



Sonder les infinis : des particules au cosmos

The background image for the title section shows a dark space filled with colorful, glowing particle tracks and a nebula-like structure on the right side.

Subatech 2024/2025
Gines MARTINEZ, Director

The background image for the bottom section is a green-tinted photograph of a large, modern building with a curved facade.



Subatech in few words



**NUCLÉAIRE
& PARTICULES**



IN2P3

Institut national de physique nucléaire
et de physique des particules

Subatech



Institut Mines-Télécom

IMT Transfert



IMT Atlantique

Bretagne-Pays de la Loire

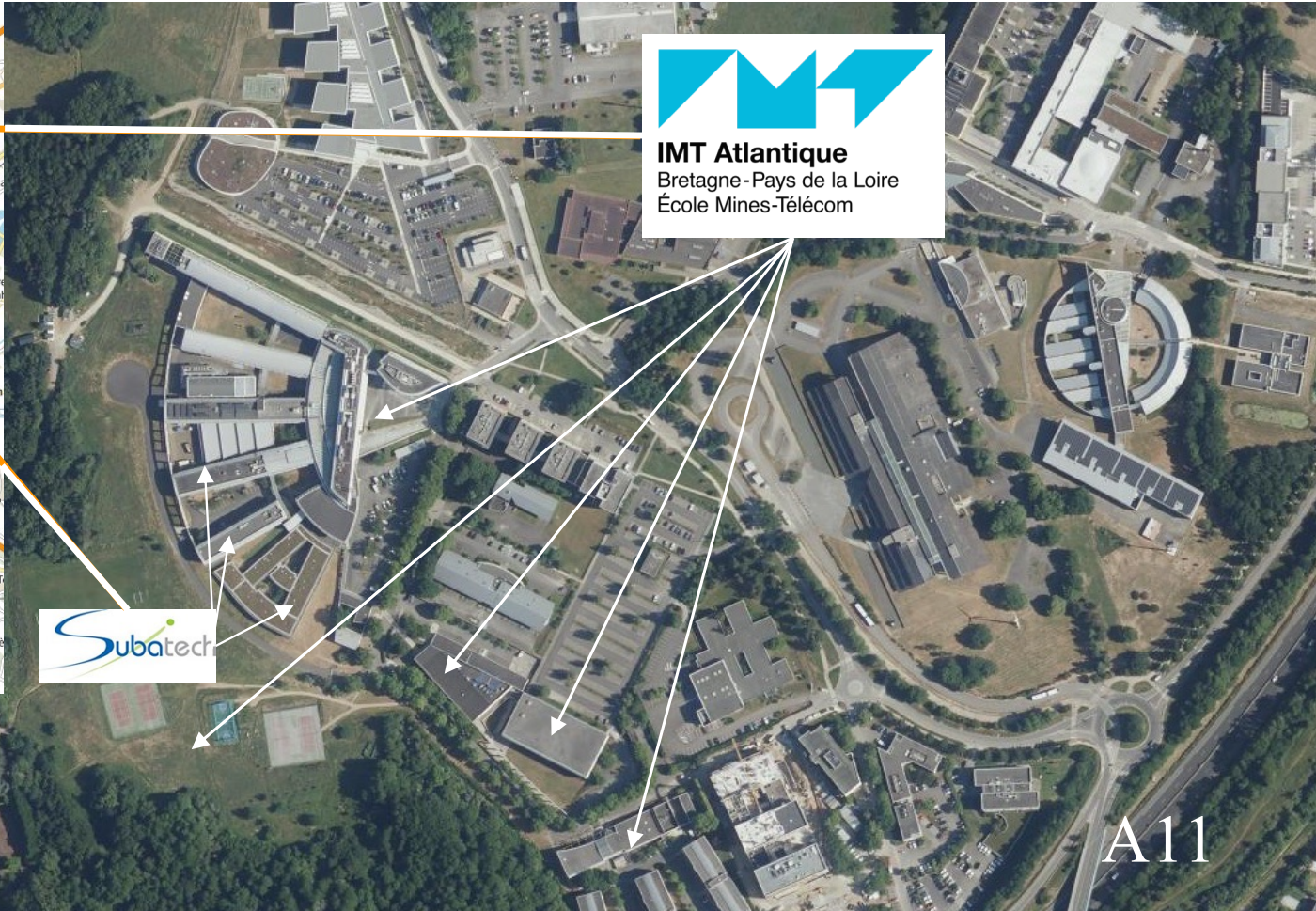
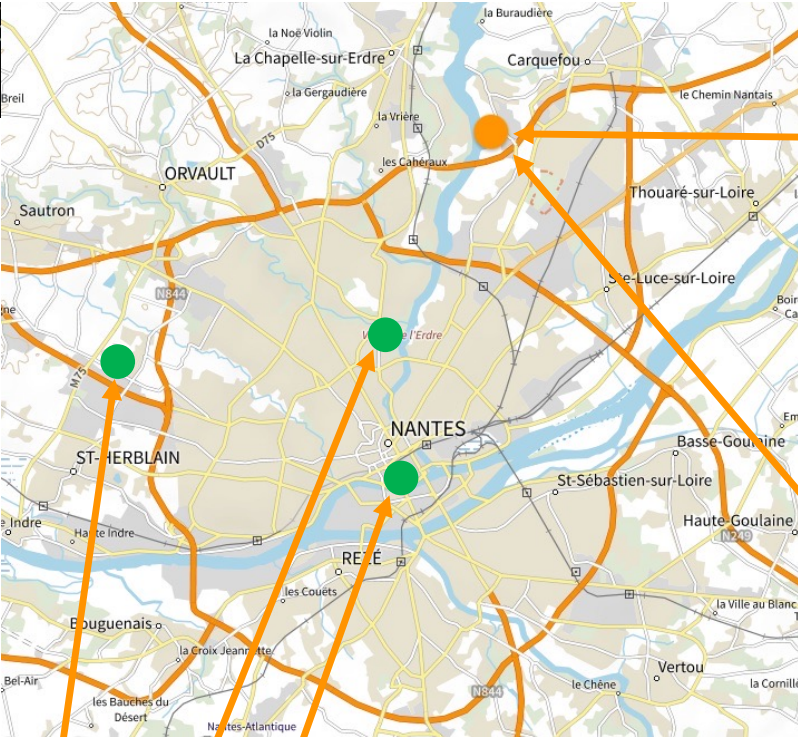
École Mines-Télécom

**Nantes
Université**

Pôle Sciences et Technologie
UFR Science et Techniques

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





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

Subatech



UFR Sc & Tc



XEMIS2



2024

Erdre
River

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)



Subatech research “leitmotif”

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

Nuclear applications for energy, the environment and health.

Ambitious research programme in radiochemistry.

Ambitious research programme in theory, in collaboration with experimentalists.

Technological research and development programmes. Integration into major experimental collaborations.

