LISE++ development: Fusion-Fission

* LISE++ new reaction mechanism: Fusion-Fission

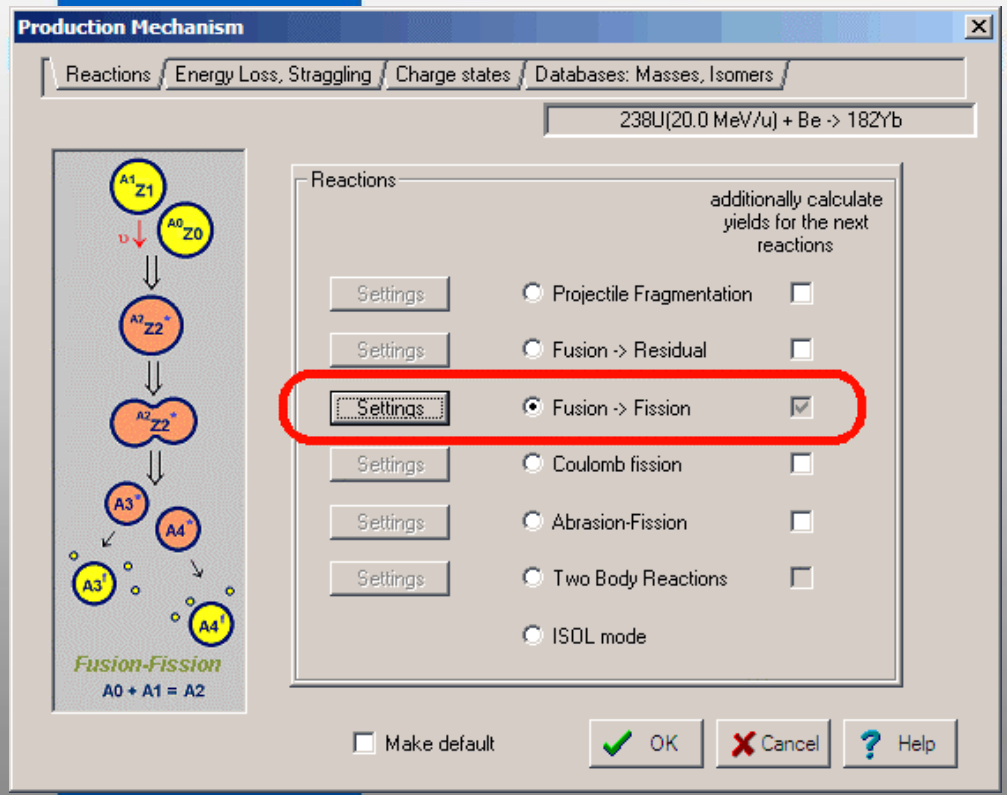
* LISE++: combination of consecutive transmission product calculation for several reactions

Version 7.8.87 beta from 6/6/6 available through LISE sites

LISE++

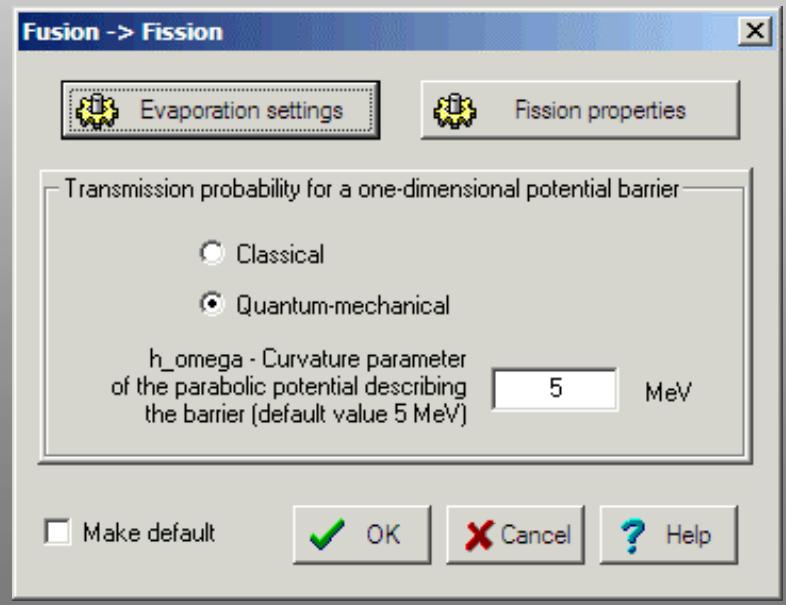
v. 7.8

LISE++ new reaction mechanism: Fusion-Fission



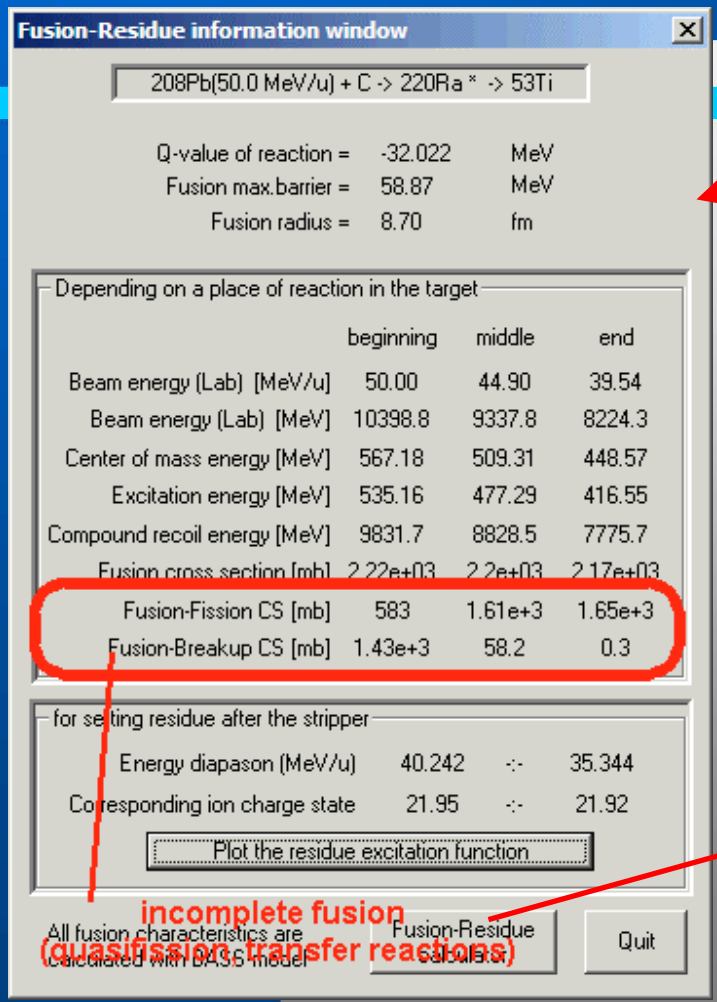
Fusion from "Fusion-Residual"

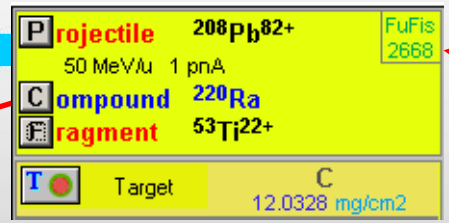
Fission from "Abrasion-Fission"



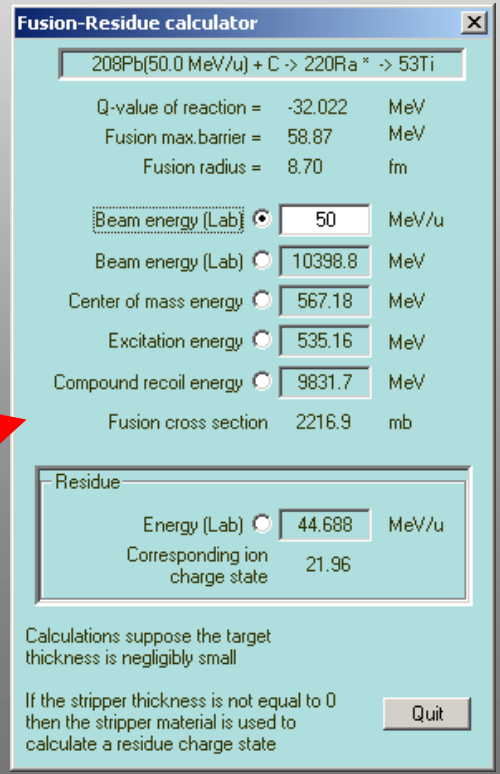
1. No angular momentum contribution
2. Fission cross section is taken without pre-fission neutrons

Fusion-Residue (Fission) information window





Calculated fusion-fission cross sections are kept in memory

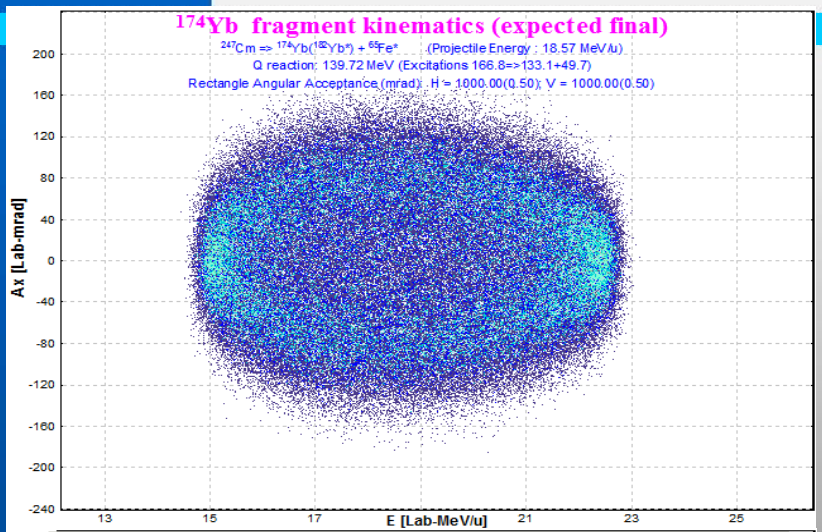


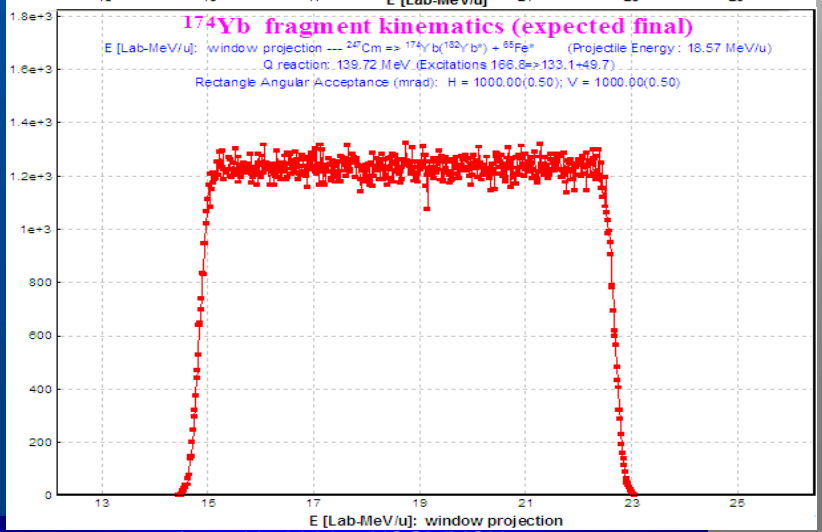
incomplete fusion
(quasifission, transfer reactions)

