進捗報告
～REPIC打ち合わせ～

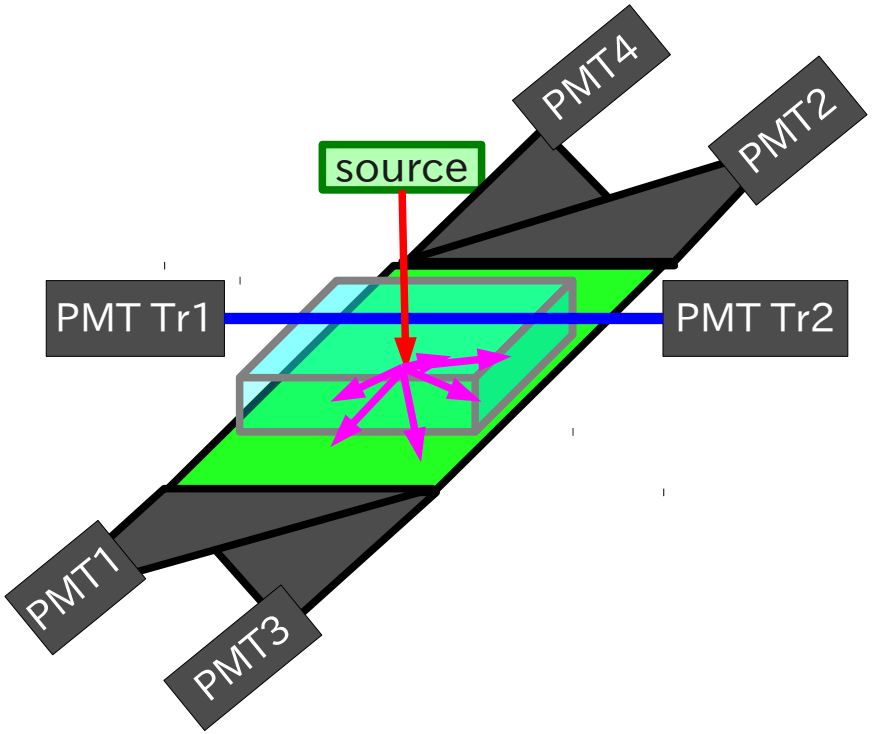
2014.06.10
H.ITO

Outline
(1) 前回の打ち合わせ内容
(2) TIPP'14学会発表結果
　　[30cm x 10 cm]試作器のテスト
　　製作＆性能評価測定
(3) 中部電力デモンストレーションに向けて

