

VOPLOT utility tutorial

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The VOPLOT utility allows one to extract the information contained in catalogues and tables by plotting 2D diagrams for which the axis may contain either the available columns or column combinations. The tool is also able to select subsets in the original dataset. We propose here two examples that show some functionalities of the current version of VOPLOT.

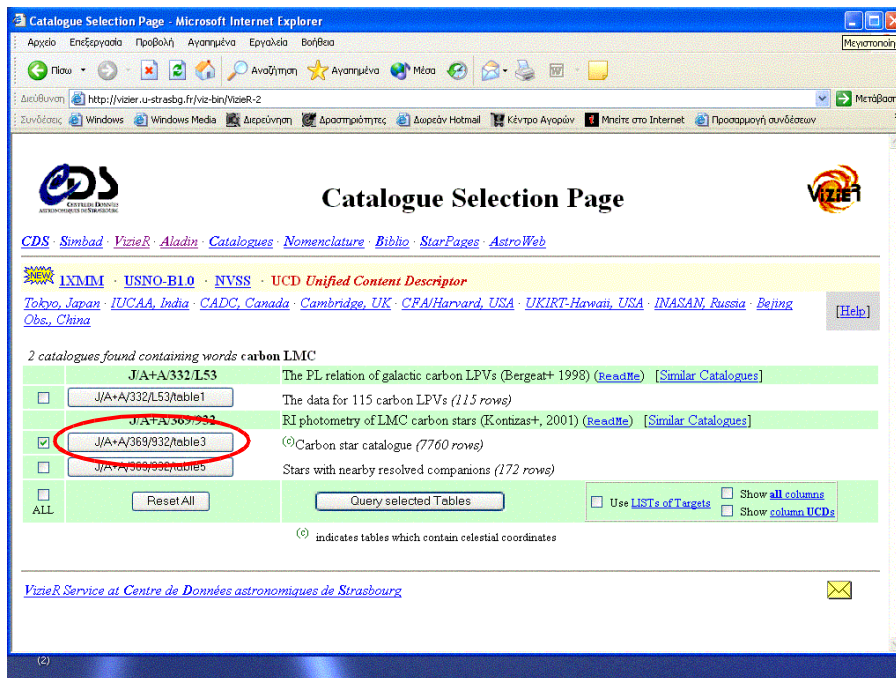
In the first example we present an analysis of the spatial distribution of carbon stars in the Large Magellanic Cloud (LMC) according to their luminosity. We relate the results to the age and mass of the stars and show that the youngest objects are located in the center of the galaxy. The second example focuses on a galactic globular cluster and concludes on the mass segregation that dynamically put the more massive objects at the center of the cluster.

I. Carbon stars in the Large Magellanic Cloud.

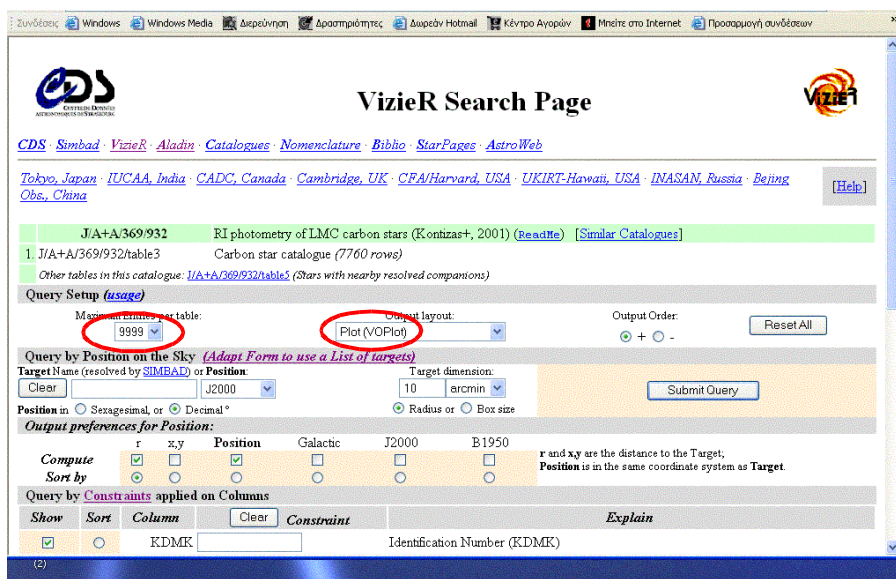
- 1) go to the vizier webpage.
write "carbon LMC" in the second box.
click on the button "Find Catalogues".

