

NEWAGE

Kentaro Miuchi (Kobe University)

IDM 2018 @ Brown University

introduction
negative ION TPC R&D
low BG μ PIC development
underground measurement



科研費
KAKENHI

JSPS 二国間事業

「ガス飛跡検出器を用いた暗黒物質探索実験」

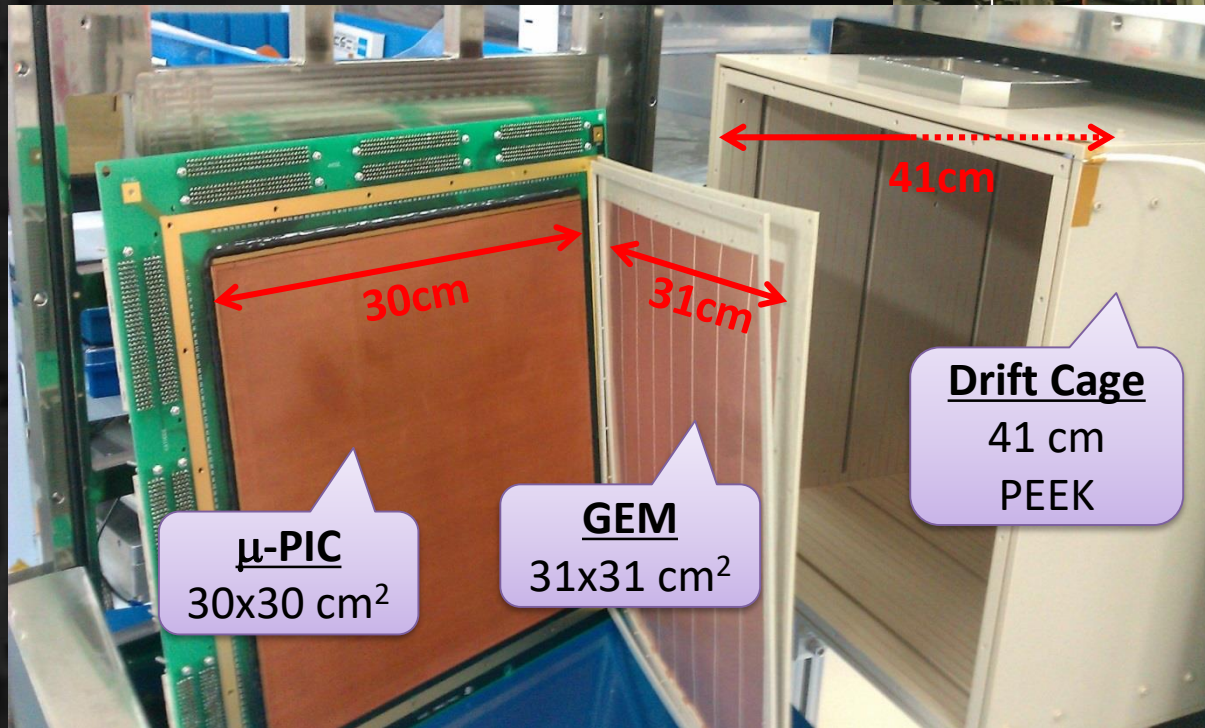
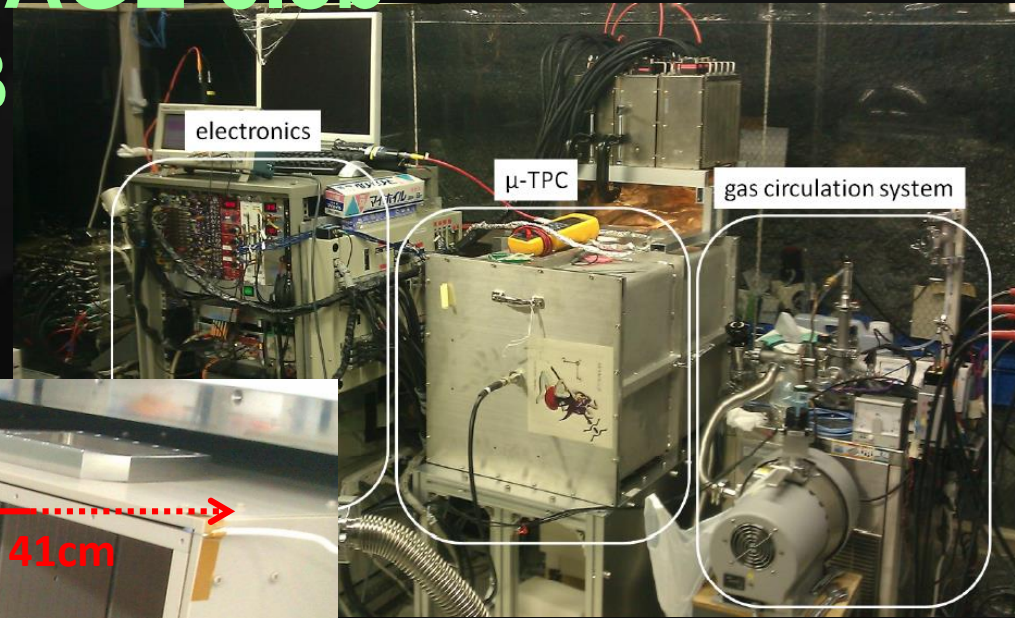
Direction Sensitive
WIMP-search

