

# Les activités sur l'énergie nucléaire au sein du GDR SciNÉE

## Activities on nuclear energy within the GDR SciNÉE

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➔ <http://lpsc.in2p3.fr/SCINEE>

- **Scope of the GDR SciNÉE**
- **Structure of the GDR versus IN2P3**
- **Scientific approach**
  - ➔ **Activities and projects**
- **Actions of the GDR**
  - ➔ **The prospective exercise**
- **Conclusion**

« **Sciences Nucléaires pour l'Énergie et l'Environnement** »

« Nuclear Sciences for Energy and the Environment »

Created on January 1<sup>st</sup> 2018 for 5 years → renewal at the end of 2022

Supported by **IN2P3 & INC**

Annual operating budget: ~**23 k€** (78% IN2P3, 22% INC)

CNRS: Sections 01 & 13 (& 15)

CNU: 29 & 31, 33

Labs: CENBG (LP2I), CSNSM (IJCLab), GANIL, IPHC, IPNL (IP2I), IPNO (IJCLab), LPC  
Caen, LPSC, Subatech, **CEMHTI, ICCF, ICN, ICSM, IRCER, NIMBE, SPMS, UCCS, UMET,**  
**Synchrotron SOLEIL**

## The GDR is an animation tool, its missions are:

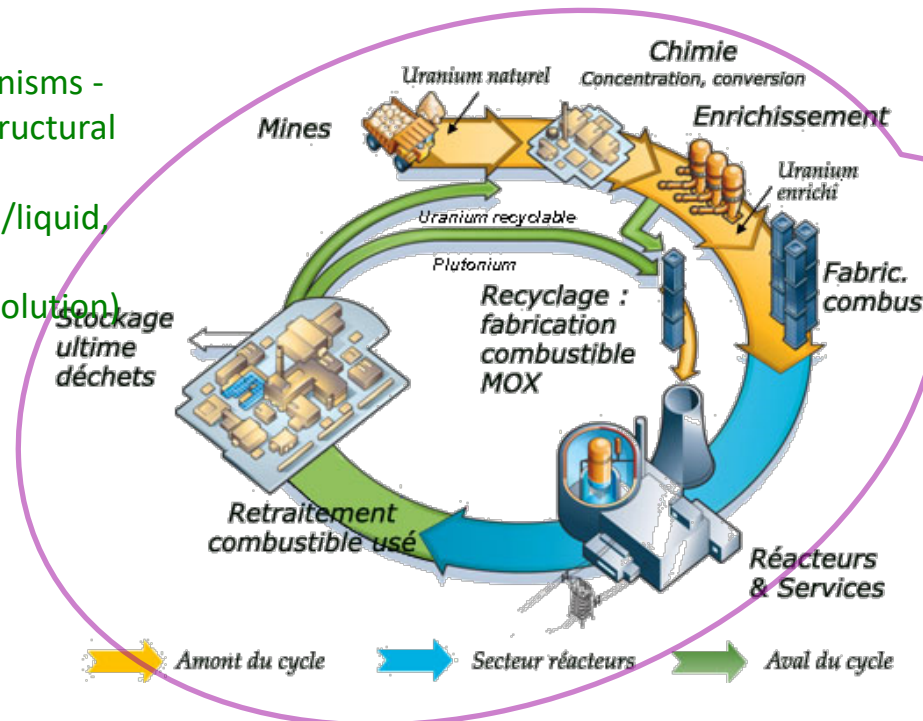
- **to gather the IN2P3 and INC researchers** involved in the nuclear energy and environment theme for their competences in nuclear sciences (communities especially coming from the CNRS interdisciplinary programs)
- **to animate the community** (no project budget) on the scientific level (propose workshops, support actions), within and between themes
- **to structure CNRS actions**, especially with respect to partner organizations (interface with the management of the Institutes)
- **to encourage the emergence of new projects with our partners in order to respond to calls for projects from the funding agencies**, to identify transversal theses
- **to broaden the vision of young people** on the theme and **make young people more visible**
- **to give visibility** to the theme
- **to offer a framework to carry out prospective studies in our Institutes, to prepare evaluations**
- **to support training actions, schools (Ecole Joliot-Curie 2019)**

## Topics

### Present & Future nuclear industry

#### Nuclear materials

- Radiation damage mechanisms - Understanding of microstructural evolution
- Material behavior at solid/liquid, and liquid/gas interfaces (radiolysis, corrosion, dissolution)



#### Behavior and impact of radionuclides (RN) in the environment

- Measuring / mapping radioactivity
- Speciation of radioelements
- Mechanistic description of the behavior of radioelements

