Universal parameterization (“Convolution” method) revision

- “Universal parameterization” (UP) consists from two main blocks
  - Prefragment search
    - search direction,
    - excitation energy model
  - Momentum distribution “Convolution” model
    - separation energy models
- UP has been created more than 20* years ago and some solutions were long overdue

- Active development of the LISE^{++} Abrasion-Ablation (AA) model, that helped to understand reaction physics at intermediate energies, and results of comparison AA calculations with experimental data should be used to revise the UP model
- Some new experimental results in exotic regions demonstrated deviation from UP-2000 predictions

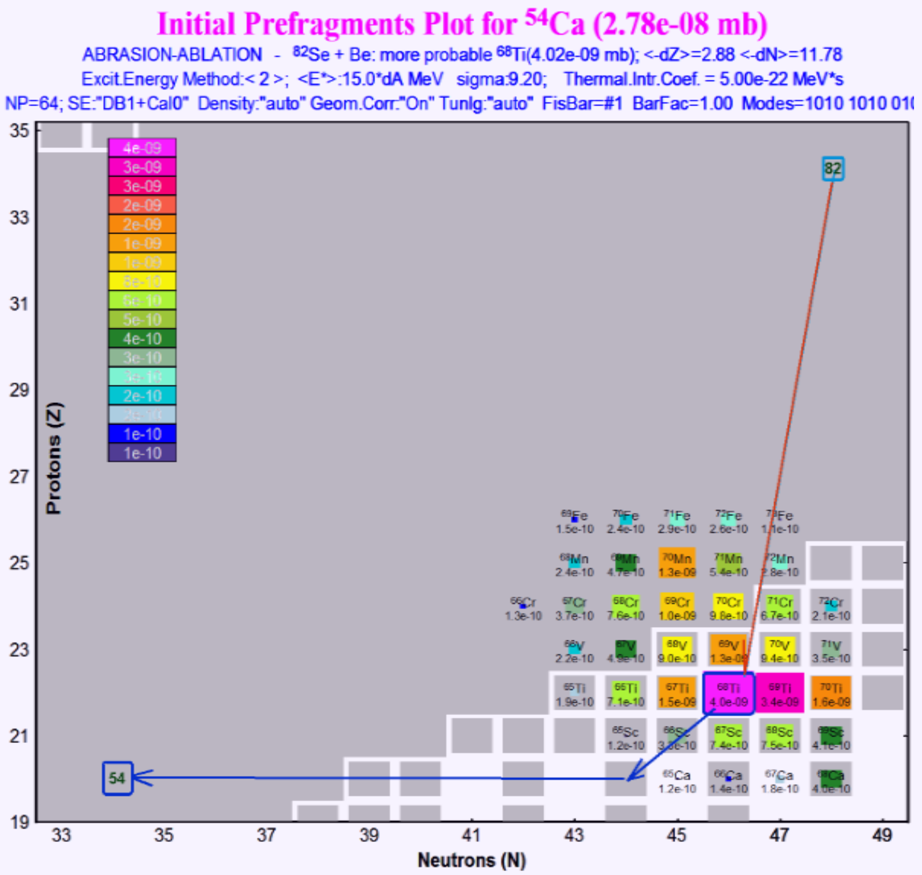
** Published in 2004: O.T., Nuclear Physics A734 (2004) 536-540*

❖ Prefragment search

- search direction

❑ More probable prefragments calculated with LISE++ Abrasion-Ablation (AA) model show drastically differences with the UP search results

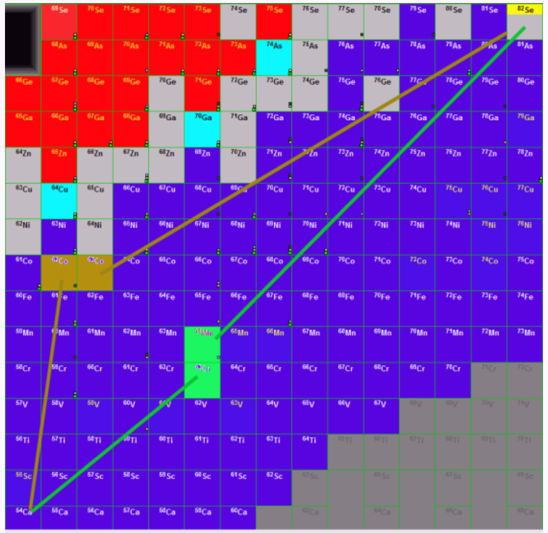
http://lise.nscl.msu.edu/9_4/94_AA.pdf#page=10



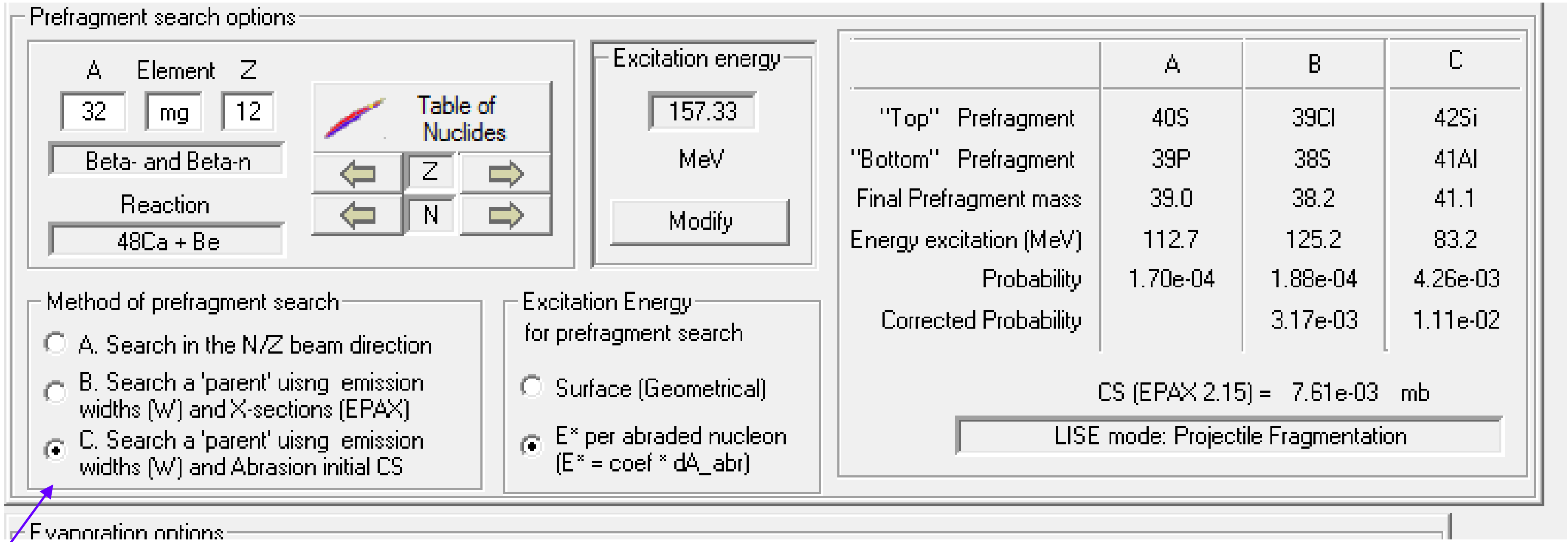
Method of prefragment search
A. Search in the N/Z beam direction
B. Search a 'parent' uisng emission widths (W) and X-sections (EPAX)

Excitation Energy for prefragment search
Surface (Geometrical)

	A	B
"Top" Prefragment	64Mn	63Co
"Bottom" Prefragment	63Cr	62Co
Final Prefragment mass	63.4	62.0
Energy excitation (MeV)	149.3	169.2
Probability	1.67e-06	4.55e-07



New prefragment search method "C"

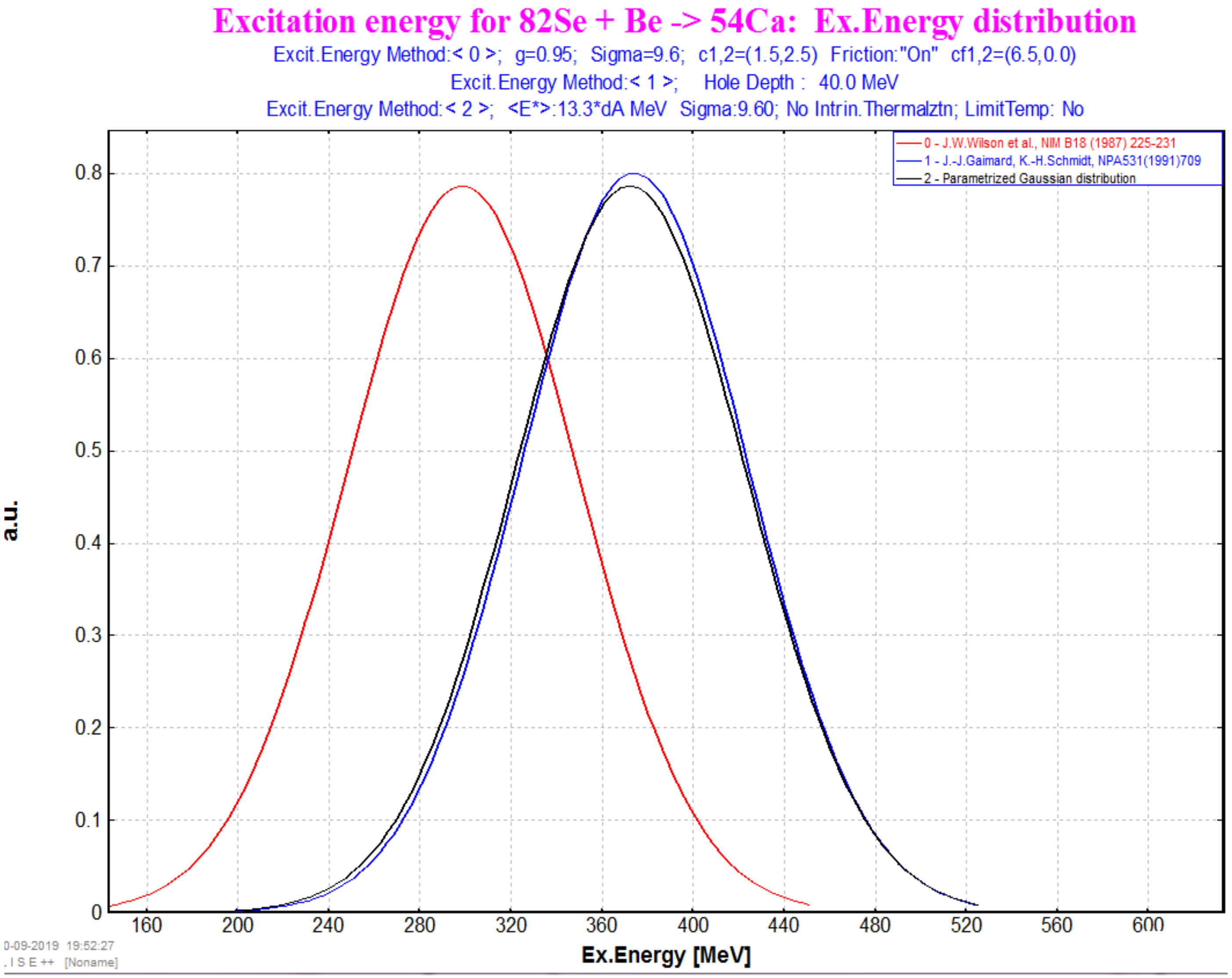


new search option :
$P = W * CS_{geom} * factorial$

CS_{geom} – geometrical cross section to for production of prefragment with A-nucleons,
factorial – probability for Z-protons and N-protons after projectile abrasion

What is already out of date? [2]

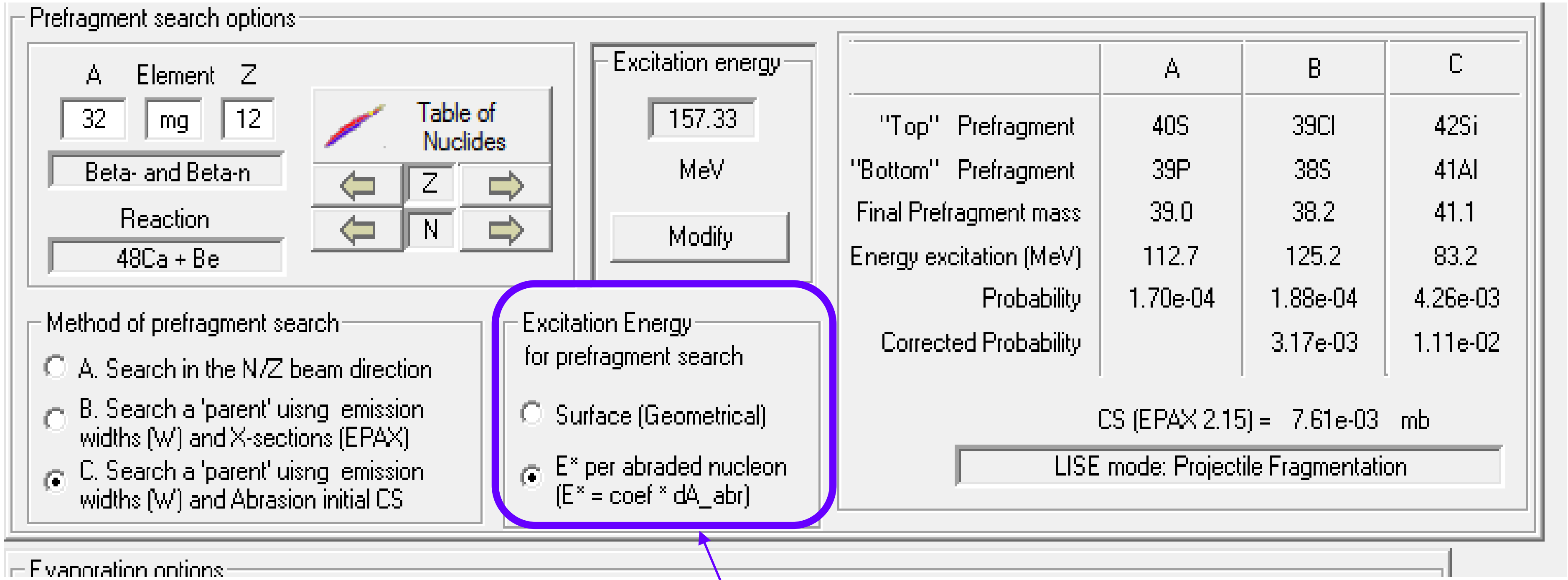
- **Prefragment search**
  - excitation energy model



- The Previous prefragment search version was based only on geometrical “dSurface” excitation energy model (J.W.Wilson et al., NIM B18 (1986) 225),

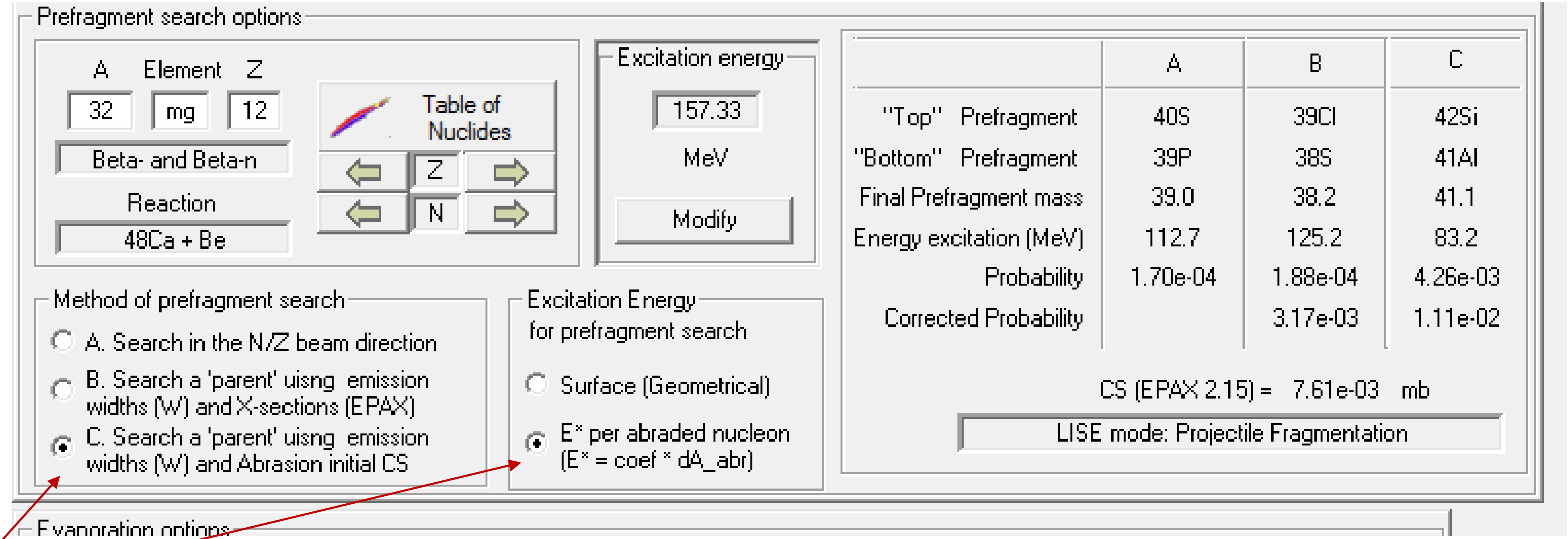
  although mainly J.-J. Gaimard and K.-H.Schmidt NPA531(1991)709 model used in LISE^{++} Abrasion-Ablation cross-sections calculations

New excitation energy model (#1) to use in prefragment search



New radiobutton frame with new search option: “E* per abraded nucleon”. The Previous search version was based only on the “dSurface” energy.

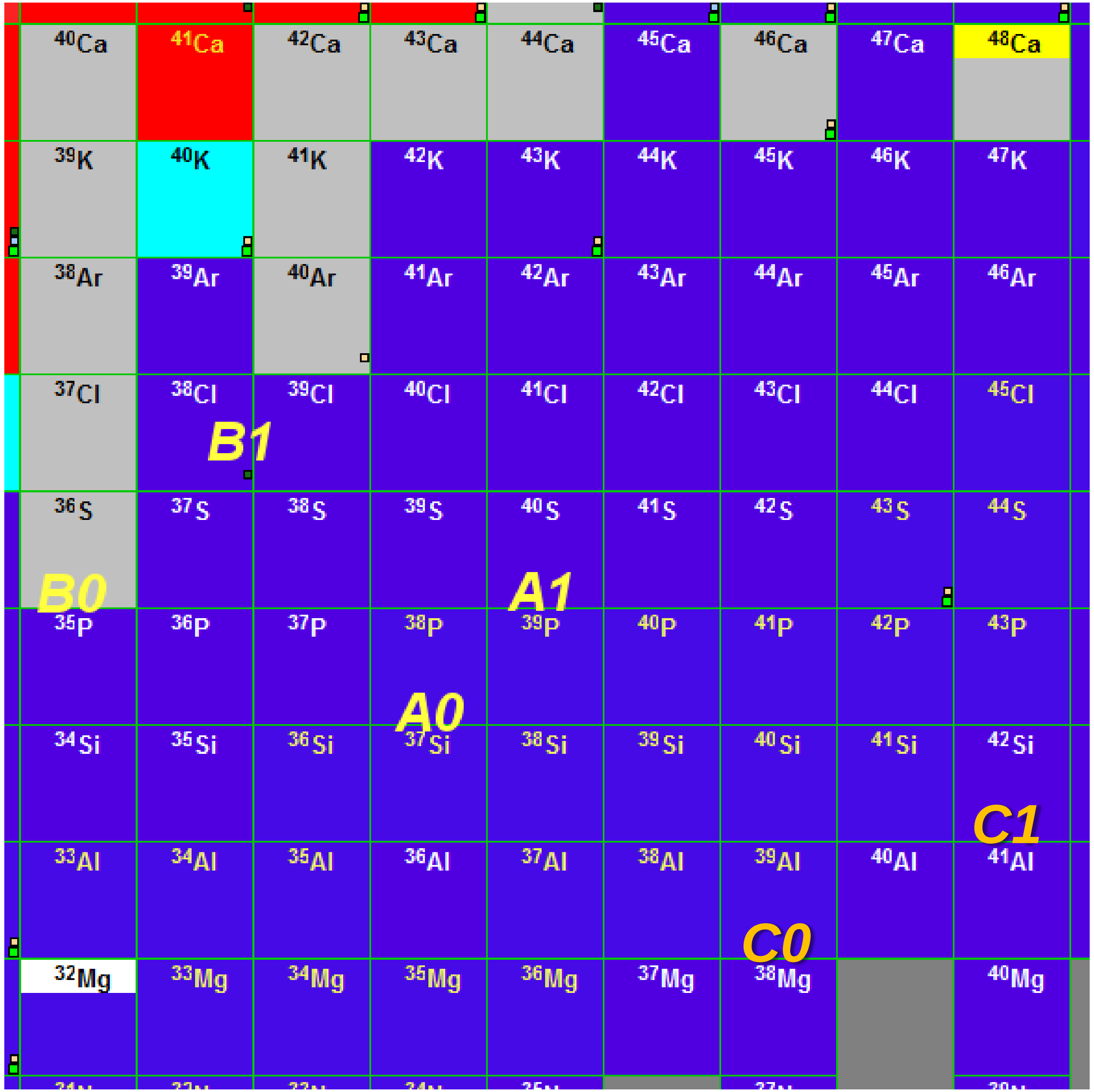
Prefragment calculation settings : v.11.1.102



New default
Settings **"C1"**

^{48}Ca (140 MeV/u) → ^{32}Mg : options A, B & C

v.11.1.102



Excitation Energy for prefragment search

- Surface (Geometrical)
- E* per abraded nucleon (E* = coef * dA_abr)

	A	B	C
"Top" Prefragment	40S	39Cl	42Si
"Bottom" Prefragment	39P	38S	41Al
Final Prefragment mass	39.0	38.2	41.1
Energy excitation (MeV)	112.7	125.2	83.2
Probability	1.70e-04	1.88e-04	4.26e-03
Corrected Probability		3.17e-03	1.11e-02

Starting v.11.1.102
"C1" is recommended option!

MICHIGAN STATE UNIVERSITY

- Momentum distribution
  "Convolution" model
  - separation energy models

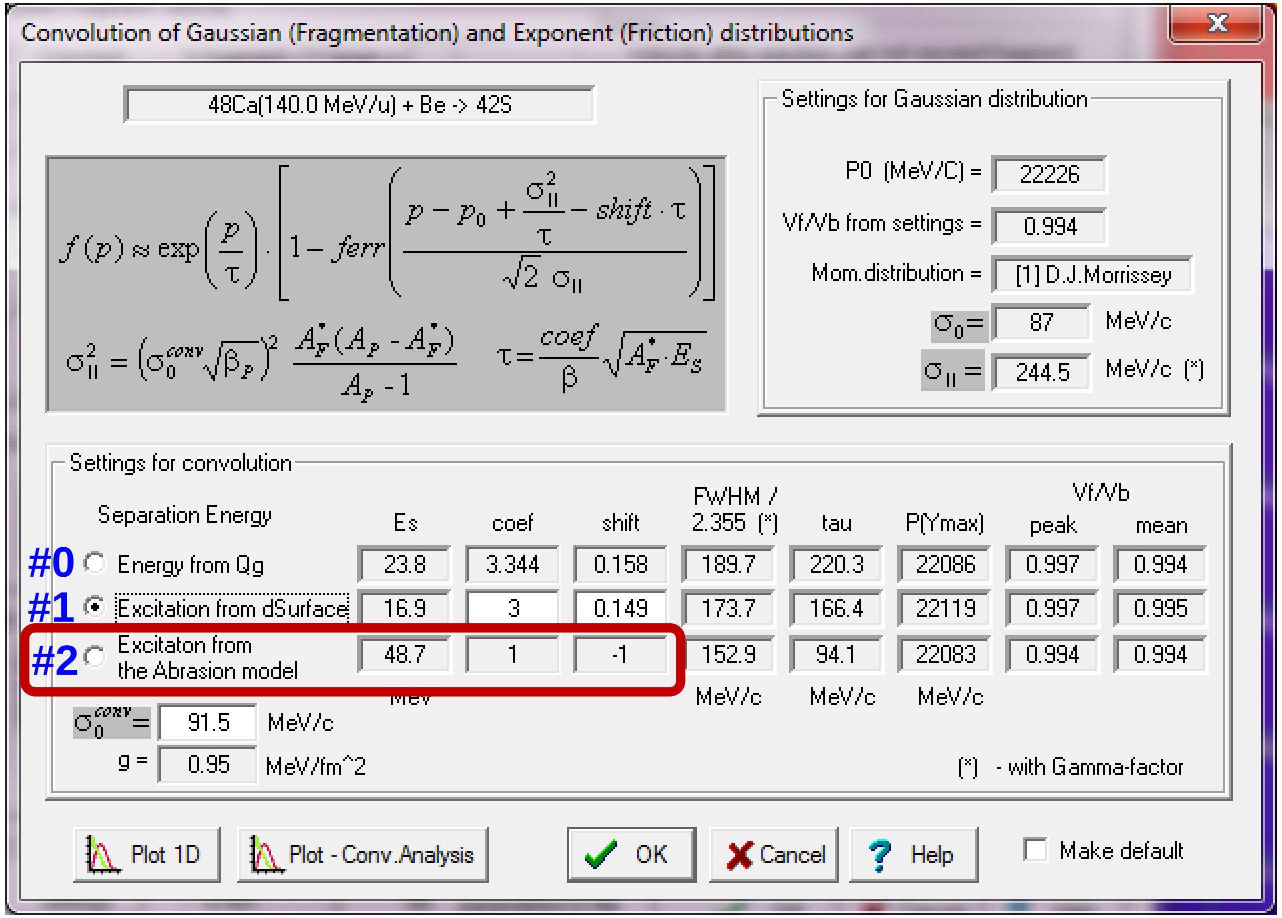
Update of the Convolution method dialog

$$E_S = E_0 * dA$$

dA - number of abraded nucleons calculated by a module set in the Prefragment search dialog

E0 – currently set to 14 Mev

New version

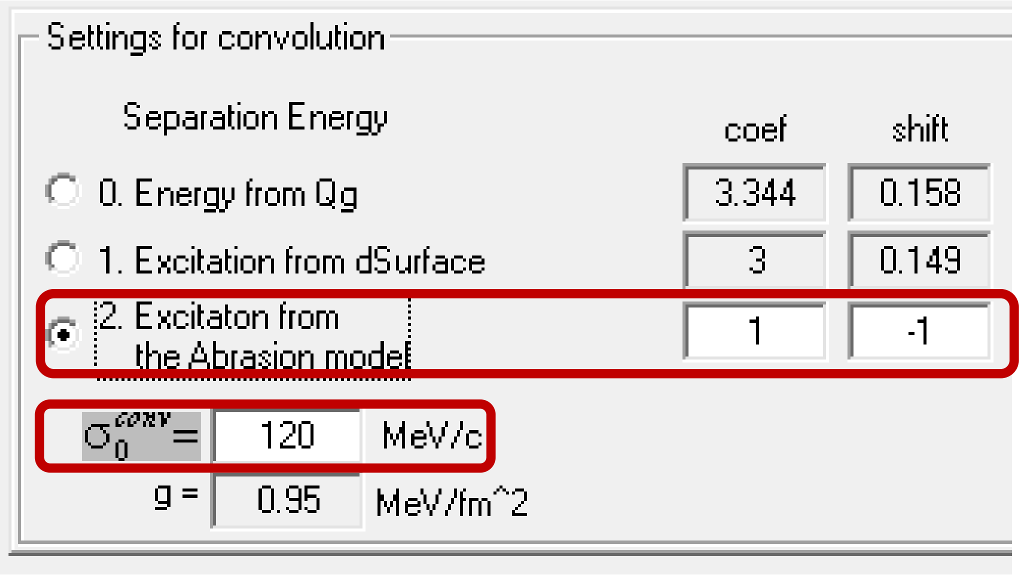


Old version

New default parameters for the Convolution model

$$f(p) \approx \exp\left(\frac{p}{\tau}\right) \cdot \left[1 - ferr\left(\frac{p - p_0 + \frac{\sigma_{\parallel}^2}{\tau} - shift \cdot \tau}{\sqrt{2}\,\sigma_{\parallel}}\right)\right]$$

$$\sigma_{\parallel}^2 = \left(\sigma_0^{conv}\sqrt{\beta_p}\right)^2 \frac{A_F^{\bullet}(A_p - A_F^{\bullet})}{A_p - 1} \qquad \tau = \frac{coef}{\beta}\sqrt{A_F^{\bullet} \cdot E_S}$$

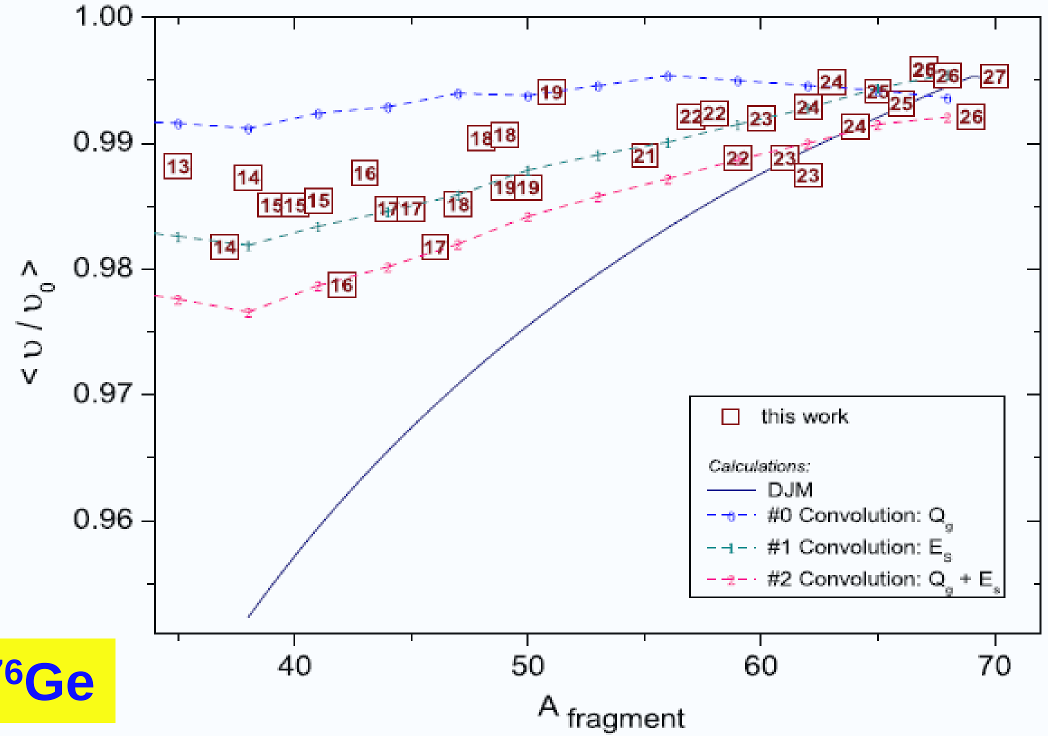


All new default parameters can be downloaded from "A1900_2019.lopt" file in the LISE^{++} v.11.1.102 package

Projectile Isospin and Velocity fragment

Velocity of fragments : neutron-rich region

O.B. Tarasov et al. / Nuclear Instruments and Methods in Physics Research A 620 (2010) 578–584



^{76}Ge

Fig. 4. (Color online) Experimental mean ratios of the fragment velocities to the projectile velocity for neutron-rich isotopes (located along the line $A=2.56q+1.6$) produced by fragmentation of a ^{76}Ge beam at 132 MeV/u with beryllium targets. The atomic numbers are shown inside of rectangles. The solid line represents calculations using Morrissey's model [2] with default settings ($\sigma_0=87$ MeV/c, $E_S=8$ MeV). See text for details. The dashed lines represent the convolution model results with separation energy modes as listed in Table 4.

the separation energy parameter for nuclei observed in the present work in the region $A_P/2 \le A_F \le A_P$ exhibits a linear decrease with the number of removed nucleons:

for DJM

$$E_S = 8 - 11.2\Delta A/A_P$$

where $\Delta A = A_P - A_F$, A_P is the projectile mass number, and A_F is the fragment mass number.

