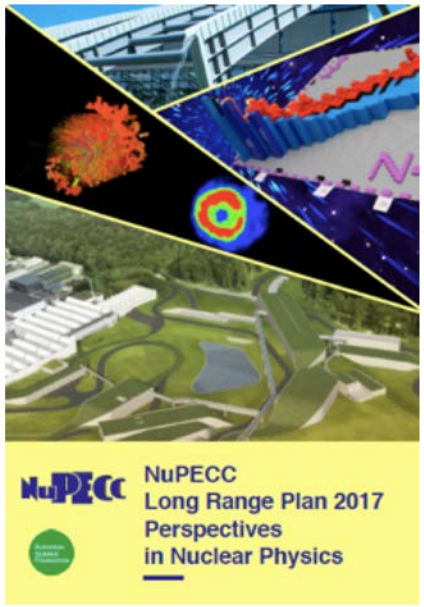


NuPECC Strategy for Nuclear Physics in Europe

Marek Lewitowicz
Chair of NuPECC

Disclaimer: ***Focus on Nuclear Physics Facilities***

IUPAP WG9, Washington

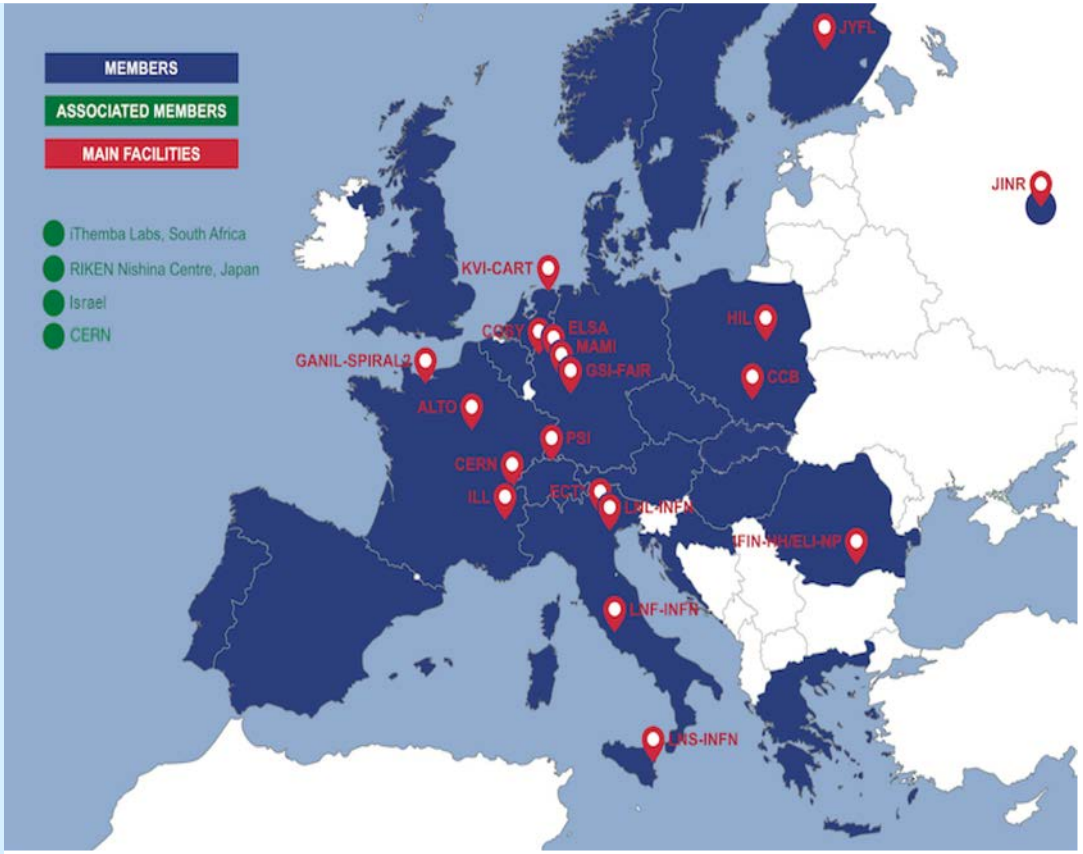
What is NuPECC ?

The European Expert Board for Nuclear Physics hosted by European Science Foundation

Representing
about 6000 scientists

Composition:

- 34 representatives from 22 countries (new members Slovakia, Slovenia), 3 ESFRI NP Infrastructures & ECT*
  JINR Dubna – suspended in March 2022
- 4 associated members
  - CERN
  - Israel
  - iThemba Labs
  - Nishina Center
- 9 observers (ESF, NPD/EPS, ECFA, NSAC, ANPhA, ALAFNA, CINP, IAEA, APPEC)

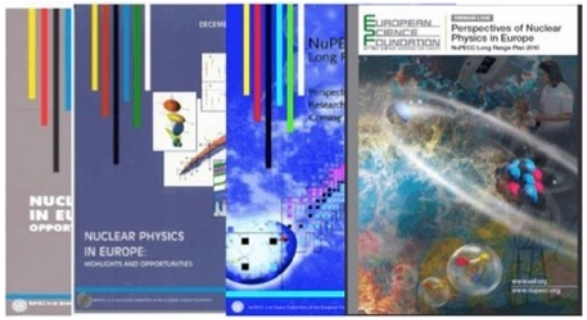


3 regular Committee meetings/y

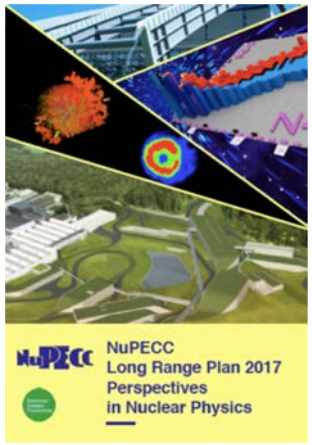
33 Years of NuPECC activities

Towards NuPECC Long Range Plan 2024

1991 1997 2004 2010



- **The LPR identifies opportunities and priorities for the nuclear science in Europe**
- **The LRP provides national funding agencies, ESFRI and European Commission with a framework for coordinated advances in nuclear science in Europe**



Assessment of Implementation of the NuPECC Long Range Plan 2017

February 2022

Liaisons: G. Aarts, D. Bettoni, S. Courtin, P. Giubellino, J. Gómez Camacho, A. Görgen, R.-D. Herzberg, D. Ireland, B. Krusche, M. Lewitowicz, A. Maj, U. Meissner, E. Nappi, G. Neyens, L. Popescu, B. Sharkov, E. Widmann,

Contributors: H. Abele, N. Alahari, W. Barth, D. Bemmerer, K. Blaum, F. Bossi A. Bracco, M. Chiossi, A. Denig, M. Doser, S. Freeman, M. Gazdzicki, F. Gélis, H. Goutte, M. Grecco, M. Harakeh, M. Hori, G. Imbriani, E. Khan, K. Kirch, W. Korten, A. Laird, J. P. Lansberg, D. Lunney, F. Maas, G. Martinez-Pinedo, S. Masciocchi, A. Mengoni, O. Navillat-Cuncic, D. Rifuggiato, P. Rossi, E. Scomparin, J. Simpson, H. Schmieden, O. Schneider, N. Severijns, Th. Stöhlker, J. Stroth, H. Ströher, U. Thoma, S. Ulmer, C. A. Ur, Ch. Weinheimer, U. Wiedner, H. Wittig

NuPECC LRP 2017

http://www.nupecc.org/lrp2016/Documents/lrp2017.pdf

February 2022

http://nupecc.org/2017_LRP_Assessment_of_Implementation_final.pdf

NuPECC LRP 2024

Launched in May
Call for inputs
dead-line Oct. 1st, 2022

Joint Expressions of Interest (EoI) – astroparticle, nuclear and particle physics

http://nupecc.org/jenaa/

1. Dark Matter - iDMEu – **Kick-off meeting in May 2021**
2. Gravitational Waves for fundamental physics
3. Machine-Learning Optimized Design of Experiments - MODE - **Kick-off workshop in September 2021**
4. Nuclear Physics at the LHC
5. Storage Rings for the Search of Charged-Particle Electric Dipole Moments (EDM) - **online workshop March 29-31, 2021**
6. Synergies between the Electron-Ion Collider and the Large Hadron Collider experiments – **kick off workshop June 20-21, 2022**

Presentations of EoI at the recent JENA Seminar in Madrid
Articles in Nuclear Physics News published on EoI 1, 2, 3, 4 and 5

JENA Seminar (JENAS) in Madrid May 3-6, 2022

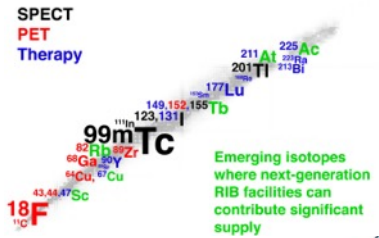
➢ *Sessions*

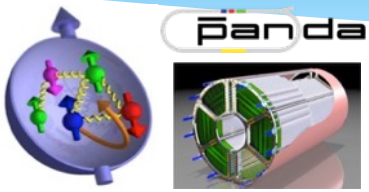
- *Welcome and physics highlights*
- *Overall strategies of APPEC, ECFA & NuPECC*
- *JENA EoI Reports*
- *Transfer of knowledge*
- *Training, Education & Outreach*
- *Computing and Software situation, challenges and avenues for the future*
- *Precise calculations, diversity, recognition*
- *Technology and Detector R&D*
- *Poster session*
- ***Sessions with Funding Agencies***

