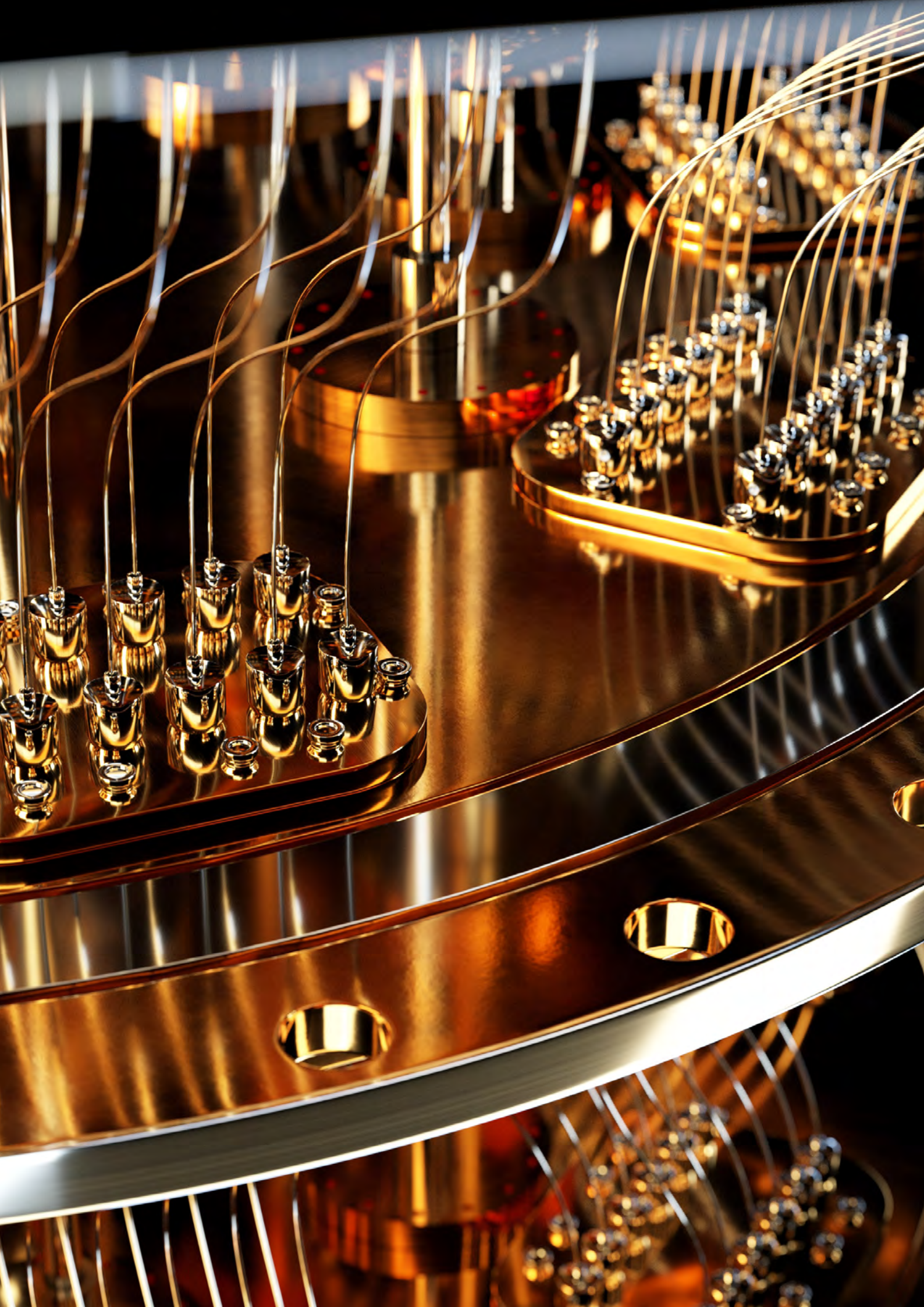


# Quantum Technologies

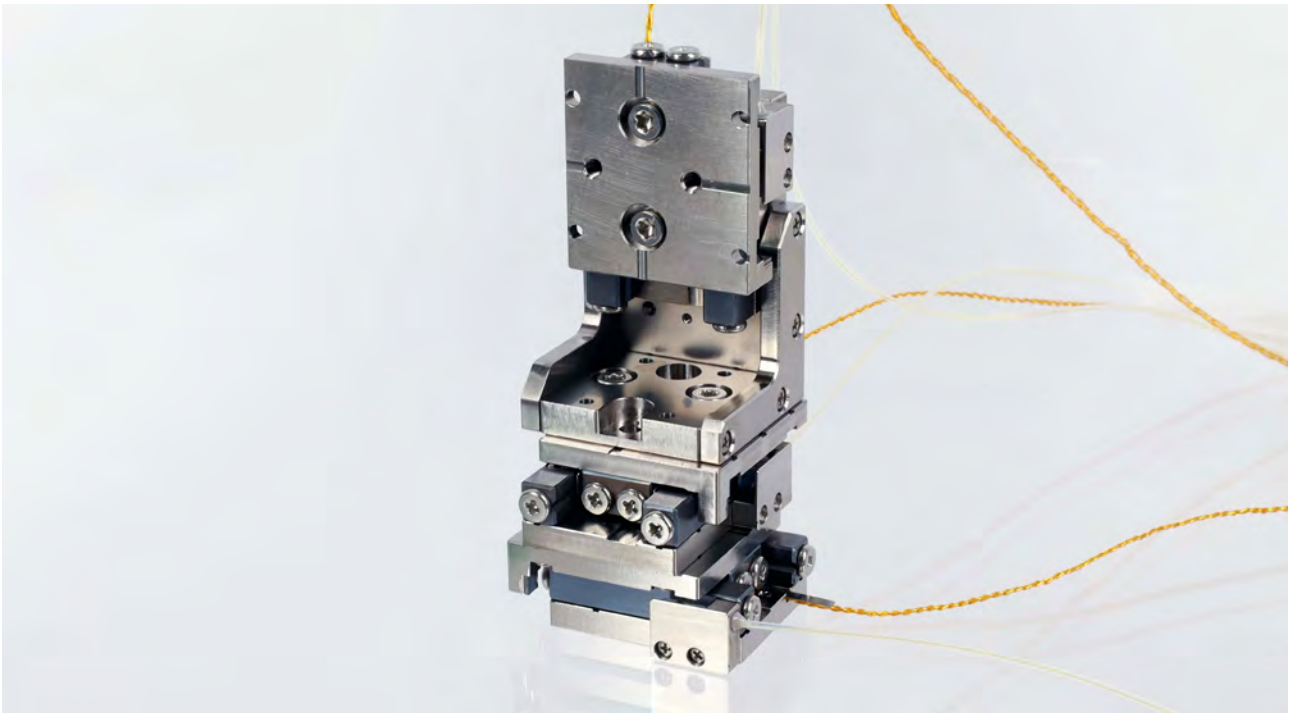


# Unlocking the Power of Quantum Technologies

Quantum technologies are revolutionizing fields ranging from computation to sensing and secure communication. At the heart of these advancements lies the necessity for ultra-precise positioning – a challenge that SmarAct meets with its high-precision stages and nanometer-accurate motion control systems.

Many quantum experiments take place in high vacuum (HV), ultra-high vacuum (UHV), and cryogenic (Cryo) environments requiring motion systems that maintain exceptional stability and reliability under extreme conditions. SmarAct piezo-based positioning solutions and closed-loop stages provide the accuracy and repeatability essential for aligning quantum circuits, trapping atoms and ions, and optimizing photon pathways. With non-magnetic materials available for magnetically sensitive applications and a high degree of customization, SmarAct enables seamless integration into quantum computing, metrology, and photonic setups.

SmarAct modular and vacuum-compatible positioning systems allow researchers and engineers to push the boundaries of quantum mechanics, ensuring precise motion control in even the most demanding environments. Whether fine-tuning nanophotonic structures, stabilizing optical cavities, or integrating into quantum measurement setups, SmarAct delivers cutting-edge motion control tailored for the quantum age.

