

# CALIBRATION MANUAL

## Calibration Setup

In a lab setting the calibration can be completed with just one person, but a second person is desirable.

***Calibration should always be completed before the first capture of a session, or if a camera has been moved.***

For a calibration these materials are needed:

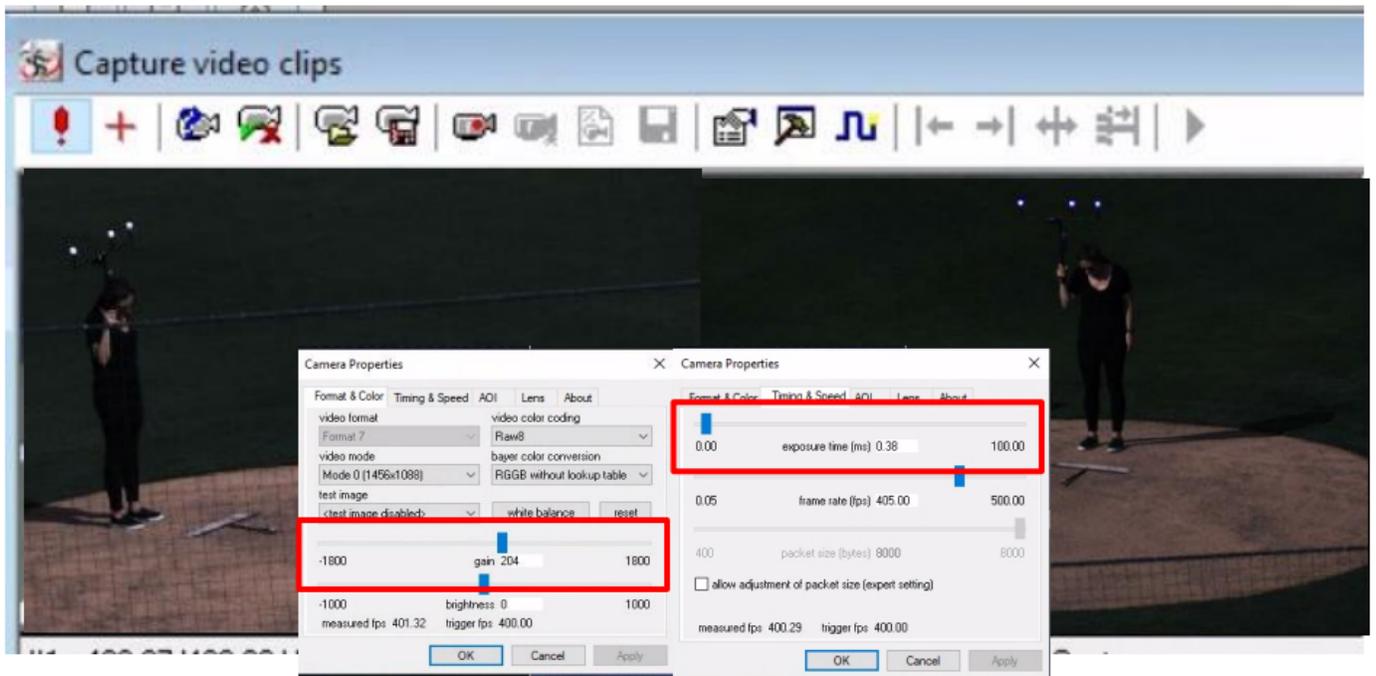
- Calibration wand (make sure it is charged if LED)
- L-Frame (make sure it is charged if LED)
- Simi Motion software (located on desktop)