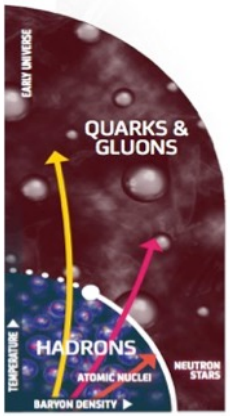
- ***164 registered participants***

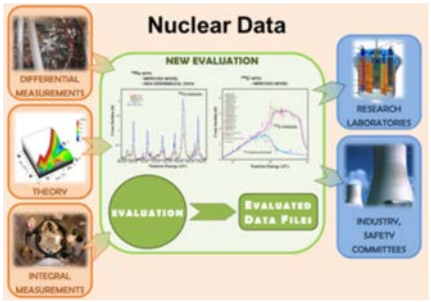
Nuclear Physics in Europe

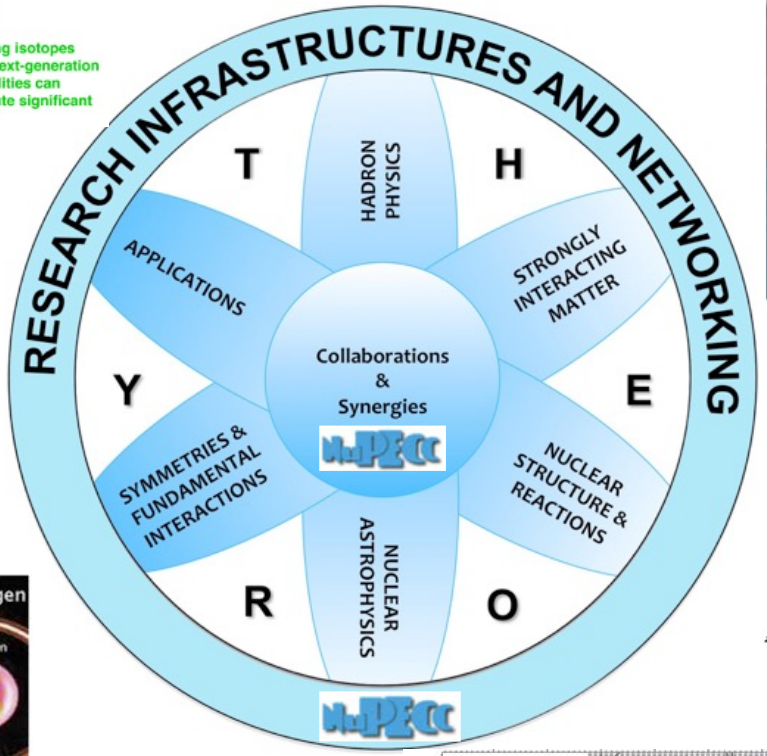
http://www.nupecc.org

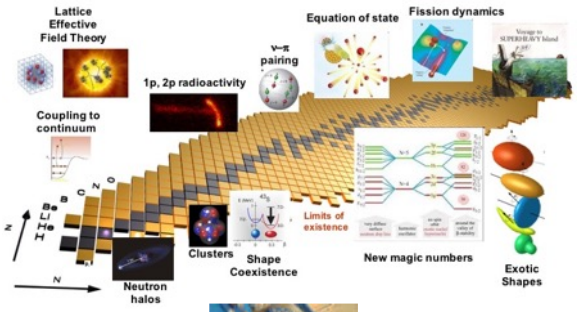


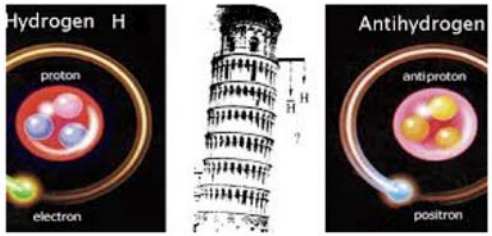


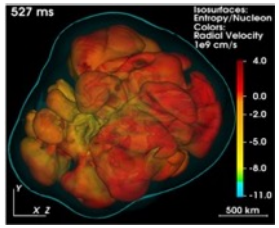


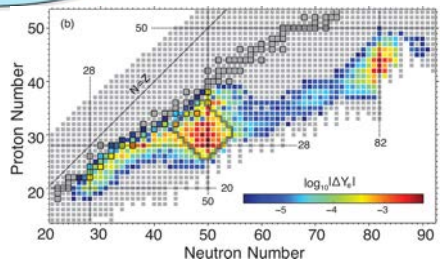


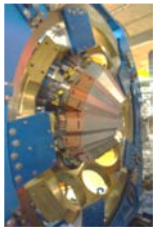






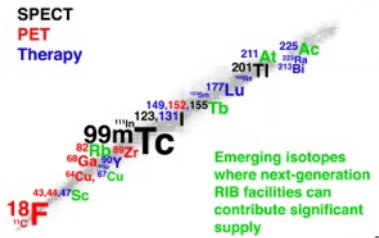


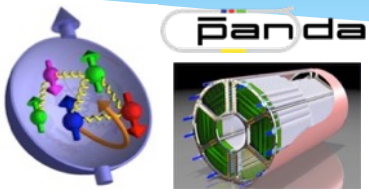


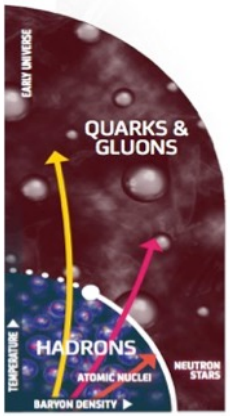


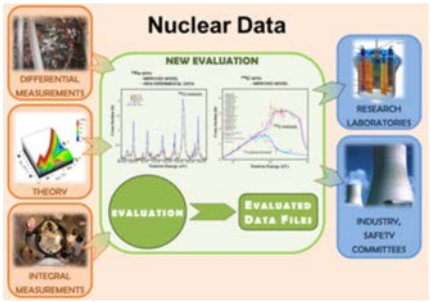
Nuclear Physics in Europe

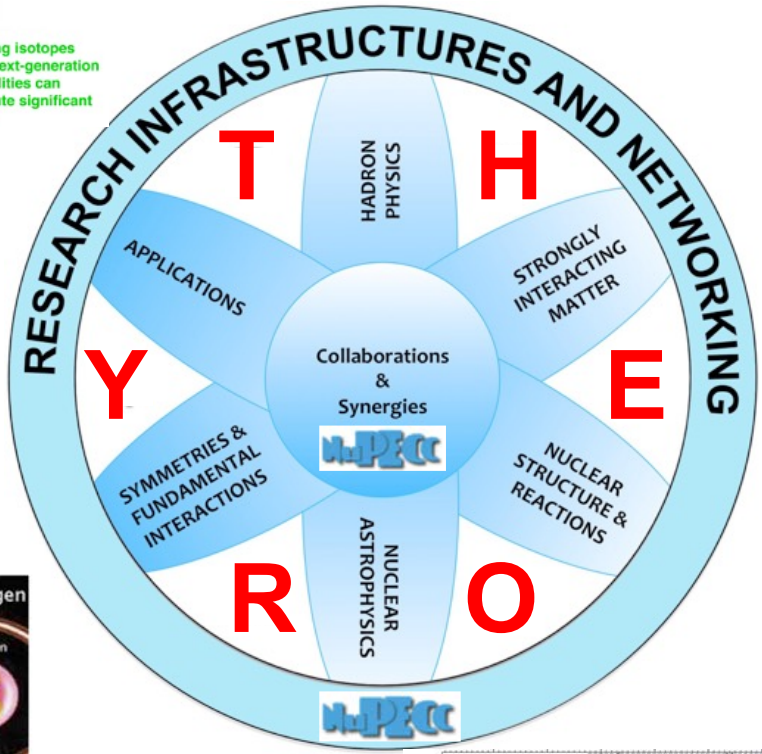
http://www.nupecc.org

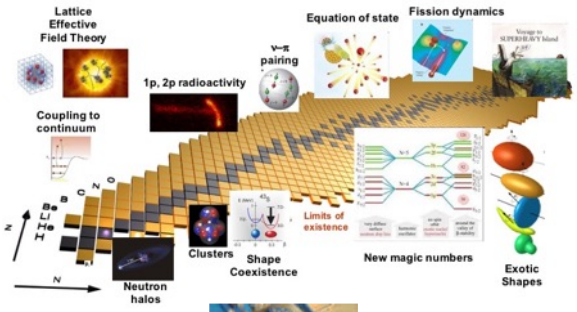


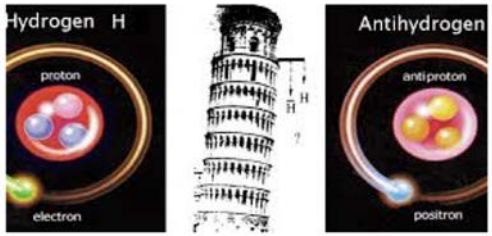


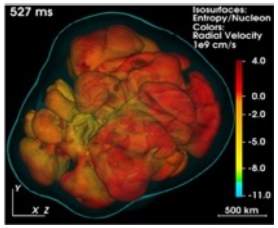


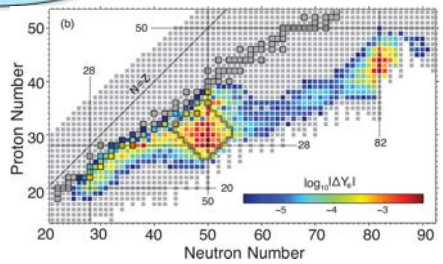


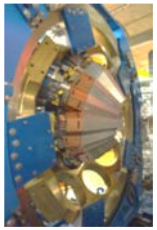




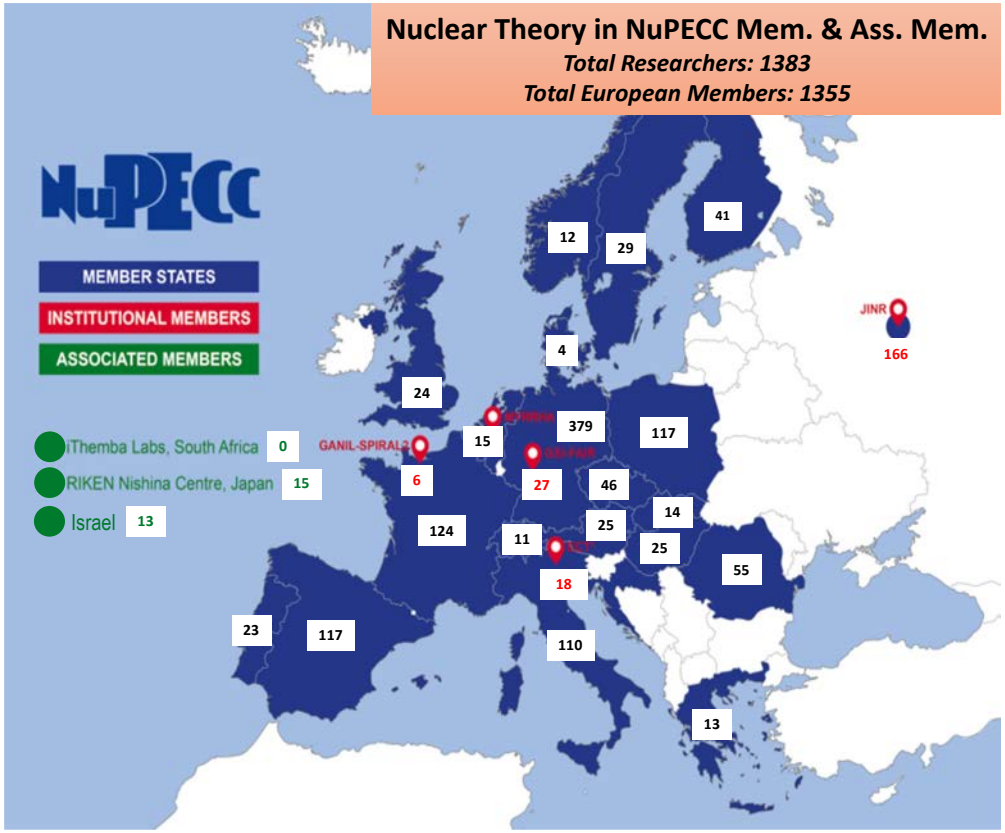




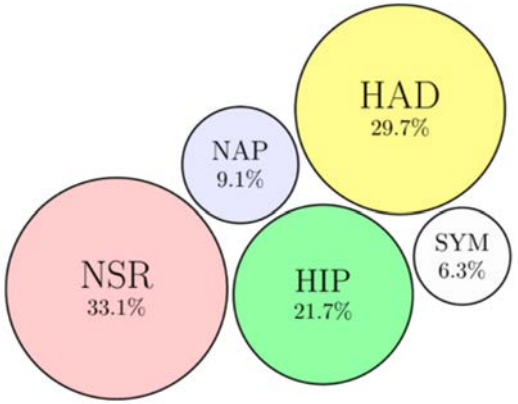




2021 NuPECC Survey of Nuclear Theory in Europe



- Nuclear structure and reactions (**NSR**)
- Nuclear astrophysics (**NAP**)
- Heavy-ion physics (**HIP**)
- Hadron physics (**HAD**)
- Nuclei as laboratories/symmetry tests (**SYM**)



- **In order for the field to prosper, healthy nuclear theory is absolutely essential: the numbers show that this is indeed the fact**
- **There is an approximate equal partition among the big fields (except SYM)**
- **A concentration on specific sites/labs seems to occur (e.g. Germany, Czech Republic, Romania)**
- **Much lower number of PhD students & post-docs per permanent staff researcher in some countries**

http://nupecc.org/snt/meissner_sep21.pdf

Ulf-G. Meißner et al.

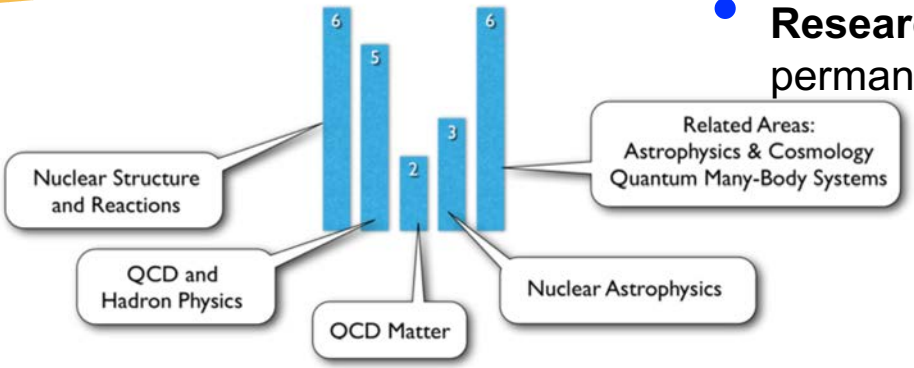
Support for Nuclear Theory – ECT*

Scientific activities at ECT*

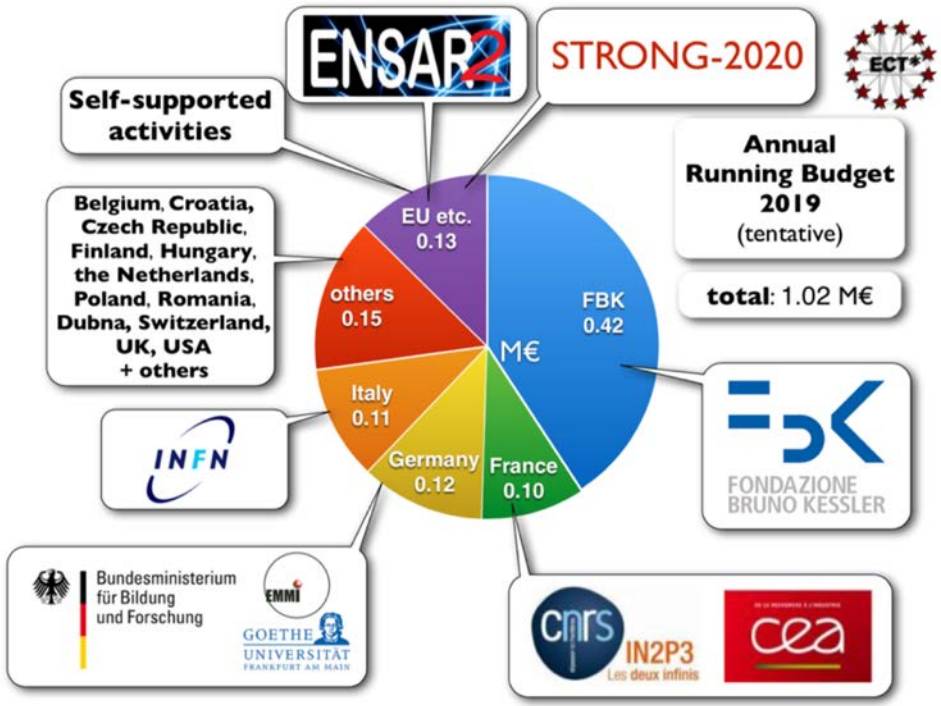
Trento, Italy

Running almost full program in 2022

- International **workshops** and **collaboration meetings** (typically around 20-25 events per year)
- **Doctoral training** programs and **Talent schools** (4 weeks of lectures for advanced PhD students)
- **Research activities** of the local team composed of permanent and temporary staff members



