

IVOA standards potentially useful for CTA / KM3net : current status

F.Bonnarel, CDS, ESCAPE-CEVO task 2

Data levels

- DL6 / catalogues
- DL5 / images, spectra, timeseries
- DL3 / filtered event lists
- DL4 / binned data → ?



DL6 : catalogues

- Choose basic SCS :
 - Very simple interface
 - Response is in VOTable = XML standard for tables.
 - FIELD attributes = name, datatype, unit, ucd (standardized vocabulary)
 - (+utype = *pointer to datamodel leaves*)



DL6 : catalogues

- Or more advanced TAP :
 - interoperable remote access interface for relational databases
 - Using ADQL, a SQL-like query language
 - Database described in the TAP_SCHEMA
- HiPS also possible (see next section)



SCS access through TOPCAT application (VizieR catalogues)

Window Columns Registry Interop Help

Available Cone Services
Registry: <http://dc.zah.uni-heidelberg.de/tap>

Keywords: 2mass

Match Fields: ☒ Short Name ☒ Title ☒ Subjects ☒ ID

☒ Accept Resource Lists

Subjects

Identifiers

of galaxies

otometry:wide-band

rs

stars:peculiar, Stars

ars

otometry, AGN

Equivalent_widths, AGN

Multiple_Stars

ipetroscopy, Stars

is, Stars, Clusters_of_galaxies

ars, Globular_Clusters

s

vae, Binaries:cataclysmic

TOPCAT(1): Table Browser

Window Subsets Help

Table Browser for 1: LMC-J_AJ_127_501-180d

	r	rectno	IRAS	f_IRAS	2MASS	MSX5C	Jmag	f_Jmag	Hmag	f_Hmag	Ksmag	f_Ksmag	J-Ks	rho	Obj	RA	DE
1	93.332	1	01037+1219		01062598+1235530		7.437	4.641	2.217		5.22	1.57	1	16.60825	12.598		
2	86.56427	2	02420+1206		02444549+1219029		4.037	3.21	2.601		1.436	7.72	1	41.18954	12.317		
3	82.79071	3	04575+1251		05002460+1256066		8.735	6.425	4.861		3.874	10.25	1	75.1025	12.935		
4	98.95442	4	05423+2905		05452992+2907054		5.117	3.591	2.46		2.657	2.78	1	86.37467	29.118		
5	94.15845	5	05506+2414	*	05534356+2414447	184.9546-00.8558	12.546	10.241	8.333		4.213	0.92	1	88.4315	24.245		
6	87.32052	6	05552+1720		05580750+1720584	191.4392-03.4322	7.902	6.317	5.328		2.574	2.65	1	89.53125	17.349		
7	95.07595	7	07542+2127		07570936+2119099		5.059	4.054	3.606		1.453	0.65	1	119.289	21.319		
8	114.41449	8	09425+3444		09453429+3430427		1.71	0.551	-0.077		1.787	4.79	1	146.39287	34.511		
9	119.79717	9	12562+2324		12583891+2308215		4.967	4.006	3.27		1.697	16.31	1	194.66212	23.139		
10	144.21964	10	16260+3454		16275135+3448105		5.014	3.657	2.511		2.503	3.61	1	246.96396	34.802		
11	127.35675	11	17050+1714		17071761+1710228		4.597	3.6	3.059		1.538	3.08	1	256.82337	17.173		
12	142.72539	12	17296+3231		17312879+3229525		4.902	3.687	2.956		1.946	2.28	1	262.86996	32.497		
13	139.72946	13	17554+2946		17571974+2946286		3.589	2.787	2.239		1.35	1.25	1	269.33225	29.774		
14	132.33134	14	18033+2229	*	18052663+2230039		6.343	5.468	4.745		1.598	29.81	1	271.36096	22.501		
15	144.4537	15	18076+3445		18092467+3446192		7.612	5.687	4.404		3.208	3.74	1	272.35279	34.772		
16	141.1183	16	18099+3127		18114749+3128199		6.083	5.117	4.267		1.816	6.39	1	272.94787	31.472		
17	121.75872	17	18223+1217	*	18243665+1219170		6.601	5.772	5.176		1.425	9.28	1	276.15271	12.321		
18	109.3144	18	18341+0005		18364067+0008011	031.3668+03.3438	10.317	7.699	6.032		4.285	2.98	1	279.16946	0.133		
19	130.99831	19	18441+2216		18461336+2220109		7.846	6.792	6.128		1.718	7.02	1	281.55567	22.336		
20	130.43489	20	18444+2143		18463213+2146376		4.928	4.347	3.795		1.133	5.76	1	281.63387	21.777		
21	121.95553	21	18554+1333		18574367+1337167		7.936	6.737	5.964		1.972	6.44	1	284.43196	13.621		
22	122.53799	22	18556+1409		18575917+1413196		11.565	9.226	7.449		4.116	2.05	1	284.49654	14.222		
23	134.07277	23	18568+2554		18585040+2558507		8.238	7.256	6.571		1.667	3.34	1	284.71	25.980		
24	125.67233	24	18569+1722		18591096+1727036		6.489	5.51	4.852	e	1.637	2.42	1	284.79567	17.451		
25	122.38149	25	18581+1405		19002812+1409534	046.5779+04.4497	7.384	6.082	5.276		2.108	1.5	1	285.11717	14.164		
26	122.27823	26	18588+1400		19010713+1405133	046.5799+04.2741	10.546	8.779	7.137		3.409	1.34	1	285.27971	14.087		
27	123.16662	27	18592+1455		19013225+1500218	047.4481+04.5999	6.351	4.924	4.011		2.34	1.92	1	285.38437	15.006		
28	125.0105	28	19007+1652		19030151+1656312		9.12	7.746	6.797		2.323	6.11	1	285.75629	16.942		
29	121.31199	29	19010+1307		19032150+1312012	046.0352+03.3863	11.2	8.302	6.286		4.914	2.6	1	285.83958	13.200		

AccessURL: <http://vizier.u-strasbg.fr/viz-bin/conesearch/JAJ/131/1942/table1?>

Description: Cone search capability for table JAJ/131/1942/table1 (2MASS observation of the IRAS 1 Jy sample of Ultra-luminous infrare...)

