

IDEAAL Work Package 4

Innovation and Industries

WP4 objectives

- The Innovation and Industries workpackage focuses on actions towards industrial users and on actions for industrial valorisation and innovation
- It will provide
 - access dedicated for new applications to the existing GANIL accelerators and to the new SPIRAL2 facility
 - **general support for industrial applications and technology transfer**
 - increase of innovation potential for GANIL

WP4 Tasks and associated coordinators

- **Task 1** : Access provision to research teams from industries and involvement of industrial users (GANIL - MH Moscatello/X.Ledoux)
- **Task 2** : Industrial Applications and Technology Transfer (NUCLEOPOLIS - N.Renard)
 - Sub-Task 2.1 – Provide industrial application tools to GANIL
 - Sub-Task 2.2 – Operational implementation (*General Case*)
 - Sub Task 2.3 – Operational implementation : Support for the technology transfer of the beam profile monitors
 - Sub-Task 2.4 – Operational implementation: Innovative radioisotope production
- **Task 3** : Increase of innovation potential (CEA/DRF - A.Leservot)
- **Workpackage leader: M-H. MOSCATELLO GANIL**
- **Workpackage deputy leader: E. DUVAL NUCLEOPOLIS**

Status of Task1

Access provision for research teams from industries and involvement of industrial users (GANIL)

- Task 1 will finance 240 hours of beam time (and travel expenses) for some new industrial experiments that would like to test the capabilities of the SPIRAL2 and GANIL facilities in order to confirm industrial's interest in the available beams.
- The task will include the Creation of an international selection panel to assess the proposed experiments

Status

- International panel identified and validated by GANIL Director
- First call for proposals with GANIL beams – Deadline for proposal: August 31th 2018
- Selection of experiments in October 2018, they will be scheduled in 2019

Sub-Task 2.1 – Provide industrial application tools to GANIL

- Mapping of existing potential at GANIL (technologies – Know-How - competences) and identify industrial candidates for technology transfer
- Identify new areas for industrial applications (market research) and potential customers for existing facilities GANIL and SPIRAL2
- Build the implementation arrangements for transfers (financial and legal aspects)
- Build tools to promote this activity in connection with the communication service

STATUS:

- Mapping of existing potential: meetings and interviews with most of the groups at GANIL (~ 40 meetings occurred) → report in progress
- Presentation of a cartography (non-exhaustive) and selection of transferable or valorisable subjects for June-July 2018 with the GANIL management

TO DO:

- Market research to be started (explore the possibility to get an expert)
- Select subjects to be transferred, to be decided together with GANIL Direction -> **Communication on these subjects with WP5 (Deadline end 2018 – precise schedule to be defined)**

Reminder (already presented in November 2017)

GANIL Sectors	Groups
Secteur des accélérateurs	Alimentation et charges
	Opération et dynamique faisceau
	Gestion des installations
	Hautes fréquences
	Electronique machine
	Production d'ions
	Vide et cryogénie
Secteur des techniques de la physique	Instrumentation pour la physique
	Bureau d'études
	Fabrication mécanique
	Acquisition pour la physique
	Détection pour la physique
	Informatique et infrastructure
Groupe physique	A. CHBIHI / G. FREMONT / C. SPITAEELS
Secteur SPIRAL2	P. Anger, N. Lecesne MH Stodel / H. Franberg
Service de Protection contre les Rayonnements	M. DUPUIS / A. MADELEINE
Groupes radioisotopes	X. LEDOUX / AM. FRELIN / G. DE FRANCE

