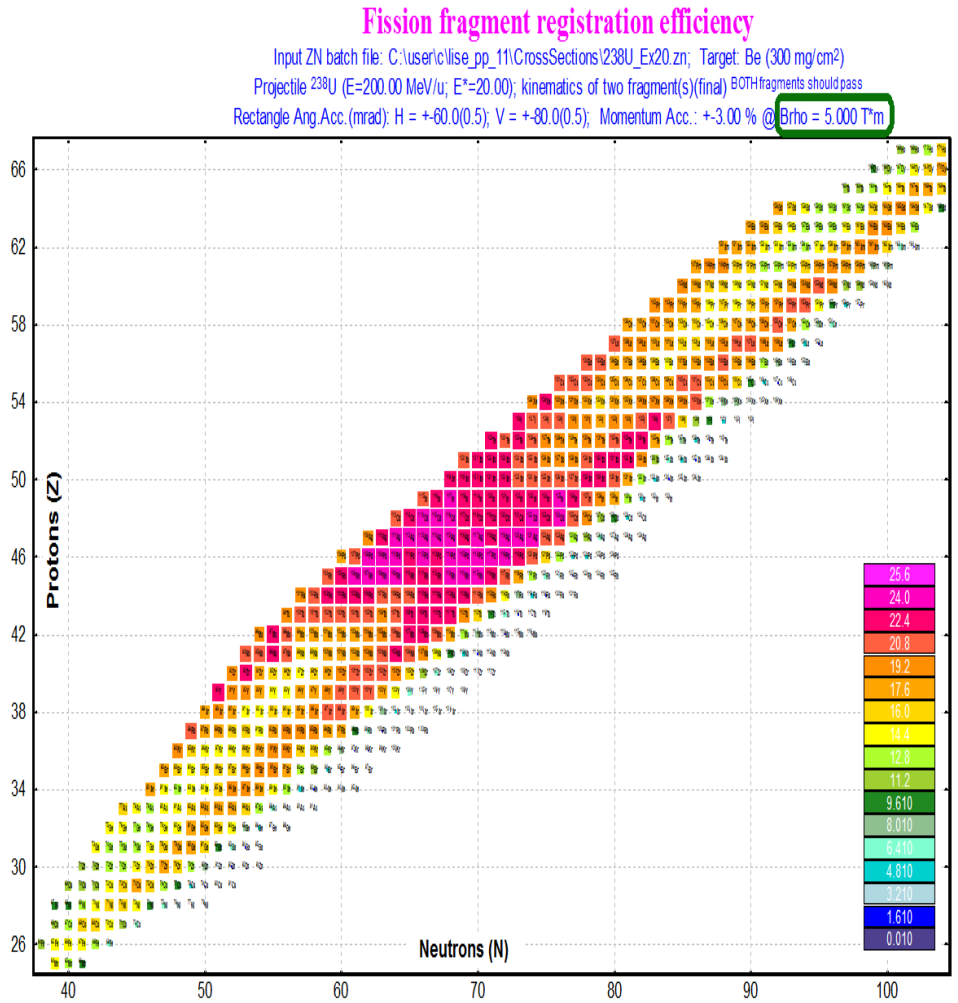
Two Fission Fragments registration efficiency BATCH

Version 11.0.79

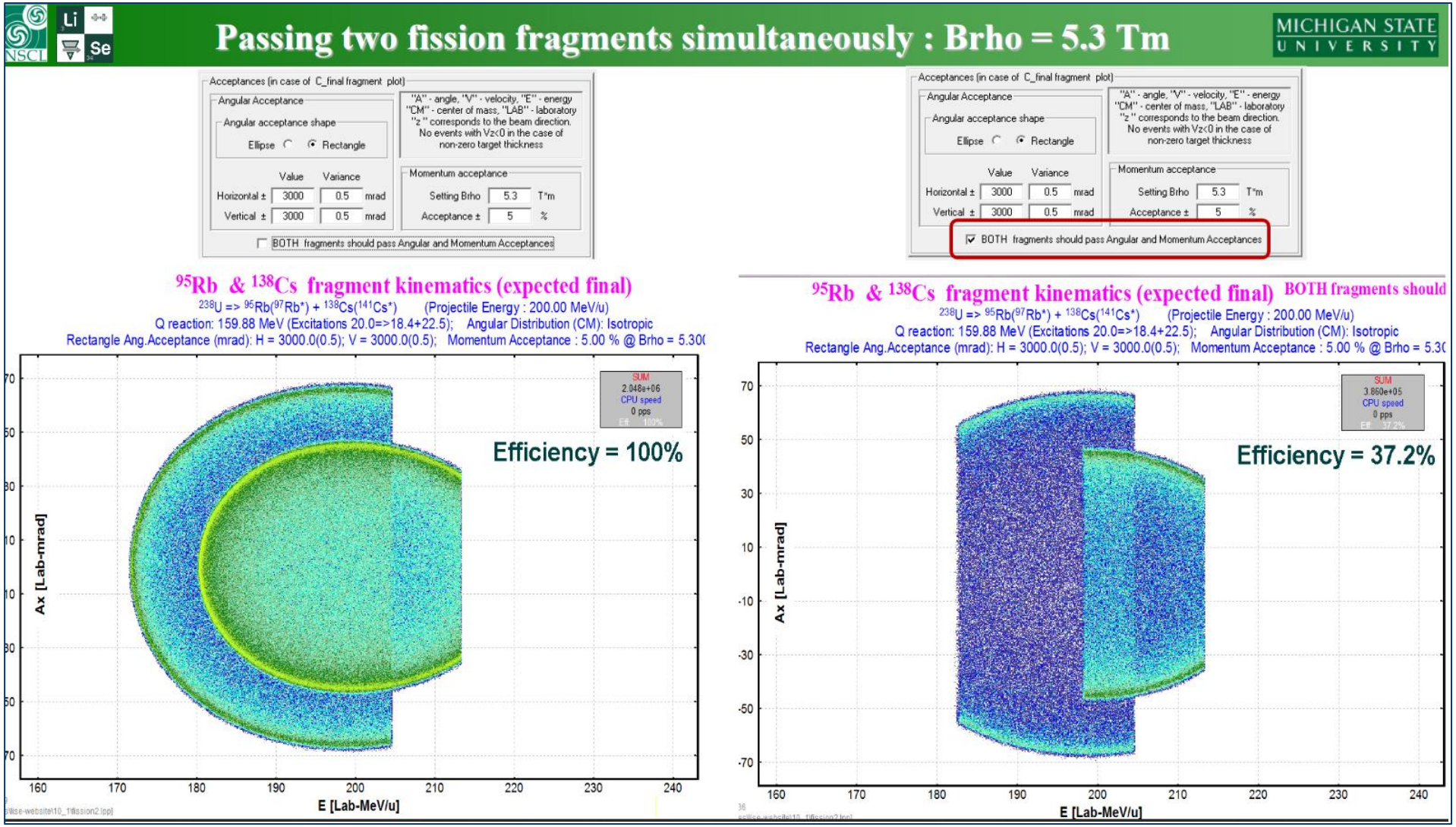
05/29/19



- Plotting and passing two fission fragments v.11.0.64
- Creation of input ZN-file for the FisFrag Batch Mode
- Initialization of the Kinematics Calculator before launch the FisFrag Batch Mode
- The Fission Fragment Batch Mode dialogue
- First element of the list: initialization of 2D Monte Carlo calculation settings
- Calculation settings discussion
- Results :
  - **no** energy loss in a target, **6**% momentum acceptance
  - **no** energy loss in a target, **100**% momentum acceptance
  - **with** energy loss in a target , **6**% momentum acceptance
- Final fragment iterations

Plotting and passing two fission fragments v.11.0.64

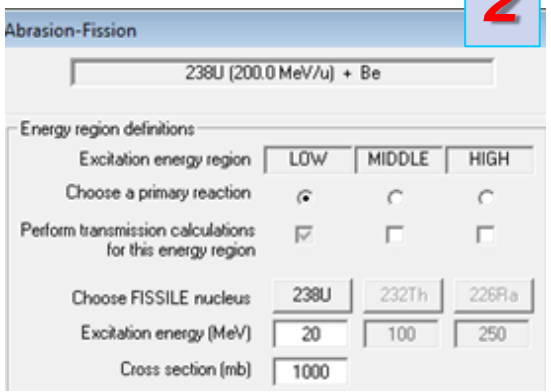
http://lise.nscl.msu.edu/10_1/11_0_64_FissionKinematics.pdf



1st step : Creation of input ZN file (a)

