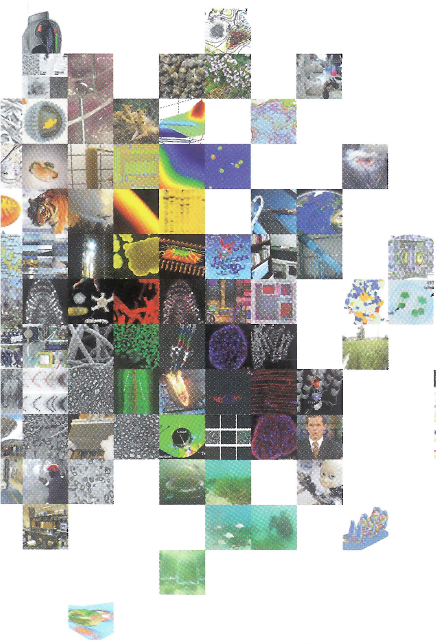
# HIGHLIGHTING PORTUGUESE SCIENCE

ASSOCIATE LABORATORIES' REVIEW, 2010



[1]GoLP/Instituto de Plasmas e Fusão Nuclear - Laboratório Associado, Instituto Superior Técnico, Lisbon, Portugal

[2]DCTI/ISCTE - Lisbon University Institute, Lisbon, Portugal

[3]University of California Los Angeles, Los Angeles CA, USA

[4]Departamento de Física, Instituto Superior Técnico, Lisbon, Portugal

#### References

[1] Martins SF, Fonseca RA, Lu W, Mori WB, Silva LO, "Exploring LWFA regimes for near term lasers using particle-in-cell simulations in Lorentz boosted frames", Nature Physics, 6, 311 (2010).

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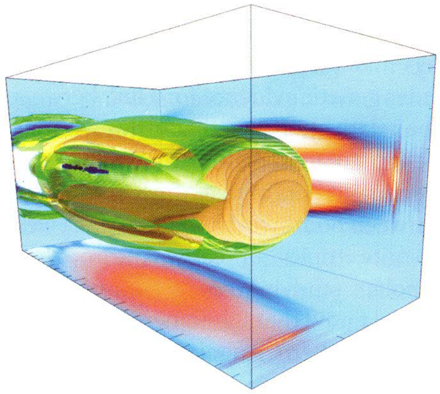

**Figure 1** Results from numerical simulations of a laser plasma accelerator in a Lorentz boosted frame, showing the laser field (yellow, in front), and the accelerating structure (green isosurface). The accelerated electrons can be seen in dark blue, inside the accelerating structure. Simulations were performed in a boosted frame reducing the computation time by several orders of magnitude.

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IPFN

# CHALLENGES OF THE TRANSFER CASK SYSTEM OPERATION IN ITER

Ribeiro I[1], Vale A[2], Ruibanys P[3], Queral V[4]

The International Thermonuclear Experimental Reactor (ITER) is a joint international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power, a safe and almost unlimited energy source to meet the needs of a growing world population. ITER will be constructed in Cadarache, France.

During ITER lifetime all components that provide the base functions of the machine must be inspected and maintained. Because of the level of radioactivity, soon after the start of the Deuterium-Tritium pulses, these operations will heavily rely on Remote Handling (RH) procedures and human access will not be authorized to the Tokamak Building (TB) (Fig. 1- left) and other activated areas. The Transfer Cask System (TCS) (Fig. 1- right) is one of the adopted RH components. It consists on a partially shielded vehicle unit (with respect to gamma radiation), composed by a cask envelope that encloses the load to be transported, a pallet that holds the cask and an Air Transfer System that acts as a mobile robot. The TCS has large dimension: 8.5m (length) x 2.62m (width) x 3.62m (height).

To perform a nominal operation, the TCS moves autonomously or semi-autonomously between each level of the TB and an adjacent building, the Hot Cell Building (HCB), transporting heavy (20~80T) and highly activated in-vessel components. In the TB, trajectories are executed between the Vacuum Vessel (VV) port cells and the lift that connects to the various levels of TB and HCB. To accomplish this task, the TCS moves along optimized trajectories, constrained by the highly confined spaces and the demanding safety requirements of transportation. IST, through the collaboration between two Associate Laboratories, developed a motion planning methodology yielding smooth trajectories that maximize the clearance to the closest obstacles and that incorporate manoeuvres whenever necessary, [1]. The area spanned by the TCS along the optimal

