LA-UR-24-28826

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Title:	MCNP tallied weight functions to improve multigroup simulations
Author(s):	Kreher, Miriam Anne
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MCNP tallied weight functions to improve multigroup simulations

Miriam Kreher

Metropolis
Postdoctoral Fellow
PhD MIT ’23

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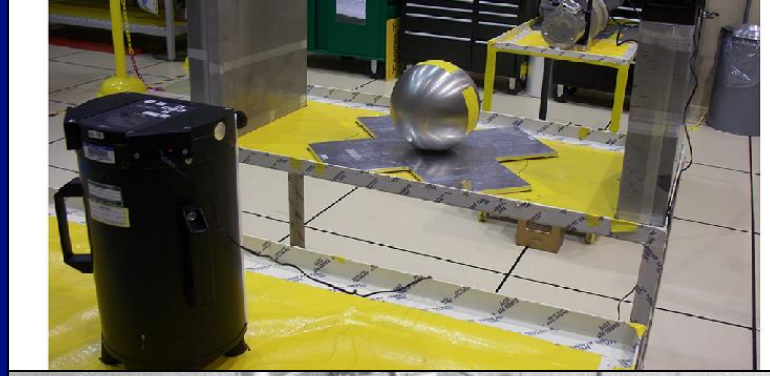
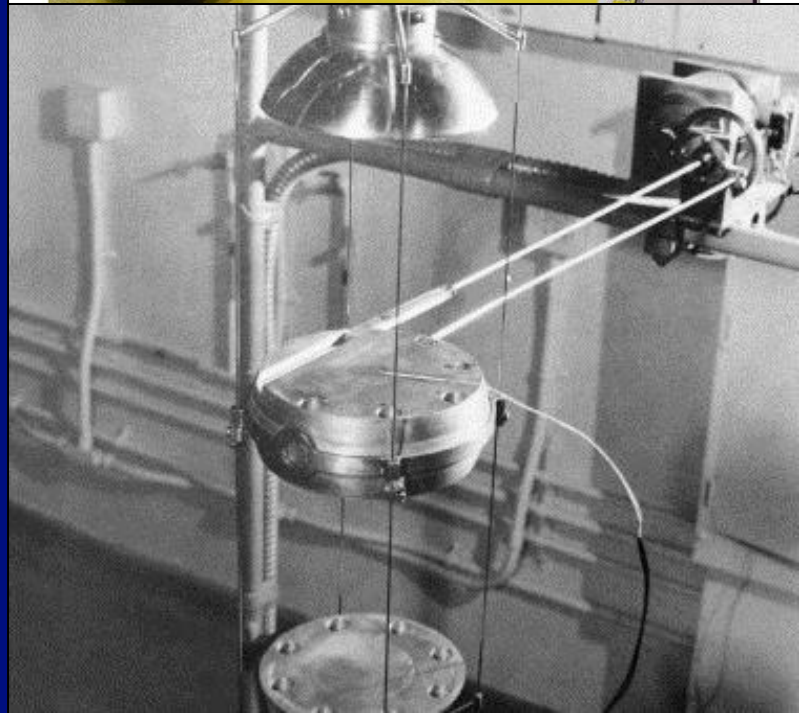
Motivation

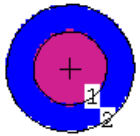
- LANL-30 to LANL-618 group structures are relied on heavily at LANL for fast system modeling.
- While proven useful, “why it works” is still an open question.
- Fast plutonium critical experiments are the testbed for exploring the group structures and potential optimization paths.
- The following examples use MCNP generated data to run a deterministic simulation.





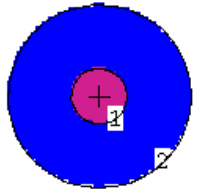
BeRP and Jezebel critical experiments

Which problems?



PMF018

Plutonium core
Beryllium reflector



PMF038 (BeRP)

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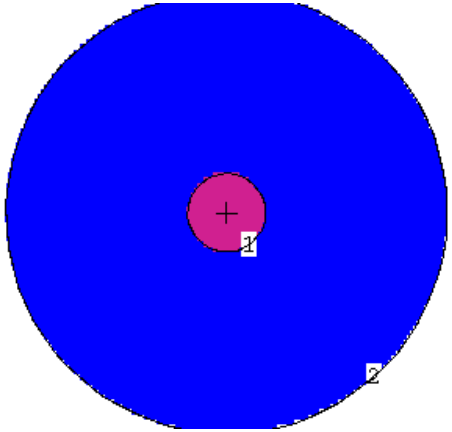
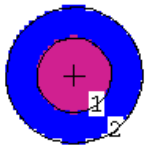
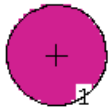


PMF008

Plutonium core
Thorium reflector

Which problems?





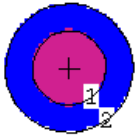
PMF010

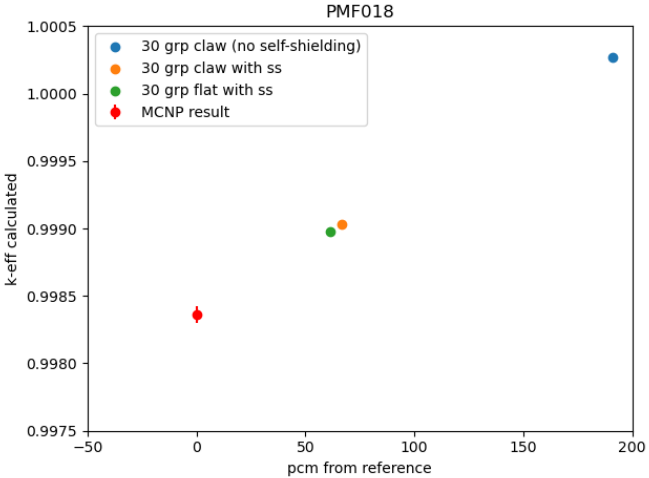
Plutonium core
Natural Uranium reflector

PMF002

Bare plutonium

How do they behave?





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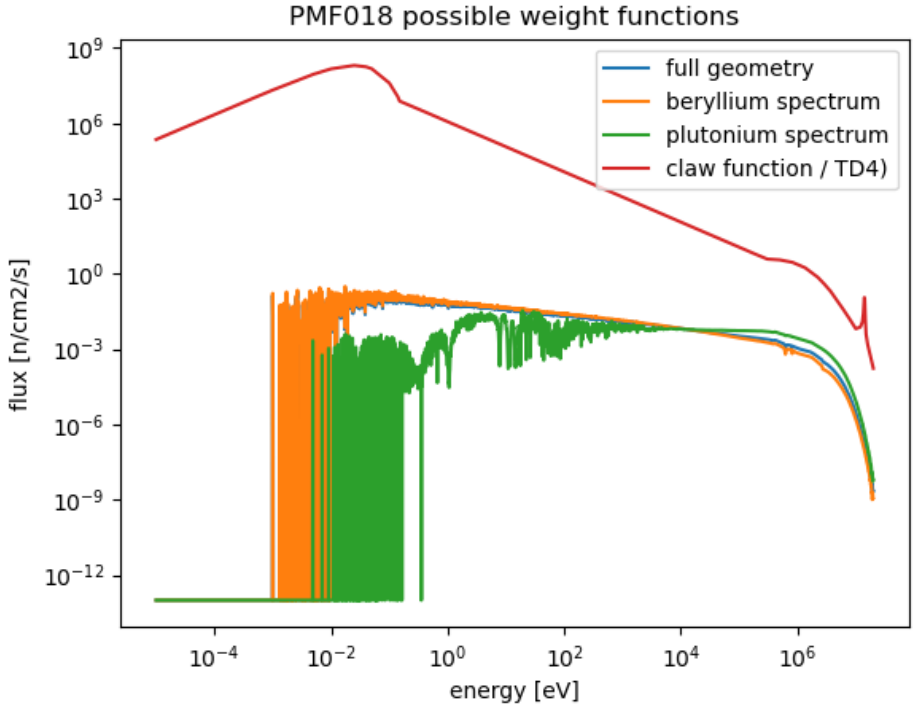

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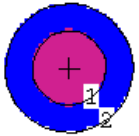

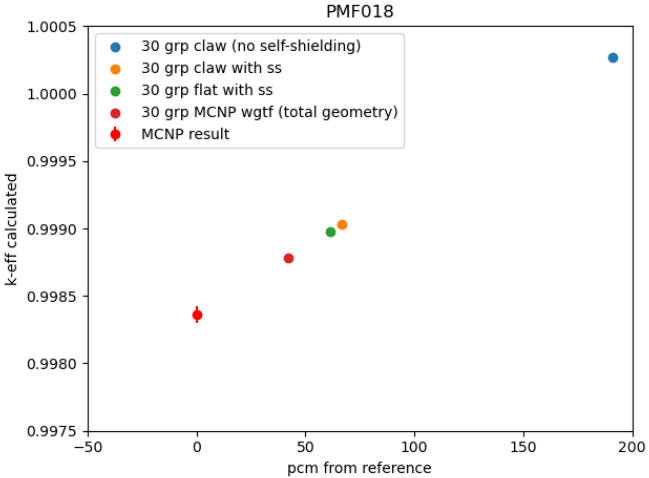

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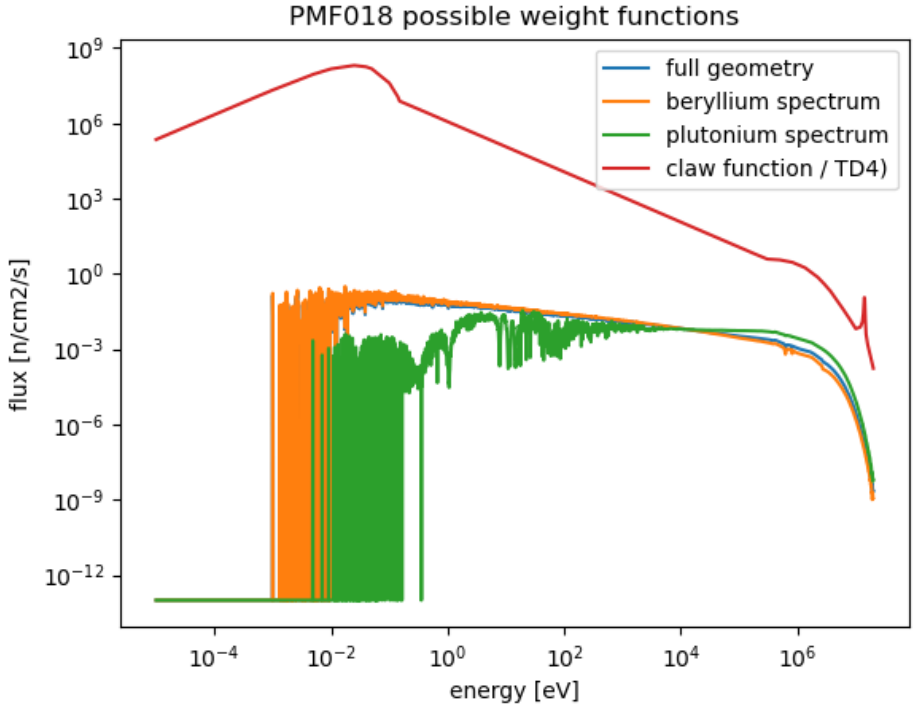

