High-Performance Computer and Quantum Simulator hybrid

PRESS RELEASE

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Inauguration of Jade and Ruby Quantum Processors: Milestone towards a hybrid high-performance computing and quantum simulator infrastructure for Europe

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The High-Performance Computing and Quantum Simulator hybrid (HPCQS) project has reached a major milestone with the inauguration of two Pasqal quantum processors —*Jade* and *Ruby*— respectively situated at Forschungszentrum Jülich (FZJ) and Commissariat à l'énergie atomique et aux énergies alternatives (CEA). The successful integration of the two next-generation quantum processors into high-performance computing (HPC) environments, an achievement made possible by EuroHPC Joint Undertaking, marks a decisive step toward making quantum computing a practical component of Europe's scientific and industrial computational landscape. Moreover, it delivers on the ambition set out by the European Commission in the 2030 Digital Compass: the European way for the Digital Decade, proposing that, by 2025, Europe will have its first computer with quantum acceleration paving the way for Europe to be at the cutting edge of quantum capabilities by 2030.

On November 13th, the quantum processors Jade and Ruby are being jointly inaugurated in a triplex event at FZJ, CEA and the European Commission's premises, reflecting the collaborative nature of the project. In the course of the event, the two processors, situated respectively at Jülich Supercomputing Centre (JSC) in Germany and Très Grand Centre de Calcul (TGCC) will be presented.

Hardware Integration: Quantum Computing capabilities for HPC Infrastructure

The integration of the two quantum processors represents significant progress in transforming quantum technology from laboratory experiments into reliable computing infrastructure. This integration will provide a key step towards a federated EuroHPC quantum–HPC infrastructure, enabling users from both industry and research to develop hybrid quantum–classical algorithms and tackle complex problems such as industrial battery design, drug discovery, and optimization challenges in finance and traffic management.

The quantum processing units (QPUs) were prefabricated by the company Pasqal before being shipped to the data centres of CEA and FZJ. Pasqal's technology is based on arrays of neutral atoms that are trapped and manipulated by lasers in programmable geometries for quantum operations. These systems operate at room temperature and with low power consumption, making them particularly robust and scalable.

HPCQS has received funding from the European High-Performance Computing Joint Undertaking (JU) under grant agreement No 101018180. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Germany, France, Italy, Ireland, Austria and Spain in equal parts.

The combination of optical precision and naturally identical atoms creates a unique platform designed for quantum computing on an industrial scale.

Software and Connectivity: Seamless Quantum-Classical Integration

Beyond the hardware assembly, the integration also focuses on achieving a seamless quantum-classical workflow through advanced software solutions.

The quantum processors are integrated into the HPC environment through standard workload management systems such as SLURM, enabling hybrid quantum-classical computations to run using familiar commands. This ensures that researchers and HPC operators can leverage quantum computing power with minimal adaptation, turning quantum into a natural extension of classical infrastructure.

A specific HPC-Quantum Computing software stack was developed by the consortium, relying on industrial and open-source software components, including Eviden Qaptiva, ParTec's ParaStation Modulo, the ParityQC Architecture and ParityOS operating system, and the Pasqal SDK. This software stack is interoperable with Eviden’s Qaptiva and myQLM platforms, supporting applications in optimization, simulation, and machine learning. By bridging the gap between quantum physics and real-world computation, the HPCQS infrastructure will enable quantum resources to be directly embedded in industrial workflows.

European leadership in quantum computing

As part of the inauguration, two use cases are being demonstrated to showcase the integration of the two quantum processors, each capable of controlling more than 100 qubits, with Europe’s Tier-0 supercomputers. These demonstrations, led by research teams from across the consortium, will show how quantum-HPC integration can accelerate scientific discovery and industrial innovation.

This milestone represents a cornerstone of Europe’s Quantum Flagship initiative, reinforcing European leadership and technological sovereignty in the field of quantum computing. By linking quantum processors directly to Europe’s supercomputers, we are turning an ambitious scientific vision into a working reality.

