

THE KEY ROLE OF CRITICAL MOCK-UP FACILITIES FOR NEUTRONIC PHYSIC ASSESSMENT OF ADVANCED REACTORS :AN OVERVIEW OF CEA/CADARACHE TOOLS.

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The Experimental Physics Section of CEA-CADARACHE operates three critical facilities devoted to neutronic studies of advanced reactors /1/ :

*The EOLE facility is a cylindrical vessel able to contain various types of core and related structures. This reactor is ,at the present time, dedicated to the qualification of neutronic calculation codes for 100% MOX core in ABWR (in the context of a collaboration with NUPEC-Japan- and COGEMA).

*The MINERVE facility is a pool type reactor devoted to neutronic studies of lattices of different reactor types. One of its main advantages is it's oscillating device which allows us to perform very precise reactivity measurements of small samples and so to improve knowledge on basic nuclear data for heavy nuclides, structural material and certain long-life fission products. The OSMOSE programme , which will start beginning of 2003 for 5 years, will be focused on this purpose in order to improve calculation tools for new options of the fuel cycle: LWR , Fast spectrum reactor: ADS, multi-recycling of plutonium.

*The MASURCA facility is a critical mock-up for fast reactor studies with a great flexibility and availability of fissile material :UO₂-PuO₂ (25%),Pu metal (100%).

It is today dedicated to the understanding of neutronic behaviour of sub-critical multiplying media using an external source (in support to ADS studies for transmutation) in a large international cooperation :EEC,US-DOE,JAERI,PSI...This MUSE program/2/ is divided in two phases:MUSE4 (MOX fuels with sodium cooling) and MUSE5 (MOX fuels with "gas" cooling).The MUSE5 configuration represents a step towards High Efficiency Gas Cooled Reactor studies which is a promising candidate for GENERATION 4 (combination of high thermodynamic conversion yield and high nuclear burner yield).

It is important to note that ,for these three facilities, a great effort is under way for the improvement of experimental techniques in order to reduce significantly the uncertainties on the evaluation of the following physical parameters :

- absolute reactivity,
- effective delayed neutron fraction,

- neutron life-time,
- axial and radial flux distribution,
- minor actinide fission rates,
- spectrum indices.

This improvement is performed using different ways :

- firstly, a new generation of miniature fission chambers with very precise characterization (uncertainty of fissile mass deposit of about 1%) is made for the in-core measurements. The fissile material of these fission chambers can vary from Th232 to Cm244 (research is performed to manufacture detectors with heavier actinides: Cm245, Cm246).
- secondly in order to investigate dynamic measurements (pile noise, reactor transfer function, frequency modulation method, pulse source method) a specific experimental technique is under development leading to a new acquisition system for neutronic pulse dating (temporal information of neutron pulses) allowing an on-line measurement of the physical parameters listed above.

The paper will present in detail the three experimental facilities, the new development indicated (with the target uncertainties) and the probable future until 2015.

REFERENCES

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2) "Validation of neutronic methods applied to the analysis of fast subcritical systems: the MUSE experiments" R. Soule et al GLOBAL 1997 JAPAN