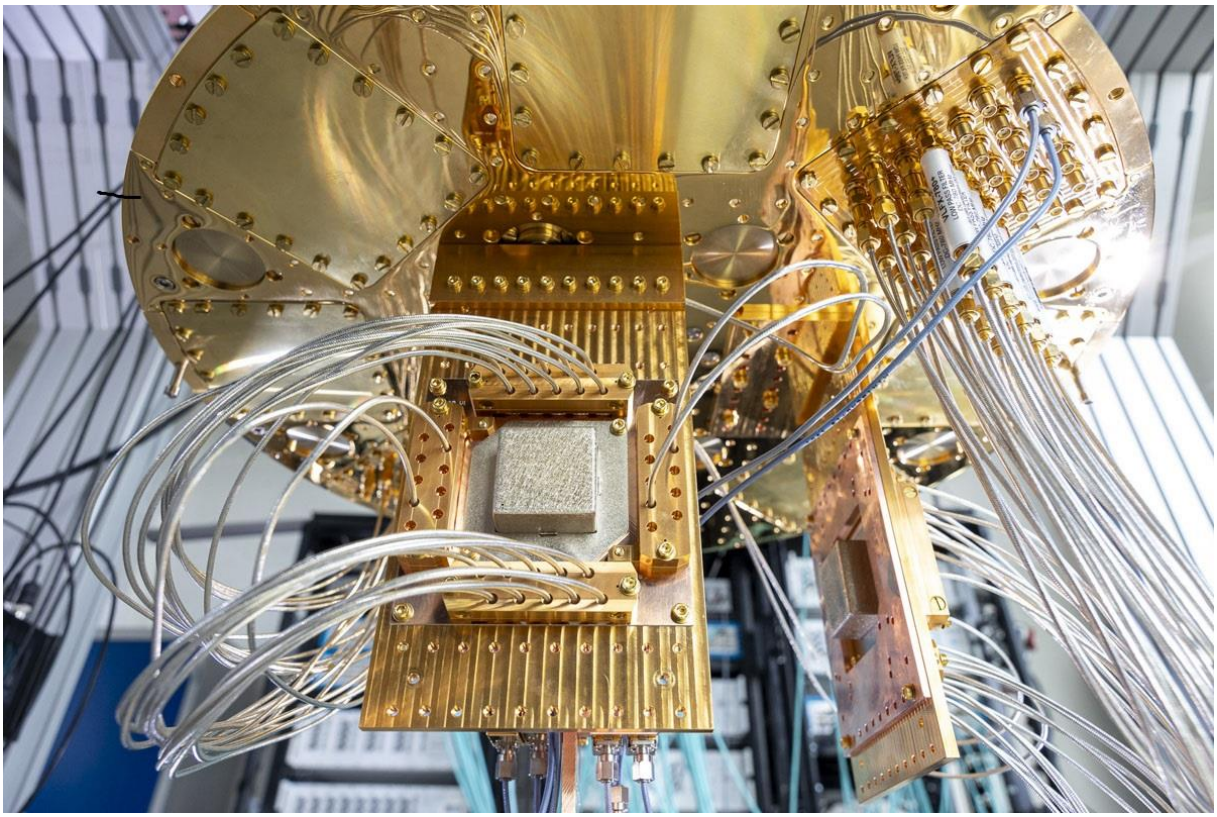
QSOLID
Quantum Computer in the Solid State

Press Release

QSolid Project: Quantum Computer Demonstrator In Operation

Jülich, 7 November 2024 – In the large-scale QSolid project, Forschungszentrum Jülich and its partners have put the first prototype for a German quantum computer with optimised qubit quality into operation. It forms the basis for a future quantum computer developed in Germany using superconducting qubits, which will be able to perform complex calculations for industry and research.



