MINISTRY OF EDUCATION, YOUTH AND SPORTS

Progress Report on the Implementation of the Large Research, Experimental Development and Innovation Infrastructure (LI) CANAM in 2015

Full name of the LI: CANAM – Center of Accelerators and Nuclear Analytical Methods
LI's code: LM2011019
Recipient: Nuclear Physics Institute of the Czech Academy of Sciences
Another participant/s of the LI: -
Principal investigator of the LI: Jan Dobeš
Resolution of the Government of the day, number: 29th of June, 2011; No 502
Start of the LI's financing: 9th of November, 2012

The main mission of the LI (max. 500 characters):

The mission of the infrastructure is utilization of energy ions and neutrons for fundamental research in physics, chemistry, biology, energetics and other scientific fields. CANAM integrates the large experimental facilities of the Nuclear Physics Institute of the CAS, v. v. i. (NPI CAS) – isochronous cyclotron, including a generator of fast neutrons (LC&FNG), an electrostatic accelerator Tandetron (LT) and facilities installed at irradiation channels of the LVR-15 research reactor in Řež (NPL).

A. Scientific and Technological Excellence

1. Research Team

List the members of research team (all persons that are paid via personnel costs), append brief job descriptions and classifications including their full-time equivalent (lowest, highest and average) and overall budget; distinguish as well between permanent and temporary staff.

A list of the research team members, including their work load, is attached in Annex 3. In the framework of the infrastructure, one agreement to perform an activity for 1 month in 2015 outside the employment relationship (identified in the Annex) has been concluded; all other members of the research team are regular employees of the NPI CAS.

Annex 3 – List of the research team members

1. Scientific results

I. *Indicate the main scientific results achieved on the basis of the infrastructure's use during last period of time. Present single results according to valid methodology of CRDI (Council for Research, Development and Innovation), if possible J type results supplement with impact factor according to WoK or Scopus. Among these results specify 10 most important ones.*

II. *Indicate the main scientific results (not more than 10) achieved on the basis of the LI's use (its Czech branch in case of distributed research infrastructure) by its users, if possible to attest. Present single results according to valid methodology of CRDI (Council for Research, Development and Innovation), if possible J type results supplement with impact factor according to WoK or Scopus.*

Publications within the infrastructure in 2015:

- 50 Articles in impacted journals
- 1 Article in non-impacted journal
- 9 Proceedings papers from journals
- 2 Abstracts in impacted journals
- 2 Abstracts in Book of Abstracts

I. Most important scientific results achieved on the basis of the infrastructure's use
(10 most important articles are numbered):

1. ***Experimental cross-sections of deuteron-induced reaction on Y-89 up to 20 MeV; comparison of Ti-nat(d,x)V-48 and Al-27(d,x)Na-24 monitor reactions.***
Lebeda, O.; Štursa, J.; Ráliš, J.
Nuclear Instruments & Methods in Physics Research Section B. Vol. 360, OCT (2015), pp. 118-128. ISSN 0168-583X
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 1.124, year: 2014

2***. Charge-sensitive fluorescent nanosensors created from nanodiamonds.***
Petráková, V.; Řehoř, I.; Štursa, J.; Ledvina, M.; Nesladek, M.; Cígler, P.
Nanoscale. Vol. 7, No. 29 (2015), pps. 12307-12311. ISSN 2040-3364
Scientific discipline: Solid-state physics and magnetism
Impact factor: 7.394, year: 2014

3. ***Erbium-ion implantation into various crystallographic cuts of Al2O3.***
Nekvindová, P.; Macková, A.; Malinský, P.; Cajzl, J.; Švecová, B.; Oswald, J.; Wilhelm, R. A.
Nuclear Instruments & Methods in Physics Research Section B. Vol. 365, DEC (2015), pp. 89-93. ISSN 0168-583X
Scientific discipline: Nuclear, atomic and molecular physics, accelerators; Solid-state physics and magnetism
Impact factor: 1.124, year: 2014

4. ***Elemental Characterization of Single-Wall Carbon Nanotube Certified Reference Material by***

Neutron and Prompt gamma Activation Analysis.
Kučera, J.; Bennett, J. W.; Oflaz, R.; Paul, R. L.; De Nadai Fernandes, E. A.; Kubešová, M.; Bacchi, M. A.; Stopic, A. J.; Sturgeon, R. E.; Grinberg, P.
Analytical Chemistry. Vol. 87, No. 7 (2015), pp. 3699-3705. ISSN 0003-2700
Scientific discipline: Analytical chemistry, separation
Impact factor: 5.636, year: 2014

5. ***Ferromagnetic and paramagnetic magnetization of implanted GaN:Ho,Tb,Sm,Tm films.***
Maryško, M.; Hejtmánek, J.; Laguta, Valentyn; Sofer, Z.; Sedmidubský, D.; Šimek, P.; Veselý, M.; Mikulics, M.; Buchal, C.; Macková, A.; Malinský, P.; Wilhelm, R. A.
Journal of Applied Physics. Vol. 117, No. 17 (2015), "17B907-1"- "17B907-4". ISSN 0021-8979
Scientific discipline: Solid-state physics and magnetism
Impact factor: 2.183, year: 2014

6. ***The use of Raman spectroscopy for the monitoring of changes in the glass structure of the thin layers caused by ion implantation.***
Nekvindová, P.; Švecová, B.; Staněk, S.; Vytykačová, S.; Macková, A.; Malinský, P.; Machovič, V.; Špirková, J.
Ceramics; Silikáty. Vol. 59, No. 3 (2015), pp. 187-193. ISSN 0862-5468
Scientific discipline: Electronics and optoelectronics
Impact factor: 0.435, year: 2014

