



Expandable Management of Astrophysical Catalogues The case of CLASH-VLT data

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& CLASH-VLT Collaboration*

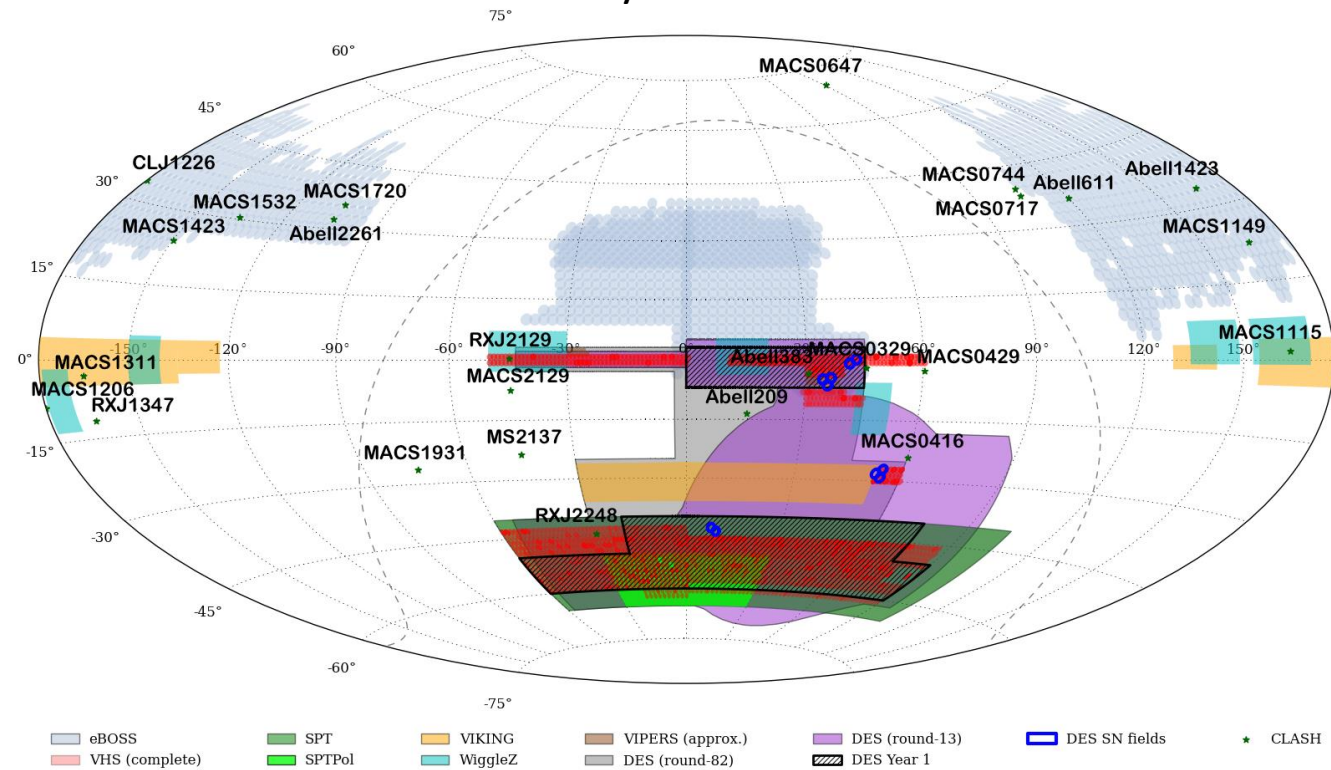


Workshop Laboratorio Spettroscopia INAF - Roma, 10-11 Giugno, 2019

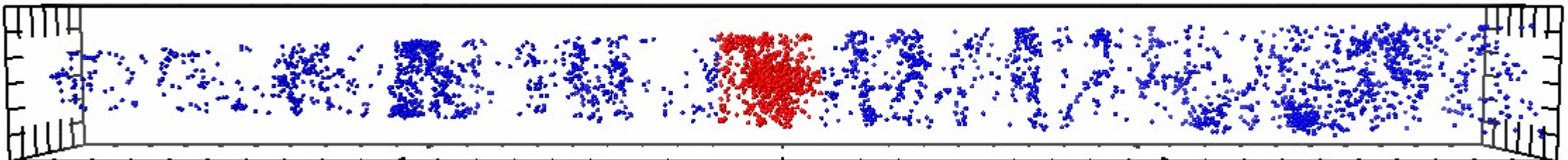
CLASH-VLT survey



The CLASH-VLT survey (*ESO Large Programme 186.A-0798, PI: Piero Rosati, Rosati+2014*) consists of 12 massive clusters from the CLASH survey. It includes 2 of the Frontier Fields clusters, namely MACS0416 and RXJ2248 (AS1063)



- ~500 spectroscopic members per cluster (3-5Mpc) to reconstruct cluster mass profile from dynamic analysis
- Obtain z for high- z galaxies and SL features in the cluster cores out to $z \sim 7$
- Full spectro-photo characterization of the largest sample of cluster galaxies to date (10^8 to $10^{12} M_{\odot}$)
- Derive highest accuracy mass density profiles with SL+WL, dynamics, X-ray methods, over 10-3000 Kpc radial range
