Beam Diagnosis System





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2020/04/16 LAMPS Collaboration Meeting

Current Status

Moving BDC production facility to CNU

- Installation of clean room : Hard type 1500 mm x 1500 mm
 - > Cleanliness class 1000 same as KRISS requirement
 - Price : 5556000 won
 - Plan : next week (delayed to 5/19)
- Purchase of Equipment to construct

Product	Serial	Price	Remarks
LV PowerSupply	GPD-3303S	608217	Eleparts (719000)
ASD LV connector	S6P-VH(LF)(SN)	25 pieces*910=22750	eleparts
18 AWG 실리콘 와이어 6색 SET (30m:5m*6)	EPXMUUDH	24100	eleparts
멀티미터	FLUKE-17B+	140000	eleparts
인두기			
무연인두기+인두팁	Hakko FX-951	304000	eleparts
무연실납(0.3mm, 약233m)	HS-341	49000	eleparts
초음파 클리너		~1000000 - 1500000	
Ion Blower		352000	
플럭스 펜		9000	
도르래		9400	
플라스틱 고정대 (or 볼트)		~ 10000	
전자저울	0.01 g 정밀도의 저울	220000	
기판을 고정시키는 판, 와이어를 걸어두는 고리		KRISS에 의뢰 필요 (CNC 선반으로 직접가공)	
절연테이프 등 추가		<100000	약 3550000 원 예상 크린부스 시공비까지 8995000 원











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Moon

Summary & Plan

- Moving the place to construct BDC to CNU will be done (middle of May)
- Working on designing the frame of BDC (middle of May)
- Will test ASD board as soon as possible to have power (middle of May)
- Will setup cosmic muon test



Thank You Very Much for your attention !

Back Up

Get Yield of ¹³⁶Sn by LiSe++

- In order to verify if our understanding would be correct or not, we reproduced yield of ¹³⁶Sn by LiSe++
- BigRIPS results : Y. Shimizu et al., JPSJ 87 (2018) 014203

	Sn setting						
Primary beam	²³⁸ U ⁸⁶⁺						
	345 MeV/nucleon						
$B ho^{ m a)}$	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	$+43.0/-64.2\mathrm{mm}$						
F2 slit	$+12.0/-18.0\mathrm{mm}$						
F7 slit	$+10.0/-10.0\mathrm{mm}$						
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) = 6.24×10^9 particles/s.

LISE++ [D:WDropboxWAnalysisWHIDataWLAMPSWLSe++W238U_Be_fission_Standard_LAA Wedge 1_shLlpp]
 Ele __Options Experiment Settings _Physics Models __alculations __Utilities __ID=Plot __2D=Plot __2D=Plot





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🗙 Cancel 🛛 🥐 Help

🗸 ОК |

Get Yield of ¹³⁶Sn by LiSe++

Results



Not same but similar order of magnitude for the yield of ¹³⁶Sn



Beam Size Study

136Sn : Monte Carlo Transmission Plot



Final observed beam size : $x (-1.4 \sim 1.2 \text{ cm})$ and $y (-1.2 \sim 1.2 \text{ cm})$ Possible to trace ¹³⁶Sn beam step by step



SMURAI Detector





Beam Profile Detector in SMURAI

 Detectors for incoming beams: beam position (BDC), PID(Plastic and ICB), γ(DALI2) and tracking detector(FDC1) for electro-magnetic spectroscopy at SAMURAI.





SMURAI BDC (Beam Drift Chamber)



Fig. 6. Expanded view of the upstream part of the experimental setup.



