SRIMfit
Examples

Update Log :

2018.10/22 ver 3.01.03 English edition.
A few examples are picked up from Japanese version.

SRIMfit Examples

Contents

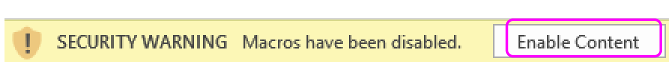
- Guide for SRIMfit Utilities

- Examples using SRIMfit

(Note)

Some Excel files of SRIMfit include macro description inside.

When you open those files, the following message will appear;



Then, click “Enable Content” and continue.;

Guide for SRIMfit Utilities

● Util / srOut2Ws folder

srOut2Ws.xlsm (macro included Excel book)

Cnv.Txt : Read a text file (like Output.txt) of Stopping/Range Table provided by SRIM-2013, and convert it to a Work-Sheet format of MySRIMwb.xlsx.

Cnv.Csv : Read an Excel book file (like SRIMout.xlsx) which contains many Stopping/Range Tables provided by SRIM-2013, and convert all sheets in the book file to the format of MySRIMwb.xlsx.

● Util / forCprog folder

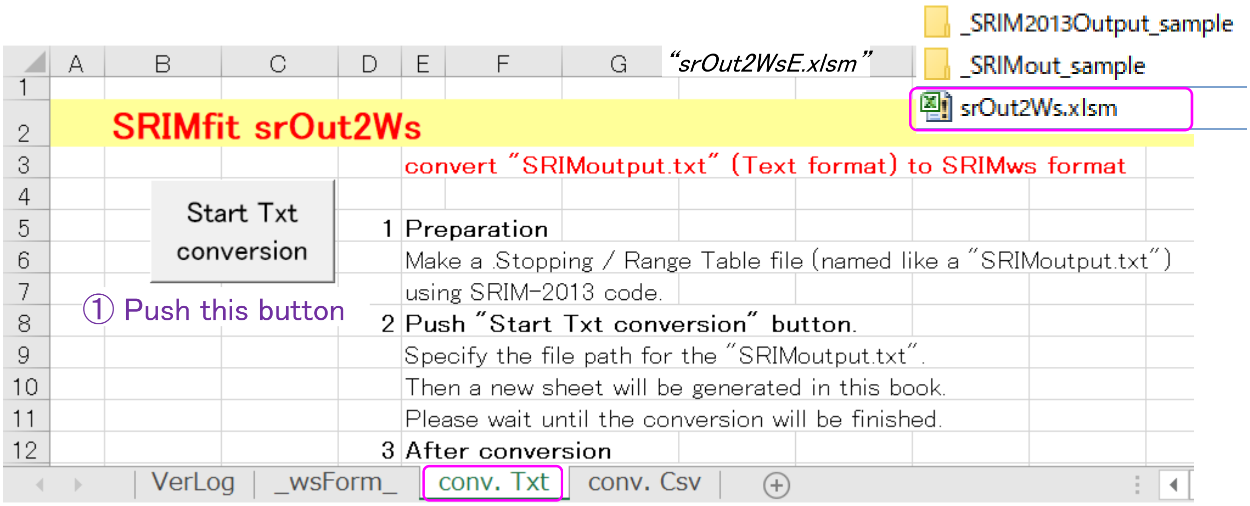
mk R(E) LET(E) array.xlsx

mk E R LET array : Make Range(E), LET(E) static array for C-program.

eg)C++prog : Sample functions using the array.

File name : **srOut2Ws.xlsm** Sheet name : **conv.Txt**

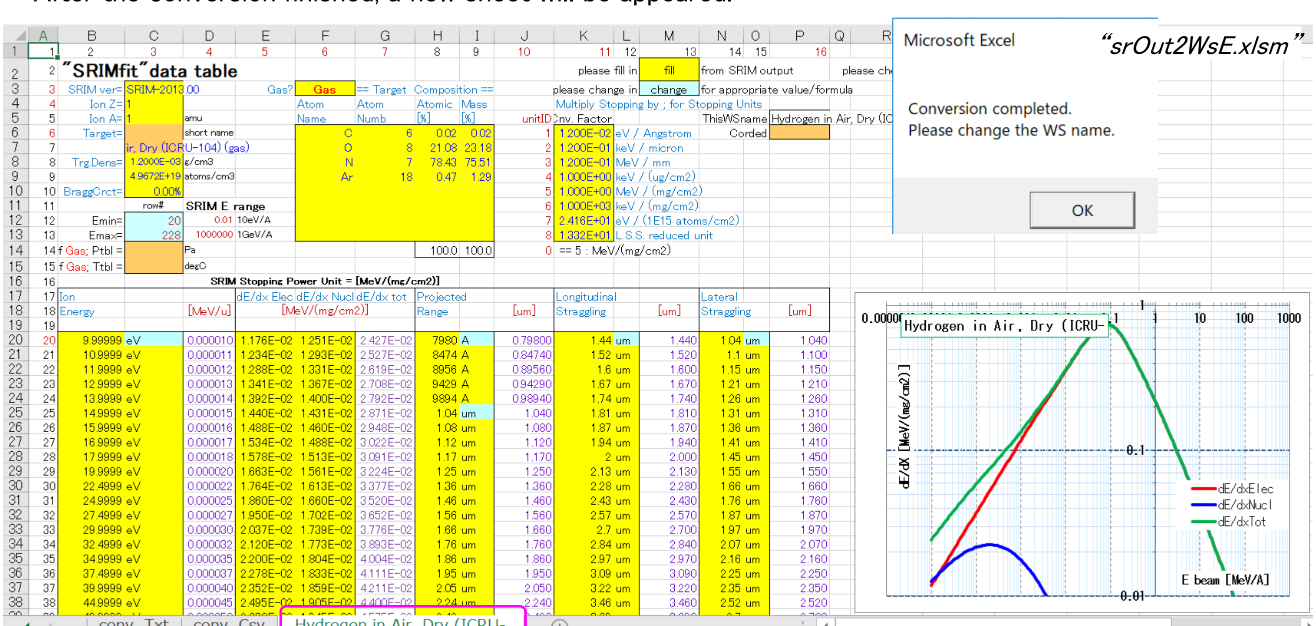
This macro included sheet reads a text file (like Output.txt) of Stopping/Range Table provided by SRIM-2013, and convert it to a Work-Sheet format of MySRIMwb.xlsx.



Some sample files for the "SRIMoutput.txt" are included in this folder.

② Select a Text file

After the conversion finished, a new sheet will be appeared.

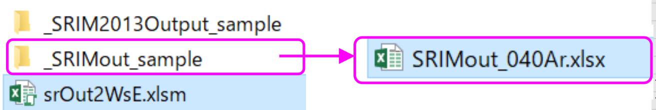


※ for detail, please see "UsersManual : Prepare MySRIMwb".