- Census of primordial galaxies playing crucial role in the Universe reionization
- Explore galaxy structure and evolution from a dataset of ~6000 cluster galaxies



CLASH-VLT DBMS



- ❖ Full spectroscopic catalogues/images for single clusters
- ❖ Cluster members catalogues/images
- ❖ Catalogues of lensed galaxies and multiply imaged background sources

We designed and developed a web app to access and navigate through the database.

Currently hosted on an expandable WS
2CPUs x 8 cores
128GB RAM
4TB HDD
NVIDIA Kepler GPU

<https://kyle.na.astro.it/CLASH-VLT/Public/index.html>

Visit the Official Site

CLASH-VLT Web App



The web app makes data available via any kind of device connected to internet. We differentiate user rights.

Guest: only public data and partial privileges on query functionalities.

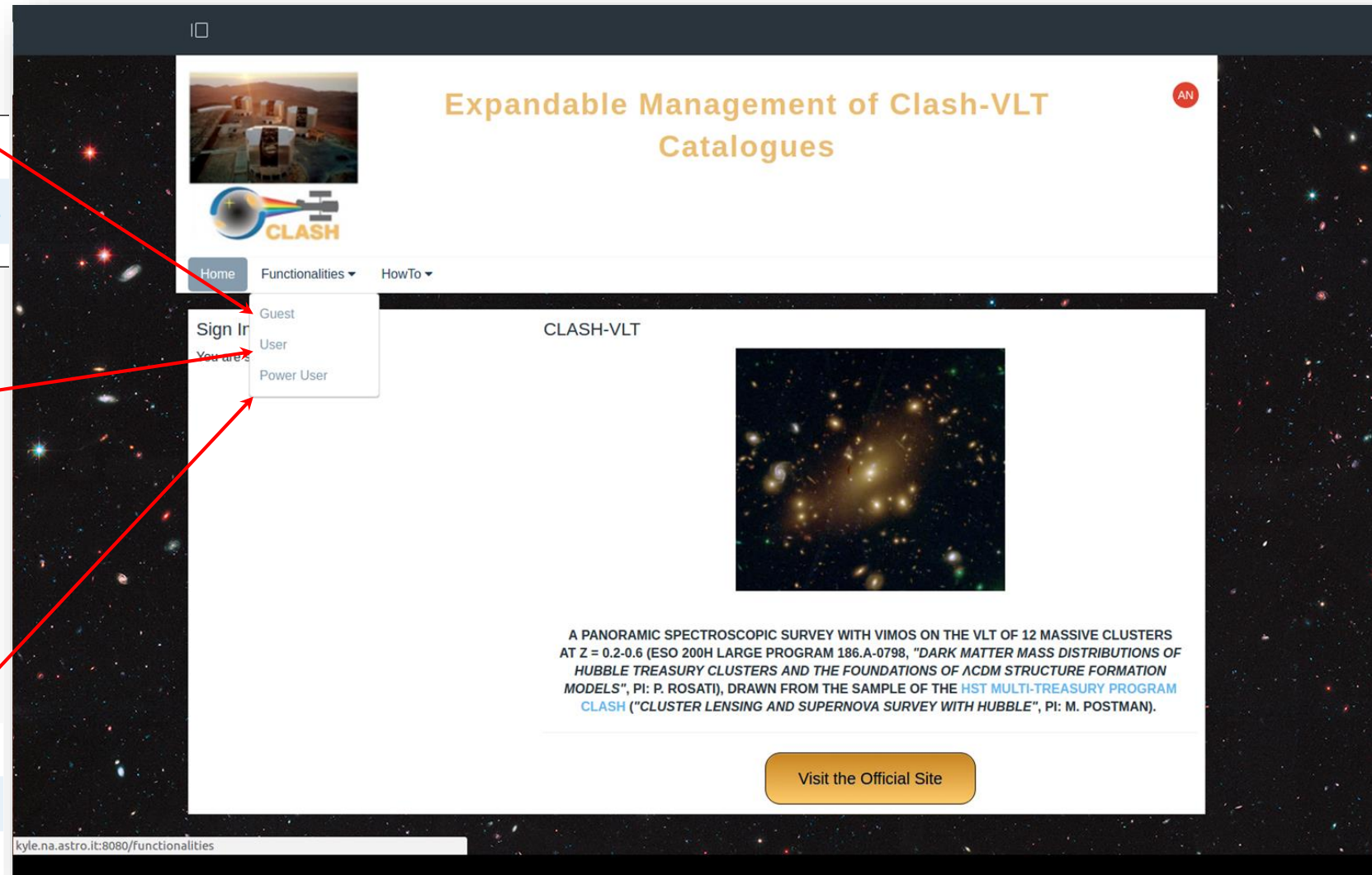
Public Data	Guest
Query Wizard	Please select a tool from the left menu.

