# Moira simulations for n_TOF

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# Table of Contents

# Moira

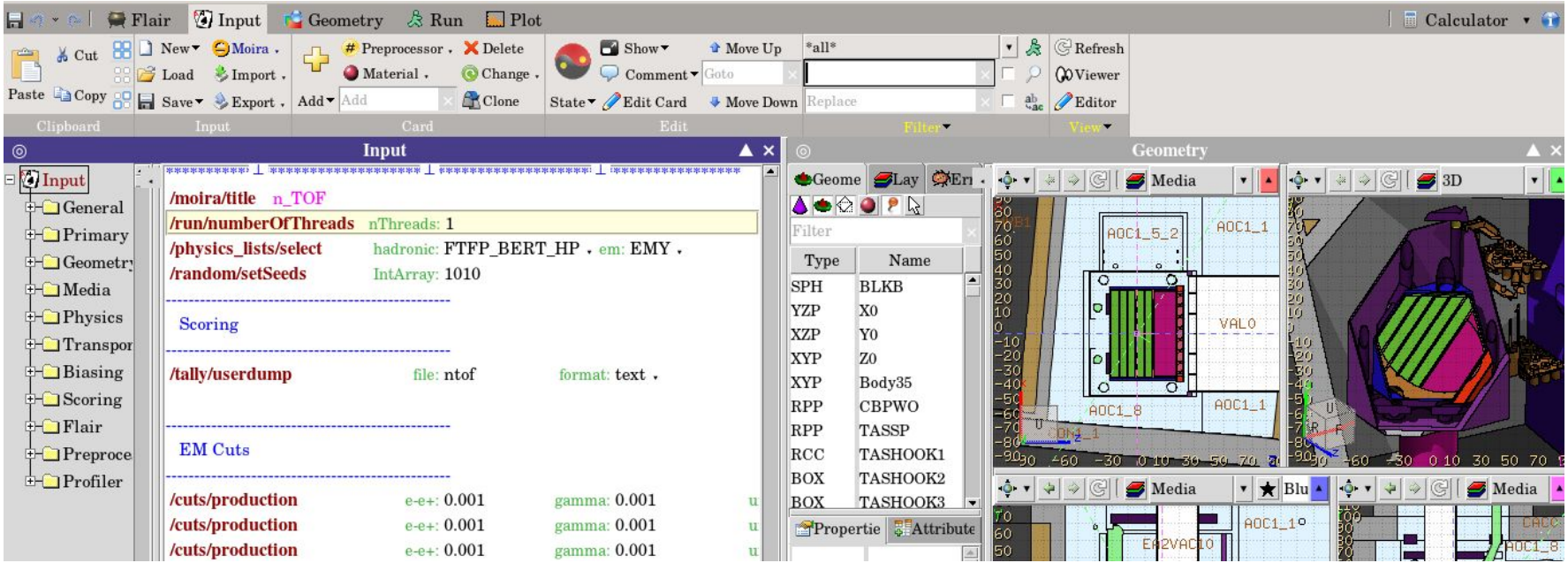
# Moira overview

- **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

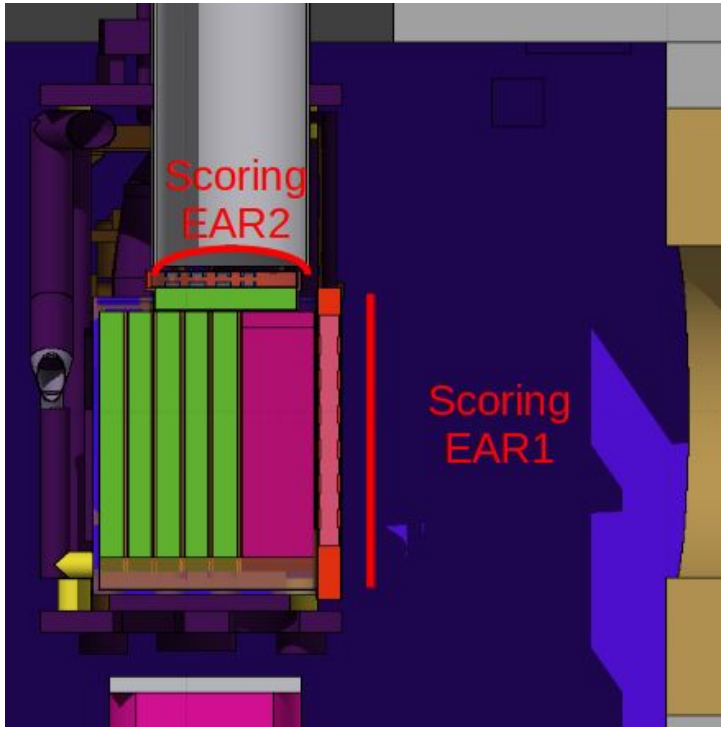
Flair, the advanced Graphical User Interface for FLUKA has been extended to integrate Moira, this is, editing input files, visualising geometry, running and post-processing results. It is also able to convert FLUKA inputs to Moira automatically.



# n_TOF simulations

# FLUKA and GEANT4 geometries and scoring planes

p+ beam




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.