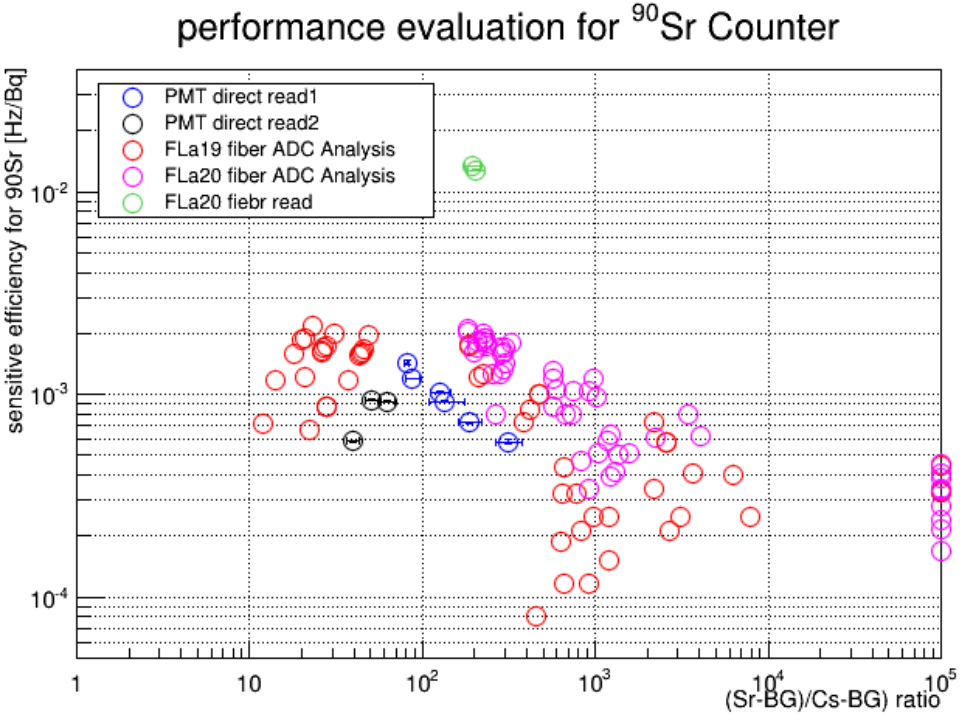
前回(3/7)の打ち合わせ

PMT直接読み出しには限界がある!?
Sr/Cs ratio ～ 100
Sr sensitive eff. ～ 10^{-3}[Hz/Bq]