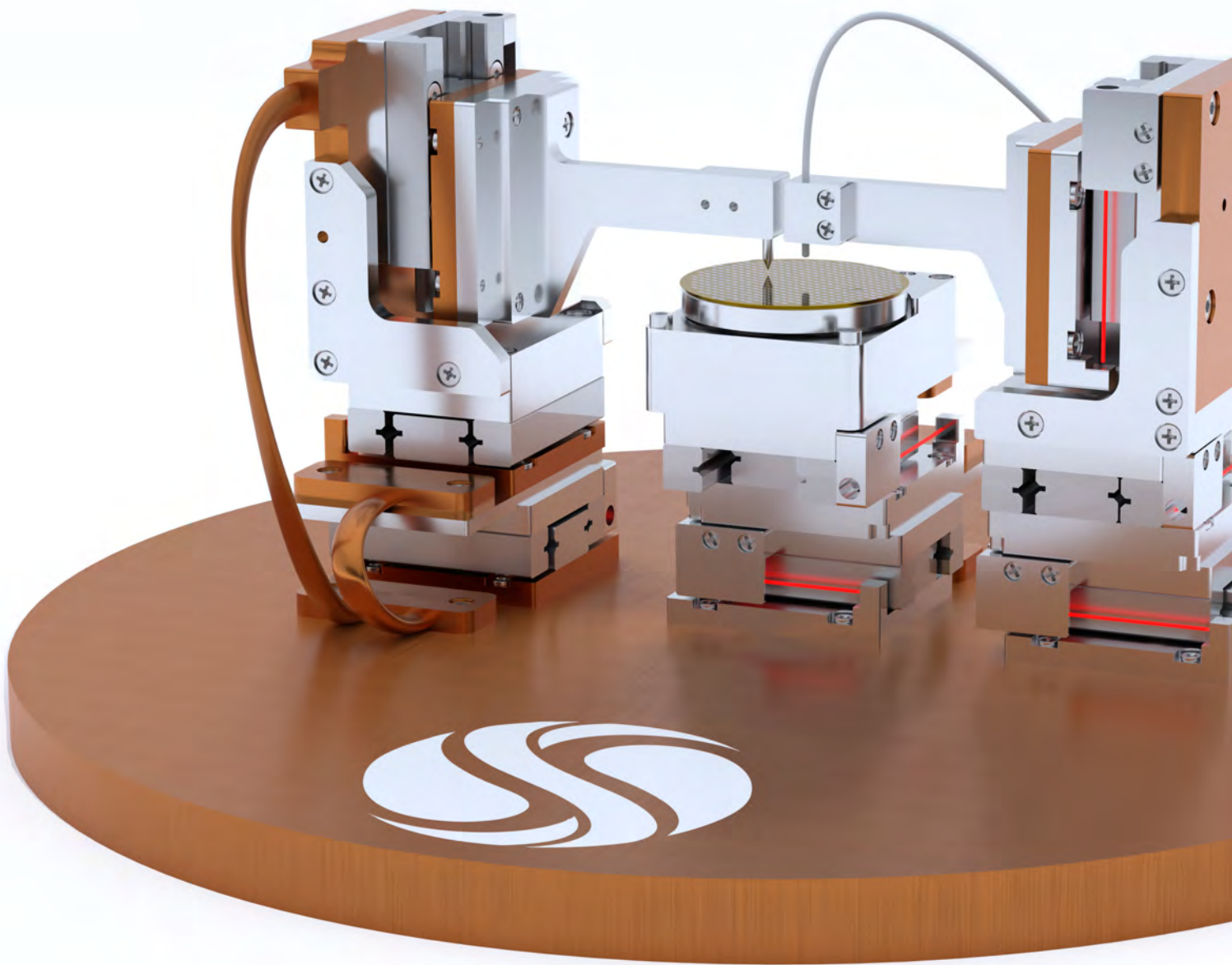


## Linear Positioning Stages & Multi-Axis Solutions for Extreme Environments

SmarAct high-performance linear stages combine ultra-precision positioning with a compact footprint, making them ideal for applications where space constraints and high accuracy are critical. Whether used as single-axis solutions or integrated into multi-degree-of-freedom systems, these stages provide exceptional reliability and versatility across various high-tech industries and research fields using different quantum technology applications. Designed for maximum

flexibility, SmarAct linear stages are available in both open-loop and closed-loop configurations. Closed-loop versions feature high-resolution optical encoders, ensuring precise and repeatable positioning. For applications in cryogenic environments, SmarAct Metrology's **PICOSCALE Interferometer** can be used to achieve picometer-level resolution, providing unmatched stability in extreme conditions.

