

Status of the Efinion brochure

Karl Johnston



EFINION: The European Forum for Innovative
Applications of Nuclear ION beams and tools





Feedback from all the TNA labs: EFINION questionnaire



EFINION QUESTIONNAIRE #1

please submit a Word file, including everything – not a PDF!

A.1	Name person filling the questionnaire	dr. E.R. van der Graaf
A.2	Affiliation	KVI-CART (Center for Advanced Radiation Technology)
A.3	Email	vandergraaf@kvi.nl

B.1	Activities presented here refer to institution:	KVI-CART (Center for Advanced Radiation Technology)
B.2	Contact person of your institution for EFINION matters	dr. M.A. Hofstee, head cyclotron operations
B.3	Email	m.a.hofstee@rug.nl

In the following table(s) please describe as clear as possible the application(s) running at your lab that, in your view, deserve to be included in the EFINION catalogue. Though, EFINION's goal is to document all applications running at ENSAR institutions, some major criteria for the final composition of the catalogue will be the following:

1. Innovative aspects of the application
2. Socio-economic impact
3. Multi-disciplinary character
4. Existing links with "end-users"
5. Involvement of radioactive beams in the application
6. Uniqueness
7. Sustainability beyond ENSAR's termination
8. Potential for patents
9. European added-value
10. Potential for public awareness

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D6.1	Preliminary survey of past and present multidisciplinary and application-oriented research within EN	16	2.00	R	PU	12
D6.2	Report on the Workshop on "ENSAR applications - oriented research"	16	6.00	R	PU	36
D6.3	"Catalogue of multidisciplinary applications-oriented research activities of ENSAR"	16	5.00	R	PU	36
D6.4	"Synergies and collaboration opportunities in applications-oriented research with and within ENSAR".	16	6.00	R	PU	36
D6.5	The EFINION's website	16	5.01	O	PU	6
D6.6	"Nuclear scientists and policy makers communicate"	16	6.00	R	PU	48
		Total	30.01			

Efinion “Pre-workshop” CERN 20th Feb

Overview of the received information (at the time missing many labs)

Presentation and overview of similar projects from DidweDo agency (Lausanne)
Schedule laid out....

Initial plan was finalising by ~ 16th June....this has slipped

Structure of Brochure

Brochure structure:

- Editorials of ENSAR coordinator and GA chair – 1 page (videos on the digital edition)
- What is ENSAR – 1 page
- ENSAR response to Society + **top success story** – 2 pages
- Map with facilities/beneficiaries (similar to NuPECC brochure) - 1 page
- Table/Map with labs vs. application fields – 1 page
- TNA facilities: success stories – 7x4=28 pages
- JRA & NA – 4 pages
- Interviews with “end-users” – 2 pages
- Forward look and future plans – 2 pages

BACK COVER	FRONT COVER	inside FRONT COVER	table of contents	editorial	ENSAR + GA chair	What is ENSAR?	ENSAR map	Added Value of the project	Success Stories by field	TNA 01 GANIL (F)			
		1		2	3	4	5	6	7	8	9	10	11
TNA 01 GANIL (F)		TNA 02 GSI (D)		TNA 02 GSI (D)		TNA 03 LNL (I)		TNA 03 LNL (I)		TNA 04 JYU-JYFL (FI)		TNA 04 JYU-JYFL (FI)	
12	13	14	15	16	17	18	19	20	21	22	23	24	25
TNA 05 RUG-KVI (NL)		TNA 05 RUG-KVI (NL)		TNA 06 CERN-ISOLDE (CH)		TNA 06 CERN-ISOLDE (CH)		TNA 07 CNRS-ALTO (F)		TNA 07 CNRS-ALTO (F)		TNA 08 LNS (I)	
26	27	28	29	30	31	32	33	34	35	36	37	38	39
TNA 08 LNS (I)		JRA (7 Joint Research Activities)		NA (6 Network Activities)		Interviews with End users		After ENSAR	inside BACK COVER				
40	41	42	43	44	45	46	47	48	49	50	51	52	

“Flavour of content...”



FINAL REPORT OF THE IOC COORDINATION COMMISSION

GAMES OF THE XXX OLYMPIAD, LONDON 2012



This vision – to use the power of the Games to inspire lasting change – went far beyond simply hosting a memorable 17-day event: it aimed to capture the imagination of young people, while also creating physical, sporting and social legacies.

