SPECTRUM
THE QUANTUM SWITCH

Quantum computers can spur the development of breakthroughs in science and technology, tackling problems that today's computers cannot handle. Unfortunately, the low number of qubits that hardware can support and the large number of required cables are preventing the technology from making a bigger market penetration. The EU-funded SPECTRUM project will develop a technology to simplify the control over multiple qubits through the same cable. Researchers will develop a superconducting switch featuring high switching speeds and negligible power dissipation. The switch can be directly connected to the quantum processing units, leading to lower system downtime, costs, and smaller hardware footprint.
The new switch will also lower related downtime cost and overall space occupied by the hardware.

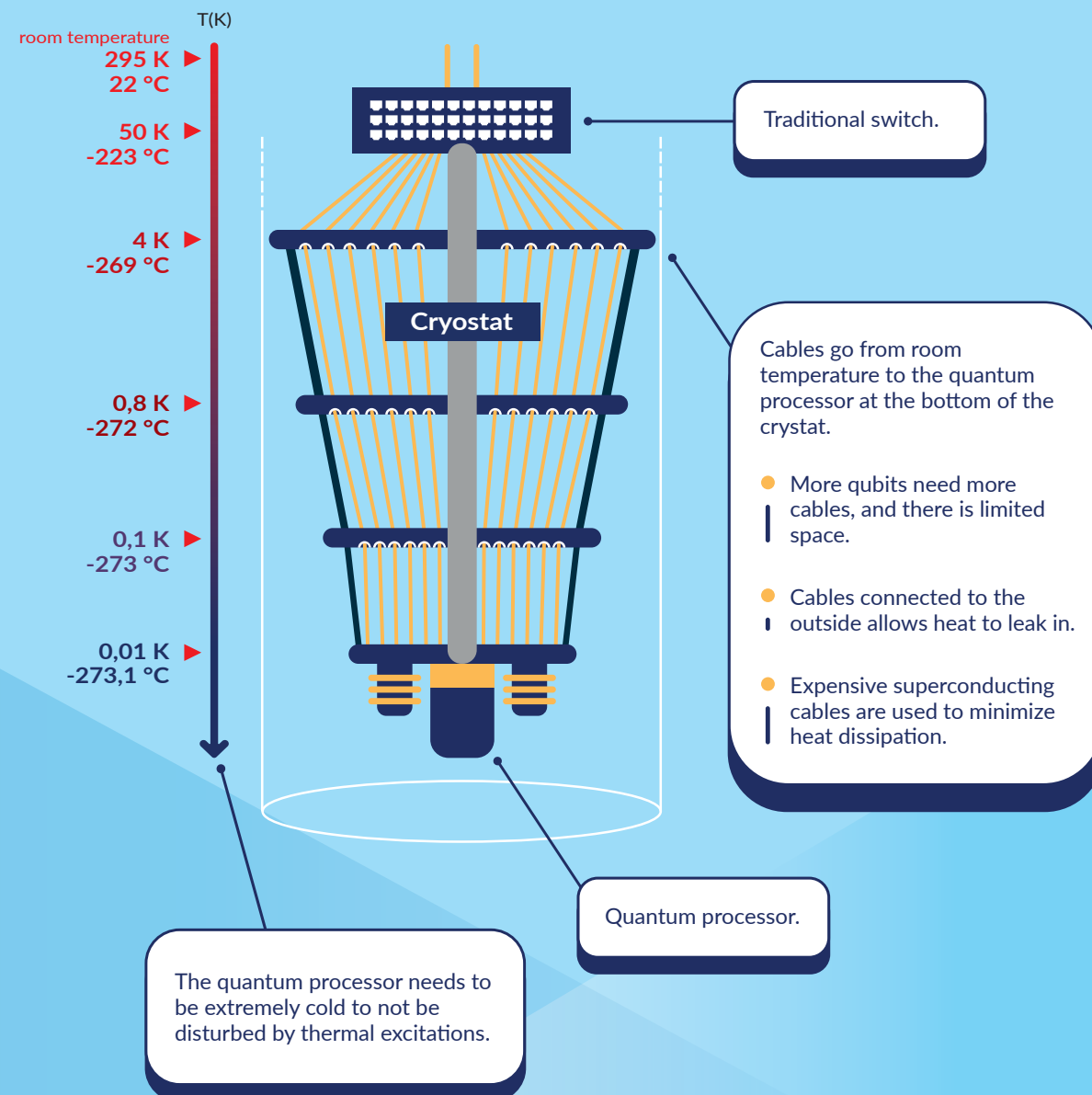## Traditional VS Quantum computer

0 1
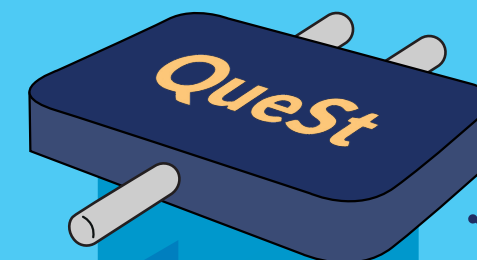Classical computers store information in bits that can take one of two possible values: either 0 or 1.

A quantum bit, or qubit, is the basic unit of quantum information. It can be in a quantum superposition of 0 and 1.

Quantum computers process information stored in quantum states. This means quantum effects such as superposition and entanglement can be utilized.

T(K)

room temperature
295 K / 22 °C
50 K / -223 °C
4 K / -269 °C
0,8 K / -272 °C
0,1 K / -273 °C
0,01 K / -273,1 °C

Cryostat

Traditional switch.

Cables go from room temperature to the quantum processor at the bottom of the crystat.