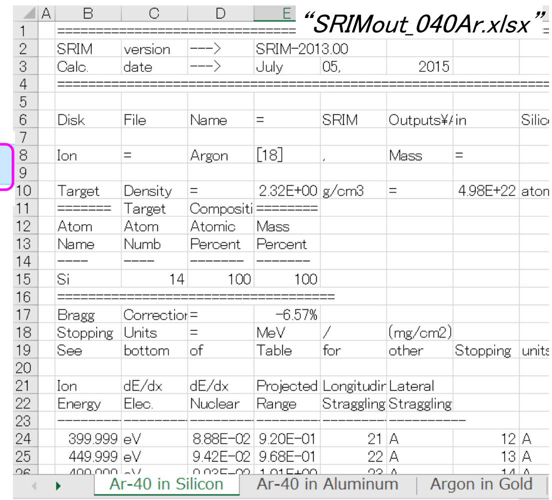
File name : **srOut2Ws.xlsm (cont.)** Sheet name : **conv.Csv**

This macro included sheet reads an Excel book file (like SRIMout.xlsx) which contains many Stopping/Range Tables provided by SRIM-2013, and convert all sheets in the book file to the format of MySRIMwb.xlsx.

Some sample files for the "SRIMout.xslx" are included in this folder.



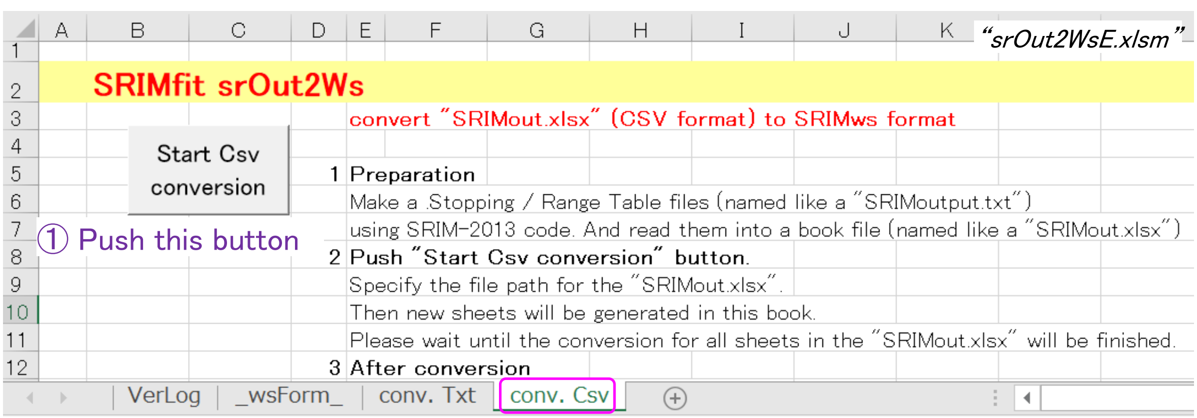
Other samples can be downloaded from SRIMfit Home Page.



"SRIMout_040Ar.xlsx"

	B	C	D	E	F	G	H	I
1	============================							
2	SRIM	version	--->	SRIM-2013.00				
3	Calc.	date	--->	July	05,		2015	
4	==							
5								
6	Disk	File	Name	=	SRIM	Outputs¥/in		Silic
7								
8	Ion	=	Argon	[18]	,	Mass	=	
9								
10	Target	Density	=	2.32E+00	g/cm3	=	4.98E+22	aton
11	=======	Target	Compositi	========				
12	Atom	Atom	Atomic	Mass				
13	Name	Numb	Percent	Percent				
14	----	----	-------	-------				
15	Si	14	100	100				
16	============================							
17	Bragg	Correctior	=	-6.57%				
18	Stopping	Units	=	MeV	/	(mg/cm2)		
19	See	bottom	of	Table	for	other	Stopping	units
20								
21	Ion	dE/dx	dE/dx	Projected	Longitudir	Lateral		
22	Energy	Elec.	Nuclear	Range	Straggling	Straggling		
23	---------	---------	---------	---------	---------	---------		
24	399.999	eV	8.88E-02	9.20E-01	21	A	12	A
25	449.999	eV	9.42E-02	9.68E-01	22	A	13	A

Ar-40 in Silicon | Ar-40 in Aluminum | Argon in Gold



"srOut2WsE.xlsm"

SRIMfit srOut2Ws

convert "SRIMout.xlsx" (CSV format) to SRIMws format

[Start Csv conversion]

① Push this button

1 Preparation
Make a Stopping / Range Table files (named like a "SRIMoutput.txt")
using SRIM-2013 code. And read them into a book file (named like a "SRIMout.xlsx")
2 Push "Start Csv conversion" button.
Specify the file path for the "SRIMout.xlsx".
Then new sheets will be generated in this book.
Please wait until the conversion for all sheets in the "SRIMout.xlsx" will be finished.
3 After conversion

VerLog | _wsForm_ | conv. Txt | conv. Csv

② Select a book file (like SRIMout_040Ar.xlsx)

All sheets included in the "SRIMout *.xlsx" will be converted.
As it takes time, please wait for a while.

※ for detail, please see "UsersManual : Prepare MySRIMwb".

File name： mk R(E) LET(E) array.xlsx　　Sheet name： mk E R LET array

This sheet makes Range(E), LET(E) static array for C-program.
Save this sheet as a text file, and include it into your C-program.

sample_cpp
mk R(E) LET(E) array(sample out).prn
mk R(E) LET(E) array.xlsx

Row	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1																				
2			SRIMfit forCprog								make R(E) LET(E) array									
3																				
4		*	This sheet makes three arrays below using SRIMfit functions																	
5			Eu[ ]						Beam Energy Index. Using this index array, next two arrays are generated.											
6			E2R_BeamName_TargName[ ]						Beam E --> Range conversion table											
7			E2L_BeamName_TargName[ ]						Beam E --> LET conversion table											
8		*	Energy step in Eu[ ] can be modified for your own purpose.																	
9			default is made for RIKEN AVF+RRC Emax = 135MeV/A experiment.																	
10		*	Please change "Decimal precision" as you like.																	
11		*	Save this sheet, as TEXT(*.prn format)																	
12			save as *.csv is not good, because these tables have commas ',' already.																	
13																				
14																				
15	static double Eu[] = { /* [MeV/u] Ebm index table (common for all beams) */																			
16	150.0	,	149.0	,	148.0	,	147.0	,	146.0	,	145.0	,	144.0	,						
17	140.0	,	139.0	,	138.0	,	137.0	,	136.0	,	135.0	,	134.0	,						
18	130.0	,	129.0	,	128.0	,	127.0	,	126.0	,	125.0	,	124.0	,	123.0	,	122.0	,	121.0	,
19	120.0	,	119.0	,	118.0	,	117.0	,	116.0	,	115.0	,	114.0	,	113.0	,	112.0	,	111.0	,
66	0.0010	,	0.0009	,	0.0008	,	0.0007	,	0.0006	,	0.0005	,	0.0004	,	0.0003	,	0.0002	,	0.0001	
67	};																			
68																				
69	/*		Beam =		84Kr					*/										
70	/*		Target =		Si					*/										
71	/*		LETunit =		0		MeV/(mg/cm2)			*/										
72	/*		WSname=		srim84Kr_Si					*/										
73	/*		Rng tbl =		E2R_84Kr_Si[ ]					*/										
74	/*		LET tbl =		E2L_84Kr_Si[ ]					*/										
75																				
76	static double				E2R_84Kr_Si[ ]				= { /* [um] */											
77	5802.0	,	5737.3	,	5672.6	,	5608.0	,	5543.3	,	5478.6	,	5413.9	,	5349.2	,	5288.2	,	5227.7	,
78	5167.2	,	5106.7	,	5046.2	,	4985.8	,	4925.3	,	4864.8	,	4804.3	,	4743.8	,	4683.4	,	4622.9	,
127	0.05428	,	0.04987	,	0.04539	,	0.04085	,	0.03632	,	0.03162	,	0.02686	,	0.02192	,	0.01666	,	0.01078	
128	};																			
129																				
130	static double				E2L_84Kr_Si[ ]				= { /* [MeV/(mg/cm2)] */											
131	5.6228	,	5.6481	,	5.6733	,	5.6985	,	5.7237	,	5.7489	,	5.7741	,	5.7993	,	5.8281	,	5.8574	,
132	5.8867	,	5.9161	,	5.9454	,	5.9747	,	6.0040	,	6.0334	,	6.0627	,	6.0920	,	6.1214	,	6.1507	,
133	6.1851	,	6.2198	,	6.2546	,	6.2893	,	6.3240	,	6.3587	,	6.3934	,	6.4281	,	6.4628	,	6.4975	,
181	7.0602	,	6.9943	,	6.9148	,	6.8107	,	6.6778	,	6.5013	,	6.2663	,	5.9316	,	5.4157	,	4.4769	
182	};																			

