



école  
normale  
supérieure  
paris-saclay



# SEISM Institute

*Seismology and Earthquake engineering for rISK assessMent Paris  
Saclay Research Institute*

Evelyne FOERSTER (CEA)

[www.institut-seism.fr](http://www.institut-seism.fr)

# The SEISM Institute at a glance

Seismology and Earthquake engineering for rISk assessMent Paris Saclay Research Institute

## A scientific interest group

The SEISM Institute has been created in 2012 by:

The mission of the Institute is to gather the expertise of the different partners (~30 permanent research staffs) in seismic risk from fault to the structure, and to become a center of international reference in the field.



## Scope: from fault to structure



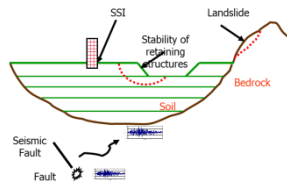
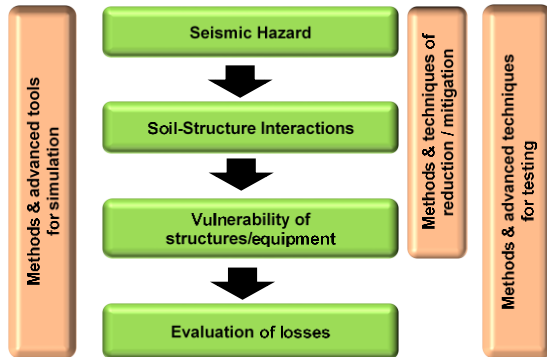
• Normal risk



• Special risk



## Scientific Roadmap: 7 research axes



## Experimental Facilities



Pseudo-dynamic testing  
ENS Cachan ([www.lmt.ens-cachan.fr](http://www.lmt.ens-cachan.fr))



Tamaris test facilities ([www.tamaris.cea.fr](http://www.tamaris.cea.fr))  
CEA Saclay

## Numerical modeling

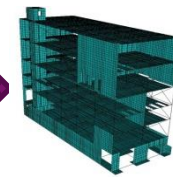
### Structures



([www-cast3m.cea.fr](http://www-cast3m.cea.fr))



([www.code-aster.org](http://www.code-aster.org))



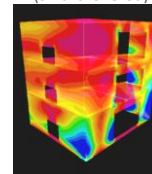
### Wave Propagation & SSI

MISS3D  
SEM3D  
CeaMka3D  
GefDyn  
...



## Example of collaborative projects

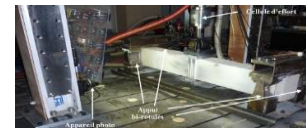
• Benchmark: SMART  
([smart2013.eu](http://smart2013.eu))



ANR Project:



• PhD on Damping identification (2012)



## Main objectives

- Coordinate and promote research activities of partners
- Develop research programs to meet calls for proposal
- Contribute to the education and training programs (MSc and PhD students, engineers)
- Contribute to transfer knowledge to industry (regulation, ...)
- Develop relations between the communities of researchers involved in the analysis of seismic risk in France and abroad.

## More information

Web site: [www.institut-seism.fr](http://www.institut-seism.fr)

### Contacts

Director: [evelyne.foerster@cea.fr](mailto:evelyne.foerster@cea.fr)

Deputy director: [faiza.sefta@edf.fr](mailto:faiza.sefta@edf.fr)

# About the « team »

Researchers & technicians (experimental facilities)