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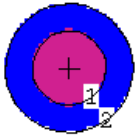

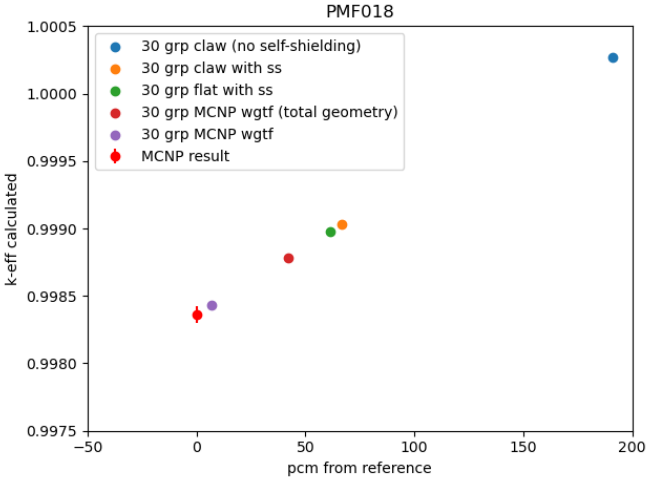

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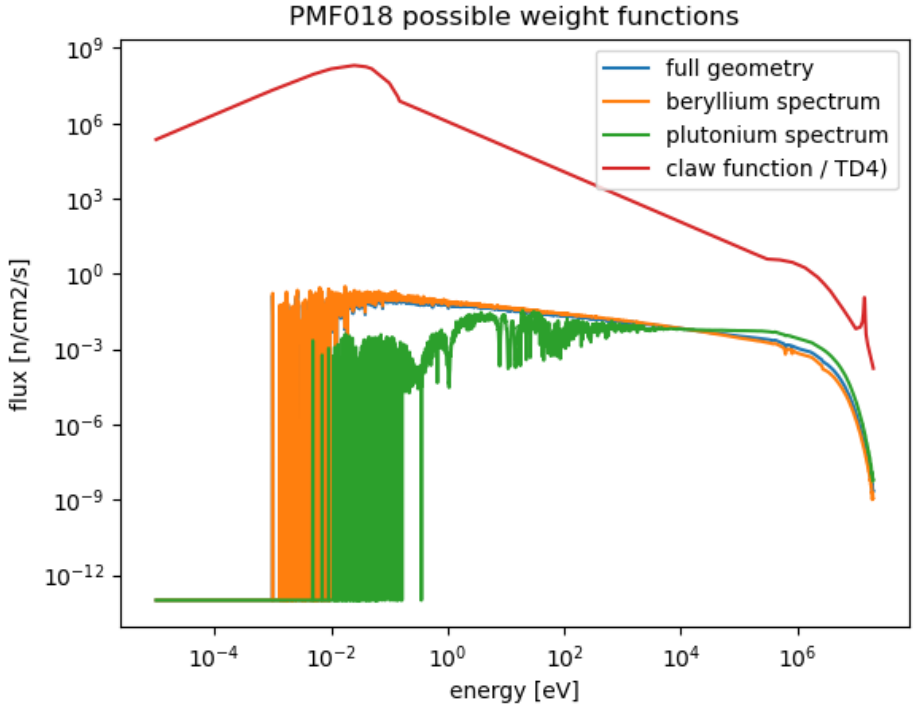

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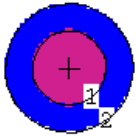

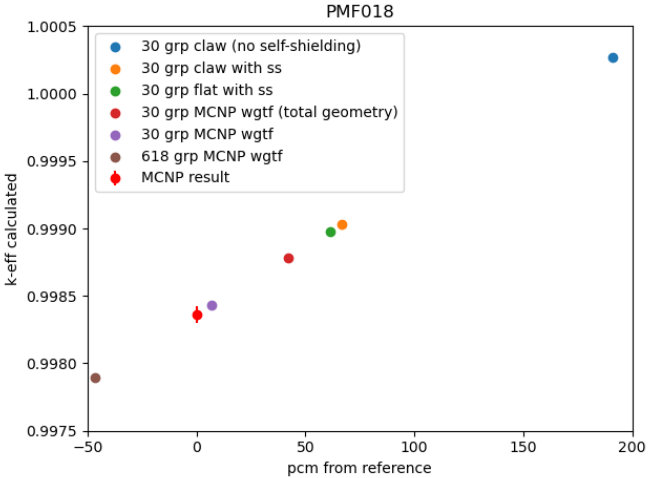

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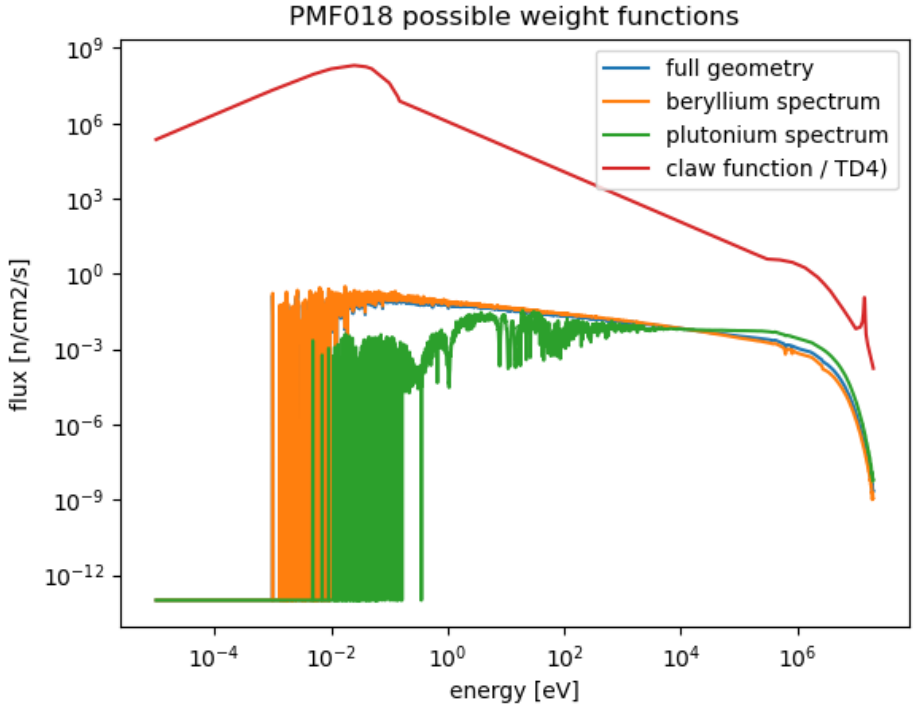

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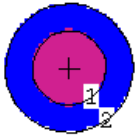

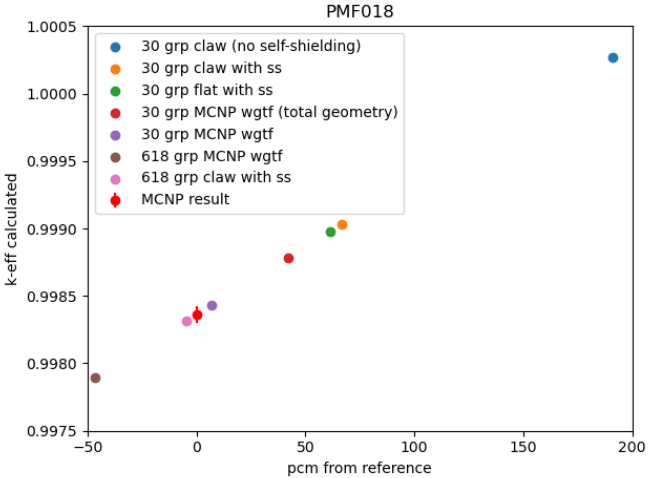

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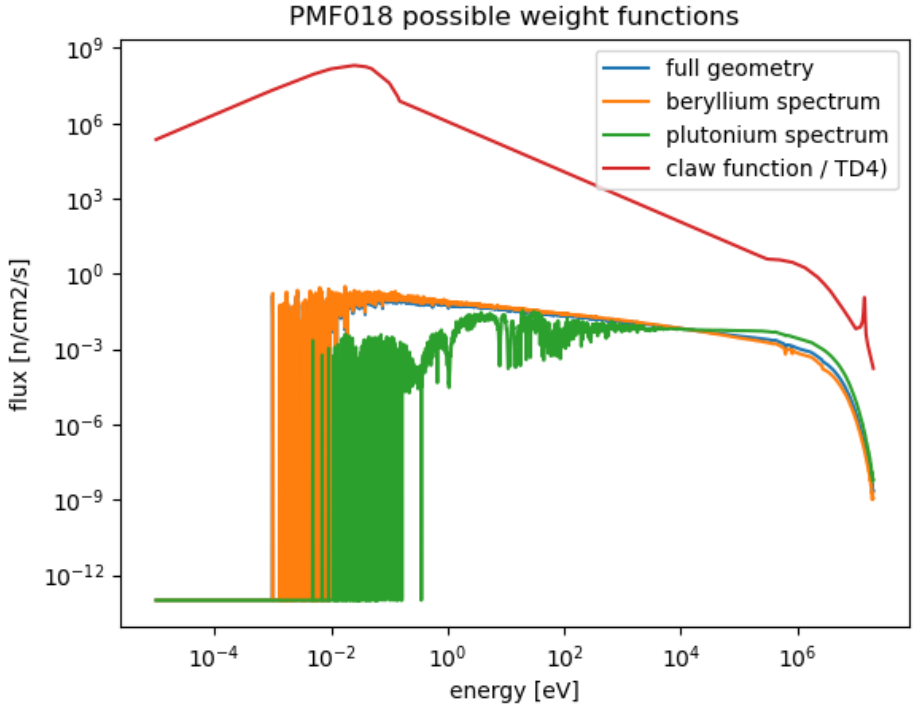

