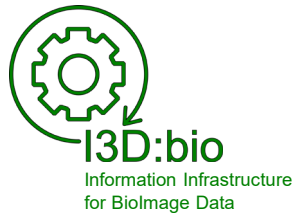


Research Data Management for Bioimage Data at the HHU

Data organization: Search Function

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Adapted from: Schmidt C., Bortolomeazzi M., Boissonnet T., Fortmann-Grote C. *et al.* (2023). I3D:bio's OMERO training material: Re-usable, adjustable, multi-purpose slides for local user training. Zenodo. DOI: 10.5281/zenodo.8323588
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Tags and Key-Value Pairs in OMERO (recommendations)

Tags and Key-Value Pairs can be added to:

- Images
- Groups of Images
- Datasets
- Projects

Tags are linked to users or groups

Advanced users:

Annotate Tags and Key-Value Pairs using ontologies and ontology terms (see Chapter on Metadata Curation)

I3D:bio recommendation:

- Use tags for data organization across datasets and projects (categorization)
 - can substitute deep folder hierarchies
- Use Key-Value Pairs for metadata enrichment

Tags and Key-Value Pairs (here: in OMERO.web)

The screenshot displays the OMERO.web webclient interface. On the left, a file tree shows a folder structure under 'Mary Mayperson', with the file '20171123_M36_1_D0h_pERK.czi' selected. The main area shows a grid of 20 thumbnail images of cells. An orange callout box with two arrows points to the 'Tags' and 'Key-Value Pairs' sections in the right-hand metadata panel.

Tags 0

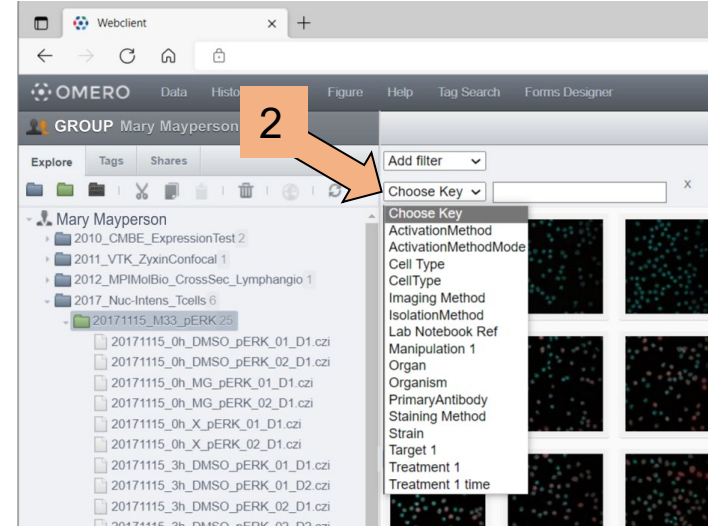
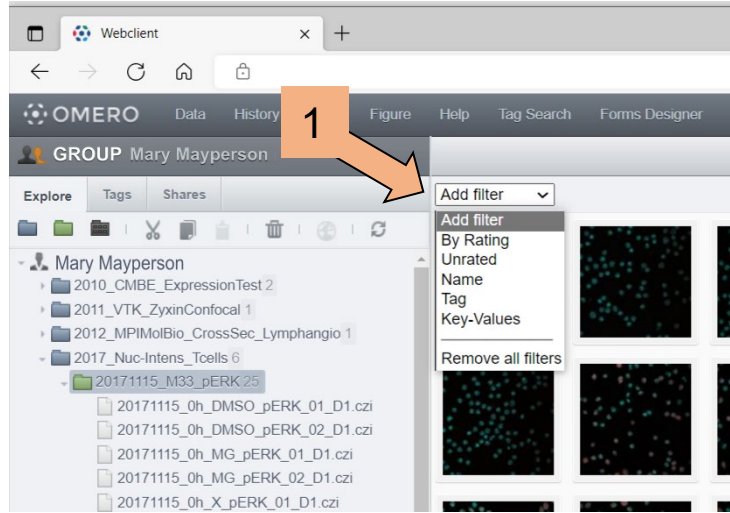
Key-Value Pairs 2

Added by: Mary Mayperson

Key	Value
primary_AB	anti-p-ERK1/2 (Cell Signaling)
secondary_AB	goat anti-rabbit Alexa-Fluor-647
Cell type	CD4+ T cells
Organ	spleen
Organism	Mus musculus
Strain	C57BL/6

