


Zeiss Supra 35 VP FEG Operating Instructions

November, 2007 - V 1.75

Pre-Start:

1. Microscope is On and Operational (Green light on front panel)
2. Sign into log book.

Startup:

1. Login to Zeiss Computer
2. Start **SMARTSEM USER INTERFACE** Software 
3. Login to software [User: Basic User Password: Zeiss]
4. **VAC:** and **GUN:** are on and operational, and **EHT:** IS OFF
5. <CTRL + G>, goto **GUN** tab, record Extractor Current in Log book.
6. Toggle DataZone if not visible <CTRL + D>
7. Goto Windows Desktop, start RemCon32 
8. In RemCon32, left-click **COMM** → **OPEN PORT** ; minimize window, return to **SMARTSEM**

Loading/Changing Samples:







1. Scope to High Vac mode (not VP - See "VP Mode" section to change).
2. Verify that **VAC:** and **GUN:** are on and operational, and **EHT:** IS OFF
3. Switch **Signal-A** to TV mode; Left-Click Signal-A select **TV**
4. Check sample/stage is clear of pole piece and BSD, lower stage (Z-control)
5. Withdraw EBSD detector if inserted (See EBSD Instructions)
6. Left-click **VAC:** indicator and click **VENT** (Check Vent gas cylinder is open)
7. When vented roll out chamber door
8. Using gloves and/or forceps, Remove/Load Samples
9. Close chamber door, watch TV-Chamber scope to check samples will clear pole piece and detectors
10. Left-click **VAC:** indicator and click **PUMP** (Listen)
11. Wait until **VAC:**

General Operating Parameters:



InLens Detector	WD 3mm optimal	
SE2 Detector	WD 6-8mm optimal, and longer	
VPSE	WD: Shorter the better	
BSD	Min. WD 4mm, shorter the better	
XEDS	WD 8.5 and No Tilt	
EBSD	70° tilt, shorter WD WD: 8.5, 10, 11, 14.5mm	

Generating an Image:

☞ Start in High Vac and SE2 mode

1. Verify that **VAC:** and **GUN:** are on  and operational, and **EHT: IS OFF** 
2. Set desired **EHT** (Double-Click **EHT** in Datazone or **SEM CONTROL** → **GUN** → **EHT**)
3. Left-click **EHT:** indicator and click **EHT ON;** indicator transitions from  to ready 
4. Switch **Signal-A** to **SE2** mode (Left-Click Signal-A select **SE2**)
5. Use faster scan rate (i.e. Scan rate **1** or **2**) initially to setup imaging
6. Left-click Contrast/Brightness  and Mag/Focus  controls to adjust the image
7. Use slower scan rate to reduce the signal-to-noise



Astigmatism Correction:

1. <Shift+F2> to clear the lenses, and then focus the image
2. Choose suitably high mag (above 20K), and refocus the image
2. Toggle reduced scan area  , and scan rate **3**
3. Open the **SEM CONTROL** panel, <CTRL + G>
4. Go to the **APERTURES** tab
5. Select **STIGMATION**,
6. Adjust X-slider to maximize image resolution, Adjust Y-slider to maximize image resolution
7. Select **MAG/FOCUS**, focus image (MB Mouse)
8. Repeat Steps 5-7 until image does not streak at 90°
9. **Warning:** Make sure **MAG/FOCUS** is selected before exiting **SEM CONTROL PANEL**
10. Toggle normal scanning  , and scan rate **3**

Stigmator Sensitivity Setting (for high magnification work):



TOOLS → **GO TO PANEL** → **USER SETTINGS**

Aperture Alignment:

1. <Shift+F2> to clear the lenses, and then focus the image
2. Choose suitably high mag (above 20K), and refocus the image
2. Toggle reduced scan area  , and scan rate **3**
3. Open the **SEM CONTROL** panel, <CTRL + G>
4. Go to the **APERTURES** tab
5. Select **APERTURE ALIGN**, Select **FOCUS WOBBLE**, set **WOBBLE AMPLITUDE**
6. Adjust X-slider to minimize image shift, Adjust Y-slider to minimize image shift
7. Repeat Step 6 until image does not streak at 180° - it should appear to pulse in & out
8. De-select **FOCUS WOBBLE**
9. Select **MAG/FOCUS**, and focus image (MB Mouse)
10. Goto Stigmatism if needed
11. **Warning:** Make sure **MAG/FOCUS** is selected before exiting **SEM CONTROL PANEL**
12. Toggle normal scanning  , and scan rate **3**


Capturing Images:

- Images are “*captured*” as they appear on the screen.

