

ROADMAP 2026–2033



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.

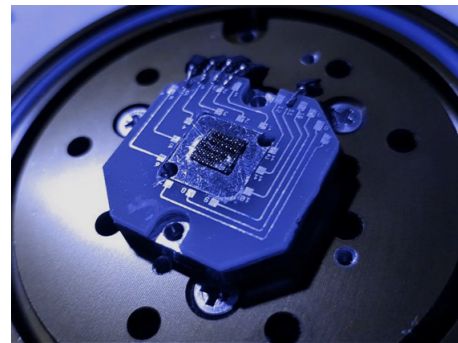
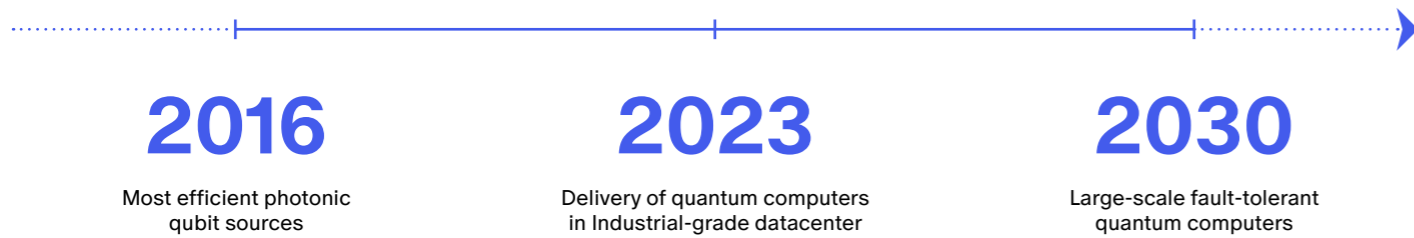
A defining advantage of our photonic approach is its energy efficiency. Preliminary estimates suggest that even at the scale of hundreds of logical qubits, our systems will operate below 500 kW of power consumption—orders of magnitude lower than the 100+ MW projections associated with alternative quantum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



Leading the way towards the fault tolerant era



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.



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

2017-2018 ✓

World-leading quantum light sources

2019 ✓

Commercialization of core technology

2020 ✓

Modular integration – building blocks for scalable quantum systems

2021 ✓

Industry-grade, stand-alone quantum emitters

2022 ✓

Photonic Quantum Computing user-experience

2023 ✓

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

Initiated 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



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

2024–25 ✓

Accessible, Reliable Quantum Computing

Altair — QOPS >400, 10 physical qubits
Belenos — QOPS >550 (CNOT), 12 physical qubits
Fidelity gains via error mitigation

- Quantum Machine Learning demonstrations
- Winner of Airbus–BMW challenge (QML)

Error mitigation techniques validated on hardware

SINGLE PHOTONS

- Cloud 2.0 released
Toolbox of solvers for early use cases

UTILITY

MerLin released: hybrid quantum – AI framework.

UTILITY

Factory expansion and semiconductor pilot line

SEMICONDUCTOR QUANTUM DEVICE FABRICATION FACILITY

2026 ♡

Targeted Quantum Acceleration

Canopus – QOPS >2000, 24 physical qubits

Hybrid quantum – AI acceleration pilots

First photonic logical qubit demonstrations

LOGICAL QUBITS CLUSTER PHOTONS

- Error mitigation suite release
Developer access to logical-qubit-aware workflows.

- MerLin extension for acceleration workflows
- Beta release of logical-qubit resource estimator
Energy-aware resource estimation

Establishment of wafer-scale production line (Munich, DE)

2027

Quantum Computing Scaling via Modularity

Deneb
QOPS >5000
48 physical qubits
Modular, energy-efficient photonic architecture

- Hybrid quantum – AI acceleration use cases
- Measured performance-per-watt advantages in ML and optimisation

- Multi-logical-qubit demonstrations
- Logical qubits (demo): ~10

NETWORKING

- Fault-tolerant software extensions
- Logical-qubit-aware programming workflows

ADVANTAGE

- Error-correction compilers and decoders
- Optimised for photonic architectures

ERROR CORRECTIONS

- Automated clean-room fabrication
- Increased throughput and yield for complex devices

MULTI-SITE, LARGE-SCALE PRODUCTION

2028–29

Crossing Fault-Tolerance Thresholds

Diadem
QOPS >9500
~100 physical qubits
Modular, networked photonic system

- Sustained hybrid quantum – classical workloads
- System-level energy-efficiency benchmarks

