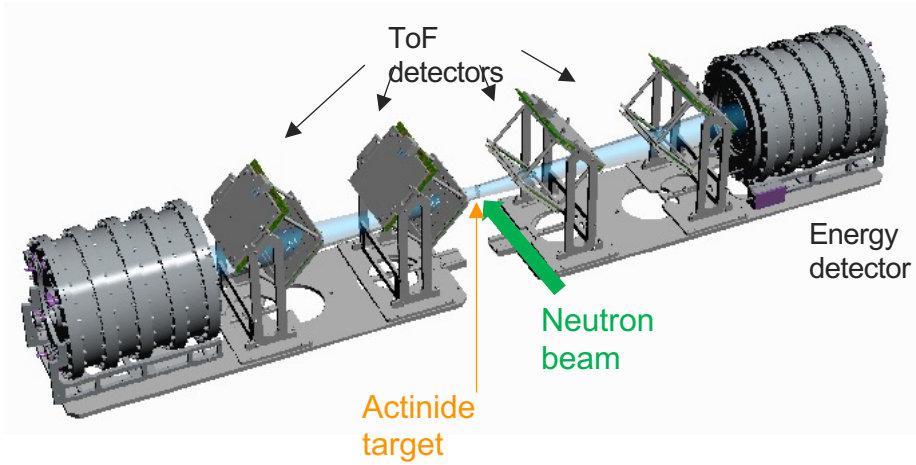


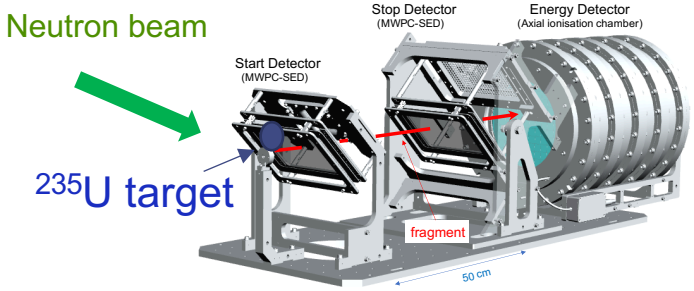
WP2 Task 2.5 Deliverable 2.13 Report on fission yield studies with FALSTAFF at ILL (M48)

→ replaced by Falstaff@NFS : fission yield studies in (n,f) reactions

→ Deliverable 2.13 OK (end of January 2024)

This project has received funding from the Euratom support safe operation of nuclear systems programme 2014-2018 under grant agreement No 847552 (SANDA).

^{235}U fission fragment study with FALSTAFF at NFS



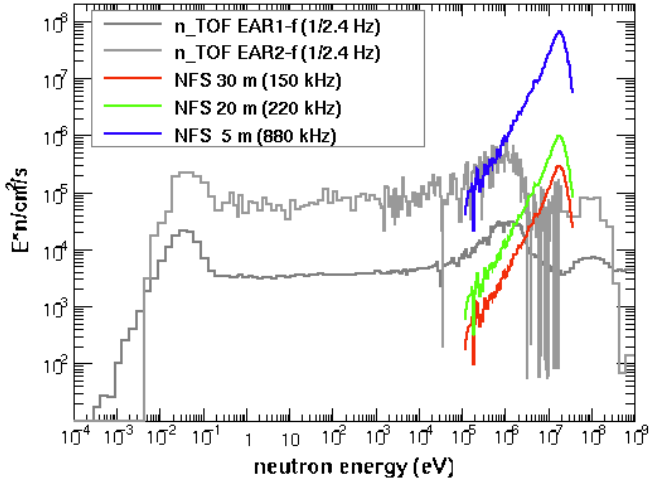
One arm experiment

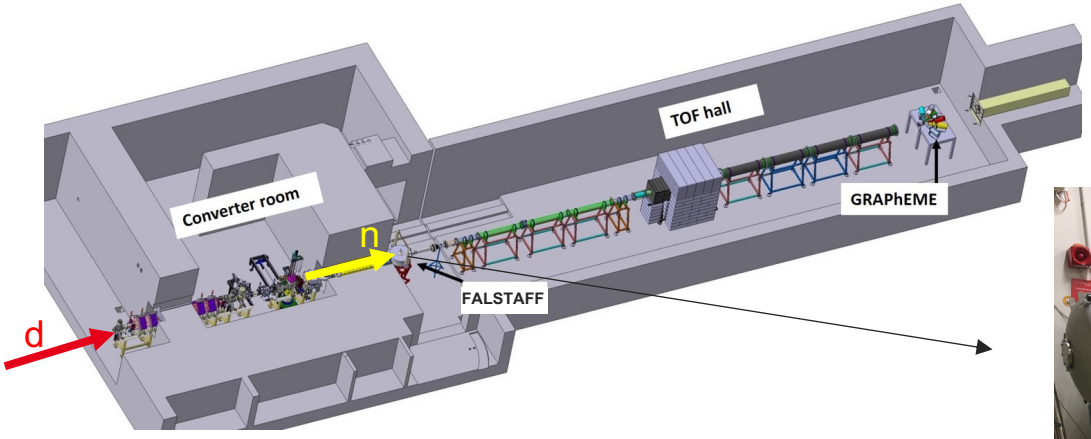
Post-evaporation fragment mass (EV method)