Groups participating to the interviews

Mapping example

Groupe	Personne(s) rencontrée(s)	Fonction	Savoir-faire identifié(s) et valorisable(s)	Type de valorisation : R&D / Prestation	Domaine(s) d'application(s)	Actions communication
Groupe alimentation et charges	Franck ESNAULT	Chef de groupe (CEA)	informatique industrielle (interfaces de commande/automates) Alimentation : convertisseurs de puissance et électroaimants (maintenance d'environ 2000 convertisseurs sur le parc) Charges : banc de mesure de tous les aimants (utilisé pour SPIRAL2 et autre application possible pour la perméabilité des matériaux)	R&D / prestation de mesures magnétiques	expertise en génie électrique informatique industrielle métrologie	
Groupe gestion des installations	Cyrille BERTHE	Chef de groupe	conception de systèmes classés (sûreté et fonctionnement) ventilation nucléaire (maintenir la dépression et collecter les flux des régions dangereuses qui sont ensuite captés par des filtres) automatisme de sécurité expertises système de commande pour le vide	R&D public et privé (piste MH Moscatello de collaboration avec entreprise de sous-traitance des travaux)	potentiellement tous domaines industriels ayant besoin de sécurité	
Groupe vide et cryogénie	Pierre Emmanuel BERNAUDIN (Resp. gpc) Matthieu Collard Jacques Denoyer Mamadou Faye Adnan Ghribi Romuald Levallois Philippe Robillard Yann Thiviel Abrams excusés Guillaume Loccalicé Guillaume Peschard		1. Vide Dimensionnement de systèmes de pompage pour le vide Entreposage des gaz (développement pour les besoins en interne installation SPIRAL2) Mesures d'étanchéité : les industriels font faire des tests de fuite de leurs équipements par le GANIL car ils n'ont pas les moyens d'acheter les équipements pour faire ces mesures Caractérisation matériaux sous vide (intérêt pour le spatial +++) = dégazage du matériau dans le vide) compétences mesures flux bas Combinaison vide et rayonnement neutrons - liens avec CERN Mesure dégazage induit - demande de manip sur SME faite par LAL dans le cadre d'une thèse LAL/CERN Cible cryogénique : nouvelle demande d'expérience avec une cible cryogénique 2. Cryogénie (Pas encore REX sur exploitation) Collaboration « GRAL » (thème : thermodynamique, automatisme) mise en place avec CEA/SBT dans un 1er temps (+ partenaires futurs potentiels ESS, ISOLDE) Objet de cette collaboration : Chiffrer, dimensionner les paramètres d'une installation cryogénique complexe S3 : à plus long terme, une partie de l'installation cryogénique de S3 pourra être utilisée comme banc test	Prestation, R&D	Accélérateurs, spatial, industrie nucléaire (?) Gaz liquéfiés : intérêt industriel pour la thermoélectricité. Il est prévu sur le long terme de développer une zone de tests dans SPIRAL2, pour une activité de R&D sur les gaz liquéfiés	Workshop ganil sur le vide à l'automne 2017 (dans le cadre du Réseau Vide du CNRS) Tests de fuite pour les industriels (étanchéité)
Groupe informatique machine	Dominique TOUCHARD	Chef de groupe	contrôle commande des accélérateurs du GANIL (expert faisceaux SPIRAL2) o réglage des faisceaux et travaux interfaisage + Bases de données o temps réel : prendre en compte les contraintes de temps (ex : lecture en moins de 50 ms) o 2 syst. actuels : langage ADA (langage en temps réel utilisé dans armée et milieu de la sûreté) et pour SPIRAL2 : EPICS (open source) développé par labo US o Gestion de maintenance o Commande contrôle pour instrumentation o Compétence algorithme pour analyse faisceau qui sort de la cible pour GANIL et SPIRAL2 o Système contrôle cible-source (SCICS) (mesure intensité et déclenche arrêt du faisceau) o Pour SPIRAL2 : syst limitation de l'activité de l'arrêt du faisceau	R&D		

Sub-Task 2.2 – Operational implementation (General Case)

To allow the "matching" between industrial application opportunities and the companies

- B2B meetings
- GANIL conferences
- Set up a virtual trading place on the website
- Participation in exhibitions

STATUS:

- Exchange of good practices with GSI laboratory: meeting in GSI on November 30th
 - Practices for technology transfer
 - Meetings with companies
- Participation in WNE 2018 with Nucleopolis (June 26th to 28th Paris Nord Villepinte) – booth J141
Organization of the stand for WNE in progress (together with WP5)

TO DO:

- Participation to the ENSAR2/NUPIA Workshop in October 2018
- Organize meetings GANIL/companies (based on GSI scheme)

Sub Task 2.3 – Operational implementation: Support for the technology transfer of the beam profile monitors

Technology and pre-existing know-how transfer (legal, economical and marketing aspects) and research agreements – started in June 2016 because of urgent need

STATUS:

Milestone in June 2017: not completed

- Transfer contract signed in December 2017 and transfer to Pantechnik in progress
- **Collaboration contract: depends on a national agreement between CEA and CNRS...**

