D5.11 Report on integral experiments at LR-0

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2022

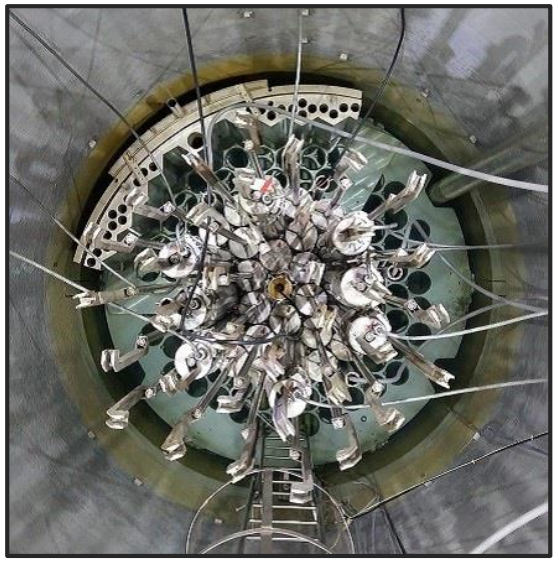
- Neutron noise measurement on 37 fuel element core [1,2]
- Measurements in pulse an current mode

2023

- Publication of pile noise experiment on LR-0 reference core [3]

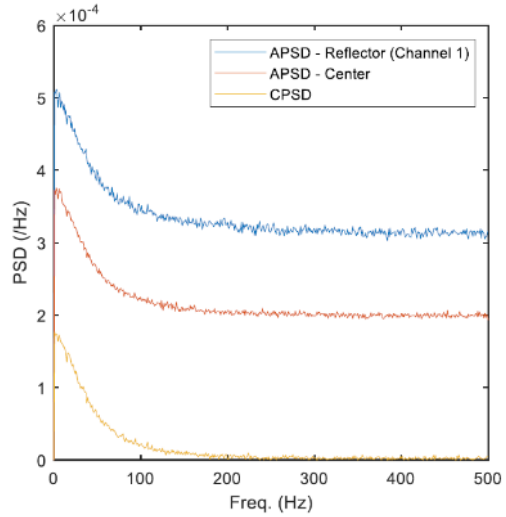
To-do in 2024

- Analysis and experimental report on 2022 experiment
  - Submission to peer-reviewed journal
  - **D5.11 SANDA deliverable report June 2024**



↑ 37 fuel element LR-0 core ↑

↓ Power spectral density in pulse mode ↓



References
[1] R. Boffy, B. Geslot, and P. Casoli, “Preparation of a neutron noise experiment in A37 VVER mock-up at LR-0,” *CEA/DES/IRESNE/DER/SPESI/LP2E/NT/2022/011/indice A*, 2022.
[2] R. Boffy, B. Geslot, and E. Lerouge, “Compte-rendu de mission d’expérience MIRROR : Mesure des paramètres cinétiques d’un cœur à 37 éléments dans LR-0,” *CEA/IRESNE/DER/SPESI/LP2E/NT/2022/013_A*, 2022.
[3] B. Geslot *et al.*, “A pile noise experiment in the reference core of the nuclear research reactor LR-0,” *Ann. Nucl. Energy*, vol. 189, p. 109833, Sep. 2023, doi: 10.1016/j.anucene.2023.109833.