~15



~2



~6



~3

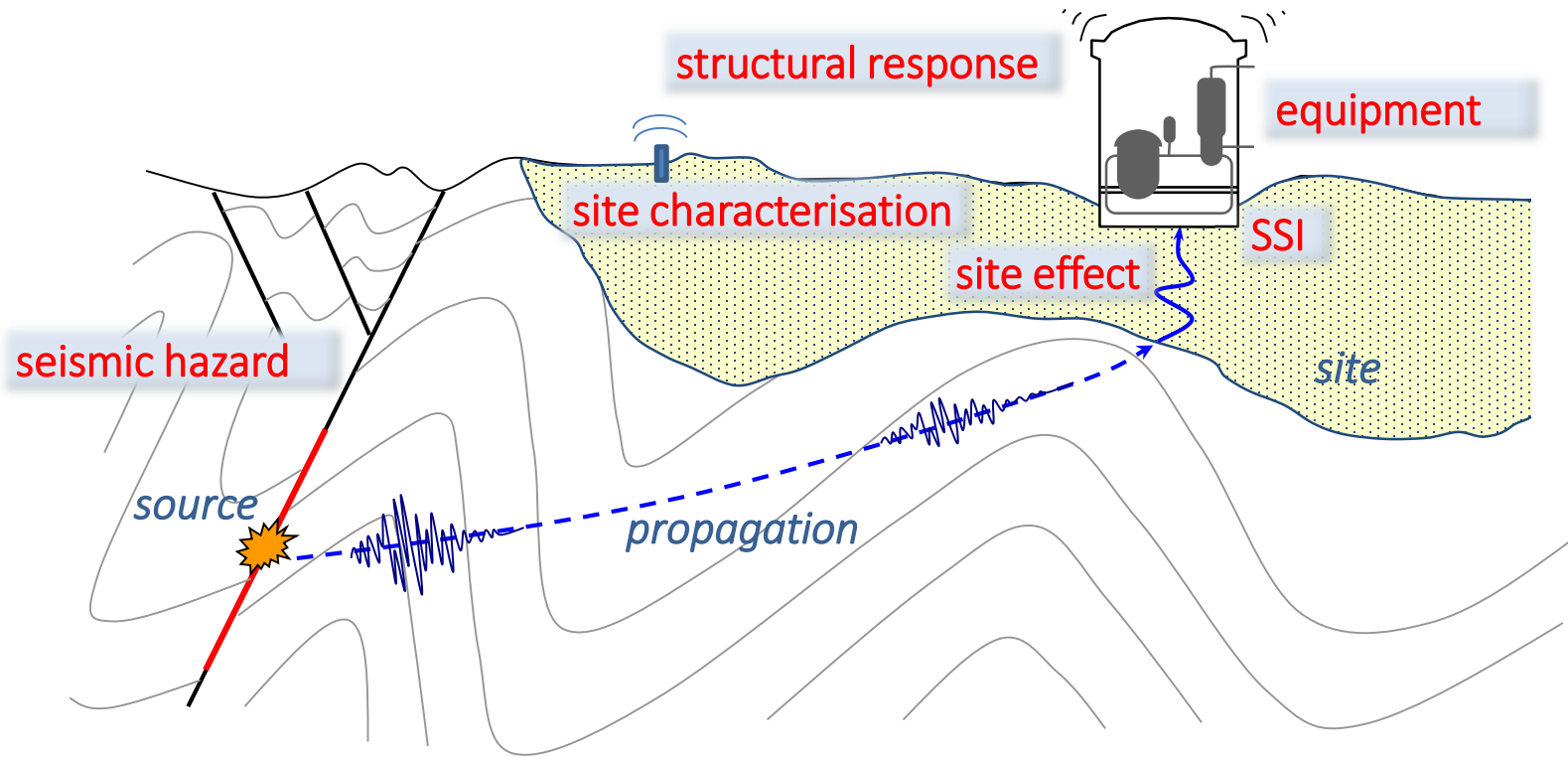


~7

Students: PhDs (>20), postdocs (>5), masters, ...

