

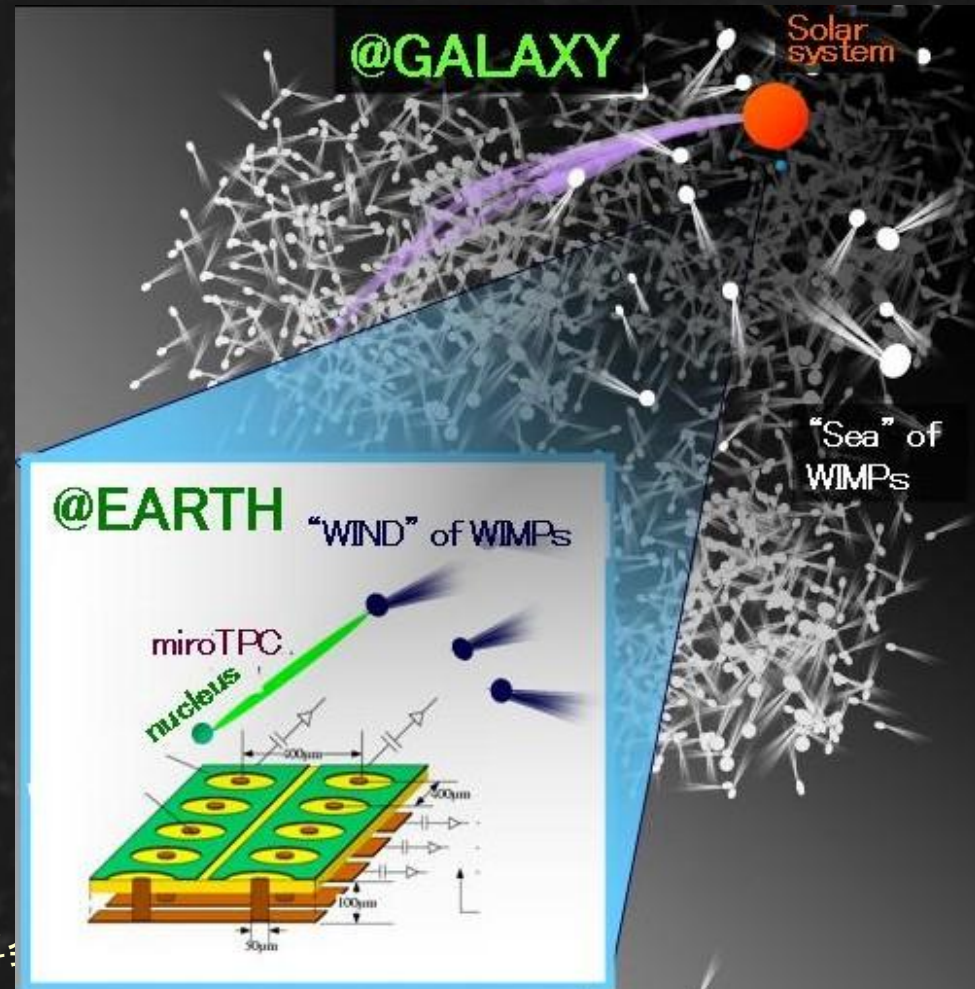
NEWAGE実験23: 2012年地下測定経過報告

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

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with

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Joseph, 高田淳史, 水村好貴,
水本哲矢,
西村広展, 澤野達哉,
松岡佳大, 古村翔太郎,
佐藤快, 中村祥吾



流れ

- ◆ 実験概要
- ◆ 感度向上
- ◆ 測定経過
- ◆ まとめ

1. NEWAGE 実験概要

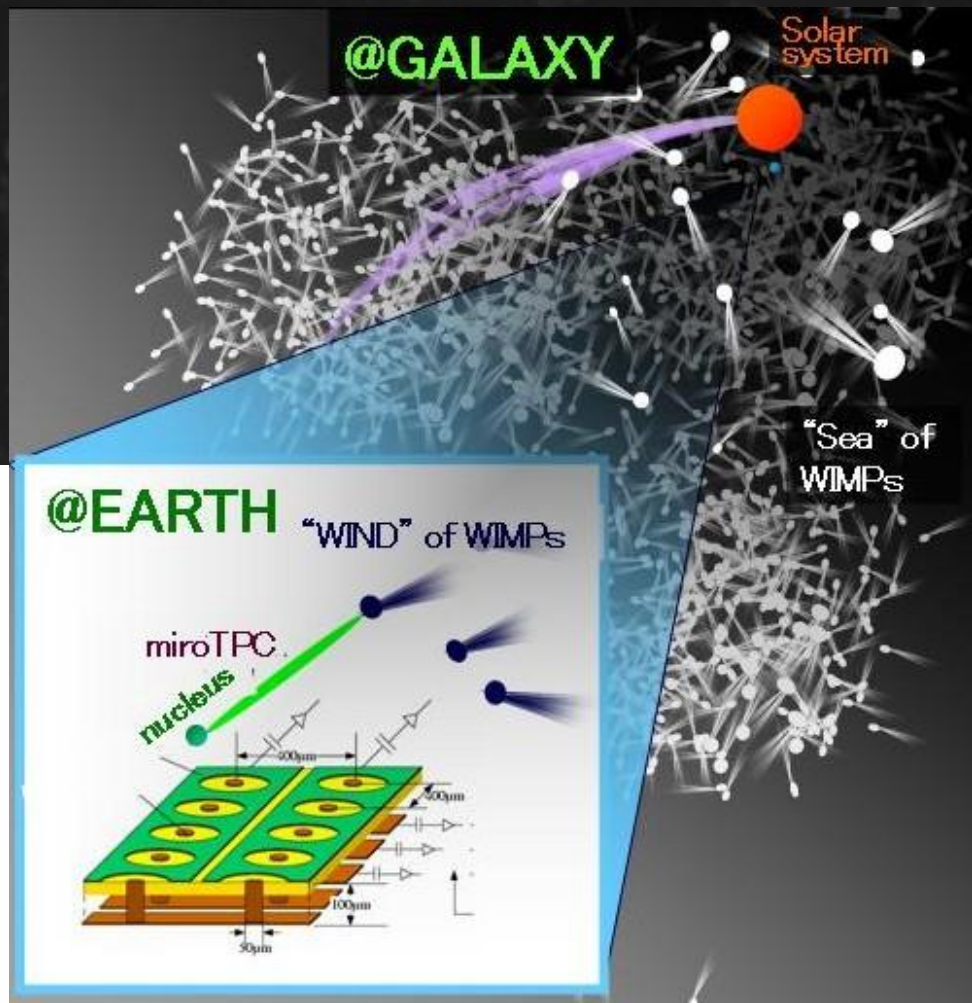
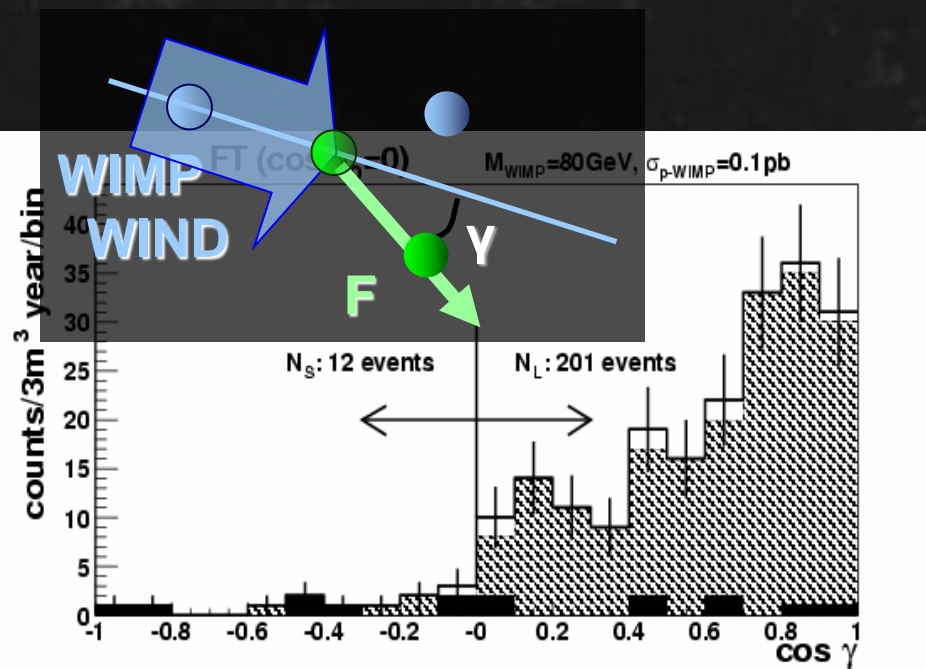
(PLB 578 (2004) 241)

