

Moira simulations for n_TOF

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Moira

Moira overview

- **Geometry & navigation:** G4 geometry + zones ‘a la FLUKA’ + fully custom navigator.
- **Materials:** Directly from G4.
- **Magnetic fields:** Custom implementations directly deriving from G4.
- **Cuts:** Directly from G4.
- **Run & stepping:** Custom implementations deriving from G4 / directly from G4.
- **Seeding:** Directly from G4 + custom implementation deriving from G4, for event restart mode.
- **Scoring:** Fully custom.
- **Biasing:** Custom implementations directly deriving from G4.

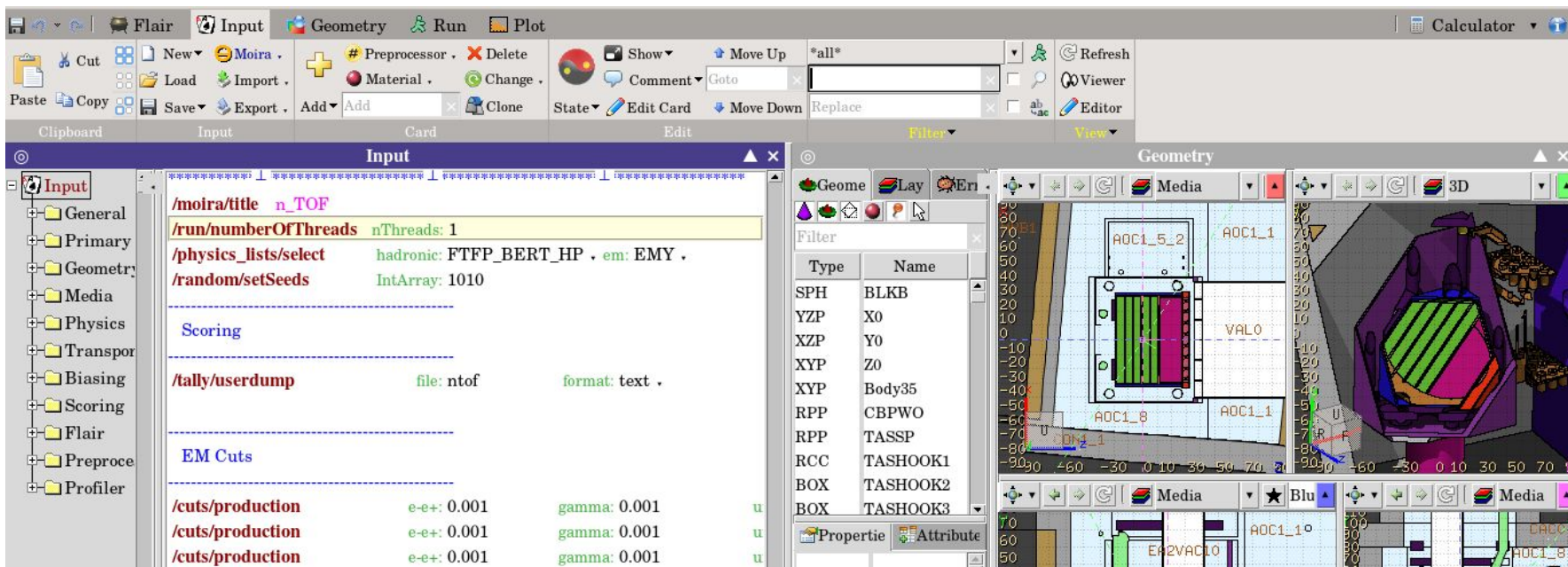
[G. Hugo - Fluka-Cern status and plans, Moira, and scoring](#)

[A. Donadon Servelle - Studies driven by the Moira Framework](#)

[JA Pavon - Moira simulations for n_TOF](#)

Moira: Flair integration

Flair, the advanced Graphical User Interface for FLUKA has been extended to integrate Moira, this is, editing input files, visualising geometry, running and post-processing results. It is also able to convert FLUKA inputs to Moira automatically.



The screenshot displays the Moira software interface, which is integrated with the Flair GUI. The interface is divided into several panels:

- Input Editor:** Shows the FLUKA input file content. The visible text includes:

```
*/moira/title n_TOF
*/run/numberOfThreads nThreads: 1
*/physics_lists/select hadronic: FTFP_BERT_HP . em: EMY .
*/random/setSeeds IntArray: 1010

-----
Scoring

*/tally/userdump file: ntof format: text .

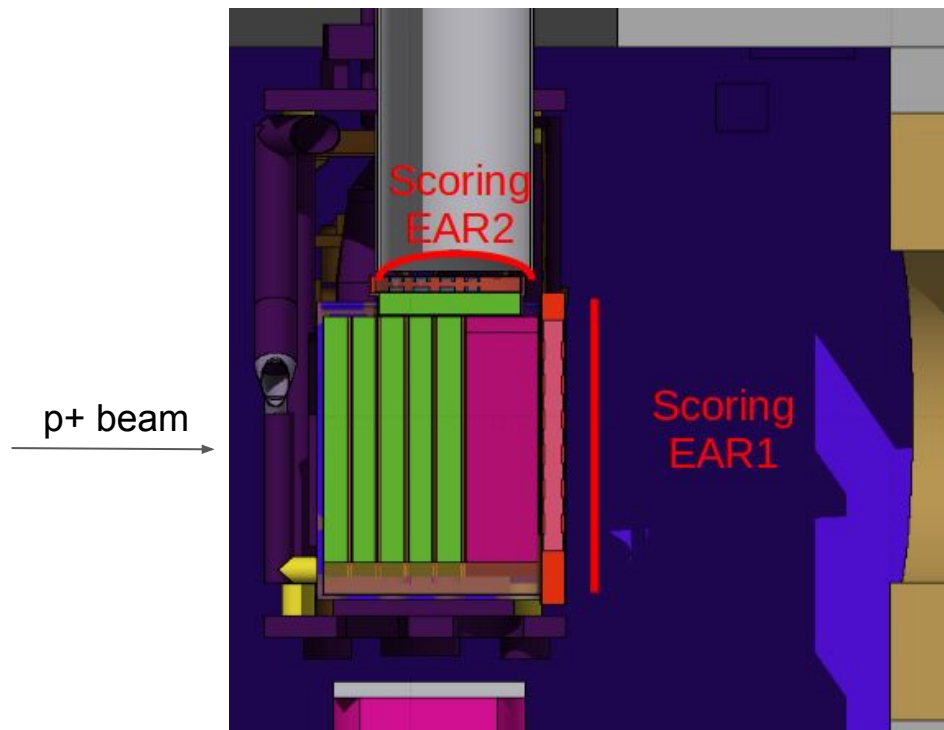
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EM Cuts

*/cuts/production e-e+: 0.001 gamma: 0.001 u
*/cuts/production e-e+: 0.001 gamma: 0.001 u
*/cuts/production e-e+: 0.001 gamma: 0.001 u
```
- Geometry Viewer:** Displays a 3D visualization of the detector geometry. A central component is highlighted with a green and pink striped pattern. Labels such as AOC1_1, AOC1_2, VALO, and DN1_1 are visible.
- Object List:** A table listing the geometric bodies defined in the input file:

Type	Name
SPH	BLKB
YZP	X0
XZP	Y0
XYP	Z0
XYP	Body35
RPP	CBPWO
RPP	TASSP
RCC	TASHOOK1
BOX	TASHOOK2
BOX	TASHOOK3

n_TOF simulations

FLUKA and GEANT4 geometries and scoring planes



The FLUKA geometry of the spallation target has been implemented in detail using the Flair interface.

