NEWAGE

(New generation WIMP search with an advanced gaseous tracker experiment)

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with

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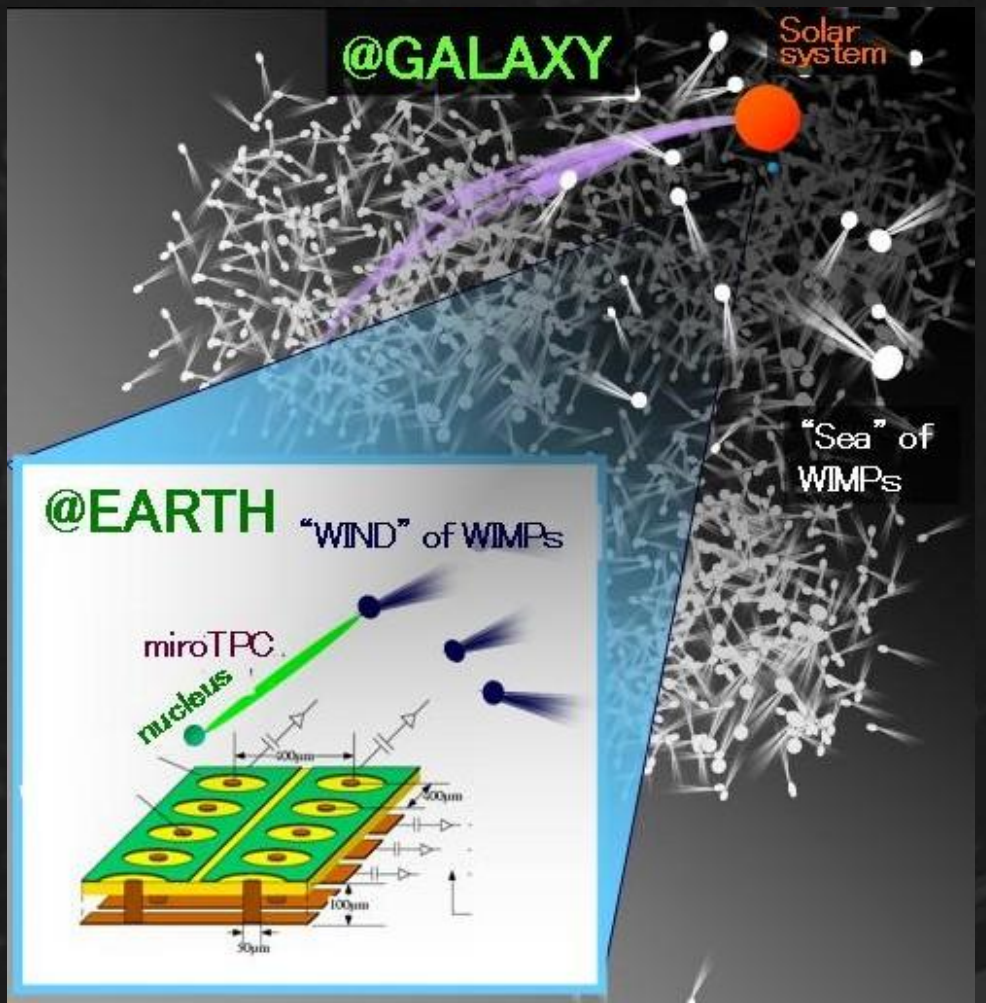
(Kamioka)



OUTLINE

- NEWAGE
  - detector, its performance
- Highlights since CYGNUS 2007
  - underground activities
  - angular resolution measurement
  - background
  - R&D for future
- Summary

for further info…
visit our page

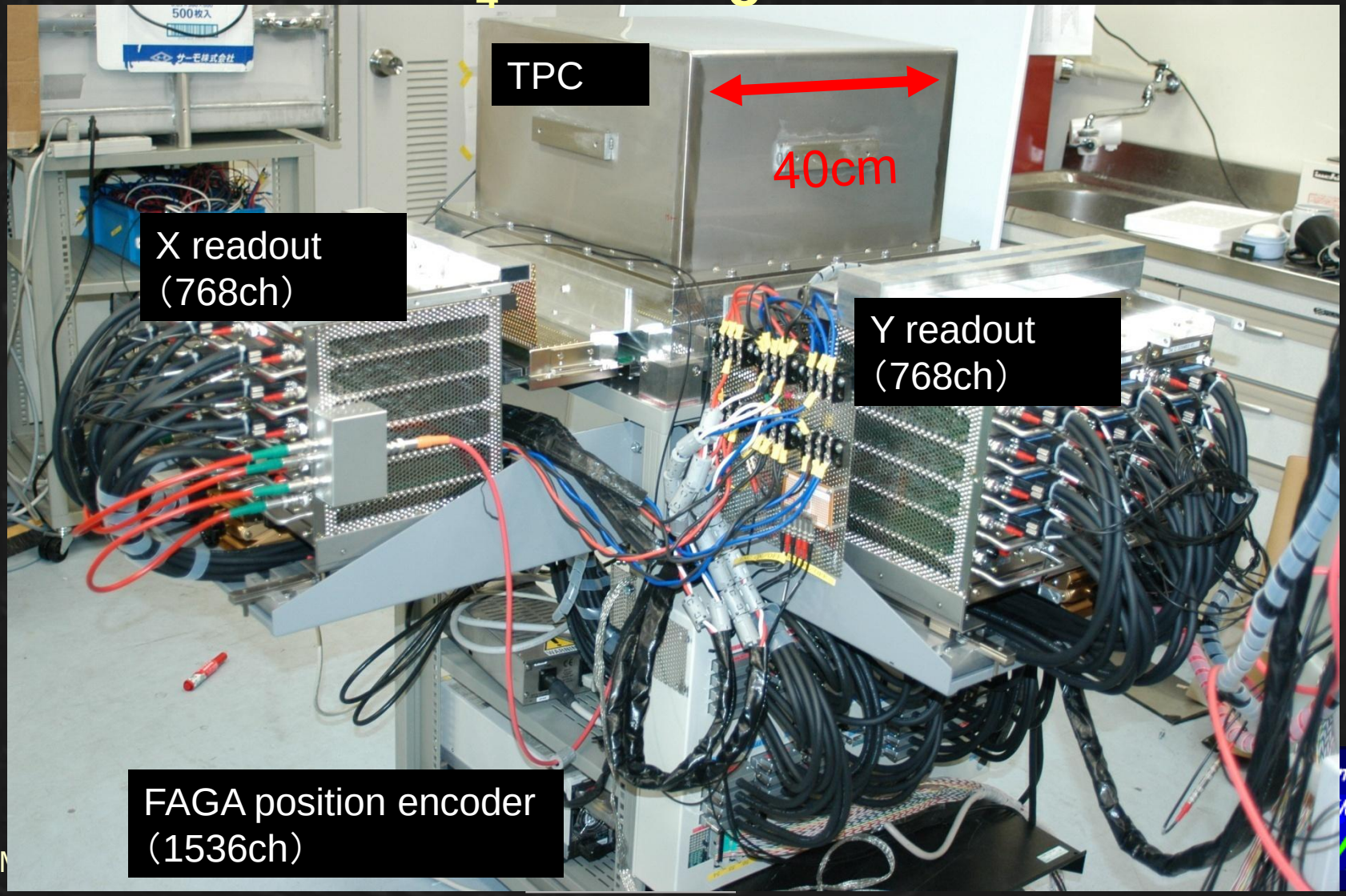
and get Nishimura's doctor thesis

NEWAGE：system

Direction Sensitive
WIMP-search
NEWAGE

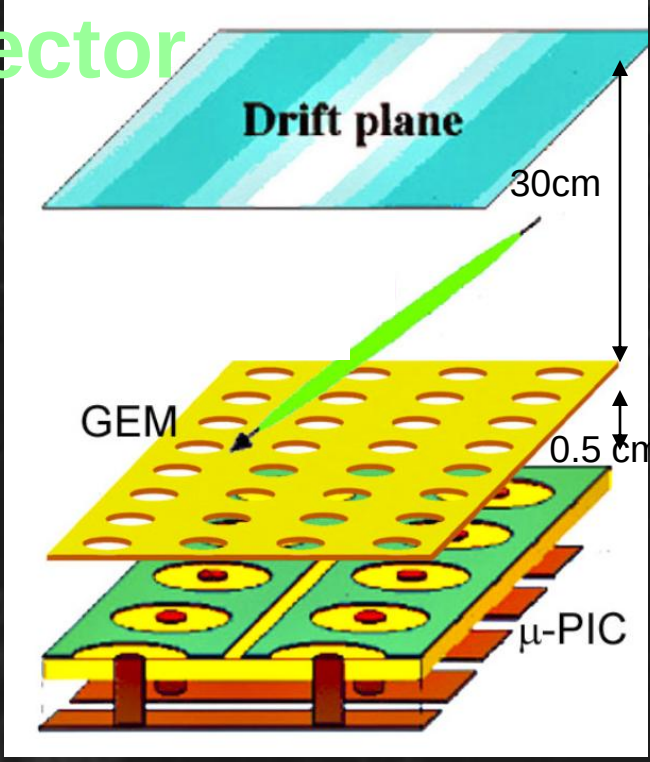
Detector

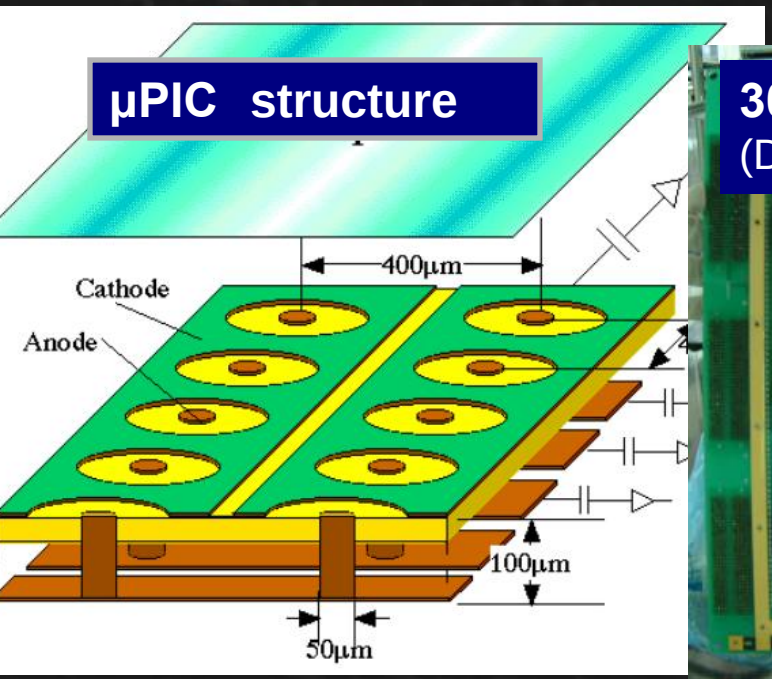
- NEWAGE-0.3a $23 \times 28 \times 31 cm^3$
- 152torr CF_4 = 11.48g