NEWAGE

introduction

Introduction “NEWAGE-0.3b” @Kamioka Lab-B

- 76Torr CF_4
- $30 \times 30 \times 41 \text{ cm}^3$



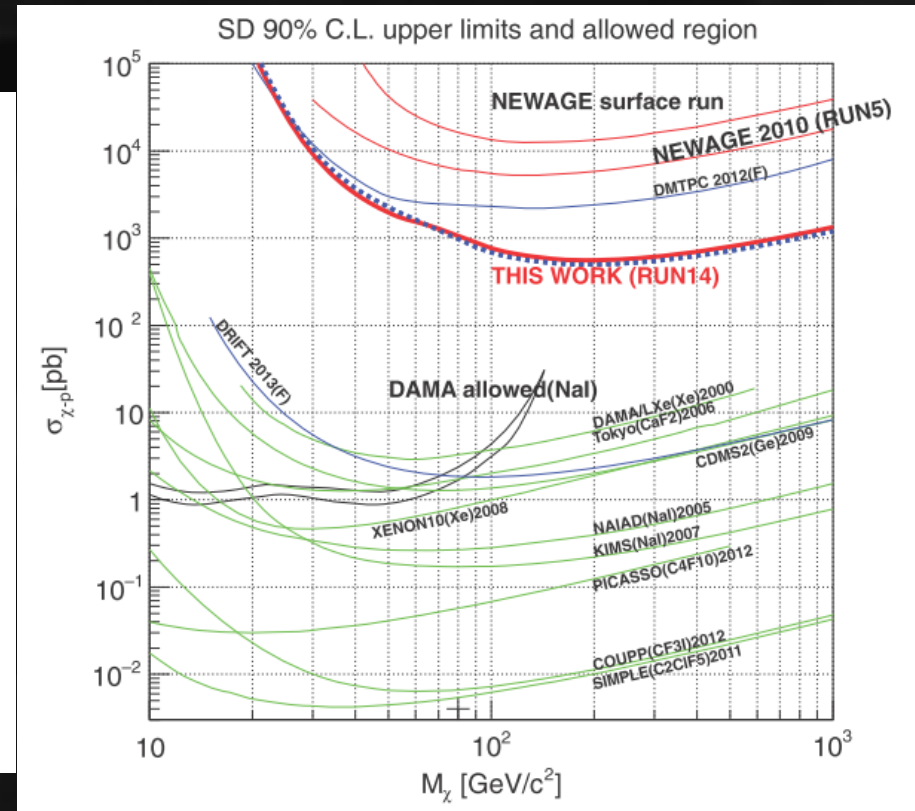
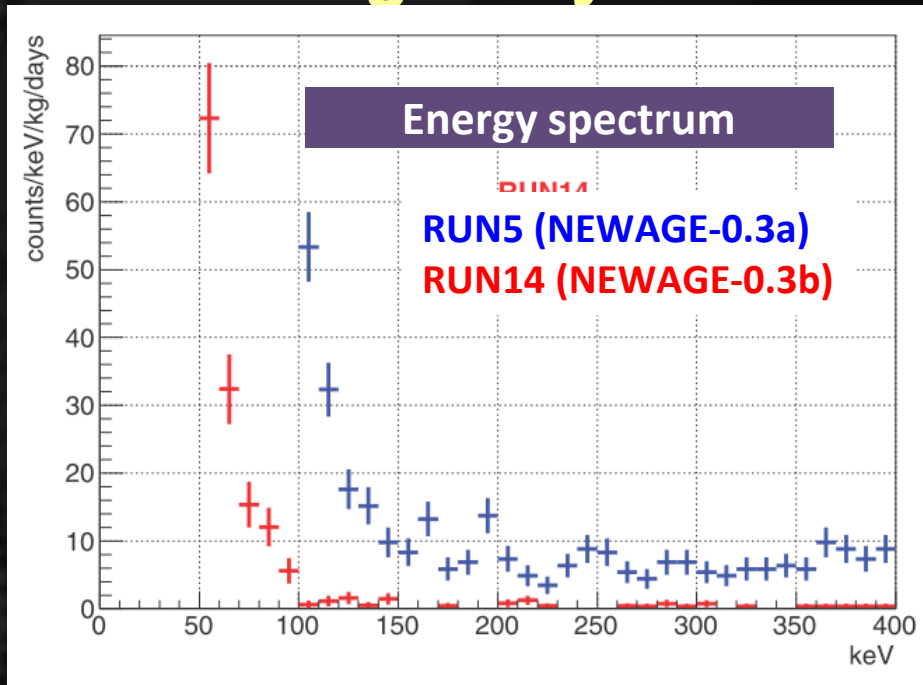
- 3D tracks for
“SKYMAP” analysis

Introduction : Kamioka RUN14

- 2013/7/20-8/11, 10/19-11/12
- live time : 31.6 days
- 0.327 kg · days

(PTEP(2015) 043F01s)

limit curve



- Increased exposure
- low BG μ -PIC development
- Negative ION TPC

red : gas, with directional analysis
blue : gas, without directional analysis
green : solid, liquid detector

WIMP-search
NEWAGE

underground measurement

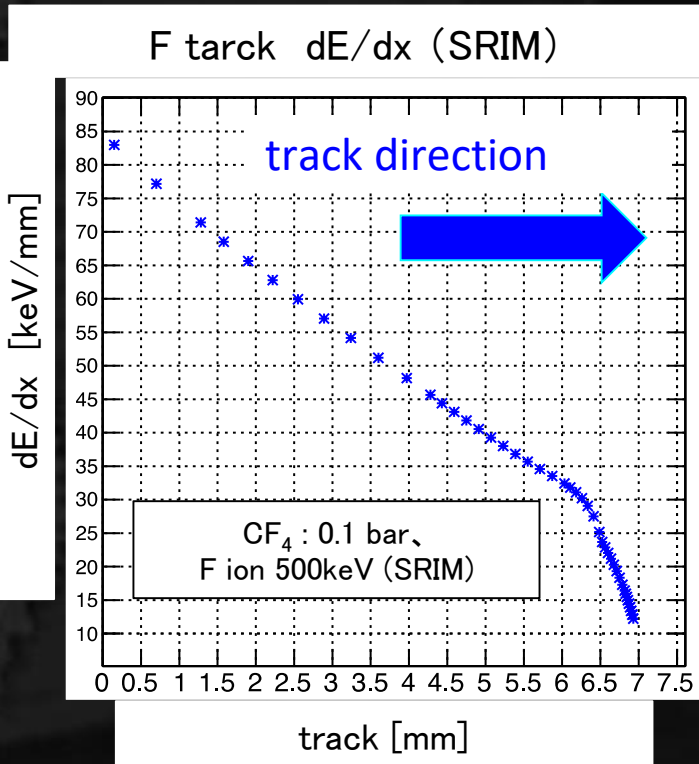
◆ since RUN14-1,2

- ~ 400 days of data (exposure $\times 14$)
- analysis update including head/tail (3D-vector)

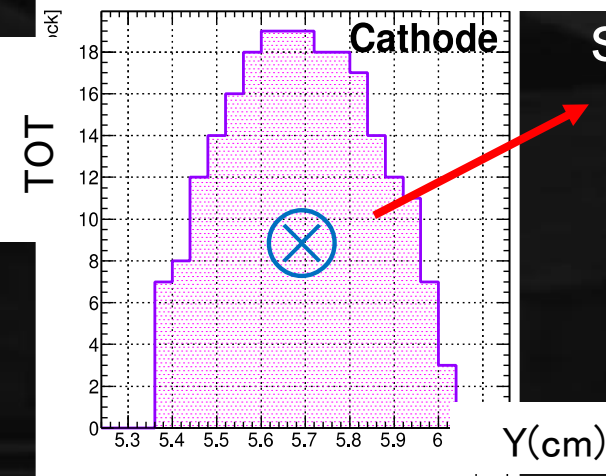
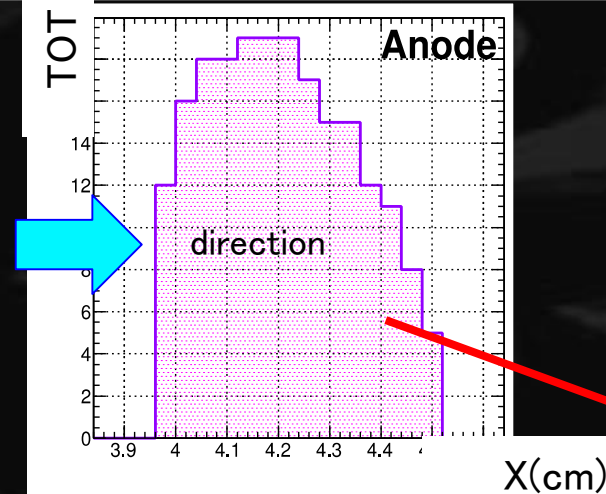
Run number	Measured date	Live time [days]
Run14-1	2013/7/17 - 2013/9/16	17.10
Run14-2	2013/10/17 - 2013/11/14	14.52
Run14-3	2014/01/29 - 2014/3/12	25.34
Run15-1	2015/3/30 - 2015/8/17	N/A
Run15-2	2015/8/17 - 2015/10/27	N/A
Run15-3	2015/11/6 - 2016/1/14	N/A
Run16-1	2016/1/14 - 2016/3/10	42.28
Run16-2	2016/3/25 - 2016/6/28	69.94
Run17-1	2016/6/28 - 2016/8/24	26.16
Run18-1	2016/8/24 - 2016/8/27	N/A
Run18-2	2016/9/1 - 2016/10/19	41.43
Run18-3	2016/10/20 - 2017/1/19	66.86
Run18-4	2017/1/26 - 2017/4/21	49.51
Run18-5	2017/4/27 - 2017/8/8	81.71
Total	2013/7/17 - 2017/8/8	434.85