Filter Datasets for Tags and Key-Value Pairs (here: in OMERO.web)

At the Dataset-level, use filters to show a set of images based on Key-Value-Pairs or Tags



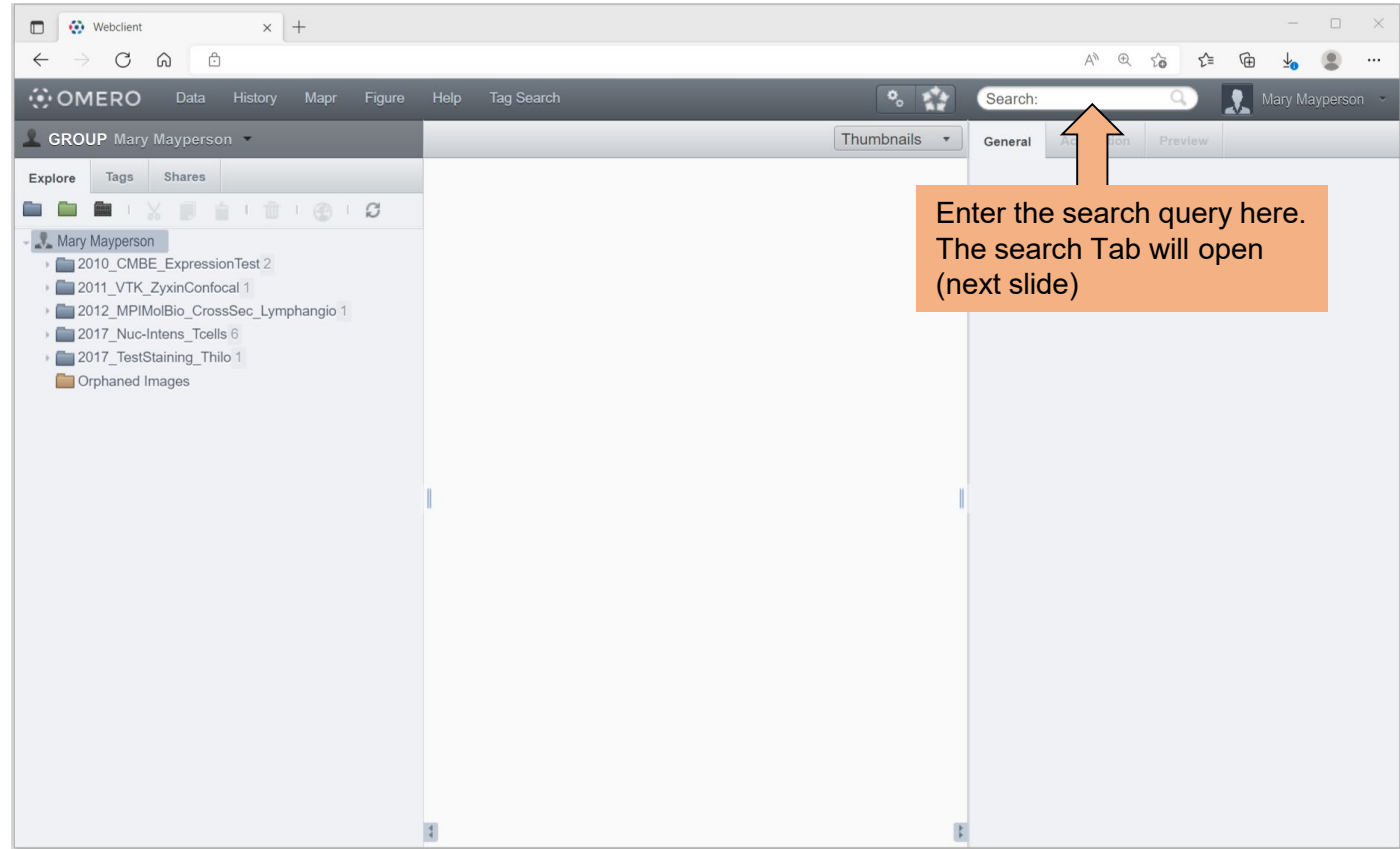
Example shown here: Filtering by Key-Values
(also showing which Keys were used on this Dataset)

(You can also filter by Name or Rating)

Search function to find data, e.g., based on Tags or Key-Value Pairs 1/3

Use the *Search* field to look for data across

- Users
- Groups
- Projects
- Datasets



Enter the search query here.
The search Tab will open
(next slide)