1

2

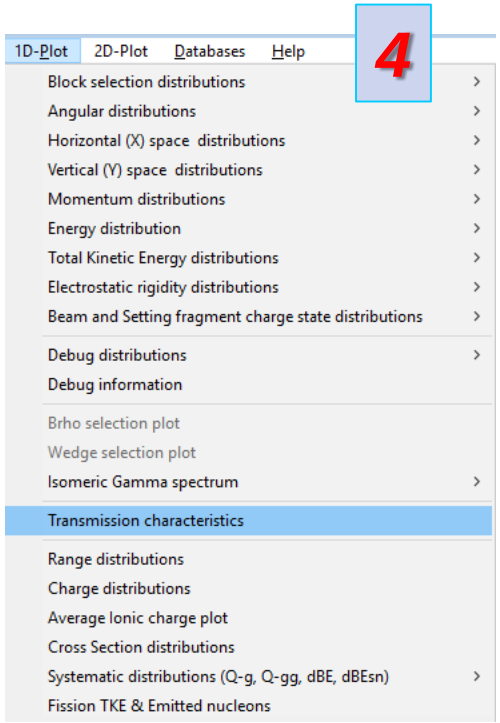


3

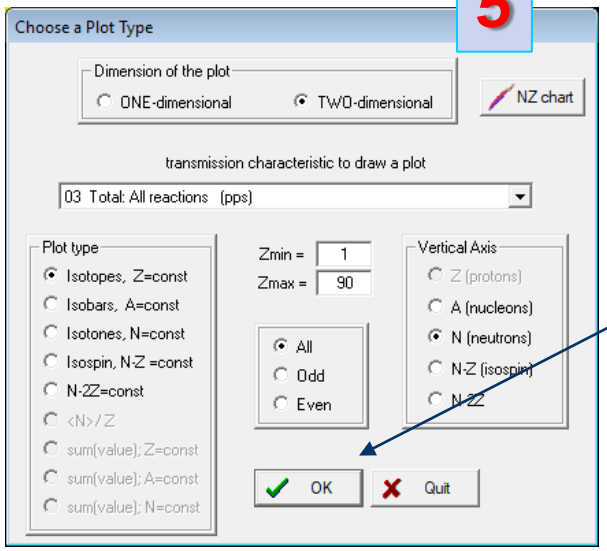
Calculate ALL

Take primary beam yield from the list

4



5



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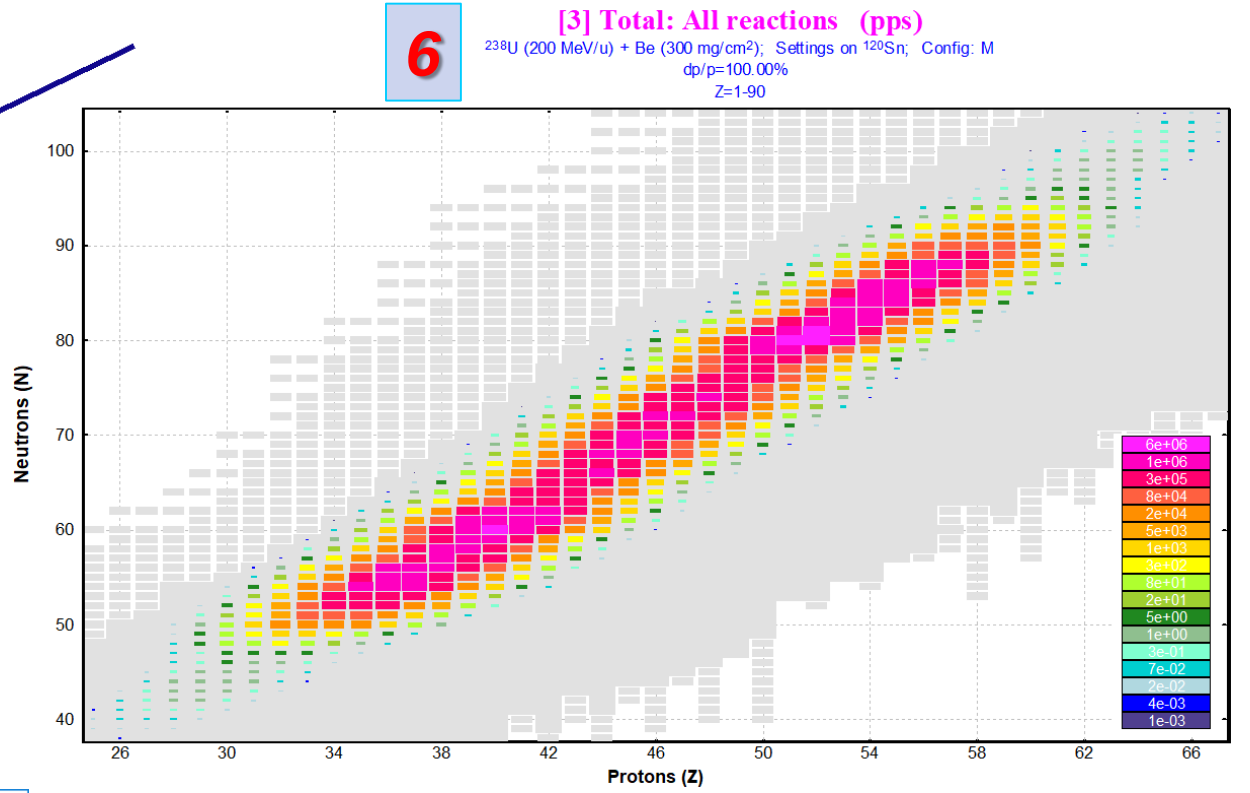
1st step : Creation of input ZN file (a)

6



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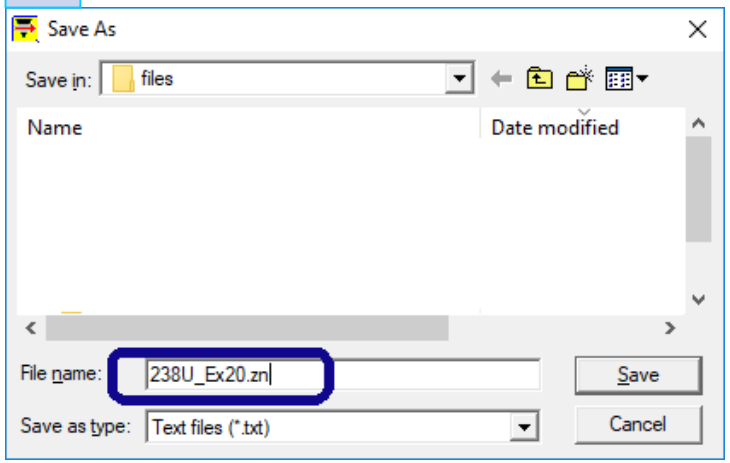
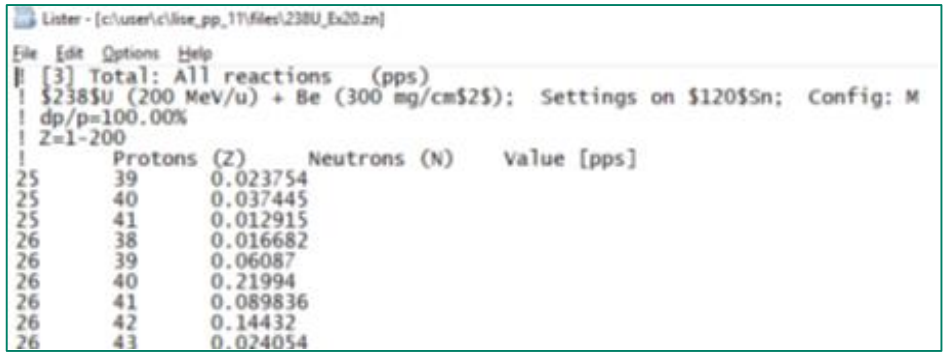
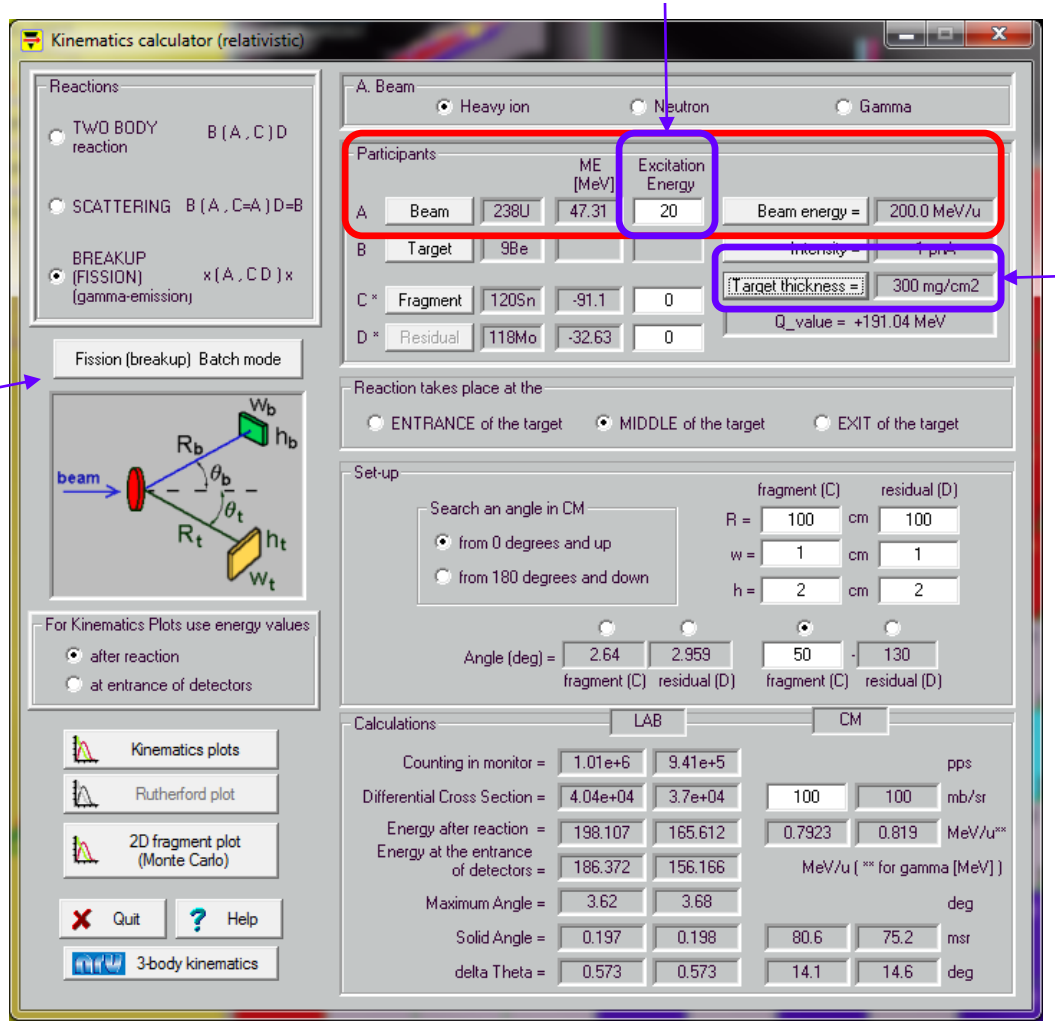




Initialization of the Kinematics Calculator before launch the FisFrag Batch Mode

1. LISE^{++} fills out the Beam parameters (A,Z,energy), the user should provide manually an excitation value corresponding to an input ZN-file