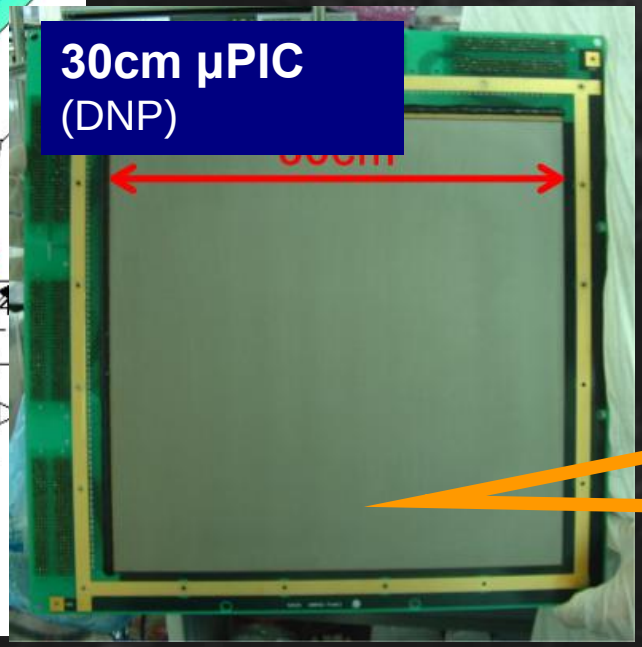


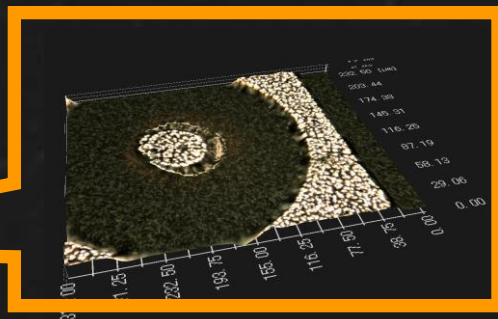
Micro-patterned gaseous detector

- μ-PIC (30*30cm^2)
  - Gas amplification + readout
  - 400μm pitch
  - 768+768 readouts
  - Gas gain ~1000 with 152torr CF_4





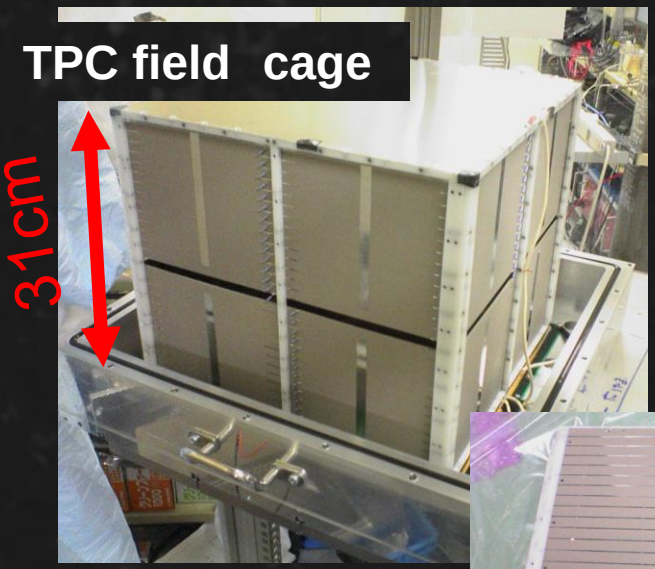


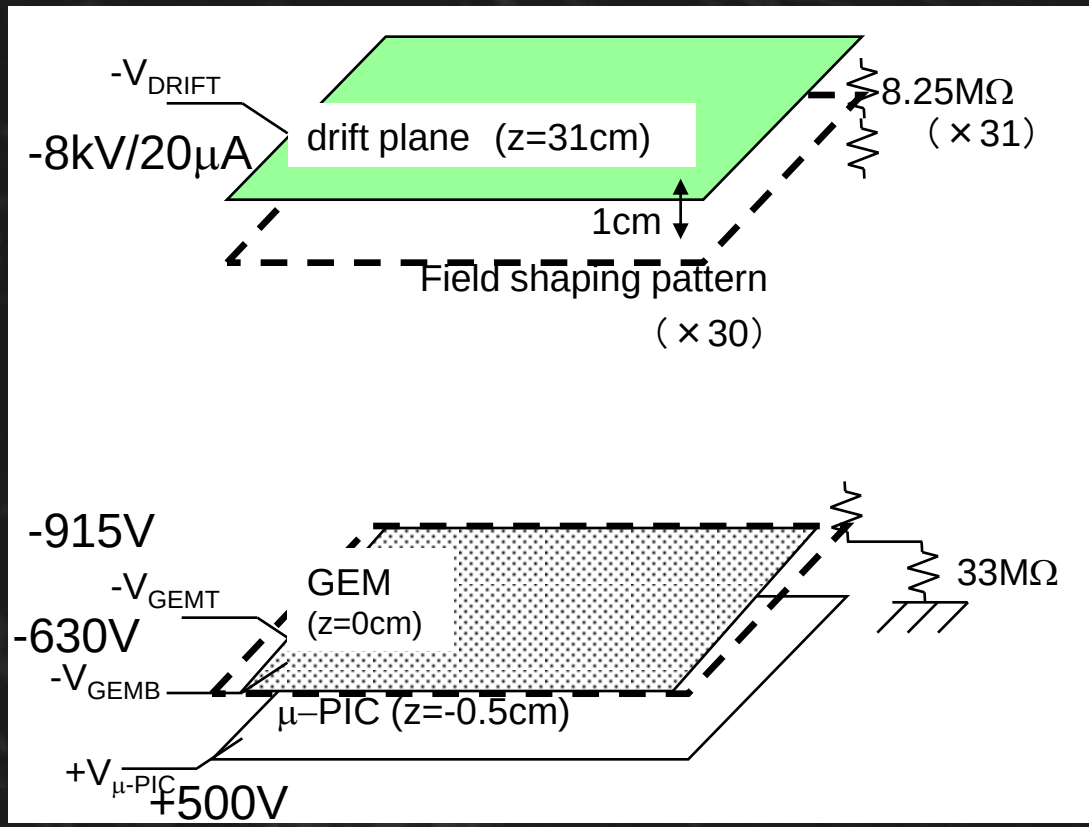


NEWAGE

TPC system

- Gas volume
  - DRIFT length 31cm
  - CF_4 152 torr gas
  - sealed operation with a getter pump





- Readout electronics tomorrow

Direction Sensitive WIMP-search NEWAGE

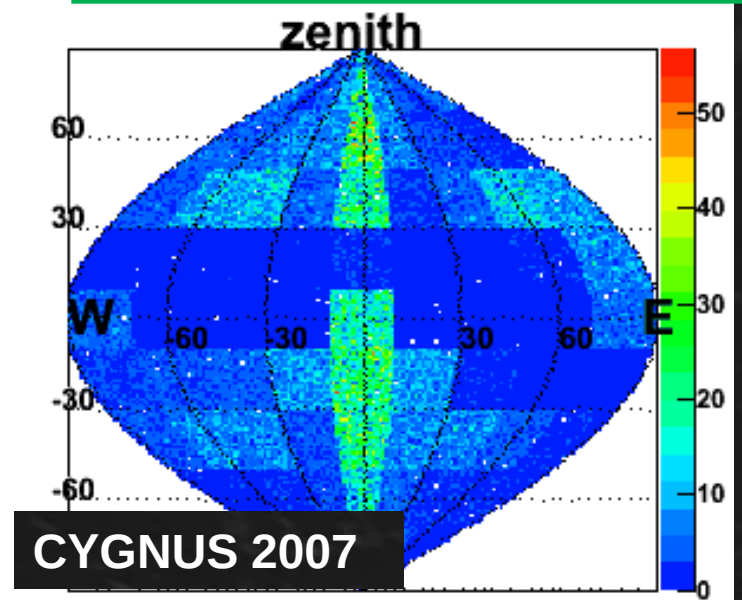
NEWAGE：performance

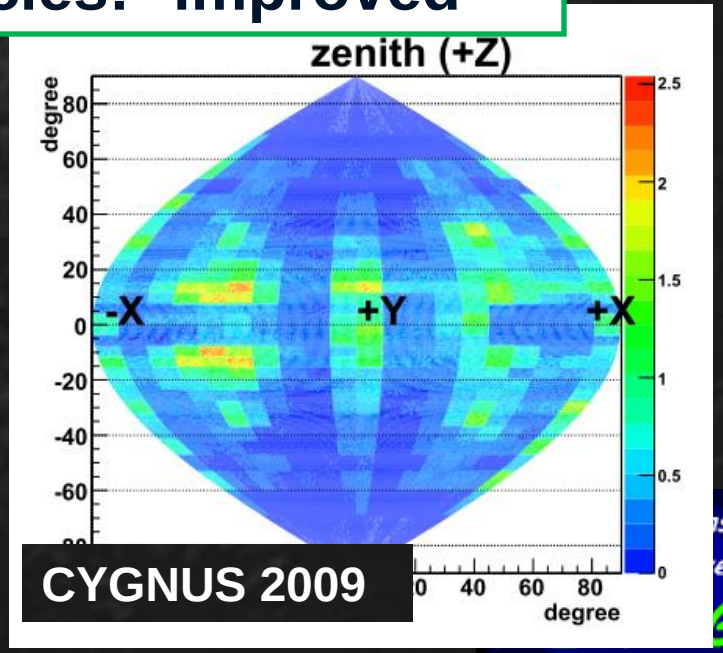
Direction Sensitive
WIMP-search
NEWAGE

- **Performance summary (skipping measurement details…)**

parameter	value	
energy resolution	45%(FWHM)	@6MeV
	70%(FWHM)	@100keV
γ-ray efficiency	8.1×10^{-6}	@100keV
Energy threshold	100keV	
Detection efficiency	80%	@100keV

direction-dependent efficiencies: improved

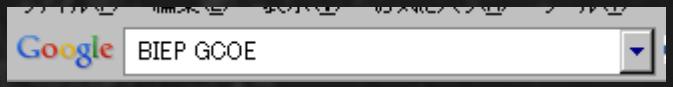




Before the HIGHLIGHTS : announcement

Kyoto university's GCOE started
BIEP (Bilateral International Exchange Program)

for graduate students, up to 3 month



Direction Sensitive WIMP-search NEWAGE

HIGHLIGHTS : underground activities

Direction Sensitive WIMP-search NEWAGE

Underground log (NEWAGE-0.3a at Kamioka)

run ID
exposure(kg・days)

