

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

MRS Agency Webinar: NIST

NIST works with industry and academia to enhance economic security and improve our quality of life

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CELEBRATING EST. 1901 NIST 125 YEARS

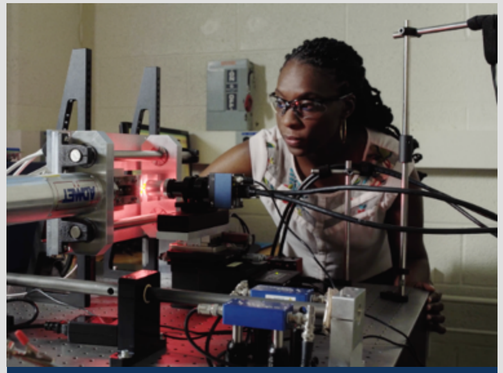
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

Overview and opportunities in Materials R&D

Learn more about NIST's 125th anniversary www.nist.gov/125th-anniversary



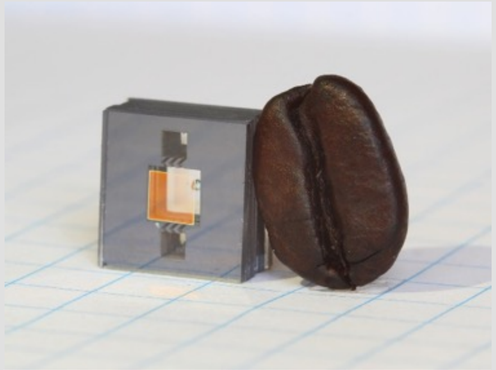
Priorities and Opportunities in Materials R&D



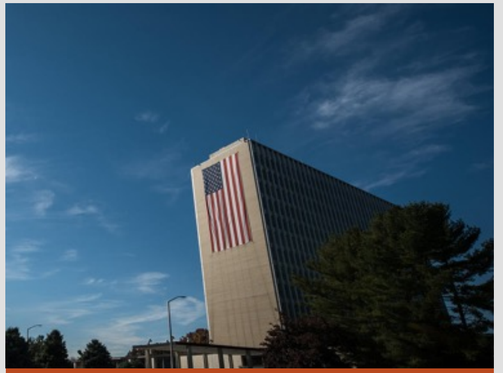
Critical & Emerging Technologies



U.S. Leadership in Standards



Adoption of U.S. Innovations

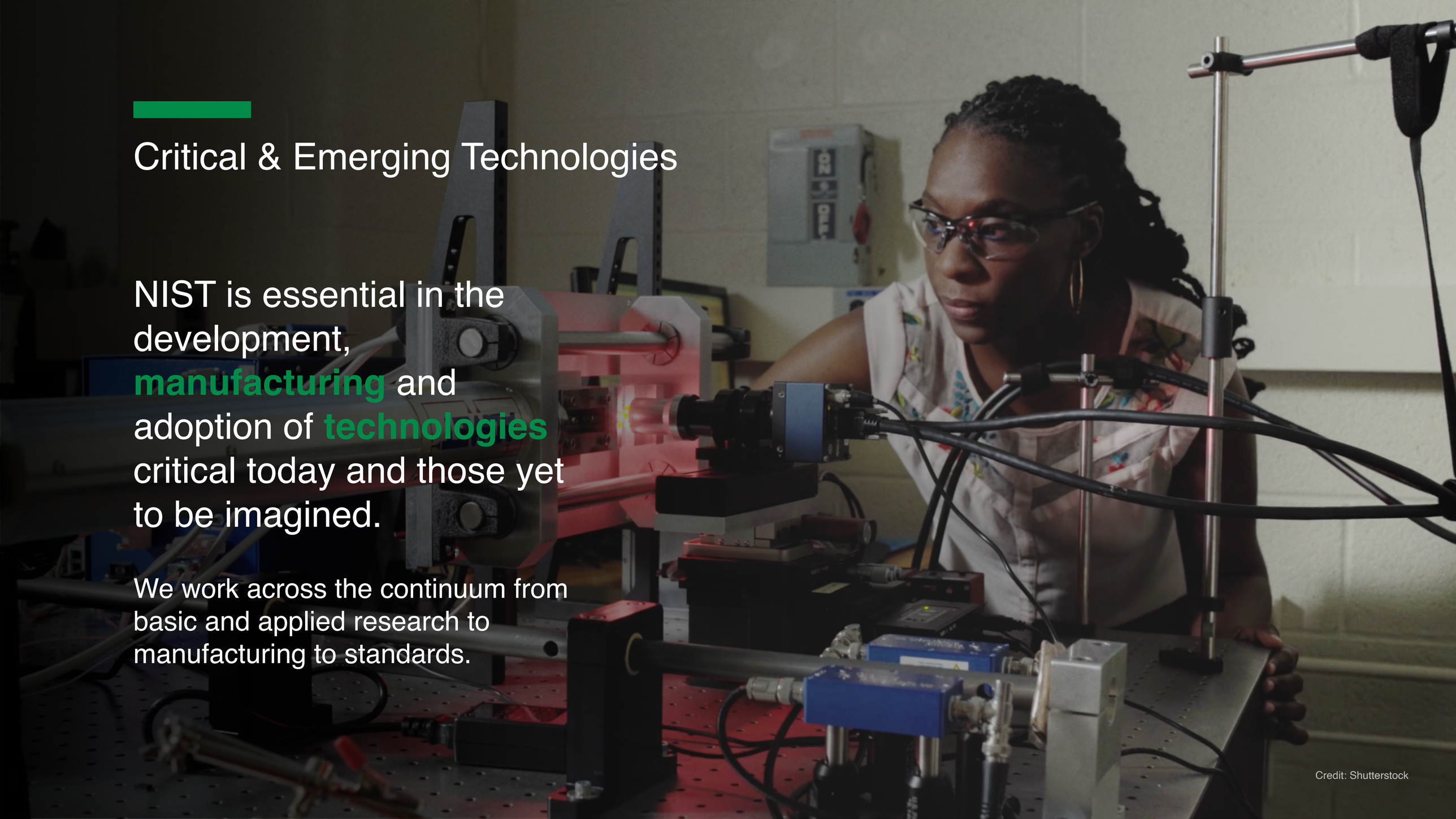


Research Infrastructure

Critical & Emerging Technologies

NIST is essential in the development, **manufacturing** and adoption of **technologies** critical today and those yet to be imagined.