OT et al., PHYSICAL REVIEW C **87**, 054612 (2013)

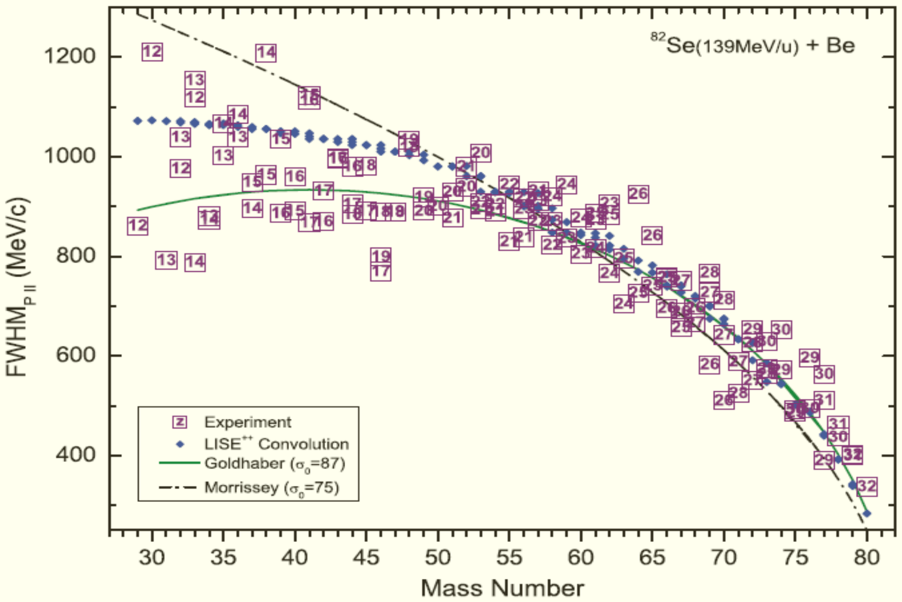


FIG. 5. (Color online) Widths of the parallel momentum component as a function of the mass number of fragments produced in the reaction ^{82}Se beams with beryllium targets. Small diamonds denote calculations by the convolution model [38] with default settings for separation energy (E_s) option #1 in LISE^{++}. Solid green and dot-dashed black lines represent the best fit to the data for the Goldhaber [35] and Morrissey [36] models, respectively.

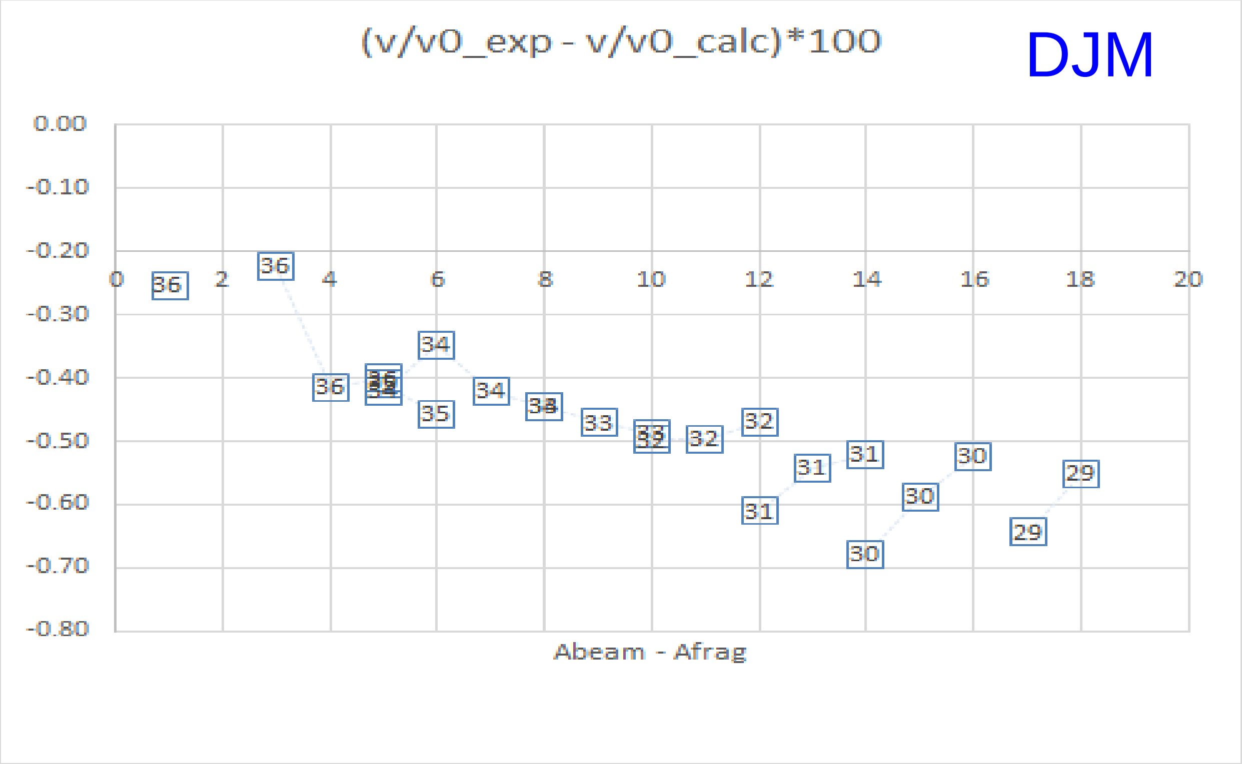
^{82}Se

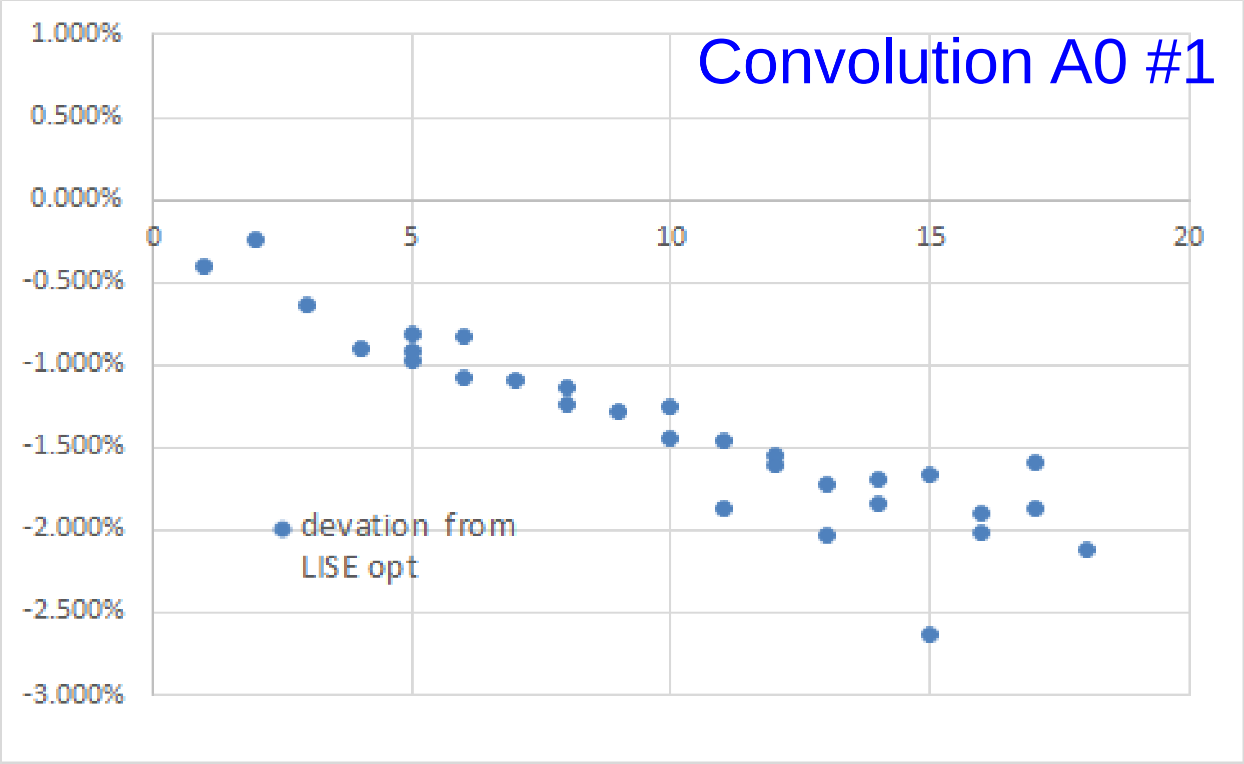
for DJM $\quad E_S = 8 - 9.2\Delta A/A_P,$

The Universal parameterization fairly describes mean values and widths of velocity distributions in a neutron-rich region, whereas fragments are faster and distributions are narrow comparing to the DJM parameterization with default parameters.

Velocity of fragments : proton-rich region

^{78}Kr (150 MeV/u) + Be(374 mg/cm^2) @ NSCL

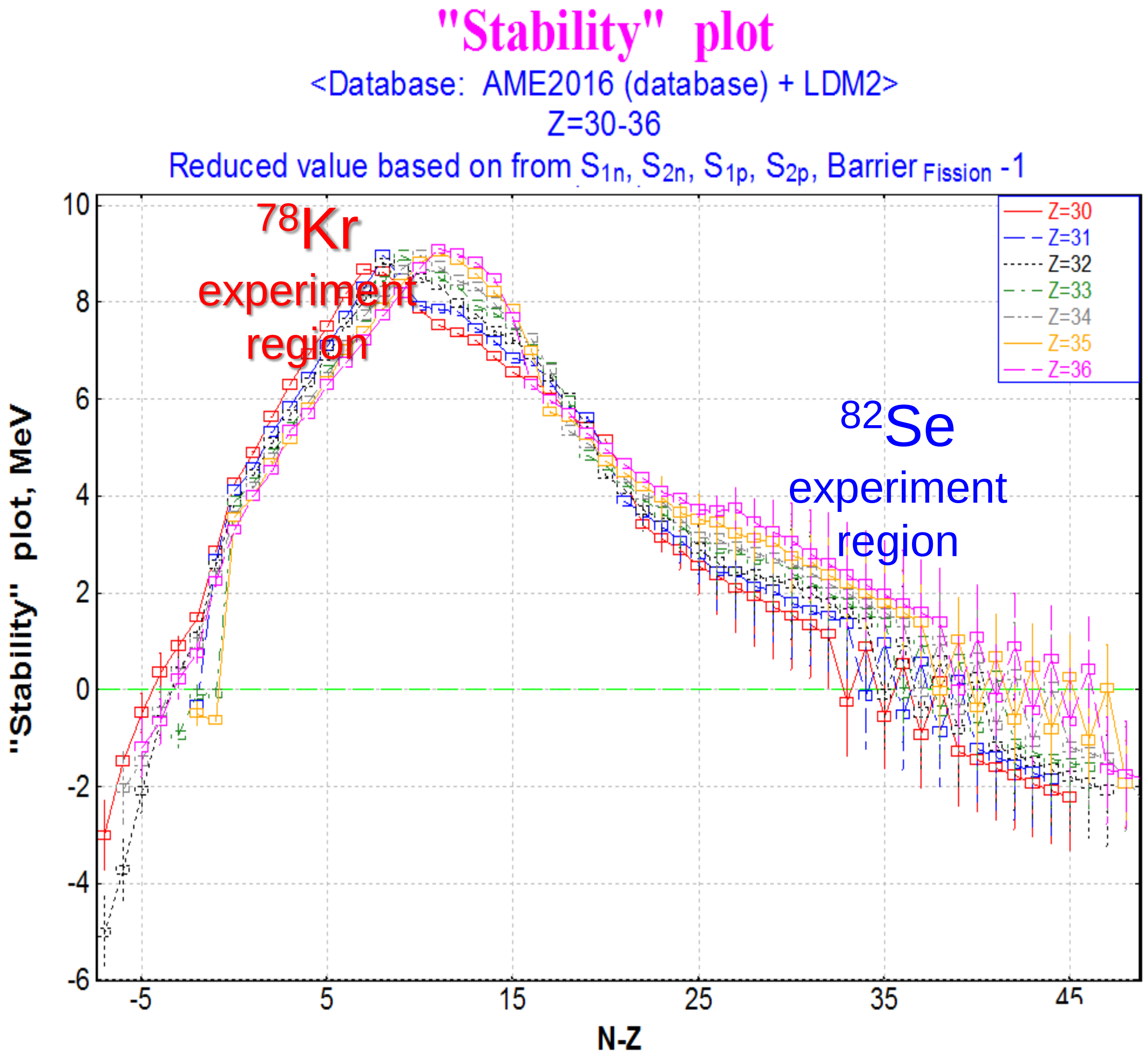


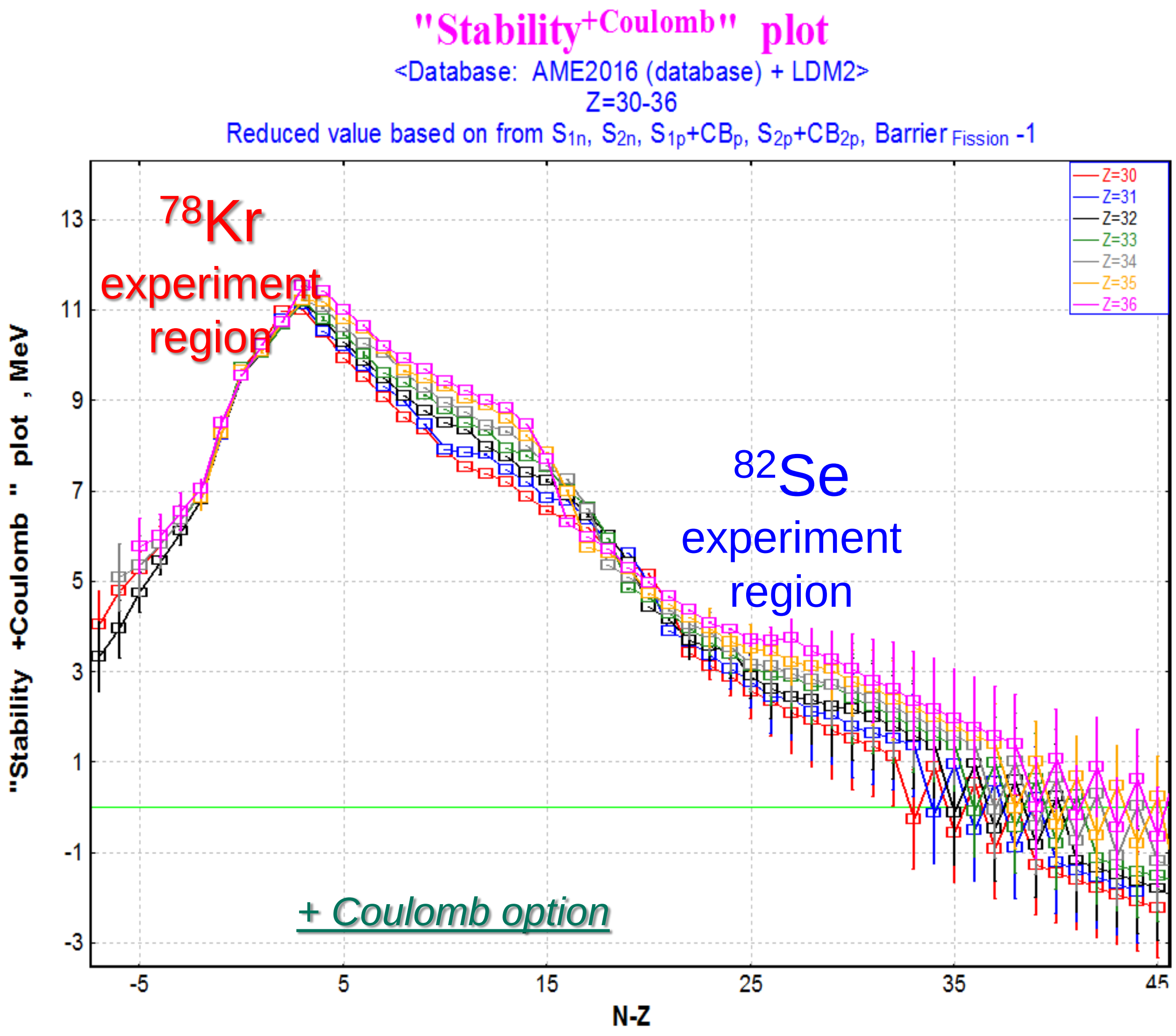


http://lise.nscl.msu.edu/paper/velocity/2019_05_17_78Kr_results.pdf

Both models with default parameters predict significantly faster fragments.
DJM with E_s parameter equal to 10 (instead default 8) reproduce experimental data

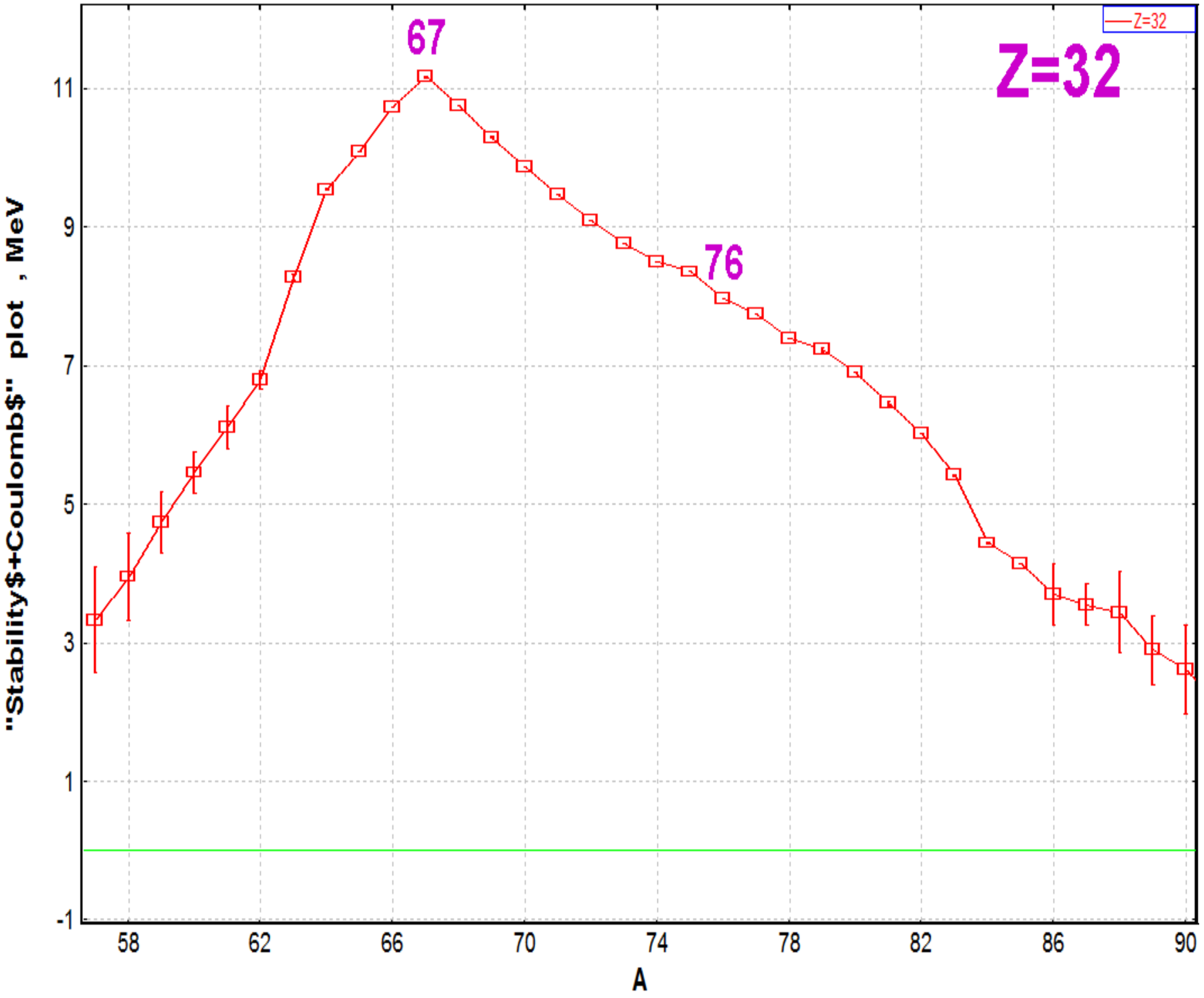
Binding energies changes from west to east

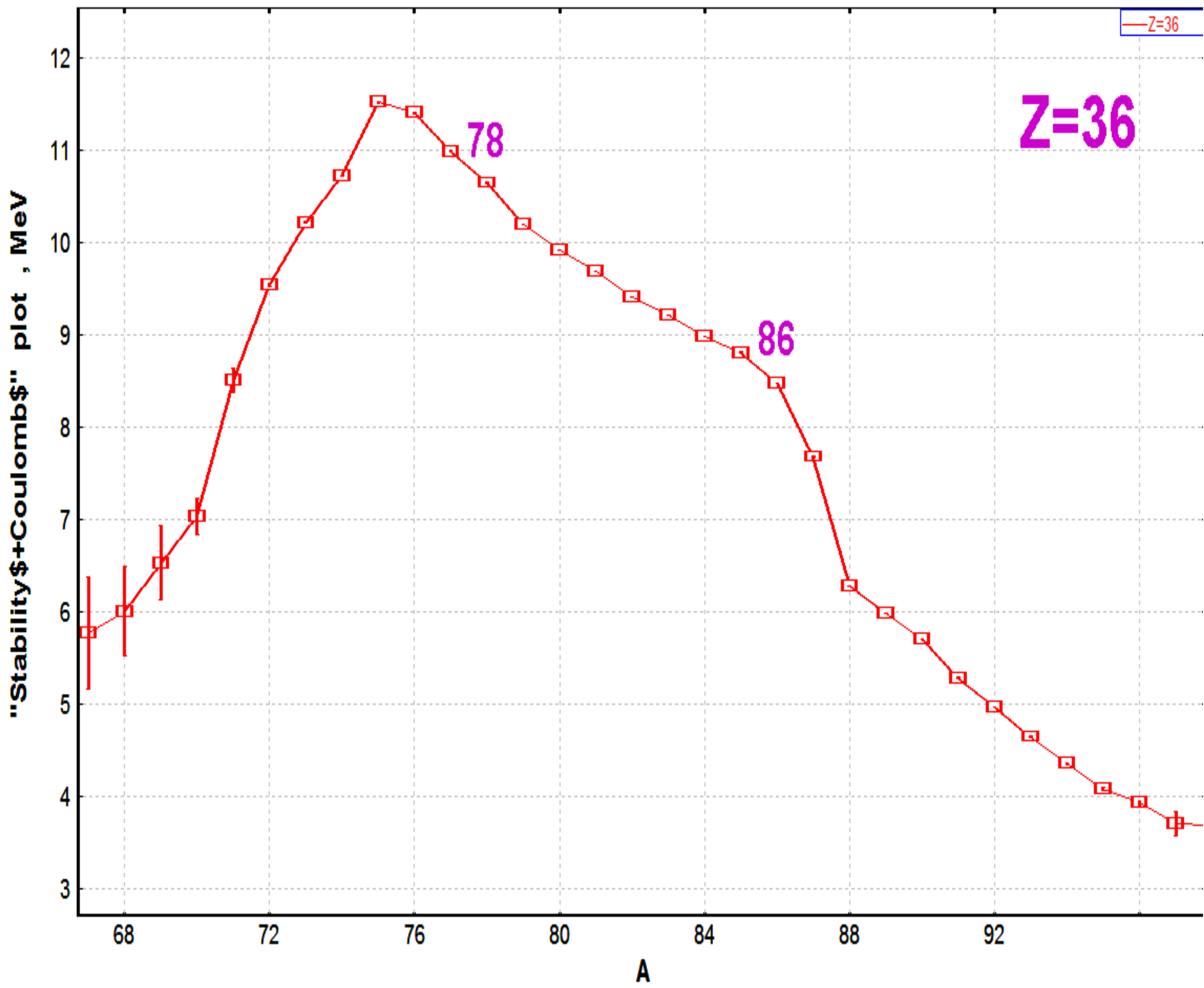




http://lise.nscl.msu.edu/9_8/LISE_stability_plot.pdf

“Stability” plots + Coulomb option





“Stability” plots with Coulomb option demonstrate isotope ability to the evaporation cascade, because a charge evaporated particle should overcome Coulomb barrier

