MICHIGAN STATE UNIVERSITY

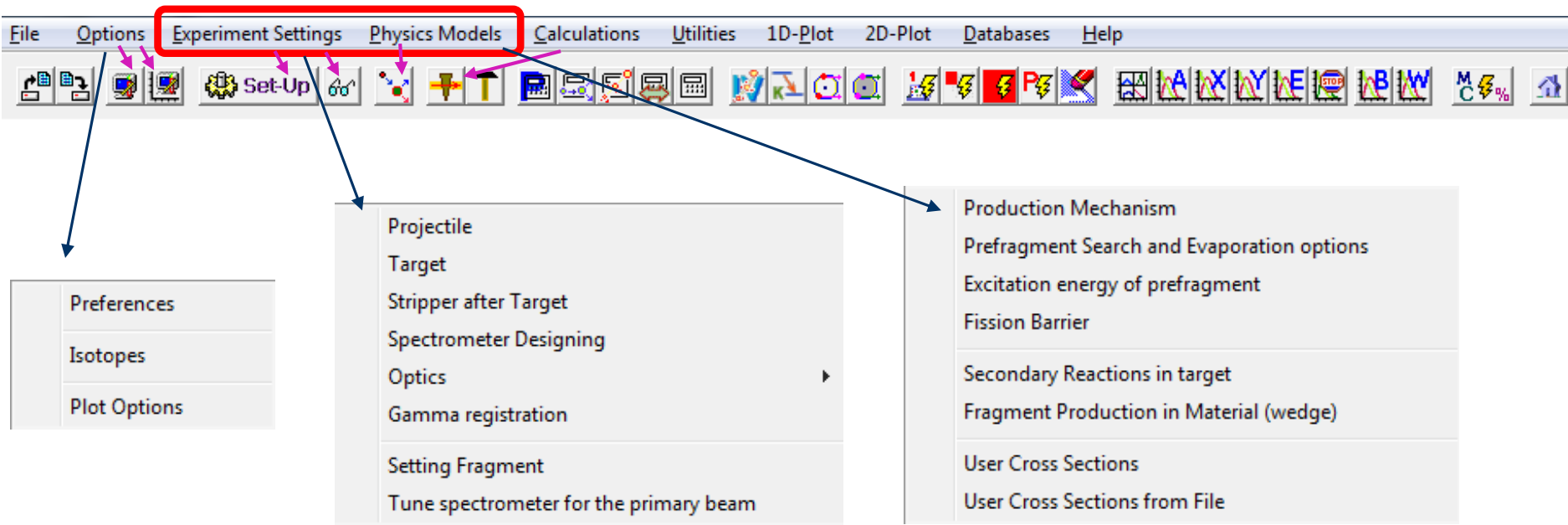**L I S E ++**

from 04/06/15

1. **Update of Fusion reaction mechanism in LISE++**
   external link: http://lise.nscl.msu.edu/9_10/9_10_Fusion.pdf

2. **Main menu modifications:**
   Gadget and menu orders have been changed
   New item "Physics Models"

3. **Range table up to 50 AGeV**

4. **Number of blocks increased up to 500**

5. **Plots:**
   Plotting method : V-Histogram
   1D-plot : user line thickness

6. **Modification in "Find_Simple_Wedge_Anlge" subroutine**
   for zero-dispersion of the 2nd half

7. **Range Gas Cell : modifications of energy loss distribution**
   for material passing and stopping

8. **Angular Momentum in the Plots of**
   the "Excitation energy of prefragments" dialog

