QUANASTRA

Quantum & Photonics Innovation

Quanastra's VORTEX: 2-Channel cutting edge single photon detection technology

Quanastra's RF and DC feedthrough enable cryogenics and High vacuum applications

The QUANTUM PASTRY

LET'S BUILD THE FUTURE TOGETHER

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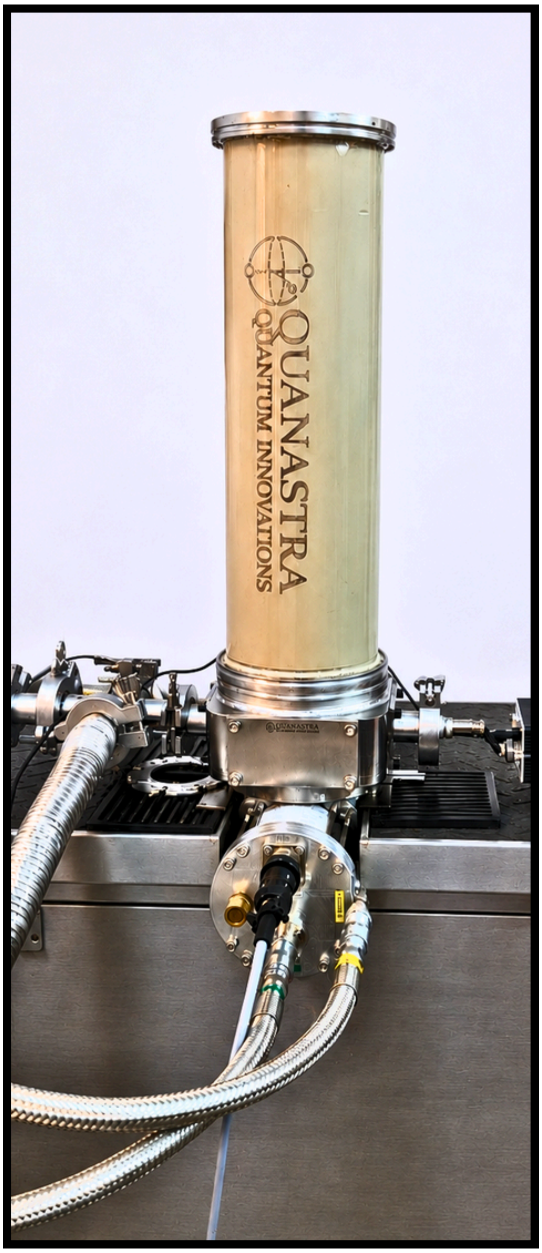
SNSPD SYSTEM

Quanastra's Vortex is a 2-channel cutting-edge rack-mountable SNSPD system designed for high-efficiency single-photon detection. UltraCompact and precise, Vortex delivers unmatched performance for quantum optics, communication, and sensing applications. Its plug-and-play design ensures seamless integration, empowering researchers and industrial innovators to explore next-generation quantum technologies with reliability, speed, and accuracy.



Operating Temperature <3K
No. of Channels - 2
Peak Detection Efficiency >40% (Upto 95%)
Dark Count Rates <100 CPS (Upto <10 CPS)
Timing Jitter <80ps (Upto 30 ps)
Electrical Readout - SMA
Wavelength - 1550 nm

Photon Detection Area >70 µm
Polarization Sensitivity - Tuneable
Response Time <20 ns
Cooling Time <9hrs
Fibre - single or multimode
Material Composition - NbN
Channel Crosstalk - Zero

Why Buy From Us?

- **Cutting-edge SNSPD technology with >90% efficiency for unparalleled quantum detection performance.**
- **Customizable systems tailored to specific quantum communication and photonic research needs.**
- **Comprehensive product range: tabletop, rack-mounted, and scalable multi-channel solutions.**
- **Proven expertise in cryogenics, superconducting photodetectors, and integrated quantum systems.**

300 MM SPUTTER DEPOSITION SYSTEM

At our company, we are dedicated to developing advanced hardware solutions for quantum technologies, with a strong emphasis on photon-based quantum systems.

As part of this mission, we are collaborating with the Tata Institute of Fundamental Research (TIFR), Hyderabad, to jointly develop a state-of-the-art India's first Ultra-High Vacuum (UHV) thin-film deposition system that can deposit quantum grade high precision thin-films. The platform is being designed for the deposition of high-quality superconducting niobium nitride (NbN) and amorphous thin films, a key material for superconducting quantum devices, including single-photon detectors, quantum circuits and other cryogenic technologies. The system is being engineered to provide industrial-scale deposition capabilities while maintaining exceptional film quality and process control.