← E = Eu[ix] is an index array for generating following arrays.

← Specify Beam, Target, LETunit
E2R_Beam_Targ [ ] ← srE2Range()
E2L_Beam_Targ [ ] ← srE2LETt()
are generated.

Sheet tabs: VerLog | mk E R LET array | eg) C++prog

File name : **mk R(E) LET(E) array.xlsx** Sheet name : **mk E R LET array**

This sheet shows a sample C-program to read the generated Eu(ix), R(ix) and LET(ix) arrays.
Some simple functions like E2RNG(E), E2LET(E), RNG2E(R), Enew(E), Eold(E) are presented.

Some sample files for C++ are included here.
May be it runs on usual C, also.

- sample_cpp
- mk R(E) LET(E) array(sample out).prn
- mk R(E) LET(E) array.xlsx

	A	B	C	D	E	F	G	H
1								
2		SRIMfit forCprog			C++ function example			
3								
4		*Below is a sample program using E2R[] E2L[] array generated by previous sheet.						
5		e.g.) LET, Range, Enew, Eold calculation functions						
6								
7								
8		// File:	CRIPSsub_LET.cpp					
9		// Descript.	E2LET, E2Rng table					
10		// Update:	2014.10/14 Ay Kr-exp anal.					
11		//---						
12								
13		static double Eu[] = { /* [MeV/u] Ebm index table (common for all beams) */					common Eu[ ] table	
14		150.0, 149.0, 148.0, 147.0, 146.0, 145.0, 144.0, 143.0, 142.0, 141.0,						
15		140.0, 139.0, 138.0, 137.0, 136.0, 135.0, 134.0, 133.0, 132.0, 131.0,						
64		0.0010, 0.0009, 0.0008, 0.0007, 0.0006, 0.0005, 0.0004, 0.0003, 0.0002, 0.0001						
65		};						
66								
67		static	int	iEuMax = sizeof(Eu)/sizeof(double);				
68		static	int	jDBG = 0;	// for DBG message			
69								
70			//					
71			// include E2Range, E2LET tables					
72			//					
73		//		E2R, E2L data table	bmID beam			
74		#include	CRIPSdat_12C.cpp	// 1	12C		include E2R[ ] E2L[ ] tables	
75		#include	CRIPSdat_40Ar.cpp	// 2	40Ar			
76		#include	CRIPSdat_84Kr.cpp	// 3	84Kr			
77		#include	CRIPSdat_86Kr.cpp	// 4	86Kr			
78		#include	CRIPSdat_136Xe.cpp	// 5	136Xe			
79		#include	CRIPSdat_197Au.cpp	// 6	197Au			
80								
81		// Work area variables are defined as suitable for OnLine analysis.						
82		// (One_Beam) x (Range , LET tables of) x (Some Materials used)						
83			double	bmA;	// Beam Mass Number		table pointers	
84					// Range, LET table pointer			
85			double	*E2Rsi, *E2Lsi;	// Material = Si			
86			double	*E2Ral, *E2Lal;	// Material = Al			
87								
185		//==						
186		//	Enew	E --> Th --> Enew				
187		//==						
188		double	Enew(double* E2R, double E1, double Th)		// [MeV/u]		Enew(E, Thick) function	
189		//	E2R[]		E --> Range table pointer			
190		//	E1	[MeV/u]	beam Energy			
191		//	Th	[um]	material Thick of E2R[]			
192		{						

Sheet tabs: VerLog | mk E R LET array | eg) C++prog

Examples using SRIMfit

- **example Install_check folder**

sr_eg_AddIn.xlsm = exactly same as “3_Install_check.xlsm” in the “_Install” folder

eg11Macro Info : tutorial of srMcr*( ) functions

eg12MySRwb check : tutorial of srInfo*( ) and other fundamental functions

eg21 : tutorial of srEnew( ), srEnewGas( ) and srE2LET() functions

eg22 : tutorial of srEold( ) and other functions

- **example for RIKEN_Exp folder**

Sample sheets used for heavy ion irradiation exp. at E5A beam line in RIKEN.

