

NCEM FIB driver license Checklist

User:

Approver:

Date:

1. Safety

Understand emergency shutdown procedure	
Know emergency contact numbers	
Understand long milling session should be avoided.	

2. Load specimen

Wear gloves	
Mount specimen on holder	
Open nitrogen gas valve	
Vent the chamber	
Insert the holder and tighten gently.	
Check sample height!	
Push door handle and press "Pump"	
Close nitrogen gas valve	
Check if vacuum in 10E-5 mbar range in 5 minutes.	

6. Start beam

Wait until vacuum $< 5 \times 10^{-5}$ mbar	
Select SED detector	
Press "Beam On"	
Wait until ion beam current is stabilized, record V/I value	
If the ion source needs heating, notify NCEM staff	

7. Eucentric height and basic alignment

Start continuous e-beam imaging	
Press shift-F9 to set focus to eucentric height	
Search for area and raise stage up until interested feature are in focus	
Use "Stage"- "Align X/Y" to orientate the feature	
Center one feature on screen by double click on it, tilt sample to 10 degree, then use Z control to center the feature.	
Repeat at higher magnification ($>1.5K$)	
Repeat with 52 degree sample tilt	
Back to 0 degree tilt and finely focus on the feature	
Press OK on pop-up window	
Check stigmatism and lens alignment	

8. Making ion beam and e-beam coincident

Tilt sample to 52 degree	
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Magnification couple checked	
Choose ion beam aperture 30pA	
Start ion beam live imaging, adjust contrast/brightness, focus	
Use image shift X and Y to center the same feature which had been centered in e-beam image.	

9. Milling

Change to a desired beam current	
Go to area of interest	
Adjust focus and astigmatism at the magnification	
Draw a pattern, start milling	

10. Shutting down

Press Beam Off	
Press off HT button	
Select Stage Initialization, wait until stage stop moving	
Open Nitrogen gas valve	
Press Vent	
Remove holder properly.	
Press door handle and press Pump.	
Close nitrogen gas valve	
Log in source live time and V/I, and any problem.	

11. Pt deposition with ion beam or e beam

Heat Pt source	
Find area of interest, adjust eucentric height.	
Take one ion beam (or e beam) image, draw a box for depositing area.	
Choose materials file as Pt.mtr	
For ion beam deposition, choose beam current by $2 \times \text{Area}(\text{square of microns})$. For e-beam deposition choose spot size 5-7.	
Re-adjust contrast/brightness, and refocus	
Insert Pt needle	
Take one image, adjust deposition box position.	
Start deposition and check progress by taking one e beam or ion beam image	
Turn off Pt source and wait at least 10 minutes before venting	

12. Insulator deposition using ion beam

Purge insulator source if the source has not been used for several days	
Follow same procedure as Pt deposition, but use 1 pA/square micron	

13. Omniprobe lift-out

Find area of interest, adjust eucentric height	
Adjust e beam/ion beam coincident.	
Tilt stage to 52 degree and cut trenches on each side of interested area.	
Tilt stage to 10 degree and cut out the window with one side attaching to the wall.	
Tilt stage to 52 degree, choose 10 pA current	
Lower stage Z for about 1 mm	
Insert the Omniprobe, bring it to the center with both beams	
Insert Pt needle	
Raise stage slowly, use both beam images to bring the side of the sample to the needle until they touch.	
Draw a deposition box and weld with 10pA current	
Cut the sample free	
Lower the stage to lift out the sample	
Retract the Ominiprobe with Z control first, then retract it completely	
Find the TEM grid and adjust eucentric height	
Tilt the stage to 52 degree	
Lower stage Z for about 1 mm	
Insert the Omniprobe, bring it to the center with both beams	
Insert Pt needle	
Raise stage slowly, use both beam images to bring the grid bar to the side of the sample until they touch.	
Weld the sample and cut the needle free	
Lower the stage, retract the Ominiprobe and Pt needle	
Thin the sample with ion beam until desired thickness reached	

14. Low Energy Ar Ion Source

Open Ar gas cylinder main valve.	
Use e-beam to set sample to eucentric height, and align sample to Ar beam as necessary.	
Switch on Ion Gun Control Unit. Wait gun pressure meter reading < 0.5 mTorr.	
Set emission knob to 100 uA, switch Beam "On". Wait for 5 minutes.	
Set emission to 1mA and 10 mA, wait 5 minutes at each step.	
Switch Beam "Off". Wait gun pressure meter reading < 0.5 mTorr.	
Open Ar gas leak valve CCW slowly until gun pressure is 7.0 mTorr.	
Choose condenser setting. A is preferred.	
Turn up ion energy to desire value, such as 1000 eV.	
Dial in corresponding Focus value and Centering X/Y values.	
Switch Beam "On". Ion beam is energized.	
Switch Beam "Off" when desired time is reached. Turn down ion energy. Use e-beam to check milling process.	
To shutting down the ion gun, set emission knob to 100uA. Check beam is "Off" and ion energy knob is turned fully CCW.	
Switch off Control Unit.	

Wait 10 minutes for the filament to cool down before venting the chamber. Turn off Ar gas leak valve (CW about 1 turn).	
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A user can qualify to the following levels:

A user becomes a **C level** user when they have completed sit down training and can pass the drivers test. They can then sign up for daytime usage.

A user becomes a **B level** user once they have several trouble free sessions and who demonstrate responsibility for maintaining the microscope in best working condition. They may sign up for weeknight sessions.

A user becomes a **A level** user after several trouble free weeknight sessions and who demonstrate responsibility for maintaining the microscope in best working condition. They may sign up for evening and weekend sessions.