Multi-facility call management: NFFA-EU

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NFFA-Europe Pilot

TLNet Coordinator, IPR Manager, WP10 Leader: TAS - TA programme support structures: Technical Liaison Network (TLNet) and pilot User Office Network (UONet)

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This initiative has received funding from the EU's H2020 framework program for research and innovation under grant agreement n. 101007417, NFFA-Europe Pilot Project

IMPULSE

User access workshop
Trieste Jan 30-31 , 2024

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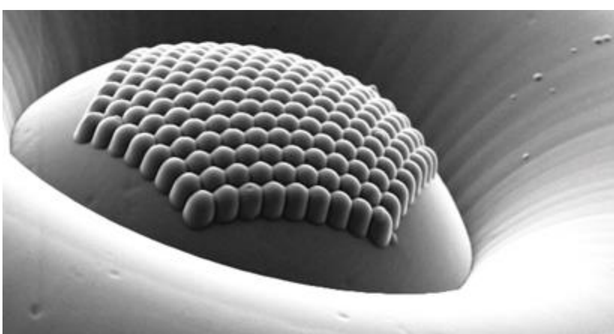
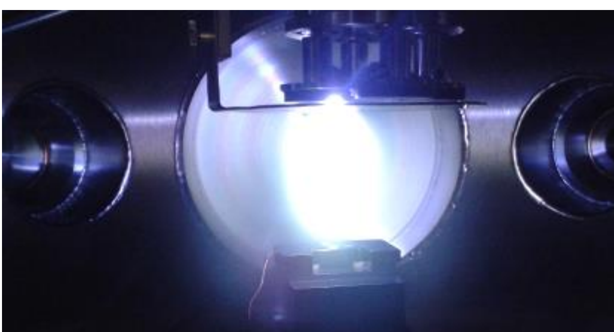
research infrastructure

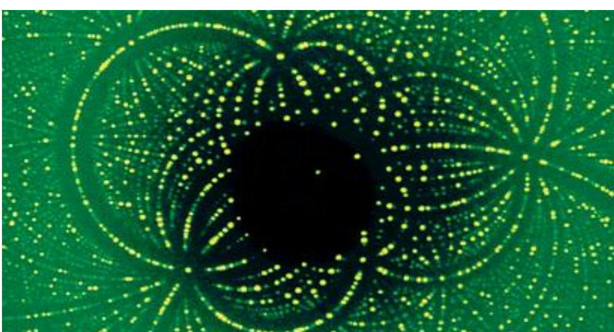
The widest range of tools
for research at the nano- & micro-scale