User: full privileges on data, and queries;

Public Data	User
Query Wizard SQL Query	Please select a tool from the left menu.

PowerUser: full privileges on data and queries, personal views temporary storage and query history list;

Public and Private Data	Power User
File Browser Query History Query Wizard SQL Query	Please select a tool from the left menu.



DB queries



Query Wizard: guests and users may build and submit simple queries on public data in a very easy way.

SQL Query: users and power users may write and submit their own queries on public and private data (based on privileges) using SQL (Structured Query Language) scripts.

Expandable Management of Clash-VLT Catalogues

Home Functionalities HowTo

Public and Private Data

File Browser
Query History
Query Wizard
SQL Query

Query Wizard

B_band

RA^(°) DEC^(°) RADIUS^(°) Results

10

Submit

B_band

- B_band
- B_band_description
- lc_band
- Rc_band
- Rc_band_description
- U_band
- V_band
- g_band
- hst_acs_f435w_band
- hst_acs_f475w_band
- hst_acs_f555w_band
- hst_acs_f606w_band
- hst_acs_f625w_band
- hst_acs_f775w_band
- hst_acs_f814w_band
- hst_acs_f850lp_band
- hst_wfc3ir_f105w_band
- hst_wfc3ir_f110w_band
- hst_wfc3ir_f125w_band
- hst_wfc3ir_f140w_band

Expandable Management of Clash-VLT Catalogues

Home Functionalities HowTo

Public and Private Data

File Browser
Query History
Query Wizard
SQL Query

SQL Query

Type your query...

```
SELECT * FROM U_band WHERE (ra BETWEEN 341.4277295 AND 342.4277295) AND (dec BETWEEN -45.1610769 AND -44.1610769) LIMIT 100;
```

Submit

User data and queries



Query History: power users may list their own submitted queries (suitable for re-use).

File Browser: power users may list their own retrieved data up to 10 days in the past.



