

2021 CONFERENCE PROGRAM

17-22 OCT 2021

IEEE QUANTUM WEEK

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When we launched the world's first quantum computer on the IBM cloud back in 2016, we were astonished to gain 8000 users in a few weeks.

Today we've had over 350,000 users. We also have the largest open-source quantum developer community by far, running over 2 billion executions a day on a fleet of 21 of the most powerful commercially available quantum computers in the world.

We now have over 140 active clients including Exxonmobil, Daimler-Benz, Goldman Sachs, BP, Mitsubishi Chemical and Boeing. In 2021 we've already shared our development roadmap, showing a clear path to 1000+ qubit systems by 2023.

In May we launched Qiskit Runtime demonstrating a remarkable 120X speedup to our existing hardware. Later this year we're unveiling our 127 qubit Eagle Processor, offering unprecedented 100+ qubit performance to our clients and partners.

We feel this is just the beginning. If you're as excited about what quantum computing can do for your organization as we are, then we should talk.

If you'd like to learn more, please contact us on hmcortes@us.ibm.com



IEEE QUANTUM WEEK

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Welcome!

IEEE Quantum Week is a multidisciplinary quantum computing venue where attendees have the unique opportunity to discuss challenges and opportunities with quantum researchers, scientists, engineers, entrepreneurs, developers, students, practitioners, educators, programmers, and newcomers.

Have a great week at
IEEE Quantum Week 2021!



Chairs Message

Hausi Müller, Greg Byrd, Candace Culhane, Travis Humble

Welcome to the second *IEEE International Conference on Quantum Computing and Engineering (QCE21)* or IEEE Quantum Week. With your outstanding contributions and participation, we are once again offering an unparalleled opportunity to interact with experts in a full range of quantum technologies, from quantum device engineering to quantum computing and applications, and the broader quantum ecosystem. From its beginning, a goal of IEEE Quantum Week has been to enable a meaningful exchange of ideas and to broaden the quantum community through networking with peers and exploring partnerships among industry, government, and academia. We hope that you will agree that this year's program delivers on all fronts.

Due to the continuing difficulties created by the COVID-19 pandemic, including restrictions on travel and large gatherings, IEEE Quantum Week is once again fully virtual. Our virtual home is Broomfield, Colorado, which was the planned site for the original conference in 2020. We will miss the opportunity to see you all in person, but we aim to provide many ways for attendees to interact with each other and to make those connections that energize and inspire us. The virtual platform allows for broad participation from around the world, and all content will be available on demand until 22 December 2021.

With outstanding contributions from the international quantum community, we have put together an exceptional program that spans quantum science and engineering—from qubit and control technologies, to quantum software infrastructure and development platforms, to promising

quantum applications. IEEE Quantum Week aims to bring together different skill sets to generate synergies among quantum professionals, researchers, educators, entrepreneurs, champions, and enthusiasts exchanging and sharing their experiences, challenges, research results, innovations, applications, pathways and enthusiasm on all aspects of quantum computing, engineering and technologies. Hardware-software co-design is an important theme in the quantum communities. Thus, bringing together researchers and practitioners from quantum information science and algorithms, quantum technologies, the spectrum of hardware and software platforms, software and systems engineering, as well as promising application domains will foster partnerships, alliances, and start-ups.

QCE21 features ten parallel tracks over five days comprising 10 keynotes by world-class speakers, 19 workforce-building tutorials, 23 community-building workshops, 53 technical paper and invited presentations, 18 stimulating panels, 30 innovative posters, thought-provoking Birds of Feather (BoF) sessions, and virtual rooms to network and relax in the Colorado Rockies. In its virtual exhibits, IEEE Quantum Week highlights technologies as well as R&D opportunities by established quantum companies and start-ups as well as quantum research labs and institutes. There are 57 scheduled exhibitor events, featuring over 35 companies and partners.

While one week is not enough to explore the 320+ hours of quantum computing and engineering programming offered by IEEE Quantum Week, registered participants can access recorded quantum week sessions



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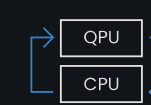
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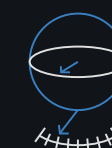
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at their leisure over eight weeks until mid-December. Moreover, different cohorts will be attracted to different program tracks. For example, quantum newcomers will be best served by the stellar keynotes, tutorials, panels, and BoFs. Experienced quantum researchers, engineers, and developers will find workshops, technical papers, and posters in their subject area. The QCE21 Exhibitors, Patrons, and Supporters will showcase their technologies and discuss training and R&D opportunities. Entrepreneurs can get to know the founders of quantum start-ups and learn how to build and fund a start-up in the Exhibits as well as the Quantum Entrepreneurship workshop.

As the quantum realm is highly interdisciplinary and spans many scientific and engineering fields and application areas, one of the key ideas for Quantum Week was to enlist the IEEE Societies, Councils and Organizational Units in the quantum space as financial and technical sponsors. IEEE Quantum Week 2021 is financially co-sponsored by IEEE Future Directions Quantum Initiative, IEEE Computer Society (IEEE CS), IEEE Communications Society (ComSoc), IEEE Photonics Society, and IEEE Council on Superconductivity (CSC) as well as technical co-sponsored by IEEE Technology & Engineering Management Society (TEMS), IEEE Electronics Packaging Society (EPS), IEEE Signal Processing Society (SPS), and IEEE Electron Devices Society (EDS). We encourage all participants to explore membership and further engagement with IEEE and our sponsoring societies as a natural home for quantum engineering, education, and research.

The call for papers sought contributions for five different program tracks: (1) Quantum Applications and Algorithms, (2) Quantum Computing and Systems, (3) Quantum Networking and Communications, (4) Quantum Engineering, Devices, and Sensing, and (5) Quantum Workforce and Society. Some of these tracks map directly to sponsoring

societies where others reflect ongoing working groups as part of the IEEE Quantum Initiative. The demand and number of submissions varied significantly among the tracks. QCE21 received 110 technical paper submissions from 27 countries on 6 continents. Roughly 50% of the submissions had at least one author from industry or government laboratories; each paper was reviewed by at least three reviewers from the set of 65 international program committee members. In the end, given the reviews the 10 program track chairs accepted 48 technical papers for QCE21.

We are deeply indebted to many people for their help and support in orchestrating QCE21. First, we would like to thank all the contributors—the keynote speakers, the technical paper and poster authors, the panel organizers and panelists, the tutorial presenters, the workshop organizers, and the BoF orchestrators. We especially would like to thank the exhibitors, the Platinum, Gold, Silver, Bronze sponsors and patrons, and the supporters for their financial, technical, and in-kind contributions. Their contributions are recognized with their logos and ads below as well as in the beautiful final program, the conference website, and the Hubb virtualization website.

Second, we would like to thank all attendees who registered for QCE21. Your enthusiasm and appreciation of the speakers and the program made it all worthwhile. Third, we would like to recognize all technical program track chairs and committee members, who conducted the review process under the leadership of the Technical Program Board Chair Greg Byrd. We also would like to thank the co-chairs and reviewers of the tutorial, workshop, poster, panel, and BoF tracks for their dedication and innovative ideas in soliciting proposals. The track co-chairs and committee members are enumerated and recognized in the QCE21 Committee pages below in detail. Finally, we are indebted to the union of the IEEE Quantum Week

Steering Committee and the IEEE Quantum Initiative Steering Committee for their extensive contributions, feedback, and support in the weekly conference calls over the past twelve months. These folks greatly shaped the structure and format of IEEE Quantum Week 2021.

We are deeply indebted to all the IEEE staff who worked tirelessly over the last three years in getting IEEE Quantum Week come to fruition. First and foremost, we would like to thank Terence Martinez, IEEE Quantum Initiative Program Director at IEEE Future Directions, for his dedicated support. Terence orchestrated our weekly conference calls, liaised to all the IEEE Societies and organizational units sponsoring IEEE Quantum Week, organized the QCE21 publicity campaign at the IEEE level, and kept us on track over the past year. We would like to thank all the staff at IEEE and the different sponsoring societies, councils, and organizational units for promoting IEEE Quantum Week in their respective channels.

We especially would like to commend the staff of the IEEE Computer Society, the official QCE21 Conference Management Organization, for their superb help and support throughout the entire journey of IEEE Quantum Week. First, we thank Silvia Ceballos, who believed in the concept of IEEE Quantum Week and encouraged us to take on this journey. Second, we would like to thank our outstanding meeting planner, Carmen Saliba, for her outstanding project management skills, her attention to details, and for looking after IEEE Quantum Week and its volunteers. She conducted all our contract negotiations with the hotel, the virtualization company, registration services, and many more. She was the perfect interface to IEEE Computer Society staff and services. We thank Patrick Kellenberger and Meghan O'Dell for their outstanding Conference Publications Services (CPS) and Marie Trinh and Tricia Yamaguchi for their Registration Services. Patrick was

a terrific sounding board throughout this journey. We especially thank the outstanding exhibits team that exceeded all our exhibits sales expectations, including Michelle Tubb, Regan Pickett, Georgann Carter, and Amir Draquez. Marketing is critical for an emerging conference. We are deeply indebted to Michelle Tubb, Katherine Mansfield, and Jennie Zhu-Mai at IEEE Computer Society and Melissa Power at Interpose. We thank Stephen Woods for being the logistical lead in setting up QCE21 on the Hubb virtual platform, his support, patience, and problem-solving skills played an integral role in the success of building the virtual presence for the conference. Finally, we would like to thank the Hubb.me team for getting QCE21 virtualized and online.