Sub-Task 2.4 – Operational implementation: Innovative radioisotope production

Innovative medical radioisotope production methods are a new research topic at GANIL

- Develop R&D programs for innovative radioisotope production
- Identify possibilities and methods of transfer

STATUS:

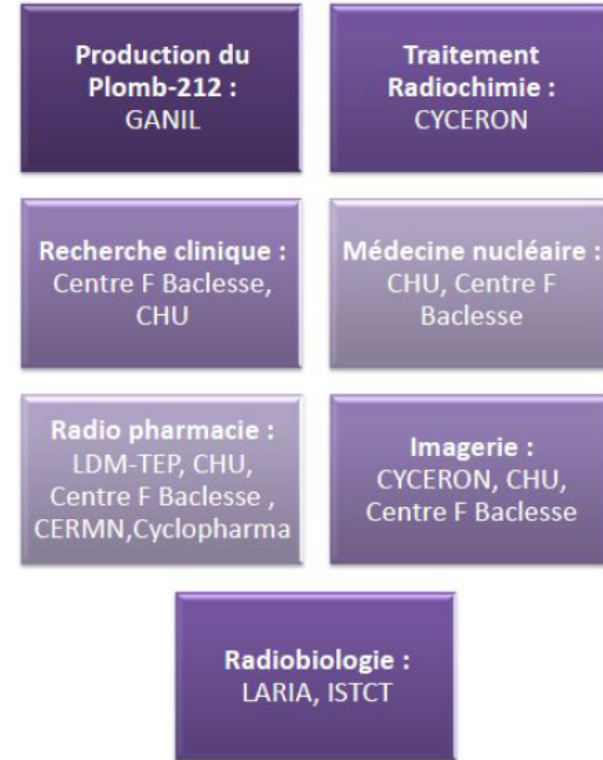
- Study and proposals of possible methods for transfer with the M2 trainee - January to June 2017 (GANIL/Nucleopolis)

→ **211At** and **212Pb**

- ARRONAX collaboration: presently on stand-by

212Pb R&D project

- 212Pb: 3 possibilities studied during the M2 training
 - Thesis with a company
 - Establish production parameters for Pb212
 - R&D project with the « plateau-nord » of Caen Innovative treatment using Pb212
 - R&D project with a laboratory (CYCERON for radiochemistry and GANIL for radioisotope production)
 - Radiopharmaceutics (radiochemistry and radioisotope production)



Example R&D project with « Plateau-Nord »

TO DO:

-> Launch discussions with industrial companies on these various possibilities (to be coordinated by Nucleopolis)

Increase of innovation potential (CEA/DRF)

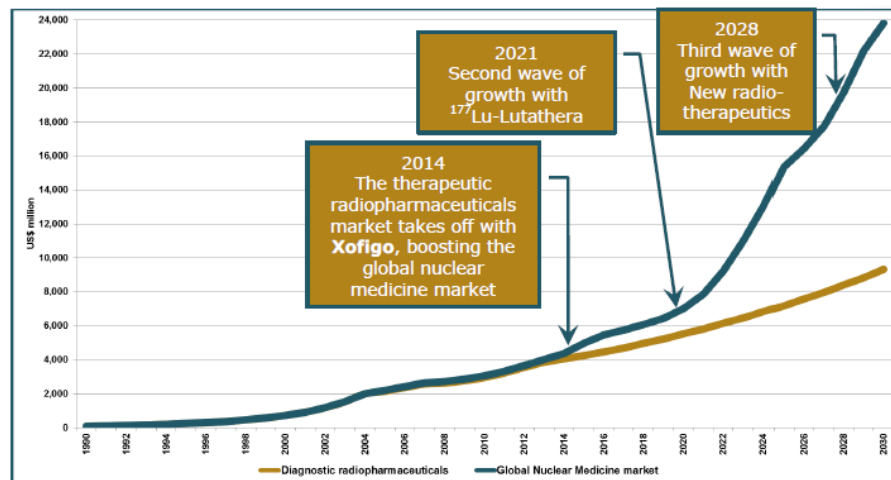
Study the possibilities of increasing the innovation potential of the GANIL laboratory:

- Identify new applications to heavy and light ions beams, in order to replace the reactor technology with the accelerator technology, for as many applications as possible.
- Identify new R&D subjects that might lead to innovative technologies and application
- Identify the necessary technical developments to adapt the facility to these future and new applications

