Kick-off meeting on new H2020 project

Report of Abstracts

Abstract ID : **1**

The ISOLPHARM project at INFN-LNL

Content

The aim of the ISOLPHARM project is to develop a technology for the production of highly pure radionuclides for medical applications making use of the ISOL (Isotope Separation On-Line) method at the SPES facility. This will allow to overcome the difficulties related to the state of the art production with nuclear reactors or cyclotrons (high cost, production of big quantities of waste, presence of impurities in the final product) opening the way to a cleaner production of high specific activity radionuclides. Among the possible produced radionuclides at ISOLPHARM, 111Ag, 64Cu, 67Cu, 43Sc, 44Sc and 47Sc are the most promising for both diagnostic and therapeutic applications. The experimental activities currently undergoing can be shared in the international H2020 project for Integrating European Infrastructures for Starting Communities. The main activities are focused on the development of secondary targets, chelators, linkers and targeting agents

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Presenter(s) : ANDRIGHETTO, Alberto Andrighetto

Contribution Type : Network activity for co-operation

Status: SUBMITTED

Submitted by **ANDRIGHETTO, Alberto** on **Friday 12 April 2019**

Abstract ID : **2**

Mass separator magnet studies at IBA

Content

Over 30 years ago, a mass separation device called the "EMIS250" was developed and put in the IBA catalogue. The device was build and tested at the university of Louvain-la-Neuve in the late 80's. Nevertheless, the whole system was never sold and got archived and more or less forgotten. Recently, IBA was contacted again about this system and some preliminary simulations were done to assess the resolution and magnetic properties. The magnet itself consists of an ion source, one quadrupole, one 90 degrees bend magnet and a collector plate at the end of the beamline. The dipole magnet shows remarkable similarities to the recently developed high resolution mass separators at Triumf [1] and GANIL [2].
Since IBA has an extensive in-house experience in magnet design and particle tracking codes, collaborations with research institutes and universities could be envisaged within the INFRAIA network.

[1] J. Lassen, EMIS 2018 conference
[2] http://www.cenbg.in2p3.fr/desir/-HRS-

Primary author(s) : Dr VAN DE WALLE, Jarno (Ion Beam Applications); Dr FORTON, Eric (Ion Beam Applications)

Presenter(s) : Dr VAN DE WALLE, Jarno (Ion Beam Applications)

Contribution Type : Network activity for co-operation

Status: SUBMITTED

Submitted by **VAN DE WALLE, Jarno** on **Thursday 18 April 2019**

Abstract ID : **3**

Isotope Production at European Spallation Source – A potential new access to neutrons and protons

Content

It is an obvious possibility to augment the ESS installation with irradiation facilities to enable production and extraction of medically important, otherwise unavailable isotopes.

We present potential locations to place isotope production targets in the vicinity of the spallation target and warm linac. Initial calculations on available radiation quality, spectrum and flux at potential target locations are presented, which is based on current ESS design parameters, a 2.0 GeV proton beam on the solid tungsten target at 5 MW beam power.

Two equally important source terms can be identified in the vicinity of the spallation target. These are direct neutron activation in small targets located in points of high thermal neutron flux close to the water moderator and fast neutron activation using unmoderated spallation neutrons. Additional potential source is sub-100 MeV protons at the DTL.

We propose the formation of an EU funded consortium of research institutions to work out detailed plans for necessary infrastructure at ESS and a feasibility list of worthy, feasible radioisotopes together with their calculated yields. A future facility of this kind may benefit from close collaboration with facilities for electromagnetic isotope separation of radioisotopes, increasing radio-nuclidic purity and specific activity.

