Subatech Scientific Programme

Scientific Council of Subatech

April 29-30 2024

Outline

- Subatech in few words
- Highlights 2018-2024
- Subatech Projects
- Technical services
- Subatech in 2030

Subatech in few words

cnrs

NUCLÉAIRE & PARTICULES
IN2P3

Subatech

Institut Mines-Télécom

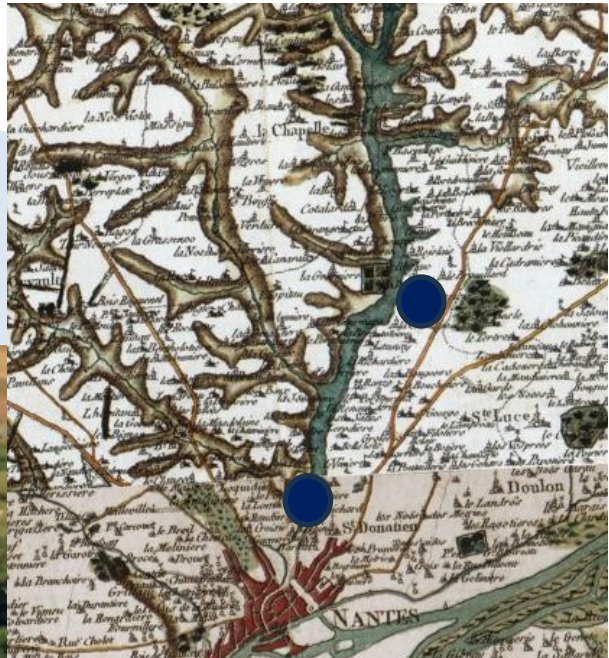
IMT Transfert

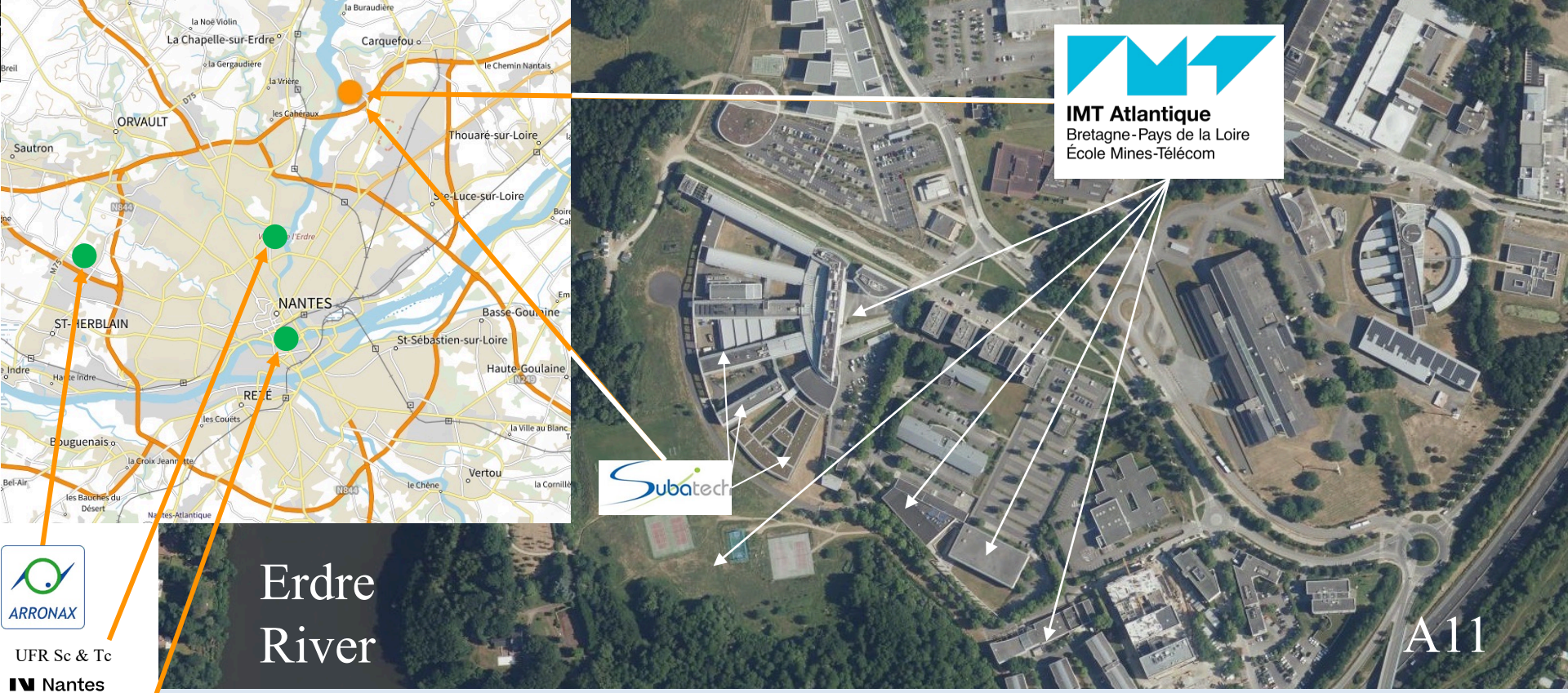
IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

Nantes Université

Pôle Sciences et Technologie
UFR Science et Techniques

UMR 6457 (since 1994)
Located at IMT Atlantique
Campus de Nantes





Total surface of Subatech about 7350 m² (1126 m² experimental area, 800 m² mechanical workshop, 560 m² + 320 m² radiochemistry laboratory and SMART, including 590 m² ZRR)

2024

Subatech research “leitmotif”

Probing and understanding the infinitely small and the infinitely large, structured around large instruments for nuclear and particle physics in international collaborations, driven by the IN2P3.

Research programme and large team in radiochemistry.

Applications of nuclear field to energy, environment and health.

Research and development technology programs. Integration in large experiments. Mastering of new techniques associated to subatomic physics.

Human Resources of Subatech

On February 1st 2024: 207 staff

64 C & EC: 23 CNRS, 18 NU, 21 IMT Atlantique, 2 Associated researches ICO). Among them 4 Emeritus professor NU and 1 IMT Atlantique and 1 CPJ (French Tenure Track). Number of HDR : 28 + 4 (Emeritus professor). And 4 HDR soon.

79 IT : 49 CNRS, 11 IMT Transfer, 8 IMT Atlantique, 4 NU, 7 CDD.

2 Apprentice CNRS.

15 post-docs (8 CNRS, 3 NU, 4 IMT Atlantique)

47 PhD. 13 under CNRS contract, 23 IMT Atlantique, 5 NU, 10 others

Organisation

cnrs NUCLÉAIRE & PARTICULES IN2P3

IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

Nantes Université
Pôle Sciences et Technologie

AP & CRP & CSSI

Seminars, Comm, Web

IMT Teaching

NU Teaching

Management DU, DUA, DA, DT

Scientific Council

Laboratory Council

DDRS, F/H, PSI Committees

Neutrino

OG

Plasma

Prisma

SEN

Scenario

Theory

Xenon

Radiochimie

PTR

SMART

Administration

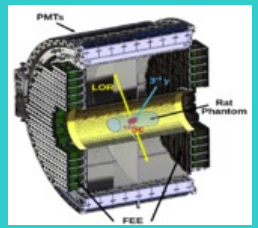
Electronic

Computing

Mechanics

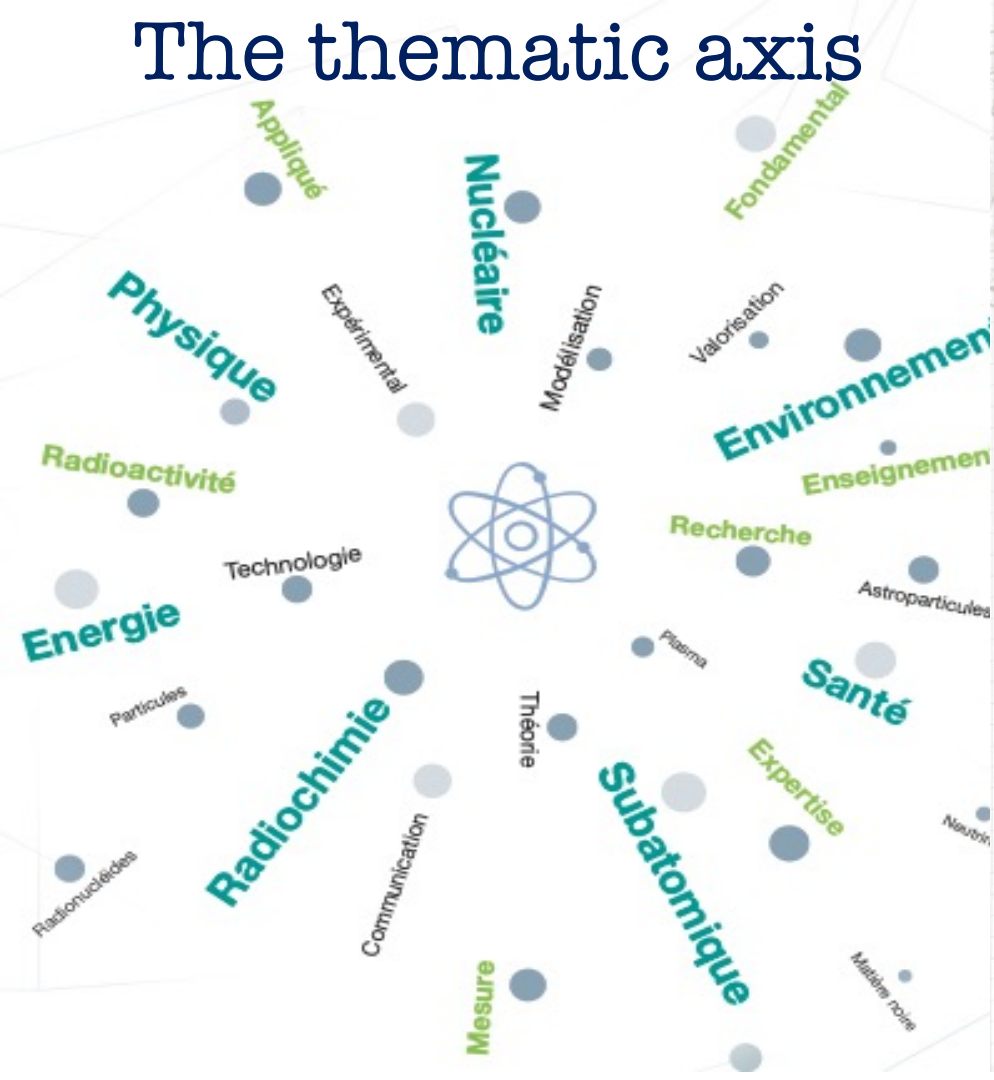
SPR-I

Infrastructures and platforms



- SMART : Platform for the measurement of radioactivity in the environment created in 1994, 14 staff (1 CNRS, 11 IMT Transfert, 2 IMT Atlantique). Valorisation / Visibility / Neutrality. About 42 (over 49) ASN (Autorité de Securité Nucléaire) authorizations for the measurement of radionuclides in the environment. Cofrac Accreditation since 1998.
- Installation XEMIS2@CIMA (CHU). Infrastructure ready in CHU since 2020. Commissioning in 2024. Photon-positron Emission Tomography of small animals using new radionuclides (^{44}Sc). Collaboration CRCINA, CHU, Arronax, LS2N (Nantes), LATIM (Brest) and Subatech.
- Radiochemistry Laboratory (PTR). Unique Laboratory in the local and regional context. ASN authorisation of active sample analysis. Nuclear metrology, isotopic/element analysis, spectroscopic analysis etc.
- Mechanical workshop. Large equipment which are unique in the local context. A 3D printer (for PEEK matter). New 5-axis machining system to be acquired in 2022.

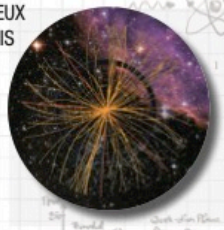
The thematic axis



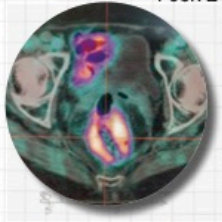
Subatech

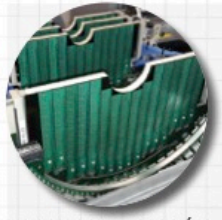
NUCLÉAIRE
POUR L'ÉNERGIE
ET L'ENVIRONNEMENT

LES DEUX
INFINIS



NUCLÉAIRE
POUR LA SANTÉ



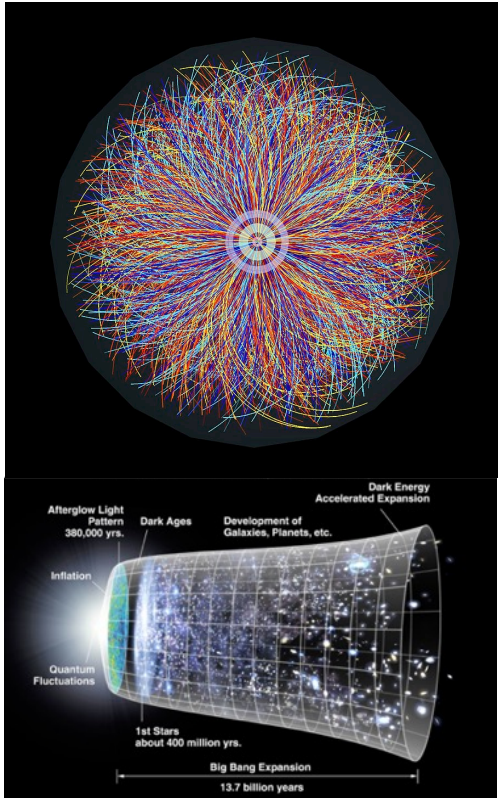


TECHNOLOGIES ASSOCIÉES

The two infinites

6 of the 12 IN2P3 Science Drivers

- 2005 - Explore further the physics associated with the properties of neutrinos (Neutrinos)
- 1994 - Pursue the exploration of the hadronic matter phase diagram (Hadronic Matter)
- 2005 - Identify the nature of dark matter (Dark Matter)
- 2021 - Study the physics of high energy messengers and probe extreme astrophysical phenomena — new
- 2009 - Understand how nuclear processes shape the Universe (Nuclear Processes)
- 2021 - Use gravitational waves to explore the Universe and its fundamental laws (Gravitational Waves) — new



