Prepare for Quantum Today

HPC x AI Wall Street

QUANTINUUM

Utility-scale quantum computers will be here

within one business planning cycle

H-Series Development Roadmap

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H-Series Development Roadmap

	2020	2023	2025	2027	2029
SYSTEMS:	SYSTEM MODEL H1	SYSTEM MODEL H2	QUANTINUUM HELIOS	QUANTINUUM SOL	QUANTINUUM APOLLO
PHYSICAL QUBITS:	20	56	96	192	1000’s
PHYSICAL 2-QUBIT GATE ERROR:	1×10^{-3}	1×10^{-3}	$< 5 \times 10^{-4}$	$< 2 \times 10^{-4}$	1×10^{-4}
LOGICAL QUBITS:		10+	~ 50	~ 100	100's
LOGICAL ERROR RATES:		1×10^{-3}	$< 10^{-4}$	$\sim 10^{-5}$	1×10^{-5} to 1×10^{-10}*

*analysis based on recent literature in new, novel error correcting codes predict that error could be as low as 1E-10 in Apollo (ref: arXiv:2403.16054, arXiv:2308.07915)

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SYSTEM MODEL H2

PHYSICAL QUBITS:	56
PHYSICAL 2-QUBIT GATE ERROR:	1×10^{-3}
LOGICAL QUBITS:	10+
LOGICAL ERROR RATES:	1×10^{-3}

Cannot be simulated
using even the largest supercomputer

Consumes 30,000X less power
than a supercomputer on a benchmark "quantum supremacy" problem

Can detect and correct errors
in real-time for improved performance

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2025

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HELIOS

PHYSICAL QUBITS:	**96**
PHYSICAL 2-QUBIT GATE ERROR:	**$< 5 \times 10^{-4}$**
LOGICAL QUBITS:	**~ 50**
LOGICAL ERROR RATES:	**$< 10^{-4}$**

The most advanced computer
with a state space $>10^{28}$

Deployable on-premise
for data sovereignty and localized development

Enabling scientific breakthroughs
across high-energy, condensed matter, nuclear physics, and more

H-Series Development Roadmap

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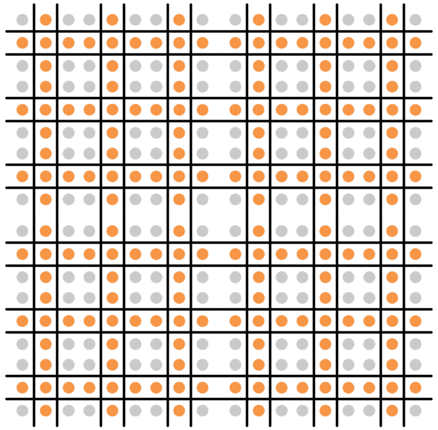
2029



QUANTINUUM
APOLLO

PHYSICAL QUBITS: **1000’s**

PHYSICAL 2-QUBIT GATE ERROR: **1×10^{-4}**

LOGICAL QUBITS: **100's**

LOGICAL ERROR RATES: **1×10^{-5} to 1×10^{-10}***

Arriving in less than 5 years

Performant system capable of solving industrial use cases

Prepare today to know how to use it

Full-Stack Integration. Accelerating Development.

INQUANTO™

Next generation of molecular and materials discovery

Algorithm Libraries

Quantum Machine Learning
Quantum Monte Carlo Integration
Quantum Natural Language Processing

Third party software

Enables other partners to leverage the power of quantum

QUANTINUUM NEXUS — Quantum workflow orchestration platform

TKET — High-performance quantum SDK | Open-source

Quantum Error Correction: Quantinuum and partners

H-SERIES Powered by Honeywell — The world's highest-performing quantum hardware

Other quantum computers

Building on the cloud.
Combining with HPC and AI.

Building on the cloud.

Combining with HPC and AI.

Quantinuum partners with Riken for hybrid quantum supercomputing platform

Deal will see Quantinuum install H1 Series ion trap quantum computer at Japanese research lab

DatacenterDynamics – Jan 10, 2024

QUANTINUUM

Building on the cloud.
Combining with HPC and AI.

