Independent, systematic, reproducible and open-source quantum benchmarking with metriq-gym

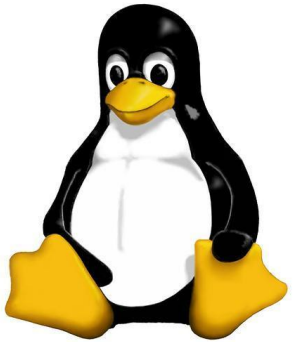
Nathan Shammah
Chief Technology Officer, UF
Managing Director, UF France
nathan@unitary.foundation

Unitary Foundation

TQCI Quantum Benchmarks Workshop
Paris Telecom, Palaiseau, June 25, 2025

Creating a quantum technology ecosystem faster, better, and to benefit everyone.

Open Source Software Needs Institutional Support



THE LINUX FOUNDATION

"$5Bn in contributed development costs"

WIKIMEDIA FOUNDATION

>56M wiki pages, 309 languages

arXiv

Cornell University

Open-access archive for >2M scholarly articles

We do three main things

Unitary Foundation

Microgrants

- We run a microgrant program to fund explorers across the world to work on quantum technologies. **100+ teams across 31 countries**.

Research

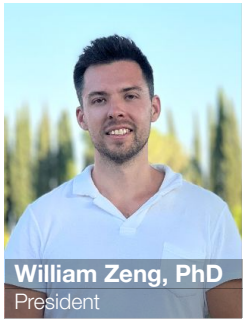
- We do our own research to help the ecosystem as a whole. For example, we are developing (1) **mitiq (250k+ downloads; 120+ citations)**, an open source compiler for error-mitigated quantum programming, (2) **ucc**, a cross-platform compiler and (3) **metriq**, an open community platform for sharing quantum tech benchmarks.

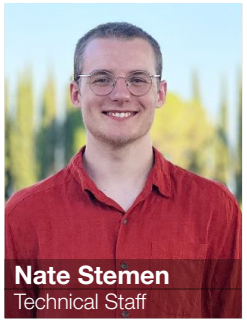
Community

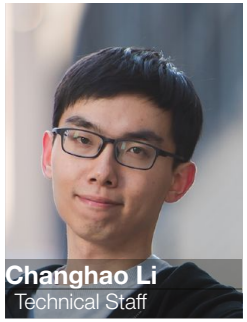
- We host an open source quantum tech community **(4k+ open quantum tech developers)** that runs hackathons, community surveys and events.

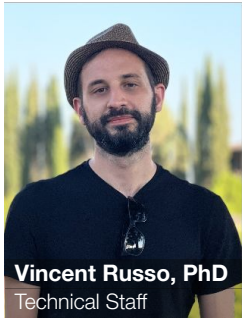
The **Team**

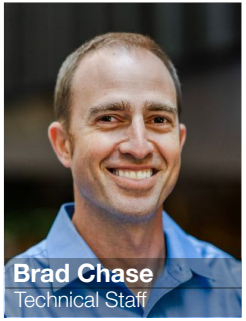
Unitary Foundation

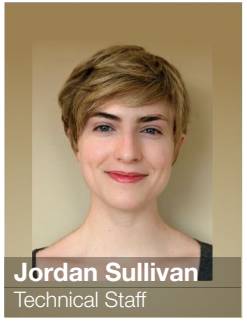


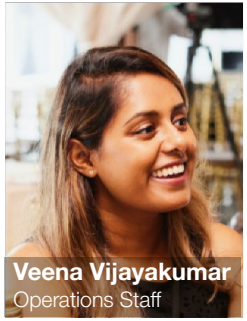












Unitary Foundation

UF Supporters

Core members (2024)

IBM Quantum

Open Quantum Design

scientifica venture capital

DoraHacks

Supporting members (2024)

Microsoft

aws

QCWARE

river lane

PASQAL

IONQ

QUANTUM MACHINES

Institutional Supporters

European Commission

U.S. DEPARTMENT OF ENERGY

NSF

leap

LF QLASS

SMART

mitiq

Additional supporters

- Alphabet X (formerly Google X)
- Atom Computing
- Boston Consulting Group
- Microsoft
- Cambridge Quantum Computing
- Classiq
- IQT Labs
- Rigetti
- QCWare
- quantumcomputing.com
- QuEra
- Riverlane
- Xanadu
- Strangeworks
- PLOS
- Steve Willis & NYC Quantum Meetup
- EeroQ
- Q-CTRL
- BlueQubit
- John Hering
- Jeff Cordova
- Nima Alidoust
- Travis Humble
- George Umbrarescu
- Michał Stęchły
- Terrill Frantz
- Konstantin Vinogradov
- Jordan Rule
- Greg Ramsay
- Peter Johnson
- Guillaume Verdon
- Rishi Sreedhar
- Travis L. Scholten
- Amir Ebrahimi
- Jens Koch
- Christophe Jurczak
- Angelo Danducci II
- Amira Abbas
- Shahnawaz Ahmed
- Tomas Babej
- Ntwali Bashige
- Amy Brown
- Mark Fingerhuth
- Cassandra Granade
- Josh Izaac
- Sarah Kaiser
- Nathan Killoran
- Peter Karalekas
- Alex McCaskey
- Pranav Gokhale
- Will Zeng

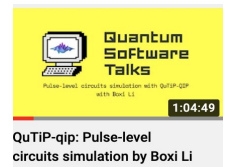
UF **Community**

Advisory board

- 23 volunteer experts in quantum systems & software from:

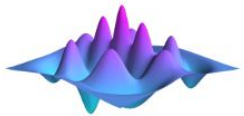
Discord community

- 3,700+ active members
- **Office hours**
- **Community calls**



Collaborators

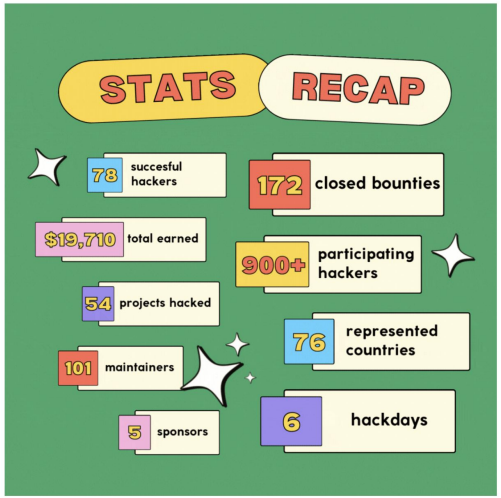
and many others

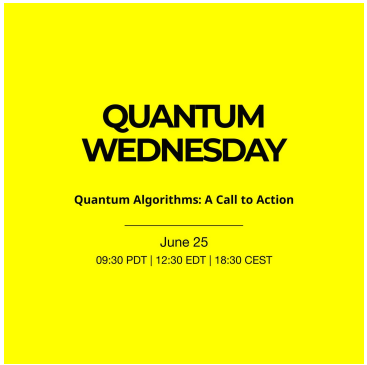


QuTiP *10 years on!*

Quantum Toolbox in Python

Events: Online and IRL





github.com/unitaryfoundation/quantum-wednesday

Sep 2-4, Albuquerque, NM, USA
@IEEE Quantum Week

Open Source Quantum Software

Mitiq

pip install **mitiq**

- Quantum Error Mitigation Toolkit
- 250k downloads, 80+ contributors
- Several mitigation techniques
- Fully compatible with front/backends
- Composable techniques