Search function to find data, e.g., based on Tags or Key-Value Pairs 2/3

Refine your search query

Optional:
Restrict for which fields you wish to search

Example 1:
Search for images with both **Tags**

The screenshot shows the OMERO webclient interface. The search bar contains the query "DMSO-control" AND "phospho-ERK". The search results table shows 8 results, all of which are images. The search filters are set to "Images" and "Tags". The "Tags" section shows two tags: "phospho-ERK" and "DMSO control". The "Key-Value Pairs" section shows two key-value pairs: "PrimaryAntibody" with value "anti-phospho-ERK" and "CellType" with value "CD4+ T cell".

Type	Name	Acquired	Imported	Group	Link
Image	20171115_0h_DMSO_pERK_01_D1.czi	2022-04-08 13:50:20	2022-04-08 13:50:20	OE0629	Browse
Image	20171115_0h_DMSO_pERK_02_D1.czi	2022-04-08 13:50:22	2022-04-08 13:50:22	OE0629	Browse
Image	20171115_3h_DMSO_pERK_02_D2.czi	2022-04-08 13:50:31	2022-04-08 13:50:31	OE0629	Browse
Image	20171115_3h_DMSO_pERK_03_D2.czi	2022-04-08 13:50:32	2022-04-08 13:50:32	OE0629	Browse
Image	20171115_3h_DMSO_pERK_01_D2.czi	2022-04-08 13:50:34	2022-04-08 13:50:34	OE0629	Browse
Image	20171115_3h_DMSO_pERK_01_D1.czi	2022-04-08 13:50:44	2022-04-08 13:50:44	OE0629	Browse
Image	20171115_3h_DMSO_pERK_02_D1.czi	2022-04-08 13:50:53	2022-04-08 13:50:53	OE0629	Browse
Image	20171115_3h_DMSO_pERK_03_D1.czi	2022-04-08 13:50:41	2022-04-08 13:50:41	OE0629	Browse

Search function to find data, e.g., based on Tags or Key-Value Pairs 3/3

Refine your search query

Optional:
Restrict for which fields you wish to search

Example 2:
Search for images with specific value in **Key-Value Pairs**

The screenshot displays the OMERO webclient interface. On the left, the search panel shows a search query 'CD4+' and various filters. An orange arrow points to the 'Restrict by Field' section, where 'Annotations' is selected. Below this, the 'Search for' section has 'Images' checked. The 'Scope' is set to 'All Groups' and 'Data owned by' is 'All Users'. The 'Date' is set to 'Import date'. A 'Search' button is at the bottom of the panel.

