École Normale Supérieure
- Lyon – (FRANCE).
Laboratoire de Physique. ENS-Lyon & CNRS
Laboratoire transdisciplinaire Joliot-Curie.

Dr. Santiago Cuesta-López

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In collaboration with:

DIN/DENIM – (UPM, SPAIN), T.S. Van Erp (UKL – Leuven), Francesco Delogu (UCA-Italy), M.Peyrard (ENS -Lyon), D. Angelov (ENS-Lyon) , A. Wildes (ILL-Grenoble), A.Velazquez-Campoy (Unizar-ARAID), R. Iglesias (Univ. Oviedo), A.Caro (LANL-USA), M. Tolley (RAL & SRFC-UK) … and many more …

Qué estamos implantando ?:

- Área de nuevos materiales avanzados y Nanotecnología:

Diseño Multiescala de materiales. **¿A la carta? H2020**

Industria en general, energía nuclear en particular (Fusión + Fisión).

Implementación de nuevos materiales en ingeniería.

- Simulaciones CFD avanzadas multiescala. Desde Tecnología de Fusión Nuclear, energías renovables (eólica), a problemas industriales tradicionales.

- Linea modesta de Nanoseguridad.

Qué nos gustaría?:

- Clusters de empresas regionales (CyL). Creación grupo de I+D mixto.
- Sinergia entre Parques Tecnológicos/Científicos, Centros tecnológicos y Universidades.
- Triangulación entre regiones? Soluciones en Red?

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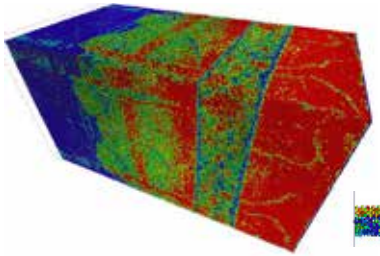
PROJECTS & ACTIVITIES - I

MATERIALES PARA INGENIERÍA EN CONDICIONES EXTREMAS

EU FP7 – HiPER ESFRI. Fp7-infraestructures-2007-1. Grant Agreement No. 211737.
Target delivery group. WP11. Responsible of Design Advanced Materials for NF target manufacturing.

Our role (WP11): Advanced Materials Modelling (15 WPs and 20 international partners):

- Shock propagation and design of advanced materials under extreme pressures. Inertial Fusion Target Manufacturing.
- Reach with simulations the scale of experiments and close interaction.

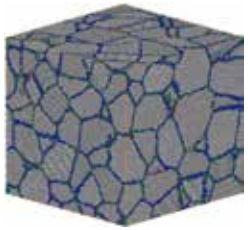


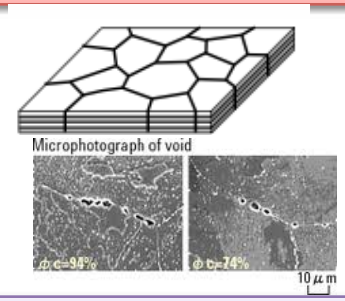
Stress distribution and evolution of the GB:

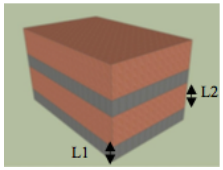
EU.FP7-NMP-2010-SMALL-4. RADINTERFACES: Radiation damage resistant nanocrystaline materials / Self – healing materials:

WPs and 10 international partners:

- Design, inclusion and test of new compounds and substitutions.
- Multiscale modelling of multilayered, nanostructured / nanocrystalline samples. Diffusion phenomena. Clustering phenomena.
- Interface between scales and methodologies. Interface Theory – Experiment.



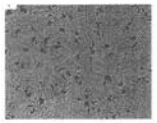


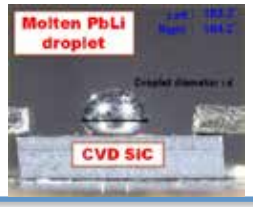


TECHNOFUSION 2009-2012:

Advanced Materials.

