

Version 9.8.*
from 12/30/2014

- Update of the transmission information window
- Using ion masses instead atomic
- A1900: Beam dump
- dBE & dBEsn plots
- ISOL rate plot
- FRIB new isotope plot
- “Stability” plot
- Data error analysis (statistical)
- Abrasion-Fission : speed of fissile nuclei

- Critical undocumented modifications

Update of the transmission information window

statistics: 37Ar

37Ar	Beta+ decay (Z=18, N=19)	Argon		Argon		Argon		Argon		Old
Q1 (D1)	18	18	17	17	16	16	15	15	14	
Q2 (D2)	18	18	17	17	16	16	15	15	14	
Q3 (D3)	18	18	17	17	16	16	15	15	14	
Q4 (D4)	18	18	17	17	16	16	15	15	14	
Reaction	FusRes	ProjFrag	FusRes	ProjFrag	FusRes	ProjFrag	FusRes	ProjFrag	FusRes	
Ion Production Rate (pps)	9.73e+2	1.79e+3	1.55e+3	1.29e+3	5.23e+2	1.47e+2	7.5e+1	6.13e+0	6.28e+0	
Total ion transmission (%)	8.728	18.111	13.927	13.009	4.688	1.485	0.673	0.062	0.056	
Total: this reaction (pps)	3.13e+3	3.24e+3	3.13e+3	3.24e+3	3.13e+3	3.24e+3	3.13e+3	3.24e+3	3.13e+3	
Total: All reactions (pps)	6.37e+3	6.37e+3	6.37e+3	6.37e+3	6.37e+3	6.37e+3	6.37e+3	6.37e+3	6.37e+3	
X-Section in target (mb)	1.44e+1	1.28e+1	1.44e+1	1.28e+1	1.44e+1	1.28e+1	1.44e+1	1.28e+1	1.44e+1	
Target (%)	31.08	55.43	49.59	39.81	16.7	4.55	2.4	0.189	0.201	
X space transmission (%)	100	100	100	100	100	100	100	100	100	
Y space transmission (%)	100	100	100	100	100	100	100	100	100	
Unreacted in material (%)	100	100	100	100	100	100	100	100	100	
Q (Charge) ratio (%)	31.09	55.44	49.6	39.82	16.7	4.55	2.4	0.189	0.201	
Unstopped in material (%)	100	100	100	100	100	100	100	100	100	
D1 (%)	28.08	32.68	28.08	32.68	28.08	32.68	28.08	32.68	28.08	
X angular transmission (%)	62.55	66.68	62.55	66.68	62.55	66.68	62.55	66.68	62.55	
Y angular transmission (%)	44.9	49	44.9	49	44.9	49	44.9	49	44.9	

FaradayCup 1

statistics: 37Ar

37Ar	Beta+ decay (Z=18, N=19)	Argon		Argon		Argon		Argon		New
<div style="border: 2px solid red; padding: 2px;"> All reactions total isotope rate 6.37e+3 pps </div>										
and Overall isotope transmission 30.234 % <div style="float: right; margin-top: -10px;"> → Ratio of all final ions to all produced isotopes </div>										
Q1 (D1)	18	18	17	17	16	16	15	15	14	
Q2 (D2)	18	18	17	17	16	16	15	15	14	
Q3 (D3)	18	18	17	17	16	16	15	15	14	
Q4 (D4)	18	18	17	17	16	16	15	15	14	
Reaction	FusRes	ProjFrag	FusRes	ProjFrag	FusRes	ProjFrag	FusRes	ProjFrag	FusRes	
Ion Production Rate (pps)	9.73e+2	1.79e+3	1.55e+3	1.29e+3	5.23e+2	1.47e+2	7.5e+1	6.13e+0	6.28e+0	
Total ion transmission (%)	8.728	18.111	13.927	13.009	4.688	1.485	0.673	0.062	0.056	
Total: this reaction (pps)	3.13e+3	3.24e+3	3.13e+3	3.24e+3	3.13e+3	3.24e+3	3.13e+3	3.24e+3	3.13e+3	
X-Section in target (mb)	1.44e+1	1.28e+1	1.44e+1	1.28e+1	1.44e+1	1.28e+1	1.44e+1	1.28e+1	1.44e+1	
Target (%)	31.08	55.43	49.59	39.81	16.69	4.55	2.4	0.189	0.201	
X space transmission (%)	100	100	100	100	100	100	100	100	100	
Y space transmission (%)	100	100	100	100	100	100	100	100	100	
Unreacted in material (%)	100	100	100	100	100	100	100	100	100	
Q (Charge) ratio (%)	31.09	55.44	49.6	39.82	16.7	4.55	2.4	0.189	0.201	
Unstopped in material (%)	100	100	100	100	100	100	100	100	100	
D1 (%)	28.08	32.68	28.08	32.68	28.08	32.68	28.08	32.68	28.08	
X angular transmission (%)	62.55	66.68	62.55	66.68	62.55	66.68	62.55	66.68	62.55	
Y angular transmission (%)	44.89	49	44.89	49	44.89	49	44.89	49	44.89	

FaradayCup 1

Total transmission includes blocks from Target up to FaradayCup 1

AME2012 index 18019 error

If more than 1 ion produced

9.8.117 10/15/14

- * PhysCalculator -- ion mass field, all calculations uses ion mass
- * Global changes of the code to use new ion masses
- * New functions : ion mass (taking into account lost electrons)

Physical calculator v.9.8.114

Table of Nuclides: A=36, Element=Ar, Z=18, Q=18. Stable.

