

# VO ツール利用法

## TOPCAT



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# TOPCAT

(Tool for Operations on Catalogues And Tables)

- カタログ・テーブルデータの処理
- グラフの作成
- サポートするデータ形式
  - FITS, VOTable, ASCII, CSV ...
- VOサービスから直接データ取得可能
- ホームページ
  - <http://www.star.bris.ac.uk/~mbt/topcat/>

# インストール

- Java と topcat 両方インストール
- <http://www.star.bris.ac.uk/~mbt/topcat/#install>

## Standalone Jar File

The most convenient form for downloading is to pick up a single Jar file containing the required classes:

- [topcat-full.jar](#) (27.2M) – core facilities plus some optional extras
- [topcat-lite.jar](#) (20.7M) – core facilities

(Note: if you try to download these directly your browser may say something about a failed security check. Make sure that you save it to a file, for instance by right-clicking in Firefox).

On Unix-like operating systems, download one or other of these jar files and the startup script [topcat](#) into the same directory, then “chmod +x topcat”, and you can just run the command:

## MacOS X

If you have an Apple Mac, you can pick up the following for easy installation:

[topcat-full.dmg](#) (31.9M)

A couple of FAQ entries are relevant: [how to set flags for memory usage etc](#) and [problem with “damaged” dmg file](#).

# マニュアル類

- 講習会ページ
  - <http://jvo.nao.ac.jp/vos2015a/>
- 本家マニュアル
  - <http://www.star.bristol.ac.uk/~mbt/topcat/#docs>
  - FAQ、スクリーンショット集、利用例の紹介などもある。
- Euro VO による使用例
  - <http://www.euro-vo.org/?q=science/scientific-tutorials>
- Help
  - TOPCAT 画面上の  をクリックすると Help 画面が表示される。

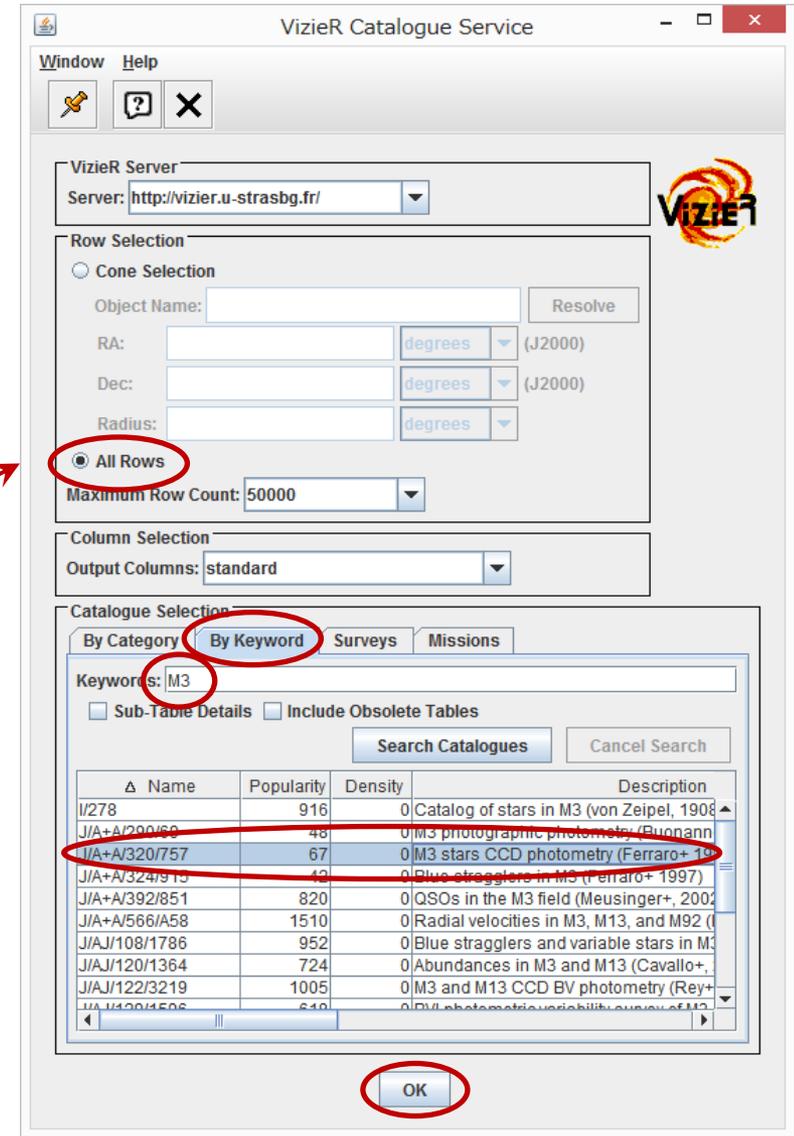
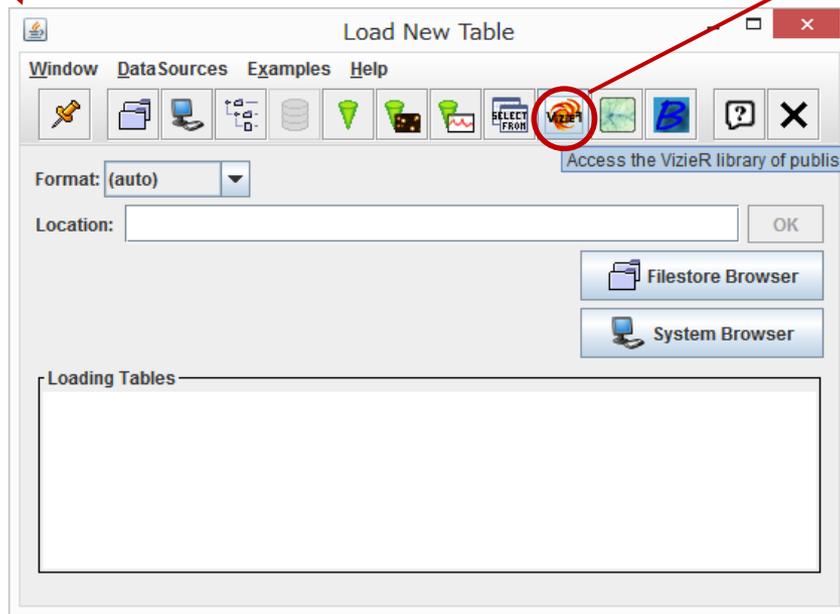
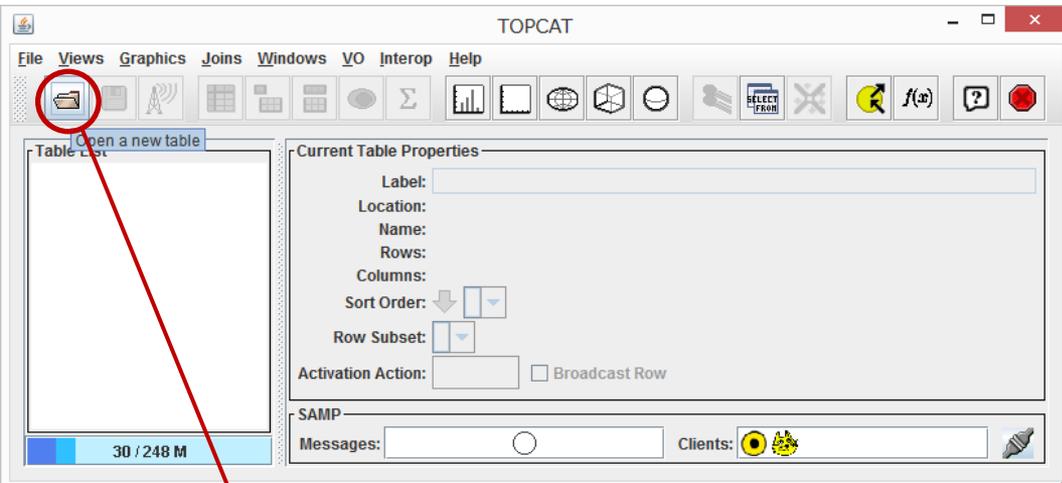


# 使用例1

## 球状星団 M3 の HR図の作成

- 講習会ページの TOPCAT 簡易マニュアル参照
  1. TOPCAT から VizieR Catalog Service にある「M3 stars CCD photometry (Ferraro+1997)」を取得する。

