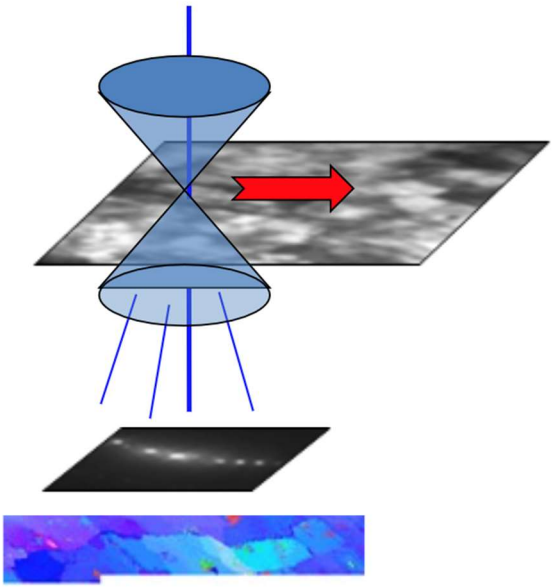
COLUMBIA | NANO INITIATIVE

ASTAR (Orientation and Phase Mapping System on TEM)

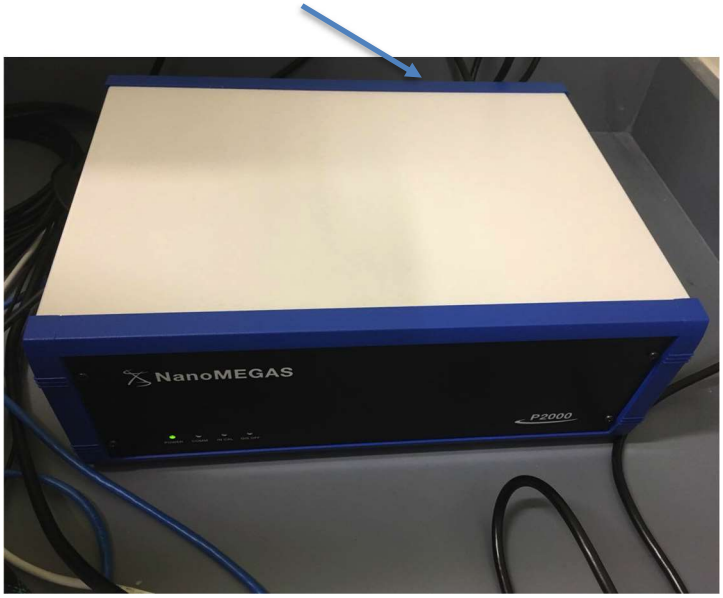
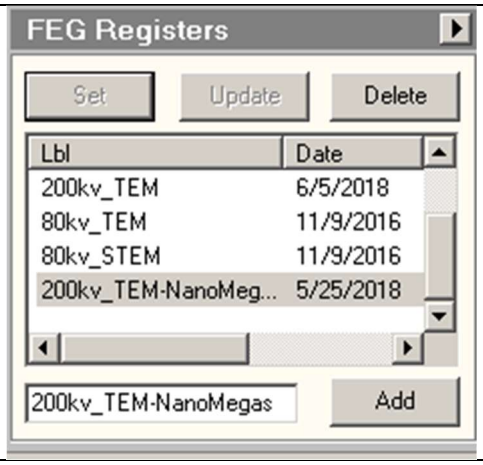
Standard Operating Procedure