To support advanced thin-film process development, the deposition system will incorporate substrate heating up to 700 °C, planetary substrate motion for enhanced thickness uniformity and substrate biasing up to 100 W for precise control over film density, microstructure and superconducting properties.

A major milestone has already been achieved with the successful validation of the vacuum chamber, which has demonstrated a base pressure of **10^{-8}** mbar. The project is currently in its final stages of system integration, subsystem validation and commissioning. Once these activities are completed, the platform is expected to become fully operational in the near future.

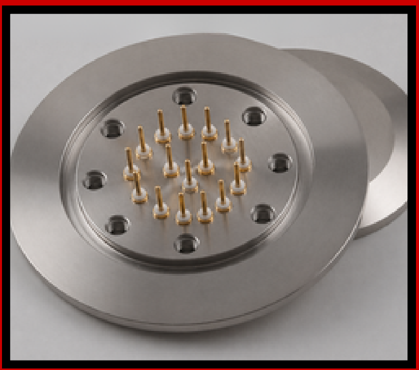
Once fully operational, this advanced UHV deposition platform will enable the production of quantum-grade superconducting, dielectric, and metal thin films with exceptional uniformity, repeatability and process stability.

DC/RF FEEDTHROUGH

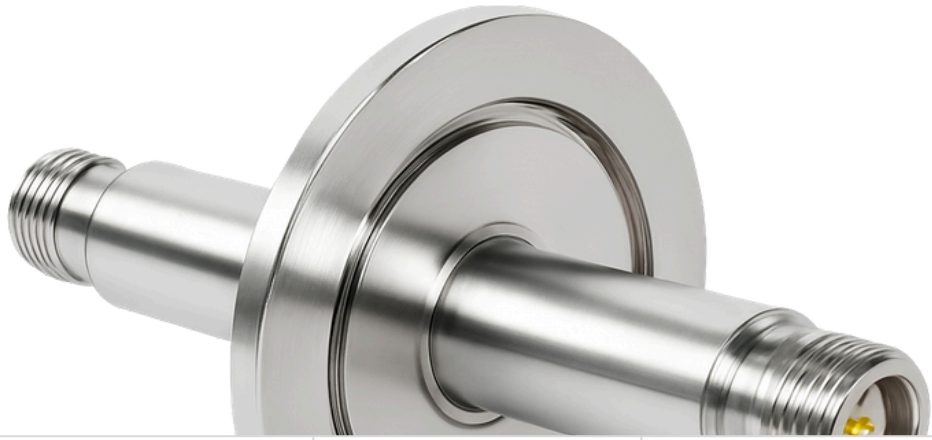
Quanastra provides custom RF and DC feedthrough assemblies designed for reliable electrical interfacing with cryogenic and high vacuum systems. The feedthrough assemblies provide hermetic electrical connections between external electronics and components operating inside the vacuum chamber, while maintaining the required vacuum integrity during continuous cryogenic operation.

The feedthroughs are compatible with high-vacuum cryogenic environments and are integrated with appropriate vacuum-rated sealing and electrical insulation materials. Channel count, connector type, cable length, RF configuration, and internal wiring can be customized to suit the cryostat and high vacuum architecture.

DC FEEDTHROUGH



Dedicated DC feedthroughs are provided for detector bias, temperature sensors, heaters, and other cryogenic and high vacuum instrumentation. Multi-pin D-sub configurations can be incorporated where a higher number of electrical connections is required. The feedthrough configuration can be adapted to the cryostat geometry, detector architecture, and required channel count.



Parameter	RF Feedthrough	DC Feedthrough
Vacuum Application	High Vacuum	High Vacuum
Typical Vacuum Level	≤10^{-6} mbar*	≤10^{-6} mbar*
External Connector	SMA	D-sub / Custom
Number of Channels	2–8*	4–15*
Characteristic Impedance	50 Ω	N/A
Operating Frequency	DC–6 GHz*	DC
Insertion Loss	<2 dB*	N/A
Isolation	>40 dB*	>100 MΩ
Operating Temperature	300–1.5 K	300–1.5 K
Vacuum Sealing	Hermetic / Vacuum Rated	Hermetic / Vacuum Rated
Customization	Yes	Yes

THESIS SUMMARY: HOW HIGH-END THIN FILMS ARE POWERING THE SECOND QUANTUM REVOLUTION

BY NIVED MURALI

As quantum technology is evolving, one of the notable variable which ensures the performance of quantum systems is high uniformity, quantum grade, high precision thin-films.