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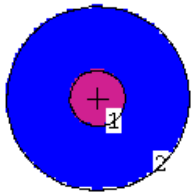
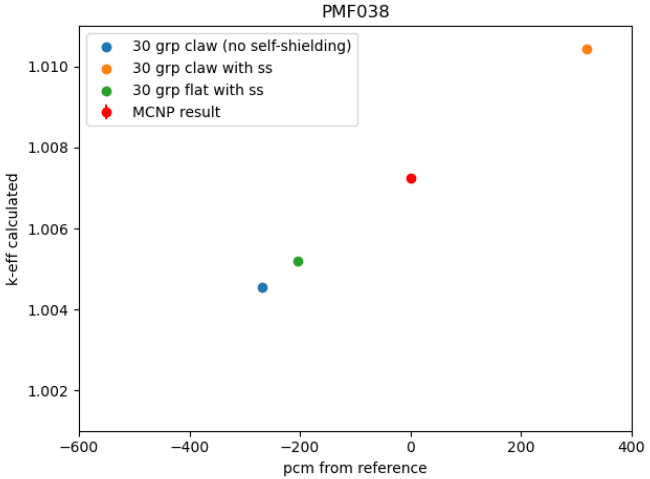
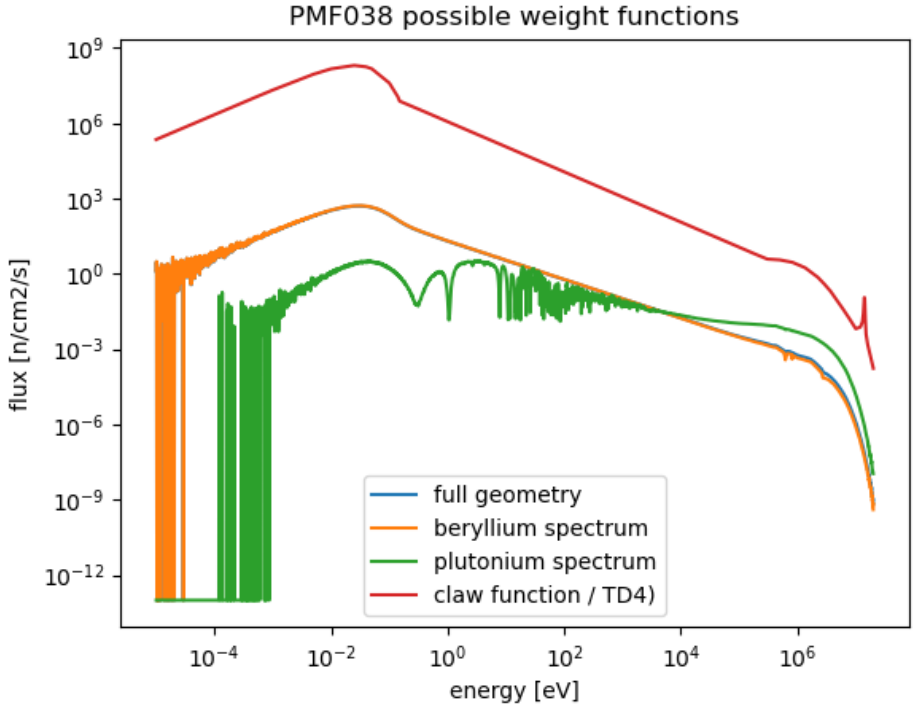




PMF038 (BeRP)

Plutonium core
Beryllium reflector



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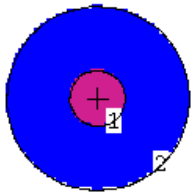

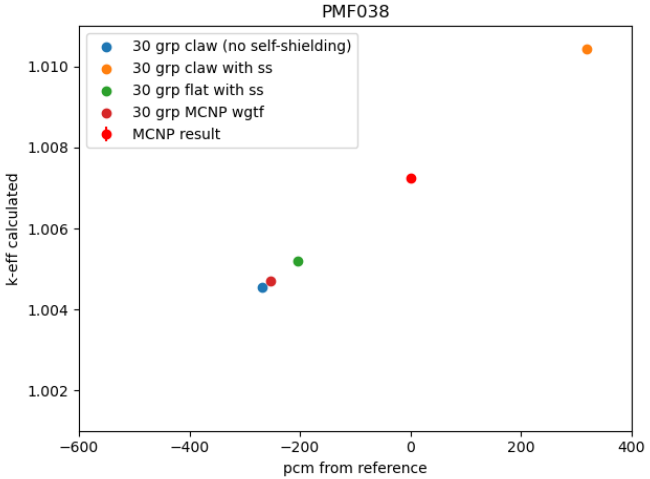

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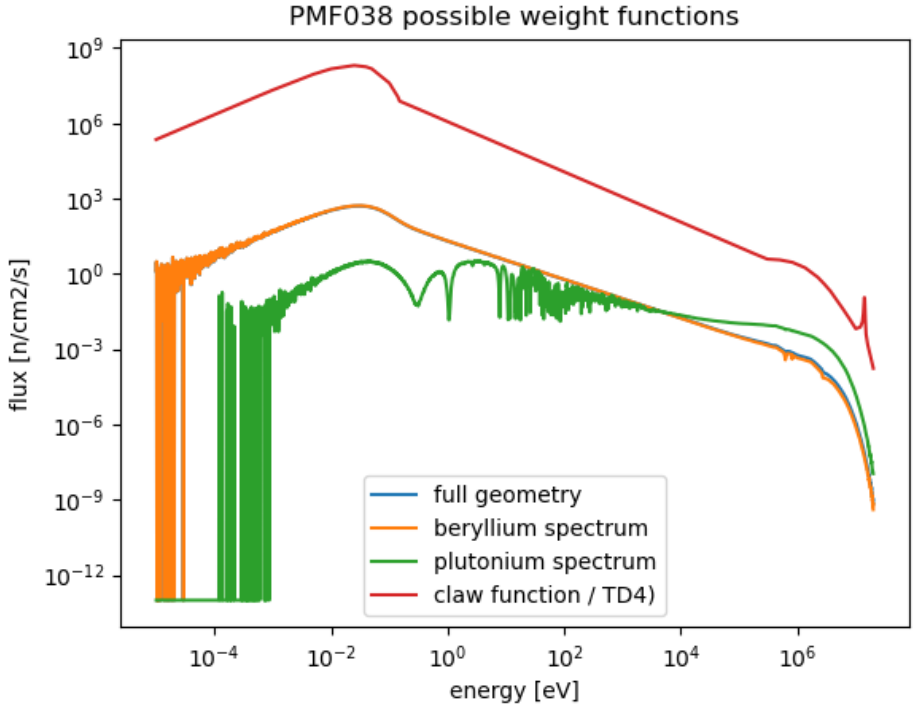

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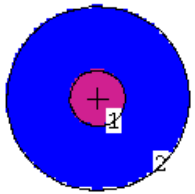

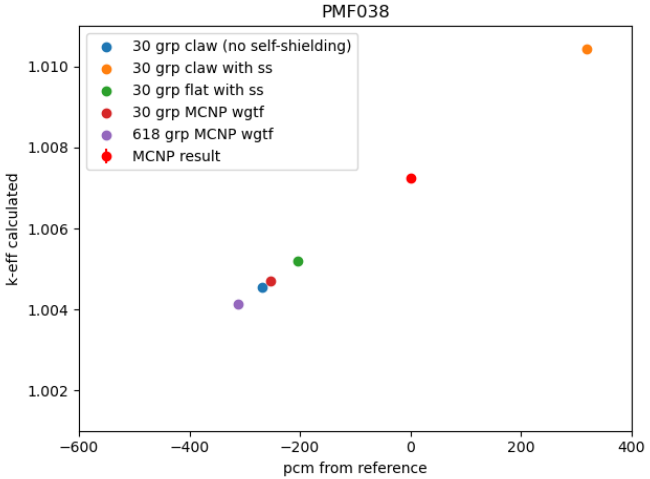

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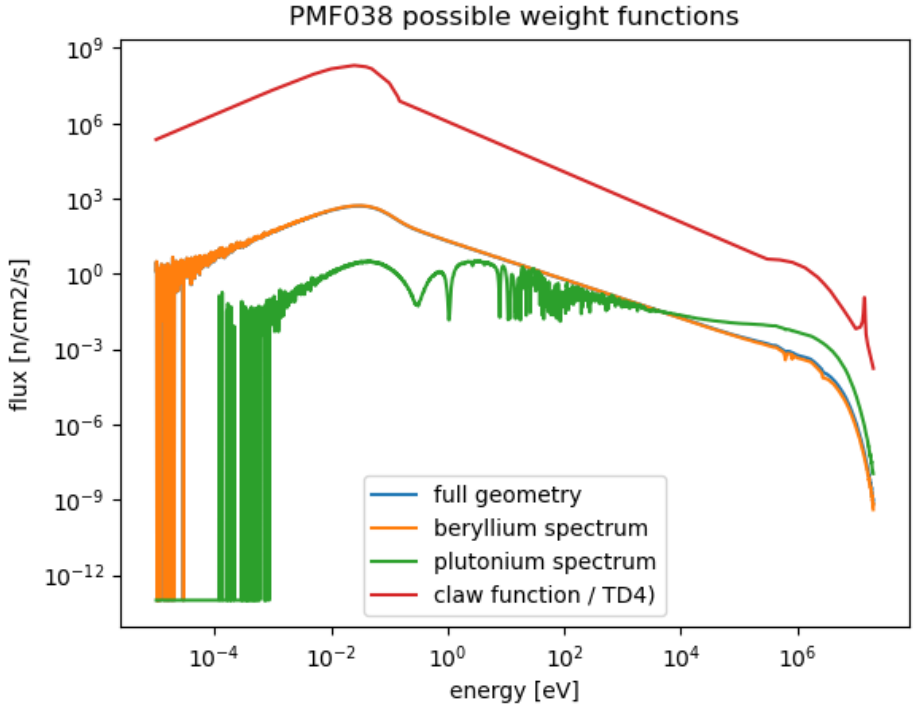

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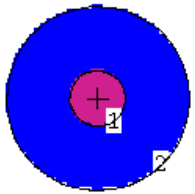

