FRIB mass tables in the LISE^{++} package

v.9.10.270
from 02/03/16

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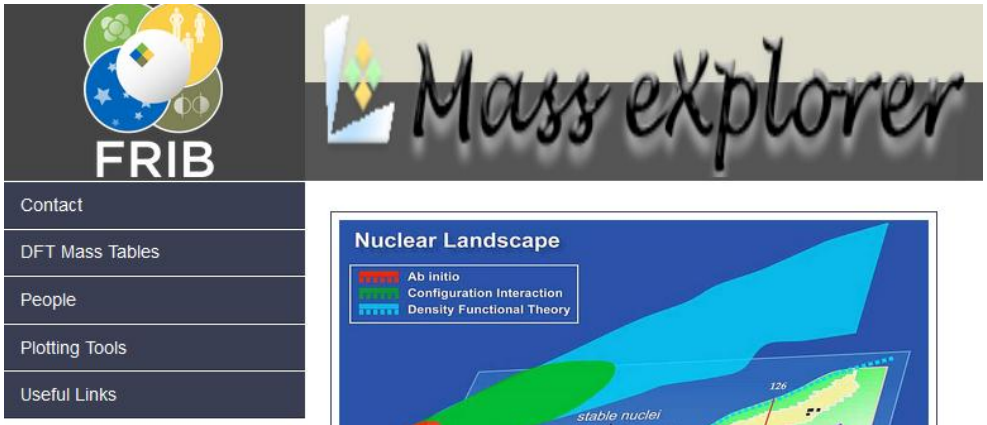
6. How to update the LISE^{++} table of nuclides with a new mass table
7. How to create a LISE^{++} mass excess file from an FRIB mass table
8. LISE^{++} “stability” plots with different mass tables

Acknowledgement to Dr. Erik Olsen for help in porting the FRIB mass tables to LISE^{++}

The FRIB mass explorer

http://massexplorer.frib.msu.edu/

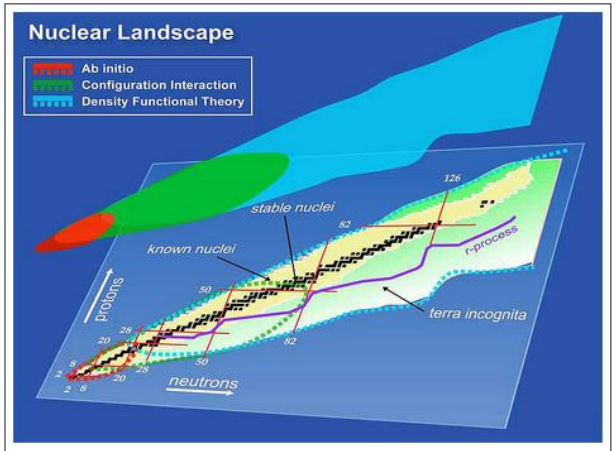


References for the mass tables:

- Erler et al., *Nature* **486**, 509 (2012).
- http://massexplorer.frib.msu.edu.

References for the individual energy density functionals:

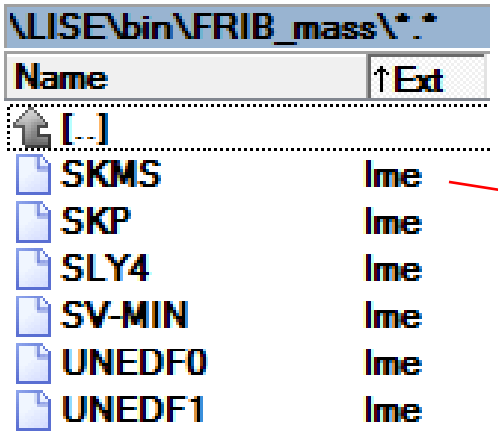
- **SkM***: Bartel et al., *Nucl. Phys. A* **386**, 79 (1982).
- **SkP**: Dobaczewski et al., *Nucl. Phys. A* **422**, 103 (1984).
- **SLy4**: Chabanat et al., *Nucl. Phys. A* **635**, 231 (1998).
- **SV-min**: Klupfel et al., *Phys. Rev. C* **79**, 034310 (2009).
- **UNEDF0**: Kortelainen et al., *Phys. Rev. C* **82**, 024313 (2010).
- **UNEDF1**: Kortelainen et al., *Phys. Rev. C* **85**, 024304 (2012).



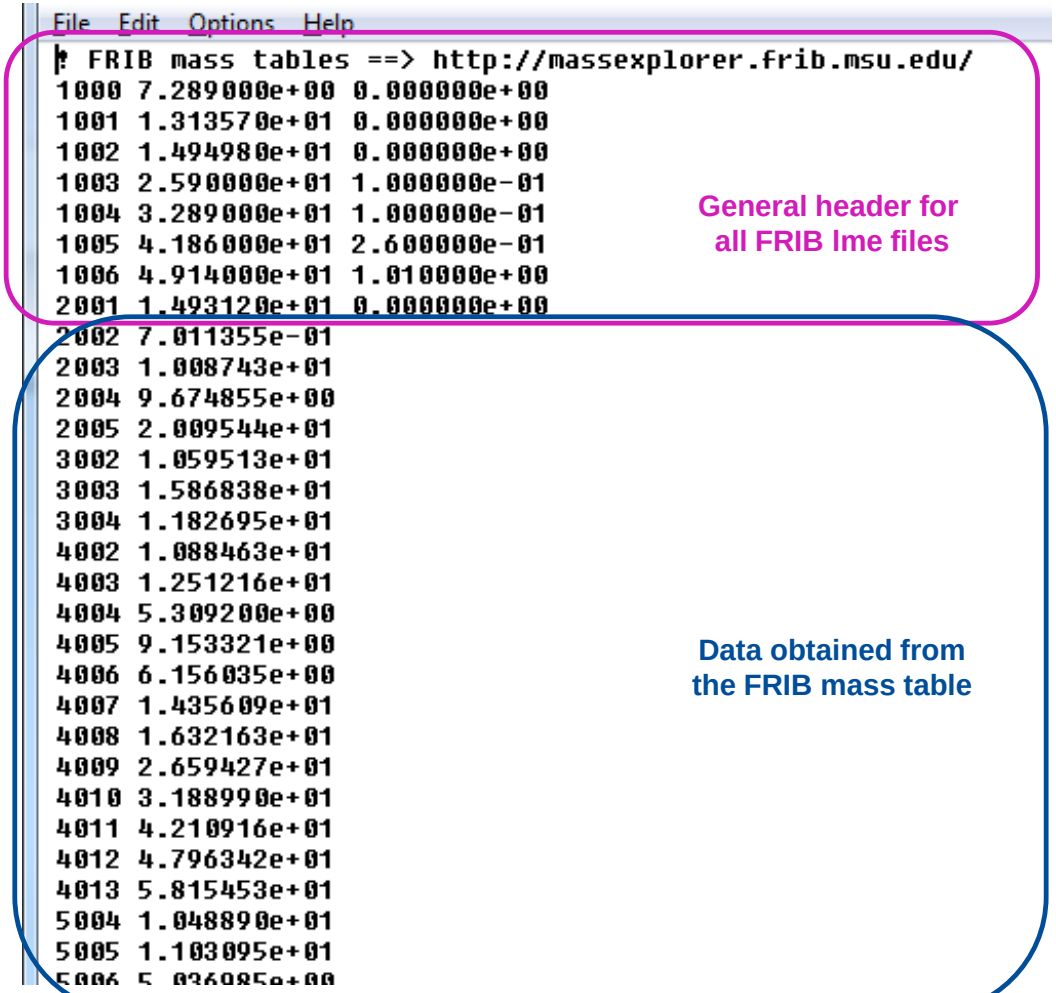
An understanding of the properties of atomic nuclei is crucial for a complete nuclear theory, present and future energy and defense applications, and an understanding of both element formation and the properties of stars. The long term vision of nuclear theory is to arrive at a comprehensive and unified description of nuclei and their reactions grounded in the fundamental interactions between the constituent protons and neutrons. The new and exciting frontier in nuclear theory lies in the description of exotic, short-lived nuclei that have unusually large (or small) neutron-to-proton ratios. This website contains results from large-scale Density Functional Theory calculations of ground state properties of even-even nuclei throughout the nuclear landscape.