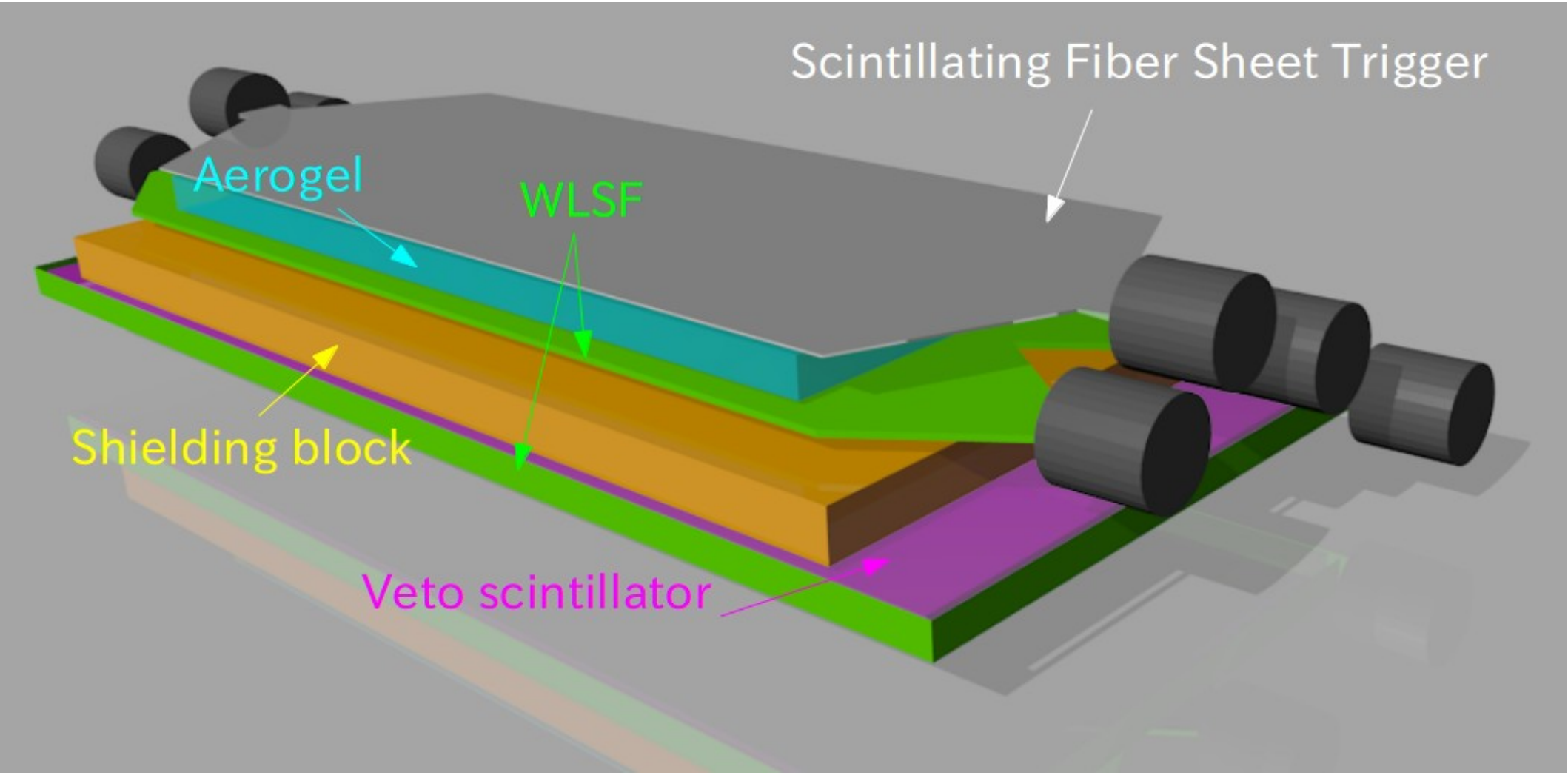
ファイバー読み出しの可能性
(Logic:PMT 1 or 2)
Sr/Cs ratio ～ 200
Sr sensitive eff. ～ 10^{-2}[Hz/Bq]



