

v.16.17.02
07/24/23

- LISE package optimization (phase 2)
 - Compiling with MSVC
 - MSVC “long double” issue
 - Factorial : new class “tripleValue”
 - Abrasion-Ablation model update
 - dR – tunneling
 - Exponential $\langle T \rangle$ EE model update
 - List of last modifications
- Transmission calculation speed ratio between v.16.15 vs. 16.17 (MinGW) is almost factor 2
 - Transmission calculation speed ratio between v.16.17 MinGW and v.16.17 MSVC is factor 1.63

LISE package optimization (phase 2)

version	compiler	release date	time elapsed (sec)		Average factor
			124Xe, EPAX, charge states	198Pt, Abrasion-Ablation charge states	
13.4	Borland(32)	5/5/2020	206	685	12.40
16.3.1	MinGW	4/6/2022	99	290	5.60
16.14.20	MinGW	4/26/2023	50	187	3.20
16.16.14	MinGW	7/25/2023	48	167	2.96
16.16.34	MinGW	8/12/2023	35	90	1.86
16.17.2	MinGW	8/18/2023	28	87	1.63
16.17.2	MSVC	8/18/2023	17	54	1.00

Project by S.Tarasova: [search for time-consumed nodes \(weeks 31-33\)](#)

Desktop_Qt_6_5_2_MSVC2019_64bit

← → ↻ <https://lise.nsl.msu.edu/download/Windows/>

Index of /download/Windows

Name	Last modified	Size	Description
Parent Directory	-	-	-
LISE_RevReader/	2023-07-25 04:21	-	-
LISEcute++_16_17_2.exe	2023-08-18 23:29	38M	-
LISEcute++_16_17_2_MSVC.exe	2023-08-18 23:15	40M	-
open_version/	2023-08-18 23:18	-	-
other/	2023-08-18 23:18	-	-

Compiler indicator

DoublePrecision = (sizeof(double) != sizeof(long double));

- MSVC doesn't support "long double"
- It was necessary to modify LISE to avoid crashes in corresponding functions as factorial() for abrasion of nuclei up to A=300
- Construction of new class "tripleValue"

```

class tripleValue {
public:
    tripleValue();
    tripleValue(double init);
    tripleValue(const tripleValue& other);

    tripleValue& operator = (const tripleValue& other);
    tripleValue operator * (double factor);
    tripleValue operator * (const tripleValue& other);
    tripleValue operator / (const tripleValue& other);

    double mantissa;
    int order;
    bool positive;

    void multi(double v);
    void divide(double v);
    void optimize();

    double getDouble();
};
    
```

```

// ~~~~~
tripleValue factorial0(int A)
{
    #define arrNO 400          Factorial array is tabulated for speed
    static tripleValue array[arrNO+1];

    if(array[1].mantissa==0)
    {
        array[0] = tripleValue(1);
        array[1] = tripleValue(1);

        for(int i=2; i<=arrNO; i++)
            array[i] = array[i-1] * i;
    }

    A = qMin(A,arrNO);
    return array[A];
}
// ~~~~~
// ~~~~~
long double combi_factorial(int Aup, int Adown)
{
    if(Aup > Adown) return 1;

    long double f1 = factorial(Aup);
    long double f2 = factorial(Adown-Aup);
    long double f3 = factorial(Adown);
    long double res = f1*f2/f3;

    return res;
}
// ~~~~~
// ~~~~~
tripleValue combi_factorial0(int Aup, int Adown)
{
    if(Aup > Adown) return 1;

    tripleValue f1 = factorial0(Aup);
    tripleValue f2 = factorial0(Adown-Aup);
    tripleValue f3 = factorial0(Adown);
    tripleValue res = f1*f2;
    tripleValue res2 = res / f3;

    return res2;
}
// ~~~~~
// ~~~~~
    
```