2007

Installation | run1 0.08 | run2 0.15 | Commissioning

2007/3/6 — 2007/5/15 — 2007/8/6 — 2007/12/7

1/4 volume run

GEM replacement

2008

run3 1.744 kg・days | run4 0.602 | run5 0.524

2008/6/9 — 2008/9/9 — 2008/12/2

full operation performance study

BG study

DM run

2009

Commissioning | run6 0.817+

2009/3/2

gas circulation system installation

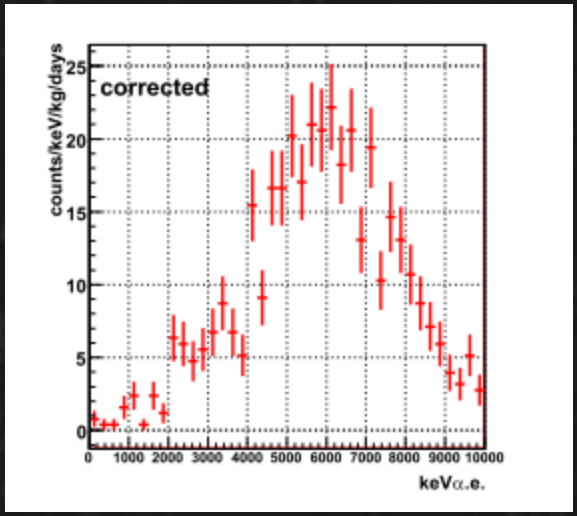
total exposure
3.917 kg・days

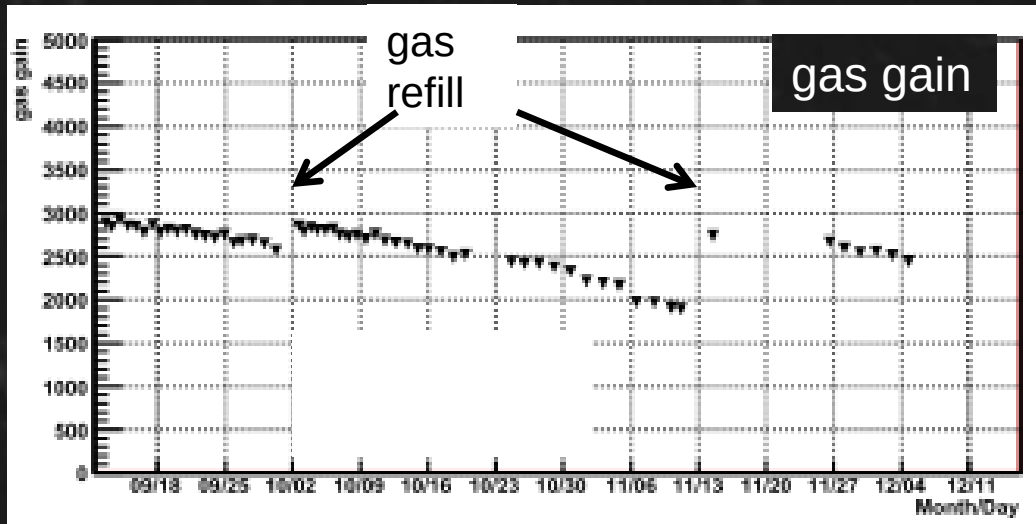
K.

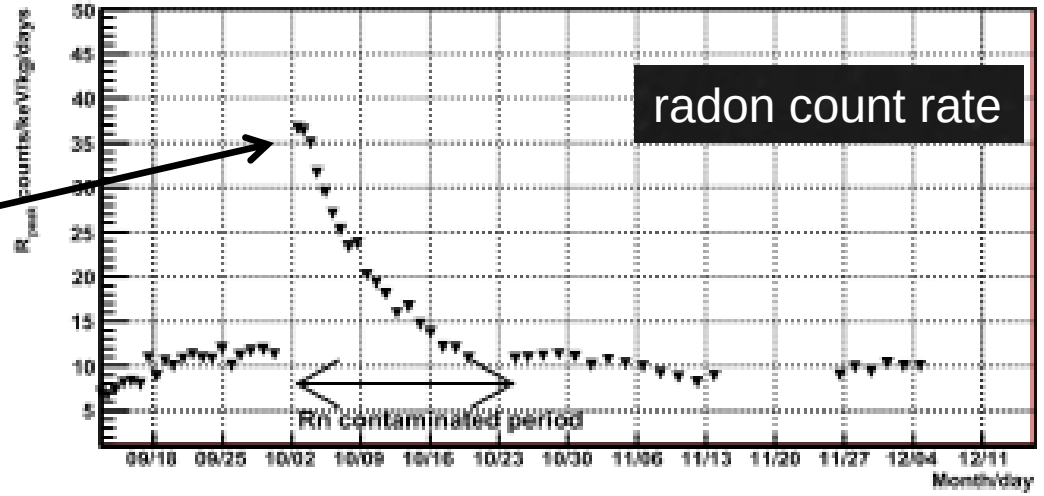

(NEWAGE-0.3a at Kamioka)
run ID
CYGNUS 07
HIGHLIGHTS:
Latest Dark Matter Run
2007
0.08
0.15
commissioning
2007/3/6
2007/5/15
2007/8/6
2007/12/7
1/4 volume run
GEM replacement
2008
run3
1.744 kg･days
run4
0.602
run5
0.524
2008/6/9
2008/9/9
2008/12/
full operation
performance study
BG study
DM run
2009
Commiss
ioning
run6
0.817+
2009/3/2
gas circulation
system installation
total exposur
3.918 kg･day

RUN5 results①：stability

- gas gain 3000 ⇒ 2000 in one month
  ⇒ refilled with fresh gas
- radon rate (~6MeV)

