ROADMAP 2026–2033

QUANDELA

At Quandela, our mission is to make quantum computing a practical, reliable, and transformative technology for industry and science. Over the past decade, we have pioneered the development of photonic quantum hardware and software platforms that bring us closer to unlocking the full potential of quantum computation. Our roadmap reflects not only our technological achievements but also a clear vision for how quantum computing will evolve, from today's early utility to tomorrow's large-scale, fault-tolerant systems.

Phase 1
Utility

Over the past two years, we have ushered in the era of accessible, usable quantum computing: systems capable of addressing meaningful industrial and scientific use cases, supported by our unique single-photon technology and cloud-accessible quantum processors. Our hardware is complemented by a comprehensive software stack, enabling developers, researchers, and businesses to experiment, design algorithms, and prototype solutions that harness quantum resources. At this stage, our focus is on hybrid workflows in which classical and quantum computing operate together, ensuring users can derive measurable value today while preparing for future performance gains.

Phase 2
Quantum Advantage

We are now moving forward to the second milestone: using quantum computers to accelerate classical computation. Quantum-augmented AI is where we expect to see the largest near-term impact. The enrichment of classical data sets with quantum data and quantum processes—improving machine learning models, synthetic data generation, and classification tasks—represents some of the earliest areas where performance gains stand out. This phase marks the transition from experimentation to demonstrable advantage in targeted application domains.

Phase 3
Large-Scale Fault-Tolerant Architecture

Our north star objective is a fault-tolerant quantum computer capable of tackling the most complex challenges in science and industry. Our hybrid spin-photon quantum computing architecture offers a natural path toward scalable systems with high connectivity and modular design. Major performance achievements in entanglement generation will be demonstrated in early 2026, followed by experimental demonstrations of logical qubits based on our spin-photon platform. This will also be the year we open access to our resource-estimation software tools, enabling partners and users to begin exploration and development of acceleration-scale algorithms, both internally and collaboratively.

In parallel, we are assembling the first quantum computing system integrating our spin-photon sources with unprecedented entanglement generation capabilities, enhanced by a high-speed feedforward module, upgraded compilation software, and new encoding strategies that push computing power far beyond raw qubit number metrics. Our hardware engineering program leverages photonic integrated circuits fabricated with partner foundries, enabling the development of control-chip modules for "repeat-until-success" gates by 2027.

2028–2029 will see performance metrics pushed to within error-correction thresholds, in particular through improvements in optical transmission across all modules and scaling via modular, high-speed optical networking. This hardware trajectory is matched by the continued evolution of our middleware and software stack.

By 2027, we will deliver to our users all the tools needed to begin experimenting with and developing algorithms on hundreds of logical qubits, preparing the way for the hardware of 2030, when we will enter the era of large-scale fault-tolerant quantum computing.

A defining advantage of our photonic approach is its energy efficiency. Preliminary estimates suggest that even at the scale of hundreds of logical qubits, our systems will operate below 500 kW of power consumption—orders of magnitude lower than the 100+ MW projections associated with alternative quantum computing platforms.

As we progress through these phases, our commitment remains clear: to deliver quantum technologies that are not only scientifically groundbreaking but also practically impactful. We invite our partners, customers, and the broader community to join us on this journey—from accessible, usable quantum computing to the era of fault-tolerant, world-changing quantum computation.

Shane Mansfield,
Chief Research Officer

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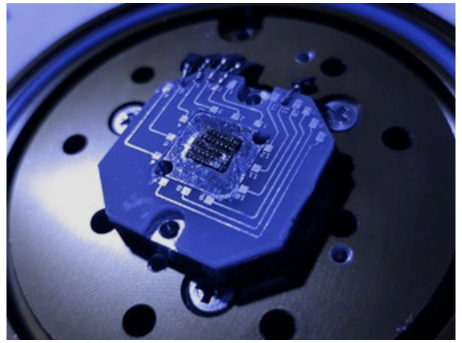
QUANDELA'S ROADMAP

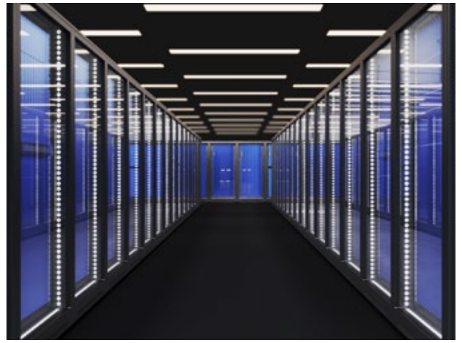
Leading the way towards the fault tolerant era

2016
Most efficient photonic qubit sources

2023
Delivery of quantum computers in Industrial-grade datacenter

2030
Large-scale fault-tolerant quantum computers





Photons at the Heart of Quantum Transformation

Founded in 2017, Quandela is a world leader in full-stack photonic quantum computing. We develop hardware, middleware, and software for a range of industrial applications, including energy, cybersecurity, and finance, showcasing the versatility of our unique technology.

