

// 14.7.10 06/12/20

// d\_Twinsol dialog : redesign 90%, connection 30%

// d\_Converter\_massLME dialog : redesign 80%, connection 20%

// revision of main external reference header-file: myextern.h,

// and corresponding update of source-files

FRIB mass table converter to LISE++ lme file

Open file View file Clear

--- absent ---

Number of rows

Data	Comments	Total

Convert Cancel ? FRIB mass link

Note

The FRIB mass file is in ASCII format. Comment string begin with "!" or ";"

The Coulombs can be separated by a Space, a Comma or a Tabulation. User can put comments also at the end of data line.

There are FIVE columns: "Z", "N", "HFB\_Energy\_LN", "Pairing\_gap\_P", "Pairing\_gap\_N", where Z is atomic number, N is number of neutrons.

Pairing\_energy\_P and Pairing\_energy\_N are proton and neutron pairing gaps (MeV)

There are only even-even isotopes. LISE++ calculates odd values

TwinSol

Twinsol settings

Use the second solenoid

Twinsol operation mode  Antiparallel  Parallel

Use the defocusing solenoid

Use the absorber

Use the "soft-edge" corrections for solenoid matrix calculations

Twinsol optical matrix

Twinsol scheme

Twinsol Length = 6.0 m

Distance to plot rays = 7.4 m

Twinsol Length = 0.002 m

Initial Beam

Projectile

	Beam emittance	Initial ray values
1. X	1	12
2. T	5	22
3. Y	1	32
4. F	5	42
1&3. R	1	52
2&4. A	7	62

40Ar 18+

P trnsprt 0.854 GeV/c

1-st solenoid block

1-st solenoid block settings

Optical matrix for setting fragment

Block Length = 2.3 m

B = 1.2 T

2-nd solenoid block

2-nd solenoid block settings

Optical matrix for setting fragment

Block Length = 2.3 m

B = 1.2 T

Absorber

Absorber settings

absorber

Distance from target to absorber 1.954 m

Change state after absorber (Z-Q) 0

defocusing solenoid

Settings

Optical Matrix

Length = 2.3 m

B = 1.2 T

Files

current file

twinsol\_origin

Save file as

Load file

Utility

Function of

from

at 10.854 m

Plot options. Show:

Transport: Beam Sigmas

Transport: Ray Values

Ray Trace

Scratch file data

Selected plot

Calculate Save & Exit Plot Quit

Beam tracking 10.854 m

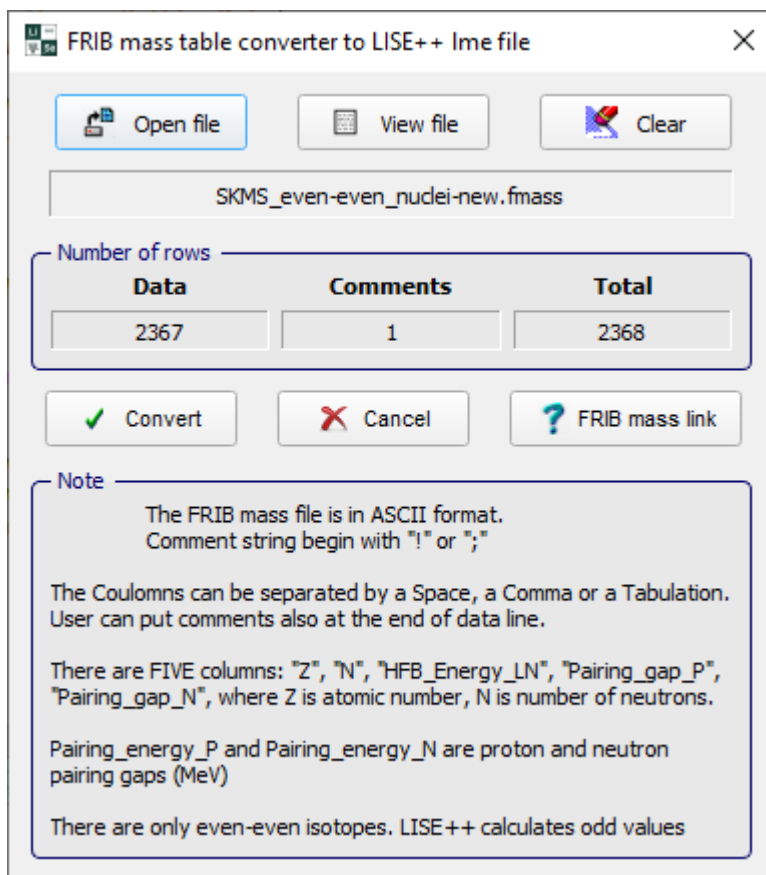
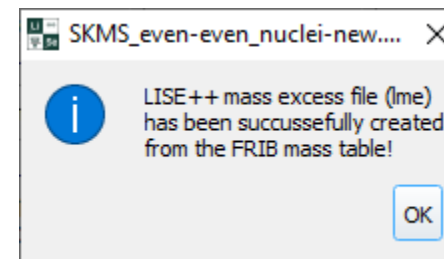
"Transport" (matrix solution)

