

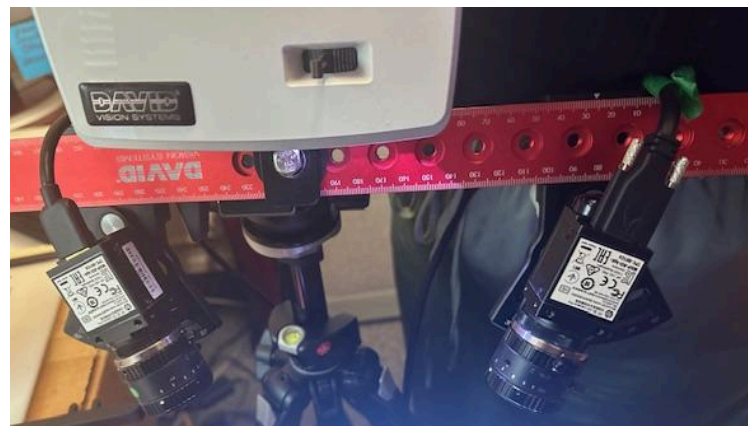
David scanning components:

- **Stationary bar** (red) is mounted to the tripod and holds
 - Projector
 - Left camera
 - Right camera
- **Right camera** should have a **cable plugged into the back** and the USB plugged DIRECTLY INTO THE COMPUTER
- **Left camera** should have a **cable plugged into the back** and the USB plugged DIRECTLY INTO THE COMPUTER
- **Projector** has a **circular power cable** plugged into the back and the 3 pronged plug goes into an outlet
 - Projector also has a **HDMI cable** plugged into the back and plugs DIRECTLY INTO THE COMPUTER
- **Dongle** (usb drive) should be plugged into the usb adapter. If removed from the adapter PUT IN A SAFE PLACE. **The software does not run without this dongle.**
- **Turntable** has a **circular power cable** plugged into the side and the other end plugged into the outlet. The **silver cord with a square plug** in the side of the turntable has a usb on the other end which should be plugged into the usb adapter.
- **Calibration plates**, there are three types: glass, cardboard, and a 3D print. The glass plates and the smaller 3D printed plates are the most effective at calibrating to 30. Handle the glass plates with the utmost care, they are irreplaceable. The cardboard plates are best for aligning to 60 or 120mm.
- [Download the david software](#) on any windows computer

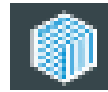


Scanning hardware positions for 30mm calibration:

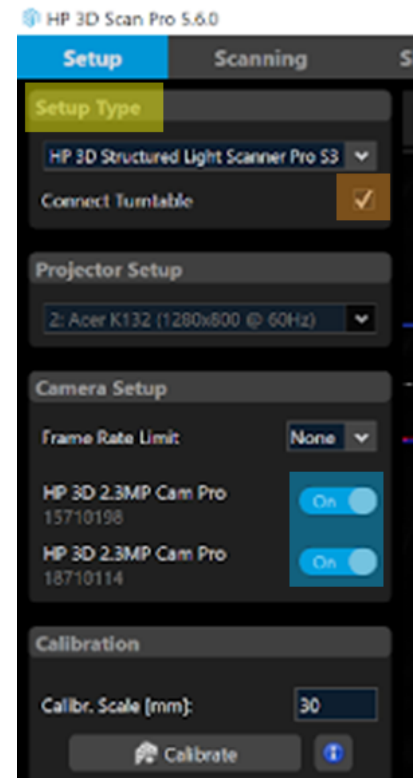
- Left camera position on bar= about 75mm, 22 degree rotation
- Right camera position on bar= about 280mm, 22 degree rotation
- The projector should be mounted on the extended bar and the extended bar mounted at around 220 mm. Ensure bolts are secure and threaded tightly.