Home Functionalities ▾ HowTo ▾

Public and Private Data

File Browser
Query History
Query Wizard
SQL Query

Query History

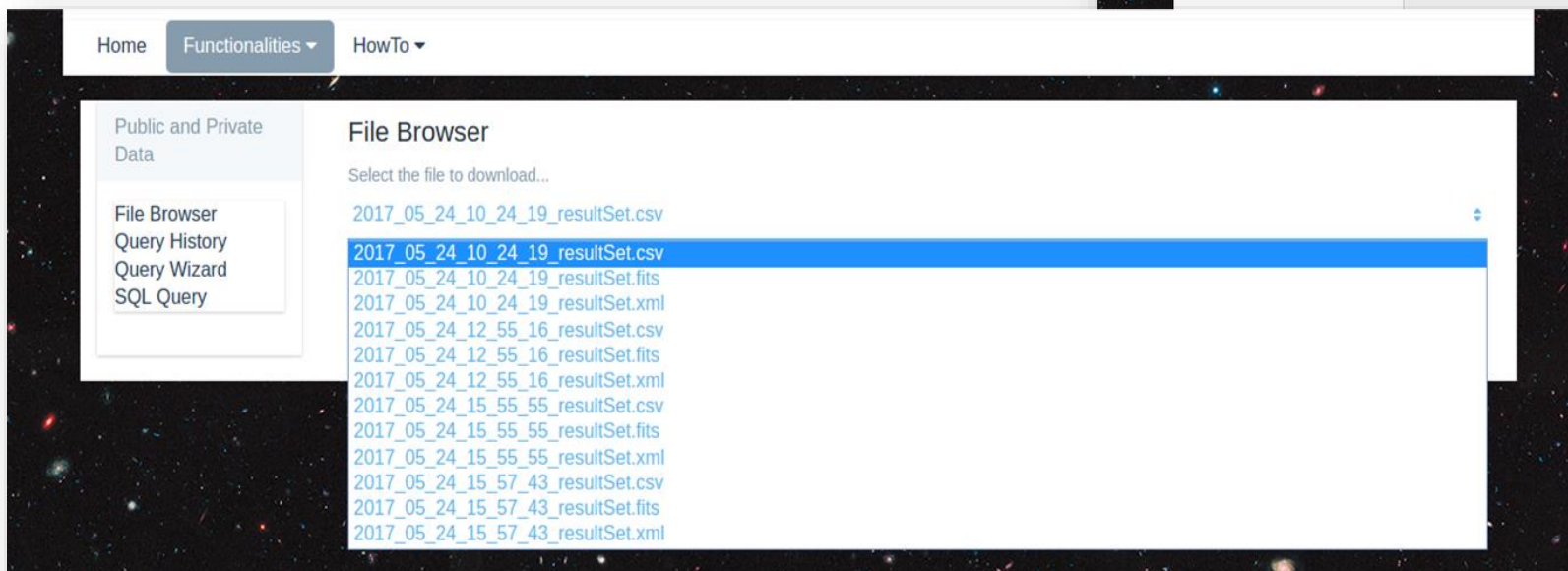
```
select * from U_band
```

```
SELECT * FROM U_band WHERE (ra BETWEEN 341.4277295 AND 342.4277295) AND (dec BETWEEN -45.1610769 AND -45.1610769)
```

```
select mpetro from B_band
```

```
select * from U_band as A join B_band as B where A.id = B.id
```

```
select a.ra, b.ra from U_band as a join B_band as b where a.id = b.id
```



Home Functionalities ▾ HowTo ▾

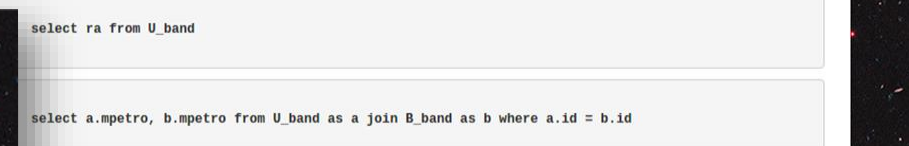
Public and Private Data

File Browser
Query History
Query Wizard
SQL Query

File Browser

Select the file to download...