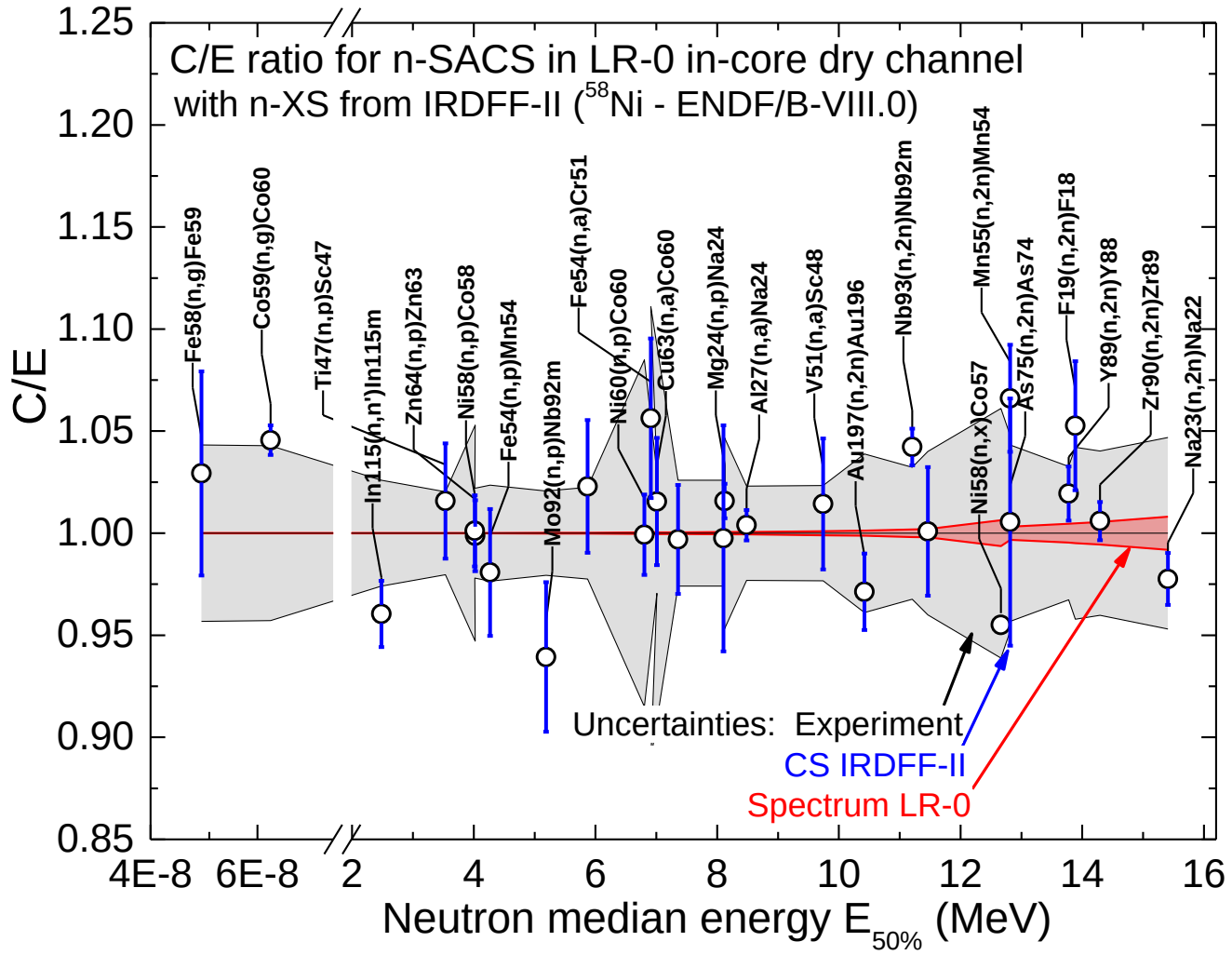
New experiments in benchmark reference neutron field