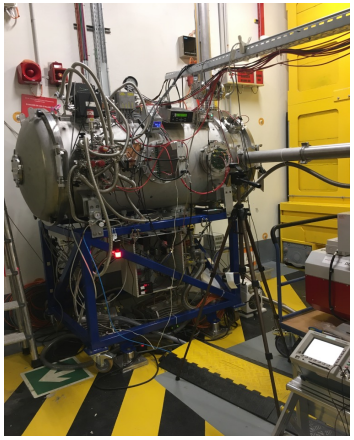
- Velocity (time & position) : SED-MWPC
- Energy : Axial Ionization Chamber

+2 LaBr3 detectors (Subatech, Nantes)

d+^{9}Be (thick)
I_{beam} = 8 μA (nominal 50 μA)
f = 1/200 * 88 MHz

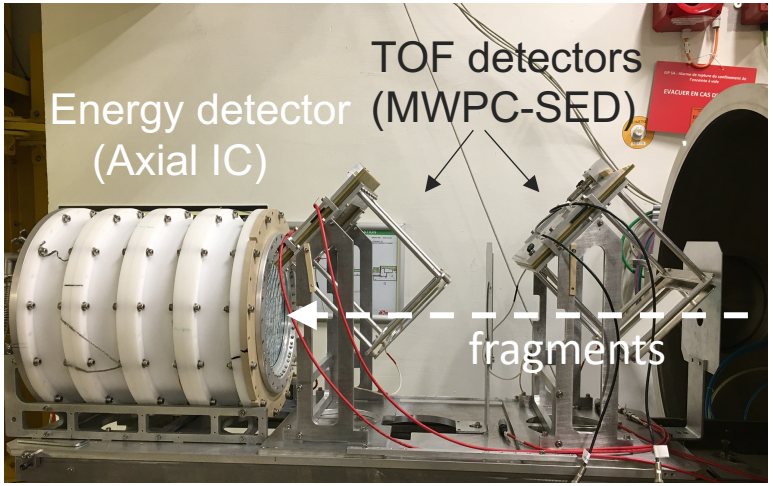






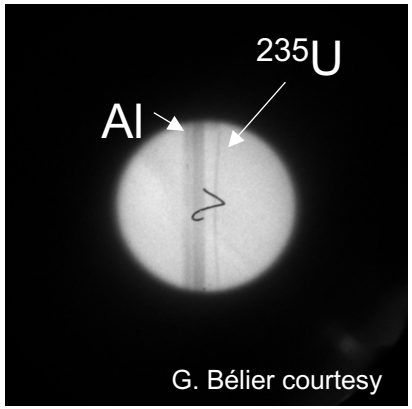
~1/5 of the expected neutron flux
< 1 detected fragment /s

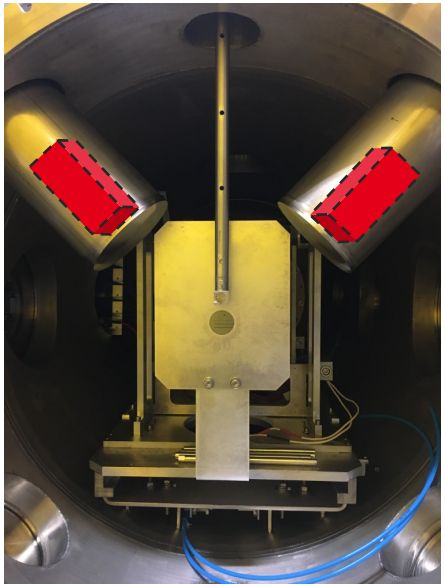
^{235}U fission fragment study with FALSTAFF at NFS



^{235}U target:

- JRC-Geel (99.94% ^{235}U)
- 195 μg/cm^2
- Φ 28 mm
- 1.2 mg
- Ta backing
- Al support



