

VUV MPPC

2014/12/5

B02

2

ANKOK

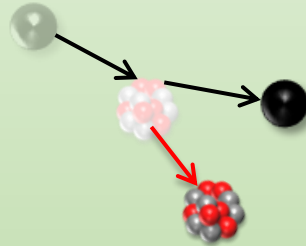
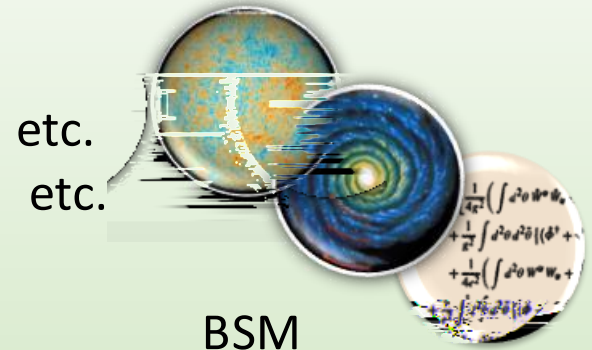
M2

暗黒物質(WIMP)とその直接探索

-
-
-

SUSY,

etc.

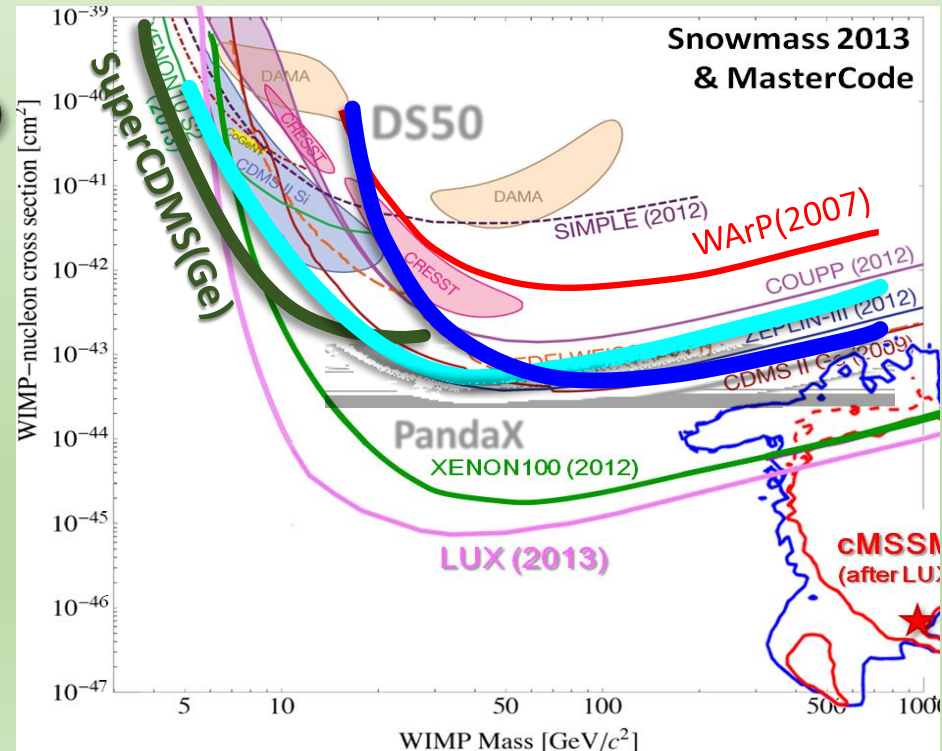


- ()
- (Xe2)

-SuperCDMS (Ge)

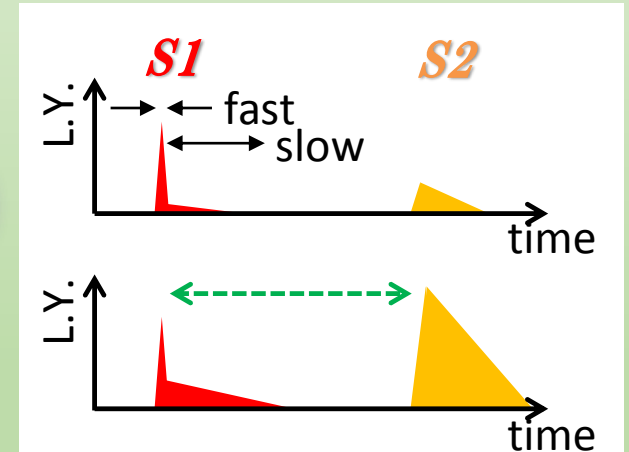
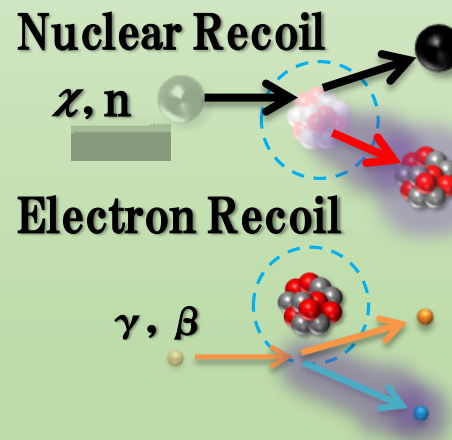
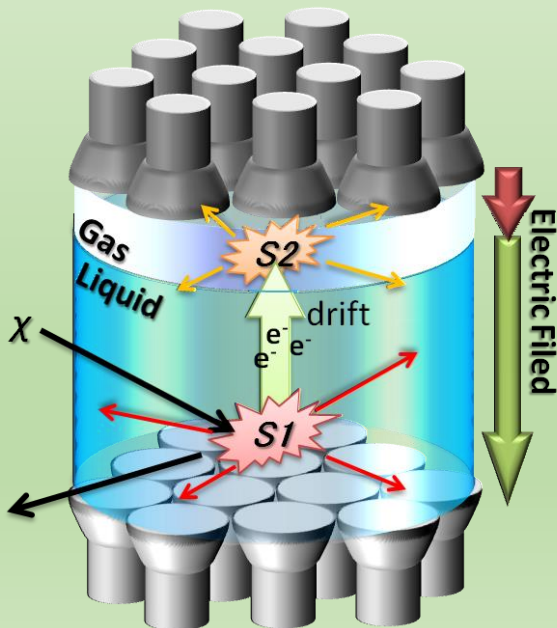
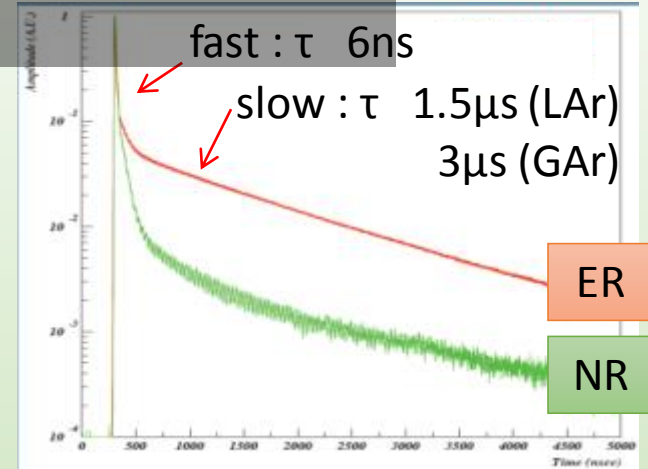
-PandaX Low mass Xe2

-DarkSide50 (commissioning run) Ar2



アルゴンによる暗黒物質探索

- 128nm ()
- 40 photon/keV_{ee}
- 2 (fast slow)