This compelling vision for the London 2012 Olympic Games provided a clear direction for the Organising Committee, guiding its decisions and inspiring its stakeholders throughout the planning and preparation phase.

London's vision also helped the Organising Committee to create its Games masterplan, which shaped the image of the Games and provided the foundations for its various achievements and innovations, which included delivering a unique Games-time experience for all key client groups, including athletes and spectators.

LOCOG also successfully and consistently repeated key messages in a very disciplined and coordinated way, using every member of its organisation, every possible ambassador and every programme or activity deployed by the organisers. It communicated its Games vision to all key stakeholders, including the public and the media, which was crucial to spreading the message of the Games to young people around the world.

By consistently delivering against its vision throughout the planning phase, LOCOG was able to successfully deliver during the Games themselves and also looks set to realise its legacy ambitions.



Sebastian Coe, Chairman, London 2012 Bid Limited.



London 2012 – Delivering on a vision video



Digital Edition: Content can be embedded...



Socio-economic benefit
Space electronics
Ion sources



Space electronics
Atomic collision
physics: astrochemistry



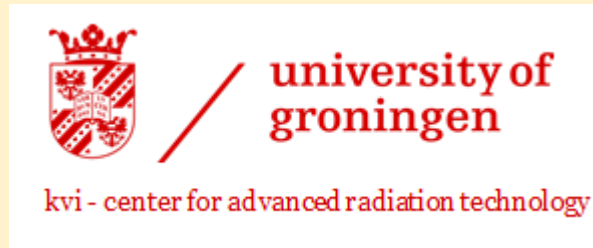
RADEF(mostly)
Pelletron



Solid state physics/biophysics
Medicine



AGOR-FIRM



Ion beam radiotherapy
Mass spectroscopy in everyday
life
Mine detection
Algorithms: "bunny"



Topics received



Ion beam writing
Diamond biosensors
Particle beam channelling
Materials for Gamma/neutron
detection

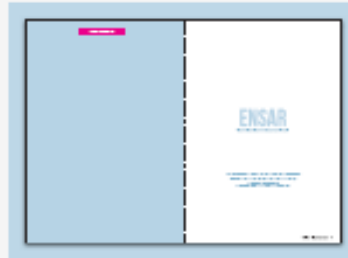


Hadron therapy
Medical imaging

Following some digestion, snapshot of a first look....



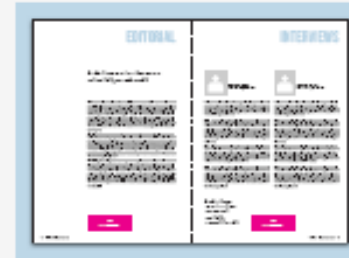
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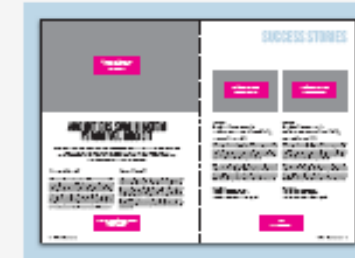
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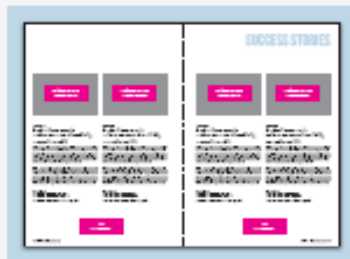
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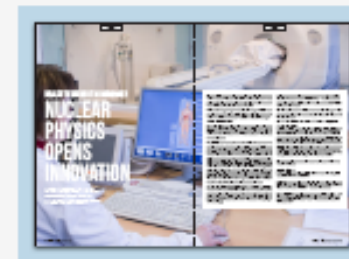
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9



10



11



12



13



14



15



16



17



18

ABOUT ENSAR

The European Research Network on Nuclear Physics

The European ENSAR is divided in 10 sub-projects, also called workpackages.

7 TNAs

Transnational Accelerator Activities

7 JRAs

Joint Research Activities

6 NAs

Networking Activities

Nuclear Physics is the study of the properties and behaviour of nuclei and particles, ranging from tiny quarks to giant explosions deep in space. Nuclear physics is important in a vast variety of situations, from understanding how the Sun provides the energy for life on this planet, to nuclear power plants and radiation therapy. Without nuclei, we simply would not exist, and it is important to understand why!