#### Radiochemistry and chemistry of the nuclear fuel cycle

- Physico-chemistry of actinides

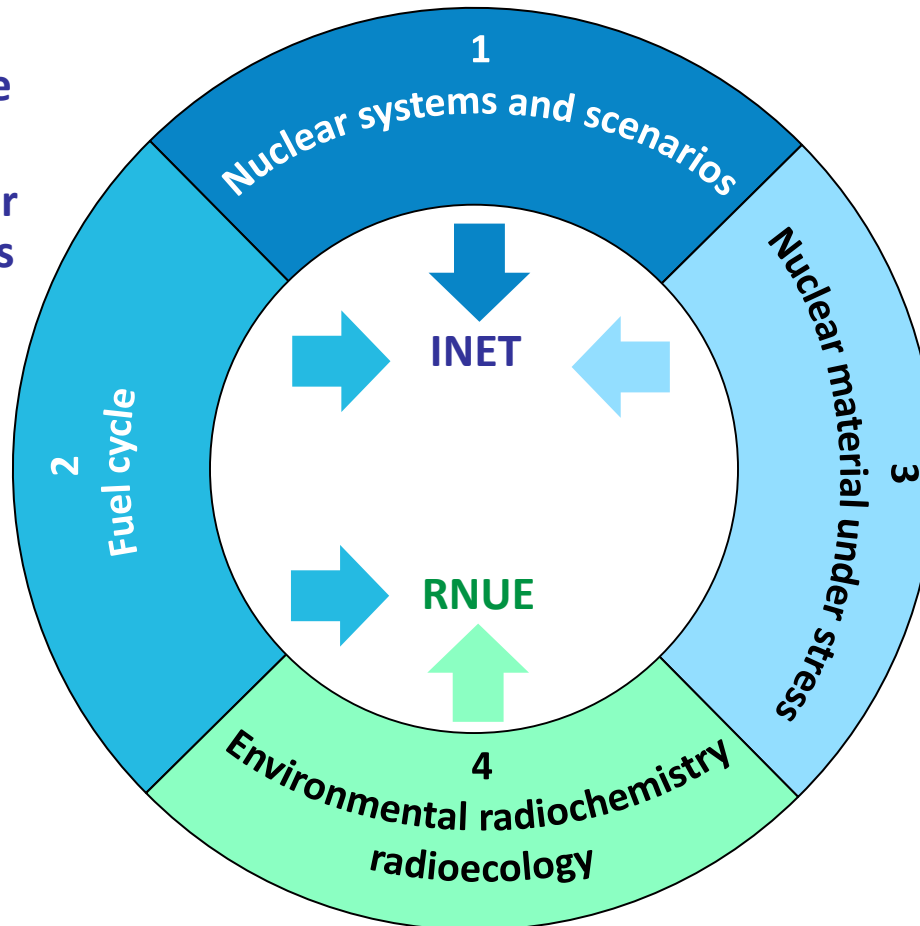
#### Nuclear reactors and associated nuclear data

- Nuclear data measurement, modelling, evaluation
- Neutronics and thermohydraulics models, sensitivity analysis
- Fuel cycle and interdisciplinary scenarios

# Structure of the GDR / IN2P3

- 4 thematic poles for an animation representative of the diversity of our research:

**IN2P3 programme  
« INET »  
Innovative Nuclear  
Energy Techniques**

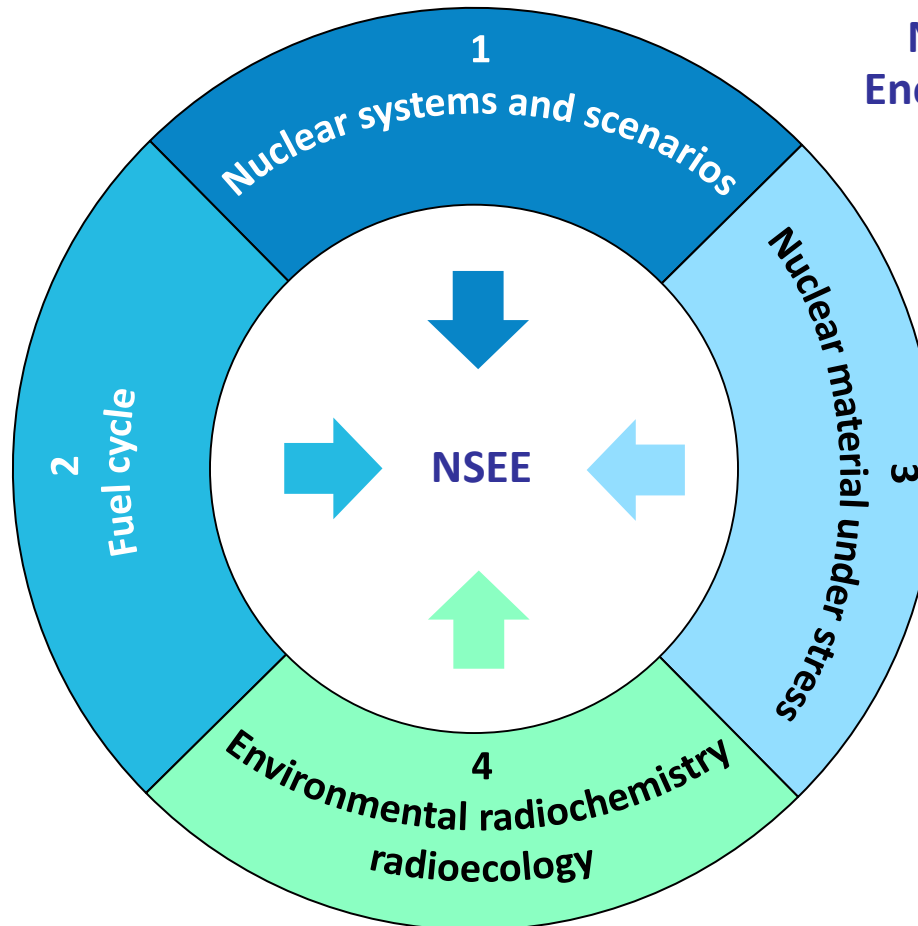


**IN2P3 programme  
« RNUE »  
Radionuclides in  
Environment**

# Structure of the GDR / IN2P3

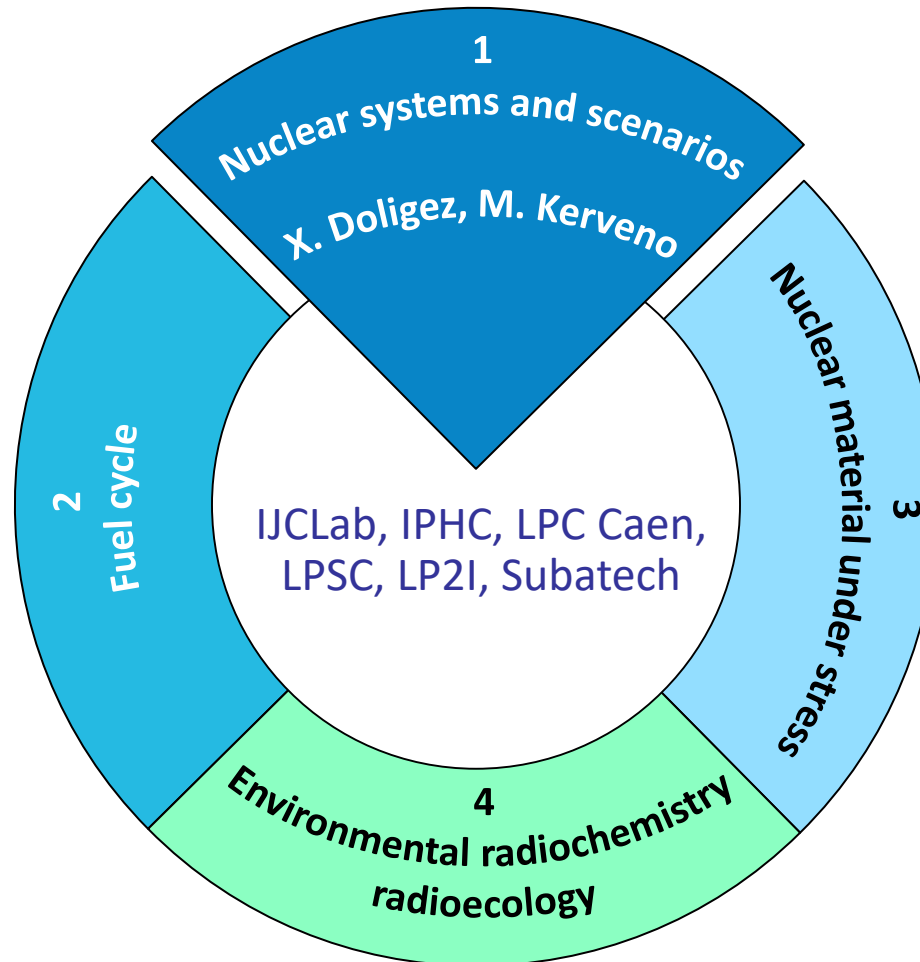
- A possible evolution ?

IN2P3 programme  
« SNEE »  
Nuclear Sciences for  
Energy and Environment



# Structure of the GDR / IN2P3

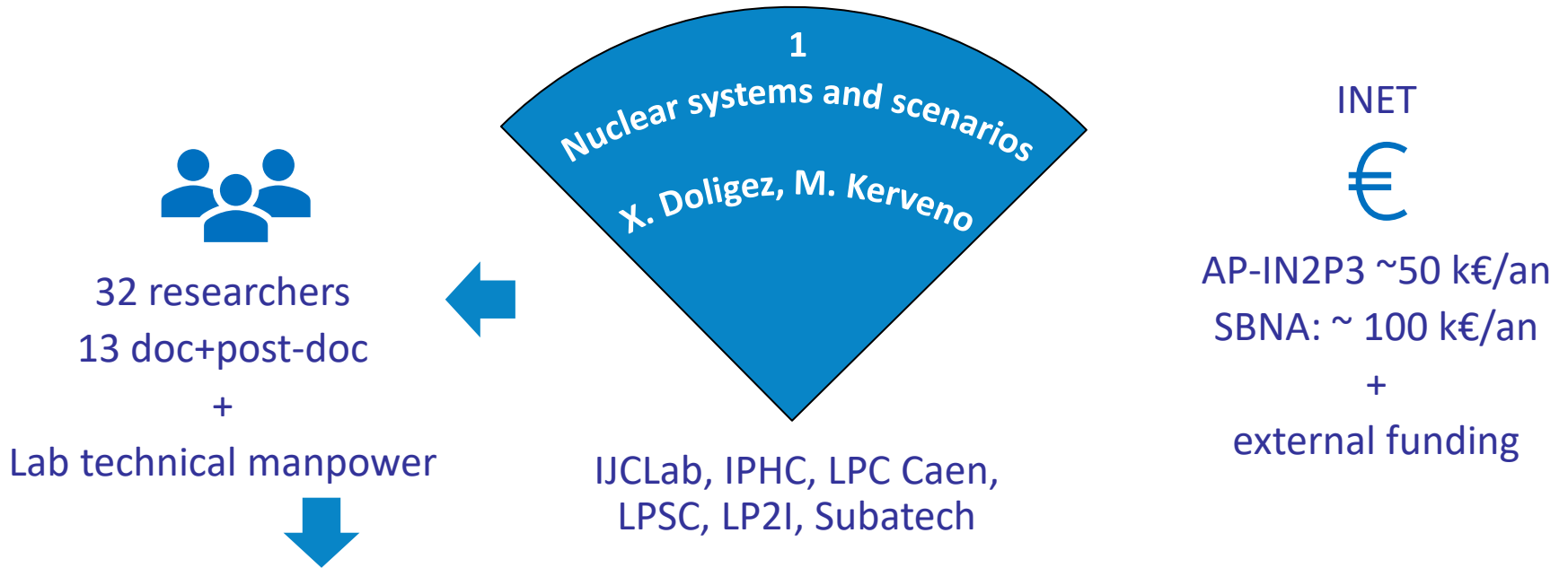
- Activities reviewed by the SC today belong to pole 1 whose specificity is to concern only IN2P3 staff





