

TITLE and type of activity (Networking, Joint Research development):

Complex approach for materials study by combination of analytical and structural techniques (neutrons, X-ray and photons)

Networking and JRA

Leading beneficiary: ILL/PSI/LLB (as neutron and synchrotron sites) or BNC/FRM-II (neutrons + complex research environment)

Partners: as above + ELETTRA+ TU Delft/TU Budapest/ELTE Budapest.....

Estimated budget (in person months, other direct cost) and tentative distribution per partner:

(100 PM + 25k€/partner, 10-20% share of partners) per activity

Abstract of your innovative activity: *(please make sure that you mention the following points)*

1. State of the Art

- Research fields and communities targeted: life sciences/structural biology (emphasis on lamellar systems); food quality and safety; material science (emphasis on materials for transport industry as well as energy production, saving and storage); geology.
- Capability to solve wide variety of questions in material sciences and geology on macro and micro scales
- Wide variety of elemental and chemical analytical tools as well as structural investigation techniques for characterising bulk, surface and nano materials
- We have experience and good knowledge in performing experimental research for the following particular fields related to the above items: catalysis, functional materials, photosynthesis, metallic parts of industrial systems, objects of cultural heritage, rock samples etc.

2. What is new? Why should it be done on a European consortium level (synergies)?

- We would like to implement new ways of renewable/low-carbon energy related research for hydrogen economy, chemical and electric energy storage or CO₂ geological storage research.
- We are intending to cooperate in working out in-situ methods for better understanding processes that driving better efficiency e.g. in energy conversion, storage and saving or influencing long-term safety.
- Complex approach to materials by exploring elemental/analytical and structural features using combination of various neutron techniques (diffraction, imaging, gamma analysis, inelastic scattering...) extended with other tools as X-ray, laser, NMR, electron microscopy etc.

3. How could your activity be connected with other methods and techniques (outside the neutrons community)?
- Non-neutron tools (such as synchrotron X-ray sources for structural studies or electron microscopy laboratories) are to be involved and cooperation with partners in other research communities (see item 1.) should be enhanced.
 - We also need theoretical support for characterizing and finding suitable materials for the above research
 - Development of sample preparation laboratories (tools, techniques, equipment, sample environment) in various fields (as above) for elaboration of samples (single crystals, nano-powders, gels etc.) and treatment of samples (rock samples) to be used in various types of measurements (neutrons, X-rays...)
 - To develop new methodologies (e.g. sampling for in situ measurements) for applications of existing instrumentations
 - BNC is a member of the CERIC (Central-European ERIC).
 - The cluster of RIs integrates some of the unique and highly competitive centres for development of metrology and instrumentation in mid-Europe and will therefore generate new innovative improvements for analytical and structural techniques boosting the European research capabilities and exploitation of new advanced metrology
4. Is there any link with national initiatives/projects (e.g. national data initiatives, but also European roadmaps etc)?
- There is a National action plan till 2030 in accordance with the EU energy and climate policy to build up the sustainability of energy production and decrease the CO₂ emission and for better integration our electric system to the EU grid in which we could conduct research in some specific areas. Similar for healthcare, food-quality, transport industry...
 - We have collaboration with our National Innovation Office which can help us proceed along the innovation chain if we find innovative ideas to be realized.
5. How is the user community involved in your activity? Benefit for the user (evtl for any specific science community?)
- We run the Budapest Neutron Centre and in addition we can provide access to our catalytic and surface chemistry laboratories (UV-Vis, FT-IR, TEM Kelvin probe, adsorption/chemisorptions of gases, XPS, SEM/EDS, XRF, potentiometry, impedance spectrometry), preferably related to the thematic of energy research.
 - We are on the way to build up national platforms for various fields (as listed above) integrating RIs, universities, other research establishments (e.g. biology centres, agriculture research units, museums) as well as industrial partners.

- Usually most of the partners have close collaboration with universities and will transfer their knowledge through lectures, university workshops, and publications, to students and young scientists.
- The networking activities will provide presentations, tutorials and dedicated presentations for the training of researchers, engineers, and potential users of the research infrastructure.

Two types of activities are suggested:

1. Networking for the integration of the different type of RIs, targeted user communities and innovation partners.

The network aims at integrating a unique collection of key research infrastructures in mid-Europe supplying and developing analytical and structural techniques and metrology in the areas of neutron science, x-ray etc. offering highest accuracy for a broad range of physical and chemical properties as well as highest resolution.

One important object is to integrate and link users to a network of scientist within the research infrastructure by productive internal and external communication e.g. regular workshops, conferences

The network catalyzes the improvement of instrumentations and techniques motivated by the requirements and needs from the users

2. JRA-1 for development of instrumentation for combined tools within neutron/X-Ray/Photon techniques as well as combining e.g. neutrons with other methods (e.g. Raman, XRF, microscope...)

3. JRA-2 for development of complex sample preparation and environment techniques.

4. JRA-3 for life sciences/structural biology R&D (emphases of lamellar systems); food quality and safety

5. JRA-4 for material science R&D (emphases on materials for transport industry as well as energy production, saving and storage)