

## ***This document***

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- **Update of the internal database based on AME &NUBASE 2012**
- **Probability for compound nucleus formation**
- **LISE++ site address and download link**
- **Update of Transmission calculations**
- **Fixed bugs**
- **Site statistics (2012)**

## ***External links***

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- [New Database Plots, Database features, Plot options](#)
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- [Asymmetry of momentum distributions \(projectile fragmentation\)](#)
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## Improved empirical parametrization of fragmentation cross sections

K. Sümmerer

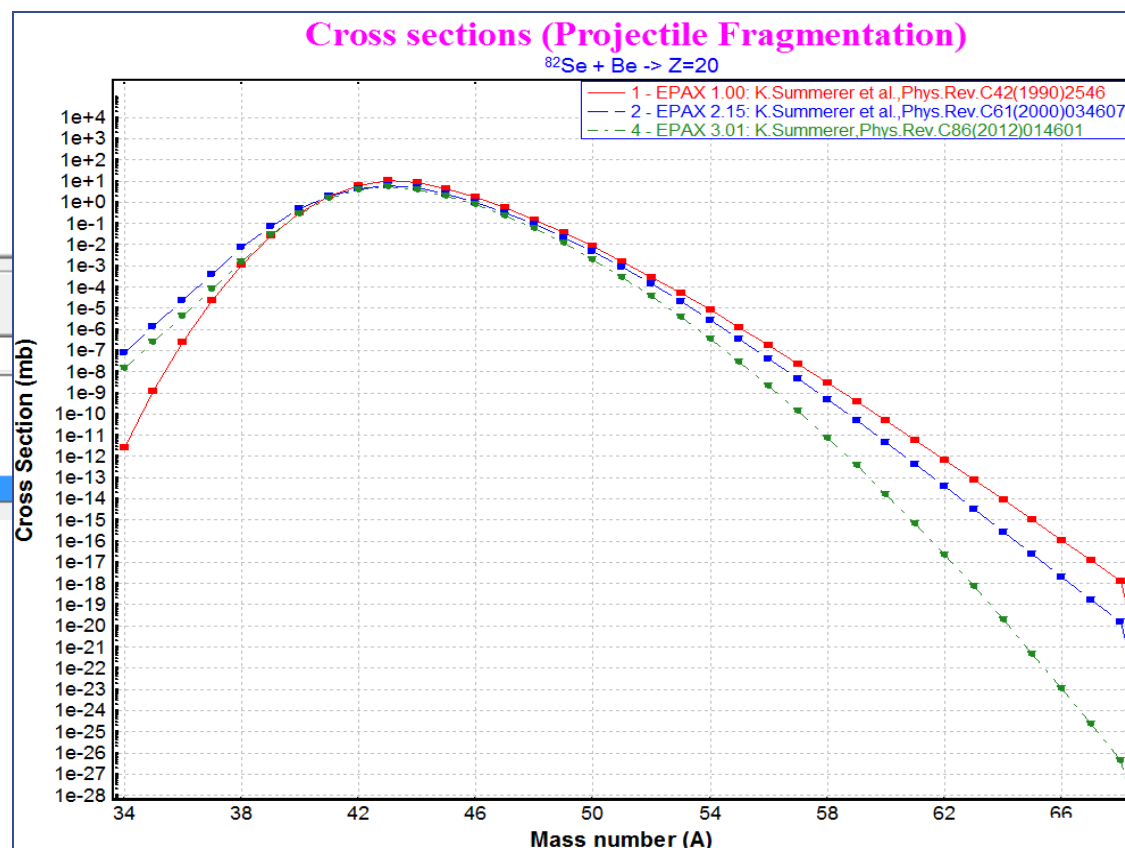
*GSI Helmholtzzentrum für Schwerionenforschung, Planckstr.1, D-64291 Darmstadt, Germany*

(Received 25 May 2012; published 2 July 2012)

### EPAX 3 set by default in the version 9.5

A new version is proposed for the universal empirical formula, EPAX, which describes fragmentation cross sections in high-energy heavy-ion reactions. The new version, EPAX 3, is shown to yield cross sections that are in better agreement with experimental data for the most neutron-rich fragments than the previous version. At the same time, the very good agreement of EPAX 2 with data on the neutron-deficient side has been largely maintained. Comparison with measured cross sections show that the bulk of the data is reproduced within a factor of about 2, for cross sections down to the picobarn range.

