Status Report for Beam Profile Detector in LAMPS

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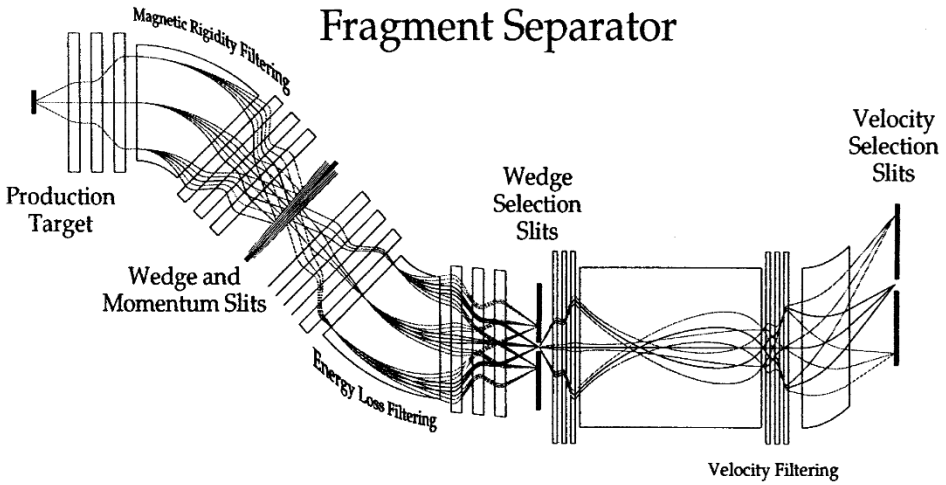
2019/02/27 LAMPS Collaboration Meeting @ Sejong Univ.

Contents

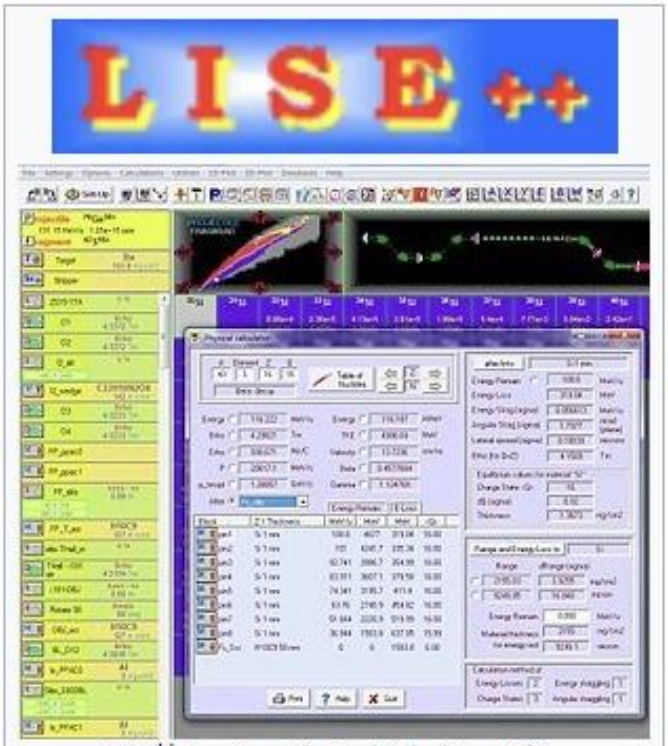
- LiSe++ Study
- Proto-type Drift Chamber Construction

LiSe++ Study

- IF System (In-flight Fragmentation) Simulation Program
- Tutorial and following paper
  - (NIM A 482 (2002) 307-327)



LISE++



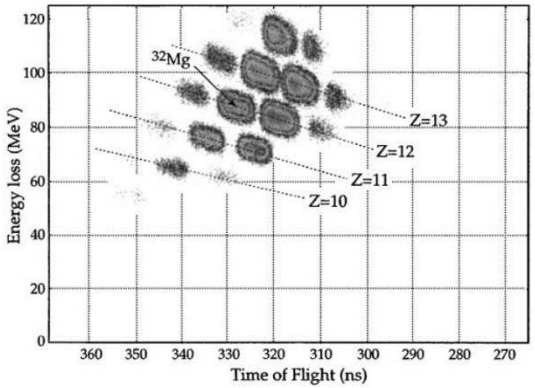
LISE++ in action. Physical Calculator utility