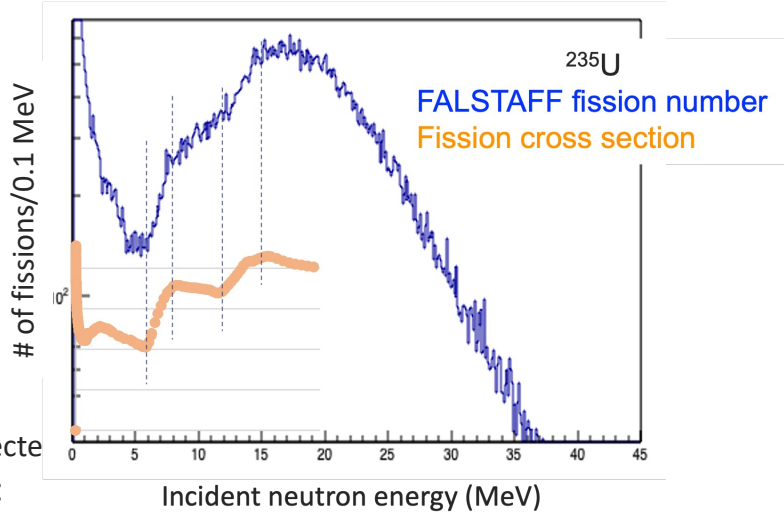


- Need of reference time

  Low energy γ flash at NFS:
  no photo-fission

- 2 LaBr3 detectors from Subatech
  51x51x102 mm^3
  2 PM of 2''
  2% fwhm pour 1.33MeV
  Internal bkg 730 cps

- Neutron time spectra (producing detecte fission in FALSTAFF) is obtained using:
  Different dtime (HF, Falstaff, LaBr3)

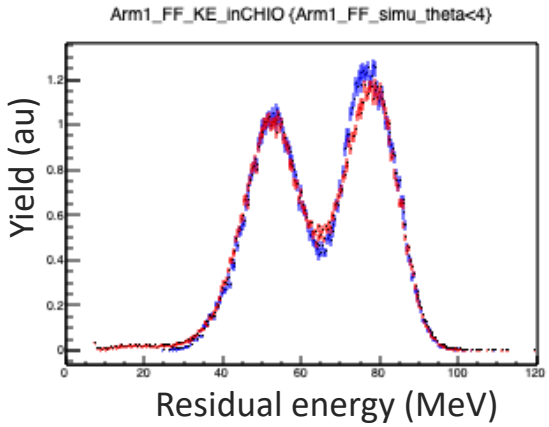


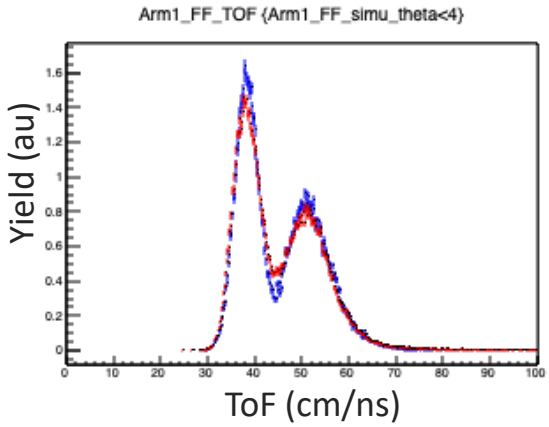
^{235}U fission fragment study with FALSTAFF at NFS

- Based on simulations : ^{252}Cf

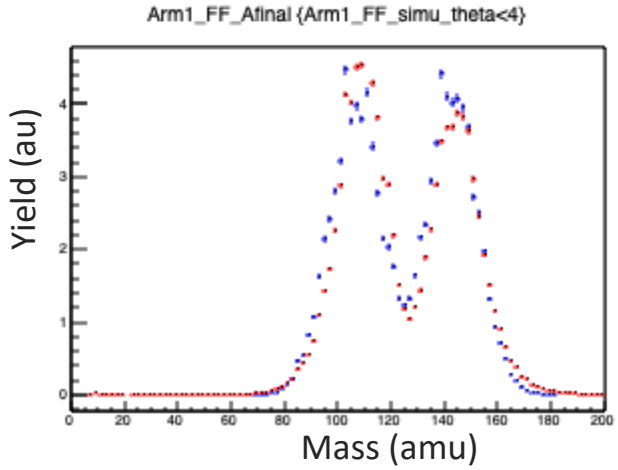
Simulations with GEF code (v2021.v1.1) : *K.H. Schmidt et al., Technical report, JEFF Report 24, 2014.*

- Use Z, A, KE_{pre}, ν
- Perform homemade evaporation
- G4 simulation with e814 geometry (a condition on theta applied)