ECT* budget



Nuclear Physics in Europe

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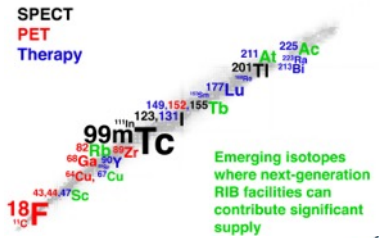
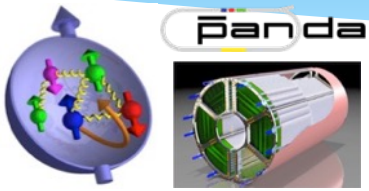
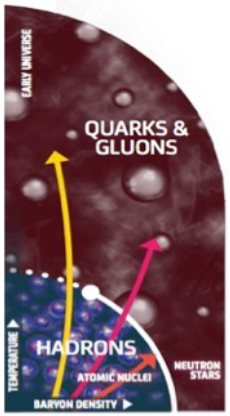
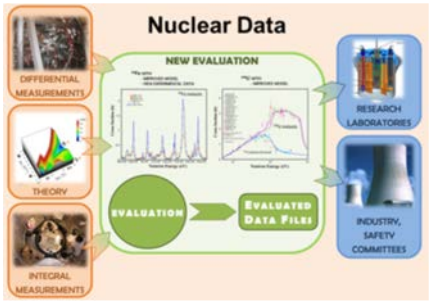
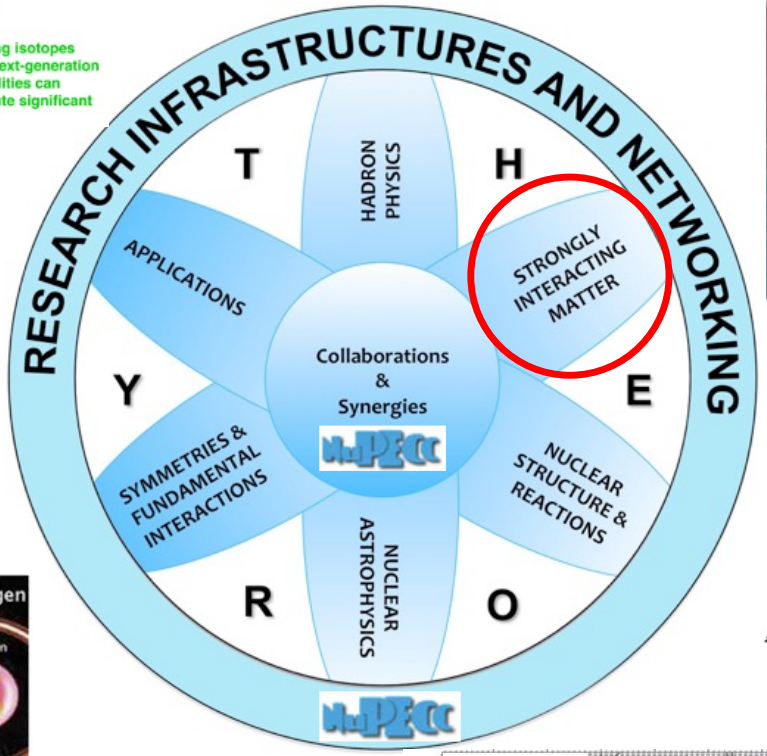
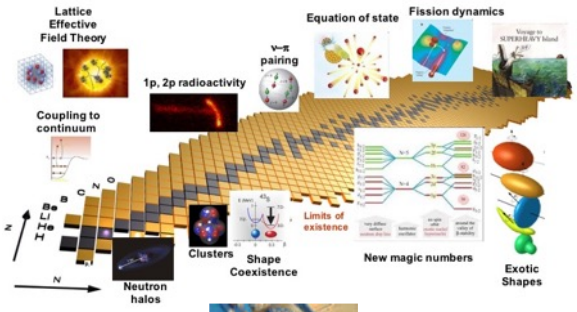


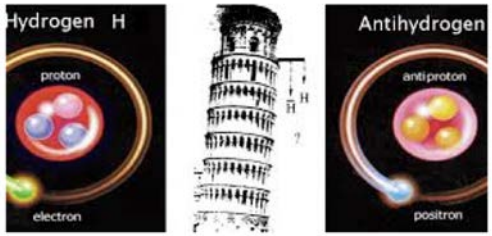


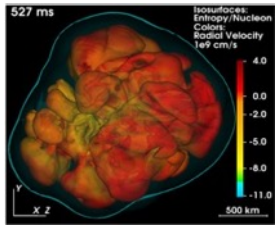


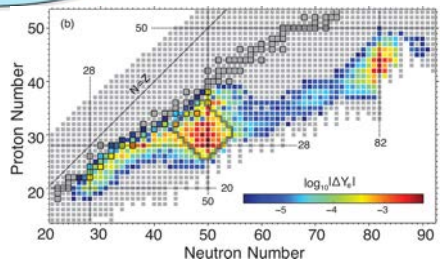


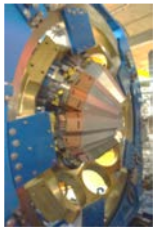




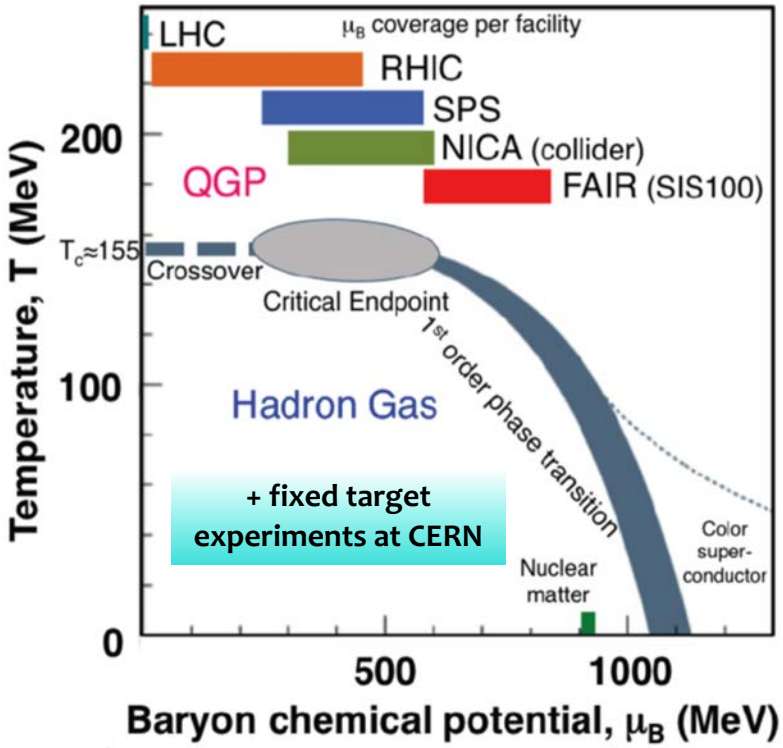


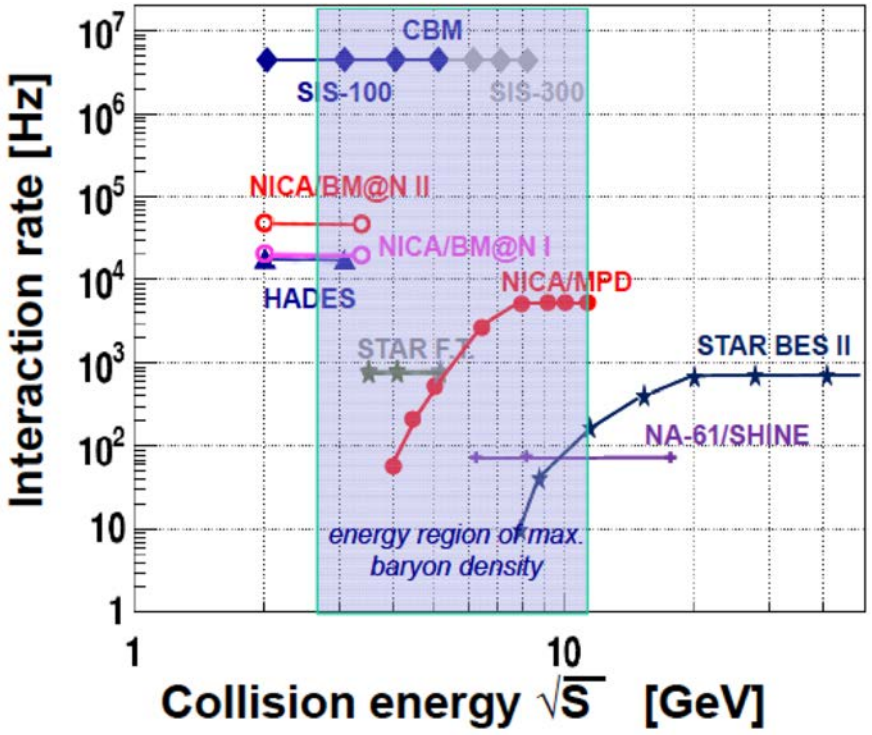






Hadronic Matter at the very extremes





NuPECC LRP recommendation:
Fully develop synergies between ALICE, NICA, FAIR and fixed target experiments at CERN

NuPECC has expressed its support for the hh and heavy-ion programs at FCC

ALICE ⇨ ALICE3

Fundamental questions will remain open after LHC Run 3 & 4
→ **next-generation heavy-ion programme for LHC Run 5 & 6**

- What is the nature of interactions between highly energetic quarks and gluons and the quark-gluon plasma?
- To what extent do quarks of different mass reach thermal equilibrium?
- How do quarks and gluons transition to hadrons as the quark-gluon plasma cools down?
- What are the mechanisms for the restoration of chiral symmetry in the quark-gluon plasma?

Curtesy of B. Erazmus

Letter of Intent for ALICE 3 endorsed by LHCC

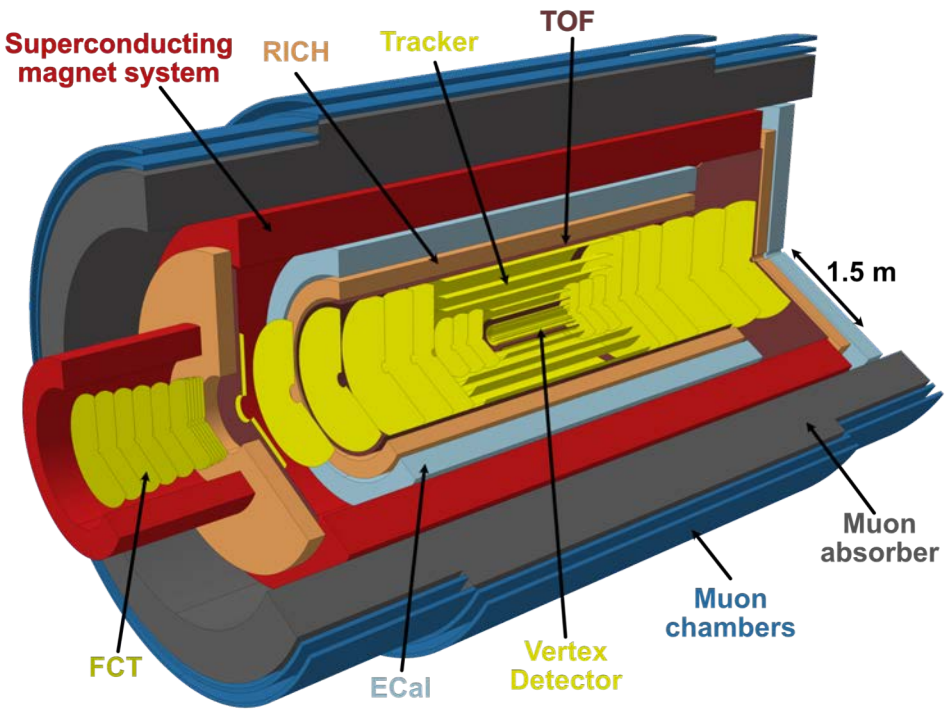
provides "a road map for exciting heavy-ion physics starting in 2035"

"ALICE 3 detector concept […] is well matched to the proposed, ambitious physics program"

Letter of Intent: CERN-LHCC-2022-009
LHCC minutes: LHCC-149

ALICE ⇨ ALICE3

- Compact all-silicon tracker
  → clean separation of signal and background
- Vertex detector with excellent pointing resolution
  → clean reconstruction of decay chains
- Particle identification
  → background suppression
- Large acceptance
  → statistics and correlations
- Superconducting magnet system
  → effective provision of required magnetic field
- Continuous read-out and online processing
  → large data sample to access rare signals



Novel detector concept based on innovative technologies relevant for all future HEP experiments

Curtesy of B. Erazmus

Nuclear Physics in Europe

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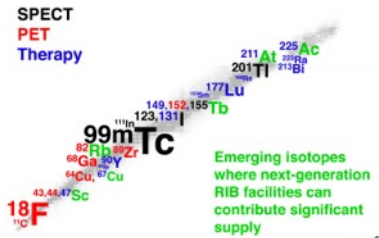
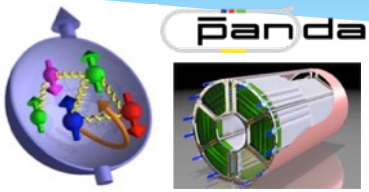
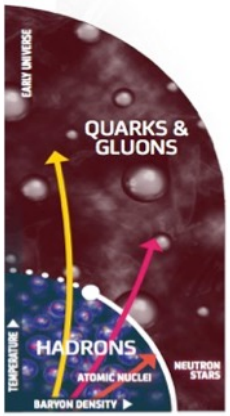
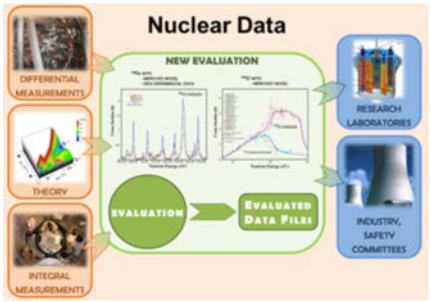
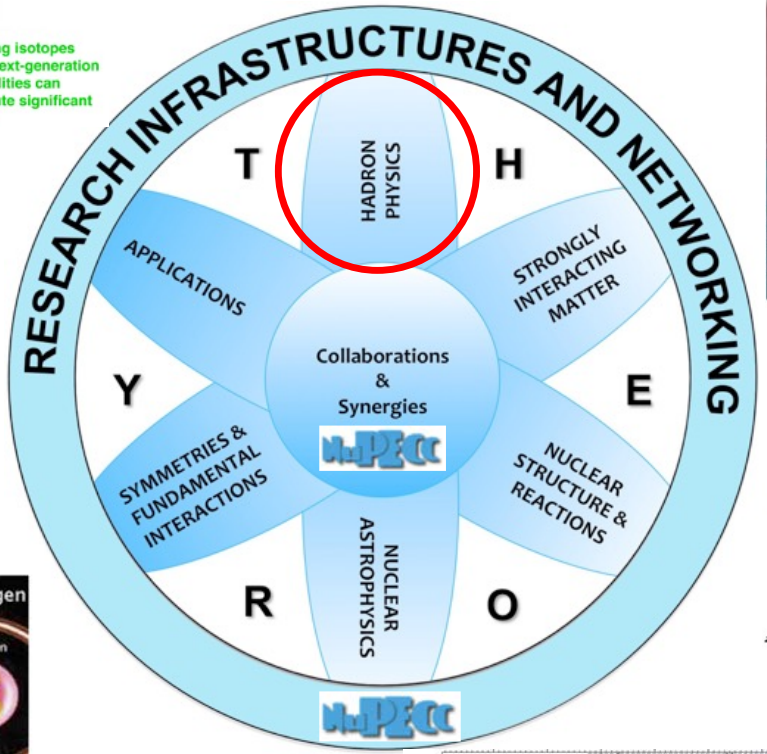
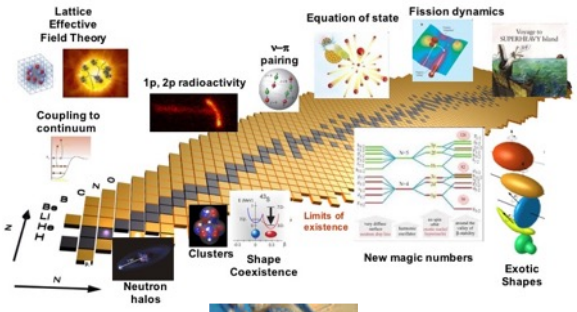


