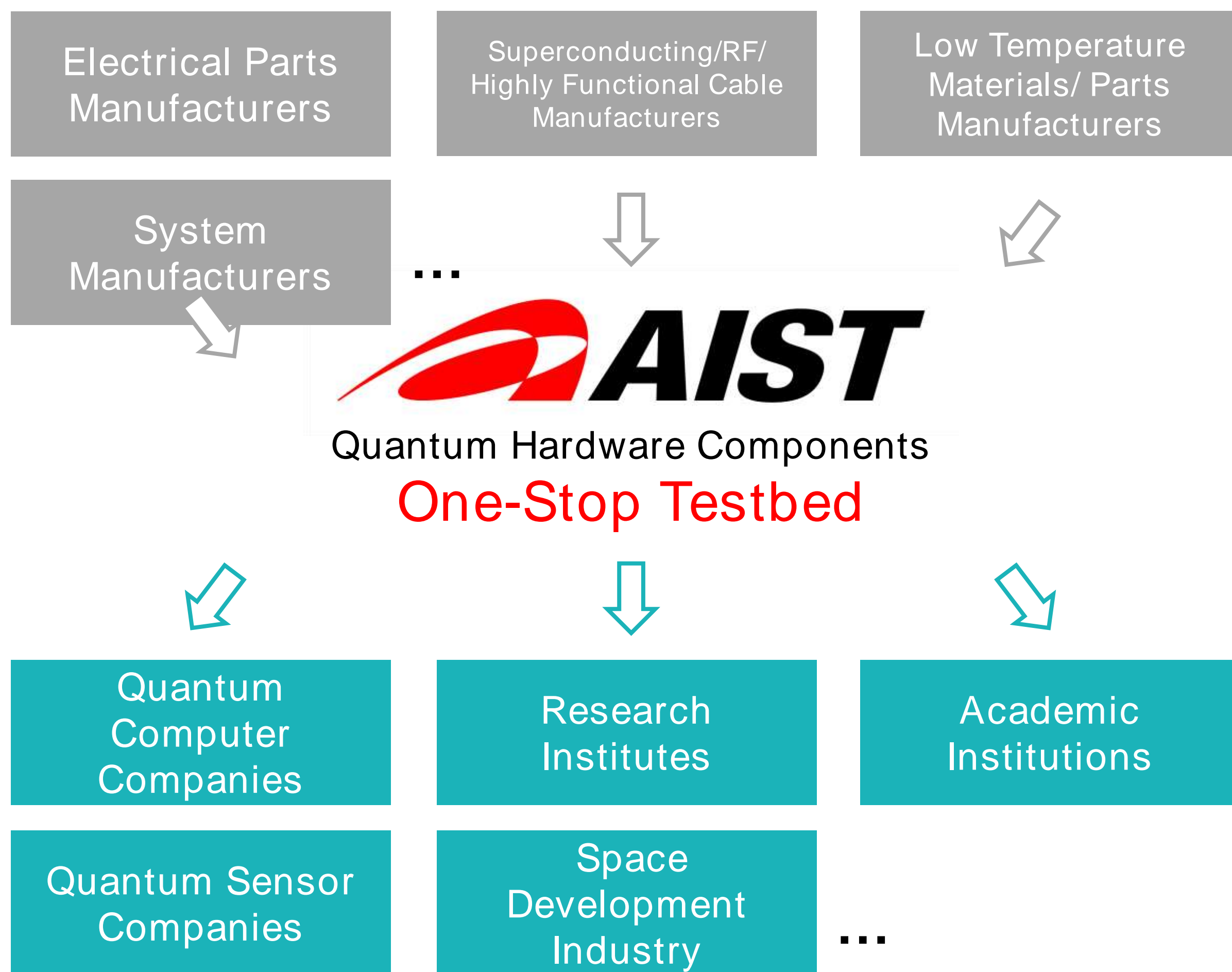


# Quantum Computer / Sensor Hardware Component Testbed in G-QuAT

Aiming for a sustainable supply chain of quantum hardware components

- ▶ Quantum hardware component supply chain/ecosystem with standardization
- ▶ Electrical/thermal/optical measurements from low temperatures to room temperature (RT)
- ▶ Reducing the entry barriers for non-quantum companies into the quantum business