◆ Goal: 暗黒物質の風を検出

- 低圧力 (CF_4 0.05 気圧)・大質量 ($1\text{m}^3 \times \text{N}$)

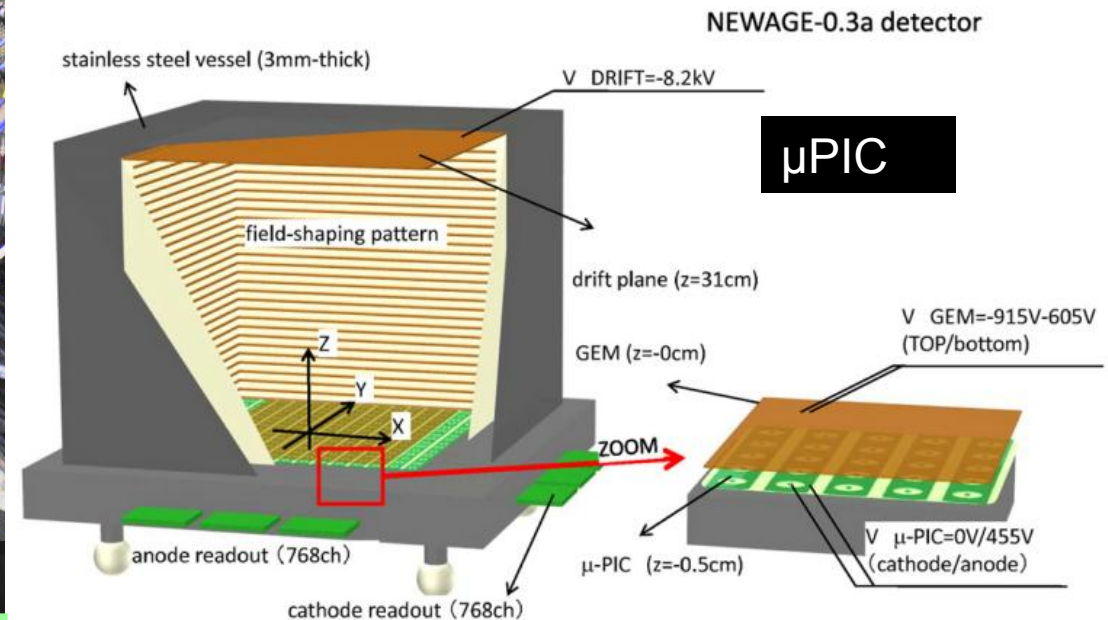
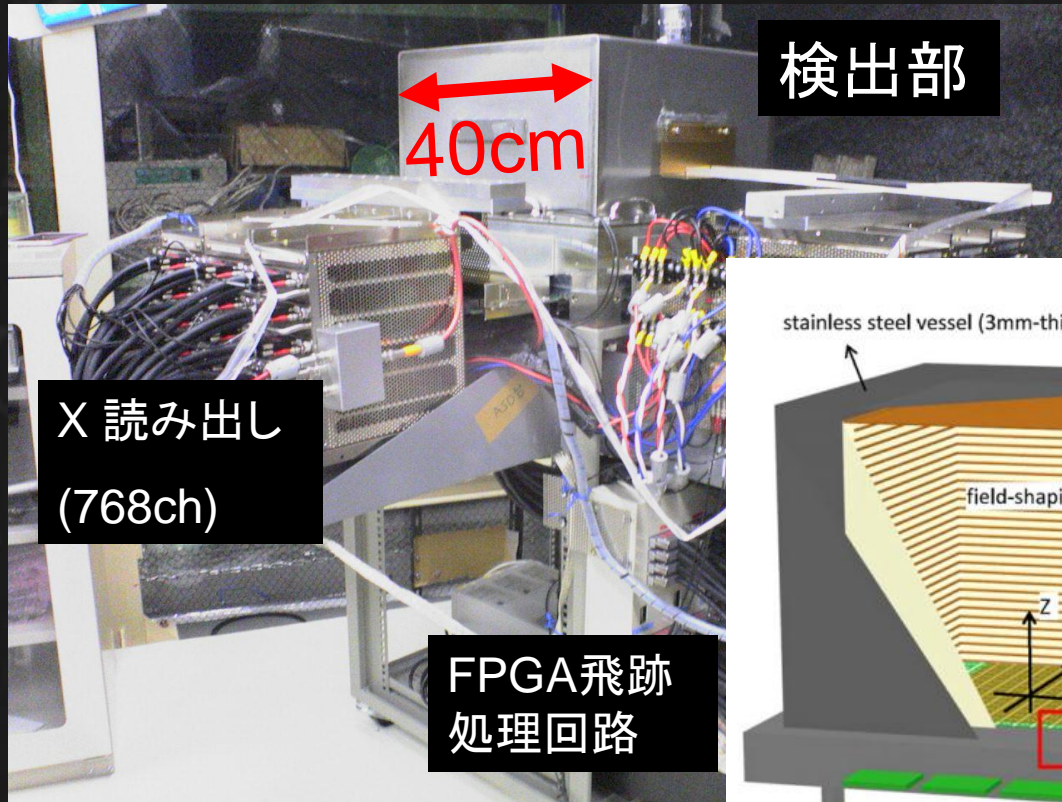
◆ 現状:

- CF_4 0.2 気圧・30cm角



μPIC、マイクロTPC “NEWAGE-0.3a”

(PLB 686 (2010) 11)



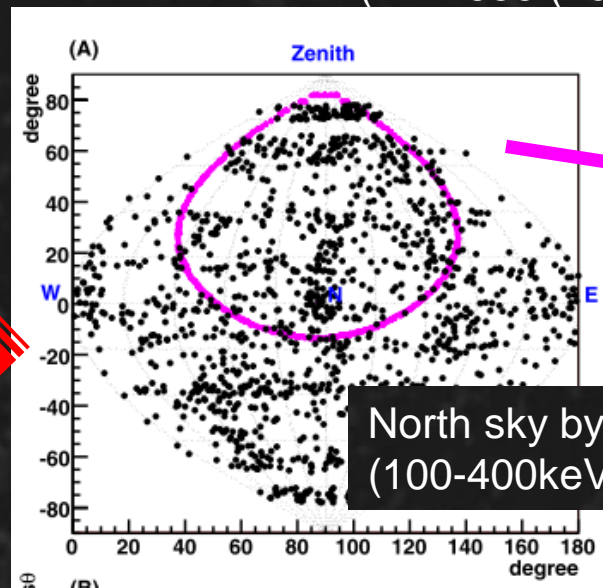
ガス検出器の特徴

- 原子核の飛跡検出(3次元)
- ガンマ線バックグラウンド排除

NEWAGE2010(神岡RUN-5)

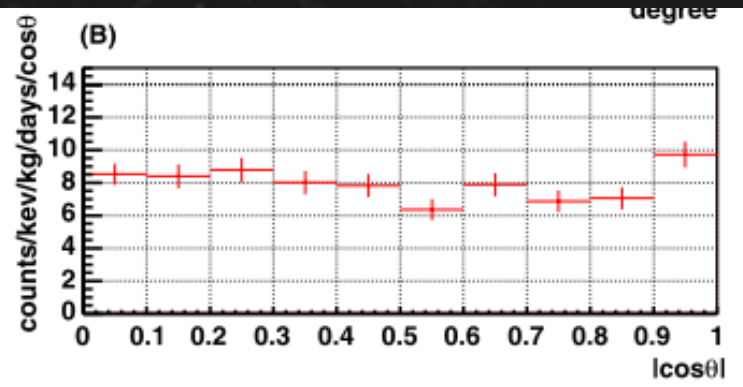
- 方向に感度を持つ制限の更新
- 5400pb for 150GeV

(PLB 686 (2010) 11)



DM direction

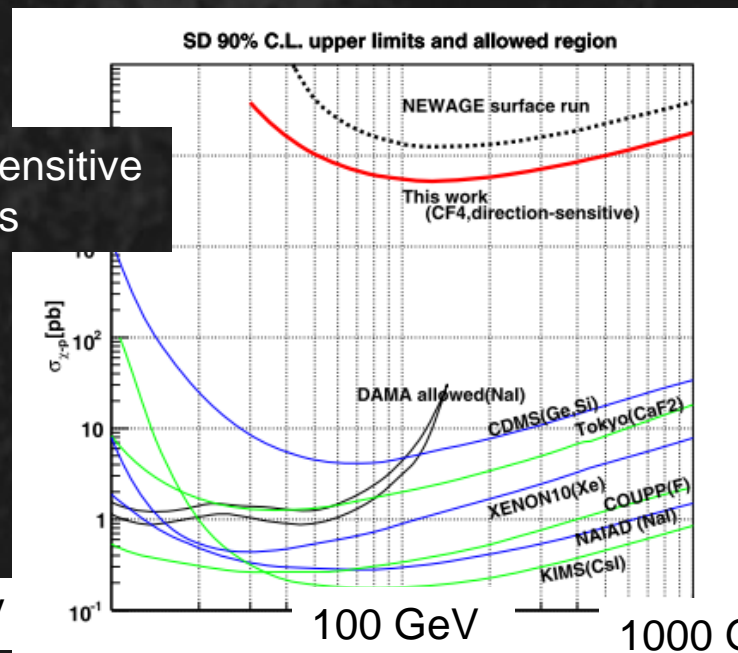
North sky by C and F nuclei (100-400keV)