Version:

Resource Count: 96

Cone Parameters

Cone URL: <http://vizier.u-strasbg.fr/viz-bin/conesearch/JAJ/131/1942/table1?>

Object Name: LMC

RA: 80.89417 degrees (J2000)

Dec: -69.75611 degrees (J2000)

Radius: 180 degrees

Verbosity: 2 (normal)

Accept Sky Positions ☒

Resolve

OK

VOTable : header

```
<?xml version="1.0" encoding="UTF-8"?>
<VOTABLE xmlns="http://www.ivoa.net/xml/VOTable/v1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2">
  <RESOURCE type="results">
    <INFO name="QUERY_STATUS" value="OK" />
    <INFO name="QUERY" value="SELECT * FROM ivoa.ObsCore WHERE dataproduct_type IN ( 'image', 'cube' ) AND (INTERSECTS(CIRCLE('ICRS',20.0,30.0,0.2), s_region) = 1)" />
  <TABLE>
    <FIELD name="dataproduct_type" datatype="char" ucd="meta.id;class" utype="obscore:ObsDataset.dataProductType" xtype="adql:VARCHAR" arraysize="128*">
      <DESCRIPTION>type of product</DESCRIPTION>
    </FIELD>
    <FIELD name="calib_level" datatype="int" ucd="meta.code;obs.calib" utype="obscore:ObsDataset.calibLevel" xtype="adql:INTEGER">
      <DESCRIPTION>calibration level (0,1,2,3)</DESCRIPTION>
    </FIELD>
    <FIELD name="obs_collection" datatype="char" ucd="meta.id" utype="obscore:DataID.collection" xtype="adql:VARCHAR" arraysize="128*">
      <DESCRIPTION>short name for the data collection</DESCRIPTION>
    </FIELD>
    <FIELD name="facility_name" datatype="char" ucd="meta.id;instr.tel" utype="obscore:Provenance.ObsConfig.Facility.name" xtype="adql:VARCHAR" arraysize="128*">
      <DESCRIPTION>telescope name</DESCRIPTION>
    </FIELD>
    <FIELD name="instrument_name" datatype="char" ucd="meta.id;instr" utype="obscore:Provenance.ObsConfig.Instrument.name" xtype="adql:VARCHAR" arraysize="128*">
      <DESCRIPTION>instrument name</DESCRIPTION>
    </FIELD>
    <FIELD name="obs_id" datatype="char" ucd="meta.id" utype="obscore:DataID.observationID" xtype="adql:VARCHAR" arraysize="128*">
      <DESCRIPTION>internal dataset identifier</DESCRIPTION>
    </FIELD>
    <FIELD name="obs_release_date" datatype="char" ucd="time.release" utype="obscore:Curation.releaseDate" xtype="adql:TIMESTAMP" arraysize="*">
      <DESCRIPTION>timestamp of date the data becomes publicly available</DESCRIPTION>
    </FIELD>
    <FIELD name="access_url" datatype="char" ucd="meta.ref.url" utype="obscore:Access.reference" xtype="adql:CLOB" arraysize="*">
      <DESCRIPTION>URL to download the data</DESCRIPTION>
    </FIELD>
    <FIELD name="access_format" datatype="char" ucd="meta.id;class" utype="obscore:Access.format" xtype="adql:VARCHAR" arraysize="128*">
      <DESCRIPTION>format of the data file(s)</DESCRIPTION>
    </FIELD>
    <FIELD name="access_estsize" datatype="int" ucd="phys.size;meta.file" unit="kB" utype="obscore:Access.size" xtype="adql:INTEGER">
      <DESCRIPTION>estimated size of the download</DESCRIPTION>
    </FIELD>
    <FIELD name="target_name" datatype="char" ucd="meta.id;src" utype="obscore:Target.name" xtype="adql:VARCHAR" arraysize="32*">
      <DESCRIPTION>name of intended target</DESCRIPTION>
    </FIELD>
    <FIELD name="s_ra" datatype="double" ucd="pos.eq.ra" unit="deg" utype="obscore:Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C1" xtype="adql:DOUBLE">
      <DESCRIPTION>RA of central coordinates</DESCRIPTION>
    </FIELD>
    <FIELD name="s_dec" datatype="double" ucd="pos.eq.dec" unit="deg" utype="obscore:Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C2" xtype="adql:DOUBLE">
      <DESCRIPTION>DEC of central coordinates</DESCRIPTION>
    </FIELD>
    <FIELD name="s_fov" datatype="double" ucd="phys.angSize;instr.fov" unit="deg" utype="obscore:Char.SpatialAxis.Coverage.Bounds.Extent.diameter" xtype="adql:DOUBLE">
      <DESCRIPTION>size of the region covered (~diameter of minimum bounding circle)</DESCRIPTION>
    </FIELD>
    <FIELD name="s_region" datatype="char" ucd="phys.area;obs" unit="deg" utype="obscore:Char.SpatialAxis.Coverage.Support.Area" xtype="adql:REGION" arraysize="*">
      <DESCRIPTION>region bounded by observation</DESCRIPTION>
    </FIELD>
    <FIELD name="s_resolution" datatype="float" ucd="pos.angResolution" unit="arcsec" utype="obscore:Char.SpatialAxis.Resolution.Refval.value" xtype="adql:REAL">
      <DESCRIPTION>typical spatial resolution</DESCRIPTION>
    </FIELD>
    <FIELD name="s_xel1" datatype="long" ucd="meta.number" utype="obscore:Char.SpatialAxis.numBins1" xtype="adql:BIGINT">
      <DESCRIPTION>dimensions (number of pixels) along one spatial axis</DESCRIPTION>
    </FIELD>
    <FIELD name="s_xel2" datatype="long" ucd="meta.number" utype="obscore:Char.SpatialAxis.numBins2" xtype="adql:BIGINT">
      <DESCRIPTION>dimensions (number of pixels) along the other spatial axis</DESCRIPTION>
    </FIELD>
  </TABLE>
</VOTABLE>
```