Primary author(s) : LEE, Yong Joong (European Spallation Source ERIC); JENSEN, mikael (Technical university Denmark)

Presenter(s) : LEE, Yong Joong (European Spallation Source ERIC)

Contribution Type : Facility as key research infrastructure

Status: SUBMITTED

Submitted by **LEE, Yong Joong** on **Wednesday 24 April 2019**

Abstract ID : **4**

Integrating the preclinical radiobiology platform and high throughput omics infrastructures (proteomic, genomic, transcriptomic) of SCK•CEN into INFRAIA

Content

The Belgian Nuclear Research Centre SCK•CEN has a strong, long-standing expertise in Radiobiology, evaluating the potential risks of ionising radiation on human beings. Our main research goal is to identify molecular markers (genetic, epigenetics, proteomics) that are modulated at low and high dose radiation exposure and to reveal their relationship to the biological effects at the cellular level and, more importantly, to the health effects on the whole organism. In addition, we actively contribute to the development of new cancer treatment modalities, such as targeted radionuclide therapy and proton therapy.

With this know-how, SCK•CEN Radiobiology could support the INFRAIA initiative in:

▸ Networking activities
- through the set-up of an integrated and active student and researcher exchange network programme to foster co-operation amongst the various institutions and mobility between the various infrastructures
- through integrated education and training althrough Europe (the group has a track record in Radiobiology Summer Schools and Eur MSc in Radiation Biology)
- through an active use of social media platforms in order to involve stakeholders outside the field and increase the knowledge of the general public

▸ Joint research activities, by offering following preclinical work for the study and development of radiopharmaceuticals:
- Preclinical evaluation of newly developed radiopharmaceuticals, in terms of pharmacodynamics (binding characteristics, internalization degree, cell inhibiting efficacy) pharmacokinetics (biodistribution/imaging, radiometabolite analysis) and toxicity, in vitro as well as in vivo
- Investigation of the therapeutic and cytotoxic effects of radiopharmaceuticals on a molecular level and identification of radiobiological markers, in vitro as well as in vivo, for more effective treatments preventing or mitigating adverse side effects

Primary author(s) : Dr AERTS, An (Radiobiology Unit, Interdisciplinary Biosciences, Institute for Environment, Health and Safety, SCK•CEN | Belgian Nuclear Research Centre); Dr DERRADJI, Hanane (Radiobiology Unit, Interdisciplinary Biosciences, Institute for Environment, Health and Safety, SCK•CEN | Belgian Nuclear Research Centre); Dr BECKER, Guillaume (Radiobiology Unit, Interdisciplinary Biosciences, Institute for Environment, Health and Safety, SCK•CEN | Belgian Nuclear Research Centre); Prof. BAATOUT, Sarah (Radiobiology Unit, Interdisciplinary Biosciences, Institute for Environment, Health and Safety, SCK•CEN | Belgian Nuclear Research Centre)

Presenter(s) : Dr AERTS, An (Radiobiology Unit, Interdisciplinary Biosciences, Institute for Environment, Health and Safety, SCK•CEN | Belgian Nuclear Research Centre); Dr DERRADJI, Hanane (Radiobiology Unit, Interdisciplinary Biosciences, Institute for Environment, Health and Safety, SCK•CEN | Belgian Nuclear Research Centre); Prof. BAATOUT, Sarah (Radiobiology Unit, Interdisciplinary Biosciences, Institute for Environment, Health and Safety, SCK•CEN | Belgian Nuclear Research Centre)

Contribution Type : Joint research activities

Status: SUBMITTED

Submitted by **AERTS, An** on **Thursday 25 April 2019**

Abstract ID : **5**

Development and production of radioisotopes and radiopharmaceuticals at SCK•CEN

Content

SCK•CEN is one of the largest and most renowned research institutions in Belgium, studying peaceful applications of radioactivity. It hosts BR2 which is a High-Flux Material Test Reactor providing thermal neutron fluxes up to 10^15 n/cm2 s. Hence it is considered as a major facility worldwide for the routine supply of medical and industrial radioisotopes. The reactor was refurbished in 2015-2016 to allow safe and reliable operation for another period of 10 to 20 years. It will continue to play its key role in the field including the development of new radioisotopes. NURA, a strategic program of SCK•CEN to develop medical radioisotopes and radiopharmaceuticals, will of course take advantage of the proximity of BR2 to produce new medical isotopes. New radiochemical laboratories have and are being installed to process irradiated targets. In addition, several other laboratories have and are being installed to enable radiolabeling and preclinical evaluation of newly developed radiopharmaceuticals.