9. **Others**

❑ *Menu and gadget and orders have been changed*

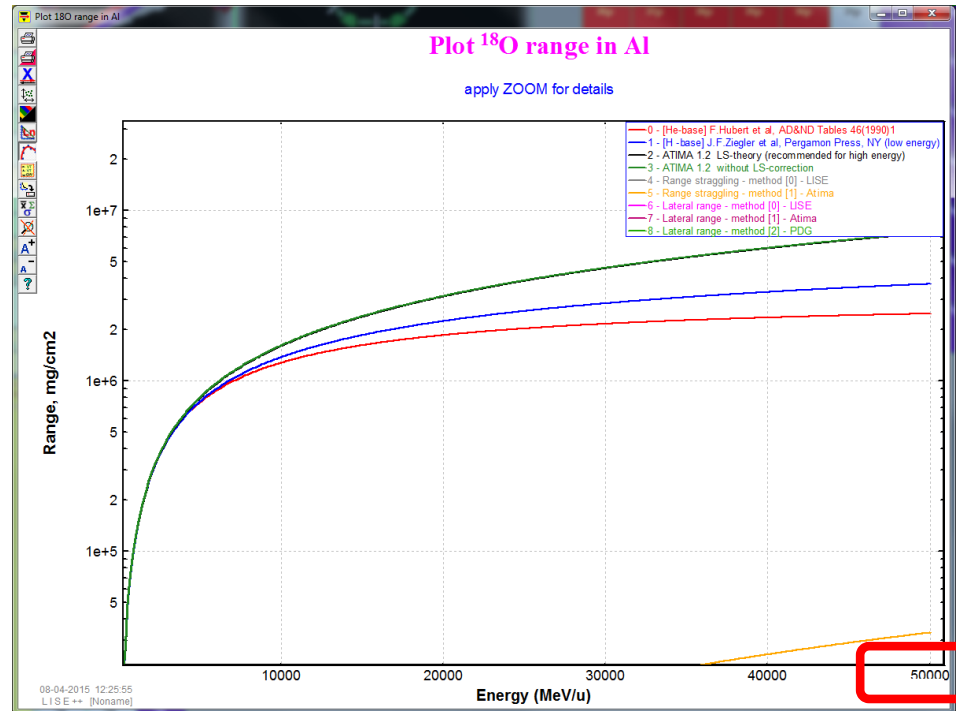❑ *New item "Physics Models"*

Version 9.9

Version 9.10

| Preferences |
| Isotopes |
| Plot Options |

| Projectile |
| Target |
| Stripper after Target |
| Spectrometer Designing |
| Optics ▸ |
| Gamma registration |
| Setting Fragment |
| Tune spectrometer for the primary beam |

| Production Mechanism |
| Prefragment Search and Evaporation options |
| Excitation energy of prefragment |
| Fission Barrier |
| Secondary Reactions in target |
| Fragment Production in Material (wedge) |
| User Cross Sections |
| User Cross Sections from File |

Plot ^{18}O range in Al

apply ZOOM for details

0 - [He-base] F.Hubert et al, AD&ND Tables 46(1990)1
1 - [H -base] J.F.Ziegler et al, Pergamon Press, NY (low energy)
2 - ATIMA 1.2 LS-theory (recommended for high energy)
3 - ATIMA 1.2 without LS-correction
4 - Range straggling - method [0] - LISE
5 - Range straggling - method [1] - Atima
6 - Lateral range - method [0] - LISE
7 - Lateral range - method [1] - Atima
8 - Lateral range - method [2] - PDG

