# Nord Quantique aims for compact 1,000-qubit quantum computer with breakthrough error correction by 2031



A quantum computing startup, Nord Quantique, has embarked on an ambitious journey to develop a utility-scale quantum computer boasting over 1,000 logical qubits by 2031. This initiative, if successful, could herald a transformative shift in the realm of high-performance computing (HPC), challenging the very foundations of traditional computing paradigms.

Nord Quantique's proposition hinges on a sophisticated technique known as “multimode encoding” through a method they call the Tesseract code. This innovative approach allows each physical cavity within their quantum system to represent multiple quantum modes, thereby enhancing redundancy and resilience while maintaining a compact design. Julien Camirand Lemyre, the company's CEO, has emphasised that this multimode encoding not only bolsters error correction capabilities but also circumvents the need for a cumbersome array of physical qubits typically required in quantum systems. Their design aims for a reduced operational footprint, occupying merely 20 square metres compared to the sprawling 1,000 to 20,000 square metres demanded by existing platforms.

The implications of this reduced scale are profound. Smaller systems potentially simplify the transition to utility-scale operations, as they require less elaborate cryogenics and control electronics. Moreover, in a significant technical demonstration, Nord’s system showcased remarkable stability over 32 error correction cycles, with no observable decay in quantum information. Expert Yvonne Gao, an Assistant Professor at the National University of Singapore, remarked on the impressive capabilities of their multimode Tesseract encoding and its significance in advancing toward utility-scale quantum computing.

However, scepticism lingers in the quantum community. Despite these promising results, doubts remain regarding the independent validation of Nord Quantique's claims. The company's assertion that its system could crack RSA-830—a substantial cryptographic challenge—in just one hour while using 120 kWh of energy is striking. In contrast, traditional HPC systems would require around 280,000 kWh over nine days to achieve the same result. Although the potential for energy efficiency is intriguing, the milestones toward practical deployment of quantum computing technologies can be perilously vast.

In tandem with Nord Quantique's pursuits, Atom Computing has announced its own advancements in quantum technology, unveiling a 1,225-qubit quantum computer. This achievement places Atom at the forefront, exceeding the previous capabilities of IBM's Osprey processor. Atom's approach uses neutral atoms as qubits, leveraging lasers to maintain precision and stability while presenting scalability advantages through a two-dimensional grid system. They aim to develop a fault-tolerant quantum computer capable of executing quintillions of operations per second. Such progress mirrors the competitive landscape within quantum computing, highlighting the race to overcome existing barriers in error correction and scalability.

As the venture into quantum computing accelerates, the interplay between Nord Quantique’s and Atom Computing’s methodologies underscores the growing momentum within the industry. Both companies are tackling pivotal challenges; while Nord proposes innovations with a focus on compactness and energy efficiency, Atom seeks to demonstrate the viability of scaling qubits effectively. The journey towards practical quantum computing continues to be one filled with promise, alongside a necessity for rigorous validation and consistent real-world performance. As this technological race unfolds, the stakes for cybersecurity, computational speed, and energy sustainability have never been higher.

## Reference Map:

* Paragraph 1 – [[1]](https://www.techradar.com/pro/quantum-computing-startup-wants-to-launch-a-1000-qubit-machine-by-2031-that-could-make-the-traditional-hpc-market-obsolete)
* Paragraph 2 – [[1]](https://www.techradar.com/pro/quantum-computing-startup-wants-to-launch-a-1000-qubit-machine-by-2031-that-could-make-the-traditional-hpc-market-obsolete), [[6]](https://thequantuminsider.com/2023/10/24/quantum-startup-atom-computing-first-to-exceed-1000-qubits/)
* Paragraph 3 – [[1]](https://www.techradar.com/pro/quantum-computing-startup-wants-to-launch-a-1000-qubit-machine-by-2031-that-could-make-the-traditional-hpc-market-obsolete), [[3]](https://arstechnica.com/science/2023/10/atom-computing-is-the-first-to-announce-a-1000-qubit-quantum-computer/), [[4]](https://www.newscientist.com/article/2399246-record-breaking-quantum-computer-has-more-than-1000-qubits//)
* Paragraph 4 – [[1]](https://www.techradar.com/pro/quantum-computing-startup-wants-to-launch-a-1000-qubit-machine-by-2031-that-could-make-the-traditional-hpc-market-obsolete), [[5]](https://singularityhub.com/2023/10/25/atom-computing-says-new-quantum-computer-is-first-to-hit-1000-qubits/), [[6]](https://thequantuminsider.com/2023/10/24/quantum-startup-atom-computing-first-to-exceed-1000-qubits/)
* Paragraph 5 – [[2]](https://www.forbes.com/sites/moorinsights/2023/10/24/atom-computing-announces-record-breaking-1225-qubit-quantum-computer/), [[3]](https://arstechnica.com/science/2023/10/atom-computing-is-the-first-to-announce-a-1000-qubit-quantum-computer/), [[7]](https://siliconangle.com/2023/10/24/quantum-computing-startup-atom-computing-launch-industrys-first-1000-qubit-system/)
* Paragraph 6 – [[1]](https://www.techradar.com/pro/quantum-computing-startup-wants-to-launch-a-1000-qubit-machine-by-2031-that-could-make-the-traditional-hpc-market-obsolete), [[2]](https://www.forbes.com/sites/moorinsights/2023/10/24/atom-computing-announces-record-breaking-1225-qubit-quantum-computer/), [[4]](https://www.newscientist.com/article/2399246-record-breaking-quantum-computer-has-more-than-1000-qubits//)

