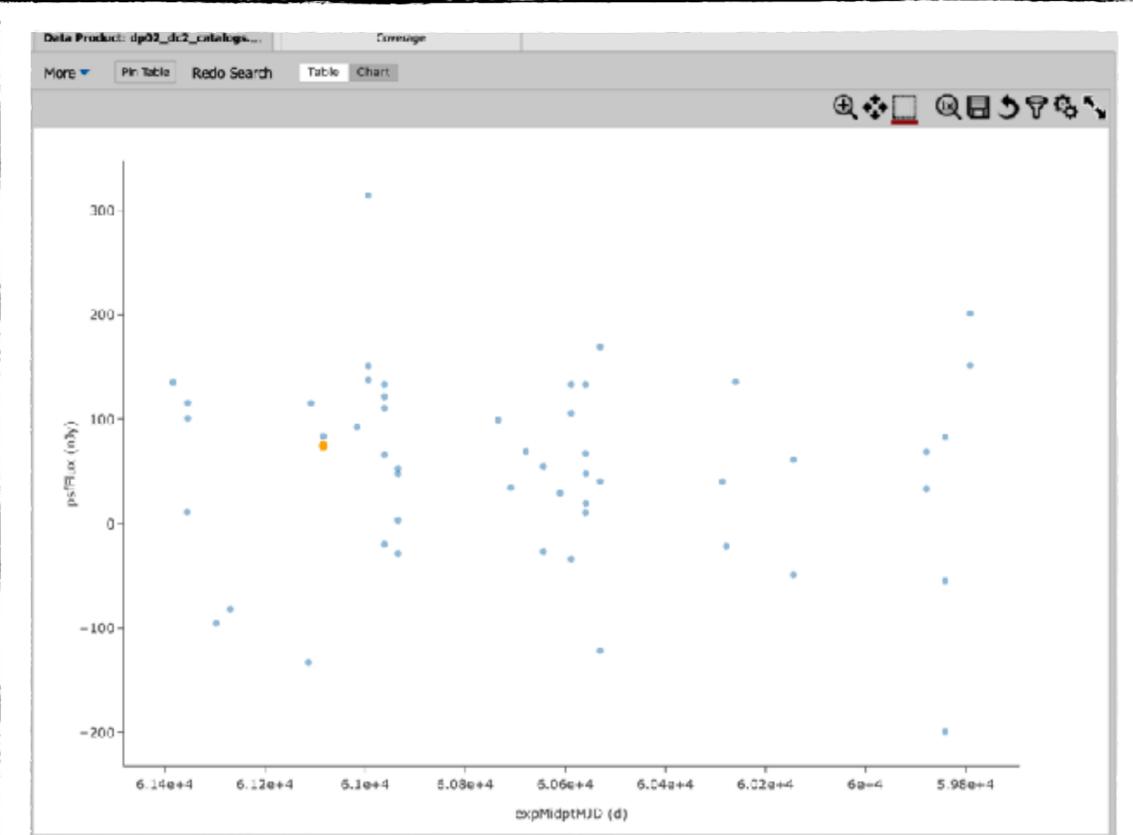


Le service TAP avec les résultats de la query renvoie une annotation

- Une UI est générée
- On sélectionne une source
- On choisit la bande photométrique
- On récupère les données

Table des Données

coord_dec (deg) double	coord_ra (deg) double	detect_IsDeblendedSource boolean	detect_IsTractInner boolean
-35.8026196	62.1524271	true	true
-35.8059909	62.1489762	false	false
-35.8054522	62.1489762	false	false
-35.8073336	62.1519718	true	true
-35.8075867	62.1393808	true	true



RSP - PORTAL

Création de plot



Plot Parameters

Add New Chart Overplot New Trace Modify Trace

Plot Type: Scatter
 Heatmap
 Histogram

*For X and Y, enter a column or an expression
ex. log(col); 100*col1/col2; col1-col2*

X:

Error:

Y:

Error:

Trace Style:

▶ Trace Options

▶ Chart Options

OK Close

Add New Chart

Plot Type:

*For X and Y, enter a column or an expression
ex. log(col); 100*col1/col2; col1-col2*

X:

Error:

Y:

Error:

Trace Style:

▶ Trace Options

▶ Chart Options

OK Close

Add New Chart

Plot Type:

*For X and Y, enter a column or an expression
ex. log(col); 100*col1/col2; col1-col2*

X:

Error:

Y:

Error:

Trace Style:

▼ Trace Options

Symbol: circle
 circle-open
 square
 square-open
 diamond
 diamond-open
 cross
 x
 triangle-up
 hexagon
 star

Color:

Color Map:

Color Scale:

Size Map:

▶ Chart Options

OK Close

▼ Trace Options

Symbol:

Color:

Color Map:

Color Scale:

Size Map:

▼ Chart Options

Chart title:

X Label:

Options: grid reverse top log

Y Label:

Options: grid reverse right log

Set plot boundaries if different from data range.

X Min: X Max:

Y Min: Y Max:

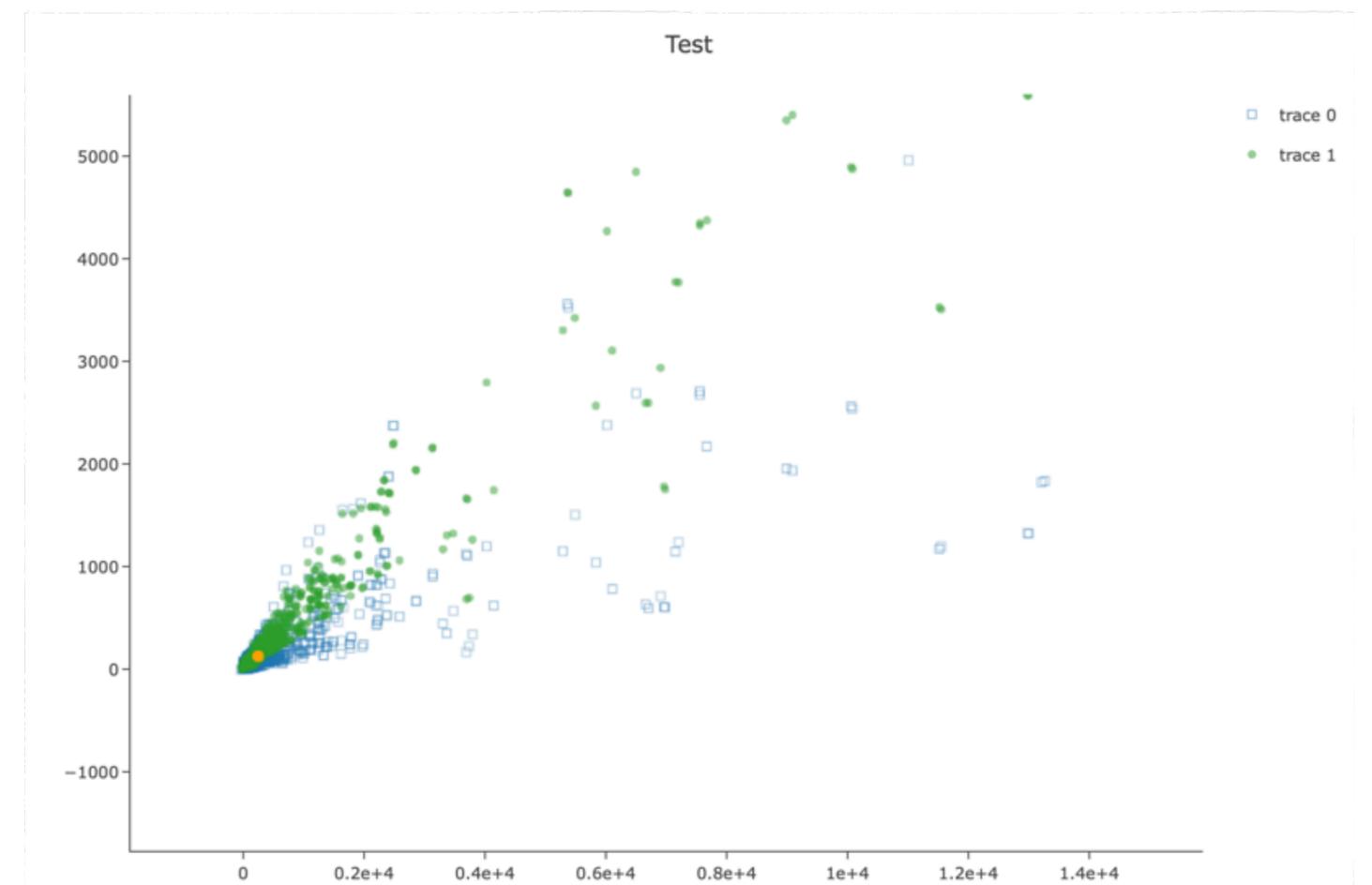
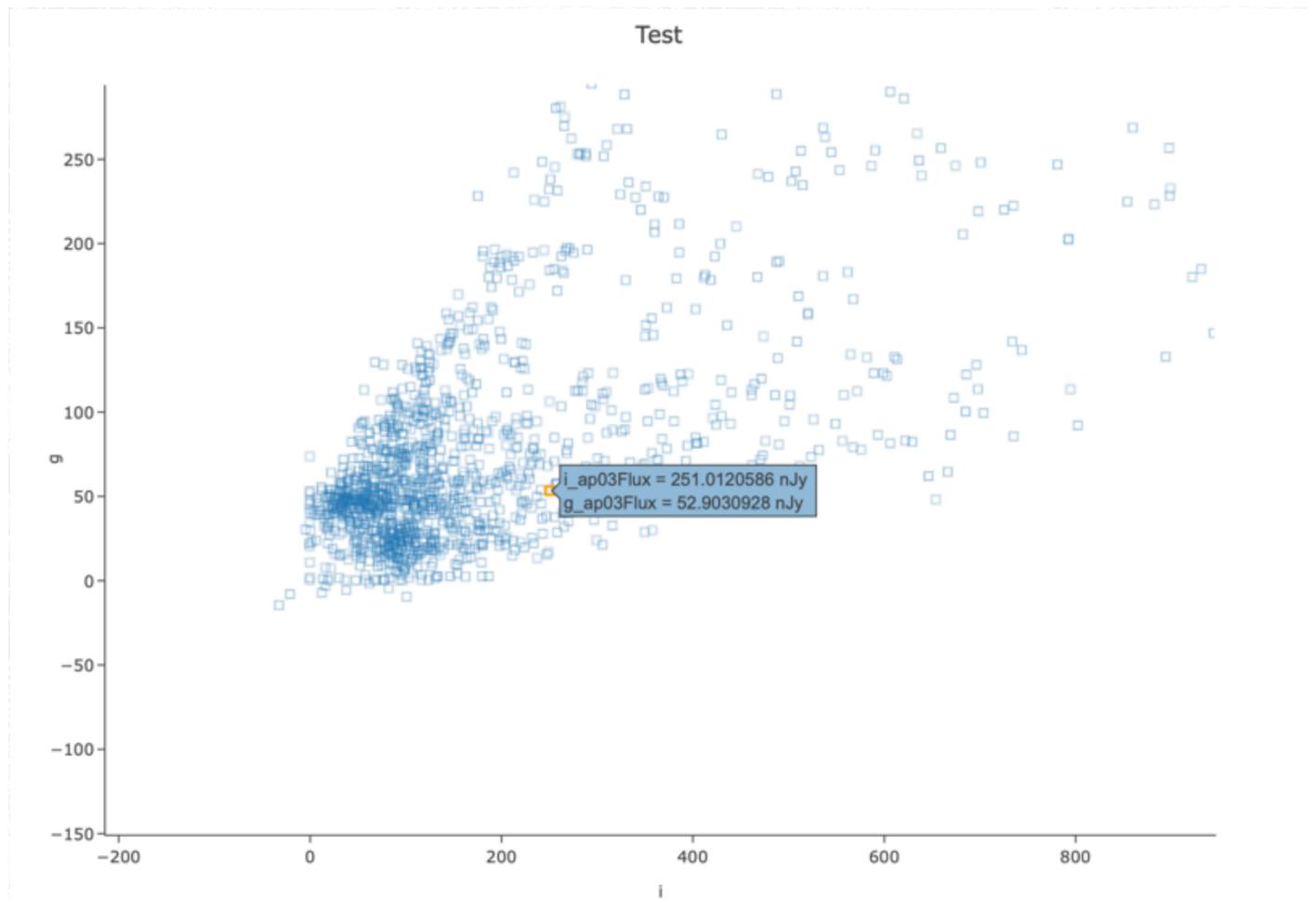
*Enter display aspect ratio below.
Leave it blank to use all available space.*