At the heart of our innovations lies eDelight, our cutting-edge solid-state single-photon source that effectively eliminates barriers to the scalable manipulation of single-photon qubits.

Featuring a modular, scalable, upgradeable, and energy efficient architecture, Quandela's mission is to deliver the first useful quantum computer to drive quantum transformation to industry and society.

Shaping the Quantum Future With a Pragmatic Approach

Developing Fault-Tolerant Quantum Devices:

We are building error-corrected quantum computer systems enabled by our industry-grade architecture. Quandela's unique technology is modular, interconnected, and compatible with state-of-the-art error-correcting codes. Our proprietary **Spin-Optical Quantum Computing** architecture empowers us to execute error correction protocols with highly efficient use of qubits. We leverage spin-mediated qubit devices, a unique innovation that enables us to generate deterministic entanglement links between qubits as they are created.

Manufacturing Quantum Computers with Value from Today:

We have a proven track record of delivering industry-grade solutions and high-end products to customers. Our long-term partnerships with world-class research laboratories fuels our ongoing technology innovations. Our QPU manufacturability is guaranteed by high-quality foundry-produced photonic integrated circuits and in-house factory assembly.

Industrializing Quantum Technologies:

In our path to quantum utility, we have optimized the assembly and testing of quantum computers, creating a pilot line for our novel spin-mediated qubit devices. Our architecture ensures scalability and manufacturability via industrial processes.

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Constantly Achieving Timed Roadmap With First-Of-A-Kind Milestones

		2017-2018 ✓	2019 ✓	2020 ✓	2021 ✓	2022 ✓	2023 ✓
		World-leading quantum light sources	Commercialization of core technology	Modular integration – building blocks for scalable quantum systems	Industry-grade, stand-alone quantum emitters	Photonic Quantum Computing user-experience	Integration and long-term operability
Customer Value	QUANTUM SYSTEMS	World's best-in-class single-photon emitter technology made available on the market.		Delivered: • DMX-6: state-of-the-art active demultiplexer for single-photons, • Pigtailed single-photon source device.	**Prometheus:** the first stand-alone single-photon device on the market	Europe's first commercial photonic quantum computer available on the cloud	Ascella QPU 6 qubits >140 QOPS
	APPLICATIONS & USE CASES		Top-class quantum technologies delivered to research labs.			**Entropy:** Quantum-certified random number generation product	• Polymer Classification • Stress simulations for large mechanical structures
		PHOTON EMITTER DEVICES		MODULE INTEGRATION		MIDDLEWARE INTEGRATION	SINGLE PHOTONS
	ERROR CORRECTION & LOGICAL QUBITS						
	DEVELOPER PLATFORM					Launched **Perceval**, Quandela's open-source programming framework with emulator backends.	Quantum Machine Learning and VQE algorithm primitives available to end-users
							DISCOVERY
Innovation	SOFTWARE & ALGORITHMS				Inititated full-stack approach, offering software interface for device testing and characterization.	Created **LOv-calculus:** The user-friendly graphical language for linear-optics	Introduced full software developer kit and REST APIs for cloud-connected Quantum Processor Units.
							FULL-STACK INTEGRATION
	MANUFACTURING & INDUSTRIALIZATION	Reproducible, stable fabrication process for quantum emitter devices	Customer value delivery; market validation; assembled opto-electronic modules.	Production increased to ~10 opto-electronic modules/ year.	Produced over 200 quantum emitter devices/year.	Produced over 350 quantum emitter devices/year.	Paris quantum computer factory opened; factory-scale semiconductor production of over 500 quantum emitter devices/year.
		REPRODUCIBLE AND STABLE SOURCE-DEVICES FABRICATION PROCESS					QUANTUM COMPUTER FACTORY

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Scaling to High-Value, Error-Corrected, Networked Quantum Computing