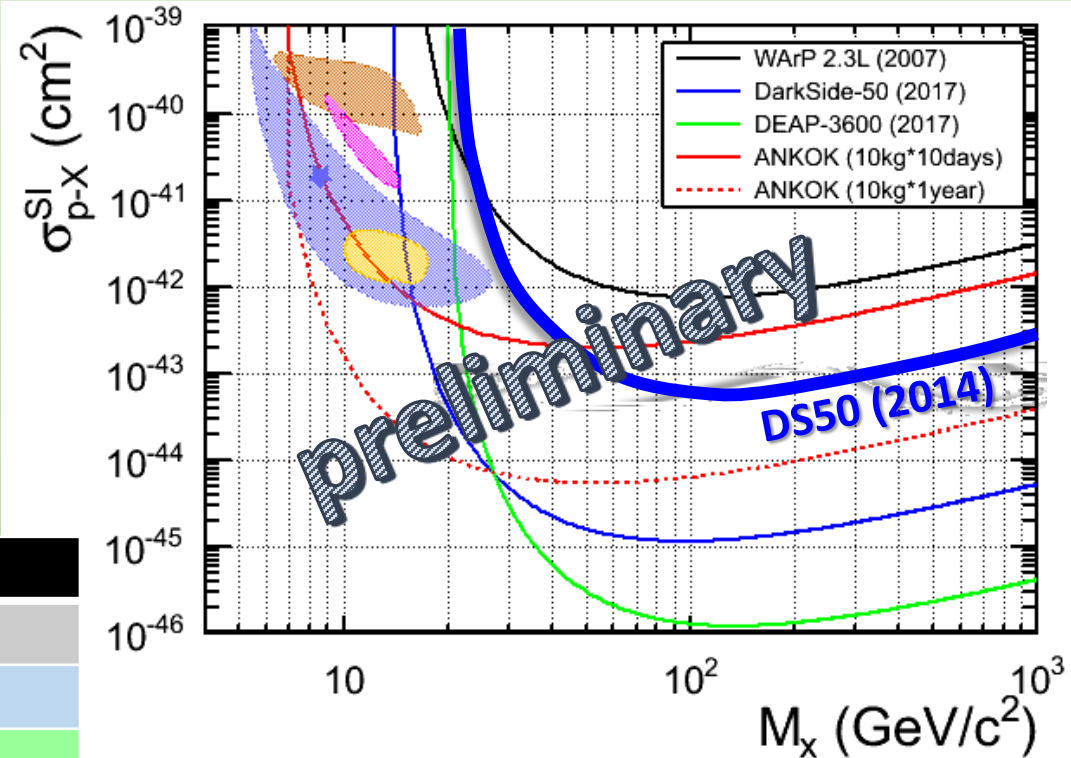
ANKOK 目標

2

10GeV

Low Mass WIMP

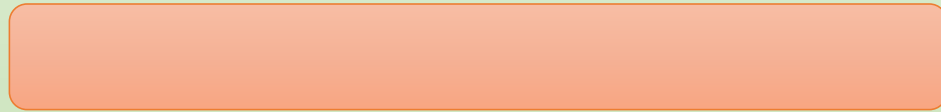
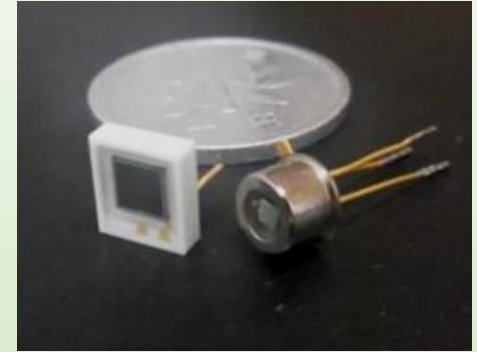
< 10keV_{nr}
> 10pe/keV_{ee}
> 10⁵@10keV_{nr}



WArP	42 keV _{nr}	3.2 kg	1
DarkSide-50	35 keV _{nr}	44.1 kg	3
DEAP-3600	60 keV _{nr}	3600kg	3
ANKOK	10 keV _{nr}	10 kg	10 /1

MPPC(Mulch Picxel Photon Counter)

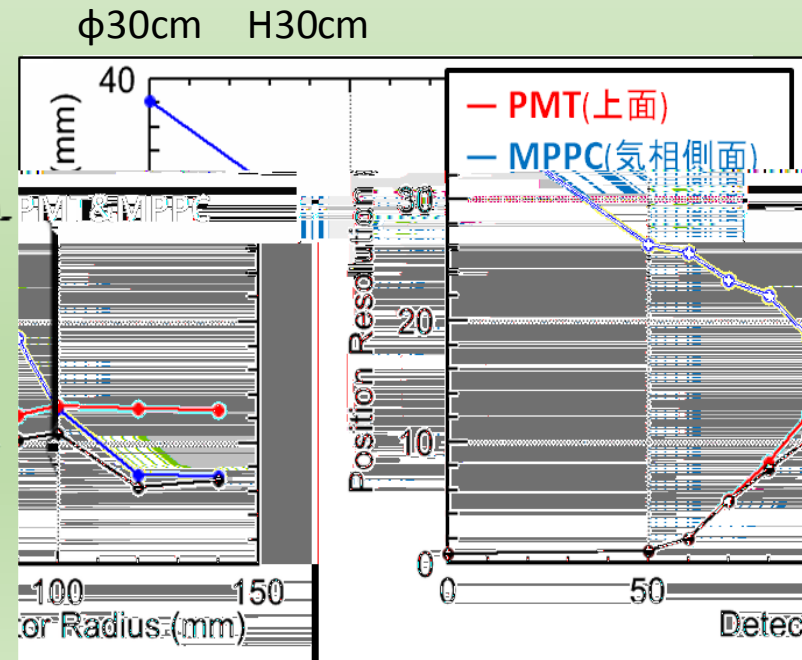
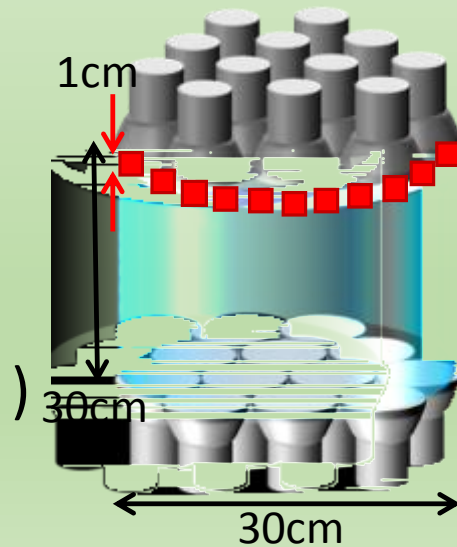
-
-
- ~60V
-
- APD Gain 10^5 10^6