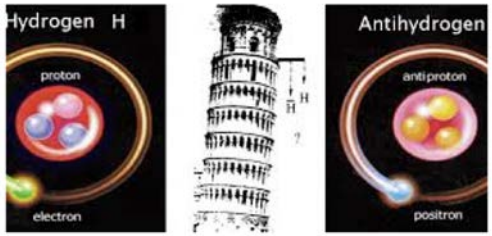


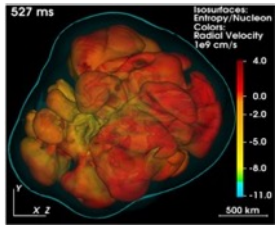


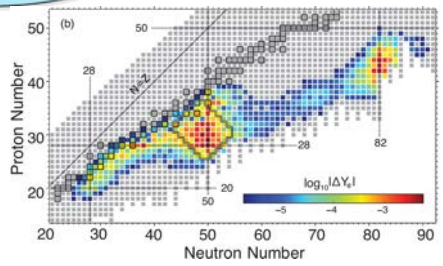


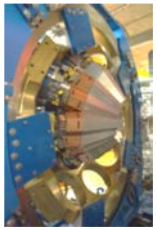






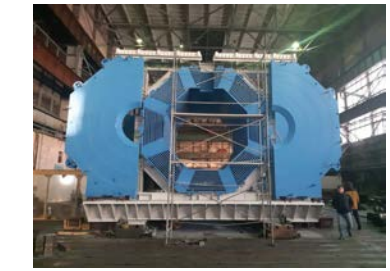






The Physics of Hadrons

- How is mass generated in QCD and what are the static and dynamical properties of hadrons?
- How does the strong force emerge from the underlying quark-gluon structure of nucleons?



High resolution experiments with antiprotons (PANDA) at FAIR to test QCD in detail

European contribution to the EIC project in US

-> NuPECC EIC Task Force

EoI 6 - Synergies between EIC and LHC experiments

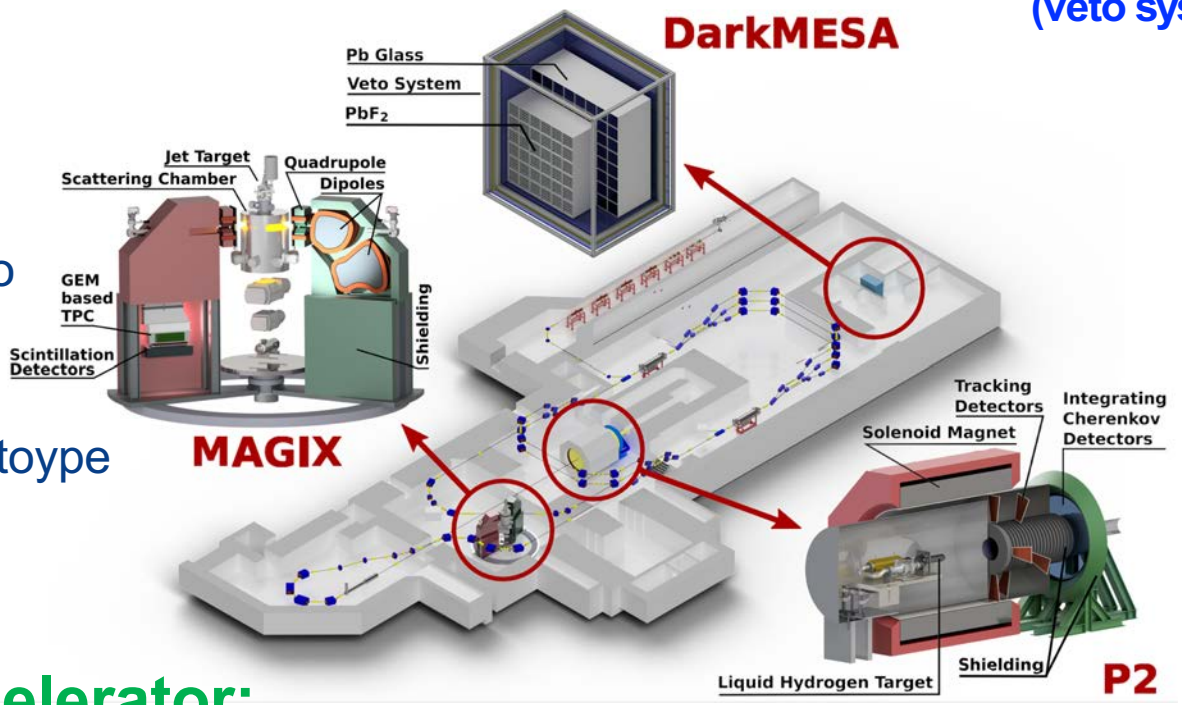
kick off workshop June 20-21, 2022

Main NuPECC LRP 2017 priority for this topic:

The antiproton programme at the FAIR/PANDA facility combined with programmes with polarised protons in Dubna (NICA) and those with lepton and hadron beams at existing facilities (MAMI, Bonn, INFN-Frascati).

World-class Physics Program at MESA in Mainz

- Gas Jet Target already used at MAMI/A1
- Spectrometers under construction at DANFYSIK
- TPC/GEM under construction
- Trigger and Veto Detector under construction
- Si Detector Protoype



- Prototype existing
- Additional Pb-Glass being tested (veto system of phase B)

- Superconducting coil under construction
- Return Yoke from GSI
- Cerenkov Detectors and PMTs ordered
- He refrigerator target to be ordered
- Tracking detect. Q^2 being developed
- Polarimeter chain

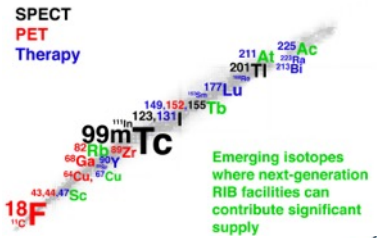
MESA-Accelerator:

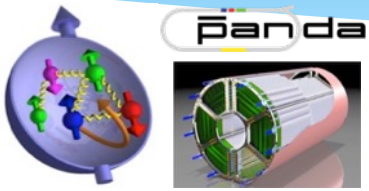
- Energy recovery (1 mA) 105 MeV electron beam
- Extracted beam, polarized electrons at 155 MeV, 150 µA

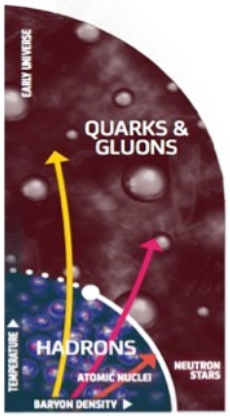
Civil construction finished in 2022, operation in 2025

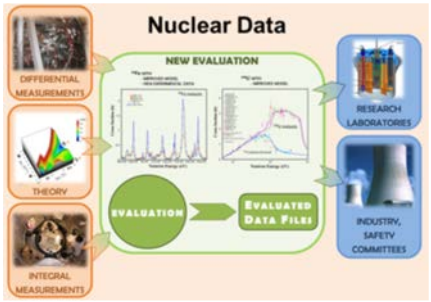
Nuclear Physics in Europe

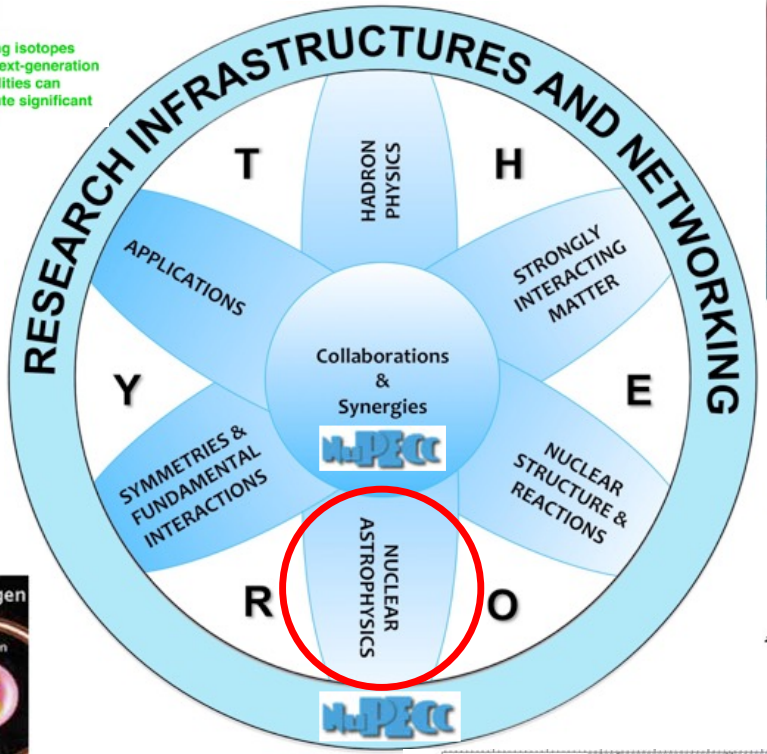
http://www.nupecc.org

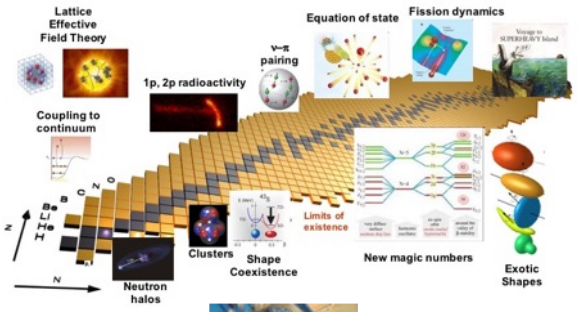


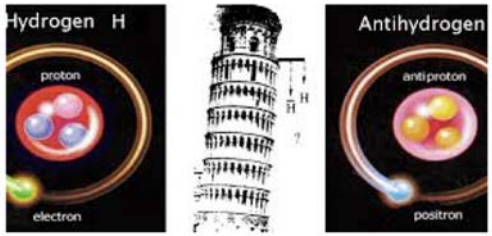


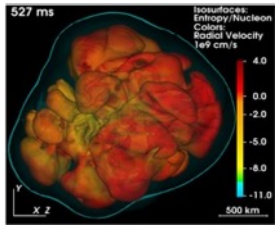


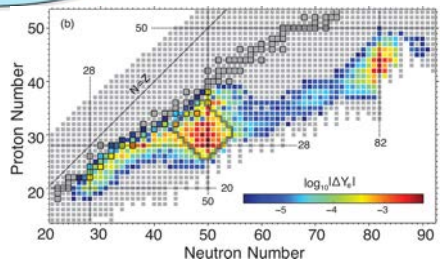


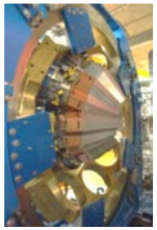










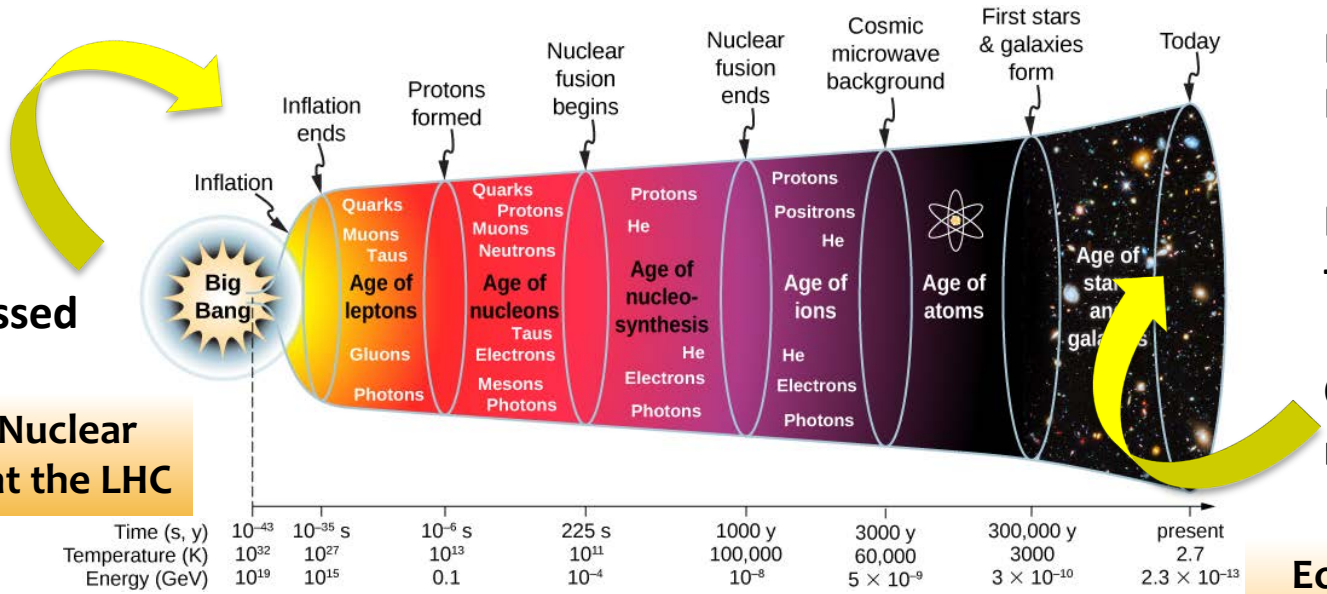


Nuclear physics and the evolution of the Universe

- What are the properties of nuclei and strong-interaction matter as encountered shortly after the Big Bang, in catastrophic cosmic events, and in compact stellar objects?
- How and where in the universe are the chemical elements produced?