Break-up and fission channel cross sections in the Fusion information dialog (Fusion-Residual reaction)

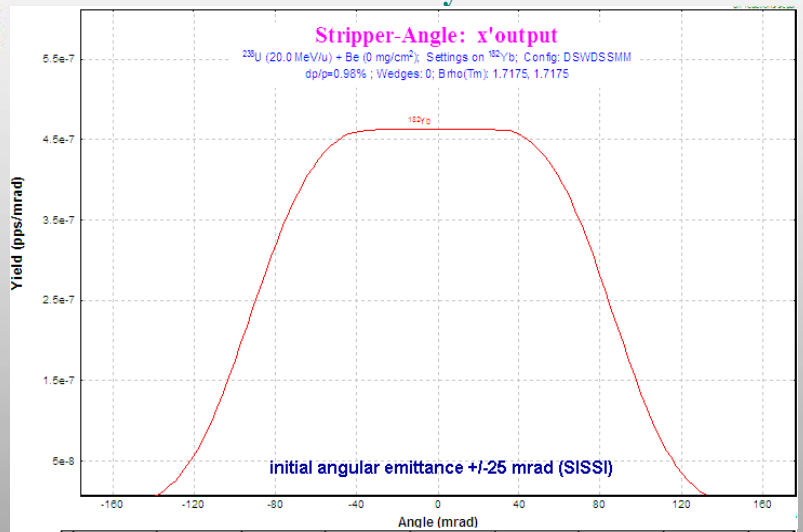
Fusion-Fission kinematics (after target)

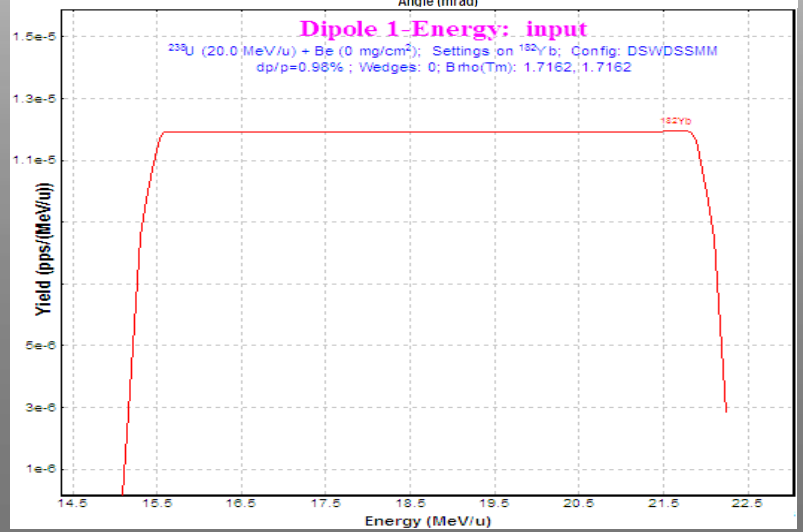
Monte Carlo





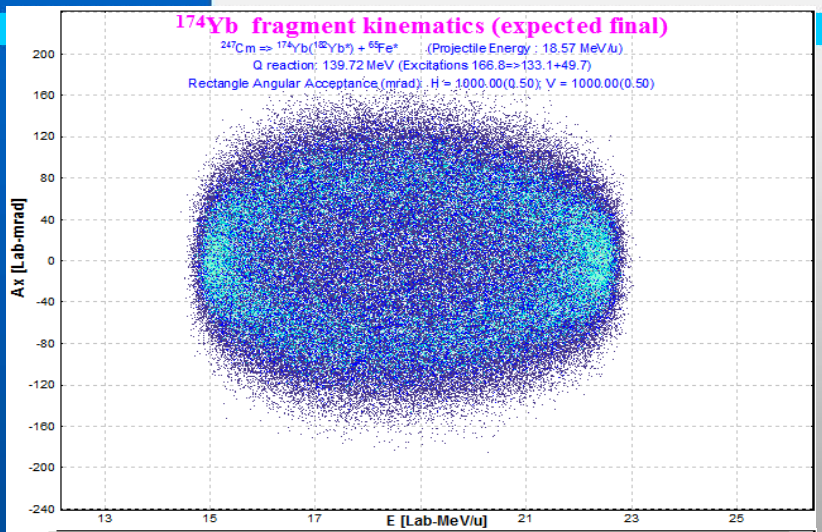
LISE analytical

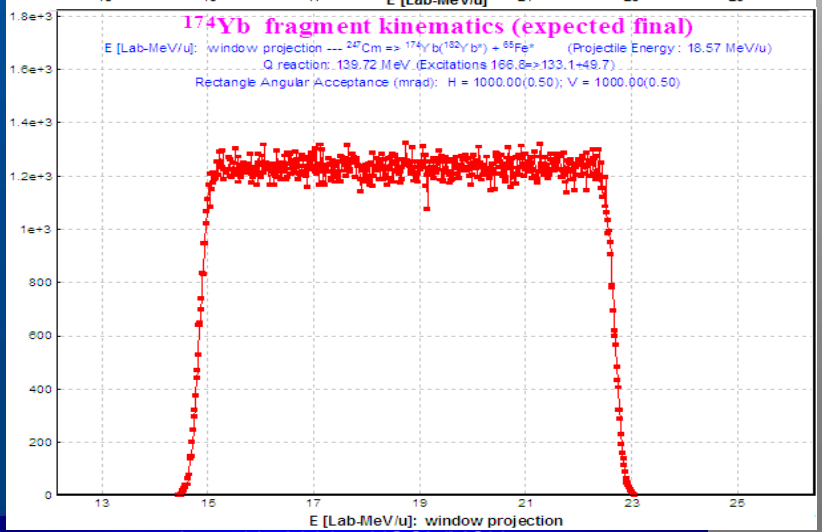




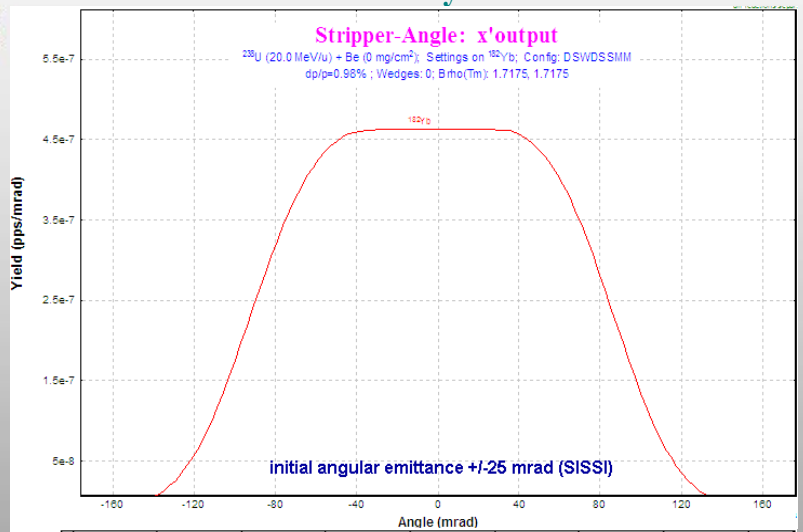
Fusion-Fission kinematics (after target)