MPPC S2



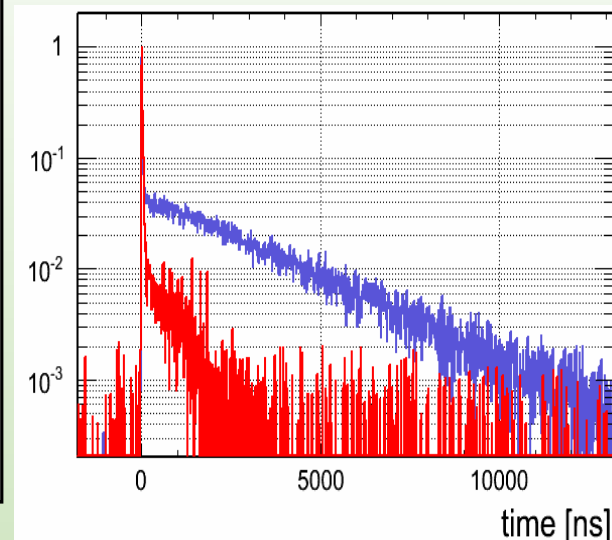
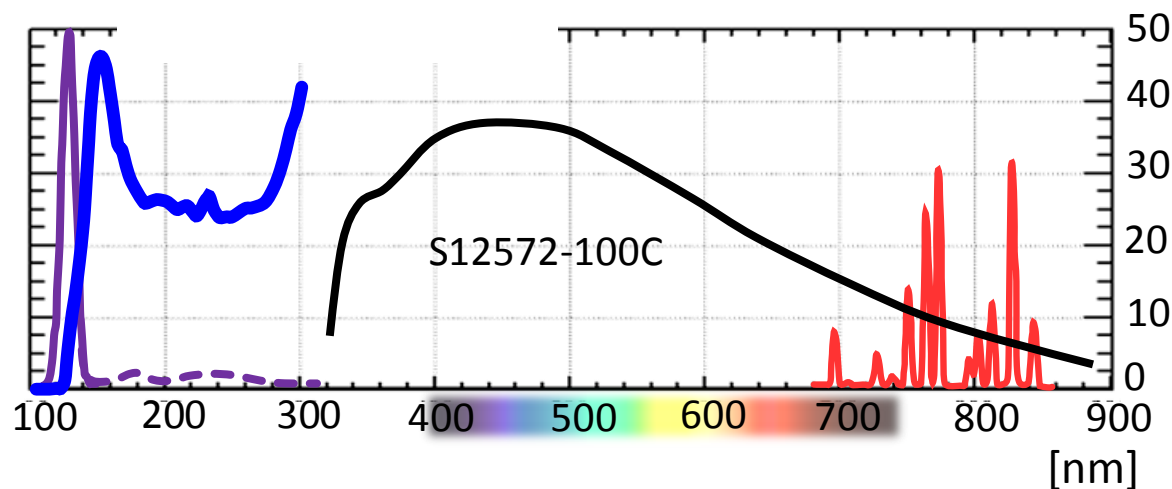
(PMT



XY

BG

アルゴン蛍光の特徴とVUV MPPC

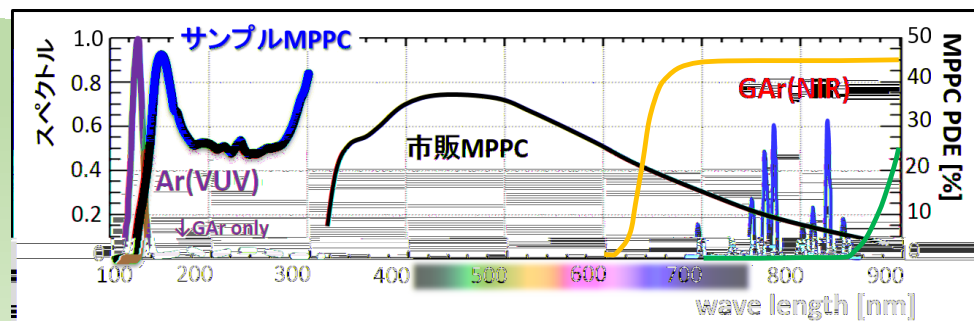
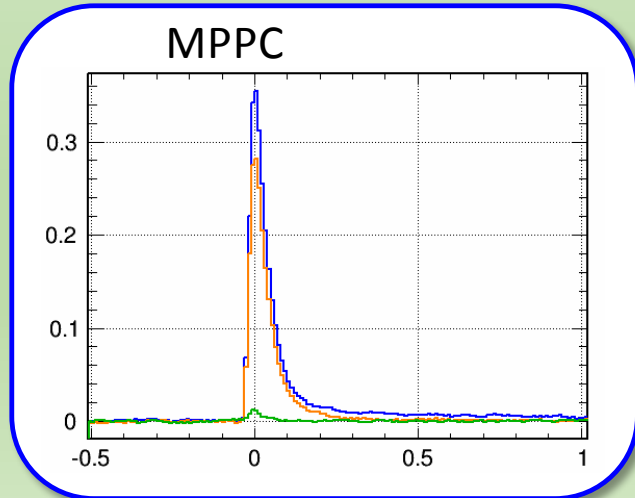
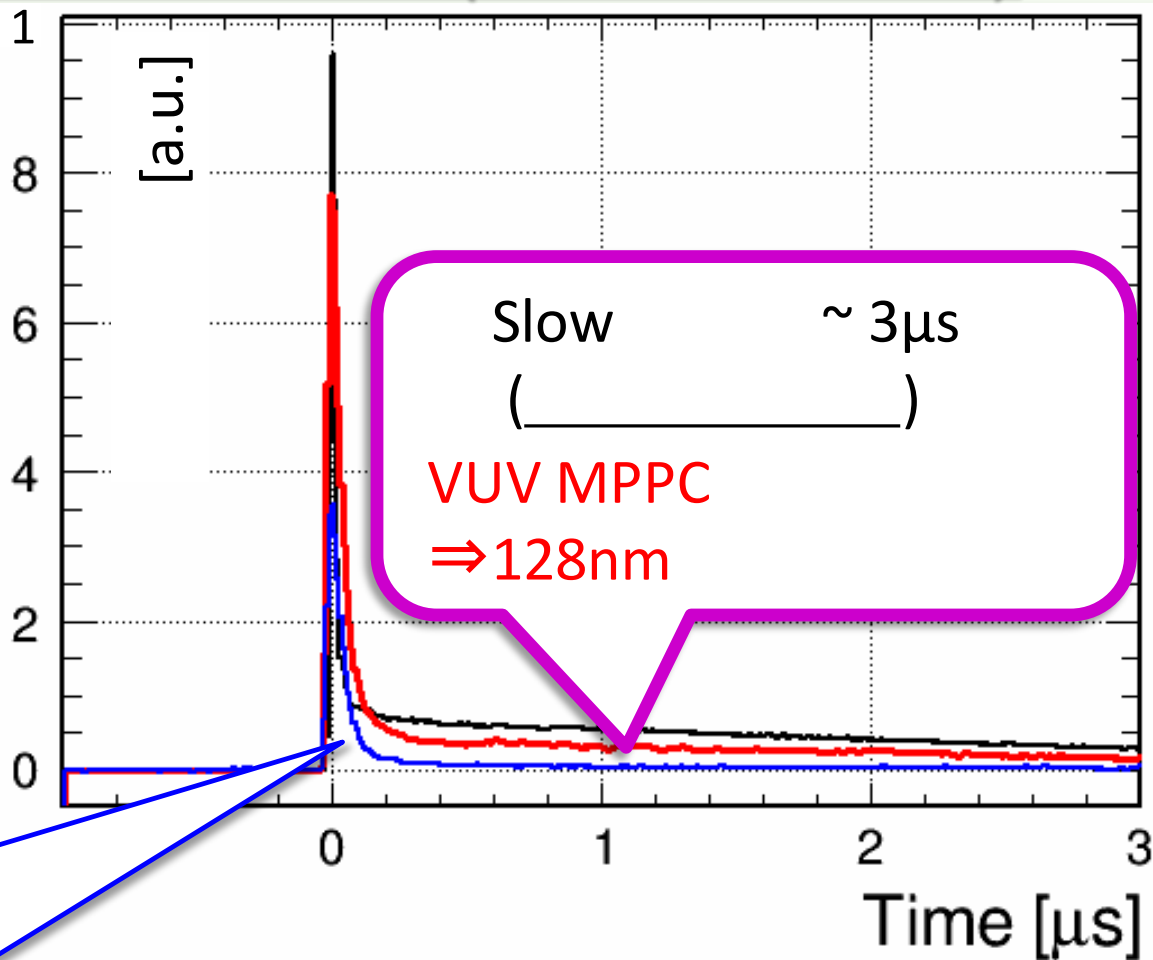
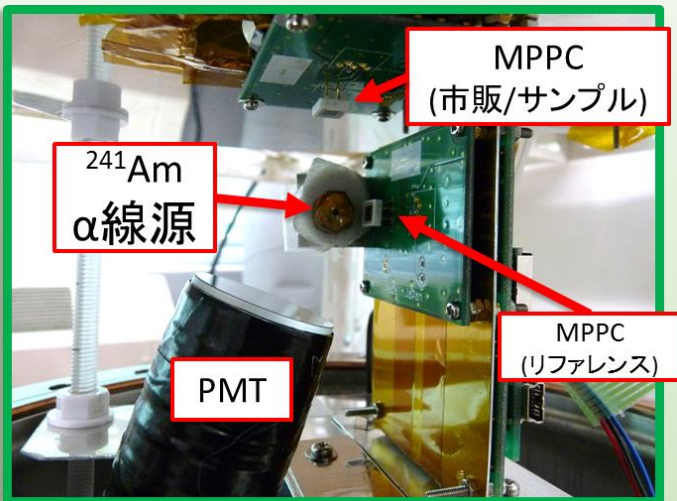