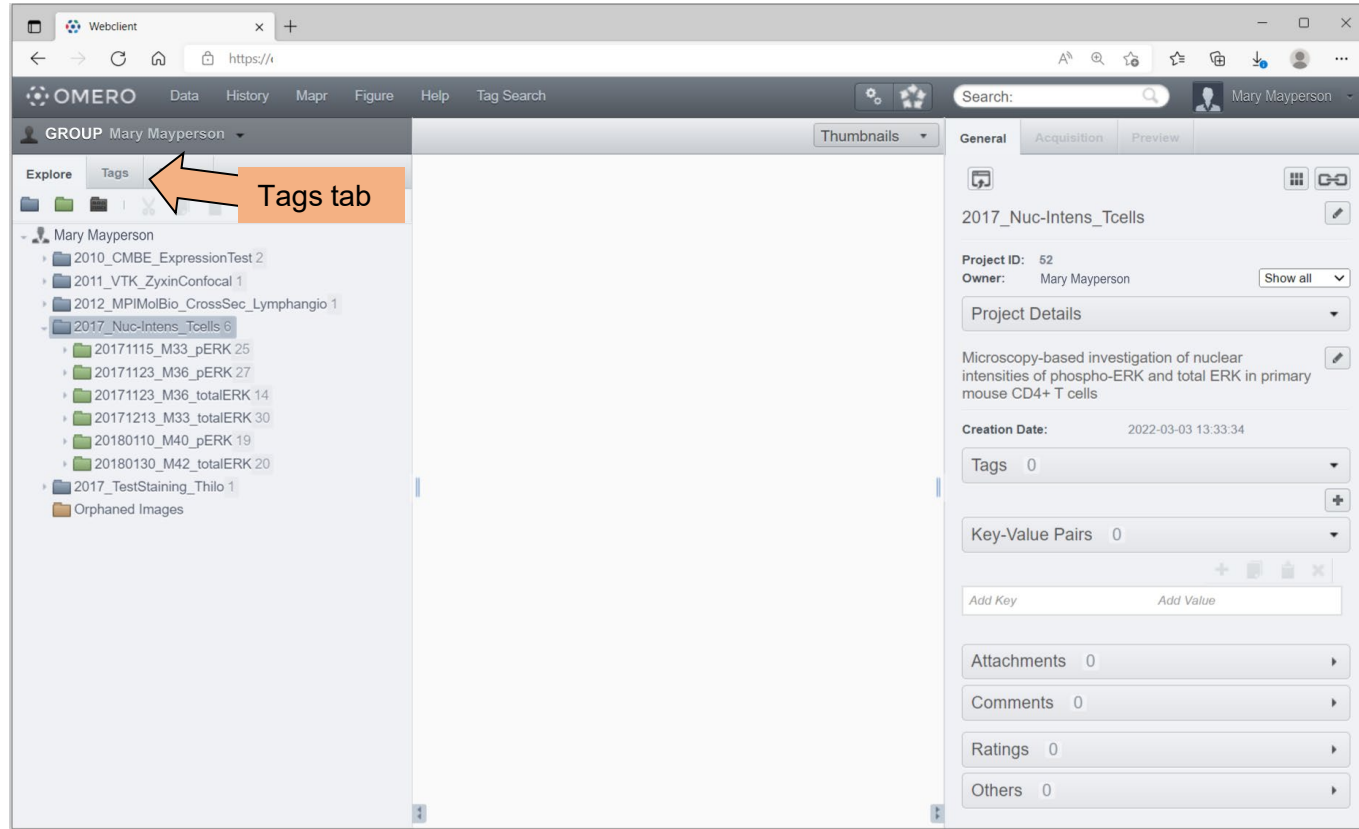
The main area shows a table of search results with columns for Type, Name, Acquired, and Imported. The table lists several image files with their respective acquisition and import dates.

On the right, the 'Image Details' panel is open for a selected image. It shows 'Image ID: 58100' and 'Owner: Mary Mayperson'. Below this, the 'Key-Value Pairs' section is expanded, showing a table of metadata. An orange arrow points to the 'CellType' key, which has the value 'CD4+ T cell'.

Key	Value
PrimaryAntibody	anti-phospho-ERK
CellType	CD4+ T cell
Organism	Mus musculus
Organ	Spleen
IsolationMethod	MACS negative sort

No need to search – Use Tags for dynamic data re-organization (1/3)

If you have annotated your data with Tags, use the **Tags** tab to view files based on the Tags



No need to search – Use Tags for dynamic data re-organization (2/3)

The Tags tab allows for a dynamically re-organized data-tree representation based on your Tags

→ Advantage over deep folder hierarchies

The screenshot shows the OMERO webclient interface. On the left, the 'Explore' tab is active, showing a tree view of data under 'GROUP Mary Mayperson'. The 'DMSO control' folder is selected, and an orange arrow points to it. The main area displays a grid of 20 microscopy image thumbnails. The right sidebar shows the 'General' tab for the selected image, displaying metadata such as 'DMSO control', 'Tag ID: 19545', and 'Owner: Mary Mayperson'. An orange text box in the bottom right corner states: 'Dynamically show all DMSO-control treated samples across Datasets and Projects'.

Using Tag Search (OMERO.webtagging extension)

Tag Search allows combining tags (if it is installed)

Example:
Review all images from control-treated samples for the staining target across repetitions

The screenshot shows the OMERO webclient interface. The top navigation bar includes 'Data', 'History', 'Mapr', 'Figure', 'Help', and 'Tag Search'. An orange arrow points to the 'Tag Search' menu item. Below the navigation bar, the 'TAG SEARCH' section shows 'Selected Tags: DMSO control x phospho-ERK x'. The 'RESULTS' section shows a list of filtered images with columns for Object, Name, Import Date, Group, and Link. The results are filtered by the selected tags.