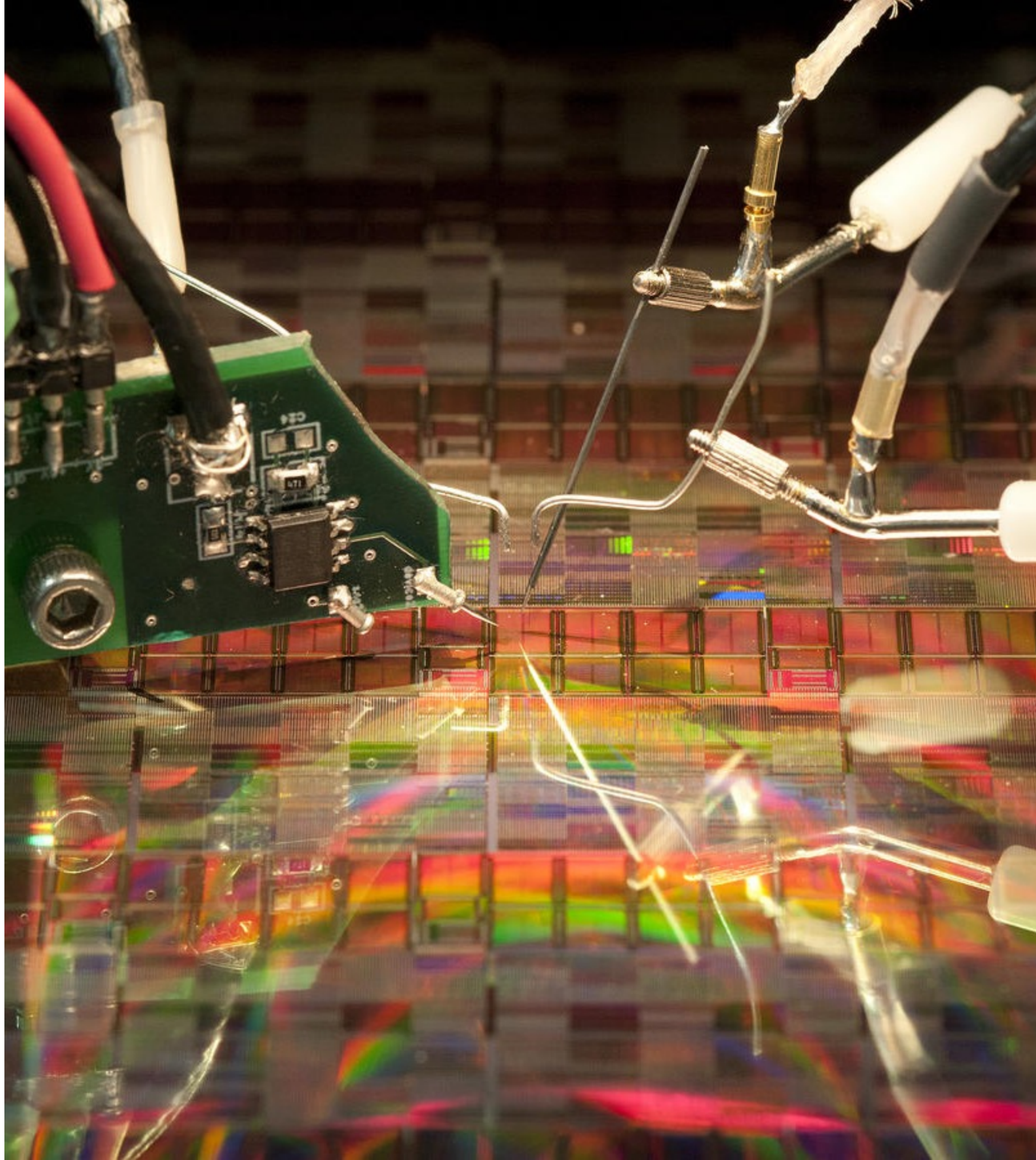
We work across the continuum from basic and applied research to manufacturing to standards.



Credit: Shutterstock

Accelerate Innovation in Critical & Emerging Technologies of the Future

- Accelerate the Buildout and Scale-Up of the U.S. Quantum Industrial Base
- Solidify American Dominance in AI Innovation
- Harness the Power of Biotechnology
- Grow U.S. Leadership in Semiconductors



Bolster American Leadership in Standards

Leverage NIST’s unique research and standards expertise while working with the private sector to advance American strength and agility in international standards development, especially within sectors of national importance.



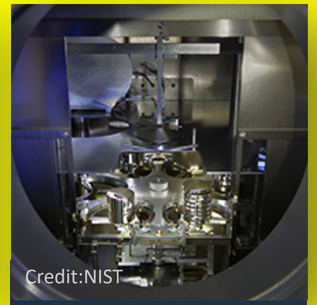
NIST Laboratory Programs

NIST Products and Services

Engagement, Convening Power, Participation



Material Measurement Laboratory



Physical Measurement Laboratory



Engineering Laboratory



Information Technology Laboratory



Communication Technology Laboratory



NIST Center for Neutron Research

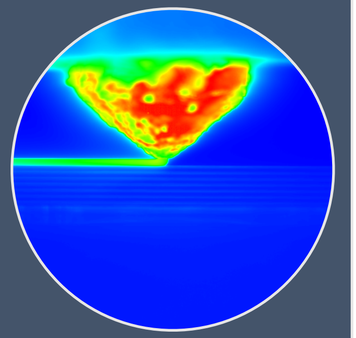
NIST MATERIAL MEASUREMENT LABORATORY

Measurement science research, products, and services to benefit industries based in the chemical, biological and materials sciences

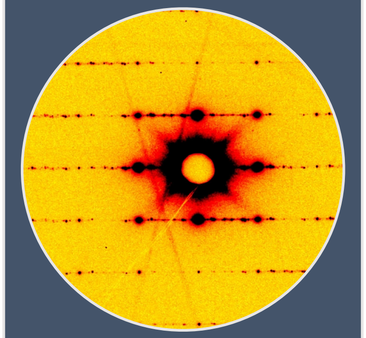
- ≈$150 million base budget (FY24 total allocation $330 million)
- > 1100 formal agreements with industry, academia, and other agencies
- 750-ish staff members and visiting scientists
- 5 sites across the US

