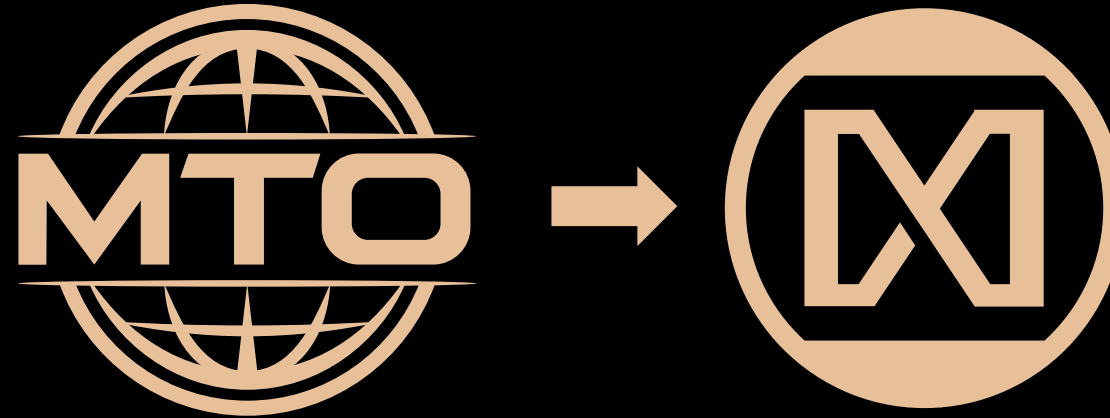


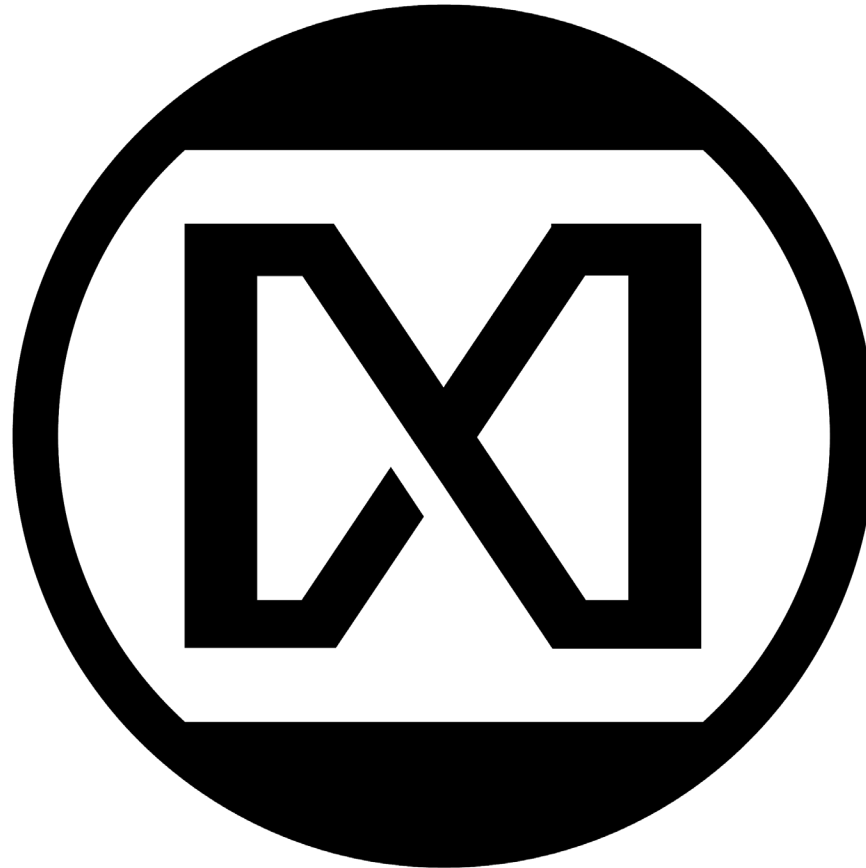


Microsystems Technology Office → Multi X Office

**Disrupt across scale and function to dominate militarily
and economically**



Disrupt across scale and function to dominate
militarily and economically.



Perrseus Security Requirements

U.S. Permanent Residents/Foreign Nationals
Controlled Unclassified Information (CUI)
Publication Review

Scott Rolston
PSR
17 July 2026





U.S. Permanent Resident and Foreign National Requirements

- **ALL participating in the Perrseus proposal and program execution period, must submit a DARPA eForm60**
 - If you are here today, you completed the eForm60 during registration and it was approved (link to eForm60 in solicitation)
- **Once completed and approved, you are good for 6 months**
 - Examples:
 - Ex:1 Professor has two foreign nationals working on the program. They must submit eForm60 every 6 months.
 - Ex:2 Foreign company is performing. They must submit eForm60 every 6 months for all foreign nationals performing on the contract.
 - Ex:3 A subcontractor has a foreign national working on the program. They must submit eForm60 every 6 months.
- **Upon contract award, it is the PI's responsibility to maintain records of all U.S. PRs and FNs supporting the program**
 - New individual joins
 - Individual departs
 - Residency or citizenship status changes

Utilize DARPAconnect <https://www.darpaconnect.us> and perrseus@darpa.mil for assistance and questions



Handling CUI

- **What is Controlled Unclassified Information (CUI)?**
 - CUI is sensitive but unclassified government information that requires protection.
 - Examples: Processing and integration recipes, Architectural design of final product, Export controls
- **Your information system must be compliant to work on CUI:**
 - National Institute of Standards and Technology (NIST)
 - Cybersecurity Maturity Model Certification (CMMC) level 2
- **What is NIST SP 800-171?**
 - The technical rulebook
 - 110 security controls that define exactly what you must do to protect CUI on your information system
- **What is CMMC Level 2?**
 - It's how you verify that you are compliant with NIST SP 800-171 Security Controls
 - Self-Assessment or
 - Third-Party Assessment
 - Resources for CMMC: link located in Solicitation
 - <https://dodcio.defense.gov/cmmc/Resources-Documentation/>

Utilize DARPAconnect <https://www.darpaconnect.us> and perrseus@darpa.mil for assistance and questions



Perrseus CUI Guide

- The purpose of the guide is to ensure the protection of Perrseus information and identifying what elements are CUI and UNCLASSIFIED.
- All performers/subs must be compliant with CUI certifications **if** handling CUI information.

Examples

- **CUI Elements**

- Integrated manufacturing capabilities revealing Perrseus microscale-Ultra-High Vacuum (μ UHV)
- Architectural design of the final process
- Export control thresholds
- Proprietary data

- **UNCLASSIFIED Elements**

- Standard non-integrated components that do not reveal the "how to" of the capability
- Methods of measurement and data of vacuum parameters

Read through the CUI guide to understand the cut lines



Publication Review Requirements

- **All aspects of the Perrseus program are Non-Fundamental research**
- **All information developed under the Perrseus program is subject to DARPA review and prior approval before any public release**
 - All publications require DISTAR review!
 - Google "DARPA DISTAR". Follow the instructions. Please allow **at least** 15 business days.



Public Release Submission Form

The U.S. Department of Defense (DoD) mandates all official DoD unclassified information that pertains to military matters, national security issues, or subjects of significant concern to the Department receive appropriate scrutiny before release to the public. As part of fulfilling this mandate, DARPA requires all DARPA-related information intended for unlimited public release to undergo reviews for technical accuracy, security and policy compliance, and adherence to overall quality standards. These reviews help DARPA offer accurate and timely information to the public, Congress and other key stakeholders, which in turn improves overall understanding of the valuable contributions DARPA and its performers provide to national security.

DARPA's process for the unlimited public release of Agency-related information is handled through the Distribution Statement A Request (DISTAR) online system, which is administered by DARPA's Public Release Center (PRC), part of the Agency's Business Processes Directorate (BPD). The DISTAR system is certified by DARPA program managers (PMs) and executed jointly by the Agency's Public Affairs Office (PAO) and DARPA's Security and Intelligence Directorate (SID).

SUBMISSION INSTRUCTIONS: After completing this form please save the .pdf. Attach it and the materials you're submitting to an email and send to DARPA's Public Release Center: public_release_center@darpa.mil. If the materials exceed 40 MB, please email the Public Release Center to receive a drop-off request code to submit this form and your materials via DoD SAFE (Secure Access File Exchange): <https://safe.apps.mil/>.

If you require additional assistance in submitting this form, please contact PRC/BPD at public_release_center@darpa.mil.



Questions?

Perrseus Program

Program Solicitation: DARPA-PS-26-127

Proposers Day

July 17, 2026

Niko Georgakopoulos
Agreements Officer
DARPA Contracts Management Office





Proposers Day Disclaimer

The Core Purpose

The purpose of Proposers Day is to make general information available to potential proposers to clarify program goals, objectives, and proposal preparation instructions.

Rule of Precedence

The Program Solicitation (PS) takes absolute precedence. The information and instructions in the PS override any other source of information, including this Proposers Day presentation.

Evaluation Standard

Proposals will only be evaluated in accordance with the official instructions provided in the PS.

FAQ vs. PS Conflict

Any response provided by the Government in the FAQ that differs from the PS will only be made formal by an official written amendment to the PS.

Authority to Obligate

Only a duly authorized Contracting/Agreements Officer has the legal authority to obligate the United States Government.



Perrseus Overview & Program Structure

The Perrseus PS	➤ Permits a variety of technical solutions. ➤ Defines the problem set; the proposer defines the solution.
Program Structure	➤ Phase 0: Up to 3 months. (Non-technical security prep). ➤ Phase 1: 24 months. ➤ Phase 2 (OPTION): 18 months.
Phase 0 (Security Set-up)	➤ Applies only to selected performers handling CUI who are not already compliant with CMMC Level 2 (Self-Assessment). ➤ Required only for performers who are not already CUI-compliant. ➤ Must be successfully completed before technical work in Phase 1 begins.
Award Instruments	Other Transaction for Prototype Agreements under 10 U.S.C. 4022.
DARPA Scientific Review Process	➤ Proposals are evaluated on individual merit and relevance to stated research goals (not against one another). ➤ Selections are made based on what is most advantageous to the Government (considering research contributions and funding availability). ➤ Evaluation Criteria are strictly outlined in the PS.



