### **Customer training**

- At the end of installation, the customer should receive training on the use of the instrument with a max of 3 persons.
- This is basic operation of the instrument and software, not full applications training.







### **Customer training**

#### Tour of the instrument

- Power switch
- Bakeout control / lock out switch
- Service connections
- Cameras
- Load-lock
- Sample mounting
  - Sample handling (gloves etc)
  - Considering the source positions
  - · Different mounting options (rotating holder, powder holder)
- Sample loading

Sample Navigation / Optical view

- Setting up point analysis
  - Survey spectra & narrow scans
  - Axial & scattered lighting controls
  - Manual height setting & auto-positioning
  - Charge compensation
- Setting up auto-analysis
  - Enable auto-positioning
- Setting up line scans
  - Snapshot acquisition
- Setting up area scans
- Setting up depth profiles
  - Rotation sample holder
- Using the ion gun to clean samples
- Simple Advantage features
  - Survey ID, adding peaks, simple peak fitting, reporting out to Word & Excel
  - Help files / Processing manual
- NEXSA set-up tool
  - How to calibrate & check performance
  - · How to send logs / data to a service centre





### Suggested samples

#### Essential

- PET (charge compensation specification)
  - Monitor protector
  - Mineral water bottles (clear plastic not coloured)
- Al foil (testing gas purity, depth profile demonstration)
- Glass (setting up the flood gun)
  - Microscope slide

#### Good training samples

- Business cards need charge compensation
- Ink on paper / PET
- Samples with small features to show alignment





# Sample Mounting

**Always use gloves and tweezers** to avoid contamination of the sample surface. Avoid touching areas that you wish to analyze.

Samples are usually mounted onto a standard sample holder using the spring clips provided. Alternatively, conducting carbon adhesive tape may be used (sparingly).

**Samples must not go outside the area of the top plate** (must not overhang the edges of the holder). This is to prevent samples hitting surfaces inside the system during transfer, which could cause internal damage to the transfer mechanism. **Before loading,** a gauge is used to **check sample height limit.** 

Good and bad mounting examples.

Source orientation around the sample holder.







For more details on mounting options refer to OPERATION MANUAL pages 17-22





### Sample Loading

- Do not load samples that are touched by the loading test gauge. Do not attempt to load samples that are outside the edges of the top plate.
- The Sample page is used to load and unload samples.
- The sample is loaded onto the plate in the entry-lock as shown, ensuring that the two holes on the bottom
  of the holder (white arrows) engage correctly with the pins on the carrier plate (black arrows).



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# Sample Navigation

- Here is the main Screen layout. Optical view is opened via the Main Command Toolbar.
- Optical View contains an image of the entire sample holder and light controls for sample illumination.
- Area of interest is moved to the cross hair, hence to the X-ray beam and analysis area.

(Electrons are captured from the cross hair region, then collected to generate XPS data. All beams land here).

• We can zoom in on small areas of interest or use the snap map feature (top right) for ultimate precision.







- 1. Navigate to sample by double-clicking on the platter (upper view)
- 2. Choose the analysis position by doubleclicking on the required position
- 3. Set the height
- 4. Select "point" from menu
- 5. Hold down "Ctrl" and left-click on the analysis point required
- 6. Set the size of the x-ray spot
- 7. Click on the spectrum icon
- 8. Select "multi spectrum"
- 9. Choose required narrow scans / surveys
- 10. Turn on the flood gun in the x-ray object if required
- 11. Insert a Gun Shutdown (sources) object.
- 12. Run the experiment or the experiment step.