◆ head/tail

- TOT(time-over-threshold) of each strip

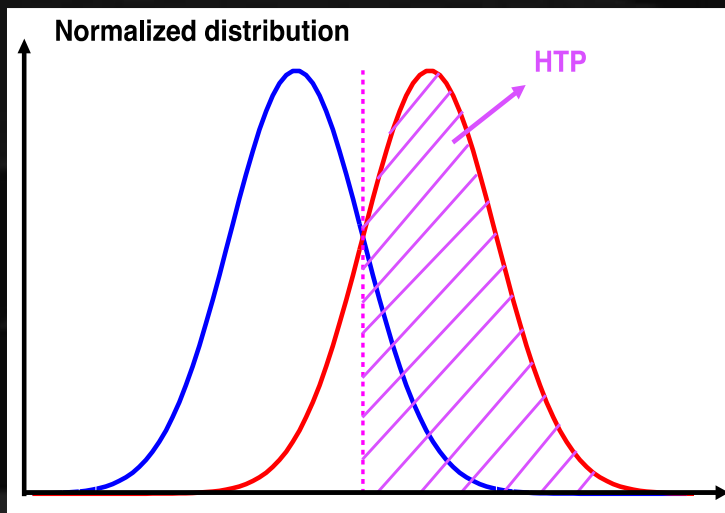
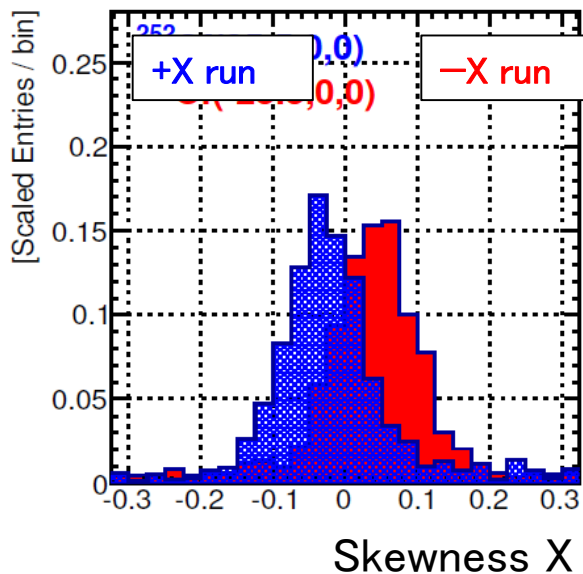


neutronirradiation (measurement)

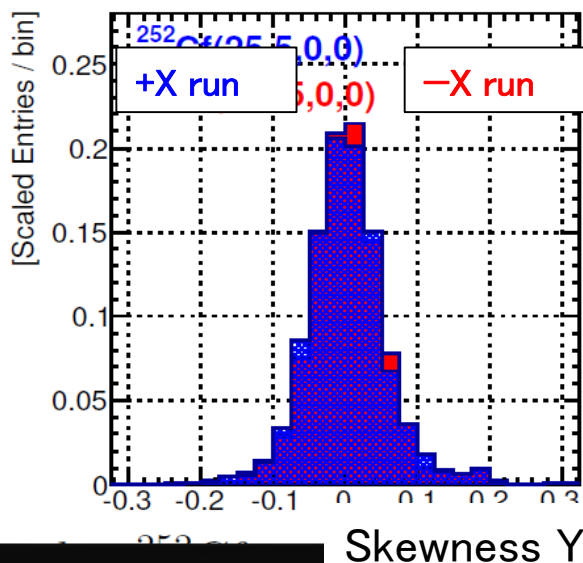


head/tail by TOT strip

● head/tail confirmed for $>100\text{keV}$



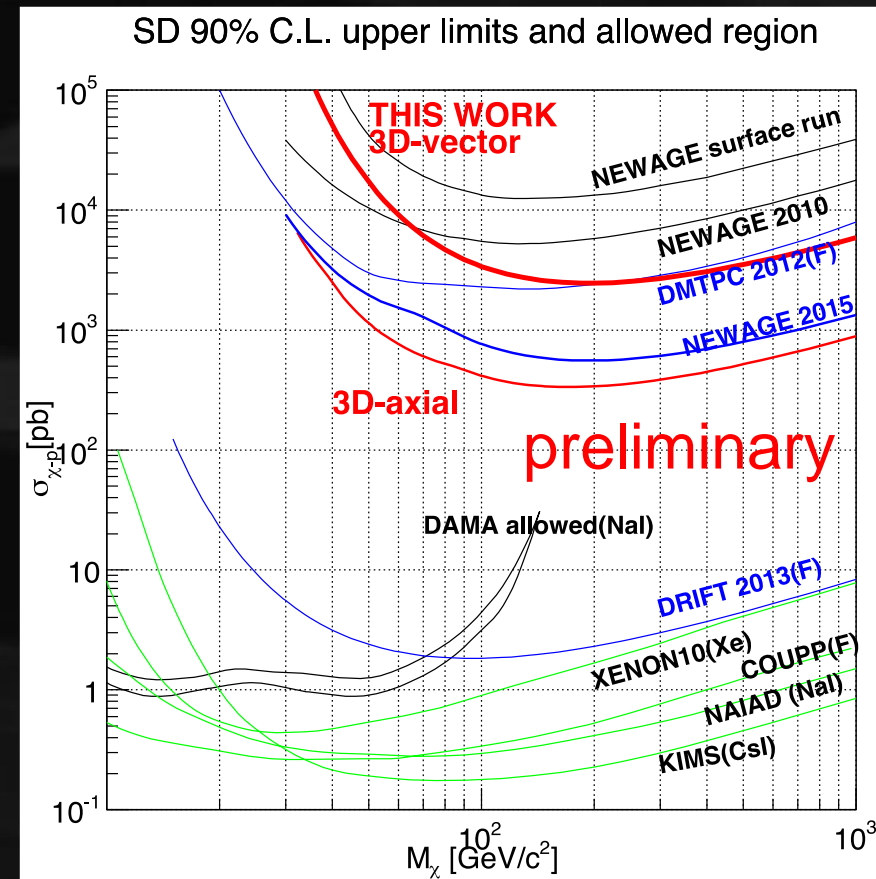
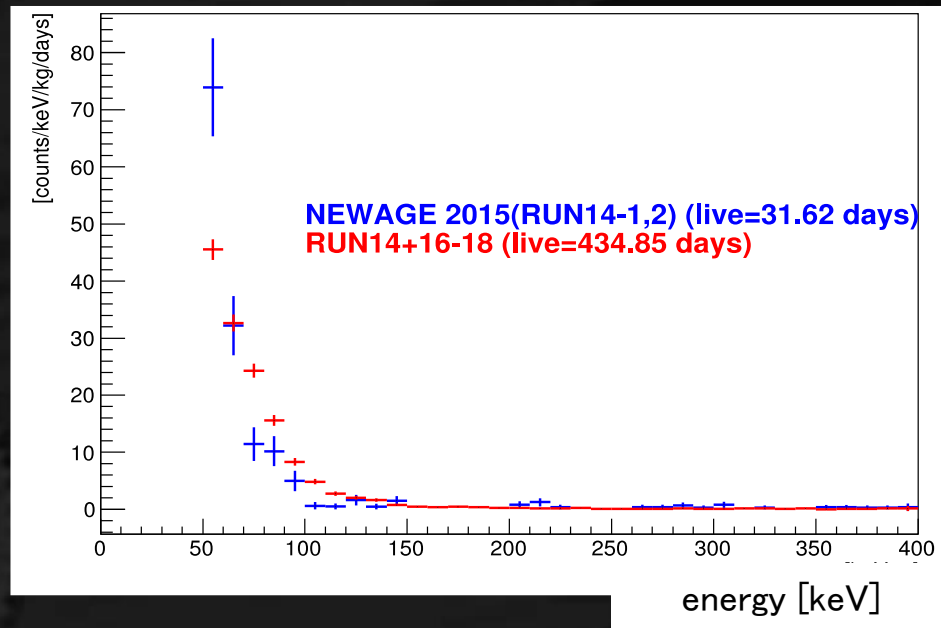
Energy range	HTP [%]
50-100 keV	57 ± 6
100-200keV	64 ± 4
200-400keV	76 ± 8