Concerned teams : Neutrino, Plasma, SEN, Theory, Xenon

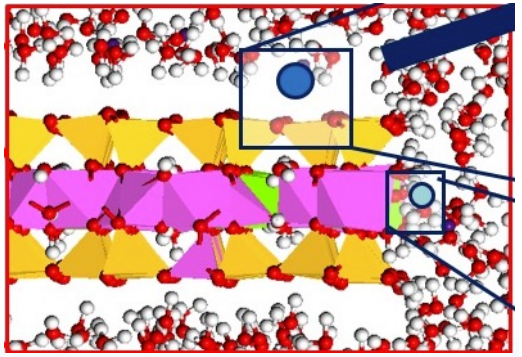
Synergy with domains where theory team has high impact : QCD, Heavy Ion Collisions, Hard Probes, Hadronic Matter

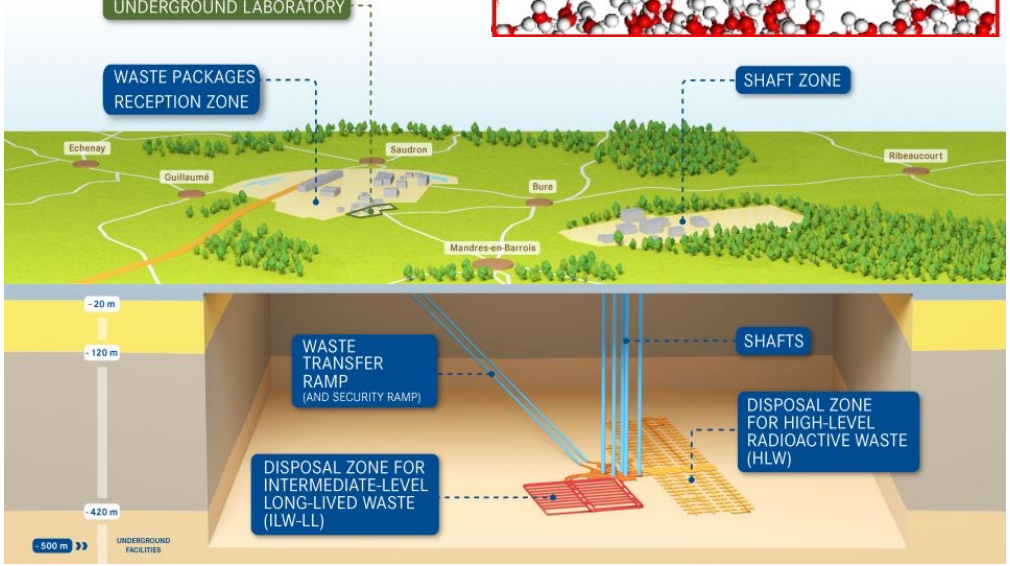
Nuclear for Energy and Environment

National leadership. Unique "*plateau technique*"

- Materials under radiation — 1998 -
- Molecular modelling — 2009 -
- Nuclear data — 2000 -
- Nuclear reactors — 2000 -
- Scenario — 2010 -
- Radionuclides in environment — 1994 -

Main concerned teams : Radiochimie and SEN. Also Neutrino and Xenon





Nuclear for Health

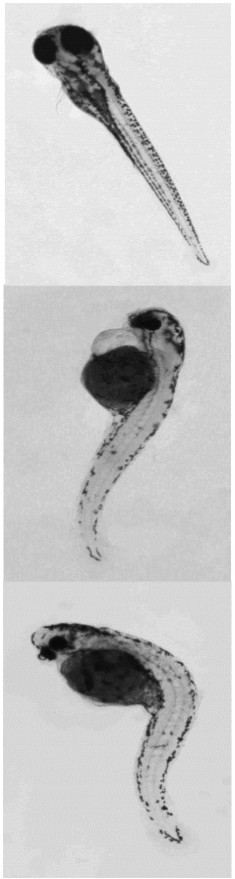
Very rich local ecosystem

New radionuclides for health — 2010 -

Irradiation of small animals — 2020 -

Medical imaging — 2010 -

Main concerned teams : Prisma, Radiochimie and Xénon. Also Neutrino in near future.



Associated technologies

Mastering technologies

Mechanics, electronic and computing for research — 1994 -

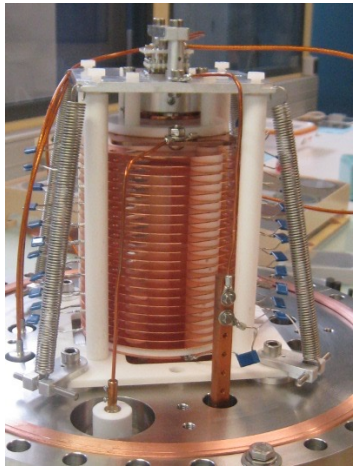
New technologies of *ionising* detection — 1994 -

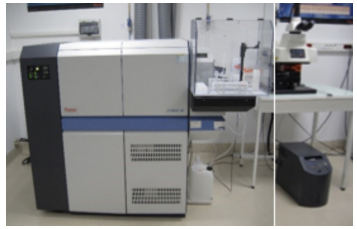
Techniques in radiochemistry — 1994 -

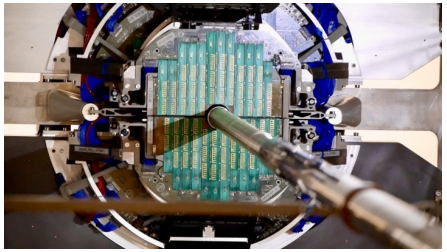
Ion beam analysis — 2015 -

Measurement of radioactivity in environment — 1994 -

Technical services, research teams and SMART







Local, regional, national and international ecosystem

The two infinites

JUNO · KM3NeT · XENON Dark Matter Project · ALICE · CERN · nEXO · DARWIN · STRONG 2020 · JYVÄSKYLÄN YLIOPISTO UNIVERSITY OF JYVÄSKYLÄ · IJCLab Irène Joliot-Curie Laboratoire de Physique des 2 Infinis · IFIC · CEA – Saclay · LPNHE PARIS · CPPM · SoLid

Health

CEISAM · iRON lobox · Institut de Cancérologie de l'Ouest · ARRONAX · GANIL · Spiral2 · AIR LIQUIDE · LATIM · orano · Isotop4life · LS2N · CRCI²NA · Medicis Promed · CERN · NeXT IRC TransForMed · CENTRE HOSPITALIER UNIVERSITAIRE DE NANTES

Energy and environment

ANDRA · orano · eurad · osuna planètes et environnement · TRISKEM · IRSN · LPG · Zone Atelier · EDF · PREDIS · SAM · SAFER · LPSC Grenoble · cea · MIMOSA

Sanda

cnrs · IMT Atlantique · Nantes Université · Subatech · DOCTORAT MATIERE BRETAGNE MOLECULES LOIRE ET MATERIAUX · ANR Agence Nationale de la Recherche · Investir l'Avenir · Liberté • Égalité • Fraternité République Française · NeXT · INSTITUT CARNOT M.I.N.E.S · MARIE CURIE ACTIONS · erc

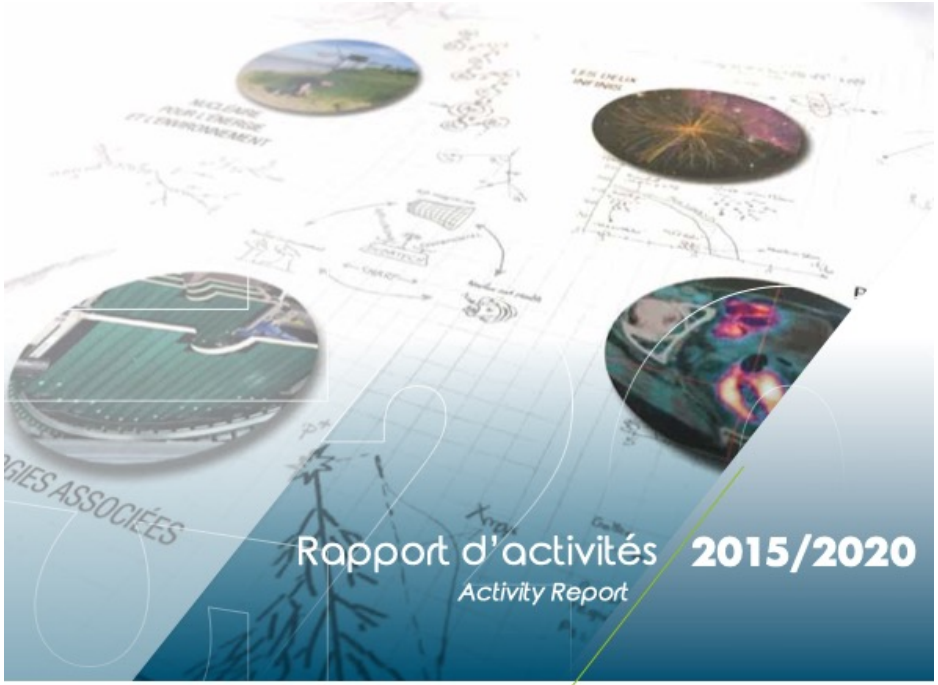
Arc'Antic

XENON Dark Matter Project · CERN · DAMIC-M · ARRONAX · AIR LIQUIDE · Tesmarac joint research laboratory · SMART · AI4R

Associated technologies

Région Pays de la Loire · Nantes Métropole

Rapport d'activité 2015 - 2020



Le mot du directeur de Subatech

A word from the director of Subatech

Ayant pris la direction de Subatech au 1er septembre 2018, succédant à Bernd GRAMBOW, c'est un honneur de présenter cette synthèse de nos activités pendant le quinquennat 2015-2020.

Comme vous allez le découvrir dans ce document, la production scientifique et technique des équipes et services de Subatech a été abondante et de très bonne qualité. Elle a été accompagnée d'une implication forte dans l'enseignement de nos domaines, la valorisation de nos recherches et un engagement déterminé autour de la diffusion de la culture. La fin de cette période a été fortement affectée par la crise COVID19 à laquelle les membres de Subatech ont fait face, respectant les nouvelles règles, garantissant une continuité d'activité, participant à des projets collaboratifs pour réduire l'impact de l'épidémie et en faisant des dons de matériel lors des premiers instants incertains de cette crise inédite.

Ce bilan très positif n'aurait pas été possible sans l'engagement du personnel de Subatech, le soutien et le financement fidèle de nos tutelles, des collectivités locales, de la Région des Pays de la Loire, de l'État et de l'Europe. Merci !

Je vous souhaite une très bonne lecture.

Since September 1st 2018, I succedeed Bernd GRAMBOW as head of Subatech. As the Directror, it is an honor to present this summary of our activities during the 2015-2020 five-year period.

As you will reading this document, the scientific and technical production of Subatech's teams and services has been abundant and of very high quality. It has been accompanied by a strong involvement in the teaching of our fields, the valorization of our research and a determined commitment to the diffusion of culture. The end of this period was strongly affected by the COVID19 crisis, which Subatech members faced, respecting the new rules, guaranteeing business continuity, participating in collaborative projects to reduce the impact of the epidemic, and donating materials in the first uncertain moments of this unprecedented crisis.

This very positive assessment would not have been possible without the commitment of Subatech staff, the support and faithful funding of our supervising organisations , local authorrities, the Pays de la Loire Region, the French gouvernement and European Union. Thank you for your support!

I wish you a very good reading.

Bernd GRAMBOW,
Prof. IMT Atlantique,
Directeur du laboratoire de Subatech de 2011 à août 2018

Director of the laboratory of Subatech from 2011 to August 2018

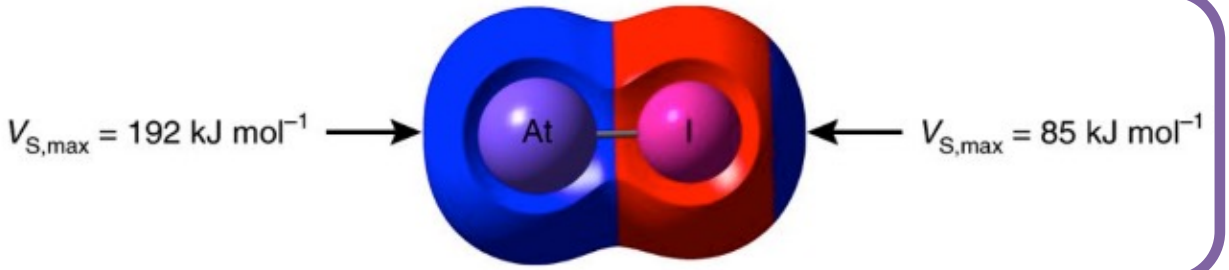
Gines MARTINEZ,
DR1 CNRS,
Directeur du laboratoire de Subatech depuis septembre 2018

Director of the laboratory of Subatech since september 2018

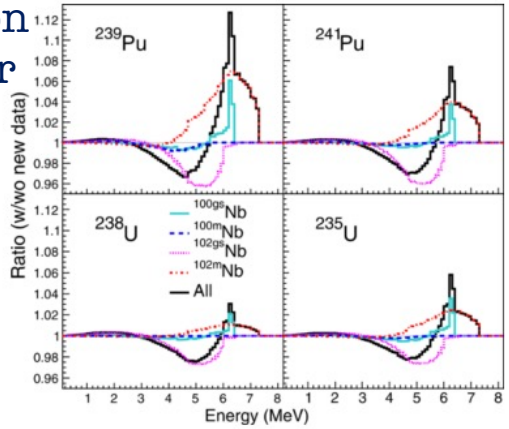
Highlights 2018-2024

Highlight Selection 2018-2019 (I)

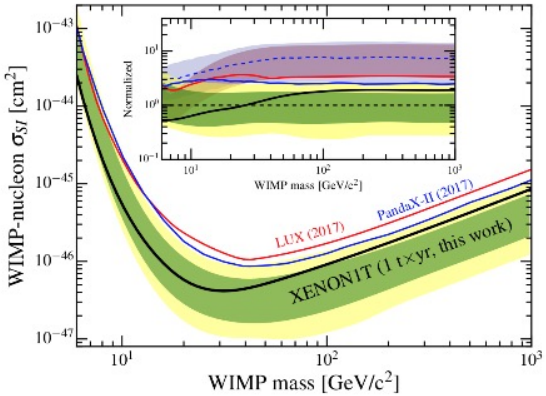
Experimental and theoretical evidence of halogen bonds with astatine, Nature Chemistry 10 (2018) 428



Major contribution of Niobium isomer decay to reactor neutrino simulation, Physical Review Letters 122 (2019) 042502



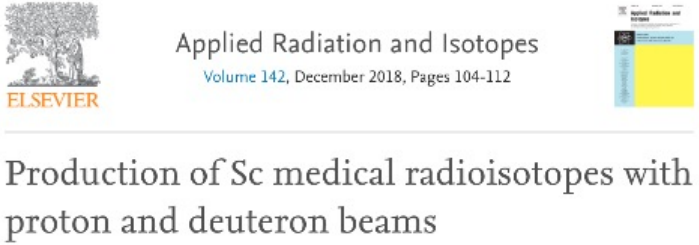
Results of the search for dark matter after 1 tonne x year of exposure of Xenon-1T Physical Review Letters 121 (2018) 111302.