# VizieR Catalog Service 検索ウィンドウ



# テーブルデータを表示

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List  
1: J\_A+A\_320\_757\_tables

Current Table Properties  
Label: J\_A+A\_320\_757\_tables  
Location: J\_A+A\_320\_757\_tables  
Name: J/A+A/320/757/tables  
Rows: 20,191  
Columns: 9  
Sort Order:   
Row Subset: All  
Activation Action: (no action)  Broadcast Row

SAMP  
Messages:  Clients:

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TOPCAT(1): Table Columns

Window Columns Display Help

Table Columns for 1: J\_A+A\_320\_757\_tables

	Visible	Name	\$ID	Class	Units	Description
0	<input type="checkbox"/>	Index	\$0	Long		Table row index
1	<input checked="" type="checkbox"/>	recno	\$1	Integer		Record number assigned by the VizieR team. Should Not be used for
2	<input checked="" type="checkbox"/>	Name	\$2	Integer		Star designation (this paper)
3	<input checked="" type="checkbox"/>	Vmag	\$3	Float	mag	V magnitude
4	<input checked="" type="checkbox"/>	Bmag	\$4	Float	mag	B magnitude
5	<input checked="" type="checkbox"/>	Imag	\$5	Float	mag	I magnitude
6	<input checked="" type="checkbox"/>	Xpos	\$6	Float	arcsec	X coordinate (arcsec)
7	<input checked="" type="checkbox"/>	Ypos	\$7	Float	arcsec	Y coordinate (arcsec)
8	<input checked="" type="checkbox"/>	Star	\$8	Short		Name of the stars (if variable) in the 3rd Sawyer-Hogg catalog (1973F
9	<input checked="" type="checkbox"/>	n_Star	\$9	Short		[0-1] 0: constant stars, 1: variable stars

TOPCAT(1): Table Browser

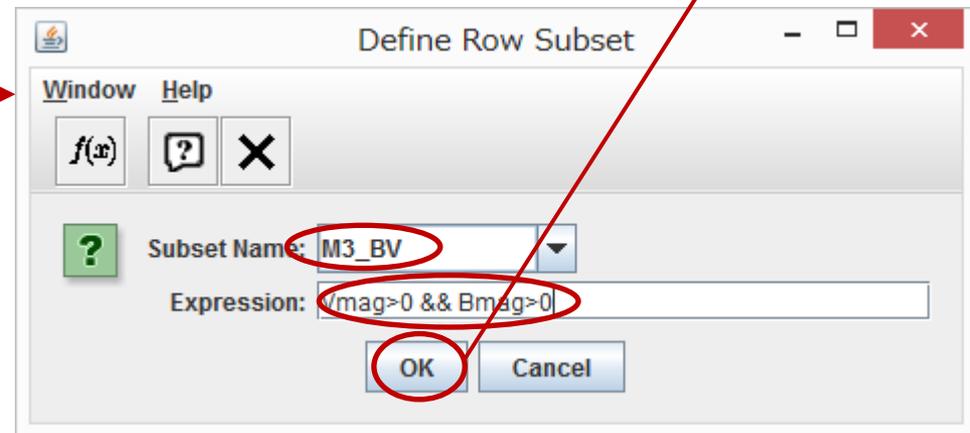
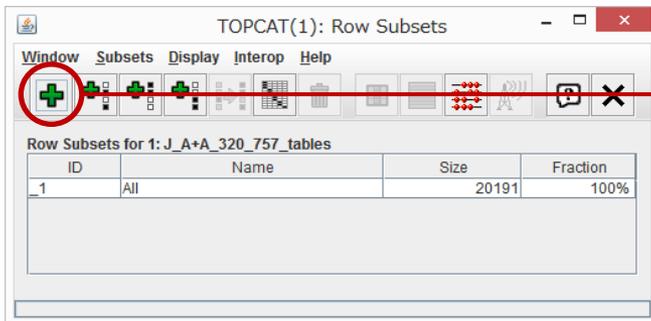
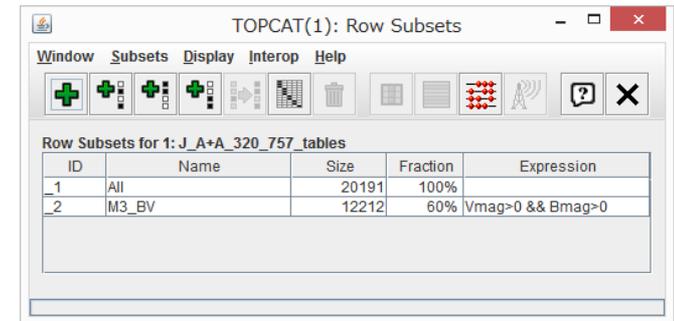
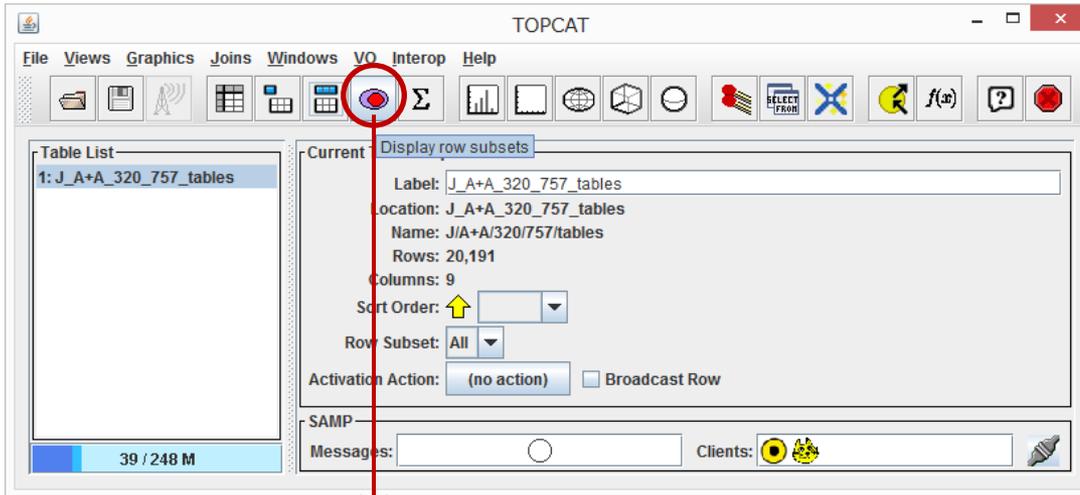
Window Subsets Help

Table Browser for 1: J\_A+A\_320\_757\_tables

	recno	Name	Vmag	Bmag	Imag	Xpos	Ypos	Star	n_Star
1	1	1	17.024	17.746	0.	-87.	-460.	0	0
2	2	2	15.737	16.137	0.	142.	-440.6	17	1
3	3	3	17.618	18.305	0.	163.	-436.	0	0
4	4	4	16.304	17.028	0.	-3.	-433.	0	0
5	5	5	15.745	16.215	0.	127.	-431.	0	0
6	6	6	17.715	18.384	0.	218.	-421.	0	0
7	7	7	16.411	17.526	0.	269.	-417.	0	0
8	8	8	15.89	16.715	0.	126.	-411.	0	0
9	9	9	12.844	14.286	0.	-178.	-410.	0	0
10	10	10	15.685	16.036	0.	-29.4	-408.7	92	1
11	11	11	15.199	15.951	0.	-84.	-398.	430	1
12	12	12	16.106	16.886	0.	40.	-398.	0	0
13	13	13	15.908	16.655	0.	-301.	-397.	0	0
14	14	14	15.938	16.652	0.	-358.	-396.	0	0
15	15	15	17.618	18.49	0.	-61.	-383.	0	0
16	16	16	17.995	18.636	0.	285.	-378.	0	0
17	17	17	15.745	16.215	0.	101.	-377.	0	0
18	18	18	17.636	18.306	0.	230.	-375.	0	0

# サブセットを作成

- B, V バンドのデータがあるサブセットを作成



# B-V カラムを作成

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List  
1: J\_A+A\_320\_757\_tables

Current Table Properties  
Label: J\_A+A\_320\_757\_tables  
Location: J\_A+A\_320\_757\_tables  
Name: J/A+A/320/757/tables  
Rows: 20,191 (12,212 apparent)  
Columns: 9  
Sort Order: [dropdown]  
Row Subse: **M3\_BV** [dropdown]  
Activation Action: (no action)  Broadcast Row

