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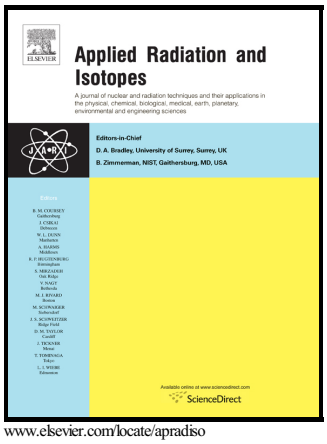


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PII: S0969-8043(14)00444-8
DOI: http://dx.doi.org/10.1016/j.apradiso.2014.12.017
Reference: ARI6859

To appear in: *Applied Radiation and Isotopes*

Received date: 16 July 2014
Revised date: 3 December 2014
Accepted date: 18 December 2014

Cite this article as: R. Henry, I. Tiselj and L. Snoj, Analysis of JSI TRIGA MARK II reactor physical parameters calculated with TRIPOLI and MCNP, *Applied Radiation and Isotopes,* http://dx.doi.org/10.1016/j.apradiso.2014.12.017

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# Analysis of JSI TRIGA MARK II reactor physical parameters calculated with TRIPOLI and MCNP

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## Abstract

New computational model of the JSI TRIGA Mark II research reactor was built for TRIPOLI computer code and compared with existing MCNP code model. The same modelling assumptions were used in order to check the differences of the mathematical models of both Monte Carlo codes. Differences between the TRIPOLI and MCNP predictions of $k_{eff}$ were up to 100 pcm. Further validation was performed with analyses of the normalized reaction rates and computations of kinetic parameters for various core configurations.

## Keywords

TRIGA reactor; Monte Carlo calculations; MCNP; TRIPOLI; Reaction rate profiles; Kinetic parameters.

## 1. Introduction

The TRIGA MARK II research reactor at the Jožef Stefan institute (JSI) is a typical 250 kW TRIGA reactor, which is used for various applications: such as Neutron Activation Analysis (NAA), Neutron Radiography and Tomography, education and training, radiation hardness studies (Cindro et al., 2009, Kramberger et al., 2013, 2010, 2009, Mandić et al., 2013) and benchmark experiments for verification and validation of computer codes. The criticality benchmark experiment was performed in 1991, after reconstruction (Ravnik and Jeraj, 2003). In 1999 the computational model of the reactor in MCNP (Jeraj and Ravnik, 1999, X-5 Monte Carlo Team, 2004) was developed, in order to evaluate the experimental uncertainties and to use the model to computationally support experimental campaigns at the reactor. The evaluated criticality benchmark experiment was later published in the International Handbook of Evaluated Criticality Safety Experiments (ICSBEP, 2013). Until recently, this was the only publicly available TRIGA criticality benchmark featuring homogenous mixture of fuel, moderator and Zr. Due to U-ZrH fuel; it is very sensitive to Zr absorption and scattering cross sections (Snoj et al., 2012b). In the last years criticality benchmark experiments from Idaho National Laboratory (INL) were also evaluated and publicly published in the ICSBEP Handbook (ICSBEP, 2013).

In order to expand the utilisation of the JSI TRIGA computational model, an extensive experimental campaign was launched in 2007, with the purpose of experimental verification and validation of the computational model in MCNP for reaction rate distribution (Snoj et al., 2011). Within this campaign Al-Au (99.9 wt. Al – 0.1 wt. Au) were irradiated at various irradiation positions/channels in the reactor. Then, measured and calculated $^{27}Al$ (n, α) and $^{197}Au$ (n, γ) reaction rates were compared. Within this campaign the criticality benchmark model of the TRIGA reactor was upgraded by modelling more reactor components, such as reflector, irradiation channels in the reflector and irradiation channels.



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