



HFFexplorer User Guide

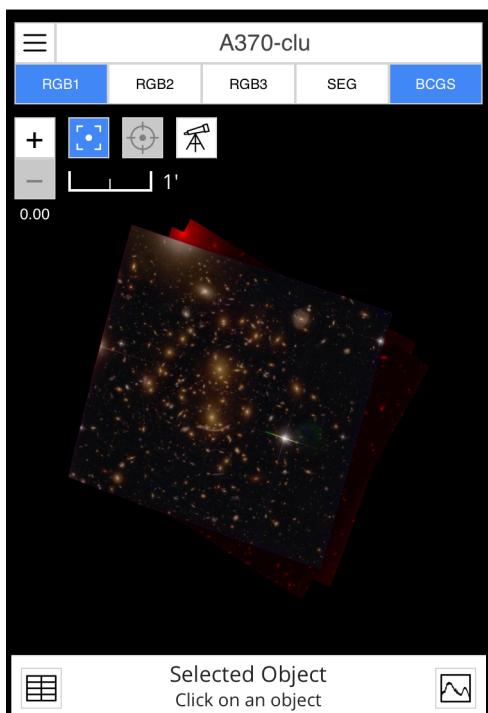
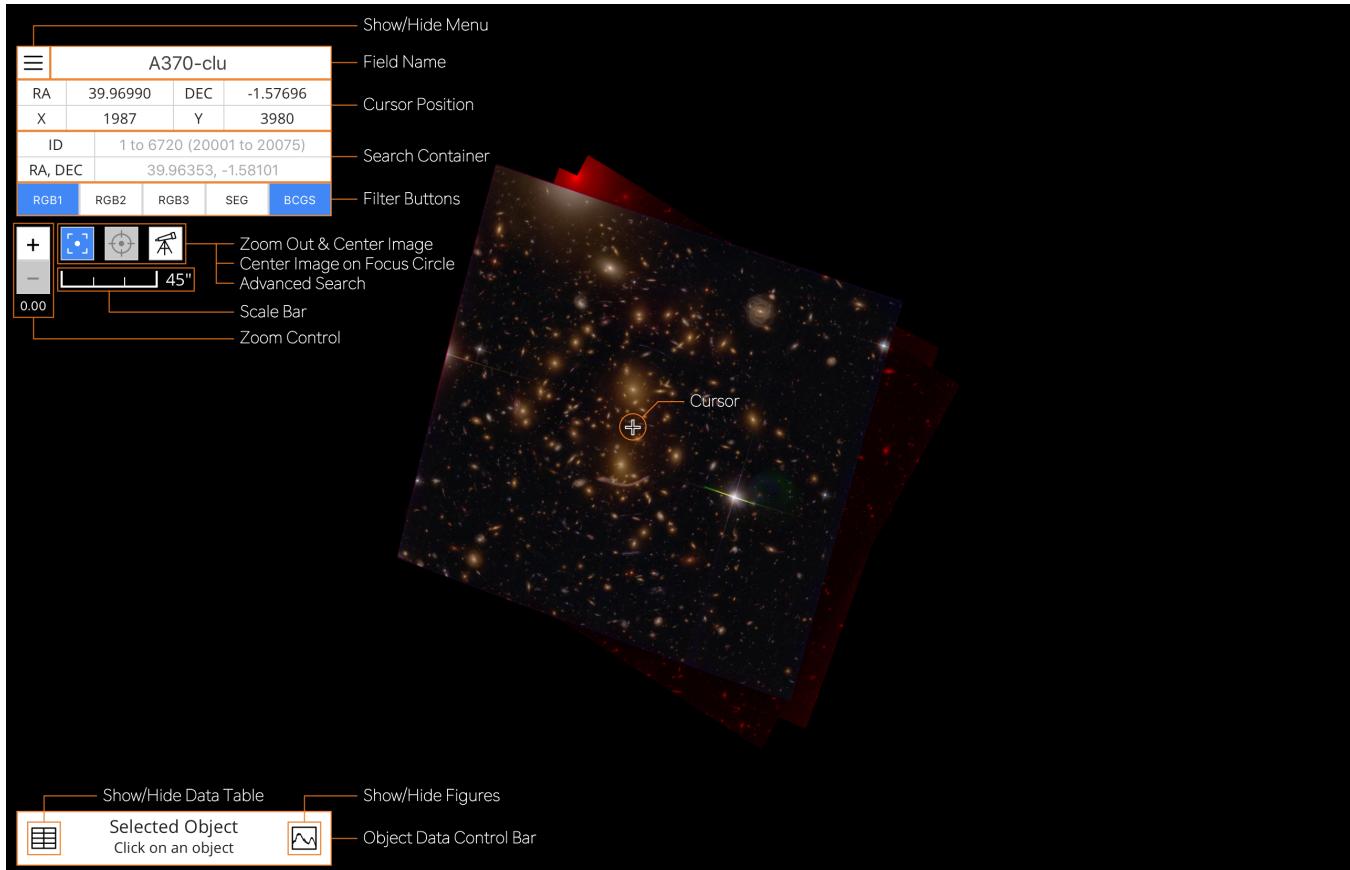
Daniel Lange Vagle • Tufts University • Medford MA 02155 • USA

