

EBSD (Electron Backscattered Diffraction)

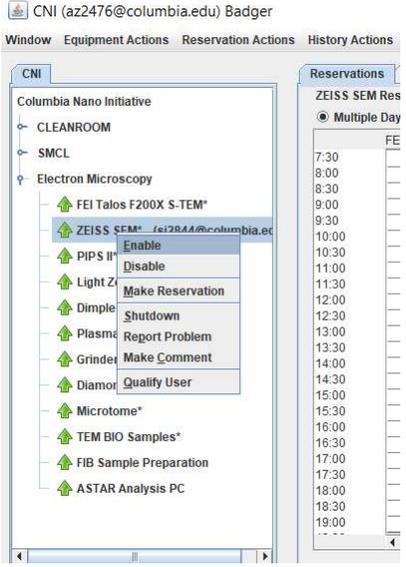
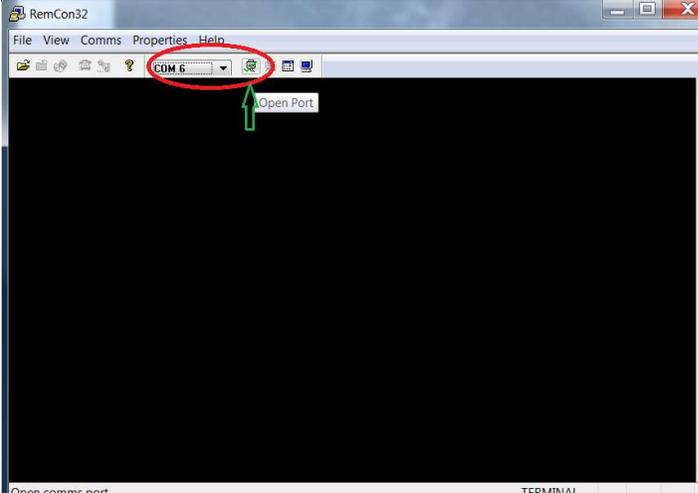


Orientation Imaging Microscopy (OIM) developed by EDAX is a powerful tool for analyzing local texture and grain boundary structure of polycrystalline materials.

These instructions are intended for reference only, and will *not* replace the thorough training required for proper system operation. Contact a clean room staff member with questions or to report a system problem.

Written by Dr. Amir Zangiabadi



<p>1.</p>	<p>Enable the tool in BADGER</p>	
<p>2.</p>	<p>Switch the controller to EBSD.</p> <p>(switch it back to EDS at the end of your session)</p>	
<p>3.</p>	<p>Select RemCon32 program from the Windows Task bar</p> <p>Select "Com 6" then click on "open port" button.</p> <p>(switch it back to "Com 5" at the end of your session)</p>	
<p>4.</p>	<p>For EBSD, your sample needs to be tilted 70° to maximize the signal</p>	



reaching to the EBSD detector located on the right.

There is a pre-tilted stub that you install the regular SEM stub on it.

(alternatively, you can tilt the stage 70°, but using the pre-tilt stub is a reliable and easy method.)

Make sure your sample is smaller than 2 cm in length.

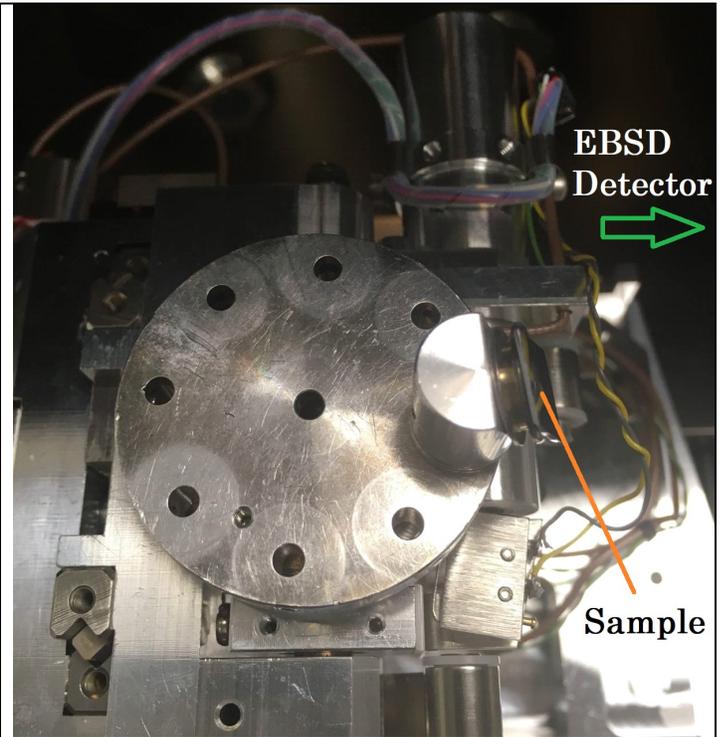


5. ****Important****
The stub should be installed on the **rightmost hole** of the stage. The sample should be facing towards the right direction as well (as shown).