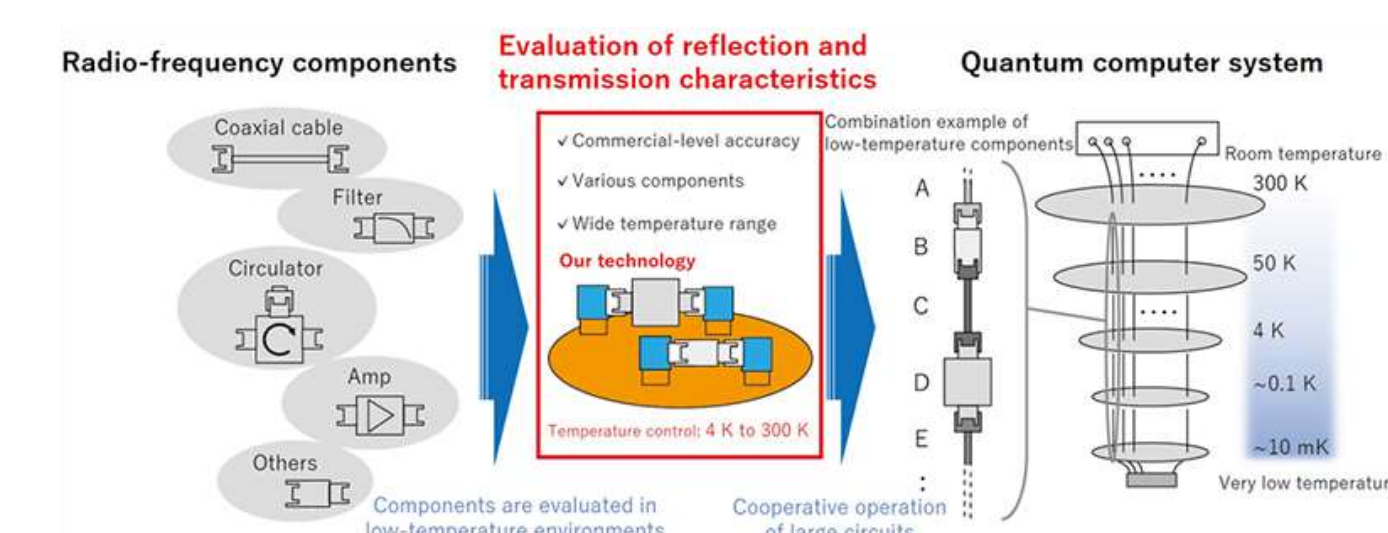
## Quantum hardware testbed



- Facilities enabling the evaluation of components and materials from low temperatures (as low as ~ 20 mK) to room temperature
  - ➔ Target: large-scale quantum hardware components capable of handling up to 1000 qubits
- Testing, evaluation, certification, and standardization of components and materials.
  - ➔ Collaboration with Q-STAR, companies, academia, and research institutes
  - ➔ Commercialization by companies, strengthening of the supply chain.



