

The code operates under MS Windows environment and provides a highly user-friendly interface.
It can be freely downloaded from the following internet addresses:
<http://www.nslcl.msu.edu/lise>

version 8.3.147

**To estimate FRIB rates :
Gas-cell, re-accelerator etc**

<http://groups.nslcl.msu.edu/frib/rates/>

Can be used as

- Gas-cell
- Re-accelerator
- Storage rings
- etc

To calculate the fraction of nuclei
which survived decay,
To apply extraction efficiency and
so on.

Reaccelerated beam rates

The reaccelerated beam rate is dependent on the charge breeding efficiency and the transport efficiency through the Q/A separator and the acceleration efficiency in the linac. These rate estimates are based on assumptions of performances that have not all been demonstrated. Further R&D will be required to achieve this performance.

The reaccelerated beam rates are calculated by the formula:

$$\text{Reaccelerated beam rate} = \text{Stopped_beam_rate} \times \text{Survive}_{\text{breeding}} \times \text{Beps} \times \text{TraQA} \times \text{Reeps},$$

where *Reeps* is the Re-accelerator efficiency (80%), *TraQA* is the transport efficiency through the Q/A separator (95%), *Survive_{breeding}* is part of nuclei which survived at breeding process, and *Beps* is the accumulation and breeding efficiency for single charge states. Different values were assumed for different mass regions, as shown in Table 4.

Table 4.

Mass region	Accumulation and breeding efficiency, <i>Beps</i>	Breeding time [ms]
M < 40	60%	10
40 ≤ M ≤ 150	50%	15
M > 150	40%	20

http://groups.nslcl.msu.edu/frib/rates/FRIB_rates_readme.pdf

Spectrometer designing

Block	Given Name	Z-Q	Length,m	Enable
D	Dipole	D4	0 9.39	+
M	Material	FP_PPAC0		+
M	Material	FP_PPAC1		+
S	Drift	FP_slits	0	+
M	Material	FP_PIN		+
Z	Delay	GS_Delay	0	+
Z	Delay	Reaccelerator	0	+
Z	Delay	Breeding	0	+
M	Material	XF_SCI		NO
M	Material	FP_Stack0		NO
M	Material	FP_Stack1		NO
M	Material	FP_Stack2		NO
M	Material	FP_Stack3		NO
M	Material	FP_Stack4		NO
M	Material	FP_SCI		NO

Selected block
 Enable Delay (efficiency) block
 Let call automatically Block Length [m] 0
 Block name = Reaccelerator Length after this block [m] 35.643
 Total Length [m] 35.643

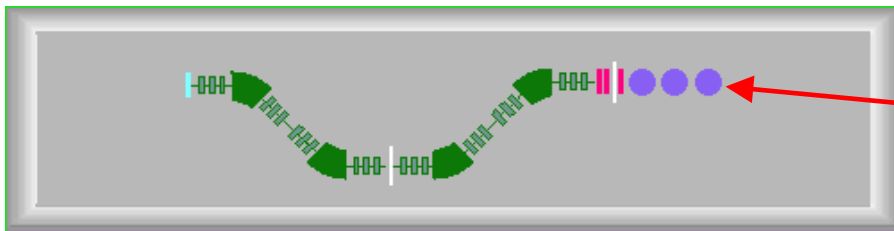
Insert Mode
 before
 after

Move element
 Up
 Down

Insert block

- Target
- Stripper after Target
- Wedge
- Material(Detector)
- Faraday cup
- Dispersive (Dipole)
- Wien velocity filter
- Drift (space)
- Beam Rotation
- Electric dipole
- Gas-filled separator
- Compensating Dipole
- RF separator
- Solenoid
- Delay (efficiency) block**

Buttons: Edit, Delete, OK, Help



- Z GS_Delay
- Z Reaccelerator
- Z Breeding

statistics 35Ca		
35Ca Beta+ decay (Z=20, N=15)		
Q1 (D1)		20
Q2 (D2)		20
Q3 (D3)		20
Q4 (D4)		20
Production Rate	(pps)	4.69e-1
Reaction		Fragmentn
Sum of all reactions	(pps)	4.69e-1
CS in the target	(mb)	3.73e-7
Total transmission	(%)	30.086
Target	(%)	98.5
X space transmission	(%)	100
Y space transmission	(%)	100
Unreacted in mater.	(%)	98.5
Unstopped in mater.	(%)	100
Delay	(%)	30.55
Surviver coefficient	(%)	76.37
Regular Efficiency	(%)	80
Efficiency from Rate	(%)	50

Delay

Time (drift,extraction or breeding)