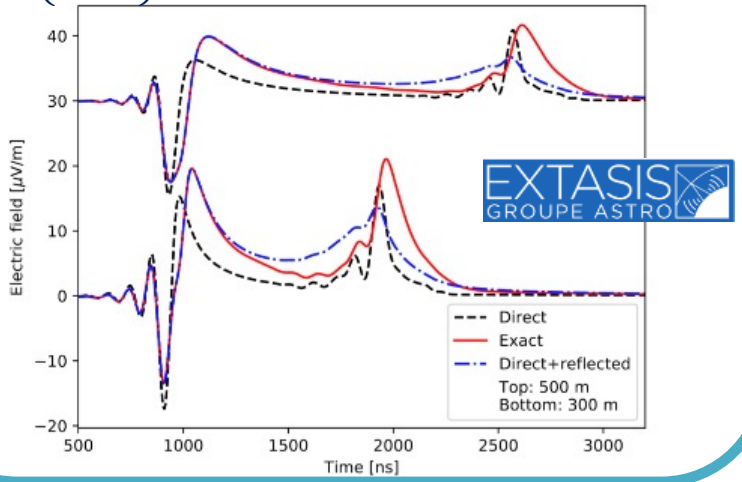
and Nature 568 (2019) no.7753, 532

Highlight selection 2018/2019 (II)

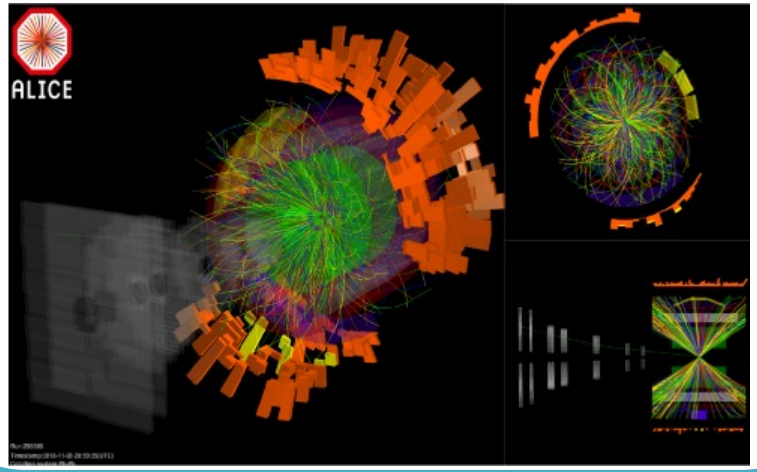
Production of Scandium isotopes for health (43, 44g, 44m, 47) using proton and deuteron beams. With enriched targets, production reaches : 10^2 – 10^3 MBq/µAh



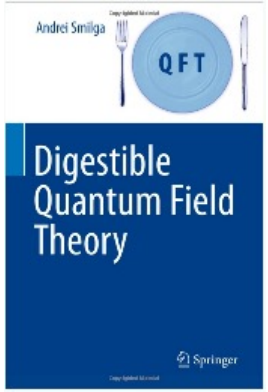
« State of Art » calculations of radio emission from cosmic ray showers, Physical Review D99 (2019) 063009

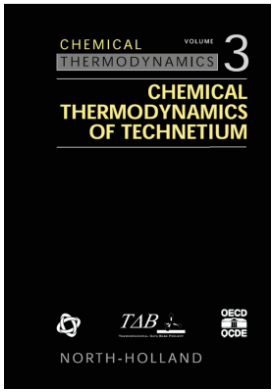


Data Taking Pb-Pb du Run2 au LHC November 2018. ALICE data : 0,5 nb-1 (2x 2015)



Highlight Selection 2018-2019 (III)





Livre d'Andrei SMILGA sur la théorie quantique de champs
Contributions sur les verres et la thermodynamique du technétium de A. Abdelouas, J. Neeway, B. Grambow

Mohamad Tarhini a effectué sa thèse intitulée :

Measurement of Z-boson and J/ψ Production in p-Pb and Pb-Pb Collisions at √sNN = 5.02 TeV with ALICE at the LHC »

à l'Institut de Physique Nucléaire d'Orsay, CNRS/Université Paris-Sud, sous la direction de Bruno Espagnon.

La thèse de Mohamad Tarhini porte sur la première mesure dans l'expérience ALICE de la production de boson Z dans les collisions p-Pb et Pb-Pb. ALICE est l'une des quatre grandes expériences du Grand Collisionneur de Hadrons (LHC) au CERN. Elle a pour objectif d'étudier un état extrême de la matière nucléaire qui aurait existé quelques microsecondes après le Big-Bang : le Plasma de Quarks et de Gluons (QGP). La mesure effectuée par Mohamad est essentielle car le boson Z étant insensible à l'interaction forte, elle permet de sonder l'état initial de la collision dans les domaines cinématiques couverts par l'expérience et ainsi d'espérer pouvoir séparer les effets dus à l'état initial de la collision des effets dus au QGP.

Prix à la meilleure thèse de la collaboration ALICE 2017

Prix de thèse 2017 (5 prix) la Chancellerie des Universités de Paris

Accessit Prix SFP Jeune Chercheur 2017

Lauréate de la bourse L'Oréal-Unesco 2018.

Audrey Francisco-Bosson, lauréate de la bourse L'Oréal-Unesco 2018

Précédemment doctorante en physique à IMT Atlantique, Audrey Francisco-Bosson a été récompensée lors de l'édition 2018 du programme national L'Oréal-UNESCO "Pour les Femmes et la Science". La cérémonie s'est déroulée le 8 octobre au Palais de la Découverte. Une bourse de 15 000€ lui a été remise pour financer ses futures recherches.

Ce programme a été créé en 2007 à partir d'un constat : la sous-représentation des femmes en science. Aux côté de l'UNESCO et de l'Académie des Sciences, la Fondation L'Oréal agit pour faire croître la part des femmes dans la recherche scientifique. Le programme "Pour les Femmes et la Science" a pour but d'encourager de jeunes chercheuses talentueuses à un moment clé de leur carrière et à susciter les vocations scientifiques des plus jeunes. Cette année, le jury, présidé par le Président de l'Académie des sciences, a sélectionné 30 dossiers de doctorantes et post-doctorantes parmi les 891 candidates.

Crédit photo Fondation L'Oréal / Carl Diner

Highlight Selection 2018-2019 (IV)

STRONG2020
Theory and experiment of strong interaction
European Project 2019-2024 10 M€
Coordinator :
B. ERAZMUS (Subatech)

EJP EURAD
Radiochimie
European project 2019-2023 35 M€
Prof Bernd GRAMBOW member of the executive committee

Stockage chair ANDRA & EDF & ORANO, Prof B. Grambow, 2019-2024

International collaboration meeting KM3NeT in Nantes (Château & IMT Atlantique) 10-14 june 2019

SAfe and REliable Nuclear Applications » (SARENA) : Master with label Erasmus Mundus (2019-2024), A. Abdelouas & Ch. Hartnack, 66 student Master Finland – Spain – France - Slovenie

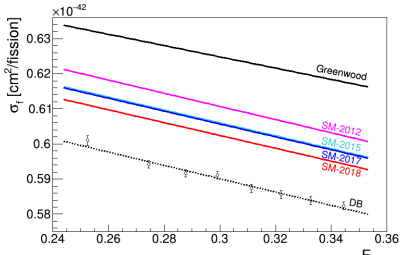
Magnetica Exposition (1st April – 27 May 2019) , J. Masbou, T. Pierret , 1600 visitors,

CG SFP 2019 Nantes
8-12 juilet 2019
Expo Grand Public

Electronics test bench of Small-PMT. Installation in Chine scheduled in 2019. Maintenance 2020/21

Highlight Selection 2019-2020 (I)

New data for better precision in simulation of neutrino and residual power of nuclear reactor



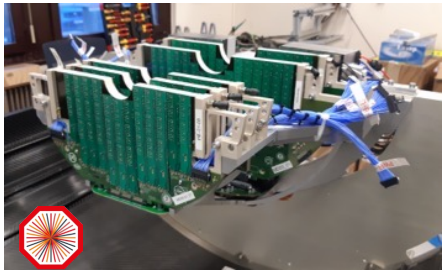
M. Estienne et al. PRL 123 (2019) 022502.

Successful E-Shape commissioning (Jyvaskyla)

Springer Handbook of Glass. All the work carried out by Subatech researchers over the last 30 years.
Molecular modelling. New developments in the ClayFF force field. Journal of Physical Chemistry avec la couverture page.

New ANR LabCom "TESMARAC"

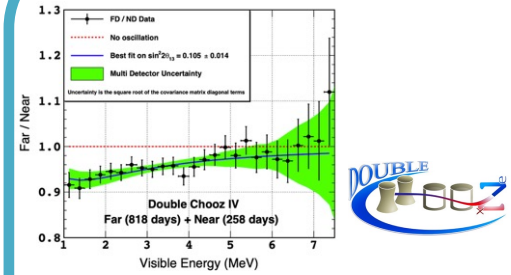
ALICE-CERN / Jets physics, Photon & Quarkonia for QGP studies



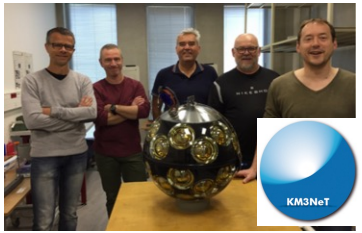
MFT 2nd half cone @ CERN

34 publications peer-review
Studies of J/ψ production in Pb-Pb, JHEP 02 (2020) 041
Measurement of the inclusive isolated photon in pp collisions,Eur. Phys. J. C (2019) 79: 896
Measurements of inclusive jet spectra in pp and central Pb-Pb collisions at 5.02 TeV, Phys. Rev. C 101 (2020), 034911

Double-Chooz and KM3NeT



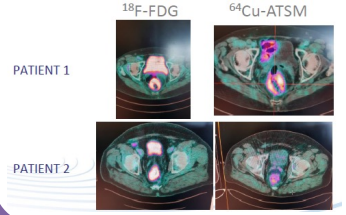
Double-Chooz Coll, Nature Physics 16 (2020) 558



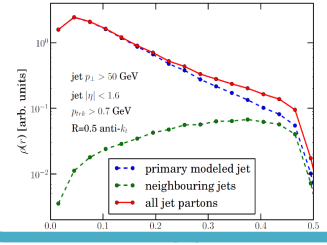
Production of 9 DOM.s
Contribution to the installation of 6 lines in Mediterranean sea.

Highlight Selection 2019-2020 (II)

ARRONAX / Radionuclides production, irradiation FLASH /

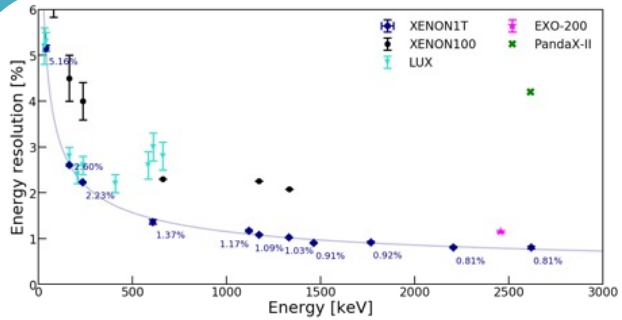


Work on copper-64 production
Irradiation of cells : spread of the Bragg alpha peak
Review article on beta+gamma TEP, App. Rad & Iso 155 (2020) 108898



EPOS3

Coupling of a jet energy loss algorithm with the EPOS3 code, Phys. Rev. C 101, 014905



Excellent energy resolution for a liquid xenon based detector Eur.Phys.J.C 80 (2020) 8, 785
XENONnT installation and commissioning in LNGS (Italy). ReStoX2 built by Subatech. Collaboration with Air Liquid.

Workshops and outreach : Fête de la Science, Kick-off STRONG2020, CG SFP 2019, Masterclasses, La nuit blanche des chercheurs, KM3NeT colalboration, SoLiD, Workshop GT03 Physique Hadronique, ...

Highlight Selection 2019-2020 (III)

CoVid19 Crisis

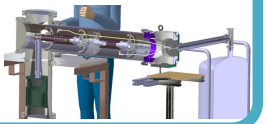


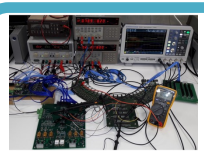
100 masks from IHEP Beijing, JUNO collaborators
600 masks from CCNU Wuhan, ALICE collaborators
Manufacture of hundreds of visors and dozens of handles by the mechanical department
Participation in the Ventilator Milano (MVM) project
Donation via Région PdL, in coordination with ARS

Replacement of the core network switch/router
Implementation of new tools for teleworking (OpenVPN, NextCloud and Only Office servers)
Addition of 640 new cores to the CCIPL (total of 1040) for Tiers2-LCG ALICE

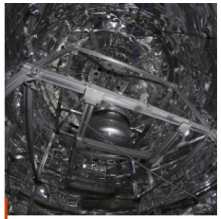
Covid19 crisis follow-up (PCA, PRA, IMT Atlantique coordination)
Preparation of ASN renewal
Monitoring of ~150 sources and 2000 samples
2500 inspections on average per year

DAMIC-M : Conception LN2 exchanger





Design, construction and test of the MFT Power Supply Unit, ALICE, CERN



Accueil › Actualités

Observation d'un excès d'événements dans l'expérience de recherche directe de matière noire XENON1T

17 juin 2020 RÉSULTATS SCIENTIFIQUES

Le cryostat de XENON1T à l'intérieur du château d'eau qui le protège des rayons cosmiques. crédit : XENON collaboration

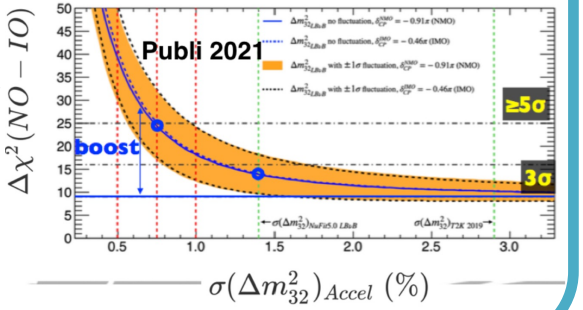
Xémis2 moves to the CHU
Development of 10 Gbit/s FPGA and TPC configuration software.
Complete acquisition chain including Idef-X, XTRACT, PU, Xenie.