7. ***Temperature dependence of twinning activity in random textured cast magnesium.***
Čapek, J.; Farkas, G.; Pilch, J.; Máthis, K.
Materials Science and Engineering A-Structural materials. Vol. 627, MAR (2015), pp. 333-335. ISSN 0921-5093
Scientific discipline: Solid-state physics and magnetism
Impact factor: 2.567, year: 2014

8. ***Definitive Insight into the Graphite Oxide Reduction Mechanism by Deuterium Labeling.***
Jankovský, O.; Šimek, P.; Luxa, J.; Sedmidubský, D.; Tomandl, I.; Macková, A.; Mikšová, R.; Malinský, P.; Pumera, M.; Sofer, Z.
ChemPlusChem. Vol. 80, No. 9 (2015), pp. 1399-1407. ISSN 2192-6506
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 2.997, year: 2014

9. ***Cortinarius prodigiosus—a new species of the subgenus Phlegmacium from Central Europe.***
Borovička, J.; Bušek, B.; Mikšík, M.; Dvořák, D.; Jeppesen, T. S.; Dima, B.; Albert, L.; Froslev, T. G.
Mycological Progress. Vol. 14, No. 5 (2015), pp. 29. ISSN 1617-416X
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 1.913, year: 2014

10. ***Separation of thorium ions from wolframite and scandium concentrates using graphene oxide.***
Jankovský, O.; Sedmidubský, D.; Šimek, P.; Klimová, K.; Bouša, D.; Boothroyd, C.; Macková, A.; Sofer,

Z.
Physical Chemistry Chemical Physics. Vol. 17, No. 38 (2015), pp. 25272-25277. ISSN 1463-9076
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 4.493, year: 2014

Definitive proof of graphene hydrogenation by Clemmensen reduction: use of deuterium labeling.
Sofer, Z.; Jankovský, O.; Libánská, A.; Šimek, P.; Nováček, M.; Sedmidubský, D.; Macková, A.; Mikšová, R.; Pumera, M.
Nanoscale. Vol. 7, No. 23 (2015), pp. 10535-10543. ISSN 2040-3364
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 7.394, year: 2014

Use of deuterium labelling-evidence of graphene hydrogenation by reduction of graphite oxide using aluminium in sodium hydroxide.
Jankovský, O.; Šimek, P.; Nováček, M.; Luxa, J.; Sedmidubský, D.; Pumera, M.; Macková, A.; Mikšová, R.; Sofer, Z.
RSC Advances. Vol. 5, No. 24 (2015), pp. 18733-18739. ISSN 2046-2069
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 3.840, year: 2014

Structure and Plasmonic Properties of Thin PMMA Layers with Ion-Synthesized Ag Nanoparticles.
Popok, V. N.; Hanif, M.; Macková, A.; Mikšová, R.
Journal of Polymer Science. Polymer Physics Edition. Vol. 53, No. 9 (2015), pp. 664-672. ISSN 0887-6266
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 3.830, year: 2014

A study of the degradation of polymers irradiated by Cn+ and On+ 9.6 MeV heavy ions.
Mikšová, R.; Macková, A.; Malinský, P.; Slepička, P.; Švorčík, V.
Polymer Degradation and Stability. Vol. 122, DEC (2015), pp. 110-121. ISSN 0141-3910
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 3.163, year: 2014

Characterization of advanced polymethylmethacrylate (PMMA) targets for TNSA laser irradiation.
Torrisi, L.; Cutroneo, M.; Semián, V.; Ceccio, G.
Applied Surface Science. Vol. 351, OCT (2015), pp. 580-587. ISSN 0169-4332
Scientific discipline: Solid-state physics and magnetism
Impact factor: 2.711, year: 2014

Protective double-layer coatings prepared by plasma enhanced chemical vapor deposition on tool steel.
Muresan, M.; Charvátová Campbell, A.; Ondračka, P.; Buršíková, V.; Peřina, V.; Polcar, T.; Reuter, S.; Hammer, M. U.; Valtr, M.; Zajíčková, L.
Surface and Coatings Technology. Vol. 272, JUN (2015), pp. 229-238. ISSN 0257-8972
Scientific discipline: Nuclear, atomic and molecular physics, accelerators

Impact factor: 1.998, year: 2014

Comparative analysis of thermal stability of two different nc-TiC/a-C:H coatings.
Zábranský, L.; Buršíková, V.; Daniel, L.; Souček, P.; Vašina, P.; Dugáček, J.; Sťahel, P.; Caha, O.; Buršík, J.; Peřina, V.
Surface and Coatings Technology. Vol. 267, APR (2015), pp. 32-39. ISSN 0257-8972
Scientific discipline: Solid-state physics and magnetism; Nuclear, atomic and molecular physics, accelerators
Impact factor: 1.998, year: 2014

Mercury mass measurement in fluorescent lamps via neutron activation analysis.
Viererbl, L.; Vinš, M.; Lahodová, Z.; Fuksa, A.; Kučera, J.; Koleska, M.; Voljanskij, A.
Radiation Physics and Chemistry. Vol. 116, NOV (2015), pp. 56-59. ISSN 0969-806X
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 1.380, year: 2014

Ta-ion implantation induced by a high-intensity laser for plasma diagnostics and target preparation.
Cutroneo, M.; Malinský, P.; Macková, A.; Matoušek, J.; Torrisi, L.; Slepička, P.; Ullschmied, J.
Nuclear Instruments & Methods in Physics Research Section B. Vol. 365, DEC (2015), pp. 384-388. ISSN 0168-583X
Scientific discipline: Nuclear, atomic and molecular physics, accelerators; Plasma physics and discharge through gases
Impact factor: 1.124, year: 2014

