TNA03: TRANSNATIONAL ACCESS TO INFN LNL-LNS

PUBLICITY CONCERNING THE OPPORTUNITIES FOR ACCESS TO TNA03

A web site dedicated to the Transnational Access activity was built and published at http://www.lnl.infn.it/~ENSAR/ since 15th November, 2010. It is continuously updated and contains all the useful information for the European research groups interested to apply in order to get the financial support foreseen by the grant agreement. The site comprises information about:

- Accelerators
- Instrumentation
- Research activities
- Scientific Committees
- How to apply
- Financial support
- After leaving LNL-LNS
- Logistic support
- Documents
  - Grant Agreement
    - Annex II - General Conditions
    - Annex III – Specific Provisions for Transnational Access Activities
  - TNA forms
    - TNA03 application form
    - List of users
    - List of users publications
    - Experiment Summary Report
- Calls.

ENSAR opportunities were presented by the TNA scientific leader during the following meetings and workshops:

- Giornata d'incontro Utenti-Divisione Acceleratori - Febraury 11th, 2011
  The EU-FP7 funded Integrating Activity ENSAR
- Interdisciplinary Physics with Ion Beams: Status and Perspectives - LNL Users Workshop June 16th-17th, 2011 – LNL
  The ENSAR project
  (http://agenda.infn.it/conferenceDisplay.py?confId=3777)
- Meeting the LNL User Community – July 11th, 2011 – LNL
  The EU-FP7 funded Integrating Activity ENSAR
- Meeting of the LNL Research Division - Proposte attività di ricerca con acceleratori 2012-2013 January 19th, 2012 – LNL
  The EU-FP7 funded Integrating Activity ENSAR

SCIENTIFIC COMMITTEES

LNL and LNS are user oriented laboratories offering several research infrastructures to national and international groups. The access to these facilities (accelerators and experimental set-ups) has to be requested by submitting a written scientific proposal. An additional application form has to be submitted by the users interested to obtain the EU support foreseen by the ENSAR grant agreement. The evaluation of the scientific proposal is carried out by the LNL and LNS Scientific Committees:

- a Program Advisory Committee (PAC) for nuclear physics experiments at the XTU Tandem/PIAVE-ALPI accelerator complex of LNL and a User Selection Panel (USP) for applied and interdisciplinary physics projects to be performed at the same accelerator complex and at the AN2000 and CN Van de Graaff accelerators;
- a Program Advisory Committee (PAC) for nuclear, applied and interdisciplinary physics experiments at the SMP Tandem, the K800 Superconducting Cyclotron and the EXCYT facility of LNS.

The PAC compositions are available at: LNL PAC (http://www.lnl.infn.it/pages/pac.htm) and LNS PAC (http://www.lns.infn.it/index.php?option=com_content&view=article&id=477&Itemid=223). Please note the LNL PAC was renewed at the end of 2011 with the replacement of 5 members including its chairman. The LNL USP composition is available at http://www.lnl.infn.it/pages/usp.htm.

The Program Advisory Committees (PAC) of LNL-LNS and the LNL USP meet once/twice a year depending on the limits of the beam time available for users fixed by the schedule of maintenance and upgrade operations of the research infrastructures. Calls for proposals are routinely published on the LNL/LNS web pages. Moreover, user groups are informed by e-mail about the deadline for proposal submission. Proposals must be submitted via web by using the on-line submission forms available within the LNL and LNS web pages.

For the selection of the projects which could benefit of TNA funds within the ENSAR project INFN adopted a two-step procedure involving the local PACs and USP for the reviewing of the scientific proposals on the basis of the scientific merit and the allocation of beam time and leaving the final decisions about the financial support to a unique ENSAR User Selection Panel (ENSAR USP). Its composition is available at http://www.lnl.infn.it/~ENSAR/. The ENSAR USP has been appointed by the President of INFN on May 24th, 2011 (Disposizione N. 14447). No changes occurred in the composition of the ENSAR USP during the reporting period.

The list of the ENSAR USP members for the reporting period can be found in Annex 1 (Database).

Calls for Proposals, both for the beam time request and for the EC support, are issued once/twice a year according to the schedule of the accelerators. Detailed information on how to submit a proposal is available at:
http://www.lnl.infn.it/%7Etandem/TAcall.html and
http://www.lns.infn.it/index.php?option=com_content&view=article&id=543&catid=1&Itemid=100.

Call for Proposals during the reporting period:

- ***LNL PAC*** for experiments at Nuclear Structure and Dynamics Based Facilities (NSDBF)
  Deadlines: February 4th, 2011 and June 10th, 2011;
- ***LNL USP*** for experiments at Applied and Interdisciplinary Physics Facilities (AIPF).
  Deadlines: February 12th, 2011 and June 30th, 2011;
- ***LNS PAC*** for experiments at NSDBFs and AIPFs.
  Deadlines: May 8th, 2011;
- ***ENSAR USP***
  Deadlines: June 22nd, 2011; October 3rd, 2011.

MEETINGS OF THE SCIENTIFIC COMMITTEES

The PAC and LNL USP meetings during the reporting period were held:

- on March 3rd – 4th, 2011 – PAC at LNL;
- via e-mail in March 2011 – LNL USP;
- on July 11th – 13th, 2011 – PAC at LNL;

- via e-mail in July 2011 – LNL USP;
- on June 23rd – 24th, 2011 – PAC at LNS.

The ENSAR USP meetings during the reporting period were held on:

- July 13th, 2011 at LNL;
- October 10th – 12th, 2011 via e-mail.

SELECTION CRITERIA

All proposals, including those requiring EC support under the grant agreement, are reviewed, on the basis of scientific merit, by the local PACs and the LNL USP (for applied and interdisciplinary projects at LNL). In a second step, the ENSAR USP reviews the funding applications evaluating the support requested for setting up and executing the experiment and deciding on the person-days and travel refund to be allocated to the involved user groups. Communication of the selection result, whether positive or negative, is finally sent by e-mail to all group leaders (spokespersons) of the projects. The ENSAR USP bases its selection on the scientific merit following the priorities and the prescriptions mentioned in the Annex III "Specific Provisions for Transnational Access Activities" of the grant agreement.

TRANSNATIONAL ACCESS ACTIVITY DURING THE REPORTING PERIOD

The activity started at the end of May 2011 after the signature of the Consortium Agreement, the first budget transfer to INFN and the appointment of the ENSAR User Selection Panel.
Please find below short reports on the status of the LNL and LNS accelerators and details about the supported experiments during the reporting period.

Status of the LNL accelerators

TANDEM/PIAVE-ALPI accelerator complex - After more than 13000 hours operation, the laddertron charging belt of the XTU Tandem was replaced in September 2010, due to worn plastic links. In the last part of the year an unscheduled Tandem opening revealed a leakage of one of the two large heat exchangers located in the SF6 tank. These heat exchangers were replaced in February 2011. After this intervention the maximum terminal voltage increased from 13.3 MV to 14.5 MV,

During ordinary maintenance in September 2010, the internal purifier of the cold box of the ALPI Linac was found to be severely damaged by an oil contamination originating from the compressor system. Due to the long downtime which would have been necessary for its repair, it was decided to start the plant using the PIAVE cryo-plant purifier in its place. However, during the setup phase of the accelerator the liquid helium level in the medium-β cryostats located at the end of the low energy branch was not stable, but rather subject to sudden emptying. Eventually, on December 24 a fault in the cryo-plant control system caused even a plant stop. These events called for a major extraordinary maintenance of the whole plant, completed in April 2011. The first beams accelerated by the XTU Tandem-ALPI accelerator complex were provided starting from the beginning of June. The experimental activity with superconducting injector PIAVE coupled to the Linac ALPI was postponed to the beginning of July. Due to the long shutdown and to the laboratory commitments towards the users, it was decided to keep the cryogenic facilities on, and the accelerators in stand-by, during August 2011, in order to anticipate the restart of operations after the summer break.

Operation was resumed, with Tandem, PIAVE and ALPI facilities all available, at the end of September 2011, and continued with a high degree of reliability till the end of the herein relevant period.

AN2000 Van de Graaff accelerator - The interventions on the machine were mainly focused on the water cooling system and on the accelerator vault re-cabling to improve the safety of the accelerator and the experimental hall. The control system of the micro-beam slits was motorized and automated in order to be able to operate them being in the control room and to improve the beam quality of the micro-beam line. A new magnetic field NMR meter was installed in order to have the possibility of a new energy calibration of the delivered beam. In consequence of the aging of the accelerator components the machine requires a more careful maintenance which is time consuming and presents problems about the acquisition of spare parts. In spite of that the accelerator followed the beam time schedule with a good reliability.

