**Pro/Briefings**

# Quantum computing

## The European startups lining up a quantum leap

Classical computers use binary "bits" that exist either as 0 or 1 to encode information. Quantum computers instead use infinitely small quantum bits — qubits — which can be 0 or 1 at the same time. This allows them to simultaneously consider a much larger number of possible combinations than classical computers can, and therefore calculate outcomes at much faster speeds.

# Market 101

For years, "quantum supremacy" was the holy grail that labs around the world were striving towards as they tried to produce a quantum computer that would be able to solve problems a traditional computer could not. After teams at Google and China's University of Science and Technology demonstrated quantum supremacy (in fairly specific and theoretical situations) in 2019 and 2021, the goal posts have moved to demonstrating "quantum advantage", with a focus on solving problems in a practical application. Though it may still be a long while until then, the timelines are now clearer than ever.

This is fuelling cautious excitement in quantum startups — combined with the fact that in this nascent industry, breakthroughs can come in unexpected places. American giants may have the biggest quantum computers with the most qubits, but startups are betting that any of them could discover higher quality qubits that are more reliable and easier to scale. Their pitch to investors is ultimate risk with ultimate reward, in a sector where there's all to play for.

## Market map

### Software

| | | | |
|---|---|---|---|
| Cambridge Quantum Computing | Qilimanjaro Quantum Tech | Multiverse Computing SL | HQS Quantum Simulations |
| Riverlane | Phasecraft | Molecular Quantum Solutions | ColibrITD |
| Qubit Pharmaceuticals SAS | Pharmacelera | Kuano | ChemAlive |
| Quantastica | ParityQC | JoS Quantum | Beit.tech |

### Hardware

#### Computing

| | | | |
|---|---|---|---|
| Oxford Ionics | Orca Computing | Pasqal | Quantum Motion |
| Universal Quantum | Alice and Bob | IQM | QuiX |

#### Components + materials

| | | | |
|---|---|---|---|
| Qblox | Delft Circuits | C12 quantum electronics | Quandela |
| AegiQ | Sparrow Quantum | Quantware | |

#### Quantum internet

| | | |
|---|---|---|
| Miraex | QphoX | Nu Quantum Ltd |

### Security

| | | | |
|---|---|---|---|
| Crypta Labs Limited | Infiniquant | PQShield | Quside |
| Crypto Quantique | KETS Quantum Security | QuantiCor Security | Terra Quantum |
| CryptoNext Security | | | |

## Key stats

# €400-750bn

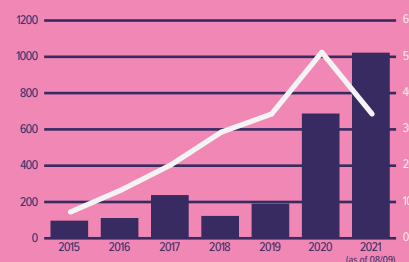projected value created through quantum computing in the next 15-30 years[1]

# 28

% of large companies with quantum aspirations that plan to invest more than $1m in the technology[2]

# 20 seconds

speed at which a photon-based quantum system calculated what would take a supercomputer 600m years, in a show of quantum supremacy at China's University of Science and Technology

**Funding for quantum computing increased more than 10x since 2015**
Global VC funding into quantum computing ($m) 📊
and number of funding rounds 📈



Source: Pitchbook

**sifted/** FT

**Quantum computer use cases**

**1. Simulations:** Using quantum computers to simulate structures and processes that classical computers have trouble representing
*E.g. drug discovery, battery design*

**2. Optimisation:** Dramatically decreasing the range of possible options in complex situations involving multiple variables
*E.g. route logistics, portfolio risk management*

**3. Machine learning:** Identifying patterns in large datasets to improve machine learning
*E.g: accelerating the use of AI for autonomous vehicles*

**4. Cryptography:** As quantum computers can perform gazillions of calculations at the same time, they are likely at some point to be able to break classical encryption systems, requiring a new wave of quantum encryption tech for stronger protection

# Trends to watch

## 1. The money tree

→ Quantum-as-a-service allows startups to collect revenues and clients to reap the benefits of quantum technology before the industry reaches quantum advantage.

→ Startups are collaborating with the American tech giants dominating the subsector, or going it alone by offering quantum software services for specific use cases.

## 2. Cutting through the noise

→ Today's quantum computers can perform calculations stably for only a few seconds before qubits encounter errors and break down, limiting their utility.

→ Some startups are trying to develop error-tolerant quantum computers, while others are designing hardware with a specific application in mind, requiring less complex algorithms and leading to fewer errors.

## 3. The winning technology

→ There are many competing types of qubits being developed. Superconducting qubits are the most advanced in their development, but other qubits are based on photonics, trapped ions and neutral atoms.

→ One of these could emerge as the ultimate winner, sweeping away the rest, but in the medium term at least it's more likely that multiple types of quantum computer will coexist, with different machines suited to particular types of applications.