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Change view button





Change height with Z buttons









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Change view button









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Cs       Ba       Lu       Hf       Ta       W       Re       Os       Ir       Pt       Au       Hg       TI       Pb       Bi       Fo       At       Rn         Fr       Ra       Ff       Ds       Sg       Bh       Hs       Mt       Ds       Fo       Just Sustained       Just Sustained       Just Sustained       Fo       At       Rn         *       La       Ce       Pr       Nd       Pm       Sm       Eu       Gd       Tb       Dy       Ho       Er       Tm       Yb         *       La       Ce       Pr       Nd       Pm       Sm       Eu       Gd       Tb       Dy       Ho       Er       Tm       Yb         *       Ac       Th       Pa       U       Np       Pu       Gd       Tb       Dy       Ho       Er       Tm       Yb         **       Ac       Th       Pa       U       Np       Pu       Gd       Tb       Dy       Ho       Er       Tm       Yb       W       No       Ta       Th       Pu       No       Tm       Tm       Yb       No       Th       Pu       Su       S	f	Rb	Sr		Y	Zr	Nb	Mo	To	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	L.	Xe	
*       La       Ce       Pr       Nd       Pm       Sm       Eu       Gd       Tb       Dy       Ho       Er       Tm       Yb         **       Ac       Th       Pa       U       Np       Pu       Gd       Tb       Dy       Ho       Er       Tm       Yb         Survey Spectrum       Spectrum       Spectrum       Type       Energy Offset (Kinetic Energy)       For Scanned       Offset       Im       Im       eV         Image by :		Cs	Ва	×	Lu	Hf	Та	w	Re	0s	Ir.	Pt	Au	Hg	TI	Рb	Bi	Po.	At	Rn	
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- 1. Navigate to sample by double-clicking on the platter (upper view)
- 2. Choose the analysis position by doubleclicking on the required position
- 3. Set the height
- 4. Select "point" from menu
- 5. Hold down "Ctrl" and left-click on the analysis point required
- 6. Set the size of the x-ray spot
- 7. Click on the spectrum icon
- 8. Select "multi spectrum"
- 9. Choose required narrow scans / surveys
- 10. Turn on the flood gun in the x-ray object if required
- 11. Run the experiment or the experiment step.









#### Auto Analysis

Follow the same procedure for "point analysis", but choose "auto analysis" on the menu. There
is no need to insert any spectra, but you may need to turn on "auto-positioning" to set the
height.

33	6	Point	Control Proper	ies	
Position	Spectrum	N Stage Auto	o Position   Au	:oAnalyse   0	ieneral
	e Coordina )efined Poi jave Video	tes nt Image		nable Auto-F nable Auto-A	oositioning Analyse
X	(µm)	<u>Υ</u> (μm)	<u>Ζ (μm)</u>	∐ilt	<u>A</u> zimuth
3	2928.1	14412.5	33890.0	0.000	359.996
		B	ead	Move	<u>S</u> top
			Apply	] Rese	t Close





#### Line scans

 Follow the same procedure for "point analysis", but choose "line" on the menu, and draw the line on the optical view by holding down the left mouse button and "Ctrl"









#### Line scans

 Set the number of points in the line in the properties dialog box, and insert either scanned or snapshot spectra from the multi-spectrum tool

	* 👯 🖉 🕍 🐨 🔅 📄 🖓 X-Ray005 90um
Scanned Snapshot	Insert Multiple Spectrum Into Experiment
LineScan Control Properties           Position         Spectrum         Stage Auto Position         General           X         Y         Z         Tilt         Rot           34946.1         36327.5         33369.7         0.000         Read Start           37581.3         36327.5         33369.7         0.000         Read End	Periodic Table           B         C         N         F         Ne           Li Be         B         C         N         C         F         Ne           Na Mg         Al Si         P         S         CI         Ar           K         Ca         Si         CI         Ar           K         Ca         Si         CI         Ar           K         Ca         Si         CI         Ar           K         Ca         Ni         Cu         Si         F         Ne           Ma         Si         T         Ni         Cu         Cl
34946.1         36327.5         33369.7         Current Point in Line           Enable Auto Height Setting	<ul> <li>* La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb</li> <li>★★ Ac Th Pa U Np Pu Am Cm Bk Cf Er Fm Md No</li> </ul>
Apply Reset Close	Survey Spectrum Spectrum Type Energy Offset (Kinetic Energy) Scanned Snapshot Offset view of the set of the
	OK Cancel