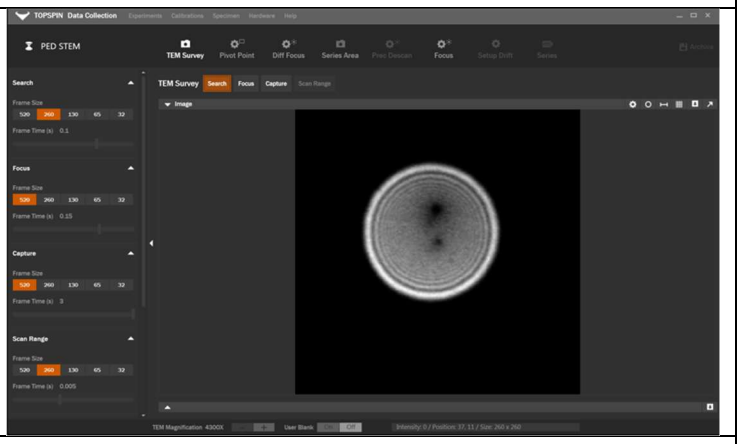


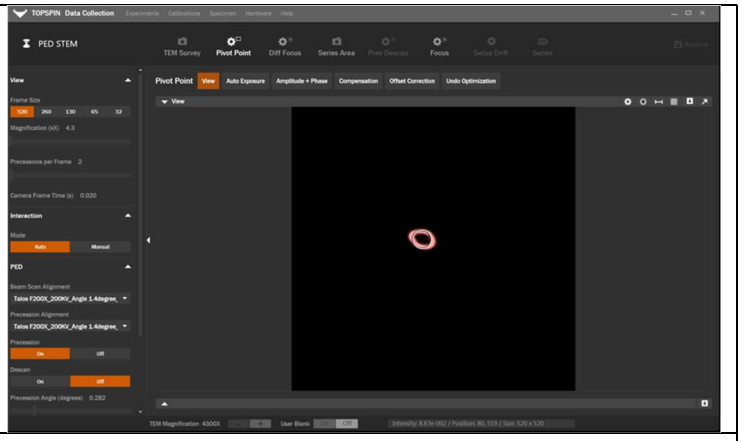
Orientation map

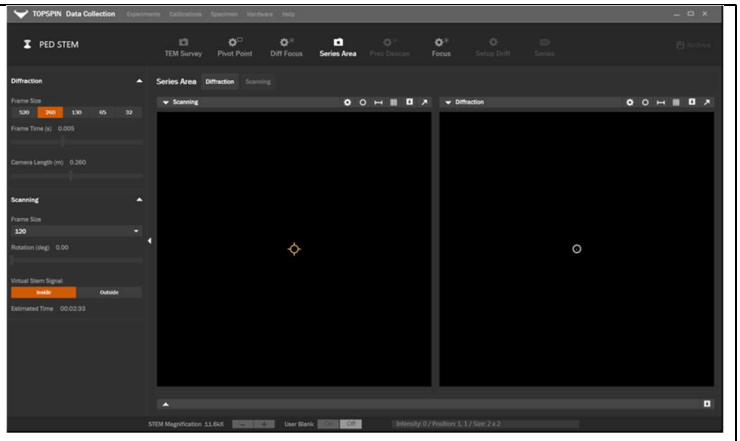
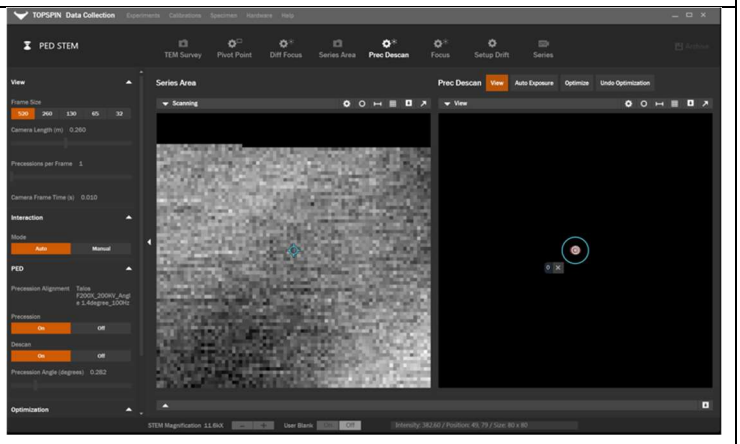
These instructions are intended for reference only, and will *not* replace the thorough training required for proper system operation. Contact a clean room staff member with questions or to report a system problem.