High-intensity laser for Ta and Ag implantation into different substrates for plasma diagnostics.
Cutroneo, M.; Macková, A.; Malinský, P.; Matoušek, J.; Torrisi, L.; Ullschmied, J.
Nuclear Instruments & Methods in Physics Research Section B. Vol. 354, JUL (2015), pp. 56-59. ISSN 0168-583X
Scientific discipline: Nuclear, atomic and molecular physics, accelerators; Plasma physics and discharge through gases
Impact factor: 1.124, year: 2014

The stopping power and energy straggling of heavy ions in silicon nitride and polypropylene.
Mikšová, R.; Hnatowicz, V.; Macková, A.; Malinský, P.; Slepička, P.
Nuclear Instruments & Methods in Physics Research Section B. Vol. 354, JUL (2015), pp. 205-209. ISSN 0168-583X
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 1.124, year: 2014

Determination of elemental impurities in phosphoric acid by INAA employing a novel method of phosphate precipitation.
Kameník, J.; Amsil, H.; Kučera, J.
Journal of Radioanalytical and Nuclear Chemistry. Vol. 304, APR (2015), pp. 157-162. ISSN 0236-5731

Scientific discipline: Analytical chemistry, separation
Impact factor: 1.034, year: 2014

Improving iodine homogeneity in NIST SRM 1548a Typical Diet by cryogenic grinding.
Kučera, J.; Kameník, J.
Accreditation and Quality Assurance. Vol. 20, No. 3 (2015), pp. 189-194. ISSN 0949-1775
Scientific discipline: Analytical chemistry, separation
Impact factor: 0.966, year: 2014

Neutron Diffraction Study and Deformation Behavior of a Composite Based Mg Alloy Reinforced by Short Saffil Fibers.
Farkas, G.; Máthis, K.; Pilch, J.
Acta Physica Polonica. A. Vol. 128, No. 4 (2015), pp. 758-761. ISSN 0587-4246.
Scientific discipline: Solid-state physics and magnetism
Impact factor: 0.530, year: 2014

New type of versatile neutron diffractometer with a double-crystal monochromator system.
Mikula, Pavol; Vrána, M.
Powder Diffraction. Vol. 30. Toronto: JCPDS, 2015, pp. 41-46. ISSN 0885-7156.
[14th European Powder Diffraction Conference (EPDIC14). Aarhus (DK), 15. 06. 2014 - 18. 06. 2014]
Scientific discipline: Solid-state physics and magnetism

Impendance Measurement of Gas Sensors with Nickel(II)-and Copper(II)-Oxide Active Layers.
Horák, P.; Khun, J.; Vrňata, M.; Bejšovec, Václav; Lavrentiev, V.; Vacík, J.
NANOCON 2014. 6th International conference proceedings. 469-474. ISBN 978-80-87294-53-6.
[NANOCON 2014. 6th International Conference Brno (CZ), 05. 11. 2014 - 07. 11. 2014]
Scientific discipline: Other materials

Research of Late Hallstatt princely grave near Rovná (distr. Strakonice) and natural scientific analyses and measurements.
Chytráček, M.; Chvojka, O.; Egg, M.; John, J.; Křivánek, R.; Michálek, J.; Kyselý, René; Stránská, P.; Kozáková, Radka; Fikrle, M.
Fines Transire. 39-52 ISBN 978-3-89646-218-3. ISSN 1868-2308.;
[23. Archäologische Arbeitsgemeinschaft Ostbayern/West- und Südböhmen/Oberösterreich Kostenz (DE), 19. 06. 2013 - 22. 06. 2013]
Scientific discipline: Archaeology, anthropology, ethnology

Differences in Chemistry of the Ries Area Sediments and Central European Tektites Revisited.
Skála, R.; Žák, K.; Jonášová, Š.; Ackerman, Lukáš; Řanda, Zdeněk; Mizera, J.; Kameník, J.; Magna, T.
Goldschmidt2015 Abstracts. Cambridge: Cambridge, 2015. pp. 2913-2913.
[25th Goldschmidt Conference Prague 16. 08. 2015 - 21. 08. 2015]
Scientific discipline: Geochemistry

Determination of Trace Concentration in TMD Detectors using PGAA.
Tomandl, I.; Viererbl, L.; Kudějová, P.; Lahodová, Z.; Klupák, V.; Fikrle, M.

EPJ Web of Conferences. Vol. 93. 2015, 08003. ISBN 978-2-7598-1794-8. ISSN 2100-014X.
[15th International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics (CGS) Dresden (DE), 25. 08. 2014 - 29. 08. 2014]
Scientific discipline: Nuclear, atomic and molecular physics, accelerators

Hellenistic mosaic glass vessels in Bohemia and Moravia.
Venclová, N.; Hulínský, V.; Jonášová, Š.; Frána, J.; Fikrle, M.; Vaculovič, T.
Archeologické rozhledy. Vol. 67, No. 2 (2015), pp. 213-238. ISSN 0323-1267
Scientific discipline: Archaeology, anthropology, ethnology; Geochemistry; Nuclear, atomic and molecular physics, accelerators