For the first time, profiting from the Moira application, the **exact same geometry** has been used to run GEANT4 and FLUKA.

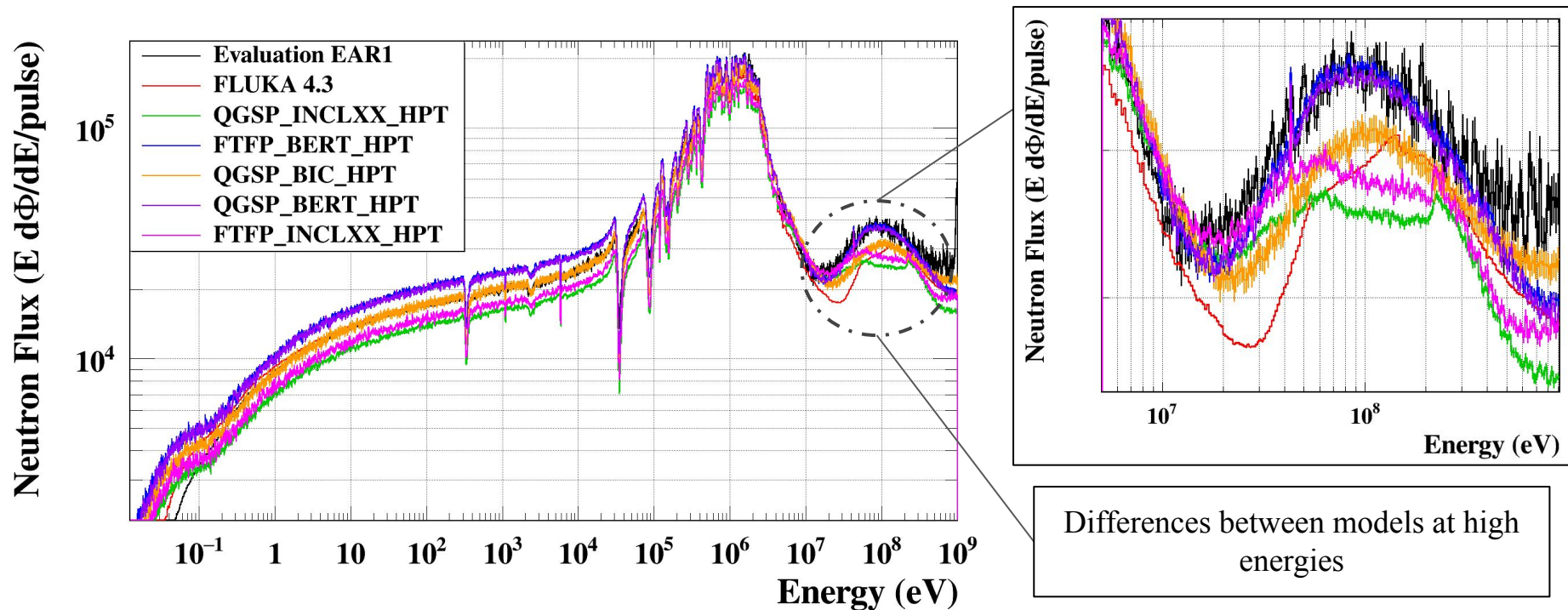
CPU Time: FLUKA 4.3 vs Geant4 v.11

	FLUKA	QGSP_INCLXX_HPT	QGSP_BIC_HPT	FTEP_BERT_HPT
CPU Time (s/primary)	0.649	7.266	8.226	10.852
Factor	1.	11.192	12.672	16.717

This CPU times for Geant4 11.0 have been similar to previous calculations for Phase 3.
Geant4 simulations are considerably slower than FLUKA.

[J. Lerendegui - ENSAR2 workshop](#)

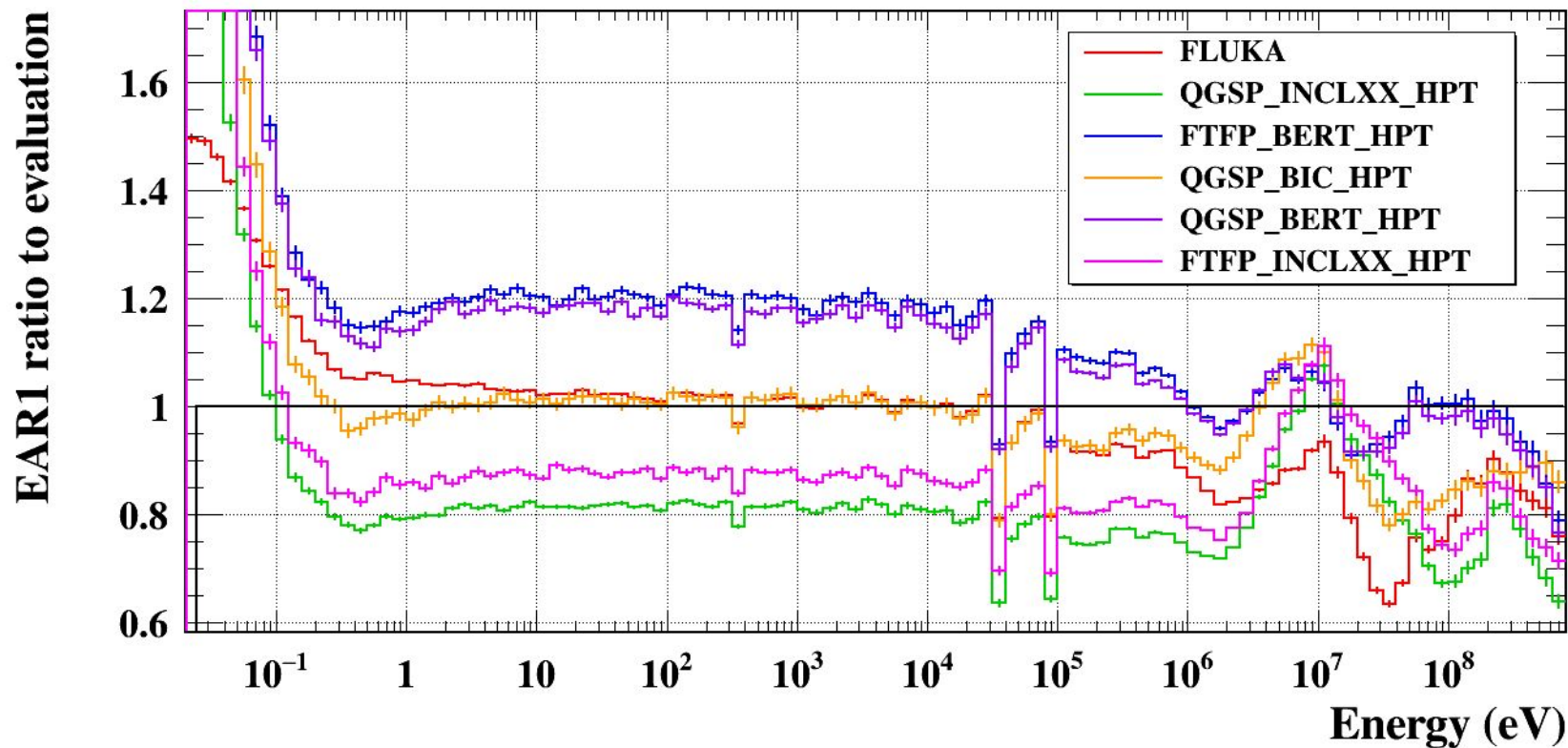
EAR1 simulations and experimental results



