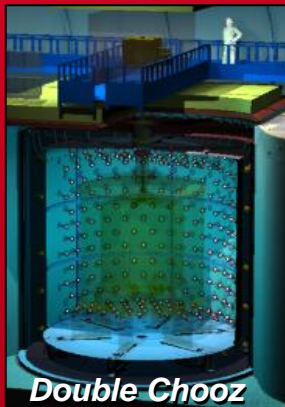


DE LA RECHERCHE À L'INDUSTRIE

cea

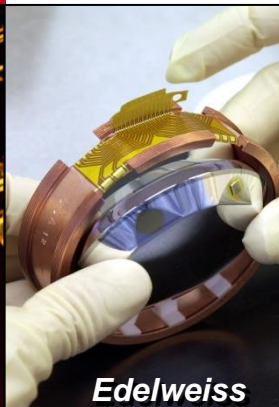
IRFU



*Double Chooz*



*ALICE*



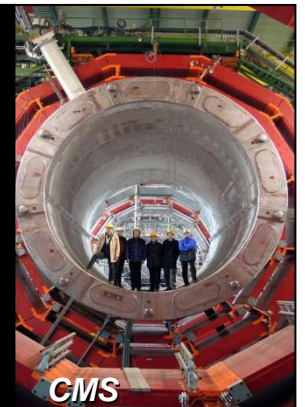
*Edelweiss*



*HESS*



*Herschel*



*CMS*

*Déchiffrer les rayons de l'Univers*



Marie-Cécile AUBERT

IRFU deputy director

[marie-cecile.aubert@cea.fr](mailto:marie-cecile.aubert@cea.fr)

## CEA

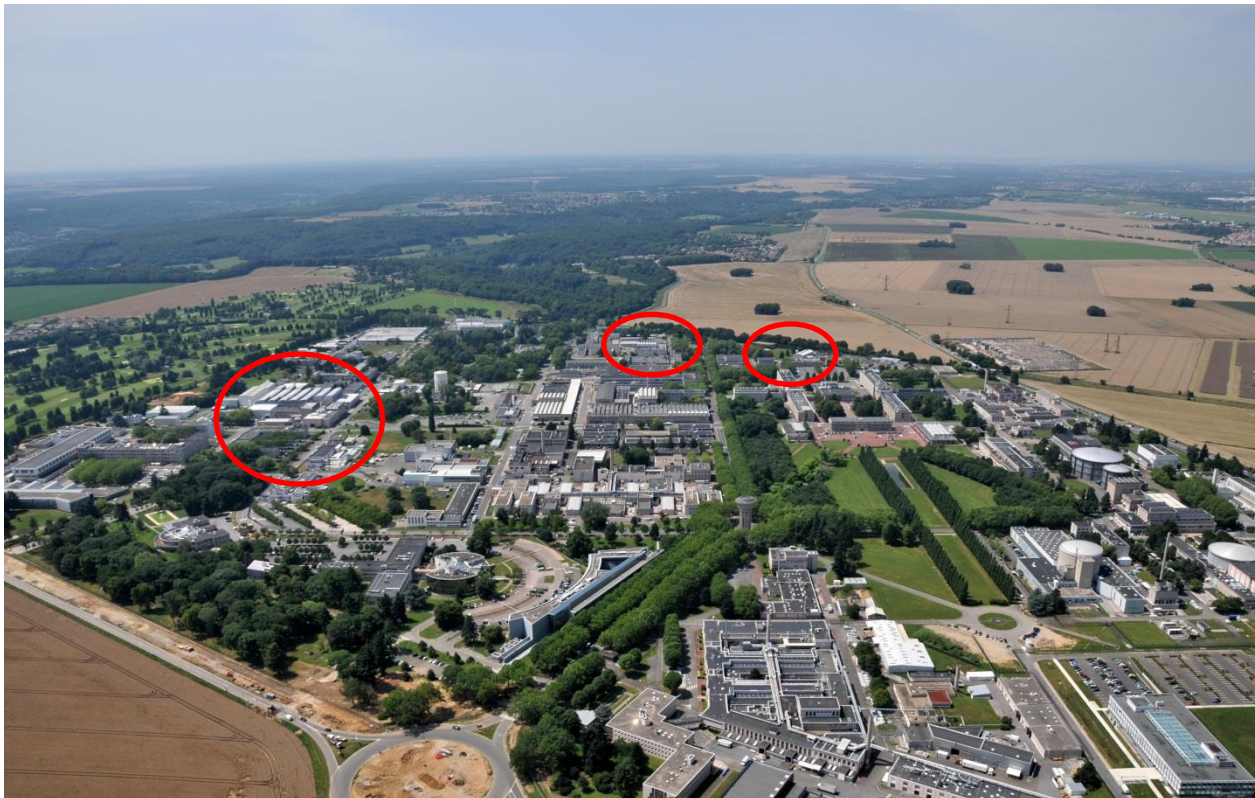
### Alternative Energies & Atomic Energy Commission



