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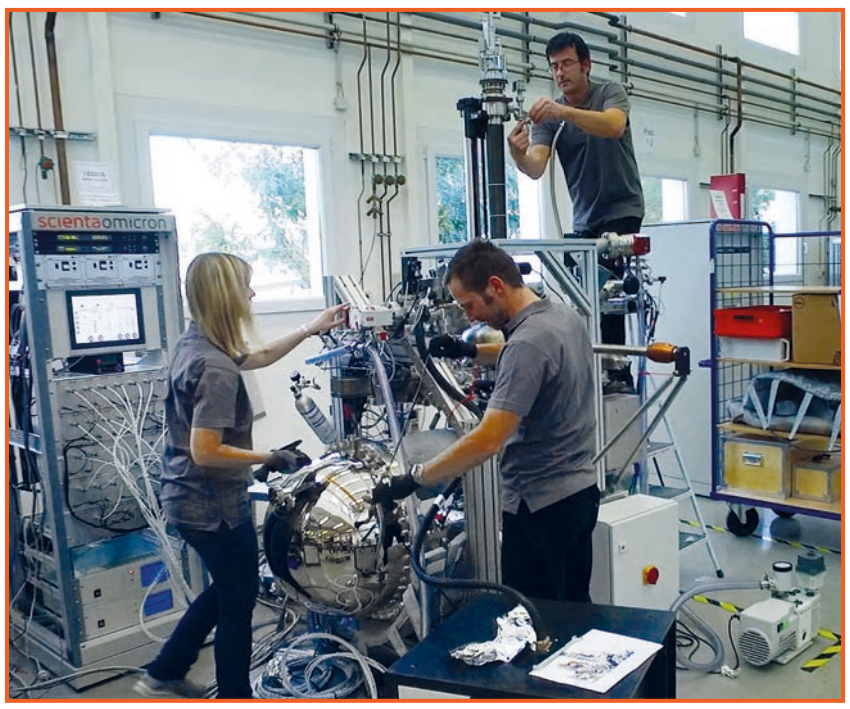
# Spring 2017 News

Scienta Omicron - Superior Technology

## Scienta Omicron - 2 Years of Success

### Thank you for your support!




Installation of an ARPES-Lab in Taunusstein / Germany

In May 2017 we will celebrate our second birthday since the establishment of Scienta Omicron from the merger of VG Scienta and Omicron NanoTechnology. This merger combined three world-class areas of expertise – scanning probe microscopy, electron spectroscopy, and UHV system design – providing customers with an experienced partner for stable, well-supported instruments employing the most advanced technology.

But the merger has brought additional benefits. As a privately held, financially sound company, we have increased the pace of our investments in technology, facilities and employees for long term technology and manufacturing leadership.

The merger provided a modern operational framework for the entire organization, increasing our responsiveness to customer needs while reducing costs. A new, higher capacity production facility has now opened for our sister company and key supplier, VacGen, and our new purpose-built facility for electron spectroscopy products opens in Uppsala later in 2017. Our customers will benefit from these investments with individualized solutions provided rapidly at an affordable price.
The Scienta Omicron merger was notable in having two similarly sized companies possessing similar core business models. This preexisting compatibility translated into a rapid merging of best practices in all of our operations. This has fed our significant and ongoing hiring of scientists and engineers for development and customer support.
Our increase in customer support translates directly into increased customer productivity.

**Now, as the largest company supporting the UHV surface science community, Scienta Omicron thanks you for your support in our first two years. We look forward to serving the research community for a long time to come.**

## 3rd Generation LT STM

### Advanced performance

Scienta Omicron is pleased to announce the release of a new, third-generation instrument that further improves the performance and productivity of the LT STM.

A key feature of the third generation is a 30% increase in liquid Helium hold time. This is of great advantage for all low temperature experiments, reducing operating costs and providing users more flexibility. The new cryostat design enables long-term spectroscopy experiments without any compromise to the stability the LT STM has always delivered.

Additionally, completely new state of the art wiring and connections have been designed throughout the system. The LT STM III now supports high frequency, time resolved STM experiments in the GHz range. Further, the ultimate resolution for spectroscopy has been improved to < 1 meV, ideal for work with superconducting materials. When combined with the Matrix 4 controller and its new, high performance AFM PLL, performing QPlus AFM experiments in the LT STM will be easier to use and more powerful than any other QPlus AFM platform.