Energy: 100.09 MeV/u, Energy: 100 AMeV, Brho: 2.95449 Tm, TKE: 3600 MeV.

Erho: 381.114 MJ/C, Velocity: 12.8819 cm/ns, P: 15943.2 MeV/c, Beta: 0.4296947, p_trnspt: 0.885733 GeV/c, Gamma: 1.107451.

Block	Z \ Thickness	MeV/u	MeV	MeV	<Q>
FP_PIN	Si 516 micron	93.651	3368.4	231.6	18.00
FP_SCI	C9H10 100 mm	0	0	3368.4	0.00

Equilibrium values for material "Si": Charge State <Q>: 18, dQ (sigma): 0.04, Thickness: 1.8736 mg/cm2.

Range and Energy Loss to Si: Range: 1106.57, dRange (sigma): 2.2378 mg/cm2, 4767.24, 9.6409 micron. Energy Remain.: 0.000 MeV/u, Material thickness for energy rest: 1106.6 mg/cm2, 4767.2 micron.

Calculation method of: Energy Losses: 2, Energy straggling: 1, Charge States: 3, Angular straggling: 1.

v.9.8.114

Physical calculator v.9.8.117

Table of Nuclides: A=36, Element=Ar, Z=18, Q=18. Stable. Ion mass = 35.9577 aem.

Energy: 100.118 MeV/u, Energy: 100 AMeV, Brho: 2.9541 Tm, TKE: 3600 MeV.

Erho: 381.109 MJ/C, Velocity: 12.8834 cm/ns, P: 15941.1 MeV/c, Beta: 0.4297452, p_trnspt: 0.885618 GeV/c, Gamma: 1.107481.

Block	Z \ Thickness	MeV/u	MeV	MeV	<Q>
FP_PIN	Si 516 micron	93.678	3368.4	231.56	18.00
FP_SCI	C9H10 100 mm	0	0	3368.4	0.00

Equilibrium values for material "Si": Charge State <Q>: 18, dQ (sigma): 0.04, Thickness: 1.872 mg/cm2.

Range and Energy Loss to Si: Range: 1106.79, dRange (sigma): 2.2385 mg/cm2, 4768.18, 9.6439 micron. Energy Remain.: 0.000 MeV/u, Material thickness for energy rest: 1106.8 mg/cm2, 4768.2 micron.

Calculation method of: Energy Losses: 2, Energy straggling: 1, Charge States: 3, Angular straggling: 1.

v. 9.8.117

P rojectile	$^{76}\text{Ge}^{32+}$
130 MeV/u	1 pnA
F ragment	$^{67}\text{Cu}^{29+}$
T arget	Be 483 mg/cm ²
S tripper	
D 1	Brho 3.2822 Tm
<input type="checkbox"/> beam dump	slits
+10	+200
-100	+100
<input type="checkbox"/> 2nd triplet	beam-line 2.81 m
<input type="checkbox"/> I1_slits	slits
-100	+100
D 2	Brho 3.2822 Tm

Databases Help

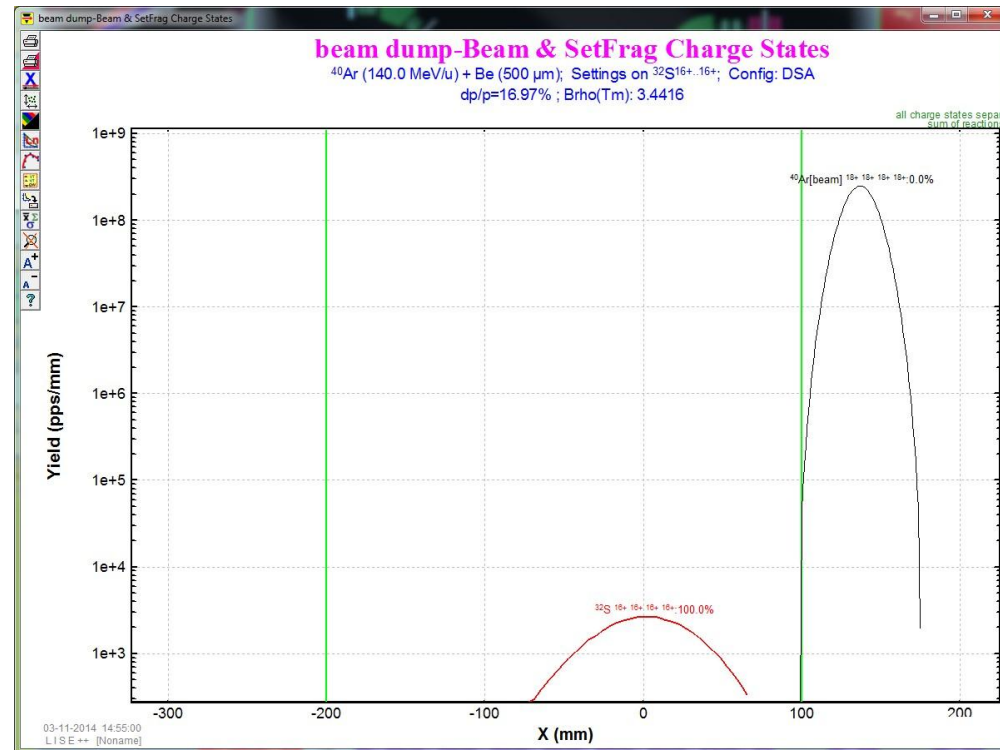
Open

Look in: NSCL

Name	Date modified
Extended	2/3/2014 3:44 PM
A1900_2012.lcn	4/16/2012 10:10 PM
A1900_2013.lcn	2/26/2013 12:05 PM
A1900_2014_BeamDump.lcn	11/3/2014 2:42 PM
A1900_RFFS_2013.lcn	2/26/2013 12:07 PM

