

NEWAGE



Kentaro Miuchi KOBE University

K. Nakamura⁽²⁾, Y. Yamaguchi⁽¹⁾,
T.Hashimoto⁽¹⁾, R. Yakabe⁽¹⁾, T. Ikeda⁽¹⁾,
R.Taishaku⁽¹⁾, M. Nakazawa⁽¹⁾,
T.Tanimori⁽²⁾, K.Kubo⁽²⁾, A.Takada⁽²⁾,
H.Nishimura⁽²⁾, J.D.Parker⁽²⁾, T.Mizumoto⁽²⁾,
Y.Mizumura⁽²⁾, Y.Matsuoka⁽²⁾, S.Komura⁽²⁾,
A.Takeda⁽³⁾, H.Sekiya⁽³⁾,

(1) Kobe university

(2) Kyoto university

(3) ICRR

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科研費
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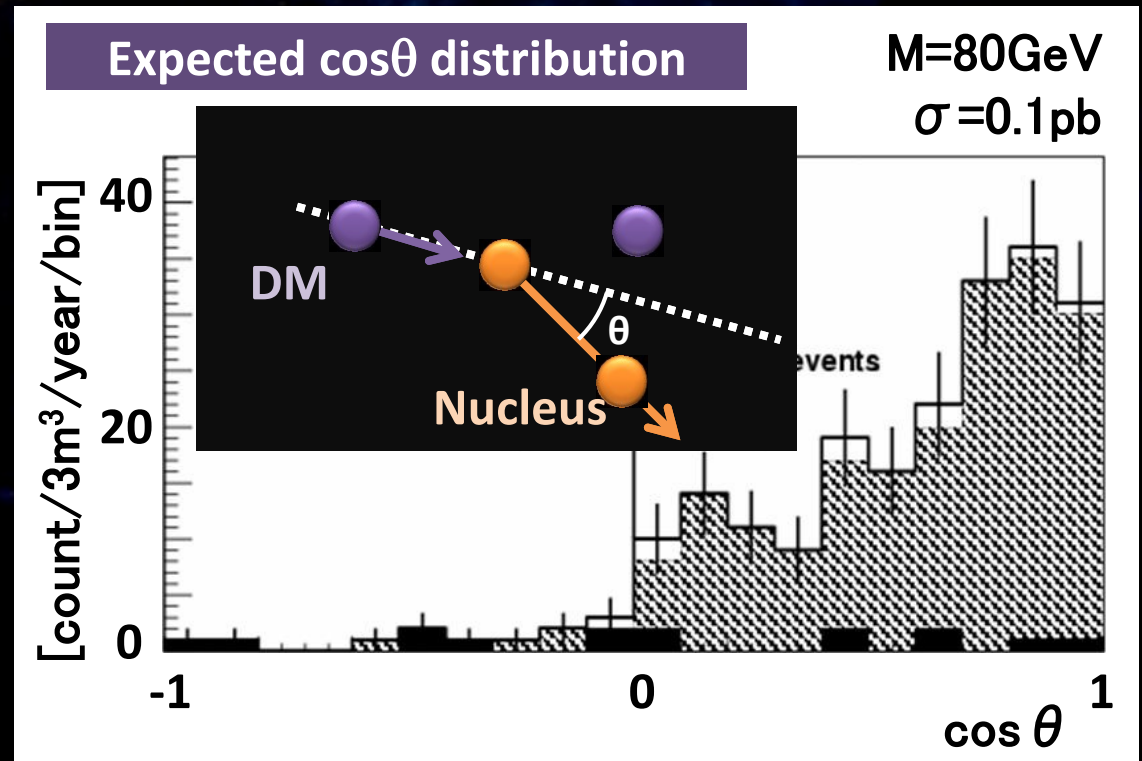
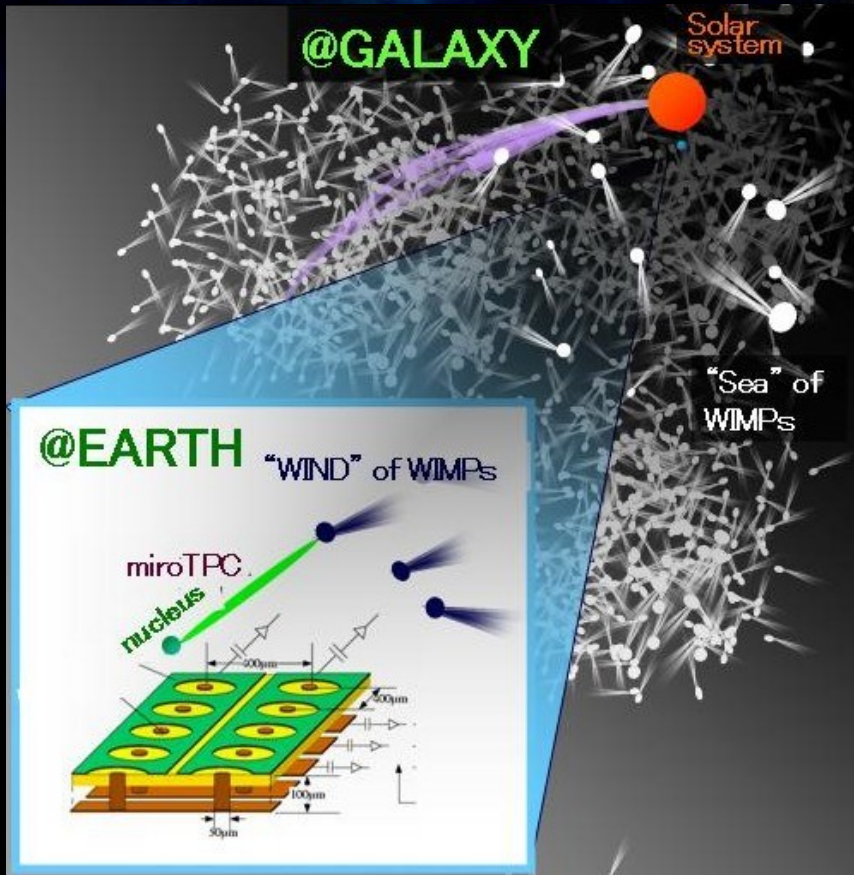
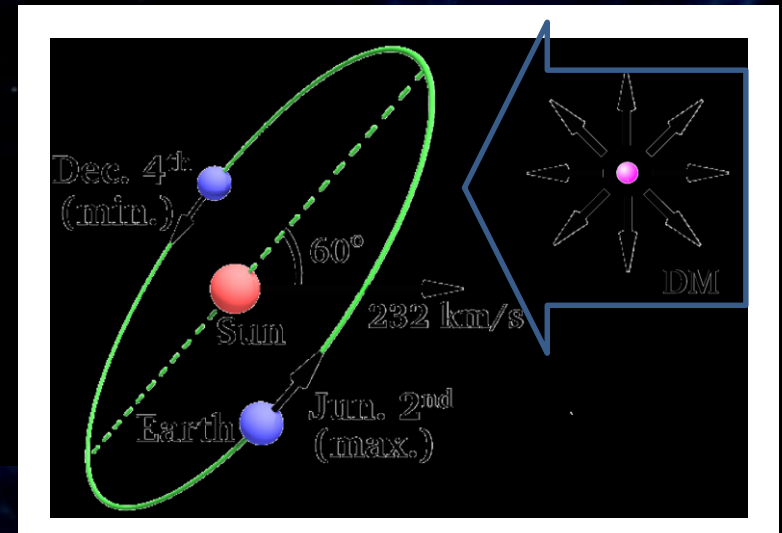
NEWAGE