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Map Layout

Below is the default HFFexplorer desktop layout (screenshot taken on late 2013 13" MacBook Pro using Safari Version 12.1.1). Layouts on other browsers may differ slightly but overall functionality should remain the same. I recommend using Safari, Chrome, or Firefox.



In the layout above, important containers, buttons, and map features have been labeled for reference.

To the left is the default HFFexplorer layout for mobile devices (screenshot taken on iPhone 6s using Safari 12). This layout removes the cursor, cursor position, and search container.

Refer to the [Menu → Settings → Map](#) section to learn how to show the search container in this layout.

Occasionally, images may not load completely on older devices (due to limited RAM) or with a slow internet connection. I've found that zooming in a bit or reloading the page a couple of times usually fixes this issue.

Map Actions

- **Zoom:** The action that changes the scale of the map. Zoom level must be between 0 and 5.
 - **For all web apps:**
 - Click the + or - buttons on the Zoom Control to zoom in or out.
 - Click on the number below the Zoom Control and enter a zoom level. You can also press the **Z** key on the keyboard to quickly focus on this number.
 - **For desktop:**
 - Use the + or - keys on the keyboard to zoom in or out.
 - Scroll/pinch using your mouse or trackpad to zoom in or out.
 - **For mobile:**
 - Pinch the screen to zoom in and out.
- **Pan/Drag:** The action of panning/dragging the map while keeping it at the same scale.
 - **For desktop:**
 - Click and hold your mouse or trackpad, then drag the map by moving your mouse or finger. Release to stop panning. If enabled on your MacBook, a three finger touch on the trackpad can act as a click, allowing for quick one-handed control.
 - You can also use the arrow keys on the keyboard to pan.
 - **For mobile:**
 - Use one finger to pan/drag the map. You may zoom and pan at the same time by doing a pinch motion while moving both fingers.
- **Single Click:** Clicking on the map without panning will place a focus circle on the map. If you click on an object, the focus circle will move to the center of that object.
- **Double Click (on an object):** Clicking on an object twice in a row will center the image on that object. This produces the same affect as clicking on an object and then clicking the Center Image on Focus Circle button.

Field Name

Located in the top left corner of the map, next to the Menu button, the Field Name displays the name of the field currently loaded in HFFexplorer. To load a new field, click on the Field Name and enter one of the following Frontier Fields names: **A2744-clu**, **A2744-par**, **M0416-clu**, **M0416-par**, **M0717-clu**, **M0717-par**, **M1149-clu**, **M1149-par**, **A370-clu**, **A370-par**, **A1063-clu**, or **A1063-par**. When changing fields, all of the [Settings](#) and some of the [Advanced Searches](#) will carry over to the new field. See these sections for more details.

Cursor Position

Located in the top left corner of the map, under the Field Name, the Cursor Position shows the RA, DEC and X, Y coordinates of the cursor. The cursor position is unavailable in mobile web apps.

Search Container

ID	1 to 6720 (20001 to 20075)
RA, DEC	39.97430, -1.55765

Located in the top left corner of the map, under the Field Name and Cursor Position, the Search Container contains object ID and RA, DEC search entry fields. By default, this container is hidden in mobile web apps. To show/hide this container, refer to the [Menu → Settings → Map](#) section.