## Basic Research

16 000 Employees, 4 000 M€

法国权威研究机构 - 法国原子能与替代能源委员会  
[www.cea.fr](http://www.cea.fr)



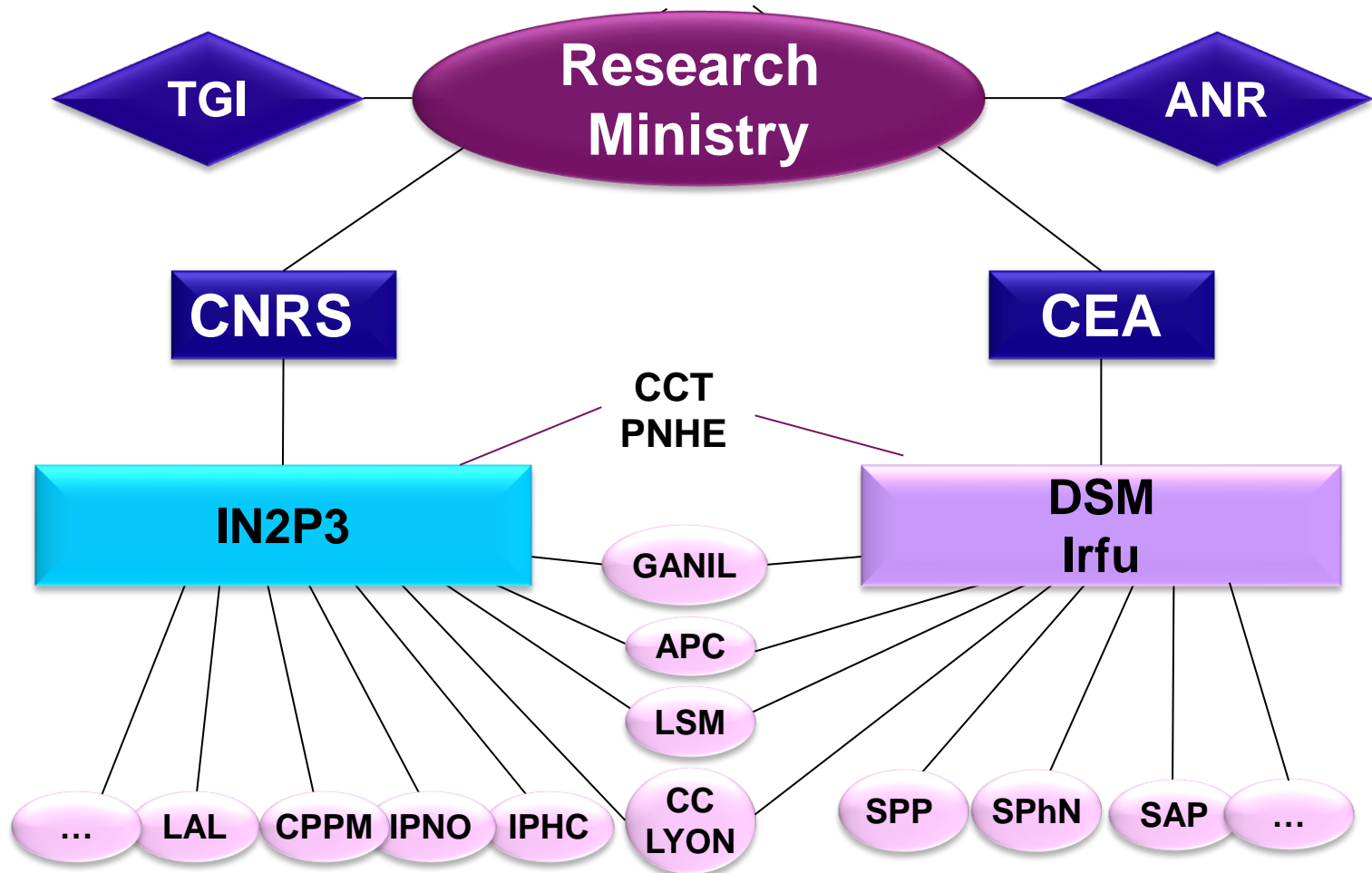
**Physics**  
- Infinitely large & small  
- Technology

800 employees  
90 M€

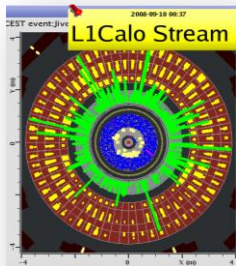
Institute of Research into the Fundamental Laws of the Universe (Irfu)