QCD

QCD in hot compressed matter



Nuclear structure
Nucleosynthesis

Reactions for astrophysics

Compressed nuclear matter

EoI 4 - Nuclear Physics at the LHC

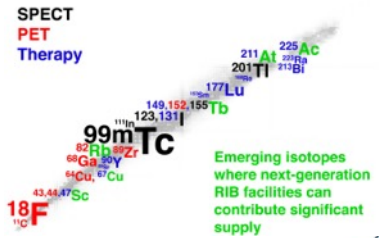
EoI 2 - Gravitational Waves for fundamental physics

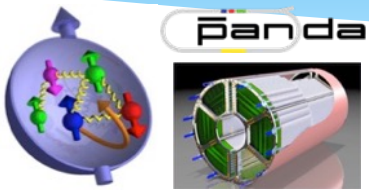
GW- Interdisciplinary and multi-messenger science

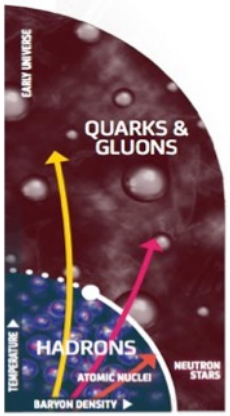
To tackle the different related problems one needs a distributed approach and efforts : different accelerator types and energies

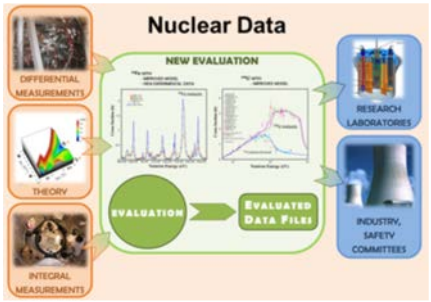
Nuclear Physics in Europe

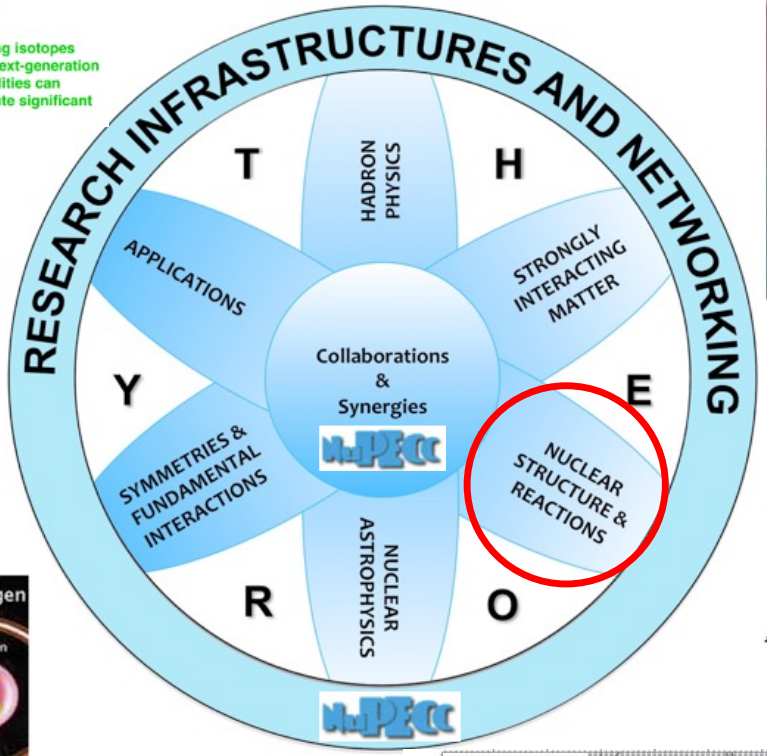
http://www.nupecc.org

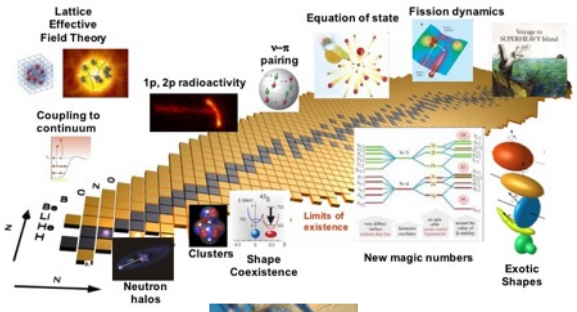


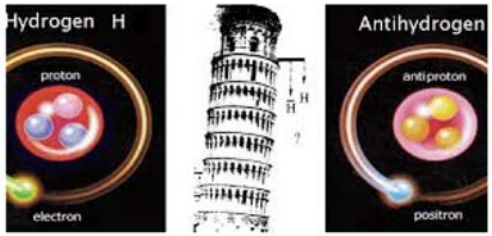


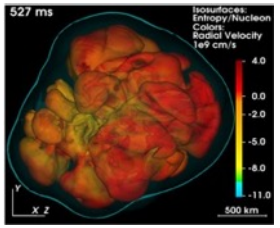


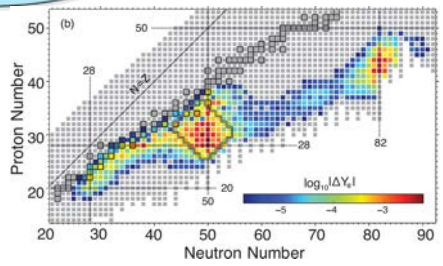


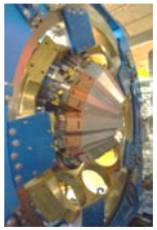




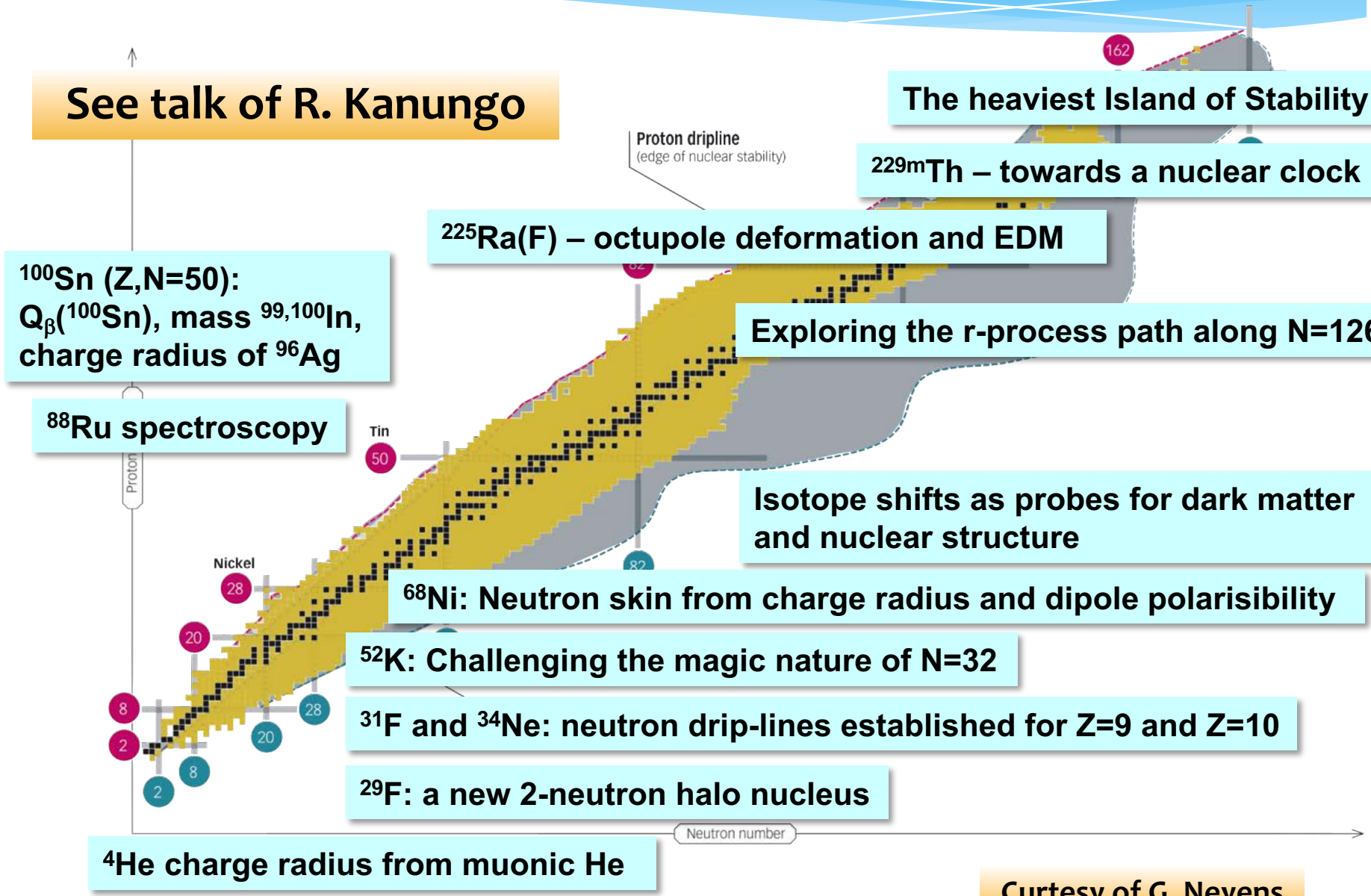








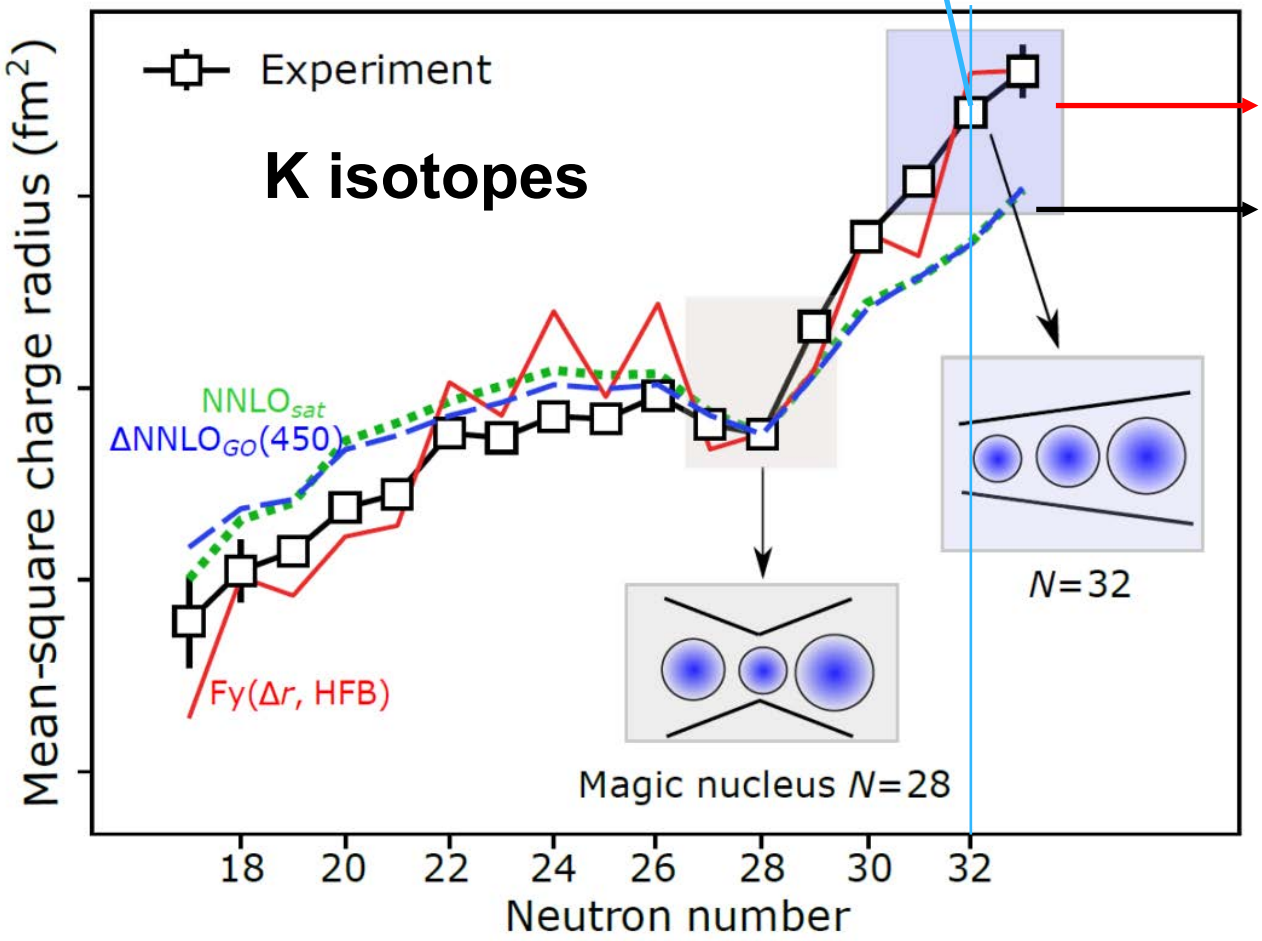
Nuclear structure - recent experiments



Charge radius of ^{52}K (Z=19)

Challenging the magic nature of N=32 and ab-initio nuclear theories

→ No signature of magicity at N=32 !