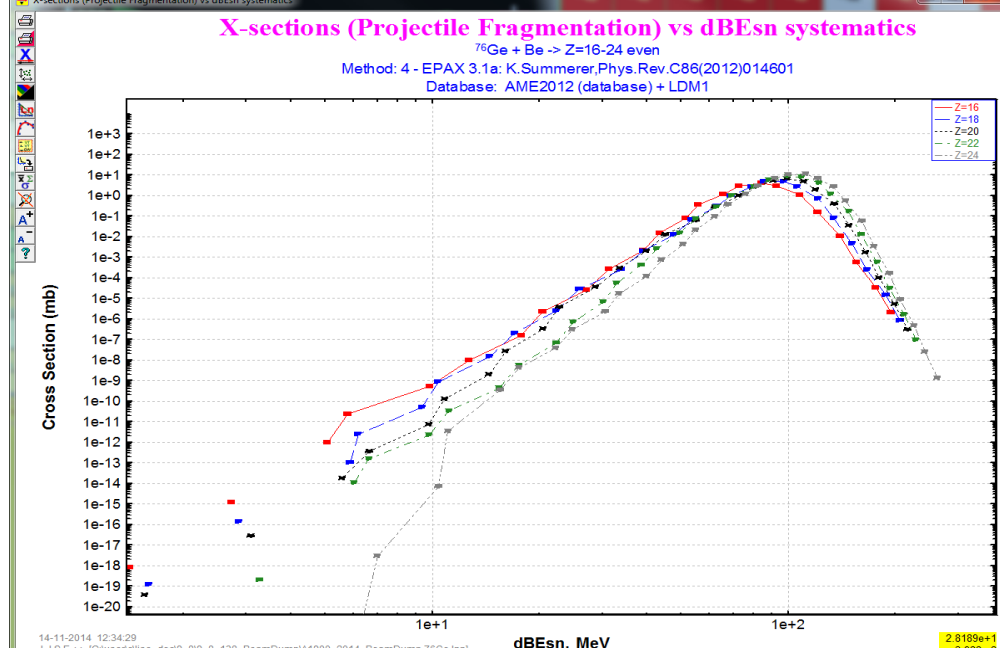
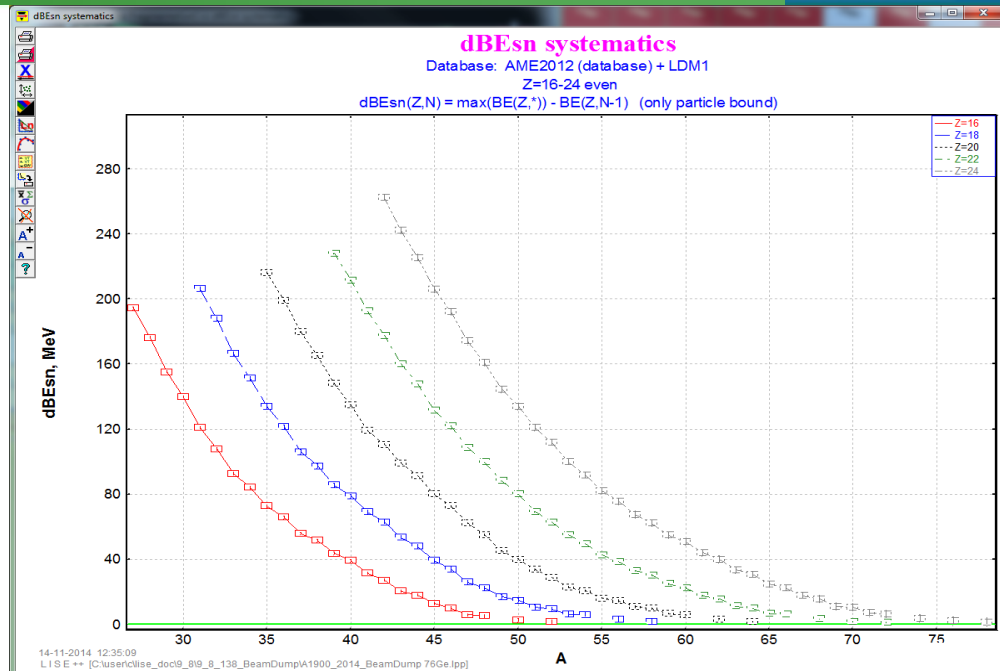
File name:

Files of type: LISI++ Configurations (*.lcn)



1D-Plot 2D-Plot Databases Help

- Block selection distributions >
- Angular distributions >
- Horizontal (X) space distributions >
- Vertical (Y) space distributions >
- Momentum distributions >
- Energy distribution >
- Total Kinetic Energy distributions >
- Electrostatic rigidity distributions >
- Beam and Setting fragment charge state distributions >
- Debug distributions >
- Debug information >
- Brho selection plot >
- Wedge selection plot >
- Isomeric Gamma spectrum >
- Transmission characteristics >
- Range distributions >
- Charge distributions >
- Average Ionic charge plot >
- Cross Section distributions >
- Systematic distributions (Q-g, Q-gg, dBE, dBEsn) >
 - Q-gg distributions
 - Q-g distributions
 - dBE distributions**
 - dBEsn distributions**
 - Q-g vs CS
 - Q-g vs CS
 - dBE vs CS**
 - dBEsn vs CS**
- Velocity after reaction >
- Plot Options >