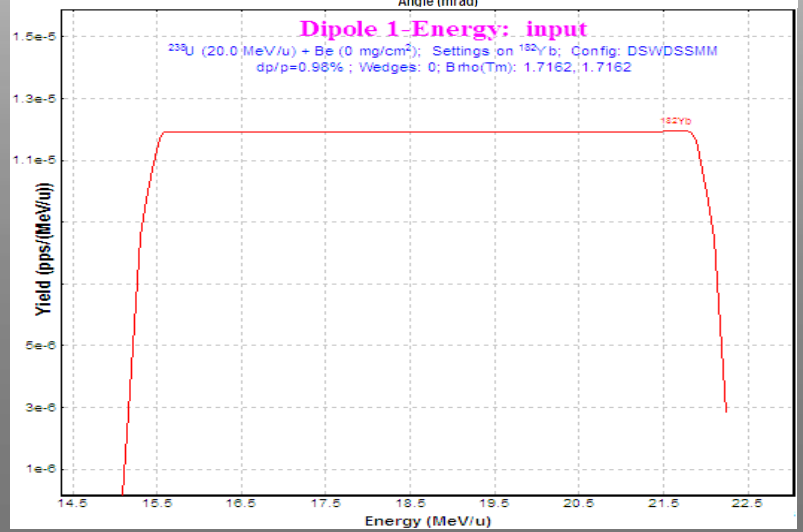
Monte Carlo





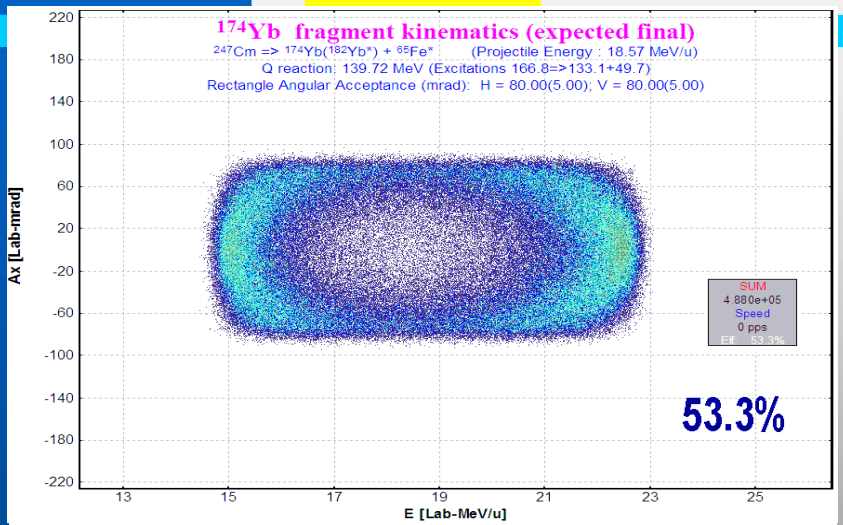
LISE analytical

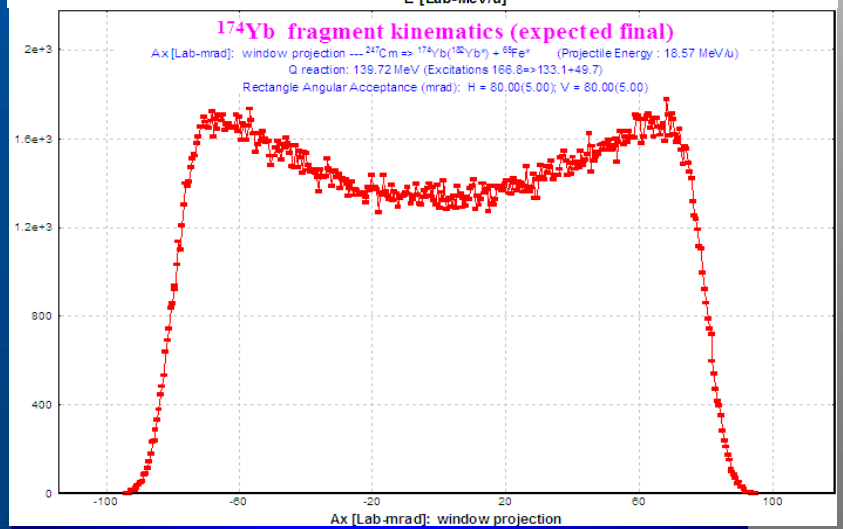




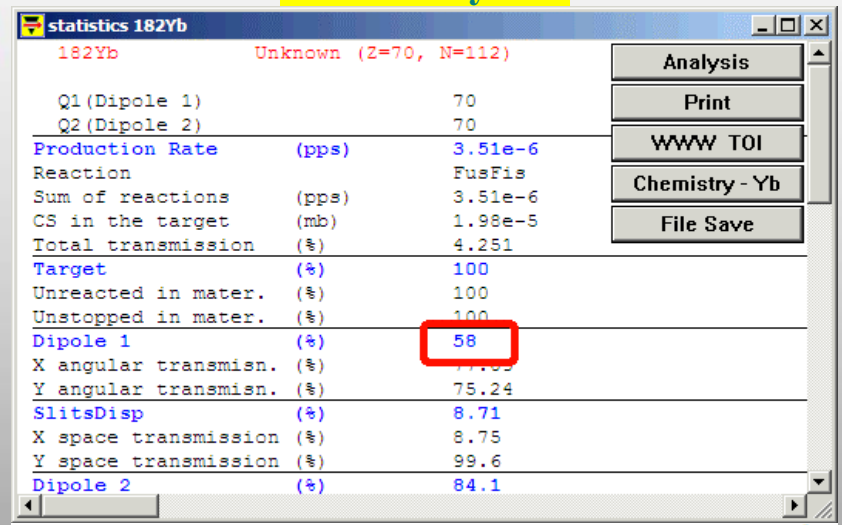
Angular acceptance

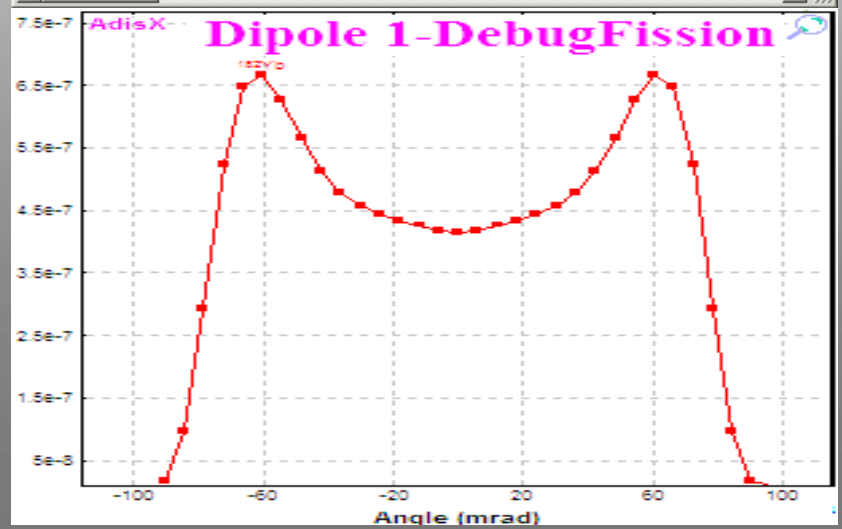
Monte Carlo





LISE analytical

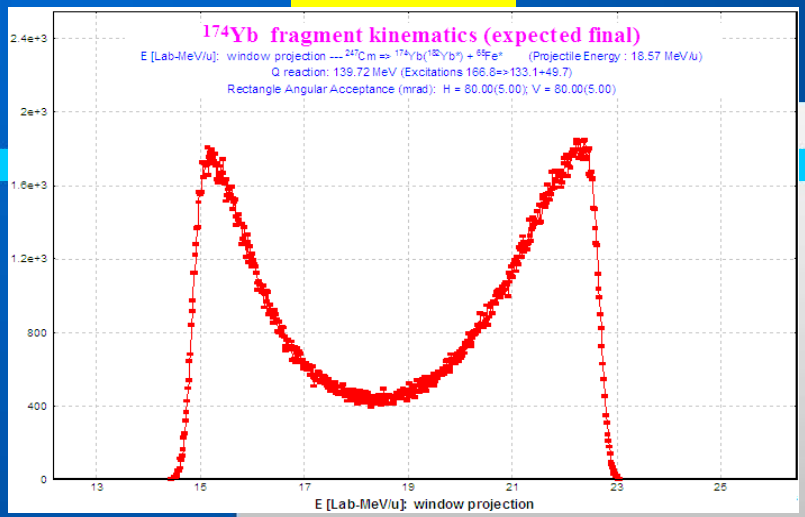




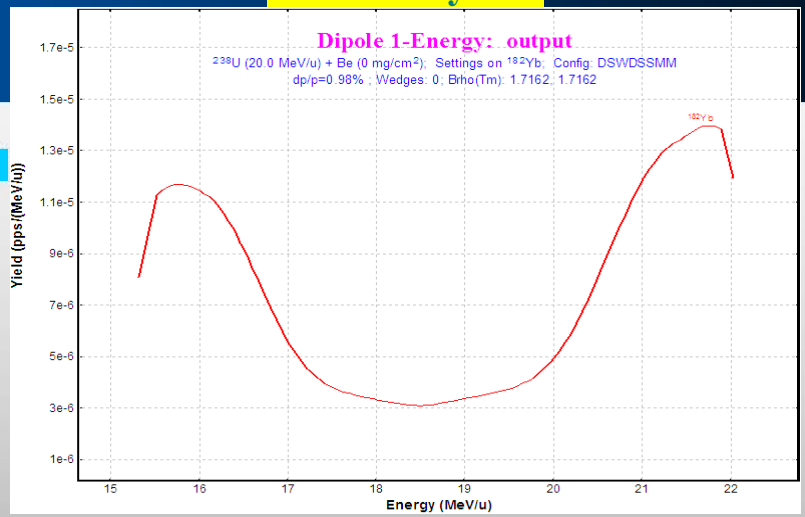
Angular and Momentum acceptances

Angular acceptance (2)