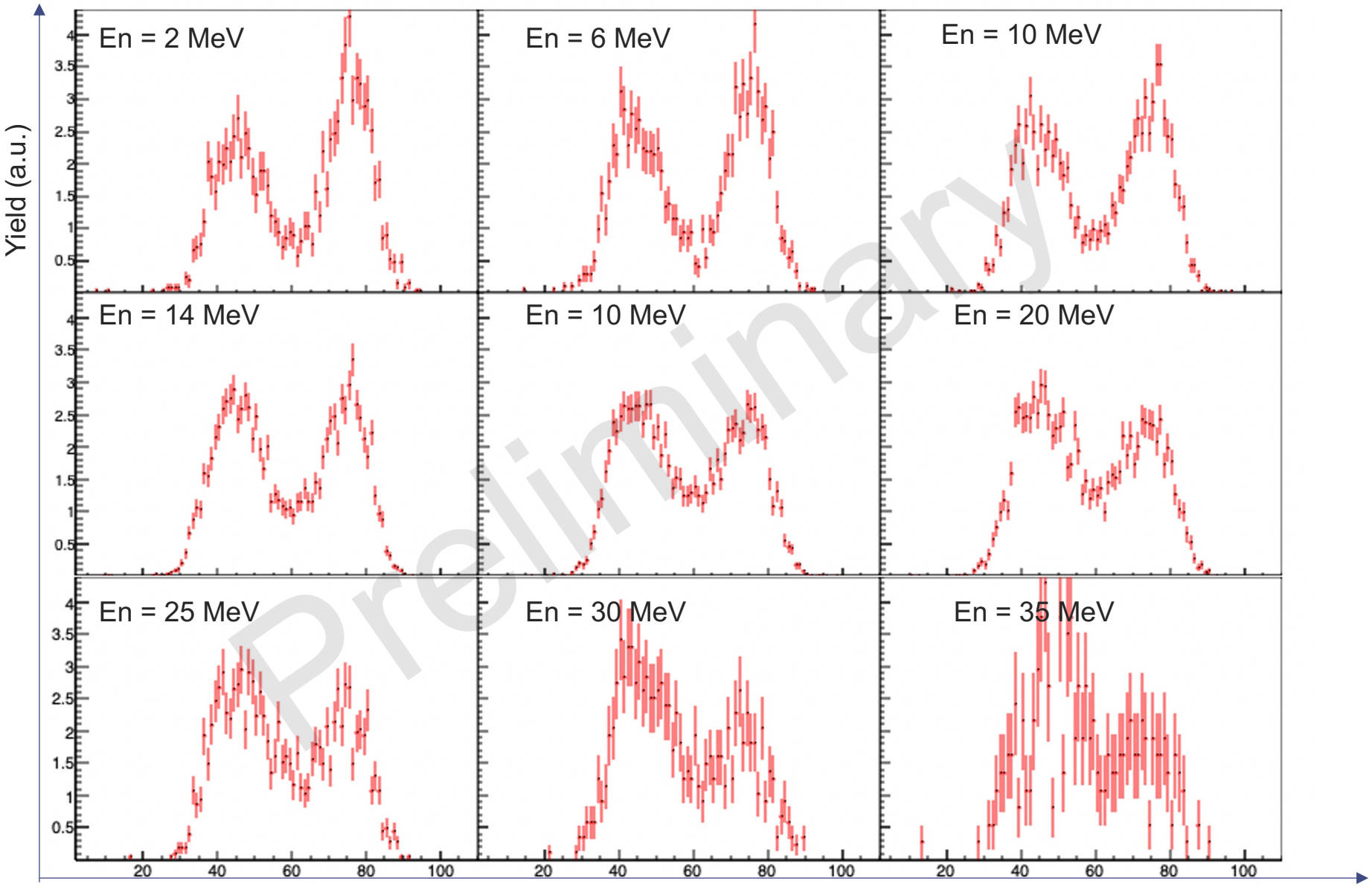


Data
GEF + G4 + analysis



^{235}U fission fragment study with FALSTAFF at NFS

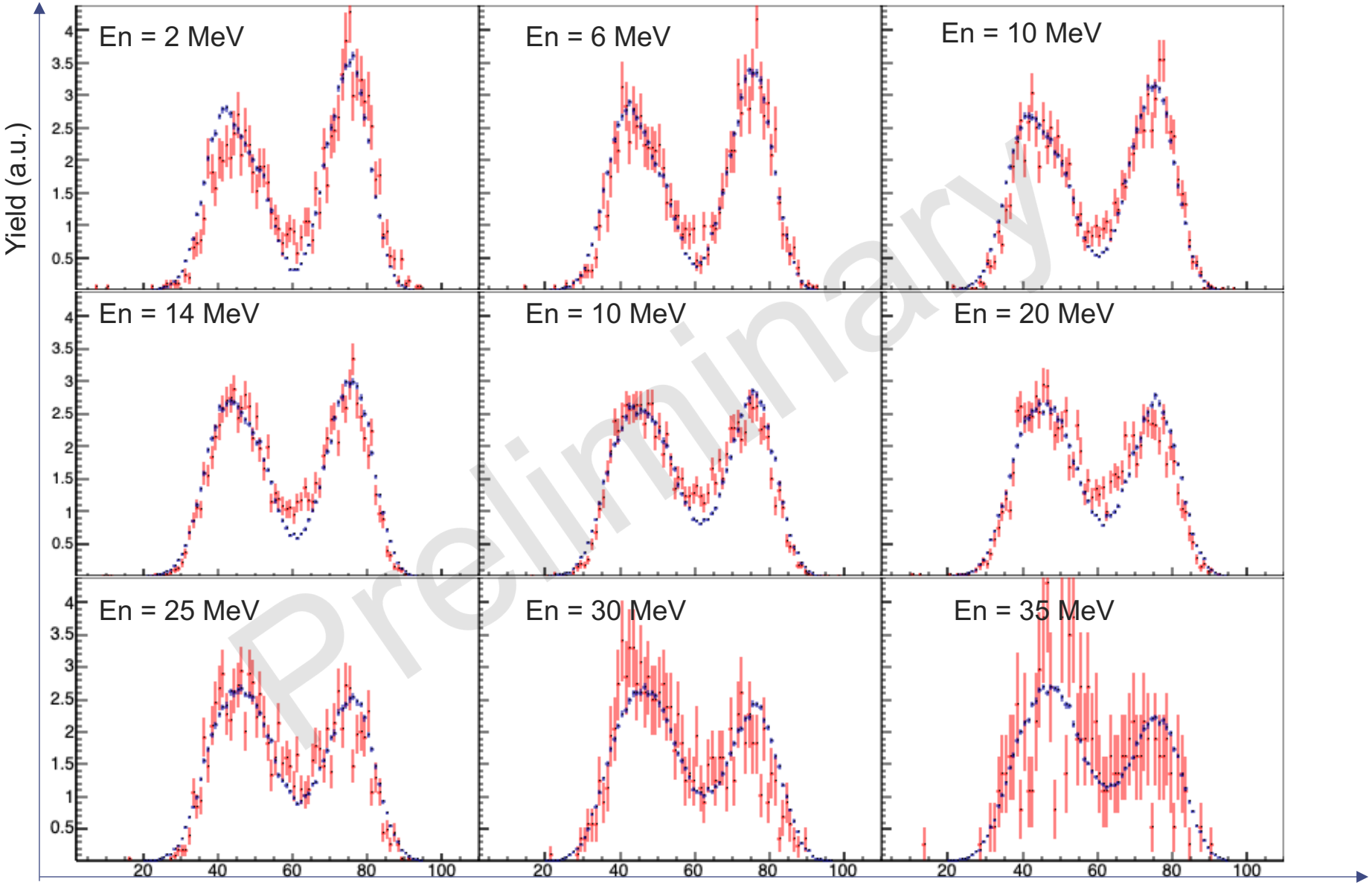
Spectra normalized to integral