→ DFT reproduces the trend but overestimates the staggering

→ Ab-initio coupled-cluster underestimate the increase in the size of the radii

ISOLDE

CRIS

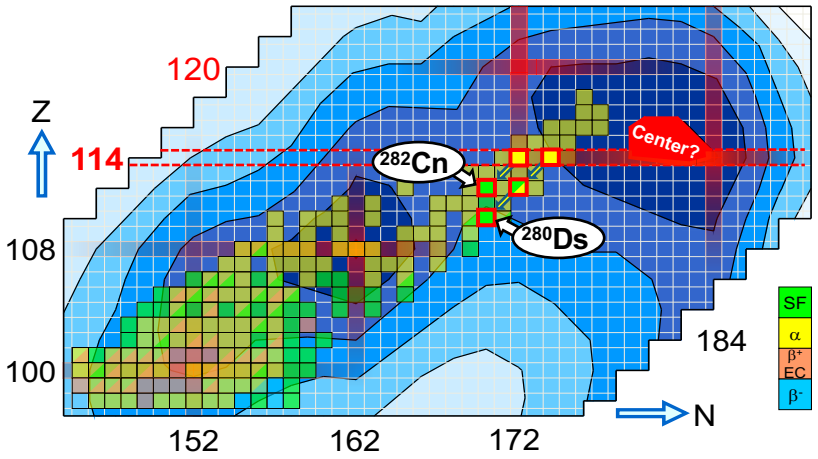
A. Koszorus et al., Nature Physics 17 (2021) 439–443

Curtesy of G. Neyens

SHE island of stability

The centre of the Island of Stability: it is not at Z = 114

Chart of nuclei of superheavy nuclei

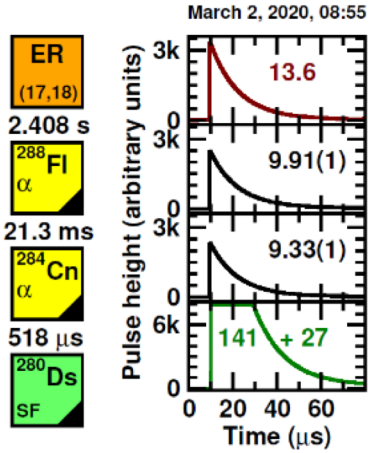


Calculated shell stabilization energy (Sobiczewski *et al.*)
Colored boxes: known nuclei

- First detailed nuclear spectroscopy of flerovium (Z=114) decay chains with TASISpec+ at *TASCA* recoil separator
- Discovery of new isotope ^{280}Ds (Z=110) provides first sequence of α-decay energies across Z=114 shell gap
- Discovery of excited 0^+ state in ^{282}Cn (Z=112): shape coexistence

➔ together with extensive triaxial beyond mean-field theory these findings suggest that there is no pronounced shell gap at proton number Z=114

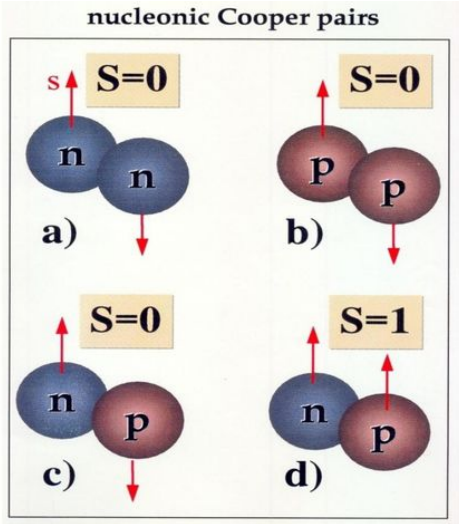
- Focus shifts to heavier elements: 120? 126?



A. Såmark-Roth *et al.*, Phys. Rev. Lett. 126 (2021) 032503
J.L. Egido & A. Jungclaus, Phys. Rev. Lett. 125 (2020) 192504; *ibid.*, 126 (2021) 192501

Curtesy of G. Neyens

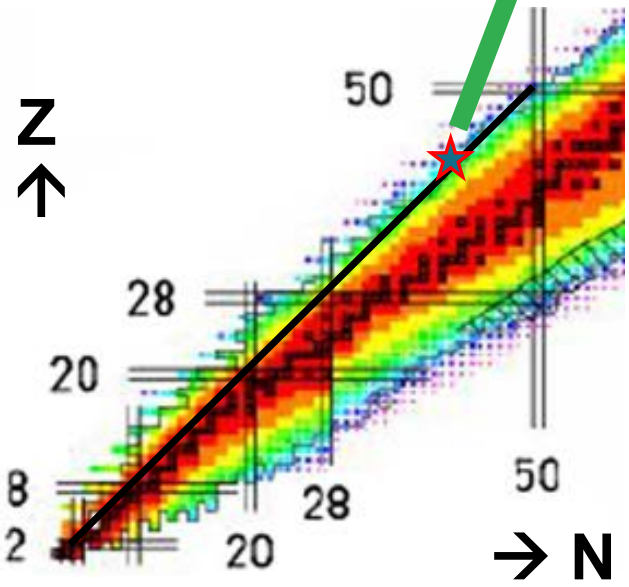
N=Z isotopes: study p-n (iso-scalar) pairing correlations

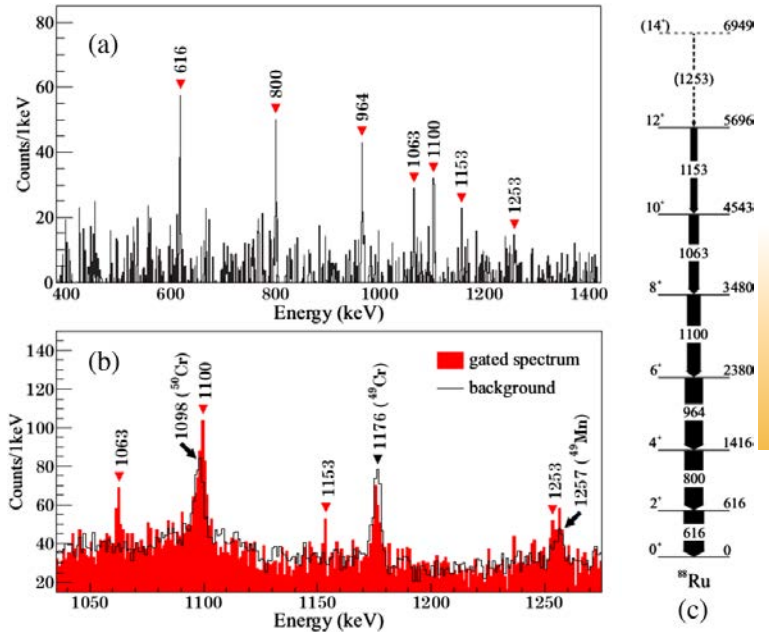


Nucleons can form strongly correlated pairs which impacts strongly on nuclear structure.

Only in N=Z nuclei will the p-n (iso-scalar) pairing be important, as protons and neutrons occupy the same orbit.

^{88}Ru: 44 protons and 44 neutrons (near proton dripline)



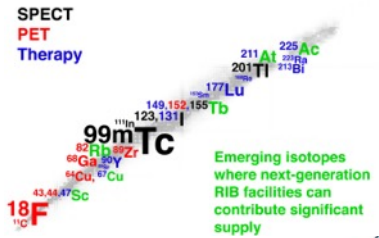


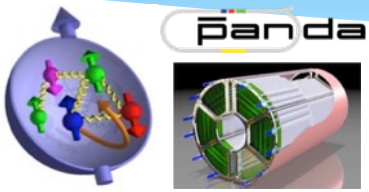
Rotating deformed nucleus with strong ISO-SCALAR p-n pairing !

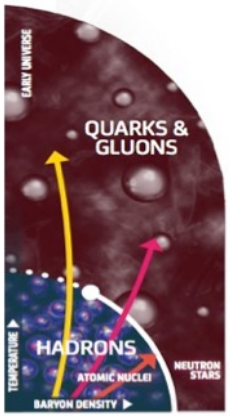
B. Cederwall et al., PRL 124, 062501 (2020)

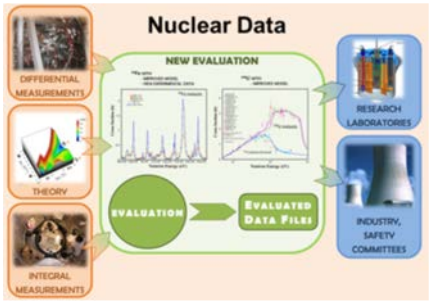
Nuclear Physics in Europe

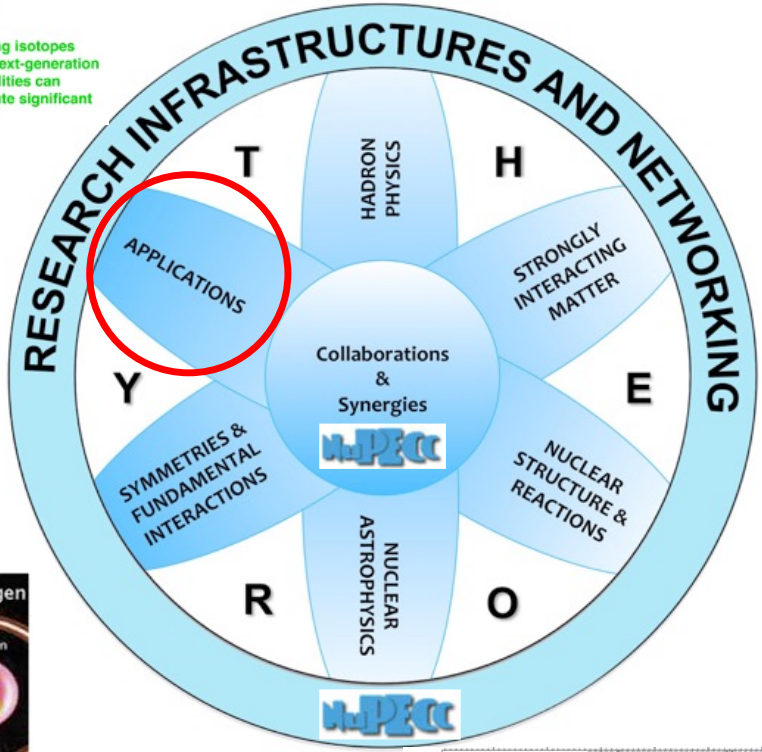
http://www.nupecc.org

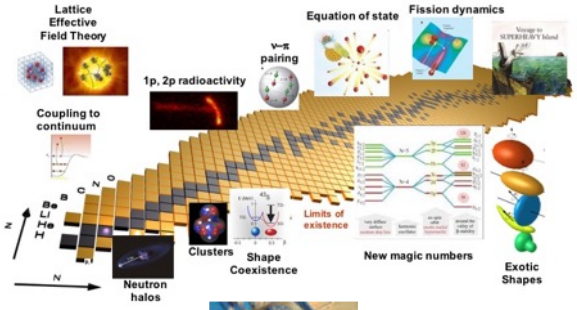


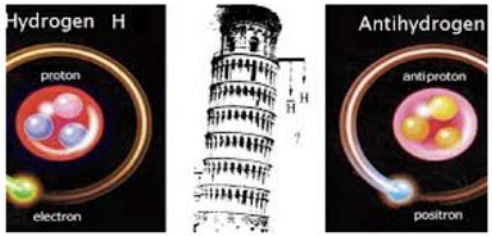


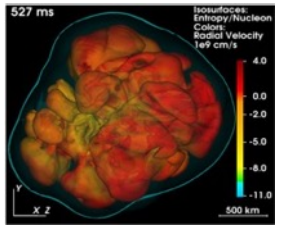


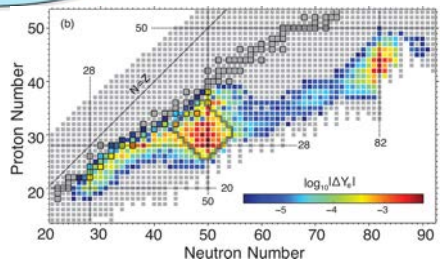


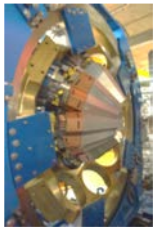






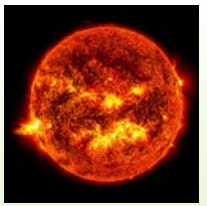




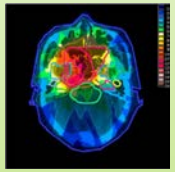


Applications of nuclear science

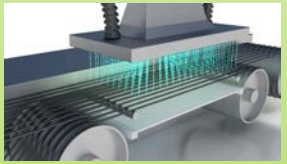
- Climate & Environment (Sun activity, heat in the Earth interior, ocean monitoring, wastewater treatment, mapping of groundwater resources, ...)



- Energy (electric power generation, waste management, nuclear data)



- Health (radioisotopes for therapy and diagnosis, hadrontherapy)
- Everyday life products (sterilization, radiation processing, cross-linked coatings, material modification, food and agriculture)



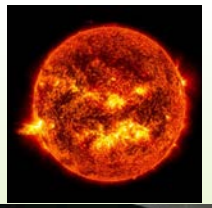
- Cultural heritage and Forensics
- Space technology & exploration

Important role of large and smaller scale facilities

NuPECC report on Nuclear Physics in Everyday Life (soon)

Applications of nuclear science

- Climate & Environment (Sun activity, heat in the Earth interior, ocean monitoring, wastewater treatment, mapping of groundwater resources, ...)