Monte Carlo

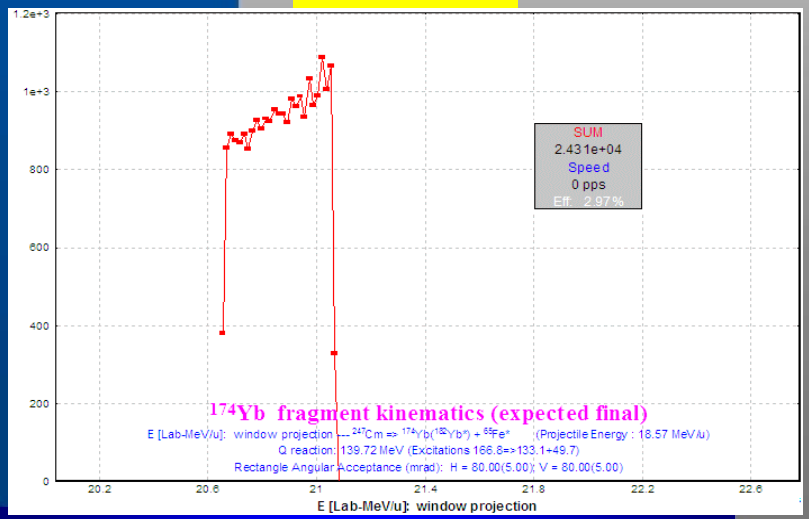


LISE analytical

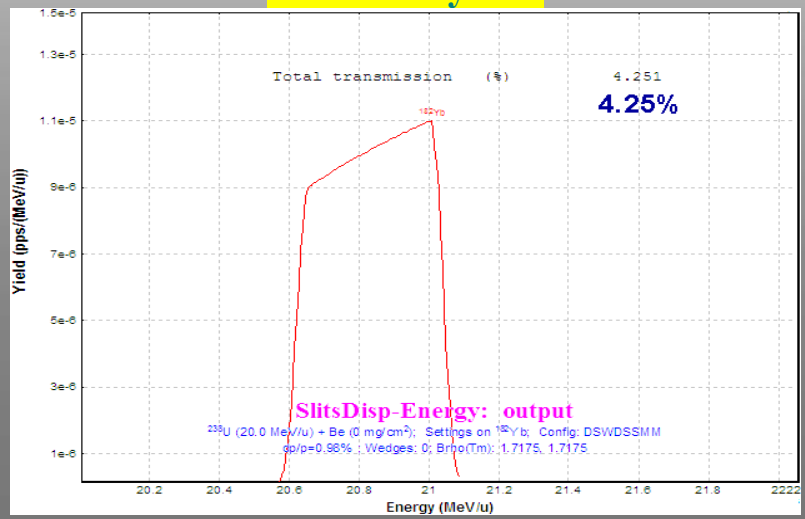


Momentum acceptance

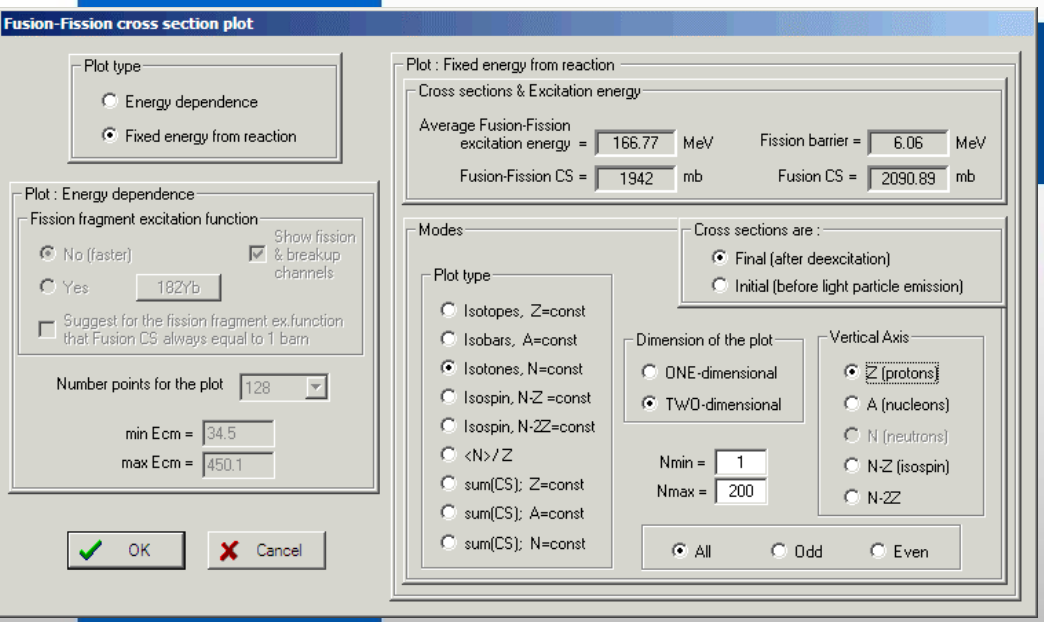
Monte Carlo

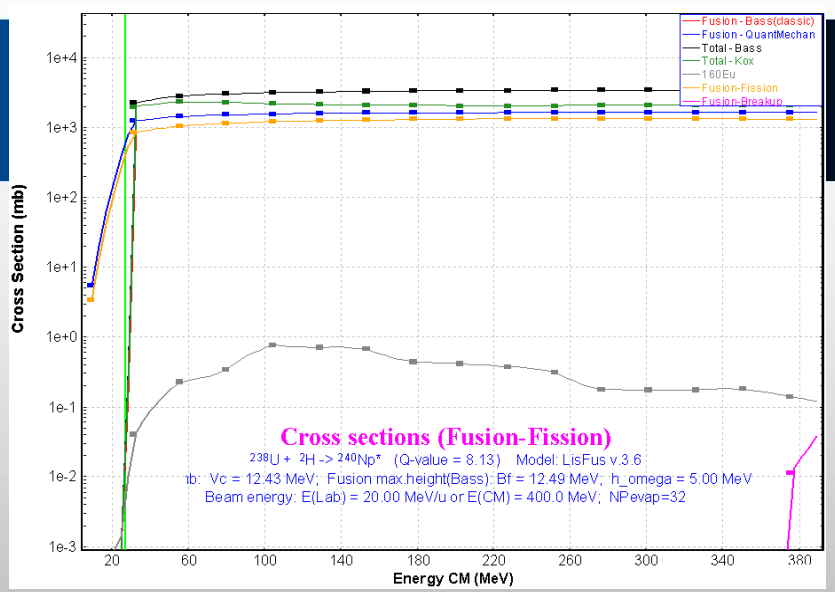


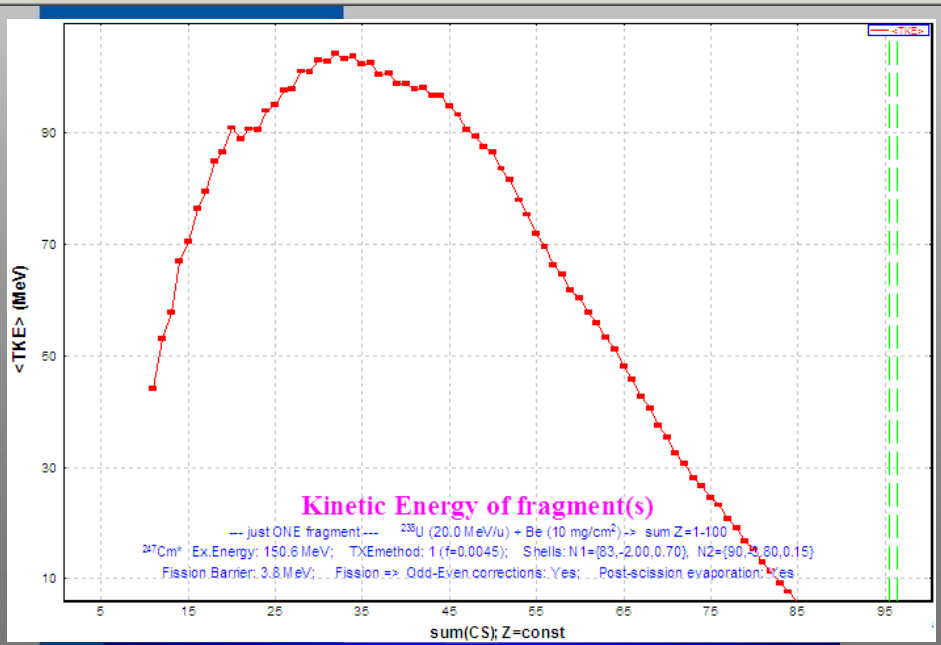
LISE analytical

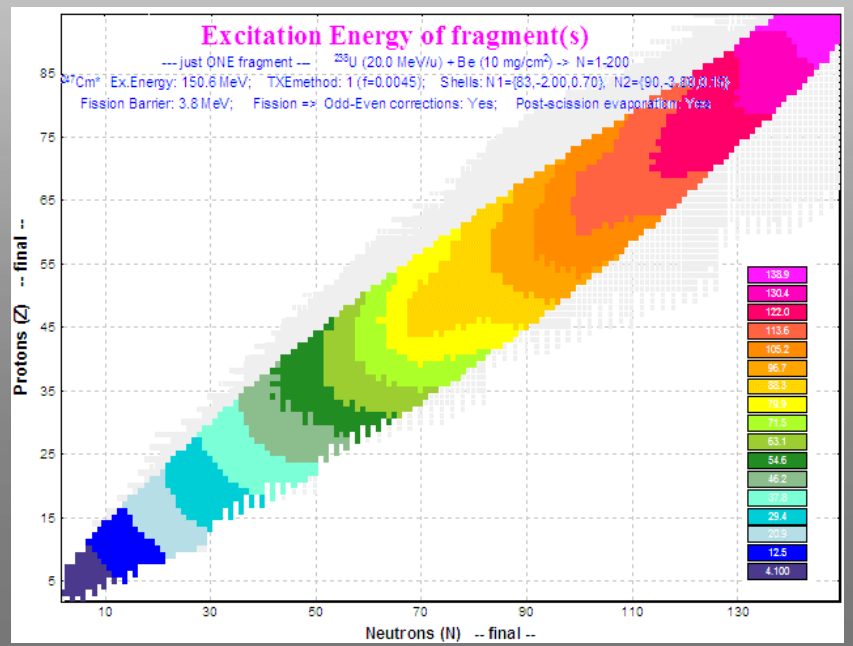


Fusion-Fission plots

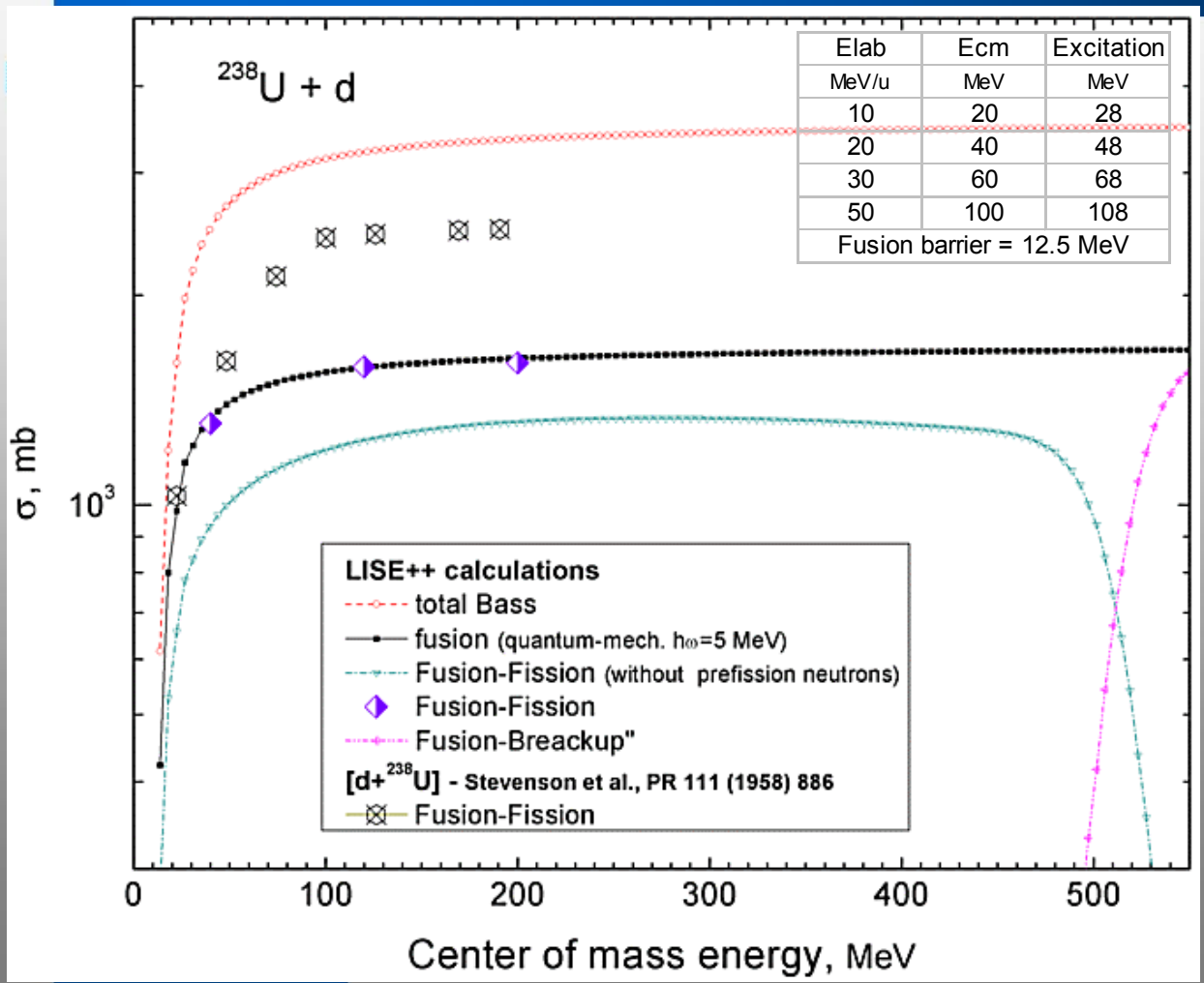




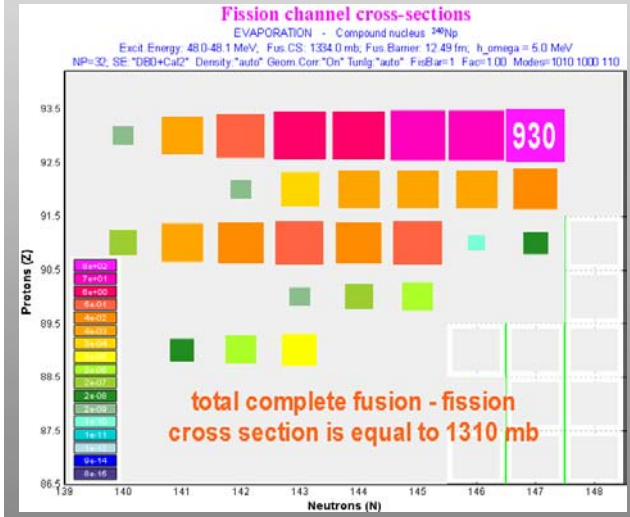




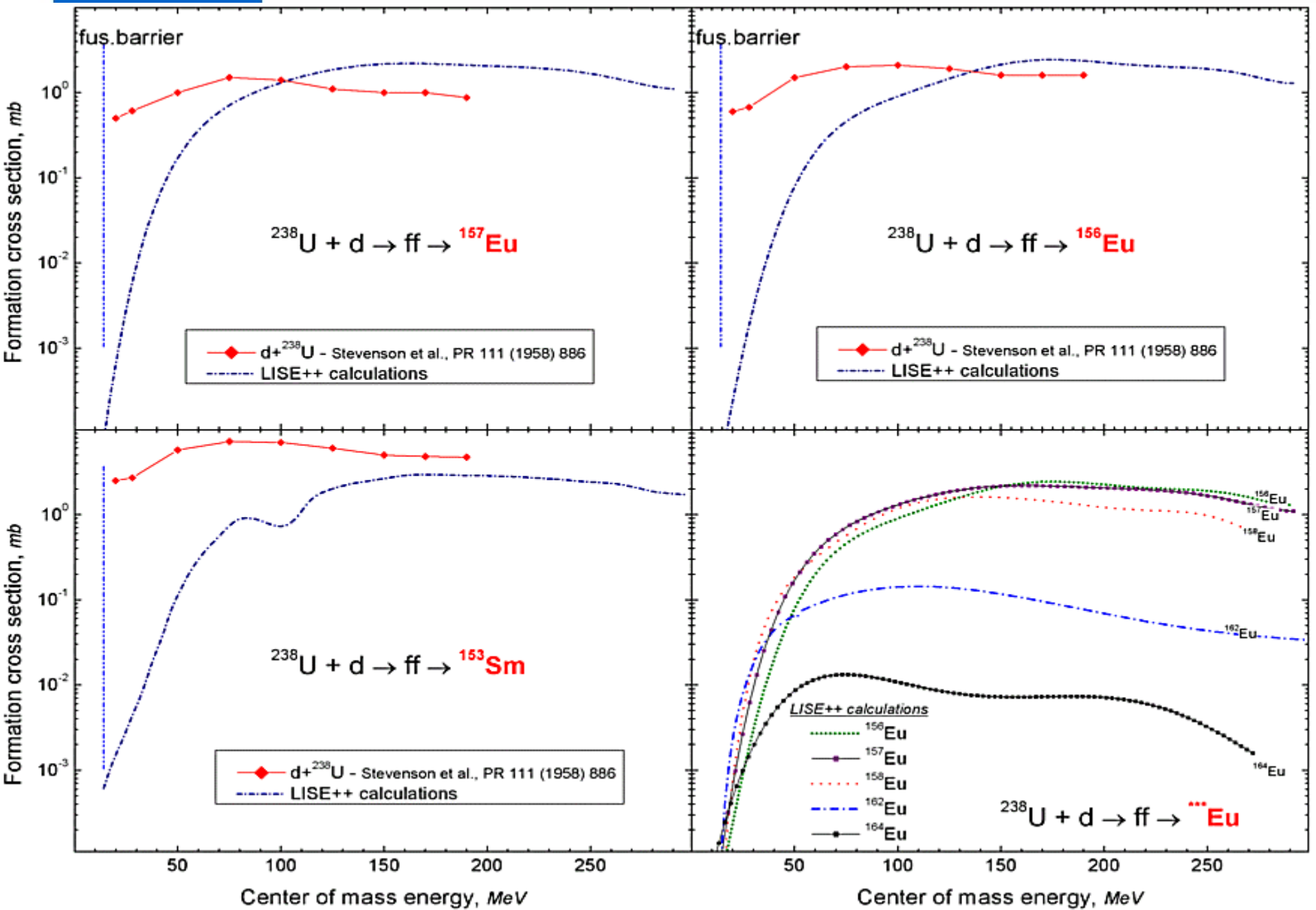
^{238}U + d : data and LISE calculations (1)



