The Era of Quantum Utility

IBM **Quantum**

Zora Hollá
IBM Quantum Ambassador

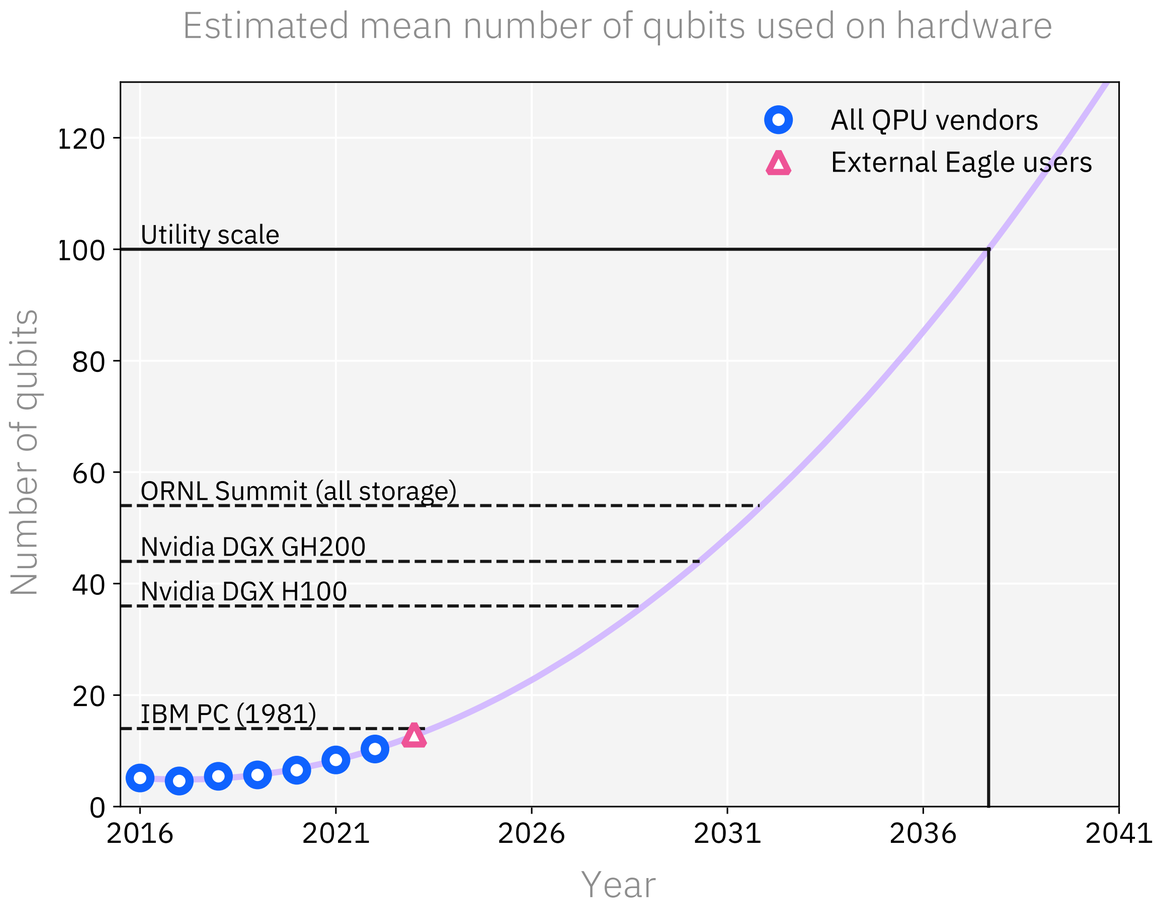
Quantum state of play

Since we put the first quantum computer on the cloud in 2016, quantum computing has largely been in an exploratory phase.

Experiments validate the tenets of quantum computation, but do not push the field beyond the reach of classical compute.

Simulators provide little experimental value; you can't do quantum computing without quantum hardware.

The community needs to move beyond simple experiments to demonstrate the utility of quantum computing in multiple domains.



