

# Treasure hunt

Mark Allen



CoSADIE Project

with thanks to Mike Fitzpatick

# Breaking down science questions

- Find a place to start
- Understand what information already exists
- Identify step by step process

# Tools at your disposal

- Be resourceful!
- TOPCAT, Aladin, VizieR, and many other VO tools have rich set of capabilities
- Many ways of doing the same thing!



# The Rules

- 5 questions
- ~10 minutes per question
- Answer revealed after each question
- Scoring:
  - 1 point if you have an answer
  - 2 points if you have the 'right' answer

*\* Prizes \**

# Question 1.

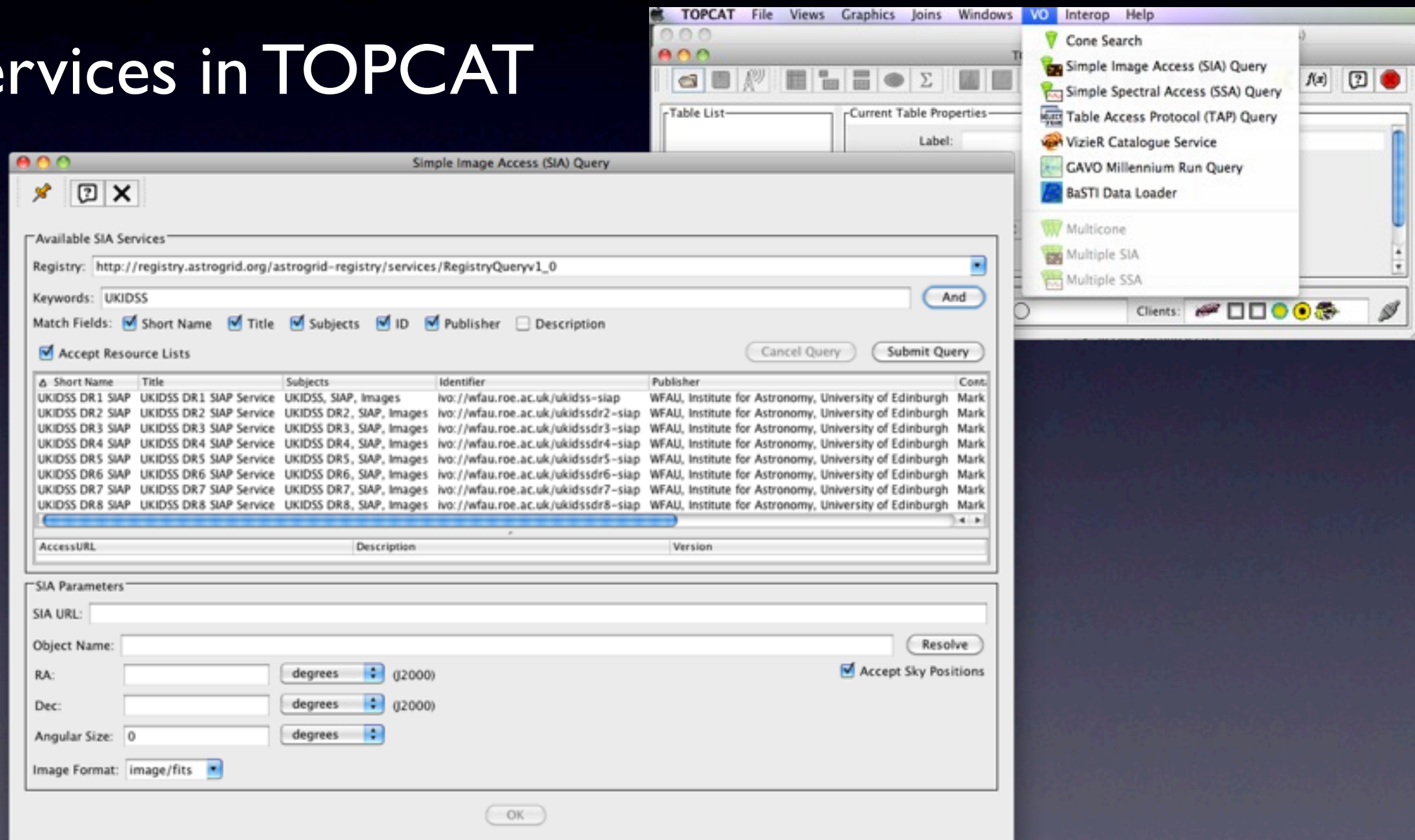
- What VO service provides images from the UKIRT Infrared Deep Sky Survey (UKIDSS) ?





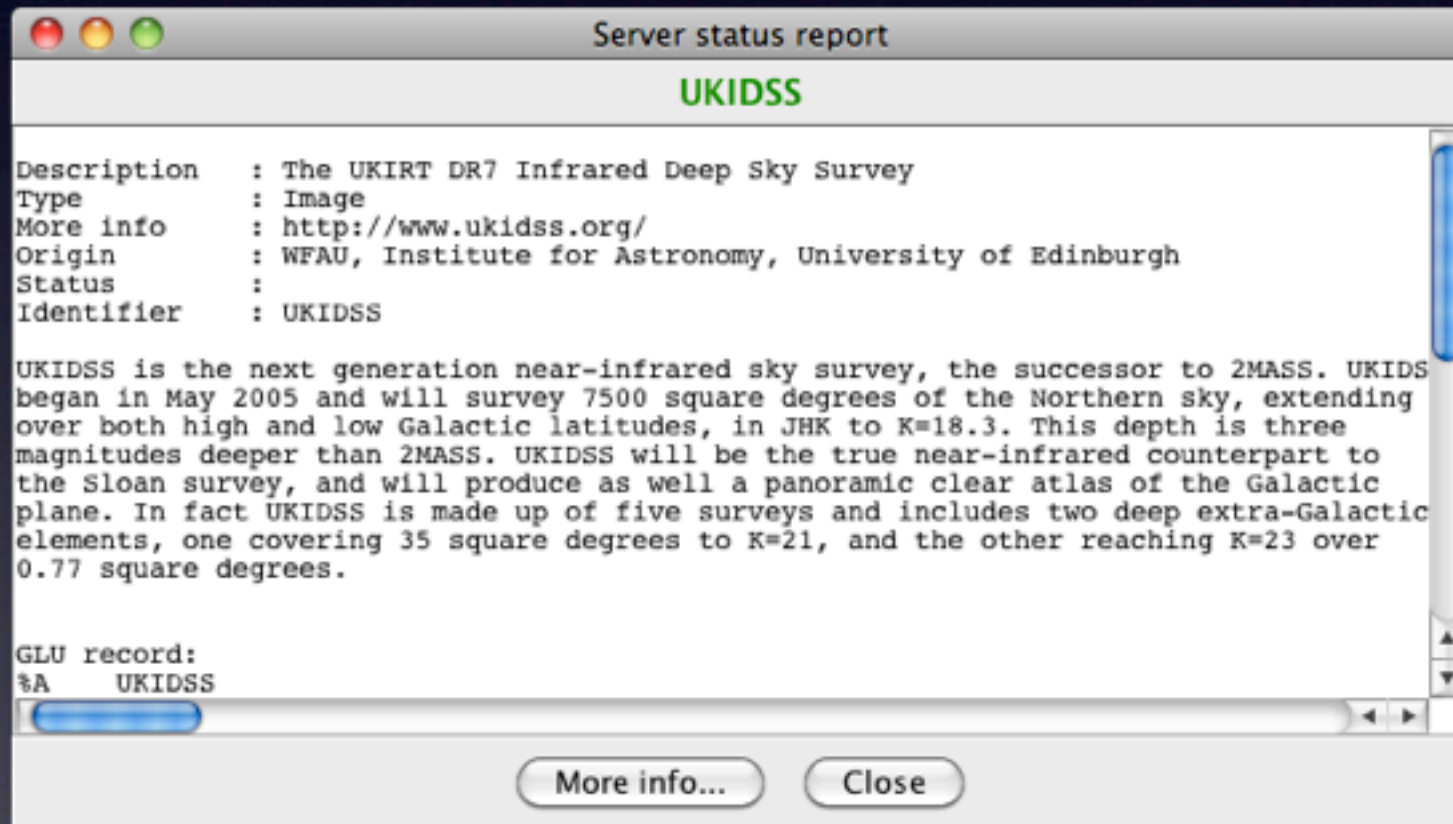
- UKIDSS DR8 SIAP Service
- e.g. <ivo://wfau.roe.ac.uk/ukidssdr8-siap>
- found via TOPCAT SIA query, or 'All VO' in Aladin