The screenshot shows the VizieR Service web interface. At the top, there are logos for CDS (Centre de Données astronomiques de Strasbourg) and VizieR. Below the logos, there are navigation links: CDS · Simbad · VizieR · Aladin · Catalogues · Nomenclature · Biblio · StarPages · AstroWeb. A yellow banner contains links for 1XMM · USNO-B1.0 · NVSS · UCD Unified Content Descriptor. Below this, there are links for Browsing through Catalogues · Output Preferences · FAQ · More about VizieR. The main search area is titled "Direct access to Catalogues from Name or Designation (tips and examples)". It features a search box with the text "carbon LMC" and a "Find Catalogue" button. Below the search box, there is a section titled "Find catalogues or Data (tips and examples)" with the text "Find catalogues among 3831 available". A red circle highlights the search box and the "Find Catalogues" button. Below the search box, there is a section titled "Words matching author's name, word(s) from title, description, etc." with the text "carbon LMC". Below this, there is a section titled "Select from Wavelength, Mission, and controlled Astronomical keywords:" with three columns of keywords. Below the keywords, there is a section titled "Target Name (resolved by SIMBAD) or Position:" with a text box and a "J2000" dropdown menu. Below this, there is a section titled "Target radius:" with a text box containing "10" and an "arcmin" dropdown menu. Below the radius section, there are radio buttons for "Radius" and "Box size". At the bottom right, there is a "Find Data around Target" button.

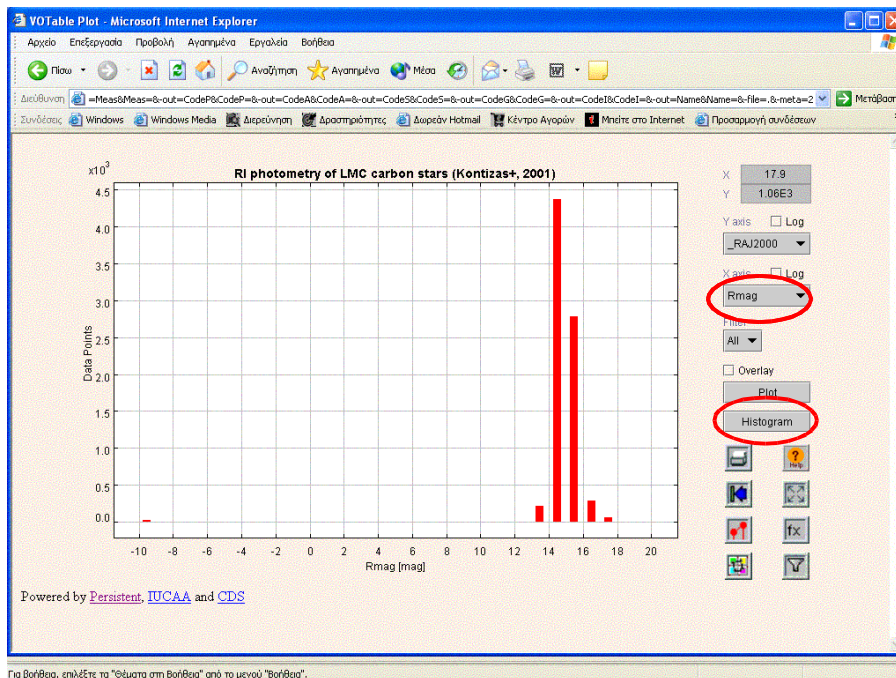
- 2) click on "Carbon star catalogue (7760 rows)".



- 3) select "9999" rows in the "maximum entry" menu and the "Plot (VOPlot)" output in the "output layout" menu (at the bottom of the list).
submit the query.



- 4) The plot utility appears, the selected catalogue is loaded.
Have a look at the available columns in the X and Y axis menus (you may have to increase the window size to see the buttons on the right).
- 5) choose "Rmag" for the X axis and press the button "Histogram".
It displays the Rmag histogram.



