

- New recommended AF settings : dialogs
- How to apply new fission settings
- Comparison RIKEN user table with 3EER results
- Impact of multi-step reactions
- High-Z 3ERR settings
- IFN (Initial fissioning nuclei) analyzer

Evaporation calculation settings

Evaporation options
 Dimension of evaporation distributions [64]
 Version of Cross-Section evaporation file
 Correction dR for the deduced effective Coulomb barrier in the TUNNELLING mode [fm]

Decay modes
 1n 2n 1p 2p α d t ^3He Fission Breakup γ
 protected mode debugging mode

Mode
 manual auto
 For "daughter" nucleus excitation energy distribution apply:
 energy distribution of emitted light particle (qualitatively)
 average energy of emitted light particle (fast) (recommended for high Z)

Fission Barrier
 Model = "FisRot" - RLD(Cohen)
 BarFac =

Tunnelling for charge particle evaporation
 Take into account unbound nuclei
 Create cross-sections file
 Create Parent-Daughter references file
 Use Ablation in Abrasion-Ablation calculations (for plots)
 Avoid residual cross section for nuclei with $T_{1/2} < t_{ns}$

State density
 [A] - Equidistant model
 [B] - as [A] + pairing corrections
 [C] - as [B] + shell corrections

Dissipative effects in fission
 use Krammers's factor use Gamma_f(t) as a step function
 Reduced dissipation coefficient "B" (10^{-21}) / s

Odd-Even Delta parameters
 Evaporation =
 Fission =

Break-up parameters
 The limiting temperature calculated from the curve based on three points for masses 50, 150, 250
 T (A=050)=
 T (A=150)=
 T (A=250)=
 Diffuseness=
 Default values from Zi Li & M.Liu, PRC69, 034615 (2004), Fig.5

Fission properties

Cross sections
 Use Odd-Even corrections in fragment yields
 Include post-scission (n,p,a) evaporation
 Neutron-distribution width scaling parameter
 effective at high E*
 In current versions the default value is 3.5. Before LISE version 17 this parameter was always 1.
 Parameters for shell structures**

Shell position	Strength	Curvature	
$N_{sh,i}$	dU_i (MeV)	$2C_{sh,i}$ (MeV)	
1	83	-2.65	0.7
2	90	-3.8	0.15

 **1* J.Benlliure et al., NPA628(1998)458
 **2* see LISE++ v.7.5 documentation

Fragment excitation (TXE) depends on
 #0 Dissipated energy [NPA 628(1998)458]
 $\text{TXE} = E^* - Bf + E_{dis}$
 #1 Reaction Q-value [EPhysJA14(2002)459]
 $\text{TXE} = (a1 + a2) (f Q)^2 + E^*$
 $f =$
 Fragment excitation energy distribution width
 St.Dev =
 High-Energy Excitation-Sharing Asymmetry Parameter
 $k =$

Angular distribution cut by momentum slits
 Do not use
 Use just for "MatrixKinematics" class
 Use for all Angular Distributions (default)

Angular distribution shape
 Isotropic Anisotropic

NP-evap : fission case
 Dimension of evaporation distributions for de-excitation of fission fragments
 8 (default)
 12
 16
 24
 32

Settings of Quadrupole deformation (beta) at the scission point
 Manual B.D.Wilkins et al., PRC14 (1976) 1832
 Fit (Pr.v.1) tip distance: d (TKE) =

Beta values
 Fragments:
 1. light =
 2. heavy =
 These values are used for Wilkins' TXE plot, and in the "manual" mode in LISE++ fission kinematics calculations with TXE #0 mode

Excitation Energy of prefragment

(default 1) Use

Abrasion model
 Geometrical : J.Gosset et al., PRC 16 (1977) 629
 Exponential ($Y \sim \exp(-k^*d_{abr})$) $k =$

Excitation Energy Models
 1. J.W.Wilson et al., NIM B18 (1987) 225-231
 2. J.-J.Gaimard and K.-H.Schmidt, NPA531 (1991) 709
 3. Parametrized Gaussian distribution
 4. Exponential <T> excitation-energy distribution
 5. Log-normal distribution
 Use LISE++ corrections for Geometric A-A model
 [beta] Use one-nucleon pickup contribution (charge exchange)
 Apply the limiting temperature threshold: $T = \min(T, T_{lim})$
 "isospin-thermometer model", corresponds to Fig.9 K.-H.Schmidt et al., NPA 710 (2002) 157
 Apply thermalization for Excitat.energy according to

2. J.-J.Gaimard and K.-H.Schmidt, NPA531 (1991) 709 -- convolution
 Linear Hole depth (MeV) $\langle E^* \rangle =$ $*d_{abr}$
 Exponent $\sigma(E^*) =$ $*d_{abr}$

3. Parametrized Gaussian distribution -- simplified combination from N

$\langle E^* \rangle$	$\sigma(E^*)$	$\langle E^* \rangle$	$\sigma(E^*)$
<input type="text" value="0"/> $*d_{abr}^2 +$	<input type="text" value="0"/> $*d_{abr} +$	<input type="text" value="0"/> $*d_{abr}^2 +$	<input type="text" value="0"/> $*d_{abr} +$
<input type="text" value="20"/> $*d_{abr} +$	<input type="text" value="14"/> $*d_{abr}^{1/2} +$	<input type="text" value="0"/> [MeV]	<input type="text" value="0"/> [MeV]

4. Exponential excitation-energy distribution -- L.Audirac et al., PRC88
 $\langle T \rangle$ - Mean Distribution Value (MeV)

k_1	k_2	$k_{1/2}$
<input type="text" value="25.08691"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

5. Log-normal distribution -- O.T. private communication

1 st order	2 nd order
Median(E) / dA = <input type="text" value="20"/> MeV	<input type="text" value="0"/>
Sqr(Var) / Sqr(dA) = <input type="text" value="20"/> MeV	<input type="text" value="0"/>

Masses

Database + Calculations (recommended) DataBase
 only Calculations Formula
 User's MassExcess File

Abrasion-Fission

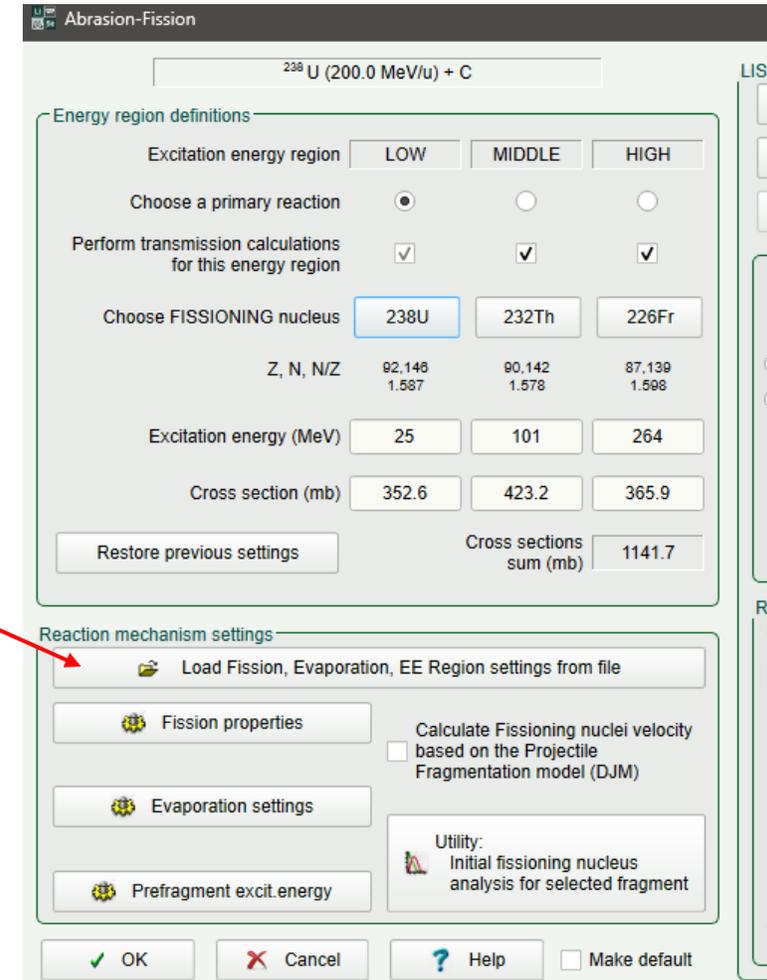
^{238}U (200.0 MeV/u) + C

Energy region definitions

Excitation energy region	LOW	MIDDLE	HIGH
Choose a primary reaction	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Perform transmission calculations for this energy region	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Choose FISSIONING nucleus	<input type="text" value="238U"/>	<input type="text" value="232Th"/>	<input type="text" value="226Fr"/>
Z, N, N/Z	92, 146, 1.587	90, 142, 1.576	87, 139, 1.586
Excitation energy (MeV)	<input type="text" value="25"/>	<input type="text" value="101"/>	<input type="text" value="264"/>
Cross section (mb)	<input type="text" value="352.6"/>	<input type="text" value="423.2"/>	<input type="text" value="365.9"/>
Restore previous settings	Cross sections sum (mb)		<input type="text" value="1141.7"/>