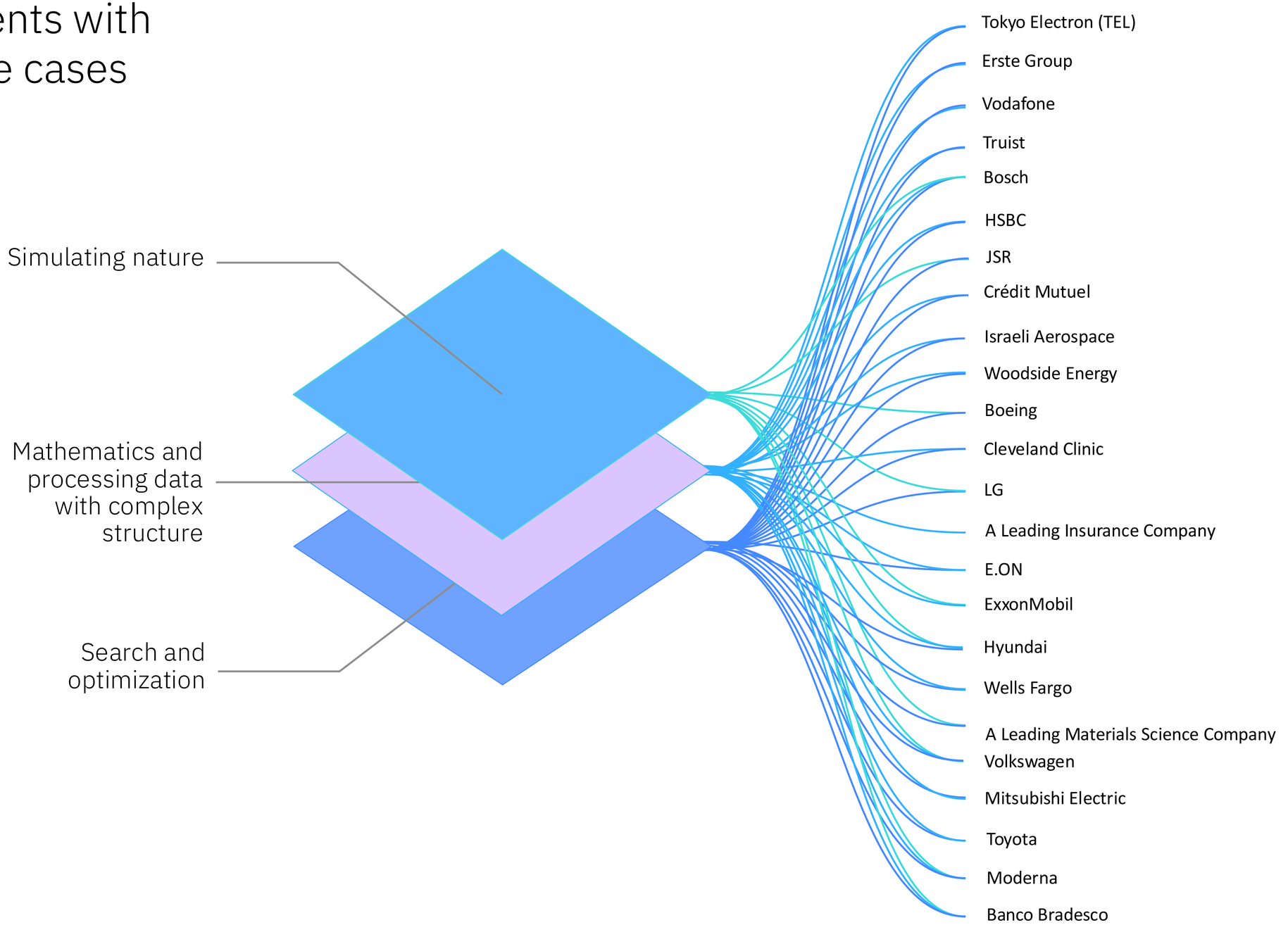
Data for all vendors taken from: arXiv:2307.16130

This will take too long!

We need a disruptive change!

A Quantum Computational Scientist is *not* interested in the quantum machine itself, but rather in utilizing the machine to solve a distinct computational problem.

