Managing Plates in OMERO

Uploading, annotating, exploring, challenges

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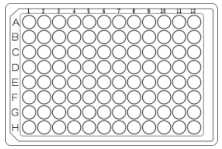
RDM4mic Dec 2021

Characteristics of Plate Data

- **What is special about plate data?**
  - Additional layer



Project
➢ Dataset
➢ Image

vs.

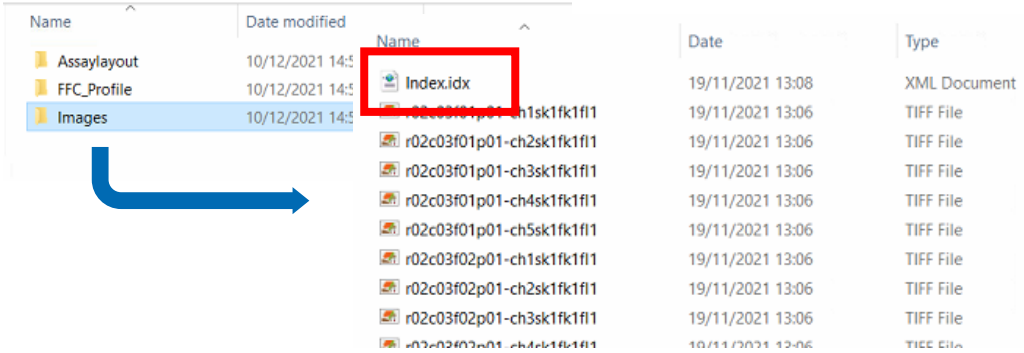
Screen
➢ Plate
➢ Well
➢ Image

  - Many single images (typically 1k - 50k per plate)
  - Equal imaging settings, but many different sample conditions
  - Filename contains no metadata except position & dimension, e.g. r04c09f05p02-ch6sk1fk1fl1.tif
  - Structured metadata of the plate is available before an image is created

- Our data comes from a **PerkinElmer Operetta CLS HCS system**
  - Expensive Harmony Software licences

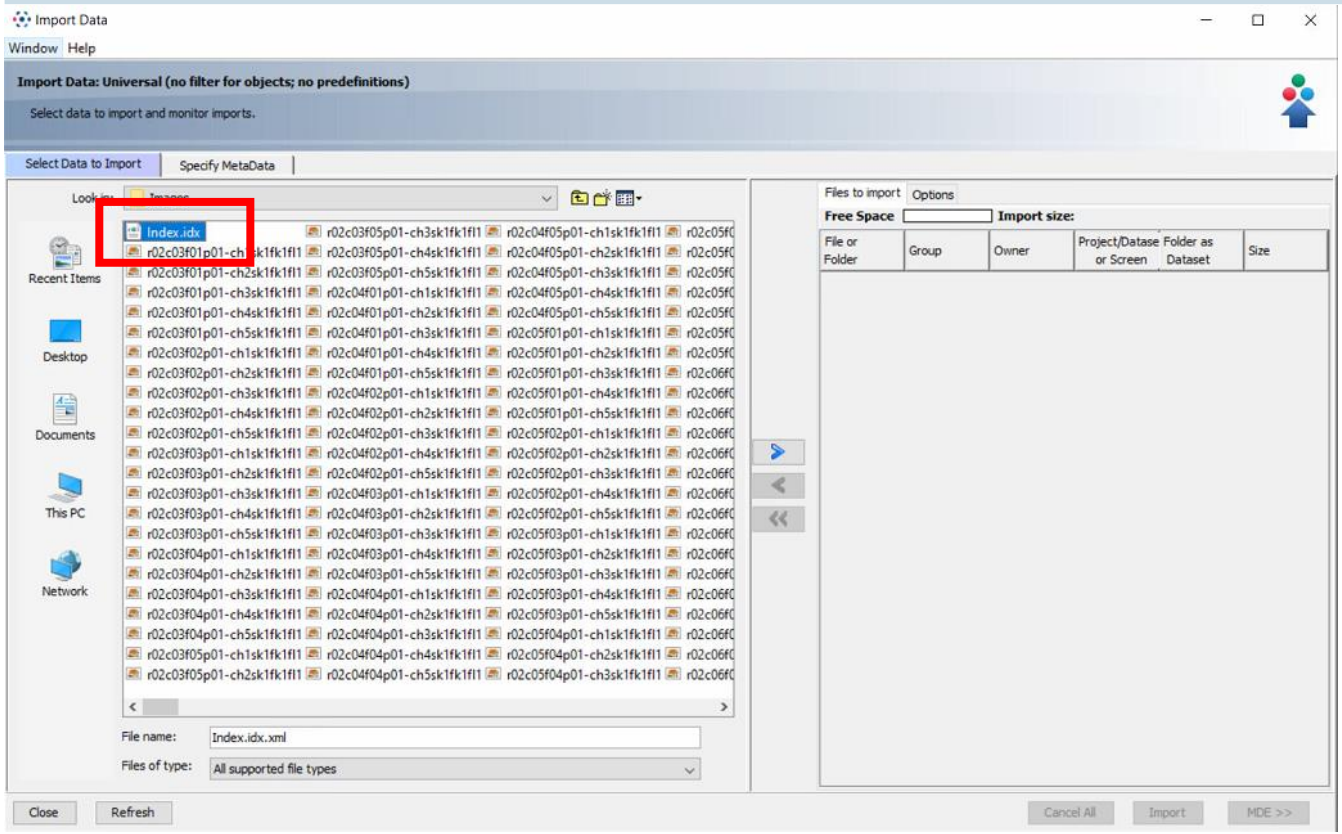
Uploading Plate Data

1. Via **OMERO.insight**
   - Pretty straightforward
   - Uploads full folder structure!



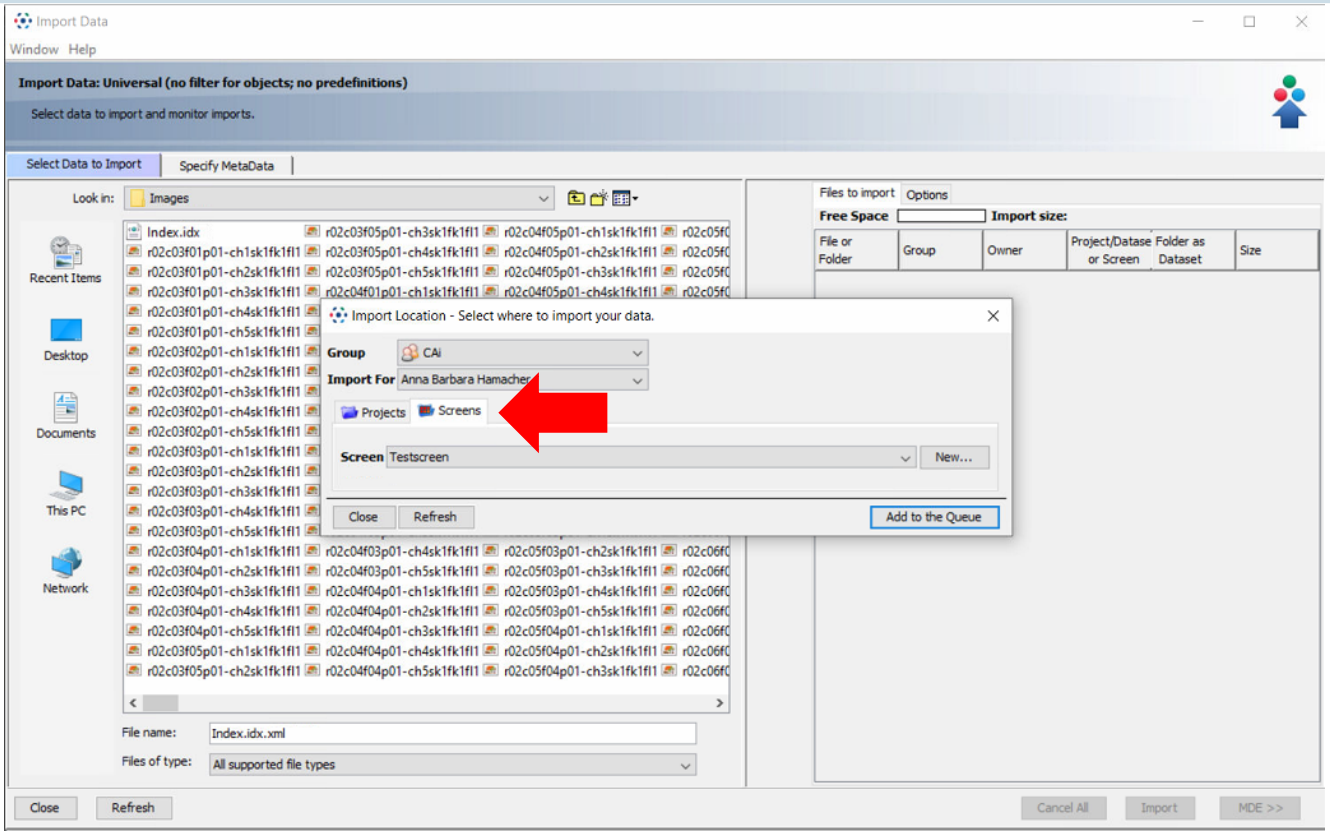
2. Without index file:
   - Server-side-script (util_scripts > **Dataset to Plate**)