VOTable : data

```
<DATA>
<TABLEDATA>
  <TR>
    <TD>image</TD>
    <TD>1</TD>
    <TD>CFHT</TD>
    <TD>CFHT 3.6m</TD>
    <TD>MegaPrime</TD>
    <TD>1022444</TD>
    <TD>2008-01-01T00:00:00.000</TD>
    <TD>http://www.cadc-ccda.hia-ih.nrc-cnrc.gc.ca/caom2ops/datalink?runid=q8p071gzw9v2rxkf&ID=caom%3ACFHT%2F1022444%2F1022444o</TD>
    <TD>application/x-votable+xml;content=datalink</TD>
    <TD>/>
    <TD>FM33_09</TD>
    <TD>20.6621229608811</TD>
    <TD>30.2998934335786</TD>
    <TD>1.40046285285166</TD>
    <TD>Polygon ICRS UNKNOWNREFPOS SPHERICAL2 21.23053934693744 29.801543490109047 20.098218552646575 29.798156162746917 20.08852659238419 30.7960764114054 21.231225994547927 30.799206638194327</TD>
    <TD>/>
    <TD>18984</TD>
    <TD>19274</TD>
    <TD>54713.4549109</TD>
    <TD>54713.4554322542</TD>
    <TD>45.045</TD>
    <TD>45.045</TD>
    <TD>1</TD>
    <TD>4.078E-7</TD>
    <TD>5.702E-7</TD>
    <TD>3.01108374384</TD>
    <TD>1</TD>
    <TD>/>
    <TD>/>
    <TD>/>
    <TD>phot.count</TD>
    <TD>445576258379037328</TD>
    <TD>2015-06-29T23:28:05.340</TD>
    <TD>caom:CFHT/1022444/1022444o</TD>
  </TR>
  <TR>
    <TD>image</TD>
    <TD>1</TD>
    <TD>CFHT</TD>
    <TD>CFHT 3.6m</TD>
    <TD>MegaPrime</TD>
    <TD>1022574</TD>
    <TD>2008-01-01T00:00:00.000</TD>
    <TD>http://www.cadc-ccda.hia-ih.nrc-cnrc.gc.ca/caom2ops/datalink?runid=q8p071gzw9v2rxkf&ID=caom%3ACFHT%2F1022574%2F1022574o</TD>
    <TD>application/x-votable+xml;content=datalink</TD>
    <TD>/>
    <TD>FM33_09</TD>
    <TD>20.6621229608811</TD>
    <TD>30.2998934335786</TD>
    <TD>1.40046285285166</TD>
    <TD>Polygon ICRS UNKNOWNREFPOS SPHERICAL2 21.23053934693744 29.801543490109047 20.098218552646575 29.798156162746917 20.08852659238419 30.7960764114054 21.231225994547927 30.799206638194327</TD>
    <TD>/>
    <TD>18984</TD>
    <TD>19274</TD>
    <TD>54714.4055485</TD>
    <TD>54714.4060700278</TD>
    <TD>45.06</TD>
    <TD>45.06</TD>
    <TD>1</TD>
    <TD>4.078E-7</TD>
    <TD>5.702E-7</TD>
    <TD>3.01108374384</TD>
    <TD>1</TD>
    <TD>/>
    <TD>/>
    <TD>/>
    <TD>phot.count</TD>
    <TD>445576258379037328</TD>
    <TD>2015-06-29T23:28:05.340</TD>
    <TD>caom:CFHT/1022574/1022574o</TD>
  </TR>
```


UCD

(unified content descriptor)

- Standard terms for each astronomical « property »
 - Hierarchical structure and possible composition
 - Possibility to add new terms/branches
 - Do we need that for high energy catalogues ?



International
Virtual
Observatory
Alliance

The UCD1+ controlled vocabulary Version 1.3

Update including new terms for Planetary and
Solar data

Submitted 20180219

IVOA recommendation 2018 may 27

This version:

<http://ivoa.net/documents/UCD1+/20180527/REC-UCDlist-1.3-20180527.pdf>

Latest version :

<http://ivoa.net/documents/UCD1+/20180219/PR-UCDlist-1.3-20180219.pdf>

Previous version(s):

<http://www.ivoa.net/Documents/REC/UCD/UCDlist-20070402.html>

Editor(s):

A. Preite Martinez, M. Louys

Author(s):

Andrea Preite Martinez, Mireille Louys, Baptiste Cecconi, Sebastien Derriere, François Ochsenbein, and the IVOA Semantic Working group.

Abstract

This document describes the list of controlled terms used to build the Unified Content Descriptors, Version 1+ (UCD1+). The document describing the UCD1+ can be found at the URL: <http://www.ivoa.net/Documents/latest/UCD.html>. This document reviews the structure of the UCD1+ and presents the current vocabulary.

S em.IR.J	Infrared between 1.0 and 1.5 micron
S em.IR.H	Infrared between 1.5 and 2 micron
S em.IR.K	Infrared between 2 and 3 micron
S em.IR.3-4um	Infrared between 3 and 4 micron
S em.IR.4-8um	Infrared between 4 and 8 micron
S em.IR.8-15um	Infrared between 8 and 15 micron
S em.IR.15-30um	Infrared between 15 and 30 micron
S em.IR.30-60um	Infrared between 30 and 60 micron
S em.IR.60-100um	Infrared between 60 and 100 micron
S em.IR.NIR	Near-Infrared, 1-5 microns
S em.IR.MIR	Medium-Infrared, 5-30 microns
S em.IR.FIR	Far-Infrared, 30-100 microns
S em.UV	Ultraviolet part of the spectrum
S em.UV.10-50nm	Ultraviolet between 10 and 50 nm EUV extreme UV
S em.UV.50-100nm	Ultraviolet between 50 and 100 nm
S em.UV.100-200nm	Ultraviolet between 100 and 200 nm FUV Far UV
S em.UV.200-300nm	Ultraviolet between 200 and 300 nm NUV near UV
S em.X-ray	X-ray part of the spectrum
S em.X-ray.soft	Soft X-ray (0.12 - 2 keV)
S em.X-ray.medium	Medium X-ray (2 - 12 keV)
S em.X-ray.hard	Hard X-ray (12 - 120 keV)
Q em.bin	Channel / instrumental spectral bin coordinate (bin number)
Q em.energy	Energy value in the em frame
Q em.freq	Frequency value in the em frame
Q em.freq.cutoff	cutoff frequency
Q em.freq.resonance	resonance frequency
S em.gamma	Gamma rays part of the spectrum
S em.gamma.soft	Soft gamma ray (120 - 500 keV)
S em.gamma.hard	Hard gamma ray (>500 keV)

TAP service within TapHandle (here NED)

saada.u-strasbg.fr/taphandle?url=https%3A%2F%2Fned.ipac.caltech.edu/tap/ 170 %

Enter a TAP service URL or a keyword

Tap Nodes

- nedipac-tap
- TAP_SCHEMA
- NEDTAP
- objdir
- Goodies (not used)

Hide tree

prefname	ra	dec	uncmaja	uncmina	uncposa	gallon	gallat	bhextin	refcode
MCG -01-01-025 ...	0.66058262	-3.6309347	0.75000000	0.75000000	90.000000	94.434009	-63.769480	0.13280360	1987AJ..
MCG -02-01-010 ...	0.78154327	-12.403108	0.75000000	0.75000000	90.000000	83.021901	-71.426394	0.050693600	1987AJ..
UGC 00013 ...	0.87178145	27.351644	0.50000000	0.50000000	90.000000	110.02559	-34.315466	0.12500000	1987AJ..
Hide query 04-01-016 ...	0.88513165	25.115144	0.50000000	0.50000000	90.000000	109.41775	-36.496454	0.10100000	1987AJ..