Phase 0: Security & CMMC Readiness

Core Definition

Phase 0 is a non-technical, security-focused setup period of up to three months prior to agreement execution, designed to establish a CMMC-compliant environment.

Applicability

Applies only to selected performers whose efforts involve handling Controlled Unclassified Information (CUI) and who do not yet meet CMMC Level 2 (Self-Assessment) compliance.

Critical Rule

Proposers must successfully establish and verify their CMMC Level 2 self-assessment environment during this period. No technical performance or Phase 1 work may begin until Phase 0 is successfully completed.



Phase 0 Scope & Applicability

Pre-award Security Preparation	
Applicability	Applies only to proposers whose efforts involve handling CUI and who have not yet uploaded a compliant CMMC Level 2 (Self-Assessment) score to SPRS.
Timeline	Allows selected performers up to three (3) months to achieve and verify compliance prior to Phase 1 agreement execution.
Key Restriction	No technical performance or Phase 1 technical funding is authorized during Phase 0.



Phase 0: CMMC Level 2 Compliance Milestone

End of Month 3	
Milestone Definition	Applies only to performers utilizing the Alternative Compliance Pathway (Phase 0).
Exit Criteria	Performer must achieve and post a valid CMMC Level 2 (Self-Assessment) status and current annual affirmation in the Supplier Performance Risk System (SPRS). Successful completion is required to proceed to Phase 1. Failure to meet this milestone may result in immediate termination of the agreement.
Deliverables	➤ Evidence of SPRS posting. ➤ Approved Operational Security (OPSEC) Plan.



Phase 0: CMMC Compliance Plan Requirements

Mandatory Proposal Content for Non-Compliant Proposers

Who Must Propose This?	Any proposer without a valid, unexpired CMMC Level 2 (Self-Assessment) status and annual affirmation posted in SPRS at the time of proposal submission.
The 3 Core Plan Elements	1. Realistic Path: Detail how final CMMC Level 2 status will be achieved within the 3-month Phase 0 period. 2. System & Gap Analysis: Identify specific info systems, current gaps against NIST SP 800-171 Rev 2, and target assessment dates. 3. CUI Hard Stop: Acknowledge that no CUI will be processed, stored, or transmitted until the SPRS posting is active.
Evaluation & Award Impact	➤ Evaluation: The plan's feasibility and schedule risk are actively evaluated under the <i>Budget, Price, and Schedule</i> criterion. ➤ Binding Milestone: If awarded, attaining compliance is a binding Phase 0 exit milestone. Failure to meet it may result in immediate termination before Phase 1 technical work begins.



Phase 0 Financial Risk & Reimbursement

Core Concept

Phase 0 is at-risk performance executed under a pre-contract cost agreement.

Proposal Requirement

Proposed Phase 0 costs must be detailed and fully supported in the proposal's cost volume.

Reimbursement Condition

Costs are reimbursed only if the performer successfully completes the Phase 0 CMMC milestone within the 3-month period.

Non-Reimbursement Condition

If the performer fails to complete the Phase 0 milestone, costs will not be reimbursed, and the Government may choose not to proceed to Phase 1.



Perrseus Program Timeline

All Times are Eastern Time Zone (ET)

Timeline Table

- Posting Date: July 15, 2026
- Proposers Day: July 17, 2026
- Abstract Due Date: August 3, 2026, at 1:00 p.m.
- Intent to Propose Due Date: September 1, 2026, at 4:00 p.m.
- Question Deadline: September 16, 2026, at 4:00 p.m.
- Proposal Due Date: September 23, 2026, at 1:00 p.m.
- Oral Presentations: September 30 - October 8, 2026
- Estimated PoP Start: January 15, 2027

The dates above are subject to change. Please monitor [SAM.gov](https://sam.gov) for updates or amendments.



Other Transaction for Prototype Agreements (10 USC § 4022)

Project Scope & Structure	➤ Covers basic, applied, and advanced research projects. ➤ Deliverable items can be created, built, and delivered for testing & validation. ➤ Fixed Payable Milestones: Milestones are <i>not</i> best-effort. <i>Payment is made only upon Government acceptance of the completed deliverables and exit criteria.</i>
Statutory Compliance	CRITICAL: To comply with 10 U.S.C. § 4022, at least ONE of the following four conditions must be satisfied:
Condition 1: NDC Participation	There is at least one Non-Traditional Defense Contractor (NDC) or non-profit research institution participating to a significant extent in the prototype project.
Condition 2: All Small/NDC	All significant participants in the transaction (other than the Federal Government) are small businesses (including SBIR/STTR programs) or NDCs.
Condition 3: 1/3 Cost Share	At least one-third (1/3) of the total cost of the prototype project is to be paid out of funds provided by parties other than the Federal Government.
Condition 4: SPE Waiver	The Senior Procurement Executive (SPE) determines in writing that exceptional circumstances justify the use of an OT.



Intellectual Property: Baseline Rights & Alternate Path

Program Objective

To ensure sufficient Government license rights for use, transition, and sustainment, while preserving commercialization incentives for performers.

Path 1: Baseline Government Expectation

The Government requires, at a minimum, Government Purpose Rights (GPR) for both Foreground IP (FIP) and Background IP (BIP), plus a specially negotiated license to enable transition to an alternative domestic source.

Path 2: Alternative IP Approach (SNLR)

The Government may accept Specially Negotiated License Rights (e.g., Limited/Restricted Rights) if and only if the proposer meets strict criteria for cost-sharing and commercialization.

Key Takeaway

Proposals that fail to meet the Baseline Expectation and do not provide a compelling case for the SNLR path will be evaluated as having unacceptable program risk.



IP: Qualifying for SNLR & Reversionary Rights

The two mandatory criteria for the Alternative IP (SNLR) path:

Criterion 1: Significant Cost-Share

- Target: A 35% cost-share contribution to the technology development.
- Waivers may be considered for non-profits, small businesses, or teams with significant non-traditional participation.

Criterion 2: HVM Commercialization Pathway

- Proposer must present a credible and aggressive plan to establish a domestic High-Volume Manufacturing (HVM) capability.
- This plan will be measured against specific, negotiated commercialization milestones.

Critical Risk: Reversionary Rights

If a performer is granted SNLR but fails to meet the agreed-upon HVM milestones, the Government's data rights will automatically revert back to the Baseline (GPR). This is a non-negotiable enforcement mechanism.

Required Artifacts

All proposers must submit a detailed Intellectual Property Management Plan and a Commercialization and Transition Strategy.



Security: Research Classification & Publications

Research Classification

100% Non-Fundamental Research. The entirety of the Perseus program is classified as non-fundamental research.

Publication Rights

Strictly Restricted. Performers do not have the right to freely publish or openly disseminate technical findings, academic papers, or program data.

Public Release Process

Any requests for public release must be routed through the DARPA strict pre-publication review process (e.g., DISTAR). Approval is highly restricted due to the CUI nature of the work.

Proposal Acknowledgment

Proposers must explicitly acknowledge and accept these publication restrictions within their proposal. Academic institutions must demonstrate how they will firewall this effort from open-campus networks.



Mandatory CUI & Personnel Security Requirements

CUI Safeguarding

The prime contractor is solely responsible for CUI compliance across the entire team (including all sub-contractors). The environment must meet CMMC Level 2 (Self-Assessment) standards.

OPSEC Plan

All proposers must submit an Operational Security (OPSEC) Plan detailing how they will protect critical program information and CUI from unauthorized disclosure.

Foreign Nationals & eForm 60

Mandatory: An eForm 60 is required for all U.S. Permanent Residents and Foreign Nationals participating in the effort (including those attending oral presentations).

Teaming Restrictions

Proposals must clearly outline the physical and logical access controls that will prevent unauthorized personnel (including unvetted foreign nationals) from accessing the Perrseus data environment.



Eligibility & Entity Restrictions

Prime Performer Restriction

FFRDCs, UARCs, and other Government Entities CANNOT be prime performers. The prime agreement must go to a commercial/private sector entity.

Subcontractor/Teaming Exception

FFRDCs, UARCs, and Government entities may participate as subcontractors/team members only if they offer unique capabilities that are not demonstrably available in the private sector.

Funding Flow Mechanism

For approved FFRDC/UARC/Government team members, funding will not flow through the prime's OT agreement. DARPA will fund these entities directly through existing government-to-government sponsor agreements.

Foreign Participation

Foreign participation is subject to strict CUI, export control, and security regulations. Non-U.S. entities must demonstrate full compliance with the OPSEC and CMMC requirements to participate.



Teaming Restrictions: OCI & IV&V

OCI Disclosure Requirement

All proposers must identify and disclose any potential, actual, or apparent Organizational Conflicts of Interest (OCI) at the time of proposal submission, accompanied by a robust mitigation plan.

The IV&V Teaming Ban

STRICT RESTRICTION: Proposers are absolutely prohibited from teaming with any entity that is serving as an Independent Verification and Validation (IV&V) partner for the Perrseus program.

No Firewalls for IV&V

Unlike standard OCIs, the IV&V teaming restriction cannot be mitigated. Internal corporate firewalls or separation plans are not permitted. Proposing with an IV&V partner will result in immediate disqualification.

Teaming Finality

Due to these strict OCI checks, the teaming list submitted during the Mandatory Intent to Propose phase will be heavily scrutinized and must be complete.