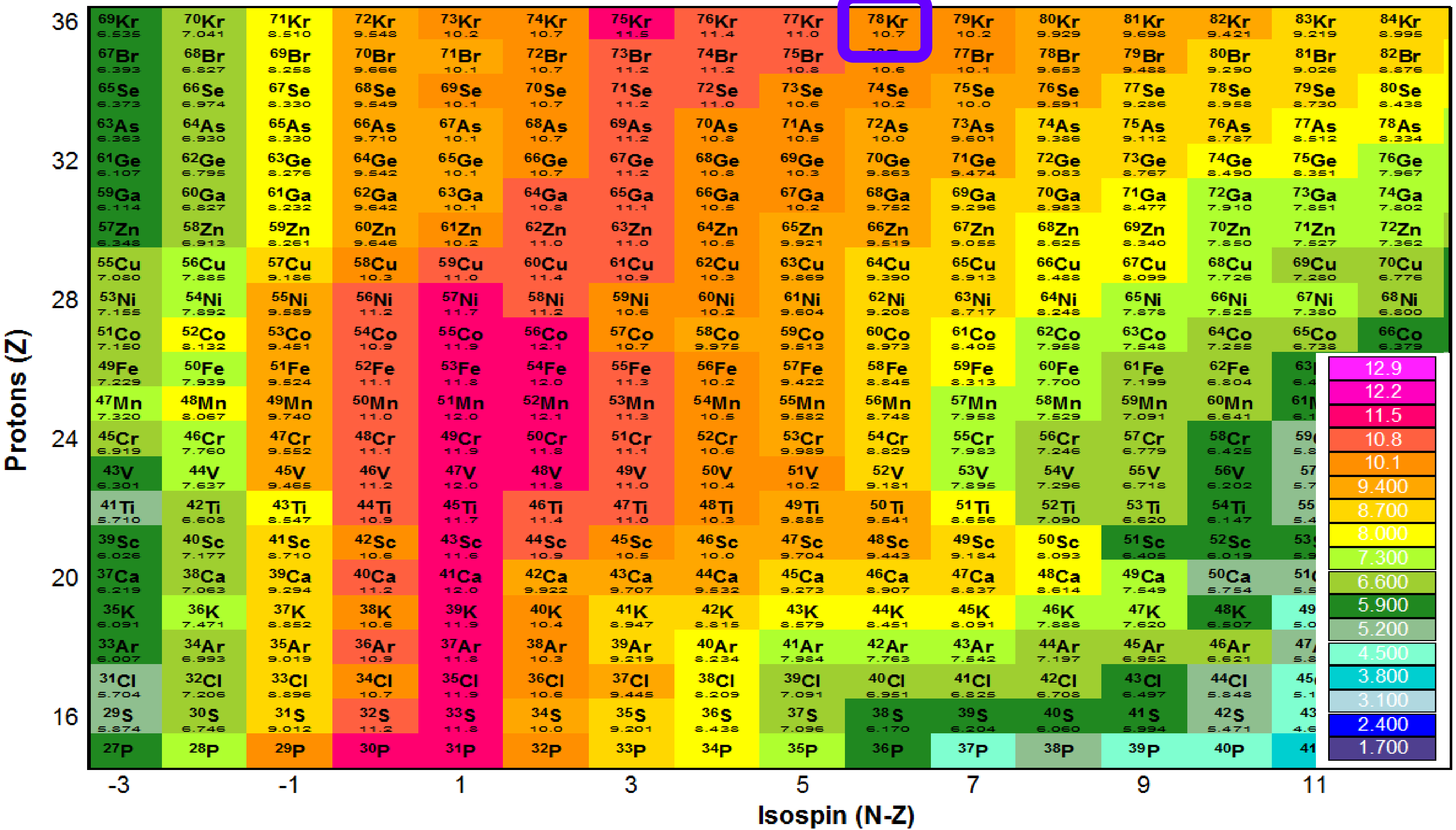
“Stability” plots + Coulomb option

"Stability$^{+Coulomb}$" plot

<Database: AME2016 (database) + LDM2>

N-Z=-50-200

Reduced value based on from S_{1n}, S_{2n}, S_{1p}+CB_p, S_{2p}+CB_{2p}, Barrier $_{Fission}$ -1



“Stability” plots with Coulomb option demonstrate isotope ability to the evaporation cascade, because a charge evaporated particle should overcome Coulomb barrier

Repeat:

DJM’s model with E_s parameter equal to 10 (instead default 8) reproduce ^{78}Kr beam experimental data

^{78}Kr (150 MeV/u) + Be(374 mg/cm^2) experiment @ NSCL

MICHIGAN STATE UNIVERSITY

A0

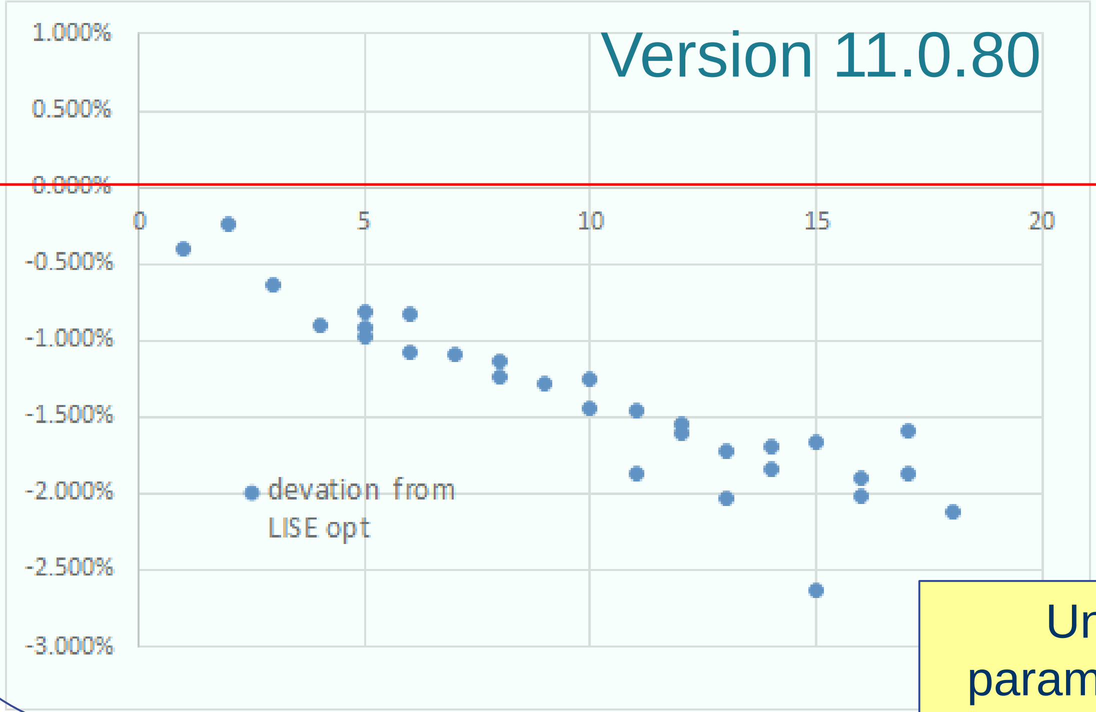
Method of prefragment search
- (•) A. Search in N/Z beam direction
- ( ) B. Search a 'parent' nucleus uisng emission widths and cross-sections

Exc.Energy to prefragment search
- (•) Surface (Geometrical)
- ( ) E* per abraded nucleon E* = c * dAabr

#1

Separation Energy	coef	shift
( ) Energy from Qg	3.344	0.158
(•) Excitation from dSurface	3	0.149
( ) Excitaton from the Abrasion model	1	-1

σ_0^{conv} = 91.5 MeV/c



A1

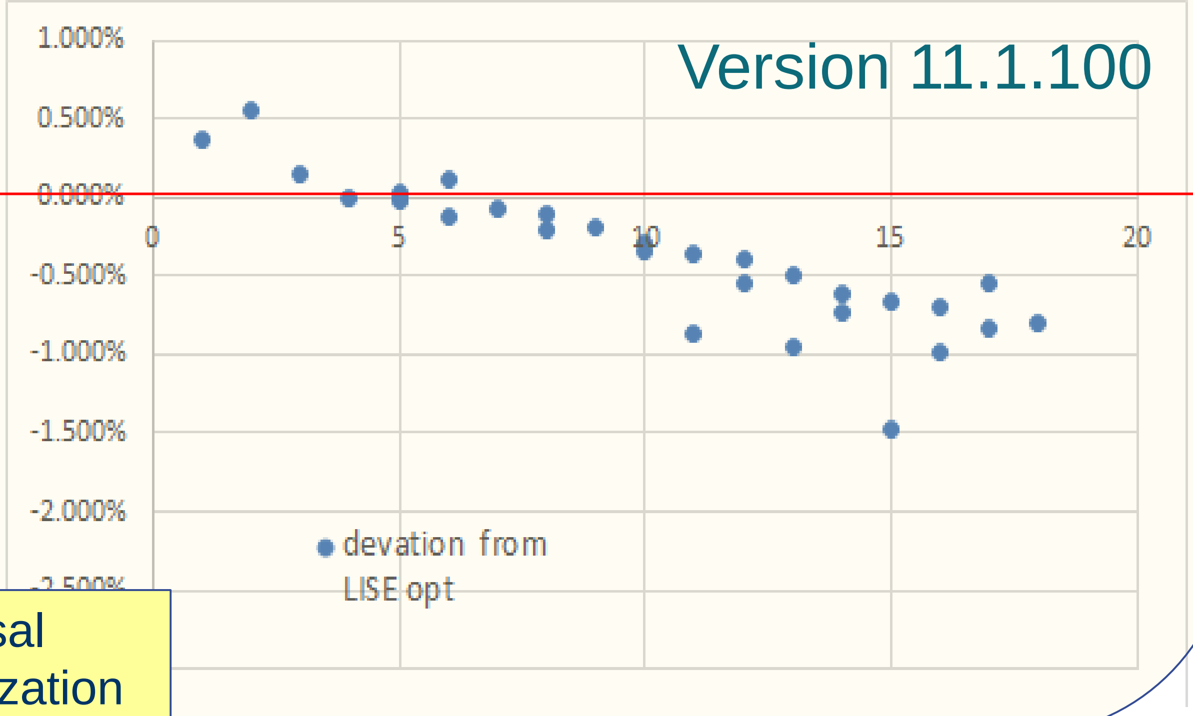
Method of prefragment search
- (•) A. Search in N/Z beam direction
- ( ) B. Search a 'parent' nucleus uisng emission widths and cross-sections

Exc.Energy to prefragment search
- ( ) Surface (Geometrical)
- (•) E* per abraded nucleon E* = c * dAabr

#2

Separation Energy	coef	shift
( ) Energy from Qg	3.344	0.158
( ) Excitation from dSurface	3	0.149
(•) Excitaton from the Abrasion model	1	-1

σ_0^{conv} = 120 MeV/c



Universal parameterization

X-axis: A_{beam} - $A_{fragment}$

LISE_opt → Brho-value corresponding to maximum yield from the convolution model

^{78}Kr (150 MeV/u) + Be(374 mg/cm^2) experiment @ NSCL

MICHIGAN STATE UNIVERSITY

A0

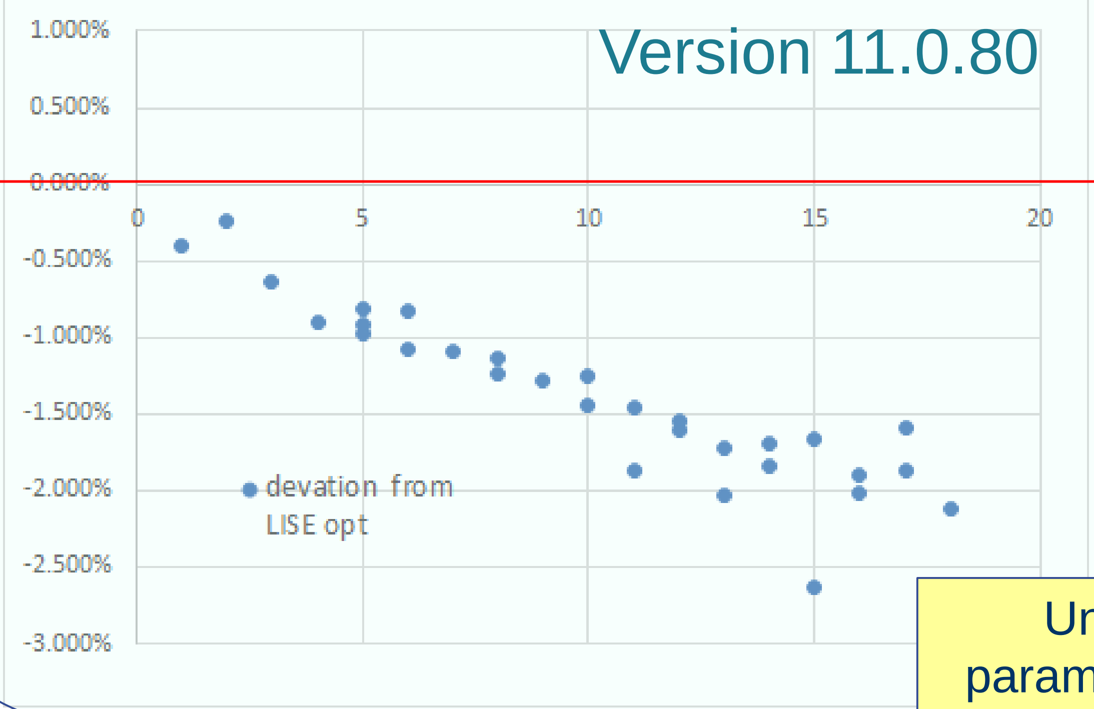
Method of prefragment search
- (•) A. Search in N/Z beam direction
- ( ) B. Search a 'parent' nucleus uisng emission widths and cross-sections

Exc.Energy to prefragment search
- (•) Surface (Geometrical)
- ( ) E* per abraded nucleon E* = c * dAabr

#1

Separation Energy	coef	shift
( ) Energy from Qg	3.344	0.158
(•) Excitation from dSurface	3	0.149
( ) Excitaton from the Abrasion model	1	-1

σ_0^{conv} = 91.5 MeV/c



C1

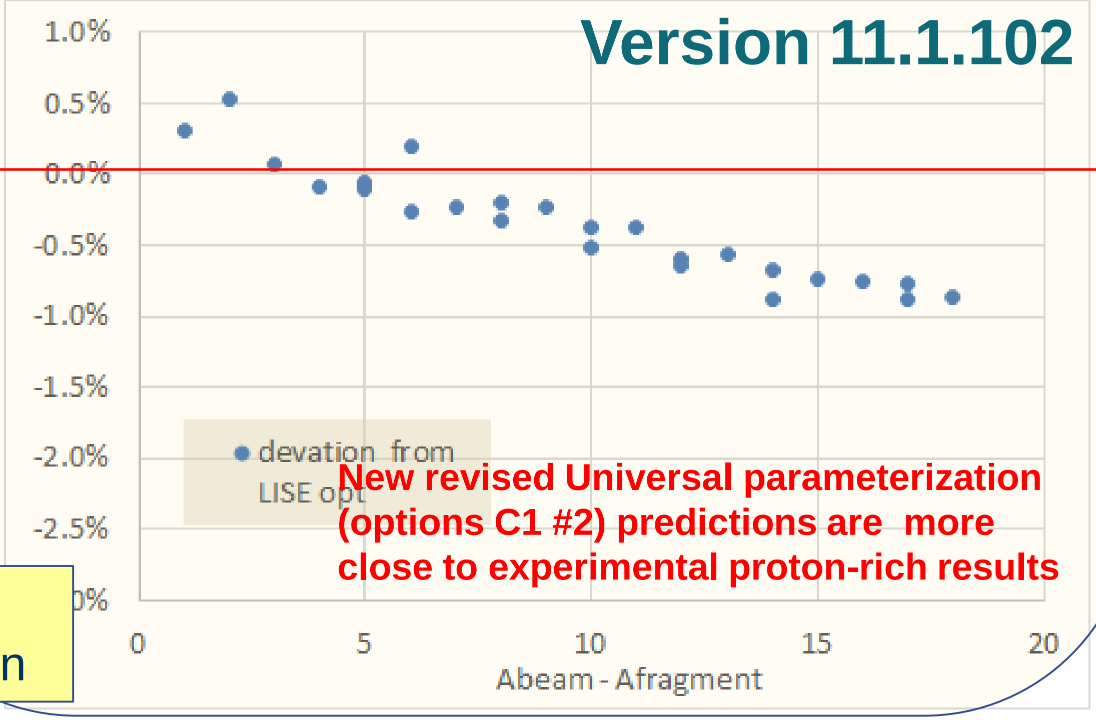
Method of prefragment search
- ( ) A. Search in the N/Z beam direction
- ( ) B. Search a 'parent' uisng emission widths (W) and X-sections (EPAX)
- (•) C. Search a 'parent' uisng emission widths (W) and Abrasion initial CS

Exc.Energy to prefragment search
- ( ) Surface (Geometrical)
- (•) E* per abraded nucleon E* = c * dAabr

#2

Separation Energy	coef	shift
( ) Energy from Qg	3.344	0.158
( ) Excitation from dSurface	3	0.149
(•) Excitaton from the Abrasion model	1	-1

σ_0^{conv} = 120 MeV/c



New revised Universal parameterization (options C1 #2) predictions are more close to experimental proton-rich results

Universal parameterization

X-axis: A_{beam} - $A_{fragment}$

LISE_opt → Brho-value corresponding to maximum yield from the convolution model

Momentum distributions as beam isospin function : - 10n

MICHIGAN STATE UNIVERSITY

Convolution "C1"

"C1" – prefragment search
2 – convolution model (120,1,-1)

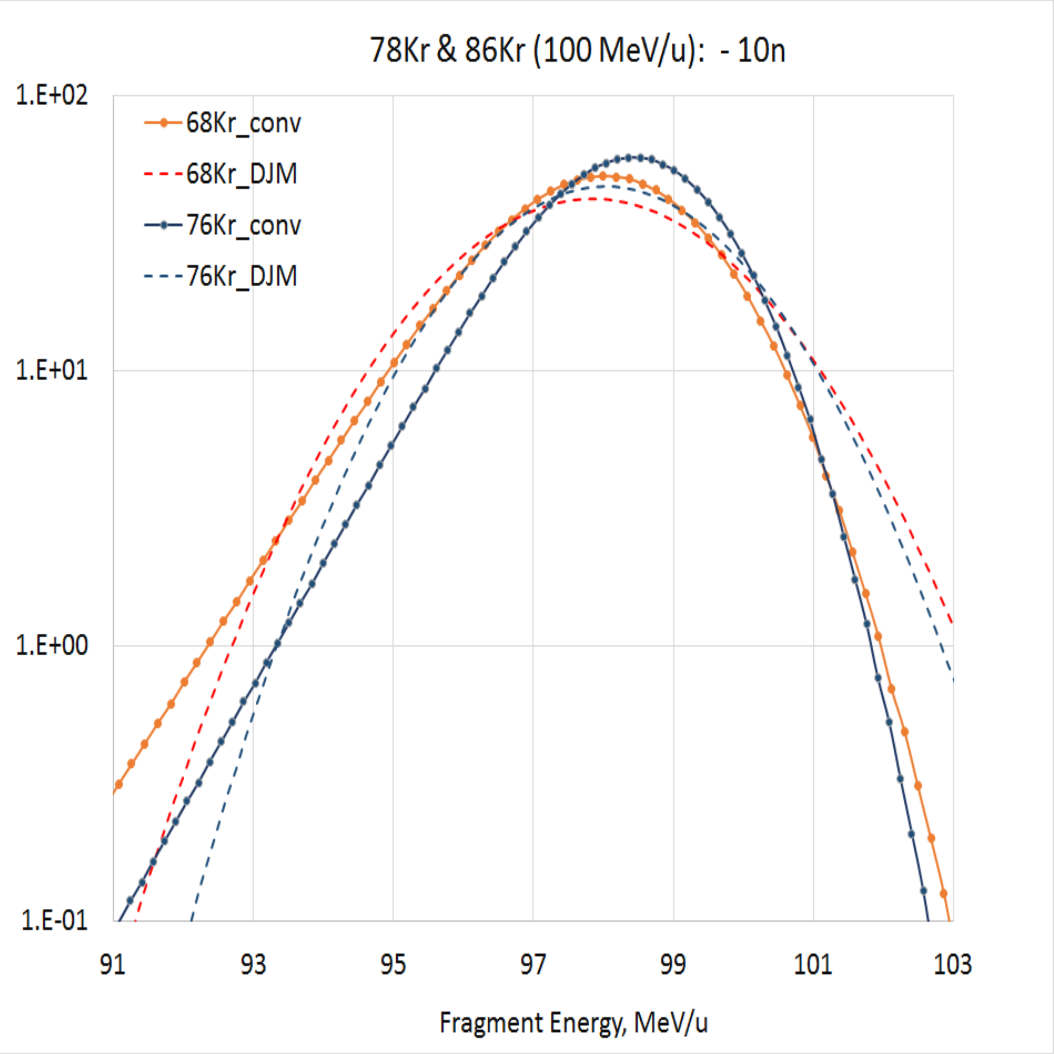
DJM – standard parameters (8,87)
E= 100 MeV/u, very thin Be-target

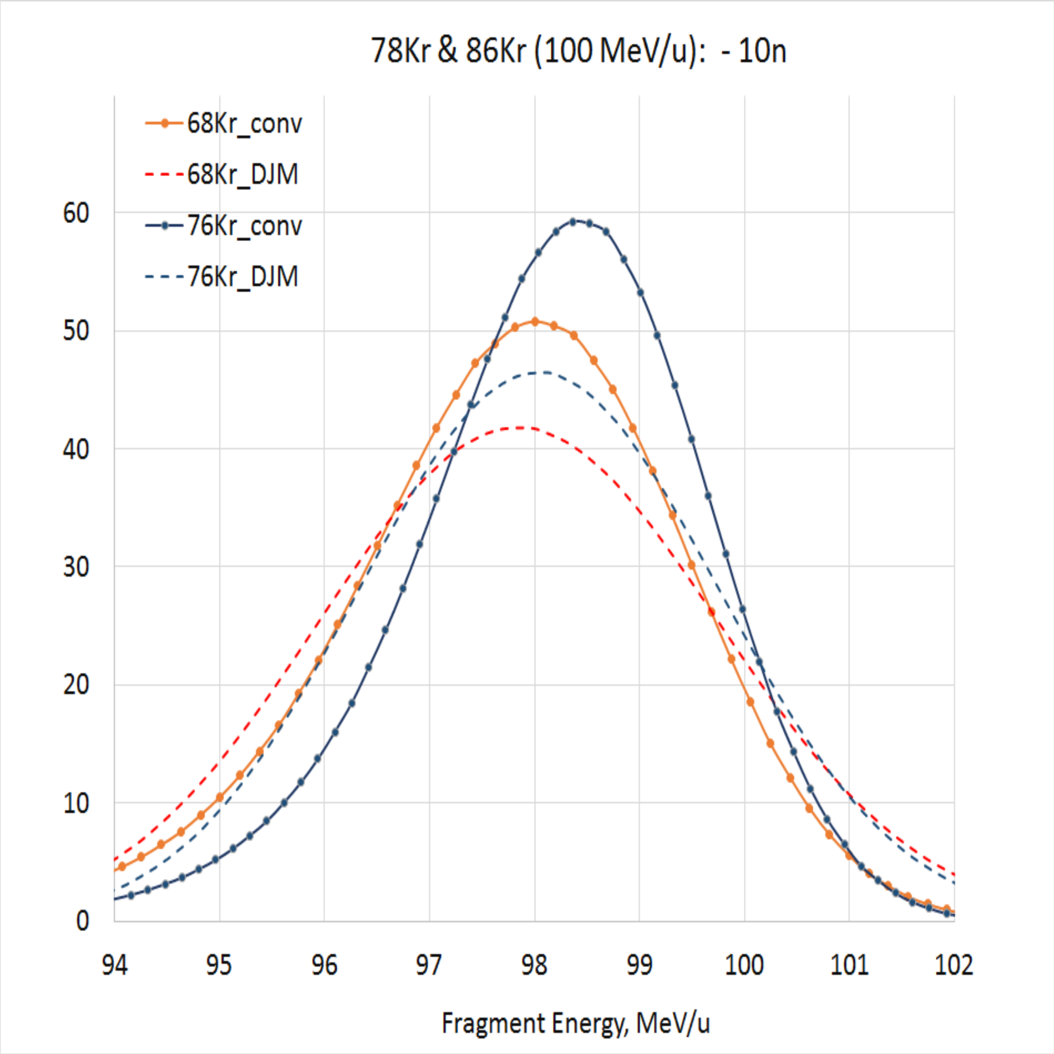
$^{78}Kr \rightarrow {}^{68}Kr$

"Top" Prefragment	73Kr
"Bottom" Prefragment	72Kr
Final Prefragment mass	72.0
Energy excitation (MeV)	76.3
Probability	1.20e-05
Corrected Probability	1.20e-05
	1.96e-08

$^{86}Kr \rightarrow {}^{76}Kr$

"Top" Prefragment	81Kr
"Bottom" Prefragment	80Kr
Final Prefragment mass	80.8
Energy excitation (MeV)	68.5
Probability	1.05e-01
Corrected Probability	1.05e-01
	5.00e-02





Momentum distributions as beam isospin function : - 10p

Convolution "C1"

"C1" – prefragment search
2 – convolution model (120,1,-1)

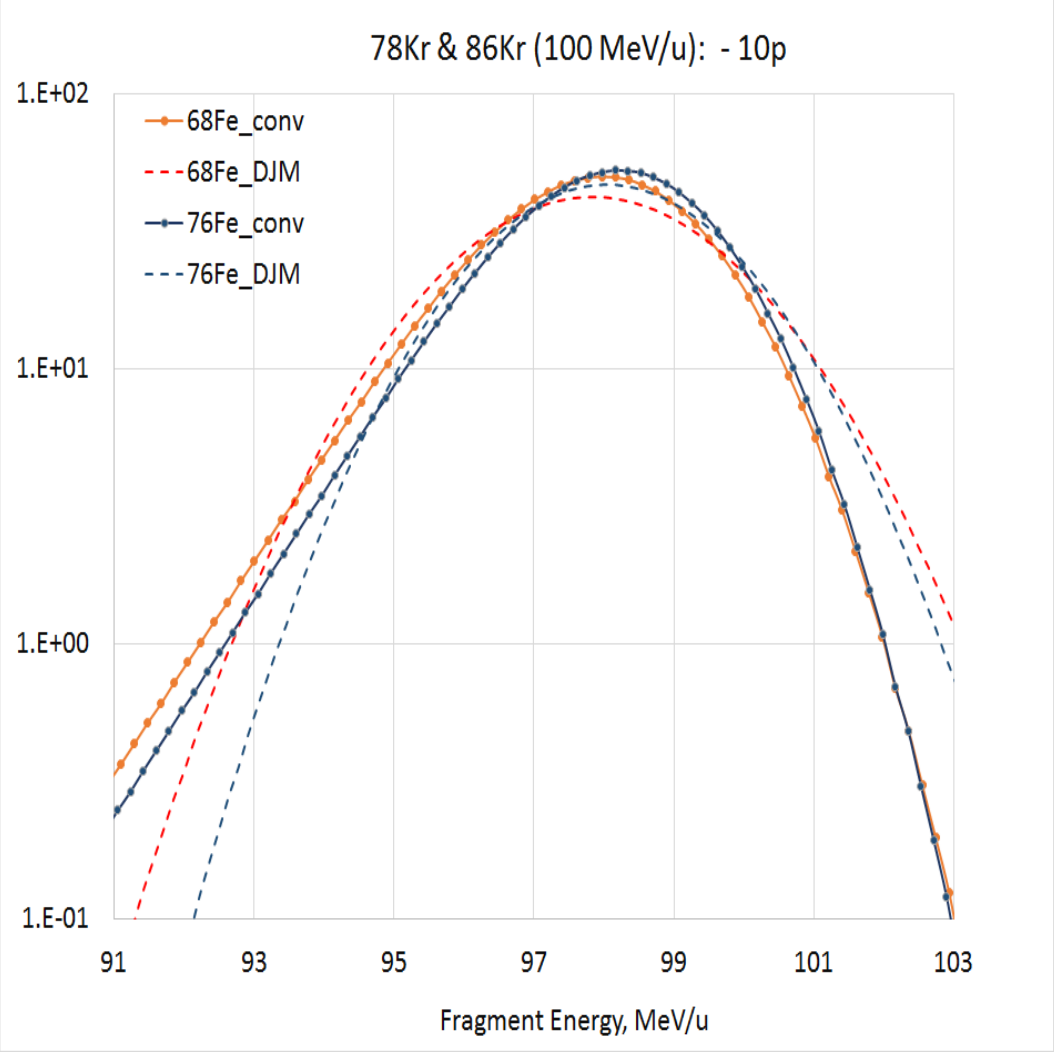
DJM – standard parameters (8,87)
E= 100 MeV/u, very thin Be-target