We hope that the virtual platform and experience for IEEE Quantum Week on-demand recordings will be a great success. We sincerely hope that you will enjoy IEEE Quantum Week 2021 and find plenty of time to explore and experience the many outstanding contributions we received from the international quantum community.



H. Müller

Hausi Müller
QCE21 General Chair
Co-Chair IEEE Quantum Initiative
University of Victoria



Greg Byrd

Greg Byrd
QCE21 Technical Program Board Chair
NC State University



Candace Culhane

Candace Culhane
QCE21 Finance Chair
Co-Chair IEEE Quantum Initiative
Los Alamos National Laboratory



Travis Humble

Travis Humble
QCE21 Workshops Co-Chair
Co-Chair IEEE Quantum Initiative
Oak Ridge National Laboratory

Thank You to Our Sponsors!

With your support, we are pleased to present the all-virtual IEEE International Conference on Quantum Computing and Engineering (QCE21), a multidisciplinary event focusing on quantum technology, research, development, and training.

We are grateful to our amazing lineup of sponsors for being a part of Quantum Week.

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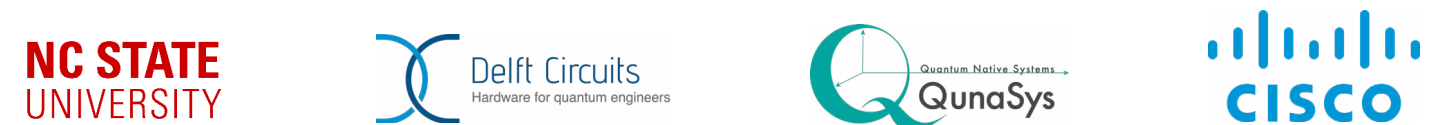
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Sponsor Event Highlights

Exhibits Schedule-at-a-Glance

Mountain Time (UTC-6)	10:00–10:45	12:15–13:00	14:30–15:15
Monday 18 October	IonQ →	IBM Quantum →	Microsoft →
	IQM →	ColdQuanta →	D-Wave →
	Bluefors →	Riverlane →	Seeqc →
	Classiq →	OZ Optics →	Tabor Electronics →
Tuesday 19 October	Quantum Machines →	Intel →	AWS Braket →
	Keysight →	Nu Quantum →	Quantropi →
	Toptica →	QAI →	CMC Microsystems →
	Zurich Instruments →	Qblox →	NC State →
Wednesday 20 October	IBM Quantum →	IonQ →	Honeywell →
	Riverlane →	Toptica →	Zapata →
	TII →	Quantum Machines →	ColdQuanta →
	Delft Circuits →	Zurich Instruments →	
Thursday 21 October	IQM →	Microsoft →	Seeqc →
	Quantropi →	CMC Microsystems →	OZ Optics →
	TII →	Classiq →	QAI →
	Bluefors →	Tabor Electronics →	C12 Quantum Electronics →
	iXblue →	Agnostiq →	
Friday 22 October	AWS Braket →	D-Wave →	Honeywell →
	Nu Quantum →	Intel →	Google →
	Agnostiq →	Keysight →	
	Zapata →	Qblox →	
		Pasqal →	

Sponsor Event Schedule

Mountain Time (UTC-6)	Event	Company
Monday, 18 October 10:00–10:45 JOIN →	Cooling Your Qubits Cryogenics is an integral part of today's quantum technology and as such it need to keep the same high pace of development. In this presentation Sauli Sinisalo, Vice President and General Manager of Bluefors Inc. will present how Bluefors keeps up on that pace with the new Bluefors branch in New York.	Bluefors
Monday, 18 October 12:15–13:00 JOIN →	Overview of Careers at IBM Quantum IBM Quantum is dedicated to building the quantum workforce of tomorrow through industry-leading work, research, and educational opportunities. Team members receive educational and professional development support, as well as invaluable research and work experience with the latest quantum technologies. Team members participate in building a global quantum community with hands-on engagements such as hackathons, internships, and mentorship, helping to refine their research, leadership, and science communications skills.	IBM
Monday, 18 October 13:00–14:00 JOIN →	iXblue Components for Optical Quantum Key Distribution iXblue proposes state-of-the-art components that improve Alice's transmitter efficiency. They are Phase and Amplitude Modulators, RF amplifiers and come with outstanding performance such as low insertion loss modulators, high extinction ratio amplitude modulators, highly linear RF amplifier.	iXblue Inc.
Monday, 18 October 14:30–15:15 JOIN →	Experiment Design Considerations for Real-time, Closed-Loop Pulse Streaming As an experimentalist, you are trying to gain the most insight from the work you perform, such as a better understanding of electron spin behavior and maintaining coherence in the presence of noise and across multiple devices. Iteratively changing the characteristics of the electromagnetic pulses being applied to the system is one of the techniques that can help gain that insight. Changing pulse-to-pulse phase shift, pulse duration, and pulse shaping techniques, combined with a measurement feedback system can correct errors or enhance the performance of the experiment. In this workshop, we will look at direct-to-microwave, real-time shaped pulse generation and measurement. We will examine how to generate dynamic waveforms with characteristics that change periodically based on measurement. Understanding the architecture of instrumentation and fundamentals, such as sampling rates, on-board memory, and analog bandwidth will be covered; however, this type of application often goes beyond signal generation and measurement. Computing requirements such as memory and processing speed, data transfer rates, and interface choices must also be considered. By the end of this workshop, you will be able to take a system approach to the experiment and be able to understand the key design requirements of a high-performance control and feedback system for your Quantum experiment.	Tabor Electronics

Sponsor Event Schedule, continued

Mountain Time (UTC-6)	Event	Company
Monday, 18 October 14:30–15:15 JOIN →	Working in Quantum at Microsoft Please join Microsoft recruiting and Azure Quantum engineering team members where we'll answer your questions and cover the various roles within our team.	Microsoft
Tuesday, 19 October 9:00–10:00 JOIN →	iXblue Laser and Optical Power Splitting Solutions for Quantum Applications iXblue intelligent laser systems – ILS – features fast tunability and accurate control of the absolute laser frequency, phase and amplitude. Tailored solutions with several fiber outputs can be proposed as a turn-key solution for ultra-stable atom cooling, atom interferometry, or Bose-Einstein Condensation. We will also feature our high-performance, robust, and ultra-stable optical power splitter with an adjustable ratio in a fully integrated package.	iXblue Inc.
Tuesday, 19 October 10:00–10:45 JOIN →	Qiskit Advocates: Community Building The Qiskit Advocate program is a global program that provides support to the individuals who actively contribute to the Qiskit Community. Being a part fo this enthusiastic community offers mentorship with experts on specific projects, networking, and priority access to events. Stop by to meet Qiskit Advocates, learn about the program, and how to get involved.	IBM
Tuesday, 19 October 12:15–13:00 JOIN →	Fully-Integrated Quantum Control Stacks for a Handful to 100s of Qubits Reaching quantum advantage requires tackling major challenges in various aspects such as qubit quality, scalable control hardware, application of quantum error mitigation techniques and others. Qblox enables the quantum industry to move forward by building quantum control stacks that manipulate and read out quantum devices. We facilitate fundamental research in university labs and build highly scalable systems for industry-level R&D labs with proprietary technology. In this session, we will explain how the Cluster series reduces the system size, complexity, cost per qubit and operational costs via fully-integrated modules and advanced sequence processing. The Cluster series inputs and outputs signals over a wide frequency range from DC to 18.5 GHz. Thanks to its low noise it is the ideal equipment to push gate fidelities and the ultra low drift reduces the need for recalibration. Our SYNQ protocol makes sure that signals across multiple devices are synchronized to the level of picoseconds and the LINQ protocol distributes measurement outcomes for many-qubit quantum error correction. The hardware stack is managed by the python-based software framework Quantify. It is built to intuitively set up experiments, reduce the runtime by orders of magnitude and automate calibration protocols.	Qblox
Wednesday, 20 October 10:00–10:45 JOIN →	Overview of Careers at IBM Quantum IBM Quantum is dedicated to building the quantum workforce of tomorrow through industry-leading work, research, and educational opportunities. Team members receive educational and professional development support, as well as invaluable research and work experience with the latest quantum technologies. Team members participate in building a global quantum community with hands-on engagements such as hackathons, internships, and mentorship, helping to refine their research, leadership, and science communications skills.	IBM