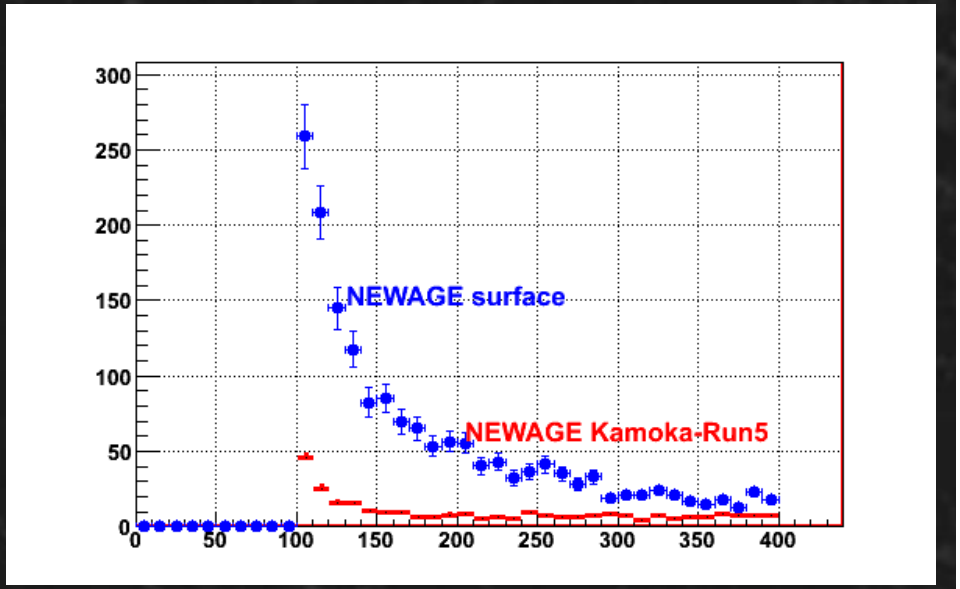


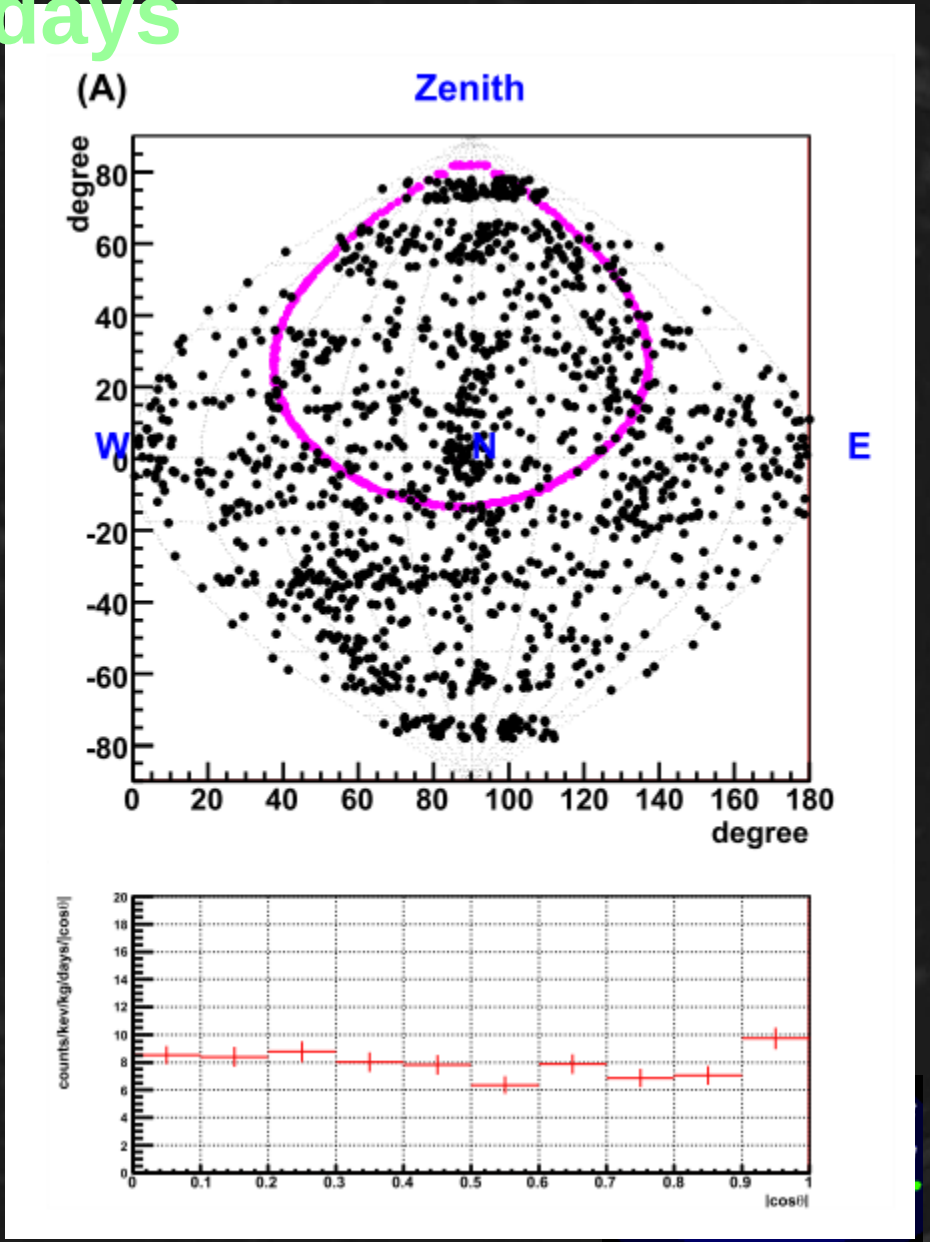




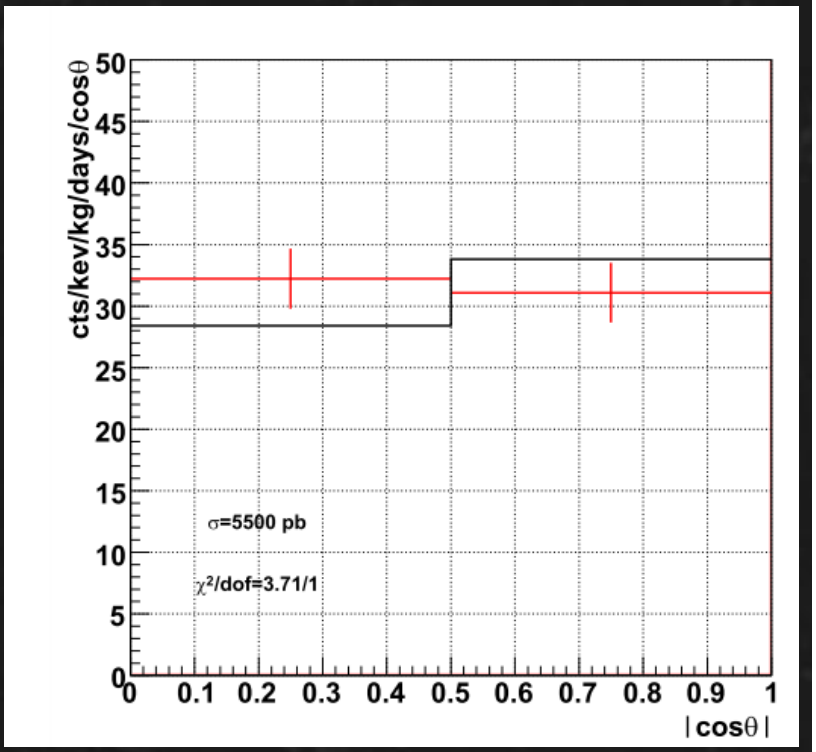
We used a gas tube exposed to the mine air…

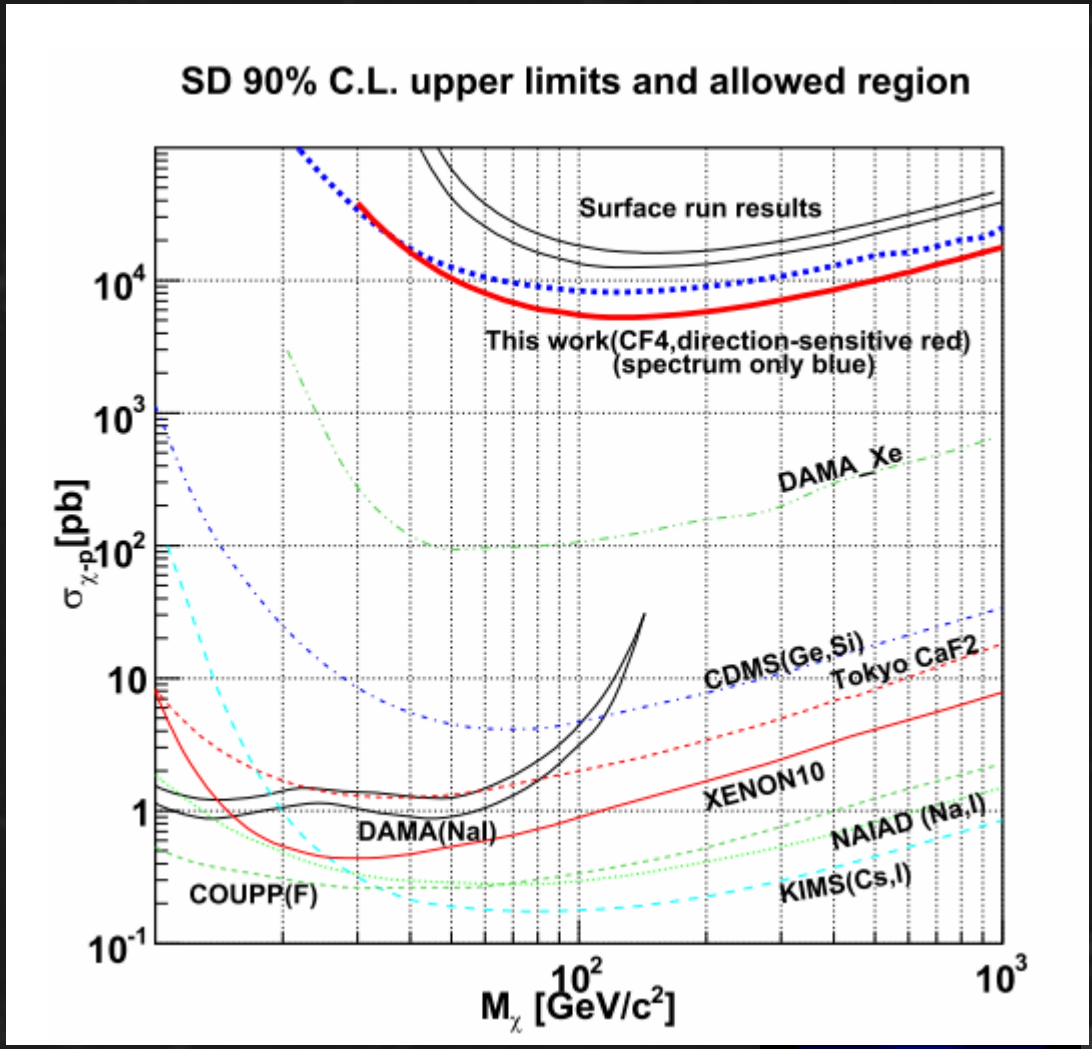
- RUN5 results②
  - exposure 0.524 kg･days
  - spectrum
    1/5 rate of the surface run
  - sky map
    flat cosθ distribution



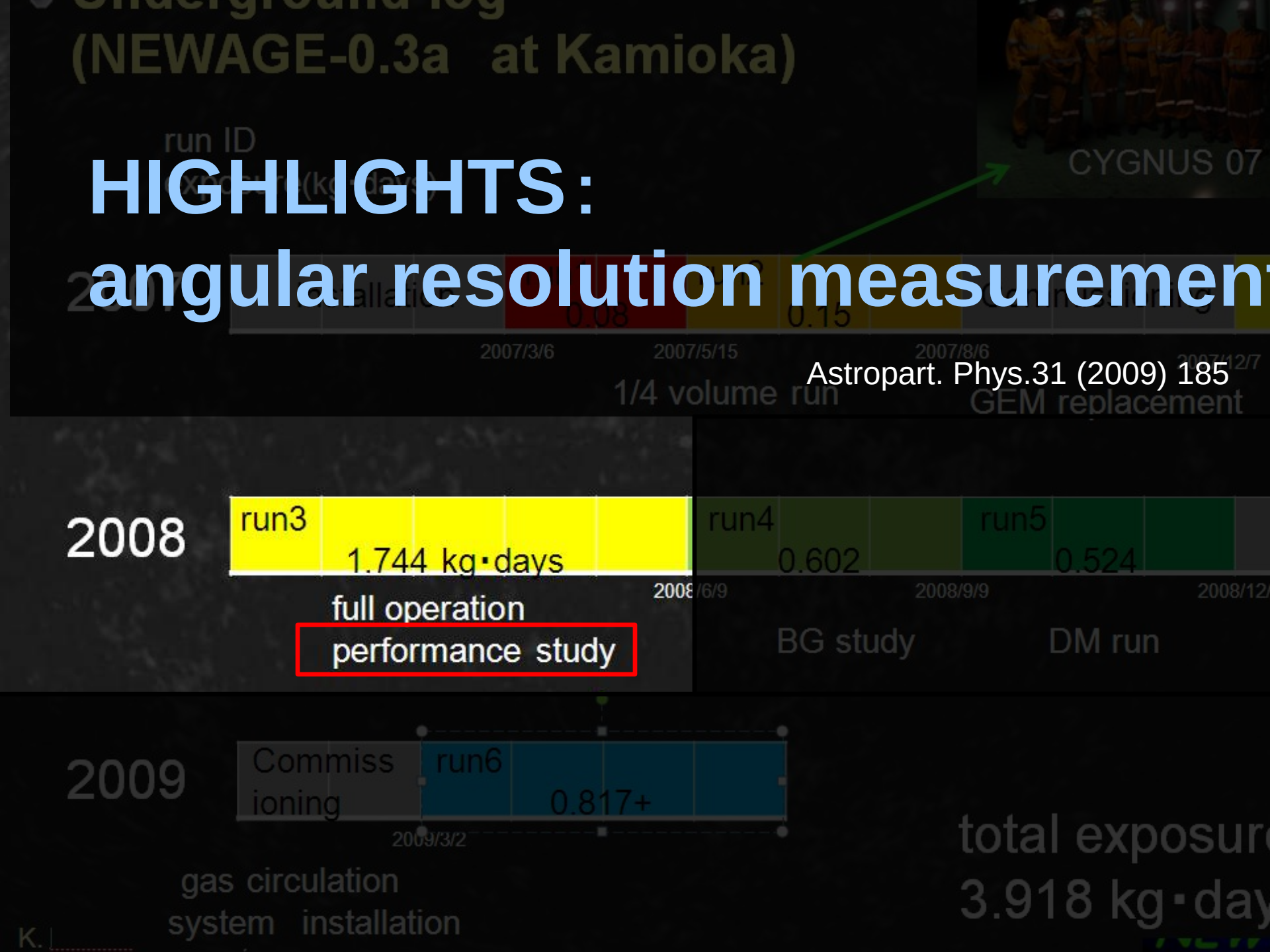


- RUN5 results③
  - poor statistics： 2bin analysis
  - new limits 5400pb for 150GeV