宇宙基本原理研究所 [www.irfu.cea.fr](http://www.irfu.cea.fr)

at Saclay - 位于巴黎南郊萨克莱地区







## 1. Elementary constituents?



- Standard Model, Higgs boson (D0, ATLAS, CMS)
- Neutrinos oscillations (T2K, D-Chooz, Cern, Stereo)

## 2. Energy content?



- Dark Universe (Edelweiss, Boss/Desi, Euclid ...)
- Antimatter (Gbar)

## 3. Structures in the Universe?

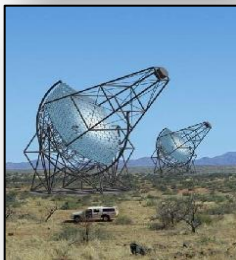
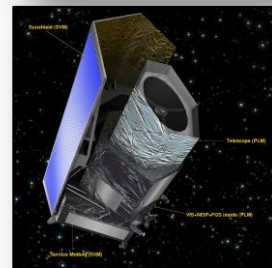


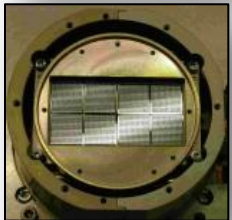
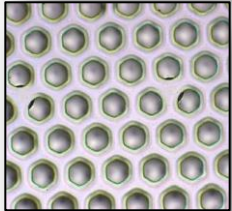
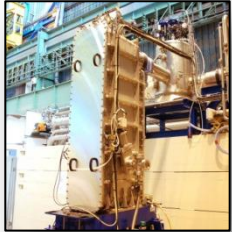
- Cosmology (Planck)
- Formation of galaxies & stars (Herschel, JWST, ELT)
- High energy phenomena (Fermi, **SVOM**, Hess/CTA)

## 4. Origin of particles and nuclei?



- Plasma of quarks and gluons (ALICE)
- Structure of Hadrons (COMPASS, JLAB)
- Exotic nuclei (GANIL/SPIRAL2, FAIR)





## 1. Production and manipulation of radiations

- Accelerators (Spiral2, XFeL, FAIR, CERN, IFMIF, ESS)
- Magnets & Superconductivity (R3B, ISEULT, JT60SA)

## 2. Detecting radiation

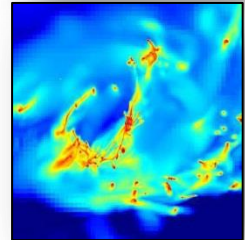
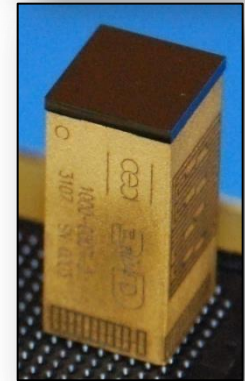
- Microstructured detectors (RD51, CLAS12)
- Imaging device (ELT-METIS, APEX, CALIST)
- ASIC

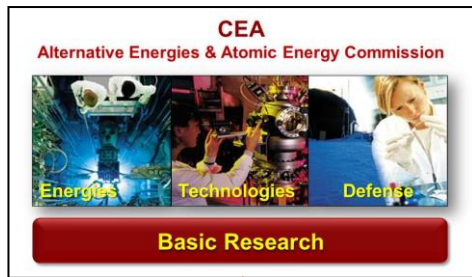
## 3. Space technology

- Camera (PACS, MIRI, SVOM/MXT)
- Data center (Fermi, SVOM)

## 4. Simulation and data treatment

- Massively parallel calculations
- Grid
- Data processing

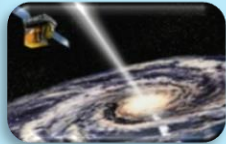




## ■ Research & Technology

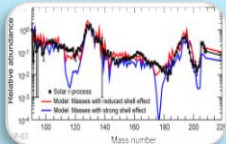
- Physics: Infinitely large & small
- Technology: Radiations

# Institute of Research into the Fundamental laws of Universe



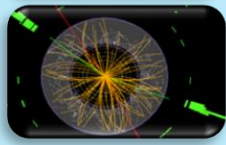
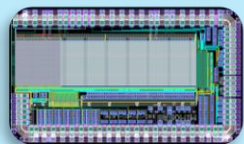
**SAp:** Astrophysics  
Space technologies