Uploading Plate Data



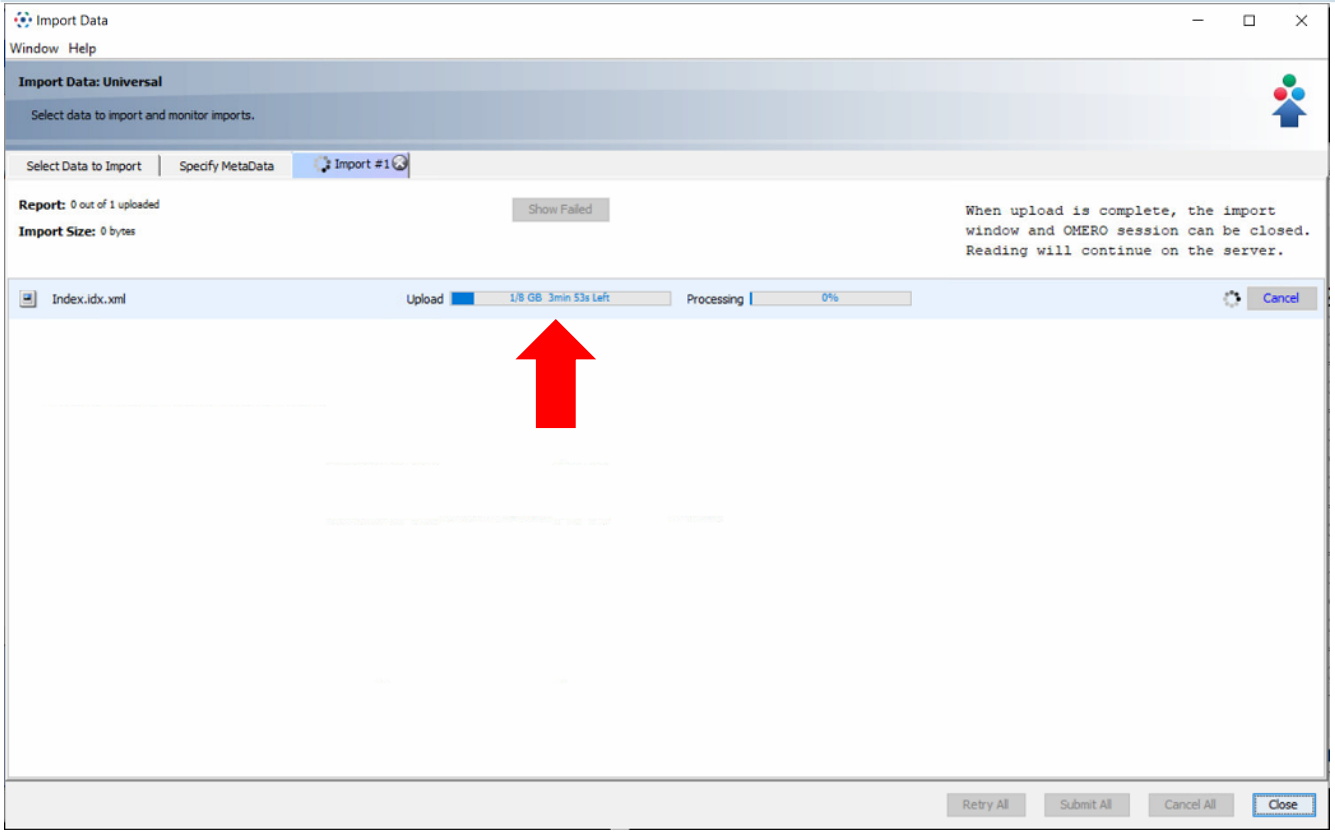
- Start insight
- Start „Importer“
- Select index file