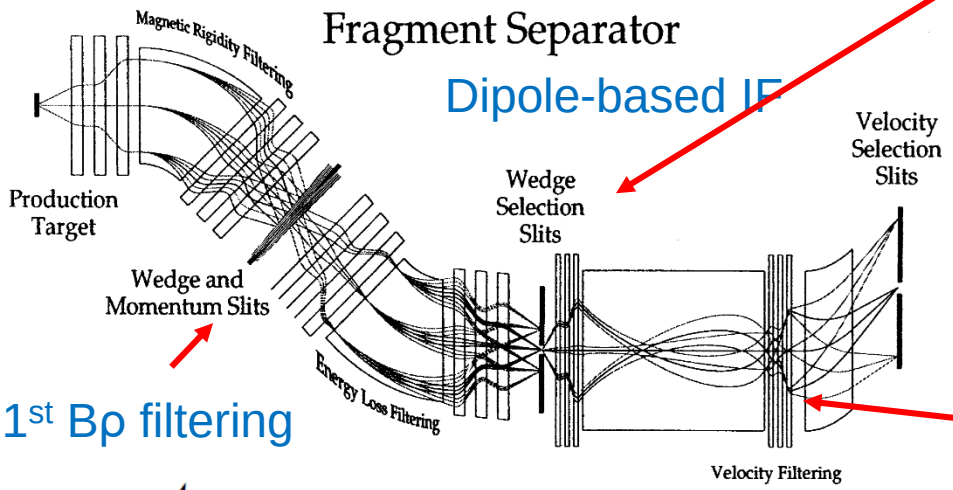
Developer(s)	LISE++ group @ NSCL / MSU
Stable release	10.0.6 / December 19, 2016; 2 years ago
Written in	C++
Operating system	Microsoft Windows
Type	Simulation software

LiSe++ Study

- IF System (In-flight Fragmentation) Simulation Program
- Tutorial and following paper
  - (NIM A 482 (2002) 307-327)

2nd Energy loss filtering



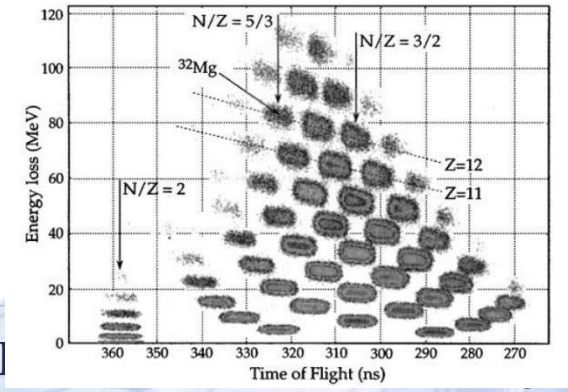


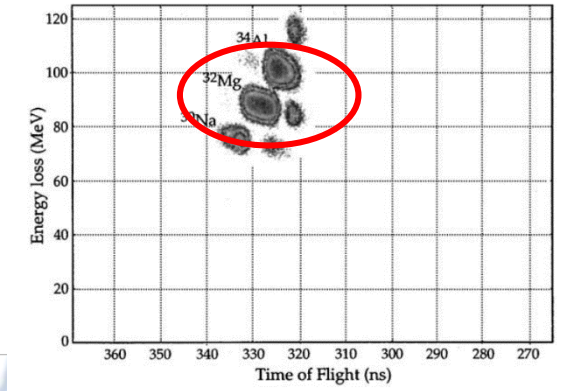
Dipole-based IF

1st Bρ filtering

3rd Velocity filtering

$$B\rho = 3.107\beta\gamma\frac{A}{Q}$$





LiSe++ Study

- IF System (In-flight Fragmentation) Simulation Program
- 1st Trial

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RIBF
RIKEN NISHINA CENTER
RIKEN Nishina Center for Accelerator-Based Science
Introduction to RI Beam Factory and Users' Information

Nishina Center Top | RIBF Top

Facility Information
- Accelerator
  - Intensity
- BigRIPS
  - Intensity
- RIPS
- GARIS
- SAMURAI
- Rare-RI Ring (R3)
- SHARAQ(CNS)
- OEDO(CNS)
- SR2
- Biology Beamline
- Material Beamline
- CRIB(CNS)
- KISS(KEK)
- DAQ