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Sponsor Event Schedule, continued

Mountain Time (UTC-6)	Event	Company
Wednesday, 20 October 12:15–13:00 JOIN →	Using the Quantum Development Kit and Azure Quantum in Education Learn about the various Azure Quantum courses, curriculum and training for EDU.	Microsoft
Wednesday, 20 October, 13:00–14:00 JOIN →	ixblue NIR Modulators for Quantum Applications ixblue has made technical choices that provide an advantage in terms of optical power handling and stability in the near infrared. For frequency shifting or pulse generation, we have the solution for you.	ixblue Inc.
Wednesday, 20 October, 14:30–15:15 JOIN →	Using Amazon Braket for Quantum Research: How to Get Started Amazon Braket is a cloud-based quantum computing service that enables researchers at universities, research labs, and businesses to experiment with a range of quantum hardware technologies in one place, including trapped ions, superconducting qubits, quantum annealing, and more to be added in time. Join this session to learn how you can accelerate your quantum information science research on Amazon Braket. AWS quantum computing experts — former researchers themselves — will show you how to access and use Amazon Braket and make best use of features for researchers. We will also cover AWS credit programs specifically designed to help researchers, so you can make the best use of resources and grants.	AWS
Thursday, 21 October 12:15-13:00 JOIN →	Getting Started with Azure Quantum for Python Developers Please join us for this session where we'll run through demos (Qiskit/Cirq + Q#+Python), and an overview of new Azure Quantum capabilities	Microsoft
Thursday, 21 October 12:15-13:00 JOIN →	Simplifying FPGA Programming for Closed-Loop Qubit Control and Measurement Systems	Tabor Electronics
Thursday, 21 October 14:30-15:15 JOIN →	Qiskit Metal Qiskit Metal is quantum EDA toolkit that is a first-of-its-kind, open-source project for engineers and scientists to design superconducting quantum devices with ease; Qiskit Metal. Users can create their own custom qcomponents, that act as 'super pcells', or make use of an available library of auto-routing transmission lines, couplers and qubits. Incorporated quantum analysis tools, such as Lumped Oscillator Model (LOM) or Energy Participation Ratio (EPR), can be leveraged to tune the qubit chip design. The completed design can then be generated to a GDS file ready for fabrication.	IBM

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Sponsor Event Schedule, continued

Mountain Time (UTC-6)	Event	Company
Friday, 22 October 12:15–13:00 JOIN →	Fully-Integrated Quantum Control Stacks for a Handful to 100s of Qubits Reaching quantum advantage requires tackling major challenges in various aspects such as qubit quality, scalable control hardware, application of quantum error mitigation techniques and others. Qblox enables the quantum industry to move forward by building quantum control stacks that manipulate and read out quantum devices. We facilitate fundamental research in university labs and build highly scalable systems for industry-level R&D labs with proprietary technology. In this session, we will explain how the Cluster series reduces the system size, complexity, cost per qubit and operational costs via fully-integrated modules and advanced sequence processing. The Cluster series inputs and outputs signals over a wide frequency range from DC to 18.5 GHz. Thanks to its low noise it is the ideal equipment to push gate fidelities and the ultra low drift reduces the need for recalibration. Our SYNQ protocol makes sure that signals across multiple devices are synchronized to the level of picoseconds and the LINQ protocol distributes measurement outcomes for many-qubit quantum error correction. The hardware stack is managed by the python-based software framework Quantify. It is built to intuitively set up experiments, reduce the runtime by orders of magnitude and automate calibration protocols.	Qblox
Friday, 22 October 12:15–13:00 JOIN →	Meet and Greet with Microsoft Azure Quantum While passion for quantum computing is a core driver for our Azure Quantum team, we have many diverse team interests outside of work that build on top of that. Please join us for this informal session where members of the Azure Quantum team discuss these projects including online lectures, authoring books and more.	Microsoft





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General Conference Information

Best Practices for Attending a Virtual Conference

1. Prioritize your time, engage in sessions and presentations, and use the chat or other networking tools to engage with attendees, presenters, and exhibitors.
2. Schedule sessions, presentations, exhibition time, and networking opportunities on your calendar. This will allow you dedicated time to engage with every element of the program.
3. Minimize distractions: When you're watching alone; it's easy to multi-task and get distracted. Instead, try to reduce interruptions, avoid double booking yourself with other meetings or priorities—this will allow for a better attendee experience.
4. If you miss a session, no fear, all content will be available on demand until **22 December 2021**.

Additional Information available on Hubb website.

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Mountain Time (UTC-6)	Monday–Friday Sessions
8:30–10:00	Session 1: Keynote, Awards, Announcements
10:00–10:45	Session 2: Exhibits, Posters, BoFs, Keynote Hangouts, Networking, Breaks, Supporter Programs
10:45–12:15	Session 3: Papers & Panels, Tutorials, Workshops
12:15–13:00	Session 4: Exhibits, Posters, BoFs, Networking, Breaks, Supporter Programs
13:00–14:30	Session 5: Papers & Panels, Tutorials, Workshops
14:30–15:15	Session 6: Exhibits, Posters, BoFs, Networking, Breaks, Supporter Programs
15:15–16:45	Session 7: Papers & Panels, Tutorials, Workshops
16:45–18:15	Session 8: Keynotes
18:15–18:45	Session 9: Keynote Hangouts

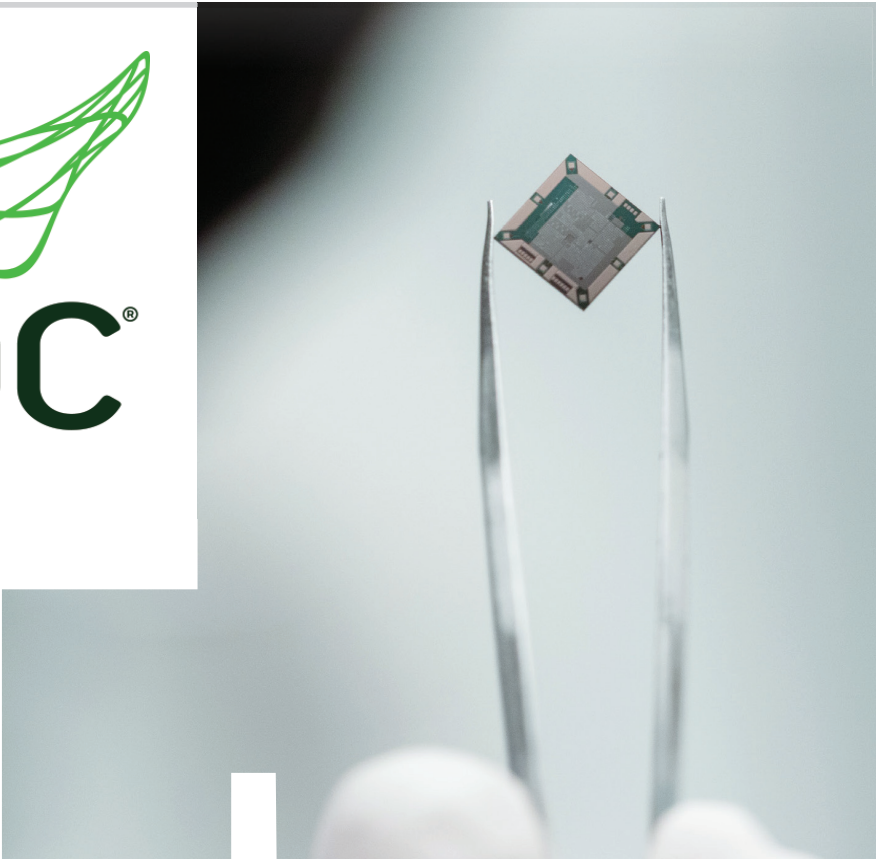
Keynote Zoom Room — Eagle	Tutorials Zoom Rooms — Bear 1, 2, 3, 4, 5	Workshops Zoom Rooms — Elk 1, 2, 3, 4, 5
Panels Zoom Rooms — Moose 1, 2, 3	Technical Papers Zoom Rooms — Bighorn 1, 2	Birds of a Feather (BoF) Zoom Room — Hawk
Exhibits Zoom Rooms — Patron Names	Posters Zoom Room — Bison	Networking Zoom Rooms — Wise-Owl 1, 2
Relax & Recharge Zoom Room — Colorado	Exercise Room	