E_{neut} bin width : 1 MeV



Data
GEF + G4 + analysis

^{235}U fission fragment study with FALSTAFF at NFS

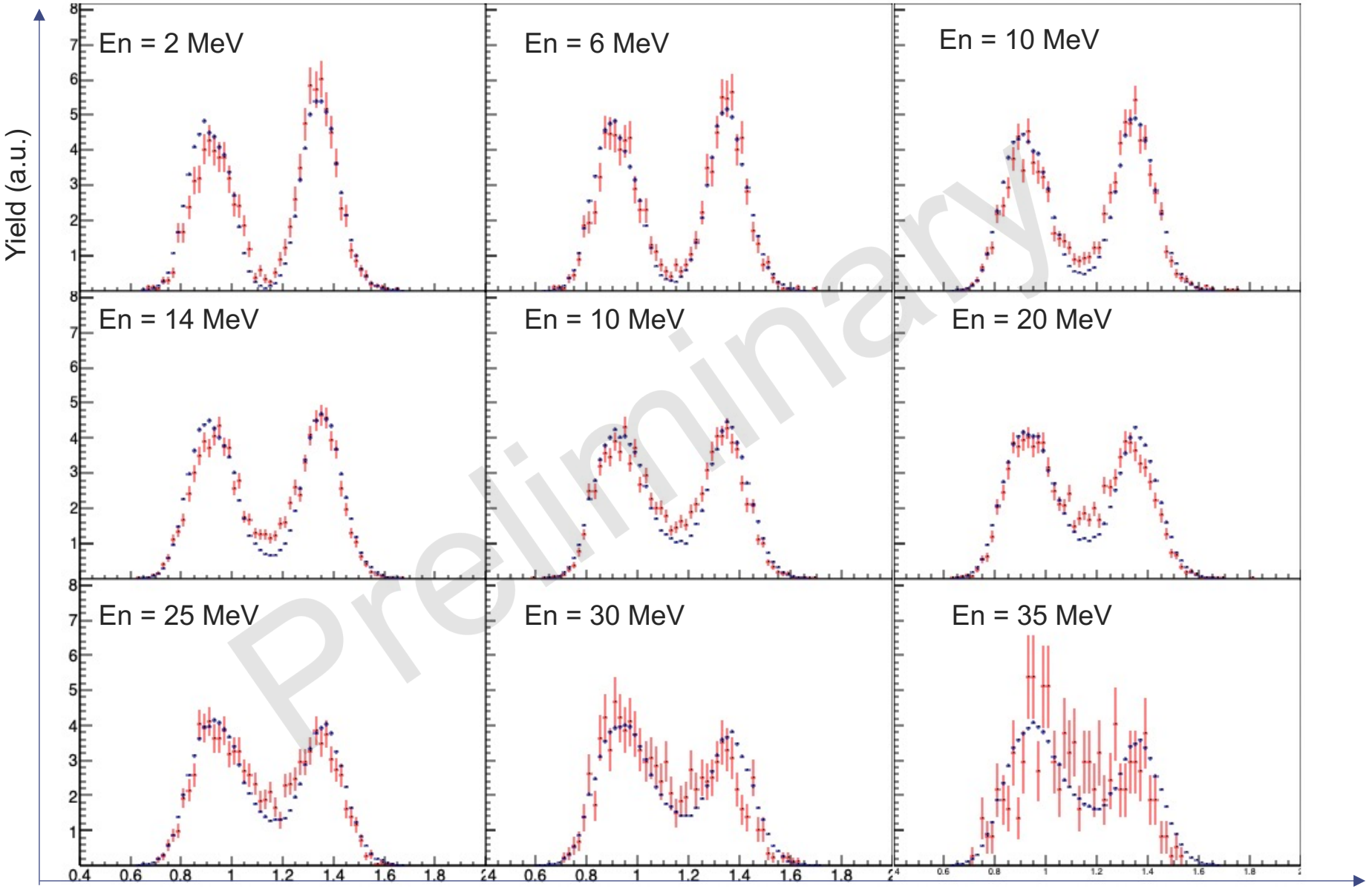
Spectra normalized to integral
E_{neut} bin width : 1 MeV



