

The first data management infrastructure for nanoscience

Rossella Aversa/Stefano Cozzini
CNR-IOM

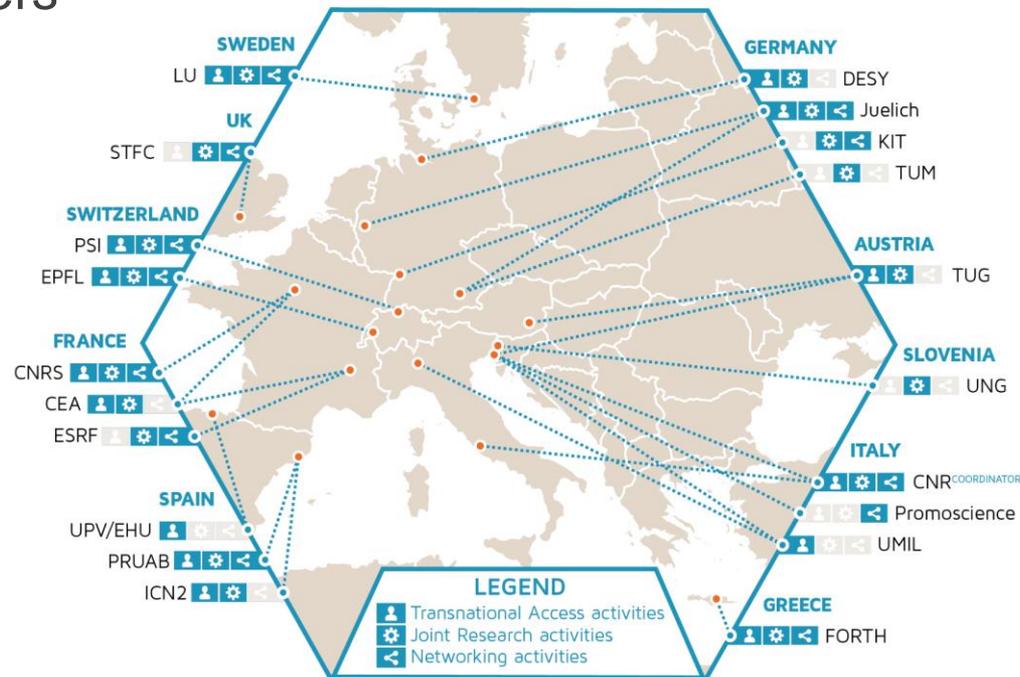


GARR Conference, Cagliari, 3-5 October 2018



The NFFA-Europe Project

- **NFFA** (*Nano Foundries and Fine Analysis*) EU-funded
- Led by CNR-IOM (Trieste)
- 20 partners





The Mission

- ***Manage and store*** the high volume/variety of scientific data generated at the NFFA facilities
- Offer ***High Performance data access***
- Educate to produce ***FAIR data*** (**F**indable, **A**ccessible, **I**nteroperable, **R**eusable)
- Identify and organize ***metadata*** associated to data
- Make scientific data accessible and searchable by means of a ***metadata search engine***