If two holes are relatively close to the right side, **rotate** the stage with the joystick (while the door is open) till you see one hole is getting closer to the right side (detector location).

Do NOT put the stub in the middle hole. This will result in damage to the microscope!

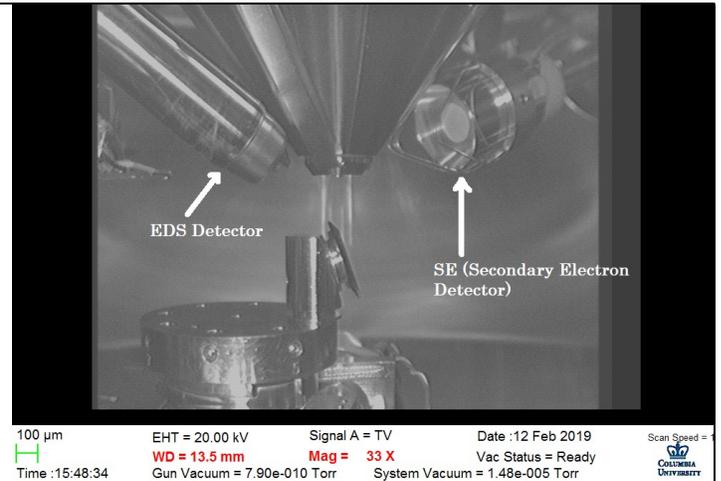
****Important****



6. Close the door and pump.

Then move the stage while looking at the CCD camera until you see the sample (or stub) is under the electron beam, as shown.

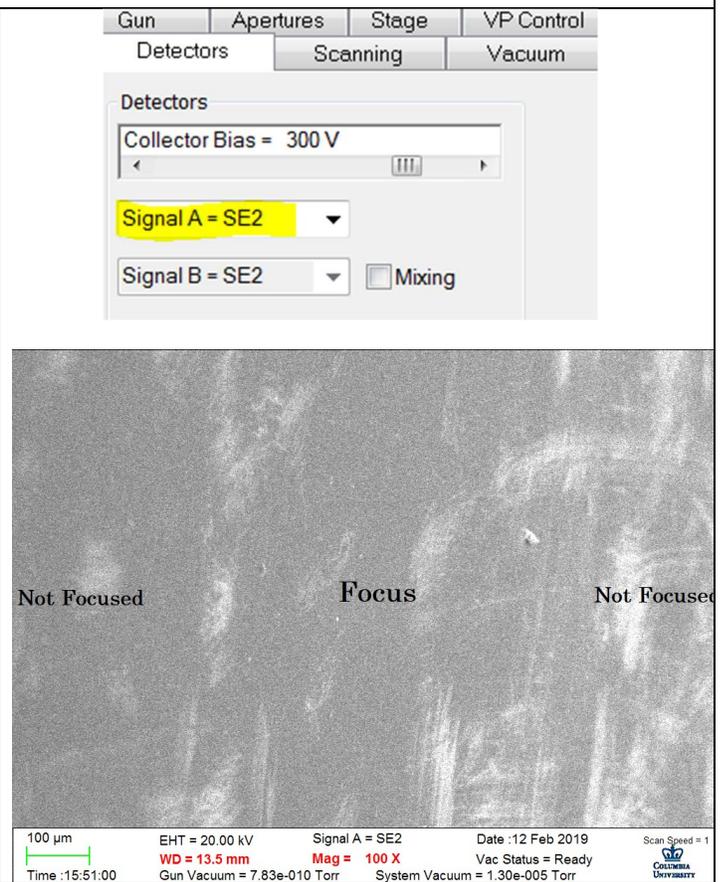
Your sample should also be **facing the SE (Secondary Electron) detector this way.**

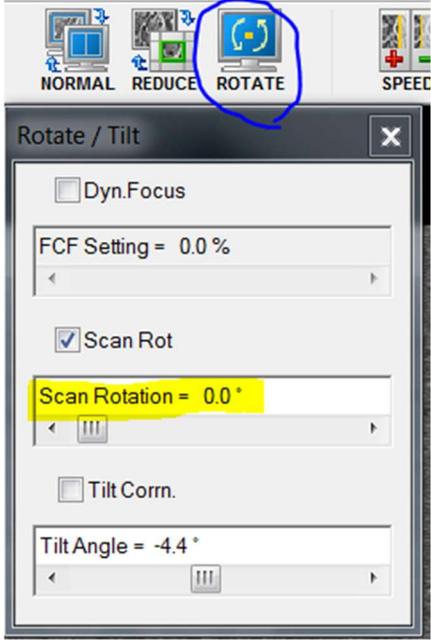
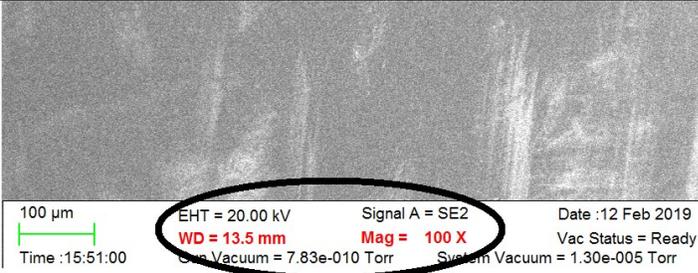