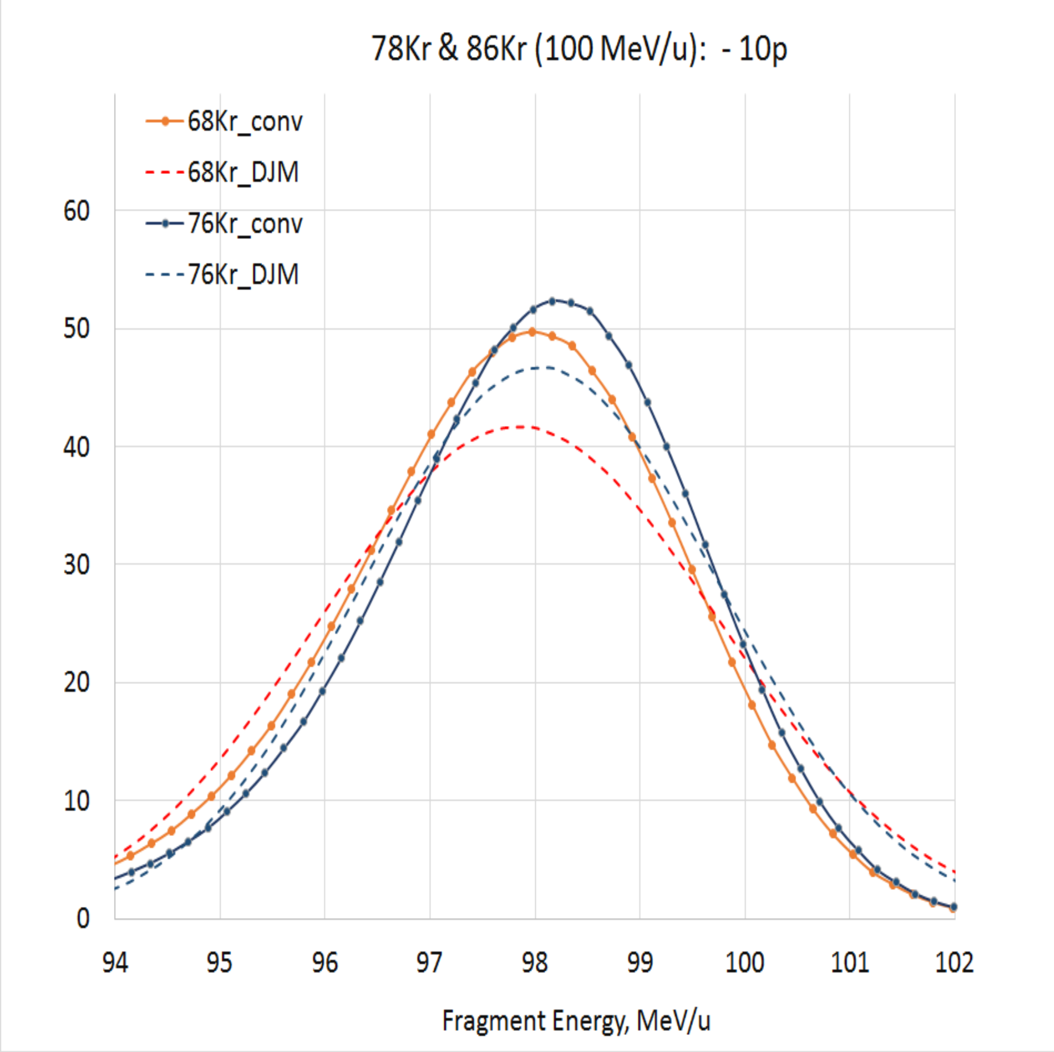
$^{78}Kr \rightarrow ^{68}Fe$

"Top" Prefragment	72Zn
"Bottom" Prefragment	71Cu
Final Prefragment mass	71.8
Energy excitation (MeV)	82.6
Probability	1.52e-06
Corrected Probability	1.52e-06
	3.30e-09

$^{86}Kr \rightarrow ^{76}Fe$

"Top" Prefragment	80Zn
"Bottom" Prefragment	79Cu
Final Prefragment mass	79.2
Energy excitation (MeV)	82.5
Probability	3.51e-09
Corrected Probability	3.51e-09
	3.04e-12





Momentum distributions as beam isospin function : - 10p -10n

MICHIGAN STATE UNIVERSITY

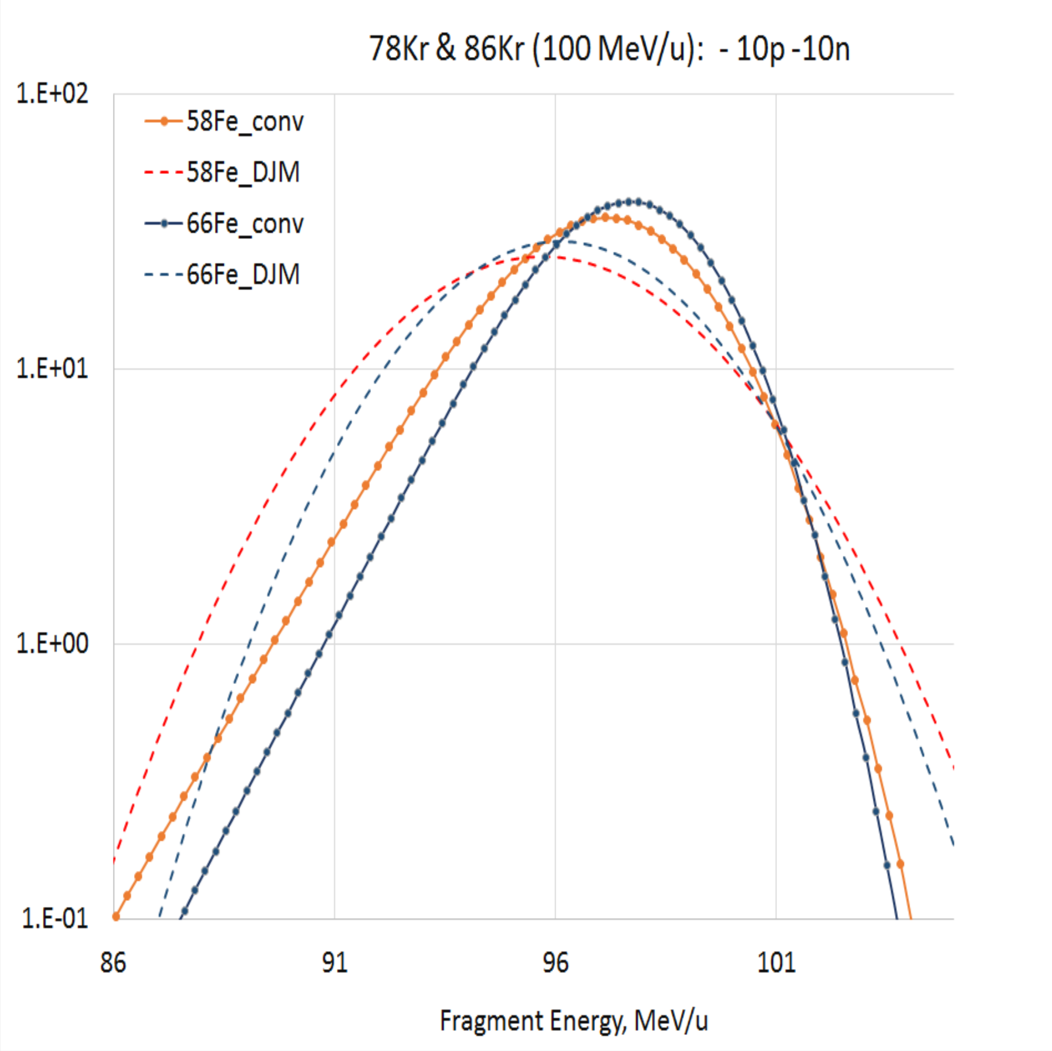
Convolution “C1”

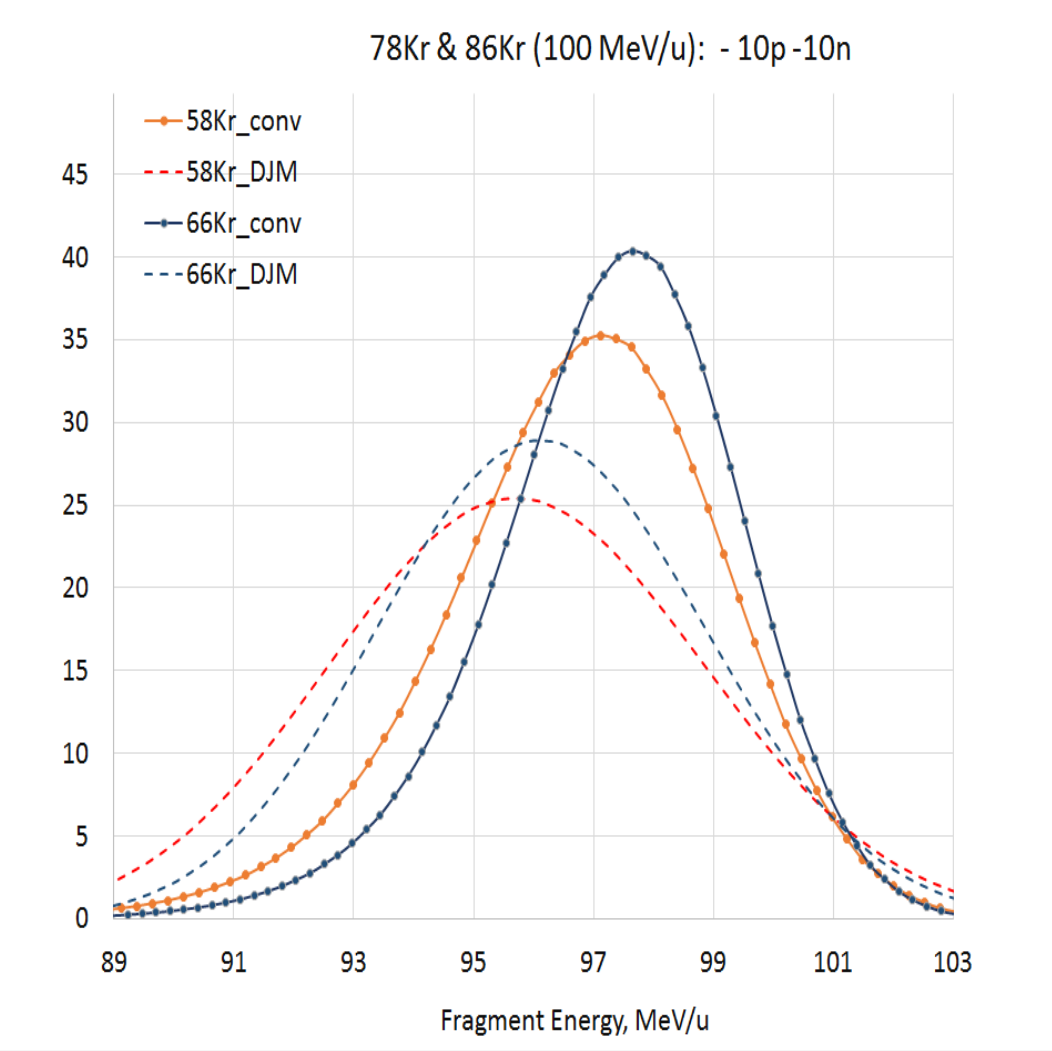
“C1” – prefragment search
2 – convolution model (120,1,-1)

DJM – standard parameters (8,87)
E= 100 MeV/u, very thin Be-target

$^{78}Kr \rightarrow {}^{58}Fe$

"Top" Prefragment	69Co
"Bottom" Prefragment	68Fe
Final Prefragment mass	68.5
Energy excitation (MeV)	124.6
Probability	1.21e-01
Corrected Probability	5.85e+00
	2.28e+00





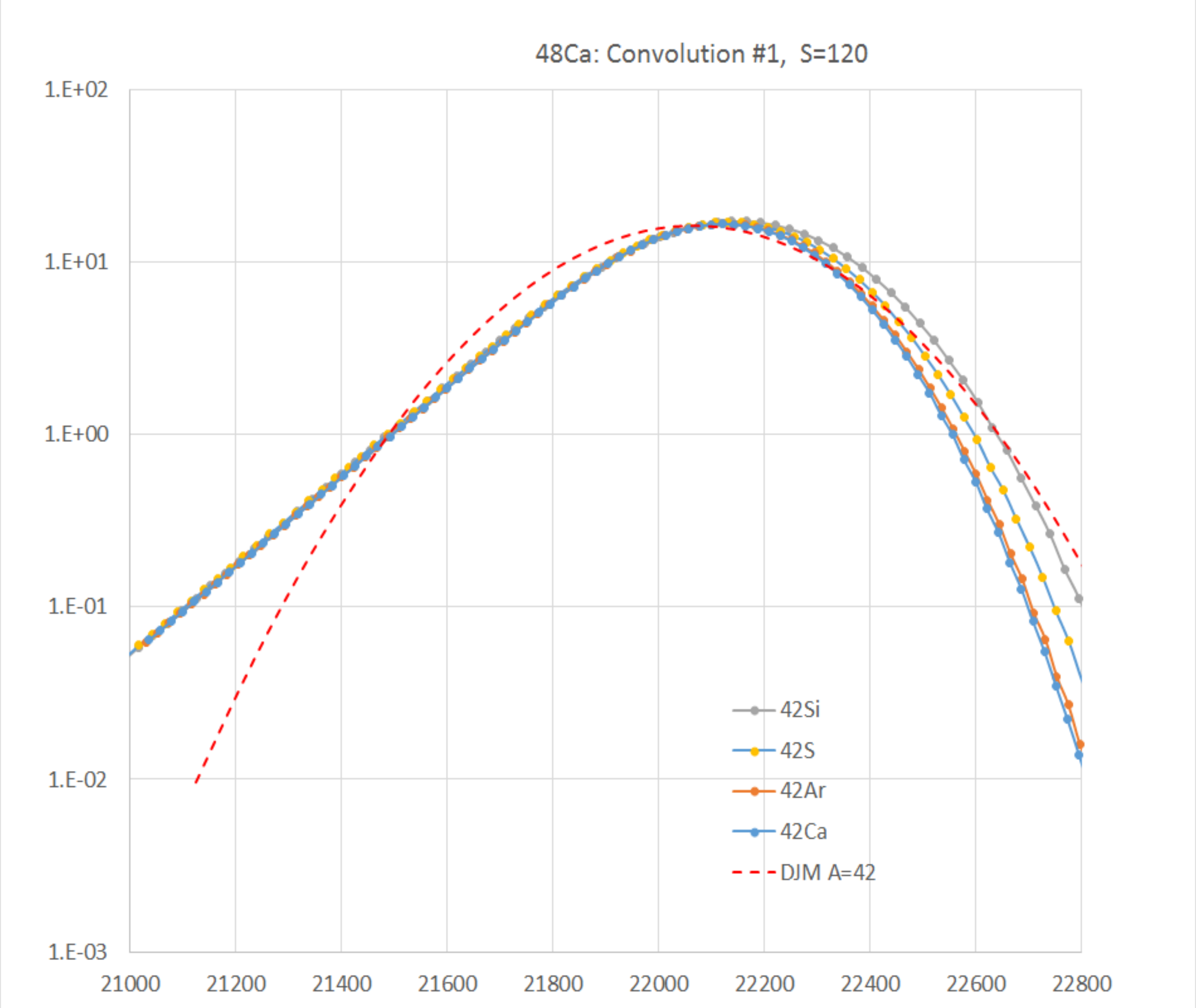
$^{86}Kr \rightarrow {}^{66}Fe$

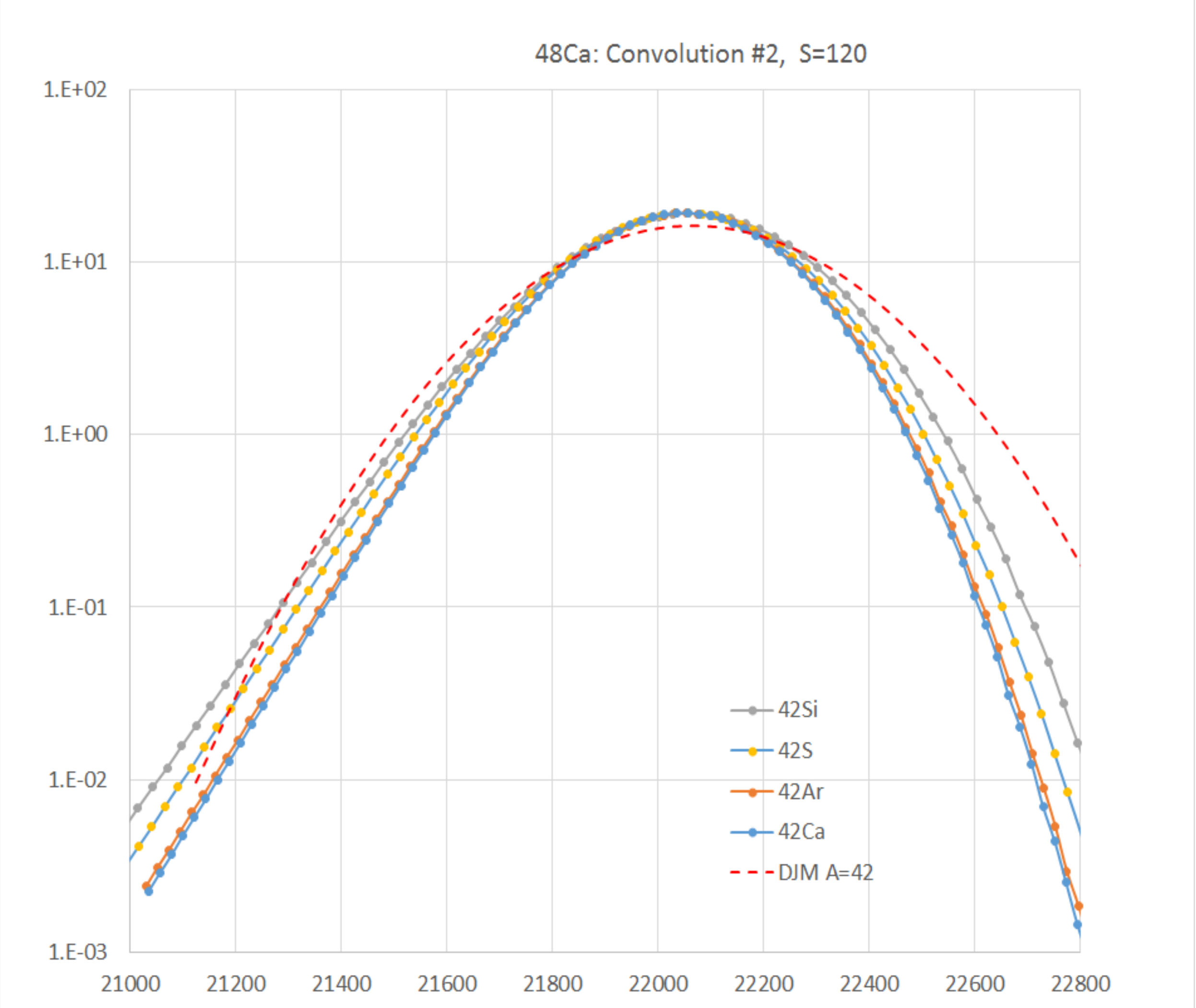
"Top" Prefragment	78Ni
"Bottom" Prefragment	77Co
Final Prefragment mass	77.1
Energy excitation (MeV)	110.5
Probability	9.44e-04
Corrected Probability	2.48e-03
	4.55e-04

See more quality computing results of more probable prefragments in the last presentation slide

Benchmarks of Universal parameterization prefragment search methods

^{48}Ca (140 MeV/u) → A=42 : Prefragment search "A1"





Settings for convolution

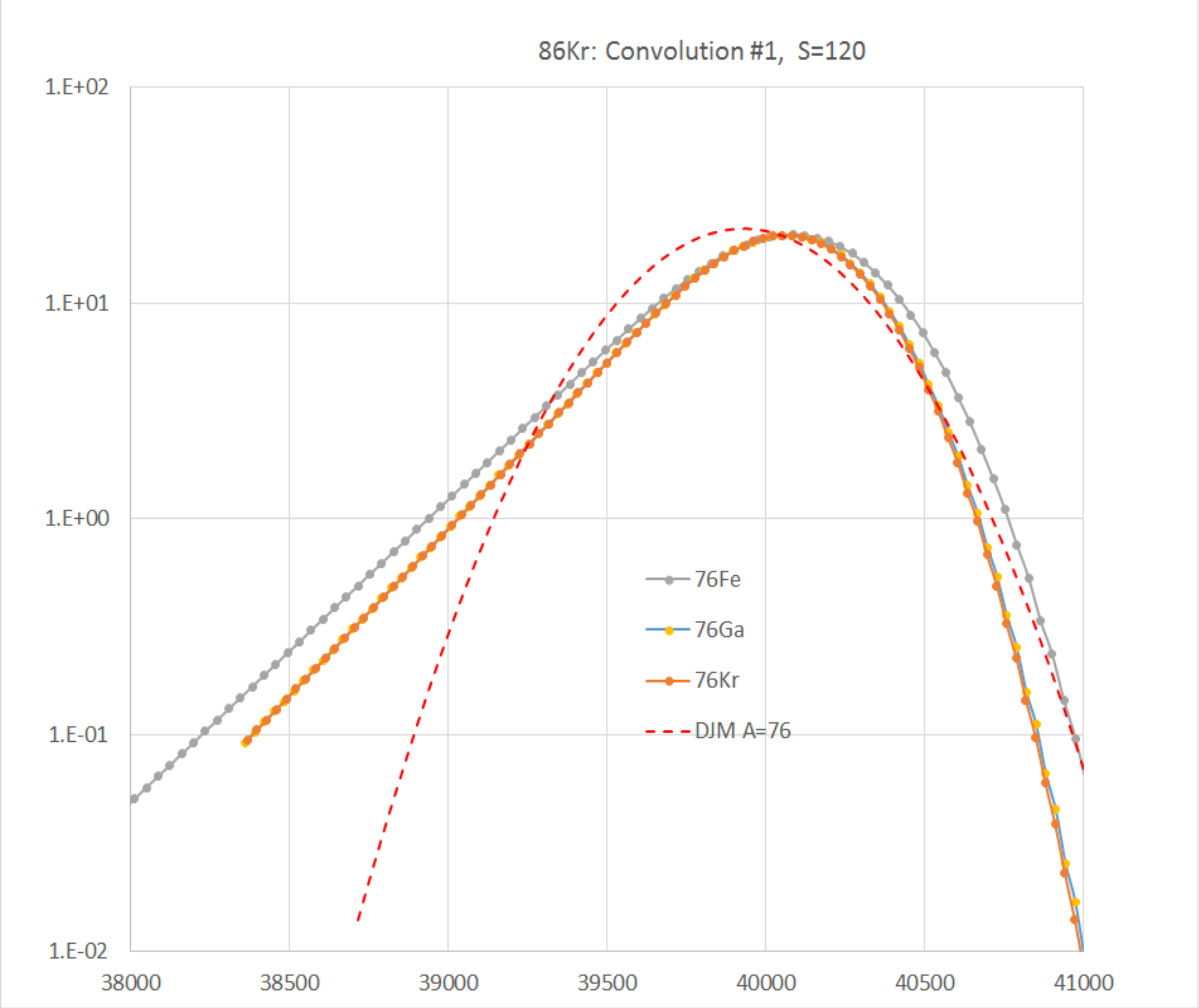
Separation Energy	Es	coef	shift
Energy from Qg	23.8	3.344	0.158
Excitation from dSurface	16.9	3	0.149
Excitaton from the Abrasion model	48.7	1	-1
	MeV		

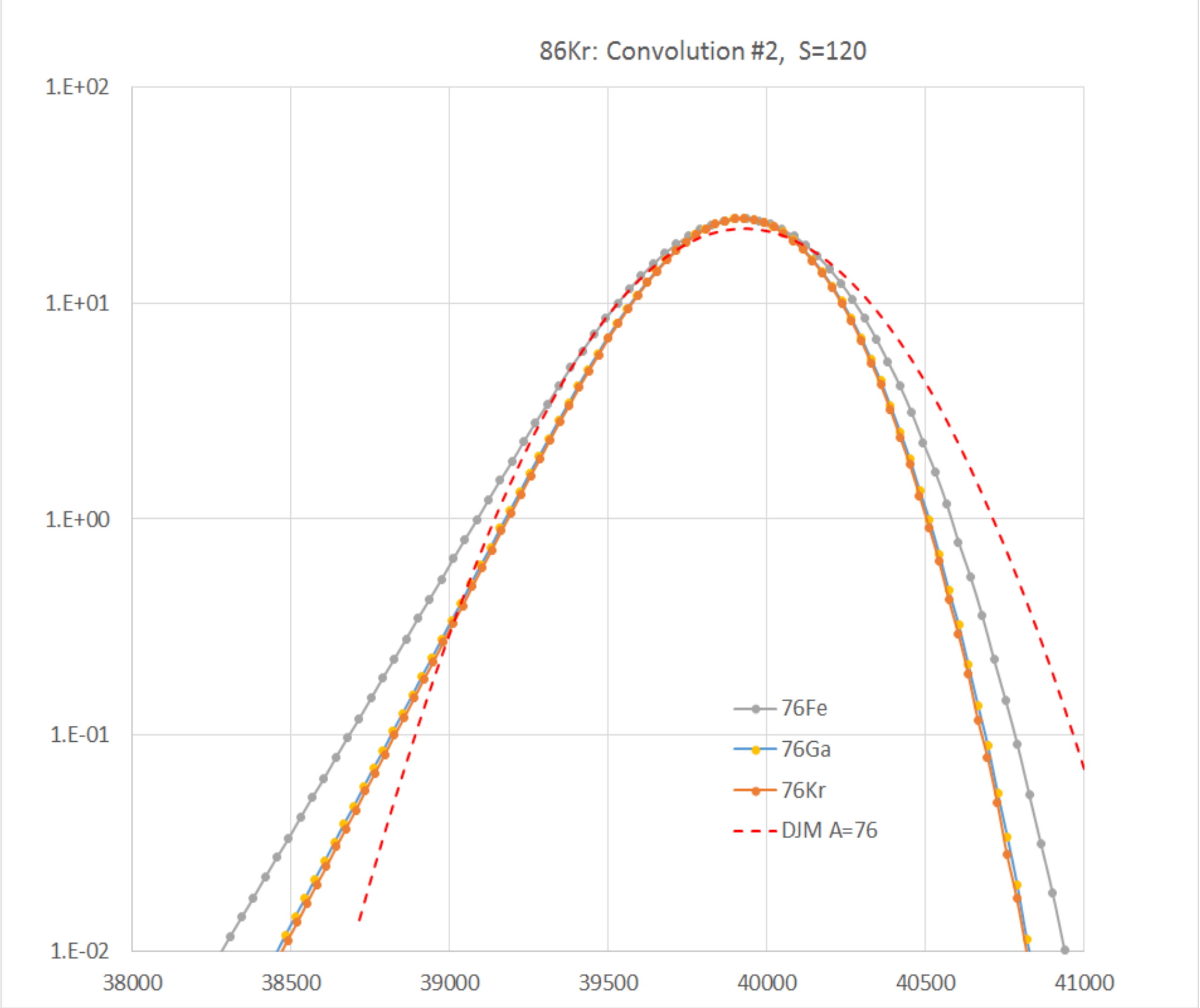
σ_0^{conv} = 120 MeV/c

g = 0.95 MeV/fm^2

Prefragment search "A1"

^{86}Kr (140 MeV/u) → A=76 : Prefragment search "A1"





