

HORIZON 2020 RESEARCH INFRASTRUCTURES

H2020-INFRAIA-2014-2015

INFRAIA-1-2014-2015 INTEGRATING AND OPENING EXISTING NATIONAL AND REGIONAL
RESEARCH INFRASTRUCTURES OF EUROPEAN INTEREST



ENSAR2 EUROPEAN NUCLEAR SCIENCE AND APPLICATION RESEARCH 2

GRANT AGREEMENT NUMBER: 654002

D1.4 STUDY OF THE INTEGRATION OF NUCLEAR PHYSICS RESEARCH COMMUNITY: STATUS AND
PERSPECTIVES

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Author: Muhsin N. Harakeh
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D1.4 Study of the integration of nuclear-physics research community: status and perspectives

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	Contributors:	Marek Lewitowicz, GANIL
	Reviewed by:	
	Approved by:	Sabrina Lecerf-Rossard, GANIL

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LIST OF ACRONYMS AND ABBREVIATIONS

ENRI	ENSAR2 Research Infrastructures
ENSAF	European Network of Small-scale Accelerator Facilities
ERINS	European Research Infrastructures for Nuclear Science
FCG	Facility Coordinating Group
FISCO2	FInancial and Scientific COordination 2
IA	Integrating Activity
IFF	In-Flight Fragmentation
ISOL	Isotope Separation On-Line
JRA	Joint Research Activity
MediNet	Medical Network
MoU	Memorandum of Understanding
NA	Networking Activity
NuPECC	Nuclear Physics European Collaboration Committee
NuPIA	Nuclear Physics InnovAtion
PAC	Programme Advisory Committee
RI	Research Infrastructure
TNA	TransNational Access

EXECUTIVE SUMMARY

ENSAR2 has strived from the beginning to integrate activities of European nuclear scientists who are performing research in three of the six major subfields defined by the Nuclear Physics European Collaboration Committee (NuPECC): Nuclear Structure and Dynamics, Nuclear Astrophysics and Applications and Societal Benefits. It created the proper frameworks through the Networking Activities and Joint Research Activities. It also helped the integration between the ENSAR2 research Infrastructures by signing the ENRI (ENSAR2 Research Infrastructures) agreement and establishing the Facility Coordinating Group (FCG) to help realise the goals of integration. The signing of the MoUs with important international research infrastructures helped further in this context.

Introduction

ENSAR2 is the integrating activity (IA) for European nuclear scientists who are performing research in three of the six major subfields defined by NuPECC: Nuclear Structure and Dynamics, Nuclear Astrophysics and Applications and Societal Benefits. Its core aim is to provide transnational access (TNA) to nine of the complementary world-class large-scale facilities: GANIL (F), GSI (D), LNL-LNS (I), JYFL (FI), KVI-CART (NL), CERN-ISOLDE (CH), ALTO (F), IFIN-HH/ELI-NP (RO) and NLC (PL). These facilities provide stable and radioactive ion beams of excellent qualities ranging in energies from tens of keV/u to a few GeV/u and intense photon beams up to 20 MeV energy. The stable-ion beams range from protons to uranium. The radioactive ion beams are produced using the two complementary methods of in-flight fragmentation (IFF) and isotope-separation on-line (ISOL), so that several hundred isotopes are available for the users. The high-intensity, high-energy photon beams will be produced at ELI-NP (Bucharest) by laser back scattering from high-energy electron beams. In addition, a small-scale facilities network has been established in support of large-scale facilities. Furthermore, the infrastructure ECT* (I) will provide a unique place for meetings, seminars and workshops to the community. The joint research activities (JRAs) deal with novel and innovative technologies to improve the operation of and enhance the access to ENSAR2 facilities. They are in general relevant to more than one facility and rely on strong participation of the European university groups. These activities involve all facets of operation of an accelerator facility. The Networking Activities (NAs) have been set-up with specific actions to strengthen the community work in TNAs and JRAs.

Integrating Actions and Activities

Already at the time of preparation of ENSAR2 project, it was decided that Networking Activities (NAs) and Joint Research Activities (JRAs) would hold workshops that would discuss progress within the fields addressed by these NAs and JRAs and integrate these activities within a European framework.