NEWAGE

New general WIMP search with an Advanced Gaseous tracker Experiment

Direction-sensitive dark matter search

Detect nuclear track by gaseous detector



NEWAGE

- μ -PIC based TPC with electronics

- 3-D tracks

- Proposal

PLB 578 (2004) 241-246

- First direction-sensitive DM limits

PLB654 (2007) 58

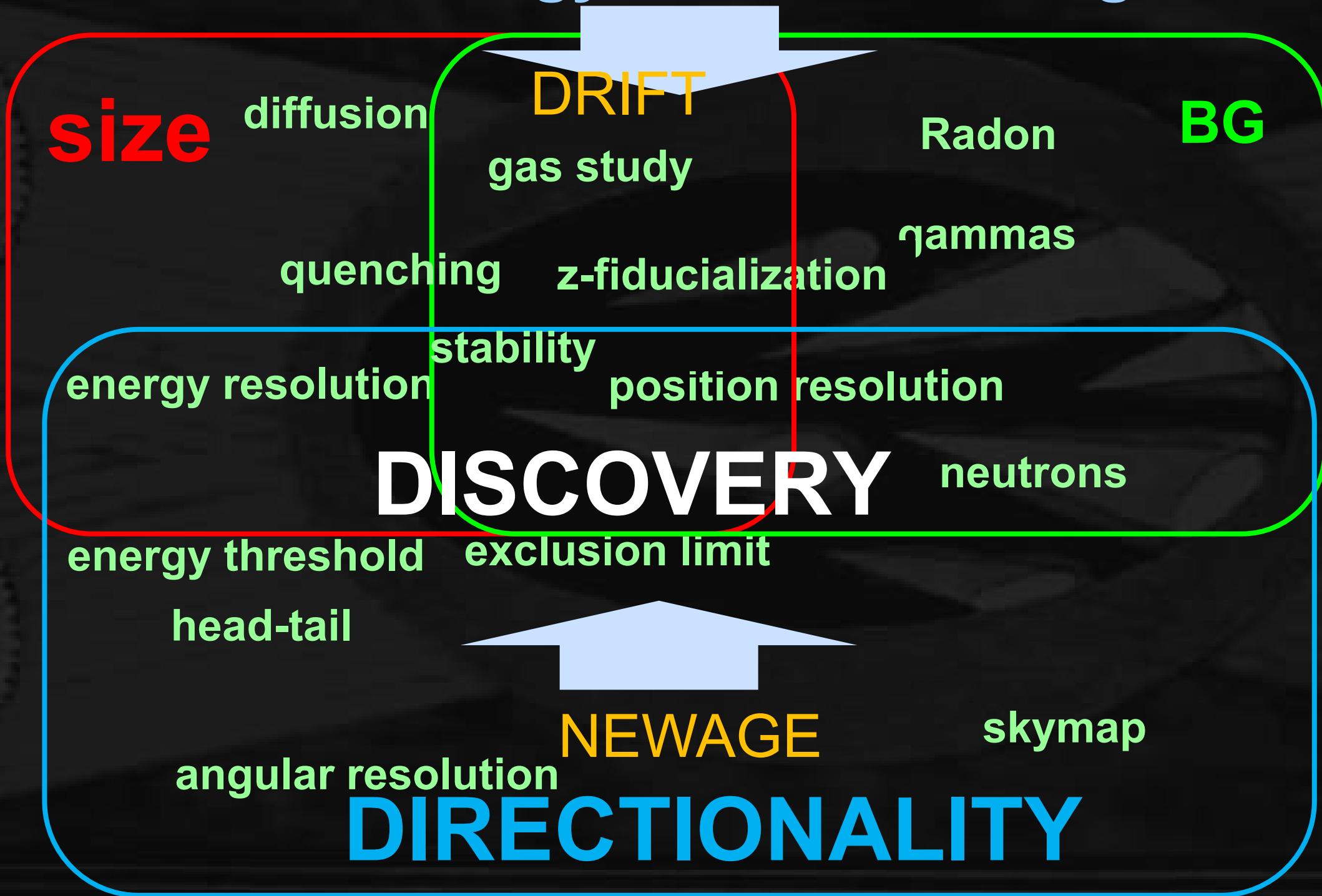
- Underground results

PLB686 (2010) 11, PTEP (2015) 043F01s

- Phase for “low BG detector”

