Beam Size Study

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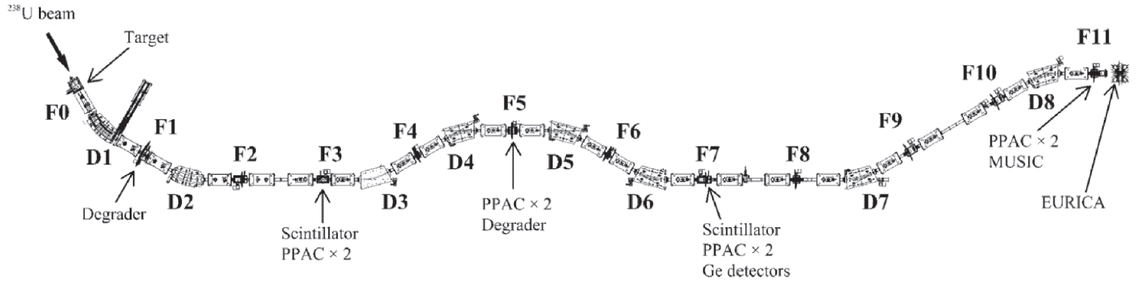
LAMPS Workshop @ YeoSu

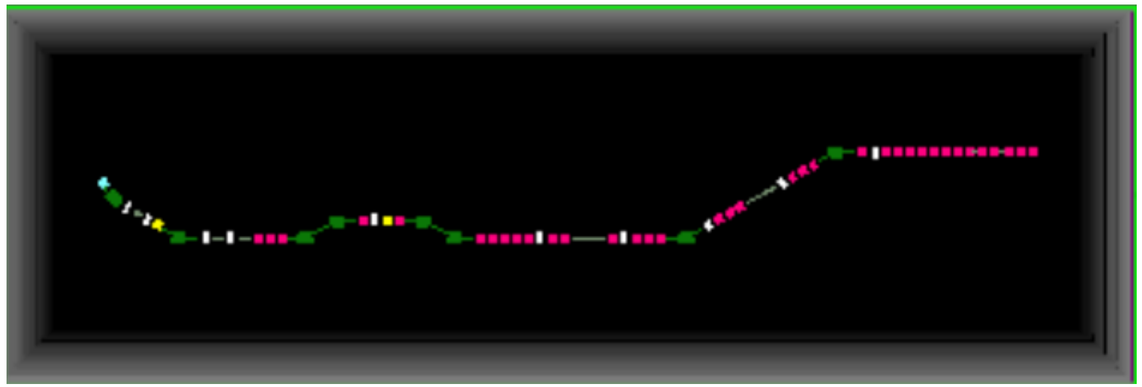
Simulation Setting at BigRISP

	Sn setting
Primary beam	$^{238}U^{86+}$
	345 MeV/nucleon
$B\rho$[a)]	8.004 Tm
Central particle[b)]	$^{136}Sn^{50+}$
Production target	Be 2.92 mm
Degrader at F1	Al 2.82 mm
Degrader at F5	Al 2.46 mm
Exit beam dump	+90.0/−125.0 mm
F1 slit	+43.0/−64.2 mm
F2 slit	+12.0/−18.0 mm
F7 slit	+10.0/−10.0 mm
Average beam intensity[c)]	8.70 pnA
Total dose	1.95×10^{16} particles
Average live time	98.2%
Average trigger rate	55.1 particles/s
Irradiation time	99.6 h

a) Values from the magnetic fields of the first dipole ma
b) The $B\rho$ setting after F1 is tuned for the listed ions.
c) 1 pnA (particle nA) $= 6.24 \times 10^9$ particles/s.