## Calibration

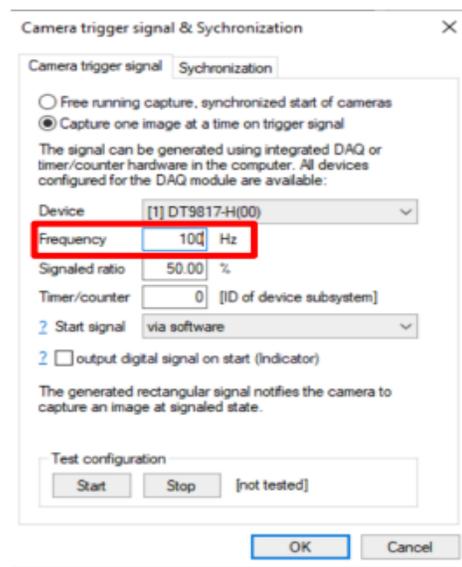
1. Place L-Frame in the proper position in the capture area. This may be a certain corner of a force plate, a specific area inside the capture volume, or on a treadmill. If you need help identifying this location contact S3D for assistance.
2. Open Simi Motion from the desktop and select, “Create New Project”.
3. Activate camera views by clicking the camera button (main toolbar)



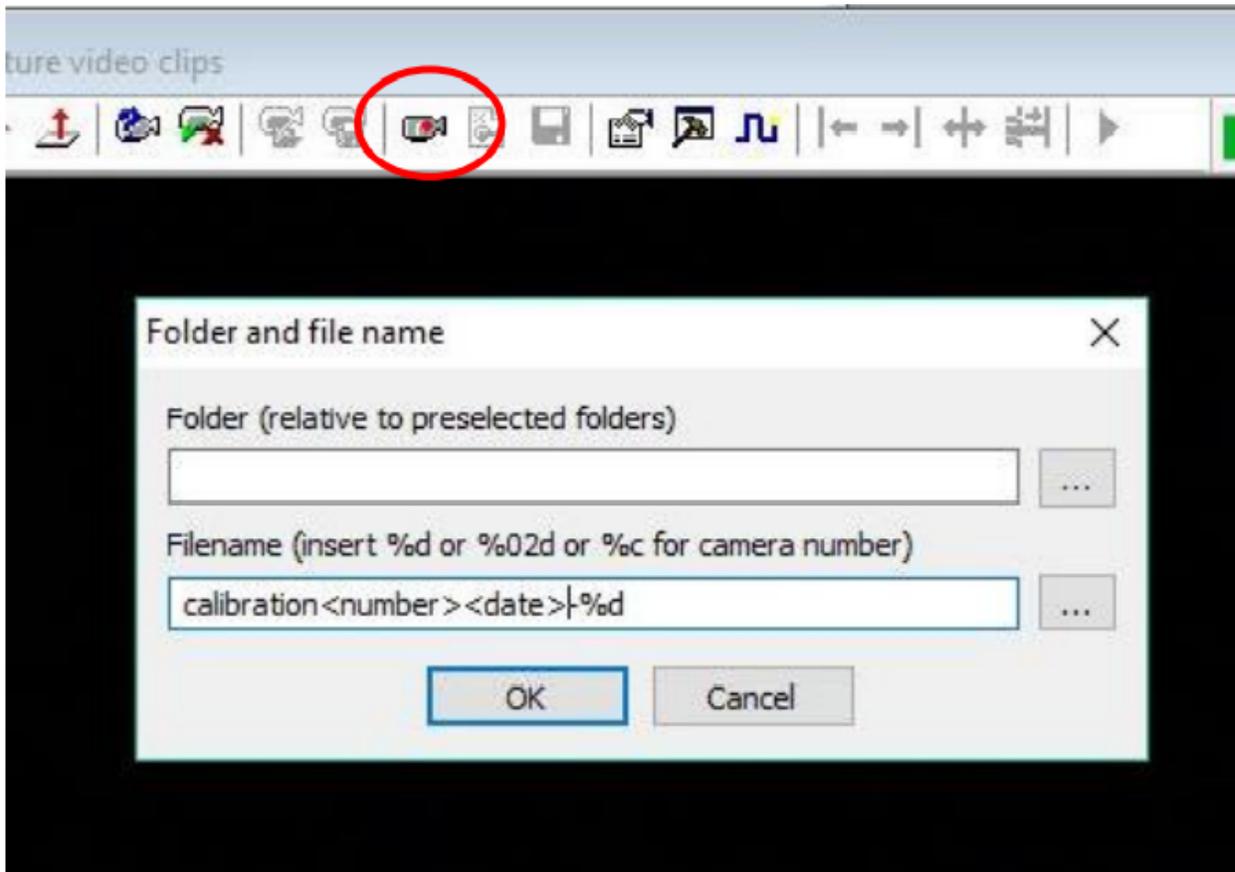
4. Ensure that the wand markers and T frame can be clearly seen. Do this by right-clicking on each camera and select “Camera Properties”.
  - a. Set the gain (each camera individually) as close to 0 as possible and then set the exposure time by moving the slider, (select ok to apply the exposure time settings to all cameras at once) until the image looks fairly dark, but the markers are still clearly visible. Use the image below as a reference for lighting.