Use	Mass	Time, sec
<input checked="" type="checkbox"/>	Light <= 40	0.01
<input type="checkbox"/>	40 < Medium < 80	0.02
<input type="checkbox"/>	80 <= Heavy	0.03

Efficiency

Use	Mass	Efficiency, %
<input checked="" type="checkbox"/>	Light <= 50	80
<input type="checkbox"/>	50 < Medium < 150	70
<input type="checkbox"/>	150 <= Heavy	60

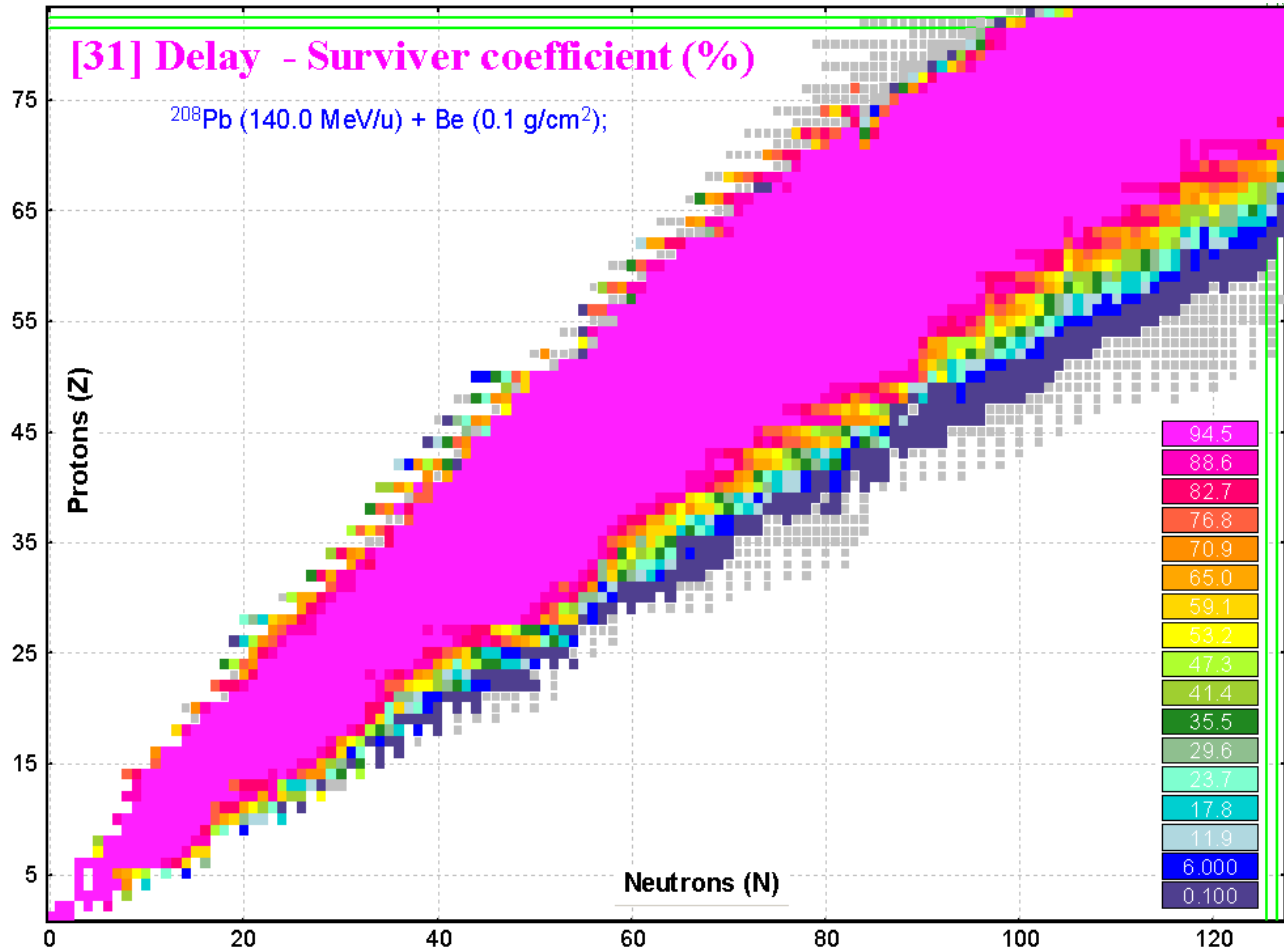
Efficiency as function of RATE

Use	Mass	Efficiency file	Plot
<input checked="" type="checkbox"/>	Light <= 60	gas_cell_eff_light.eff	<input type="checkbox"/>
<input type="checkbox"/>	60 < Medium < 100	gas_cell_eff_medium.eff	<input type="checkbox"/>
<input type="checkbox"/>	100 <= Heavy	gas_cell_eff_heavy.eff	<input type="checkbox"/>