In the current call of the H2020 INFRAIA Project, SCK•CEN could provide irradiation services to produce high-potential radioisotopes. These isotopes can be shipped to ISOLDE/MEDICIS for mass separation and return to SCK•CEN for final purification. Furthermore, SCK•CEN can perform radiolabeling and preclinical evaluation to contribute to development of new radiopharmaceuticals.

Primary author(s) : DARTIGUELONGUE, Adrien (SCK•CEN, Radiochemistry Expert Group); PONSARD, Bernard (SCK•CEN, BR2 Reactor)

Co-author(s) : OOMS, Maarten (SCK•CEN, Radiochemistry Expert Group); BURGOYNE, Andrew (SCK•CEN, Radiochemistry Expert Group); VAN DE VOORDE, Michiel (SCK•CEN, Radiochemistry Expert Group); ELEMA, Dennis (SCK•CEN, NURA Program); CARDINAELS, Thomas (SCK•CEN, Radiochemistry Expert Group)

Presenter(s) : DARTIGUELONGUE, Adrien (SCK•CEN, Radiochemistry Expert Group)

Contribution Type : Facility as key research infrastructure

Status: SUBMITTED

Submitted by **DARTIGUELONGUE, Adrien** on **Thursday 25 April 2019**

Abstract ID : **6**

Radionuclide development at PSI for nuclear medicine applications

Content

In this talk, the research of Radionuclide Development Group of PSI on the production of innovative radionuclides, from targetry to preclinical applications, is reviewed. PSI is a federal research institute, which possesses large-scale facilities for basic research. Facilities include Injector 2 cyclotron and the spallation-induced neutron source for isotope production research. In addition, the group has collaborations with medical cyclotrons, high-flux research reactors, ISOL facilities, and radiometrology laboratories to enhance research capabilities. The focus of the research on the production of therapeutic and diagnostic radionuclides is briefly described, as well as the possible roles to play as a partner for INFRAIA project.

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Contribution Type : Facility as key research infrastructure

Status: SUBMITTED

Submitted by **TALIP, Zeynep** on **Friday 26 April 2019**

Abstract ID : **7**

CEMHTI and its cyclotron : good tools for radiochemists

Content

Author : I. Da Silva, L. Frealle
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CEMHTI (Conditions Extrêmes et Matériaux : Haute Température et Irradiation) is a French laboratory (at Orléans) dedicated to characterisation of materials under irradiation and high temperatures. For that, various experimental facilities exist in it : high resolution solid state and high temperature NMR, high temperature and application of ion beams.
3 Around all these facilities, one is very particular and interesting in terms of developments of non-conventional medical isotope production, CGR-MeV 680 Cyclotron : multienergy (10-45MeV) and various particles (proton, deuteron, alpha, neutronic activation) accelerator. Exotic radionuclides have been (64Cu, 211At, 89Zr), are (52Mn, 165Er) and could be produced (161Tb) for development of methods of production (irradiation, radiochemistry, Targetry, target, radiolabelling molecules).
In terms of research, development of radiochemistry for easy access to radiometals in tracer imaging for bimodality MRI/SPECT (165Er) or PET (52Mn) is our main subject of investigation. For that technical feasibility (targetry, target, radiochemical separation, and automatization) have been experimented. Relative to 165Er, two questions have been emerged which largely concern a number of lanthanides: therapy Auger and separation of heavy adjacent lanthanides. These points have an application on production of 161Tb perhaps a future medical radiosotopes.
That why, it will be a great opportunity for our laboratory to be associated to CERN/Sciprom's proposal, Physical mass separation to foster a new research era with emerging medical isotopes.