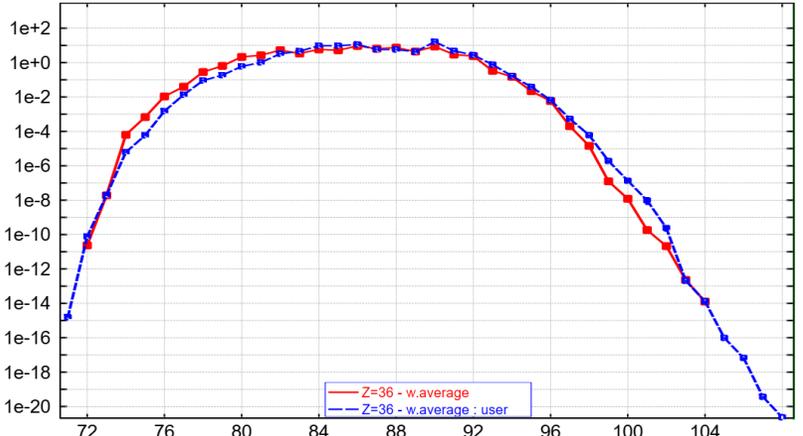
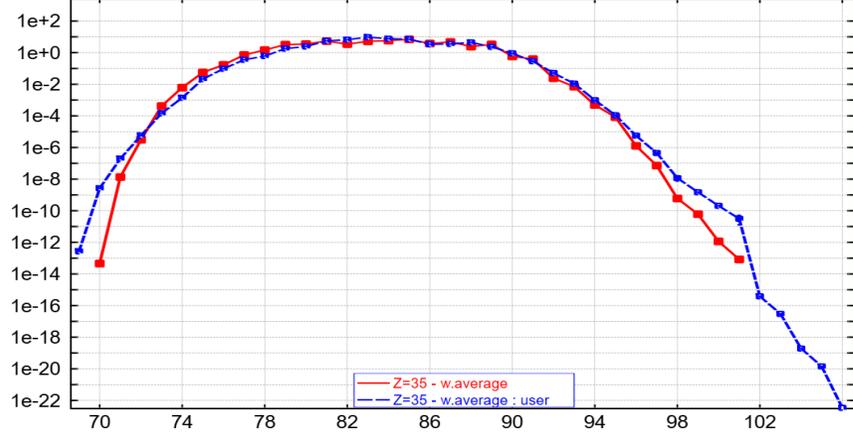
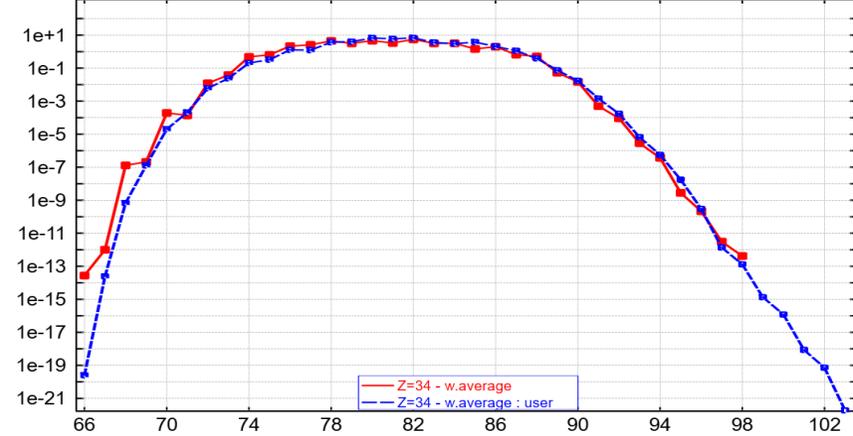
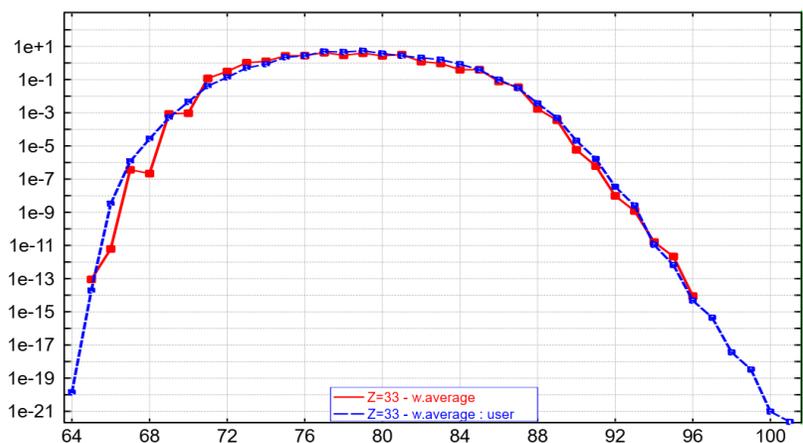
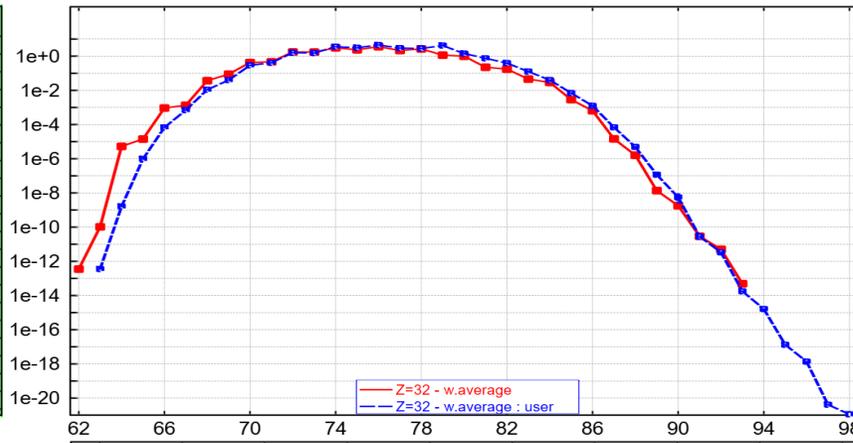
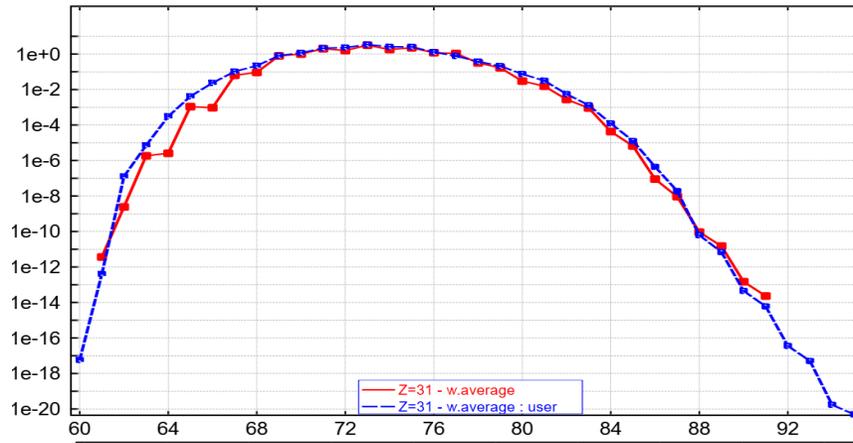
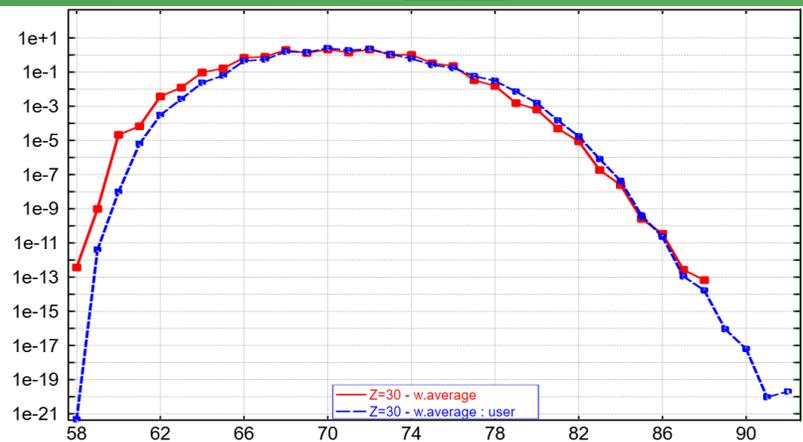
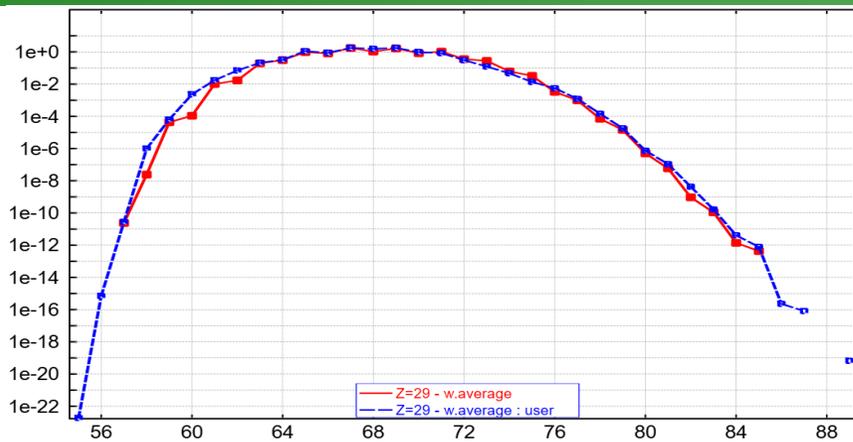
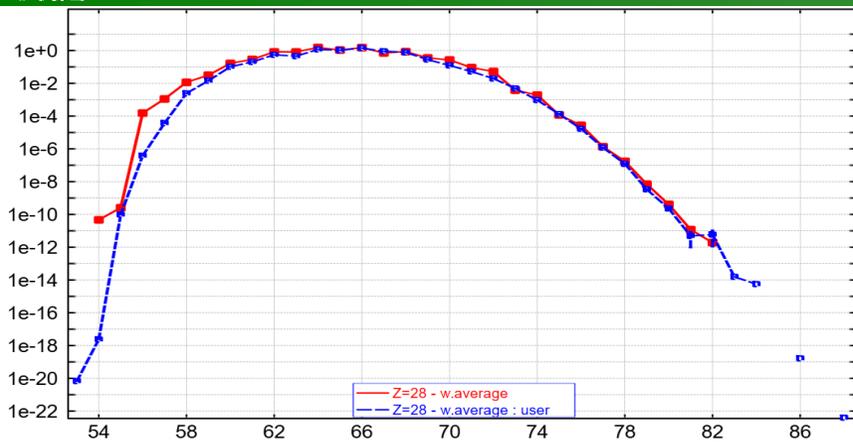
new fission settings: <LISEcute>\files\examples\afission\2026\FissionSettings_2026.lpp
 new fission highZ settings : <LISEcute>\files\examples\afission\2026\FissionSettings_2026_HighZ.lpp

1. Use “Load Fission, Settings from file” in the Abrasion-Fission dialog
2. A. Run “FissionSettings_2026.lpp” file in LISE.
 B. Erase all blocks in this files
 C. Use “Append blocks from file..” to merge your configuration file