VUV成分 (~128nm)

- /
- Fast(~6ns) Slow(~3 μ s, ~1.5 μ s)
- UV (150~300nm) NIR (:700~850nm, :250nm~1 μ m)
- Slow (~1 μ s)

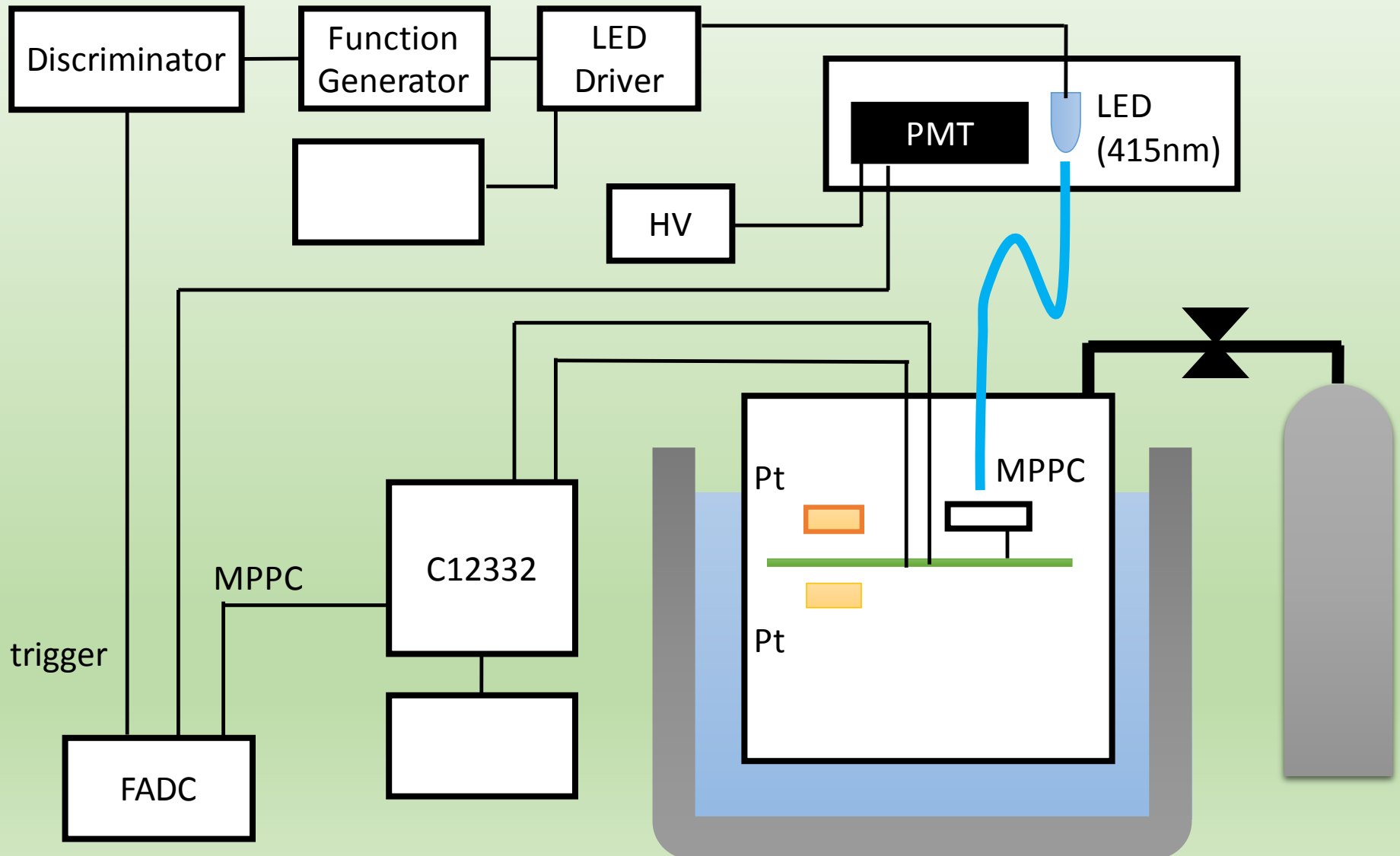
UV MPPC	S12572-33-050C	A0021	66.63V	1.25 10 ⁶	0.77 MHz
VUV MPPC	3X3MM-50UM VUV2				

ガスアルゴン蛍光検出(2014秋JPS)



