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*SEISM Institute: 2013 Annual Report*

**Reference** SEISM-2014-03



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## SEISM Institute



## Profile

In 2012, the CEA, EDF, the CNRS, the Paris *Ecole Centrale* and the Cachan *Ecole Normale Supérieure* - all long-standing partners - decided to pool their scientific expertise and skills in seismic risk assessment by setting up the SEISM Paris-Saclay Research Institute (Seismology and Earthquake engineering for Risk assessment).

The members share the ambition to establish a **scientific research centre of European standing at the Paris-Saclay Campus devoted to seismic risk control where they can develop tools and methodologies capable of modelling earthquakes from fault to structure** and focusing on all seismic earth pressure reduction (EPS) issues. The SEISM Institute not only conducts its own research programmes, but is also open to partnerships with R&D organisations, university groups, technical support bodies for safety authorities, and the industry.

The SEISM Institute is registered as a scientific interest group (SIG). The members collaborate while remaining within their own laboratory. The SIG has a operating budget that is voted annually by its steering committee. Among others, it is used to organise seminars and to cover the travel expenses of its scientific council members. The SIG does not have its own budget for research: R&D projects are proposed and financed by partners and through conventional channels via calls for research projects, such as through the French national research agency (ANR), IDEX initiatives of excellence, the EU 7<sup>th</sup> Framework Project and Horizon 2020, and even through international programmes (IAEA, OECD). The SEISM Institute does not currently issue any calls for research proposals with the

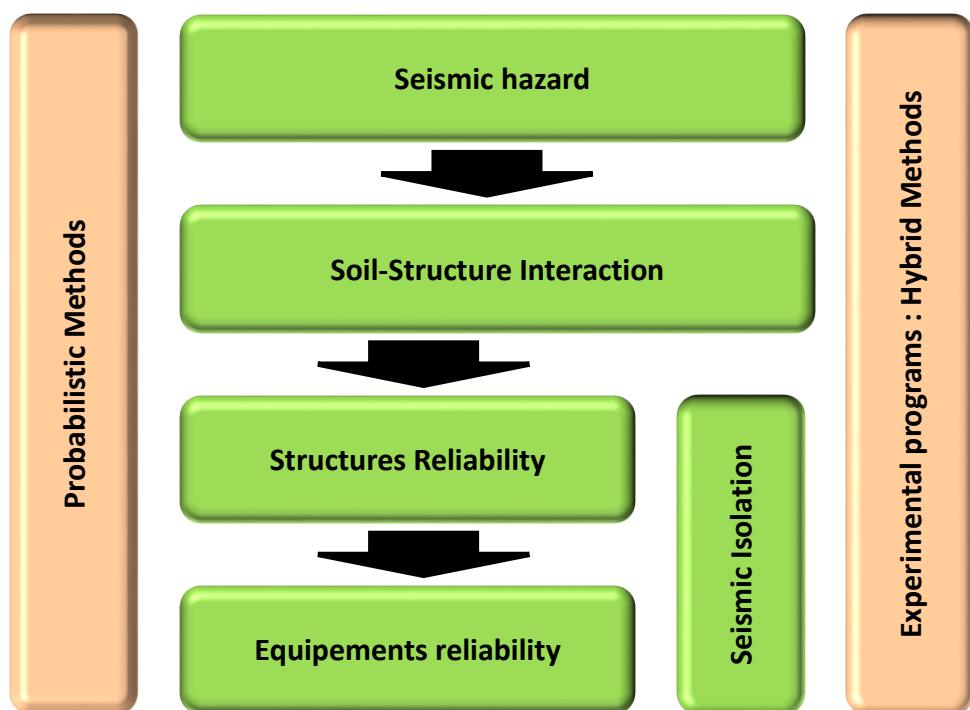
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objective of financing them directly. The Institute is, however, a place where its members and research partners can bring their research projects for gestation and development before submitting them via the above-mentioned channels.

It welcomes researchers, trainees, post-doctoral fellows and thesis students working in the different fields of research as defined in the Institute's scientific road map, who thus take part in **training via research**. The Institute also plays a role in disseminating knowledge via **teaching**.

The strength of the SEISM Institute lies its capacity to propose and perpetuate a structure that **supports projects while welcoming staff whose research - involving both experiments and modelling – aims at making progress in earthquake engineering**.