Getting set up:



1. **Computer password** is either aisos or aisosadmin
2. Press the power button **once** on top to turn the projector on
3. Take the lens caps off the cameras
4. Pinned to the toolbar you will find a hexagonal icon in blue and silver called HP 3D Scan 5. Click on this to begin
5. Click the setup tab at the top left of the program
6. **Setup type** (first section under the setup tab on the left side of the screen) should either be **HP 3D Structured Light Scanner Pro S3** or **Custom Structured Light Setup**
 - 6.1. Ensure the **box** next to Connect Turntable is checked
7. **Projector Setup** if the projector is plugged in and responding properly this will automatically be set to the projector
8. **Camera Setup** both on/off switches should be set to **On**.
 - 8.1. The camera screens on the right hand side of the screen should be red and black. To determine which is left and which is right, place your hand in front of each camera individually
 - 8.2. If at any point one or both camera(s) stop responding (either grey with X or red and black but not updating to show current view), refer to [Cameras](#) under the troubleshooting section



Aligning/calibrating the scanner:

1. CHOOSING THE RIGHT CALIBRATION RESOLUTION AND ORIENTING YOUR OBJECT

- 1.1. Hold your object up to the alignment plates and choose the proper scale based on the size of your object. For the best resolution, align to 30mm
- 1.2. Place the object in the center of the turntable and move the turntable as close to the tripod as possible

2. TRIPOD MECHANICS

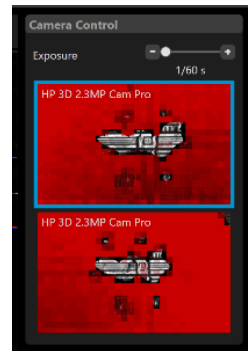
- 2.1. Grasp the area of the tripod where the stationary bar is mounted (put your hand around the **ball-in-socket-joint**). You must secure the equipment in hand before loosening the knob to move it.
 - 2.1.1. The **cylindrically shaped knob** on the side controls how fast the ball-in-socket joint will move. Keep it tight.
 - 2.1.2. The **teardrop shaped knob** will allow the ball-in-socket joint to move.
- 2.2. **Angle the projector directly down. We want the cameras and projector to be looking directly down at the object.**



- 2.3. Turn the knob near the top of the three legs to extend and lower the bar the cameras and projector are mounted on. Get the projector and cameras as close to the object as you can. Keep in mind:

- 2.3.1. The object should be in view in both left and right cameras in the **camera control** section on the left hand side of the software.

- 2.3.1.1. There needs to be enough overlap between left and right that the scans will align properly. The object should always be in view in both cameras.



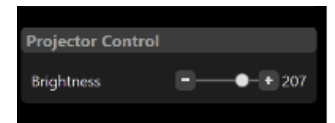
3. PROJECTOR SETTINGS

- 3.1. **Looking at the object (not the screen)**, you should see black and white lines and a box, the black and white box should be on the object.
- 3.2. On top of the projector there is a **knob**, slide it left and right while looking at the object to focus the black and white pattern.
- 3.2.1. If you cannot get a crisp image you are probably too close and need to extend the tripod arm up.
- 3.3. If you get a crisp image, try getting closer to the object by lowering the tripod arm. This ensures that we are getting the best resolution possible.



4. CAMERA SETTINGS

5. On the right side of the screen, set the **Projector Control** brightness setting around 75% (about 190)
6. There are two small screws on each camera, start with the one in the back which will adjust how much light is being let in.



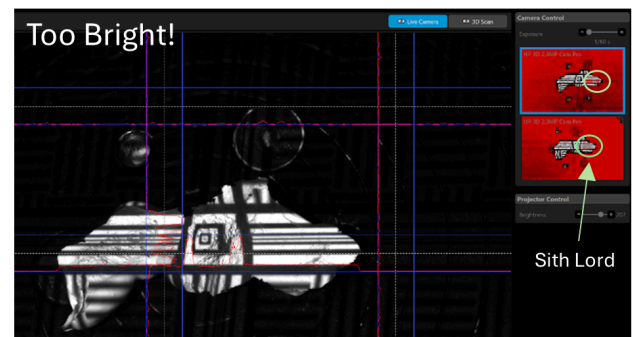
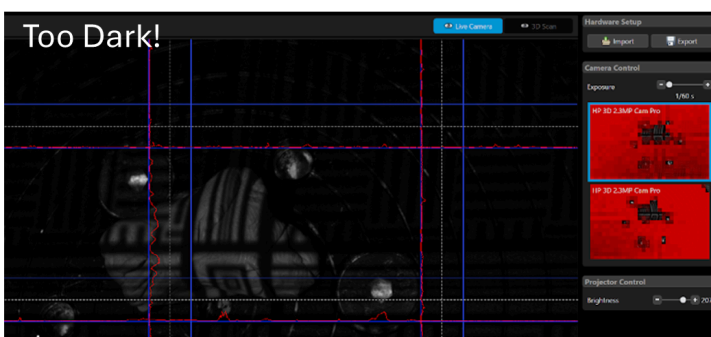
- 6.1. Click on the camera viewing window on the right side of the screen to bring that camera's view into the full screen. With the **screw loosened on the back ring**, rotate the ring left and right to adjust brightness.