In order to carry out research at the forefront of fundamental nuclear science, our community of nuclear scientists profits from the diverse range of large research infrastructures existing in Europe. These infrastructures are particle accelerators that can supply different species of ion beams and energies. In this way, we can learn how the nuclear forces arising from their interaction between the building blocks of neutrons and protons manifest themselves in the rich structure of atomic nuclei, and how different isotopes of elements are synthesised in primordial stellar processes. Our community also has a long tradition of applying state-of-the-art developments in nuclear infrastructures to other research fields (e.g. archaeology) and to benefit humanity (e.g. medical imaging).

The large nuclear research infrastructures that exist in Europe are complementary in their provision of beams and address different aspects of nuclear science. These European nuclear facilities are world-class and excel in comparison with facilities elsewhere in the world. Furthermore, the vibrant European nuclear physics community has made great efforts in the past to make the most efficient use of these facilities by developing the most advanced and novel equipment needed to pursue the excellent scientific programmes proposed there. This has been done under the auspices of NUPDEC (Nuclear Physics European Collaborative Committee) and drawing support from previous framework programmes of the European Commission.

This community works to do the same in the future and has delivered the steps needed to pursue coherent research programmes at these facilities. This was done within the framework of the recent Long-Range Plan (LRP) of NUPDEC "Perspectives for Nuclear Physics Research in Europe in the Coming Decade and Beyond" which has been published in 2016. In this LRP, NUPDEC addressed future perspectives in its major subfields of research in nuclear physics and re-emphasised the role of the European Network of complementary large-scale facilities where past achievements and future perspectives for research in nuclear physics are excellent. In this LRP are also recommendations for future Pan-European facilities.

ENSAR is the scientific project for European nuclear scientists who are performing research in three of these major subfields: Nuclear Structure, Nuclear Astrophysics and Applications of Nuclear Science.

Its core aim is to provide access to some of the complementary world-class large-scale facilities: GSI (Germany), GANIL (France), JRCN-LNS (Italy), JYFL (Finland), KVI (Netherlands), GEMINI-ISO-LUG (Switzerland) and ALTO (France). These facilities provide ion beams of excellent qualities ranging in a large range of energies.

These facilities are offering access to a very large, wide and diverse user community. The scientific community of physicists in nuclear structure, nuclear astrophysics, and applications of nuclear science in addition to the staff that is involved in accelerator and detector development and in running the facilities ranges between 2000-3000 scientists and highly qualified engineers according to a recent survey by NUPDEC. The facilities will provide an increased amount of beam time for applications of nuclear techniques.





GSI

Helmholtzzentrum für
Schwerionenforschung

LOCATION



APPLICATIONS

ESA Laboratory
Nuclear Physics
Atomic Physics
Biophysics
Plasma Physics
Material Research
Accelerator Development

DESCRIPTION

The goal of the scientific research conducted at GSI Helmholtzzentrum für Schwerionenforschung is to reach a better understanding of the structure and behavior of the world that surrounds us. GSI operates a unique large-scale accelerator for heavy ions. More than 1,000 researchers from around the world and 200 master and doctoral candidates use the facility each year for experiments that help them make fascinating discoveries in basic research.

In addition, they continually develop new and improve existing applications. Probably the best-known results are the discovery of all new chemical elements and the development of a new type of cancer therapy using ion beams. In the coming years, a new international accelerator center called FAIR (Facility for Antiprotons and Ion Research) – one of the largest research projects in Europe – will be built adjacent to GSI. The FAIR accelerators will allow proton injection at GSI.

FACILITIES

170-metre-long linear accelerator UNILAC
Ring accelerator SIS18 with a circumference of 216 metres
Upstream injector GSI
Fragments separator FRS

LABS

Detector Laboratory
Target Laboratory
Technology Laboratory
Vacuum Technology
Diagnosis
High-Performance Computing

GSI

CANCER THERAPY

ION BEAM RADIOTHERAPY IS PRECISE AND HIGHLY EFFECTIVE



Together with physicians, scientists at GSI develop new and unique new forms of cancer treatment with carbon ions. This development was the result of many years of research in conjunction with GSI's large ion beam accelerator system.