	Beam sigmas	Ray Values	Ray TRACE
1. X	1	1	1
2. T	5	5	1
3. Y	1	1	1
4. F	5	5	1
1&3. R	1	1	1
2&4. A	7	7	1

Energy (MeV/u) = 0.854

Matr Energy (MeV/u) = 0.854

```
//-----
// 14.7.11 06/13/20
// d_Converter_massLME dialog : DONE%
// d_Twinsol dialog : redesign 100%, connection 70%
// implementation of o_Solenoid, o_Twinsol, d_Twinsol_plot files from Borland to Qt
```



C:/LISEcute/\_install/files/SKMS\_even-even\_nuclei-new.fmass

Save As | Print

!Z	N	BE_(MeV)	Pair_P_(MeV)	Pair_N_(MeV)
2	2	-30.019440	5.880323	5.956823
2	4	-37.188354	5.416633	3.842049
2	6	-39.728661	5.134650	3.396794
4	2	-34.413891	3.724175	5.446302
4	4	-56.131949	3.25322	3.38419
4	6	-71.427749	2.905741	3.457215
4	8	-77.404787	2.638051	2.777292
4	10	-77.979158	2.474336	2.199719
4	12	-78.048266	2.356055	2.165283
4	14	-78.088202	2.218031	2.114237
6	4	-66.948978	3.34526	2.956019
6	6	-94.354056	3.204523	3.274609
6	8	-109.783212	2.999881	2.683654
6	10	-118.008452	2.812351	2.241218
6	12	-124.489896	2.656441	2.167915
6	14	-130.352166	2.504788	2.112382
6	16	-133.725507	2.371611	2.229535
8	4	-67.401491	2.606757	2.701708
8	6	-103.906436	2.566302	3.074793
8	8	-128.856436	2.559389	2.62743
8	10	-144.746257	2.499344	2.068974
8	12	-158.460613	2.45757	2.097429
8	14	-170.486446	2.396408	2.035074
8	16	-178.908577	2.348128	2.142164
8	18	-180.984737	2.363978	1.675568
8	20	-181.364441	2.378885	1.759038
10	6	-104.964003	2.110146	2.88936
10	8	-137.483993	1.984471	2.583105
10	10	-159.62262	1.843837	1.919997
10	12	-180.087753	1.745064	1.95947
10	14	-196.932899	1.584432	1.947746
10	16	-209.966657	1.488828	2.059654
10	18	-216.306409	1.442042	1.672681

//-----  
 // 14.7.12 06/14/20  
 // d\_Solenoid dialog : DONE%  
 // d\_Twinsol dialog : redesign 100%, connection 85%  
 // d\_Electrode dialog : redesign 100%, connection 20%

Beam	emittance	Initial ray values
1. X	1	5 mm
2. T	20	-5 mrad
3. Y	1	20 mm
4. F	20	25 mrad
1&3. R	1.41	7.07 mm
2&4. A	28.28	32.02 mrad