Fig. 9. Schematic view of the BDC and the BDC box,

NIMB 317 (2013) 294-304

- Walenta type Drift chamber
- 2.5 mm drift length
- i-C₄H₁₀ at 50-100 torr
- Anode, potential wire diameter of 20 µm(Au-W), 80 µm(Au-Al)
- Cathode (gas window) 8 µm^t Al-Kapton
- Effective area : 8 cm x 8 cm



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Requirements

- Position resolution : ~ 100 μm
- Efficiency : 100 % at > 600 V



SMURAI BDC (Beam Drift Chamber)

Beam Rate Estimation : LiSe++ (Seonghak Lee)

Deces Trac	Primary bea	m (400 kW)	Production	RI beam eneryg	RI beam Intensity	RI Beam purity
Бесау Туре	Туре	에너지 (MeV/u)	Reaction	(MeV/u)	(pps)	(%)
Beta- decay	238U	200	in-flight fission	133.2	8.21E+06	1.4661
Beta- decay	238U	200	in-flight fission	133.1	3.74E+08	13.6
stable	124Sn	230	transmission	230	8.77E+13	100
stable	112Sn	263	transmission	263	8.49E+13	100
	Decay Type Beta- decay Beta- decay stable stable	Primary beaDecay TypeTypeBeta- decay238UBeta- decay238Ustable112Sn	Primary beam (400 kW)Decay Type $O[I \downarrow] X]$ (MeV/u)Beta- decay238U200Beta- decay238U200Beta- decay124Sn230stable112Sn263	Primary beam (400 kW)Production ReactionDecay Type $O [L X]\\(MeV/u)$ Production ReactionBeta- decay238U200in-flight fissionBeta- decay238U200in-flight fissionstable124Sn230transmissionstable112Sn263transmission	Decay TypePrimary beam (400 kW)Production ReactionRI beam enerygType0[14]X] (MeV/u)0[14]X] (MeV/u)(MeV/u)Beta- decay238U200in-flight fission133.2Beta- decay238U200in-flight fission133.1stable124Sn230transmission230stable112Sn263transmission263	Primary berne 400 kW Production Production ReactionRI beam energgRI beam

- Expected Beam : ¹³²Sn : 8 x 10⁺⁶ pps with 133.2 MeV/u
- To determine specific conditions of Drift Chamber, we will use GarField program (Dr. Hwang with Seonghak Lee)

BDC Construction

Prototype Design

Configuration : xx'yy' (4 planes) Sensor Wire : 32ch Potential Wire : 33ch Drift Length : 2.5 mm 32 * 2.5 * 2 = 160 mm

Active Area : 160 x 160 mm²





BDC Construction

• NIM Crate & Power Supply & SH Cable





Place for wiring





Comparison of Distribution Method and MC Method



- Distribution method : fast analytical method to calculate the fragment transmission through all optical blocks of the spectrometer.
- MC method : developed for a qualitative analysis of fission fragment kinematics and utilized in the Kinematics calculator. (random event generation one by one)
- Distributions are quite different but MC method is more reliable due to considering more effect of optical matrix.



• MC method in IF system (possible up to 2nd order calculation)

L I S E ++ (D:#Dropbox#Analysis#HIData#LAMPS#LISe++#20190918_RAON_BDC#20190626-ifseparator-UF-mode-LAMPS4_All_SC_BDC_All.lpp)
 File Options Exceriment Settings Physics Models Calculations Utilities 1D-Plot 2D-Plot Databases Help