SAMP  
Messages: [input] Clients: [icons]

Define Synthetic Column

Window Help

$f(x)$  [?] [X]

? Name: **B-V**  
Expression: **Bmag-Vmag**  
Units: [input]  
Description: [input]  
UCD: [input] no UCD  
Index: [input] 10 [input]

**OK** Cancel

TOPCAT(1): Table Columns

Window Columns Display Help

+ [?] [X]

Add a new column defined algebraically from existing ones

Table Columns for 1: J\_A+A\_320\_757\_tables

	Visible	Name	\$ID	Class	Units	
0	<input type="checkbox"/>	Index	\$0	Long		Table row index
1	<input checked="" type="checkbox"/>	recno	\$1	Integer		Record number assigned by the
2	<input checked="" type="checkbox"/>	Name	\$2	Integer		Star designation (this paper)
3	<input checked="" type="checkbox"/>	Vmag	\$3	Float	mag	V magnitude
4	<input checked="" type="checkbox"/>	Bmag	\$4	Float	mag	B magnitude
5	<input checked="" type="checkbox"/>	Imag	\$5	Float	mag	I magnitude
6	<input checked="" type="checkbox"/>	Xpos	\$6	Float	arcsec	X coordinate (arcsec)
7	<input checked="" type="checkbox"/>	Ypos	\$7	Float	arcsec	Y coordinate (arcsec)
8	<input checked="" type="checkbox"/>	Star	\$8	Short		Name of the stars (if variable) in

TOPCAT(1): Table Columns

Window Columns Display Help

+ [?] [X]

Table Columns for 1: J\_A+A\_320\_757\_tables

Display help for this window in browser

	Visible	Name	\$ID	Class	Units	Description
1	<input checked="" type="checkbox"/>	recno	\$1	Integer		Record number assigned by the VizieR team. Should Not be used
2	<input checked="" type="checkbox"/>	Name	\$2	Integer		Star designation (this paper)
3	<input checked="" type="checkbox"/>	Vmag	\$3	Float	mag	V magnitude
4	<input checked="" type="checkbox"/>	Bmag	\$4	Float	mag	B magnitude
5	<input checked="" type="checkbox"/>	Imag	\$5	Float	mag	I magnitude
6	<input checked="" type="checkbox"/>	Xpos	\$6	Float	arcsec	X coordinate (arcsec)
7	<input checked="" type="checkbox"/>	Ypos	\$7	Float	arcsec	Y coordinate (arcsec)
8	<input checked="" type="checkbox"/>	Star	\$8	Short		Name of the stars (if variable) in the 3rd Sawyer-Hogg catalog (197
9	<input checked="" type="checkbox"/>	n_Star	\$9	Short		[0-1] 0: constant stars, 1: variable stars
10	<input checked="" type="checkbox"/>	B-V	\$10	Float		

# HR図のプロット

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List  
1: J\_A+A\_320\_757\_tables

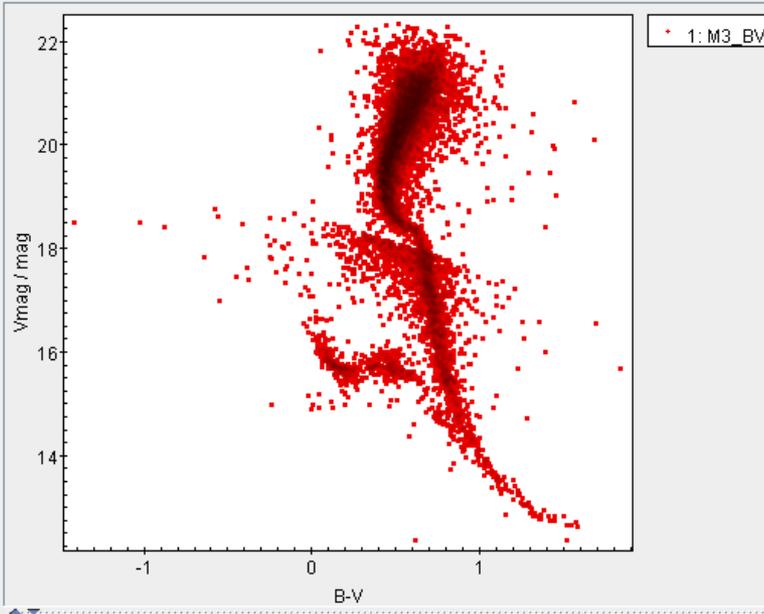
Current Table Properties  
Label: J\_A+A\_320\_757\_tables  
Location: J\_A+A\_320\_757\_tables  
Name: J/A+A/320/757/tables  
Rows: 20,191 (12,212 apparent)  
Columns: 10  
Sort Order:    
Row Subset: M3\_BV  
Activation Action: (no action)  Broadcast Row

SAMP  
Messages:  Clients: 

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Plane Plot

Window Layers Subsets Plot Export Help



Vmag / mag

B-V

1: M3\_BV

Frame

Axes

Legend

Table: 1: J\_A+A\_320\_757\_tables

X: B-V

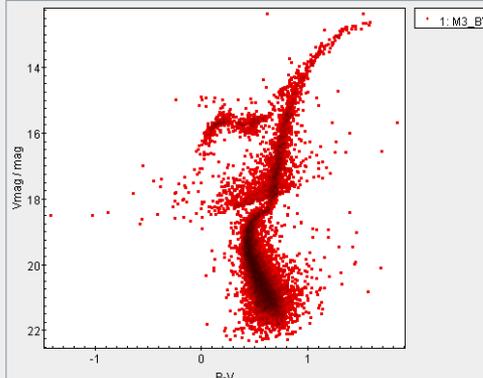
Y: Vmag

Position: Count: 12,212 / 20,191

Select Pan X/Y Stretch X/Y Frame X/Y Zoom Iso

Plane Plot

Window Layers Subsets Plot Export Help



Vmag / mag

B-V

1: M3\_BV

Frame

Coords Navigation Range Grid Labels Font

Axes

X Log:

Y Log:

X Flip:

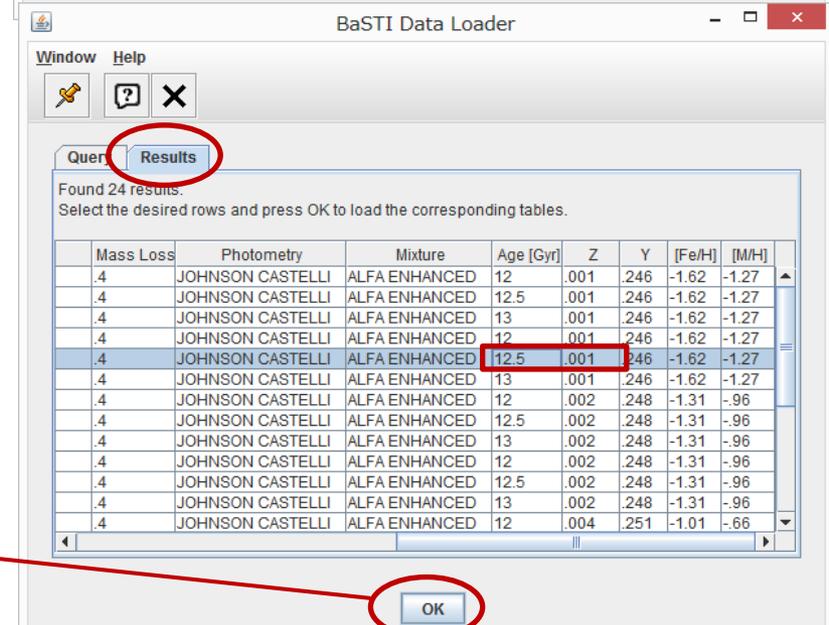
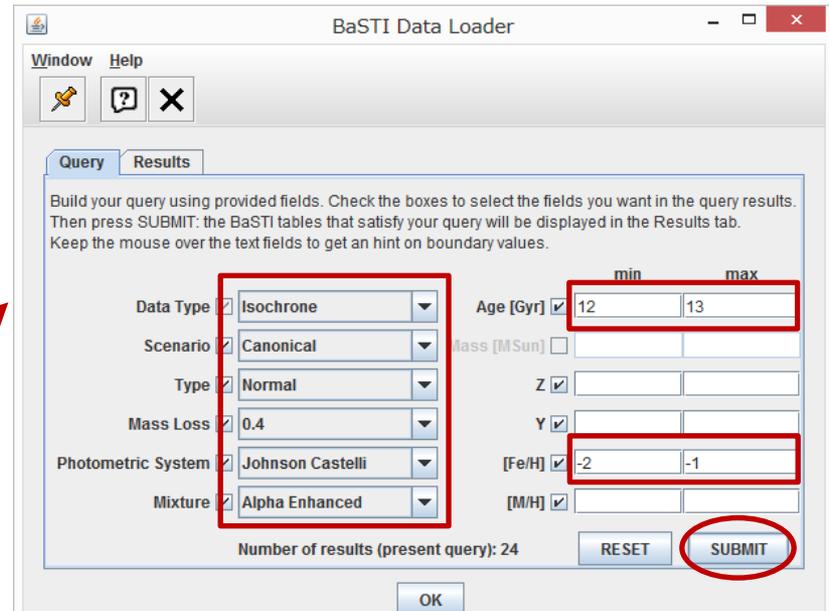
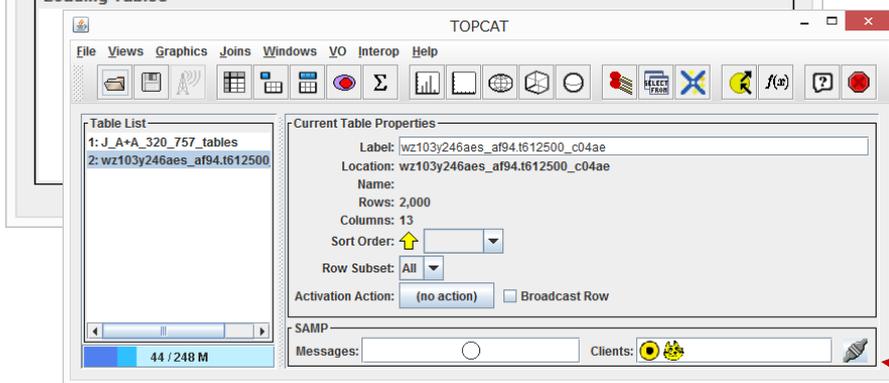
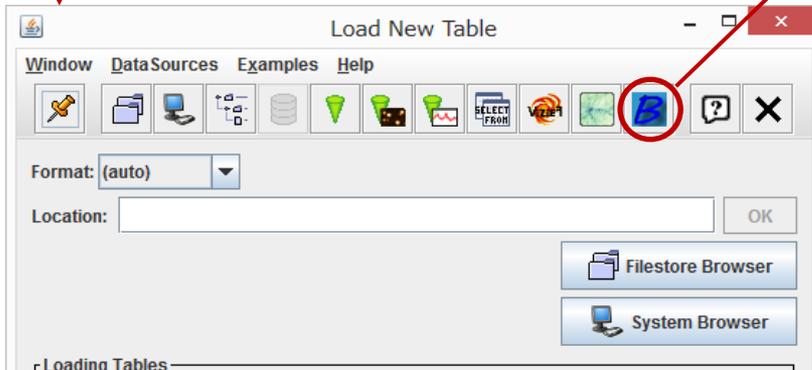
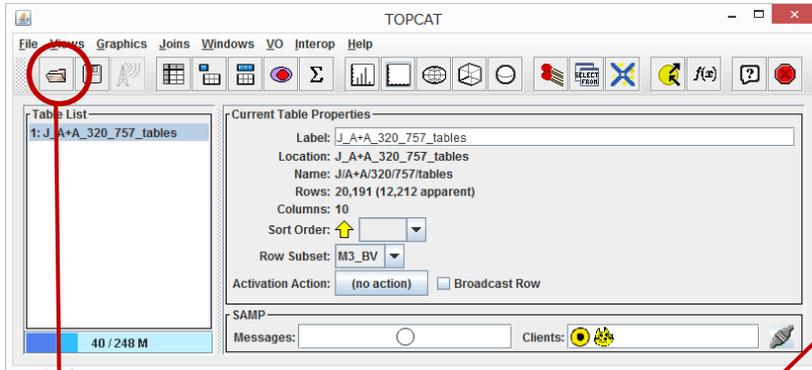
Y Flip:

Aspect Lock:

Position: Count: 12,212 / 20,191

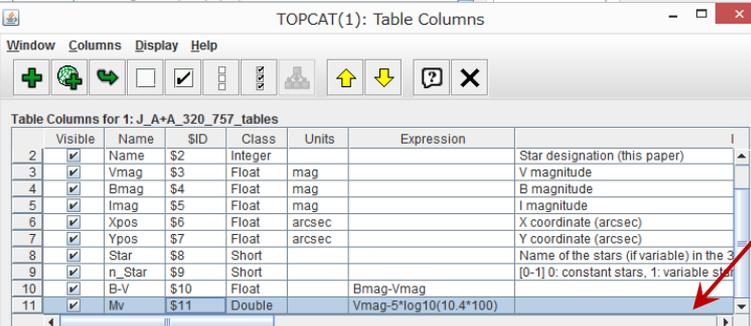
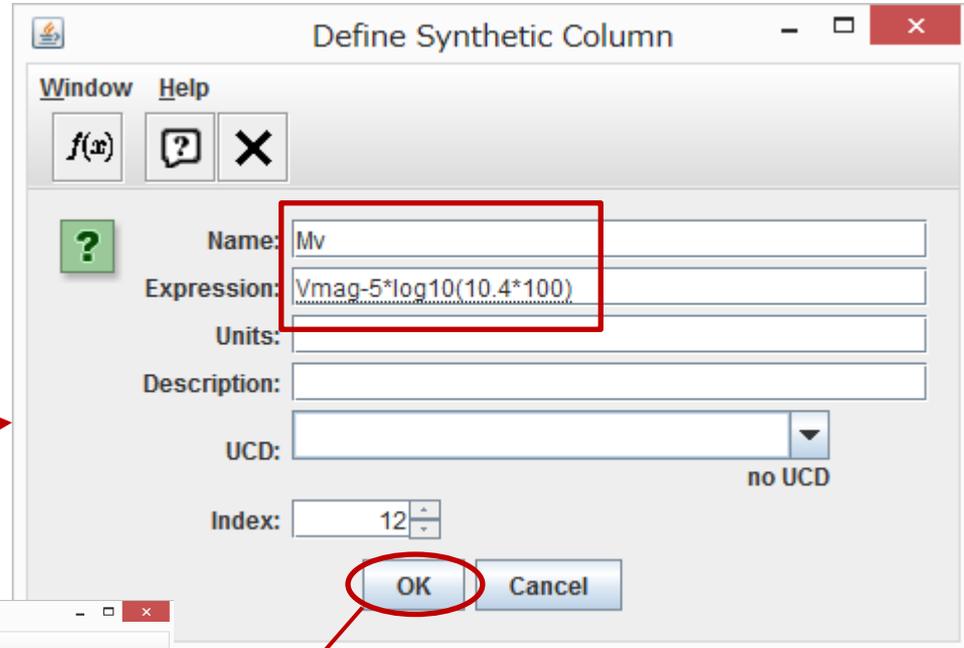
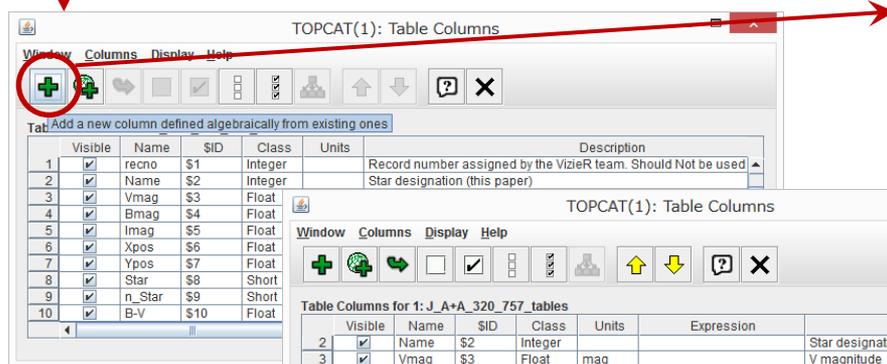
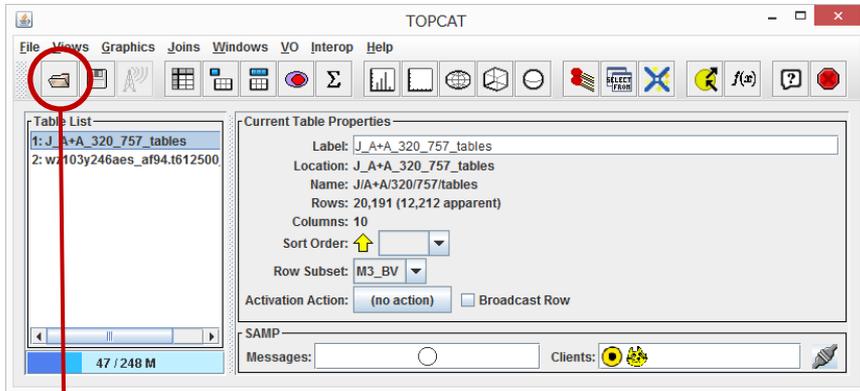
Select Pan X/Y Stretch X/Y Frame X/Y Zoom Iso