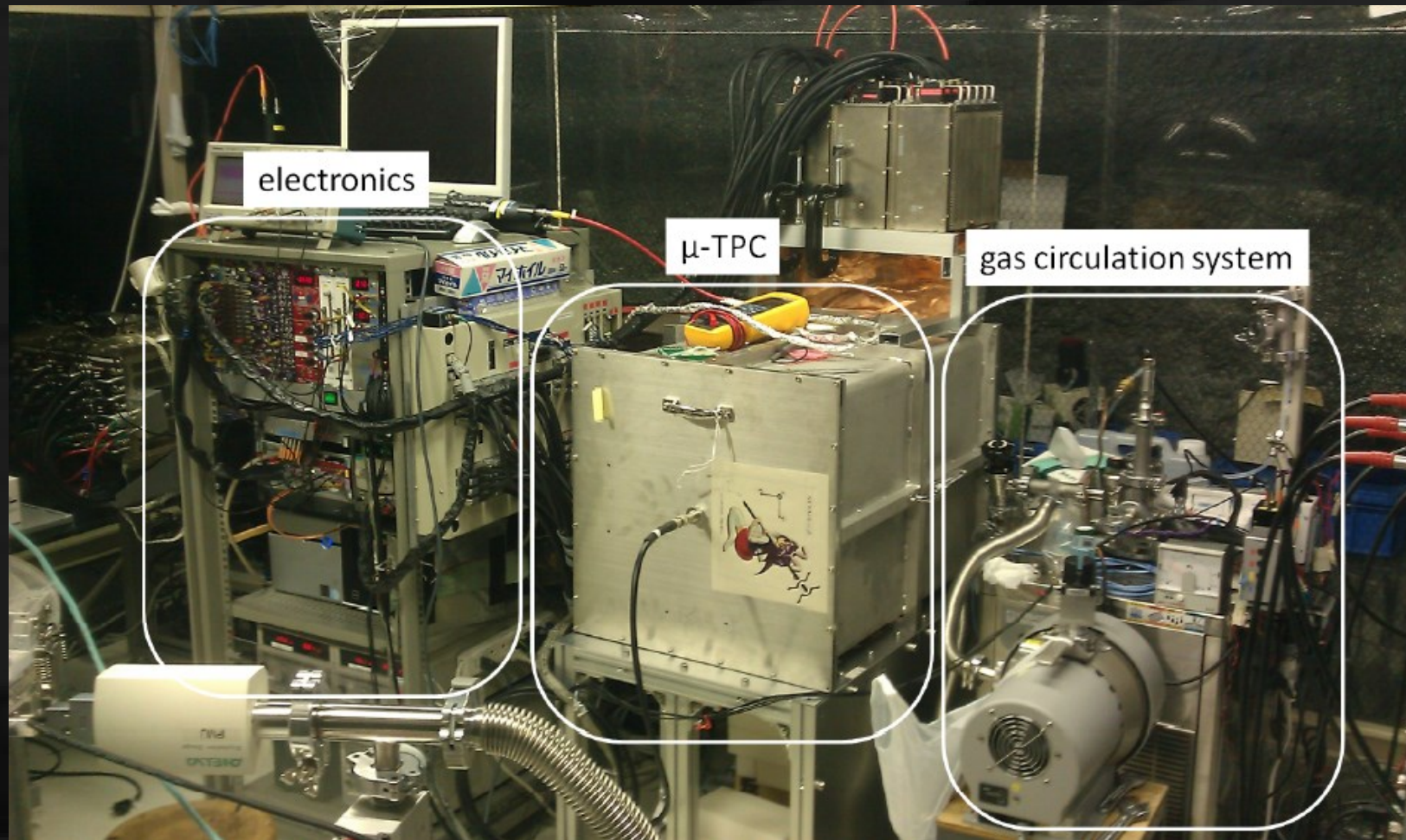


NEWAGE strategy since its new ages



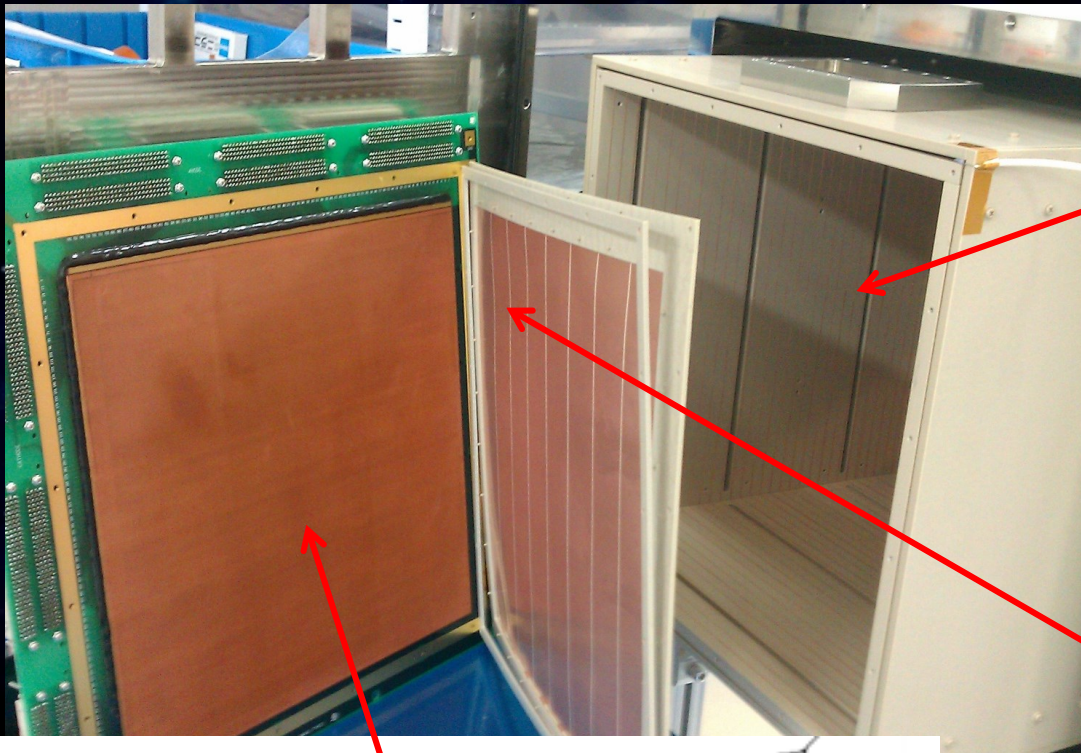
NEWAGE detector

- NEWAGE-0.3b'
- Detection Volume: $31 \times 31 \times 41 \text{cm}^3$
- Gas: CF₄ at 0.1atm (50keVee threshold)
- Gas circulation system with cooled charcoal

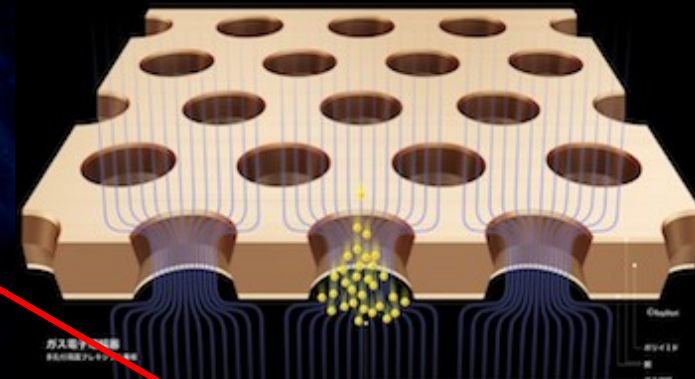


NEWAGE-0.3b' inside view

Detection Volume: $30 \times 30 \times 41 \text{cm}^3$

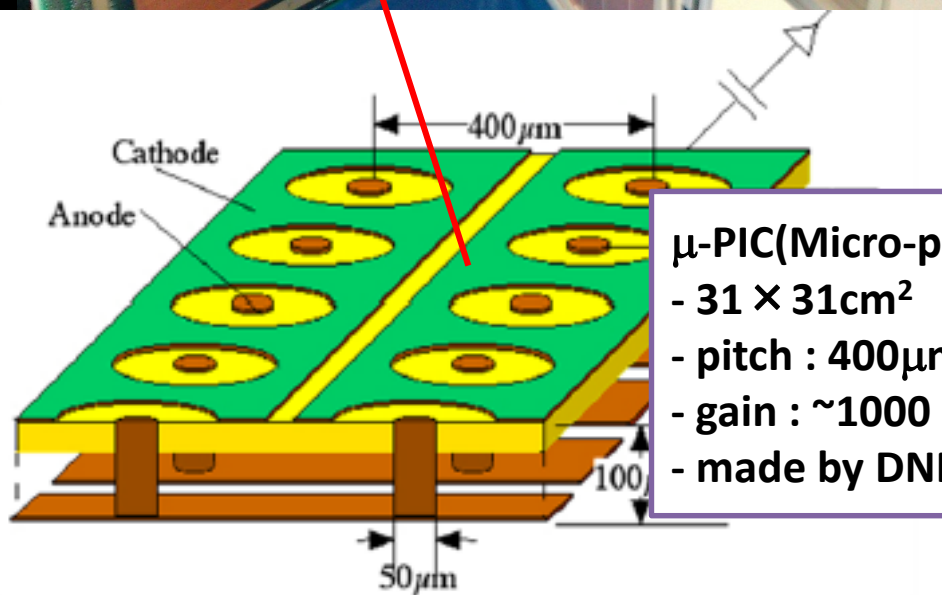


Field cage
Drift length: 41cm
PEEK + copper wires



GEM

- $31 \times 32 \text{cm}^2$
- 8-segmented
- hole pitch : $140 \mu\text{m}$
- hole diameter: $70 \mu\text{m}$
- insulator : LCP $100 \mu\text{m}$
- gain : ~ 5
- made by Scienergy, Japan