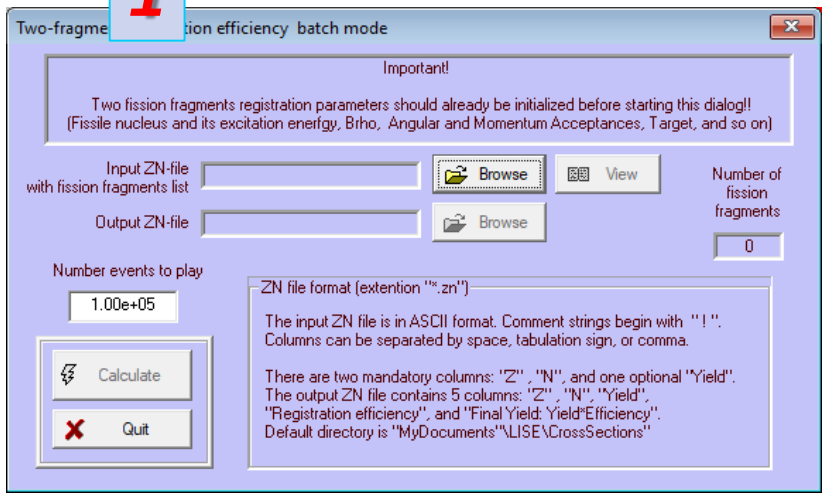


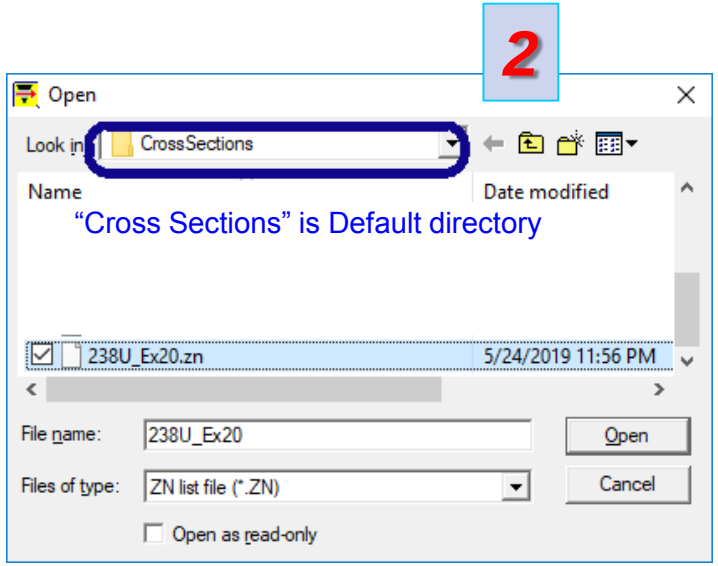
2. Input target thickness, if you are interested to take energy loss into account

3. After Beam and Target initialization steps Press the “Fission batch mode” button to download the corresponding dialog.

This button is shown if the “Break-up (Fission)” radiobutton is selected in the Reactions group, and reaction Q-value is positive

Fission Fragment Batch Mode dialogue

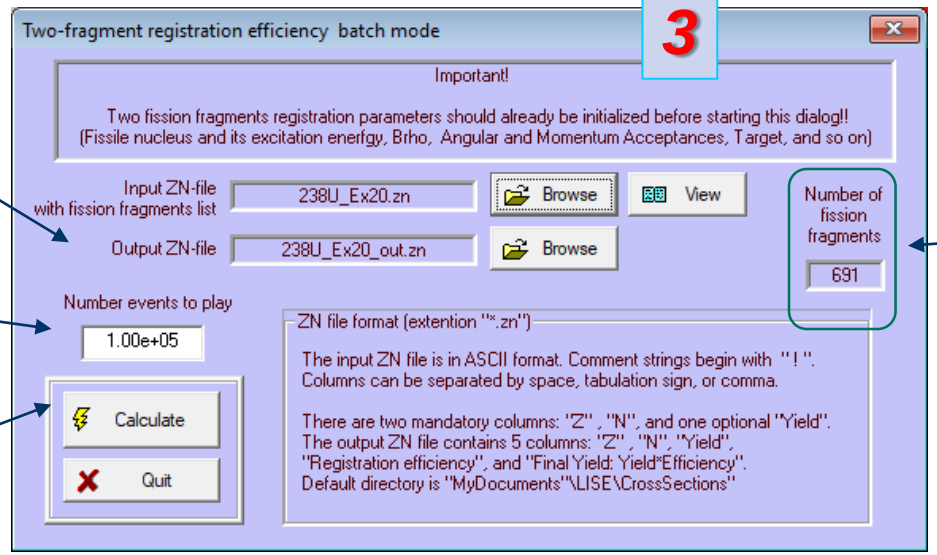




LISE^{++} automatically proposes output fil name. The user can rename it.

Calculations will be stop reaching this set number of events.
Default value is equal to 1e5, that correspond of 1 event registration to 0.001% efficiency

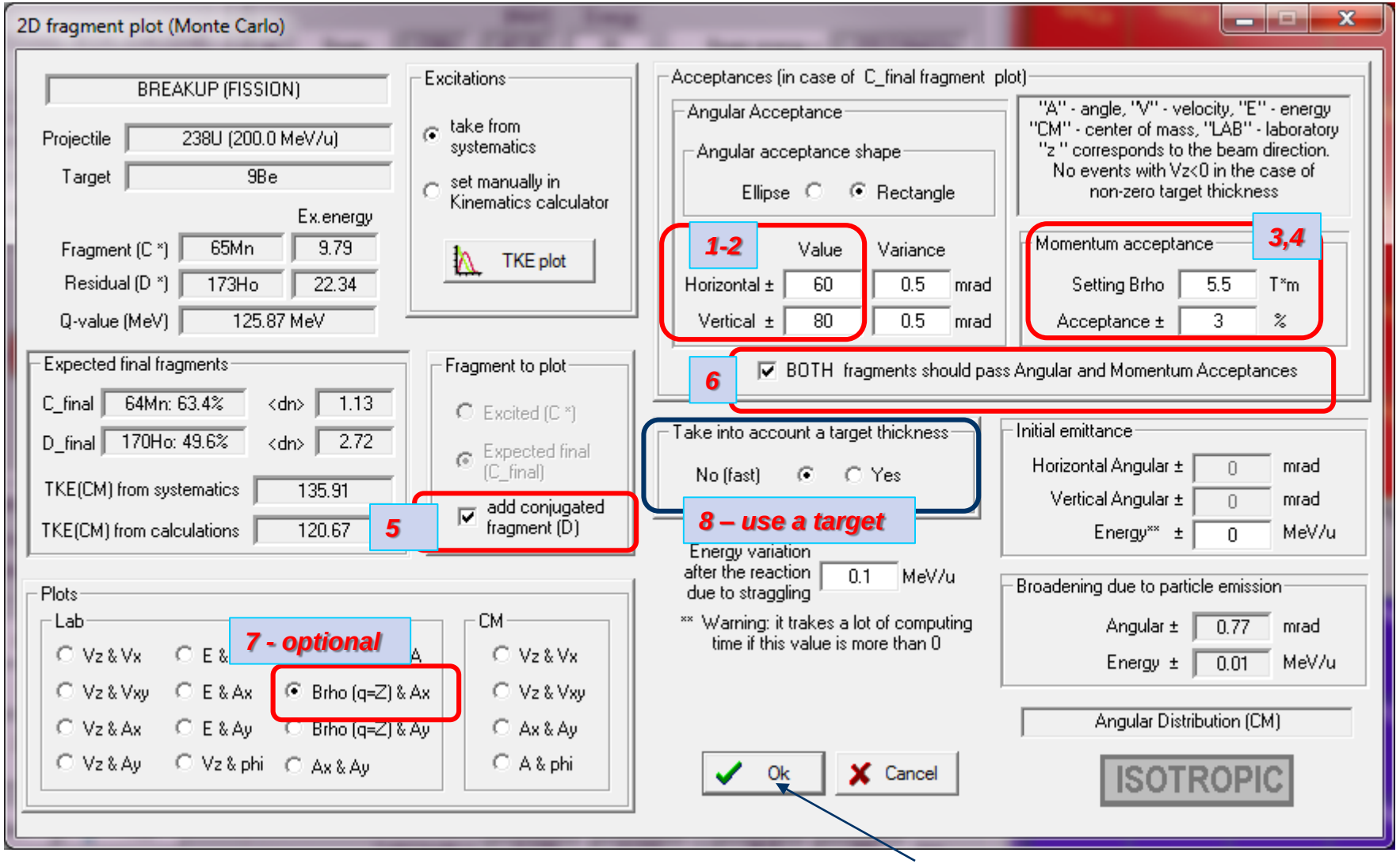
Run Calculations



Pay attention for the number of lines corresponding to number of fission fragments (Z, N, Yield after target)

First element of the list: initialization of 2D Monte Carlo calculation settings

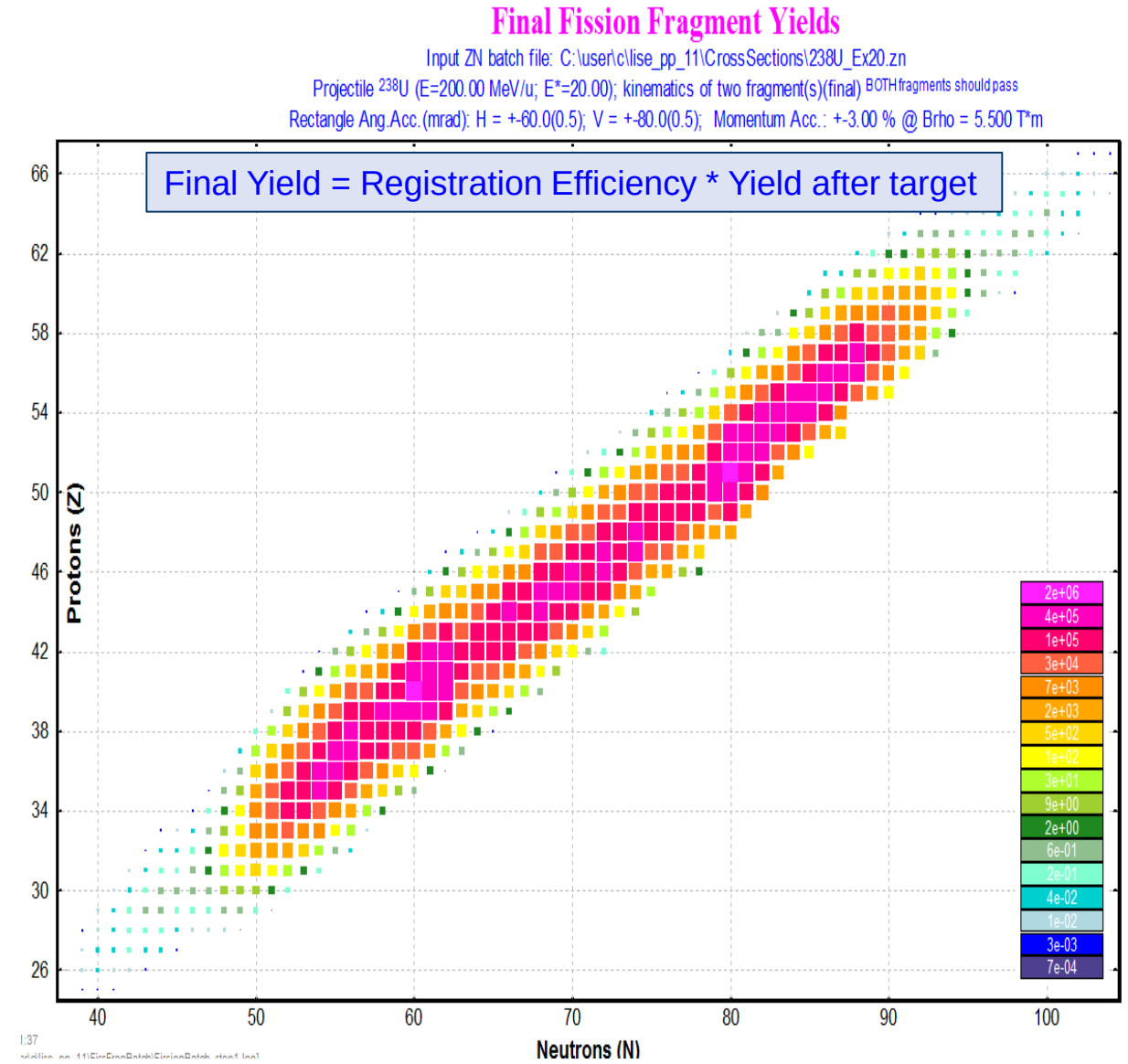
The user has an opportunity to modify 2D fission fragments Monte Carlo plot settings once at the beginning of batch calculations

