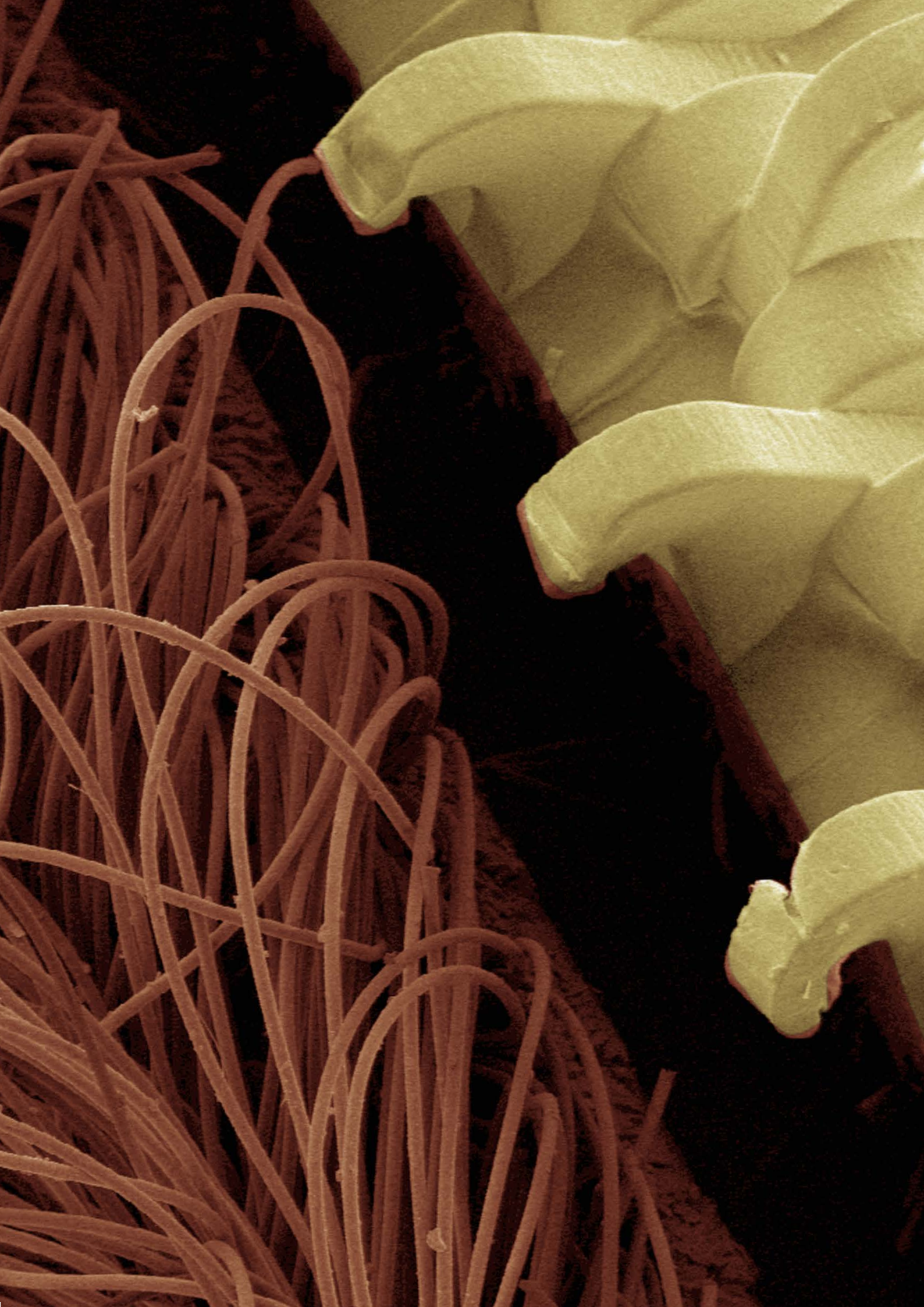
Materials Science & Microscopy

SmarAct



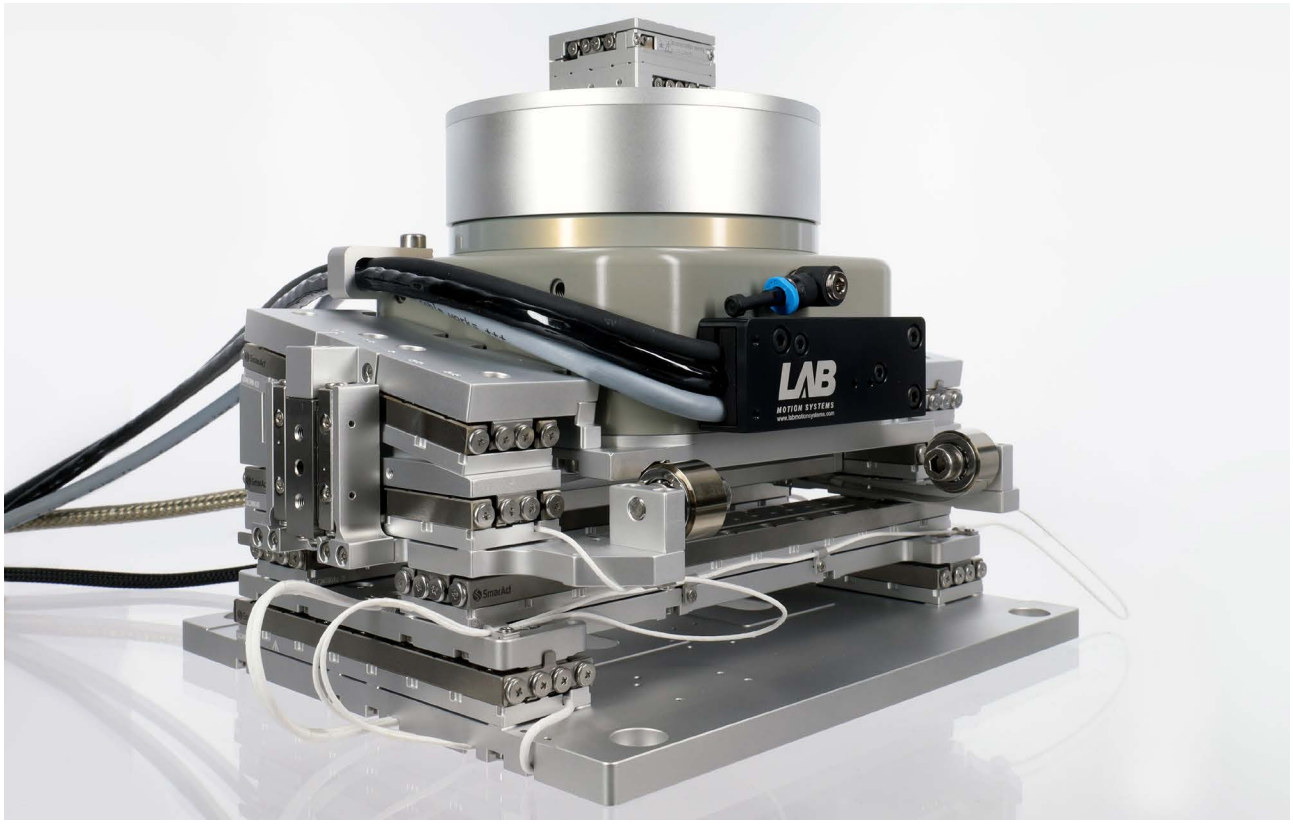
What we are doing

SmarAct provides high precision positioning components for advantage in all of the cutting-edge technologies in materials science.

Whether it is high-resolution 3D printing, electron or scanning probe microscopy (SEM, TEM), nanoindentation, spectroscopy, diffractometry or quantum computing, industrial and OEM customers as well as research facilities rely on SmarAct's expertise.