SUBMIT Select What Where Position Plain Text Query Job Control

Result Limit
100

```
SELECT TOP 100 *  
FROM NEDTAP.objdir where refcode = '1987AJ.....94..501K'
```

Widgets do not reflect the query anymore after you modified it directly



DL6 catalogue - new : MANGO

- Model for ANnotation of Generic Objects
- A data model intended to organize parameters associated to a source or any kind of root feature according to a specific view
- Coupled with the new «Mapping syntax in VOTable » may add a specific datamodel view on TOP of tabular data

DL5 data : images

- Create a « Simple Image Access » (SIA) service
- Query parameters allow to select on
 - POSITION, BAND , TIME, POL,
 - FORMAT, COLLECTION, INSTRUMENT, DataID
- FORMAT of images is generally in fits but could be in jpeg, png, etc...
- Response is an ObsCore table .
 - What is ObsCore ? See Mireille's talk
- The ObsCore table can be accessed in a TAP service.
 - This is called « ObsTAP ».
 - → ADQL constraints set on table columns
- DataLink (in access_url) allows to link several resources to the dataset record :
 - data, preview, documentation, standardized metadata, etc...



SIA2 server at CDS

*** BETA VERSION (based on v10.073) ***

Edit Image Catalog Overlay Coverage Tool View Interop Help

Available data → 2388 Command Frame |CRS Projection |Aitoff

in view out view

DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Gaia Simbad NED CDS/P/DSS2/color +

Collections → 23886
Image → 471
Data base → 59
Catalog → 22394
Cube → 13
Ancillary → 13

DSS2 color

Server selector

Others File Fov... Tools... Vizier HIPS

Image servers

- Aladin images
- SkyView
- Hips2Fits
- Sloan
- DSS...
- VLA...
- Archives...
- Others...

Catalog servers

- All Vizier
- Simbad
- TAP
- Gaia
- SkyBot
- NED
- VO
- Others..

HIPS CDS SIAv2 virtual data prototype ?

Fill in all these fields and press the SUBMIT button

POS 207.5 60.0 0.3

BAND

TIME

FORMAT application/fits

RESPONSEFORMAT VOTable

Reset Clear **SUBMIT** Close ?

15°

1.756° x 54.99°

Search

aprod...	calib_1e...	obs_coll...	obs_id	obs_publ...	access_f...	access_e...	target_n...	s_ra	s_dec	s_fov	s_region	s_resolu...	s_xel1	s_xel2	em_min	em_max	em_res_p...	em_xel1
1 The Two ...	...	...	...	...	...	...	...	207.5	60	0.299999...	...	0.804959...	1341	1341	1.525e-06	1.798e-06	NaN	-32768
1 AKARI FI...	...	...	...	...	...	...	...	207.5	60	0.299999...	...	0.804959...	1341	1341	1.147e-06	1.323000...	NaN	-32768
1 AKARI FI...	...	...	...	...	...	...	...	207.5	60	0.299999...	...	0.804959...	1341	1341	2.015000...	2.302999...	NaN	-32768
1 AKARI FI...	...	...	...	...	...	...	...	207.5	60	0.299999...	...	12.88440...	83	83	0.000160...	0.000160...	NaN	-32768
1 AKARI FI...	...	...	...	...	...	...	...	207.5	60	0.299999...	...	12.88440...	83	83	6.499999...	6.499999...	NaN	-32768
1 AKARI FI...	...	...	...	...	...	...	...	207.5	60	0.299999...	...	12.88440...	83	83	0.000139...	0.000139...	NaN	-32768
1 AKARI FI...	...	...	...	...	...	...	...	207.5	60	0.299999...	...	12.88440...	83	83	9.000000...	9.000000...	NaN	-32768
1 CO compo...	...	...	...	...	...	...	...	207.5	60	0.299999...	...	51.51599...	20	20	0.002609...	0.002604...	NaN	-32768

adin v10.0 *** BETA VERSION (based on v10.073) ***

select all collecti...

sort view scan filter

epoch size dens. opac. zoom

13:49:59.89 +60:00:00.8
1.756° x 54.99°

18 Université de Strasbourg/CNRS - developed by CDS, distributed under GPLv3

274 sel / 274 src 32fps / 452Mb

SIA2 server at CDS

Available data → 2388
In view Out view

Collections → 23886
Image → 471
Data base → 59
Catalog → 22394
Cube → 13
Ancillary → 13
Outreach → 43
Others → 891
Problematic → 2

Command 13:51:23.53 +60:01:16.2

Frame ICRS Projection Aitoff

DSS2 color

30.28° x 18.42°

access url	dataprod...	calib_level	obs_coll...	obs_id	obs_publ...	access_f...	access_e...	target_n...	s_ra	s_dec	s_fov	s_region	s_resolu...	s_xel1	s_xel2	em_min	em_max	em_r...
http://...	image	1	The Two ...	CDS/P/2M...	1wo://CD...	image/fits	-32768		207.5	60	0.299999...		0.804959...	1341	1341	1.525e-06	1.798e-06	
http://...	image	1	The Two ...	CDS/P/2M...	1wo://CD...	image/fits	-32768		207.5	60	0.299999...		0.804959...	1341	1341	1.147e-06	1.323000...	
http://...	image	1	The Two ...	CDS/P/2M...	1wo://CD...	image/fits	-32768		207.5	60	0.299999...		0.804959...	1341	1341	2.015000...	2.302999...	
http://...	image	1	AKARI FI...	CDS/P/AK...	1wo://CD...	image/fits	-32768		207.5	60	0.299999...		12.88440...	83	83	0.000160...	0.000160...	
http://...	image	1	AKARI FI...	CDS/P/AK...	1wo://CD...	image/fits	-32768		207.5	60	0.299999...		12.88440...	83	83	6.499999...	6.499999...	
http://...	image	1	AKARI FI...	CDS/P/AK...	1wo://CD...	image/fits	-32768		207.5	60	0.299999...		12.88440...	83	83	0.000139...	0.000139...	
http://...	image	1	AKARI FI...	CDS/P/AK...	1wo://CD...	image/fits	-32768		207.5	60	0.299999...		12.88440...	83	83	9.000000...	9.000000...	
http://...	image	1	CO compo...	CDS/P/CO...	1wo://CD...	image/fits	-32768		207.5	60	0.299999...		51.51592...	20	20	0.002609...	0.002604...	