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Presenter(s) : Mr DA SILVA, Isidro (CNRS CEMHTI)

Status: SUBMITTED

Submitted by **DA SILVA, isidro** on **Friday 26 April 2019**

Abstract ID : **8**

CERN-MEDICIS: Non-conventional medical isotopes by electromagnetic mass separation

Content

The Isotope mass Separation OnLine (**ISOL**) technique has been developed for over fifty years to address fundamental questions in nuclear structure and astrophysics and for applications, notably at ISOLDE at CERN.

CERN-MEDICIS is a recent extension of the ISOLDE Class A laboratory at CERN dedicated to medical radioisotopes with an irradiation station in the HRS beam dump position, a target remote handling system and a standalone electromagnetic isotope mass separator. It will also comprise a laser ion source and a simple radiochemical laboratory.

It started operating in 2018 with CERN's protons and will be using for 2019-2020 radioisotopes produced at partner institutes for mass separation at CERN and distribution for biomedical research. It has already produced and distributed Terbium isotopes and high specific activity 169Er and 165Tm, and has plans for others such as 225Ac/Ra.

The present **MEDICIS collaboration** comprises 15 European institutes with a background in the different scientific disciplines needed in translational research such as isotope beam production techniques, radiochemistry, radiopharmaceutical and preclinical research, possibly extending to clinical perspectives in the field of precision medicine.

Primary author(s) : STORA, Thierry (CERN)

Presenter(s) : STORA, Thierry (CERN)

Contribution Type : Facility as key research infrastructure

Status: SUBMITTED

Submitted by **STORA, Thierry** on **Friday 26 April 2019**

Abstract ID : **9**

Contribution of C2TN/IST to the INFRAIA Consortium

Content

The Radiopharmaceutical Sciences Group (RSG) from the Centro de Ciências e Tecnologias Nucleares (C2TN)/IST develops research activities on the design and preclinical evaluation of radioprobes for Positron Emission Tomography (PET) or Single Photon Emission Computed Tomography (SPECT) Imaging and Targeted Radionuclide Therapy (TRT). Currently, the research group is mainly involved in the study of targeted radiopharmaceuticals to image/interfere with different disease-associated molecular and biological pathways. In the past few years, this included the design of novel molecular and nanometric radiocompounds for imaging and/or therapy of cancer, using peptidic molecules and imaging or therapeutic radiometals, which in some cases provided results with clinical potential.1-4
To perform this research work, the RSG from C2TN/IST gathers a multidisciplinary team of scientists with national and international recognized expertise in organic, inorganic, organometallic chemistry and nanochemistry, radiochemistry, radiopharmacology/radiopharmacy and biology/biochemistry, who run dedicated facilities for: i) chemical synthesis, including solid phase peptide synthesis; ii) radiosynthesis; iii) biochemical, molecular biology and cellular studies; iv) animal studies. These skills and facilities make C2TN/IST an attractive partner of the INFRAIA consortium, where the C2TN team can contribute in the design and preclinical evaluation of innovative radioconjugates to be obtained with the less-explored medical isotopes foreseen in the project.

[1] E. Pereira, L. Quental, E. Palma, M.C. Oliveira, F. Mendes, P. Raposinho, I. Correia, J. Lavrado, S. Di Maria, A. Belchior, P. Vaz, I. Santos, A. Paulo, "Evaluation of Acridine Orange Derivatives as DNATargeted Radiopharmaceuticals for Auger Therapy: Influence of the Radionuclide and Distance to DNA". Scientific Reports 7:42544 (2017).
[2] F. Silva, A. Zambre, M. P. C. Campello, L. Gano, I. Santos, A. M. Ferraria, M. J. Ferreira, A. Singh, A. Upendran, Antonio Paulo, R. Kannan, "Interrogating the Role of Receptor-Mediated Mechanisms: Biological Fate of Peptide-Functionalized Radiolabeled Gold Nanoparticles in Tumor Mice". Bioconjugate Chem., 27, 1153−1164 (2016).
[3] M. Morais, M.P.C. Campello, C. Xavier, J. Heemskerk, J.D.G. Correia, T. Lahoutte, V. Caveliers, S. Hernot, I. Santos, "Radiolabeled mannosylated dextran derivatives bearing an NIR fluorophore for sentinel lymph node imaging", Bioconjugate Chemistry, 25(11), 1963-1970 (2014).
[4] M. Morais, B.L. Oliveira, J.D. Correia, M.C. Oliveira, M.A. Jiménez, I. Santos, P.D. Raposinho, "Influence of the bifunctional chelator on the pharmacokinetic properties of 99mTc(CO)3-labeled cyclic amelanocyte stimulating hormone analog", Journal of Medicinal Chemistry 56(5) 1961-1973 (2013).