Cosθ distribution (100-400keV)



direction-sensitive upper limits

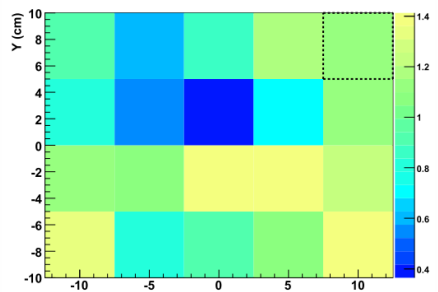


ガンマ線： 精細なゲインマップを作成

- gas gain is not uniform in $30 \times 30\text{cm}^2$

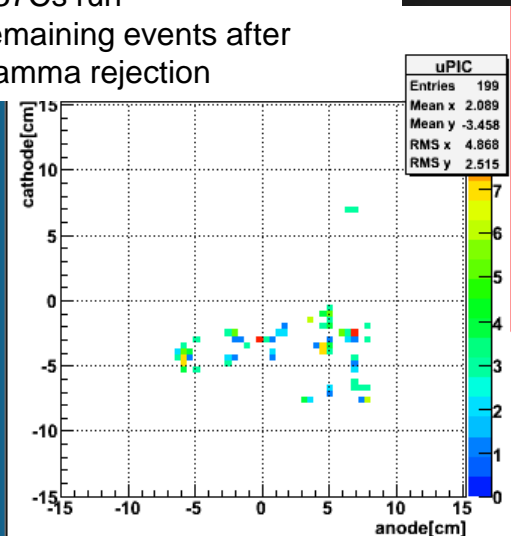
old gain map

RUN5



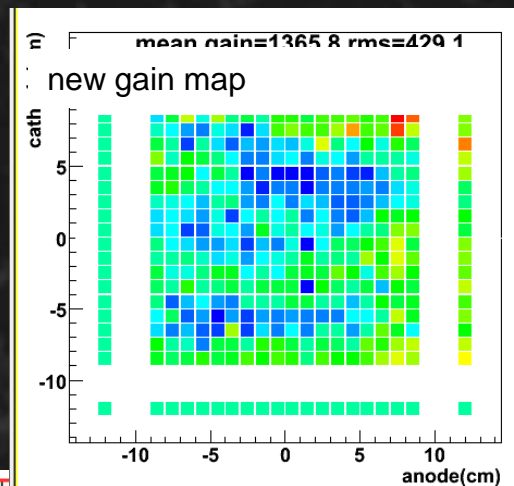
20cm

137Cs run
remaining events after
gamma rejection



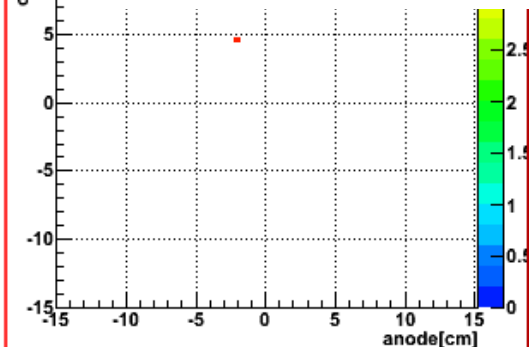
gamma rejection

$8.1e-6$



RUN13

137Cs run
remaining events after
gamma rejection



gamma rejection

$1.0e-6 >$

内部α、ラドン: 小型のラドン検出器で材料の選択 ラドン放出を <1/10 へ

ガラス繊維強化