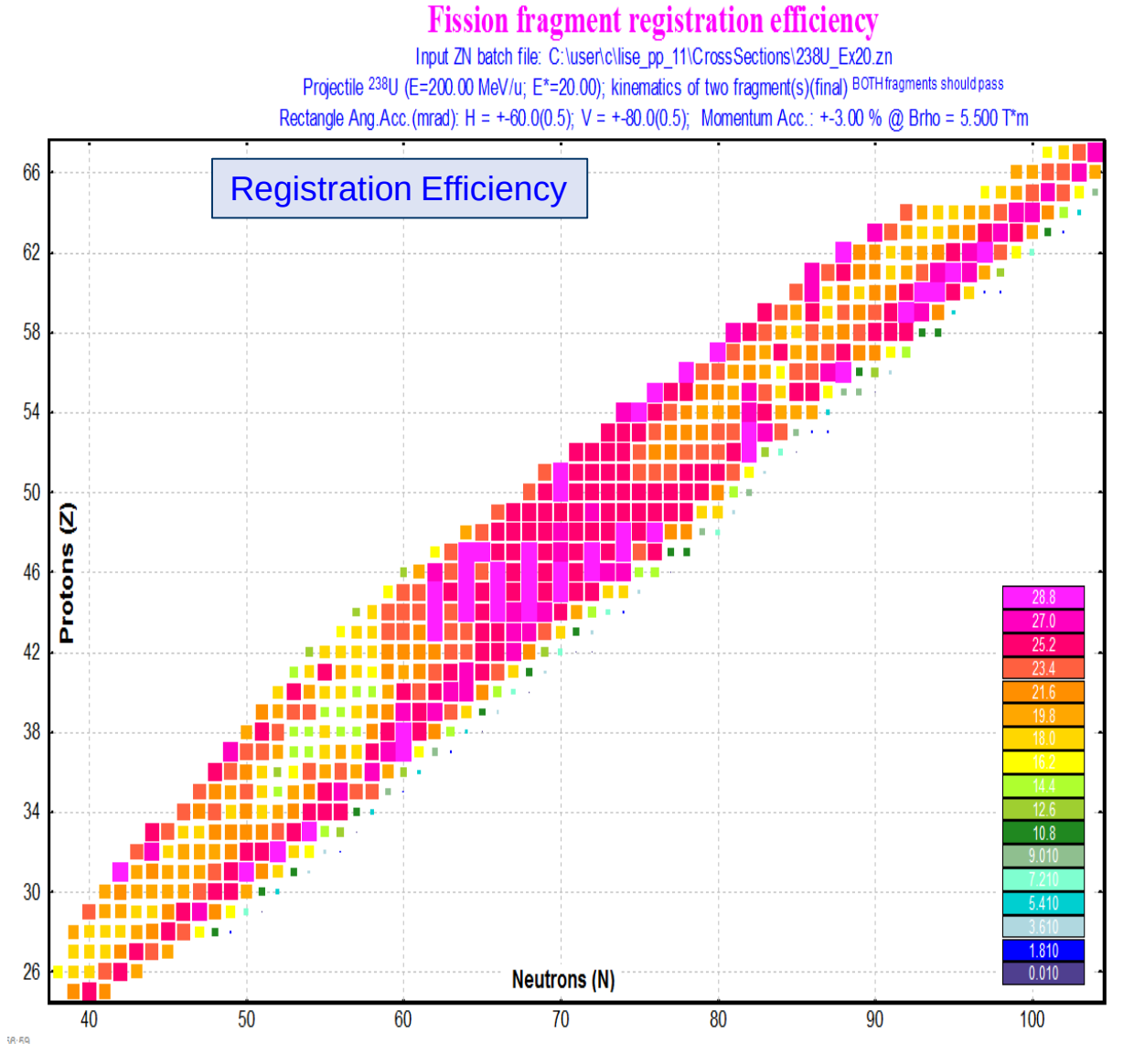


Continue calculations

Results : no energy loss in a target

Two 2D (N vs Z) will appear immediately after the batch calculations end





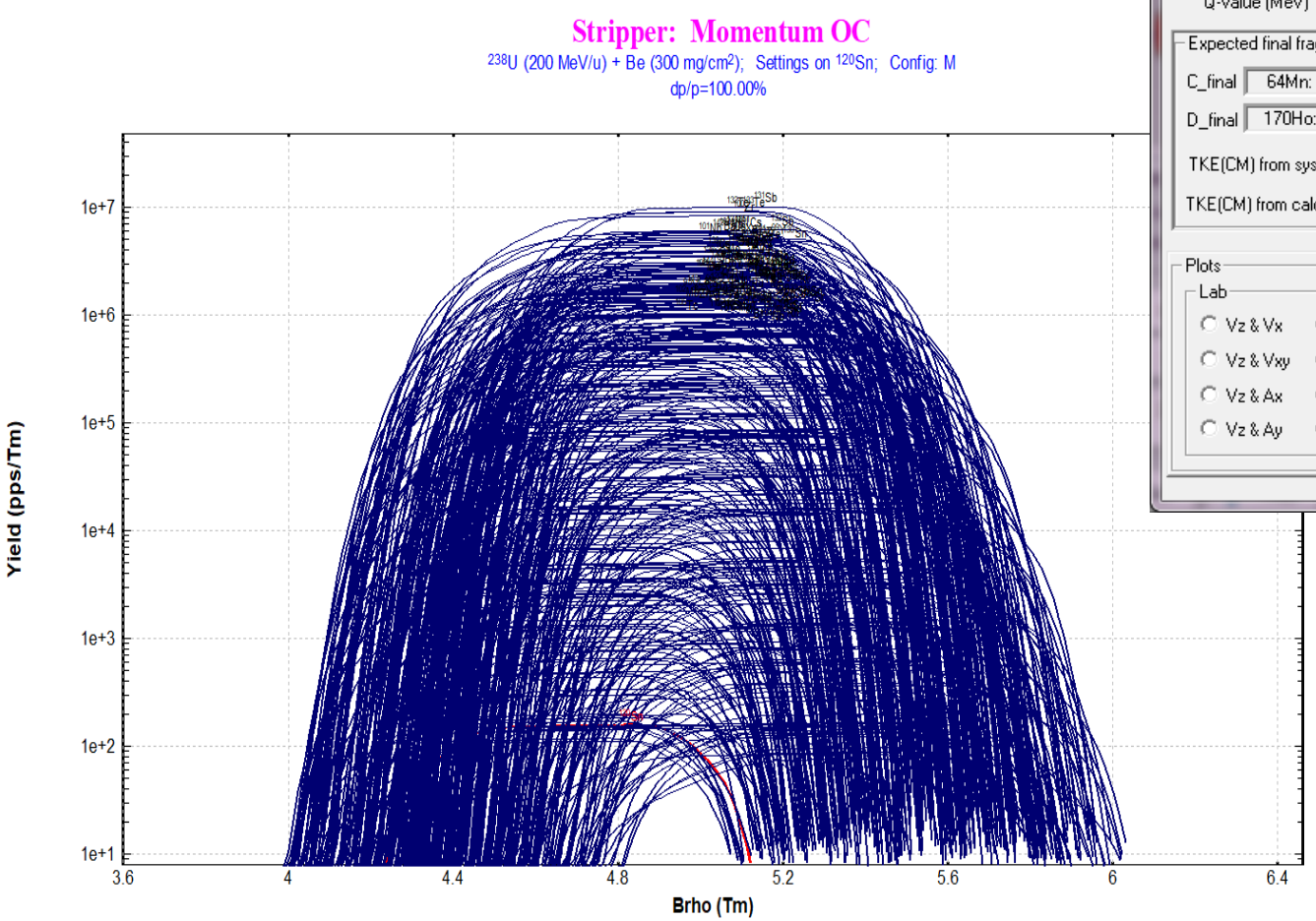
Results : no energy loss in a target

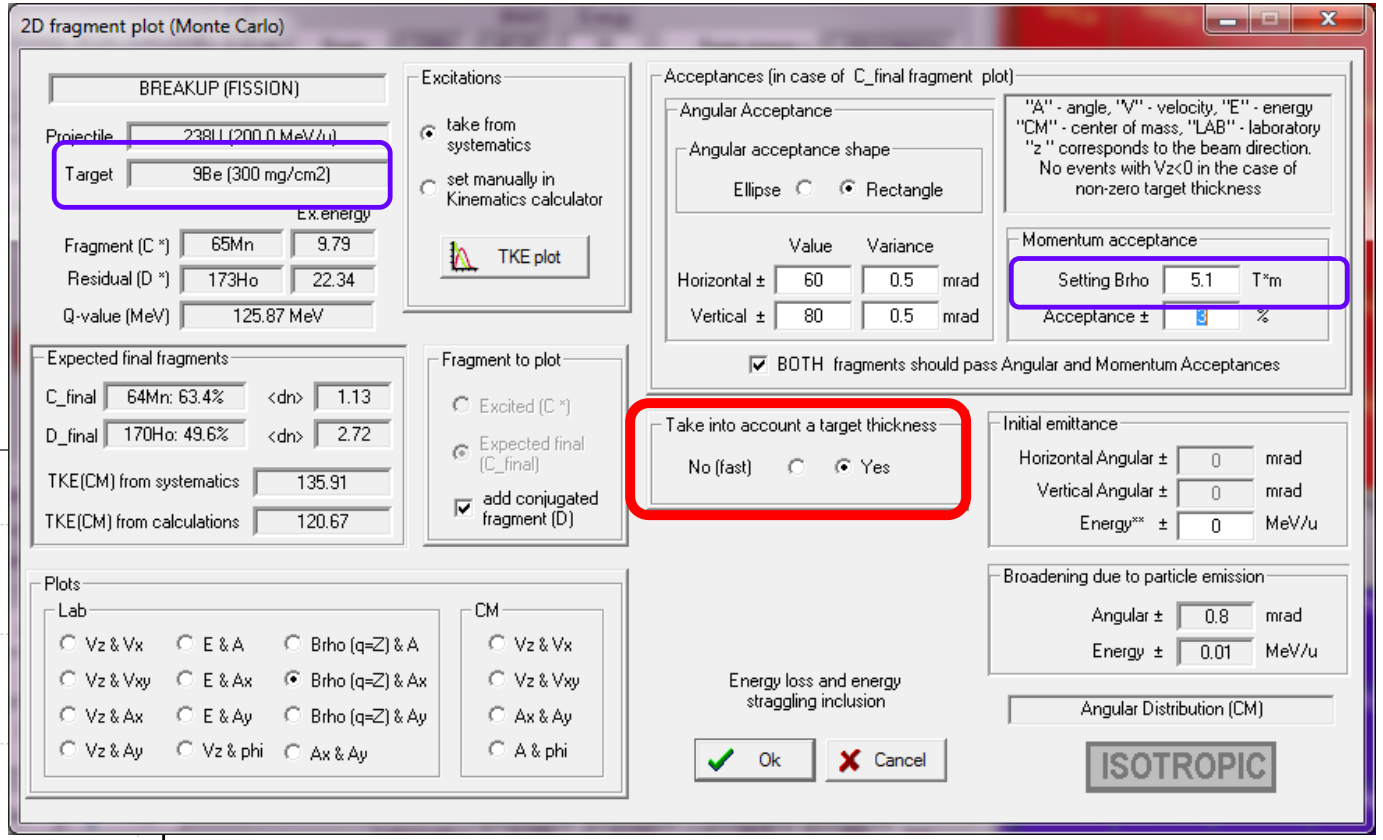
ZN Output File

Lister - [C:\user\c\lise_pp_11\CrossSections\238U_Ex20_out.zn]

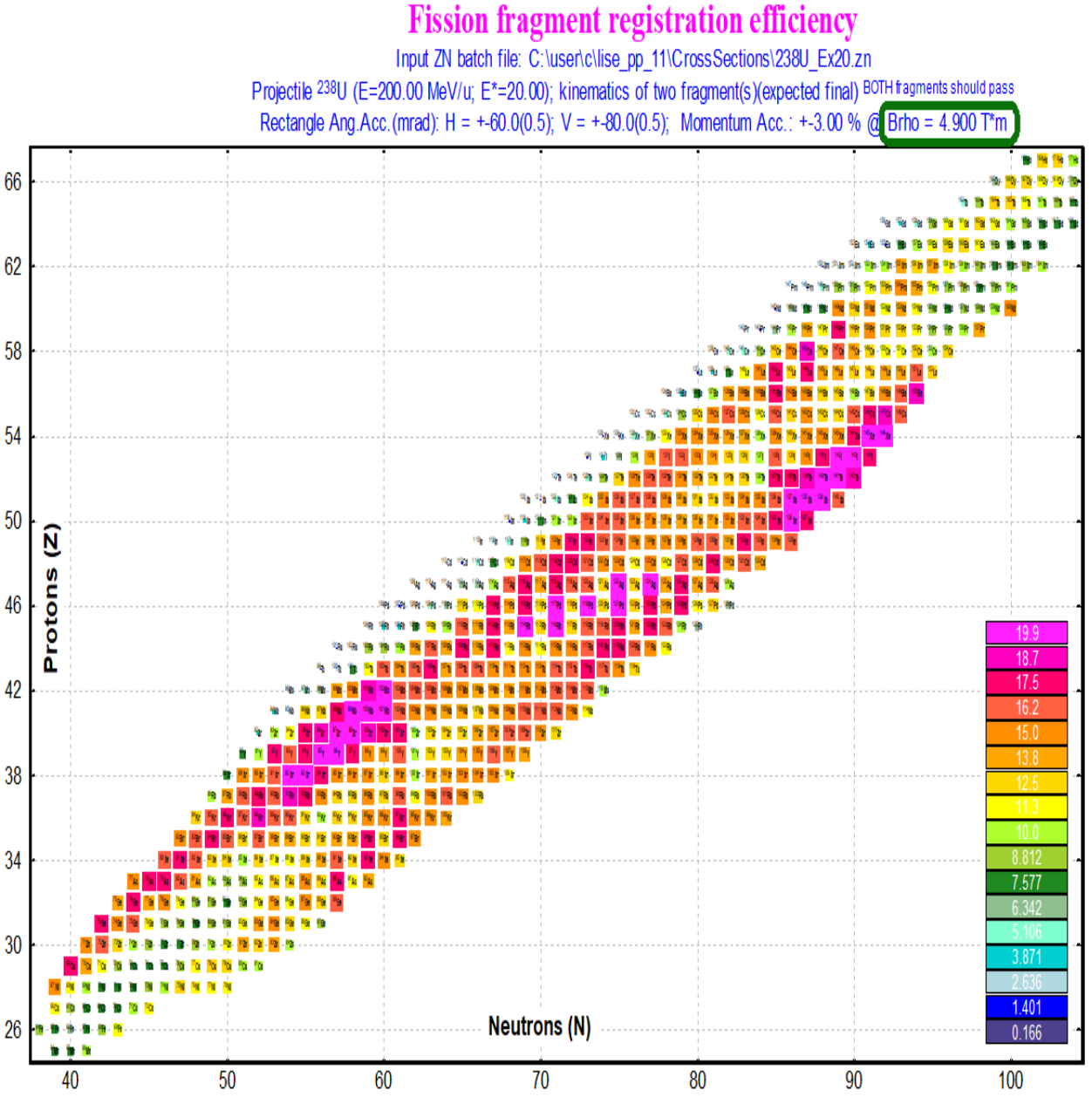
```
Input ZN batch file: C:\user\c\lise_pp_11\CrossSections\238U_Ex20.zn
Projectile $238$U (E=200.00 MeV/u; E*=20.00); kinematics of two fragment(s)(final) $BOTH fragments should pass$
Rectangle Ang.Acc.(mrad): H = +-60.0(0.5); V = +-80.0(0.5);  Momentum Acc.: +-3.00 % @ Brho = 5.500 T*m
!----------------------------------------
!Z      N       YieldAfterTarget        Eff,%   FinalYield
25      39      2.38e-02        2.20e+01        5.24e-03
25      40      3.74e-02        2.58e+01        9.65e-03
25      41      1.29e-02        2.28e+01        2.95e-03
26      38      1.67e-02        1.63e+01        2.72e-03
26      39      6.09e-02        1.88e+01        1.14e-02
26      40      2.20e-01        1.95e+01        4.29e-02
26      41      8.98e-02        2.42e+01        2.17e-02