The NAs held workshops that discussed the progress in their subfields, further stimulating the access to the ENSAR2 Research Infrastructures. One of the networks, MediNet (Medical Network), was devoted to nuclear-physics applications for medicine through the developments of beam and detection techniques and of ion-beam therapy. It has successfully integrated the activities of scientists in Europe involved in the medical applications. Two other activities should be noted here due to their success in reaching their goals of integrating their new communities. ENSAF (European Network of Small-scale Accelerator Facilities) had the aim to support technical developments and tests for experiments at large-scale infrastructures. This has been very successful in integrating the activities of the small-scale facilities such that in the preparation of the successor to ENSAR2, the ERINS (European Research Infrastructures for Nuclear Science: Nuclear Structure, Astrophysics and Applications) project, an integrated but distributed small-scale research infrastructure transnational activity was proposed. On the other hand, NuPIA (Nuclear Physics InnovAtion) was meant to be a transversal activity to support innovation through bridging actions between academic research and industry, and training of industrial personnel in research institutions thereby promoting the use of Nuclear-Physics Infrastructures by industrial researchers. It also aimed to be the link between innovation officers of the institutions, research groups in various ENSAR2 WPs and industry. NuPIA organised workshops jointly with representatives of industry, i.e. First Nuclear-Physics Research – Technology Coaction Workshop held October 11-12, 2018 in Warsaw at Heavy-Ion Laboratory (HIL) and Second Nuclear-Physics Research – Technology Coaction Workshop held November 6-8, 2019 in Sevilla at National Accelerator Centre (CAN). In addition, NuPIA organised training sessions through courses offered to industry staff at Universities of

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Liverpool and Jyväskylä. One of the networks, NuSPRASSEN (Nuclear Structure Physics, Reactions, Astrophysics and Superheavy Elements Network), deserves special mention. It was intended as an overarching network that provides a forum to discuss the scientific interests of the nuclear structure and nuclear astrophysics communities (including EURISOL community), the progress in these subfields and the optimisation of the use of the large-scale research infrastructures for that purpose. Therefore, it organised and supported workshops on nuclear structure, nuclear reactions, nuclear astrophysics and superheavy elements as well as applications. This was realised in the Workshop on Nuclear Structure, which took place on December 6, 2016 in Geneva.

Workshop on Nuclear Reactions – Theory and Experiment, which took place on January 22-24, 2018 in Warsaw.

EURISOL Town Meeting, which took place on July 2-4, 2018 in Pisa.

Workshop Indirect Methods in Nuclear Astrophysics, which took place November 5-9, 2018 at ECT* in Trento.

Workshop on Superheavy-Element Research, which took place on February 25-27, 2019 at GSI in Darmstadt.

Workshop on Nuclear Science Applications, which took place on November 25-27, 2019 in Helsinki.

Workshop on “New science opportunities at ELI-NP”, which will take place in May-June 2020 in Bucharest.

NuSPRASSEN further supported other workshops organised by the community as well as schools for educating and training young scientists.

The JRAs established frameworks for joint endeavours in designing, development and construction of equipment. This is indeed the usual tasks of the JRAs, i.e. to deal with novel and innovative technologies to improve the operation of and enhance the access to ENSAR2 facilities. They are in general relevant to more than one facility and rely on strong participation of the European university groups. These activities involve all facets of operation of an accelerator facility. However, two JRAs in ENSAR2 deserve special attention. The TheoS (Theoretical Support for nuclear facilities in Europe - Nuclear Structure and Reactions) JRA, which is a theory support activity to experiments in nuclear structure and reactions. We note here that in ENSAR2 the close collaboration between the nuclear theory sub-communities, i.e. nuclear structure and nuclear reactions, was realised for the first time. Joint workshops were held to seek ways of collaboration in performing state-of-the-art calculation. This was of great importance for the interpretation and understanding of the experimental results, which benefitted from these joint efforts where calculations of nuclear structure and nuclear reactions were combined. The other JRA SATNuRSE (Simulations and Analysis Tools for Nuclear Reactions and Structure in Europe) has been devoted to simulations, developments of analysis tools and data management, which benefit both JRAs and TNAs. In particular, the development of a data management protocol that would be useful for all TNAs has been one of the major aims as required by the European Commission and most of the national funding agencies. This would further improve the integration of the TNAs and the implementation of the Open Science principles in the nuclear physics infrastructures.

ENSAR2 organised two Town Meetings to bring the whole nuclear-physics research community together to discuss research results, achievement progress and perspectives. The first Town Meeting was held in Groningen, the Netherlands in the period April 17-20, 2018. The second Town Meeting was held in Athens, Greece in the period February 10-14, 2020.