User Guide
- Access to RIBF

HOME > BigRIPS > Technical Information > Secondary beam intensity expected

BigRIPS

Overview

Device Information (password protected)

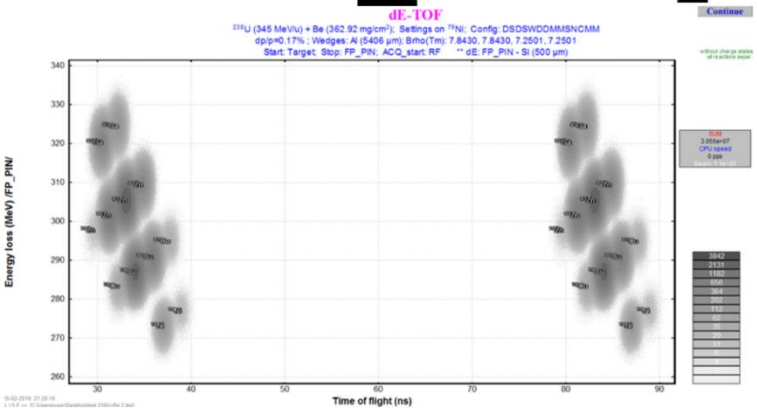
Technical Informati

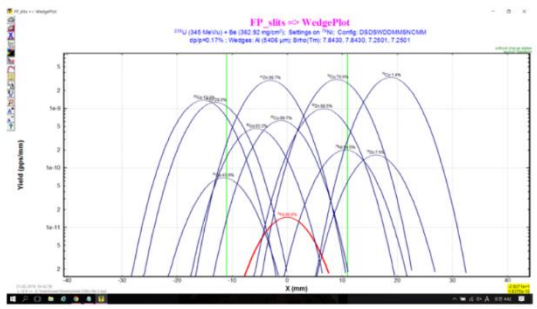
- The LISE++ input file
- Production cross s
- Production cross s
- Production cross s
- Production cross s
- Production cross s
- Production cross s

LISE ++ 해보기

이성학 (전남대)

3. Magnetic-rigidity filtering  + Energy-loss filtering  + Wien Velocity filtering 





Wien filter의 default 값 인 slits -20~+20 을 사용하니,
전 슬라이드와 결과가 거의 동일 (E = 3000KV/m)

LiSe++ Study

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Next plan

- Applying to RAON IF, get yield of ^{132}Sn (pps) and understand the final requirement of energy, time and position resolution for beam profile detector
- Determine the position of this installed between IF and LAMPS (28.4m)

Wien filter의 default 값 인 slits -20~+20 을 사용하니,
전 슬라이드와 결과가 거의 동일 (E = 3000KV/m)

Prototype Beam Drift Chamber Construction

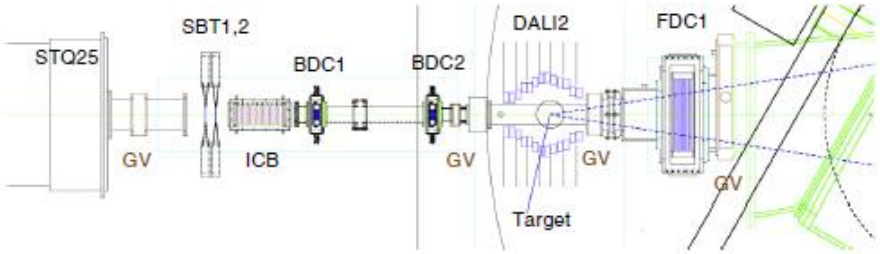

Fig. 6. Expanded view of the upstream part of the experimental setup.