5. Set the "Trigger" settings for calibration by clicking on the trigger icon, then changing the frequency to 100Hz.

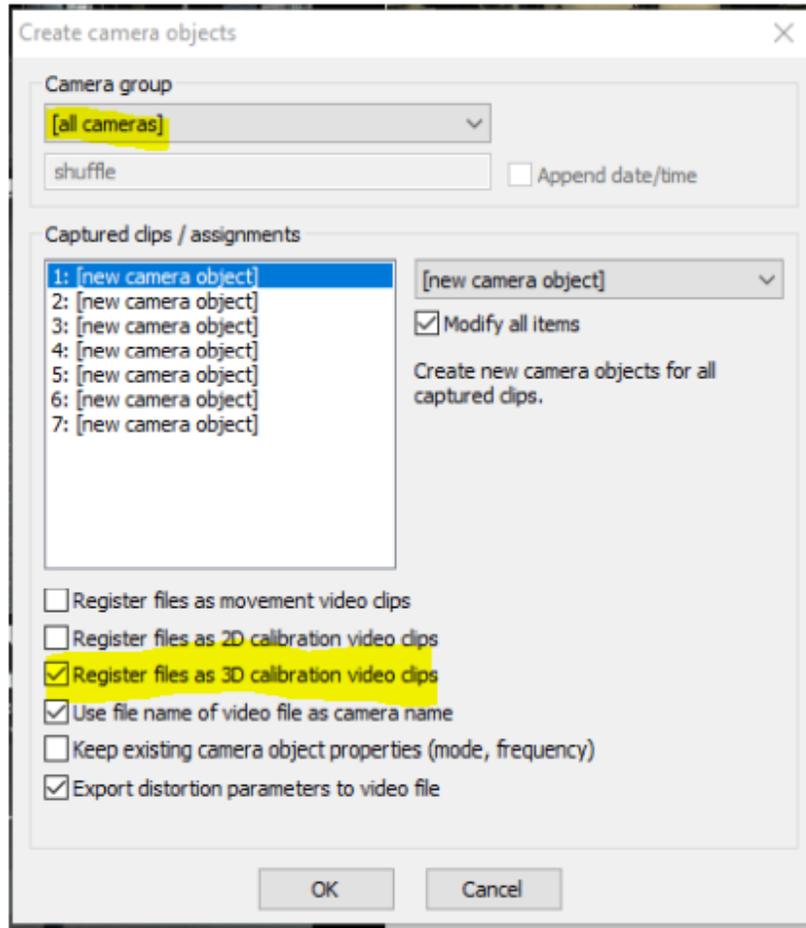


6. Press the capture button and set the filename as shown below, for example “calibration1\_012023”. **LEAVE THE “-%d” AT THE END OF YOUR FILE NAME!**