II. Main scientific results achieved on the basis of the infrastructure's use by external workers:

Designing the nanobiointerface of fluorescent nanodiamonds: highly selective targeting of glioma cancer cells.
Šlegerová, Jitka; Hájek, M.; Řehoř, I.; Sedlák, F.; Štursa, J.; Hrubý, Martin; Cígler, P.
Nanoscale. Vol. 7, č. 2 (2015), pp. 415-420. ISSN 2040-3364
Scientific discipline: Organic Chemistry; Macromolecular Chemistry
Impact factor: 7.394, year: 2014

Hydroboration of Graphene Oxide: Towards Stoichiometric Graphol and Hydroxygraphane.
Poh, H. L.; Sofer, Z.; Šimek, P.; Tomandl, I.; Pumera, M.
Chemistry - A European Journal. Vol. 21, č. 22 (2015), pp. 8130-8136. ISSN 0947-6539
Scientific discipline: Inorganic Chemistry
Impact factor: 5.731, year: 2014

Crystal structure and antiferromagnetic spin ordering of LnFe(2/3)Mo(1/3)O(3) (Ln = Nd, Pr, Ce, La) perovskites.
Ivanov, S. A.; Beran, P.; Bazuev, G. V.; Ericsson, T.; Tellgren, R.; Kumar, P.; Nordblad, P.; Mathieu, R.
Physical Review. B. Vol. 91, č. 9 (2015), 094418. ISSN 1098-0121
Scientific discipline: Solid-state physics and magnetism
Impact factor: 3.736, year: 2014

Influence of multiple small-angle neutron scattering on diffraction peak broadening in ferritic steel.
Woo, W.; Em, V.; Shin, E.; Mikula, Pavol; Ryukhtin, V.
Journal of Applied Crystallography. Vol. 48, APR (2015), pp. 350-356. ISSN 0021-8898
Scientific discipline: Solid-state physics and magnetism
Impact factor: 3.720, year: 2014

Growth and Potential Damage of Human Bone-Derived Cells Cultured on Fresh and Aged C-60/Ti Films.
Kopová, I.; Lavrentiev, V.; Vacík, J.; Bačáková, L.
PLoS ONE. Vol. 10, č. 4 (2015), e0123680. E-ISSN 1932-6203
Scientific discipline: Biotechnology and bionics

Impact factor: 3.234, year: 2014

Saturable absorption of silver nanoparticles in glass for femtosecond laser pulses at 400 nm
Ajami, A.; Husinsky, W.; Švecová, B.; Vytykačová, S.; Nekvindová, P.
Journal of Non-Crystaline Solids. Vol. 426, OCT (2015), pp. 159-163. ISSN 0022-3093
Scientific discipline: Other materials
Impact factor: 1.766, year: 2014

Determination of the separation efficiencies of a single-stage cryogenic distillation setup to remove krypton out of xenon by using a Kr-83m tracer method.
Rosendahl, S.; Brown, E.; Cristescu, I.; Fieguth, A.; Huhmann, C.; Lebeda, O.; Murra, M.; Weinheimer, C.
Review of Scientific Instruments. Vol. 86, č. 11 (2015), pp. 115104. ISSN 0034-6748
Scientific discipline: Sensors, detecting elements, measurement and regulation
Impact factor: 1.614, year: 2014

Proton-induced direct and indirect damage of plasmid DNA.
Vyšín, Luděk; Pachnerová Brabcová, K.; Štěpán, V.; Moretto-Capelle, P.; Bugler, B.; Legube, G.; Cafarelli, P.; Casta, R.; Champeaux, J. P.; Sence, M.; Vlk, M.; Wagner, Richard; Štursa, J.; Zach, Václav; Incerti, S.; Juha, Libor; Davídková, M.
Radiation and Environmental Biophysics. Vol. 54, č. 3 (2015), pp. 343-352. ISSN 0301-634X
Scientific discipline: Biophysics
Impact factor: 1.528, year: 2014

Neutronics experiments, radiation detectors and nuclear techniques development in the EU in support of the TBM design for ITER.
Angelone, M.; Fischer, U.; Flammini, D.; Jodlowski, P.; Klix, A.; Klodeli, I.; Kuc, T.; Leichtle, D.; Lilley, S.; Majerle, M.; Novák, J.; Ostachowicz, B.; Packer, L.; Pillon, M.; Pohorecki, W.; Radulovic, V.; Šimečková, Eva; Štefánik, Milan; Villari, R.
Fusion Engineering and Design. 96-97, OCT (2015), pp. 2-7. ISSN 0920-3796.
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 1.152, year: 2014

Radiation hardness investigation of avalanche photodiodes for the Projectile Spectator Detector readout at the Compressed Baryonic Matter experiment.
Kushpil, V.; Mikhaylov, V.; Kushpil, S.; Tlustý, P.; Svoboda, O.; Kugler, A.
Nuclear Instruments & Methods in Physics Research Section A. Vol. 787, JUL (2015), pp. 117-120. ISSN 0168-9002
Scientific discipline: Nuclear, atomic and molecular physics, accelerators
Impact factor: 1.216, year: 2014

Full list of articles published in 2015 is given in the CANAM website:
(http://canam.ujf.cas.cz/en/open-access-to-data/scientific-results/publication)

3. Utilisation of the LI

Describe utilisation of the LI's capacity (according to the type and scientific field of the LI describe the percentage utilisation, eventually number of accesses, volume of produced, stored or provided data, distribution of users by their affiliation – universities, public research institutions, industry). In case of construction of the LI describe the current status or data from performed tests or limited service providing, etc.