Search

epoch -
size -
dens. -
opac. -
zoom -

13:50:00.00 +60:00:00.0

DL5 data : spectra

- Create a « Simple Spectrum Access » (SSA) service
- Query parameters allow to select on :
 - POS, SIZE, BAND , TIME, SPECPR, APERTURE, FORMAT, etc...
- Response is an SSA table.
 - See next slide for example (close but not identical to ObsCore)
- The FORMAT can be fits, VOTable, etc...
- DataLink also available



SSA query response in SPLAT

Starlink SPLAT-VO: Query VO for Spectra

File Options Resolver Interop Help

Options Tags

Source

☒ Survey ☐ Theory ☒ Pointed
☐ Custom ☐ Artificial ☐ ALL

Wave Band

☒ Radio ☒ Millimeter ☒ IR
☒ Optical ☒ UV ☒ EUV
☒ X Ray ☒ Gamma R... ☒ ALL

SSAP Servers

- POLLUX SSAP [POLLUX Database]
- POPSTAR+Chabrier [POPSTAR with ...]
- POPSTAR+Ferrini [POPSTAR with Fer...]
- POPSTAR+Kroupa [POPSTAR with K...]
- SEDSSP [SED@ Evolutionary Synthesis]
- ST-ECF/HLA/SSA [ST-ECF Hubble Le...]
- ST-ECF/HST/SSA [ST-ECF Hubble Sp...]
- SVO HERBIG AeBe [SVO EXPORT HER...]
- TBL Narval [TBL Narval legacy]
- theossa [TheoSSA - Theoretical Stell...]
- TLUSTY BSTAR2006 [TLUSTY BSTAR...]
- TLUSTY Merged [TLUSTY OSTAR200...]
- TLUSTY OSTAR2002 [TLUSTY OSTAR...]
- TUES [Tubingen Echelle Spectra]
- VVDS_F02_DEEP [VVDS-F02 DEEP s...]
- WUPPE [Wisconsin Ultraviolet Photo-...]
- XCATDBDR3-SSA [Epic Spectra SSA...]
- XIDResult SSA [Optical spectra of the...]
- ZCOSMOS DR2 SSA [SSA Service for ...]

server selection options

SSAP servers

Search parameters:

Simple Query

Object: 60cyg

RA: 21:01:10.928 Dec: +46:09:20.78

Radius: 100.0

Band: /

Time: /

Query Format: fits

Wavelength calibration: None

Flux calibration: None

Optional Parameters

Use	Name	Value
☐	APERTURE	
☐	REDSHIFT	..NULL..

Query: <SERVER>?REQUEST=queryData&POS=315.29553333333333,46.15577222222222&FORMAT=fits&SIZE=1.6666666666666667

Query results:

HEROS OND CUTOUT		ELODIE	HEROS OND	HPOL	IUE	HFA
TBL Narval		castor		HEAVENS @ ISDC		
Index	ssa_score	accrref	mime	accsize	ssa_dst	
46	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	109440	NORMrxn23	
47	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	109440	NORMrxn24	
48	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	109440	NORMrxn25	
49	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	109440	NORMrxn29	
50	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	112320	NORMrxn41	
51	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	112320	NORMrxn41	
52	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	112320	NORMrxn41	
53	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	112320	NORMrxn41	
54	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	112320	NORMrxn44	
55	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	112320	NORMrxn44	
56	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	109440	NORMrxn45	
57	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	109440	NORMrxn47	
58	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	109440	NORMrxn47	
59	0.	http://ssaproxy.asu.cas.cz/getp...	application/fits	109440	NORMrxn47	

Remove selected Remove unselected

Query registry Add New Server

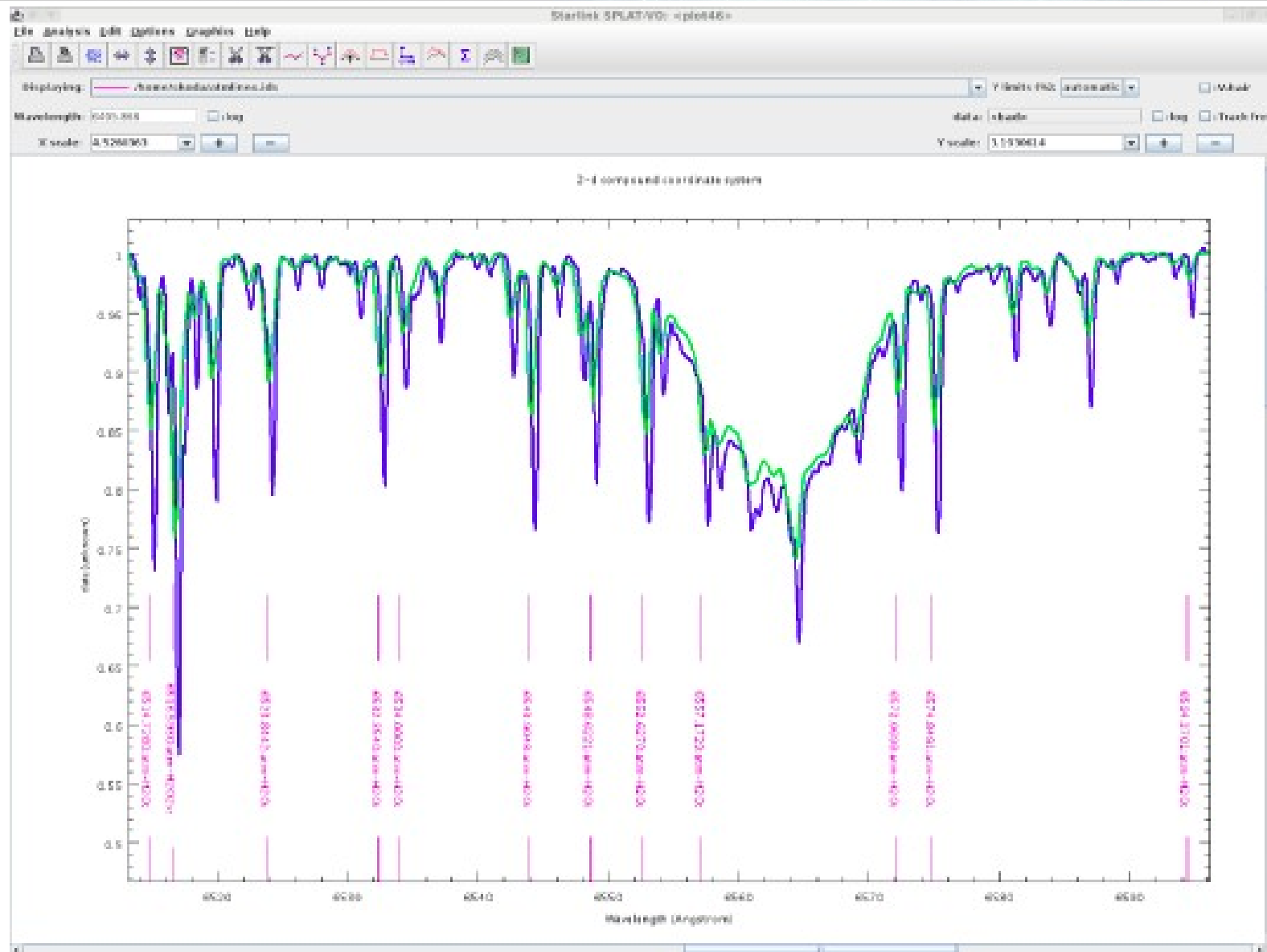
Display selected Display all Download selected Download all Deselect Deselect all