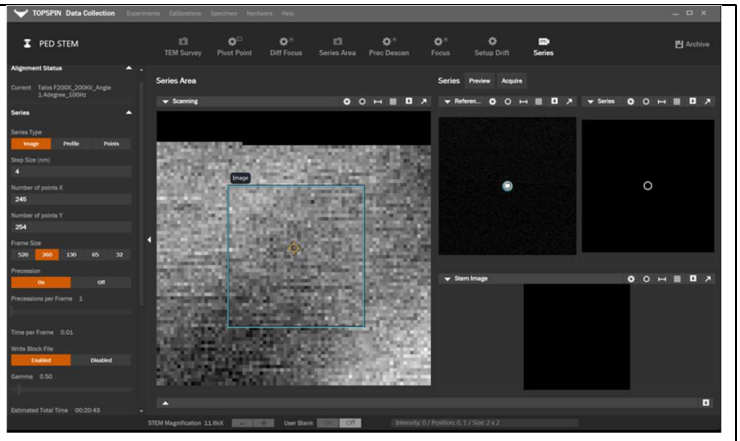
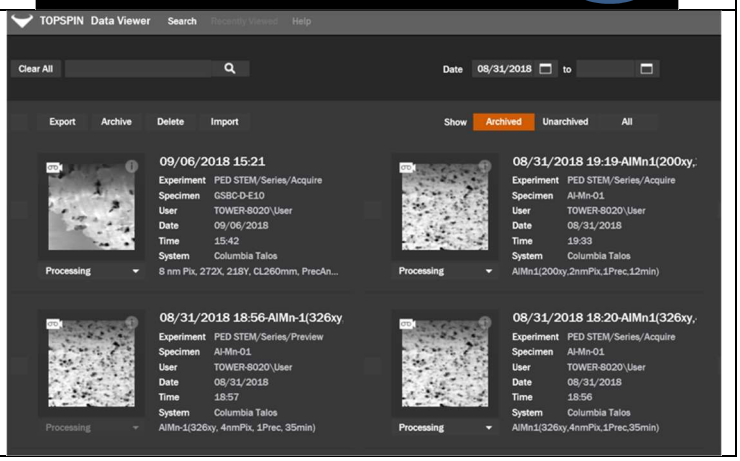
CNI Shared Facilities

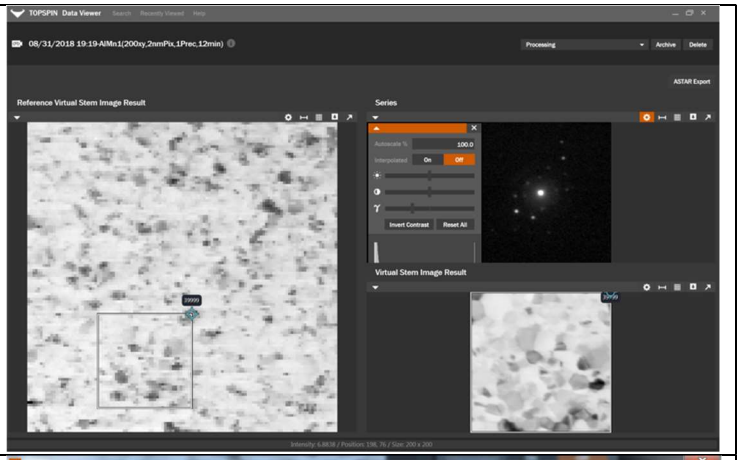
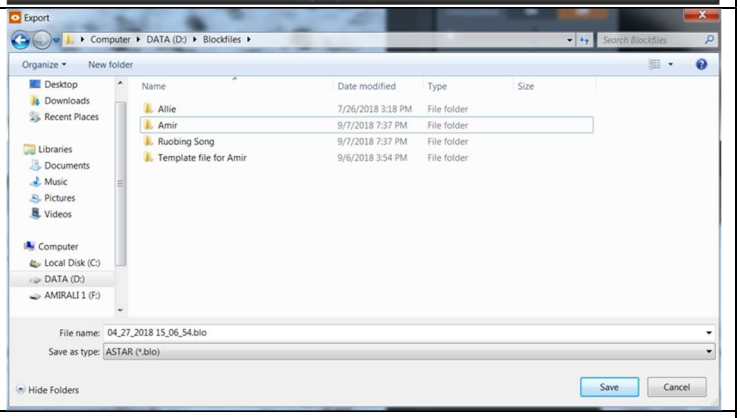
1.	Enable the TEM in **BADGER**	The ASTAR PC with black case on the ground (right side) should be on. Otherwise turn the PC on.
2.	Turn on the NanoMEGAS controller (behind the big monitor on the right)	(the switch is on the back) 
3.	After loading the sample, find the region of interest and adjust the **eucentric height** (the *Z*)	
4.	Load the FEG Registry **200kv_TEM-NanoMegas**	