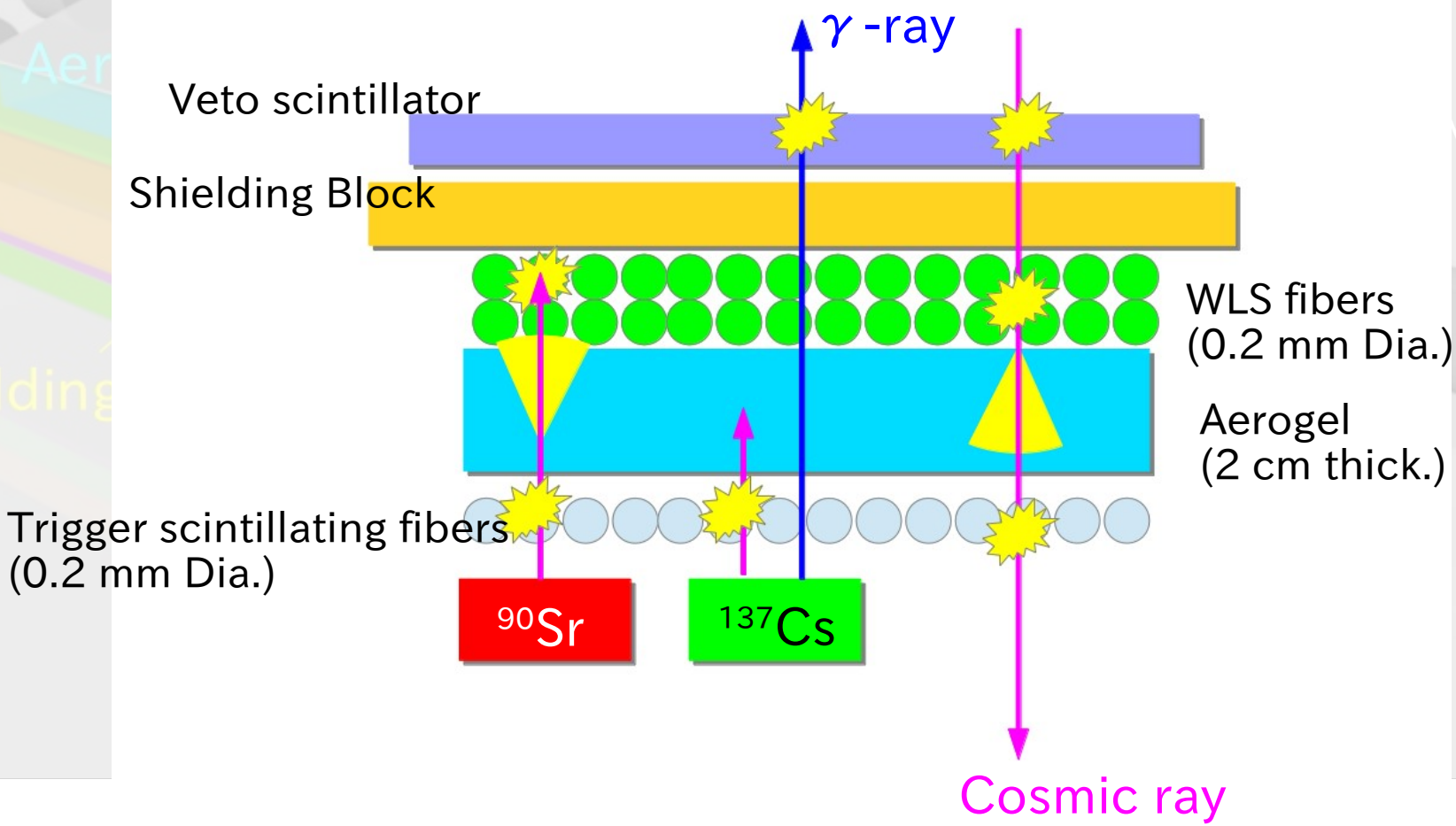
[10cm x 6 cm]試作器



Development of ^{90}Sr Counter

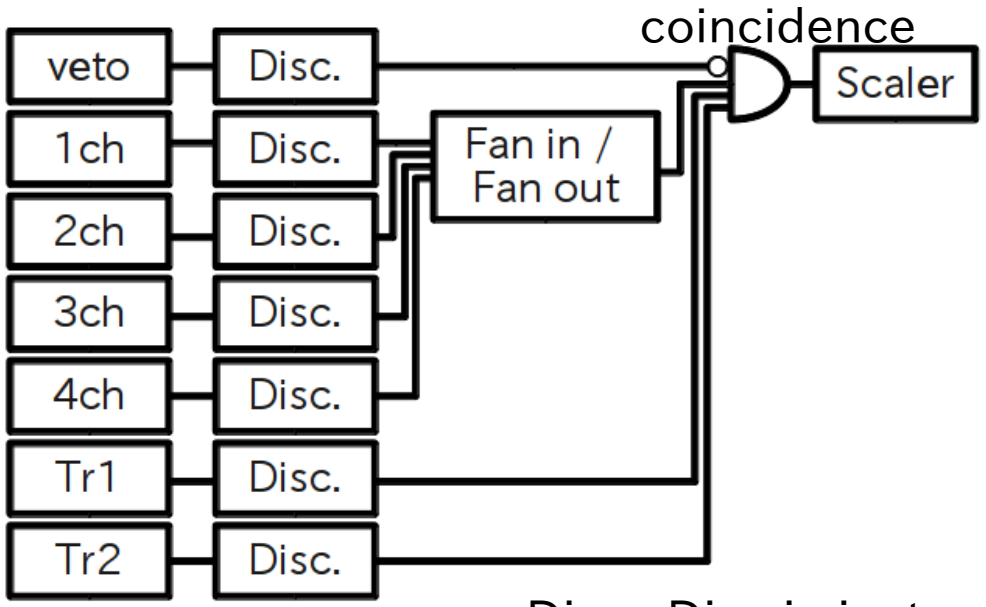