# SIA services in TOPCAT





# Image servers in Aladin



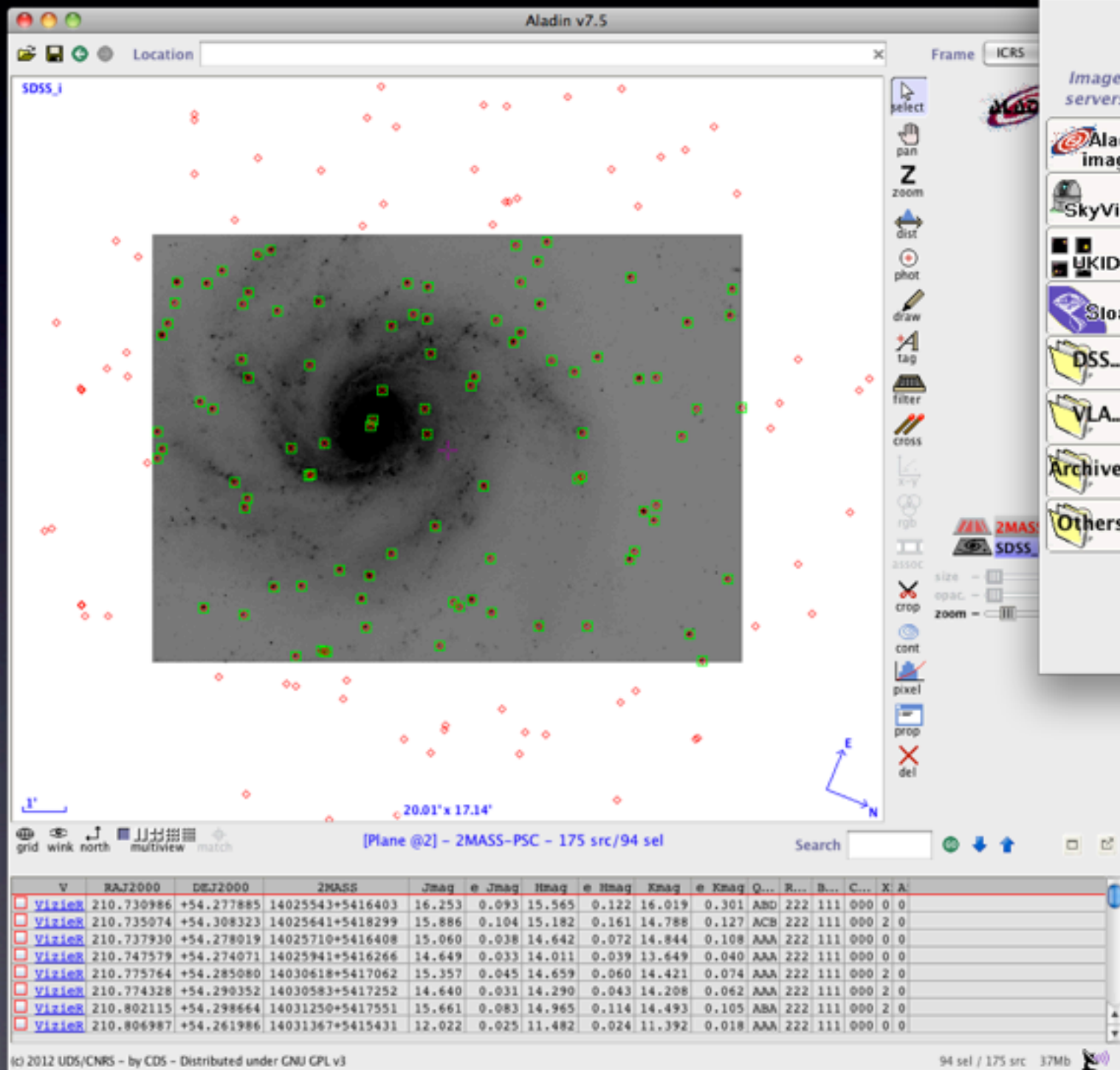
# Question 2.

- How many 2MASS point sources are in the following image?
- [http://cdsweb.u-strasbg.fr/~allen/SDSS\\_i.fits](http://cdsweb.u-strasbg.fr/~allen/SDSS_i.fits)
- (same as: <http://bit.ly/XnknIZ> )
- Bonus: What galaxy is it?





- 94
- M101 (also known as NGC 5457, UGC 8981, The Pinwheel, IRAS 14013+5435, ...)



Server selector

Others Allsky File all-VO Watch FoV... Tools...

Image servers

Aladin images

SkyView

UKIDSS

Sloan

DSS...

VLA...

Archives...

Others...

Surveys in VizieR

Specify a target and a survey name.

Target (ICRS,... 14 03 13.50 +54 22 46.7 Grab coord

Survey 2MASS-PSC Radius 8.356'

All columns

You can pick up a survey name from the list below

Name	Description	Nb of KRows
2MASS-PSC	The 2MASS Point Source and 2MASS6x catalogu...	470993
2MASX	The 2MASS Extended Source Catalogue (2003)	1648
AKARI	AKARI IRC (9/18um) and FIS (60-160um)all-sky...	1298
CMC14	The Carlsberg Meridian Catalog 14 (-30<Dec<...	95858
GSC2.3	The GSC-II Catalog, Version 2.3.2 (2006)	945592
PPMXL	PPMXL catalog of positions and proper motions...	910469
UCAC4	The USNaval CCD Astrograph Catalog, 4th Relea...	113780
UKIDSS	GPS(DR6)+LAS(8)+GCS(DR8)+DXS(8)	727073
USNO-A2	The USNO-A2.0 Catalog	526281
USNO-B1	The USNO-B1.0 Catalog	1045913
ASCC-2.5	All-Sky Compiled Catalog of 2.5M* (2003)	2501
Tycho-2	The Tycho-2 Catalog (08-Feb-2000)	2540
B/DENIS	The DENIS database (3rd Release 2005 version)	355220

Get info.

Reset Clear SUBMIT Close ?



# Question 3.

- How many Eclipsing Binaries in the Kepler mission first data release fall within the sky area covered by the Sloan Digital Sky Survey?