The SEISM Institute is structured around the following fields of research according to which its scientific road map has been defined:



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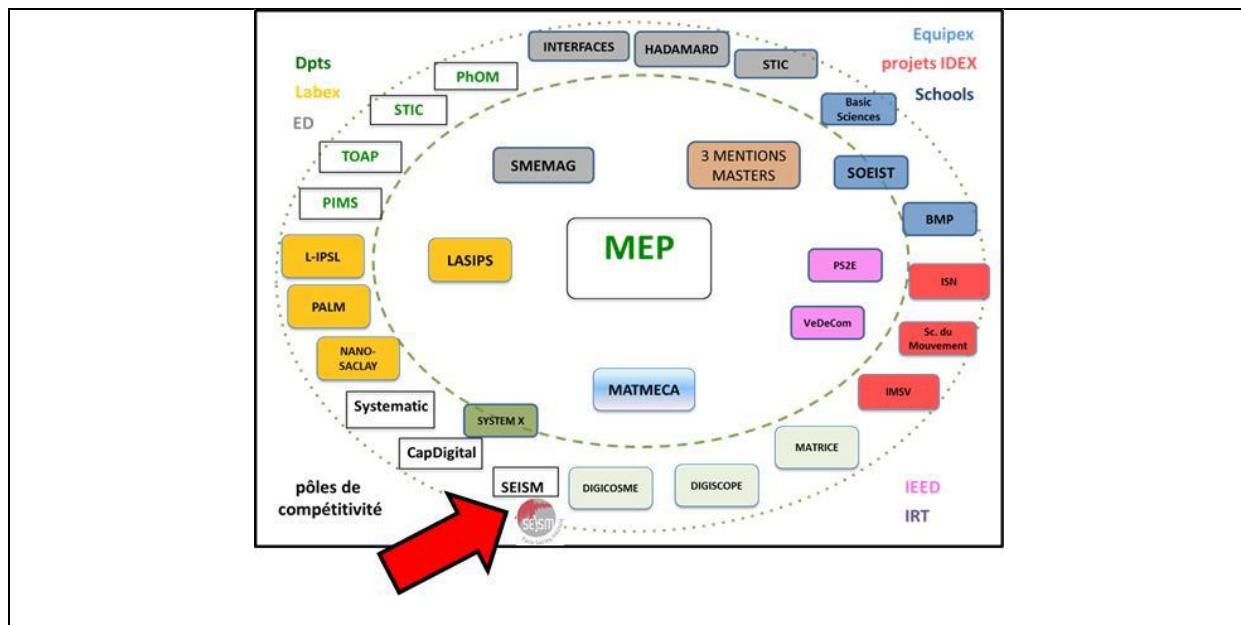
The SEISM Institute relies primarily on experimental means of European standing, such as the TAMARIS facility, to fulfil its scientific ambitions. Nonetheless, it intends to develop its experimental and numerical means in the future so as to secure its position on a European level and to provide its laboratory partners with promising research prospects.



<b>Campus Paris Saclay</b> FONDATION DE COOPERATION SCIENTIFIQUE
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The SEISM Institute is fully involved in the creation of the future University of Paris-Saclay:

- The SEISM Institute was identified as a cross-functional project when the **laboratory of excellence** called LaSIPS (*Laboratoire Systèmes et Ingénierie de Paris-Saclay*) was created.
- Within the scope of setting up the **future departments of Paris-Saclay University**, the SEISM Institute has been incorporated into the Mechanics, Energy & Processes Department (MEP), while maintaining close ties with the Earth, Oceans, Atmospheres & Planets Department (TOAP), and the Human & Social Sciences Department (SHS).



## Foreword from the Executive Committee

Predicting the vulnerability of engineered structures and equipment subjected to seismic loads is one of the key points in reducing the impact of earthquakes both on 'standard-risk' buildings (usual constructions and public structures such as hospitals, schools, bridges, etc.) and on 'specific-risk' industrial buildings such as those existing in the nuclear sector.

In October 2010, the French earthquake regulations were revised with the aim of continuously improving the **safety** of populations with respect to **seismic risks**. Two ministerial decrees define the new French seismic zoning strategy to replace the former strategy which was in force since 1991. Thus, some regions barely concerned by seismic risks until recently are now subject to these new earthquake-resistant construction rules **which are applicable to 'standard-risk' buildings and facilities requiring authorisations (environmentally regulated facilities, etc.), and they must justify the earthquake resistance of any existing buildings.**

Europe and its bordering countries are far from being spared by earthquakes, as recalled in the European Strategic Research Agenda on "Earthquake Engineering" published in July 2007, which



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highlights this risk with respect the lack of European investment in earthquake-resistant engineering test facilities.