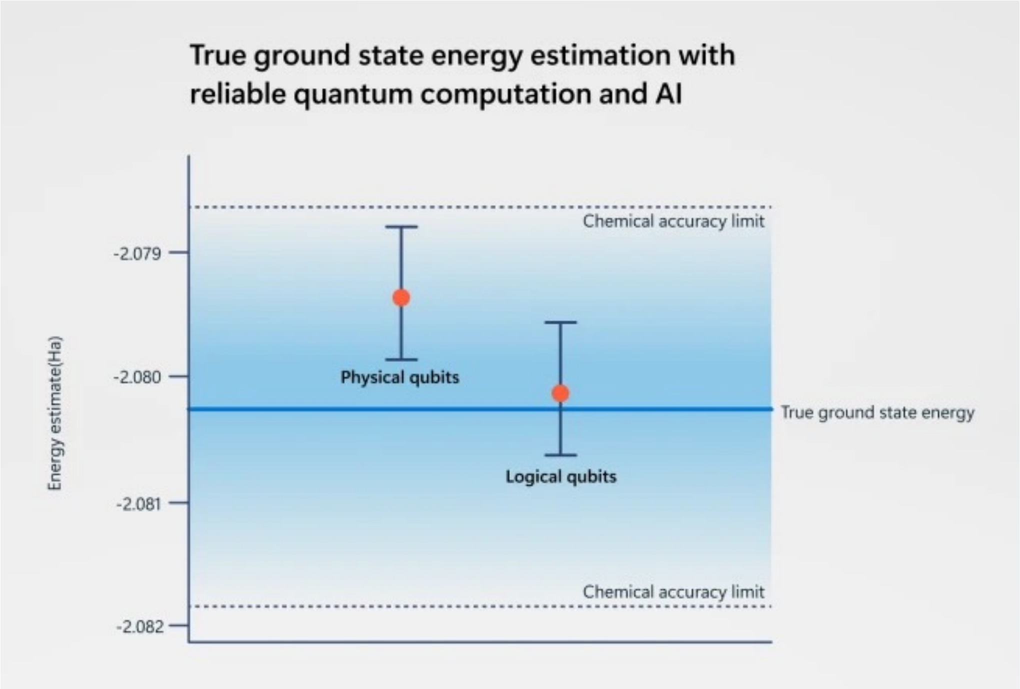
DEEP TECH

Microsoft, Quantinuum combine HPC, AI, quantum to solve real-world chemistry problem

The pair have also tripled its highly-reliable logical qubit count from earlier this year

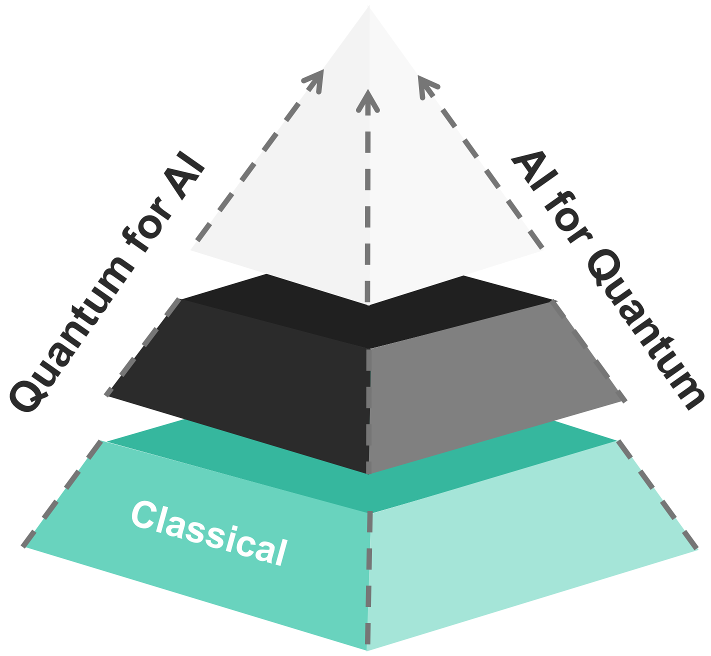
September 10, 2024 - 1:00 pm

[The Next Web]