As modern techniques in the research, production and inspection of materials do typically involve special environments like the existence of particle beams, high magnetic fields, hard radiation, cryogenic temperatures or ultra-high vacuum, our highly-precise positioning devices and metrology components can be customized to almost any application requirement. This includes for example fully non-magnetic stages for SEM and TEM or closed-loop stages for the operation at cryogenic temperatures.

Since SmarAct develops all technologies for all aspects of our products in-house, we are able to provide you the optimal and most efficient solution for your application requirements. No matter if you are starting from scratch, plan to retrofit an existing system, if you are looking for an individual solution for your laboratory or a recurrent high-volume system, we are eager to hear about your project and assist you in taking it to the next level.



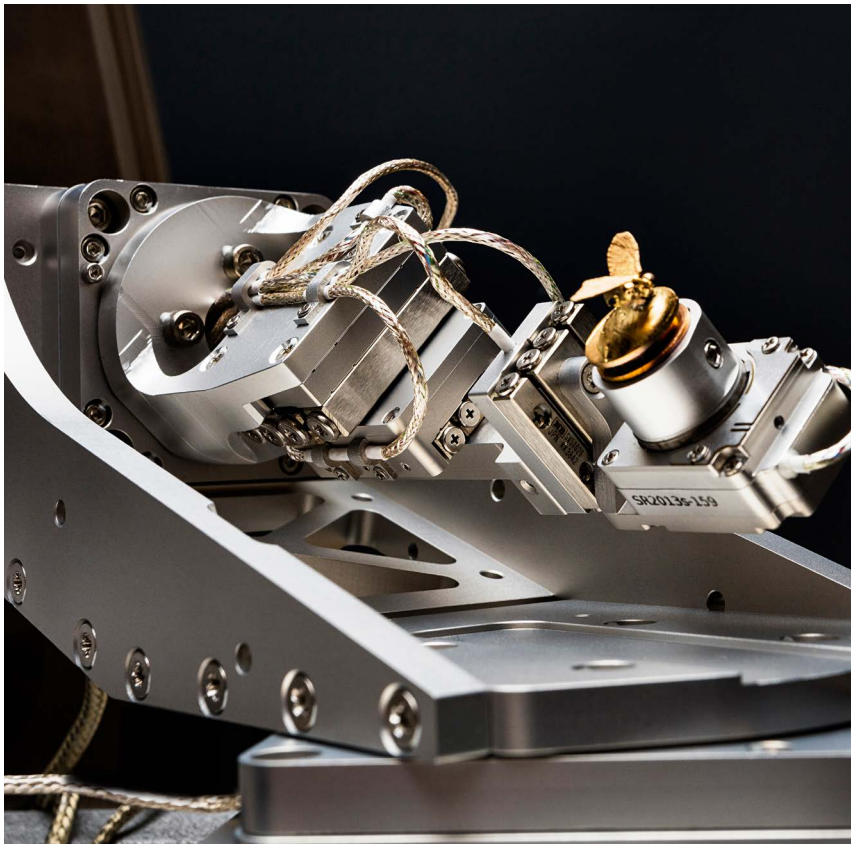
Computer Tomography

More and more functional properties of novel materials and material systems are based on complex internal structures. Non-destructive analysis methods, such as computer tomography, can make these structures accessible at high resolution and in multiple dimensions. The high information depth of the measurement data allows not only a structural but also a chemical analysis of the material system. Only the use of short-wave X-ray light in combination with nanometer-precise positioning technology allows to achieve this detail level in the nanometer range. SmarAct positioning systems offer compact, customized solutions that can fully meet the requirements in terms of complexity, precision, operating environment, and controllability and user-experience.

The smallest of such systems can be seamlessly integrated into existing REM environments allowing in-situ measurements as well as probing or simply add functionality.
For example, a high load vertical stage accommodates for an ultra-high precision air bearing that is utilized for the sample manipulation. An additional motions system allows the alignment of the specimen in up to six degrees of freedom relative to the axis of rotation.
Additionally, specific kinematic calculation system could be applied to the specific model for user-friendly and easily accessible control and programming.