^{235}U fission fragment study with FALSTAFF at NFS

Data
GEF + G4 + analysis

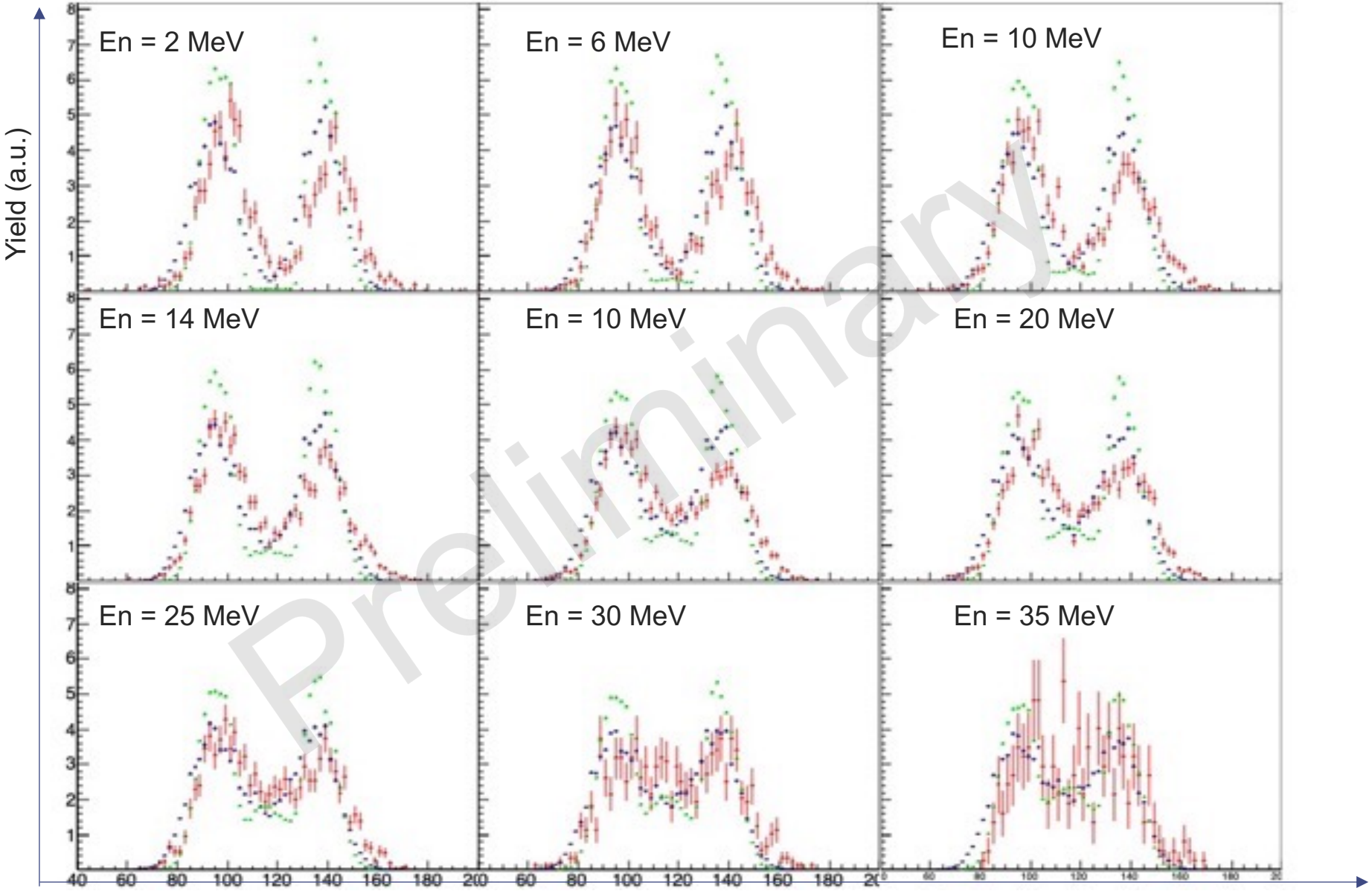
Spectra normalized to integral
E_{neut} bin width : 1 MeV



