

Logical Qubits: Alice & Bob Publishes Report for Industry to Benchmark Claims

Five criteria create an objective standard for measuring milestones across modalities, including neutral atom, superconducting, spin, photonic and trapped ions



ALICE & BOB

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/EINPresswire.com/ -- Quantum

computing company [Alice & Bob](#) has

released a new five-criteria framework to define and benchmark logical qubits and establish a fair and comprehensive performance evaluation across hardware modalities. Logical qubits are a key milestone on the path to fault-tolerant quantum computing, but there is no industry-wide standard for defining, measuring or comparing them.

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Investors, analysts, enterprise decision-makers and researchers can use this new framework to objectively compare achievements from hardware with different levels of performance, maturity, and capability.

The paper, [Defining the Logical Qubit: Five Criteria to Benchmark Logical Qubit Claims](#), builds on a growing body of industry research to argue that a logical qubit should be defined strictly as a fundamental building block of a fault-tolerant quantum computer. It sets out five qualities a true

logical qubit must demonstrate to be a credible candidate for scaling the technology.

"Logical qubits are rapidly becoming the industry's primary benchmark for progress toward fault-tolerant quantum computing, yet the term is used to describe achievements with vastly different levels of performance and capability," said Jérémie Guillaud, VP Quantum Software, Alice & Bob. "Without a common benchmark, it's difficult for the industry to compare approaches and evaluate genuine progress. At Alice & Bob, we believe a logical qubit should be more than an experimental demonstration - it should represent a fundamental building block of a fault-tolerant quantum computer. By proposing a clear definition and common set of criteria, we hope to make logical qubit claims more transparent, comparable, and easier to evaluate."

Alice & Bob's five essential criteria to "score" logical qubit claims are:

1. Breakeven - Can you outperform your physical qubits? The logical qubit lifetime must exceed that of the physical qubits it is built from.
2. Scalable Parameters - Can you make it better? The error correction code has a parameter that can be tuned to lower the logical error rates.
3. Sufficient QEC Cycles - Have all the errors had time to happen? To measure the true logical error rate, the number of quantum error correction cycles must exceed the code distance.
4. Performance Across All Runs – Does it work without cherry-picking? Logical error rates are only meaningful if we can reproduce them during utility-scale computation, not just in experiments that rely on heavy post-selection.
5. Utility Timescales - Does error correction last the duration of the computation? A logical qubit must exhibit no logical error rates for the full duration of intended computations. Low-frequency errors are detected, not merely inferred from short benchmarking runs.

The whitepaper can be downloaded [here](#).

"This is a strong, timely, and useful framework for cleaning up logical-qubit claims," said Russ Fein, Managing Director, Corporate Fuel Partners. "It is especially valuable for investors and non-expert decision-makers because it provides a simple checklist for separating FTQC-relevant progress from weaker demonstrations."

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.

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.

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