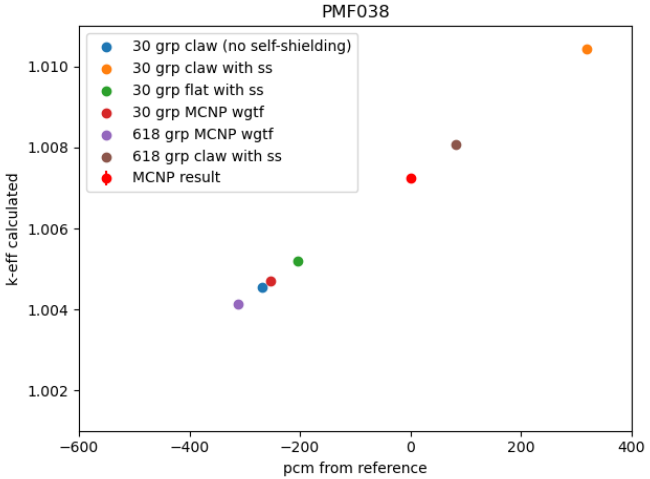

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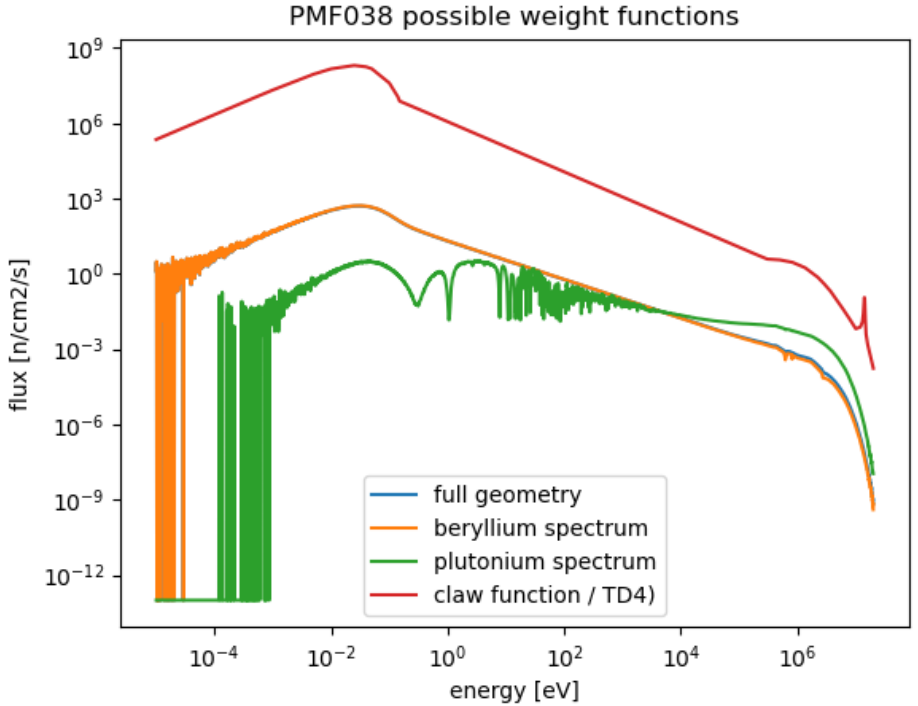

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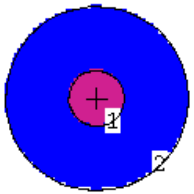

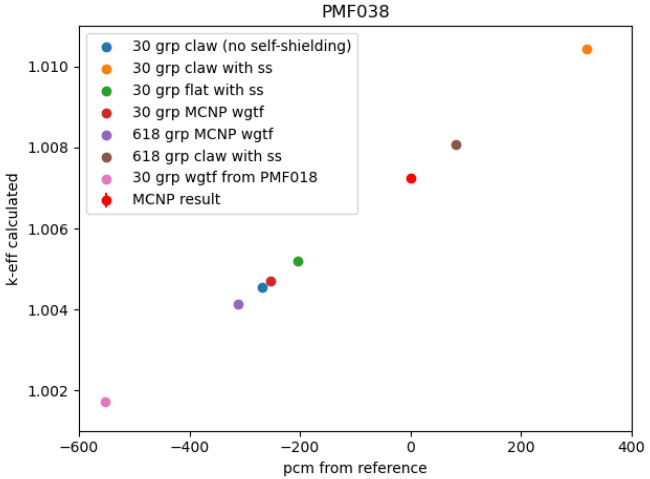

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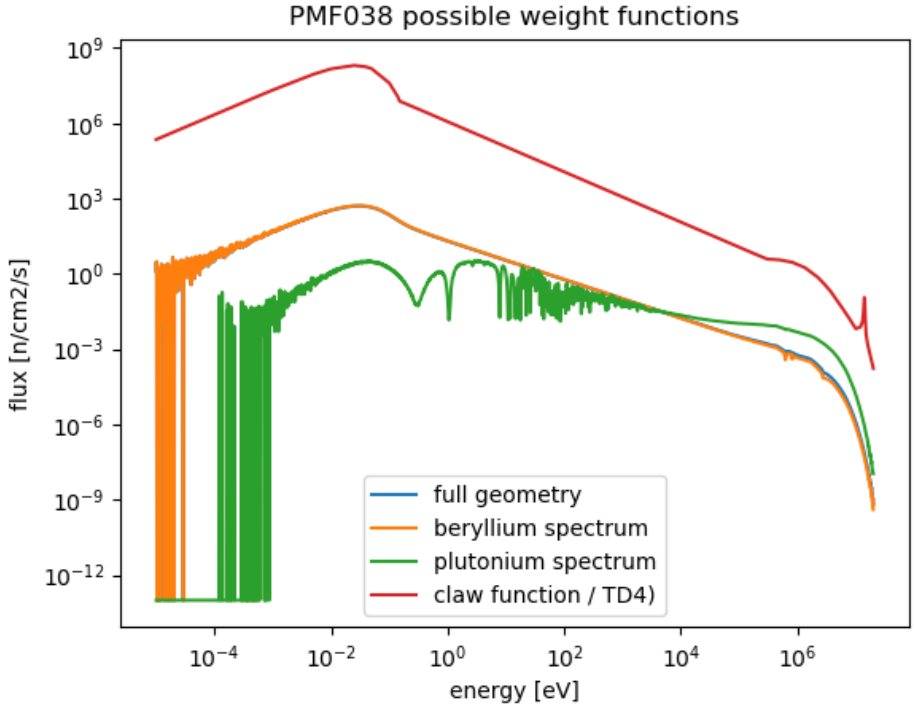

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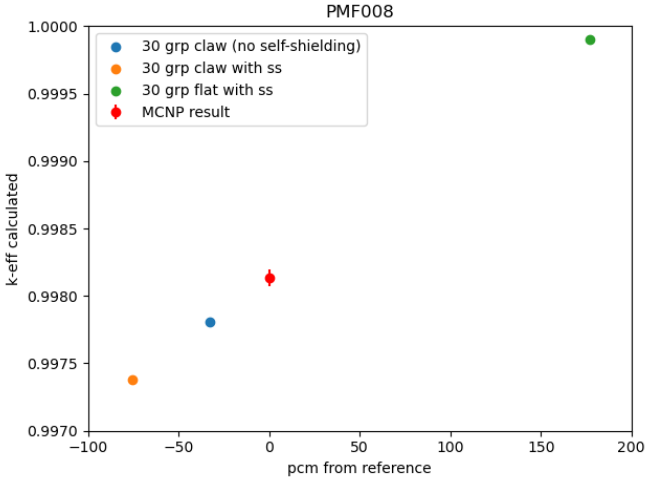

PMF008

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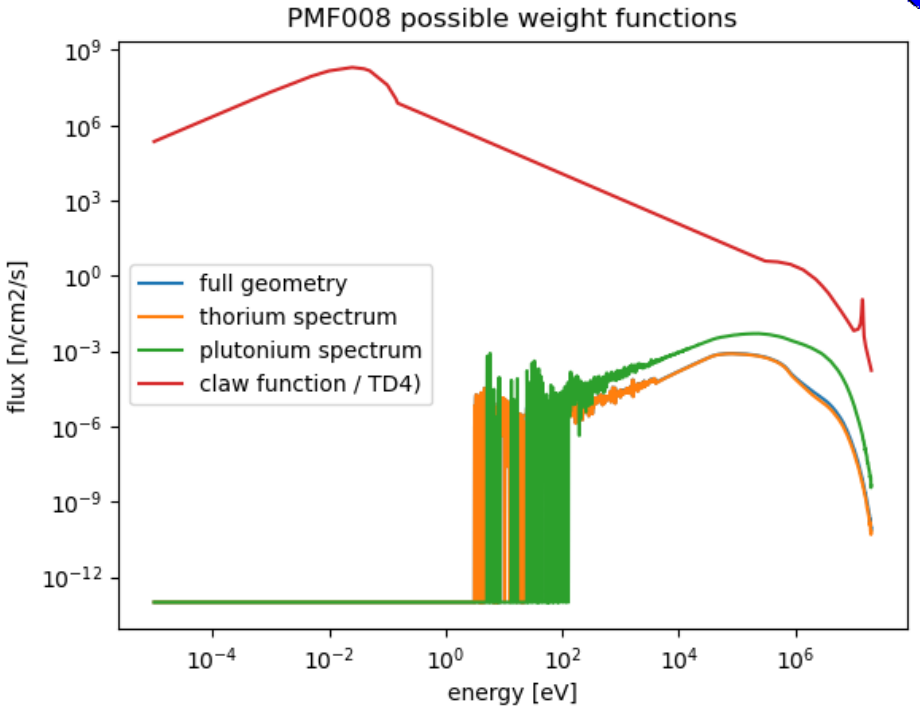

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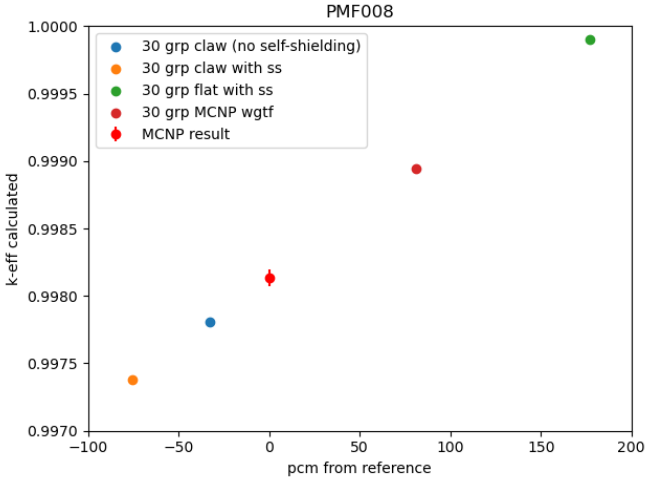

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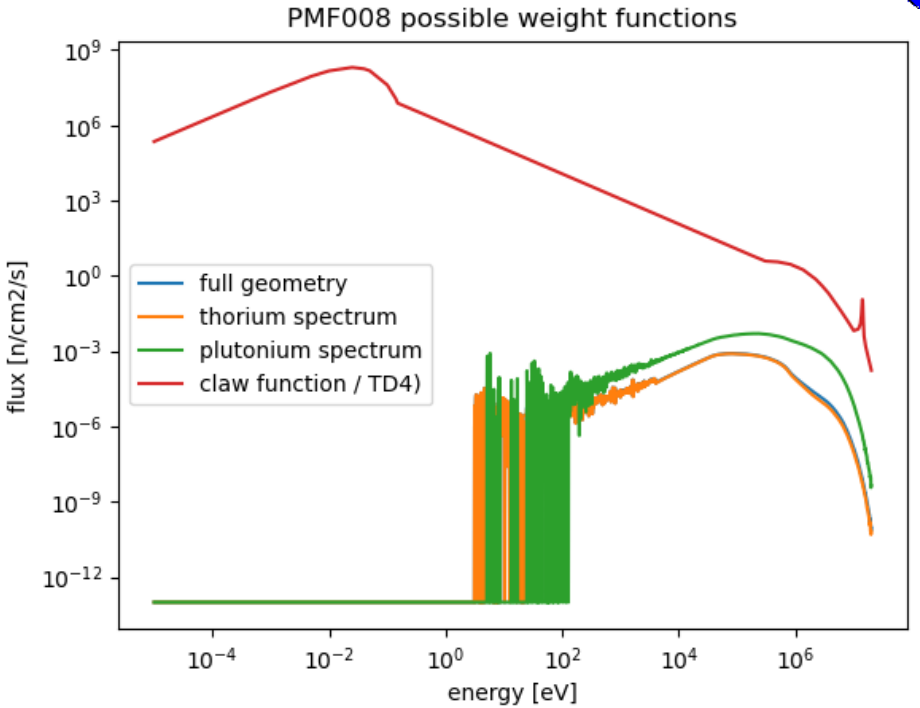