"Transport" (matrix solution)		
Beam sigmas	Ray Values	Ray TRACE
1. X	1	5
2. T	20	20
3. Y	1	-5
4. F	20	25
1&3. R	1.41	7.07
2&4. A	28.28	32.02

```
//-----
// 14.7.13 06/15/20
// d_Electrode dialog : DONE%
// w_Navigation window : 20%
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**Solenoid electrode** ✕

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**Electrode parameters**

Length = <input type="text" value="0.288"/> m	Center to center distance from solenoid to electrode = <input type="text" value="0"/> m
Inner radius = <input type="text" value="0.026"/> m	Inner potential = <input type="text" value="-30000"/> V
Outer radius = <input type="text" value="0.098"/> m	Outer potential = <input type="text" value="0"/> V

**LISE ++** [c:\LISEcute\\_install\files\1900\_wedge.lpp]

File Options Experimental Settings Physics Models Calculations Utilities 1D-Plot 2D-Plot De

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<b>Projectile</b>	<sup>238</sup> U <sup>92+</sup>	600 MeV/u	1 pA
<b>Fragment</b>	<sup>147</sup> Cs <sup>55+</sup>		
<b>Target</b>	<sup>9</sup> Be	1 mg/cm <sup>2</sup>	
<b>Stripper</b>			
<b>D1</b>	Bp=11.0197 T·m		
<b>Fit XX</b>	R11 < 12		

PROJECTILE FRAGMENT

// 14.7.14 06/16/20

// d\_Kinematics dialog : redesign 70%, connection 20%

// update of Kinematics & fission files (v.10) by v.13

// o\_fission.\*, o\_MC\_fission.\*, d\_Kinematics.\*, d\_Kinemaics\_2.cpp,

// d\_Kinemaics\_fission.\*, d\_Kinemaics\_fissionDlg.\*, d\_Kinemaics\_batch.\*

// w\_Navigation window : 60% (all mouse operations to navigate were done)

**Kinematic calculator (relativistic)**

**Reactions**

- TWO BODY reaction B (A, C) D
- SCATTERING B (A, C = A) D=B
- BREAKUP (FUSSION) x (A, C D) x (gamma-emission)

**Beam**

Heavy ion  Neutron  Gamma

**Participants**

Spin: 0 ME [MeV]: 125 Excitation Energy: 0 E (CM) = 123.22 MeV

A: Beam 40Ar 125 0 Beam energy 140.0 MeV/u

B: Target 181Ta 125 0 Intensity 1 pnA

C\*: Fragment 40Ar 125 0 Target thickness 521 micron

D\*: Residual 181Ta 125 0

Q-value is less than 0! Input an excitation energy of the projectile!

Q value = 123.2 MeV Q opt = 123.2 & Ex=123.5 MeV

**Reaction takes place at the**

ENTRANCE of the target  MIDDLE of the target  EXIT of the target

No reaction! The projectile stopped. The target is too thick for this energy.

The gamma-ray energy is equal to 0! E\_CM + Q-value < 0 !!!!

**Set-up**

Search an angle in CM

from 0 degrees and up  from 180 degrees and down

R = 100 cm fragment (C) residual (D)

w = 1 cm

h = 2 cm

Angle (deg) = 5 5 50 130