# 理論モデル曲線を取得

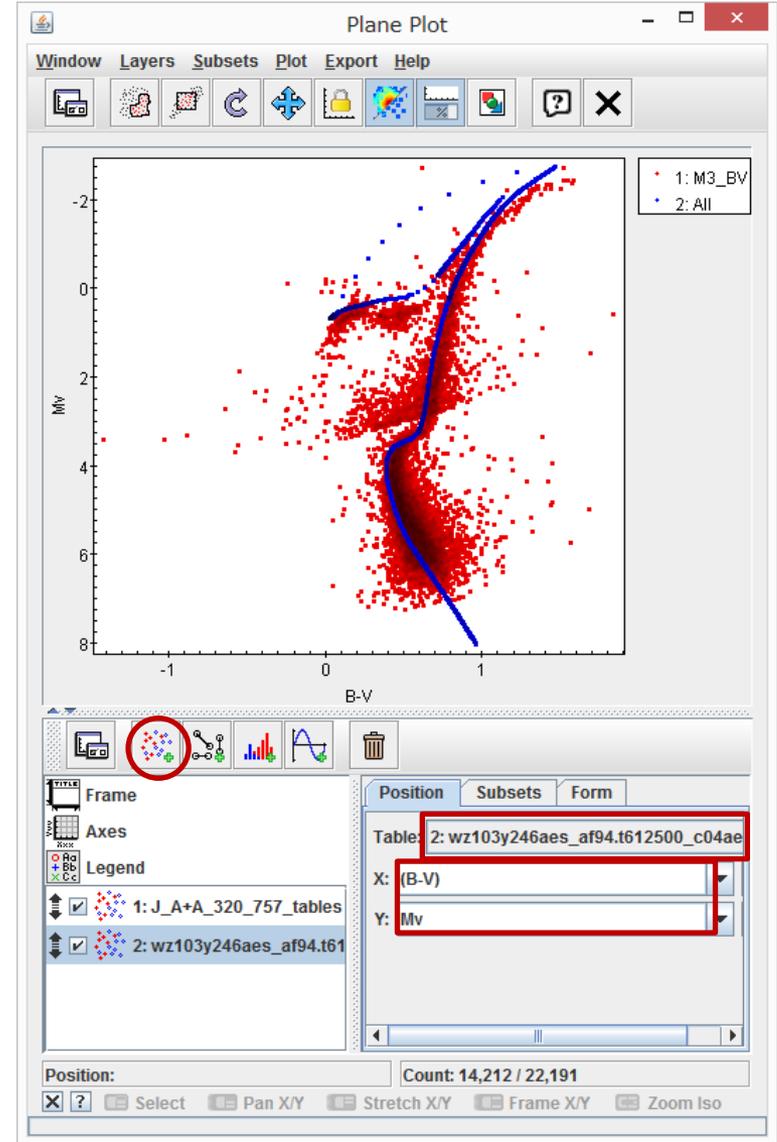
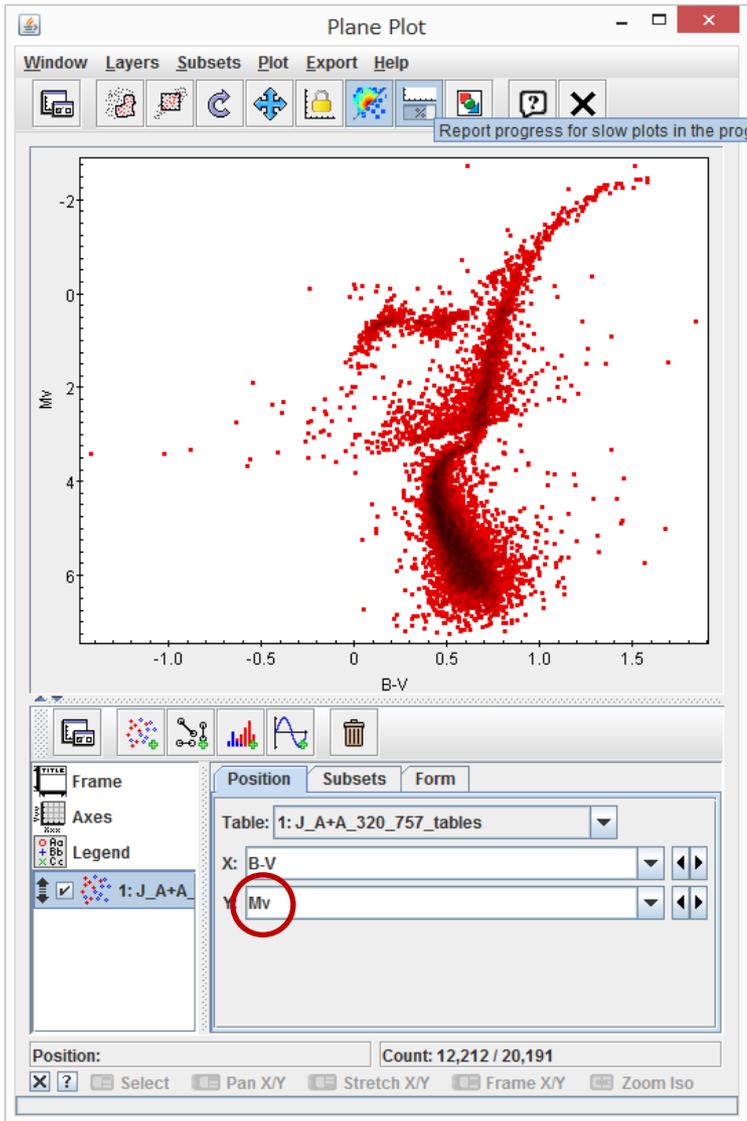