8-Axes Positioning System: the Art of SEM Imaging

For the Carolas Garden from the Austrian-born artist Yadegar Asisi, displayed at the Leipzig Panometer, the scientific photographer Stefan Diller took very complex and detailed scanning electron microscopy (SEM) images of the bee and the chamomile blossom in a TESCAN MIRA3 FE-SEM equipped with a multi detector setup and a SmarAct SEM stage.



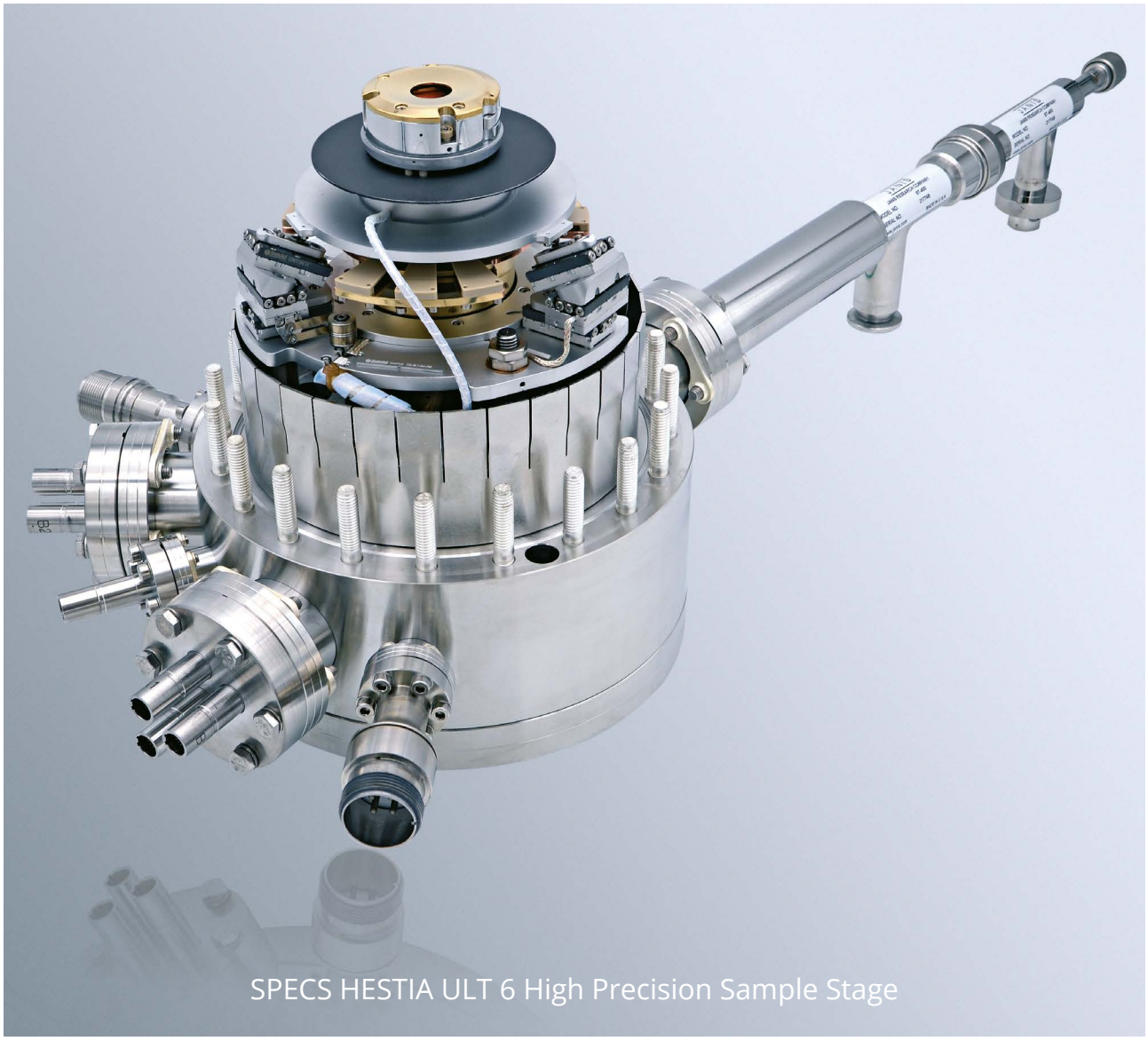
This SEM sample stage with eight degrees of freedom consists of three axis of rotation and five translational degrees of freedom to position the SEM sample with nanometer precision under the electron lens allowing an eucentric rotation of the specimen.