Cross Sections	
4	EPAX 3.01: K.Sümmerer,Phys.Rev.C86(2012)014601
0	Abrasion/Ablation v.6.3
1	EPAX 1.00: K.Sümmerer et al.,Phys.Rev.C42(1990)2546
2	EPAX 2.15: K.Sümmerer et al.,Phys.Rev.C61(2000)034607
3	EPAX 2.15 + user modifications
4	EPAX 3.01: K.Sümmerer,Phys.Rev.C86(2012)014601



## The 2012 Atomic Mass Evaluation (AME2012)

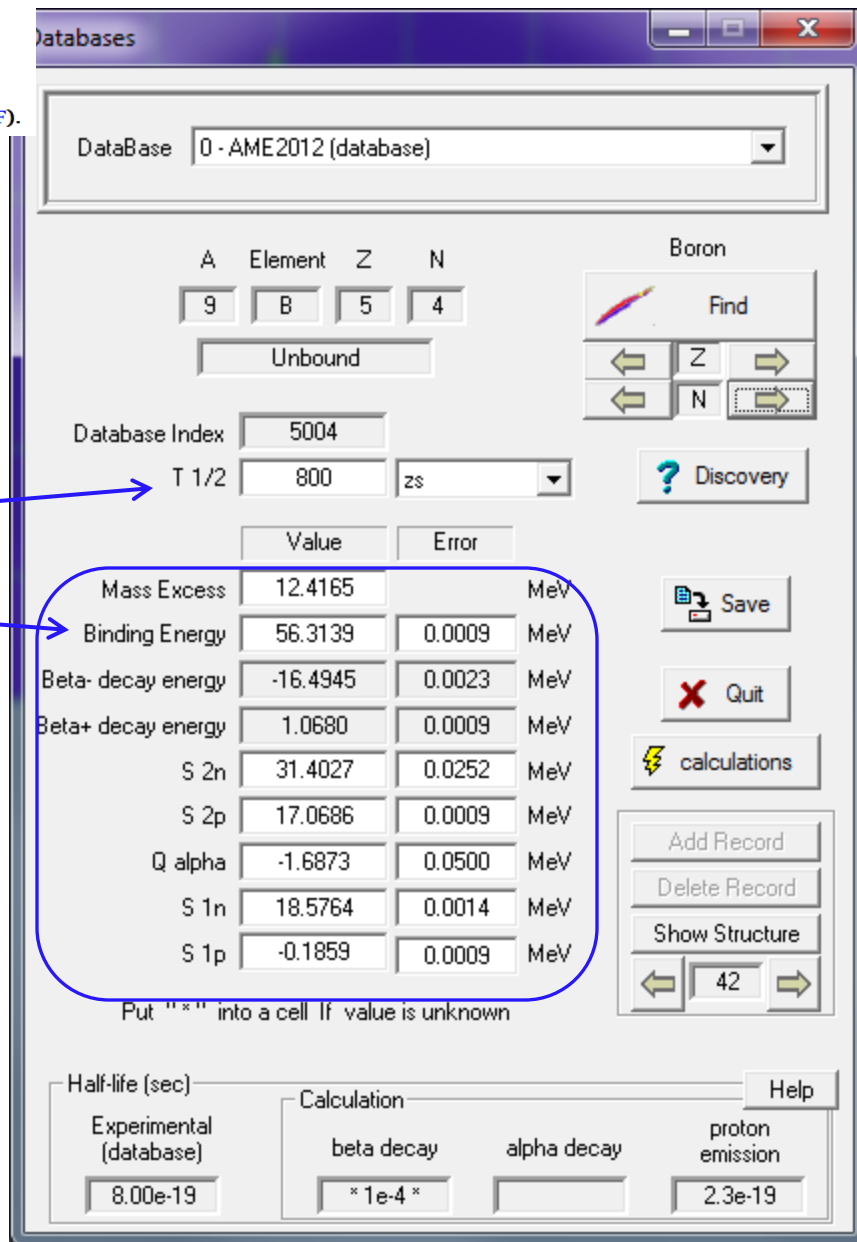
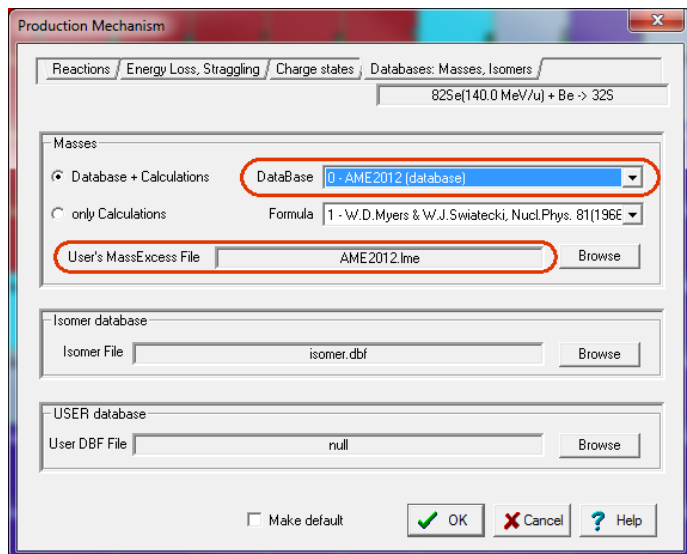
The evaluation has been published in Chinese Physics C 36 (2012) 1287-1602 (PDF), 1603-2014 (PDF).

