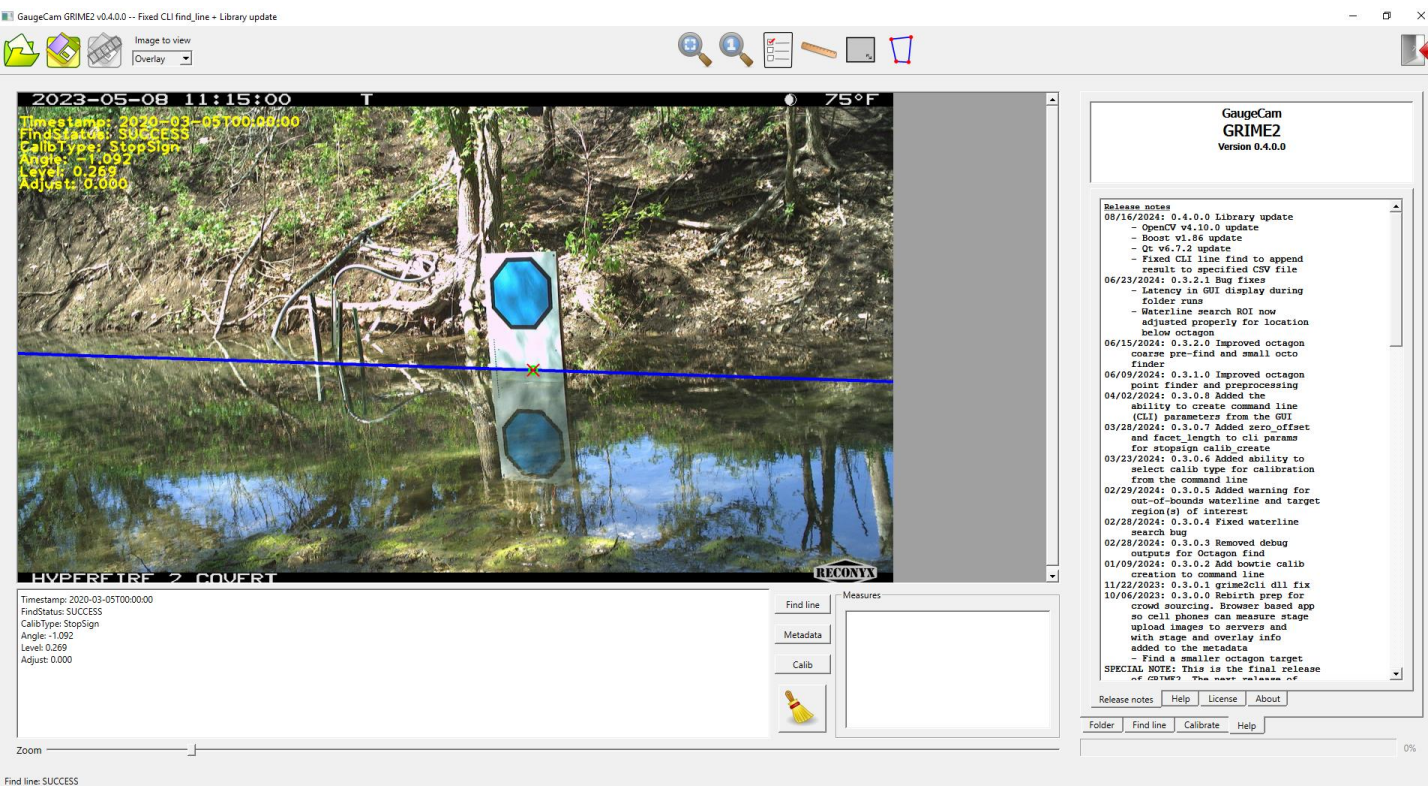# GRIME2 User Guide
V0.4.0.0

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November 1, 2024

GRIME2 is open-source (Apache 2.0) software dedicated to image-based water level measurement.


This guide provides step-by-step instructions for navigating GRIME2 and the two critical steps for measuring water level: calibration and line find.

1. Overview of menus and icons
2. Image calibration
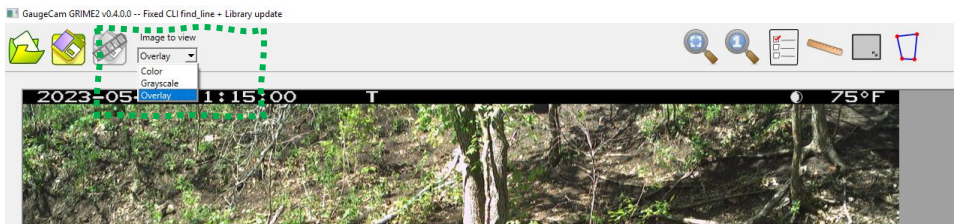3. Water level find (processing)