Uploading Plate Data



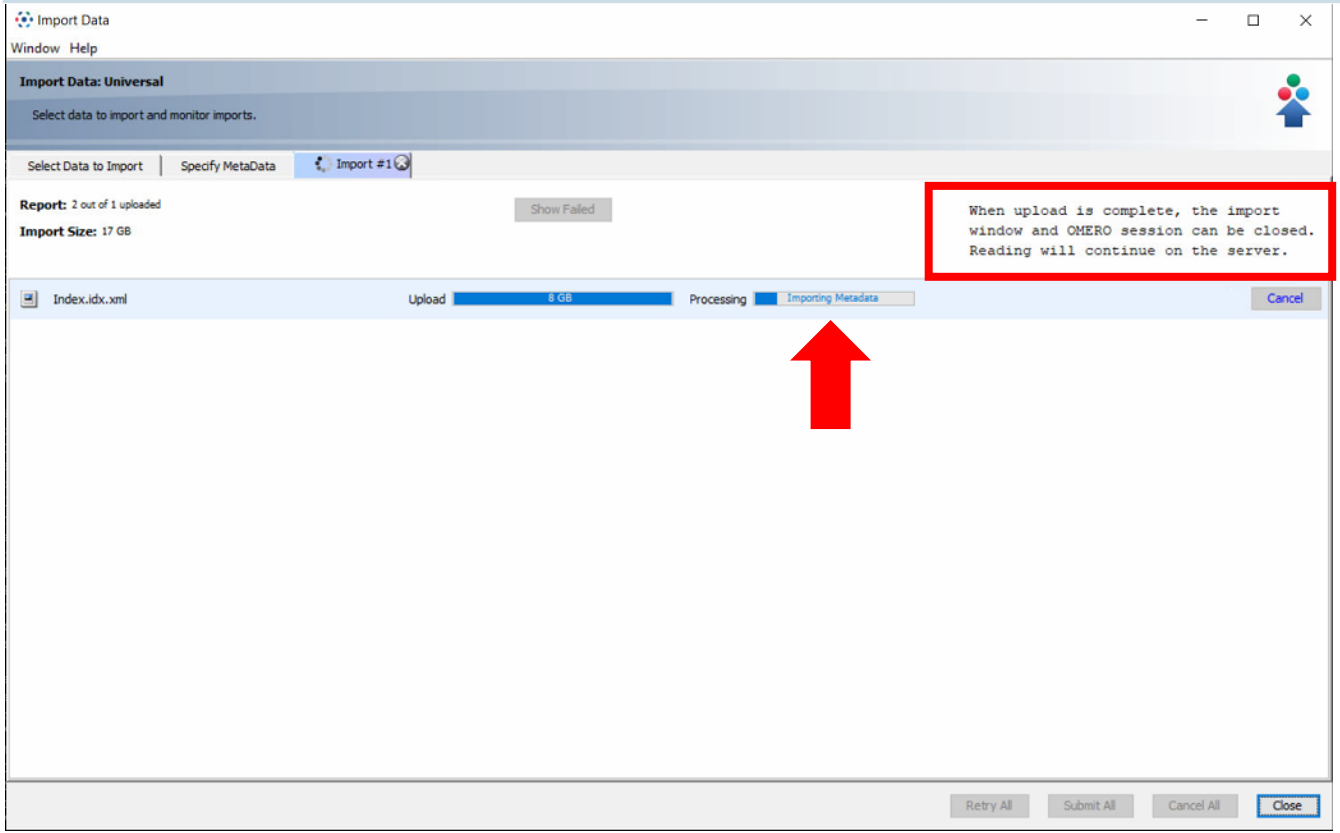
- Choose tab „Screen“
- Add to queue

Uploading Plate Data



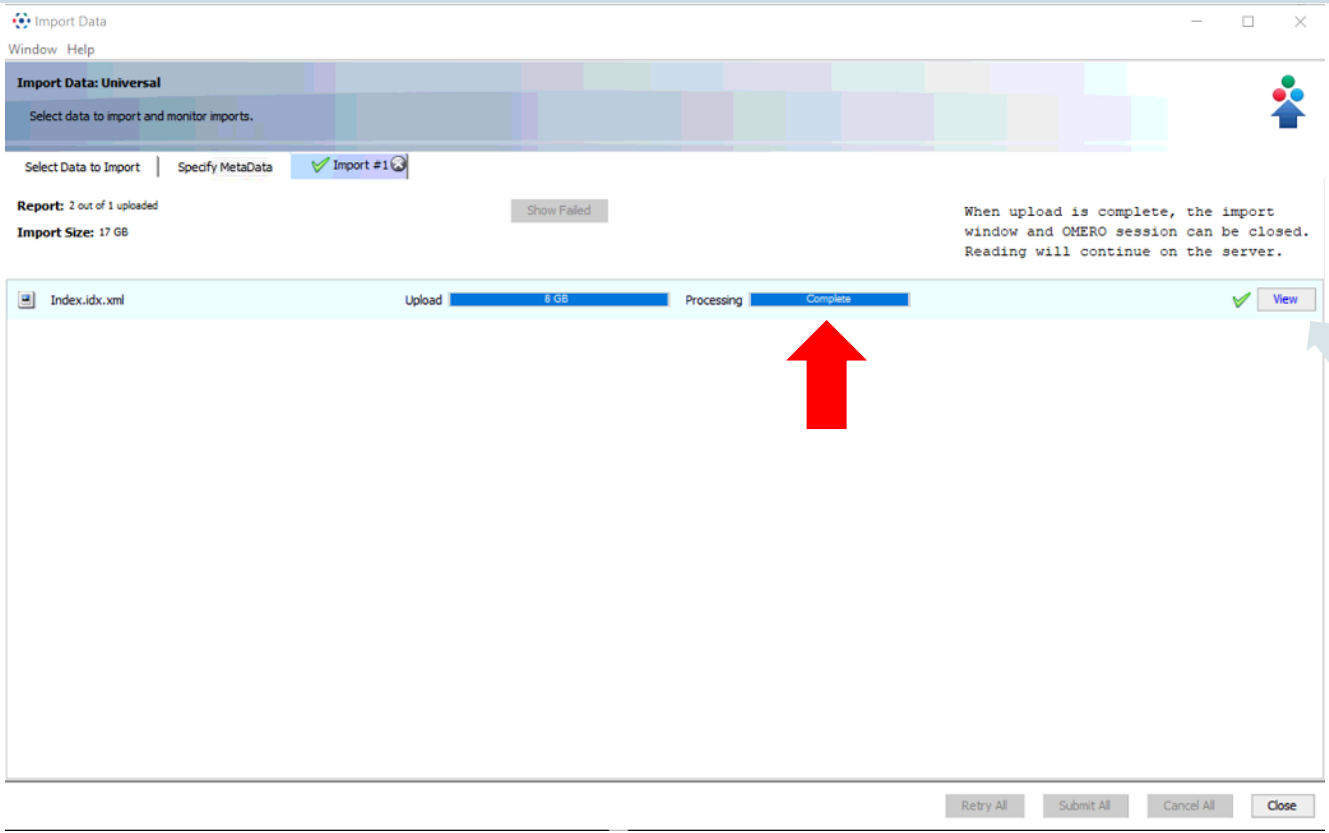
- File upload starts
- Speed depends on connection

Uploading Plate Data



- Metadata import
- Reading pixels
- Can take multiple hours

Uploading Plate Data

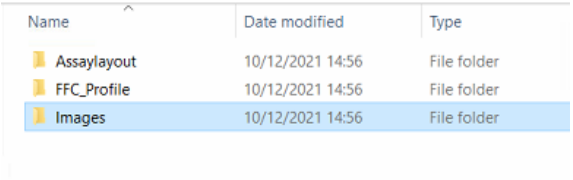


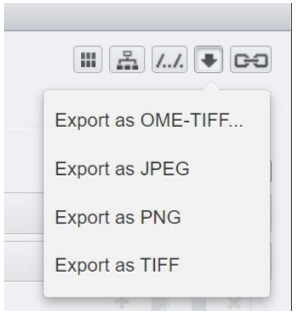
- Done!

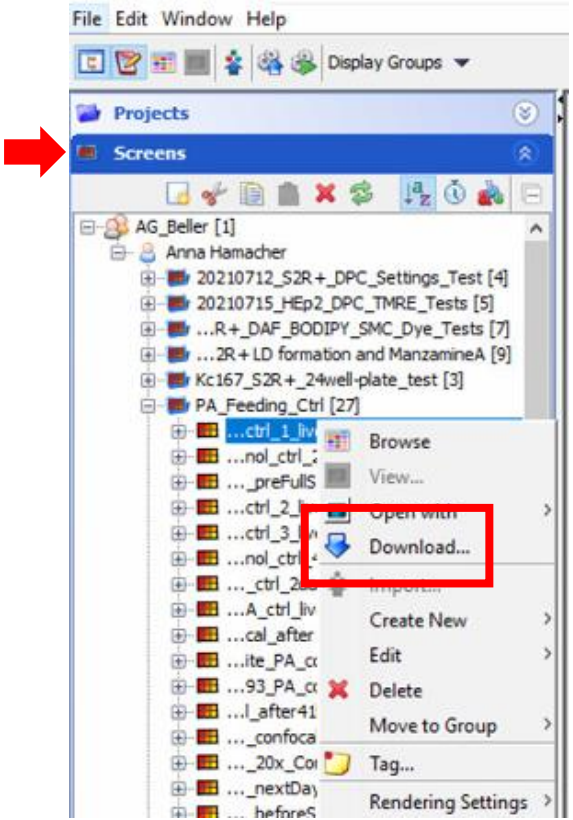
(if fails, check the log)

Downloading Plate Data

- Has to be activated in the OMERO server configuration! (plate downloads are **disabled by default**)
- Only possible via OMERO.insight
- Restores full directory structure with all previous content (nice but users need to be aware of this!)
- Single image views can be exported via OMERO.web, but not the original data