See Erler et al., Nature **486**, 509 (2012) for details.

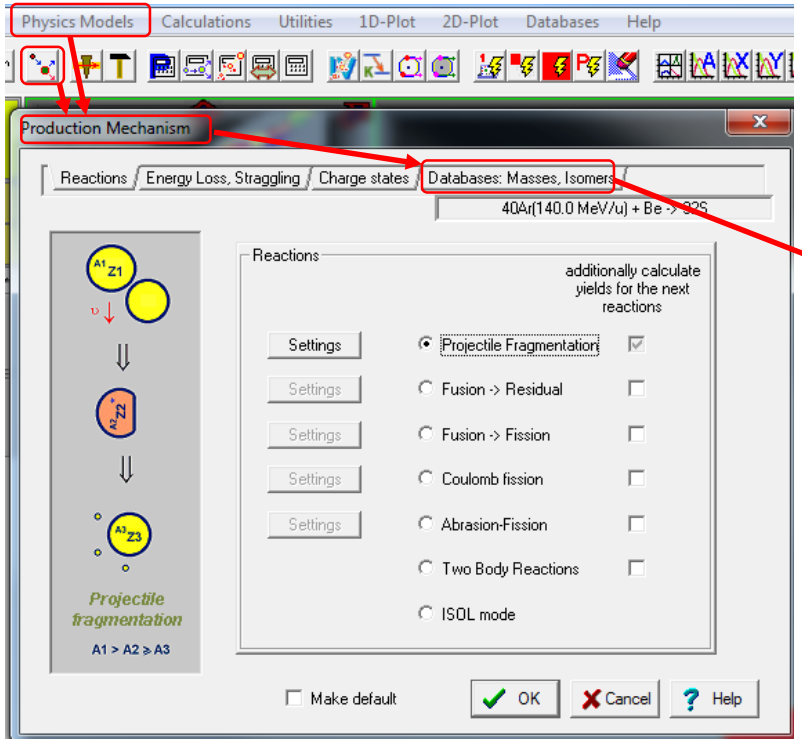
LISE\bin\FRIB_mass*.lme

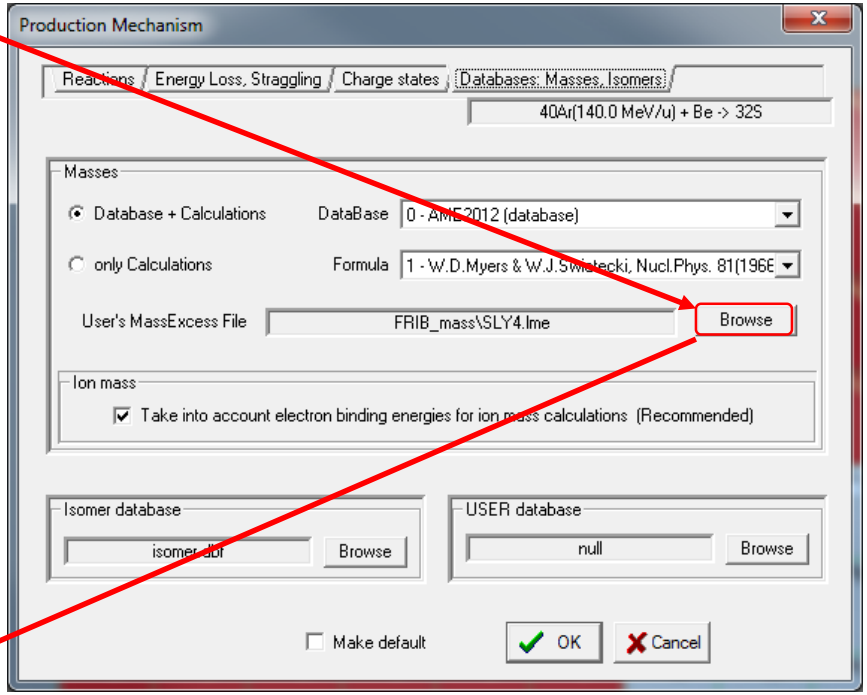


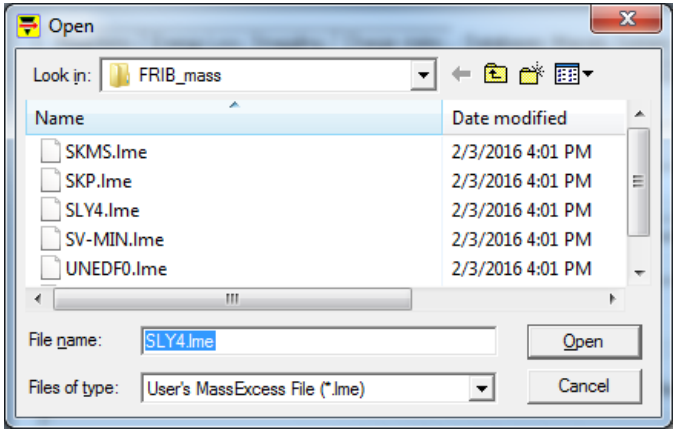
"lme" - LISE Mass Excess file



How to load a LISE^{++} mass excess file







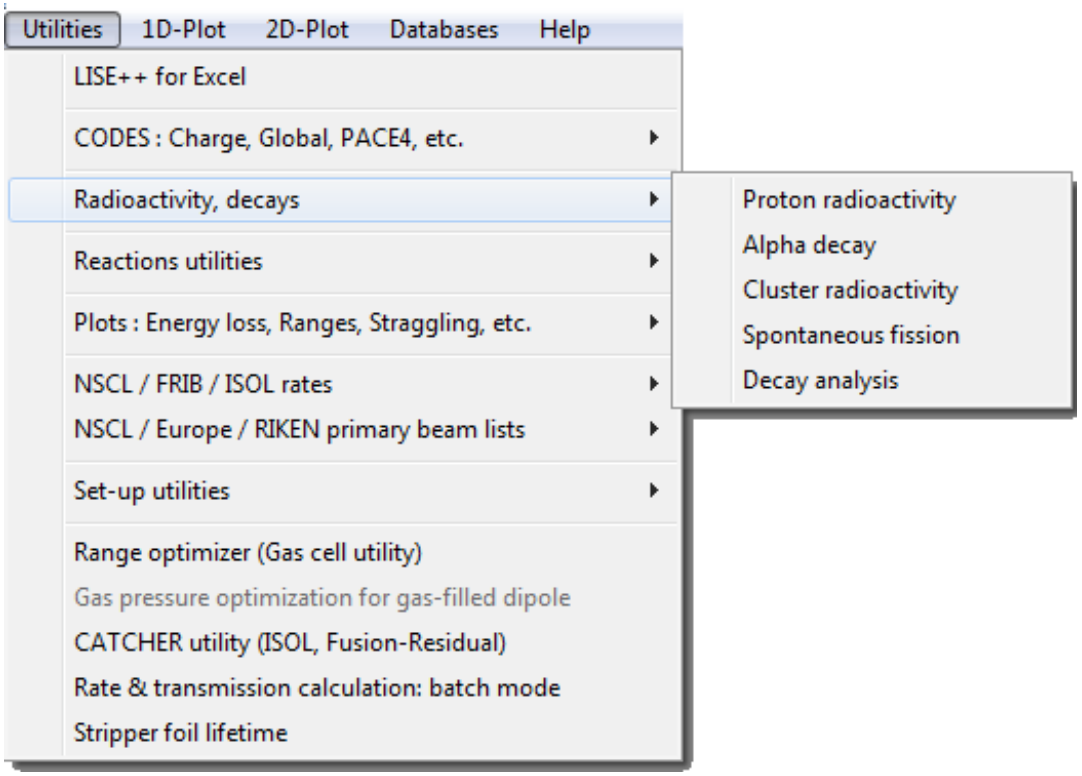
Where and how are mass tables used in the code (1)

1. Transmission (ion mass) calculations