X/Y ratio:

OK Close

RSP - PORTAL

Création de plot



RSP - PORTAL

Image externes



1. Choose Image Type View FITS Images Create 3-Color Composite View HPS Images

2. Select Image Source Search Use my Image URL Workspace

3. Select Target Coordinates or Object Name:
RA: 156.1416667 deg DEC: -32.0841944 deg RA: 156.1416667 deg DEC: -32.0841944 deg

Output size (empty blank for full size):
Valid range between: 1" and 3580"

4. Select Data Set

Filter By: Selection: [Clear Selections](#) [Expand All](#) [Collapse All](#)

MISSION:

- SDSS (1)
- DES (1)
- 2MASS (8)
- WISE (4)
- AKARI (1)
- ZTF (1)
- [more](#)

PROJECT TYPE:

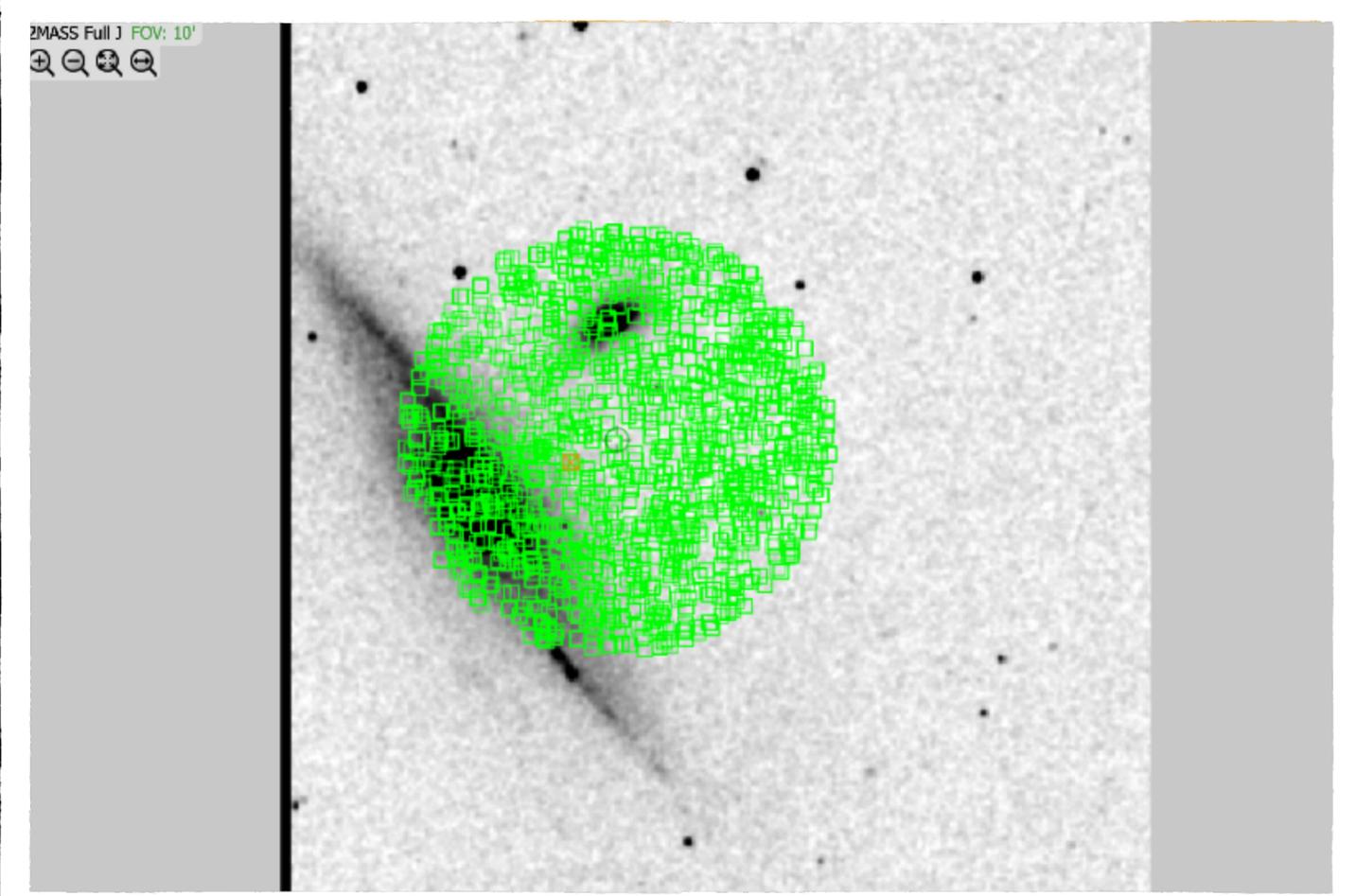
- all-sky (10)
- compilation (9)
- extragalactic (50)
- generic (17)

BAND:

- x-ray (1)
- UV (3)
- optical (14)
- near-IR (12)
- mid-IR (146)
- far-IR (40)
- [more](#)

Selection:

- SDDS: Sloan Digital Sky Survey (1)
 - u (2510 Angstroms)
 - g (4810 Angstroms)
 - r (6250 Angstroms)
 - i (7610 Angstroms)
 - z (9090 Angstroms)
- DSS: Digitized Sky Survey (1)
 - POSS2/UKSTU Red (6900 Angstroms)
 - POSS2/UKSTU Infrared (8500 Angstroms)
 - POSS2/UKSTU Blue (4100 Angstroms)
 - POSS1 Red (6500 Angstroms)
 - POSS1 Blue (4800 Angstroms)
- 2MASS All-sky (1)
 - J (1.225 microns)
 - H (1.642 microns)
 - K_s (2.159 microns)
- 2MASS Full Survey (1)
 - J (1.225 microns)
 - H (1.642 microns)
 - K_s (2.159 microns)
- 2MASS 6X Catalog (2 images) (1)
- 2MASS Full 6X (1)
- 2MASS Calibration (1)
- 2MASS Six Degree Mosaik (1)
- 2MASS GK Lockman Hole (LH) Ancillary Data Atlas (1)
- 2MASS LGA: Large Galaxy Atlas (1)
- WISE AllWISE Atlas (1)
- WISE AllSky Atlas (1)
- WISE unWISE on addn (1)
- zNGS: The z=0 Multiwavelength Galaxy Synthesis (1)
- AKARI Far-infrared All-sky Maps (1)
- ZTF Reference Image (1)