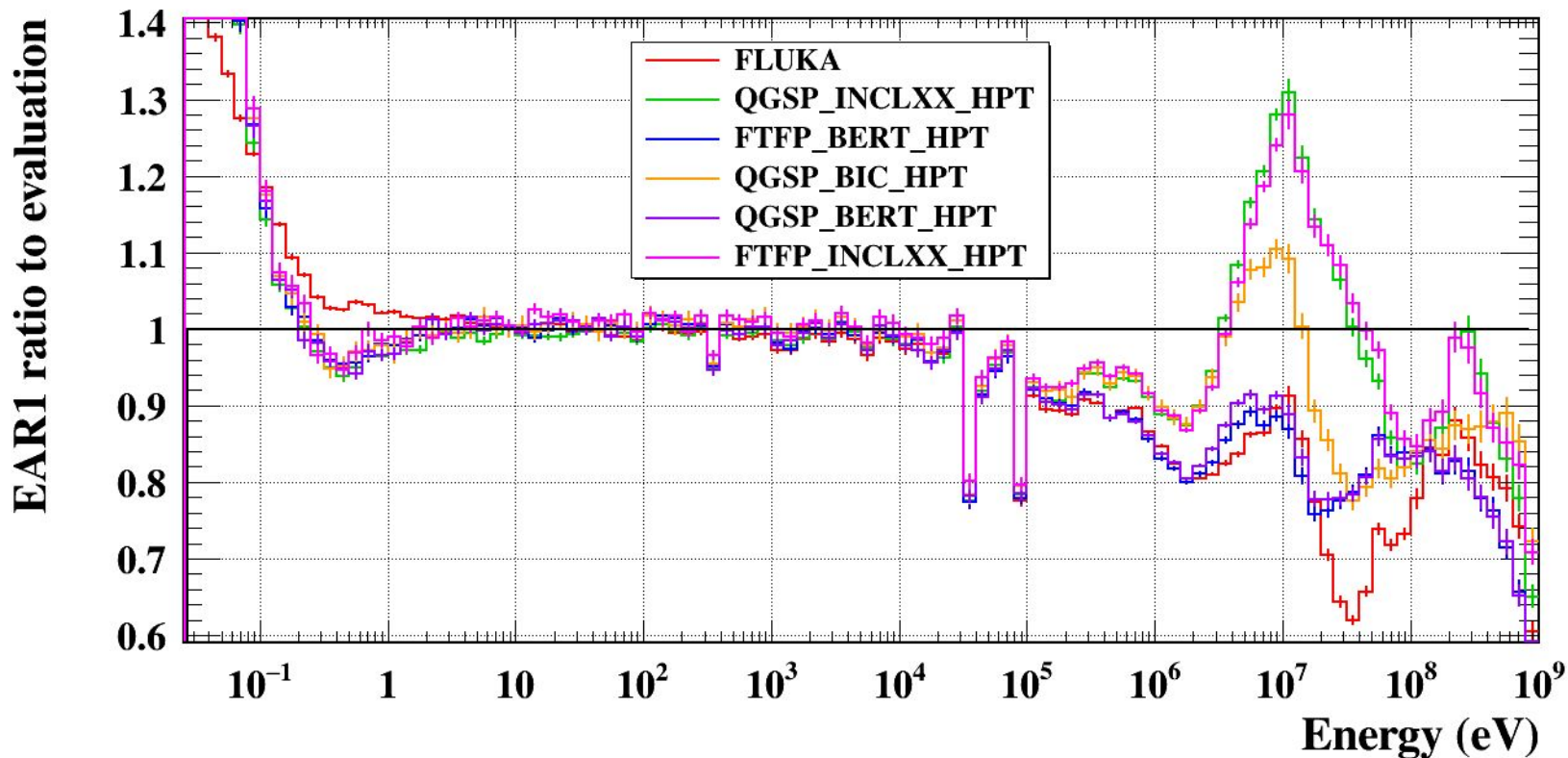
All physics lists incorporate **G4ThermalNeutrons** (< 4 eV)