Settings for convolution

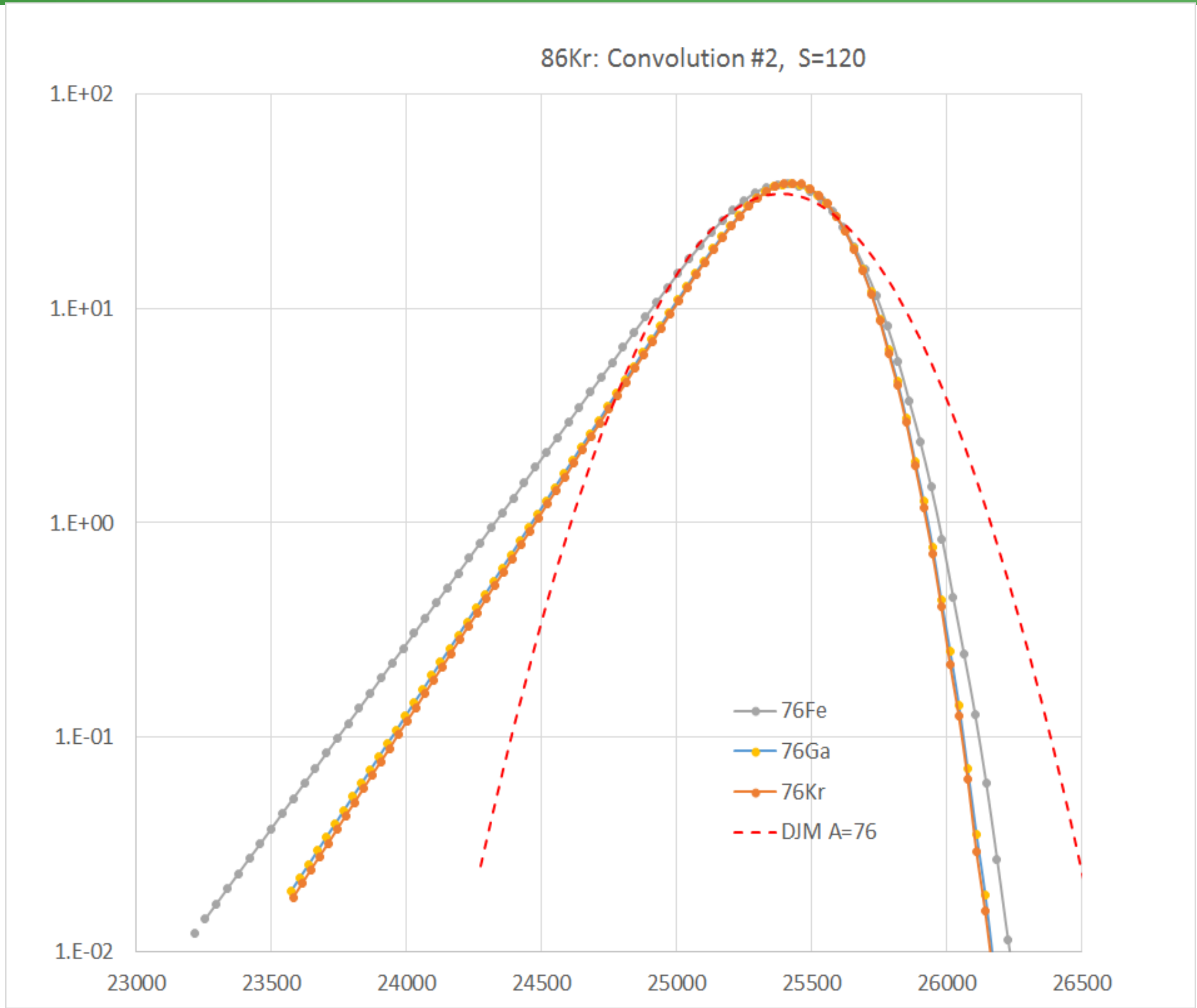
Separation Energy	Es	coef	shift
○ Energy from Qg	23.8	3.344	0.158
◉ Excitation from dSurface	16.9	3	0.149
○ Excitaton from the Abrasion model	48.7	1	-1
	MeV		

σ_0^{conv} = 120 MeV/c

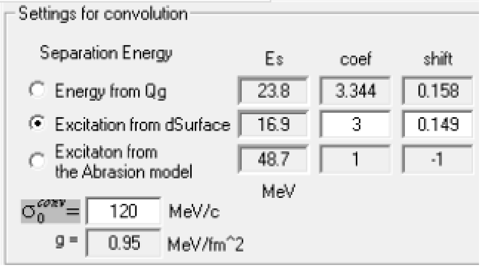
g = 0.95 MeV/fm^2

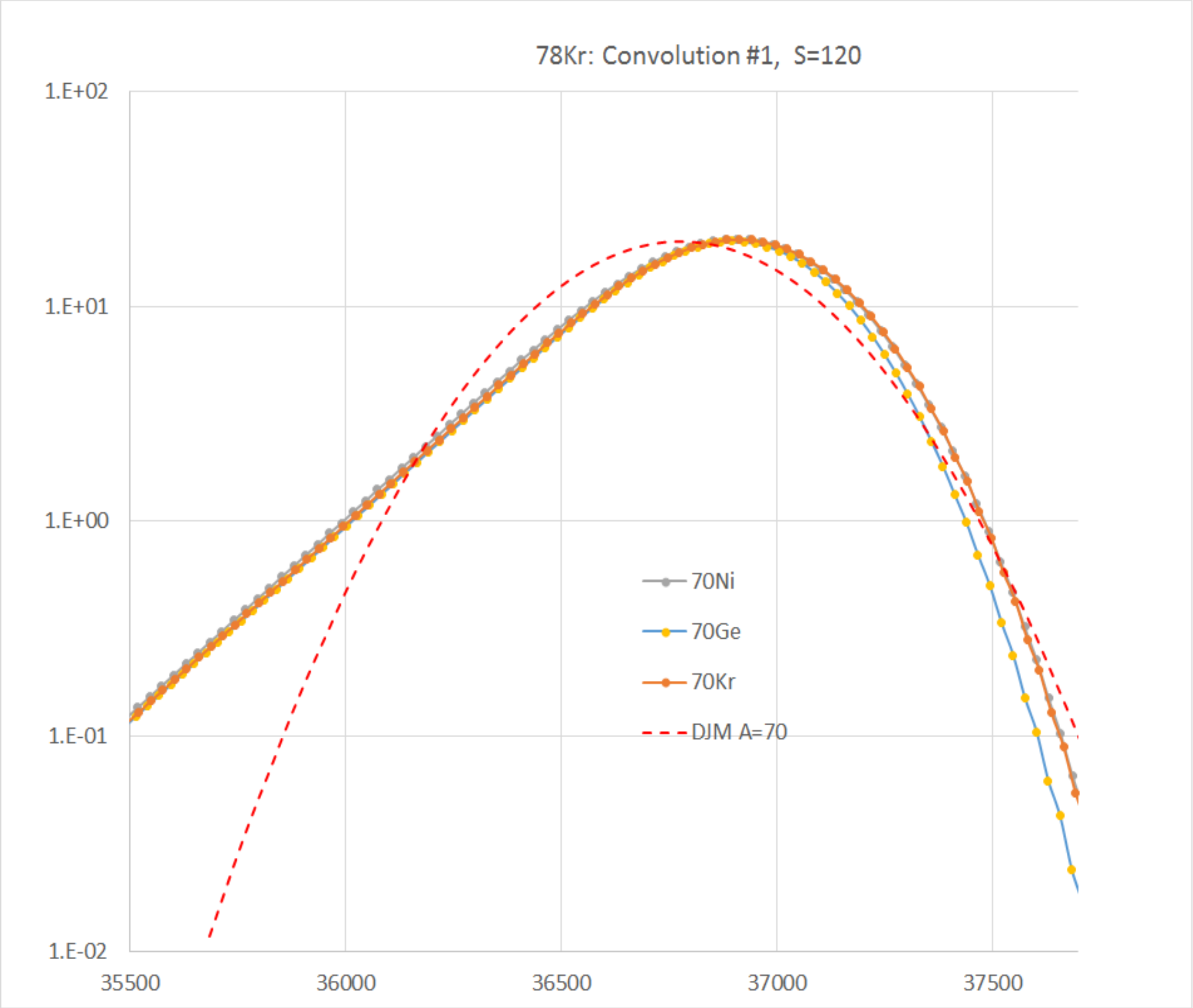
Prefragment search "A1"

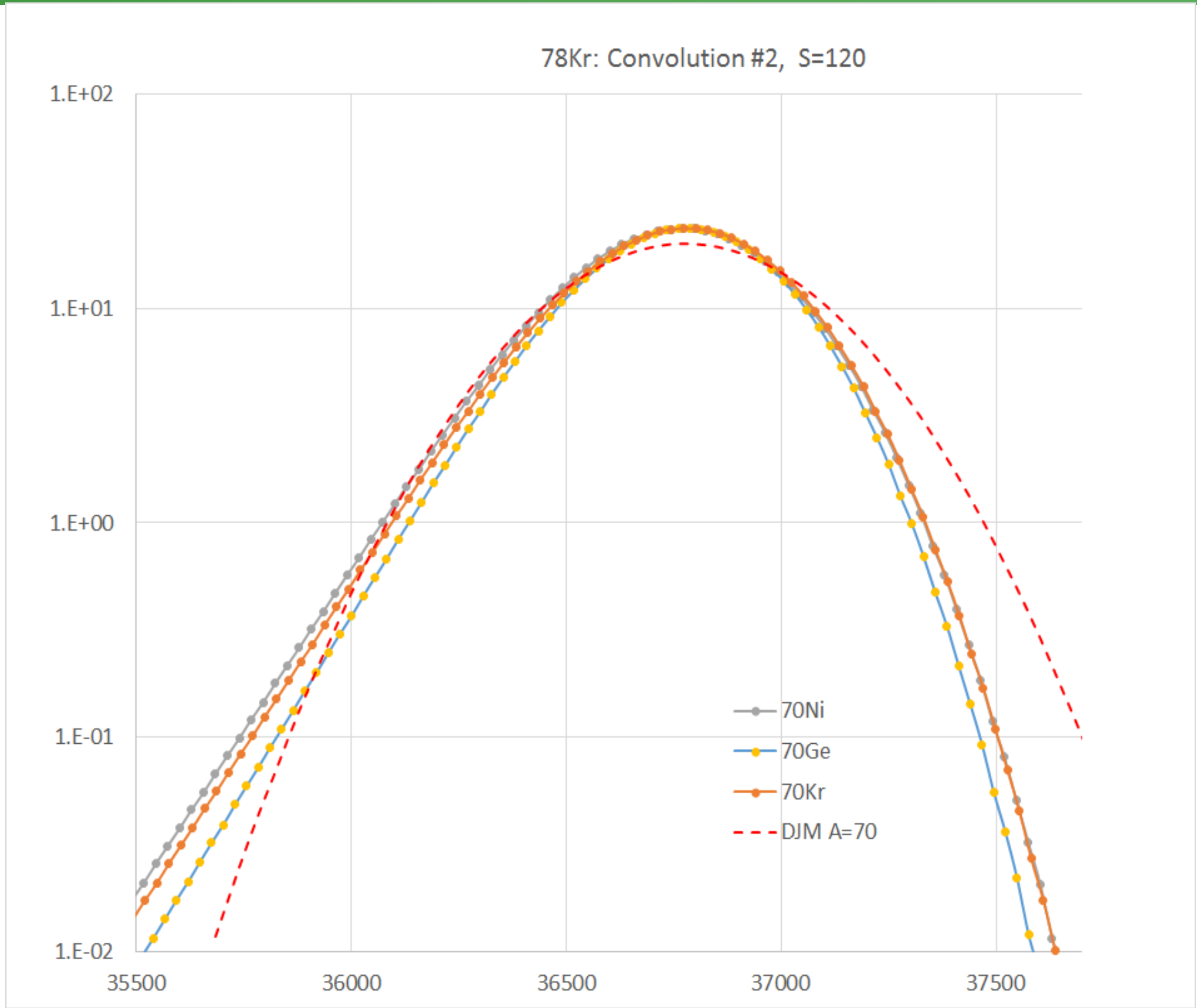
^{86}Kr (60 MeV/u) → A=76 : Prefragment search "A1"

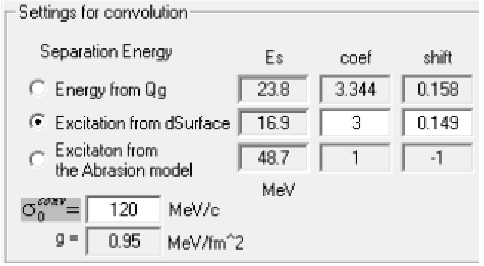


Prefragment search "A1"





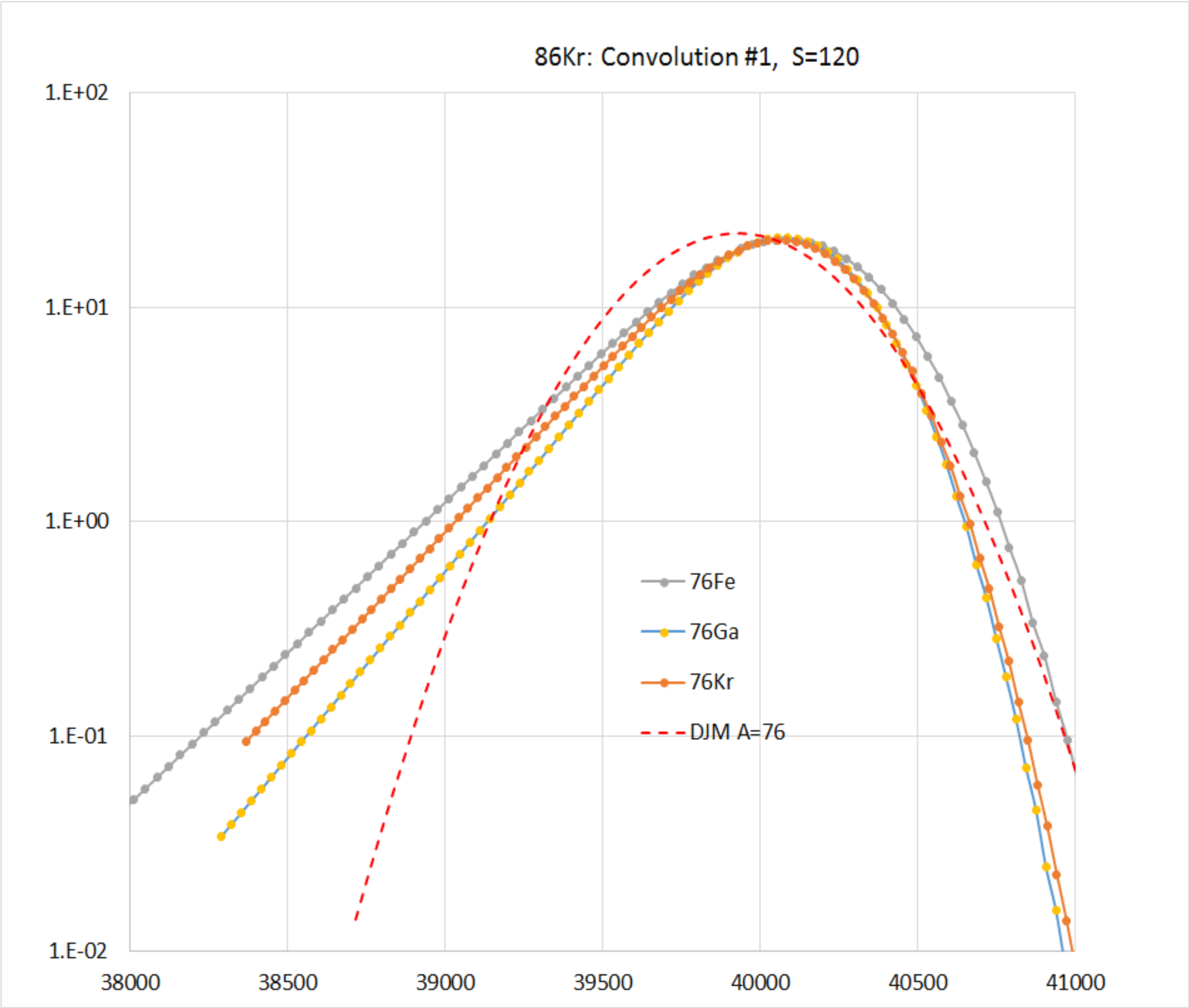


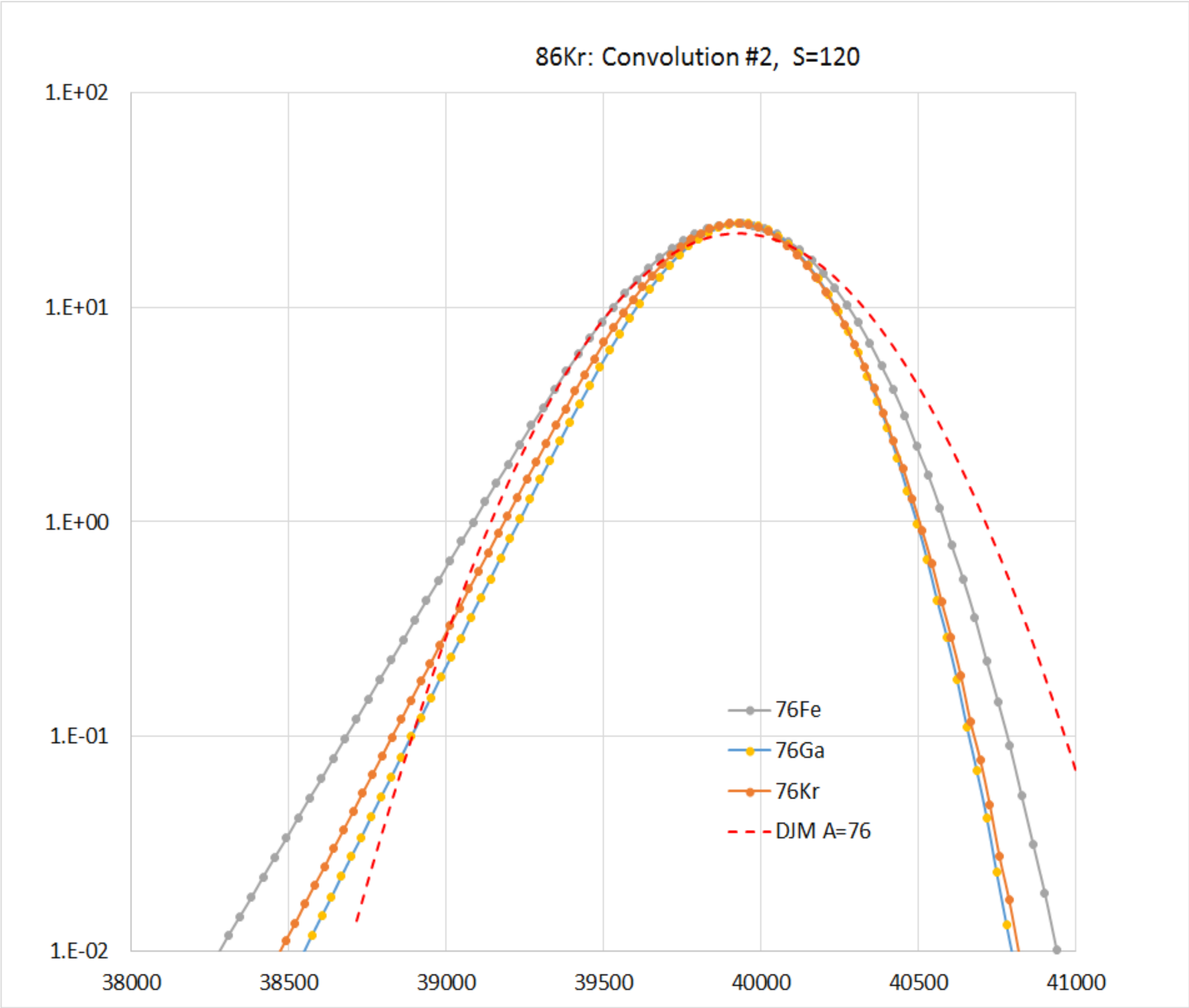


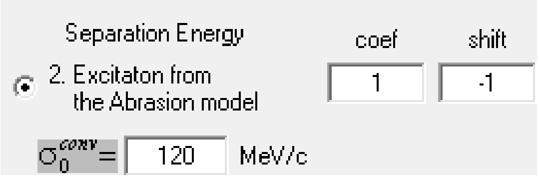
Prefragment search "A1"

^{86}Kr (140 MeV/u) → A=76 : Prefragment search "C1"

Version 11.1.102 default settings



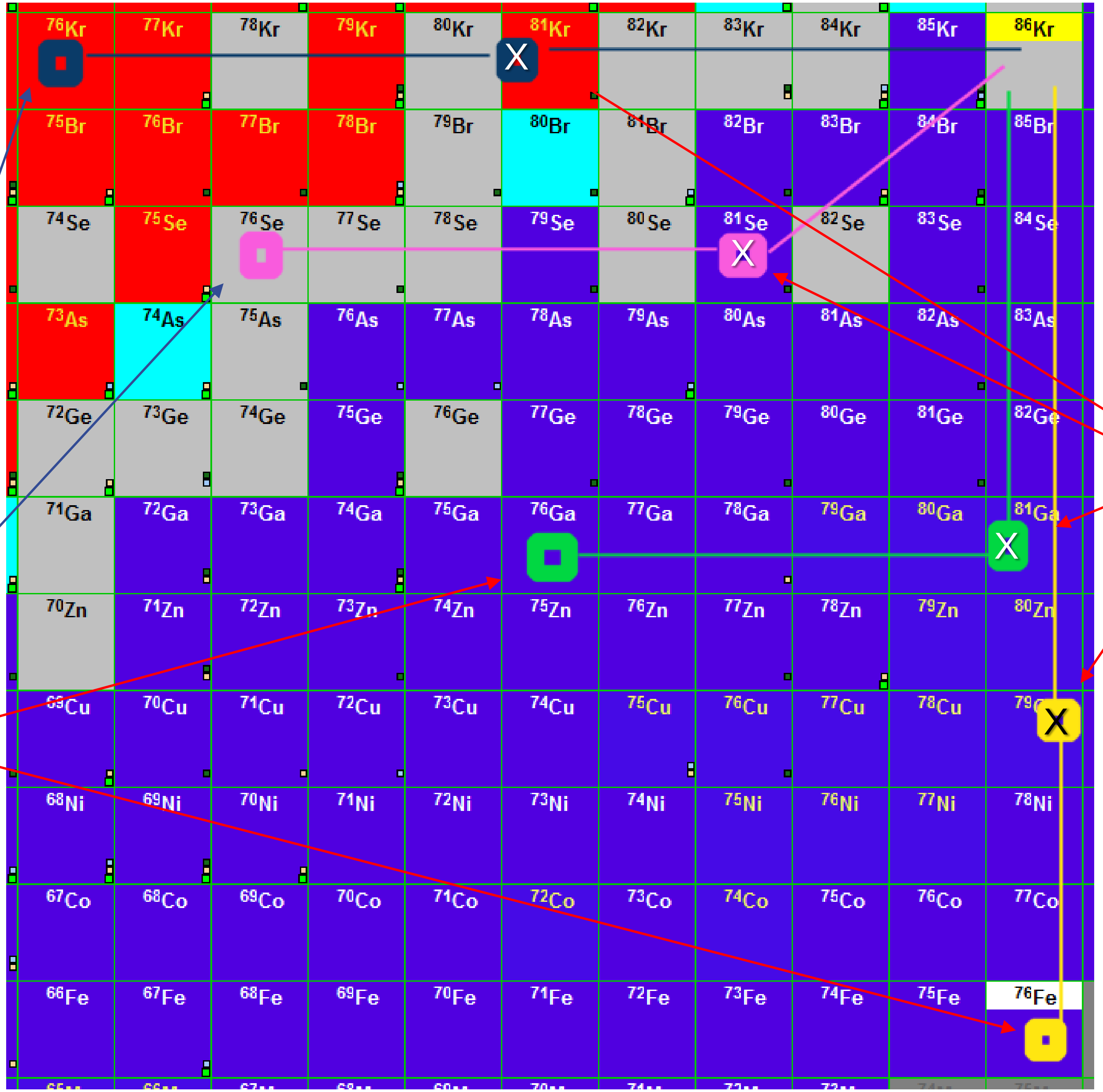




Prefragment search "C1"

^{86}Kr (140 MeV/u) → A=76 : Prefragment search "C1"

MICHIGAN STATE UNIVERSITY



Prefragments

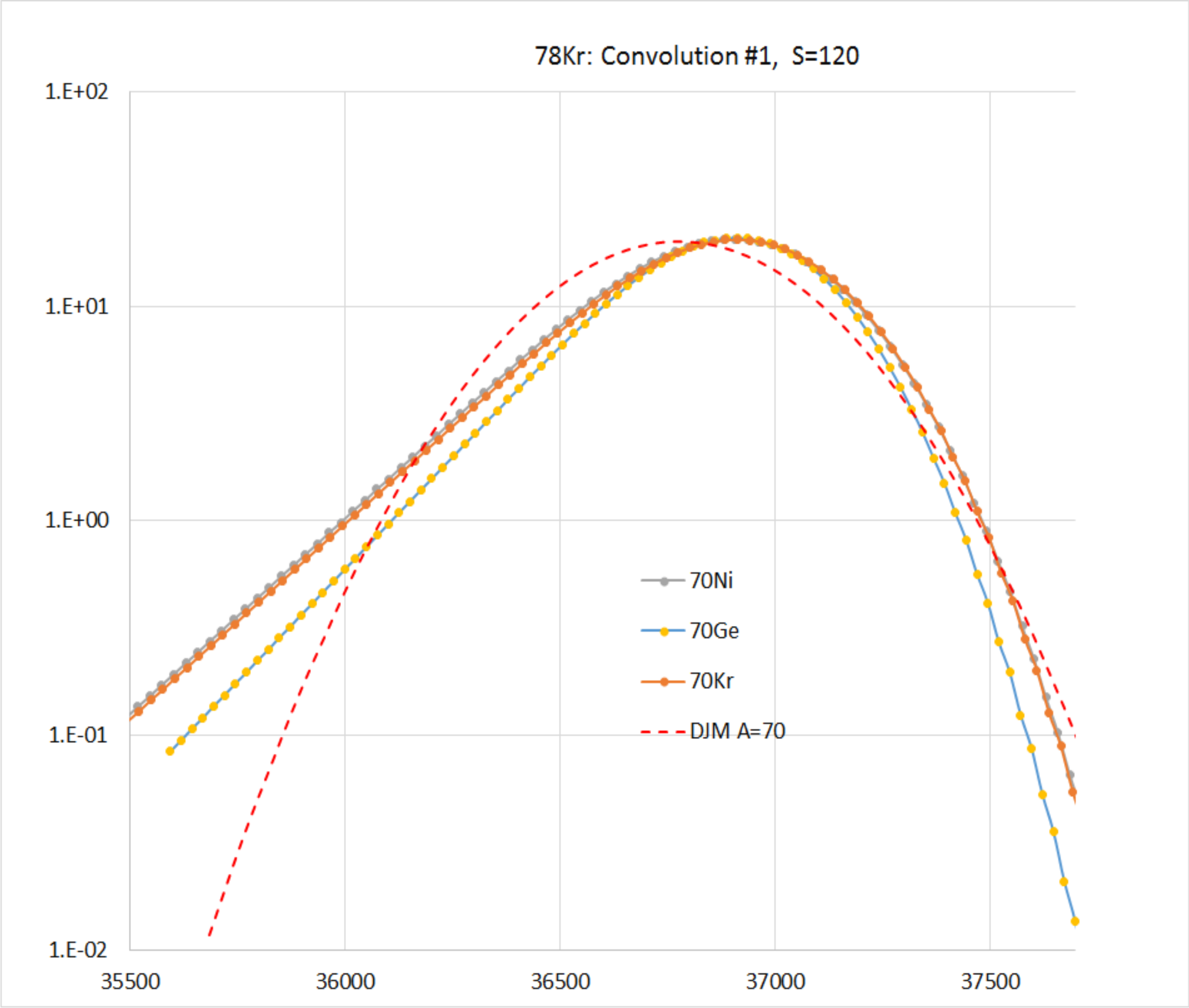
Final fragments

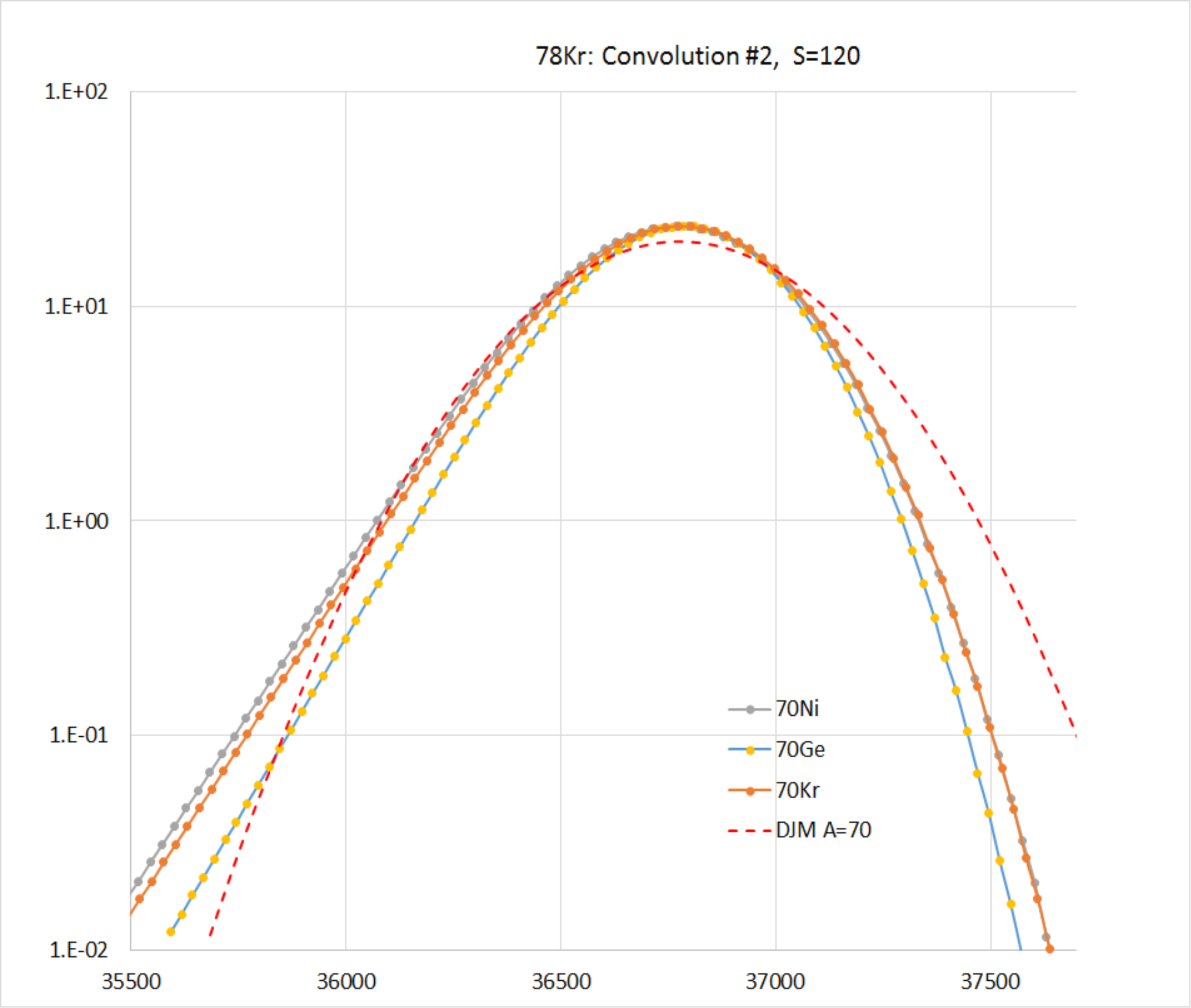
	76Kr	76Se	76Ga	76Fe
"Top" Prefragment	81Kr	82Se	82Ge	80Zn
"Bottom" Prefragment	80Kr	81Se	81Ga	79Cu
Final Prefragment mass	80.8	81.0	81.2	79.2
Energy excitation (MeV)	68.5	62.5	54.5	82.5
Probability	1.05e-01	4.46e-01	7.08e-01	3.51e-09
Corrected Probability	1.05e-01	7.61e-01	1.02e+00	3.51e-09
EPAX2	5.00e-02	1.52e+01	9.63e-02	3.04e-12