RSP - PORTAL

Catalogues externes

Table Search

ERSA Catalogs | VO SCS Search | MED

Select Project: **Gala**

Select Catalog: **Gala DR3**

Search Method: **Polygon**

Search Area: **Image** **Visible** **Catalog**

Coordinates: **63.04793 -32.91212**

Field width is defined by a 1000x1000 arc of the visible pole
 - A pair of RA and DEC or RA and Galactic longitude
 - Example: 287.5, 5, 200, 200, 210, 210, 215, 215

constraint	description	units	index	datatype	table	rel
id	Unique identifier	int	int	number (32 bit)	table	1:1
name	Unique name identifier (unique across all Data Releases)	string	string	string (255)	table	1:1
unique_name	Unique name identifier (unique within a particular Data Release)	string	string	number (255)	table	1:1
name_index	Random index used to select subsets	int	int	number (32 bit)	table	1:1
ra	Right ascension	deg	float	float (double)	table	1:1
dec	Declination	deg	float	float (double)	table	1:1
ra_error	Standard error of right ascension	deg	float	float (double)	table	1:1
dec_error	Standard error of declination	deg	float	float (double)	table	1:1
parallax	Parallax	mas	float	float (double)	table	1:1
parallax_error	Standard error of parallax	mas	float	float (double)	table	1:1
parallax_divided_by_error	Parallax divided by its error	float	float	float (float)	table	1:1
proper_motion_ra	Proper motion in right ascension direction	mas/yr	float	float (double)	table	1:1
proper_motion_dec	Standard error of proper motion in right ascension direction	mas/yr	float	float (double)	table	1:1
proper_motion_dec_dir	Proper motion in declination direction	mas/yr	float	float (double)	table	1:1
proper_motion_dec_err	Standard error of proper motion in declination direction	mas/yr	float	float (double)	table	1:1

Data Product: dp02_dc2_catalogs.Object...

Coverage

Options: **FITS** **HIPS** **HIPS(Auto)** **Auto** **Eq J2000** **HIPS / MOC**

DSS colored: **FOV: 6.6'**

dec. (deg)

ra (deg)

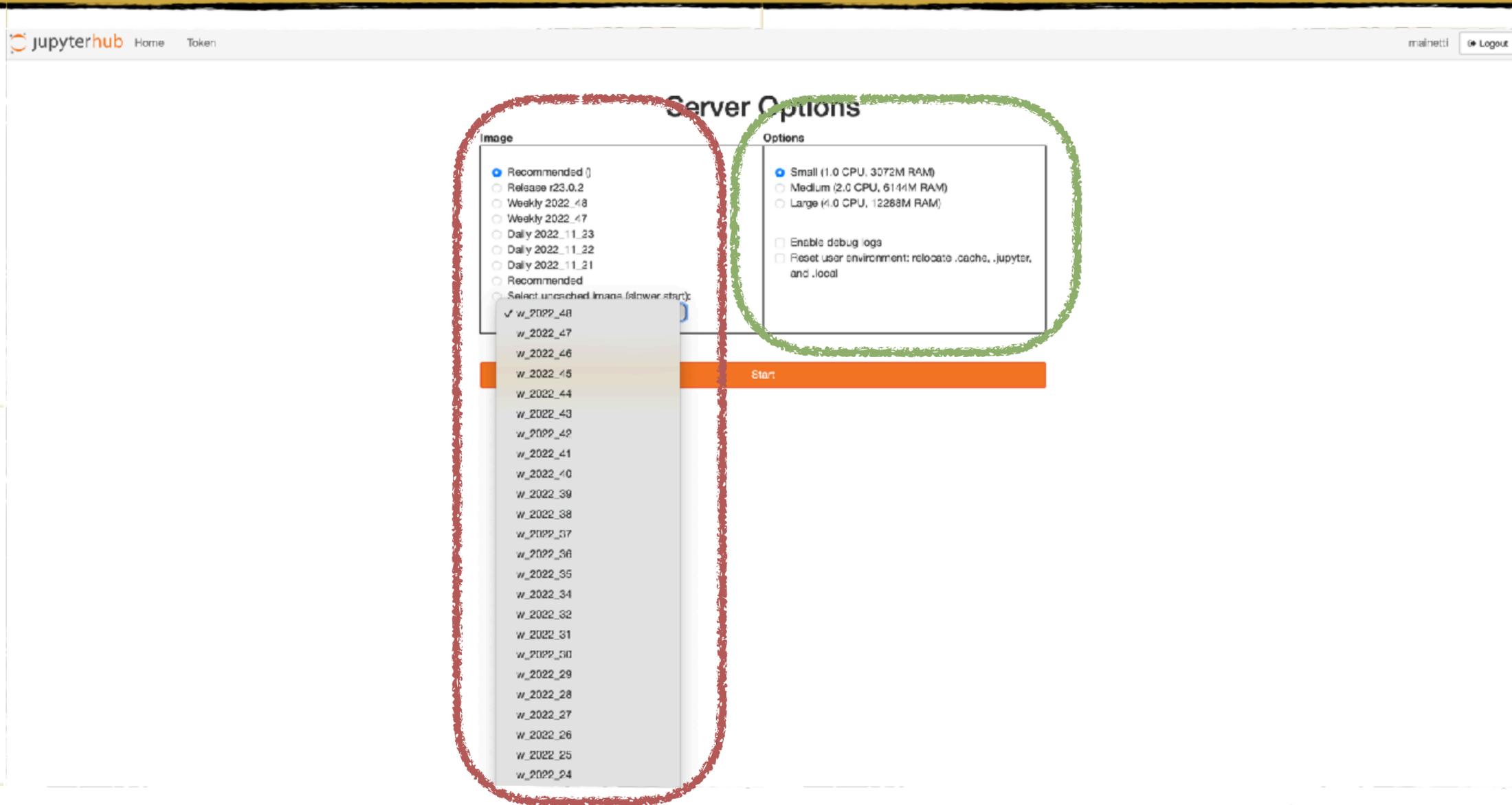
dp02_dc2_catalogs.Object - data-dev... x **Gala-gala_dr3_source (polygon)** x