**SACM:** Accelerators,  
Supra. Magnets



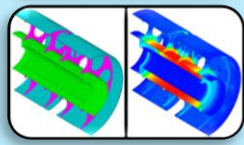
**SPhN:** Nuclear Physics

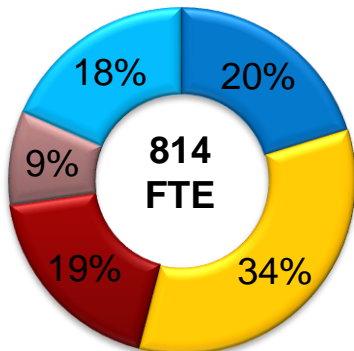
**SEDI:** Detectors,  
electronic, computing



**SPP:** Particle Physics

**SIS:** Systems engineering





**814 FTE**

- Physicists 165 FTE
- Engineers 274 FTE
- Technicians 152 FTE
- Adm. Staff 72 FTE
- PhD & Post Docs 150 FTE

**90 M€**

Government fundings  
Internal CEA contracts  
External contracts

## Institute of Research into the Fundamental laws of Universe

116 CDI  
94 CDD

**SAP:** Astrophysics  
Space technologies

**SACM:** Accelerators,  
Supraconducting Magnets

121 CDI  
10 CDD

56 CDI  
29 CDD

**SPhN:** Nuclear Physics

**SEDI:** Detectors,  
electronic, computing

125 CDI  
11 CDD