1. Change resolution if desired: **SCANNING → STORE RESOLUTION →**
 - 512*384 - rapid scan mode
 - 1024*768 - normal operating mode
 - 2048*1536
 - 3072*2304 - High Resolution mode
2. Middle-click camera icon  select → “**End of Frame**”
3. Compose image, set brightness & contrast.
4. Left-click camera icon  to freeze image
5. **FILE → SAVE IMAGE** to store

Sample that exhibit significant “charging” effects:

– these charging problems can be somewhat mitigated by changing to a fast scan rate and averaging multiple frames.

- 1) Use scan speed **2** or **3** button to select field of view and focus as normal
- 2) Open the **SEM CONTROL** panel, **<CTRL + G>** and go to the **SCANNING** tab
- 3) Set the following:
 - SCAN SPEED = 2**
 - FREEZE ON = COMMAND**
 - NOISE REDUCTION = FRAME AVERAGE**
 - N = 60 to 150** (Note: Set N = 1 for “normal” viewing)
- 4) Watch Image on screen, when image looks good Left-click camera icon  to freeze image

VPSE Mode:

- Shorter the WD the better
- ↑ Increasing Signal with more gas
- Use BSE with faster scan rates to find sample
- Collector Bias is actually sample bias (Vacuum > VP Control)
 - NOTE: Collector Bias must be below ~325v


CATHODOLUMINESCENCE:

- The VPSE Detector can be used to detect Cathodoluminescence
- Stay in High-Vacuum mode and switch to VPSE Detector

BSD Mode:

 **Warning:** Sample *MUST* be below WD of 4mm 

Inserting Detector:

- Make sure sample(s) is at least 4mm below bottom of lens before inserting detector.
- Insert the detector (Back left side of scope, hold knurled knob, lift “T” shaped stop, gently ease rod/detector into column, release “T” stop)
- Switch **SIGNAL A** to **BSD**
- You can use  to switch between BSD and SE2 detectors

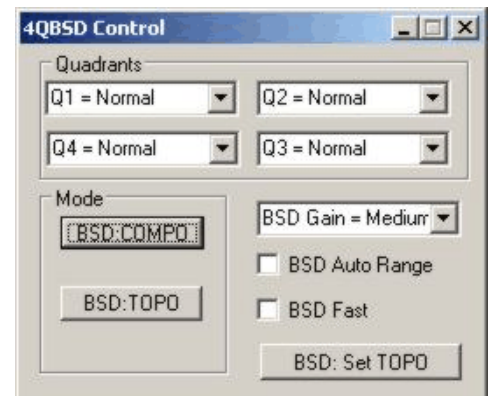
Detector Control Panel:

- 1) Open **Back Scatter Detector [BSD]** control Window 

- BSD Auto Range Off (box unchecked)
- BSD Fast to Off (box unchecked)

- 2) Chose Detector Operating Mode (Compo or Topo).
- 3) Adjust Contrast and Brightness Controls. If more or less “contrast” is needed change the course

BSD GAIN range: **LOW, MEDIUM, HIGH, VERY HIGH**



COMPO MODE:

- All four quadrants operating together (**NORMAL**), image contrast is generated as a function of Backscattered electron signal (Z-number).

TOPO MODE:

- Configure each quadrant as: **NORMAL, INVERTED OR OFF**. Make use of line-of-sight nature of backscattered electrons to generate a “pseudo-topographic” image.
- Once quadrants are set as desired, click “**BSD: SET TOPO**” to preserve current setup as new default setting.

Normal Shutdown:

1. Specimen(s) out, and chamber at High Vacuum.
2. **VAC:** and **GUN:** are on and operational, and **EHT: IS OFF**
3. Back off/Remove BSD and EBSD detectors
4. Close HKL EBSD software that *before* exiting SEM software
5. Exit/Log off of **SMARTSEM** User interface.
6. Exit EM Server.
7. Logoff workstation(s)
8. Clean up scope room
9. **SIGN OUT OF LOG BOOK**
10. Lights off

Standby - Partial Shutdown / System Reboot:

- Gun can be left On
1. Complete **NORMAL SHUT DOWN**.
 2. Close software interface
 3. Logoff workstation(s) and **SHUT DOWN** Workstation
 4. Press Yellow-**STANDBY** button on front scope panel wait 15-30sec
 5. Record Partial Shutdown event in Logbook