Geant4 version 11.0.p02

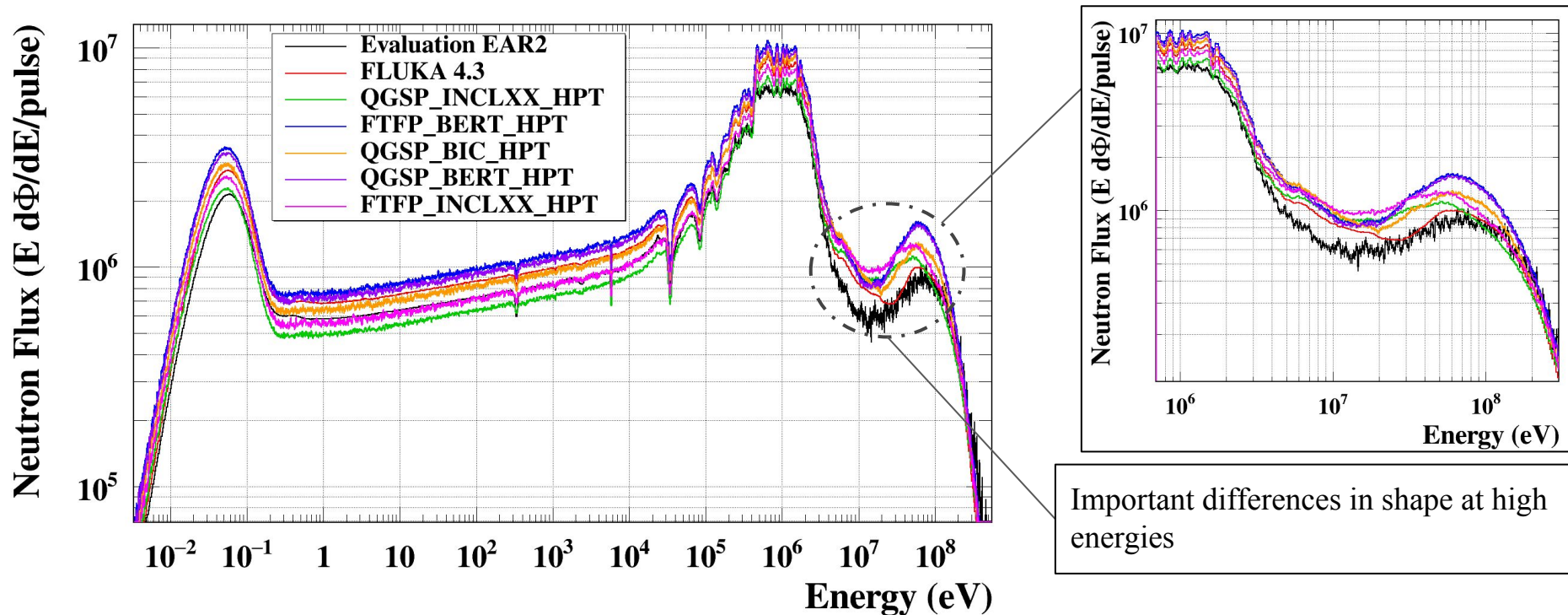
EAR1 ratio MC to evaluation



EAR1 ratio MC to evaluation scaled



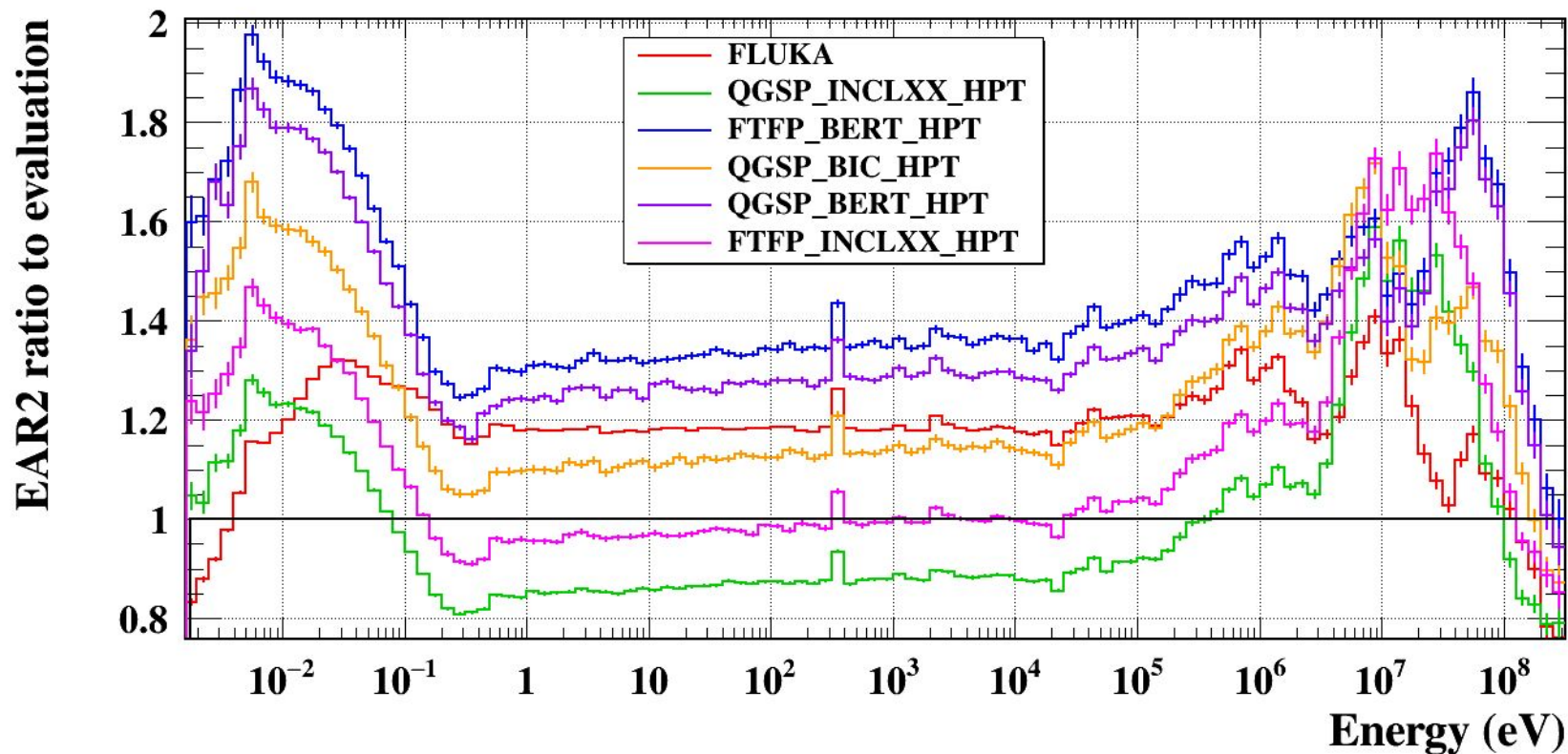
EAR2 simulations and experimental results