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Quotes

FZJ

“Today marks an important milestone for European research. We are entering a new phase in which quantum and classical computing begin to evolve together. This is more than a technical achievement – it signals a new paradigm for computation, one that will shape the future of scientific discovery.”

Kristel Michielsen, Director of the Jülich Supercomputing Centre and HPCQS Project Coordinator

CEA

“The CEA is very proud to host one of the first two Pasqal computers delivered and operated in an HPC computing centre. With this milestone, TGCC users and European scientific communities will be able, after three years of experiments with emulators, to use real quantum computers for their use cases. This a first step on the road to large scale hybrid computing, which we will achieve with quantum processors integrated with the Alice Recoque exascale supercomputer.”

Bruno Lebret, Director of CEA DAM Ile de France Centre

GENCI

“In a context of international competition for critical/major technologies, the joint inauguration of Ruby in France and Jade in Germany attests to the strong position of France and Europe in this quantum race against time. The commissioning of the cold atom quantum computer produced by the French company Pasqal is a source of pride for GENCI and its Associates. This cutting-edge tool was acquired as part of the European HPCQS project thanks to the support of the French public authorities, in line with the national quantum strategy and the HQI project, which enables the hybridisation of quantum technologies with those of classical computing. All this major effort should lead to new breakthroughs in French and European scientific, academic and industrial research.”

Philippe Lavocat, CEO of GENCI

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About HPCQS

The High-Performance Computing Quantum Simulator hybrid (HPCQS) brings together leading research centres and industry partners from across Europe to pioneer hybrid quantum–classical computing.

HPCQS aims to build a federated hybrid quantum-HPC infrastructure, integrating Pasqal's quantum simulators directly with Europe's top supercomputing centres, such as CEA and FZJ.

The HPCQS Project is funded by the European High-Performance Computing Joint Undertaking (JU). The JU receives support from the European Union's Horizon 2020 research and innovation programme and Germany, France, Italy, Ireland, Austria and Spain in equal parts.

Key Facts

Start Date	1 December 2021
Duration	4 years
Budget	€ 12 Mil (50% funded by EuroHPC JU)
Coordination	Forschungszentrum Jülich, Prof. Dr Kristel Michielsen
Partners	FZJ, CEA, GENCI, BULL, CNR, NUIG-ICHEC, University of Innsbruck, EURICE, CNRS, Inria, CINECA, BSC, FlySight, ParityQC and Fraunhofer IAF
Linked 3rd parties	ParTec, Sorbonne Université and CentraleSupélec
Website	**hpcqs.eu**
X	https://twitter.com/HPCQS_EU
LinkedIn	https://www.linkedin.com/showcase/hpcqs-eu

Full Project Partner List

Austria

- ParityQC - Parity Quantum Computing GmbH
- UIBK - University of Innsbruck

France

- CEA - Commissariat à l'Energie Atomique et aux Energies Alternatives
- CNRS - Centre National de la Recherche Scientifique
- CNRS - Sorbonne University (Linked Third Party – LTP)
- CNRS - CentraleSupélec (LTP)
- GENCI - Grand Équipement National de Calcul Intensif
- Inria - French national research institute for digital science and technology
- EVIDEN - EVIDEN

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Germany

- FZJ - Forschungszentrum Jülich
- ParTec AG - ParTec AG (LTP)
- Fraunhofer IAF - Fraunhofer Institute for Applied Solid State Physics
- EURICE - European Research and Project Office GmbH

Ireland

- ICHEC-NUIG - Irish Centre for High-End Computing, National University of Ireland Galway

Italy

- CNR-INO CNR-IIT - Consiglio Nazionale delle Ricerche
- CINECA - CINECA
- Flysight - Flysight Srl

Spain

- BSC-CNS - Barcelona Supercomputing Center-Centro Nacional de Supercomputación

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