フッ素樹脂基板



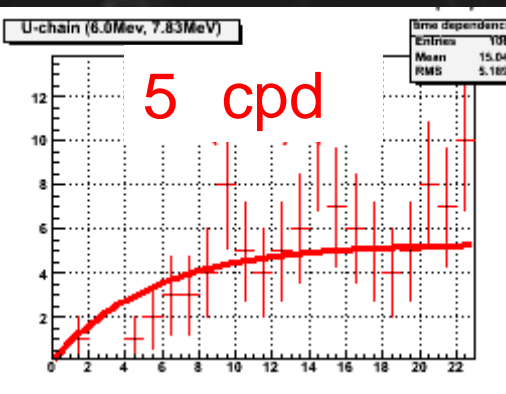
NEWAGE-0.3a

テフロン板+銅線
TPCケージ



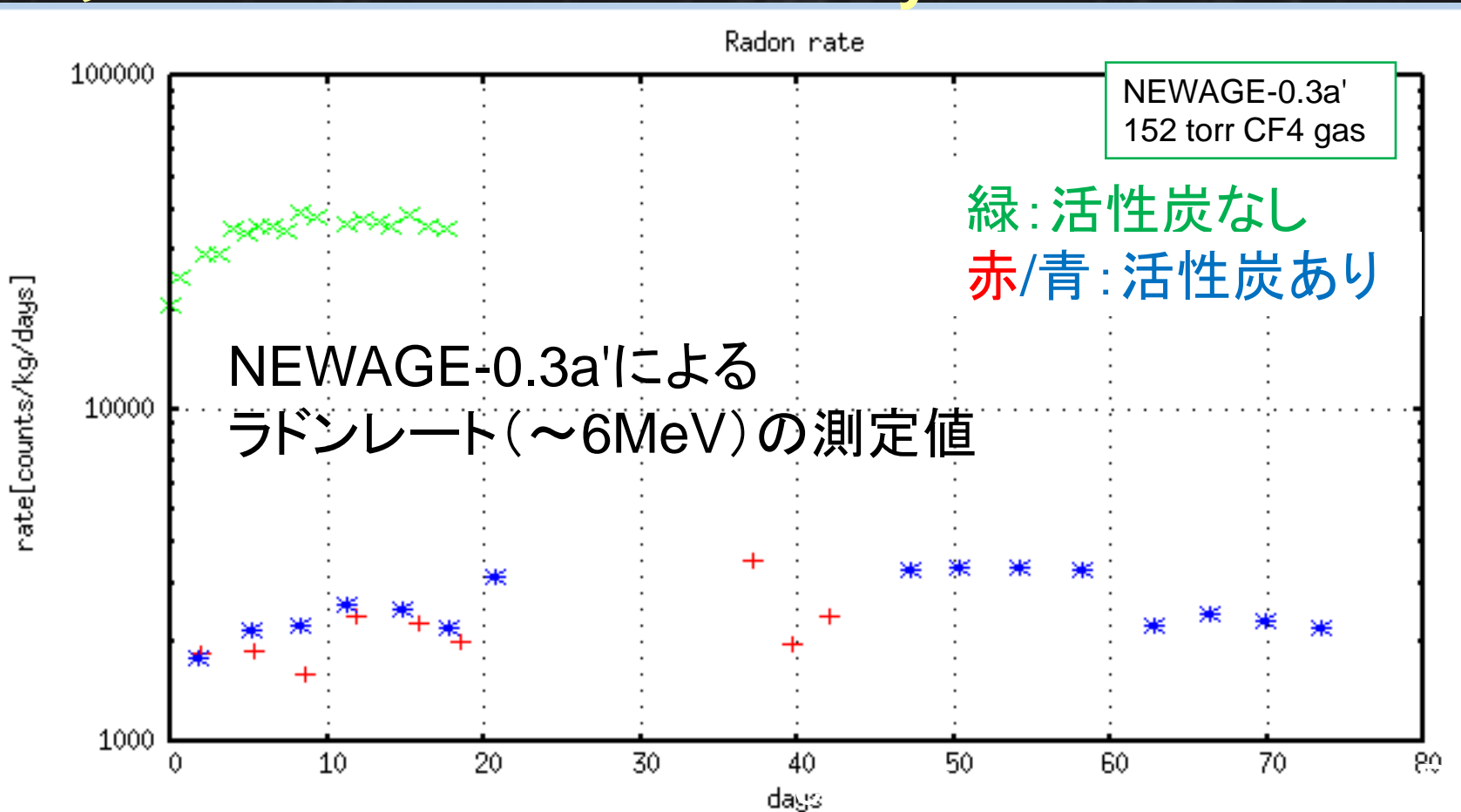
<0.5 cpd

NEWAGE-0.3a'



◆ ラドン: 活性炭

- 常温活性炭 100g (ツルミコール2GS)
- 循環 170ml/min (メタルベローズポンプ)
- ラドンレート $\sim 1/10$ after day10



3、測定経過

◀ 検出器

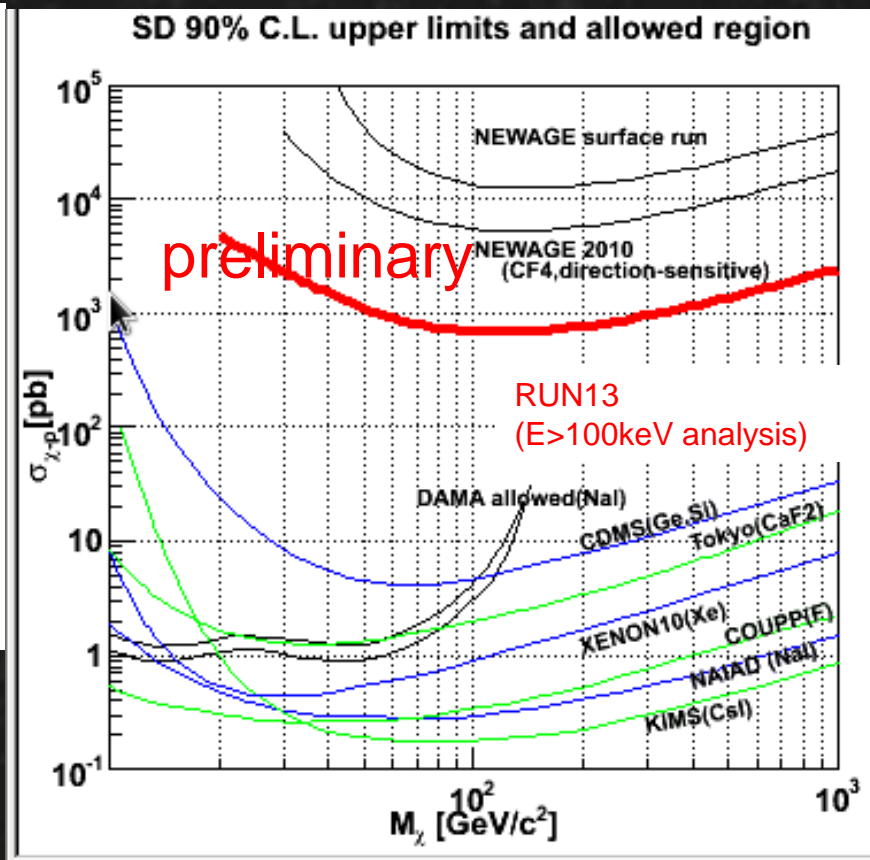
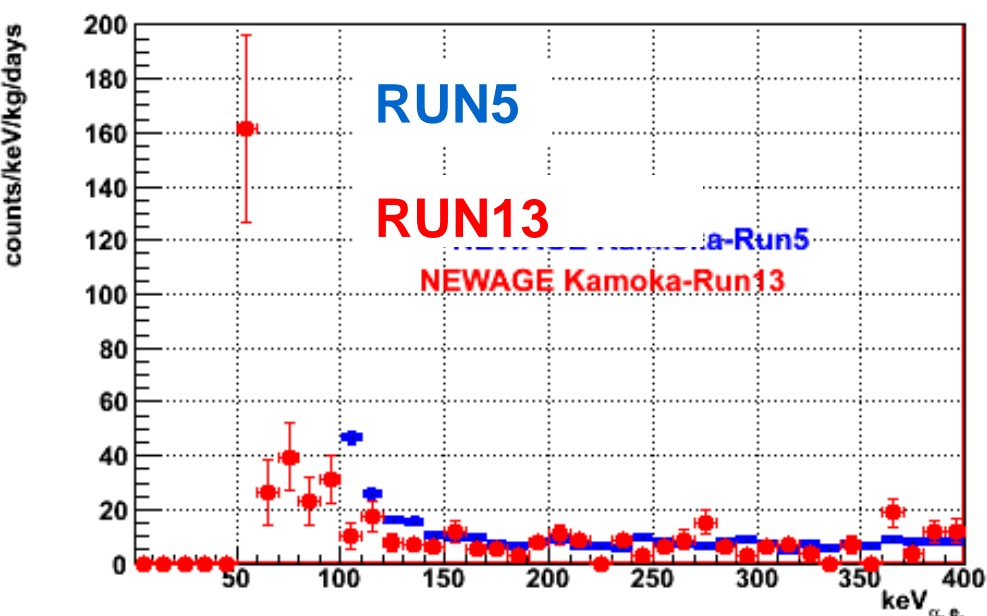
- NEWAGE-0.3a'
- 152torr CF4

◀ 神岡RUN-13

- RUN13-1 : 2012 Jan. 23 – Mar. 8 (31.6 live-days)
- RUN13-2 : 2012 Mar. 8 – May 24 (30.7 live-days)
- RUN13-3 : 2012 May 28- Jul. 17
- RUN13-4 : 2012 Aug. 8-