HIGHLIGHTS:
angular resolution measurement



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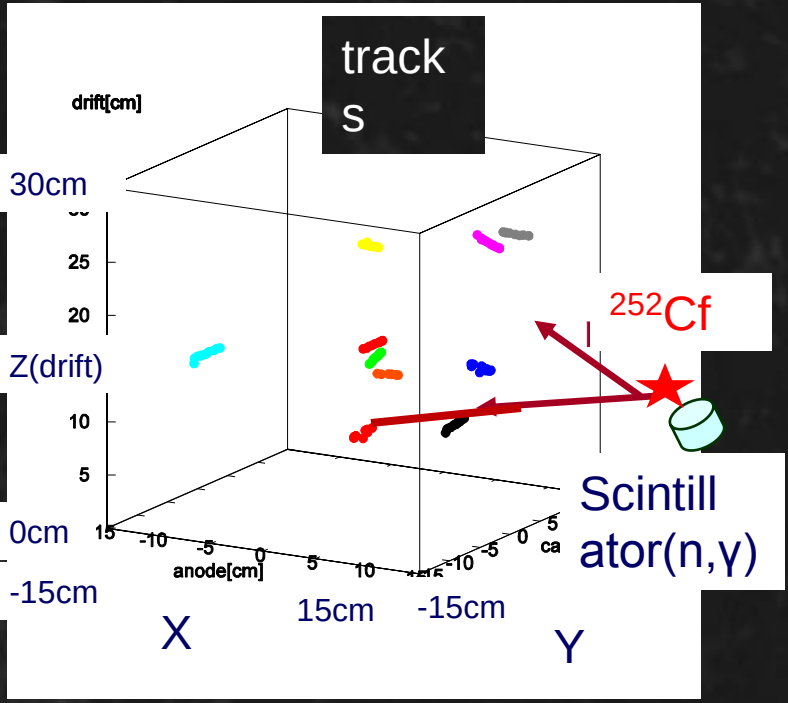
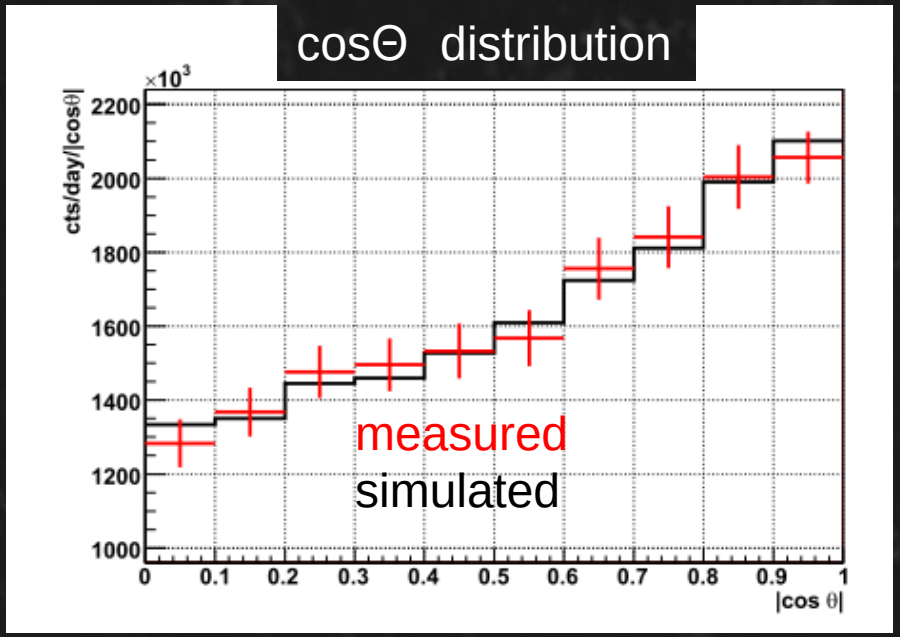
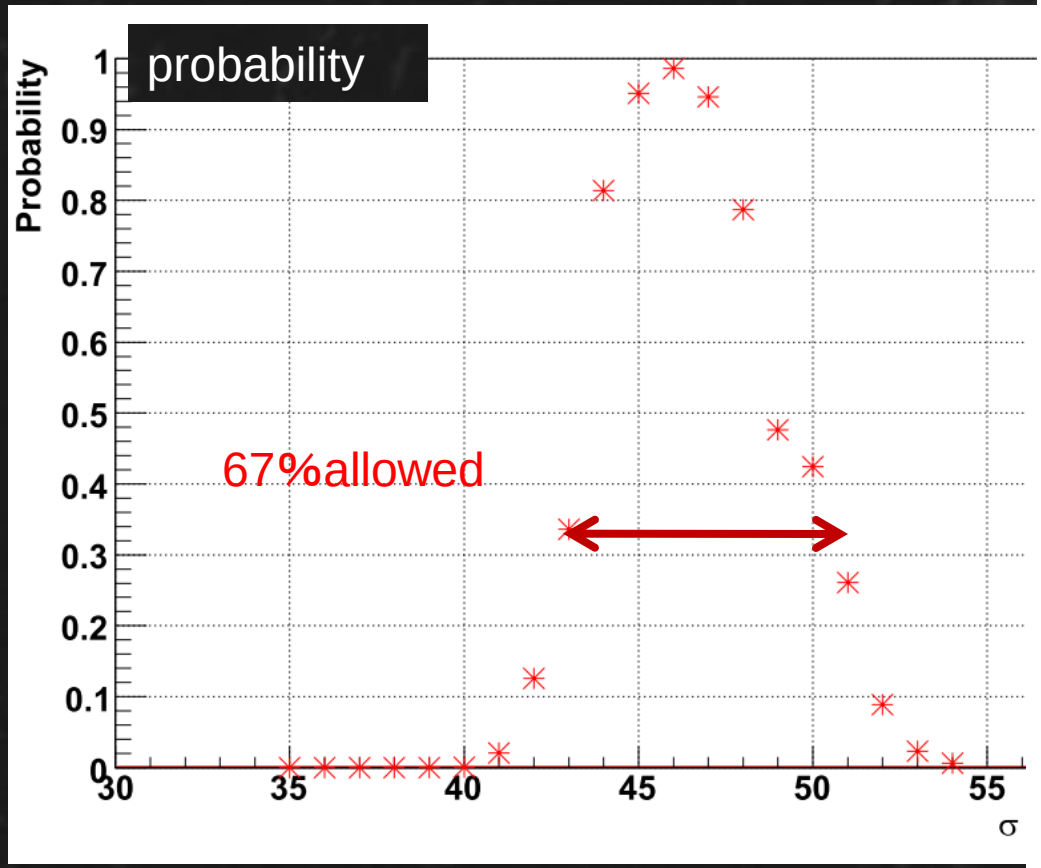
Methods

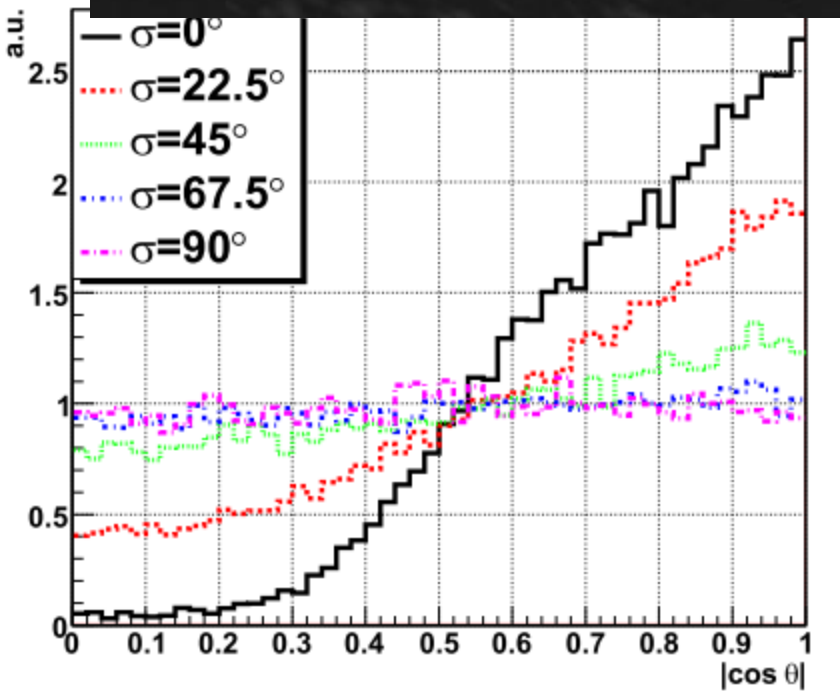
- 252Cf + trigger scintillator
- tracks with an absolute z
- measure recoil angle θ
- compare θ distribution