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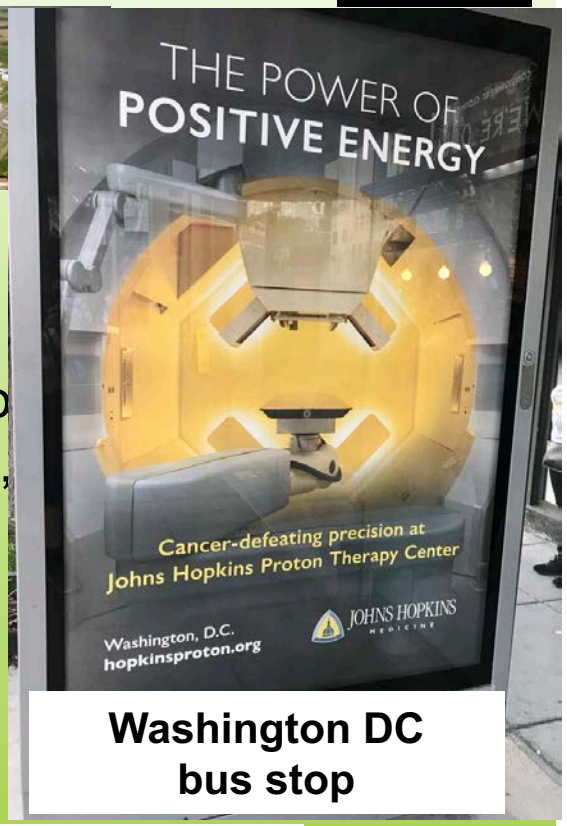


Washington DC bus stop

Important role of large and smaller scale facilities

NuPECC report on Nuclear Physics in Everyday Life (soon)

Nuclear Energy in Europe

In 2019, nuclear plants generated 25 % of the electricity produced in the European Union, with nuclear reactors operating in 13 Member States

128 nuclear power reactors (119 GWe)
Under construction:
3 reactors in EU & 2 in UK

New reactors will be constructed in Bulgaria, France (14), Poland and UK

A Complementary Climate Delegated Act including, under strict conditions, specific nuclear and gas energy activities in the list of economic activities covered by the EU taxonomy was formally adopted in all EU official languages on 9 March 2022. The criteria for the specific gas and nuclear activities are **in line with EU climate and environmental objectives** and will help accelerating the shift from solid or liquid fossil fuels, including coal, towards a climate-neutral future.

ESFRI

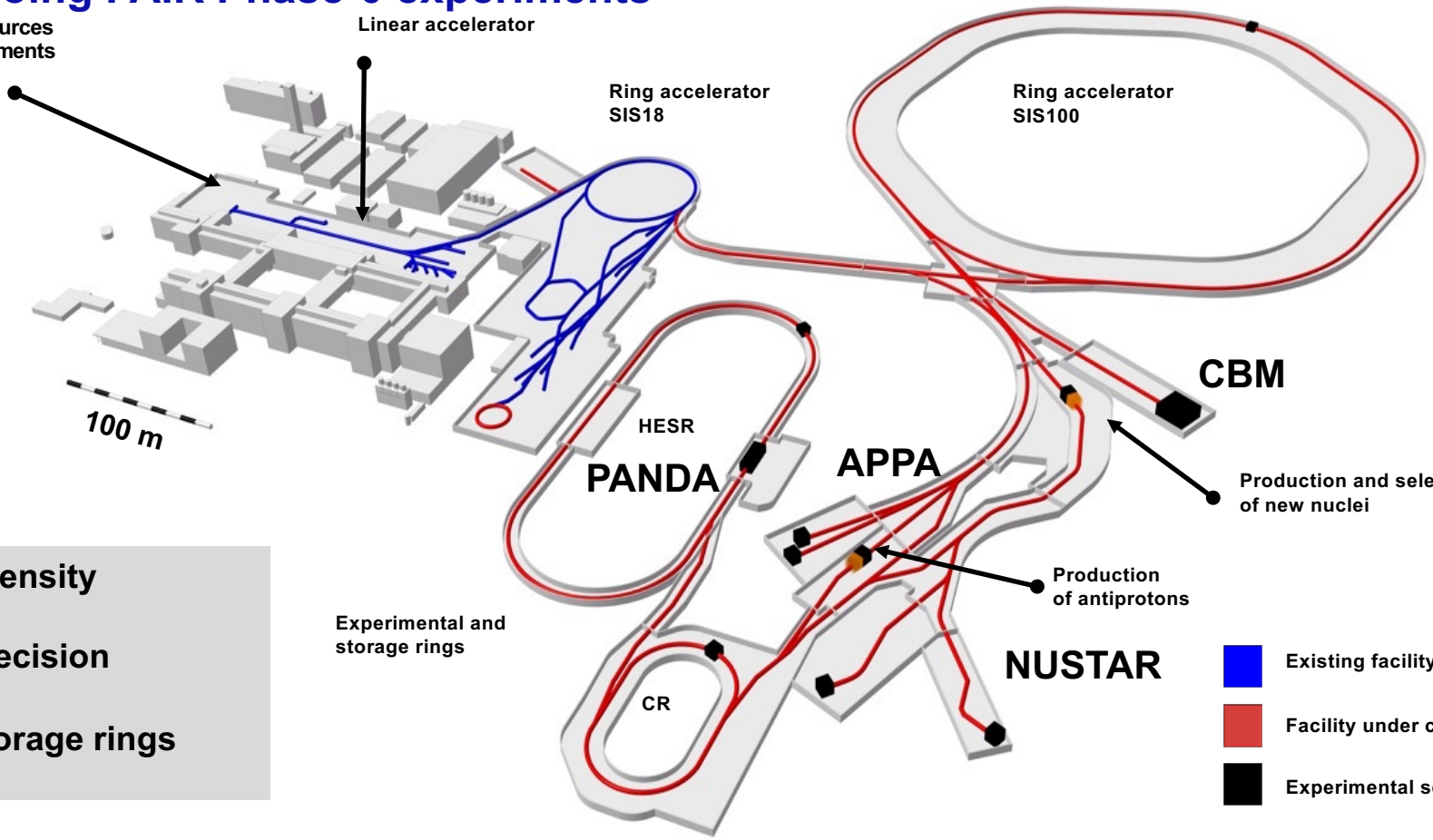
First phase of MYRRHA ADS facility under construction in Belgium

IFMIF-DONES - test facility for fusion materials under design

Full support of NuPECC for the construction of FAIR

ESFRI

Ongoing FAIR Phase-0 experiments



- Intensity
- Precision
- Storage rings

Finland France Germany India Poland Romania Russia Slovenia Sweden United Kingdom Czech Republic

Curtesy of P. Giubellino

Full facility MSV and Intermediate Objective

- **All FAIR shareholders remain committed to the realization of the full facility („Modularized Start Version“ – MSV) enabling the comprehensive scientific research program**
- **FAIR Council defined in 2019 the Intermediate Objective (IO) as an interim step towards full MSV. The IO comprises**
  - **full scope of accelerator and experiments for the MSV**
  - **realization of the buildings for MSV except the buildings for CR, HESR and p-Linac.**
- **The international shareholders are at various stages of their national approval processes to obtain the financial resources of the three buildings of CR, HESR, and p-Linac (highlighted in light green).**

Courtesy of P. Giubellino and Y. Leifels

Roadmap NP facilities

FAIR- Construction Site
(October 2021)

FAIR - Construction Site South
(April 2022)

Courtesy of P. Giubellino and Y. Leifels

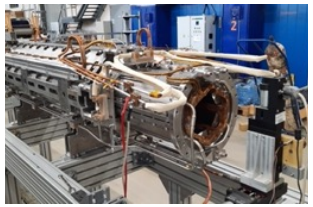
Roadmap NP facilities

FAIR full facility – Worldwide production and delivery of accelerator and experiment components


p-Linac: RFQ-Entwicklung

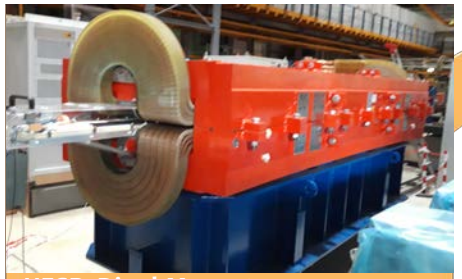

HEBT: Dipol-Magnet


Netzgeräte Gesamtanlage


SIS100: Quadrupol-Magnet


HESR: Quadrupol-Magnet


SIS100: Vakuumkammern


HESR: Dipol-Magnet


CR: Dipol-Magnet im Bau


Teststand


SIS100: Dipolmagnete

Courtesy of P. Giubellino and Y. Leifels

Roadmap NP facilities

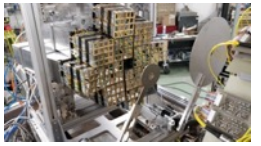
NFS - running

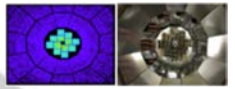
S3 operational by 2023

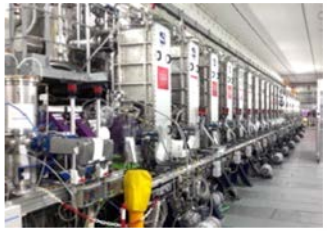
DESIR civil construction by 2023

AGATA VAMOS

FAZIA INDRA







HI SC LINAC operational

5mA 14-20 MeV/n light and 1mA heavy ions

New High-intensity heavy-ion injector under development

LINAC nominal light-beam intensity capabilities demonstrated in 2021
Routine operation of SPIRAL2 with experiments at Neutron For Science since 2021

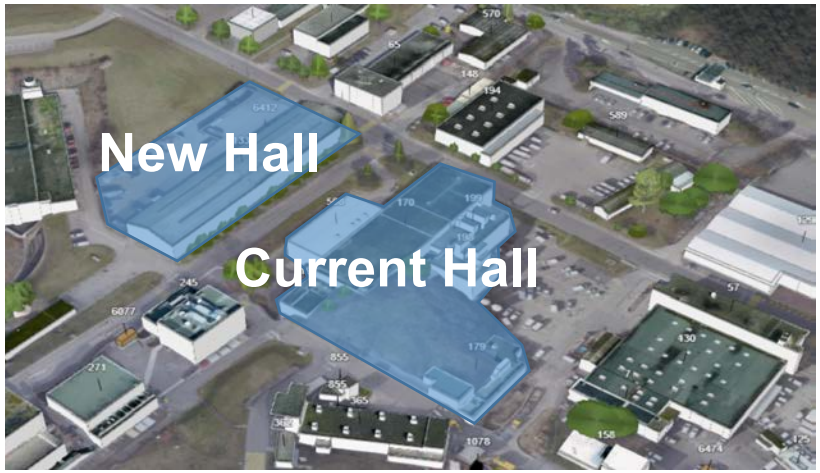
CERN / ISOLDE
World-leading ISOL facility

Mid-term goals (up to and including LS3 2026-28)

- New lab for nano-material based targets
- Parallel RIB operation
- Upgrades to receive higher energy protons at higher intensity
- Upgrade of transfer line from Booster to ISOLDE to deliver 2-GeV
- …

Long-term goals (> LS3): EPIC

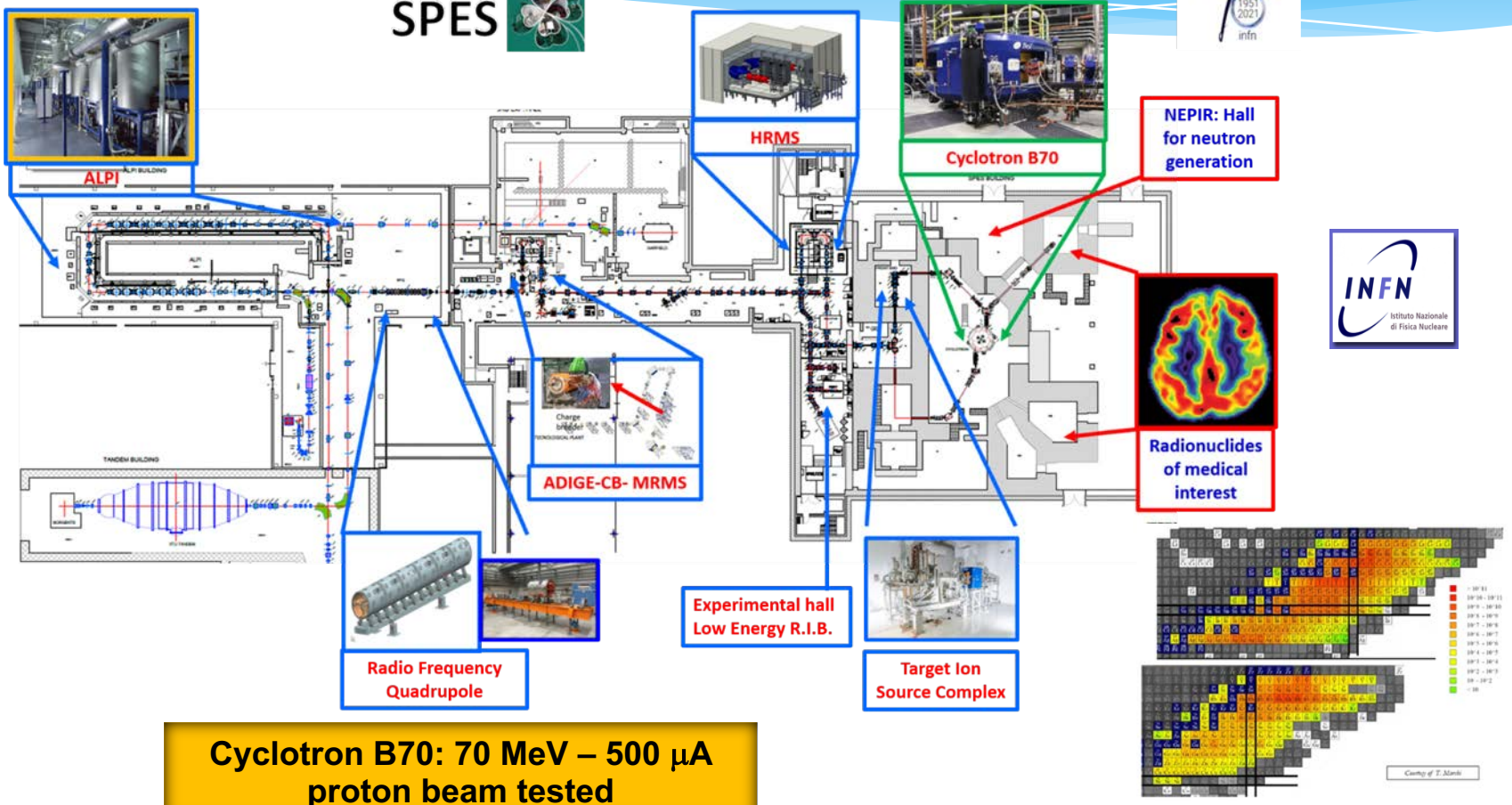
- A new ISOLDE building + target stations.
- Dedicated space and facilities for new (and existing) low-energy experiments.
- Improved beam purity (mass resolution) and quality (time structure).
- Parallel operation with existing (HIE-ISOLDE) facility.
- Improvements to post-accelerators
- Extra space for new re-accelerated RIB experiments, including a compact storage ring.