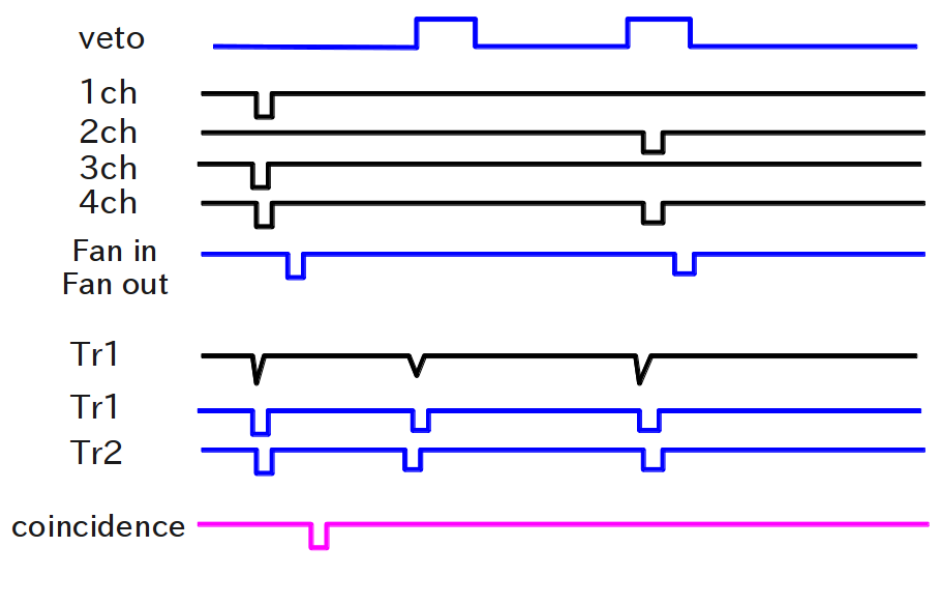
Development of ^{90}Sr Counter
Detection mechanism