Personnel Security - Pre-Award Requirements (Oral Presentations)

Prime Responsibility	The prime contractor is responsible for ensuring all personnel, including subawardees, comply with security screening for DARPA-sponsored events (in-person or virtual).
eForm 60 Submission	A DARPA eForm 60 is mandatory for all U.S. Permanent Residents and foreign nationals participating in the oral proposal presentation.
CRITICAL DEADLINE	The eForm 60 must be submitted no later than the due date for the Notification of Intent to Propose.
Consequence of Failure	Failure to submit the eForm 60 on time may result in the individual being denied access to the oral presentation, without exception.
Submission Portal	All forms must be submitted electronically via the secure portal: https://dtsn.darpa.mil/eform60/



Personnel Security: Post-Award (Program Execution)

eForm 60 Submission

All U.S. Permanent Residents and foreign nationals must have an approved eForm 60 on file prior to performing any work on the program.

Restrictions on Engagement

Individuals may begin technical work upon submission of the eForm 60, but they are not authorized to participate in any meetings or engagements with DARPA personnel (virtual or in-person) until the eForm 60 is officially approved.

PI Responsibilities

The Principal Investigator (PI) is responsible for maintaining complete records of all foreign individuals and must promptly notify DARPA of any changes (new hires, departures, status changes).

Letter of Compelling Need

For any individual from a country on the "Critical" or "High" threat matrix, the PI must submit a Letter of Compelling Need justifying their participation.



Proposal Pricing & Award Administration

Critical Guidance for Cost Volumes & Registration

Pre-Determined Fee Range	DARPA has determined a reasonable fee range for the Perrseus program is 9.0% – 10.5%.
Fee Justification Rule	Proposers should propose a fee within this range. Because the range is pre-determined as reasonable, no further fee justification is required in the proposal. <i>(This reduces proposal effort and accelerates award timelines).</i>
Cost Sharing (OT)	Cost sharing is not required unless the proposer is a traditional defense contractor who is not teaming with a non-traditional defense contractor to a significant extent.
Mandatory Award Registrations	<i>At the time of contract award, performers MUST have:</i> ➤ SAM.gov: An active registration with a valid CAGE code and Unique Entity ID (UEI). ➤ WAWF: Registration in the Wide Area Work Flow invoicing system (https://wawf.eb.mil/).



Abstract Submission: A "Safe Harbor" Review

Submission Rule	Submission of an abstract is OPTIONAL but STRONGLY RECOMMENDED as a risk-reduction opportunity.
Purpose	To receive early, non-binding feedback from the Government on your technical approach, programmatic structure, and compliance with key solicitation requirements before committing to a full proposal.
Key Feedback Areas	Proposers are highly encouraged to use the abstract to get feedback on: ➤ Intellectual Property (IP) Strategy: A preliminary overview of your IP Management Plan. ➤ Teaming & OCI: DARPA will use the team list to pre-screen for prohibited IV&V partners.
The Value to Proposers	This feedback provides a valuable opportunity to adjust your IP strategy, restructure your team, and mitigate program risk prior to the binding full proposal deadline.
Government Response	DARPA will provide a formal response letter with feedback to all proposers who submit an abstract.



Full Proposal Submission Requirement

Format, Portal, and Mandatory Prerequisites

Submission Portal	All written proposal materials must be submitted securely through the Broad Agency Announcement Tool (BAAT) (https://baat.darpa.mil).
Two-Part Proposal Structure	1. Written Volumes: Includes Administrative, Cost, IP Management, and the Phase 0/CMMC Compliance Plan. 2. Oral Presentation: A 30-minute in-person presentation to the DARPA review team, followed by a 45-minute Q&A session. <i>(May include an optional 5-minute video demonstration).</i>
Strict Deadline (Not Rolling)	Proposal evaluations are NOT rolling. The complete proposal package must be submitted via BAAT no later than September 23, 2026, at 1:00 PM ET. Late submissions will be rejected.
Mandatory Prerequisites	Full proposals will only be accepted and scheduled for Orals if the proposer successfully submitted the mandatory Intent to Propose and all required eForm 60s (for personnel security) by their respective prior deadlines.
Read the PS Carefully	Proposers must strictly adhere to the formatting, page limits, and compliance checklists outlined in the Program Solicitation (PS).



Tips for a Compliant Proposal

Key Rules to Avoid Administrative Disqualification

1. Submit on Time!

The proposal due date and the solicitation closing date are the same. ***Do not be late!***

2. Submit All Attachments!

- Read the instructions within each attachment carefully.
- This includes providing separate attachments for all subcontractors.
- Ensure the detailed Milestone Plan and list of all deliverables are included.

3. Respect Page Limits!

- Adhere strictly to the page limitations described in the Program Solicitation.
- Pages beyond the specified limit will not be read or reviewed.

Final Check

A compliant proposal is a complete proposal. Double-check all requirements before submitting through the BAAT portal.



Communications & Questions

Official Channels for Solicitation Inquiries

The Golden Rule	Do NOT contact the Program Manager directly. All communication must flow through the official program email alias to ensure fairness and transparency.
Official Email Alias	Send all technical, administrative, and contractual questions to: Perrseus@darpa.mil
FAQ Updates	An updated FAQ document will be periodically posted to SAM.gov. Proposers are strongly encouraged to review the FAQ before submitting a question.
Question Deadline	The deadline to submit questions is September 16, 2026, at 4:00 PM ET. <i>Questions received after this time may not be answered.</i>



www.darpa.mil



Perrseus

Slaying the “horror vacui”

Dr. Travis Autry



Proposer's Day
July 17th, 2026



- Performance at scale
 - Production capacity for advanced quantum sensors is unacceptably low.
- No more hand assembly
- Performers who wish to operate “fabless” or near-fabless may do so and may suggest new milestones.
- **Transition Outcome:** It is the government’s desire to realize a UHV packaging as a service using a “fabless” model.
 - This will form the basis of future quantum sensor development.

Vacuum Tube Assembly 1944



https://www.jproc.ca/marconi/tube_production.html

Transistor Assembly



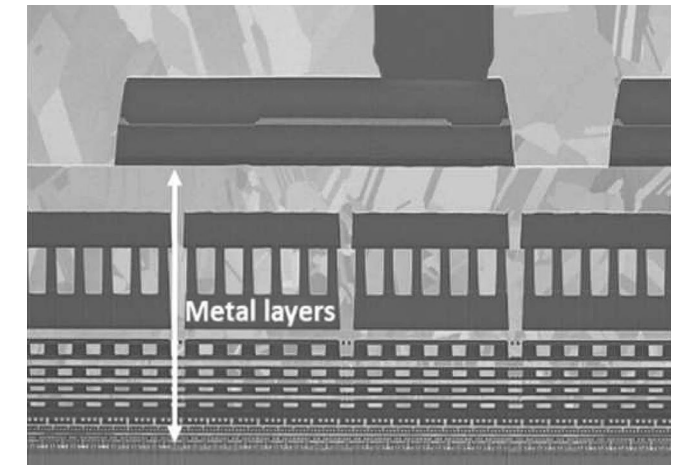
https://en.wikipedia.org/wiki/History_of_the_transistor

Quantum Sensor Assembly 2019



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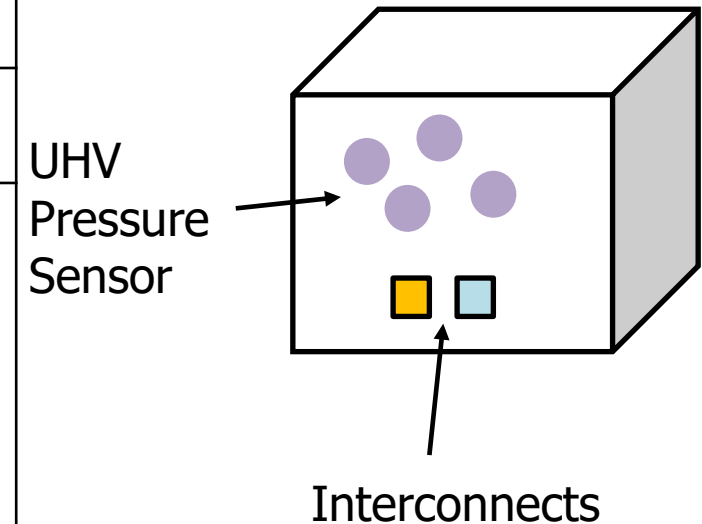
Transistor Fabrication



<https://spectrum.ieee.org/tsmc-n2>

Metric	Unit	Phase 1 (24 months)	Phase 2 (18 months)
Vacuum	mbar	1×10^{-7}	1×10^{-10}
Lifetime	years		>3
Pressure Measurement		Demonstrated pressure sensor(s) integrated in external UHV system covering entire range of operation	Demonstrated pressure sensor(s) integrated in Perrseus μ UHV system covering entire range of operation

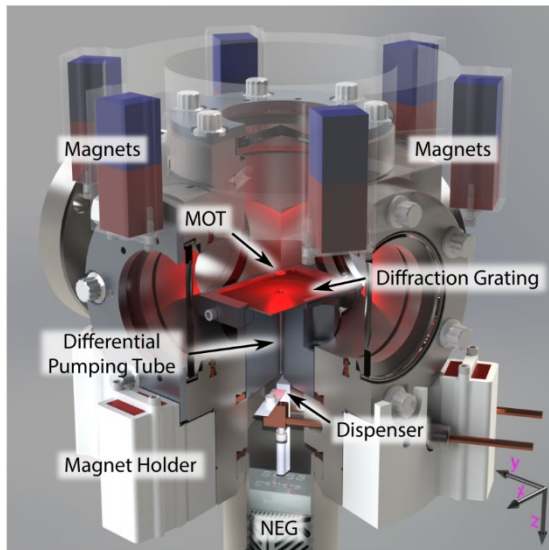
Quantum pressure sensor in a μ UHV package



*Low-leak through package photonic and electrical interconnects must be demonstrated with ≥ 2 photonic and ≥ 2 electrical interconnects with <3 dB loss as the exclusive control and readout interface for the package.