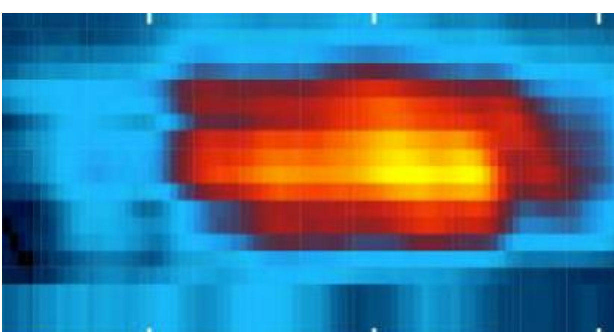
Lithography & Patterning



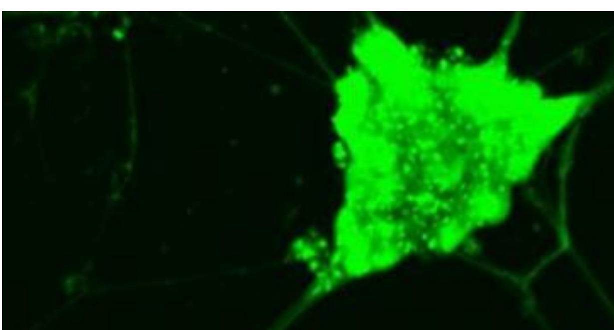
Growth & Synthesis



Structural & Morphological Characterization

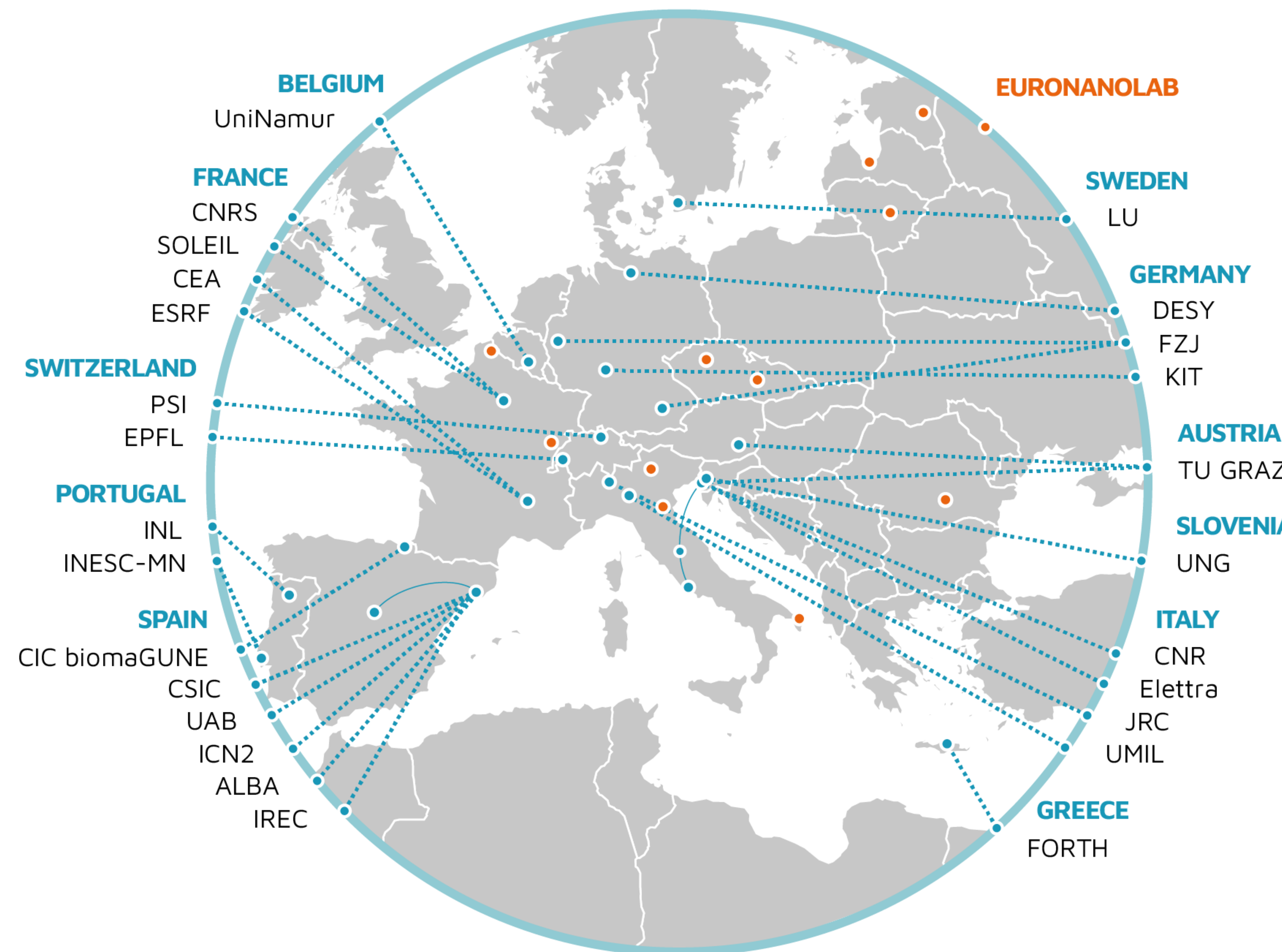


Electronic, Chemical & Magnetic Characterization



From Nano to Micro/Macro

Theory & Simulation



A distributed Research Infrastructure of outstanding expertise and world-class facilities

- **39** research infrastructures
- **183** techniques
- **600** instruments
- **23** partners
- **16** countries

Free of charge access
for academia and industry

HOW TO APPLY

1
BROWSE & CHOOSE
from the online catalogue at **nffa.eu**

2
SUBMIT YOUR PROPOSAL
on a single- entry point

3
HAVE IT EVALUATED
& ranked by an international peer-review panel

4
GET FREE ACCESS
and receive a contribution for travel & subsistence costs

Thanks to

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Grant agreement n. 101007417, NFFA-Europe Pilot Project.