Schematic view of BigRIPS

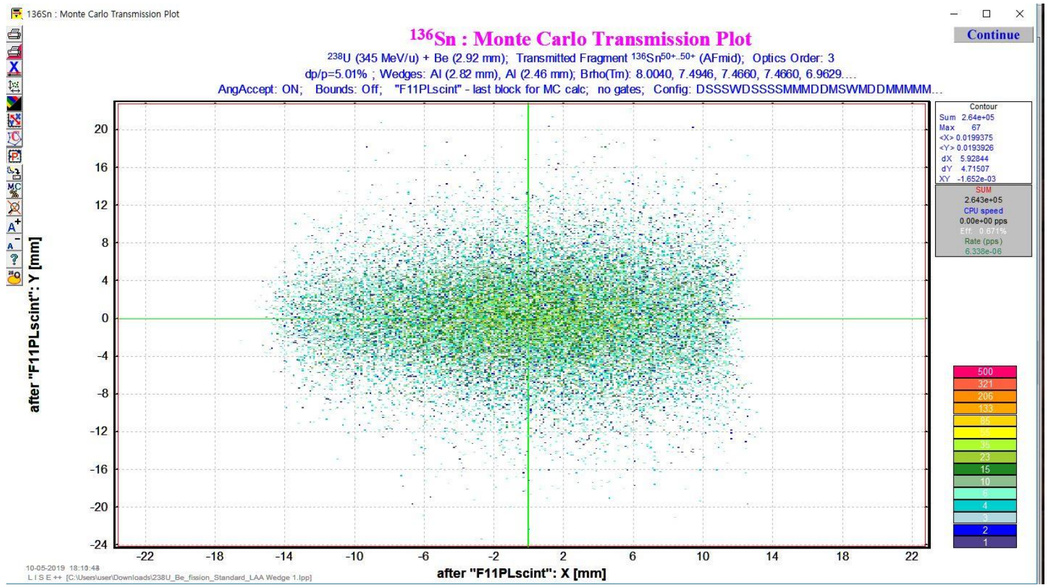


Schematic view of BigRIPS in LISE++

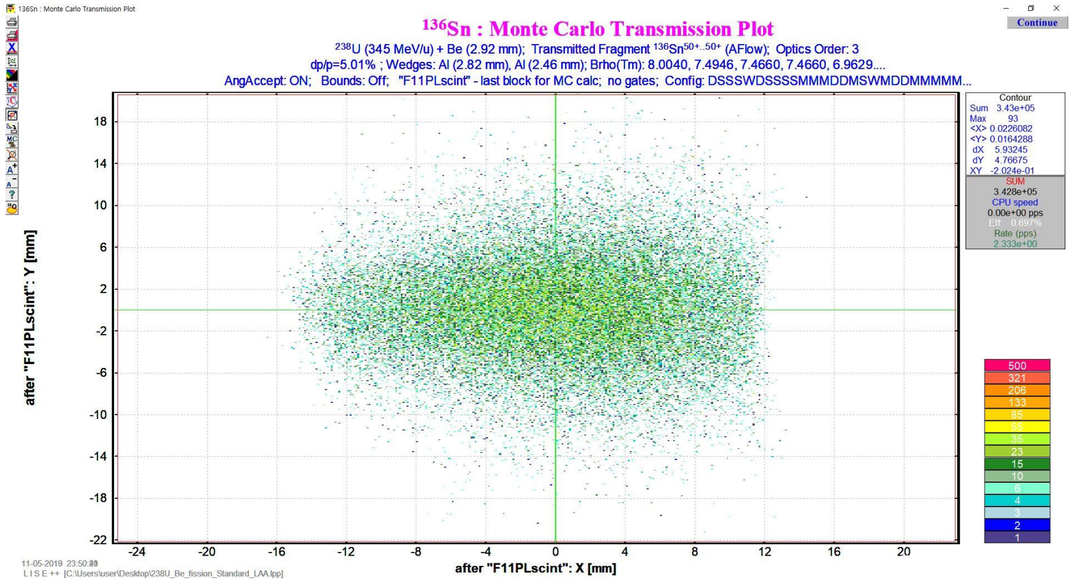
Beam Size Estimation

Monte Carlo Setting : One fragment (^{136}Sn) calculation, 3rd order calculation

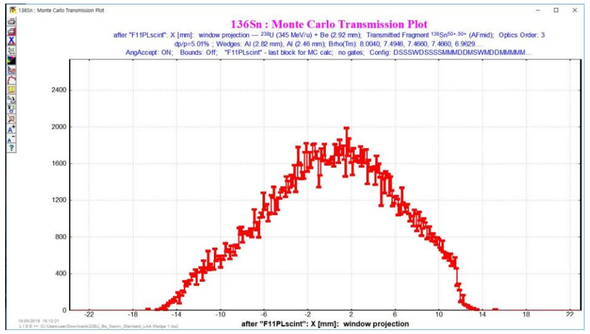
- x : -1.4 ~ 1.2 cm (2.6 cm), y : -1.2 ~ 1.2 cm (2.4 cm)



