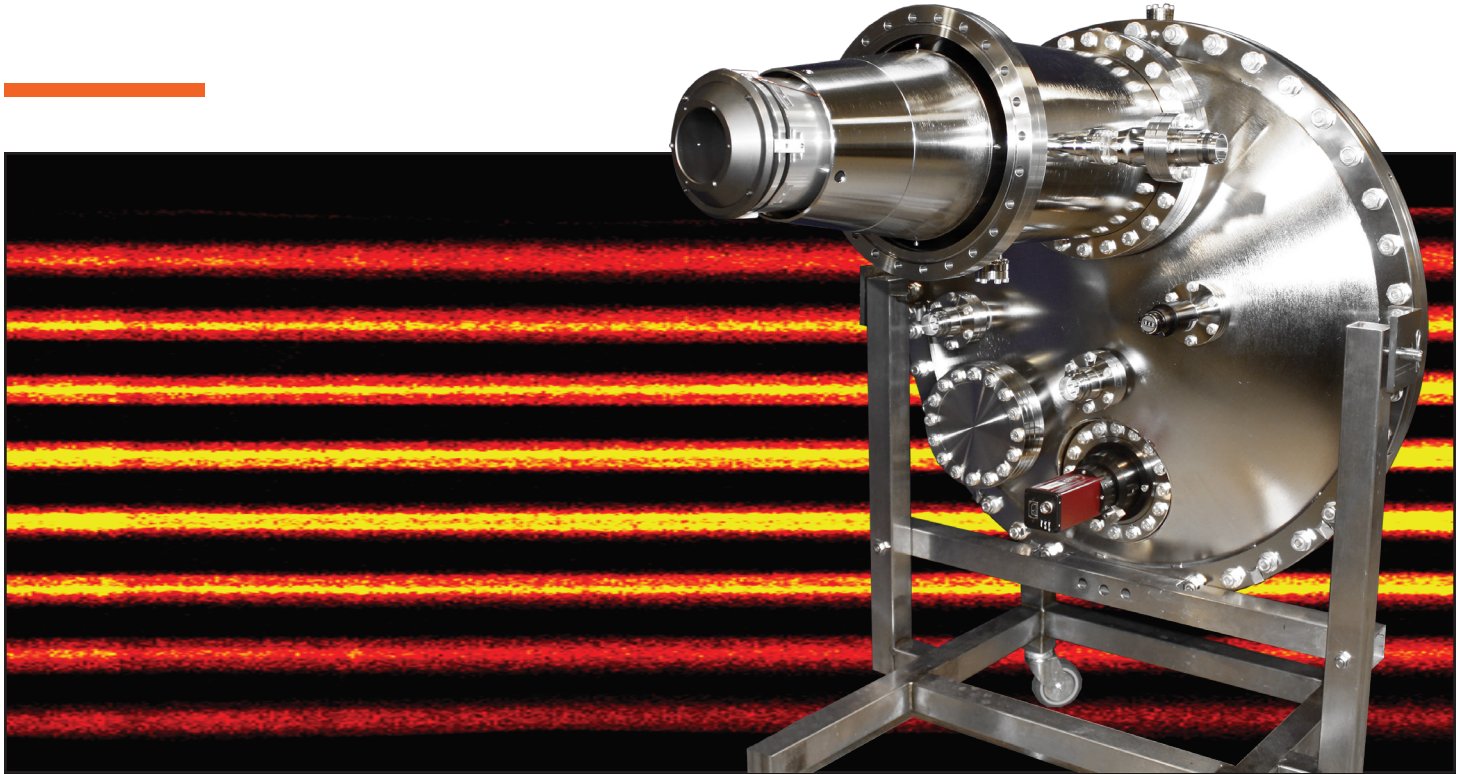


## EW4000 - ELECTRON SPECTROMETER

### Expanding the Parallel Angular Detection Range



#### EW4000 applications:

- 3D XPS (ARXPS)
- High resolution UPS
- X-ray Photoelectron Diffraction
- High Energy ARPES
- High Transmission HAXPES
- Angle resolved HAXPES

#### EW4000 advantages:

- 60° wide angular mode
- 44° higher dispersive angular mode
- 40 mm working distance
- Intensity optimized transmission mode
- Angle resolved kinetic energy range up to 10 000 eV
- < 1.8 meV energy resolution
- Real time image correction

The EW4000 opens new directions of science. Where previous Scientia Omicron spectrometers have been a revolution to ARPES, the EW4000 goes one step further. Expanding the parallel angular detection range to 60° gives great possibilities for high transmission measurements as well as novel Standing Wave and XPD experiments.

