# SIMULATION OF TANGENTIAL COLLIMATOR FOR NEW POTENTIAL NEUTRON RADIOGRAPHY SYSTEM AT TRIGA MARK II PUSPATI RESEARCH REACTOR

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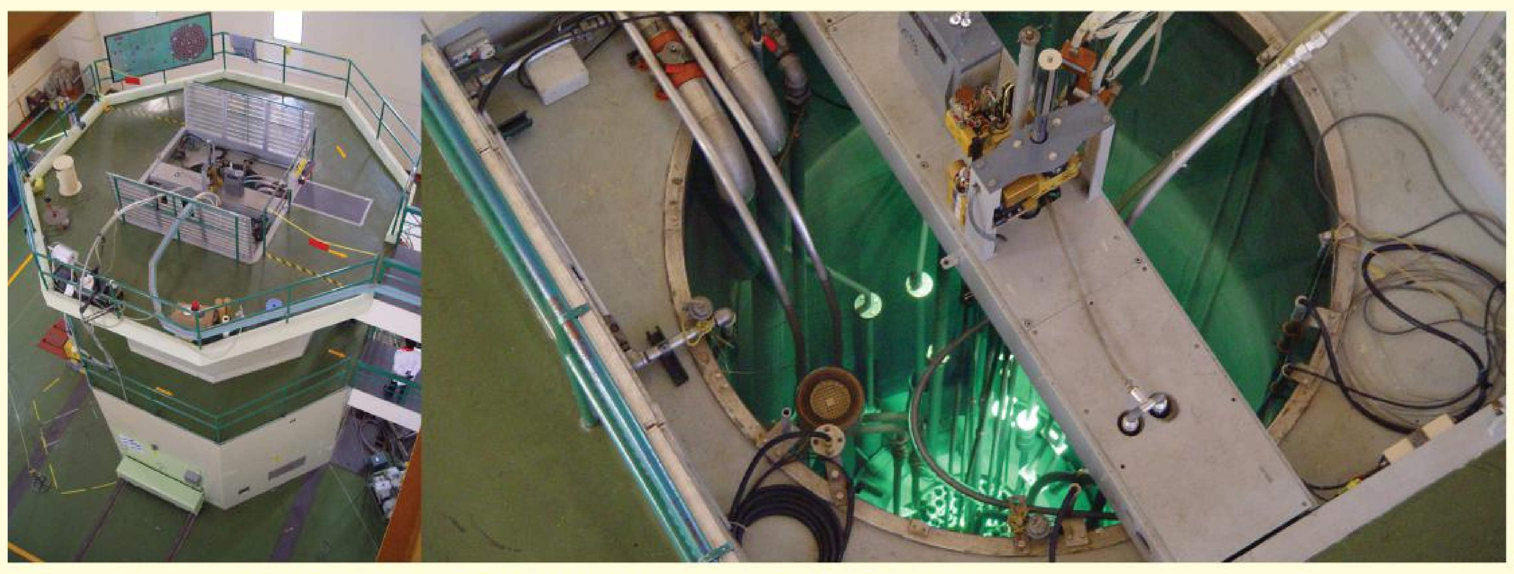
A Monte Carlo simulation of neutron beam on the neutron radiography collimator utilizing at tangential beam channel of the Reactor TRIGA MARK II PUSPATI (RTP) at Malaysian Nuclear Agency was performed using the MCNPX and SIMRESS computer code. The aim of this work is to design the best geometry and to choose the best materials selection for thermal neutron and filtering photon radiation so as to obtain a uniform neutron beam, high L/D ratio and a maximum thermal neutron flux at the object plane. This paper describes the characteristic of neutrons and photons profile of the newly designed tangential collimator based on the simulation result.



Reactor TRIGA MARK II PUSPATI (RTP)

## 1. INTRODUCTION

Neutron radiography is typically used to create images of non-hydrogenous materials due to the fact that a neutron beam can pass through a significant amount of non-hydrogenous material without being completely attenuated neutron flux which is has been pass through a collimator. The collimator is a beam forming assembly, which can determines the geometric properties of the beam. In addition, it may contain filter to modify the energy spectrum or to reduce gamma contaminations of the beam. Various effective parameters on the image quality are needed to be studied to achieve a neutron radiography system with a good resolution. The geometry of collimator must be selected based on maximum intensity and beam uniformity of a neutron flux at the image plane. In practice, it is intended to have an experimental arrangement which is accomplishing neutron beam parameters as close as possible to the ideal ones. For that reason the neutron collimator should be optimized in respect to neutron and gamma radiation using MCNPX and SIMRES codes based on Monte Carlo Method.