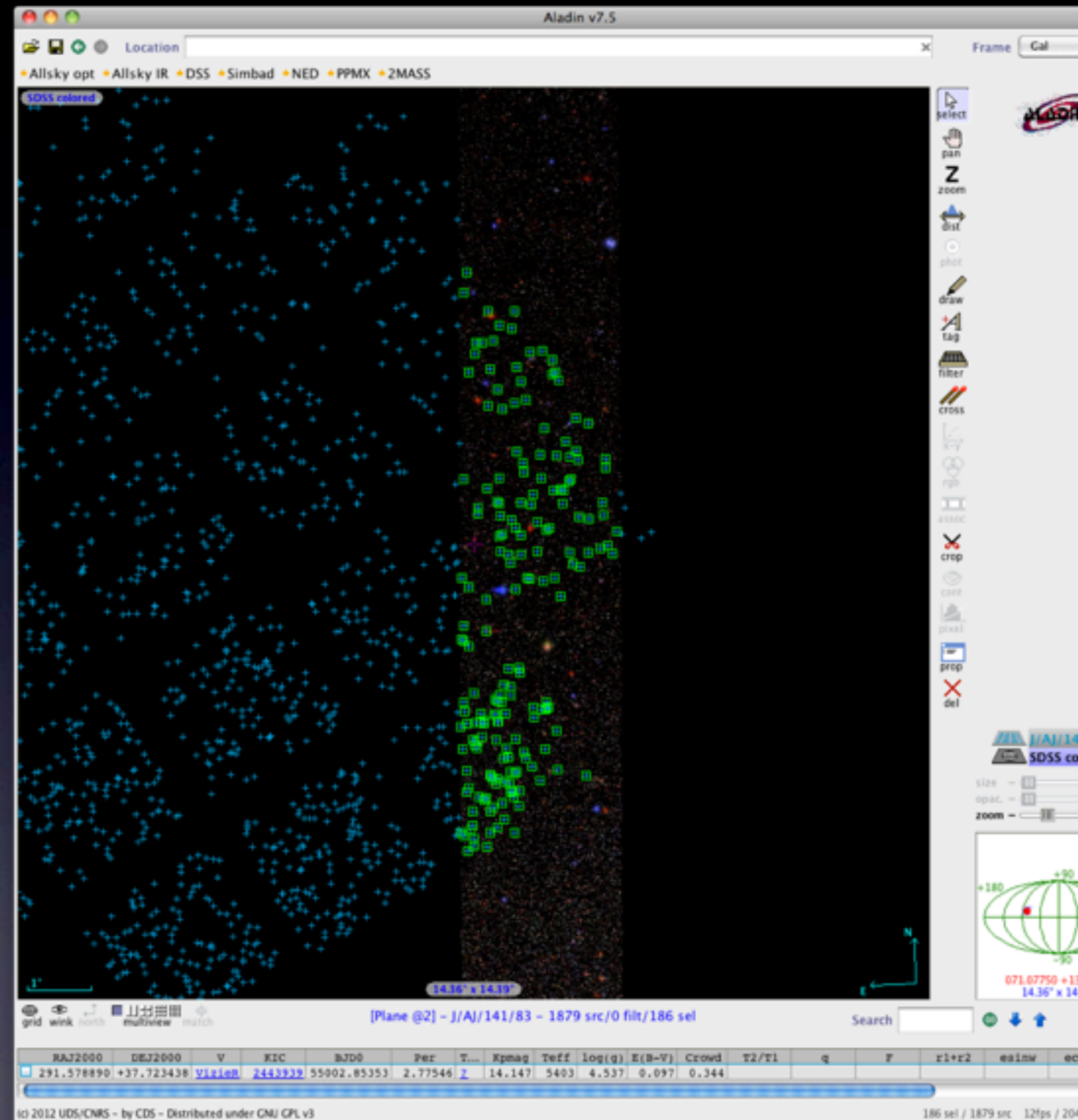
**hint:** Data Release catalogue by Prsa+, 2011

**hint:** Use the All-Sky image of SDSS





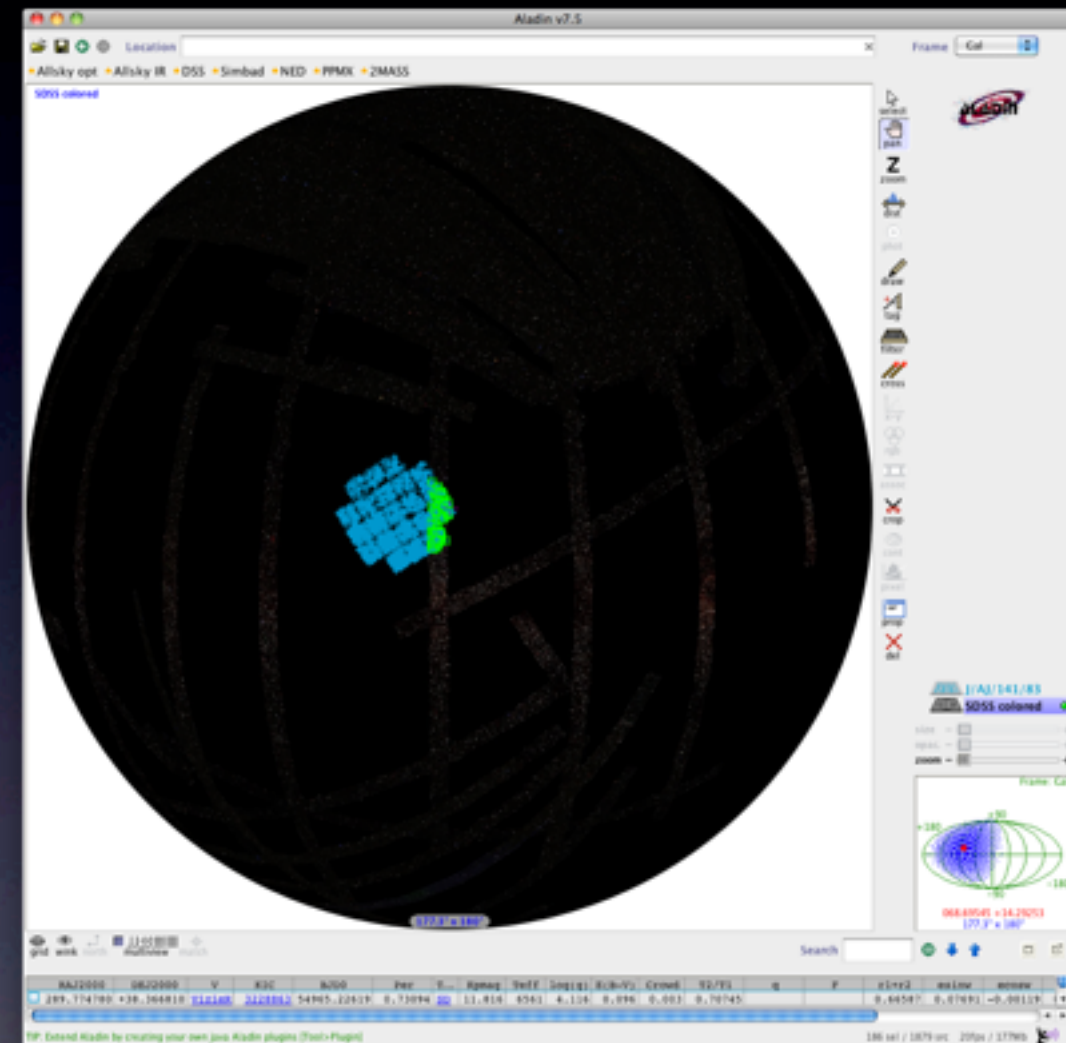
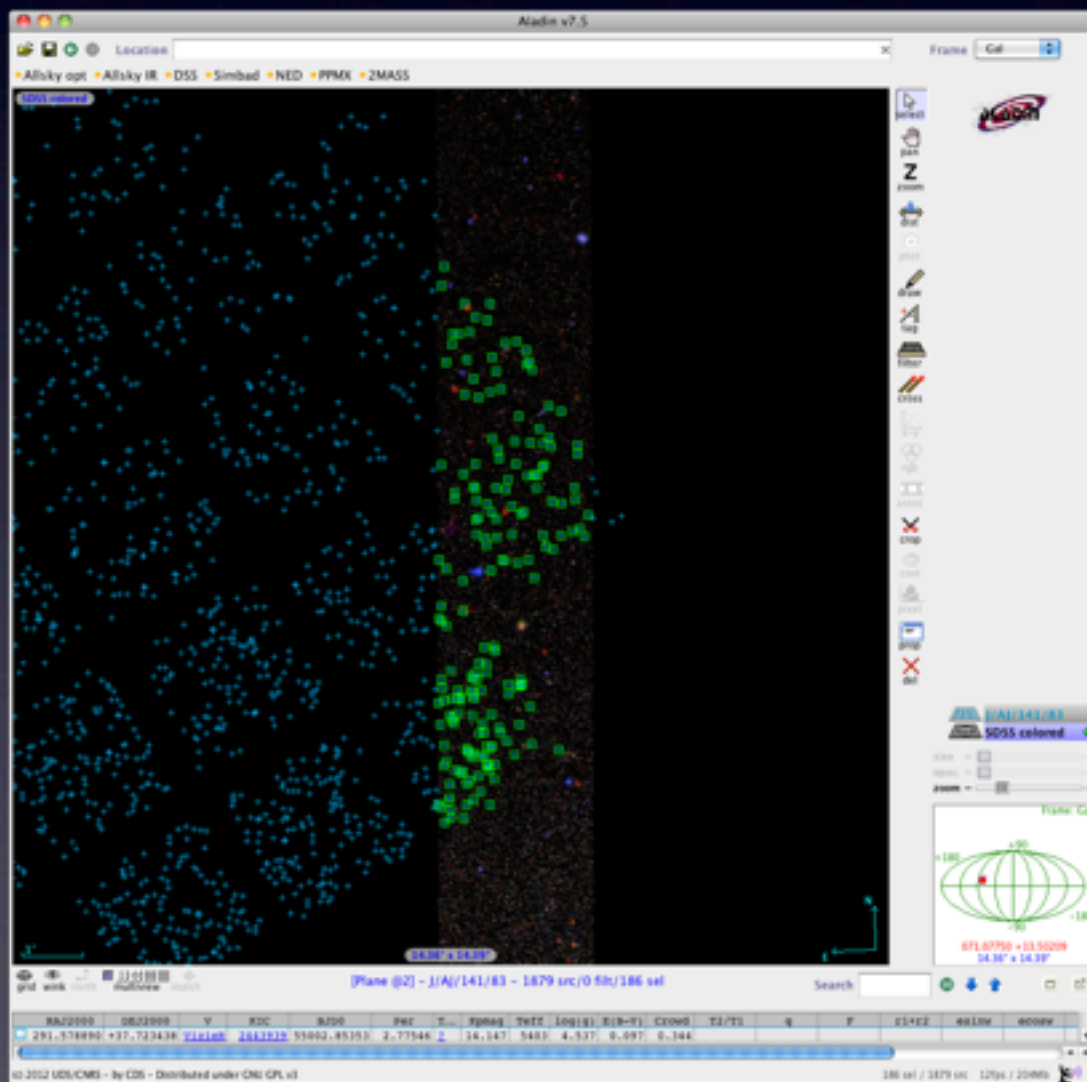
- 185 - 193
- depends on SDSS version