^{235}U fission fragment study with FALSTAFF at NFS

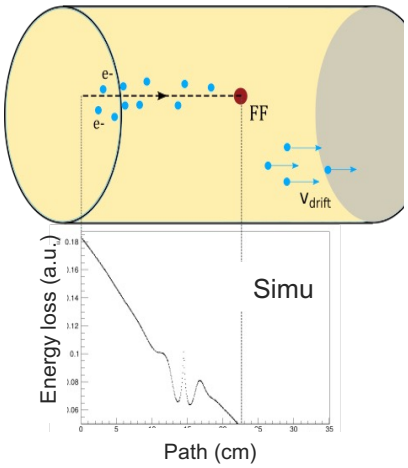
Data
Simu in G4
GEF + G4 + analysis

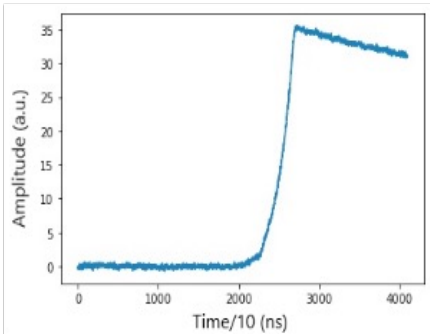
Spectra normalized to integral
E_{neut} bin width : 1 MeV

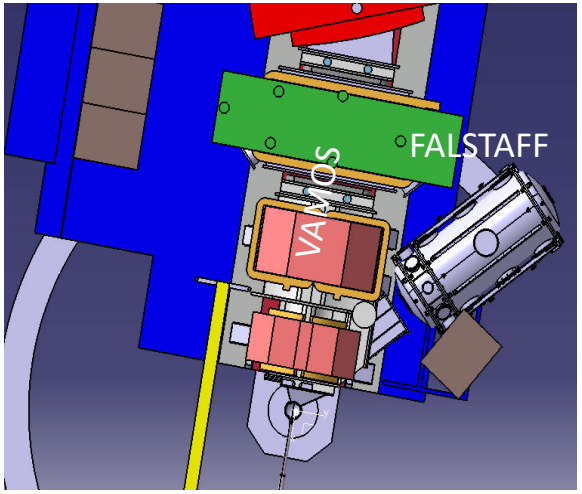


Nuclear charge determination

1st tentative





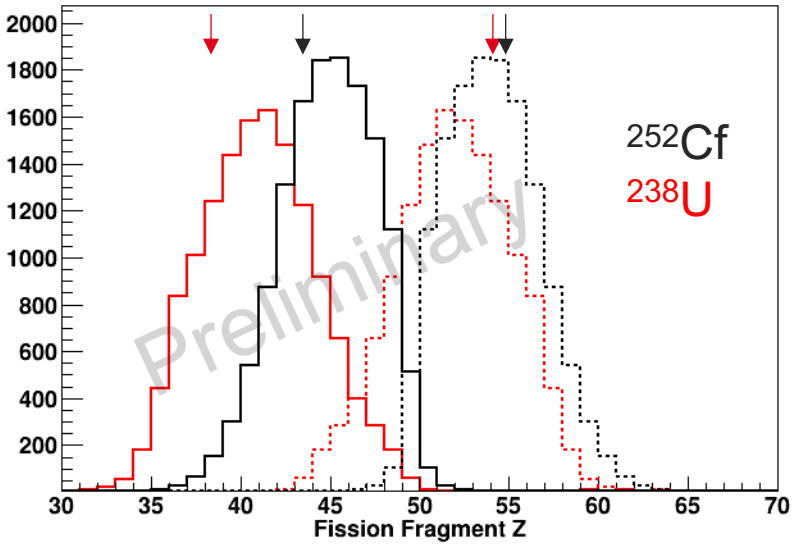


FALSTAFF @ VAMOS

(test experiment, March 2022, PI D. Ramos)

^{238}U + Be (Al) → fusion-fission main channel

- one fragment fully (Z,A,E) identified in VAMOS
- one fragment slowed down (small IC close to the target) and detected in FALSTAFF IC.