## 2. MATERIALS AND METHODS

### MCNPX and SIMRESS

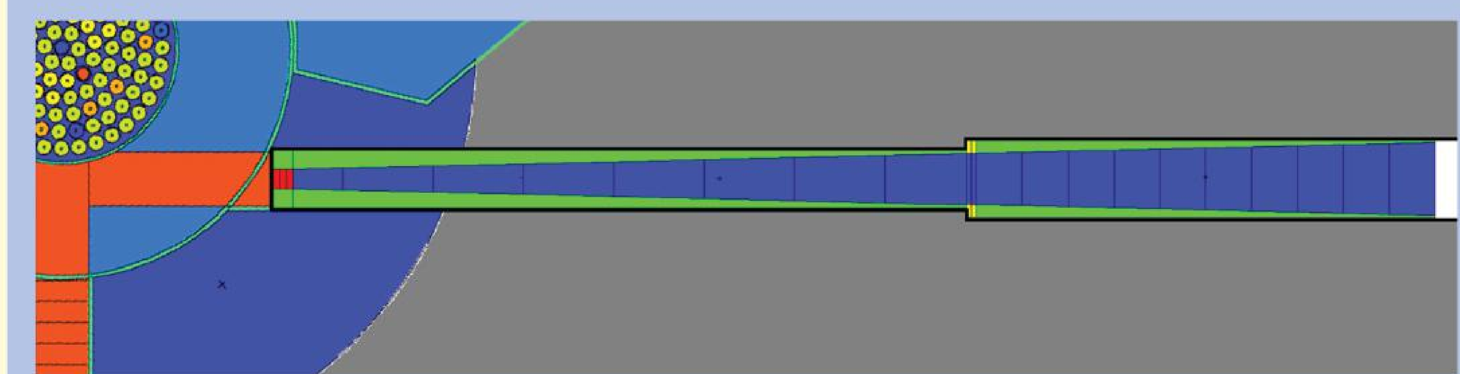


Fig.1: Full view of the tangential collimator RTP

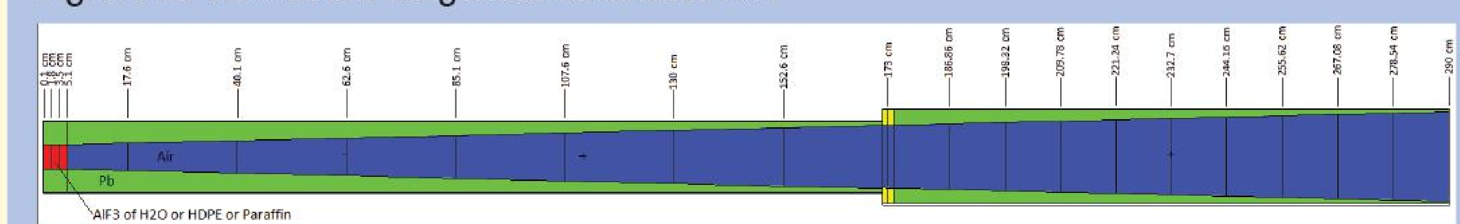