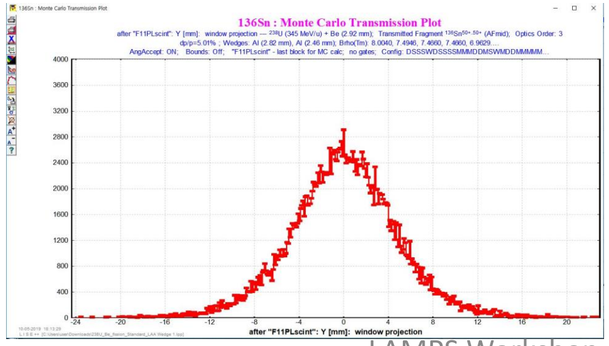
1st calculation



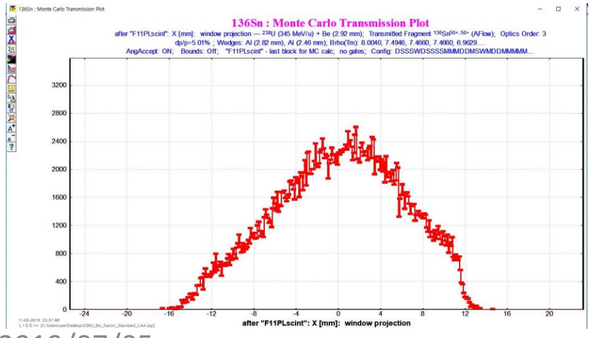
2nd calculation



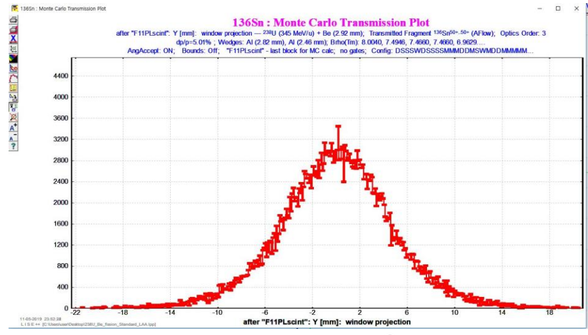
Projection X FWHM : 12.92mm



Projection Y FWHM : 8.21mm



Projection X FWHM : 13.53mm