- $>100\text{keV}$: 3D vector
- 50~100keV : 3D axial

underground result

- 4.5kg days (435 live-days) exposure
- limits by 3D-axial and 3D-vector



9 ● to do : 3D vector analysis below 100keV

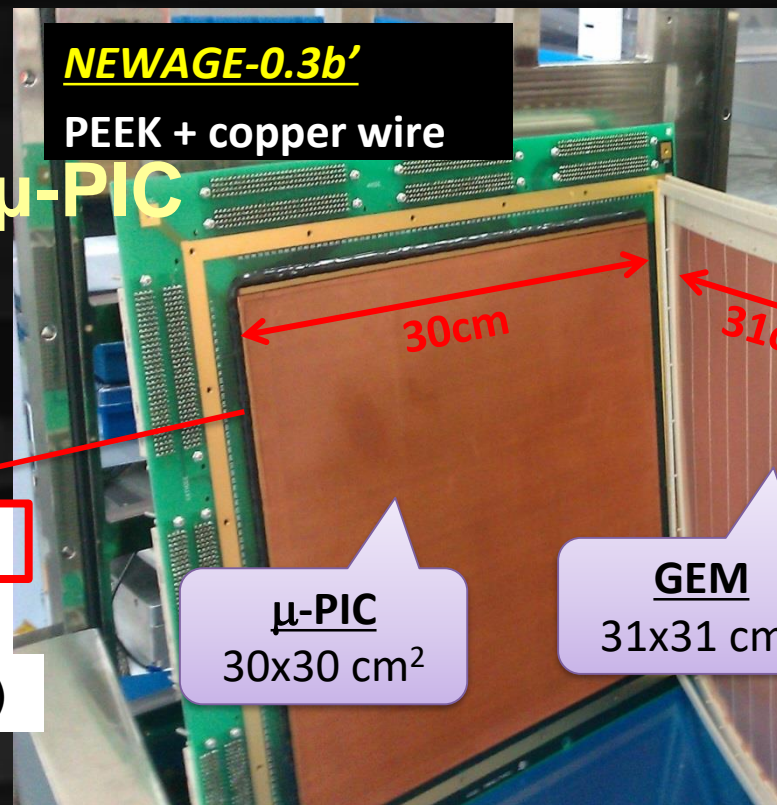
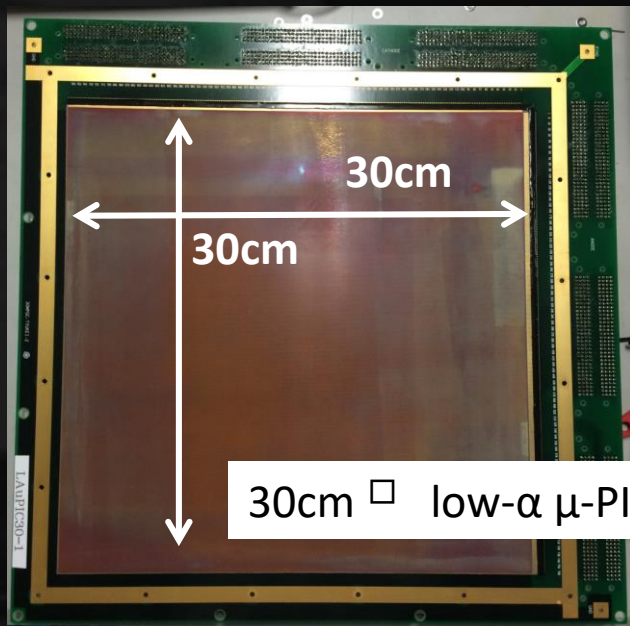
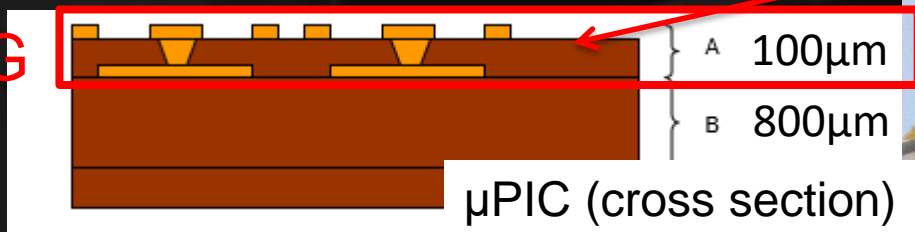


low BG μ -PIC development

low BG μ -PIC

- main BG : α particles from μ -PIC
- “low- α μ -PIC” with clean polyimide (U / Th $\times 1/100$)