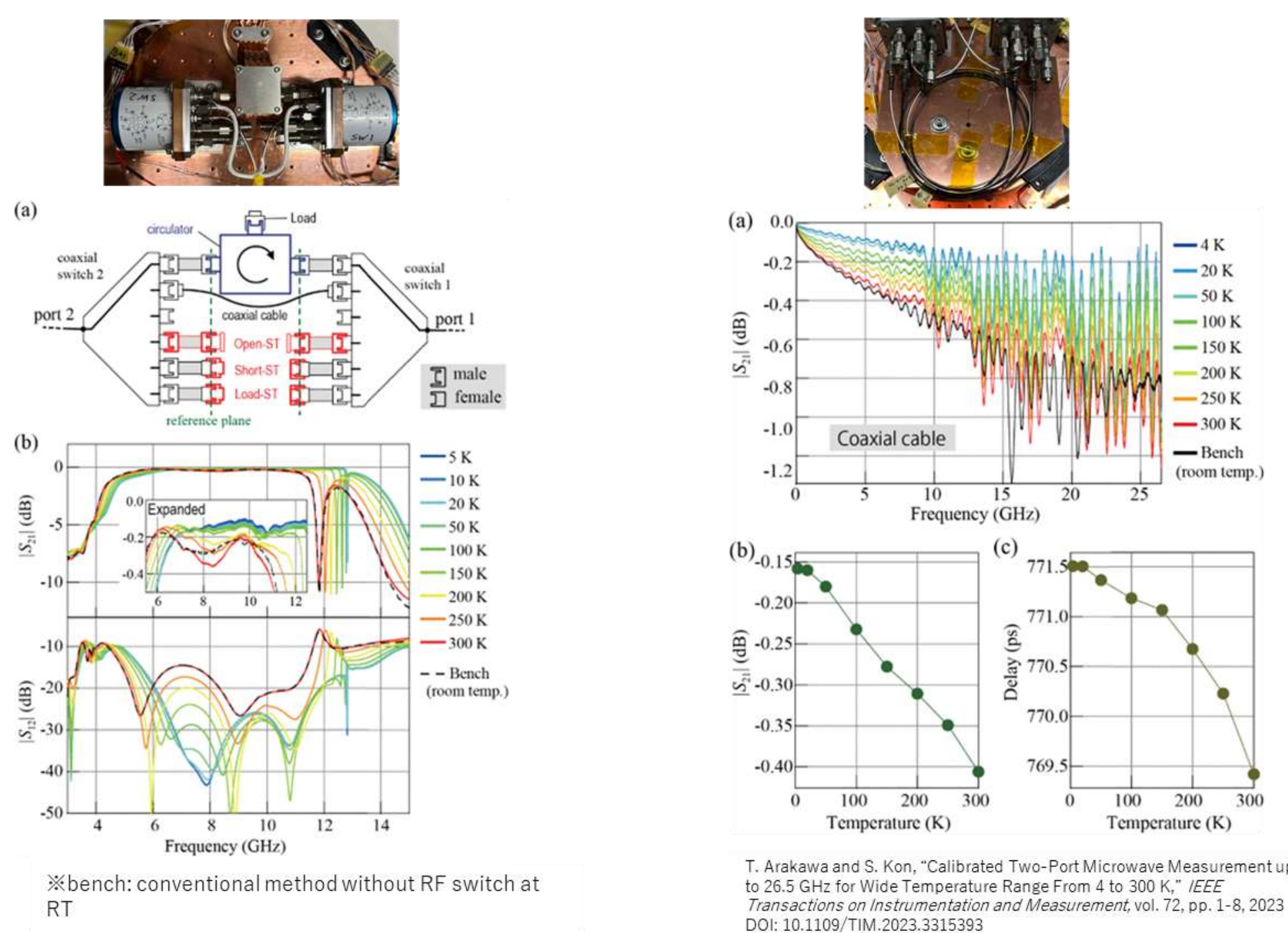
### Developed Evaluation Technology for RF Components Used in Quantum Computers



– Measurements of temperature dependence of reflection and transmission characteristics from cryogenic to room temperature –  
(AIST press release on September 21, 2023)