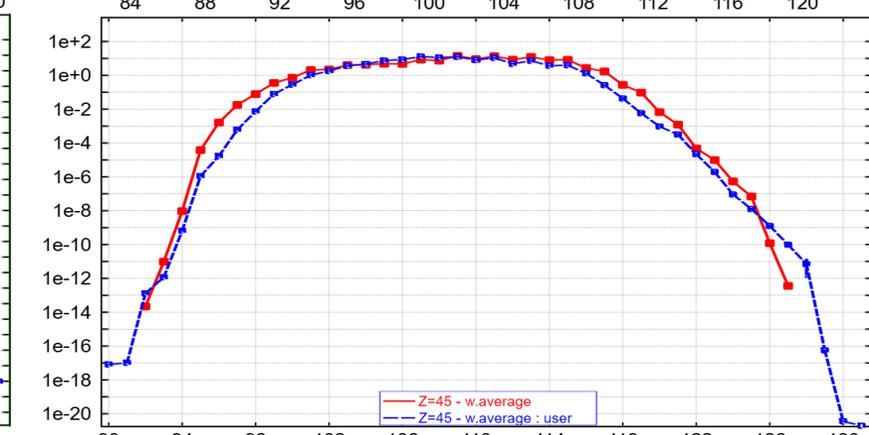
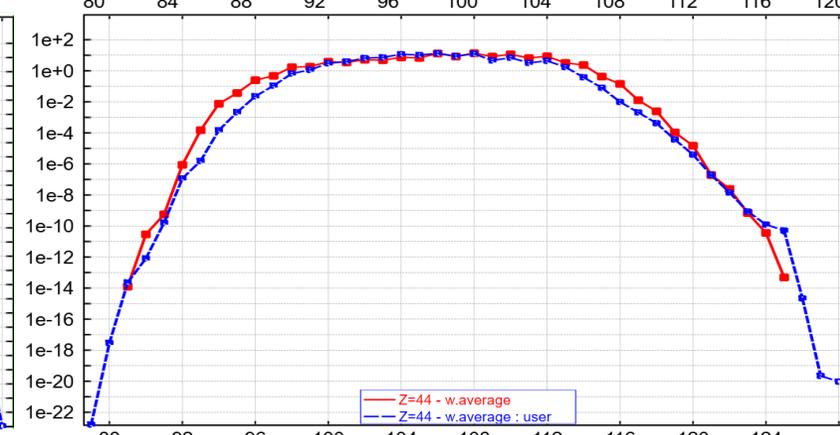
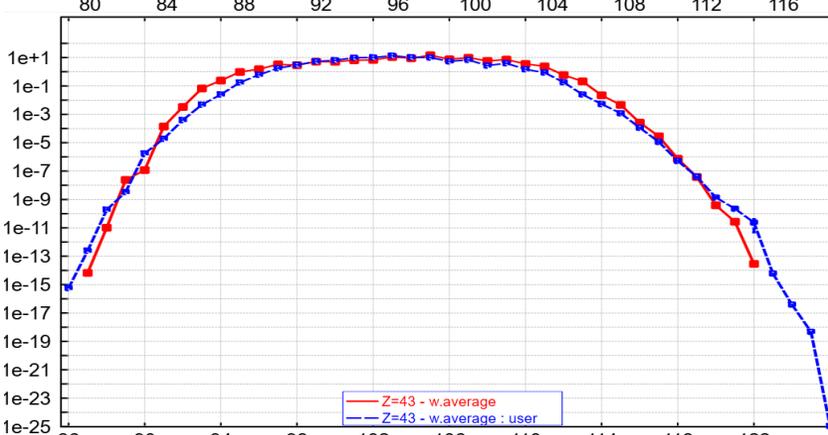
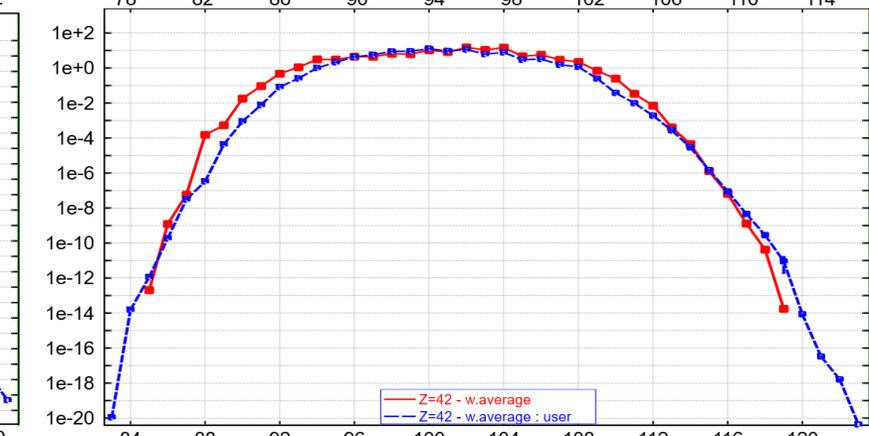
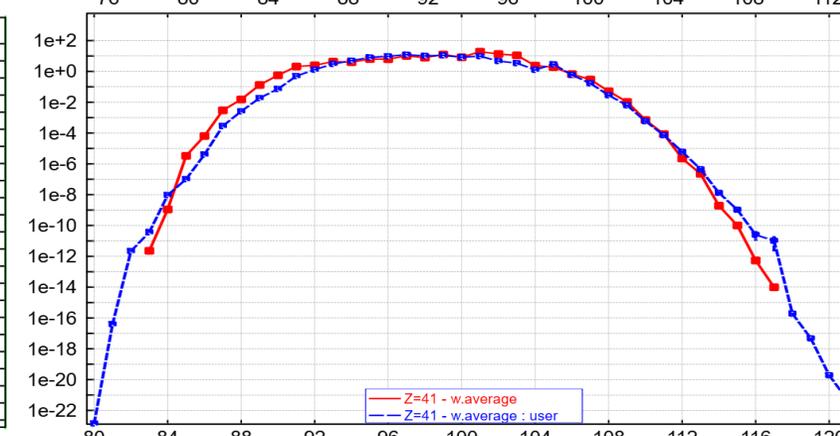
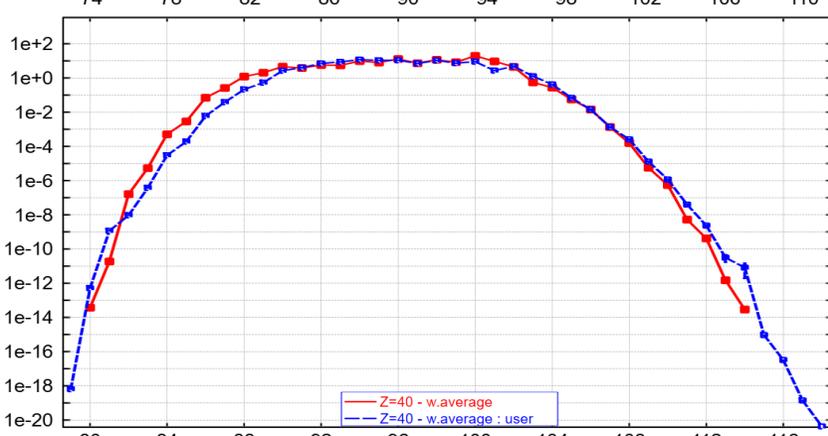
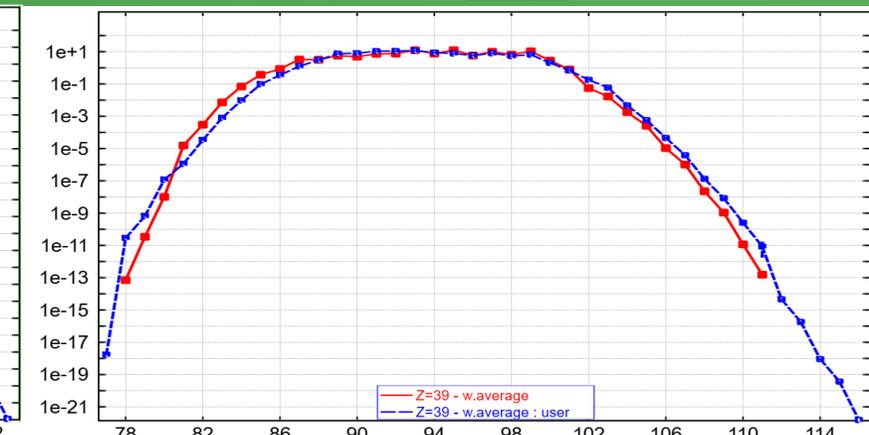
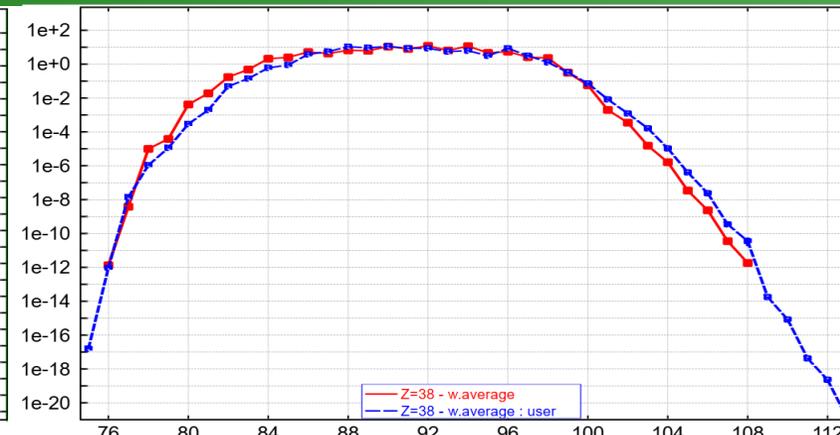
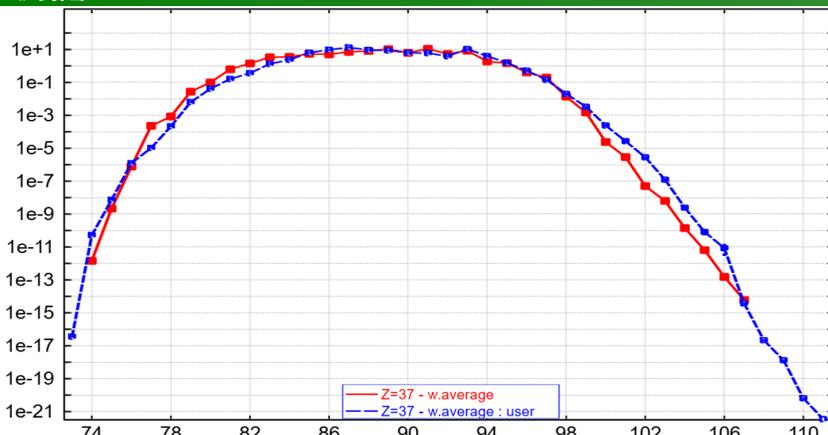