Status :

- **Bibliography and brainstorming (discussions with nuclea physicists, to be organised with CIMAP physicists) – cf. slide 10**
- > **Intermediate internal milestones have been defined**
- **Year 1: Identification of possible applications / markets (those not studied by Task 2)**
Brain storming on potential applications linked to Ganil science
- **Year 2: Quantify markets of some selected foreseen applications**
Qualify some application issued of « science to application » brain storming
- **Year 3: Propose a strategy to adress applications identified in Y1 & Y2 (beam modification...).**
Estimate a budget to the proposed strategy
- > **Select 2 subjects to be studied into details during T1 2018**

Potential Topics	Impact GANIL / SPIRAL	Connex impact	Comment
BNCT	SPIRAL2 adaptation	Development of neutron capture studies	Complementary to Archade
Neutrons for analysis and Neutron Activation Analysis	NFS : Structure neutronography, diffusion & hot cells	Visibility of neutron offer to be increased	Discuss with LLB
Production & separation of Radiolotopes	Development of new production/separation methods (ISOLDE process) ? Use of the Beam Dump ?	Radiochemistry	Strong demand for health developments. Some may increase for Information Tech
Membranes & filtration	Adapt the GANIL facility (CIME) Develop instruments with CIRIL for these applications	Give more visibility to this activity	Ganil environment positive for these applications
Low Energy Focused Ion Beams	PELIICAEN Project (Maskless material modification at nanometer scale)	What about a low energy radioactive focused ion beam and its potential applications?	Micro-electronics, quantronics, spintronics, data storage, quantum cryptography, nano-sensors, high speed electronic components... Energy: Studies for solar cells, LEDs, catalysis, piezo-electrics conversion...



Extract of the table of subjects to be deepened



Task 2.4

Medical radioisotope tendency

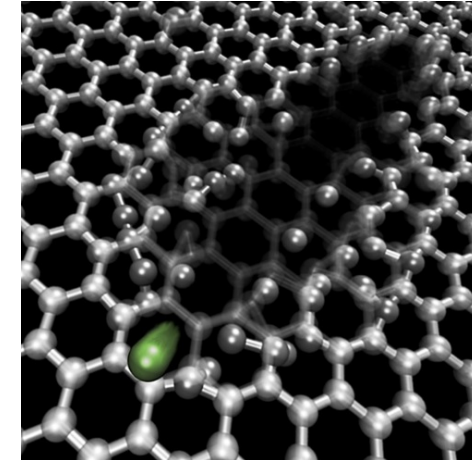
Nanostructuration with Middle and High Energy Ion Beam

Nanometer tracks with high aspect ratio induced by ion irradiation (membranes):

- Controlled size, shape and fluence
- High area available (m² scale)

Field of applications:

- Health: Filtration of biological particles (agro chain, bioproduction, depollution), sea water desalination...
- Energy: Salinity Gradient Energy, piezo-electrics conversion, electrical power storage...
- Devices: micro and nano sensors/actuators, Multi Channel Foil...



<http://www.futura-sciences.com/sciences/actualites/chimie-dessaler-eau-mer-graphene-cest-possible-52599/>

2 subjects will be investigated in details in 2018 :

- Production & separation of radioisotopes (non health) by ISOLDE process
- Membranes & filtration

Innovation and Industries deliverables

Task1: Limited pilots of access provision to research teams from industries and involvement of industrial users

- **D4.1 Business plan for the industrial application activities at GANIL (M36)**

Task 2: Industrial Applications and Technology Transfer

- **D4.2 Report on the technology transfers developed in the framework of the project (M36)**

Task 3: Increase of Innovation Potential

- **D4.3 Report on the increase of innovation potential study (M36)**

Innovation and Industries milestones

Milestone number	Milestone name	Due date	Means of verification
MS9	Beam profile monitors: Licence contract and R&D collaboration contract with the company	Months 6 DELAYED	Report
MS10	Report on the methodology for the technology transfer for radioisotope production	Months 30	Report

Budget and human ressources

Partner	Budget (Euros)	Human Ressources Person.Month
GANIL	485000	30* (6 p.m GANIL staff)
NUCLEOPOLIS	222500	30
CEA/DRF	83585	6

*: 18 p.m for Task3 to be confirmed

Thank you for your attention