- 2017_05_24_10_24_19_resultSet.csv
- 2017_05_24_10_24_19_resultSet.csv**
- 2017_05_24_10_24_19_resultSet.fits
- 2017_05_24_10_24_19_resultSet.xml
- 2017_05_24_12_55_16_resultSet.csv
- 2017_05_24_12_55_16_resultSet.fits
- 2017_05_24_12_55_16_resultSet.xml
- 2017_05_24_15_55_55_resultSet.csv
- 2017_05_24_15_55_55_resultSet.fits
- 2017_05_24_15_55_55_resultSet.xml
- 2017_05_24_15_57_43_resultSet.csv
- 2017_05_24_15_57_43_resultSet.fits
- 2017_05_24_15_57_43_resultSet.xml



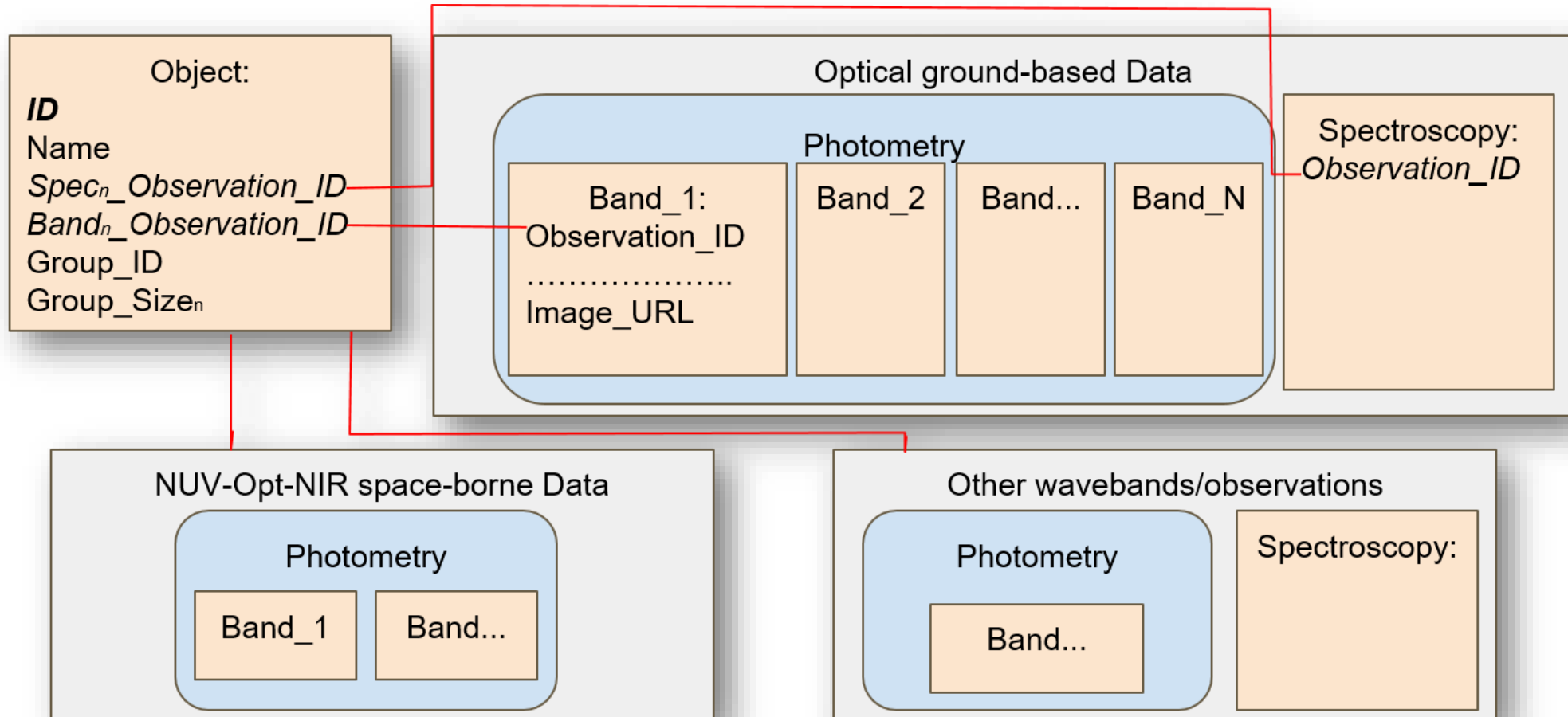
```
select ra from U_band
```

```
select a.mpetro, b.mpetro from U_band as a join B_band as b where a.id = b.id
```

