Image shift – Coma calibration

1. On cross grating: make sure alignments are done and the grid is at eucentric height and eucentric focus at about the center of a square.
2. Edit fcn preset to be at 0.7 microns defocus
3. Correct coma free alignment in K1n\_Beam\_Tilt\_Image (use fcn as the preset)
4. In the Calibrations application: before running the calibration, you can observe how badly the coma is if you apply image shift in the +x,-x,+y,-x directions – also good for comparing before and after calibration
	1. To do this: go to K1\_Presets\_Manager, click fcn, click icon “Edit Selected Preset Parameters,” and change image shift of X to -5e-06.
	2. Go to K1 K1n\_Beam\_Tilt\_Image settings and check:
		1. Wait 1 seconds before acquiring image
		2. Beam tilt: 0.006 radians
		3. Number of tilt directions: 4
		4. Presets order: fcn
	3. Simulate target in this node. Repeat this for X= +5e-06, Y= -5e-06 and Y=+5e-06
	4. Make sure to change fcn image shift back to (0,0)
5. Go to K1n\_Beam\_Tilt:
	1. Send fcn preset to scope
	2. Change “Defocus” to “Image-Shift Coma”
	3. Click “Parameter settings” on the right (there are two settings icons)
		1. Measure coma at 1 position per image shift direction
		2. Add additional 5e-06 m image shift at each position
		3. \*\*These settings will allow you to correct for defocus, astigmatism, and coma for x=-5e-06, 0, 5e-06 and y=-5e-06, 0, 5e-06
	4. Click “Calibrate”
		1. A window will appear called “Aberration Free State”
		2. The top should read: Image shift x= -5.0um, y=0.0 um
			1. If it does not, check that parameter settings are correct, and that fcn image shift is at (0,0)
		3. Defocus should be -7e-07
		4. Click “View Live FFT”
			1. Adjust defocus and astigmatism
				1. For defocus: the easiest way is to find zero, check the defocus on the microscope monitor, then subtract -7e-07 from that number – you want to make sure the defocus is consistent with the defocus at zero applied image shift
				2. Adjust objective astigmatism through stigmator – I suggest copying slot 2 (the current obj astig) to slot 1 and then adjusting using slot 1. \*\*It will revert back to the original obj astig at the end of the calibration, but I found it helpful.\*\*

It helps to adjust coma closer to zero

* + - 1. Once finished, click OK. If you think you did something incorrect, press cancel.
		1. Click “Align ComaFree Manually”
			1. The parameters for the tilt cannot be changed – it is automatic: astigmatism will look terrible, but its ok.
			2. Manually correct the coma-free alignment – make sure the movements are very small and close to the center of the middle power spectrum – it is very sensitive.
			3. Once +x and -x look similar, and +y and -y look similar, press OK. If you think you did something incorrect, press cancel.
		2. Click OK in the “Aberration Free State” window.
		3. Then complete steps iv through vi again for the following image shifts: (x=0, y=0), (x=5, y=0), (x=0, y=-5), (x=0, y=0), (x=0, y=5).
		4. \*\*The image shift will change automatically. You cannot exit the calibration until calibrations for each image shift pair has been completed.\*\*
	1. Now click “Parameter settings” on the right (there are two settings icons)
		1. Measure coma at 2 position per image shift direction
		2. Add additional 5e-06 m image shift at each position
		3. \*\*These settings will allow you to correct for defocus, astigmatism, and coma for x=-10e-06,-5e-06, 0, 5e-06, 10e-06 and for y=-10e-06,-5e-06, 0, 5e-06, 10e-06
		4. It should be a little easier now that it has been calibrated once.
	2. Repeat step d: the starting image shift should read x= -10.0 um, y= 0.0 um
	3. Once completed: go to K1\_Presets\_Manager, click fcn, click icon “Edit Selected Preset Parameters,” and change image shift of X to -5e-06 and Y to -5e-06.
	4. Go to K1 K1n\_Beam\_Tilt\_Image settings and simulate target
		1. This is useful for comparing the tableaus with applied image shift before and after calibration.