Design and neutron scattering of liquid metals: structural properties / diffusion/ magnetic field response/ -> eutectic PbLi (Fusion), eutectic PbBi (SNS)





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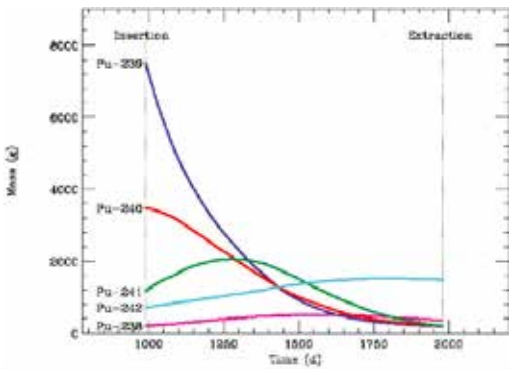
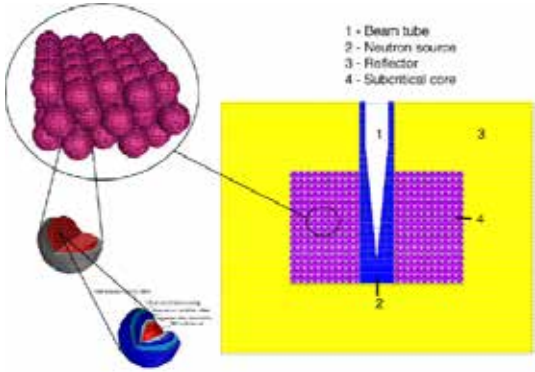
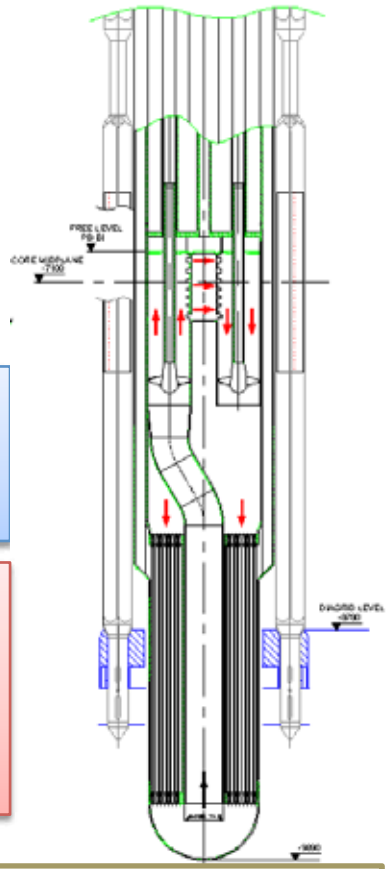
PROJECTS & ACTIVITIES - II

TECNOLOGíA NUCLEAR

** European Union 5th Framework Program of EURATOM "Prototype Design Study – Experimental Accelerator Driven System (PDS-XADS)", reference FP5-EAECTP C.* (2001 – 2003)







** FIKW-CT-2001-00179, and European Union 6th Framework Program of EURATOM "Transmutation on Adiabatic Resonance Crossing, TARC"* (2005 – 2006). EURADWASTE.

** Codes for Generation And Transport Of Particles – Radioprotection*

Radiation shielding for a neutron tomography instrument (3 axis diffract.) – Anteproyecto Industrial LA3P Lab - DGA (Spain) – 2003

*** Incorporation of Advanced Materials into modern civil engineering /radiations shielding /**

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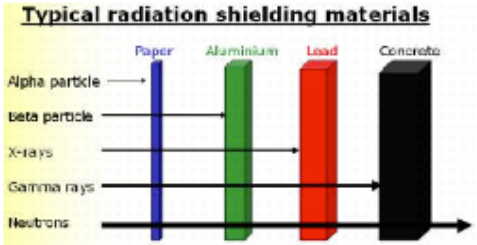
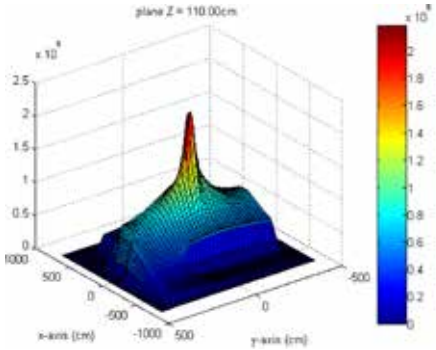
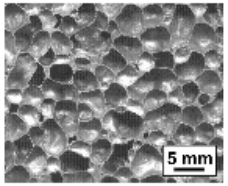
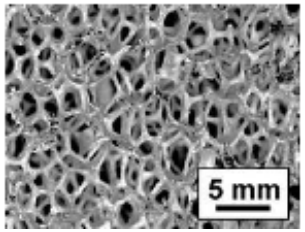
Materials development: It is critical !