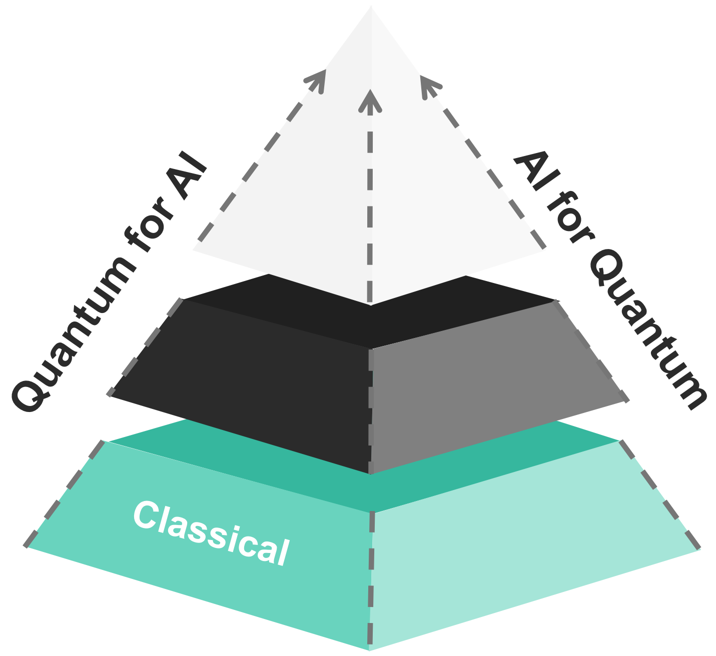
The Next Generation of AI.
Enabled by Quantum.

The Next Generation of AI.
Enabled by Quantum.

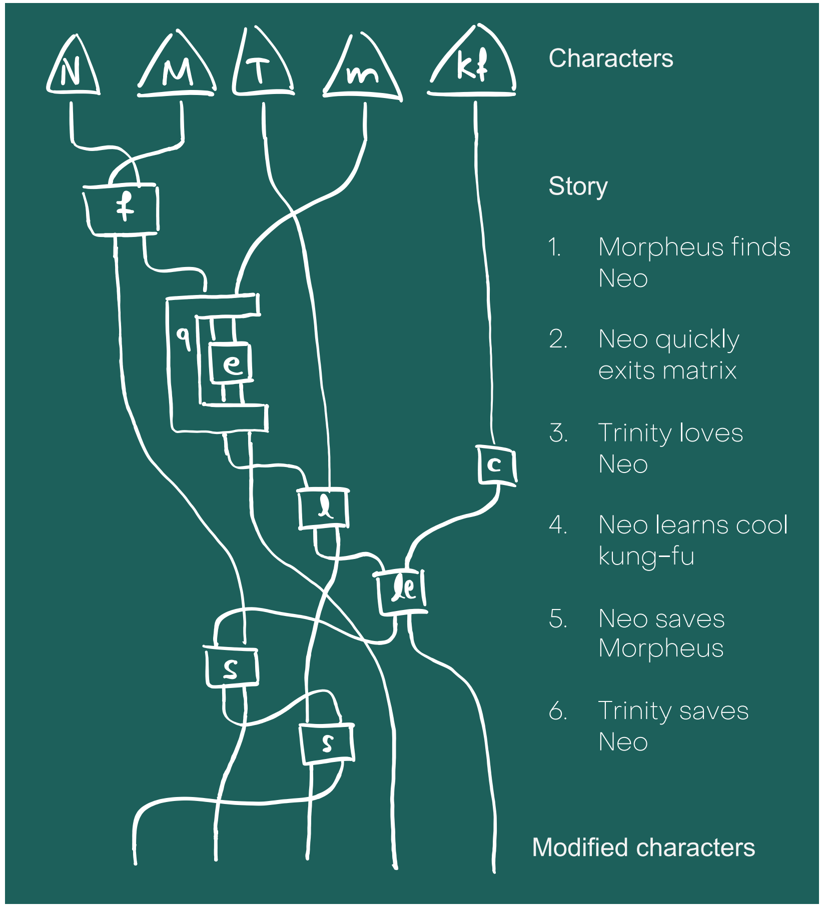


Category Theory
Compositionally Interpretable AI

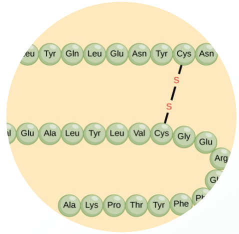
The Next Generation of AI.
Enabled by Quantum.