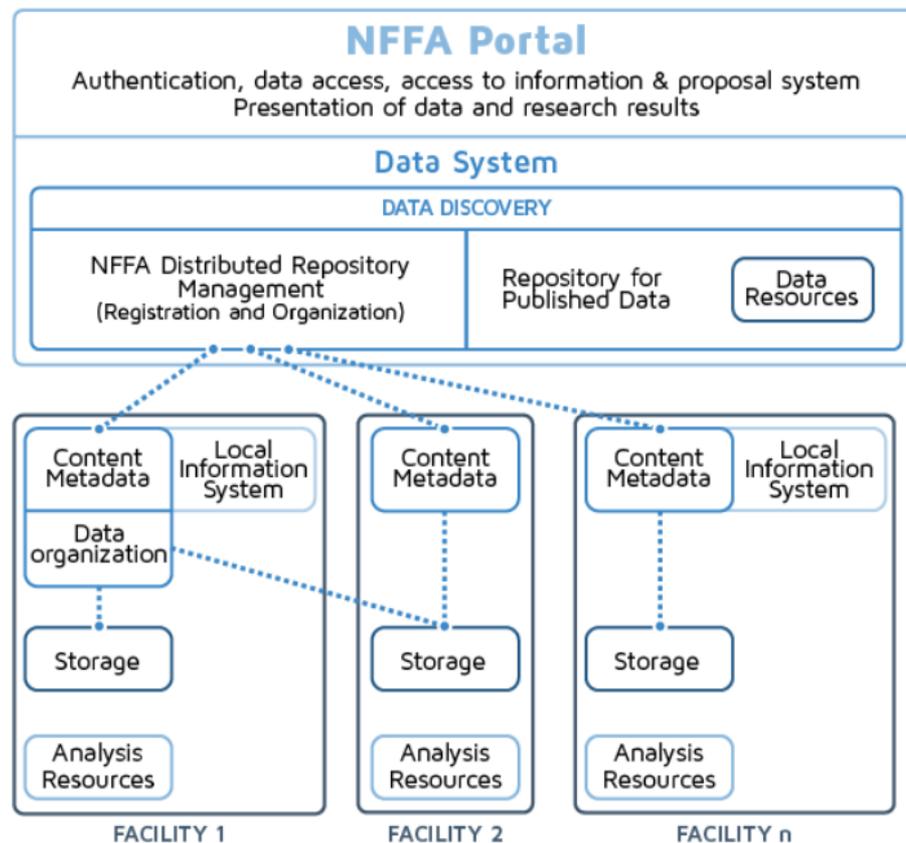


Advantages of this infrastructure

- Standardized data access to all the facilities (NFFA portal)
- Scientific data accessible worldwide
- Scientific results can be easily published for open access
- (FAIR) Data policy

The prototype: Architecture

Windows/Ubuntu Virtual machines
Instances on CNR-IOM **OpenStack** cloud



The prototype: portal.nffa.eu

R. Aversa ▾ **IDRP** your applications your wishlist submit your application

ABOUT
the project

OFFER
tools catalogue

NEWS
events & highlights

APPLY
guidelines

nffa.eu
nanofabrication facilities & tools catalogue

ABOUT the project | OFFER tools catalogue | APPLY guidelines | OUTCOMES the latest outcomes | NEWS events & highlights

the latest outcomes [view all](#)

FROM OUR JOINT RESEARCH
Deep neural networks lead to nanoscience images classification software

FROM OUR USERS
One step preparation of ZnFe₂O₄/Zn₃(OH)₄(CO₃)₂ nanocomposite with improved Au(V) removal capacity

FROM OUR JOINT RESEARCH
Enquiry into an industrial user experience at NFFA-Europe

FROM OUR USERS
Atomic-to-microscale evaluation of large-area two-dimensional metal dichalcogenides for microelectronics

FROM OUR USERS
Metal Enhanced Resists for EUV Lithography

FROM OUR USERS
Magnetoelectricity in La₂Sr₂NiO₆

FROM OUR JOINT RESEARCH
Plasma etching and pyrolysis contribute to size reduction of laser polymerized 3D structures

Researchers within NFFA Europe develop processes enabling fabrication of sub 100 nm smallest features sizes in free form 3D structures.

FROM OUR JOINT RESEARCH
Self-texturizing electronic properties of a 2-dimensional GdAu₂ layer on Au(111): the role of out-of-plane atomic displacement

We demonstrate the spontaneous patterning of the electronic properties of a 2-dimensional layer

Installation 1
Lithography & Patterning

Installation 2
Growth & Synthesis

Installation 3
Theory & Simulation

Installation 4, 5 & 6
Characterisation

Next deadline
16 July 2018 at 17:00 (CEST)

BROWSE THE OFFER & APPLY FOR FREE ACCESS

The widest range of tools for research at the nanoscale.
Free of charge access for academia and industry thanks to Horizon 2020.

The prototype: idrp.nffa.eu

1. register, manage and retrieve metadata and data stored in the local repositories
2. manage authorization of metadata and data access

Information and Data Repository Platform

MY PROPOSALS FIND MORE...