- 6.1.1. There is a grid on the computer screen with two solid blue lines and a dotted white line in the middle. The red lines represent the level of exposure across the screen.

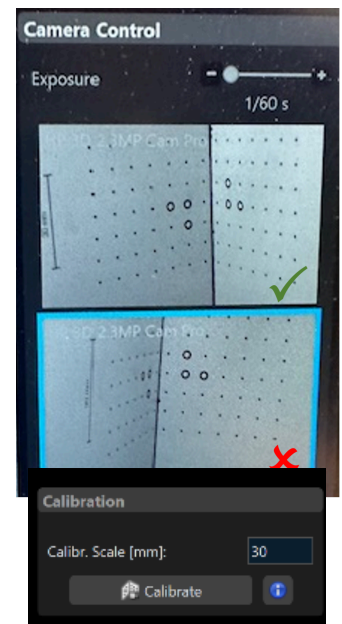
- 6.1.1.1. You want the red line waves to be near the center dotted line or below (vertically below would be on the left of the dotted line and above would be to the right of the dotted line).

- 6.1.1.2. Also check the object in the **Camera control** section, if it has red spots on it, it's too bright! It is okay if things outside the object are too bright or too dark, we just need the object to be the correct brightness.

- 6.1.2. Once the desired brightness has been obtained, tighten the screw.

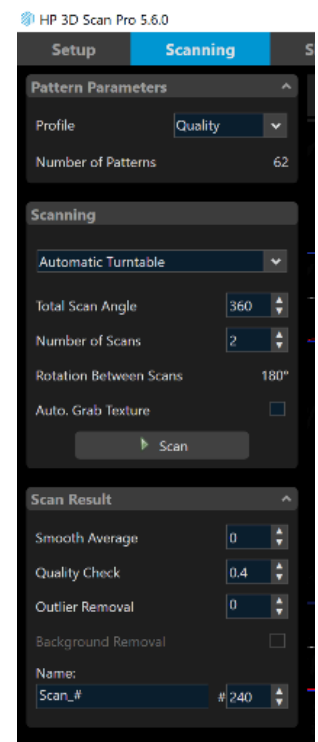


- 6.2. Loosen the screw closer to the front of the camera then you want to adjust the focus by rotating the camera lens at the very front of the camera and watching the screen. Once the optimal focus has been selected, tighten the screw
7. Repeat the previous steps for the other camera. If you're struggling to get a crisp image of the pattern on the screen, you're likely too close to the object and need to extend the tripod arm upward. Repeat projector and camera setup.
8. **CALIBRATION PLATES**
 - 8.1. Move the turntable out of the way and place the alignment plates in front of the projector. Adjust the projector angle and height when necessary so that the cameras and projector are perpendicular with the long access of the alignment plates
 - 8.1.1. You want the projected pattern to be in focus which can be achieved by moving it closer or further away from the alignment plates.
 - 8.1.2. Adjust projector brightness by clicking plus or minus under **projector control** on the right hand side. Turn the projector brightness up to about 240.
 - 8.1.3. Each camera needs to be able to see the 6 open circles which can be achieved by rotating the plates left and right or sliding left and right.
 - 8.1.4. **The alignment plates should always be at a 90 degree angle. never align without the plastic black cross bar to hold the plates at the proper angle**
 - 8.2. In the software on the left hand side in the setup tab, under **calibration** type in either 30, 60, or 120mm whichever you determined will work best for your object
 - 8.2.1. Generally you want to align to 30
 - 8.3. Click the calibrate button. If it fails, you may need to angle the board differently so **both** cameras can see the open circles.
 - 8.4. [Having trouble calibrating? Check out this section of troubleshooting](#)