Overview of menus and icons

Open GRIME2. Information on the version and detailed release notes are shown on the Release Notes tab. Note the Help tab at the very bottom is also selected to reach this screen. You can also view Help, License and About sub-menus here.
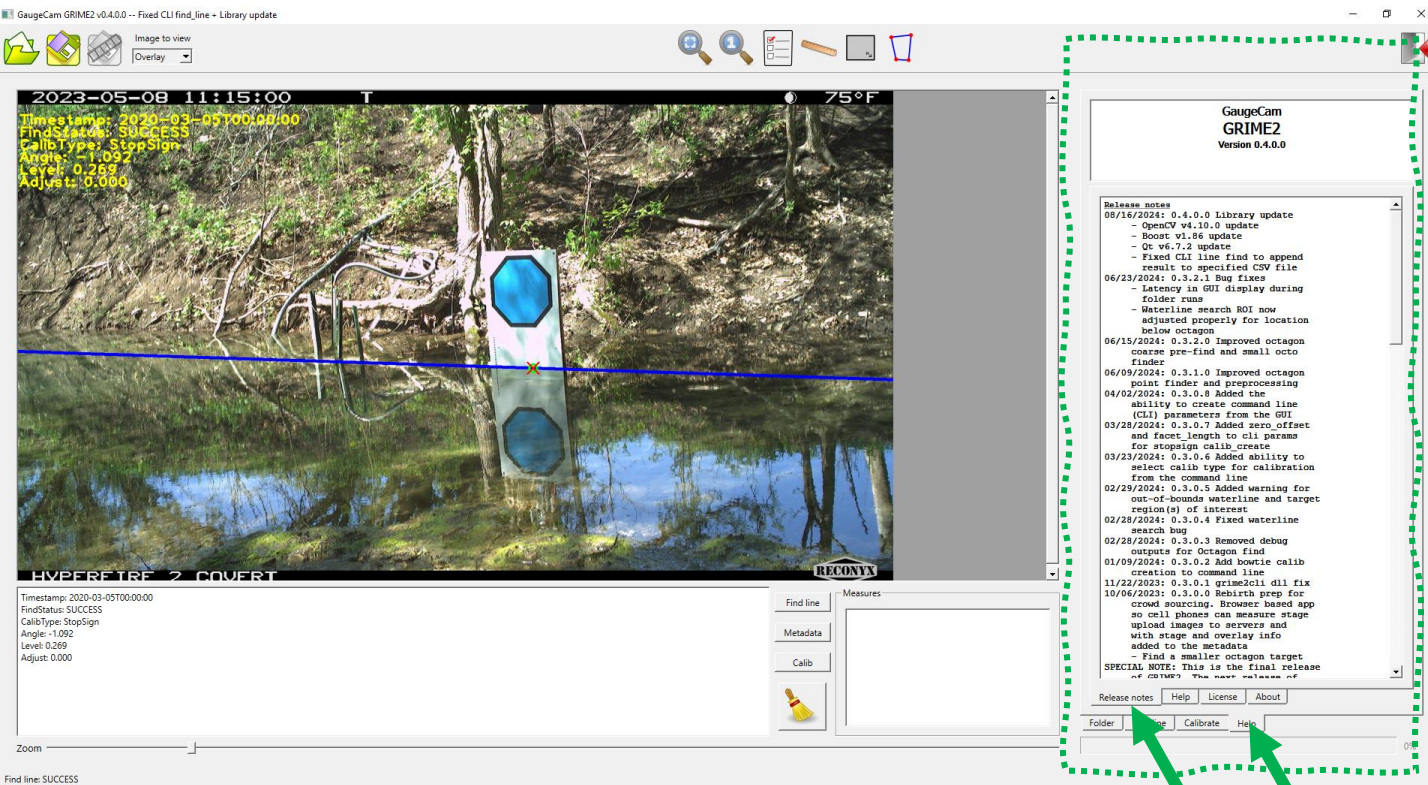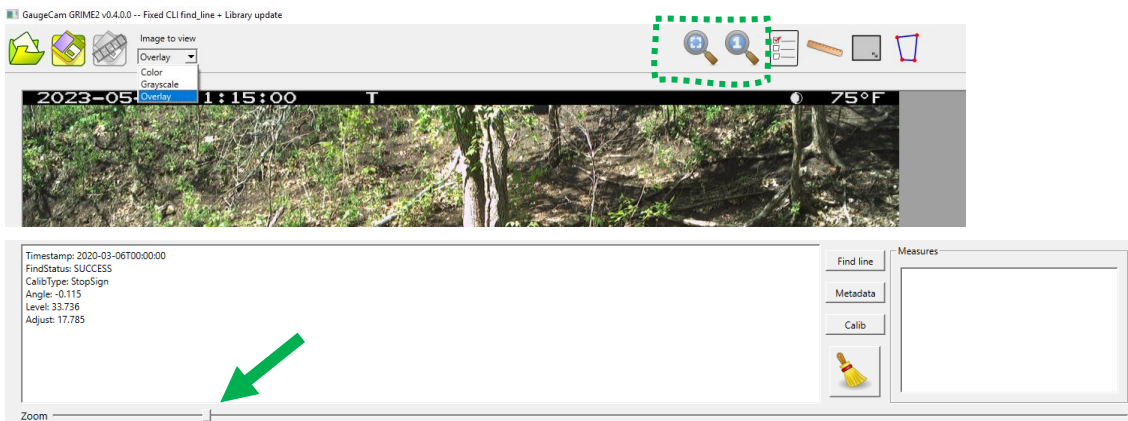

Other menus and icons:
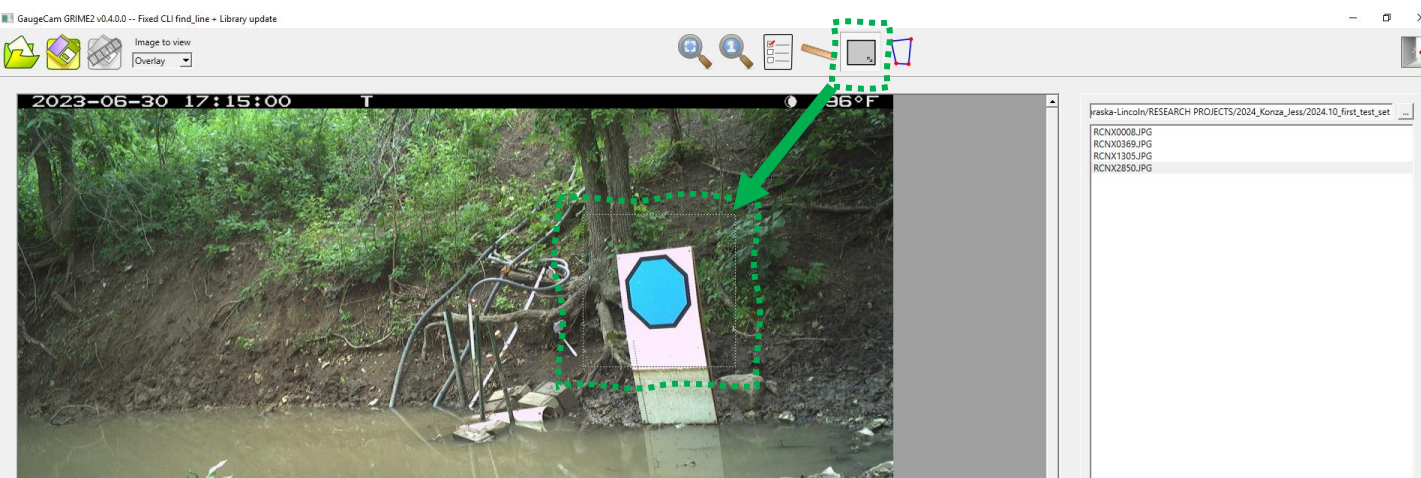
Choose type of image to display.

Quick zoom buttons (top) and fine zoom control (bottom).

Other menus and icons (continued):

Toggle calibration search region of interest (ROI). This is the region where GRIME2 searches for calibration targets (e.g., octagon).
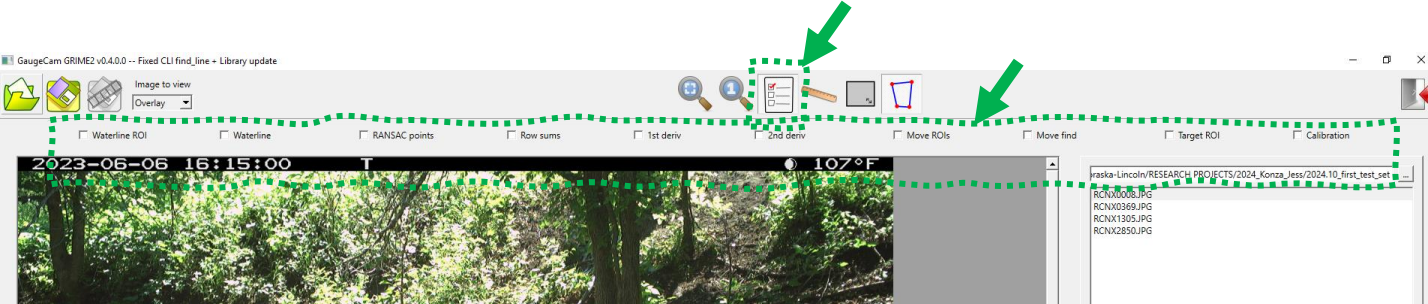

Toggle water line find search region of interest (ROI). This is the region where GRIME2 searches the edge of the water.
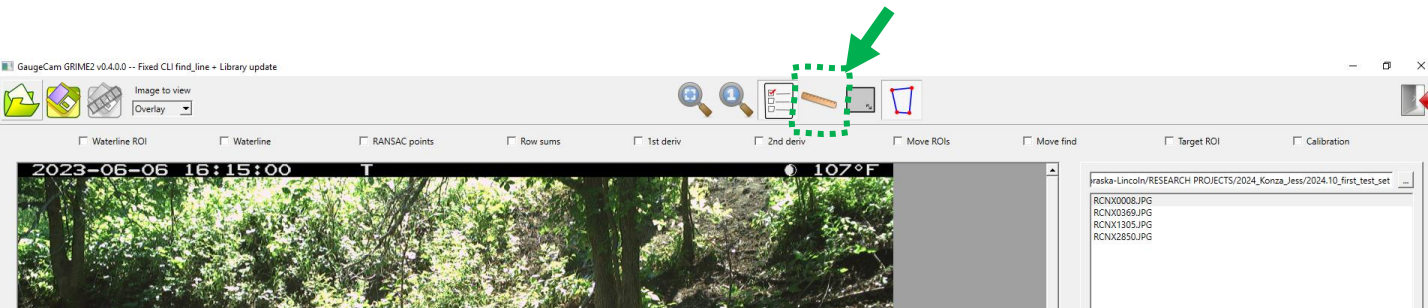
Other menus and icons (continued):

Toggle overlay displays. This icon reveals a range of potential image overlays that can be toggled on and off. These overlays are especially useful for troubleshooting measurement issues.