Carbon ion radiotherapy at GSI has been used to treat more than 1,000 patients for tumors in the head and neck region. The advantage of the new treatment modality is that the ion beam selectively damages tumor tissue while sparing the surrounding healthy tissue. The therapy with ion beams is precise, highly effective and very gentle for the patients. Subsequent monitoring of these patients over a half-year period revealed that the growth of the irradiated tumors was stopped in 75 to 90 percent of the patients, depending on the type of tumor. Side effects requiring treatment occurred only in very few cases.

Since 2009, this type of cancer therapy is in routine clinical use at the Heidelberg Ion Beam Therapy Center (HIT). There, up to 1,000 patients can be treated annually. The accelerator facility and the technical infrastructure at HIT were developed and built by scientists and technicians at GSI.

Further developments aim to treat tumors which change their position constantly due to body movements, like breathing. Experiments show that it is possible to follow a movement of the tumor inside the body by adapting the ion beam's stopping position in three dimensions. The implementation could expand the treatment to other organs like the lung or the liver. The method is continuously improved by GSI scientists and their cooperation partners. Up to today, 300 patients benefited from this novel therapy technique that has been devised.

HEALTH TREATMENT IN NORMANDY

NUCLEAR
PHYSICS
OPENS
INNOVATION

As technology is increasingly reshaping the face of treatment, so the right time for the right patient has to be personalised and determined.

In this manner, scientific excellence has no boundaries, especially between research and industry.

Nuclear medicine uses radioisotopes that are produced in reactors and accelerators. This is possible thanks to developments in nuclear physics. Therefore, nuclear physics and medicine are two expertise areas, different but complementary and linked.

The city of Caen gets a unique scientific, technologic and medical environment in nuclear physics for health. Thus, these skills are consolidated to create the principal platform for Normandy region.

A dynamic ecosystem

First of all, the hospital "Centre de Lutte contre le Cancer François Baclesse" (CLCCF) and "University Hospital Center" of Caen (CHU) treat cancer patients, they are also involved in research and education. The CLCCF is one of the most efficient radiotherapy centres in France.

For fundamental research, on one hand, Caen hosts various research institutions in nuclear physics which are used in medical applications. The LPC group (laboratoire de Physique Corpusculaire) called "Applications industrielles et médicales" is expert in beam control, simulation and dose calculations for radiotherapy. Now, GAMIL is starting a research track in medical applications. In fact, GAMIL is one of the bigger laboratories in the world for research with ion beams. Within the framework of the FRMAG (FRANCO-AMERICAN network part of French investments for the Future) programme, GAMIL adapted a beam line to specific needs in hadrontherapy, and now is in use by interested researchers, starting in 2013. SPIRAL2, the new GAMIL accelerator, is under construction now. The facility will provide the beam unique in the world. SPIRAL2 will also be used for R&D studies on radioisotope production.

On the other hand, CYCOTON, IMC3-16, or GEMM are biomedical research centers. CYCOTON studies are essentially devoted to cancer studies and neurosciences. This research institution has a medical imaging platform including a cyclotron. All of these facilities are involved in researches about radioisotopes, drug design, medical imaging.

Industry plays also an important role in nuclear and health. Cyclopharma laboratories, PerseusTech, IM/Adone... are important players in this area. Cyclopharma produces radioisotopes (Tc-99m) for medicine and research.

All these laboratories and companies are some among all the participants in this wide ecosystem at the frontier of Physics and Health in Caen area.

NUCLEOPOLIS: a nuclear cluster for health, energy and risk management

In the heart of this ecosystem, there is NUCLEOPOLIS. Its members are international industrial and research leaders as AREVA, CEA, CNRS, ILL or GAMIL, successful and innovative small and medium enterprises, large research and training institutions. NUCLEOPOLIS federates the available know-how in Normandy. The aim is to improve territorial cohesion for players, make the attractive aspects of Normandy, in this field more legible and strengthen its position on both national and international levels, act as a projects coordinator and facilitate the development of joint cooperation with a strong ambition to break new ground and create new jobs.

Nucleopolis is the master of several collaborations between research and industry.

Radionormandie

In matter of Nuclear Physics for Health, Caen area has a bright future with AREVA/CEA and SPIRAL2.

AROMAX is a project for research and industry in order to develop hadrontherapy. It will be built in the coming years. GAMIL, CLCCF, Baclesse, LPC, PerseusTech, IM... are part of this project.