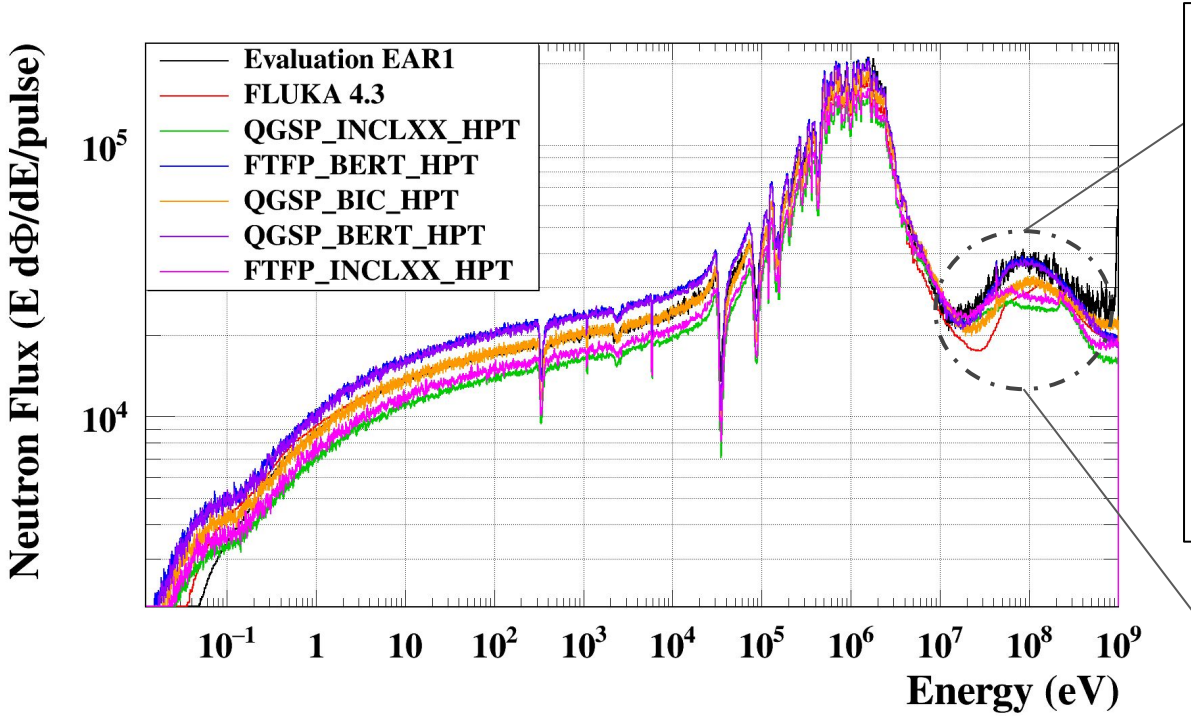
# CPU Time: FLUKA 4.3 vs Geant4 v.11

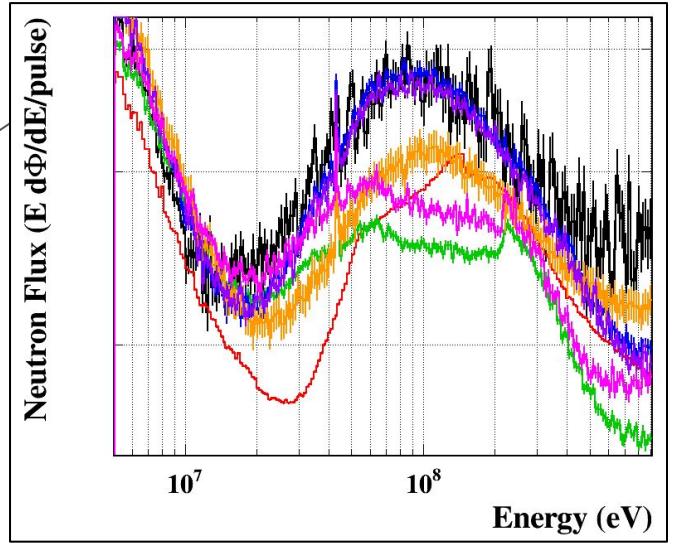
| | FLUKA | QGSP_INCLXX_HPT | QGSP_BIC_HPT | FTFP_BERT_HPT |
|---|---|---|---|---|
| **CPU Time (s/primary)** | 0.649 | 7.266 | 8.226 | 10.852 |
| **Factor** | 1. | 11.192 | 12.672 | 16.717 |