186-2+1

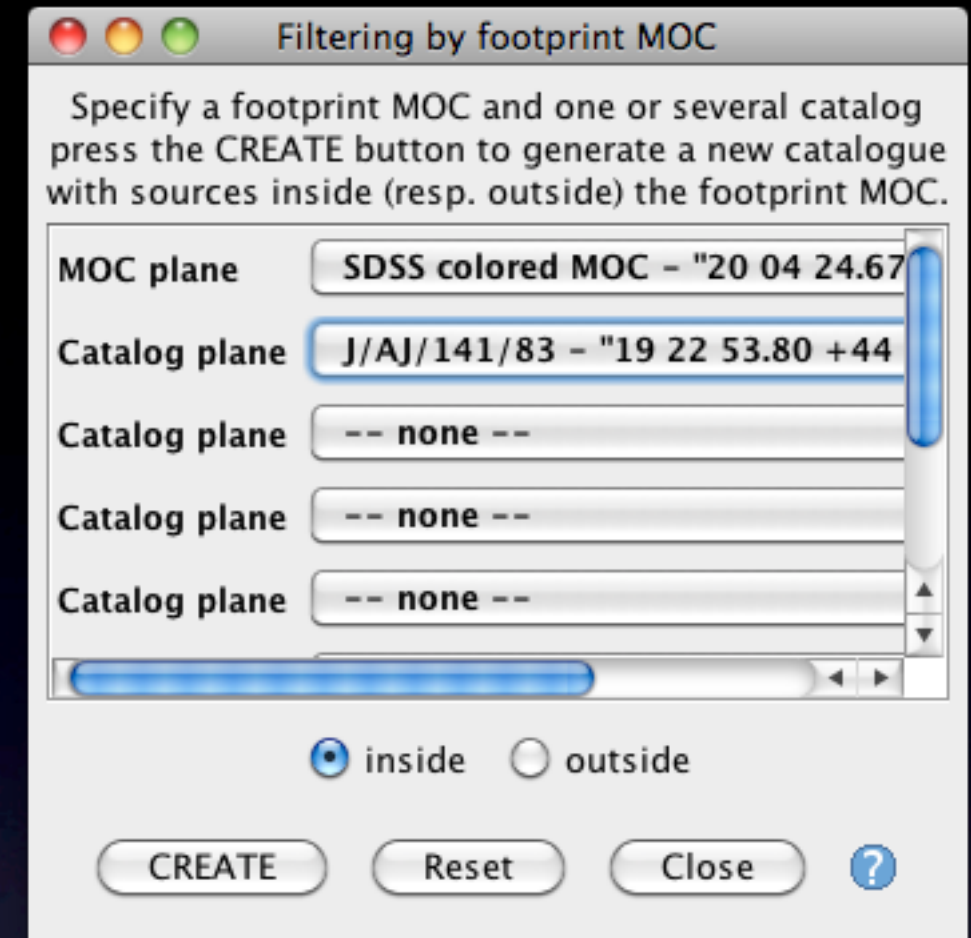
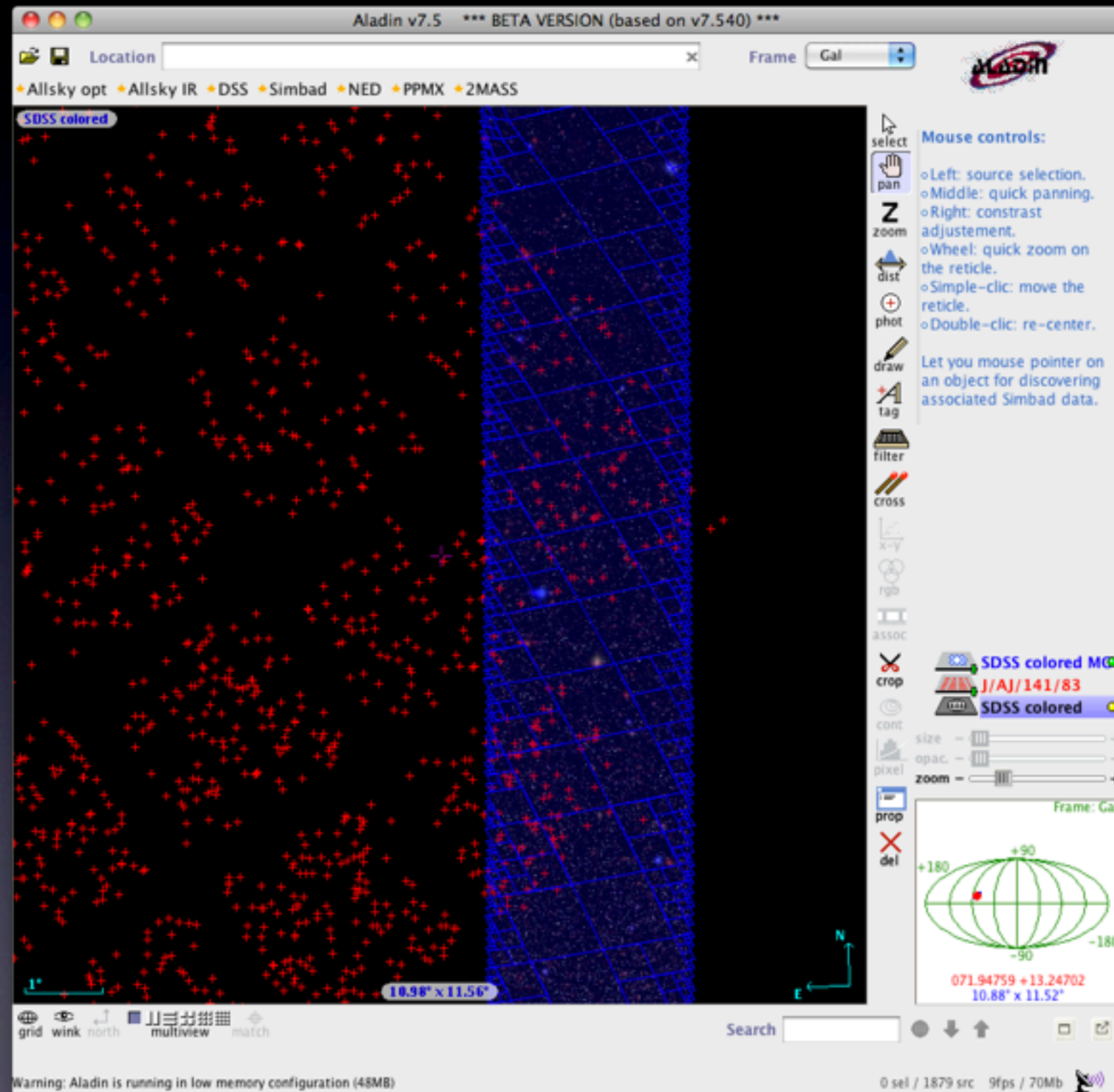