- **Object ID Search:** Enter a target object ID in the object ID entry field. The map will pan to this object and the focus circle will move to its center. The RA, DEC search entry field will be updated with the RA, DEC of this object.
- **RA, DEC Search:** Enter a target RA, DEC coordinate (separated by a space or comma) in the RA, DEC entry field. The map will pan to the submitted RA, DEC coordinate and the focus circle will center on that location. If an object is located at the given coordinate, the focus circle will move to its center and the object ID and RA, DEC search entry fields will be updated with its information.

Filter Buttons

RGB1	RGB2	RGB3	SEG	BCGS
------	------	------	-----	------

Clicking the filter buttons will change the displayed image on the map. There are three colored images, RGB1, RGB2, and RGB3, and a segmentation map SEG. For each of the colored images, there is an option to add or remove the modeled galaxies, BCGS. The filter currently in view on the map will have a blue button.

- **RGB1:** Click this filter button to view an optical false color image made from the following bands: F814W, F606W, F435W. For desktop users, pressing the **1** key on the keyboard will give a *quick view* of this image.
- **RGB2:** Click this filter button to view a NIR false color image made from the following bands: F160W, F125W, F814W. For desktop users, pressing the **2** key on the keyboard will give a *quick view* of this image.
- **RGB3:** Click this filter button to view a NIR false color image made from the following bands: Ks (smoothed), F105W + F125W, F814W. For desktop users, pressing the **3** key on the keyboard will give a *quick view* of this image.
- **SEG:** Click this filter button to view the segmentation map. The segmentation map can be used to distinguish objects and determine an objects associated pixels. For desktop users, pressing the **4** key on the keyboard will give a *quick view* of the segmentation map.
- **BCGS:** Click this filter button to add or remove the modeled galaxies from the current color image. When viewing the segmentation map, the BCGS button will be disabled. For desktop users, pressing the **5** key on the keyboard will give a *quick view* of the current color image with or without the modeled galaxies.

Map Buttons

HFFexplorer has 3 map buttons located to the right of the Zoom Control.

-  **Zoom Out & Center Image:** Click this button to set the zoom level to 0 and center the image. You can also click the **0** key on the keyboard to zoom out and center image.
-  **Center Image on Focus Circle:** Click this button to center the map on the focus circle. This button is disabled if you have not clicked on the map yet or if the focus circle is outside of the map boundaries. You can also click the **O** key on the keyboard to center the image on the focus circle.

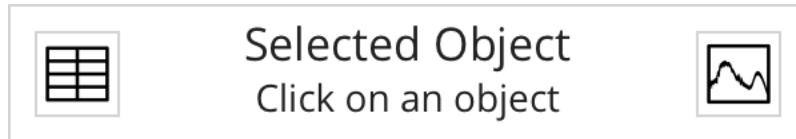
 **Advanced Search:** Click this button to open Advanced Search. If you already have one or more advanced searches that are showing on the map and that have any number of matching objects, clicking this button will cycle through the results of your advanced searches. The color of the circle that appears inside of this button will match the color of the advanced search being viewed. To cycle through the search results (matching objects) of an advanced search, click the arrow buttons that appear to the right of this button. Refer to the [Advanced Search](#) section to learn more about the Advanced Search feature.

Scale Bar



The full scale bar represents the angular distance to the right, usually given in arcseconds (") or arcminutes ('). In the scale bar above, the full scale bar represents an angular distance of 45", with the intervals between the tick marks representing angular distances of 15". The scale bar is dynamic and changes when zooming in or out of the map.

Object Data Control Bar



The object data control bar in the bottom left corner of the map contains the controls for viewing the data table and figures. When you click on an object, the *Click on an object* text will update with the object ID and act as a link to a separate object webpage.

- **Data Table:** Click the data table button to show/hide the data table. This table lists information from the publicly available HFF-DeepSpace v3.9 catalogs. To show/hide specific data table entries, refer to the [Menu → Settings → Data](#) section. If some of the data table entries are out of view, hover the cursor over the data table and scroll down as needed to view them.
- **Figures:** Click the figures button to show/hide the figures. By default, all figures (**SED**, **PFZ**, **RGB1**, **RGB2**, **RGB3**, **Detection Image**, and **Magnification Map**) are displayed. Modeled galaxies (IDs > 20000) do not have the **Detection Image** or **Magnification Map** figures. To show/hide specific figures, refer to the [Menu → Settings → Data](#) section. If some of the figures are out of view, hover the cursor over the figure container and scroll over as needed to view them. You can zoom into the figures container by clicking on any one of the figures. Once zoomed in, scroll as needed to view the other figures and click anywhere or press the **esc** key to exit.