7. Set the Gun Voltage to 20 kV.

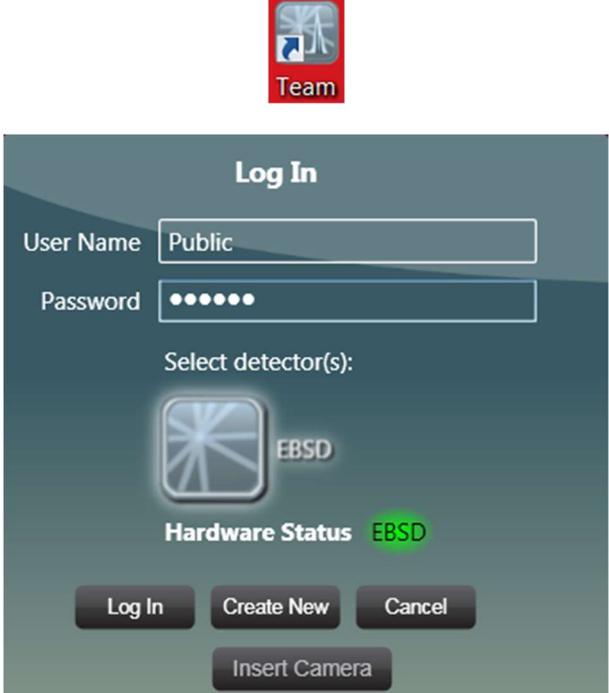
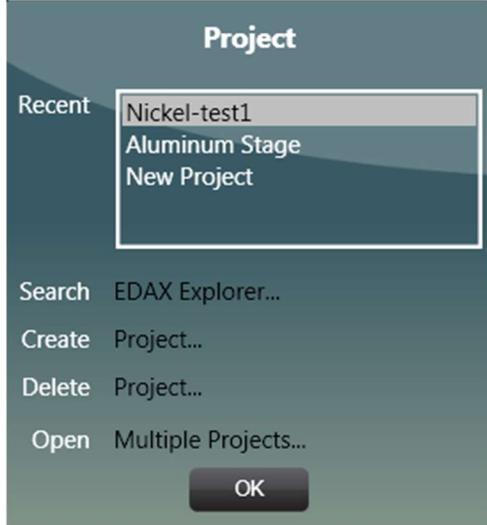
In the Detector menu, select “SE2” detector. Find your sample in the electron beam image. Since the sample is facing the SE detector, it looks brighter compared to the stub. **Focus** on the middle part of your region of interest.

Since the sample is tilted, image sides are not focused (it’s OK).



<p>8. To be consistent all the time, check whether the SEM image is already rotated or not, then reset (or double click on the highlighted) to set it to 0 deg.</p> <p>In this case, the higher part of the sample (higher Z) is located on the bottom of the SEM image and the part of the sample with lower Z is on the top of the SEM image.</p>	
<p>9. After focusing, go to low magnification in electron image (e.g. 100x). While viewing live, change the working distance (or Z height) till the WD reaches to 13.5 mm. The microscope automatically keeps your image at focus. Then increase the mag. to refine the focus and find the desired area.</p>	



<p>10. In the EBSD monitor, open “Team” software. It asks you for username, password. It is recommended to create your own account (clicking on “Create New”) with your first name as username and as password (the same). The general username, pass is: public.</p>	
<p>11. Create a “Project”, or select from your recent projects and click OK.</p>	