QCE21 Program — Sun, 17 October

MT (UTC-6)	Session Type	Session Room	Sunday Sessions	
10:45–15:15	Workshop	Elk 2	Angara, U Victoria, Honeywell: Pathways to QC for Youth	JOIN →
	Tutorial	Bear 1	Pakin, Rieffel, LANL, NASA: Quantum Computing Intro	JOIN →
	Workshop	Bear 2	Jiang, GMU: QuantumFlow: End-to-End NN Framework	JOIN →
	Tutorial	Elk 1	ANL, NASA, ORNL, NVIDIA, FNAL, HRL: Advanced Quantum Simulation	JOIN →
16:00–19:00	Tutorial	Bear 3	Thomasen, Sho, QunaSys, Japan: Quantum Chemistry	JOIN →

QCE21 Program — Mon, 18 October

MT (UTC-6)	Session Type	Session Room	Monday Sessions	
8:30–10:00	Keynote	Eagle	Krysta Svore Microsoft Quantum Systems	JOIN →
10:00–10:45	Exhibit	IonQ	IonQ	JOIN →
	Exhibit	IQM	IQM	JOIN →
	Exhibit	Bluefors	Cooling Your Qubits	JOIN →
	Exhibit	Classiq	Classiq	JOIN →
	Posters	Bison	Posters 1	JOIN →
	BoF	Hawk	Community Ideation: Transformative Quantum Computing Applications for Electrical Engineering	JOIN →
	Keynote Hangout	Eagle	Keynote Hangout	JOIN →
	Exercise	Exercise	HIT Workout	JOIN →
10:45–12:15	Papers	Bighorn 1	QAA-1: Quantum Algorithms and Applications	JOIN →
	Workshop	Elk 2	Chen, Wong, Sotelo, Ibaraki, TEMS: Quantum Computing Entrepreneurship 1	JOIN →
	Tutorial	Bear 3	Lavrijsen, LBNL: Workflow for Hybrid Quantum-Classical Algorithm 1	JOIN →
	Workshop	Elk 1	ANL, NASA, ORNL, NVIDIA, FNAL, HRL: Advanced Simulations of Quantum Computations 1	JOIN →
	Tutorial	Bear 4	Moreno, Spain: Quantum Metropolis Solver: A Quantum Walk Software for Optimization Problems 1	JOIN →
	Workshop	Elk 3	Zanner, Microsoft: Furthering Quantum Computing through Azure Quantum Ecosystem Development 1	JOIN →
	Tutorial	Bear 1	Wootton, IBM: Benchmarking Near-term Devices with Quantum Error Correction 1	JOIN →
	Workshop	Elk 4	Giani, Eldredge, GE Research & DOE: Quantum Computing Opportunities in Renewable Energy and Climate Change 1	JOIN →

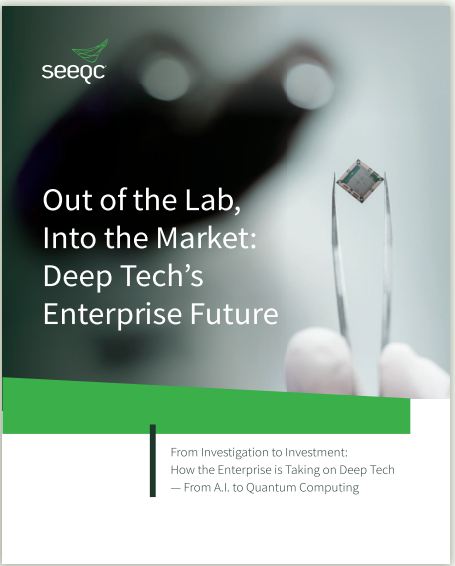


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Read the full report at seeqc.com/report



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MT (UTC-6)	Session Type	Session Room	Monday Sessions	
12:15–13:00	Tutorial	Bear 2	Almudever: Learning Quantum-Accelerated Scientific Computing with LibKet 1	JOIN →
	Panel	Moose 1	Sivan, Martinis, Aaronson, Blatt, Keesling: Aiming for the Future: Quantum Computing in 2050	JOIN →
	Exhibit	IBM Quantum	Overview of Careers at IBM Quantum	JOIN →
	Exhibit	Cold Quanta	Cold Quanta	JOIN →
	Exhibit	Riverlane	Riverlane	JOIN →
	Exhibit	OZ Optics	OZ Optics	JOIN →
	Exhibit	Pasqal	Pasqal	JOIN →
	Poster	Bison	Posters 2	JOIN →
	Networking	Network	Networking: Quantum Computing	JOIN →
	Networking	Network	Networking: Quantum Engineering	JOIN →
	Relax & Recharge	Colorado	Beautiful Colorado	JOIN →
	Panel	Moose 3	Supporting Diversity in Quantum Computing	JOIN →
13:00–14:30	Papers	Bighorn 1	QAA-2: Quantum Algorithms and Applications	JOIN →
	Workshop	Elk 2	Chen, Wong, Sotelo, Ibaraki, TEMS: Quantum Computing Entrepreneurship 2	JOIN →
	Tutorial	Bear 3	Lavrijsen, LBNL: Workflow for Hybrid Quantum-Classical Algorithm 2	JOIN →
	Workshop	Elk 1	ANL, NASA, ORNL, NVIDIA, FNAL, HRL: Advanced Simulations of Quantum Computations 2	JOIN →
	Tutorial	Bear 4	Moreno, Spain: Quantum Metropolis Solver: A Quantum Walk Software for Optimization Problems 2	JOIN →
	Workshop	Elk 3	Zanner, Microsoft: Furthering Quantum Computing through Azure Quantum Ecosystem Development 2	JOIN →
	Tutorial	Bear 1	Wootton, IBM: Benchmarking Near-term Devices with Quantum Error Correction 2	JOIN →
	Workshop	Elk 4	Giani, Eldredge, GE Research & DOE: Quantum Computing Opportunities in Renewable Energy and Climate Change 2	JOIN →
	Tutorial	Bear 2	Almudever: Learning Quantum-Accelerated Scientific Computing with LibKet 2	JOIN →
	Panel	Moose 1	D-Wave: Accelerating Practical Quantum Computing	JOIN →
13:00–14:00	iXblue	iXblue	iXblue Components for Optical Quantum Key Distribution	JOIN →
14:30–15:15	Exhibit	Microsoft	Working in Quantum at Microsoft	JOIN →
	Exhibit	D-Wave	D-Wave	JOIN →
	Exhibit	Seeqc	Seeqc	JOIN →
	Exhibit	Tabor Electronics	Experiment Design Considerations for Real-time, Closed-Loop Pulse Streaming	JOIN →

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MT (UTC-6)	Session Type	Session Room	Monday Sessions	
	Poster	Bison	Posters 3	JOIN →
	Networking	Network	Networking: Hybrid Quantum Classical Problems, Algorithms, Architectures, Solutions	JOIN →
	Networking	Network	Networking: Welcome Quantum Newcomers	JOIN →
	Relax & Recharge	Colorado	Colorado: Cheyenne Mountain Zoo	JOIN →
	Exercise	Exercise	Stretch Exercise	JOIN →
15:15–16:45	Papers	Bighorn 1	QAA-3: Quantum Algorithms and Applications	JOIN →
	Workshop	Elk 2	Chen, Wong, Sotelo, Ibaraki, TEMS: Quantum Computing Entrepreneurship 3	JOIN →
	Tutorial	Bear 3	Lavrijsen, LBNL: Workflow for Hybrid Quantum-Classical Algorithm 3	JOIN →
	Workshop	Elk 1	ANL, NASA, ORNL, NVIDIA, FNAL, HRL: Advanced Simulations of Quantum Computations 3	JOIN →
	Tutorial	Bear 4	Moreno, Spain: Quantum Metropolis Solver: A Quantum Walk Software for Optimization Problems 3	JOIN →
	Workshop	Elk 3	Zanner, Microsoft: Furthering Quantum Computing through Azure Quantum Ecosystem Development 3	JOIN →
	Tutorial	Bear 1	Wootton, IBM: Benchmarking Near-term Devices with Quantum Error Correction 3	JOIN →
	Workshop	Elk 4	Giani, Eldredge, GE Research & DOE: Quantum Computing Opportunities in Renewable Energy and Climate Change 3	JOIN →
	Panel	Moose 1	QPARC: Creating an Industry Community to Advance Quantum Advantage Discovery	JOIN →
16:45–18:15	Keynote	Eagle	Alan Baratz, D-Wave Systems	JOIN →
18:15–18:45	Keynote Hangout	Eagle	Keynote Hangout	JOIN →

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QCE21 Program — Tue, 19 October