Based on the histogram distribution, we can create filters to analyse the distribution of a specific range of magnitude.


6) click on the filter button .

- fill the data subset name box with "R<14".
- fill the expression box with "\$6<14".
- press "Ok".

The screenshot shows a "Create new data subsets" dialog box (Java Applet Window) overlaid on a plot. The dialog has a table with columns "Column Id", "Column Name", and "Expression". The table lists various columns like _RAJ2000, _DEJ2000, KDMK, RA2000, DE2000, Rmag, R-I, CodeP, CodeA, and CodeS. Below the table, there are two input fields: "Enter data subset name:" with the value "R < 14" and "Enter expression:" with the value "\$6 < 14". Both input fields are circled in red. At the bottom of the dialog, there are "OK", "Cancel", and "Help" buttons. The "OK" button is circled in red. To the right of the dialog, there are several control buttons, including a "Filter" dropdown set to "All", a "Histogram" button, and a "Filter" button (circled in red).

This filter selects the brightest objects in the sample. Since the distance is the same


for all sources (the LMC distance), it selects the more massive stars.

7) create a second filter by clicking again on the filter button  .

fill the data subset name box with "14<R<15".

fill the expression box with "\$6>14 && \$6<15".

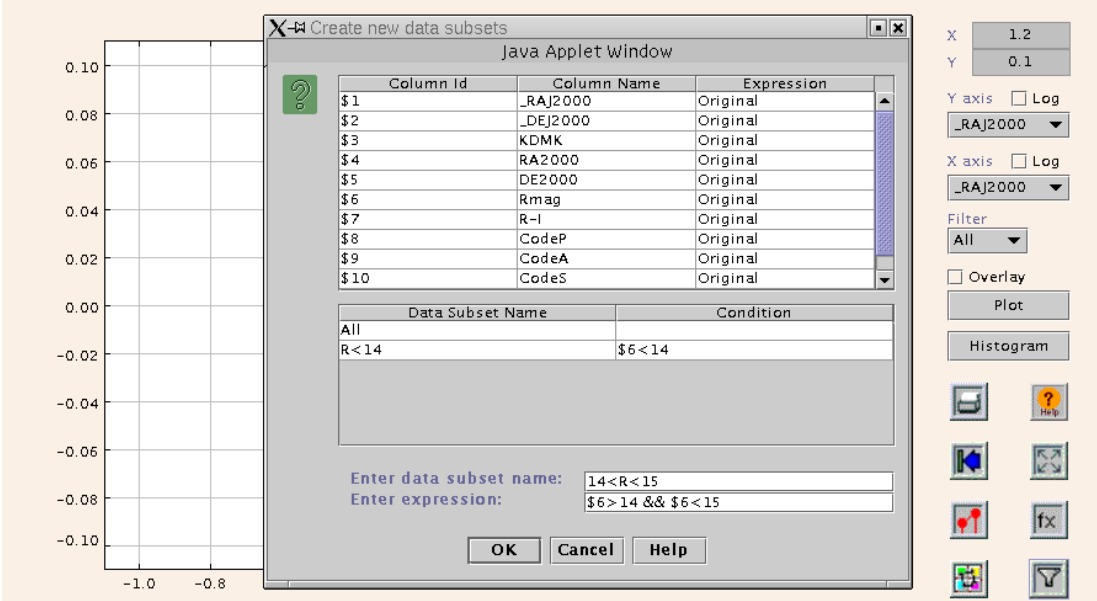
press "Ok".

create a third filter by clicking again on the filter button  .

fill the data subset name box with "R>15".

fill the expression box with "\$6>15".

press "Ok".