Fig.2: MCNP surface tally for fluence calculation

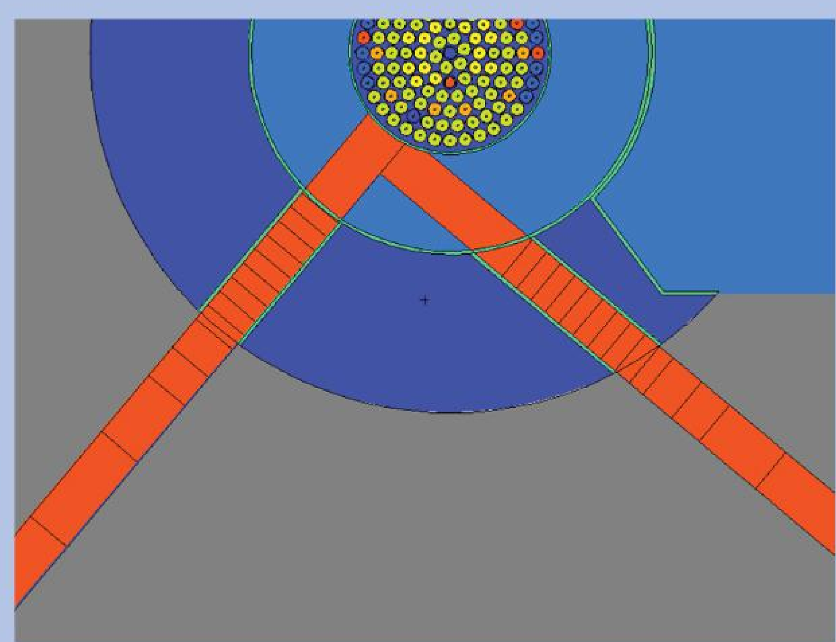


Fig.3: Cross section of the tangential collimator

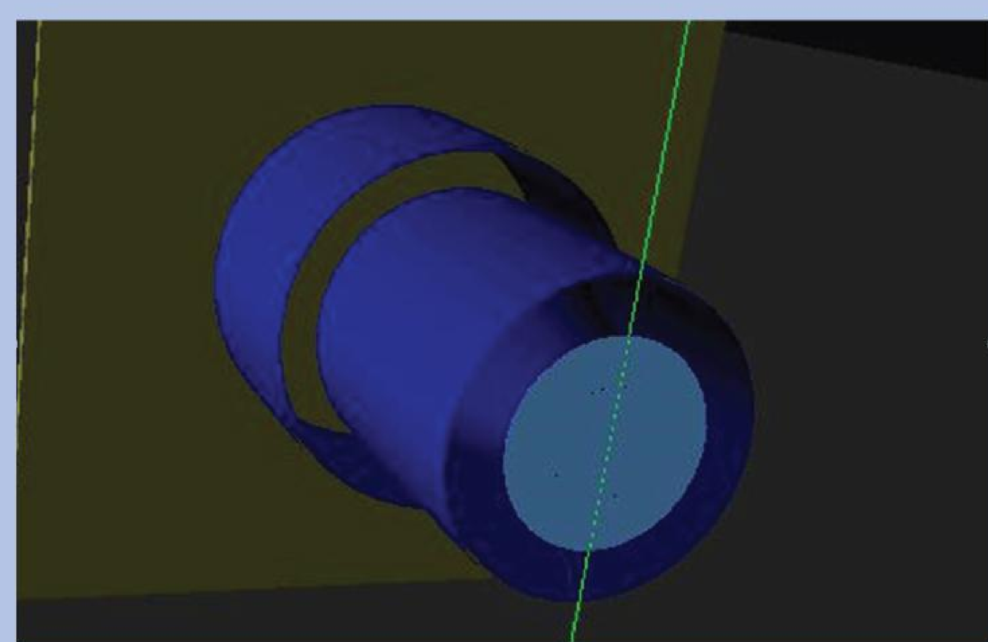
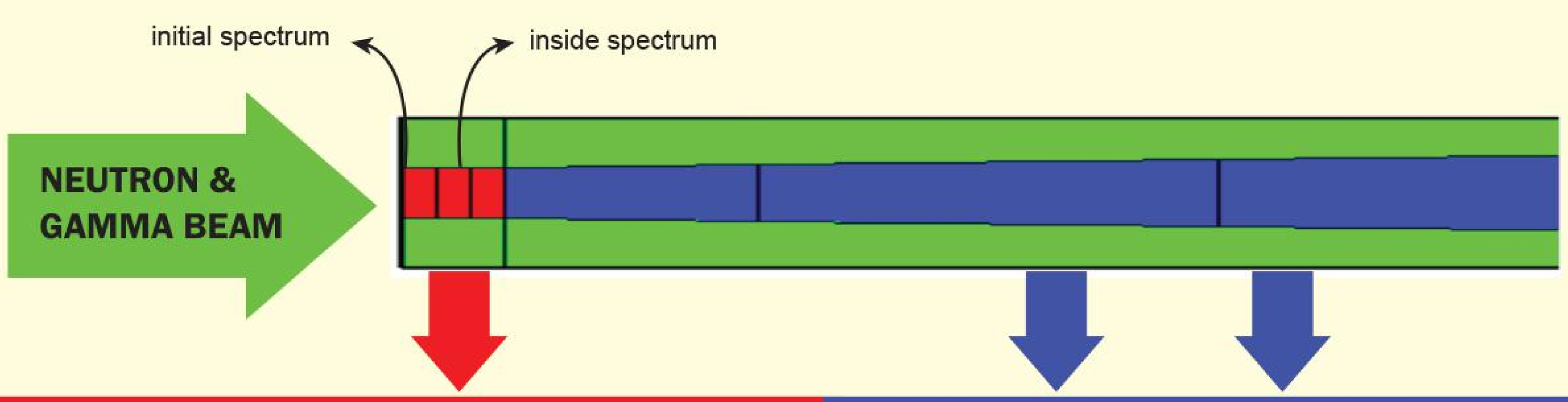