Primary author(s) : Dr PAULO, Antonio (Centro de Ciências e Tecnologias Nucleares, Instituto Superior Técnico, Universidade de Lisboa)

Presenter(s) : Dr PAULO, Antonio (Centro de Ciências e Tecnologias Nucleares, Instituto Superior Técnico, Universidade de Lisboa)

Contribution Type : Undefined

Status: SUBMITTED

Submitted by **PAULO, António** on **Friday 26 April 2019**

Abstract ID : **10**

CERIMED : Center dedicated to medical imaging Research

Content

CERIMED (European Center for Research in Medical Imaging) is a Aix Marseille Univ and CNRS affiliated UMS platform (UMS 2012) labeled FLI and IBISA homed in a 2500sqm dedicated building. CERIMED platform and CERIMED scientific community (physicist, physician, pharmacist, biologist, engineer) dedicated their expertise to enhanced development in the field of in vivo imaging R&D (clinical and preclinical). In the preclinical department the opportunity is offered to academic and industrial partners to access news technologies such microsurgery and radiopharmaceutical R&D platforms (2 cyclotrons, GMP hot labs; QC lab), (µ)TEP-CT, (µ)SPECT-CT, MRI, (µ)ultrasound and interventional radiology technologies applied in rodent, pigs and Non Human Primates. Clinical and radiopharmaceutical departments allow studies in healthy volunteers and patients as early as the "first in man step".
Since 2015 CERIMED collaborated in more than 130 international publication and with 4 international patents.

Primary author(s) : Prof. GUILLET, Benjamin (AMU-APHM); Prof. GUEDJ, Eric (AMU-APHM)

Presenter(s) : Prof. GUILLET, Benjamin (AMU-APHM)

Contribution Type : Facility as key research infrastructure

Status: SUBMITTED

Submitted by **-, -** on **Saturday 27 April 2019**

Abstract ID : **11**

PRODUCTION OF RADIOISOTOPES AT THE HIGH FLUX REACTOR OF INSTITUT LAUE-LANGEVIN

Content

Institut Laue-Langevin (ILL) is an international user facility that exploits a high flux reactor as powerful neutron source. Most of the over 40 instruments served by these intense neutron beams exploit neutron scattering for studying questions in condensed matter physics, chemistry, biology, materials science, etc. Other instruments are dedicated for nuclear and particle physics experiments. Moreover, high flux in-pile irradiation positions are used to produce radioisotopes with high specific activity for medical applications and fundamental research.

The irradiation positions of the ILL reactor provide thermal neutron fluxes of up to 1.5E15 n.cm-2s-1, i.e. by far the highest in the European Union and among the top three facilities worldwide, together with HFIR (Oak Ridge, USA) and SM3 (Dimitrovgrad, Russia).

For carrier-added radioisotopes produced by single neutron capture, such as 103Pd, 153Sm, 169Er, c.a. 177Lu, 181W, 193mPt, 204Tl, etc., the high neutron flux provides a proportional gain in achievable specific activity. The gain in specific activity is even more pronounced (roughly proportional to the square of the neutron flux) for radioisotopes produced by double neutron capture, such as 166Dy, 188W, 194Os, etc., which in turn can be used for generators to elute the non-carrier-added radioisotopes 166Ho, 188Re, 194Ir respectively. For production of non-carrier-added radioisotopes, such as 47Sc, 131Cs, 147Pm, 161Tb, 163Ho, 171Tm, n.c.a. 177Lu, etc., the high flux provides a corresponding gain in production yield.