- More qubits need more cables, and there is limited space.
- Cables connected to the outside allows heat to leak in.
- Expensive superconducting cables are used to minimize heat dissipation.

Quantum processor.

The quantum processor needs to be extremely cold to not be disturbed by thermal excitations.

QueSt
QUANTUM SUPERCONDUCTING SWITCH

QueSt

The switch bridges the connection from classical electronics outside of the cryostat to the qubits on the inside, to be able to route signals to and from the qubits in a versatile and programmable way.
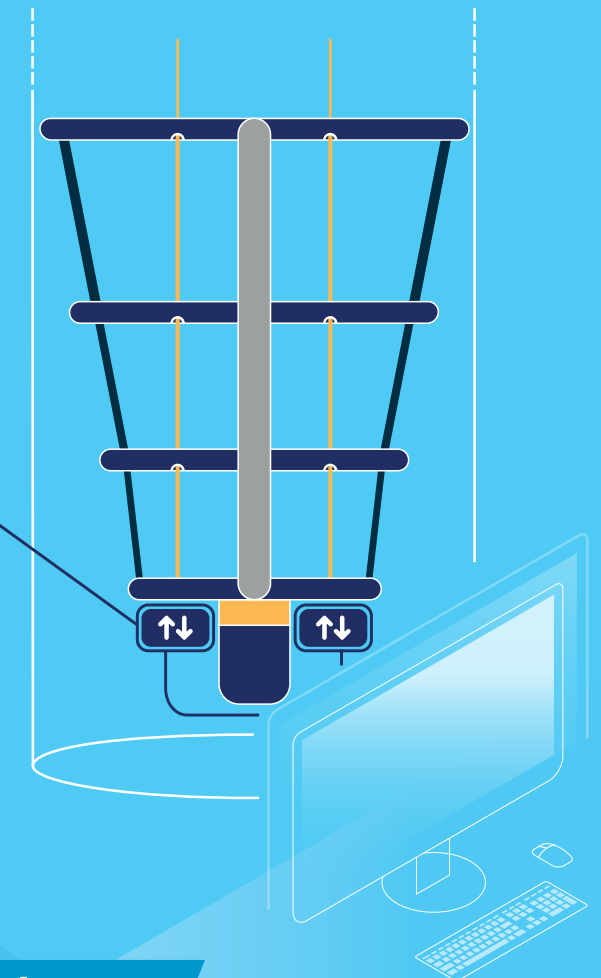
Advantages

- **Q** Integrates with classical electronics as well as quantum processors.
- ❄ Minimal heating. Fewer expensive cables needed.
- ⚡ Rapid switching rate. Wide frequency range.

Some applications of a Quantum computer

⚙ Optimization
Optimization is the process of finding the best solution to a problem. Quantum computing is believed to be useful for logistics in particular, where optimization problems of for example traffic flow and airline route assignments are extremely complex.

Simulation
Calculating the behavior of quantum systems is difficult on classical computers, but a quantum computer being a quantum system itself could simulate other quantum systems. This could be especially useful for materials science and chemical engineering.

🛡 Cybersecurity & criptography
A large quantum computer could break crypto protocols that are popular in this day. But quantum technology also provides new secure ways of encrypting data.

Project partners

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