low BG

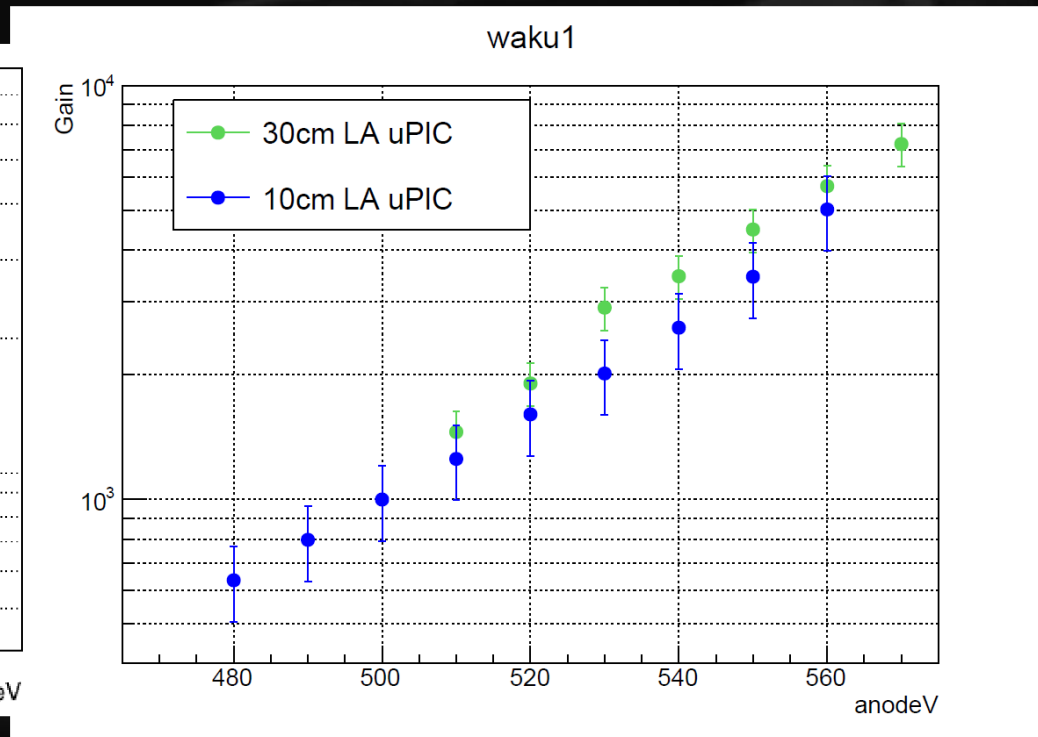
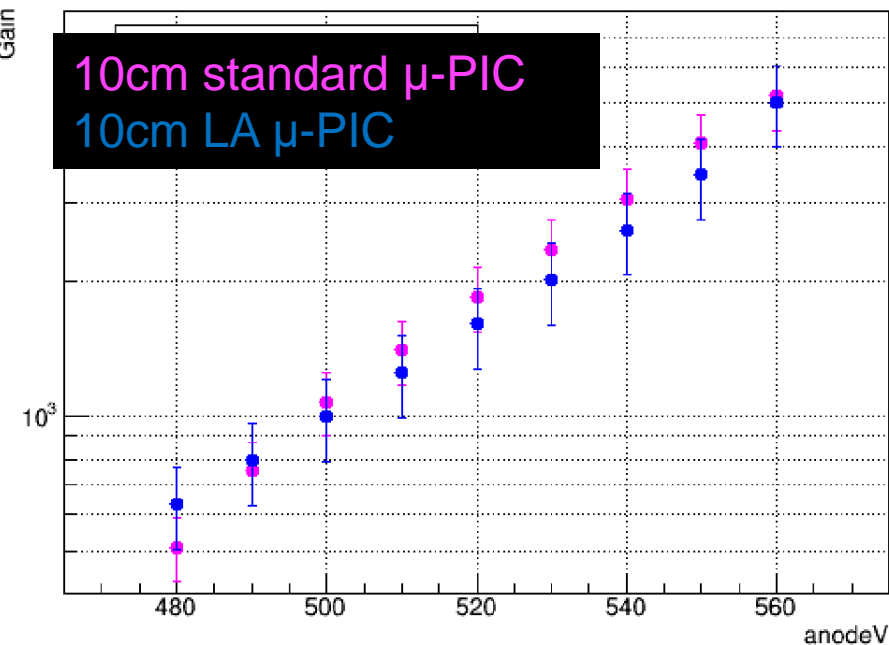


test (\sim Oct 2017)
underground measurement
(Nov 2017 \sim)



low- α μ -PIC(LA- μ PIC): performance

- gain curve measurement with Ar/C₂H₆ gas
- similar performance with standard ones



new material for TPC field cage: resistive sheet with $\sim 10\text{G}\Omega/\square$

many di-electric sheet candidates
(most of them are too low resistive)