Training the neural network on these data, results for ^{252}Cf and ^{235}U were obtained.

Analysis ongoing, but encouraging

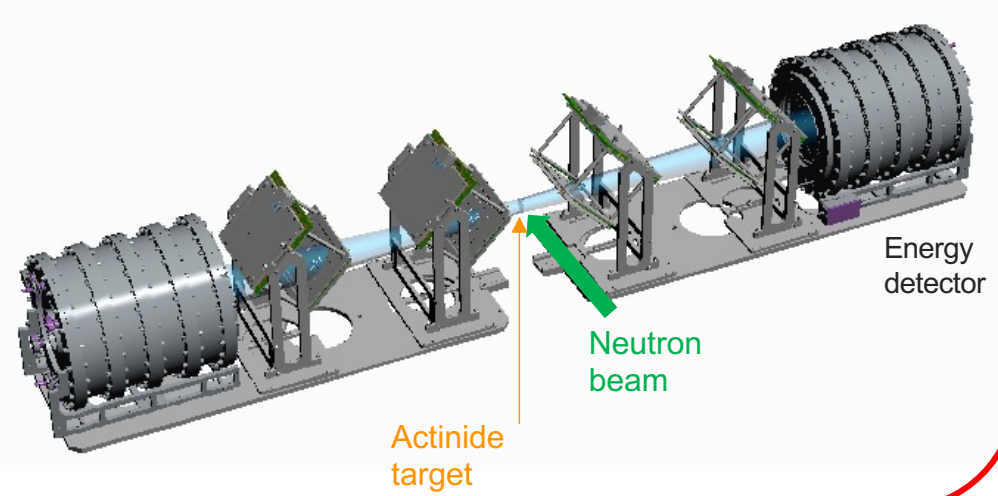
In summary

- Deliverable ready, but analysis of ^{235}U (n,f) exp. at NFS is still ongoing.
  Draft of the paper by the end of the year. Contacts with EXFOR have been made.
- ^{237}Np experiment (1-arm) to be performed in October 2024.
- Collaboration with FIFRELIN developers.

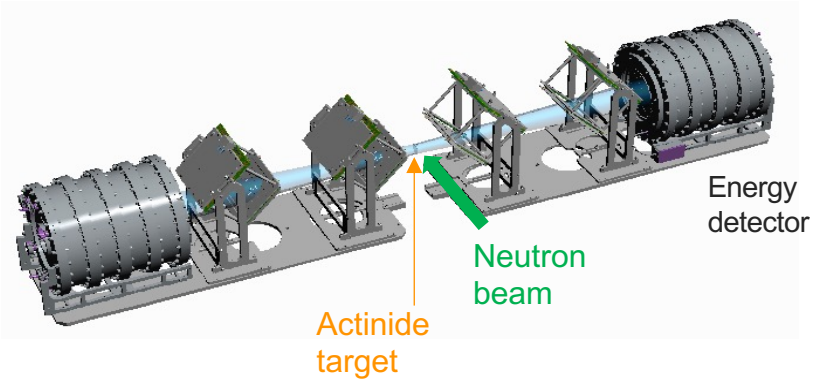
Next step

- Second arm of FALSTAFF in development (Région Normandie, Irfu/GANIL, Irfu/DPhN)
  - Reaction chamber ready
  - Ionization chamber ready
  - SEDS-MWPC to be delivered this Fall

- Proposal to be submitted this Fall
- Experiment expected in 2025



Falstaff



Participants to the E814 experiment

DPhN: *D. Doré, Eric Berthoumieux, Alain Letourneau, Thomas Materna, LoïcThulliez, Marine Vandebrouck, Mattéo Ballu, Pierre Herran, Gurpreet Kaur, Périne Miriot, Borana Mom*

GANIL: *Jean-Eric Ducret, Xavier Ledoux, Paola Marini, Diego Ramos , Anne-Marie Frelin, Indu Jangid, Priya Sharma*

JRC/Geel: *Stephan Oberstedt*

Subatech: *Eric Bonnet, Magali Estienne, Muriel Fallot, Amanda Porta, Julien Pépin*

LP2I: *Ludovic Matthieu, Teresa Kurtukian Nieto*

+ Technical staff at GANIL and Irfu/Saclay

+ support from CEA/DES/Iresne (A. Chebboubi, O. Litaize, O. Serot)

Gracias