As part of my master's thesis, I perform a detailed research on important of thin-films across different dimensions of quantum technologies.

In the first phase of the survey, we identified over 700 experimental quantum technology researchers from 34 countries where quantum technology research is currently fostering.

Then all these researchers were contacted through an email containing a questionnaire, asking about the use and specifications of thin films in their current research in the field of quantum technology. Out of more than 700 contacted, we got 78 responses and out of those 59 were used for this report. The insights realized through these expert inputs are listed below.

2. REQUIRED THIN FILM THICKNESS AND ROUGHNESS

For the thin films used by the researchers, 27% requires thickness less than 10nm and 47% requires a thickness range between 10nm to 100nm. The roughness tolerance is reported to be less than 1% by 35% of the researchers whereas 44% of the researchers reported to require 1-5% roughness.

A correlation map between this required thickness and roughness tolerance shows us that about 40% of the researchers who uses thin films need an atomically smooth surface, that is a surface roughness less than 1nm and around 70% requires a surface roughness less than 5nm. This points towards the need of high-end thin film deposition systems for quantum technology hardware.

3.THIN FILM MATERIALS USED

Materials used as thin films for quantum technology devices consists of a very big palette. We have identified over fifty unique materials, ranging from super conductors like Niobium to complex dielectrics. And the list is still incomplete and expanding. This diversity suggests that future thin film facilities must be highly versatile and capable of handling multi material stacks.

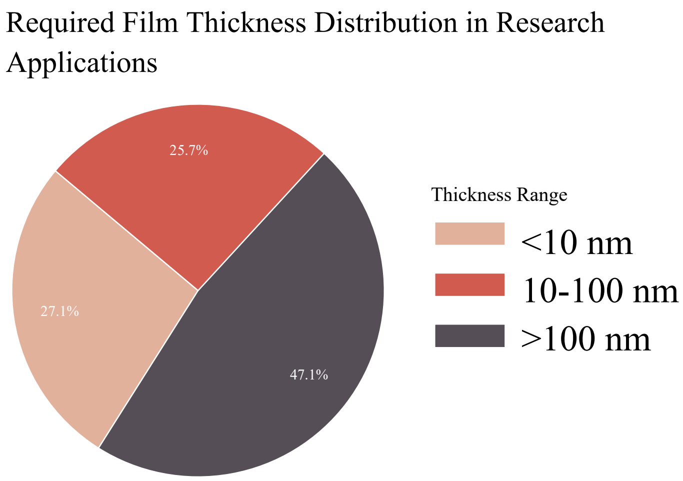


FIGURE 1

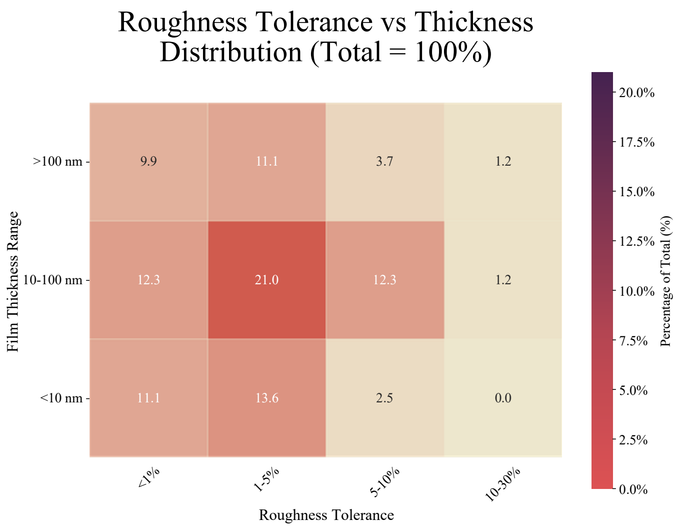


FIGURE 2

4. BOTTLENECKS FACED BY THE EXPERIMENTALISTS

Another key finding is that 41% of the experimentalists prefer in house deposition systems for their thin film fabrication while the most cited bottleneck is regarding the maintenance and reliability of equipment. This includes the lead time latency caused by the dependency on overseas manufacturers. A lack of technical expertise, qualified suppliers, and financial constraints are also notable in the reported bottlenecks.

5. RECOMMENDATIONS

In conclusion, for achieving the goal of quantum sovereignty, the Indian ecosystem needs to build a localized high-end thin film supply chain including precursor synthesis and tool servicing. This will require participation and collaboration between industries and academia on a large scale. We will need to develop indigenous high end thin film fabrication systems which can provide not just thinness, but also atomically smooth surfaces and high purity, reproducible thin films of a very versatile list of materials ranging from superconductors and metals to complex dielectrics.