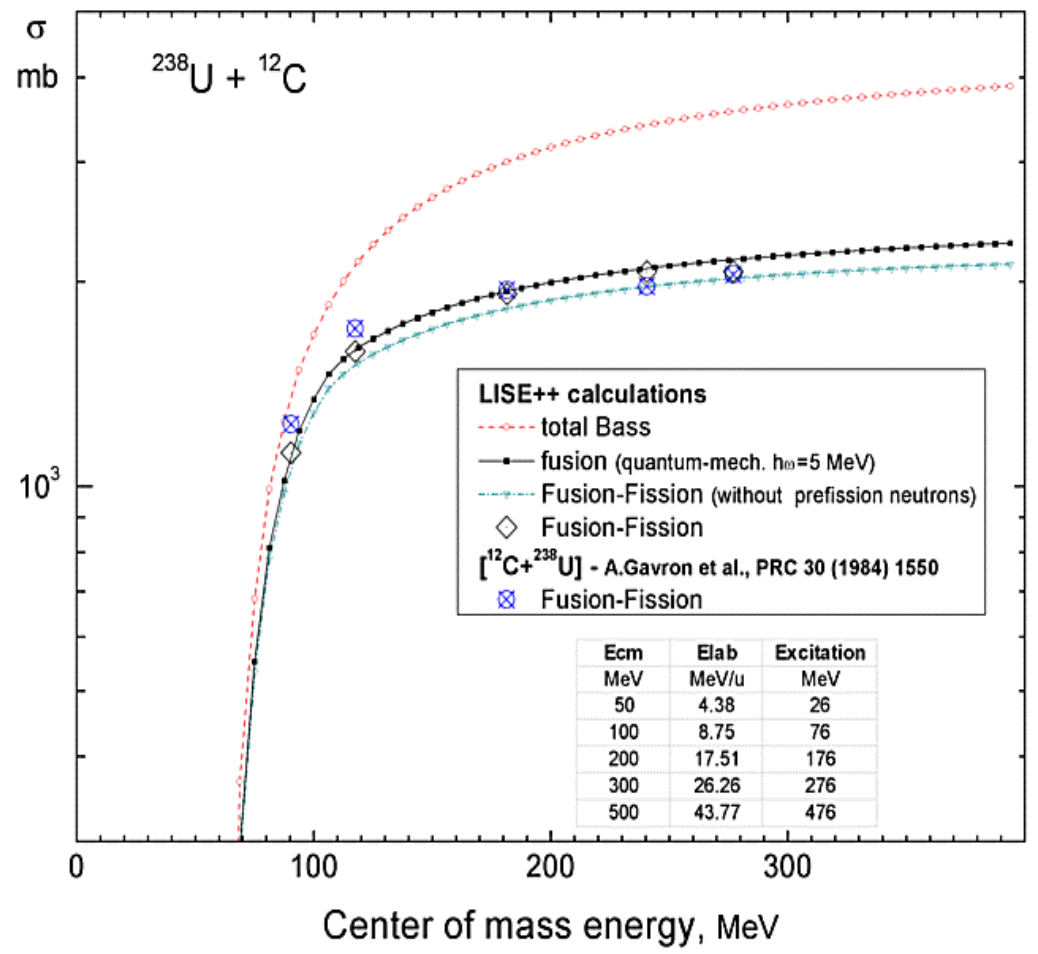
Elab	Ecm	Excitation
MeV/u	MeV	MeV
10	20	28
20	40	48
30	60	68
50	100	108
Fusion barrier = 12.5 MeV		



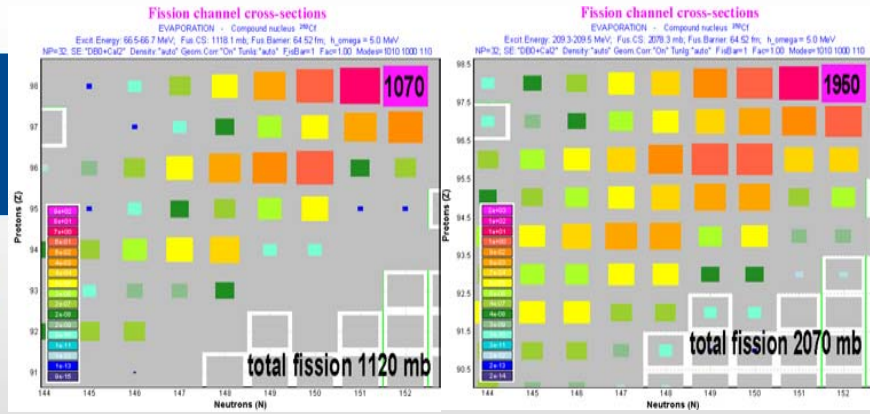
^{238}U + d : data and LISE calculations (2)



^{238}U + C : data and LISE calculations



Ecm	Elab	Excitation
MeV	MeV/u	MeV
50	4.38	26
100	8.75	76
200	17.51	176
300	26.26	276
500	43.77	476



Fusion and fusionlike process
A.Gavron et al., PRC30 (1984) 1550

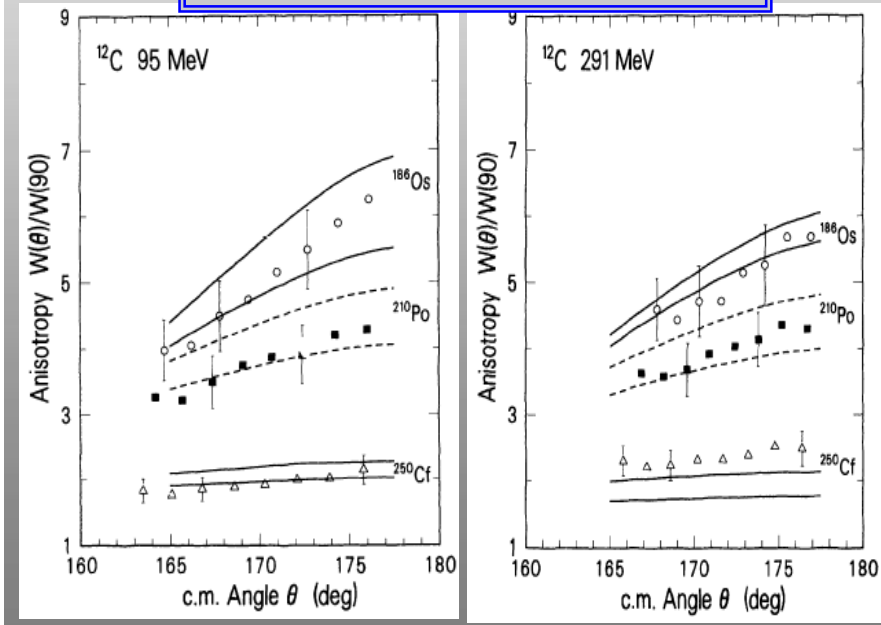
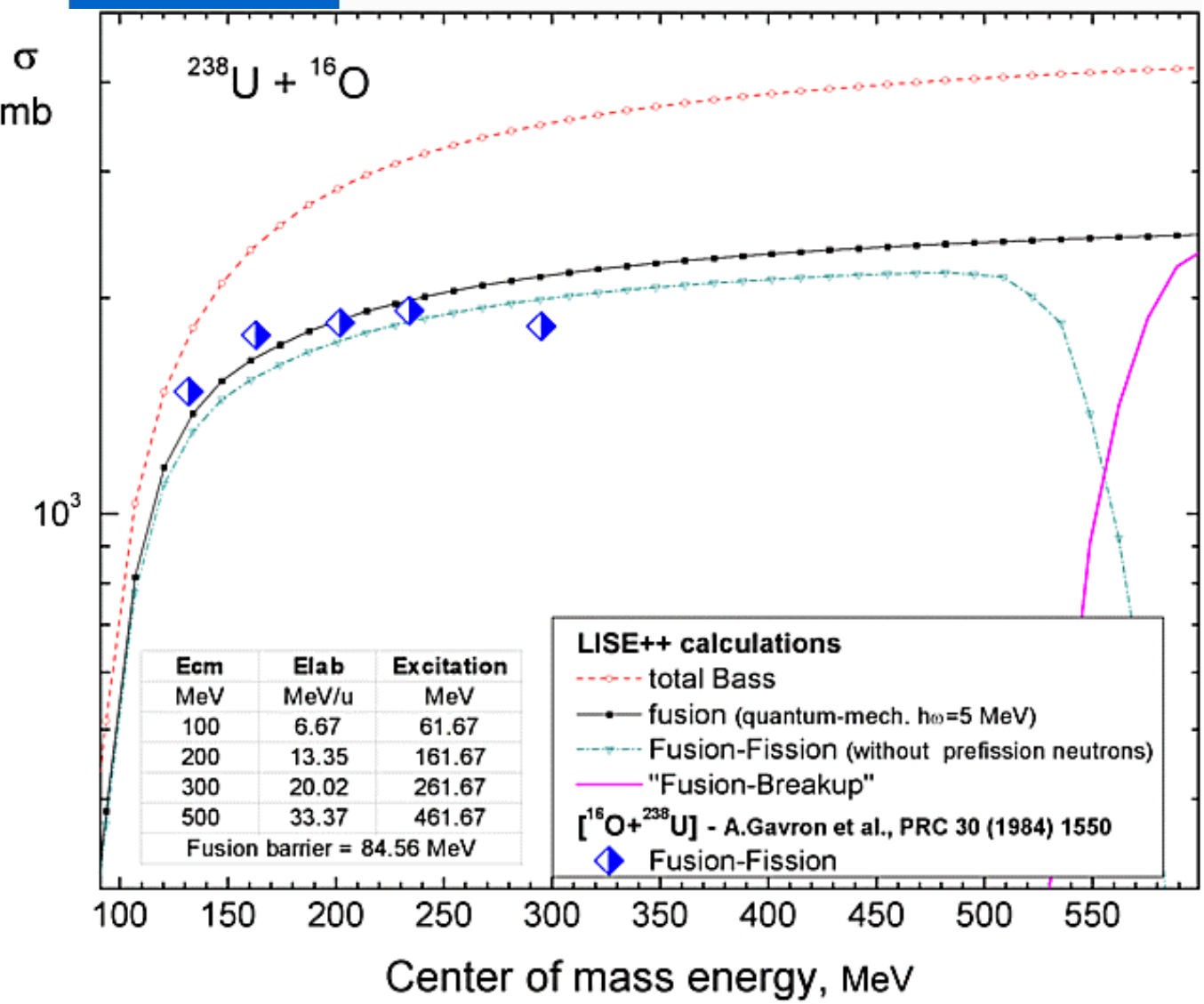