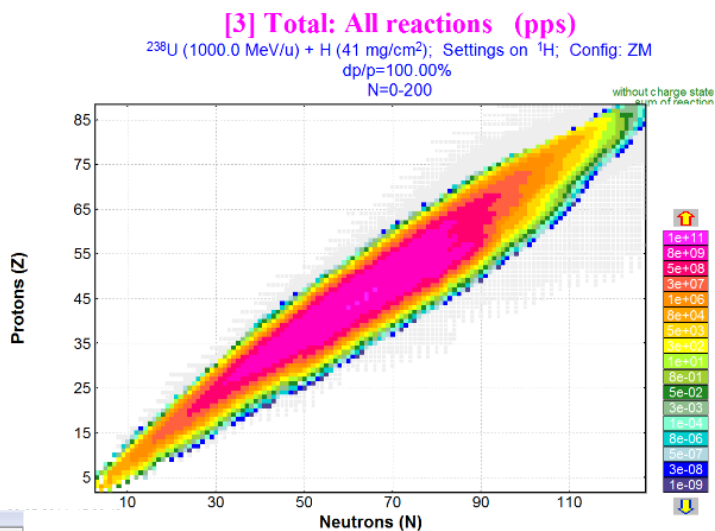


See the next link for dBE & dBEsn details

Projectile fragmentation as a tool to observe shell effects close to the neutron drip-line

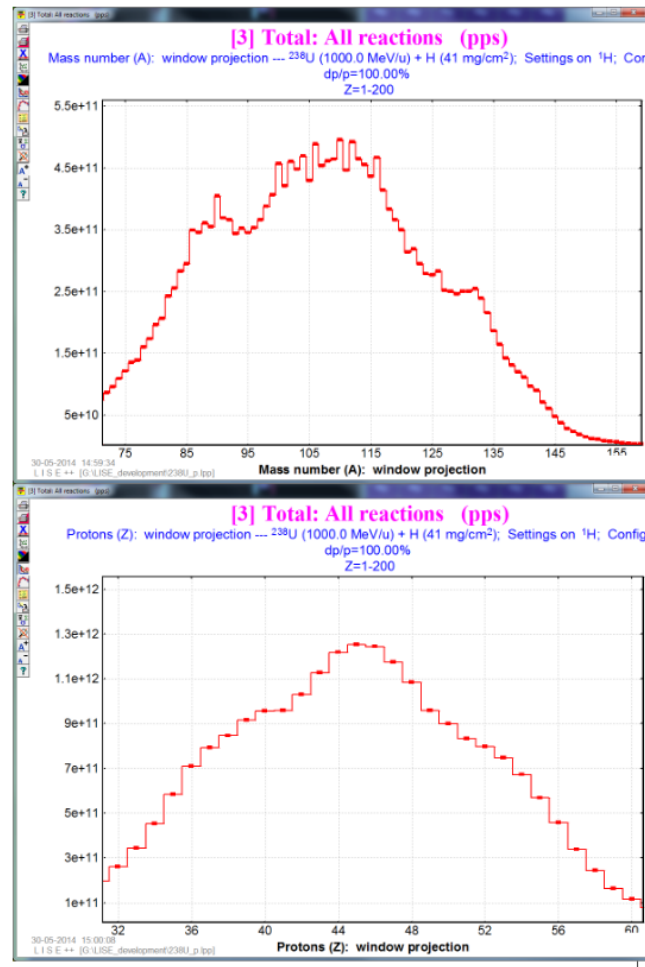
http://lise.nslc.msu.edu/9_8/ISOL/ISOLatLISE.pdf

Total rate 2.3e13 pps



- Utilities | 1D-Plot | 2D-Plot | Databases | Help
- LISE++ for Excel
- CODES : Charge, Global, PACE4, etc. ▶
- Radioactivity, decays ▶
- Reactions utilities ▶
- Plots : Energy loss, Ranges, Stragglng, etc. ▶
- NSCL / FRIB / ISOL rates ▶
- Set-up utilities ▶
- Range optimizer (Gas cell utility)
- Gas pressure optimization for gas-filled dipole
- CATCHER utility (ISOL, Fusion-Residual)
- Rate & transmission calculation: batch mode
- Stripper foil lifetime

