

A wide-angle photograph of the Cornell NanoScale Science & Technology Facility. The building is a large, modern structure with a white facade and numerous large glass windows. On the roof, several tall, cylindrical chimneys are visible. The building is surrounded by a landscaped area with green grass, paved walkways, and some small trees. In the foreground, a few people are walking on the paths. The sky is blue with scattered white clouds.

Cornell NanoScale Science & Technology Facility

NNCI ANNUAL CONFERENCE

October 28-30, 2024

Cornell Nanoscale Facility (CNF)



Prof. Judy Cha
PI, Director



Prof. Allison Godwin
Assoc. Director



Ron Olson
Director of Operations

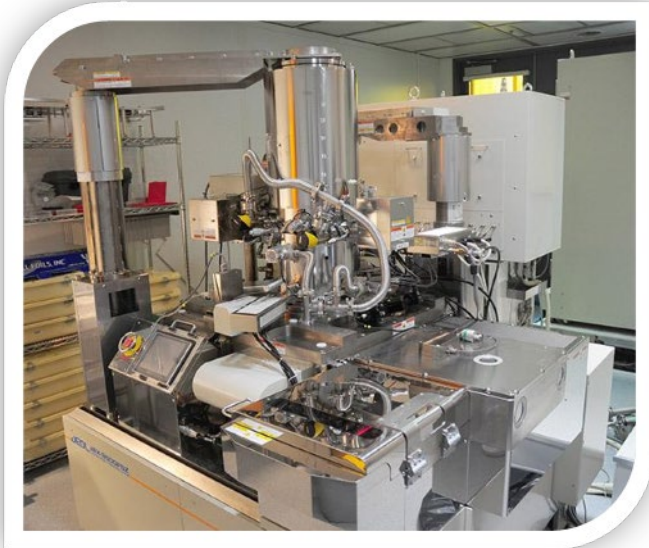
Lynn Rathbun, Ph.D.
Laboratory Manager



- Open user facility for nanofabrication for U.S. and international users
- Fundamental & industry research
- New York State Nanofabrication Network (NNN) founded 2022
- ME Commons - Northeast Regional Defense Technology Hub (NORDTECH)
- Upgrade tool base with new capabilities

Addressing National Research Priorities and NSF's 10 Big Ideas

Most Advanced Lithography Suite in NNCI



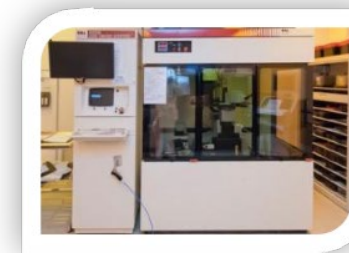
JEOL 9500 and JEOL 6300

Most advanced e-beam lithography in NNCI



ASML 300C DUV Stepper (248 nm)

Most advanced and only Deep UV Stepper in NNCI



UV Steppers (i-line and g-line) (x2)

Mask Fabrication

Maskless Photolithography (MLA 150)

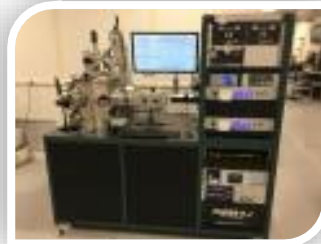
Contact Lithography (x3)

Nanoimprint

Nanoscribe 3D printer

CNF: Facilities

Broad Process Support



Etch Tools

20 total dry etch chambers
Deep silicon etch (x2)
ALE, RIE and ICP RIE
Vapor HF and XeF₂
Ion Milling
Ashing and descum

Thin-Film Deposition and Growth

ALD x3, PECVD x2
11 CVD tubes
10 Atmospheric tubes
10 Advanced evaporation and sputtering tools
AlN sputtering for piezoelectric and quantum applications

Testing and Characterization

Electron and optical microscopy
Electrical characterization
High frequency testing
Ellipsometry and reflectometry
Profilometry
Microfluidic probe station
AFM
Particle size/zeta potential

CNF: Staff

Faculty Directors



Lab Management



Ph.D. User Support Staff



Admin



Process Engineering & User Support (B.S./M.S.)