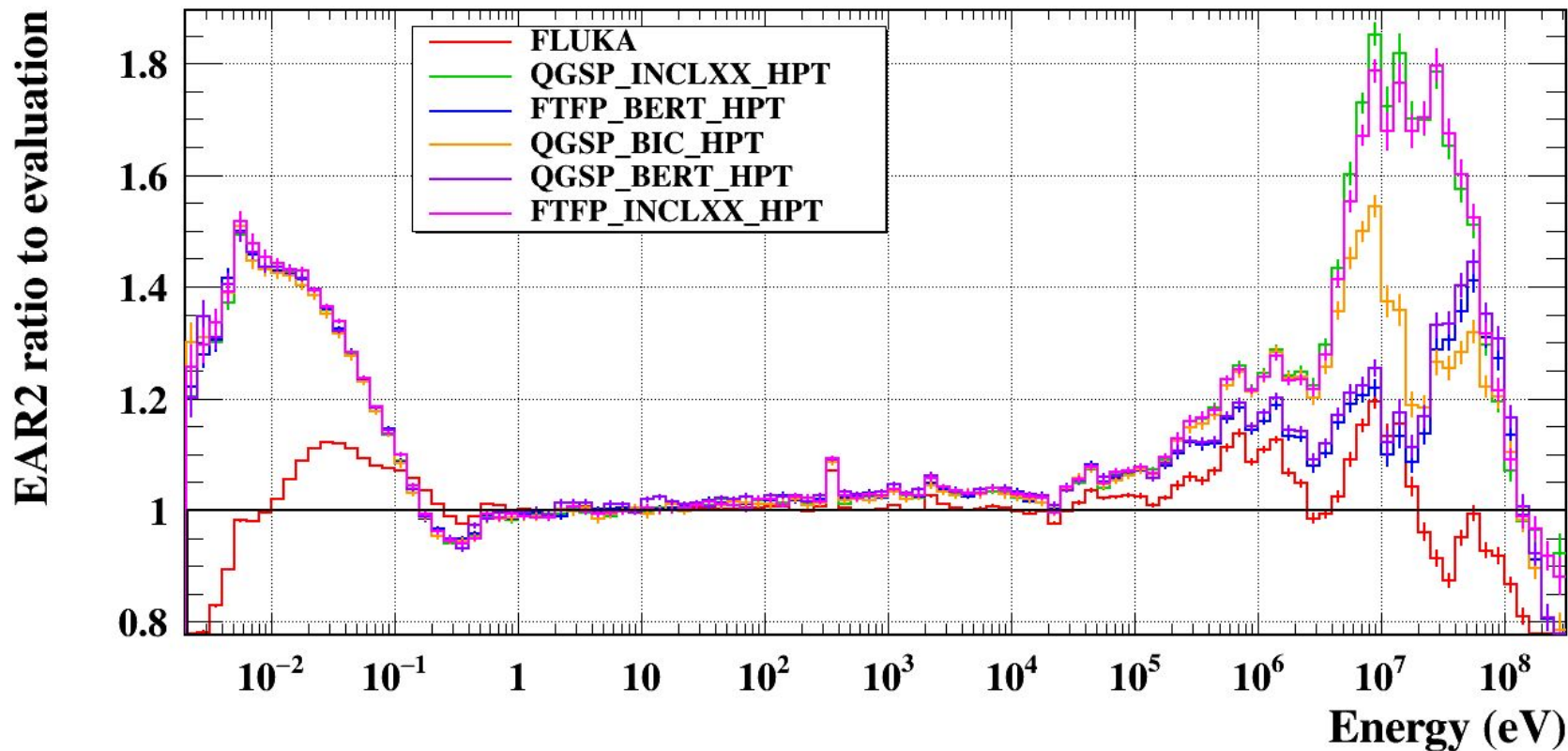
All physics lists incorporate **G4ThermalNeutrons** (< 4 eV)