2. Cross section (de-excitation channel) calculations

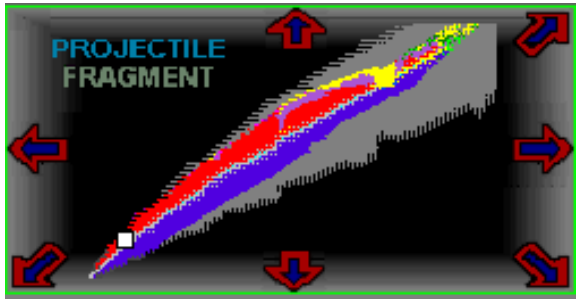
   see for example Fig.11 in PRC 87, 054612 (2013)

3. Radioactivity utilities

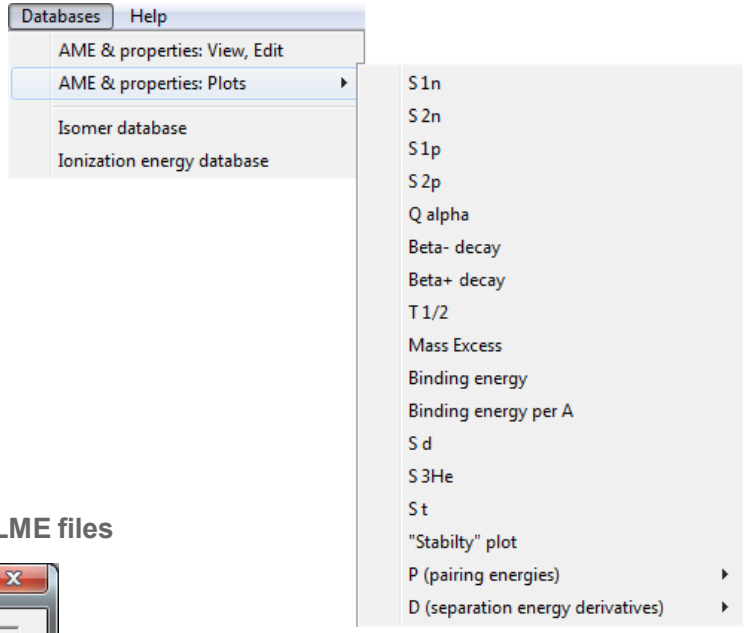


Where and how are mass tables used in the code (2)

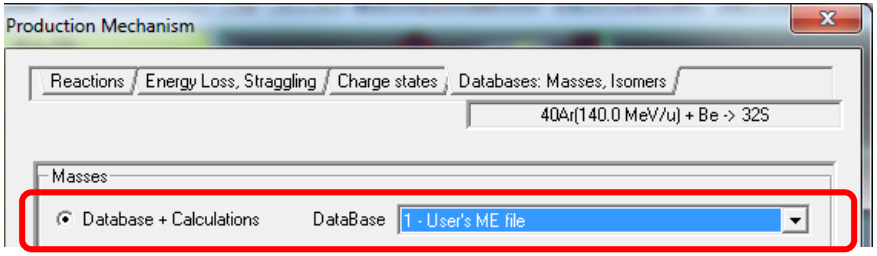
4. Generate the LISE^{++} table of nuclides



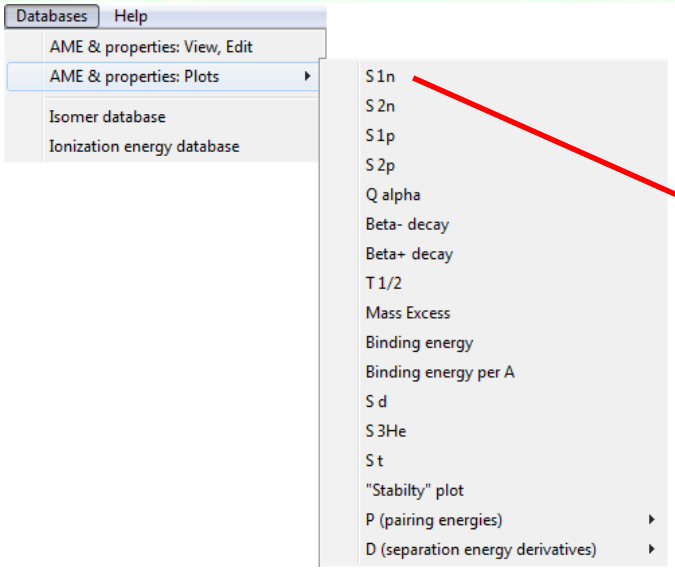
5. Plotting mass-related isotope characteristics