Primary author(s) : KÖSTER, Ulli (Institut Laue-Langevin)

Presenter(s) : KÖSTER, Ulli (Institut Laue-Langevin)

Contribution Type : Facility as key research infrastructure

Status: SUBMITTED

Submitted by **KOESTER, Ulli** on **Sunday 28 April 2019**

Abstract ID : **12**

Arronax contribution to the INFRAIA Kick-off meeting

Content

Production of non-conventional radionuclides is the main objective of the Arronax cyclotron [1], acronym for "Accelerator for Research in Radiochemistry and Oncology at Nantes Atlantique", has been built to support research in nuclear medicine. ARRONAX, is a high energy (70 MeV) and high intensity (2*375 µA) multi-particles cyclotron located in Nantes (France). It is operating since 2011. On the technical aspects, two proton beams can be extracted at the same time (dual beam mode) and experimental vaults are equipped with irradiation stations connected to hot cells via a pneumatic transport system. In 2017, a radio-pharmacy able to produce sterile radiopharmaceutical according to the Good manufacturing Practices (GMP) for human use has opened in our site. In 2018, FDA approved our Sr-82 production as an Active Pharmaceutical ingredient and the ASNM, its French equivalent, gave use the GMP certification. At the moment, we plan to provide within the CERN MEDICIS collaboration Tb isotopes from gadolinium target irradiated by protons.
We are looking forward enlarging the number of radionuclide available for the medical community. To this end, we will use as much as we can the Arronax capabilities. However, in some case, the use of mass separation may allow to reach required radionuclide purity or specific activity or even increase yields
In the INFRAIA on masse separation, we will be able to contribute in each of the activities.
1. Trans-national access or virtual access activities: we can provide targets as we plan to do in the MEDICIS collaboration for mass separation at CERN or elsewhere. We can also provide, to external or internal users, radionuclides that we are producing as Cu-64, Sc-44, …
2. Networking activities: we will be able to participate to the networking activities.
3. Joint research activities: we are particularly interested to validate excitation schemes for laser ionizations for all radionuclides of potential interest in medicine, to develop a new target system for the mass separator which is more flexible than the Isolde model and is designed to be reusable and to explore all radioprotection aspects related to the use of irradiated targets within the mass separator: inside/outside protection, contamination,…
References:
1. F. Haddad et al.. Eur. J. Nucl. Med. Mol. Imaging, 35:1377–1387, 2008

Primary author(s) : Prof. HADDAD, ferid (GIP Arronax); Prof. HADDAD, Ferid

Presenter(s) : Prof. HADDAD, Ferid

Status: SUBMITTED

Submitted by **HADDAD, Ferid** on **Monday 29 April 2019**

Abstract ID : **13**

Radioisotope-beams-integration test facility at MedAustron

Content

MedAustron is a state of the art ion therapy center[1, 2] with the goal to become a center of excellence in the field of particle therapy. The center undergoes an ambitious performance increase program[3] and numerous continuous improvement projects. As part of the MEDICIS Promed network[4] MedAustron contributed to a TDR[5] for the integration of an (_^11)C production facility into an existing synchrotron based treatment center. MedAustron aims to broaden the field of particle therapy and increase its applications to a wide number of indications while improving treatment quality.
Our institution is looking forward to improve ties to innovation or research networks which pursues the above mentioned goals. A joint research activity is proposed to develop and engineer a critical component for the integration of radioisotope beams in a particle therapy facility, in particular a high capacity EBIS which fulfills all requirements and constraints portrayed in the TDR. The charge breeder shall be developed together with international partners of distinguished expertise[6] as well as suitable industrial partners[7] to commercialize the resulting prototype. After development, assembly and pre-testing, the EBIS shall be integrated in an existing synchrotron based treatment facility to proof the accomplishment of the required performance as well as overall facility efficiency. Upon conclusion of the JRA the installation shall be made accessible to researchers and developers who are interested to test the performance and integration of further components required for a complete radioisotope treatment chain.