Scientific Axis of Subatech





The two infinities

6 of the 12 IN2P3 Science Drivers

Explore further the physics associated with the properties of neutrinos (Neutrinos)

Pursue the exploration of the hadronic matter phase diagram (Hadronic Matter)

Identify the nature of dark matter (Dark Matter)

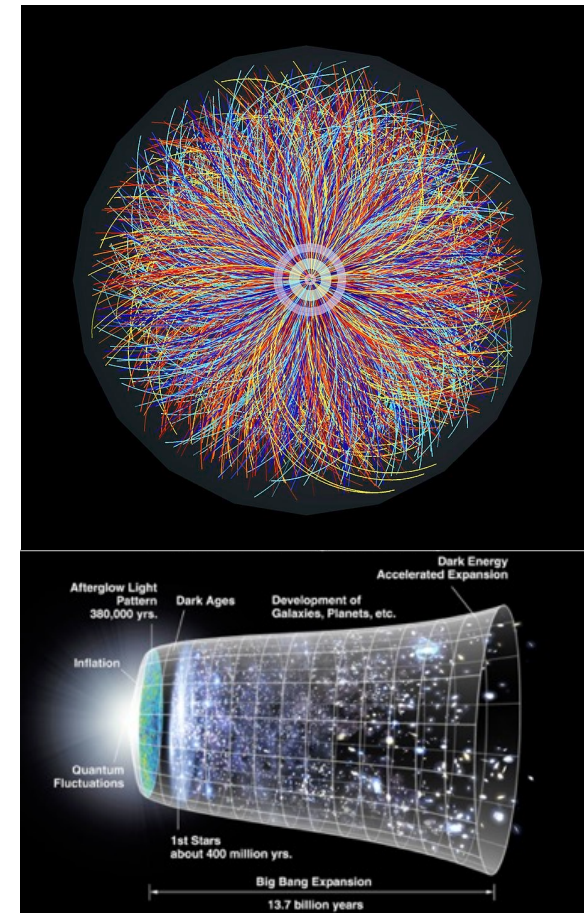
Study the physics of high energy messengers and probe extreme astrophysical phenomena

Understand how nuclear processes shape the Universe (Nuclear Processes)

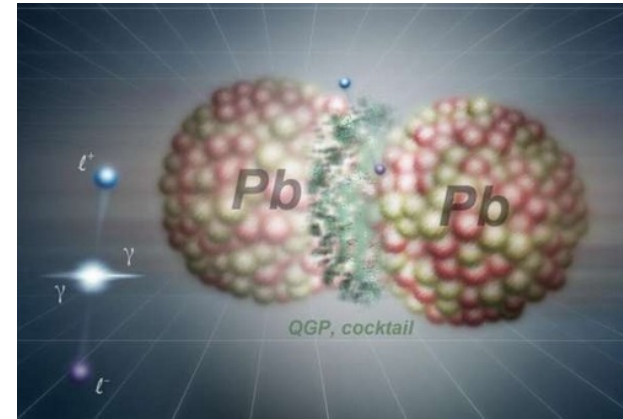
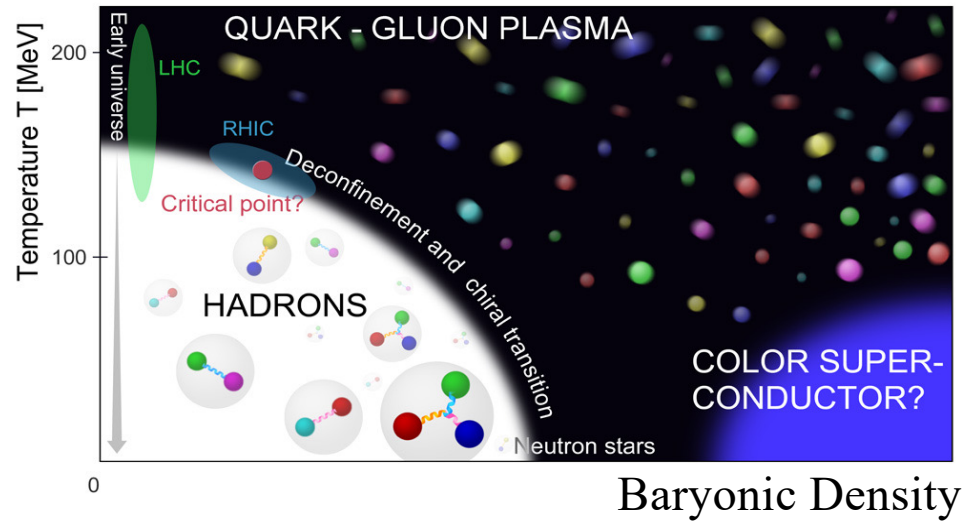
Use gravitational waves to explore the Universe and its fundamental laws (Gravitational Waves)

Implied teams : Neutrino, Plasma, SEN, Théorie, Xénon

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



Hadronic Matter Phase Diagram

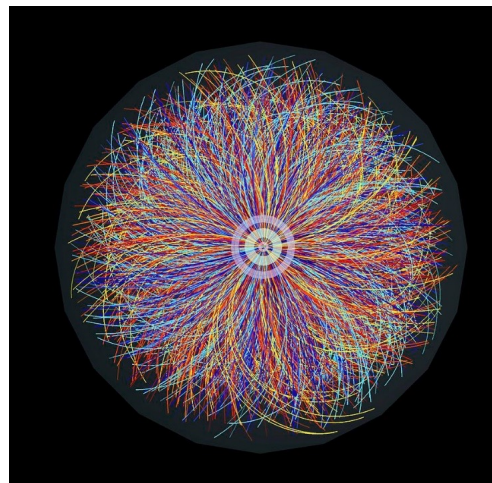


ALICE@LHC



2015-2020 : ALICE upgrade project
2013-2018 : leaded by Subatech

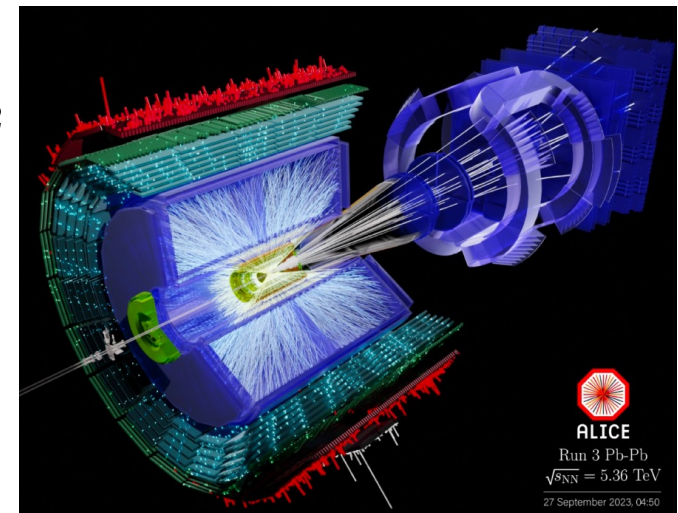
2024



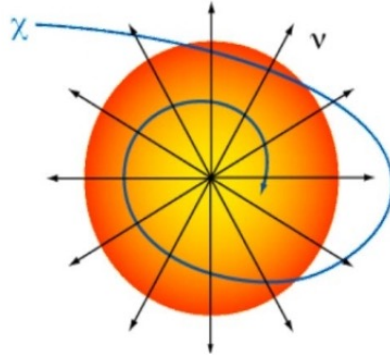
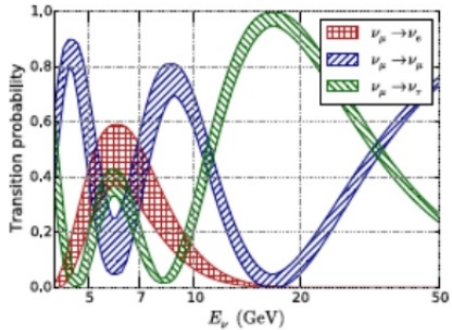
Subatech Laboratory