Adone SPIRAL2, a collaboration is starting between Caen and Nantes, in France (GEMMEX, Subatech). It concerns medical applications with SPIRAL2, in particular radioisotope production R&D and waste D+.

INFN — LNL

Laboratori Nazionali di Legnaro

LOCATION



APPLICATIONS

Radiobiology
Micro-dosimetry
Detector development
Ion beam analysis
Advanced materials and micro-fabrication

DESCRIPTION

The Italian Institute of Nuclear Physics (INFN) main mission is the study of the fundamental constituents of the matter, conducting theoretical and experimental research in the field of subatomic, nuclear and astroparticle Physics. INFN has a key role in the European framework as it regards particle accelerators and detector developments. Moreover, it is strongly involved in the application of the developed technology in several fields, as for instance medicine, superconductivity, cultural heritage and computing sciences. All these activities are carried out in collaboration with the academic world. Research activities at INFN are carried out within two complementary types of facilities: the *Devis*, located at the Physics Department of Universities, and the four National Laboratories, housing the major facilities.

The Laboratori Nazionali di Legnaro (LNL) is one of the four national laboratories of INFN: its mission is to perform basic research in nuclear Physics and nuclear astrophysics, together with applications in nuclear technologies. Its accelerating machines are currently in operation as LNL-A3000, CN, WAND, ALP and RNF. These facilities deliver ion beams of 100 hours or better time per year.

FACILITIES

Several facilities at the INFN LNL in Legnaro are devoted to applied and interdisciplinary physics projects. In particular, the micro-beam facility at the A3000 accelerator used for ion beam micro-writing and for elemental analysis of geological, archeological and environmental samples, the horizontal single-ion micro-beam facility for radiobiological single-cell irradiations installed at the RNF CN accelerator, and the modular facilities at the tandem and CN accelerators for radiation damage studies (bulk damage, radical dose and Single Event Effects) for detector development, micro-electronics and space applications.

LABS

A testing laboratory for the preparation of the cell cultures to be used in radiobiology experiments.
An other laboratory supports the user groups for the preparation of the samples to be studied by ion beam analysis.

Visit us **TODAY**

INFN — LNL

ADVANCED MATERIALS FOR GAMMA AND NEUTRON DETECTION

Transparent polycrystalline based scintillators are analyzed by TDS methods at the LNL-CN. A 4 MeV proton pulsed beam (3 MHz, 3 ns) impinges on a thin LiF target to obtain nearly mono-energetic 3.3 MeV neutrons.

The sensitivity to fast and thermal neutrons and the scintillation pulse shape for the γ gamma discrimination capability is analyzed.

Going with boron for the detection of thermal neutrons preserved the scintillator transparency, while with suitable dye concentrations a good pulse shape discrimination has been obtained.

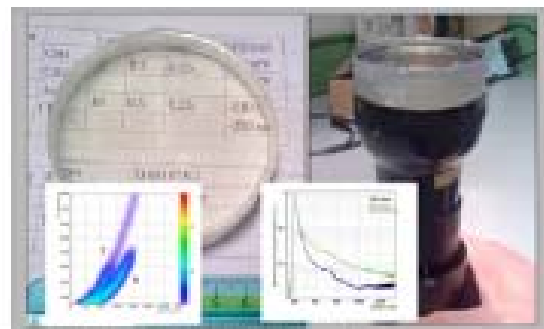
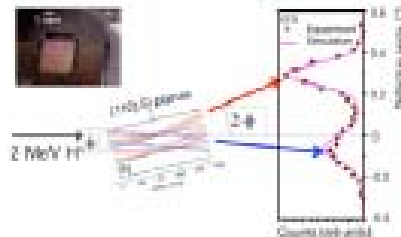


Fig. 1: Polycrystalline scintillators CF doped for thermal neutron detection. Lower light yield values are observed for boron loaded samples. The light yield is measured at 3 MeV neutron energies and only at 0.1 MeV for boron loaded samples.

PARTICLE BEAMS MANIPULATION AND STEERING BY CHANNELING IN BENT CRYSTALS



Channeling of MeV charged particles has a wide application as a powerful tool for ion-beam analysis. In recent years, channeling of beam ions made opened up new schemes for beam manipulation and steering of GeV particle beams.