Save query results Restore query results Close

query parameters

optional query parameters

query results



DL5 data : TimeSeries

- Create an ObsTAP service dedicated to « timeseries » datasets
 - There is no « simple access » protocol for TimeSeries at the moment (see next slide)
- ADQL query allows to select on
 - s_ra, s_dec, em_min , em_max t_min, t_max, pol_states
 - obs_collection, instrument, facility, obs_publisher_id,
- Response is an ObsCore table .
- The FORMAT can be fits, VOTable, etc.
 - TIMESYS element in VOTable for time system + PhotCal GROUP (for light curves)
- DataLink also available

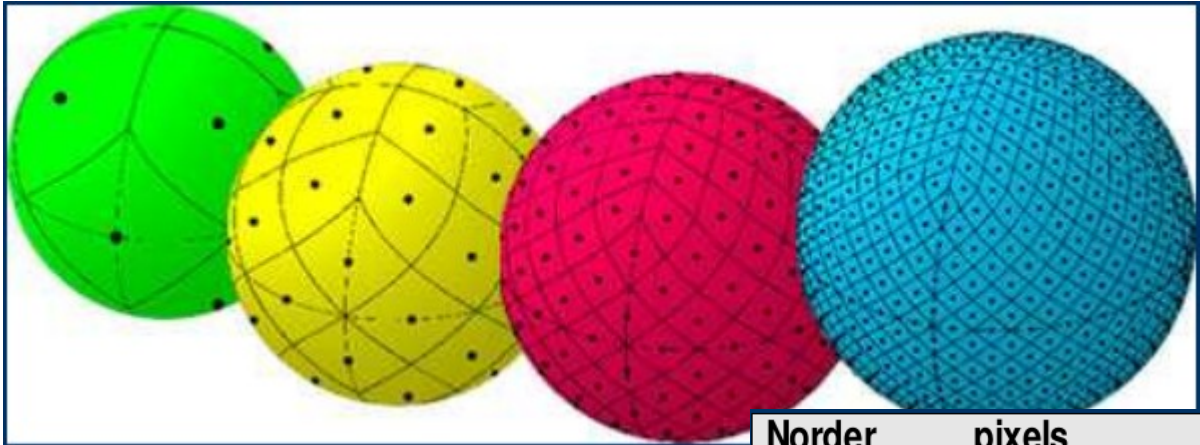


DL5 data : Generic
« Simple Dataset acces » ?
proposal

- Extending SIA2 features to all productypes in ObsCore (spectra, timeseries, event lists...)
- Possibly for ObsCore + extension for specific data protuct type



DL5 images and cubes : HiPS - Hierarchical Progressive survey

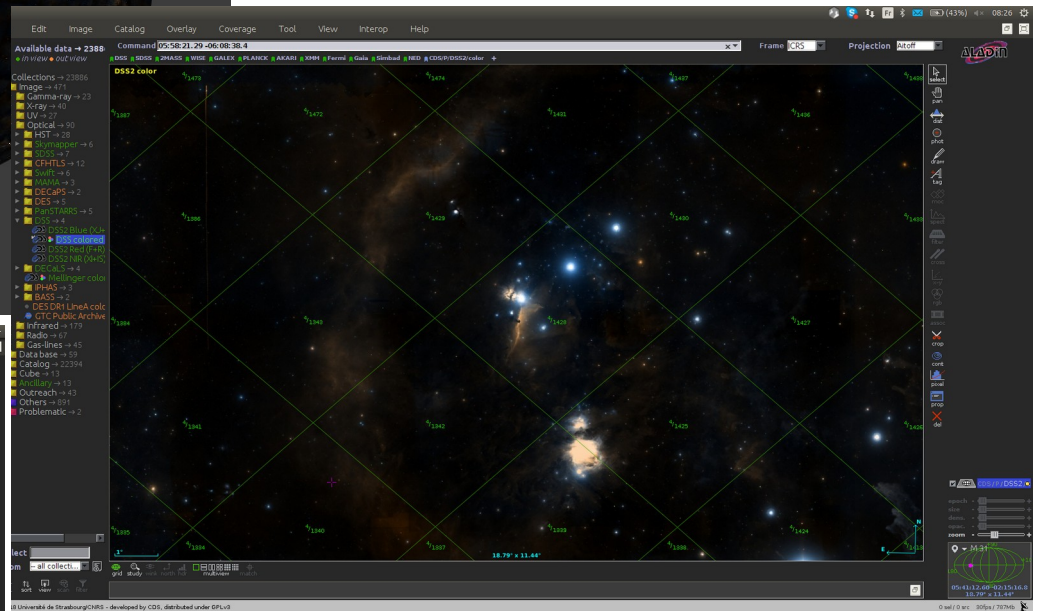
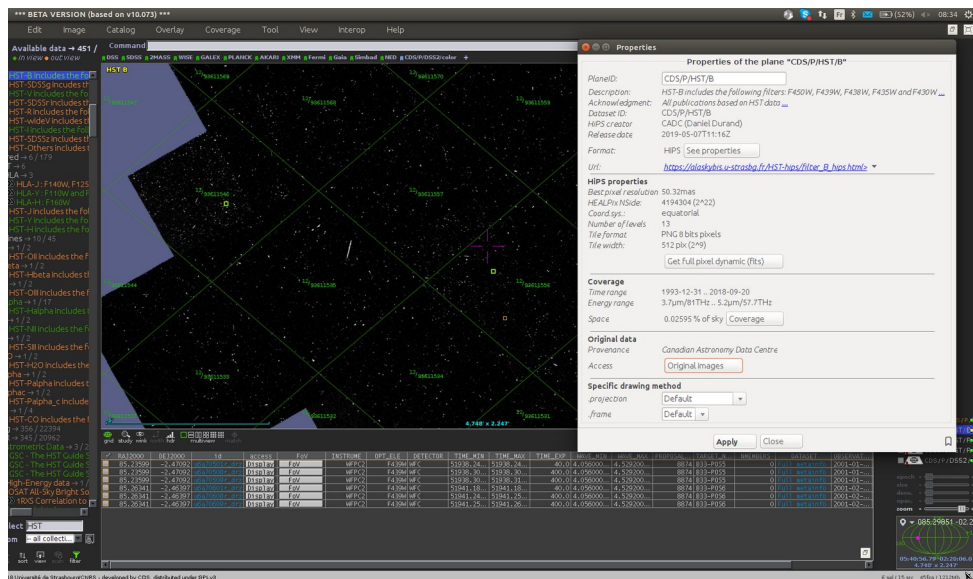