IT Staff



Equipment /Facilities



New Associate Director

- ***Professor Allison Godwin*** –
 - Professor of Chemical Engineering
 - Appointed as Associate Director for Workforce Development
 - January 2024



CNF: Welcome

New CNF Staff Member

- ***Paul Pelletier*** –
 - Returned to CNF March 2024
 - Worked at CNF from 2004 to 2014
 - Tool Installations
 - Odyssey Semiconductor



CNF: Thank You for Your Service

Departed For New Position

- **George (Mac) McMurdy** –
 - MIT Lincoln Lab
 - Departed February 2024



CNF: Thank You for Your Service

Retired from the CNF

- ***Melanie-Claire Mallison***
 - October 2nd, 2024
 - 28 years of service at CNF



CNF: Commercialization Ecosystem

171 different companies (127 small/startup and 44 large) have used CNF for research/prototyping (under NSF NNCI)

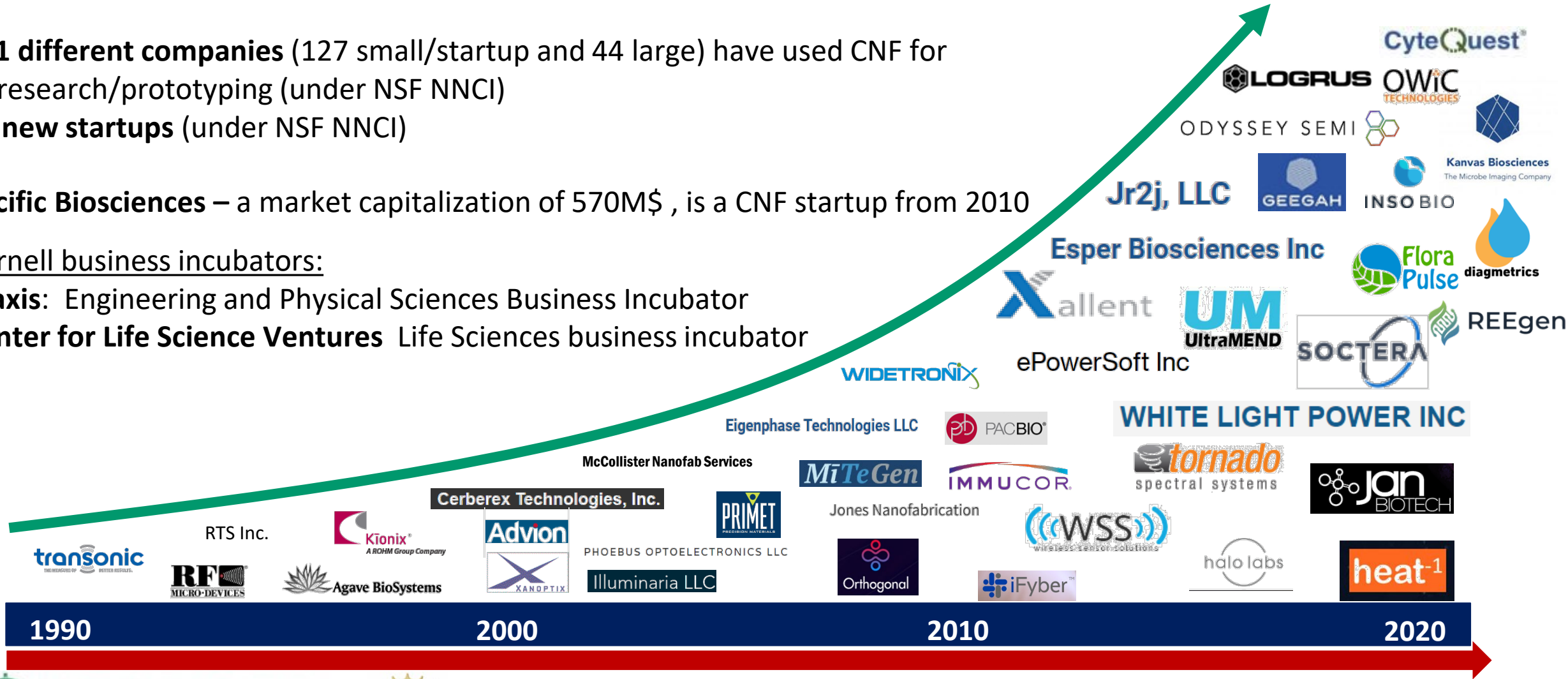
19 new startups (under NSF NNCI)