Measurement tool. This icon toggles a measurement tool on and off. As of version 0.4.0.0, the measurement tool may not be stable.

Open GRIME2. Information on the version and detailed release notes are shown on the Release Notes tab. Note the Help tab at the very bottom is also selected to reach this screen. You can also view Help, License and About sub-menus here.
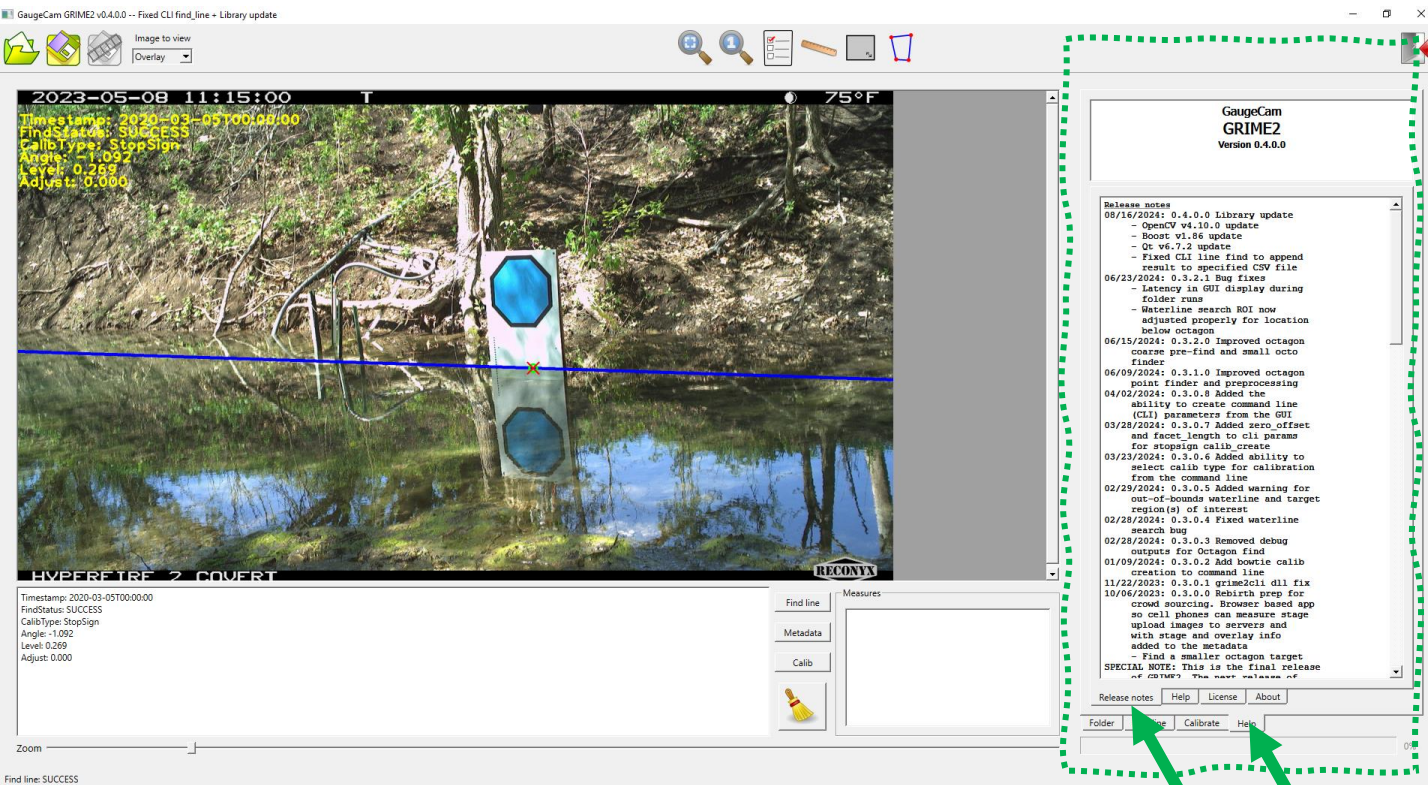
The Folder tab allows selection of an image folder to display.
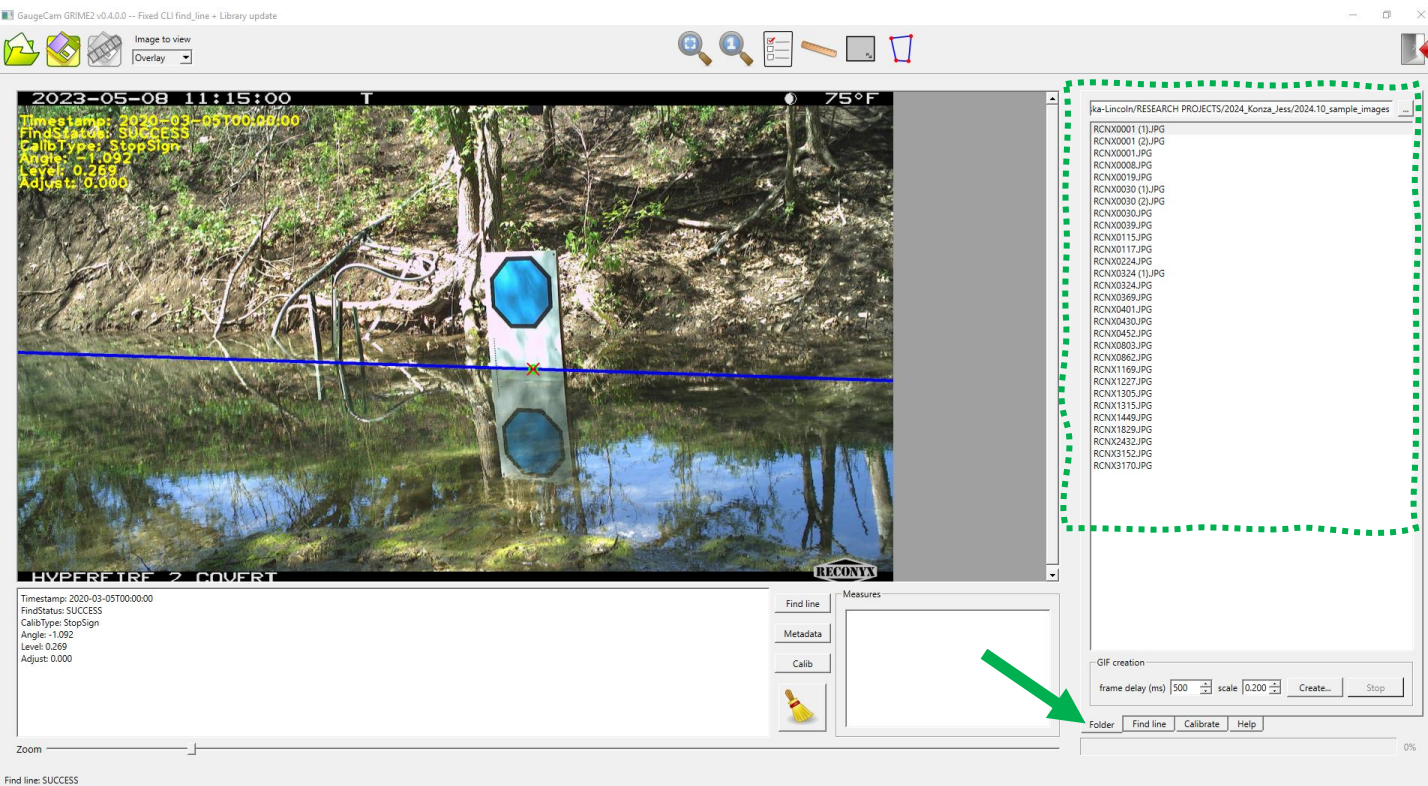
The Find Line tab is where we select the folder of images we want to process (batch processing), where the results (optional CSV file and/or overlay images) will be stored, whether to process a single folder or nested folders, and **importantly**, the source and format of image Timestamps.