E5A06_IC_RangeAna.xlsx

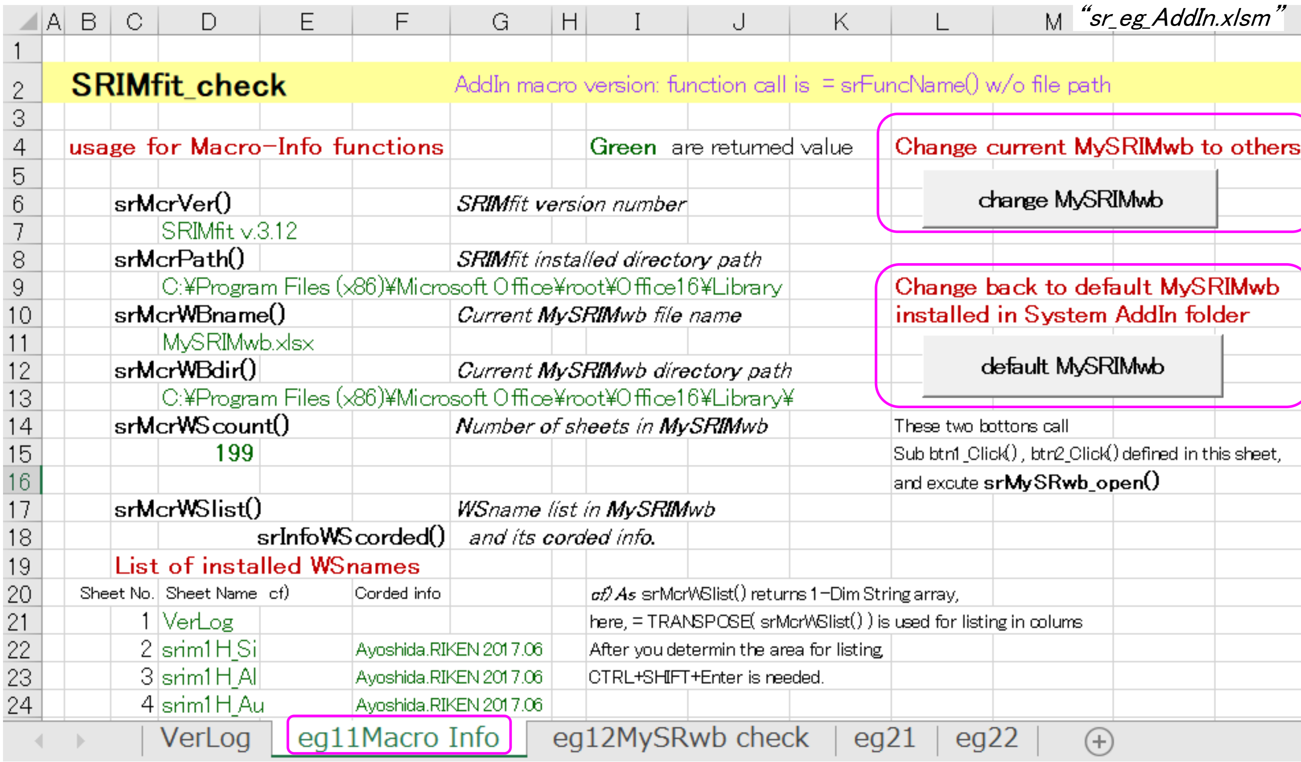
Determine beam energy for irradiation setup in air pressure environment

E5A07_EspcComp.xlsx

Solve a material thickness comparing two beam-energy spectra (Espc) of w/o (Espc1) and w/ (Espc2) the material.

File name : **sr_eg_AddIn.xlsm** Sheet name : **eg11Macro Info**

This sheet is a tutorial of srMcr*( ) functions.
These functions return the status of running "SRIMfit.xlam" in Excel system.



change MySRIMwb

Push this button, then file selection window will appear.
You can "temporally change" the default "MySRIMwb.xlsx" in the system AddIn folder to other SRIMwb file.

default MySRIMwb

Push this button, then the reference to SRIMwb will change back to the default one.

Note) When you restart your Excel system, the "MySRIMwb.xlsx" in the system AddIn folder is the default file, always.

File name : **sr_eg_AddIn.xlsm (cont.)** Sheet name : **eg12MySRwb check**

This sheet is a tutorial of srInfo*( ) and other fundamental functions of SRIMfit.
These functions return the contents of a sheet included in "MySRIMwb.xlsx"

SRIMfit_check

AddIn macro version: function call is = srFuncName() w/o file path

MySRIMwb.xlsx contents check

Blue are inputs, Green are return values.

WS.name =	srim40Ar_Air	<- write a WSname in the MySRIMwb.xlsx

← Change "WSname" then you can inspect the contents of the sheet

Corded	Ayoshida RIKEN 2016.07		Gas?	Gas	== Target	Composition ==		
SRIM ver	SRIM-2013.00			Atom	Atom	Atomic	Mass	
Ion Z	18	Ar		Name	Numb	[%]	[%]	
Ion A	40		0	C	6	0.02	0.02	
Target	Air		1	O	8	21.08	23.18	
	Air (Dry ICRU-104(gas		2	N	7	78.43	75.51	
Tgt.Dens	1.205E-03	g/cm3	3	Ar	18	0.47	1.29	
	4.987E+19	atoms/cm3	4		0	0	0	
Bragg Crct.	0.00%		5		0	0	0	
			6		0	0	0	
Table Range	Min	Max	7		0	0	0	
E [MeV/u]	1.00E-05	1.00E+03			sum	100.0	100.0	
Rng[μm]	3.28E+00	3.66E+08						
Long.Strg[μm]	1.39E+00	1.27E+07						
Late.Strg[μm]	1.01E+00	1.12E+06						

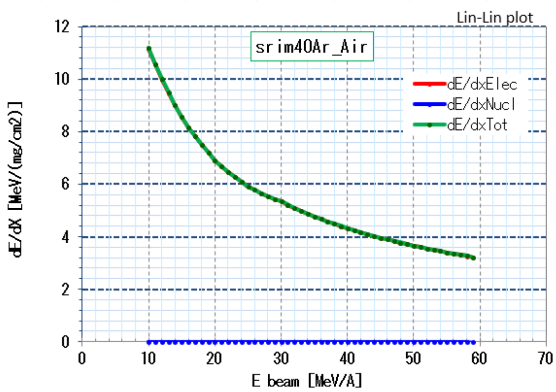
Multiply Stopping by ; for Stopping Units

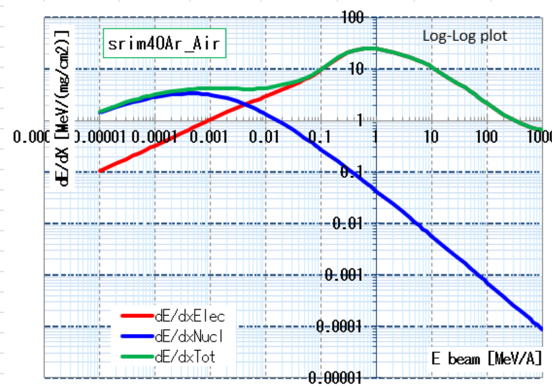
unitID	Cnv. Factor	
1	1.20E-02	eV / Angstrom
2	1.20E-01	keV / micron
3	1.20E-01	MeV / mm
4	1.00E+00	keV / (ug/cm2)
5	1.00E+00	MeV / (mg/cm2)
6	1.00E+03	keV / (mg/cm2)
7	2.42E+01	eV / (1E15 atoms/cm2)
8	9.71E-02	L.S.S. reduced unit
0	== 5 : MeV/(mg/cm2)	

dE/dX unitID	0	= 0,1 .. 8		
	LETt	LETe	LETn	
dE/dx max	25.138	25.080	3.355	in unitID
at E =	0.688	0.688	0.00043	MeV/u
LET@ 70%	17.60	17.56	2.349	in unitID
Elow side	0.217	0.219	0.00004	MeV/u
Ehigh side	3.517	3.533	0.00304	MeV/u