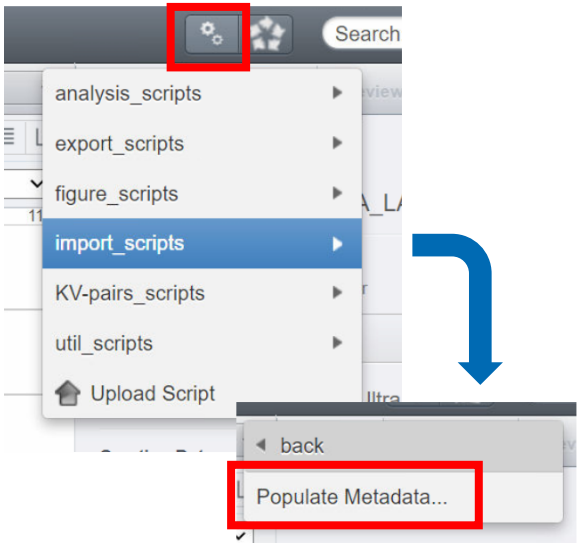




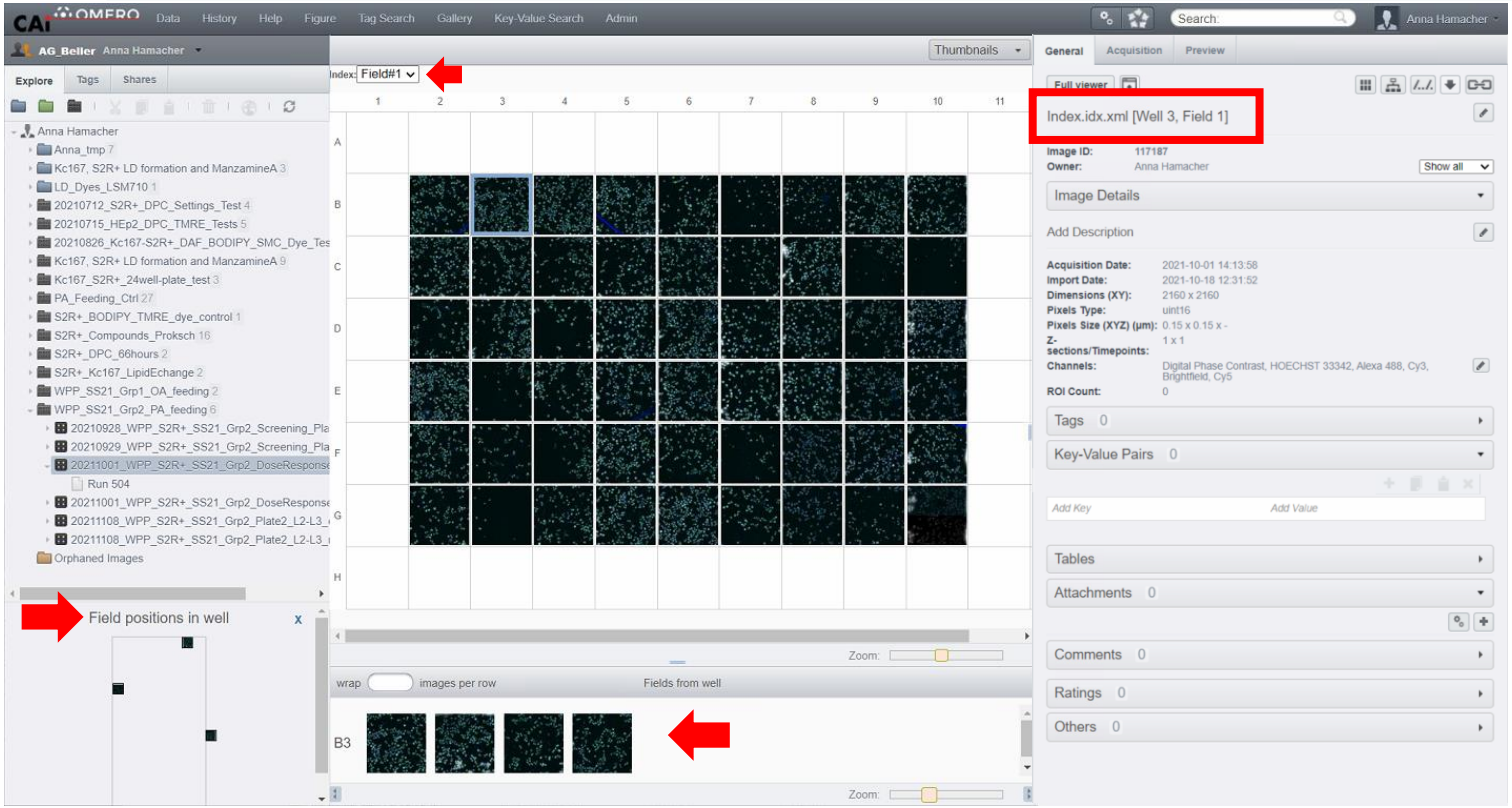


Annotating Plate Data

- **Annotate wells or images** or both? And what about plates?
  - Metadata for wells (but needs to be visible when viewing images!)
  - Image analysis results for images (but also aggregated for wells!)
  - Metadata for plates (microscope settings)
- **How?**
  - Manually (via webclient or OMERO.mde per image/image group)
  - Key-Value-Pair import via CSV-files (equivalent to implementation for Project/Dataset/Images)
  - IDR workflow (`populate metadata` to create a bulk annotation OMERO.table, define mapping and import als key-value-pairs)
  - Details discussed at image.sc

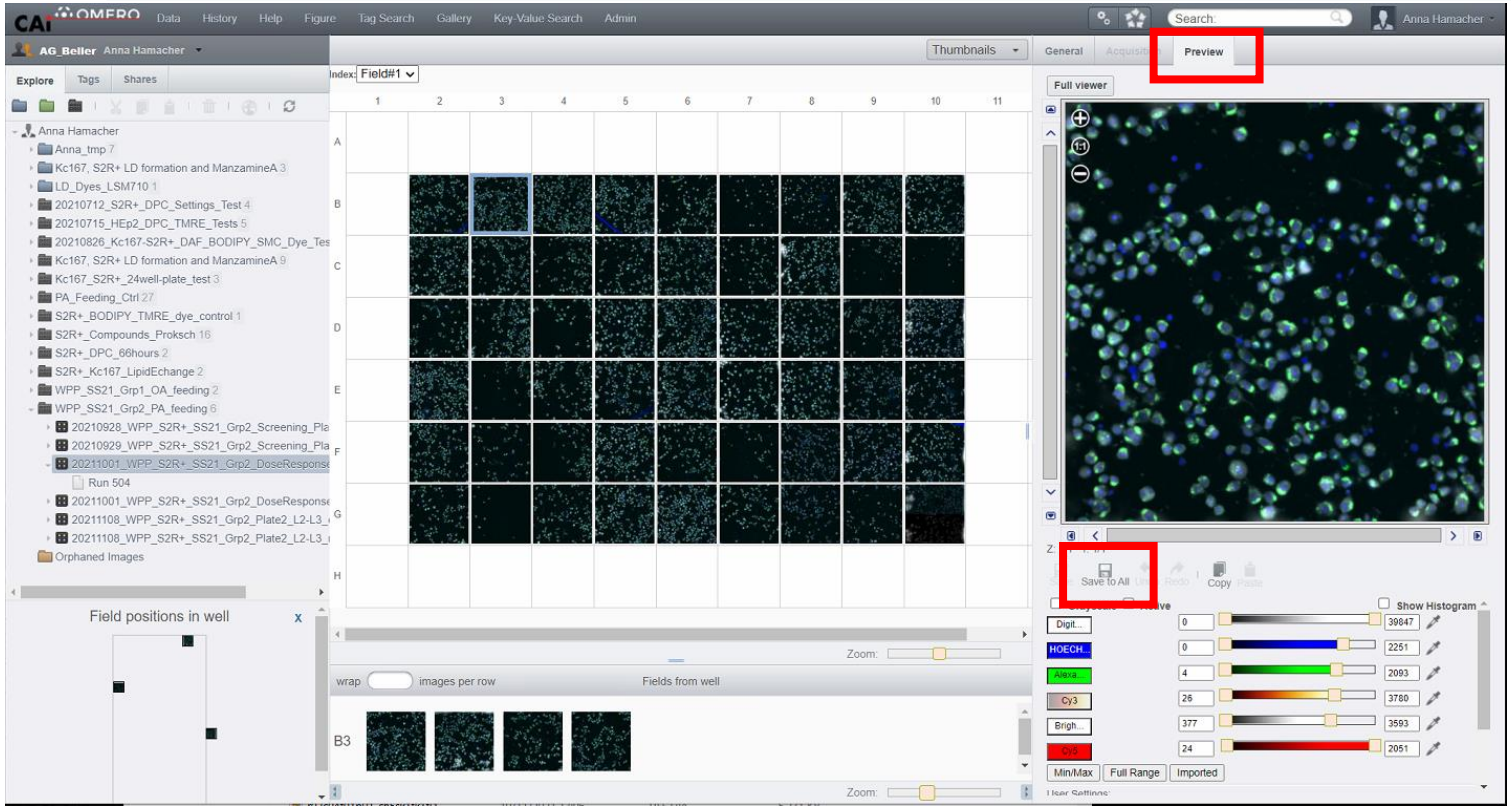


Viewing Plate Data



- Overview
- Plate layout
- Thumbnails
- Fields
- Positions
- Metadata

Viewing Plate Data

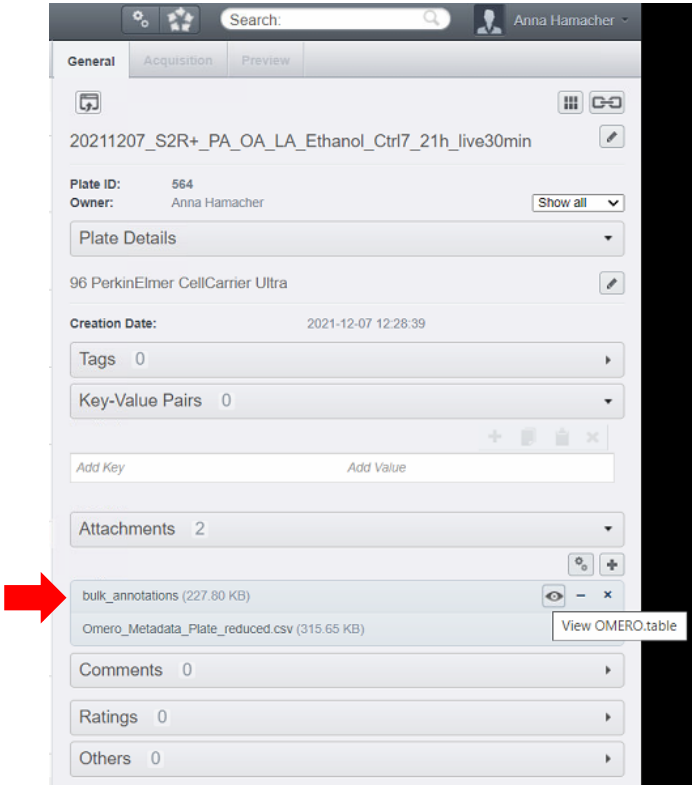


- Standard UI
- Modify viewer settings
  - Channels
  - Colors
  - Dimension
  - …
- „Save to All“ to apply on plate
- How about **related data**?