		2024—25 ✓ Accessible, Reliable Quantum Computing	2026 Targeted Quantum Acceleration	2027 Quantum Computing Scaling via Modularity	2028—29 Crossing Fault-Tolerance Thresholds	2030—31 Quantum Computing in the Fault-Tolerant Regime	2032—33 Large-Scale Quantum Utility
Customer Value	QUANTUM SYSTEMS	**Altaïr** — QOPS >400, 10 physical qubits **Belenos** — QOPS >550 (CNOT), 12 physical qubits Fidelity gains via error mitigation	**Canopus** – QOPS >2000, 24 physical qubits	**Deneb** QOPS >5000 48 physical qubits Modular, energy-efficient photonic architecture	**Diadem** QOPS >9500 ~100 physical qubits Modular, networked photonic system	**Sirius** QOPS >10^{10} Logical qubits: 100+ Fully error-corrected quantum processor	**Ursa Major** QOPS >10^{14} Logical qubits: ~1000 Large-scale, fault-tolerant quantum system
	APPLICATIONS & USE CASES	• Quantum Machine Learning demonstrations • Winner of Airbus–BMW challenge (QML)	Hybrid quantum – AI acceleration pilots	• Hybrid quantum – AI acceleration use cases • Measured performance-per-watt advantages in ML and optimisation	• Sustained hybrid quantum – classical workloads • System-level energy-efficiency benchmarks	Reliable execution of large-scale scientific and industrial workloads	Cross-domain quantum utility Secure delegated quantum computing
	ERROR CORRECTION & LOGICAL QUBITS	Error mitigation techniques validated on hardware	First photonic logical qubit demonstrations	• Multi-logical-qubit demonstrations • Logical qubits (demo): ~10	Andromeda prototype QOPS >10^{6} Logical qubits: ~50 Operation below error-correction thresholds Distributed quantum error correction		
		SINGLE PHOTONS	LOGICAL QUBITS · CLUSTER PHOTONS	NETWORKING	DISTRIBUTED ERROR CORRECTIONS		
	DEVELOPER PLATFORM	• Cloud 2.0 released Toolbox of solvers for early use cases	• Error mitigation suite release Developer access to logical-qubit-aware workflows.	• Fault-tolerant software extensions • Logical-qubit-aware programming workflows	Fault-tolerant execution workflows	Hardware-agnostic fault-tolerant programming model	**Ursa Major:** QOPS>10^{14} Logical qubits: 1000
		UTILITY		ADVANTAGE	LARGE SCALE QUANTUM ADVANTAGE		
Innovation	SOFTWARE & ALGORITHMS	MerLin released: hybrid quantum – AI framework.	• MerLin extension for acceleration workflows • Beta release of logical-qubit resource estimator Energy-aware resource estimation	• Error-correction compilers and decoders • Optimised for photonic architectures	• Distributed compilation and scheduling • Error- and energy-aware resource estimation	• Secure delegated quantum computing • Distributed resource management	
		UTILITY		ERROR CORRECTIONS			
	MANUFACTURING & INDUSTRIALIZATION	Factory expansion and semiconductor pilot line	Establishment of wafer-scale production line (Munich, DE)	• Automated clean-room fabrication • Increased throughput and yield for complex devices	Increased integration through heterogeneous chips	Repeatable production of heterogeneous integrated quantum chips	Mass manufacture of logical-qubit chips
		SEMICONDUCTOR QUANTUM DEVICE FABRICATION FACILITY		MULTI-SITE, LARGE-SCALE PRODUCTION	QUANTUM-CENTRIC DATA CENTER		

Relevant Scientific Publications

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Driven by Quantum, Empowered by Quandela

Our modular and interconnected approach enables a reliable, scalable platform for quantum computing systems with real-world impact.

We deployed the first photonic quantum processing units on the cloud in January 2023, and soon after delivered quantum computers to datacenters in France and Canada.

Quandela's technical roadmap focuses on delivering useful near-term products while laying the foundations for large-scale, fault-tolerant quantum computing through a patented modular architecture and industrial-scale manufacturing processes.

From enhancing data security and optimising computational performance to advancing scientific discovery in fields from medical imaging to environmental monitoring, Quandela is helping turn quantum potential into practical utility.

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Of Technology and Usher
In A New Era of Innovation.

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Quantum Technologies
Developed in Europe, deployed globally