



# OUR QUANTUM COMPUTER

INSIDE INDUSTRY-STANDARD 19" RACK



## AQT DEMONSTRATED:

- 50+ ion-qubits
- 24-qubit entanglement
- Shor's algorithm
- Quantum Error Correction
- Fault-tolerant performance
- Demo'd finance applications
- Demo'd security applications
- Demo'd chemistry applications
- ...

## WITH OUR SYSTEM BEING:

- Rack-mounted
- Cloud-accessible
- Data-center compatible



# HOLLISTIC PERFORMANCE

Evaluating the quality of our quantum computer



## QUANTUM VOLUME

Achieving high fidelity control in continuously larger registers, while maintaining versatile computations, and achieving sufficient output quality is highly challenging.

**We demonstrate a quantum volume of 128, which outperforms all devices in Europe.**





# APPLICATION: CYBER - SECURITY

1-2 BEUR market by 2030, according to McKinsey (2021)

Realization in 2021 with  
 CAMBRIDGE QUANTUM COMPUTING

## ENCRYPTION

In data-centers, the trustworthiness of the hardware and routines may be questioned – in particular processes for encryption purposes.

Applications extend to classical Monte-Carlo simulations and online casinos.

Results from our quantum computer implementations

Device	Type	$M_{obs}$	$\max \delta$ (Raz)	$\max \delta$ (Dodis)	$\eta$	$\eta_S$
AQT/UIBK	Ion-trap	3.9	0.209	0.132	0.15	1.16
Quantinuum H1	Ion-trap	3.88	0.209	0.127	0.14	1.11
Quantinuum H0	Ion-trap	3.83	0.209	0.114	0.12	1.01
IBM <i>ibmq_toronto</i>	Superconducting	3.62	0.209	0.082	0.06	0.72
IBM <i>ibmq_ourense</i>	Superconducting	3.35	0.203	0.058	0.015	0.49
IBM <i>ibmq_valencia</i>	Superconducting	3.11	0.149	0.043	0	0

Duncan Jones, CQC, Head of Quantum Cybersecurity:  
We are comfortable describing that [AQT device] as "world-class".

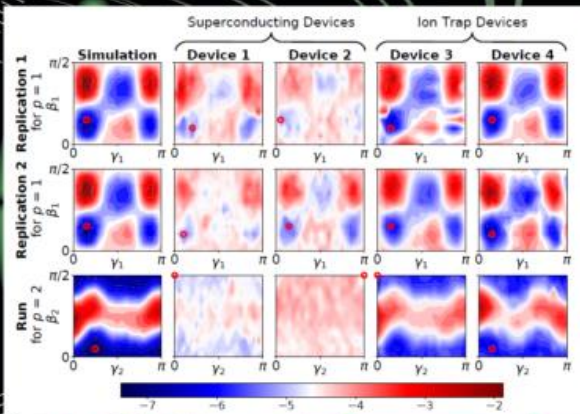
Reference: Quantum 7, 969 (2023)



# OPTIMISATION

2-5 BUSD market by 2030, estimate based on BCG (2019)

Realization in 2023 with  
 PlanQK



## MAX-CUT PROBLEM

Quantum Computers offer new solution for optimisation problems such as positioning of antennas, hospitals, supermarkets, etc.

Prof. Leymann, PlanQK & IAAS @ Uni Stuttgart  
With your [AQT] devices, we get better and faster answers than from your competitors.

Reference: arxiv, 2304.12718



# APPLICATION: CHEMISTRY

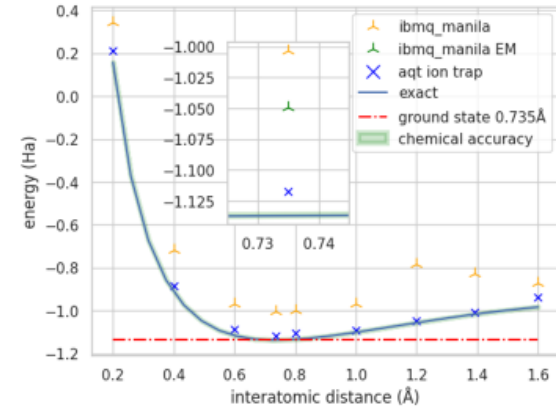
4-6 BUSD market by 2030, according to BCG (2019)

Realization in 2023 with  
 Fraunhofer IKS

## LITHIUM-HYDRATE / H2

Quantum computers are perfectly suited to support calculations in chemistry, e.g. investigate the energy of molecules.

We implemented such calculations for Hydrogen and Lithium-Hydrate, which may find later use via batteries in the automotive-market.



Jeanette Lorenz, FH IKS, Head of Department:  
We can do notably better calculations with AQT than with IBM devices.

Reference: internal project (2023)



# APPLICATION: RISK

2-5 BUSD market by 2030, according to BCG (2019)

Realization in 2023 with  
 JoS QUANTUM

# BLACKOUT

## RISK ANALYSIS OF NETWORK FAILURE

Nodes in a network can work, fail, and even trigger other nodes in the system to fail. The calculation of probabilities for different scenarios scales unfavourable with the system size and topology. Quantum computers offer means to calculate these probabilities beyond Monte-Carlo methods. These methods are applicable to power lines, mobile networks, water lines, banks, and more

Markus Braun, JoS, CEO:  
Risk analysis can be shorten from days to minutes.

Reference: arXiv:2303.16588 (2023)