SACS measured in LR-0

Measurement in 3 large irradiation experiments

Very good agreement with calculation (ENDF/B-VIII PFNS and IRDFF-II dosimetry XS

Even foils in Cd cladding are in good agreement



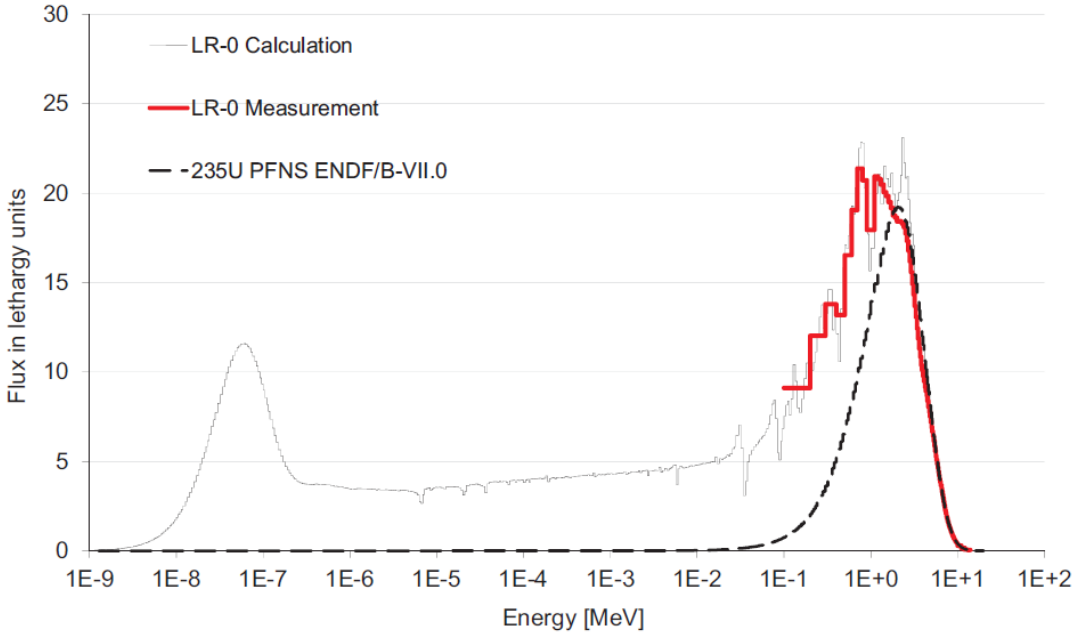
Will be published in ANE

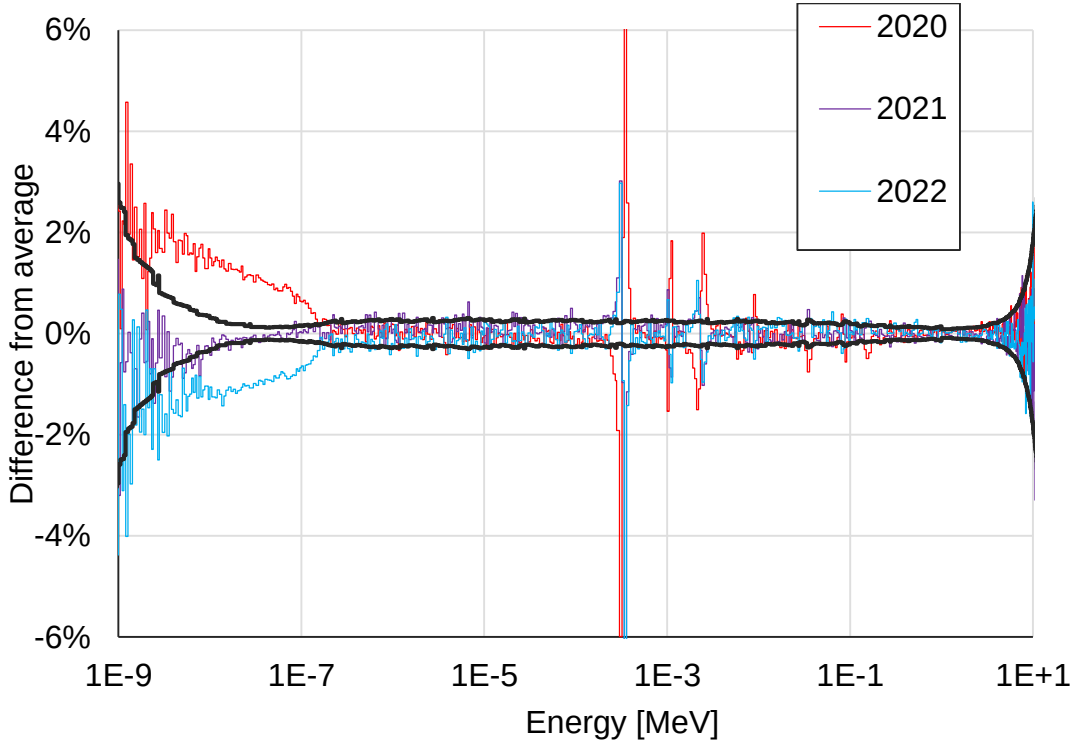
New experiments in benchmark reference neutron field