HOME

6 of 6 Proposals

(no filter active)

Proposal Id (ASC)

Proposal bc154604-ca44-458b-998a-e7771a304967

★ SWAGGER

47 Experiment(s)

EDIT DETAILS

9 of 9 Experiments in Proposal

(no filter active)

Experiment Id (ASC)

Placeholder Experiment using instrument 2045@CEA-LETI

16/02/2017, 08:23:44 - 16/02/2017, 08:23:44 1 Measurement(s)

One description

EDIT DETAILS NEW MEASUREMENT

Placeholder Experiment using instrument 1842@CNRS

16/02/2017, 08:23:39 - 16/02/2017, 08:23:39 1 Measurement(s)

No description

EDIT DETAILS NEW MEASUREMENT

NEW EXPERIMENT

DIRECT LINK

NEW EXPERIMENT

The prototype: datashare.nffa.eu

The Data Management System at the Local Facility adopted at CNR-IOM is **NextCloud** based

Nome utente o email

Password

Accedi →

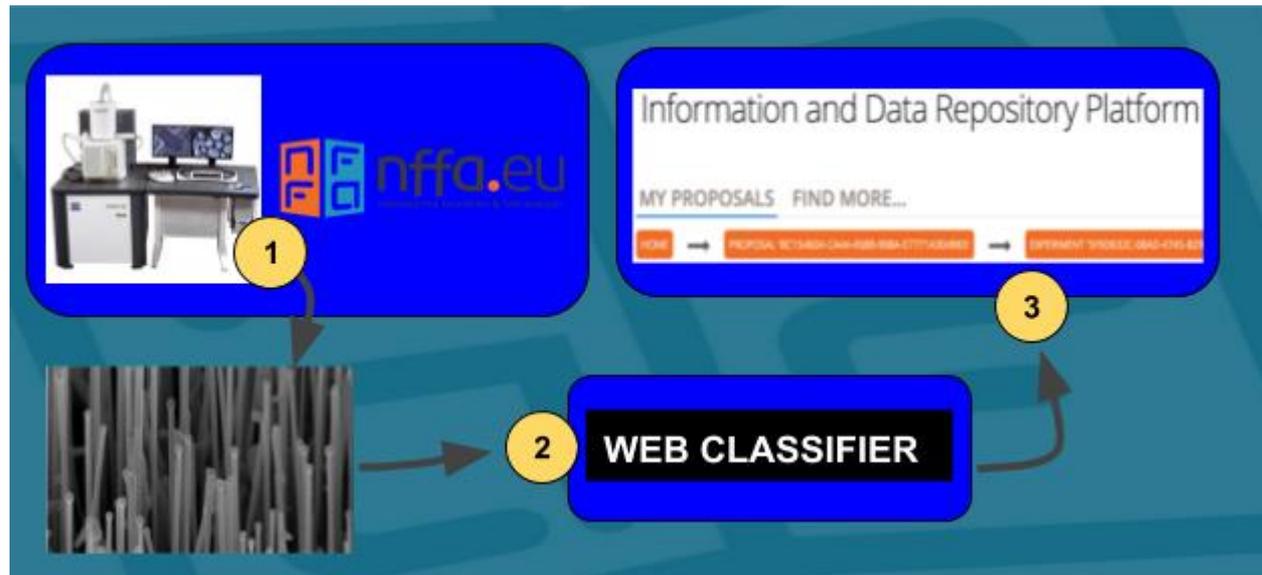
Rimani collegato

Hai dimenticato la password?

