














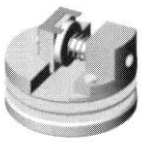


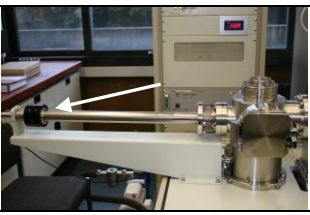

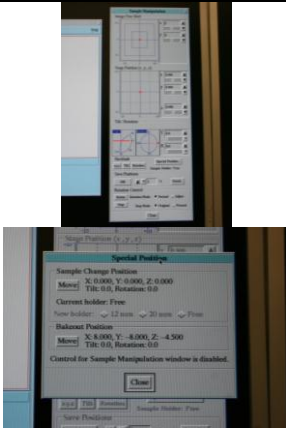



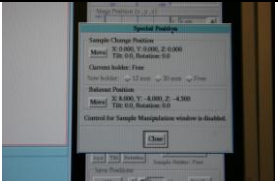
JAMP Manual

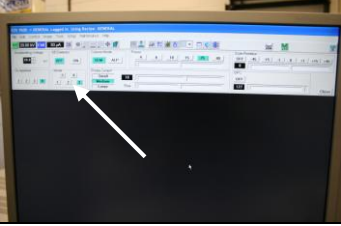
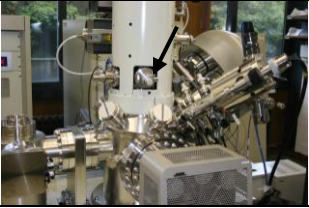
Constituents/standard stand-by settings


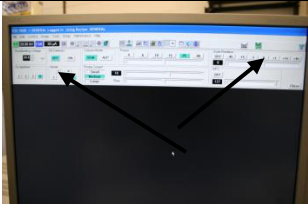
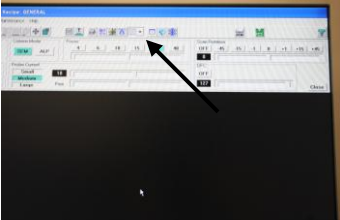
	<p>Keep this place clean and leave it as you found it!</p>
	<p>Ion gauge main chamber: pressure should be in low 10^{-7} Pa scale or lower (down to 5×10^{-8} Pa)</p> <p>Water flow meter for electron gun: Should show 0.2 or more</p>
	<p>Control panel for turbo pump: Pump should be in "normal operation"</p> <p>Control panel for ion pump(s) and titanium sublimation pump: SIP1+SIP2 should be highlighted, left display should show around 6 kV Ti Pump used for improving vacuum, used when needed</p>
	<p>Ion gun control panel: See details in "Ion gun" chapter Check, that the main "On/Off" is turned to "On"</p>
	<p>X-ray source: See details in "X-ray source" chapter</p>
	<p>Control panel for ion gun operation</p>
	<p>Control panels for SEM operation Upper: wobbler Left: movement Right: focus, magnification, alignment, scansize...</p>
	<p>Exchange chamber and manipulator</p>



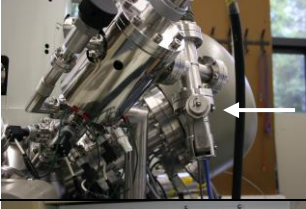

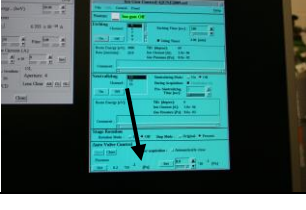

	<p>Main chamber, SEM column, motors, ion gun, detector</p>
	<p>View from the right side, detector and X-ray source</p>
	<p>Water cooling pump for SEM column</p>
	<p>Water cooling pump for X-ray source (not turned on at standard standby setting)</p>
	<p>Water for SEM column (right, always on) and X-ray source (left)</p>
	<p>Control panel and LED schema of the system (all highlighted LED's should be green, "L" green at Penning gauge)</p>
	<p>On/Off of main unit</p>