25 Calls for access	**850** proposals submitted	**63%** rate of acceptance
30% with Large Scale Facilities	**12%** with theory	**12%** with industry
~3 Average users per proposal	**63** Countries applying	**2568** Lab sessions

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Multi-facility call management in a "single" distributed infrastructure

Need to integrate

- many different methods/techniques (more than 180) by more than 600instruments
- many different institutions (39 infrastructures + internal structures)
- different procedures to host and support users

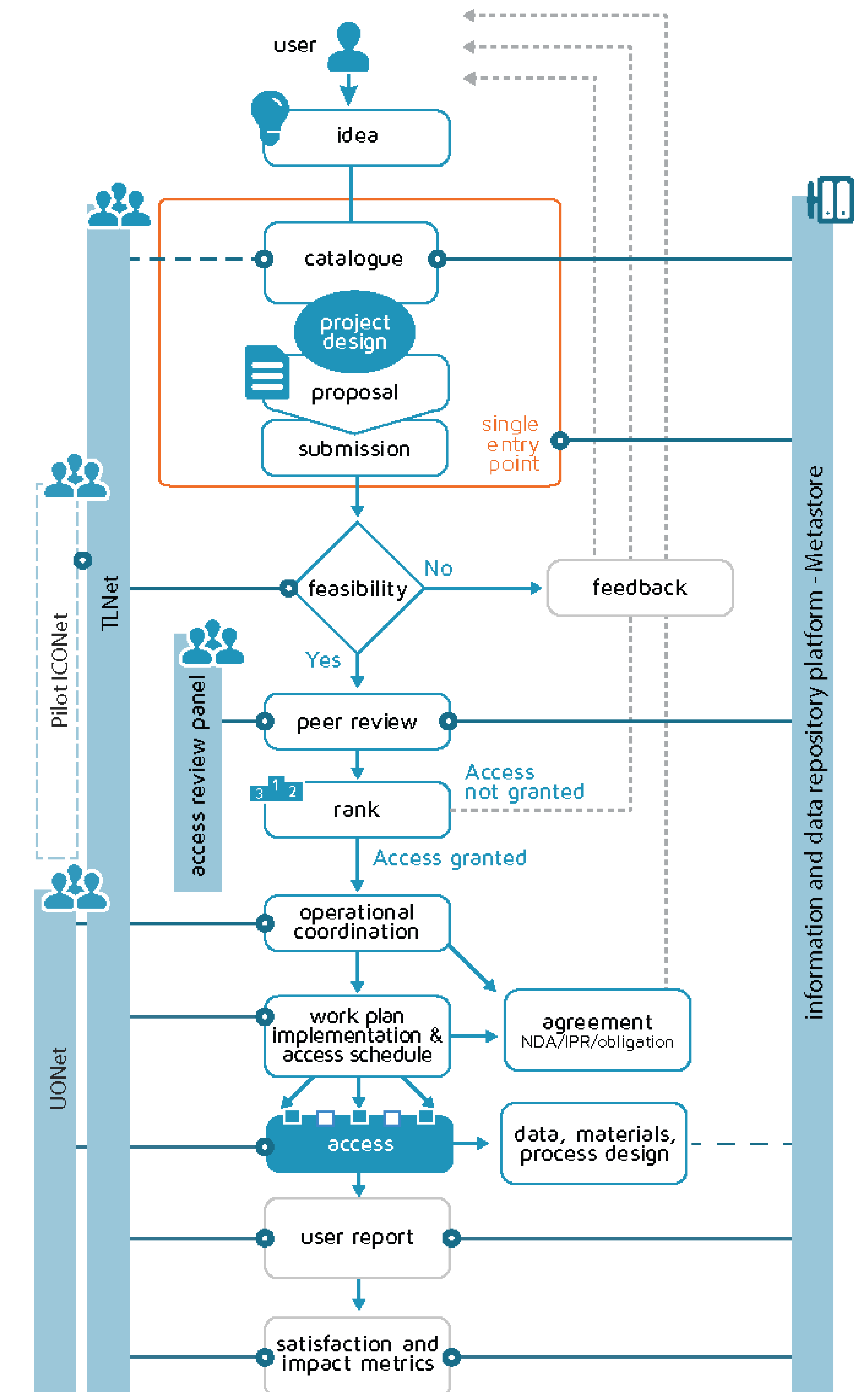
with the **challenge** to make all of these **to appear as a single entity**, with strandard, smart procedures user- friendly for both users and providers

i.e. to implement

not a **network of infrastructures**

but

a single **Interoperable Distributed Research Infrastructure for Nanoscience (IDRIN)**



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CATALOGUE: from a wish-list to the proposal