$$E = mc^2$$

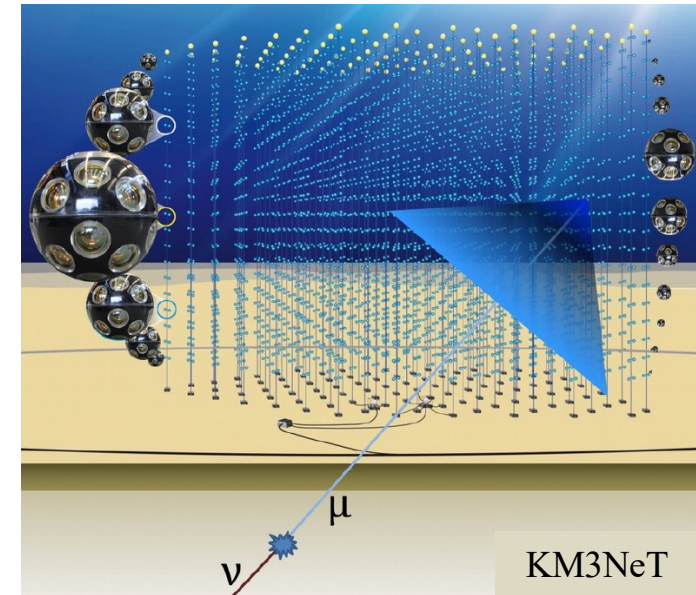
Thousands
of tracks



Neutrino Properties & Neutrino Messenger



Neutrino Telescope using Cherekov light



Low Energy
 $\text{MeV} < E_\nu < 100 \text{ GeV}$

Medium Energy
 $10 \text{ GeV} < E_\nu < 1 \text{ TeV}$

High Energy
 $E_\nu > 1 \text{ TeV}$

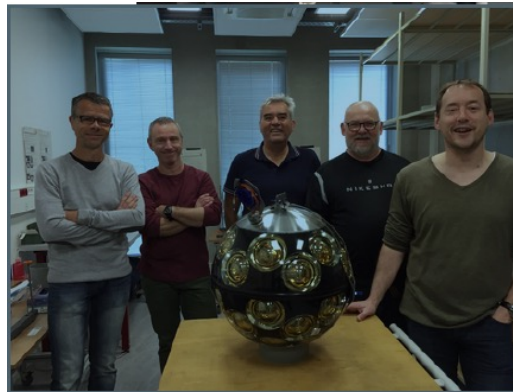
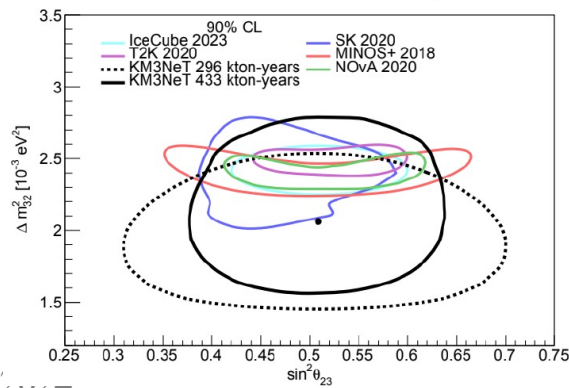
Neutrino oscillation parameter
and mass hierarchy

Indirect Dark Matter

ν from the Universe

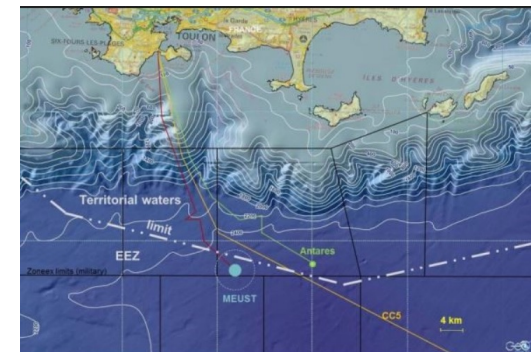
2023 : Oscillation results

KM3NeT/ORCA6 Preliminary



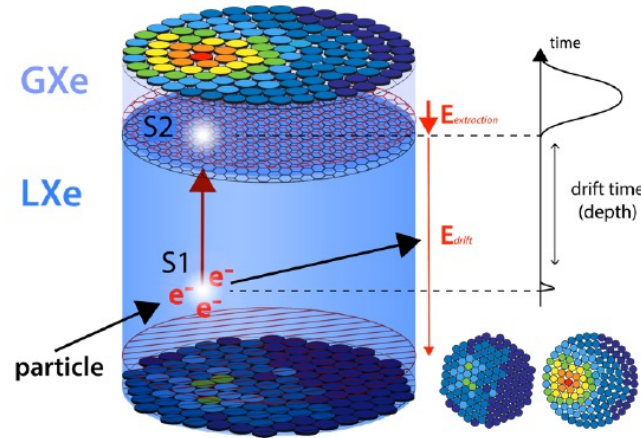
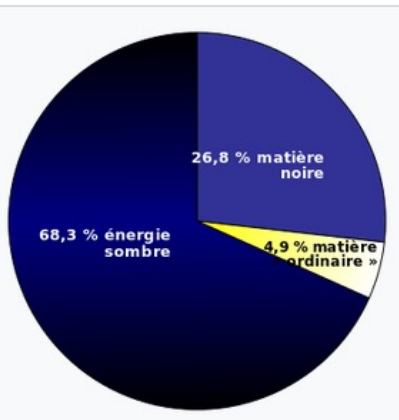
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Production of DOM
in Subatech.
Quality process

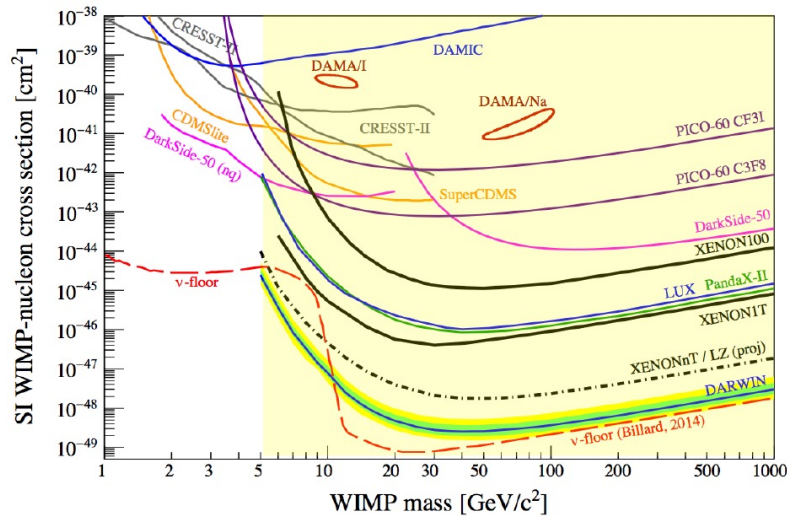




Direct Research of Dark Matter



Detection of the recoil energy deposited by a particle of unknown nature (WIMP) in a time projection chamber filled with noble gas (Xenon)
Mastery of new techniques associated with subatomic physics (nuclear and particles).