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



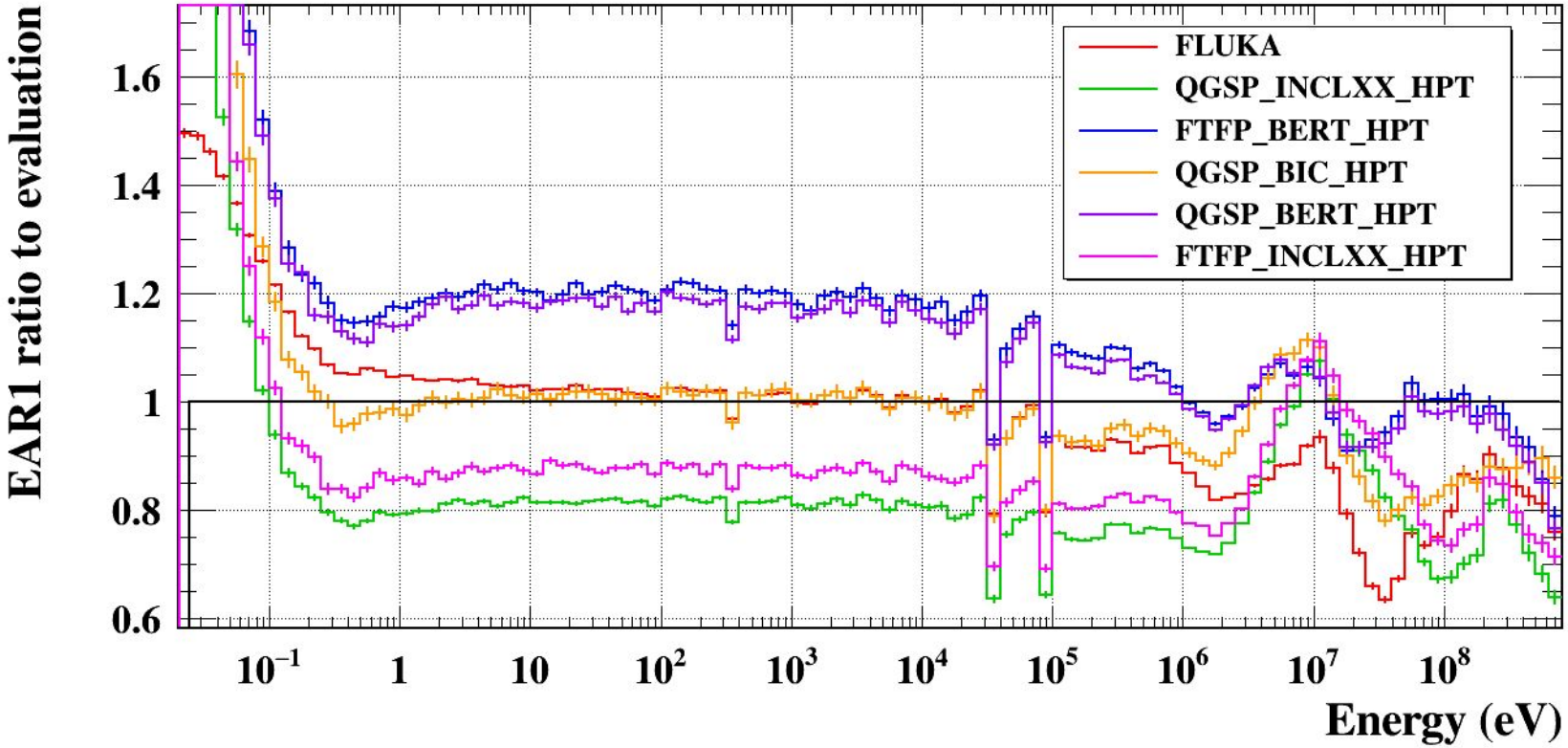




Differences between models at high energies

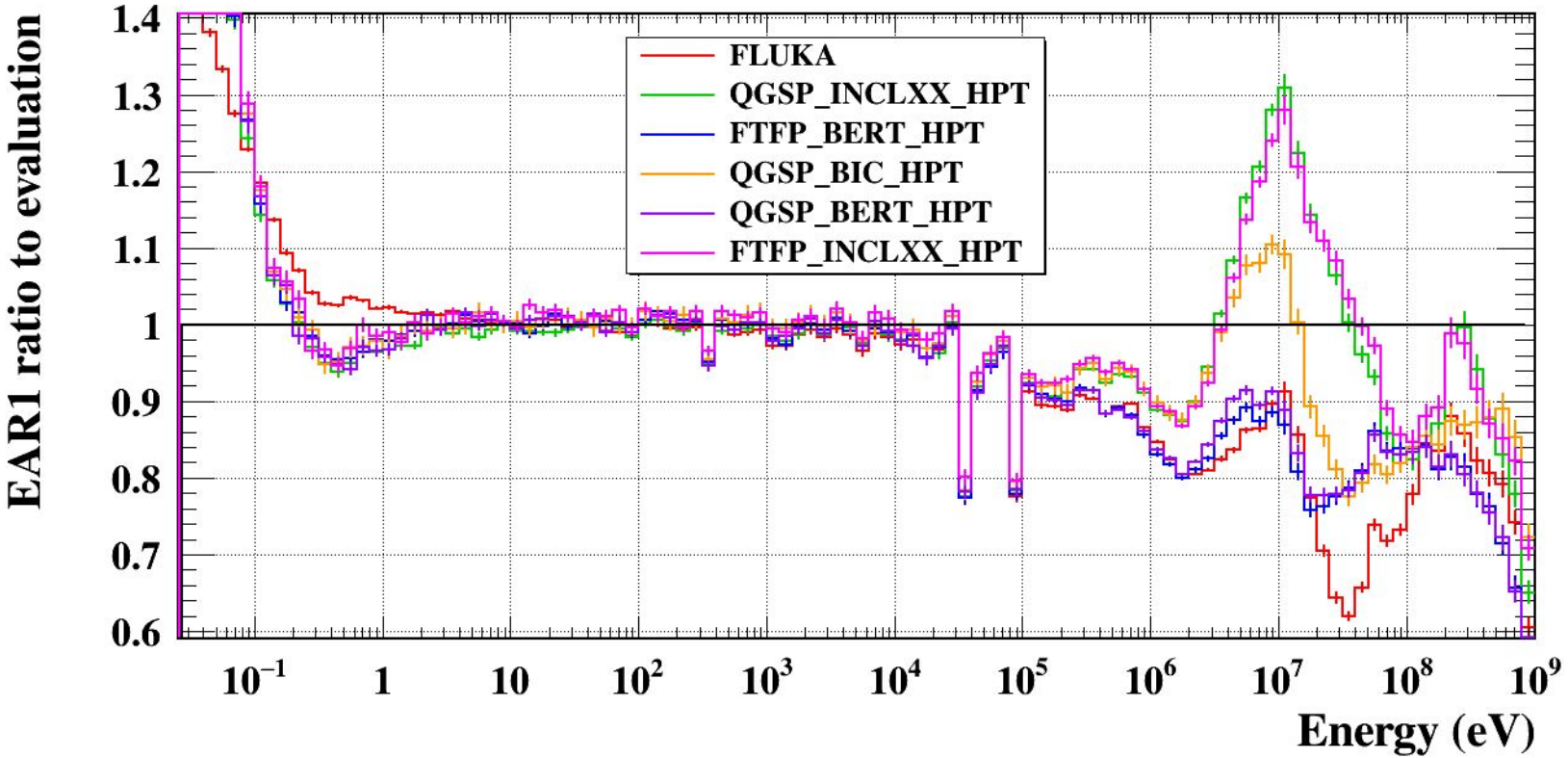
All physics lists incorporate **G4ThermalNeutrons** (< 4 eV)