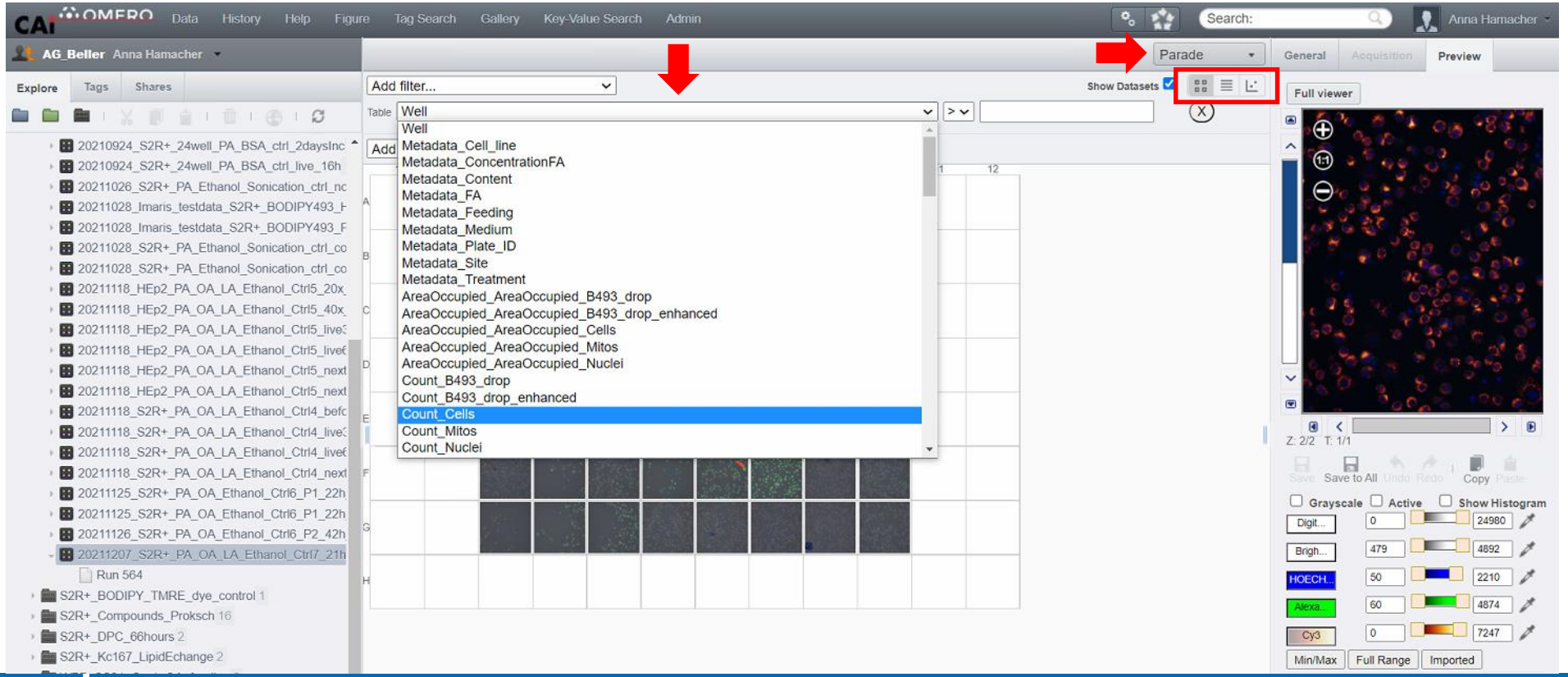
Exploring Plate Data

- Metadata-mining plugin **OMERO.parade**
  - Plot, display and filter images based on metadata
  - Supports ROIs, Key-Value pairs and data stored in OMERO.tables
  - More infos: https://omero-guides.readthedocs.io/

- **Our workflow**
  - Extract analysis data from CellProfiler™ cell image analysis software result tables
  - Prepare datasheet (CSV) with appropriate header
  - Upload CSV with `populate metadata` script to get an OMERO.tables object