New experiments focused on validation of $^{14}N(n,p)$ cross section

A very large set of reaction rates were evaluated

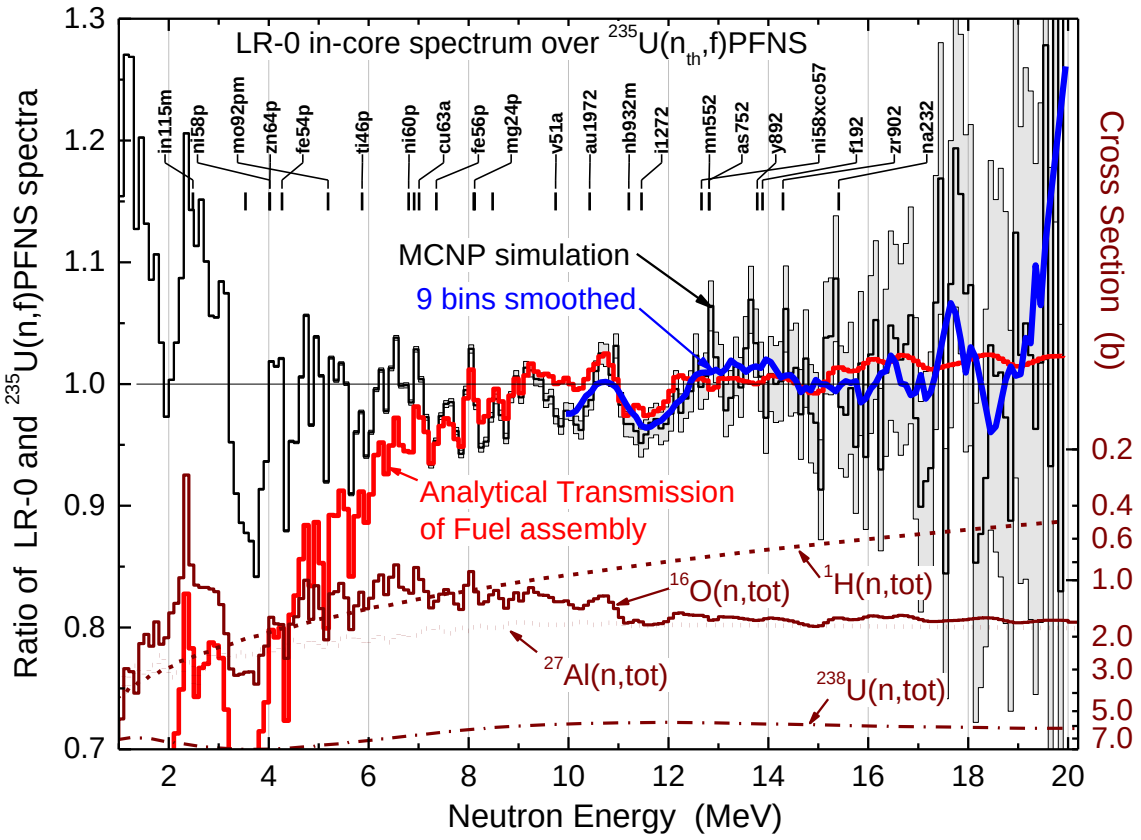
$^{14}N(n,p)^{14}C$	Mean [b]	Unc.	C/E-1
Experiment	0.3067	10.4%	-
ENDF/B-VIII.0	0.2920	0.10%	-4.8%
JEFF-3.3	0.2920	0.10%	-4.8%
JENDL-5	0.3060	0.10%	-0.2%