# Structure of the GDR / IN2P3

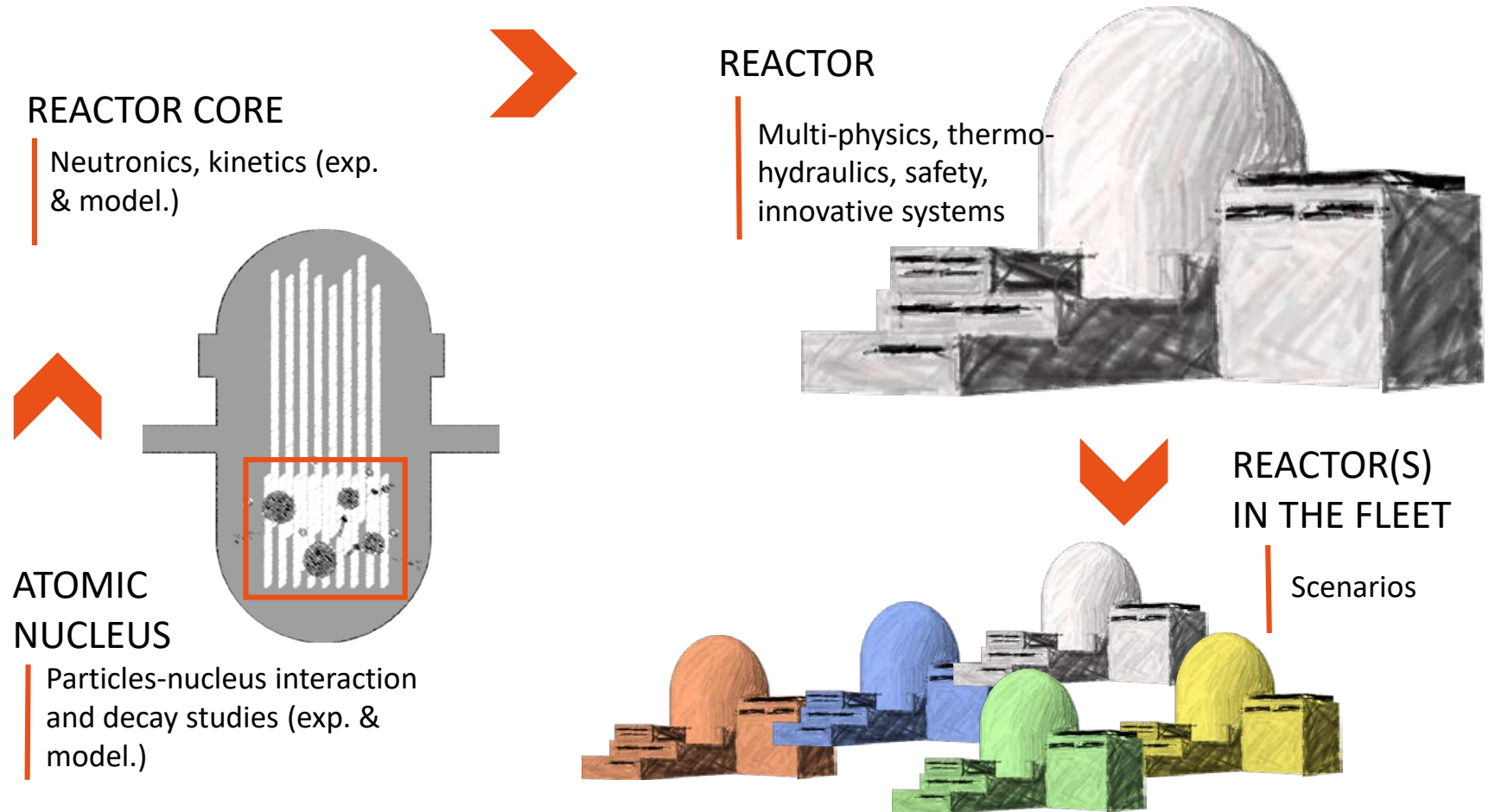
- What resources



	IJCLab	IPHC	LPCC	LPSC-1	LPSC-2	LP2I	Subatech
Ch	3	3		3	1	2	2
EC	2		3	7	1	1	4
Post-docs		1					
docs		2	2	3	4		1

