Updates on FLUKA–G4 study

Simons team meeting
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John (JP) Dervan
U. Tennessee, Knoxville

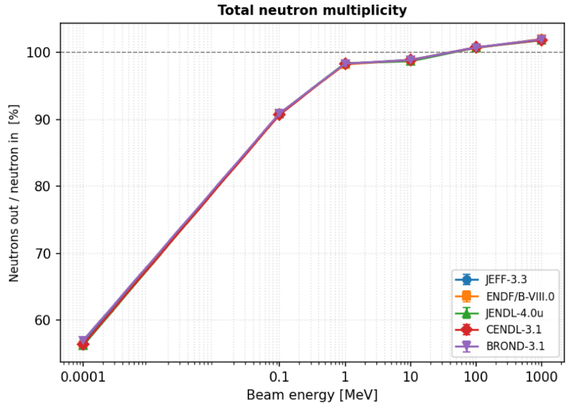
USMCC

THE UNIVERSITY OF TENNESSEE KNOXVILLE

Main updates for this week

1 *JEFF discrepancy — RESOLVED*

- JEFF disagreement was nonphysical, caused by FLUKA internal normalization artificially inflating boron fraction by 1.25%
- All NDLs agree within error



	JEFF	*ENDF*	*JEFF (norm)*	*ENDF (norm)*
H	0.12	0.136	0.1500	0.136
C	0.63	0.814	0.7875	0.814
B	0.05	0.050	**0.0625**	0.050
Total	**0.8**	1		

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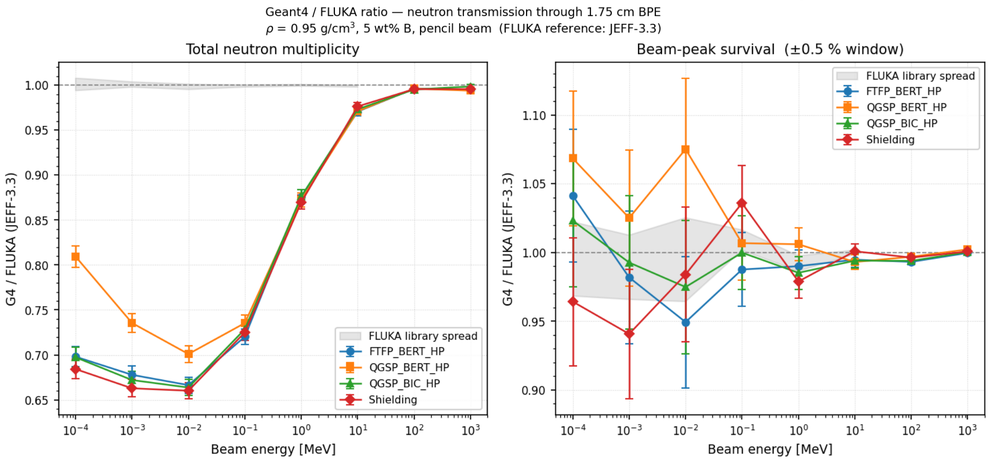
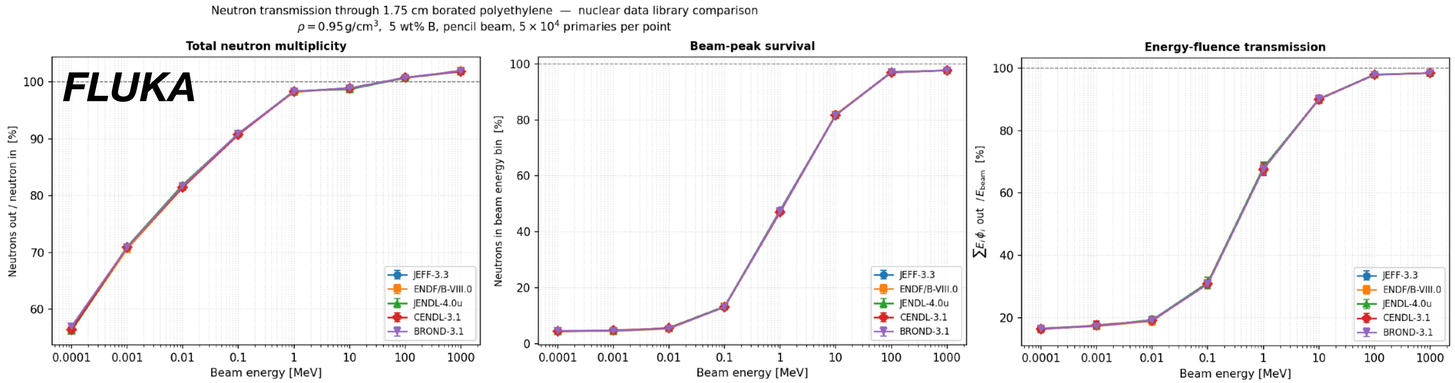
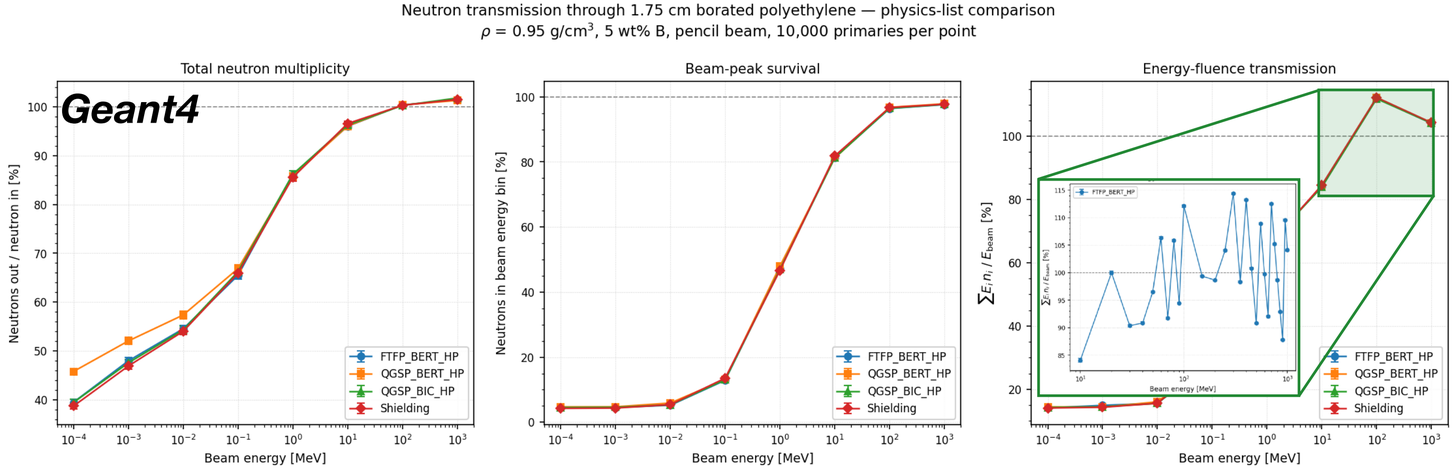
2 *FLUKA-G4 direct comparison*