All the NAs and JRAs reported on their activities via milestone and/or deliverable reports. In a certain sense, the NAs and JRAs have created successful procedures for integrating the sub-communities of ENSAR2 through their activities.

The major step towards integration of the TNAs was through the signing of the ENRI agreement, which foresaw close cooperation and coordination between the ENSAR2 Research Infrastructures (RIs) on topics of common interest including accelerator facilities, experiments in nuclear (astro-)physics, nuclear theory, expensive and technically advanced experimental equipment, and coordination of activities. In order to facilitate this, the Facility Coordinating Group (FCG) comprising the directors and chairpersons of local PACs of the ENRI participating laboratories, a representative of ENSAF network and the coordinator of ENSAR2 was established with the mission of this overarching FCG being the coordination and harmonisation between the ENSAR2 research infrastructures and also their PACs. The FCG met annually to discuss these issues and to consider further aspects of the collaboration between the research infrastructures on topics such as radiobiology, hadron therapy and other applications, educational programme (e.g., Euroschool on Exotic Beams) and the international dimension of the research. Regarding the latter point, the FCG mandated the ENSAR2 coordinator to sign MoUs with outstanding international laboratories. The objectives of the MoUs are to establish a general framework of collaboration and project relationship, implemented by the international partner institutes and IA ENSAR2 to increase cooperation between

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the parties in general and to provide a framework for establishing specific collaborative activities between the parties. The collaboration between the international partner institutes and ENSAR2 aims at:

- providing access to the international partner facilities for European physicists and vice versa to the facilities of IA ENSAR2 research infrastructures to international physicists following the rules of the various infrastructures, i.e. approved projects based on scientific merits and feasibility, and
- increasing cooperation and mutual support between the parties in general.

In an appendix of the MoUs, it was stipulated that each party shall be responsible for its own costs and expenses under the MoU, except as otherwise agreed in writing by the parties. The international partner institute will cover the daily expenses of European physicists, while performing experiments at its facilities, according to local per diem rules, and vice versa, IA ENSAR2 will cover the daily expenses of international physicists, while performing experiments at IA ENSAR2 RIs, according to local per diem rules of the IA ENSAR2 RIs. In the case of IA ENSAR2 support, mutual spokespersonship for the experiments is required.

Such MoUs were signed with the following international Research Infrastructures.

- China: IMP-CAS, Lanzhou
- Japan: RCNP, Osaka; RIKEN, Tokyo; IPNS (KEK) and CNS both located at RIKEN
- India: Tata Institute of Fundamental Research (TIFR), Mumbai
- JINR, Dubna
- South Africa: iThemba LABS, Cape Town
- U.S.A.: NSCL East Lansing; ANL Argonne

The MoUs were valid up to 29 February 2020. However, extension of ENSAR2 up to 31 August 2020 the international partners agreed likewise to extend the MoUs up to that date. These MoUs provided an international dimension for the integration of the ENSAR2 RIs.

The progress of the ENSAR2 project was regularly (3 times a year) presented by the project coordinator at the NuPECC meetings thus informing and getting feedback from the representatives of the EU countries and the ESFRI roadmap nuclear physics facilities represented in NuPECC. These presentations contributed to the continuous exchange of information and integration of the ENSAR2 facilities and other nuclear physics facilities or new projects in Europe (JINR, Dubna in Russia and MYRRHA project in SCK-CEN Belgium) and on other continents (Nishina Centre, RIKEN in Japan, iThemba LABS in South Africa and facilities in China and India).

CONCLUSIONS

ENSAR2 was very successful in integration of the nuclear-physics research community through its network activities and joint research activities but as importantly through integration action of the Transnational Access Activities by signing and implementing the ENRI agreement and the establishment of the Facility Coordinating Group (FCG). The overarching FCG met annually to do the coordination and harmonisation between the ENSAR2 research infrastructures and also their PACs and thus went a long way in the spirit of the ‘Integrating activity’ programme through integration of the transnational access and the progressive harmonisation of the access rules and procedures at the TNA facilities. The MoUs with the outstanding international laboratories gave an extra dimension for the integrating activities of ENSAR2, which should be pursued in any future integrating activity of the nuclear-physics community. In fact, the integration steps taken by ENSAR2 pave the way for the successor project to further integration of the community.