** Volume is <5 mL

Cold neutral atom vacuum gauge



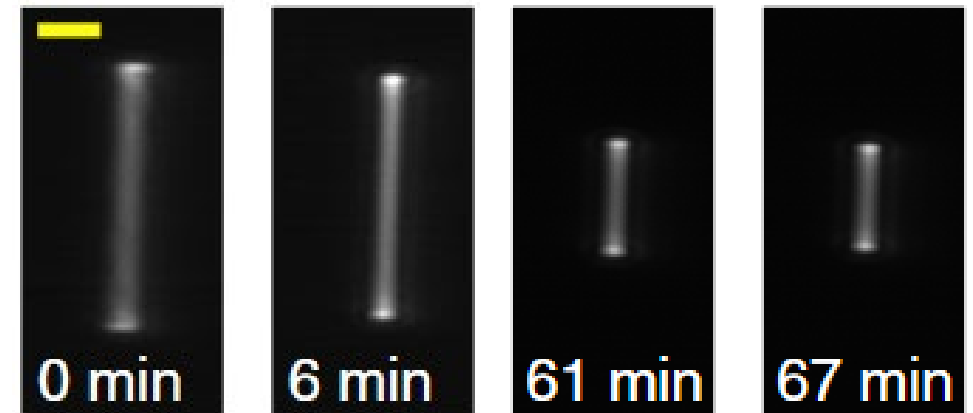
Ehinger, L. H. *et al.* Comparison of two multiplexed portable cold-atom vacuum standards. *AVS Quantum Science* **4**, 034403 (2022).

Cold ionized atom vacuum gauge



Aikyo, Y. *et al.* Vacuum Characterization of a Compact Room-temperature Trapped Ion System. *Applied Physics Letters* **117**, 234002 (2020).

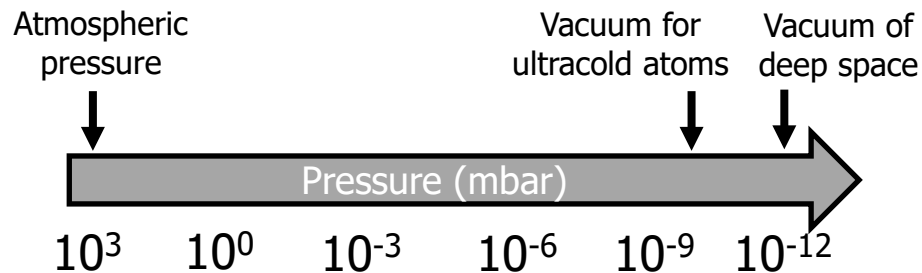
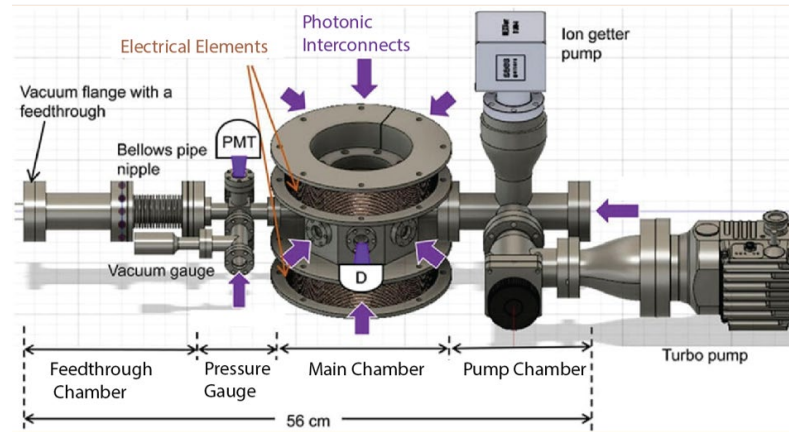
Ultra-High Q Optomechanical Vacuum Gauge



Dania, L. *et al.* Ultrahigh Quality Factor of a Levitated Nanomechanical Oscillator. *Phys. Rev. Lett.* **132**, 133602 (2024).

Vacuum is not a solved problem

SoA lab-scale vacuum system



Nomura, J. *et al.*, *AIP Advances* **13**, 025361 (2023).

SoA Microscale Vacuum System

Cs dispensing by laser activation

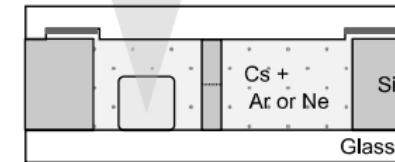
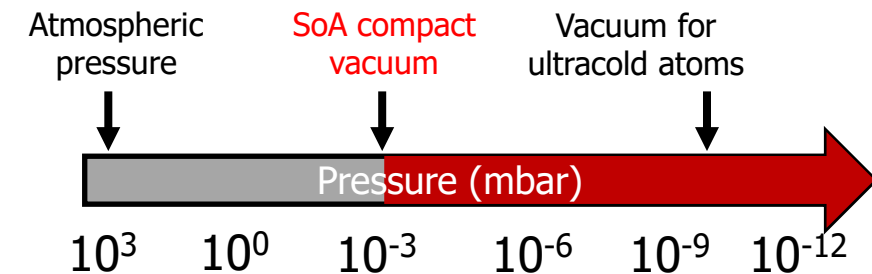


Table 1. Effects of getter films on cell atmosphere^a.

	Residual gas pressure (mbar)	
	Cell A (Getter-free)	Cell B (Getter-integrated)
H ₂	2.76×10^{-2}	0.00
He	3.71×10^{-3}	1.63×10^{-3}
CO	0.00	0.00
N ₂	8.12×10^{-2}	0.00
CH ₄	4.45×10^{-3}	2.79×10^{-2}
H ₂ O	0.00	0.00
Ne	1.40×10^2	1.42×10^2
O ₂	8.09×10^{-1}	0.00
C ₂ H ₆	0.00	5.28×10^{-3}
C ₃ H ₈	7.62×10^{-3}	2.12×10^{-2}
Ar	7.28×10^{-3}	0.00
CO ₂	1.33	0.00

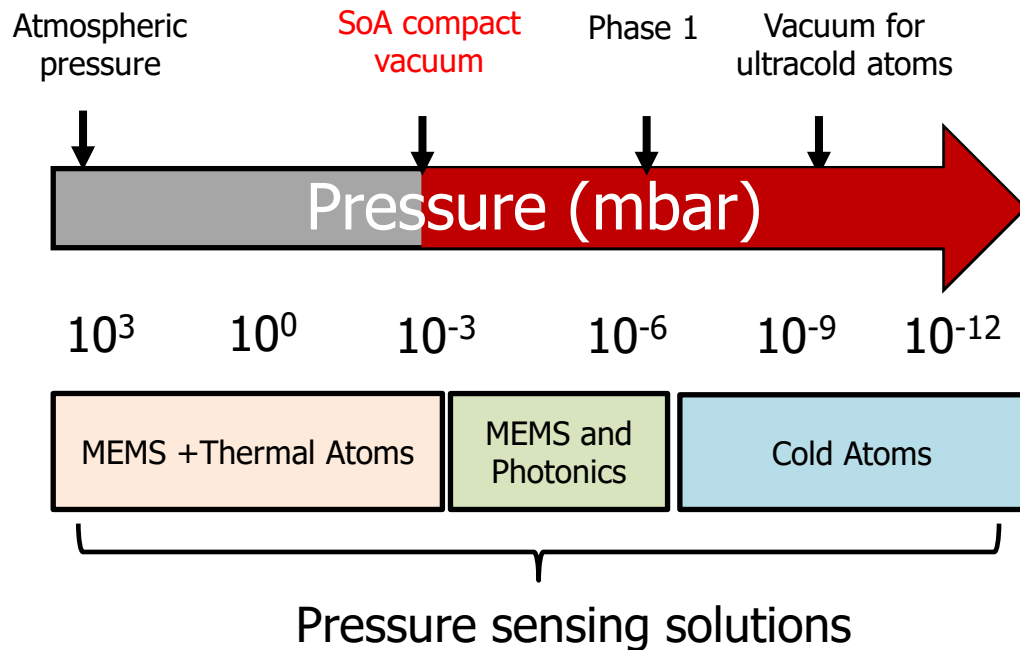
^a Cells were filled with Ne (set pressure: 133 mbar).



M. Hasegawa *et al.*, "Effects of getters on hermetically sealed micromachined cesium–neon cells for atomic clocks," *J. Micromech. Microeng.*, vol. 23, no. 5, p. 055022, Apr. 2013, doi: [10.1088/0960-1317/23/5/055022](https://doi.org/10.1088/0960-1317/23/5/055022).

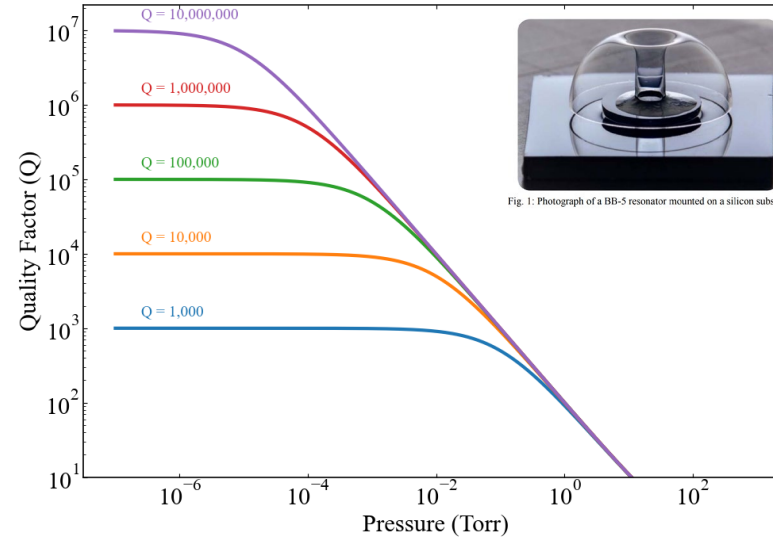
Quantum sensor performance depends on vacuum technology

Spanning the HV Pressure Sensing Gap



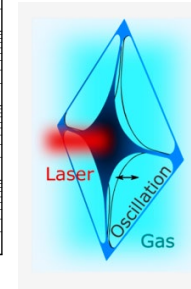
How to measure vacuum pressure and how to iterate quickly?