5.	**Tune** the beam: Gun shift, Beam tilt pp x Beam tilt pp y Beam shift	At this beam setting, the beam is significantly less bright and less invasive.
6.	Fine tune the eucentric height (**adjusting the *Z***) by converging the beam (intensity) to a point. The goal is that the beam produces the minimum amount of diffracting spots.	Adjusting the *Z* height is crucial in the final image quality
7.	Click on the **pause** button on the top menu of FluCam screen	
8.	Go to the **NanoMegas** tab (next to the tabs STEM, Tune, etc.) And click on both grey buttons (**NanoMegas** and **FluCam**)	
9.	On the computer on the right open the application **Topspin Data Collection**	
10.	In the first window, enter you sample name.	
11.	The window should look like this. Click on the search button. By using the **track ball**, bring the beam to the center.	
12.	Use the **intensity knob**, make the beam to a spot.	

13.	From the top menu click on the **Pivot Point** tab. You should be able to see a beam is circular.	
14.	The current **magnification** is in the medium range.	46,000 x
15.	Make sure the circle is in the middle. Click on the **Amplitude + Phase** button on the top. Wait several seconds till it greys out.	This will try to bring the beam to a spot automatically.
16.	Click View and then click **Offset Correction**	This will try to bring the beam to one point with the precession on/off.
17.	Gradually go to higher magnification and at mag. 245,000x repeat the two steps above.	The beam may move by going to higher mag. Use trackball to bring the beam to the middle.
18.	Go to the **diffraction mode** on TEM control panel, then click on the **Diff Focus** tab in Topspin	
19.	Click **View**. Use **magnification knob** and change the **Camera Length** to 260 mm (or smaller) Change the **cameral length** of the **software** in the left menu, accordingly.	If the beam is off center, use Multifunction X and Y to bring the beam to the center.

20.	Click on the **Series Area** tab. Then click on **Diffraction** button. This is a preview scan tab that shows you where it is going to scan and how your sample looks like. The **STEM Magnification on the bottom** of the screen defines the preview scan magnification	
21.	By clicking on the scanning button, it starts showing you the preview. The estimate time is indicated on the left.	Changing the **Frame Size** define the number of scanning points in one line. More frame size, better resolusion, longer time.
22.	Click on the **Prec Descan** tab. Then click on the **View** button. Normally at this view, the spots are spot-like and not circular and you don't need to change anything. Otherwise go to the Pivot Point tab and repeat the steps from Pivot Point. The default value for **Precession Angle** is 0.3.	
23.	Click on the **Focus** tab. Press the View button to see the diffraction pattern. Normally no change is necessary at this point. However, **advanced Focus tuning** is explained.	**Advanced Focus tuning:** Use the blue arrow and put it on a feature with relatively high contrast. Click on **Diffraction**, then **Beam Focus** button (unprocessed profile). Click on **Pivot Height** and adjust the BDLX or BDLY Amplitude using the left alignment knobs on the Digistar hand panel to make the STEM profile with precession most closely match the unprecessed profile.
24.	You can skip the **Setup Drift** and go directly to **Series** tab.	Drift Correction is not necessary on this microscope. Sometimes with Drift Correction on, the acquition time may takes way longer.

25.	In the **Series** tab you can select the area for the final data acquisition (blue rectangle), the **step size** (resolution in nm) and number of precession per frame (diffraction pattern). 2 nm to 4 nm is the resolution of data acquisition for the Talos microscope.	
26.	Click **Preview** and put the **blue circle** in the diffraction pattern around the central beam (this will make the virtual **bright field image**)	The estimate time as shown on the left menu. 20 minutes to 30 minutes scanning time is normal.
27.	After the scan is done, in case your scan is satisfactory and you want to save your data, click on **Archive**.	
28.	On the desktop, open the application Topspin Data Viewer.	
29.	Select **Show Archived** to find your scan. Double click on the image to open it.	

30.	On the top right, click on the gear icon (⚙) to correct the image gamma level to reveal some of the faint spots in the diffraction pattern. Then click **ASTAR Export**	
31.	Save your data in D:\Blockfiles\your personal folder Saving this data may take several minutes.	
32.	After saving your data, both programs should be **closed**. Data analysis and pattern solving are described in separate SOP.	
33.	In the TEM software (left screen) **deactivate** the **NanoMEGAS** and **FluCam** in the NanoMegas tab. Restart FluCam.	
34.	Close the TEM software as usual.	
35.	**BADGER LOGOUT:** Don't forget to disable the tool in badger after you're done.	