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 Follow the same procedure for "point analysis", but choose "area" on the menu, and draw the area on the optical view by holding down the left mouse button and "Ctrl". Set the step size in the properties area, and the x-ray spot size in the usual way



Quick	Corners	•	Spacing St	ep size	▼ 50	. ÷
T Ena	able Auto H	eight Se	tting	Ú.		μπ
1.	t Corner	ž	Y	<u>z</u>		Bead 1
13	si Comer		1.0			TICOG T
2nd	d Corner	-			mm	Read 2





### Ion Beam Etch / Depth Profile

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 For a depth profile experiment use the "Depth Profile" object on the experiment menu and use the same procedure as point analysis. An ion beam etch object is just used to clean the sample and is selected from the icons.

A Thermo Avantage	VgIonBeamEtch Control Properties	ф ×
:	General Ion Gun	
File       Edit       View       Window       Heip         Image: Second state         Image: Second state<	Ion Energy	
File Edit View Window Help     Image: Second state s	Depth Profile Properties         Y.Ray       Ion         Profile       Ion Gun       Etch Phases         Etching       Rotation         Move to etch position       Image: None         Single Phase Etching       Azimuthal         Delay after       1         Etch (s)       Compucentric         Termination Condition       Total Levels       1         Total Etch Time       Hour       Image: Compute	General Close



#### Vacuum System Overview



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- Specification in analysis chamber 5 x 10-9 mBar
  - Analysis chamber / Entry chamber turbo pumped.
    210l/s N2, Pfeiffer PTR27002
  - Backed by single foreline pump,
  - Titanium sublimation pump (TSP) in main chamber



#### Vacuum System Overview

Specification in analysis chamber 5 x 10<sup>-9</sup> mBar

Vacuum Schematic Window (layout seen depends on the options fitted)





# **Backing Pump**



- One backing pump for all turbos
- Rotary Vane Pump
- <u>OR</u> Dry Pump option
   Mains Powered
  - Wide range input, selectable





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### Turbo Pumps



- Analysis chamber / entry chamber turbo pumped 260l/s N<sub>2</sub>
- On-board controller (TC100)
  - Driven from 24V DC supply
  - 24V signal in to "Run/Stop"
  - 24V signal back indicating "at speed"
  - Main pumps identical, ISO 100 interface
    - Seal to analysis chamber aluminium Knife-edge
    - Seal to entry turbo single O-ring





### Titanium Sublimation Pump (TSP)

#### Titanium Sublimation Pump (TSP)

Runs at 50A for 1 minute automatically every 4 hours Filaments are fired in turn Status can be viewed via vacuum details TSP Tab Periodic firings are Inhibited during experiment Can be manually fired by user (via Engineer log on) in experiment





Analysis Chamber Pressure 2.8E-08 mBar	Backing Pu	ump Pressure	5.4E-03 mBar	Load Lock Pressure	8.3E-08 mBar
acuum Schematic Vacuum Detailed TSP Control	Miscellaneous				
TSP Status	Demand	Readback	Action		
Experiment Running		False			
TSP Running	False		Run Now		
Last Filament Fired		3			
Filament 1 State		OK			
Filament 2 State		OK			
Filament 3 State		OK			
Filament 1 Number Of Times Used		53	Reset Stats		
Filament 2 Number Of Times Used		54			
Filament 3 Number Of Times Used		54			
Time Until Next Next TSP Firing (mins)		187			
				PLC Comms States	PLC Code States



#### Vacuum Measurement





- Analysis chamber and Load Lock contain ion / Pirani combination gauge
  - Reads from atm. to  $5 \times 10^{-10}$  mBar
  - Powered from 24VDC line
  - Analogue signal back to vacuum controller
- Backing line contains Pirani gauge
  - Reads from atm. to  $5 \times 10^{-4}$ mBar
  - Powered from 24V DC
  - Analogue signal back to vacuum controller



#### **User Accounts**



#### VG Engineer: Everything

**VG Expert:** Typical user, create experiments. Cannot edit system settings.

**VG Operator:** Can only run experiments created by a higher user.

Administrator: Install software, install licence, add/remove users, change user access level.