Scanning specs:

1. Click on the scanning tab at the top left of the software
2. Under **Pattern Parameters**, Profile should be **Quality**.
3. **Scanning** section is where you can adjust total scan angle, most of the time you want this to be 360 unless you are scanning large bones
 - 3.1. This is also where you can select the number of scans. I suggest 4-6 scans. 4 scans for less topographically variable modifications.
 - 3.2. Auto grab texture **should not be checked**
4. The **Scan Result** section should have **Smooth average** set to **0**
 - 4.1. **Quality check** should be set to **0.4**
 - 4.2. **Outlier Removal** should be set to **0**
 - 4.3. **Background removal** should be unchecked
 - 4.4. Don't worry about changing scan name

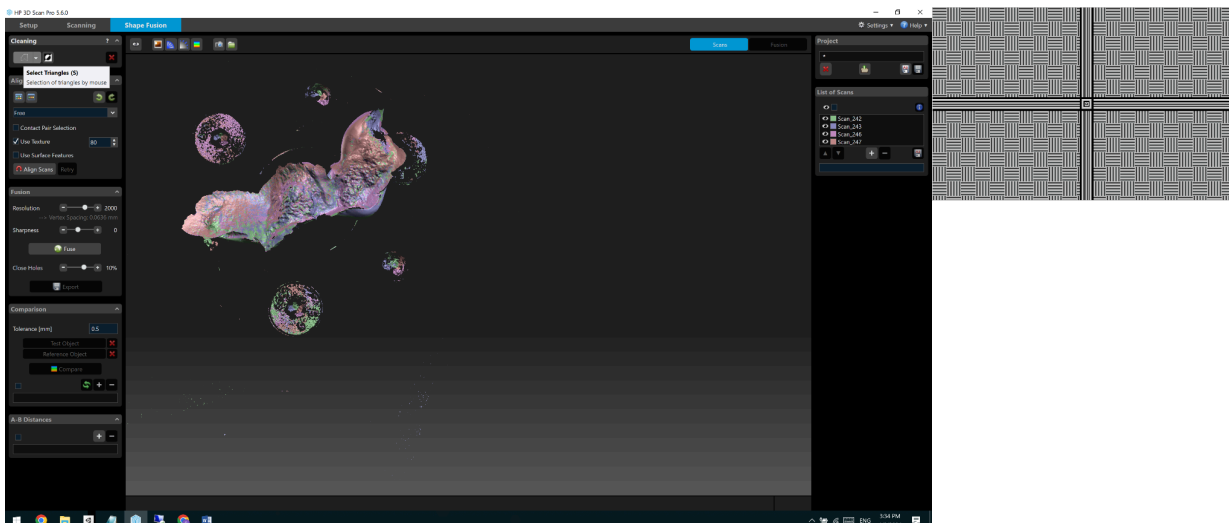


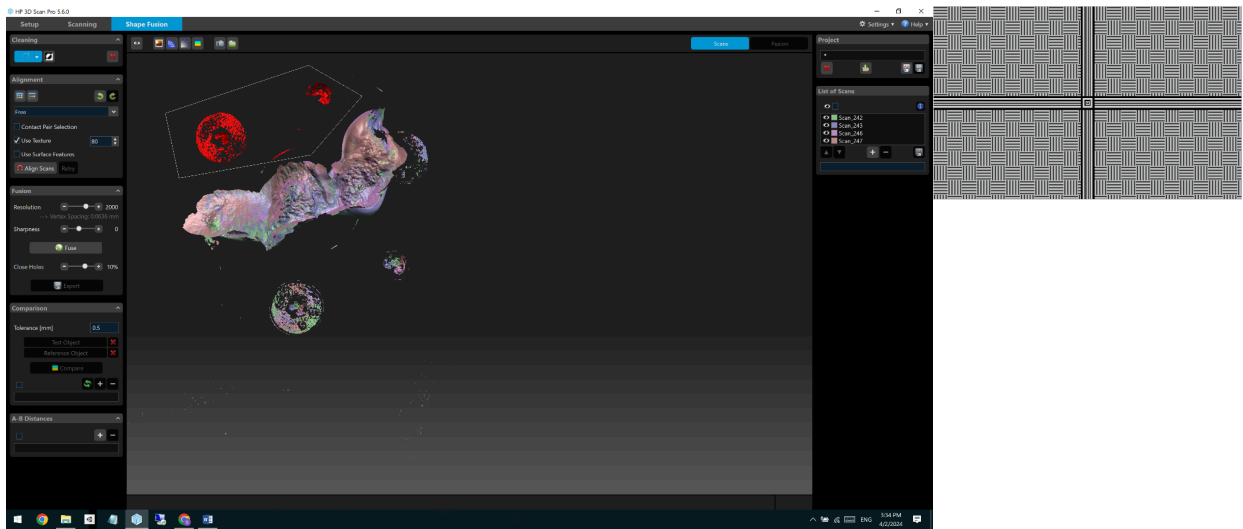
Scanning:

1. Move the turntable back to where it was before, angle the projector directly down like you had it when you adjusted the projector and camera focus. Move the tripod up and down to wherever the black and white pattern is in focus on the object.
2. Click scan! **Do not walk around, do not touch the table the turntable is on until scanning is complete**
 - 2.1. [I think my scans look funky... proceed to troubleshooting!](#)
3. Yay you did it! Proceed to [Cleaning scans](#)
4. Take additional scans if there's any missing data. There should be no holes in the data.
 - 4.1. [How can I tell if my scan is missing data? Proceed to troubleshooting!](#)
 - 4.2. You may need to prop the object up to angle it and scan deeper crevices

Cleaning scans:

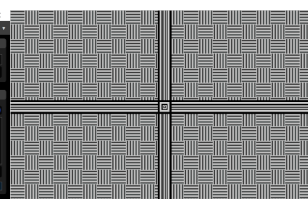
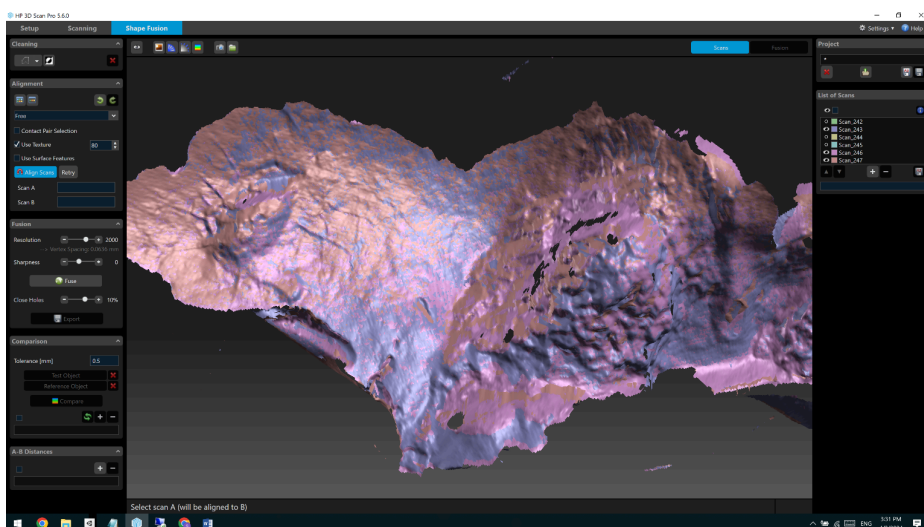
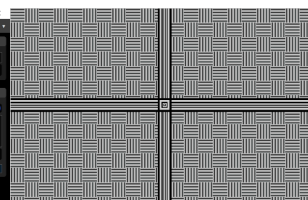
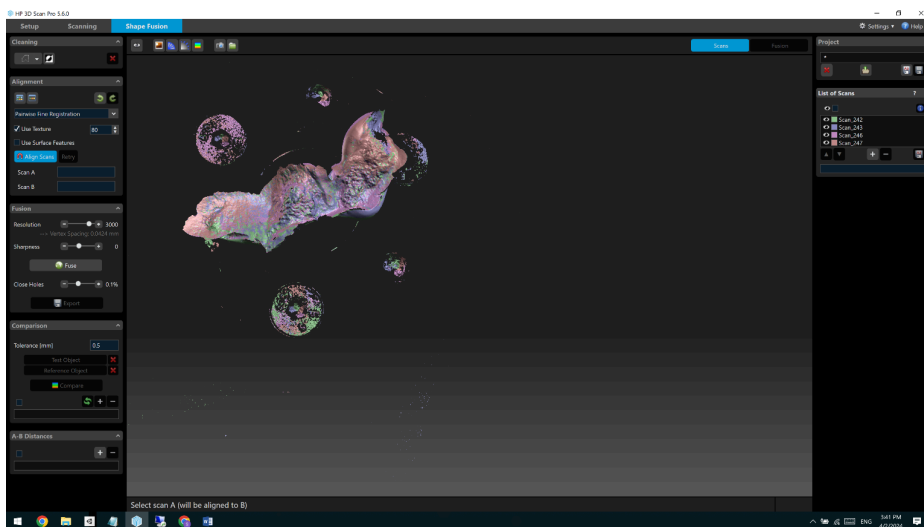
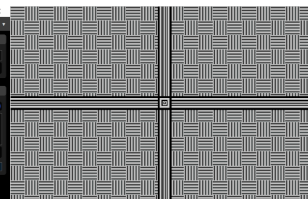
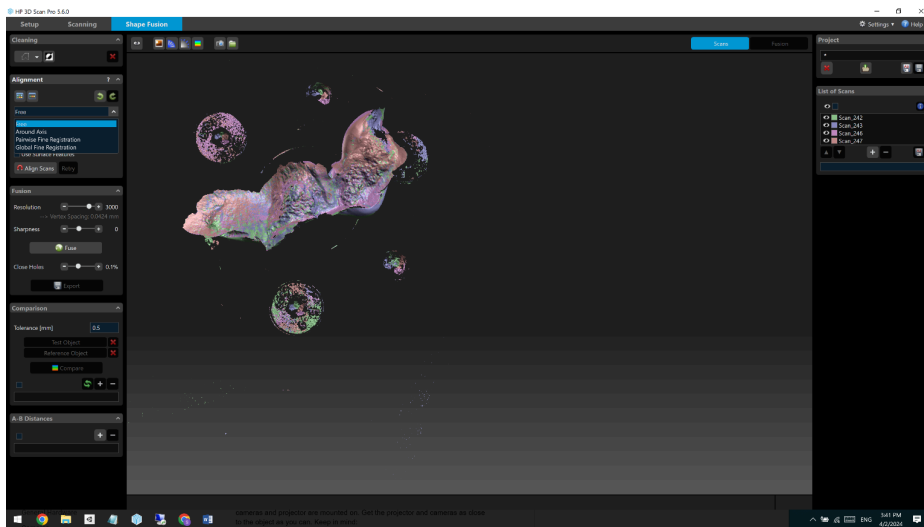
1. Once a single set of scans is complete, enter the **Shape fusion tab**
2. If you need additional scans:
 - 2.1. Check all boxes of individual scans, right click, and combine scans. This will help with aligning scans later.
3. Click the box under the **Cleaning** section to activate the lasso selection tool. Left click around the undesirable objects to select them, right click once your selection of undesirables is complete, click the red X under the cleaning section next to the lasso tool
 - 3.1. Alternatively you can select the object with the lasso tool then select the invert selection button then hit the red X to delete the undesirables.
4. Are there holes in your scan?
 - 4.1. Identify the area with missing data, position the object so that the part with missing data is pointing up toward the projector.
 - 4.2. Click the eye to hide this set of scans
 - 4.3. Return to the scanning tab and repeat the steps in [Scanning](#).
5. There are no holes left in my scan 🎉





Aligning Scans:

- 1.