Development of ^{90}Sr Counter

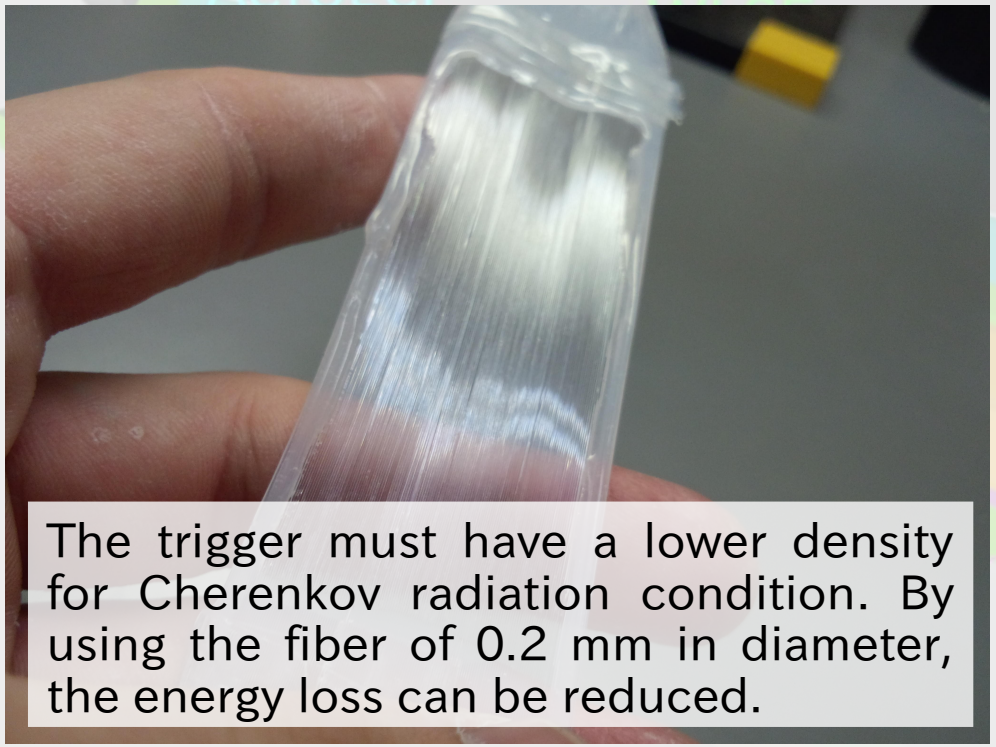
Detection Logic





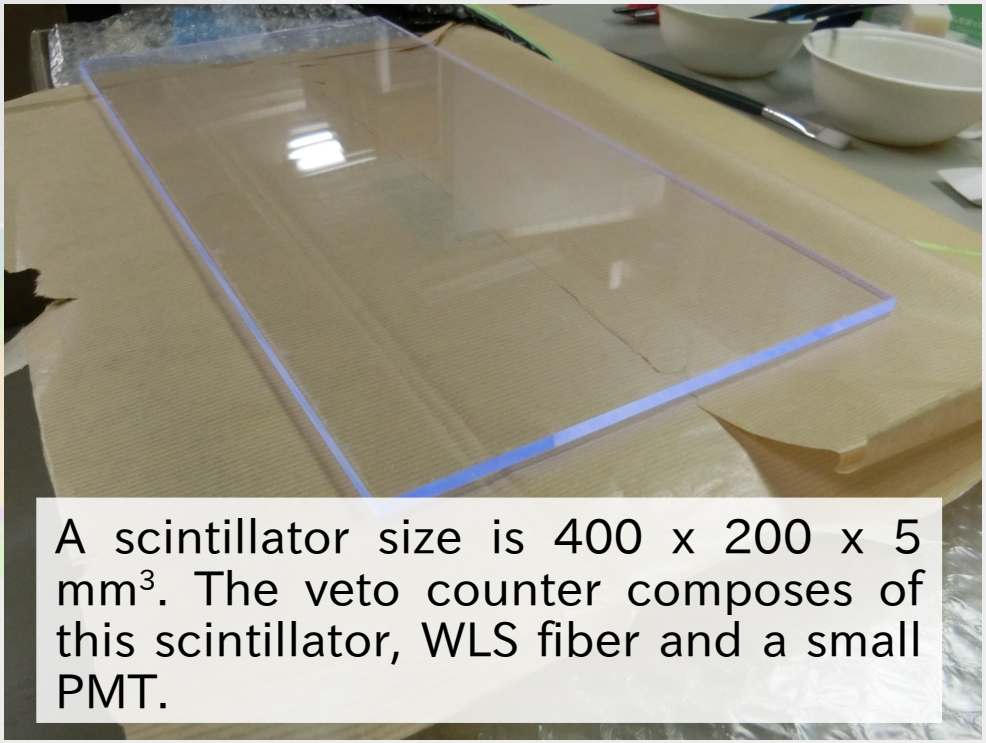
Development of ^{90}Sr Counter

Trigger fiber



The trigger must have a lower density for Cherenkov radiation condition. By using the fiber of 0.2 mm in diameter, the energy loss can be reduced.