Nuclear for Energy and Environment

National leadership. Unique “*plateau technique*”

Environment & Nuclear

Materials under radiation and nuclear wastes

Molecular modelling

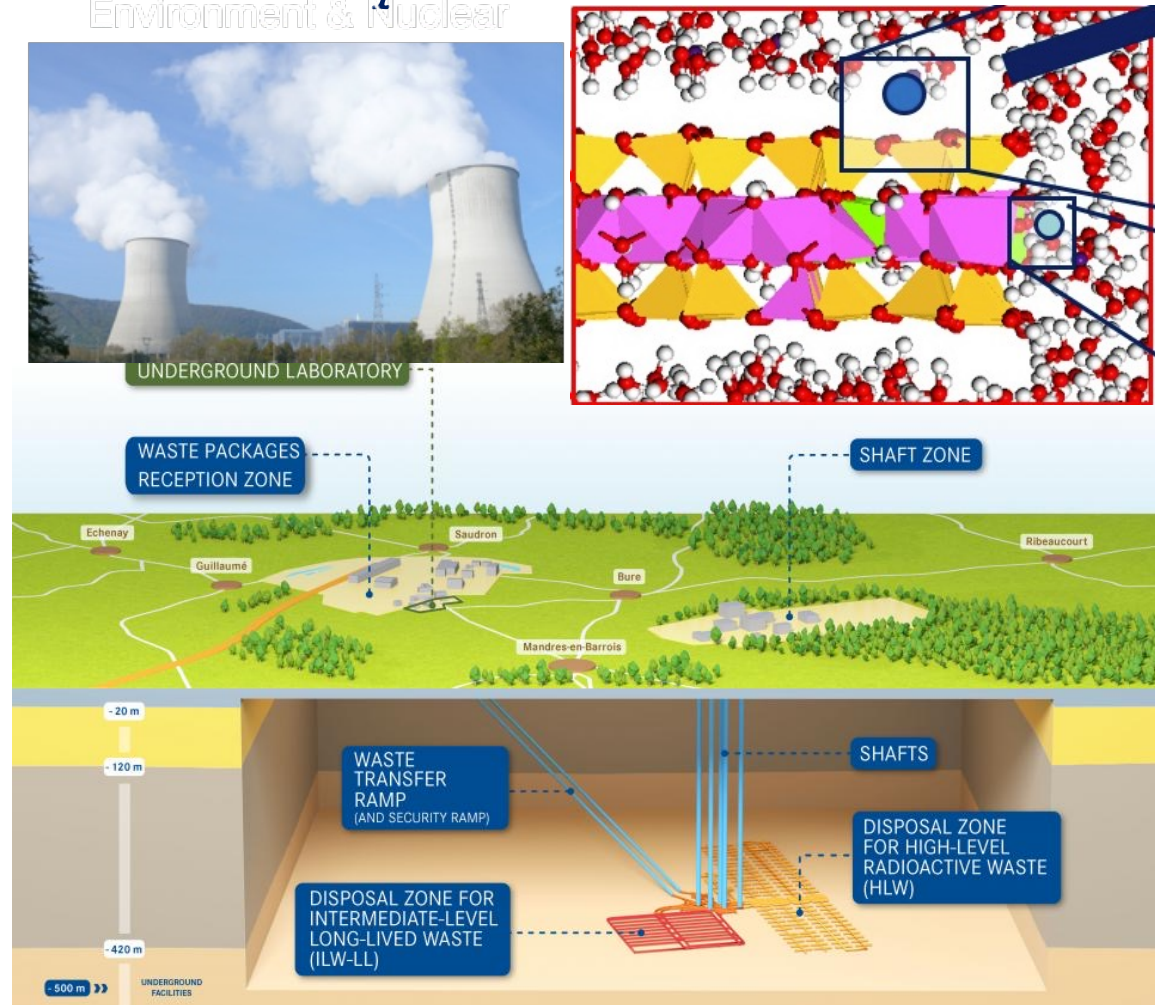
Nuclear data

Nuclear reactors

Scenario

Radionuclides in environment

Implied teams : Radiochimie, SEN, Scenario. LabCom Tesmarac.



Subatech Laboratory



Nuclear for Health

Very rich local ecosystem

New radionuclides for health

Irradiation of small animals

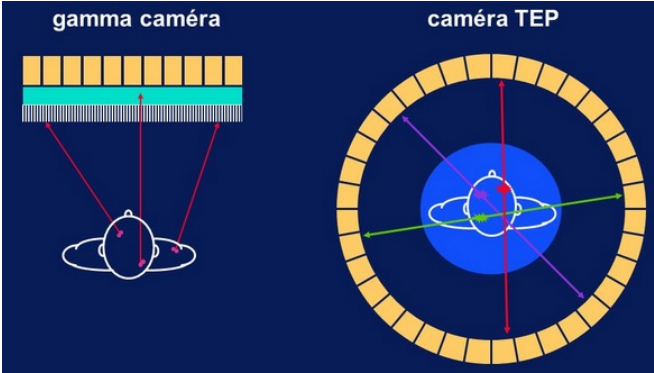
Instrumentation for health :
Medical imaging

Main concerned teams : Prisma,
Radiochimie and Xenon.

