Konvensyen Teknikal Nuklear Malaysia 2015 (NTC15)

Practical Application of Monte Carlo Code in RTP

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  - Exercise on Flux and Power
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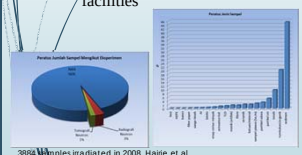
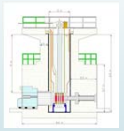
3 Overview Of PUSPATI TRIGA Reactor (RTP)

First criticality on 28 June 1982

Functions:
- Irradiations of samples for NAA, beam experiments
- Education and training facilities



3884 samples irradiated in 2008, Hairie et al.

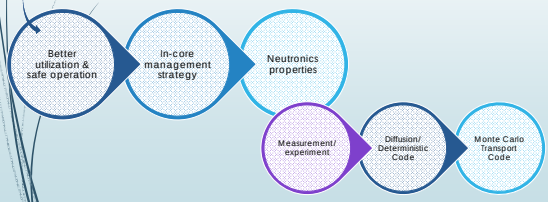


Type:
1 MW TRIGA Mark II
Fuel:
19.9% enriched U-ZrH
**20 wt% U*
**12 wt% U*
**8.5 wt% U*
No. Fuel :
111 (Core #15)
Coolant:
Light Water
Moderator:
Light Water
Reflector:
Graphite
Control Rod:
Boron Carbide
3 FFCR & 1 AFCR

4 Research Group

Reactor Technology Center:

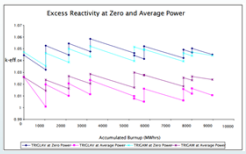
- Operation and Maintenance
- Technology Assessment, Engineering and Safety
- **Reactor and Nuclear Physics (RxP)**
- Reactor Electronic, Instrumentation and Control
- Quality Assurance and Integrated Management System

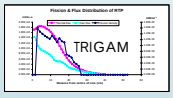


5 Neutronics Codes Used

- Codes are used for core management calculation, namely, WIMSD/4, TRIGAM and TRIGLAV.
- TRIGAM and TRIGLAV were developed by Josef Stefan Institute, Ljubljana, Slovenia.
- TRIGAM is a1-D geometry and two-group approximation
- TRIGLAV based on 2-D and four-group approximation.
- Since 1995 RTP apply TRIGLAV for its core management calculations.
- Lattice cells approximation were still calculated using WIMS D/4.

Julia et al.

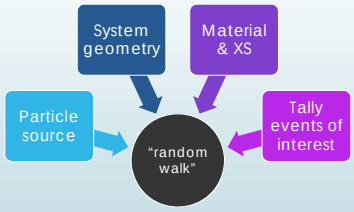




TRIGLAV

6 Familiarized with MCNP

MCNP, is a general purpose Monte Carlo radiation transport code designed to track many particle types over broad ranges of energies



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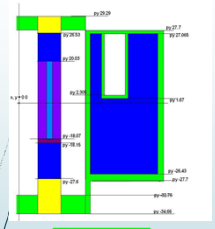
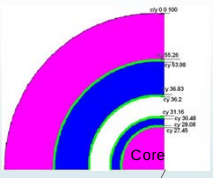
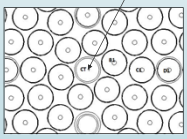
Familiarized with MCNP







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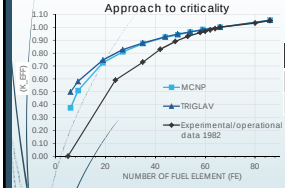
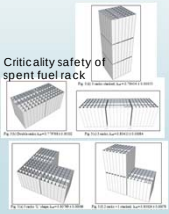
Exercise on k-*eff* Calculation

Approach to criticality

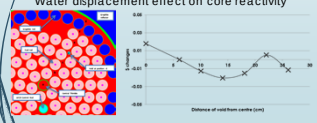


	MCNP (±0.0001)	TRIGLAV	Operational data
Critical core	1.00132	1.00105	1.001
Core-01	1.05677	1.05562	1.053

Criticality safety of spent fuel rack



Water displacement effect on core reactivity



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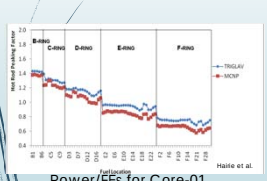
Exercise on Flux and Power

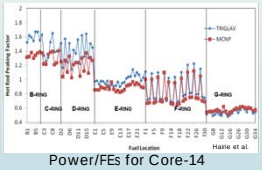
Thermal Neutron Flux Core-14

neutron/ cm².s	Central Thimble ×10¹³	G20 Irradiation hole ×10¹²	Rotary rack ×10¹²
MCNP model	1.897 ± 0.019	5.025 ± 0.029	2.948 ± 0.012
Measured	1.777 ± 0.031	4.813 ± 2.447	2.33 ± 0.08
	Julia et al.	Julia et al.	Ibrahim Alnour et al.

Hailie et al.



Power/FEs for Core-01



Power/FEs for Core-14

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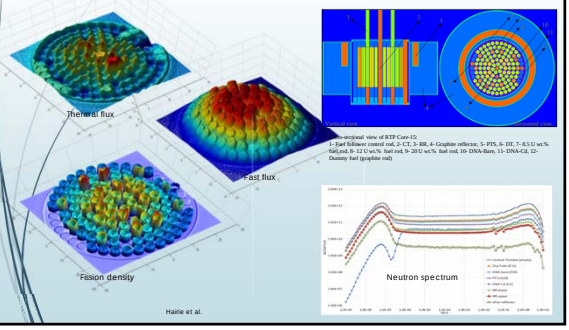
Exercise on Mesh tally

Mesh tally for Core-15



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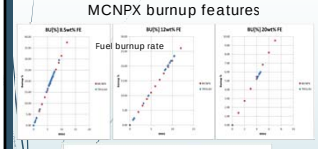
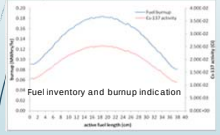
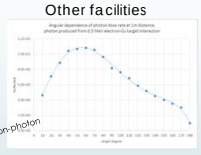
Other Calculation / Application

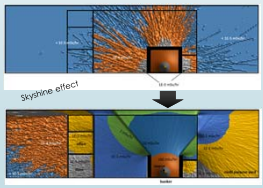
MCNPX burnup features





Other facilities





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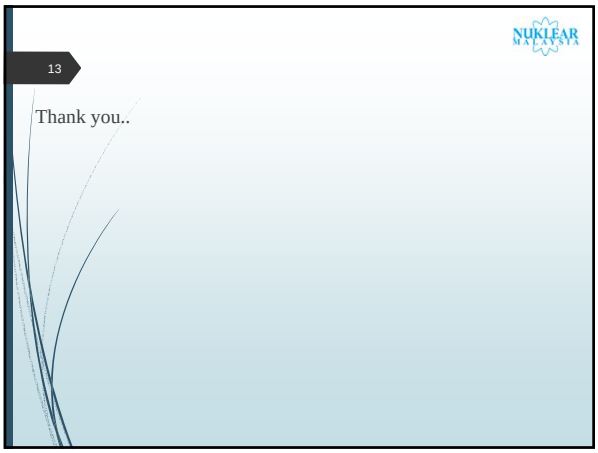
Issues & Challenges

1. Neutronics analysis (calculation & measurement) performed at basic level, lacking in expertise and experience
2. Combine WIMSD + MCNPX code for RTP in-core fuel management
3. Quality assurance program;
   - V&V of codes and computational approach
   - Management of codes, computational process and documentation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Thank you..