26      42      1.44e-01        2.65e+01        3.83e-02
26      43      2.41e-02        2.15e+01        5.17e-03
27      39      6.28e-02        1.84e+01        1.16e-02
27      40      2.45e-01        1.84e+01        4.52e-02
27      41      5.61e-01        1.90e+01        1.07e-01
27      42      7.38e-01        2.19e+01        1.62e-01
27      43      4.97e-01        2.53e+01        1.26e-01
27      44      2.06e-01        2.45e+01        5.04e-02
27      45      2.38e-02        2.05e+01        4.88e-03
28      39      2.49e-02        2.07e+01        5.15e-03
28      40      1.73e-01        1.86e+01        3.22e-02
28      41      7.04e-01        1.94e+01        1.36e-01
28      42      1.64e+00        1.91e+01        3.14e-01
28      43      1.87e+00        2.04e+01        3.82e-01
28      44      1.50e+00        2.33e+01        3.48e-01
28      45      2.91e-01        2.66e+01        7.73e-02
28      46      1.30e-01        2.37e+01        3.09e-02
28      47      8.62e-02        1.72e+01        1.48e-02
28      48      1.82e-01        1.18e+01        2.16e-02
28      49      6.45e-02        2.86e+00        1.85e-03
28      50      2.47e-02        0.00e+00        0.00e+00
```