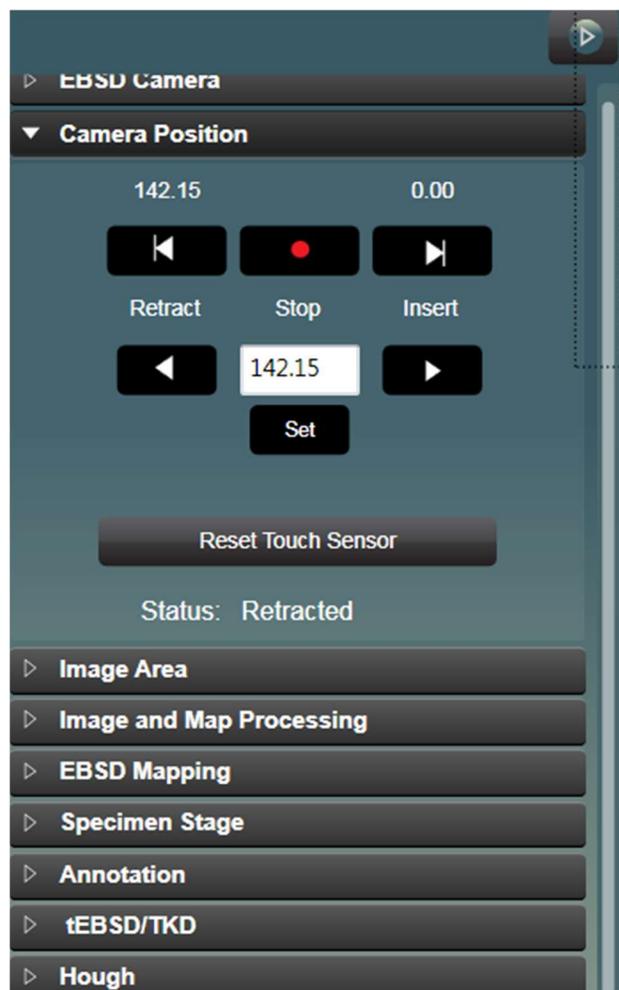
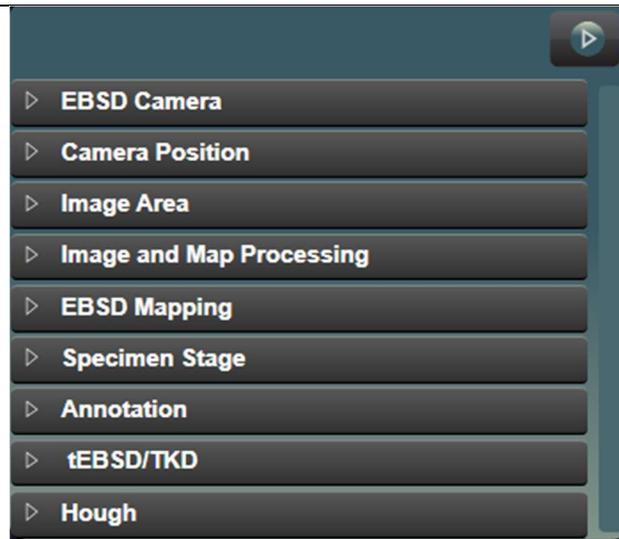


12. From the “Advanced Properties” on the right side of the TEAM software, select “Camera Position” and select “Insert”. Switch to TV mode on Zeiss.

If you have loaded the sample properly in step 5, the detector will never hit the stage.

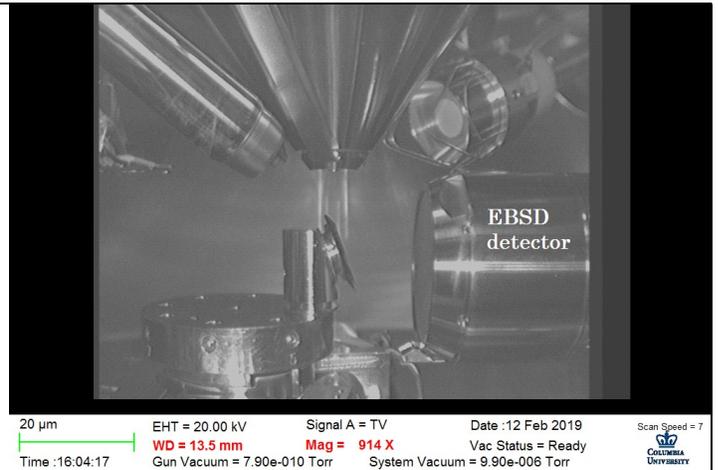
However, hold the mouse pointer over the “Stop” button, in case the EBSD detector is getting too close to the stage/sample and click on stop to prevent a crash.

The EBSD insertion **would not stop automatically** if there is a touch or hit.



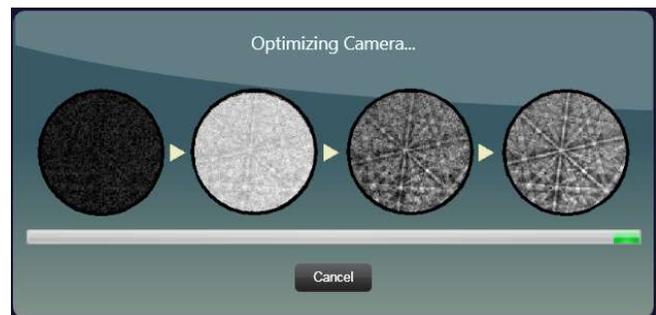
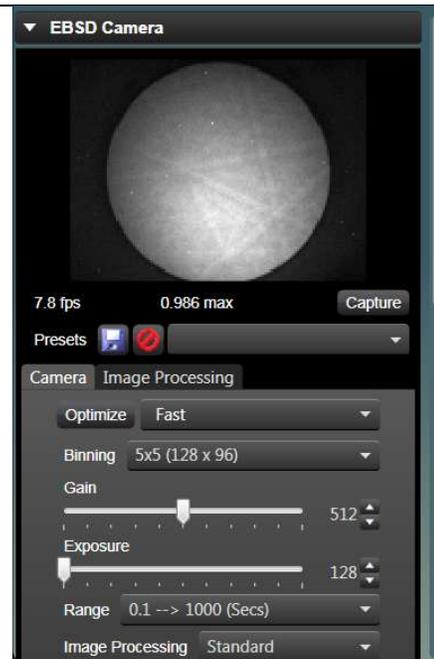
13. If you install the sample and stub properly, the EBSD detector will never hit the stage at full insertion (shown).