fragment (C) residual (D) fragment (C) residual (D)

**Calculations**

LAB CM

The monitor is found in the beam direction!!!

Counting in monitor =	4500	4500		pps
Differential Cross Section =	30.1	30.2	100	30.4 mb/sr
Energy after reaction =	40.1	40.2	40.3	40.4 MeV/u**
Energy at the entrance of detectors =	45.1	45.2		MeV/u (** for gamma [MeV])
Maximum Angle =	46.1	46.2		deg

The monitor angle exceeds a maximum angle in LAB!!

Solid Angle =	1.1	1.2	1.3	1.4 msr
delta Theta =	0.1	0.2	0.3	46.2 deg

**Fission (breakup) Batch mode**

Use Mott's scattering

**For Kinematic Plots use energy values**

after reaction  at entrance of detectors

Kinematics plots

Rutherford plot

2D fragment plot (Monte Carlo)

Quit Help

3-body kinematics

// 14.7.15 06/17/20

// d\_Kinematics dialog : redesign 100%, connection 80%

// d\_Kinematics\_2 dialog : connection 70%

// w\_Navigation window : 85%

**Kinematics calculator (relativistic)** (Borland)

Reactions:  TWO BODY reaction B (A, C) D

Participants:
 

	ME [MeV]	Excitation Energy	E(CM) = 2570.59 MeV
A Beam	237Pa	47.53	0
B Target	9Be	11.35	0
C * Fragment	238U	47.31	0.000
D * Residual	8Li	20.95	0.000

Reaction takes place at the:  MIDDLE of the target

Set-up: Search an angle in CM:  from 0 degrees and up

Angle (deg) = 1.592 60 52.574 127.426

Calculations (LAB / CM):
 

Counting in monitor =	4.77e+5	5.21e+2	pps
Differential Cross Section =	1.28e+05	144	100 100 mb/sr
Energy after reaction =	287.636	263.665	0.4064 307.257 MeV/u**
Energy at the entrance of detectors =	285.367	263.515	MeV/u ( ** for gamma [MeV] )
Maximum Angle =	2.06	180.00	deg
Solid Angle =	0.192	0.2	263 0.287 msr
delta Theta =	0.573	0.573	27 0.897 deg

**Kinematic calculator (relativistic)** (Qt)

Reactions:  TWO BODY B (A, C) D

Beam:  Heavy ion

Participants:
 

	ME [MeV]	Excitation Energy	E(CM) = 2570.59 MeV
A Beam	237Pa	47.53	0
B Target	9Be	11.35	0
C Fragment	238U	47.31	0
D Residual	8Li	20.95	0

Reaction takes place at the target:  Middle

Set-up: Search an angle in CM:  from 0 degrees and up

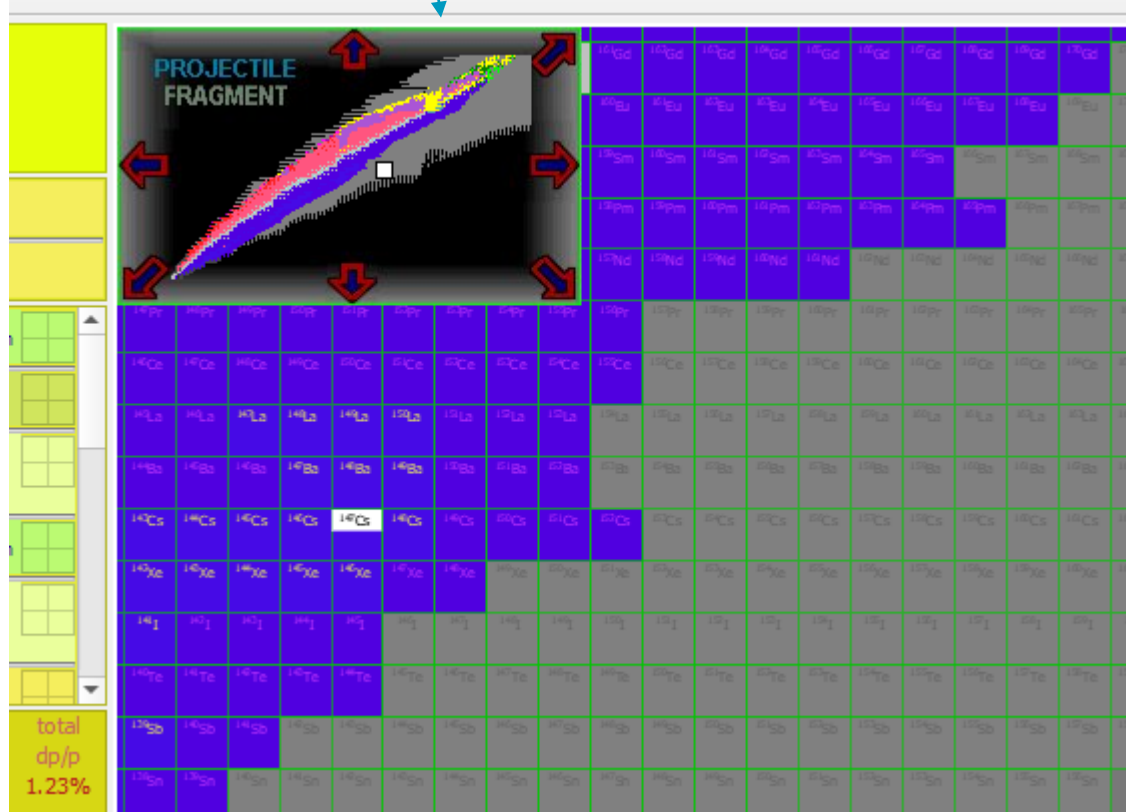
Angle (deg) = 1.592 60 52.575 127.425

Calculations (LAB / CM):
 

Counting in monitor =	4.77e+05	5.21e+02	pps
Differential Cross Section =	1.28e+05	144	100 100 mb/sr
Energy after reaction =	287.636	263.668	0.4064 307.259 MeV/u**
Energy at det.entrance =	285.367	263.518	MeV/u (** MeV for $\gamma$ )
Maximum Angle =	2.06	180	deg
Solid Angle =	0.192	0.2	263 0.287 msr
delta Theta =	0.573	0.573	27 0.897 deg



//-----  
 // 14.7.16 06/18/20  
 // d\_Kinematics dialog : DONE!  
 // w\_Navigation window : DONE!  