# 絶対等級カラムを追加

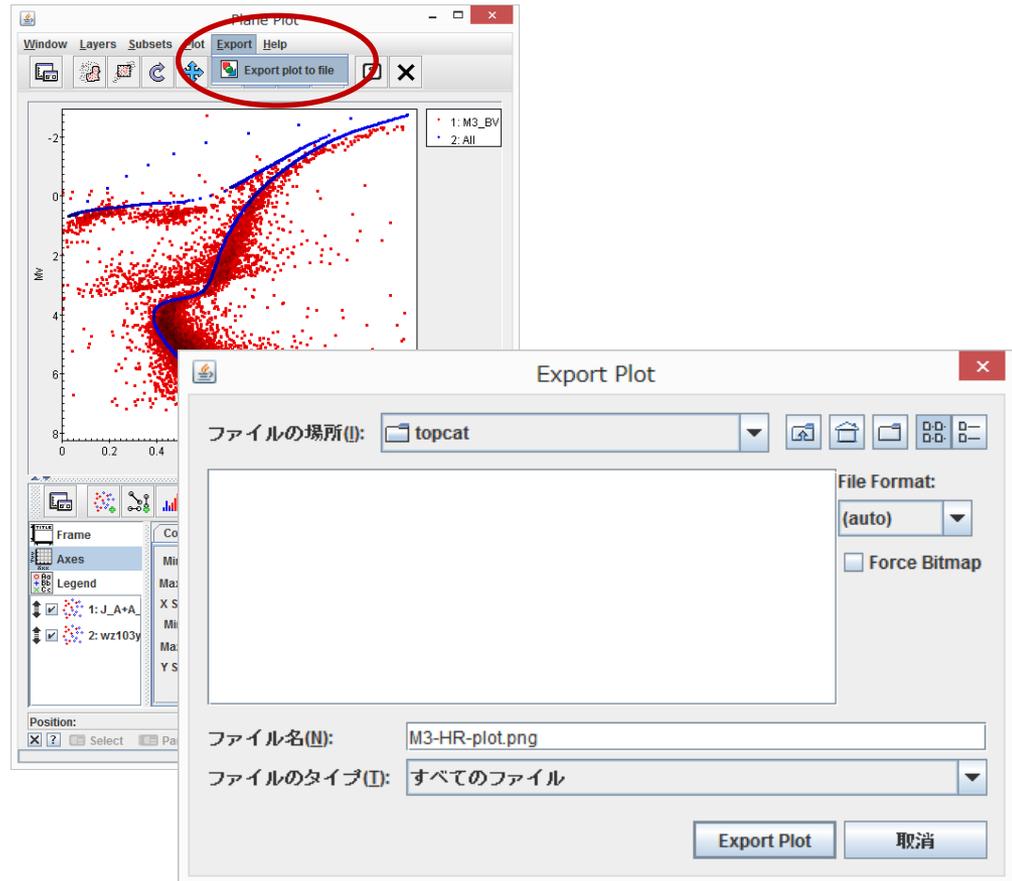
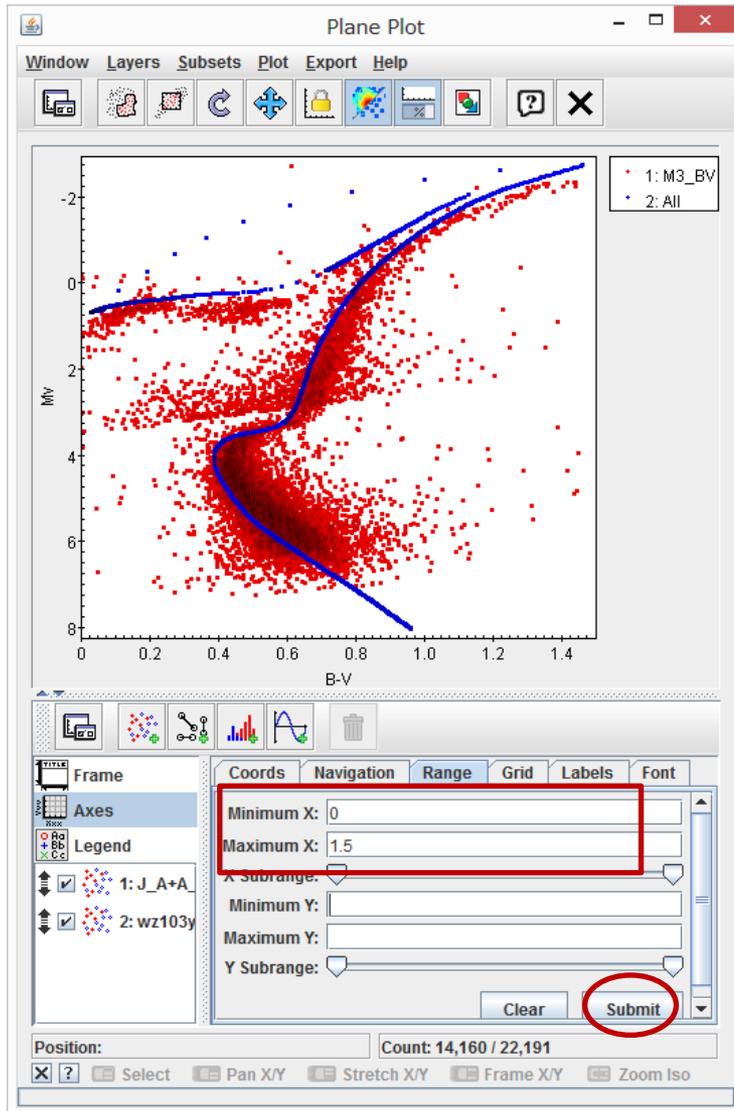
- 最初に取得した M3 カタログのサブセットテーブルに絶対等級カラムを追加します。