When the EBSD detector is in, do not move the stage anymore (only movements in micrometer scales are allowed)



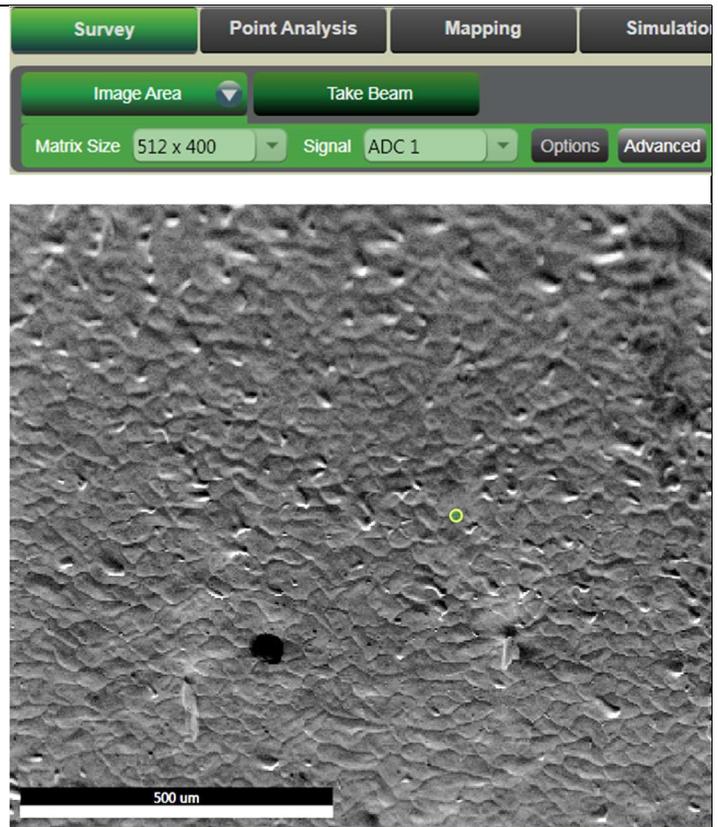
14. From the “EBSD Camera” menu on the right, select “Fast” from the menu and click on the “Optimize” button.

After optimizing camera and background subtraction, you should be able to see Kikuchi lines on the viewing window on the right (as shown here).



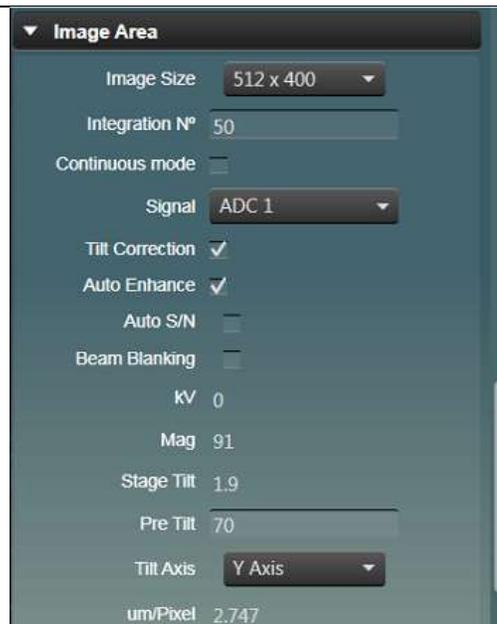
15. From the top menus click on “Survey”, then click on “Image Area”. This will show an SEM image.

On the image, there will be a small green circle in the center. That is the beam stop location. If you hold it and move it around, the beam moves as well, and you can see other Kikuchi patterns on the right in the EBSD Camera menu.



16. TEAM software should correct the pre-tilting effect of the SEM image automatically.

The two parameters that control this are “Pre Tilt” angle (set to 70 deg.) and “Tilt Axis” (set to Y Axis).