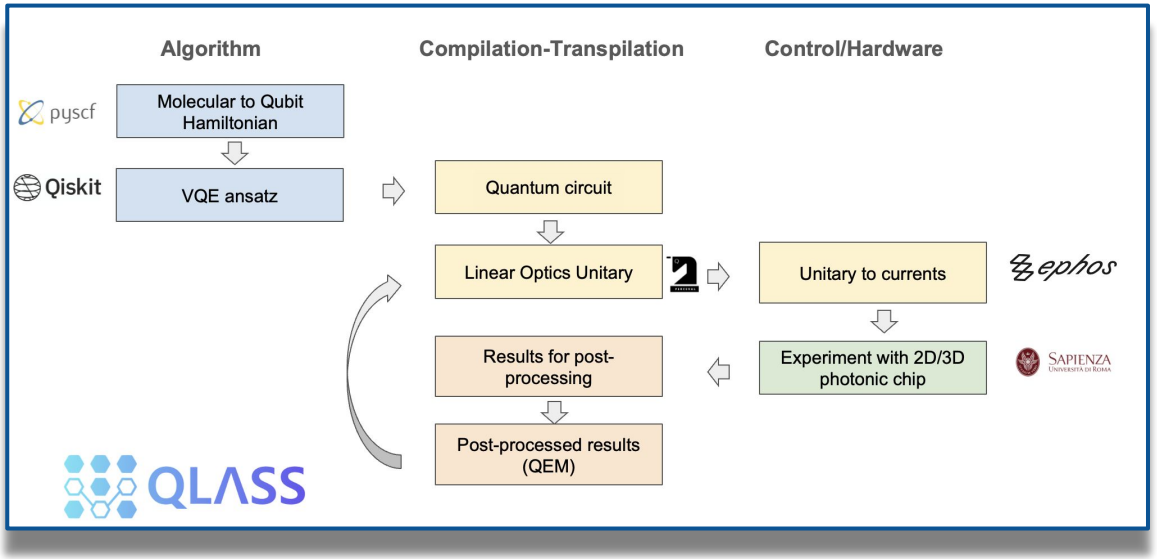
Unitary Compiler Collection (ucc)

- Best-in-Class Compilation
- No Code Changes to Switch Between Frontends
- Compatible with Any Backend Supporting OpenQASM

https://unitary.foundation/blog/

EU QLASS Project: Photonics Compilation

Building quantum compilers to run quantum chemistry simulations on photonic quantum processors.



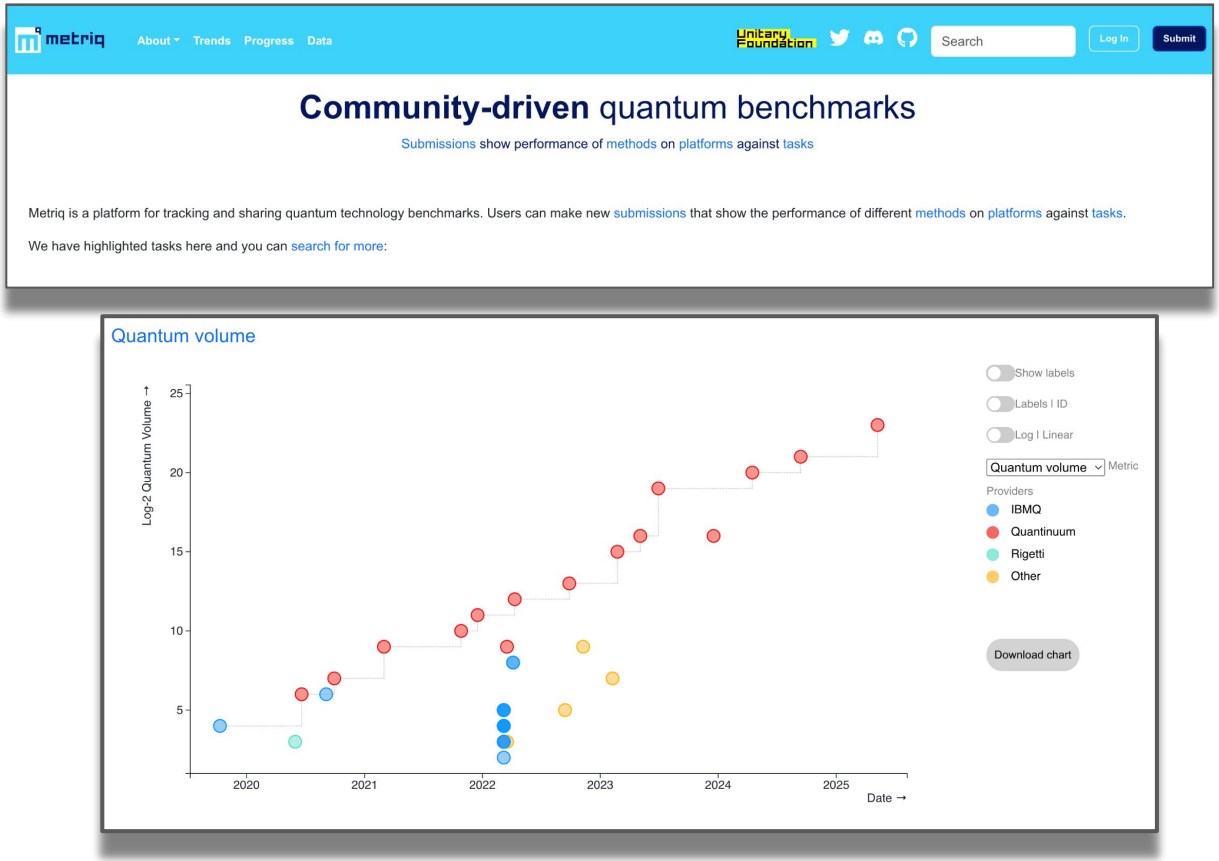
- UF leads the software & theory efforts
- Designed end-to-end compilation architecture of Lithium battery problem on photonic chip (simulated)
- Simulating 2D device and QLASS 3D devices
- UF Code Open Sourced at github.com/unitaryfund/qlass
- Leveraging existing open source infrastructure
- First completed project in unitaryHACK

Learn more at https://www.qlass-project.eu/

Unitary Labs builds public good quantum technologies:

- Compilation - including error mitigation and early FTQC
- Benchmarks

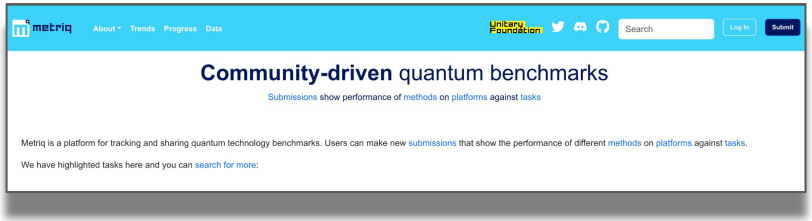
The Metriq project: Online Platform for Open Benchmarks

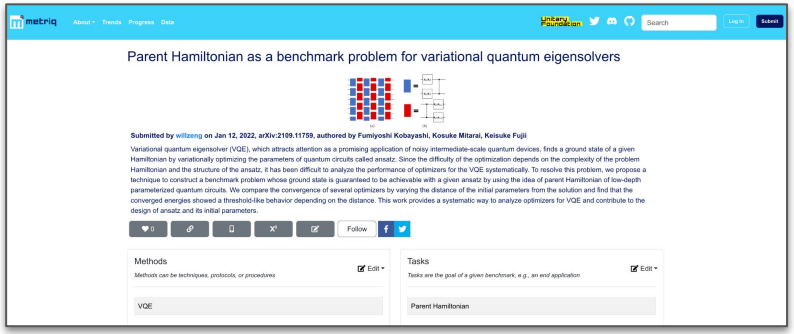


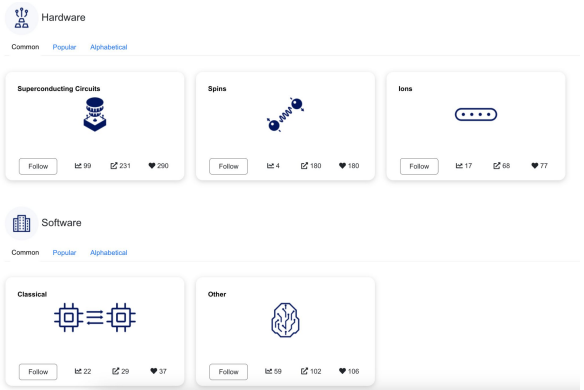
https://metriq.info/

Metriq.info: Online Platform and Taxonomy for Open Benchmarks

https://metriq.info/

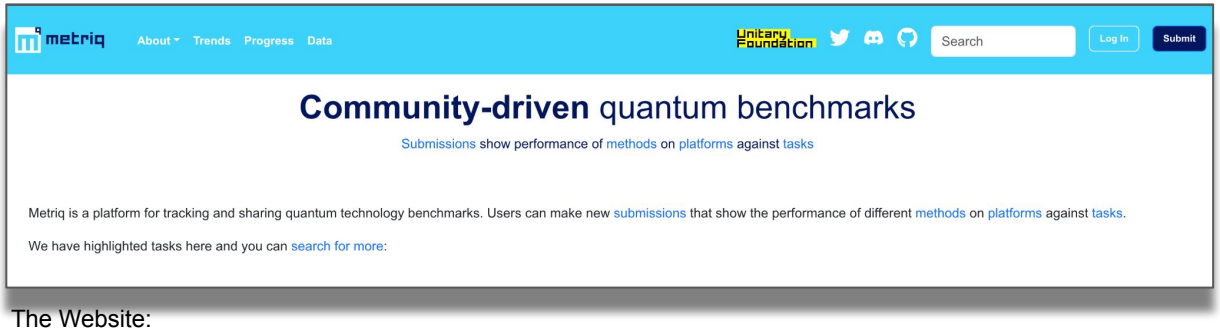






The Metriq project: Online Platform for Open Benchmarks

https://metriq.info/



The Website:

- Anyone can submit to www.metriq.info
- About 500 users per month
- Users from 50 different countries.

