

Optical, Electron, and Scanning Probe Microscopy Online Workshop



Nanoscience Foundries and Fine Analysis – Digital Infrastructure

Massimo Cuscunà



Nanoscience Foundry and Fine Analysis - Digital Infrastructure



UNIVERSITÀ
DEGLI STUDI
DI MILANO



Partners and Operational Units

CONSIGLIO NAZIONALE DELLE RICERCHE (CNR)

CNR-IOM (Trieste) - Coordinator

CNR-IFN (Milano and Trento)

CNR-IMM (Bologna and Catania)

CNR-ISM (Roma)

CNR-NANOTEC (Lecce)

CNR-SPIN (Napoli)

AREA SCIENCE PARK (Trieste)

POLIFAB - POLITECNICO DI MILANO

UNIVERSITÀ DEGLI STUDI DI MILANO



Implementation period:

Jan 2023 - Dec 2025



Finanziato
dall'Unione europea
NextGenerationEU



Ministero
dell'Università
e della Ricerca



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PIANO NAZIONALE
DI RIPRESA E RESILIENZA



Consiglio Nazionale
delle Ricerche

Materials



NanoFab



Devices



12.000 sqm labs
200 Researchers

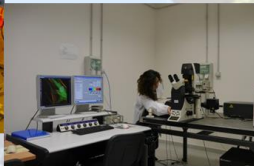
Chemistry



Biology



Characterization



Photonics



Correlative Microscopy Facility

X-ray

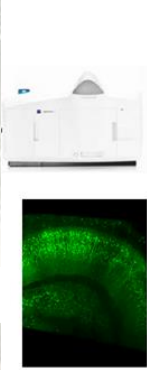


X-ray

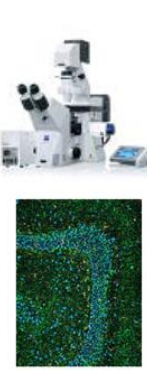
Optical Microscopy



Confocal
(Airyscan)