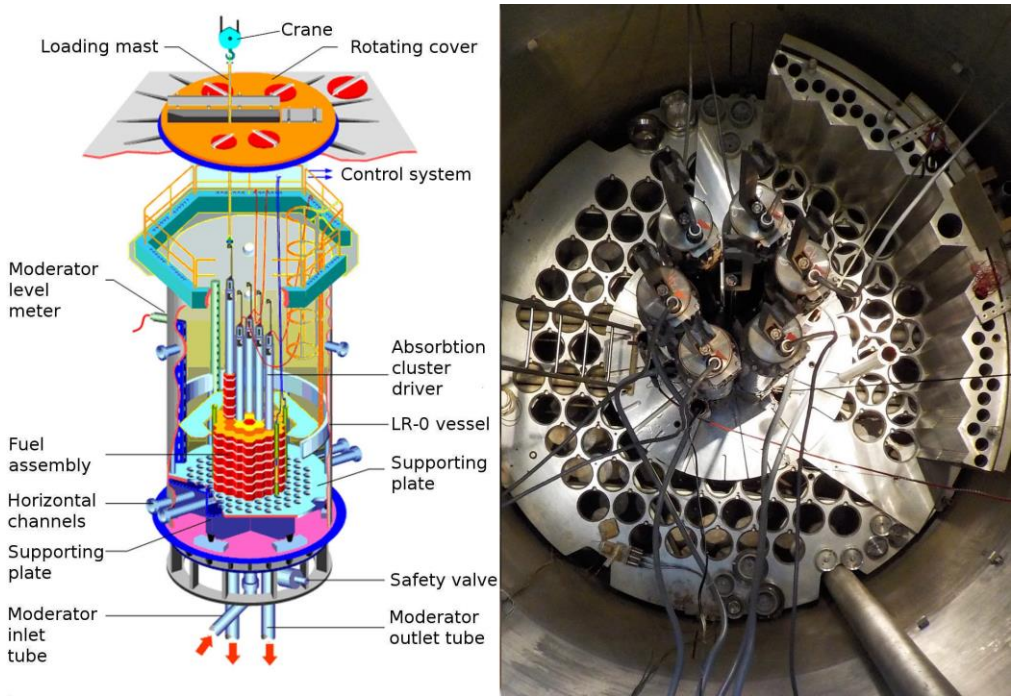
Correction from LR-0 to ^{235}U PFNS

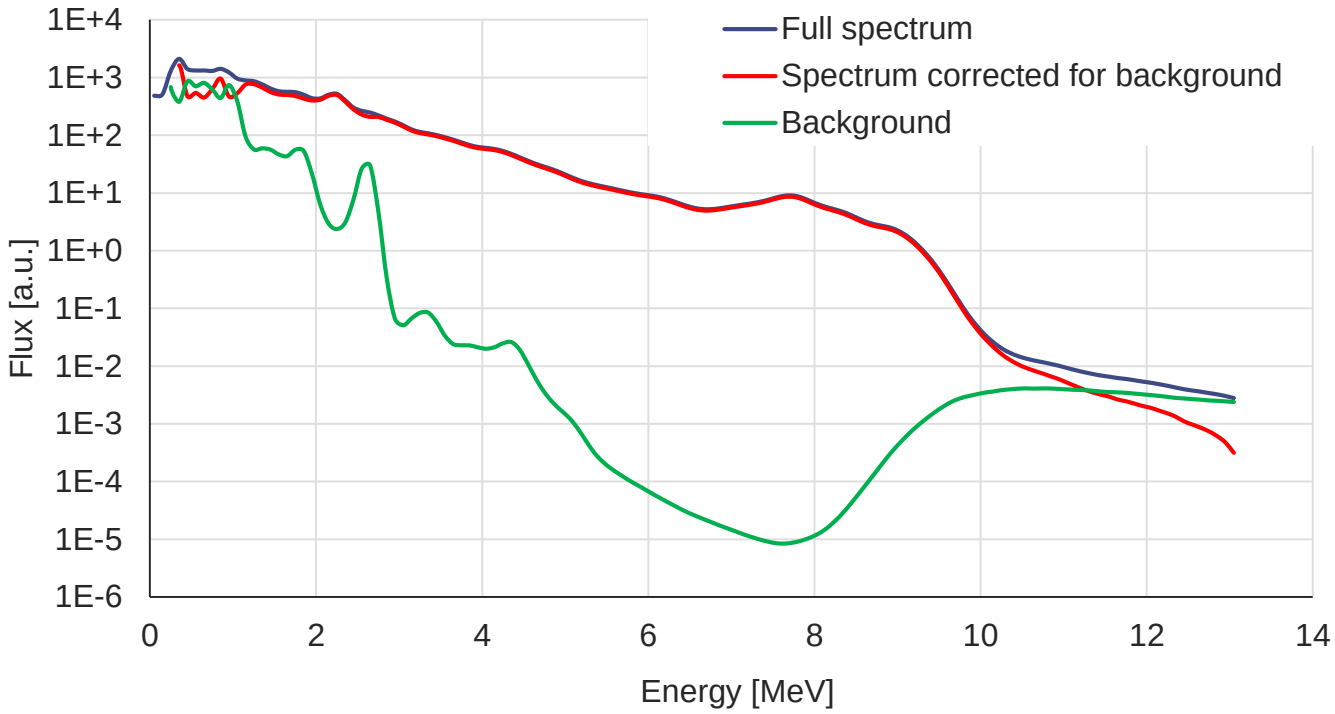
SACS measured in LR-0 corrected to ^{235}U PFNS are in good agreement (disagreement in ^{115}In(n,n') reflecting difference between LR-0 and ^{235}U PFNS)