The Database:

- 1600+ results
- 300 new numerical benchmark results YoY
- 750+ submissions

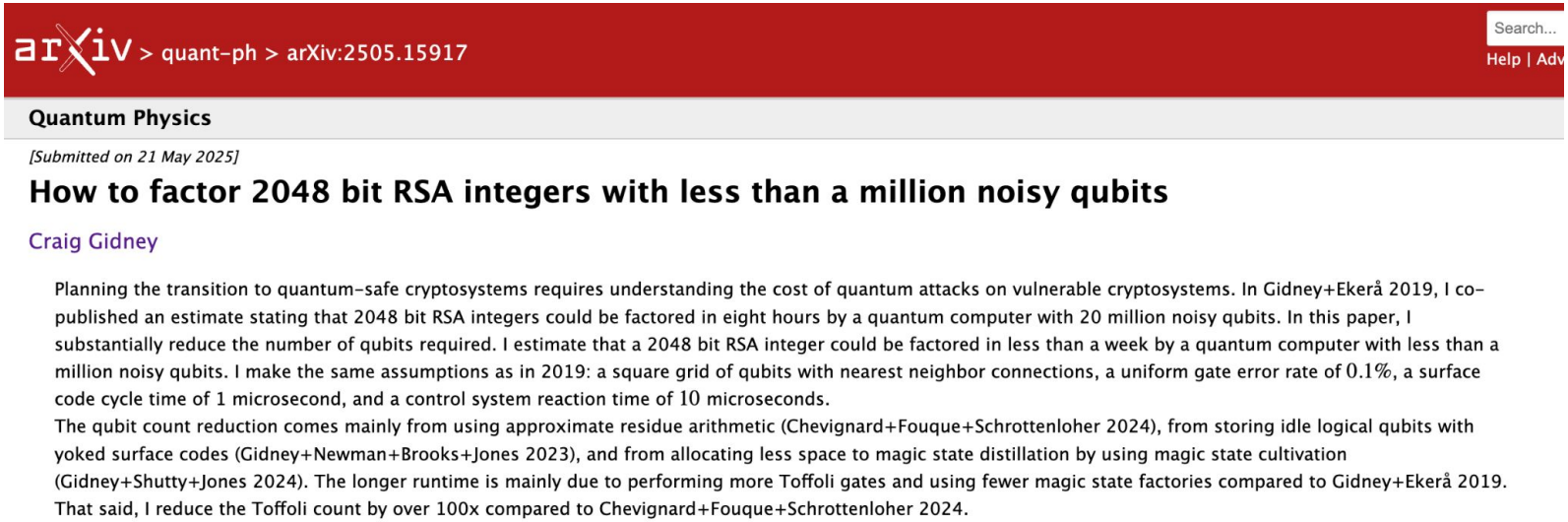
The Taxonomy:

- 200+ tasks
- 400 methods
- 200 platforms.

Partners include: In-Q-Tel Labs, USRA, RIKEN, and IBM.

Anyone can contribute results to Metriq.info

The Metriq project: Online Platform for Open Benchmarks



arXiv > quant-ph > arXiv:2505.15917

Search...

Help | Adv

Quantum Physics

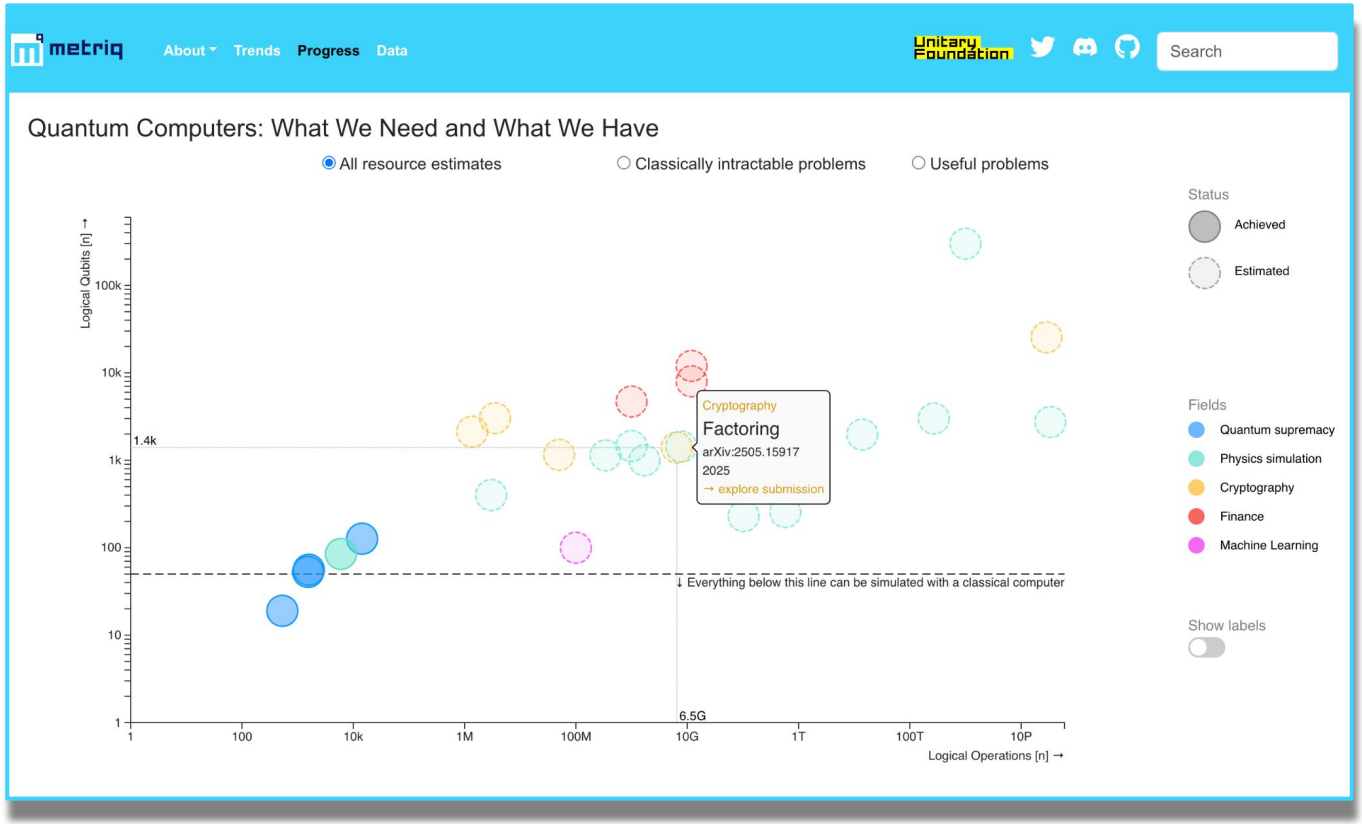
[Submitted on 21 May 2025]

How to factor 2048 bit RSA integers with less than a million noisy qubits

Craig Gidney

Planning the transition to quantum-safe cryptosystems requires understanding the cost of quantum attacks on vulnerable cryptosystems. In Gidney+Ekerå 2019, I co-published an estimate stating that 2048 bit RSA integers could be factored in eight hours by a quantum computer with 20 million noisy qubits. In this paper, I substantially reduce the number of qubits required. I estimate that a 2048 bit RSA integer could be factored in less than a week by a quantum computer with less than a million noisy qubits. I make the same assumptions as in 2019: a square grid of qubits with nearest neighbor connections, a uniform gate error rate of 0.1%, a surface code cycle time of 1 microsecond, and a control system reaction time of 10 microseconds.
The qubit count reduction comes mainly from using approximate residue arithmetic (Chevignard+Fouque+Schrottenloher 2024), from storing idle logical qubits with yoked surface codes (Gidney+Newman+Brooks+Jones 2023), and from allocating less space to magic state distillation by using magic state cultivation (Gidney+Shutty+Jones 2024). The longer runtime is mainly due to performing more Toffoli gates and using fewer magic state factories compared to Gidney+Ekerå 2019. That said, I reduce the Toffoli count by over 100x compared to Chevignard+Fouque+Schrottenloher 2024.