**This third generation of the LT STM allows for the most advanced low temperature STM, spectroscopy and QPlus AFM experiments. Like its previous generations, the ease-of-use, stability and proven reliability in the LT STM ensure a high productivity, workhorse microscope.**

- Extended hold times to > 65 hours
- STS with ΔE < 1 meV
- New cabling for GHz signals for improved time resolution
- Scienta Omicron's leading QPlus AFM technology

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# New MATRIX 4 SPM Controller

## AFM PLL powered by Zurich Instruments

**Continuing our history of providing the most advanced SPM technology, we are pleased to announce the Matrix 4 Scanning Probe Controller, setting the new standard for SPM control. This new generation controller implements extensive customer feedback as well as advanced, new hardware features to enhance day-to-day usability and provide the most advanced AFM control.**

**The MATRIX 4 includes advanced AFM PLL hardware, developed through a strategic partnership with industry leader, Zurich Instruments. The new MATRIX 4 software interface enables all standard types of AFM measurements as well flexibility to program custom control. There is a basic mode for reliable and safe measurements requiring minimum effort to initiate.**

**Users can directly switch to an expert mode giving access to the complete parameter space of an AFM PLL with 4 digital, freely configurable demodulators. Preset options in the MATRIX 4 for AFM perform high quality, high resolution AFM (for either beam deflection or QPlus) with easy switching to other modes like Kelvin Probe Force Microscopy (KPFM) or spectroscopy with a few mouse clicks.**

**With the Matrix 4 including the AFM PLL powered by Zurich Instruments a new standard for SPM controllers has been set for both, ease-of-use and ultimate performance.**

- New high performance AFM PLL for advanced QPlus AFM
- TipGuard and PLLGuide
- Integrated Lock-In
- New compact design for easy access to hardware and all signals
- Remote- and software-control for coarse motors


AFM PLL powered by Zurich Instruments

# New TESLA JT SPM

## STM and QPlus AFM at low temperatures and in high magnetic fields

**Scienta Omicron is proud to present the new TESLA JT SPM, the most recent development based on the strategic partnership with CryoVac. CryoVac's field proven, proprietary Joule-Thompson (JT) cooling and dry magnet technology for UHV are united with Scienta Omicron's expertise in STM, advanced spectroscopy and QPlus AFM.**

**The new TESLA JT SPM provides access to more than 5 days SPM measurement time at temperatures T < 1.4 K with magnetic fields larger than B > 3 T. Careful thermal design of the bath cryostat and JT cooling stage as well as the integrated dry magnet lead to exceptionally low LHe consumption, specifically during magnet operation. The external JT Helium supply allows for 3He operation and significantly lower temperatures.**

**The microscope head is a proven, highly stable design developed specifically for high magnetic field environments. It offers the full range of SPM measurements modes, including our leading QPlus AFM technology. Safe and independent tip/sample exchange under optical control is one of several key ease-of-use features delivering dependable high performance SPM and successful scientific work.**

**In contrast to a conventional wet magnet concept, the dry split-pair magnet provides for optical access enabling various optical experiments and even in-situ evaporation into the SPM at low temperatures.**

**The TESLA JT SPM perfectly fits into Scienta Omicron's comprehensive surface science technology portfolio and can also be integrated into tailored UHV systems with thin film deposition (MBE) and electron spectroscopy, such as ARPES, APPES, UPS and XPS.**

- > 5 Days uninterrupted measurement time in magnetic fields
- Base temperature T < 1.4 K with $^4$He
- Dry UHV magnet $B_z$ > 3 T
- Optical access & ease of use
- STM and advanced spectroscopy
- Leading QPlus AFM technology

Compact TESLA JT SPM head

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# MBE Growth of Chalcopyrite Nanowires