	$E_{50\%}$	SACS [mb]	Rel. unc.	Eval./E-1
^{115}In(n,n')	2.589	**209.3**	**2.70%**	**-10.30%**
^{47}Ti(n,p)	3.647	17.97	2.00%	-0.70%
^{64}Zn(n,p)	4.036	38.21	5.30%	1.80%
^{58}Ni(n,p)	4.051	106.1	2.20%	2.00%
^{54}Fe(n,p)	4.294	78.33	2.40%	-0.30%
^{92}Mo(n,p)	5.19	6.938	2.20%	-3.60%
^{46}Ti(n,p)	5.862	**10.72**	**2.20%**	**7.40%**
^{60}Ni(n,p)	6.811	2.086	8.50%	4.50%
^{63}Cu(n,α)	7.019	0.5009	2.90%	3.30%
^{54}Fe(n,α)	7.205	0.8707	10.50%	-0.70%
^{56}Fe(n,p)	7.362	1.05	2.60%	2.80%
^{48}Ti(n,p)	8.103	0.2909	2.60%	3.60%
^{24}Mg(n,p)	8.125	1.412	4.60%	2.60%
^{27}Al(n,α)	8.471	0.6764	2.30%	3.60%
^{51}V(n,α)	9.737	0.0234	3.50%	4.00%
^{197}Au(n,2n)	10.414	3.372	4.00%	0.40%
^{93}Nb(n,2n)^{92}*	11.21	0.4307	3.10%	0.90%
^{127}I(n,2n)	11.459	1.177	4.00%	1.80%
^{55}Mn(n,2n)	12.796	0.2324	4.50%	0.00%
^{75}As(n,2n)	12.797	0.3228	4.30%	-1.10%
^{89}Y(n.2n)	13.797	0.1698	3.20%	0.80%
^{19}F(n,2n)	13.911	**0.00769**	**4.00%**	**5.90%**
^{90}Zr(n,2n)	14.32	0.1053	4.00%	-0.70%
^{23}Na(n,2n)	15.483	0.00394	4.80%	-1.90%