DB structure

- ❑ Clusters & Members
- ❑ Photometric & Spectroscopic parameters
- ❑ 2D photometric images
- ❑ 1D, 2D, 3D spectroscopic images
- ❑ PNG thumbnails of spectroscopic images

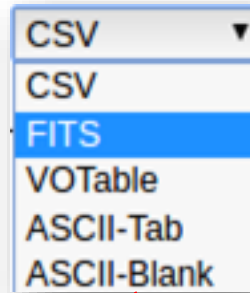
- ✓ Primary key obtained from object astrometry
- ✓ Design flexibility to allow future updates with additional tuples (object entries) as well as attributes (new columns)



IVOA Samp
(Simple Applications Messaging Protocol)
for applications interoperability.

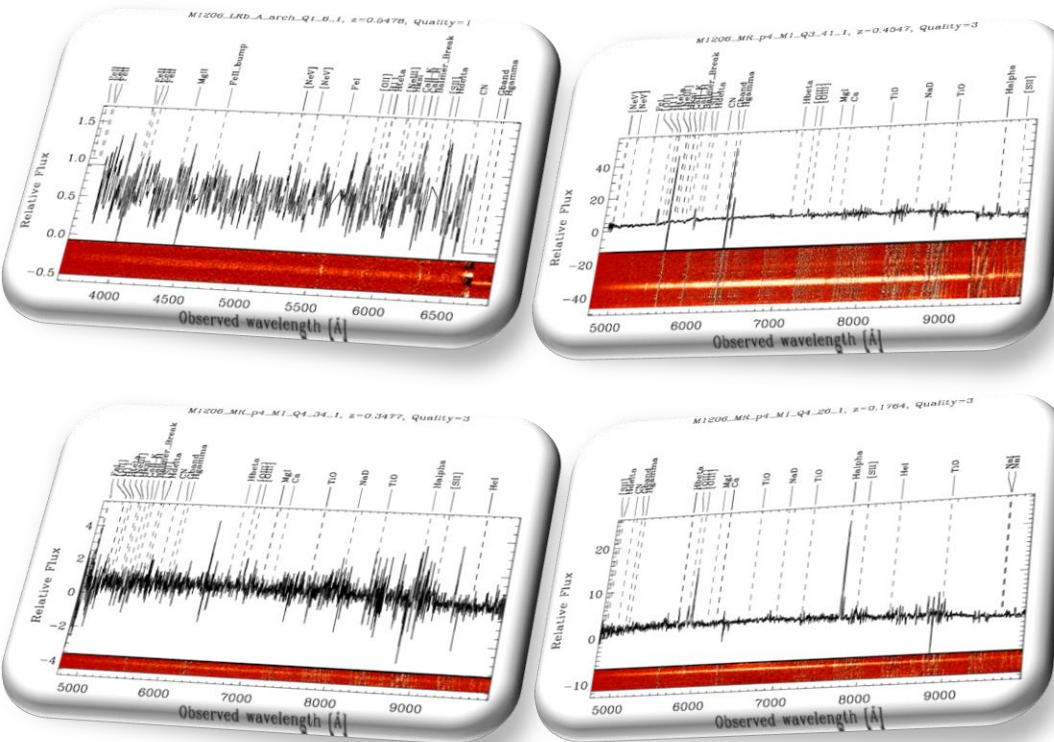
IVOA Standard file format: **VOTable**

(but also most common CSV, Fits, ASCII supported);



Send via Samp: the user is able to redirect query results on local instances of **VO tools** (e.g. Topcat, Aladin etc...);