Time (drift, extraction or breeding)

Use

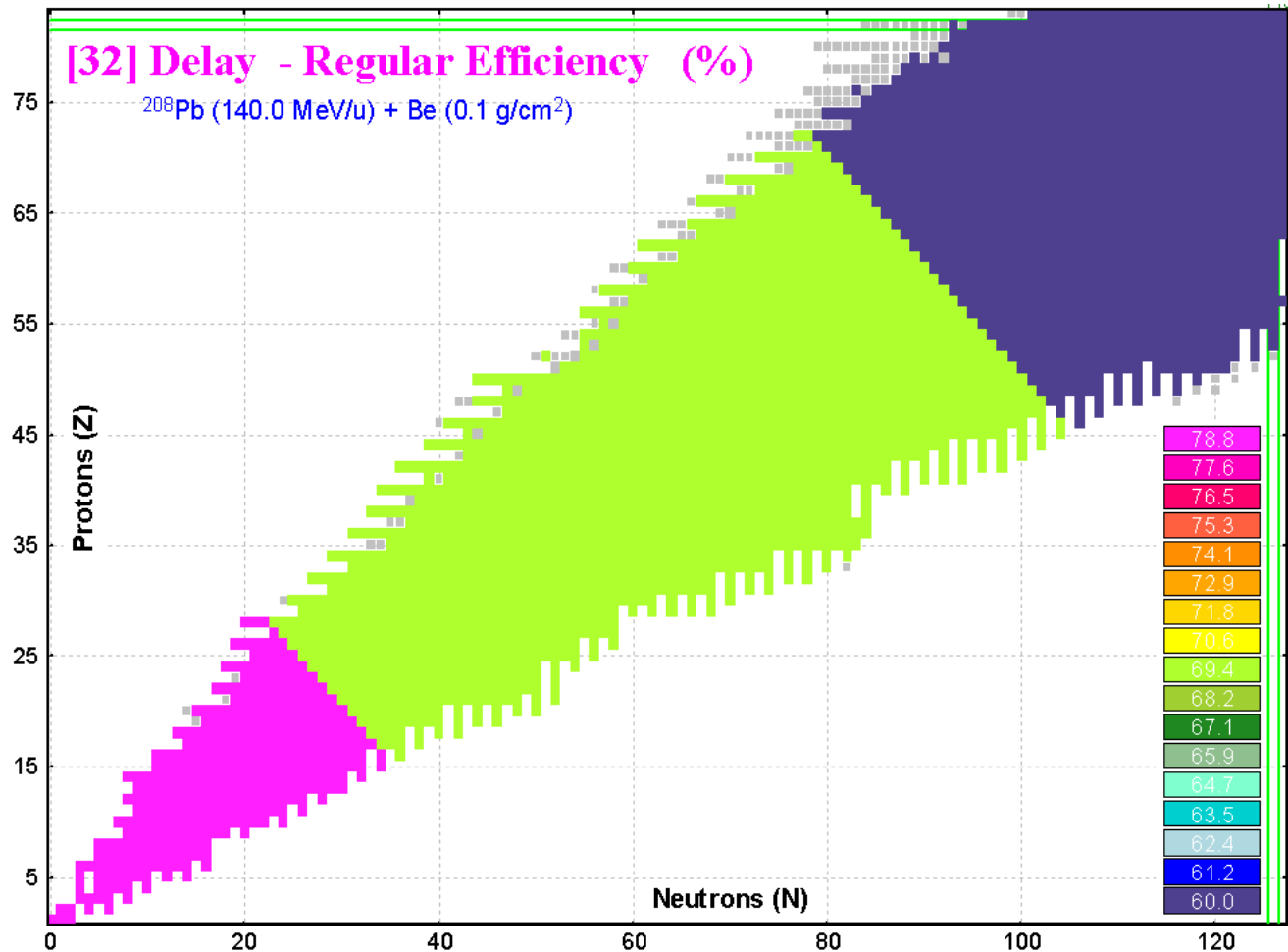
Mass	Time, sec
Light <= 80	0.03
80 < Medium < 250	0.05
250 <= Heavy	0.07



Efficiency

Use

Mass	Efficiency, %
Light <= 50	80
50 < Medium < 150	70
150 <= Heavy	60



Efficiency as function of RATE

Use

Mass

Light <= 60

60 < Medium < 100

100 <= Heavy

Efficiency file

gas_cell_eff_light.eff	Plot
gas_cell_eff_medium.eff	Plot
gas_cell_eff_heavy.eff	Plot