Fig.4: 3D view of the tangential collimator using SIMRESS

## 3. RESULT AND DISCUSSION



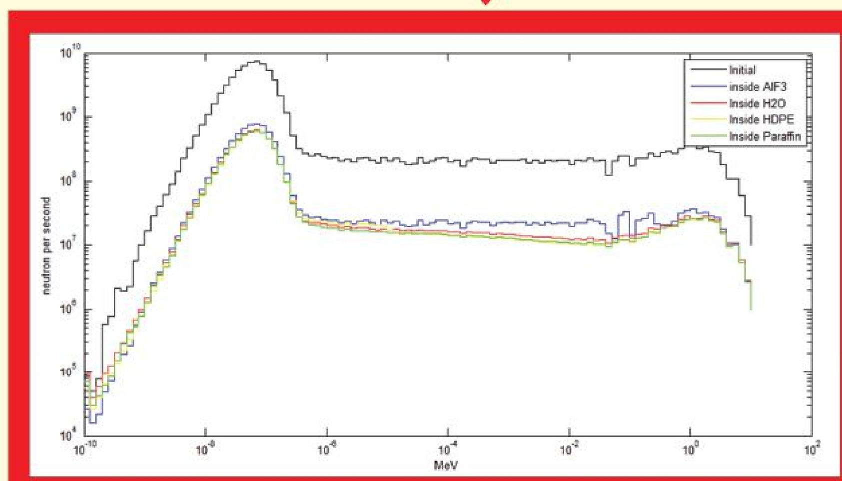



Fig.5: Spectrum inside different collimator material

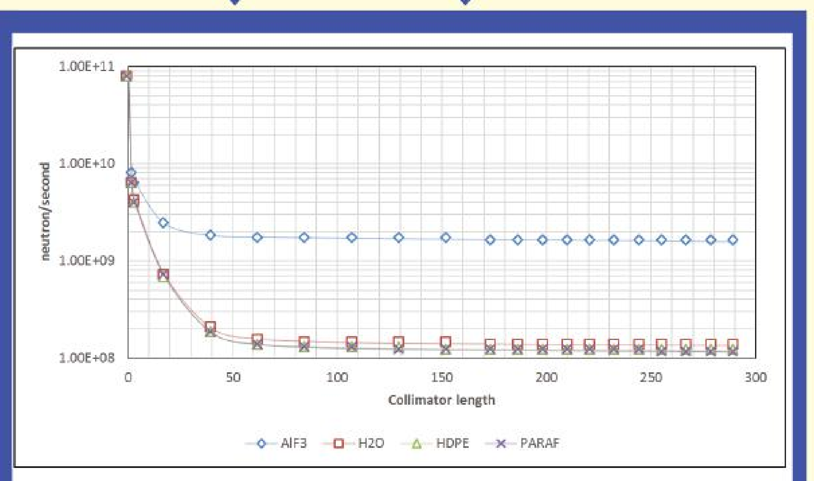


Fig. 7: Neutron fluence along tangential collimator

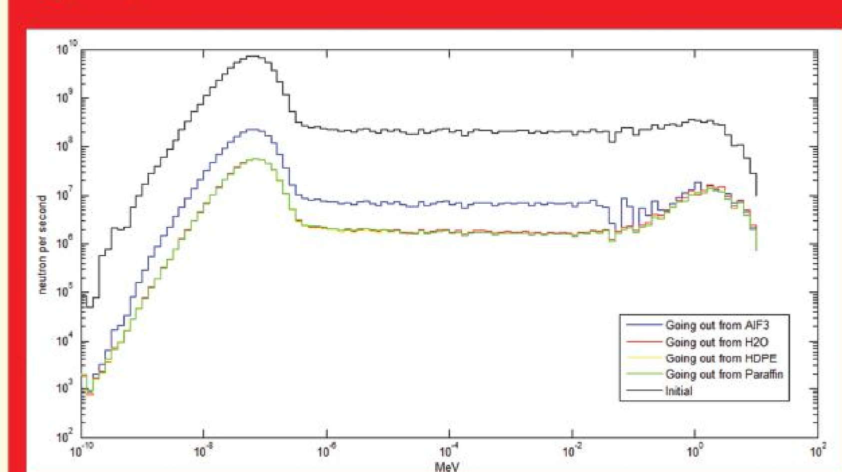


Fig.6: Spectrum leaving different collimator material

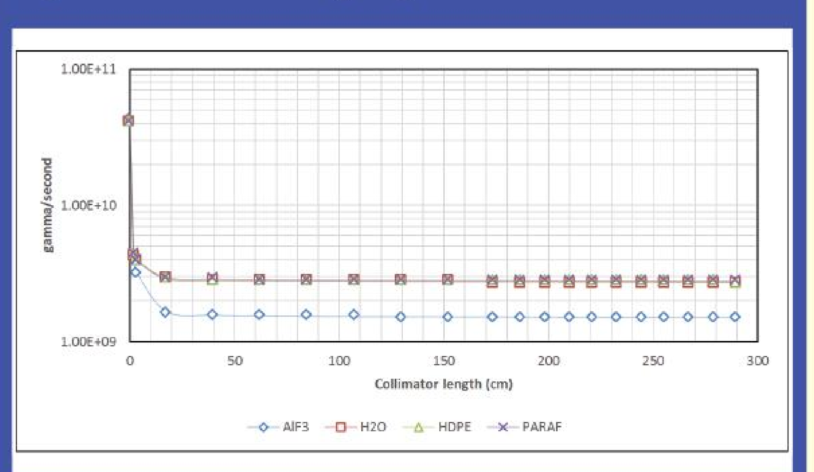


Fig.8: Gamma fluence along tangential collimator

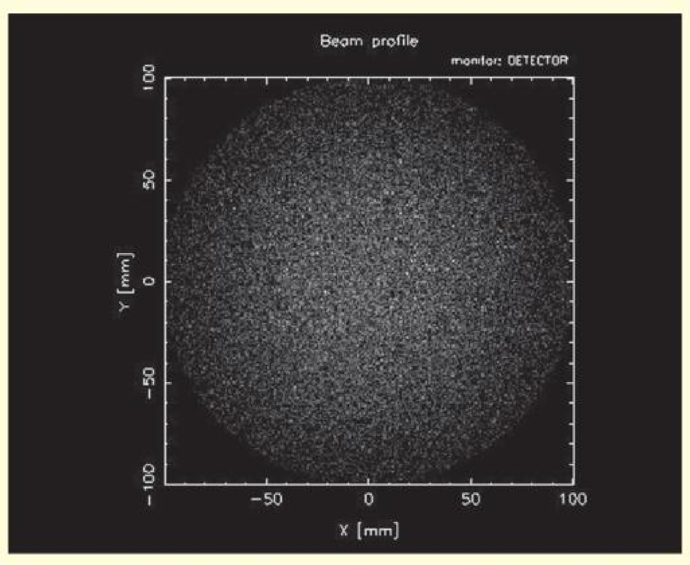



Fig. 9: Beam profile at the image plane using SIMRESS

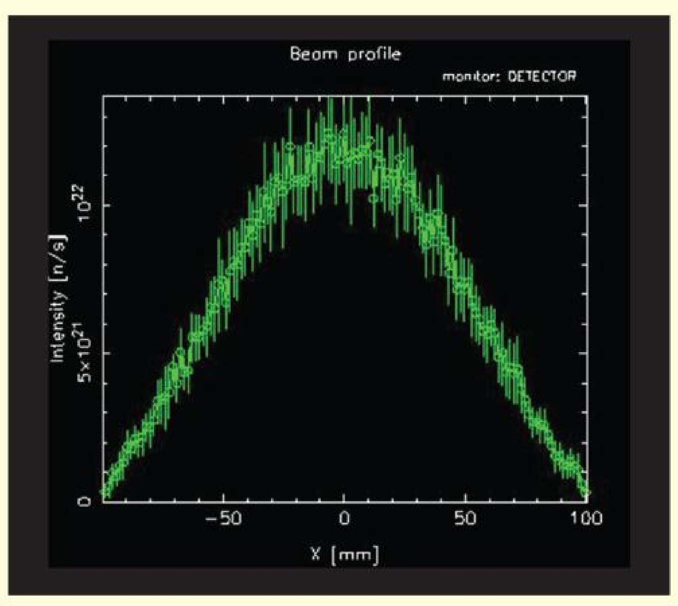



Fig. 10: Line profile at the image plane by SIMRESS

## 4. CONCLUSION

The Monte Carlo simulation of the potential NR at tangential collimator was successfully modeled using MCNPX and SIMRESS. The Monte Carlo technique gives reasonable picture of flux distributions inside the new potential neutron radiography collimator outlet.

## REFERENCES

- Journal of Instrumentation · July 2017, 1-12
- Physics Procedia 88 ( 2017) 361 – 368
- http://neutron.ujf.cas.cz/restrax/
- Journal of Energy and Power Engineering 5 (2011) 1168-1172

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