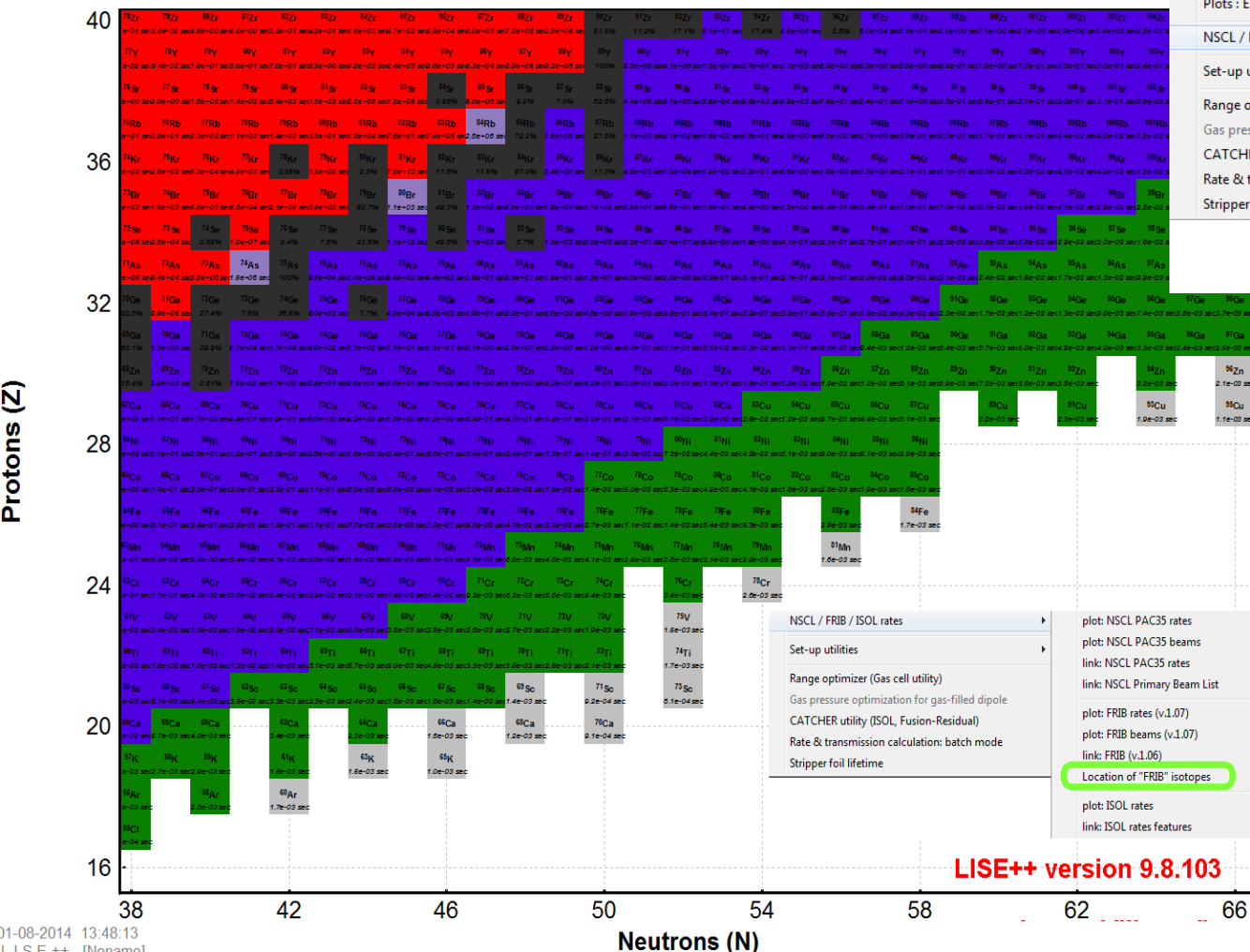
- plot: NSCL PAC35 rates
- plot: NSCL PAC35 beams
- link: NSCL PAC35 rates
- link: NSCL Primary Beam List
- plot: FRIB rates (v.1.07)
- plot: FRIB beams (v.1.07)
- link: FRIB (v.1.06)
- Location of "FRIB" isotopes
- plot: ISOL rates**
- link: ISOL rates features



$T_{1/2}$ (sec) (compilation)

using FRIB rates(v.1.07) based on

EPAX 3.1 for Projectile Frgamnetation and the LISE++ 3EER model for in-flight fission
for "new" isotopes ==> Number of days to run: 1; Minimum number of events



Utilities | 1D-Plot | 2D-Plot | Databases | Help

- LISE++ for Excel
- CODES : Charge, Global, PACE4, etc.
- Radioactivity, decays
- Reactions utilities
- Plots : Energy loss, Ranges, Stragglings, etc.
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- plot: NSCL PAC35 rates
- link: NSCL PAC35 beams
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- plot: FRIB rates (v.1.07)
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- plot: ISOL rates
- link: ISOL rates features

- New (FRIB)
- unknown
- unbound
- SF & A
- SF & B-
- SF & B+
- Spont.fission
- P & A decay
- B+ & B- decay
- Proton decay
- A & B- decay
- A & B+ decay
- Alpha decay
- B+ & B- decay
- Beta decay
- Beta+ decay
- Stable

Sorry, this utility under development...

Input a word to get the access

OK [X] Quit

NSCL / FRIB / ISOL rates

Set-up utilities

Range optimizer (Gas cell utility)

Gas pressure optimization for gas-filled dipole

CATCHER utility (ISOL, Fusion-Residual)

Rate & transmission calculation: batch mode

Stripper foil lifetime

plot: NSCL PAC35 rates

plot: NSCL PAC35 beams

link: NSCL PAC35 rates

link: NSCL Primary Beam List

plot: FRIB rates (v.1.07)

plot: FRIB beams (v.1.07)

link: FRIB (v.1.06)