H.W.'s request

LISE v.9.9

Range and Energy Loss to   Al

Range	dRange (sigma)	
5.52107e+6	20620	mg/cm2
2.04333e+7	76312	micron

LISE v.9.10

Range and Energy Loss to   Al

Range	dRange (sigma)	
4.15358e+6	14840	mg/cm2
1.53722e+7	54923	micron

ATIMA

```
charge of fragment          [5.000000] ? 8
mass of fragment [amu]      [8.024606] ? 18
energy of fragment [MeV/u]  [308.500000] ? 27000
charge of material          [13] ?
mass of material            [27] ?
material thickness [mg/cm2] [100.000000] ? 1000
<I> read ATIMA splines for Al.
1: Z=13, A=26.981541, w=1.000000, pot=166.000000

particle Z=8 A=18.000000 E=27000.000000 MeV/u
target Z=13 A=27 T=1000.000000
exit energy         : 26993.083984 MeV/u
energy straggling : 2.050005 MeV/u (SD)
range               : 4154606.915041 mg/cm2 > 4153606.753428 mg/cm2
```
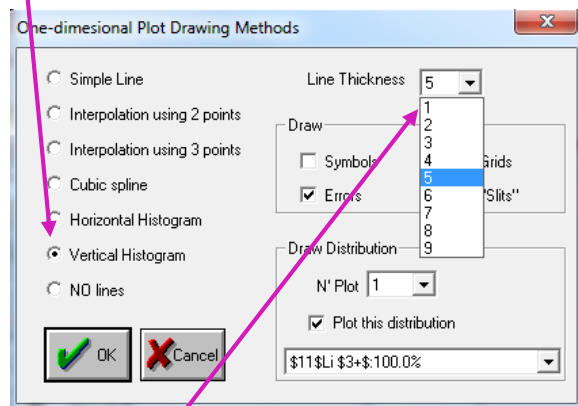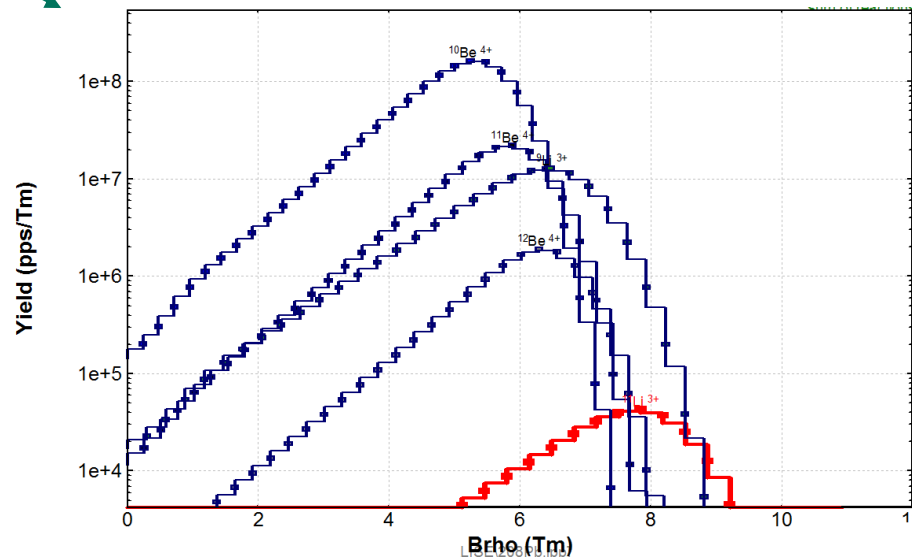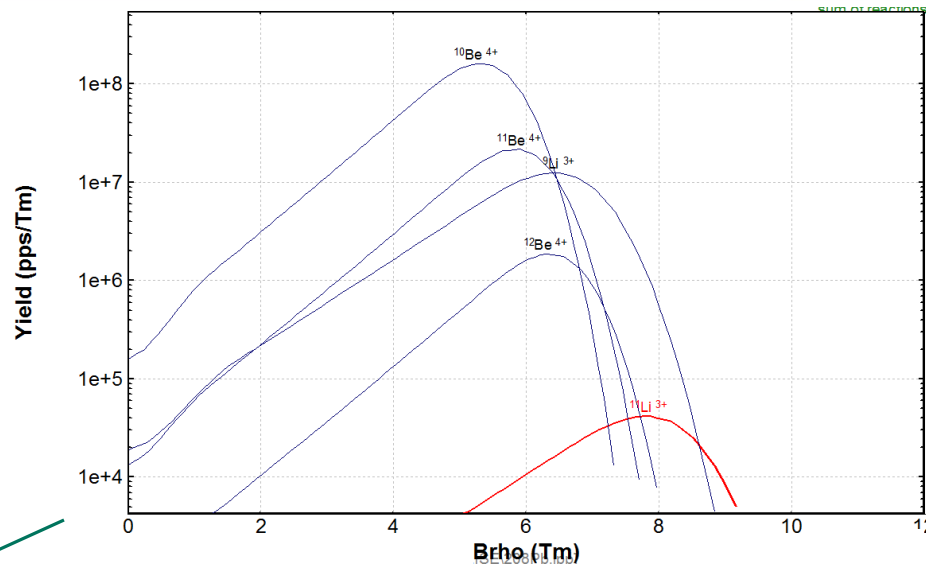
M.P.'s request