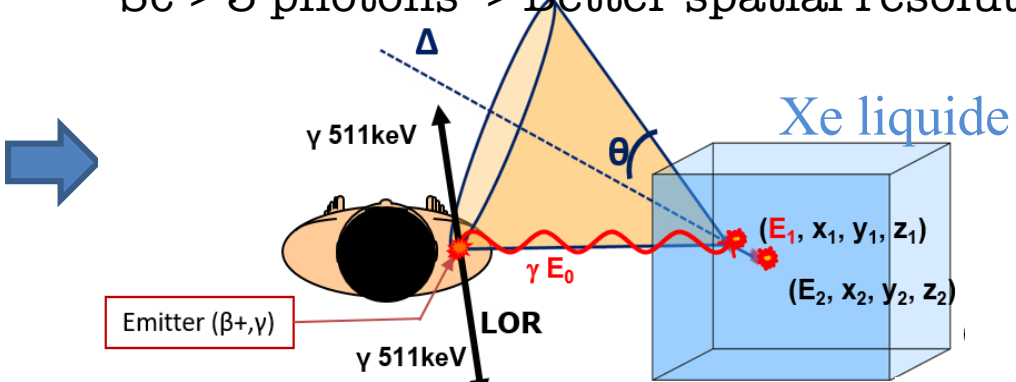




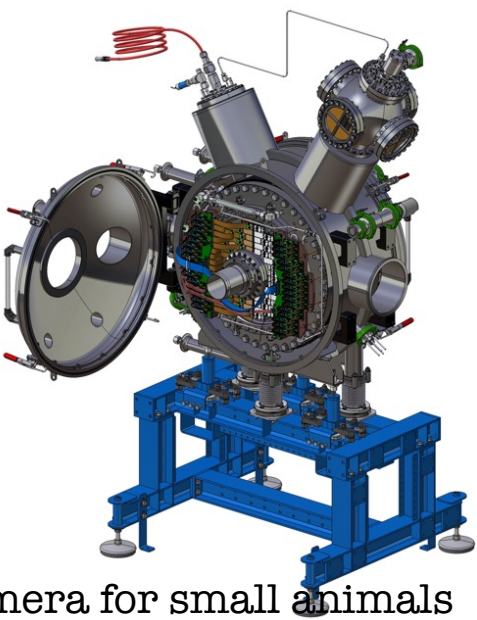
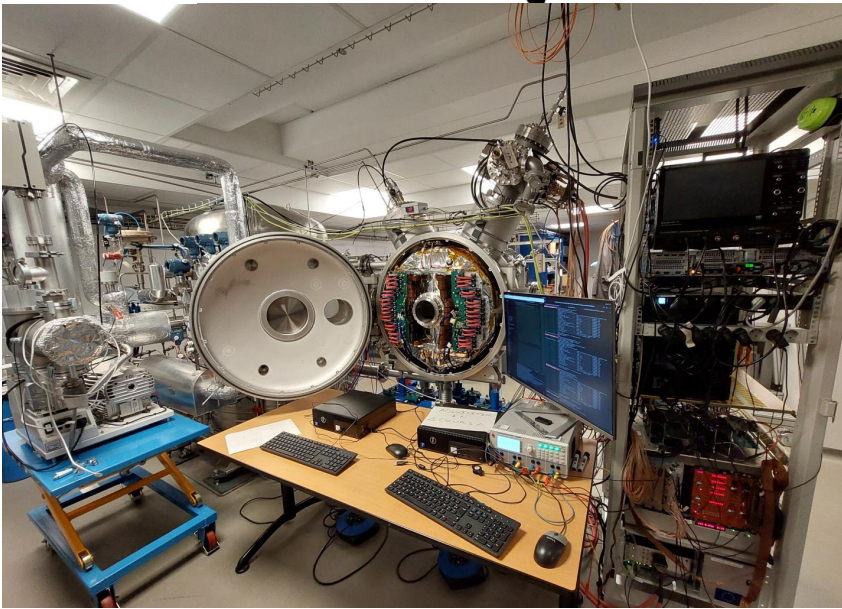
Nuclear for Health : The Xemis2 camera



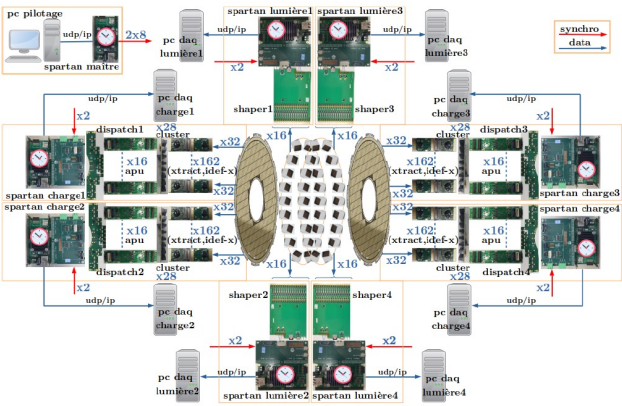
$^{44}\text{Sc} \rightarrow 3 \text{ photons} \rightarrow$ Better spatial resolution evt by evt



Hot Xe flowing right now



Camera for small animals



A Particle Physics Detector

2024

Subatech Laboratory



Associated technologies

Mastering technologies

Mechanics, electronic and computing for research

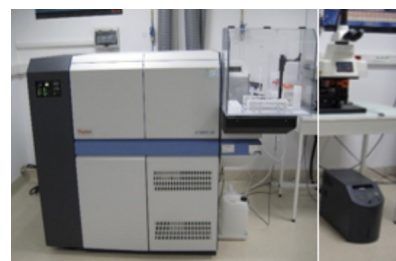
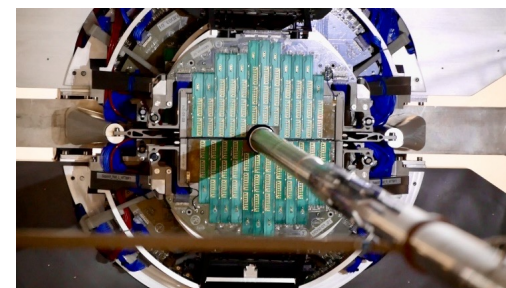
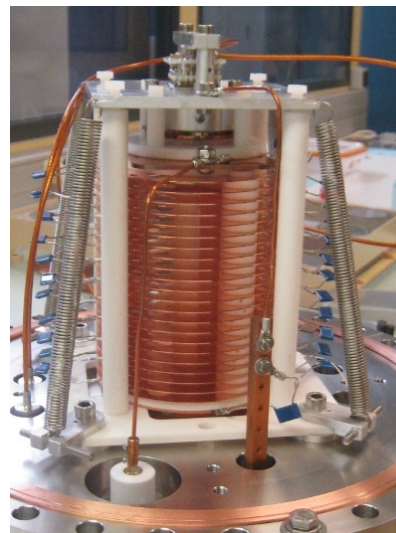
New technologies of *ionising* detection

Techniques in radiochemistry

Ion beam analysis

Measurement of radioactivity in environment

Technical services, research teams and
SMART





Human Ressources

On May 1st 2025:

188 personnels

63 C & EC (22 CNRS, 18 NU, 21 IMT Atlantique, 2 AR ICO) among them 5 émérites + 1 CDD Chaire Prof Junior

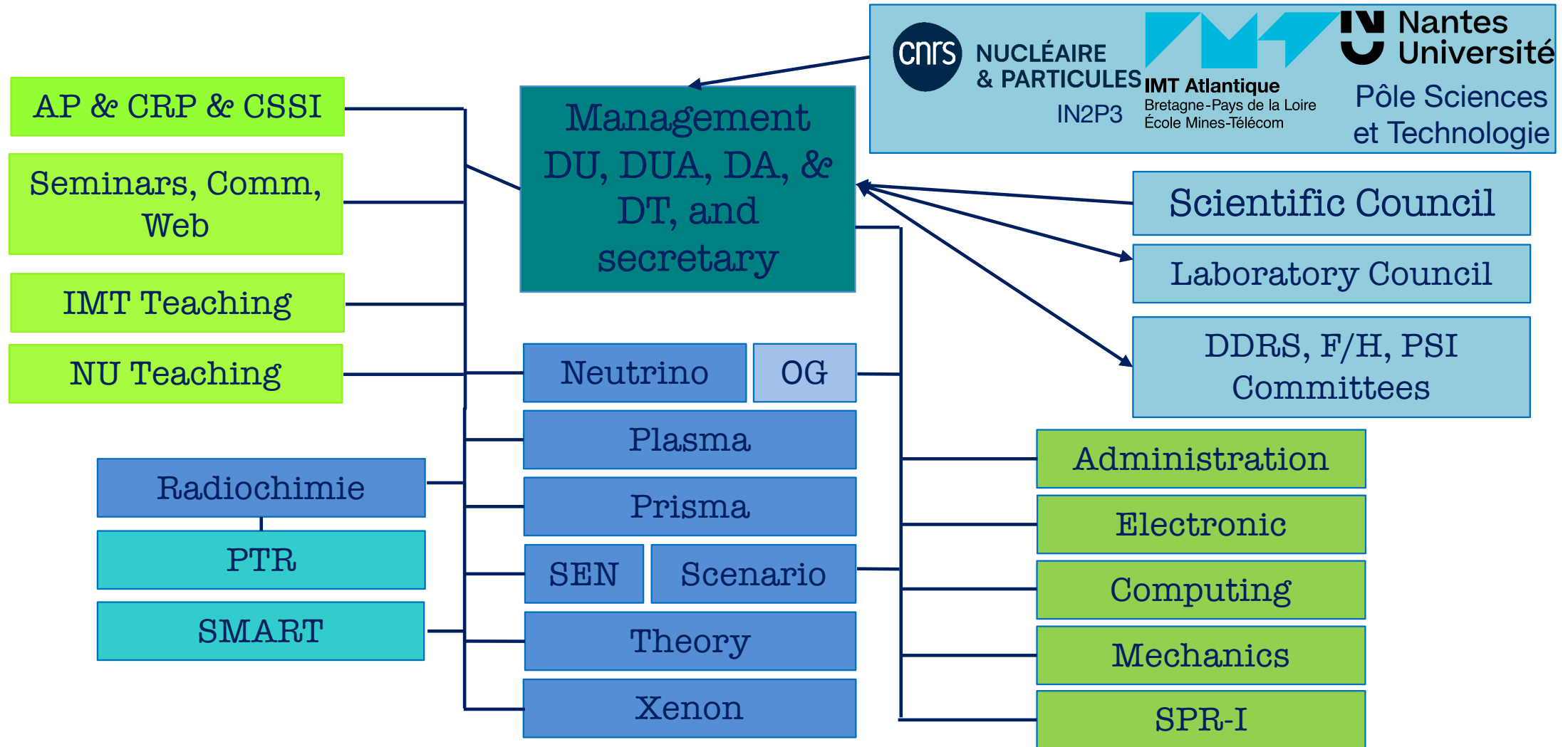
75 IT (52 CNRS dont 2 apprentis, 8 IMT Atlantique, 5 NU, 10 IMT Transfert)