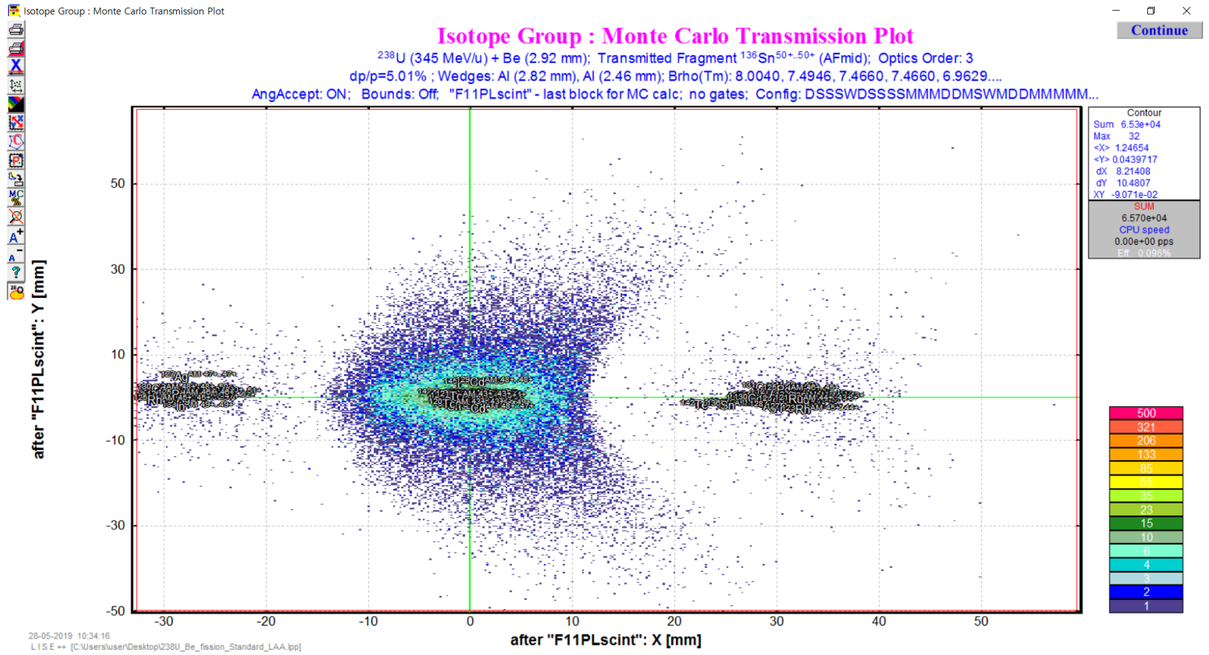


Projection Y FWHM : 8.14mm

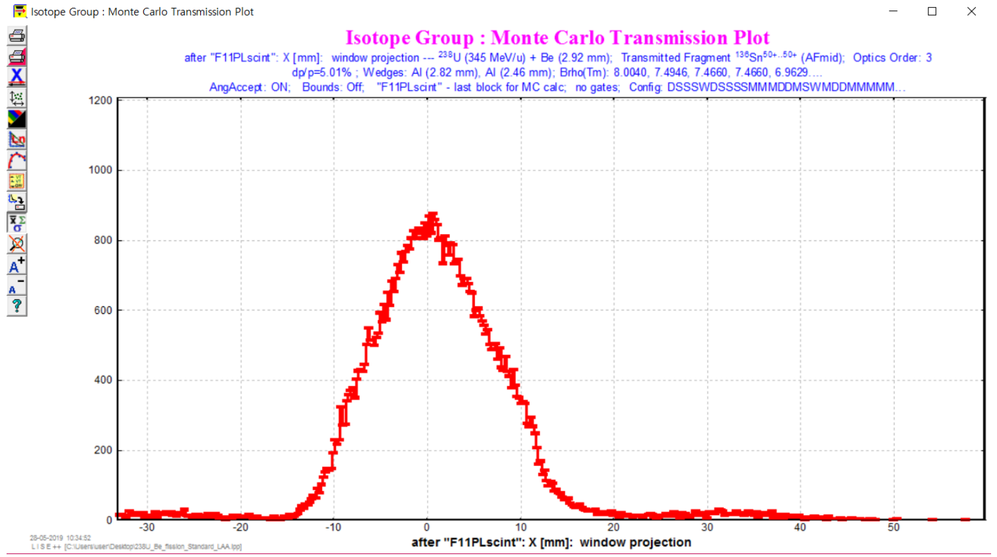
Beam Size Estimation

Monte Carlo Setting : Total Isotopes calculation , 3rd order calculation

- x : -1.5 ~ 2.0 cm (3.5 cm), y : -3.0 ~ 3.0 cm (6.0 cm)



