The EU Grant Agreement ENSAR: Transnational Access to LNL and LNS

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INTRODUCTION

The duration of the EU grant agreement ENSAR (no. 262010) was extended up to end of 2014 (four more months). In 2014, data taking of experiments at Laboratori Nazionali di Legnaro (LNL) and Laboratori Nazionali del Sud (LNS) was mainly supported through the reimbursement of travel and/or subsistence expenses of eligible users involved in sixteen projects selected by the ENSAR User Selection Panel. In total, 534 person-days were delivered to 78 European users. The nationality distribution of the belonging institutions of the supported users is shown in figure 1.

![Number of users grouped according to nationality of the belonging institution.](image)

NUCLEAR PHYSICS PROJECTS

Nine experiments made use of Nuclear Structure and Dynamics Based Facilities (NSDBF).

Secondary beams ⁶Li and ⁷Be produced by means the EXOTIC facility at LNL have been used to study possible deviations from the Rutherford scattering and the coupling channel effects for the ⁶Li+⁹⁰Zr system at energies below the Coulomb barrier and to investigate elastic scattering and reaction mechanisms at near barrier energies for the ⁷Be+²⁰Si reaction (two projects funded).

Measurements of astrophysical interest have been performed on the LIRAS beam line. In particular, the structure of carbon nuclei A=10-14 populated in the ¹⁴N+⁶B reaction and resonances in the excitation function of the ²⁰Ne+⁴He have been studied through kinematically complete measurements. The reaction products have been detected in highly segmented silicon strip detector telescopes which made possible their unambiguous identification (two projects funded).

Fragment yields populated in the inverse kinematics reaction ¹⁹⁷Au+¹³⁰Te have been measured with the large solid angle magnetic spectrometer PRISMA at LNL equipped with the new second arm. This experiment should allow to evaluate the population of neutron rich nuclei via multinucleon transfer reactions in certain regions of the nuclear chart, like that below ²⁰⁹Pb or in the actinides, which can be hardly accessed by fragmentation or fission reactions (one project funded).

Detailed studies of the fusion process for the reactions ⁶⁴Ni+¹²⁵Sn, ⁴²Ca+⁴⁰Ca and ⁵⁸Ni+¹²⁵Sn were performed with the electrostatic deflector at LNL (three projects funded).

Near- and sub-barrier fusion excitation functions have been measured in order to:

- verify the effect of Q-value systematics on heavy ion fusion below the Coulomb barrier;
- extract barrier distributions with good accuracy;
- investigate the possible influence of transfer channels on sub-barrier fusion of heavy ions.

Total reaction and breakup cross sections have been measured at LNS for the inverse kinematic reaction ⁶Li+p at near Coulomb barrier energies in coincidence measurements between the large acceptance magnetic spectrometer MAGNEX close to 0° and a silicon detector at ⁵° (one project funded).

INTERDISCIPLINARY PHYSICS PROJECTS

Seven experiments were carried out at Applied and Interdisciplinary Physics Facilities (AIPF).

Rutherford Back-scattering Spectrometry and the PIXE techniques were used at the Micro-beam facility of LNL to perform elemental analysis of archaeological samples from Romanian museums (four projects funded).

The effects of the irradiation of cell cultures and human malignant cells with for ⁶²A²⁺ MeV protons and ¹²C ions were studied at the CATANA facility and the irradiation facility located at the ⁰° beam line at LNS (two projects funded).

The ionization cluster size distributions generated by ¹²C⁺ ions with kinetic energies of 48 MeV, 78 MeV, 96 MeV, 102 MeV and 156 MeV in a target gas, consisting of 1.2 mbar C₃H₈, have been studied with the PTB counter at LNL (one project funded).

Status of the data analysis and achievements of the LNL funded projects are reported in this annual report.