NIMB 317 (2013) 294-304

- Walenta type Drift chamber
- 2.5 mm drift length
- i-C_4H_{10} at 50-100 torr

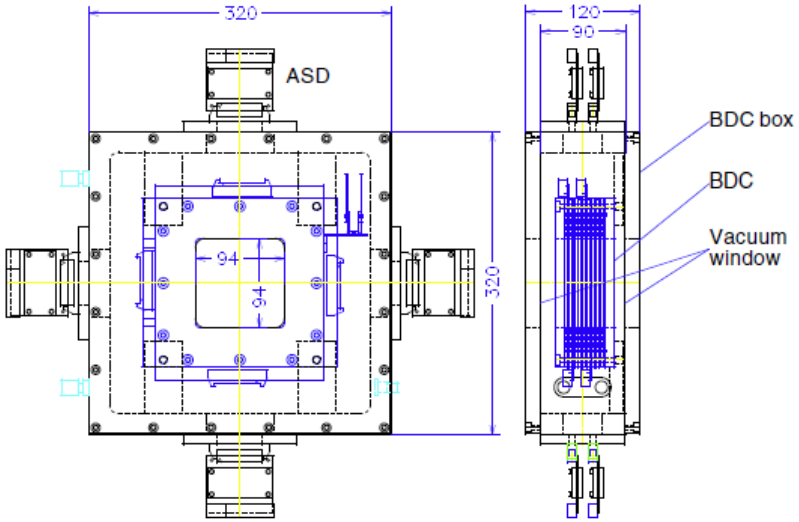

Fig. 9. Schematic view of the BDC and the BDC box.

Table 3
BDC Parameters.

Drift length, half gap	2.5 mm, 2.5 mm
Anode, potential wire	ϕ20 rmum Au-W/Re, 80 μmϕ Au-Al
Cathode (gas window)	8 μm^t Al-Kapton $\times$ 9 (2)
Configuration	xx′yy′xx′yy′ (8 planes)
Effective area	8 cm $\times$ 8 cm
Readout	128 ch/chamber
Operating gas	i-C_4H_{10} at 100 (50) torr
Vacuum window	80 (16) μm^t Kapton $\times$ 2
Thickness	$L/L_r = 0.9 \times 10^{-3}$

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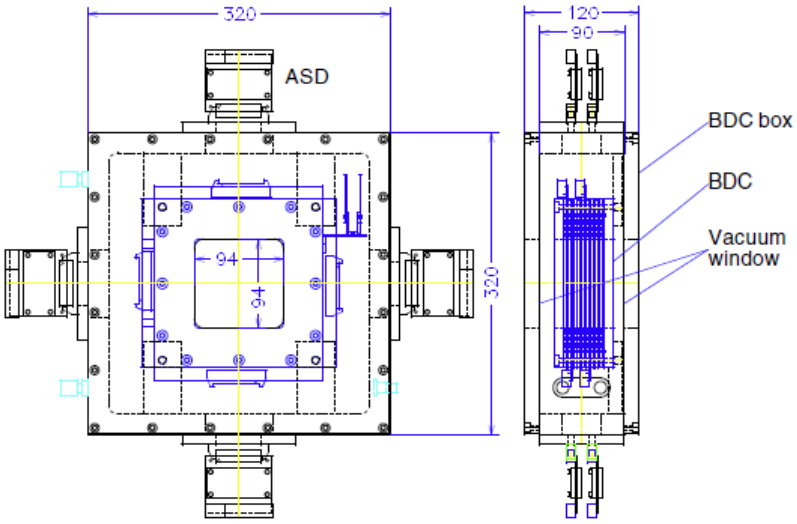

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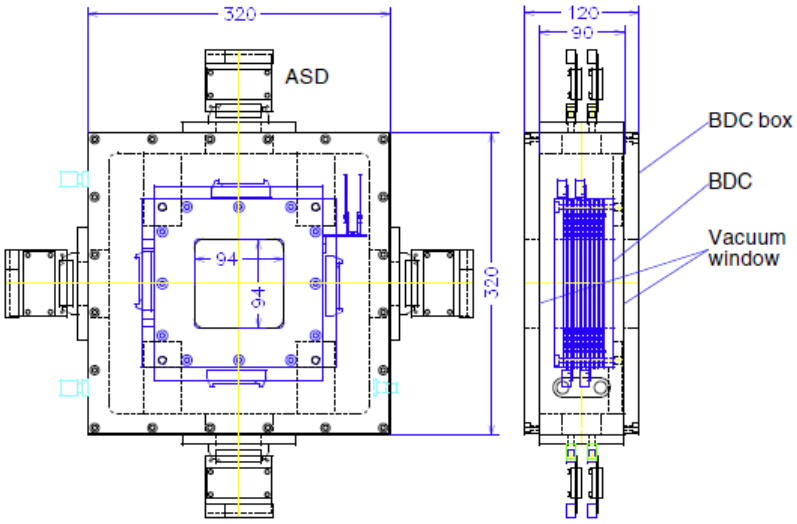
Discussion with Dr. Hwang at KRISS