Get into OMERO.parade



Filtering in OMERO.parade

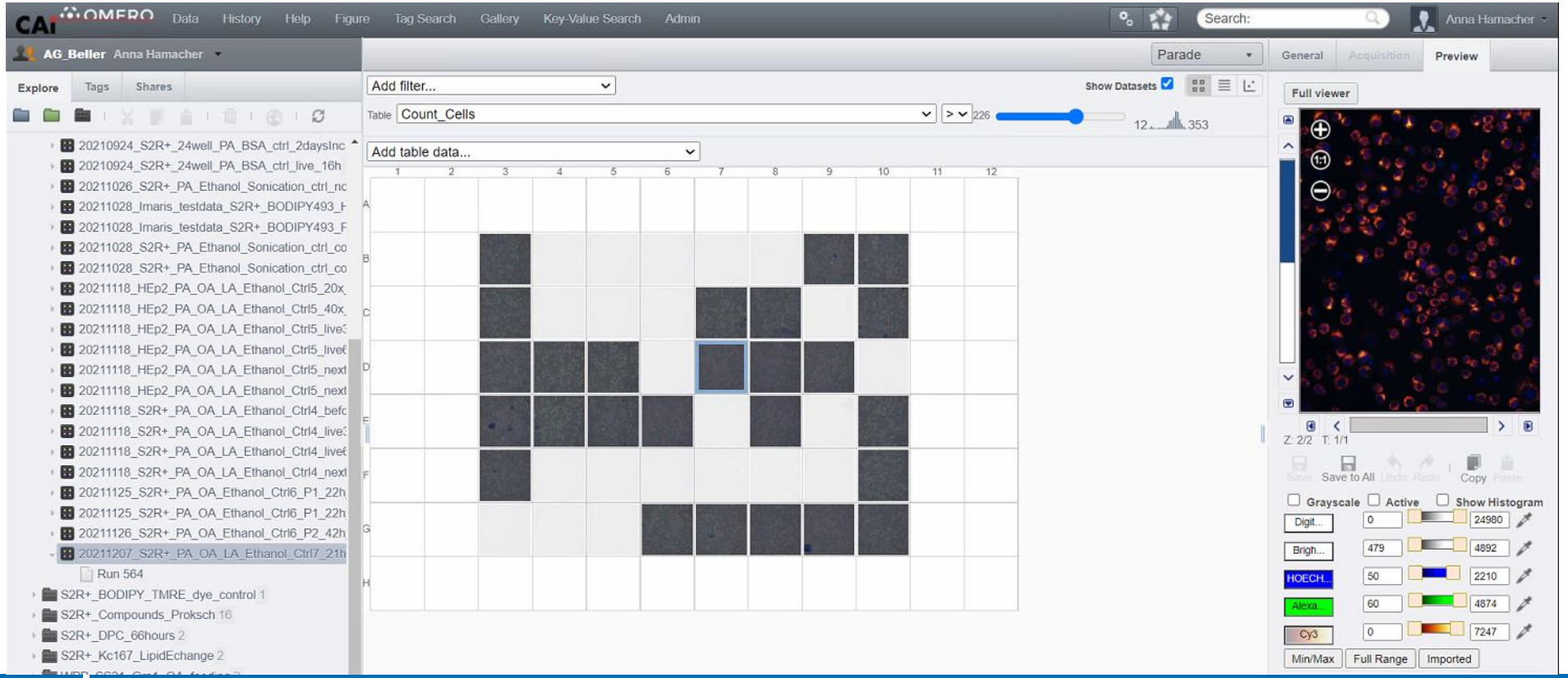


Table view in OMERO.parade

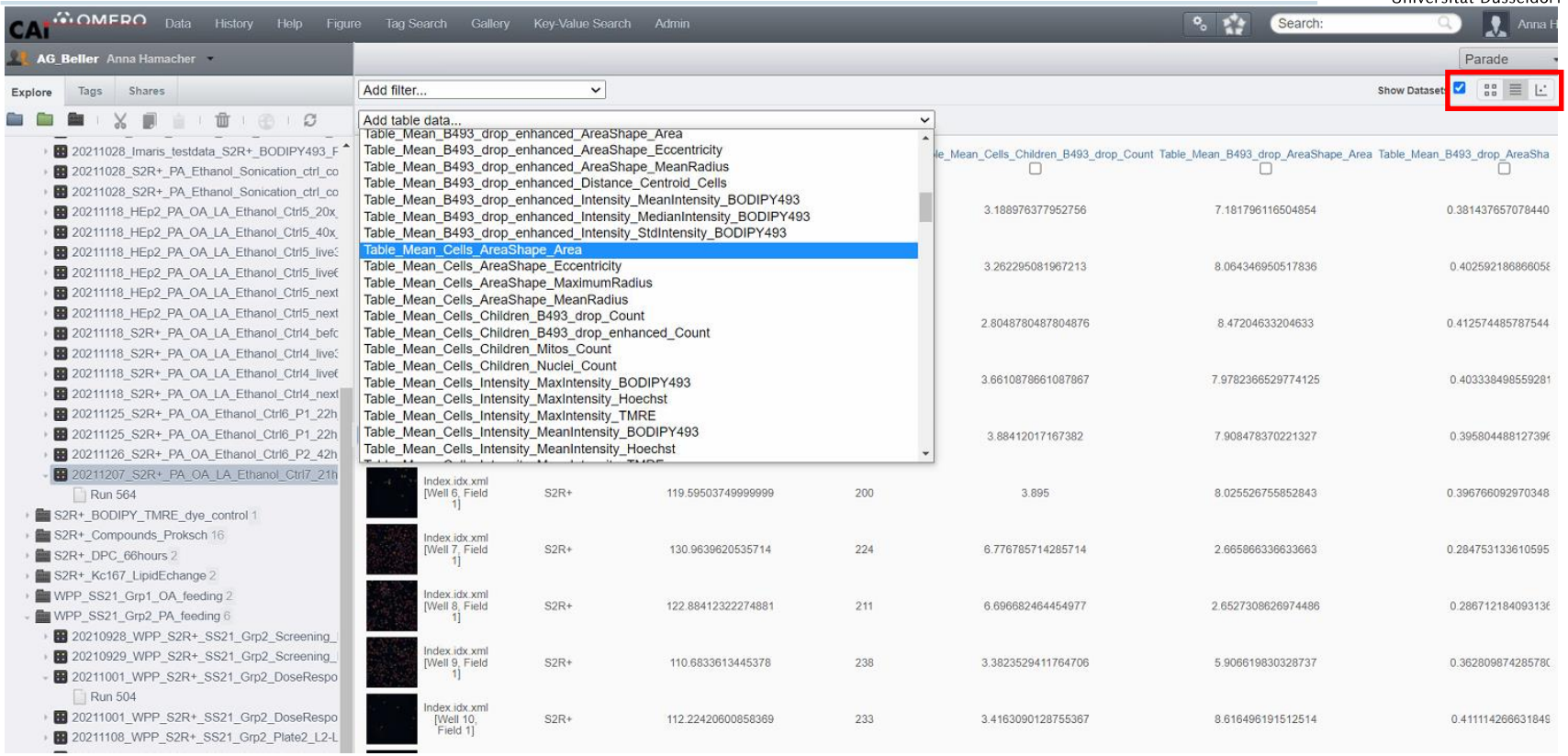
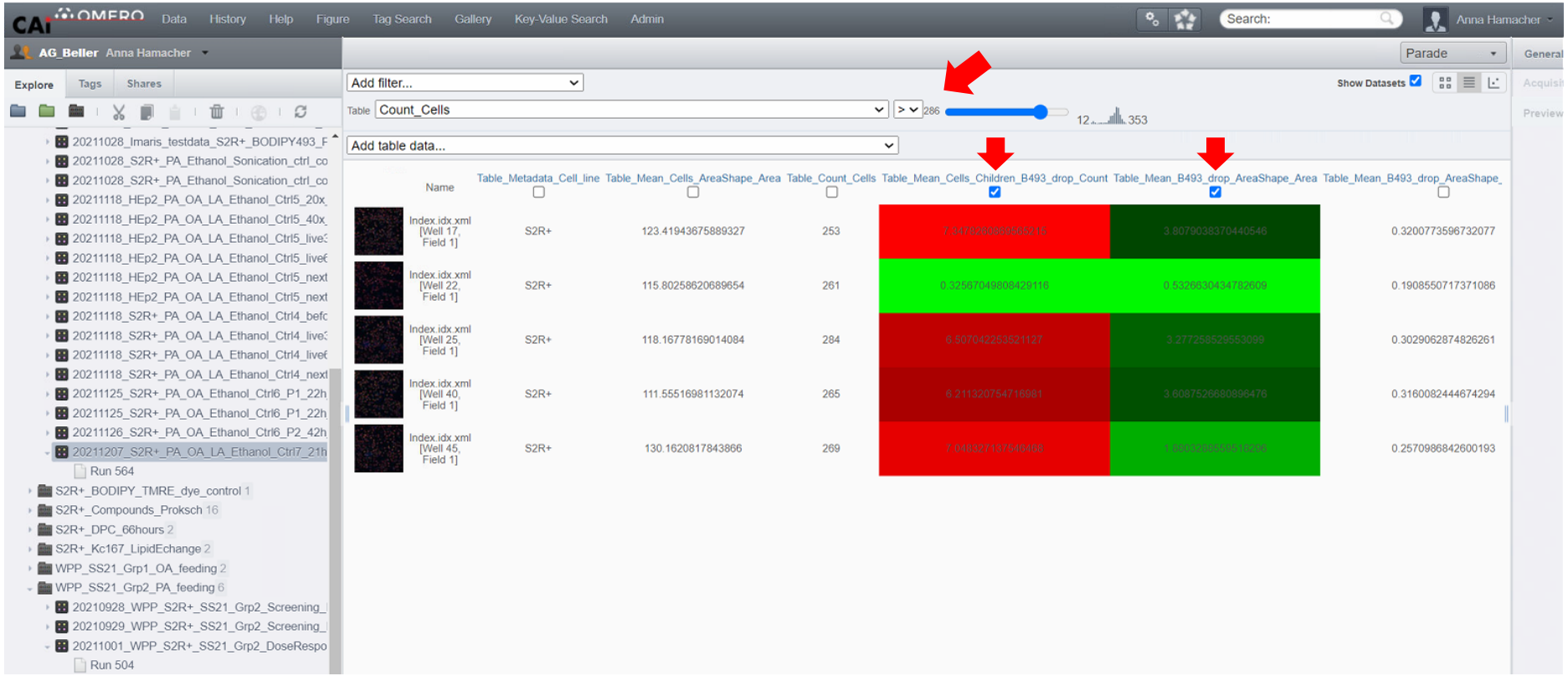
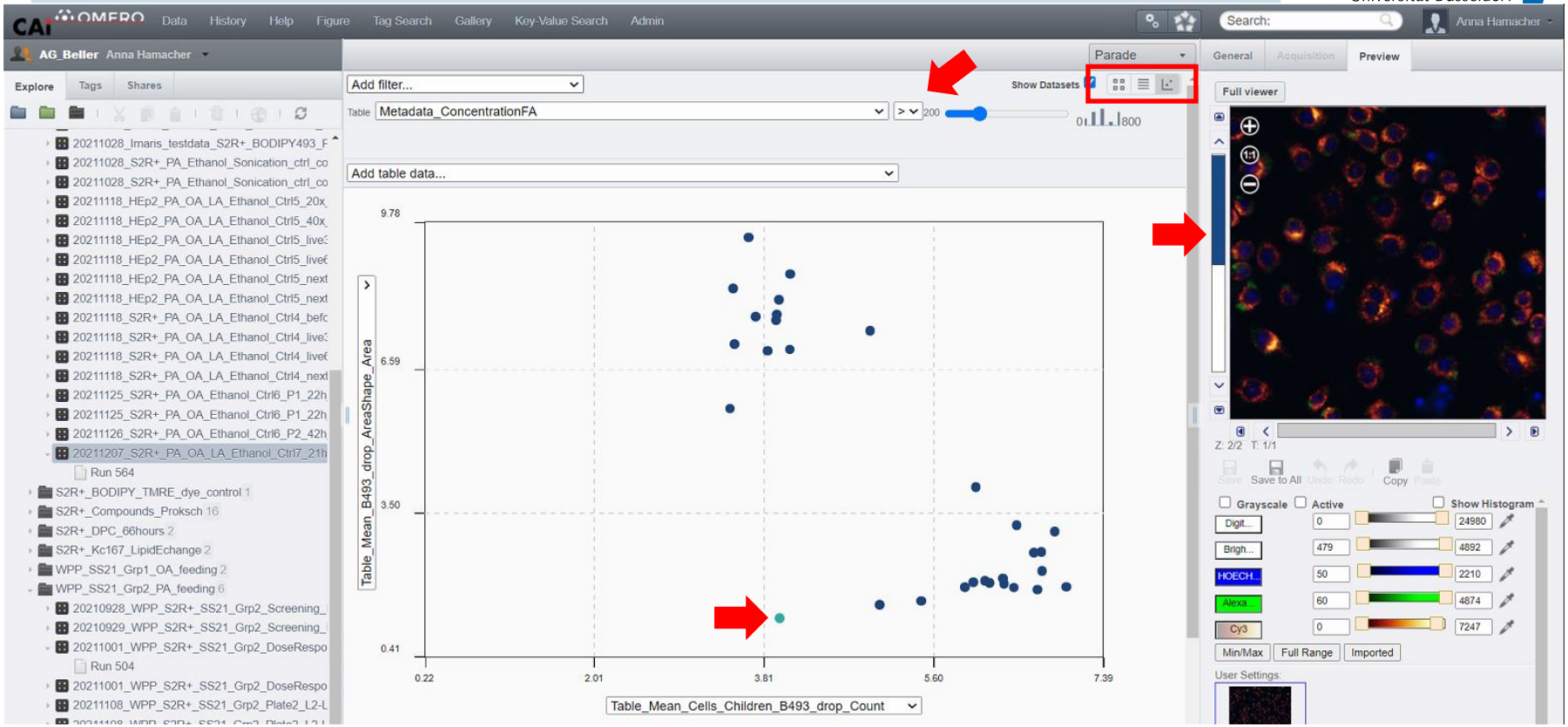