The governments should also introduce more programs and facilities to upskill personnel through hands-on training in high-end thin film fabrication and the maintenance of related equipment to fill the gap in the human capital side. Ultimately by synchronizing all of these above, India can transition from a consumer of quantum components to a global provider of quantum grade components. This approach will not only make India quantum ready, but also a frontier in future quantum technology globally.

ANNUAL QUANTUM CONCLAVE 2026

Quanastra got the opportunity to attend the Annual Quantum Conclave on 10-11 April 2026, held at the Indian Institute of Technology Bombay in connection with the I-HUB Quantum Technology Foundation (I-HUB QTF) Ecosystem. This event was organised to bring together researchers, industrialists, startups and technology companies devoted to the development of the quantum technology domain in India.

Dr Vidur Raj (founder) and Mr Anand Mohan (head of the Precision Measurement and Electronics Lab) represented Quanastra at the annual quantum conclave. They presented the expanded list of quantum technology solutions by Quanastra and communicated with other researchers, industrialists and stakeholders of the quantum technology field.

At the event, Quanastra showcased some of its advanced products, including a high-precision current source and high-vacuum feedthroughs (DC feedthroughs) as well as a high-precision microvoltmeter and fibre-packaged superconducting nanowire single-photon detector (SNSPD) chip. These are critical elements for building the next generation of quantum computing, sensing and communication technologies.

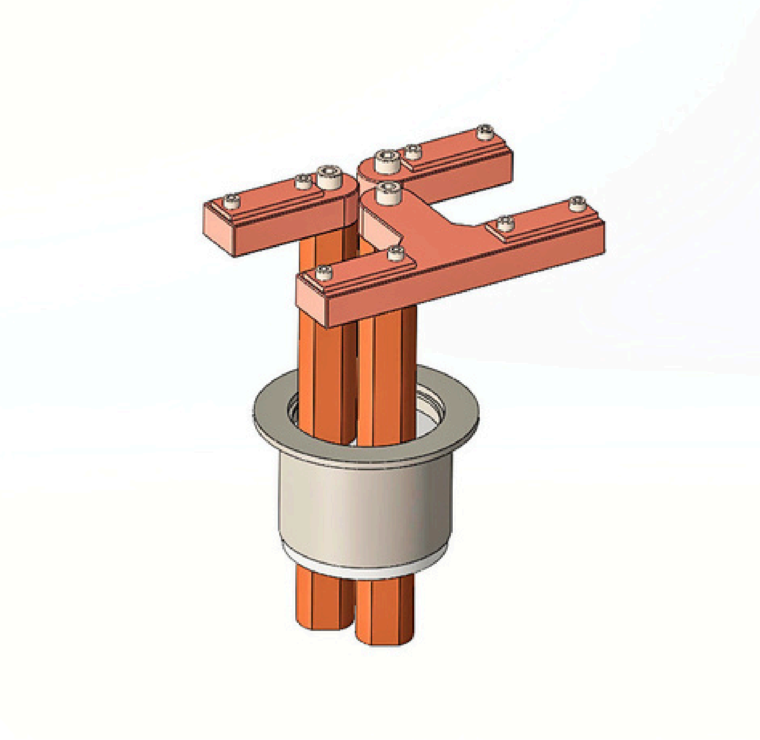
The conference enabled Quanastra to present its indigenous technological solutions, exchange ideas with field experts and make connections with potential partners and collaborators. Through such exchanges, Quanastra emphasised its efforts in designing precise hardware components satisfying the requirements of quantum technologies.

Taking part in events like the Annual Quantum Conclave helps to emphasise the significance of Quanastra for the growing quantum technology ecosystem and gives Quanastra a platform to connect with the scientific and entrepreneurial community.

DUAL-BOAT THERMAL EVAPORATION SOURCE ELECTRODE

As part of our continued efforts to develop advanced scientific instrumentation, we have successfully designed and fabricated a prototype dual-boat thermal evaporation source electrode for vacuum thin-film deposition systems.

The newly developed source electrode is designed to accommodate two evaporation boats simultaneously, enabling the evaporation of two metallic materials within a single thermal evaporation setup. The design provides greater flexibility for thin-film research, allowing researchers to perform sequential or co-evaporation processes without frequent hardware modifications.