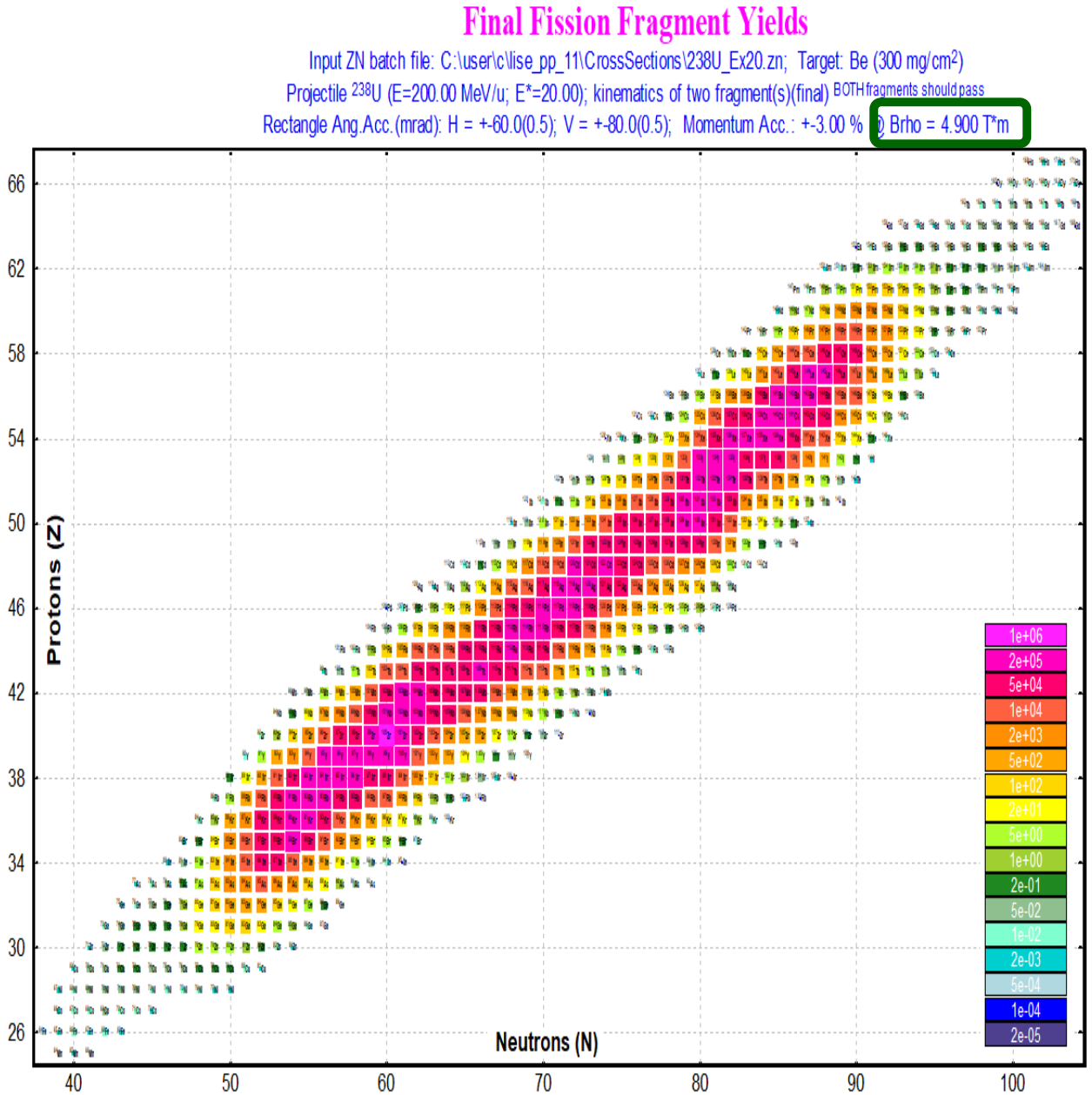
Results : with energy loss in a target





Results : with energy loss in a target → Brho = 4.9 Tm

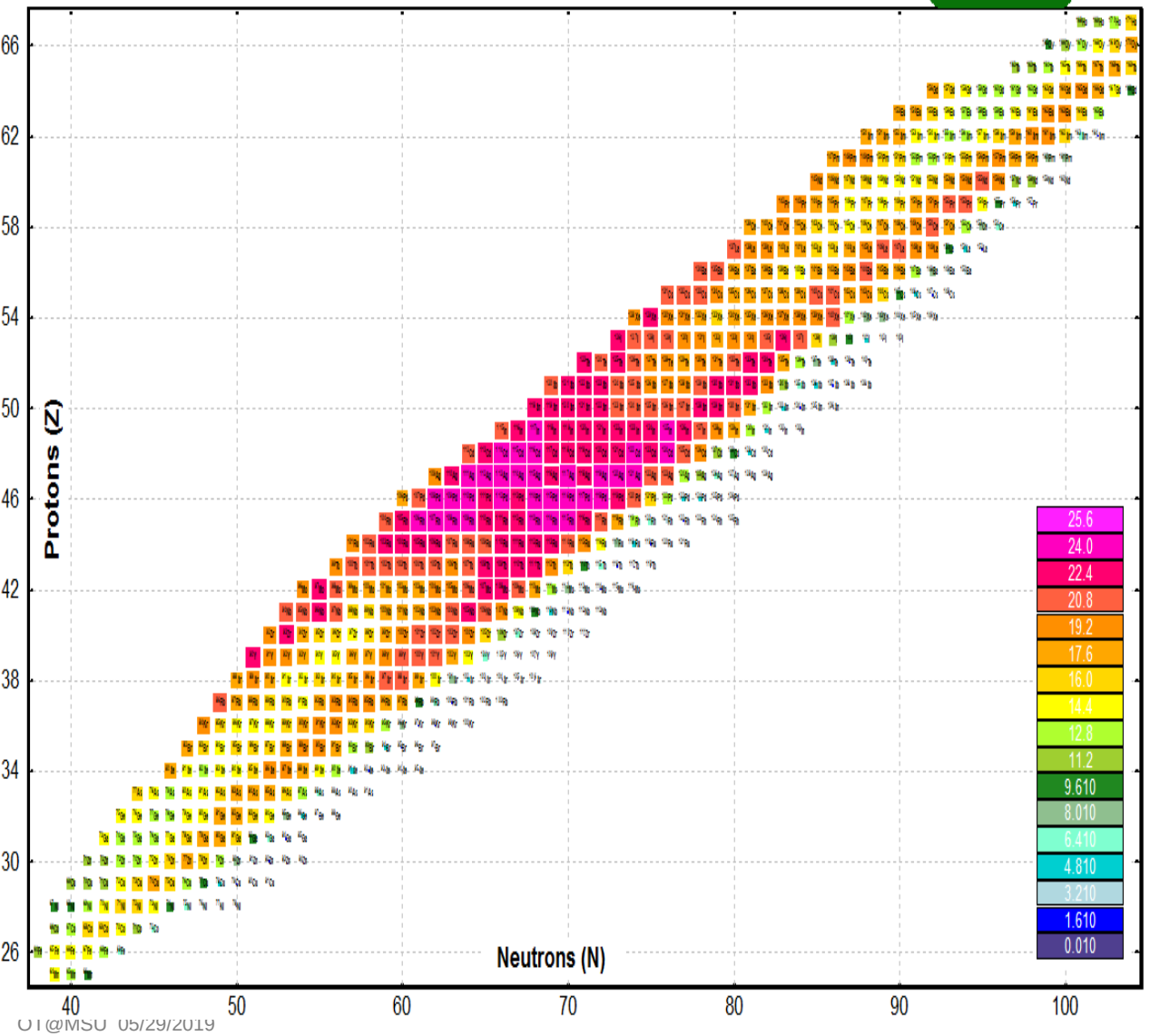




Results : with energy loss in a target → Brho = 5.0 Tm

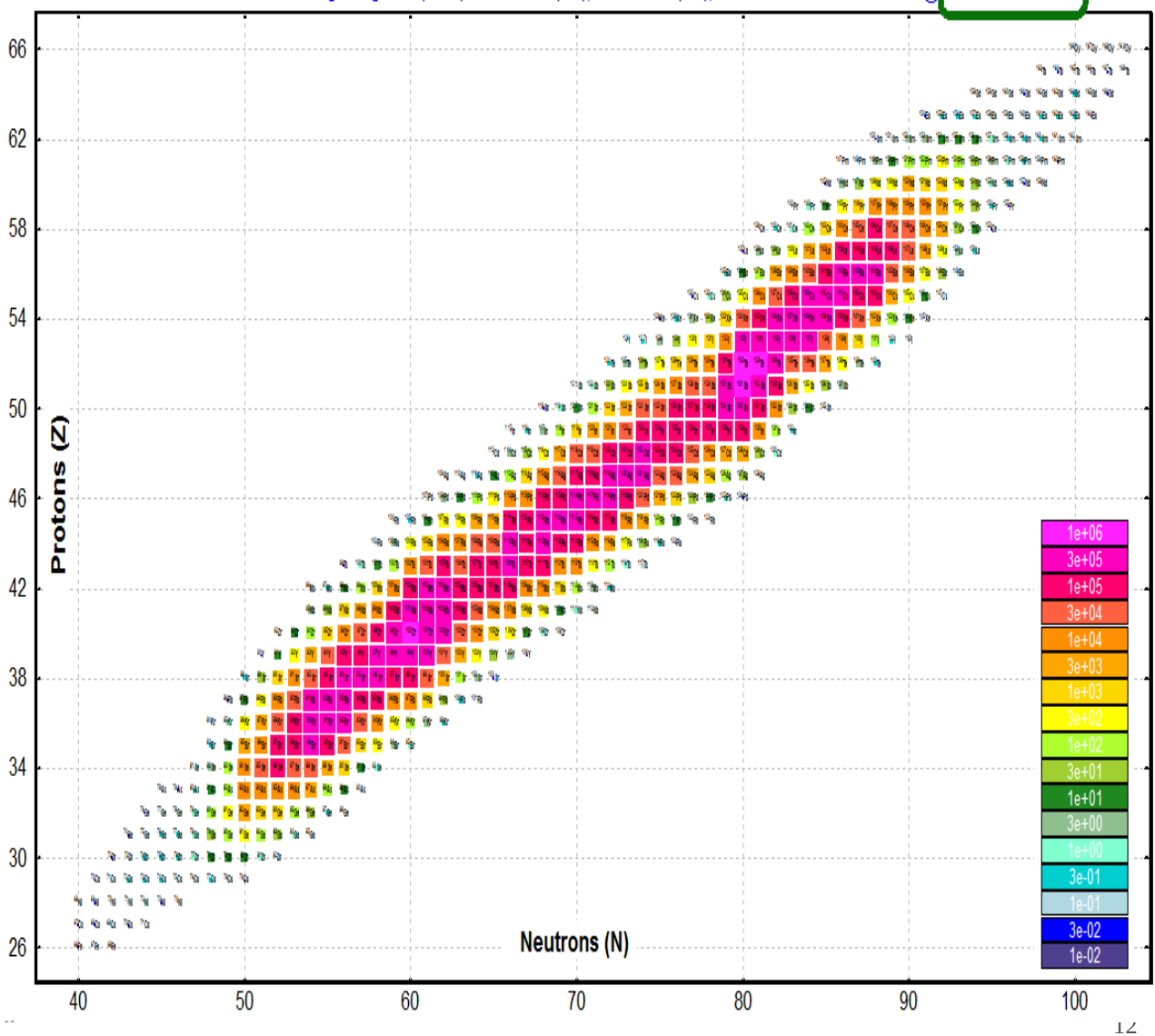
Fission fragment registration efficiency