7 post-docs (4 CNRS, 3 NU)

43 PhD (14 CNRS, 15 IMT Atlantique, 4 NU, 10 others)

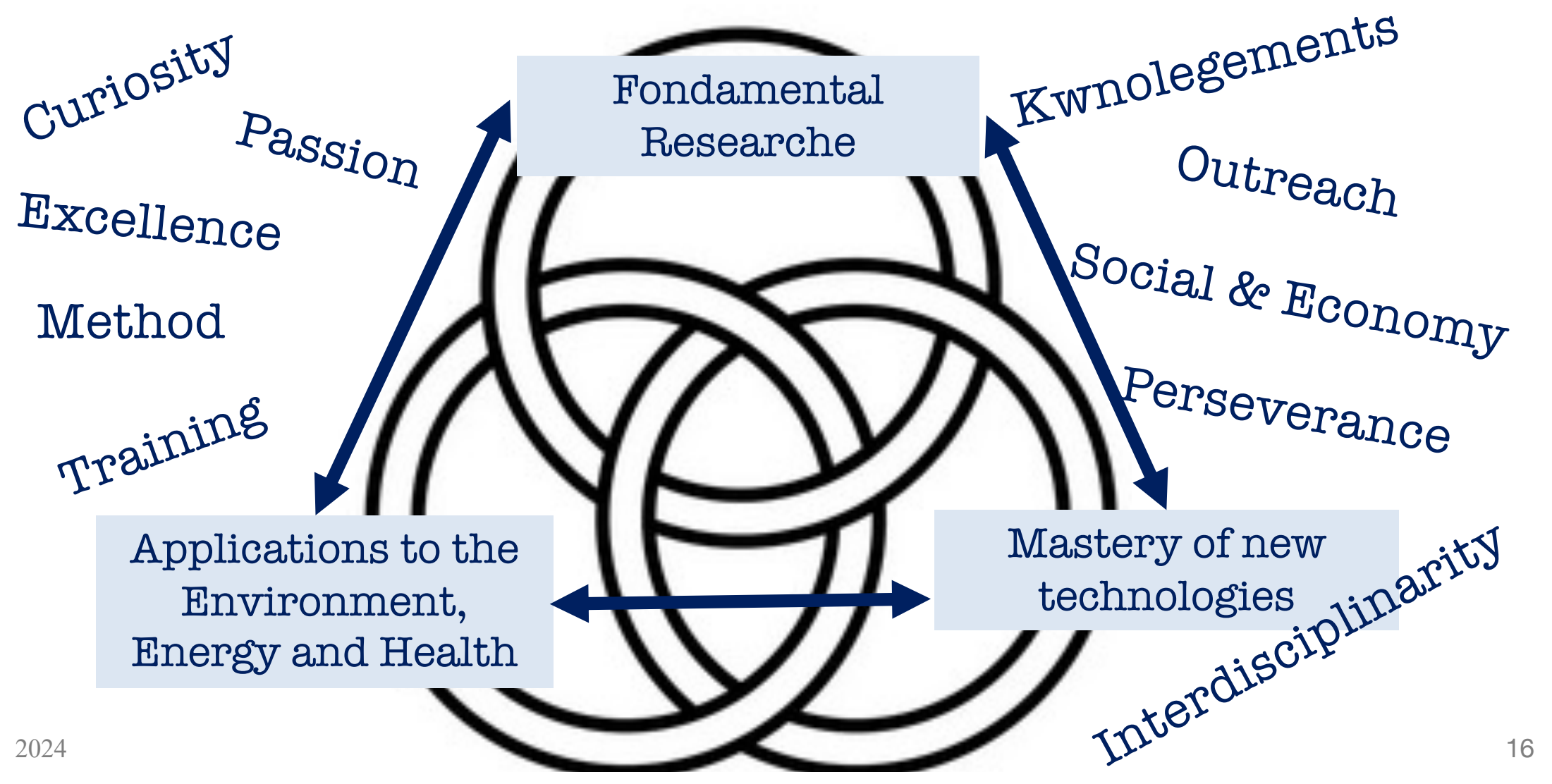


Organisation





Subatech compromise



Local, regional, national & international ecosystem

The two infinities



Energy and environment



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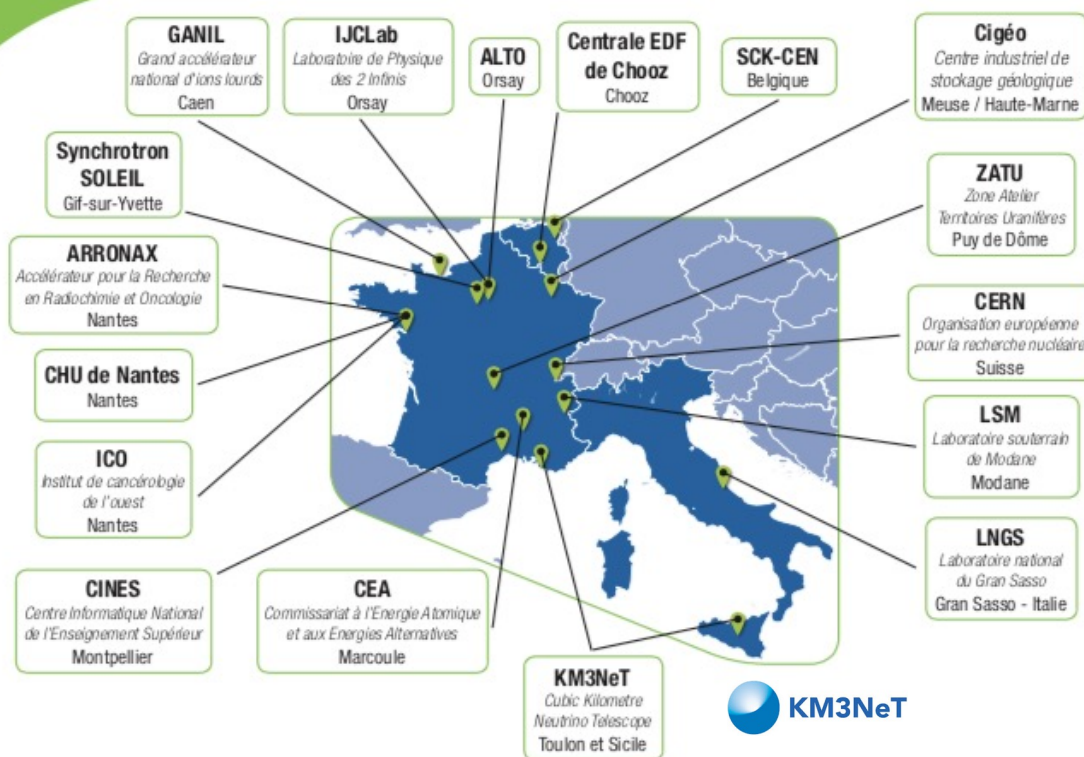
Health