For **nuclear reactor** safety, improving our knowledge and capacity to simulate the response of structures in the event of an earthquake is a top R&D requirement in the field of accident prevention which has been brought to the forefront by the Fukushima disaster. **Quantifying margins** is a key factor in demonstrating the robustness of any facility.

The impact of an earthquake on engineered structures is far too complex to understand without resorting to significant experimental means, both in terms of identifying models and validating them. Nonetheless, regardless of the test means and their performance, it is almost always impossible to perform tests on entire full-scale buildings. Hybrid tests provide a solution to this restriction as they optimise the test means by dividing the structure into two sub-structures: one tested sub-structure and one simulated sub-structure.

Developing this methodology and this key innovative experimental technology for the future is a scientific hurdle that the SEISM Institute must overcome if it wishes to sustainably remain at the forefront of its field in experimentation. Therefore, its efforts to submit projects on this subject must be maintained.

It should be pointed out that, in 2013, the ambitious project called SINAPS@ "**Earthquakes and Nuclear Facilities: Improving and Perpetuating Safety**" was accepted. **Developed under the SEISM SIG, this project answered the call for projects launched in 2012 by the French National Research Agency (ANR) on the subject of research on radiation protection and nuclear safety (RSNR).** It must help to provide answers to the safety issues highlighted by the French stress tests conducted after the Fukushima accident, particularly in terms of seismic margins. With a total estimated cost of about €12.5 M over 5 years, the ANR has provided €5 M, i.e. 10% of the budget set aside for the 2012 call for projects under the RSNR future investment programme (*programme d'investissements d'avenir - PIA*).

While reaffirming the tasks of the SIG, this annual activity report also details the results obtained in 2013 in the different fields of research as defined in its road map. The results of 2013 will therefore be described in greater detail throughout this report, which the executive committee hopes you will find informative.



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## Key Figures

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The Institute currently relies on **about 40 researchers** and **6 thesis students**. In 2013, it also published about **15 papers and articles in journals with review boards**.

## Scientific Activities at the Institute in 2013

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The Institute set up a governance structure to ensure its scientific management and coordination tasks within the research fields defined in its road map:

- Steering committee which defines the Institute's strategic orientations and related means for implementing these choices
- Executive committee which implements the decisions of the steering committee and carries out day-to-day business
- Advisory scientific council.

The executive and steering committees met twice in 2013.

The first **scientific council** comprises<sup>1</sup>:

- Pierre Sollogoub (AFPS – French Earthquake Engineering Association)
- Georges Magonette (JRC- European Laboratory for Structural Assessment, Italy)
- Roberto Paolucci (Politecnico di Milano, Italy)
- Donat Fäh (Swiss Seismological Service of the ETH Zurich)
- Philippe Renault (Swissnuclear).

The scientific council got together on 8 November 2013 after the 3<sup>rd</sup> annual seminar which was held on 7 November 2013 at the offices of EDF R&D in Clamart. The scientific council both attended and

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<sup>1</sup> The scientific council was joined in early 2014 by Pr. Deodatis from Columbia University, NY

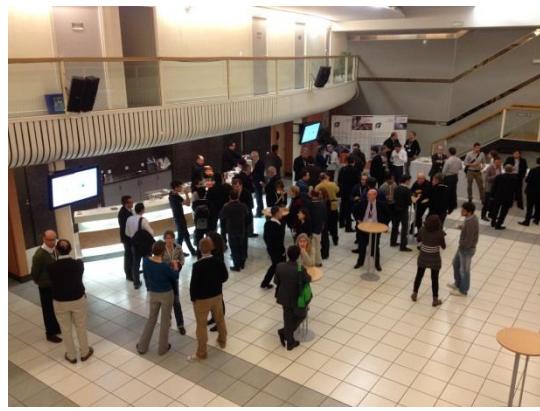


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participated in this seminar. Mr Makris from the University of Patras (Greece) also took part in the seminar.

About 120 people - half of which were external to SEISM - attended the seminar on 7 November 2013, which demonstrates the interest the scientific and industrial communities have for this scientific interest group. Professor Makris from the University of Patras in Greece was the special guest.