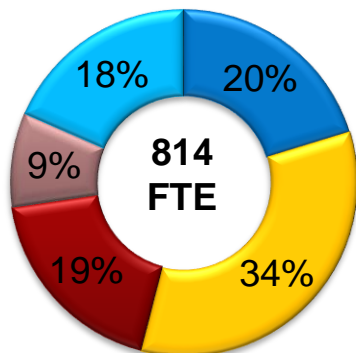
72 CDI  
45 CDD

**SPP:** Particle Physics

**SIS:** Systems engineering

97 CDI  
8 CDD



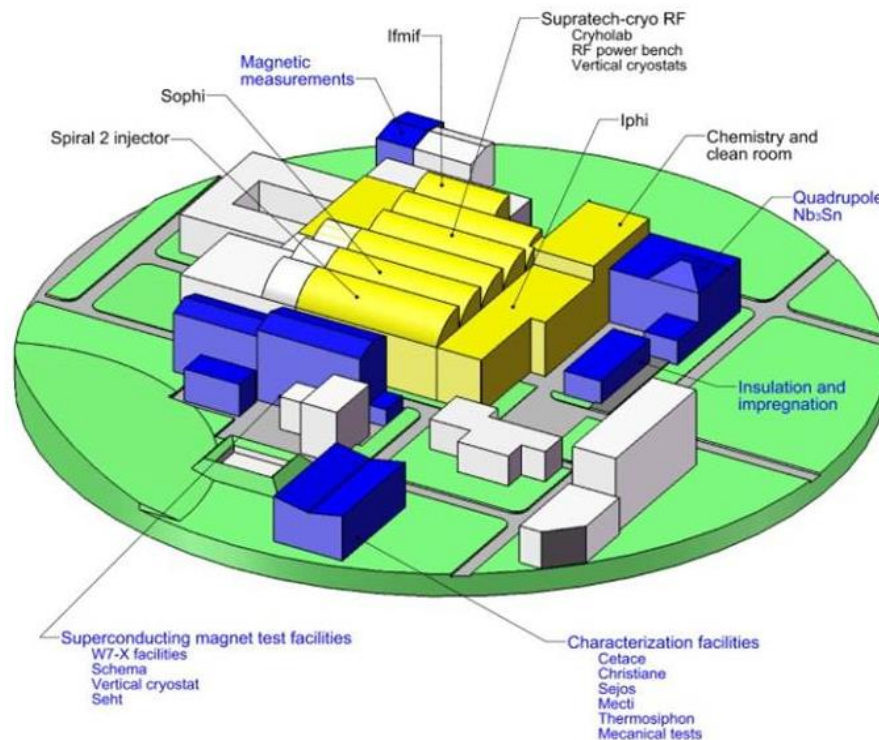


**814 FTE**

- Physicists 165 FTE
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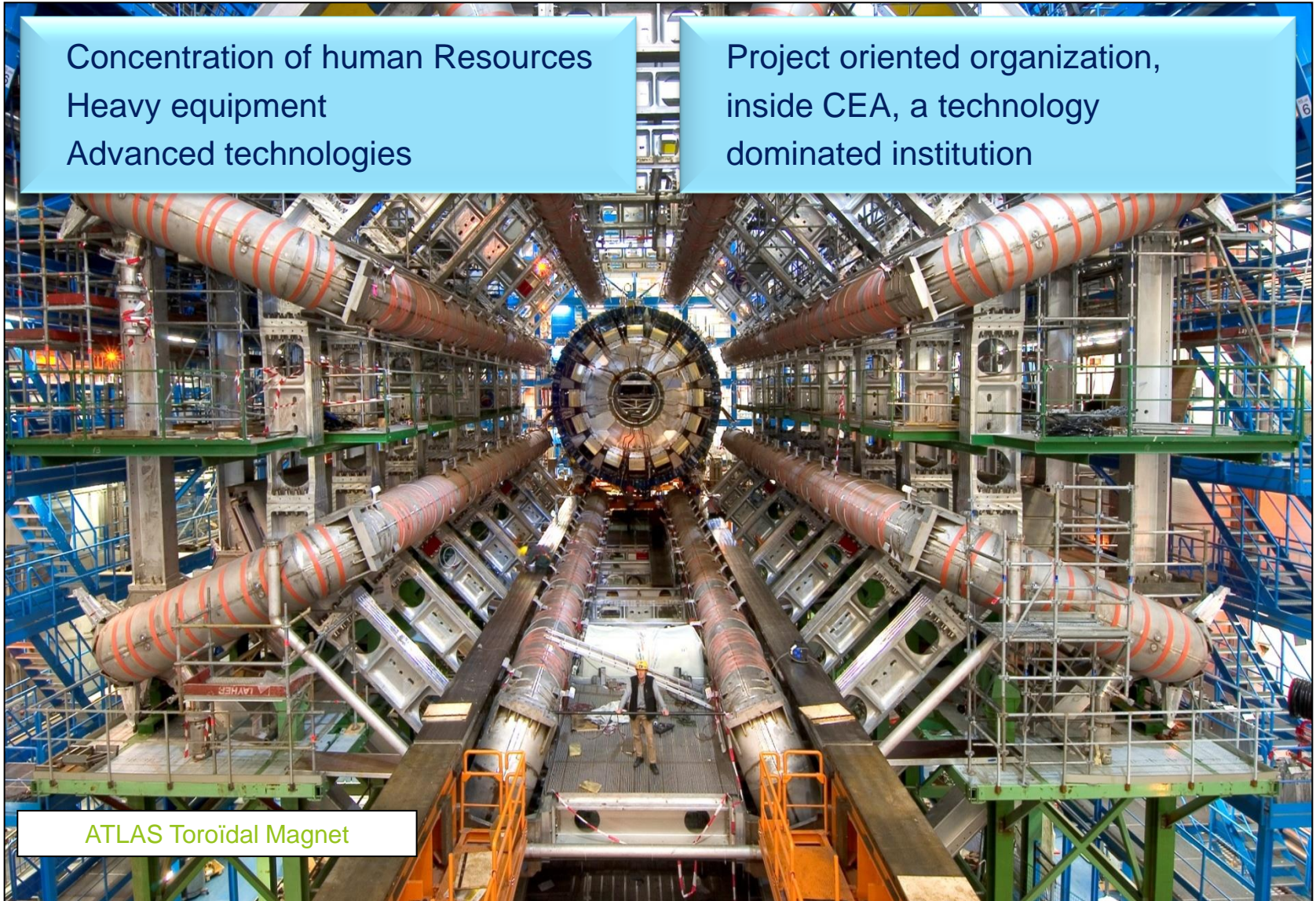
## ■ Platforms Saclay

- 50 000 m<sup>2</sup>, 130 M€
- Radiations Techno :  
Accelerators, magnets, space,  
detection, computing



Concentration of human Resources  
Heavy equipment  
Advanced technologies

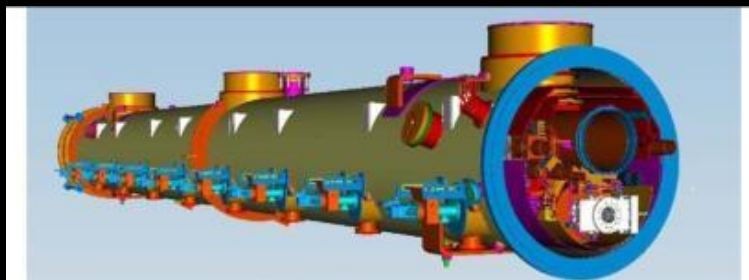
Project oriented organization,  
inside CEA, a technology  
dominated institution



ATLAS Toroidal Magnet



- Each cavity string contains 8 cavities, 8 RF couplers, 1 quadrupole, 1 BPM and 2 vacuum valves