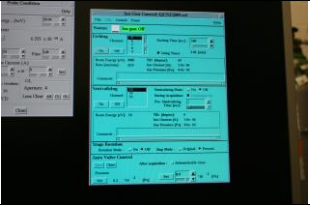
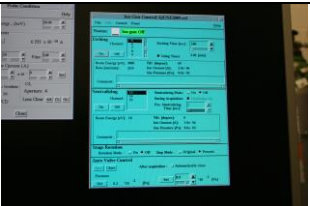
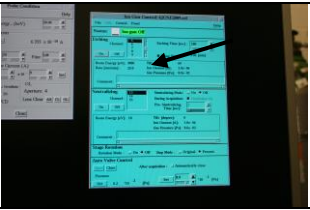

Insert/remove sample	
	Inserting
	<p>Mount sample on sample holder</p> <p>For cross sectional holder: film towards spring + massive part in direction of transfer!</p>
	Press "exchange vent"
	Open door exchange chamber
	<p>Wait until door opens and N₂ stops to flow</p> <p>Insert sample into manipulator in upper ring of sample holder</p>
	Take care that the manipulator is at the very left end (otherwise MGL1 LED will highlight orange)
	<p>Close door exchange chamber</p> <p>Press "exchange vent"</p>
	Wait till pressure in low green region + green light "L" is on
	Check stage position (at "sample change position"?)
	Press "open V2"

	Insert sample onto stage	
	Press "open V2"	
	Choose right sample holder!	
	-Small sample holder (12mm)	-Big sample holder (20mm) -Cross sectional sample holder
	Tilt max = 90°	Tilt max = 55°
	Be aware that if "Auger Master" software crashes, the holder will be set to "free"!!! You have to go back to "sample change position" and choose right holder again!!!	
	Removing	
	Check stage position (at "sample change position"?)	
	SEI detector OFF	
	PCD in (green)	
	Turn on ion gauge and check pressure in main and exchange	
	Press "open V2"	
	Pick sample with manipulator and withdraw manipulator	
	Press "open V2"	
	Press "exchange vent"	
	Open door exchange chamber	
	Wait until door opens and N ₂ stops to flow	
	Remove sample	
	Close door as soon as possible and start pumping again (see "Inserting"!)	

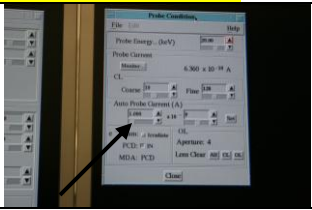

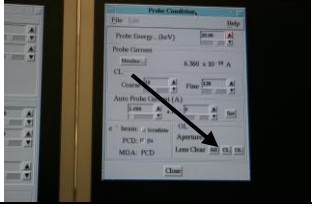
Modes SEM (for SEI detector)	
	Mode 3 -> 300V (more e detected)
	Mode 2 -> 200V
	Mode 1 -> 100V
	Mode 0 -> 0V
	Mode -1 -> -300V (to detect BSE, but no BSE detector present!)
Aperture	
	4 -> 30µm (for high-res. SEM) (can be too less for AES)
	3 -> 50µm
	2 -> 70µm
	1 -> 110µm
	After changing aperture align everything again!

Acquiring pictures	
	Ion gauge off?
	Window flanges shut?
	PCD out (white) SEI detector ON
	Focus has to be set to/at 25!
	Accelerating voltage max 30kV (after changing accelerating voltage-> alignment!)
	Z max = ± 6 mm around eucentric position
	Focus/eucentric position ~ 24mm
	Magnification from 35 to 100.000
	High magnification and big tilt? -> dynamic focus (DFC)!
Search for eucentric position (when using for SEM + AES/Ion gun/XPS)	
	Activate guiding lines
	Bring a line to a characteristic point
	Tilt some degrees
	Adjust z (bring point back on line)
	Tilt to 30°
	adjust
	Tilt back to 0°
	Mark characteristic point again with a guiding line
	Start procedure again
	No movement upon tilting? -> OK!