Menu



Settings

To view settings options, select **Menu** → **Settings**. Any settings that are updated will carry over when changing fields (e.g. if the brightness is changed in one field, it will remain changed when a new field is loaded).

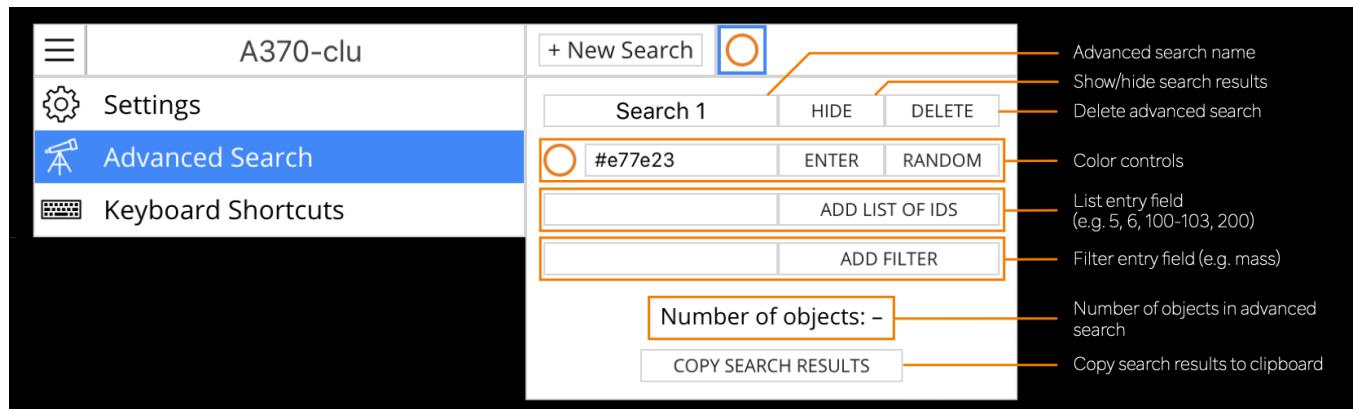
- **Map:** Customize the brightness, layout of the map, and focus circle color. To view map settings, navigate to the **Menu** → **Settings** → **Map** tab.
- **Brightness:** Adjust the slider to the right or left to increase or decrease the brightness of the image. You may also hold down the **B** key while pressing the **+** or **-** keys to increase or decrease the brightness.
- **Show/Hide Cursor Position:** Check/uncheck the box to show/hide the cursor position.
- **Show/Hide Search Container:** Check/uncheck the box to show/hide the search container.
- **Show/Hide Object Data:** Check/uncheck the box to show/hide the object data control bar, data table, and figures.
- **Focus Circle Color:** You may change the color of the focus circle here. To reset the color back to the default setting (#00ff00) click the **RESET** button.
- **Data:** Customize which data table entries and figures are displayed. To view data settings, navigate to the **Menu** → **Settings** → **Data** tab.
 - **Table:** Check/uncheck the data table entries you wish to be shown or hidden in the data table. Click the **Check/Uncheck All** button to check/uncheck all of the data table entries.
 - **Figures:** Check/uncheck the figures you wish to be shown or hidden. Click the **Check/Uncheck All** button to check/uncheck all of the figures. Modeled galaxies (IDs > 20000) do not have the **Detection Image** or **Magnification Map** figures whether or not these checkboxes have been checked.

Advanced Search

The Advanced Search feature is designed to give the user a way to find sources from a list of IDs, a number of catalog filter constraints, or a combination of both. In this section, I will outline how to use this feature with a couple of simple examples, as well as, a more complicated multi-search example at the end.

To open Advanced Search, select **Menu → Advanced Search** or press the **A** key on the keyboard. Clicking the Advanced Search map button will also open Advanced Search if no advanced searches currently exist, all advanced searches are hidden, or none of the advanced searches have any matching objects.

To begin an advanced search, click the **+ New Search** button (see layout below for reference).



Switching between multiple advanced searches

If there are multiple advanced searches, you may switch between them by clicking one of the colored circle icons to the right of the **+ New Search** button. The advanced search currently in view will have an icon with a blue outline around it. Any advanced searches that are hidden will have icons with gray backgrounds (see **Example 3** below).