Associated technologies

National & International Collaborations

NOS SITES EXPÉRIMENTAUX PARTENAIRES

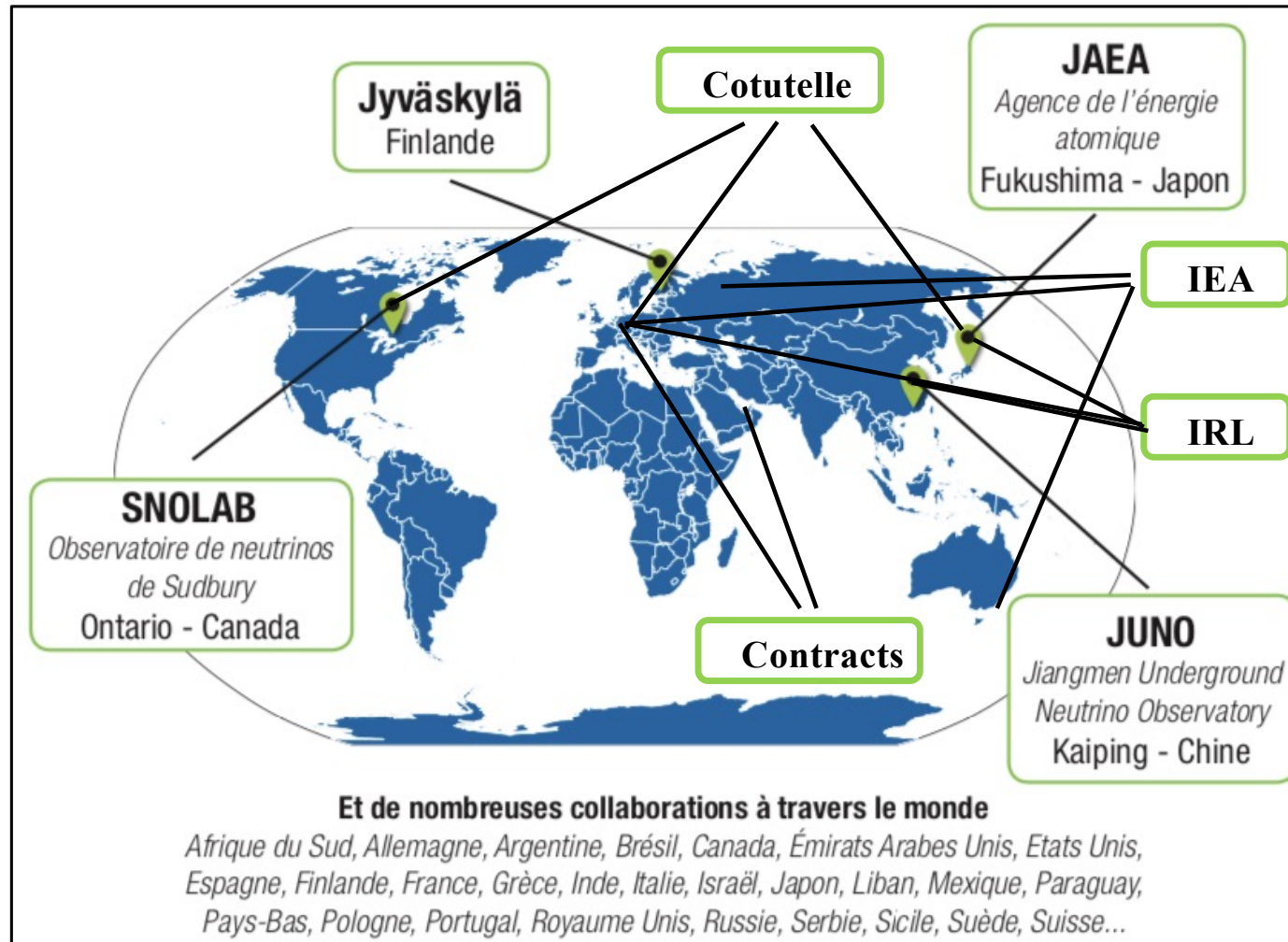


EURAD, STRONG2020, PREDIS, SANDA, APRENDE
SAMOSAfer, ANDURANCE, RADIONORM, HEAVYQGP,
SARENA, ENEN+, A-CYNCH

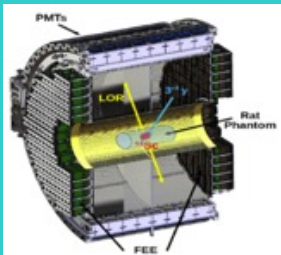
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International Collaborations



Infrastructures and platforms



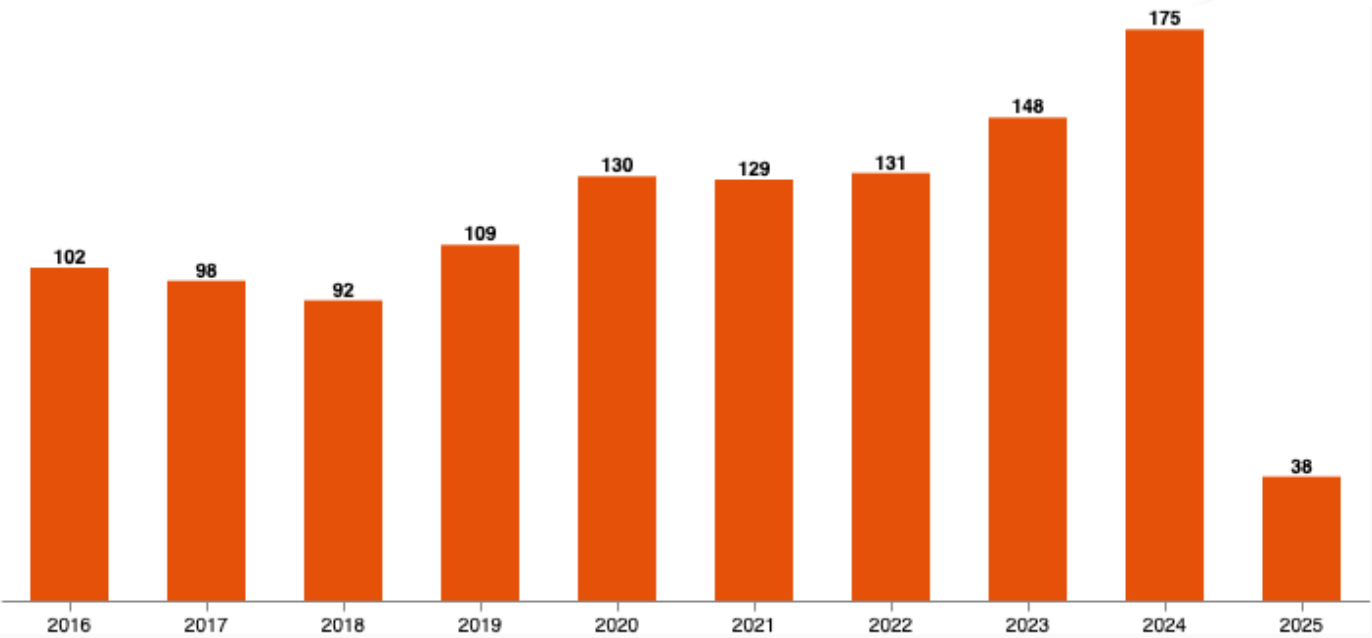
- **SMART** : Platform for the measurement of radioactivity in the environment created in 1994, 14 staff (1 CNRS, 11 IMT Transfert, 2 IMT Atlantique). Valorisation / Visibility / Neutrality. About 42 (over 49) ASN (Autorité de Sécurité Nucléaire) authorizations for the measurement of radionuclides in 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 & 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 acquired in 2022.