At the LNL-A3000 accelerator, it has been recently demonstrated that beam injection manipulation can also be performed at MeV energy by means of beam interaction with a thin monocrystal. A 50 nm thick silicon membrane was tested by microchanneling. A 3.0 MeV proton beam interacts with the (111) planes along the membrane thickness with an incident angle $\alpha = 0.5^\circ$. The channelled particles make on average half an oscillation into the 50 nm crystal, therefore they are reflected by the lattice planes at the membrane with good trajectory.

GeV beam particles are slightly deflected in the opposite direction (back trajectory). Angular distribution of the particles has been measured and perfectly agrees with Monte Carlo model.

Image quality....



Background info etc.



THE AGORFIRM FACILITY

FROM MICROELECTRONICS TO CANCER THERAPY

Insulation of radiolabelled microfluidic particles for medical diagnosis. Each device is then processed, stored and finally, e.g., a patient is able to transport them, giving maximum availability of diagnostic components by means of various handling systems, from laboratory to the patient.

On the other hand, radiolabelled devices can also be applied to a more medical use, such as for example, when they are used in the treatment of various types of tumours, using being for evaluation of the treatment with radiolabelled or producing some kind of action in the treatment of various diseases (e.g. cancer or other). In this case, the particles are used to deliver the drug to the target.

For this radiolabelled application, it is important to have the radiolabelled particles in a form that is suitable for the treatment of the disease, that is, the particles must be long-term stable and have a high degree of stability. For this reason, it is possible to use the device as a radiolabelled particle, which makes the device more stable and more suitable for the treatment of the disease.

Microfluidics

Optical design of radiolabelled devices is largely based on the use of radiolabelled components. As a standard component, however, smaller and smaller components (e.g. components) are used, which makes the device more stable and more suitable for the treatment of the disease. On the other hand, the use of radiolabelled components, however, makes the device more stable and more suitable for the treatment of the disease. In this case, the particles are used to deliver the drug to the target.

For this radiolabelled application, it is important to have the radiolabelled particles in a form that is suitable for the treatment of the disease, that is, the particles must be long-term stable and have a high degree of stability. For this reason, it is possible to use the device as a radiolabelled particle, which makes the device more stable and more suitable for the treatment of the disease.

For future design

For this design, it is important to have the radiolabelled particles in a form that is suitable for the treatment of the disease, that is, the particles must be long-term stable and have a high degree of stability. For this reason, it is possible to use the device as a radiolabelled particle, which makes the device more stable and more suitable for the treatment of the disease.

This implies that improvements are needed in the treatment of the disease, that is, the particles must be long-term stable and have a high degree of stability. For this reason, it is possible to use the device as a radiolabelled particle, which makes the device more stable and more suitable for the treatment of the disease.

The future

For this future, it is important to have the radiolabelled particles in a form that is suitable for the treatment of the disease, that is, the particles must be long-term stable and have a high degree of stability. For this reason, it is possible to use the device as a radiolabelled particle, which makes the device more stable and more suitable for the treatment of the disease.

Need
to
harmonise
the
editorial...

CERN — ISOLDE

Isotope Separation
Online Device

LOCATION



APPLICATION

Isotope separation for spatial biology
Nuclear medicine
Development of new cancer therapies and diagnostic
Medical applications

DESCRIPTION

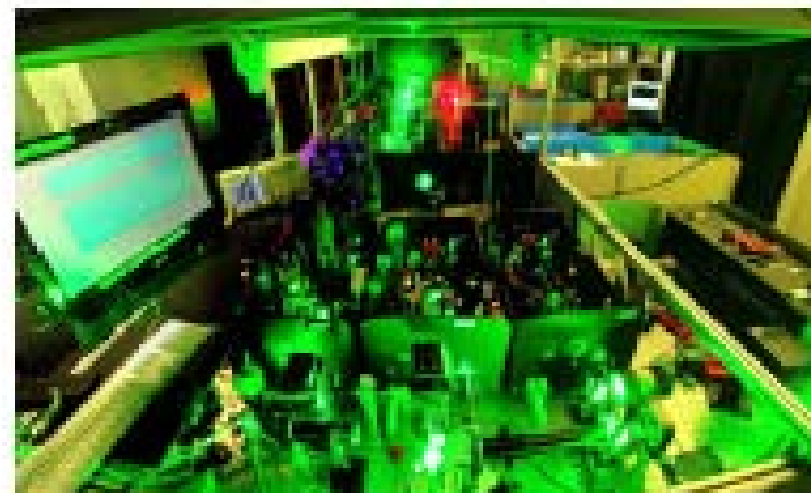
ISOLDE is a nuclear physics facility which is capable of producing 100 microamperes (mA) of almost any lightest isotopes available naturally. Through the new online programme at ISOLDE, it makes physics, the huge number of nuclear reactions and nuclear properties of the stable isotopes, including simple and complex nuclear reactions and decay.