Lightsheet



Widefield



Lattice
Lightsheet



Super-
resolution

Electron Microscopy



Field Emission
Scanning Electron



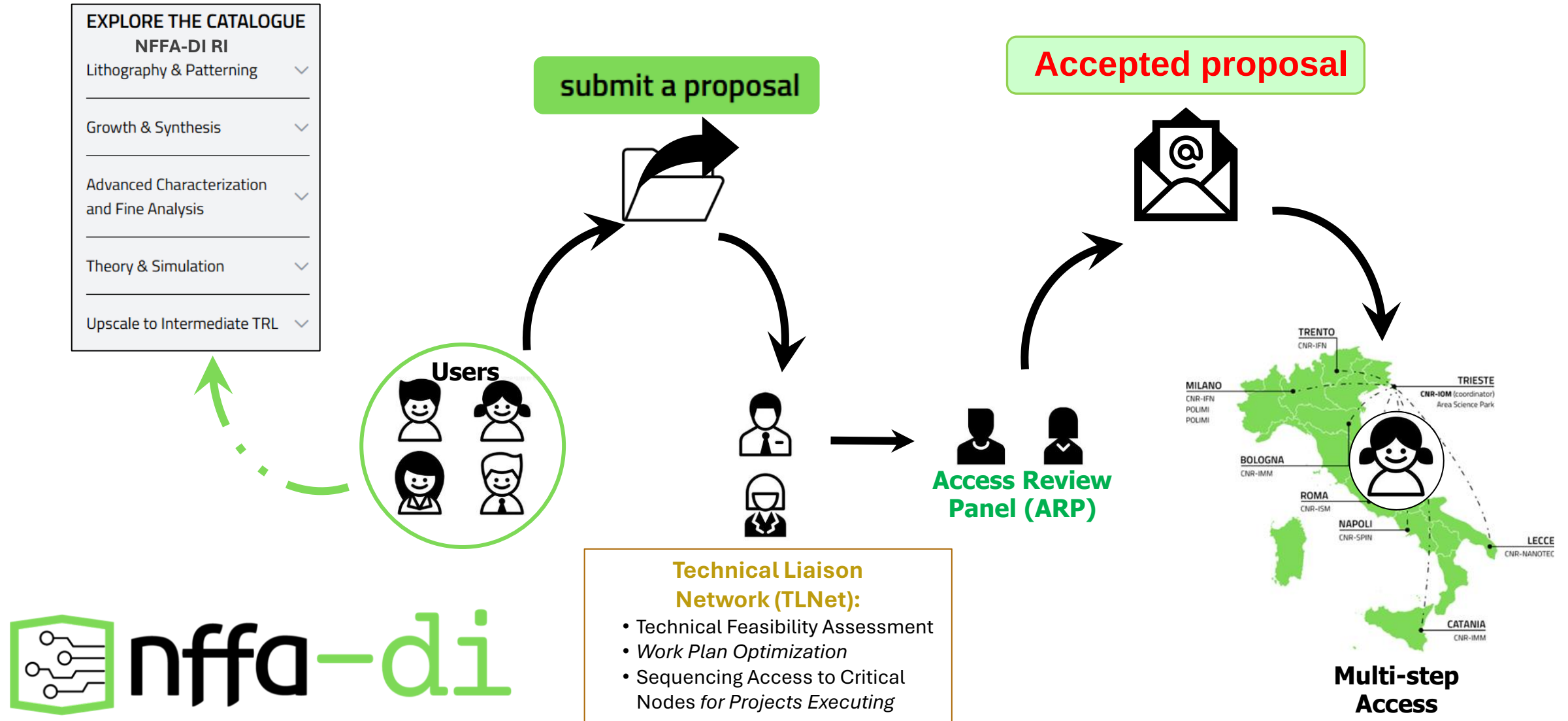
Focused
Ion Beam

High-Performance Computing (HPC)



ACCESS TO NFFA-DI

Digital Catalogue: <https://nffa-di.it/en/our-offer/>



Digital catalogue



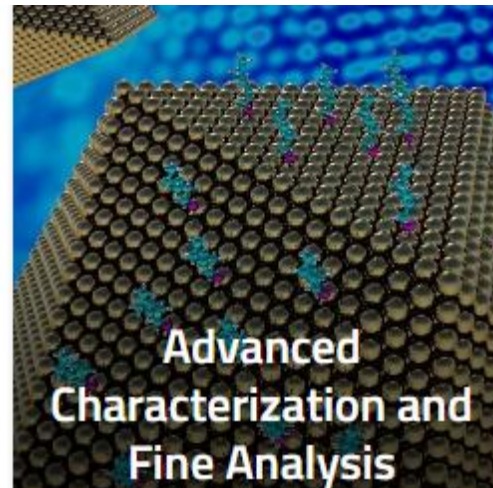
Lithography & Patterning

- Thermal Scanning Probe Lithography
- Optical-Lithography
- Electron Beam Lithography
- Focused Ion Beam
- Reactive Ion Etching
- Deep Reactive Ion Etching



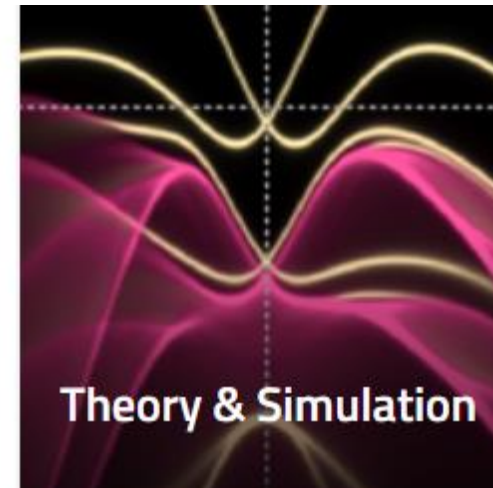
Growth & Synthesis

- Atomic Layer Deposition
- Chemical Vapor Deposition
- Synthesis of NPs
- Molecular Beam Epitaxy
- Pulsed Laser Deposition
- PVD Sputtering
- Organic Molecular Beam Deposition



Advanced Characterization and Fine Analysis

- Ultrafast-Spectroscopy
- Synchrotron Based X-ray/soft-X-ray spectroscopy
- Optical and luminescence spectroscopy
- Electron, ion and photon beam microscopy
- ...



Theory & Simulation

- Transport properties
- Atoms And Molecules In Motion
- Excited-state Properties
- Magnetic Properties
- Structural and ground-state electronic properties
- ...