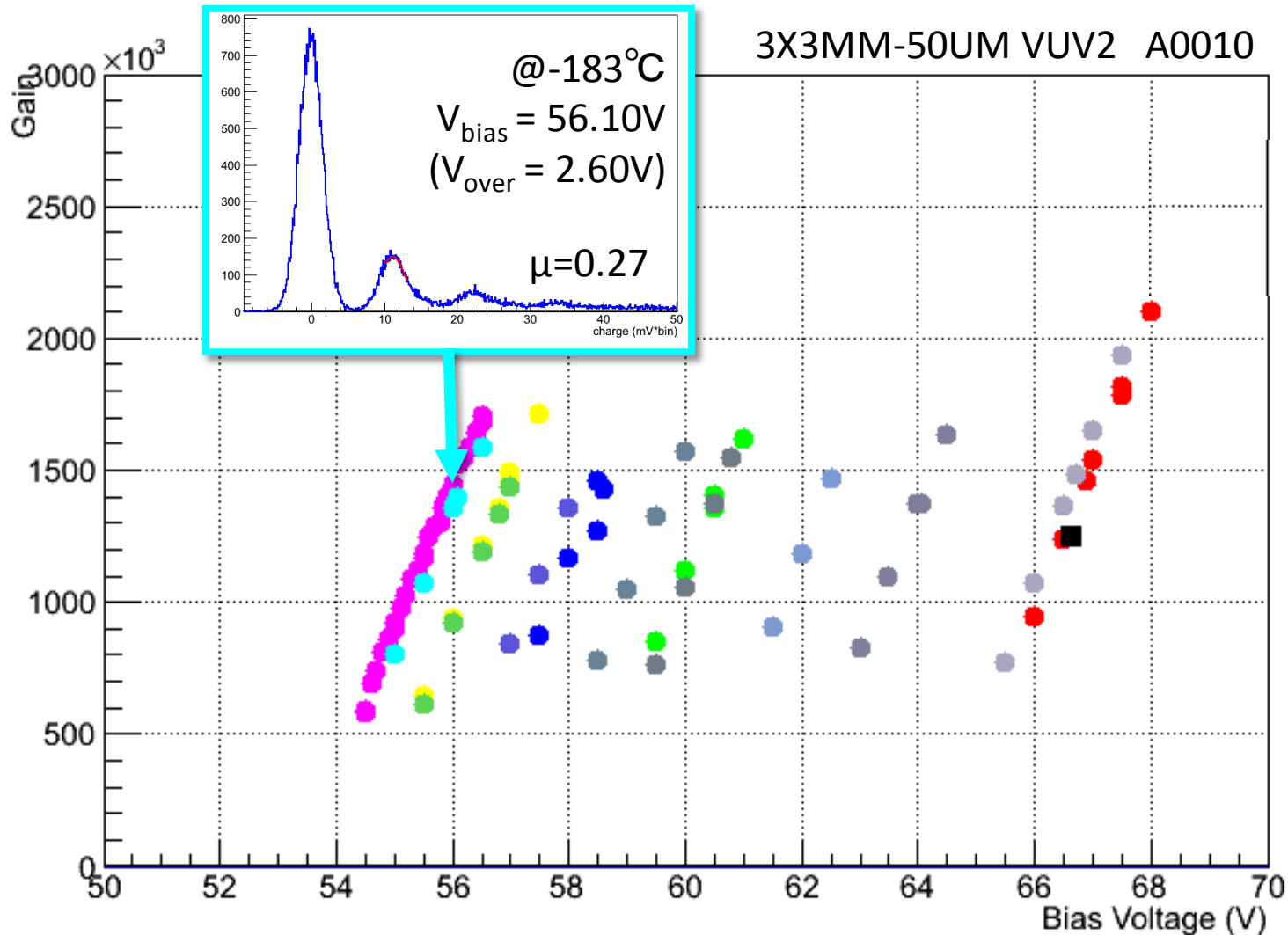
低温基礎特性試験：セットアップ

VUV MPPC (3X3MM-50UM VUV2 A0010)