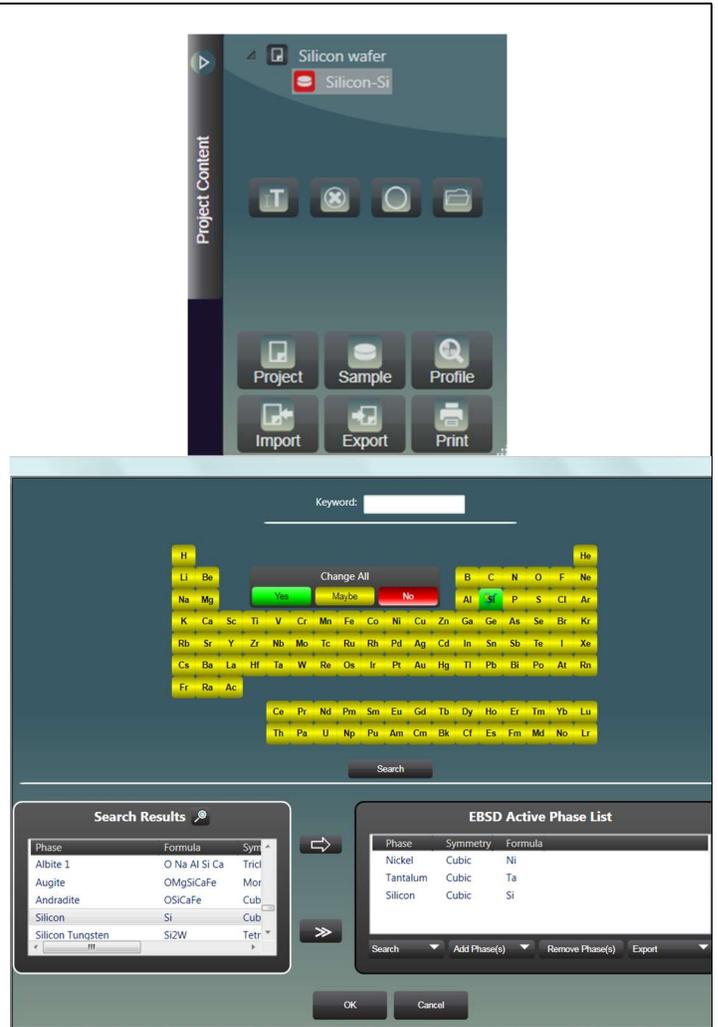


17. From the “Project Content” on the left, select “Profile”.

Another window will open and you can select the element/compound you have in your sample, then click on “Search”.

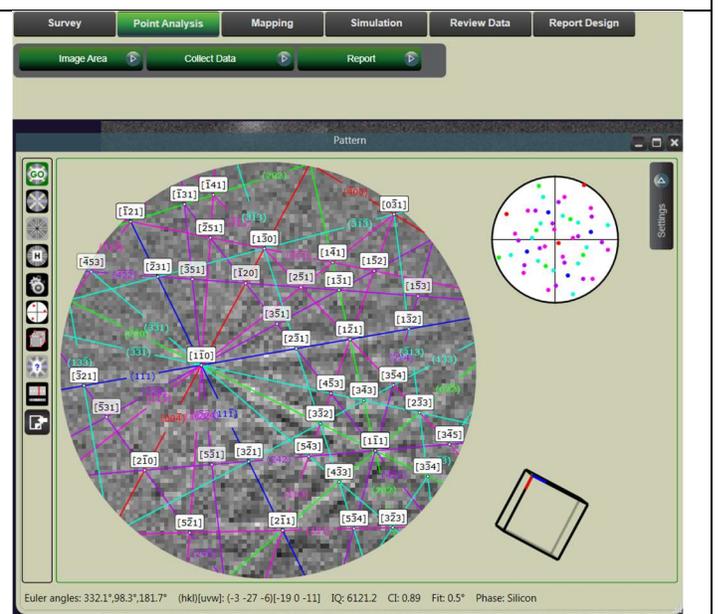
Find the element/compound in the list on the left, click the top arrow to import it as an “EBSD Active Phase List”.

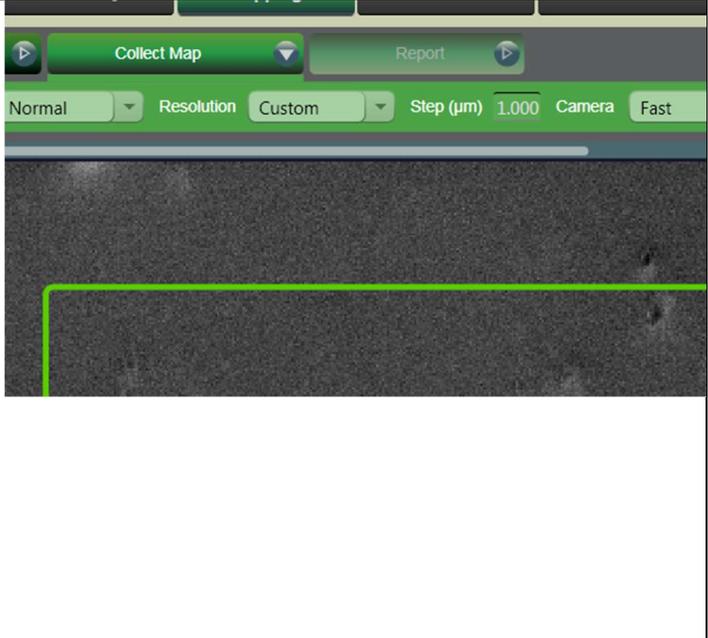
Remove other irrelevant phases, then click OK.



18. Normally EBSD is recorded for mapping, however, in case you are interested to analyze only one or several points, you can do it through the “Point Analysis” menu.