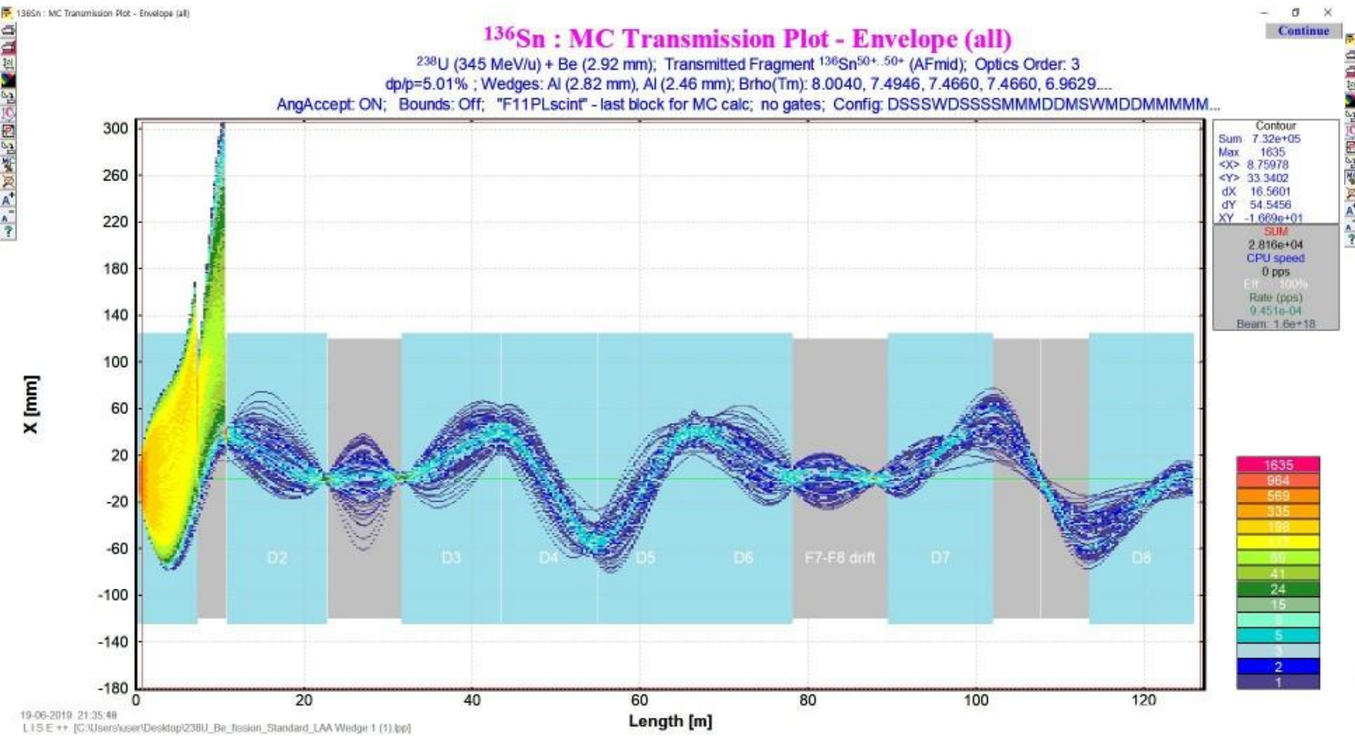
Total Isotopes calculation

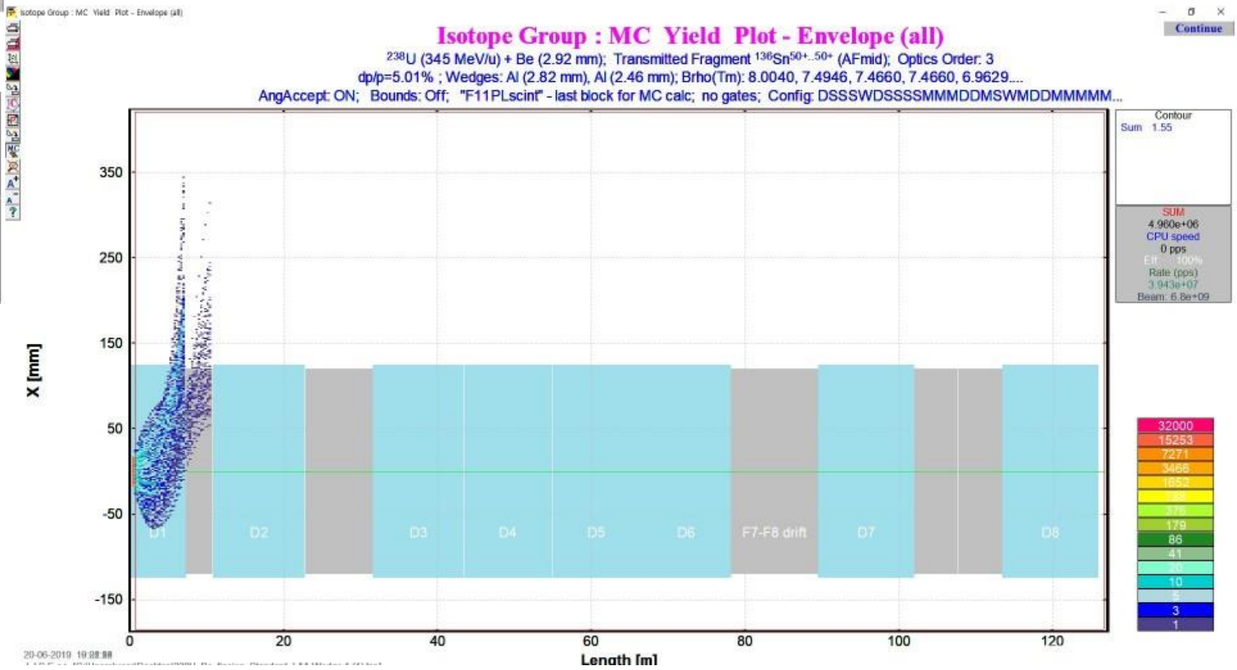


Projection X FWHM : 14.75mm

Issue : Not easy to run stably. LiSe++ simulation took long time (~ days) and often died.

