

Statistical analysis of Tritium Breeding Ratio deviations in the DEMO due to nuclear data uncertainties

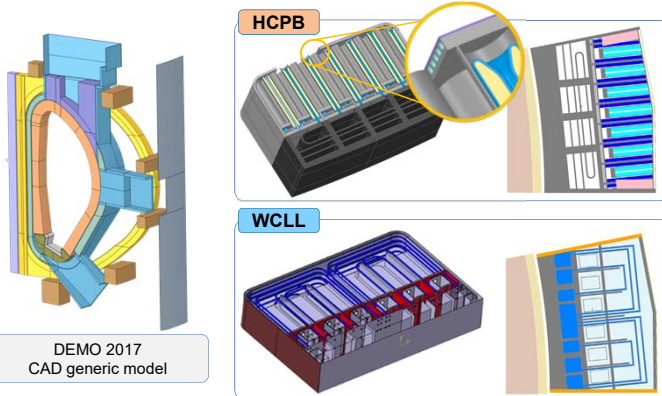
Jin Hun Park, Pavel Pereslavl'tsev

Objectives

- Estimation of TBR uncertainty due to Nuclear Data
 - Compare TBR results for different DEMO concepts using different international nuclear Data libraries
 - Assessment of the TBR uncertainty in different DEMO concepts due to uncertainty of the nuclear data
 - using global Monte-Carlo method
 - using up to 300 TENDL-2017 random files for each isotope

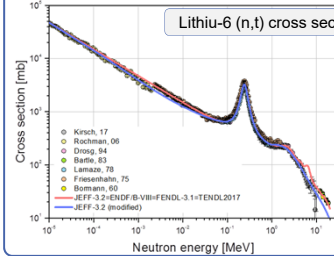
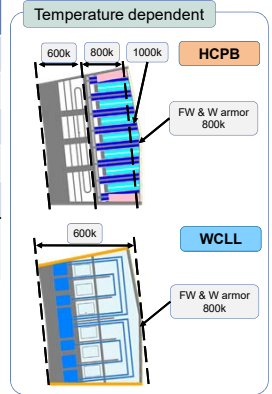
Design & models

- Based on CAD model of DEMO Base line 2017
- Full size 3D DEMO model of 11.25 torus sector
- Fully heterogeneous designs DEMO HCPB & WCLL Breeder Blanket



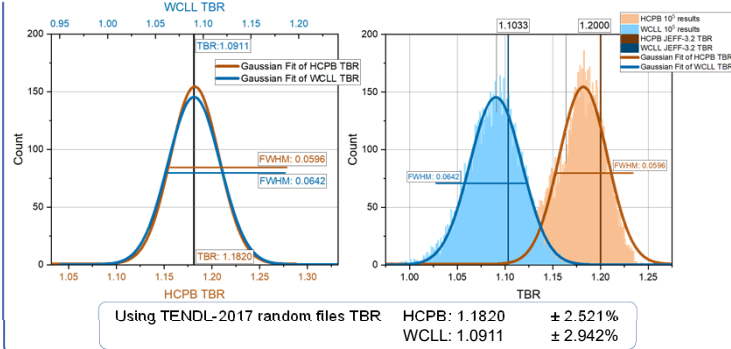
TBR results based on different nuclear data library

	HCPB	(%)	WCLL	(%)
JEFF 3.2	1.2000	100	1.1033	100
JEFF 3.3	1.1996	99.967	1.1040	100.063
FENDL-3.1d	1.1968	99.733	1.0988	99.592
TENDL-2017	1.1945	99.542	1.0911	98.894
ENDF/B-VIII	1.1983	99.858	1.0996	99.665
JEFF 3.2 + temperature dependent	1.1983	99.858	1.1002	99.716

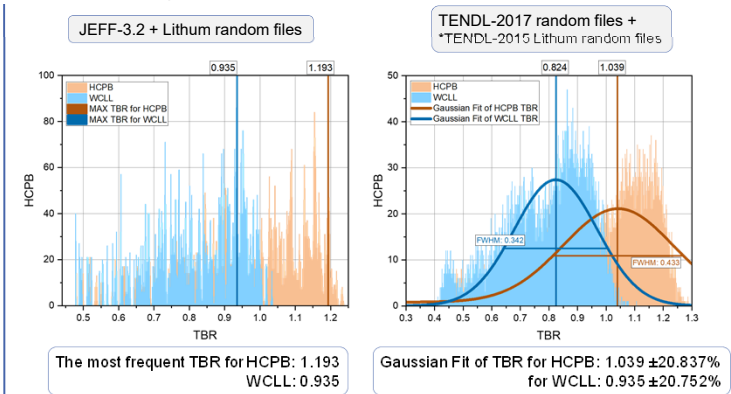


	TBR Standard JEFF-3.2	TBR Modified Li JEFF-3.2	(%)
HCPB	1.2000	1.1882	99.017
WCLL	1.1033	1.0934	99.103

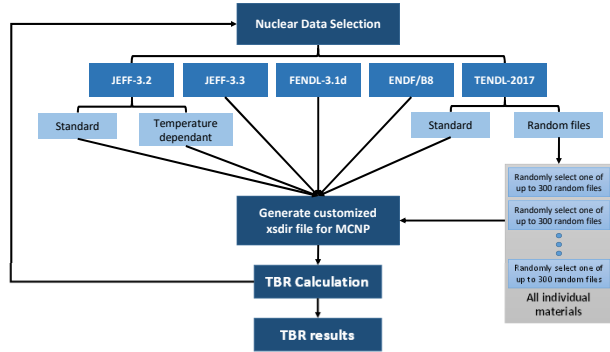
TBR results using TENDL-2017 random files



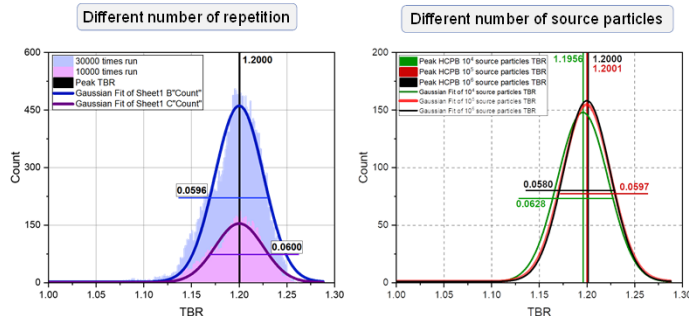
TBR results using TENDL-2017 random files + Lithium*



Workflow



Sensitivity analyses: HCPB case



Repetition (times)	TBR	Uncertainties(%)	Source Particles	TBR	TBR difference (%)	Uncertainties (%)
10000	1.2000	± 2.483	10 ⁴	1.1956	-0.3667	± 2.626
30000	1.2000	± 2.500	10 ⁵	1.2001	0.0083	± 2.487
			10 ⁶	1.2000	0	± 2.417

Summary

- The TBR uncertainty due to nuclear data was assessed:
 - Uncertainty due to different libraries: > ± 1.2%
 - Uncertainty due to temperature effects: ± 0.3%
 - Global Monte-Carlo methods using random TENDL-2017 data files
 - Without random files for Li and Be: > ± 3% for both HCPB and WCLL DEMOS
 - With Lithium [TENDL-2015 random files]: > ± 21%
 - The random files for Li and Be were produced with TALYS code outside the valid mass number region – the results are not justified
- The uncertainty of the TBR due to nuclear data uncertainty: ± 3%