MML Program areas: Modern Materials

NIST MATERIAL MEASUREMENT LABORATORY



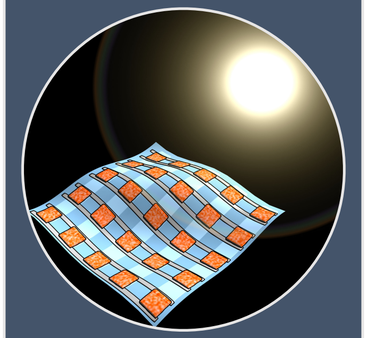
Advanced manufacturing



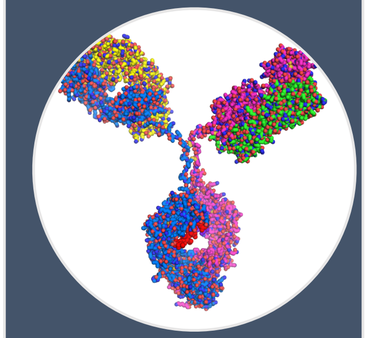
Semiconductors



Physical infrastructure



Energy



Biotechnology



Food safety and nutrition



Safety, security, and forensics

Data and informatics | Artificial intelligence and machine learning

CHIPS for America: Semiconductor Metrology

NIST MATERIAL MEASUREMENT LABORATORY

CHIPS for AMERICA

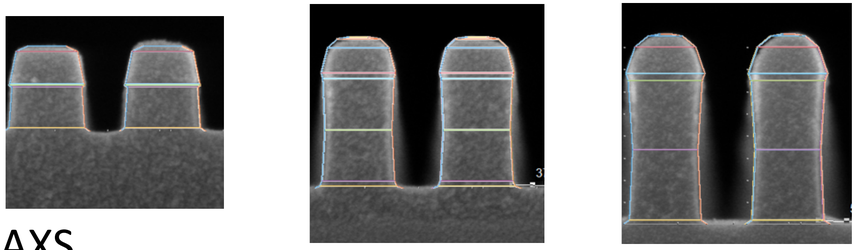
Overall MML semiconductor themes

- Microscopy and spectroscopy of 3D nanoscale features
- Multiscale/multimode defect and failure characterization
- Materials to extend scaling and enable new functionalities
- Reference materials and data to enhance interoperability

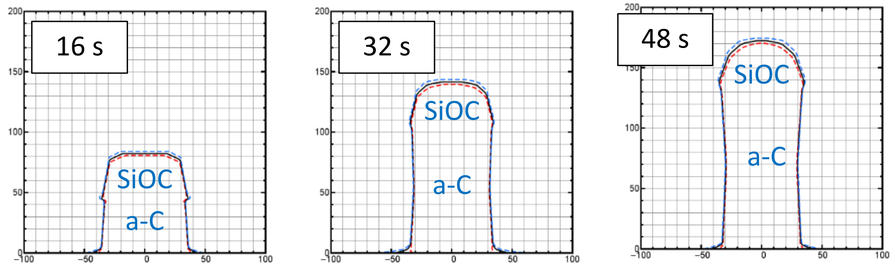
MML CHIPS efforts by the numbers

- Leading and contributing to 30+ CHIPS Metrology projects
- Over $100M in funding (over 4 years; 35% in large procurements)
- Committed efforts from 120 MML staff

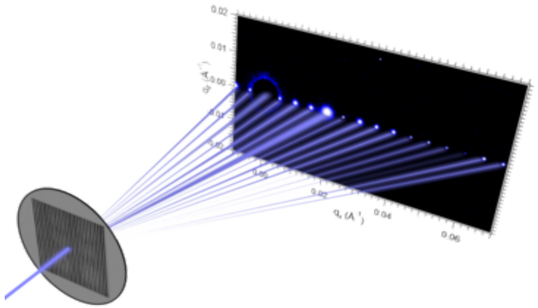
SEM



CDSAXS



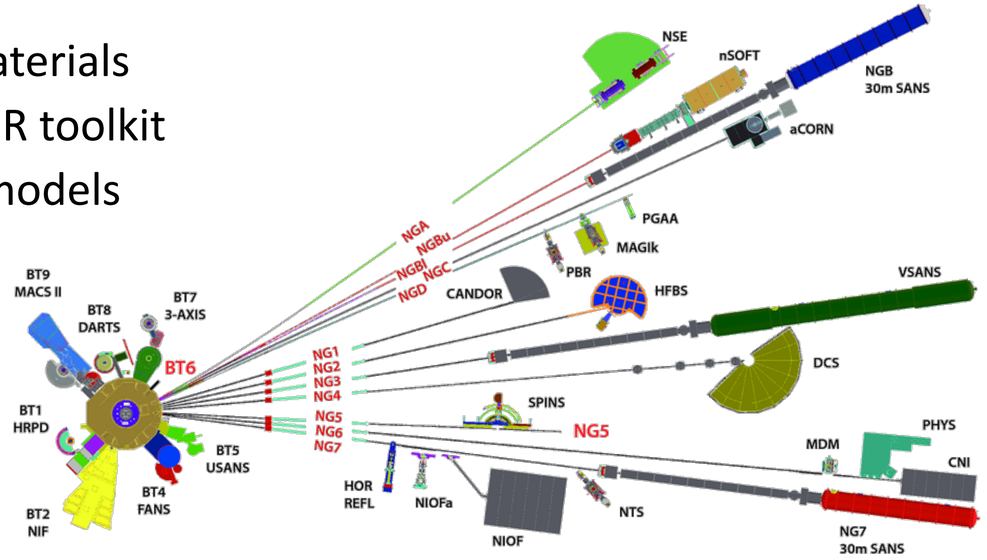
CDSAXS measurements of a-Carbon hard mask shape after etch



Neutron Materials (nMAT) Consortium

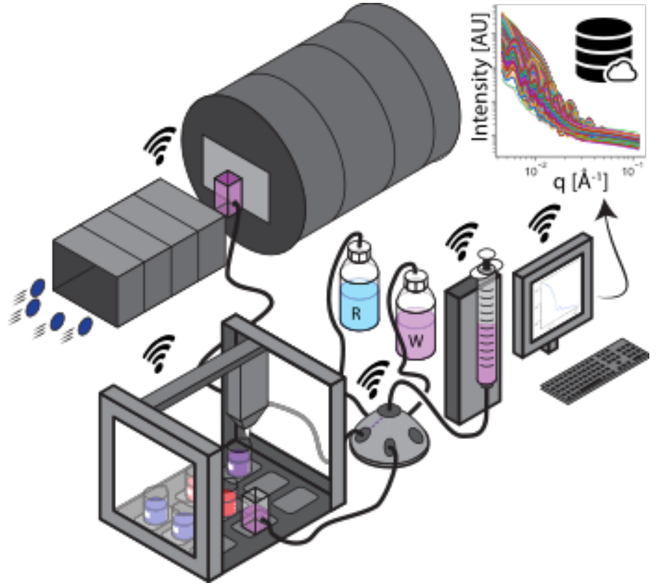
nMat

More Materials — Expanding beyond soft materials
More Instruments — Leveraging the full NCNR toolkit
More Engagement — Flexible collaboration models



Building on the success of the *n*Soft Consortium, the *upcoming* nMat Consortium will:

- **Advance industrial innovation**
  Apply neutron-based measurement techniques to ALL materials
- **Foster pre-competitive research**
  Create a collaborative framework for solving shared manufacturing challenges
- **Expand access to advanced neutron tools**
  Enable broader use of NCNR + partner facilities for industry needs
- **Accelerate translation to manufacturing impact**
  Turn measurement science advances into real-world manufacturing improvements



Contact: Jon Seppala

www.nist.gov/nsoft

Funding From NIST

2025 NIST MSE 01

U.S. Department of Commerce, Notice of Funding Opportunity (NOFO), NIST, Measurement Science and Engineering (MSE) Research Grant Programs, 2025-NIST-MSE-01

Funding Opportunity Description: NIST is soliciting applications for financial assistance for Fiscal Year 2025 (FY25) within the following NIST grant programs:

(1) Associate Director for Innovation and Industry Services (ADIIS);
(2) Associate Director for Laboratory Programs (ADLP);
(3) CHIPS Research & Development Program Office (CRDO);
(4) Communications Technology Laboratory (CTL);
(5) Engineering Laboratory (EL);
(6) Fire Research (FR);
(7) Information Technology Laboratory (ITL);
(8) International and Academic Affairs Office (IAAO);
(9) Material Measurement Laboratory (MML);
(10) NIST Center for Neutron Research (NCNR);
(11) Physical Measurement Laboratory (PML);
(12) Special Programs Office (SPO); and
(13) Standards Coordination Office (SCO).

Announcement Type: Initial

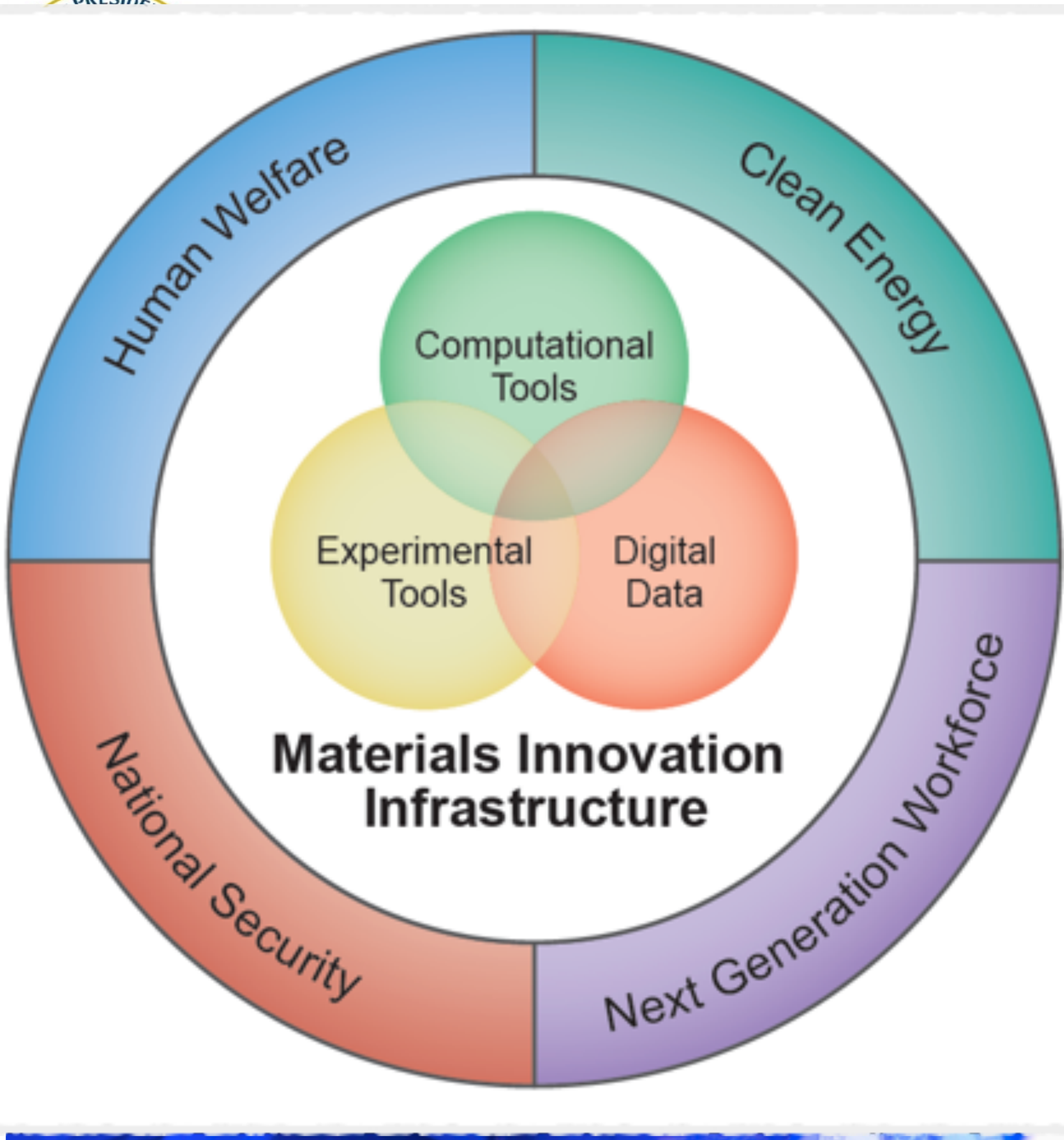
Funding Instrument: This funding opportunity will result in the award of grants or cooperative agreements. A grant or cooperative agreement is not the correct funding vehicle if the principal purpose is to provide products or services for the direct benefit or use of the federal government.

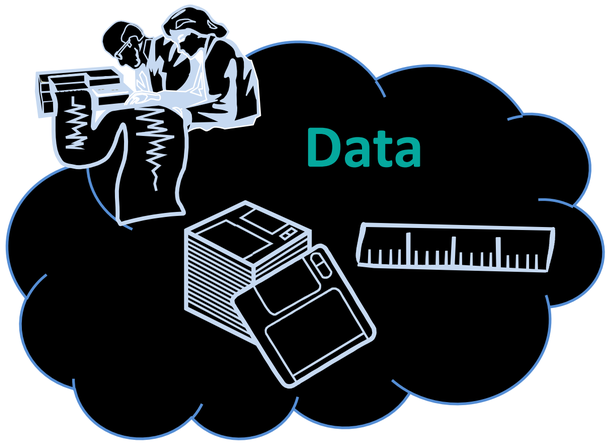
Working With NIST, Beyond Funding

- Postdoc (NRC and PREP)
- We’re delighted to collaborate!
- We’re delighted to host students/postdocs
- User Facilities