The launch of the SINAPS@ project was also announced at this seminar. This project will mobilise the SEISM Institute and 8 other partners (IRSN, AREVA, EGIS, IFSTTAR, Ecole Centrale de Nantes, Grenoble INP, ISTerre and CETE) over 5 years.



The SEISM SIG also organises a number of events on the fringe of its annual seminars to encourage scientific exchanges between researchers:

- Invitation to watch the BRACED tests performed under the SERIES programme
- Invitation to watch the SMART tests
- June 2013: EDF R&D scientific seminar
  - Hydrodynamic calculation of an earth dam using the Aster code - **M. Kham**
  - Substantiation of concrete dams under seismic loads - adjustments to take into account experimental data and non-linearities - **D. Combescure, A. Nieto-Ferro, J. Fouqué**



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## SEISM Institute on the International Scene

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C. Berge-Thierry, the scientific director of the SEISM SIG, had the opportunity to present the SEISM SIG at the 5<sup>th</sup> "Kwang-Hua forum on innovations and implementations in Earthquake Engineering Research" which held in Shanghai , 8-10 December 2012.



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## Theses, Publications and Projects

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In accordance with its scientific road map<sup>2</sup>, the fields of research structuring the activities of the SEISM SIG are:

- Topic 1 [A1]: Seismic events
- Topic 2 [A2]: Ground-structure interactions
- Topic 3 [A3]: Seismic vulnerability of structures
- Topic 4 [A4]: Seismic vulnerability of components
- Topic 5 [A5]: Seismic isolation and reinforcement
- Topic 6 [A6]: Probabilistic methods
- Topic 7 [A7]: Innovative experimental methods

Here below is a summary of the theses that were either defended in 2013 or are currently in progress, including reference to the relevant field of research.

## Theses:

### Defended theses:

- **EDF, Ch. Combescure** "Formulation of a comprehensive model of reinforced concrete slab for seismic applications" - defended on 25 September 2013 [A3]
- **CEA, S.C. Teodorescu**: "Commande de systèmes d'isolation antismique mixte" - defended on 30 September 2013 [A5]
- **CEA, ENSC R. Crambuer** , "Contribution to damping identification : experimental and numerical approaches" - defended on 7 October 2013 [A3]
- **CEA, ENSC, EDF, L. Moutassamy** , "Essais hybrides en temps réel sur structures de Génie Civil" defended on 18 December 2013 [A7]

### Theses in progress:

- **CEA, ECP, P. Tran**, "Effet de l'incohérence spatiale sismique sur l'interaction sol-structure" - in progress - end of contract: 23/11/2014 [A2]
- **CEA, ENS Cachan, E. Kishta**, "Modélisation des éléments de structure en béton armé à l'aide d'éléments finis enrichis plaques/coques" - in progress - Oct 2013 - 10/2016 [A3]
- **CEA, C. Mathey**, "Contribution à l'étude du comportement des structures élancées glissantes et basculantes sous séismes" - in progress - end of contract: 31/12/15 [A4]
- **CEA, ENSC, Maxime Vassaux** "Heterogeneous quasi-brittle materials modeling by means of discrete elements" - in progress - end of contract 31/12/2014 [A3]

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<sup>2</sup> The fields of research are listed in a slightly different order to that of the road map as it is more logical in terms the sequencing of actions to estimate the seismic risk, while being consistent with the SINAPS@ project structure.

- **EDF, ECP Angkeara SVAY** "Modeling the spatial variability of seismic field for studies of soil-structure interaction" – in progress – Dec 2013/ Dec 2016 [A2]
- **EDF, ECP, Angkeara SVAY** "Modelling of soil liquefaction: application to the seismic analysis of the holding dams" – in progress 2013/2016 [A2]
- **EDF, ECP Ioanna RAPTI** "Modeling of soil liquefaction: application to the seismic analysis of the holding dams" – in progress 2013/2016 [A2]
- **ECP Silvana MONTOYA-NOGUERA** "Numerical modeling of discrete spatial heterogeneity in seismic risk analysis: Application to treated liquefiable soil foundation" – in progress 2013/2016 [A2 - A6]

#### Post-Doctoral research:

- **CEA, G. KAMARIS** "Modélisation non linéaire du comportement sismique des ponts roulants", 2013. [A4]