Geant4 version 11.0.p02

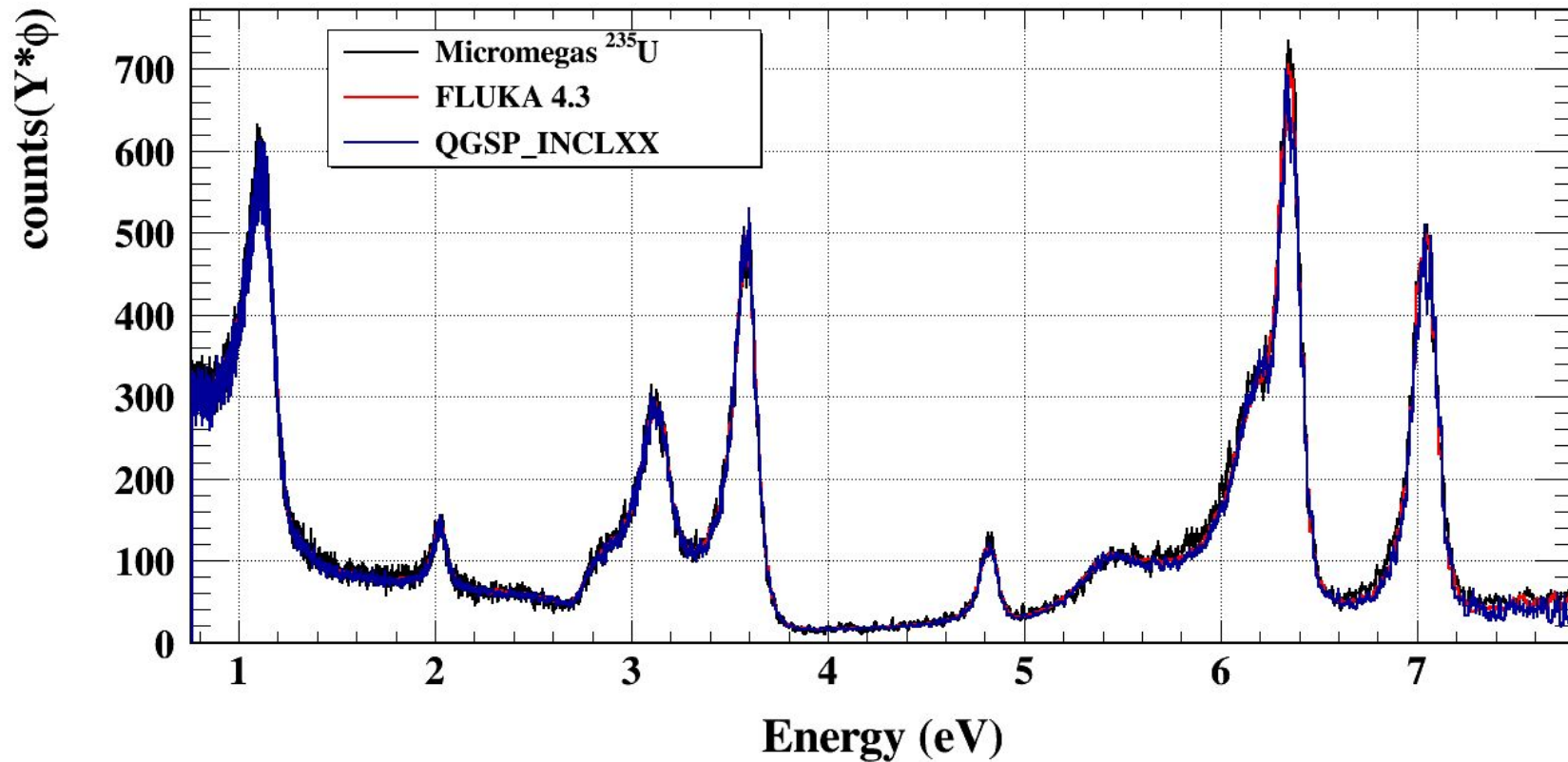
EAR2 ratios MC to evaluation



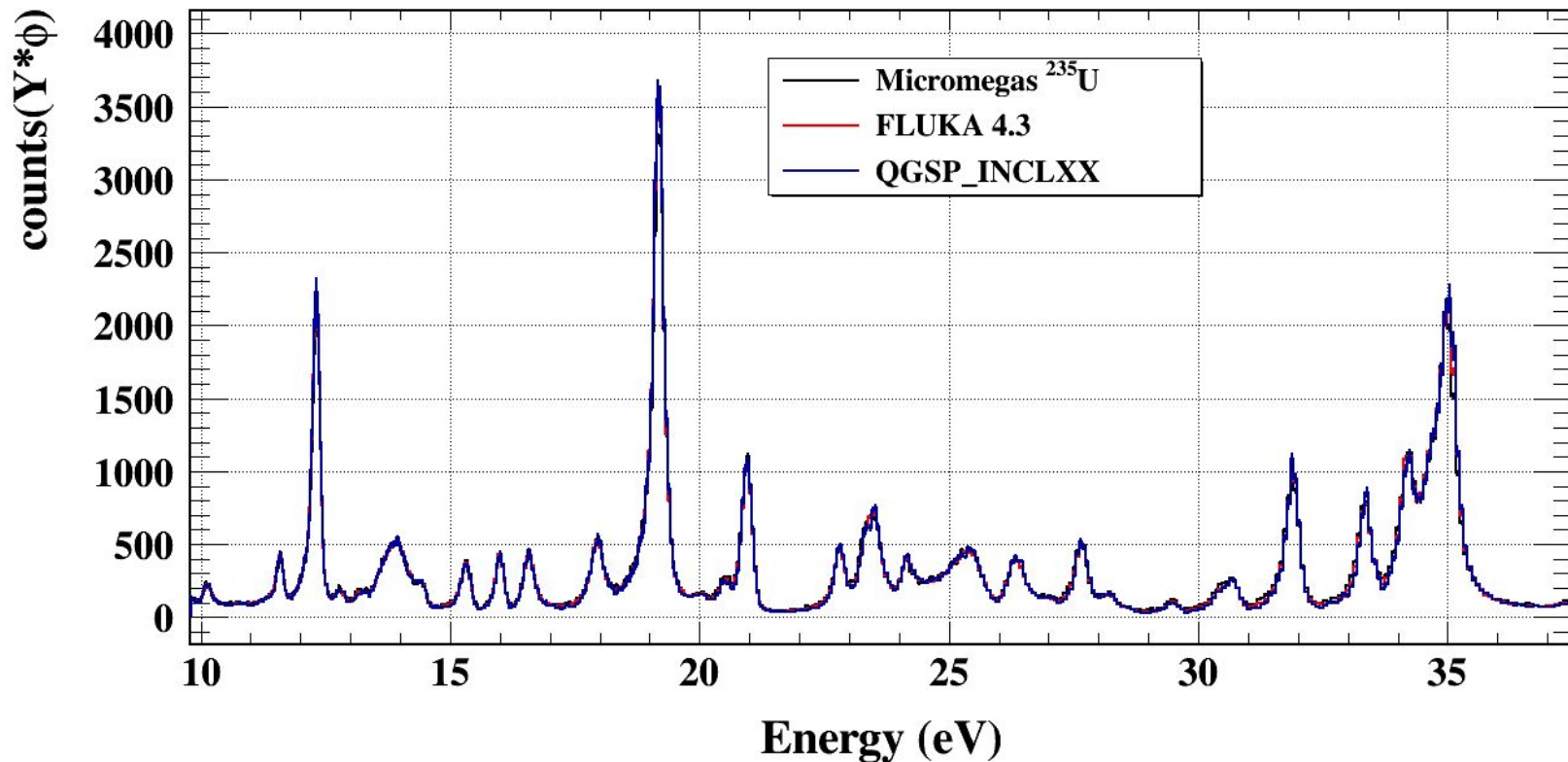
EAR2 ratio MC to evaluation scaled



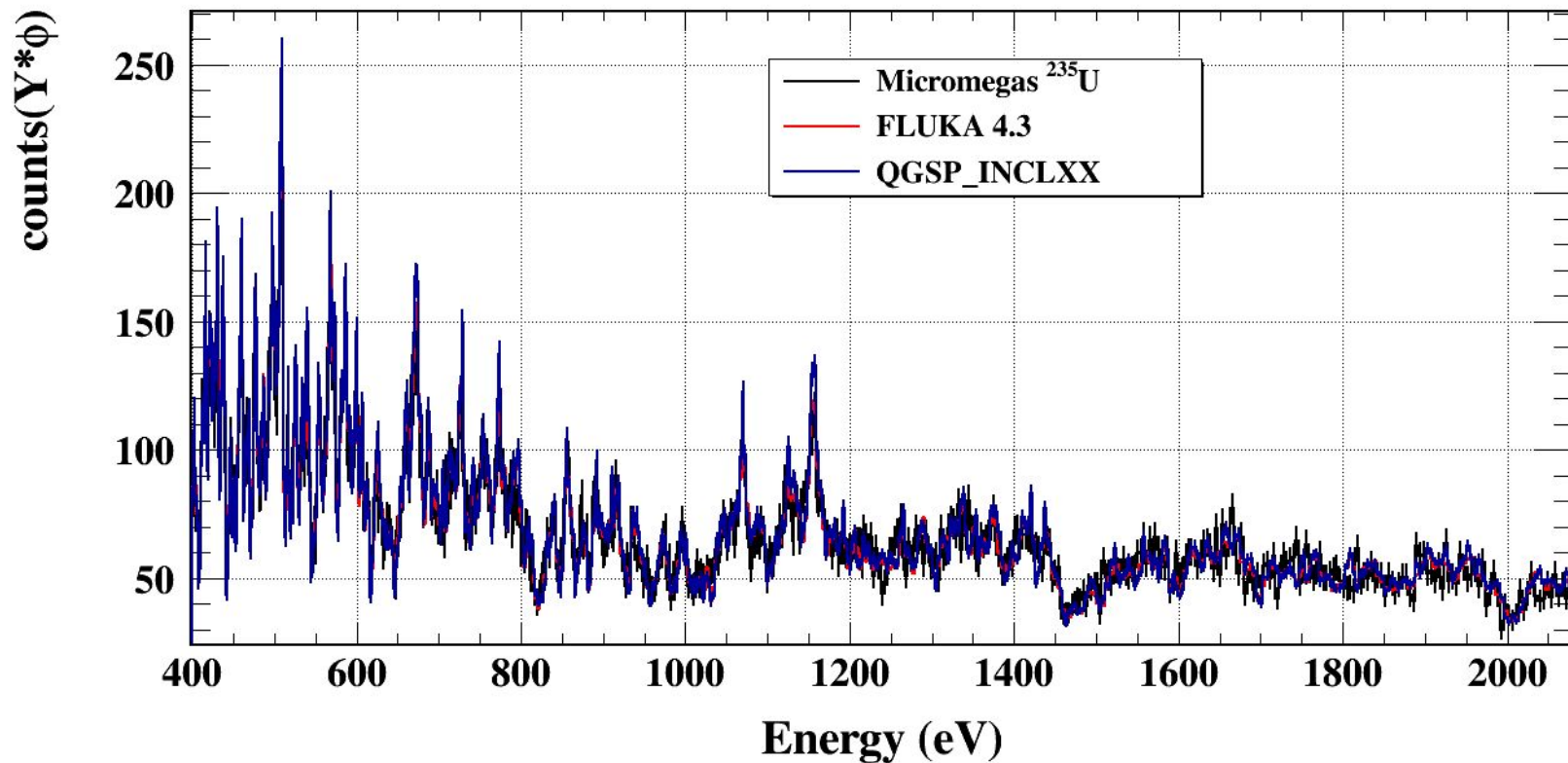
EAR2 ^{235}U ENDF8 convoluted with GEANT4 and FLUKA