NEW

OLD

NEW

Abrasion-Ablation model update

dR – tunneling:
obtained from
⁷⁸Kr (RIKEN data)
analysis

Settings of AUTO mode

Effective Coulomb Barrier

$$B_{eff} = \frac{1.44 Z_1 Z_2}{dR + 1.22(A_1^{1/3} + A_2^{1/3})}$$

$$dR = a2 \cdot (A_x^{1/3})^2 + a1 \cdot A_x^{1/3} + a0$$

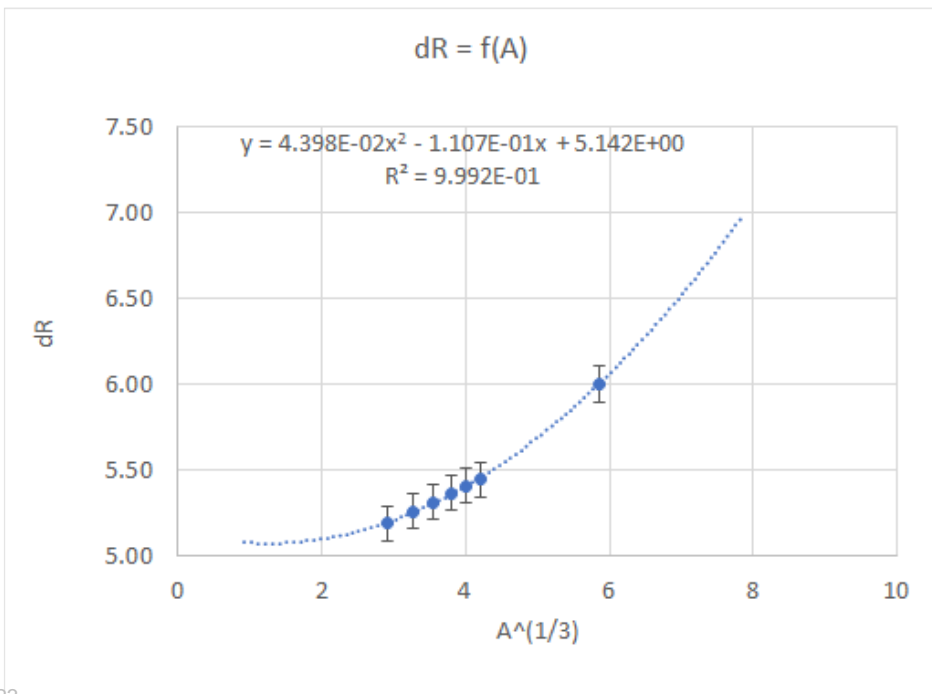
where $A_x = \max(A_1, A_2)$ dR(A=42)= 5.289 fm

a2 = 4.39800e-02
a1 = -1.10700e-01
a0 = 5.142

Unbound nuclei
Take into account unbound nuclei with A < 300

State density
Include pairing and shell corrections for nuclei with A > 70

Make default



Exponential <T> EE model update
Based on 198Pt (MSU data) analysis

Excitation Energy of prefragment

Excitation Energy Models

- 1. J.W.Wilson et al., NIM B18 (1987) 225-231
- 2. J.-J.Gaimard and K.-H.Schmidt, NPA531 (1991) 709
- 3. Parametrized Gaussian distribution
- 4. Exponential <T> excitation-energy distribution
- 5. Log-normal distribution

Use LISE++ corrections for Geometric A-A model

Apply the limiting temperature threshold: T=min(T,Tlim)
 "Isospin-thermometer model", corresponds to Fig 9
K.-H.Schmidt et al., NPA 710 (2002) 157

Apply thermalization for Excitat. energy according to
J.-J.Gaimard, K.-H.Schmidt, NPA531 (1991) 709; Equation 3.4

2. J.-J.Gaimard and K.-H.Schmidt, NPA531 (1991) 709 -- convolution of triangle distributions

Hole depth (MeV) = 40 <E*> = 13.36 *d_abr [MeV] Mean Excitation Energy = 160.25 MeV
 $\sigma(E^*) = 9.43$ *d_abr^{1/2} [MeV] Standard deviation = 32.47 MeV

3. Parametrized Gaussian distribution -- simplified combination from NPA710 (2002) 157

<E*> = 1.611 *d_abr² + 21.954 *d_abr + 0 [MeV] $\sigma(E^*) = -1.999 *d_abr + 18.915 *d_abr^{1/2} + 0$ [MeV]
Mean Excitation Energy = 495.43 MeV
Standard deviation = 41.54 MeV
Ap is the projectile mass, d_abr is the number of abraded nucleons

4. Exponential <T> excitation-energy distribution -- L.Audouard et al., PRC88, 041602(R) (2013)

Mean Temperature (MeV)
base + k1*d_Nabr + k2*d_Zabr
27.8416 1.9557 -0.0049 Mean Excitation Energy = 474.56 MeV
Standard deviation = 136.99 MeV

User Cross-Section analysis using the Abrasion-Ablation model: MINIMIZATION => exp_Tmean_ame20_cut_np64_2t_Nocorr.mfit

EXE <T> model #4

Exponent	base (MeV)	ΔN corr	ΔZ corr
<input checked="" type="checkbox"/>	2.784e+01	1.9557	-0.0049
<input checked="" type="checkbox"/>	7	0	-2
<input type="checkbox"/>	30	2	0