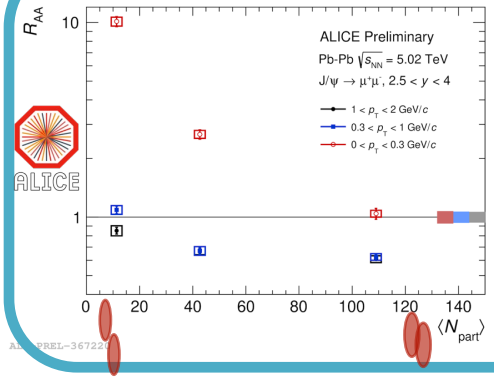
Un prototype du scanner au xénon est en cours d'installation au CIMA (Centre d''imagerie appliquée) du CHU de Nantes. – Crédit photo Laboratoire Subatech

Esquisse de la caméra au xénon utilisée sur des petits mammifères – Crédit photo Laboratoire Subatech

Highlight Selection 2020-2021 (I)

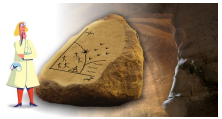
Mass hierarchy determination at 5σ before 2030 arXiv: 2008.11280



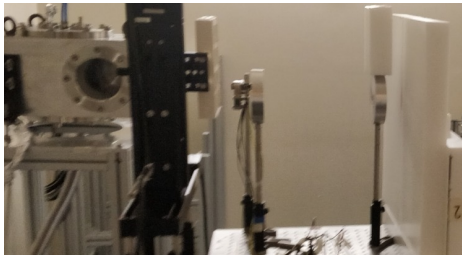


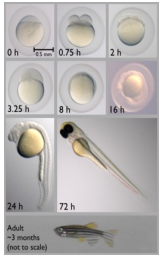
High precision results on J/psi photo-production in Pb-Pb

IS2021 The VI^th International Conference on the INITIAL STAGES OF HIGH-ENERGY NUCLEAR COLLISIONS



FLASH Radiotherapy Proton irradiation of zebrafish in Arronax

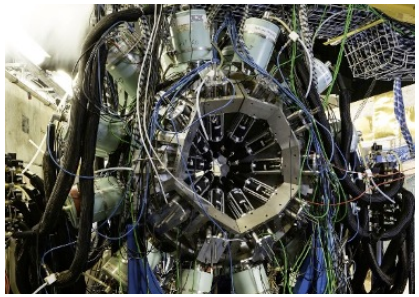




ARRONAX

Institut de Cancérologie de l'Ouest

Generation of angular momentum during nuclear fission



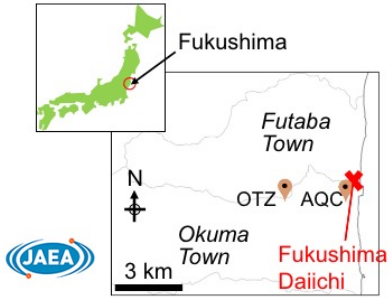
Collaboration nu-Ball

IJCLab Irène Joliot-Curie Laboratoire de Physique des 2 Infinis

Nature 590, 566 (2021)

Highlight Selection 2020-2021 (II)

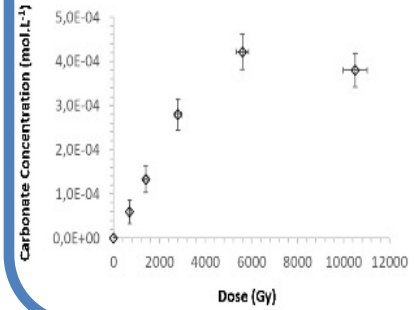
Pu particles released by the Fukushima Daiichi meltdown



CS-rich Microparticules CsMP with Pu

Sci. Tot. Environ 743 (2020) 140539

Radioactivity causing H2 and carboxylate anions

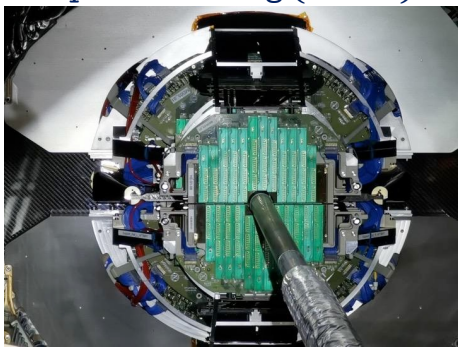


Microbiota deep below the surface

Earth and Plan. Sci. Letters 564 (2021) 116892

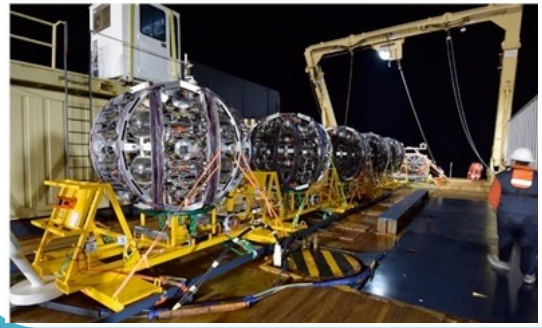
XENON-nT filled with 8.6 t of liquid Xe during the pandemic

Installation of the MFT Si-pixel tracking (MAPS) at point 2 of the LHC



Highlight Selection 2020-2021 (III)

Commissioning of the new KM3NeT lines



KM3NeT

Acoustic positioning

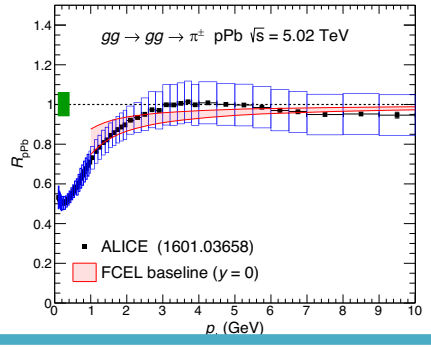
Pollusols scientific programme results

POLLUSOLS

Tritium in the Loire, Old Mines of U (ZATU CNRS) CNRS Journal March 2021

Energy loss and suppression of light hadrons in p-A at the LHC

Phys.Rev.Lett.125 (2020) 032301



QCD at finite perturbative temperature

Perturbative thermal QCD: Formalism and applications

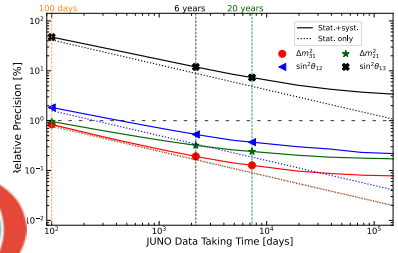
Jacopo Ghiglieri [a], Aleksi Kurkela [b,c], Michael Strickland [d], Aleksi Vuorinen [e,*]

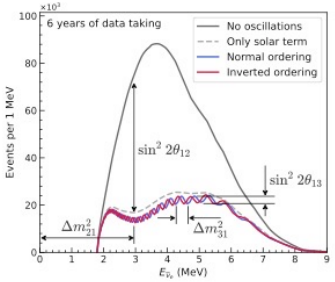
[a] SUBATECH, Université de Nantes, IMT Atlantique, IN2P3/CNRS, 4 rue Alfred Kastler, 44307 Nantes cedex 3, France
[b] Theoretical Physics Department, CERN, CH-1211 Genève 23, Switzerland
[c] Faculty of Science and Technology, University of Stavanger, 4036 Stavanger, Norway
[d] Physics Department, Kent State University, OH 44242, United States
[e] Department of Physics and Helsinki Institute of Physics, FI-00014 University of Helsinki, Finland

Phys. Rep.880 (2020) 1

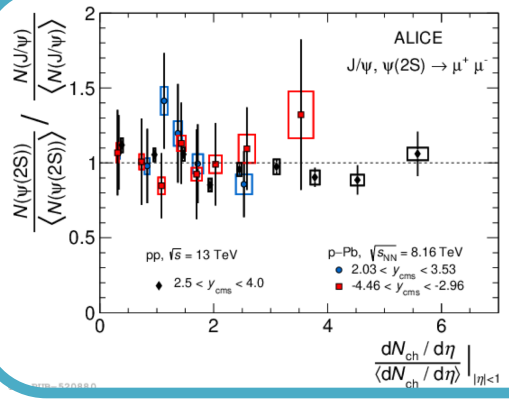
Highlight Selection 2021-2022 (I)

Precision measurement with JUNO arXiv:2204.13249 (2024-2030)





ERC Submission in 2022 (FY NU)



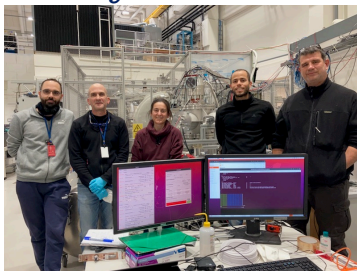
Psi(2S) in small systems

QM2022, arXiv:2204.10 253, JHEP

FlashMod at FRPT 2021 conference

Physica Medica - European Journal of Medical Physics, Sep 2022 (6 contributions)

E-Shape campaign at IGISOL (University of Jyväskylä) in January 2022.



Spectral measurements of "forbidden" β decays for reactor neutrino, nuclear structure, and astrophysics.

Highlight Selection 2021-2022 (II)

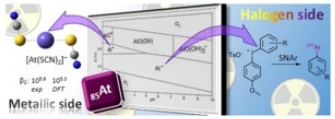
Review of astatine chemistry


François Guérard


Gilles Montavon

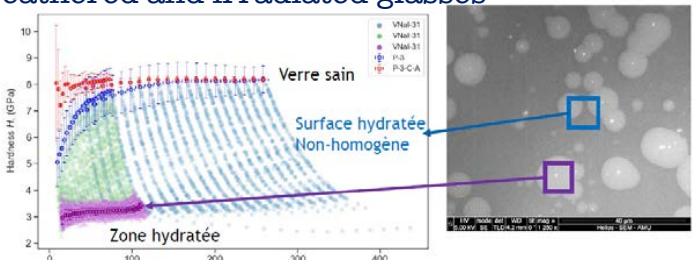

Nicolas Galland

Advances in the Chemistry of Astatine and Implications for the Development of Radiopharmaceuticals
Acc. Chem. Res. 54, 16, (2021) 3264



Nantais & Interdisciplinaire 100% : Arronax, CEISAM, CRCINA, Subatech

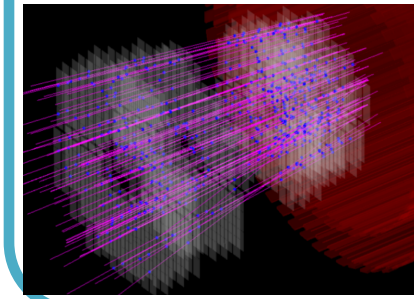
Understanding boron and iodine release in hydrated, weathered and irradiated glasses



Haohan Zhang et al. Journal of Non-Crystalline Solids 587 (2022) 121584.

R&D XeLAB IN2P3 avec le LPNHE
Research Contract ORANO XEMOX
Joining nEXO collaboration
Organisation of XeSAT 2022

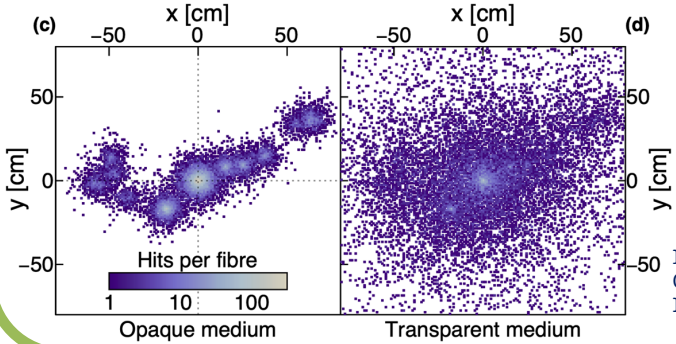
First Run3 particles (LHC Pilot Run3 November 2021)



MID, MCH ready. O2 close to ready.

Highlight Selection 2021-2022 (III)

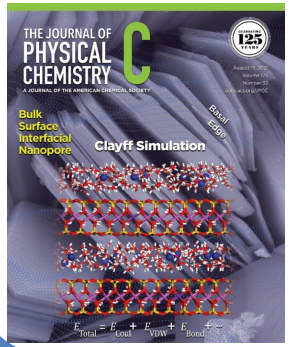
LiquidO Technology

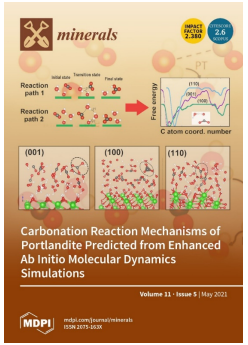


Nature Comm. Phys. 4 (2021) 273

Projects ANR TEP-OTECH ANR et EIC A AM-OTECH

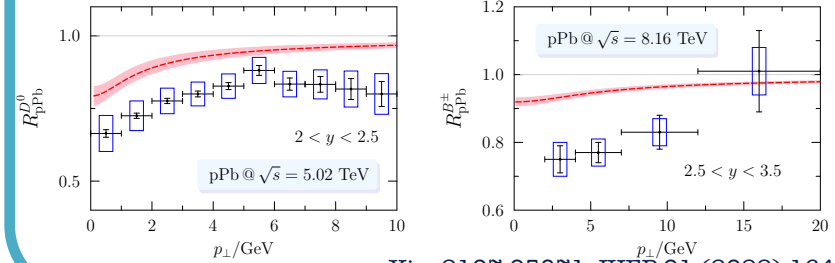
Molecular Modelling in cover pages





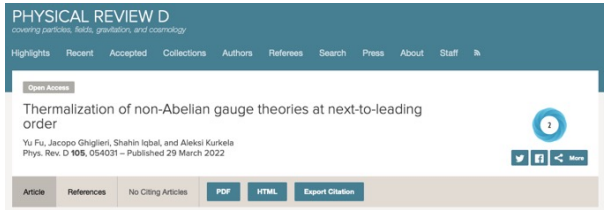
Andrey Kalinichev, guest editor special issues Clay Minerals 2022 and Minerals 2021

Impact of fully coherent energy loss on heavy meson production in pA collisions



arXiv: 2107.05871 JHEP 01 (2022) 164

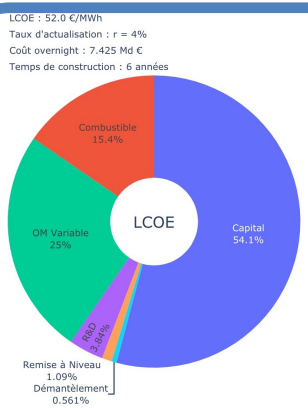
First NLO calculation for thermalisation in non-abelian gauge theory



Phys. Rev D 105 (2021) 054031

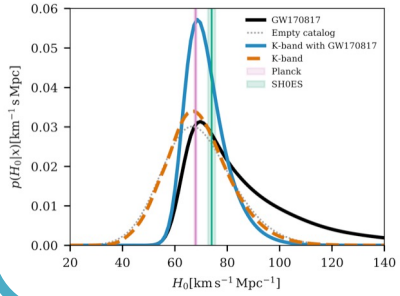
PB Gossiaux, J Ghiglieri plenary speakers at major conferences in the QM2022 and SQM2022 fields