Change the name of an advanced search

Click on the advanced search name and enter a new one. Each advanced search must have a unique name.

Show/Hide an advanced search

Click the **HIDE** button to hide the markers for an advanced search. This will remove the markers from the map. Click on the **SHOW** button (same button) to show the markers for an advanced search. This will add the markers back onto the map.

Delete an advanced search

Click the **DELETE** button to delete an advanced search.

Change the color of an advanced search

Click on the container containing the current color (given in hex code) and enter a new color.

Click the **RANDOM** button to change the color to a randomized color.

Add a list of IDs to the advanced search

Click on the entry field next to the **ADD LIST OF IDS** button and enter a list of IDs (separated by spaces or commas). The list of IDs can also include ranges of numbers (e.g. 123-200). Lists are added to the advanced search as **OR** conditions by default and cannot be updated once added. See **Example 1** and **Example 3** below for more details.

Add a filter to the advanced search

Click on the entry field next to the **ADD FILTER** button and enter a filter from the catalog.

Filters are added to the advanced search as **AND** conditions by default. See **Example 2** and **Example 3** below for more details.

Number of objects

Displayed is the number of matching objects. If an advanced search has no matching objects, there will only be a dash.

Copying search results to clipboard

Click the **COPY SEARCH RESULTS** button and the search results will be copied to the clipboard. More specifically, each object ID separated by a comma will be copied to the clipboard.

Transferring advanced searches to new fields

When you change fields, all advanced search filters will transfer to the new field and any lists will be removed. **Example 1** would not transfer, **Example 2** would transfer completely, and **Example 3** would partially transfer (the list in *Bright High z* would be removed).

On the next few pages are some examples of advanced searches. These examples were conducted on the **A370-clu** field.

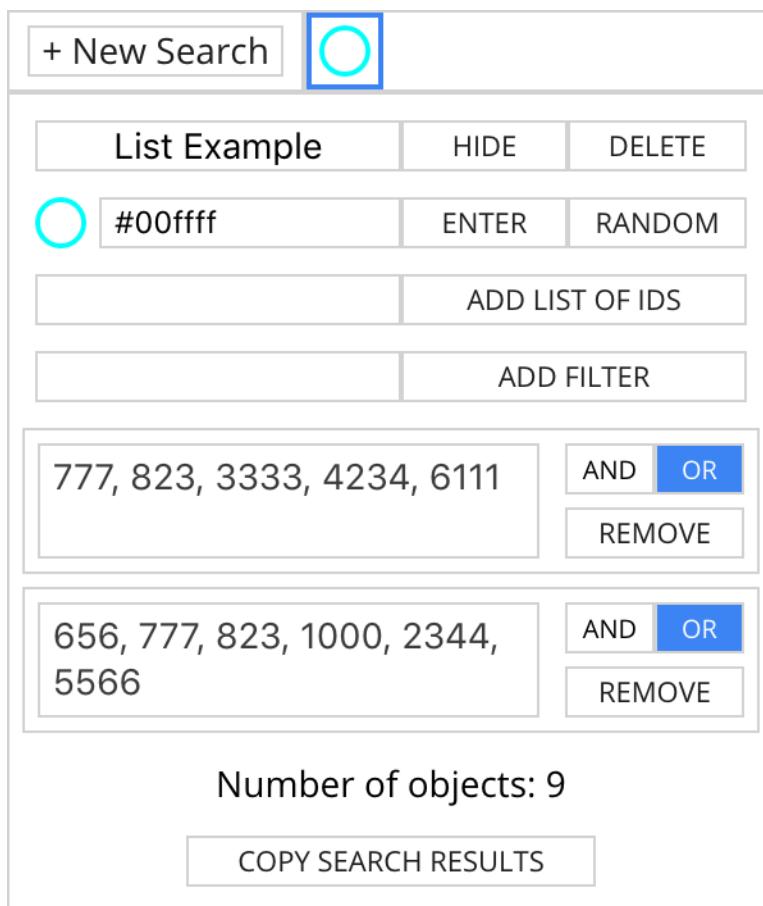
Example 1: Advanced search using lists

You are interested in two lists of objects and you would like to see all of the objects in these two lists.

Step 1: Start a new Advanced Search by clicking the **+ New Search** button.