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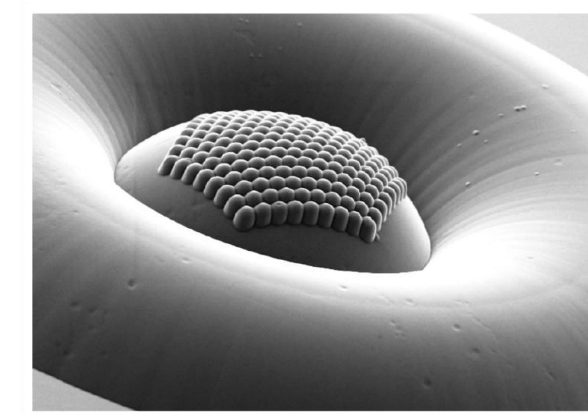
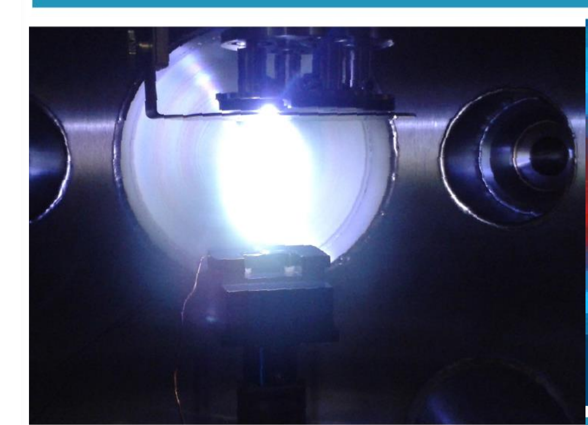
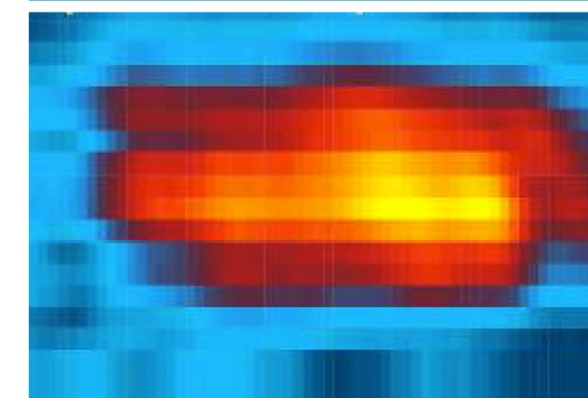
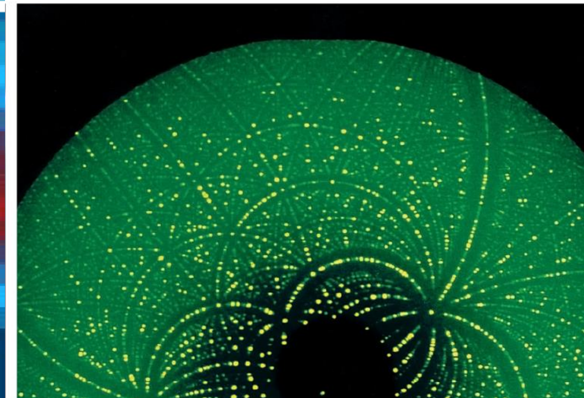