低温基礎特性試験: Gain

$$G = \frac{C(V_{\text{bias}} - V_{\text{break down}})}{e}$$



23°C

-80°C

-120°C

-160°C

-190°C

-183°C

-160°C

-130°C

-100°C

-80°C

-50°C

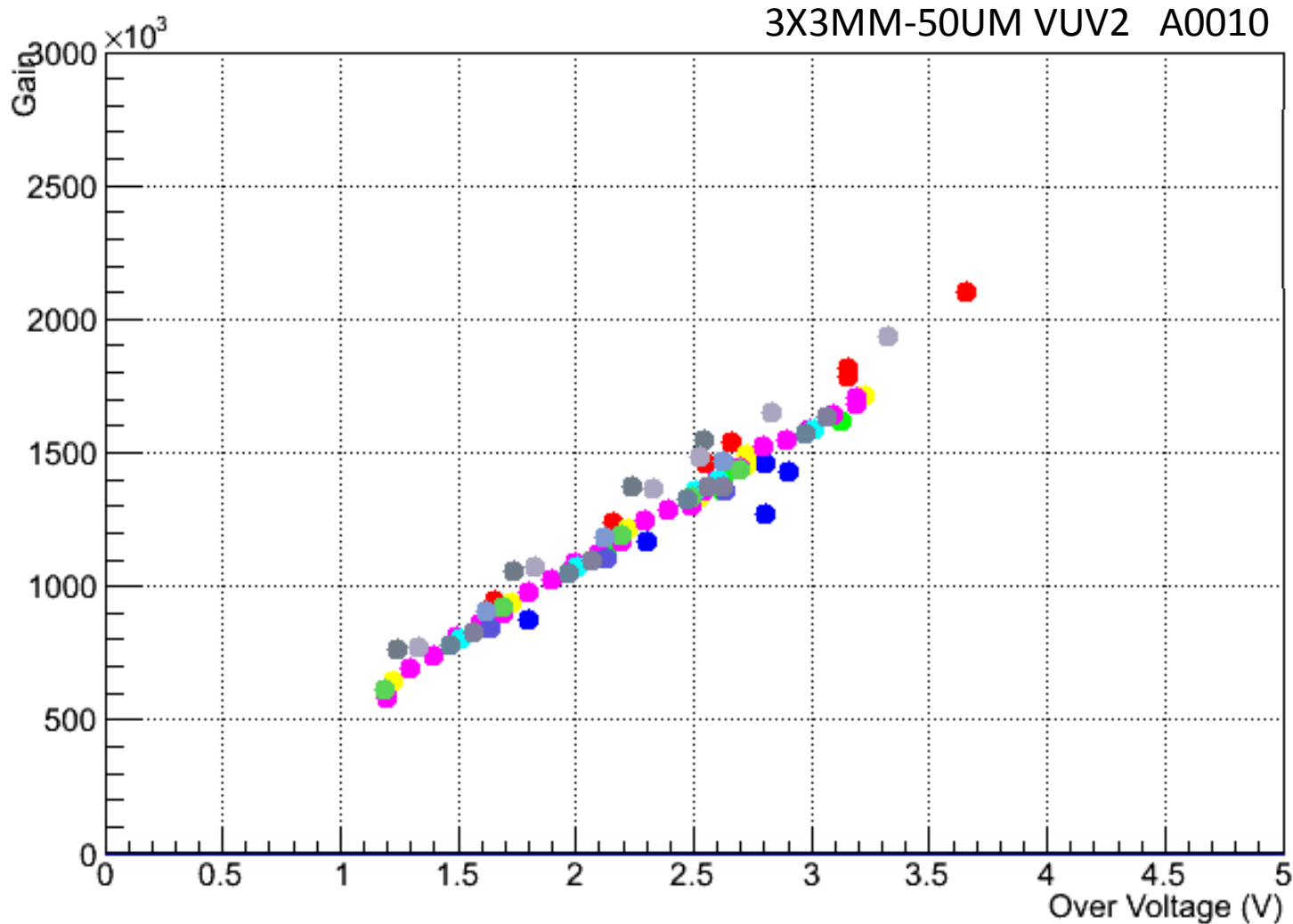
-20°C

21°C

DataSheet

低温基礎特性試験: Gain

$$G = \frac{CV_{\text{over}}}{e}$$



23 $^{\circ}\text{C}$

-80 $^{\circ}\text{C}$

-120 $^{\circ}\text{C}$

-160 $^{\circ}\text{C}$

-190 $^{\circ}\text{C}$

-183 $^{\circ}\text{C}$

-160 $^{\circ}\text{C}$

-130 $^{\circ}\text{C}$

-100 $^{\circ}\text{C}$

-80 $^{\circ}\text{C}$

-50 $^{\circ}\text{C}$

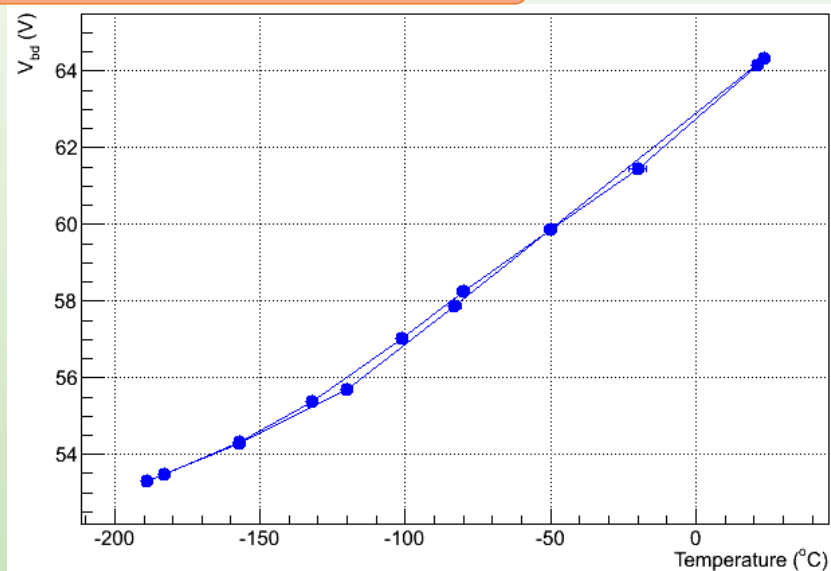
-20 $^{\circ}\text{C}$

21 $^{\circ}\text{C}$

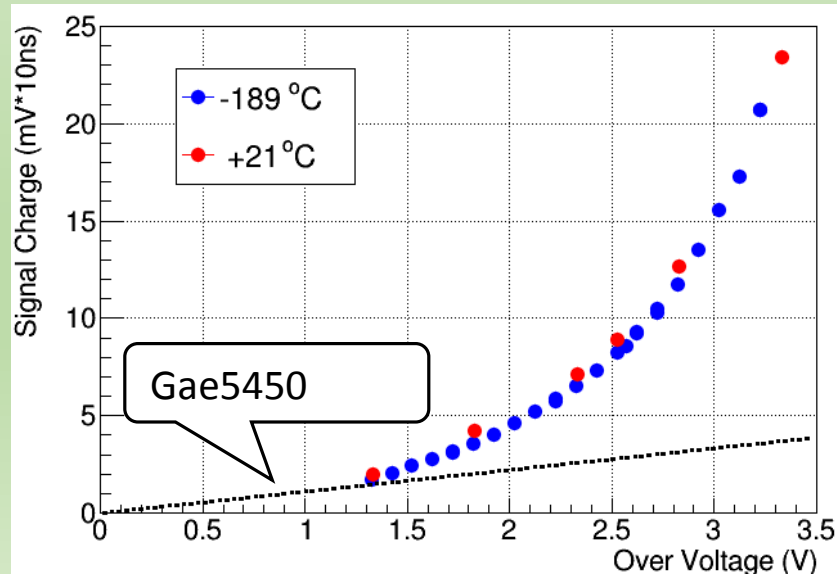
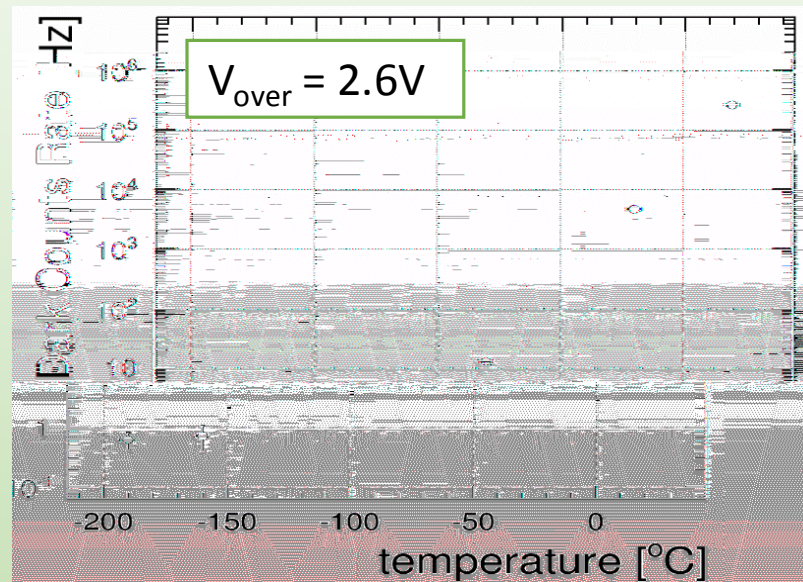
低温基礎特性試験結果

3X3MM-50UM VUV2 A0010

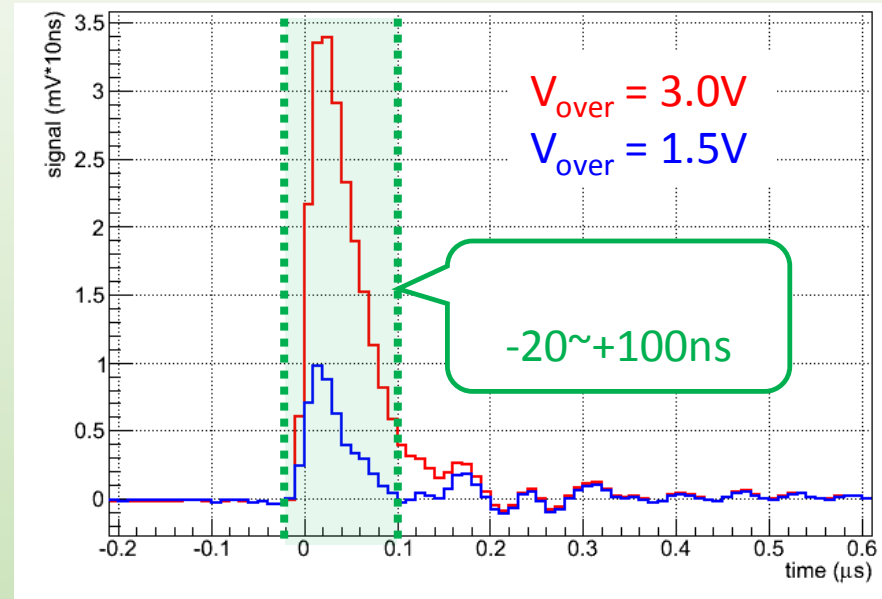
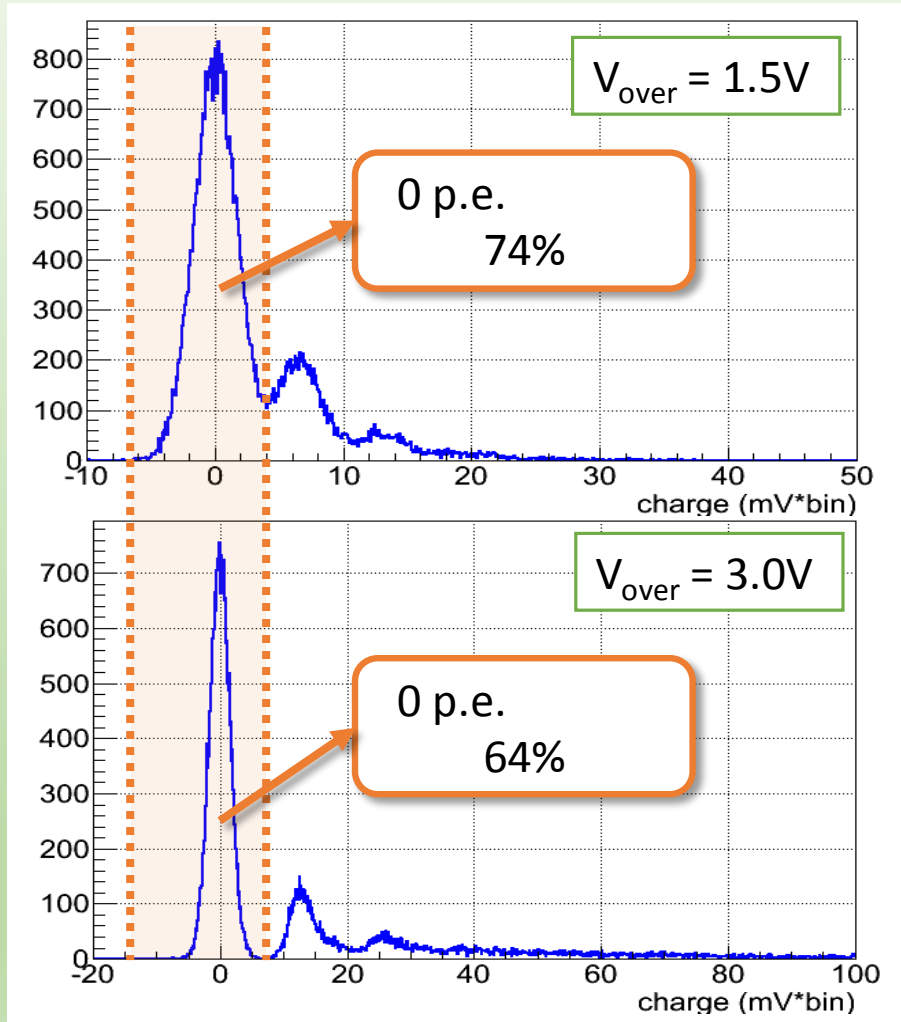
Breakdown Voltage