Connecting industry clients with quantum computing use cases

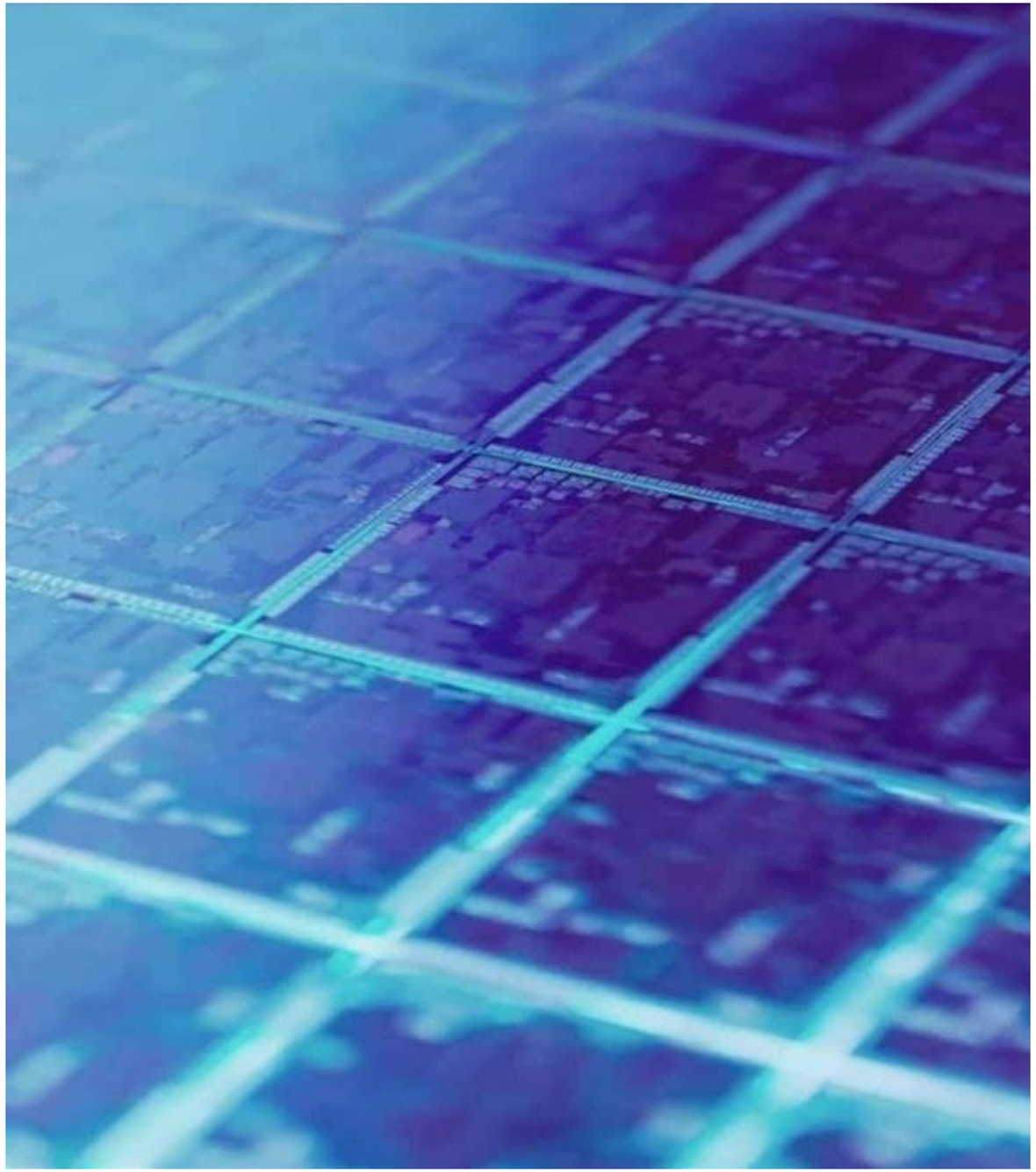


Wells Fargo

- Wells Fargo + IBM Quantum have published more than 10 quantum research papers in recent years.
- These papers explore new kinds of algorithms and new ways of thinking about problems in the financial services industry.
- Research focus on training quantum systems to mimic the probability distributions seen in the real world, then use that system for predictive modeling.