MT (UTC-6)	Session Type	Session Room	Tuesday Sessions	
8:30-10:00	Keynote	Eagle	Jay Gambetta, IBM Quantum	JOIN →
9:00-10:00	iXblue	iXblue	iXblue Laser and Optical Power Splitting Solutions for Quantum Applications	JOIN →
10:00-10:45	Exhibit	Quantum Machines	Quantum Machines	JOIN →
	Exhibit	Keysight	Keysight Technologies	JOIN →
	Exhibit	Toptica	Toptica	JOIN →
	Exhibit	Zurich Instruments	Zurich Instruments	JOIN →
	Exhibit	IBM Quantum	Qiskit Advocates: Community Building	JOIN →
	Posters	Bison	Posters 4	JOIN →
	BoF	Hawk	Workforce Development: Exploring the Jobs Landscape	JOIN →
	Keynote Hangout	Eagle	Keynote Hangout	JOIN →
	Exercise	Exercise	Dance Abba	JOIN →
10:45-12:15	Papers	Bighorn 1	QCS-1: Quantum Computing and Systems	JOIN →
	Workshop	Elk 1	Cohen, Quantum Machines: Standardized Quantum Control with QOP: Single Control System for All Qubit Platforms 1	JOIN →
	Tutorial	Bear 1	Yu, Glick, IBM: Introduction to the Qiskit Runtime, A Platform for Efficient Quantum-Classical Computation 1	JOIN →
	Workshop	Elk 2	Perez, UCLM: Quantum Software Engineering & Technology 1	JOIN →
	Panel	Moose 2	Riverlane: Quantum Error Correction – How to Train the Dragon	JOIN →
	Workshop	Elk 3	Shammah, Scholten, Unitary Fund: Open Quantum Hardware: Accelerating the Control, and Use, of Quantum Computing Systems 1	JOIN →
	Tutorial	Bear 2	Silvério, Pasqal: Pulse-Level Programming of Neutral-Atom Devices with Pulser 1	JOIN →
	Workshop	Elk 4	Fahim, FNAL & Charbon, EPFL: Cryogenic Electronics for Quantum Systems 1	JOIN →
	Panel	Moose 1	Qblox: The Future of Quantum Control Stacks	JOIN →
	Papers	Bighorn 2	QWS-1: Quantum Workforce and Society	JOIN →
12:15–13:00	Exhibit	Intel	Intel	JOIN →
	Exhibit	Nu Quantum	Nu Quantum	JOIN →
	Exhibit	QAI	Quantum Algorithms Institute	JOIN →
	Exhibit	Qblox	Fully-Integrated Quantum Control Stacks for a Handful to 100s of Qubits	JOIN →



 QBLOX



1 qubit



20 qubits



100s qubits

Shorten Setup Time
Quick Calibration
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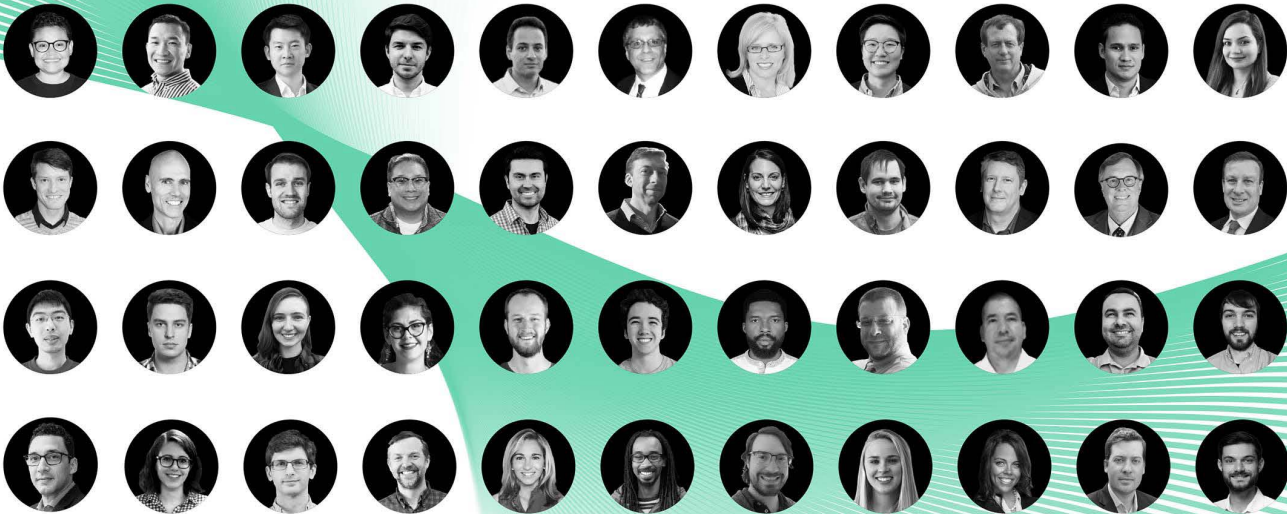
Fully-integrated
Quantum Control Stacks
Ultrastable DC to 18.5 GHz
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Dedicated Qubit OS

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MT (UTC-6)	Session Type	Session Room	Tuesday Sessions	
12:15–13:00	Exhibit	Google	Google Quantum AI	JOIN →
	Posters	Bison	Posters 5	JOIN →
	Networking	Network	Networking: Quantum Developers	JOIN →
	Networking	Network	Networking: Nature Simulation	JOIN →
	Relax & Recharge	Colorado	Colorado: Hike from Bear Lake to the Continental Divide	JOIN →
	Exercise	Exercise	Yoga for Focus	JOIN →
13:00–13:45	Panel	Moose 1	Zurich Instruments: Full Quantum Stack of Superconducting Qubits	JOIN →
13:00–14:00	Papers	Bighorn 1	QCS-2: Quantum Computing and Systems	JOIN →
	Workshop	Elk 1	Cohen, Quantum Machines: Standardized Quantum Control with QOP: Single Control System for All Qubit Platforms 2	JOIN →
	Tutorial	Bear 1	Yu, Glick, IBM: Introduction to the Qiskit Runtime, A Platform for Efficient Quantum-Classical Computation 2	JOIN →
	Workshop	Elk 2	Perez, UCLM: Quantum Software Engineering & Technology 2	JOIN →
	Workshop	Elk 5	North, ColdQuanta: Remotely Programmable Sensing & Simulation 1	JOIN →
	Workshop	Elk 3	Shammah, Scholten, Unitary Fund: Open Quantum Hardware: Accelerating the Control, and Use, of Quantum Computing Systems 2	JOIN →
	Tutorial	Bear 2	Silvério, Pasqal: Pulse-Level Programming of Neutral-Atom Devices with Pulser 2	JOIN →
	Workshop	Elk 4	Fahim, FNAL & Charbon, EPFL: Cryogenic Electronics for Quantum Systems 2	JOIN →
	Papers	Bighorn 2	QWS-2: Quantum Workforce and Society	JOIN →
14:30–15:15	Exhibit	AWS Braket	AWS Braket	JOIN →
	Exhibit	Quantropi	Quantropi	JOIN →
	Exhibit	CMC.ca	CMC Microsystems	JOIN →
	Exhibit	NC State	NC State	JOIN →
	Posters	Bison	Posters 6	JOIN →
	BoF	Hawk	Birds of a Feather: TQE	JOIN →
	Networking	Network	Networking: Mentoring Students and Grooming Champions	JOIN →
	Networking	Network	Networking: Quantum Runtimes	JOIN →
	Relax & Recharge	Colorado	Colorado: Experience Fantastic Powder Skiing	JOIN →
	Exercise	Exercise	Meditation	JOIN →
15:15–16:45	Papers	Bighorn 1	QCS-3: Quantum Computing and Systems	JOIN →

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MT (UTC-6)	Session Type	Session Room	Tuesday Sessions	
15:15–16:45	Workshop	Elk 1	Cohen, Quantum Machines: Standardized Quantum Control with QOP: Single Control System for All Qubit Platforms 3	JOIN →
	Panel	Moose 1	Student Mentorship Program	JOIN →
	Tutorial	Bear 1	Yu, Glick, IBM: Introduction to the Qiskit Runtime, A Platform for Efficient Quantum-Classical Computation 3	JOIN →
	Workshop	Elk 2	Perez, UCLM: Quantum Software Engineering & Technology 3	JOIN →
	Workshop	Elk 5	North, ColdQuanta: Remotely Programmable Sensing & Simulation 2	JOIN →
	Workshop	Elk 3	Shammah, Scholten, Unitary Fund: Open Quantum Hardware: Accelerating the Control, and Use, of Quantum Computing Systems 3	JOIN →
	Tutorial	Bear 2	Silvério, Pasqal: Pulse-Level Programming of Neutral-Atom Devices with Pulser 3	JOIN →
	Workshop	Elk 4	Fahim, FNAL & Charbon, EPFL: Cryogenic Electronics for Quantum Systems 3	JOIN →
	Panel	Moose 1	Dark Star Lab: Quantum Technology Ecosystem 1.0: A Multi-Industry Perspective on Applications	JOIN →
16:45–18:15	Keynote	Eagle	Urbasi Sinha, Raman Research Institute	JOIN →
18:15–18:45	Keynote Hangout	Eagle	Keynote Hangout	JOIN →



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


TUESDAY OCT 19, 2021
10:45–16:45 UTC-6



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At TII, our Cryptography Research Centre is pioneering – everywhere from ground-breaking cryptanalysis to novel security protocols – giving us all confidence in confidentiality and enabling digital society to flourish.