Centrepiece of the QSolid prototype
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After two and a half years of project work, the 160-strong consortium led by project coordinator Prof. Dr Frank Wilhelm-Mauch from Forschungszentrum Jülich has reached a major milestone in the national joint project. 'We have developed a compact but powerful system that is now ready to enter the next phase of development,' Prof. Frank Wilhelm-Mauch is pleased to say. In the coming years, the system is to undergo further expansion and be integrated into the existing Jülich supercomputing environment in order to enhance its performance – from the current 10 to 30 qubits. The abbreviation stands for 'quantum bits', the central information unit of a quantum computer.

'We are happy that we were able to build up our expertise in the first half of the project and bundle it into an initial system. With the funding secured, we can now scale up to a truly remarkable platform,' says Prof. Wilhelm-Mauch.

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The QSolid project acknowledges the support of the Federal Ministry of Education and Research (BMBF) within the framework programme "Quantum technologies – from basic research to market".

Part of the German research strategy

QSolid is 90 per cent funded by the Federal Ministry of Education and Research (BMBF). The project, in which 25 institutions from Germany are collaborating, is part of the German strategy to secure technological sovereignty in the field of quantum research. The overarching aim is to strengthen Germany's industrial competitiveness and to enable new applications in science and industry, for example in areas such as chemistry, materials science and medical technology.

A total of 76.3 million euros is being allocated to the project. The funding has now been fully approved by the BMBF due to the convincing performance data of the 10-qubit prototype.

Cryostat in which the central unit of the QSolid prototype is cooled
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10-qubit demonstrator in operation

The now completed system has a low error rate, a customised software stack and will be connected to the JUelich user infrastructure for quantum computing, JUNIQ, via cloud access in the coming weeks. The centrepiece of the prototype is the quantum processor, which already delivers high performance. The software stack has also passed initial functional tests and is currently being connected to the quantum processor. In addition, larger subsystems for the cabling, electronics and software have already been developed and installed on the central system. There are also new test options for developing the next generation for the cryogenic control of qubits so that qubit operation will be simpler and more energy-efficient in future.

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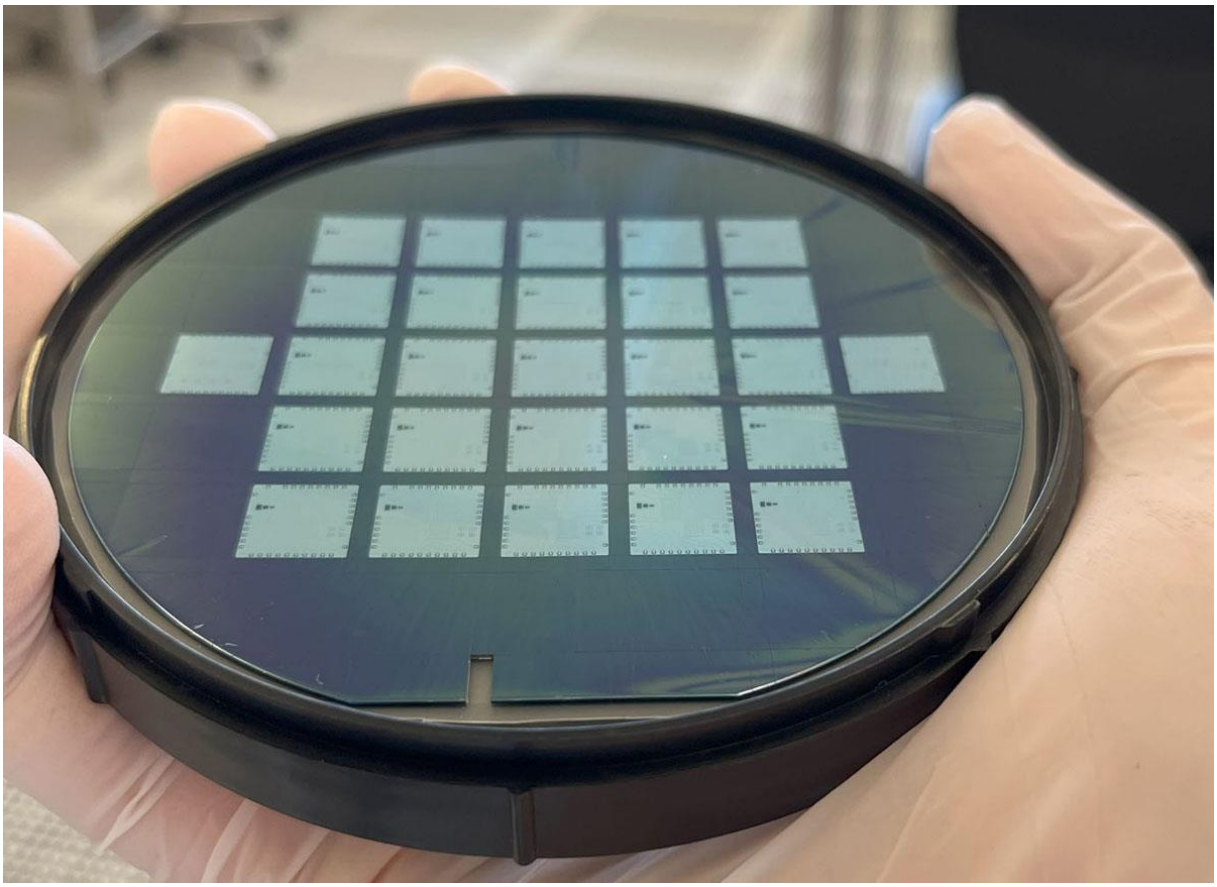