Highlight Selection 2021-2022 (IV)



Book « Economie de l'énergie nucléaire » in collaboration with Jacques PERCEBOIS.
Editions ISTE, 500 pages, 9 chapitres, 2 annexes, co-éditeru Nicolas THIOLLIERE

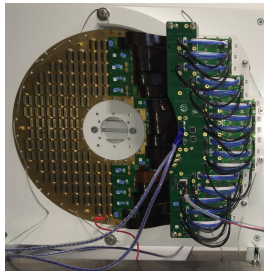
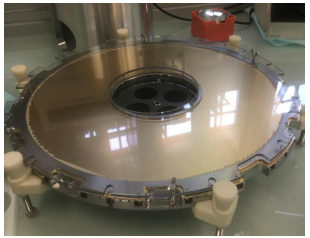
Virgo : constraining H_0



B. Revenu, paper committee
arXiv:2111.03604v2
Astr. Phys. Jour.

Contribution technique: controller of Peltier cell associated to the Faraday isolator

Key milestones in Xemis2 project


Light acquisition and micro-grill installation

ISRS 2022

More than 600 participants, 80 industrial parteners, 70 oral presentations. Program Chair : Sandrine Huclier

Highlight Selection 2022-2023 (I)

Review talk in ICRC2023 by Valentin DECOENE

ICRC2023
The Astroparticle Physics Conference
Nagoya, Japan, Jul 26–Aug 3, 2023

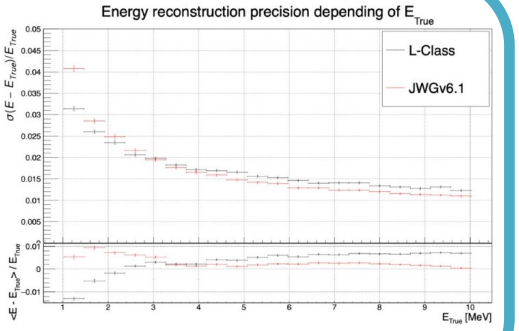
Hundred of DOMs assembled in Subatech during 2022-2023
4 offshore mission to deploy lines
10 articles KM3NeT

KM3NeT

Deep Learning for reactor neutrino reconstruction.

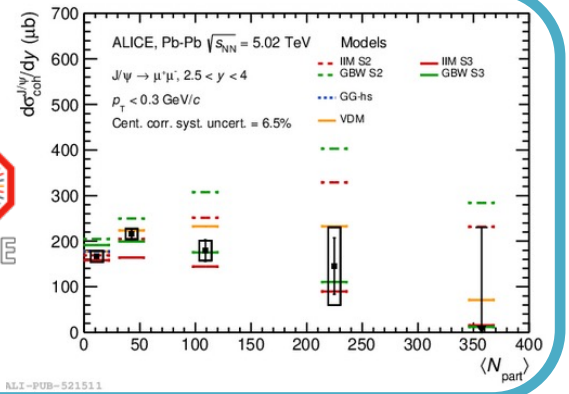
JUNO

NN Graph for energy and vertex reconstruction



Photoproduction of J/psi in Pb-Pb collisions.

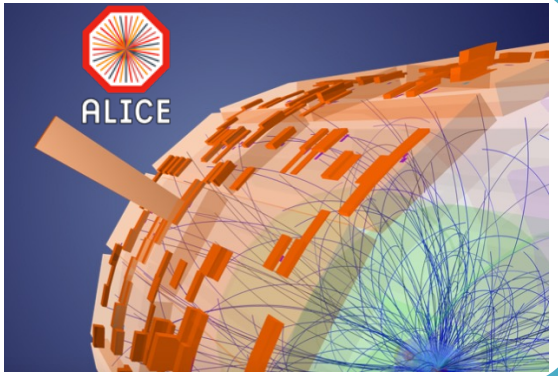
ALICE



Phys. Lett. B 846 (2023) 137467

ALICE EMCAL performances

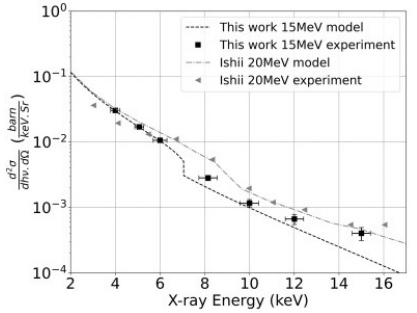
JINST 18 (2023) 08, P08007
129 pages



Highlight Selection 2022-2023 (II)

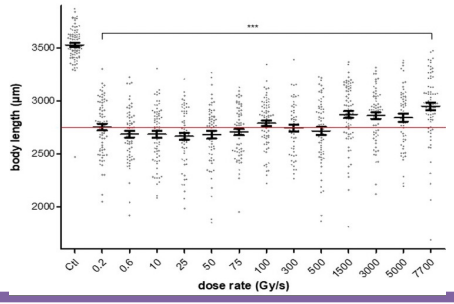
New experimental bremsstrahlung cross-section for light ion beams up to 60 MeV and comparison to theoretical »

Radiat. Phys. Chem., 203, 110605, 2023



Ultrahigh-Dose-Rate Proton Irradiation Elicits Reduced Toxicity in Zebrafish Embryos.

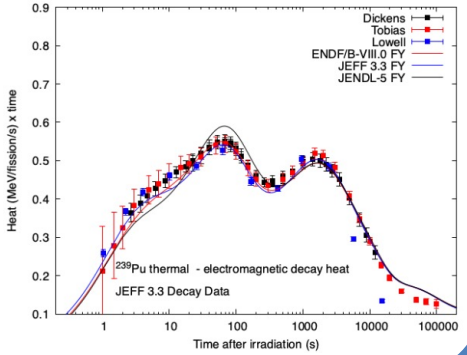
Advances in Radiation Oncology, 8(2):101124, 2023



New TAGS Campaign in Jyvaskyla Sep 2022 17 nuclei measured!

Improving Fission-product Decay Data for Reactor Applications : Decay Heat

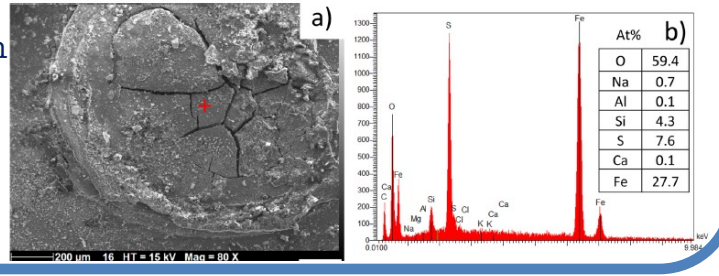
Eur. Phys.J. A59 (2023) 4, 78



Highlight Selection 2022-2023 (III)

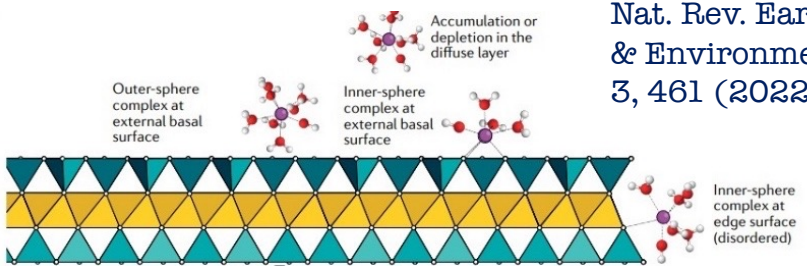
Study of the physico-chemical evolution at the interface of wrought barrier materials used for high activity waste storage.

Corrosion Science 211, 110852 (2023).



Molecular modelling of metal retention on clay materials.

Nat. Rev. Earth & Environment 3, 461 (2022)



Critical fluctuations in baryon densities PRC 107, 014908
Microscopic model for the production of J/ψ 2206.01308 (PRC)]
Clas. and quan. corrections to jet broadening in a QGP JHEP 11 (2022) 068
Length dependence of parton energy loss in QGP 2212.01324
Energy loss (FCEL) in LHC and atmospheric heavy hadron production, [JHEP01 (2022) 164, PLB 835 (2022) 137541

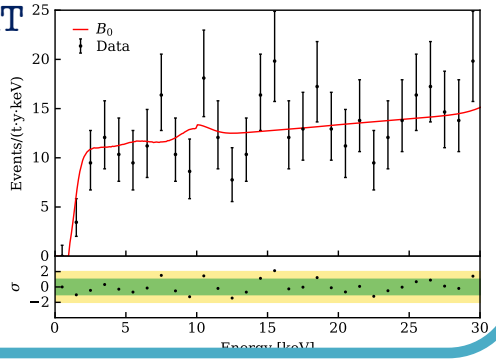
Hard Probes 2023

Theory :
2 plenaries et 6 parallels talks

Highlight Selection 2022-2023 (IV)

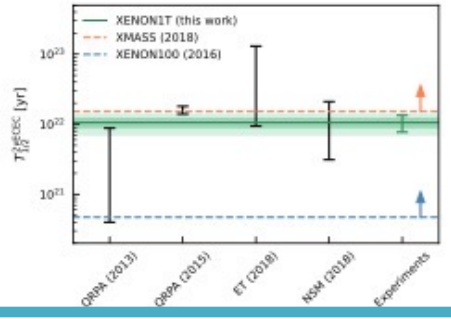
Search for New Physics in Electronic Recoil Data from XENONnT

Phys. Rev. Lett. 129, 161805 (2022)



Double-Weak Decays of 124Xe and 136Xe in the XENON1T and XENONnT Experiments

Phys.Rev.C 106 (2022) 2, 024328

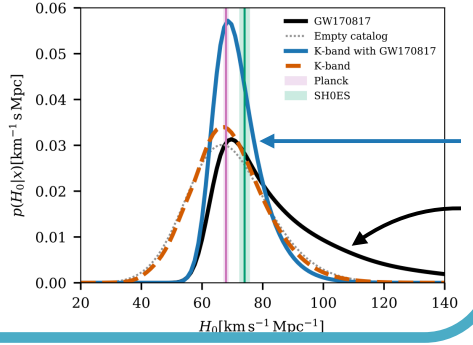


Nuclear Energy Economics, Jacques Percebois and Nicolas Thiollière, Editions iSTE

2023 Award of the Société de l'Énergie Nucléaire (SEN) July 5th Paris

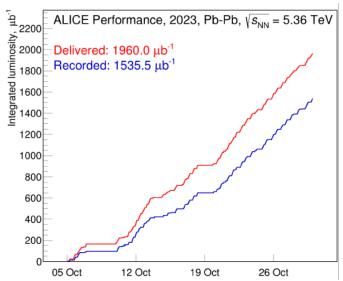
New measurement of the Hubble constant with gravitational waves

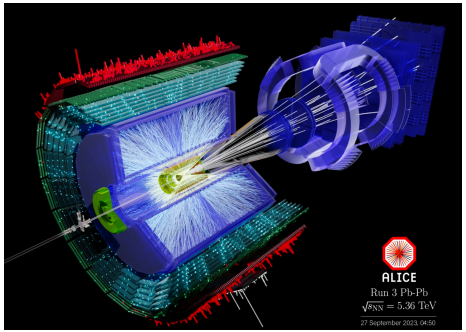
2111.03604 Astrophysics Journal 949 (2023) 2, 76



Highlight Selection 2023-2024 (I)

ALICE@Run3 Pb-Pb 5.36 TeV





End 2023

ALICE Thesis Award 2023

Rita SADEK FINOT
28/10/2022
HAL Id : tel-04008085

Heavy quarks in the QGP

Quarkonium dynamics in the quantum Brownian regime with non-abelian quantum master equations, S. Delorme et al., arXiv:2402.04488

Heavy quark dynamics in EPOS4 for pp and AA

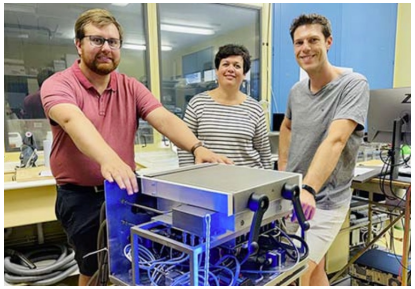
Energy losses of partons in a dense medium

Calculation of the two-loop thermal contribution to the thermal mass of partons in jets passing through the QGP, J. Ghillieri et al. JHEP 03 (2024) 111
The crucial role of energy loss in the energy-energy correlator measured in heavy-ion collisions at the LHC, J. Barata et al, 2312.12527
Calculation of the FCEL spectrum beyond the dominant log approximation G. Jackson et al., 2312.11650

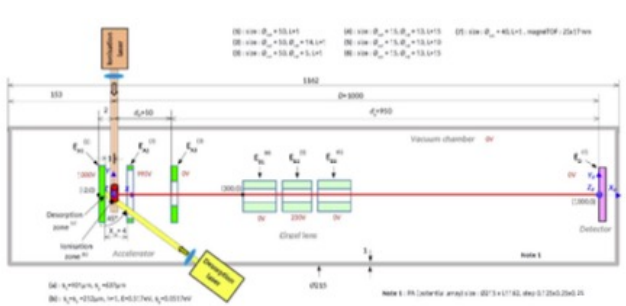
Highlight Selection 2023-2024 (II)

BePAT Project : BeaQuant for alpha emitters and application for alpha-therapy

Young Investigator Award for his poster presentation at the 'International Symposium on Trends in Radiopharmaceuticals (#ISTR2023) organised by IAEA.

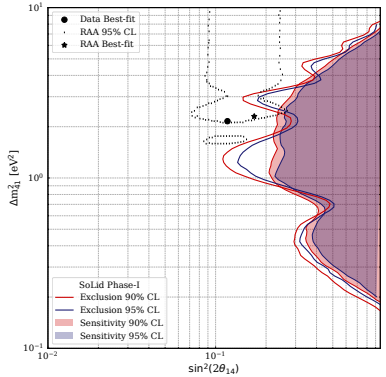


Construction of a linear ToF for SMILES



SoLid

Presentation of Frederic YERMIA de final results of the experiment in ICHEP-2024
Article being finalised



99 DOMs for KM3NeT integrated at Subatech.
24 foreseen in 2024.
Recognized experts

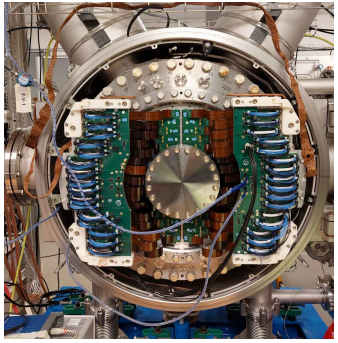
Musée d'Arts et Métiers

Highlight Selection 2023-2024 (III)

XeSAT 2023 à Nantes

https://indico.in2p3.fr/event/28661/

Installation 1st endcap
Light calibration ready
Charge calibration in good shape
Assembly of 2nd endcap on-going
Ready for commissioning in autumn



New e-shape campaign in Jyvaskyla for completing initial proposal of nuclei list
December 2023
PhD starting in September 2024

Accepted!