After taking an “Image Area”, click on a point on the image and the



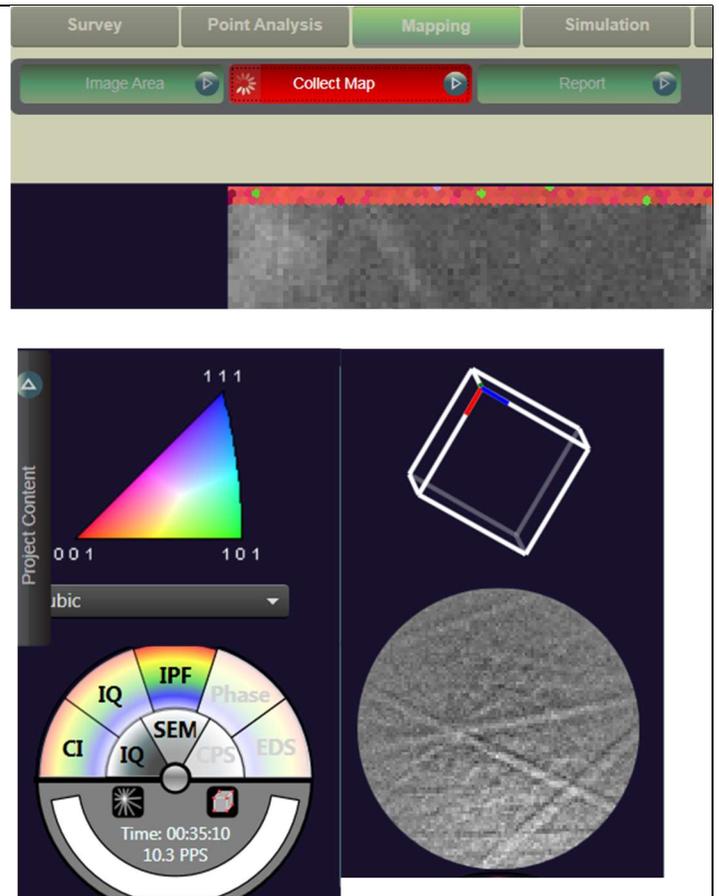
<p>program shows the solved orientation and phase.</p> <p>This information will be saved temporarily in the “Project Content” menu on the left side.</p>	
<p>19. To do the “Mapping” analysis, first click on the “Image Area” to have a fresh image. Use the bottom right corner of the green rectangle to change the size of the scan area. Use the top right corner to move the rectangle.</p>	
<p>20. From the menu on top, change the resolution to the desired value. At “Course” resolution mode, it scans around 15,000 points at around 30 minutes. To lower the resolution (and time), choose “Custom” and enter the step size manually.</p>	



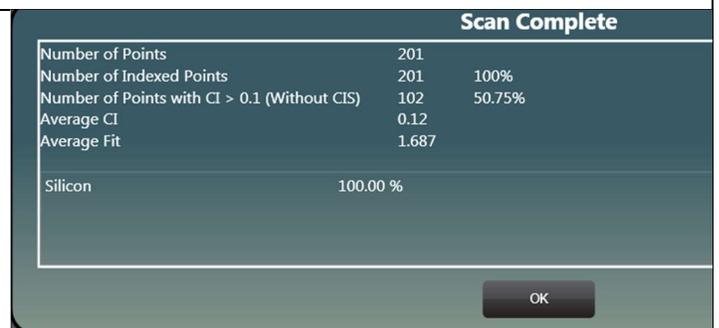
21. Click on “Collect Map” to start scanning.

On the left side, you can click and see different maps and the Kikuchi patterns while scanning and solving, as well as the remaining time at the bottom.

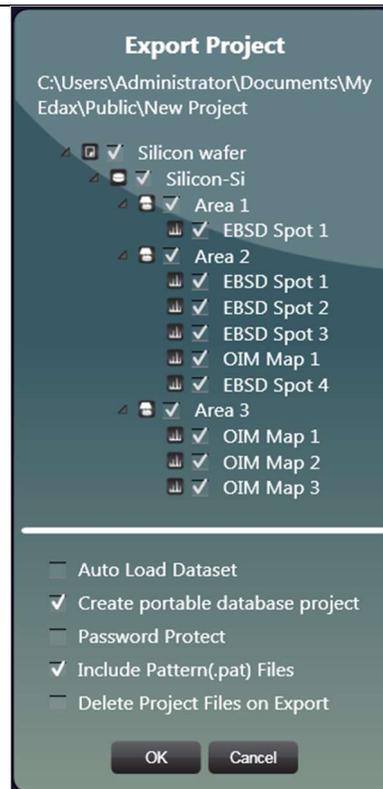
IPF (Inverse Pole Figure)
 IQ (Image Quality)
 CI (Confidence Index)
 PPS (points per second)



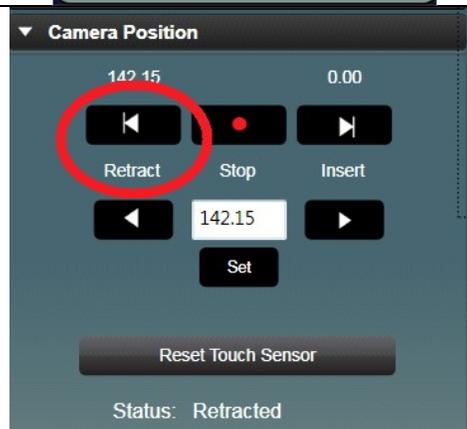
22. At the end of the scan, it shows a “Scan Complete” window with some solution statistics. Click “OK”, then click on red “Finish” on the top of the menu to release the electron beam.