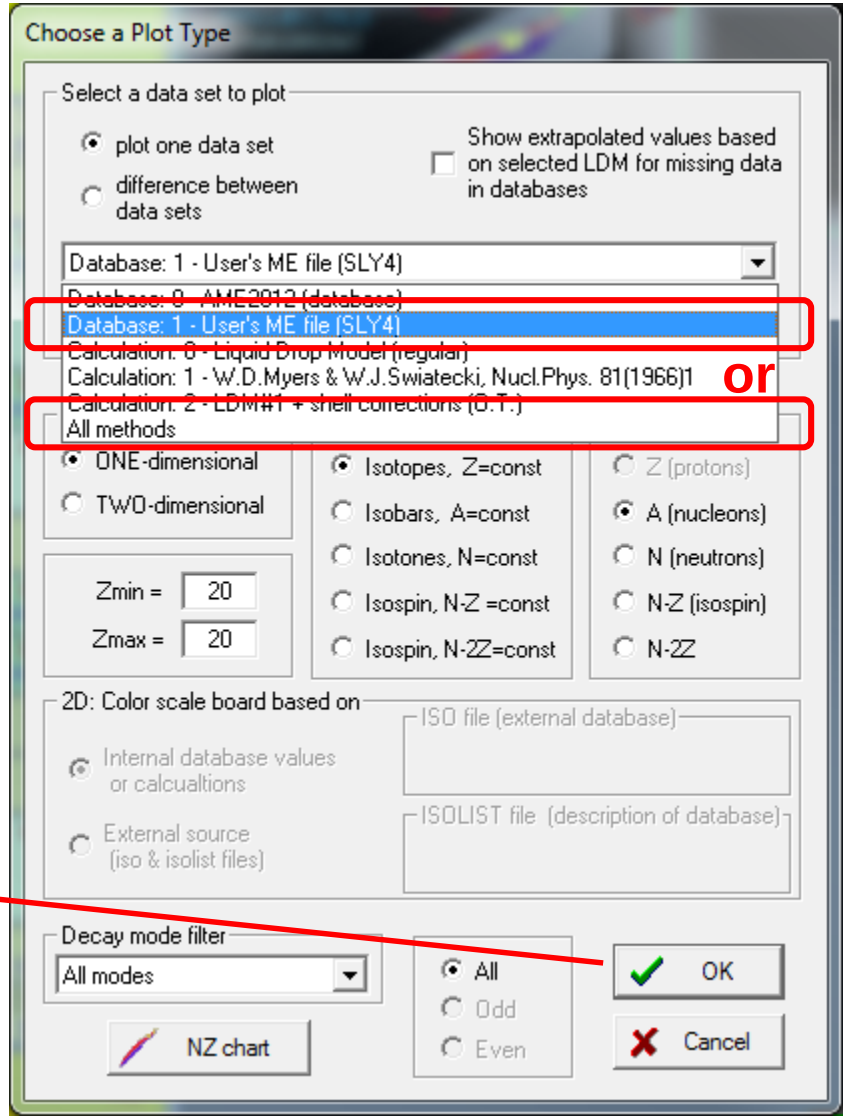


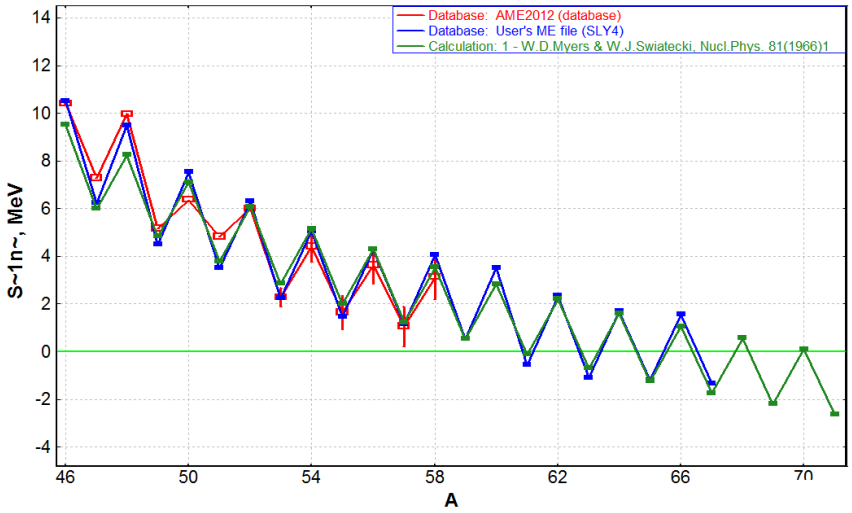
Note: Items 1-4 require to set "1-User's ME file" in order to use LME files



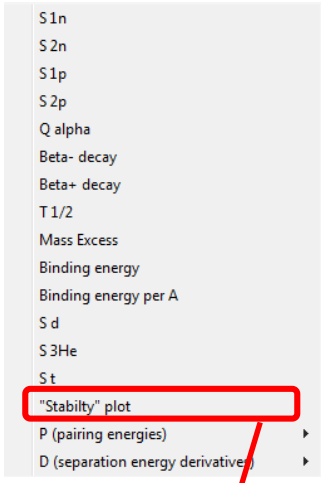
Plotting mass-related isotope characteristics