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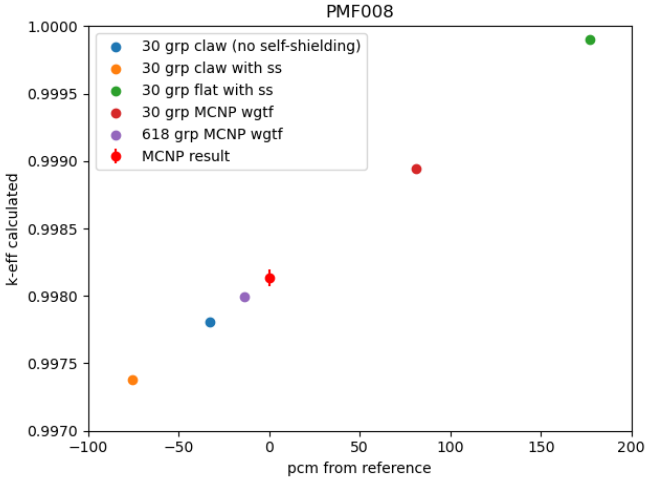

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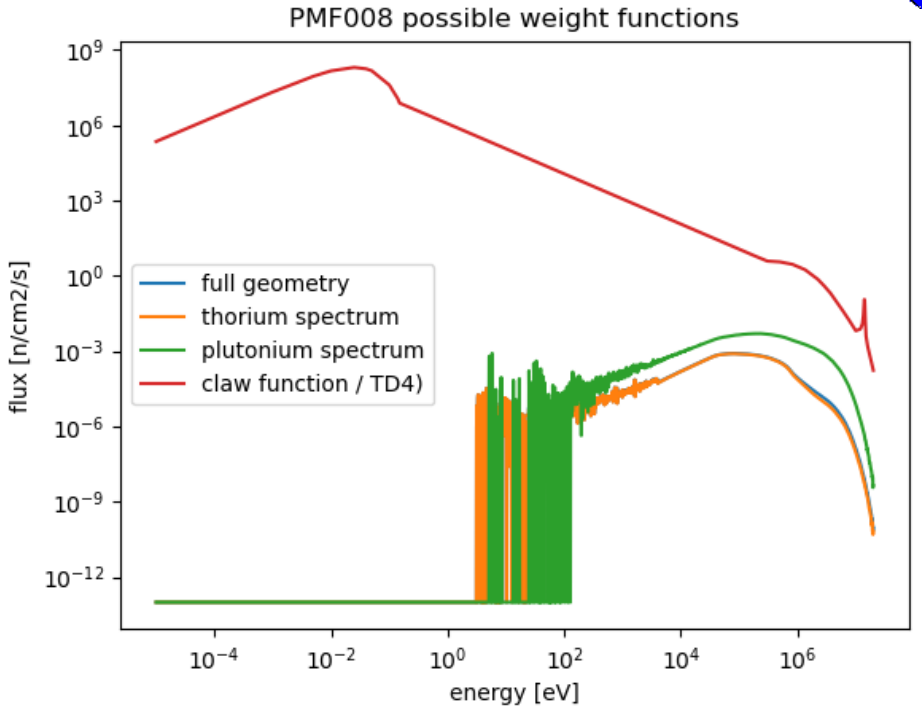

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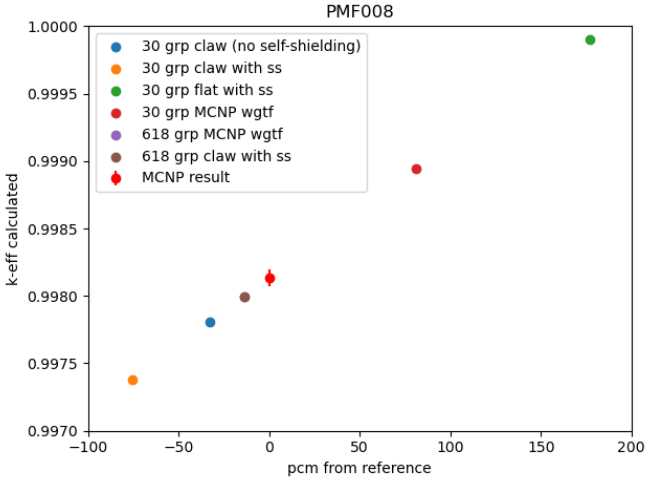

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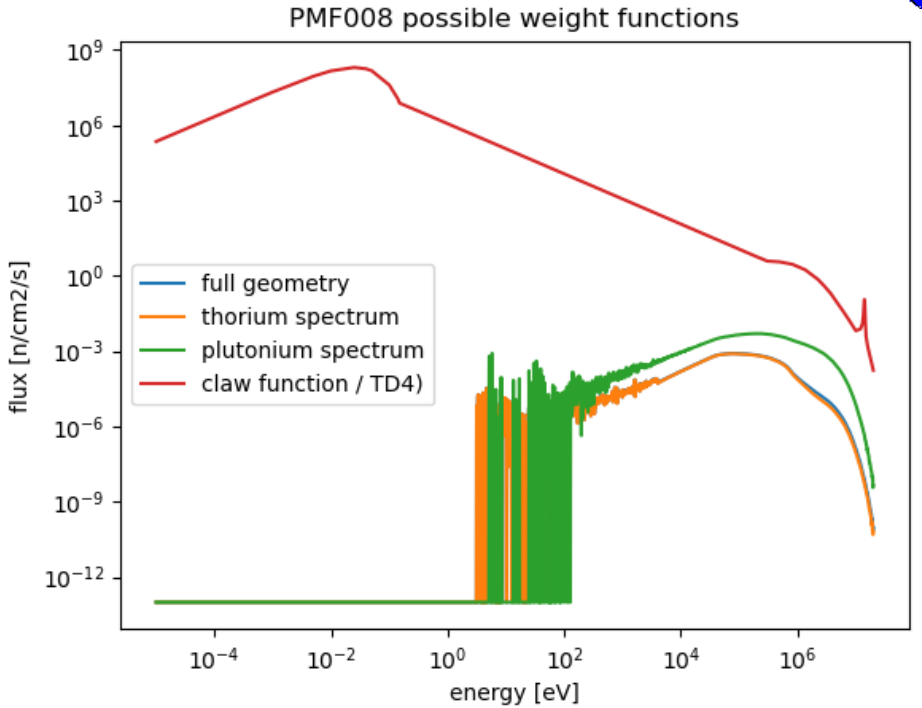

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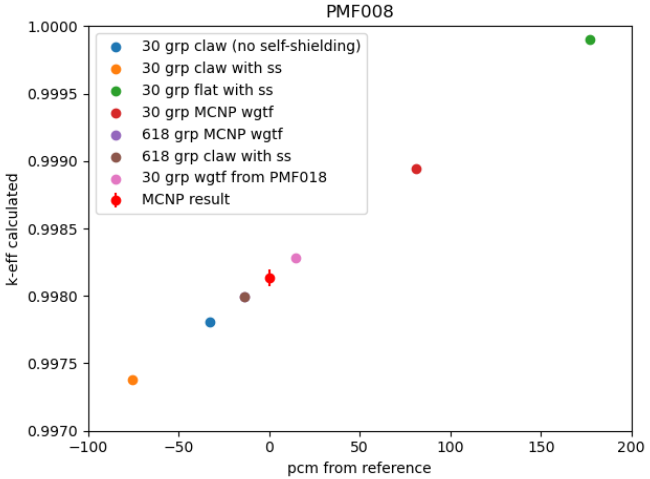

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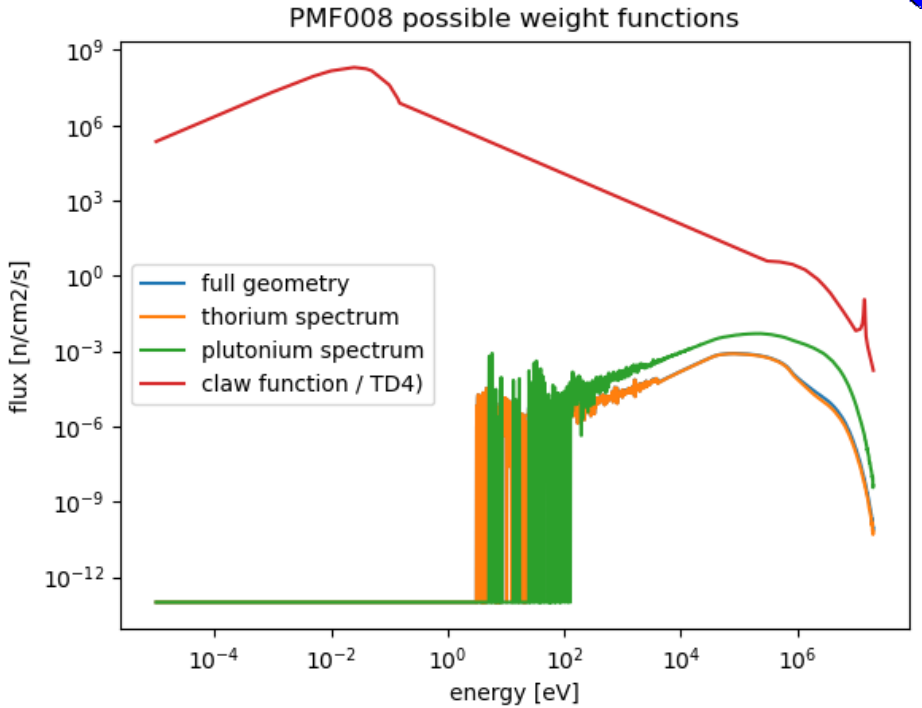