Tracking progress in algorithms and applications with resource estimation



https://metriq.info/Progress/

The Open Quantum Benchmarks Committee

Experts from Leibniz Supercomputing Centre; University of Milano-Bicocca; Lawrence Berkeley National Laboratory; Pasqal; THALES; NVIDIA; IBM Quantum; University of British Columbia; Oak Ridge National Laboratory; qBraid; European Center for Quantum Sciences; and Amazon Braket.

Established in 2024 by Unitary Foundation

Expert practitioners and researchers (hands-on)
Focus areas:

- Hardware
- Compilation
- Simulation
- Applications
- Error correction and mitigation

Goals:

- Provide the field with a comprehensive and reliable framework for evaluating quantum computing systems
- Empower researchers and developers with open-source tools to navigate this landscape
- Advise on Metriq project

Meeting quarterly online, with more frequent discussions in Discord chat channels

Please do reach out if you'd like to join at info@unitary.foundation

The Metriq Gym (beta project)

Python framework for quantum computing benchmarking

- ✅ **Open** (open-source since its inception)
- ✅ **Transparent** (parameters/result easy to review)
- ✅ Running seamlessly **Cross-platform**
- ✅ **User-friendly** (for benchmark devs and final users)

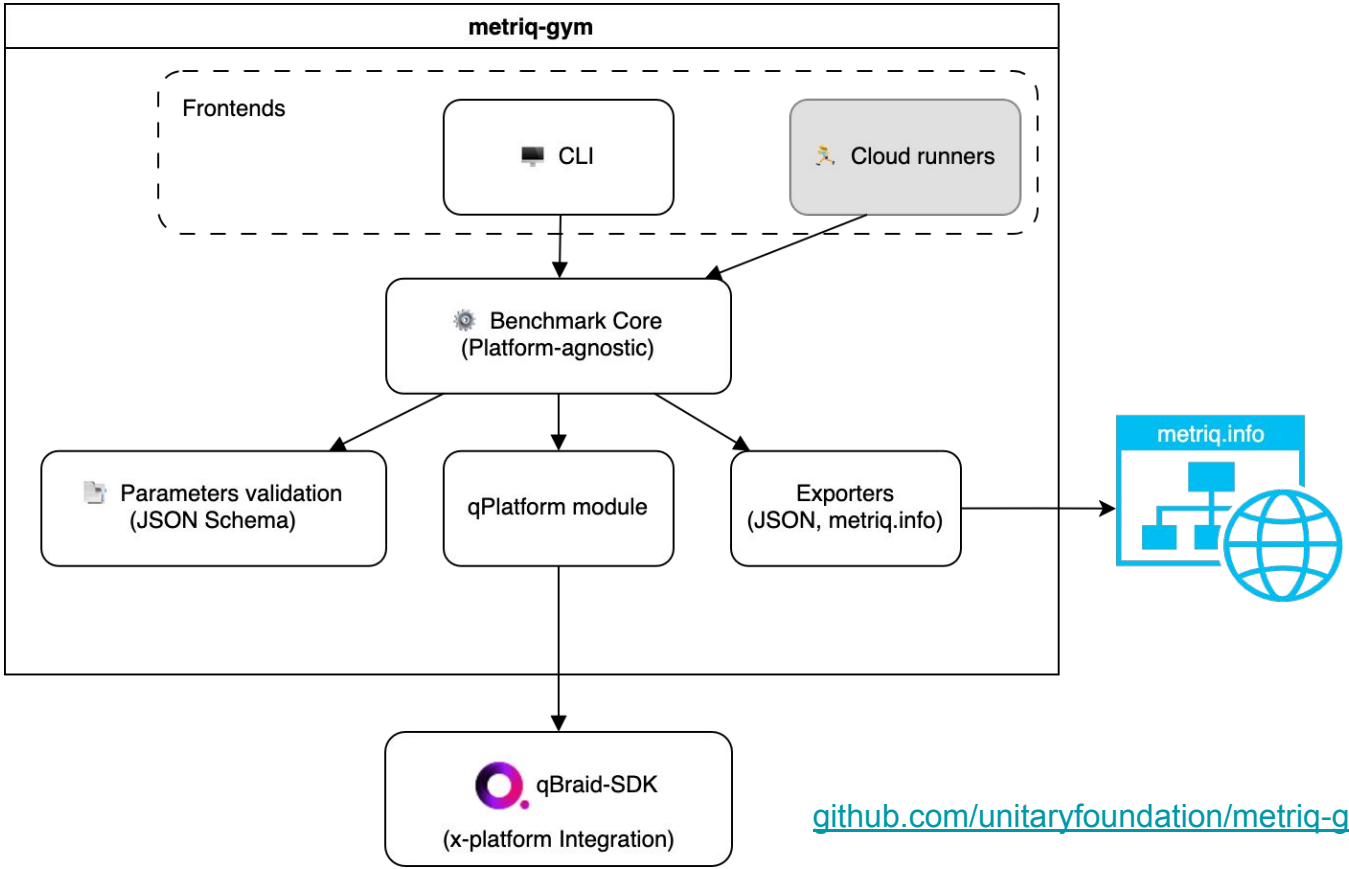
github.com/unitaryfoundation/metriq-gym

Metriq Gym: Inspiring projects and important work

Classical
- LINPACK/HPL
- MLPerf™ Inference

Quantum
- Systemic
  - IQM iqm-benchmarks
  - IBM qiskit-device-benchmarking
  - Benchpress Qiskit/benchpress
- Applications
  - Benchmarks for Application-Centric Quantum Computing (BACQ)
  - QED-C QC-App-Oriented-Benchmarks
  - QUARK QUARK

Metriq-gym architecture: A tool for independent benchmarks



github.com/unitaryfoundation/metriq-gym

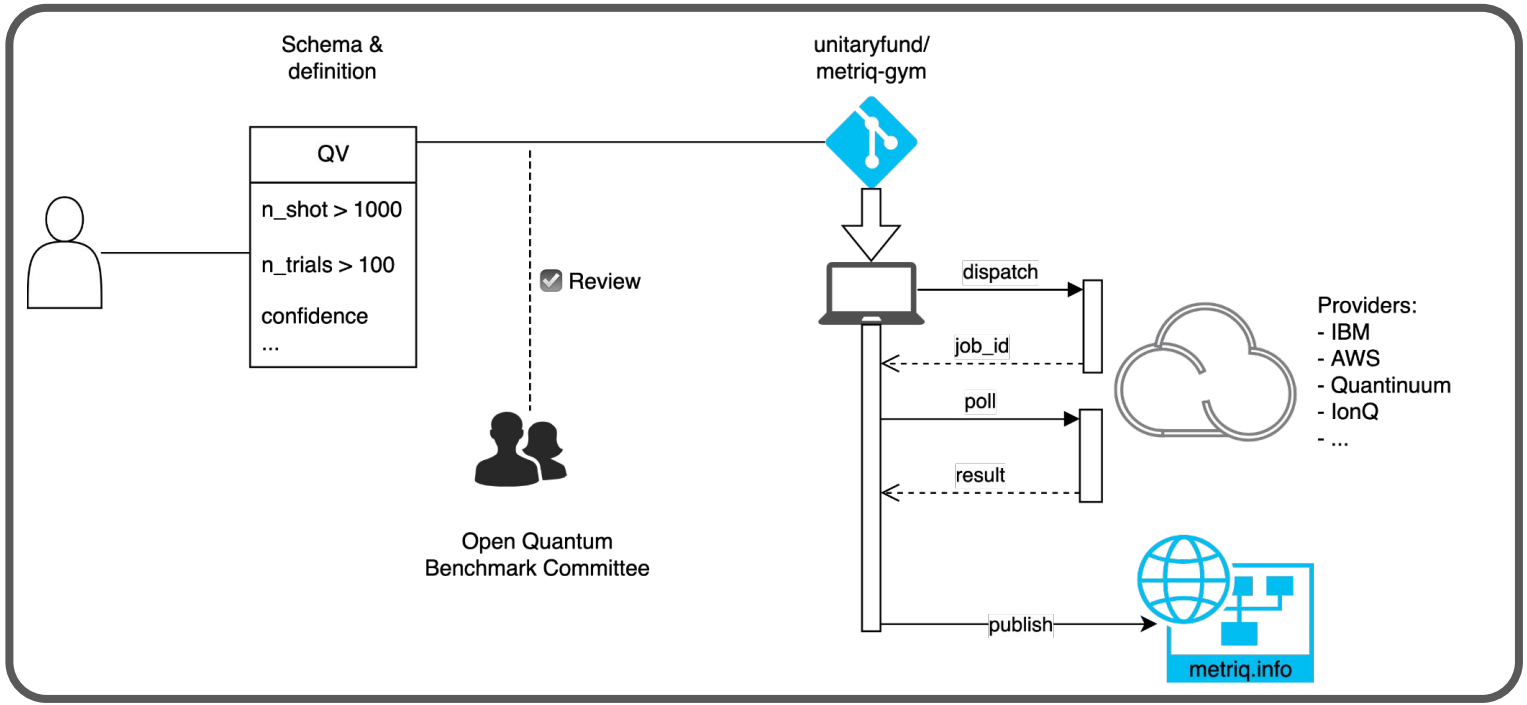
Metriq-gym: Dispatching a benchmark on a QPU - in one line

```
$ mgym dispatch bseq.json -p ibm -d ibm_sherbrooke
```