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## Bibliography

1. <https://www.techradar.com/pro/quantum-computing-startup-wants-to-launch-a-1000-qubit-machine-by-2031-that-could-make-the-traditional-hpc-market-obsolete> - Please view link - unable to able to access data
2. <https://www.forbes.com/sites/moorinsights/2023/10/24/atom-computing-announces-record-breaking-1225-qubit-quantum-computer/> - Atom Computing has unveiled a 1,225-qubit quantum computer, marking a significant advancement in the field. Developed in Boulder, Colorado, this machine represents a substantial leap from their previous 100-qubit system. The company has been selected by DARPA to participate in a program aimed at scaling qubits and developing quantum error correction algorithms. Challenges in scaling include maintaining laser power to hold atoms in place while ensuring precision control. Atom Computing aims to build a fault-tolerant quantum computer capable of executing quintillions of operations per second.
3. <https://arstechnica.com/science/2023/10/atom-computing-is-the-first-to-announce-a-1000-qubit-quantum-computer/> - Atom Computing has announced internal testing of a 1,180-qubit quantum computer, with plans to make it available to customers next year. This system represents a significant advancement from their previous 100-qubit machine. The company employs neutral atoms as qubits, using lasers to create energetically favorable locations for atoms. While the error rate for individual qubit operations is currently high, the system serves as a testbed for quantum error correction work. Atom Computing aims to build a fault-tolerant quantum computer capable of running complex algorithms.
4. <https://www.newscientist.com/article/2399246-record-breaking-quantum-computer-has-more-than-1000-qubits//> - Atom Computing has developed the world's first quantum computer to exceed 1,000 qubits, featuring 1,180 qubits. This machine surpasses IBM's Osprey processor, which has 433 qubits. The system uses neutral atoms trapped by lasers in a 2-dimensional grid, offering scalability advantages. Achieving fault tolerance in quantum computers requires tens of thousands of dedicated error-correcting qubits alongside programmable qubits. Atom Computing's approach aims to address these challenges, moving closer to practical quantum computing applications.
5. <https://singularityhub.com/2023/10/25/atom-computing-says-new-quantum-computer-is-first-to-hit-1000-qubits/> - Atom Computing has announced a 1,180-qubit quantum computer, surpassing IBM's previous record of 433 qubits. The system employs neutral atoms held in place and manipulated by lasers in a vacuum chamber. This approach offers scalability advantages, as adding more qubits involves expanding the 2D grid. Atom Computing's technology aims to address challenges in scaling qubits and developing quantum error correction algorithms, moving closer to practical quantum computing applications.
6. <https://thequantuminsider.com/2023/10/24/quantum-startup-atom-computing-first-to-exceed-1000-qubits/> - Atom Computing has created a 1,225-site atomic array, currently populated with 1,180 qubits, in its next-generation quantum computing platform. This marks the first time a company has crossed the 1,000-qubit threshold for a universal gate-based system. The company's atomic array approach is scaling rapidly and gaining ground on other modalities. CEO Rob Hays highlighted the rapid scaling as a key benefit of Atom Computing's unique technology.
7. <https://siliconangle.com/2023/10/24/quantum-computing-startup-atom-computing-launch-industrys-first-1000-qubit-system/> - Atom Computing has announced the forthcoming availability of a 1,225-site atomic array, populated with 1,180 qubits, within the next generation of its quantum computing platform. This launch marks the first time any company has crossed the 1,000-qubit threshold with a universal gate-based system. Atom Computing employs nuclear-spin qubits created with neutral atoms, aiming to build a fault-tolerant quantum computer capable of executing complex operations.