NEWS RELEASE

PsiQuantum Partners With U.S. Department of Energy's SLAC National Accelerator Laboratory to Access State-of-the-Art, High-Powered Cryogenic Cooling Capabilities for Large-Scale Quantum Computing

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PsiQuantum to start installation of its cryogenic quantum modules, each containing photonic quantum hardware, into SLAC's LCLS-II cryoplant facility, capable of kilowatts of cooling power. This partnership accelerates the development and testing of this novel technology while also defining opportunities for further collaboration in the future.

PALO ALTO, Calif.--(BUSINESS WIRE)-- **PsiQuantum** announced that it is beginning work with the U.S. Department of Energy's (DOE) SLAC National Accelerator Laboratory to leverage the existing infrastructure and cryogenic engineering expertise at SLAC to prove the viability of existing cryogenic cooling solutions to support building a large-scale, error-corrected quantum computer. This effort takes place under a Cooperative Research and Development Agreement with Stanford University, which operates SLAC for the DOE.

SLAC NATIONAL ACCELERATOR LABORATORY, MENLO PARK, CALIFORNIA (Photo: Business Wire)

Quantum computing promises to be a profound, transformational technology, capable of driving here-to-unimaginable advances across all science and industry. The quantum computers in service today are designated as Noisy, Intermediate-Scale Quantum (NISQ) systems with at most a few hundred physical qubits. Not unexpectedly, when these NISQ systems try to run useful quantum algorithms, they are quickly overrun by errors and noise, leading to unreliable or unusable results.

To realize the full potential of quantum computing, error correction is required to suppress the "noise" in the computation and to limit the number of errors in algorithm output. It is increasingly acknowledged that commercially valuable use cases will require large-scale, error-corrected systems. All quantum computing efforts face similar scaling challenges for manufacturability, connectivity, control electronics, and cooling power. From its inception, PsiQuantum has singularly focused on finding a fast path to a large-scale, fault tolerant system.

While all mainstream quantum computing efforts require cryogenic cooling, in PsiQuantum's approach, these cooling requirements are relaxed relative to other prevailing technologies. Under the photonic approach, the qubit itself does not feel heat – it is only the extremely sensitive single-photon detectors, which are used to read the state of the qubit, which require cryogenic cooling.

These single-photon detectors operate at temperatures a few degrees above absolute zero. While extremely cold, this operating temperature is – relatively-speaking – hundreds of times warmer than the milli-Kelvin temperatures required by superconducting qubit-based quantum computing approaches. Photonic quantum computing architectures therefore do not require dilution refrigerators – the "chandelier" often associated with quantum computing. Dilution refrigerator cryostats operating at the 10's of mK temperatures needed for superconducting qubit technologies, typically achieve less than one thousandth of a Watt of cooling power. The SLAC cryoplant can provide more than 30,000 Watts of cooling power at 4.5 Kelvin.

As a result of this higher operating temperature, PsiQuantum can utilize existing high-power cryogenic infrastructure, with a path to increased cooling capacity as the company progresses from R&D to prototype to utility-scale production systems. SLAC, alongside STFC's Daresbury Laboratory, provide existing cryogenic infrastructure that allows for progressive levels of scaling and could help shorten the time needed to develop a large-scale quantum computer. Integration at SLAC provides the capabilities for sub-system and core module development and validation.

Implemented to support upgrades to its x-ray free electron laser (XFEL) facility, SLAC has two cryoplants (C1 and C2) that can each supply an equivalent power of 18kW @4.5 K, overseen by a team of 25 cryogenic engineers and operations staff. The first phase of the collaboration will focus on high-capacity cryostat development while operating parasitically from the C1 plant. The second phase will focus on cryogenic cooling, distribution, and controls for a large array of networked modules connected to the C2 plant. By 2024, the collaboration will provide PsiQuantum with over 100 watts of cooling capacity at 2 Kelvin. This is ~100X larger than PsiQuantum's initial cryocooler-based systems in its Palo Alto HQ development lab.

This partnership also deepens PsiQuantum's existing collaborations with the U.S. Government, including its ongoing work with DARPA (**read more**), the Air Force (**read more**) and a recently completed project with Los Alamos

National Laboratory. That collaboration resulted in a world-beating quantum linear solver algorithm, combining groundbreaking ideas from adiabatic quantum computing and quantum signal processing filtering techniques (**read more**).

Fariba Danesh, Chief Operating Officer at PsiQuantum, said:

“We are extremely excited to be entering this partnership with DOE’s SLAC National Accelerator Laboratory. For more than 60 years, SLAC has been home to a talent pool of the smartest scientists and engineers that have constantly been at the forefront of scientific innovation. We are looking forward to continuing this tradition as we leverage its state-of-the-art cryogenic infrastructure to accelerate PsiQuantum’s mission to deliver a large-scale, error corrected quantum computer.”

Prof. Mike Dunne, Associate Laboratory Director of SLAC National Accelerator Laboratory, said:

“Development of quantum computing is a grand challenge that will transform many areas of science if it can be successfully harnessed – with examples ranging from drug discovery to advanced materials, weather forecasting and cybersecurity. As such, we are pleased to partner with PsiQuantum as part of its community-wide research in this area. By reutilizing capabilities that were deployed for our LCLS facility [**read more**], we are building on the DOE’s investments at our laboratory to keep our nation at the forefront of this exciting field.”

About PsiQuantum

PsiQuantum’s mission is to build and deploy the world’s first useful quantum computer. The company was founded on the premise that commercially valuable quantum computing systems will require fault tolerance and error correction, demanding a very large-scale system implementation. The company believes that it has the fastest and most feasible path to a large-scale fault-tolerant system, based largely on existing technologies and infrastructure – including high-volume semiconductor manufacturing, packaging, and high-power cryogenic systems.

Society today – and by extension a large fraction of global industry – is built on a foundation of chemistry, physics, and information. Quantum computing has the potential to categorically advance our mastery of the physical world and of information, with widespread impact across science and technology. We are engaged with customers and partners to evaluate and revolutionize applications spanning climate, healthcare, finance, energy, agriculture, transportation, communications, and beyond.

PsiQuantum’s founders had a combined sixty years of experience in academia prior to the inception of the company in 2015. The company has assembled a world-class team of quantum physicists, semiconductor, electrical and mechanical engineers all supported by a group of notable investors and advisors. Our work spans semiconductor process development, integrated photonic device and systems design, superconducting device manufacturing, high-throughput wafer, chip and sub-assembly test, optoelectronic packaging, cryogenic CMOS control electronics, high-power cryogenic cooling, quantum optics, quantum error correcting codes, fault-tolerant quantum algorithm compilation, and domain-specific quantum algorithm development. Currently, the company utilizes the capacity and expertise of a tier-1 semiconductor foundry to build thousands of wafers and millions of quantum chips.

For more information, go to: **psiquantum.com/about**

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About SLAC

SLAC is a multiprogram laboratory that explores how the universe works at the biggest, smallest and fastest scales. SLAC is operated by Stanford University for the U.S. Department of Energy's **Office of Science** .

https://www6.slac.stanford.edu/

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