Pacific Biosciences – a market capitalization of 570M\$, is a CNF startup from 2010

Cornell business incubators:

Praxis: Engineering and Physical Sciences Business Incubator

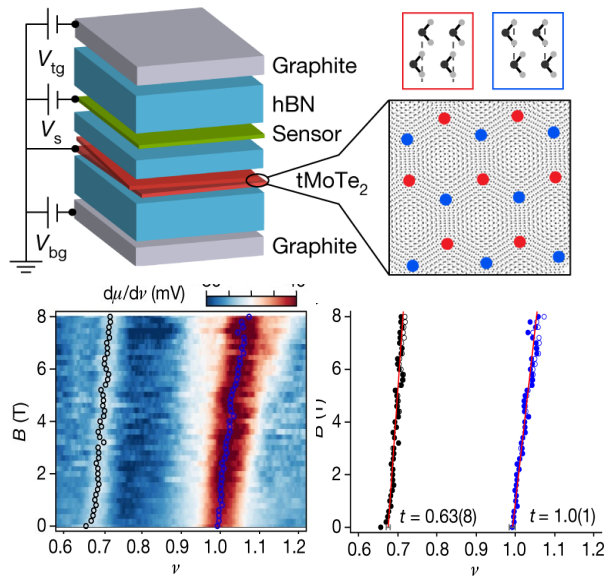
Center for Life Science Ventures Life Sciences business incubator



CNF: User Research

Quantum Leap

Thermodynamic Evidence of Fractional Chern Insulator in Moiré MoTe₂

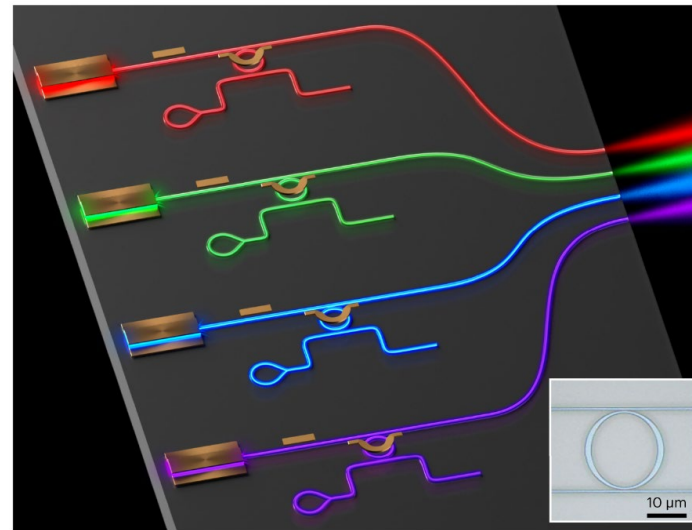


Y. Zhen, Z. Xia, K. Kang, J. Zhu, P. Knüppel, C. Vaswani, K. Watanabe, T. Taniguchi, K. F. Mak, and J. Shan, Dept. of Physics and School of Applied and Engineering Physics, Cornell University. Nature 622, 69-73 (2023).

DOE no. DE-SC0019481 and AFOSR no. FA9550-20-1-0219 and NSF DMR-1719875 (device fabrication).