**Geant4 version 11.0.p02**

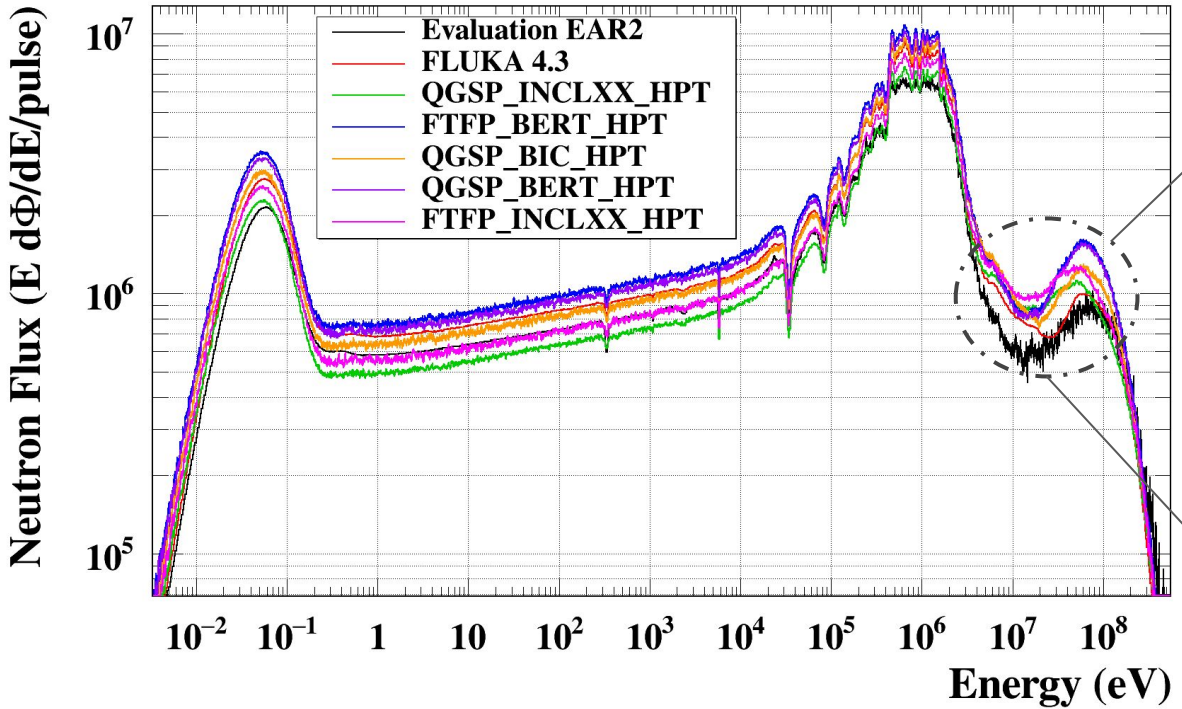
# EAR1 ratio MC to evaluation

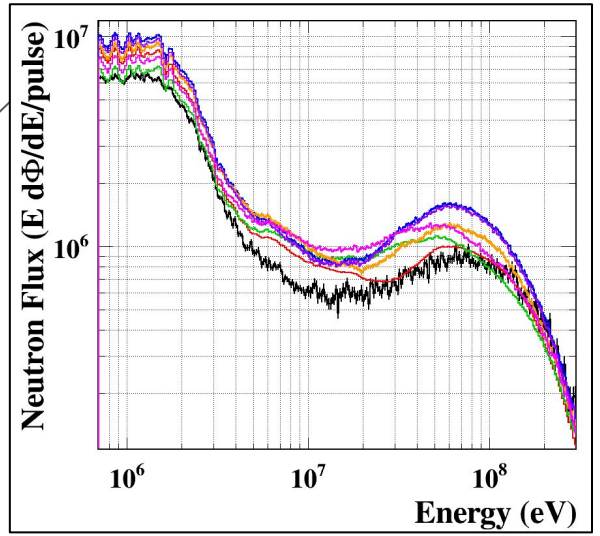


# EAR1 ratio MC to evaluation scaled



# EAR2 simulations and experimental