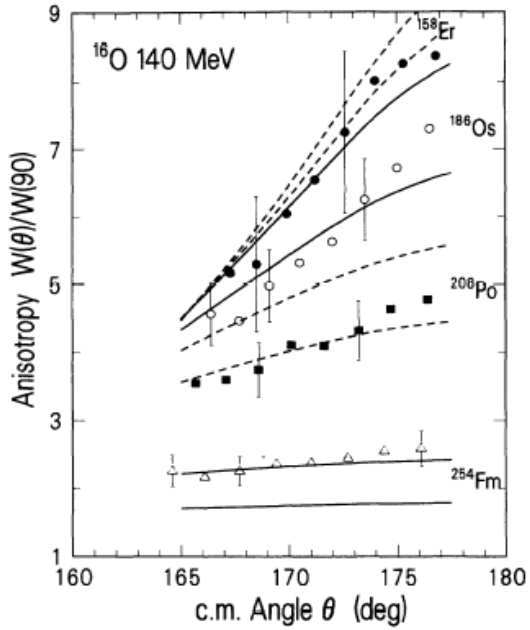
FIG. 8. Angular distribution of fission fragments for ^{12}C at 95 MeV. Circles, on ^{174}Yb; squares, on ^{198}Pt; triangles, on ^{238}U. Lines are results of calculations using the transition state model. Alternate systems have solid and dashed lines to improve readability.

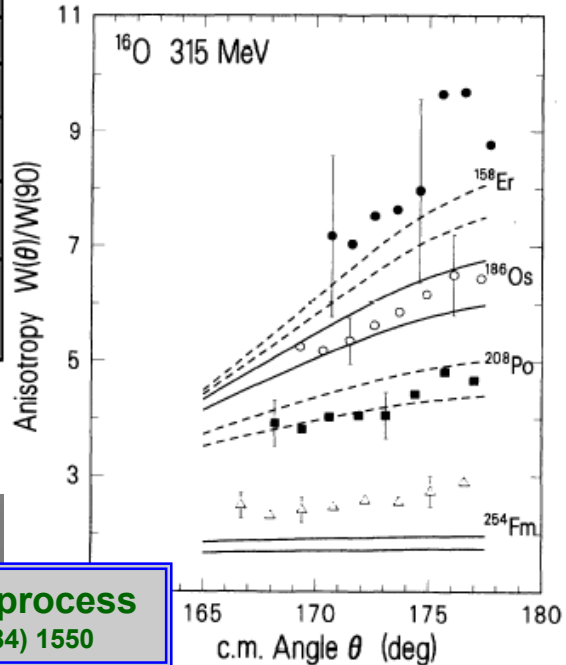
$^{238}U + ^{16}O$: data and LISE calculations



Ecm	Elab	Excitation
MeV	MeV/u	MeV
100	6.67	61.67
200	13.35	161.67
300	20.02	261.67
500	33.37	461.67

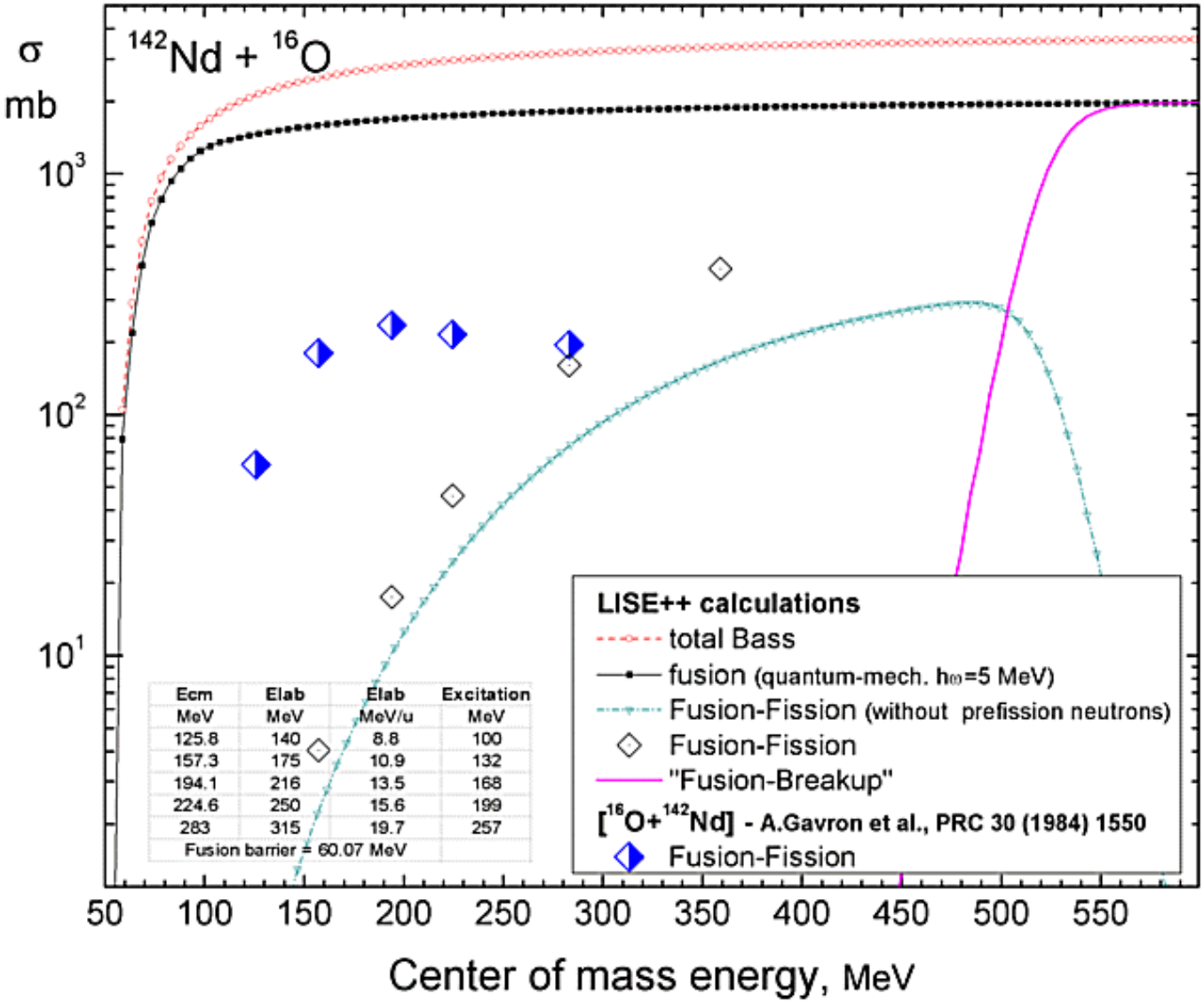
Fusion barrier = 84.56 MeV





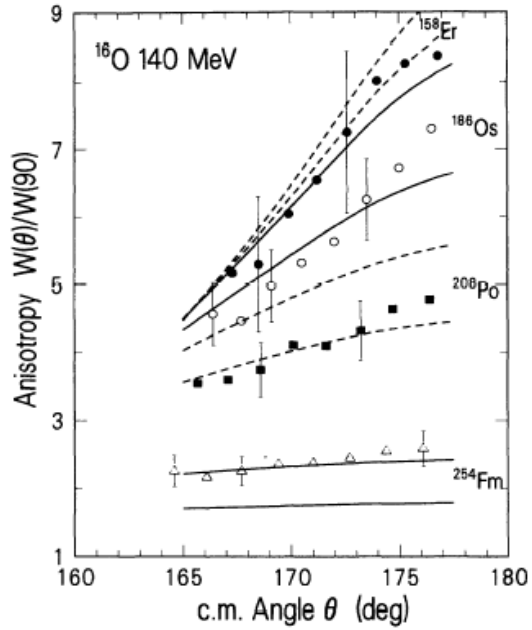
Fusion and fusionlike process
A.Gavron et al., PRC30 (1984) 1550

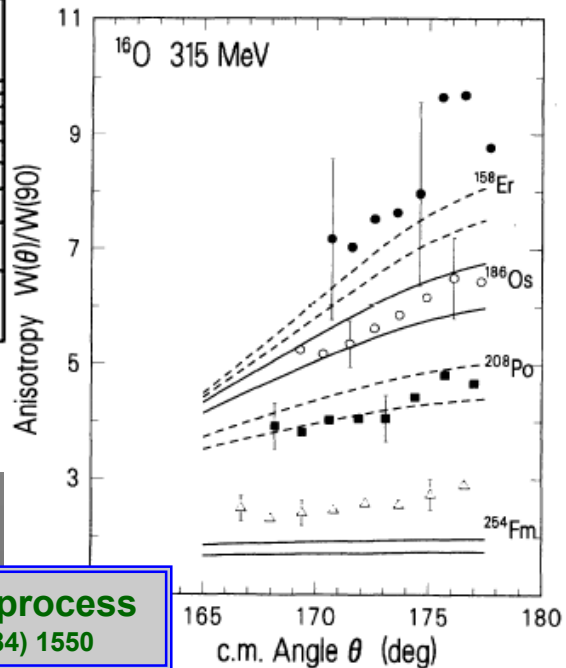
^{142}Nd + ^{16}O : data and LISE calculations (1)



Ecm MeV	Elab MeV	Elab MeV/u	Excitation MeV
125.8	140	8.8	100
157.3	175	10.9	132
194.1	216	13.5	168
224.6	250	15.6	199
283	315	19.7	257

