

Letter of intent:

ALFA: AcceLerator FAcilities for Hadron and Nuclear Physics

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On behalf of the participating nuclear physics infrastructures

1. Research objectives

In order to address contemporary issues and open questions in Hadron and Nuclear Physics, it is proposed to form a network of accelerator and other facilities offering physical Transnational Access for provision of services and instrumentation to carry out leading-edge research. The ultimate goal of the research to be carried out is to further our understanding of the strong interaction in a wide variety of systems covering a vast variation in scales (both spatial and temporal). Whilst to some extent being historically considered separate, there are many synergies and similarities in the scientific topics being addressed by the “Hadron”, “Nuclear” and “Particle” physics communities. In particular, the Hadron and Nuclear Physics communities are naturally linked within the scope of NuPECC and the scientific objectives outlined in the Long Range Plan for Nuclear Physics in Europe. The core areas of Hadron Physics: Hadron Spectroscopy, Structure and Interactions are paralleled in Nuclear Structure and Spectroscopy and Nuclear Reactions. In both Hadron and Nuclear Physics, a wide variety of probes and facilities are employed in parallel in order to understand the phenomena in question. The progression from the fundamental interactions of quarks, gluons and hadrons up to the stability of superheavy elements and physics of neutron stars is seamless and requires understanding at all scales.

Scientific topics of interest could include, but not be limited to:

- Nucleon-nucleon, nucleon-hyperon, nucleus-neutrino, three-body interactions
- Equation of State of nuclear matter
- Nuclear charge and matter radii
- Nuclear clustering phenomena
- Nuclear shapes and deformation determined through complementary methods
- Precision experiments in the search for BSM physics

In this LoI we focus on the services which can be offered by the so-called “low-energy nuclear physics” facilities, but this could be potentially expanded into a WP covering all physical TA for the project. The experimental facilities are supplemented by the centre for theoretical studies ECT*.

2. Connection to Transnational Access infrastructures (TAs) and / or Virtual Access projects (VAs)

As this LoI is directly focused on provision of TA, the connection is clear. The current LoI will strongly contribute to answering the expected outcomes of the Work Programme in providing:

- Wider, simplified, and more efficient access to the best research infrastructures available to researchers to conduct curiosity-driven research, irrespective of location;

- Breakthrough and leading-edge research enabled by advanced research infrastructure services, including from emerging facilities, made available to a wider user community, including in emerging areas of research;
- Improved and harmonised research infrastructure services and broader and more balanced use of research infrastructure resources across the EU and Associated Countries deriving from the exploitation of synergies and complementarities;

As highlighted in the Research Infrastructures chapter of the NuPECC Long Range Plan 2024, the Nuclear, Particle and Hadron physics communities have benefitted “from a number of selected leading European Research Infrastructures of excellent quality, ranging from test facilities for instrumentation to fully-fledged experimental facilities providing top-quality beam delivery and support...”. Owing to the complexity of the scientific goals, the current tendency is to follow a multi-observable experimental approach which often requires experimental campaigns at several “fully-fledged” facilities. Moreover, to ensure the success of an experiment at one of the “fully-fledged” facilities, it is essential to carry out development work (e.g., advanced tests of detectors, electronics and new technologies) at a smaller facility in advance. In many cases, it the same user group which is carrying out both type of experiments at different facilities. Such an approach is fully in line with the spirit and goal of TA activities as expressed by the EC.

Also in line with the expected outcomes and objectives of the call, we propose to investigate the possibilities of providing more streamlined access with revised access models compared to earlier projects. For example, a two-tier system could be envisaged, whereby scientific quality of the experimental proposals is still overseen by the local Program Advisory Committees of the Research Infrastructures, but a centralised User Selection Panel would oversee the distribution of T&S costs to the researchers. We are also investigating the various possibilities allowed within the grant agreement for provision of services, whilst not necessarily being a direct beneficiary of the project.

3. Estimated budget request

Based on the experience from the previous EU integrating activities and HE projects the budget request was estimated to be 2.5 M€. The budget will be distributed between TA access costs and provision of T&S support to users.

4. Participating and partner institutions

The following facilities are committed to providing TA to the community. More details will be presented at the Town Meeting in Nantes.

CERN – ISOLDE and n-TOF

FAIR/GSI (ESFRI)

INFN – LNL and LNS

IN2P3 – IJCLab infrastructures

GANIL-SPIRAL2 (ESFRI)

ELI-NP / IFIN-HH (ESFRI)

JYFL-ACCLAB

NLC Consortium - HIL Warsaw, IFJ/CCB Krakow

Consortium Group – IABA (CNA Seville/CMAM Madrid), ATOMKI Debrecen, IST Lisbon

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