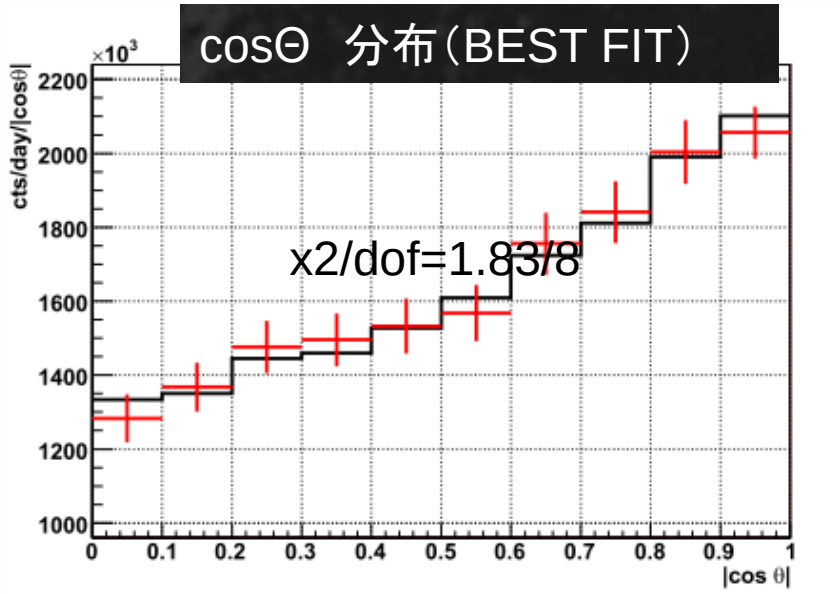




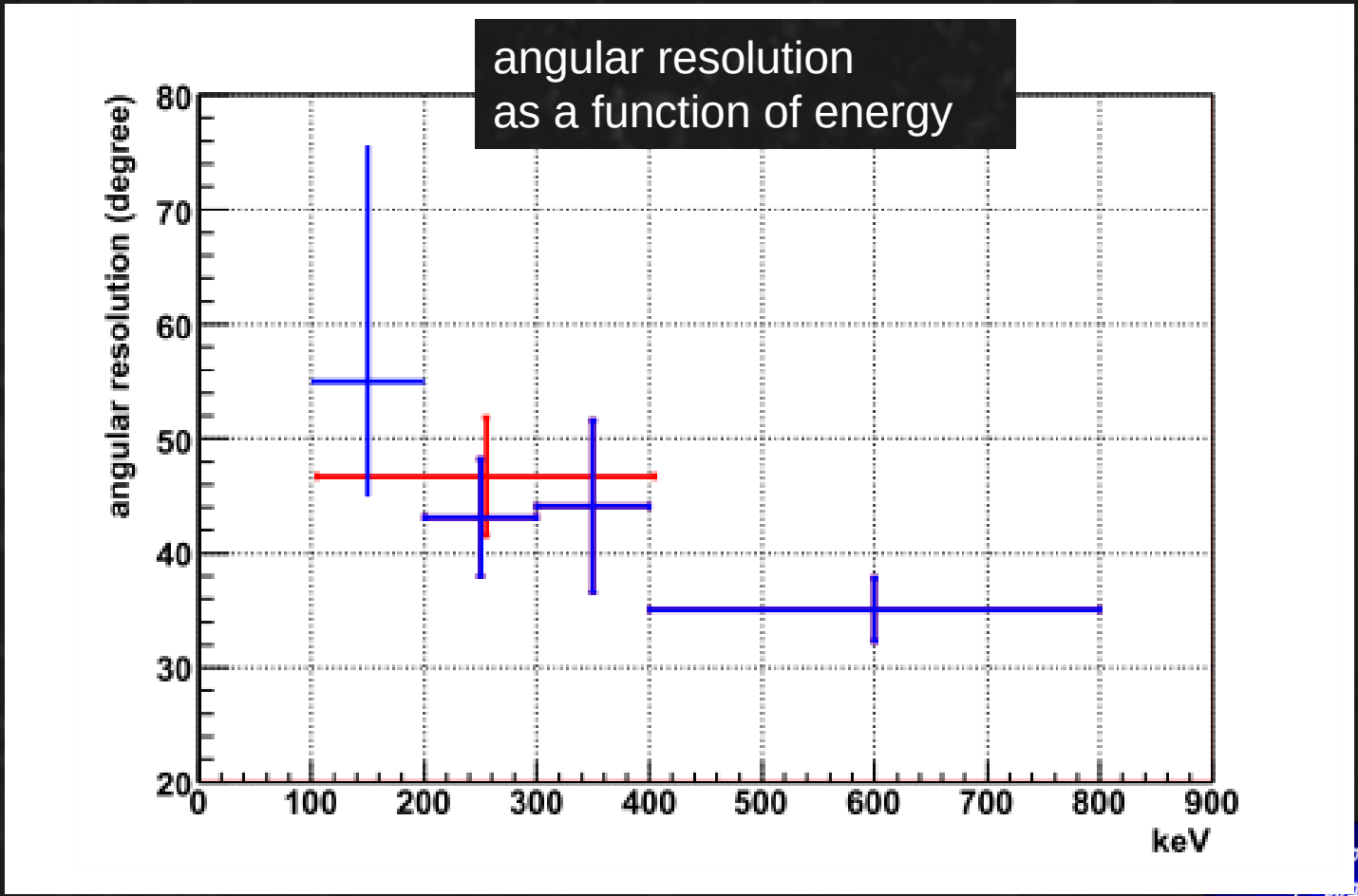
- analysis
  - 分解能σをふって、cosθ分
  - χ2 tests







- **results**
  - **46±3° (100-400keV)**
  - **would be improved with lower pressure gas**

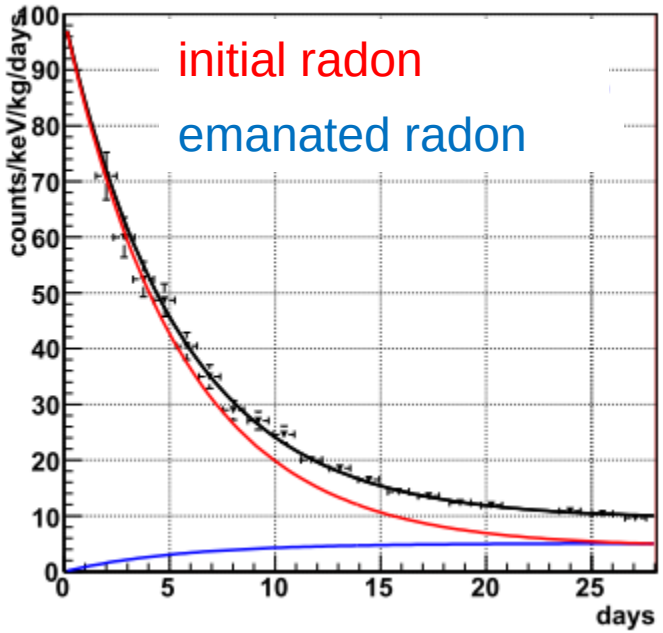


HIGHLIGHTS: Background Studies

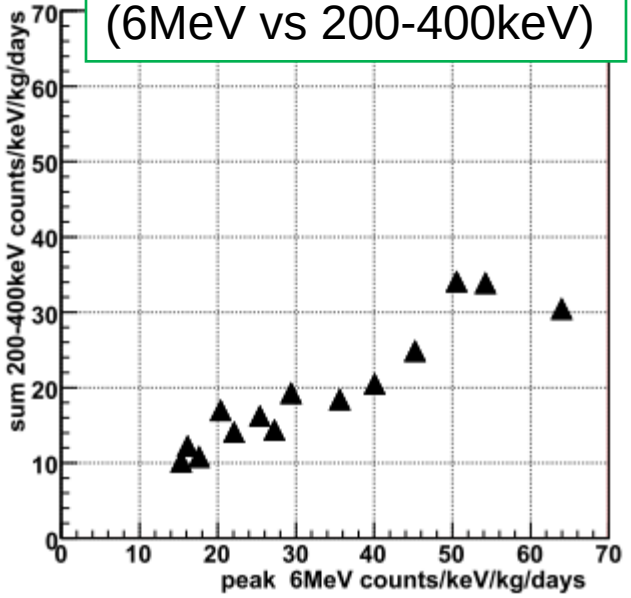
Radon contribution study (run4)

- exposed the TMP mine air
- radon-rich run

radon rate (~6MeV)

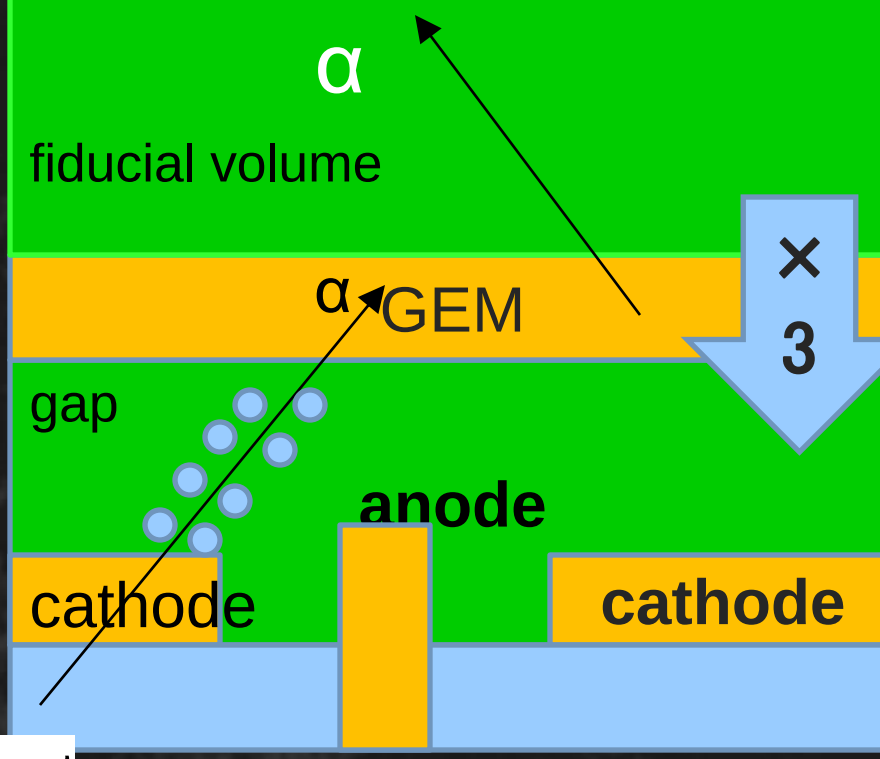


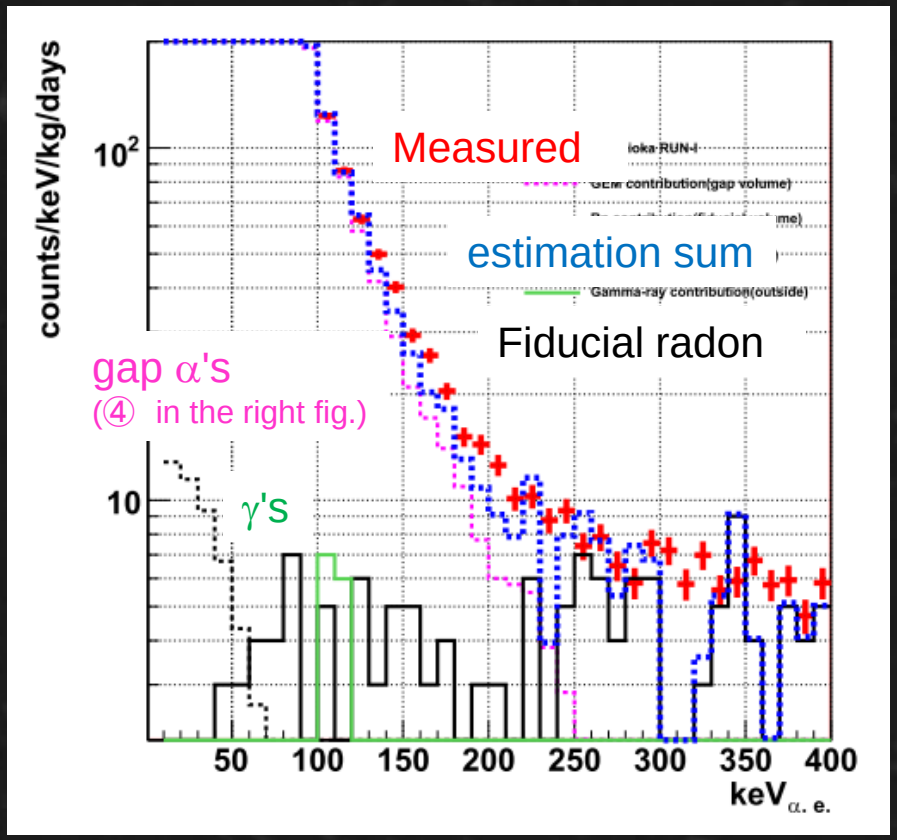
correlation
(6MeV vs 200-400keV)