- Tessellation of celestial sphere thanks to Healpix (Hierarchical equal area pixelisation)
- Tiles at some order stored with metadata in directories
- Addition of pixels from higher orders by zooming

Norder	pixels	16bits	Pix res
0	12	24B	58.63°
1	48	96B	29.32°
:	:	:	:
6	49152	96KB	54.97'
:	:	:	:
8	786432	1,5MB	13.74'
9	3145728	6MB	6.87'
:	:	:	:
12	201326592	384MB	51.53"
:	:	:	:
18	8,25E+011	1,5TB	0.81"
:	:	:	:
29	3,46E+018	6 ZetaB	0,39mas
30	1,38E+019	24 ZetaB	0,2mas
<i>Healpix 64 bits limit</i>			

The image shows a deep field observation of the sky, displaying a vast number of distant galaxies and stars. The galaxies appear as faint, elongated, and irregular shapes, while the stars are bright, point-like sources. The overall color palette is dominated by dark blues and blacks, with some brighter, yellowish-white points of light. The image is presented in a software interface, likely a astronomical data viewer, with various panels and controls visible on the right side.

The interface includes a main viewing area, a panel on the right with tabs for 'Edit', 'Image', 'Catalog', 'Overlay', and 'Color', and a bottom panel with a list of available data and collections. The 'Available data' section lists various astronomical datasets, including 'DSO', 'SDSS', 'ZEMAS', 'WISE', and 'GALEX'. The 'Collections' section lists various astronomical collections, including 'DSO', 'SDSS', 'ZEMAS', 'WISE', and 'GALEX'. The 'Color' section shows a color bar with a gradient from blue to red, indicating the color of the objects in the image.



More adapted Datamodels ?

ongoing work

- Full dataset datamodels :
 - Cube datamodel ?
 - Mango ?
- Discovery/description metadata
 - More characterization parameters ?
 - Is that common between neutrino/particle/gamma ?
 - And X-Ray ?
 - ObsCore extension ?
 - Access to characterization maps/functions : response functions



DL3 data : different strategies

- Progenitor in HiPS
- Progenitor link in DataLink response
- Direct discovery with ObsTAP (with extension?)
- Access via provenance
- Question :
 - event list + IRF gruppued or separated ?
 - (DataLink?) .
 - Change the dataproductype « event » ?



DataLink for several use cases

- Endpoint delivering several links from the main endpoint
 - From catalogues items (sources , ...) → to images, spectra, cubes, timeseries, metadata, documentation
 - From dataset « records » → to data, metadata, service interfaces, other data, progenitors, calibration data, documentation
 - Semantics FIELD to characterize the relationship (this, documentation, progenitor, counterpart, etc...)
- Use cases :
 - Source in A catalogue related to provenance or spectra
 - Images related to previews, original DL4 data (or DL3)
 - Spectra related to DL4 or DL3 data
 - DL3 event list Relationship to IRF ?
 - Any level related to provenance record
 - DL5 cubes related tu SODA cutout



DataLink in the browser (GAVO)

▼ the data itself

the primary (as opposed to related) data of the identified resource

[The full dataset.](#) (92 MiB)

▼ Preview

low fidelity but easily viewed representation of the data

[A preview for the dataset.](#)

► Image preview

preview of the data as a 2-dimensional image

► Processing

server-side data processing result

► Documentation

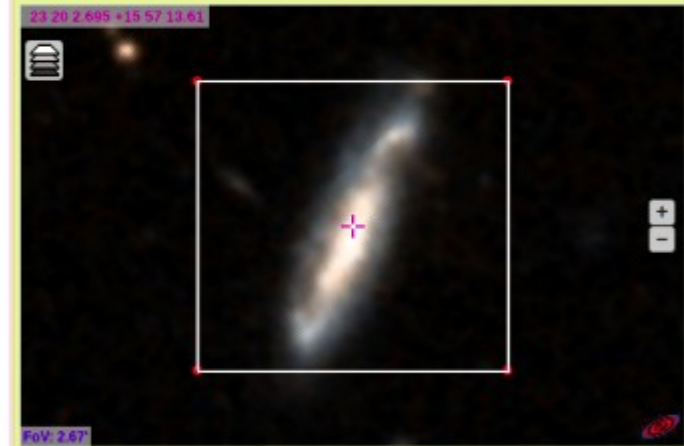
Extra information on the item in human-readable text form, ranging from processing logs to weather reports to technical documents on instruments to related publications.

SODA data access

In the parameters below, leave everything you do not want constrained empty.

[Retrieve data](#)

Adjust the cutout region by clicking and dragging the handles.