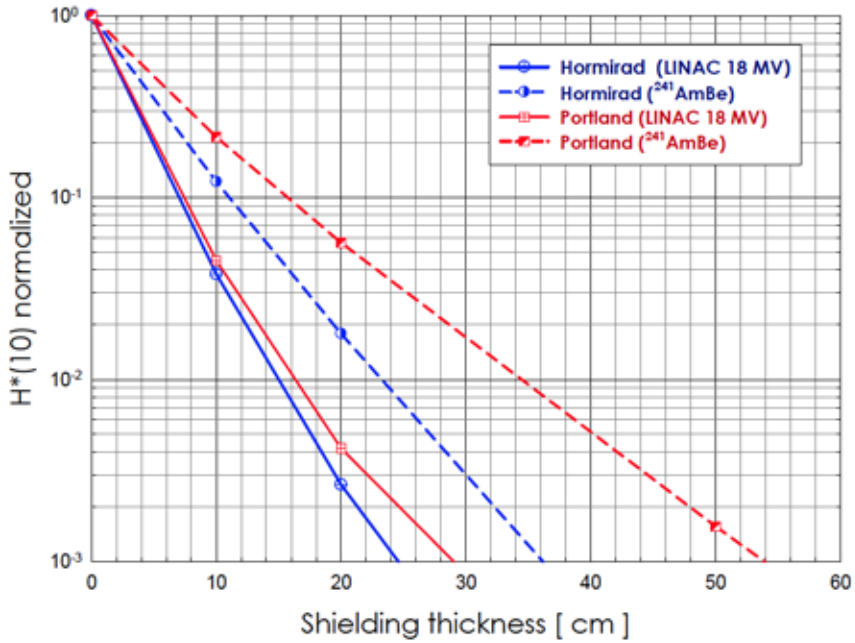






- **Test of commercial building materials.**
- **Introducing new advanced materials in the code ! Mimics + weights !**

Element	**Hormirad™** density: 3.44 ÷ 4.10 g·cm^{-3}	**Portland concrete** density: 2.30 g·cm^{-3}
Fe	60.80%	1.40%
O	31.26%	52.91%
Ca	4.36%	4.40%
Si	1.87%	33.70%
H	0.44%	1.00%
Mg	0.39%	0.20%
P	0.29%	-
Ti	0.19%	-
Al	0.17%	3.39%
K	0.06%	1.30%
Mn	0.06%	-
V	0.05%	-
C	0.04%	0.10%
S	0.01%	-
N	0.003%	-
Na	-	1.60%



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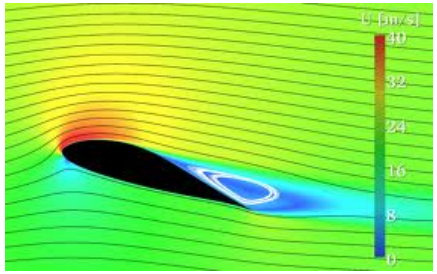
OTHER PROJECTS & ACTIVITIES

ADVANCED CFD TECHNOLOGY / MATERIALS SCIENCE / INNOVATION

- Simulation of small prototypes (eolic energy).
- Adapt codes and solutions coming from nuclear fusion to build a CFD tool to simulate wind tunnels.
- Mechanical modelling of materials (FEM) – Innovation of materials in prototypes



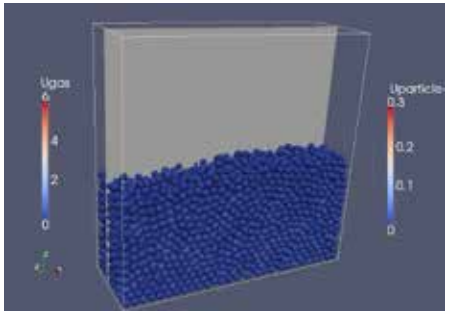
INNOVATION IN PRECISION MACHINERY INDUSTRY. GENERAL INDUSTRY?