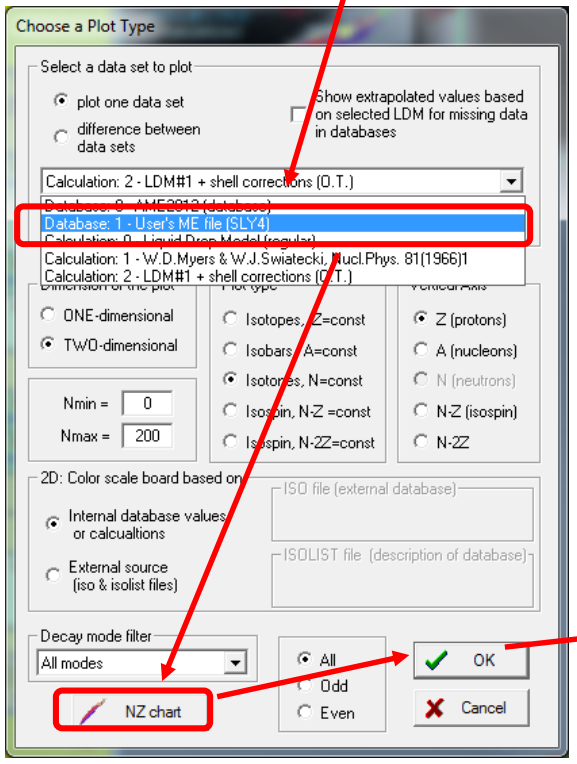


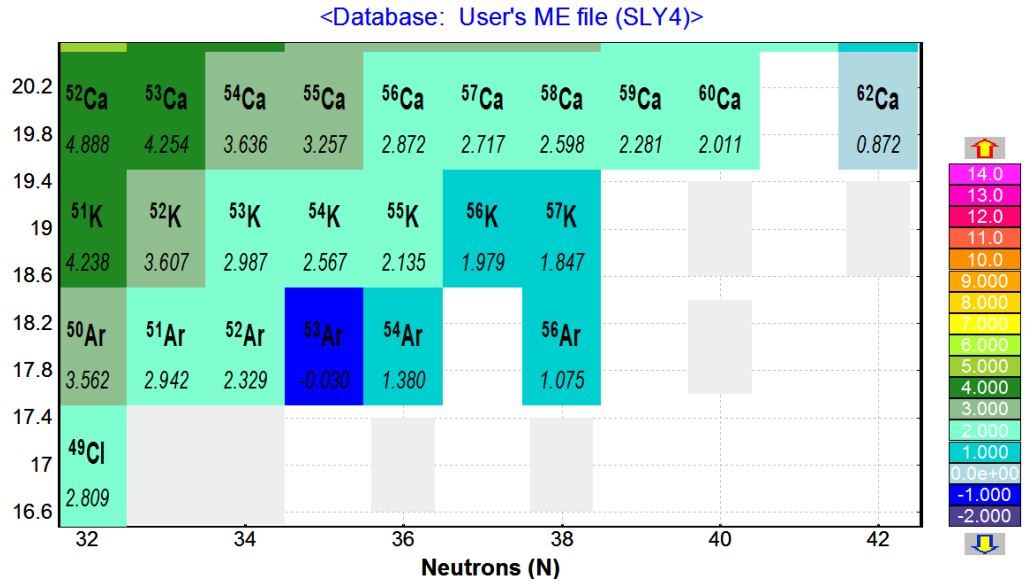




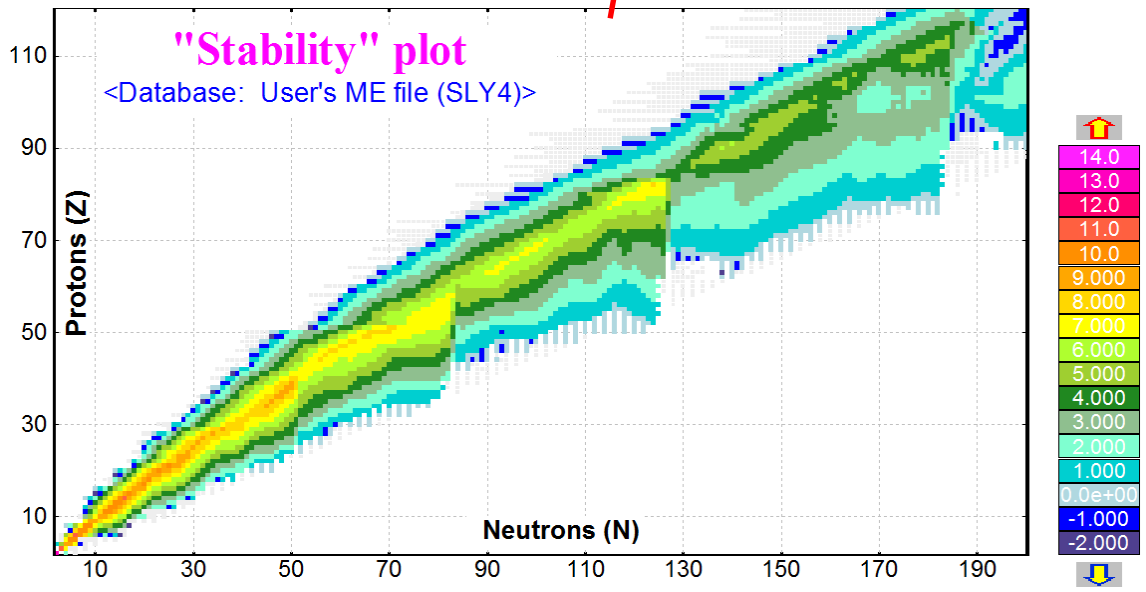
Plotting mass-related isotope characteristics