Advanced Photonics

Tunable and Narrow-Linewidth Chip-Scale Laser From Near-UV to Near-IR

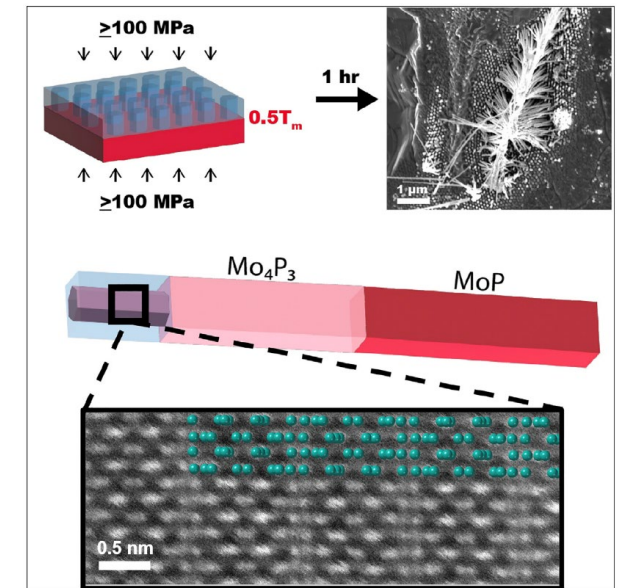


M. Corato-Zanarella, A. Gil-Molina, X. Ji, M. C. Shin, A. Mohanty, and M. Lipson, Dept. of Electrical Engineering, Columbia University. Nature Photonics 17, 157-164 (2023).

Army Research Office under award no. W911NF2110286.

Microelectronics

Nanomolding of Metastable Mo₄P₃



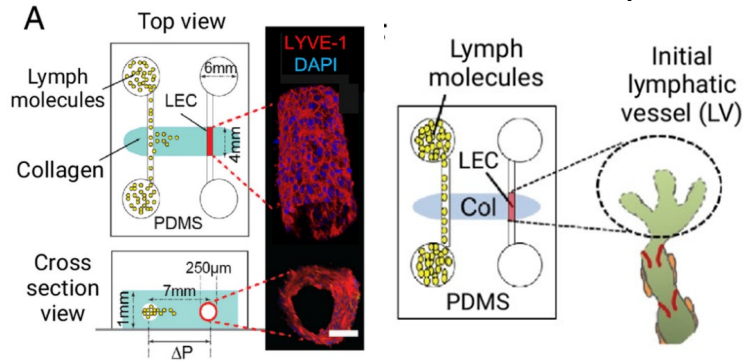
M. T. Kiani, Q. P. Sam, G. Jin, Betül Pamuk, H. J. Han, J. L. Hart, J. R. Stauff, and J. J. Cha, Dept. of Materials Science and Engineering, Cornell University. Matter 6, 1894-1902 (2023).

NSF DMR 2240956 and the Gordon and Betty Moore Foundation's EPIQS Initiative (GBMF 9062).

CNF: User Research

Rules of Life

3D Biomimetic Model of Lymphatics Reveals Cell-Cell Junction Tightening and Lymphedema Via a Cytokine-Induced ROCK2/JAM-A Complex

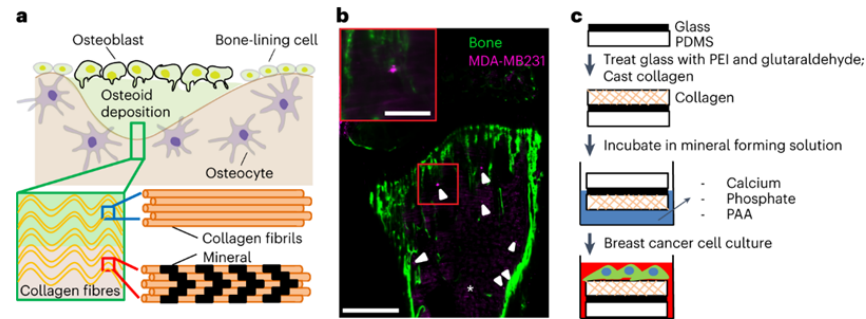


E. Lee, S.L. Chan, Y. Lee, W. J. Polacheck, S. Kwak, A. Wen, D. H. T. Nguyen, M. L. Kutys, S. Alimperti, A. M. Kolarzyk, et al., Wyss Institute for Biologically Inspired Engineering, Harvard University. PNAS 120 (41) e2308941120 (2023)

NIH (EB025765; EB000262; HL133216; and HL141858), the NSF (CMMI-1548571; EEC-1647837), and the Wellcome Leap HOPE program.