 // d\_Kinematics\_batch dialog : redesign 100%, connection 60%



### Kinematic calculator (relativistic)

Reactions

- TWO BODY B (A, C) D
- SCATTERING B (A, C=A) D=B
- BREAKUP (FISSION) x (A, C D) x (or  $\gamma$ -emission)

Use Mott's scattering

For Kinematic Plots use energy values

- after reaction
- at entrance of detectors

Beam:  Heavy ion  Neutron  Gamma

Participants

	ME [MeV]	Excitation Energy	E(CM) = 112.23 MeV
A Beam	45Ca -40.81	0	Beam energy 5 MeV/u
B Target	45Ca -40.81	0	Intensity 1 pA
C Fragment	45Ca -40.81	0	Target thickness 1e-001 micron
D Residual	45Ca -40.81	0	Q_value = +0.00 MeV

Reaction takes place at the target

- Entrance
- Middle
- Exit

Set-up

Search an angle in CM

- from 0 degrees and up
- from 180 degrees and down

	fragment (C)	residual (D)
R =	100 cm	100
w =	1 cm	1
h =	2 cm	2

Selected participant

- LAB-C
- LAB-D
- CM-C
- CM-D

	fragment (C)	residual (D)	fragment (C)	residual (D)
Angle (deg) =	24.971	64.971	50	130

Calculations

	LAB		CM		
Counting in monitor =	4.85e-01	2.26e-01			pps
Differential Cross Section =	1.9e+03	882		522	mb/sr
Energy after reaction =	4.105	0.8926	1.2486	1.249	MeV/u**
Energy at det. entrance =	4.102	0.885			MeV/u (** MeV for $\gamma$ )
Maximum Angle =	90	90			deg
Solid Angle =	0.2	0.2	0.726	0.338	msr
delta Theta =	0.573	0.573	1.15	1.14	deg

Buttons: Kinematics plots, Rutherford plot, 2D fragment plot (Monte Carlo), Exit, Help, 3-body kinematics

06/11

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Directory	Subdirectory	Dialog	re-Design, %	Link, %	DONE	Plots total	Plots done	Bench-mark	Comments	date	size	size done				
218	w_Stuff		d_Password											03/31/20	2234		0
219	w_Stuff		d_Transmission_statistics	100	100	1	0							05/28/20	60991		60991
220	w_Stuff		d_Value_input	100	100	1								04/15/20	3401		3401
221	w_Stuff		w_Gauge	100	100	1								03/31/20	5122		5122
222																	
223		total		220	sum	126	57.3%								5.15E+06	3.42E+06	66.5%
224		procent			completely done	110	50.0%										

06/18

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Directory	Subdirectory	Dialog	re-Design, %	Link, %	DONE	Plots total	Plots done	Bench-mark	Comments	date	size	size done				
217	w_Stuff		d_Password											03/31/20	2234		0
218	w_Stuff		d_Transmission_statistics	100	100	1	0							05/28/20	60991		60991
219	w_Stuff		d_Value_input	100	100	1								04/15/20	3401		3401
220	w_Stuff		w_Gauge	100	100	1								03/31/20	5122		5122
221																	
222		total		219	sum	132	60.3%								5.14E+06	3.58E+06	69.7%
223		procent			completely done	114	52.1%										