ASONE通販

静電対策

AXEL

3,000円以上
140万点
送料無料で
お買い上げ
当日出荷

23シリーズが該当します

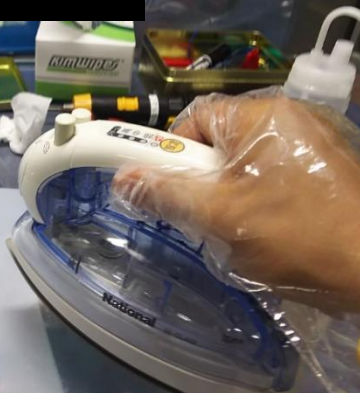
電磁波シールドクロス 960mm×1m
標準価格：9,700円

導電性フィルム (基材レス)
標準価格：14,200円

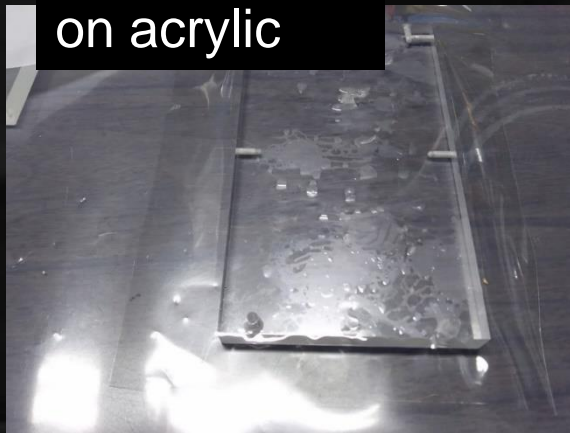
帯電防止PVCシート
標準価格：60,600円～

chosen one (in terms of
resistivity and uniformity

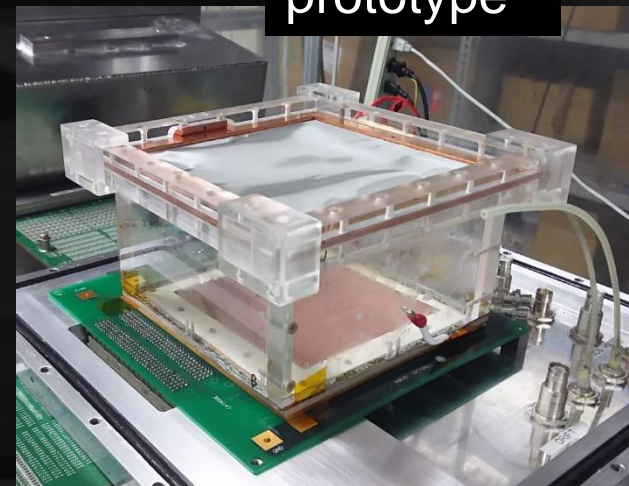
thermal press



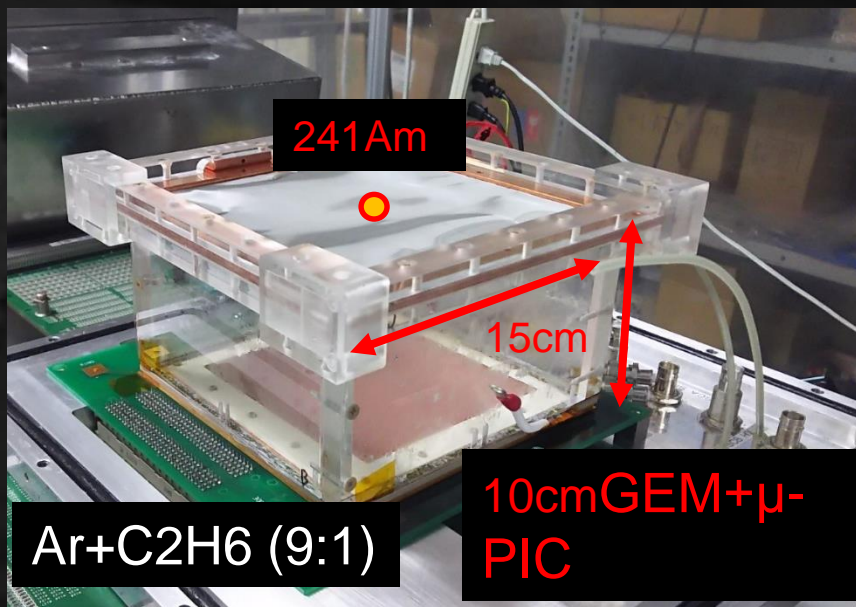
on acrylic



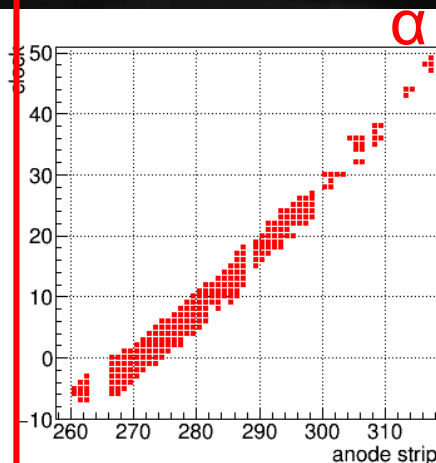
prototype



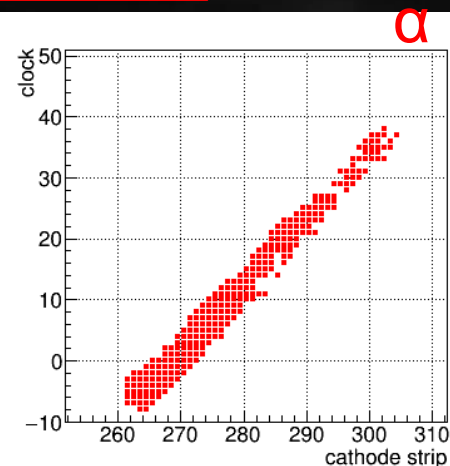
TPC test



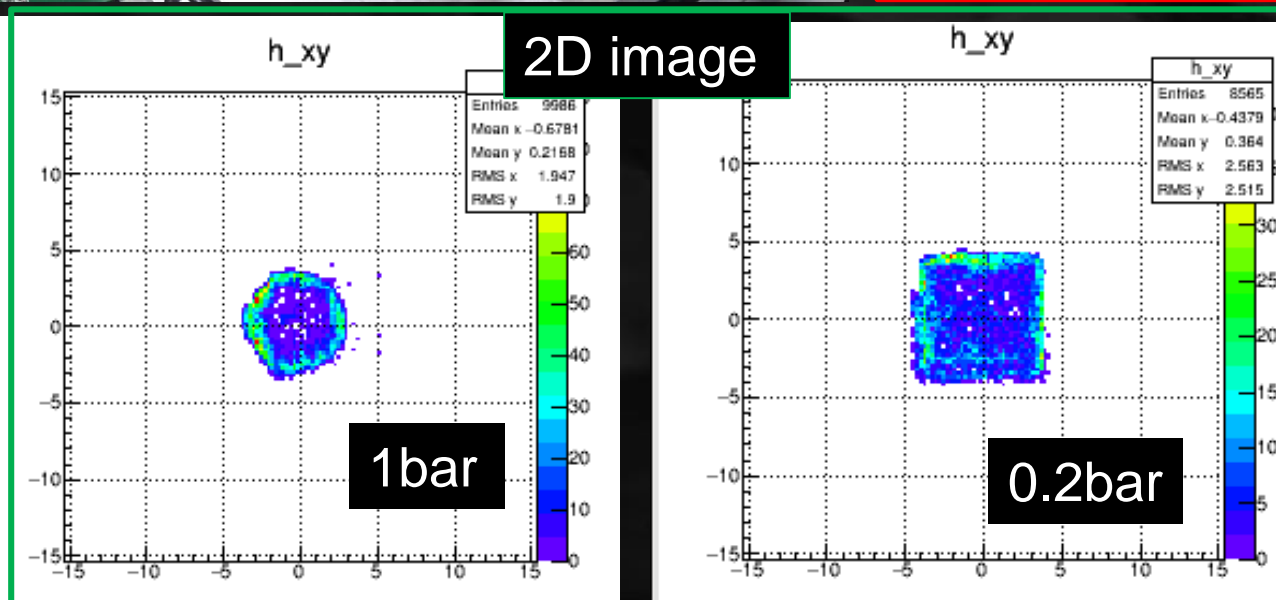
α ray data (raw data)