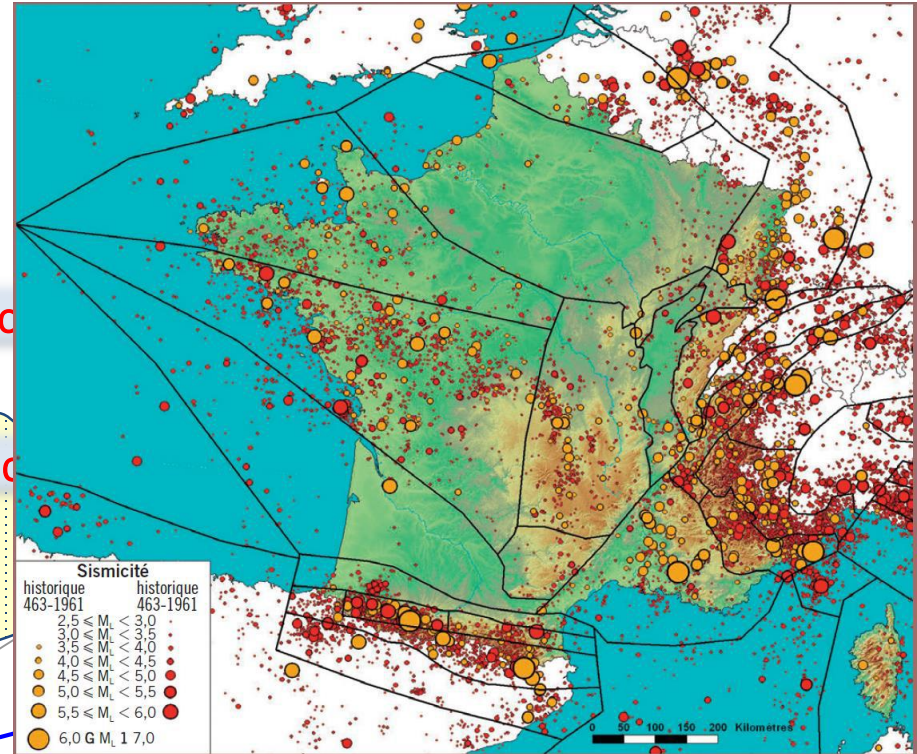
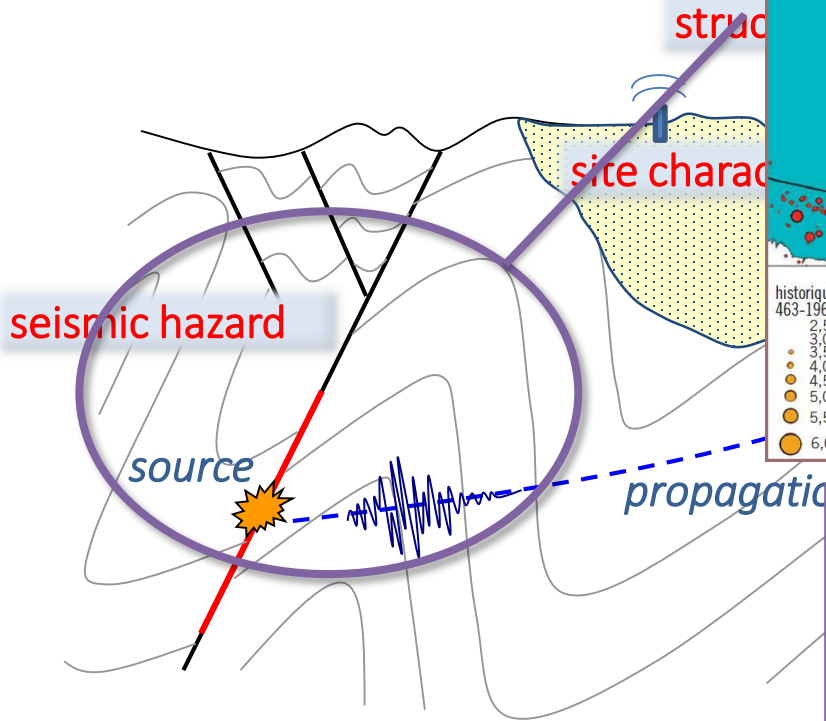
# An integrated vision