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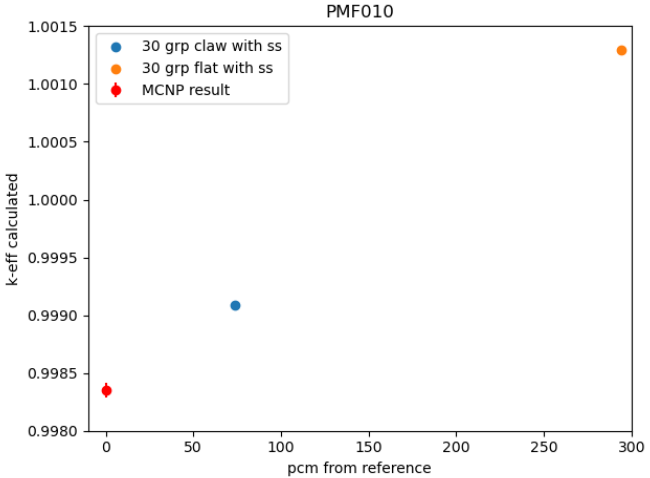
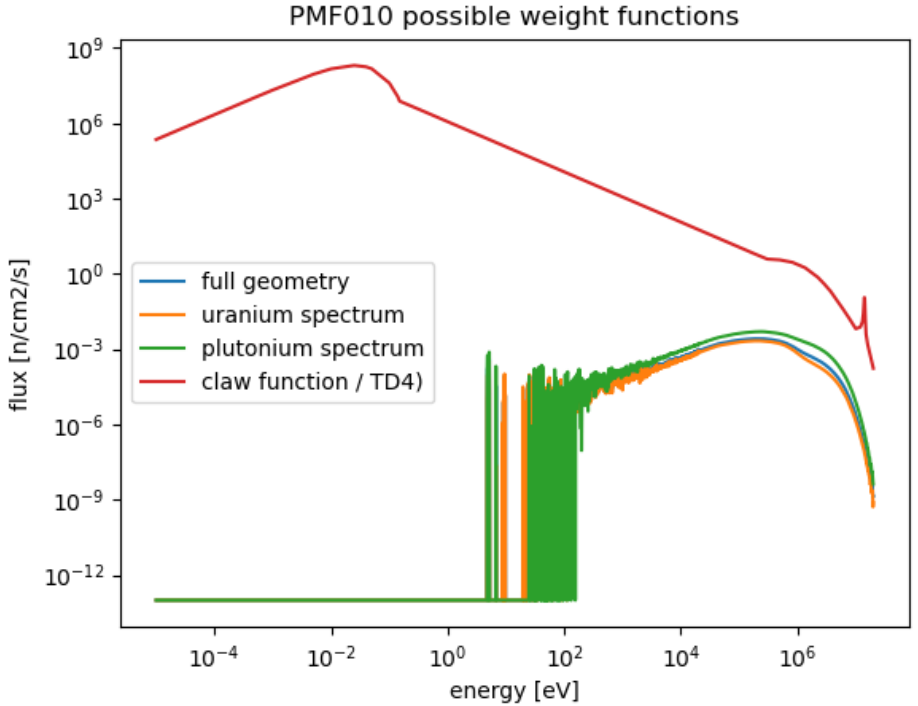


PMF010

Plutonium core
Natural Uranium reflector



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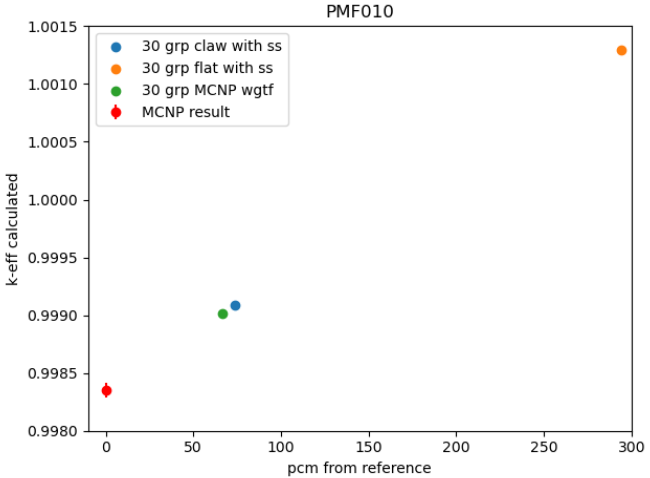

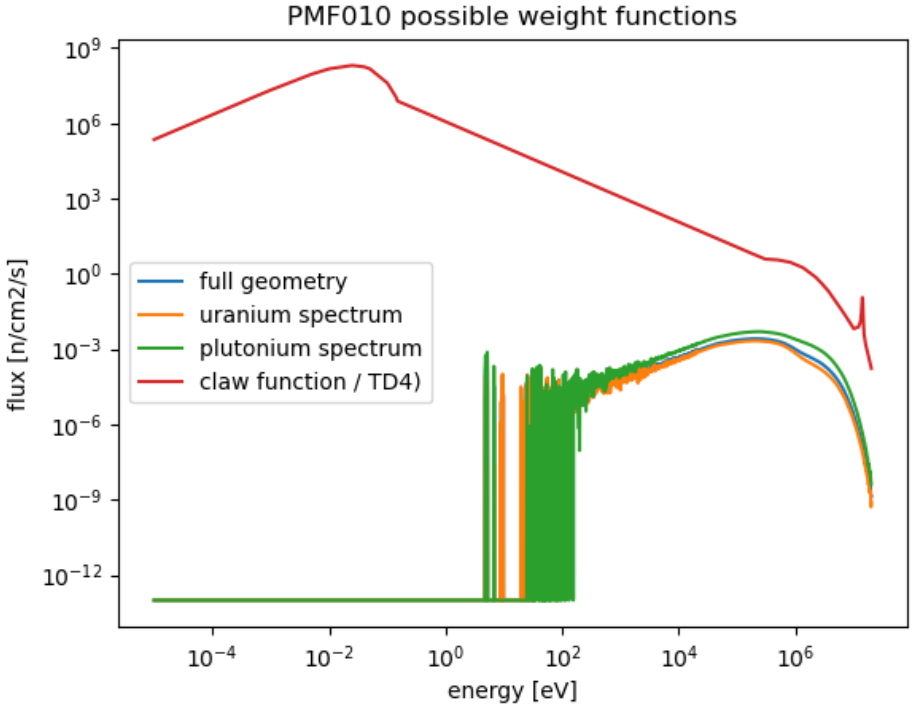

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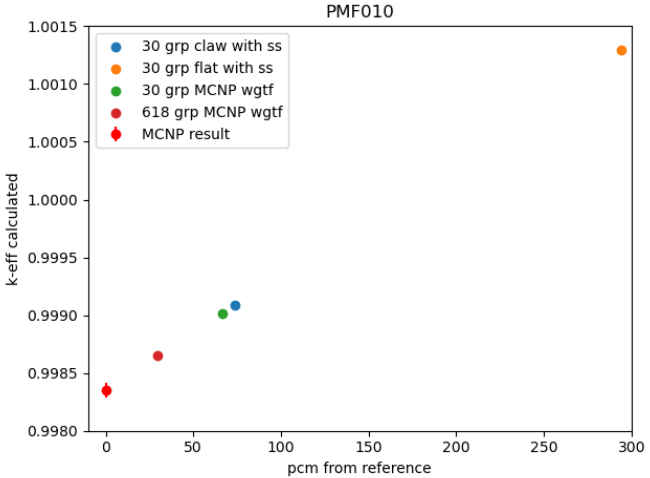

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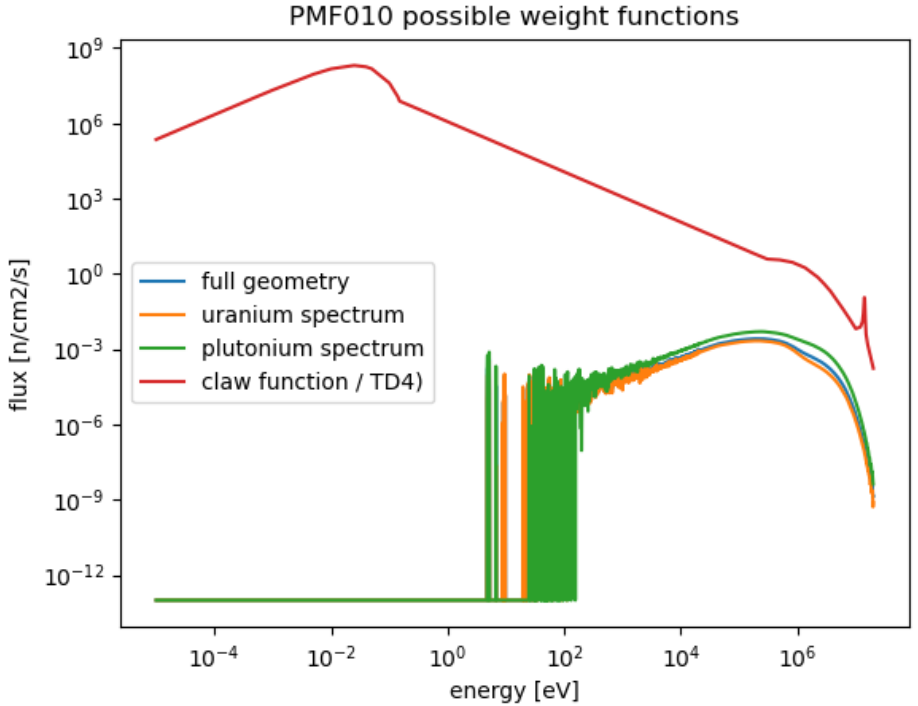

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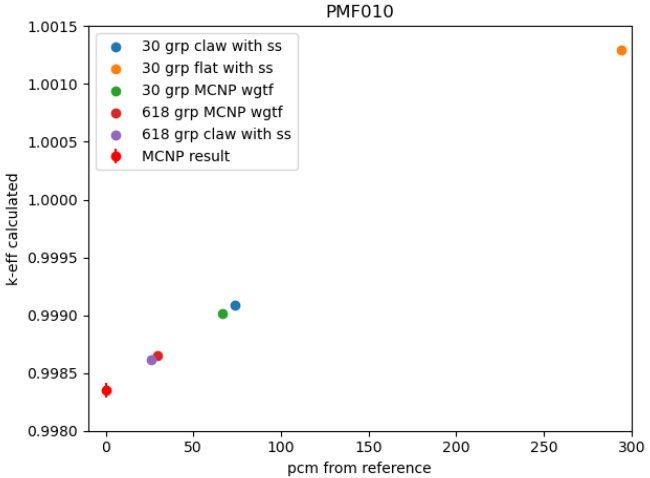