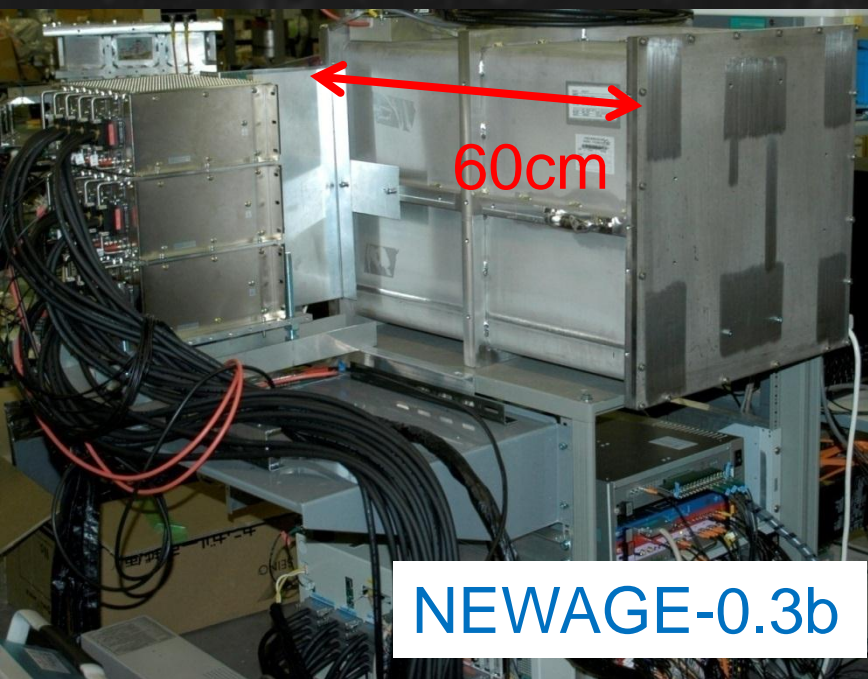
測定経過

- exposure 0.140kg·days
- スペクトル閾値 100keV⇒50keV
- rate: ~1/5 at 100keV
- 方向に感度を持つ解析:進行中

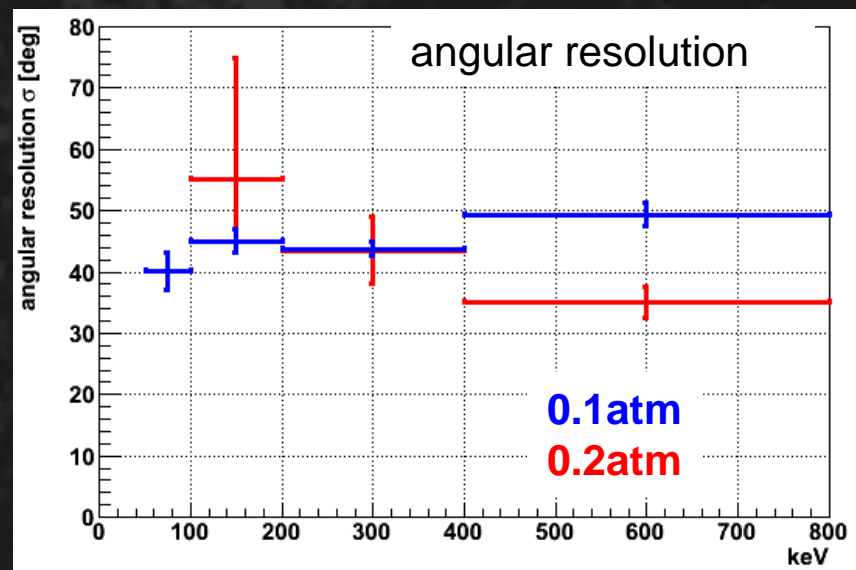


この先 (中村トーク)