CN Van de Graaff accelerator - It presented some problems due to the aging of the components, such as: a vacuum leak in the analysing magnet vacuum chamber, a leaking problem with the gas valves of the ion source, the breaking of the insulating transformer on the high voltage terminal. These events limited the beam-on-target time and in some occasion forced unscheduled maintenance. During the operation the beam quality was good in terms of intensity and of energies which are now limited by a voltage little more than 6 MV due to the machine conditioning time requirements and the accelerating tube aging. The capability of delivering pulsed beam was restored for user activities.

The following table summarizes the total number of hours for unscheduled maintenance and for beam preparation of the LNL accelerators and the total quantity of access actually provided to all users during the reporting period.

Accelerator	Unscheduled maintenance (hours)	Beam on target (hours)	Beam preparation (hours)
Tandem/PIAVE-ALPI	660	5.154	717
AN2000		2.835	
CN		1.661	

Status of the LNS accelerators

SUPERCONDUCTING CYCLOTRON - From September to December 2010 the Superconducting Cyclotron was not operated to allow the upgrade of the Fragmentation Radioactive Ion Beams (FRIBs) facility providing in-flight "tagged" radioactive beams. In particular, a new configuration of the cyclotron extraction line, based on several quadrupole and two sextupole magnets, was arranged according to optics simulations. The upgraded facility, named FRIBS@LNS, is able to increase the acceptance of the beam line and therefore the yield of the produced radioactive beams.

In 2011 Cyclotron beams were delivered from January to July and from October to December, for a total amount of about 2670 beam hours on target. In May 2011, for a couple of weeks, extraordinary maintenance was needed to replace the inflector system, which caused two experiments to be re-scheduled. As usually every year, September 2011 was dedicated to scheduled maintenance.

In January 2012, for a couple of weeks, the new injection system was installed and tested on the ECR source CAESAR. The new installation will improve the source performance. In the same period, it was necessary to open the cyclotron to fix an iron shim, which had accidentally moved.

From January to February 2012, a total amount of 450 beam hours were delivered.

SMP TANDEM - Since the above mentioned upgrade of the FRIBs facility involved also the Tandem area, no Tandem beam was delivered from September to December 2010, when maintenance was accomplished. The maintenance activities mainly concerned the replacement of the charging belt.

In 2011, Tandem beams were delivered from January to July, for a total amount of 1810 beam hours on target.

In May 2011 (the whole month) the tank was opened to replace some damaged resistors. In September-October 2011 (2 months) the control system of the 450 KV pre-injector was renovated (scheduled maintenance). In November 2011 frequent breakdowns of the terminal voltage forced to cancel the experiments planned until the end of 2011. Also, the residual pressure in the Low Energy section increased by one order of magnitude. Then it was decided to have a long stop for extraordinary maintenance, with the aim of investigating on the two major problems of the Tandem: a) the charging system; b) vacuum losses in the Low Energy section. Consequently no Tandem beam has been delivered in 2012.

The following table summarizes the total number of hours for the maintenance and for beam preparation of the LNS accelerators and the total quantity of access actually provided to all users during the reporting period.

Accelerator	Maintenance (hours)	Beam on target (hours)	Beam preparation (hours)
Tandem SMP	1.330	1.810	280
SC Cyclotron	580	3.120	1.420

Supported projects

NUCLEAR STRUCTURE AND DYNAMICS BASED FACILITIES (NSDBF) - The research activity of the nuclear physics community has been mainly centred around the **AGATA Demonstrator** at LNL coupled to the large acceptance magnetic spectrometer **PRISMA** and one or more specialized ancillary devices such as the Köln **differential Plunger**, ΔE-E Si telescopes of the **TRACE** array, position sensitive micro-channel plate detectors of the **DANTE** array, and **large volume $LaBr_3$ scintillators** for the detection of high-energy γ-rays. The AGATA Demonstrator in its final configuration comprising five triple clusters, fully equipped with the detector support system and electronics, was operational at LNL since the beginning of June 2011, bringing its performance to the expected values, namely photopeak efficiency ranging from 3% to 7.5% (depending on the target-detector distance) for single 1 MeV photons, with a P/T~50%. It made use of more than 50% of the total beam time available at the XTU Tandem/PIAVE-ALPI accelerator complex of LNL. Binary reactions were routinely used to populate moderately neutron-rich nuclei in mass regions of interest for nuclear structure studies. Measurements of the energy and angular distributions of the gamma radiation, tagged by the PRISMA spectrometer identifying element Z, mass A and energy E of the emitting source, allowed the identification of the populated states with the assignment of spin and parity.

Proposed experiments also requested access to the large solid angle magnetic spectrometers **PRISMA** (as standalone device) at LNL and **MAGNEX** at LNS and **scattering chambers**.

In total during the reporting period:

- 33 proposals were presented to the LNL PAC Committee, 15 of which were approved for beam time (average acceptance rate of about 45%);
- 32 proposal were presented to the LNS PAC Committee, 29 of which were approved for beam time (average acceptance rate of about 90%);
- 17 projects asked for EC support (six of them referred to projects approved in the LNL and LNS PAC meetings held on July 22nd-23rd, 2010 at LNL and on June17th-18th, 2010 at LNS, and one to a project approved in the LNL PAC meeting held on July 14th-15th, 2008), 16 were considered eligible and 15 of them were selected by the ENSAR USP.

Research projects funded during the reporting period have covered the most up-to-date research fields:

Project Acronym	***Project Title***
LNL 10.44	Lifetimes of intruder states in N~20 *sd-pf*-shell neutron-rich nuclei
LNL 10.40	Development of the nuclear structure of neutron–rich isotopes in the Z~38 region populated by heavy–ion induced fission
LNL 10.30	RDDS lifetime measurement in the region of the neutron-rich doubly magic ^{132}Sn: Lifetime of the 6^+ state in ^{136}Te
LNL 10.41	Structure beyond the N=50 closure in neutron-rich nuclei in the vicinity of ^{78}Ni: the case of N=51 nuclei
LNL 11.22	Spectroscopy of neutron rich Th and U nuclei after multi-nucleon reactions
LNL 11.25	Collectivity at maximum nucleon valency: investigation of ground-state rotation in the neutron-rich Dy, Er and Yb nuclei
LNL 11.32	Study of high-lying bound and unbound states in ^{124}Sn and ^{140}Ce via inelastic scattering of ^{17}O ions
LNL 11.33	Transfer reactions in ^{116}Sn+^{60}Ni at deep sub-barrier energies
LNS GPV	GPV measurement in Sn and Pb with (*p*,*t*) reaction
LNS FAZIA	Test of FAZIA prototypes at LNS

It is worthwhile to mention that:

- the experiments LNL 10.41, LNL 11.22, LNL 11.25, LNL 11.32 have been already performed and partially reimbursed;
- the experiment LNL 11.33 has been performed at the beginning of February 2012 but not yet reimbursed.

The ENSAR USP also approved the following experiments:

- LNS NICAR which was scheduled in December 2011 but postponed due to technical problems with the SMP Tandem;
- LNS COSMOLIT which was cancelled by the group leader because new experimental results (published after the PAC meeting at LNS in June) made it irrelevant. The purpose of the experiment was to study the properties of a certain state in ^{9}B which, it had been argued, could potentially solve the cosmological lithium problem. The new experimental results, published in August and September, showed that the state did not have the right properties to solve the cosmological lithium problem. Consequently, the ENSAR support approved for this experiment was also cancelled;
- LNL 11.24, LNS LIP-MAGNEX, LNS TODD which will be performed in the forthcoming months.

Objectives and achievements of the funded experiments

LNL 10.44 - *Lifetimes of intruder states in N~20 sd-pf-shell neutron-rich nuclei*

To measure the lifetimes of states of neutron-rich nuclei in the *sd-pf*-shell region and, particularly, in the N=20 isotones, ^{34}Si, ^{35}P, ^{36}S, and ^{37}Cl. The neutron-rich species are populated in binary grazing reactions following the interaction of 6*A* MeV ^{36}S ions with a thin ^{208}Pb target. Lifetimes are measured using the Köln **differential Plunger** in conjunction with the **PRISMA** magnetic spectrometer and the **AGATA Demonstrator** (5 triple clusters).

The lifetime data are currently being analysed by two PhD students at IPHC Strasbourg and at University of the West of Scotland. The data will form the basis of the PhD theses of the two students. Good progress is being made with the analysis.

LNL 10.40 - *Development of the nuclear structure of neutron–rich isotopes in the Z~38 region populated by heavy–ion induced fission*

To investigate the nuclear structure in the neutron–rich Zr (N≥64) and of the neutron-rich Kr and Se isotopes (N≥56) regions using the **PRISMA** spectrometer and the **AGATA Demostrator** with heavy–ion induced fission reactions of ^{238}U bombarded with ^{136}Xe ions at about 1 GeV beam energy.

Due to instabilities in the PIAVE-ALPI cryogenic plant, additional days of beam time were allocated to the experiment. The data analysis of the data is ongoing. Data taken during the recovery time have to be re-played due to recalibrations.