Actions:
{*dispatch*, *poll*, *view*, *upload*}

```
{
  "benchmark": "BSEQ",
  "num_circuits": 2,
  "shots": 1000
}
```

Metriq-gym integration with Metriq.info



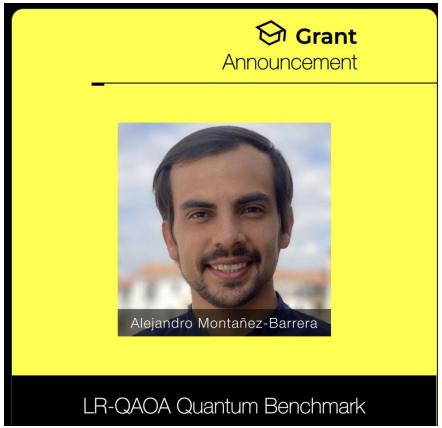
github.com/unitaryfoundation/metriq-gym

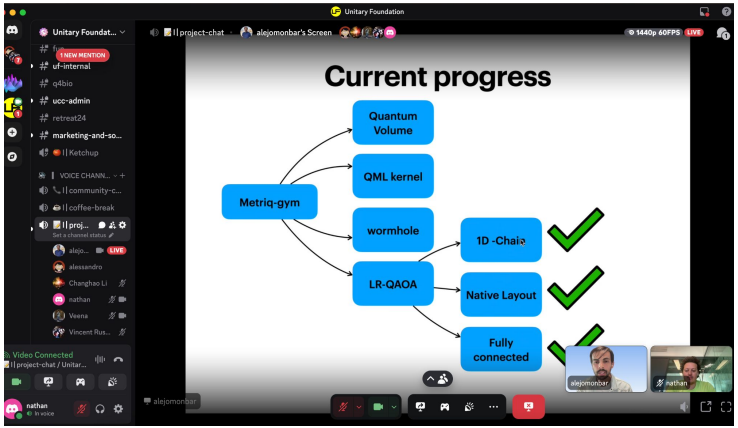
Metriq-gym: Current benchmarks

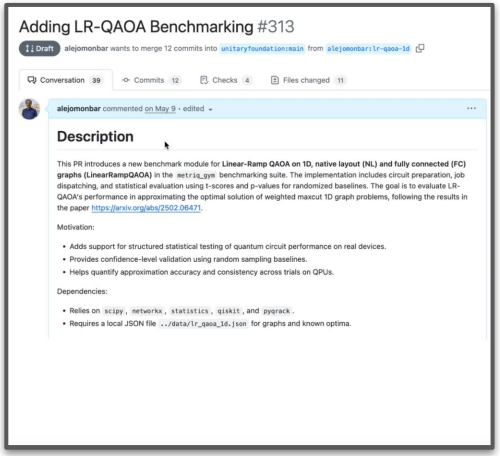
System-level benchmarks
- Quantum Volume
- Circuit Layer Operations Per Second (CLOPS)
- Bell State Effective Qubits (BSEQ)
- Mirror Circuits

Application-level benchmarks
- QML Kernel
- Wormhole-inspired teleportation
- [WIP] Bernstein Vazirani (BV)
- [WIP] RL-QAOA
- …
- **… Submit your benchmark by opening a new pull request**

Microgrants: Impact & collaboration







https://arxiv.org/abs/2502.06471
J.A. Montanez-Barrera, K. Michielsen, D.E. Bernal Neira

24 QPUs (+5 from paper v1) from 6 vendors (+4 from paper v1) benchmarked in total

Metriq-gym: Early results

Metriq-gym results

Provider	Device	Device Properties	BSEQ (Metriq Gym) – largest connected size	BSEQ (Metriq Gym) – connected fraction	QML Kernel (Metriq Gym) – Accuracy	WIT (Metriq Gym) – p1
IQM	IQM Garnet	Qubits: 20	20	1	0.068	0.713
Rigetti	Rigetti Ankaa-3	Qubits: 82, Year: 2024	6	0.073	0.037	0.463
IBMQ	ibm-sherbrooke	Qubits: 127	100	0.787	0.121	0.491
IBMQ	ibm-torino	Qubits: 133	71	0.534	0.485	0.843
IBMQ	ibm-marrakesh	Qubits: 156	150	0.962	0.532	0.875
IBMQ	ibmq-fez	Qubits: 156	150	0.962	0.435	0.865

Live at https://metriq.info/

Providers & hardware information online

Provider	Device	Physical System	Qubit number	Analog/Digital	Topology	Native gate set	suit. for QV	suit. for CLOPS	suit. for BSEQ
IBM	ibm-sherbrooke	Superconducting Qubits (fixed-coupling)	127	Digital	2D lattice	ECR, ID, RZ, SX, X	✅	✅	✅
IBM	ibm-strasbourg	Superconducting Qubits (fixed-coupling)	127	Digital	2D lattice	ECR, ID, RZ, SX, X	✅	✅	✅
IBM	ibm-brussels	Superconducting Qubits (fixed-coupling)	127	Digital	2D lattice	ECR, ID, RZ, SX, X	✅	✅	✅
IBM	ibm-kyiv	Superconducting Qubits (fixed-coupling)	127	Digital	2D lattice	ECR, ID, RZ, SX, X	✅	✅	✅
IBM	ibm-brisbane	Superconducting Qubits (fixed-coupling)	127	Digital	2D lattice	ECR, ID, RZ, SX, X	✅	✅	✅
Rigetti	Ankaa-3	Superconducting Qubits (tunable-coupling)	82	Digital	2D lattice	rx, rz, iswap	✅	❌	✅
IQM	Garnet	Superconducting Qubits (tunable-coupling)	20	Digital	2D lattice	cz, prx	✅	?	✅
IonQ	Aria-1	Trapped Ions ($^{171}Yb^{+}$)	25	Digital	fully connected (chain)	gpi, gpi2, ms	✅	?	❌[2]
IonQ	Aria-2	Trapped Ions ($^{171}Yb^{+}$)	25	Digital	fully connected (chain)	gpi, gpi2, ms	✅	?	❌[2]
IonQ	Forte	Trapped Ions ($^{171}Yb^{+}$)	36	Digital	fully connected (chain)	gpi, gpi2, ms	✅	?	❌[2]
Quantinuum	H1-1	Trapped Ions ($^{171}Yb^{+}$)	20	Digital	fully connected (QCCD)	1Q rotation, zz, SU(4)	✅	?	❌[2]
Quantinuum	H2	Trapped Ions ($^{171}Yb^{+}$)	56	Digital	fully connected (QCCD)	1Q rotation, zz, SU(4)	✅	?	❌[2]
QuEra	Aquila	Neutral atoms (Rb-87)	256	Analog	fully connected	N/A[1]	❌	❌	❌

Adding it to metriq.info

Currently on Github project's wiki
unitaryfoundation/metriq-gym/wiki/

Nice to see similar endeavor (price focused) at
https://quantumbenchmarkzoo.org/

QED-C-Metriq-gym software integration, 2025 student internship

Quantum Economic Development Consortium (QED-C): Members represent industry, academia, and government laboratories.