EAR2 ^{235}U ENDF8 convoluted with GEANT4 and FLUKA

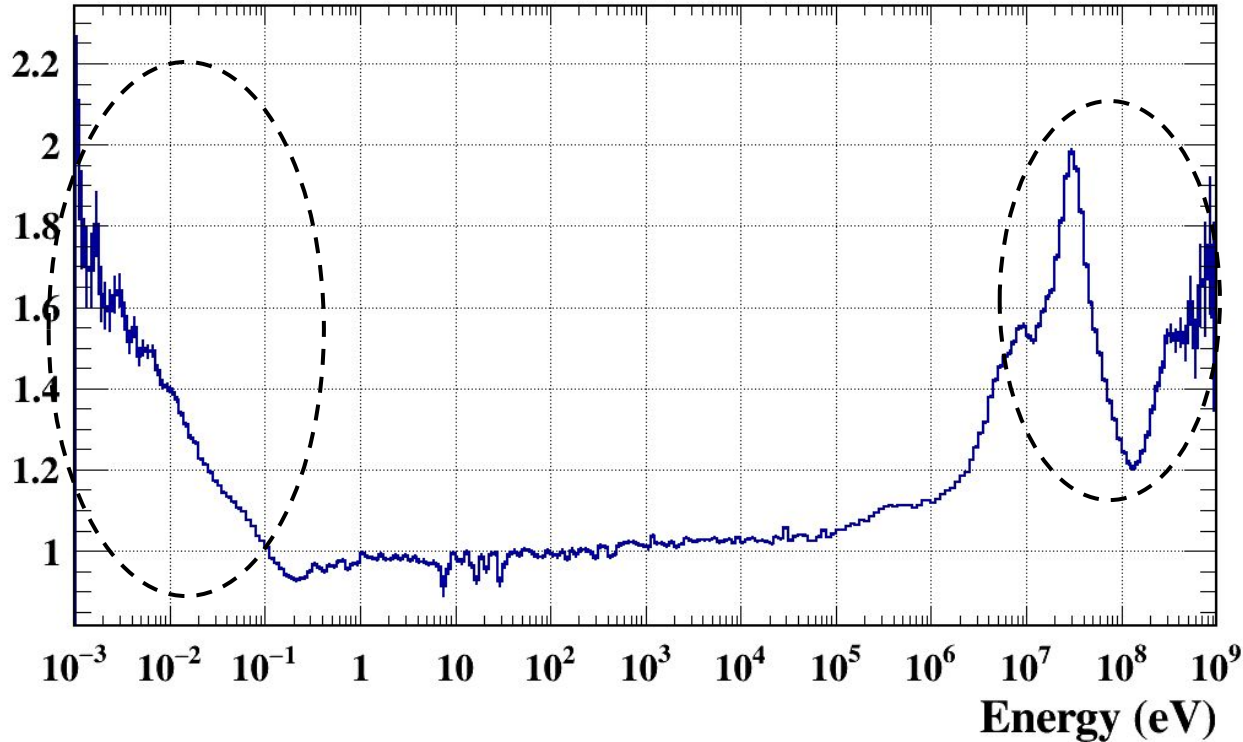


EAR2 ^{235}U ENDF8 convoluted with GEANT4 and FLUKA



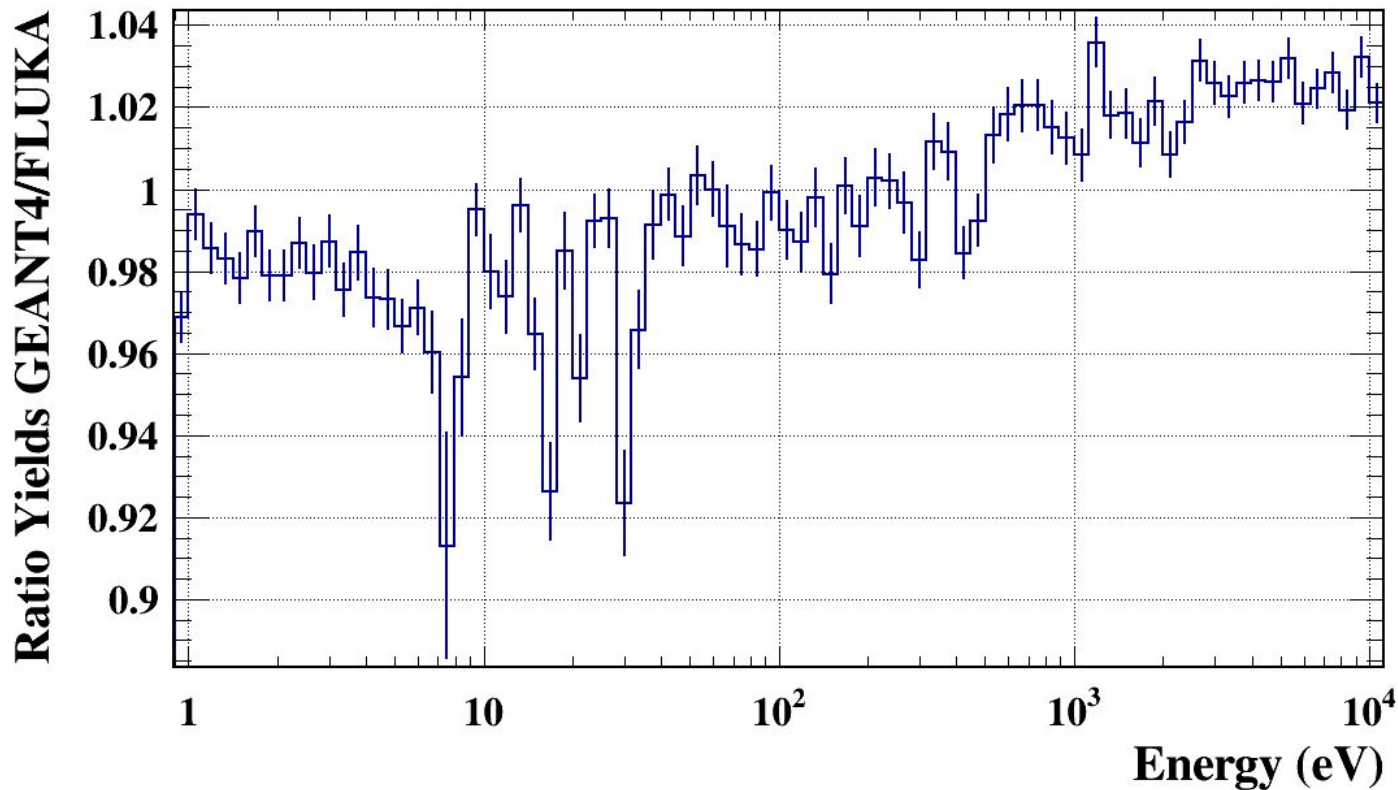
Ratio ^{235}U ENDF8 convoluted with GEANT4 and FLUKA