- Started developing a Claude-assisted setup in G4 that closely mimics FLUKA setup in geometry, material, neutron exit scoring, peak width, and metrics (see backup)
- Geant4 setup performs nKE scan for QGSP_BERT_HP, QGSP_BIC_HP, FTFP_BERT_HP, Shielding
- Initial observations:
  - Agreement within error in beam peak survival
  - Coherent disagreement in total exit multiplicity







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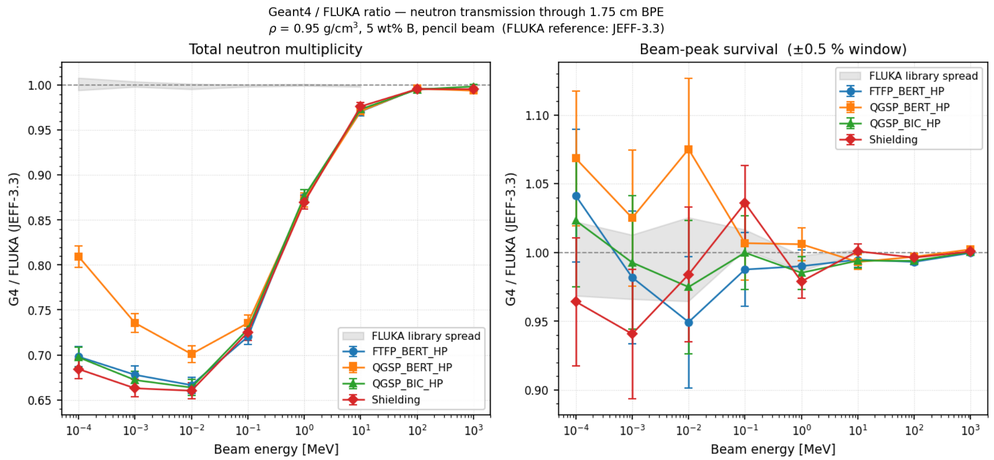