Fusion barrier = 60.07 MeV

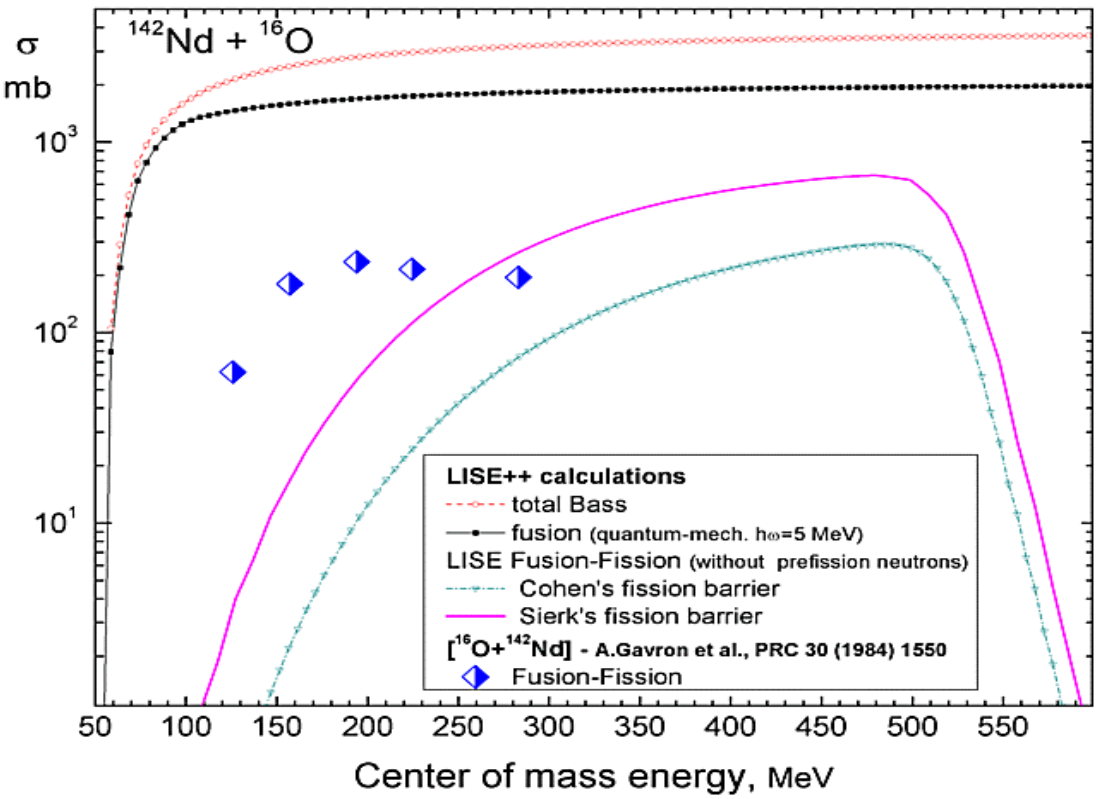


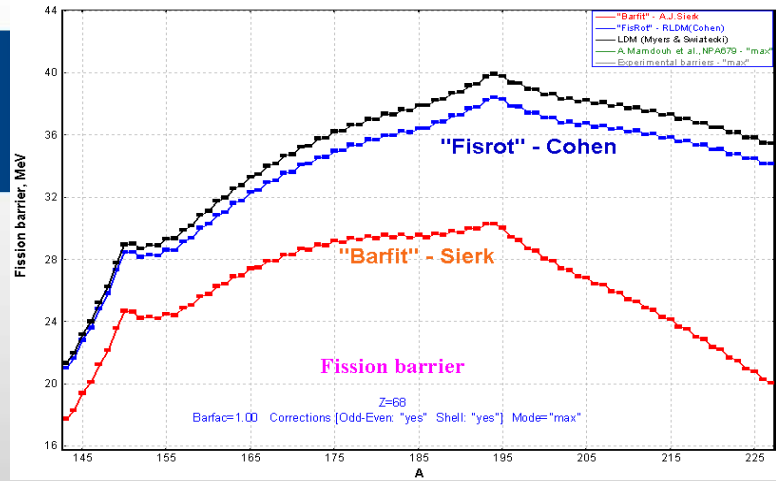


Fission barrier? "FisRot"(Cohen) was used default

Fusion and fusionlike process
A.Gavron et al., PRC30 (1984) 1550

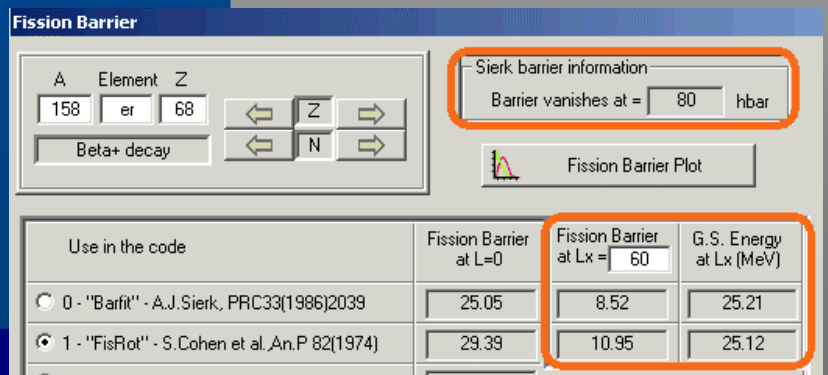
^{142}Nd + ^{16}O : data and LISE calculations (2)





Fission barriers at L=0 for Z=68 isotopes

LISE calculations without angular momentum contribution do not reproduce well this region !



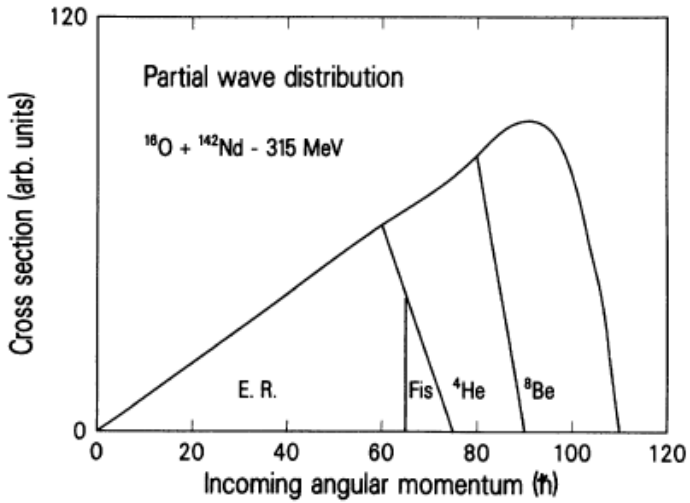
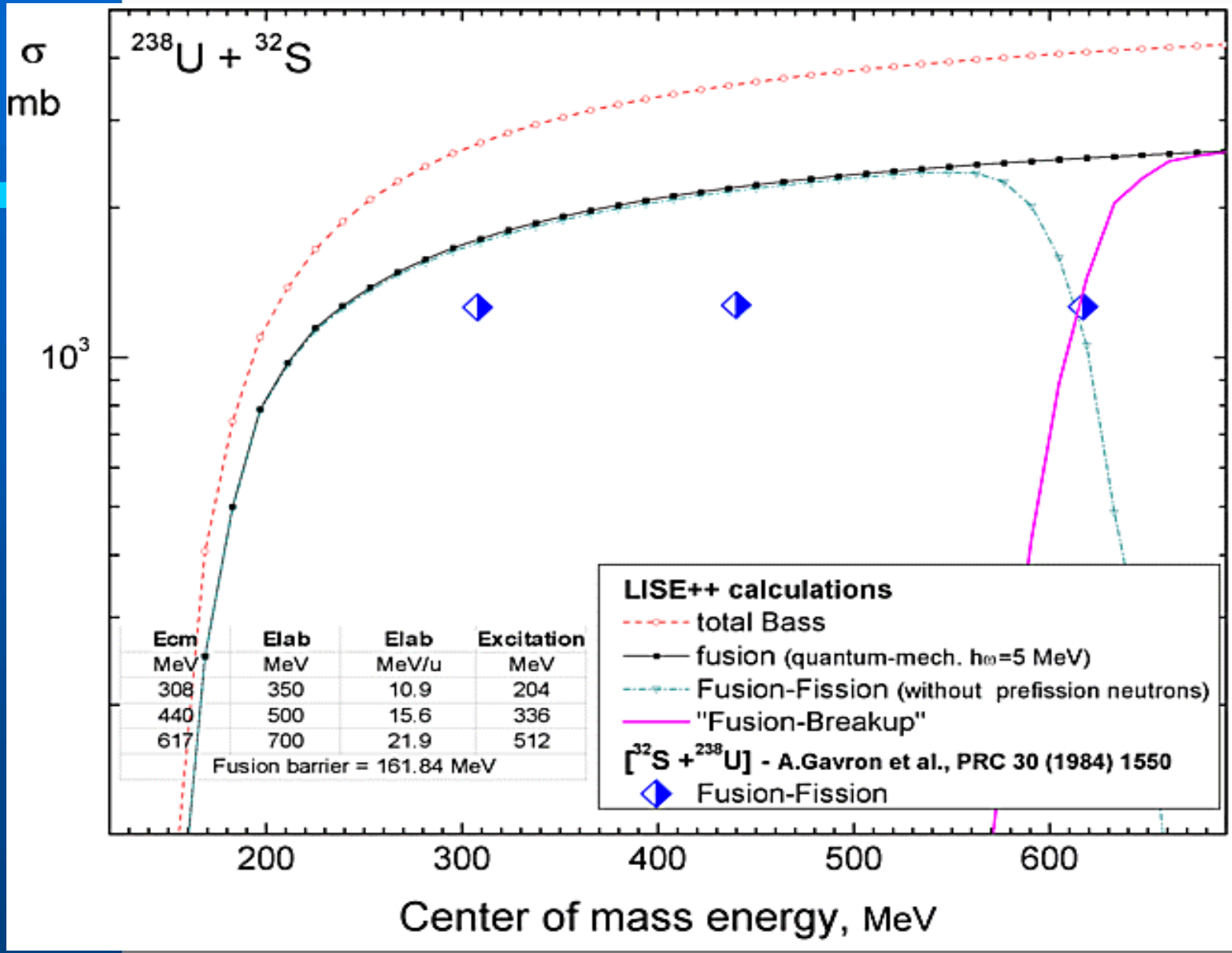
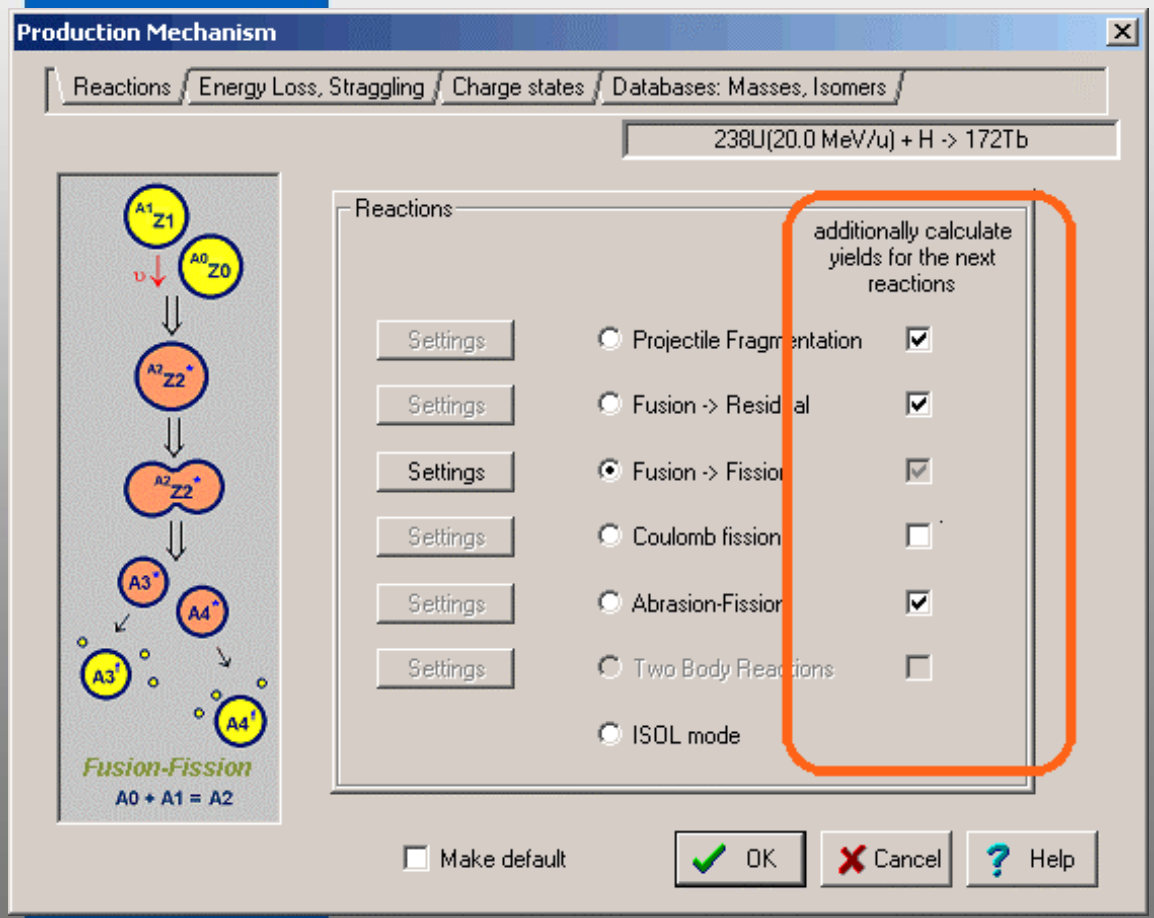