Envelop process



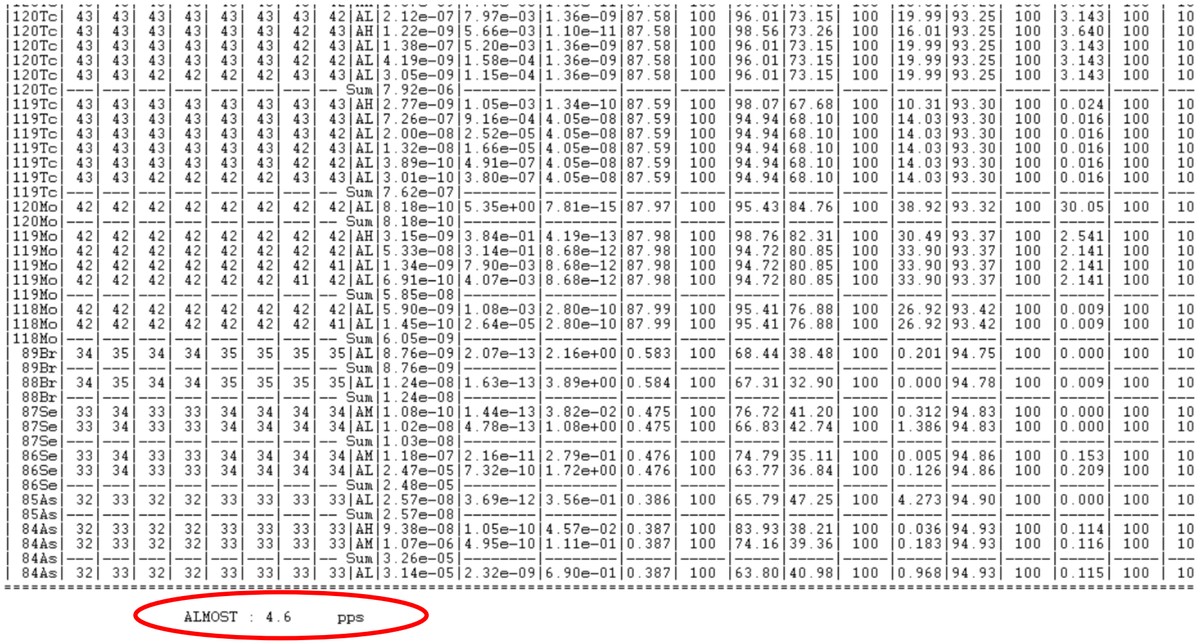


Beam process for only ^{136}Sn

Beam process for all isotopes

Issue : processing of envelop for all nuclear stops during the calculation very often.