## Publications in 2013

1. B. Richard, F. Ragueneau, Continuum damage mechanics based model for quasi brittle materials subjected to cyclic loadings: Formulation, numerical implementation and applications, *Eng. Fract. Mech.* 98 (2013) 383–406.
2. Oliver C., Delaplace A., Ragueneau F., Richard B. Non-intrusive global/local analysis for the study of fine cracking. *International Journal for Numerical and Analytical Methods in Geomechanics*, 37 (2013) 973–992.
3. R. Crambuer, B. Richard, N. Ile, Ragueneau F. Experimental characterization and modelling of energy dissipation in reinforced concrete beams subjected to cyclic loading *Engineering Structures*, 56 (2013) 919–934.
4. E. Borgonovo, I. Zentner, A. Pellegrini, S. Tarantola, E. de Rocquigny, On the importance of uncertain factors in seismic fragility assessment, *Reliability Engineering and System Safety*, Vol. 109, pp. 66–76, 2013
5. I. Zentner. Simulation of non stationary conditional ground motion fields in the time domain. *Georisk* Vol. 7(1), 37-48, 2013.
6. F. Poirion, I. Zentner, Non-Gaussian Non-stationary models for natural hazard modelling. *Applied Mathematical Modelling*, Vol. 37(8), 5938-5950, 2013.
7. A. Nieto Ferro, D. Clouteau, N. Greffet and G. Devésa. On a hybrid Laplace-time domain approach to dynamic interaction problems. *European Journal of Computational Mechanics*, Vol. 21, Iss. 3-6, 2012 C. Combescure, H. Dumontet, F. Volodire : Homogenised constitutive model coupling damage and debonding of reinforced concrete structures under cyclic loadings. *Int. J. Solids and Structures*, Online July 2013
8. Akkar S., M.A. Sandikkaya, M. Senyurt, A. Azari Sisi, B.O. Ay, P. Traversa, J. Douglas, F. Cotton, L. Luzi, B. Hernandez and S. Godey (2013). Reference database for seismic ground-motion in Europe (RESORCE). *Bull. Earthquake Eng.* DOI 10.1007/s10518-013-9506-8.



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9. Sapkota, S.N., L. Bollinger, Y. Klinger, P. Tapponnier, Y. Gaudemer and D. Tiwari (2013) Primary surface ruptures of the great Himalayan earthquakes in 1934 and 1255, *Nature Geoscience*, 6, 71-76, doi:10.1038/ngeo1669
  10. Grandin, R., M.P. Doin, L. Bollinger, B. Pinel-Puyssegur, G. Ducret, R. Jolivet, S.N. Sapkota (2012) Long-term growth of the Himalaya inferred from interseismic InSAR measurement, *Geology*, 40 (12), 1059-1062.
  11. Girault, F., F. Perrier, A.P Gajurel, M. Bhattarai, B.P. Koirala, L. Bollinger, M. Fort and C. France-Lanord (2012) Effective radium concentration across the Main Central Thrust in the Nepal Himalayas, *Geochimica et Cosmochimica acta*, 98, 203-227.
  12. Ader, T., J.P. Avouac, J. Liu-Zeng, H. Lyon-Caen, L. Bollinger, J. Galetzka, J. Genrich, M. Thomas, K. Chanard, S.N. Sapkota, S. Rajaure, P. Shrestha, L. Ding, M. Flouzat (2012) Convergence rate across the Nepal Himalaya and interseismic coupling on the Main Himalayan Thrust: Implications for seismic hazard, *Jour. Geophys. Res.*, 117, B04403, DOI: 10.1029/2011JB009071.