# Catalogue compared to SDSS All sky (galactic coords helps selection)





also by using MOC



but be careful of resolution!



# Question 4.

- How many Bautz-Morgan type II Abell clusters are within 10 degrees of the south equatorial pole?

(not including intermediate types)

**Hint:**

Use: Rich Clusters of Galaxies (Abell et al. 1989)  
[Astrophys. J. Suppl. Ser. 70, 1 (1989)]

or/ the Abell catalogue from HEASARC







- 12
- Identify a version of the Abell catalog of galaxy clusters, that has Bautz-Morgan types listed
  - HEASARC Abell catalog via TOPCAT cone search
  - Vizier VII/110A (Abell et al 1989)
- Query and filter the catalog on coordinates DEC<-80, and BMtype
- Or include spatial constraint in initial query

VizieR

http://vizier.u-strasbg.fr/viz-bin/VizieR-4

ADS ADS J/Vol/Page The astro-ph Map Object class... in SIMBAD VOSchoolGrenoble2011 School Wiki VizieR Photometry Tool VizieR WeatherSpark Google Translate

Bautz-Morgan classification - Wi... VizieR ABELL - Abell Clusters

Portal Simbad **VizieR** Aladin X-Match Other Help

### VizieR Result Page

Send to VO tools

Search Criteria  
Save in CDSportal  
Keywords Back  
VII/110A  
Tables Add  
VII/110A  
..table3  
..table4  
..table5  
..table6  
Enlarge Choose  
Constraints  
BMtype =II  
\_DE.icrs <-80  
Modify Query  
Preferences  
max: 20  
HTML Table  
All columns  
Compute  
Submit  
Mirrors  
CDS, France

► Show the target form  
► Show constraint information

The 2 columns in **color** are computed by VizieR, and are **not part of the original data**.

**VII/110A/table5** [Rich Clusters of Galaxies \(Abell+ 1989\)](#) [ReadMe+ftp](#)  
[Post annotation](#) Supplementary southern clusters (1174 rows)

Full	RAJ2000	DEJ2000	ACOS	RAB1950	DEB1950	BMtype	Count	m10	z	Rich	Dclass	RA.icrs	DE.icrs
	"h:m:s"	"d:m:s"		"h:m:s"	"d:m:s"		ct	mag				"h:m:s"	"d:m:s"
1	03 35.9	-85 37	389	03 45.5	-85 47 II		8	17.1		0	5	03 35.9	-85 37
2	15 44.5	-85 27	785	15 30.8	-85 17 II		13	17.2		0	5	15 44.5	-85 27
3	21 27.5	-85 01	934	21 16.6	-85 14 II		4	17.1		0	5	21 27.5	-85 01
4	22 23.8	-84 49	1009	22 15.9	-85 04 II		5	17.3		0	5	22 23.8	-84 49
5	22 49.9	-84 08	1061	22 43.9	-84 24 II		-62	16.8	0.0723	0	5	22 49.9	-84 08
6	00 15.9	-84 04	21	00 14.1	-84 21 II		-8	16.0		0	4	00 15.9	-84 04
7	16 03.4	-83 11	788	15 52.9	-83 03 II		24	17.6		0	5	16 03.4	-83 11
8	19 12.6	-82 23	809	19 02.0	-82 28 II		29	17.8		0	5	19 12.6	-82 23
9	01 55.3	-81 23	211	01 56.3	-81 38 II		0	16.8		0	5	01 55.3	-81 23
10	00 19.7	-80 49	30	00 17.7	-81 06 II		-20	16.8		0	5	00 19.7	-80 49

Available Visualisations:  
• Plot the results with the VOPlot utility

giving the VizieR Service

VizieR

http://vizier.u-strasbg.fr/viz-bin/VizieR-4

ADS ADS J/Vol/Page The astro-ph Map Object class... in SIMBAD VOSchoolGrenoble2011 School Wiki VizieR Photometry Tool VizieR WeatherSpark Google Translate

Bautz-Morgan classification - Wi... VizieR ABELL - Abell Clusters

Portal Simbad **VizieR** Aladin X-Match Other Help

### VizieR Result Page

Send to VO tools

Search Criteria  
Save in CDSportal  
Keywords Back  
VII/110A  
Tables Add  
VII/110A  
..table3  
..table4  
..table5  
..table6  
Enlarge Choose  
Constraints  
BMtype =II  
\_DE.icrs <-80  
Modify Query

► Show the target form  
► Show constraint information

The 2 columns in **color** are computed by VizieR, and are **not part of the original data**.

**VII/110A/table4** [Rich Clusters of Galaxies \(Abell+ 1989\)](#) [ReadMe+ftp](#)  
[Post annotation](#) Southern "Abell Catalog" (1364 rows)

Full	RAJ2000	DEJ2000	ACORAB1950	DEB1950	BMtype	Count	m10	z	Rich	Dclass	RA.icrs	DE.icrs	
	"h:m:s"	"d:m:s"	"h:m:s"	"d:m:s"		ct	mag				"h:m:s"	"d:m:s"	
1	04 10.7	-88 45	3299	04 57.7	-88 51 II		39	18.0		0	5	04 10.7	-88 45
2	04 59.5	-86 42	3333	05 16.0	-86 46 II		32	19.4		0	6	04 59.5	-86 42

giving the VizieR Service

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Contact



ADS

ADS J/Vol/Page

The astro-ph Map

Object class...n in SIMBAD

VOSchoolGrenoble2011

School Wiki

VizieR Photometry Tool

VizieR

WeatherSpark

Google Translate

Bautz-Morgan classification - Wi...