Efficiency file

Open file View file Clear

gas_cell_eff_heavy.eff

Rows = 77

OK Cancel

Axis scale

X: Yield (pps) log10

Y: Efficiency (0-1) log10

Note

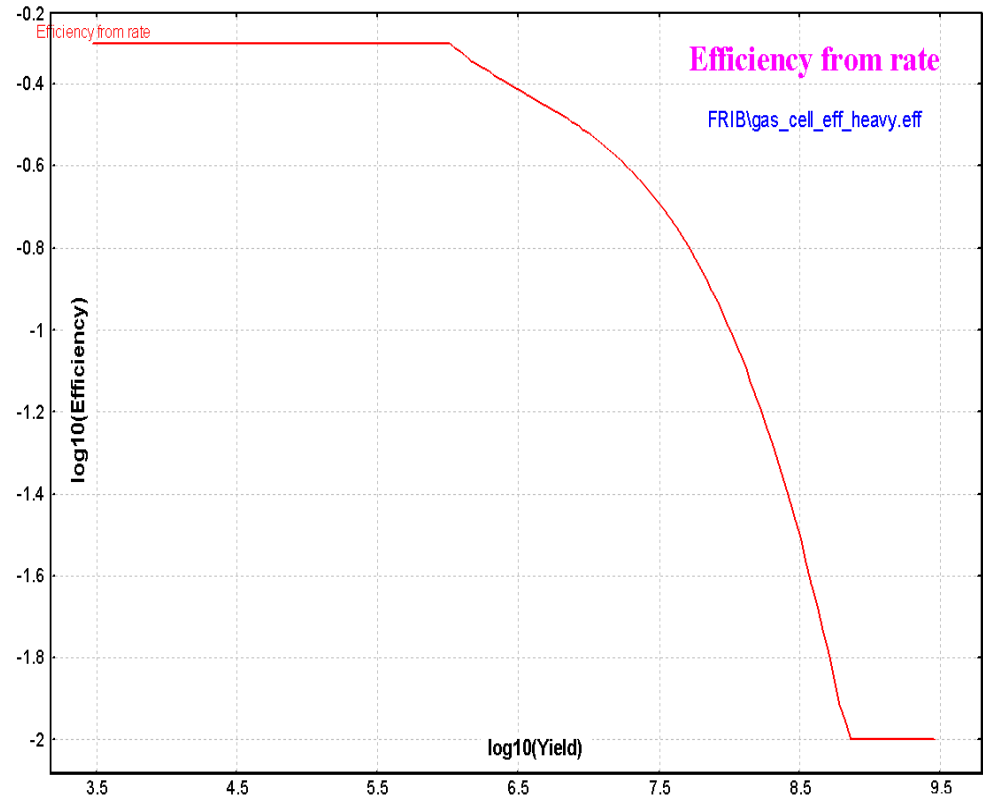
The calibration file is in ASCII format. The first line contains 3 integer values describing the structure of the file :