10.0	= Emin [MeV/u] (for Lin-Lin plot)
1.0	= Estep

E [MeV/u]	dEdX Elec [MeV/(mg/cm2)]	dEdX Nucl	dEdX Tot	Range [μm]	Long.Strag [μm]	Late.Strag [μm]
12.56	9.684.E+00	4.675.E-03	9.688.E+00	2.994.E+05	1.070.E+04	1.859.E+03
10.00	1.117.E+01	5.724.E-03	1.118.E+01	2.174.E+05	6.990.E+03	1.510.E+03
11.00	1.055.E+01	5.269.E-03	1.056.E+01	2.482.E+05	8.494.E+03	1.638.E+03
12.00	9.988.E+00	4.878.E-03	9.993.E+00	2.807.E+05	9.920.E+03	1.778.E+03
13.00	9.468.E+00	4.540.E-03	9.473.E+00	3.149.E+05	1.130.E+04	1.926.E+03
14.00	8.992.E+00	4.246.E-03	8.996.E+00	3.508.E+05	1.267.E+04	2.080.E+03
15.00	8.556.E+00	3.988.E-03	8.560.E+00	3.884.E+05	1.401.E+04	2.240.E+03
16.00	8.168.E+00	3.768.E-03	8.172.E+00	4.284.E+05	1.536.E+04	2.416.E+03
17.00	7.812.E+00	3.570.E-03	7.816.E+00	4.700.E+05	1.672.E+04	2.592.E+03
18.00	7.495.E+00	3.397.E-03	7.499.E+00	5.140.E+05	1.867.E+04	2.778.E+03
19.00	7.206.E+00	3.240.E-03	7.209.E+00	5.597.E+05	2.121.E+04	2.974.E+03
20.00	6.917.E+00	3.083.E-03	6.920.E+00	6.054.E+05	2.375.E+04	3.170.E+03
21.00	6.691.E+00	2.959.E-03	6.694.E+00	6.554.E+05	2.611.E+04	3.386.E+03
22.00	6.465.E+00	2.836.E-03	6.468.E+00	7.055.E+05	2.846.E+04	3.602.E+03
23.00	6.265.E+00	2.724.E-03	6.267.E+00	7.577.E+05	3.077.E+04	3.824.E+03
24.00	6.090.E+00	2.623.E-03	6.092.E+00	8.118.E+05	3.304.E+04	4.052.E+03
25.00	5.915.E+00	2.523.E-03	5.918.E+00	8.660.E+05	3.531.E+04	4.280.E+03
26.00	5.783.E+00	2.440.E-03	5.785.E+00	9.236.E+05	3.751.E+04	4.524.E+03
27.00	5.650.E+00	2.357.E-03	5.653.E+00	9.812.E+05	3.970.E+04	4.768.E+03
28.00	5.535.E+00	2.281.E-03	5.538.E+00	1.040.E+06	4.187.E+04	5.018.E+03
29.00	5.438.E+00	2.212.E-03	5.440.E+00	1.100.E+06	4.400.E+04	5.274.E+03
30.00	5.341.E+00	2.142.E-03	5.343.E+00	1.160.E+06	4.613.E+04	5.530.E+03
31.00	5.219.E+00	2.082.E-03	5.221.E+00	1.224.E+06	4.824.E+04	5.798.E+03
32.00	5.097.E+00	2.022.E-03	5.099.E+00	1.288.E+06	5.035.E+04	6.066.E+03
33.00	4.983.E+00	1.966.E-03	4.985.E+00	1.354.E+06	5.247.E+04	6.340.E+03





VerLog | eg11Macro Info | eg12MySRwb check | eg21 | eg22

File name: **sr_eg_AddIn.xlsm (cont.)** Sheet name: **eg21**

This sheet is a tutorial of srEnew( ), srEnewGas( ) and srE2LET() functions.

Below is an example to calculate 40Ar beam energy AFTER pathing through the materials of Kapton, Aluminum and Air. Then goes through additional Al_Edegrader foils to control the LET value in a Si semiconductor device at a depth of 200 μm.

SRIMfit_check

AddIn macro version: function call is = srFuncName() w/o file path

srEnew(), srEnewGas() example

This example calculates Energy & LET(dE/dX)
for a beam pathing through four target materials.

Blue are inputs
Green are return values

You can change the values in Blue cells.

Header: srim
Beam: 40Ar

Mat	W.S.name	Dens	maxLET@MeV/u		Mat.name
Si	srim40Ar Si	2.32	18.7	1.13	Silicon
Al	srim40Ar Al	2.70	18.5	1.13	Aluminum
Air	srim40Ar Air	1.2E-03	25.1	0.69	Air (Dry ICRU-104(gas))
Kaptc	srim40Ar Kapton	1.42	27.3	0.75	Kapton(Polyimide Film ICRU-179)

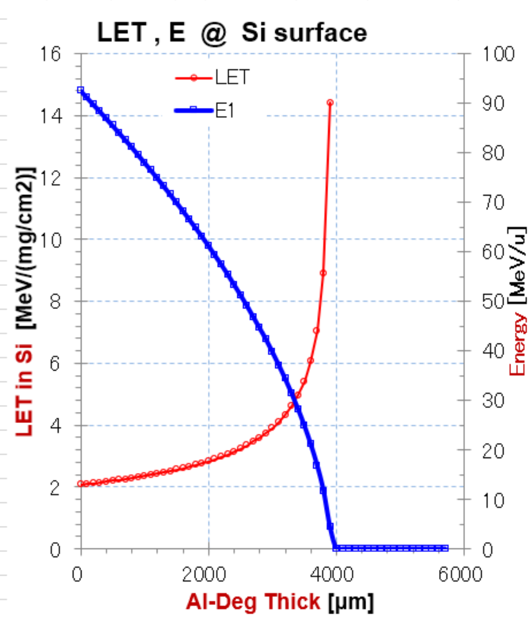
E after pathing through the materials

Beam A	Z	in Vacuum MeV/u	→ MeV	Vac. Foil Kapton μm	→ MeV/u	Edeg foils Al μm	→ MeV/u	Air path Air mm	→ MeV/u
40 Ar	18	95.0	3800	75.0	94.39	50.0	93.74	175.0	92.53
LET(Si)		2.03	[MeV/(mg/cm2)]		2.04		2.05		2.07
Range(Si)		4668	[μm]		4615		4559		4461
Long.Strg(Si)		175	[μm]		174		172		169
Later.Strg(Si)		27	[μm]		27		26		26
Range(Al)		4126	[μm]		4079		4029		3942
Range(Air)		8256	[mm]		8163		8064		7889

T air 25.0 degC
P air 101325 Pa
for std. T,P correction 0.983 =srThkStd()

step= 100 | at Si surface | 200 μm depth in Si

Al-Edeg μm	E1 MeV/u	LET MeV/(mg/cm2)	E2	LET
0	92.53	2.07	90.08	2.12
100	91.14	2.10	88.85	2.14
200	89.75	2.12	87.63	2.16
300	88.36	2.15	86.34	2.18
400	86.95	2.17	85.03	2.21
500	85.50	2.20	83.73	2.23
600	84.04	2.23	82.43	2.26
700	82.59	2.26	81.12	2.29
800	81.13	2.29	79.76	2.32
900	79.57	2.32	78.40	2.35
1000	78.00	2.36	77.05	2.38
1100	76.44	2.39	75.69	2.41
1200	74.87	2.43	74.28	2.44
1300	73.23	2.47	72.83	2.48
1400	71.58	2.51	71.37	2.52
1500	69.94	2.56	69.92	2.56
1600	68.27	2.60	68.45	2.60
1700	66.53	2.66	66.88	2.65
1800	64.80	2.71	65.32	2.69
1900	63.06	2.76	63.76	2.74
2000	61.22	2.83	62.18	2.79
2100	59.32	2.90	60.54	2.85
2200	57.43	2.97	58.89	2.92
2300	55.46	3.05	57.25	2.98
2400	53.38	3.14	55.52	3.05



VerLog | eg11Macro Info | eg12MySRwb check | eg21 | eg22

File name : **sr_eg_AddIn.xlsm (cont.)** Sheet name : **eg22**

This sheet is a tutorial of srEold( ) and other functions.

