Alignment method in STEM mode

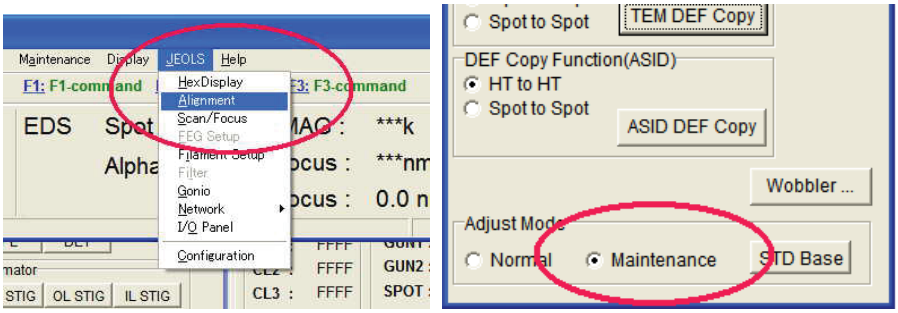
for JEM-2100, 2100F, 2200FS Version 4.0

Key word: MAG, AMAG LMAG, Correct Image Rotation, Focus with Brightness

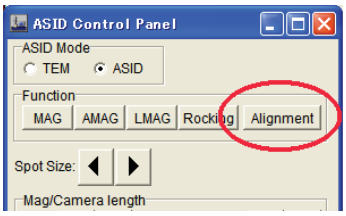
MAG

0. You must finish make alignment in TEM mode completely. Note hex data of GUNA, compensator of SHIFT, TILT and ANGLE, and **TEM OL focus voltage** measured by volt meter in CBD mode, Spot 0.5nm, Alpha 9, MAG x40k. In case of JEM-2200FS, you note also FL, FL-comp, FLA and FLS data. **Focus image using Z-height in TEM standard focus.**
1. Switch to ASID mode.

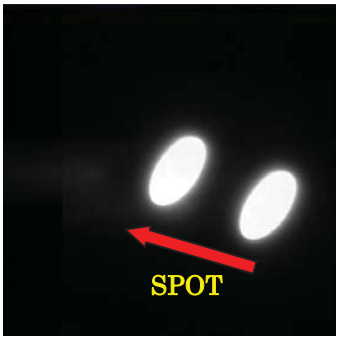
2. Open an Alignment window. Change to maintenance mode.



3. Select each deflector once in order to clear preset value in user's mode. Input hex data you noted in 0. in STEM's MAG.
4. Set CLA1 to 8000(hex).
5. Change mode to Alignment.

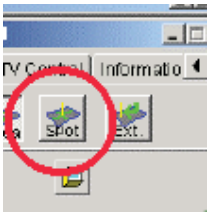


6. Set Spot size to 0.2nm or minimum. Make converged beam using Brightness knob at left panel in **Near TEM OL focus voltage**. Center beam by **SPOT** Alignment. Turn the Brightness knob CW fully. Reduce OL focus to make caustic spot. Center caustic spot by **CLA2**.
   Reference movie is "01_Alignment_in_AlignMode.avi"

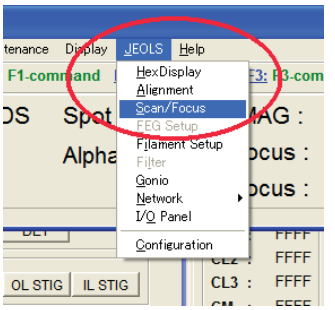


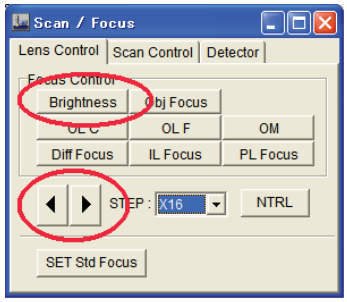
7. Center converged beam in **TEM OL focus voltage** using **SPOT** in all spot size.
8. Change mode to MAG