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-  Cryptography Engineering
-  Cryptography for the Cloud
-  Cryptanalysis

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QCE21 Program — Wed, 20 October

MT (UTC-6)	Session Type	Session Room	Wednesday Sessions	
8:30-10:00	Keynote	Eagle	Prineha Narang, Harvard University & Aliro	JOIN →
10:00-10:45	Exhibit	IBM Quantum	IBM Quantum	JOIN →
	Exhibit	Riverlane	Riverlane	JOIN →
	Exhibit	TII	Technology Innovation Institute	JOIN →
	Exhibit	Delft Circuits	Delft Circuits	JOIN →
	Exhibit	IBM Quantum	Overview of Careers at IBM Quantum	JOIN →
	Posters	Bison	Posters 7	JOIN →
	BoF	Hawk	IEEE & Regional Quantum Entities — A Framework for Collaboration and the Role of International Experts	JOIN →
	Keynote Hangout	Eagle	Keynote Hangout	JOIN →
10:45-12:15	Exercise	Exercise	Beginner HIIT	JOIN →
	Papers	Bighorn 1	QAA-4: Quantum Algorithms and Applications	JOIN →
	Workshop	Elk 1	Date, ORNL: Quantum Artificial Intelligence 1	JOIN →
	Tutorial	Bear 1	Liu, Microsoft: Automatic Quantum Resource Estimation for Chemistry Applications at Scale 1	JOIN →
	Workshop	Elk 2	Keysight & Bluefors: Engineering Challenges in Scaling from NISQ to Universal Fault-Tolerant Quantum Computers 1	JOIN →
	Tutorial	Bear 2	Meichanetzidis, CQC: lambeq—A Python Library for Compositional Quantum Natural Language Processing	JOIN →
	Workshop	Elk 3	Karlsson, TU Denmark: Integrating High-Performance Computing with Quantum Computing 1	JOIN →
	Tutorial	Bear 3	Alexander, IBM: Real-time Control of Quantum Computers with OpenQASM3, Qiskit, and IBM Quantum Services 1	JOIN →
	Workshop	Elk 4	Mohiyaddin, IMEC: Closing the Temperature Gap between Spin-qubits and their Control Electronics 1	JOIN →
	Panel	Moose 2	Newburn, Yeh: Status & Opportunities in K-12 Quantum Edu	JOIN →
12:15-13:00	Panel	Moose 1	IBM, SeeQC, MIT, EPFL, MS, Intel: Opportunities for Cryoelectronics to Drive Scaling of Future Quantum Systems	JOIN →
	Exhibit	IonQ	IonQ	JOIN →
	Exhibit	Quantum Machines	Quantum Machines	JOIN →
	Exhibit	Toptica	Toptica	JOIN →
	Exhibit	Zurich Instruments	Zurich Instruments	JOIN →

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MT (UTC-6)	Session Type	Session Room	Wednesday Sessions	
12:15–13:00	Exhibit	Microsoft	Using the Quantum Development Kit and Azure Quantum in Education	JOIN →
	Posters	Bison	Posters 8	JOIN →
	BoF	Hawk	Birds of a Feather: QAI Ecosystem	JOIN →
	Networking	Network	Networking: LANL	JOIN →
	Networking	Network	Networking: Quantum Education & Training	JOIN →
	Relax & Recharge	Colorado	Ascend Pikes Peak by Cog Wheel Railway	JOIN →
	Panel	Moose 3	Classiq: Quantum Scale-Up: What Would it take to Deliver Truly Useful Quantum Circuits?	JOIN →
13:00–14:30	Papers	Bighorn 1	QAA-5: Quantum Algorithms and Applications	JOIN →
	Workshop	Elk 1	Date, ORNL: Quantum Artificial Intelligence 2	JOIN →
	Tutorial	Bear 1	Liu, Microsoft: Automatic Quantum Resource Estimation for Chemistry Applications at Scale 2	JOIN →
	Workshop	Elk 2	Keysight & Bluefors: Engineering Challenges in Scaling from NISQ to Universal Fault-Tolerant Quantum Computers 2	JOIN →
	Workshop	Elk 3	Karlsson, TU Denmark: Integrating High-Performance Computing with Quantum Computing 2	JOIN →
	Tutorial	Bear 3	Alexander, IBM: Real-time Control of Quantum Computers with OpenQASM3, Qiskit, and IBM Quantum Services 2	JOIN →
	Workshop	Elk 4	Mohiyaddin, IMEC: Closing the Temperature Gap between Spin-qubits and their Control Electronics 2	JOIN →
	Papers	Bighorn 2	QEDS-1: Quantum Engineering, Devices, and Sensing	JOIN →
	Panel	Moose 1	IEEE EPS: Packaging and Interconnect Challenges for Different Quantum Environments	JOIN →
14:00–15:00	iXblue	iXblue	iXblue NIR modulators for Quantum Applications	JOIN →
14:30–15:15	Exhibit	Honeywell	Honeywell	JOIN →
	Exhibit	Zapata	Zapata	JOIN →
	Exhibit	ColdQuanta	ColdQuanta	JOIN →
	Exhibit	AWS Braket	Using Amazon Braket for Quantum Research: How to Get Started	JOIN →
	Posters	Bison	Posters 9	JOIN →
	BoF	Hawk	Birds of a Feather: Standards	JOIN →
	Networking	Network	Networking: Quantum Stacks	JOIN →
	Networking	Network	Networking: Quantum Applications	JOIN →
	Relax & Recharge	Colorado	Step Back in Time at Dinosaur National Monument	JOIN →
	Exercise	Exercise	Dance and Listen to 60's Music	JOIN →

TOP TIPS FOR ATTENDING A VIRTUAL IEEE COMPUTER SOCIETY CONFERENCE



Get the most out of Virtual Events with these tips.

1. Register Early

With no travel required and lower overhead costs, virtual conferences expand accessibility to a larger group of people. Just like an in-person conference, virtual conferences do have pre-set capacities, based on the expected number of attendees. Ensure your place by registering early.

2. Plan Ahead

Curate your conference experience by determining your goals and priorities ahead of time. By creating a plan, you'll gain the most from the event. Virtual conferences flow differently than in-person events, so schedule time for breaks, networking, and exploration. Also, be mindful of time zones and plan your availability accordingly.

3. Support the Sponsors

Broaden your knowledge by visiting sponsor and supporter chat rooms, online exhibits, and sessions that align with your interests. Discover new opportunities and new solutions that will help propel your projects and your career.

4. Test System Apps and Settings

Make sure that your device is set-up and ready to go by updating your system's apps and settings. Each virtual conference platform has its own set of requirements. Helpful set-up guides and FAQs are

available from virtual platforms, including On24, Zoom, and WebEx. Use the resources applicable to the conference's service provider.

5. Minimize Distractions

Attending a conference virtually comes with its own set of distractions. Treat the conference as the unique learning experience that it is! Turn off your email notifications. Set up a dedicated space for attending your event. Gather whatever you need to stay comfortable. Resist distractions—this time is an investment in yourself.

6. Change Your Mindset

You may not have traveled to the conference, but treat the conference as seriously as if you had. Block off the time and use it to attend the virtual conference.

7. Network and Engage

Don't miss an opportunity to network with other attendees and engage with the sessions and presenters. Utilize the chat features, online meeting rooms, and social media to connect with other attendees. Join discussions that interest you, and participate by asking questions during the many Q&A opportunities.