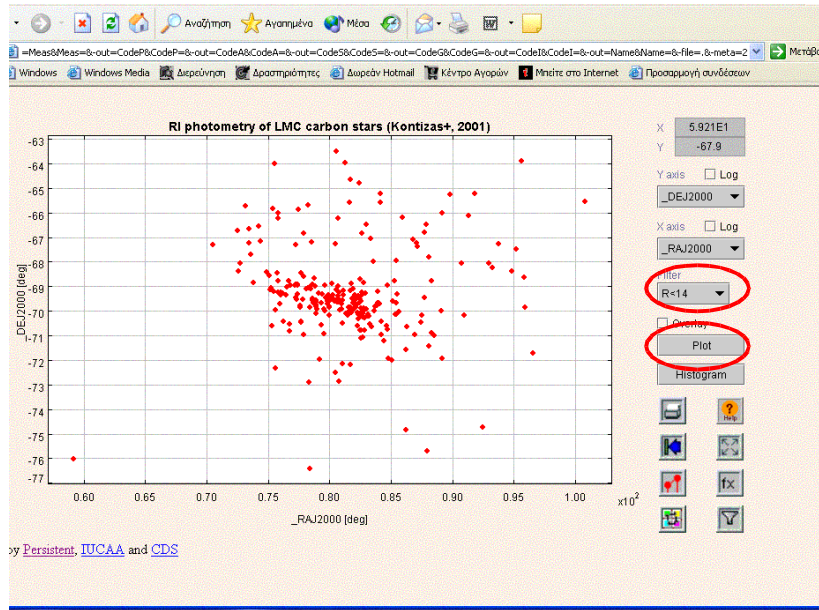
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We create two additional filters for the intermediate and the faint luminosity ranges.

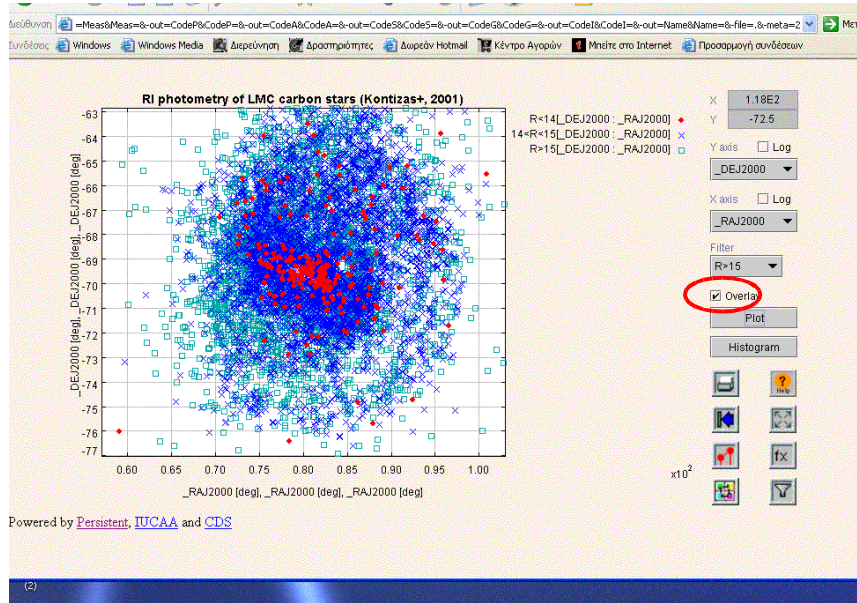
8) choose DEJ2000 for Y axis and RAJ2000 for the X axis.

choose R<14 in the filter menu.

press "Plot".



- 9) choose the filter " $14 < R < 15$ ".
- check the "overlay" box, then click on "Plot".
- choose the filter " $R > 15$ ", then click on "Plot".



The resulting plot shows the carbon star distribution in the LMC for different luminosity ranges. Carbon stars brighter than 14 in R are roughly about 3 to 4 solar masses and objects fainter than 15 are about 1 solar mass. The more massive stars are in the center where the recent star formation occurred. Their distribution matches the star cluster system of the LMC.