Detailed description for entries with images

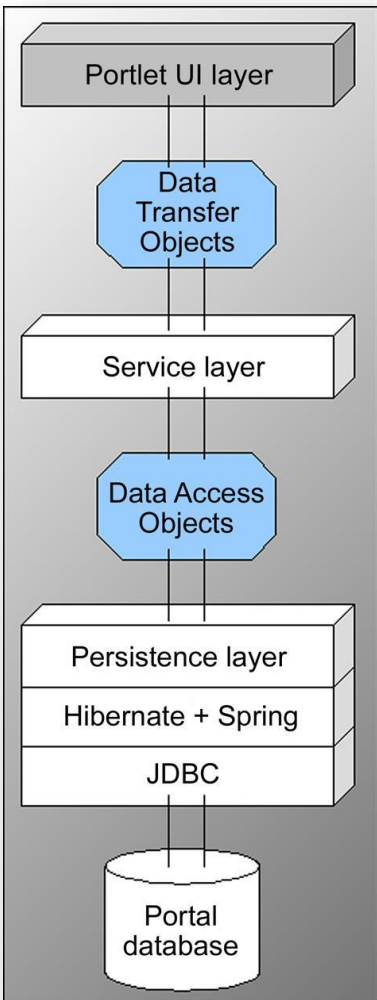






id	cluster_name	instrument	name	ra	dec	mk	emk	rk	a	b	theta	ma_15	ema_15	ma_50	ema_50	ma_80	ema_80	fr_50	si	mpsf	empsf	mmodel	emmodel	mpetro	empetro
1	null	null	CLASHVLT224906.14-444813.2	342.2755631	-44.803667	21.7674	0.0442	5.46	4.321	3.2	-33.62	23.3604	0.0354	21.9053	0.031	21.8043	0.0451	6.349	0.037	22.0445	0.0247	21.5258	0.1178	21.6441	0.0624
10	null	null	CLASHVLT224847.11-444814.0	342.196307	-44.803801	24.8753	0.1709	8.69	0.772	0.446	18.42	25.0379	0.1455	24.1631	0.2135	24.252	0.3695	2.463	0.348	23.9607	0.1259	23.9958	0.263	24.6025	0.1576
100	null	null	CLASHVLT224719.51-444758.8	341.831308	-44.7996566	19.5899	0.0063	3.89	6.319	5.48	22.28	21.5026	0.0059	19.8076	0.0042	19.6224	0.0057	7.431	0.028	20.0897	0.0038	19.4995	0.0258	19.5421	0.0081
1000	null	null	CLASHVLT225002.57-444400.3	342.5107263	-44.7334129	23.7694	0.1717	6.51	1.784	0.711	-23.61	24.1889	0.1353	23.327	0.1933	24.081	0.6396	2.863	0.423	23.0949	0.115	22.7981	0.519	23.5777	0.192
1001	null	null	CLASHVLT224905.10-444401.0	342.2712315	-44.7335998	22.9601	0.0867	6.27	2.517	1.88	67.85	24.1172	0.0689	22.9487	0.0789	22.9162	0.1216	4.904	0.666	22.9231	0.0534	22.9608	0.285	22.861	0.1164
1002	null	null	CLASHVLT224758.78-444400.5	341.9949311	-44.7334861	22.7518	0.084	7.68	2.214	1.997	-27.12	24.1454	0.0707	22.9017	0.0741	22.683	0.098	5.936	0.548	22.9776	0.0564	22.7508	0.3245	22.758	0.1171
1003	null	null	CLASHVLT224837.43-444400.9	342.1559391	-44.7335948	22.9069	0.0906	7.5	2.574	2.178	33.75	24.3914	0.0753	23.0292	0.0718	22.9874	0.1096	5.583	0.149	23.1262	0.0551	22.9074	0.215	23.3787	0.1967
1004	null	null	CLASHVLT224723.89-444358.7	341.8495371	-44.7329758	24.7423	0.1692	8.5	0.774	0.574	-44.16	25.0137	0.1463	24.5416	0.3166	24.7064	0.5917	2.315	0.348	23.9757	0.132	23.9968	0.5822	24.4672	0.166
1005	null	null	CLASHVLT224927.40-444400.1	342.3641849	-44.7333495	22.5607	0.0596	5.41	2.745	2.556	70.31	23.799	0.0488	22.6349	0.0558	22.6142	0.0871	5.208	0.107	22.5852	0.0374	22.408	0.1658	22.5839	0.0815
1006	null	null	CLASHVLT224901.42-444400.3	342.2558978	-44.733404	24.6357	0.1431	8.93	0.759	0.45	72.18	25.2059	0.1756	24.0001	0.202	24.4662	0.4929	2.803	0.352	23.8585	0.1198	23.0597	0.4372	24.3282	0.1282
1007	null	null	CLASHVLT224952.03-444359.0	342.4667714	-44.733048	23.3022	0.0956	5.48	2.445	1.687	86.15	24.3091	0.0811	23.1813	0.0959	23.3561	0.182	4.384	0.49	23.096	0.0624	23.1482	0.1054	23.5184	0.1977