Example

Three ARIS separators
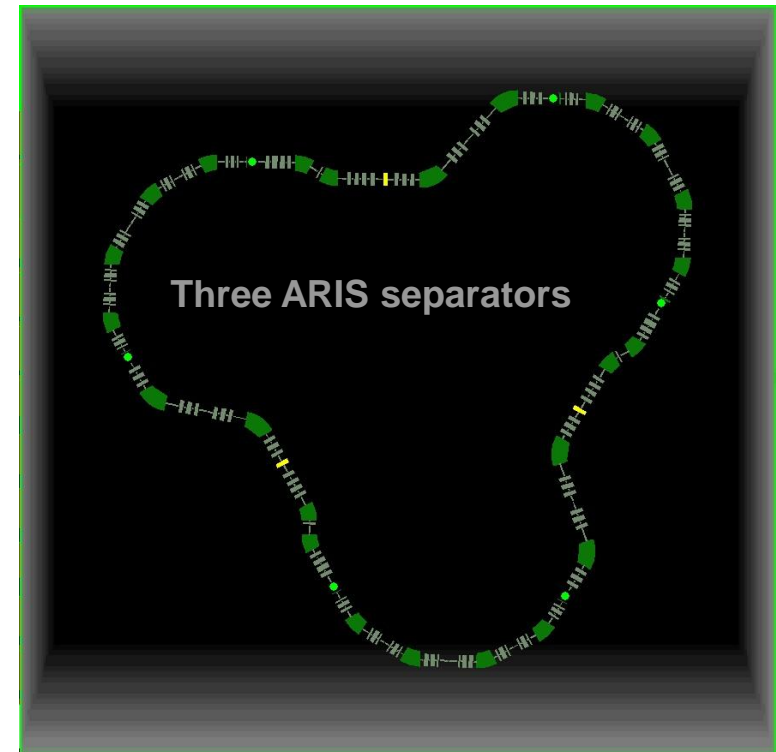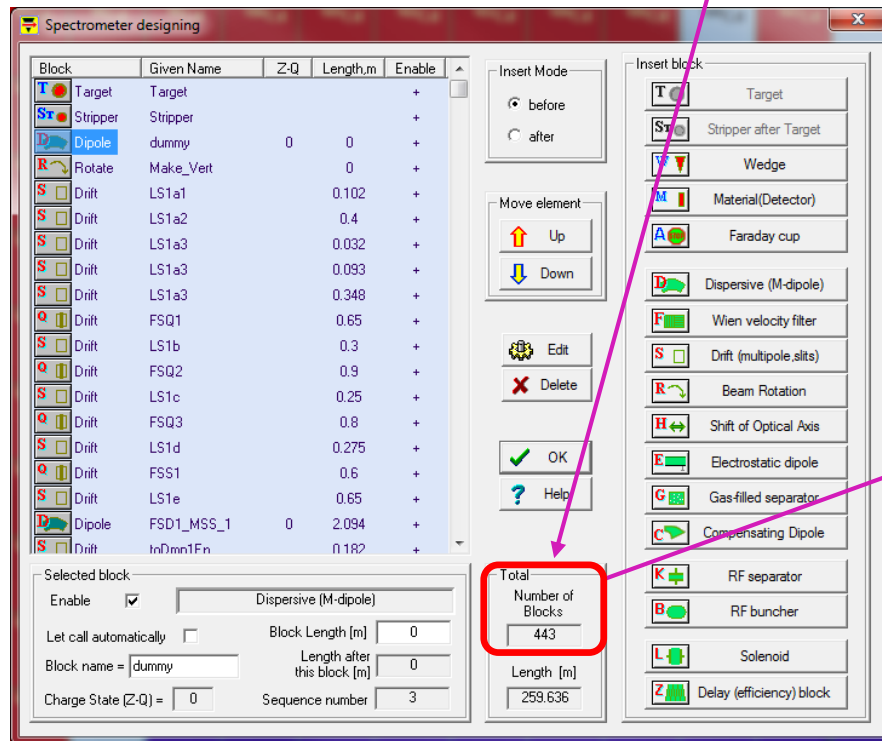
V-Histogram