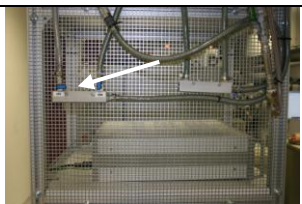


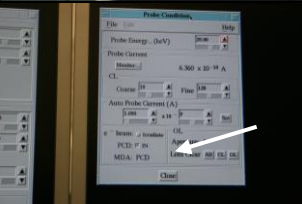

Using Ion gun	
	Make sure, that the main "On/Off" is at "On" at the control unit
	To turn on gas:
	Turn on ion gauge
	AVC on
	Open the gas till 10×10^{-2} Pa (slowly!)
	Switch the pin upwards
	"Set" in software to 9×10^{-2} Pa
	Check with "get"
	Example for cleaning/etching: Cu if big peaks appear: oxide layer < 6nm if small peak within the layer is appearing+O+N+C: oxide layer ≈ 3 nm -> ion gun, 60 seconds, channel 3
	Tilt sample to 30° for AES and 60° for XPS!
	Button on panel "Spot" non-highlighted (scanmode)?
	Etching area: 300x300µm
	Accelerating voltage: 10kV
	2500 eV max for Analyzer
	100.000 count max

	<p>Channels: Choose a channel corresponding to the tilt and the sample you are using. There are channels for 0°, 30° and 60° + from 500 eV to 3000 eV. Than choose the time you want to etch in seconds.</p>
	<p>To turn gas off:</p> <p>Press "close" in software and wait till 2×10^{-2} Pa</p>
	<p>Switch pin downwards</p>
	<p>Wait until it rises back to 10×10^{-2}</p>
	<p>Close the gas carefully and do not close it brutally!</p>
	<p>AVC off</p>
	<p>Ion gage off</p>
	<p>Neutralizing mode:</p> <p>Works best if tilt $\geq 60^\circ$ (check sample holder if it is possible! Not for 20mm holder!) Best: 75°</p>
	<p>Dwell time 50->100</p>
	<p>Probe current medium (6)</p>
	<p>On controlling panel press -> Spot mode instead of scan mode (highlighted)</p>
	<p># sweeps = min. 2 to see a possible peak shift due to charging</p>

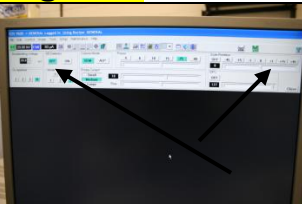
AES measurement

	<p>Best to set probe current to 1×10^{-8}: Sample observ. -> Probe cond. -> Auto probe current</p>
	<p>Focus</p>
	<p>Observation -> start digital scan If sample might charge: Observation -> transfer image from SEM</p>
	<p>Before acquisition (after ion gun+focus): Probe cond. -> OL -> lens clear -> OL (otherwise the magnetic field is not stable and peaks at lower energy are too small/worse)</p>
<p>Wide scan spectrum:</p>	
	<p>Analyzer condition->choose "spot" for normal measurements "scan": spectrum may shift You can defocus to enlarge the spot and the analyzed area</p>
	<p>Start spectrum at 30 eV (0-30 eV is SEM signal)</p>
	<p>Stop spectrum at 2000 eV (higher energy gives BSE-information)</p>
	<p>Choose acceleration voltage 10 kV to 30 kV</p>
<p>Analyzer conditions</p>	
	<p>M1 -> const. E pass (for XPS)</p>
	<p>M2 to M5 -> M5 higher count rate, less resolution</p>
	<p>M4: standard</p>
	<p>M1: choose pass energy = for mappings (choose e.g. $E_p=50$ eV)</p>
	<p>M2: 0.05% energy resolution = XPS res.</p>
	<p>M3: 0.1% energy resolution = XPS res.</p>
	<p>= for chem. analysis</p>
	<p>M4: 0.35% energy resolution</p>
	<p>M5 0.5% energy resolution = for mappings (high int. but low res.)</p>
	<p>40000 counts is optimum for detector (with M5)</p>
<p>Specifications</p>	
	<p>>0.1% detection limit</p>
	<p>$\pm 1-2\%$ quantitative</p>
	<p>Resolution</p>
	<p>Spatial: 10-20 nm \varnothing</p>