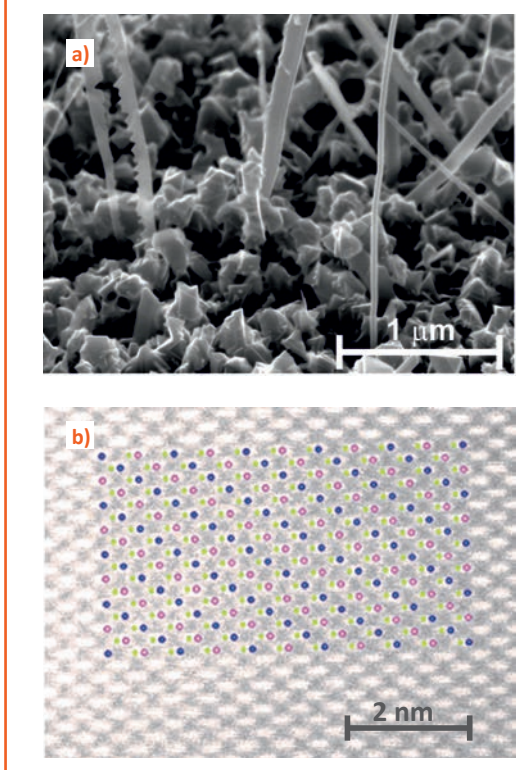
## Precise control of growth parameters

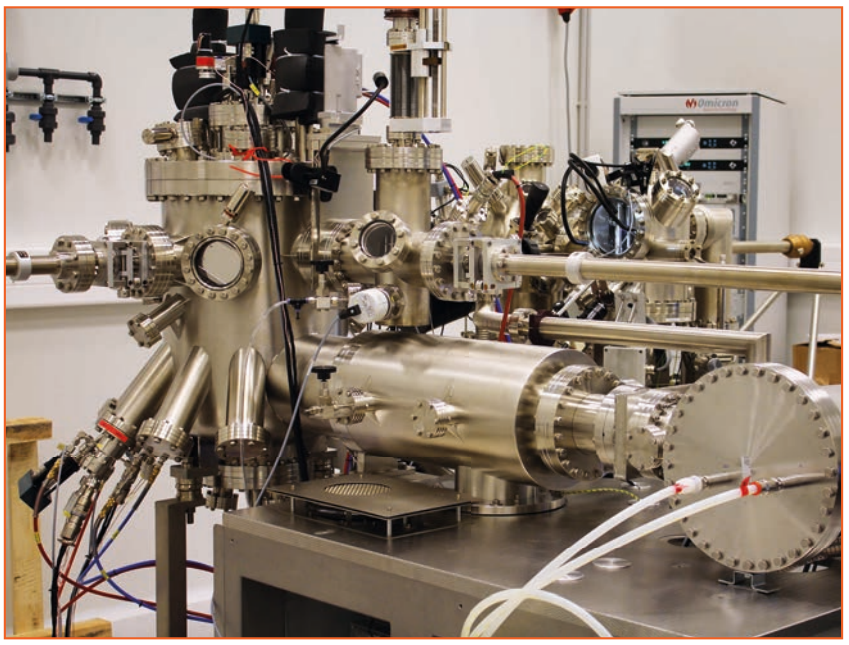
**Chalcopyrite semiconducting materials are of particular interest for high-efficiency thin film photovoltaic applications.**
**Novel growth methods for chalcopyrite-type nanostructures are investigated with a Scienta Omicron EVO-50 MBE system at the Laboratory for Nanostructured Solar Cells (LaNaSC) at INL in Braga, Portugal. Recent research led to a single-step growth process for $CuInSe_2$ nanowires.[1]**

### $CuInSe_2$ nanowires

**Precise control of growth parameters is key for the deposition of composite nano-materials. By choosing a low growth rate and a large excess Selenium flux, formation of $CuInSe_2$ nanowires on top of a thin polycrystalline layer was achieved. Due to reduced reflectivity and strong photo-luminescence, this material is attractive for photovoltaic applications.**

**For further questions please contact us.**



Left: a) SEM image of $CuInSe_2$ nanowires on a polycrystalline base layer.
b) Atomic structure projection of the tetragonal crystalline phase by HR-STEM.
Data courtesy: S. Sadewasser et al., International Iberian Nanotechnology Laboratory, Braga, Portugal.

Above:Scienta Omicron EVO-50 MBE system combined with a VT-SPM module. Nanowire growth was achieved by using hot lip Knudsen cells (Cu, In) and a valved cracker cell (Se).
Image courtesy: S. Sadewasser et al., International Iberian Nanotechnology Laboratory, Braga, Portugal.