Step 2: Add the first list to the advanced search by copying it into the entry field next to the **ADD LIST OF IDS** button and then enter it by clicking the **ADD LIST OF IDS** button or by pressing the **enter** key on the keyboard.

Step 3: Add the second list in the same way.



The screenshot shows a user interface for an advanced search. At the top left is a button labeled '+ New Search'. To its right is a blue square icon with a white circle inside. Below this is a section titled 'List Example' with buttons for 'HIDE' and 'DELETE'. Underneath is a list entry with a blue circle icon, the text '#00ffff', and buttons for 'ENTER' and 'RANDOM'. Below this is a button labeled 'ADD LIST OF IDS'. Further down is a button labeled 'ADD FILTER'. The next section contains the text '777, 823, 3333, 4234, 6111' and buttons for 'AND' and 'OR', with a 'REMOVE' button below. The following section contains the text '656, 777, 823, 1000, 2344, 5566' and similar buttons. At the bottom of the interface, the text 'Number of objects: 9' is displayed, followed by a button labeled 'COPY SEARCH RESULTS'.

This is how such an advanced search might look. As you can see, I have changed the name and color of the advanced search and added the two lists.

Together these lists have 9 unique objects and 2 duplicate objects. If you want to see only the duplicate objects, click the **AND** button on both lists. To remove a list, click the **REMOVE** button.

Example 2: Advanced search using filters

You want to see all objects that have $2 \leq z_{\text{phot}} \leq 3$ AND star flag set to 0.

Step 1: Start a new Advanced Search by clicking the **+ New Search** button.

Step 2: Add the first filter to the advanced search by entering **z_phot** into the entry field next to the **ADD FILTER** button and then enter it by clicking the **ADD FILTER** button or by pressing the **enter** key on the keyboard.

Step 3: In the new **z_phot** filter container, uncheck the **-99** checkbox and enter the lower and upper bounds from above.

Step 4: Add the second filter in the same way as the first.

Step 5: In the new **star** filter container, uncheck the **1** and **2** checkboxes.

The screenshot shows the 'Advanced Search' interface with the following configuration:

- Name:** + New Search (highlighted with a blue border)
- Color:** A pink circle and a cyan circle are highlighted with blue borders.
- Filter Example:** #ffc0cb
- Buttons:** HIDE, DELETE
- Filter Container 1 (star):**
 - Condition:** star
 - Operator:** AND (highlighted with a blue border)
 - Checkboxes:** 0 (checked), 1, 2
 - Buttons:** REMOVE, ADD FILTER
- Filter Container 2 (z_phot):**
 - Condition:** $2 \leq z_{\text{phot}} \leq 3$
 - Operator:** AND (highlighted with a blue border)
 - Checkboxes:** -99 (unchecked)
 - Buttons:** REMOVE
- Summary:** Number of objects: 90
- Buttons:** COPY SEARCH RESULTS

This is how such an advanced search might look. As you can see, I have changed the name and color of the advanced search and added the two filters. To remove a filter, click the **REMOVE** button.

There are 90 objects in **A370-clu** that have a **z_phot** between **2** and **3** and their **star** flag set to **0**.

Example 3: Advanced search using filters and lists

You want to see all objects that have **mag814 \leq 25 OR mag160 \leq 25 AND**, from this set, the objects with **5 \leq z_phot** (bright, high-z objects). This example will require two separate Advanced Searches.

Step 1: Start a new Advanced Search by clicking the **+ New Search** button.

Step 2: Add the first filter to the advanced search by entering **mag814** into the entry field next to the **ADD FILTER** button and then enter it by clicking the **ADD FILTER** button or by pressing the **enter** key on the keyboard.

Step 3: In the new **mag814** filter container, uncheck the **-99** checkbox and enter the upper bound of **25**. Click the **OR** button.

Step 4: Add the second filter, **mag160**, in the same way as the first.

Step 5: In the new **mag160** filter container, uncheck the **-99** checkbox and enter the upper bound of **25**. Click the **OR** button.

Step 6: Click the **HIDE** button to hide the markers from this advanced search.

Step 7: Click the **COPY SEARCH RESULTS**.