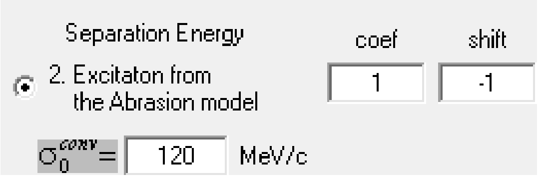
^{78}Kr (140 MeV/u) → A=70 : Prefragment search "C1"

MICHIGAN STATE UNIVERSITY

Version 11.1.102 default settings

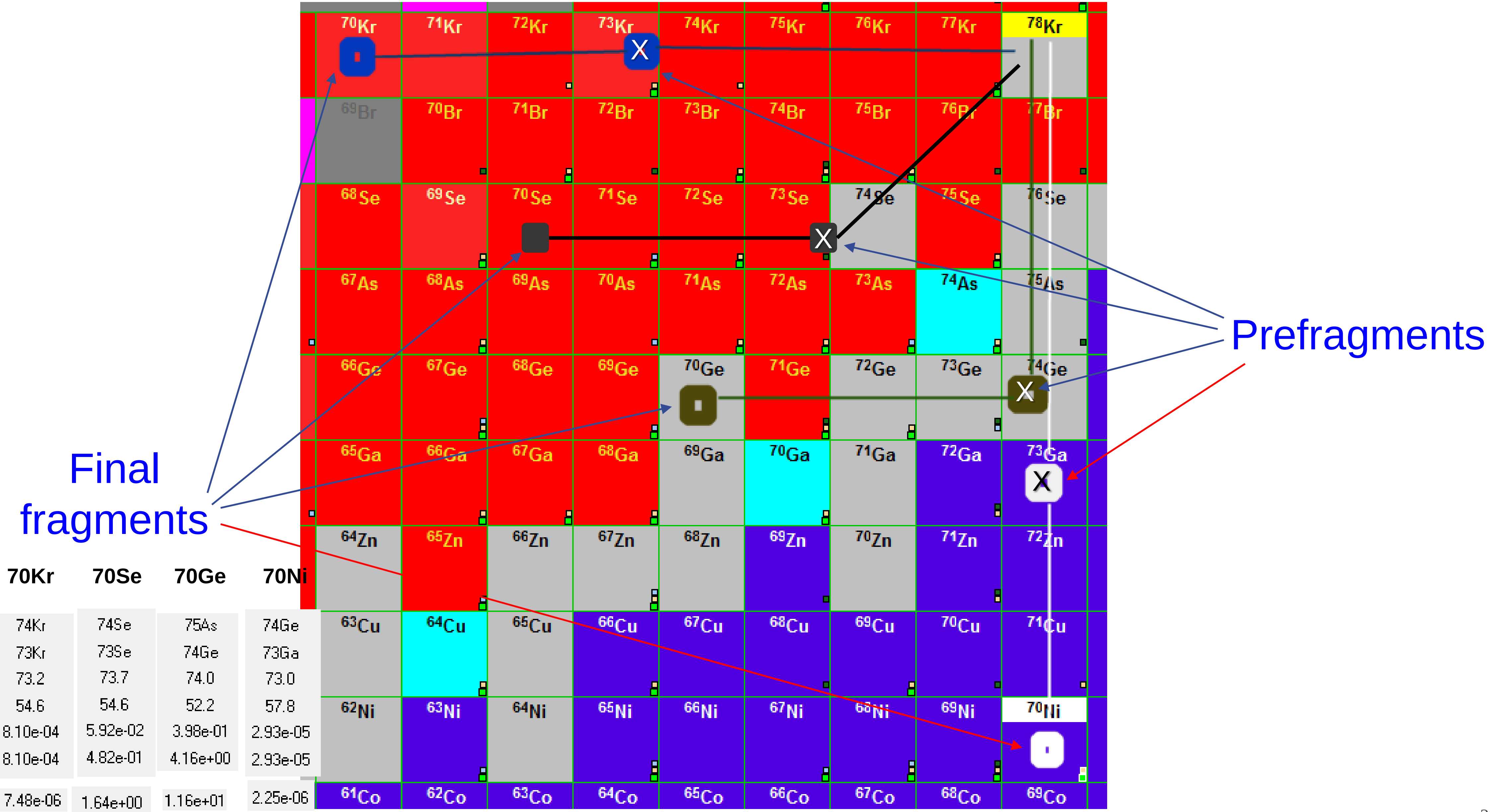






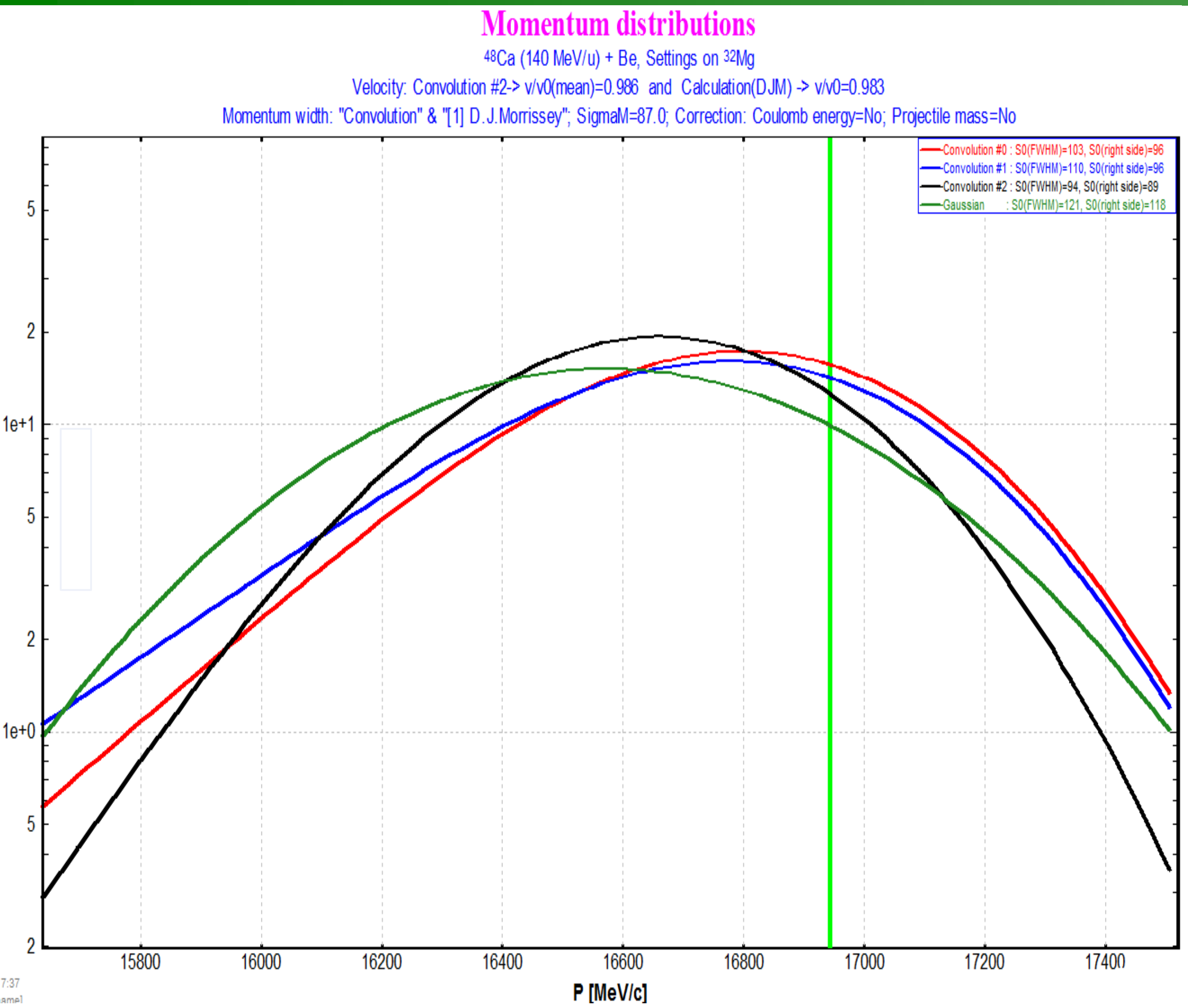
Prefragment search "C1"

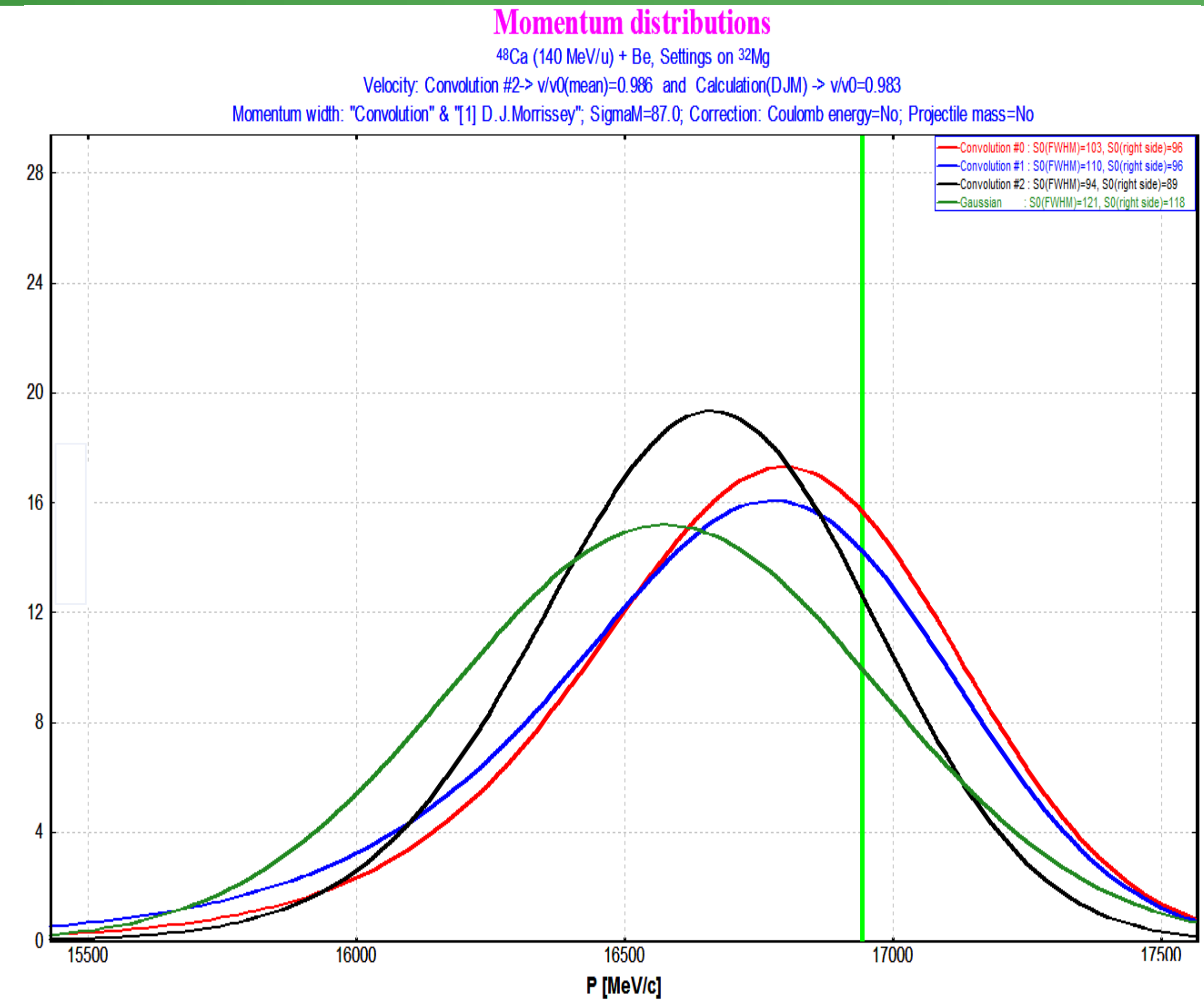
^{78}Kr (140 MeV/u) → A=70 : Prefragment search "C1"



	70Kr	70Se	70Ge	70Ni
"Top" Prefragment	74Kr	74Se	75As	74Ge
"Bottom" Prefragment	73Kr	73Se	74Ge	73Ga
Final Prefragment mass	73.2	73.7	74.0	73.0
Energy excitation (MeV)	54.6	54.6	52.2	57.8
Probability	8.10e-04	5.92e-02	3.98e-01	2.93e-05
Corrected Probability	8.10e-04	4.82e-01	4.16e+00	2.93e-05
EPAX2	7.48e-06	1.64e+00	1.16e+01	2.25e-06

^{48}Ca (140 MeV/u) → ^{32}Mg : A0 prefragment search options





Method of prefragment search

- (•) A. Search in N/Z beam direction
- ( ) B. Search a 'parent' nucleus uisng emission widths and cross-sections

Exc.Energy to prefragment search

- (•) Surface (Geometrical)
- ( ) E* per abraded nucleon E* = c * dAabr

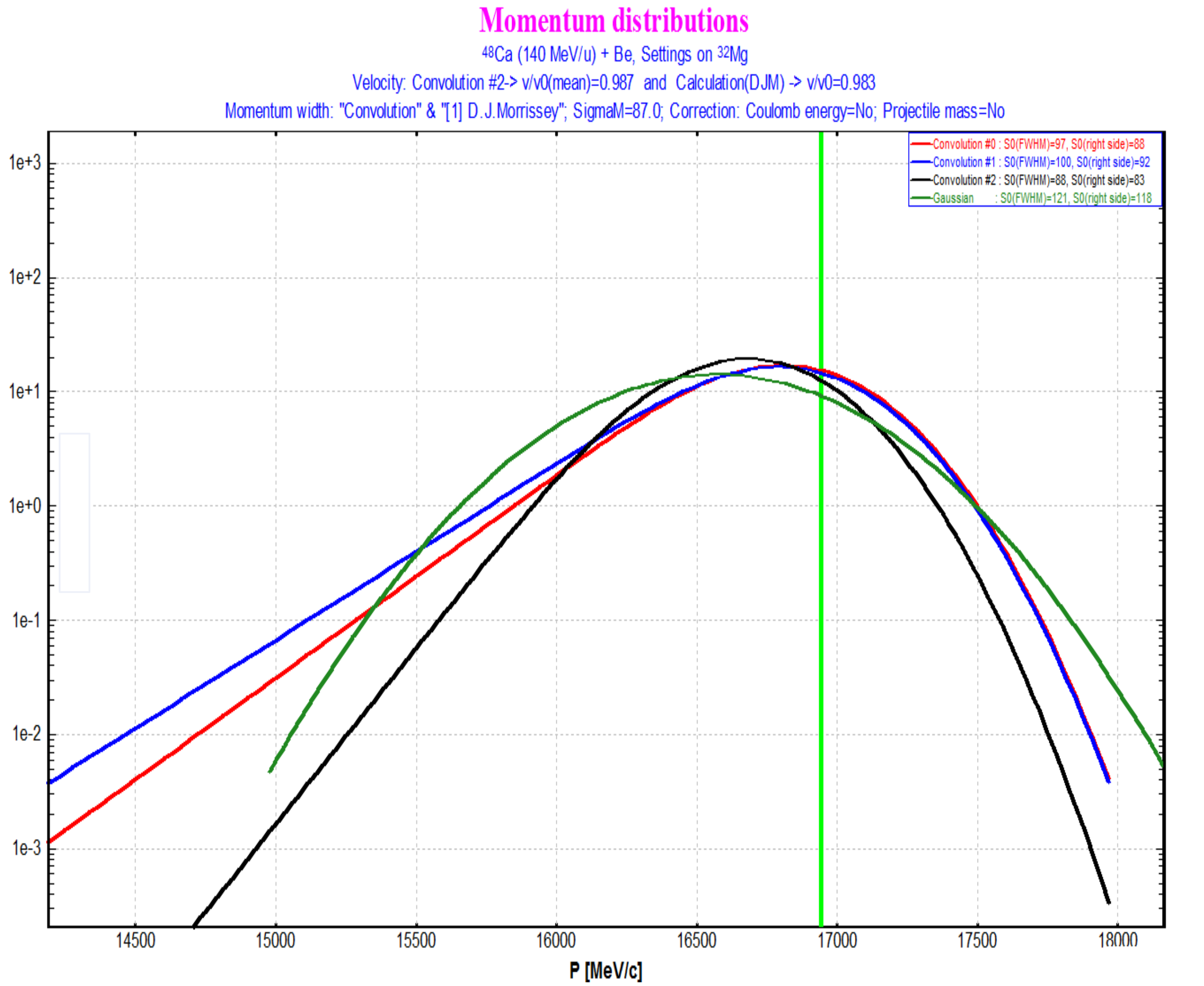
"Top" Prefragment	38P
"Bottom" Prefragment	37Si
Final Prefragment mass	37.0
Energy excitation (MeV)	77.3
Probability	3.04e-04

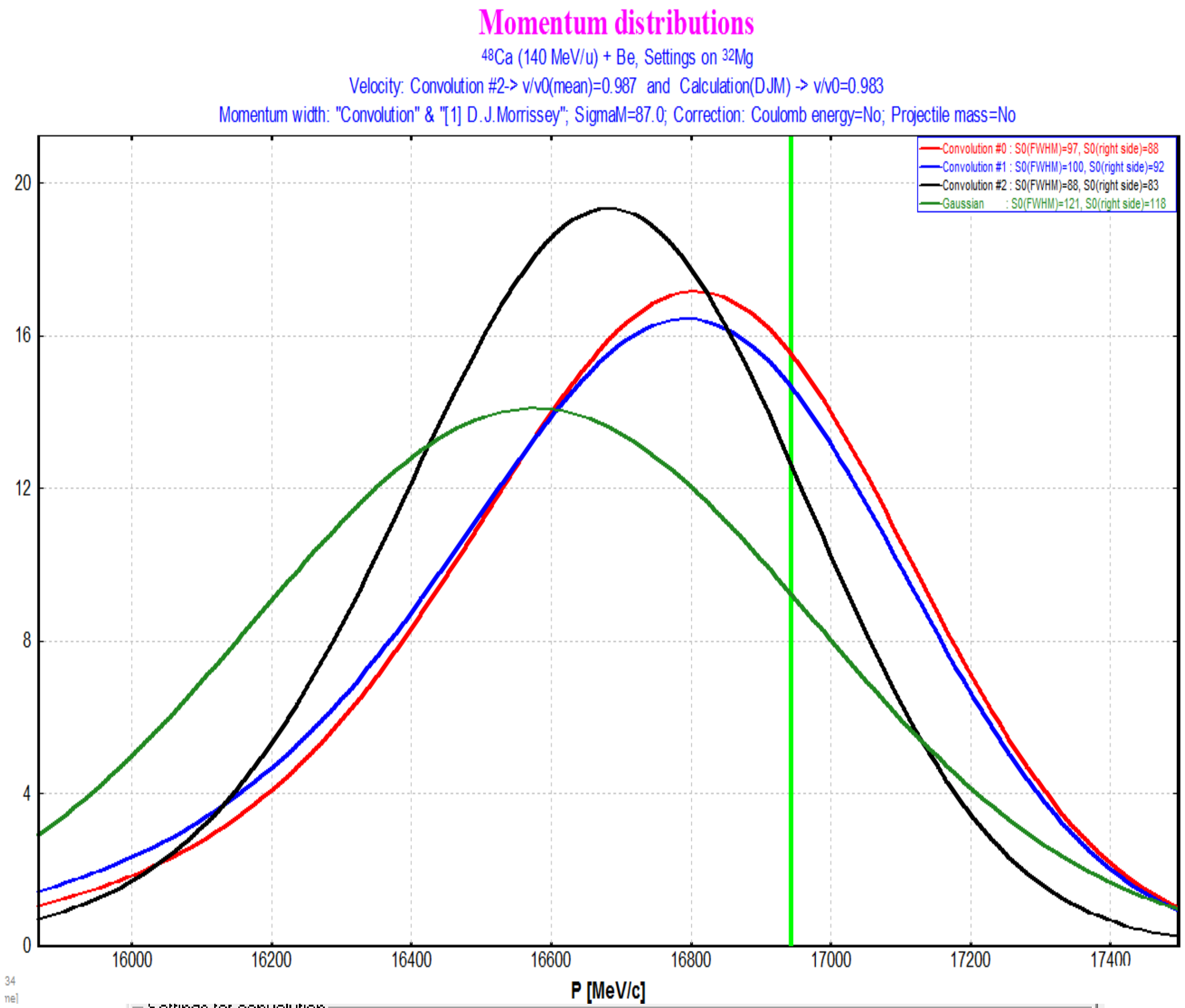
Settings for convolution

Separation Energy	Es	coef	shift	FWHM / 2.355 (*)	tau	P(Ymax)	Vf/Vb peak	Vf/Vb mean
( ) 0. Energy from Qg	38.7	3.344	0.158	340.8	255.9	16780	0.994	0.990
( ) 1. Excitation from dSurface	77.3	3	0.149	361.8	324.6	16733	0.993	0.988
(•) 2. Excitaton from the Abrasion model	153.2	1	-1	311.3	152.3	16711	0.987	0.986
	MeV			MeV/c	MeV/c	MeV/c		

σ_0^{conv} = 120 MeV/c

^{48}Ca (140 MeV/u) → ^{32}Mg : A1 prefragment search options





Method of prefragment search

- (•) A. Search in N/Z beam direction
- ( ) B. Search a 'parent' nucleus uisng emission widths and cross-sections

Exc.Energy to prefragment search

- ( ) Surface (Geometrical)
- (•) E* per abraded nucleon E* = c * dAabr

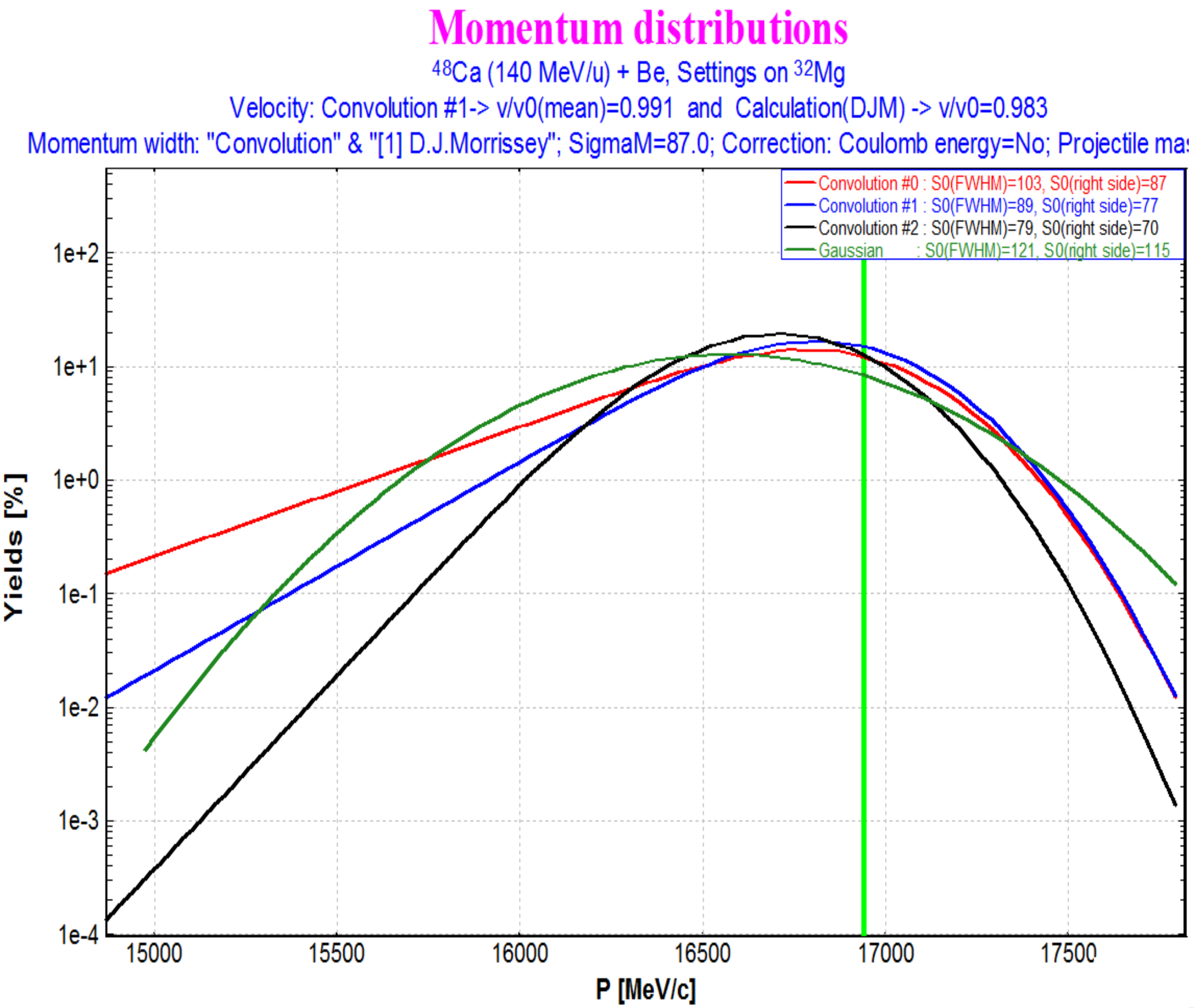
"Top" Prefragment	39Cl
"Bottom" Prefragment	38Cl
Final Prefragment mass	38.0
Energy excitation (MeV)	65.6
Probability	7.12e-05
Corrected Probability	1.05e-03