LISE 3EER recommended vs. RIKEN table: Z=28-36

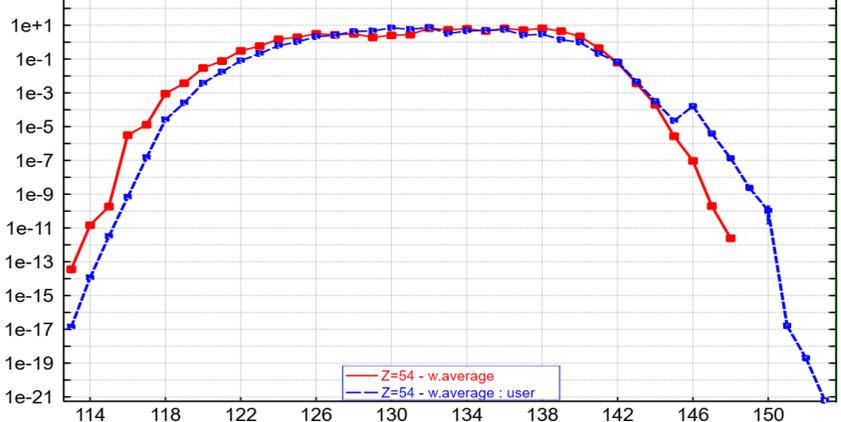
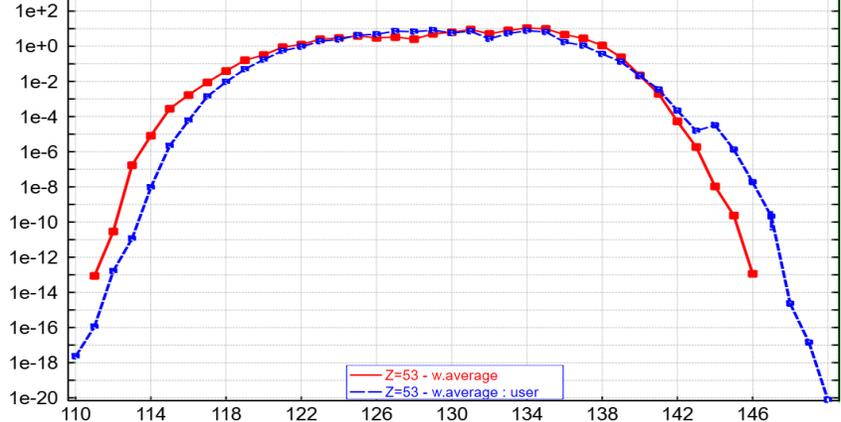
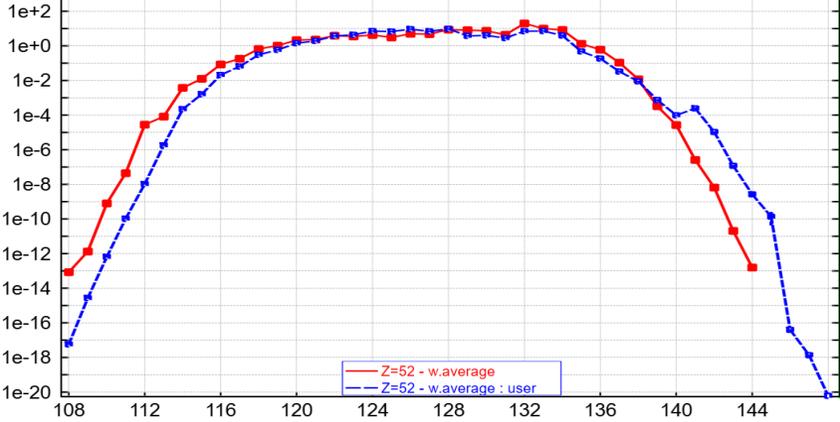
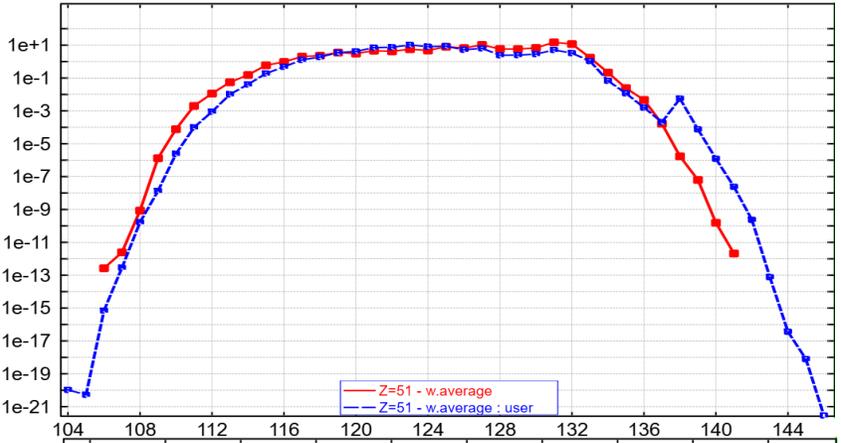
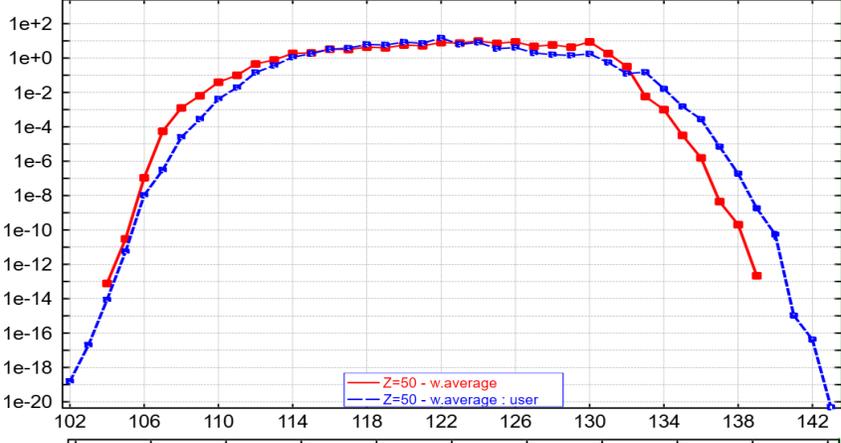
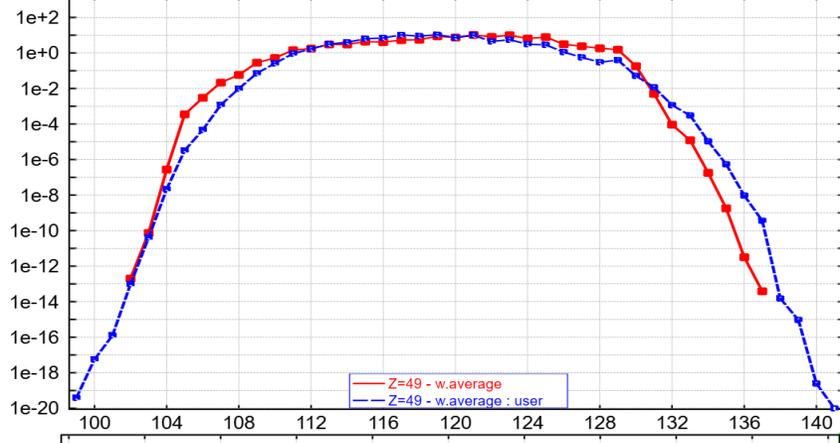
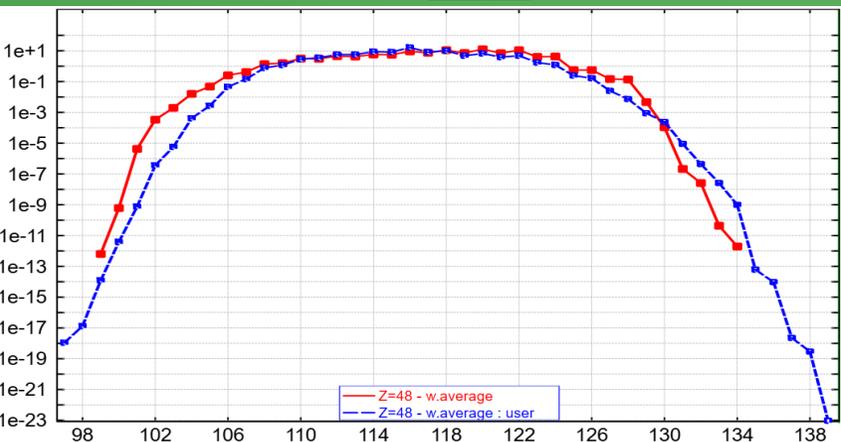
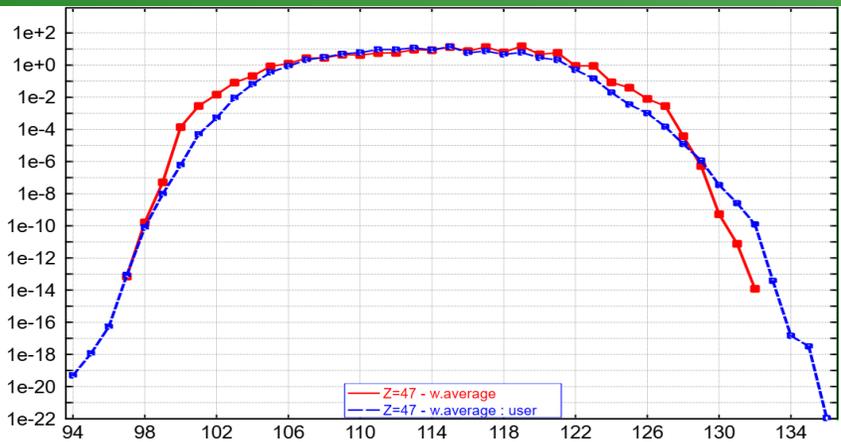
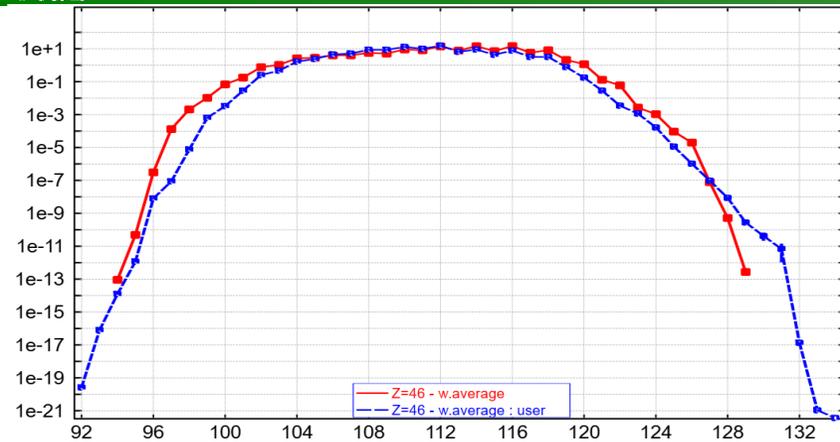