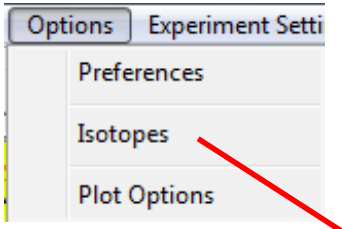


Zoom using mouse

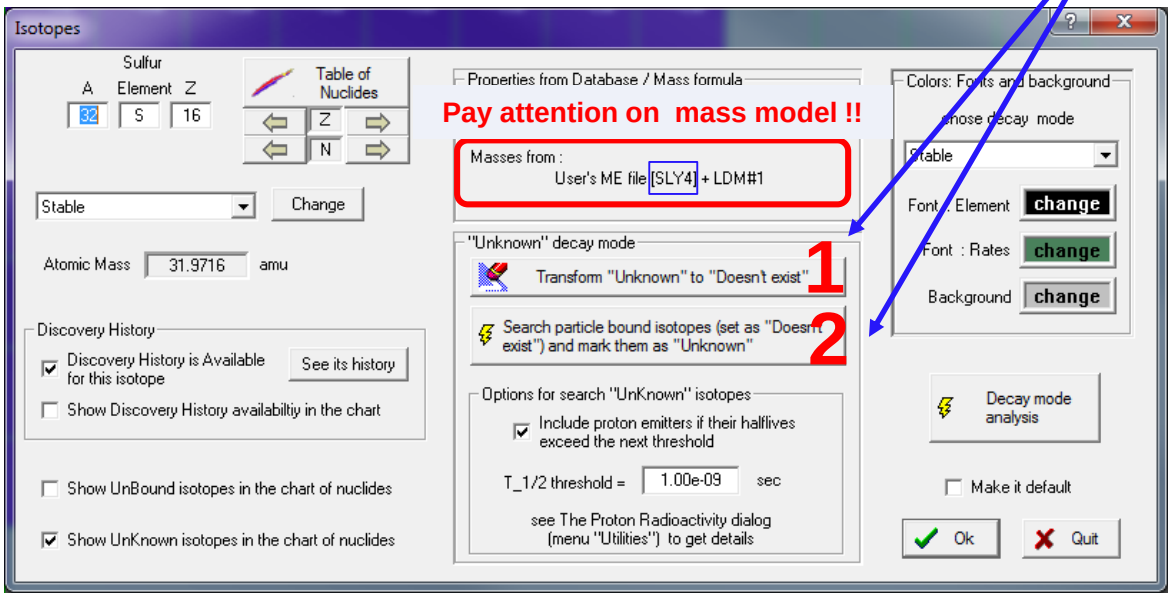


How to update the LISE^{++} table of nuclides with a new mass table

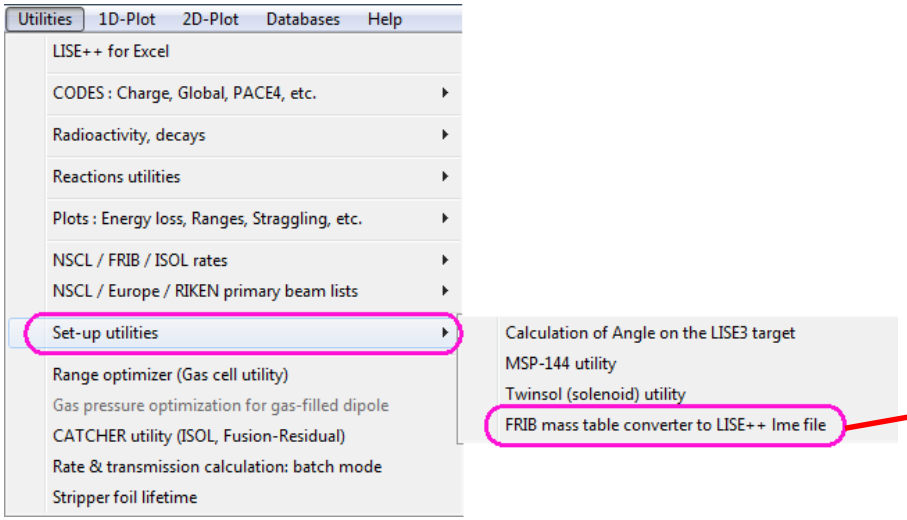
The table of nuclides defines isotopes to be used in transmission calculations and shown in the resulting 2D-plots

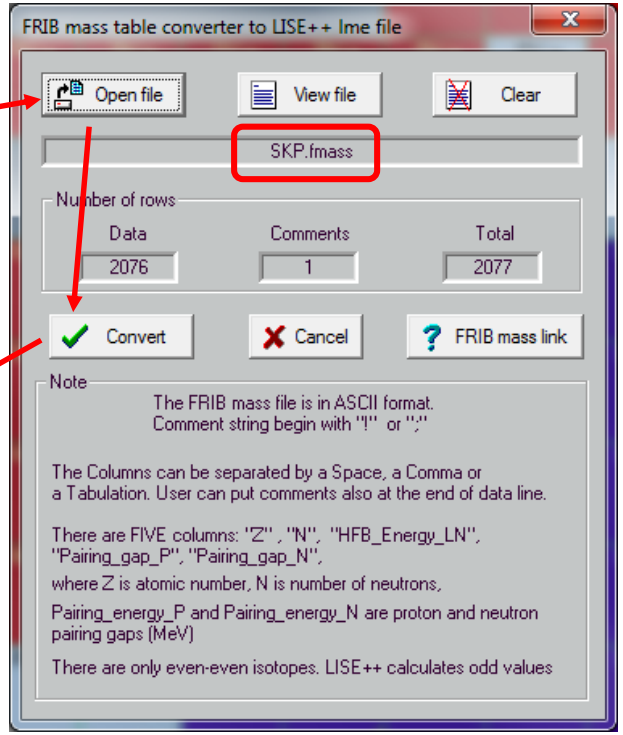


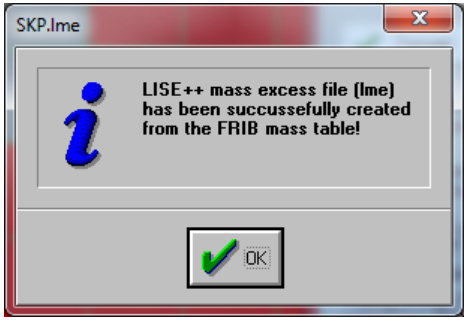
Steps to generate the table



How to create a LISE^{++} mass excess file from an FRIB mass table (1)







How to create a LISE++ mass excess file from an FRIB mass table (2)

- All results shown here (except for HFB_energy) were calculated with Lipkin-Nogami.
- HFB_energy_LN should be considered as the calculated ground-s energy for a particular nucleus.

SkM* (.dat file)
SkM* (Excel file)

SkP (.dat file)
SkP (Excel file)

	A	B	C	D	E	F	G	H	I	J	K	L	
1	LBL	Z	N	A	Kinetic_P	Kinetic_N	Kinetic_tc	Spin-orbit	Coulomb_	Coulomb_	Pairing_e	Pairing_e	HF
2	HE	2	2	4	26.09783	26.34019	52.43801	-1.48917	1.379825	-0.58694	-6.2486	-6.32941	-
3	HE	2	4	6	25.31138	51.91349	77.22487	-3.17426	1.372689	-0.58427	-3.76806	-5.83494	-
4	HE	2	6	8	24.36406	74.9851	99.34916	-3.54678	1.34226	-0.57169	-2.91611	-5.95368	-
5	BE	4	2	6	50.33793	25.54716	75.88509	-3.01015	4.620827	-1.23983	-5.61533	-3.97994	-
6	BE	4	4	8	56.21231	57.00721	113.2195	-6.57324	4.807899	-1.29381	-4.60803	-4.71233	-
7	BE	4	6	10	56.837	86.60532	143.4423	-7.75717	4.777887	-1.28794	-3.79965	-5.06791	
8	BE	4	8	12	55.76331	112.6172	168.3805	-6.62418	4.68743	-1.26543	-3.33107	-4.95453	-
9	C	6	4	10	83.97169	57.24428	141.216	-7.51225	9.78803	-2.0133	-4.65626	-3.89557	-
10	C	6	6	12	86.85803	88.75272	175.6108	-9.24611	9.897299	-2.04145	-3.68427	-4.17756	-
11	C	6	8	14	86.38727	118.4034	204.7907	-7.78804	9.795554	-2.02491	-3.3669	-4.58892	-
12	C	6	10	16	85.14888	154.5517	239.7006	-9.37585	9.676541	-2.00366	-2.98685	-5.81252	-
13	C	6	12	18	83.91125	192.0603	275.9716	-12.765	9.574547	-1.98518	-2.53741	-6.87705	-
14	C	6	14	20	82.68523	224.7899	307.4751	-15.6267	9.475461	-1.96679	-2.21643	-5.88334	-
15	C	6	16	22	81.07899	252.1156	333.1946	-15.8899	9.3551	-1.9434	-2.06847	-5.07086	-

