SET UP

EBSD SYSTEM STARTUP

1. Set KMV switch to position #3
2. If computer is not currently on, turn computer on (Note: KVM MUST be on #3 before computer boots up).
3. Login to HKL Computer

MICROSCOPE

1. Conduct regular sample loading and microscope preparation procedure.
2. Change to TV-MODE, LOWER the stage and then move it the FAR LEFT SIDE of the screen (-Y axis movement).
3. <Ctrl+G>, go to STAGE tab; set SAMPLE TILT to 70 DEGREES. Move the stage further left if needed, so that it will be on the LEFT SIDE IN RESPECT TO POLE-PIECE.

HKL HARDWARE AND SOFTWARE

1. Turn on EBSD CAMERA (red button on the back of the grey box, on the floor, next to microscope). REMOTE CONTROL will turn on.
2. Insert EBSD CAMERA into microscope chamber.
   On the REMOTE CONTROL: Press “STOP” button to unlock and then PRESS and HOLD “IN” button. Insert camera to the FINAL STOP
3. If you wish to use BACKSCATTERED ELECTRON DETECTORS located on the EBSD camera turn BACKSCATTER CONTROL PANEL on; set GAIN to HIGH and MODE to RECORD. In the QUADRANT SELECT panel choose: negative 1 & 2 for the FORE-scattered DETECTOR OR negative 3 & 4 for BACK-SCATTERED DETECTOR

MICROSCOPE

1. Place the stub with your sample directly under the pole-piece.
   CAUTION: DO NOT CRASH THE STAGE OR SAMPLES INTO EBSD CAMERA OR THE POLE-PIECE. BE EXTREMELY CAREFUL
2. Set EHT at 10 kV (good value to start with, can be change if needed during analysis); start with WD of 10 mm and STANDARD APERTURE 30 µm.
3. Start at LOW magnification, find region of interest and optimize image.
4. Go to **ROTATE/TILT** window; set **SCAN ROTATION** at *0.8 degrees*, **TILT** at *70 degrees*. Optimize image again. You can also use **DYNAMIC FOCUS** option from the **ROTATE/TILT** window. Reduce scan area to 4 inch wide stripe, choose slow scan rate and adjust **DYNAMIC FOCUS** until the image will look uniformly focused in the whole scan area (sometimes impossible).

5. In the Apertures Tab in the SEM Control Panel change **APERTURE SIZE** to *120 µm*. Optimize the image, then turn **HIGH CURRENT MODE** (same Control Panel) on and conduct final image optimization.

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**IMAGING**

**FLAMENCO – ACQUISITION SOFTWARE**

**ACQUIRING AN IMAGE**

1. Start **FLAMENCO – ACQUISITION** Software on the HKL Computer. Choose profile, click OK.

2. Load **CALIBRATION FILE** corresponding to the settings of the scope. Go to **Calibration** menu → **Load Calibration** and pick up relevant file. Adjust settings of the scope and/or EBSD camera if needed.

3. Make sure you are in the **IMAGING MODE**.

4. From the Property Control Panel on the left choose **SOURCE** for the image acquisition:
   - **CHANNEL 0** – image will be acquired using detector currently active in the microscope
   - **CHANNEL 1** - image will be acquired using fore-scattered or backscattered detector of the EBSD camera

5. To obtain an image click on the **SCANNING BUTTON**.

6. Adjust brightness and contrast to optimize the image. If you are using Channel 1 detector use **BRIGHTNESS/CONTRAST KNOBS** on the **BACKSCATTER CONTROL PANEL** together with the Brightness/Contrast slide bars present in the Property Control Panel in the software.

7. Move to desired area of the specimen **BE EXTREMELY CAREFUL**

8. Freeze the scanning by clicking on **to freeze it at the end of the frame or on** to freeze it immediately.
ACQUIRING A BACKGROUND

1. Change to the Setup Mode by clicking on Setup Icon in the Menu Panel.

2. Make sure the Live EBSP window is active. This will open the Property Control Panel on the left.

3. Ensure that the In-Software Image Enhancement is Switched Off

4. Alter the Timing per Frame until the signal in the live EBSP is suitable

5. If necessary adjust the Gain level using the Camera Controls. High gain will increase the sensitivity of the camera.

6. Using Controls on the Microscope Computer Switch to fast-scan rate. Choose magnification that is as high as possible, but still produces No Discernible Kikuchi Bands.

7. Collect the background by clicking on the icon to the side of the Live EBSP window. The progress will be displayed in the relevant box.

8. Turn the In-Software Image Enhancement back on.

ACQUIRING AN EBS PATTERN AND INDEXING
1. Go to **FROZEN SEM IMAGE** tab.
2. Turn **SPOT MODE** on.
   Drag and place **GREEN CROSS** in the region of interest. In the Live EBSP window you should be able to see distinct Kikuchi bands present.
3. When you are ready to collect EBSP hit **SNAP EBSP** button in the **CYCLE CONTROL PANEL**.

4. If you plan on detecting bands automatically choose **BAND EDGES** or **BAND CENTERS** from the drop-menu in the Property Control Panel. Use Band Edges when the edges of the bands are sharp and clearly visible. For blur and narrow bands Band centers may work better.

Click **DETECT BANDS** in the Cycle Control Panel (auto-detection done by software)

If you are not satisfied with the bands detected by **Flamenco** delete the bands using and mark them manually.
You can mark the edges or the centre of a Kikuchi band.
To mark the edges click on the edge of the band and drag to the other end.
Then click the right mouse button and keep it down – a parallel line will appear. Move the mouse until the line is over the other edge of the Kikuchi band.

To mark the centre, click on the centre of the band and drag to the other end.

5. Click **VIEW MATCH UNIT** icon, then **ADD** and pick up phases of interest. You can choose from three different databases.

6. Click **INDEX** in the Cycle Control Panel.

7. **Flamenco** will display a simulation of the EBS pattern in the **SOLUTION** window and detail information about the phases to the left of the screen. The solutions list
in the Property Control Panel shows all the solutions that Flamenco found for this EBS pattern; they are listed in order of increasing MAD value (Mean Angular Deviation – goodness of fit of the solution). A number less than 1 degree is acceptable for most systems.

You can decrease MAD value (improve the fit of your solution) by refining projection parameters. Go to PROJECTION PARAMETERS in the CALIBRATION menu; STATUS OF CALIBRATION window will show up. Make sure that all boxes are ticked on and click REFINE button and check the new projection parameters and see whether the simulated EBSP fits more to the real EBSP. Repeat the process until MAD stays constant.

**ACQUIRING AN EBSD MAP**

Proceed through the Set up and Imaging stages as outlined above. Collect an SEM image of the region you are interested in and perform a routine background acquisition procedure. Ensure that the EBSPs are of reasonable quality.

1. Click on the AUTOMATIC button in the Menu Panel. The Job List window will appear.

2. Press the NEW JOB button at the top right corner of the window. A dialogue box will pop up asking you to choose type of job you want to create. Choose New Mapping under Beam Jobs.

3. Type the name of the project and choose directory you want it to be saved in. Click Save and Flamenco will automatically jump to Frozen SEM image.

4. Adjust position and size of the blue box to place it over the region of interest using mouse in the Frozen SEM image window. Define Step Size (spacing between points).

5. Click Add Job to List button. The Cycle Control panel will change appearance.

6. To start analyzing the job click Run button in the Cycle Control panel. If you wish to alter any of the parameters click
7. Once all the jobs in the Job List have been completed, *Flamenco* will display a Summary Window.