LNL 10.30 - *RDDS lifetime measurement in the region of the neutron-rich doubly magic ^{132}Sn: Lifetime of the 6^+ state in ^{136}Te*

To study the lifetime of the 6^+ state in ^{136}Te by using the differential RDDS technique in order to extend the knowledge of the transition probabilities in this nucleus to the 6+→4+ transition. This nucleus has been populated using multinucleon transfer reactions with a ^{136}Xe beam at an energy of 1.2 GeV, impinging on the ^{208}Pb target. Lifetimes have been measured using the **differential Plunger** in conjunction with the **PRISMA magnetic spectrometer** and the **AGATA Demonstrator**.

Instabilities in the PIAVE-ALPI cryogenic plant as well as problems with the stability of the beam, required that additional days of beam time were allocated to the experiment. Nevertheless, it was possible to obtain data for two of the proposed three RDDS distances. The complex analysis procedure for AGATA-PRISMA is being performed at IFIC.

LNL 10.41 - *Structure beyond the N=50 closure in neutron-rich nuclei in the vicinity of ^{78}Ni: the case of N=51 nuclei*

To measure the lifetime of excited states (especially the $7/2^+$) in N=51 Br, Se, and Ge nuclei in order to assign a single-particle or a collective character to them. The nuclei of interest were produced in multi-nucleon transfer reactions of ^{82}Se (at 505 MeV) on U. Residues were detected in the **PRISMA** spectrometer, the gamma-rays in the **AGATA Demonstrator** and a **differential Plunger** was used to slow down the residues before entering into PRISMA.

All the multi-nucleon transfer residues Se, As and Ge have been identified on-line and A,Z conditioned gamma-ray spectra have been produced. This enabled to follow the statistics accumulation during experiment and to realize the right choices for the plunger positions. Surprisingly, a strong pollution from Se was observed in all spectra.

Data analysis is in progress.

LNL 11.22 - *Spectroscopy of neutron rich Th and U nuclei after multi-nucleon reactions*

To measure γ-spectroscopy of excited states in neutron-rich actinide nuclei $^{234\text{-}238}$Th and $^{240\text{-}242}$U populated through multi-nucleon transfer reactions in the ^{136}Xe+^{238}U system at 930 MeV. The experiment aims for verification of several recent theoretical predictions for the most neutron rich U and Th nucleus. The **PRISMA** spectrometer was used to detect beam-like reaction products of Xe isotopes after neutron transfer and Ba nuclei after two-proton and neutron transfer. Highly fissile actinide reaction products were selected with the **DANTE** array and the coincidences with target like gamma-rays have been observed with the **AGATA Demonstrator**.

A reasonable large data set was collected. Data analysis is ongoing and individual isotopes of the beam like reaction products have been identified successfully for a various Z channels. The analysis of the kinematic coincidences between the two reaction products is just started and will allow clean conditions for in-beam γ-ray spectroscopy with the AGATA demonstrator.

LNL 11.25 - *Collectivity at maximum nucleon valency: investigation of ground-state rotation in the neutron-rich Dy, Er and Yb nuclei*

To explore the ground-state structure in neutron-rich rare-earth nuclei populated through multinucleon transfer reactions with the ^{136}Xe+^{170}Er system at 900 MeV. The ^{136}Xe beam was delivered by the PIAVE-ALPI accelerator complex. The experimental setup consisted of **AGATA Demonstrator**, **DANTE** array and **PRISMA** spectrometer.

The experiment went quite nicely. The data analysis is in progress.

LNL 11.32 - *Study of high-lying bound and unbound states in ^{124}Sn and ^{140}Ce via inelastic scattering of ^{17}O ions*

To study of the nuclear structure properties of the Giant Quadrupole Resonance and, in particular, of the pygmy dipole resonance in the ^{124}Sn and ^{140}Ce mass region and to compare the results with previous experiments concerning similar studies for ^{208}Pb. The measurement was done using inelastic scattering of ^{17}O beam on ^{124}Sn and ^{140}Ce targets. The experimental setup consisted of **AGATA Demonstrator**, 8 **large volume $LaBr_3$** detectors and two ΔE-E Si telescopes of the **TRACE** array for the scattered ions identification.

The data analysis is still in the pre-sorting phase (i.e. data replay with the narval emulator).

LNL 11.33 - *Transfer reactions in ^{116}Sn+^{60}Ni at deep sub-barrier energies*

To study the behaviour of single and pair transfer channels at far sub-barrier energies and compare this superfluid system with the previously measured closed shell ^{96}Zr+^{40}Ca case. The comparison will improve our understanding of the origin of the enhancement factors for even number of transferred particles and of the role played by nucleon-nucleon correlations. An excitation function (from 500 MeV to ~400 MeV) was measured for multinucleon transfer channels in the ^{116}Sn+^{60}Ni inverse kinematics reaction from the Coulomb barrier to ~25 % below. Ni-like target recoils at forward angles with the **PRISMA** magnetic spectrometer,

The data analysis is in a preliminary stage, but the first results demonstrate the good resolution in charge and mass, and a low background of the collected data.

LNS GPV - *GPV measurement in Sn and Pb with (p,t) reaction*

To study the Giant Pairing Vibrations (GPV) - which is a collective mode in the two neutron transfer channel – in Sn and Pb nuclei through the (*p*,*t*) reaction at 35 MeV. The large solid angle magnetic spectrometer **MAGNEX** at LNS was used for this experiment. The study of the GPV would also provide crucial information on the pairing interaction: the transfer cross-section depends on the form factor of the two transferred neutrons.

The data analysis is in progress.

LNS FAZIA - *Test of FAZIA prototypes at LNS*

To further extend mass identification for very low energy particles using the additional information provided by Time of Flight. To that aim, new detectors have been ordered, with reduced sheet resistance in order to improve timing performances. Some prototypes of the **FAZIA** detection system were installed in the **CICLOPE scattering chamber** and tested with the ^{84}Kr+Sn reaction at 35*A* MeV.

The experiment was a success. The ^{84}Kr beam delivered by the Superconducting Cyclotron had a good timing resolution and the user group was able to perform time of flight measurements and to test the new detectors. In a second step different depletion voltages applied to the silicon detectors were also used in order to study how the particle identification performances evolve. Also in this case very good results have been achieved. The full analysis is still in progress.

Details about the quantity of access and the ENSAR support for the selected user groups are available in the following table.

Project Acronym	***Access (beam-on-target hours)***	***Person-days***	***Visits***	***Users***
LNL 10.44	187,5	59	7	7
LNL 10.40	312,5	65	8	8
LNL 10.30	329,5	44	7	7
LNL 10.41	236	68	9	9
LNL 11.22	178,5	80	10	9
LNL 11.25	112,5	78	12	12
LNL 11.32	192	64	12	11
LNL 11.33	208	36	5	5
LNS GPV	120	6	1	1
LNS FAZIA	170	45	6	6
	2046,5	**545**	**77**	**75**

APPLIED AND INTERDISCIPLINARY PHYSICS FACILITIES (AIPF) - The research activity has been mainly centred around the elemental analysis of samples of different nature by using nuclear techniques based on the Ion-Beam Analysis (IBA) with the **micro-beam** facility and radiobiological studies with the irradiation of cell cultures at the **0° beam line** at LNS. The **Micro-beam** facility at the AN2000 V.d.G. accelerator represents the most important Applied and Interdisciplinary Physics Facility of LNL.

In total during the reporting period:

- 84 proposals were presented to the LNL USP, 79 of which were approved (corresponding to an average acceptance rate - in the number of experimental days - of about 70%) for beam time;
- 10 proposals were presented to the LNS PAC, 9 of which were approved (acceptance rate of 90%) for beam time.
- 7 projects asked for EC support, 7 were considered eligible and 4 of them were selected by the ENSAR USP.

The funded projects covered different fields of applications:

Project Acronym	***Project Title***
LNL USP11.71	Micro-PIXE studies on archaeological samples (MicroArchaeoStudy)
LNS DNA-BRAGG	DNA damage and cellular response along and around the Bragg curve of heavy ions
LNL USP11.58	Contaminant Migration in radioactive waste repositories by Ion Beam Techniques (COMIBEAT)

It is worthwhile to mention that the experiment:

- LNS DNA-BRAGG has been partially funded because it comprises several irradiation shifts and the second one was performed at the beginning of February but not yet reimbursed;
- LNL USP11.58 has been performed at the end of February 2012 but not yet reimbursed.

The ENSAR USP also approved the following experiment:

- LNS BIOMAS-Arcor which will be performed in the forthcoming months.