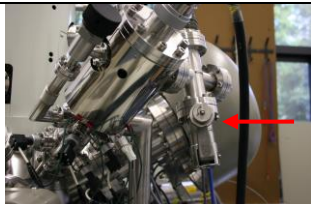

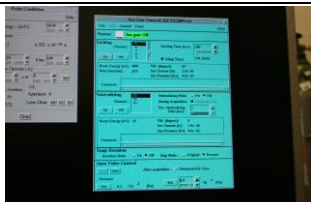
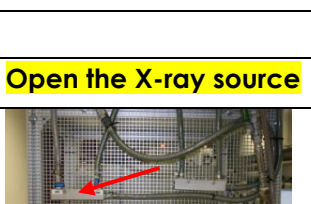
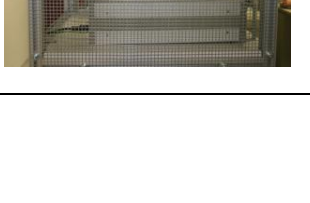
	Z: 0-6 nm
	Elements: Li-U
	SEM: 3 nm, AES: 8 nm
	Energy resolution: 0.05% to 0.6%
	Chemical analysis: 0.1%
	Standard spectra as reference: ...aes/std_AES -> M2-M5



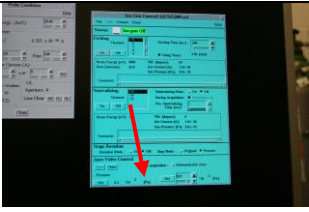
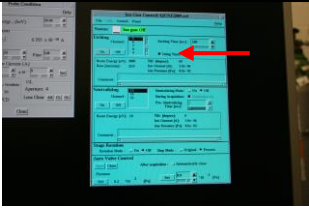

XPS measurement	
You have to complete the whole procedure: start/stop/back to SEM!	
	Tilt sample to 60°! (then it is 90° to analyzer)
	Make sure that you are at the eucentric position
	For XPS always use analyzer mode M1 (const. E pass)!
	Start spectrum at 100eV never at 0eV!
	Irradiated area is big (1 cm ²), analyzed area is defined by magnification (SEM picture)
	To start a measurement:
	Turn on water
	Turn on water pump
	Turn on x-ray source (power switch)
	Press water button till red square disappears
	Choose source: Al or Mg?
	Press "Standby"
	In Auger Master software: ??? -> „XPS Aquisition mode”-> On
	Press "Hv On"
	Wait until value gets stable
	Press "Operate"
	To stop measurement:
	Press "Standby"
	Press "Hv On"
	Turn off x-ray source (power switch)
	Turn off water pump
	Close water
	To get back to SEM:
	In Auger Master software: ??? -> „XPS Aquisition mode”-> Off

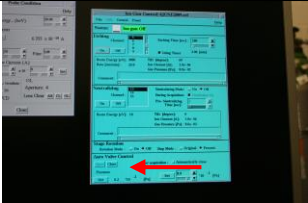


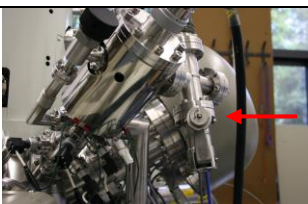
	PCD out
	e beam irradiate
Analyzer conditions	
	M1-> const. E pass (for XPS)
	M2 to M5 -> M5 higher count rate, less resolution
	M4: standard