Each year, ISOLDE produces approximately 100 microamperes of the most abundant isotopes of the elements from hydrogen to uranium. These are produced using various methods. In addition, ISOLDE can produce rare isotopes of the elements from hydrogen to uranium, including simple and complex nuclear reactions and decay.

ISOLDE is a nuclear physics facility which is capable of producing 100 microamperes of the most abundant isotopes of the elements from hydrogen to uranium. These are produced using various methods. In addition, ISOLDE can produce rare isotopes of the elements from hydrogen to uranium, including simple and complex nuclear reactions and decay.

FACTS

Isotope separation



ISOLDE is a nuclear physics facility which is capable of producing 100 microamperes of the most abundant isotopes of the elements from hydrogen to uranium.

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THE HISTORY OF MEDICINE

INNOVATIVE WAYS OF DETECTING AND TREATING CANCER

ISOLDE is a nuclear physics facility which is capable of producing 100 microamperes of the most abundant isotopes of the elements from hydrogen to uranium. These are produced using various methods. In addition, ISOLDE can produce rare isotopes of the elements from hydrogen to uranium, including simple and complex nuclear reactions and decay.

ISOLDE is a nuclear physics facility which is capable of producing 100 microamperes of the most abundant isotopes of the elements from hydrogen to uranium. These are produced using various methods. In addition, ISOLDE can produce rare isotopes of the elements from hydrogen to uranium, including simple and complex nuclear reactions and decay.

**Terbium can serve
as the
"Swiss Army
knife of
Nuclear
Medicine"**



LOCATION OF Mg IMPURITIES IN SEMICONDUCTORS

THE BASIS FOR FUTURE ELECTRONIC DEVICES

The semiconductor is one of today's greatest and best known materials. It is the basis of modern electronics. It is the material that makes possible the modern electronic devices. It is the material that makes possible the modern electronic devices. It is the material that makes possible the modern electronic devices.

Remember that, nearly four years ago, we began the study of the physical properties of the semiconductor. We began the study of the physical properties of the semiconductor. We began the study of the physical properties of the semiconductor.

The study of the physical properties of the semiconductor is a study of the physical properties of the semiconductor. It is a study of the physical properties of the semiconductor. It is a study of the physical properties of the semiconductor.



TERBIUM PIS IN MEDICINE

Innovative ways of detecting and treating cancer

Researchers at ISOLDE are using its capabilities to produce radioactive ions to search for new and innovative ways of detecting and treating cancer. Because of the variety of isotopes it can produce, ISOLDE is able to go beyond the facilities that hospitals presently offer, and explore isotopes which may – in the future – be considerably more efficient in the treatment and detection of cancer, such as Terbium (Tb).

What is so great about terbium?

Terbium (Tb) is the only element in Mendeleev's table offering not only a matched pair but also two clinically interesting radioisotopes, with complementary nuclear decay characteristics covering all nuclear medicine modalities: terbium-152 for PET, terbium-155 for SPECT, terbium-149 for α particle therapy and terbium-161 for therapy with electrons (β^- , conversion and Auger electrons).

Thus, terbium can serve as the "Swiss Army knife of Nuclear Medicine", for fundamental studies of new radiopharmaceuticals and for detailed comparisons of suggested therapy options.

So-called "matched pairs" of a diagnostic and a therapeutic isotope of the same chemical element are particularly valuable since their identical chemical properties ensure identical in vivo behaviour, enabling a precise determination and optimisation of the radiation dose given to the tumour prior and during treatment. This opens the way for "theragnostics", where patients are first given a diagnostic isotope, then, based on the obtained patient-specific uptake of the radiopharmaceutical, the optimum therapy option is selected and applied. This type of personalised medicine ensures best possible efficacy and minimises side effects since the therapy is tailored to the patient's needs.