Objectives and achievements of the funded experiments

LNL USP11.71 - *Micro-PIXE studies on archaeological samples (MicroArchaeoStudy)*

To determine the (micro)composition – major and minor traces of elements and micro-inclusions – of same archaeological objects from Romanian museums (obsidian Neolithic tools, ceramics and glass mineral pigments, bronze and gold items) using the PIXE technique at the **Micro-beam** facility. Samples of geological obsidian from different sources have been also analyzed and compared with the archaeological samples. The data should allow the archaeologists to authenticate and to determine the provenance of the objects (geological deposits, metal mines). The user group is planning to present some preliminary results at the 5th Annual International Conference on Mediterranean Studies in Athens, 4th-7th April, 2012.

LNS DNA-BRAGG - *DNA damage and cellular response along and around the Bragg curve of heavy ions*

To characterize the Relative Biological Effectiveness (RBE) of glioma cell line (U87) exposed at different depths of a 62 MeV carbon ion beam. The **0° beam line** at LNS was used for the characterization of Biological endpoints investigated: cell survival and formation of chromosomal aberrations.

LNL USP11.58 - *Contaminant Migration in radioactive waste repositories by Ion Beam Techniques (COMIBEAT)*

To determine radionuclide transport and retention parameters within the materials selected as barriers in radioactive waste repositories (cement materials, clay and crystalline rock). The RBS (Rutherford Backscattering Spectrometry) and μPIXE (micro-Particle Induced X-Ray Emission) techniques, available at the **Micro-beam** facility, were selected for determining quantitative diffusion surface retention coefficients, accounting for the materials heterogeneity, what cannot be studied by conventional methodologies.

Within last semester (July 2011-March 2012), the comparative study of uranium retention on granite was undertaken, under oxic and anaoxic conditions, on granite samples from the underground research laboratory of Aspö (Sweden). Anoxic experiments were carried out preserving the natural reducing conditions, occurring 500 m depth in granite, from the site extraction to sorption experiments. Uranium distribution coefficients were measured, by μPIXE analyses, on selected minerals, under both redox conditions. Very little data were so far available. These data is very helpful to provide sound sorption parameters to be used in performance assessment studies of deep geological repositories for high-level radioactive waste.

Details about the quantity of access and the ENSAR support for the selected user groups are available in the following table.

Project Acronym	***Access (beam-on-target hours)***	***Person-days***	***Visits***	***Users***
LNL USP11.71	44	10	4	2
LNS DNA-BRAGG	64	23	5	3
LNL USP11.58	22,5	8	2	2
	130,5	**41**	**11**	**7**

During the reporting period, in total 13 projects have been supported, 2177 beam-on-target hours were provided, 82 users (59 users already reimbursed) – 70 individual users and 29 new users - had access to the INFN/LNL-LNS research infrastructures and 586 person-days and 88 visits were allocated (438 person-days and 62 visits already reimbursed).

The list of user-projects supported in the reporting period and the list of users can be found in Annex 2 and Annex 3 (Database).

SCIENTIFIC OUTPUT OF THE USERS AT THE FACILITIES

The activity started at the end of May 2011 and, due to the time requested for the data analysis, obviously no publications can be expected from such complex experiments within less than one year. Publications gathering results from financed projects are constantly monitored: e-mails are periodically sent to group leaders inviting them to send any scientific useful detail concerning the funded projects (last e-mail January 20th, 2012). Some results from the supported experiments are given below.

LNL USP11.71

Beam: ^{1}H at E_{lab}=2 MeV

During the two shifts 25 samples of archaeological Neolithic obsidian (small blades) from Transylvanian sites (near Oradea and from Danube border between Romania and Serbia) and 10 samples of geological obsidian from various sources (Tokay Mountains, Melos and Yali Greek islands, Lipari island, Armenia, Mexico) have been analyzed by using the micro-beam facility at the AN2000 Van de Graaff accelerator of LNL. The goal of these studies is to allow the archaeologists to authenticate and to determine the provenance of the objects (geological deposits, metals mines, workshops).

The preliminary data indicate for the Danube region a model of obsidian trade routes – from Greek islands at the end of Mesolithic and Early Neolithic (using Morava and Drava rivers) and from Tokay Mountains (now in Hungary and Slovakia) during Neolithic and Chalcolithic (using Danube river).

LNS DNA-BRAGG

Beam: ^{12}C at E_{lab}=62A MeV

Survival curves (0-5 Gy in duplicate) at 10 different depths (including the Bragg peak) along the trajectory of a 62 MeV carbon ion beam have been performed using the glioma U87 cell line. Accurate dosimetry at each position has been performed using Gaffchromic films and a Markus ionization chamber. Data have been used to calculate the Relative Biological Effectiveness (RBE) of each depth. Cells have also been exposed (2 depths, entrance and centre of the Bragg peak) for chromosomal aberration analysis.

These data are expected to help dosimetry planning for clinical applications.

Up to now no publications linked to the projects funded within ENSAR has been provided by the user group leaders. The list of publications appeared in peer-reviewed journals (or peer-reviewed conference proceedings) and resulting from projects carried out at LNL and supported through the EC contract EURONS (no. RII3-CT-2004-506065) within the Sixth Framework Programme can be found in Annex "PR1 _TNA03_Publications.pdf" These publications have been never reported in previous EURONS activity reports.

USERS MEETINGS

The User Community of both laboratories is represented by committees composed of several selected members (User Board at LNL and User Committee at LNS). The composition of these committees is available at:

- http://www.lnl.infn.it/~lnldir/USERS/members.html
- http://www.lns.infn.it/us_com

The User Communities meets once/twice a year.

Several user meetings were held during the reporting period:

- March 16th, 2011 at LNL – LNL User Board;
- July 11th, 2011 at LNL – LNL User meeting;
- January 19th, 2011 at LNS – LNS User Committee;
- June 22nd, 2011 at LNS - LNS User meeting.

Moreover, several meetings and workshops, related to the Access Activity, were also held at LNL and LNS during the reporting period (see table below).

Title of event	Venue	Date	Attending people
SPES2010 International Workshop	LNL	November 15th-17th, 2010	163
IV French-Italian meeting of the Associate European Laboratory (LEA-COLLIGA)	LNL	November 18th-19th, 2010	
MAGNET 2010 - Nuclear Physics with Modern Magnetic Spectrometers.	LNS	December 14th-16th, 2010	65
Giornata d'incontro Utenti-Divisione Acceleratori	LNL	February 11th, 2011	30
National Course: "Detectors and Electronics for High Energy Physics, Astrophysics, Space Applications and Medical Physics"	LNL	April 11th-15th, 2011	72
Interdisciplinary Physics with Ion Beams: Status and Perspectives - LNL Users Workshop	LNL	June 16th-17th, 2011	38
First SPES school on experimental techniques with radioactive beams	LNS	November 8th-11th, 2011	60
Meeting of the LNL Research Division - Proposte attività di ricerca con acceleratori 2012-2013	LNL	January 19th, 2012	20

List of Panel members

Grant Agremeent 262010
ENSAR

Reporting Period PR1
Eligible proposals 23
Selected proposals 19

Infrastructure Short Name	Family_Name	First_Name	Gender	Nation-ality	Home Institution			Email	Additional Information
					Institution Name	Town	Country		
LNL-LNS	Vitturi	Andrea	M	IT	Università degli Studi di Padova (Prof.)	PADOVA	IT	andrea.vitturi@unipd.it	
LNL-LNS	Kacperek	Andrzej	M	GB	Douglas Cyclotron, Clatterbridge Center for Oncology NHS FT (Dr.)	Bebington	GB	andrzej.kacperek@ccotrust.nhs.uk	
LNL-LNS	Bougault	Remi	M	FR	Einsicaen, Ecole Nationale Superieure d'Ingenieurs de Caen & Centre de Recherche (Prof.)	Caen Cedex 4	FR	bougault@lpccaen.in2p3.fr	
LNL-LNS	Fioretto	Enrico	M	IT	INFN - Laboratori Nazionali di Legnaro (Dr.)	Legnaro Padova	IT	enrico.fioretto@lnl.infn.it	
LNL-LNS	De France	Gilles	M	FR	Grand Accélérateur National d'Ions Lourds (Prof.)	CAEN Cedex 05	FR	defrance@ganil.fr	

List of UserProjects

UserProject Acronym

LNL 10.30

Title RDDS lifetime measurement in the region of the neutron-rich doubly magic Sn: Lifetime of the 6+ state in Te

Continuation N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

To study, with the differential RDDS technique, the lifetime of the 6+ state in 136Te. This nucleus will be populated using the multinucleon transfer reactions with a 136Xe beam, from the PIAVE-ALPI accelerator complex, at an energy of 1.2 GeV, impinging on the 208Pb target in the AGATA-PRISMA RDDS setup. The goal of the present proposal is to extend the knowledge of the transition probabilities in this nucleus to the 6+-->4+ transition. The yrast 6+ states in the Z=52 isotopes as well as in the N=84 isotones are isomers with main wave function components of the g7/2 and f7/2 multiplets respectively.The main neutron component in each state arises from the corresponding state in 134Sn, with the two protons being in the ground state of 134Te. Clearly, quenching of the neutron pairing gap would have strong effects on this lifetime.