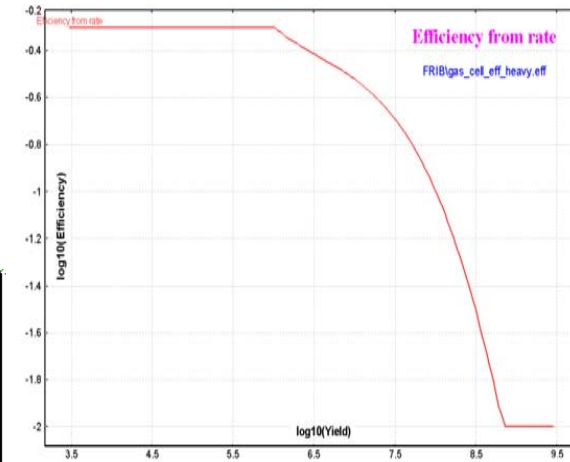
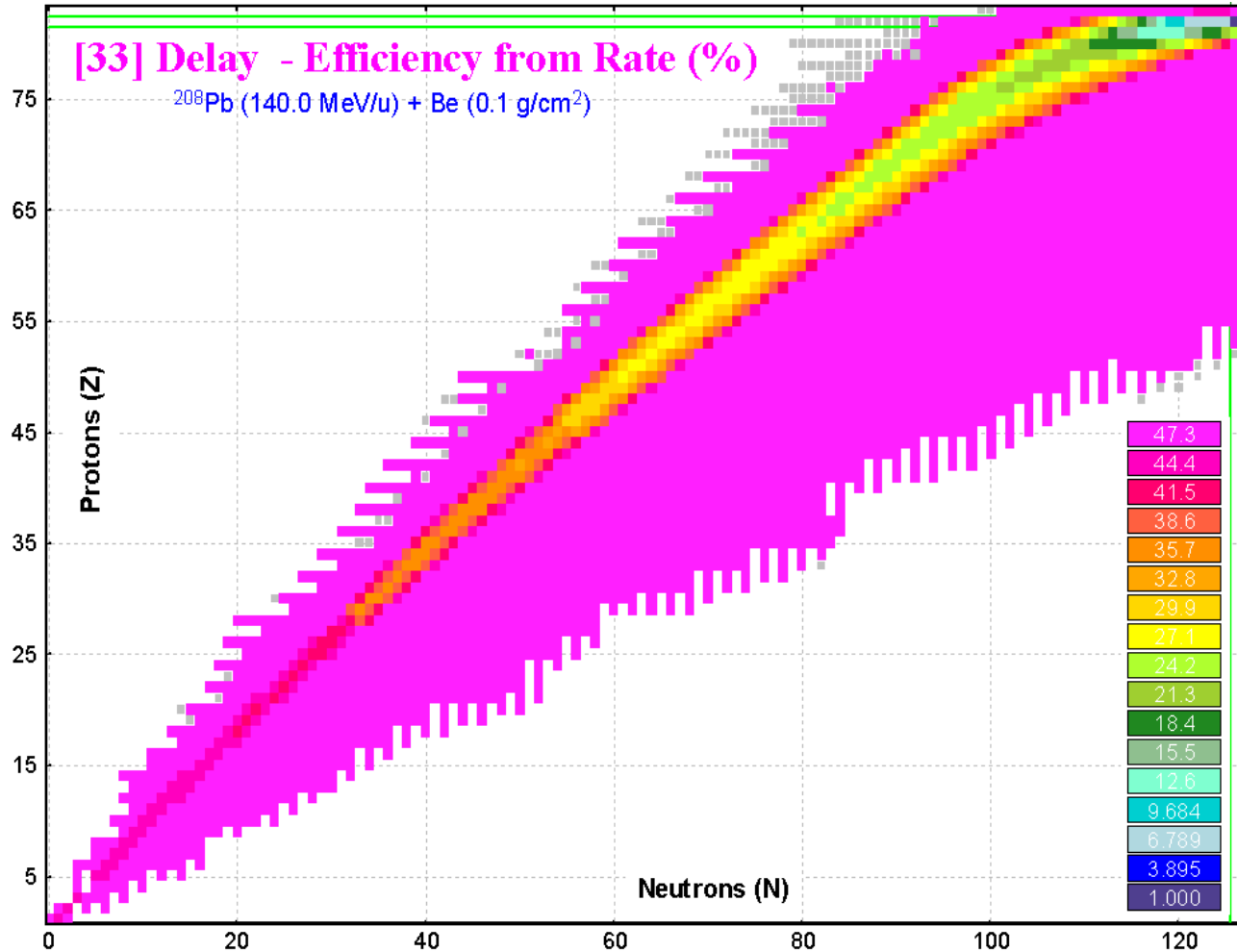
1. Number of rows (calibrated points)
2. X-scale: 0=linear, 1=log10
3. Y-scale: 0=linear, 1=log10

The next lines are the calibration data. The Columns can be separated by a Space, a Comma or a Tabulation. User can put comments after the data.

1st column: Yield (pps)
2nd : Efficiency (0-1)

Default directory "LISE\calibrations"








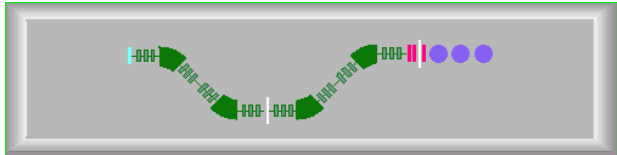





Thanks to
 Prof. D.J.Morrissey, Prof. G.Bollen
 (NSCL/MSU)
 for fruitful discussions

http://groups.nsl.msu.edu/lise/8_3/Delay/

Index of /lise/8_3/Delay

Name	Last modified	Size	Description
 Parent Directory	-	-	-
 delay_example.lpp	16-Jul-2009 12:13	265K	
 gas_cell_eff_heavy.eff	14-Jul-2009 16:42	1.9K	
 gas_cell_eff_light.eff	14-Jul-2009 16:41	1.9K	
 gas_cell_eff_medium.eff	14-Jul-2009 16:43	1.9K	



-  GS_Delay
-  Reaccelerator
-  Breeding

Copy *.eff files in the
 directory “LISE\calibrations\FRIB”