Below is an example to calculate the beam energy BEFORE pathing through materials.
In order to solve a “Problem” indicated in this sheet,
① the start energy at the given depth is calculated by using srLETt2E()
② goes to upstream direction using srEold() and reaches to the “Answer”.
③ then goes back to downstream, again, using srEnew() and reaches to the “given condition” of “LET in Si must be 39.0 MeV/u”; a check by re-calculation is done.

SRIMfit_check

srEold(), srEnew() example

This example is used for a semiconductor irradiation exp. at E5A beam line in RIKEN
To solve a problem below, beam E pathing before materials are calulated by srEold()
then re-calculate E after pathing through them by srEnew()

Fill in **Blue** *cells as your irradiation condition*
Green *cells are return values from SRIMfit*

Problem) Solve the beam energy under following conditions.
where the beam extracted into air pressure and pathing through materials listed below, moreover,
at the depth of 20 *[μm] from the sample surface,*
LET in Si must be 39.0 *[MeV/(mg/cm2)]* <-Less than 41.0 = max LET in sample (=srMaxLETt())

room temperature 27.7 degC
air pressure 100800 Pa (1atm=101325)
STPcoef. 0.969 =srThkStd()

Header: srim
Beam: 84Kr

	Scat.foil	Vac.foil	IonChamber	Light shield	Plastic Scinti	E-Degrader	Air	Sample
WSname	srim84Kr_Au	srim84Kr_Kaptor	srim84Kr_Mylar	srim84Kr_Mylar	srim84Kr_EJ212	srim84Kr_Al	srim84Kr_Air	srim84Kr_Si
Mat.name	Au	Kapton	Mylar	Mylar	EJ212	Al	Air	Si
Thickness	45.8 μm	78.0 μm	24 μm	48 μm	100 μm	800.0 μm	305 mm	20 μm ①

Answer — *calculate E before pathing through it, using* ***srEold()*** — at the depth

A		Z	MeV/u	MeV	MeV/u		MeV/u		MeV/u		MeV/u		MeV/u		MeV/u		MeV/u		MeV/u		MeV/u
84	Kr	36	67.15	5641	67.15	<-	60.72	<-	59.10	<-	58.59	<-	57.57	<-	55.92	<-	19.77	<-	6.68	<-	4.61

② in Vacuum — *re-calculate E after pathing through it, using* ***srEnew()*** — =srLETt2E()

	Scat.foil	Vac.foil	IonChamber	Light shield	Plastic Scinti	E-Degrader	Air	Sample
	60.72 ->	59.10 ->	58.59 ->	57.57 ->	55.92 ->	19.77 ->	6.68 ->	4.61
LET(Si) [MeV/(mg/cm2)]	**10.46**	**10.65**	**10.72**	**10.86**	**11.08**	**21.78**	**35.98**	**39.00** ③
Range(Si) [μm]	1302	1246	1230	1198	1145	241	68	48
Long.Strg(Si) [μm]	50	48	47	46	44	8	2	1
Later.Strg(Si) [μm]	6	6	6	6	5	2	1	1
Range(Al) [μm]	1156	1107	1092	1062	1012	212	60	42
Range(Air) [mm]	2325	2224	2194	2134	2036	421	116	81

VerLog | eg11Macro Info | eg12MySRwb check | eg21 | eg22

Examples

※ *This sheet needs E5Aexp.xlam*

File name： **E5A06_IC_RangeAna.xlsx**　　　Sheet name： **Params**

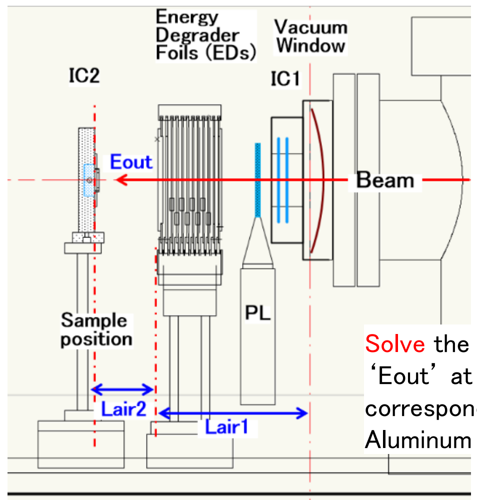
This sheet is used to determine beam energy for irradiation setup in air pressure environment.

	B	C	D	E
1	(name def.)	common param. in this book		
2	WBtitle		2018 Kr Exp	
7		Edeg	adopted	measured
8		Deg#	μm	μm
9	ThEDtbl	1	10.20	10.10~10.33
10		2	12.80	12.80
11		3	23.80	23.80
12		4	48.59	
13		5	100.24	
14		6	100.80	
15		7	196.39	
16		8	485.95	
17		9	5000	5000
18		A	5.48	5.48
19		B	975.39	975.39
20		C	2000	2000
21				
22		Beam	adopted	measured
23		monitors	μm	μm
24	ThAu	Au	45.8	75
25	ThKapton	Kapton	78.0	75
26	ThICmylar	IC1.mylar	24.0	24
27	ThPLmylar	PL.mylar	48.0	72
28	ThPL	PL.EJ212	100.0	500
29			mm	mm
30	ThAir1	Air1	145.0	Kap~EdegOut
31	ThAir2	Air2	165.0	EdegOut~IC2
32	AirT	avrTair	27.7	℃
33	AirP	avrPair	1008.0	hPa
34				
35		IC2	adopted	measured
36	ICs_Mylar	I.Mylar [μm]	4.0	4
37	ICs_Th	AirLay. [mm]	2.000	2mm
38				

params | ICcalc | ICana

In「Params」sheet, thickness of the materials are listed.

An air-ionization chamber (IC2) is placed at sample irradiation position. The Beam is extracted from vacuum and goes through many materials.



Solve the beam energy 'Eout' at the exit of EDs as corresponding Range value in Aluminum 'ExpR'.

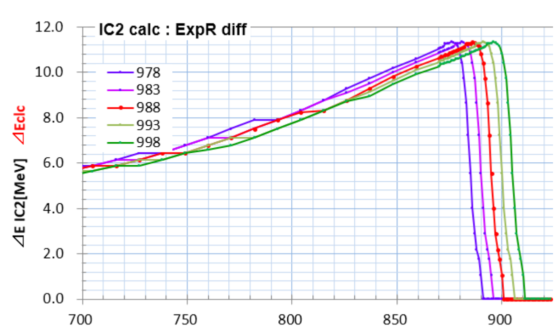
To Solve the 'ExpR', please change the value in this cell.