Terbium can serve as the "Swiss Army knife of Nuclear Medicine"

Figure: Several matched decay modes, specific to the rare earth element terbium, are illustrated. The diagram shows the various decay paths of the terbium isotopes, highlighting the unique properties of terbium-152, terbium-155, terbium-149, and terbium-161. The diagram also shows the various decay products of these isotopes, including stable and radioactive elements.



RESEARCH IN NUCLEAR PHYSICS BENEFITS TO ALL CITIZENS

JRAs & NAs

Joint Research Activities (JRAs) are meant to be innovative and explore new fundamental technologies or techniques underpinning the efficient and joint use of existing research infrastructures.

JRAs are in general relevant across the entire field, and help in strengthening the European research groups.

The main objective of such activity is to support an excellence facility serving both the scientific and the societal needs by increasing the training and discovery of scientists and students for future experiments. JRAs are also meant to be innovative in terms of technology, which means increasing the energy and safety of the infrastructure without overloading the existing European facilities. These are meant to be implemented by an activity to improve the energy, safety, performance and sustainability of the project and the use of the infrastructure to be used in future experiments.

Experimenting in such facilities requires the development of new detector materials and the development of new technologies for both detection systems and beam delivery systems. JRAs are also meant to be innovative in terms of technology, which means increasing the energy and safety of the infrastructure without overloading the existing European facilities. These are meant to be implemented by an activity to improve the energy, safety, performance and sustainability of the project and the use of the infrastructure to be used in future experiments.

These developments will give a strong impetus to the existing facilities and their maintenance and enhance their scientific and societal impact. It is also an activity to improve the energy, safety, performance and sustainability of the project and the use of the infrastructure to be used in future experiments.

Networking Activities (NAs) mean a culture of co-operation between the participants in the project, the scientific communities benefiting from the research infrastructures, industries and other stakeholders, and to help developing a more efficient and attractive European Research Area.

ENSCAR has a two-step activity to strengthen the international scientific and technical research community. The first step is to develop and implement the research infrastructure. The second step is to develop and implement the research infrastructure.

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ENSCAR: ENHANCING
ATOMIC RESEARCH
WITH NUCLEAR BENEFITS

AFTER ENSAR

After ENSAR
there will be ENSAR2, hopefully!

The scientific and technical community is eager to continue the European research infrastructure for the next generation of scientists and students. The first step is to develop and implement the research infrastructure. The second step is to develop and implement the research infrastructure.

The European Commission is planning to launch a new framework programme, covering a wide range of scientific research. This programme is called HORIZON and will be implemented by the European Commission. The first step is to develop and implement the research infrastructure. The second step is to develop and implement the research infrastructure.

The nuclear physics community is planning to propose a new activity, called ENSAR2, to the European Commission. The first step is to develop and implement the research infrastructure. The second step is to develop and implement the research infrastructure.

This new project is called ENSAR2 and will be implemented by the European Commission. The first step is to develop and implement the research infrastructure. The second step is to develop and implement the research infrastructure.

ENSCAR: ENHANCING ATOMIC RESEARCH WITH NUCLEAR BENEFITS

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STRONG MESSAGE
AT THE BEGINNING
WITH BACKGROUND IMAGE

RESEARCH IN NUCLEAR PHYSICS BENEFITS TO ALL CITIZENS

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To be thought about!
Cover

From our side.....

What is still missing

- editorial and interviews (p.4-5)
- success stories – introduction text + 6 examples by theme (p.8-11)
- end users experience/interviews (p.46-47)

High quality images.....we need original jpgs (ideally 300dpi if possible)
Also, some more pictures would allow for more varied output, or at least choice...

Presentation of the TNAs: the core of the brochure

To be decided...- the order of the 7 TNAs → Alphabetical?

Italy...separate or together....- the two Italian facilities are separate, which may be confusing (8 TNA or 7?)

Layout presentation of each TNA (4 pages):

- 1 page is dedicated to "Facts & figures"
- 3 pages are dedicated to the presentation of success stories. One story is usually presented in a more important way. → choose the most successful success story

More info from KVI? Good description of facility, but no specific success stories...

Cover image and text: this is NOT a final version: we have to discuss together at the end about the image of the cover.

Logos/Contributors: where to locate logos and contributors etc. All collected at the end?

Typical delivery time....

About 3-4 weeks from final “finalising” of the text...

Printing takes about 2 weeks...