Location of "FRIB" isotopes

plot: ISOL rates

link: ISOL rates features

LISE++ version 9.8.103

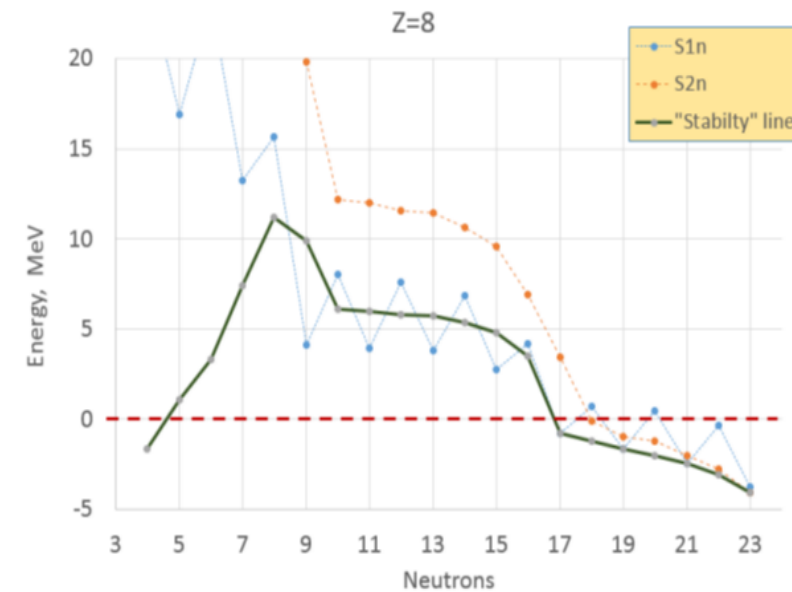
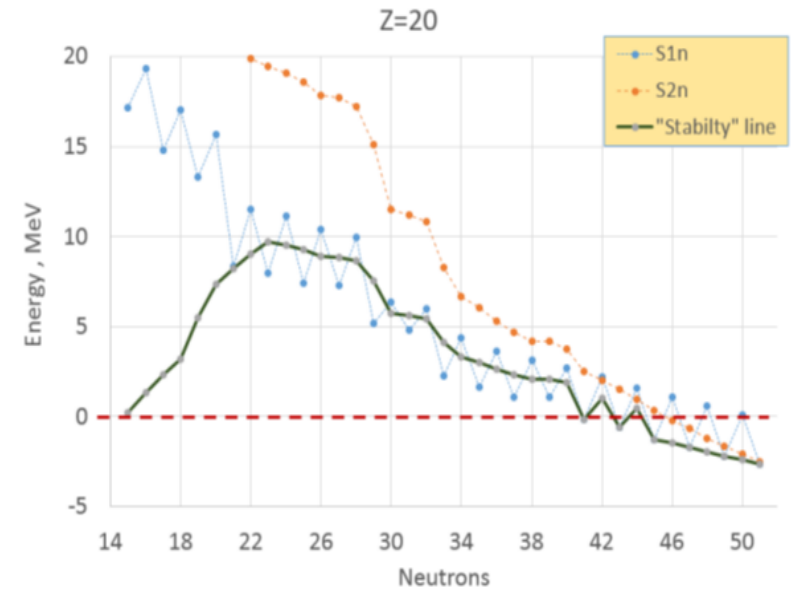
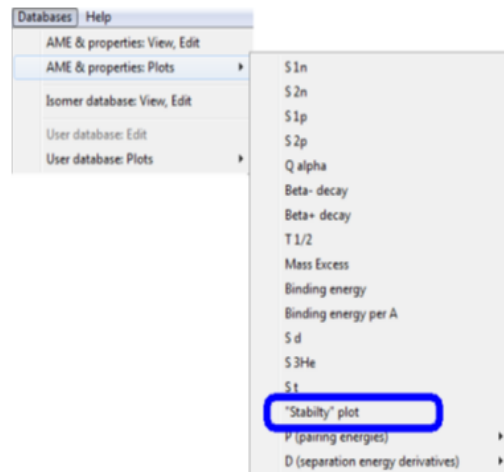
"Stability" plot