Saving your scans:

1.

Shutting down the scanner and cleaning up:

1. Make sure your scans are saved!
2. Put the mold back in its bag and put any materials away neatly
3. Close the david software
4. Replace the lens caps on the cameras
5. Press the power button on the projector twice
6. Turn the mouse off
7. Shut the computer down if you aren't waiting for your scans to back up to google drive

Returning to previous scans:

1. Open the david software like normal
2. Click on the fusion tab
3. On the right hand side of the screen under the ____ section, click the + button to load individual scans into the software
 - 3.1. Navigate to the proper folder and proper mold folder, highlight all individual scans by holding Ctrl and pressing A or selecting the first mesh in the folder, holding down shift and then selecting the last mesh in the folder.
 - 3.2. Select all scans and combine if aligned, otherwise align first then combine scans
4. Examine combined meshes and object to identify what areas need to be scanned today and place the part of the object with missing data on the turntable facing up toward the projector
5. Follow the steps to [align/calibrate the scanner](#) then continue scanning

Troubleshooting:

General Hardware

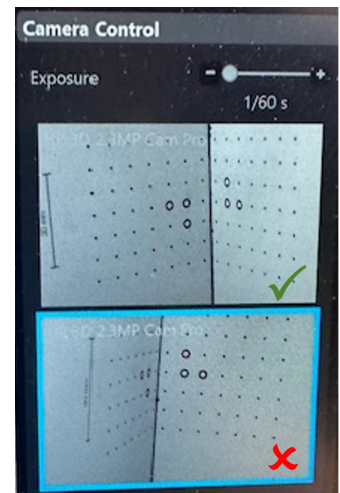
- Hardware not working? Wiggle the cables or unplug and plug back in.
 - Turn off and back on is also a solid option

I can't get the scanner to calibrate! What do I do?

- **If alignment is going unusually slow**, close the program, empty recycling, clear caches and cookies (do whatever you can to free up data) and reopen the program.
 - You won't need to readjust your cameras or projector focus, just repeat steps to make sure they connect properly
- If your calibration fails you will no longer see the projected pattern. You can bring back to the screen by clicking on the **scanning tab** and going back to the **setup tab** at the top of the software
- My calibration has failed:
 - Check the view of the calibration plates in the cameras in the **Camera Control** section, make sure you can clearly see all dots on the board in the proper size. You may need to...
 - Brighten or darken the projector brightness under the **Projector Control** section



- Make sure the pattern being projected on the board is in focus
- Make sure both cameras can see all six open circles (rotate the plates slightly clockwise or counterclockwise to achieve optimal conditions once the pattern is in focus)
 - Make sure only the circles for 30, 60, or 120mm are in view ONLY.
- Adjust projector angle and/or tripod arm height so that the pattern is being projected at the calibration plates at a 90 degree angle.
- **Calibration cheat code!** Rotate the plates 90 degrees so that the long edge of the plates is against the table instead of the black brackets. Angle the projector down at the calibration plates so both cameras can see all 6 open circles.