Spectroscopy

Spectroscopy and spectro-microscopy are the most important methods for characterization of materials' surfaces with a focus on electronic structure and transport properties of charge carriers. For this the electron binding energies and emission angles have to be measured with ultimate precision as a function of the wavelength or frequency of the probing radiation.
Since the investigated structures of materials become smaller and more complex, the analyzed areas have to be in the µm to nm regime. Thus the request for high precision positioning systems increase in the field of spectroscopy.

SmarAct provides a variety of different nano-positioning systems with resolution down to 1 nm for linear and rotational motions well suited for these tasks.
SmarAct is specialised on providing the perfect fit of the positioning system to your application and positioning task by individual customizations.

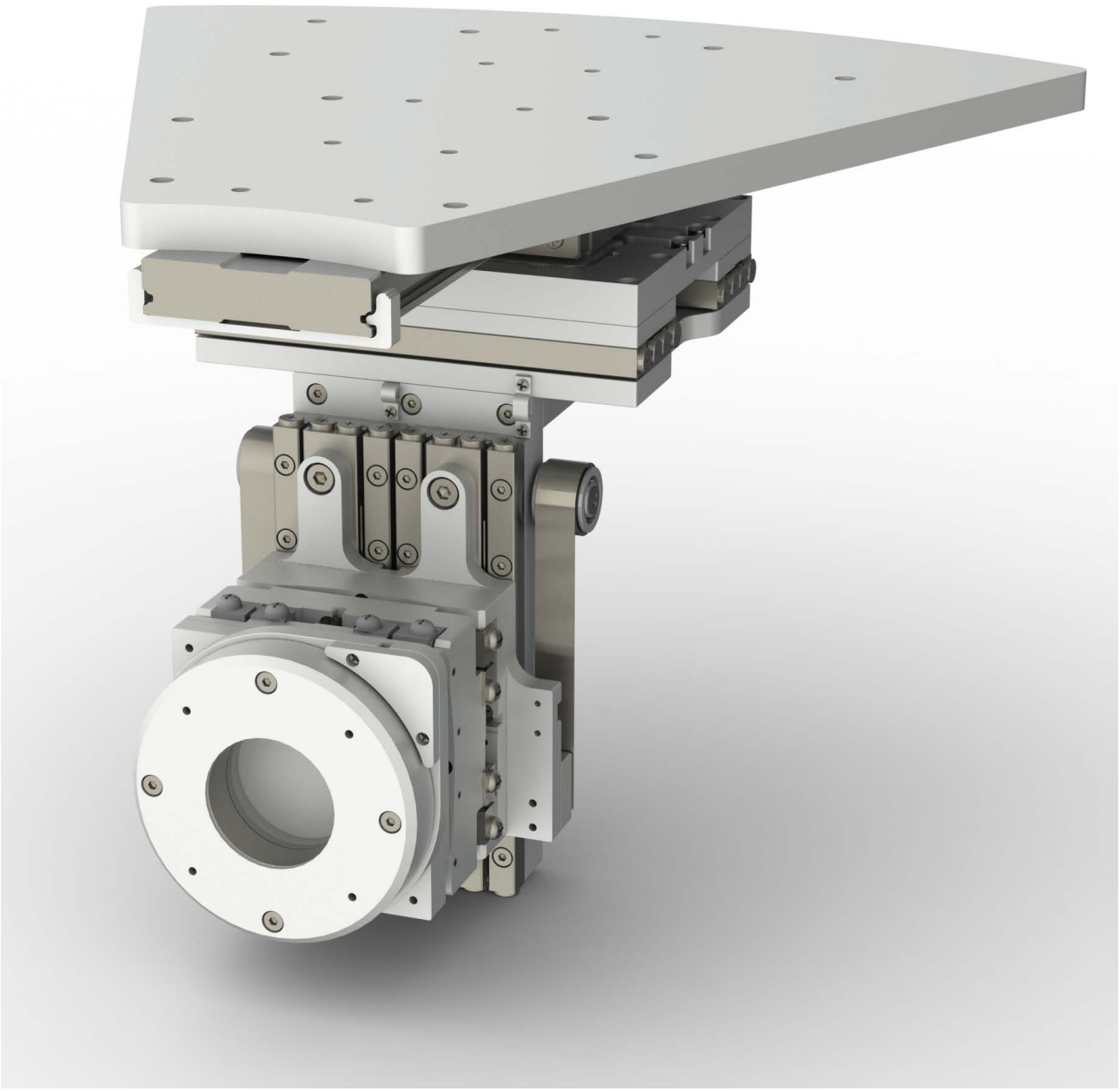
Smaract has developed a special version of the **SMAR**POD based on which SPECS was able to develop a high precision microscopy stage for momentum microscopy:



SPECS HESTIA ULT 6 High Precision Sample Stage

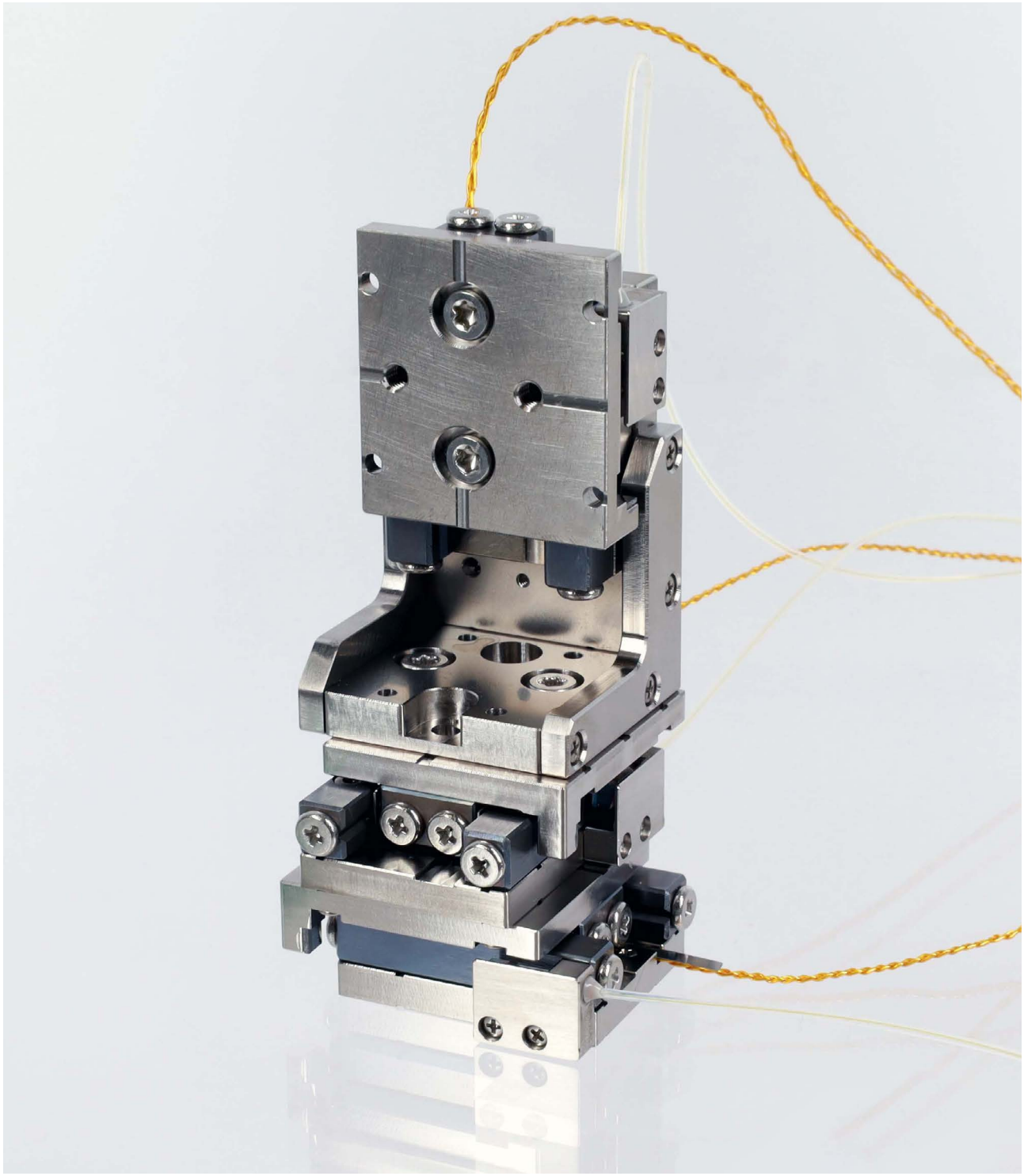
The SPECS HESTIA ULT 6 is a high-performance photoemission microscopy sample stage developed for momentum microscopy and electron momentum spectroscopy solutions. It features high precision and stability, combined with a true 6 axes positioning of the sample under the microscope. The HESTIA stage is designed to operate at sample surface temperatures below 9 K to support modern research requirements.