Paths to Pressure Sensing at HV

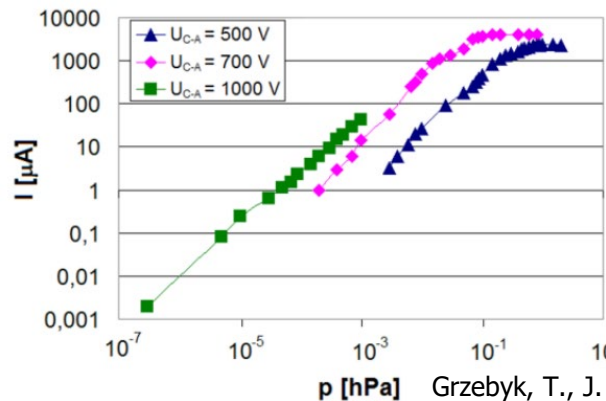


Trusov, A. A., *Micromech. Microeng.* **18**, 095016 (2008).

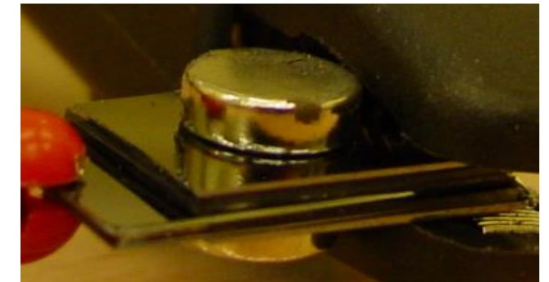
Singh, S. *et al.*, 2018 IEEE/ION Position, Location and Navigation Symposium (PLANS) 15–19 (2018).



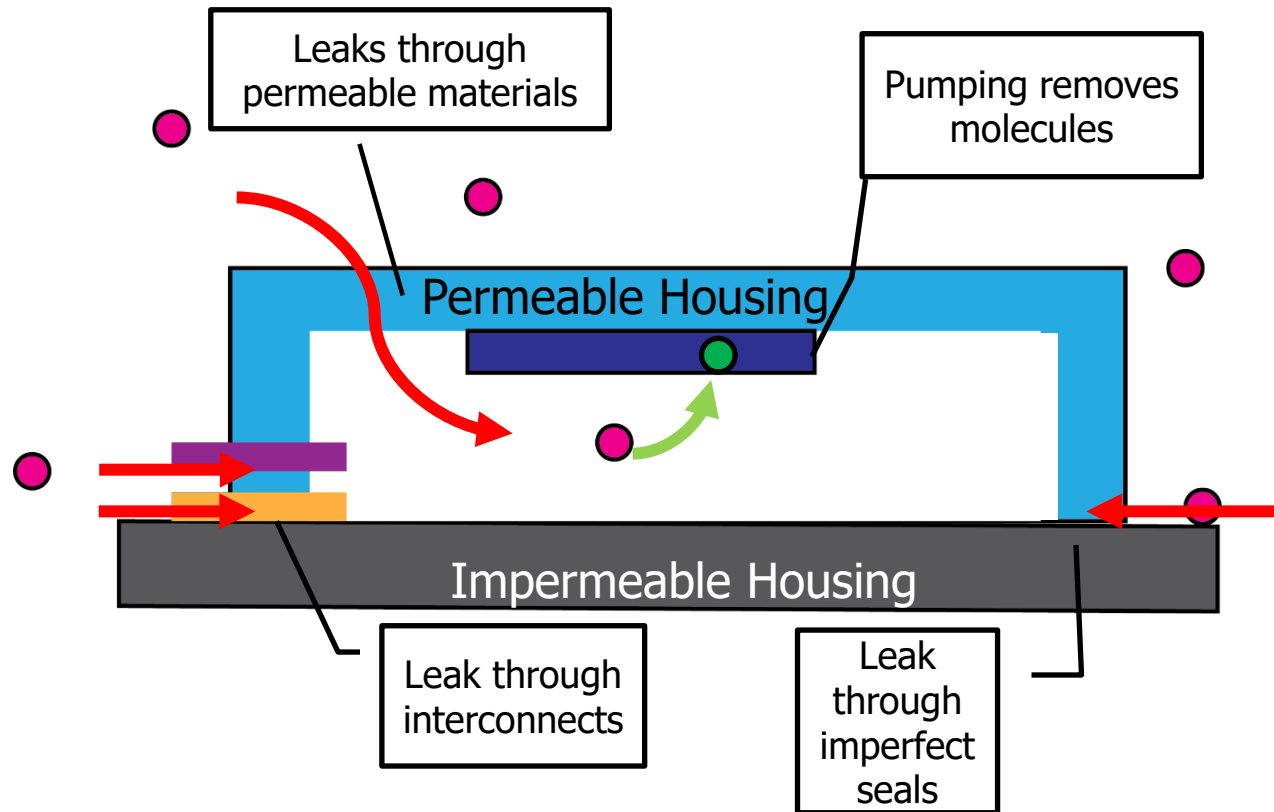
Reinhardt, C. *et al.*, *ACS Photonics* **11**, 1438–1446 (2024).



Grzebyk, T., J. MEMS ion-sorption high vacuum pump. *Journal of Physics: Conference Series* **773**, 012047 (2016).



What needs to be done for μ UHV with long lifetime?



Without pumps: $\sim 10^{-21} \frac{\text{mbar} \cdot \text{l}}{\text{s}}$
 With pumps: $< ??$ You tell us!

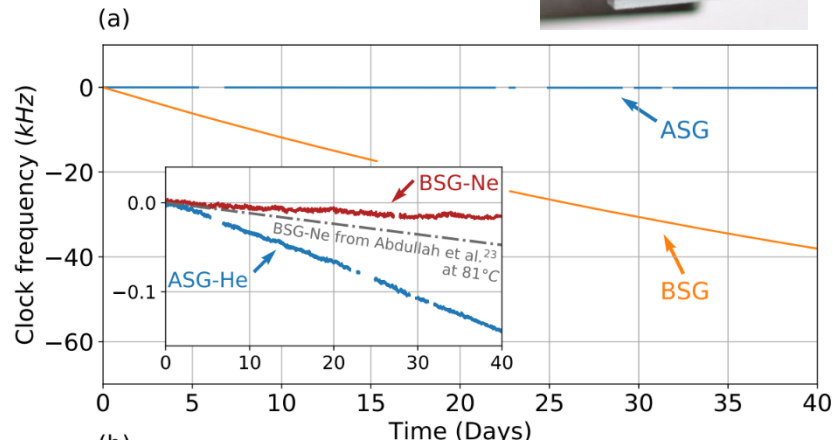
Rushton, J., *Review of Scientific Instruments* **85**, 121501 (2014).

Fundamental interplay between techniques for making and maintaining vacuum systems

Pump Rate - Leak Rate = Vacuum Level
Pump Capacity / Leak Rate = Device Lifetime

SoA: Anodically Bonded Vapor Cells with "Reduced Permeation"

- High Yield
- Typically uses Glass: He-Permeable
- Generates O_2



Carlé, C. *et al. Journal of Applied Physics* **133**, 214501 (2023).

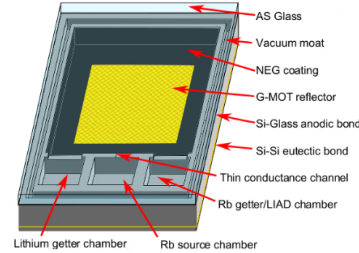
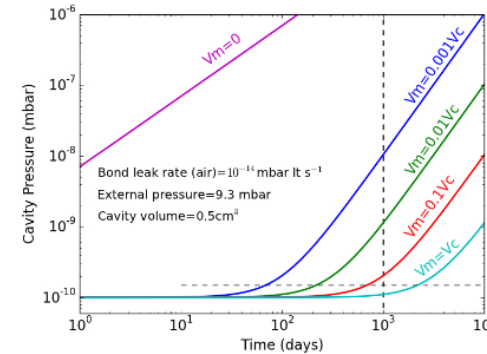


FIG. 10. Prototype design of a miniaturized magneto-optical trap incorporating all the elements discussed in the text. Dimensions are $20 \times 24 \times 5 \text{ mm}^3$.

Rushton, J., *et al, Review of Scientific Instruments* **85**, 121501 (2014).



Change the Architecture

Change the Materials

All Silicon MEMS Cells

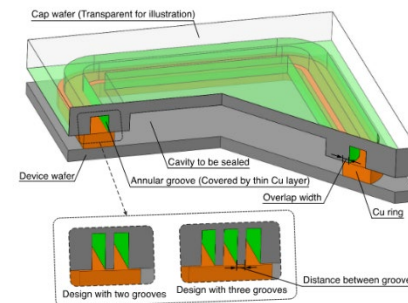


Fig. 1. Schematic drawing of our sealing approach. The close-up images indicate evaluated design variations of the sealing ring structures.

Wang, X., Bleiker, S. J., Antelius, M., Stemme, G. & Niklaus, F. *Journal of Microelectromechanical Systems* **26**, 357–365 (2017).