23. In order to permanently save your results, click on “Export” from the left menu and save it as .zip in C:\Team_DB_Backup\ folder and your name as the subfolder. Click “Include Pattern(.pat)” to save the pattern images.

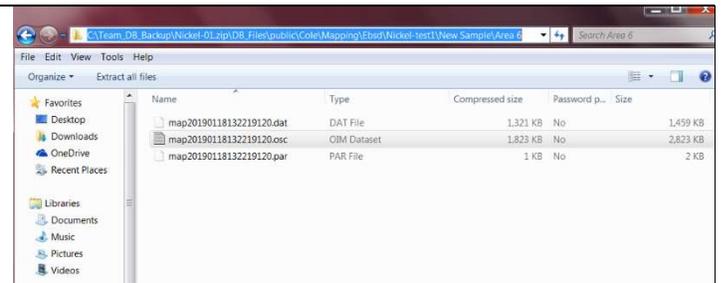


24. If you are done with the TEAM software, **make sure to retract** the EBSD camera or close the TEAM software, this will retract the camera automatically.

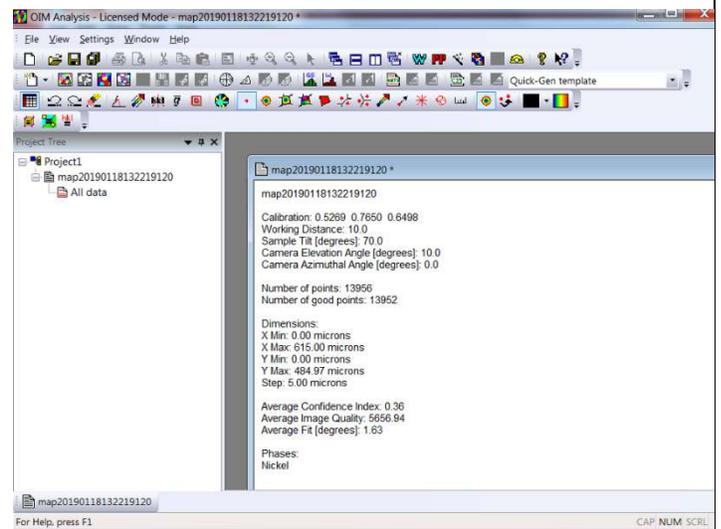


25. In order to view and analyze your data in “TSL OIM Analysis 8” software, you need to follow a relatively long but straightforward path to find and open the .osc file, mentioned here. The bold texts are the names you save while running the TEAM program.

The .osc is inside the .zip folders. You don’t need to unzip it. Opening .osc file will automatically open the OIM software.



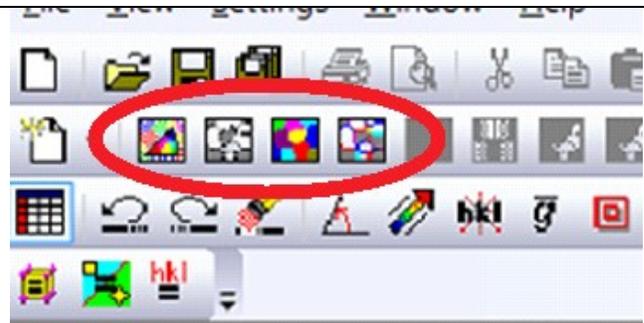
C:\Team_DB_Backup**saved name .zip**\DB_Files**your name \Cole**\Mapping\Ebsd**Project Name****Sample Name**\Area or Point #

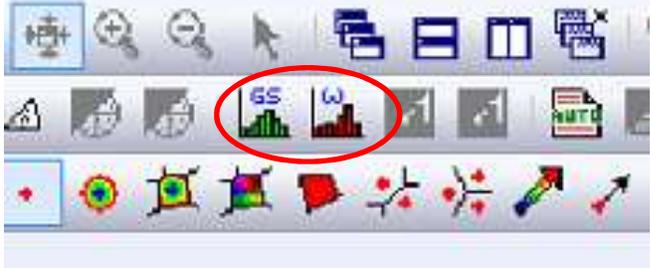


26. After opening the .osc file in TSL program, four functions will be activated.

- Icons from left to right:
- 1- IPF (Inverse Pole Figure) Map
 - 2- IQ (Image Quality Map)
 - 3- GC (Unique Grain Color) Map
 - 4- IQ overlaid with GB (Grain Boundary) Map

Click on them to see the maps.



<p>27. Two more options in this software are the “Grain Size Chart” and “Misorientation Angle Chart”. There are many more features in this software that you can find details in the OIM manual (CNI website).</p>	
<p>28. If you are done with the EBSD analysis, close the software, turn the knob back to EDS and switch back the RemCon32 to “Com 5”. Take out your sample.</p>	
<p>29. BADGER LOGOUT: Don't forget to disable the tool in badger after you're done.</p>	