Table view in OMERO.parade



Plotting in OMERO.parade

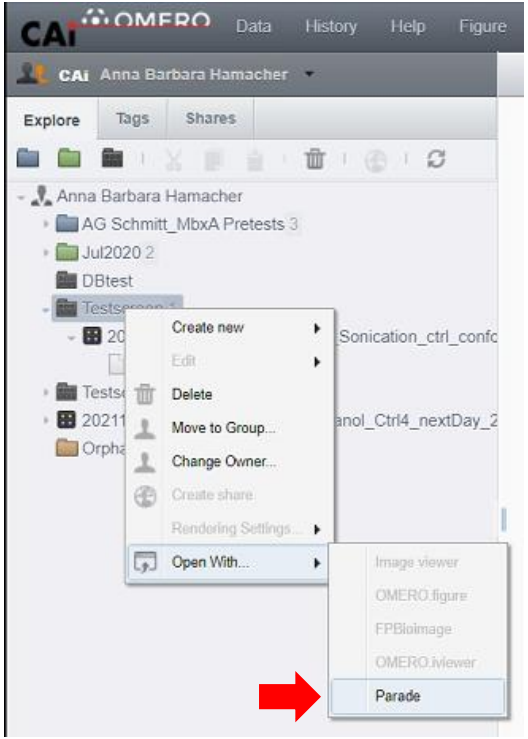


Exploring Plate Data

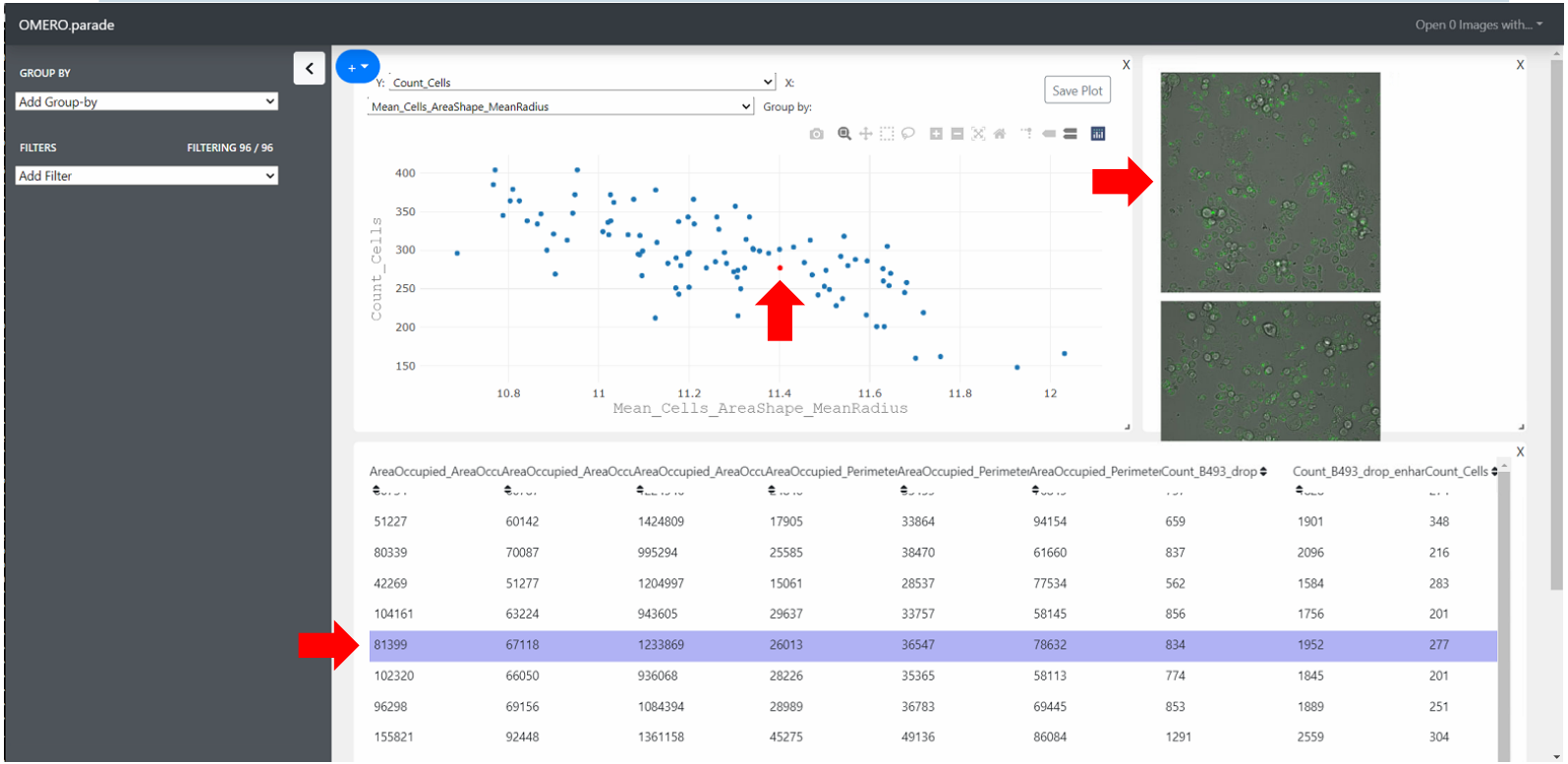
There are some limitations in OMERO.parade, so Will Moore (OME) has developed a prototype:

OMERO.parade-crossfilter

- Screen exploration, not only single plates!
- Individual grouping
- Box plots
- Data exploration dashboard
- React webapp



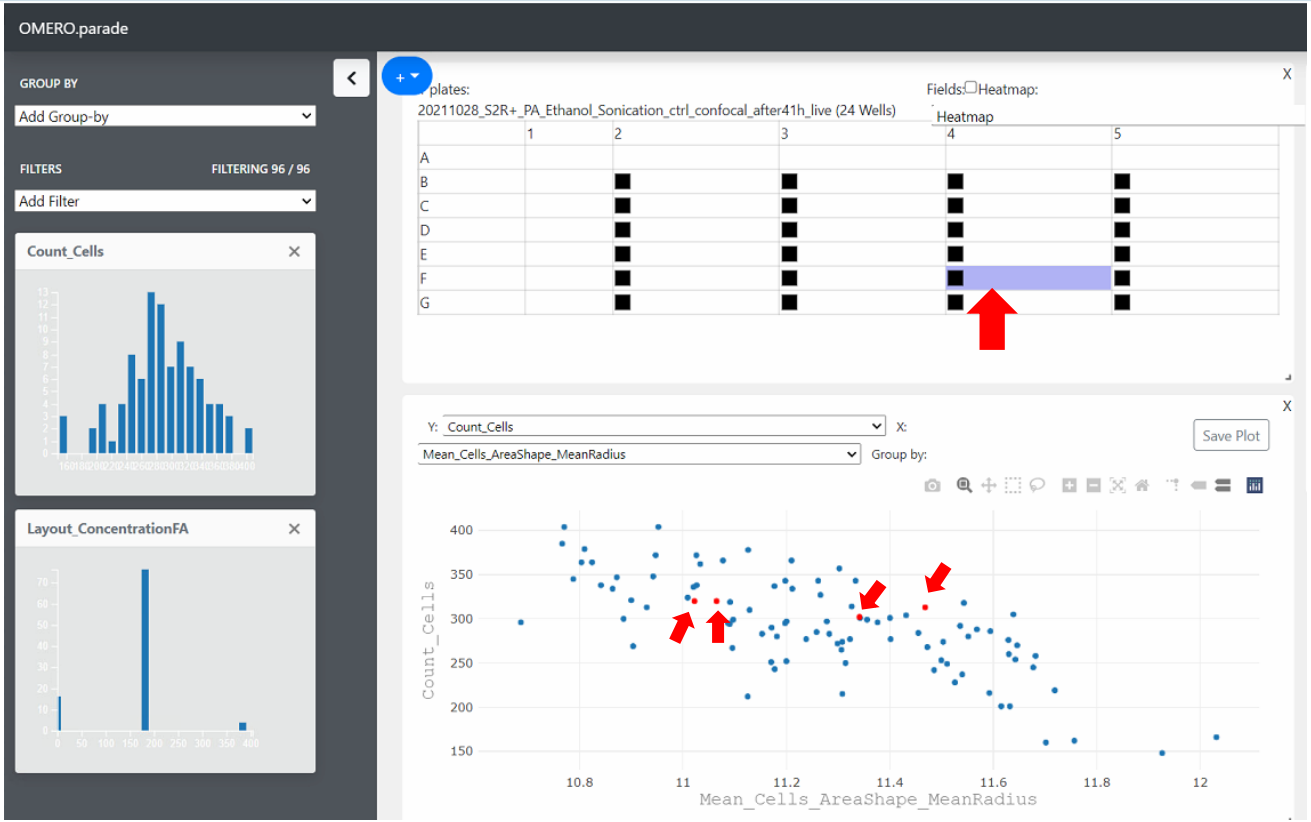
OMERO.parade-crossfilter



- Similar to parade
  - Filter
  - Scatter plot
  - Table view
  - Image preview

but interactive Dashboard!