Rules of Life

Bone-Matrix Mineralization Dampens Integrin-Mediated Mechanosignalling and Metastatic Progression in Breast Cancer

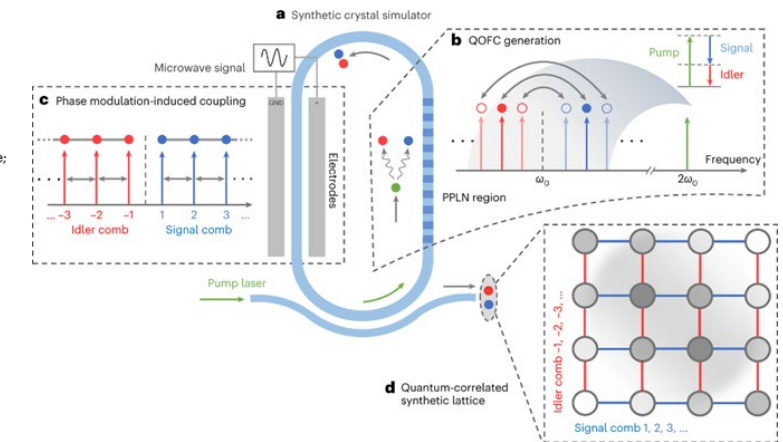


S. Choi, M. A. Whitman, A. A. Shimpi, N. D. Sempertegui, A. E. Chiou, J. E. Druso, A. Verma, S. C. Lux, Z. Cheng, M. Paszek, O. Elemento, L. A. Estroff, C. Fischback, Cornell University, Nature Biomedical Engineering 7, 1455-1472 (2023)

Human Frontier Science Program (RGP0016/2017); the National Cancer Institute (IU54CA210184); NIH F31 (F31CA228448).

Quantum

Chip-Scale Simulations in a Quantum-Correlated Synthetic Space



U. A. Javid, R. Lopez-Rios, J. Ling, A. Graf, J. Staffa, and Q. Lin, Dept. of Electrical and Computer Engineering, University of Rochester, Nature Photonics, 17, 883-890 (2023)

NSF nos. OMA-2138174 and ECCS-2231036, DARPA QuICC program no. FA8650-23-C-7312 and LUMOS program no. HR001-20-2-0044.

CNF: New Equipment and Capabilities

Oxford ASP ALD
Arrival: Jan. 2025



AJA UHV Multi-Technique Dep
Installation: Nov. 2024



AJA UHV Sputter Dep.
Arrival: Jan. 2025



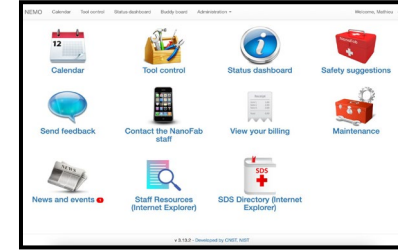
SEKI Plasma CVD System
Arrival: March 2025



Plasma-Therm MDS-100
Arrival: March 2025



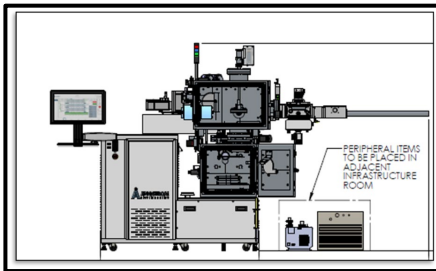
NEMO Web Application
Installed: Jan. 2024



KLA SPTS E2
Arrival: Feb. 2025



Angstrom UHV Ebeam Dep.
Arrival: April 2025



YES PB8
Installed: Oct. 2024



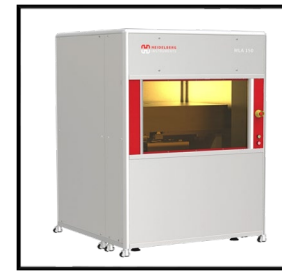
**OSIRIS Temporary
Bond Debond**
Arrival: Nov. 2024



Oxford PlasmaPro 100
Arrival: March 2025



Heidelberg MLA150
Installed: Oct. 2024



**Disco DI H2O
Recycling Unit**
Arrival: Feb. 2025



Disco DAG810 Grinder
Arrival: Feb. 2025



Nano-Master Brush Cleaner
Arrived: Oct. 2024



Logitech Orbis
Arrival: Nov. 2024



Zeiss GeminiSEM 560
Arrival: Nov. 2024



Keyence Digital Microscope
Installed: Feb. 2024



Veeco Fiji XT
Arrival : Q1 2025



**REYNOLDSTECH
Electroplating System**



CNF: Panel Question

Panel 1:

What are you doing now and how can a future infrastructure better reach out to underserved communities (for example, rural areas, underrepresented groups, or low research activity institutions)?