1. Benedikt M Overview of the MedAustron Design and Technology Choices. 3
2. Pivi MTF, Franco AD, Farinon F, et al (2017) Overview and Status of the MedAustron Ion Therapy Center Accelerator. 4
3. Franco AD, Boehlen TT, Farinon F, et al (2017) Upgrade Study of the MedAustron Ion Beam Center. 4
4. MEDICIS-PROMED | MEDICIS-PROMED. https://medicis-promed.web.cern.ch/. Accessed 29 Apr 2019
5. MEDICIS-Promed Final Conference (29 April 2019 - 4 May 2019) · Indico. In: Indico. https://indico.cern.ch/event/7824 Accessed 29 Apr 2019
6. potential partners are: CERN, CNAO, INFN-LNS, Abstract Landscapes
7. potential partners are: DREEBIT

Primary author(s) : SCHMITZER, Claus (MedAustron)

Presenter(s) : SCHMITZER, Claus (MedAustron)

Contribution Type : Joint research activities

Comments:

Network Activity or JRA to establish test facility

Status: SUBMITTED

Submitted by **SCHMITZER, Claus** on **Monday 29 April 2019**

Abstract ID : **14**

High-throughput ion sources for medical radioisotope extraction and separation

Content

The premise for the ion sources used in radioactive ion beam production at mass separators has always been to access the most exotic isotopes with a strong emphasis on efficiency. In the recent years, a secondary aspect has been the purity of the beam, with the dual research aspects of selective ionisation (e.g. with the resonance laser ionisation process) and suppression of contaminants. The interest in medical radioisotopes, however, requires to dramatically shift the aim, from exoticity (in the sense of accessing the shortest-lived species) to quality (in the sense of isotopic purity). Moreover, the required throughput to produce meaningful samples will be dramatically increased with respect to the existing ISOLDE facility. Indeed, the MEDICIS operation already leads to the extraction of isotopes over a short time period (few hours) after an irradiation of up to 5 times tat period, resulting immediately in a 5-fold increase of instantaneous outgasing. Future facilities, such as ISOL@MYRRHA, will feature a 50-fold increase of power – and likely in-target radioisotope production – which the ion source will have to cope with.
There is therefore a great need at this stage of our community to investigate how new concepts can be adapted in the ion source development to provide the best samples possible. The requirements will be the high selectivity and purity, with the smallest compromise possible on efficiency, while maintaining the versatility of the facility in delivering a large catalog of available radioisotopes.
There are already some promising that we propose to further, namely working on the Versatile Arc Discharge (Laser) Ion Source (VADIS/VADLIS) and the Laser Ion Source and Trap (LIST), which have been developed at CERN ISOLDE and require further improvement in light of the needs of MEDICIS and similar facilities.
The starting point will be to perform advanced simulations into the geometry and operation of these ion sources with particle-in-cell simulations (VSim from TechX), followed by experimental validation. Access to the Leuven Isotope Separator will be available for those experimental campaigns prior to suggesting their utilisation at online facilities.

Primary author(s) : Prof. COCOLIOS, Thomas Elias (KU Leuven - IKS)

Presenter(s) : Prof. COCOLIOS, Thomas Elias (KU Leuven - IKS)

Contribution Type : Joint research activities

Comments:

This is a general tag line and I would be happy to join any other participants in forming a JRA on ion sources or production aspects.