User line thickness

D.J.M.'s request

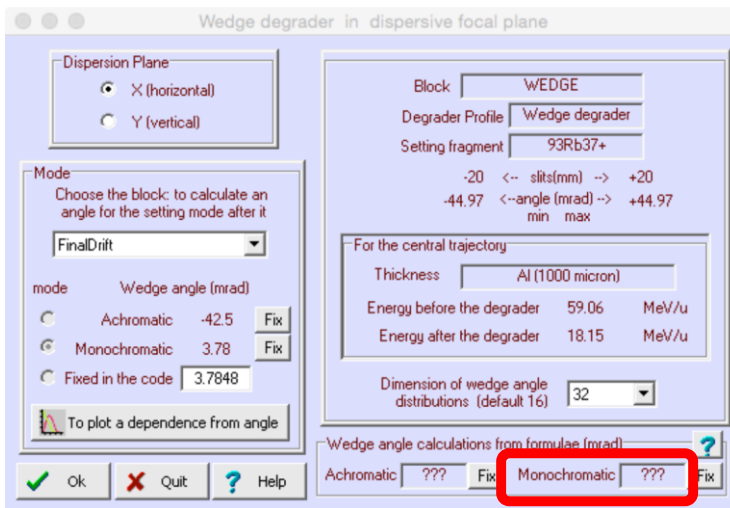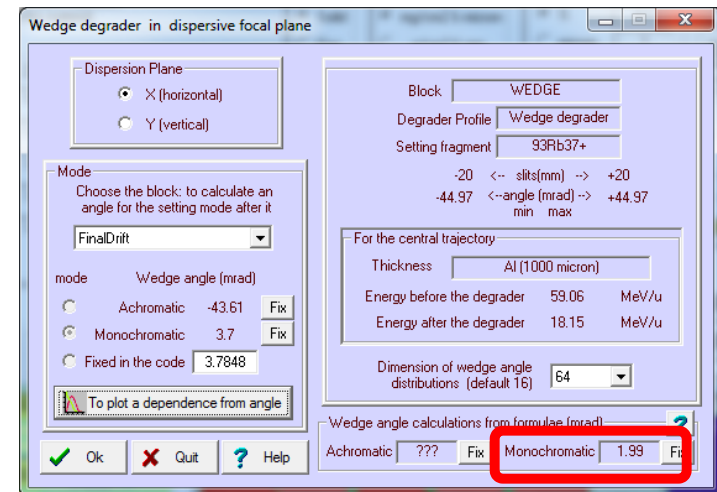**Local Dispersion between wedge and Final drift blocks is equal to 0.**
No solution in achromatic case, but for monochromatic case should be
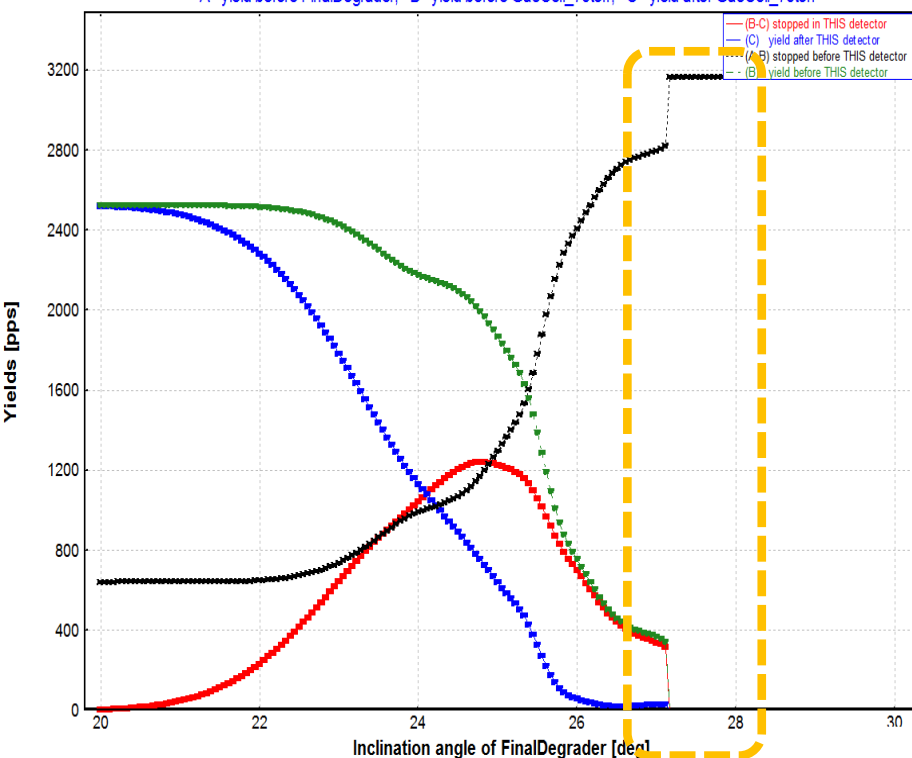
LISE v.9.9