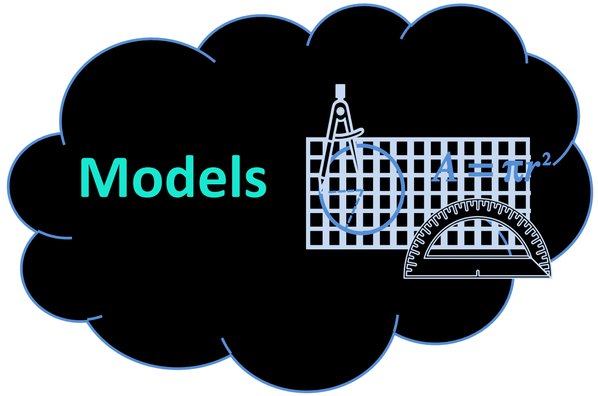
To decrease time-to-market by 50% while <$$

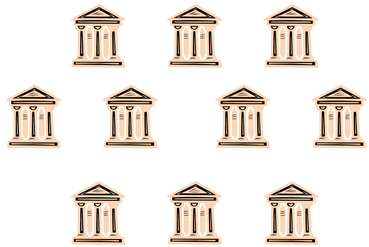
- Develop a Materials Innovation Infrastructure
- Achieve National goals in energy, security, and human welfare with advanced materials
- Equip the next generation materials workforce











NIST

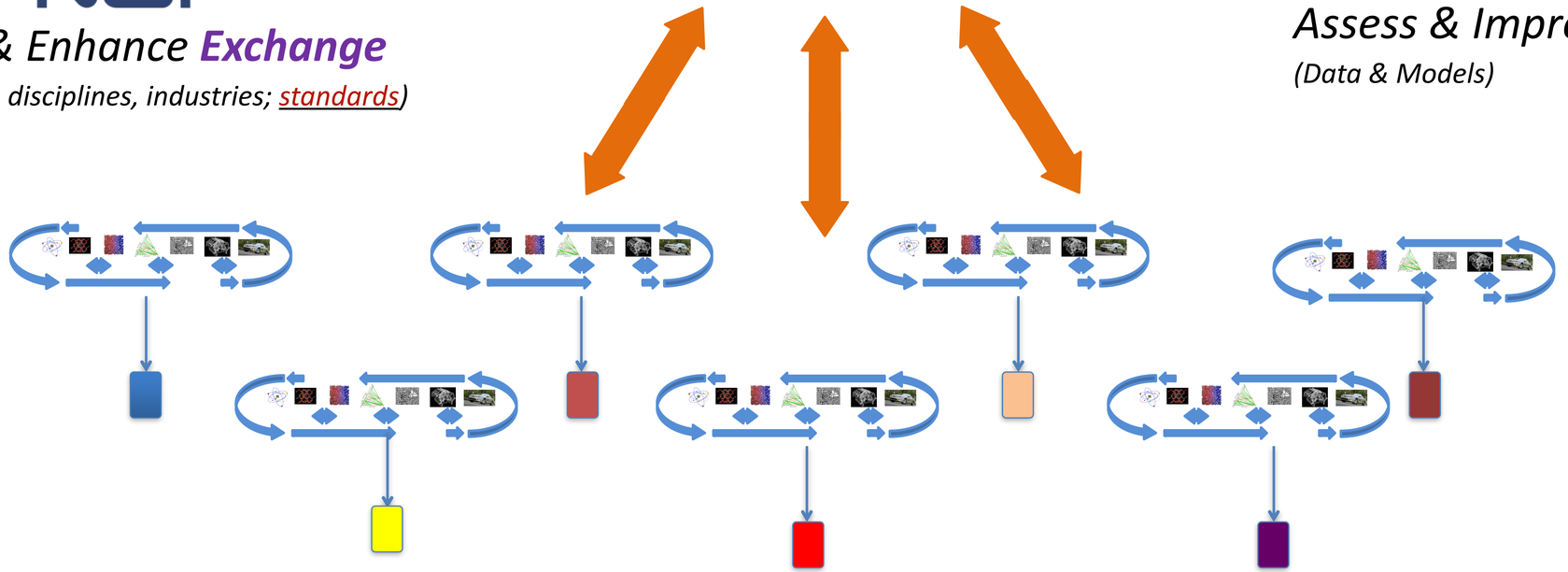
*Enable & Enhance **Exchange***

(repositories, disciplines, industries; standards)

NIST

*Assess & Improve **Quality***

(Data & Models)



NIST

*New **Methods and Metrologies***

(data driven analysis and models)

The Materials Genome Initiative

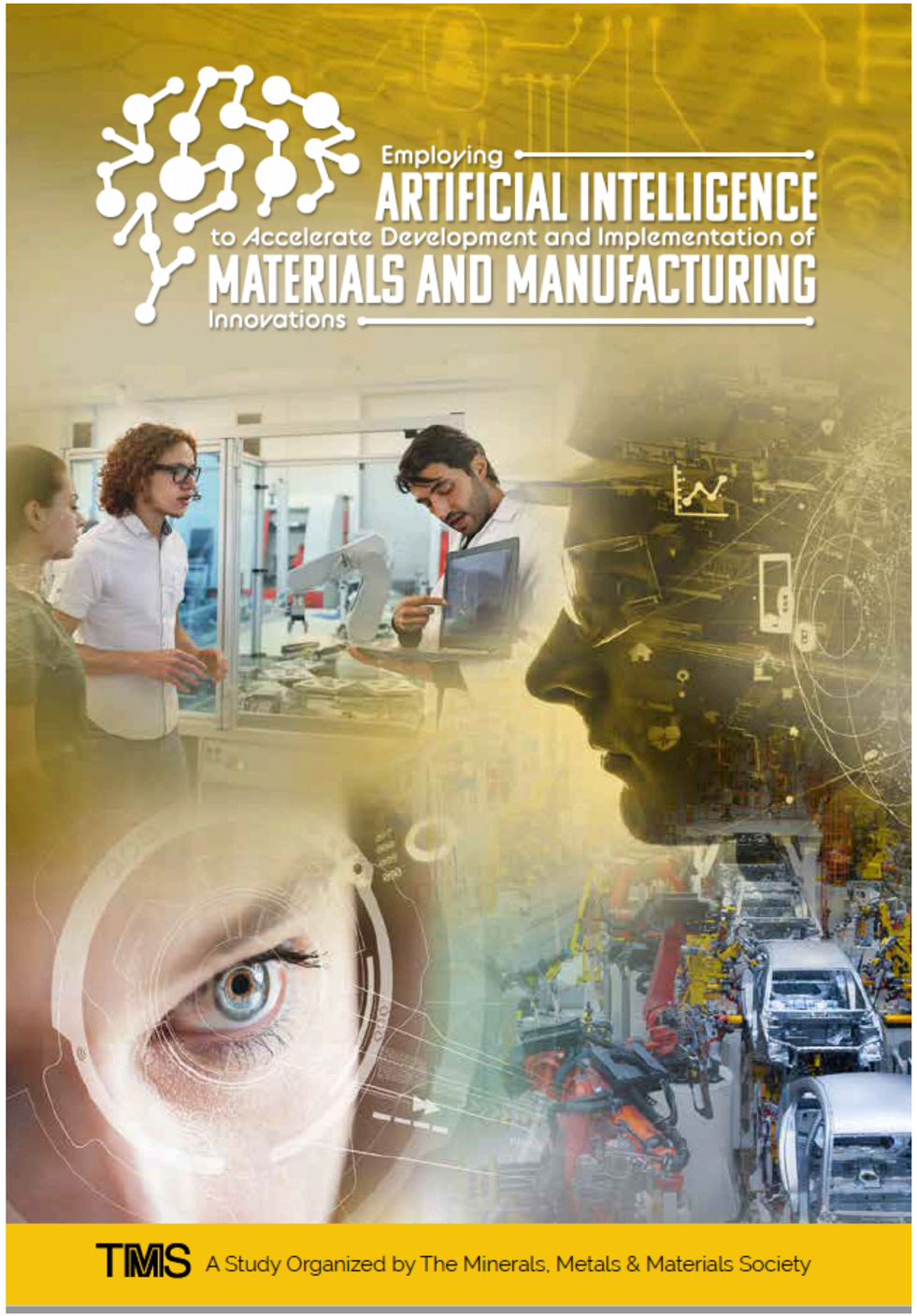
James A Warren
Director, Materials Genome Program
Material Measurement Laboratory
National Institute of Standards and Technology
Executive Secretary, NSTC Subcommittee on MGI