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 | ¹³⁷ Pm | ¹³⁸ Pm | ¹³⁹ Pm
 | ¹⁴⁰ Pm | ¹⁴¹ Pm | ¹⁴² Pm | ¹⁴³ Pm | 144Pm
 | ¹⁴⁵ Pm | ¹⁴⁶ Pm | ¹⁴⁷ Pm | ¹⁴⁸ Pn |
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 | 0% | 4.67e+2
0% | 0% | 0.009% |
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ghEx: 250 MeV 220 Ra * | Kind of Dri | ft (or Multipole | e) block | |
 | Optic | cal block pro | perties and data |
 | ¹³⁴ Nd | ¹³⁵ Nd
 | ¹³⁶ Nd | ¹³⁷ Nd | ¹³⁸ Nd
 | ¹³⁹ Nd | ¹⁴⁰ Nd | ¹⁴¹ Nd | ¹⁴² Nd | ¹⁴³ Nd
 | ¹⁴⁴ Nd | ¹⁴⁵ Nd | ¹⁴⁶ Nd | ¹⁴⁷ Nd | |
| ragment ¹³² Sn ⁵⁰⁺ | C BEAM | C BEAM-LINE block. Non-dispersive optical block. | | Length (physical) = 0.9 m |
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 | 4.07e-1 | 2.06e+2 | 1.74e+4 | 1.5e+5 | 6.27e+5
 | 8.12e+5 | | | |
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1.3 mm | User can change the optical matrix values. | | | Effective length = 0.9 m 132pr |
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 | 136Pr | 137Pr
 | 138pr | 139Pr | 140Pr
 | 141Pr | 142Pr | 143Pr | 144Pr | 145Pr
 | 146Pr | | | | |
| stripper Stripper | STANDARD DRIFT block as in the
Transport code. Use this mode for a long
detector. The Opical matrix is determined | | | Brho = 5.12 Tm |
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1.5e+5 | 8.56e+5 | 1.68e+6 | 2.14e+6
 | 1.96e+6 | | | |
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1.5765 kg | by the code. | | | | J 🕴
 | • <u>‡</u> Cut(Slits) & Acceptances | | | ¹³² Ce
 | ¹³³ Ce | ¹³⁴ Ce
 | ¹³⁵ Ce | ¹³⁶ Ce | ¹³⁷ Ce
 | ¹³⁸ Ce | ¹³⁹ Ce | 140Ce | ¹⁴¹ Ce | ¹⁴² Ce
 | ¹⁴³ Ce | 1495%
144Ce | ^{3,103%}
¹⁴⁵ Ce | |
| D061 c standard | MULTIPOLE (magnetic Quadrupole +
Sextupole). The matrix can be calculated | | | 1 60 | 60° Optical matrix
 | | | |
 | |
 | 1.46e-2 | 4.56e+1 | 9.61e+3
 | 1.81e+5 | 3
1.41e+6
0.04% | 2.2e+6 | 3.34e+6 | 4
2.6e+6
2.725%
 | 6.87e+6 | 1.14e+7 | | |
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-2.1587 kg | C as in the Transport code with using block parameters (radius, effective length, mannetic field) | | | | 1
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 | ¹³² La | ¹³³ La
 | ¹³⁴ La | ¹³⁵ La | ¹³⁶ La
 | ¹³⁷ La | ¹³⁸ La | ¹³⁹ La | ¹⁴⁰ La | ¹⁴¹ La
 | ¹⁴² La | ¹⁴³ La | 144La | | |
| D062 c standard | eQUAI | DRUPOLE (el | ectrostatic).] | he matrix |
 | 1 Show | Show in the "Setup" window | |
 | |
 | | 8.36e+0 | 5.5e+3
 | 1.27e+5 | 1.41e+6 | 3.63e+6 | 6.67e+6 | 4.08e+6
 | 6.45e+6 | 1.27e+7
6 371% | 2.72e+7 ⁴ | 2.57e+7 |
| LMQ6 C QUAD 11531 kg | C can be
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) | * _ | 🚓 Settings
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 | 132Ba | 133Ba | 134Ba
 | ¹³⁵ Ba | ¹³⁶ Ba | 137Ba | 138Ba | 139Ba
 | 140Ba | 141Ba | 142Ba | 143Ba | |
| Material 3 H11C10 | permitted (1,7.3g/c) | | | |
 | | Brhovalue | |
 | 6.01e-6 | 2.02e+0
 | 1.51e+3 | 5.95e+4 | 1.44e+6
 | 4.26e+6 ³ | 1.17e+7 | 9.69e+6 | 9.53e+6 | 7.08e+6
 | 2.14e+7 | 3.15e+7 ⁴ | 4.24e+7 | 1.72e+7 |
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 | 131Cs | 132Cs | 133Cs
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 | 8.254%
139Cs | 12.072%
140Cs | 14.031%
141Cs | 142Cs |
| L-Target standard | | | | the DHIFT | MUDEI
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 | 6.2e+5 | 3.98e+6 | 1.53e+7
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1.7e+7 | 4
1.11e+7 | 4
1.94e+7 | 2.23e+7
 | 3.92e+7 | 4
2.92e+7 | 3
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• MC method in IF system (possible up to 2nd order calculation)



• MC method in IF system (possible up to 2nd order calculation)





• MC method in IF system (possible up to 2nd order calculation)