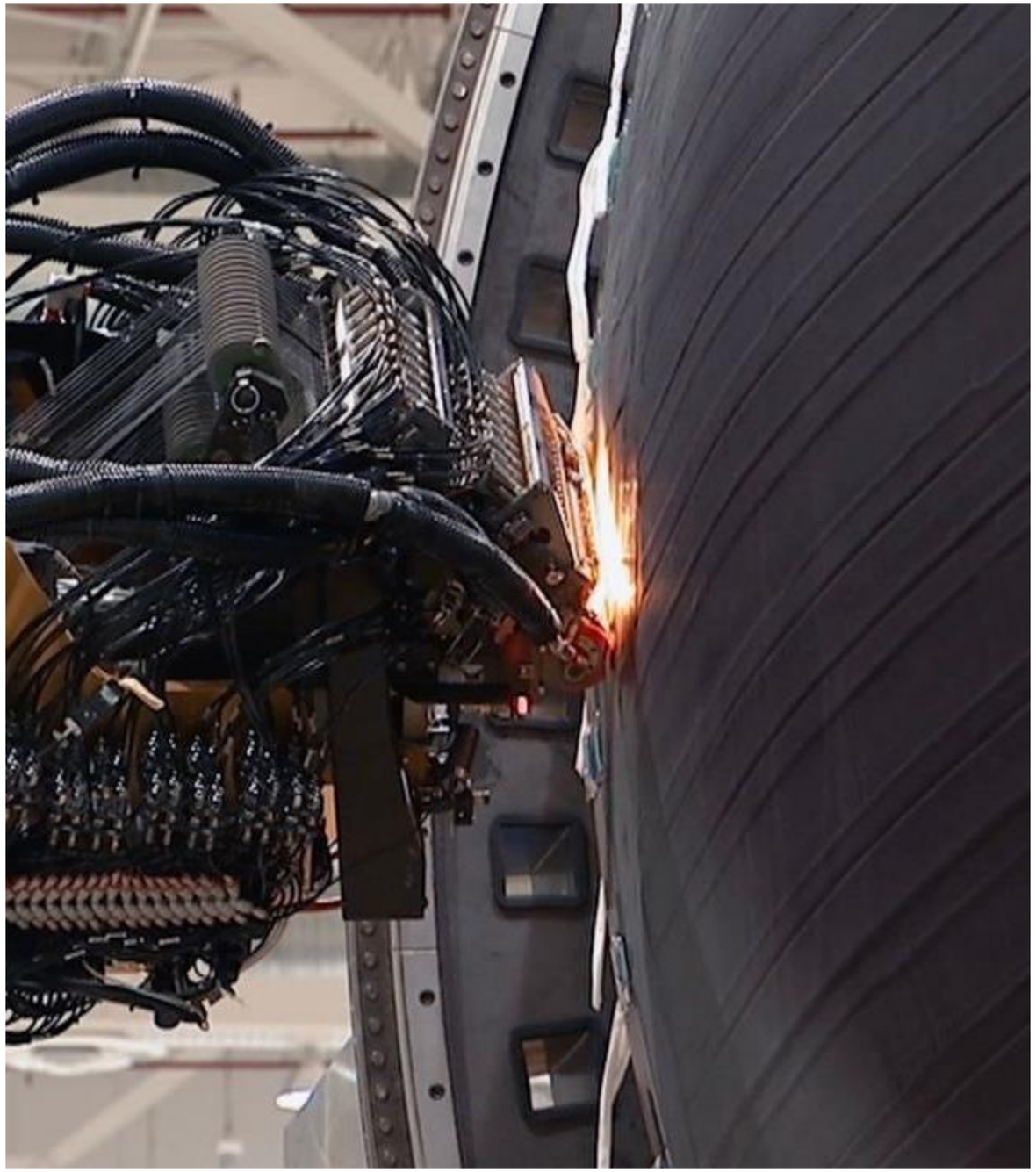
JSR

- JSR + IBM are experimenting with chemical simulations to help improve the development and manufacture of photoresists.
- We've already demonstrated that we can simulate small molecules that mimic parts of the photoresist.
- We hope that simulations like these will help us realize even faster chips.



Boeing

- Boeing + IBM demonstrated a way to create larger computational spaces for simulating new materials.
- The simulations that the team ran are among the most complex quantum optimizations ever run.
- Boeing hopes these simulations will let them design lighter and stronger materials so planes can fly farther with less fuel.