Cameras

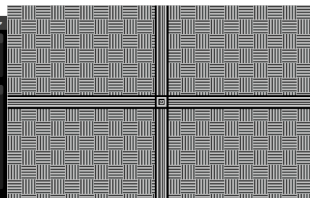
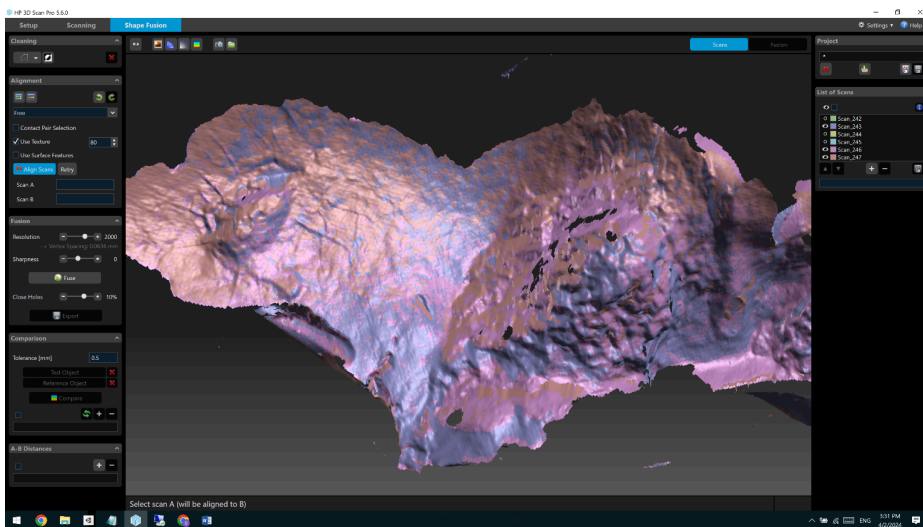
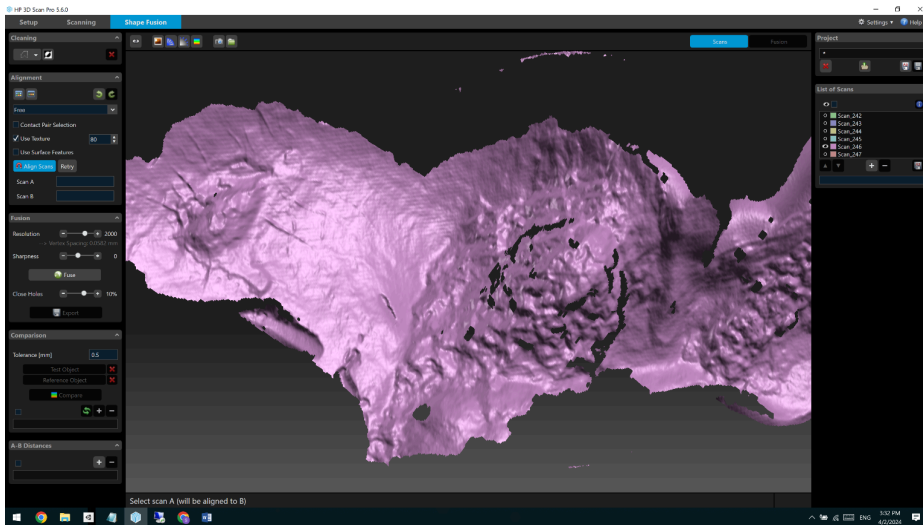
- If there are more than two cameras (if the program thinks the webcam is part of the setup), you are on the wrong **setup type**.
- If the cameras screens on the right hand side of the screen are grey with white x's
 - Make sure the dongle is plugged in
 - Toggle cameras off and back on
 - Double check the cameras are properly plugged in to the computer all the way
 - Change the **Setup type to the other option**
 - If all else fails, close program and turn back on
-

Do I need additional scans of the object?

- If you're not sure, hit the fuse button under the **Shape Fusion** tab! Just make sure **Close Holes** is set to 1-0.1%. This will combine all your scans beautifully and show you where you have missing data.
 - To get back to your individual scans, just hit the red X next to fusion results. We are not ready to save the fused scan, we only want the individual scans at this point.
- **When in doubt, contact the project overlord or just do those additional scans.**

My scans look funky

- Weird little horizontal lines in your scan? Too much movement, you should rescan. Try not to touch the table or walk around while the scanner is scanning
- Do the individual scans when all visible look like TV poltergeist static? Lights are probably too bright, turn off any overhead lights and cover windows if you can
 - If that doesn't work, go to scanning mode and watch the screen, if you see any weird movement see if you can weigh down the tripod more to limit vibrations
 - If that doesn't work, your camera cables might be having issues or your cameras might be having issues. Contact project overlord or scanning overlords



The pattern is being projected super slowly and things just aren't working quite as quickly as they should

- Stop the scan, it's not worth waiting for. Just hit cancel at the bottom of the screen.
- Check to see if the cameras are live
 - If not, refer to [Cameras](#)
- Are you scanning something tall and have the projector more parallel with the ground?
 - She doesn't like that, try changing the orientation of the object so the projector is looking down at the object.
- Just close the program and restart your setup (you have to realign/calibrate)