# Fermi DryCool™ SPM

## Infinite measurement time & convenient cooling below T = 10 K

**The Fermi DryCool™ SPM which combines the best from two worlds: the possibility to stay infinitely long at low temperature and a state-of-the art SPM head which is capable of doing imaging (STM, nc-AFM) and spectroscopy in ultra-high vacuum below 10 K.**

**The integral closed-cycle (CC) technology allows for access to low temperatures without helium consumption and its associated costs. Due to the inherent mechanical vibrations induced by the displacer of the CC-cooler, scientists believed that such a technology could be combined with scanning probe microscopes (SPM) without sacrificing performance.**

**Scienta Omicron has effectively decoupled the mechanical and thermal noise to the level of state-of-the-art low temperature SPM´s. The extremely low drift of the Fermi DryCool™ SPM outperforms SPM´s with conventional LHe cooling. With a sub-pm mechanical and thermal stability, the Fermi DryCool™ SPM is an excellent platform for long-term spectroscopy experiments.**
**The unique cooling principle allows for independent temperature control of the tip and the sample in a temperature range from 10 to 400 K. This approach paves the way for scientists to continuously perform low and variable temperature STM, STS and QPlus nc-AFM experiments.**


- Cryogen-free cooling for unlimited operation at low & variable temperatures
- Independent tip & sample temperature control from LT to above RT
- Ultra-low noise level below 1 pm with active cooling
- Superior drift performance
- Scienta Omicron‘s leading QPlus AFM technology

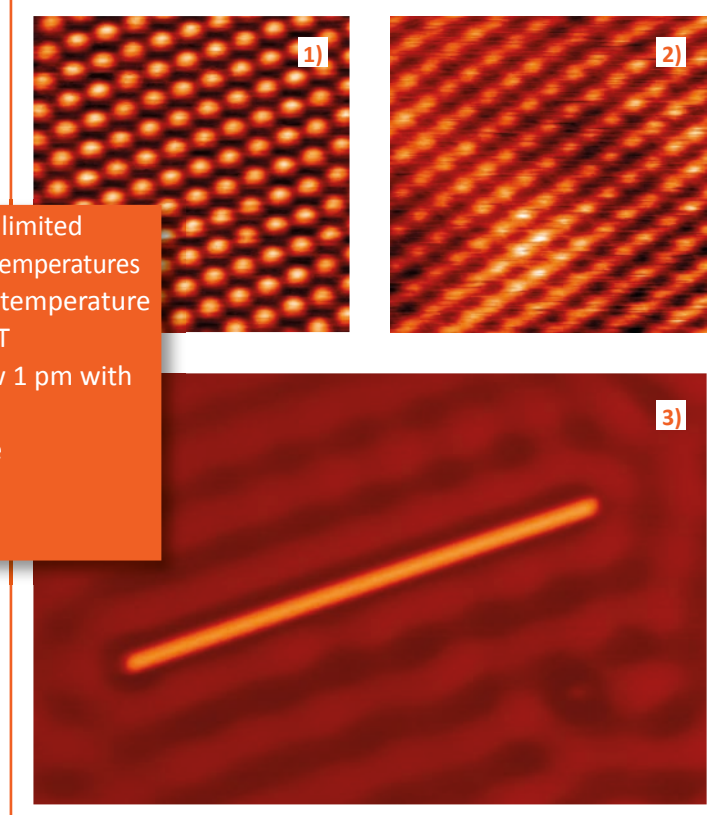



Fig. 1: STM measurement on Ag(111) at T = 9.8 K with running CC-cooler
Fig. 2: nc-AFM QPlus measurement on NaCl(100)
Fig. 3: Ag nanowire on Ag(111) surface

[1] H. Limborço et al., CrystEngComm, 2016, 18, 7147.

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# Lab Solutions for Electron Spectroscopy

## XPS-Lab, ARPES-Lab, and HAXPES Lab


Scienta Omicron offers several families of home-lab solutions for electron spectroscopy, ranging from well-established XPS to more specialized techniques like ARPES, HAXPES and APPES. All Lab solutions have in common the combination of excellent analysers and long term cutting edge system integration experience. Thereby we are happy to introduce you to our 'Lab" product range.

Our XPS-Lab is designed to act as a stand-alone system or to be part of a multi-technique system. With a large variety of analysers, light sources, sample preparation facilities and more, it can be tailored to your specific needs.

The ARPES-Lab integrates our state-of-the-art DA30-L analyser with patented deflector technology into a dedicated UHV environment with a best-fitting combination of light-sources, manipulation and preparation capabilities for your home lab environment – the turn-key solution to perform top class ARPES measurements.