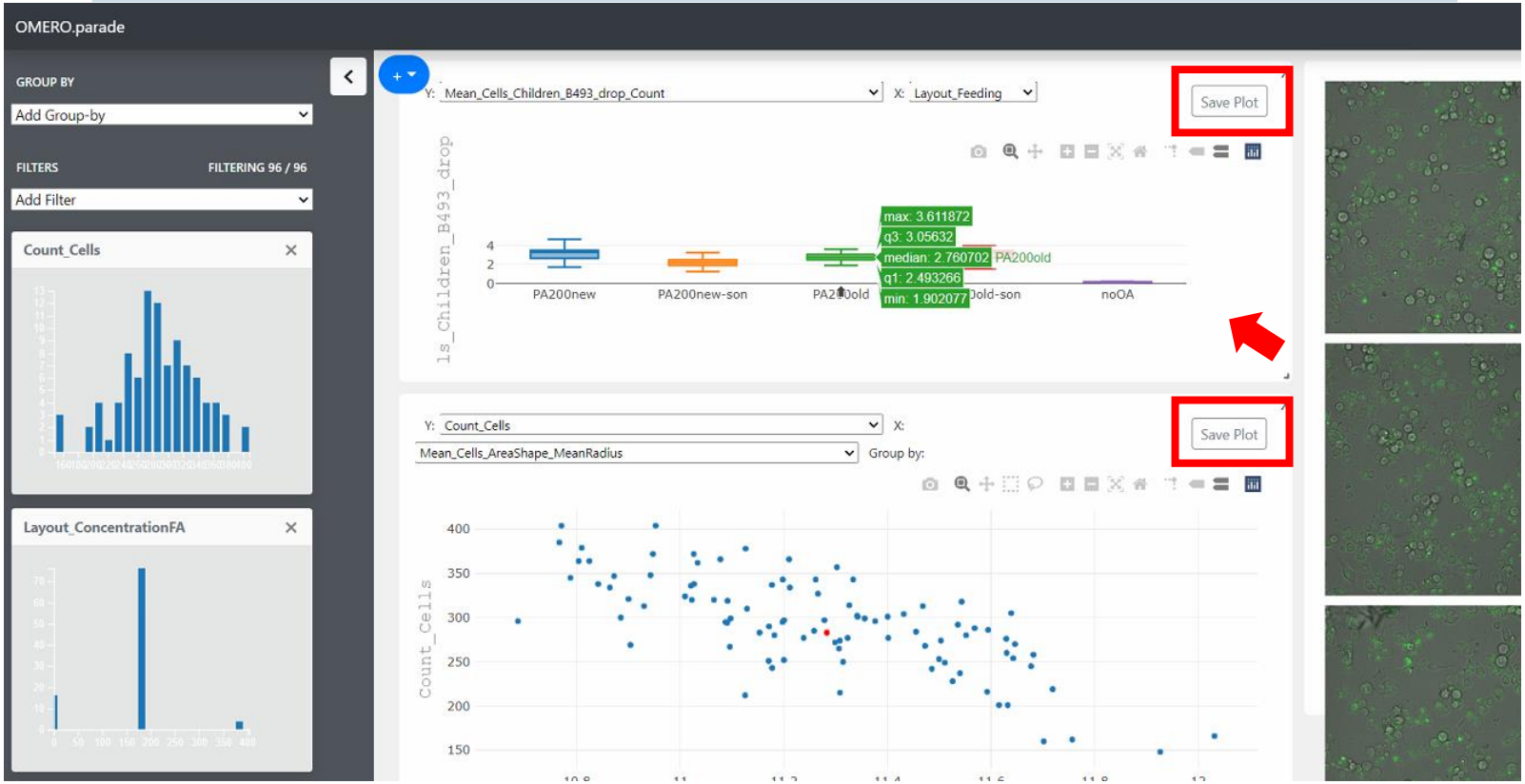
OMERO.parade-crossfilter



New features

- Grouping
- Interactive heatmap
- Interactive charts (plotly)

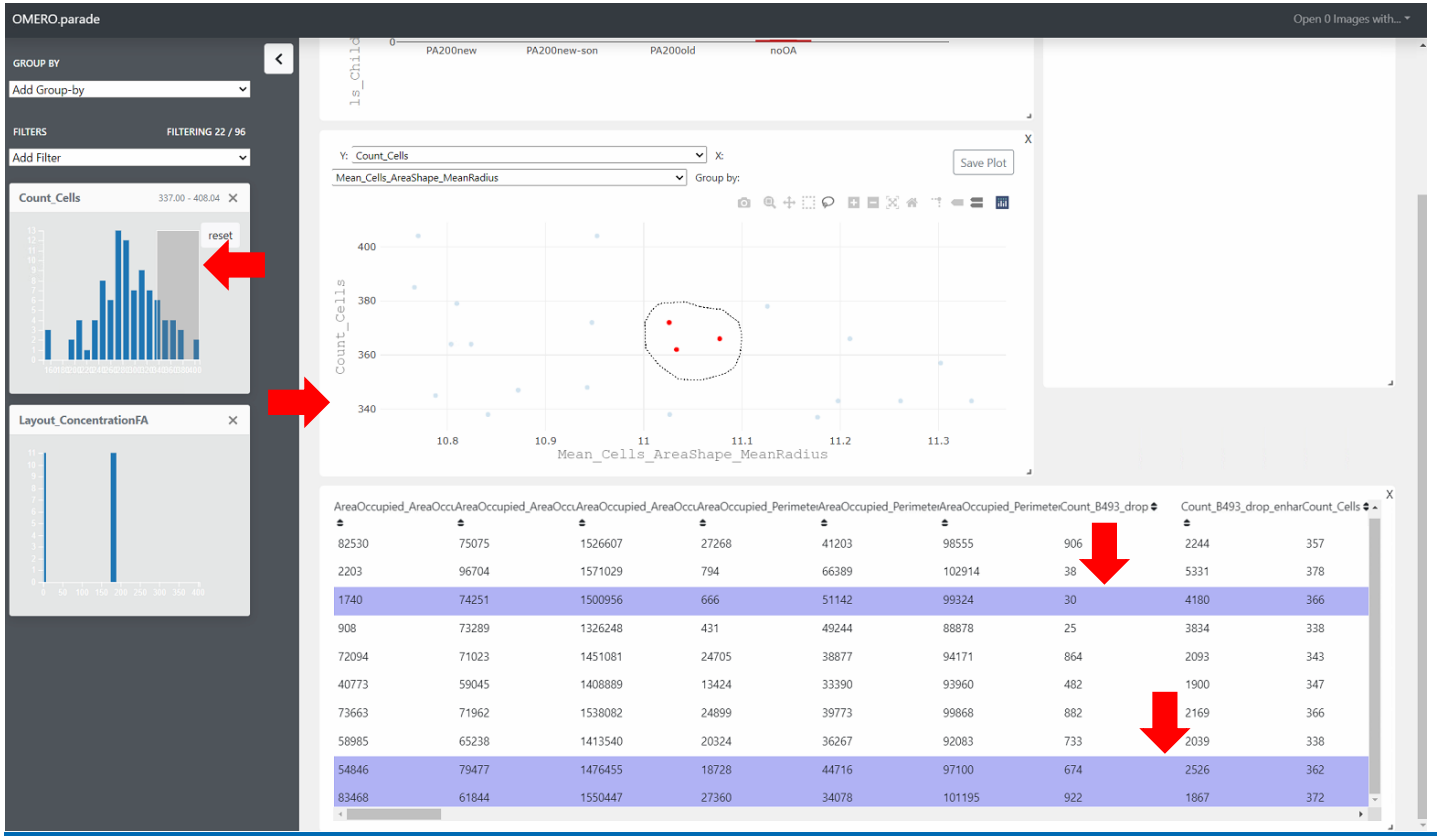
OMERO.parade-crossfilter



New features

- Box plots
- Save plots to OMERO

OMERO.parade-crossfilter



New features

- Interactive filtering
- Interactive selection
- **Everything is connected!**

Next Steps and Challenges

- **Hardware** related:
  - Long uploads, long processing
  - **Performance** with many concurrent connections on the same plate (e.g. student courses)
  - Data gets duplicated when uploading to OMERO (native PerkinElmer file format can‘t be imported in-place)

- **Workflow and software** related:
  - Hard-copy/duplicate works only on command line ➔ integration into server-side-scripts needed
  - **Metadata import** via `populate metadata` is too complex/error-prone ➔ integration into server-side-scripts for more usability and user acceptance
  - OMERO.parade-crossfilter has many nice features, but is not ready for production yet

Thanks for your attention!