Nextcloud – un posto sicuro per tutti i tuoi dati

The prototype: SEM Workflow

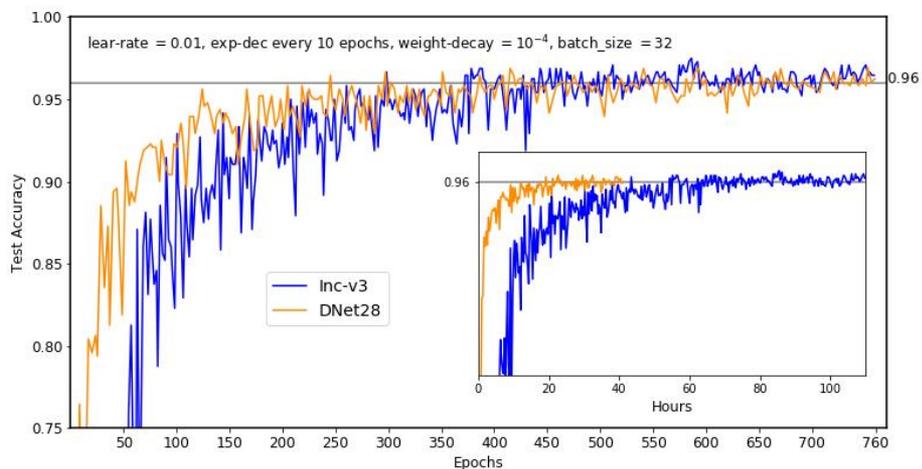
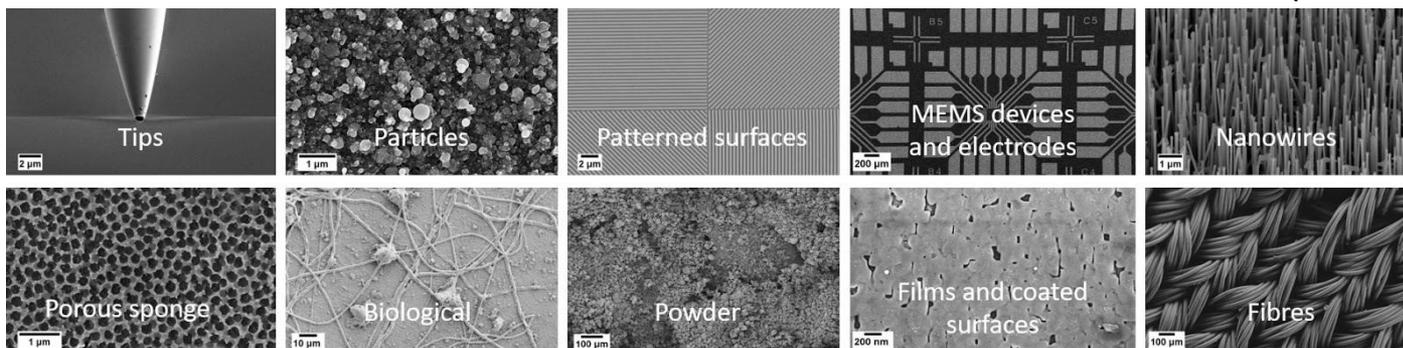
First online analysis tool:
Web SEM image classifier
(additional metadata)



SEM images classification

Dataset: 18577 (10 GB) SEM images (1024 x 728 pixel)
manually classified into 10 categories

Aversa et al. (2018)



Deep Neural
Networks trained for
image recognition

Modarres et al. (2017)
Aversa et al. (in prep.)

SEM images classification

nffa.eu

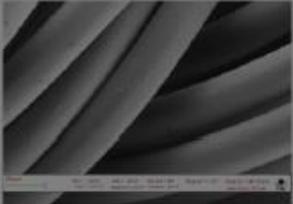
Classify



A30_801V_glass_12.jpg

Biological

Add a category See Results



ecomo_12_02.jpg

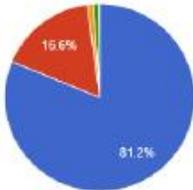
Fibres

Add a category See Results

Thank you for using the SEM image classifier! Your results are precious to the performance of our neural network, and NOT for any other scientific purpose.

I agree to provide my results to improve next neural network trainings

Results for each category



Biological
Tips
Powder
MEMS devices and electrodes
Other

| Category | Rate |
|-----------------------------|-------------------------|
| Biological | 0.8124286032402039 |
| Tips | 0.16636784374713898 |
| Powder | 0.010371863842010498 |
| MEMS devices and electrodes | 0.008679845370362268 |
| Porous sponges | 0.001098776119761169 |
| Films coated surfaces | 0.0007601917604915798 |
| Particles | 0.00018723949324339628 |
| Patterned surfaces | 0.00009903764293994755 |
| Nanowires | 0.000006558407221746165 |
| Fibres | 3.438829776492014e-10 |

SEM images classification

nffa.eu

Glassify

A30_BDIV_glass_12.jpg

Biological

Add a category

See Results

scamp.fz.02.jpg

Fibres

Add a category

See Results

Choose a category

- Porous sponges
- Patterned surfaces
- Particles
- Films coated surfaces
- Powder
- Tips
- Nanowires
- Biological
- MEMS devices and electrodes
- Fibres

Type a new category

Confirm



Future perspectives

Currently under development:

- Save data and register metadata directly from the web classifier
- Implement new neural network architectures

Planned next steps:

- Extend the dataset (images/categories)
- Export to other partners (10 SEMs)

In the meanwhile:

- Other online analysis tools

Thank you!

CONTACTS

aversa@iom.cnr.it

+39 040 37 87 515

www.nffa.eu