www.mgi.gov

MRS Kavli Lecture 2017 (9 years ago!)

AI/ML is a true enabler and driver for MGI

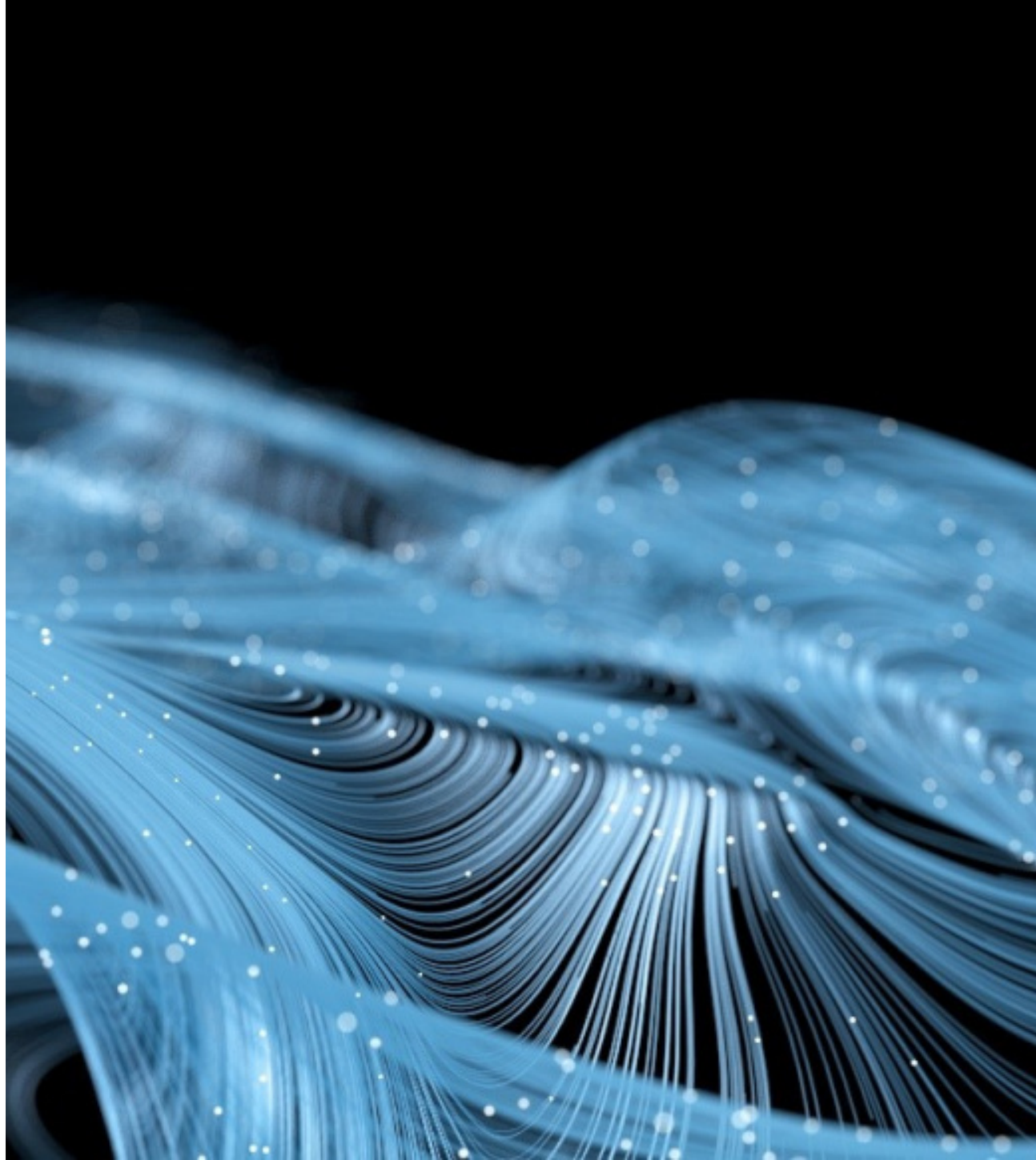
A(nother) system for generating models



DOE Genesis Mission

26 Challenge Areas including

- Explicit Materials:
  - Securing America’s Critical Minerals Supply
  - Realizing Quantum Systems for Discovery
  - Accelerating Materials Discovery, Production, and Qualification for Strategic Deterrence
  - Designing Materials with Predictable Functionality
  - **Achieving AI-Driven Autonomous Laboratories**
- Materials Central:
  - Recentering Microelectronics in America
  - Reenvisioning Advanced Manufacturing and Industrial Productivity
  - Delivering Nuclear Energy That is Faster, Safer, Cheaper
  - Accelerating Delivery of Fusion Energy
  - Transforming Nuclear Cleanup and Restoration