Dark Rate

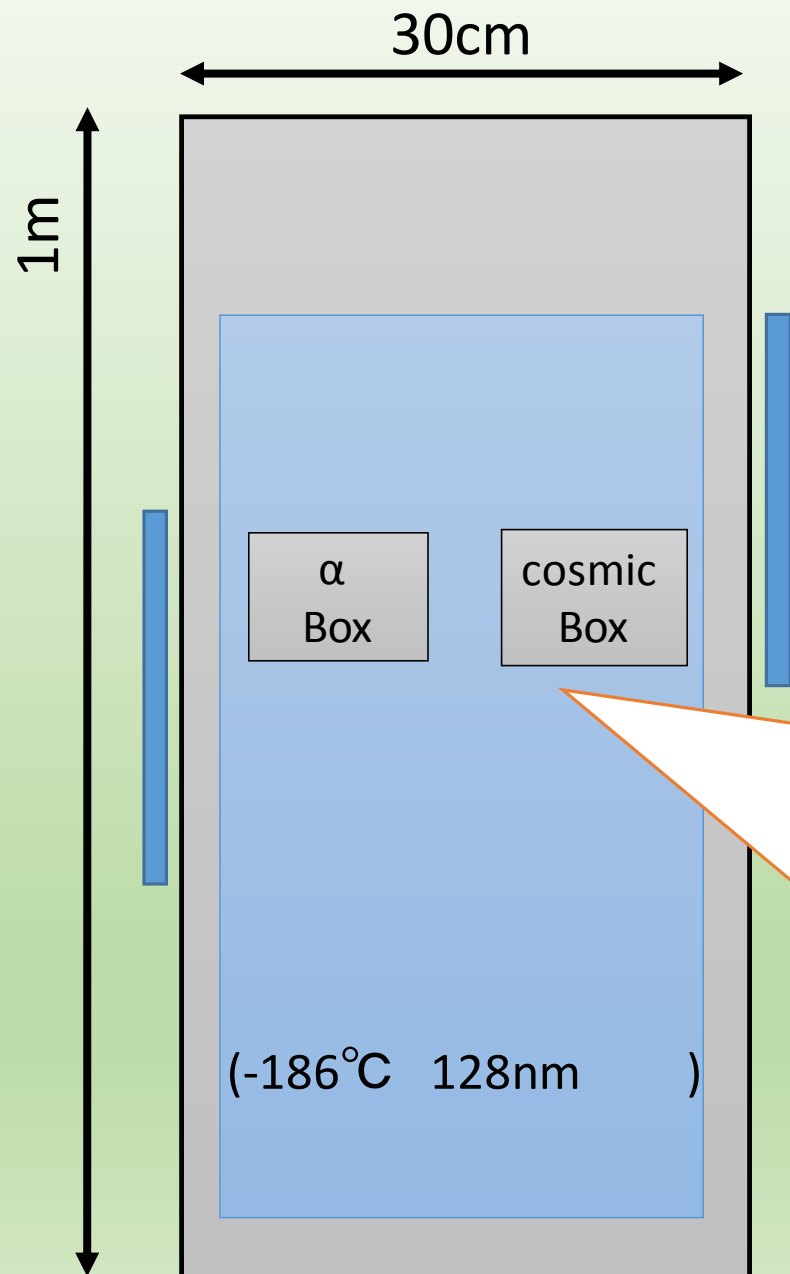


PDEとcross-talkの切り分け(-180°C)

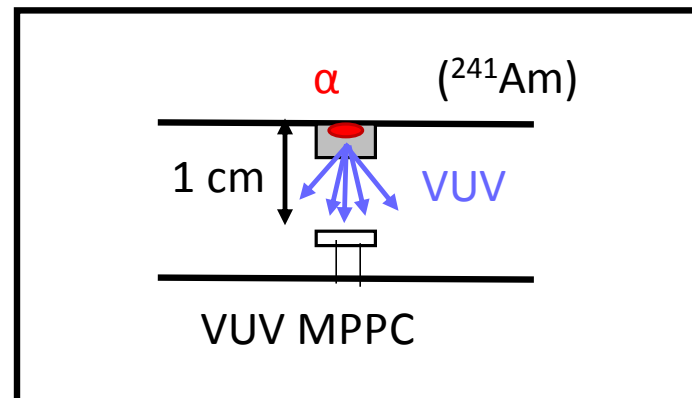


$\mu = 0.30 \text{ photon} \rightarrow 0.45 \text{ photon}$

液体アルゴン試験：セットアップ

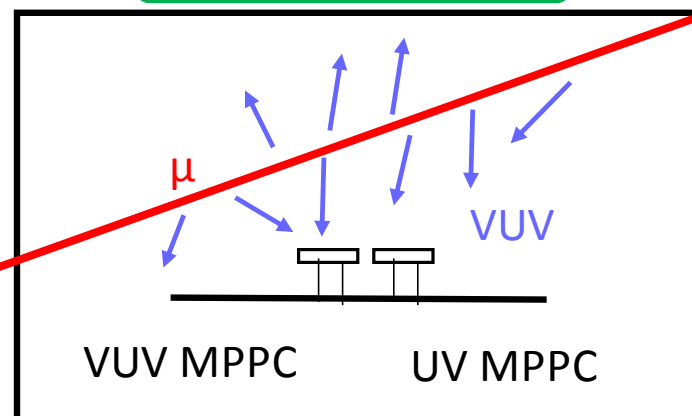


α Box



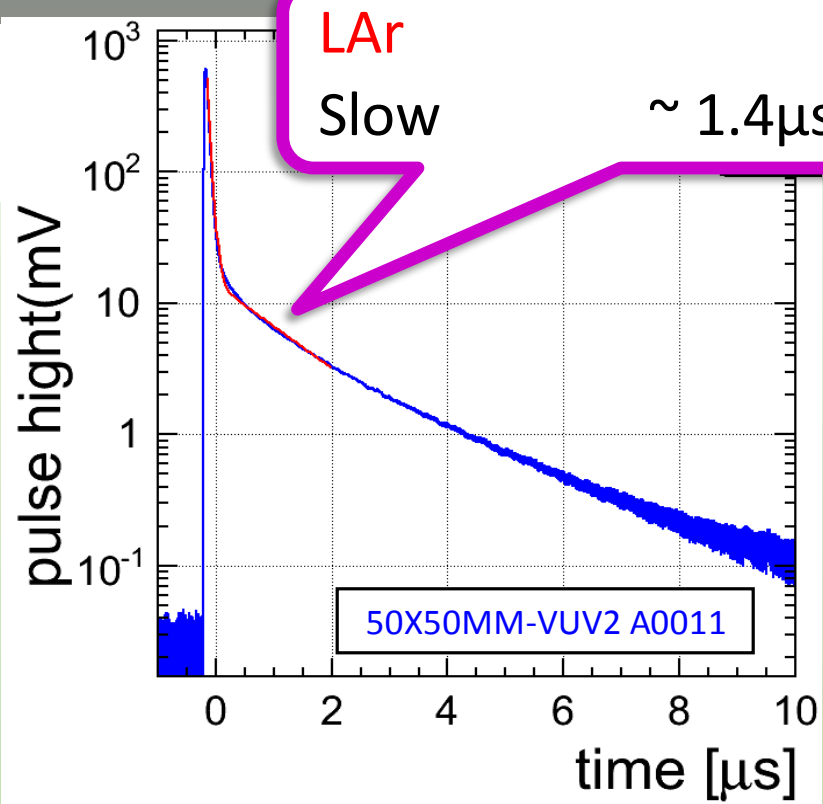
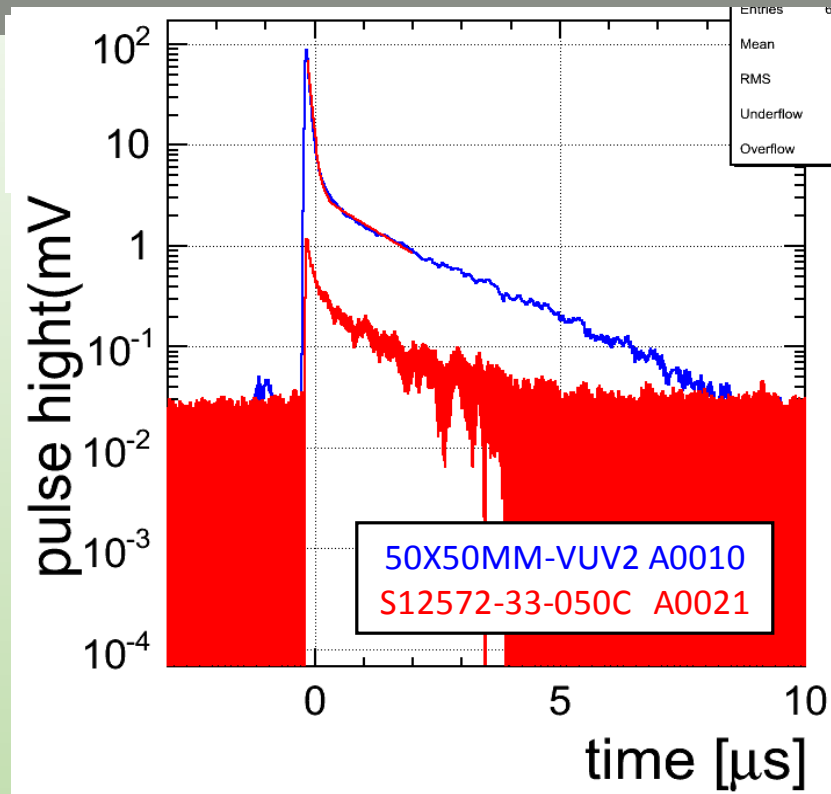
- α (5.2MeV) LAr
- 480photon