LISE v.9.10

D.J.M.'s request

LISE v.9.9

LISE v.9.10

Range 1D-Optimizer: Number of particles stopped in GasCell_75torr
^{36}Ar (150.1 MeV/u) + Be (1269 mg/cm^2); Settings on ^{26}Si; Config: DDSWDDSDDDMDMDMWSMMM
dp/p=1.00% ; Wedges: Al (240 mg/cm^2), O2Si (1016 μm); Brho(Tm): 2.6319, 2.6319, 2.4570, 2.4570, 2.4570....
A - yield before FinalDegrader; B - yield before GasCell_75torr; C - yield after GasCell_75torr
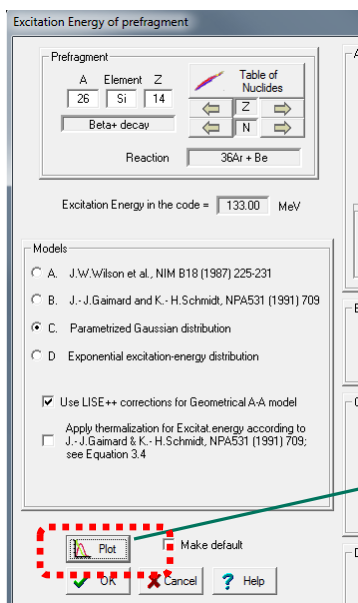
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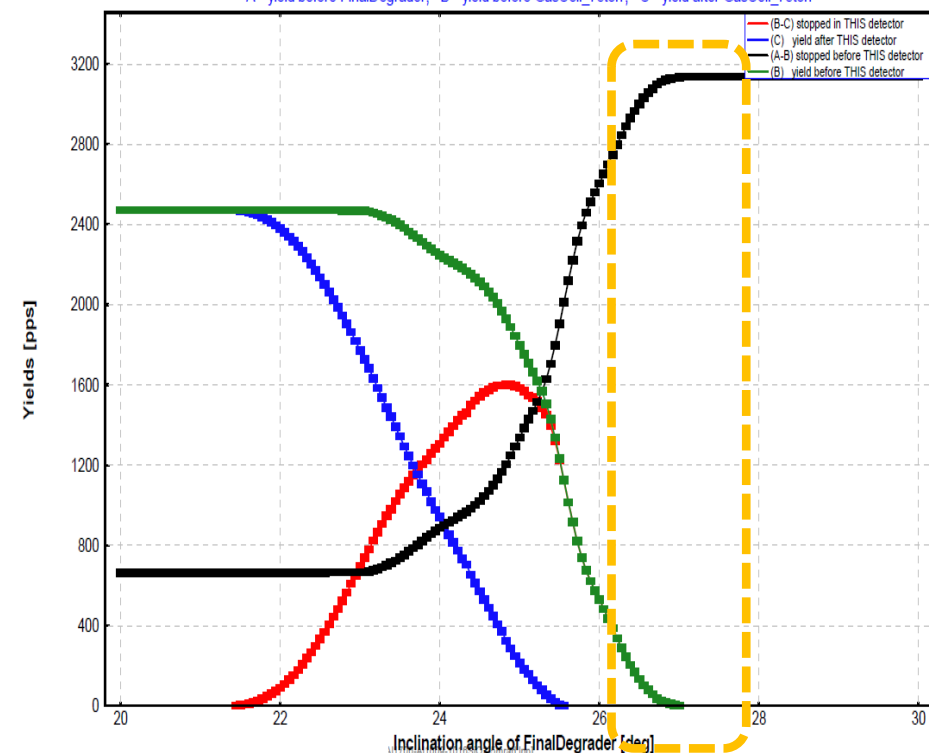
Purpose : obtain L_direct from the Geometrical Abrasion-Ablation model **assuming one nucleon stripping**
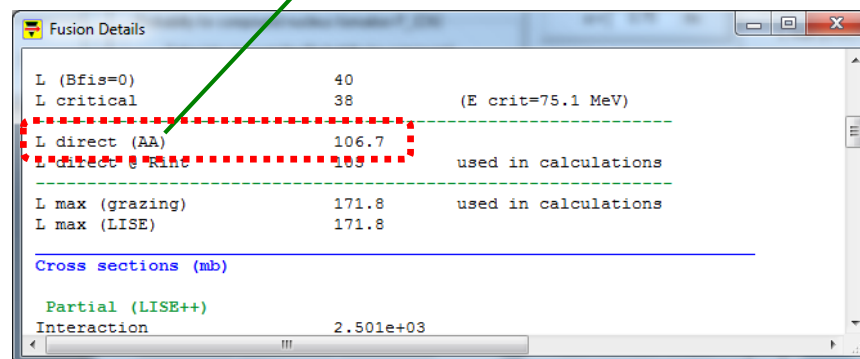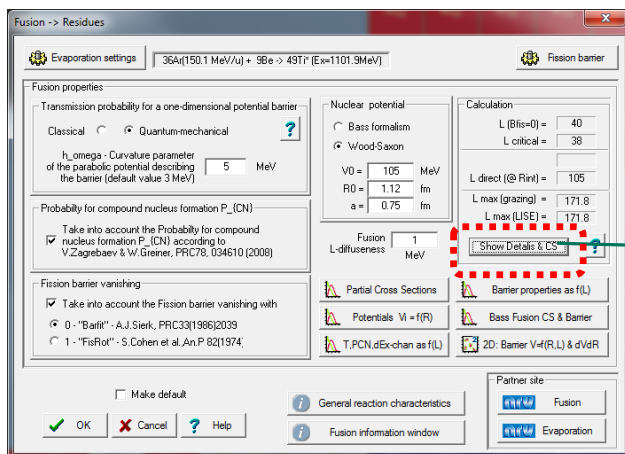
1. Atomic number of target in the "Show Setup" frame

2. "Dummy" blocks modifications for the Scheme

3. Physical Calculator modifications for Range and degrader values

4. Plot1 legend size

5. Energy loss : MaxZtargetHubert=92, NumberTabELOSS = 100

6. Momentum "L" is new parameter of the "S_Element" class for Abrasion-Ablation

7. New class "TListShowWindow" :
   TShowMCtrans based on TListShowWindow
   W_ShowCalc based on TListShowWindow
   Correction for overall transmission in the ShowCalc window
   ShowCalc -- modification for charge state numbers (%-3d format)
   Bug correction in the WShow subroutine
   Upgrade The ShowValues window class in the Fusion dialog

8. Reaction characteristics from Energy : corrections

9. "Custom shape degrader" dialog: option to skip
   energy/position calculations in polynomial mode