Spectral range Enter the spectral range you want to cut out in your preferred units

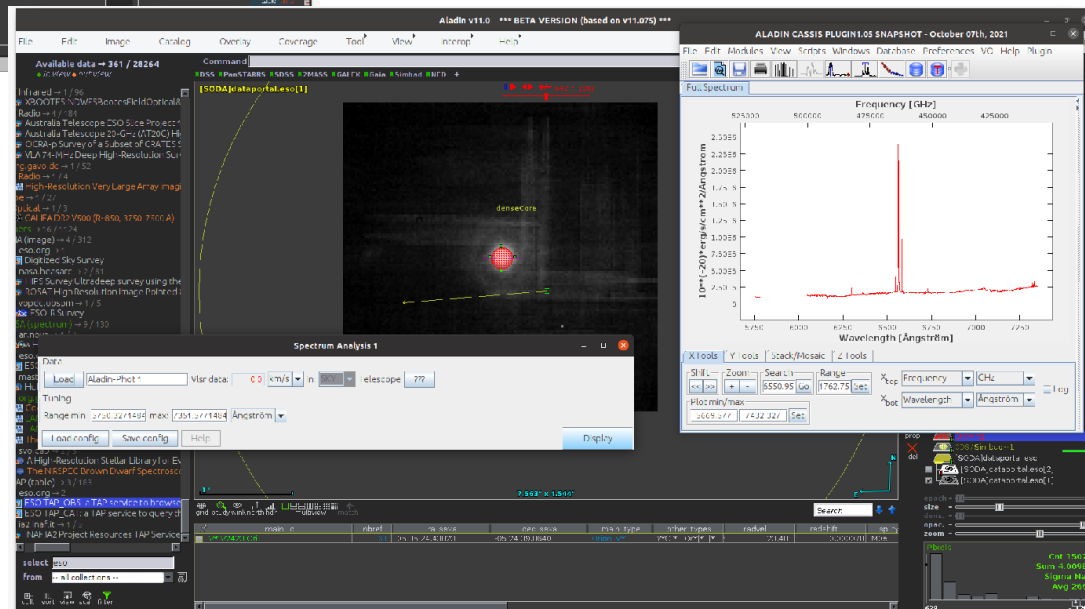
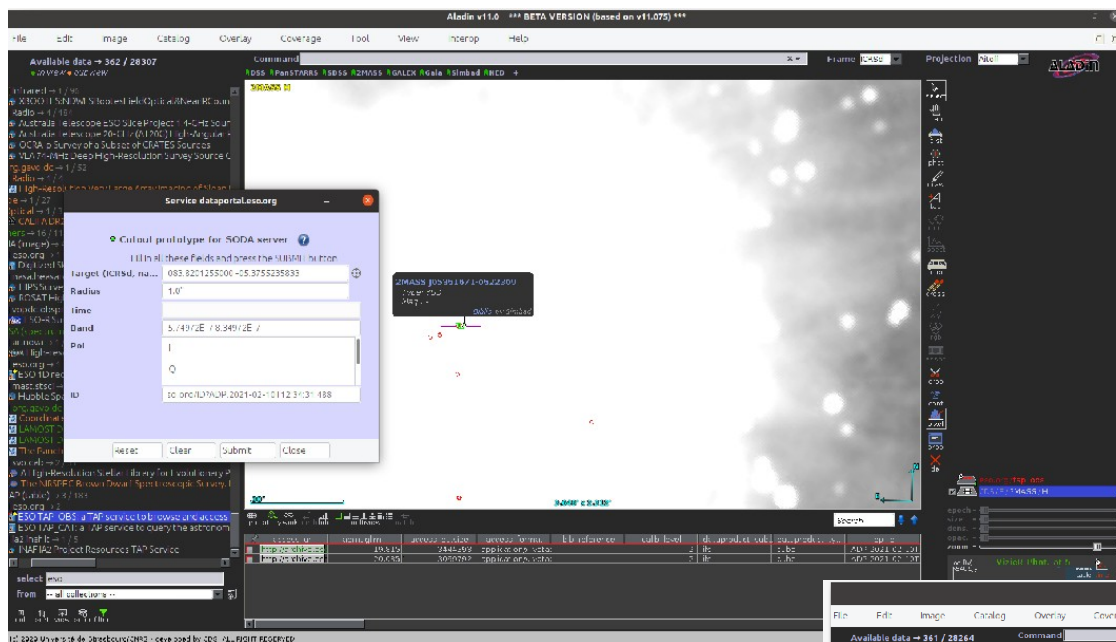
Ångström ▼

SODA interface evolution

- Originally for « cutouts/selection »
- Interface could be extended to drive server side operation to access data such as :
 - Extraction of integrated spectra or timeseries from cubes.
 - Spatial/spectral Resampling
 - Other type of reduction ?



SODA for ESO service



Trans use case services

- Coverage in time and space:
 - MOC coverage description
 - MOC servers
- Registration
 - Relational registry database (RegTAP) for any kind of resource
 - hipslists (for HiPS)
- VoEvent ?
- Provenance → other path in CEVO



References

Formats :

VOTable : <https://www.ivoa.net/documents/VOTable/20191021/>

TimeSeries (ongoing work / no full datamodel behind) : <https://www.ivoa.net/documents/Notes/LightCurveTimeSeries/20200429/index.html>

Vocabularies :

UCD : <https://www.ivoa.net/documents/UCD1+/20210616/index.html>

Protocols :

SCS 1.0 : <http://www.ivoa.net/documents/latest/ConeSearch.html>

SIAP2.0 : <http://www.ivoa.net/documents/SIA/20151223/>

SSAP 1.0 : <http://www.ivoa.net/documents/SSA/20120210/index.html>

DataLink : <https://www.ivoa.net/documents/DataLink/20150617/index.html>

TAP : <https://www.ivoa.net/documents/VOTable/20191021>

HiPS : <https://www.ivoa.net/documents/HiPS/20170519/index.html>

Data models (+ObsCore and Provenance):

Mango : <https://github.com/ivoa-std/MANGO/>

Characterisation : <https://www.ivoa.net/documents/latest/CharacterisationDM.html>

Cube : <https://www.ivoa.net/documents/CubeDM/20180516/index.html>

Registration / coverage :

MOC : <https://www.ivoa.net/documents/MOC/20211101/index.html>

RegTap : <https://www.ivoa.net/documents/RegTAP/20191011/index.html>

Query Language :

ADQL : <https://www.ivoa.net/documents/ADQL/20210528/index.html>

Services :

SODA : <https://www.ivoa.net/documents/SODA/20170517/index.html>