checkbox	solution_id	designation	source_id	random_index	ref_epoch	ra	ra_error	dec	clon	clat	dec_error	parallax	parallax_error
	long	char	long	long	(yr)	(deg)	(mas)	(deg)	char	char	(mas)	(mas)	(mas)
<input type="checkbox"/>	1536148058921375768	Gala DR3 4882788722153405080	4882788722133405696	783779693	2016.000	62.92204694795	82.70+0	-32.89581246627	0+h11m+41.29s	-32c53m+44.92s	14.4997	null	null
<input type="checkbox"/>	1536148058921375768	Gala DR3 4882788722154692864	4882788722134652854	514097444	2016.000	62.93948662248	0.0562	-32.89787151200	0+h11m+45.48s	-32c53m+52.34s	0.1200	0.0585	0.1376
<input checked="" type="checkbox"/>	1536148058921375768	Gala DR3 4882788722154693120	4882788722134652854	1767859462	2016.000	62.93625101399	0.0512	-32.89501000423	0+h11m+44.70s	-32c53m+42.04s	0.0366	0.0026	0.0445
<input type="checkbox"/>	1536148058921375768	Gala DR3 4882788722155155224	4882788722135156736	799906689	2016.000	62.92799050449	3.7017	-32.89321279921	0+h11m+42.72s	-32c53m+35.57s	4.1344	null	null
<input type="checkbox"/>	1536148058921375768	Gala DR3 48827887221520031168	4882788722200631296	694223503	2016.000	62.97403925095	0.3191	-32.9151269635	0+h11m+53.77s	-32c54m+53.06s	0.3787	0.0123	0.4415
<input type="checkbox"/>	1536148058921375768	Gala DR3 4882788722152965400	488278872212966912	124483212	2016.000	62.96061976492	2.0625	-32.9008410429	0+h11m+50.55s	-32c54m+29.10s	1.7896	null	null

Example: catalogue GAIA DR3

RSP - NOTEBOOKS

Jupyter Hub



Images basées sur les stack logiciel LSST :

- Dernière 3 Weekly / 3 Daily en cache
- Les autres à télécharger

- Trois options pour les ressources
- Possible de ajouter/modifier les options

```
sizes:  
- name: Small  
  cpu: 1  
  ram: 3072M  
- name: Medium  
  cpu: 2  
  ram: 6144M  
- name: Large  
  cpu: 4  
  ram: 12288M
```


Table Access Protocol (TAP)

Rubin Science Platform APIs

Integrate Rubin data into your analysis tools with APIs.

Table Access Protocol

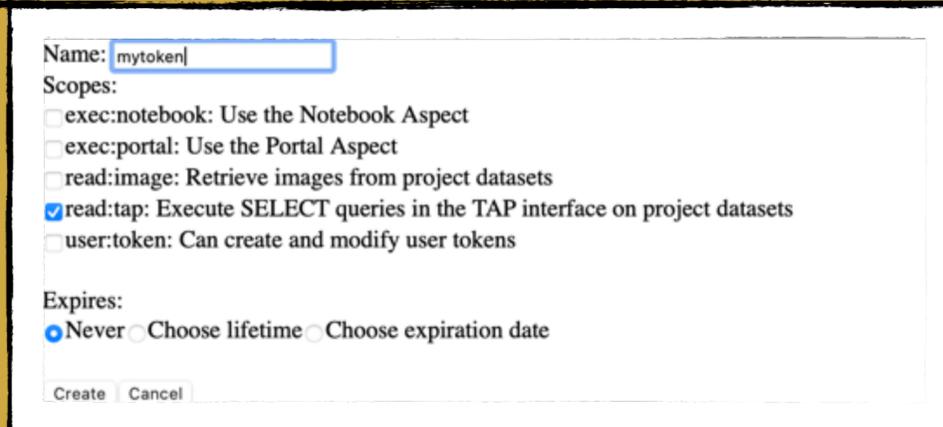
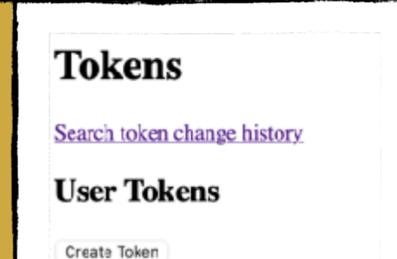
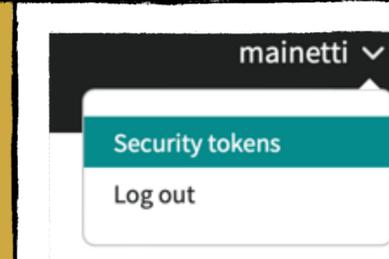
You can access catalog data using the Table Access Protocol (TAP) service with popular tools such as [TOPCAT](#) (GUI) and [pyvo](#) (Python package). The TAP endpoint is:

~~<https://data.lsst.cloud/api/tap>~~ <https://data-dev.lsst.eu/api/tap>

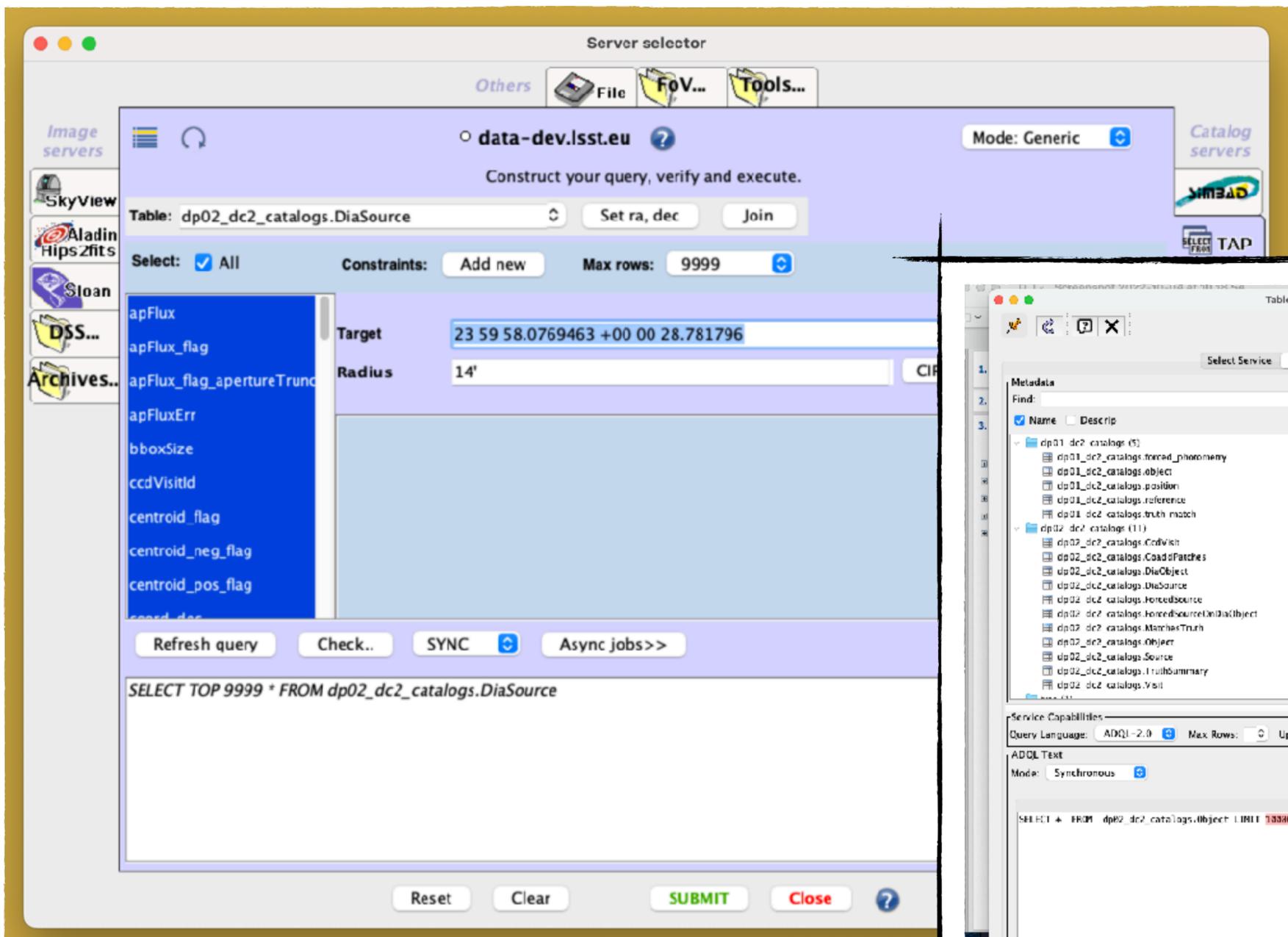
To access the TAP service, you also need an **access token**:

1. Log into the Science Platform by clicking on the **Log In** button at the top-right of this page (if you aren't already logged in).
2. Click on **Security tokens** from your user menu at the top-right of this page.
3. On the **Tokens** page, click on **Create Token**.
4. Fill out the fields:
 1. Type a token name, such as `tap`
 2. Select the **read:tap** scope.
 3. Choose an expiration timeline. The default, **Never**, is good for tokens that you manage yourself.
 4. Click on **Create**.
5. Copy the token string and use it in any TAP client. If your client has both username and password fields, enter `x-oauth-basic` as the username and the token as the password.