## List of SEISM-related papers published at conferences in 2013

1. L. Adelaide, B. Richard, Analyse comparative de la modélisation de numérique d'un élément de structure en béton armé : approches 2d et 3d, oral communication, GC 2013, 26/03/13-27/03/13, Cachan, France.
2. R. Crambuer, B. Richard, N.Ile, F. Ragueneau , Toward a physically motivated damping model, oral communication, SMIRT 22 , 18 – 23 August 2013 San Francisco USA.
3. M. Vassaux, B. Richard, F. Ragueneau, A. Millard, Un outil d'expérimentation numérique adapté à l'étude des phénomènes liés à la fissuration, oral communication, AUGC, May 2013, Cachan, France.
4. C. Olivier, B. Richard, A. Delaplace, F. Ragueneau, Méthode globale/locale : fissuration des structures en béton, oral communication, AUGC, May 2013, Cachan, France.
5. M. Vassaux, B. Richard, F. Ragueneau, A. Millard, An implicit solving algorithm adapted to numerical identification for simple lattice discrete element models of quasi-brittle materials, oral communication, COMPLAS, Sept 2013, Barcelona, Spain.
6. R. Crambuer, B. Richard, N. Ile, F. Ragueneau, Experimental characterization and modelling of energy dissipation in reinforced concrete beams subjected to cycling loading, oral communication SMiRT 22 – 22/08/2013 – San Francisco, CA, USA.
7. P. Tran, F. Wang, D. Clouteau, Generation of incoherent ground motion for soil-structure interaction applications, oral communication COMPDYN2013, 12-14/06/2013, Kos, Greece.
8. A. Frau, B. Richard, Damping identification in shaking table tests, oral communication: TINCE 2013, Paris 28 – 31 October 2013.
9. P. Tran, F. Wang, D. Clouteau, Analysis of soil structure interaction of large embedded structures subjected to spatially varying ground motion, oral communication: SMiRT 22, 18-23/08/2013, San Francisco, USA.



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10. C. Berge-Thierry, Seismic Hazard Assessment and uncertainties treatment: discussion on the current French regulation, practices and open issues. OECD-CSNI workshop, Prague, June 2013.
  11. Politopoulos I., Base Rocking Excitations of Seismically Isolated Structures", 10th HSTM conference on Mechanics, 25-27 May, 2013, Chania, Greece.
  12. Teodorescu C.S, Diop S, Politopoulos I, Benidir M. "A robust non-linear semi-active control for base seismically-isolated structures" 21st Mediterranean Conference on Control and Automation (MED'13), Crete, Greece, 25-28 June 2013.
  13. Teodorescu C.S, Diop S, Politopoulos I, Benidir M. "A semi-active controller tuning and application to a base seismically-isolated structure" 12th Biannual European Control Conference (ECC 2013), Zurich, Switzerland, 17-19 July 2013
  14. ICOSARR2013: Organisation d'un mini-symposium par I. Zentner avec F. Poirion (ONERA) dans le cadre de l'ANR MODNAT:
  15. I. Zentner, P. Cacciola, L. D'Amico : Simulation of non stationary ground motion compatible with NGA-spectra
  16. I. Zentner, F. Poirion : Stochastic model construction of natural hazards given experimental measures
  17. S. Fayolle, A. Nieto-Ferro, I. Zentner, D. Combescure, P. Billion (EDF), N. Mezher, JM Vezin, S. Ghavamian (NECS) : Benefits of advanced non linear modelling in assessing the seismic safety margin of NPP structures SMIRT2013
  18. T-L Do, S. Fayolle, I. Petre-Lazar, Nicolas Humbert, Pierre Labbé : Non-linear modelling of a torsion sensitive building under near-field and far-field earthquakes SMIRT2013
  19. A. Nieto Ferro, N. Greffet, G. Devésa and D. Clouteau. Accounting for non-linear dynamic soil-structure interaction in earthquake engineering. COMPDYN2013, Kos, Greece, 12-14 June. COMPDYN2013
  20. Nicolas GREFFET, Alex NIETO FERRO, Georges DEVESA, Didier CLOUTEAU : Interaction sol-structure non-linéaire : étude industrielle avec la méthode Laplace-temps CSMA201
  21. C. Combescure, H. Dumontet, F. Voldoire : Modèle DHRC de comportement non linéaire de plaques en béton armé sous sollicitations sismiques. CSMA2013
  22. Hernandez B., E. Cazes. Variabilité du mouvement sismique dans la vallée d'Azumi-Matsumoto (Japon). VIème Biennale du RAP – 30 May - 01 June 2012.
  23. Hernandez B. L'alerte sismique du Laboratoire de Détection et de Géophysique pour la France et les régions frontalières. VIème Biennale du RAP – 30 May - 01 June 2012.
  24. Hernandez B. Response of the Matsumoto valley to the 2011 Tohoku earthquake and source influence on the site effect variability. Symposium franco-japonais post-Tohoku-Oki sur les séismes et les tsunamis. 13-14 November 2012. Tokyo. Japan.
  25. Hernandez B. et Y. Cano. Quels paramètres de mouvements forts utiliser pour prédire les effets des séismes ? Rencontres scientifiques et techniques RESIF. Yenne, 14-16 October 2013.
  26. Bollinger, L., SN. Sapkota, P. Tapponnier, Y. Klinger, M. Rizza, J. Van Der Woerd (2013) Return period of great himalayan earthquakes in eastern Nepal inferred from studies along the Patu and Bardibas strands of the Main Frontal Thrust, 4th International INQUA meeting on paleoseismology, Active tectonics and Archeoseismology, 9-14 October 2013, Aachen, Germany