Tool Handling in Scanning Electron Microscopy



The µRobotex platform is a facility dedicated to characterization and microassembly of micro/nanosystems with dimensions below 10 µm. It is located at the École nationale supérieure de mécanique et des microtechniques (ENSMM) in Besançon and is managed by the AS2M department of the FEMTO-ST Institute.
The µRobotex team requested SmarAct to build a 6D system with position feedback for tool handling in a scanning electron microscope. The positioning system consists of two 3D subsystems mounted onto each other. The first consists of two SLC Series and one long travel piezo stage, the later of two goniometers and a rotation stage in order to be able to manipulate nano-tools in six degrees of freedom.

Closed-Loop Stages for Operation in Cryogenic Environment



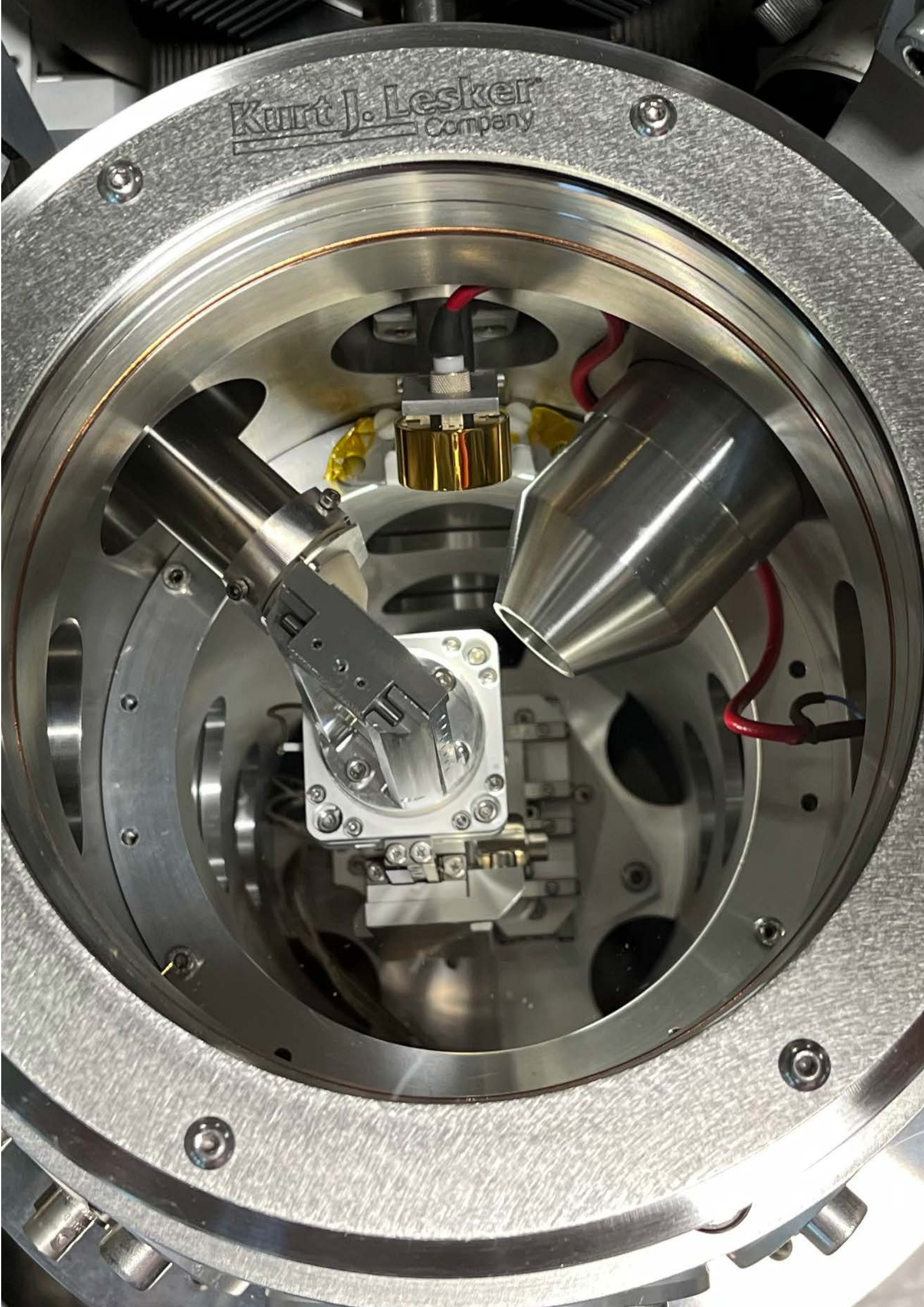
Our XYZ cryogenic positioning system, composed of three easily combined titanium linear stages, holders and adapter plates, is a compact, modular and highly precise multi-axis setup that can be the perfect match for your quantum computing applications. It can optionally be equipped with cold plates and copper braids to ensure optimal heat transfer from the payload to the mounting base plate.

Sample Manipulators for Microbeams

The interaction of matter gives the user many options to study new materials and their properties. The investigation methods often include a fixed microbeam and an adjustable sample stage. In materials science the composition or mapping of samples is an interesting field that requires movements of a sample with high precision and stability and a repeatable process.

SmarAct designs and assembles motion systems that are optimized for the requested degree of freedom. The example shown is a sample manipulator system designed for movements in four degrees of freedom with three linear stages and one rotational stage based on the stick-slip principle of our piezo stages.

The positioning system is inserted to a sample chamber from Oxford Microbeams for angle-resolved IBA (Ion-Beam-Applications), 3D imaging or grazing incidence PIXE (Particle-Induced X-ray Emission) allowing reliable automated operation with programmed sample positioning.


Kurt J. Lesker Company

With the development and production of market-leading solutions in the field of high-precision positioning, automation and metrology, the SmarAct Group reliably accompanies their customers in achieving their goals. The broad product portfolio – from single positioning stages to complex parallel kinematics, miniaturized robots, control systems and measurement technology – is complemented by automated microassembly solutions. Even the most challenging customer requirements can be met by maximum adaptability and complete in-house production.

Since its founding in 2005, SmarAct has steadily grown from a small team of engineers to a group of companies with three independent business units and over 220 highly skilled members. Today, SmarAct relies on years of experience and, above all, on a very passionate team with unconditional customer focus.

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