All Sapphire Cells

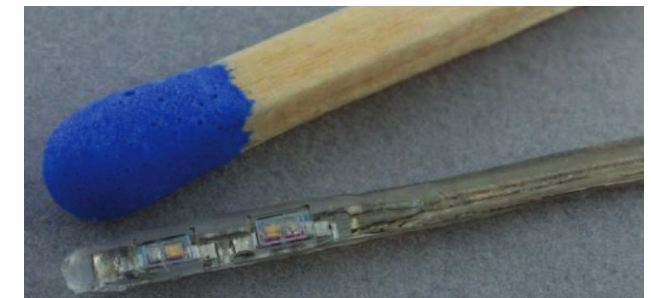


Figure 10: Optical cochlear implant demonstrator

James, R. J. *et al. 2021 IEEE 71st Electronic Components and Technology Conference (ECTC)* 1673–1681 (2021).

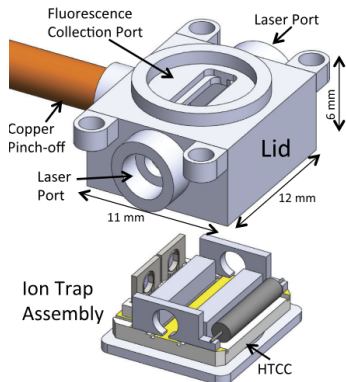
SoA:

Wafer Bonder (Base Pressure
 $\gg 1E^{-10}$ mbar)



Li, Y., Sohn, D. B., Hummon, M. T., Schima, S. & Kitching, J. *Opt. Lett.*, **OL 49**, 4963–4966 (2024).

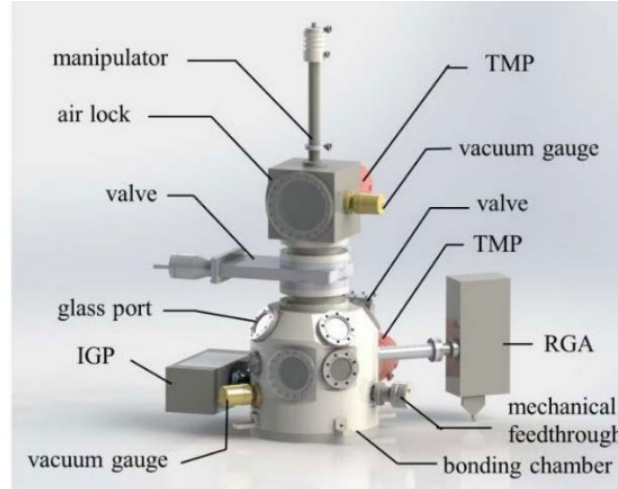
Custom Pinch Off (UHV)



Schwindt, P. D. D. *et al.*, *Review of Scientific Instruments* **87**, 053112 (2016).

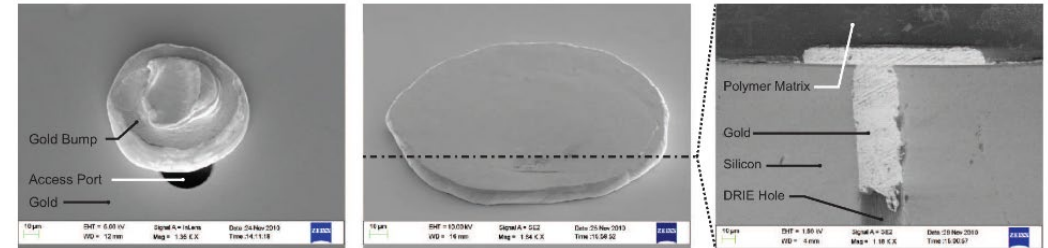
New SoA Sealing Methods

Multi-chamber Wafer Bonder



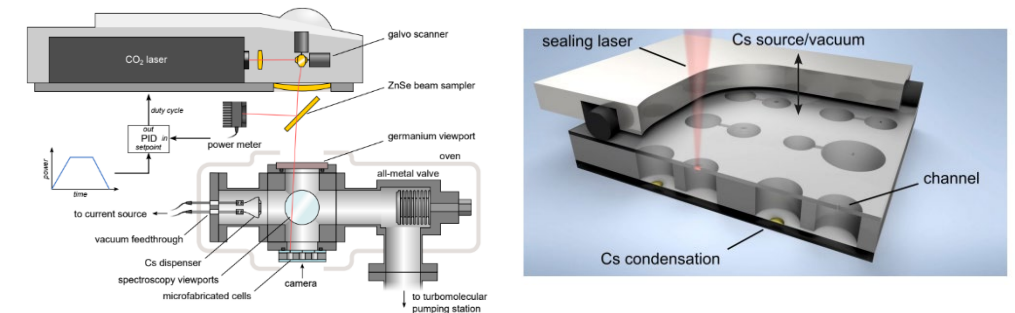
Droese, N. *et al.* Setup of an ultra-high vacuum bonder for the encapsulation of quantum systems. 763–766 (2023) doi:[10.15488/18549](https://doi.org/10.15488/18549).

MEMS Pinch-Off



Antelius, M., *et al.*, *Journal of Microelectromechanical Systems* **22**, 1347–1353 (2013).

UHV Chamber + Ex-Situ Cs + Seal



Péroux, L. *et al.*, *Appl. Phys. Lett.* **126**, 144003 (2025).

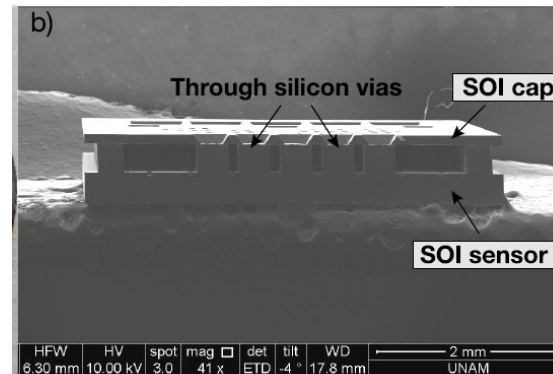
Interconnects = holes for leaks

Electrical Interconnects

Ex: SoA Electrical Vias
Drill Hole



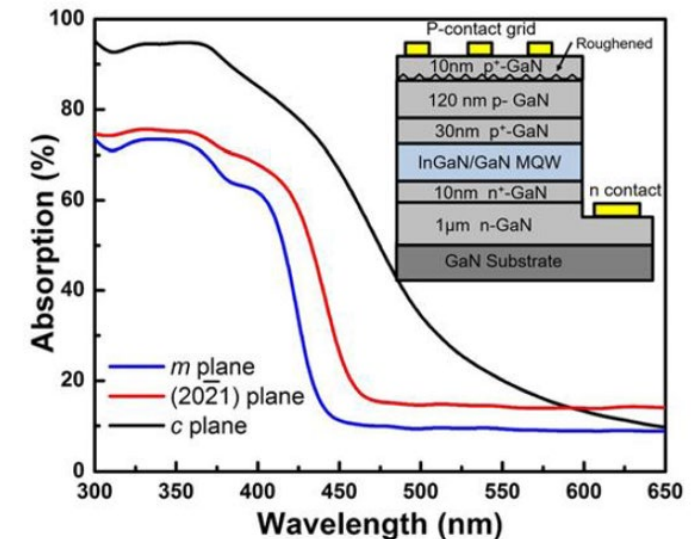
Electrical Interconnects: Why not avoid holes altogether?



Torunbalci, M. M., et. al., *IEEE Sensors Journal* **21**, 13958–13964 (2021).

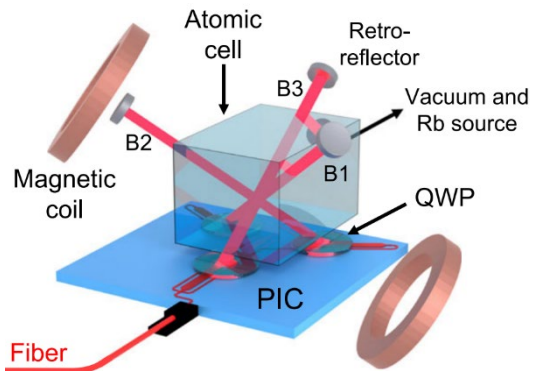
Thin Film GaN Vias

Silicon Vertical Vias



Vadiei, E. et al. *Appl. Phys. Express* **11**, 082304 (2018).

SoA: Windows as "Photonic interconnects"



Isichenko, A. *et al.*, *Nat Commun* **14**, 3080 (2023).

A. Architecture

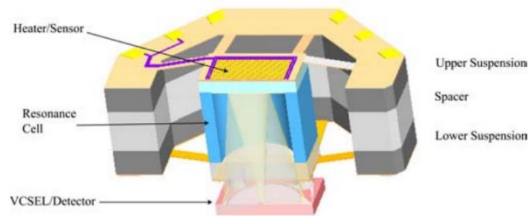


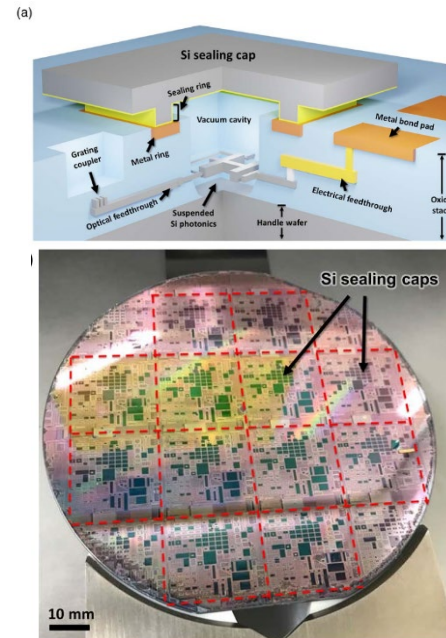
Figure 1. Physics Package Architecture

Lutwak, R. *et al.*, *2005 IEEE International Frequency Control Symposium and Exposition, 2005*. 6 pp.- (2005).