LC & FNG
Overall running time: 2 652.75 irradiation hours (of the total capacity 4000 hours)
Applicability of the cyclotron: experiments 62.7% (2 507.25 hours) / service and tests 5.6% (145.5 hours)
Statistic of utilization: university 0% / public research institutions 36.9% / industry 63.1%

LT
Overall running time: 1 430 hours
Applicability of the Tandetron: experiments 83% (1 170 hours) / service and tests 17% (260 hours)
Statistic of utilization: university 31% / public research institutions 67% / industry 2%

NPL
Overall running time: 198.5 days
Applicability of the reactor: experiments 38.2% / service and tests 61.8%
Statistic of utilization: university 46.4% / public research institutions 48.3% / industry 5.3%

4. Cooperation

I. *Indicate newly established or running cooperation within the Czech Republic and abroad with research institutions, industry and other entities using results of the LI.*

II. *Indicate newly established or running cooperation with other research infrastructures in the field, both Czech and foreign ones.*

I. In 2015 new cooperation was established with 4 entities from CR and 21 entities from abroad. Running cooperation continued with 36 entities from CR and 119 entities from abroad.

II. Number of cooperation with infrastructures in the field was enlarged to 14. The infrastructure NMI3-II (FP7) will finish in beginning of 2016, the new infrastructure SINE2020 (Horizont 2020) started in October 2015.

Full list of cooperation is given in the Annex 4.

Annex 4 – List of cooperation

5. Service to Science Community

Indicate the number of users (eventually number of accesses) of the LI from the Czech Republic and abroad. Indicate the number of conferences and seminars organized by the LI, including the number of participants from the Czech Republic and abroad. Indicate the number of meetings with users and the feedback results thus obtained. Indicate the number of agreements with other institutions (e.g. contracts, memoranda).

In 2015, 103 proposals of experiments were submitted, carried out or completed, in which 238 users (137 from CR, 79 from ERA and 22 from third countries), including non-registered co-proposers, participated. More than 50% of the proposals were submitted in collaboration with foreign institutions. By 31.12.2015, 269 users, from that number 84 evaluators (44 from CR, 40 from abroad) and 177 proposers (86 from CR, 91 from abroad), were registered in the User Portal CANAM.

Number of conferences and seminars organized by the infrastructure: 0

Number of meetings with users and the feedback results: individual meetings before experiments

Number of agreements with other institutions: 18

- GAP107/12/0800 Fatigue of NiTiX High Temperature Shape Memory Alloy Actuators /FACT/
- GAP108/11/0958 Investigation of point defects in ZnO and their interaction with hydrogen and nitrogen
- GAP504/11/0484 Hyperaccumulation of heavy metals in macrofungi - molecular, geomycological and ecotaxonomic aspects
- GA13-07117S Statistical approaches to quantum many-body systems
- GA13-22351S Combined use of novel and traditional stable isotope systems in identifying source components and processes of moldavite formation
- GA13-27885S Photon activation analysis using short-lived products of photonuclear reactions for application in geochemical research
- GA14-12837S Interaction of hydrogen isotopes with candidate fusion materials
- GA15-01602S Creation and characterization of optical nanostructures by energetic ion beams
- GB14-36566G Multidisciplinary research centre for advanced materials
- GBP108/12/G108 Preparation, modification and characterization of materials by radiation
- TA01010237 Facility for nondestructive testing, diagnostics and 3D imaging based on neutron radiography and tomography
- TA02010218 Research of cable polymer material degradation and development of methods for their qualification in conditions of a severe accident of nuclear power plants of the new generation
- Bilateral cooperation agreement between the Scientific and Technological Research Council of Turkey (TÜBITAK) and Nuclear Physics Institute ASCR
- Bilateral cooperation agreement between the Hungarian Academy of Sciences (MTA) and Nuclear Physics Institute ASCR
- + 4 international grants mentioned below in the paragraph 6. Internationalisation

6. Internationalisation

Indicate the number of international research grants gained by research team, their names, a brief description and financial volume.

Number of international research grants: 4

1) F4E co-fund project - Experimental Validation of IRDFF Cross-Sections in Quasi-monoEnergetic Neutron Fluxes in 20/35 MeV Energy Range (5 k EUR p. a.)
   The scope of the work is the validation of the cross-sections for neutron dosimetric reactions (n,xn) on 59Co, 169Tm, 209Bi, 54Fe and 197Au in the energy range 20-35 MeV.

2) FP7 - NMI3-II - Neutron Scattering and Muon Spectroscopy Integrated Initiative (36 k EUR p. a.)
   Consortium of 18 partner organizations from 12 EU countries (comprising 13 infrastructures in the field of neutron scattering and muon spectroscopy).
   Consortium provides access to unique analytical instrumentations and methods with neutron and muon beams for materials research.

3) F4E co-fund project - Cu experiment and TBM instrumentation (5 k EUR p. a.)
   The gas production due to neutron irradiation represents one of the main concerns for the structural material performance in future power reactors. Experimental data (cross-sections) above 20 MeV are scarce and estimations of gas production in neutron spectra of future power reactors have large uncertainties.

4) Horizont 2020 - SINE2020 - Science and Innovation with Neutrons in Europe in 2020 (39 k EUR p. a.)
   Consortium of 18 partner organizations from 12 EU countries
   Consortium provides access to unique analytical instrumentations and methods with neutrons for materials research. SINE2020 is a new EU grant project (launched in October 2015) that will substitute the project NMI3-II in 2016.

7. Multidisciplinarity

Indicate the number and titles of scientific disciplines that use the LI's services. Append particular results.