NSF Programmable Cloud Labs $400M Investment



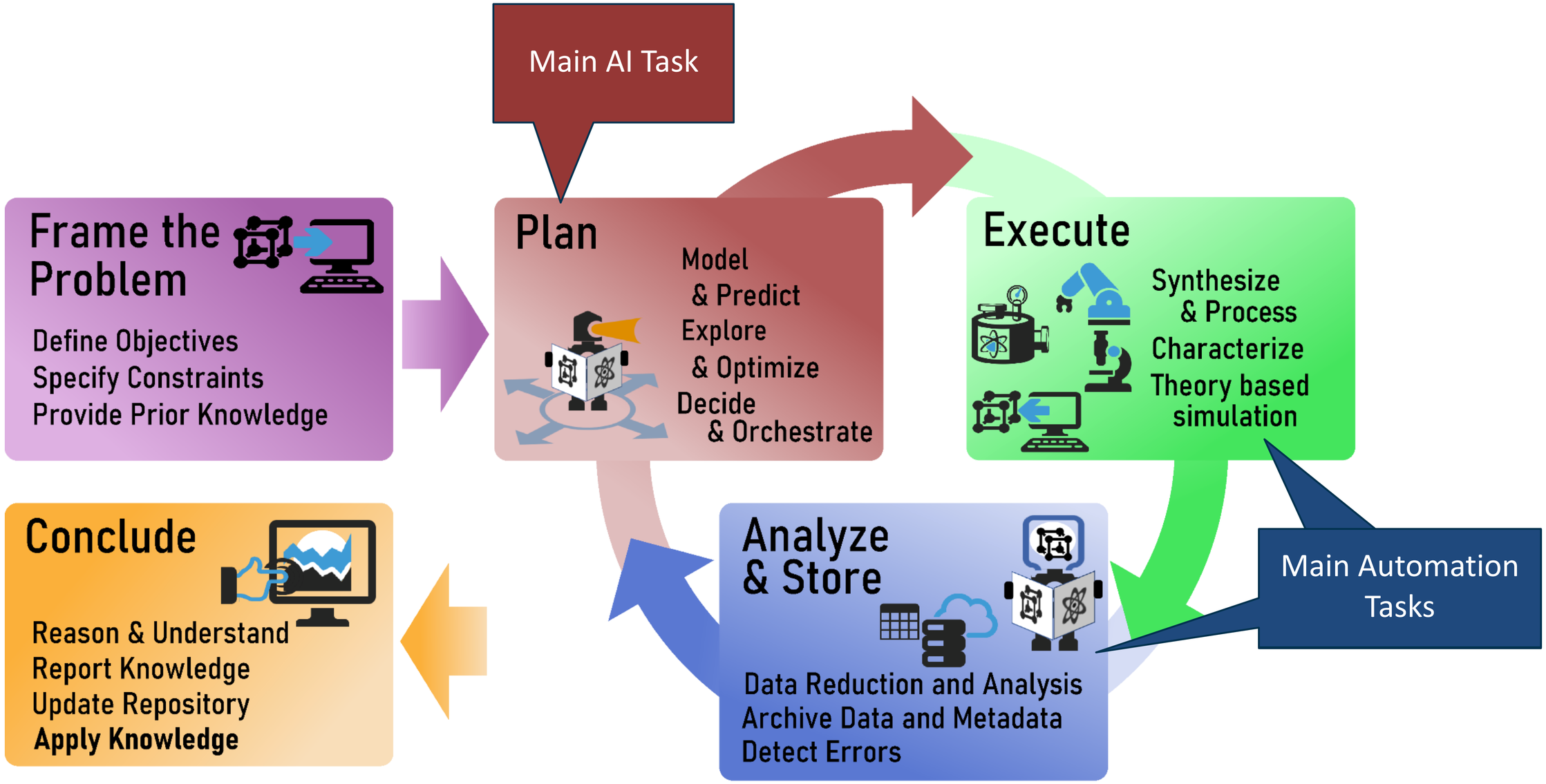
National Network of AI-Programmable Cloud Laboratories (PCLNet) Summit

September 24-25, 2026

Washington, D.C.

NSF PCLNet EBRC Engineering Biology Research Consortium ASTERA

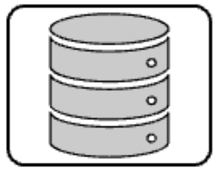
Autonomous System



Advantages of Autonomous Research



Efficient knowledge generation



Digitally native and rich data and metadata



Low human bias and high repeatability



Low downtime leads to fast results



Resource efficient

The Short Version

SDLs can insert low TRL knowledge into manufacturing

- The MGI developed many new materials but insertion into manufacturing remains very challenging (bridging across many TRLs)
- Self driving labs not only can rapidly deliver targeted materials but also can generate the vast quantities of data required to create AI-based “surrogate models” of materials processes and properties that can substitute for traditional physics/chemistry models which are often very slow (but are still the benchmark for all modeling)
- These surrogate models can be used as “materials digital twins” which can operate at the speed of manufacturing, inserting materials knowledge into the manufacturing paradigm.
- This would accelerate materials R&D towards realizing engineering impact

NIST's Role

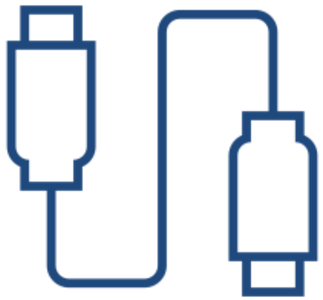
NIST's Unique Role

Metrology Needs



- What and how to measure?
- Capture metadata – measurement context
- Combine measurements
- Automated rigorous analysis

Standardization Needs



- Instrument communication
- Algorithm interoperability
- Hardware interoperability
- Data Archiving
- Ensure flexibility, reusability, and longevity

Rigor vs. Novelty



- Quantify uncertainty
- Map parameter spaces
- Rigorous conclusions

Precompetitive Tools



- Open-source software
- Open-source hardware
- Reference data
- Best practice documents

Enabling Robust Experimental Autonomous Materials Science

NIST Punchlines

- Autonomous experimentation is rapidly evolving and NIST is well-positioned to be a force multiplier by developing accelerated measurement science capabilities.
- Industry is building these systems but can stumble into common pitfalls. There's a need for common protocols and standards
- Autonomous methods can lead to new measurement methods, critical to NIST's measurement institute mission
- Autonomous materials development has already seen highly public failures due to lack of measurement rigor

Trustworthiness is crucial for Success in SDLs

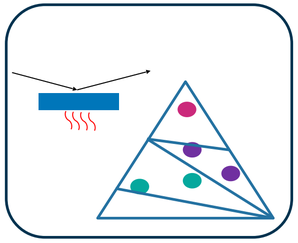
NIST Portfolio

Other Self-Driving Measurements & Labs

Optimize and Discover:

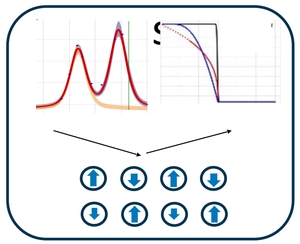
System:

Phase Maps



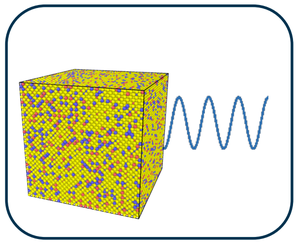
X-ray Diffraction

Magnets + Superconductor



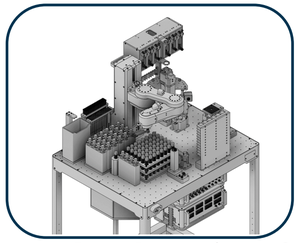
Neutron Scattering

Alloy Design



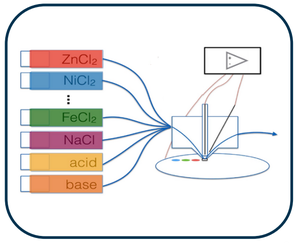
Autonomous x-ray spectroscopy

Porous Materials



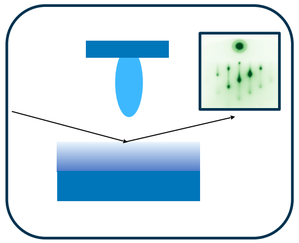
MOF Synthesis and Characterization

Corrosion Resistant Films



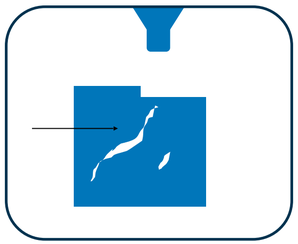
Scanning Droplet Cell

Epitaxial Growth



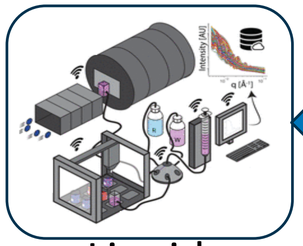
PLD + in-situ RHEED

3D Printed Alloys



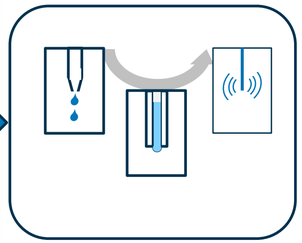
Add. Manuf. with *in-situ* X-ray measurements

Adhesives, etc.

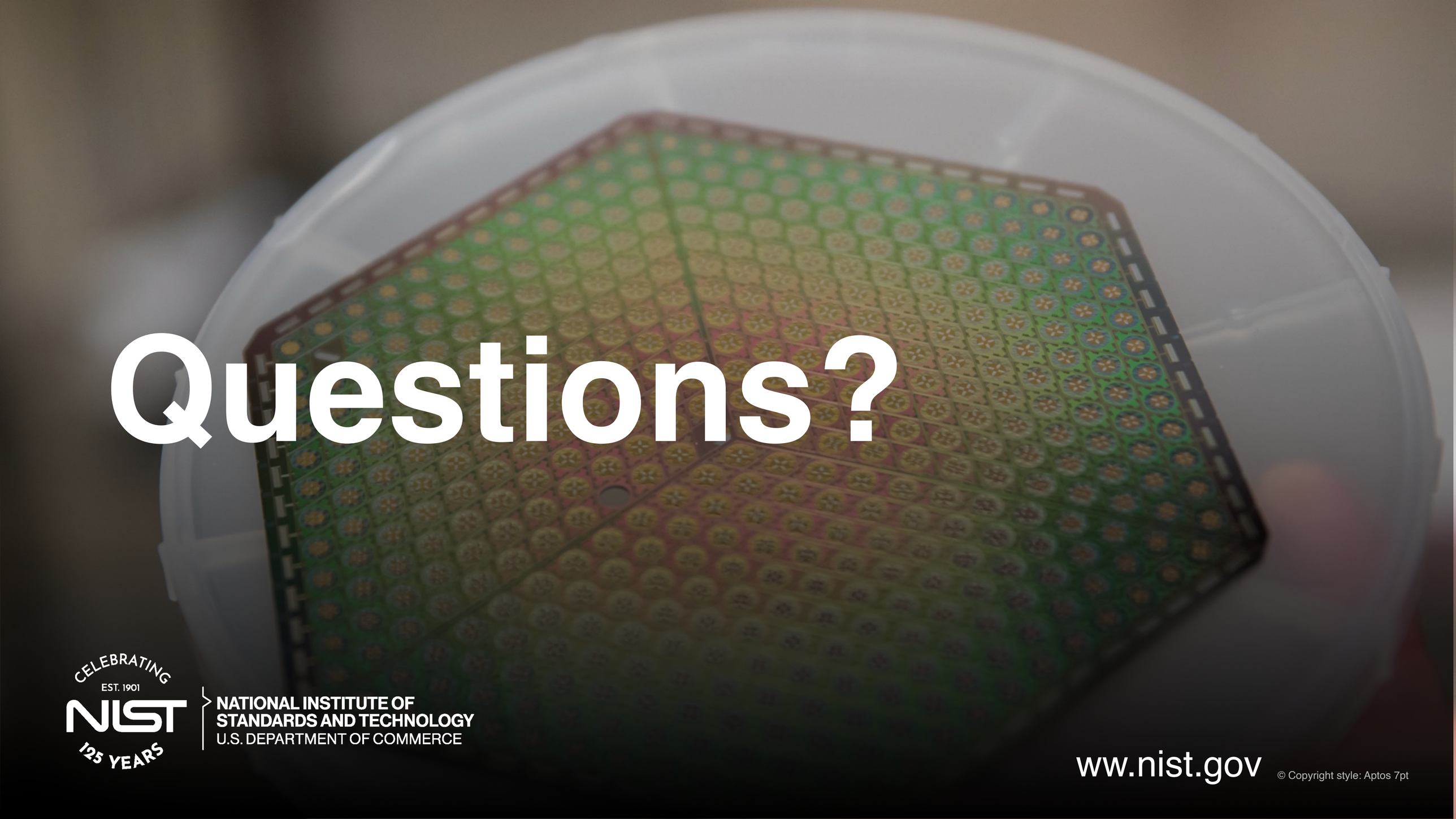


Liquid Formulation Lab

Teaching Platform



Modular, Low-Cost Platform



CELEBRATING EST. 1901 NIST 125 YEARS

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

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