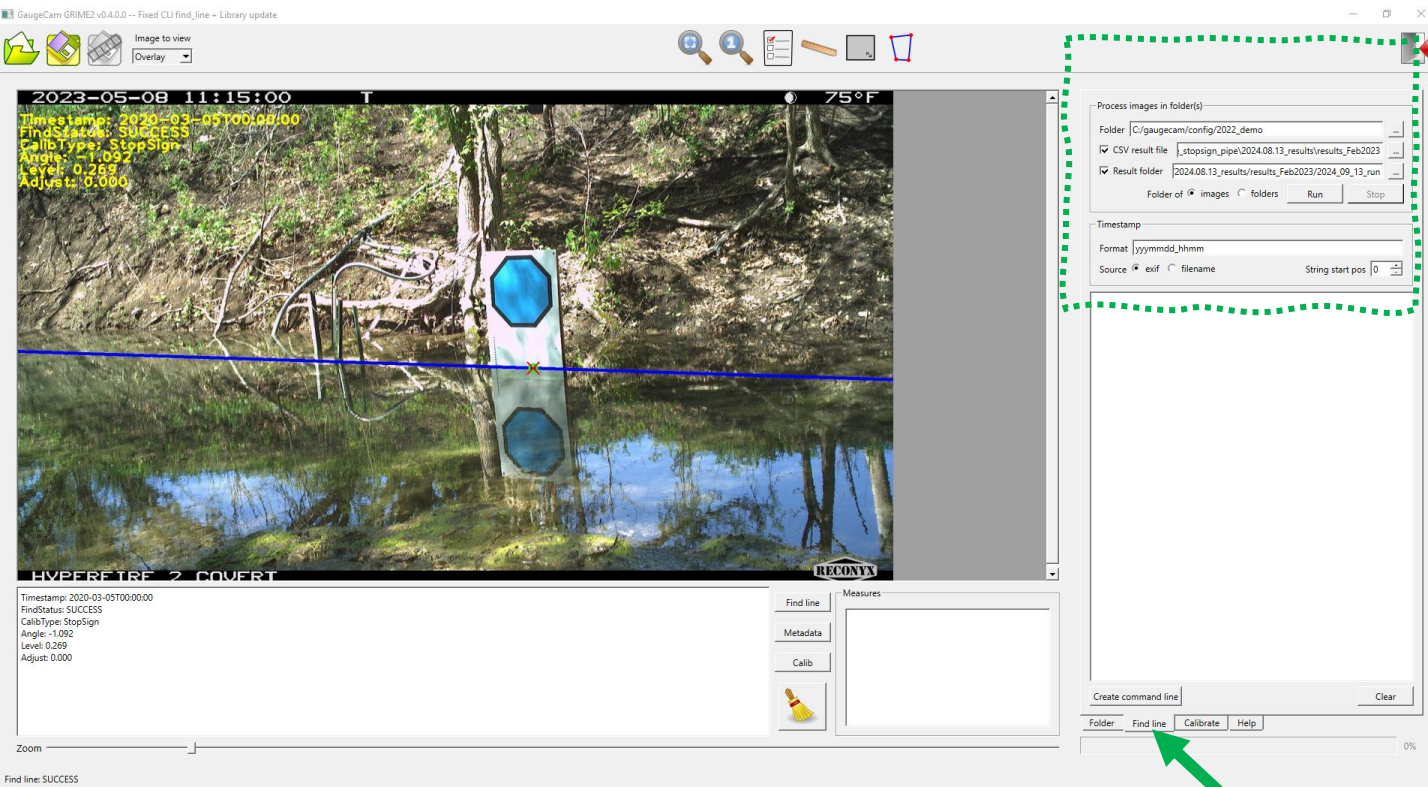
The Calibration tab is where calibration parameters are set. Major selections are Bow tie or Octagon. We will cover more details later in this guide.
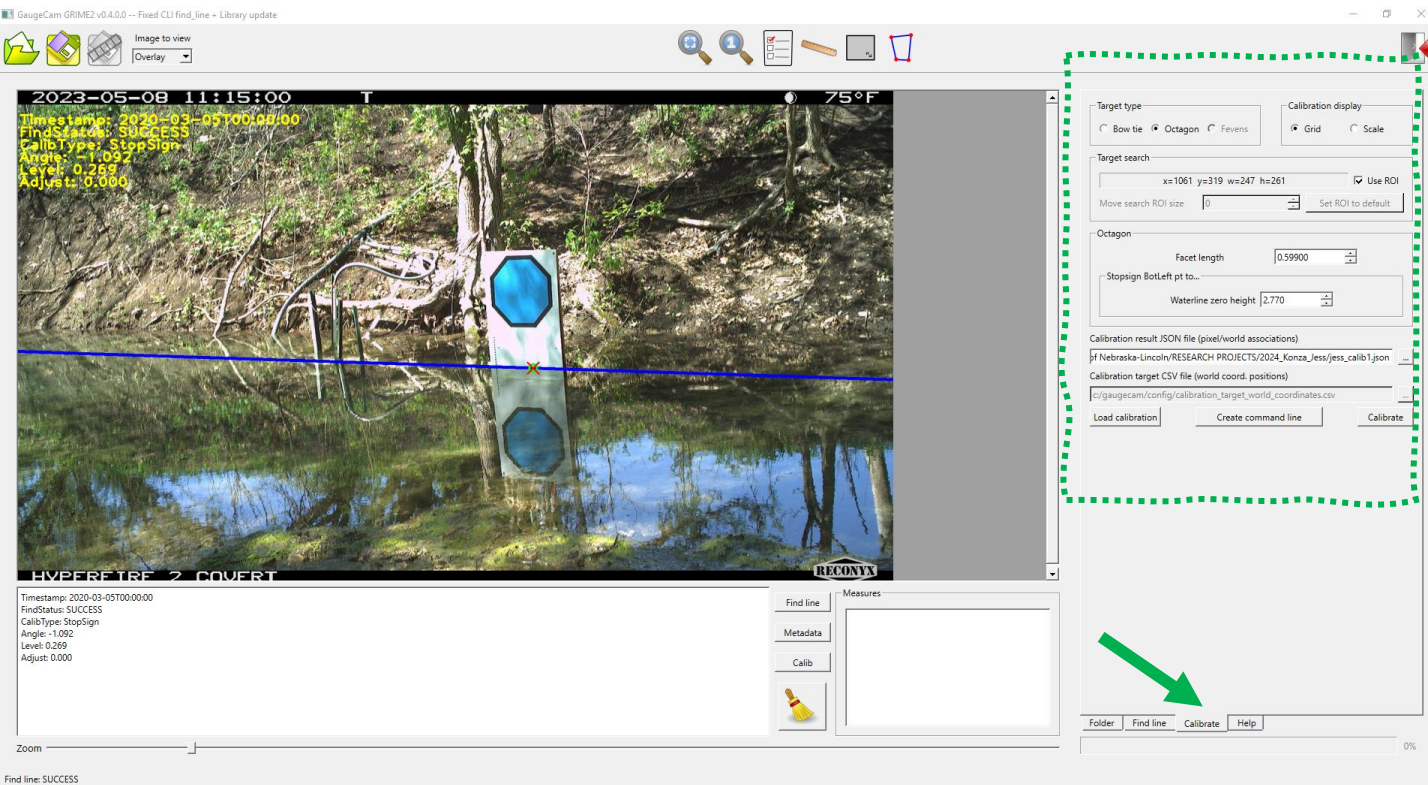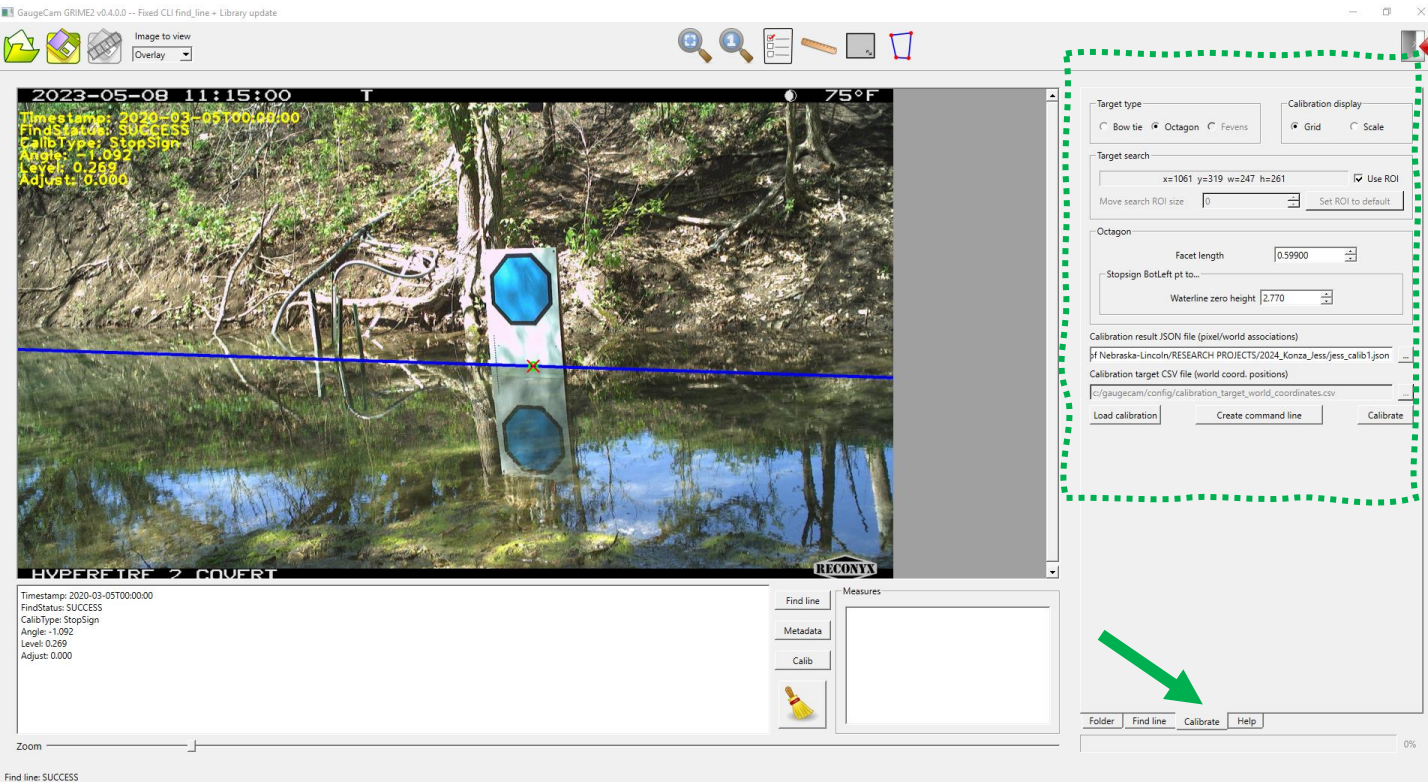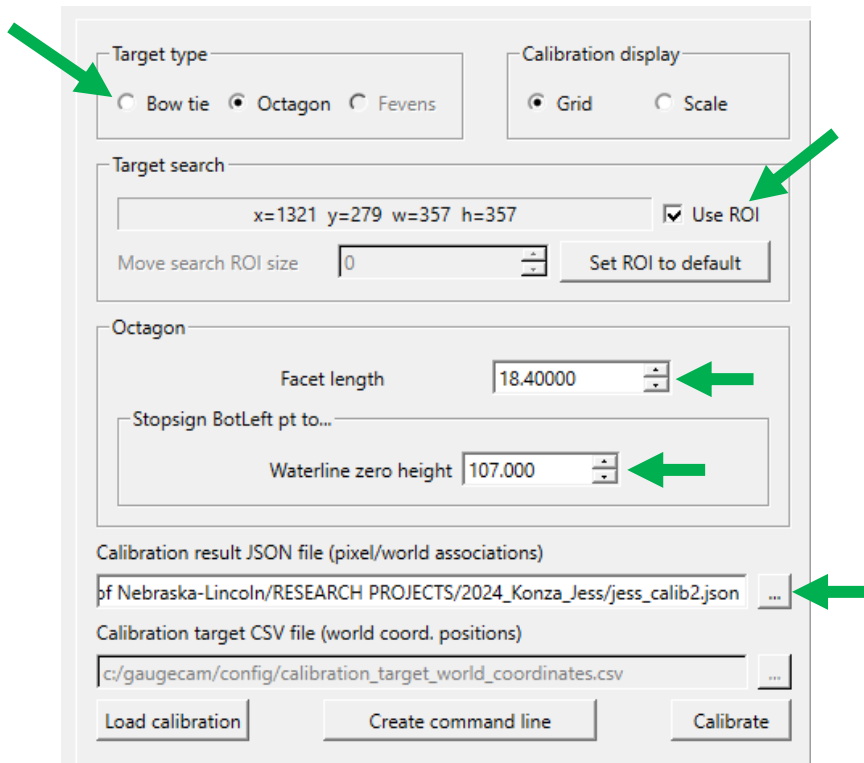
Image calibration