To Restart/Reboot System:


6. Press Green-**ON** Button Allow system to re-start.

Full Shut Down:

- Inherent to Field Emission Guns (FEGs), the gun is always left On
→ Full shutdown can only be done with administrative access.
- Full shut down is to be done ONLY in case of:
- a. Interruption of building utility services (Electrical or Water)
 - b. Vacuum system failure
 - c. Instruction of EMF Staff
1. EHT to OFF
 2. Right-click Gun in status bar select **SHUTDOWN**
<Ctrl-G> **SEM CONTROL** panel → **GUN** → **BEAM STATE** to **SHUTDOWN**
 3. Wait until Gun OFF - it takes awhile to ramp the gun down.
 4. Close software interface
 5. Logoff workstation(s) and **SHUT DOWN** Workstation
 6. Press Yellow-**STANDBY** button on front scope panel wait 15-30sec
 7. Press Red **OFF**
 8. Turn **OFF** power on back scope panel.
 9. Breaker box to **OFF**
 10. **Record Shutdown event in Logbook !!!!!**

TURNING SCOPE ON AFTER FULL SHUT DOWN

☞ To be done ONLY after correction of the reason for the full shut down

1. Breaker box to **ON**
2. Verify cooling water recirculator manual switch to **ON**
3. Back scope panel Power switch to **ON**
4. Press Yellow- **STANDBY** button, wait 15-30 seconds.
5. Press **GREEN-ON** button
6. Computer system will startup, login and start **SMART SEM** software 
 - IGP starts at 2×10^{-5} mbar at column
 - Ready when for Gun & EHT (Grey indicates not ready).
7. Right click Gun → "Gun On"
 - This takes a while to ramp up Gun (5-10mins), and then a while (2-3 hrs) to stabilize Extractor Current (**EXT I**)

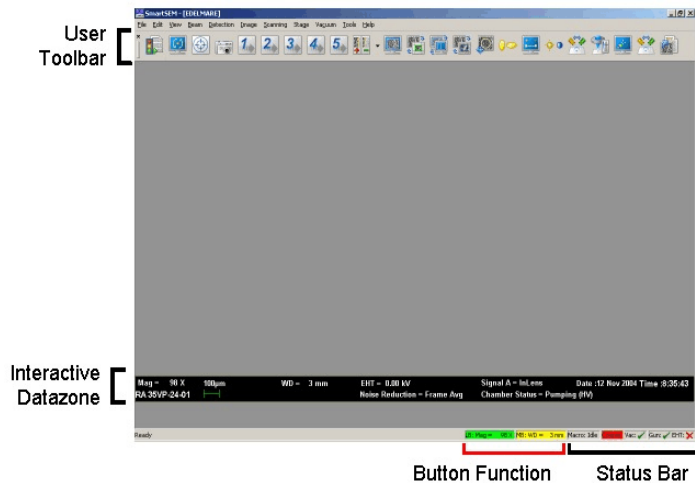
EMERGENCY SHUTDOWN

☞ ***IN CASE OF EMERGENCY ONLY,
POTENTIAL DAMAGE TO THE FEG IS VERY POSSIBLE.***

1. Press RED button on Front Panel.
 - This will shut off scope including vacuum and gun.
2. Flip breaker switch on wall.

☞ **Contact Dr. Edelmann or Matt Duley ASAP and report the emergency.**

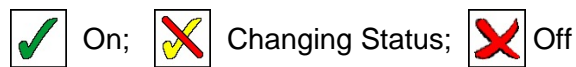
SMARTSEM USER INTERFACE



There are multiple ways to trigger the desired commands:

- Icons
- Pull- down Menus
- double-clicking in the Datazone or Status Bar
- <key> combinations.

Status Bar:



Interactive Datazone:

- <Double-Click> on any paramter (i.e Mag., WD, EHT, Signal) to change

Toolbar Icons:



Dynamic Focus / Rotation & Tilt correction



BSD Controls (**B**ack **S**catter **D**etector)



Capture Control: Middle-click camera icon select → “**End of Frame**” or “**Freeze Now**”
Left-click camera icon to freeze image



Scanning speeds



Scanning Speed pulldown menu.