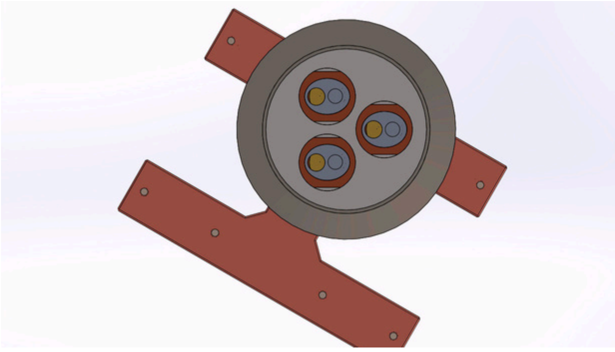


This development reflects our commitment to solving practical challenges faced by research laboratories through innovative engineering. By designing and manufacturing critical components in-house, we continue to strengthen our expertise in vacuum technology and thin-film deposition systems while reducing dependence on imported solutions.

The prototype represents an important milestone in our product development journey and will serve as the foundation for future enhancements, including improved compatibility, modular configurations, and expanded capabilities for advanced materials research.

Key Features

- Designed for simultaneous mounting of two thermal evaporation boats.
- Precision-machined electrode assembly for reliable electrical contact.
- Robust mechanical design for stable operation under high-vacuum conditions.
- Optimized current path for efficient power delivery to the evaporation boats.
- Modular construction for easy installation, replacement and maintenance.
- Compatible with standard thermal evaporation systems.
- Developed and manufactured entirely in-house.



THE QUANTUM PASTRY

Riya and Priya decided to bake pastries one afternoon. At the market, they found a strange ingredient that was labelled.

“Quantum flavour – Results may be connected.”

“Marketing gimmick", Priya laughed, tossing it into the basket anyway.

Back home, they mixed everything into a single bowl of batter and split it evenly into two pastries.
“Let’s make it fun,” Riya said.
“We’ll bake them and taste separately—no peeking.”
Priya agreed and took her pastry to the other room.
Riya took a bite.

“Chocolate,” she said, smiling.
From the other room, Priya shouted,
“Vanilla?! That’s weird—I didn’t add anything!”
They ran back to the kitchen.

“How did we end up with different flavours?" Priya asked.
“We used the same batter!”
They rushed back to the market.

The shopkeeper grinned when he heard the story.

You didn’t use ordinary flavour,” he said.
“You used quantum flavour."
“What does that even mean?” Riya asked.

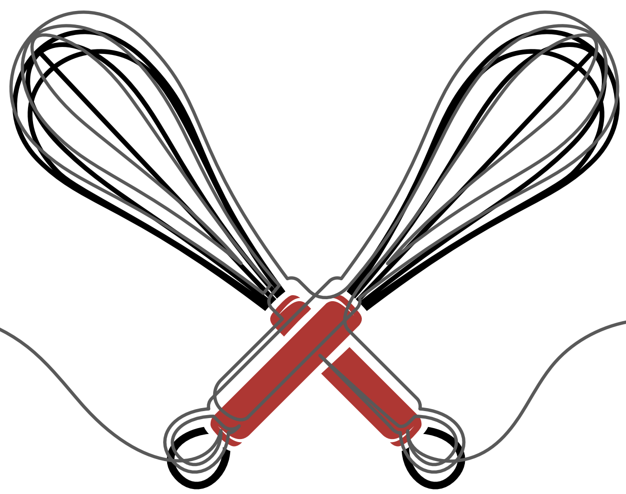
“It means the pastries weren’t independent,” he explained.
“They were created from the same mixture—in a single, shared state.”
“So the flavours were decided beforehand?” Priya asked.
The shopkeeper shook his head to convey a no.
“No. Neither pastry had a fixed flavour until one of you tasted it.”
“When Riya tasted chocolate, the system resolved—and Priya’s pastry became vanilla at that very moment.”

“But we were in different rooms,” Riya said.
“How did one affect the other?”
“It didn’t send anything,” the shopkeeper replied.
“They were never truly separate to begin with.”
“That’s entanglement,” he continued.

“In the classical world, each pastry would have its own fixed flavour. Independent.”
“But in the quantum world, parts of a system can be deeply connected—so that only the whole has a definite description.”

“And that connection,” he added,
“is what powers quantum technologies.And it is known as Quantum Entanglement”

- **Quantum computers use entangled bits (qubits, a fundamental unit of information in quantum technologies) to process information in linked ways.**
- **Quantum communication uses these connections for secure data transfer.**
- **Quantum sensors use correlations to measure the world with extreme precision.**



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