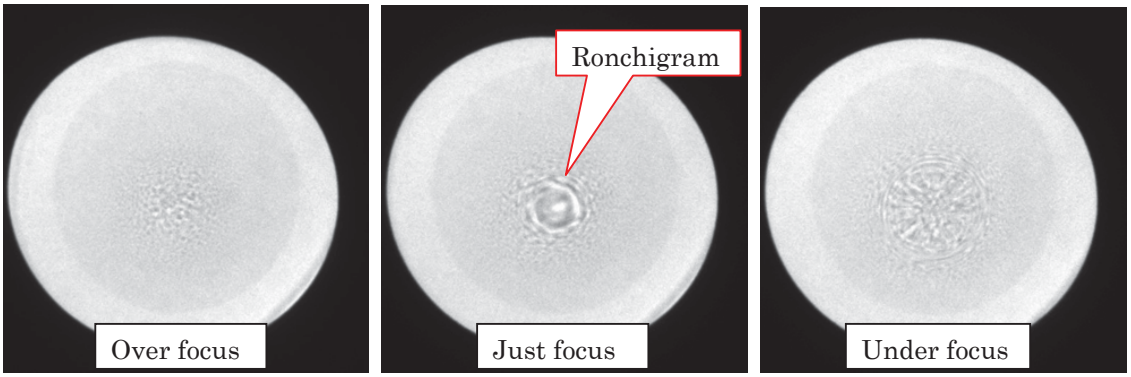
9. Set magnification at x2M (2100F over x200k, 2200FS over x2M) and Scan speed S4 in order to add electrical filters to scan controller. Set spot size to 0.2nm (Minimum size) and camera length to 60cm or 80cm. Then push SPOT.



10. Adjust focus in STEM standard focus by Brightness at JEOLS → scan/focus. When the Ronchigram center is away from center, center it to screen center using **PLA.**
    (i.e. STEM standard focus = TEM standard focus – 0.02V)
    It's better to use amorphous area on a specimen in this adjustment.
    Reference movie is "02_Ronchigram_Focus_Amorphous.avi"
    and "02_Ronchigram_Focus_Gold.avi".

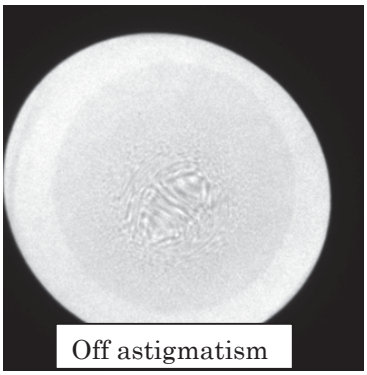


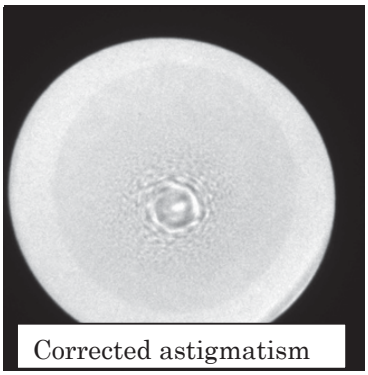




11. Correct astigmatism by **CL-stig**.

    Reference movie is “03_Ronchigram_Correct_Astigmatism.avi”

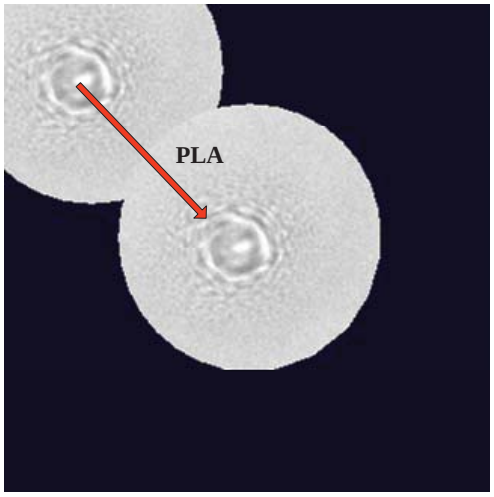




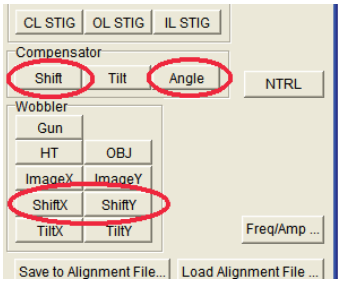
12. Turn Anode wobbler on. Center converging point to Ronchigram center using **GUNA2**.

    Reference movie is “04_Ronchigram_Crrect_GUNA_Tilt.avi”

13. Adjust focus refer 10. and correct astigmatism by **CL-stig** in all spot size.
14. Center Ronchigram to Screen center by **PLA** in all camera length.