Lithography & Patterning



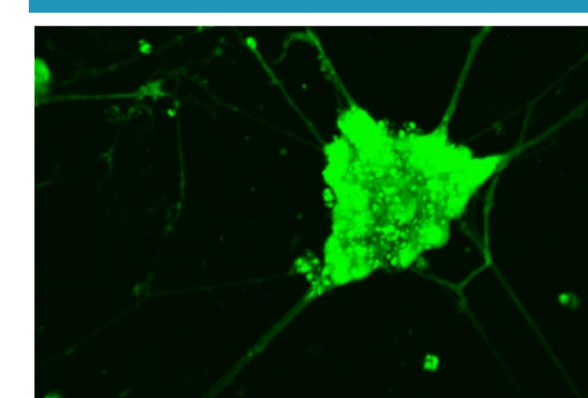
Growth & Synthesis

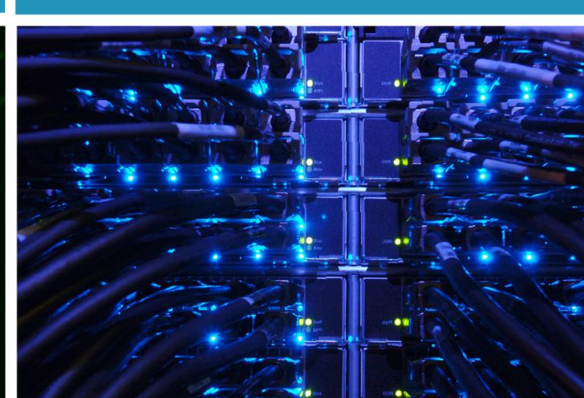




Electronic & Chemical, Magnetic Characterisation

Structural & Morphology Characterisation





From Nano to Micro/Macro

Theory & Simulation

Installation

Level 1
Techniques overview
one small box for each

Lithography & Patterning

Installation 1

Lithography and nanopatterning installation is devoted to the top-down patterning of materials covering from nanostructured surfaces (patterning of nanomaterials, nanopatterning of materials) to advanced micro-nano devices of interest (sensor, electronic, magnetic probes, microfluidics, etc.) and advanced functional sample environments for in-operando characterization. Standard lithography and nanolithography tools such as UV-lithography, e-beam lithography (EBL), focused ion beam (FIB) as well as unique or rare in-house tools such as Extreme ultraviolet interference lithography or synchrotron X-ray lithography are available, to be combined with pattern transfer tools by physical and chemical processes. Important note: Building test structures or making a device around a functional (nano) material may require additional iterations of growth/deposition and litho/patterning steps of ancillary materials (e.g. defining metal electrodes). Techniques similar to the ones reported for Installations 1 & 2 together with others like sputtering/evaporation may be used to define ancillary structures by lithography followed by dry or wet patterning processes. To avoid burdening in excess the catalogue and the evaluation process, not all such processes are listed. Please, make sure that your needs in relation to such ancillary elements are contained in the description of your proposal. TLNet will figure out if a process sequence fitting your purposes can be established within NFFA.

EBL ELECTRON BEAM LITHOGRAPHY

Electron-beam lithography is a nanopatterning technique utilizing a very well-focused electron beam in order to write nanoscale patterns directly on special e-beam resists. A variety of powerful techniques is provided for the lateral as well as three-dimensional pattern transfer with resolutions down to 10 nm. Compared to other nanostructuring methods, it stands out for a high level of flexibility and resolution and reasonable patterning speed.

FIB FOCUSED ION BEAM

By FIB, usually combined with an electron column, it is possible to achieve nanometric structures, either by ion milling or by ion/electron beam disposition. In such systems 2D and 3D nanostructures can be fabricated, with a high degree of control and flexibility. With nanomanipulators electrical measurements are possible, as well as characterization when combined with different detectors. It is a good technique for TEM lamellae sample preparation.

UVL ULTRA VIOLET LITHOGRAPHY

Ultraviolet lithography also known as optical or photolithography is the most commonly used patterning technique in microfabrication. A photosensitive material (photoresist) is spin-coated onto the substrate to be patterned. The photoresist is illuminated with UV light through a photomask which contains the relevant geometric patterns. The pattern is transferred on the photoresist, after the required development of the exposed sample.

Level 2
Technique description

EBL

Electron Beam Lithography

Lithography & Patterning Installation 1

add to your wishlist

ypical electron beam lithography tool is a vector-scan direct write tool th a Gaussian shaped beam. The electrons are accelerated to typically keV or 100 keV and the beam scanning is controlled by a combination usually two deflection systems. The beam is directed to a position in the ain deflection field (with a maximum size of a few 100 μm²), where a ttern is written by stepping around the electron beam. For larger tterns, the pattern is divided in main field blocks, which are completely posed one-by-one after moving the substrate to the right position. A er interferometer can often measure the actual stage position, and this signal is fed back to the deflection system with sub-nm resolutions.

The electron beam stepping frequencies can be as high as 50 MHz, which provides relatively high speed direct nanopatterning. The electron beam spot size can be focused to sub-10 nm in diameter. Owing to the wide range of available beam currents (typically 200 pA – 200 nA), high-throughput as well as high-resolution exposures are possible. With high accelerating voltages, thick layers of e-beam resists can be exposed with small forward electron scattering. Electron-beam lithography systems typically have small overlay precisions and can handle full wafers, mask blanks, and custom shaped samples. Typical features can include automatic laser focusing for height measurement, and manual or automatic detection of alignment markers for multiple lithography level processes. Users can implement or supply their designs in most standard formats.