- NEWAGE-0.3b
- 冷却活性炭
- 0.2atm \Rightarrow 0.1atm CF4 gas for lower threshold



K.Nakamura
2012 JINST 7 C02023



まとめ

- ◆ **NEWAGE 2013年 地下実験**
 - 5倍以上の感度向上 (preliminary)
- ◆ **地下・地上でさらなる高感度化へのR&D**

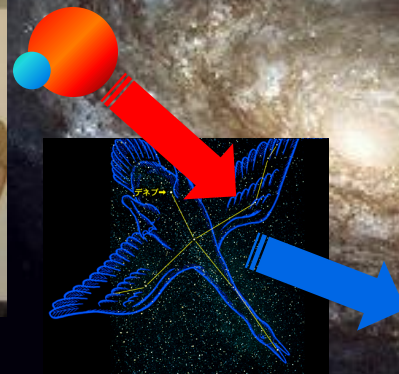
科研費
KAKENHI

CYGNUS 2013

第四回方向に感度を持つDM国際会議

◆ 2013年6月 10-12 富山

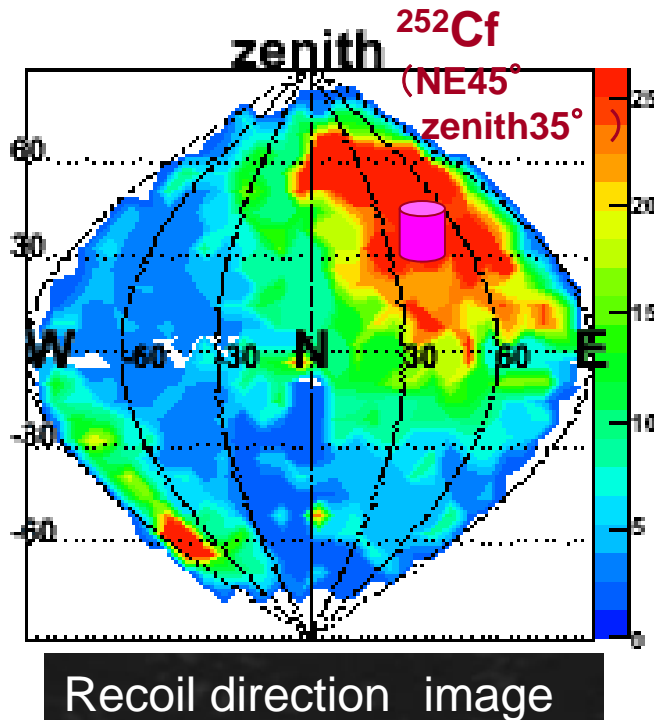
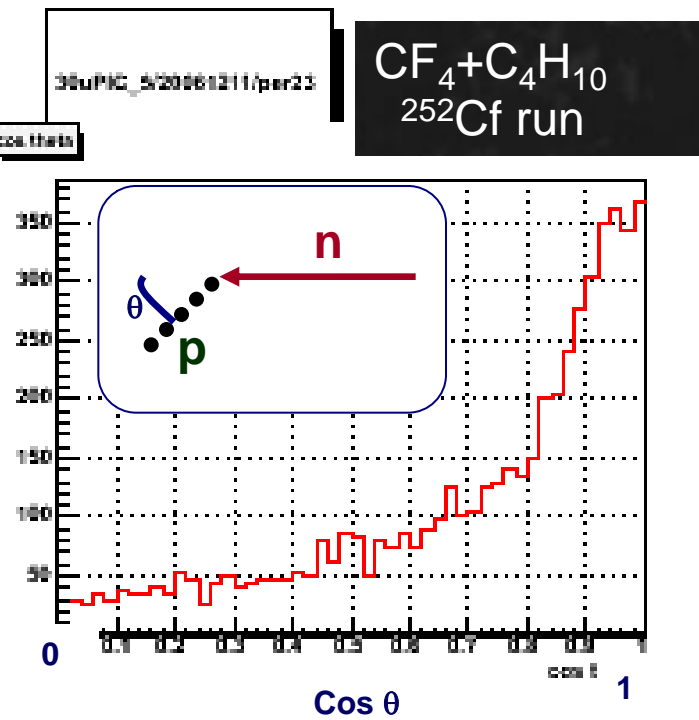
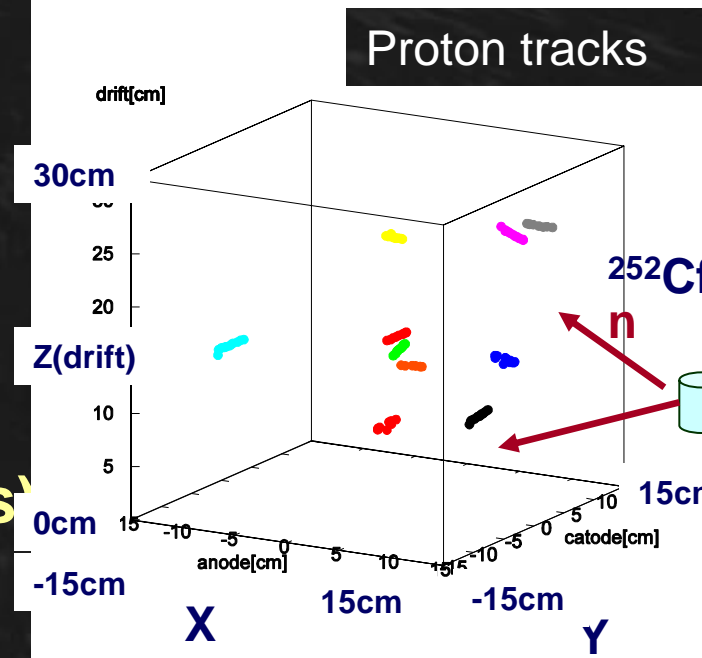
- 方向感度実験
- 日本での関連分野



TPC Performance

① nuclear tracking

- $\text{CF}_4 + \text{C}_4\text{H}_{10}$ (9:1) 0.2 atm
- $n \rightarrow p$ forward scattering (emulation of $\text{WIMP} \rightarrow \text{F}$ scatterings)



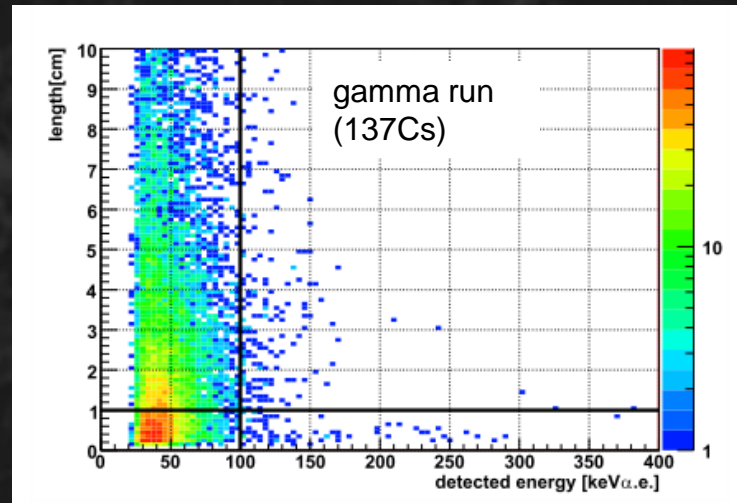
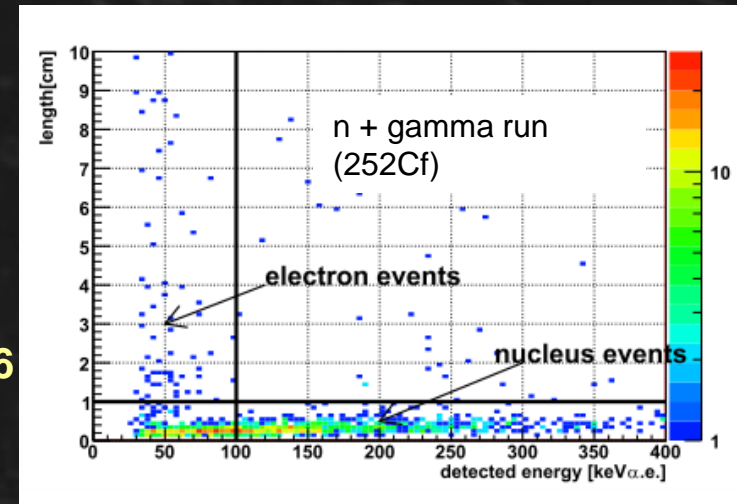
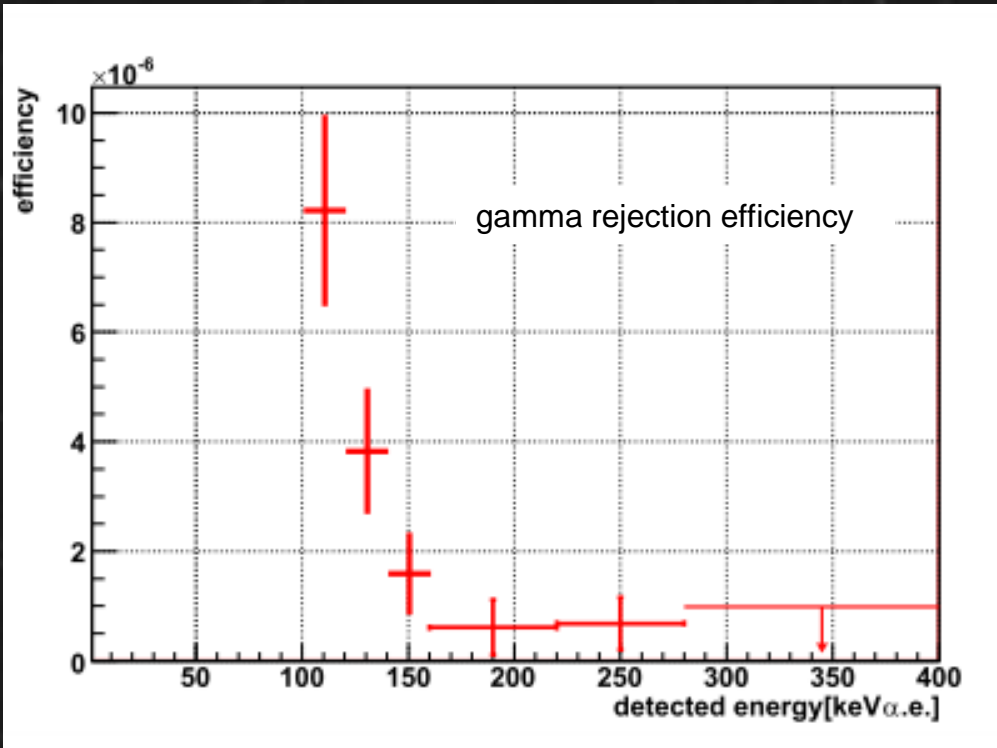
Direction Sensitive
WIMP-search
NEWAGE