Neer Patel, PhD student at UCF, Summer Intern

QED-C Technical Advisory Committee (TAC):

- **Siyuan Niu**
- Tom Lubinski

TAC on Standards and Performance Metrics

Metriq:

- **Vincent Russo**
- Changhao Li
- Alessandro Cosentino
- Nathan Shammah

Prior work

- QED-C toolkit - Metriq API initial integration (2023): "Automatically running QED-C benchmarks on Metriq" (blog post)

Goals

- Integrating the open-source quantum software tools
- Expanding the scope and complexity of available benchmark programs
- Collecting execution results from currently available quantum computing systems.

What's next for Metriq

Roadmap

- Refresh the website, metriq.info [open web-dev position]
- Further integrate metriq-gym and metriq.info
- Add new benchmarks to metriq-gym
- Take more cross-platform results
- Engage with benchmarking projects and committees (OQBC, QED-C, BACQ, etc.)

- How you can be involved:
  - Add your benchmark and results to Metriq.info (largest quantum benchmarking dataset to date)
  - Test Metriq Gym to independently take benchmarks on QPUs
  - Propose a new benchmark to be added to Metriq Gym
  - Apply to join the Open Quantum Benchmarking Committee
  - Join the online and in-person events, sign up to our newslettter

Unitary Foundation

Because evolution is unitary.

Feel free to reach out:
Nathan Shammah
nathan@unitary.foundation

Join the community at
discord.unitary.foundation →

Unitary Foundation

Because evolution is unitary.

Extra Slides

Board of **Directors**

Unitary Foundation

President. Partner at Quantonation. Fmr. Head of Quantum at Goldman Sachs and product/sw lead at Rigetti. Oxford quantum algorithms PhD.

William Zeng, PhD

Secretary. Quantum Applications Architect at IBM Quantum and Policy Hackers Fellow at the Lincoln Network. PhD in quantum computing from the University of New Mexico (2018).

Travis Scholten, PhD

COO & Co-Founder, Convergent Research, which incubates new kinds of transformative research institutions.

Anastasia Gamick

CTO and Head of the Technical Staff. Managing Director, Unitary Fund France. QuTiP admin. PhD in Physics from Univ. of Southampton.

Nathan Shammah, PhD

Treasurer. Co-founder and managing partner at Quantonation. PhD in Quantum Physics from Ecole Polytechnique.

Christophe Jurczak, PhD

Riverlane. Fmr. Director, IBM Quantum & Qiskit Community.

Liz Durst

Microgrant Program: A Bottom-up Approach

5.1.2025

FUTURE-PROOFING PYZX

To **John van de Wetering** to improve the user-friendliness, reliability, and future-proof quality of PyZX, a library for working with large ZX-diagrams (>150k downloads) as well as its integration with ZXLive, a new tool that serves as a graphical proof assistant for ZX.

NETHERLANDS

4.11.2025

FAST NEURAL DECODERS FOR UNIVERSAL LOGICAL QUANTUM ALGORITHMS

To **Andi Gu and Pablo Bonilla** to develop an open-source toolkit for fast decoding using deep learning and simulating logical quantum algorithms.

USA

3.31.2025

PAULIE

To **Konstantin Golovkin and Oxana Shaya** to further develop and extend their project, **PauLie**, an open-source library for studying various algebraic properties of quantum circuits.

GERMANY

9.23.2024

GRAPHIX WORKSHOP

To **Maxime Garnier** and **Thierry Martinez** to further develop **Graphix** during a 2025 workshop.

FRANCE

8.26.2024

DOCUMENTATION FOR QUANTUMTOOLBOX.JL

To **Alberto Mercurio, Yi-Te Huang, and Luca Gravina** to further develop **Documentation for QuantumToolbox.jl**, a state-of-the-art Julia package designed for quantum physics simulations.

SWITZERLAND

8.26.2024

PYTHON CVXQUAD

To **Aidan Sims** to further develop **Python CVXQuad**, a project translating the CVXQuad library to Python and integrating it with the existing Toqito library.

USA

"An incredible learning opportunity. Thank you to the UF microgrant program… for following up, for creating structure, and for connecting me with idols in my field, who were able to mentor my technical work while also supporting me in making the right career move after my PhD."

- ***Katherine Van Kirk, recent grantee***

Microgrants are $4,000, no-strings attached. 100 teams funded to date in 31 countries. Apply with a 2-minute video on unitary.foundation

unitaryHACK 2025: A bounty-based program supporting quantum OSS projects

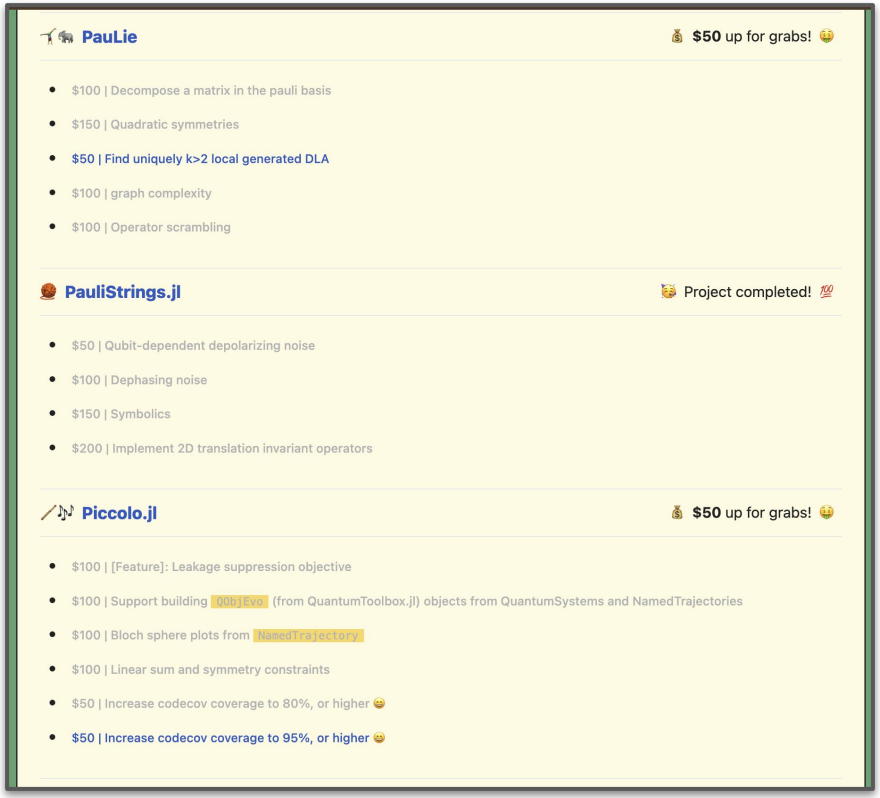
- **Dates:** May 28 - June 11, 2025
- **5th anniversary** edition
- Unitaryhack.dev
  - **900+ hackers** registered
  - **99 maintainers**
  - **54 OSS projects participating**
- **6 in-person Hackdays** (up from 3 last year)
  - PushQuantum, TUM, Germany
  - QLASS @ Milan, Italy
  - U. Coimbra, Portugal

unitaryHack impact 2021-2024

327 bounties closed across **83 oss projects**
For ~$32k

- 78 hackers awarded bounties for 172 issues closed, collecting a total of $19710

unitaryHACK 2025



PauLie

$50 up for grabs!

- $100 | Decompose a matrix in the pauli basis
- $150 | Quadratic symmetries
- **$50 | Find uniquely k>2 local generated DLA**
- $100 | graph complexity
- $100 | Operator scrambling

PauliStrings.jl

Project completed!

- $50 | Qubit-dependent depolarizing noise
- $100 | Dephasing noise
- $150 | Symbolics
- $200 | Implement 2D translation invariant operators

Piccolo.jl

$50 up for grabs!

- $100 | [Feature]: Leakage suppression objective
- $100 | Support building `QObjEvo` (from QuantumToolbox.jl) objects from QuantumSystems and NamedTrajectories
- $100 | Bloch sphere plots from `NamedTrajectory`
- $100 | Linear sum and symmetry constraints
- $50 | Increase codecov coverage to 80%, or higher
- **$50 | Increase codecov coverage to 95%, or higher**

unitaryHACK 2025

Hackathon Leaderboard

78 hackers have combined to earn **$19710** by closing **172** bounties!