VizieR

ABELL - Abell Clusters

Portal

Simbad

VIZIER

Aldrin

X-match

Other

Help

VizieR

http://vizier.u-strasbg.fr/viz-bin/VizieR-4

RSS

Google

VizieR Result Page

Send to VO tools

Search Criteria

Save in CDSportal

Keywords

Back

VII/110A

Tables

Add

VII/110A

..table3

..table4

..table5

..table6

Enlarge

Choose

Constraints

BMtype =II

\_DEJcrs <-80

Modify Query

Preferences

max: 20

HTML Table

All columns

Compute

Submit

Mirrors

CDS, France

Show the target form

Show constraint information

The 2 columns in **color** are computed by VizieR, and are **not part of the original data**.

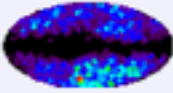
VII/110A/table4

Rich Clusters of Galaxies (Abell+ 1989)

Post annotation

Southern "Abell Catalog" (1364 rows)

ReadMe+ftp



Full	RAJ2000	DEJ2000	ACORAB1950	DEB1950	BMtype	Count	m10	z	Rich	Dclass	RA.icrs	DE.icrs
	"h:m:s"	"d:m:s"		"h:m:s"	"d:m:s"	ct	mag				"h:m:s"	"d:m:s"
1	04 10.7	-88 45	3299	04 57.7	-88 51 II	39	18.0		0	5	04 10.7	-88 45
2	04 59.5	-86 42	3333	05 16.0	-86 46 II	32	19.4		0	6	04 59.5	-86 42

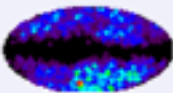
VII/110A/table5

Rich Clusters of Galaxies (Abell+ 1989)

Post annotation

Supplementary southern clusters (1174 rows)

ReadMe+ftp



Full	RAJ2000	DEJ2000	RAB1950	DEB1950	BMtype	Count	m10	z	Rich	Dclass	RA.icrs	DE.icrs	ACOS
	"h:m:s"	"d:m:s"	"h:m:s"	"d:m:s"		ct	mag				"h:m:s"	"d:m:s"	
1	03 35.9	-85 37	03 45.5	-85 47	II	8	17.1		0	5	03 35.9	-85 37	389
2	15 44.5	-85 27	15 30.8	-85 17	II	13	17.2		0	5	15 44.5	-85 27	785
3	21 27.5	-85 01	21 16.6	-85 14	II	4	17.1		0	5	21 27.5	-85 01	934
4	22 23.8	-84 49	22 15.9	-85 04	II	5	17.3		0	5	22 23.8	-84 49	1009
5	22 49.9	-84 08	22 43.9	-84 24	II	62	16.8	0.0723	0	5	22 49.9	-84 08	1061
6	00 15.9	-84 04	00 14.1	-84 21	II	8	16.0		0	4	00 15.9	-84 04	21
7	16 03.4	-83 11	15 52.9	-83 03	II	24	17.6		0	5	16 03.4	-83 11	788
8	19 12.6	-82 23	19 02.0	-82 28	II	29	17.8		0	5	19 12.6	-82 23	809
9	01 55.3	-81 23	01 56.3	-81 38	II	0	16.8		0	5	01 55.3	-81 23	211
10	00 19.7	-80 49	00 17.7	-81 06	II	20	16.8		0	5	00 19.7	-80 49	30

Thanks for acknowledging the VizieR Service

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Contact



Cone Search

Available Cone Services

Registry: [http://registry.astrogrid.org/astrogrid-registry/services/RegistryQueryv1\\_0](http://registry.astrogrid.org/astrogrid-registry/services/RegistryQueryv1_0)

Keywords:

Match Fields: ☒ Short Name ☒ Title ☒ Subjects ☒ ID ☒ Publisher ☐ Description

☒ Accept Resource Lists

Short Name	Title	Subjects
ABELLZCAT	Abell Clusters Measured Redshifts Catalog	Cluster of Galaxies
Abell	Abell Clusters	Cluster of Galaxies
J/A+A/258/243	HRV of Abell 151 galaxies (Proust+, 1992)	Clusters_of_galaxies, Velocities
J/A+A/278/379	X-ray Emission from Abell Clusters of Galaxies (Briel+ 1993)	Clusters_of_galaxies
J/A+A/363/440	BR photometry of Abell 2104 (Liang+, 2000)	Clusters_of_galaxies, Photometry, Redshifts
J/A+A/377/428	Abell 970 galaxies radial velocities (Sodre+, 2001)	Clusters_of_galaxies, Velocities
J/A+A/382/60	BVR photometry in Abell 1689 (Duc+, 2002)	Clusters_of_galaxies, Galaxies, Redshifts
J/A+A/384/383	H[alpha] galaxies in Abell 1367 and Coma (Iglesias-Paramo+, 2002)	Photometry:narrow-band, Clusters_of_galaxies, Velocities
J/A+A/393/439	Catalogue of galaxies towards Abell 496 (Durret+, 2002)	Clusters_of_galaxies
J/A+A/394/395	Spectroscopy of Abell 222 and Abell 223 (Dietrich+, 2002)	Clusters_of_galaxies, Photometry, Galaxies, Galaxies:spectra

AccessURL: <http://heasarc.gsfc.nasa.gov/cgi-bin/vo/cone/coneGet...> Description: Version:

Cone Parameters

Cone URL: <http://heasarc.gsfc.nasa.gov/cgi-bin/vo/cone/coneGet.pl?table=ab>

Object Name:

RA:   (J2000)

Dec:   (J2000)

Radius:

TOPCAT(6): Table Browser

Table Browser for 6: Abell-10d

	name	ra	dec	_count	bmtype	redshift	rich	dist	vmag	Search_Offset
52	ABELL2727	1.85	-82.	68	I-III	0.	1	6	17.3	479.89655
55	ABELL11225	351.7	-81.31	22	I-III	0.	0	5	17.1	521.14975
56	ABELL7935	259.	-81.2	16	I-III	0.	0	5	17.	528.02536
57	ABELL1585	21.23	-81.08	-44	I-III	0.	0	5	16.8	534.90097
58	ABELL1285	16.53	-81.	0	I-III	0.	0	5	16.8	540.05722
63	ABELL3615	225.72	-80.55	36	I-III	0.	0	5	17.	566.87164
64	ABELL2837	13.18	-80.25	47	I-III	0.	0	5	17.2	585.09201
65	ABELL10145	336.05	-80.17	16	I-III	0.0481	0	3	15.5	589.90494
1	ABELL3299	62.68	-88.73	39	II	0.	0	5	17.2	75.96176
9	ABELL3333	74.87	-86.7	32	II	0.	0	6	17.3	198.00156
16	ABELL3895	53.97	-85.62	8	II	0.	0	5	17.1	262.97516
17	ABELL7855	236.13	-85.43	13	II	0.	0	5	17.	273.97614
22	ABELL9345	321.88	-85.02	-4	II	0.	0	5	17.1	299.0712
25	ABELL10095	335.95	-84.8	5	II	0.	0	5	17.1	312.13486
29	ABELL10615	342.47	-84.13	-62	II	0.0723	0	5	16.9	352.01248
30	ABELL215	3.97	-84.06	-8	II	0.	0	4	16.1	356.13785
37	ABELL7885	240.85	-83.18	24	II	0.	0	5	17.	409.07913
44	ABELL8095	288.15	-82.39	29	II	0.	0	5	17.1	456.86417
54	ABELL2115	28.82	-81.38	0	II	0.	0	5	16.9	517.02438
59	ABELL305	4.93	-80.82	-20	II	0.	0	5	16.8	551.0582
4	ABELL3763	324.52	-87.2	52	II-III	0.	1	5	17.2	168.09311
5	ABELL3595	218.1	-86.92	99	II-III	0.	2	5	17.1	184.93835
6	ABELL3650	301.78	-86.8	42	II-III	0.	0	5	17.2	192.15775
7	ABELL3625	243.25	-86.8	55	II-III	0.	1	5	17.1	192.15775
13	ABELL7915	257.62	-85.9	8	II-III	0.	0	5	16.8	246.12991
15	ABELL4805	66.22	-85.8	26	II-III	0.	0	5	17.1	251.97418

# Question 5.

- How many galaxies in the Third Reference Catalog of Bright Galaxies (RC3) have counterparts in the 13th edition Veron & Veron (2010) catalogue of AGN and quasars?