	B	C	D
65		Range	adopted
66		Anal.	μm
67	ExpR	ExpR	988.0 <- Fix it by manual

File name： **E5A06_IC_RangeAna.xlsx (cont.)**　　Sheet name： **ICcalc**

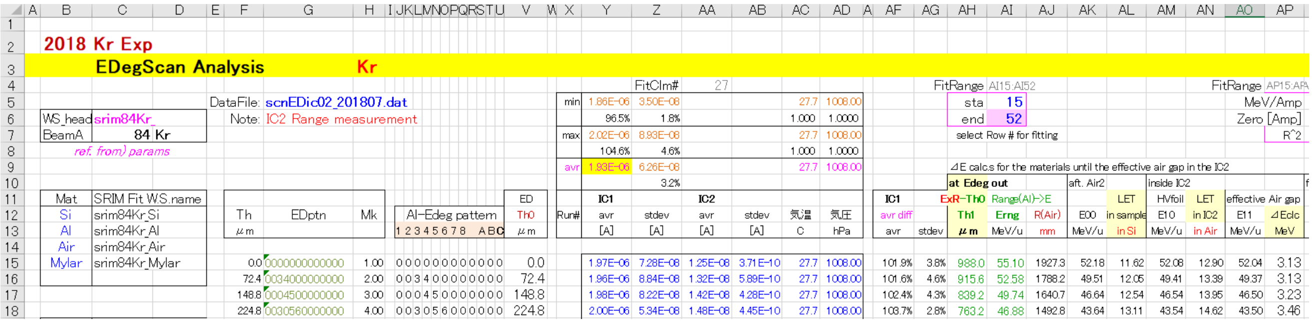
	B	C	F	G	I	J	L	M	O	P	R	S	U	V
1														
2	2018 Kr Exp													
3		EDegScan ICcalc						Kr						
4														
5														
6	WS_head	srim84Kr_												
7	BeamA	84 Kr												
8		ref. from) params												
9					ExpR(#-2)		ExpR(#-1)		ExpR(#+1)		ExpR(#+1)		ExpR(#+2)	
10				⊿ExpR	-10		-5		0		5		10	
11	Mat	SRIM Fit W.S.name		ED	978		983		988		993		998	
12	Si	srim84Kr_Si	step	Th0	Erng	⊿Eclc	Erng	⊿Eclc	Erng	⊿Eclc	Erng	⊿Eclc	Erng	⊿Eclc
13	Al	srim84Kr_Al	μm	μm	MeV/u	MeV	MeV/u	MeV	MeV/u	MeV	MeV/u	MeV	MeV/u	MeV
14	Air	srim84Kr_Air		— Graph start —										
15	Mylar	srim84Kr_Mylar	50	0.0	54.76	3.127	54.93	3.127	55.10	3.127	55.27	3.127	55.43	3.127
16				50.0	53.04	3.127	53.22	3.127	53.41	3.127	53.59	3.127	53.76	3.127

In the second「ICcalc」sheet,
⊿E in IC2 is calculated in advance for the cases of ExpR±10 μm changing the thickness of EDs.
Here, the thickness steps for EDs should be fine near the Bragg Peak, especially.

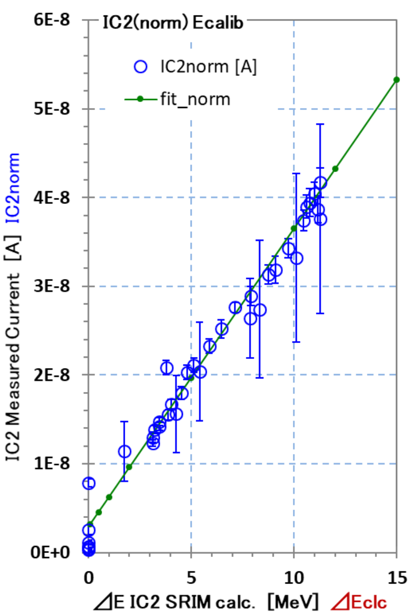


File name： **E5A06_IC_RangeAna.xlsx (cont.)**　　Sheet name： **ICana**

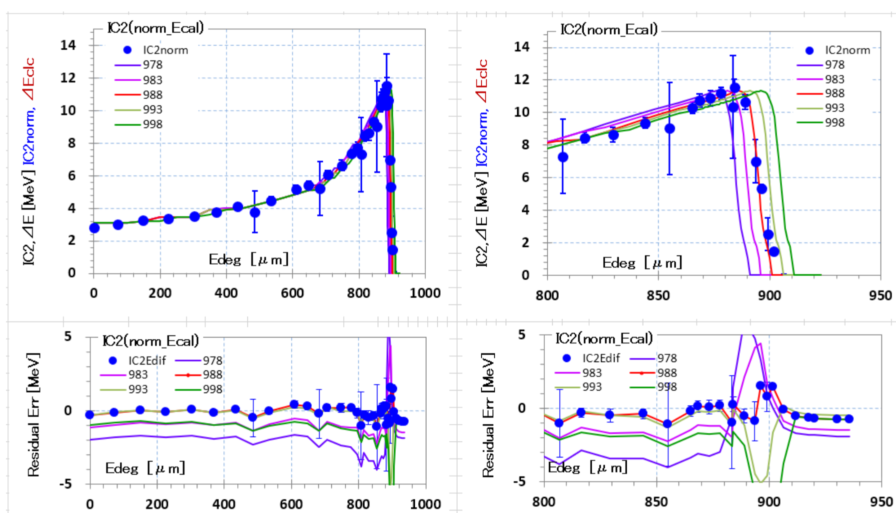
In the third「ICana」sheet, using measured current data points of IC2 according to the thickness of EDs, analysis for ExpR is performed.



EDs thickness used.　　Measured current by IC1,IC2　　⊿Ecalc in IC2 air gap.



Calibration for IC2 between ⊿Ecalc vs measured current. Using this result, the current of IC2 is converted to ⊿Emeas.



Comparisons between ⊿Emeas data points vs. ⊿Ecalc. according to the thickness of EDs.