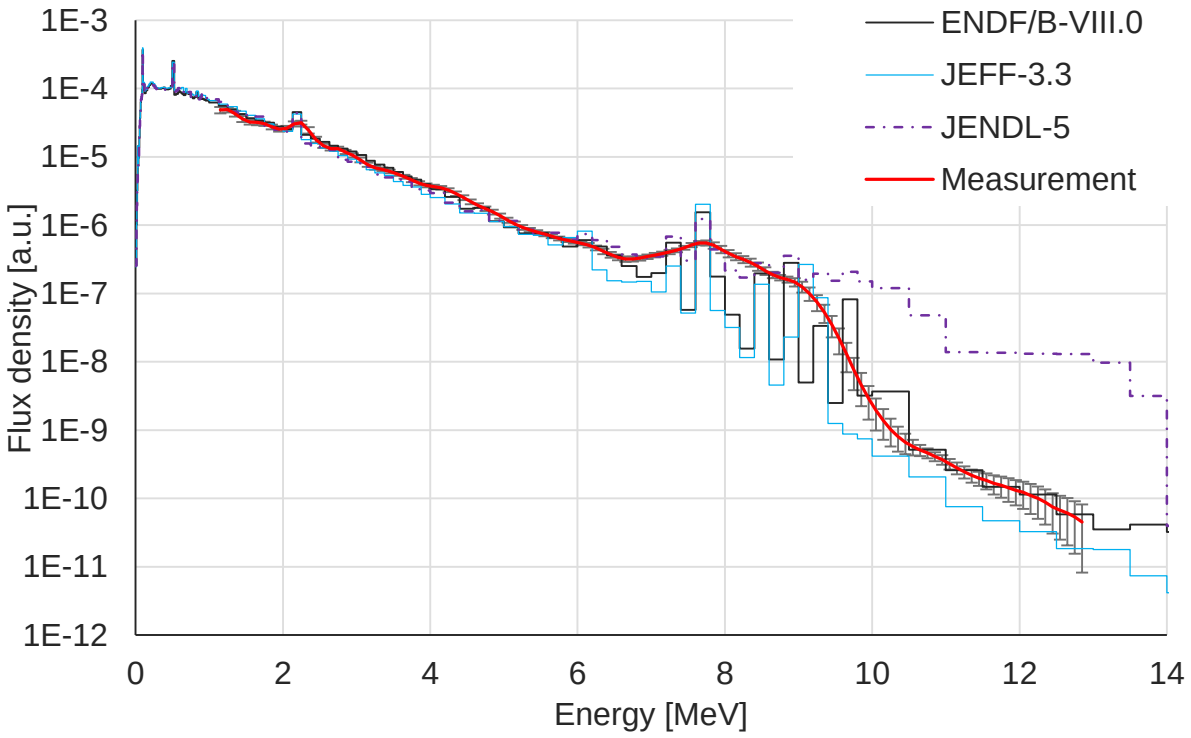
Gamma spectrum measurement in LR-0

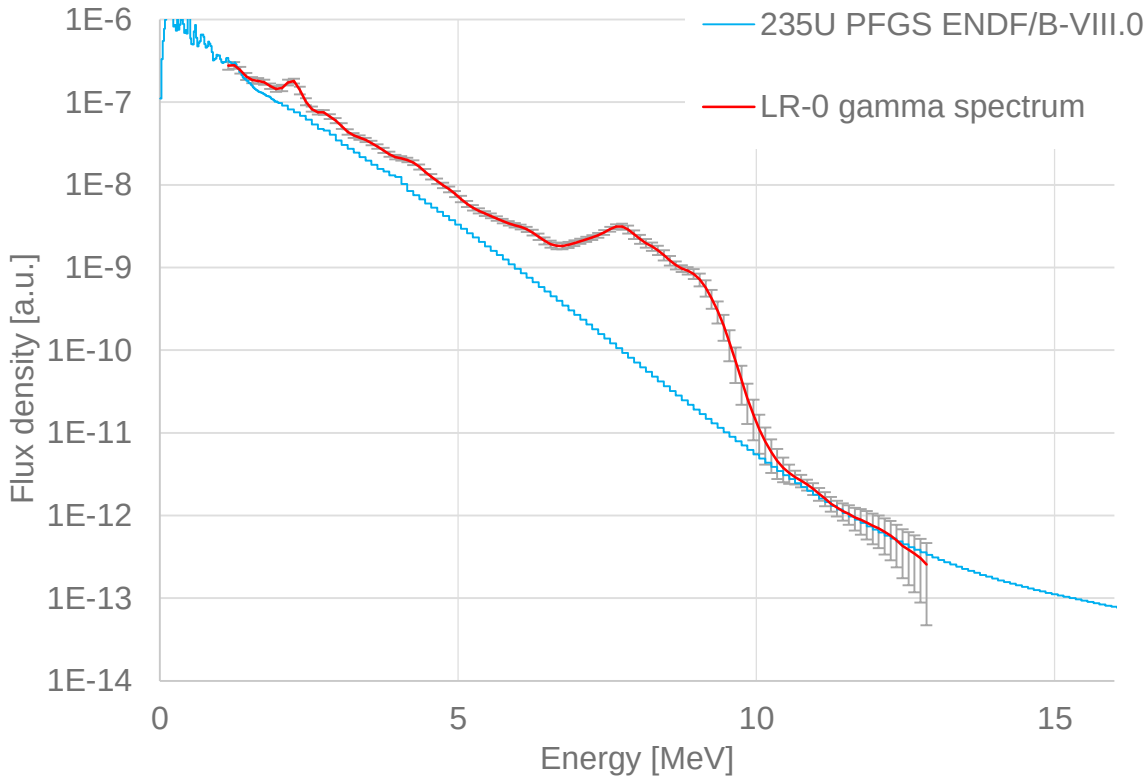




Gamma spectrum measurement in special core (6 fuel assemblies) of 3.6% enrichment (2 years decay – very low background)

Gamma spectrum in LR-0





- Measurement is consistent with ENDF/B-VIII.0
- JEFF and JENDL show discrepancies in higher energies