Status report on the Work related to the International Expert Committee on the Future of GANIL

Michel Spiro with the precious help of
Fanny Farget and Nicolas Alamanos

December 18th 2020

International Expert Committee on The Future of GANIL

- Maria Jose Garcia Borge (CSIC)
- Paolo Giubellino (GSI)
- Ulli Koester (ILL)
- Hiroyoshi Sakurai (Riken)
- Boris Sharkov (JINR)
- Brad Sherill (MSU)
- Michel Spiro (Chair)
- Johanna Stachel (University of Heidelberg)

Terms of Reference (1)

Comme vous le savez, le paysage européen, pour ce qui concerne la physique nucléaire et les applications associées est en forte évolution avec en particulier la mise en service prochaine de la phase 1 de SPIRAL 2 au GANIL, l'évolution de la construction de FAIR en Allemagne, les développements de ISOLDE au CERN et les importants investissements engagés à JINR en Russie. Sur le plan international également, d'importantes infrastructures de ces domaines de recherche sont en construction ou en projet en Corée du sud et en Chine ainsi qu'aux États-Unis.

Dans ce contexte en forte évolution et compte-tenu de la position et du rôle de notre pays dans le développement des sciences et techniques nucléaires, il nous apparait essentiel d'actualiser notre vision de la place et du rôle futur de notre installation nationale le GANIL. Nous souhaitons démarrer cet exercice en ayant en main une analyse experte et indépendante du positionnement scientifique et technologique du GANIL débouchant sur des voies possibles d'évolution du laboratoire dans son contexte local et régional.

Nous avons souhaité vous confier cette mission et proposons pour cela que vous vous entouriez d'un petit comité composé d'experts de renommée mondiale. Sans que ce soit limitatif, les personnes dont le nom suit

Terms of Reference (2)

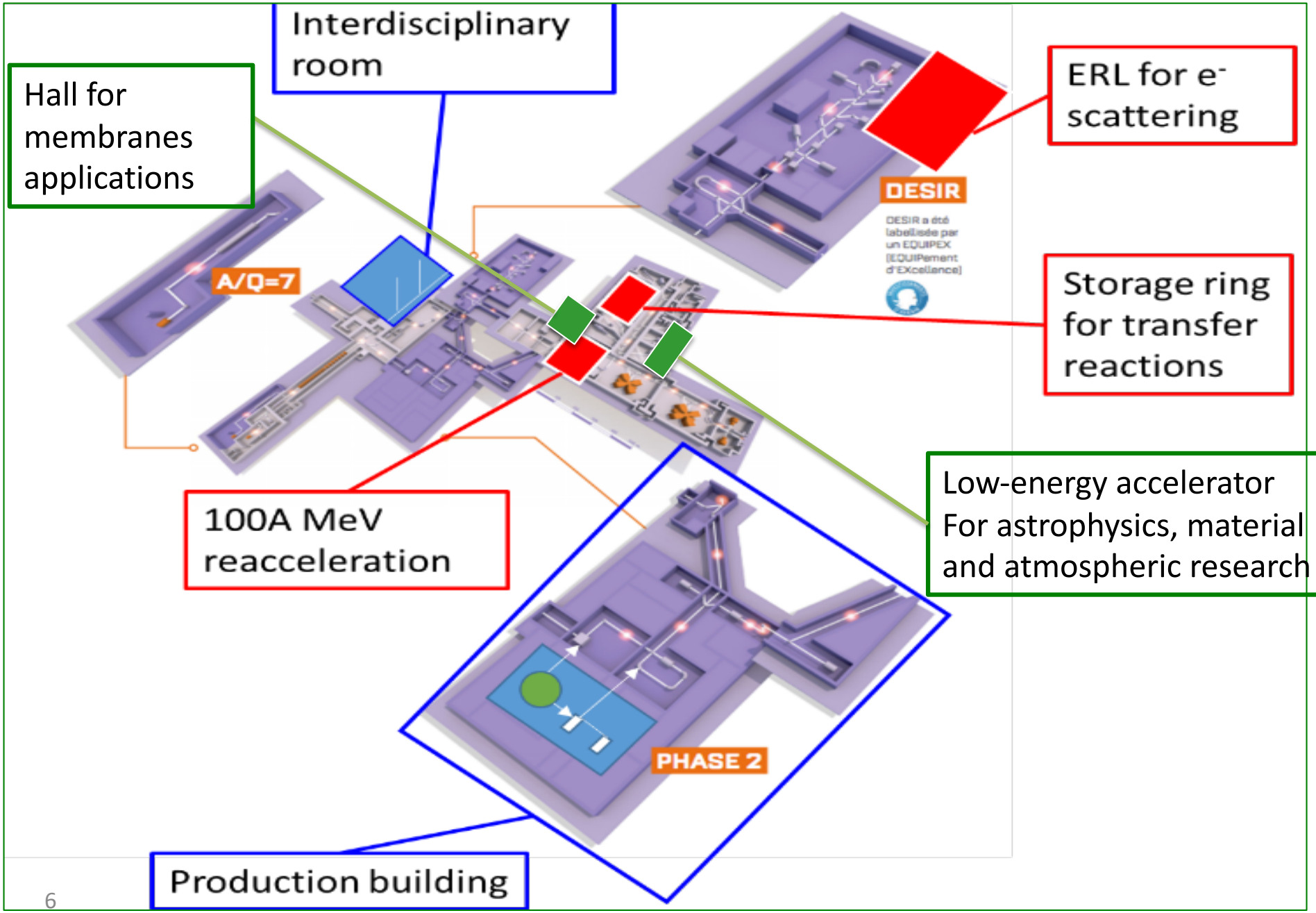
Nous souhaitons que les points suivants soient abordés :