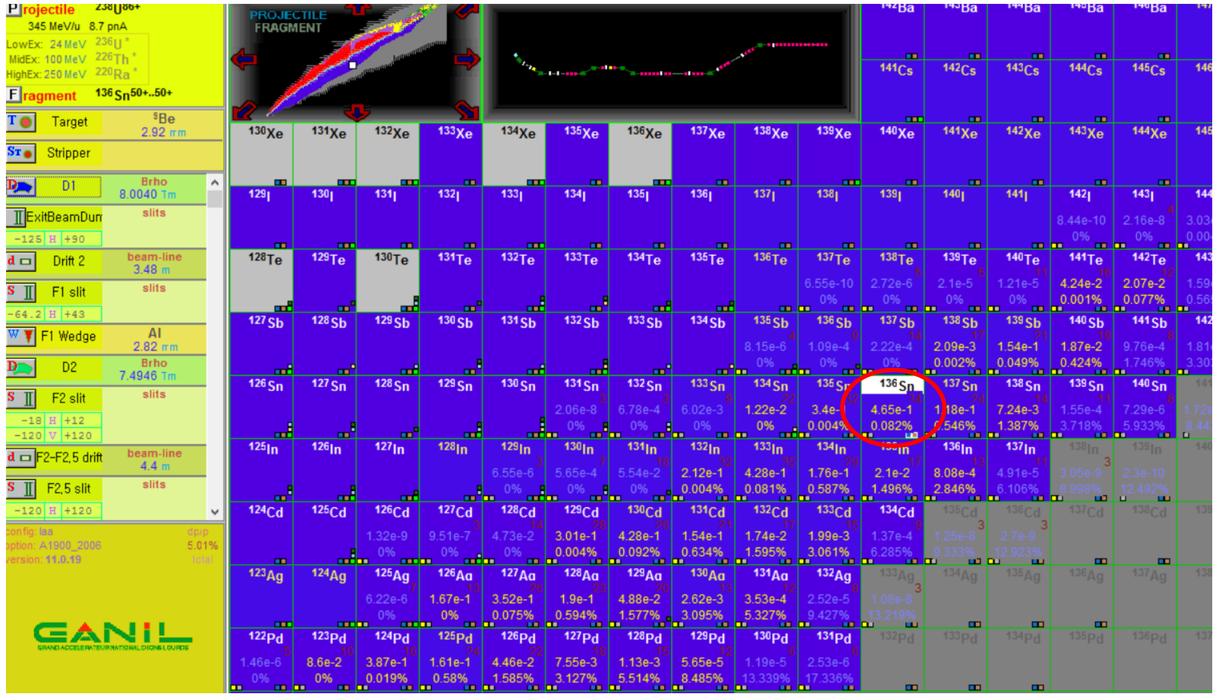
Purity Study



120Tc	43	43	43	43	43	43	42	43	AH	1.22e-09	5.66e-03	1.10e-11	87.58	100	98.56	73.26	100	16.01	93.25	100	3.640	100	10
120Tc	43	43	43	43	43	42	43	43	AL	1.38e-07	5.20e-03	1.36e-09	87.58	100	96.01	73.15	100	19.99	93.25	100	3.143	100	10
120Tc	43	43	43	43	43	42	42	43	AL	4.19e-09	1.58e-04	1.36e-09	87.58	100	96.01	73.15	100	19.99	93.25	100	3.143	100	10
120Tc	43	43	42	42	42	42	43	43	AL	3.05e-09	1.15e-04	1.36e-09	87.58	100	96.01	73.15	100	19.99	93.25	100	3.143	100	10
120Tc	---	---	---	---	---	---	---	-- Sum		7.92e-06	---	---	---	---	---	---	---	---	---	---	---	---	---
119Tc	43	43	43	43	43	43	43	43	AH	2.77e-09	1.05e-03	1.34e-10	87.59	100	98.07	67.68	100	10.31	93.30	100	0.024	100	10
119Tc	43	43	43	43	43	43	43	43	AL	7.26e-07	9.16e-04	4.05e-08	87.59	100	94.94	68.10	100	14.03	93.30	100	0.016	100	10
119Tc	43	43	43	43	43	43	42	43	AL	2.00e-08	2.52e-05	4.05e-08	87.59	100	94.94	68.10	100	14.03	93.30	100	0.016	100	10
119Tc	43	43	43	43	43	43	42	43	AL	1.32e-08	1.66e-05	4.05e-08	87.59	100	94.94	68.10	100	14.03	93.30	100	0.016	100	10
119Tc	43	43	43	43	43	42	42	43	AL	3.89e-10	4.91e-07	4.05e-08	87.59	100	94.94	68.10	100	14.03	93.30	100	0.016	100	10
119Tc	43	43	42	42	42	42	43	43	AL	3.01e-10	3.80e-07	4.05e-08	87.59	100	94.94	68.10	100	14.03	93.30	100	0.016	100	10
119Tc	---	---	---	---	---	---	---	-- Sum		7.62e-07	---	---	---	---	---	---	---	---	---	---	---	---	---
120Mo	42	42	42	42	42	42	42	42	AL	8.18e-10	5.35e+00	7.81e-15	87.97	100	95.43	84.76	100	38.92	93.32	100	30.05	100	10
120Mo	---	---	---	---	---	---	---	-- Sum		8.18e-10	---	---	---	---	---	---	---	---	---	---	---	---	---
119Mo	42	42	42	42	42	42	42	42	AH	3.15e-09	3.84e-01	4.19e-13	87.98	100	98.76	82.31	100	30.49	93.37	100	2.541	100	10
119Mo	42	42	42	42	42	42	42	42	AL	5.33e-08	3.14e-01	8.68e-12	87.98	100	94.72	80.85	100	33.90	93.37	100	2.141	100	10
119Mo	42	42	42	42	42	42	41	42	AL	1.34e-09	7.90e-03	8.68e-12	87.98	100	94.72	80.85	100	33.90	93.37	100	2.141	100	10
119Mo	42	42	42	42	42	42	41	42	AL	6.91e-10	4.07e-03	8.68e-12	87.98	100	94.72	80.85	100	33.90	93.37	100	2.141	100	10
119Mo	---	---	---	---	---	---	---	-- Sum		5.85e-08	---	---	---	---	---	---	---	---	---	---	---	---	---
118Mo	42	42	42	42	42	42	42	42	AL	5.90e-09	1.08e-03	2.80e-10	87.99	100	95.41	76.88	100	26.92	93.42	100	0.009	100	10
118Mo	42	42	42	42	42	42	41	42	AL	1.45e-10	2.64e-05	2.80e-10	87.99	100	95.41	76.88	100	26.92	93.42	100	0.009	100	10