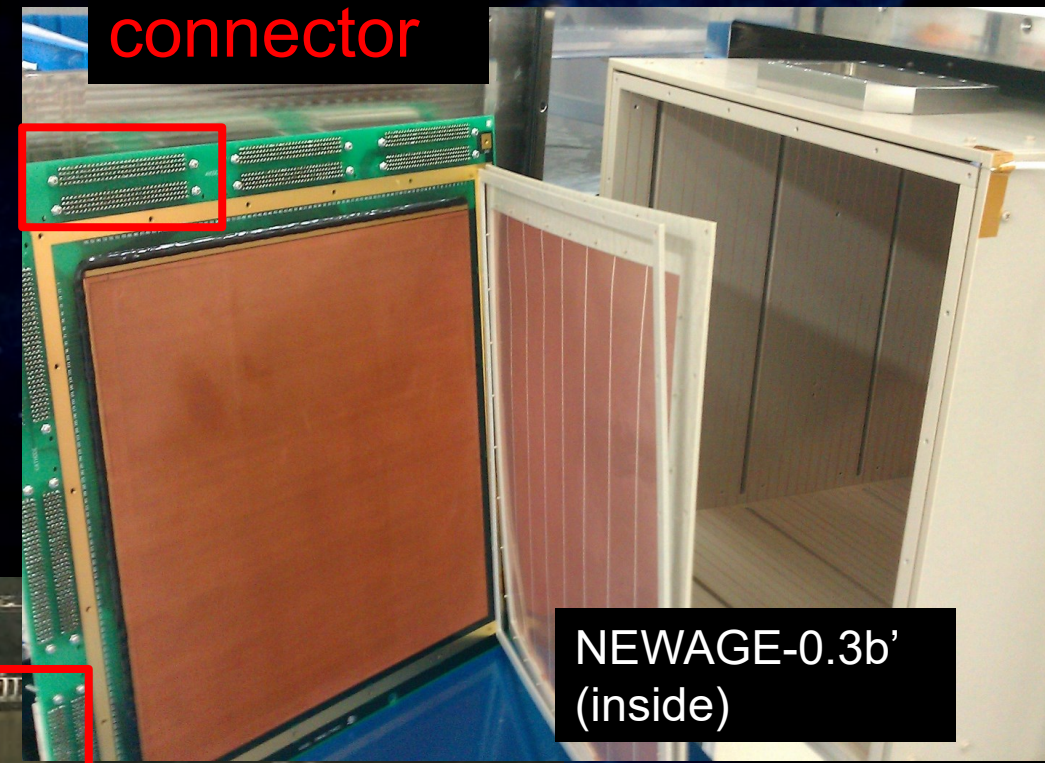
μ-PIC(Micro-pixel chamber)

- $31 \times 31 \text{cm}^2$
- pitch : $400 \mu\text{m}$
- gain : ~ 1000
- made by DNP, Japan

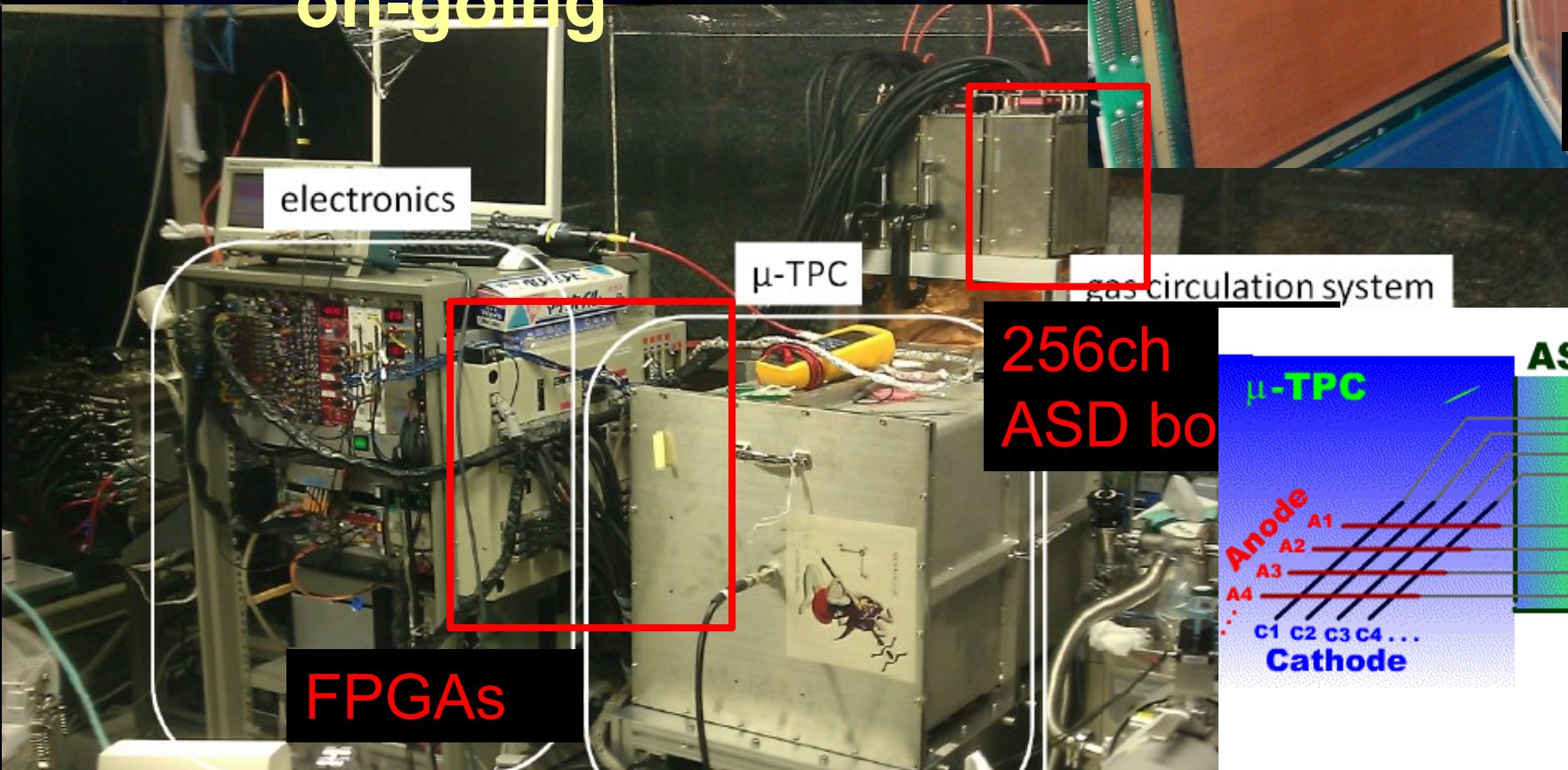
NEWAGE-0.3b' readouts

- μ -PIC is X-Y readout
- General purpose FPGA-based electronics since early 2000's.
- Updates are always on-going

256ch connector

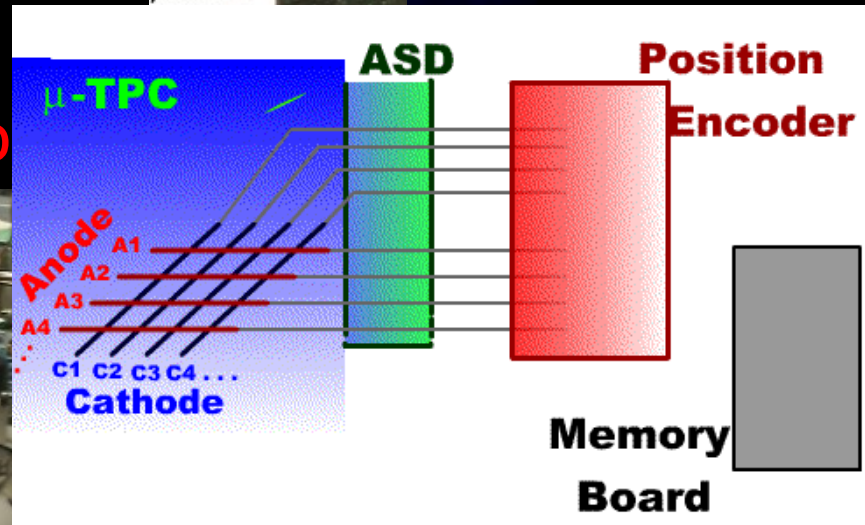


NEWAGE-0.3b' (inside)