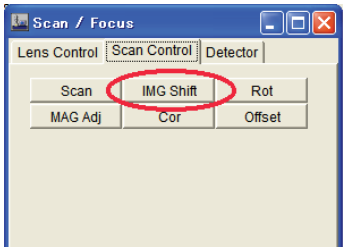


15. Set spot size to 0.2nm (Minimum size) and camera length to 60cm or 80cm. Insert a CL aperture 100um (#2) or 40nm (#3). Turn **SHIFT X** wobbler on. Stop wobbling using **Shift** and **Angle**. Follow above with **SHIFT Y**.

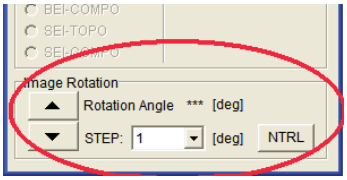


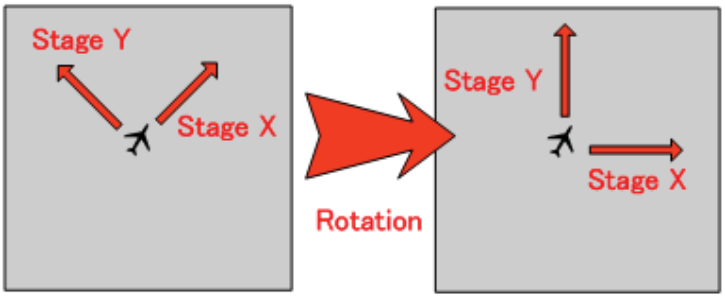
16. Correct target center between TEM and STEM by CLA1.
    - Center a target to screen centre at 40k in TEM mode.
    - Switch to STEM mode.
    - Obtain scanning image in SR.
    - Center a target using **CLA1**.

17. Adjust target centre between SR and S1 by image shift.
    - Center a target to image centre in Scan speed S1 by stage movement.
    - Set scan speed SR.
    - Select IMG Shift at JEOLS → Scan/Focus.
    - Center a target using DEF knob at left Panel. (You can correct only horizontal direction, and you must change only in SR.)



18. Adjust image movement directions at 20k by Image Rotation. Use stage move the target and monitor the direction (e.g. if you drive in X-direction the target should move in horizontal-direction, not 15 deg or other deg, otherwise please correct.)





LMAG

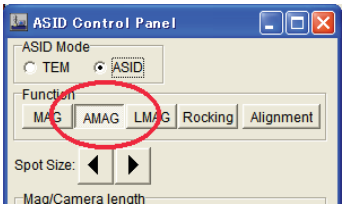
1. Center a target using stage movement at minimum magnification in STEM's MAG mode.
2. Change to LMAG. And set magnification to maximum.

3. Set GUNA hex data as same as STEM's MAG mode.
4. Obtain a scanning image with BFI.
5. Correct astigmatism using CLS
6. Center a target to image centre by **SPOT** alignment.
7. Center most bright area in scanning image using PLA.
8. Do 2. and 4.-6. in all LMAG range (LM1, LM2 and LM3)
9. Correct image rotation as same as STEM's MAG mode (18.) in LM3, LM2 and LM1.

AMAG

1. Center a target using stage movement at minimum magnification in STEM's MAG mode.

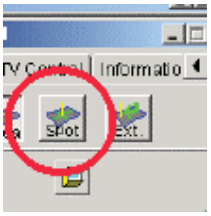
2. Change to AMAG and set camera length 60cm or 80cm.



3. Center beam using **SPOT** alignment.
4. Adjust focus in STEM standard focus with Ronchigram or scanning image in all spot size by Brightness at JEOLS → scan/focus.
5. Correct astigmatism in all spot size with Ronchigram by **CL-stig**.
6. Obtain a scanning image.
7. Center a target to image center at 20k by **SPOT** alignment in all spot size.

End Check in User's mode (STEM alignment for a customer)

1. Center the target in TEM mode and insert CL Apt #3.
   Reference movie is "05_Adjustment_in_TEM.avi"
2. Switch to STEM mode and select SPOT



3. Center the target to Ronchigram center using CLA1 in strong over focus.
   Reference movie is "06_Adjustment_in_STEM.avi"
4. Center CL aperture shadow to Ronchigram center using CLA2 in focused point.
   Reference movie is "06_Adjustment_in_STEM.avi"
5. Check STEM image. The target should be on center of image in all spot size in MAG and AMAG mode..

Please let me know your treasure opinions in order to improve this method!!

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