provided at NFFA-Europe laboratories by:
LU Sweden | PSI Switzerland | CNR-IOM Italy | CNRS France

Level 2
Including the **list of the Instruments**

COMPARE
LU Sweden
EBL - Voyager (44)

COMPARE
LU Sweden
EBL - Raith (101)

COMPARE
PSI Switzerland
EBL - Vistec/Raith EBPG 5000+ ES system @ Laboratory for Micro- and Nanotechnology

COMPARE
LU Sweden
EBL - Voyager (44)

Applications
High speed EBL exposure of electron beam sensitive resists

Source
Schottky type filament, currents up to 10nA with fast electrostatic deflection coils

Range
Fixed at 50kV

Detection
20nm resist lines

Resolution

Level 3
Tech. Specs. for each Instrument
(with the possibility to make comparisons)

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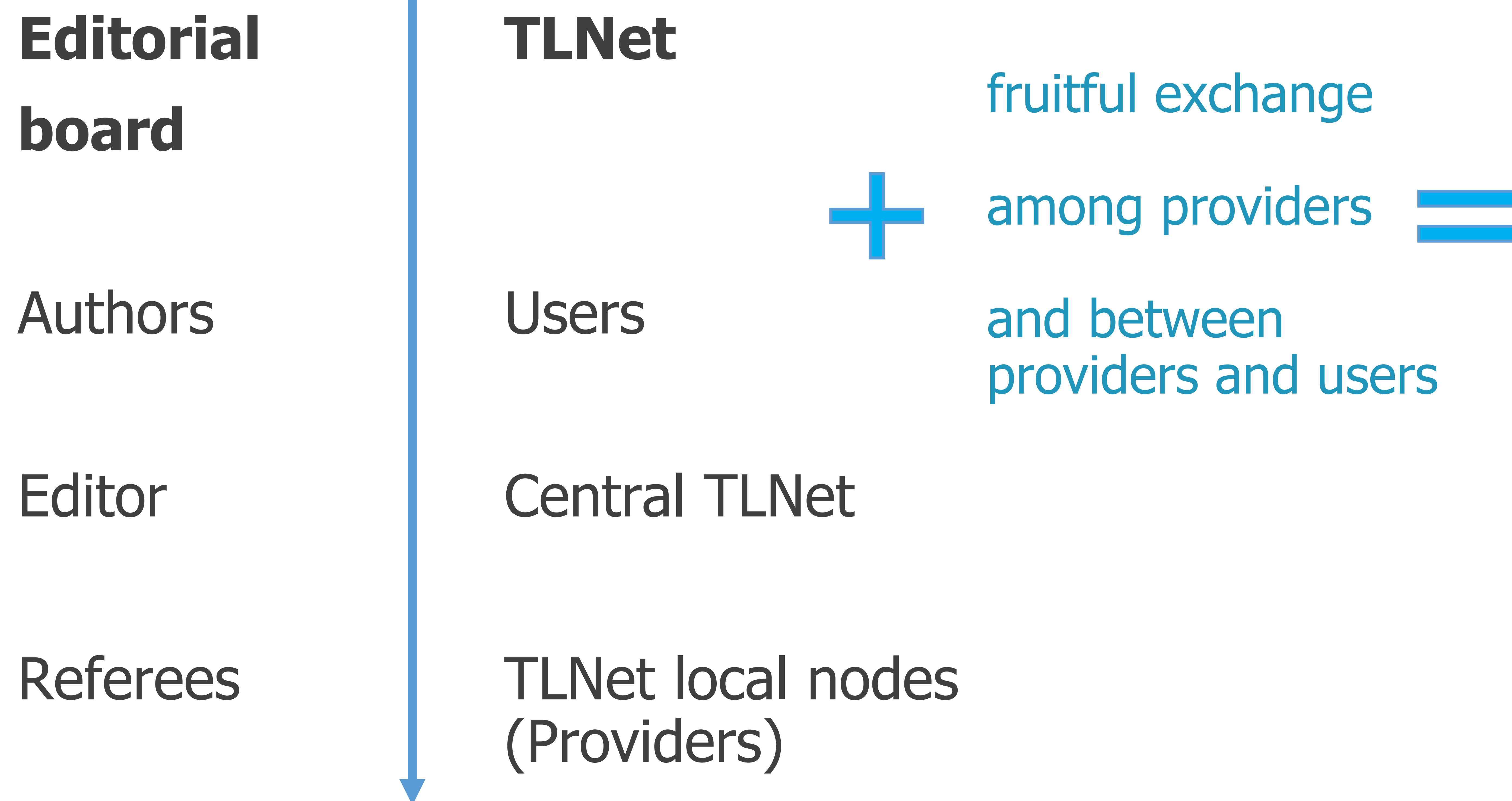
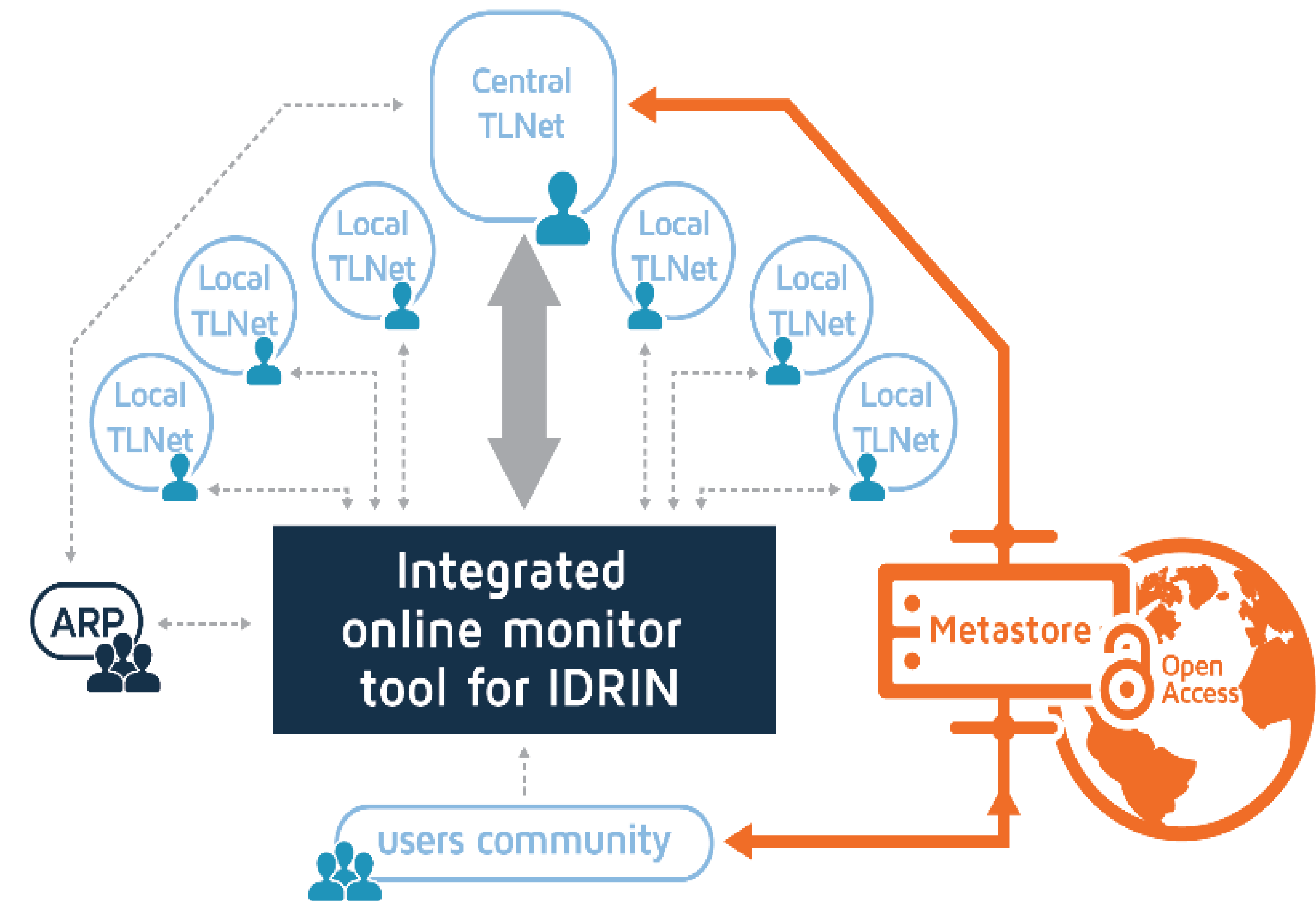
Technical Liaison Network TLNet concept and structure

Parallelism between the editorial board of a peer-review journal and the TLNet concept



Editorial board	**TLNet**
Authors	Users
Editor	Central TLNet
Referees	TLNet local nodes (Providers)

+ fruitful exchange among providers and between providers and users =



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On line monitor tools for IDRIN

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- Feasibility evaluation for each proposal-step (lab session) by more providers
- Work-plan and logistic optimisation

12/21

146
CENTER FOR PHYSICAL SCIENCES AND TE...
LITHUANIA

UoA 10	UoA 4	UoA 5	UoA 1
LSIVP	SEM	OS	MMMEI
no institution chosen	no institution chosen	no institution chosen	no institution chosen

151
UNIVERSITY OF DELAWARE
UNITED STATES OF AMERICA

UoA 16	UoA 2
BLS	AFM
12 CNR-IOM (...	1 CNR-IOM (...