Only 5 columns

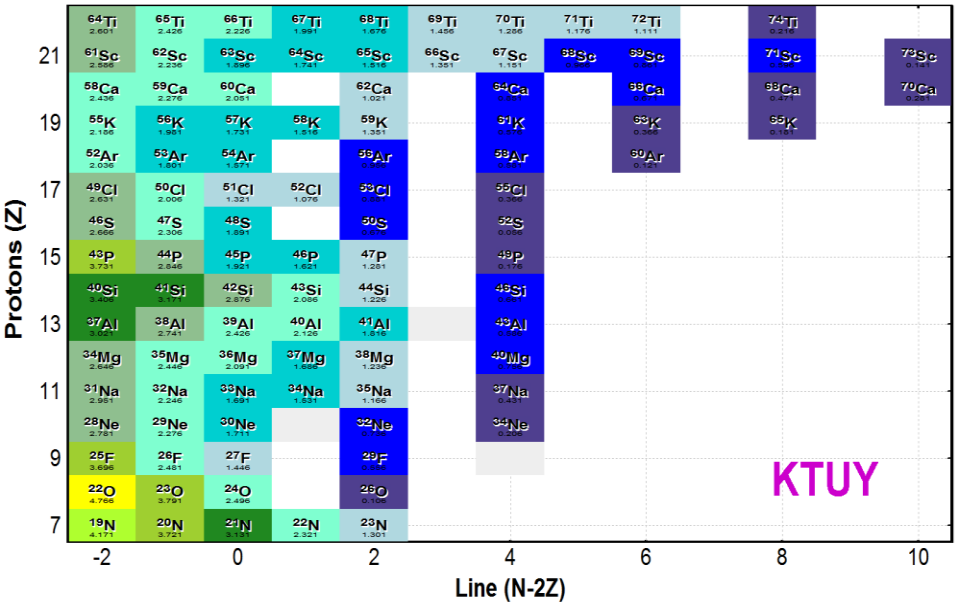
A	B	C	D	E
! Z	N	HFB_Energy_LN	Pairing_gap_P	Pairing_gap_N
2	2	-29.983718	5.597249	5.649244
2	4	-36.159424	5.015006	3.725048
2	6	-37.137744	4.718873	3.265396
4	2	-33.472573	3.600581	5.103016
4	4	-56.070979	3.335483	3.398626
4	6	-70.290303	2.947363	3.324252
4	8	-76.084841	2.659694	2.870412
6	4	-65.861318	3.178553	3.000986
6	6	-92.56665	2.948179	3.110596
6	8	-108.761114	2.792835	2.847825
6	10	-116.246051	2.613274	2.328075
6	12	-121.342826	2.422628	2.279811

Save to ASCII file

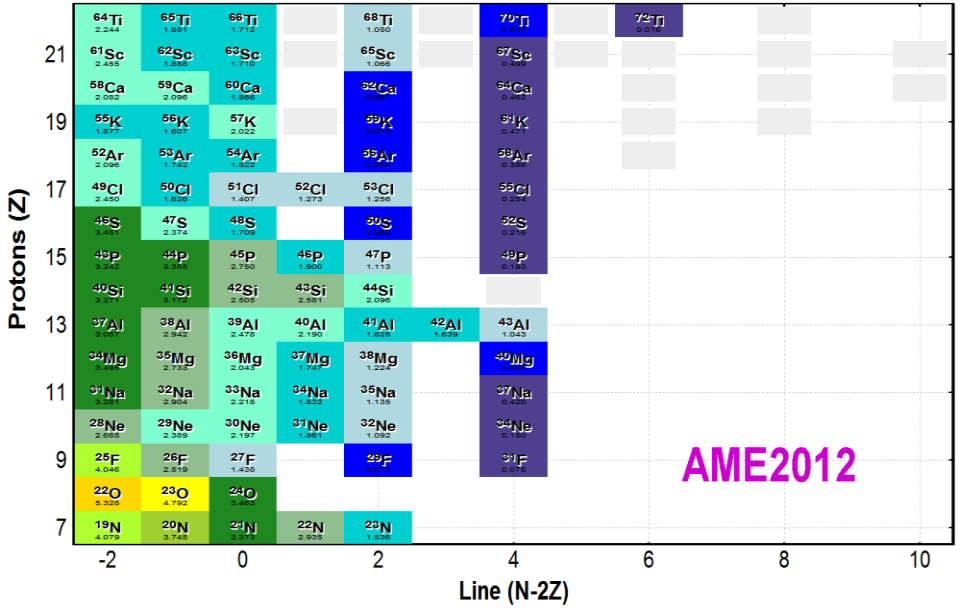
LISE++ converter to LME

LISE^{++} 2D "stability" plots with AME2012, KTUY + LDM1

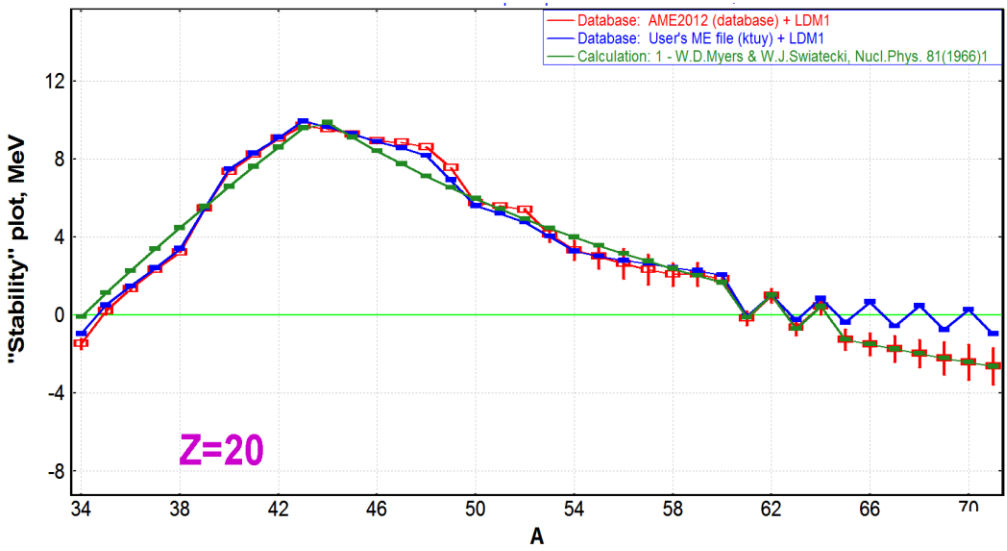
"Stability" plot
<Database: User's ME file (ktuy) + LDM1>



