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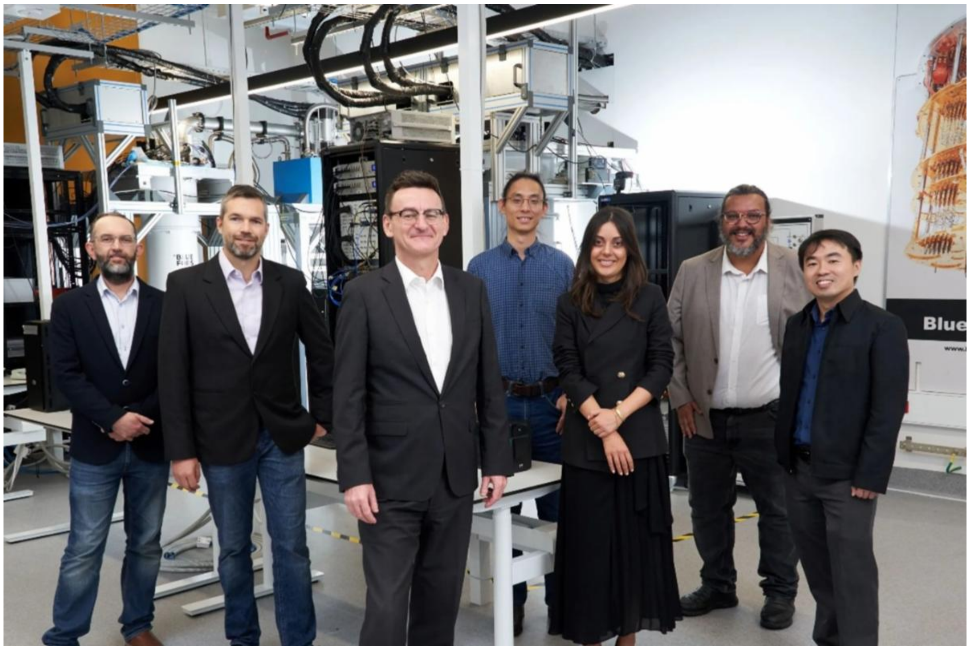
Quantum at the Speed of Silicon: Why We Backed Diraq



Preface: We are pleased to announce our investment in Diraq, a Sydney-based quantum computing company pioneering a scalable approach to fault-tolerant quantum systems. This decision follows extensive diligence into the sector's technical maturity and commercial outlook, and it reflects our conviction that quantum computing is moving from the lab into the real world.

Over the past decade, the promise of quantum computing enabling exponentially faster computation and thereby breakthroughs in cryptography, materials science, pharmaceuticals, and AI has captured the imagination of scientists, technologists, and investors alike. But despite billions in funding and world-class research, quantum's practical deployment has remained elusive, bogged down by scale, manufacturability, and stability challenges.

That dynamic is beginning to shift. By the late 2020s (2027 to 2030 estimates), quantum computing is widely expected to achieve fault tolerance and meaningful qubit counts, potentially ushering in a new era of practical quantum advantage. Industry leaders increasingly share this outlook. IBM has announced a fault-tolerant quantum computing vision by 2030+, a roadmap targeting error-corrected quantum systems with thousands of logical qubits, following its 2023 demonstration of a 1,121-qubit processor ("Condor").[1] Meanwhile, PsiQuantum, backed by BlackRock and Temasek, has publicly committed to delivering a 1 million physical qubit fault-tolerant machine before 2030, using silicon photonics.[2] IonQ forecasts commercially useful systems by 2028.[3,4]

Even former skeptics are shifting their stance. In 2023, NVIDIA CEO Jensen Huang questioned the near-term commercial relevance of quantum, citing a two-decade timeline. However, Huang reversed his view after engaging more deeply with the field, including visits with quantum startups and a growing awareness of Europe's progress. At NVIDIA's GTC Paris 2024, he remarked that "quantum computing is reaching an inflection point" and acknowledged the pace of progress had outstripped his expectations.[5] NVIDIA has since launched CUDA-Q to support hybrid quantum-classical workloads.

McKinsey's 2025 report "The Year of Quantum" forecasts a $72 billion quantum computing market by 2035 and emphasizes that what felt "five to ten years away" now appears "three to five years away." [6]

In short, our conviction in a commercially viable path to quantum computing stems partly from Diraq's rare combination of deep technical credibility and manufacturable architecture.

Why Diraq? Diraq is a Sydney-based quantum computing company spun out of over two decades of research led by Professor Andrew Dzurak, one of the world's foremost physicists in quantum dot technology.[7] In 2015, Dzurak and his team demonstrated the world's first quantum logic gate in silicon, laying the foundation for a platform that transforms conventional silicon transistors into quantum bits (qubits).[8] Andrew Dzurak has published over 200 research papers, is listed on more than 30 patents, and has earned honors including the Eureka Prize for Scientific Research.[9] He is joined by a deep bench of technical talent, a team whose collective work has garnered 25,000+ academic citations, with recognized leaders in solid-state theory, fabrication, engineering, and quantum control.[10,11,12] From spin qubit manipulation to cryogenic electronics, this team has already solved some of the most fundamental challenges in the field.