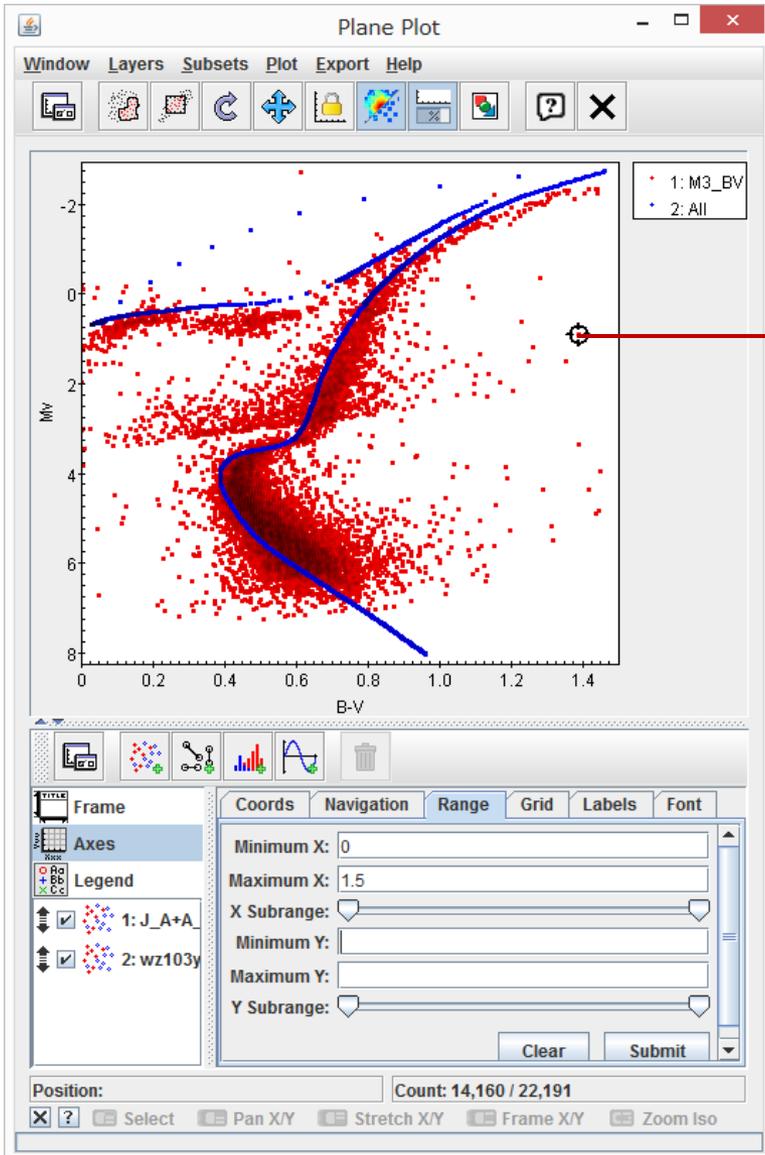
# 理論曲線をオーバープロット



# プロット範囲指定と画像の保存



# プロットとテーブルデータの対応

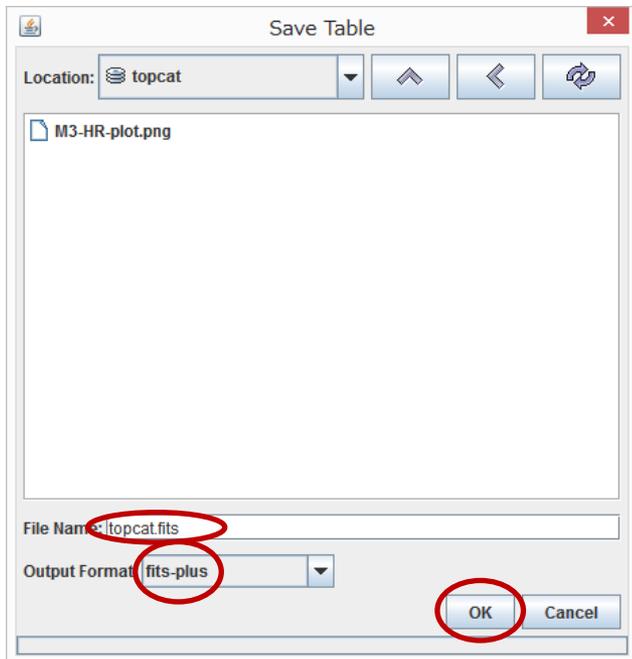
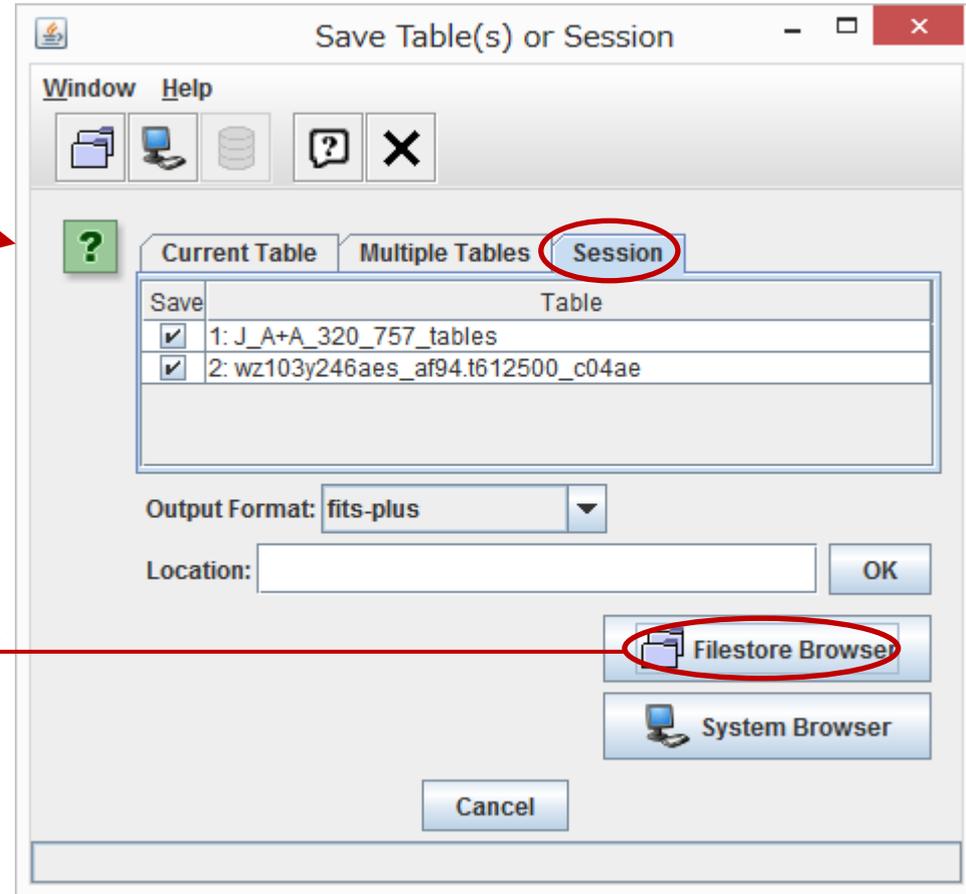
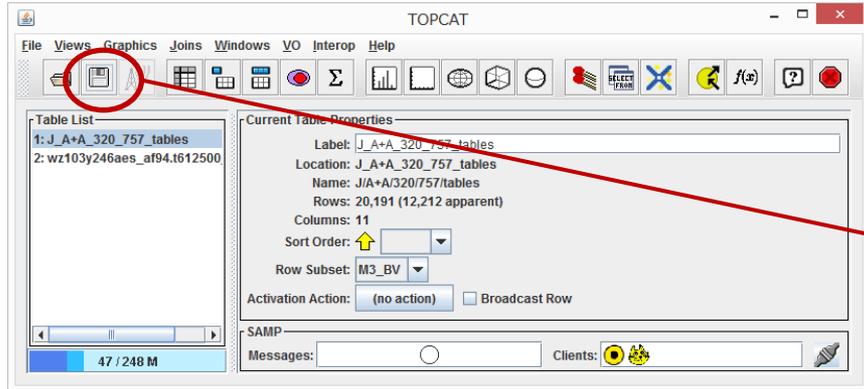


The TOPCAT(1): Table Browser window displays a table of stellar data for the J\_A+A\_320\_757 tables. The table has columns for Name, Vmag, Bmag, Imag, Xpos, Ypos, Star, n\_Star, and B-V. A red arrow points from the highlighted point in the Plane Plot to the corresponding row in the table.

Name	Vmag	Bmag	Imag	Xpos	Ypos	Star	n_Star	B-V
12719	18.706	18.181	0.	-927.	38.	0	0	0.475
12720	20.411	20.988	0.	347.	38.	0	0	0.577002
12723	17.646	18.291	16.86	41.	38.1	0	0	0.645
12724	16.718	17.448	15.851	37.8	38.1	0	0	0.73
12725	15.814	16.566	14.873	-15.3	38.1	0	0	0.752
12726	16.462	17.153	15.564	101.1	38.1	0	0	0.691
12731	16.059	16.944	15.129	-7.7	38.2	0	0	0.885
12737	15.011	15.876	13.999	13.3	38.4	0	0	0.865001
12739	15.985	17.374	15.319	-26.9	38.4	0	0	1.389
12742	15.923	16.375	15.262	-27.	38.4	135	1	0.452
12743	16.592	17.352	15.705	30.3	38.5	0	0	0.76
12748	17.866	18.54	17.116	63.8	38.5	0	0	0.674002
12749	17.213	17.719	16.379	-45.8	38.6	0	0	0.506001
12754	17.532	18.328	16.681	25.1	38.7	0	0	0.796
12755	15.348	16.188	14.362	42.7	38.7	0	0	0.85
12760	17.356	17.996	16.555	107.3	38.8	0	0	0.639999
12768	17.464	18.127	16.61	-123.1	38.9	0	0	0.663

# セッションの保存

- サブセットの定義や追加されたカラムなどすべての操作結果を保存



# 使用例2

X線カタログと可視光カタログのクロスマッチ

# XMM AGN Catalog のデータを取得

The image shows a workflow in two software applications: TOPCAT and Cone Search.

**TOPCAT (Left):** The 'Load New Table' dialog is open. The 'Format' is set to '(auto)'. The 'Location' field is empty. The 'Filestore Browser' and 'System Browser' buttons are visible. The 'Table List' on the left shows the current tables: 1: J\_A+A\_320\_757\_tables, 2: wz103y246aes\_af94.t612500.

**Cone Search (Right):** The 'Available Cone Services' dialog is open. The 'Registry' is set to 'http://reg.g-vo.org/tap'. The 'Keywords' field contains 'XMM AGN'. The 'Match Fields' section has checkboxes for 'Short Name', 'Title', 'Subjects', 'ID', 'Publisher', and 'Description'. The 'Accept Resource Lists' checkbox is checked. The 'Submit Query' button is circled in red. Below the search criteria is a table of results:

Short Name	Title
ICNSDSSXMM	Sloan Digital Sky Survey/XMM-Newton AGN Spectral Properties Catalog
CAIXA	Catalog of AGN in the XMM-Newton Archive
JJA+A/444/73	XMM observations of Lockman Hole brightest AGNs (Mateos+, 2005)
JJA+A/457/501	XMM-Newton survey of the ELAIS-S1 field (Puccetti+, 2006)
JJA+A/471/1105	XMM-LSS at 240MHz and 610MHz (Tasse+, 2007)
JJA+A/473/105	Lockman Hole AGN variability with XMM (Mateos+, 2007)
JJA+A/474/473	XMM-LSS survey: AGN classifications (Garcat+, 2007)
JJA+A/487/119	AGN in XMM-Newton Hard Bright Survey (Della Ceca+ 2008)

The 'CAIXA' entry is highlighted with a red box. Below the table is a 'Resource Count: 30' and a 'Cone Parameters' section. The 'Cone URL' is 'http://heasarc.gsfc.nasa.gov/cgi-bin/vo/cone/coneGet.pl?table=caixa&'. The 'Object Name' field is empty. The 'RA' field is set to 170 degrees (J2000), the 'Dec' field is set to 30 degrees (J2000), and the 'Radius' field is set to 20 degrees. The 'Accept Sky Positions' checkbox is checked. The 'OK' button is circled in red.