Wafer with 10-qubit chips of the QSolid demonstrator
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Further development for applications in industry and science

In the further course of the project until the end of 2026, the team will develop and optimise several processor types on the basis of the results now presented. The prototype of the QSolid demonstrator is expected to multiply its performance in the future.

A central goal of the QSolid project is also to integrate quantum computers into the existing supercomputing environment at the Jülich Supercomputing Centre. The combination of quantum and supercomputers is intended to make it possible to perform particularly complex calculations faster and more efficiently. ‘First steps towards a hybrid system that combines quantum and supercomputing have already been taken. Integration into Jülich's high-performance computing (HPC) infrastructure is already possible to some extent,’ explains Prof. Wilhelm-Mauch.

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The content of this press release reflects the views of the author only.

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QSolid key data

Acronym	QSolid
Title	Quantum Computer in the Solid State
Project duration	January 2022 - December 2026
Budget	€ 76.3 million (of which 89.8 % is funded by the BMBF)
Coordination	Forschungszentrum Jülich GmbH, Prof. Dr Frank Wilhelm-Mauch
Partners	Forschungszentrum Jülich, Fraunhofer IZM und IPMS, Karlsruhe Institute for Technology, Leibniz IPHT, ParityQC, HQS Quantum Simulations, Rosenberger, Ulm University, Physikalisch-Technische Bundesanstalt, Qruise, University of Stuttgart, FU Berlin, IQM, University of Konstanz, University of Cologne, Heinrich-Heine University Düsseldorf, Supracon, ParTec, Racyics, AdMOS, LPKF Laser & Electronics, MKS Atotech, s+c / Eviden, Globalfoundries, CiS Forschungsinstitut für Mikrosensorik, Zurich Instruments
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BMBF framework programme: “Quantum technologies – from basic research to market”

The QSolid project is part of the framework programme entitled “Quantum technologies – from basic research to market”. Coordinated by the Federal Ministry of Education and Research (BMBF), the programme combines the goals of the German Federal Government in relation to the development of quantum technologies:

1. Developing the quantum technology research landscape
2. Creating research networks for new applications
3. Establishing industrial competitiveness through lighthouse projects
4. Ensuring security and technical sovereignty
5. Shaping international collaboration
6. Getting Germany’s population involved

The aim is to transfer quantum technology to industrial application. To accomplish this task, the Federal Government has provided the BMBF with over € 1 billion in funding. More information (in German): www.quantentechnologien.de/qt-in-deutschland/programm.html

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