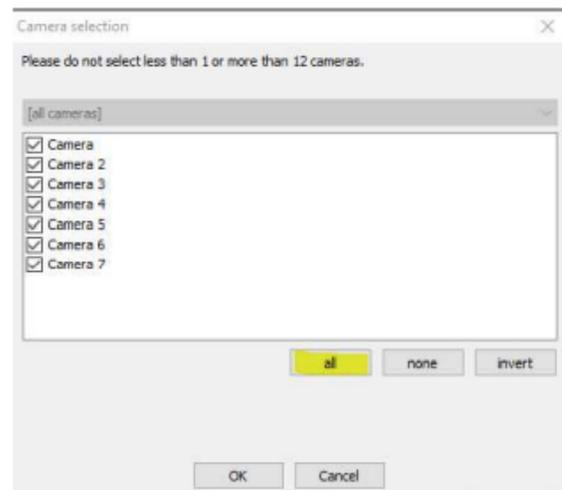
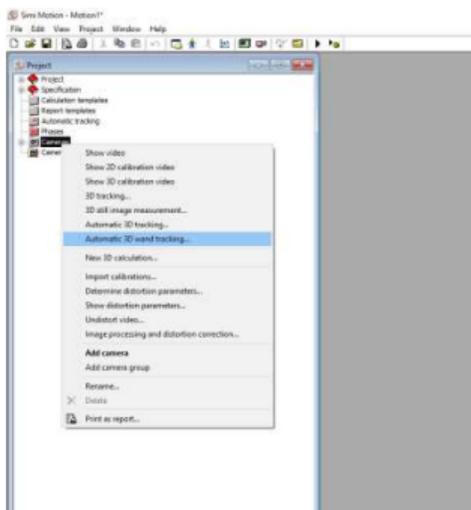


7. Start the acquisition with clicking Ok and then click Start Capture. Wave the wand for 40-60 seconds, then click again on the camera symbol or press ESC to stop the video acquisition.
- For best results, move the wand in a “figure 8” motion by rotating your shoulder (not your wrist) while walking around the capture area, covering any area that the pitcher would likely enter.
  - Change up your walking pattern to give the different cameras as many different angles of the wand as possible.
  - Cover the entire volume that the subject may move in (i.e. over the force plate, treadmill, or covering an area they may walk or jump into).

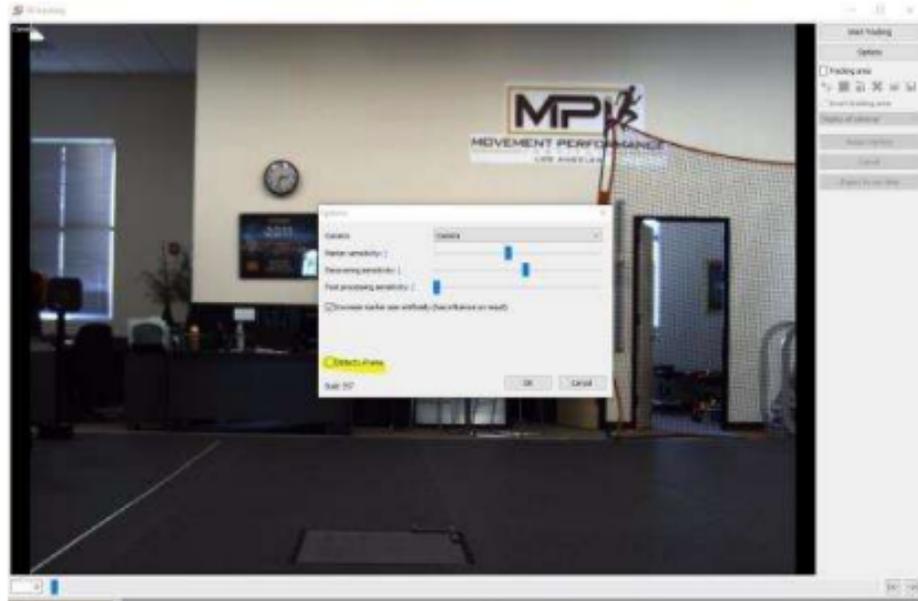
- Close the acquisition windows, select yes for the question popping up. In the menu, then check the box for “3D calibration videos” and press OK.



- Save the calibration under D:\<Year>\calibrations\calibration<Number>\_<Date>.
- After saving the calibration right click on the cameras drop down, and select “Automatic 3D Wand Tracking”. When prompted for camera selection make sure all cameras are selected.



- a. When the next window opens select options, uncheck “Detect L Frame”, then click OK.