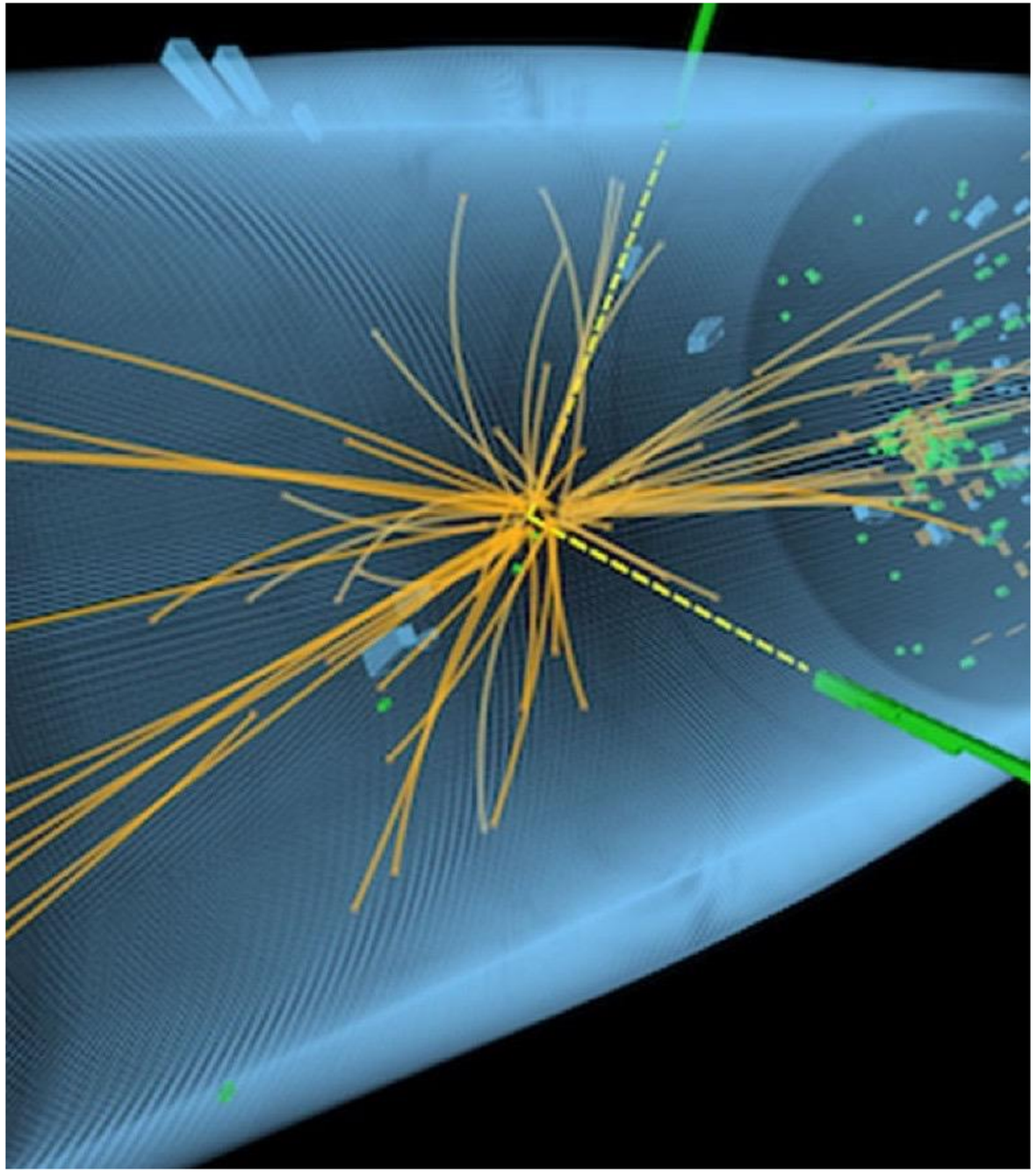


- ExxonMobil + IBM are modeling maritime inventory routing on quantum devices.
- By analyzing different strategies for vehicle and inventory routing they’re laying the foundation for constructing practical solutions for their operations.
- More efficient shipping routes could help us transport fuel more efficiently around the globe.