Brightness contrast



Magnification and Focus (Wording Distance)



Toggle Spot Mode On/Off



Normal Scan Mode



Reduced Scan area On/Off



Switch detectors: **In-Lens & SE2**



Switch detectors: **BSD & SE2**



Current Meter

Button Function:

- Displays the current function of the **LB**: Left mouse **B**utton and the **MB** Middle mouse **B**utton

Keyboard Commands:

The following keys are shortcut keys and have special meaning

- <F2> Toggles **Tool Bar** on/off
- <CTRL + D> Toggle **Data Zone** ON/OFF
- <CTRL + G> Switches **SEM Control Panel** ON
- <F2 + SHIFT> **Hysteresis** removal
- < Shift + Tab > performs **Center Point** function
- <F3 + SHIFT> Toggles **PC Plane** ON/OFF
- <CTRL + A> Switches **Annotation panel** ON
- Image Buffer keys See Image Buffer
 - <Alt + buffer #> Saves Images to **Buffer # 1-8**
 - < Alt + N > Saves Image to **Next Buffer**
- <F4> Step to next **Magnification** Table entry, or Undo Centre Feature Magnification
- <F4 + CTRL> Step to previous **Magnification** table entry.
- <F4 + SHIFT> **Exit** from Magnification Table mode.
- Keypad < + > **Faster Scan**
- Keypad < - > **Slower Scan**
- <SCROLL LOCK> Toggles **Freeze/Unfreeze**
- <HOME> **Resets Beam Shift** to zero.
- <F12>, <F12 + SHIFT> **Aborts Stage Movement.**
- <CTRL + F> Starts **Auto Focus** fine
- <CTRL + SHIFT + F> Starts **Auto Focus** coarse
- <CTRL + S> Performs **Auto Astigmatism Correction**
- <CTRL + SHIFT + S> Performs **Auto Astigmatism Correction** with **Auto Focus**
- <F9> **Keys help** (displays this information)

FULL KEYBOARD COMMAND SET:

The following keys are shortcut keys and have special meaning

- <F9> **Keys help** (displays this information)
- <F2> Toggles **Tool Bar** on/off
- <CTRL + B> Display **Toolbar View** dialog
- <CTRL + D> Toggle **Data Zone** ON/OFF
- <CTRL + G> Switches **SEM Control Panel** ON
- <CTRL + I> Switches **SEM Status Panel** ON

OPERATIONS

- <F2 + SHIFT> **Hysteresis** removal
- <F3> Closes all windows except the Tool Bar and Status Bar
- <F3 + SHIFT> Toggles PC Plane ON/OFF
- <F4> Step to **next Magnification** Table entry, or Undo Centre Feature Magnification
- <F4 + CTRL> Step to **previous Magnification** table entry.
- <F4 + SHIFT> **Exit** from Magnification Table mode.
- Keypad < + > **Faster Scan**
- Keypad < - > **Slower Scan**
- <PAUSE> Causes currently executing **macro** to continue

STAGE MOVEMENT

- < Shift + Tab > performs **Center Point** function
- <SHIFT + double click >
- ARROW** Keys **Stage movement** (See Use of ARROW Keys)
- <F12>, <F12 + SHIFT> **Aborts Stage Movement.**
- <HOME> **Resets Beam Shift** to zero.

IMAGING

- < **SCROLL LOCK** > Toggles **Freeze/Unfreeze**
- Image Buffer keys See Image Buffer
- <Alt + buffer #> Saves Images to **Buffer # 1-8**
- < Alt + N > Saves Image to **Next Buffer**
- < CTRL + C > **Freezes & Saves** Display to **temporary buffer**
- <CTRL + V> **Displays Temporary** Image buffer
- <CTRL + 2> Loads Second Image Window from display
- < ★ > Performs **Find Image** function.

ANNOTATION

- <CTRL + A> Switches **Annotation panel ON**
- <CTRL + T> Calls **Text Annotation**
- <CTRL + M> Switches to Annotation and inserts **Point to Point Marker**
- <CTRL + E> Calls the **Export TIFF** dialog
- <CTRL + O> Calls the **Import TIFF** dialog
- <CTRL + P> Performs the Print Image function.

AUTOFUNCTIONS

- <CTRL + F> Starts **Auto Focus** fine
- <CTRL + SHIFT + F> Starts **Auto Focus** coarse
- <CTRL + S> Performs **Auto Astigmatism Correction**
- <CTRL + SHIFT + S> Performs **Auto Astigmatism Correction with Auto Focus**

USER DEFINED MACROS

- <F5>, <F5 + SHIFT>
- <F6>, <F6 + SHIFT>
- <F7>, <F7 + SHIFT>
- <F8>, <F8 + SHIFT>
- <F11>, <F11 + SHIFT>