+ New Search ○ ○ ○

Bright	SHOW	DELETE
<input checked="" type="radio"/> #f1c40e	ENTER	RANDOM
		ADD LIST OF IDS
		ADD FILTER

Search results saved to clipboard

15.88	\leq mag160 \leq	25	AND	OR
<input type="checkbox"/> -99	<input type="button" value="REMOVE"/>			
14.08	\leq mag814 \leq	25	AND	OR
<input type="checkbox"/> -99	<input type="button" value="REMOVE"/>			

Number of objects: 1971

This is how such an advanced search might look. As you can see, I have changed the name of the advanced search and added the two magnitude filters. The markers from this search will not appear on the map because it is hidden.

There are 1971 objects in **A370-clu** that have **mag814 \leq 25 OR mag160 \leq 25**. After **Step 7**, the 1971 objects have been copied to the clipboard.

Example 3 (continued)

Step 8: Start a new Advanced Search by clicking the **+ New Search** button.

Step 9: In the entry field next to the **ADD LIST OF IDS** button paste the results from the previous advanced search and then enter them by clicking the **ADD LIST OF IDS** button or by pressing the **enter** key on the keyboard.

Step 10: Click the **AND** button on this list.

Step 11: Add the filter, **z_phot**, in the same way as done in **Step 2**.

Step 12: In the new **z_phot** filter container, uncheck the **-99** checkbox and enter the lower bound of **5**.

The screenshot shows the 'Advanced Search' interface with the following configuration:

- + New Search** button (highlighted with a blue border).
- Color-coded buttons: purple, yellow, pink, cyan.
- Bright High z** label, **HIDE** and **DELETE** buttons.
- #9b58b5** color swatch, **ENTER** and **RANDOM** buttons.
- ADD LIST OF IDS** button.
- ADD FILTER** button.
- 5 ≤ z_phot ≤ 11.59** range input, **AND** and **OR** buttons.
- 99** checkbox (unchecked), **REMOVE** button.
- 3, 5, 6, 7, 8, 9, 11, 13, 14, 15, 16, 17, 18, 20, 22, 23, 24, 25,** list of IDs, **AND** and **OR** buttons.
- COPY SEARCH RESULTS** button.

Below the interface, the text "Number of objects: 32" is displayed.

This is how such an advanced search might look. As you can see, I have changed the name of the advanced search and added the list of sources from the previous search and the **z_phot** filter.

There are 32 objects in **A370-clu** that have **mag814 ≤ 25 OR mag160 ≤ 25 AND 5 ≤ z_phot**.

⌨️ Keyboard Shortcuts

To view the Keyboard Shortcuts, select **Menu** → **Keyboard Shortcuts** or press the **K** key on the keyboard for a *quick view*. Listed below are the keyboard shortcuts.

- : quick view filters

: zoom-out & center image

: zoom-out/in

: show/hide table

: center image on focus circle

: open advanced search

: quick view segmentation map

: show/hide table & figures

: show/hide figures

: quick view keyboard shortcuts

: add/remove object markers

: copy map view (URL) to clipboard

Copy map view (URL) to clipboard: Pressing the **C** key on the keyboard will copy the current map view, in URL format, to the clipboard. Among other things, this allows users to conveniently share objects of interest or quickly open HFFexplorer with a set of coordinates in mind.

URL Parameters

Listed below are the parameters that can be set via the URL. To set these parameters, add the ? symbol at the end of the URL and add the & symbol between each parameter (see URL examples below).

- **Field:** *field=[Field Name]*
- **RA/DEC:** *radec=[RA, DEC coordinates in degrees, separated by a space or comma]*
- **Object ID:** *id=[Object ID]*
- **Filter:** *filter=[Filter]*
- **Remove Modeled Galaxies:** *bcgs=0*
- **Zoom Level:** *zl=[Zoom Level]*
- **Show Data:** *data=1*
- **Show Table Only:** *table=1*
- **Show Figures Only:** *figures=1*

URL Example 1: Open M0416-par in HFFexplorer centered at RA, DEC = 64.1517500, -24.1084472, viewing RGB2 without modeled galaxies, and at zoom level 4.

<http://cosmos.phy.tufts.edu/~danilo/HFF/HFFexplorer/?field=M0416-par&radec=64.15175,-24.10845&filter=rgb2&bcgs=0&zl=4.00>

URL Example 2: Open A1063-clu in HFFexplorer centered on object ID = 6882, at zoom level 3, and with the object data showing.

<http://cosmos.phy.tufts.edu/~danilo/HFF/HFFexplorer/?field=A1063-clu&id=6882&zl=3.00&data=1>