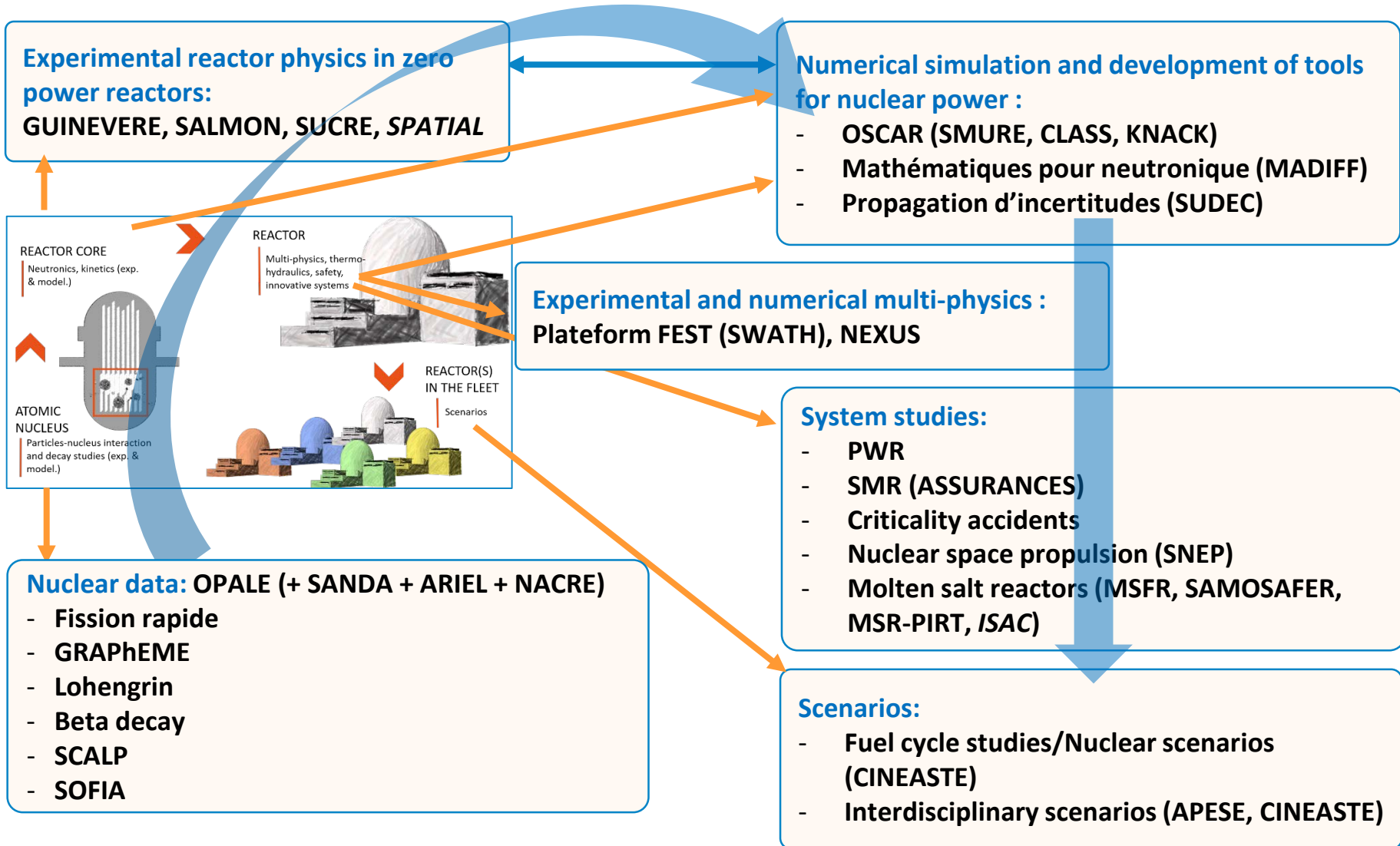
# Scientific approach

## Scientific approach: 4 levels of physics scale

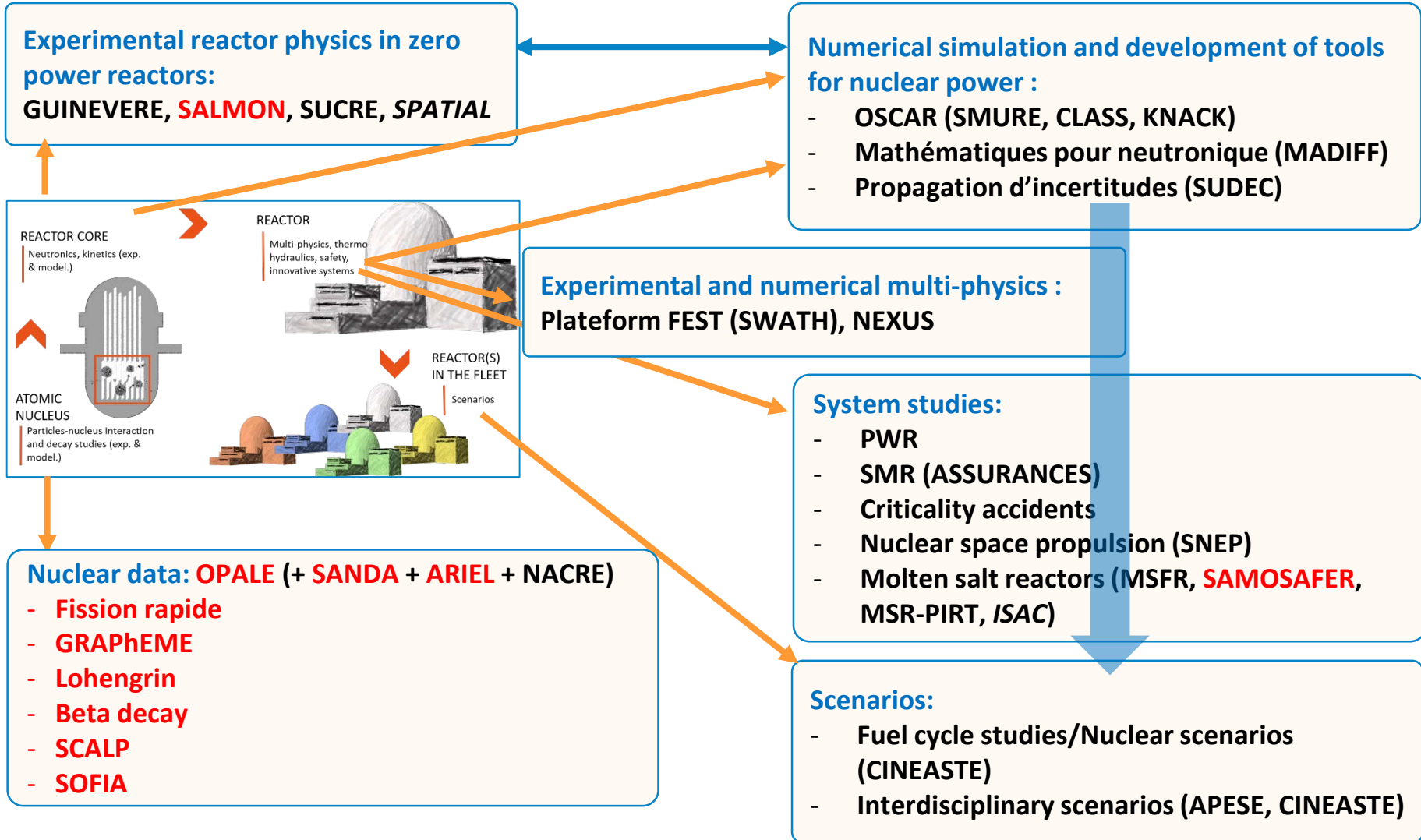


➔ **IN2P3 has the skills and know-how in all these areas : a real asset**