152
UNIVERSITY OF VIENNA
AUSTRIA

Site	UoA 10 EBL	UoA 3 IBM	UoA 4 SEM	UoA 3 MFDC
CSIC-ICMAB - SPAIN	10		4	
CSIC-CNM - SPAIN				
ICN2 - SPAIN				
UAB - SPAIN				
INESC-MN - PORTUGAL	10	3	4	
INL - PORTUGAL				
CNR-IOM (TS) - ITALY				
CNR-DSCTM - ITALY				
JRC - ISPRA - ITALY				
FORTH - GREECE				
C2N-CNRS - FRANCE				
CEA/LETI - FRANCE				
EuroNanoLab - EUROPE	10		4	3
PSI - SWITZERLAND				
KIT - GERMANY				
DESY + PETRA III - GERMANY				
LUND + MAX IV - SWEDEN				

1
09/21

154
SPANISH NATIONAL RESEARCH COUNCIL
SPAIN

Site	UoA 3 Ink-jet	UoA 4 DWL	UoA 1 TP
CSIC-CNM - SPAIN			
CSIC-ICMAB - SPAIN			
EuroNanoLab - EUROPE	3	4	1
INESC-MN - PORTUGAL			
INL - PORTUGAL			
CNR-DSCTM - ITALY			
CNR-IOM (TS) - ITALY			
PSI - SWITZERLAND			
C2N-CNRS - FRANCE			

STEP 1 of proposal **ID 154** - Fabrication of microscale kinetic energy harvesters for production of renewable electric energy
Ink-jet Ink-jet

Purpose: 1- To fabricate the device using rigid-transparent substrate such as glass, 2- To fabricate the device using a flexible-transparent substrate such as PDMS or PFA.

Measurements / processes plan: 1- For the fabrication on the rigid-transparent substrate, one side of a glass slab will be first coated with 50 micrometer-thickness PFA layer and then top and back electrodes of the 2 by 2 array will be printed on two sides (Fig 2). 2- For the fabrication on the flexible-transparent substrate, a... Read more

Technical specifications and ancillary techniques: 1- The printed electrodes should have enough mechanical stiffness that they would not be damaged by kinetic energy of water drops. 2- The printed electrodes must not be solvable in water or at least be water resistant for a certain amount of time. 3- metallic inks used for printing the top and ba... Read more

Cycles:

Cycle number	Num. of samples	Num. of measures/processes	Total
Cycle 1	4	1	4
Total Cycles			4

hide table

Preferred Site: EuroNanoLab (state of the art 2D printing facilities exists in EuroNanoLab consortium .)

Feasibility: **Ink-jet** at **CNR-DSCTM** TLNet Central requested site

- Not Feasible
- Feasible With Reservations
- Feasible
- Additional Information Required

close

Requested additional information

view all questions for all steps

2022/01/21 at 13:45
FOR STEP 1 - Ink-jet @CNR-DSCTM
In order to asses the feasibility we need to know: the nature of the metallic inks to be deposited either in terms of active part (metals) and solvent (organic, aqueous); are these to be provided by us? Thickness and in general dimensions of the patterns to be deposited should be known at least roughly in order to give a more appropriate answer.

re: 2022/01/25 at 19:10
Dear Sir/Madam We can also bring some metalic inks for printing the electrodes in case you do not have enough. The problem could be whether or not the our ink is compatible with your printer. for dimensions: L= 900 um, W=200 um, and d=50 um. Best Regards Ali

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Conclusions

- Smart presentation of the complex multiple offer in order to make the user capable to build up a reliable proposal (articulate work-plan)
- Effective procedure for feasibility evaluation, work-plan optimisation (scientific & logistic), in case interacting with the user
- Pay attention to use a team of experts, at the very end the access is provided by the specific instrument scientist

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Contact us

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