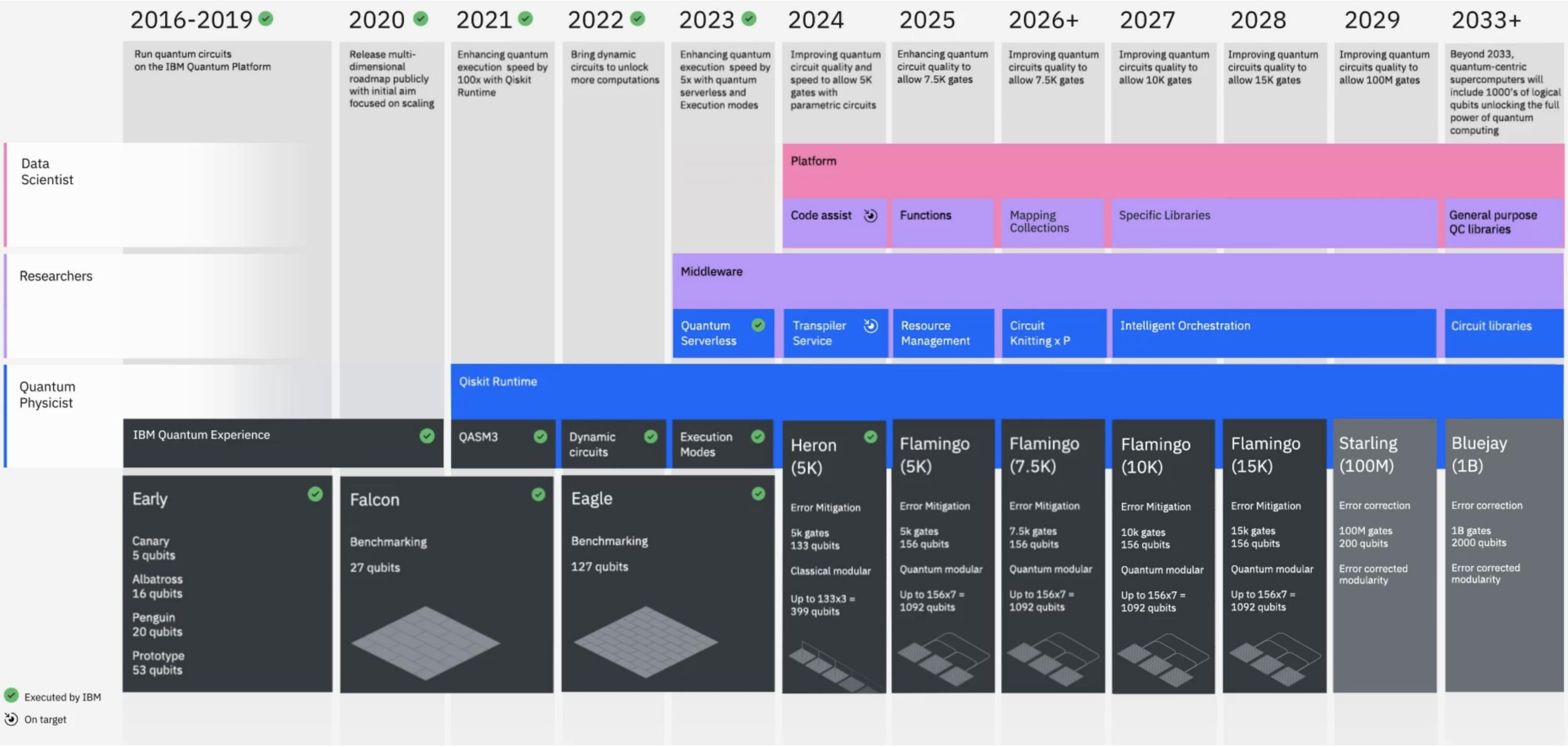
CERN

- CERN + IBM are exploring how quantum machine learning algorithms can help find notable events in their vast datasets.

- We’re using some of the smallest parts of the universe — the parts we do understand— to learn more about the smallest parts of the universe that we don’t understand.

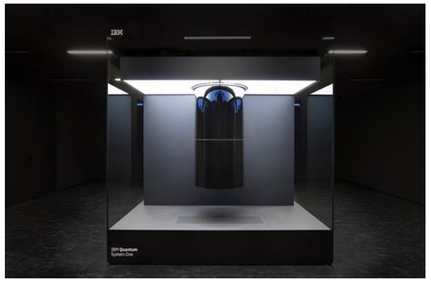


Development Roadmap



Dedicated Service

Fraunhofer
Ehningen, Germany
Dec 2020



University of Tokyo
Shin-Kawasaki, Japan
June 2021

Cleveland Clinic
Ohio, USA
March 2023

PINQ 2
Sherbrooke, Canada
Sept. 2023

Rensselaer Polytechnic
Troy, New York
April 2024

Yonsei University
Seoul, South Korea
Projected May 2024

Ikerbasque
San Sebastián, Spain
Projected Jun 2025

Riken
Kobe, Japan
Projected May 2025

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