To meet the growing interest for XPS with high photon energies (HAXPES) we have developed HAXPES-Lab, a stand-alone system for HAXPES measurements, utilizing a monochromatized liquid Ga metal jet source with an excitation energy of 9.25 keV. HAXPES is not any longer limited to few dedicated synchrotron beamlines in the world. For ambient pressure measurements we are offering the HiPP-Lab with possibilities to extend your research up to 25 mbar pressure.

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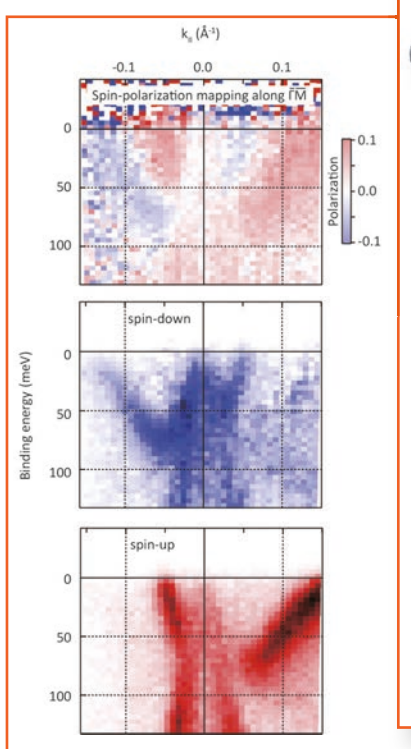
# Spin resolved Spectroscopy

## Spin transfer lens and FERRUM spin detection options

ARPES measures the electrons' energy and momentum simultaneously. This technique is now a standard tool to investigate electronic structures of materials. However, the spin degree of freedom in solids, which is important for e.g. topological insulators, magnetic memories and spintronics, is not measured for standard ARPES setups. For this reason spin-ARPES was developed. We have more than 10 years experience in the SARPES field (RSI 81, 035104).

Today Scienta Omicron has expanded the range of SARPES equipment to cover both Mott and VLEED solutions. The state of the art SARPES of today is the 3D VLEED Single Transfer System for DA30-L, which can be equipped with a Focus FERRUM detector (Figure 1) or as is for customer designed specific targets.




SARPES data of a Bi(111) film from a custom designed system from the Laser and Synchrotron Research Center at the Institute for Solid State Physics, University of Tokyo (RSI 87, 053111). Data curtesy of Dr. Yaji.

FOCUS

DA30-L with FERRUM detector from Focus - capable of investigating spin-dependent electronic states with a demonstrated 7 meV energy- and 0.7° angle resolution (e.g. PRL 118, 046802 and PRB 95, 041111(R)).

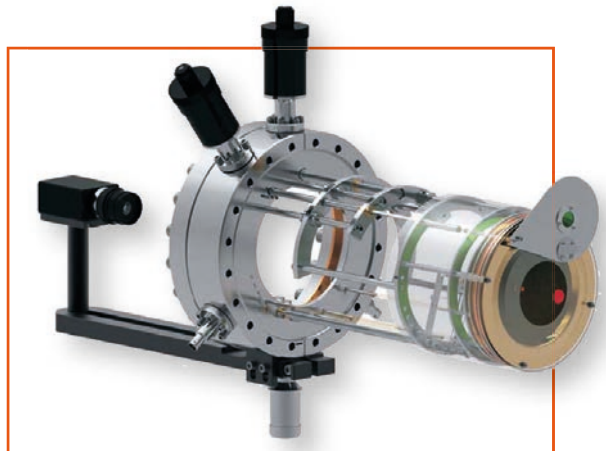
# Strategic alliance

## OCI Vacuum Microengineering & Scienta Omicron have formed a strategic alliance

We are very pleased to announce an offering of OCI LEED instruments for UHV system integration. In addition, the Scienta Omicron sales team will exclusively offer the LEED instruments in a majority of countries around the globe.

OCI Vacuum Microengineering is today the leading manufacturer in LEED with over 25 years in business, the company has both dedication and passion for LEED. The product portfolio is technically advanced with the range starting from a 4.5" entry model to advanced 6" and 8" versions with a broad range of options to choose from.

The decision will help us enhance our R&D efforts and focus on equipment which is at the forefront of scientific research.



LEED / Auger (AES) spectrometer models BDL800IR & BDL600IR with integral shutter

Scienta Omicron direct is our new platform for fast and improved scientific component sales. In the very near future we will offer more instruments through our new component sales channel SO direct (www.scientaomicron.direct).
At this moment SO direct covers a broad range of products and spares such as crucibles for EFMs and SPM tips.