results



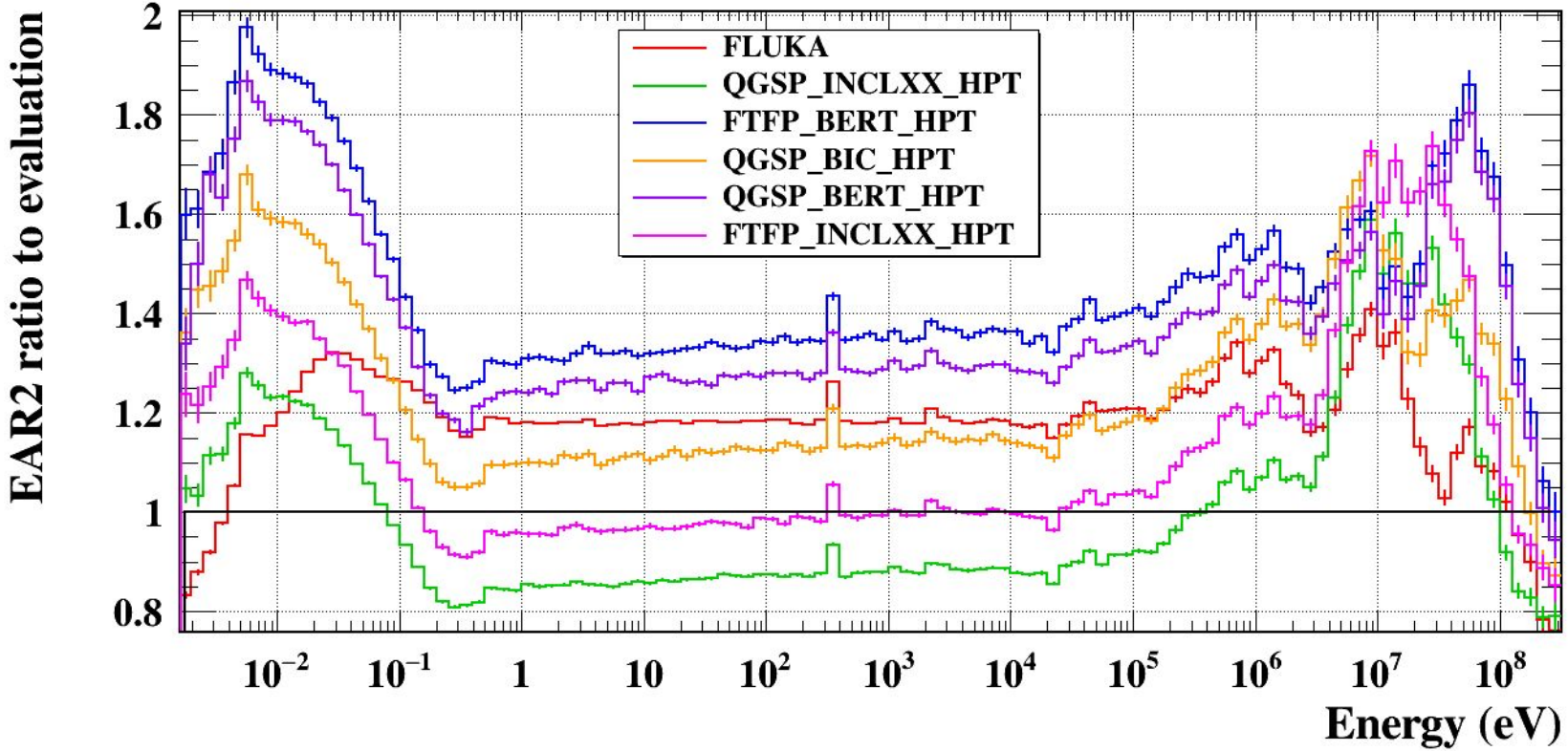




Important differences in shape at high energies

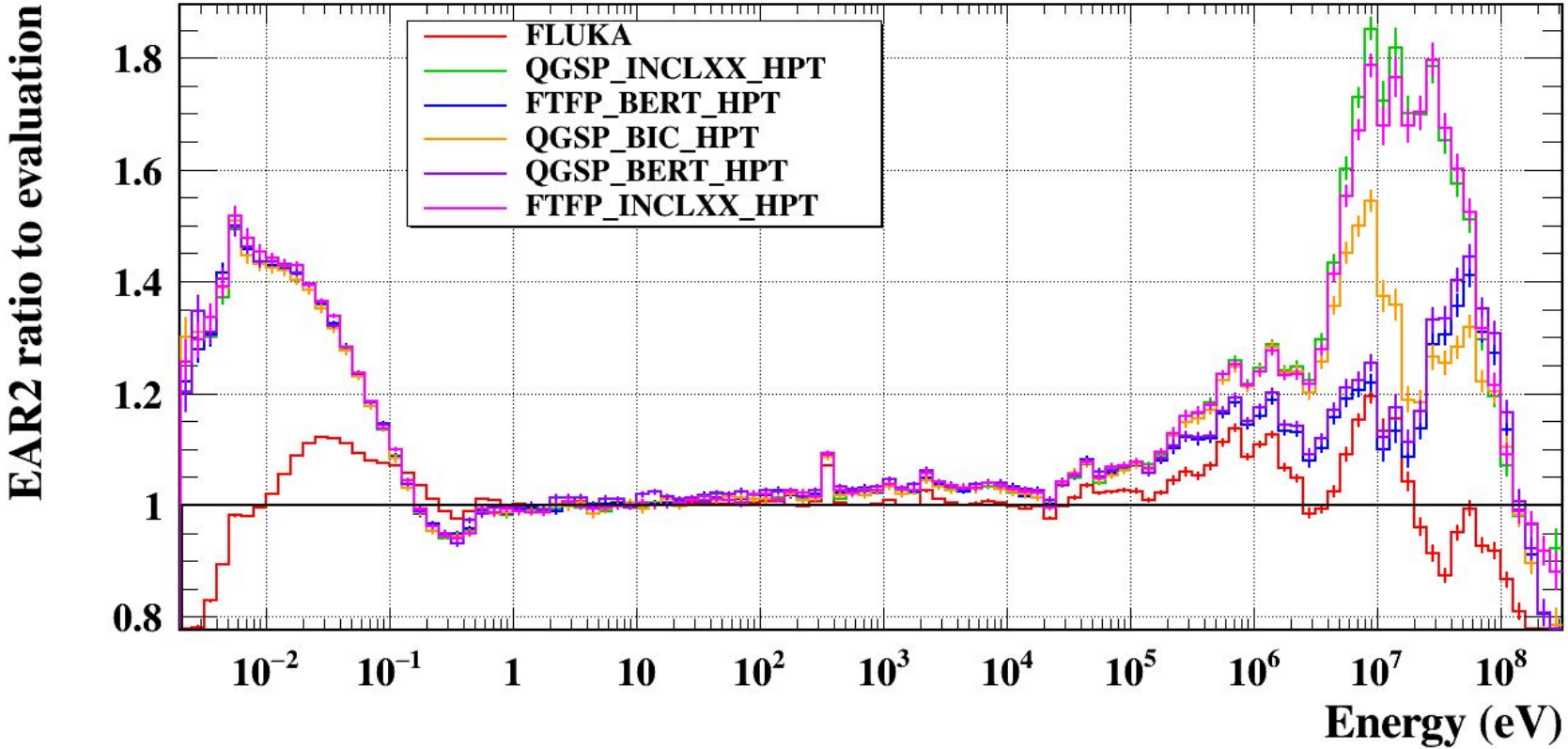
All physics lists incorporate **G4ThermalNeutrons** (< 4 eV)