...from fault to structures



# An integrated vision

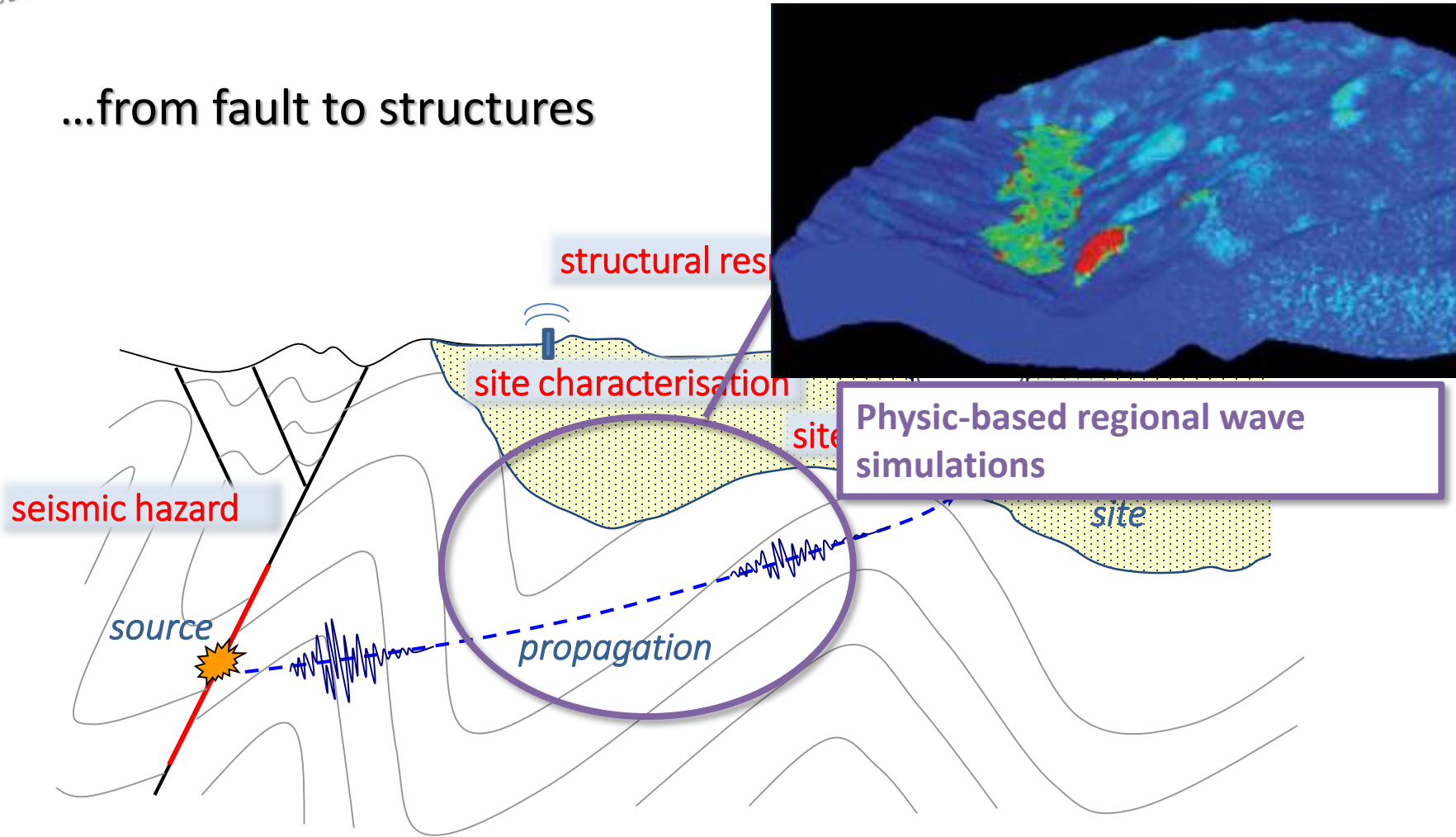
...from fault to structures



Historical seismicity and recent earthquakes characterized by instrumental measurements over the French territory, seismotectonic zoning