- Le GANIL dans son environnement local et régional : positionnement disciplinaire (physique fondamentale et applications), lien thématiques et structurels avec les laboratoires voisins, liens avec le milieu industriel régional et national,
- Quel rôle futur pour le GANIL dans la recherche en physique nucléaire fondamentale, dans le contexte européen et à l'international ? Quels partenariats privilégier ?
- Quel rôle futur pour le GANIL dans les applications associées, en France et dans le contexte européen en particulier ?
- Quelles évolutions possibles du positionnement disciplinaire ?

Agenda June 9th, 2020 meeting

- Welcome and draft agenda (5 minutes)
- Presentation of GANIL and views from the direction (1hour + 15’)
- Break 10 minutes
- Status report on the Preparatory work for the Committee MS (1hour + 20’)
- Break 10 minutes
- Closed session (1 hour)

FUTUR -- GANIL – RESUME PROPOSITIONS COMMUNAUTÉ



Priorités données par IEC sur programme de travail

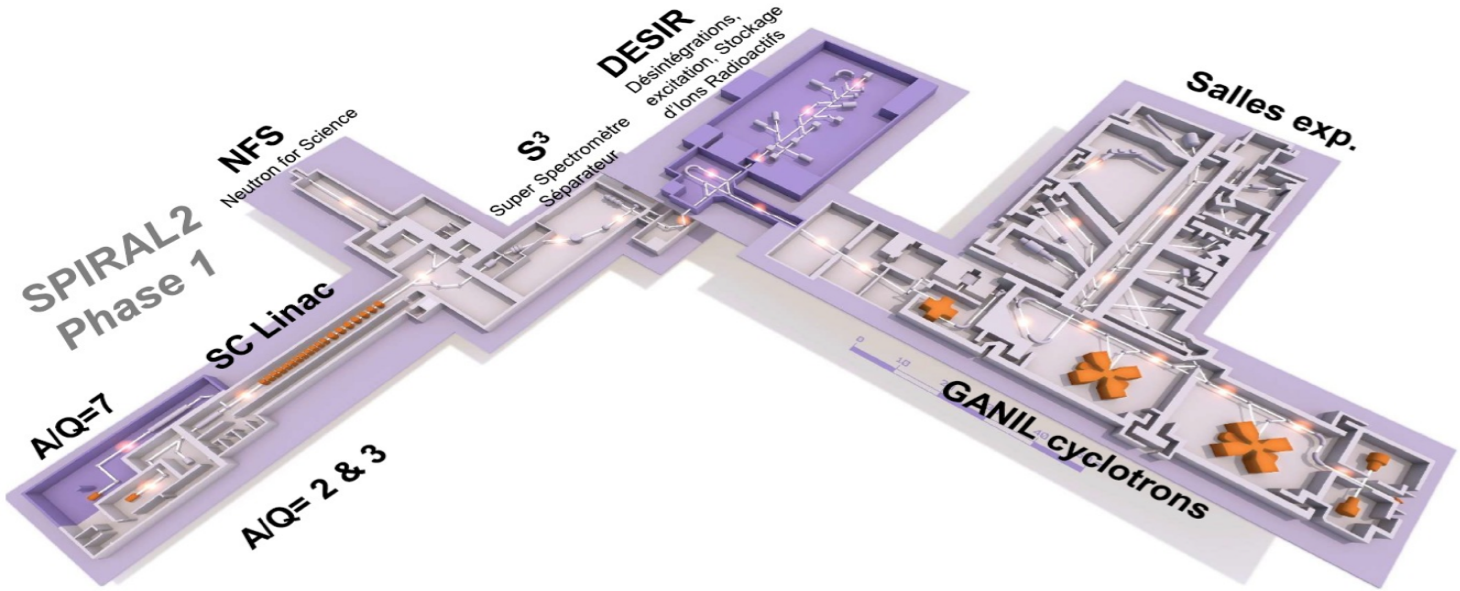
- Terminer le programme actuel déjà approuvé
- Optimiser l'exploitation
- Plus de travail nécessaire sur Production Building et Interdisciplinary Hall
- Soutien de principe à un programme ERL plus pièges qui demande à être étudié
- Cadrage financier et humain des tutelles?

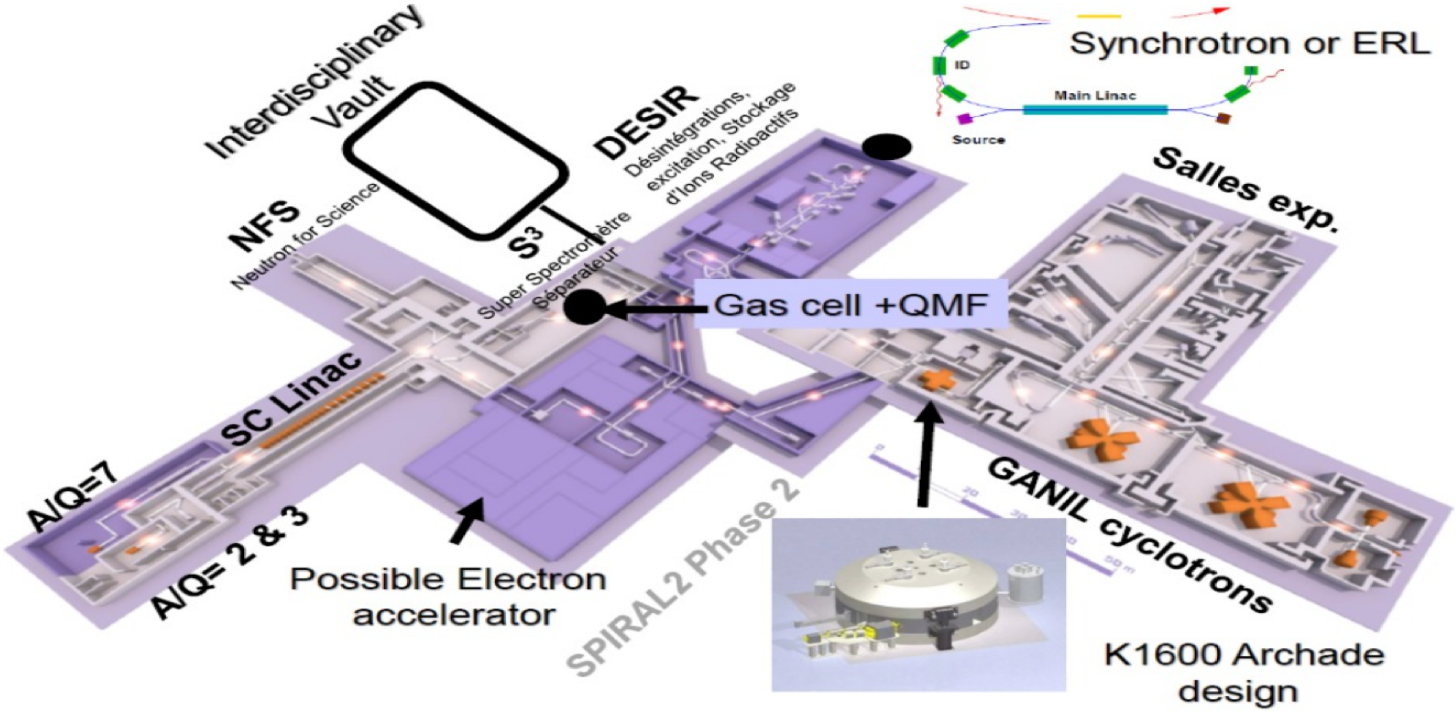
Groupes de travail avec rapport d'étape disponible au 20201203