- Decide to help us to construct BDC (also want to join in collaboration if allowed)
- Two layers (x-y) with 32 ch wires (10mum Au-Al) at clean room in KRISS
- Effective area 10 x 10 cm2
- Two ASD (Amplifier Shape Discriminator)s + one (REPIC)
- 20 x 20 cm2 Box (Al+Milar)
-

Prototype Beam Drift Chamber Construction



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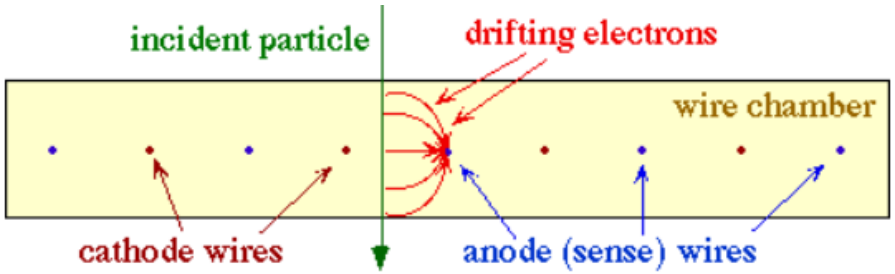
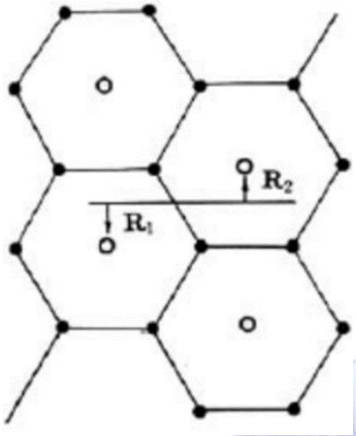
Thickness	L_r/L_r = 0.9 $\times$ 10^{-3}