**Geant4 version 11.0.p02**

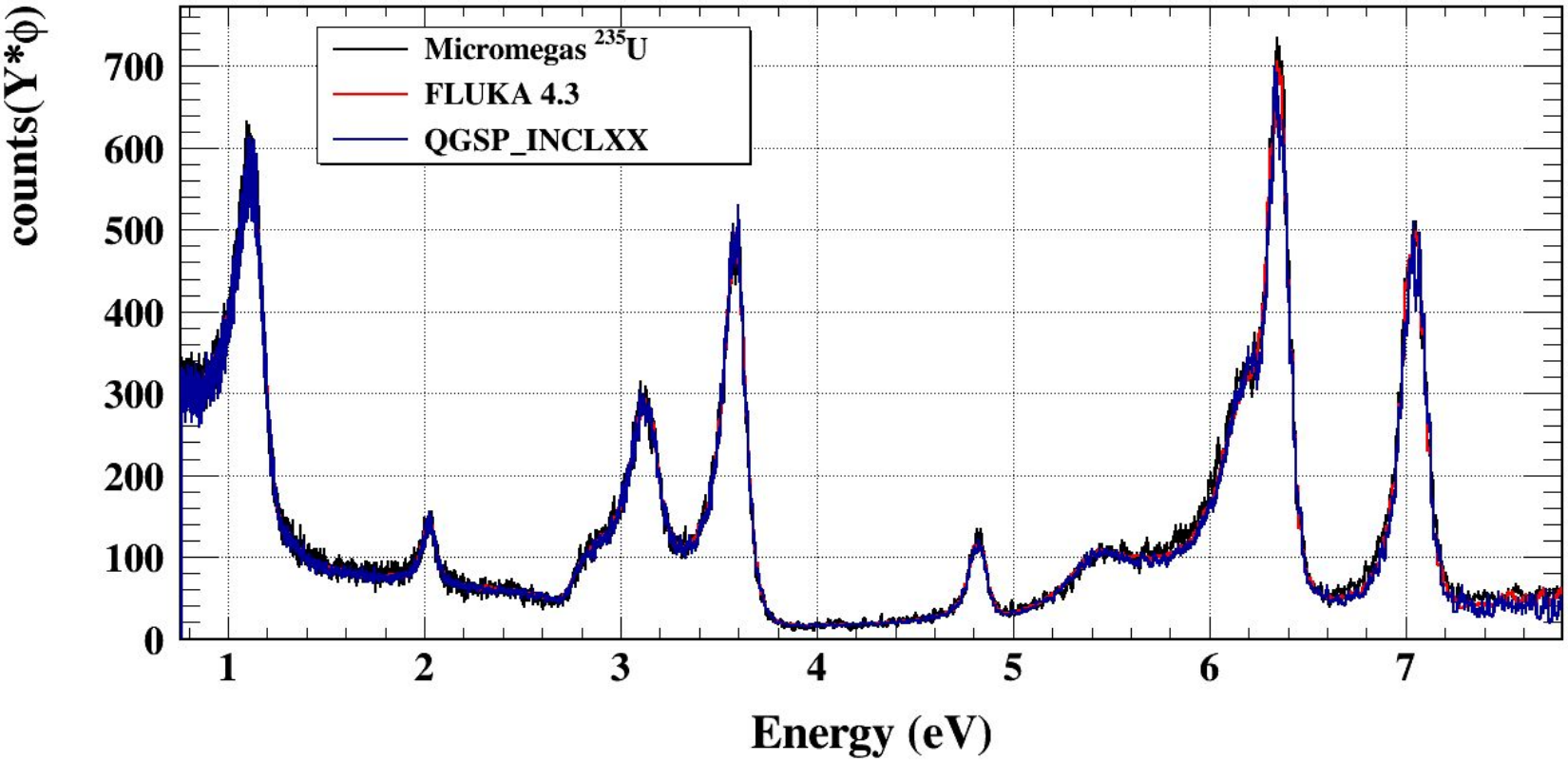
# EAR2 ratios MC to evaluation



# EAR2 ratio MC to evaluation scaled



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



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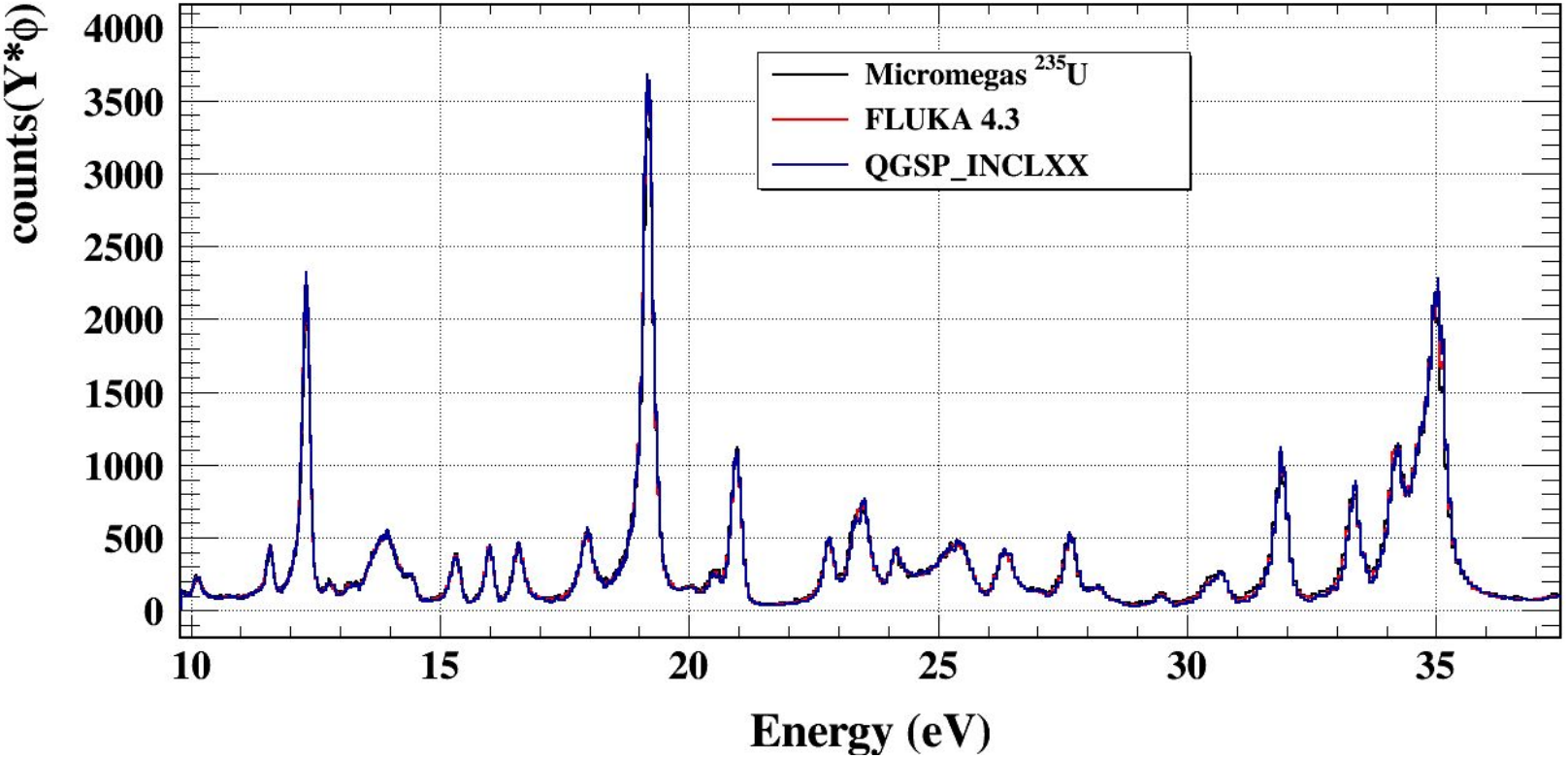