256ch ASD board

FPGAs



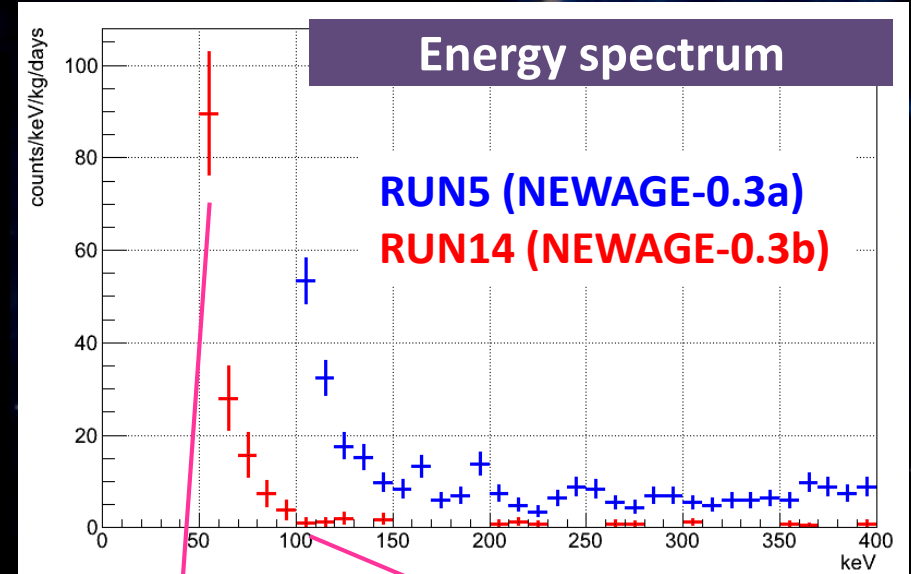


NEWAGE
Kamioka RUN14 results

NEWAGE underground run

RUN14

- period : 2013/7/20-8/11, 10/19-11/12
- live time : 31.6 days
- fiducial volume : $28 \times 24 \times 41 \text{cm}^3$
- mass : 10.36g
- exposure : 0.327 kg·days

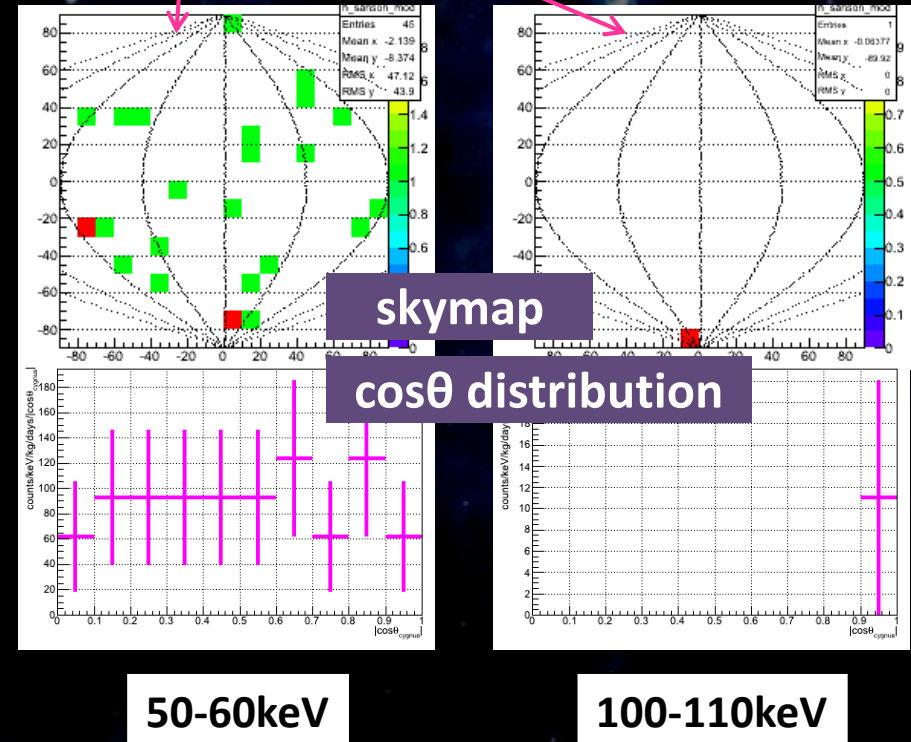


Energy spectrum

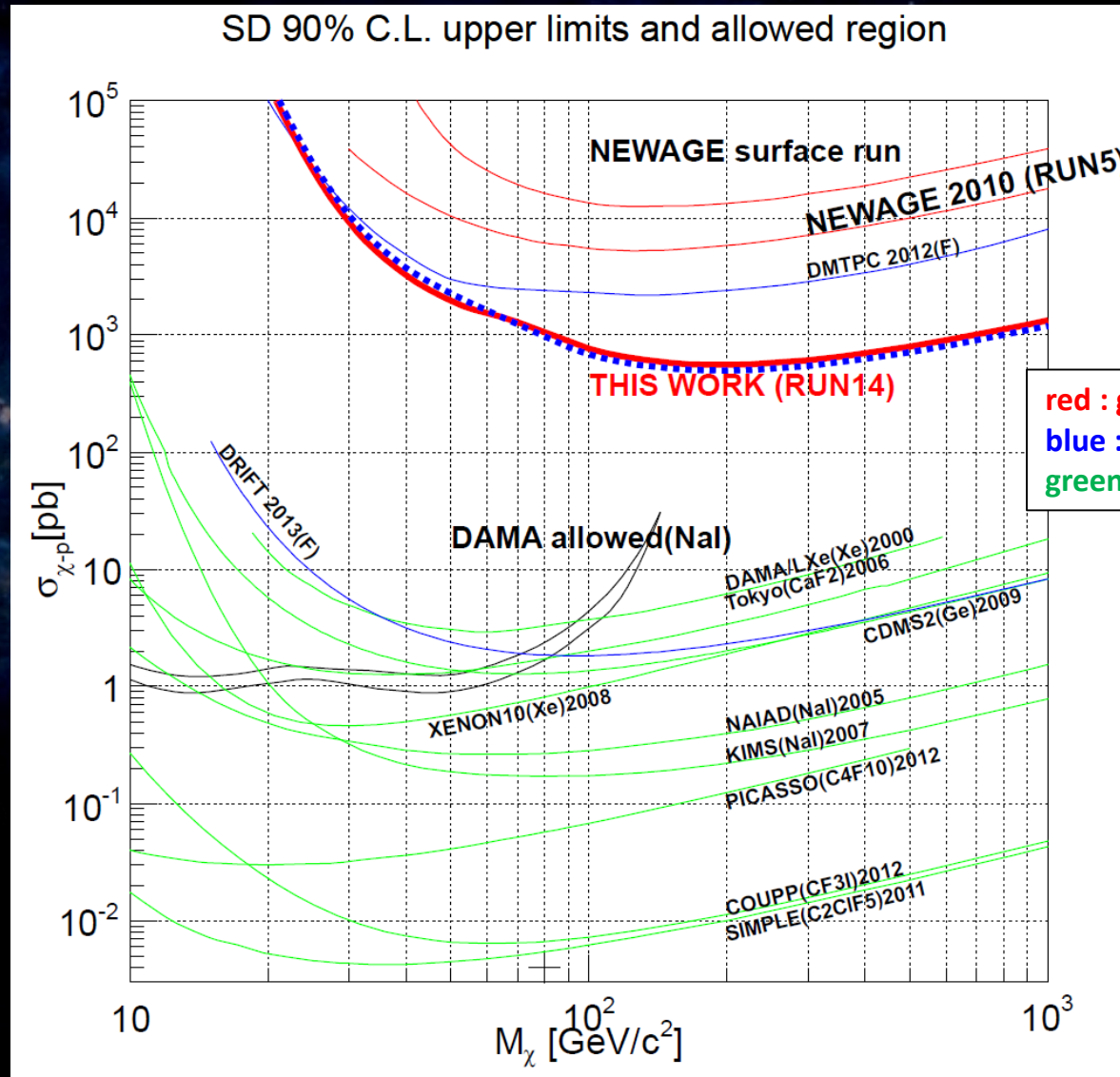
- Threshold : 100 => **50keV**
- BG rate : **1/10**@100keV