II. Mass segregation in the M3 globular cluster.

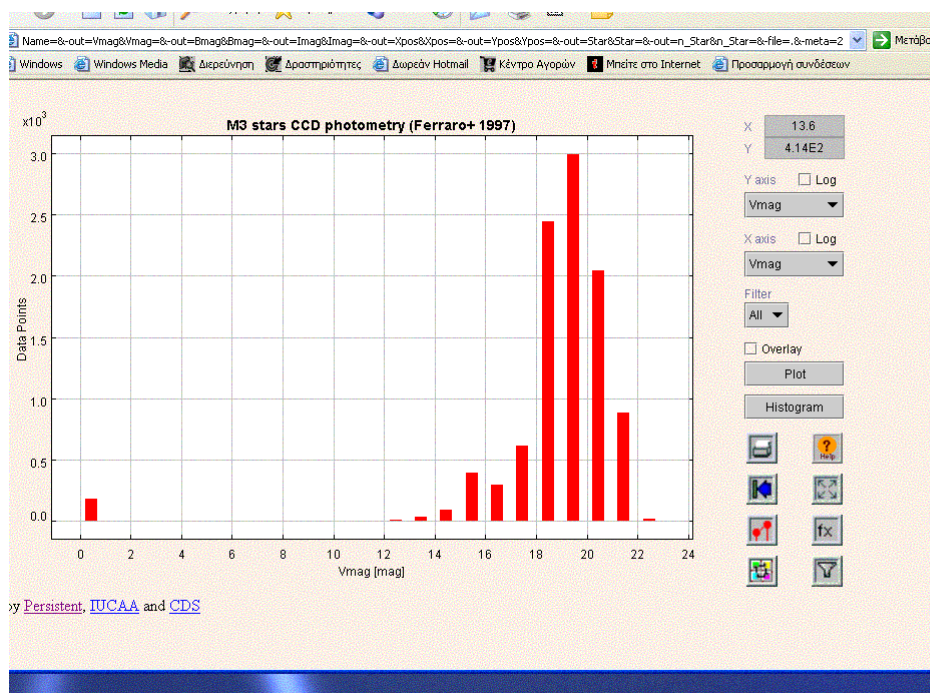
- 1) In vizier write “Ferraro” in the second box add click on “Find Catalogues”.
Choose the catalogue “J/A+A/320/757” about M3 stars CCD photometry.
Select “9999” in the “Maximum catalogue entry” menu
Select “Plot (VOPLLOT)” in the “output layout” menu
Submit the query

Maximum Entries per table: 9999
Output layout: Plot (VOPlot)
Output Order: + -


Query by Constraints applied on Columns

Show	Sort	Column	Constraint	Explain
<input type="checkbox"/>	<input type="radio"/>	Name		Star designation (this paper)
<input checked="" type="checkbox"/>	<input type="radio"/>	Vmag	mag	V magnitude
<input checked="" type="checkbox"/>	<input type="radio"/>	Bmag	mag	B magnitude
<input checked="" type="checkbox"/>	<input type="radio"/>	Imag	mag	I magnitude
<input checked="" type="checkbox"/>	<input type="radio"/>	Xpos	arcsec	X coordinate (arcsec)
<input checked="" type="checkbox"/>	<input type="radio"/>	Ypos	arcsec	Y coordinate (arcsec)
<input checked="" type="checkbox"/>	<input type="radio"/>	Star		Name of the stars (if variable) in the 3rd Sawyer-Hogg catalog (1973PDDO...3...6S)
<input checked="" type="checkbox"/>	<input type="radio"/>	n_Star		[0-1] 0: constant stars, 1: variable stars

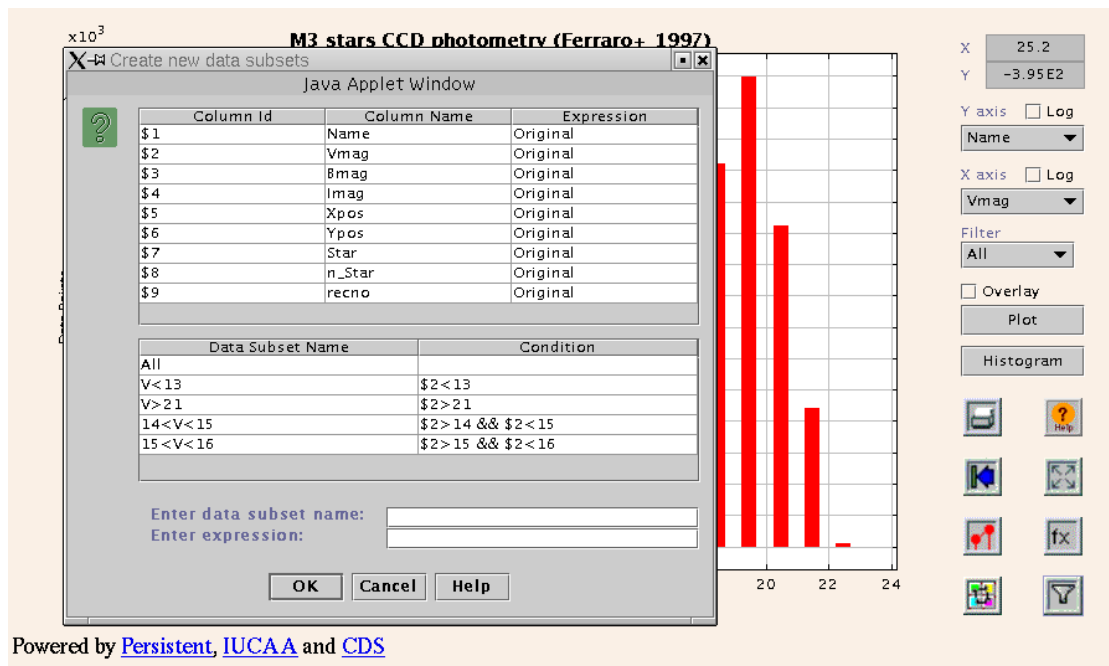
- 2) Select Vmag in the X axis menu, click on “Histogram”