Andromeda prototype
QOPS >10⁶
Logical qubits: ~50
Operation below error-correction thresholds
Distributed quantum error correction

DISTRIBUTED ERROR CORRECTIONS

Fault-tolerant execution workflows

LARGE SCALE QUANTUM ADVANTAGE

- Distributed compilation and scheduling
- Error- and energy-aware resource estimation

Increased integration through heterogeneous chips

QUANTUM-CENTRIC DATA CENTER

2030–31

Quantum Computing in the Fault-Tolerant Regime

Sirius
QOPS >10¹⁰
Logical qubits: 100+
Fully error-corrected quantum processor

Reliable execution of large-scale scientific and industrial workloads

Hardware-agnostic fault-tolerant programming model

- Secure delegated quantum computing
- Distributed resource management

Repeatable production of heterogeneous integrated quantum chips

2032–33

Large-Scale Quantum Utility

Ursa Major
QOPS >10¹⁴
Logical qubits: ~1000
Large-scale, fault-tolerant quantum system

Cross-domain quantum utility
Secure delegated quantum computing

Ursa Major: QOPS>10¹⁴
Logical qubits: 1000

Mass manufacture of logical-qubit chips

Customer Value

QUANTUM SYSTEMS

APPLICATIONS & USE CASES

ERROR CORRECTION & LOGICAL QUBITS

DEVELOPER PLATFORM

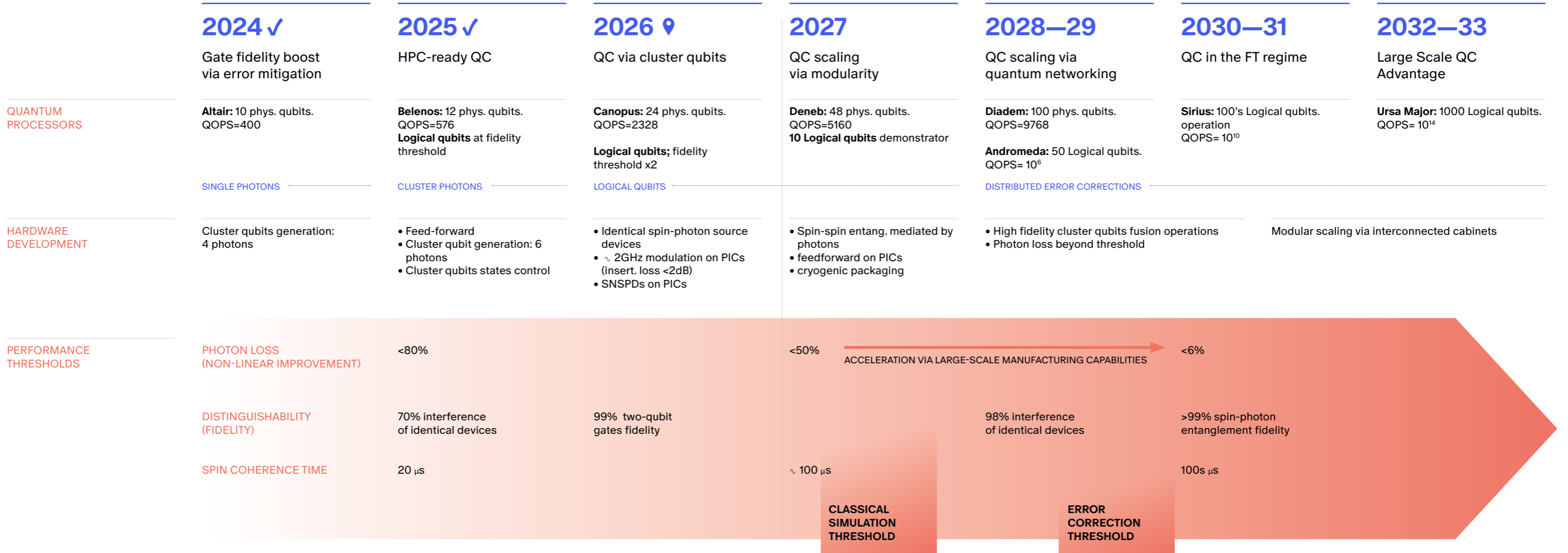
Innovation

SOFTWARE & ALGORITHMS

MANUFACTURING & INDUSTRIALIZATION



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



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quandela.com

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.





Join Us to Shape the Future
Of Technology and Usher
In A New Era of Innovation.

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Quantum Technologies
Developed in Europe, deployed globally