Range Anal.	adopted μm
ExpR	988.0 <- Fix it by manual

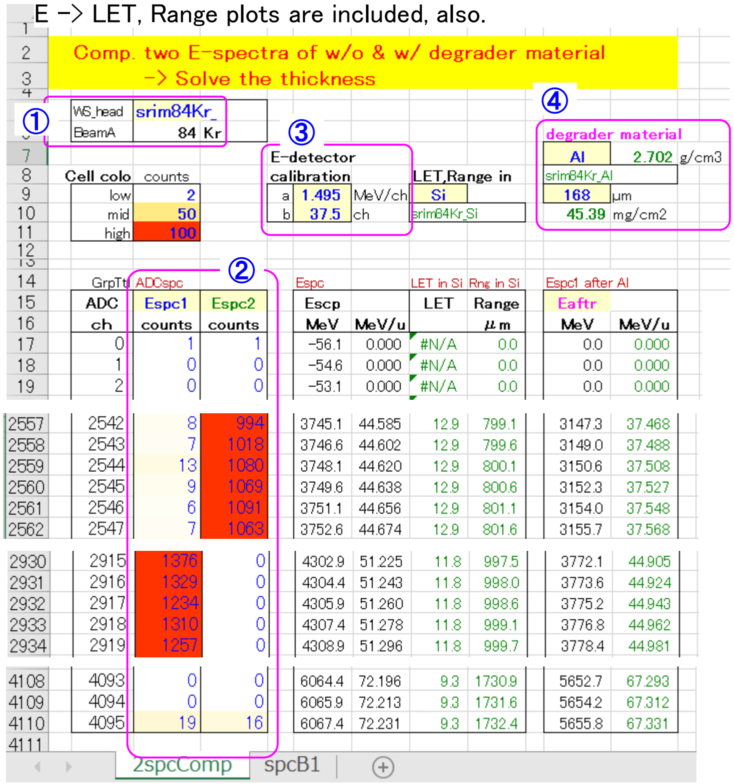
Please open two sheet of「Params」and「ICana」together, and try to chane the Exp value.

For this experimental data, ExpR=988 μm was the best fit value because ;
- the ⊿Ecalc vs current calibration becomes straight,
- the ⊿Emeas vs ⊿Ecalc plots overlap well especially near the Bragg Peak.

File name: **E5A07_EspcComp.xlsx** Sheet name: **2spcComp**

This sheet is used to solve a material thickness comparing two beam-energy spectra (Espc) of w/o (Espc1) and w/ (Espc2) the material.

Spectrum conversions listed below are simple. X axis is changed as ADC[ch] → E[MeV] → Enew(Thick).
E -> LET, Range plots are included, also.



Comp. two E-spectra of w/o & w/ degrader material
-> Solve the thickness

① WS_head: srim84Kr_ ; BeamA: 84 Kr

③ E-detector calibration: a = 1.495 MeV/ch ; b = 37.5 ch

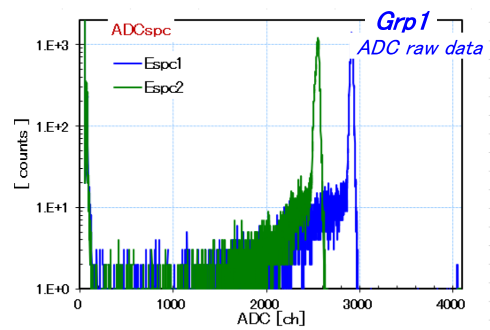
LET,Range in: Si (srim84Kr_Si)

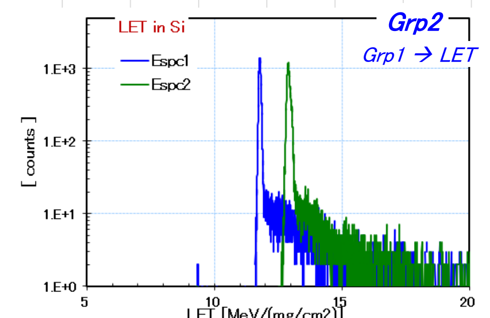
④ degrader material: Al 2.702 g/cm3 (srim84Kr_Al) ; 168 μm ; 45.39 mg/cm2

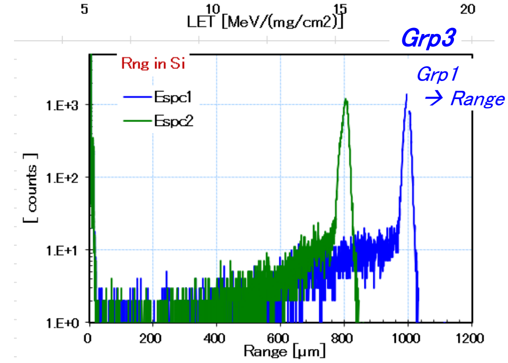
Cell colo (counts): low 2 ; mid 50 ; high 100

Row	ADC ch	Espc1 counts	Espc2 counts	Escp MeV	MeV/u	LET	Range μm	Eaftr MeV	MeV/u
17	0	1	1	-56.1	0.000	#N/A	0.0	0.0	0.000
18	1	0	0	-54.6	0.000	#N/A	0.0	0.0	0.000
19	2	0	0	-53.1	0.000	#N/A	0.0	0.0	0.000
2557	2542	8	994	3745.1	44.585	12.9	799.1	3147.3	37.468
2558	2543	7	1018	3746.6	44.602	12.9	799.6	3149.0	37.488
2559	2544	13	1080	3748.1	44.620	12.9	800.1	3150.6	37.508
2560	2545	9	1069	3749.6	44.638	12.9	800.6	3152.3	37.527
2561	2546	6	1091	3751.1	44.656	12.9	801.1	3154.0	37.548
2562	2547	7	1063	3752.6	44.674	12.9	801.6	3155.7	37.568
2930	2915	1376	0	4302.9	51.225	11.8	997.5	3772.1	44.905
2931	2916	1329	0	4304.4	51.243	11.8	998.0	3773.6	44.924
2932	2917	1234	0	4305.9	51.260	11.8	998.6	3775.2	44.943
2933	2918	1310	0	4307.4	51.278	11.8	999.1	3776.8	44.962
2934	2919	1257	0	4308.9	51.296	11.8	999.7	3778.4	44.981
4108	4093	0	0	6064.4	72.196	9.3	1730.9	5652.7	67.293
4109	4094	0	0	6065.9	72.213	9.3	1731.6	5654.2	67.312
4110	4095	19	16	6067.4	72.231	9.3	1732.4	5655.8	67.331

2spcComp | spcB1





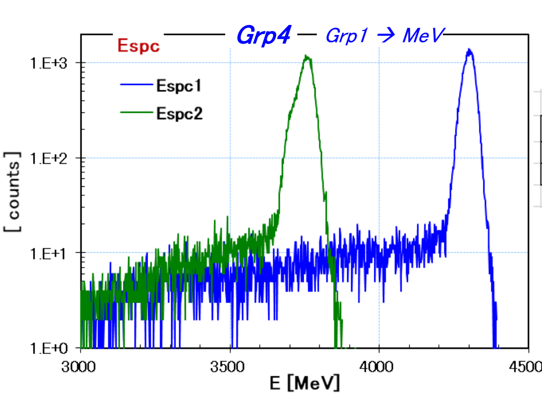


① Specify a Beam as a header name of ‘WSname’.

② Fill in ADC data of Espc1 and Espc2.

③ Put Energy-Calibration formula as **E [MeV] = a * ([ch] − b)**

④ Changing the Thickness of the material, Look Grp5, see an overlap between measured Espc2 and Enew(Thic) calculated Eafter.



Change this value manually

degrader material	
Al	2.702 g
srim84Kr_Al	
168	μm
45.39	mg/cm2