### New technology

The Scientia Omicron EW4000 is breaking new ground for advanced photoelectron spectroscopy experiments. The new extreme wide angle lens technology brings a leap not only in angular range but also in acquisition speed and kinetic energy range. In the Scientia Omicron EW4000 this new lens development is combined with the proven performance of our 200 mm radius hemisphere.

### Detection system and lens modes

Efficient low cross section measurements demand a modern detection system with low noise and high signal to noise ratio. The Scientia Omicron 2D MCP/CCD detector system combines low noise and high signal to noise with large dynamic range allowing also weak features next to strong signals to be clearly resolved. In combination with the EW4000 extreme wide angle lens the 2D detection system allows ARXPS and even HAXPES with 60° parallel detection. A higher angular resolution mode with 44° parallel detection as well as a transmission mode for maximum intensity is also available.

### The EW4000 energy resolution

The EW4000 shares hemisphere design with the proven 200 mm R4000 analyser series. The result shown in Fig. 1 demonstrates the high energy resolution of the EW4000. Note the sharp line and high signal to noise ratio in the spectrum. Better than 1.8 meV energy resolution is guaranteed with the UPS upgrade option of the EW4000.

### Image correction software

The extreme wide angle acceptance of the EW4000 puts new demands on the data acquisition software. A new real time image correction functionality has been implemented in the SES software to support high resolution wide range swept mode measurements in angular mode.

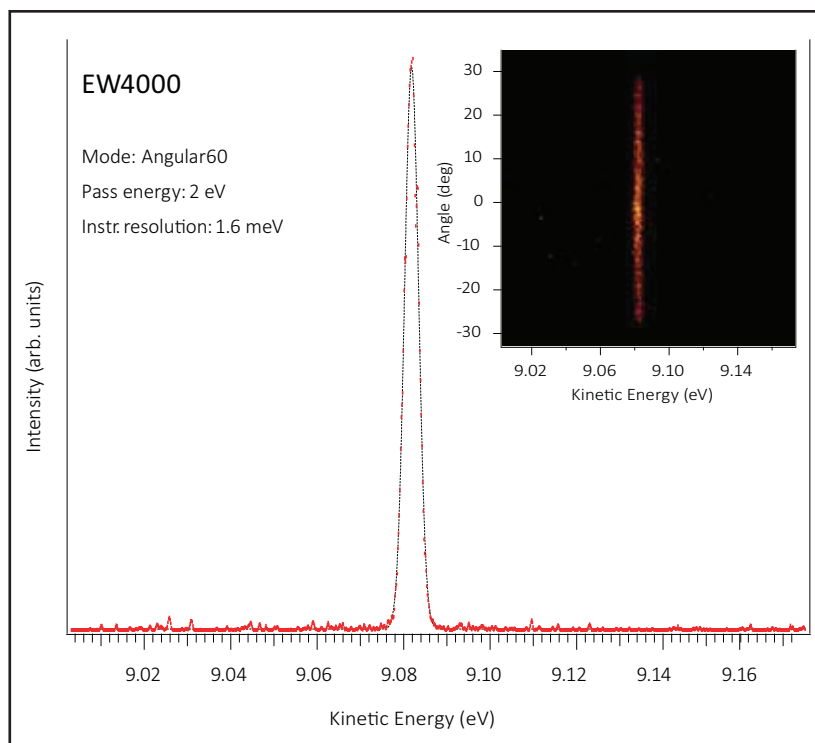


Fig 1. Using the Angular60 mode and 2 eV pass energy the EW4000 shows 1.6 meV energy resolution.