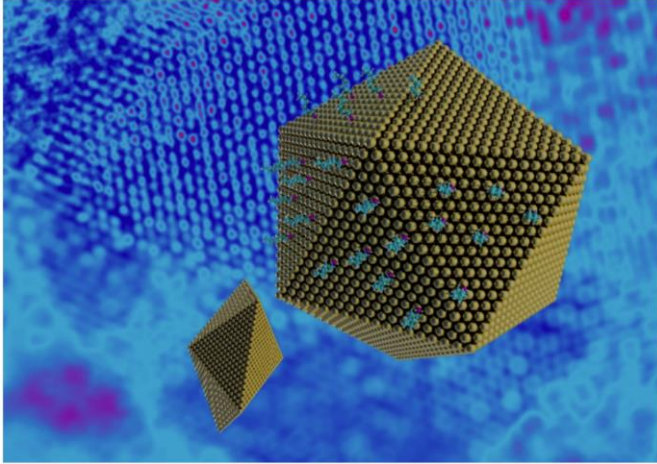
Upscale to Intermediate TRL

- Electrical Analysis
- Micro-fabrication and Large Area Deposition
- Opto-electronic Characterization
- Nano/Micro Layer Analysis
- Back-End

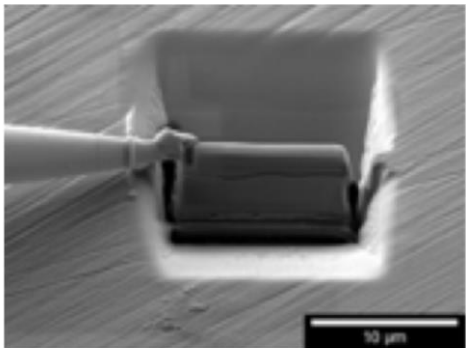
The complete catalog of techniques includes approximately 120 instruments

Digital catalogue - MICROSCOPY

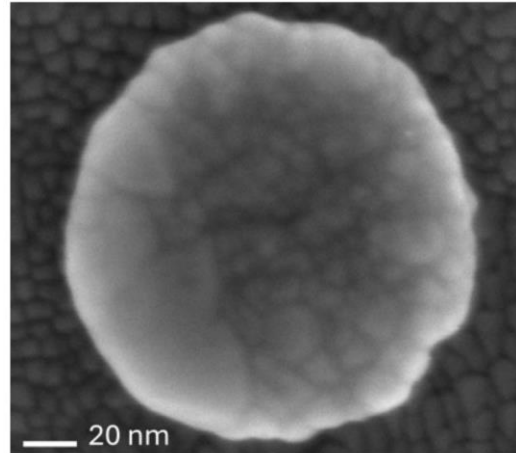
High-Resolution Transmission Electron Microscopy