## The 2012 Nubase Evaluation (Nubase2012)

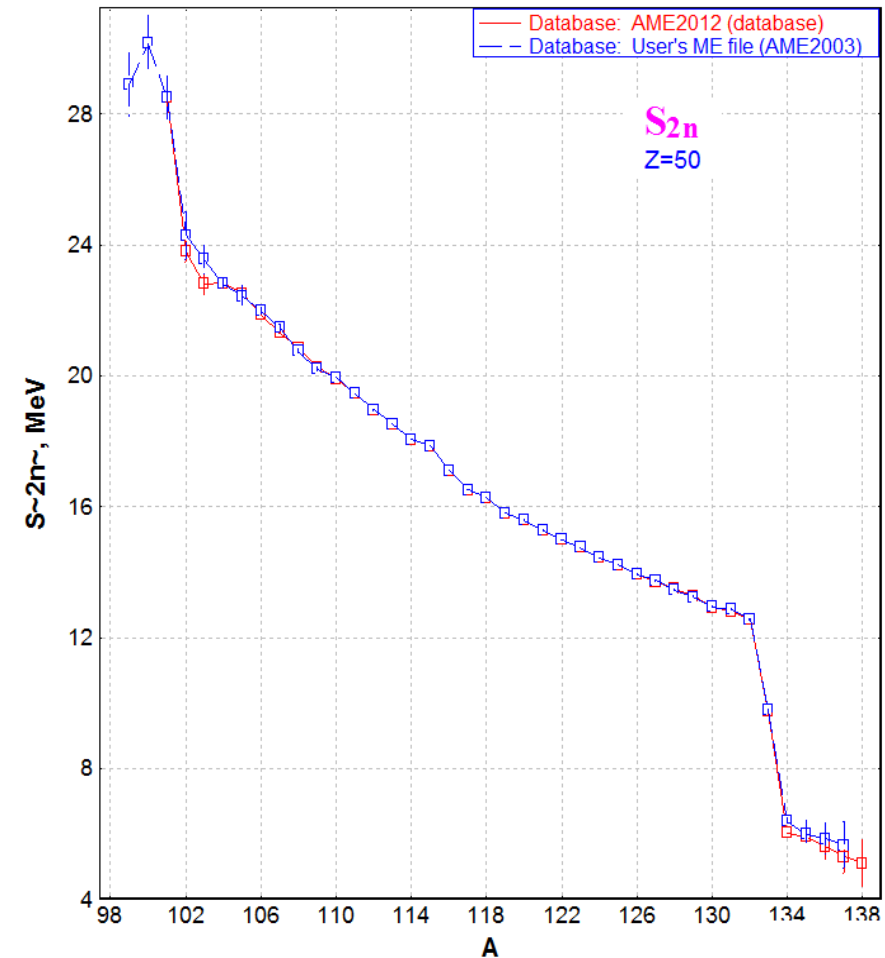
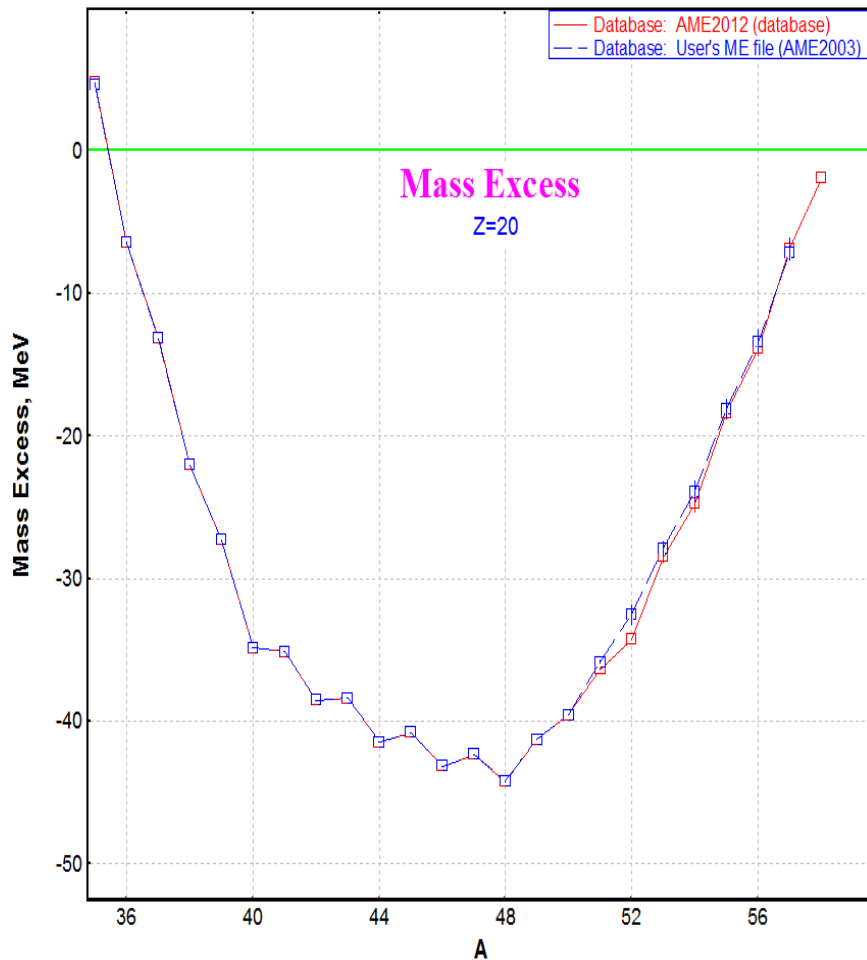
The evaluation has been published in Chinese Physics C 36 (2012) 1157-1286 (PDF).

**NUBASE 2012**

**AME 2012**



## Comparison AME2003 & AME 2012 for Z=20 & 50



PHYSICAL REVIEW C **78**, 034610 (2008)

## Synthesis of superheavy nuclei: A search for new production reactions

Valery Zagrebaev<sup>1</sup> and Walter Greiner<sup>2</sup>

<sup>1</sup>Flerov Laboratory of Nuclear Reactions, JINR, Dubna, Moscow Region, Russia

<sup>2</sup>Frankfurt Institute for Advanced Studies, J. W. Goethe-Universität, Frankfurt, Germany

(Received 23 May 2008; published 24 September 2008)