**hint:** you don't need to download the catalogues

*Try CDS X-Match service*

<http://cdsxmatch.u-strasbg.fr/xmatch>





- 392 (with 4'' match radius)
- ~1000 (with 1' match radius)

**Match Tables**

Match Criteria

Algorithm: Sky

Max Error: 4.0 arcsec

Table 1

Table: 15: VII\_258\_vv10

RA column: \_RAJ2000 degrees

Dec column: \_DEJ2000 degrees

Table 2

Table: 21: VII\_155\_rc3

RA column: \_RAJ2000 degrees

Dec column: \_DEJ2000 degrees

Output Rows

Match Selection: Best match, symmetric

Join Type: 1 and 2

Eliminating multiple row references...

Elapsed time for match: 1 seconds

Match succeeded

Go Stop

**Cone Search**

Available Cone Services

Registry: [http://registry.astrogrid.org/astrogrid-registry/services/RegistryQueryv1\\_0](http://registry.astrogrid.org/astrogrid-registry/services/RegistryQueryv1_0)

Keywords: RC3

Match Fields: ☒ Short Name ☒ Title ☒ Subjects ☒ ID ☒ Publisher ☐ Description

☒ Accept Resource Lists

Cancel Query Submit Query

Short Name	Title	Subjects	Identifier	Publisher
J/AJ/108/2128	RC3 corrections and additions (Corwin+ 1994)	Galaxies	ivo://CDS.VizieR/J/AJ/108/2128	CDS
RC3	Third Reference Catalog of Bright Galaxies	Galaxy	ivo://nasa.heasarc/rc3	NASA/GSFC HEASARC
VII/155	Third Reference Cat. of Bright Galaxies (RC3) (de Vaucouleurs+ 1991)	Galaxies	ivo://CDS.VizieR/VII/155	CDS
	RC3: Third Reference Catalog of Bright Galaxies (LEDAS)	LEDAS, rc3	ivo://uk.ac.le.star.tmpledas/ledas/ledas/rc3	LEDAS, University of Le

AccessURL	Description	Version
<a href="http://heasarc.gsfc.nasa.gov/cgi-bin/vo/cone/coneGet...">http://heasarc.gsfc.nasa.gov/cgi-bin/vo/cone/coneGet...</a>		

Cone Parameters

Cone URL: <http://heasarc.gsfc.nasa.gov/cgi-bin/vo/cone/coneGet.pl?table=rc3&>

Object Name:

RA: 0 degrees (J2000)

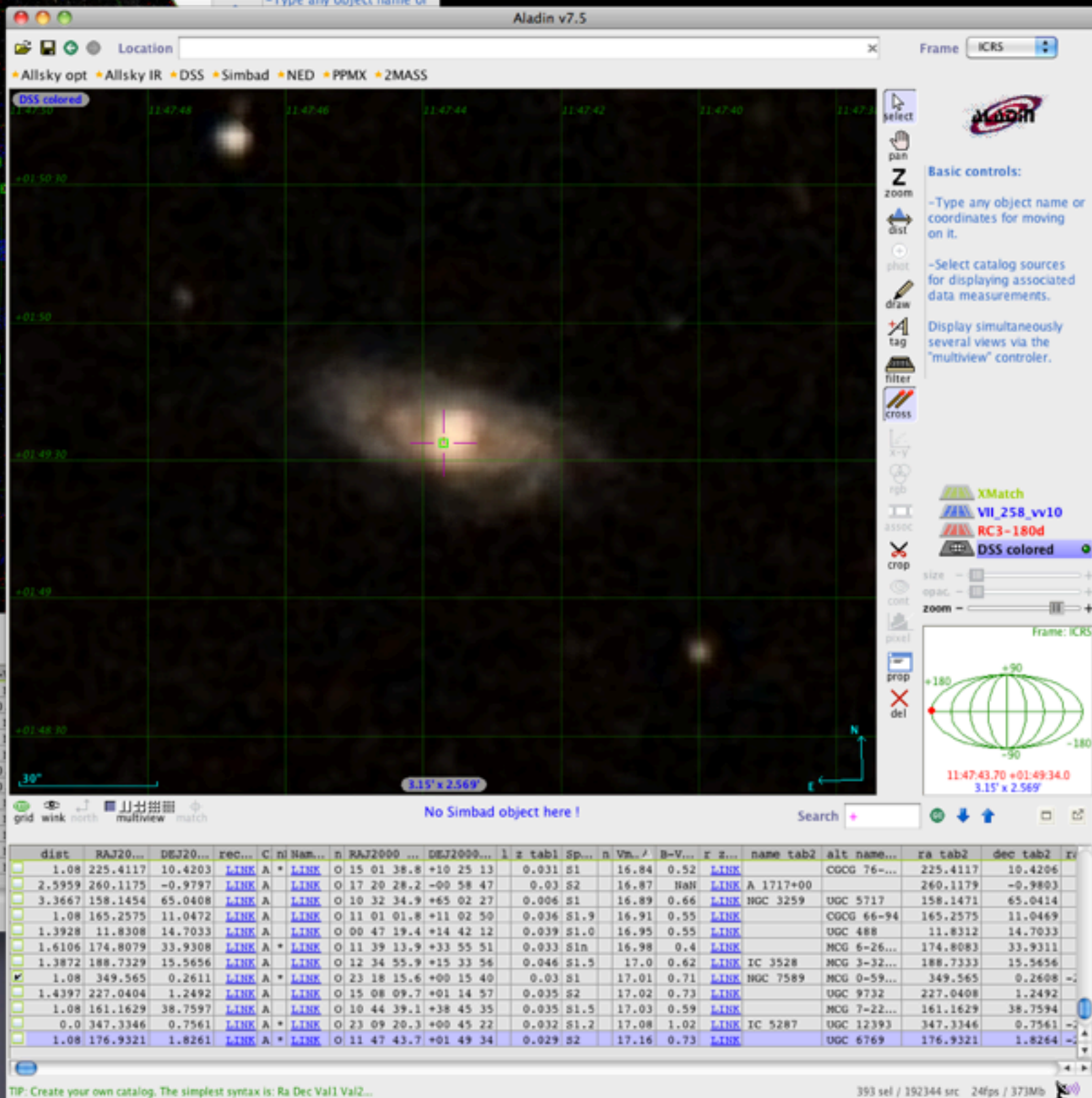
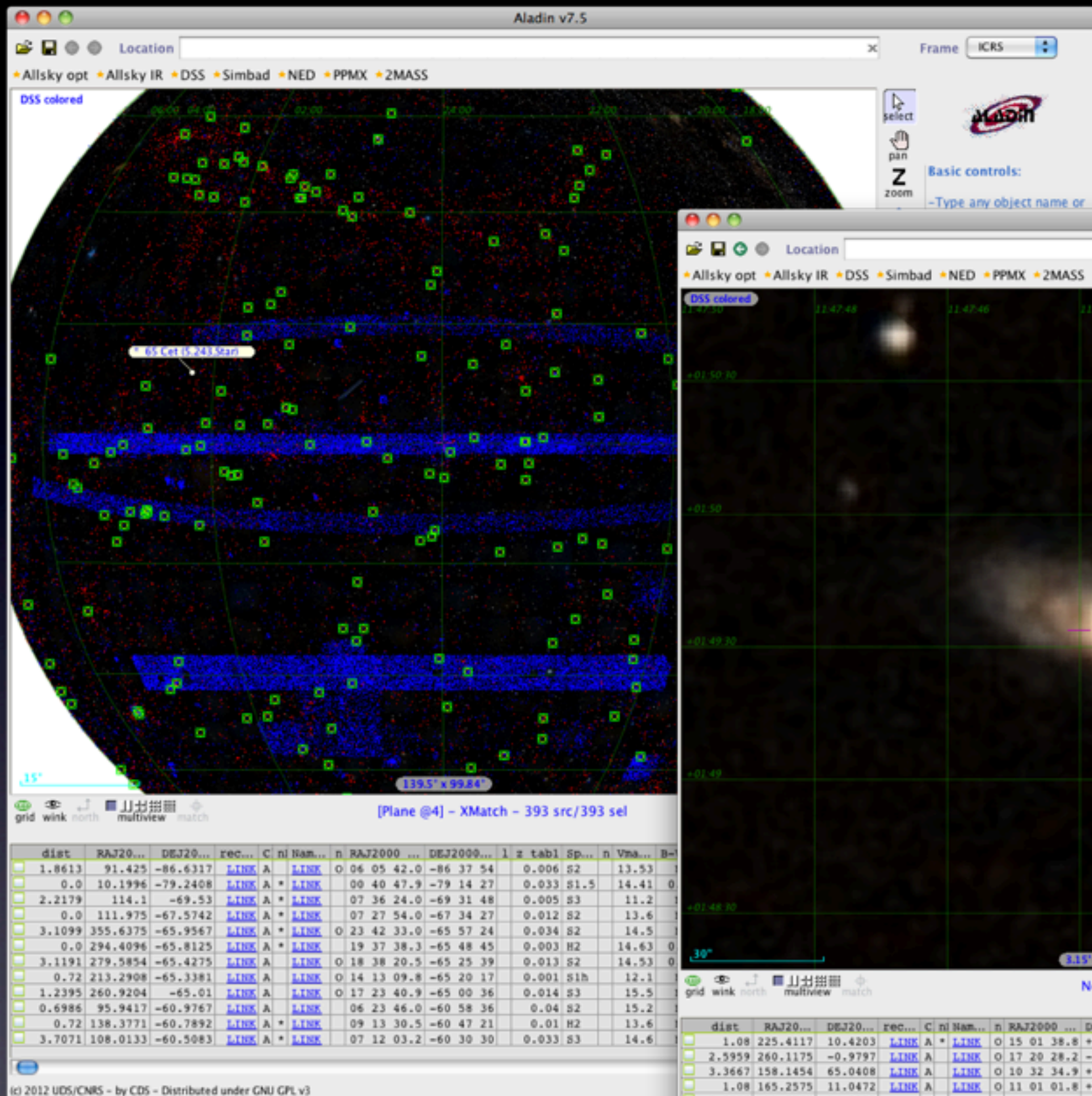
Dec: 0 degrees (J2000)