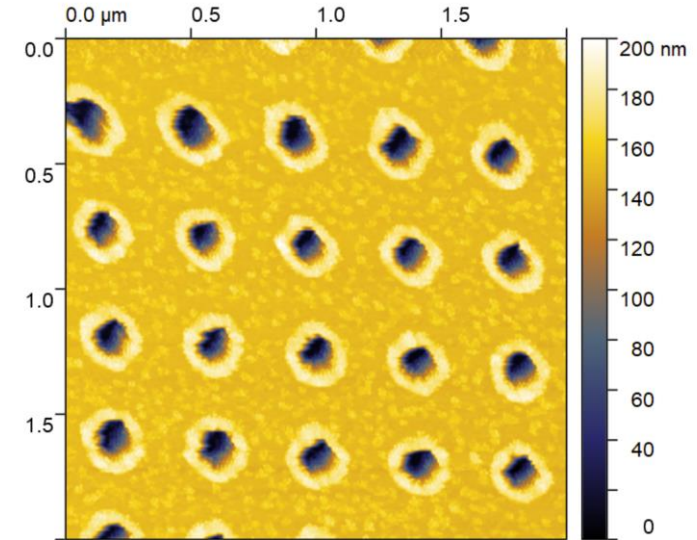
FIB-SEM for TEM Lamellae Preparation



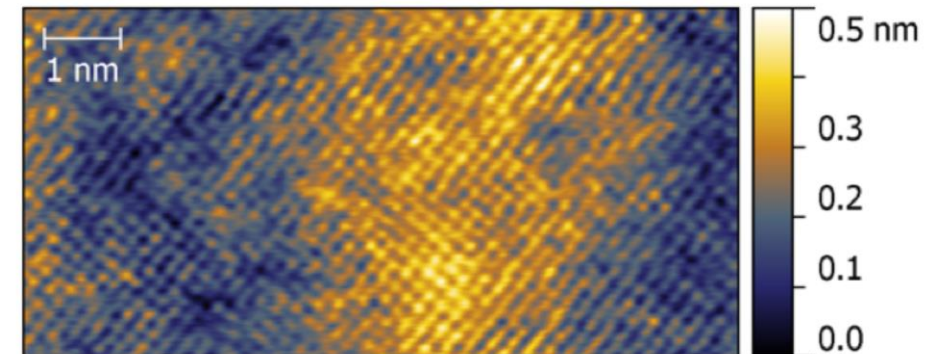
High-Resolution Scanning Electron Microscopy



