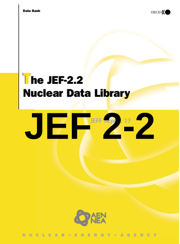

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MCNP Simulation of the TRIGA Mark II Benchmark Experiment

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1 Introduction

The scope of this contribution is to present the MCNP simulation of the TRIGA Mark II benchmark experiment [1], [2]. To reduce possible systematical errors due to inexact geometry specification, a complete and exact 3D model of the TRIGA reactor was developed. All possible fresh fuel, control and other elements were prepared to simulate any possible fresh core. According to further needs, the input also be extended to cover not-fresh fuel elements as well. The MCNP input was prepared in such a way that enables a very quick set up of any desired core configuration with adequate position of all regulating rods. Surrounding of the core was taken from the comprehensive 3D TRIGA reactor model already used and presented in [4].

2 MCNP Geometry

The introduction and detailed description of the TRIGA benchmark experiment can be found in Ref. [1]. Therefore in this contribution we will focus more on the MCNP geometry used in our calculations and eventual deviations from the real geometry.

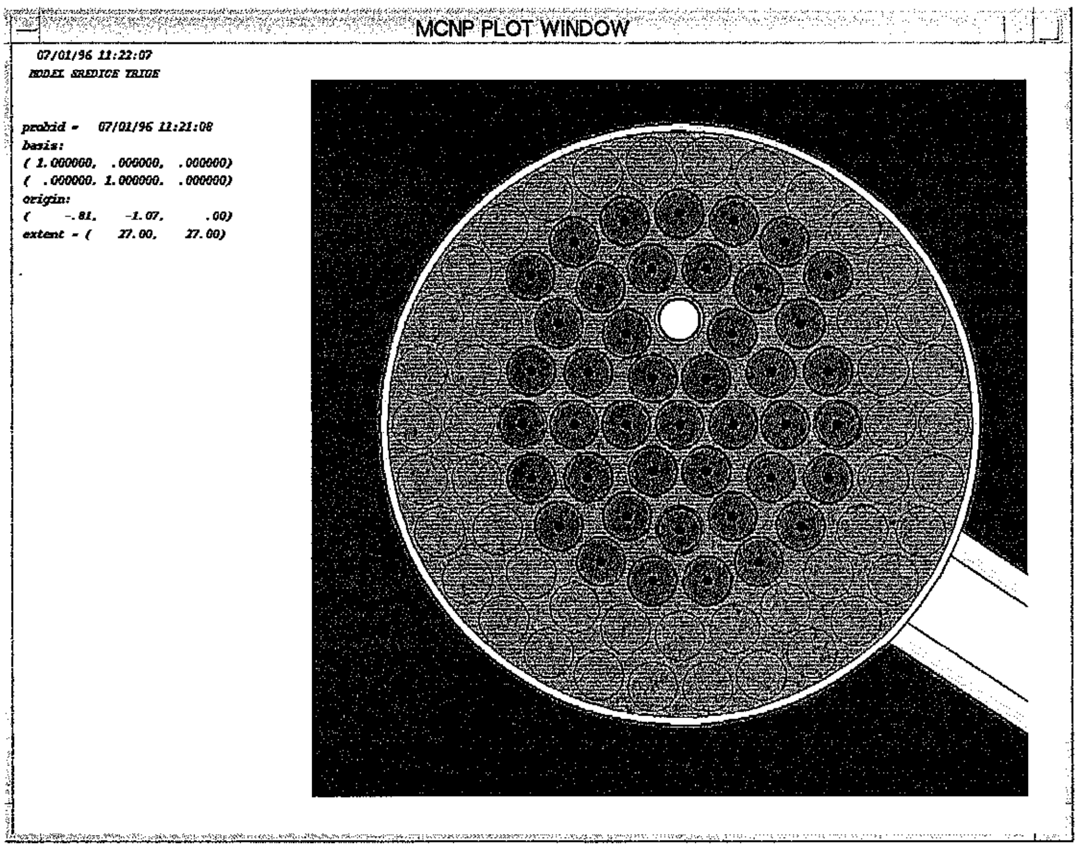

Figure 1: MCNP model of the detailed TRIGA reactor core labeled 132

Our goal in constructing the MCNP model was to prepare as much as possible faithful copy of the real TRIGA geometry. The core has cylindrical, although not periodic, configuration. In total there are 91 locations. Elements are arranged in six concentric rings with an appropriate constant distance between them (Figure 1). Around the core is a graphite reflector enclosed in an aluminium casing. Exact dimensions of the core and near surrounding can be found in Ref. [1]. In our MCNP model we used the same dimensions as quoted in that reference.

The exact description of the MCNP model of the surrounding of the core, where all the details of the irradiation channels as well as thermal and thermalizing columns were taken into account, can be found in Ref. 4.

3 Results

a) Critical Experiments

Table 1: MCNP results for critical cores labeled 132 and 133

	k_{132}	k_{133}
Experiment	0.99910 ± 0.00015*	1.00310 ± 0.00015
MCNP - ENDF/B-VI	1.00102 ± 0.00029	1.00428 ± 0.00028
MCNP - ENDF/B-V	1.00388 ± 0.00043	1.00760 ± 0.00041

*- Estimated experimental results

Table 2: Comparison between ENDF/B-VI and ENDF/B-V libraries for critical cores

	Experiment	**ENDF/B-VI**	**ENDF/B-V**
$k_{133} - k_{132}$	400 ± 50 pcm	326 ± 57 pcm	327 ± 84 pcm
MCNP - Experiment	---	+150 pcm	+450 pcm
DIMPLE S01A	---	-350 pcm[5]	-650 pcm[5]

b) Excess Reactivity

$$\overline{\rho}_{EXCESS} = 2355 \pm 90 \text{ pcm} \quad \text{(MCNP)}$$

$$\rho_{EXCESS} = 2022 \text{ pcm} \quad \text{(Experiment)}$$

} core 134

4 References

[1] I. Mele, M. Ravnik, A. Trkov: *TRIGA Mark II Benchmark Experiment, Part I: Steady-State Operation*, Nuclear Technology, 105, (1994), 37-51.

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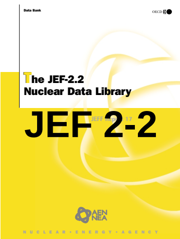
[3] I. Mele: *Technical Description of TRIGA Mark II Reactor*, IAEA - Interregional Training Course on the Application of Small Computers to Research Reactor Operation, Ljubljana, 1987.



[4] M. Maučec, B. Glumac, R. Jeraj: *Development of Irradiation Facility for BNCT Treatment of Tumors at the IJS TRIGA Research Reactor*, Procedings of 2nd Regional Meeting "Nuclear Energy in Central Europe", Portorož, Slovenia, September 1995, 153-160.

[5] M. Maučec: *Description of DIMPLE S01A Model Developed With Monte Carlo Computer Code MCNP4A*, prepared for Adjacent Meetings on the JEF and EFP Projects, NEA/OECD, January 1996.