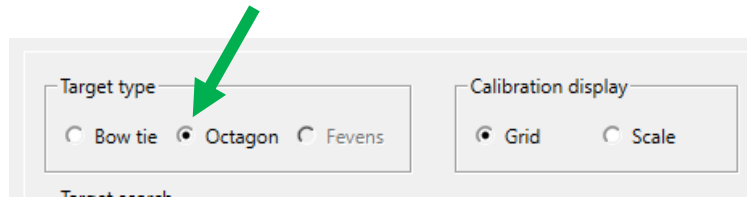**A successful calibration is required for a successful line find!**

Let's set up calibration for an octagon calibration target.

Next, we will walk through the major parameters needed to set up calibration.

Next, we will walk through the major parameters needed to set up calibration. Bow tie calibration is a legacy feature. We'll focus on Octagon calibration for now.

Dimensions of the octagon are critical parameters. Precise measurement of the facet length drives the entire calibration. The waterline zero height is to an arbitrary (or site-specific) datum. One logical approach is to use the bottom of the target sign as the zero water level. For both the facet length and the waterline zero height, measurements are made at the vertices, where the black and blue colors meet. Waterline zero height is relative to the upper left corner of the blue octagon.

NOTE: use consistent units (feet, centimeters) for both Facet length and Waterline zero height. If you do this, the resulting water level measurements will be in the same units.
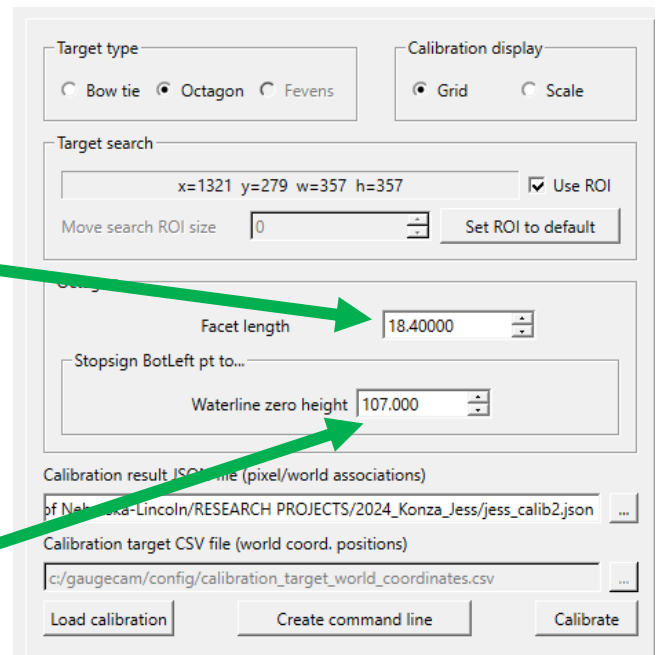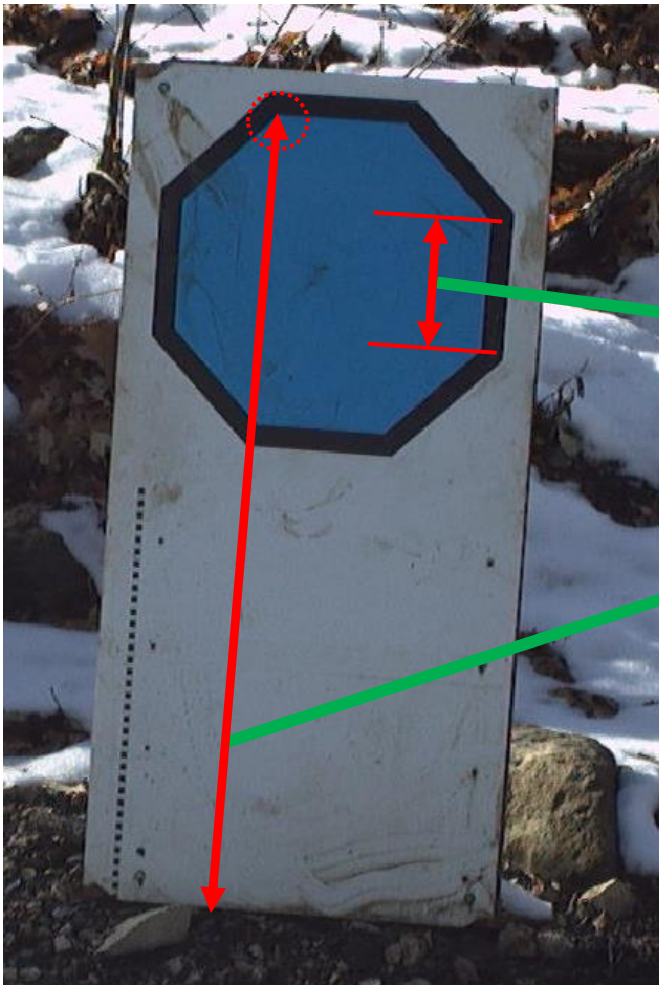
The Calibration result JSON file holds important information. If processing images in multiple folders and/or there are major changes in the field of view, then the calibration search ROI, waterline search ROI and other calibration parameters will change. In this case, it is best to have a separate calibration result JSON file for the different sets of images. That is why we have the option to change the location and name of the JSON file.

Octagon

Facet length   18.40000

Stopsign BotLeft pt to...

Waterline zero height 107.000

Calibration result JSON file (pixel/world associations)

bf Nebraska-Lincoln/RESEARCH PROJECTS/2024_Konza_Jess/jess_calib2.json   ...

Calibration target CSV file (world coord. positions)

c:/gaugecam/config/calibration_target_world_coordinates.csv   ...

Load calibration   Create command line   Calibrate

Contents of an example JSON file
(You should not have to edit these files, **this is just background information**)

jess_calib2 - Notepad

File Edit Format View Help

```
{
  "calibType":"StopSign",
  "imageWidth":2048,
  "imageHeight":1152,
  "facetLength":18.4,
  "zeroOffset":107,
  "PixelToWorld":
  {
    "points": [
      { "pixelX": 1463.496, "pixelY": 387.794, "worldX": 0.000, "worldY": 0.000 },
      { "pixelX": 1514.756, "pixelY": 384.482, "worldX": 18.400, "worldY": 0.000 },
      { "pixelX": 1557.813, "pixelY": 425.489, "worldX": 31.411, "worldY": -13.011 },
      { "pixelX": 1564.281, "pixelY": 489.441, "worldX": 31.411, "worldY": -31.411 },
      { "pixelX": 1529.932, "pixelY": 534.370, "worldX": 18.400, "worldY": -44.422 },
      { "pixelX": 1478.304, "pixelY": 536.256, "worldX": 0.000, "worldY": -44.422 },
      { "pixelX": 1432.365, "pixelY": 491.207, "worldX": -13.011, "worldY": -31.411 },
      { "pixelX": 1430.852, "pixelY": 431.367, "worldX": -13.011, "worldY": -13.011 }
    ]
  },
  "TargetSearchRegion":
  {
    "x": 1321, "y": 279, "width": 357, "height": 357
  },
  "WaterlineSearchRegion":
  {
    "toplft_x": 1568, "toplft_y": 635, "toprgt_x": 1482, "toprgt_y": 637, "botlft_x": 1502, "botl
  },
  "SearchLines": [
    { "topX": 1482, "topY": 637, "botX": 1502, "botY": 812 },
    { "topX": 1483, "topY": 637, "botX": 1503, "botY": 812 },
    { "topX": 1484, "topY": 637, "botX": 1504, "botY": 812 },
    { "topX": 1485, "topY": 637, "botX": 1505, "botY": 812 },
    { "topX": 1486, "topY": 637, "botX": 1506, "botY": 812 },
    { "topX": 1487, "topY": 637, "botX": 1507, "botY": 812 },
    { "topX": 1488, "topY": 637, "botX": 1508, "botY": 812 },
    { "topX": 1489, "topY": 637, "botX": 1509, "botY": 812 },
```

Type of calibration

Facet length

Zero water height

Pixel and real-world coordinate relationships at all of the octagon vertices.