**TOPCAT (Bottom Left):** The 'Current Table Properties' dialog is open. The 'Label' is 'CAIXA-20d', the 'Location' is 'CAIXA-20d', and the 'Name' is 'coneGet.pl?table=caixa&RA=170.0&DEC=30.0&SR=20.0'. The 'Rows' are 14 and the 'Columns' are 9. The 'Sort Order' is set to 'Ascending'. The 'Row Subset' is 'All'. The 'Activation Action' is '(no action)'. The 'SAMP' section shows 'Messages: 0' and 'Clients: 2'.

# SDSS QSO カタログのデータ取得

Cone Search

Window Columns Registry Interop Help

Available Cone Services

Registry: <http://reg.g-vo.org/tap> RegTAP

Keywords: SDSS quasar And

Match Fields:  Short Name  Title  Subjects  ID  Publisher  Description

Accept Resource Lists Cancel Query Submit Query

Short Name	Title
SDSSQSO	Sloan Digital Sky Survey QSO Catalog
SDSSUNUQSR	Sloan Digital Sky Survey Unusual Quasars Catalog
SDSSXMMQSO	Sloan Digital Sky Survey (DR5)/XMM-Newton Quasar Survey Catalog
SWSDSSQSO	Swift Simultaneous UV, Optical, and X-Ray Observed Quasar Catalog
VII/242	SDSS quasar catalog III. (Schneider+, 2005)
VII/252	SDSS-DR5 quasar catalog (Schneider+, 2007)
VII/260	The SDSS-DR7 quasar catalog (Schneider+, 2010)
VII/269	SDSS Quasar Catalog, DR9Q (Paris+, 2012)

AccessURL Description Version

<a href="http://vizier.u-strasbg.fr/viz-bin/Vo...">http://vizier.u-strasbg.fr/viz-bin/Vo...</a>		
---	--	--

Resource Count: 61

Cone Parameters

Cone URL: <http://vizier.u-strasbg.fr/viz-bin/votable/-A?-source=VII/252&>

Object Name:

RA: 170 degrees (J2000)  Accept

Dec: 30 degrees (J2000)

Radius: 20 degrees

OK

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List

- 1: J\_A+A\_320\_757\_tables
- 2: wz103y246aes\_af94.t612500
- 10: CAIXA-20d
- 11: VII\_252-20d

Current Table Properties

Label: VII\_252-20d

Location: VII\_252-20d

Name: VII/252/dr5qso

Rows: 8,335

Columns: 14

Sort Order:

Row Subset: All

Activation Action: (no action)  Broadcast Row

SAMP

Messages:

Clients:

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# 座標と redshift でクロスマッチ

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List

- 1: J\_A+A\_320\_757\_tables
- 2: wz103y246aes\_af94.t612500
- 10: CAIXA-20d
- 11: VII\_252-20d

Current Table Properties

Label: VII\_252-20d  
Location: VII\_252-20d  
Name: VII/252/dr5qso  
Rows: 8,335  
Columns: 14  
Sort Order: ↑  
Row Subset: All  
Activation Action: (no action)  Broadcast Row

SAMP

Messages:  Clients:

111 / 248 M

Match Tables

Window Tuning Help

Match Criteria

Algorithm: Sky + X  
Max Error: 2 arcsec  
Error in X: 0.02

Table 1

Table: 10: CAIXA-20d  
RA column: ra degrees  
Dec column: dec degrees  
X column: redshift

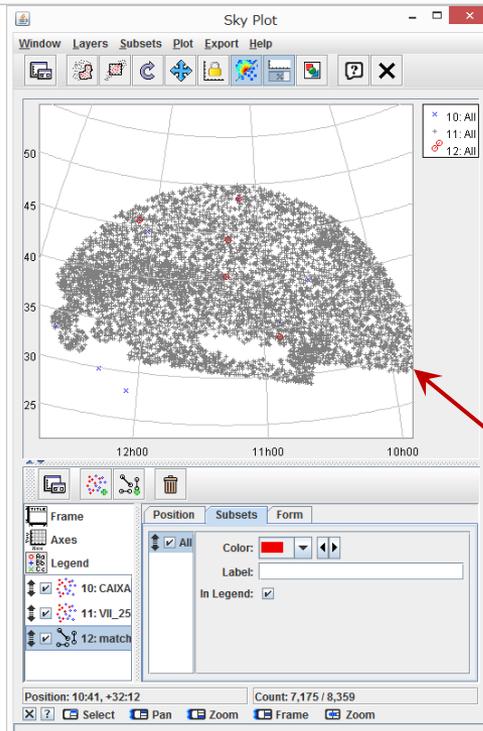
Table 2

Table: 11: VII\_252-20d  
RA column: RAJ2000 degrees  
Dec column: DEJ2000 degrees  
X column: z

Output Rows

Match Selection: Best match, symmetric  
Join Type: 1 and 2

Eliminating multiple row references...  
Elapsed time for match: 0 seconds  
Match succeeded



Successful Match

5 pairs found  
New table created by match: 12: match(10,11) (5 rows)

OK Plot Result

# マッチした天体の SDSS 画像を表示

The image shows a sequence of steps in the TOPCAT software to display SDSS images for matched objects:

- TOPCAT Main Window:** Shows the 'Current Table Properties' for 'match(10,11)'. The 'Activation Action' is initially '(no action)'. A red circle highlights this field, with an arrow pointing to the 'Set Activation Action' dialog.
- Set Activation Action Dialog:** Shows the configuration for displaying cutouts. The 'Cutout Service' is set to 'SDSS Colour Images'. The 'RA column' is 'ra' (degrees) and the 'Dec column' is 'dec' (degrees). The 'Width/Height in Pixels' is set to 100 (0.4 arcsec). The 'Display Cutout Image' radio button is selected. A red box highlights the service and column settings.
- Table Browser:** A 'Table Browser for 12: match(10,11)' window is shown. The 'RA' and 'Dec' columns are highlighted with a red box. A red circle highlights the 'Table Browser' icon in the TOPCAT toolbar, with an arrow pointing to this window.
- Window Dialog:** A small window titled 'S...' shows a preview of a galaxy image, with a red arrow pointing to it from the 'Table Browser'.
- Final TOPCAT Window:** The 'Activation Action' is now 'SDSS Colour Images(\$ra, \$dec, 100)'. A red circle highlights the 'OK' button in the 'Set Activation Action' dialog.

	name	ra	dec	_RAJ2000	_DEJ2000	hb_flux	hb_flux_error
1	PG 1048+342	182.9325	33.99056	182.9329	33.99075	1.730000E-12	6.000000E-14
2	PG 1115+407	189.82621	40.43167	189.82619	40.43167	1.120000E-12	9.000000E-14
3	PG 1114+445	189.27667	44.22592	189.27666	44.22592	2.240000E-12	6.000000E-14
4	PG 1206+459	182.24172	45.87683	182.24171	45.87682	1.700000E-13	4.000000E-14

# Aladin との連携

The image displays the Aladin v8.0 interface with three overlapping windows illustrating data integration:

- TOPCAT Window:** Shows a table list with '12: match(10,11)' highlighted in red. A red circle highlights the 'Joins' menu item in the toolbar.
- Aladin v8.0 (Top):** Shows the 'Location' field set to '11:16:52.88 +44:12:27.5' and the '2MASS' catalog selected in the toolbar. A red circle highlights the '2MASS' catalog name.
- Aladin v8.0 (Bottom):** Shows a zoomed-in view of a star field with a red crosshair. A red arrow points from the 'cross' tool in the toolbar to the crosshair. Another red arrow points from the '2MASS colored' catalog in the toolbar to the star field.

The Aladin interface includes a toolbar with tools like 'select', 'pan', 'list', 'phot', 'draw', 'tag', 'filter', 'cross', 'epoch', 'size', 'opac.', 'zoom', 'crop', 'cont', 'pixel', 'prop', and 'del'. The status bar at the bottom shows '0 sel / 5 src 24fps / 86Mb' and '©2014 UDS/CNRS - by CDS - Distributed under GNU GPL v3'.