PROPOSAL E891_23

GANIL PAC 14/11/2023

Total Absorption Spectroscopy for Nuclear Structure and Nuclear Astrophysics

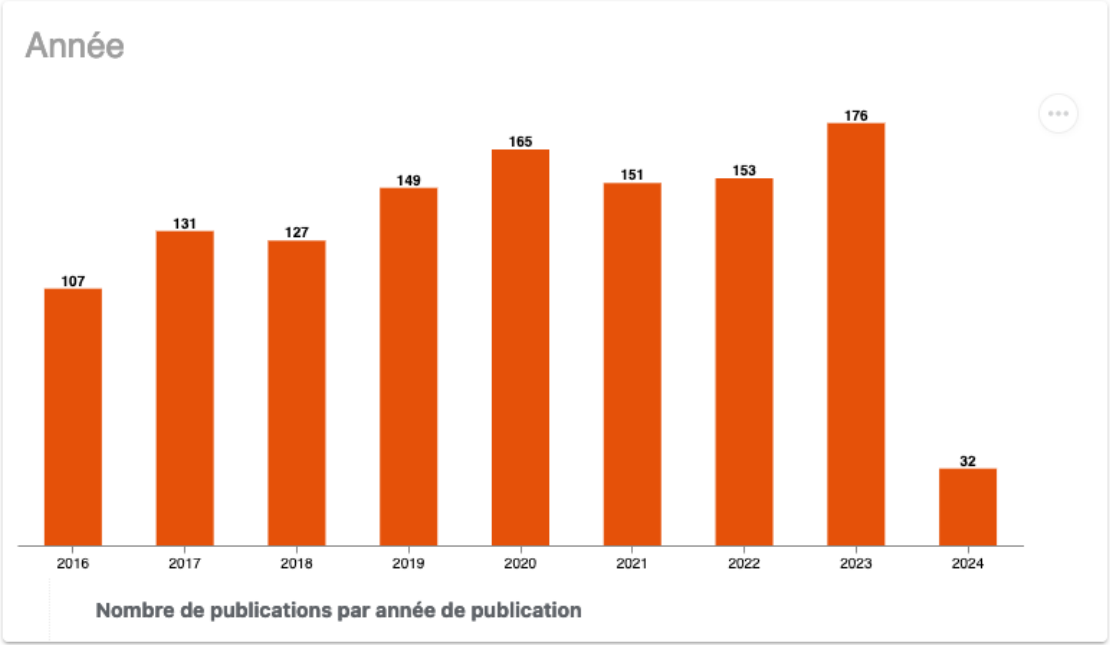
Spokespersons: M. Fallot[1], S. E. A. Orrigo[2], A. M. Sánchez Benítez[3],

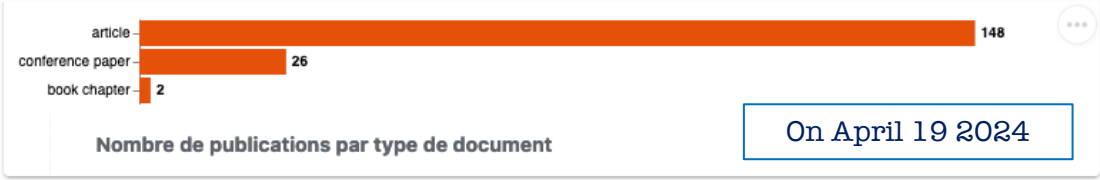
B. Rubio[2], A. Algora[2,4], J.-C. Thomas[5], W. Gelletly[6], B. Blank[7], L. Acosta[8], J. Agramunt[2], P. Aguilera[9], O. Aktas[5], G. Alcala[2], P. Ascher[7], D. Atanasov[7], B. Bastin[5], A. Beloeuvre[1], E. Bonnet[1], S. Bouvier[1], M. J. G. Borge[10], J. A. Briz[11], A. Cadiou[1], D. Cano Ott[12], G. de Angelis[13], G. de France[5], Q. Delignac[7], F. de Oliveira Santos[5], N. de Séréville[14], C. Ducoin[15], J. Dueñas[3], M. Estienne[1], A. Fantina[7], M. Flayol[7], C. Fonseca[2], C. Fougeres[16], L. M. Fraile[11], H. Fujita[17], Y. Fujita[17], D. Galaviz[18], E. Ganioglu[19], F. G. Barba[18], M. Gerbaux[7], J. Giovinazzo[7], D. Godos[8], S. Grevy[7], V. Guadilla[20], F. Gulminelli[21], F. Hammache[14], J. Mrázek[22], O. Kamalou[5], T. Kurtukian-Nieto[10], I. Martel[3], N. Millard-Pinard[15], F. Molina[23], E. Nacher[2], S. Nandi[1], S. Parra[2], J. Pépin[1], J. Piot[5], Z. Podolyak[6], A. Porta[1], B. M. Rebeiro[5], P. Regan[6], D. Rodriguez[2], O. Sorlin[5], C. Soto[15], O. Stezowski[15], C. Stodel[5], J. L. Tain[2], O. Tengblad[10], P. Teubig[18], L. Trache[24]

Production Scientifique Subatech

Published articles with Subatech affiliation

LODEX IN2P3 : https://publications-2312.in2p3.lodex.fr





2023 data not consolidated yet
In particular for the oral presentation in conferences.

On April 19 2024

Subatech Projects & Technical Services

Subatech project organisation

- The teams develop scientific projects :
  - Scientific goals
  - Project organisation (scientific and technical project leaders, management, and WP organisation)
  - Technological contributions
  - Human and financial resources
  - Planning and milestones
- Allocation of resources review every year (Jan-Feb)
- Organisation of internal reviews of the projects
- Participation to national or international reviews
- Evaluation and approval in Subatech and/or IN2P3 Scientific Councils

Projects @ Subatech, March 2024

	Two infinites	Ene & Env	Health	Technology
Radio-chemistry		MiniRap, Inspect, Radiocéan, Iron		SMART
		Radionuclides, Radonorm, RoAsta, Terraform		PTR
		Materials, EURAD, PREDIS, TESMARAC		
		Modelling, Stockage, Maeva, CHESS	Arronax	
Nuclear		OPALE, TAGs, Scenario, SMILES, FlashMod		Diamant
		Isac, CINEASTE, CLASS, TransforMed, BioHadron		Diammoni
		NA2STARS, TAS, Sanda/Aprende	RAMI	IRMA
		OPALE, Samosafer/Endurance	REPARE	R&T concentrator
Hadronic	Strong2020	Nacre, MIMOSA, Sudec	TTRIP	R&T BiCMOS
	EPOSHP, ALICE, ColdLoss			LiquidO
Particules	Autotherm, LHCb	AMOTech	TEPOTech	R2D2
	JUNO, XENONnT	Xemox	Xemis2	Xemis1
Astropart	KM3Net, Virgo, nEXO			XeLab

More about projects

Master projects of IN2P3: ALICE, Exploitation (GANIL, ISOLDE,Jyvaskyla), TAGS, OPALE (E-Shape), LiquidO, Authoterm, R&T BiCMOS, BioHadron, DAMIC, Diamant, DiamTech, (Endurance), EPOSHP, EURAD, Isac, JUNO, KM3NeT, Mimosa, MiniRap, Desir (NA2STARS), R2D2, Radiocéan, Radonorm, SMILES, Strong2020, Tesmarac, TTRIP, Xelab, Xenon

NEED: Inspect, Nacre, Sudec, Cineaste, Moustique, ...

European Projects : EURAD (EURAD2), PREDIS, RadoNorm, Strong2020, Sanda (Aprende), Samosafer (Endurance),

France 2023: ISAC, ...

Equipex: Iron, TerraForm

ANR projects: Authoterm, CPJ Scenario, ...

Industrial projects: Maeva, RadTrans, XeMox, ...

Others: Xemis2 (today NExT)

CPER: Conta-conti, SMILES,

Role of Technical Services

- Technical services are one of the laboratory's strengths, a French asset that is the envy of our colleagues from other countries.
- Its skills and strategy must be synchronised with our scientific ambitions.
- The heads of services and the technical department operate dynamically, and staff assignments are reviewed and updated for the year to come.
- Prospective in coordination with IN2P3:
  - **Evolution** (situation of the most important projects, feedback after a R&D)
  - **Transmission** (create a pool of apprentice, recognising the tutoring projects)
  - **Accompaniment** (training budget increase, national expertise units, national platforms)

The technical services of Subatech

General Services

Administrative department

SPR-I
(Risk prevention & infrastructure management)

IT ASR
(System & network)

Instrumental services

Electronics

Mechanics

Radiochemistry

IT MNDL
(Computing)

SMART
(Radioactivity measurement delivery platform)

Technical contribution to projects

	Two infinites	Ene & Env	Health	Technology
		Radioactivity measurement (SMART)		
Radio-chemistry		Radionuclides Materials		
Nuclear		TAGS / E-Shape (NA)2STARS	Arronax SMILES FlashMod REPARE	
Hadronic	EPOSHP ALICE			R&T concentrator R&T BiCMOS
Particules	LHCb JUNO		Xemis2	LiquidO R2D2
Astropart	KM3Net Virgo			XeLab

Technical contribution to projects

Projects/Instr. services	IT MNDL	Electronics	Mechanics	Radiochemistry	Research Team	SMART	FTE/project
Radiactivity measurement						12,7	12,7
EPOS HP/4	0,7						0,7
JUNO	0,4						0,4
KM3NeT	0,6	0,7	1,9				3,2
LIQUIDO	0,5	0,1	1				1,6
ALICE	0,1	0,3					0,4
LHCb	0,5	1	0,4				1,9
ARRONAX			0,8				0,8
REPARE			0,4				0,4
E-shape		0,45	0,3				0,75
(NA)2STARS		0,45	0,7				1,15
XEMIS2	0,2	1,6	1,4		0,6		3,8
XeLab			0,7		0,1		0,8
R2D2		0,25	0,5				0,75
FlashMod				0,5			0,5
SMILES		1,1	1,1		0,8		3
VIRGO		0,6					0,6
R&T BiCMOS		0,8					0,8
R&T Concentrator		1					1
Radionuclides & Environment			0,5	2,8	0,1		3,4
Materials			0,5	3,15			3,65
FTE/services in 2024	**3**	**8,35**	**10,2**	**6,45**	**1,6**	**12,7**	**42,3**
Tools, skills, teach support	0,4	1,65	1,8	1,55	0,2		5,6

General Services

- Administrative department (13 people / 13 FTE)
  - Finance and purchasing
  - Travel management
  - Human resources
  - Teaching secretariat
  - Communication, events and visitor management
  - Executive secretariat
- SPR-I (3 people / 3 FTE)
  - Risk prevention (handling, electrical, mechanical, chemical, laser)
  - Radiation protection
  - Annual management of the evacuation of radioactive waste
  - Management of the infrastructure close to IMT-Atlantique staff
  - Organization of the transport of hazardous materials
- IT ASR (4 people / 3,5 FTE)
  - Purchase, installation & maintenance of general IT infrastructure
  - Purchase and installation of workstations
  - Assistance in the installation of software packages and processing tools
  - Management of information system security

Subatech in 2030

The Neutrino Team

Main topic : *Study of the physical properties of neutrinos, detection and observation of their astrophysical sources*

Some distinctive features : Vast experience acquired in past experiments (Solid, Double Chooz), synergy btwn several ***ν*** exp. to deduce mass ordering before 2030, member of Scient. Council IN2P3, JUNO-France, largest DOM production in France for KM3NeT

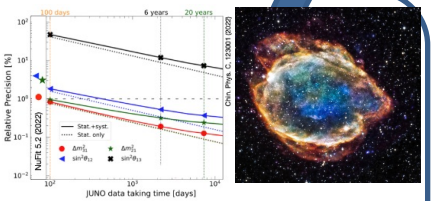
Projects and manpower (permanent staff) :

2024

KM3NeT : 4 (3 FTE)

JUNO : 4 (2,5 FTE)

Liquido / OTECH : 1 FTE



8

2030

KM3NeT : 5 (4 FTE) ; exploitation and preparation of Ultra High E ***ν*** ext. (GRAND?)

JUNO : 5 (4 FTE) ; gaining precision on fundamental parameters

SuperChooz Pathfinder

10

1 retirement

1 migration from PLASMA + **2 recruitments**

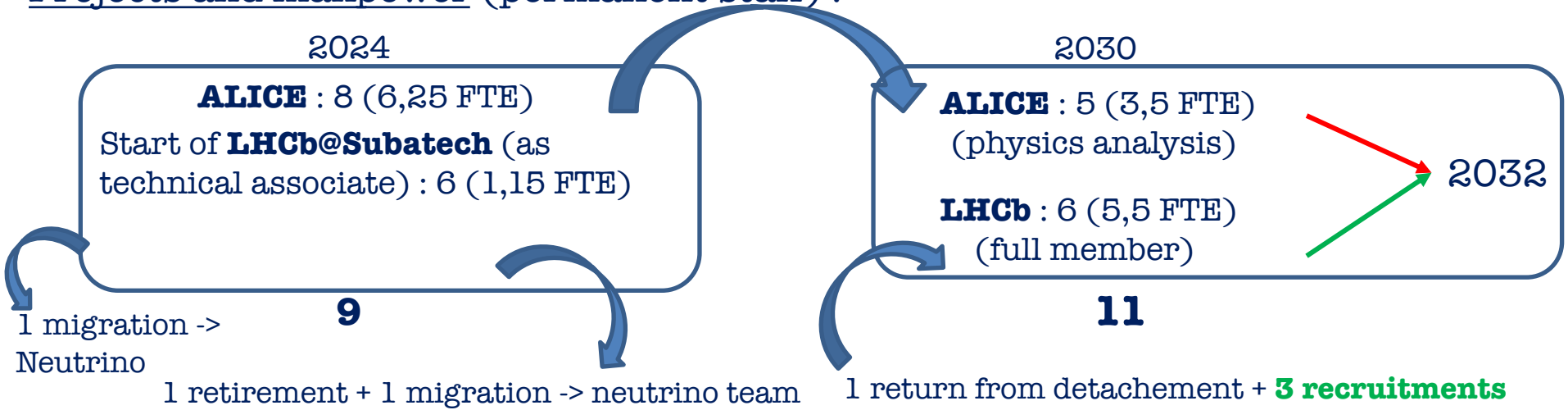
Team request

The Plasma Team

Main topic : *Experimental study of the hadronic matter, heavy ion collisions at ultra relativistic energies through hard probes (quarkonia and jets)*