Status: SUBMITTED

Submitted by **Prof. COCOLIOS, Thomas Elias** on **Monday 29 April 2019**

Abstract ID : **15**

The Leuven Isotope Separator

Content

The Ion and Molecular Beam Laboratory of the KU Leuven Department of Physics and Astronomy features many facilities, mostly aimed at the study of solid state materials, defects in doping processes, and surface interactions. One of its facility is the Leuven Isotope Separator (LIS), which consists in an offline mass separator for beams up to an energy of 80 keV and a dipole magnet for separation with a resolving power of up to 800. The LIS has been established for use with radioisotopes, primarily for the implantation of radioactive Co or In isotopes for solid state physics research. However, with the recent shift of activities within the Department of Physics & Astronomy, this machine is currently being refurbished for use in the study of radioisotope beam production, especially in the context of medical radioisotopes.
The LIS can become an ideal facility for the offline testing of new concepts while other facilities must concentrate on operation for the delivery of radioisotopes to medical research institutions. The ability to use radioisotopes can also become interesting for the detailed tracing of the ions from the source to the sample collection, towards clearly identifying processes by which the efficiency might be compromised. Finally, thanks to its proximity to the SCK-CEN, the LIS can already be a testing ground for the activities performed in the preparation of the ISOL@MYRRHA facility while the offline separator at SCK-CEN is being constructed and commissioned.
One may consider using the LIS for the separation of samples irradiated at the BR2 reactor in Mol, as in-country separation of radioisotopes can greatly simplify the logistics of radioisotope delivery.
The LIS is operated by a local technician (0.5 FTE) assisted by the PhD students from the Interdisciplinary Research Group of Prof Thomas Cocolios. Its operation is funded through scientific grants from the regional funding agency FWO.

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Presenter(s) : Prof. COCOLIOS, Thomas Elias (KU Leuven - IKS)

Contribution Type : Facility as key research infrastructure

Comments:

The LIS could be seen as potential machine for the starting activities, to be replaced by the SCK-CEN infrastructures when those become available. I am happy to enter this as well within a KU Leuven - SCK consortium if that makes more sense for the submission process.

Status: SUBMITTED

Submitted by **Prof. COCOLIOS, Thomas Elias** on **Monday 29 April 2019**

Abstract ID : **16**

γ MRI: New imaging technology with hyper polarised radiotracers

Content

Our project is devoted to a new medical imaging modality based on a revolutionary technology combining the sensitivity of γ detection and the spatial resolution and flexibility of MRI. This modality, the so-called γ-MRI, goes beyond the present technological paradigms in molecular imaging. It is not just a hybrid approach joining two separate modalities into one complex machine (like for PET/MRI machines), but a single new modality, simultaneously achieving the high spatial resolution of MRI and the high-sensitivity of PET in faster scan times.

The key innovation in this new approach is the hyperpolarization of radioactive elements with lasers. Since this process does not require ultra-high MRI magnetic fields or fast coincidence detection of gamma rays as in PET, γ-MRI can be performed using machines that are less complex and less expensive than the present state-of-the-art devices, especially hybrid ones. This disruptive approach of a more accurate and widely available molecular imaging technology will open new avenues for patient care and for the medical imaging market.

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AAA Abstract

Content

AAA's expertise in developing, producing and commercializing Nuclear Medicine theragnostics agents stems from more than 15-year legacy as a leader in radiopharmaceuticals, including both PET and SPECT imaging agents therapy agents. Our main product on therapy of GEP-NET is a ready-to-inject solution of 177Lu-Dotatate (Lutathera) with marketing registration in both USA and EU.
In the framework of AAA's R&D activities, the early stage research project "MEDICIS-produced radioisotope beams for medicine" (MEDICIS PROMED, a Marie Sklodowska-Curie Innovative Training Network of the Horizon 2020 EU program) has been actively supported. The aim of AAA participation was to investigate the use of electromagnetic isotopes mass separation (EMIS) technology applied to the production of radionuclides. This project had brought new knowledge and competences into the company.
The throughput of this project was successful; therefore, AAA would appreciate to be part of a subsequent new project consortium within the HORIZON 2020 framework and contribute to the development of the technology around mass separation already started within MEDICIS-PROMED.

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