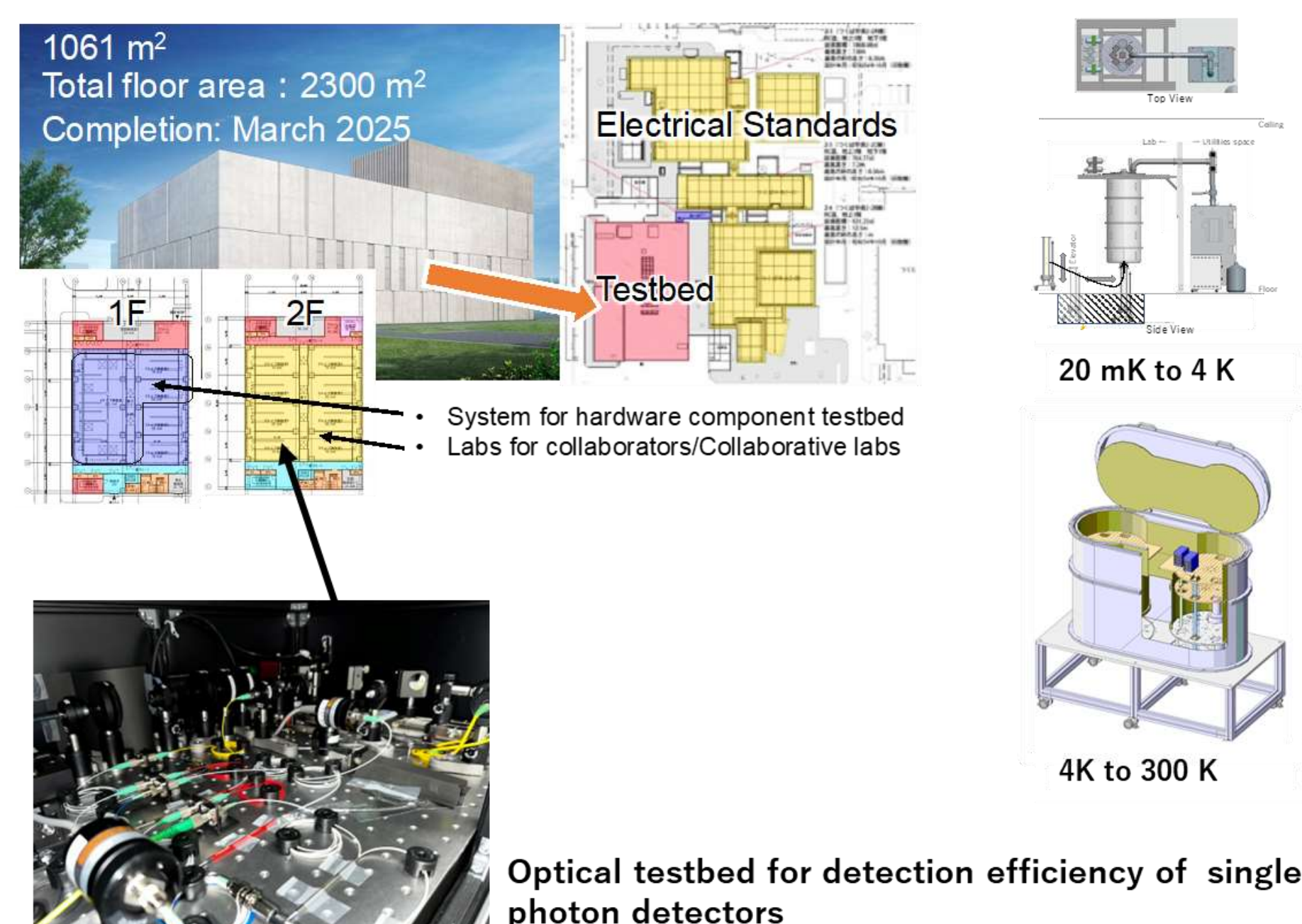
## Components and parameters under test

### Preliminary test results



- Active components
  - Amplifiers, semiconductor chips (Cryo-CMOS), MMIC, superconducting circuits/chips (e.g., AQFP, RSFQ), and others
- Passive components
  - Circulators, couplers, attenuators, capacitors, resistors, inductors, filters, chip carriers (RF), chip elements, cables (RF, SC, LF, DC), waveguides, connectors (e.g., high density), and others
- Optical components
  - Squeezed light sources, single photon sources, electrical-to-optical and optical-to-electrical transducers, fibers, and others (mainly RT)
  - Superconducting transition-edge sensors, photon number resolving detector, photon detectors, photon sources, optical wave guides, and others (20 mK to 4 K)
- Thermal properties of the above-mentioned components
  - thermal resistance/conductance, thermal expansion coefficient, and others
- Simulation and measurements of single and combined sets of the above-mentioned components, and consistency checks
- Screening of qubits (4 K and 20 mK)

### Quantum hardware component testbed building & facilities



Global Research and Development Center for Business by Quantum-AI Technology (G-QuAT), AIST

Contact : M-G-QuAT-plan-ml@aist.go.jp

