RESEARCH PROJECTS IN REACTOR PHYSICS : A COMBINATION OF BASIC PHYSICS AND EXACTING PROBLEMS OF RESEARCH

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ABSTRACT

With about 30 % of the total consumption of the OECD countries, electricity of nuclear origin plays an important role within the energy mix. In fact, in many European countries, such as Belgium, Sweden or France, this level is even higher.

It is pointless to deny that in the present context, one of the major challenges for nuclear energy lies in improving its competitiveness. Such a challenge applies not only to power plant designers but leads the industry to reduce operating, maintenance and fuel cycle costs, whilst enhancing safety features.

With a view to (i) reducing generation costs for existing Nuclear Power Plants, (ii) preparing future plants, (iii) enhancing safety features and (iv) developing public acceptance, preserving R&D projects is a crucial challenge for the nuclear industry as a whole.
After discussing typical major driving forces for R&D in reactor physics and more specifically in the field of nuclear fuel, this presentation underlines some of the apparent paradoxes which characterize so many research projects. These apparent contradictions include :

- the need to enhance performances, leading to **innovation**, against the need for reliability necessitating **stability**,
- the use of **experimental** physics, against physical **modeling**,
- …

In order to illustrate the way in which these kind of paradoxes have been handled through the past centuries, the history of the creation of the Cavendish Laboratory at the Cambridge University (UK) is briefly discussed. These events underline how physicists of the 19 th century managed to change the emphasis of such examinations as the "Mathematical Tripos" to more physical topics, including experimental physics. This integration of theoretical and experimental approaches led to many major discoveries in the first decade of the 20 th century.

Given the existing context of social and public and economic issues, such an integration of techniques is crucial, not only in different areas of physics, mathematics and computational sciences, but also for the industrial process as a whole. Solutions to reactor physics and more specifically nuclear fuel cycle issues now require principally R & D projects that combine basic physics and complex research problems. Such a combination of techniques will allow the industry to meet the dual requirements of public acceptance and the deregulated market.