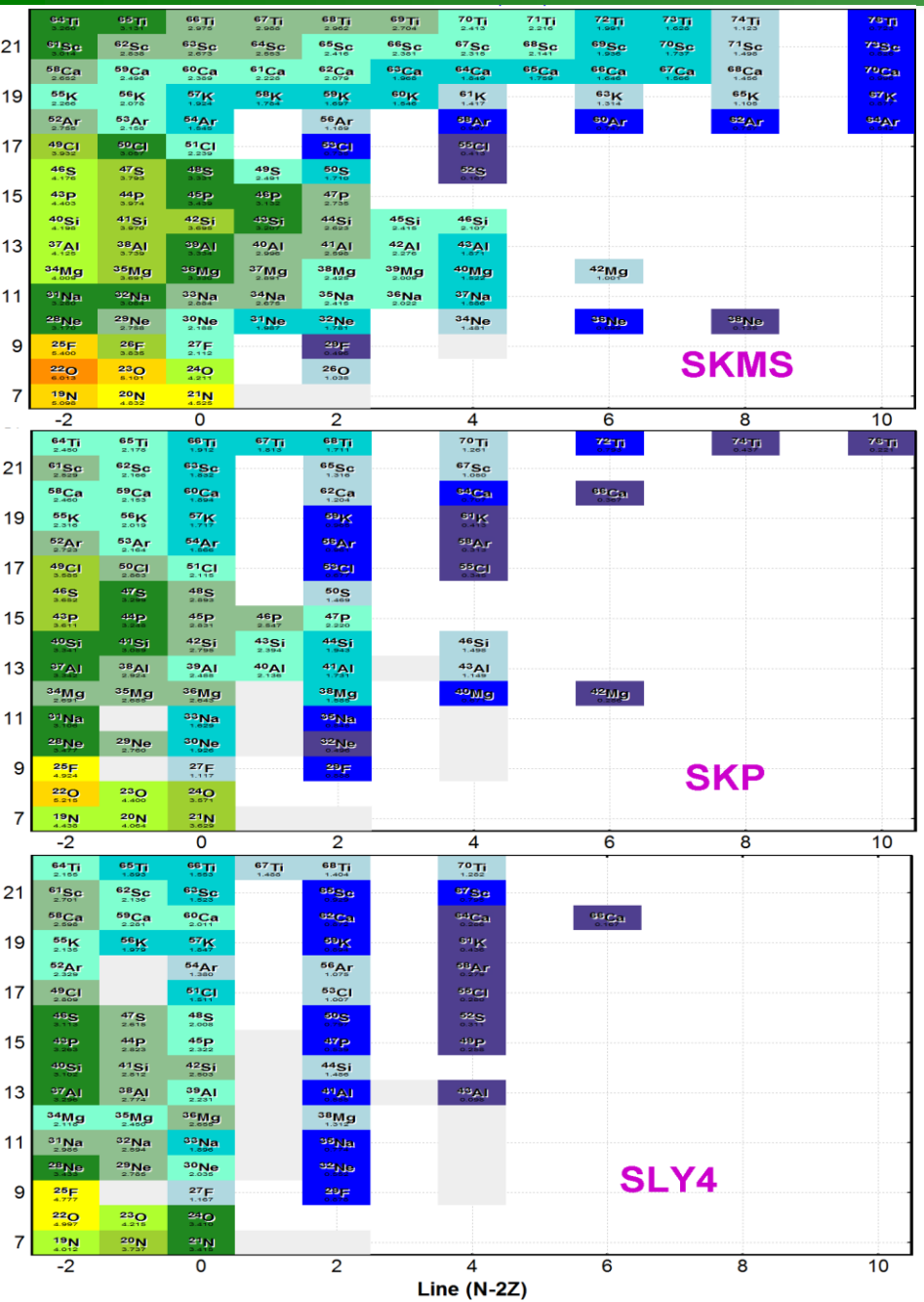
"Stability" plot
<Database: AME2012 (database) + LDM1>

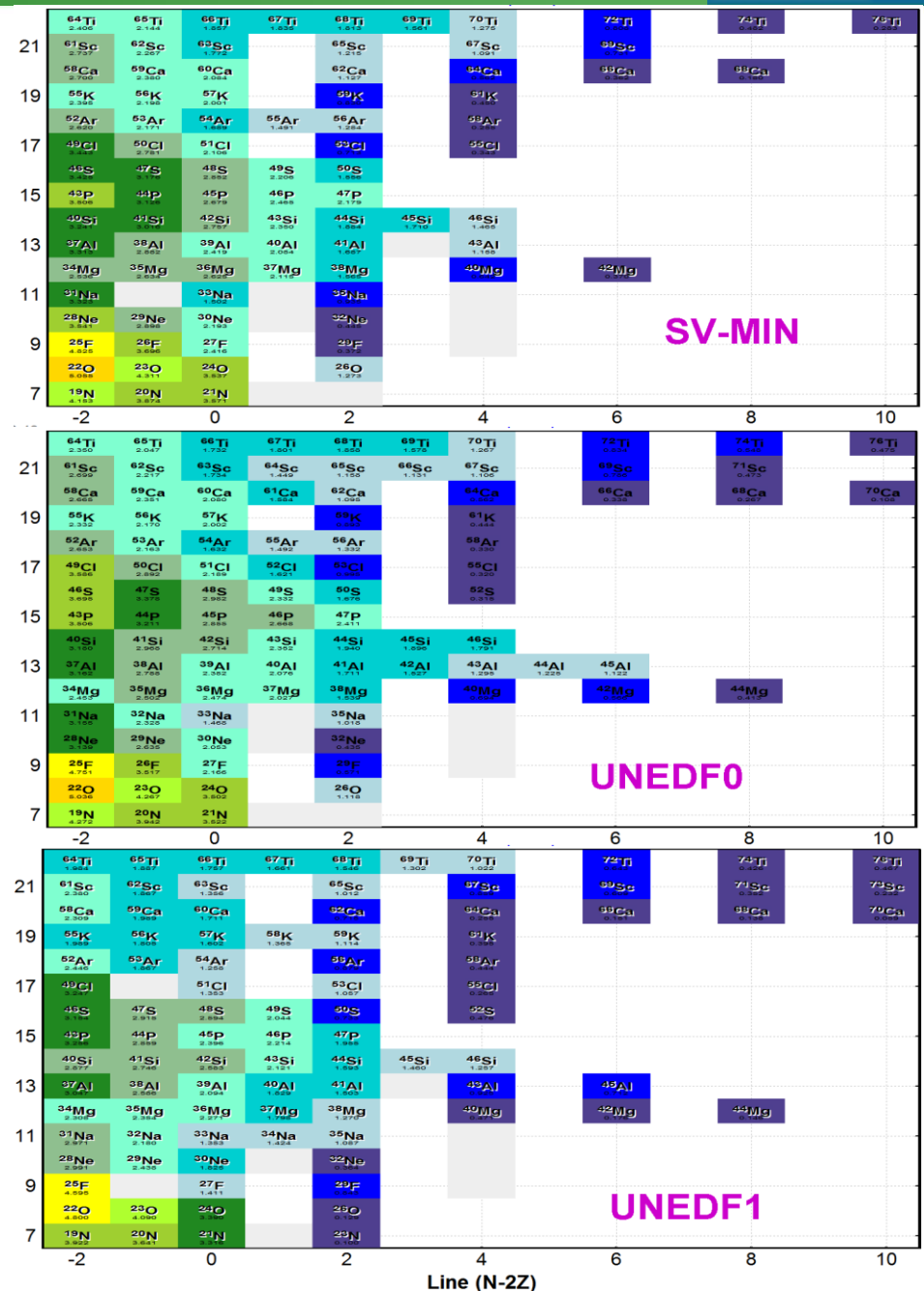


"Stability" plot information link:
http://lise.nscl.msu.edu/9_8/9_8_some_issue.pdf#page=8



LISE^{++} 2D "stability" plots with FRIB mass tables + LDM1





LISE^{++} "stability" plots for Z=20