Achievements

Instabilities in the PIAVE-ALPI cryogenic plant as well as problems with the stability of the beam required that additional days of beam time were allocated to the experiment. Nevertheless, it was possible to obtain data for two of the proposed three RDDS distances. The complex analysis procedure for AGATA-PRISMA is being performed at IFIC for the first time and therefore to reach results, if any, will require still time.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	329,5

UserProject Acronym

LNL 10.40

Title Development of the nuclear structure of neutron-rich isotopes in the Z~38 region populated by heavy-ion induced fission

Continuation N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

To investigate the nuclear structure in the neutron-rich Zr (N≥64) and of the neutron-rich Kr and Se isotopes (N≥56) regions using PRISMA and the AGATA demostrator with heavy-ion induced fission reactions of 238 U bombarded with 136Xe ions at about 1 GeV beam energy.

Achievements

The analysis will be performed by different groups, IFIN-HH, Bucharest, Romania and GSI, Germany. The data analysis is ongoing, the data taken during the recovery time have to be re-played due to recalibrations.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	312,5

UserProject Acronym

LNL 10.41

Title

Structure beyond the N=50 closure in neutron-rich nuclei in the vicinity of 78Ni: the case of N=51 nuclei

Continuation

N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

The objectives of the experiment is to measure the lifetime of excited states (especially the 7/2+) in N=51 Br, Se, and Ge nuclei in order to assign a single-particle or a collective character to them.
The nuclei of interest were produced in multi-nucleon transfer reactions of 82Se on U. Residues were detected in the PRISMA spectrometer, the gamma-rays in the AGATA demonstrator and a differential plunger was used to slow down the residues before entering into PRISMA.

Achievements

All the multi-nucleon transfer residues Se, As and Ge have been identified on line and A,Z conditioned gamma-ray spectra have been produced. This enabled us to follow the statistics accumulation during experiment and to realize the right choices for the plunger positions.
Surprisingly, a strong pollution from Se was observed in all spectra.
We are presently pre-sorting the data. Residue identification is more complex than foreseen due to some problems encountered in the PRISMA identification. However, this problem can be overcome.
Data analysis is in progress.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	236

UserProject Acronym

LNL 10.44

Title Lifetimes of intruder states in N ~ 20 sd-pf-shell neutron-rich nuclei ***Continuation*** N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

The objective is to measure the lifetimes of states of neutron-rich nuclei in the sdpf-shell region and, particularly, in the N=20 isotones, 34Si, 35P, 36S, and 37Cl. The neutron-rich species are populated in binary grazing reactions following he interaction of 6 MeV/u 36S ions with a thin 208Pb target. Lifetimes are measured using the Koln differential recoil distance apparatus in conjunction with the PRISMA magnetic spectrometer and the AGATA demonstrator (5 clusters). Gamma rays detected with AGATA are measured in coincidence with projectile-like species, detected and identified at the focal plane of PRISMA.

Achievements

The lifetime data are currently being analysed by two PhD students, one at IPHC Strasbourg and the other at UWS. The data will form the basis of the PhD theses of the two students. Good progress is being made with the analysis.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	187,5

UserProject Acronym

LNL 11.22

Title Spectroscopy of neutron rich Th and U nuclei after multi□nucleon reactions ***Continuation*** N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

To measure γ-spectroscopy of excited states in neutron-rich actinide nuclei 234-238Th and 240-242U i populated in multi-nucleon transfer reactions. The measurement aims for the ground state band, moments of inertia and the search for low-lying alternative parity bands in these heavy nuclei. The excitation energies of the ground state band members along the sequence of 234,236,238Th nuclei will shed light on the quest for predicted positions of deformed subshell closures and the middle of the neutron shell beyond N=126. The proposal aims for verification of several recent theoretical predictions for the most neutron rich U and Th nuclei which are available from the macroscopic-microscopic approach, cluster model calculations, constrained Hartree-Fock-Bogolyubov mean field calculations with the Gogny D1S force and predictions within self-consistent relativistic Hartee-Bogoliubov mean-field calculations employing the microscopic framework of nuclear energy density functionals.

Achievements

A primary 136Xe beam of 930 MeV was hitting a 238U target and produce the nuclei of interest. The PRISMA spectrometer was used to detect beam-like reaction products of Xe isotopes after neutron transfer and Ba nuclei after two-proton- and neutron-transfer. To select surviving, highly fissile actinide reaction product the position sensitive multi-channel plate detector of the DANTE array was positioned inside the scattering chamber in the reaction plane covering the angle range which corresponds to the grazing angle for the target like reaction product. A six day period of beam time was used to collect a reasonable large data set. Data analysis is ongoing individual isotopes of the beam like reaction products are identified successfully for a various Z channels. Coincidences with target like gamma-rays are observed with the AGATA array. The analysis of the kinematic coincidences between the two reaction products just started and will allow clean conditions for in-beam γ-ray spectroscopy with the AGATA demonstrator.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	178,5

UserProject Acronym

LNL 11.25

Title Collectivity at maximum nucleon valency: Investigation of ground-state rotation in the neutron-rich Dy, Er and Yb nuclei

Continuation N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

Neutron-rich rare-earth nuclei around the maximum of collectivity are predicted to exist with an extremely stable intrinsic configuration in their ground-state structure. The aim of this experiment is to explore this new phenomenon by populating and establishing the yrast bands of 170Dy and neighboring nuclei. Multi-nucleon transfer reactions using a 900 MeV beam of 136Xe delivered by the PIAVE-ALPI accelerators will be used to bombard a target of 170Er. The experimental setup consists of AGATA, DANTE and PRISMA.

Achievements

The experiment went quite nicely. We had some problems with part of the equipment (PRISMA, DANTE) but AGATA worked perfectly. The data analysis is in progress.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	112,5

UserProject Acronym

LNL 11.32

Title Study of high-lying bound and unbound slates in 124Sn and 140Ce via inelastic scattering of 17O ions

Continuation N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

Studies of the nuclear structure properties of the Giant Quadrupole Resonance and, in particular, of the pygmy dipole resonance in the 124Sn and 140Ce mass region. Comparison with the results of previous experiment concerning similar studies for 208Pb.

Achievements

The measurement was done using inelastic scattering of 17O beam on 124Sn and 140Ce targets. The experimental setup consisted of AGATA Demonstrator, 8 large volume LaBr3 detectors and two deltaE-E Si telescopes for the scattered ions identification. The data analysis is still in the presorting phase (i.e. data replay with the narval emulator).

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	192

UserProject Acronym

LNL 11.33

Title Transfer reactions in 116Sn+60Ni at deep sub-barrier energies ***Continuation*** N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

The goal of the experiment is to study the behavior of single and pair transfer channels at far sub-barrier energies and to compare this superfluid system with the previously measured closed shell 96Zr+40Ca case. The comparison will improve our understanding of the origin of the enhancement factors for even number of transferred particles and of the role played by nucleon-nucleon correlations.
We have already successfully demonstrated the powerful method of using the large solid angle spectrometer PRISMA for such studies, exploiting its unique performance in terms of both resolution and efficiency. In particular, making use of inverse kinematics, target recoils have been detected in multinucleon transfer reactions for the system 96Zr+40Ca
(L. Corradi et al, Phys. Rev. C 84 (2011) 034603).

Achievements

We measured an excitation function for multinucleon transfer channels in the 116Sn+60Ni system from the Coulomb barrier to ~25 % below. We used inverse kinematics to detect Ni-like target recoils at forward angles with the PRISMA spectrometer, exploiting its unique performance in terms of both resolution and efficiency. This measurement complements the results of the first experiment performed in direct kinematics for the same 60Ni+116Sn system via gamma-particle coincidences (PRISMA-AGATA measurement). The matching of these gamma-particle data with the new data will offer a unique opportunity to closely follow the energy dependence of the transfer process down to far distances where neutron transfers is expected to populate mostly the ground states, thus providing ideal conditions to probe pair correlations.
The excitation function have been measured spanning the energies from 500 MeV to ~400 MeV (which required 10 changes of ALPI energy). For each ALPI energy an additional energy has been measured by placing in front of the Ni targets suitable C-foils of proper thickness, in such a way to degrade the beam energy and to perform a more detailed excitation function. The data analysis is in a preliminary stage, but the first results demonstrate the good resolution in charge and mass, and a low background of the collected data. The mass identification has been obtained via an event-by-event reconstruction of the ion trajectory inside the magnetic elements, through the measurement of entrance and exit detector positions and time-of-flight. The nuclear charge Z has be obtained through the measurement of energy loss and total energy in the ionization chamber located at the focal plane.
Two additional energies, Elab = 280 and 220 MeV, have been used with the Tandem only, to have a precise reference to keep the accuracy of the energies delivered by ALPI below 1% (this has been done via an interpolation of the centroids of the peaks of Rutherford scattered Ni and C from targets in two monitor detectors). This part of the measurement has been done in the close collaboration with the accelerator.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	208

UserProject Acronym

LNL USP11.58

Title Contaminant Migration in radioactive waste repositories by Ion Beam Techniques (COMIBEAT)

Continuation N

Scientific Field

Main Field Physics

Specific discipline Other - Physics

Objectives

The global aim of the project is to determine radionuclide transport and retention parameters within the materials selected as barriers in radioactive waste repositories (cement materials, clay and crystalline rock). The RBS (Rutherford Backscattering Spectrometry) and μ-PIXE (micro-Particle Induced X-Ray Emission) techniques, available at the AN2000 accelerator of the Laboratori Nazionali di Legnaro (LNL-INFN, Padova - Italy), were selected for determining quantitative diffusion surface retention coefficients, accounting for the materials heterogeneity, what cannot be studied by conventional methodologies.