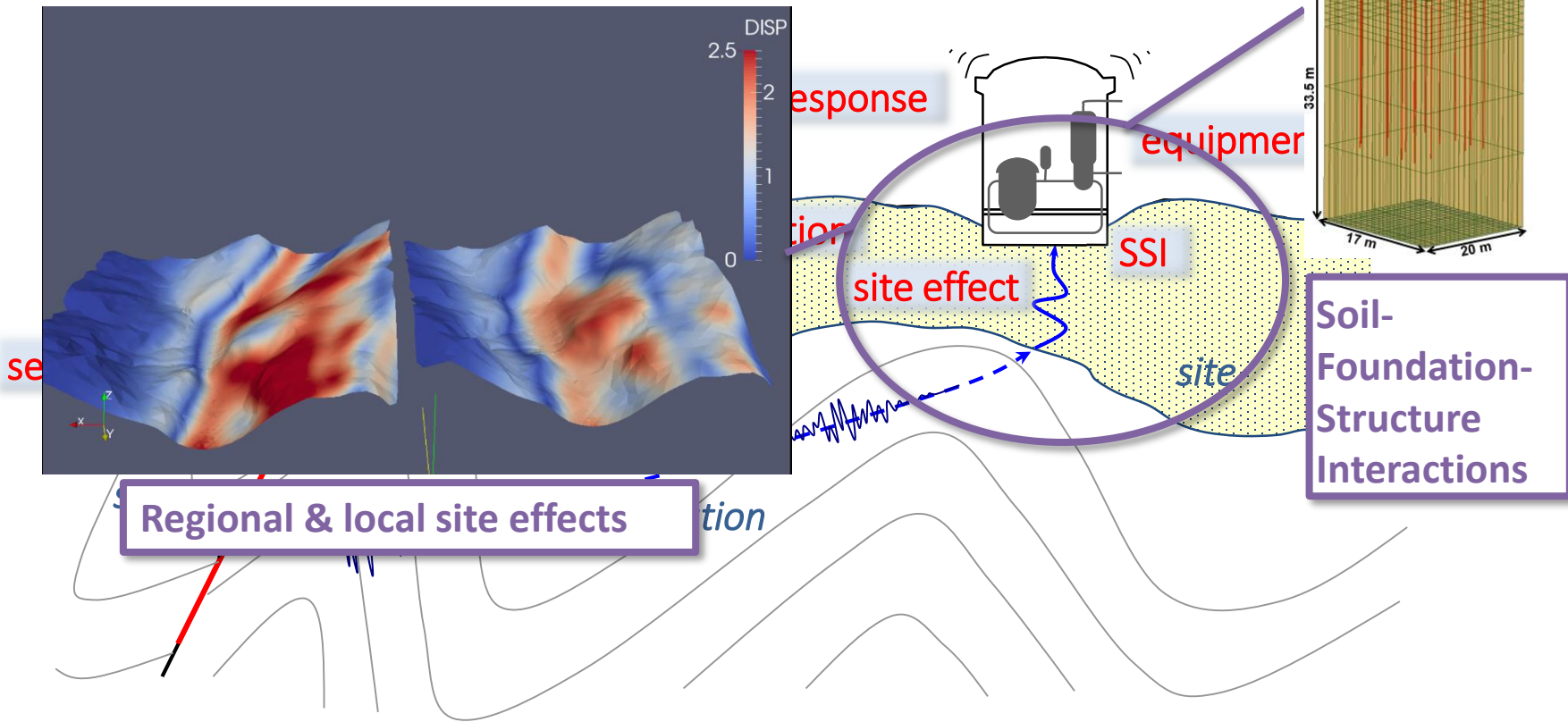
# An integrated vision

...from fault to structures



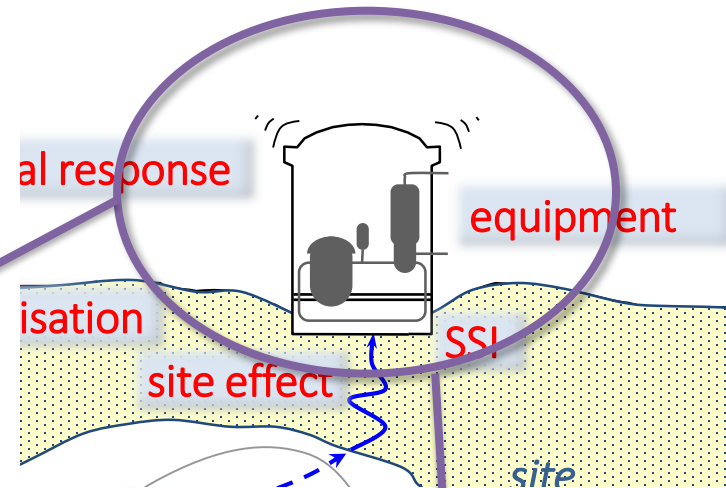
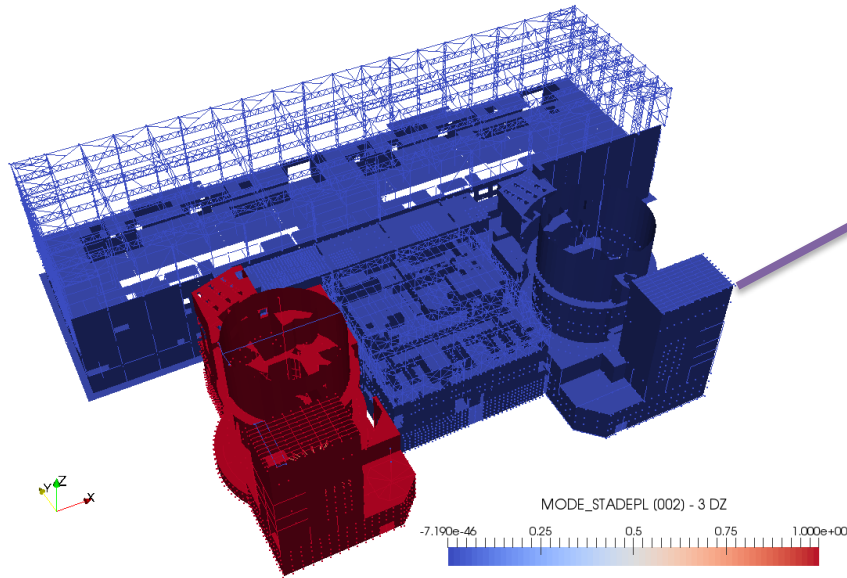