Number of scientific disciplines: 18

Titles of scientific disciplines:

BG - Nuclear, atomic and molecular physics, accelerators
BM - Solid-state physics and magnetism
GM - Food industry
JJ - Other materials
CB - Analytical chemistry, separation
BO - Biophysics
JA - Electronics and optoelectronics
CA - Inorganic chemistry

JB - Sensors, detecting elements, measurement and regulation
CF - Physical chemistry and theoretical chemistry
CC - Organic chemistry
CD - Macromolecular chemistry
EB - Genetics and molecular biology
BL - Plasma physics and discharge through gases
DD - Geochemistry
JL - Fatigue and fracture mechanics
AC - Archaeology, anthropology, ethnology
EI - Biotechnology and bionics

8. Strategic Management of the Scientific Development of the Infrastructure

Indicate the main features of the scientific strategy of the LI, including plan for update of the technology used and plan of possible decommissioning.

Main characteristics of scientific strategy of the infrastructure:

- Maintaining reliable and defect-free operation of the existing infrastructure facilities.
- Gradual improvement and modernisation of the infrastructure facilities and improvement of parameters of ion and neutron beams.
- Development and implementation of new methods and technologies (new analytical methods - TOF = Time of Flight, new target technology, etc.) for the needs of users.
- Providing irradiation services and access to infrastructure facilities for Czech and foreign institutions in the broad area of multidisciplinary research within the 'Open Access mode'.
- Effective infrastructure utilisation in basic and applied research for the facility's own research projects.
- Education of graduate and postgraduate students, Ph.D. students and specialists and their involvement in the projects.

Plan for upgrading the applied technology and decommissioning plan:

- Routine launch and verification of properties of the neutron collimator for TOF measurements on the U-120M cyclotron.
- Demanding repair of short-circuited correction coils of the U-120M cyclotron.
- Continuation of work on the development of programmes and implementation of simulations of a unique pulse system on the internal accelerated beam of the U-120M cyclotron for TOF purposes.
- Continuation of work on the implementation of a high-voltage power source for the U-120M cyclotron internal beam pulsing, verification of its parameters and properties on the experimental vacuum 'stand'.
- Development, implementation and launching the targets (including high performance) for radionuclide production and fast neutron generation for the TR 24 cyclotron and their remote control and operation.
- Construction implementation of a new ion line for ion implantation allowing to switch the implantation to ion channel 0 in the Tandetron accelerator. Construction of the vacuum part of the new ion line, vacuum control and beam monitoring, construction of hardware and

software equipment and control.

- Manufacture of a multifunctional implantation chamber according to the facility's own design for Tandetron – a modular system with a diagnostic part enables to diagnose the composition of gaseous products in the implantation, contactless and contact sample temperature measurements, sample cooling and sample heating to a pre-set temperature of up to 800°C.
- Acquisition of two vacuum generating units to generate and control the vacuum in the newly constructed implantation line.
- Purchase and installation of a new neutron guide on HK3 that would increase neutron flux at the sample site by an order of magnitude.
- Purchase and installation of an automated sample changer for the gamma spectrometer.
- Acquisition of a vacuum chamber for the deformation machine.
- Production and installation of a positioning device for massive samples or sample environment on HK9.
- Acquisition of ancillary equipment for the preparation of material research samples on equipment installed on LVR-15 reactors.

B. Stable and Efficient Management

1. The Efficiency of the Use of Funds

Describe and document by table the use of the provided grant for past period; primarily describe the personnel costs (e.g. number of jobs), overheads and investments. Describe the mechanism of calculation of overhead costs approved by the host institution. Indicate how the allocated funds are used in the context of the overall budget of the LI. Indicate the percentage of the budget of the LI that has been obtained from external international grants, in collaboration with industry or other entities using the LI's services.

Provided grant 40 000k CZK was used as follows:

- Personal costs: 16 785k CZK
  - Salaries, social and health insurance and SF of employees of the structure (48,83 FTE)
- Overhead: 4 725k CZK
  - 16 % of the non-investment grant (the indirect institute expenses ensuring the activity of the infrastructure)
- Current expenses: 7 950k CZK
  - current materials, computer technology, spare parts, mediums for the infrastructure operation, utilization of the horizontal channels at the reactor
- Investments: 10 540k CZK
  - Investment items (Annex 1)

Funds from the Targeted Support Fund (FÚUP) were also used in 2015.

- Personal costs: 5k CZK
- Current expenses: 45k CZK
- Investments: 598k CZK

Institutional directive "Methodic of allocation of the actual eligible indirect costs for projects funded under FP7" was applied to calculate overhead costs.

The entire budget of the infrastructure 73 919k CZK was divided as follows:

MEYS	54 %
NPI CAS	24 %
International grants	1 %
Industry cooperation	21 %

Annex 5 – Methodic of allocation of the actual eligible indirect costs for projects FP7

2. Stable Management

Describe your plan for human resources development. Describe your strategy for allocation of the LI's capacity. Provide an organizational chart of the LI, changes in staffing of the LI. Indicate the composition and any changes in the external advisory bodies (scientific and management focus). Describe new ways in addressing the challenges that have been implemented in the area of LI's management in the period.

Human resources development plan:

- Training of operators to operate accelerators and related technologies (vacuum systems, power sources, control and automation, electronic instrumentation of nuclear analytical methods, etc.).
- New TR 24 accelerator - gradual training of technical and operating personnel as operators and gradual familiarisation with its individual technological sub-systems.
- Training of specialists to design and maintain new systems (e.g. new targets for neutron production, new TOF system, new software for spectroscopy, new multifunctional vacuum chambers, new analytical methods on neutron beams, etc.)
- Tender procedures to supplement scientific and technical personnel.
- Strategy – designation of a single responsible employee (Instrument Responsible) for each experimental infrastructure facility.
- Maintaining or improving the age structure of the laboratory by gradually admitting new members.
- Management of diploma theses and Ph.D. theses with a view to develop graduate and postgraduate students in order to integrate them into the infrastructure research team.
- Utilisation of experiences of young scientific workers after their return from research fellowships abroad.