Achievements

Within last semester (July 2011-March 2012), the comparative study of uranium retention on granite was undertaken, under oxic and anaoxic conditions, on granite samples from the underground research laboratory of Aspö (Sweden). Anoxic experiments were carried out preserving the natural reducing conditions, occurring 500 m depth in granite, from the site extraction to sorption experiments. Uranium distribution coefficients were measured, by μ-PIXE analyses, on selected minerals, under both redox conditions. Very little data were so far available. These data are very helpful to provide sound sorption parameters to be used in performance assessment studies of deep geological repositories for high-level radioactive waste.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	22,5

UserProject Acronym

LNL USP11.71

Title Micro-PIXE studies on archaeological samples (MicroArchaeoStudy) ***Continuation*** N

Scientific Field

Main Field Physics

Specific discipline Other - Physics

Objectives

The project intends to determine the (micro)composition - major, minor, traces elements and micro-inclusions - of same archaeological objects from Romanian museums: obsidian Neolithic tools, ceramics and glass mineral pigments, bronze and gold items using the LNL Micro-PIXE facility. Small samples from the objects will be analyzed using micro-PIXE map and point spectra. The goal of these studies is to allow the archaeologists to authenticate and to determine the provenance of the objects (geological deposits, metals mines, workshops). Geological samples - obsidian, native gold, native copper - will be also analyzed and compared with the archaeological samples.

Achievements

During the two experiments (7-9 November and 19-20 December), 25 samples of archaeological Neolithic obsidian (small blades) from Transylvanian sites (near Oradea and from Danube border between Romania and Serbia) and 10 samples of geological obsidian from various sources (Tokay Mountains, Melos and Yali Greek islands, Lipari island, Armenia, Mexico) were analyzed . The preliminary data indicate for Danube region a model of obsidian trade routes - from Greek islands at the end of Mesolithic and Early Neolithic (using Morava and Drava rivers) and from Tokay Mountains (now in Hungary and Slovakia) during Neolithic and Chalcolithic (using Danube river). The data analysis is in progress and the user group intends to present some preliminary results at the 5th Annual International Conference on Mediterranean Studies in Athens, April 2012.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	44

UserProject Acronym

LNS DNA-BRAGG

Title DNA DAMAGE AND CELLULAR RESPONSE ALONG AND AROUND THE BRAGG CURVE OF HEAVY IONS.

Continuation N

Scientific Field

Main Field Physics

Specific discipline Other - Physics

Objectives

To characterize the Radiobiological Effectiveness (RBE) of glioma cell line (U87) exposed at different depths of a 62 MeV carbon ion beam. Biological endpoints will be investigated: cell survival and formation of chromosomal aberrations.

Achievements

Survival curves (0-5 Gy in duplicate) at 10 different depths (including the very peak of the Bragg peak) along the trajectory of a 62 MeV carbon ion beam have been performed using the glioma U87 cell line. Accurate dosimetry at each position has been performed using Gaffchromic films and a Markus ionization chamber. Data have been used to calculate the Relative Biological Effectiveness (RBE) of each depth. These data are expected to help dosimetry planning for clinical applications. Cells have also been exposed (2 depths, entrance and centre of the Bragg peak) for chromosomal aberration analysis. Data are currently being collected and analysed.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	64

UserProject Acronym

LNS FAZIA

Title Test of FAZIA prototypes at LNS (C114) ***Continuation*** N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

The FAZIA Collaboration has performed a two-step experiment at LNS in Catania (July and November 2009) in the framework of LEA-colliga/SPIRAL2PP-WP5.3. The first part consisted of a test beam of 84Kr at 35A MeV on various targets; during the second part a 129Xe beam at 35 A MeV was used. The results of this experiment are demonstrating that the basic goal of the Collaboration has been reached: as a matter of fact, the detection, analysis and Silicon-material control techniques developed inside the Collaboration permitted to implement a detection apparatus with unprecedented particle identification performances. The goal of the presently proposed experiment is to further extend mass identification for very low energetic particles using the additional information provided by Time of Flight. To that aim, new detectors have been ordered, with reduced sheet resistance in order to improve timing performances.

Achievements

The experiment was a success. The delivered beam had a good timing resolution and we were able to perform time of flight measurements and test our new detectors. In a second step we have also tried different depletion voltage on our silicon detectors to study how evolves the particle identification performances. Also in this case very good results have been achieved. The full analysis is still in progress.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	170

UserProject Acronym

LNS GPV

Title GPV measurement in Sn and Pb with (p.t) reaction ***Continuation*** N

Scientific Field

Main Field Physics

Specific discipline Nuclear physics

Objectives

A Giant Pairing Vibrations (GPV) is a collective mode in the two neutron transfer channel. From the theoretical point of view, this mode is of fundamental importance since it is analogous to a giant resonance. It is a L=0 transition mode from an A nucleus to a A±2 nucleus. The GPV is expected to manifest itself as a large bump in the 2 neutrons transfer energy spectrum. The study of the GPV would also provide crucial information on the pairing interaction: the transfer cross-section depends on the form factor of the two transferred neutrons. It has been showed that this form factor corresponds to the perturbation of the pairing field during the excitation of the system. The GPV will be looked after in 120Sn and 208Pb through the (p,t) reaction at 35 MeV. The large solid angle spectrometer MAGNEX at LNS was used in this experiment.

Achievements

The data analysis is ongoing.

Installation Use

Infrastructure Short Name	*Installation ID*	*Installation Short Name*	*Amount of Access Delivered*
LNL-LNS	1	LNL-LNS	120

List of Users

Grant Agreement ID 262010 **Reporting Period** PR1

UserProject Acronym	Family Name	First Name	Gender	Birth year	Natio nality	Resear. status	User Background: Sci. Field 1	Sci. Field 2	Sci. Field 3	Home Institution: Type	Name	Town	Country	User e-mail	New user	Group leader	Remote user	Nr.of visits	Dur,of stay	T+S reimb.	Additional information
LNL 10.30	Geibel	Kerstin	F	1981	DE	PGR	Physics			UNI	Universitaet zu Koeln, Institut fuer Kernphysik	Koeln	DE	k.geibel@ikp.uni-koeln.de	N	N	N	1	7	Y	
LNL 10.30	Hackstein	Matthias	M	1984	DE	PGR	Physics			UNI	Universitaet zu Koeln, Institut fuer Kernphysik	Koeln	DE	matthias@ikp,uni-koeln.de	Y	N	N	1	10	Y	
LNL 10.30	Huyuk	Tayfun	M	1983	TR	PGR	Physics			RES	Instituto de Fisica Corpuscular (CSIC - Universidad de Valencia)	Valencia	ES	huyuk@ific.uv.es	N	N	N	1	9	Y	
LNL 10.30	Korichi	Amel	F	1963	FR	EXP	Physics			RES	Centre National de la Recherche Scientifique (CNRS / IN2P3)	Paris Cedex	FR	amel.korichi@csnsm.in2p3.fr	N	N	N	1	2	Y	
LNL 10.30	Kusoglu	Asli	F	1984	TR	PGR	Physics			UNI	Istanbul University, Science Faculty, Physics Department	Instanbul	TR	kusoglu.asli@gmail.com	Y	N	N	1	9	Y	
LNL 10.30	Legay	Eric	M	1979	FR	TEC	Physics			RES	Centre National de la Recherche Scientifique (CNRS / IN2P3)	Paris Cedex	FR	eric.legay@csnsm.in2p3.fr	Y	N	N	1	2	Y	
LNL 10.30	Quintana	Begona	F	1967	ES	EXP	Physics			UNI	Universidad de Salamanca	Salamanca	ES	quintana@usal.es	N	N	N	1	5	Y	
LNL 10.40	Ameil	Frederic	M	1967	FR	EXP	Physics			RES	GSI	Darmstadt	DE	F.Ameil@gsi.de	Y	N	N	1	12	Y	
LNL 10.40	Cortes Sua	Liliana	F	1984	OT	PGR	Physics			UNI	TU Darmstadt	Darmstadt	DE	mlcortess@unal.edu.co	Y	N	N	1	10	Y	
LNL 10.40	Filipescu	Dan	M	1978	RO	PDOC	Physics			RES	IFIN-HH Bucharest	Bucharest	RO	filipescu@tandem.nipne.ro	N	N	N	1	5	Y	
LNL 10.40	Joannem	Tom	M	1984	FR	TEC	Engineering & Technology			RES	CEA Saclay	Saclay	FR	tom.joannem@cea.fr	Y	N	N	1	4	Y	
LNL 10.40	Karolak	Marc	M	1963	FR	TEC	Engineering & Technology			RES	CEA Saclay	Saclay	FR	marc.karolak@cea.fr	Y	N	N	1	4	Y	
LNL 10.40	Merchan Rodriguez	Edana	F	1982	OT	PDOC	Physics			UNI	TU Darmstadt	Darmstadt	DE	E.Merchan@gsi.de	N	Y	N	1	14	Y	
LNL 10.40	Mihai	Constantin	M	1981	RO	PGR	Physics			RES	IFIN-HH Bucharest	Bucharest	RO	cmihai@tandem.nipne.ro	N	N	N	1	8	Y	