Skymap, $\cos\theta$ distribution

- Set limit by significant difference in 2-binned measured $\cos\theta$ and DM-wind simulated $\cos\theta$



Direction-sensitive limit



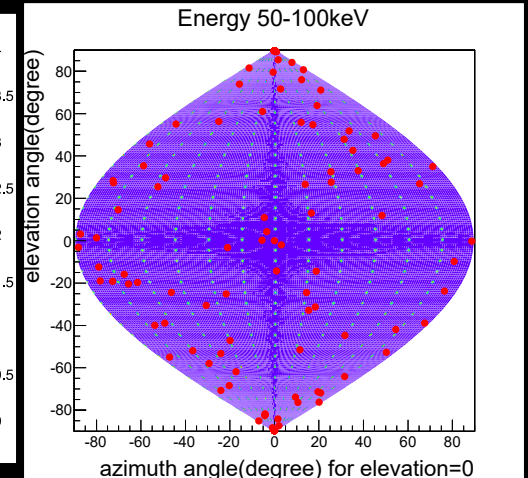
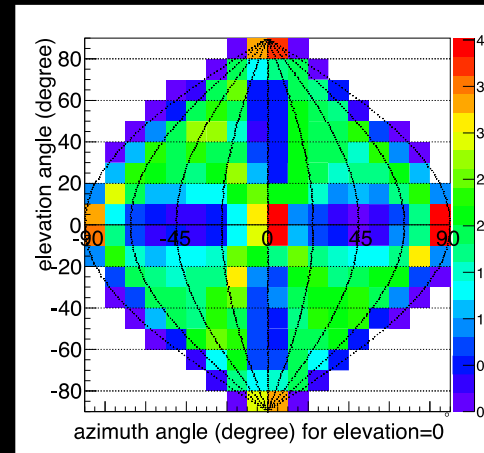
PTEP (2015) 043F01s

- Obtained limit : **557pb @200GeV**
(Best direction-sensitive limit)
- Improved one order of magnitude from previous RUN5

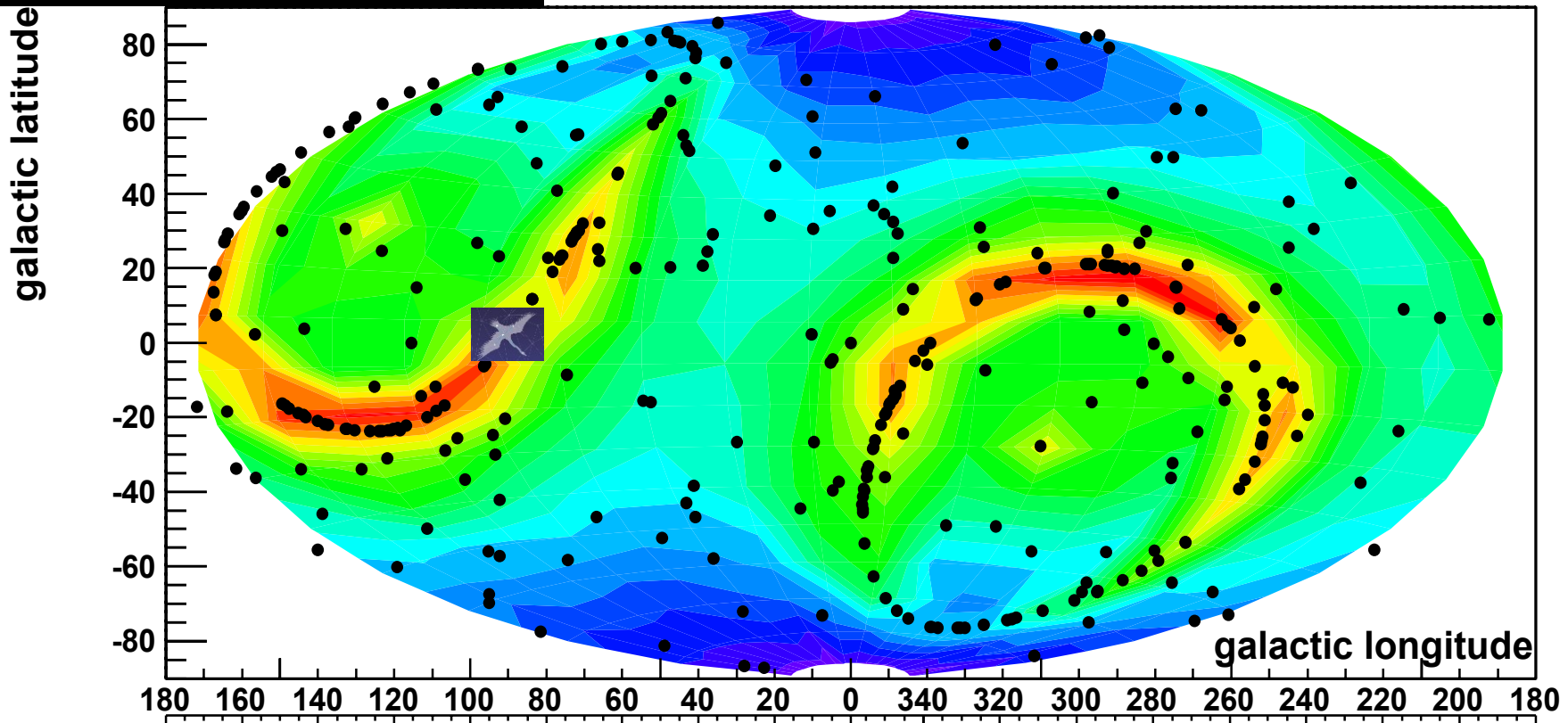
Galactic-plane sky-map

lab-coordinate

correlation with efficiency = consistent with isotropic



galactic coordinate



Recent R&Ds

A dark, stylized illustration of a hand holding a pen, with the text 'Recent R&Ds' overlaid in the center. The background is a dark, textured surface, possibly a book cover or a piece of paper, with a faint outline of a hand holding a pen. The text is in a bold, white, sans-serif font.