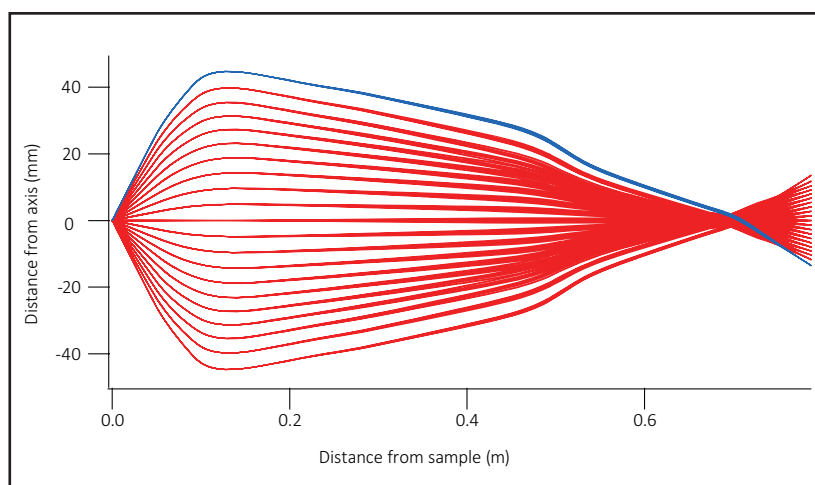


Fig 2. The EW4000 is optimised for wide angle resolved measurements in a wide kinetic energy region. The figure shows simulated electron trajectories in the EW4000 lens for the Angular60 mode at 10 eV pass energy and a 0.2 mm sample spot size. The blue lines illustrate that all electrons leaving the 0.2 mm sample at a 30 degree angle will be collected to the same spot on the detector.

The image correction routines are very fast and do not influence the acquisition speed. The data storage overhead is as fast and unnoticeable as before.

### Wide range application

Using the EW4000 brings new possibilities to the scientific community. A transmission increase of approximately a factor of 4 is an important step towards more efficient studies in for example the HAXPES where low cross sections are common. The wide angle detection will provide better means for 3D XPS and X-ray photoelectron diffraction (XPD) and will also function in the HAXPES region for standing wave spectroscopy.

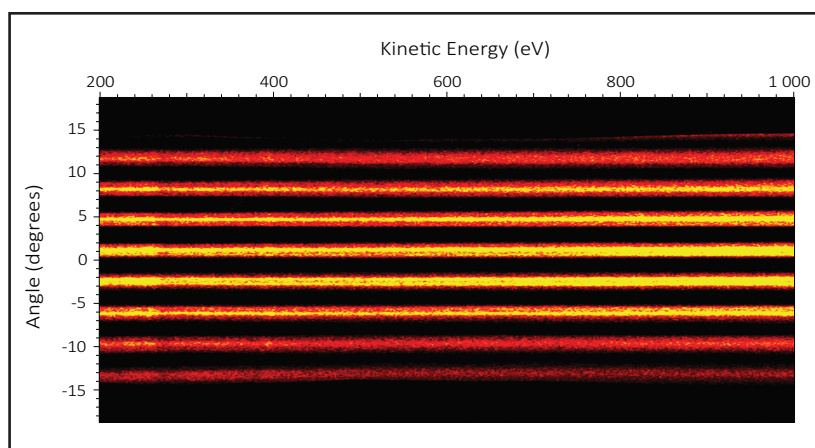


Fig 3. The figure shows a wide energy range swept mode measurement in the Angular30 mode of the EW4000 spectrometer.