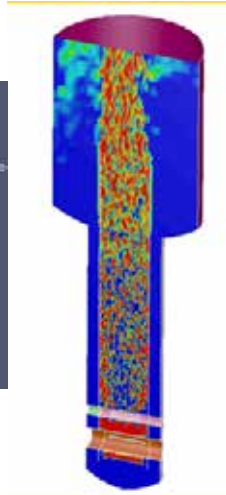
The University of Nottingham

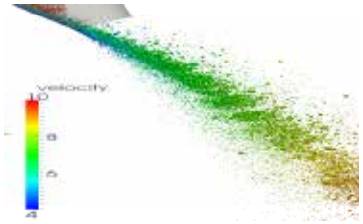
**** IMPROVEMENTS IN CUTTING FLUIDS AND LUBRICATION SYSTEMS.**

Models for two schemes: **Minimal Quantity Lubrication (MQL) / Minimal Quantity Cooling Lubrication (MQCL) vs Cooling Air/Gas and Minimal Quantity Lubrication (CAMQL)**
Simulation of Nanofluids is possible by means of our unique multiscale modelling **technology and CFD – coupled to Discrete Element Methods (DEM) – LIGGGHTS.**

**** DEVELOPMENT / IMPLEMENTATION OF POWERFUL CFD SOLUTIONS COMING FROM BASIC "exoteric" SCIENCE TO SOLVE COMMON INDUSTRIAL PROBLEMS.**







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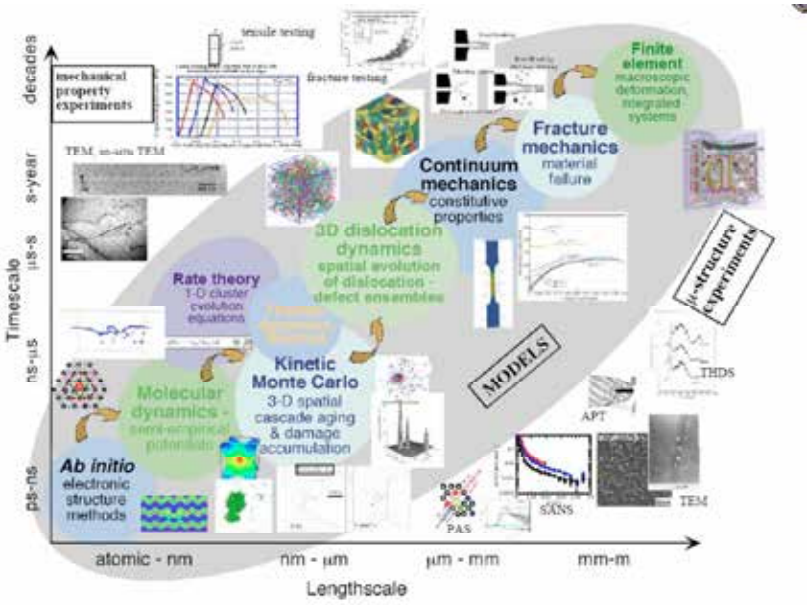
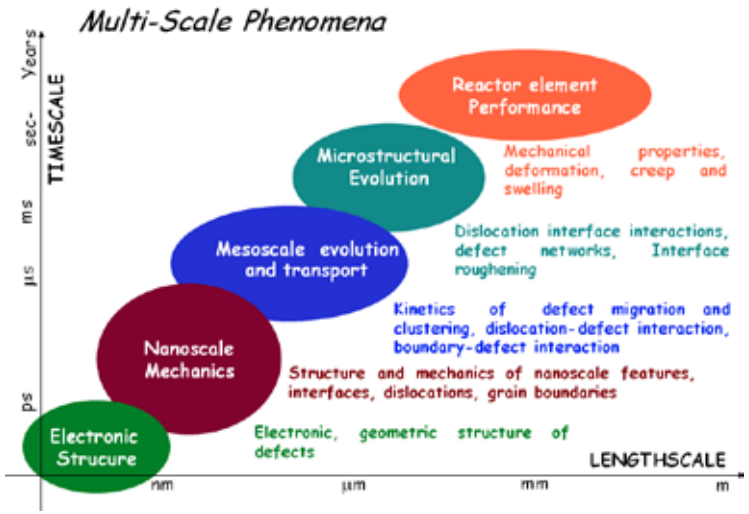
Advanced materials /Nano-Structured materials: Multiscale design & Modelling.

- We have developed our own methodology to simulate any kind of material from the atomic scale / meso-scale dynamics into integrated systems.





- Always in continuous feedback with experiments. Strong cooperation with LANL (USA), ENS-Lyon (FRANCE), ILL (Grenoble). Frequent neutron diffraction & dispersion + tomography neutron users at ILL

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