Hacker	Bounties Completed
Kitsunp	11
WingCode	10
ACE07-Sev	9

`Kitsunp`

`Kitsunp` has claimed $1145 by closing 11 issues across 6 projects!

Bounties Completed

- `guppylang` : Diagnostics rendering with `miette`
- `metriq-gym` : Add mirror circuits to benchmarks
- `metriq-gym` : Feature: Allow user to dispatch list of benchmarks on a device
- `pyqtorch` : [Testing] Test reembedding of params in HamiltonianEvolution
- `pyqtorch` : [Testing] Expand embedding tests for all operators
- `qlass` : Reduce the number of measurements: grouping commuting Pauli terms.
- `qlass` : generalize loss function to work with more executors
- `qlass` : OpenFermion as alternative quantum chemistry library
- `qurveros` : Fit BarqCurve control points to curve
- `qurveros` : Handle floating-point errors during optimization
- `scqubits` : Conversion from (`scqubits` 's custom) `NamedSlotsNdarray` to other data formats.

Save the Date: unitaryCON 2025

unitary CON 2025

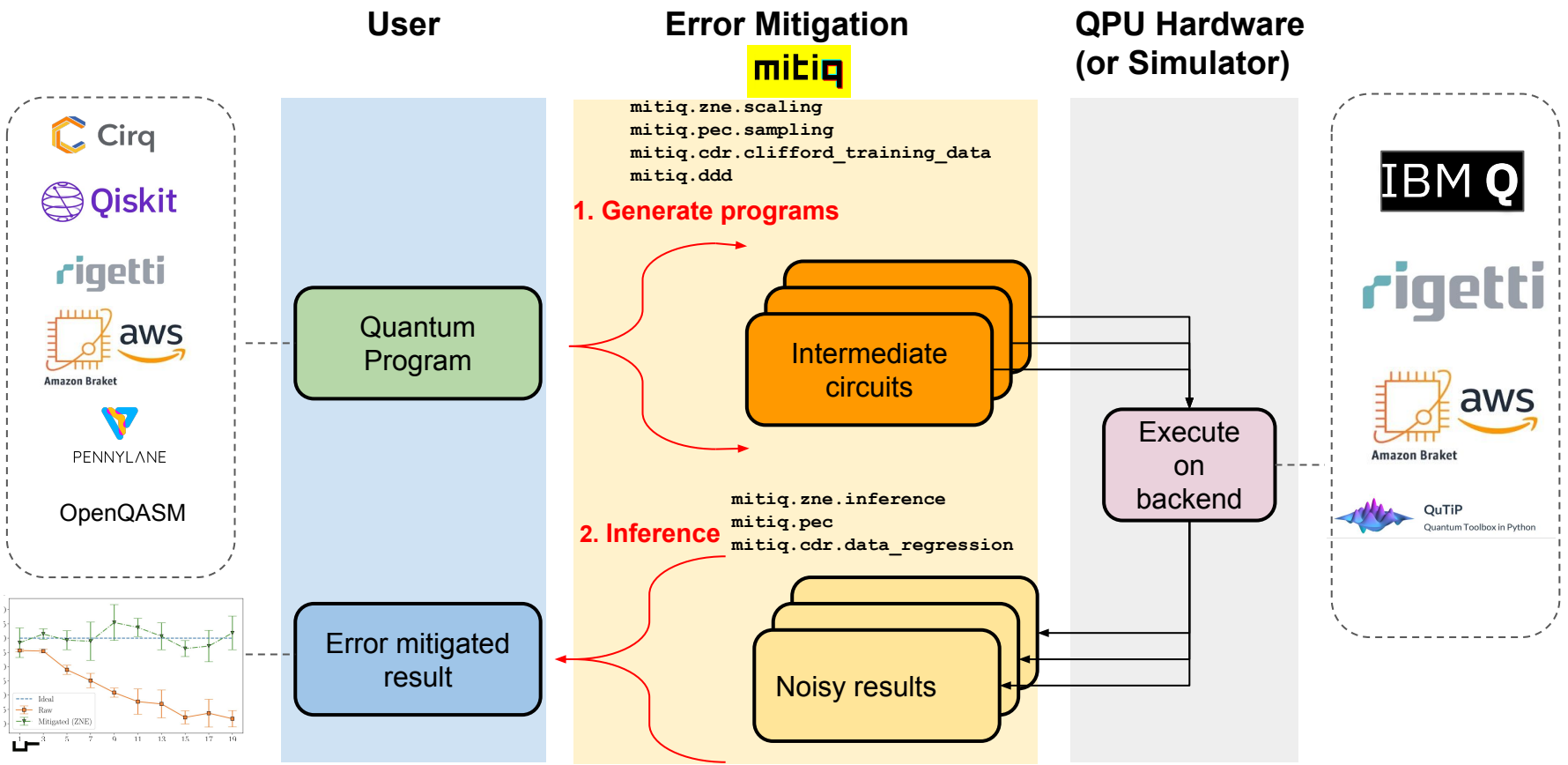
September 2-4, 2025

Albuquerque, NM, USA. In partnership with the University of New Mexico and IEEE Quantum Week.

2024: Aalto University, Finland

Bringing together the community of quantum open source software developers.

Cross-Platform Quantum Error Mitigation with Mitiq



Mitiq project: Community, Impact and Dissemination

Quantum **6** 774 (2022)

`pip install` **`mitiq`**
github.com/unitaryfund/mitiq

50+ Releases
Current version: v.0.45
250,000 Downloads

186 “forks” (copies)
80+ contributors
6 Ambassadors

mitiq.readthedocs.io
317 pages of documentation
Full API-docs, 20+ tutorials

discord.unitary.fund
Community Call: Fri 6 pm CET
Quantum Wednesday: 6:30 pm CET

First established thanks to ARQC TEAM

Mitiq is used at Ames Nat Lab, IBM, Inst. Polit. Nacional (Mexico), Iowa State, Los Alamos Nat Lab, Michigan State Univ., Perimeter Institute (Canada), Stanford, Univ. Autonoma Madrid (Spain), Univ. Compl. Madrid (Spain), Univ. of Chicago, Yale…

[Compilation] Launched the Unitary Compiler Collection (UCC)

Problem: Compiler improvements are often isolated in separate libraries or one-off repositories without integration into existing tools and there are high switching costs between quantum computing frameworks and hardware platforms.

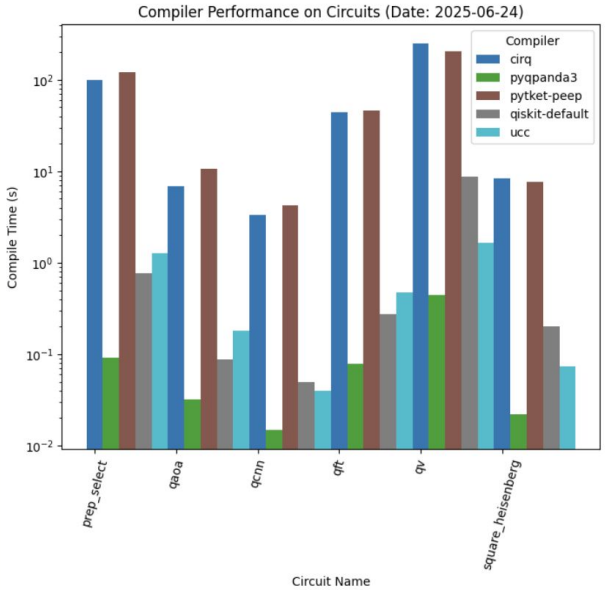
Unitary Compiler Collection
…The “quantum GCC”

Resources

- UF blog post: *Introducing ucc* - March 5, 2025
- Github Repo: github.com/unitaryfund/ucc
- Docs: https://ucc.readthedocs.io/
- UF Discord: #ucc text channel

[Compilation] Launched the Unitary Compiler Collection (UCC)