LISE 3EER recommended vs. RIKEN table: Z=37-45



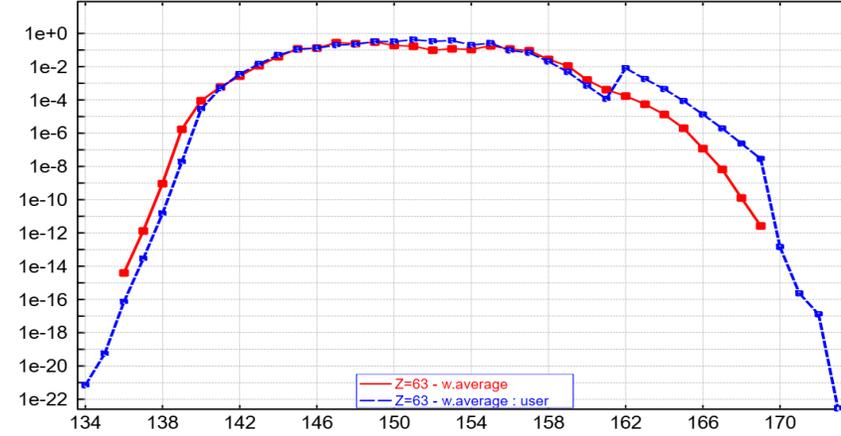
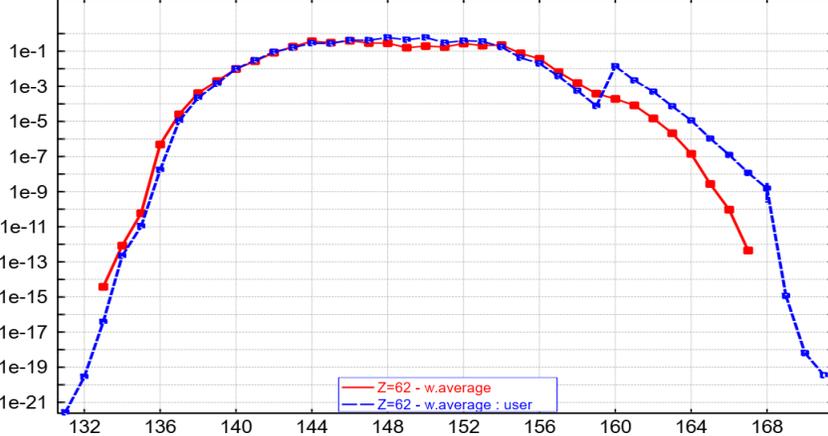
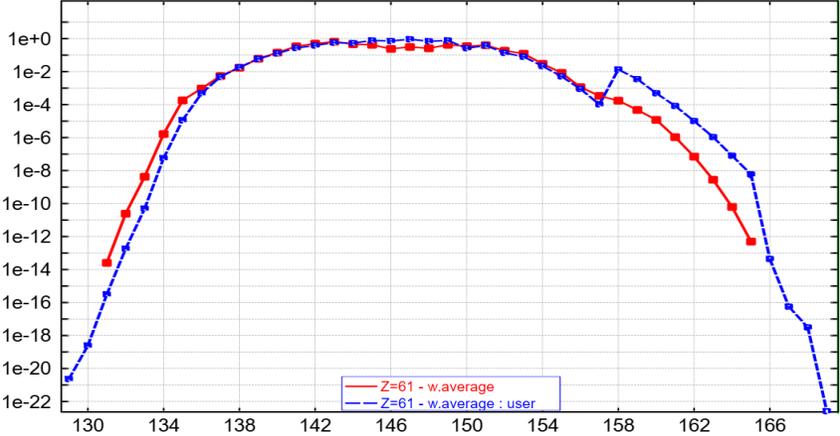
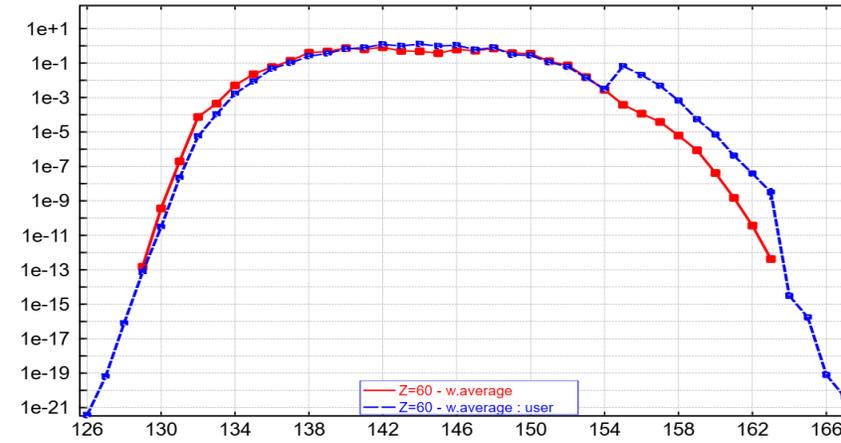
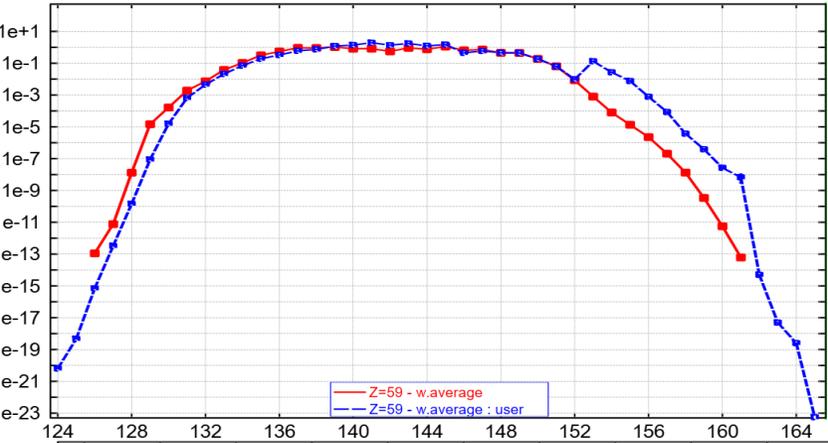
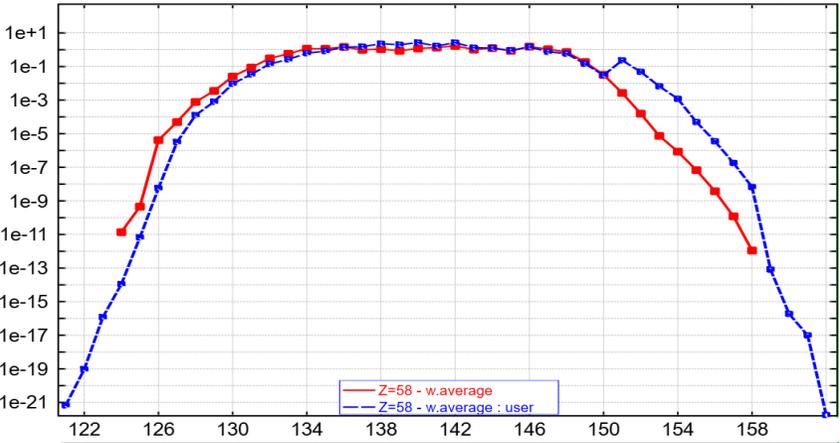
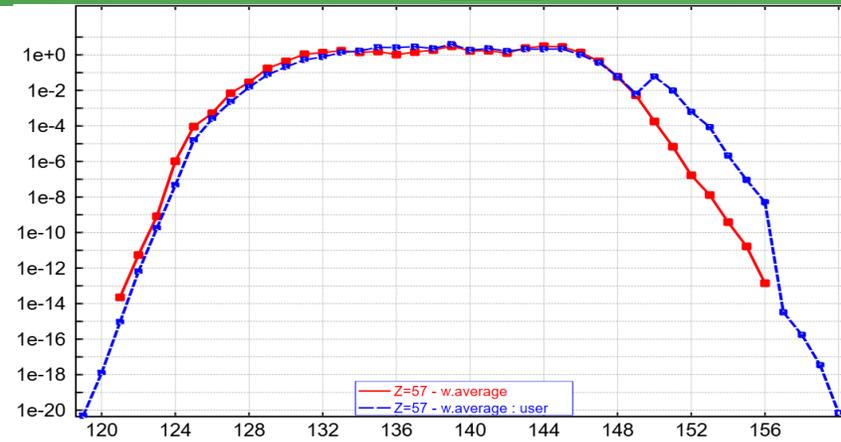
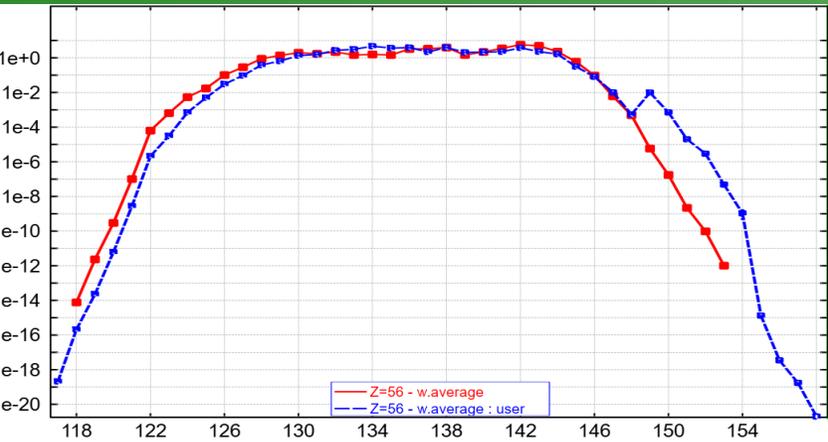
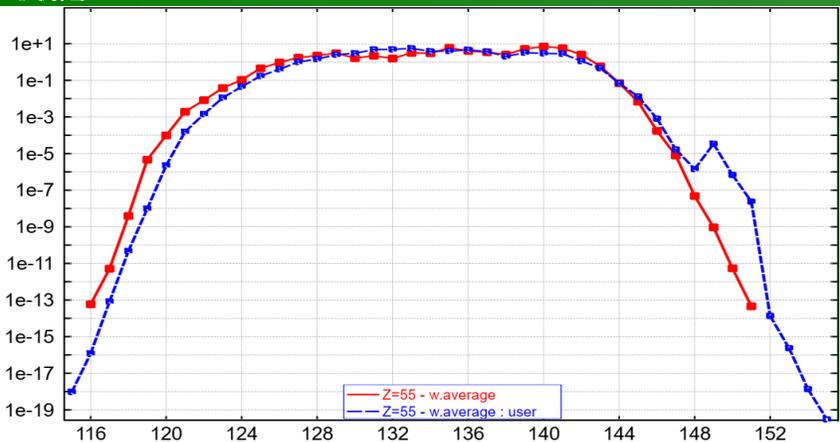