- Ouverture au services Virtual Observatory
- Token fournis pas la RSP

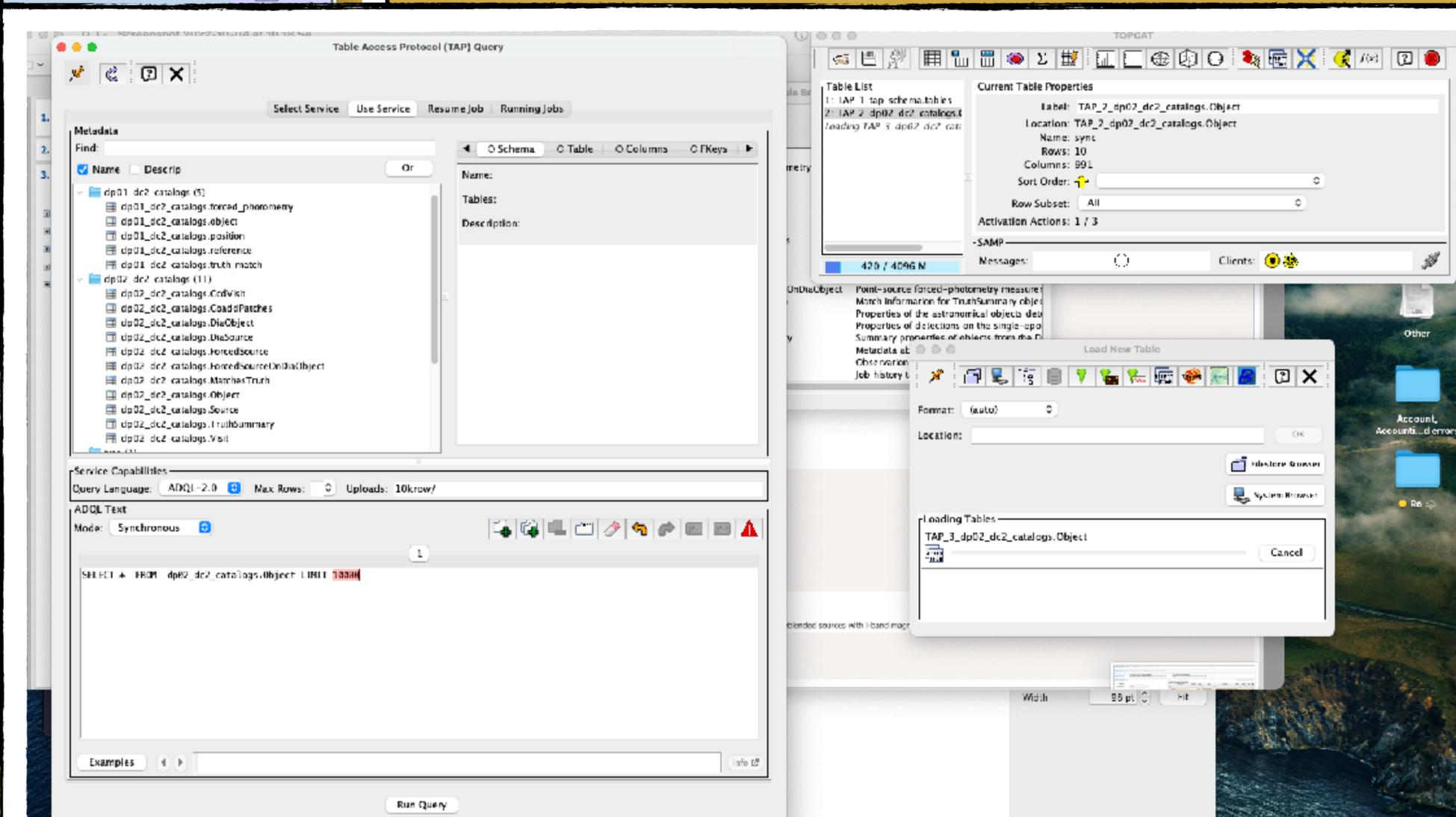


RSP - VO APIs



ALADIN

TOPCAT



RSP - VO APIs

Depuis la plateforme de notebook du CC-IN2P3

```
import pyvo as vo
import requests

Token
url="https://rate-csv.lsst.org/api/tap"
token="..."

Authentication
[5]: def get_auth():
    tap_url = url
    s = requests.Session()
    s.headers['Authorization'] = 'Bearer ' + token
    auth = vo.auth.authsession.AuthSession()
    auth.credentials.set('lsst-token', s)
    auth.add_security_method_for_url(tap_url, 'lsst-token')
    auth.add_security_method_for_url(tap_url + '/sync', 'lsst-token')
    auth.add_security_method_for_url(tap_url + '/async', 'lsst-token')
    auth.add_security_method_for_url(tap_url + '/tables', 'lsst-token')
    return auth

TAP service creation
[6]: tap_service = vo.catalog.TAPService(url, get_auth())

Query
[7]: resultset = tap_service.search("SELECT TOP 100 * FROM cp2_cc2_catalogs.Object")
[8]: resultset.to_table().show_in_notebook()
[9]: Table length=100
```

idx	coord_dec	coord_ra	deblend_nChild	deblend_skipped	detect_fromBlend	detect_isDeblendedModelSource	detect_isDeblendedSource	detect_isIsolated	detect_isPatchInner	detect_isPrimary	detect_isTractInner	footprintArea	g_ap03Flux	g_ap03Flux_flag
	deg	deg										pix	nJy	
0	-44.0322113	64.4500788	1	False	False	False	True	True	True	False	False	645	412.1322886	False
1	-44.3312562	64.3185331	2	False	False	False	False	False	True	False	False	283	60.1774559	False
2	-44.5316461	64.3796335	1	False	False	False	True	True	True	False	False	153	57.1881908	False
3	-44.330517	64.3881605	2	False	False	False	False	False	True	False	False	325	397.4578227	False
4	-44.6316349	64.3526559	1	False	False	False	True	True	True	False	False	96	21.0433418	False
5	-44.0317522	64.3783342	2	False	False	False	False	False	True	False	False	377	241.9003884	False
6	-44.620403	64.3398123	3	False	False	False	False	False	True	False	False	1251	464.6395850	False

Bibliothèque pyvo

Authentification via token

Création du service

Requête

Conclusions

4

Conclusions

- La plateforme informatique est déployée
- Qserv en ligne avec 4 catalogues disponible
- RSP en ligne, intégration avec l'environnement du CC-IN2P3 est en cours (Authentication, HOME, THRONG et SPS) : <https://data-dev.lsst.eu>
- Les services VO disponibles

Nous recherchons des beta-tester pour comprendre les limites et les besoins

Qserv DB



	data [GB]	rows	contribs
table			
CcdVisit	13.29	42072870	15
DiaSource	64.54	162448407	2469
ForcedSource	27167.36	3834373833	16021
ForcedSourceOnDiaObject	4025.28	3932290064	15565
MatchesTruth	44.22	719561612	1271
Object	1691.21	278318452	2469
Object (overlaps)	700.21	115247835	2508
Source	4890.66	5754021778	821016
Source (overlaps)	2018.54	2374904854	840631
Visit	0.05	297600	15
DiaObject	26.76	41301558	2469
DiaObject (overlaps)	11.09	17135165	2507
TruthSummary	167.90	764816913	1394
TruthSummary (overlaps)	69.39	316086516	1397

- <https://dp0-2.lsst.io/>
- https://dm.lsst.org/sdm_schemas/browser/dp02.html

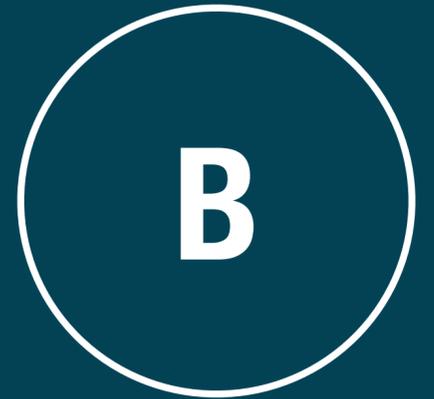
	data [GB]	rows	contribs
table			
<code>truth_match</code>	181.99	765823615	2399
<code>truth_match (overlaps)</code>	75.21	316502939	2489
<code>reference</code>	335.36	147088445	2111
<code>forced_photometry</code>	728.16	147088445	2111
<code>position</code>	17.66	147088445	2111
<code>object</code>	171.82	147088478	2111
<code>object (overlaps)</code>	70.93	60718650	2197

	data [GB]	rows	contribs
table			
<code>data</code>	7496.75	2256249331	3082
<code>position</code>	152.69	2256249331	3082
<code>position (overlaps)</code>	63.04	931538177	3192

SKYSIM 5000

	data [GB]	rows	contribs
table			
data	28321.60	8503061280	35755
position	595.06	8503061280	35755
position (overlaps)	245.52	3508359049	37037