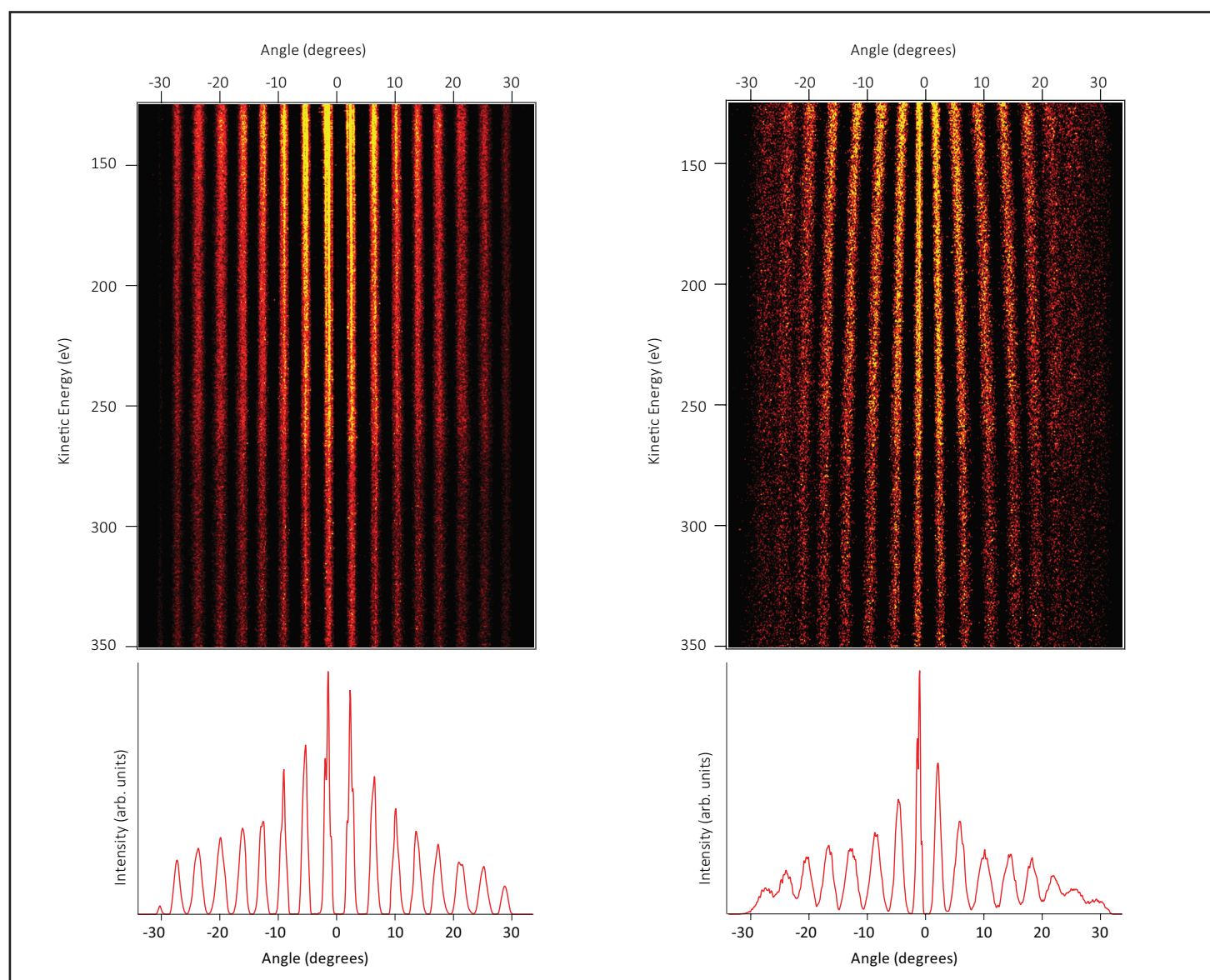


Fig 4. The Scienta Omicron acquisition software (SES) has been extended to include real time image correction functionality. As illustrated in the figures, this new software feature allows high resolution swept mode measurements using the Angular60 mode of the EW4000.

## Technical Data

Property	Specification	Models	EW4000 6 keV	EW4000 10 keV	EW4000 UPS Upgrade*
Energy resolving power	> 1 750 (0.2 mm slit)				
Max., theoretical energy resolving power	4 000 (0.1 mm slit)	Energy resolution:	40 meV at 6 keV	40 meV at 6 keV 100 meV at 10 keV	1.8 meV at 10 eV
Vacuum tank	Stainless steel	Lens acceptance angle	60°	60°	-
Magnetic shielding	Double $\mu$ -metal shield	Angular resolved range	$\pm 30^\circ$	$\pm 30^\circ$	-
Pressure	$< 2 \times 10^{-10}$ mbar	Angular modes	$\pm 30^\circ, \pm 22^\circ$	$\pm 30^\circ, \pm 22^\circ$	-
Baking temperature	150 °C	Kinetic energy range			
Analyzer radius	200 mm	Transmission mode	5 - 6 000 eV	5 - 10 000 eV	5 - 100 eV
Mounting flange	NW 200 CF, rotatable	Angular mode	100 - 6 000 eV	100 - 10 000 eV	-
Slits	9	Pass Energy	10 - 500 eV	10 - 500 eV	1 - 5 eV
Detector type	MCP/CCD camera	Working distance	40 mm	40 mm	-
Detector interface	$\varnothing$ 40 mm MCP	*Specifications in addition to any of the models above			
Energy channels	1 064 simultaneous				
Angular channels	> 750 simultaneous				
Scanned mode	Yes				
Quick mode	Yes				
Intensity deflectors	Yes, x, y				
ISS	Option				
Analyser pump port	Yes				

### High Voltage Electronics

Property	Specification
Temperature stability	$< 2$ ppm/°C (R-version) (typical 0.5 ppm/°C)
Noise (AV at analyser)	$< 1$ ppm + $< 500$ $\mu$ V (typical 0.5 ppm + $< 200$ $\mu$ V)
Drift	$< 20$ ppm/year (typical 10 ppm/year)
Electric isolation	6 kV
Min. step size HV100	1.6 mV
Min. step size DAC	200 $\mu$ V
DAC Bits	16
Modular	Yes
Communication	USB

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