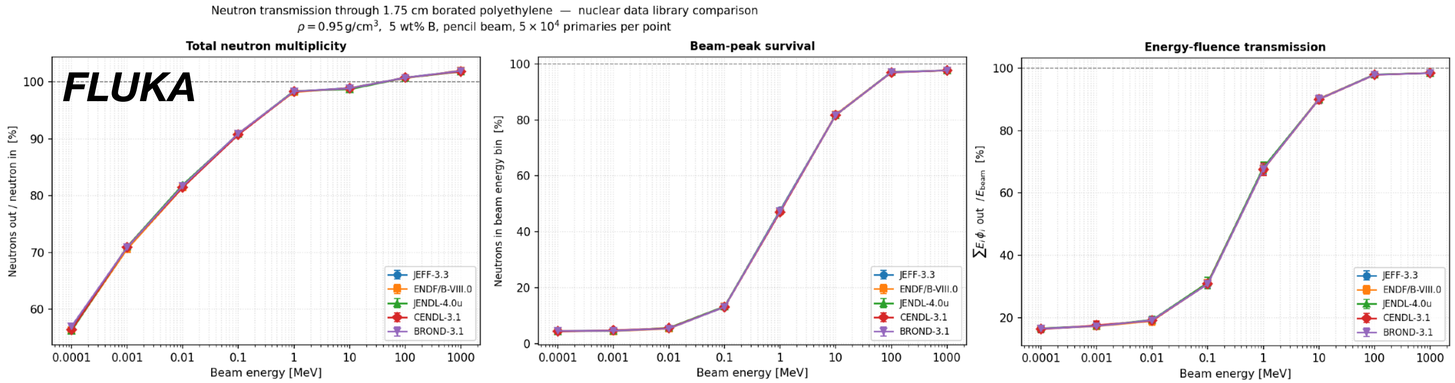

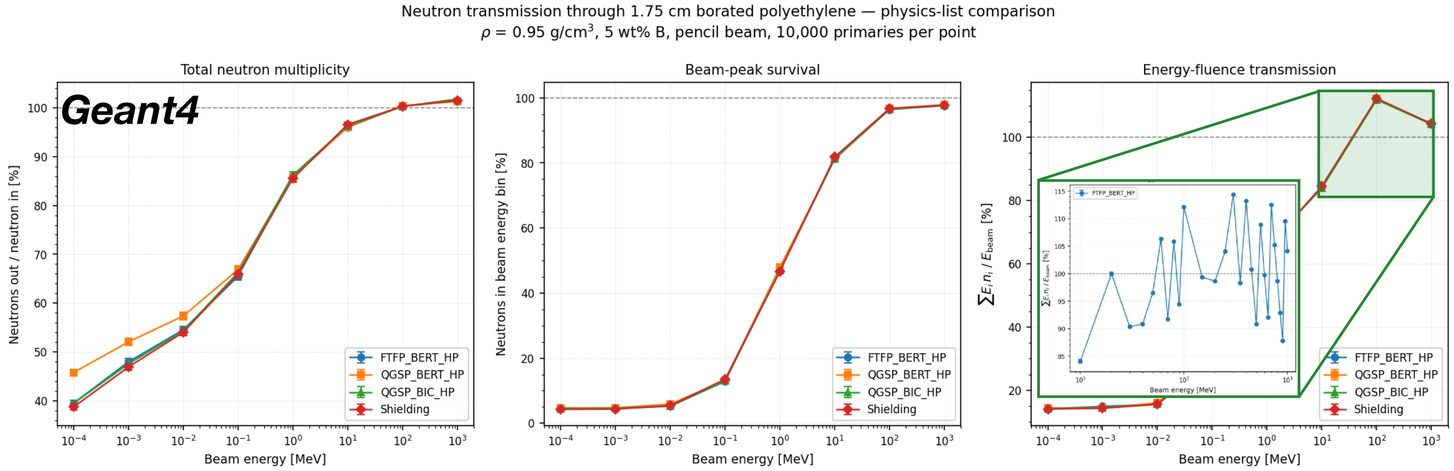

Tasks:

- Further G4 validation is needed!
- Understand why G4 discrepancy shows up only in total multiplicity
- Understand >1 noise in energy fluence transmission

Backup: FLUKA–Geant4 direct comparison

Matching FLUKA behavior in G4

	FLUKA equivalents
• Geometry	
▸ 200cm×200cm×1.75cm BPE slab, front face z=0	`RPP bpeslab −100. 100. −100. 100. 0. 1.75`
▸ Pencil beam origin at 0,0,-1cm in +z direction	`BEAMPOS 0 0 −1`
• Material	
▸ Mass fractions H 0.136, C 0.814, B 0.050	`COMPOUND −0.136 HYDROGEN −0.814 CARBON −0.050 BORON`
▸ BPE density 0.95g/cm3	`MATERIAL ... 0.95 BPE`
▸ Natural boron isotope abundance (~19.9% B10) pulled from NIST	`FindOrBuildElement("B")`
• Neutron exit scoring	
▸ Back-face boundary detection: `zPost_cm > kZMax − 1e−3`	`FLUKA USRBDX BPEREGIO -> AIRREGIO`
▸ Fluence normalized per primary per cm2 per MeV	`FLUKA USRBDX` units
▸ Sum over full face	
• Beam peak	
▸ ±0.5% energy window `|E−E_beam|/E_beam < 0.005`	width mimics `1.1∗E_beam/110`
• Metrics (analyze_transmission.py::compute_observables)	
▸ Multiplicity $\Sigma n_i / N_{\text{prim}}$	`bdx["total"]`

Backup: G4 framework flowchart