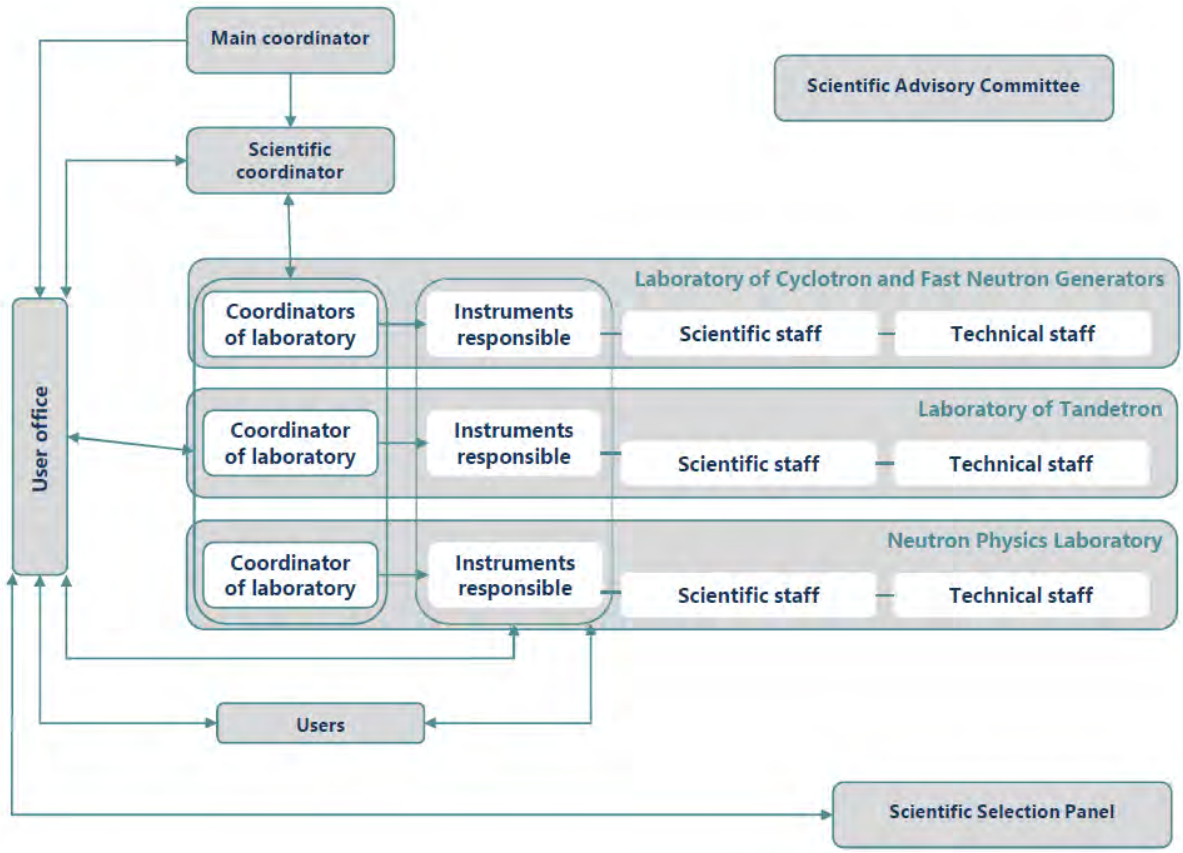
Capacity allocation strategy of the infrastructure:

- Allocation of operating time to experiments is made through the "Open Access" system where the scientific value of a particular project is evaluated by an international panel of evaluators (84 leading domestic and foreign specialists in the field); each project is evaluated by 2 evaluators.
- After the assessment of feasibility of the experiment and on the basis of operating work

load of the infrastructure, positively evaluated projects are allocated operating time by the local panels: LC panel (convenes twice a year), LT panel and NPL panel (both convene as necessary).

- User portal: http://users.canam.ujf.cas.cz is managed to administer and evaluate the designs of experiments.
- A particular scientific worker of the infrastructure is designated and is responsible for operation of the respective experimental facility (Instrument Responsible).

Organizational chart of the CANAM:



Changes in personnel base:

- Contract extended for the worker M. Cutroneo (post doc fellow) for 2016 with a view for further extension.
- P. Malinský and P. Horák successfully defended their dissertation theses and were included among the post doc fellows within the infrastructure.
- J. Pilch (Instrument Responsible) left to go abroad at the end of 2015; the selection procedure for a new scientific worker is pending.
- A selection procedure took place for the position of operator and electrical engineer. J. Stammers (a graduate of the University of the West of England) will be trained as Tandetron operator; K. Smolka was hired as designer and electrical engineer for NPL and LT.
- Bc. D. Poklop (student at the Faculty of Mechanical Engineering of the Czech Technical University, Process and Control Engineering) was hired as a part-time (50%) employee.

Changes in external and management bodies:

In 2015, the number of external evaluators within the Scientific Selection Panel was increased: three for the NPL neutron diffraction facility from South Korea, Germany and France, two for the NPL analytical method facility from Israel and Japan and one new evaluator for LT analytical methods from Germany. The total number of evaluators (both Czech and foreign specialists) is 84.

