

# PRESS RELEASE

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Fraunhofer IPMS expands its ice-cold quantum computing infrastructure

## New cryostatic systems elevate current research on Qubits

**The Center Nanoelectronic Technologies (CNT) at Fraunhofer IPMS has recently acquired new cryostats for the research on qubits and the qualification of superconducting systems. The cryogenic measuring devices, which are particularly useful for analyzing quantum systems, are now in full operation. The provision of the equipment was funded by the Saxon State Ministry for Science, Culture and Tourism (SMWK).**

Whether in medicine, material science or traffic planning - quantum computing is set to play a key role in future research. Qubits, the memory components for the development of complex quantum mechanical systems, are fragile and error-prone despite their versatility. Superconducting chips or circuits stabilize these fragile qubit states, but to do so they must be cooled down to the millikelvin range. In order to ultimately realize a complex system, such as a quantum computer, all other technical components, like circuits, memory chips or components for thermal insulation, must also function at these temperatures. The new cryostats at CNT make it possible to test a wide variety of structures, materials and circuits under these extremely cold conditions.

### **Cooler, more efficient and expandable - new systems offer optimal test conditions**

The cryostat "SD dilution refrigerator system" (SD cryostat) from the Finnish developer Bluefors offers advantages to the current inventory at Fraunhofer IPMS due to its versatility and options for expansion. With this, cables can be fitted subsequently and according to the respective requirements, but it is also possible to install additional components for signal generation and processing at warmer cooling levels. The SD-cryostat will be primarily used for cryogenic CMOS- and memory-component-development in order to create stable digital circuits and systems that function under extreme conditions. These components are aims of the current research projects "ARCTIC" and "QSolid" at Fraunhofer IPMS. Furthermore, systems with unequal temperature ranges for different sub-components will be evaluated, such as interposers in the project "QSolid".

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**Editor**

**Julia Schulze** | Fraunhofer Institute for Photonic Microsystems IPMS | Phone +49 351 8823-1314 |  
Maria-Reiche-Straße 2 | 01109 Dresden | [www.ipms.fraunhofer.de](http://www.ipms.fraunhofer.de) | [julia.schulze@ipms.fraunhofer.de](mailto:julia.schulze@ipms.fraunhofer.de)

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For tests with the “L-Type Rapid” cryostat from the Munich-based company Kiutra, samples are loaded into the sample chamber, which is a small elevator. Accordingly, only the samples themselves need cooling, rather than the entire system. This shortens the cooling and warm-up time of the sample chamber, which increases the number of samples to be analyzed. The system can also generate a strong magnetic field, as found in some quantum computers. It does not require the usual liquid helium mixture for cooling and achieves extremely low temperatures in the millikelvin range solely by using helium-4 and the rundown of several magnets to achieve even lower temperatures. The L-Type Rapid will be used primarily for the characterization of thin films and superconducting resonators for the readout of qubits. These alternative procedures reduce costs and test processes can be carried out more effectively and quickly.

Previously, samples could be cooled down to 1.7 K at CNT. The new cryostat systems now extend the measuring range down to 30mK, which is the working temperature for qubit and control chips of established quantum computer concepts. With the commissioning of these new cryogenic measuring devices, process development of the necessary components such as superconductors or cryo-electronics will be accelerated immensely. Research and analysis, inextricably linked to the development of quantum processors to ensure their low error rates and high performance, will be enhanced using the new facilities. They further expand the measurement capacities that CNT can offer its partners in funded projects or as a direct service. The goal of a sovereign quantum computer with Saxon roots is coming even closer, thanks to the funding and the ambition of the researchers.

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The provision of the facilities is co-financed by tax funds on the basis of the budget approved by the Saxon state parliament and as part of the IC4QC project - “Integration und Charakterisierung von Materialien für Quantencomputing”, which is funded by the Saxon State Ministry for Science, Culture and Tourism (SMWK).



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**About Fraunhofer IPMS**

Fraunhofer IPMS is a leading international research and development service provider for electronic and photonic microsystems in the application fields of Smart Industrial Solutions, Bio and Health, Mobility as well as Green and Sustainable Microelectronics. Research focuses on customer-specific miniaturized sensors and actuators, MEMS systems, microdisplays and integrated circuits as well as wireless and wired data communication. Services range from consulting and design to process development and pilot series production. With the Center Nanoelectronic Technologies (CNT), Fraunhofer IPMS offers applied research on 300 mm wafers for microchip producers, suppliers, device manufacturers and R&D partners.

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Cryostat „SD dilution refrigerator system“.

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Frozen puck for mounting and sample insertion into the “L-Type Rapid”.

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