LISE 3EER recommended vs. RIKEN table: Z=46-54

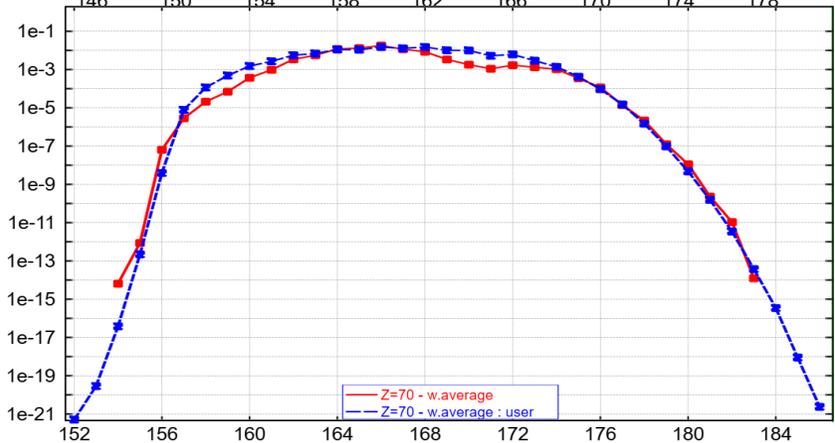
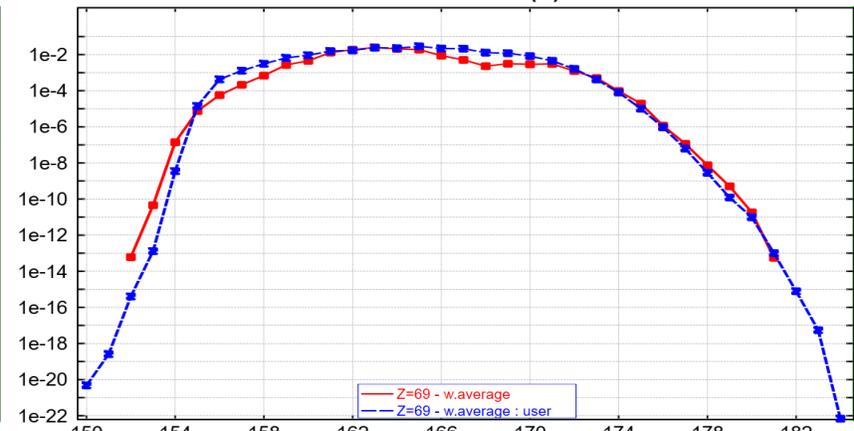
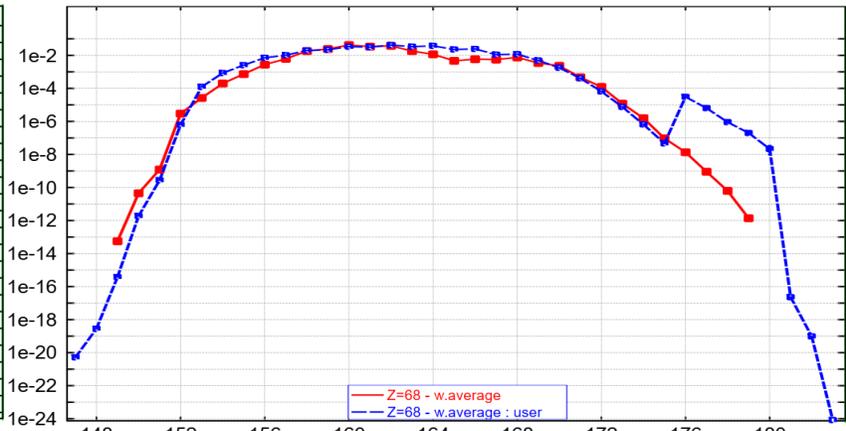
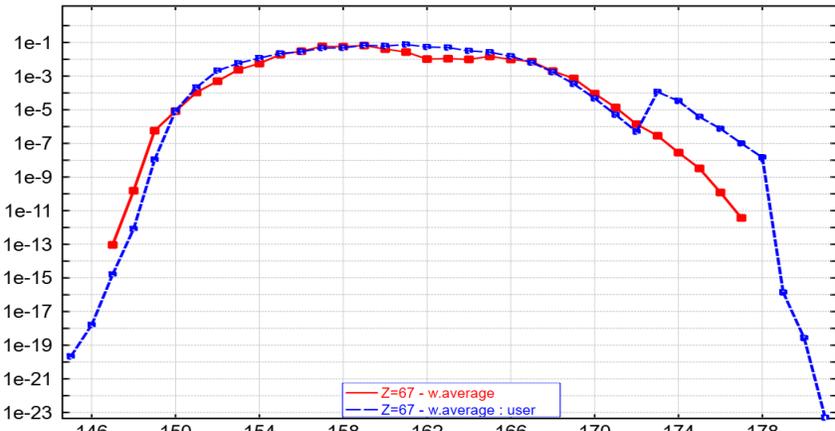
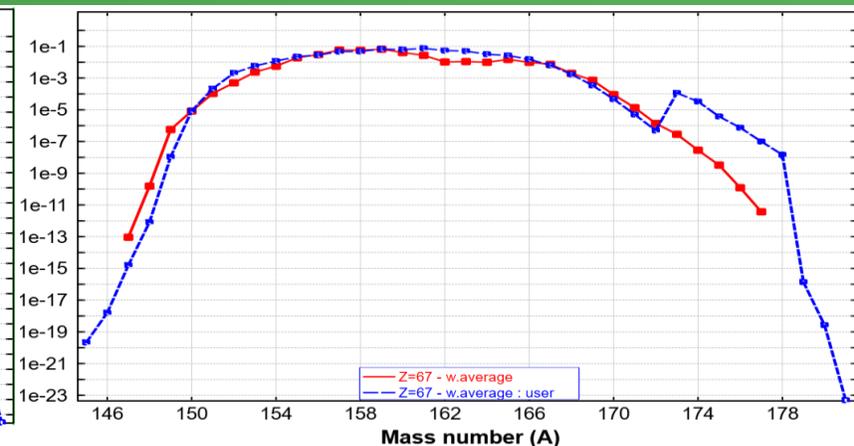
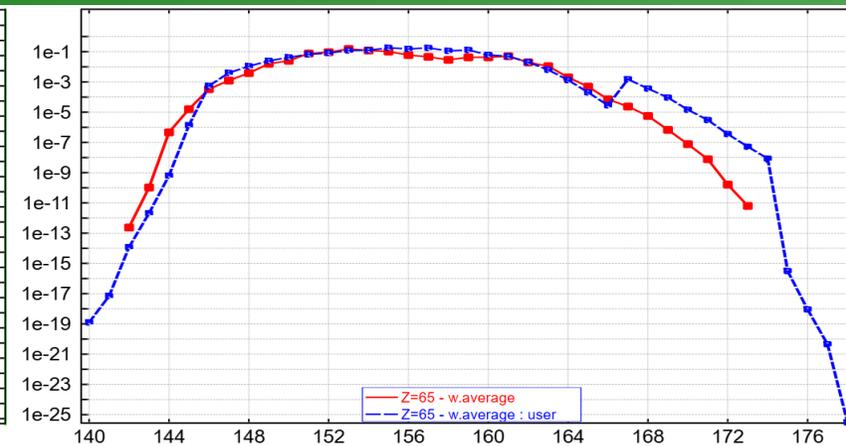
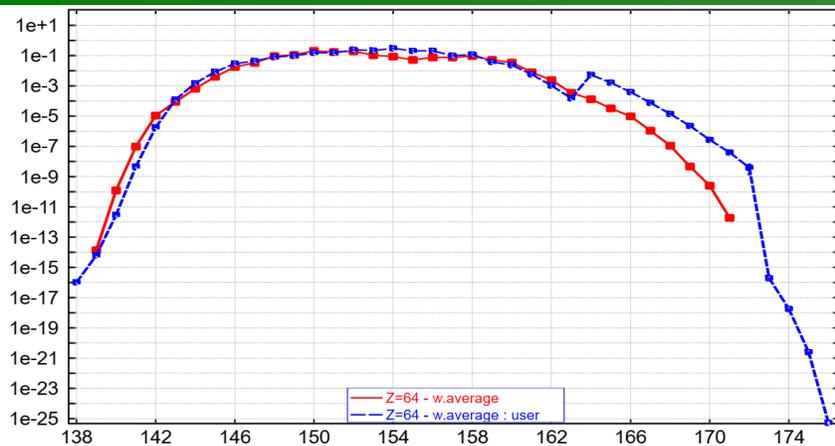




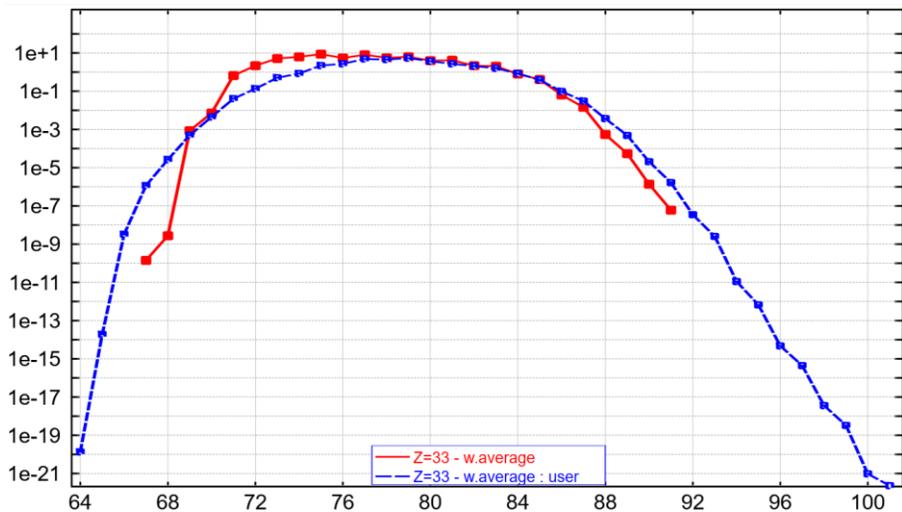
LISE 3EER recommended vs. RIKEN table: Z=55-63



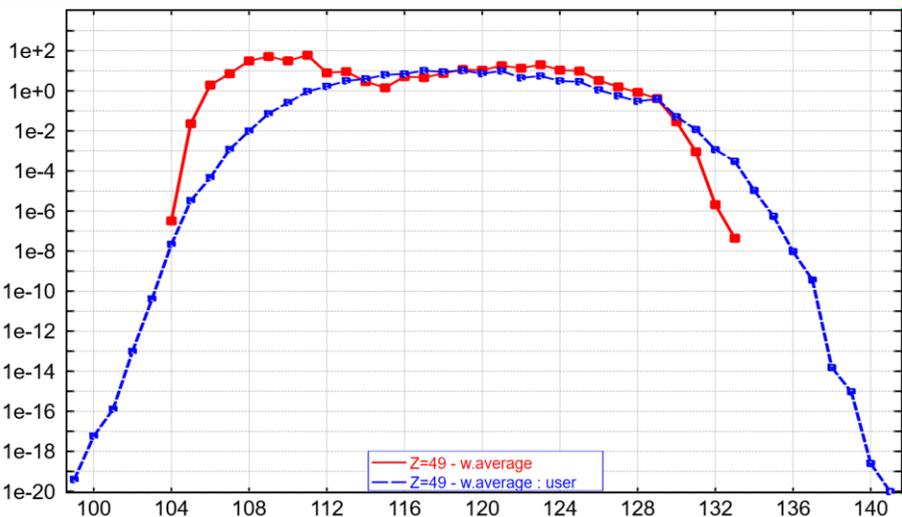
LISE 3EER recommended vs. RIKEN table: Z=64-70