cosmic Box



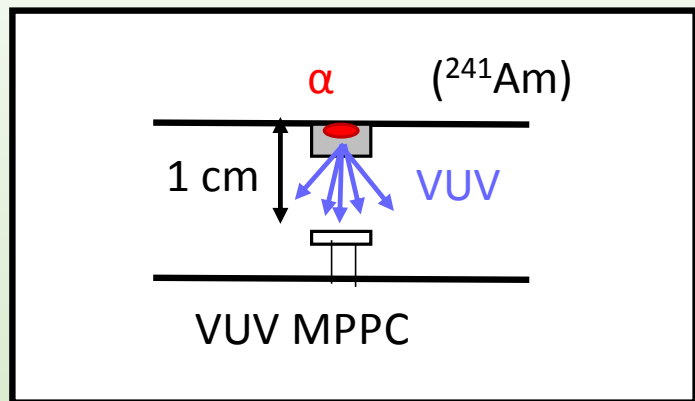
- LAr
-

液体アルゴン試験：信号波形

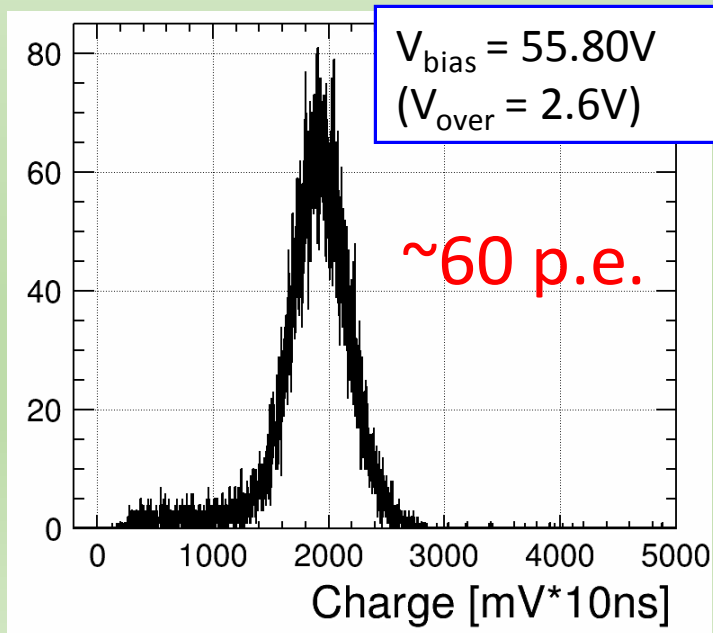


S12572-33-050C A0021	μ	57.00V	3.65V
50X50MM-VUV2 A0010	μ	57.50V	4.00V
50X50MM-VUV2 A0011	α	57.00V	3.80V

液体アルゴン試験：信号量・PDE

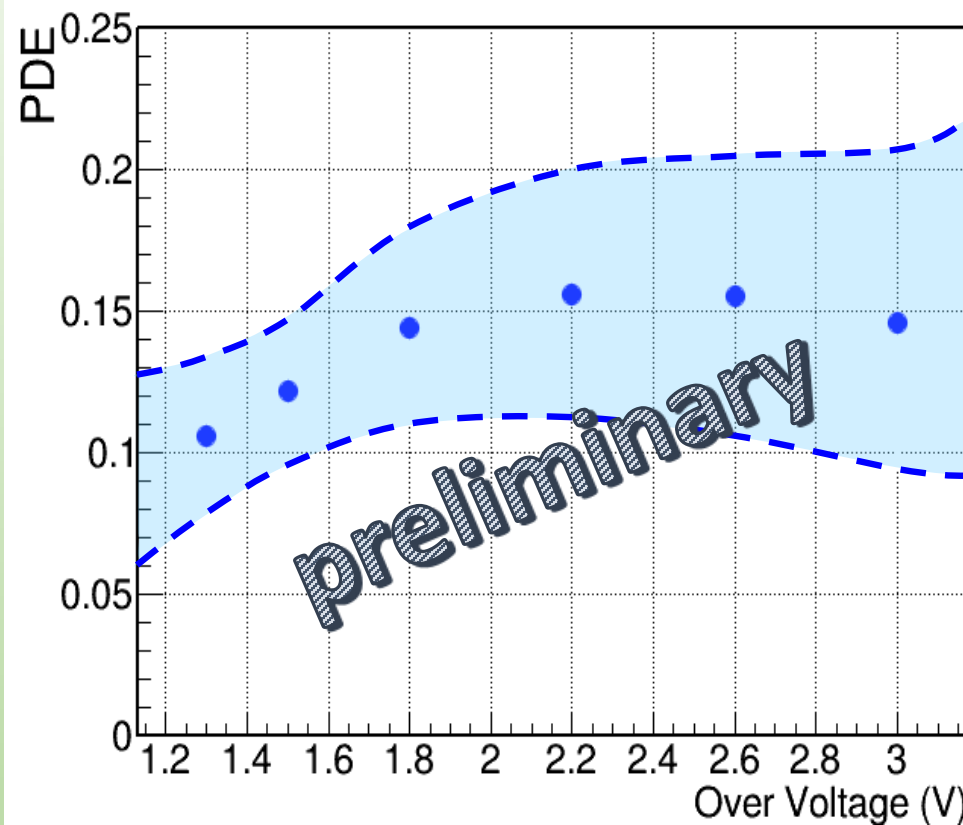


- 6.8×10^4 photon
 - MPPC 0.7%
- $\Rightarrow$ 480 photon



cross-talk

PDE



$\Rightarrow$

まとめ

- ANKOK (Argon Nisougata Kenshutuki OK) 2
Low Mass WIMP
- (-186°C 128nm)
- VUV MPPC
- MPPC
-