X strips



Y strips



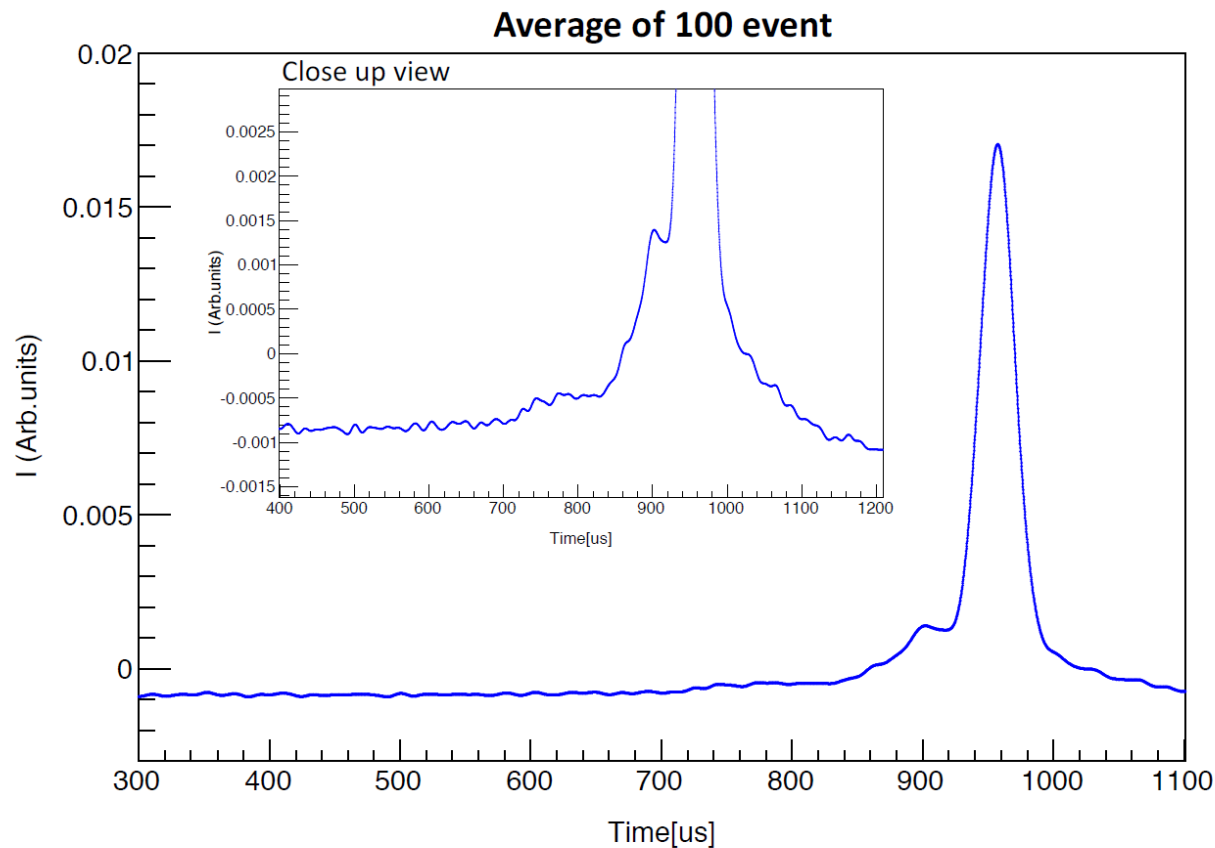
quantitative measurement is going on

z-fiducialization R&D

μ-PIC in SF6

- minority carrier for z-fiducialization

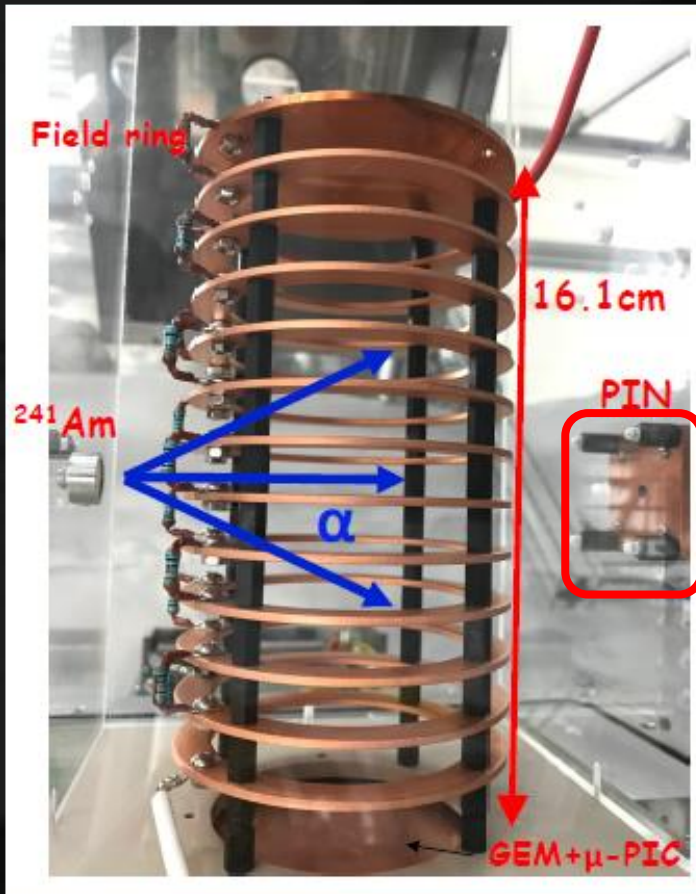
Waveform Feature



μ-PIC in SF6

- tracking test (α-rays)
- SF6 20Torr

Tomonori Ikeda JPS
Mar2018

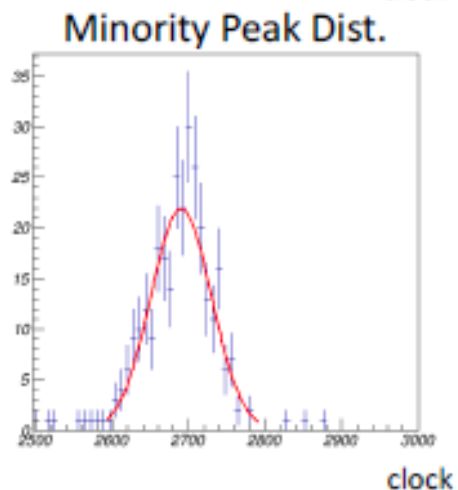
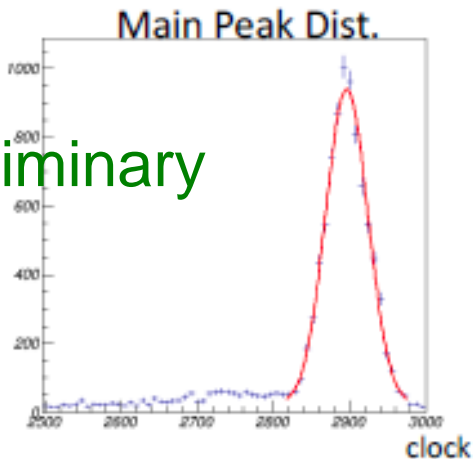


Liq argon electronics (LQARS2014)
GEM (LCP 100um-thick)+μ-PIC
PIN photodiode for trigger
detection volume
 $1.28 \times 1.28 \times 16.1$ cm
anode(32ch) cathode(32ch)

z resolution measurement with PIN trigger

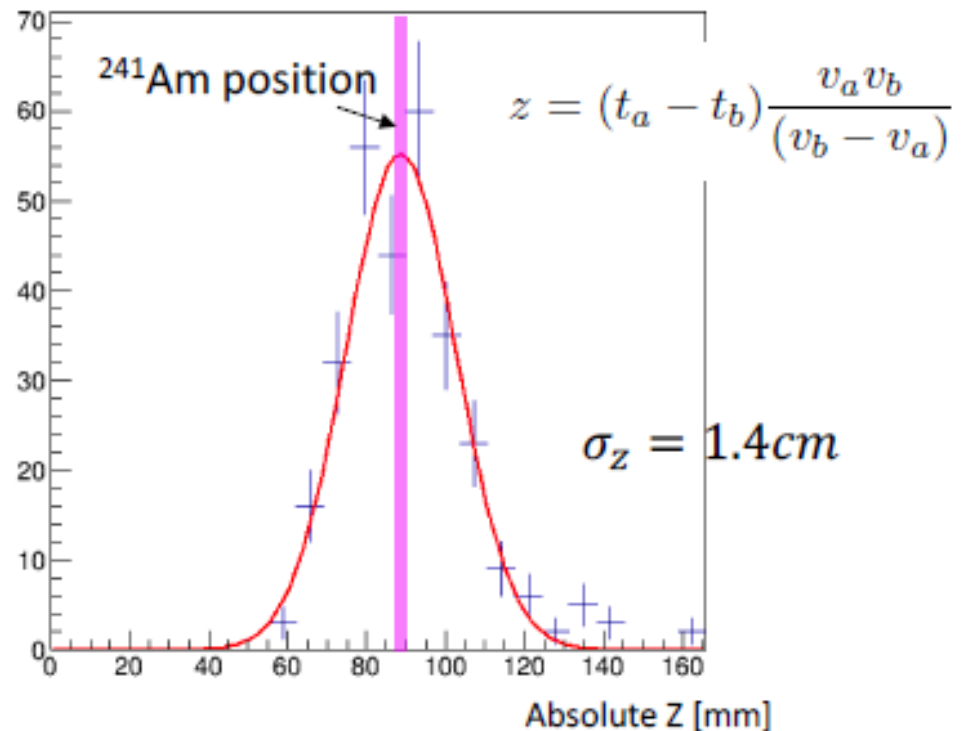
Tomonori Ikeda JPS
Mar2018

preliminary



SF₆ (Main charge) Drift V : 8.0 [cm/ms]

SF₅ (Minority charge) Drift V : 8.6 [cm/ms]