- Hand assembly

New SoA: Single-mode photonic interconnects and routing

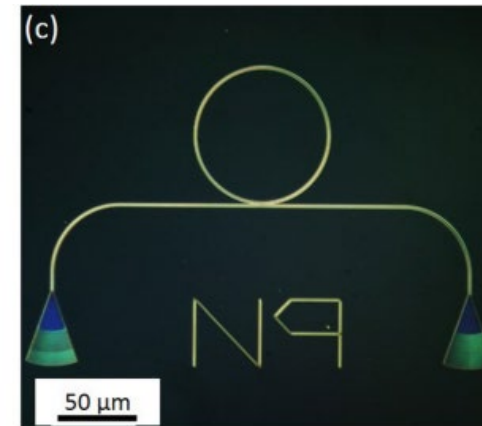
Demonstrated



Jo, G. *et al.* Wafer-level hermetically sealed silicon photonic MEMS. *Photon. Res.* **10**, A14 (2022).

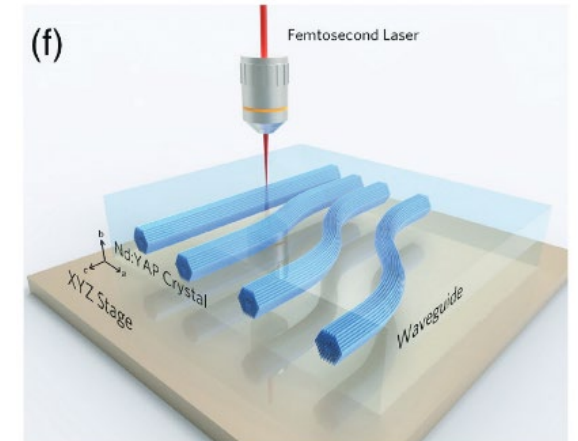
- Use SiO_2 : How leaky?

Single Crystalline Waveguides



Bruch, A. W. *et al.*, *Appl. Phys. Lett.* **107**, 141113 (2015).

- What cladding?



Li, L., Kong, W. & Chen, F. *Adv. Photon.* **4**, (2022).

- How to bend?

Passive Pumps (Getter)

Cs dispensing by laser activation

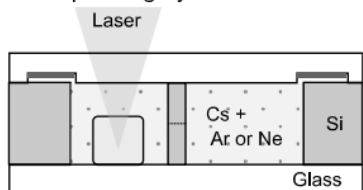
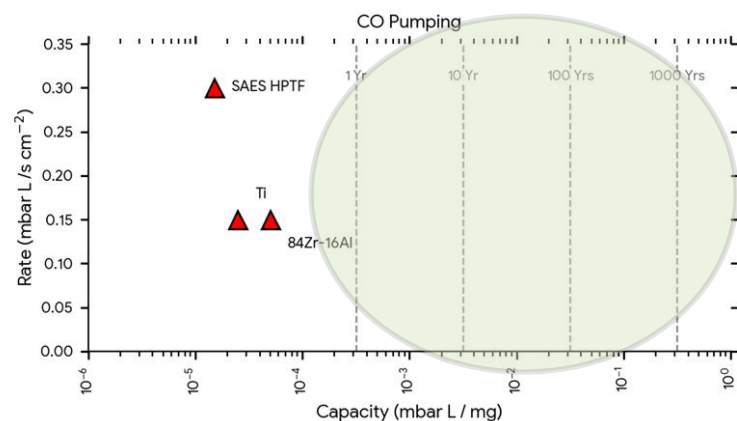


Figure 2. Fabrication steps of the micro Cs-vapor cell.

M. Hasegawa *et al.*, *J. Micromech. Microeng.*, vol. 23, no. 5, p. 055022, Apr. 2013, doi: [10.1088/0960-1317/23/5/055022](https://doi.org/10.1088/0960-1317/23/5/055022).

Erjavec, B. & Setina, J., *Journal of Vacuum Science & Technology A* **29**, 051602 (2011).



Chuntonov, K. & Setina, J. Reactive getters for MEMS applications. *Vacuum* **123**, 42–48 (2016).

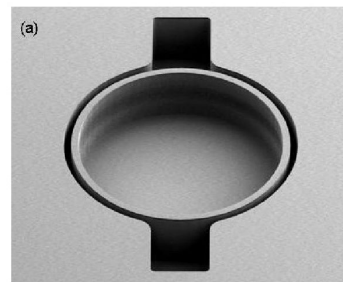
Turnbull, J. C. Barium, strontium, and calcium as getters in electron tubes. *J. Vac. Sci. Technol.* **14**, 636–639 (1977).

Table 1. Effects of getter films on cell atmosphere^a.

	Residual gas pressure (mbar)	
	Cell A (Getter-free)	Cell B (Getter-integrated)
H ₂	2.76×10^{-2}	0.00
He	3.71×10^{-3}	1.63×10^{-3}
CO	0.00	0.00
N ₂	8.12×10^{-2}	0.00
CH ₄	4.45×10^{-3}	2.79×10^{-2}
H ₂ O	0.00	0.00
Ne	1.40×10^2	1.42×10^2
O ₂	8.09×10^{-1}	0.00
C ₂ H ₆	0.00	5.28×10^{-3}
C ₃ H ₈	7.62×10^{-3}	2.12×10^{-2}
Ar	7.28×10^{-3}	0.00
CO ₂	1.33	0.00

^a Cells were filled with Ne (set pressure: 133 mbar).

Atomic Source Sublimation Pump



Manginell, R. P. *et al.*, *Opt. Express*, **OE 20**, 24650–24663 (2012).

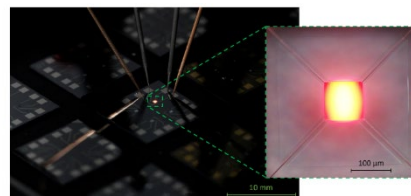
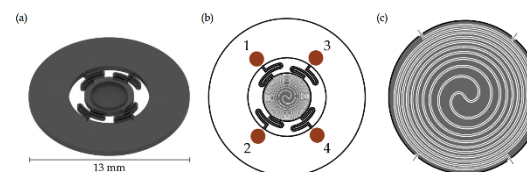


FIG. 4. Photograph of heated micro-hotplate with inlay showing a 20x magnification microscope image of the hotplate at the power dissipation of 38 mW operated in air.

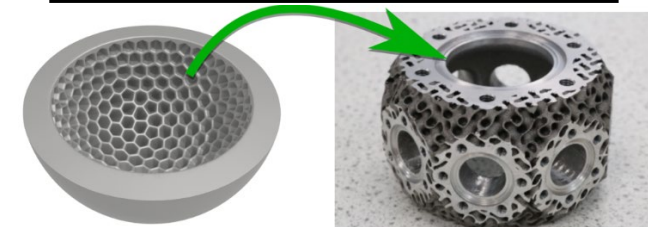
Kumar, V. *et al.*, *Appl. Phys. Lett.* **126**, 264001 (2025).



Pick, J. *et al.*, *Phys. Rev. Appl.* **23**, 014020 (2025).

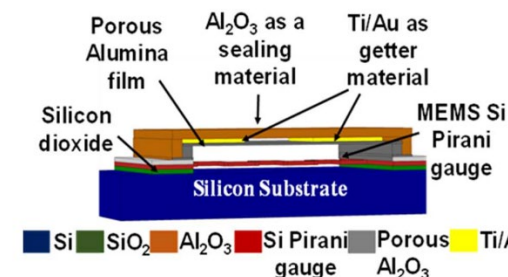
Other Approaches

Additive Surfaces for NEGS



Cooper, N. *et al.*, *Phys. Rev. Applied* **25**, 014047 (2026).

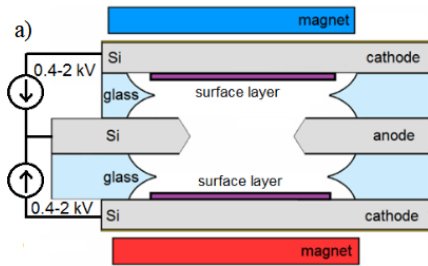
Discharge Ti Sputter Pump



Maharshi, V., *et al.*, *2023 IEEE 36th International Conference on Micro Electro Mechanical Systems (MEMS)* 665–668 (2023).

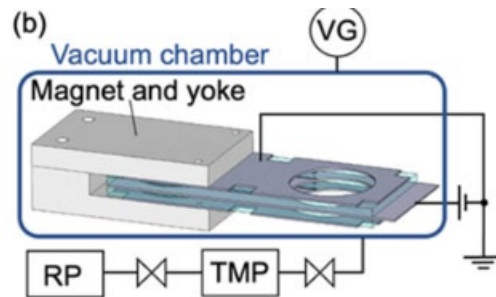
SoA: Magnet Ion Pumps

Magnets usually bad for quantum sensors



Grzebyk, T., et. Aa., J. ,*Journal of Physics: Conference Series* **773**, 012047 (2016).

Kurashima, Y. *et al.* ,*Sensors* **24**, 4000 (2024).



Do they pump noble gas?

Innovations in Magnetless Ion Pumps

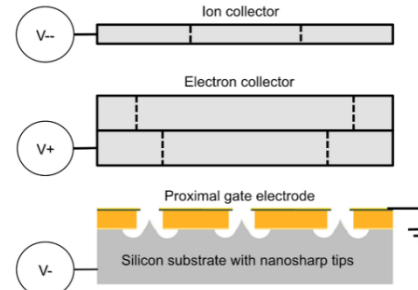
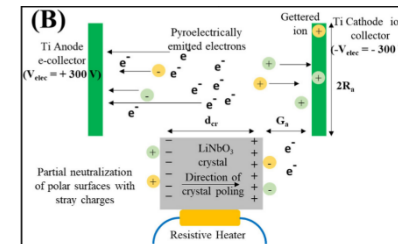


Figure 3. Schematic of proposed magnetic-less ion pump.