CNF: K-8 Outreach Activities

NYS 4-H

Career Explorations



NYS State Fair



NYS 4-H County Educators



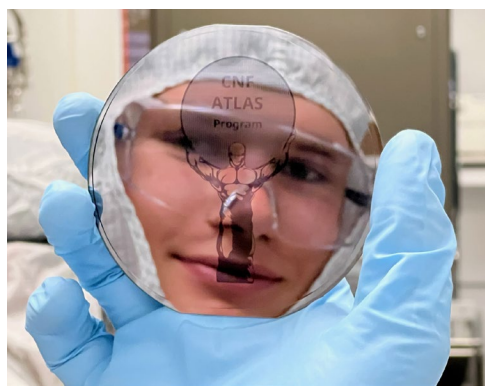
Nanooze

>100,000 copies per issue



CNF: High/Middle Schools, Vocational Schools and Partnerships

Hands-on 2-week Activity for High School Seniors (ATLAS)



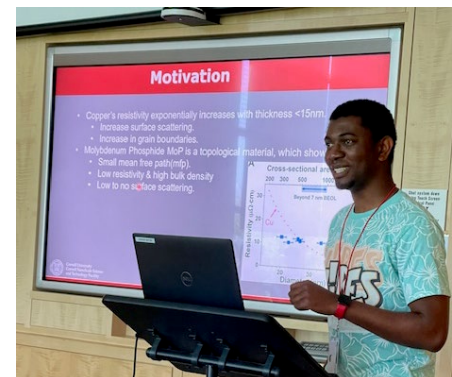
CNF High Purity Welding program



Chip Camps



Partnerships



CNF: WFD with Tompkins Cortland Community College



Carrie Whitmore



Prof. Sophia Georgiakaki

Laboratory Equipment



MNT Micro-credentials bases on CNF Laboratory Materials

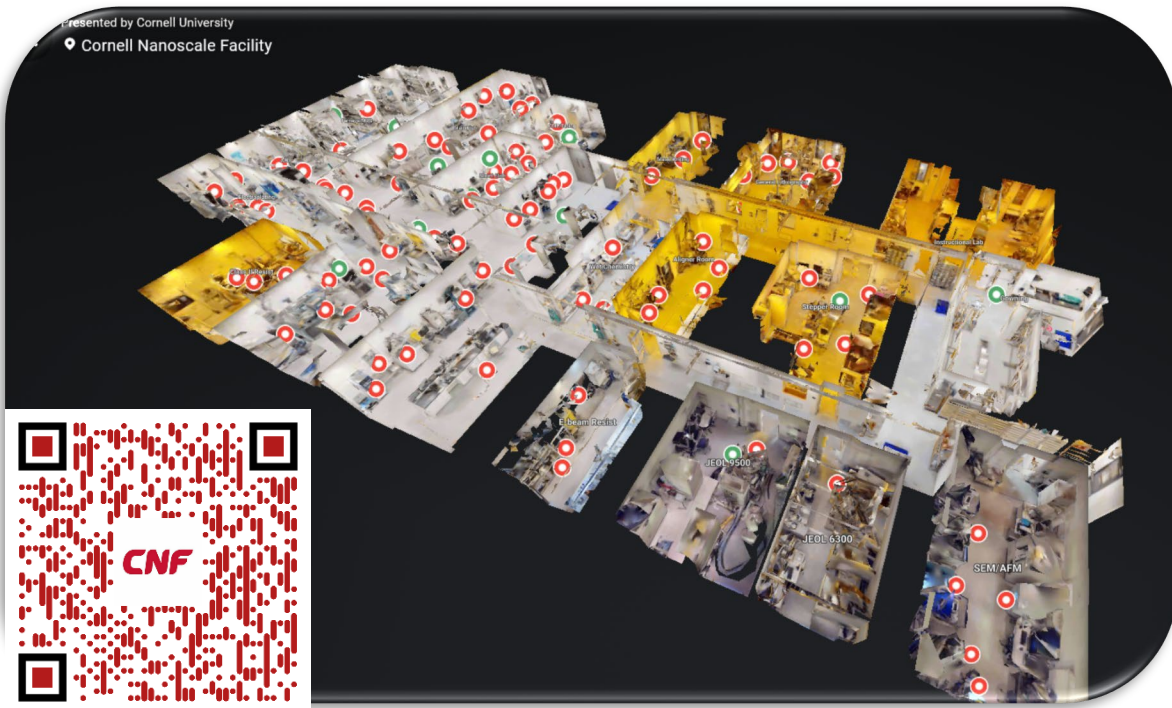


Microelectronics and Nanomanufacturing Certificate Program for Veterans

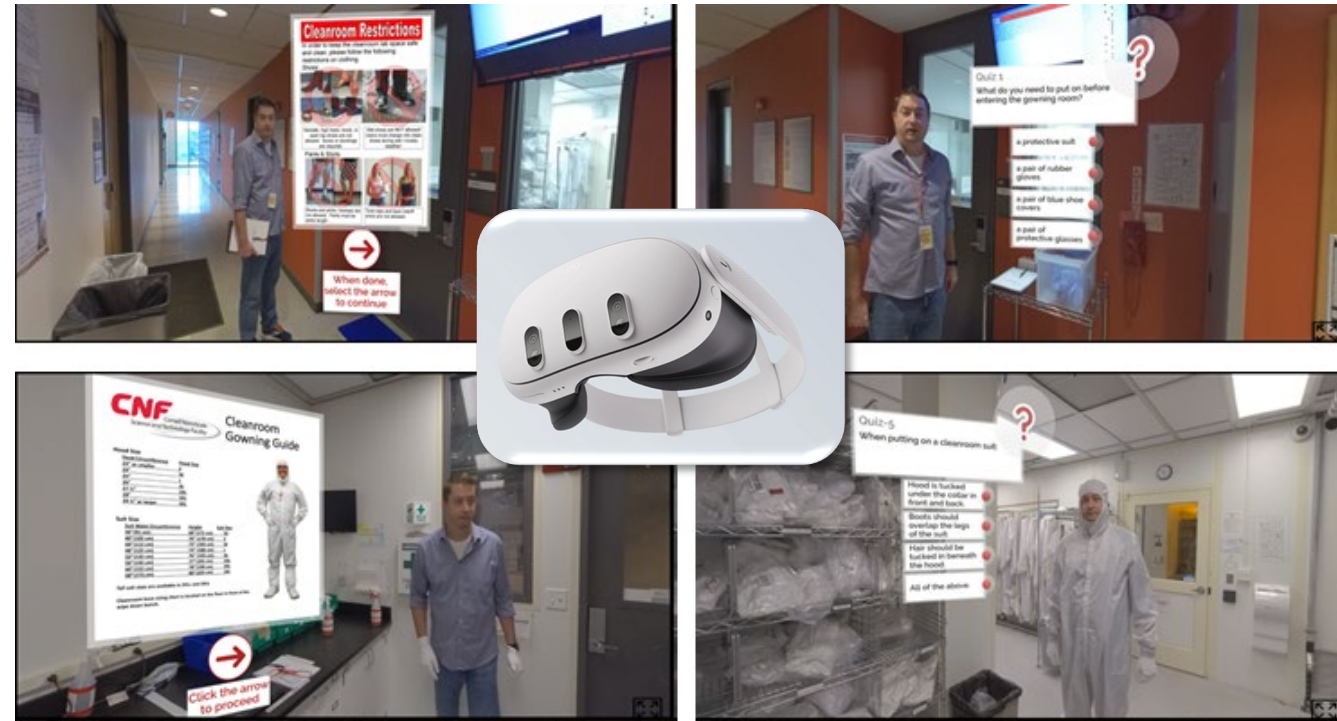


CNF: Scalability-----Virtual Reality

VR Cleanroom Tour



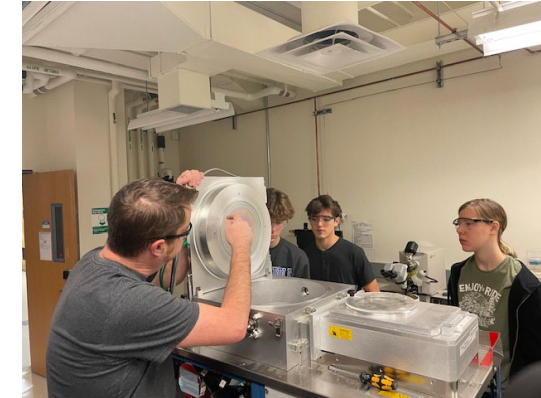
VR Experience



Backup Slides

CNF: High/Middle Schools, Vocational Schools and Partnerships

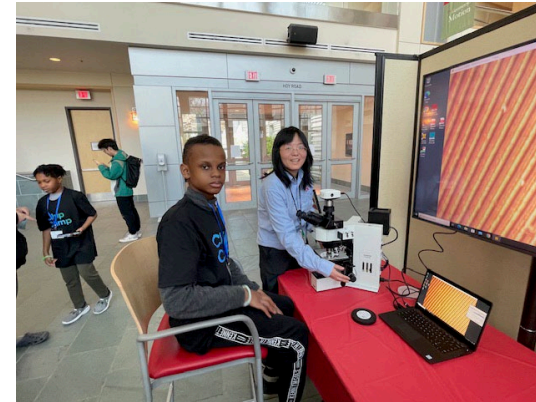
- **ATLAS- (Advanced Training for Labor Acceleration in Semiconductors)**
 - TST BOCES New Visions Engineering: High school seniors on engineering path