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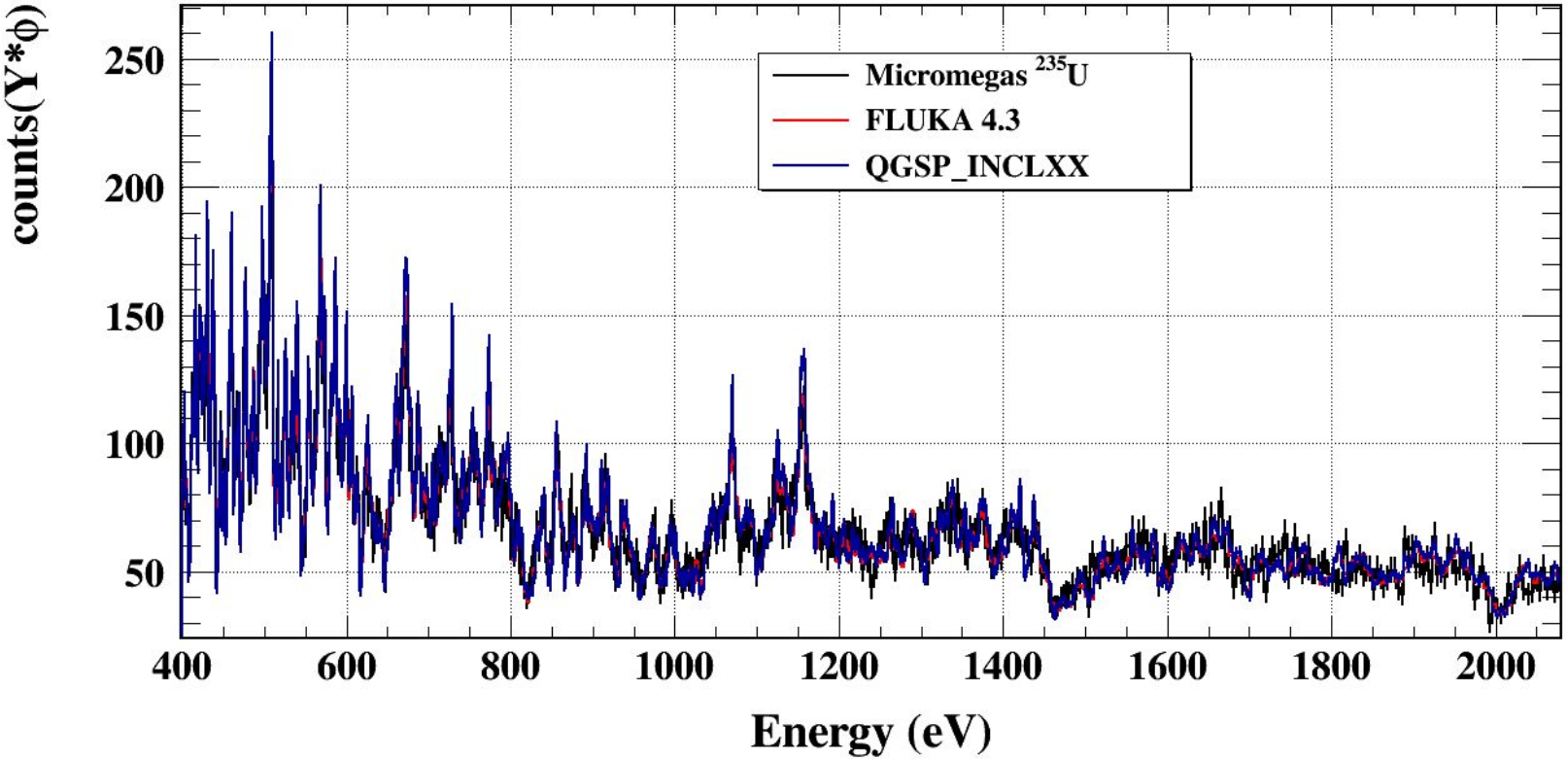
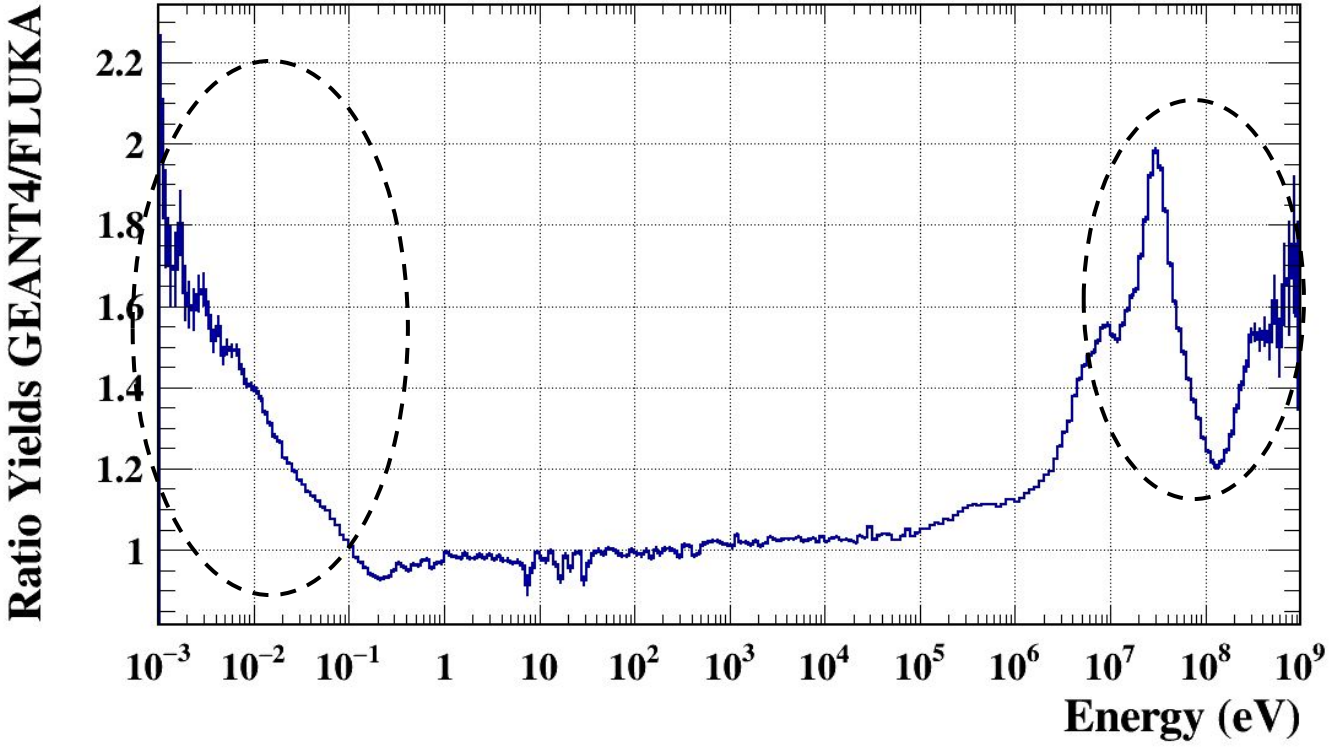
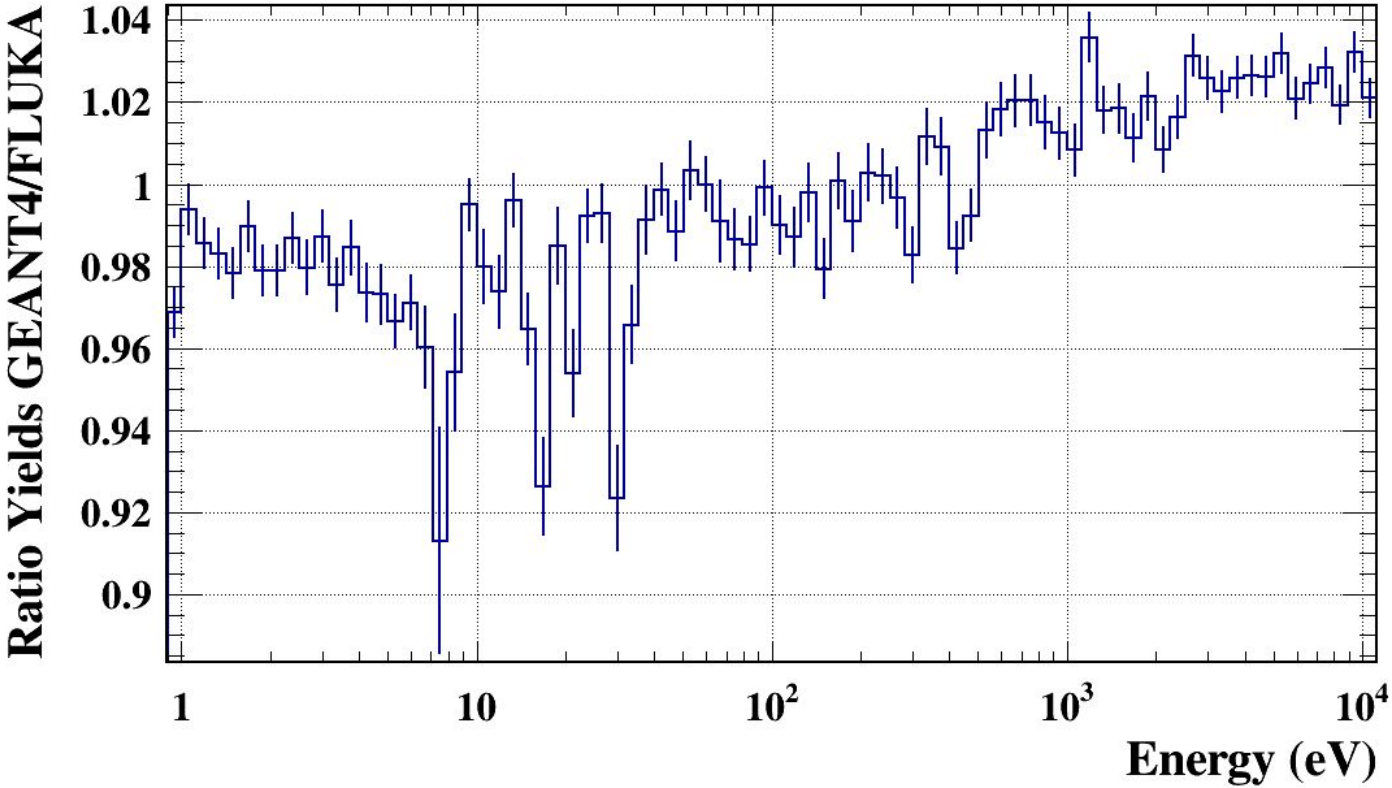