Rather than pursue more exotic hardware modalities like trapped ions or superconducting circuits, Diraq's silicon spin qubits are fabricated using standard CMOS processes, the same infrastructure behind today's classical semiconductors.[13] This allows Diraq to sidestep many of the bottlenecks facing other quantum architectures and leverage decades of foundry infrastructure for a capital-efficient path to scaling. On the contrary, Superconducting systems like Google's Willow demand room-sized cryogenic setups and complex wiring, while photonics-based approaches, such as PsiQuantum, envision facilities spanning 9,000 square meters.[14,15] Neutral atom platforms, though promising, face serious hurdles scaling from 2D to 3D arrays, an essential step to scale beyond 10,000+ qubits. Managing laser access, cross-talk, and trap stability in 3D remains largely unproven at scale. By contrast, Diraq's system fits in just 5 square meters, small enough for a standard server rack, meaning over 1,200 Diraq machines could occupy the same footprint as one photonic system. Further, silicon spin qubits are small, energy-efficient, and natively compatible with existing chip supply chains, meaning faster prototyping, lower unit costs, and the potential for mass manufacturing on a global scale.

Now that we touched on the *why*, let us shift to Diraq's track record of execution. Notably, Diraq's initial 300mm silicon wafer prototype, designed using CMOS materials and manufactured by IMEC, achieved 99.9% single-qubit fidelity and 99% for all other operations, performance levels that put the company at the cutting edge of quantum hardware.[16] What makes Diraq's 99.9% single-qubit fidelity so groundbreaking is that it disproves the long-standing belief that silicon interference[17] creates too much noise and thereby renders high error rates or low fidelity, preventing silicon quantum dots from achieving practical applications. High fidelity is the prerequisite for executing reliable quantum logic, and silicon had lagged in this metric until now. By matching the fidelity levels of superconducting and ion trap systems, while using standard CMOS processes, Diraq has overcome the noise barrier, which means faster, more reliable gate operations.

Diraq's global portfolio of over 60 patents and applications reflects what we believe to be a broad and defensible moat around silicon spin qubit architectures.[18] The portfolio includes innovations in device fabrication, signal integration, control logic, and scalable system design.[19] These patents span the entire quantum stack, from atomic-level control of quantum states to system-level error correction, and have been granted across key global jurisdictions, creating both competitive insulation and licensing potential. Importantly, Diraq is approaching multiple near-term milestones that could unlock additional breakthroughs. For example, the company is on track to deliver a chip with thousands of qubits (see Diraq's product roadmap on its website).[20] The big picture is that Diraq's architecture is designed with scalability in mind, offering a path, in principle, to integrate millions of physical qubits required to realize error-corrected logical qubits. Even a small number of these logical qubits could enable meaningful progress toward advanced applications such as materials modeling, pharmaceutical design, and eventually AI acceleration.

Further, Diraq is part of a shortlist of companies selected for DARPA's advanced quantum funding initiative, which supports high-potential approaches to scalable fault-tolerant quantum computing by 2033.[21] Through a staged evaluation process, Diraq may unlock material non-dilutive funding, adding a meaningful capital runway and validation from one of the most selective government programs in the world. In addition to DARPA, Diraq has received research funding through Australian government programs and, separately, through U.S. federal support.

Conclusion: Of course, risks remain. Like many hardware design ventures, Diraq faces a long development horizon as large-scale systems will likely take time to mature. The broader quantum landscape is competitive, with incumbents like IBM, Google, and Intel investing heavily. Global macro factors, including geopolitical tensions, supply chain fragility, and inflationary pressures in chip manufacturing, could also present obstacles in sourcing, production, or market access.

However, we believe Diraq is better positioned than most to manage these challenges. Its use of existing CMOS infrastructure provides inherent resilience and scale advantages. We believe its government alignment and academic partnerships help offset capital intensity and attract talent. Further, while we are fully aligned with Diraq's vision to bring scalable quantum computing to market, we also recognize that its modular roadmap offers intermediate milestones, such as successful chip designs and tape outs, or further logical qubit demonstrations which may attract strategic engagement from cloud, semiconductor, or defense stakeholders, offering potential optionality for value realization before full commercialization.

In a space where hype often outpaces hardware, we believe Diraq is different; it is a robust, fabrication-ready platform built by one of the most experienced teams in quantum computing. As the industry shifts from fascination to filtration, we think Diraq has a path to commercializing a fault-tolerant quantum processor.

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1https://www.ibm.com/quantum/blog/large-scale-ftqc
2]https://www.hpcwire.com/2022/04/21/psiquantums-path-to-1-million-qubits-by-the-middle-of-the-decade/
3 https://ionq.com/blog/ionqs-accelerated-roadmap-turning-quantum-ambition-into-reality
4 A physical qubit is a raw hardware qubit susceptible to noise and errors, while a logical qubit is a stable, error-corrected unit formed by encoding many physical qubits to perform reliable quantum computation.
5https://www.cnbc.com/2025/03/20/nvidia-ceo-huang-says-was-wrong-about-timeline-for-quantum-computing.html
6https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-year-of-quantum-from-concept-to-reality-in-2025
7https://www.unsw.edu.au/staff/andrew-dzurak
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16https://www.hpcwire.com/off-the-wire/diraq-reports-99-9-qubit-control-accuracy-with-imec-produced-silicon-quantum-dot/
17While the original technical concern refers specifically to *charge noise in silicon devices*, the simplified explanation in the main text has been adapted for clarity
18https://diraq.com/intellectual-property
19https://patents.google.com/?assignee=Diraq+Ltd&oq=Diraq+Ltd
20https://diraq.com/roadmap
21https://diraq.com/newsdesk/diraq-leading-australian-uk-us-consortium-for-darpa-quantum-benchmarking-initiative

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