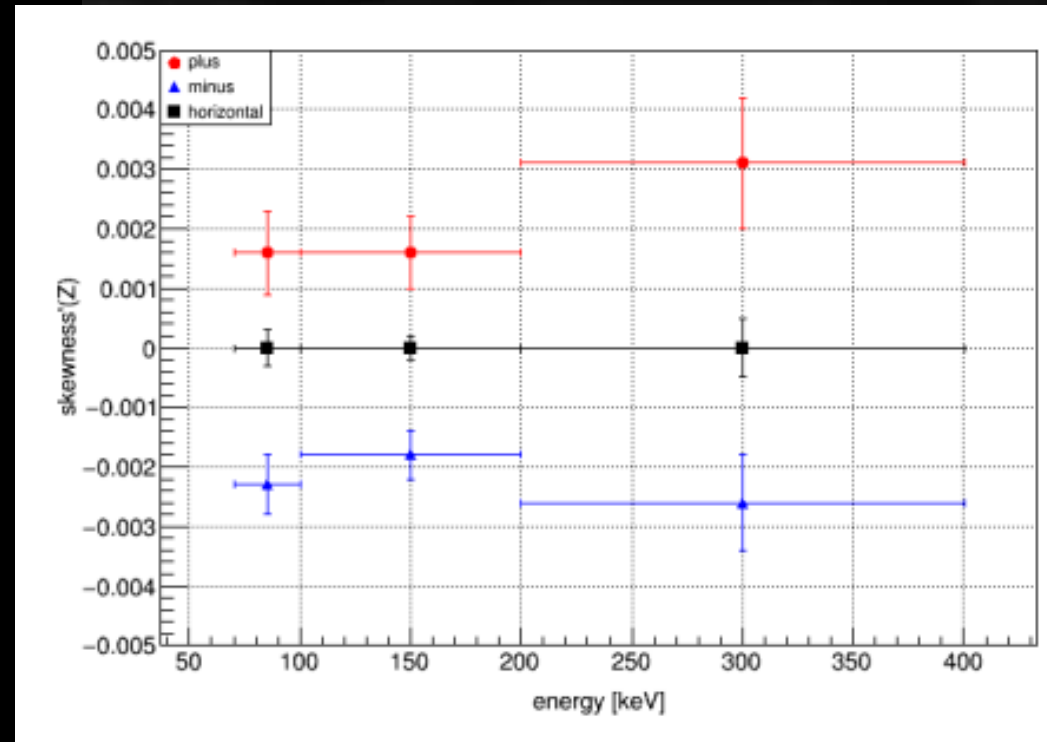
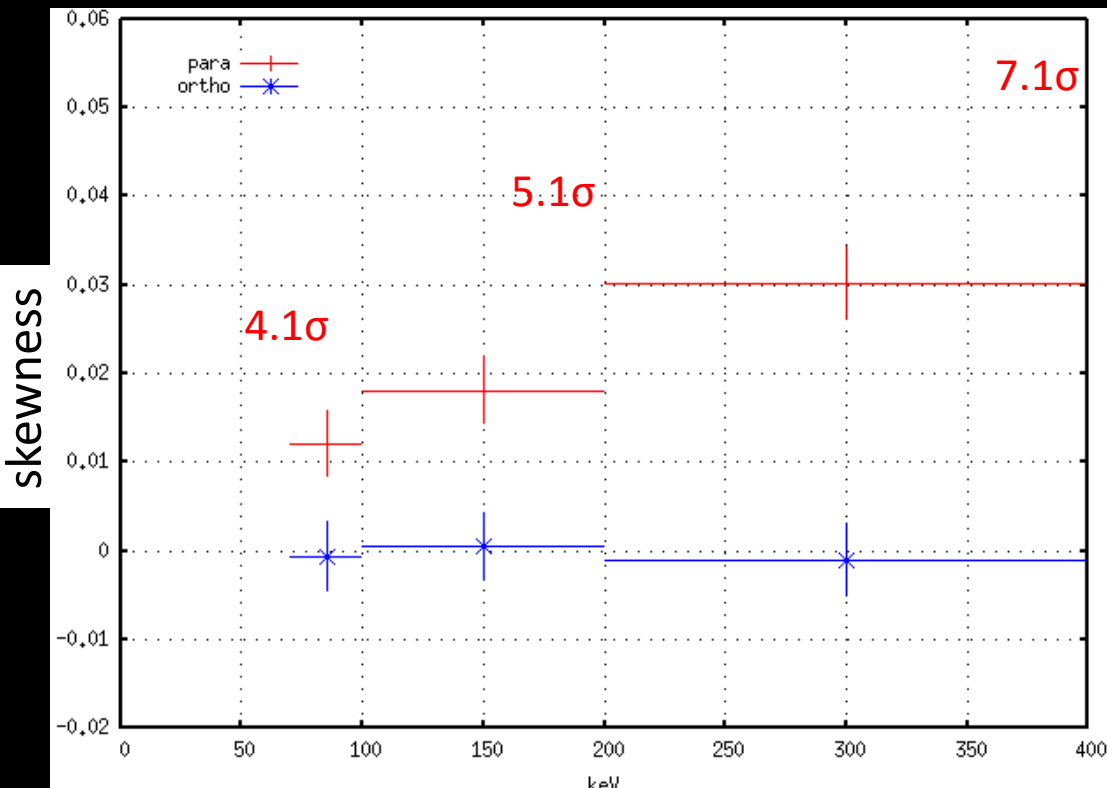
Head/tail study

Poster 14 by YAKABE

- Head tail in X-Y plane, Z-axis
- Proof of concept, DONE.
- Improvement for practical use: being studied

X-Y plane

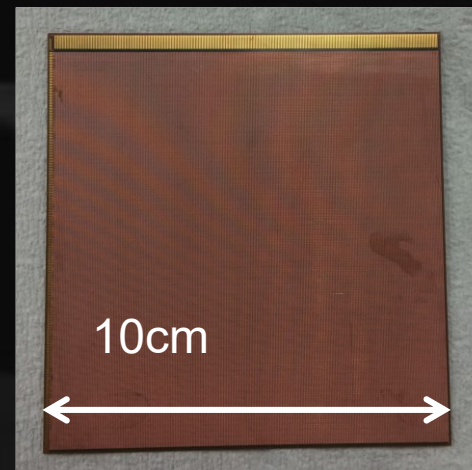
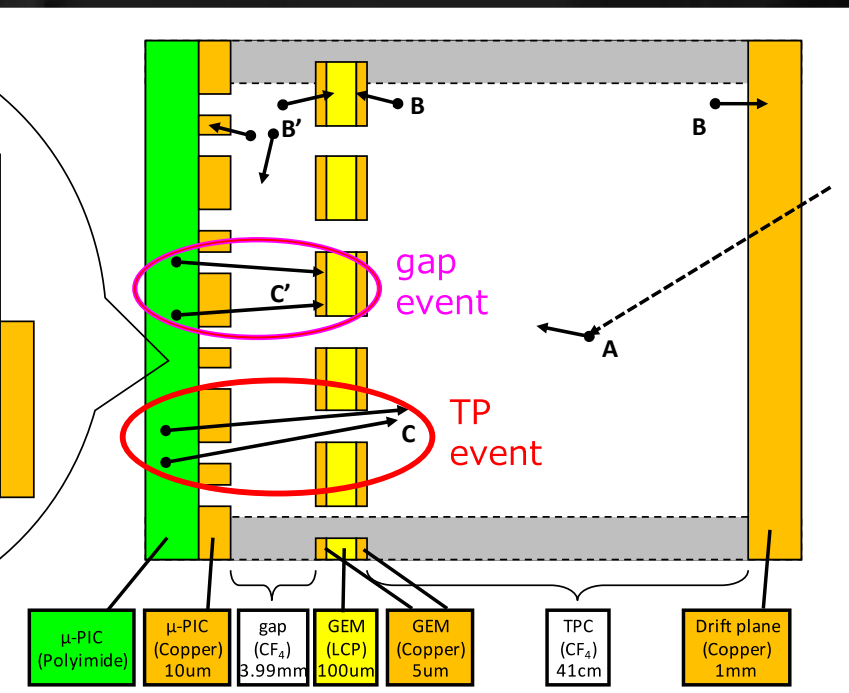
Z axis