Some distinctive features : Numerous responsibilities inside the ALICE collaboration (e.g. for the muon tracker / trigger), PI of the MFT project, head of the strong project. Contributions from detector construction, on-off-line and physics analysis

Projects and manpower (permanent staff) :

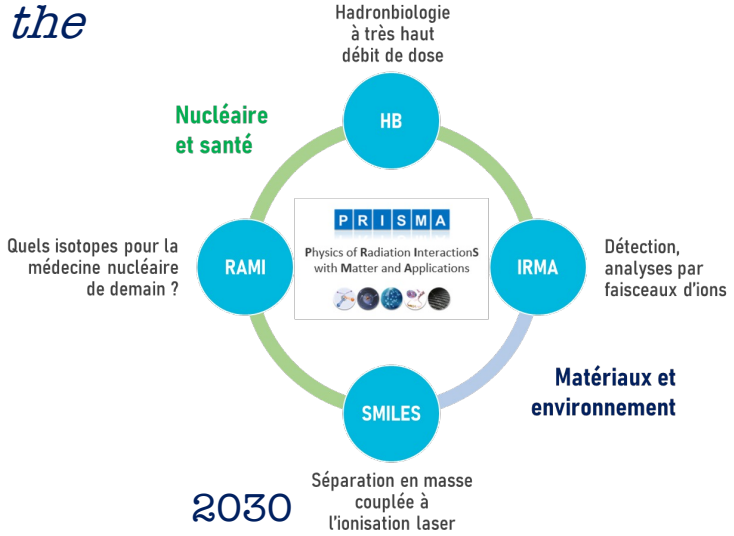


Team request

The PRISMA Team

Main topic : *Fundamental and applied research on the interaction of radiation and particles with matter*

Some distinctive features : conducts research around 3 major areas of scientific expertise with strong societal impact; strongly involved in the Arronax- Nantes community and the GDR MI2B



Projects and manpower (permanent staff) :

2024

RAMI : 2.2 FTE
IRMA : 0.9 FTE
HB : 0.9 FTE
SMILES : 2.5 FTE
(conception and integration)

9 + 1 Eng.

RAMI : improved purity, targetry
IRMA : improved detectors (DIAMANTS,...)
HB : understand Flash effect & develop irradiation means :
SMILES : under operation

1 recruitment
Team request

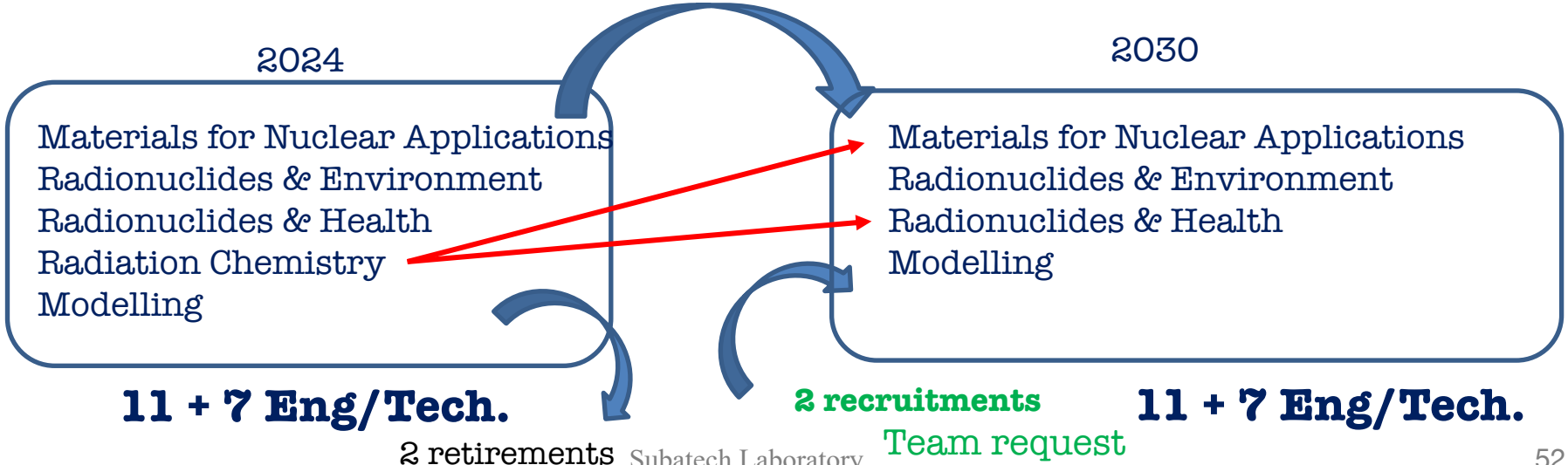
10 + 1 Eng.

The Radiochemistry Team

Main topic : *Research on the behavior of radionuclides and the migration in the environment, the conditioning of waste in storage conditions, and the problems of decontamination and cleanup of nuclear facilities.*

Some distinctive features : One of the largest radiochemistry teams in France, broad range of activities, strong links with the nuclear industry, ``plateau technique'',...

Projects and manpower (permanent staff) :

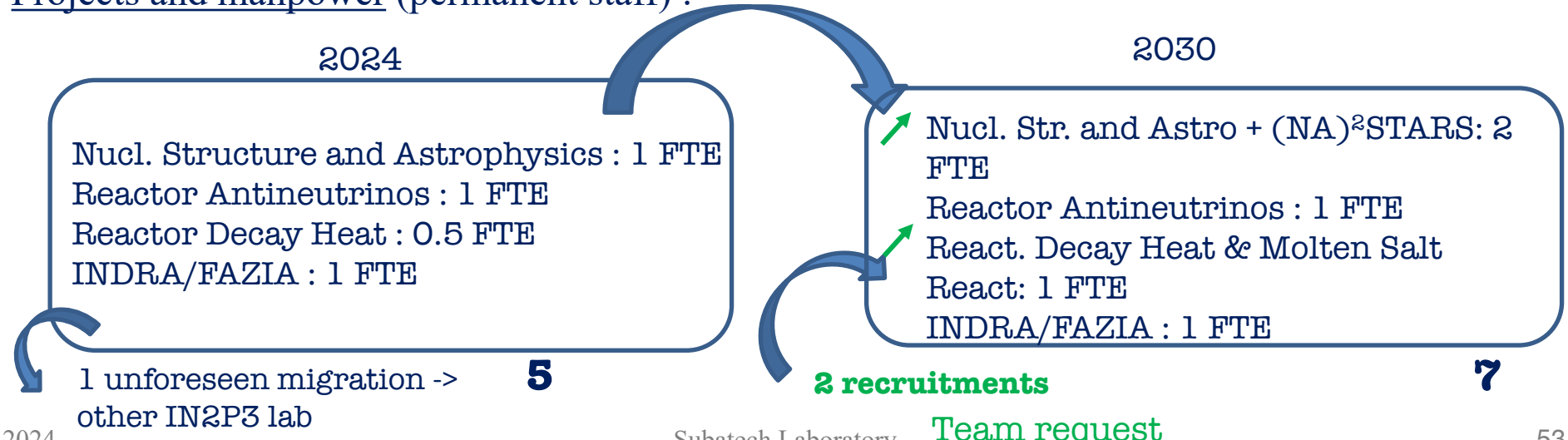


The SEN Team

Main topic : *Research on nuclear physics and associated simulations, applications to neutrino physics in nuclear reactions, nuclear energy and astrophysics*

Some distinctive features : Expertise in total absorption γ spectroscopy technique (TAGS), measurement of β energy spectra, simulations for reactor anti-ν, residual power, … clever cross-fertilization between the various axes, highly involved in relevant experiments and collaborations

Projects and manpower (permanent staff) :

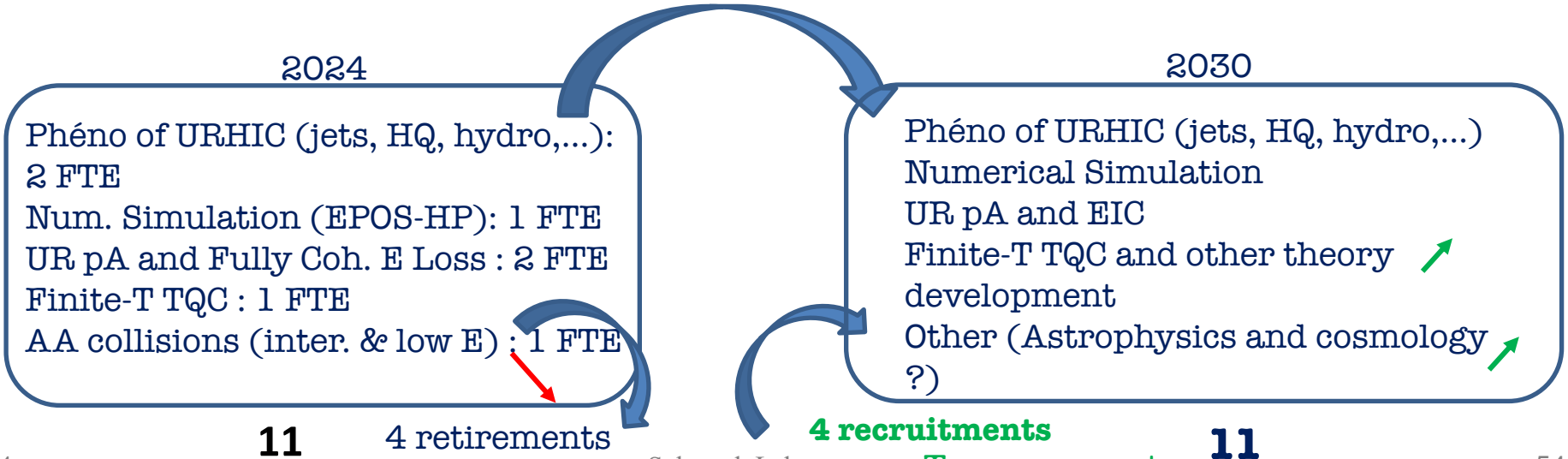


The Theory Team

Main topic : *Research on nuclear physics, hadronic physics and elementary particle physics, application to astroparticles and cosmology*

Some distinctive features : Broad range of research, high international visibility, common "langage" enabling multiple internal and external collaborations, links with some experimental teams, event generators used worldwide (EPOS, QMD),...

Projects and manpower (permanent staff) :

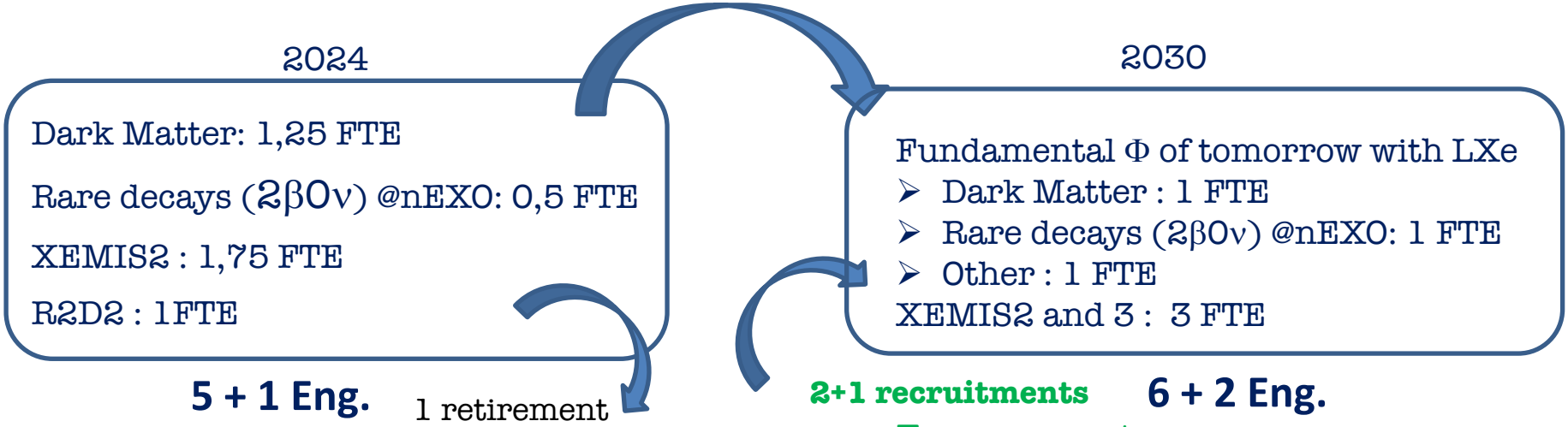


The Xenon Team

Main topic : *Direct search for dark matter and rare decays using innovative detection techniques and applications associated to these technologies*

Some distinctive features : Among the top-2 collaborations competing for sensitivity in DM detection and rare decays; smart synergy between fundamental research and applications (top-level instrumentation for medicine and nuclear industry); Scientific Council of IN2P3

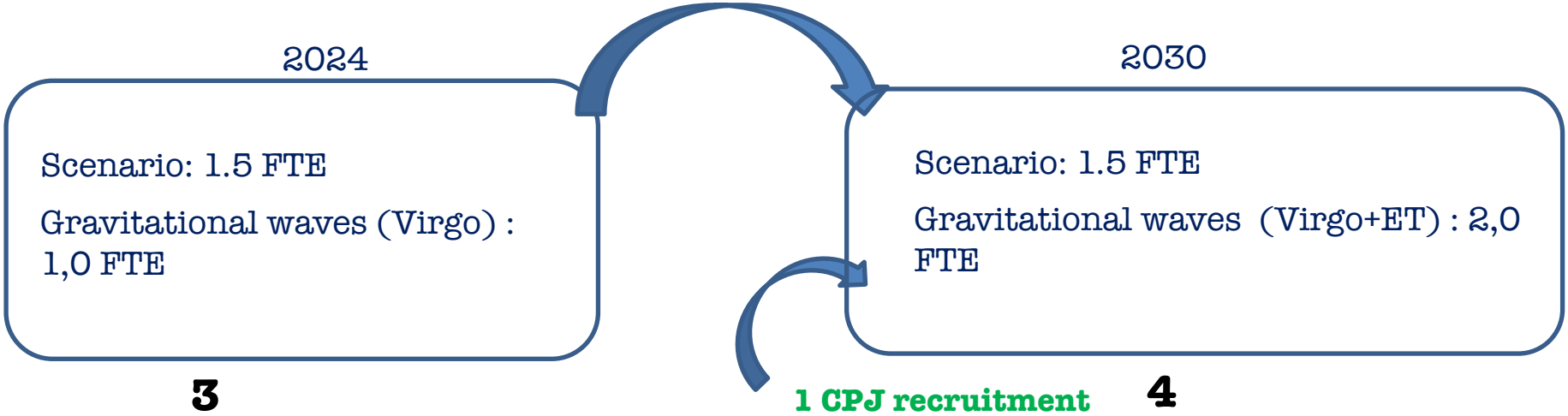
Projects and manpower (permanent staff) :