## 4. Scaling quantum computers

→ According to scientists, quantum computers need at least 1000 qubits to be commercially useful, a goal that IBM aims to reach by 2023. Today's biggest machines have just over 100.

→ The answer may lie not only in scaling up individual quantum computers, but linking them to each other to create networks of computing power using quantum modems, for example.

## Sifted take

While the US and China might have dominated on the hardware so far, Europe still has every possibility of leapfrogging them with a breakthrough. And in any case, as in classical computing, some of the biggest opportunities could come from quantum software, where the market is still wide open. The key to success right now is companies securing the best teams — the race for talent is going to dominate the industry in the next year.

## 44 startups tracked by Sifted

### Subindustries

**19**/44 Quantum hardware

**16**/44 Quantum software

**9**/44 Quantum security

## 41%

are university spinouts

**2018** Avg. launch year
**1.2 years** Avg. launch to seed
**2.5 years** Avg. seed to Series A
**€4.8m** Avg. seed funding
**€16m** Avg. seed valuation
**€32m** Avg. Series A funding
**€108m** Avg. Series A valuation

## Investors by type

**47**% VC fund

**24**% Public funding

**12**% CVC

**9**% Accelerator

**8**% Angel

## Most active investors by deal count

European Innovation Council **(8)**

Quantonation **(7)**

Innovate UK **(5)**

Creative Destruction Lab **(4)**

Bpifrance **(4)**

High-Tech Gründerfonds **(4)**

# Early stage startups to watch

Europe's leading pre-series A startups (all published data verified)

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## QphoX

**Quantum hardware** Quantum internet

📍 Delft, Netherlands   🚩 2021

*RISING STAR*

| TOTAL FUNDING (€) | LAST ROUND SIZE (€) |
|---|---|
| 2m | 2m |
| **LAST ROUND STAGE** | **VALUATION (€)** |
| Seed | 10m |

Is developing a modem to link different quantum processors together, thereby addressing the scaling challenges of quantum computing. The startup hopes to be the first to commercialise its quantum modem and expects to start tests with customers within two years.

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## Multiverse Computing SL

**Quantum software** Applications (finance)

📍 San Sebastián, Spain   🚩 2019

*RISING STAR*

| TOTAL FUNDING (€) | LAST ROUND SIZE (€) |
|---|---|
| 11.5m | 10m |
| **LAST ROUND STAGE** | **VALUATION (€)** |
| Seed | 34.5m |

Has developed quantum software that reportedly speeds up banking operations like portfolio optimisation and fraud detection by 100x. The company matches algorithms with a specific quantum computer best suited to a given problem. Clients include Caixa Bank, the Bank of Canada and Spanish bank BBVA.

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## Alice&Bob

**Quantum hardware** Computing

📍 Paris, France   🚩 2020

*RISING STAR*

| TOTAL FUNDING (€) | LAST ROUND SIZE (€) |
|---|---|
| 3m | 3m |
| **LAST ROUND STAGE** | **VALUATION (€)** |
| Seed | Undisclosed |

Has developed a prototype for the first "fault-tolerant" quantum computer, which reportedly reduces the number of errors by 300x by automating corrections. Drawing on the expertise of a consortium of French universities and research institutes, the company aims to develop a fully operational quantum computer within five years.