Pixel coordinates of the calibration target search ROI

Pixel coordinates of the water line search ROI

The last step for calibration is to set up the Target search ROI.

1. Use the Target search ROI to toggle on the search ROI in the image.
2. Drag the corners of the ROI to cover a reasonable area of the image for GRIME2 to search for the octagon target.

The smaller the ROI, the faster the image processing. HOWEVER, the ROI needs to be large enough that it contains the octagon for all images you want to process with this calibration.

Once the Target search ROI is set, click on the Calibrate button to calibrate this image.

A successful calibration!

Water Level Measurement

Once calibration is successful we can move on to actual water level measurement!

1. Use the Target search ROI to toggle on the search ROI in the image.
2. Drag the corners of the ROI to cover a reasonable area of the image for GRIME2 to search for the octagon target.

The smaller the ROI, the faster the image processing. HOWEVER, the ROI needs to be large enough that it contains the octagon for all images you want to process with this calibration.

Once the Target search ROI is set, click on the Calibrate button to calibrate this image.

A successful calibration!

Once calibration is successful we can move on to actual water level measurement!

1. Use the Line Find search ROI to toggle on the search ROI in the image.
2. Drag the corners of the ROI to cover a reasonable area of the image for GRIME2 to search for the water level. Keep in mind that if the field of view changes in other images and the search area moves off of the background or overlaps with the octagon, you will get erroneous results.
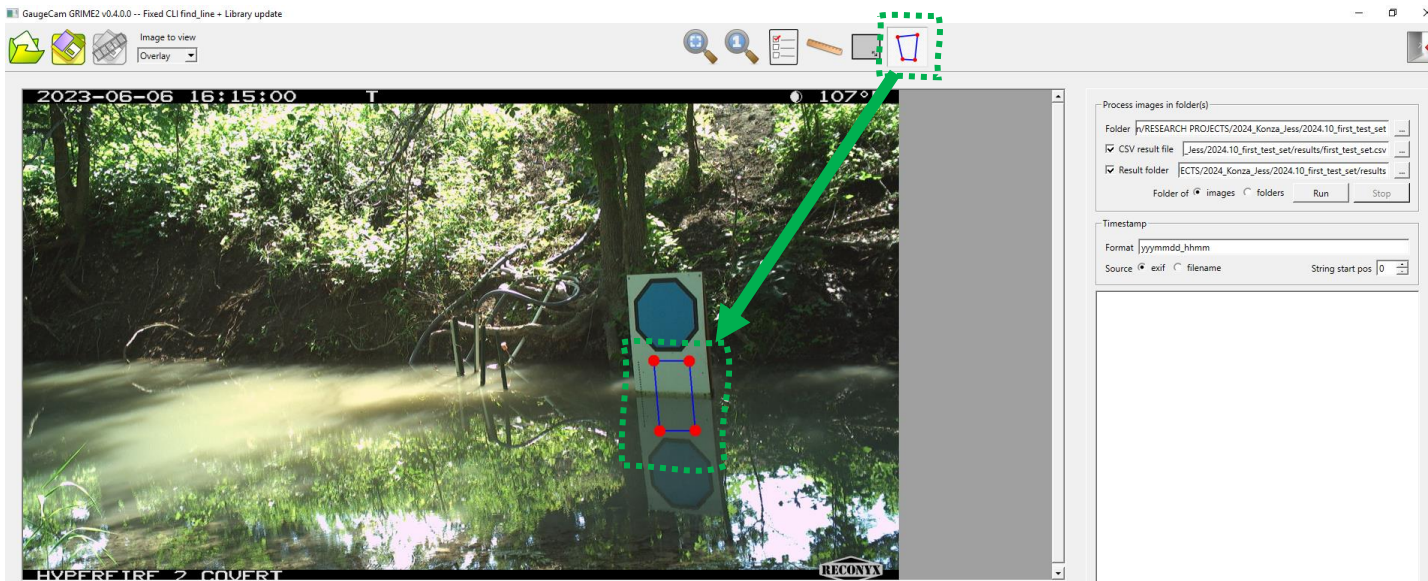
Next, we will walk through the major parameters needed to process a folder (or folder of folders) of images.
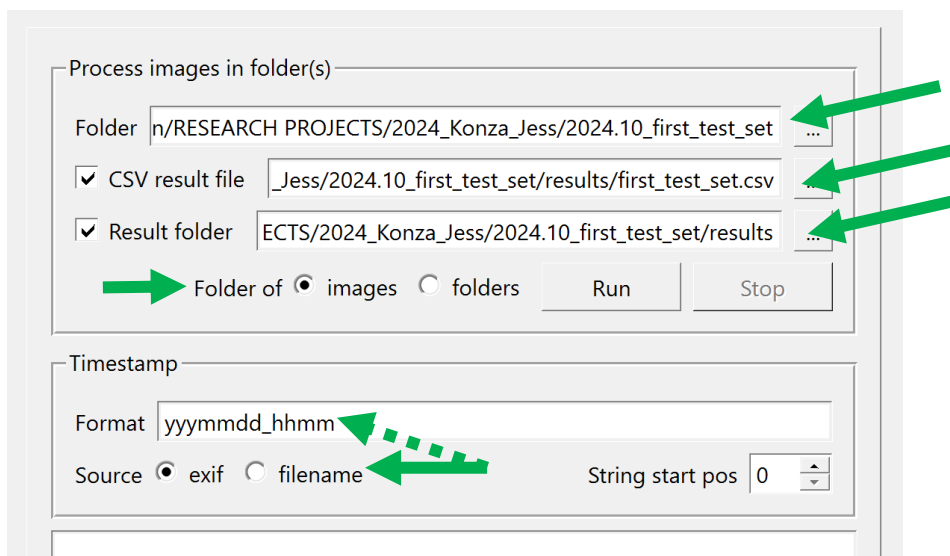
Water level measurement: setting up image and results folders.

1. Use the Line Find search ROI to toggle on the search ROI in the image.
2. Drag the corners of the ROI to cover a reasonable area of the image for GRIME2 to search for the water level. Keep in mind that if the field of view changes in other images and the search area moves off of the background or overlaps with the octagon, you will get erroneous results.

Location of images you want to process.

Location where you want the results spreadsheet stored. Be sure to have FileName.csv at the end of this location string, or you will get an error!

If you want overlay images showing the results of line finds, then check the box and enter a location here. Do NOT use the exact same location as the original images.

Example overlay image.

