

Quantum's Value in AI Supercomputing Will Be Decided by the Full Stack, Not Qubits Alone, Find Alice & Bob and Hyperion

*Report from Alice & Bob and Hyperion
Research informed by 15 interviews with
practitioners at leading supercomputing
institutions in Europe, APAC, and the US*



ALICE & BOB

BOSTON, MA, UNITED STATES,
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-- [Alice & Bob](#), a leader in fault-tolerant
quantum computing, and Hyperion

Research, the HPC industry's leading analyst and market-intelligence firm, today released a new report on what it will take to enable HPC-Quantum-AI systems with insights from HPC practitioners.

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*Juliette Peyronnet, GM US,
Alice & Bob*

As quantum hardware advances toward fault-tolerance, a key concern for HPC centers is ensuring that the software stack, hybrid workflows, and operational expertise will be ready when the hardware is. The new report "HPC-Quantum-AI: Shaping the Next Compute Era," also found that many HPC practitioners worry that an immature stack, deployed too early, risks failures that erode the HPC community's trust in quantum computing for years to come.

“What ultimately determines whether a quantum

processor can deliver value in an HPC environment is its ability to execute applications. As quantum hardware has progressed at pace, the conversation in HPC is shifting from whether qubits will be delivered to how to get the most from them,” said Juliette Peyronnet, GM US, Alice & Bob.

The report is informed by interviews with fifteen directors, quantum program leads, and engineers at leading supercomputing institutions across Europe, APAC, and the United States, including: Argonne National Laboratory, Lawrence Berkeley National Laboratory/NERSC, Oak

Ridge National Laboratory, RIKEN, Munich Quantum Valley, and Pawsey Supercomputing Centre.

The report identifies three actions the quantum-HPC community should take now:

-- Navigate the quantum-HPC-AI design space: How tightly quantum must couple to classical and AI compute is unproven and comes down to one variable: how much latency a workload can tolerate. The answer cannot be bought, only measured. Centers running testbeds today will be able to commit capital on evidence, not hypothesis.

-- Unify the software stack: Quantum vendors and HPC centers should develop open standards on the layers that do not depend on qubit modality, such as device management and job submission, while compilers and programming models stay open to competition.

-- Co-design workflows: Gains in fault-tolerant quantum computing will be best realized where HPC and AI experts and quantum vendors work on the same problem. The report cites an example of a quantum chemistry workflow targeting a 10,000-fold speed-up.

The report closes with the case for on-premise deployment, highlighting how integration expertise accrues in the centers that operate a quantum machine with full access. The first fault-tolerant machines, the report argues, will go to the centers already building that readiness.

This 2026 edition is the second report in a series titled: "Seizing Quantum's Edge" which maps HPC-Quantum-AI integration. The 2025 edition made the case that HPC centers should prepare for early fault-tolerant quantum computing.

"The timing for this report is spot on. HPC end users everywhere are looking for guidance and insights for what it will take to integrate the computational power of quantum into the current and projected advanced computing ecosystem. This report covers the key issues required to successfully navigate that process by QC vendors and end users alike. The credibility of the report is bolstered by key insights gathered from an impressive base of HPC experts who are already looking to the future of quantum computing utility," said Bob Sorensen, SVP of Research and Chief Analyst for Quantum Computing, Hyperion Research.

The report is available for download [here](#).

About Alice & Bob

Alice & Bob is a quantum computing company based in Paris and Boston whose goal is to create the first universal, fault-tolerant quantum computer. Founded in 2020, Alice & Bob has raised €180 million in funding and employs more than 250 people.

Advised by Nobel Prize winning researchers, Alice & Bob specializes in cat qubits, a technology

developed by the company's founders. Demonstrating the power of its cat architecture, Alice & Bob recently showed that it could reduce the hardware requirements for building a useful large-scale quantum computer up to 200 times compared with competing approaches.

About Hyperion Research

Hyperion Research provides data-driven research, analysis, and recommendations on technologies, applications, and markets in high-performance computing and adjacent emerging technologies, serving government, industry, commerce, and academic organizations worldwide.

Veronica Combs
HKA Marketing Communications
+1 714-426-0444
[email us here](#)

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