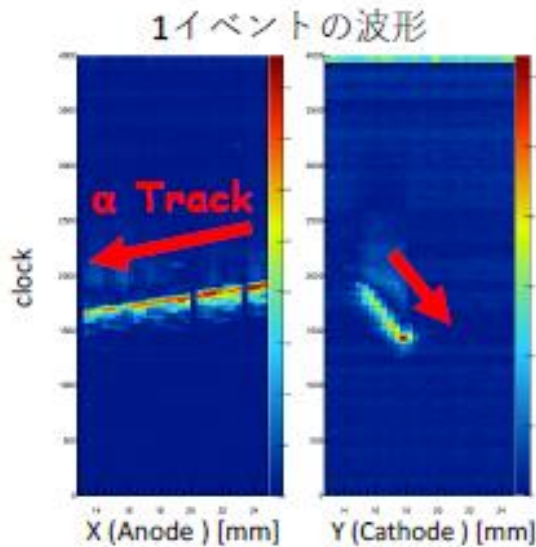


WIMP-search

NEWAGE

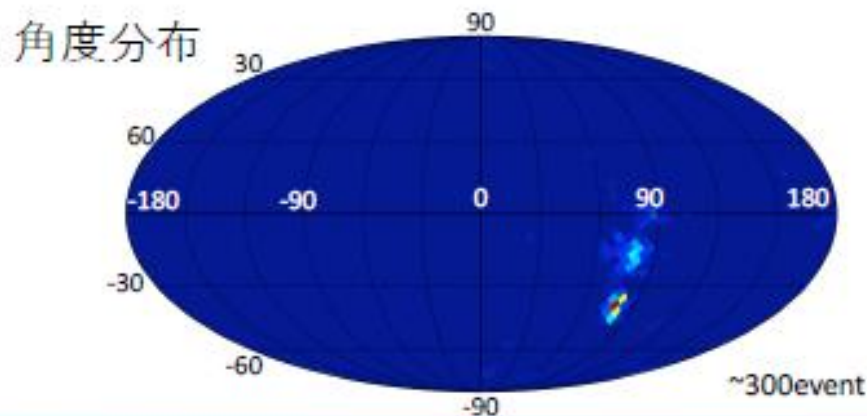
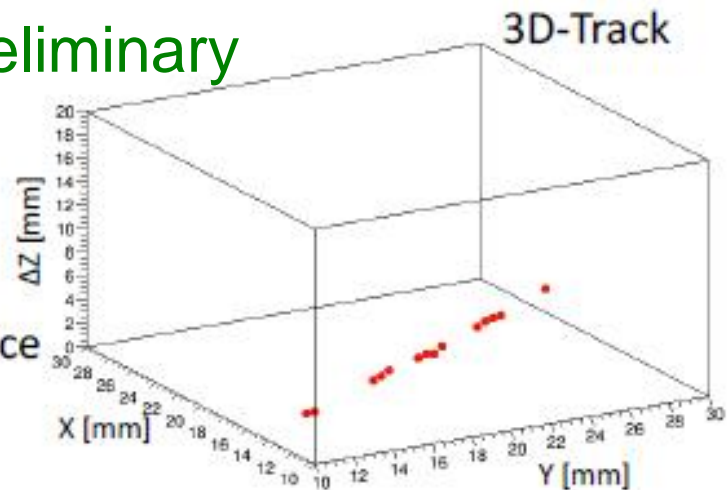
3D tracking + z-fiducialization (first shown!)

Tomonori Ikeda JPS
Mar2018



preliminary

coincidence



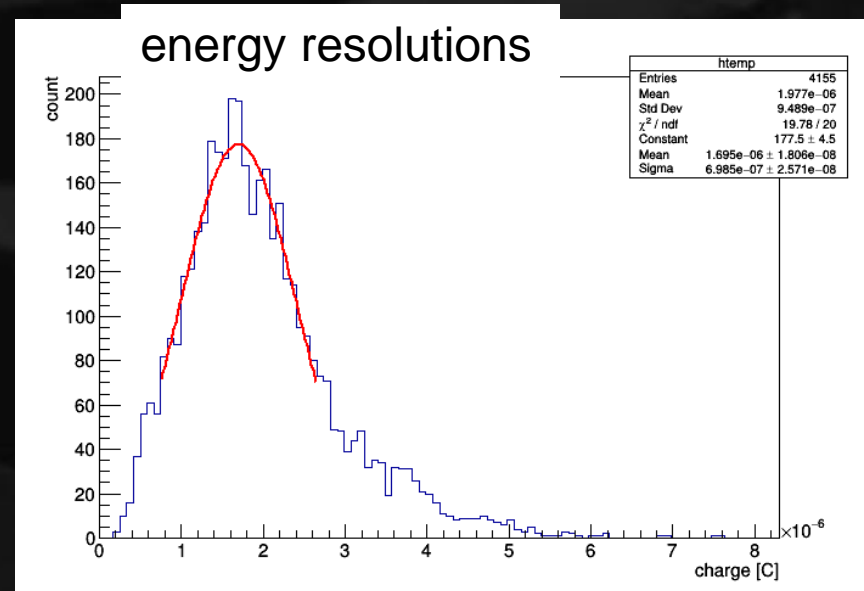
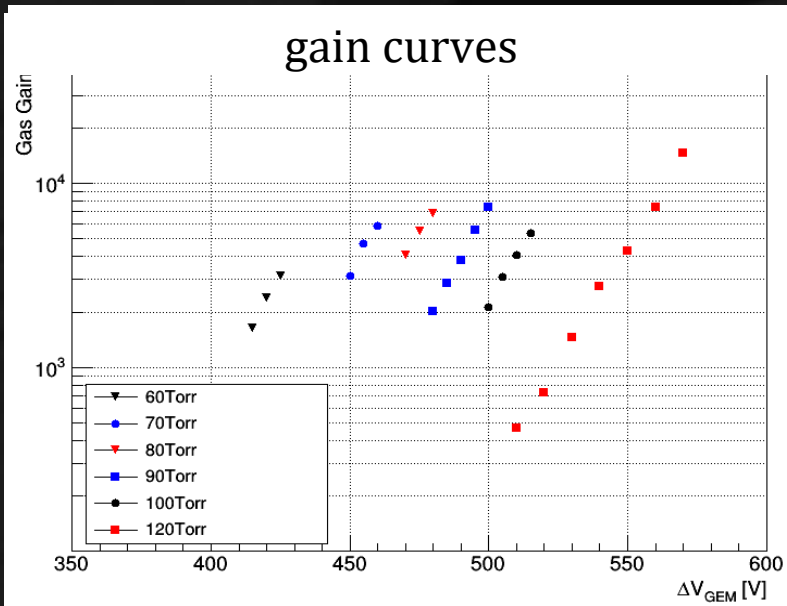
^{241}Am 配置図



paper in preparation

Negative ION simulation to Garfield++ (Hirohisa Ishiura with Rob Veenhof @ CERN July 2018)

- to optimize/understand the MPGD behavior in negative ion gas
- what we observe:



⇒ to implement avalanche process, detachment process... in Garfield++.

SUMMARY

- ◆ **>400 days underground measurement**
- ◆ **low BG μ -PIC developed**

- ◆ **SF6: 3D track + fiducialization**
- ◆ **Garfield++ work, just started**