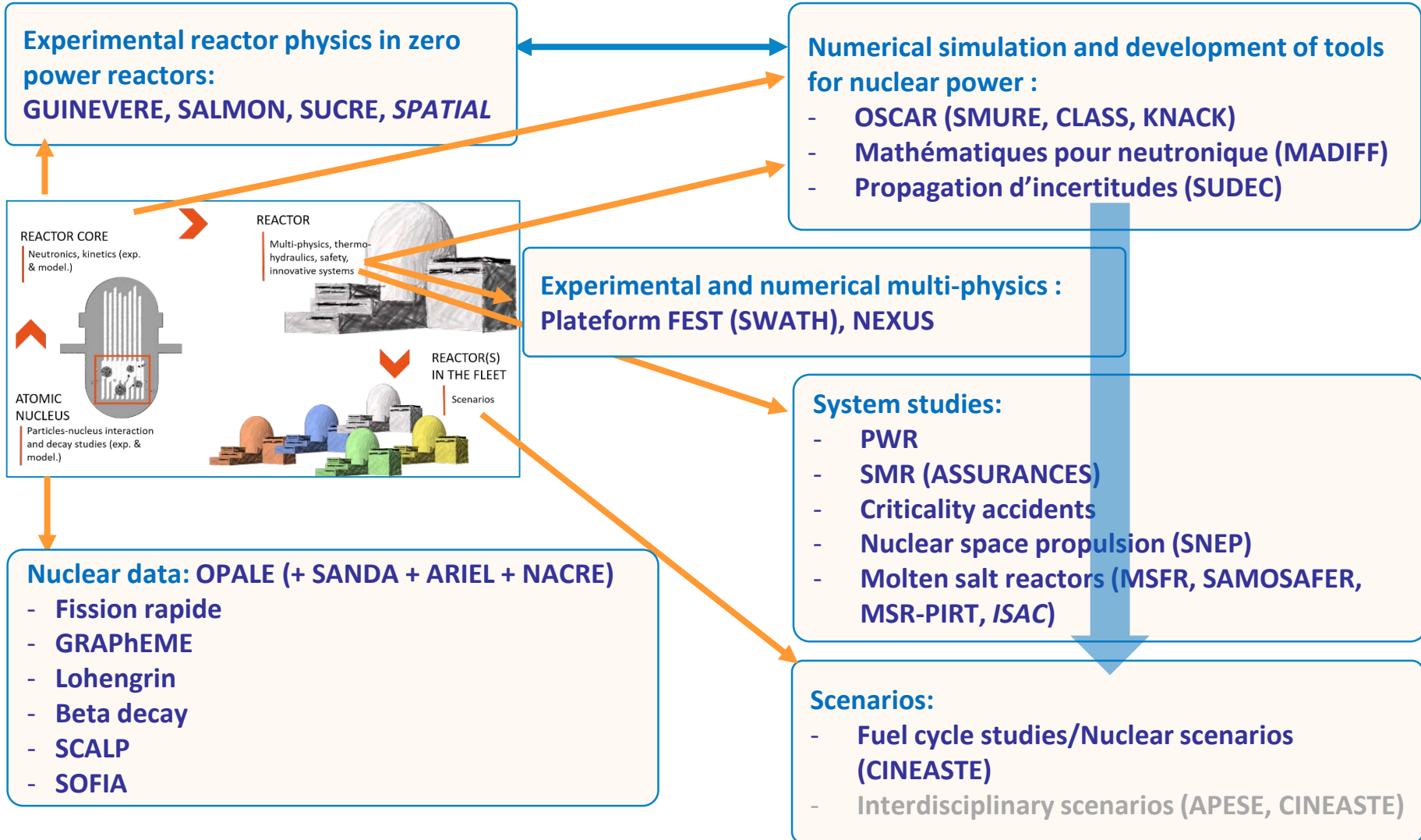
# Activities and projects



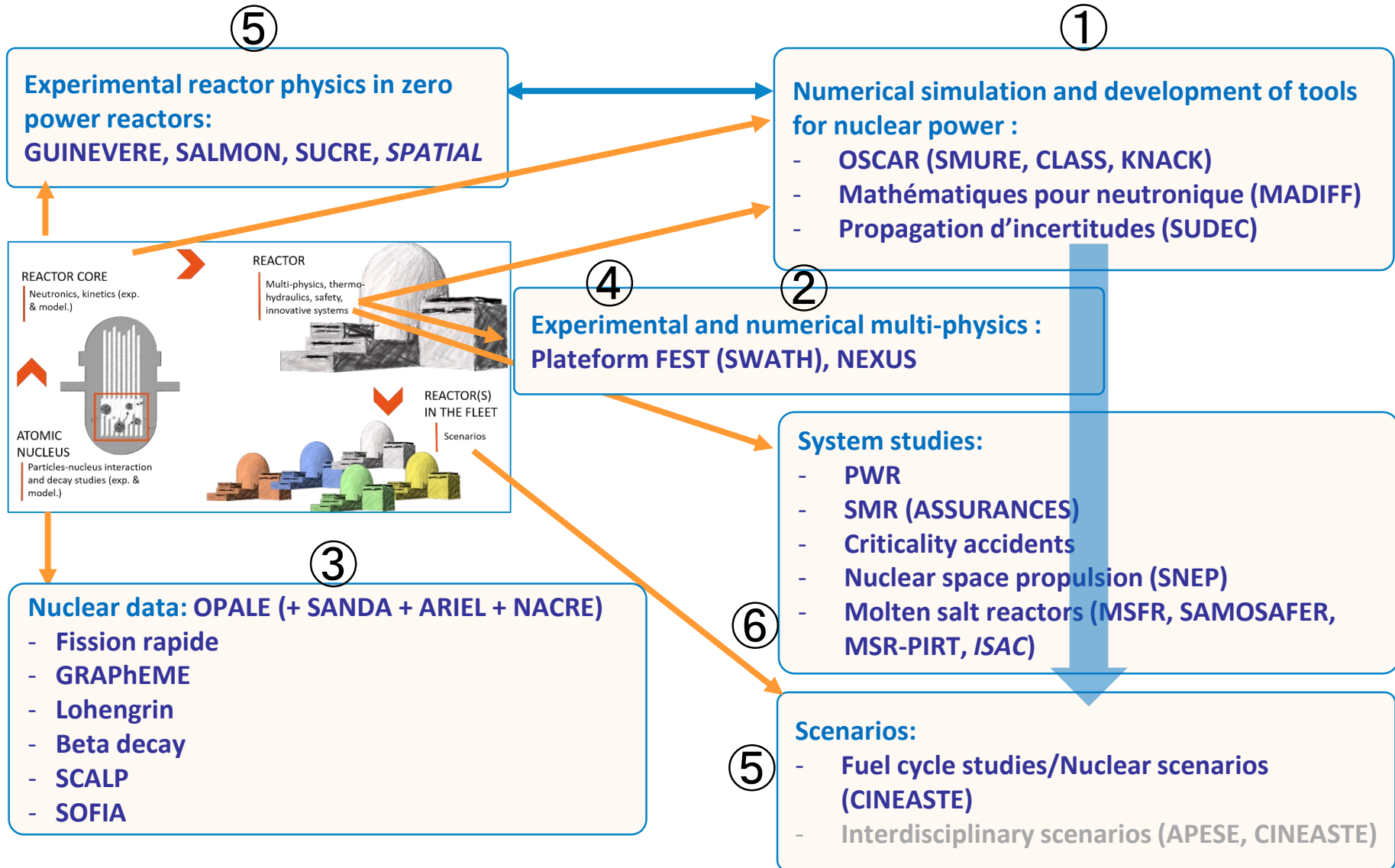
# Activities and projects (NSIP-IN2P3)



# Activities and projects (reviewed today)

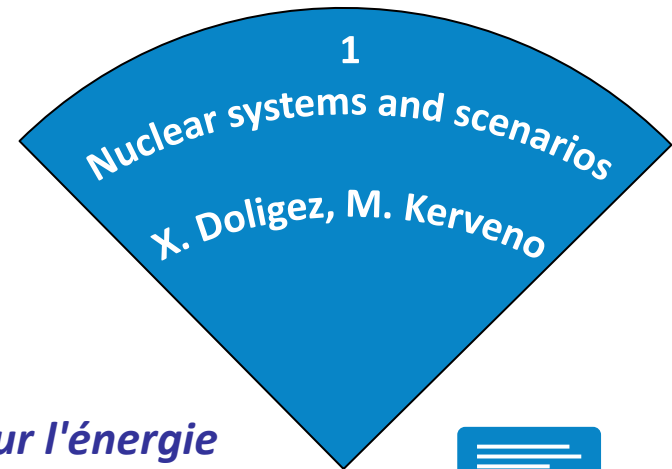


# Activities and projects (reviewed today)



- **Actions of the GDR in connection with pole 1:**

➔ **Internal workshops or with external partners (CEA, IRSN, EDF, ORANO, Framatome...)**