118Mo	---	---	---	---	---	---	---	-- Sum		6.05e-09	---	---	---	---	---	---	---	---	---	---	---	---	---
89Br	34	35	34	34	35	35	35	35	AL	8.76e-09	2.07e-13	2.16e+00	0.583	100	68.44	38.48	100	0.201	94.75	100	0.000	100	10
89Br	---	---	---	---	---	---	---	-- Sum		8.76e-09	---	---	---	---	---	---	---	---	---	---	---	---	---
88Br	34	35	34	34	35	35	35	35	AL	1.24e-08	1.63e-13	3.89e+00	0.584	100	67.31	32.90	100	0.000	94.78	100	0.009	100	10
88Br	---	---	---	---	---	---	---	-- Sum		1.24e-08	---	---	---	---	---	---	---	---	---	---	---	---	---
87Se	33	34	33	33	34	34	34	34	AM	1.08e-10	1.44e-13	3.82e-02	0.475	100	76.72	41.20	100	0.312	94.83	100	0.000	100	10
87Se	33	34	33	33	34	34	34	34	AL	1.02e-08	4.78e-13	1.08e+00	0.475	100	66.83	42.74	100	1.386	94.83	100	0.000	100	10
87Se	---	---	---	---	---	---	---	-- Sum		1.03e-08	---	---	---	---	---	---	---	---	---	---	---	---	---
86Se	33	34	33	33	34	34	34	34	AM	1.18e-07	2.16e-11	2.79e-01	0.476	100	74.79	35.11	100	0.005	94.86	100	0.153	100	10
86Se	33	34	33	33	34	34	34	34	AL	2.47e-05	7.32e-10	1.72e+00	0.476	100	63.77	36.84	100	0.126	94.86	100	0.209	100	10
86Se	---	---	---	---	---	---	---	-- Sum		2.48e-05	---	---	---	---	---	---	---	---	---	---	---	---	---
85As	32	33	32	32	33	33	33	33	AL	2.57e-08	3.69e-12	3.56e-01	0.386	100	65.79	47.25	100	4.273	94.90	100	0.000	100	10
85As	---	---	---	---	---	---	---	-- Sum		2.57e-08	---	---	---	---	---	---	---	---	---	---	---	---	---
84As	32	33	32	32	33	33	33	33	AH	9.38e-08	1.05e-10	4.57e-02	0.387	100	83.93	38.21	100	0.036	94.93	100	0.114	100	10
84As	32	33	32	32	33	33	33	33	AM	1.07e-06	4.95e-10	1.11e-01	0.387	100	74.16	39.36	100	0.183	94.93	100	0.116	100	10
84As	---	---	---	---	---	---	---	-- Sum		3.26e-05	---	---	---	---	---	---	---	---	---	---	---	---	---
84As	32	33	32	32	33	33	33	33	AL	3.14e-05	2.32e-09	6.90e-01	0.387	100	63.80	40.98	100	0.968	94.93	100	0.115	100	10

ALMOST : 4.6 pps

→ Total rate : 4.6 [pps]



→ ^{136}Sn rate : 4.65x10^{-1} [pps] in all reactions

Purity definition = ^{136}Sn rate/All isotopes rate

^{136}Sn rate in all reactions : ~ 10.1 %

Summary & Plan

Summary

- **Estimated beam size of ^{136}Sn is 2.6cm for X and 2.4cm for Y.**
- **Estimated beam size of all isotope is 3.0cm for X and 6.0cm for Y.**

- **Purity is ~ 10.1% (^{136}Sn rate/All isotope).**

Plan

- **Plan to simulate IF System on RAON instead of BigRISP.**

- **Start to involve in assembly of BDC.**