CSs from LISE files for e21027 experiment

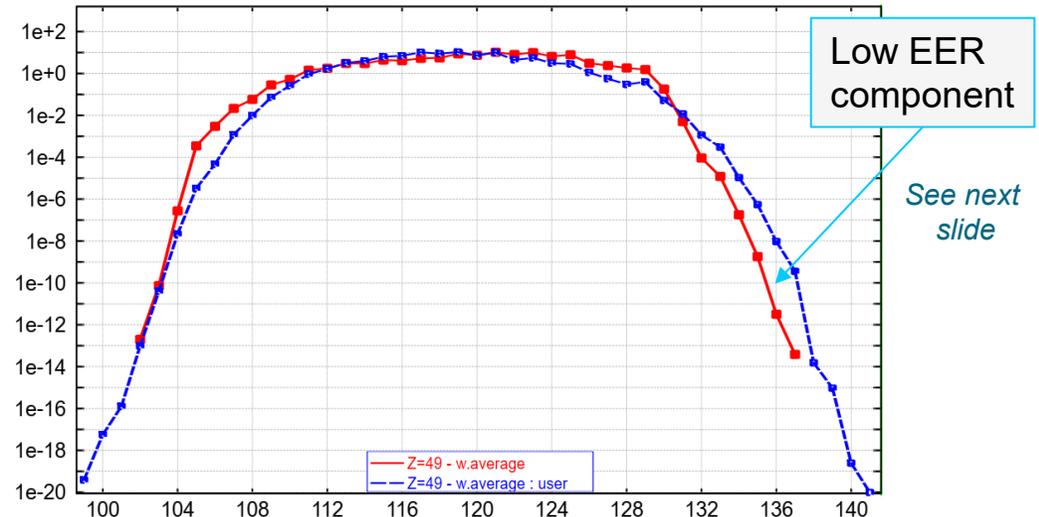
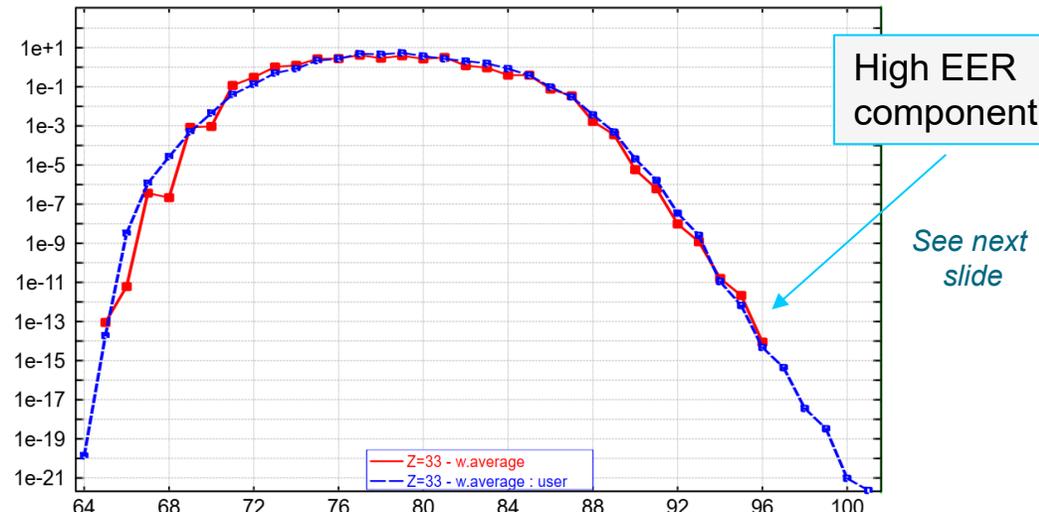


Z=33



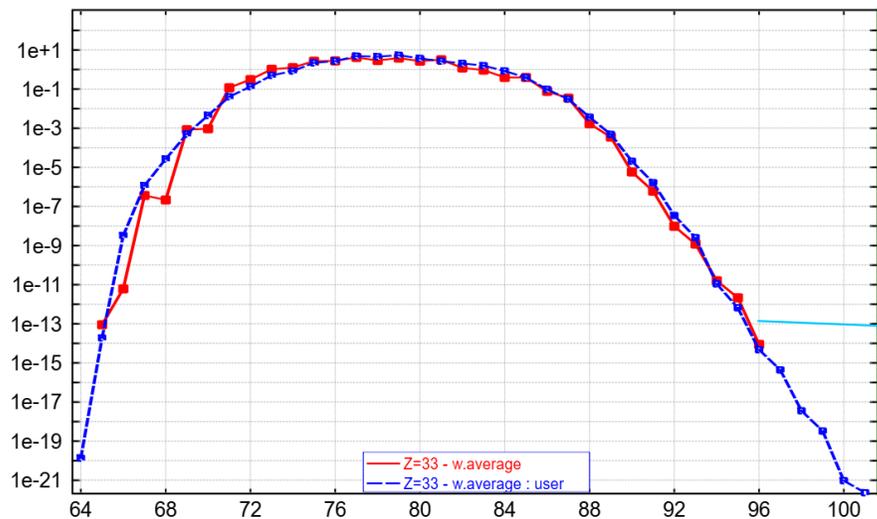
Z=49

New recommended settings 2026



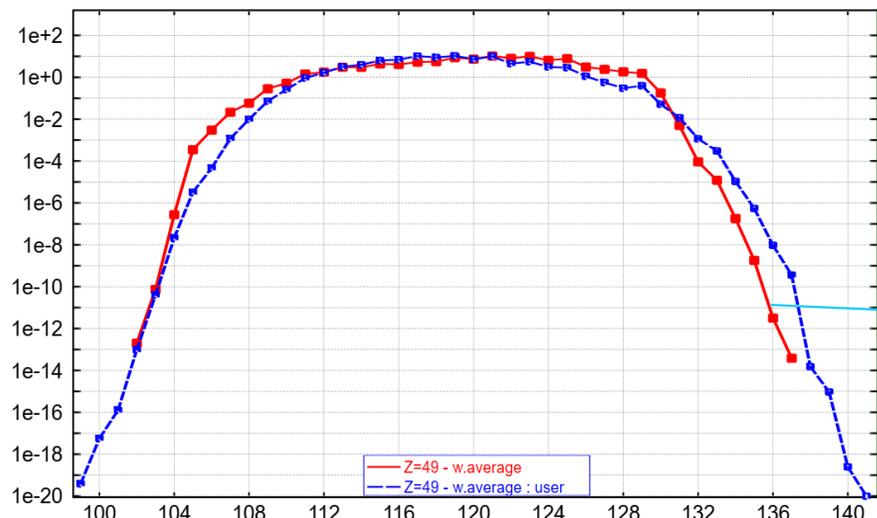
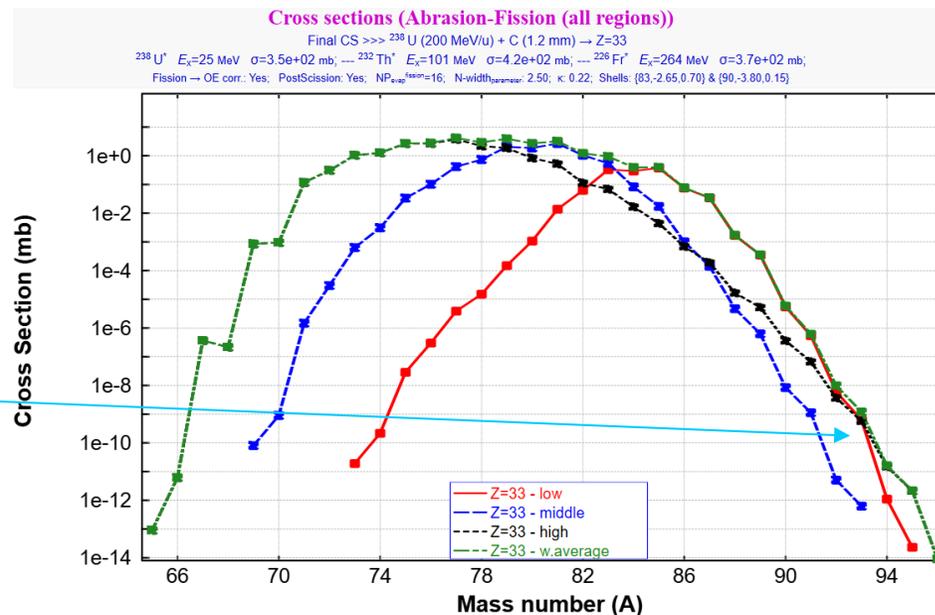
Good agreement for light Z, still underprediction for middle Z. Multi-step reactions can be explanation for middle Z.