BG study and more

Poster 13 by HASHIMOTO

- Largest BG source: alpha particle from μ -PIC
- Development of radio-pure(BG $\times 1/100$) μ -PIC:
10 \times 10cm² μ -PIC was made and tested



- FY2016: development of 30 \times 30cm² μ -PIC
- FY2017~: underground run

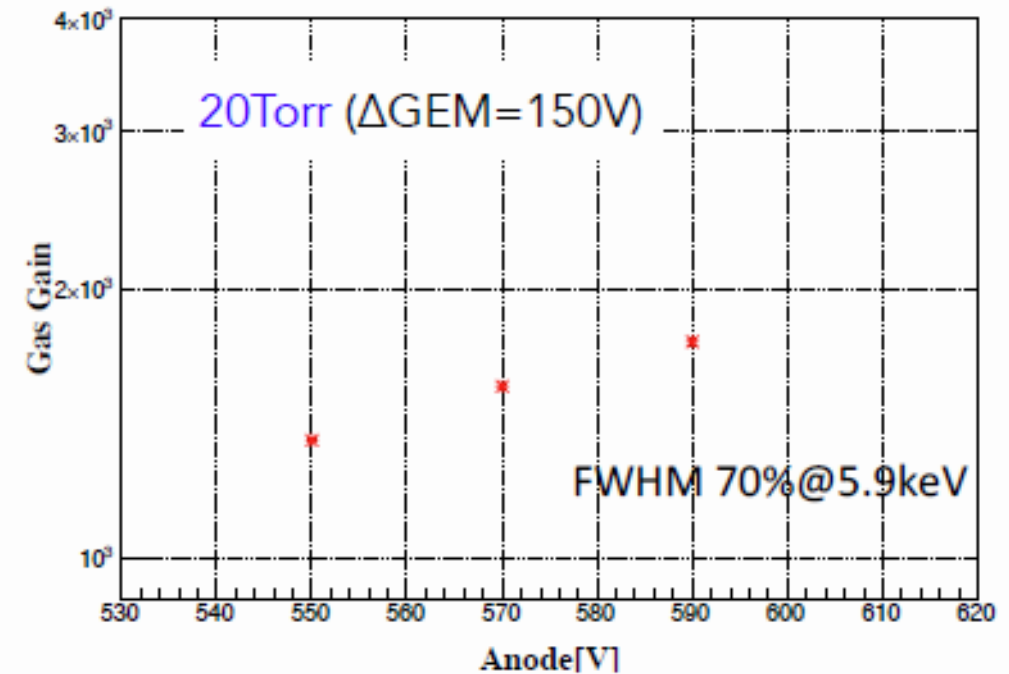
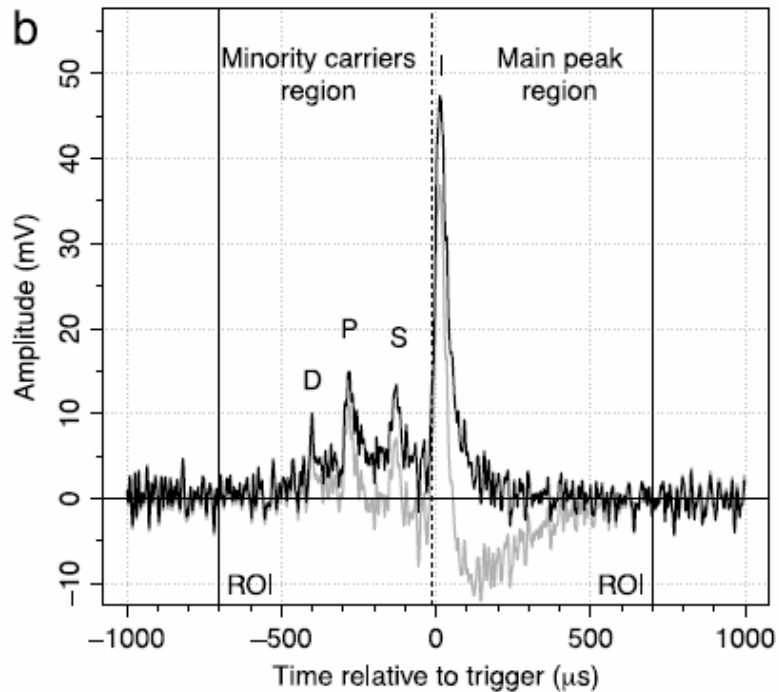
Z-fiducialization

Poster 12 by IKEDA

- minority peaks “discovery” by DERIT group
- SF₆ study for GEM+ μ PIC system

minority peaks (DRIFT group)

SF6 study



Summary

- NEWAGE has been and will always be direction sensitive with 3D track detection.
- Low BG studies are intensively on-going.

“Revealing the history of the universe with underground particle and nuclear research”

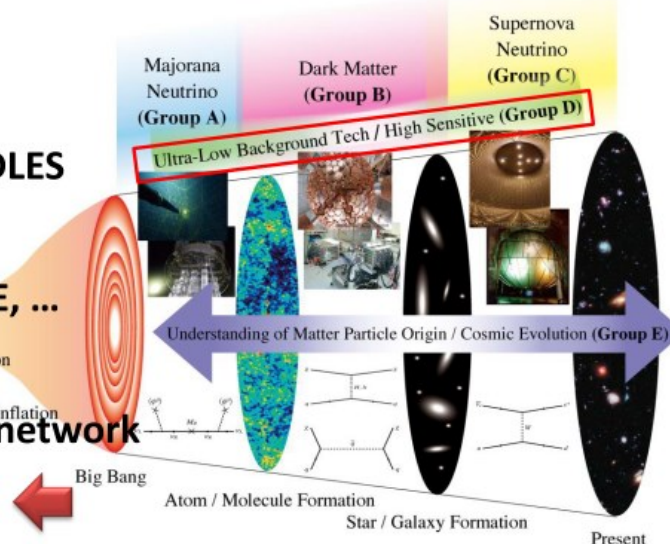
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<http://www.lowbg.org/ugnd/>

Cooperate among underground experiments, theorists, & low-BG researchers to achieve technical and scientific synergies.

Research groups:

- A: Majorana ν**
 - A01: KamLAND, A02: CANDLES
- B: Dark matter**
 - B01: XMASS, B02: NEWAGE, ...
- C: Supernova ν**
 - C01: GADZOOKS!, C02: SN network
- D01: Low BG techniques**
- E01: Theory**



Direction Sensitive
WIMP-search
NEWAGE