Magnitudes go from 12 to 23 at V. We can now select different luminosity ranges and study the spatial distribution of the corresponding objects.

3) Create the following filters (using ):

<i>data subset name:</i>	<i>expression:</i>
V<13	\$2<13
V>21	\$2>21
14<V<15	\$2>14 && \$2<15
15<V<16	\$2>15 && \$2<16



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4) Select Ypos and Xpos in the Y axis and X axis menu, respectively.

Select the V<13 filter and “Plot”


Click on “Overlay”


Select the 14<V<15 filter and “Plot”

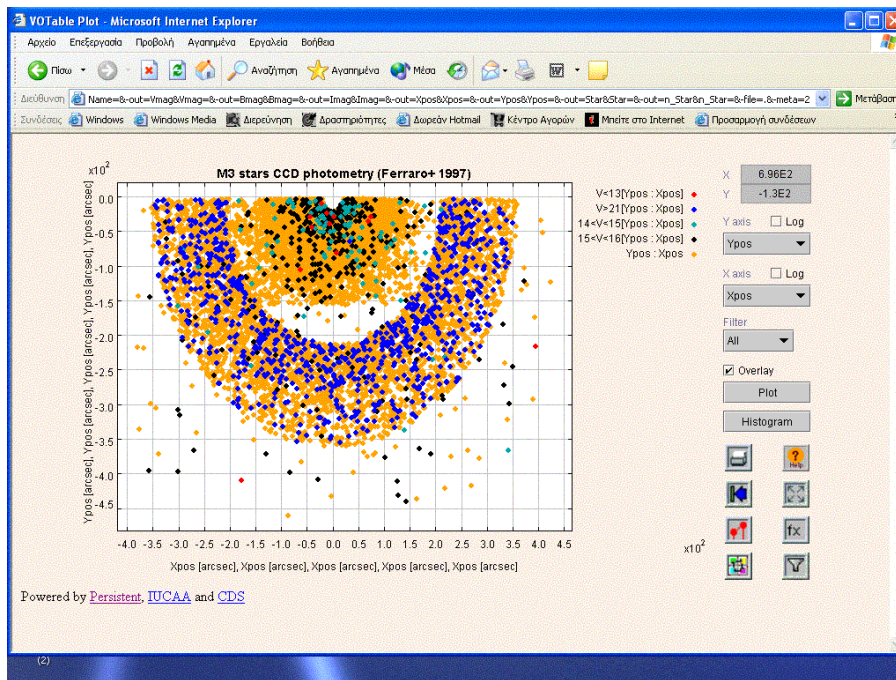
Select the 15<V<16 filter and “Plot”

Select the V>21 filter and “Plot”

Select the “All” filter and “Plot”

5) Click on the “Show full data range” button. 

6) For a better visibility you can try the “Format of the plot” button  and select “dot”.



The outer corona is only selection effect due to two different exposure times in order to achieve better resolution in the central crowded areas. However it is evident that the brightest stars (and consequently the most massive) are centrally segregated. Given the old age of M3, this mass segregation is due to dynamical evolution of the cluster.