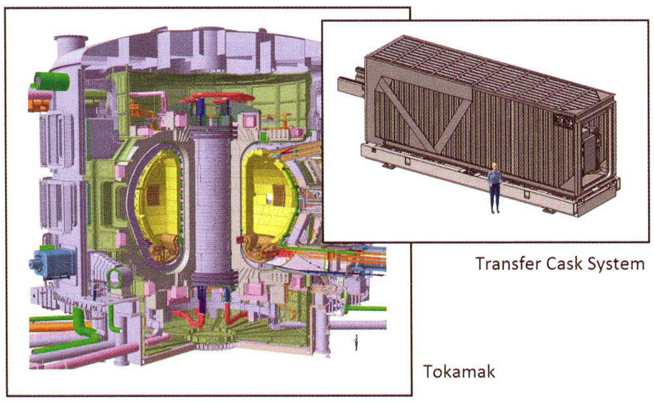


**Figure 1** left: Tokamak Building; right: Transfer Cask System

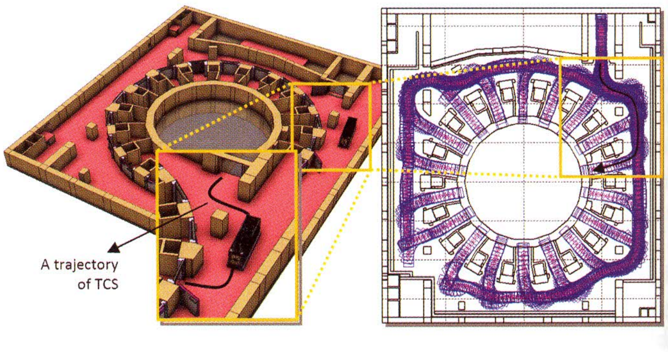


**Figure 2** Trajectories of the TCS in level B1 of the Tokamak Building

trajectories to all VV port cells in level B1 of TB is represented in Fig. 2.
ASTRIUM produced a full 3D Virtual Reality (VR) model for the TCS operating in the ITER buildings. The VR environment, where the above referred and any other trajectories are simulated, is complemented by a Human Machine Interface (HMI). The HMI functionalities allow for the choice of the TCS driving mode and of four different virtual viewing cameras placed in the environment and in the TCS. This 3D VR system is an important step on supporting the TCS design and possible building changes.

The existence of a real facility to test a full-size TCS prototype is a need recognized by ITER Organization. IST and CIEMAT specified the requirements of such test facility in terms of building and equipment characteristics.

[1] Institute for Systems and Robotics/Lisboa - Laboratório Associado, Instituto Superior Técnico, Lisboa, Portugal

[2] Instituto de Plasmas e Fusão Nuclear - Laboratório Associado, Instituto Superior Técnico, Lisboa, Portugal

[3] ASTRIUM Space Transportation, Saint Paul lez Durance, France

[4] CIEMAT - Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, Madrid, Spain

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ISR

# MARINE ROBOTS, SENSORS, AND ACOUSTIC NETWORKS: TOWARDS AN INTEGRATED APPROACH TO SEA EXPLORATION

Afonso P[1], Aguiar A[2], Fontes J[1], Magalhães M[1], Oliveira P[2], Pascoal A[2], Prieto R[1], Santos M[1], Santos RS[1], Silva M[1], Silvestre C[2], Tempera F[1]

Ecosystem-based management and the identification of critical habitats for marine top predators became dominant concepts in marine resource stewardship. Knowing the movements and interactions with the surrounding environment requires answers to challenging questions: where and when do top oceanic predators converge to exploit "hot spots", whether these are located at seamounts or oceanic fronts[1]? What features make these habitats ecologically relevant for predators? How do oceanographic and climate processes control such dynamics? The wider Atlantic around the Azores offers a unique opportunity to approach these questions because it harbours rich hotspot biodiversity and, at the same time, offers singular conditions to bridge the gap between science and technology. In fact, it affords system designers the proper setting to bring fast paced developments on robotic vehicles, transmitters, sensors, computers, acoustic communications, networks, and information systems to bear on the adoption of new technological developments for the study of marine ecosystems. Taking advantage of this setting, we have been deploying suites of biotelemetry devices (acoustic tags and networks of acoustic receivers, data storage tags and satellite transmitters) to simultaneously track whales, marine turtles, seabirds, sharks and fish around habitat "hot spots" at different scales.. The functioning of particular hotspots, such as the Condor Seamount, is being studied making use of observation capabilities through synoptic ocean sampling networks using sensor platforms, acoustic surveys and remote sensing. In parallel, we are expanding the capabilities of unmanned underwater, surface,