Nuclear reactions leading to the formation of new superheavy (SH) elements and isotopes are discussed in the paper. “Cold” and “hot” synthesis, fusion of fission fragments, transfer reactions, and reactions with radioactive ion beams are analyzed along with their abilities and limitations. If the possibility of increasing the beam intensity and the detection efficiency (by a total of one order of magnitude) is found, then several isotopes of new elements with  $Z = 120$ – $124$  could be synthesized in fusion reactions of titanium, chromium, and iron beams with actinide targets. The use of light- and medium-mass neutron-rich radioactive beams may help us fill the gap between the SH nuclei produced in the hot fusion reactions and the mainland. In these reactions, we may really approach the “island of stability.” Such a possibility is also provided by the multinucleon transfer processes in low-energy damped collisions of heavy actinide nuclei. The production of SH elements in fusion reactions with accelerated fission fragments looks less encouraging.

$$P_{\text{CN}}(E^*, l) = \frac{P_{\text{CN}}^0}{1 + \exp\left[\frac{E_B^* - E_{\text{int}}^*(l)}{\Delta}\right]},$$

where

$$P_{\text{CN}}^0 = \frac{1}{1 + \exp\left[\frac{Z_1 Z_2 - \zeta}{\tau}\right]},$$

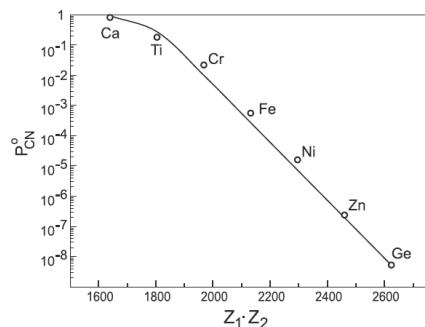


FIG. 5. Above-barrier CN formation probability in the <sup>208</sup>Pb induced fusion reactions. Results of calculation are shown by the circles, whereas the fitted curve corresponds to expression (3).

✕

Evaporation settings

Transmission probability for a one-dimensional potential barrier

Classical  
 Quantum-mechanical

h\_omega - Curvature parameter of the parabolic potential describing the barrier (default value 3 MeV)  MeV

Probability for compound nucleus formation P\_{CN}

Take into account the Probability for compound nucleus formation P\_{CN} according to V.Zagrebaev & W.Greiner, PRC78, 034610 (2008)

OK  
 Cancel

Make default  
 Help

Partner site

Fusion

Evaporation

PHYSICAL REVIEW C **78**, 034610 (2008)