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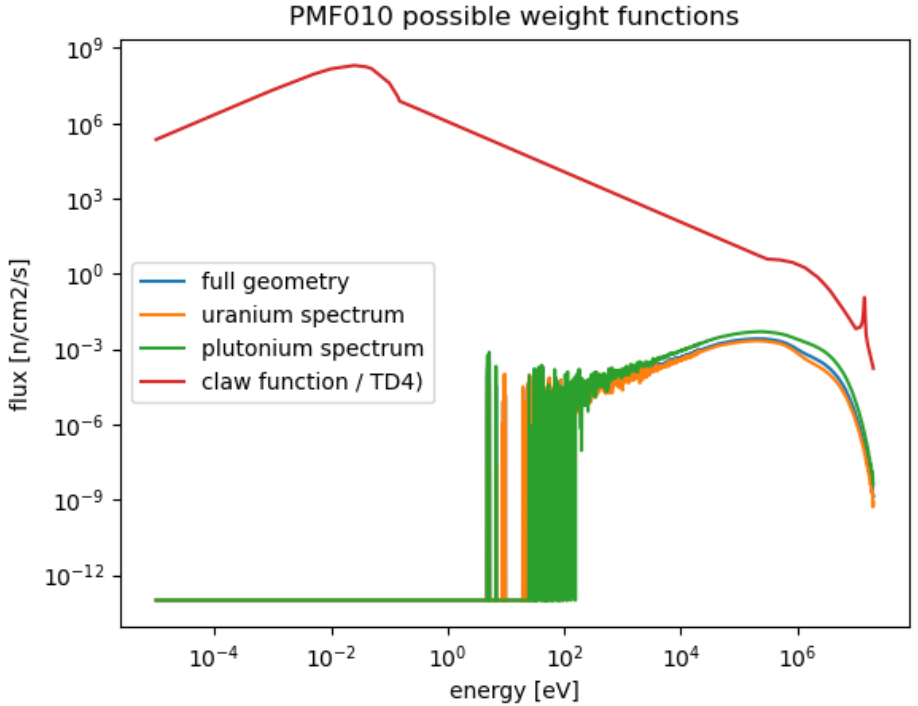

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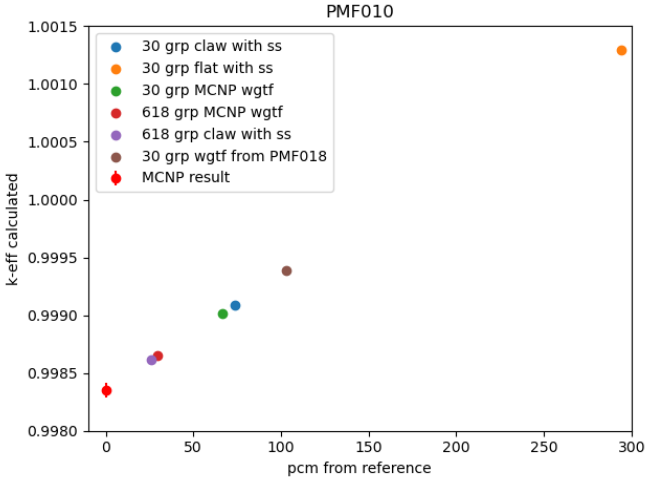

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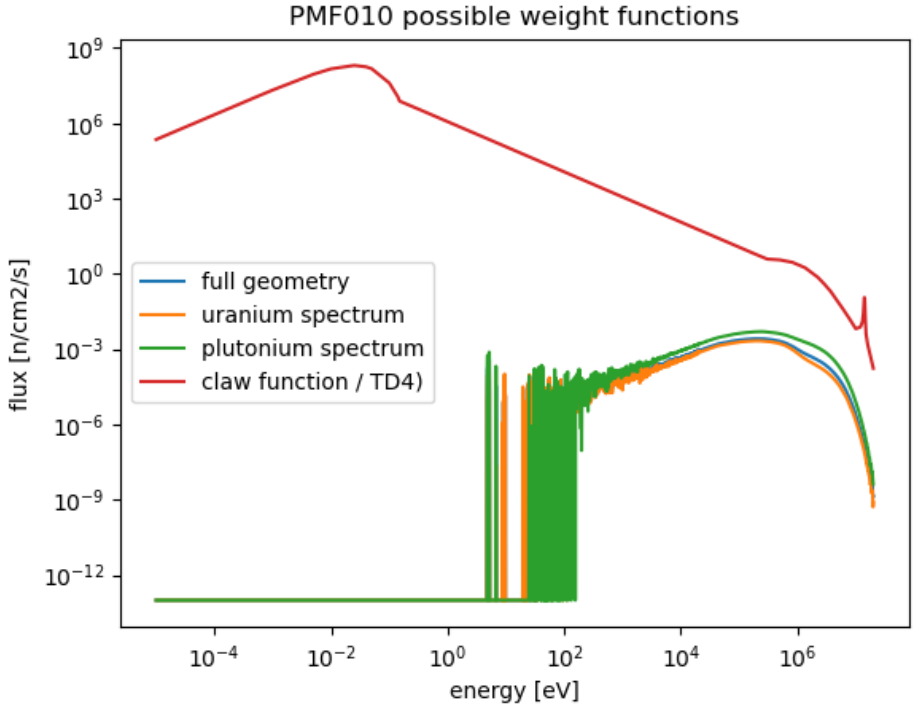
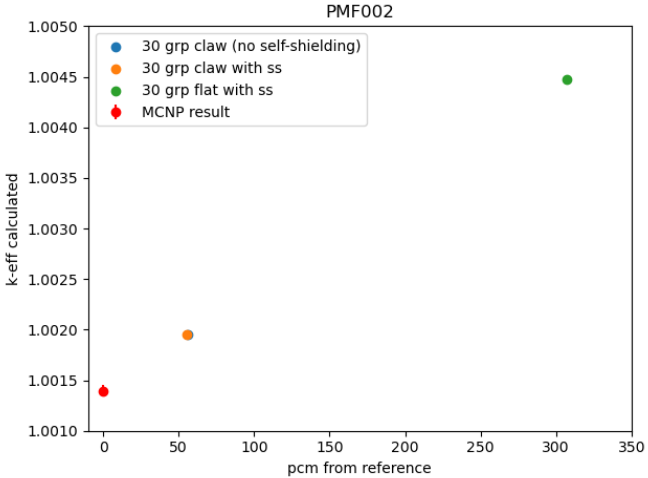
Plutonium core
Natural Uranium reflector

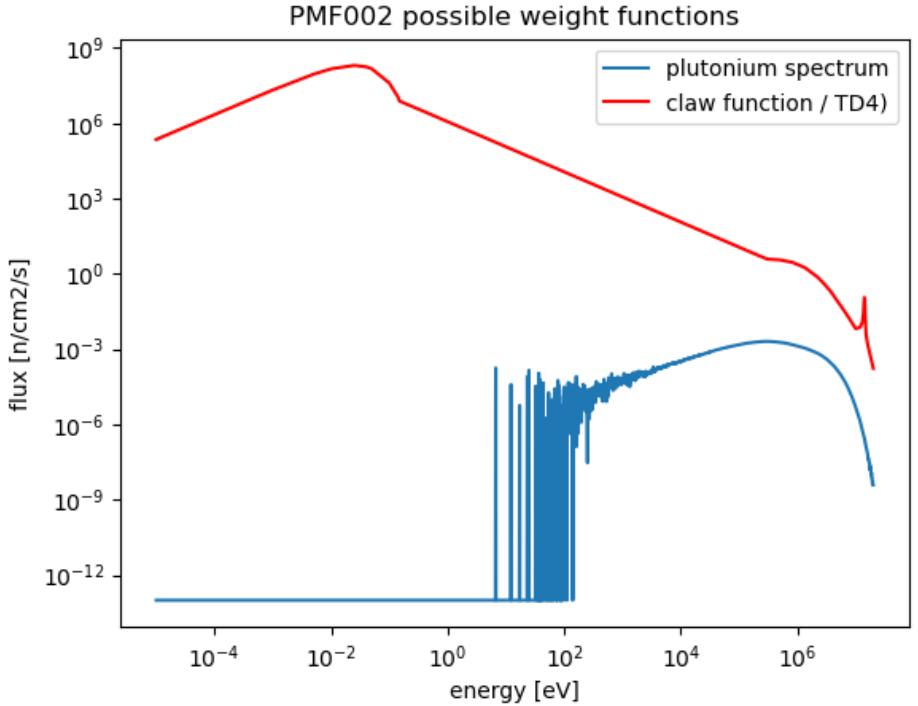


How do they behave?

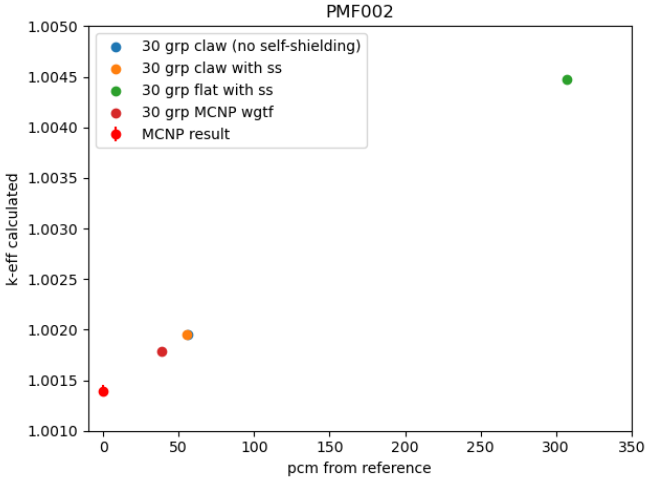


PMF002

Bare plutonium

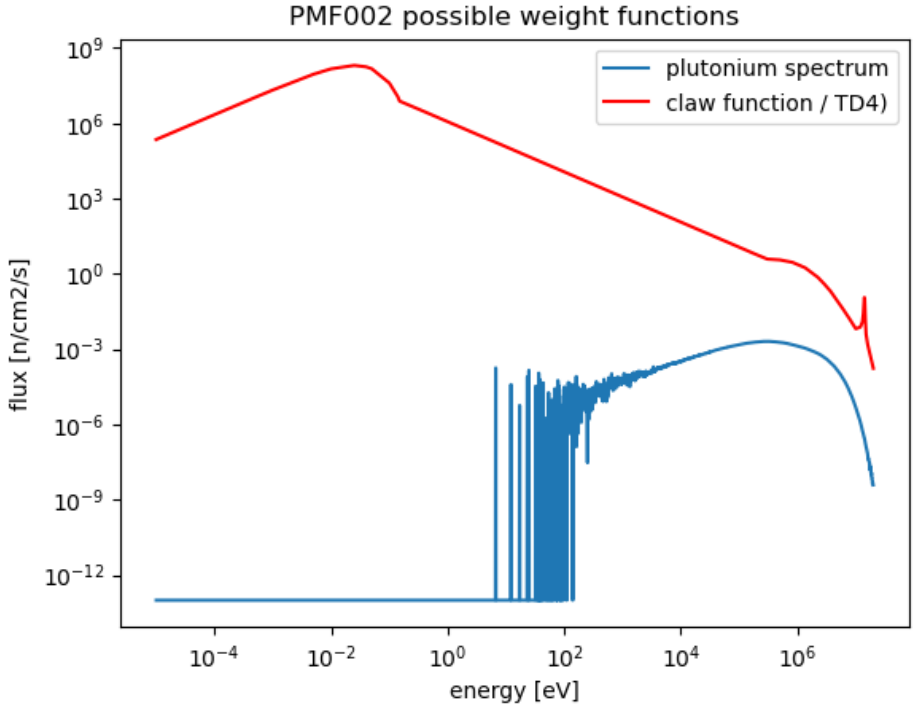


How do they behave?