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## Projects submitted in 2013:

LIST OF PROJECTS SUBMITTED IN 2013 - STATUS				
Project title	Partners	Subjects	Submitted to	Status
HARIBO	CEA Labo EMSI ENS Cachan	Post-doctoral request	AAP Lasips 2013	Refused
SINAPS@	CEA-LDG CEA-EMSI CEA-Cad EDF-AMA EDF-TEGG ENS-Cachan ECP ECN INPG-L3SR EGIS-Ind IRSN AREVA IFSTTAR ISTERRE CEREMA	"Earthquakes and Nuclear Facilities: Improving and Perpetuating Safety": this project aims at identifying and quantifying uncertainties at each stage of the seismic risk assessment - Improving the current methods used in earthquake-resistant engineering, particularly in the nuclear sector. Aiming to characterise/ quantify seismic margins.  See project description: <a href="http://www.institut-seism.fr/projets/sinaps/">http://www.institut-seism.fr/projets/sinaps/</a>	<i>Programme d'Investissements d'Avenir (PIA) – Call for proposals RSNR 2012</i>	Accepted  Total cost of project €12.5 M PIA funding – €5 M over 5 years
RUBIS	CEA-EMSI (& IFSTTAR)	"Reducing the seismic vulnerability of existing buildings based on the analysis of a reinforcement solution"  Numerical and experimental project to optimise the reinforcement of existing buildings (with ground-structure interactions)	ANR Jeunes Chercheurs	Refused
SYNEDYN	CEA-EMSI ENS-Cachan Cachan Polytechnique Supelec	SYnergic NEtwork for DYNAMIC hybrid analysis  Aiming to build a dynamic seismic test simulation platform - Phase 1 of a long-term vision of how the	AAP IDEX – Paris Saclay	Refused



		experimental means (and simulation codes) currently available at the SEISM SIG are expected to evolve.		
MIMOSA 611	CEA-EMSI ECP	SYNEDYN sub-project to update the MIMOSA table for hybrid tests	State-region programme contract	in progress, support from the FCS and the region

#### LIST OF PROJECTS SUBMITTED IN 2013 - STATUS

Project title	Partners	Subjects	Submitted to	Status
INDUSE2	CEA-EMSI	COMPONENT FRAGILITY EVALUATION AND SEISMIC SAFETY ASSESSMENT OF "SPECIAL RISKS"  Assessing the seismic fragility of components in industrial facilities (particularly pipe lines) - experimental campaigns using TAMARIS	European Commission  Research Fund for Coal and steel	Accepted



## Summary of active SEISM SIG projects by topic in 2013 and their related budget

SUMMARY OF SEISM SIG R&D ACTIONS IN 2013 - RELATED BUDGET			
SEISM SIG R&D FIELD	Contributing project	Partners	Budget
<b>Topic 1 - Seismic events</b>	<b>SINAPS@ - Section 1</b>	CEA-LDG, CEA-EMSI, IRSN and EDF-TEGG  Project launched on 15/09/2013	Budget Section 1: (whole cost - over 5 years)  59 p.month (permanent researchers) 84 p.month (post-doctoral researchers) 72 p.month (doctoral researchers) 36 p.month (trainees)  ~ €40 k business trips ~ €13 k investment/ sub-contracting  + EDF/TEGG contribution in-kind
	<b>SIGMA</b>	Project led by EDF, multi-partners (including CEA-LDG) launched with the creation of the SEISM SIG (2000-2015)	Total budget for the project: €6 M (funding from EDF, CEA, Areva)
<b>Topic 2: Ground-structure interactions</b>	<b>SINAPS@ - Section 2</b>	ECP, CEA-EMSI, CEA-LDG, CEA-Cad, ISTERRE, EDF, Areva, IFSTTAR	Budget Section 2: (whole cost - over 5 years)  140 p.month (permanent researchers) 32 p.month (post-doctoral researchers) 72 p.month (doctoral researchers) 12 p.month (trainees)  ~ €51 k business trips ~ €819 k investment/