New recommended settings 2026



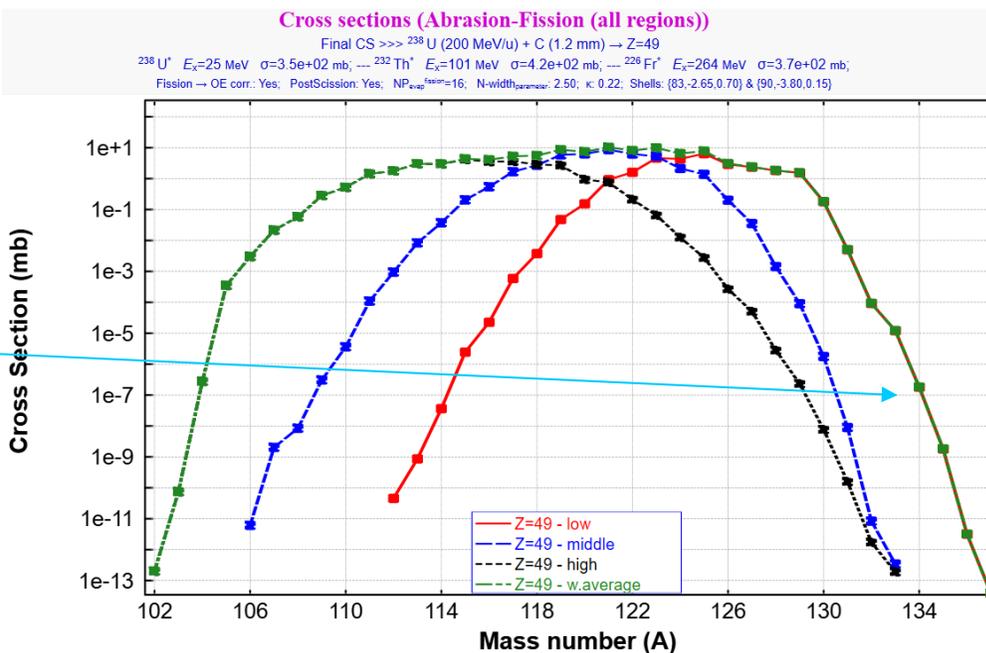
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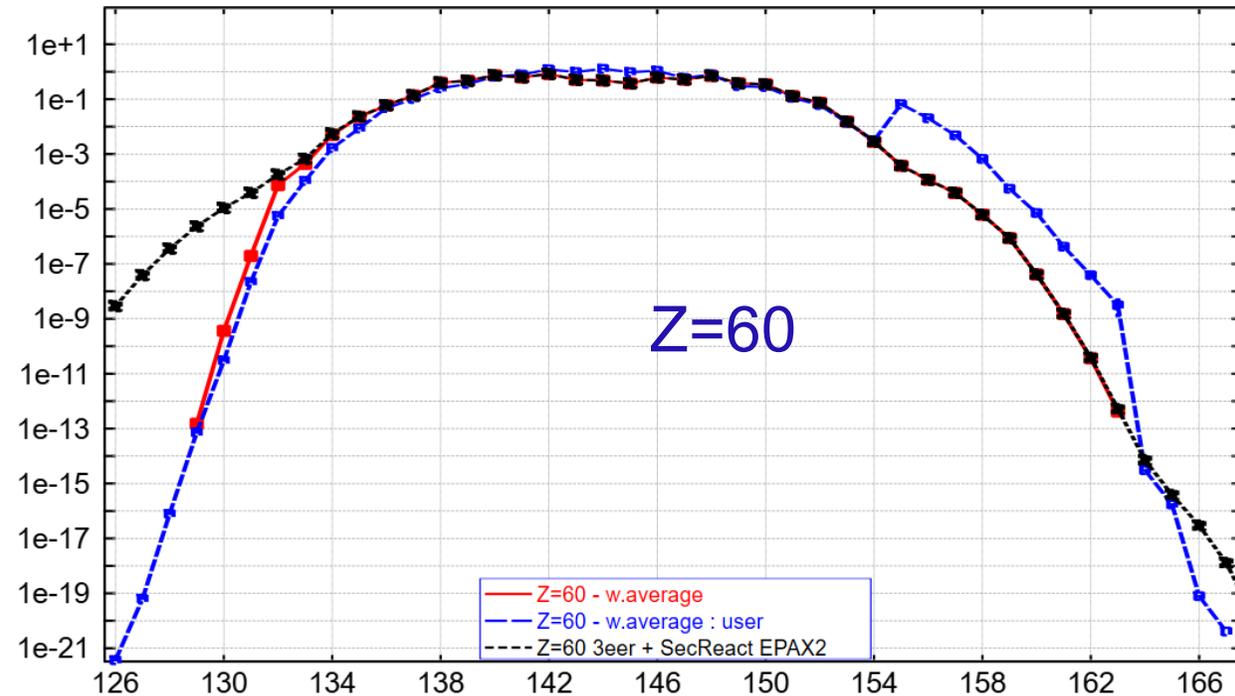
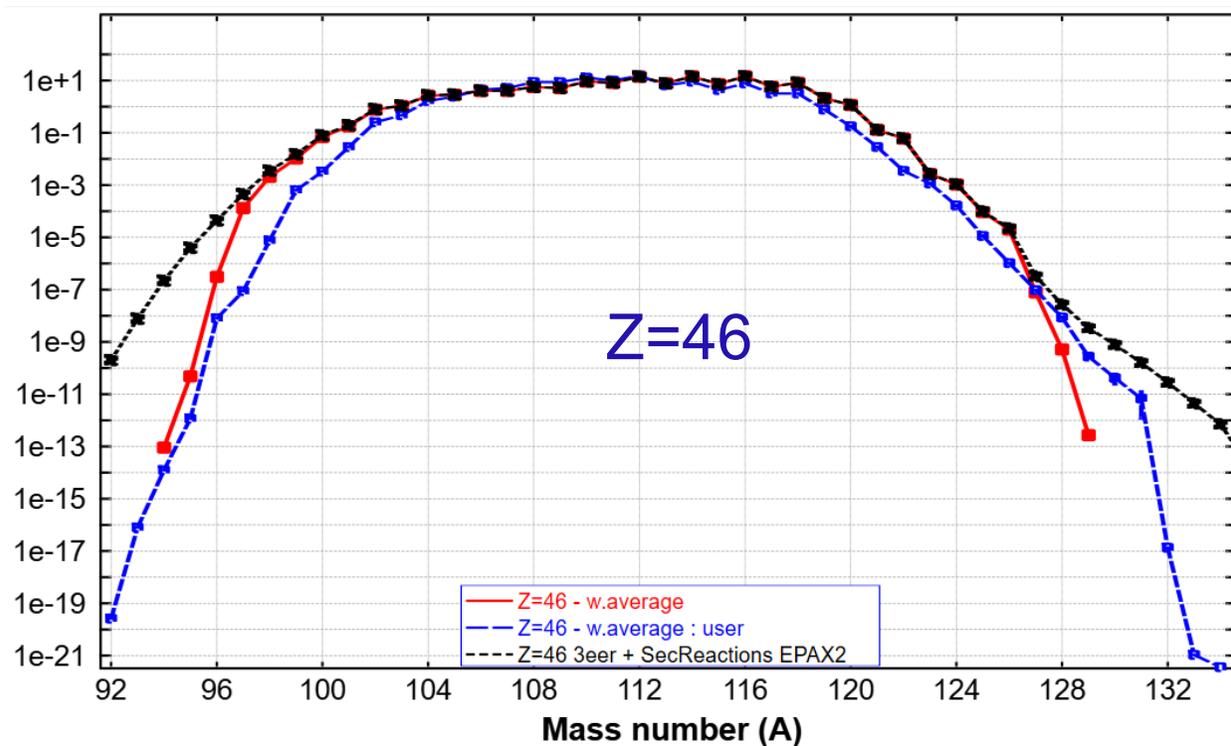
High EER component



Z=49

Low EER component





Multi-step reactions may explain the neutron-rich tail of the deduced cross sections for intermediate-Z fragments, but not for Z=60. A significant multi-step contribution is expected mainly for isotopes produced with low EER, where the cross section shows a sharp drop.

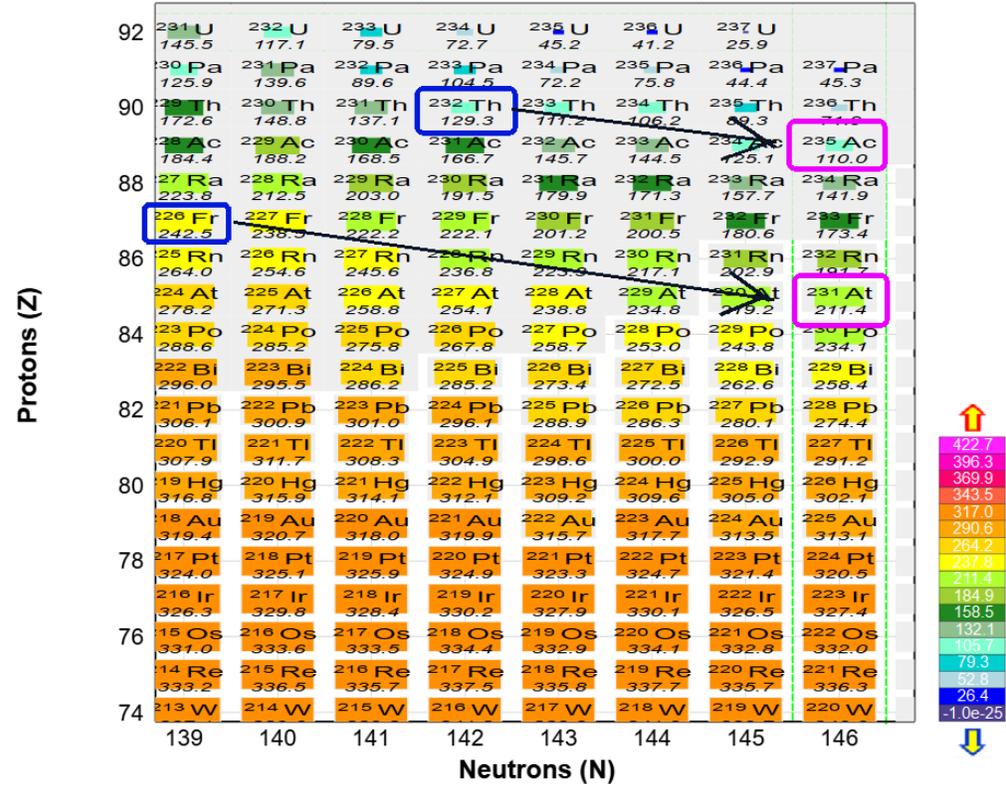
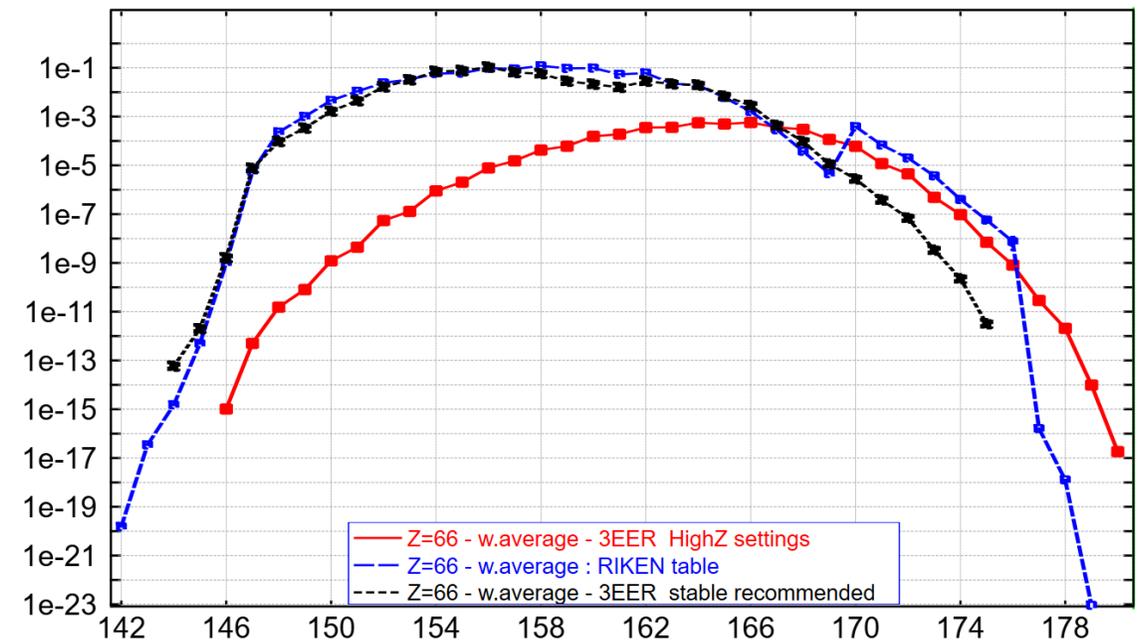
High-Z 3EER settings

https://lise.frib.msu.edu/10_1/10_1_127_highZ_AF.pdf

Average fission excitation energy

ABRASION-ABLATION - $^{238}\text{U} + \text{C}$

E* method: <3>; <T>: 25.09(0.00,0.00) MeV; No Intrin.Thermalztn; LimitTemp: No; DB=-hfb22; $\delta_{\text{vap}}=12.0$; $\delta_{\text{fss}}=14$
 NP=64; SE: "DB1+Cal3"; Den: "C"; GeomCor: "On"; Tunlg: "On"; dR=6.0fm F^{is}Bar=#1; Bar^{Fac}=1.00; Modes=¹⁰¹⁰ 1000 110

More Close to experimental data, but still underestimation

Neutron-rich: IFN3 ~ 3ERR High Z

IFN: https://lise.frib.msu.edu/10_1/11_0_28_IFN_search.pdf