MT (UTC-6)	Session Type	Session Room	Wednesday Sessions	
15:15–16:45	Papers	Bighorn 1	QAA-6: Quantum Algorithms and Applications	JOIN →
	Workshop	Elk 1	Date, ORNL: Quantum Artificial Intelligence 3	JOIN →
	Tutorial	Bear 1	Liu, Microsoft: Automatic Quantum Resource Estimation for Chemistry Applications at Scale 3	JOIN →
	Workshop	Elk 2	Keysight & Bluefors: Engineering Challenges in Scaling from NISQ to Universal Fault-Tolerant Quantum Computers 3	JOIN →
	Workshop	Elk 3	Karlsson, TU Denmark: Integrating High-Performance Computing with Quantum Computing 3	JOIN →
	Workshop	Elk 4	Mohiyaddin, IMEC: Closing the Temperature Gap between Spin-qubits and their Control Electronics 3	JOIN →
	Papers	Bighorn 2	QEDS-2: Quantum Engineering, Devices, and Sensing	JOIN →
16:45–18:15	Keynote	Eagle	Brian Neyenhuis, Honeywell Quantum Solutions	JOIN →
18:15–18:45	Keynote Hangout	Eagle	Keynote Hangout	JOIN →



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QCE21 Program — Thu, 21 October

MT (UTC-6)	Session Type	Session Room	Thursday Sessions	
8:30-10:00	Keynote	Eagle	James S. Clarke, Intel Labs	JOIN →
10:00-10:45	Exhibit	IQM	IQM	JOIN →
	Exhibit	Quantropi	Quantropi	JOIN →
	Exhibit	TII	Technology Innovation Institute	JOIN →
	Exhibit	Bluefors	Bluefors	JOIN →
	Exhibit	iXblue	iXblue	JOIN →
	Posters	Bison	Posters 10	JOIN →
	BoF	Hawk	Standardization — Circumnavigating the Entanglement of Global Quantum Standards Communities	JOIN →
	Keynote Hangout	Eagle	Keynote Hangout	JOIN →
	Exercise	Exercise	Dance and Listen to Queen	JOIN →
10:45-12:15	Papers	Bighorn 1	QNC-1: Quantum Networking and Communications	JOIN →
	Workshop	Elk 2	Sharma, Keio U, Yeah, Oxford U: Developing Effective Methodologies to Teach Quantum Information Science to Early-Stage Learners 1	JOIN →
	Tutorial	Bear 1	Rossmannek, IBM: Quantum Algorithms for Applications on the Natural Sciences Domain 1	JOIN →
	Workshop	Elk 1	Potocnik, imec: Ultra-Low Power Electronics for Superconducting Quantum Processors 1	JOIN →
	Tutorial	Bear 2	Feld, Delft UT: OpenQL: A Portable Quantum Programming Framework for Quantum Accelerators 1	JOIN →
	Workshop	Elk 3	Herrman, ORNL: Developing the Quantum Approximate Optimization Algorithm 1	JOIN →
	Tutorial	Bear 3	Hudek, Yam, Ruffner: Understanding the Fundamentals of Trapped Ion Quantum Computing 1	JOIN →
	Workshop	Elk 4	Delgado, ORNL, Caltech, CERN: Quantum Computing for High-Energy Physics 1	JOIN →
	Tutorial	Bear 4	Pfister, U Virginia: Photonic Quantum Computing 1	JOIN →
12:15-13:00	Panel	Moose 1	Technical and Organizational Aspects of Developing Applications for Early Quantum Computers	JOIN →
	Exhibit	Microsoft	Getting started with Azure Quantum for Python Developers	JOIN →
	Exhibit	CMC.ca	CMC Microsystems	JOIN →
	Exhibit	Classiq	Classiq	JOIN →
	Exhibit	Tabor Electronics	Simplifying FPGA Programming for Closed-Loop Qubit Control and Measurement Systems	JOIN →
	Exhibit	Agnostiq	Agnostiq	JOIN →

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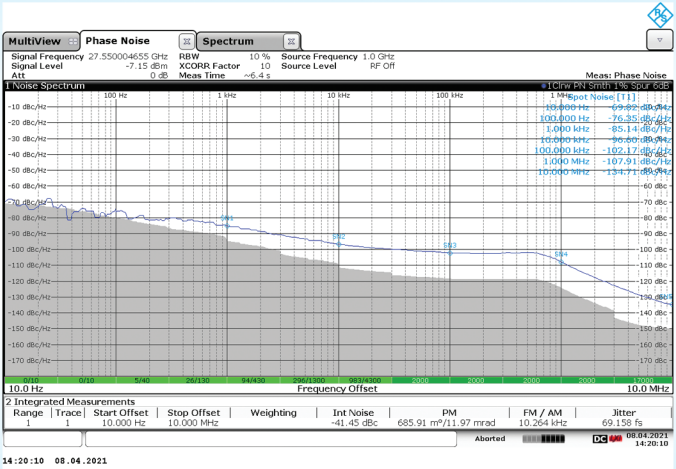
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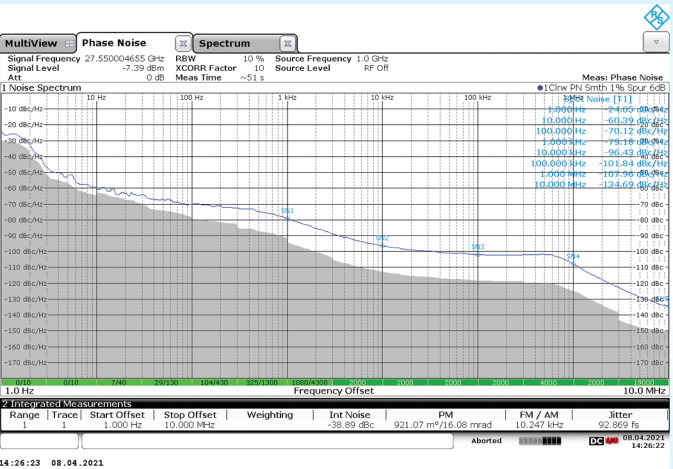
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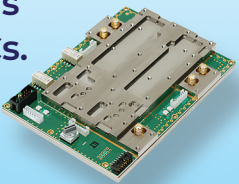
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MT (UTC-6)	Session Type	Session Room	Thursday Sessions	
12:15–13:00	Posters	Bison	Posters 11	JOIN →
	Networking	Network	Networking: Quantum Ion Technology	JOIN →
	Networking	Network	Networking: Argonne National Laboratory (ANL)	JOIN →
	Relax & Recharge	Colorado	Study the History of Cripple Creek	JOIN →
	Exercise	Exercise	Stretch - Keep Your Muscles Flexible, Strong, and Healthy	JOIN →
13:00–14:30	Papers	Bighorn 1	QNC-2: Quantum Networking and Communications	JOIN →
	Workshop	Elk 2	Sharma, Keio U, Yeah, Oxford U: Developing Effective Methodologies to Teach Quantum Information Science to Early-Stage Learners 2	JOIN →
	Tutorial	Bear 1	Rossmannek, IBM: Quantum Algorithms for Applications on the Natural Sciences Domain 2	JOIN →
	Workshop	Elk 1	Potocnik, imec: Ultra-Low Power Electronics for Superconducting Quantum Processors 2	JOIN →
	Tutorial	Bear 2	Feld, Delft UT: OpenQL: A Portable Quantum Programming Framework for Quantum Accelerators 2	JOIN →
	Workshop	Elk 3	Herrman, ORNL: Developing the Quantum Approximate Optimization Algorithm 2	JOIN →
	Tutorial	Bear 3	Hudek, Yam, Ruffner: Understanding the Fundamentals of Trapped Ion Quantum Computing 2	JOIN →
	Workshop	Elk 4	Delgado, ORNL, Caltech, CERN: Quantum Computing for High-Energy Physics 2	JOIN →
	Tutorial	Bear 4	Pfister, U Virginia: Photonic Quantum Computing 2	JOIN →
	Panel	Moose 1	Zapata: Getting Quantum Computing to Production in the Near-term	JOIN →
14:30–15:15	Exhibit	Seeqc	Seeqc	JOIN →
	Exhibit	OZ Optics	OZ Optics	JOIN →
	Exhibit	QAI	Quantum Algorithms Institute	JOIN →
	Exhibit	C12 Quantum Electronics	C12 Quantum Electronics	JOIN →
	Exhibit	IBM Quantum	Qiskit Metal	JOIN →
	Posters	Bison	Posters 12	JOIN →
	Networking	Network	Networking: Superconducting Technology	JOIN →
	Networking	Network	Networking: Oak Ridge National Laboratory (ORNL)	JOIN →
	Relax & Recharge	Colorado	Visit Boulder on Your Way to Estes Park & Rocky Mountain National Park	JOIN →
	Exercise	Exercise	Yoga for Focus	JOIN →
15:15–16:45	Papers	Bighorn 1	QNC-3: Quantum Networking and Communications	JOIN →
	Workshop	Elk 2	Sharma, Keio U, Yeah, Oxford U: Developing Effective Methodologies to Teach Quantum Information Science to Early-Stage Learners 3	JOIN →





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MT (UTC-6)	Session Type	Session Room	Thursday Sessions	
15:15–16:45	Tutorial	Bear 1	Rossmannek, IBM: Quantum Algorithms for Applications on the Natural Sciences Domain 3	JOIN →
	Workshop	Elk 1	Potocnik, imec: Ultra-Low Power Electronics for Superconducting Quantum Processors 3	JOIN →
	Tutorial	Bear 2	Feld, Delft UT: OpenQL: A Portable Quantum Programming Framework for Quantum Accelerators 3	JOIN →
	Workshop	Elk 3	Herrman, ORNL: Developing the Quantum Approximate Optimization Algorithm 3	JOIN →
	Tutorial	Bear 3	Hudek, Yam, Ruffner: Understanding the Fundamentals of Trapped Ion Quantum Computing 3	JOIN →
	Workshop	Elk 4	Delgado, ORNL, Caltech, CERN: Quantum Computing for High-Energy Physics 3	JOIN →
	Tutorial	Bear 4	Pfister, U Virginia: Photonic Quantum Computing 3	JOIN →
	Panel	Moose 1	IEEE Global Initiative in Ethics: Ethics in Quantum Computing	JOIN →
16:45–18:15	Keynote	Eagle	Sonika Johri, IonQ	JOIN →
18:15–18:45	Keynote Hangout	Eagle	Keynote Hangout	JOIN →