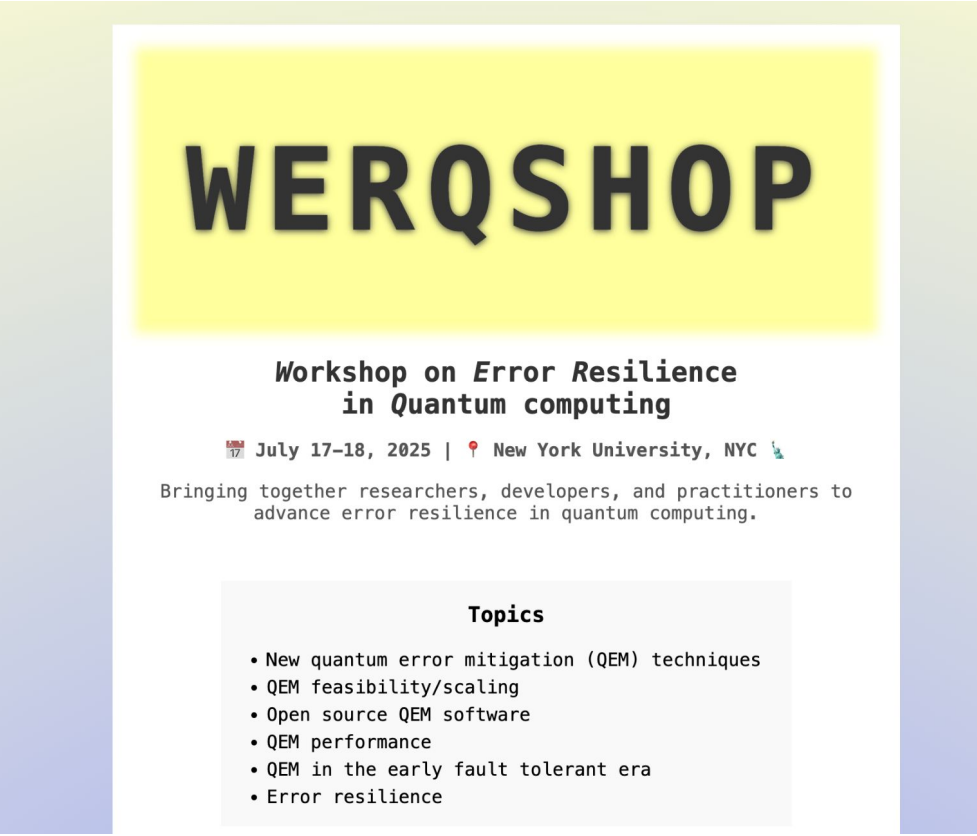
1. **Aim at Best-in-Class Compilation:** Currently leveraging a subset of Qiskit's transpiler passes optimized with Rust for circuit optimization. We benchmark UCC's default passes against existing compilers and SDKs.
2. **No Code Changes to Switch Between Frontends:** UCC leverages qBraid so that users do not need to rewrite code.
3. **Compatible with Any Backend Supporting OpenQASM:** No extra imports needed:



Resources

- UF blog post: *Introducing ucc* - March 5, 2025
- Github Repo: github.com/unitaryfund/ucc
- Docs: https://ucc.readthedocs.io/
- UF Discord: #ucc text channel

[Compilation] Mitiq Workshop



https://werq.shop/

📍 NYC, Jul 17-19, 2025

Hosted at NYU

Supported by NSF Mitiq POSE grant

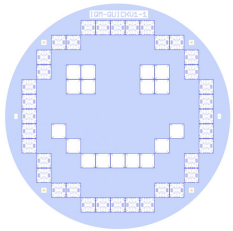
In collaboration with DoE SMART STACK & Mitiq advisors

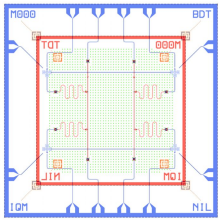
QEM, QEC, compilation in early FTQC stage

Invited Speakers (Confirmed)

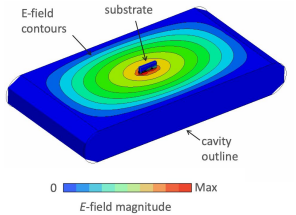
- Zhenyu Cai (Oxford)
- Yongshan Ding (Yale)
- Sam Ferracin (IBM)
- William J. Huggins (Google)
- Jin Ming Koh (Harvard)
- Matea Leahy (Algorithmiq)
- Yihui Quek (MIT)

Open Hardware in Quantum Technology: The Complete Cycle





KQCircuits



pyEPR

QPU Design, Layout and EM Simulation

Hamiltonian Simulation

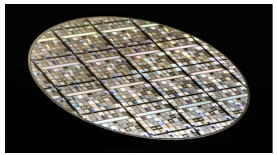
Design

1

Foundry

Fabrication

2



Foundries

Installation & Bring-Up

3

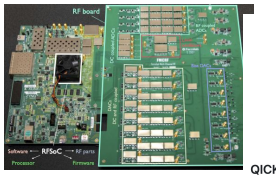
Control, Calibration & Data Acquisition

Cloud Infra

Sustained Operation

Testing and Characterisation

4



QICK

QICK: Quantum Instrumentation Control Kit

NS *et al.*, APL Quantum **1**, 011501 (2024), link

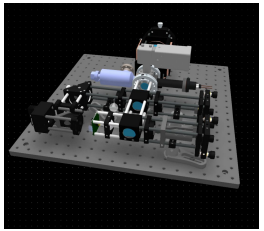
Unitary Fund: Supporting Open Quantum Hardware (OQH)

Catalyzing processes

+ First pyEPR community call (2020)
+ First OQH workshop at IEEE Quantum Week (2021)
+ First OQH review paper (2024)
+ Quantum Device Workshop (2025)

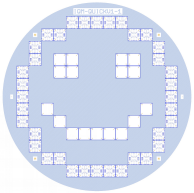
Microgrants

[OpenQuantum](): Cold-atom CAD

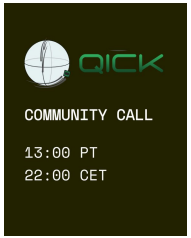


Support projects in unitaryHACK

KQCircuits



Connecting the community



Partnering with OQD (Waterloo)

Open Quantum Design

openquantumdesign.org

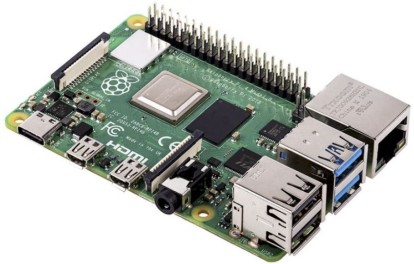
LF

Open Hardware… in Quantum Technology?

Arduino

Raspberry Pi

Classical electronics:

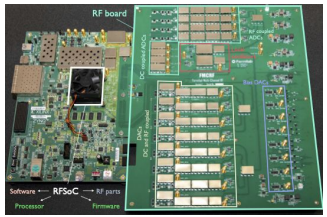


Quantum Technology:

openquantumhardware / qick

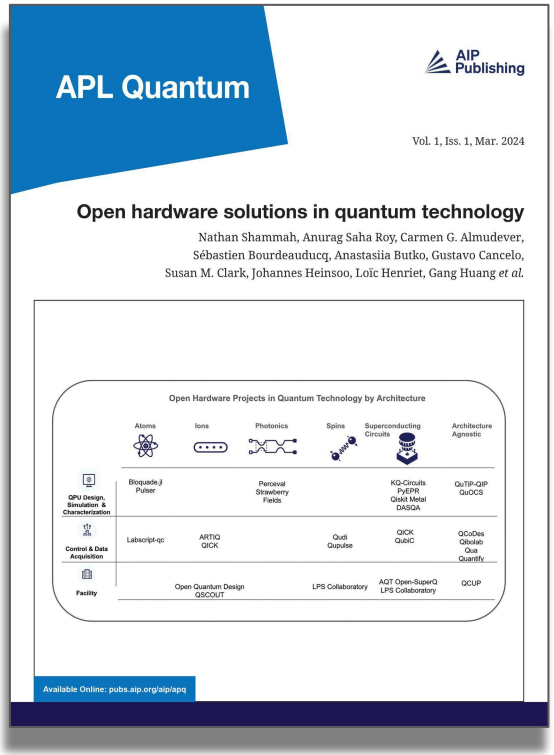
Watch 21 | Fork 64 | Star 163

QICK



RF-SoC: Radio-Frequency (RF), System on a Chip (SoC)

Open Hardware in Quantum Technology, a Review



N.Shammah *et al.*, APL Quantum **1**, 011501 (2024), link