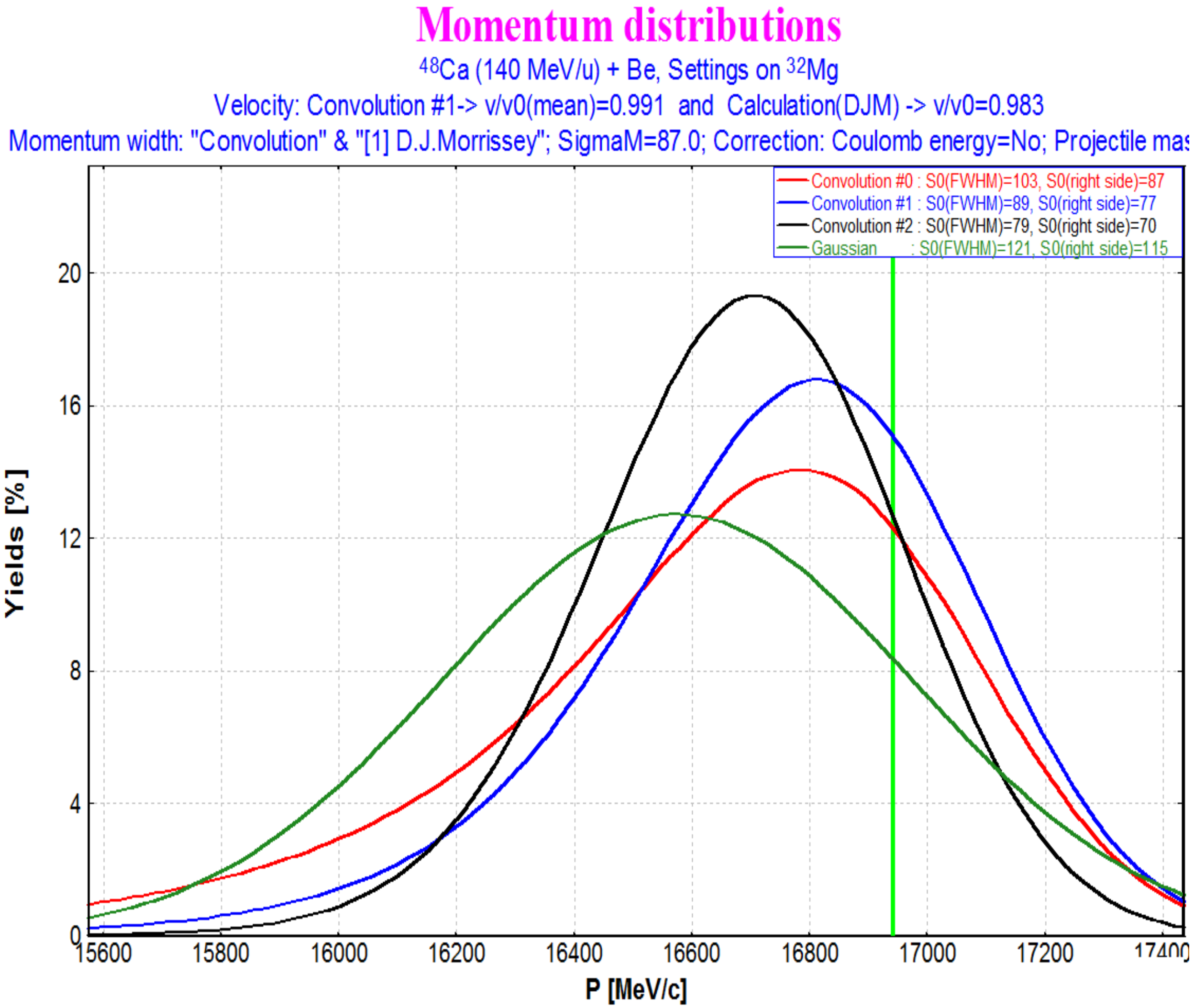
Settings for convolution

Separation Energy	Es	coef	shift	FWHM / 2.355 (*)	tau	P(Ymax)	Vf/Vb peak	Vf/Vb mean
( ) 0. Energy from Qg	33.5	3.344	0.158	318.8	244.6	16787	0.994	0.991
( ) 1. Excitation from dSurface	55.0	3	0.149	328.8	281.2	16761	0.993	0.989
(•) 2. Excitaton from the Abrasion model	125.1	1	-1	288.8	141.3	16728	0.988	0.987
	MeV			MeV/c	MeV/c	MeV/c		

σ_0^{conv} = 120 MeV/c

^{48}Ca (140 MeV/u) → ^{32}Mg : C1 prefragment search options





Method of prefragment search

- ○ A. Search in the N/Z beam direction
- ○ B. Search a 'parent' uisng emission widths (W) and X-sections (EPAX)
- ● C. Search a 'parent' uisng emission widths (W) and Abrasion initial CS

Exc.Energy to prefragment search

- ○ Surface (Geometrical)
- ● E* per abraded nucleon E* = c * dAabr

"Top" Prefragment	42Si
"Bottom" Prefragment	41Al
Final Prefragment mass	41.0
Energy excitation (MeV)	37.1
Probability	1.24e-02
Corrected Probability	4.07e-02

Settings for convolution

Separation Energy	Es	coef	shift	FWHM / 2.355 (*)	tau	P(Ymax)	Vf/Vb peak	Vf/Vb mean
○ 0. Energy from Qg	77.6	3.344	0.158	340.6	381.9	16697	0.993	0.986
● 1. Excitation from dSurface	37.1	3	0.149	293.2	236.8	16788	0.994	0.991
○ 2. Excitaton from the Abrasion model	96.9	1	-1	261.3	127.6	16747	0.990	0.989
	MeV			MeV/c	MeV/c	MeV/c		

σ_0^{conv} = 120 MeV/c

^{48}Ca (140 MeV/u) → ^{32}Mg : options A & B

A0

Exc.Energy to prefragment search
- (•) Surface (Geometrical)
- ( ) E* per abraded nucleon
  E* = c * dAabr

Method of prefragment search
- (•) A. Search in N/Z beam direction
- ( ) B. Search a 'parent' nucleus uisng emission widths and cross-sections

"Top" Prefragment	38P
"Bottom" Prefragment	37Si
Final Prefragment mass	37.0
Energy excitation (MeV)	77.3
Probability	3.04e-04
Corrected Probability	

Settings for convolution

Separation Energy	Es	coef	shift	FWHM / 2.355 (*)	tau	P(Ymax)	Vf/Vb peak	Vf/Vb mean
( ) 0. Energy from Qg	38.7	3.344	0.158	340.8	255.9	16780	0.994	0.990
( ) 1. Excitation from dSurface	77.3	3	0.149	361.8	324.6	16733	0.993	0.988
(•) 2. Excitaton from the Abrasion model	153.2	1	-1	311.3	152.3	16711	0.987	0.986
	MeV			MeV/c	MeV/c	MeV/c		

σ_0^{conv} = 120 MeV/c

A1

Exc.Energy to prefragment search
- ( ) Surface (Geometrical)
- (•) E* per abraded nucleon
  E* = c * dAabr

"Top" Prefragment	40S
"Bottom" Prefragment	39P
Final Prefragment mass	39.0
Energy excitation (MeV)	55.0
Probability	1.18e-04
Corrected Probability	

Settings for convolution

Separation Energy	Es	coef	shift	FWHM / 2.355 (*)	tau	P(Ymax)	Vf/Vb peak	Vf/Vb mean
( ) 0. Energy from Qg	33.5	3.344	0.158	318.8	244.6	16787	0.994	0.991
( ) 1. Excitation from dSurface	55.0	3	0.149	328.8	281.2	16761	0.993	0.989
(•) 2. Excitaton from the Abrasion model	125.1	1	-1	288.8	141.3	16728	0.988	0.987
	MeV			MeV/c	MeV/c	MeV/c		

σ_0^{conv} = 120 MeV/c

B0

Exc.Energy to prefragment search
- (•) Surface (Geometrical)
- ( ) E* per abraded nucleon
  E* = c * dAabr

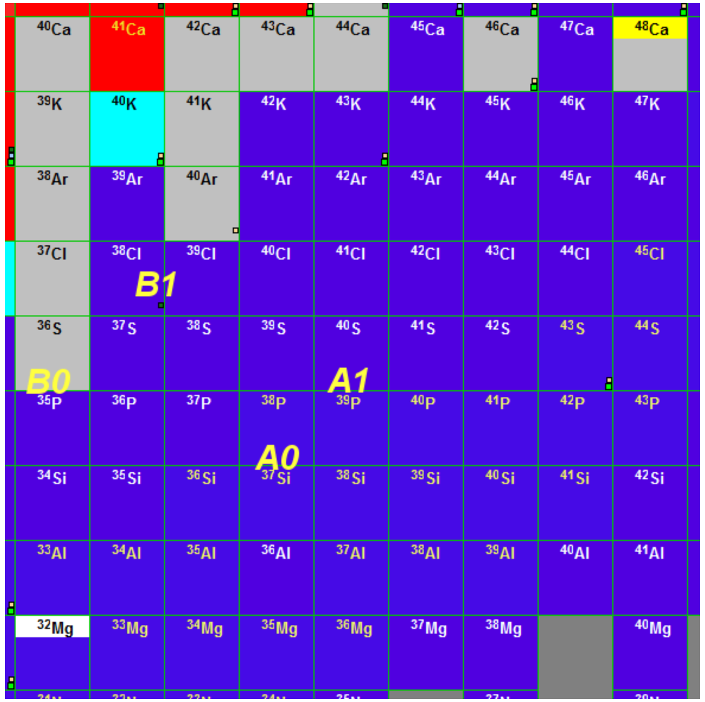
Method of prefragment search
- ( ) A. Search in N/Z beam direction
- (•) B. Search a 'parent' nucleus uisng emission widths and cross-sections

"Top" Prefragment	36S
"Bottom" Prefragment	35P
Final Prefragment mass	35.9
Energy excitation (MeV)	104.6
Probability	1.60e-04
Corrected Probability	7.05e-04

B1

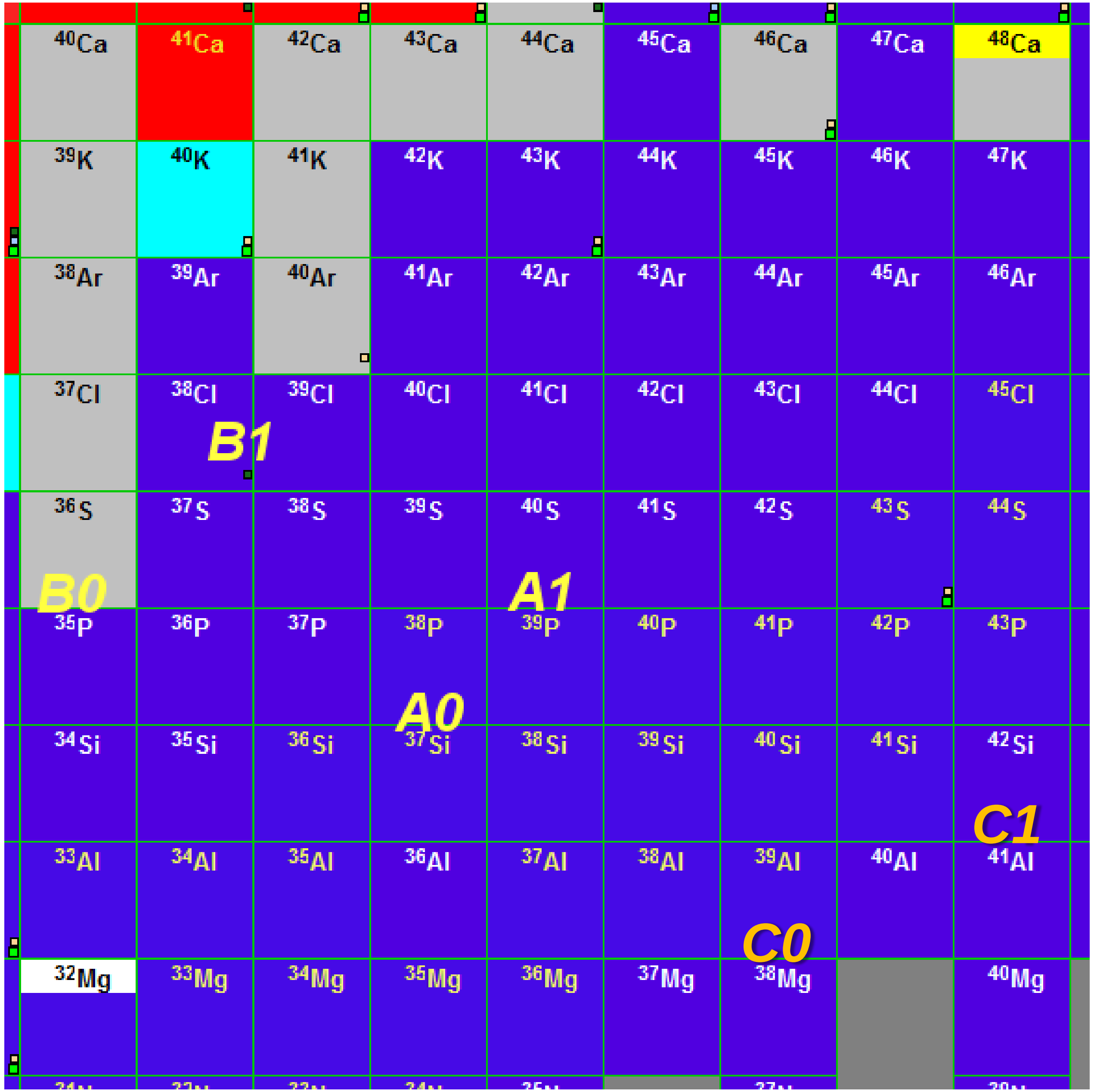
Exc.Energy to prefragment search
- ( ) Surface (Geometrical)
- (•) E* per abraded nucleon
  E* = c * dAabr

"Top" Prefragment	39Cl
"Bottom" Prefragment	38Cl
Final Prefragment mass	38.0
Energy excitation (MeV)	65.6
Probability	7.12e-05
Corrected Probability	1.05e-03



^{48}Ca (140 MeV/u) → ^{32}Mg : options A, B & C

v.11.1.102



Excitation Energy for prefragment search

- Surface (Geometrical)
- E* per abraded nucleon (E* = coef * dA_abr)

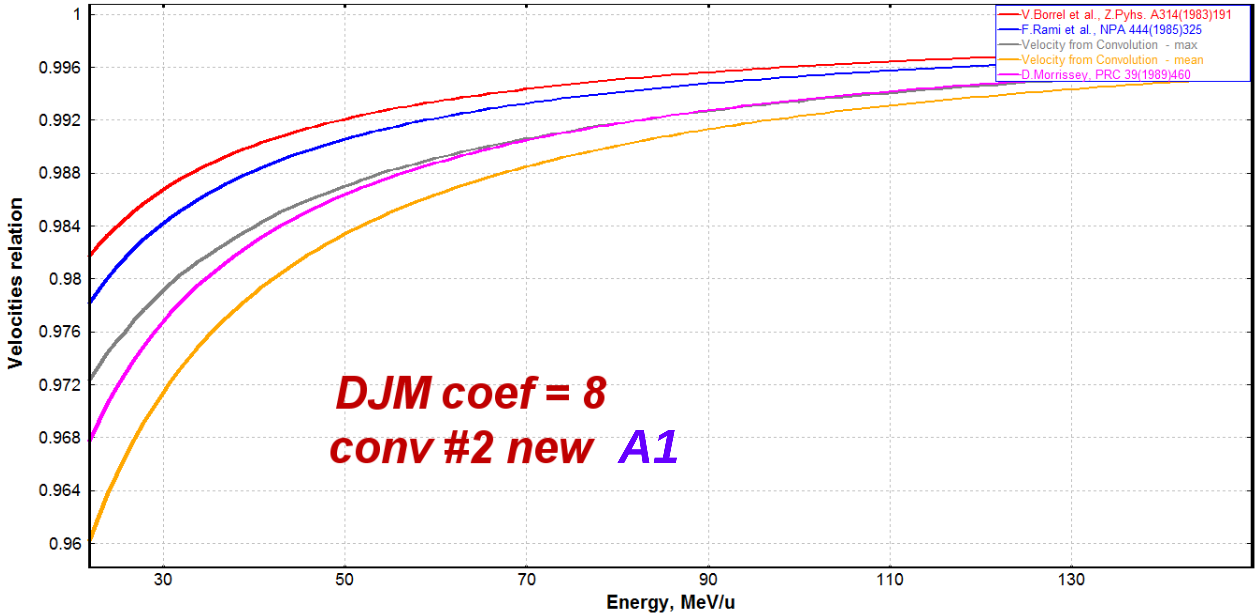
	A	B	C
"Top" Prefragment	40S	39Cl	42Si
"Bottom" Prefragment	39P	38S	41Al
Final Prefragment mass	39.0	38.2	41.1
Energy excitation (MeV)	112.7	125.2	83.2
Probability	1.70e-04	1.88e-04	4.26e-03
Corrected Probability		3.17e-03	1.11e-02

Starting v.11.1.102
"C1" is recommended option!

^{78}Kr → ^{71}Se : Convolution version & DJM vs. Energy

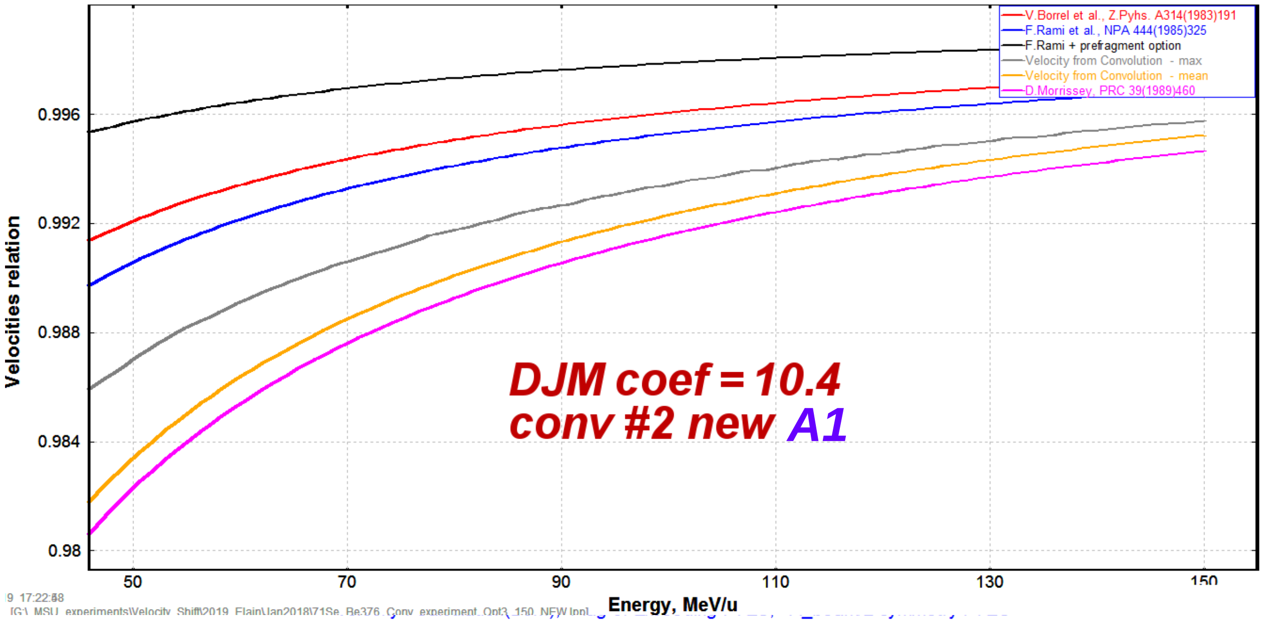
Fragment Velocity after the reaction

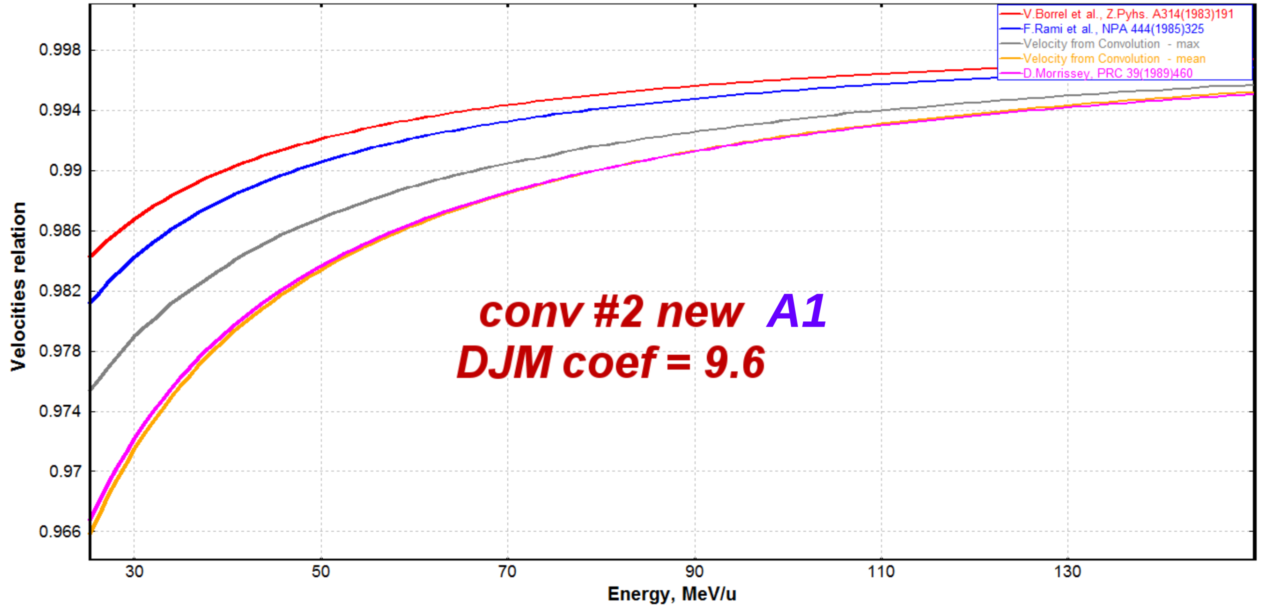
LEFT PLOT => ^{78}Kr + ^{9}Be -> Z=34
RIGHT PLOT => ^{78}Kr + ^{9}Be -> ^{71}Se (versus energy)
Velocity : Calculation(DJM); Flag of Exceeding : YES; A_beam/2 symmetry : YES

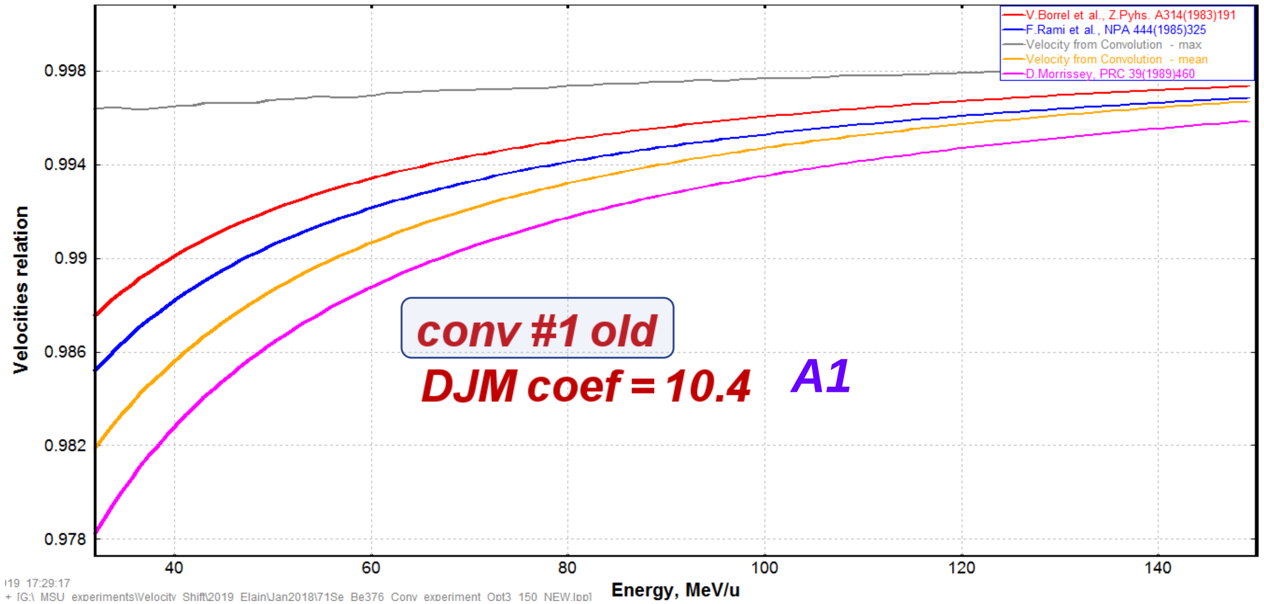


Fragment Velocity after the reaction

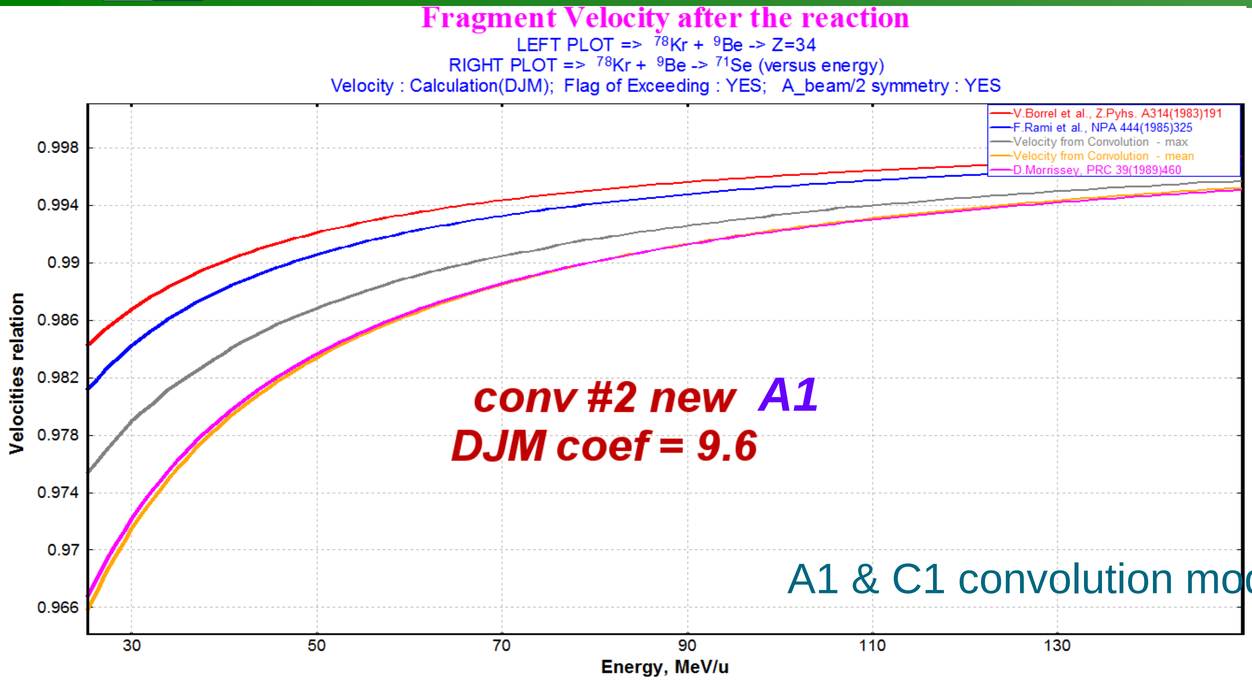
LEFT PLOT => ^{78}Kr + ^{9}Be -> Z=34
RIGHT PLOT => ^{78}Kr + ^{9}Be -> ^{71}Se (versus energy)
Velocity : Convolution; Flag of Exceeding : YES; A_beam/2 symmetry : YES