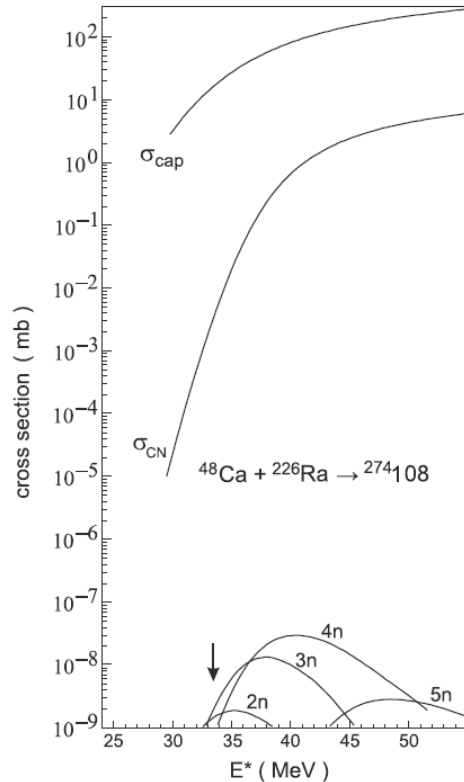


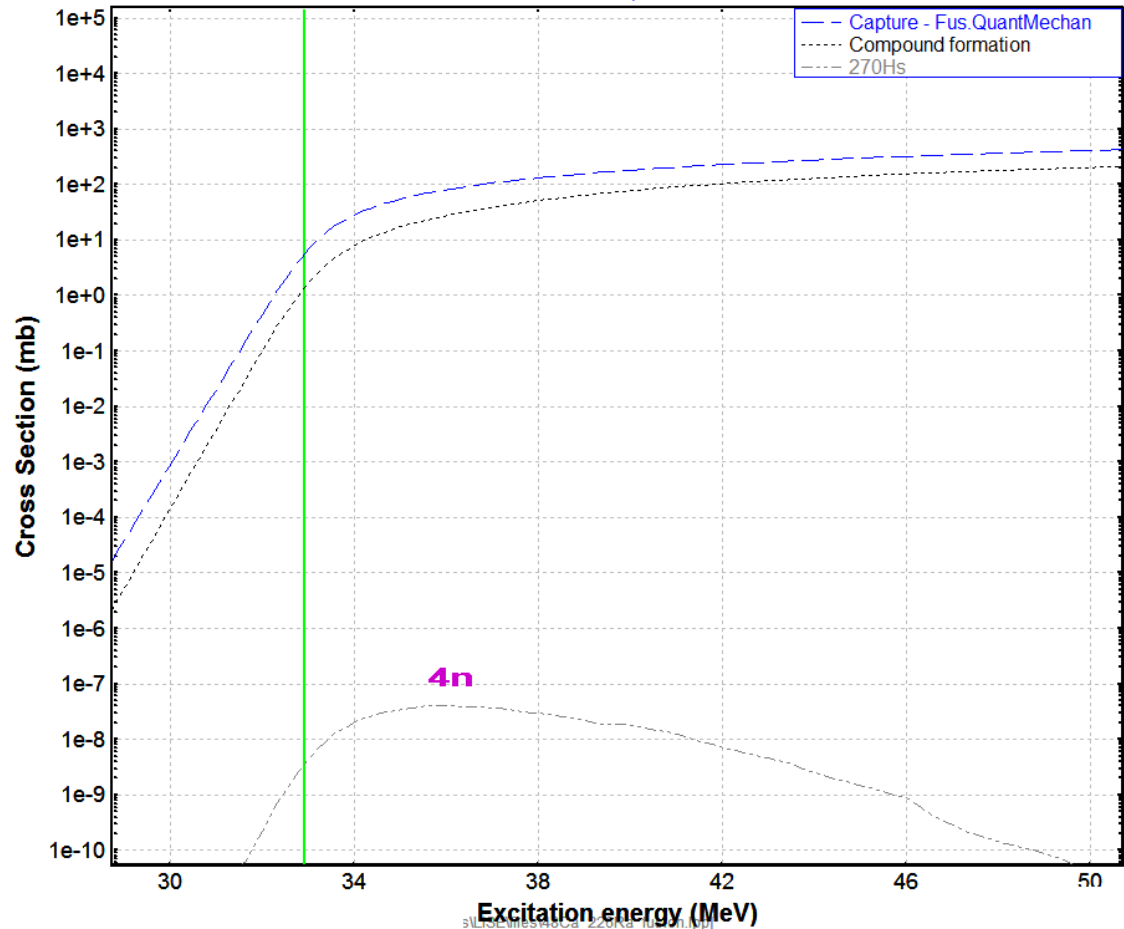
FIG. 7. Calculated capture, fusion, and evaporation residue (2n, 3n, 4n, and 5n channels) cross sections in the  $^{48}\text{Ca} + ^{226}\text{Ra}$  fusion reaction. The arrow indicates the Bass barrier.

## Cross sections (Fusion-Residual) [with $P_{\text{CN}}$ ]

$^{48}\text{Ca} + ^{226}\text{Ra} \rightarrow ^{274}\text{Hs}^*$  ( $Q = -154.04$ ) Model: LisFus v.4.0 Fis.Bar, MeV: **3.65** FisRot<sup>†</sup> - RLDM(Cohen)

$V_{\text{Coulomb}} = 184.38$  MeV; Fusion height<sup>Bass</sup><sub>max</sub>:  $B_f = 186.97$  MeV;  $h_{\omega} = 2.00$  MeV

Beam energy:  $E_{\text{Lab}} = 4.50$  MeV/u;  $N_{\text{evap}}=32$ ; Vert. lines:  $B_f$  &  $E_{\text{beam}}(1/2 \text{ target})$



Excitation energy (MeV)

New address:

<http://lise.nslc.msu.edu>

Redirection from previous addresses

<http://www.nslc.msu.edu/lise>  
<http://groups.nslc.msu.edu/lise>

New download link is

<http://lise.nslc.msu.edu/download>

No more FTP-server to download the LISE<sup>++</sup> package

version 9.5

**LISE<sup>++</sup>**

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v. 9.5

## SIMULATION OF FRAGMENT SEPARATORS

### Range of application

The program **LISE<sup>++</sup>** has been developed to calculate the transmission and yields of fragments produced and collected in a spectrometer. This code allows to simulate an experiment, beginning from the parameters of the reaction mechanism and finishing with the registration of products selected by a spectrometer. The program allows to quickly optimize the parameters of the spectrometer before or during the experiment. It also makes it possible to estimate and work in conditions of maximum output of studied reaction products and their unambiguous identification. Wedge and Wien filter selections are also included in the program.