Radius: 180 degrees

☒ Accept Sky Pos

OK







## Choose tables to cross-match

VII/155/rc3



VII/258/vv10

VizieR

SIMBAD

My store

VizieR

SIMBAD

My store

[Third Reference Cat. of  
Bright Galaxies \(RC3\) \(de  
Vaucouleurs+ 1991\)](#)

23,011 rows



[Quasars and Active  
Galactic Nuclei \(13th Ed.\)  
\(Veron+ 2010\)](#)

168,940 rows



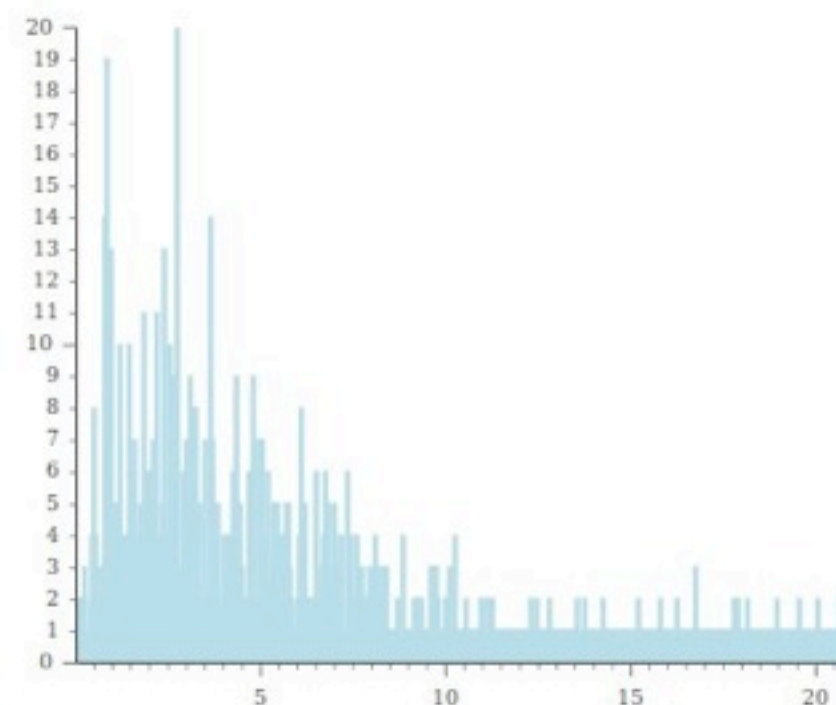
Show options

Begin the X-Match

## Visualize and manage your cross-match jobs

## List of X-match jobs

Table 1	Table 2	Options	Begin	Status	
VII/155/rc3	VII/258/vv10	fixed radius +	06/02/2013 at 9:54	completed	
VII/155/rc3	VII/258/vv10	fixed radius +	06/02/2013 at 9:53	completed	



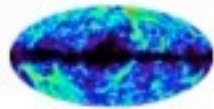
For the selected job(s): Delete

## Choose tables to cross-match

VII/155/rc3

VizieR SIMBAD My store


[Third Reference Cat. of Bright Galaxies \(RC3\) \(de Vaucouleurs+ 1991\)](#)  
23,011 rows



VII/258/vv10

VizieR SIMBAD My store



[Quasars and Active Galactic Nuclei \(13th Ed.\) \(Veron+ 2010\)](#)  
168,940 rows



[Show options](#)[Begin the X-Match](#)

## Visualize and manage your cross-match jobs

## List of X-match jobs

Table 1	Table 2	Options	Begin	Status	Actions	<input type="checkbox"/>
VII/155/rc3	VII/258/vv10	fixed radius +	06/02/2013 at 9:54	completed 	 <a href="#">Get result</a>	<input type="checkbox"/>
VII/155/rc3	VII/258/vv10	fixed radius +	06/02/2013 at 9:53	completed		<input type="checkbox"/>

Job executed in **1s**  
< **1s** to correlate  
< **1s** to generate file  
Result: **1,000** rows (178 kB)

[Delete](#)