 - Provide students with comprehensive in person/hands on training in key areas of cleanroom semiconductor environment.
- **CNF High Purity Welding program**
 - Tompkins-Seneca-Tioga BOCES
 - One-week high purity welding experience
 - CNF staff /Swagelok Western New York/BOCES staff
 - Introduces non-college track students to a high-tech career opportunity
 - Enthusiastically embraced by other regional districts for 2025
- **Technology and Characterization at the NanoScale (TCN)**
 - CNF's 3-day nanotechnology short course (on site and Virtual)



CNF: Workforce Development with Micron

Micron Workforce Development Collaborations

- **Northeast University Semiconductor Network**
 - A partnership for collectively developing the next generation of the U.S. semiconductor workforce.
- **Micron Chip Camps**
 - Introduce middle school students to the concept of microtechnology, and to the possibility of careers in the field.
 - In 2024 three separate camps with New York State central school districts
 - April 2024 , June 2024, July 2024 (> 100 students each)
- **CNF, Morgan State, and University of Washington informal Micron consortium**
 - Collaboration specific to cleanroom education and student experiential opportunities
 - All three institutions will be key to the supporting the Idaho and NY expansions.



CNF: Morgan State University Partnership

MSU is an HBCU, the top creator of African American EE students and a drive away from CNF

CNF - Morgan State Fellows

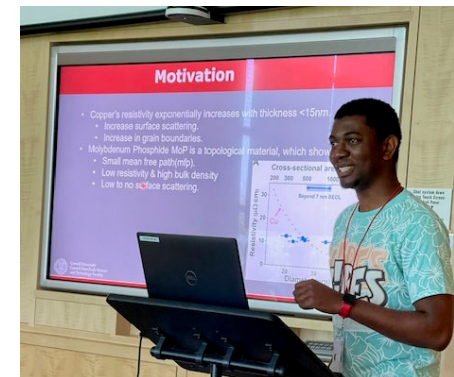
- Accept selected MSU students into REU-adjunct program
 - Financial support from CU College of Engineering
 - One student in summer 2022
 - Two students in summer 2023
 - One student in summer 2024
 - Students and faculty take part in REU convocation and speak at CNF annual meeting

CNF-MSU working relationship

- Provided advice on cleanroom design and processing equipment
- Share education, outreach workforce development activities including VR training

Create future nanoscience leaders

- Return to MSU and carry out advanced research



CNF: Community Events

FIRST Lego Jr.



Sciencenter



Insectapalooza



NanoDay



Expanding Your Horizons