Object	Name	Import Date	Group	Link
	20171115_3h_DMSO_pERK_03_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_0h_DMSO_pERK_01_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_01_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_01_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_02_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_0h_DMSO_pERK_02_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_02_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_03_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse

Using Tag Search (OMERO.webtagging extension) – create figures

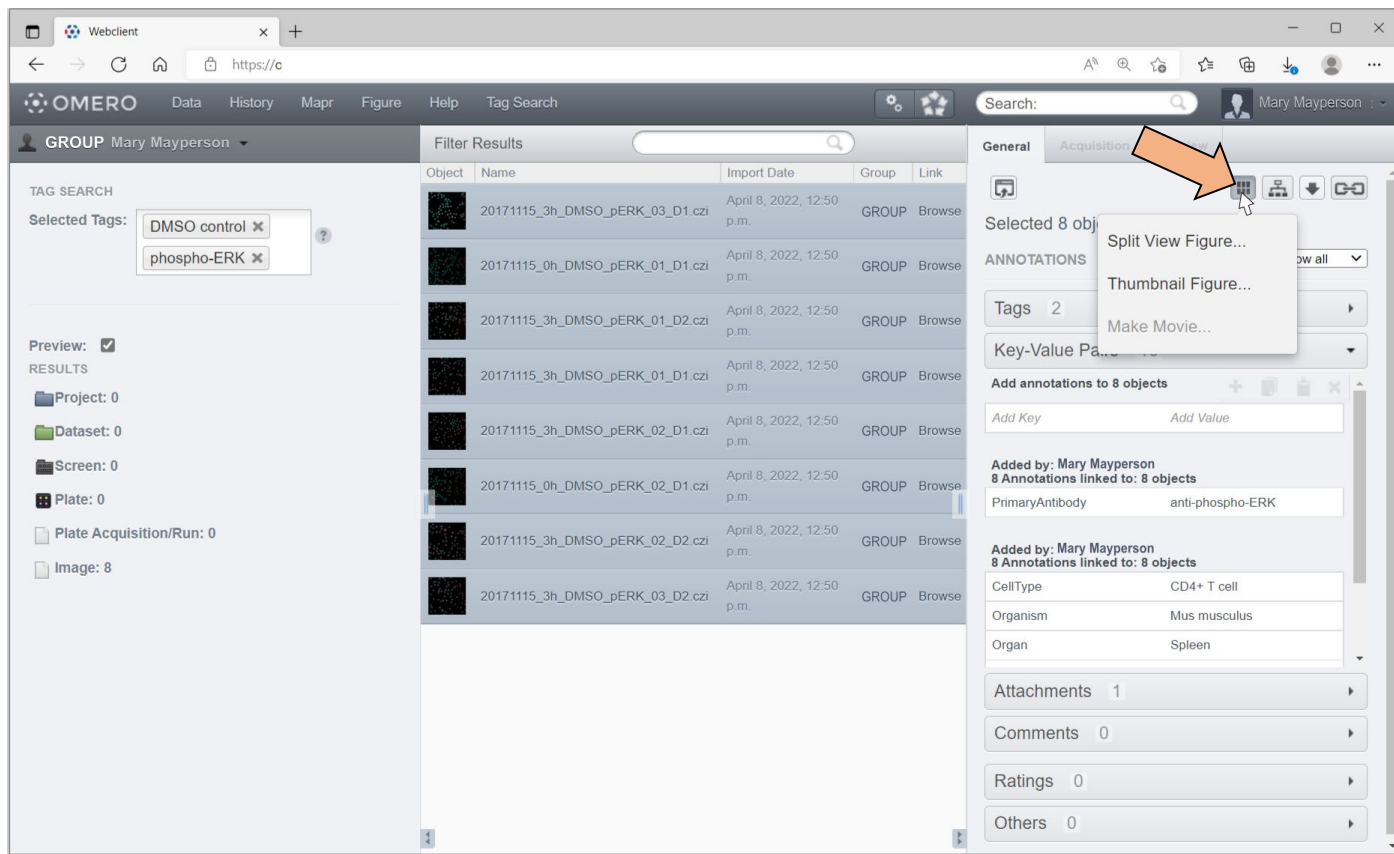
Example:
Use the Tag Search results to prepare a comprehensive figure using OMERO.figure

The screenshot shows the OMERO web client interface. On the left, the 'TAG SEARCH' section shows 'Selected Tags: DMSO control' and 'phospho-ERK'. Below it, the 'Preview' section shows 'RESULTS' with counts for Project (0), Dataset (0), Screen (0), Plate (0), Plate Acquisition/Run (0), and Image (8). The main area displays a table of search results with columns for Object, Name, Import Date, Group, and Link. An orange arrow points to the 'OMERO.figure' option in the context menu that appears over the table. The right sidebar shows the 'General' tab with metadata for the selected image, including 'Added by: Mary Mayperson', '8 Annotations linked to: 8 objects', and details for 'PrimaryAntibody' (anti-phospho-ERK), 'CellType' (CD4+ T cell), 'Organism' (Mus musculus), and 'Organ' (Spleen).