QCE21 Program — Fri, 22 October

MT (UTC-6)	Session Type	Session Room	Friday Sessions	
8:30-10:00	Keynote	Eagle	David J. Dean, ORNL	JOIN →
10:00-10:45	Exhibit	AWS Braket	AWS Braket	JOIN →
	Exhibit	Nu Quantum	Nu Quantum	JOIN →
	Exhibit	Agnostiq	Agnostiq	JOIN →
	Exhibit	Zapata	Zapata	JOIN →
	Posters	Bison	Posters 13	JOIN →
	Keynote Hangout	Eagle	Keynote Hangout	JOIN →
	Exercise	Exercise	Cardio HIT	JOIN →
	Papers	Bighorn 1	QNC-4: Quantum Networking and Communications	JOIN →
10:45-12:15	Workshop	Elk 1	McConkey, IBM: Quantum Hardware Design and Analysis 1	JOIN →



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WHO ARE WE?

Founded in 2019, PASQAL develops and markets scalable Quantum Processing Units (QPUs) that have the potential to address complex computing issues, from fundamental science to real-world grand challenges. The company is a spin-out from Institut d'Optique Graduate School in Palaiseau (France), one of the leading quantum research centres in the world. PASQAL is the only European company offering Quantum Processing Units with a number of qubits, level of performance and maturity allowing practical use for both industrial and academic applications as of today.

OUR OFFER

- The Quantum Computing Power can be made available to our clients:
 - Through appliances in national HPC centres / clients' premises
 - On the Cloud, with QPUs operated at PASQAL (Software as a Service & Platform as a Service)
- Clients also benefit from the support of PASQAL's expert engineers: we build with our partners Proof of Concept (PoC) studies on specific problematics related to their activities. We implement a co-design approach, centred on our partners needs, as we work closely with them on defining the problems to be solved and benchmarking with classical technics.

TECHNOLOGY

Our QPUs are built around a core of neutral atoms which can be precisely addressed, controlled and arranged in 1D, 2D and 3D geometries, thus providing outstanding flexibility to model and process various use cases and calculations.

100 qubit QPUs are available as of 2021 and 1000 qubit QPUs will be available by 2023. Our processors are designed as accelerators which integrate easily into High Performance Computing (HPC) Centres, and are operated at room temperature. They come with a full software stack, allowing control from any standard computer.

APPLICATIONS

Our QPUs address complex computing issues, from fundamental science to real-world grand challenges that are out of the reach of today's most powerful classical computers, covering a vast range of topics: Optimisation, Simulation, Quantum Machine Learning (QML), Material Sciences, Quantum Chemistry, etc.

CONTACT

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A sketch of the QPU



The core of the QPU



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MT (UTC-6)	Session Type	Session Room	Friday Sessions	
10:45-12:15	Tutorial	Bear 1	Thota, Weaver, IBM: IBM Certified Developer Quantum Computation using Qiskit x0.2x - Part 1	JOIN →
	Workshop	Elk 2	McCaskey, Heim, Cao, Zeng, Kaiser, Unitary Fund: Progress and Challenges in Quantum Intermediate Representations 1	JOIN →
	Tutorial	Bear 2	Bleiler, Portland St: Quantum Computation for Data Scientists 1	JOIN →
	Workshop	Elk 3	Helmy, U Toronto: Quantum-Enhanced Optical Sensing 1	JOIN →
	Tutorial	Bear 3	Roy, Saarland U: Automated Quantum Device Calibration and Characterization 1	JOIN →
	Workshop	Elk 4	Stick, Sandia: Advancing the Performance of Engineered Trapped-ion Quantum Systems 1	JOIN →
	Workshop	Elk 5	Almudever, TU Valencia: Scalability of Quantum Computing Systems: Device-Architecture Crosslayer Co-design 1	JOIN →
	Panel	Moose 1	National Quantum Initiative Roundtable	JOIN →
12:15-13:00	Exhibit	D-Wave	D-Wave	JOIN →
	Exhibit	Intel	Intel	JOIN →
	Exhibit	Keysight	Keysight Technologies	JOIN →
	Exhibit	Qblox	Fully-Integrated Quantum Control Stacks for a Handful to 100s of Qubits	JOIN →

MT (UTC-6)	Session Type	Session Room	Friday Sessions	
12:15-13:00	Exhibit	Pasqal	Pasqal	JOIN →
	Exhibit	Microsoft	Meet and Greet with Microsoft Azure Quantum	JOIN →
	Posters	Bison	Posters 14	JOIN →
	Networking	Network	Networking: Quantum Internet, Networking & Communications	JOIN →
	Networking	Network	Networking: National Quantum Initiative & Science Centers	JOIN →
	Relax & Recharge	Colorado	Find Cliff Palace in Mesa Verde National Park on Your Way to the Four Corners Area	JOIN →
	Exercise	Exercise	Dance and Listen to 50's Rock & Roll	JOIN →
10:45-12:15	Papers	Bighorn 1	QAA-7: Quantum Algorithms and Applications	JOIN →
	Workshop	Elk 1	McConkey, IBM: Quantum Hardware Design and Analysis 2	JOIN →
	Tutorial	Bear 1	Thota, Weaver, IBM: IBM Certified Developer Quantum Computation using Qiskit x0.2x - Part 2	JOIN →
	Workshop	Elk 2	McCaskey, Heim, Cao, Zeng, Kaiser, Unitary Fund: Progress and Challenges in Quantum Intermediate Representations 2	JOIN →
	Tutorial	Bear 2	Bleiler, Portland St: Quantum Computation for Data Scientists 2	JOIN →

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MT (UTC-6)	Session Type	Session Room	Friday Sessions	
10:45-12:15	Workshop	Elk 3	Helmy, U Toronto: Quantum-Enhanced Optical Sensing 2	JOIN →
	Tutorial	Bear 3	Roy, Saarland U: Automated Quantum Device Calibration and Characterization 2	JOIN →
	Workshop	Elk 4	Stick, Sandia: Advancing the Performance of Engineered Trapped-ion Quantum Systems 2	JOIN →
	Workshop	Elk 5	Almudever, TU Valencia: Scalability of Quantum Computing Systems: Device-Architecture Crosslayer Co-design 2	JOIN →
	Panel	Moose 1	QED-C: On the Use of Applications and Performance Benchmarks for Quantum Computing	JOIN →
14:30-15:15	Exhibit	Honeywell	Honeywell	JOIN →
	Exhibit	Google	Google	JOIN →
	Posters	Bison	Posters 15	JOIN →
	Networking	Network	Networking: IEEE Quantum Week 2022 in Colorado — QCE22	JOIN →
	Networking	Network	Networking: Quantum Economic Development Consortium (QED-C)	JOIN →
	Relax & Recharge	Colorado	Explore the Towering Sandstone Rock Formations in the Garden of the Gods	JOIN →

MT (UTC-6)	Session Type	Session Room	Friday Sessions	
14:30-15:15	Exercise	Exercise	Dance and Listen to Fitness Music	JOIN →
	Papers	Bighorn 1	QCS-4: Quantum Computing and Systems	JOIN →
	Workshop	Elk 1	McConkey, IBM: Quantum Hardware Design and Analysis 3	JOIN →
	Tutorial	Bear 1	Thota, Weaver, IBM: IBM Certified Developer Quantum Computation using Qiskit x0.2x - Part 3	JOIN →
	Workshop	Elk 2	McCaskey, Heim, Cao, Zeng, Kaiser, Unitary Fund: Progress and Challenges in Quantum Intermediate Representations 3	JOIN →
	Tutorial	Bear 2	Bleiler, Portland St: Quantum Computation for Data Scientists 3	JOIN →
	Workshop	Elk 3	Helmy, U Toronto: Quantum-Enhanced Optical Sensing 3	JOIN →
	Tutorial	Bear 3	Roy, Saarland U: Automated Quantum Device Calibration and Characterization 3	JOIN →
16:45-18:15	Workshop	Elk 4	Stick, Sandia: Advancing the Performance of Engineered Trapped-ion Quantum Systems 3	JOIN →
	Keynote	Eagle	Anthony E. Megrant, Google Quantum AI	JOIN →
18:15-18:45	Keynote Hangout	Eagle	Keynote Hangout	JOIN →

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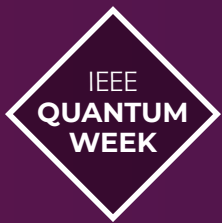
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