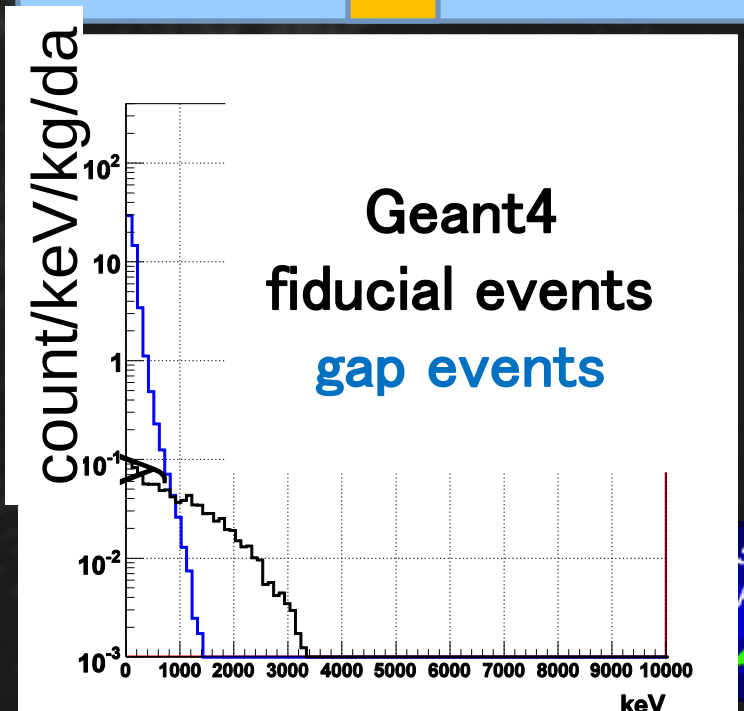


Direction Sensitive WIMP-search NEWAGE

- **Background budgets gap α's contribute most**





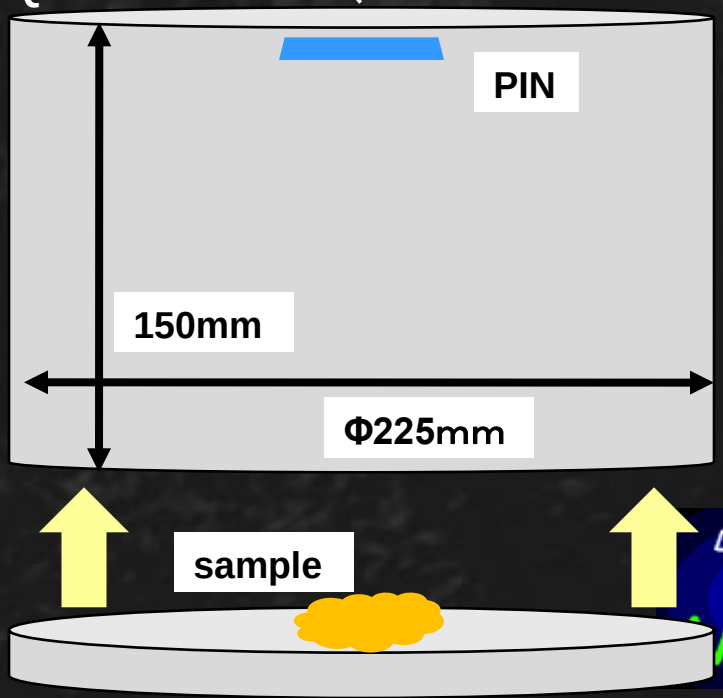


Material screening (Kyoto)

Radon detector (NEWAGE RD-1)

SPEC

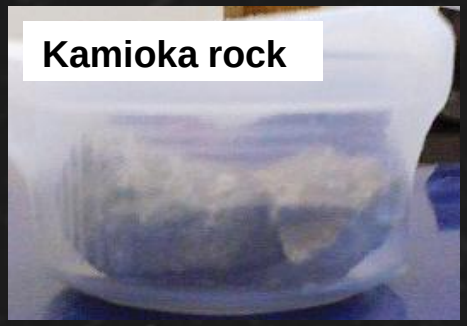
SUS 304 vessel 3mm-thick
electric polished
Windowless PIN photo-diode
（10×10mm² S3590-02）
Typical operation
-375V Po^+ capture / 9V reverse-bias
DAQ LPC-320901 （PCI-bus 40MHz FADC）

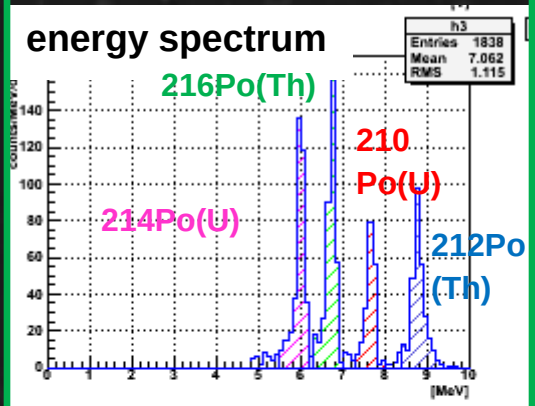


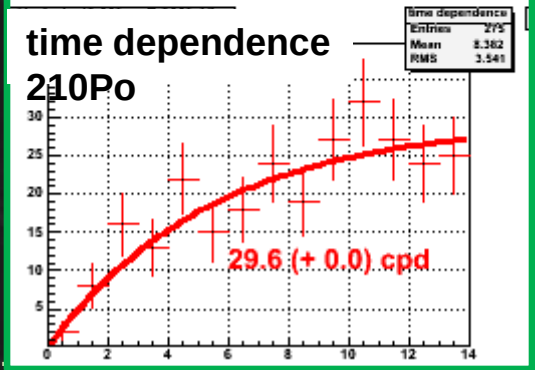
Direction Sensitive
WIMP-search
NEWAGE

NEWAGE RD-1 results (preliminary)

TEST SOURCE
(calibration to be done somehow…)

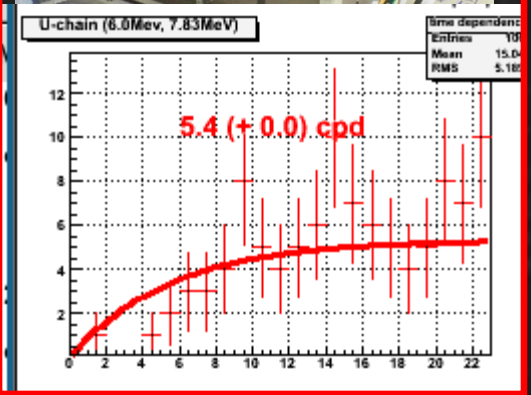






GUILTY

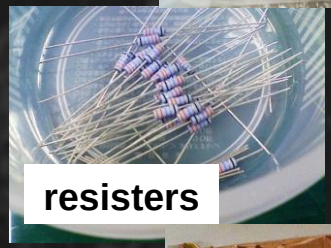
Fluoro-plastic for TPC board



NOT GUILTY

μ-PIC

μ-PIC base



resisters

GEMs

teflon-plates

Direction Sensitive WIMP-search NEWAGE

HIGHLIGHTS:
Gas circulation system

(NEWAGE-0.3a at Kamioka)

run ID

2007

0.08

0.15

2007/3/6

2007/5/15

2007/8/6

2007/12/7

1/4 volume run

GEM replacement

2008

run3

1.744 kg・days

run4

0.602

run5

0.524

2008/6/9

2008/9/9

full operation performance study

BG study

DM run

2009

Commiss ioning

run6

0.817+

2009/3/2

gas circulation system installation

total exposur

3.918 kg・day

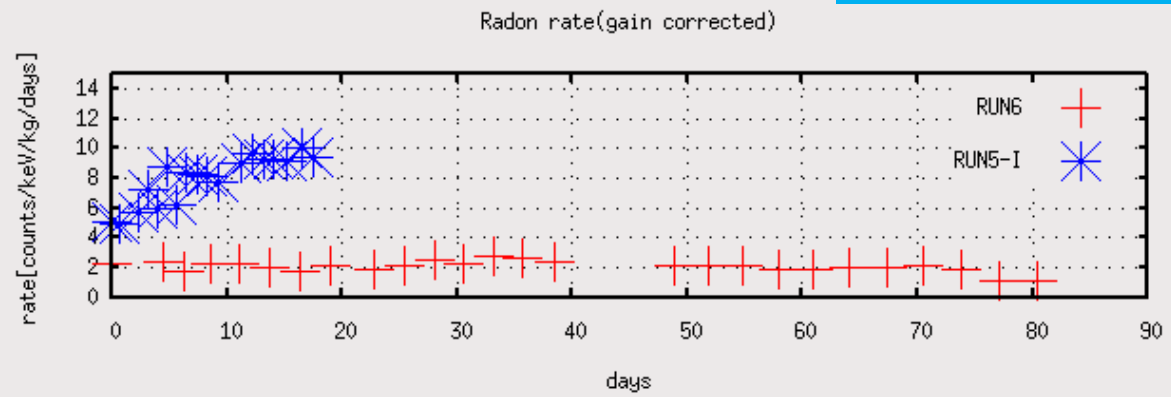
Gas system upgrade

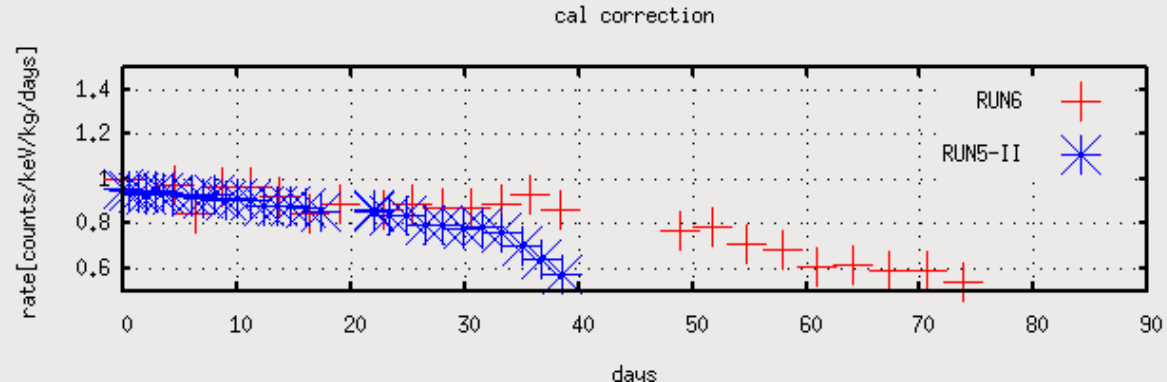
~ RUN5

sealed vessel
getter pump
(SAES GETTER C400-2DSK)
no circulation

RUN6 ~

sealed vessel
getter pump
(SAES GETTER C400-2DSK)
circulation
(Teflon bellows pump)
charcoal filter ~100g
(TSURUMICOAL 2GS)