New methods of dealing with challenges:

- Cooperation with the NMI3 European consortium which successfully dealt with the EU NMI3-II project and also secured the new EU project SINE2020. In March 2016, this consortium of research laboratories will file a new EU project entitled NEMO2020, which will also include, among other things, the Transnational Access activity again. Among other things, the consortium also focuses on the issues of integration and harmonisation of user access to neutron physics facilities in Europe, as well as on expanding cooperation with the industry.

3. Progress towards Objectives and Compliance with the Timetable of the Realization of the LI

Indicate the comparison with the original plan of the realization of the LI stated in the LI's proposal approved by the Government; describe the progress in meeting LI's objectives and the compliance with the timetable of the realization of the LI. Indicate all changes (financial, personnel, etc.) in the realization of the LI and their explanation.

During the year, the project website (see http://canam.ujf.cas.cz) and the database system for the submission and administration of experiment designs (see http://users.canam.ujf.cas.cz) were modified and supplemented as necessary.

The modernisation of equipment of the infrastructure was carried out according to the project's timetable.

The following steps were taken in the individual laboratories:

LC & FNG

- Preparation works were carried out on the U-120M cyclotron to provide for the installation of a collimator to measure neutron TOF with the existing time structure of the beam (mode debugging, testing the beam with an extended ion guide, beam axis fixation).
- Target technology: developing and testing a prototype of liquid nitrogen-cooled target for the production of a fluorescent nanodiamond, PET target with water curtain, extended PET target, design and production of mounts for irradiation of biological samples and tests of radiation resistance of electronic components.
- Beam diagnostics: development and installation of a four-piece water-cooled beam collimator for target systems.
- Installation of sources of correction coils for the U-120M cyclotron, including production and installation of polarity reversers and control software.
- CCTV system: installation of new wiring and respective power supply.
- The new TR 24 cyclotron was successfully brought into operation with maximum proton energy of 24 MeV and currents of up to 300 μA.
- The construction of new building with a shielded hall for cyclotron TR 24 was also

completed and the essential technology sub-systems were brought into operation.

LT

- A new ion line on channel 0 fully equipped with automated vacuum control and ion beam monitoring was constructed.
- A new multifunction implantation chamber was designed and manufactured and will be used for the preparation of nanoparticles in materials or possibly for the creation of radiation defects to examine construction materials of nuclear reactors.

NPL

- Standard user operation took place on all equipment, including the new XRF, in the framework of "Open Access", as well as in the framework of the Nuclear Physics Institute's own research activities.
- A 2D position-sensitive detector was installed on the horizontal channel of HK-8 (diffractometer MAUD).
- The reconstruction of the SPN-100 diffractometer (installation of a new 2D position-sensitive detector, including its new massive shielding) was completed. The SPN-100 diffractometer was also equipped with a new positioning device – a robotic hand that was interconnected with the diffractometer measuring system during the year.

Personnel changes: see the section B, part 2. Stable Management

C. Socio-economic Impacts of the Infrastructure

1. Impact on the Economy

I. *Indicate the number of jobs in the LI (researchers/research staff/other).*

II. *Indicate the number and volume of contracts with industry concluded in the framework of public procurement to maintenance and renewal of the LI.*

I. Number of jobs in the infrastructure:
total (researchers / research staff / other)
individual: 93 (58 /25 /10)
FTE: 43,6 (26,8 /12,1 /4,7)

II. Number and volume of contracts with industry concluded in the framework of public procurement: 2 (845k CZK)

2. Impact on the Society

I. *Indicate the number of master and doctorate students using the LI.*

II. *Indicate the number of new textbooks, lecture notes and other practical outputs carried out in connection with the LI's operation, number and names of curricula whose students are using the LI.*

I. Number of master / doctorate students: 6 / 20

II. Practical outputs:

- Physical Practicum - Atomic lecture (54 hours/semester), Jan Evangelista Purkyně University, Ústí nad Labem
- Neutron Physics lecture (56 hours/semester), Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague
- Physics Study Programme, Faculty of Science, Jan Evangelista Purkyně University, Ústí nad Labem
- Nanotechnology Study Programme, Faculty of Science, Jan Evangelista Purkyně University, Ústí nad Labem
- Ph.D. thesis supervision: 6
- Diploma thesis supervision: 1
- Bachelor thesis supervision: 1
- Lectures in the framework of the Summer School for Mathematics and Physics Teachers (organised by the Union of Czech Mathematicians and Physicists) for teachers and secondary school students, organised by: Jan Evangelista Purkyně University, Ústí nad Labem
- Preparation of publications in the Summer School for Mathematics and Physics Teachers collection, published by: Jan Evangelista Purkyně University, Ústí nad Labem

3. Impact on Innovation

I. *Indicate the number of spin - off companies established on the basis of LI's operation.*

II. *Indicate the number of pilot plants, utility models, demonstrators made in connection with the operation of the LI, number of patents (including their names) recognized in connection with the operation of the LI.*

I. Number of running spin-off companies: 1 (RadioMedic, Ltd.)

II. Number of pilot plants, utility models, demonstrators and patents: 1
(UV-PUV 28095 – Target for irradiation of gaseous samples with a beam of accelerated particles)

D. Appendices

1. Required:

Annex 1 - Table of the real financial costs of the LI in 2015

Annex 2 - Table of monitoring indicators of the LI's implementation

2. Optional:

Annex 3 – List of team members

Annex 4 – List of cooperation

Annex 5 – Methodic of allocation of the actual eligible indirect costs for projects FP7

In Řež

Date: Jan 15, 2016

Signature of investigator: