

PRESS RELEASE

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Information can be disclosed as of September 1st, 2020

Zurich Instruments introduces the SHFQA 8.5 GHz Quantum Analyzer

The Zurich Instruments SHFQA Quantum Analyzer provides a qubit readout system designed for experimentalists working on superconducting or spin qubits. Conceived as the next generation of quantum computing instrumentation, the SHFQA combines signal generation at microwave frequencies with direct qubit readout and real-time multi-state discrimination. With the SHFQA, reading out frequency-multiplexed qubits on up to 4 readout lines becomes a fast, high-fidelity operation that does not rely on tedious mixer calibration. As a single SHFQA can measure up to 64 qubits, it covers many functionalities that would otherwise require larger instrument racks and complex cabling arrangements.

Concept

Zurich Instruments launches the SHFQA Quantum Analyzer, the first instrument of its kind that operates at up to 8.5 GHz and can thus perform direct readout of superconducting and spin qubits. The SHFQA can read out the state of up to 64 qubits, 32 qutrits or 20 ququads in real time and with optimal signal-to-noise ratio. Thanks to the analysis chain and additional features such as multi-state discrimination and rapid resonator spectroscopy, this instrument is ready for use with the most demanding quantum algorithms.

As quantum processors become larger and more complex physical systems, the corresponding increase in footprint for the classical readout devices that measure quantum chips stands as a clear instrumentation challenge. "Current state-of-the-art control and readout systems combine several instruments and analog mixing stages to reach the microwave resonator frequencies needed for qubit readout. Keeping all pieces of equipment calibrated and synchronized over long time periods is tedious and error-prone," says Dr. Tobias Thiele, Application Scientist for Quantum Technologies at Zurich Instruments. "Now consider what happens when you plan to scale up your system to hundreds of qubits: the effort with cabling and system tune-up, the number of required instruments – they simply do not scale in your favor," Dr. Thiele adds. This is where the SHFQA makes a difference. The instrument comes with 2 or 4 readout channels, each of which can optimally discriminate the quantum states of 16 qubits, 8 qutrits or 5 ququads coupled to resonators with frequencies within an analysis bandwidth of 1 GHz. "The SHFQA is the result of combining the experience and needs of our customers in quantum technologies with the exceptional talent of our R&D team. The outcome is an

outstanding instrument that takes our philosophy of reducing laboratory setup complexity to new levels," says Dr. Paolo Navaretti, Product Manager at Zurich Instruments.

Software support and integration

As part of the Quantum Computing Control System (QCCS), the SHFQA is seamlessly integrated into new or existing setups featuring the HDAWG Arbitrary Waveform Generator and the PQSC Programmable Quantum System Controller. Thanks to the LabOne QCCS control software, the SHFQA can be added to quantum computing setups of varying sizes and specifications on instrument connectivity, providing the necessary support for feedback and error correction codes such as fast qubit reset or surface codes. The LabOne user interface already known to Zurich Instruments' customers gives access to an overview of all settings on the instrument, from the readout-band center frequency to the configuration of the low-latency analysis chain.

To read more about the new Zurich Instruments SHFQA Quantum Analyzer, including a detailed list of its specifications, visit www.zhinst.com/shfqa and the SHFQA instrument page. To arrange a live demo, write to info@zhinst.com.

Zurich Instruments is an exhibitor for the inaugural [OSA Quantum 2.0 conference](#) to be held 14 – 17 September 2020. Visit the virtual booth #113.

About Zurich Instruments

Zurich Instruments makes cutting-edge instrumentation for scientists and technologists in advanced laboratories who are passionate about phenomena that are often notoriously difficult to measure. The company's core offering includes lock-in amplifiers, impedance analyzers, arbitrary waveform generators, and the first commercially available quantum computing control system.

Zurich Instruments brings innovation to scientific instrumentation and quantum control systems in the medium-frequency (MF), ultra-high-frequency (UHF) and now also super-high-frequency (SHF) ranges by combining frequency- and time-domain tools within each of its products. This approach reduces the complexity of laboratory setups and unlocks new measurement strategies.

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