Production Scientifique Subatech

LODEX IN2P3 : <https://publications-2409.in2p3.lodex.fr> Mathieu Grivès IN2P3 (mathieu.grives@cnrs.fr)

Année

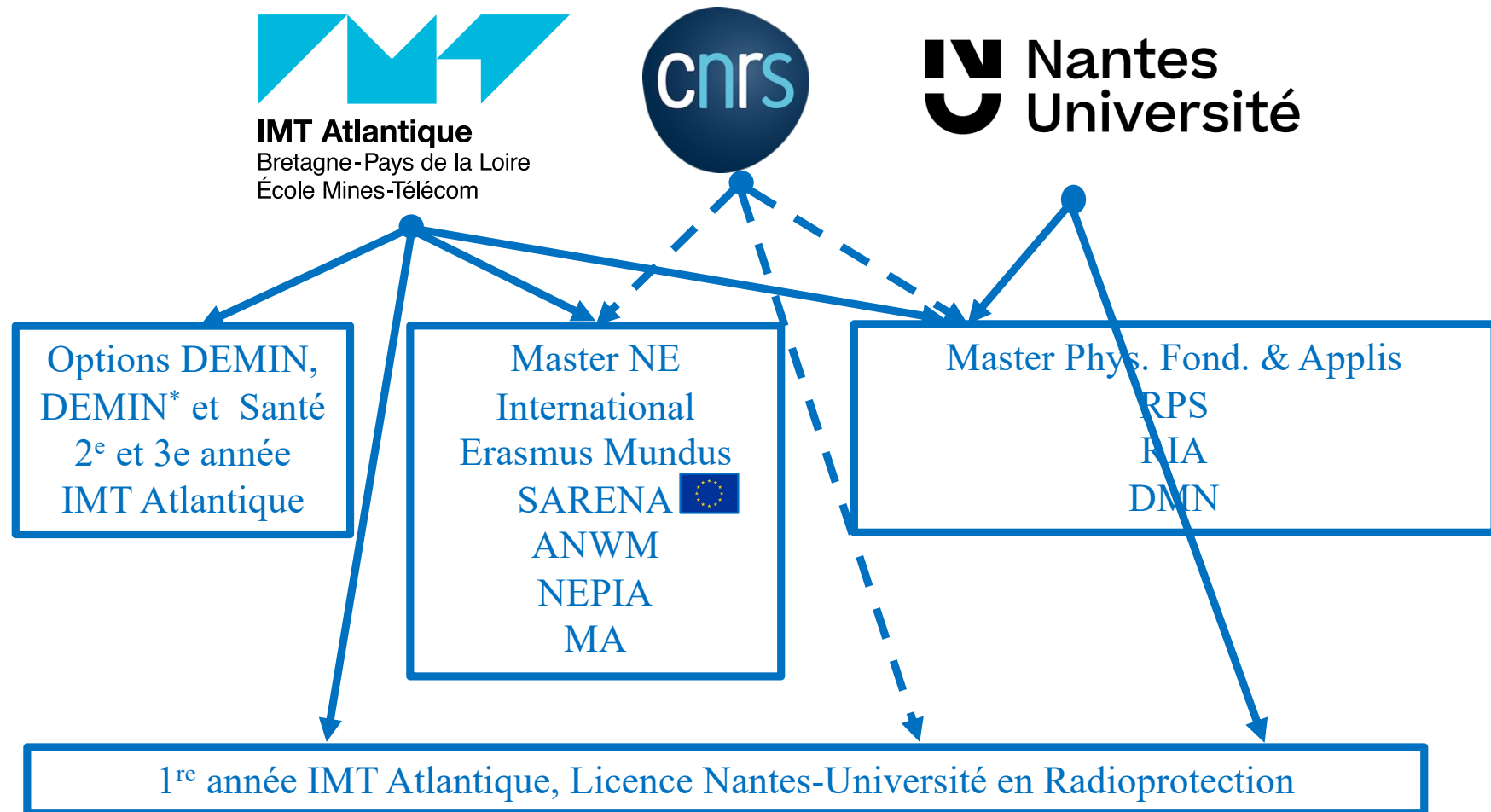


Published articles with
Subatech affiliation

2024/2025 data not
consolidated yet
In particular for the
oral presentation in
conferences.

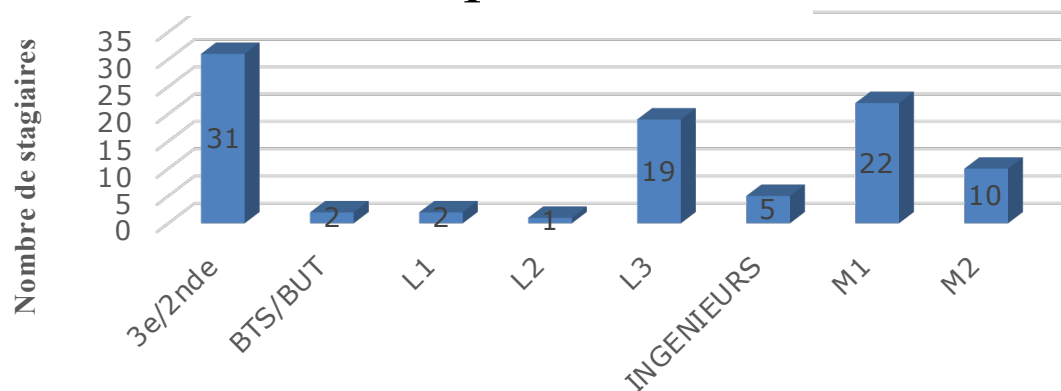
On April 2025

Teaching in NU and IMT Atlantique



Internships and outreach

92 internships in 2023 ! ²⁰²³



150 year of SFP : Accelerator Physics Expo



2023/2024 "Année de la Physique" in France
Special Day for high School professor
organized at Subatech

Congres, Workshops ... summary 2023



QCD MASTER CLASS
SAINT-JACUT-DE-LA-MER, FRANCE



Of course, visiting
researchers to
Subatech are
welcome!

Migration 2023



Atelier "Technologies de réacteurs et cycles associés: transitions vers le futur" GDR SciNÉE



30 years anniversary of Subatech : 13/06/2024



Activity Report 2015 - 2020



Le mot du directeur de Subatech

A word from the director of Subatech

Ayant pris la direction de Subatech au 1^{er} 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 succeeded Bernd GRAMBOW as head of Subatech. As the Director, 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 authorities, the Pays de la Loire Region, the French government 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*

<http://www-subatech.in2p3.fr/images/General/rapport-activites-subatech-2015-2020.pdf>



Sonder les infinis : des particules au cosmos



Merci for your attention, welcome to Nantes
and have a good time in Nantes!