Input ZN batch file: C:\user\c\lise_pp_11\CrossSections\238U_Ex20.zn; Target: Be (300 mg/cm²)
Projectile ^{238}U (E=200.00 MeV/u; E*=20.00); kinematics of two fragment(s)(final) BOTH fragments should pass
Rectangle Ang.Acc.(mrad): H = +-60.0(0.5); V = +-80.0(0.5); Momentum Acc.: +-3.00 % @ Brho = 5.000 T*m



Final Fission Fragment Yields

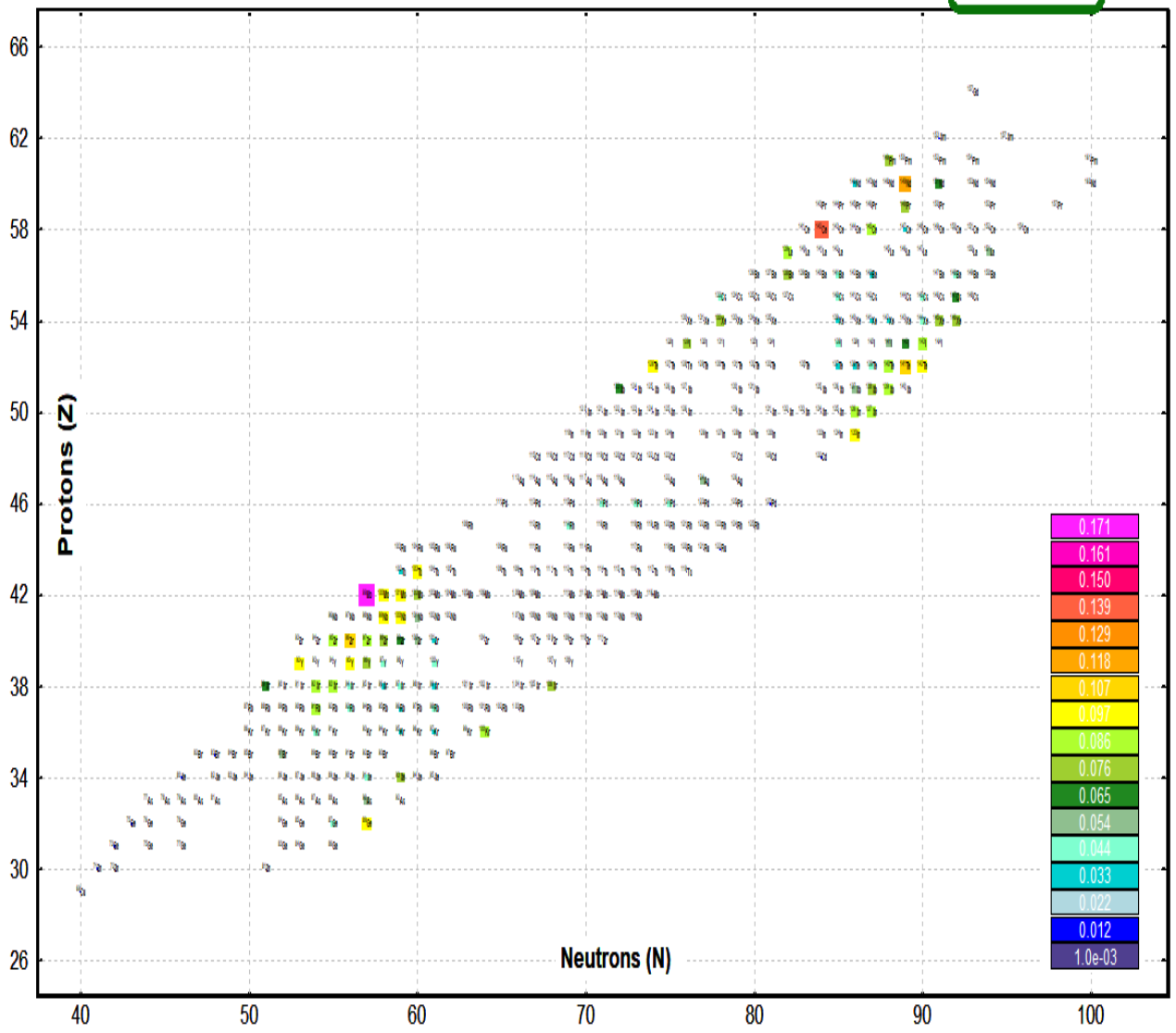
Input ZN batch file: C:\user\c\lise_pp_11\CrossSections\238U_Ex20.zn; Target: Be (300 mg/cm²)
Projectile ^{238}U (E=200.00 MeV/u; E*=20.00); kinematics of two fragment(s)(final) BOTH fragments should pass
Rectangle Ang.Acc.(mrad): H = +-60.0(0.5); V = +-80.0(0.5); Momentum Acc.: +-3.00 % @ Brho = 5.000 T*m



Results : with energy loss in a target → Brho = 4.7 & 5.1 Tm

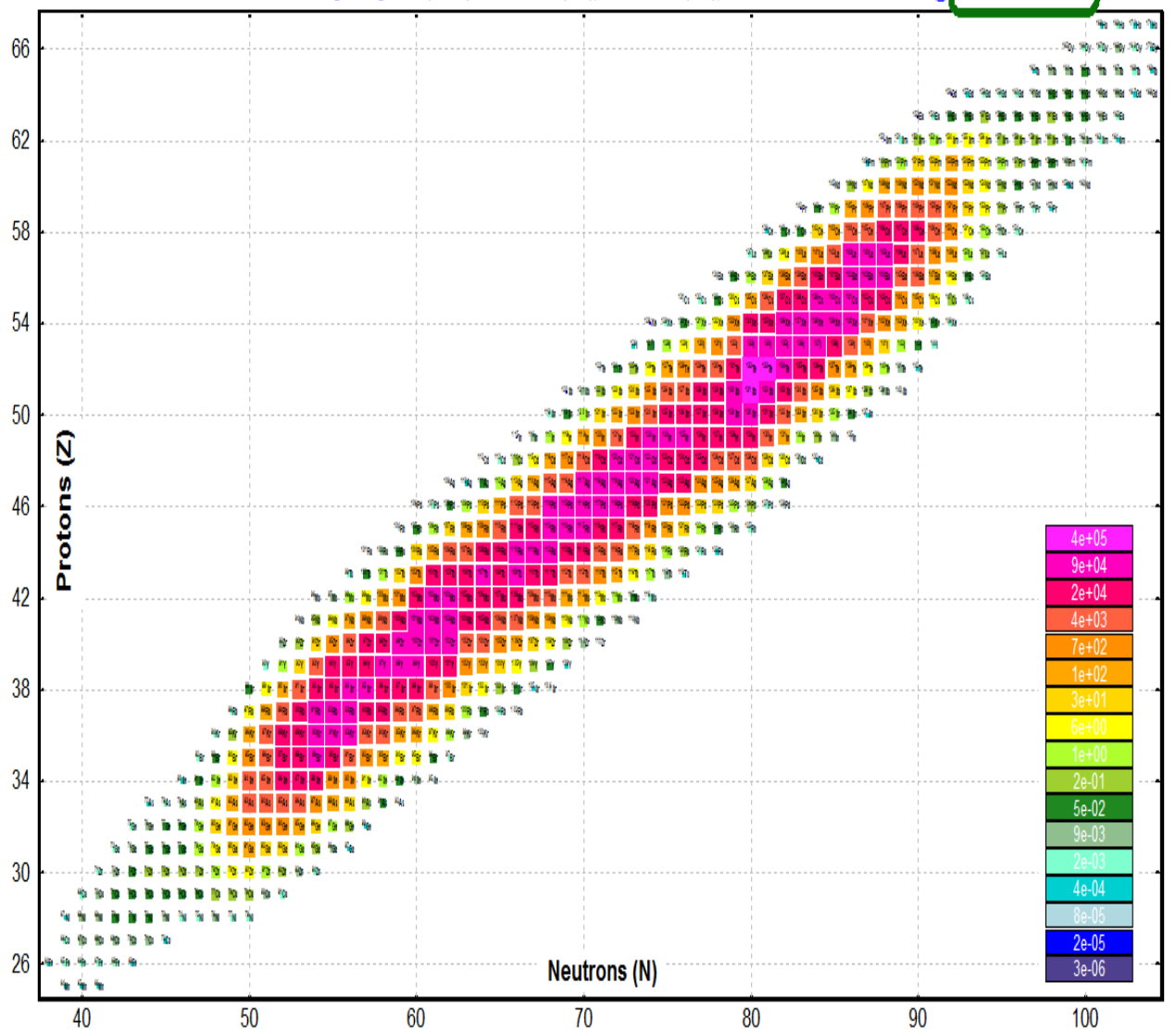
Fission fragment registration efficiency

Input ZN batch file: C:\user\c\lise_pp_11\CrossSections\238U_Ex20.zn; Target: Be (300 mg/cm²)
Projectile ²³⁸U (E=200.00 MeV/u; E*=20.00); kinematics of two fragment(s)(final) BOTH fragments should pass
Rectangle Ang.Acc.(mrad): H = +-60.0(0.5); V = +-80.0(0.5); Momentum Acc.: +-3.00 % @ Brho = 4.700 T*m