Category Theory
Compositionally Interpretable AI



Amgen & Quantinuum



Peptide Binding Classification on Quantum Computers

Charles London[1†] Douglas Brown[1†] Wenduan Xu[1] Sezen Vatansever[2]
Christopher James Langmead[2] Dimitri Kartsaklis[1] Stephen Clark[1]
Konstantinos Meichanetzidis[1]
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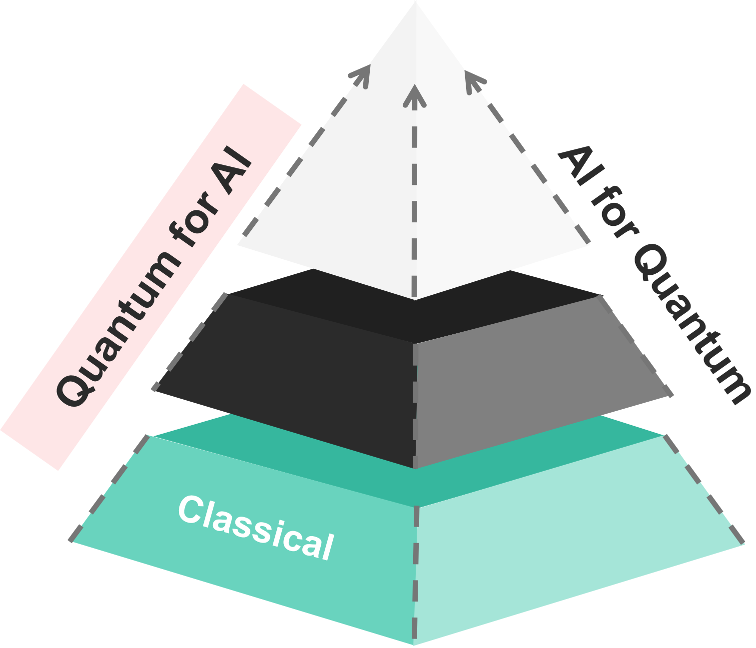
https://arxiv.org/pdf/2311.15696

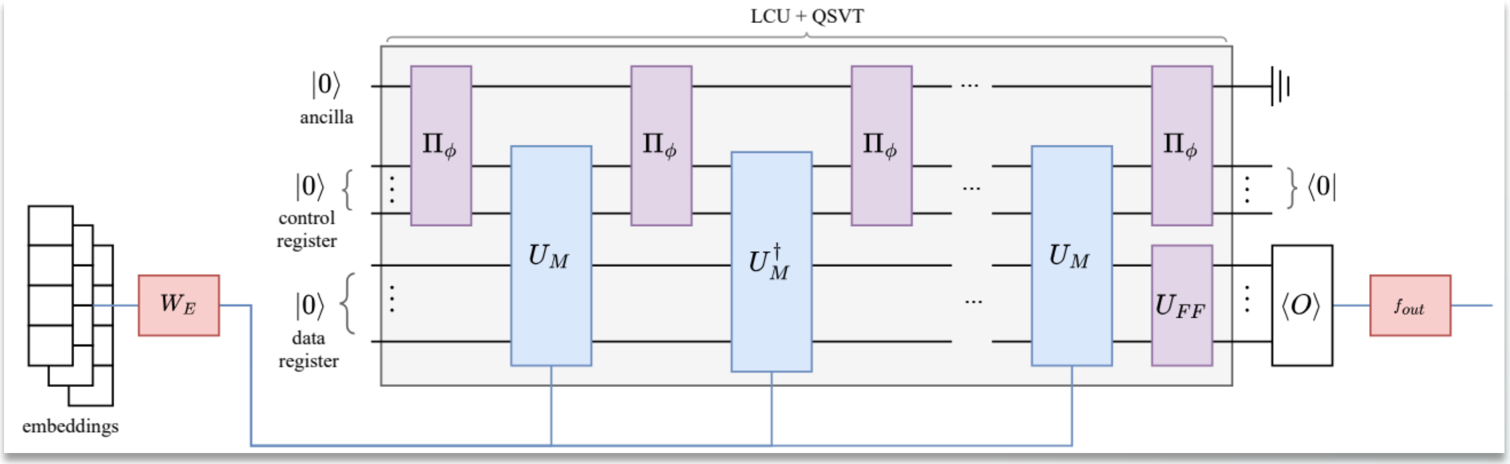
The Next Generation of AI.
Enabled by Quantum.