Basu, A. & Velásquez-García, L. F. ,*J. Micromech. Microeng.* **26**, 124003 (2016).



Vinayakumar, K., et. al, *Journal of Vacuum Science & Technology B, Nanotechnology and Microelectronics: Materials, Processing, Measurement, and Phenomena* **39**, 024202 (2021).

Do they pump noble gas and how to integrate?

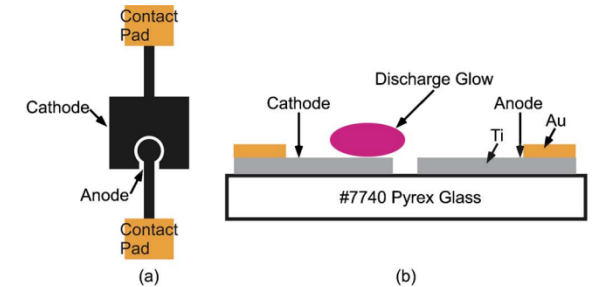
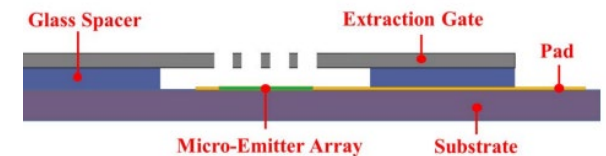
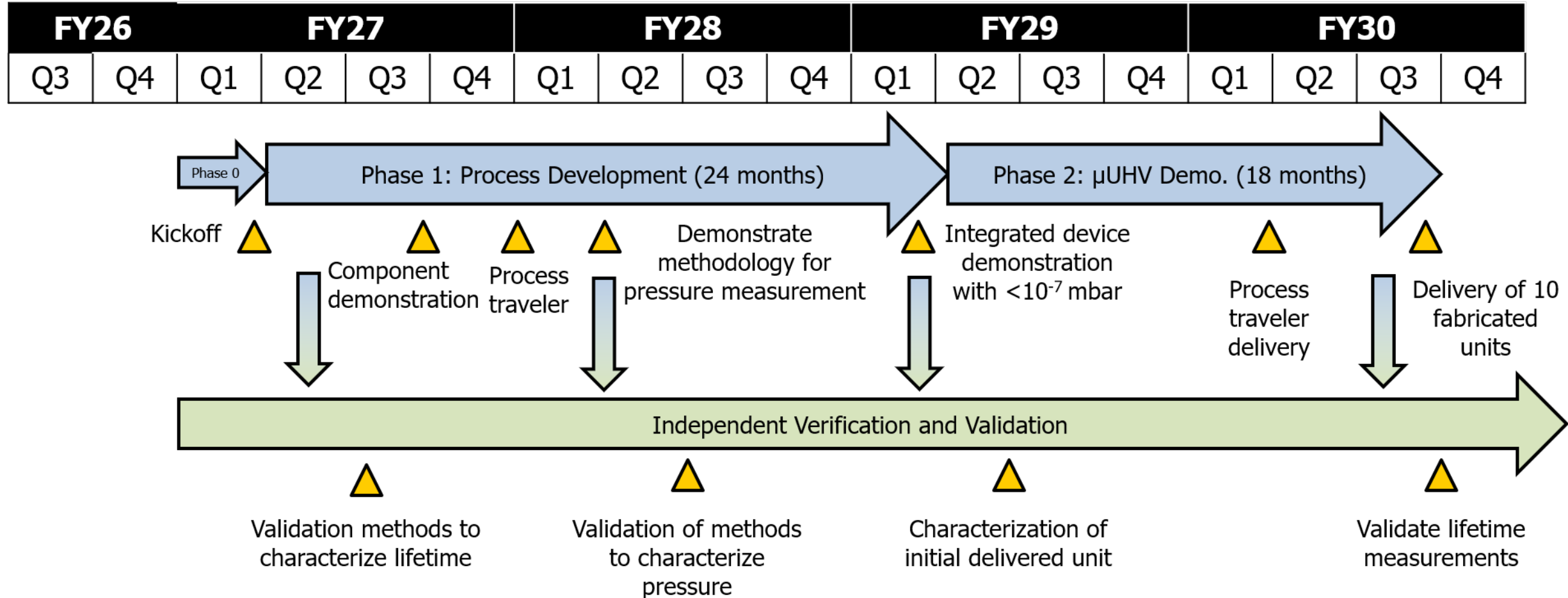


FIG. 2. Schematics of micro-SIP electrodes: (a) top view and (b) side view.

Wright, S. A. & Gianchandani, Y. B. ,*J. Vac. Sci. Technol. B* **25**, 1711–1720 (2007).



Wang, Y. *et al.* ,*IEEE Transactions on Electron Devices* **67**, 5132–5137 (2020).





- **Overall Scientific and Technical Merit:**
 - Experience with manufacturing and process development
 - Teaming composition to meet the goals of the program
- **Potential Contribution and Relevance to the DARPA Mission**
 - The adequacy of the proposed Government rights to enable the use, integration, modification, and transition of the technology for Government purposes.
 - The proposer's strategy and willingness to support the program's collaborative, "cross-pollinated" model, including the ability to integrate technologies from other performers.
 - The credibility and feasibility of the proposed Commercialization and Transition Strategy, including the plan for achieving a sustainable, high-volume manufacturing capability.
 - The proposer's identification and management of any Background IP (BIP) restrictions and the associated risks to the Government.
- **Budget, Price, and Schedule**



- Perrseus will develop manufacturing capabilities that will transition beyond R&D into meaningful utilization, operational application, and commercialization. The Government does not intend for capabilities or technical data developed under this program to become unavailable or limited to demonstration-only purposes.
- Accordingly, intellectual property (IP) license rights, transition planning, and commercialization strategies are material requirements of this solicitation. The Government's objectives are to:
 - Ensure sufficient Government license rights to use, integrate, modify, sustain, transition, and further develop program results.
 - Preserve appropriate commercialization incentives for performers.
 - Prevent IP restrictions from unreasonably limiting the Government's ability to utilize the results of Government-funded efforts.



FFRDCs, UARCS, and Government Entities to Include National Labs are not eligible to be prime proposers under this solicitation

There are technical criteria and organization conflicts of interest that will determine their eligibility to participate in the program as subcontractors (defined in greater detail in solicitation)

Technical Criteria:

1. Critical, specialized capabilities such as tool accessibility, critical components or fabrication, characterization, testing, or measurement techniques. They must clearly demonstrate that the proposed work is not otherwise available from the private sector.
2. Demonstration of active plans to transition supporting or enabling technology from the FFRDC, UARC, or Government Entity to the prime contractor on the Perrseus program.
3. Share all data and measurements performed at the FFRDC, UARC, or Government Entity under DARPA funding in the Perrseus program with all Perrseus performers.

Organization Conflict of Interest:

- As of this meeting NIST will be playing a role as IV&V for program, so NIST is not eligible to participate in the program as a subcontractor
- Feedback will be provided in the abstract phase if the list of prohibited entities expands



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- Reviewing and Analyzing a DARPA Opportunity
- DARPA SBIR and STTR Program
- Understanding DARPA Security Resources
- Preparing Your DARPA Proposal
- Tying It All Together: Strategies for Success
- Opportunities for Networking

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February 2026



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May 2026

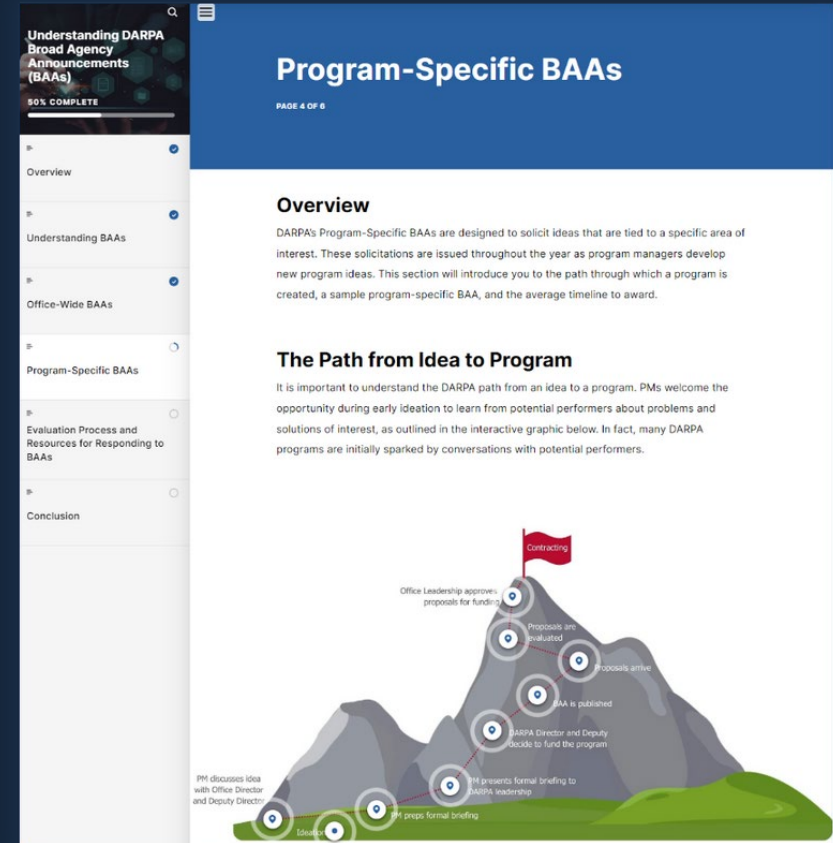
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November 2026

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- Tips for DARPA Proposal Success
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Location: Virtual



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Location: Portland, ME





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