- Sonde électron sur ions exotiques (Valérie Lapoux et al.): The construction of the electron accelerator, either an ERL or a Synchrotron, could be envisaged to start around 2030. By then the production modes of radioactive nuclei as well as the technology of ion traps will have maturate in the DESIR hall. Electron detection for elastic and inelastic electron-exotic nucleus scattering need to be developed.
- Hall Interdisciplinaire (Gilles De France et al.): This new hall could accommodate, for example, an installation for radiography/tomography or radiobiology measurements and possibly R&D activities concerning the innovative production of radioisotopes. These studies are currently in progress and proposals that are more concrete are expected by the end of the year.

Agenda IEC December 3th, 2020 meeting

- Welcome and draft agenda (5 minutes)
- Recent News from GANIL by the direction (30’ + 15’)
- Break 10 minutes: we thank the GANIL direction
- Views (working document, 12 pages) from the strategy group (Nicolas, Fanny and me), in relation with the work of the working groups and the recommendations of the International Expert Committee MS (1hour + 20’)


SPIRAL2
Phase 1
NFS
Neutron for Science
S3
Super Spectromètre
Séparateur
DESIR
Désintégrations,
excitation, Stockage
d'Ions Radioactifs
Salles exp.
SC Linac
A/Q=7
A/Q= 2 & 3
GANIL cyclotrons


Interdisciplinary
Vault
Synchrotron or ERL
ID
Main Linac
Source
DESIR
Désintégrations,
excitation, Stockage
d'Ions Radioactifs
NFS
Neutron for Science
S3
Super Spectromètre
Séparateur
Salles exp.
Gas cell +QMF
SC Linac
A/Q=7
A/Q= 2 & 3
Possible Electron
accelerator
SPIRAL2 Phase 2
GANIL cyclotrons
K1600 Archade
design