## Qblox

**Quantum hardware**  Components & materials

📍 Delft, Netherlands     🚩 2018

**TOTAL FUNDING (€)**
5m

**LAST ROUND SIZE (€)**
Undisclosed

**LAST ROUND STAGE**
Grant

**VALUATION (€)**
Undisclosed

## QuantWare

**Quantum hardware**  Components & materials

📍 Delft, Netherlands     🚩 2021

**TOTAL FUNDING (€)**
1.2m

**LAST ROUND SIZE (€)**
1.2m

**LAST ROUND STAGE**
Pre-seed

**VALUATION (€)**
Undisclosed

## Sparrow Quantum

**Quantum hardware**  Components & materials

📍 Copenhagen, Denmark     🚩 2015

**TOTAL FUNDING (€)**
1m

**LAST ROUND SIZE (€)**
1m

**LAST ROUND STAGE**
Pre-seed

**VALUATION (€)**
Undisclosed

## C12 Quantum Electronics

**Quantum hardware**  Computing

📍 Paris, France     🚩 2020

**TOTAL FUNDING (€)**
9.1m

**LAST ROUND SIZE (€)**
9.1m

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
Undisclosed

## Universal Quantum

**Quantum hardware**  Computing

📍 Brighton, United Kingdom     🚩 2018

**TOTAL FUNDING (€)**
4m

**LAST ROUND SIZE (€)**
4m

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
Undisclosed

## ORCA Computing

**Quantum hardware**  Computing

📍 London, United Kingdom     🚩 2019

**TOTAL FUNDING (€)**
3.5m

**LAST ROUND SIZE (€)**
3.5m

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
16m

## Miraex

**Quantum hardware**  Quantum internet

📍 Ecublens, Switzerland     🚩 2019

**TOTAL FUNDING (€)**
10m

**LAST ROUND SIZE (€)**
3.8m

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
Undisclosed

## Qubit Pharmaceuticals SAS

**Quantum software**  Applications (pharma)

📍 Paris, France     🚩 2020

**TOTAL FUNDING (€)**
4m

**LAST ROUND SIZE (€)**
1.3m

**LAST ROUND STAGE**
Pre-seed

**VALUATION (€)**
Undisclosed

## Molecular Quantum Solutions

**Quantum software**  Applications (pharma)

📍 Søborg, Denmark     🚩 2019

**TOTAL FUNDING (€)**
211k

**LAST ROUND SIZE (€)**
27k

**LAST ROUND STAGE**
Angel

**VALUATION (€)**
180k

## Phasecraft

**Quantum software**  Applications (various)

📍 London, United Kingdom     🚩 2018

**TOTAL FUNDING (€)**
5.3m

**LAST ROUND SIZE (€)**
4.4m

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
Undisclosed

## Quantastica

**Quantum software**  Applications (various)

📍 Helsinki, Estonia     🚩 2019

**TOTAL FUNDING (€)**
200k

**LAST ROUND SIZE (€)**
200k

**LAST ROUND STAGE**
Pre-seed

**VALUATION (€)**
1m

## ColibrITD

**Quantum software**  Applications (various)

📍 Paris, France     🚩 2019

**TOTAL FUNDING (€)**
300k

**LAST ROUND SIZE (€)**
Undisclosed

**LAST ROUND STAGE**
Bootstrapped

**VALUATION (€)**
Undisclosed

## Nu Quantum Ltd

**Quantum hardware**  Quantum internet

📍 Cambridge, United Kingdom      🚩 2018

**TOTAL FUNDING (€)**
3.3m

**LAST ROUND SIZE (€)**
2.5m

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
12.5m

## Crypta Labs Limited

**Quantum security**

📍 London, United Kingdom      🚩 2014

**TOTAL FUNDING (€)**
7.4m

**LAST ROUND SIZE (€)**
400k

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
8m

## KETS Quantum Security

**Quantum security**

📍 Bristol, United Kingdom      🚩 2016

**TOTAL FUNDING (€)**
5.5m

**LAST ROUND SIZE (€)**
3.7m

**LAST ROUND STAGE**
Pre-Series A

**VALUATION (€)**
14.5m

## QuantiCor Security

**Quantum security**

📍 Darmstadt, Germany      🚩 2018

**TOTAL FUNDING (€)**
830k

**LAST ROUND SIZE (€)**
780k

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
Undisclosed

## PQShield

**Quantum security**

📍 Oxford, United Kingdom      🚩 2018

**TOTAL FUNDING (€)**
6.4m

**LAST ROUND SIZE (€)**
6.4m

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
Undisclosed

## Quside

**Quantum security**

📍 Barcelona, Spain      🚩 2017

**TOTAL FUNDING (€)**
6m

**LAST ROUND SIZE (€)**
Undisclosed

**LAST ROUND STAGE**
Seed

**VALUATION (€)**
Undisclosed

# Europe's success stories

Who early stage startups are up against

## Arqit

**IPO**

→ Focuses on encryption and security matters in quantum computing

→ Went public via a SPAC at a $1.4bn valuation last year

## IQM Quantum Computers

**EARLY VC**

→ Aims to build Finland's first commercial 54-qubit superconducting quantum computer by 2024 (the company debuted a five-qubit machine in November)

→ Has raised the most ($118m) of all private quantum computing companies in Europe

# Sources

## Data sources

Sifted proprietary data

Dealroom.co

## Research reports

[1] The Path to Building Quantum Advantage | BCG | July 2021

## News articles

[2] Dozens of companies budget $1m+ for quantum computing as tech race intensifies | Sifted | January 2022

Quantum computing's wiring problem solved by microwave device | Sifted | December 2021

Quantum algorithms that speed up banking operations 100x are here | Sifted | October 2021

VCs make record bets on quantum computing | PitchBook | September 2021

European startups want to unleash the power of quantum computing as early as this decade | 1E9 | June 2021

The widely anticipated quantum internet breakthrough is finally here | Sifted | May 2021

Why investors love quantum-as-a-service | Sifted | March 2021

Why now is the right time to invest in European quantum computing | Sifted | March 2021

11 European quantum computing companies to watch | Sifted | March 2021

Path to European quantum unicorns | EPJ Quantum Technology | February 2021

## How would you rate this briefing?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|----|

bad                                                                 loved it

Cover image: Manuel Jota

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