Finishing SEM	
	SEI detector OFF
	PCD in (green)
	Accelerating voltage back to 10 kV
See: Insert/remove sample	
Data transfer/transformation	
Finishing working	
	Please record your time of use in the red book
	Turn off all three screens
	Turn off gauges if on so far

XPS measurement – a complete sequence

Pump the sample	
Turn on the ion gun	
	Make sure, that the main "On/Off" is at "On" at the control unit (orange)
To turn on the gas (best, when sample is already transferred):	
	Press "FIL ON" (highlights green)
	Press "AVC"(Auto Value Control) on (highlights green)
	Open the gas till 10×10^{-2} Pa (slowly!) (maybe a little higher to 10.3×10^{-2} Pa)
	Switch the pin upwards
	If sample is already transferred: Press "Get" If sample is still in exchange chamber: Press "Close"
Open the X-ray source	
	Turn on water

	<p>Turn on water pump</p>
	<p>Turn on x-ray source (power switch)</p> <p>Press “water” button till red square disappears</p> <p>Press “Standby”</p> <p>Press “HV On”</p> <p>Wait until value gets stable (10 kV)</p>
<p>AES → Ion Gun Condition</p>	<p>To set the condition in software:</p> <p>Make sure the ion gun valve is closed before sample transfer</p>
<p>Sample Alignment</p>	
	<p>Insert the sample (always the small sample holder $\Phi 12$ m)</p>
	<p>Search for eucentric position → tilting to 60° (right side)</p>
	<p>Focus the image (choose the area signal by choosing mag)</p>
	<p>Close the SEI and PCD</p>
<p>Etching the sample</p>	
	<p>In software set to 9×10^{-2} Pa by clicking “Set”</p> <p>Check with “Get”</p>
	<p>Channels:</p> <p>Choose a channel corresponding to the tilt and the sample you are using. There are channels for 0°, 30° and 60° from 500 eV to 3000 eV.</p> <p>Then choose the time you want to etch in seconds.</p>
	<p>Press “ON” in Etching</p>
	<p>Time is recorded on the panel</p> <p>Press “Reset” to make it back to 0</p>

Perform a wide scan	
AES → XPS Acquisition mode	Check that XPS Acquisition mode is on!! ■ XPS Acquisition mode
AES → spectrum → wide scan spectrum → condition → analyze	M1; <u>xx</u> eV; Start 100 to 1500 eV; step <u>xx</u> eV; Dwell time 100ms; sweeps 1
condition → Analysis position	Put the spot in the center of image and set Prob. Diam. to 10 μm
In wide scan spectrum window	Change the saving condition
	Press the “Operate” button on the X-ray source (250 power)
Acquisition → Start	The result is automatically saved
	Press “Standby” on the X-ray source
Perform a detailed scan	
	Press the “Operate” button on the X-ray source (250 power)
AES → condition → analyzer condition	M1; <u>xx</u> eV; Start <u>--</u> to <u>--</u> eV; step <u>0.05 or 0.01</u> eV; Dwell time 100ms; sweeps <u>3 to 5</u> .
Acquisition → Start	The result is automatically saved
	Press “Standby” on the X-ray source
To turn the ion gun off:	
	Press “close” in software and wait till 2×10^{-2} Pa Check with “Get”
	Switch pin downwards
	Wait until it rises back to 10×10^{-2}
	Close the gas carefully and do not close it brutally!

	"AVC" off
	"FIL On" off
To turn the X-ray source off:	
	check if it is "Standby" on the X-ray source
	Press "HV On"
	Turn off X-ray source (power switch)
	Turn off water pump
	Close water
To get back to SEM:	
	In Auger Master software: AES -> „XPS Aquisition mode”-> Off <input type="checkbox"/> XPS Acquisition mode
Data Conversion	
Processing → Data Conversion → "VAMAS" → "Yes" → "OK" → Choose Al Ka → "Apply and close" → "Cancel" → "Exit"	
Transfer the .NPL file from ftp to mobile disc	