# An integrated vision

...from fault to structures

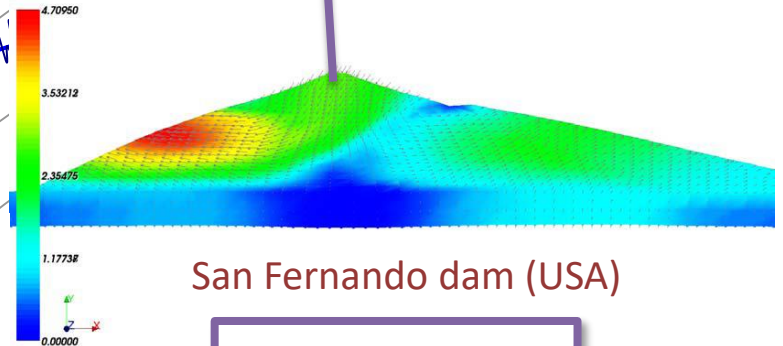
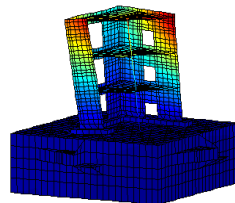
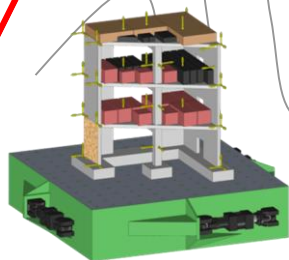