FIG. 17. Schematic partial wave distribution for the $^{16}O+^{142}Nd$ reaction. ER (evaporation residues) and FIS (fission) label regions of complete fusion which lead to evaporation residues and fission, respectively. ^{4}He and ^{8}Be label regions of incomplete fusion which, after emission of these particles, end up predominantly in the ER region.

$^{238}U + ^{32}S$: data and LISE calculations



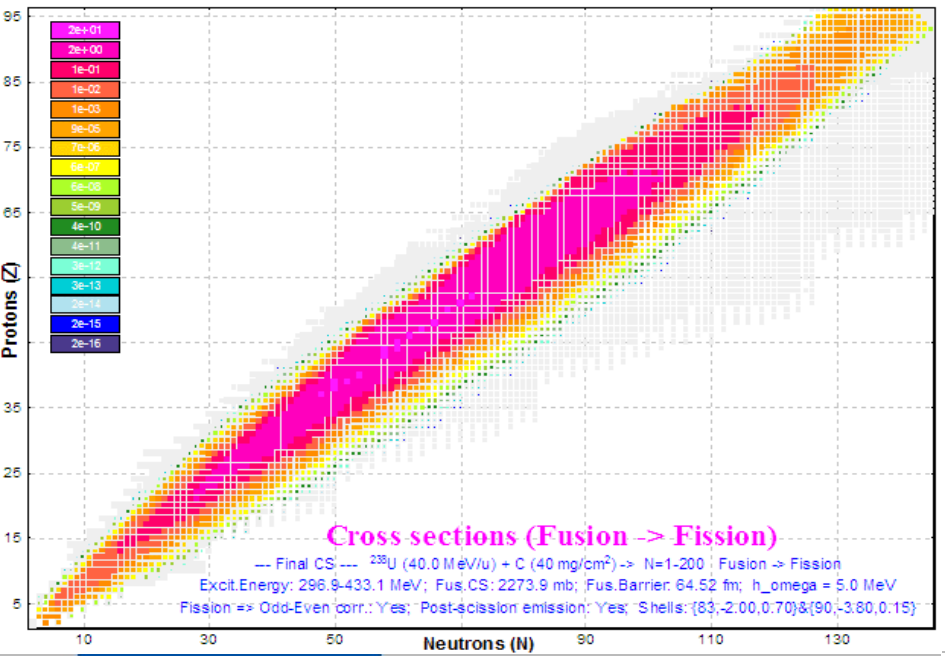
Combination of consecutive transmission product calculation for several reactions

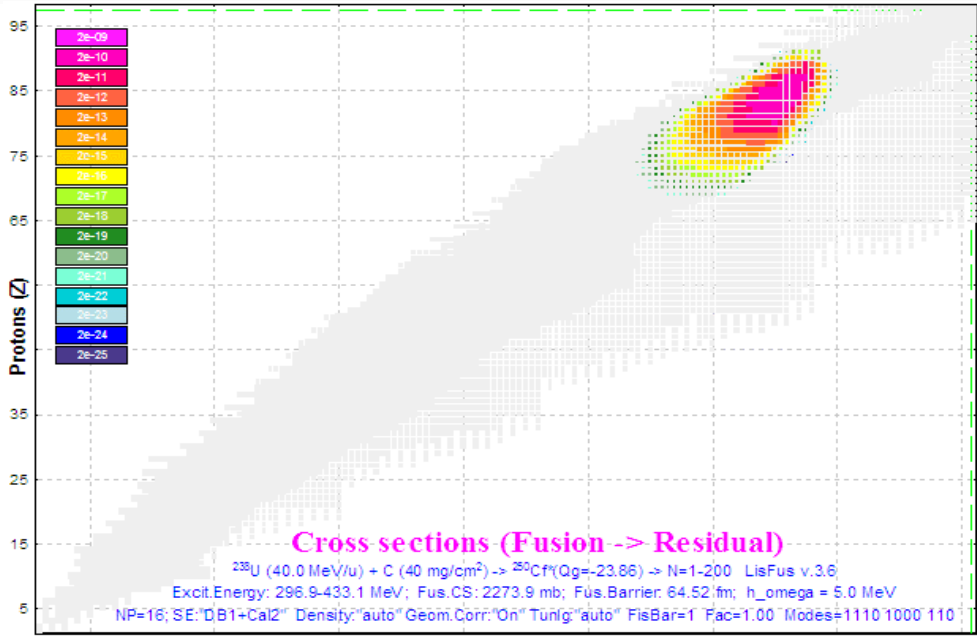


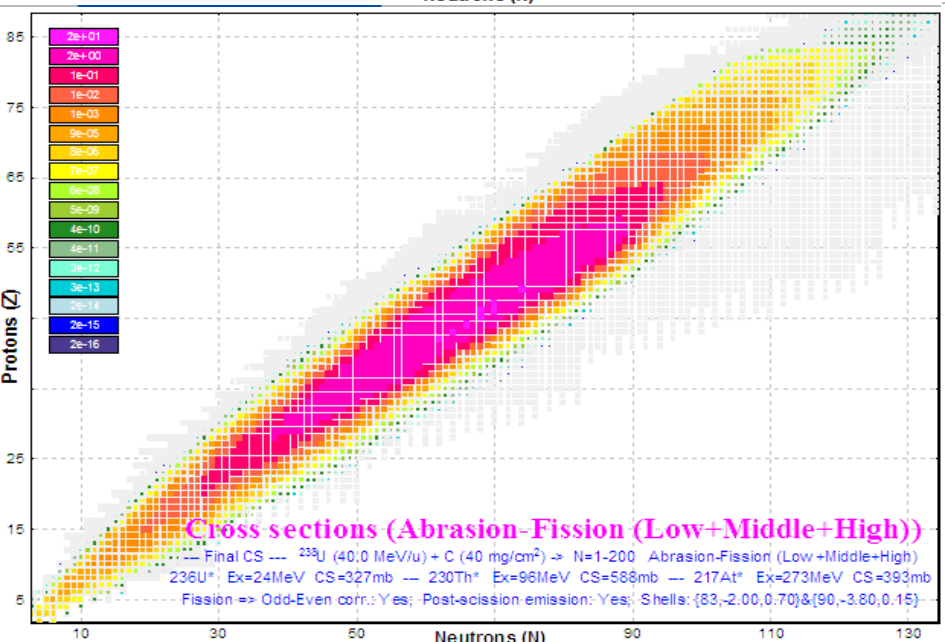
Notes

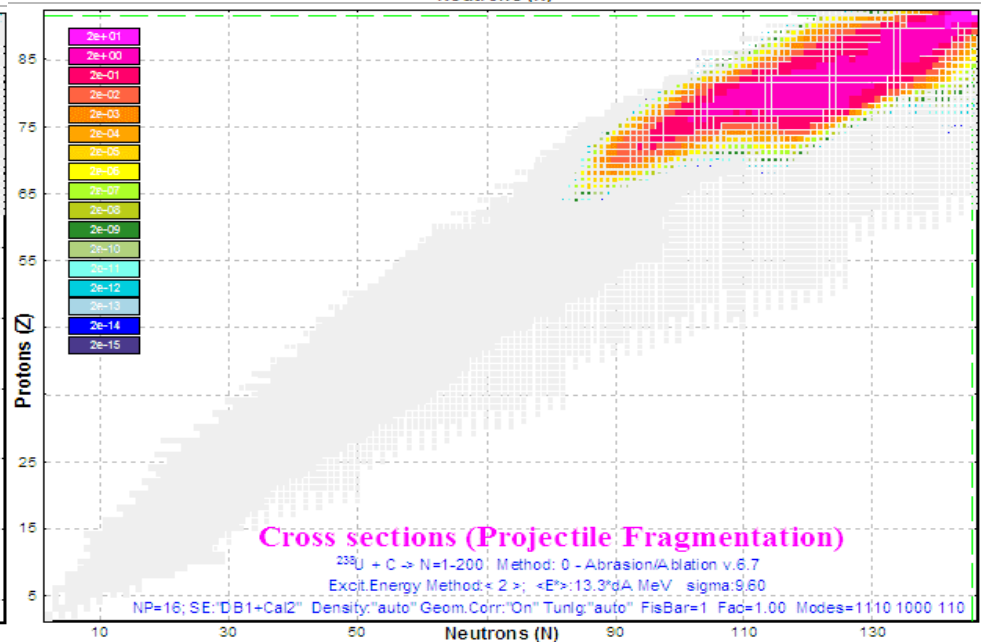
- Coulomb fission is included in Abrasion-Fission
- Use the Abrasion-Ablation model instead EPAX for the Projectile fragmentation mechanism in the case of consecutive calculations
- Preliminary check excitation energy region settings for Abrasion-Fission mode

Combination of consecutive transmission product calculation
^{238}U(40MeV/u) + C → Fusion or Abrasion ??









Combination of consecutive transmission product calculation
^{238}U(40MeV/u) + C → Angular acceptance