# Ratio $^{235}$U ENDF8 convoluted with GEANT4 and FLUKA



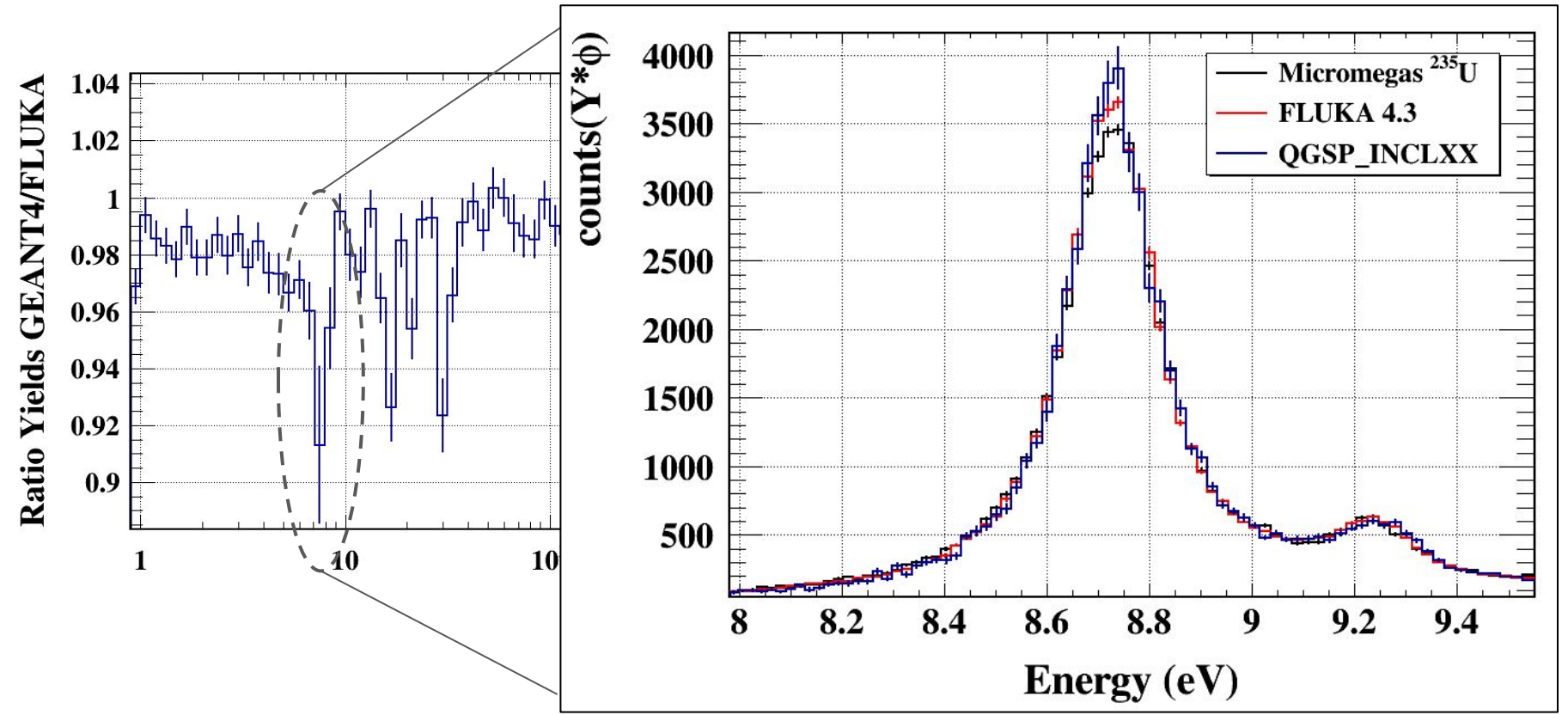

Subthermal and high energy regions present same trends to the ones observed in the flux ratios.

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




In the epithermal region the agreement is within ~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!