Category Theory
Compositionally Interpretable AI

Quixer: A Quantum Transformer Model

https://arxiv.org/pdf/2406.04305



Motivation: classical LLMs are huge and expensive to train.

Can quantum models be more efficient and performant?

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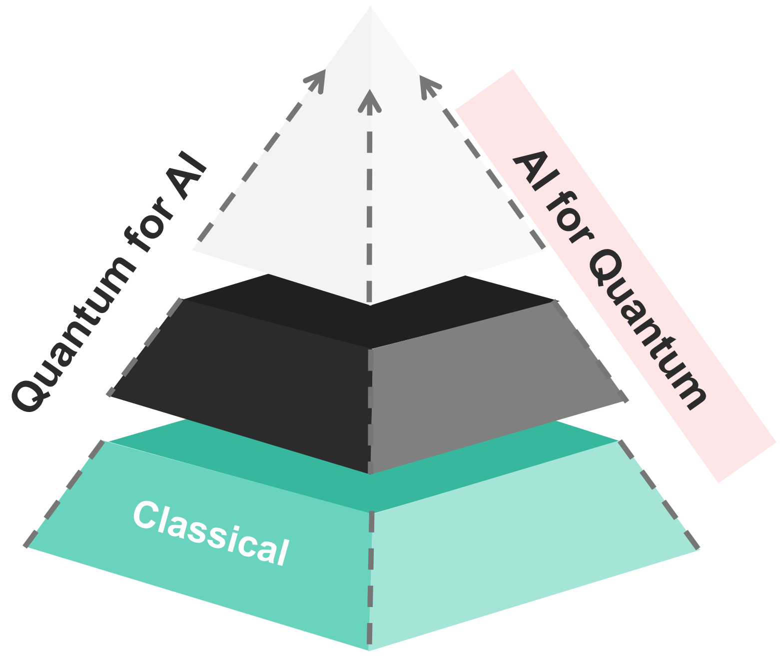
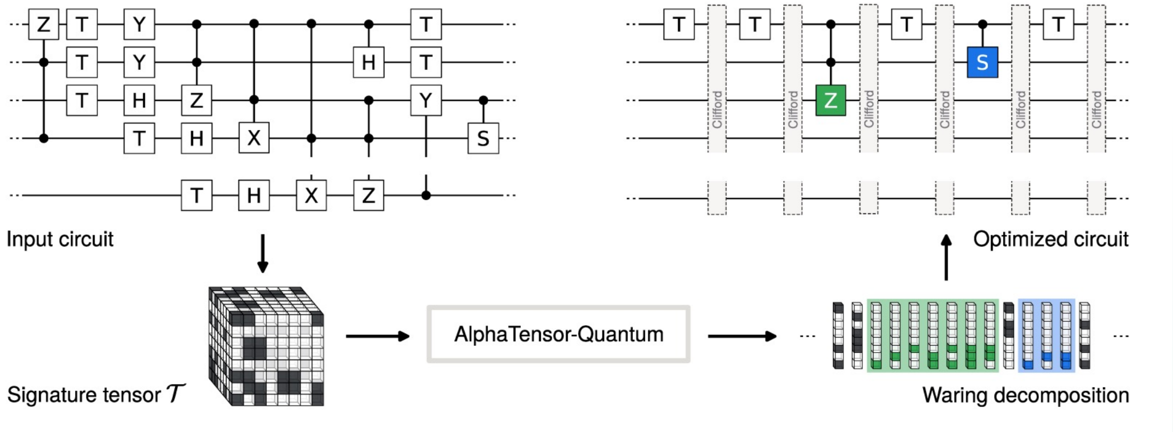
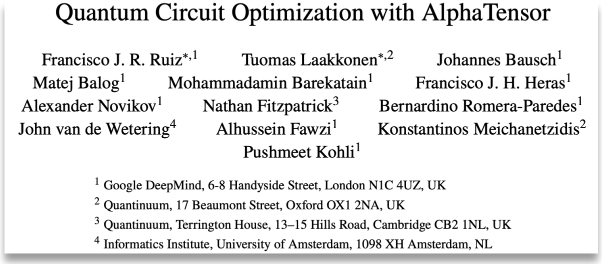
The Next Generation of AI.
Enabled by Quantum.