1008	null	null	CLASHVLT224856.90-444400.0	342.2370698	-44.7333263	23.9048	0.0995	8.16	1.239	0.754	44.59	24.8249	0.1104	23.3896	0.0993	23.3404	0.1517	4.278	0.348	23.5545	0.0804	23.3708	0.2761	23.5808	0.0971
1009	null	null	CLASHVLT224835.29-444359.8	342.1470305	-44.733288	22.973	0.0781	6.73	2.516	1.703	-35.01	24.5118	0.0871	22.9814	0.0704	23.098	0.1256	6.177	0.275	23.1473	0.058	22.8943	0.2908	23.2246	0.1541
101	null	null	CLASHVLT224731.23-444800.0	341.8801065	-44.8000128	23.6491	0.1129	8.22	1.719	0.836	43.83	24.7039	0.1121	23.4566	0.1204	23.6909	0.2412	4.573	0.367	23.4981	0.088	22.4521	0.4903	23.6147	0.1407
1010	null	null	CLASHVLT224717.48-444357.9	341.8228465	-44.7327535	23.3852	0.0867	4.73	3.352	1.815	52.09	24.3271	0.0787	23.4295	0.1162	23.4365	0.1858	4.197	0.607	23.145	0.0621	23.1974	0.0923	23.7147	0.2136
1011	null	null	CLASHVLT224956.24-444358.1	342.4843424	-44.7328126	21.7017	0.0337	4.49	3.324	3.035	-76.56	22.9165	0.0259	21.7587	0.0309	21.7172	0.0494	5.073	0.241	21.6957	0.02	21.5983	0.1065	21.83	0.0738
1012	null	null	CLASHVLT224915.93-444358.9	342.3163709	-44.7330268	21.6916	0.0377	5.06	3.172	2.991	73.6	22.9593	0.0271	21.7827	0.032	21.6266	0.0461	5.36	0.364	21.747	0.0208	21.5775	0.16	21.5447	0.0602
1013	null	null	CLASHVLT224803.41-444358.1	342.0142031	-44.7328069	23.8333	0.1059	8.39	1.119	0.688	-72.43	24.7632	0.1269	23.1723	0.1006	23.1298	0.1552	4.132	0.348	23.3688	0.0853	22.9983	0.1903	23.5577	0.1045
1014	null	null	CLASHVLT224936.20-444357.7	342.4008539	-44.7326821	24.2553	0.1267	8.88	1.24	0.449	10.97	24.8881	0.131	23.3833	0.1098	23.3419	0.169	3.35	0.412	23.5594	0.0906	22.4407	0.8279	24.0855	0.1308

Re-usable DBMS technologies



CLASH-VLT DBMS is based on «open» technologies, easily extendible to other use cases



- **Apache Tomcat**, is an application server (open-source Java Servlet Container) exposing several Java EE services and providing a "pure Java" HTTP web server environment 
- **Liferay Portal** is a Java-based web application framework, running on any machine hosting the Java Runtime Environment and an application server 
- **Portlets** are pluggable user interface software components displayed in a web portal. Portlets produce fragments of markup (HTML, XHTML, WML) code, aggregated into a portal 
- **Service-Oriented Architecture (SOA)** is a software design, where services are exposed through a communication protocol. It enables modularity and distribution, thus ensuring easy updating 
- **Component-based Software Engineering (CBSE)** is a branch of SW engineering enhancing workload separation among internal modules, thus achieving SOA implementation 