Final Fission Fragment Yields

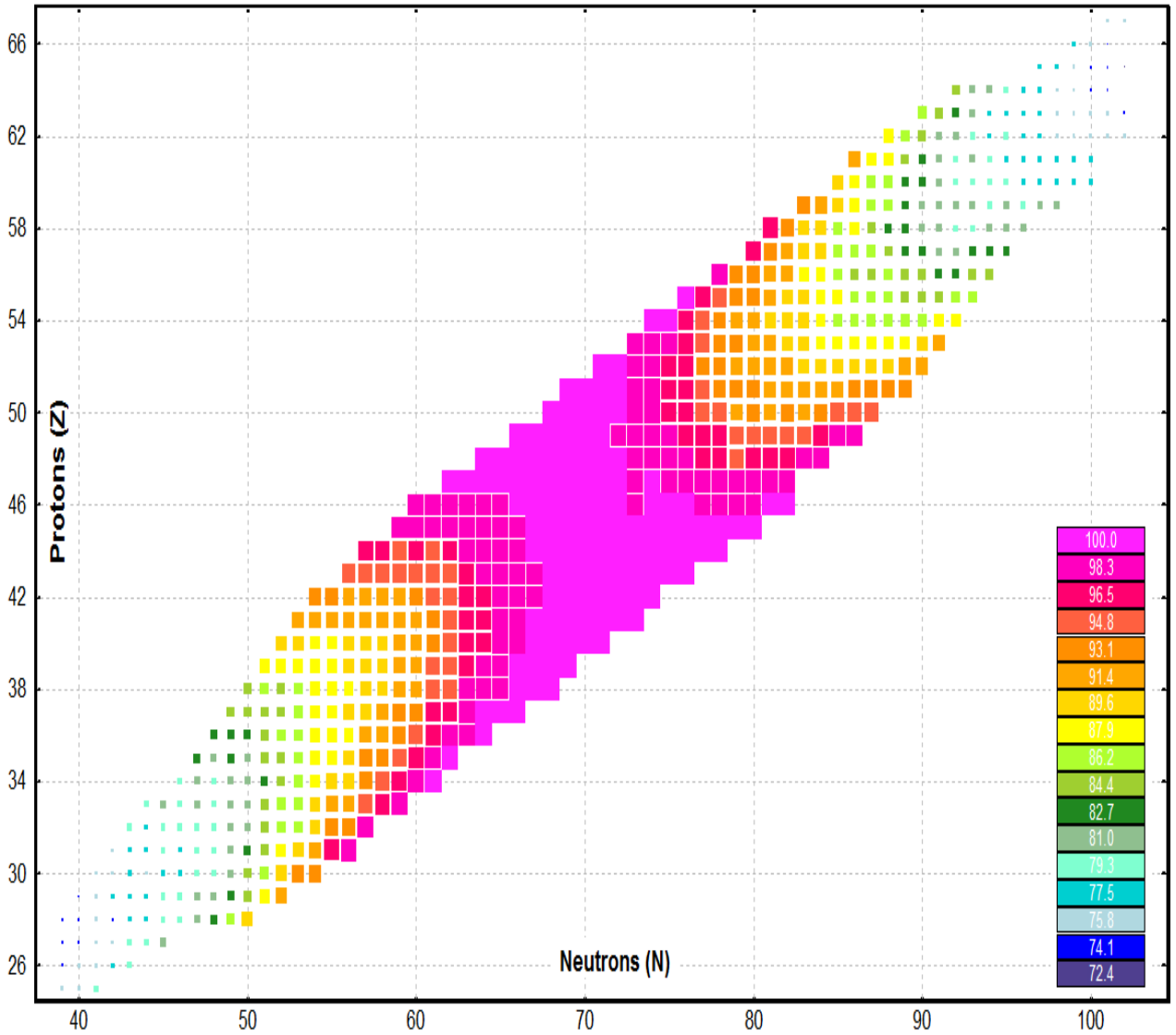
Input ZN batch file: C:\user\c\lise_pp_11\CrossSections\238U_Ex20.zn; Target: Be (300 mg/cm²)
Projectile ²³⁸U (E=200.00 MeV/u; E*=20.00); kinematics of two fragment(s)(final) BOTH fragments should pass
Rectangle Ang.Acc.(mrad): H = +-60.0(0.5); V = +-80.0(0.5); Momentum Acc.: +-3.00 % @ Brho = 5.100 T*m



Results : NO energy loss in a target; 100% momentum acceptance

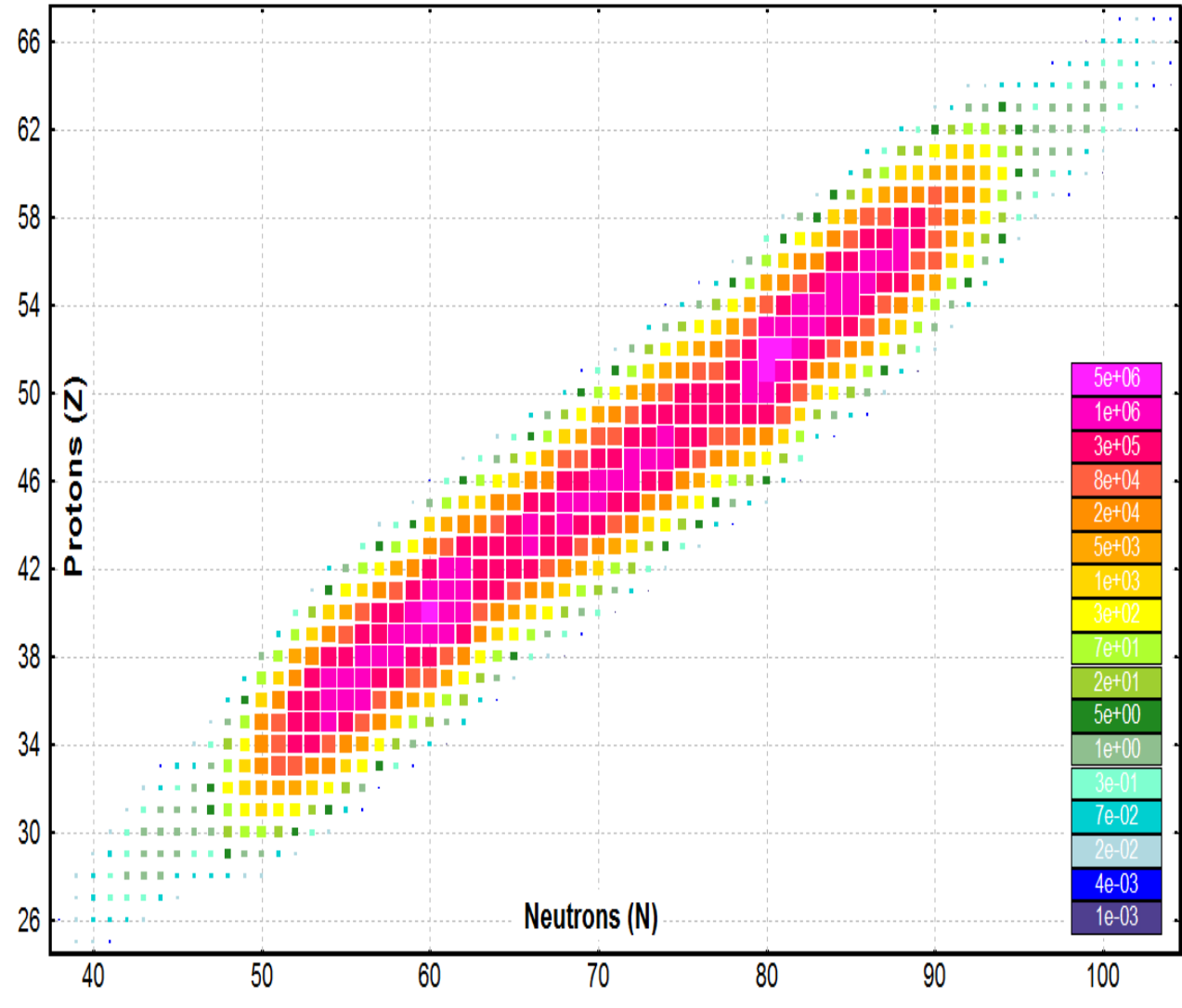
Fission fragment registration efficiency

Input ZN batch file: C:\user\c\lise_pp_11\CrossSections\238U_Ex20.zn
Projectile ^{238}U (E=200.00 MeV/u; E*=20.00); kinematics of two fragment(s)(final) BOTH fragments should pass
Rectangle Ang.Acc.(mrad): H = +-60.0(0.0); V = +-80.0(0.5)



Final Fission Fragment Yields

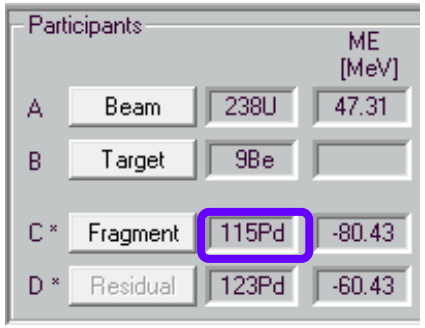
Input ZN batch file: C:\user\c\lise_pp_11\CrossSections\238U_Ex20.zn
Projectile ^{238}U (E=200.00 MeV/u; E*=20.00); kinematics of two fragment(s)(final) BOTH fragments should pas
Rectangle Ang.Acc.(mrad): H = +-60.0(0.0); V = +-80.0(0.5)

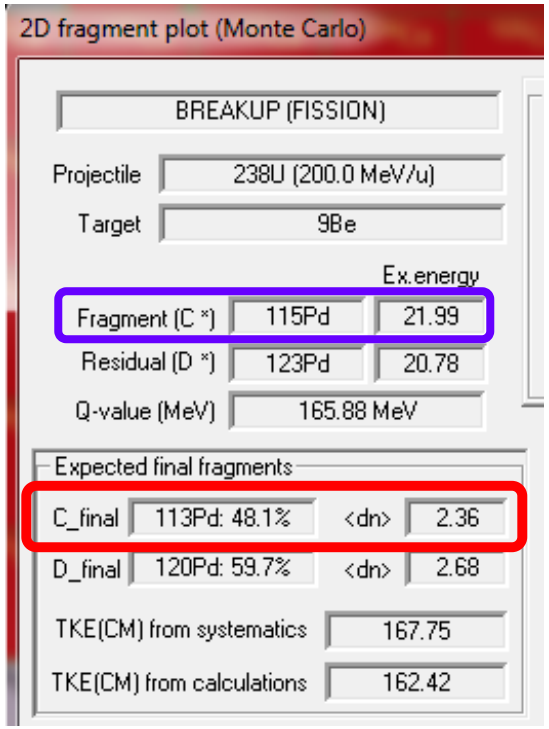


Final fragment iterations

Final fission fragments are used in an input ZN-file.
But initially in the Kinematics Calculator excited C* and D* fragments are used.
For example we need to calculate a ^{115}Pd fragment transmission:

Regular mode





Batch mode

^{115}Pd

LISE^{++} is looking for more probable excited fission fragment (here ^{118}Pd* for ^{115}Pd) by iterations for the initial final fragment