Object	Name	Import Date	Group	Link
	20171115_3h_DMSO_pERK_03_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_0h_DMSO_pERK_01_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_01_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_01_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_02_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_0h_DMSO_pERK_02_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_02_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_03_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse

Using Tag Search (OMERO.webtagging extension) – quick split view

Example:
Use the Tag Search results to produce a quick comparative figure of the Split View



The screenshot shows the OMERO webclient interface. On the left, the 'TAG SEARCH' section displays 'Selected Tags: DMSO control' and 'phospho-ERK'. Below this, the 'RESULTS' section shows a list of objects with columns for Object, Name, Import Date, Group, and Link. The main table lists 8 objects, each with a thumbnail image and a 'Browse' link. On the right, the 'General' tab is active, showing a 'Split View Figure...' menu option highlighted by an orange arrow. Other options in the menu include 'Thumbnail Figure...' and 'Make Movie...'. The right sidebar also displays 'Annotations' for the selected objects, including 'PrimaryAntibody: anti-phospho-ERK', 'CellType: CD4+ T cell', 'Organism: Mus musculus', and 'Organ: Spleen'.

Object	Name	Import Date	Group	Link
	20171115_3h_DMSO_pERK_03_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_0h_DMSO_pERK_01_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_01_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_01_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_02_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_0h_DMSO_pERK_02_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_02_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
	20171115_3h_DMSO_pERK_03_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse

Using Tag Search (OMERO.webtagging extension) – quick split view

The image displays two overlapping windows from the OMERO webclient. The background window shows the 'TAG SEARCH' interface with 'DMSO control' and 'phospho-ERK' selected as tags. A 'Filter Results' table lists image objects with their names and import dates. A 'Preview' section shows 8 image thumbnails. The foreground window shows the 'Create Split View Figure' dialog, which is a 3x3 grid of image thumbnails. The top row shows 'Ch2-T1' (red), 'Ch1-T2' (cyan), and a merged 'Ch2-T1 Ch1-T2' (red and cyan). The bottom row shows the same three channels for two different image objects. A 'Split View Figure' tooltip is visible over the 'Filter Results' table, indicating that a split view figure has been created and attached to the selected image.

OMERO Webclient Interface:

- Navigation:** Data, History, Mapr, Figure, Help, Tag Search
- Search:** Search: []
- Activities:** Split View Figure (Split view figure created and attached to image 20171115_3h_DMSO_pERK_03_D1.czi.)
- Filter Results Table:**

Object	Name	Import Date	GROUP	Browse
20171115_3h_DMSO_pERK_03_D1.czi	20171115_3h_DMSO_pERK_03_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
20171115_0h_DMSO_pERK_01_D1.czi	20171115_0h_DMSO_pERK_01_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
20171115_3h_DMSO_pERK_01_D2.czi	20171115_3h_DMSO_pERK_01_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
20171115_3h_DMSO_pERK_01_D1.czi	20171115_3h_DMSO_pERK_01_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
20171115_3h_DMSO_pERK_02_D1.czi	20171115_3h_DMSO_pERK_02_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
20171115_0h_DMSO_pERK_02_D1.czi	20171115_0h_DMSO_pERK_02_D1.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
20171115_3h_DMSO_pERK_02_D2.czi	20171115_3h_DMSO_pERK_02_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
20171115_3h_DMSO_pERK_03_D2.czi	20171115_3h_DMSO_pERK_03_D2.czi	April 8, 2022, 12:50 p.m.	GROUP	Browse
- Annotations:**
 - Tags: 2
 - Key-Value Pairs: 16
 - Added by: Mary Mayperson
 - 8 Annotations linked to: 8 objects
 - PrimaryAntibody: anti-phospho-ERK
 - Added by: Mary Mayperson
 - 8 Annotations linked to: 8 objects
 - CellType: CD4+ T cell
 - Organism: Mus musculus
 - Organ: Spleen

More information on the search syntax in OMERO:

See the OMERO guides:

<https://omero-guides.readthedocs.io/projects/introduction/en/latest/search-omero.html>