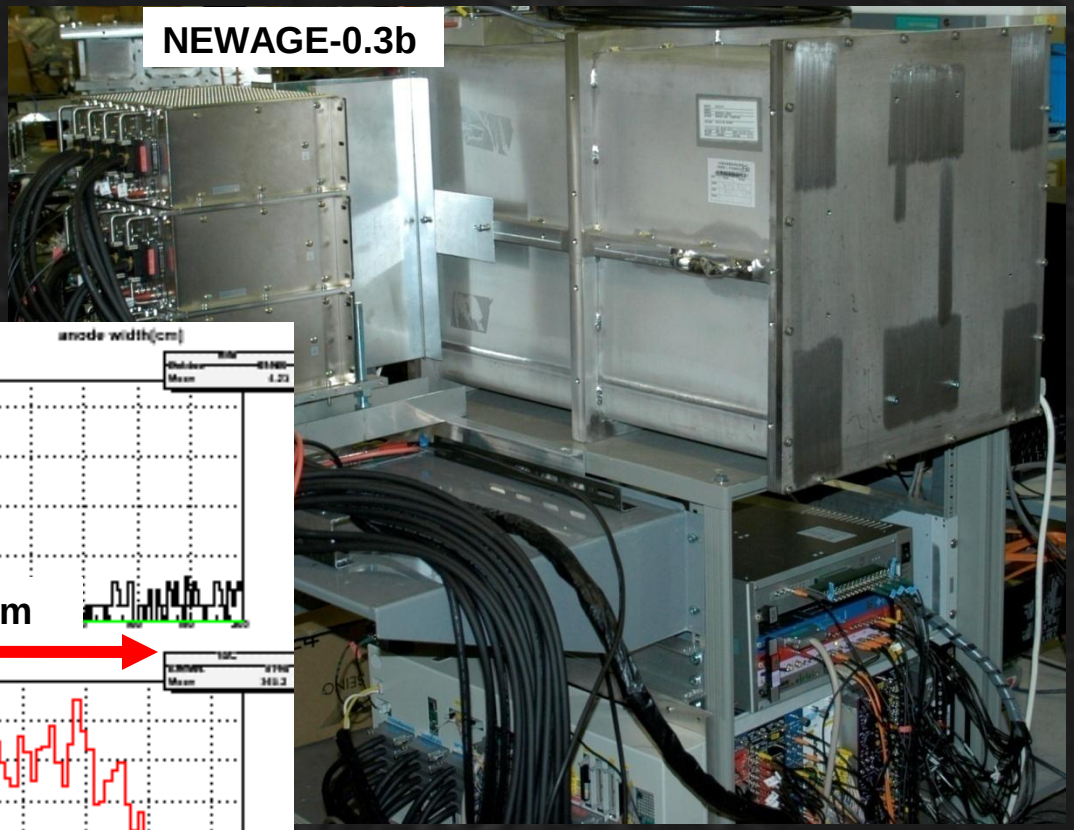
- **radon rate**
  ×1/5 @day10
- **gain stability**
  ×2

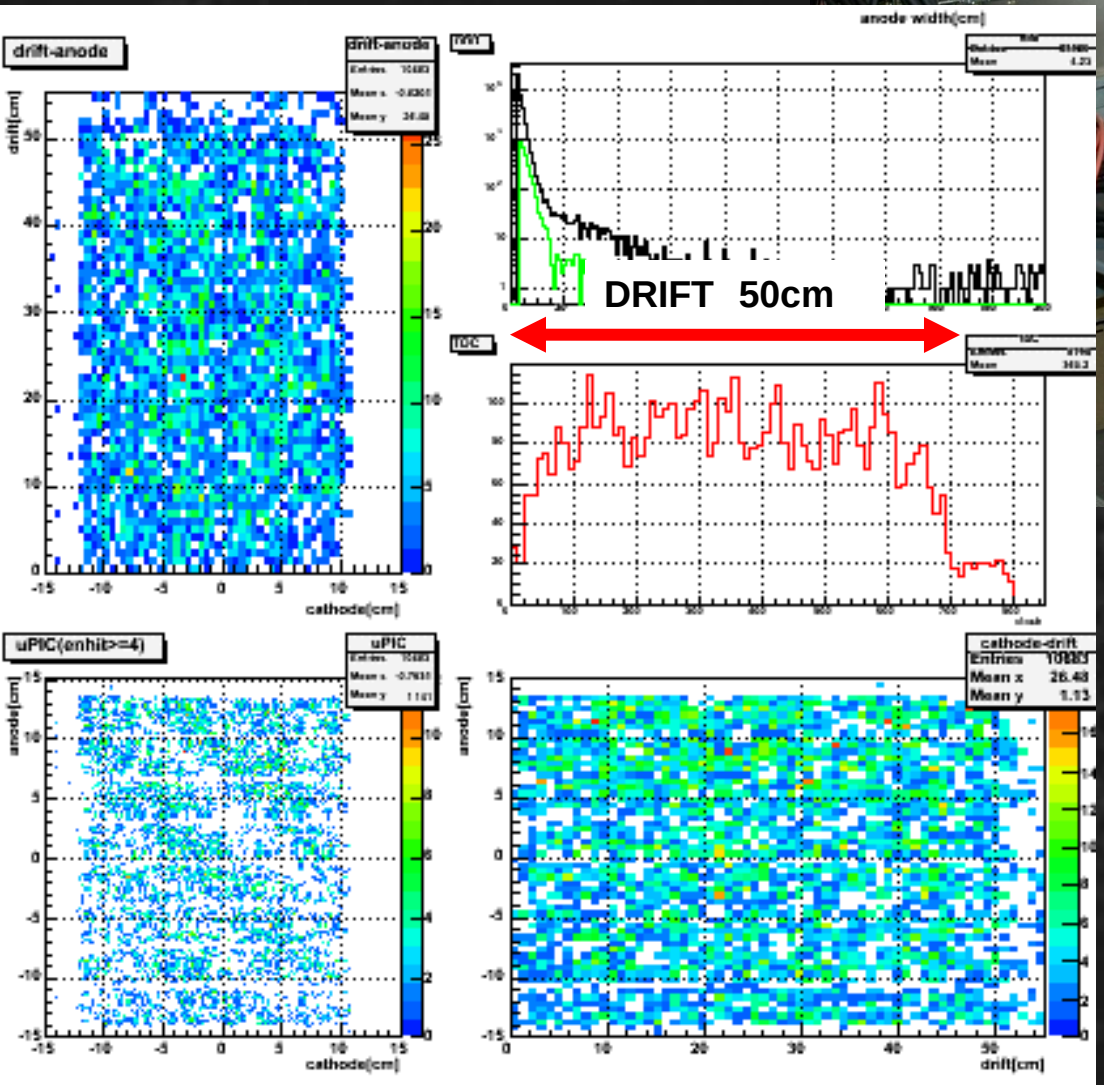
Direction Sensitive WIMP-search NEWAGE

TO THE FUTRUE

Direction Sensitive
WIMP-search
NEWAGE

- **DRIFT 50cm**
  - (CF4 152 torr)

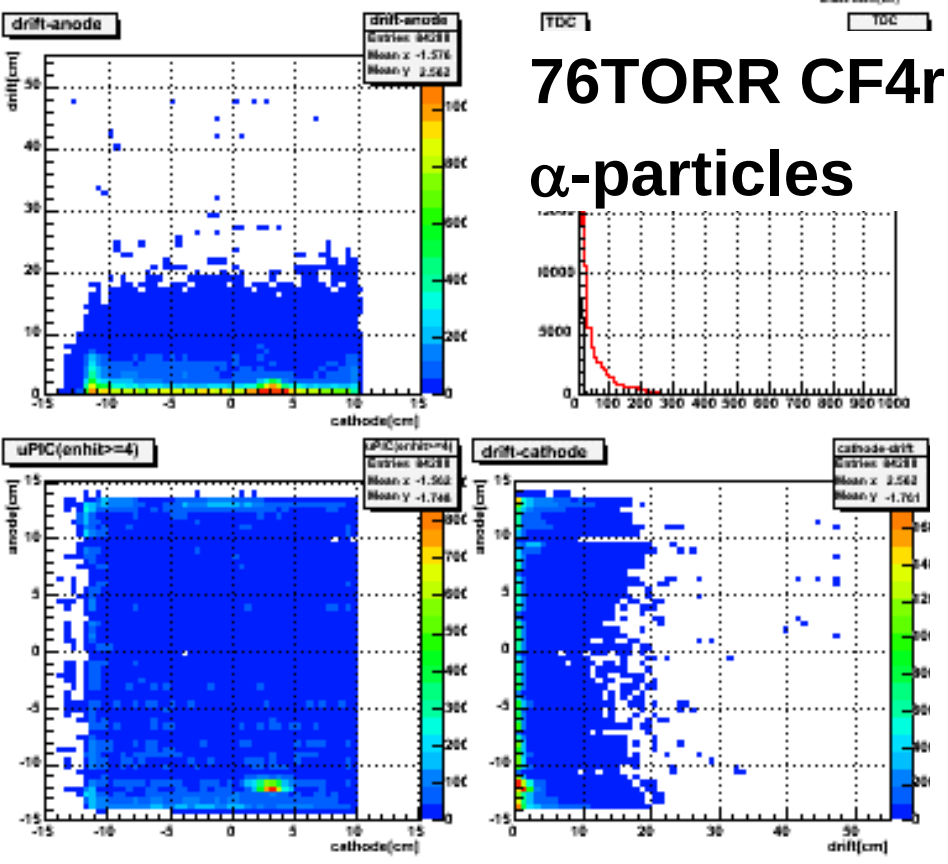




irradiated with neutrons
@1m distance (252C
uniform in 50cm drift
angular resolution:
to be measured

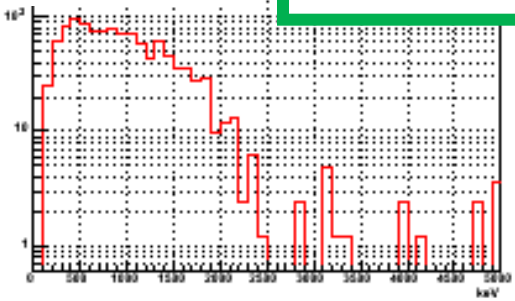
NEWAGE

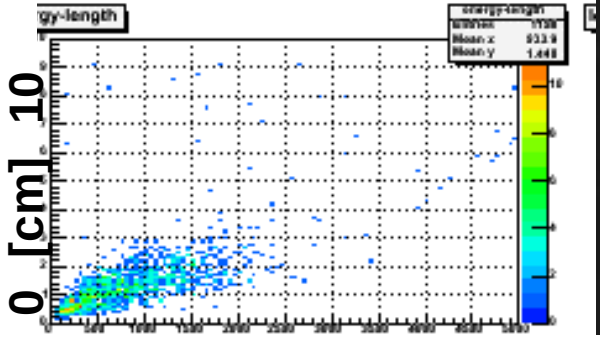
- CF4 76torr operation
  (designed value 30torr)



76TORR CF4run

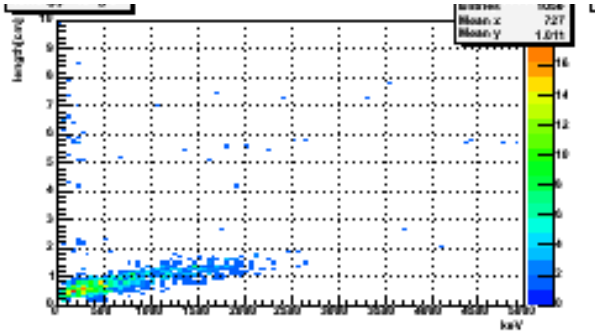
α-particles





152torr

track length vs energy
(same scale)



- parameter optimization ⇒ underground run

Direction Sensitive

SUMMARY

- **NEWAGE-0.3a: 2years' underground measurement total exposure 3.917 kg･days**
  - **New limits / BG studies / stability improvement**
- **R&D s in Kyoto**
  - **material screening (NEWAGE-RD1)**
  - **NEWAGE-0.3b**
- **Scaling up issues, electronics: tomorrow**

Direction Sensitive WIMP-search NEWAGE