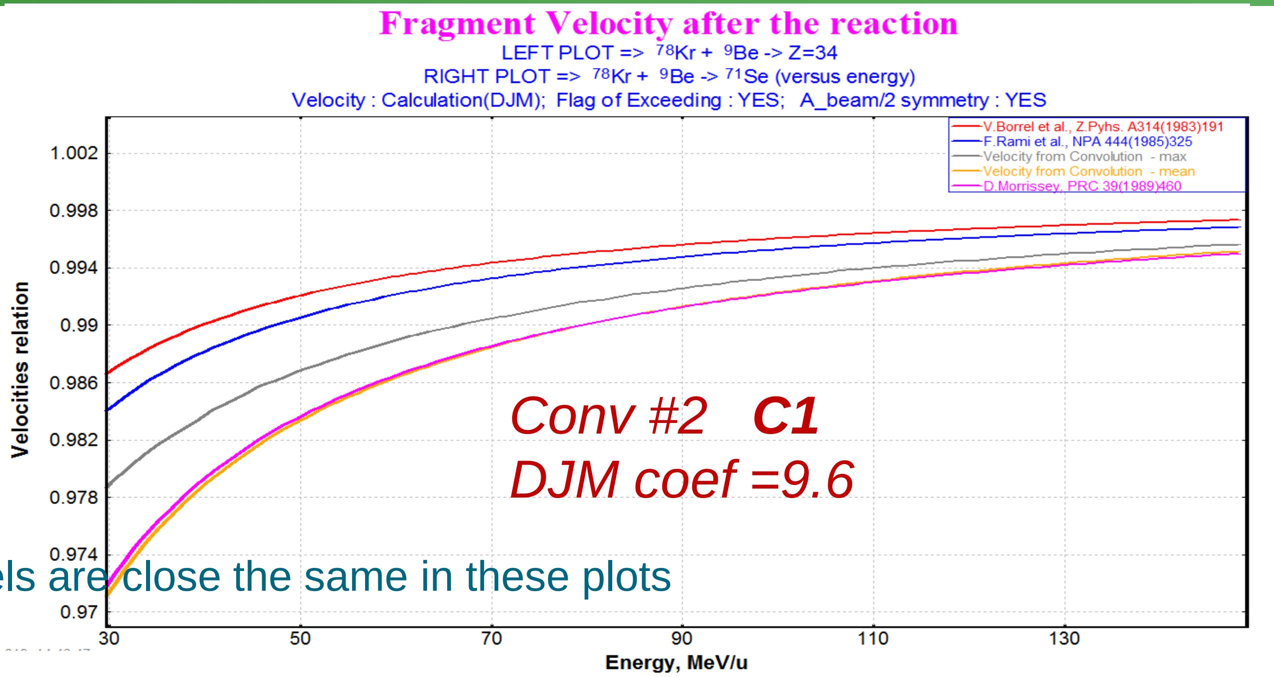




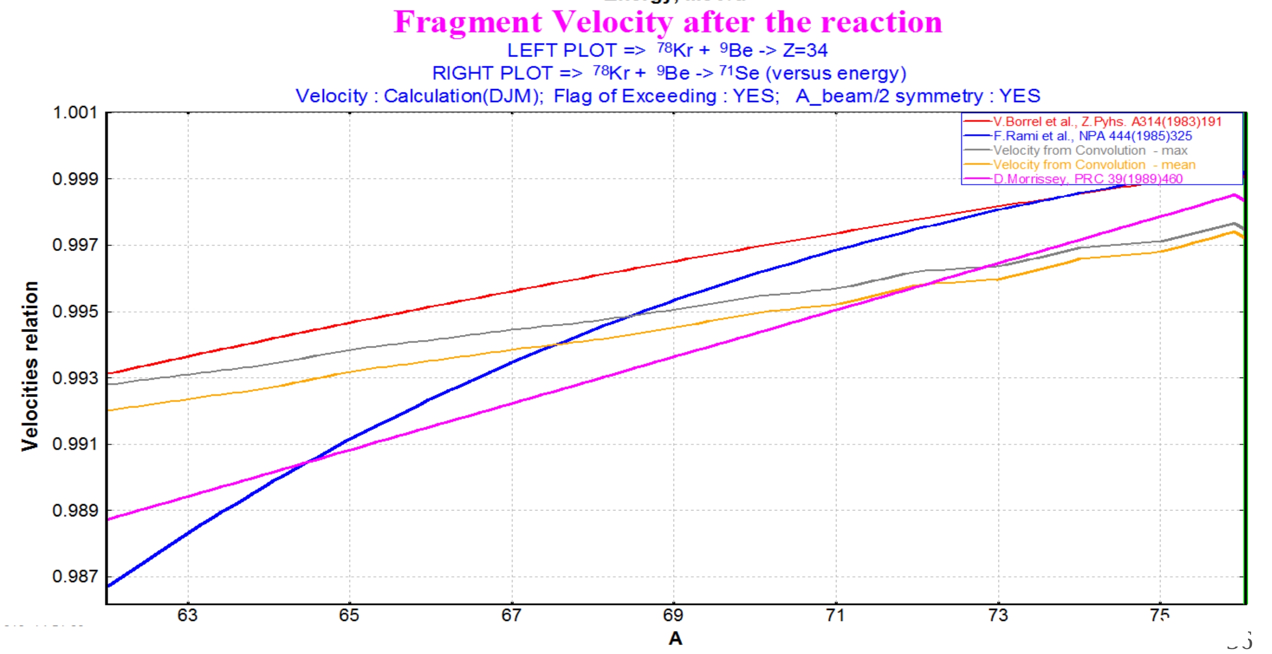


$^{78}Kr \rightarrow {}^{71}Se$: Convolution version (A1 & C1) & DJM vs. Energy





A1 & C1 convolution models are close the same in these plots



Revision details

"UP" = Universal Parameterization

Version 11.1.100

09/05/19

UPDATE:
v.11.1.102
09/09/19

o UP dialog
- UP method #2 re-make: Separation energy now from Abrasion Excitation Energy
- Update of UP plot (4 curves)
- UP modification for high energy
- UP modification for the "result_factor" value

o Prefragment Search dialog
- New option (abrasion) for excitation energy to search a prefragment
- Modification of N/Z algorithm search
- Prefragment search parameters: write/read to/from to user file
- Prefragment search parameters: new default values
- Modification of "B" searching method for prefragment
- New method "C" to search a prefragment

o Momentum distribution as function of beam isospin

o Error function modification
- Error function algorithm revision.
- Implementation of "erfc" array:
  increasing argument range from 4.2 up to 20

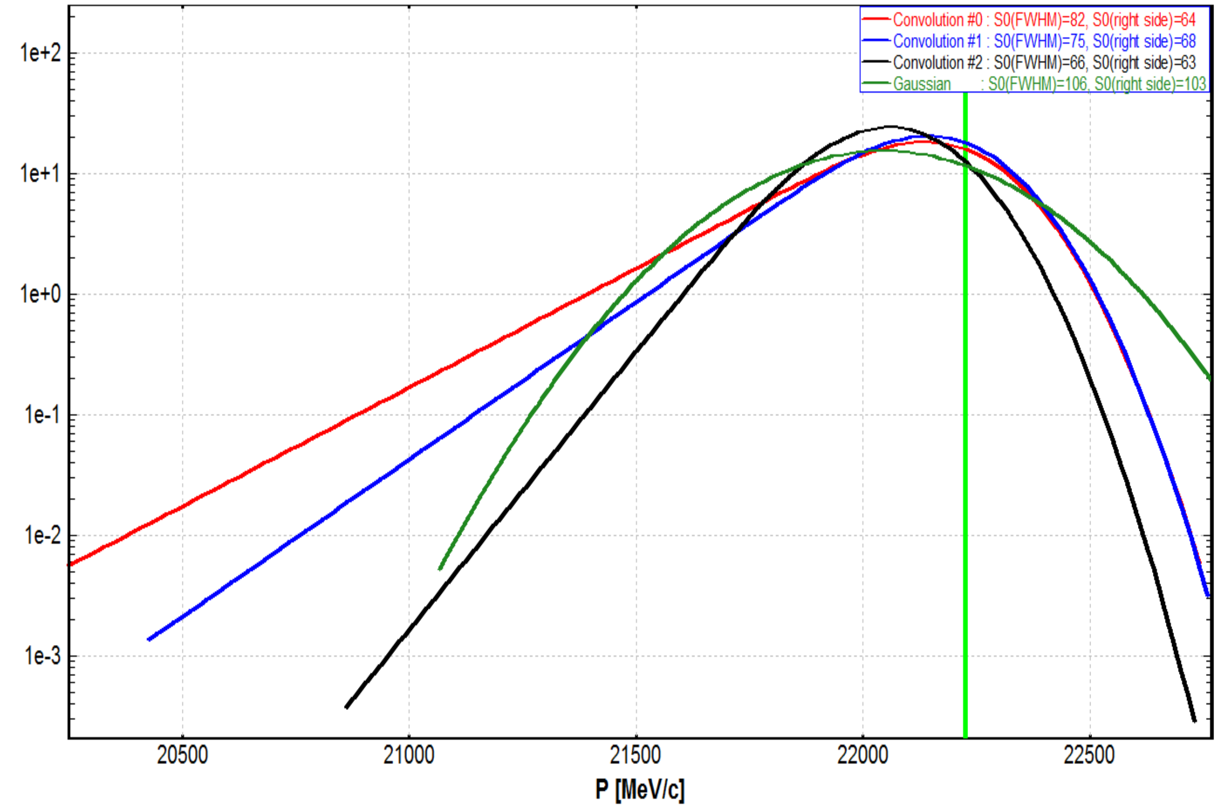
Update of UP plot (4 curves) : σ_{conv}=90 MeV/c

Momentum distributions

^{48}Ca (140 MeV/u) + Be, Settings on ^{42}S

Velocity: Convolution #1-> v/v0(mean)=0.995 and Calculation(DJM) -> v/v0=0.994

Momentum width: "Convolution" & "[1] D.J.Morrissey"; SigmaM=87.0; Correction: Coulomb energy=No; Projectile mass=No

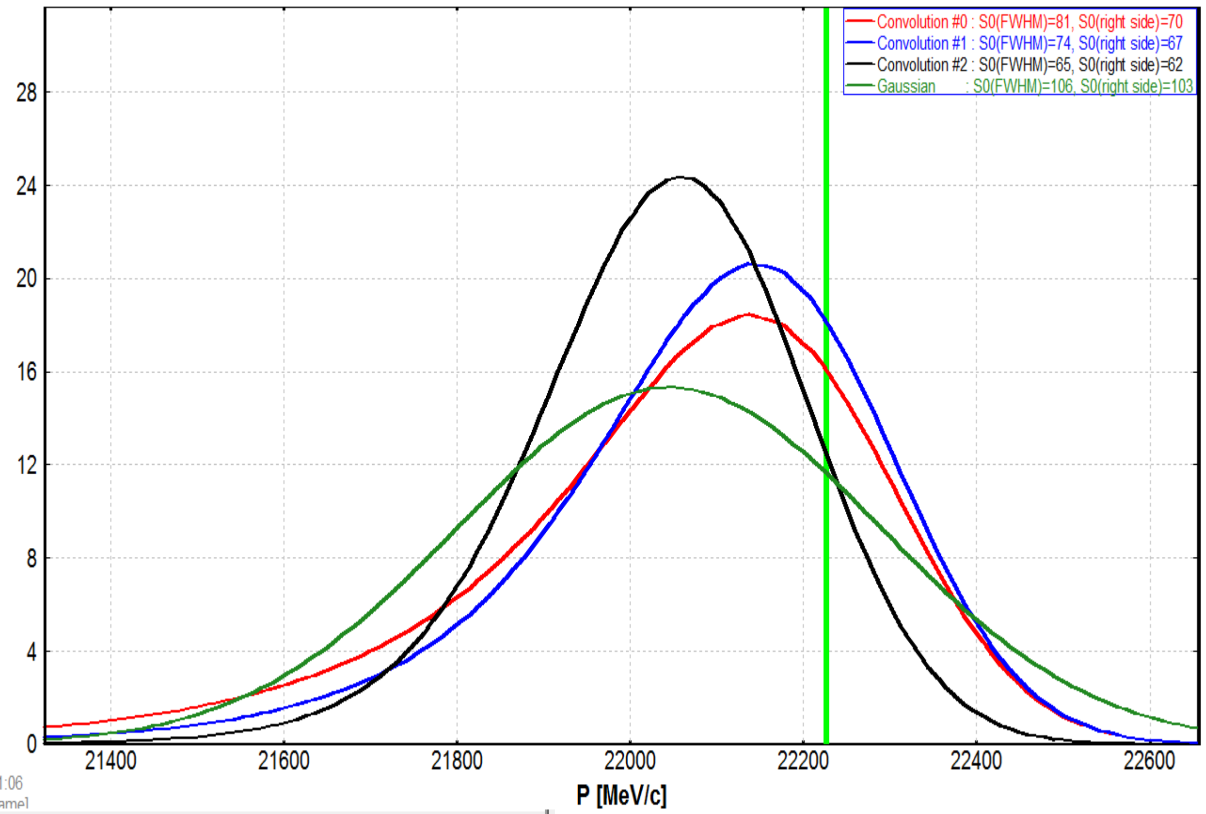


Momentum distributions

^{48}Ca (140 MeV/u) + Be, Settings on ^{42}S

Velocity: Convolution #1-> v/v0(mean)=0.995 and Calculation(DJM) -> v/v0=0.994

Momentum width: "Convolution" & "[1] D.J.Morrissey"; SigmaM=87.0; Correction: Coulomb energy=No; Projectile mass=No



14:21:06
[Noname]

^{48}Ca (140 MeV/u) → ^{42}S

Prefragment search "A1"

Settings for convolution

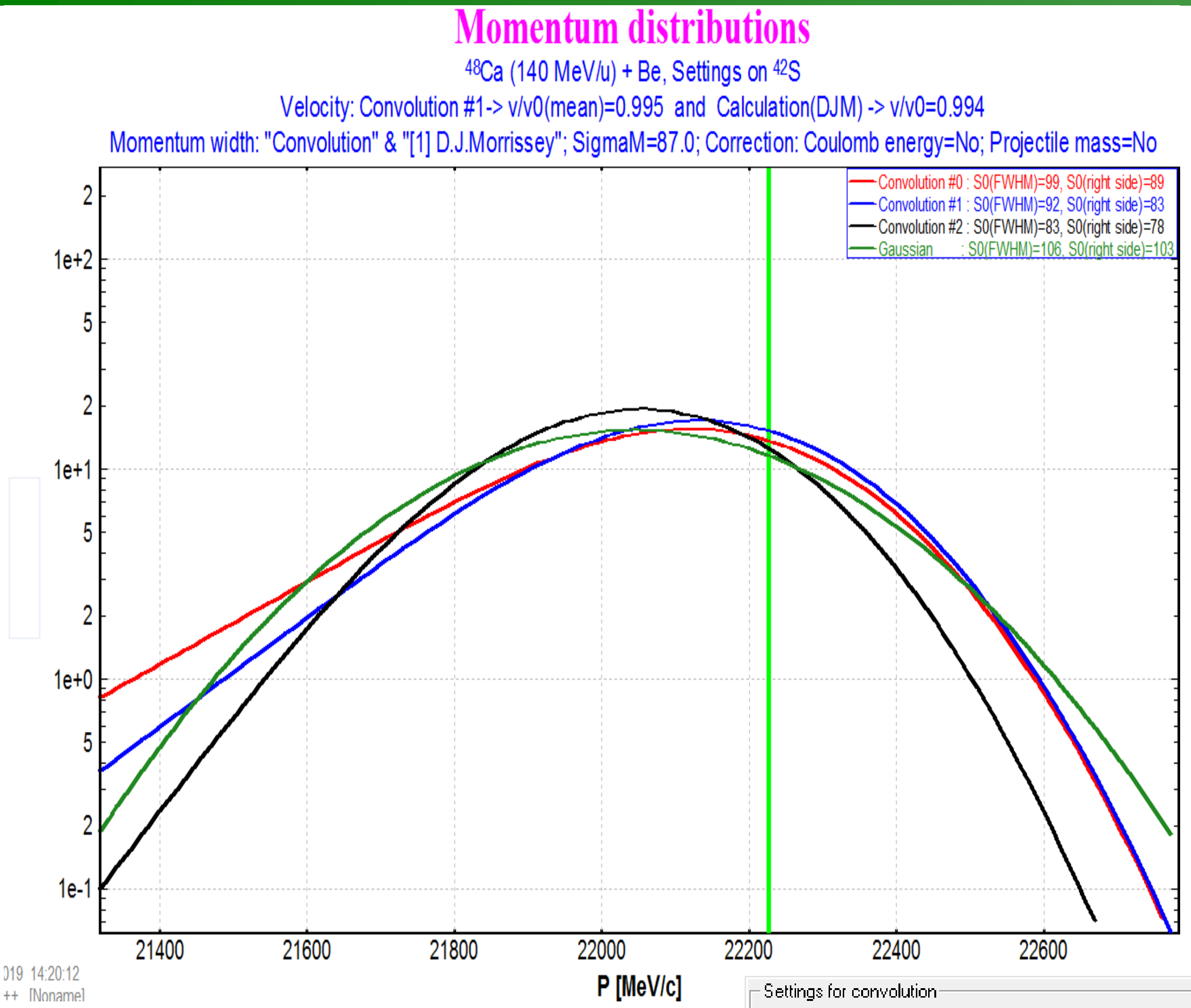
Separation Energy	Es	coef	shift	FWHM / 2.355 (*)	tau	P(Ymax)	Vf/Vb peak	Vf/Vb mean
Energy from Qg	23.8	3.344	0.158	187.5	220.3	22086	0.997	0.994
Excitation from dSurface	16.9	3	0.149	171.8	166.4	22119	0.997	0.995
Excitaton from the Abrasion model	48.7	1	-1	150.9	94.1	22083	0.994	0.994
	MeV			MeV/c	MeV/c	MeV/c		

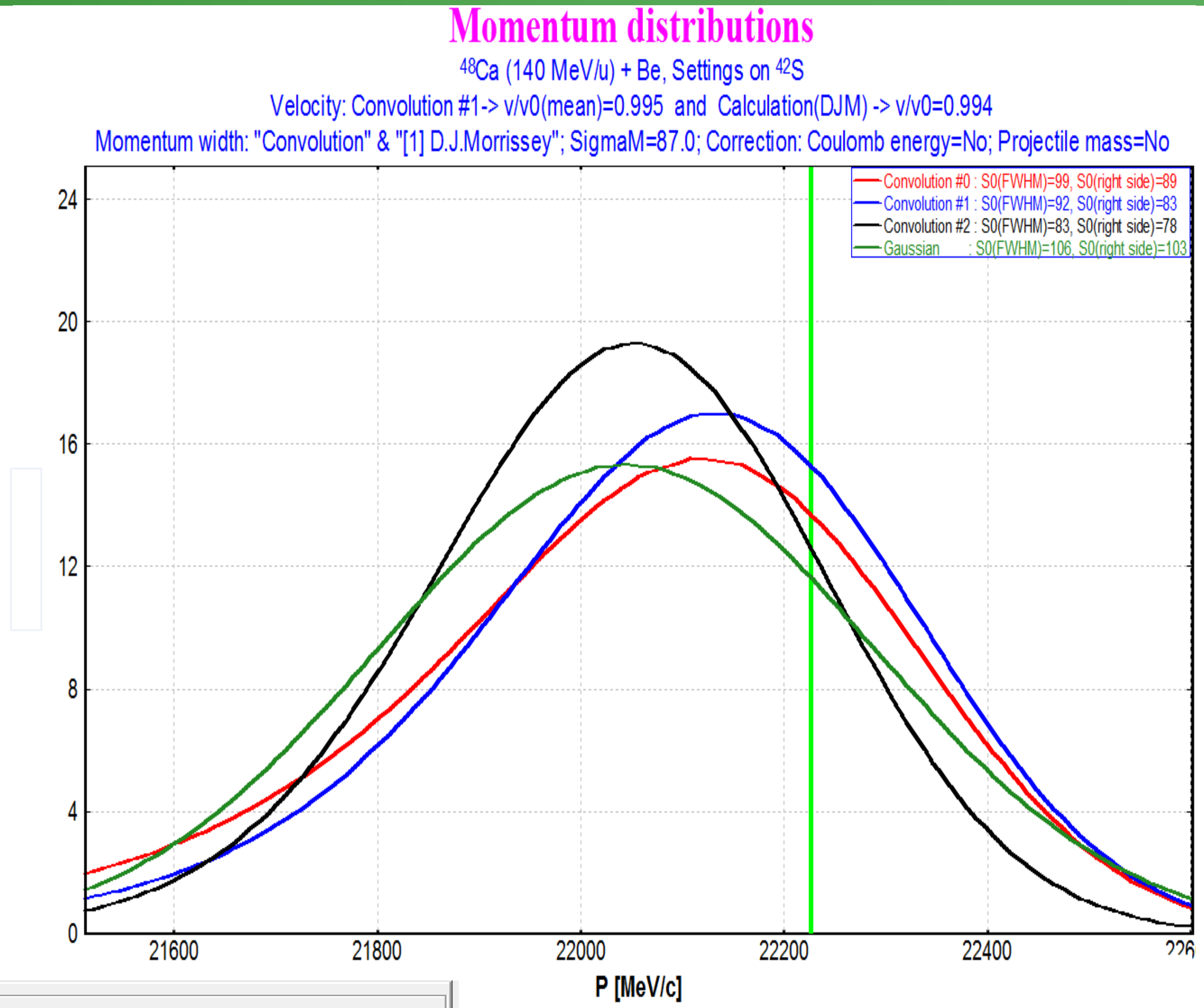
σ_0^{conv} = 90 MeV/c

g = 0.95 MeV/fm^2

(*) - with Gamma-factor

Update of UP plot (4 curves) : σ_{conv}=120 MeV/c





^{48}Ca (140 MeV/u) → ^{42}S

Prefragment search "A1"

Settings for convolution

Separation Energy	Es	coef	shift	FWHM / 2.355 (*)	tau	P(Ymax)	Vf/Vb peak	Vf/Vb mean
○ Energy from Qg	23.8	3.344	0.158	228.6	220.3	22086	0.996	0.994
◉ Excitation from dSurface	16.9	3	0.149	213.4	166.4	22119	0.997	0.995
○ Excitaton from the Abrasion model	48.7	1	-1	192.2	94.1	22083	0.994	0.994
	MeV			MeV/c	MeV/c	MeV/c		

σ_0^{conv} = 120 MeV/c

g = 0.95 MeV/fm^2

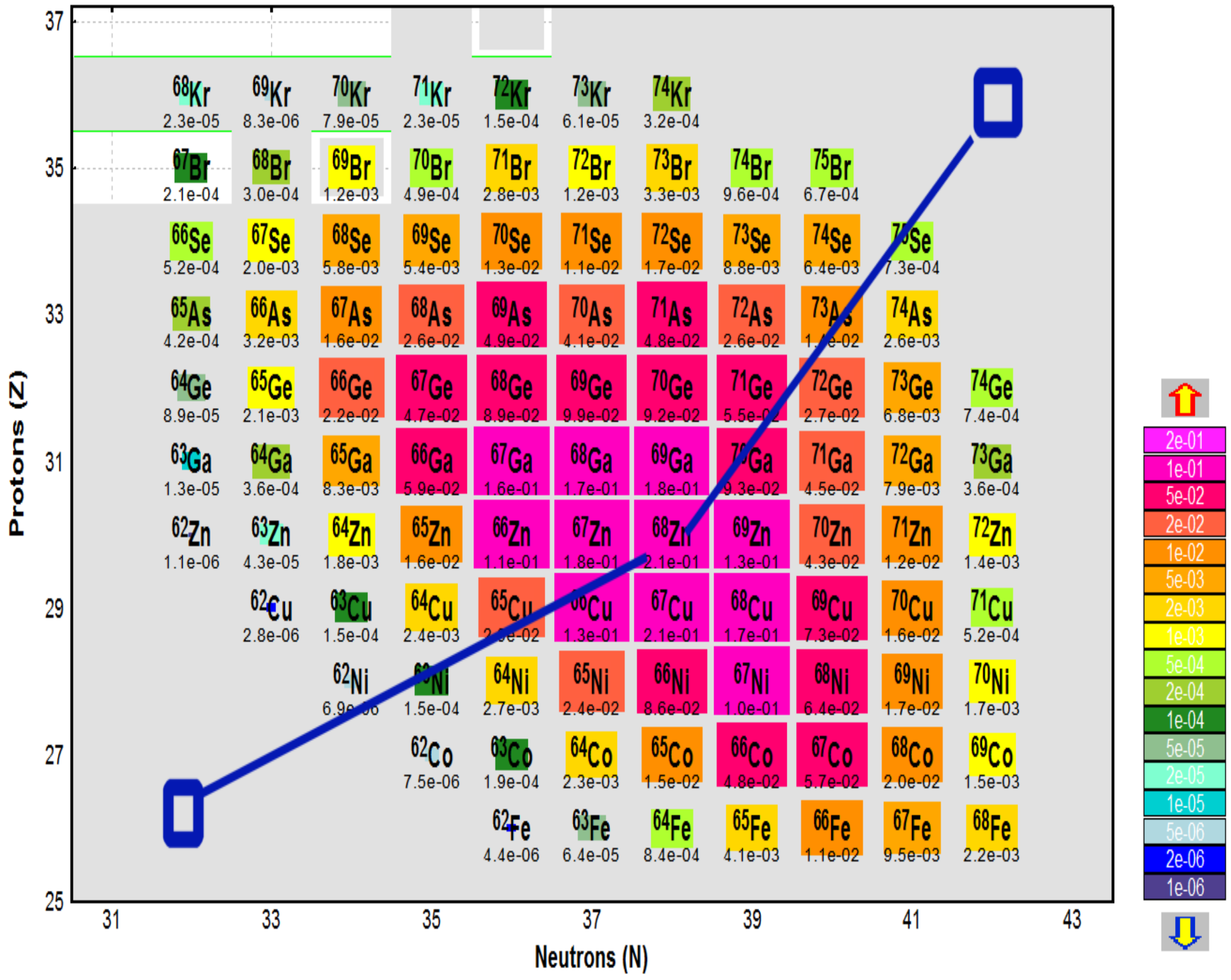
(*) - with Gamma-factor

Initial prefragment plots for $^{78}Kr \rightarrow {}^{58}Fe$ and $^{86}Kr \rightarrow {}^{66}Fe$

$^{78}Kr \rightarrow {}^{68}Zn^* \rightarrow {}^{58}Fe$

Initial Prefragments Plot for ^{58}Fe (3.27e+00 mb)

ABRASION-ABLATION - ^{78}Kr + Be: more probable ^{68}Zn(2.14e-01 mb); <-dZ>=4.26 <-dN>=5.79
Excit.Energy Method:< 2 >; <E*>:16.0*dA MeV Sigma:9.60; No Intrin.Thermalztn; LimitTemp: No
NP=32; SE:"DB0+Cal2" Density:"auto" GeomCor:"Off" Tunlg:"auto" ^{Fis}Bar=#1 Bar^{Fac}=1.00 Modes=$^{1010\ 1000\ 110}$



$^{86}Kr \rightarrow {}^{75}Fe^* \rightarrow {}^{66}Fe$

Initial Prefragments Plot for ^{66}Fe (6.17e-03 mb)

ABRASION-ABLATION - ^{86}Kr + Be: more probable ^{75}Fe(1.20e-03 mb); <-dZ>=1.09 <-dN>=8.39
Excit.Energy Method:< 2 >; <E*>:16.0*dA MeV Sigma:9.60; No Intrin.Thermalztn; LimitTemp: No
NP=32; SE:"DB0+Cal2" Density:"auto" GeomCor:"Off" Tunlg:"auto" ^{Fis}Bar=#1 Bar^{Fac}=1.00 Modes=$^{1010\ 1000\ 110}$