**LISE<sup>++</sup>** is the new generation of the **LISE** code, which allows the creation of a spectrometer through the use of different "blocks". The number of blocks used to create a spectrometer in **LISE<sup>++</sup>** is limited by operating memory of your PC and your imagination.

built-in Energy loss, Time-of-Flight, Position, Angular, Charge, Cross-Section distribution plots and dE-E, dE-TOF, Z-A/Q and dE-X two-dimensional plots allow to visualize the results of the program calculations. An application of transport integral lies in the basis of fast calculations of the program for the estimation of temporary evolution of distributions of phase space.

The **LISE** code may be applied at medium-energy and high-energy facilities (**fragment- and recoil-separators with electrostatic and/or magnetic selections**). A number of these facilities, like A1900 and S800 at NSCL, LISE3, SISSI/LISE3 and SPEG at GANIL, FRS and SuperFRS at GSI, RIPS and BigRIPS at RIKEN, based on the separation of projectile-like and fission fragments, fusion residues are included or might be easily added to the existing optical configuration files.

The Projectile Fragmentation, Fusion-Evaporation, Fusion-Fission, Coulomb Fission, and

[lise.nslc.msu.edu/download/](http://lise.nslc.msu.edu/download/)

## Index of /download

Name	Last modified	Size	Description
<a href="#">Parent Directory</a>	-	-	-
<a href="#">LISE++ 9.5.exe</a>	09-Mar-2013 16:19	11M	-
<a href="#">open version/</a>	07-Mar-2013 11:13	-	-
<a href="#">other/</a>	18-Feb-2013 14:19	-	-

LISE site connect...

<http://lise.nslc.msu.edu/version>

```

lise.nslc.msu.edu-- Host Resolved
Connected
16 bytes of 16 received
Disconnected
HTTP Success = Get Success
Status: Transaction Completed
Disconnected
9.5
06-MAR-2013
    
```

		transmission calculations up to LAST optical block, not for LAST Q-optical block --
9.4.107	03/04/13	come back to 9.4.94 version
9.4.094	02/22/13	transmission calculations not up to next optical block, only for Q-optical block
9.4.065	11/29/12	inter2 -- distribution2 --- modification
9.4.064	11/29/12	inter2 -- distribution2 --- modification
9.3.8	03/06/12	Correction in the Dispersion method for secondary target
9.3.6	02/28/12	Aperture for RotationBlocks are disable by default
9.3.6	02/22/12	LowMatrixLimit set to 1e-10. It is not applied for RotationBlocks
9.3.6	02/22/12	PassAperture : Fixed FLAG for X-use! Important!!!!
9.3.6	02/22/12	If Length of Block $\leq 0$ bounds are used just in one point as slits! Important!!!!
9.3.6	02/22/12	Envelope plot: axis title has been changed
9.3.11	01/20/12	Faraday cup -- possibility to make it disable from the Setup window

- 9.4.097 02/26/13 Fixed: bug with contour projection in MC mode (request of MP, Koeln)
- 9.4.089 01/28/13 Optics Quad Setup : corrections for second order labels
- 9.4.088 01/28/13 Fixed: bug in read/write buncher subroutine
- 9.4.086 01/24/13 Bug in the case charge state & stripper. OPTION SET "NO(ONLY FOR MIDDLE POINT)
- 9.4.055 10/30/12 Read/Write in/to file correction for EPAX mode
- 9.4.035 08/27/12 Corrections for G\_CalcReaction in the case of AF from the AF dialog (fixed)
- 9.4.002 03/15/12 Fixed: calculated transmission has been cleared during reading file from disk