- b. On the right hand side click “Start Tracking”.
- c. After that process is done click “Assign Markers”



- d. Verify marker identification for the wand.
  - i. Check that each camera has an accurate marker for “Wand Short”, “Wand Mid”, and “Wand Long”.
  - ii. If you find that markers are identified incorrectly you should redo the calibration rather than trying to fix the issue. It will likely be faster.
  - iii. When finished click OK.

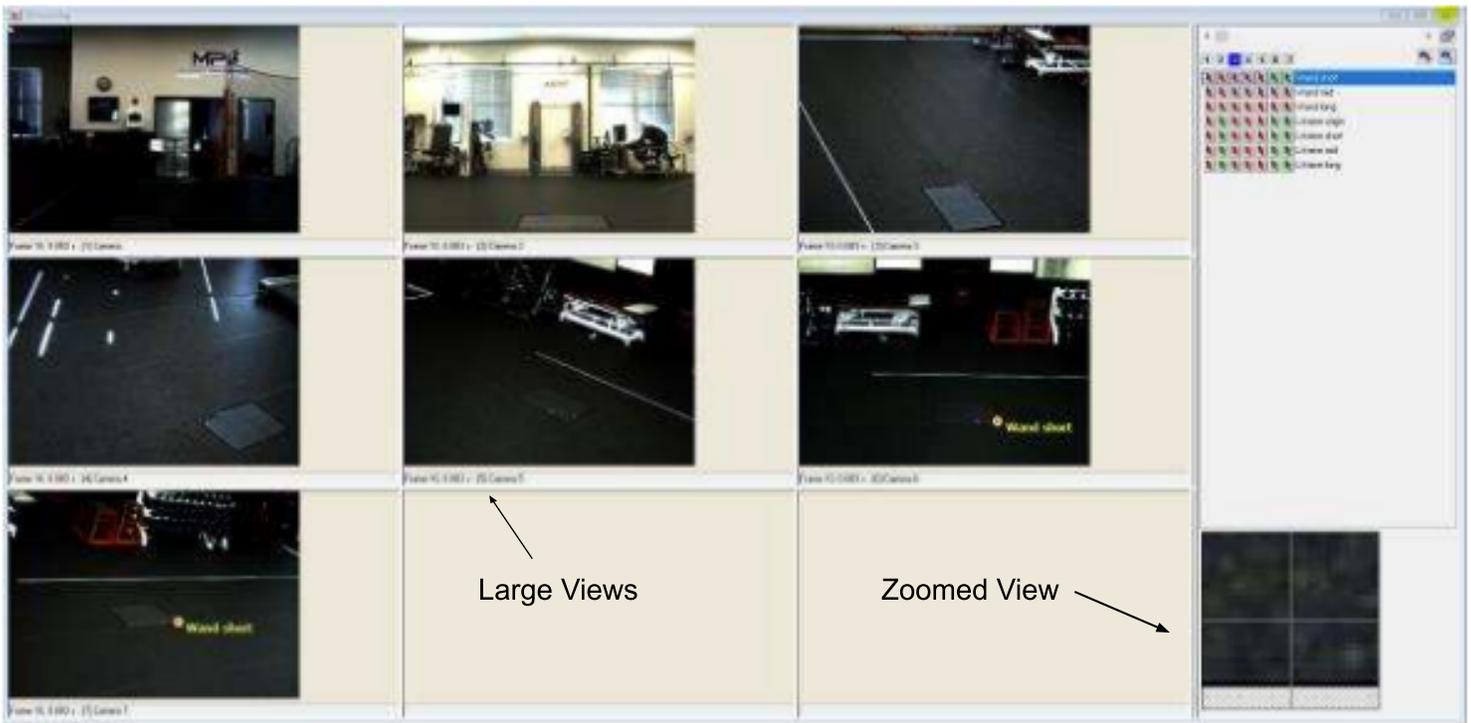


a. Proceed to identify all markers of the L frame in 3 different views all in the same frame (it can be the first frame).