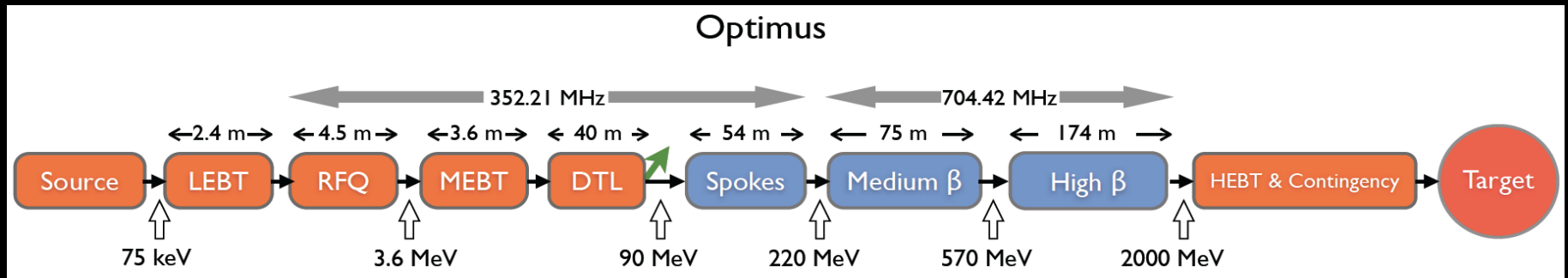
Transfer of cryomodule in clean room roll-out area



Transfer of cryomodule in RF coupler assembly area



France is « financing »  
~8% of the project  
CEA contribution of the  
Order of ~90M€



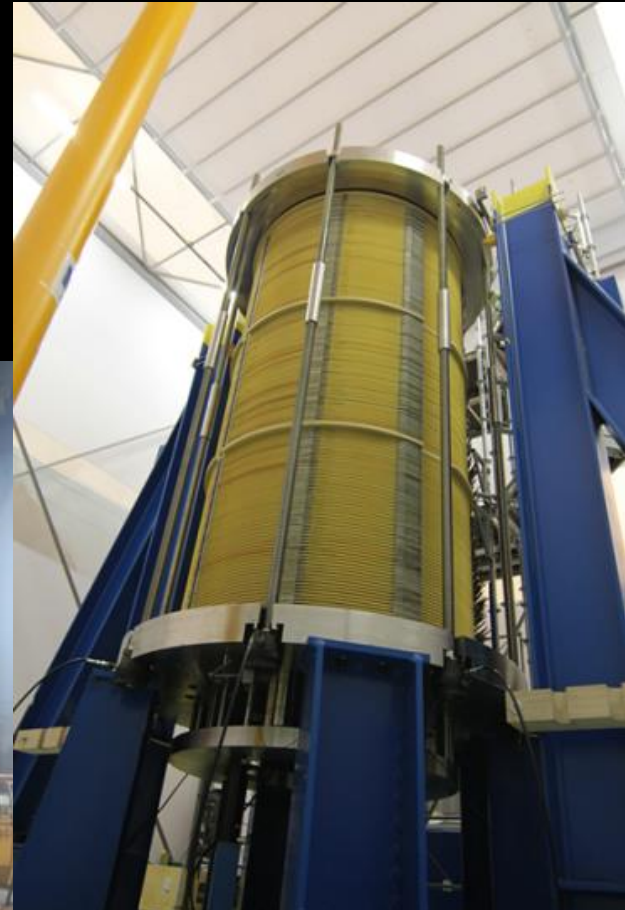
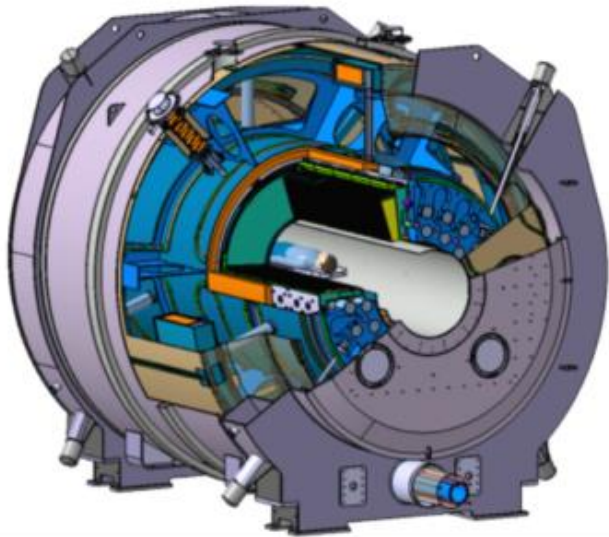