TPC Performance

② gamma rejection

energy vs length cut

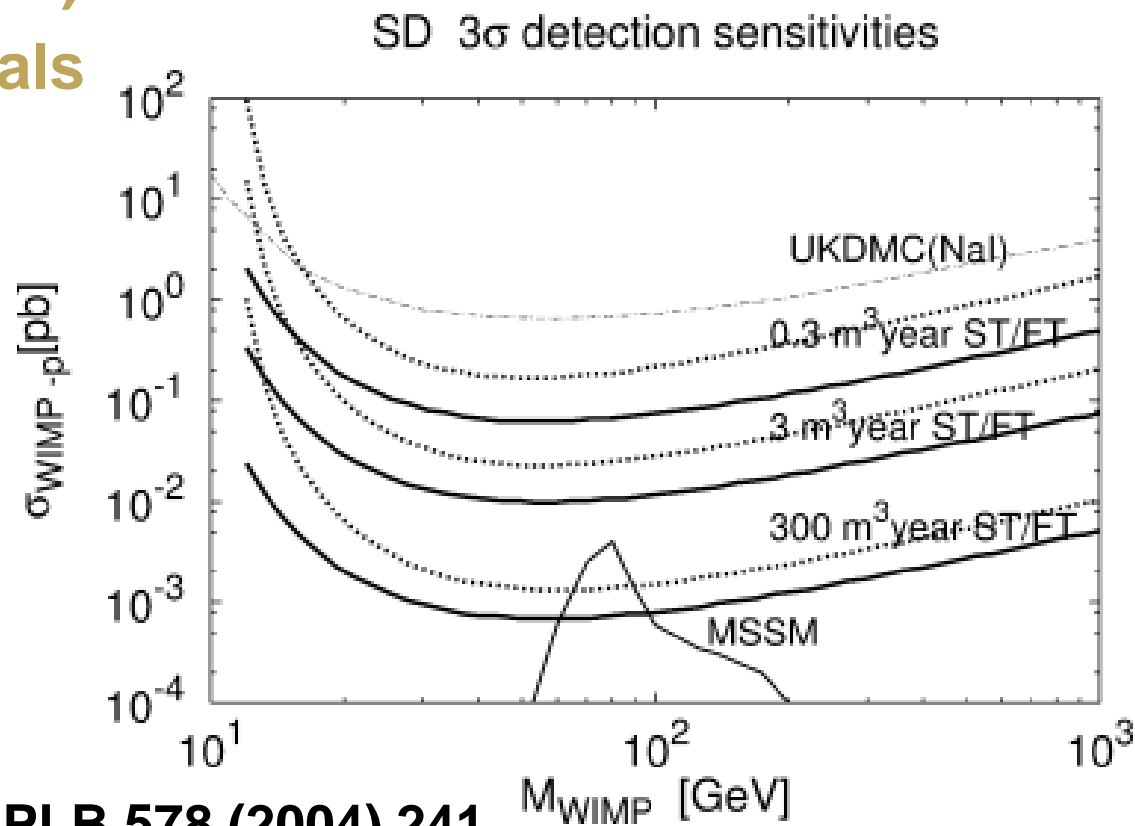
gamma rejection efficiency† 8.1×10^{-6}



† gamma rejection efficiency=electron detection efficiency

Expected Sensitivities

- **Goal: Detect the WIMP-wind**
 - low pressure (CF_4 0.05 bar) - large volume ($1\text{m}^3 \times N$) - radio-pure materials
- **CURRENT: pilot run**
 - CF_4 0.2 bar - $(0.3\text{m})^3$
 - normal materials



◆ RUN5: Detector

- Target gas: CF_4 0.2atm (0.0115kg)
- Exposure: 0.524 kg·days
(Sep. 2008 - Dec. 2008)
- Energy resolution
70% @ 100keV (FWHM)
- Position resolution
800 μm (rms)
- angular resolution
~55° (RMS)