Ratio Yields GEANT4/FLUKA



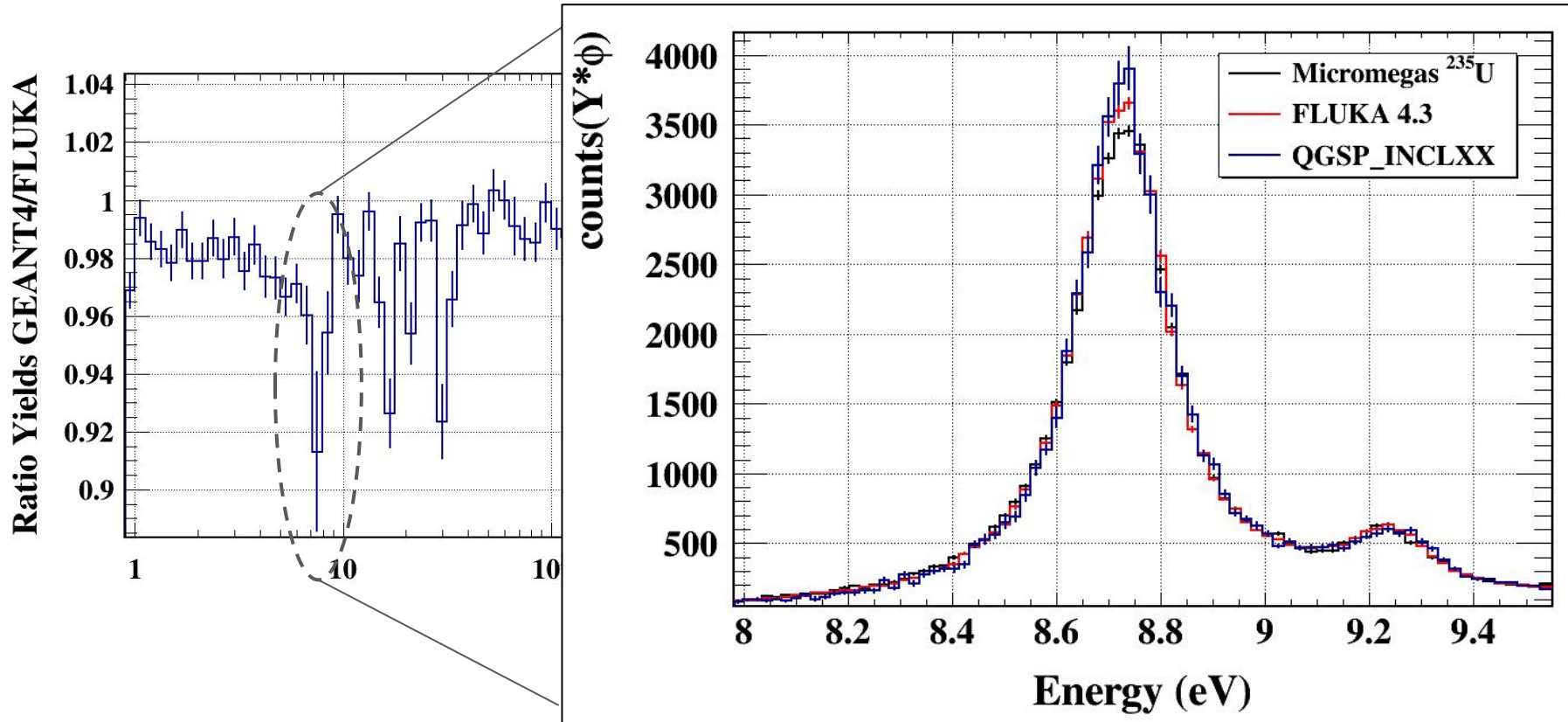
Subthermal and high energy regions present same trends to the ones observed in the flux ratios.

Ratio ^{235}U ENDF8 convoluted with GEANT4 and FLUKA



In the epithermal region the agreement is within $\sim 2\%$ except for some wide resonances.

Ratio ^{235}U ENDF8 convoluted with GEANT4 and FLUKA



Summary and conclusions

- The Moira application for Geant4 simulations with FLUKA inputs has been presented.
- The first ever n_TOF simulations, using both FLUKA and GEANT4 the exact same geometry, have been carried out and preliminary results have been shown together with experimental measurements.
- In EAR1, QGSP_BIC_HPT best reproduces the absolute value in the epithermal, while the shape and absolute value of the evaluated flux above 30 MeV is better reproduced by *_BERT_HPT. Above 300 MeV QGSP_BIC_HPT show the best shape.
- In EAR2, FTFP_INCLXX_HPT best reproduces the absolute value in the epithermal, whereas BERT model seems to give a better shape up to 10 MeV and QGSP_BIC_HPT works best above. But FLUKA in general reproduces the shape better than the GEANT4 models tested.
- RF in EAR2 with GEANT4 QGSP_INCLXX_HPT and FLUKA reproduces a similar shape of the resonances but more statistics are needed to draw conclusions.

References

- [Fluka-Cern status and plans, Moira, and scoring](#)
- [Studies driven by the Moira Framework](#)
- [Moira simulations for n_TOF](#)

Thank you for your attention!