i. Make sure you are on the proper marker selection on the right hand toolbar. **DO NOT ACCIDENTLY IDENTIFY THE WAND!**



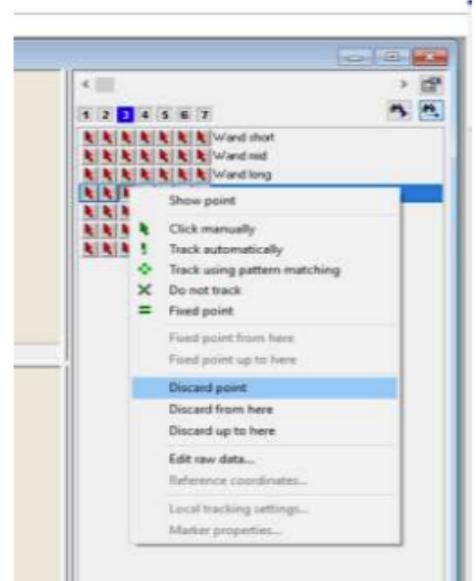
ii. To make a selection, select L-Frame Origin from the list, move the cursor over the large camera view where the L-Frame is visible, get as close to the origin marker as possible, **LEFT CLICK AND HOLD THE LEFT CLICK**, then utilize the lower right hand zoomed in camera view to get as accurate as possible with your selection, then release the left click to make your selection.



iii. You should automatically be moved to the next marker from the right hand menu after making a selection. After identifying "L-Frame long", **MAKE**

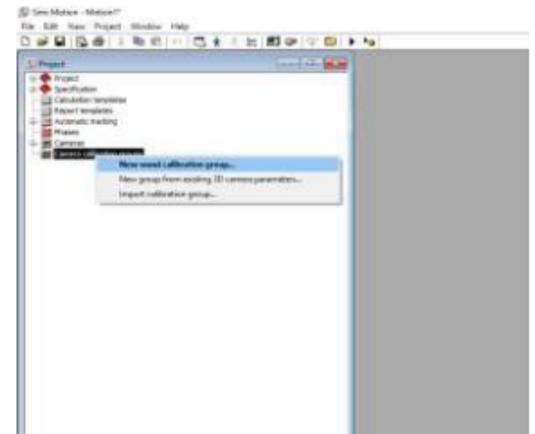
**SURE TO CLICK BACK ON L-FRAME ORIGIN AS YOU WILL HAVE JUMPED BACK UP TO WAND SHORT!**

- iv. Repeat this process for all 4 markers of the L-Frame in 3 camera views.
- v. If you incorrectly identify a marker, right click on that specific arrow and choose “discard point”.
- vi. When finished, close the window, then again go to File>Save to save your progress.

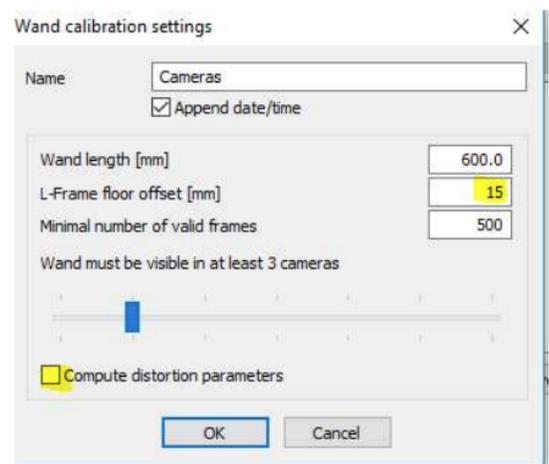


12. After detecting the L-Frame, you now need to process the calibration. Right click on “Camera calibration groups” and select “New Wand Calibration”.