			sub-contracting
	<b>Thesis called "Incohérence" - P. Tran</b>	CEA-EMSI, ECP	€36 k x 4 years (€144 k) – CEA funding
	<b>Thesis called "Liquéfaction des sols et application aux barrages" - I. Rapti 2013-2016</b>	EDF, ECP	€255 k - funding from ECP, EDF, ANRT
	<b>Thesis called "Variabilité spatiale du champ sismique et ISS" - E. Svay 2013-2016</b>		€300 k - funding from ECP, EDF, ANRT
<b>Topic 3: Seismic vulnerability of structures</b>	<b>SINAPS@ - Section 3</b>	ENS-Cachan, CEA-EMSI, EDF, AREVA, L3SR, ECN, EGIS	Budget Section 3: (whole cost - over 5 years)  115 p.month (permanent researchers) 72 p.month (post- doctoral researchers) 176 p.month (doctoral researchers) 5 p.month (trainees)  ~ €122 k business trips ~ €107 k investment/ sub-contracting
	<b>Thesis by E. Kishta</b>	CEA, ENS-Cachan	€36 k x 3 (€108 k) CEA funding
	<b>Thesis by M. Vassaux</b>	CEA, ENS-Cachan	€36 k x 3 (€108 k) ILMAB funding (project funded by the Pôle Systématic)
	<b>Thesis called "Modèle homogène de plaque en béton armé" - Ch. Combescure 2010- 2013</b>	EDF, CNRS, UPMC	€313 k funding by EDF, CNRS, ANRT
	<b>Thesis by R.</b>	CEA, ENS- Cachan	€36 k x 3 (€108 k) CEA



	<b>Crambuer</b>		funding
	<b>SMART 2013</b>	EDF, CEA	Simulation & experimentation project - International benchmark  see <a href="http://www.institut-seism.fr/projets/smart/">http://www.institut-seism.fr/projets/smart/</a>  2013 budget: €510 k (80% EDF & 20% CEA)
	<b>ANR SISBAT</b>	CEA and partners outside the SIG	CEA budget for 2013: 2.5p.month
<b>Topic 4: Seismic vulnerability of components</b>	<b>Post-Doctorate research by G. Kamaris</b>	CEA	€50 k CEA funding
<b>Topic 5: Seismic isolation and reinforcement</b>	<b>SINAPS@ - Section 3</b>	CEA, AREVA (seismic isolation part)	€200 k (over 5 years)
	<b>Thesis by S.C Teodorescu</b>	CEA	€36 k x 4 years (€144 k) – CEA funding
<b>Topic 6: Probabilistic methods</b>	<b>SINAPS@ - Section 4</b>	All SINAPS@ partners	Budget Section 4: (whole cost - over 5 years)  ~ 43 p.month (permanent researchers) 30 p.month (post-doctoral researchers) 72 p.month (doctoral researchers) 24 p.month (trainees)  ~ €3 k business trips ~ €44 k investment/ sub-contracting
	<b>ANR CHORUS</b>	CEA and partners outside the SIG	CEA budget for 2013: 2.5 p.month
<b>Topic 7: Innovative experimental methods</b>	<b>SINAPS@ - Section 5</b>	CEA, EDF, EGIS	Budget Section 5: (whole cost - over 5 years)  48 p.month (permanent researchers)



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			<p>36 p.month (doctoral researchers) 9 p.month (trainees)</p> <p>~ €25 k business trips ~ €595 k investment/ sub-contracting</p>
	<b>R&amp;D on hybrid tests</b>	CEA, EDF	2013 budget: €192 k (20% EDF, 80% CEA)



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# List of executive committee, steering committee and scientific council members in 2013

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## Steering committee

- ENS Cachan: S. Pommier (substitute F. Ragueneau)
- EDF: C. Cheviet
- ECP: E. Iacona (substitute H. Bendhia)
- CEA: D. de Prunelé (substitute JM Chaput)
- CNRS : Y. Marzin (substitute Y. Rémond)

## Executive committee

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- EDF : S. Caillaud, F. Voltaire
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- G. Magonette – JRC ISPRA
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- D. Fäh, ETH Zurich
- R. Renault, Swiss nuclear
- G. Deodatis, (Columbia University, NY)



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