UserProject Acronym	Family Name	First Name	Gender	Birth year	Nationality	Resear. status	User Background			Home Institution				User e-mail	New user	Group leader	Remote user	Nr.of visits	Dur,of stay	T+S reimb.	Additional information
							Sci. Field 1	Sci. Field 2	Sci. Field 3	Type	Name	Town	Country								
LNL 10.40	Varga Pajtler	Maja	F	1984	HR	PGR	Physics			UNI	University of Osijek	Osijek	HR	maja.varga@fizika.unios.hr	Y	N	N	1	8	Y	
LNL 10.41	Aubert	Yann, Pierre, Louis	M	1965	FR	TEC	Physics			UNI	Centre National de la Recherche Scientifique (CNRS / IN2P3)	Paris Cedex	FR	yann.aubert@ipno.in2p3.fr	N	N	N	1	2	Y	
LNL 10.41	Goasduff	Alain	M	1986	FR	PGR	Physics			RES	IPHC-UDS	Strasbourg	FR	alain.goasduff@iphc.cnrs.fr	N	N	N	1	11	Y	
LNL 10.41	Habermann	Tobias	M	1980	DE	PGR	Physics			UNI	GSI	Darmstadt	DE	t.habermann@gsi.de	N	N	N	1	5	Y	
LNL 10.41	Karolak	Marc	M	1963	FR	TEC	Physics			RES	Centre CEA de Saclay (Essonne)	Gif-sur-Yvette Cedex	FR	marc.karolak@cea.fr	N	N	N	1	4	Y	
LNL 10.41	Kolos	Karolina	F	1985	PL	PGR	Physics			RES	Institut de Physique Nucléaire	Orsay	FR	kolos@ipno.in2p3.fr	Y	N	N	1	11	Y	
LNL 10.41	Litzinger	Julia	F	1986	DE	PGR	Physics			UNI	Institut für Kernphysik der Universität zu Köln	Köln	DE	jlitzinger@ikp.uni-koeln.de	Y	N	N	1	12	Y	
LNL 10.41	Lotodé	Ange	M	1962	FR	TEC	Physics			RES	Centre CEA de Saclay (Essor)	Gif-sur-Yvette Cedex	FR	ange.lotode@cea.fr	N	N	N	1	4	Y	
LNL 10.41	Niikura	Megumi	M	1979	OT	PDOC	Physics			RES	Institut de Physique Nucléaire	Orsay	FR	niikura@ipno.in2p3.fr	Y	N	N	1	12	Y	
LNL 10.41	Sengele	Loïc	M	1987	FR	PGR	Physics			RES	Institut Pluridisciplinaire Hubert Curien	Strasbourg	FR	Loic.Sengele@iphc.cnrs.fr	Y	N	N	1	7	Y	
LNL 10.44	Braunroth	Thomas	M	1984	DE	PGR	Physics			UNI	IKP University of Koeln	Koln	DE	TBraunroth@ikp.uni-koeln.de	Y	N	N	1	10	Y	
LNL 10.44	Goasduff	Alain	M	1986	FR	PGR	Physics			UNI	IPHC-UDS	Strasbourg	FR	alain.goasduff@iphc.cnrs.fr	N	N	N	1	10	Y	
LNL 10.44	Lafay	Xavier	M	1984	FR	TEC	Engineering & Technology			RES	CSNSM-Orsay	Paris	FR	Xavier.Lafay@csnsm.in2p3.fr	Y	N	N	1	6	Y	
LNL 10.44	Liberati	Valentina	F	1984	IT	PGR	Physics			UNI	University of the West of Scotland	Paisley	GB	Valentina.Liberati@uws.ac.uk	N	N	N	1	10	Y	
LNL 10.44	Mijatovic	Tea	F	1983	HR	PGR	Physics			UNI	Ruder Boskovic Institute, Zagreb	Zagreb	HR	Tea.Mijatovic@irb.hr	N	N	N	1	8	Y	
LNL 10.44	Mulholland	Kieran	M	1986	GB	PGR	Physics			UNI	University of the West of Scotland	Paisley	GB	Kieran.Mulholland@uws.ac.uk	Y	N	N	1	9	Y	

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							Sci. Field 1	Sci. Field 2	Sci. Field 3	Type	Name	Town	Country								
LNL 10.44	Travers	Bruno	M	1980	FR	TEC	Engineering & Technology			RES	CSNSM-Orsay	Paris	FR	Bruno.Travers@csnsm.in2p3.fr	Y	N	N	1	6	Y	
LNL 11.22	Ameil	Frederic	M	1957	FR	EXP	Physics			RES	GSI	Darmstadt	DE	F.Ameil@gsi.de	N	N	N	1	12	Y	
LNL 11.22	Birkenbach	Benedikt	M	1979	DE	PGR	Physics			UNI	Institute for nuclear physics University of Cologne	Cologne	DE	bene@ikp.uni-koeln.de	N	N	N	2	13	Y	
LNL 11.22	Bruyneel	Bart	M	1974	BE	PDOC	Physics			RES	CEA-Saclay	Gif-sur-Yvette Cedex	FR	bart.bruyneel@cea.fr	N	N	N	1	10	Y	
LNL 11.22	Geibel	Kerstin	F	1981	DE	PGR	Physics			UNI	Institute for nuclear physics University of Cologne	Cologne	DE	k.geibel@ikp.uni-koeln.de	N	N	N	1	10	Y	
LNL 11.22	Hess	Herbert	M	1971	DE	PGR	Physics			UNI	Institute for nuclear physics University of Cologne	Cologne	DE	hess@ikp.uni-koeln.de	N	N	N	1	10	Y	
LNL 11.22	Merchan Rodriguez	Edana	F	1982	OT	PDOC	Physics			RES	GSI	Darmstadt	DE	E.Merchan@gsi.de	N	N	N	1	12	Y	
LNL 11.22	Schneiders	David	M	1988	DE	PGR	Physics			UNI	Universitaet zu Koeln,	Cologne	DE	schneiders@ikp.uni-koeln.de	Y	N	N	1	3	Y	
LNL 11.22	Steinbach	Tim	M	1986	DE	PGR	Physics			UNI	Universitaet zu Koeln, Institut fuer Kernphysik	Cologne	DE	t.steinbach@ikp.uni-koeln.de	N	N	N	1	3	Y	
LNL 11.22	Szpak	Bartlomiej	M	1984	PL	PDOC	Physics			RES	Niewodniczanski Insitute of Nuclear Physics	Krakow	PL	bartlomiej.szpak@ifj.edu.pl	N	N	N	1	7	Y	
LNL 11.25	Dormand	Jamie	M	1988	GB	PGR	Physics			UNI	University of Liverpool	Liverpool	GB	jd@ns.ph.liv.ac.uk	Y	N	N	1	7	Y	
LNL 11.25	Dosme	Nicolas	M	1978	FR	EXP	Physics			RES	CSNSM Orsay	Paris	FR	nicolas.dosme@csnsm.in2p3.fr	Y	N	N	1	6	Y	
LNL 11.25	Gengelbach	Aila	F	1987	DE	PGR	Physics			UNI	Uppsala University	Uppsala	SE	aila.gengelbach@physics.uu.se	Y	N	N	1	7	Y	
LNL 11.25	Hampson	Peter	M	1981	GB	PDOC	Physics			UNI	University of Liverpool	Liverpool	GB	p.j.t.hampson@liv.ac.uk	Y	N	N	1	7	Y	
LNL 11.25	Hughes	Tom	M	1988	GB	PGR	Physics			UNI	University of Liverpool	Liverpool	GB	xxx@xxx.uk	Y	N	N	1	7	Y	
LNL 11.25	Legay	Eric	M	1979	FR	EXP	Physics			RES	CSNSM Orsay	Paris	FR	eric.legay@csnsm.in2p3.fr	N	N	N	1	6	Y	
LNL 11.25	Lockwood	Michael	M	1959	GB	TEC	Physics			UNI	University of Liverpool	Liverpool	GB	mikel@hep.ph.liv.ac.uk	Y	N	N	1	4	Y	