Timestamp
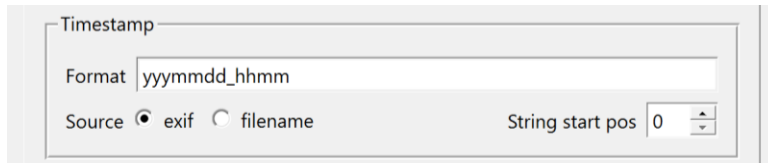
A timestamp is required to successfully process images. The ideal case is to use EXIF information (image metada) to extract the original timestamp from the image. You can check whether your images have timestamps available in the main screen of GRIME2.
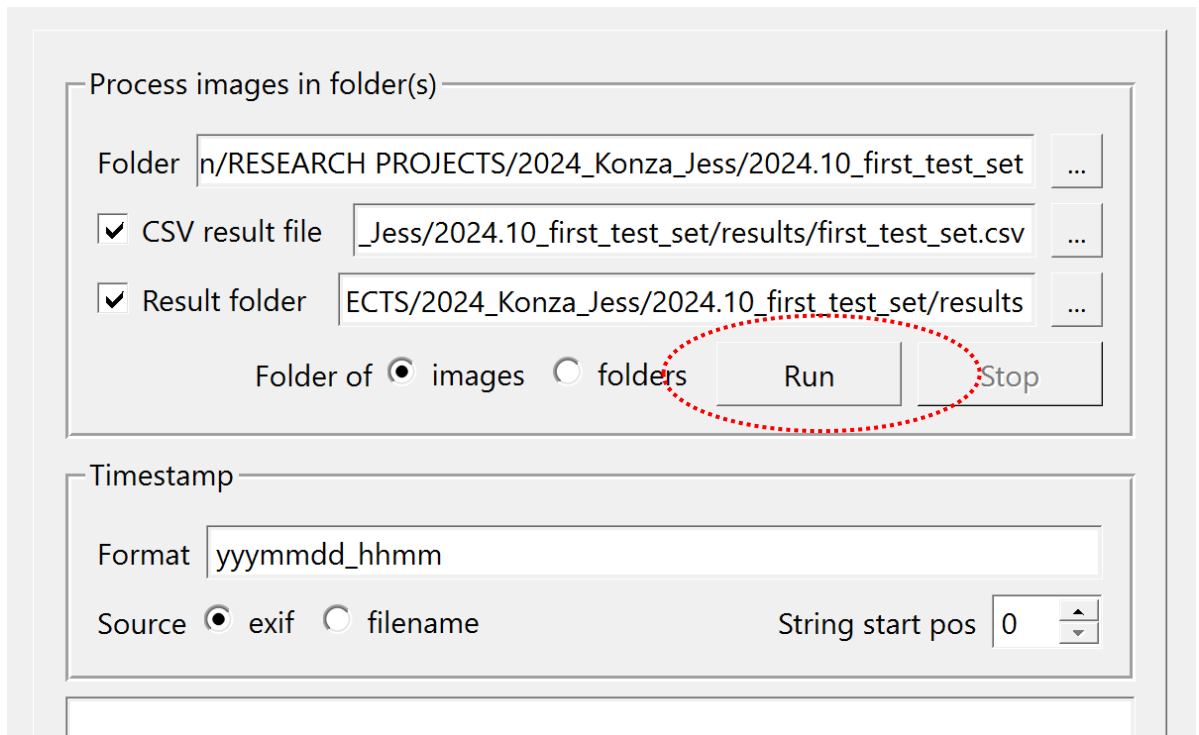
1. Select and image
2. Click on Metadata button
3. See if a timestamp exists in the extracted information
4. If so, use the exif timestamp option in the Line find parameter setup
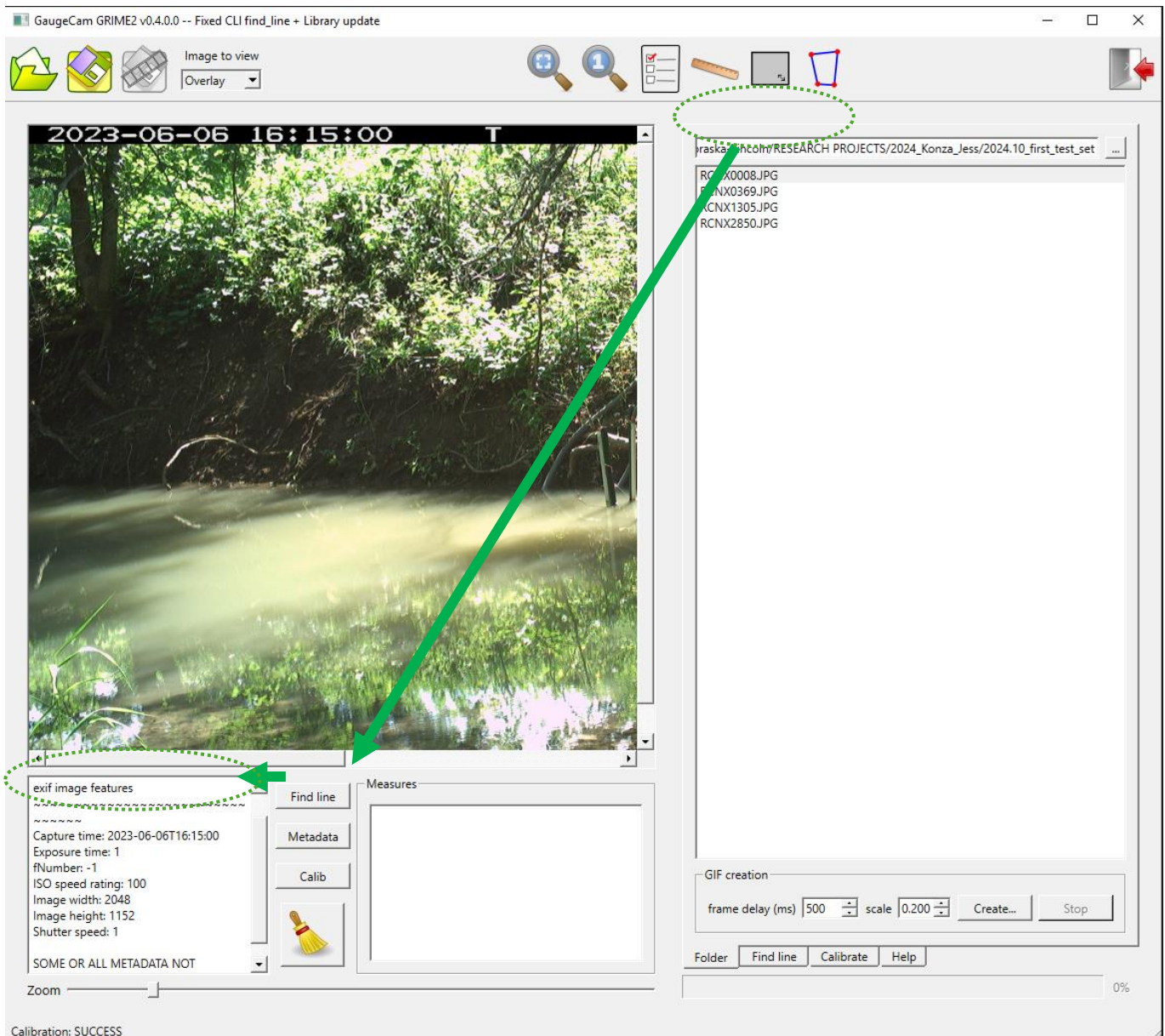
Water level measurement

Now that all parameters are set up, click "RUN"!

Results should appear in the selected folders and files.

As always, please report bugs you encounter. We want to improve GRIME2 and help you complete your project!

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