Common parameters

AA X-sections: Amplitude factor = 0.595

dR correction - polynomial mode "auto": a0 = 5.142, a1 = -0.1107, a2 = 0.04398

Break-up channel parameters: Limiting temperature (Tlim @ A=050, 150, 250) = 7.7023, 4.9989, 2.9965

Local line to analyze: Change, N = 120

Calculate down to Z = 70

Universal analysis value: Weights (Local: x^2=0.1, LoD=0.5; Global: x^2=0.5, LoD=2.5)

Use experimental CS errors in analysis:
Use Reduced chi-square (divide by "n-p"):
If exp. error is absent, then error=coef*CS, where coef is 1

Fitting: N iterations = 100, Fit options, Show initial conditions, Restore previous values, Generate chi2-table, Plot Product values from the chi2-table: Target value = 2.27e+01, Number of user CSs = 6(49), Show intermediate results:

Operations: This utility can be used if: 1. "Projectile Fragmentation" reaction mode is selected, 2. Abrasion-Ablation is the selected CS method, 3. "File" cross section option is set to "on", 4. There are more than 2 user CS in memory. Load Settings, Save Settings, Evaporation Settings, Prefragment excitation energy, Analysis Log-file: exp_Tmean_ame20_cut_np64_2t_Nocorr

Cascade Info & Dialog operations: mass model: User's ME file [WS4_RBF] + LDM#2, decay channels: Np=64; Modes=1010 1000 110, 2t, E* model: 4 - Exponential distribution, Clear AA, Make default, OK, Cancel, Help

16.16.14	07/25/23	PACE4 - migrating to sqlite format
16.16.15	07/31/23	optimization of get_i_xmin & get_i_xmax based on Sasha's analysis
16.16.16	07/31/23	optimization of inter2 based on Sasha's analysis
16.16.17	07/31/23	Cosmetic update of d_Data_Minimization
16.16.18	07/31/23	no drift and fit blocks for block selection in wedge profile and kicker dialogs
16.16.19	08/01/23	Bug correction in AbraAbla::Calculate
16.16.20	08/01/23	minimum size hints for Apf_Excitation, Apf & Evaporation
16.16.21	08/02/23	increasing precision for excitation energy parameters to display and save
16.16.22	08/03/23	d_Data_minimizationFit : implementation dR_auto group box for minimization
16.16.23	08/03/23	AA_compare modification for dR auto parameters
16.16.24	08/03/23	d_Data_minimizationFit: correction for printing final values
16.16.25	08/03/23	Big fixed with opening non-existent COSYfile from Matrix dialog
16.16.26	08/05/23	gloRange optimization with new function double polynom() based on Sasha's results bipoco1s optimization with new function double polynom()
16.16.27	08/05/23	new default parameters for dR_auto
16.16.28	08/05/23	d_Data_minimizationFit update: no AA gauge, Graph dim25 scale
16.16.29	08/08/23	TransPrev/All -> ActivateTable after 30events
16.16.30	08/10/23	new default parameters for dR_auto $y = 4.398E-02x^2 - 1.107E-01x + 5.142E+00$
16.16.31	08/11/23	new link on FRIB beam List
16.16.32	08/11/23	Exponential Tmean EE: two new parameters G_MeanTN & G_MeanTZ
16.16.33	08/11/23	Exponential Tmean EE: d_Apf_excitation
16.16.34	08/12/23	Exponential Tmean EE: d_Dat_minimizationFit
16.16.35	08/12/23	d_Apf: low threshold for even gap is -10
16.16.36	08/16/23	Bugs fixed in Gemini and PACE4
16.16.37	08/16/23	compilation MinGW and MSVC version 6.5.2
16.16.38	08/17/23	L_Distribution: implementation new functions add, input, mult noClear() to improve speed based on Sasha's analysis
16.16.39	08/17/23	L_Distribution: modification of some functions to const
16.16.40	08/17/23	implementation of delta for acceleration of ShellCorrect
16.16.41	08/17/23	Shell correction masstable in mass class update of DeltaShellCorrect() for Shell correction masstable
16.16.42	08/18/23	global variable bool DoublePrecision for long_double test important for long double myexpl()
16.16.43	08/18/23	new class "tripleValue" to operate with large-scale numbers; important for factorials
16.17.01	08/17/23	middle version has been changed
16.17.02	08/17/23	Factorial calculations were turned to work with class "tripleValue"; MSVC issue with "long_double=double" has been solved for mexpl and factorial