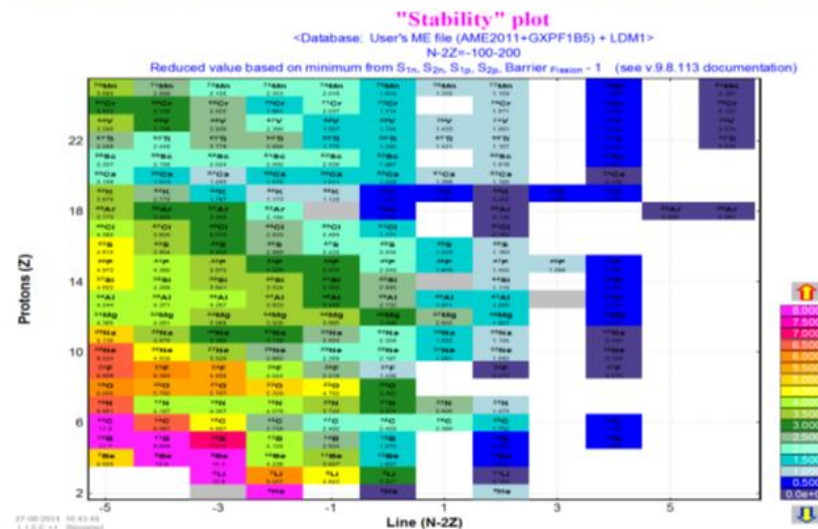
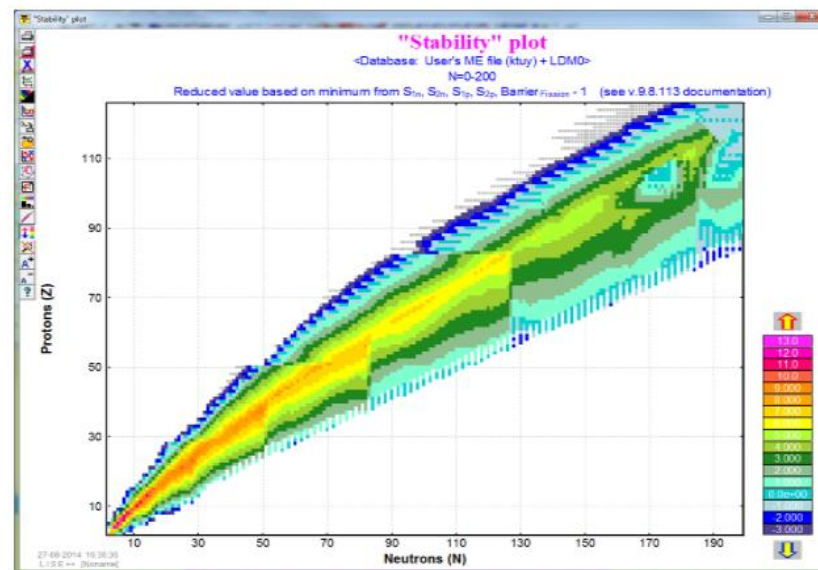
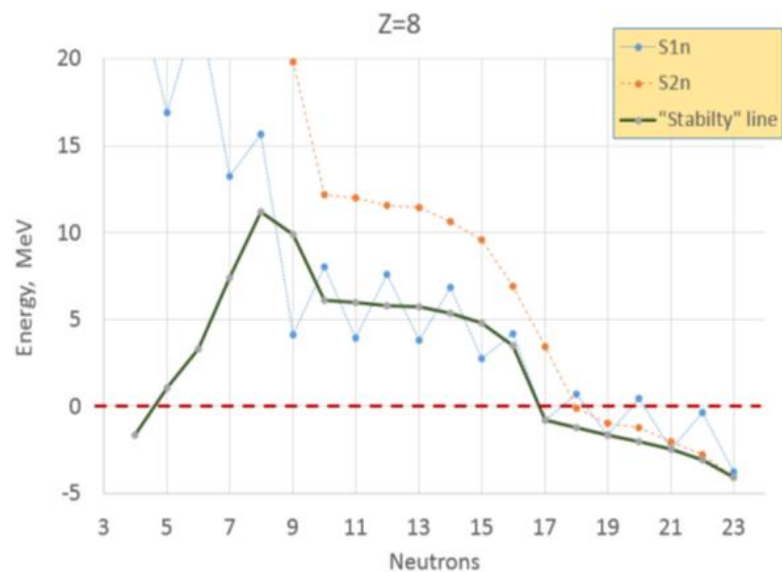
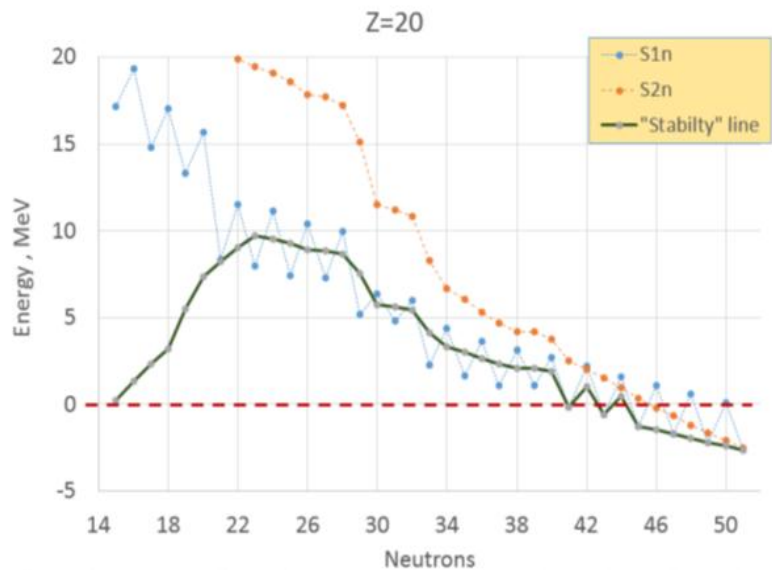
Version 9.8.113 from 08/27/2014

The Purpose is to deduce and plot a minimum value from the set of S1n, S2n, S1p, S2p, Fission-Barrier in order to

- Show particle bound isotopes
- Avoid "saw" structure due to odd-even corrections in separation energy

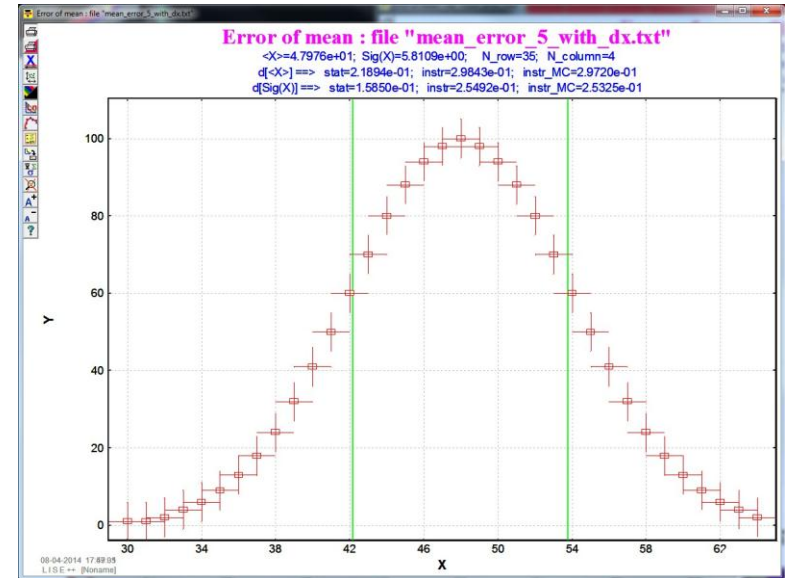
Fission barrier is a maximum value obtained from Fission barrier models in LISE++, including experimental information. BarFac=1, L=0. Fission barrier is decrease by 1.0, roughly assuming that at Fission Barrier =1 a nucleus is not particle bound against fission





Calculations Utilities 1D-Plot 2D-Plot Databases Help

- Optics
- Goodies
- Calibrations
- Transmission and rate
- Optimum Target
- Optimum Target-Wedge and Wedge-Wedge configurations
- Brho scanning
- Optimum charge state combination
- Monte Carlo calculation of transmission
- Calculators
 - Physical Calculator
 - Kinematics Calculator
 - Mathematical Calculator
 - Evaporation Calculator
 - Fusion-Residue Calculator
 - Matrix Calculator
 - Estimated error of mean**



Calibration file

Open file View file

mean_error_same.txt

Columns = 3
 Rows = 35

Data File format (columns):
 X, Y, d_Y
 X, d_X, Y, d_Y

Note
 The Data file is in ASCII format. Comment strings begin with " ! ". The Columns can be separated by a Space, a Comma or a Tabulation.