Collaboration working on science case before considering funding strategies.

Courtesy of S. Freeman

SPES Facility at LNL, Italy



Cyclotron B70: 70 MeV – 500 μA proton beam tested

LOW ENERGY RIB:
- 1/200 mass separator
- Laser Ion Source
- Low energy experimental area

≥ 2023

Radioisotopes for Medicine:
- LARAMED
- ISOLPHARM

2023 - 2024

RIB reacceleration:
- New RFQ
- ALPI

ADIGE: Charge Breeder (n+) MRMS /1/1000)

≥ 2024

HRMS (1/20000) + Beam Cooler

≥ 2025

Courtesy of F. Gramegna

Roadmap NP facilities

Commissioning of experimental setups

- with expert users – involved in defining the TDRs
- experiments approved by ELI-NP ISAB
- demonstrate the performance of the systems but also perform relevant physics experiments

Gradual transition from implementation to operation

Beam time delivered
June – December 2021:
100 TW – 16 weeks
1 PW – 20 week
2022: started in March
100 TW & 1 PW

Open access based on scientific merit/evaluation

- evaluation by international PAC
- first call for proposals organized together with ELI ERIC for the period October 2022 – March 2023 (100 TW, 1 PW)

- 100 TW : *ongoing*
  Four-wave mixing in vacuum, in search of dark matter candidates
  X ray production through betatron emission
- 1 PW : *ongoing*
  Benchmark TNSA proton acceleration
  Benchmark LWFA electron acceleration
- 10 PW solid target : *start in 2022*
  Demonstrate extreme focal intensity through laser-γ conversion ("γ-flash")
  Demonstrate over 200 MeV proton acceleration
  Dense heavy ion beams for nuclear physics
- 10 PW gas target : *start in 2023*
  10 PW laser wakefield acceleration of multi-GeV electron beams

Courtesy of N. Marginean and C. Ur

MYRRHA Accelerator Driven System
SCK-CEN Belgium

- **Phase 1 (funded) : R&D and licensing-related activities for the MYRRHA reactor, together with the construction of MINERVA, comprising the first section of the accelerator (100-MeV protons) coupled to a Full Power Facility (FPF) and a Proton Target Facility (PTF)**

Objective MINERVA

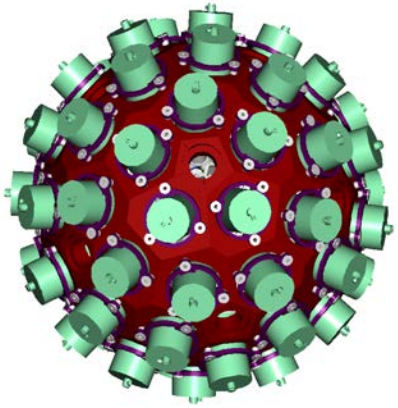
- 100 MeV SC-proton accelerator
  - Accelerator reliability
- Proton Target Facility – ISOL@MYRRHA
  - Fundamental Physics research
  - Production of isotopes for medical applications
- Fusion Target Station implemented within the Full Power Facility
  - Materials R&D

- **Phase 2: extension of the accelerator to 600 MeV**
- **Phase 3: construction and coupling of the sub-critical reactor**

Curtesy of L. Popescu

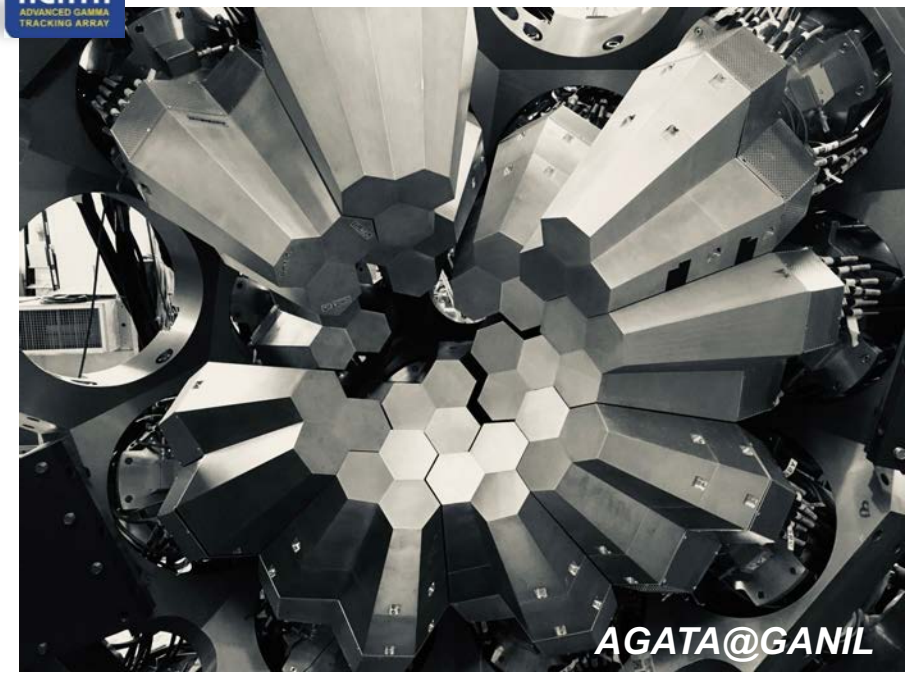
Licensing application (mid 2021) → Ground breaking (mid 2022) → Buildings ready (end 2024) → Accelerator commissioning (2026) → PTF commissioning (2027)

AGATA: THE ultimate γ-ray spectrometer



- 180 (60 triple-clusters) 36-fold segmented crystals
- Amount of germanium: 362 kg
- Solid angle coverage: 82 %
- Singles rate >50 kHz
- Efficiency: 43% (M_γ=1) , 28% (M_γ=30)
- Peak/Total: 58% (M_γ=1), 49% (M_γ=30)
- Angular Resolution: ~1°

NuPECC LRP 2017 priority

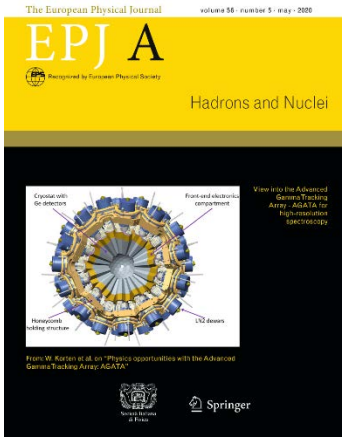


AGATA White Book : W. Korten et al, Eur. Phys. J. A (2020) 56:137

The project timeline is to complete the array by 2030

Combination of:

- ❑ segmented detector
- ❑ pulse-shape analysis
- ❑ tracking the γ rays
- ❑ digital electronics



Courtesy of E. Clement

AGATA: THE ultimate γ-ray spectrometer

AGATA is operated under a Memorandum of Understanding

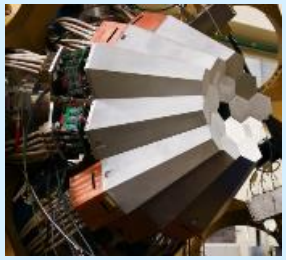
All partners have signed on the 25th of March 2022

New AGATA Spokesperson, chair of the steering :
A. Bracco (INFN-Milano) since 31st of March

Core investment ~22 M€

MoU Phase 1 + Addendum

2010-2012
Legnaro, Italy
Intense stable beams
15 detectors

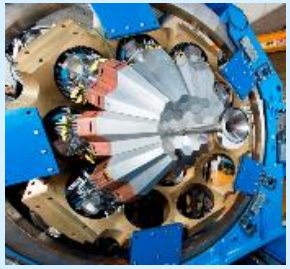


AGATA Demonstrator + PRISMA at LNL

2012-2014
GSI, Germany
Fast fragmentation beams
25 detectors

AGATA at GSI

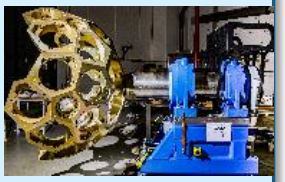
2014- 2021
GANIL, France
ISOL and stable beams
approaching 1π (45)



AGATA at GANIL

MoU Phase 2

2021--
LNL, Italy
Stable beams
SPES radioactive beams



AGATA at LNL 2.0

>2026
FAIR, Germany
ISOLDE, CERN
GANIL, France
RIB at low and high energies

Courtesy of E. Clement

Integrating community with EU projects

Support for users and facilities

New! Joint PP – NP EU project EURO-LABS

Contract 2022-2026 (14,5M€)

Starts on September 1st 2022

Coord. Navin Alahari
GANIL, France
Coordinating institution INFN, Italy
39 Research Infrastructures

- CERN
- GANIL (France)
- LNL-LNS (Italy)
- JYFL (Finland)
- IJCLab (CNRS, France)
- FAIR/GSI (Germany)
- NLC (HIL/IFJ PAN, Poland)
- IFIN-HH(Romania)
- ECT* (Italy)
- …

Hadron physics STRONG-2020

Contract 2019 -2023 (10M€)

Coord. Barbara Erazmus IN2P3, France
Coordinating Inst. IN2P3/CNRS, France

- CERN
  LHC & fixed target exp.
- GSI/FAIR (Germany)
- LNF, Frascati (Italy)
- MAMI, Mainz (Germany)
- ECT*, Trento (Italy)
- ELSA, Bonn (Germany)
- COSY, Jülich (Germany)

EU H2020 Ongoing Projects

PRISMAP - *PRoduction of hIgh purity iSotopes by Mass separation for medical APplication*

23 partners, 13 countries, 5M€

Coord. Thierry Stora – CERN, Coordinating Inst. CERN

ChETEC-INFRA - Chemical Elements as Tracers of the Evolution of the Cosmos – Infrastructures for Nuclear Astrophysics

32 partners, 17 countries, 5M€

Coord. Daniel Bemmerer - HZDR, Coordinating Inst. HZ Dresden-Rossendorf, Germany

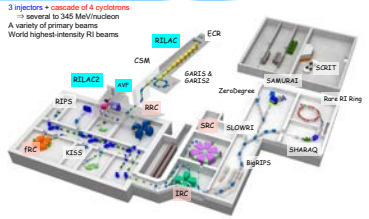
RADNEXT - RADiation facility Network for the EXploration of effects for indusTry and research

30 partners, 12 countries, 5M€

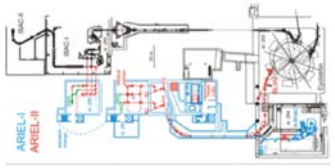
Coord. Rubén García Alía – CERN, Coordinating Inst. CERN

European involvement in the overseas Nucl. Phys. facilities

RIBF RIKEN, Japan (operational) – strong involvement including advanced detectors

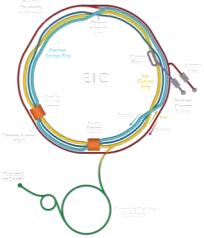


TRIUMF, Vancouver, Canada (operational & construction of ARIEL) - involvement in experiments & instrumentation

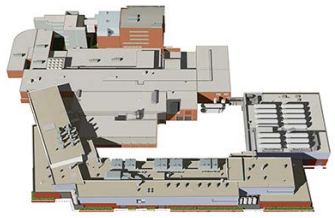


iThemba Labs, South Africa (operational & construction of SAIF) – involvement in experiments

EIC, Brookhaven, New York, US (construction) – strong interest of the European community



FRIB, East Lansing, Mi, US (beginning of operation) – involvement of European groups



NuPECC Strategy for Nuclear Physics

Strategy Pillars

- **Science: Interplay between strong Theory & ambitious Experiments**
- **Applications - huge societal impact**
- **Facilities – in Europe (FAIR, SPIRAL2, ELI-NP, ISOLDE, SPES,…) and at other continents (RIBF, TRIUMF, iThemba, EIC, FRIB)**
- **Detectors - ex. ALICE3 and AGATA**
- **Data and Open Science – ex. ESCAPE H2020 program**
- **Synergies with neighbouring fields - DM, GW, neutrinos, EDMs, detectors,…**

Strategy Development

- The 2017 NuPECC Long Range Plan defined an ambitious strategy for European Nuclear Physics
- NuPECC efforts to transform the LR Plan into reality -> Task Force meetings in European countries
- **Next NuPECC LRP 2024 begins now!**
  - **Call for inputs with a dead-line on October 1st, 2022**

http://nupecc.org/?display=lrp2024/main

Warm thanks to all colleagues for their contributions

Thank you for your attention