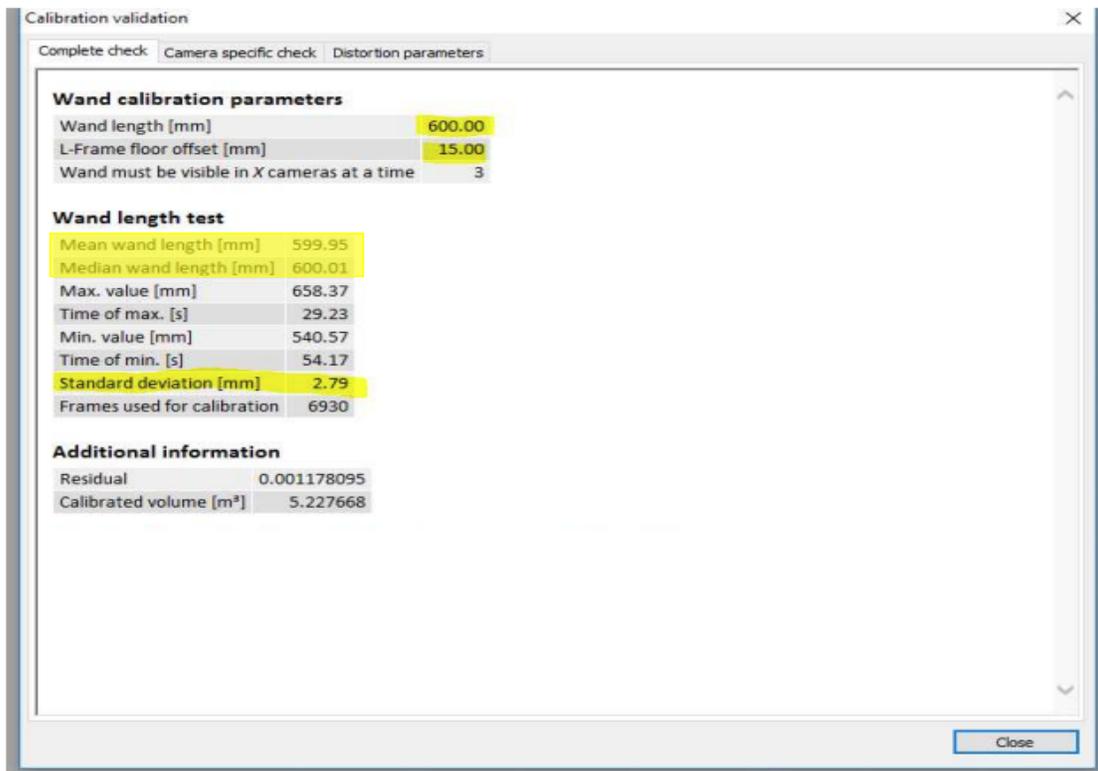
- a. Make sure all cameras are selected as well as making sure to check the box labeled “Save 3D calibration additionally in camera object”. Then click OK.
- b. In the following window you will see a list of “Wand Calibration Settings”. They should be as follows unless instructed differently by S3D.



- i. Wand Length: 600mm
- ii. L-Frame Offset: 15mm
- iii. Uncheck Compute Distortion Parameters
- iv. Wand must be visible in at least 3 cameras
- v. Click OK



- c. The calibration is now processing. It should typically take anywhere from 10 seconds to 2 minutes. If far outside of this range you should make sure the calibration is good before utilizing it.
- d. In the follow up “Camera Validation” window, check the highlighted values. Wand length should always be 600mm, L-Frame offset should be 15mm unless specified to be different for your L-Frame. Wand length mean and median should be within  $\pm 5$ mm of 600mm. For standard deviation of the calibration use the following guidelines when judging calibration. **REMEMBER TO FILE>SAVE AFTER VALIDATING CALIBRATION!**
  - i. SD < 10mm: Usable
  - ii. SD < 5mm: Good
  - iii. SD < 3mm: Very Good
- e. To double check if these values have correlated to a good calibration, you can do a 3D still image measurement to be certain. First capture a movement video with this calculated calibration attached to it. Then in motion, right click on cameras, click “3D still image measurement”, and select an identifiable point in 2 or 3 different cameras to see if the points line up across all the cameras.



13. After processing a valid calibration, go back to “Trigger” settings and change the frequency back to what it was set to before the calibration.