- Workshop "**Quels axes de recherche au CNRS pour l'énergie nucléaire ? Contribution du pôle 1 du GDR SciNEE**" les 6-7 novembre 2018, Orsay
- Workshop "**Domages d'irradiation dans les réacteurs nucléaires ; modélisations et expériences à toutes les échelles pour les études de vieillissement**", 13-14 juin 2019, Orléans
- Workshop "**Incertitudes induites par les données nucléaires : de l'usage des mesures aux études réacteurs**": 6-7 avril 2021



# Actions of the GDR

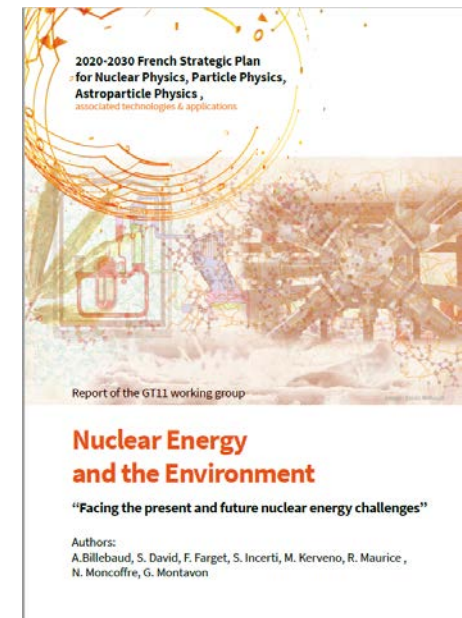
- In 2019 the GDR initiated a collective reflection for the **IN2P3 prospective exercise (2020-2030)** of the GT11 working group:

→ 2 collective proposals  
+ 2 topical proposals

→ **Science Driver: *Exploring the potential of nuclear energy for the future and its impact on resources, wastes and costs***

- **Meeting these challenges requires**

- to build nuclear databases as complete and accurate as possible
- to build relevant modelling of neutron fields at all reactor scales
- to deepen the safety aspects of innovative concept (MSFR)
- to build a modern and interdisciplinary modeling of nuclear scenarios





- **Associated fundamental issues**

- Better knowledge of nucleon-nucleus interaction and decay properties of atoms (exp. and theo.)
- Better knowledge of neutronic, thermodynamics, and coupled models... and associated numerical methods
- Innovative reactor physics experiments
- Optimization of reactor models, quantification and propagation of nuclear data uncertainties in scenarios
- Coupling of physical models with a global economic model

➔ **Main axis identified for the future presented :**

- Collective proposals:
  - **Nuclear data**
  - **Reactor physics: open access computing platform of physics models and validation experiments**
- Liquid fuel reactors
- Energy and nuclear scenarios

# Activities reviewed today meet the SD

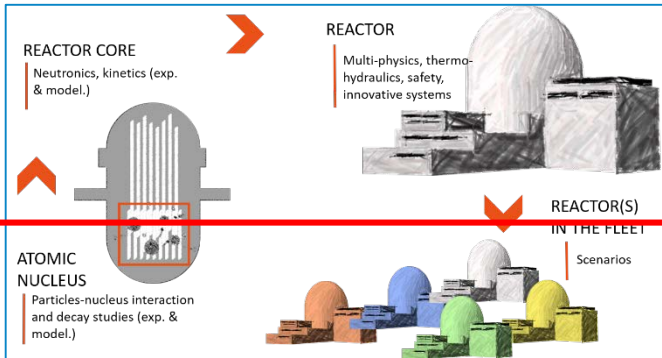
**Reactor physics: open access computing platform of physics models and validation experiments**

**Experimental reactor physics in zero power reactors:**  
**GUINEVERE, SALMON, SUCRE, SPATIAL**

**Numerical simulation and development of tools for nuclear power :**

- OSCAR (SMURE, CLASS, KNACK)
- Mathématiques pour neutronique (MADIFF)
- Propagation d'incertitudes (SUDEC)

**Experimental and numerical multi-physics :**  
**Plateform FEST (SWATH), NEXUS**



**System studies:**

- PWR
- SMR (ASSURANCES)
- Criticality accidents
- Nuclear space propulsion (SNEP)
- Molten salt reactors (MSFR, SAMOSAFER, MSR-PIRT, ISAC)

**Liquid fuel reactors**

**Nuclear data: OPALE (+ SANDA + ARIEL + NACRE)**

- Fission rapide
- GRAPHEME
- Lohengrin
- Beta decay
- SCALP
- SOFIA

**Nuclear Data**

**Scenarios:**

**Energy and nuclear scenarios**

- Fuel cycle studies/Nuclear scenarios (CINEASTE)
- Interdisciplinary scenarios (APESE, CINEASTE)

- **Assets/Strengths of iN2P3**

- **Academic approach** of the nuclear issue: credit in a societal issue
- **Collaboration** with the main actors (close collaboration with CEA, IRSN) and industrial players
- Internationally **recognized expertise**

- **Impact of the GDR**

- **Gives a structured vision of the theme (!)**
- Allows to **pilot animation actions in support of the work** of the teams in order **to achieve the objectives set by the prospective exercise**
- Allows to **keep on the long term a coordination of the upstream research** and to **create an open discussion forum with the nuclear players**