Category Theory
Compositionally Interpretable AI

Collaboration with Google DeepMind





Quantum Circuit Optimization with AlphaTensor

Francisco J. R. Ruiz[*,1] Tuomas Laakkonen[*,2] Johannes Bausch[1]
Matej Balog[1] Mohammadamin Barekatain[1] Francisco J. H. Heras[1]
Alexander Novikov[1] Nathan Fitzpatrick[3] Bernardino Romera-Paredes[1]
John van de Wetering[4] Alhussein Fawzi[1] Konstantinos Meichanetzidis[2]
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[4] Informatics Institute, University of Amsterdam, 1098 XH Amsterdam, NL

https://arxiv.org/pdf/2402.14396.pdf

Deep reinforcement learning for state-of-the-art performance in optimizing quantum circuits

The time to start using these machines was ***yesterday***

The time to start using these machines was *yesterday*

Identify and triage use cases

Understand machine performance

Develop performant algorithms

Build end-to-end workflows

Integrate with existing infrastructure

Scale up

Companies Are Using Our Technology To Build Muscle

JPMorgan Chase

Article | Open access | Published: 13 October 2022

Constrained quantum optimization for extractive summarization on a trapped-ion quantum computer

Pradeep Niroula, Ruslan Shaydulin, Romina Yalovetzky, Pierre Minssen, Dylan Herman, Shaohan Hu & Marco Pistoia

Scientific Reports 12, Article number: 17171 (2022) | Cite this article

Article | Open access | Published: 18 August 2023

Constrained optimization via quantum Zeno dynamics

Dylan Herman, Ruslan Shaydulin, Yue Sun, Shouvanik Chakrabarti, Shaohan Hu, Pierre Minssen, Arthur Rattew, Romina Yalovetzky & Marco Pistoia

Evidence of scaling advantage for the quantum approximate optimization algorithm on a classically intractable problem

RUSLAN SHAYDULIN, CHANGHAO LI, SHOUVANIK CHAKRABARTI, MATTHEW DECROSS, DYLAN HERMAN, NIRAJ KUMAR, JEFFREY LARSON, DANYLO LYKOV, PIERRE MINSSEN, [...], AND MARCO PISTOIA +19 authors Authors Info & Affiliations

SCIENCE ADVANCES • 29 May 2024 • Vol 10, Issue 22 • DOI: 10.1126/sciadv.adm6761

HSBC

Realizing Quantum Kernel Models at Scale with Matrix Product State Simulation

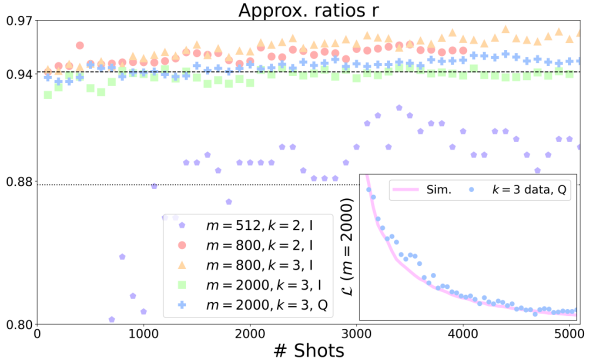
Mekena Metcalf, Pablo Andres-Martinez, Nathan Fitzpatrick

Classification task with 165 features and 6400 data points

Technology Innovation Institute – Abu Dhabi

Towards large-scale quantum optimization solvers with few qubits

Marco Sciorilli[†,1,*] Lucas Borges,[1,2,*] Taylor L. Patti,[3] Diego García-Martín,[4,1] Giancarlo Camilo,[1] Anima Anandkumar,[5] and Leandro Aolita[1]