First Step

- Garfield simulation based on Fortran





Summary & Plan

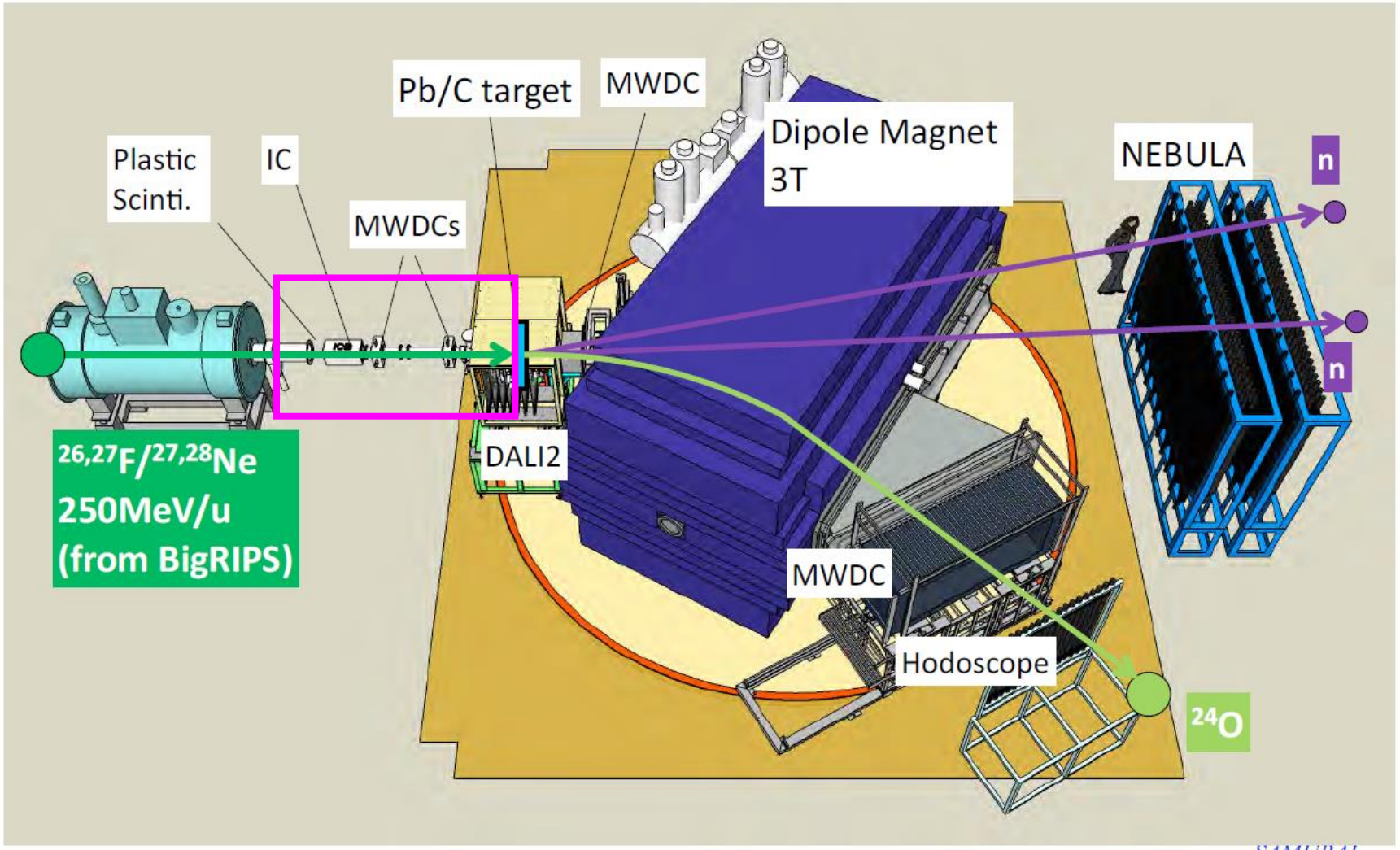
- LiSe++ Study
  - Followed paper and tutorial
  - Will examine final intensity (beam rate) and provide requirements needed for the experiments

- Prototype Drift Chamber Construction
  - Dr. Hwang at KRISS will help us to do this
  - Garfiled Simulation (Dr. Hwang will help Sung Hak Lee for training at March)
  - Preparation for construction

Thank You Very Much
for your attention !