Atomic Force Microscopy



Scanning Tunneling Microscopy



FAIR-by-Design



F Findability
A Accessibility
I Interoperability
R Reusability



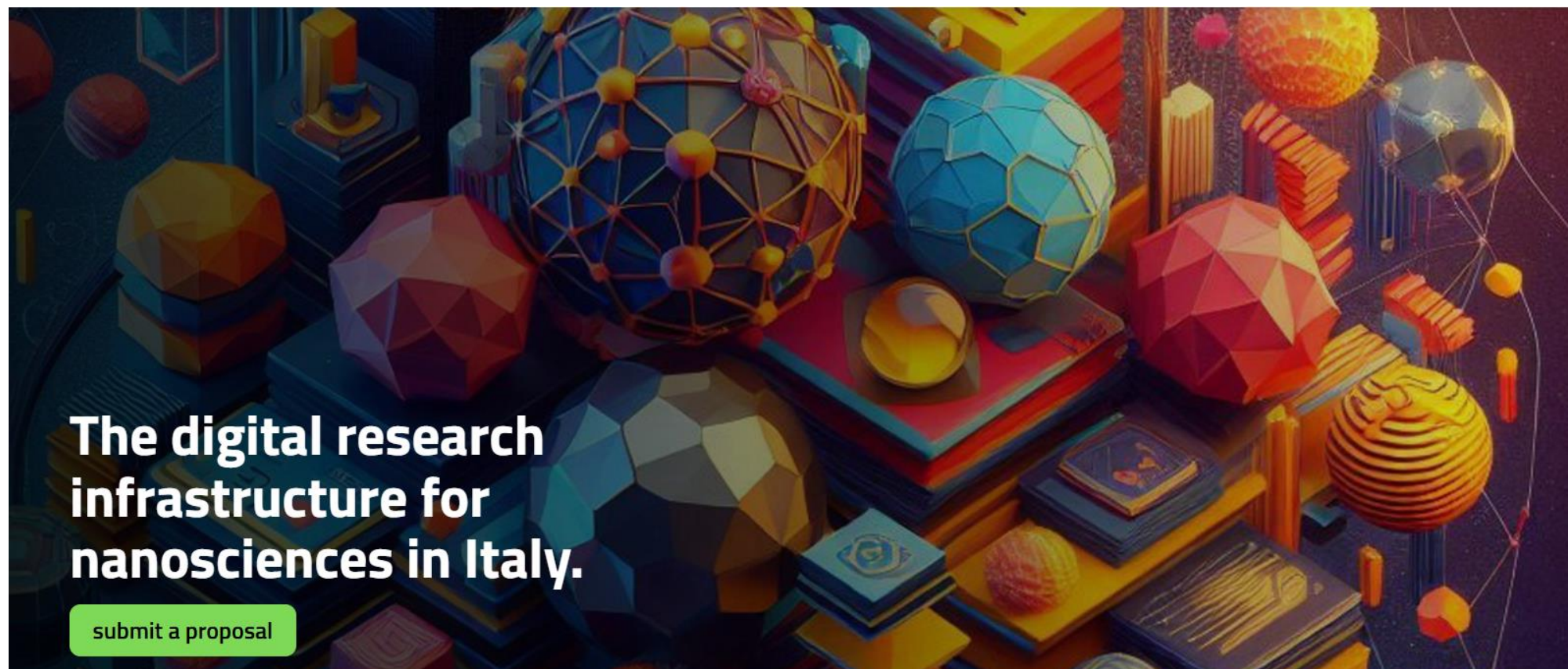
Actions

1. Use standard, cross-platform and **open file formats**
2. Identify a **Data/Metadata Schema**
3. Use **open-source** Data Analysis Software
4. Retrieve **Metadata** related to
 - Instrument
 - Sample Preparation
 - Data Analysis
5. Use **naming conventions/PIDs** (e.g. for Samples)
6. Use Electronic Laboratory Notebook (**ELN**) and Laboratory Information Management System (LIMS)



First NFFA-DI call for proposals is open!

Deadline: November 10th, 2024 <https://nffa-di.it/>



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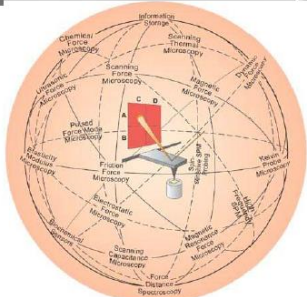
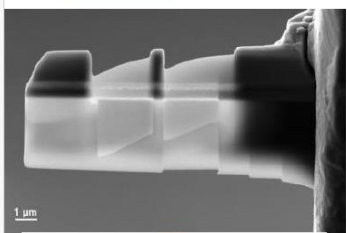
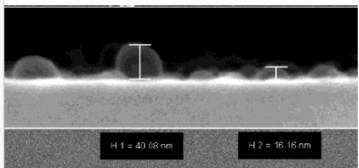


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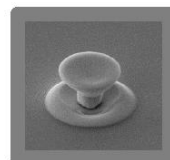


Consiglio Nazionale
delle Ricerche

AGENDA



- 9.20 - 9.30 **M. Cuscunà, CNR-Nanotec (Lecce)**
Introduction
- 9.30 - 10.00 **C. Spinella, University of Catania - CNR-IMM (Catania)**
Exploring matter at the atomic level
- 10.00 - 10.30 **C. Bongiorno, CNR-IMM (Catania)**
Sample preparations for transmission electron microscopy
- 10.30 - 11.00 **N. Gilli, CNR-IMM (Bologna)**
The Basis of Focus Ion Beam
- 11.00 - 11.15 Break**
- 11.15 - 11.45 **F. Biancardi, Carl Zeiss**
How Scanning Electron Microscopy can Work in 3 Dimensions
- 11.45 - 12.15 **C. Albonetti, CNR-ISMN (Bologna)**
Exploring Nanoworlds by Scanning Probe Microscopy
- 12.15 - 12.45 **A. Picone, Politecnico di Milano**
Scanning Tunneling Microscopy as a versatile probe to investigate low-dimensional systems at the atomic scale
- 12.45 - 14.00 Lunch break**
- 14.00 - 14.45 **F. Bazzocchi, Area Science Park (Trieste)**
NeXus and Electron Microscopy
- 14.45 - 15.45 **A. Rainer, P. Mozetic, E. De Luca, Campus Bio-Medico University (Rome), CNR-Nanotec (Lecce)**
Live demo: A primer on advanced optical microscopies: FLIM and SMLM
- 15.45 - 16.15 **Jianjun Huang, KU Leuven University (Leuven)**
Multifunctional linkers for Expansion Microscopy
- 16.15 - 16.30 **Round table**



Scientific & Organizing Committee

M. Cuscunà, Simeone CNR-Nanotec (Lecce)
A. La Magna, A. Mio CNR-IMM (Catania)
R. Bertacco, A. Giampietri PoliMi (Milano)

Acknowledgements

We are particularly grateful to **G. Iaco** and **A. Maruccia** for their invaluable technical support and to **G. Zammillo** for her effort in promoting the workshop on social media

ENJOY THE WORKSHOP

The background is a dark blue and green geometric pattern. It features several technical-style line art elements: a circular gauge-like graphic in the center, a series of horizontal lines on the left, and a cluster of hexagons in the bottom right corner.