# An integrated vision

...from fault to structures



Vulnerability of civil engineering structures

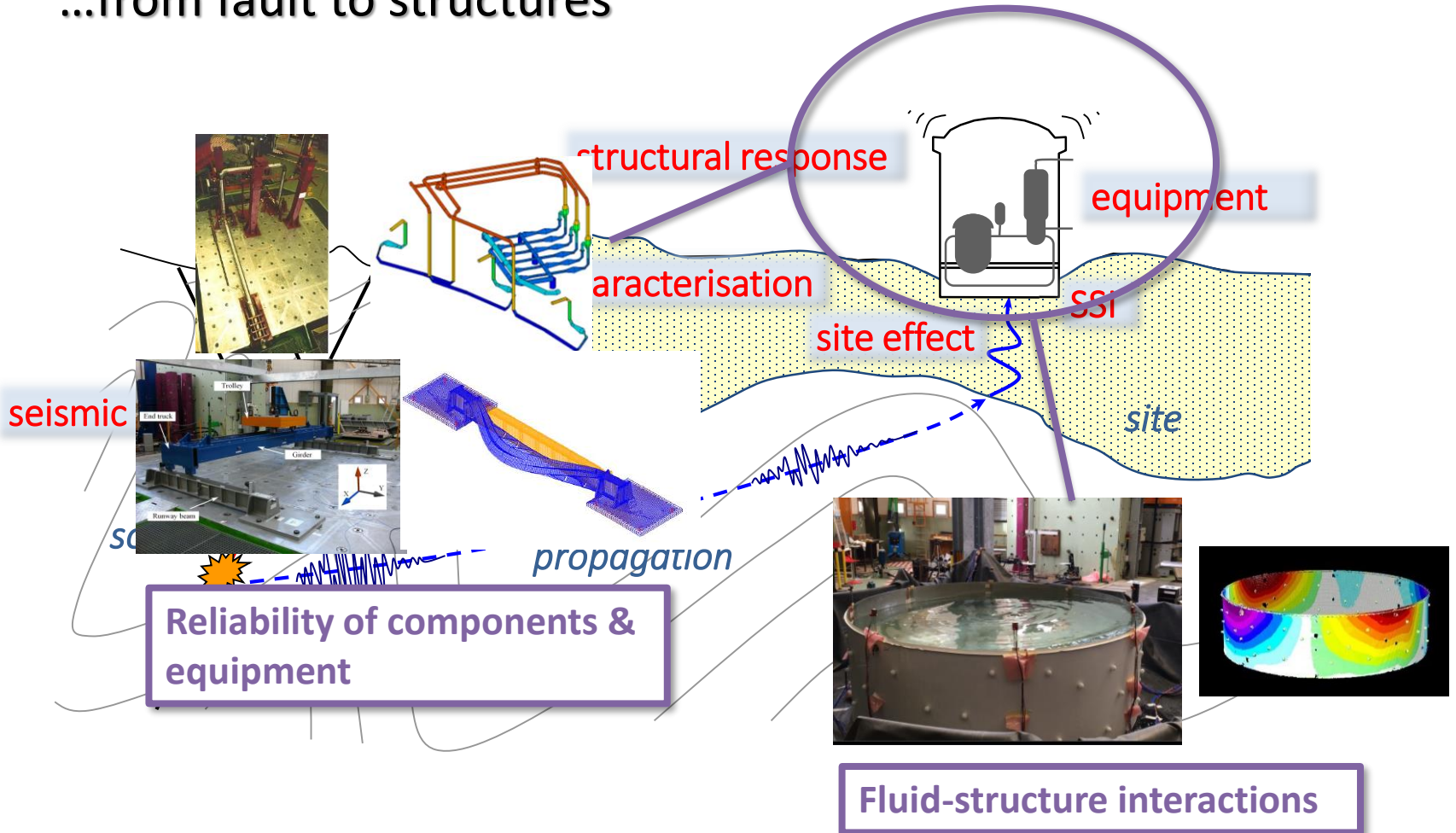


San Fernando dam (USA)