- **Phase 1 Until -2027**
- Finalization of the construction of ongoing projects, that is: NFS, S3, DESIR … A/Q=7. In addition, a decision concerning simultaneous operation of the cyclotrons and the LINAG, and a decision concerning the future of the existing cyclotrons and whether they can meet the beam requirements of the interdisciplinary physics community.
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- **Phase 2 Until -2025-2035**
- (2025-2035) Construction of the building for the production of exotic nuclei, of the multi-nucleon transfer facility, of the interdisciplinary hall and of the associated targets. Replacement of CIME by a new superconducting cyclotron. During this phase, we may consider as an option the construction of a new electron accelerator, of "rhodotron" type, to increase beam availability in the interdisciplinary vault and later on for exotic nuclei electron scattering.
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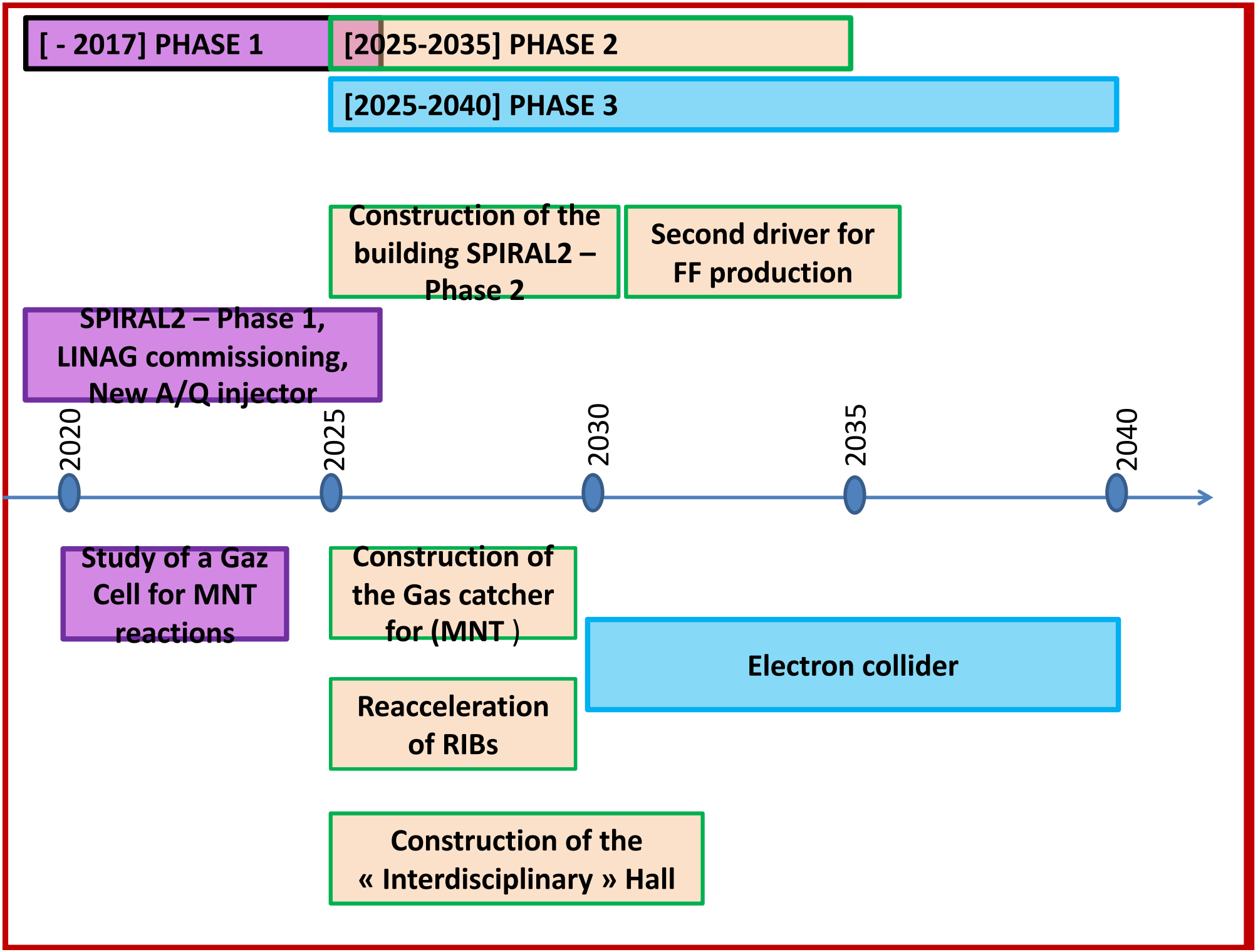
- **Phase 3 2025-2040**
- Construction of the electron accelerator. Feasibility studies and prototyping may start as soon as possibly elsewhere than at GANIL.


[- 2017] PHASE 1
[2025-2035] PHASE 2
[2025-2040] PHASE 3
Construction of the building SPIRAL2 – Phase 2
Second driver for FF production
SPIRAL2 – Phase 1, LINAG commissioning, New A/Q injector
2020
2025
2030
2035
2040
Study of a Gaz Cell for MNT reactions
Construction of the Gas catcher for (MNT)
Electron collider
Reacceleration of RIBs
Construction of the « Interdisciplinary » Hall

1. Conclusions of our strategy group

- GANIL is today a world-class fundamental research laboratory in nuclear physics, atomic physics, the physics of matter and radiobiology, as well as in their many fields of application. It provides researchers worldwide with its unique expertise and is classified as a landmark on the ESFRI list of European Very Large Research Infrastructures (TGIR). Indeed, such is the quality of many of the radioactive beams available at GANIL that, with the right detection equipment and beam tracking devices, it is possible to obtain direct nuclear reaction and scattering data using these beams that can rival in precision the best stable beam data, something that is difficult or impossible to achieve elsewhere.