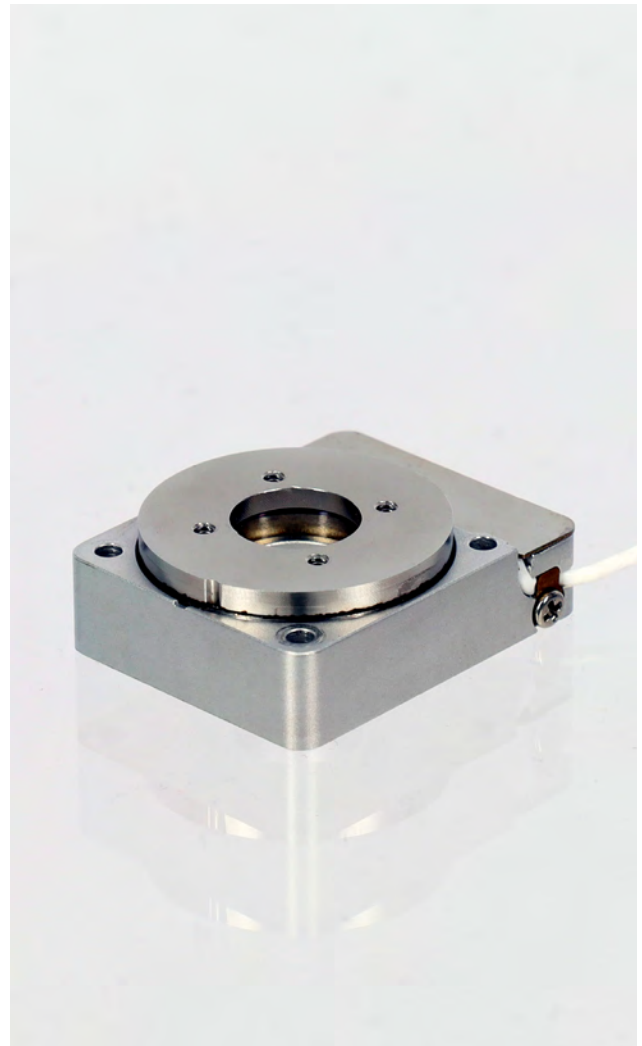
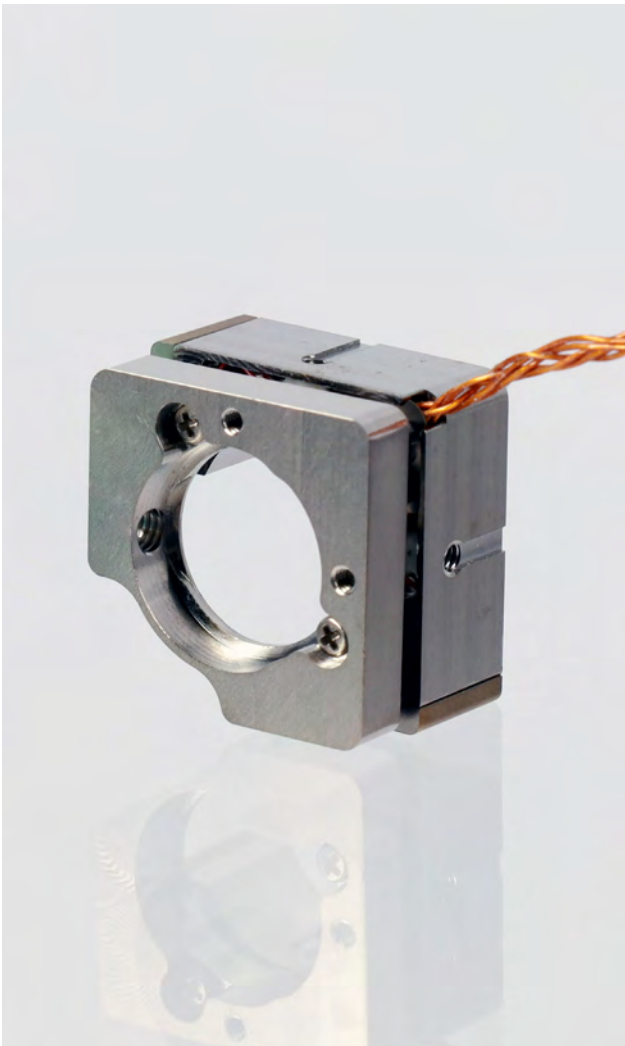




# Linear Positioning Stages & Multi-Axis Solutions for Extreme Environments

SmarAct high-precision mirror mounts and motorized opto-mechanics provide ultra-stable and compact solutions ensuring precise control of optical elements in quantum computing, quantum optics, and photonics research. With sub-microradian angular resolution and closed-loop positioning, they enable repeatable adjustments, essential for long-term experiments. These opto-mechanical components are ideal for use in superconducting qubit control, trapped ion setups, and quantum communication systems.

SmarAct high-precision rotary stages provide ultra-precise rotation solutions for quantum technologies, ensuring precise angular positioning. Applications include rotating optical elements in quantum communication systems, precise sample positioning in quantum metrology, and controlled motion in cold atom experiments. SmarAct rotary stages offer the stability, precision, and environmental adaptability needed to push the boundaries of quantum research and technology.





Christoph Hohmann  
(MCQST)

## High-Precision Positioning Technology for High-Performance Quantum Networks

A team led by Gerhard Rempe at the Max Planck Institute of Quantum Optics uses SmarAct's nanoprecise **SMARSLIDE®** piezo stages to enter the uncharted territory of quantum communications.

In order to make this happen, they couple crossed optical fiber cavities to one atom. This setup essentially forms a quantum network node that connects to two quantum channels, one provided by each cavity. It features passive, heralded and high-fidelity quantum memory which isn't dependent on any amplitude- and phase-critical control fields or error-prone feedback loops. Furthermore, slight

modifications to the crossed optical fiber cavity setup provides non-destructive qubit detection within quantum networks. Both the highly reliable quantum memory system and the nondestructive qubit detection represent breakthroughs that paved the way for fully functional, large-scale quantum networks with multiple connected nodes.

SmarAct technologies stand for precision, reliability, and future-proof solutions – making them the perfect choice for the most demanding applications in quantum research.

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 270 highly skilled members. Today, SmarAct relies on years of experience and, above all, on a very passionate team with unconditional customer focus.

[www.smaract.com](http://www.smaract.com)

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