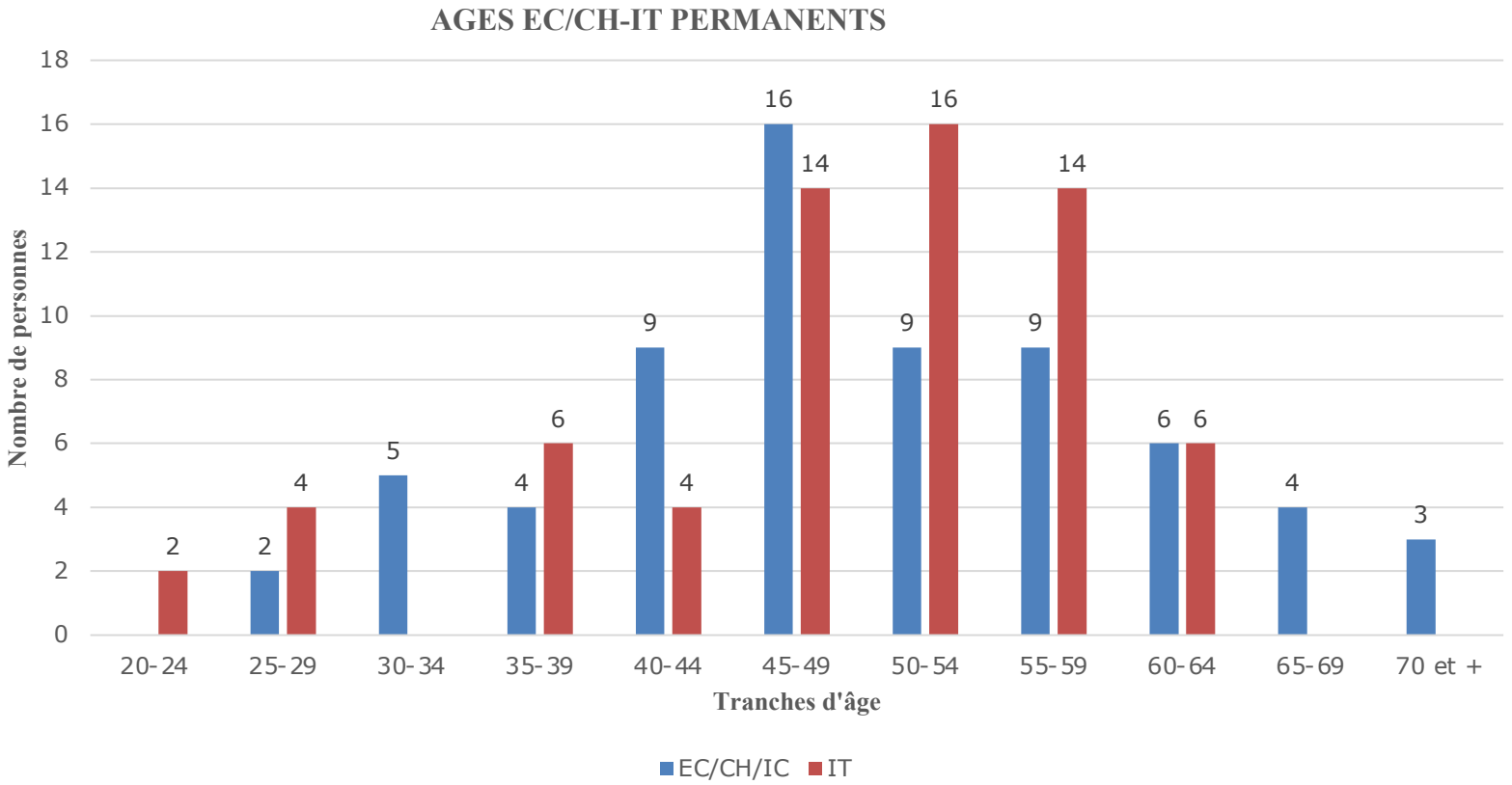
Emerging teams

Scenario: *Interdisciplinary contribution to nuclear energy: Scenario analysis for the energetic transition.*
Gravitational waves: *Cosmology with gravitational waves and populations of compact binaries and the astrophysical consequences.*

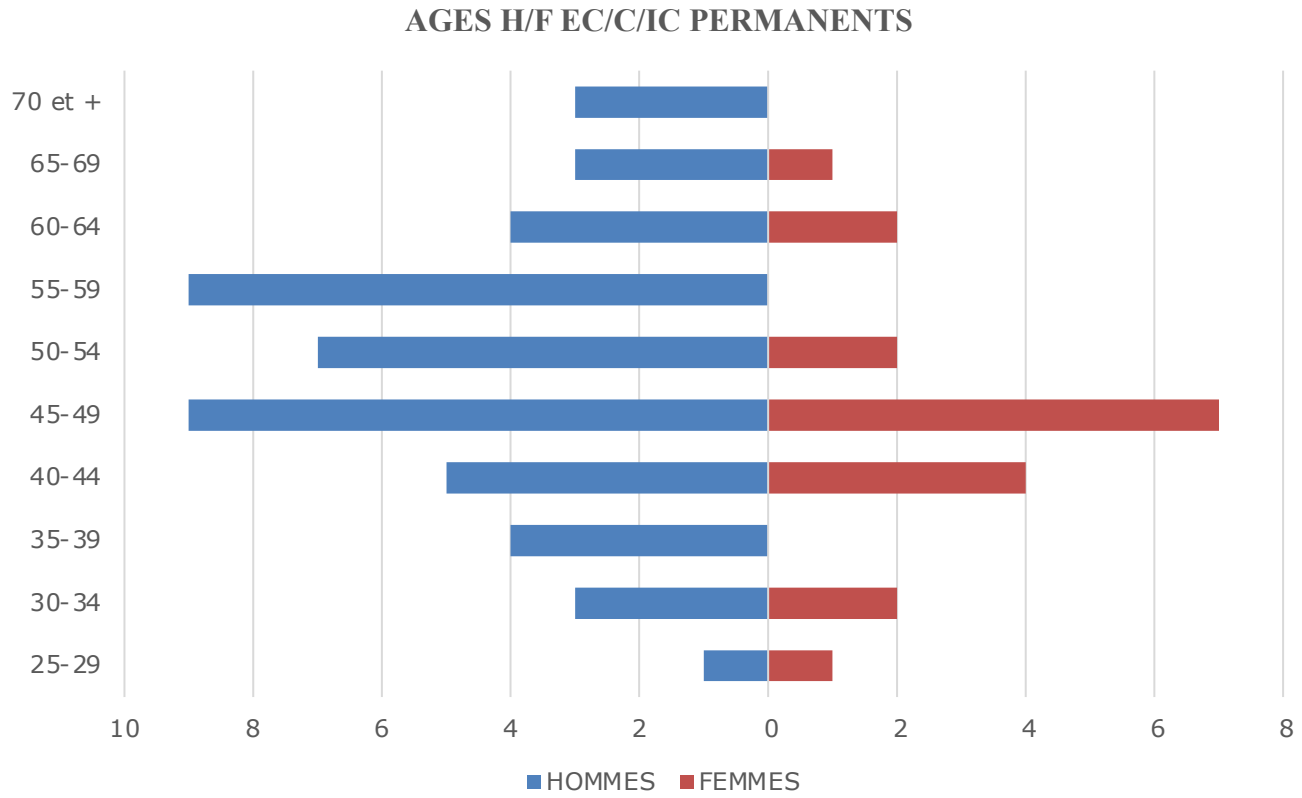
Projects and manpower (permanent staff) :



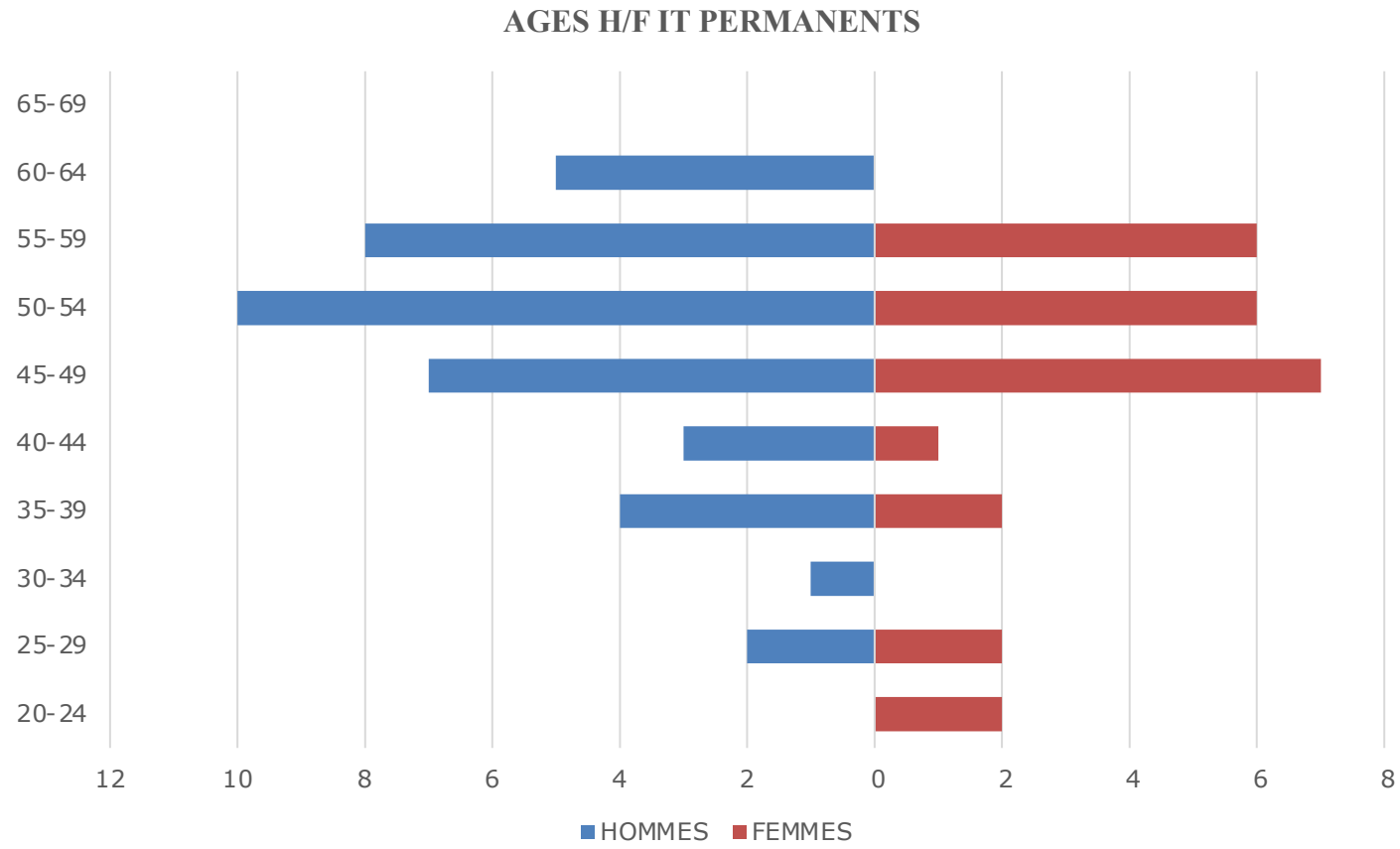
Laboratory's age pyramid



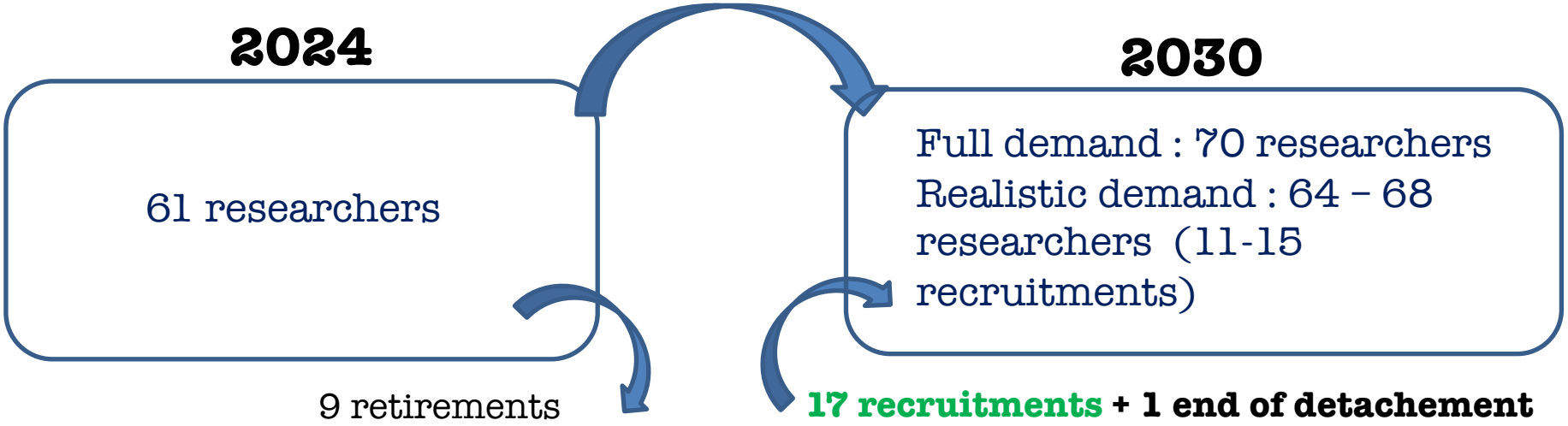
Laboratory's age pyramid : researchers



Laboratory's age pyramid : engineers



Realistic estimation positions



NU : 2 in the buffer (previous retirements : Theory and Plasma)

IMT : Atlantique : 1 in the buffer (new position Health axis)

NU : 4 retirements ➔ 4 expected positions + 1 new position

IMT Atlantique : 2 expected retirements ➔ 2 expected positions

CNRS : 3 retirements ➔ 3 expected positions + 2 new positions

Questions to the CSS

Management would therefore like to have the CSS's advice of our overall project for the laboratory as a whole, in the context of the national and international environment, and by assessing our strengths and weaknesses, the opportunities open to us and the threats. It is important for us to gauge the relevance of our project, and to know where our impact will be original, or even unique, so that we can identify priority projects as well as the critical mass in terms of human resources we need to achieve on these projects in order to have a major impact in international collaborations or in the concerned research domains.

Thank you!