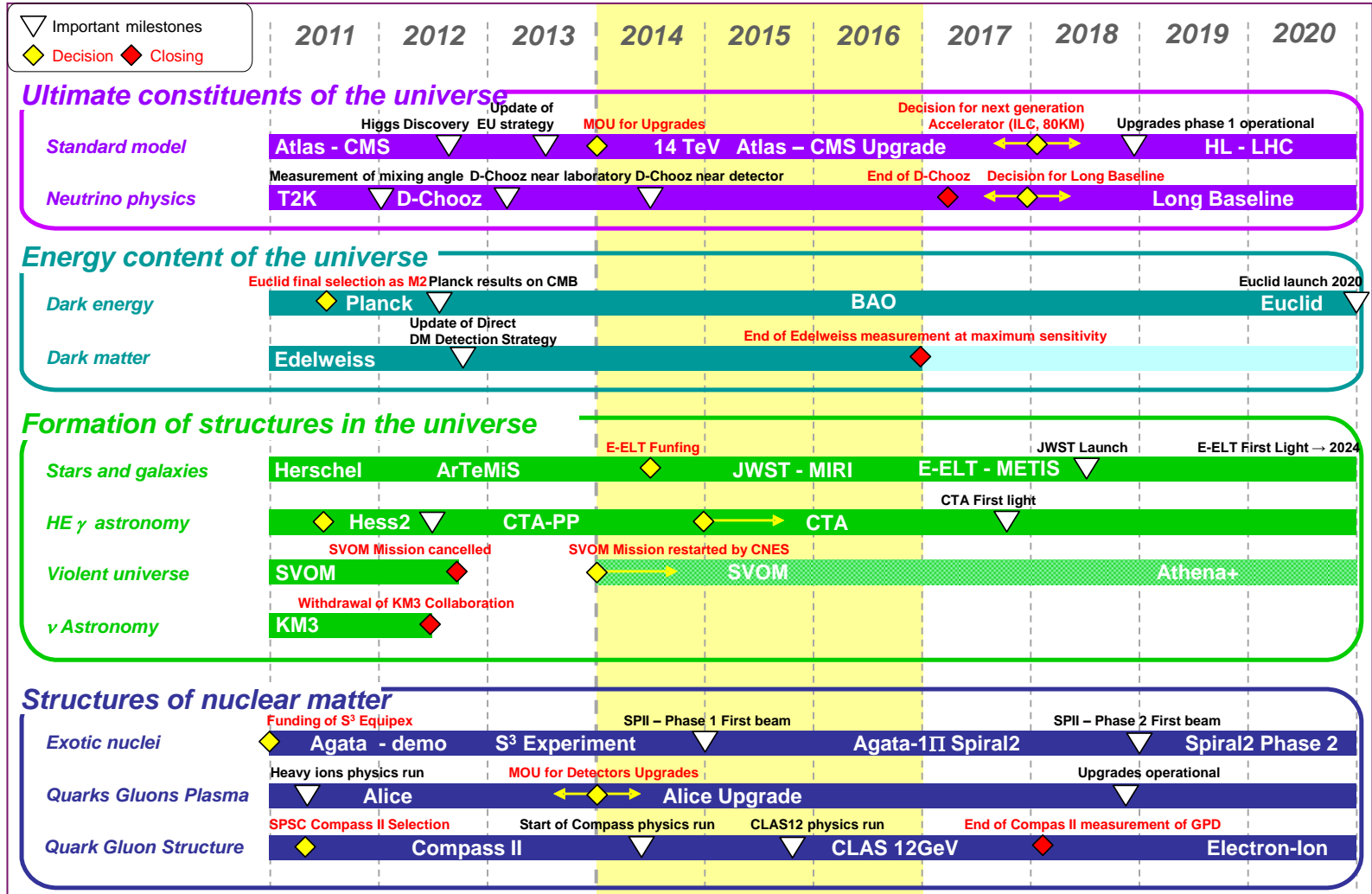
**The GLAD magnet for FAIR**



# ISEULT : WHOLE BODY MRI MAGNET AT 11.75 T



## Irfu roadmap

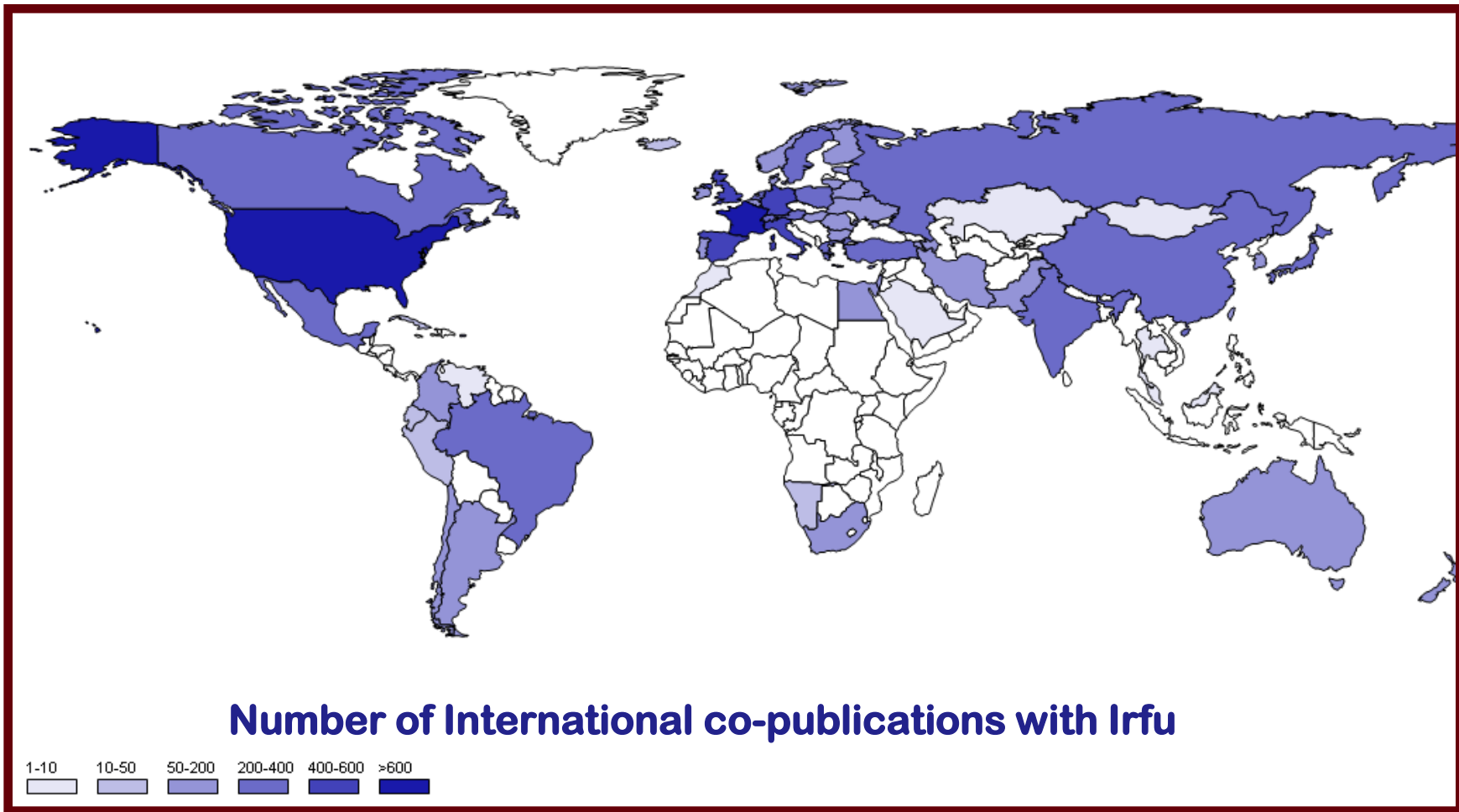


# THINK GLOBAL ...

Research projects inside large international programs  
implying a collaboration with other French and foreign institutions







## Present collaborations with labs in China:

SVOM : an on going collaboration

LIA : call for post doc, PhD, ...