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LNL 11.25	Mason	Peter	M	1983	GB	PDOC	Physics			UNI	University of Surrey	Surrey	GB	p.j.t.hampson@liv.ac.uk	N	N	N	1	7	Y	
LNL 11.25	Schaffner	Henning	M	1963	DE	TEC	Physics			UNI	GSI	Darmstadt	DE	H.Schaffner@gsi.de	N	N	N	1	5	Y	
LNL 11.25	Singh	PushPendra	M	1978	DE	PDOC	Physics			UNI	GSI	Darmstadt	DE	pushpendrapsingh@gmail.com	N	N	N	1	11	Y	
LNL 11.25	Söderström	Pär-Anders	M	1980	SE	PDOC	Physics			UNI	Uppsala University	Uppsala	SE	p-a.soderstrom@physics.uu.se	N	N	N	1	7	Y	
LNL 11.25	Whitley	Mark David Alan	M	1974	GB	TEC	Physics			UNI	University of Liverpool	Liverpool	GB	mwhitley@liv.ac.uk	Y	N	N	1	4	Y	
LNL 11.32	Ciemala	Michal	M	1983	PL	PGR	physics			RES	Institute of Nuclear Physics, PAN	Kraków	PL	Michal.Ciemala@ifj.edu.pl	N	N	N	1	10	Y	
LNL 11.32	Dosme	Nicolas	M	1978	FR	TEC	Physics			RES	Nicolas.Dosme@csnsm.in2p3.fr	Paris	FR	Nicolas.Dosme@csnsm.in2p3.fr	N	N	N	1	2	Y	
LNL 11.32	Gibelin	Laurent	M	1977	FR	TEC	Physics			RES	Centre National de la Recherche Scientifique (CNRS / IN2P3)	Paris	FR	Laurent.Gibelin@csnsm.in2p3.fr	Y	N	N	1	3	Y	
LNL 11.32	Kmiecik	Maria	F	1970	PL	EXP	physics			RES	Institute of Nuclear Physics, PAN	Kraków	PL	Maria.Kmiecik@ifj.edu.pl	N	Y	N	1	7	Y	
LNL 11.32	Krzysiek	Mateusz	M	1983	PL	PGR	physics			RES	Institute of Nuclear Physics, PAN	Kraków	PL	Mateusz.Krzysiek@ifj.edu.pl	Y	N	N	1	10	Y	
LNL 11.32	Lafay	Xavier	M	1984	FR	TEC	Engineering & Technology			RES	CSNSM-Orsay	Paris	FR	Xavier.Lafay@csnsm.in2p3.fr	N	N	N	2	7	Y	
LNL 11.32	Mazurek	Katarzyna	F	1976	PL	EXP	physics			RES	Institute of Nuclear Physics, PAN	Kraków	PL	Katarzyna.Mazurek@ifj.edu.pl	N	N	N	1	7	Y	
LNL 11.32	Siem	Sunniva	F	1969	NO	EXP	physics			UNI	University of Oslo	Oslo	NO	sunniva.siem@fys.uio.no	N	N	N	1	5	Y	
LNL 11.32	Travers	Bruno	M	1973	FR	TEC	Engineering & Technology			RES	CSNSM-Orsay	Paris	FR	Bruno.Travers@csnsm.in2p3.fr	N	N	N	1	3	Y	
LNL 11.32	Wiens	Andreas	M	1979	DE	TEC	Physics			UNI	Universitaet zu Koeln, Institut fuer Kernphysik	Cologne	DE	a.wiens@ikp.uni-koeln.de	N	N	N	1	3	Y	
LNL 11.32	Zieblinski	Miroslaw	M	1958	PL	EXP	physics			RES	Institute of Nuclear Physics, PAN	Kraków	PL	Miroslaw.Zieblinski@ifj.edu.pl	N	N	N	1	7	Y	
LNL 11.33	Courtin	Sandrine	F	1972	FR	EXP	Physics			RES	Institut Pluridisciplinaire Hubert Curien	Strasbourg	FR	sandrine.courtin@iphc.cnrs.fr	N	N	N	1	7	Y	

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LNL 11.33	Goasduff	Alain	M	1986	FR	PGR	Physics			RES	Institut Pluridisciplinaire Hubert Curien	Strasbourg	FR	alain.goasduff@iphc.cnrs.fr	N	N	N	1	8	Y	
LNL 11.33	Haas	Florent	M	1945	FR	EXP	Physics			RES	Institut Pluridisciplinaire Hubert Curien	Strasbourg	FR	florent.haas@iphc.cnrs.fr	N	N	N	1	8	Y	
LNL 11.33	Mijatovic	Tea	F	1983	HR	PGR	Physics			RES	Ruder Boskovic Institute	Zagreb	HR	tea.mijatovic@irb.hr	N	N	N	1	8	Y	
LNL 11.33	Varga Pajtler	Maja	F	1984	HR	PGR	Physics			UNI	University of Osijek	Osijek	HR	maja.varga@fizika.unios.hr	N	N	N	1	5	Y	
LNL USP11.58	Alonso	Ursula	F	1975	ES	EXP	Earth Sciences & Environment			OTH	CIEMAT	Madrid	ES	ursula.alonso@ciemat.es	N	Y	N	1	4	Y	
LNL USP11.58	Missana	Tiziana	F	1965	ES	EXP	Earth Sciences & Environment			OTH	CIEMAT	Madrid	ES	tiziana.missana@ciemat.es	N	N	N	1	4	Y	
LNL USP11.71	Constantinescu	Bogdan	M	1949	RO	EXP	Humanities	Earth Sciences & Environment	Material Sciences	RES	IFIN-HH	BUCHAREST - MAGURELE	RO	bconst@nipne.ro	N	Y	N	2	5	Y	
LNL USP11.71	Stan	Daniela	F	1970	RO	PGR	Humanities	Earth Sciences & Environment	Material Sciences	RES	IFIN-HH	BUCHAREST - MAGURELE	RO	daniela@nipne.ro	N	N	N	2	5	Y	
LNS DNA-BRAGG	Currell	Fred	M	1963	GB	EXP	Physics			UNI	Queen's University Belfast	Belfast	GB	f.j.currell@qub.ac.uk	N	N	N	1	5	Y	
LNS DNA-BRAGG	Kavanagh	Joy Naomi	F	1988	GB	PDOC	Life Sciences & Biotech			UNI	Queen's University Belfast	Belfast	GB	j.kavanagh@qub.ac.uk	N	N	N	2	9	Y	
LNS DNA-BRAGG	Schettino	Giuseppe	M	1970	GB	EXP	Physics	Life Sciences & Biotech		UNI	Queen's University Belfast	Belfast	GB	g.schettino@qub.ac.uk	N	Y	N	2	9	Y	
LNS FAZIA	Bonnet	Eric	M	1980	FR	EXP	Physics			RES	GANIL	Caen	FR	bonnet@ganil.fr	N	N	N	1	9	Y	
LNS FAZIA	Frankland	John	M	1972	FR	EXP	Physics			RES	GANIL	Caen	FR	frankland@ganil.fr	N	N	N	1	5	Y	
LNS FAZIA	Gasior	Kamila	F	1987	PL	EXP	Physics			UNI	Silesian University	Katowice	PL	Zipper@us.edu.pl	Y	N	N	1	9	Y	
LNS FAZIA	Le Neindre	Nicolas	M	1971	FR	EXP	Physics			RES	LPC Caen	Caen	FR	leneindre@lpccaen.in2p3.fr	N	Y	N	1	11	Y	
LNS FAZIA	Lopez	Olivier	M	1967	FR	EXP	Physics			RES	LPC Caen	Caen	FR	lopezo@lpccaen.in2p3.fr	N	N	N	1	4	Y	
LNS FAZIA	Twarog	Tomasz	M	1986	PL	EXP	Physics			UNI	University of Cracow	Cracow	PL	tomasz.s.twarog@gmail.com	Y	N	N	1	7	Y	

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LNS GPV	Stefan	Gheorghe	M	1984	FR	EXP	Physics			RES	Istitut de Physique Nucleaire	Orsay	FR	stefan@ipno.in2p3.fr	Y	N	N	1	6	Y	