- In this text, we wished to bring to the committee's attention the emergence of some projects at GANIL, strongly supported by the scientific community, that make up a possible path for the future of the installation.

- Electron scattering experiments with traps would enter the flagship textbook experiments in Nuclear Physics while reacceleration of a wide variety of beams would bring a large community at GANIL at the unknown frontier of Nuclear Physics and would so provide a high quality capacity building community in GANIL.

- This path is ambitious, demanding important financial and human resources, and can only be realized within the framework of a strong international collaboration.

- The new projects presented in this document, which are unique at the international level, are necessary to our mind to keep GANIL at the best global level for the decades to come. ***IEC endorses***

Outcome

- Many comments and recommendations (set up two new working groups on reacceleration and cyclotrons for interdisciplinary use)
- Incorporate a section with an idea of the needed Resources (investment, operation and maintenance, human resources)
- Next time, we hope to get “an independent” about 4 pages document from the International Expert Committee, inspired by the work of the “strategy group (Nicolas, Fanny and me), relying on the work of the 4 working groups, relying on the inputs from the community

Nouveaux Groupes de travail

- Réaccélération des ions exotiques (Sydney Galès et al.)
- Les cyclotrons historiques injecteurs du GANIL pour un usage interdisciplinaire (Nathalie Moncoffre et al.)

- Groupe de travail Hall Interdisciplinaire

G. deFrance, GANIL,
Alain Pautrat, CRISMAT
Antoine Drouart, IRFU
Maud Baylac, LPSC-IN2P3
Charles Simon, Institut Neel
Romuald Duperrier, IRFU
Frédéric Ott, LLB
Ferid Haddad, ARRONAX
Xavier Hulin, GANIL
Emmanuelle Lacaze, INP
Jean-Michel Lagniel, GANIL
Xavier Ledoux, GANIL
Loic Thulliez, LPSC-IN2P3
Marie Plazanet,
Isabelle Monnet, CIMAP
Nicolas Arbor, IPHC
Jimmy Rangama, CIMAP
Serge Bouffard, CIMAP
Sylvie Leray, IRFU
Virginie Simonet, Fédération Française de Diffusion Neutronique
Daniel Santos, LPSC-IN2P3
Marco Di Giacomo, GANIL
Robin Ferdinand, GANIL

- Groupe de travail Sonde Electromagnétique

Radioactive ion beam RIB production
-multi-nucleon transfer, fusion-evaporation :

I. Stefan, IJCLab, C. Theisen, IRFU
-fission; photofission: M. Fadil, IJCLab, P. Delahaye, GANIL
Radioprotection issues, production building:

H. Franberg, GANIL, X. Hulin, GANIL
Radioactive ion beam production and interdisciplinary activities (working group):

A. Drouart, IRFU G. de France, GANIL

Physics cases and ERL: A. Obertelli, Univ. Mainz, D. Verney, IJCLab, V. Lapoux, IRFU, A. Matta, LPCC, F. Flavigny, LPCC, V. Soma, IRFU
Discussions about ERL design and beam optics: W. Kaabi, IJCLab, A. Chancé, IRFU

- Groupe de travail Réaccélération de faisceaux exotiques

Sydney Galès, IJCLab

Antoine Lemasson, GANIL

Nicolas Leneindre, LPCC

Pascal Jardin, GANIL

Pierre Delahaye, GANIL

Iulian Stefan, IJCLab

M. Vandebrouck, IRFU

- Groupe de travail Physique interdisciplinaire avec les cyclotrons du GANIL

Nathalie Moncoffre , IP2IL, EMIR&A

Amine Cassimi, CIMAP