Dams and levees

# An integrated vision

...from fault to structures



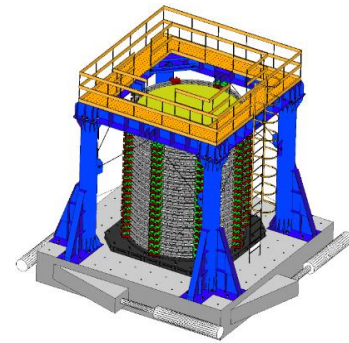
# Example of projects

## **ISOLATE** *Characterizing and Improving SOILs Against Liquefaction (2018-2021)*

**Objective** : improve characterization & simulation methods to predict liquefaction in soils and to propose mitigation techniques (BIOCALCIS)

⇒ Physical testing with various methods at different scales: lab (triaxial, centrifuge, shaking table, ...) and in situ

⇒ Improving/developing numerical approaches for liquefaction & post-liquefaction simulation



*Large laminar container for shaking table*

**Consortium** : IFSTTAR, CEA, CentraleSupélec, Ponts ParisTech, EDF, Solétanche-Bachy

# Example of projects

## ILISBAR (2017-2021)

**Objective** : characterize the dynamic behavior of retrofitting measures (composites) for RC structures at different scales (REV, structural elements)

⇒ Physical testing (shaking table, ...)

⇒ Proposing and implementing a suitable constitutive model (Cast3M)

**Consortium** : ENS Paris-Saclay, CEA, Claude Bernard Lyon Univ., IFSTTAR

## EXAMIN (2017-2021)

**MODULATE** *Modeling lOng-perioD groUnd motions, and assessment of their effects on Large-scale infrAsStructurE*



**Earthquake and NPPs:  
improving and sustaining safety**

# Example of projects

## SERA (2017-2020)

Seismology and Earthquake Engineering  
Research Infrastructure Alliance for Europe

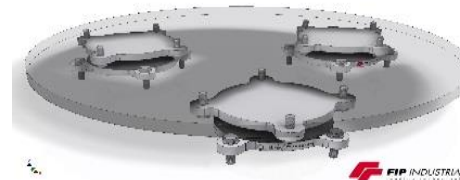
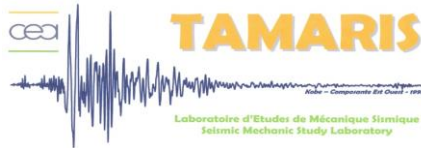
Call INFRAIA-2016-1 : “Research Infrastructures for earthquake hazard”

**Objective :** improve the access to data, services and research infrastructures, and deliver solutions based on innovative R&D in seismology and earthquake engineering

**Consortium :** 31 European partners (regrouping NERA + SERIES) ; coord. : ETHZ

### TNA:

- ⇒ FUTURE: “Full-scale experimental validation of steel moment frame with EU qualified joints and energy efficient claddings under Near fault seismic scenarios”
- ⇒ SEREME: “SEismic RESilience of Museum contEnts ”



- ⇒ IMPEC: "On the broadband synthetic signals enhancement for 3D Physics based numerical analysis, the EUROSEISTEST Case study"



# Example of projects



## NARSIS

**New Approach to Reactor Safety ImprovementS (2017-2021)**

**EURATOM NFRP-2016-2017-1** : “Continually improving safety and reliability of Generation II and III reactors”

**Objective** : improve Probabilistic Safety Assessment procedures of NPPs in case of external natural hazards (earthquake, tsunami, flooding, extreme weather)

- ⇒ An integrated risk framework for safety analyses (severe accident)
- ⇒ Scenarios with single or multi (combined or cascade) hazards
- ⇒ Physical & functional fragilities and interdependencies
- ⇒ Human factors

**Consortium** : 18 European partners; coord.: CEA



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Thank you!

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