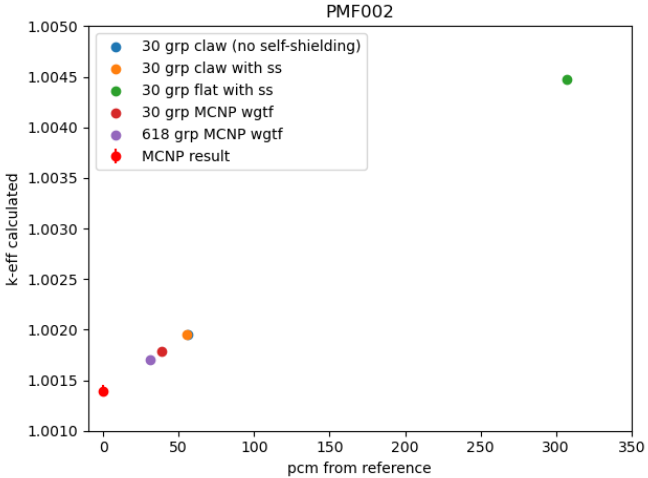


PMF002

Bare plutonium

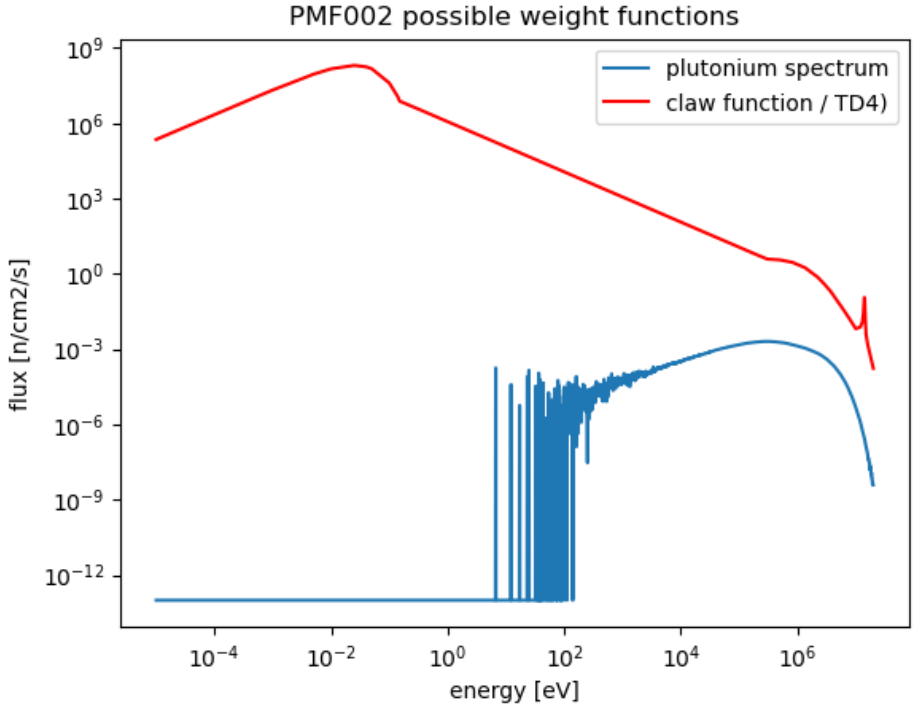


How do they behave?

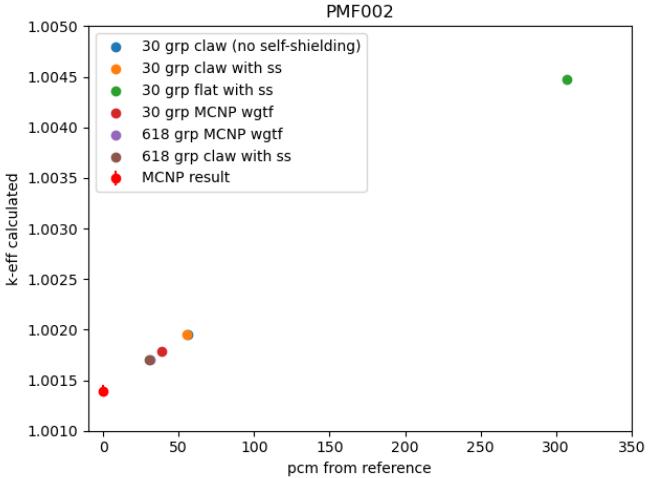


PMF002

Bare plutonium

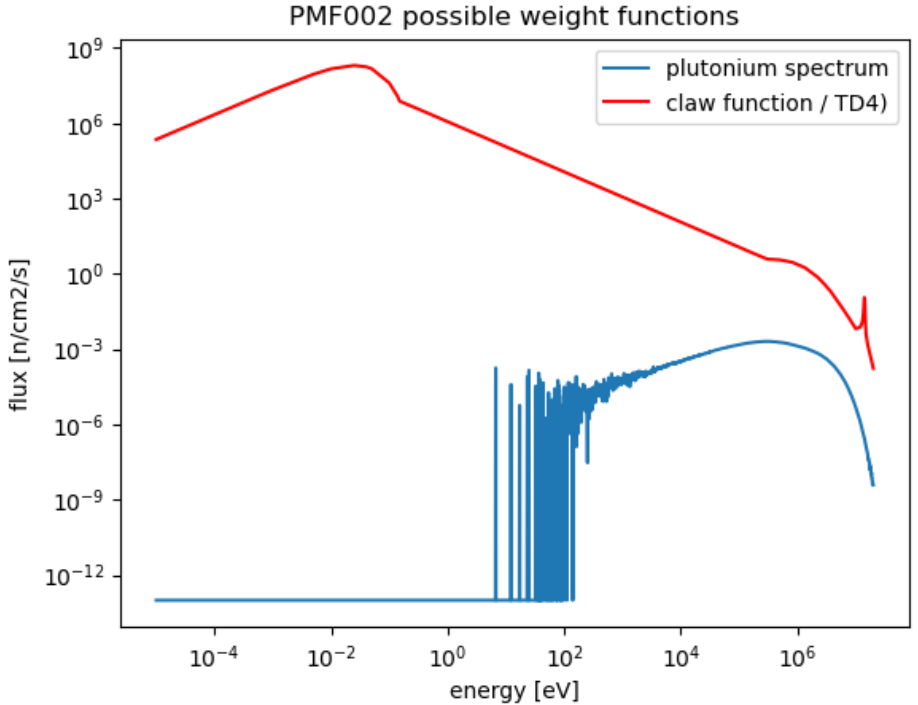


How do they behave?

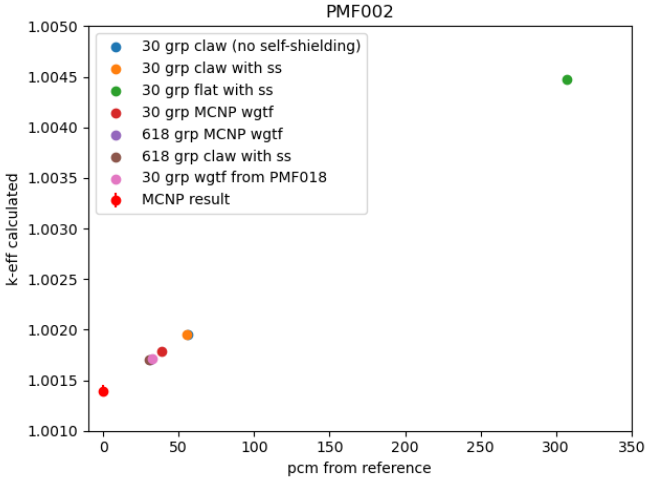


PMF002

Bare plutonium

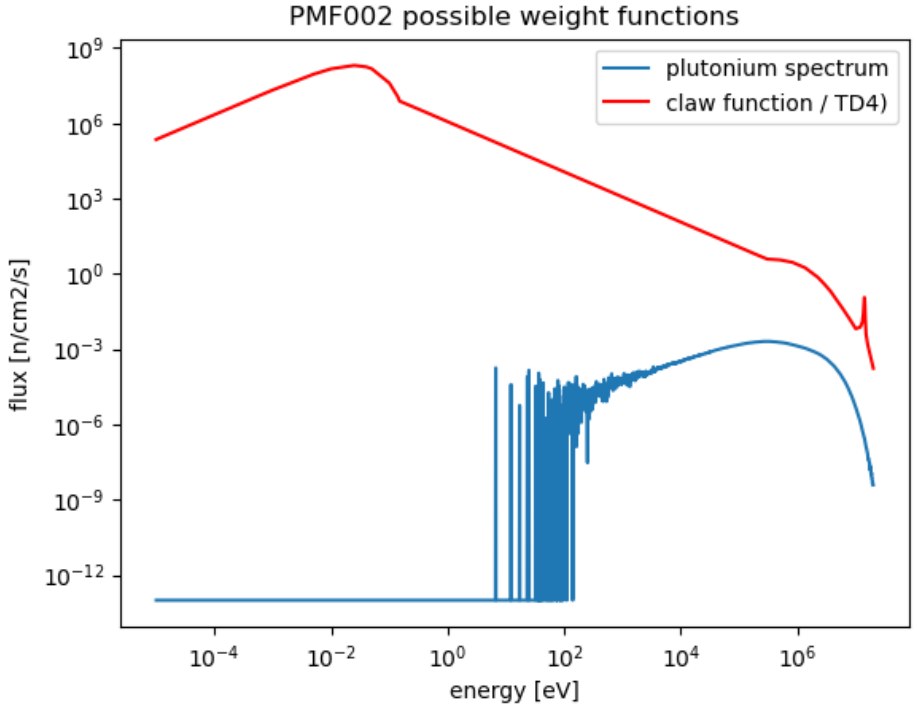


How do they behave?



PMF002

Bare plutonium



Key take-aways:

- The weight function used to generate multi-group data is important.
- MCNP-generated data is not always feasible.
- CLAW/TD4 weight function often behaves the same or better.
- More research is required to study *why* this weight function and group structure combination is so successful for fast systems.

Key take-aways: LANL-30 & claw work really well together

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