Déploiement



QSERV - Configuration et Déploiement

- Basé sur le framework operator-sdk
- 2 commandes pour le déployer
 - `k apply -f manifest/operator.yaml`
 - `k apply -k manifest/<instance>`

```
qserv-czar-0          ● 2/2
qserv-ingest-db-0    ● 1/1
qserv-repl-ctl-0     ● 1/1
qserv-repl-db-0      ● 1/1
qserv-repl-registry-5bdf55c8ff-jvp9p ● 1/1
qserv-worker-0       ● 4/4
qserv-worker-1       ● 4/4
qserv-worker-2       ● 4/4
qserv-worker-3       ● 4/4
qserv-worker-4       ● 4/4
qserv-worker-5       ● 4/4
qserv-worker-6       ● 4/4
qserv-worker-7       ● 4/4
qserv-worker-8       ● 4/4
qserv-worker-9       ● 4/4
qserv-worker-10      ● 4/4
qserv-worker-11      ● 4/4
qserv-worker-12      ● 4/4
qserv-worker-13      ● 4/4
qserv-worker-14      ● 4/4
qserv-xrootd-redirector-0 ● 2/2
```

```
apiVersion: qserv.lsst.org/v1beta1
kind: Qserv
metadata:
  name: qserv
spec:
  queryService:
    type: NodePort
    nodePort: 30040
  storageClassName: "qserv-local-storage"
  storage: "100Gi"
  worker:
    replicas: 15
    replicationResources:
      limits:
        cpu: 36
  tolerations:
  - key: "dedicated"
    operator: "Equal"
    value: "qserv"
    effect: "NoSchedule"
```

<https://github.com/lsst/qserv-operator>

<https://qserv.lsst.io/>

<https://qserv-operator.lsst.io/>

QSERV INGEST

- Utilisé pour charger les données
 - Développé par F. James (LPC - IN2P3)
 - Argo workflow

- Pre-réquis:

- Données partitionnés (CSV)
- Schema DB et partitionnement

```
ingest:
  input:
    # Servers which provides input data
    # TODO Add support for webdav protocol
    # Use file:// as first element in list when using local data
    servers:
      - https://ccnetlsst01.in2p3.fr:65101
      - https://ccnetlsst02.in2p3.fr:65101
      - https://ccnetlsst03.in2p3.fr:65101
      - https://ccnetlsst04.in2p3.fr:65101
    # Path on server where input data is available
    path: stable/idf-dp0.2-catalog-chunked/PREOPS-905
  qserv:
    # TODO add support for secondary index generation method
    # Override the default value stored in input metadata
    # 1: build secondary index after each transaction
    # 0: build secondary index after ingest
    auto_build_secondary_index: 0

    # URL of Qserv services
    # Proxy URL
    query_url: "mysql://qsmaster:@qserv-czar:4040"
    # Ingest database URL
    queue_url: "mysql://qsingest:@qserv-ingest-db-0.qserv-ingest-db/qservIngest"
    # Replication service URL
    replication_url: http://qserv-repl-ctl-0.qserv-repl-ctl:8080
```

```
- name: main
  dag:
    tasks:
      - name: queue
        template: ingest-step
        arguments:
          parameters: [{name: script, value: load-queue.sh}]
      - name: register
        template: ingest-step
        arguments:
          parameters: [{name: script, value: register.sh}]
      - name: transactions
        template: transactions
        dependencies: [queue, register]
      - name: check-transactions
        template: ingest-step
        arguments:
          parameters: [{name: script, value: check-transactions.sh}]
        dependencies: [transactions]
      - name: publish
        template: ingest-step
        arguments:
          parameters: [{name: script, value: publish.sh}]
        dependencies: [check-transactions]
      - name: index-tables
        template: index-tables
        dependencies: [publish]
      - name: validate
        template: ingest-step
        arguments:
          parameters: [{name: script, value: validate.sh}]
        dependencies: [index-tables]
      - name: benchmark
        template: benchmark
        dependencies: [validate]
```

<https://github.com/lstt-dm/qserv-ingest>

<https://qserv-ingest.lsst.io/>

RSP - Configuration et Déploiement

- Configuration via Helm chart
- Une config pour chaque environnement et pour chaque application

```
config:
  gcsBucket: "async-results.lsst.codes"
  gcsBucketUrl: "https://cccephs3.in2p3.fr:8080"
  gcsBucketType: "S3"
  jvmMaxHeapSize: "31G"

qserv:
  host: "ccqserv201.in2p3.fr:30040"

mock:
  enabled: false
```

- Déploiement via ArgoCD
- Secrets gérer via Vault (HashiCorp)

<https://github.com/lsst-sqre/phalanx>

<https://phalanx.lsst.io/>

templates	Clean up the sqlproxy service
Chart.yaml	Fix typo in science-platform Chart.yaml
README.md	Updated missed values to reflect new naming
values-base.yaml	Delete obstap service
values-ccin2p3.yaml	activate datalinker
values-idfdev.yaml	adjusted naming to be more generic
values-idfint.yaml	Update values-idfint.yaml
values-idfprod.yaml	Delete obstap service

The screenshot shows the Argo CD web interface. On the left is a sidebar with navigation options: Applications, Settings, User Info, and Documentation. Below this is a 'FILTERS' section with 'Favorites Only' checked. The main area displays a grid of application tiles. Each tile shows the application name, project, labels, status (Healthy, Synced), repository URL, target revision, path, destination, and namespace. Action buttons for SYNC, REFRESH, and DELETE are visible for each application.

Application	Project	Status	Repository	Target Revis.	Path	Destination	Namespace
argood/argood	default	Healthy Synced	https://github.com/gabrimaine/phalanx.git	ccin2p3	services/argood	in-cluster	argood
argood/cachemachine	default	Healthy Synced	https://github.com/gabrimaine/phalanx.git	ccin2p3	services/cachemachine	in-cluster	cachemachine
argood/cert-manager	default	Healthy Synced	https://github.com/gabrimaine/phalanx.git	ccin2p3	services/cert-manager	in-cluster	cert-manager
argood/datalinker	default	Healthy Synced	https://github.com/gabrimaine/phalanx.git	ccin2p3	services/datalinker	in-cluster	datalinker
argood/gaiaeflawr	default	Healthy Synced	https://github.com/gabrimaine/phalanx.git	ccin2p3	services/gaiaeflawr	in-cluster	gaiaeflawr
argood/ingress-nginx	default	Healthy Synced	https://github.com/gabrimaine/phalanx.git	ccin2p3	services/ingress-nginx	in-cluster	ingress-nginx