## Future collaborations :

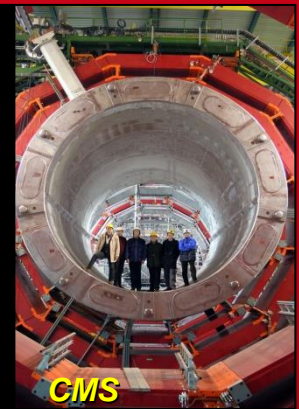
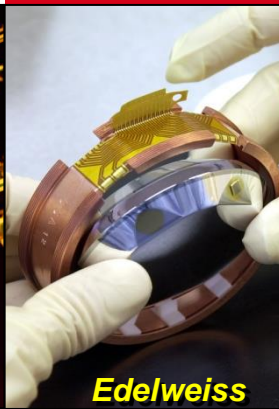
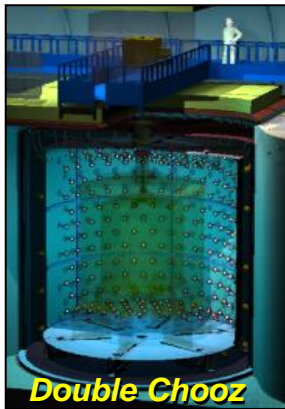
With Beijing (IHEP) : on hadronic and particle physics

With Lanzhou (IMP) : on nuclear physics and associated electronics and detectors development ⇒ MoU ongoing on FAIR and super FRS magnets

## Possible future collaborations :

On ADS development

Thank you for your  
attention.



*Interpreting radiations from the Universe.*