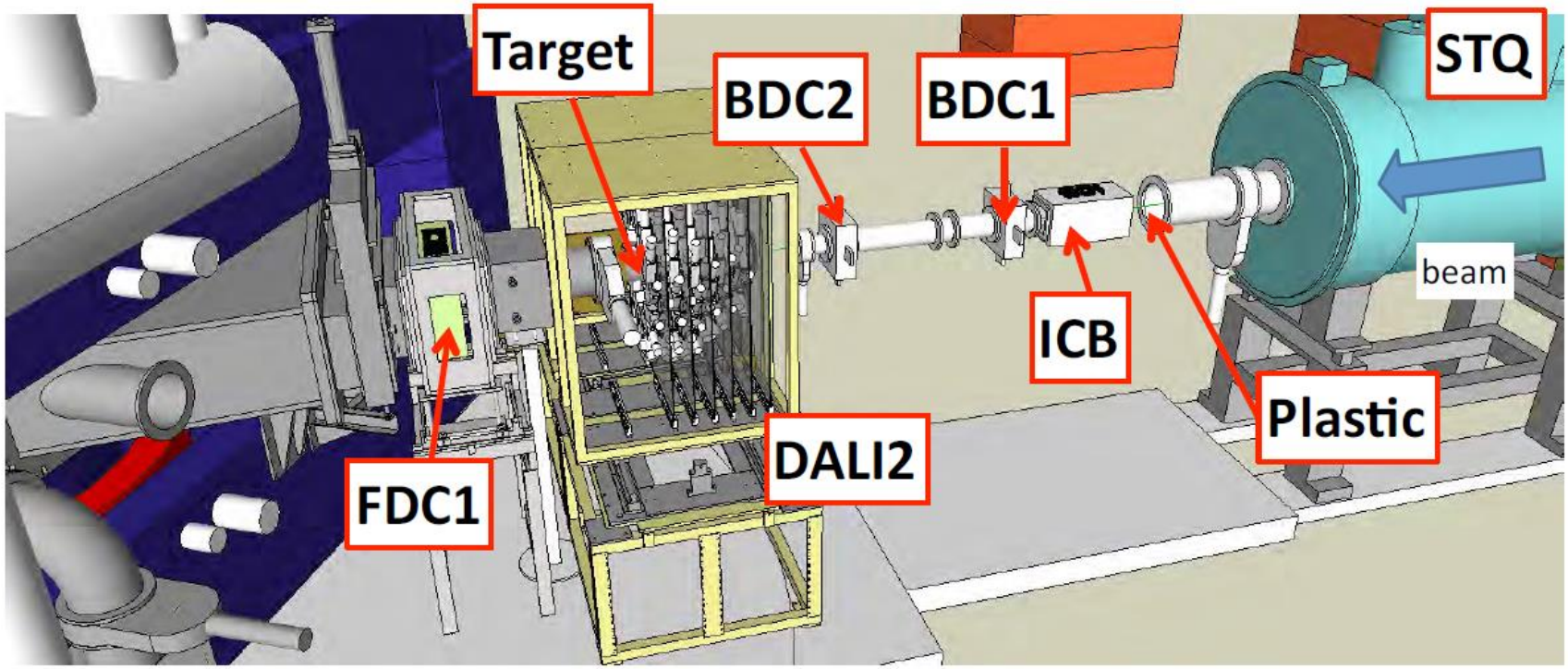
Back Up

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.



Summary & Plan

- Questions
  - Purpose : beam size determination, separation of beam Isotopes (^{134}Sn)?
  - Effective size : depends on IF beam line diameter (SAMURAI 8 cm x 8 cm) : 10 x 10 cm^2 or 15 x 15 cm^2
  - Distance between wires (potential – anode wire)
  - Readout channel : ?? (SAMURAI 128 ch)
  - Materials
    - Anode and Potential Wire : Al-Au (what radius ?)
    - Cathode : Al-Kapton
    - BDC box : Al milar ?
  - Simulation package : Geant4 simulation package ?
- If there would be code to simulate, it will be first priority.
  - Simulation, Design, etc…
- Any thing else ?

Summary & Plan

- Beam Diagnosis Detector : ICB (Ion Chamber) + BDC1 + BDC2
- LiSe++ 를 이용하여 IF 끝단에서 LAMPS 까지 Ion Beam 퍼지고 모이는 정도 계산하여 위치 설정 및 BDC effective area 결정
- Beam 퍼지는 정도의 직경이 다양하나 최대 15cm ~ 20cm 까지 퍼짐
- Drift chamber 만들기
  - Simulation : 가필드
  - https://garfield.web.cern.ch/garfield/
- SAMURAI BDC는 8 layer 이고 wire를 어떻게 설치하고 가스 넣는 법 박스 만들기 등 필요
- BDC 는 position resolution이 가장 중요

- IF 로부터 나오는 beam 이 어떻게 나아가는지 계산하고 위치를 알 수 있는 DC 를 놓고 위치 레졸루션 (시간) 을 얼마로 할 것인지 gean4로 계산

Summary & Plan

- Beam Diagnosis Detector : ICB (Ion Chamber) + BDC1 + BDC2
- Drift Chamber or Wire Chamber ?
- Design Sample
- Materials ?
  - Box
  - Wire
  - Others ?
- High Voltage :
- DAQ system : how many channels do we need ? (SAMURAI : 128 ch)
  - NIM
  - Control chip
- Position resolution :
- Prototype Construction
- How to use Garfiled

Budget

- Wire구매의 경우 1m당 2 달러 정도
  - 100 m role : 약 17만원
- 기타 검출기 housing 및 PCB board 제작 : 500만원
- 총 검출기 제작 비용 : 550만원

- 복잡한 가스시스템 : 약 1000만원
- 하나의 가스를 사용할 경우 : regulator와 flow meter만 필요 (약 10만원)
- 가스의 가격 : 1통당 약 20만원
- 총 가스 시스템 : 약 50만원

- NIM crate : 800만원, NIM HV module(4 채널) : 700만원
- VME crate : controllor 포함 약 900만원
-