Monte Carlo refresh

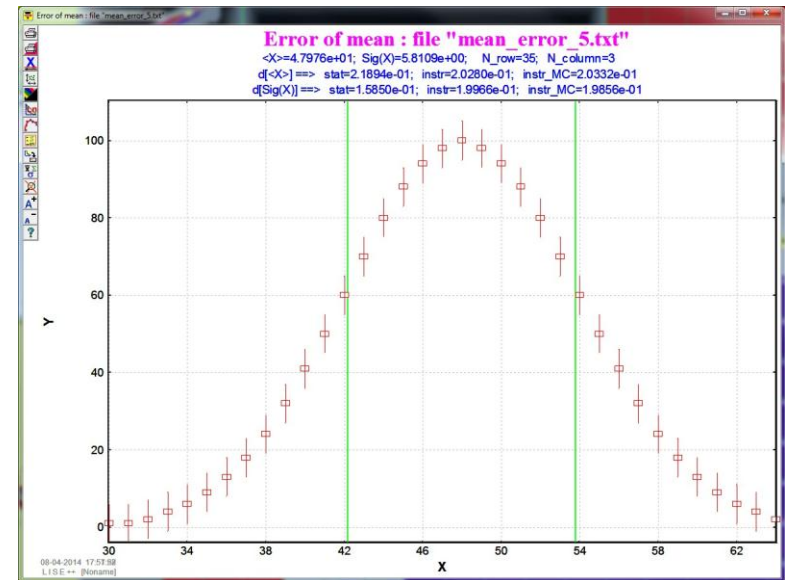
Plot data

Save results to file

Quit Help

<X> = 4.798e+01 Sig(X) = 5.811e+00

	Error of <X>	Error of Sig(X)
Statistical	2.189e-01	1.585e-01
Instrumental	9.210e-01	5.561e-01
Monte Carlo Instr.	1.002e+00	6.179e-01



The documentation should be done

Abrasion-Fission
✕

238U (750.0 MeV/u) + Be

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 FISSILE nucleus	236U	226Th	220Ra
Excitation energy (MeV)	23.5	100	250
Cross section (mb)	200	500	350

Restore previous settings Cross sections sum (mb) 1050

LISE++ Abrasion-Ablation calculations to estimate excitation energy regions

1. Calculate. 2. Use "All" hints in code. 3. Plot

Calculate * no calculations were found

Plot use "ALL" hints in code

	LOW	MIDDLE	HIGH	EM fission
LISE++ hint for the fissile nucleus from excitation energy				
Excitation energy (MeV)				
Cross section (mb)				
	use in code **	use in code	use in code	

Fission barrier < LOW < 40 Boundary energies for mean values of prefragment excitation energy distributions to split low, middle and high energy regions. Recommendation: $2.3 * dEx$, where dEx is excitation energy per abraded nucleon. Default values are equal to 40 & 180 MeV

40 < MIDDLE < 180

180 < HIGH

coef for Zb = 0.8 0.1 < coef < 0.9; recommendation: 0.75

determine low Z (element number) where Abrasion-Ablation stops. $Z_{stop} = coef * Z_{beam}$

* - takes about 0.5 - 1 minute ** - Low-excitation Abrasion-Fission and EM fission results will be used together

Load Fission, Evaporation, Excit. Energy Region settings from file

Fission properties
 Calculate Fissile nuclei velocity based on the Projectile Fragmentation model (DJM)

Evaporation settings

Prefragment excit. energy

✓ OK
✕ Cancel
? Help
 Make default

Reactions

- 9.8.165 11/19/14
 - ❖ Modifications important for fission and two-body reactions at low energies
 - ❖ Modifications of Angular Acceptance passing for fission products
 - ❖ Fission Matrix Kinematics modification - filling by a min energy value rest of matrices

- 9.8.078 05/22/14
 - ❖ Fission Kinematics revision in taulise-subroutines
 - ❖ Important update for Fusion-Fission Kinematics

- Evaporation, Abrasion-Ablation
 - ❖ Abrasion-Ablation Width decay -- correction for 26O case
 - ❖ Solving 2n-decay issue with only 1n channel option (case of 26 Oxygen)
 - ❖ Protected mode for selection of channels in the Evaporation option dialog
 - ❖ New excitation energy model #3 (Excitation energy-exponential)

- Fission, Barriers
 - ❖ Update for passing stripper in Fission kinematics. Important for low energy and thick stripper
 - ❖ correction in the Shift block for the case of angular shift and fission
 - ❖ Fission barrier : correction to use calculation in the case of Muller's file

- **Monte Carlo**
 - ❖ Modifications: Drawing MC rate (total value)
 - ❖ Angular acceptance option in the MC dialog
 - ❖ New bounds in MC plot if no event in initialization process

- **Others**
 - ❖ Links on available beams in Europe and RIKEN
 - ❖ Internal re-initialization of the generator of random numbers
 - ❖ Modification for last optical block for transmission calculations in the case of Faraday cup
 - ❖ Precise calculation of mean energy after material for qualitative estimation of reactions in material