2,000 variable problem sizes with just 17 qubits showcasing competitive performance

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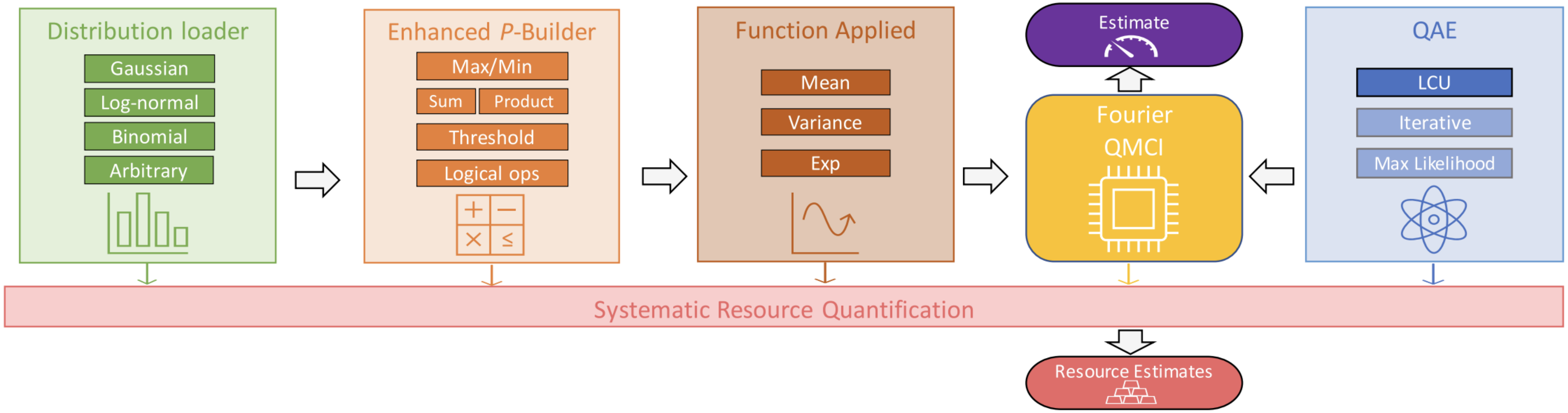
Quantum Monte Carlo Engine

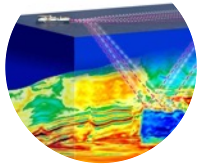
Design and benchmark end-to-end workflows for forecasting and optimization



- **Banking:** calculating price of an option or derivative
- **Insurance**: estimate risk of a flood
- **Investment Fund**: optimizing portfolio under a Value at Risk constraint
- **Utilities**: forecasting energy demand of population
- **Supply Chain**: inventory forecasting and batch delivery optimization

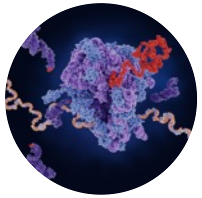
Realizing Scientific Breakthroughs with Industry Leaders

BMW & Airbus
Fuel Cell Catalytic Reactions



BP
Seismic Imaging

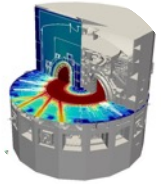
HSBC
Fraud Detection



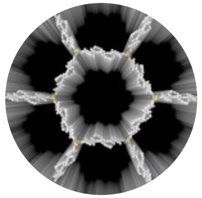
Roche
Drug - Protein Interactions

Hess
Oil Pipeline Construction

Honeywell
Efficient Synthesis of Refrigerants



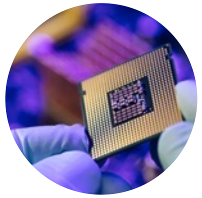
UKAEA
Magneto-hydrodynamics



TotalEnergies
Carbon Capture Materials

Equinor
Ammonia Catalysis

Nippon Steel
Modeling Iron Crystals



JSR
Semiconductor Defect Modeling

Thales
Stronger Cryptography

Chevron
LNG Vessel Chartering

Amgen
Genomics Analysis

Remember…

Utility-scale quantum computers will be here

within one business planning cycle

QUANTINUUM

Partner with us to build your quantum strategy.

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