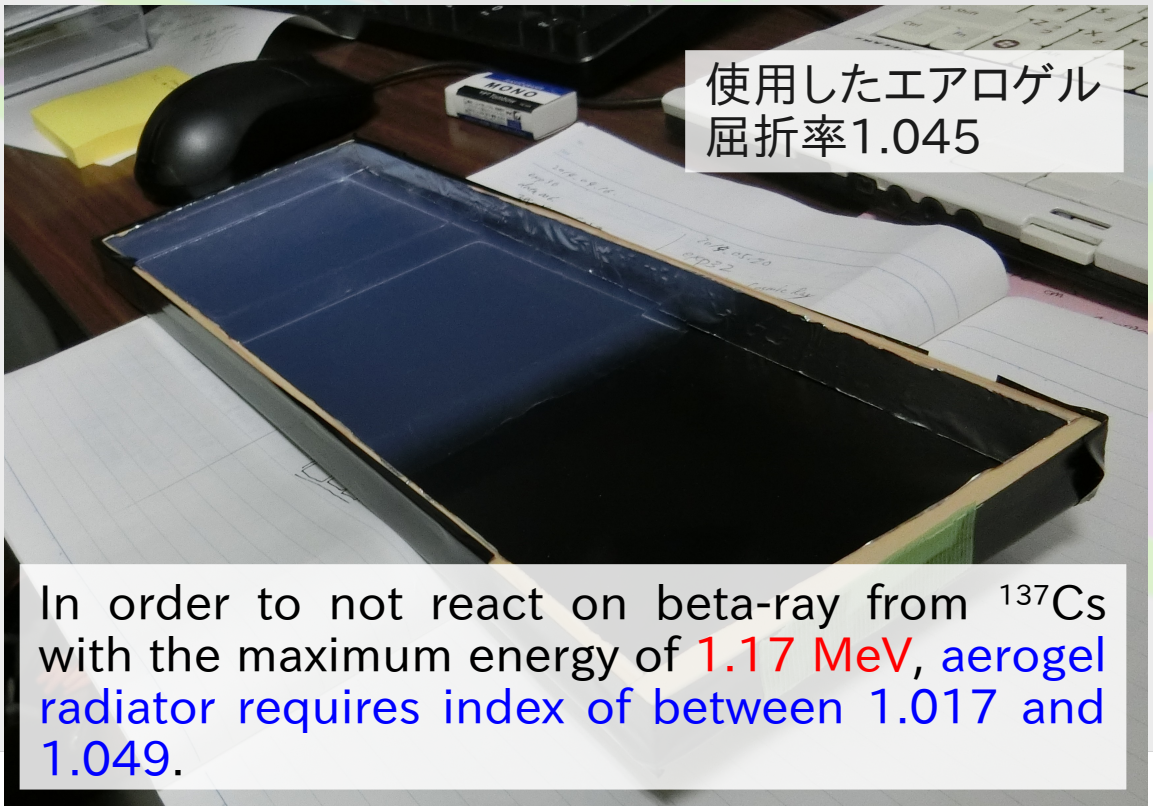
Veto scintillator



A scintillator size is 400 x 200 x 5 mm^3. The veto counter composes of this scintillator, WLS fiber and a small PMT.

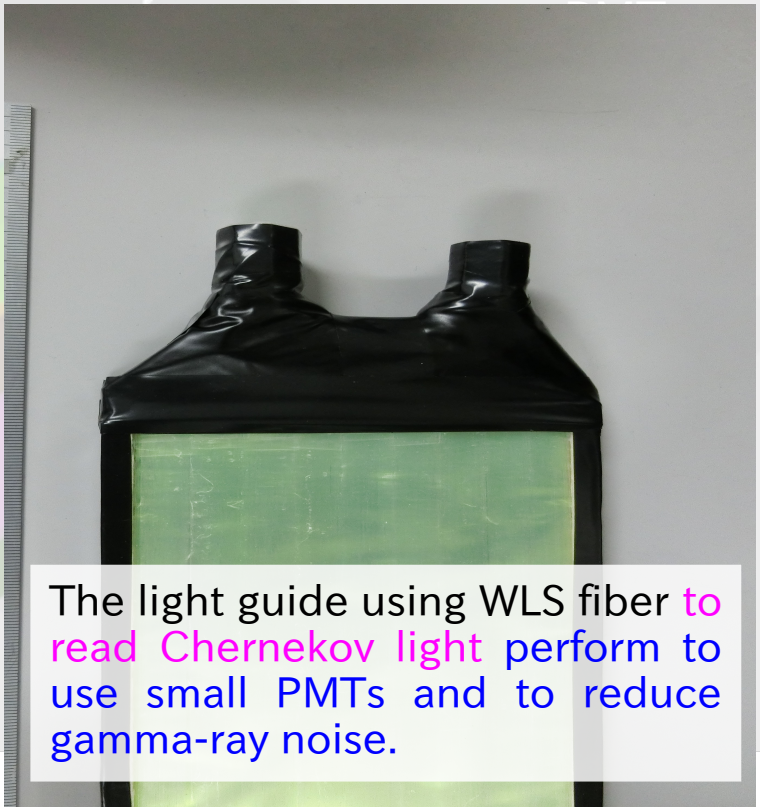
Development of ^{90}Sr Counter

Aerogel



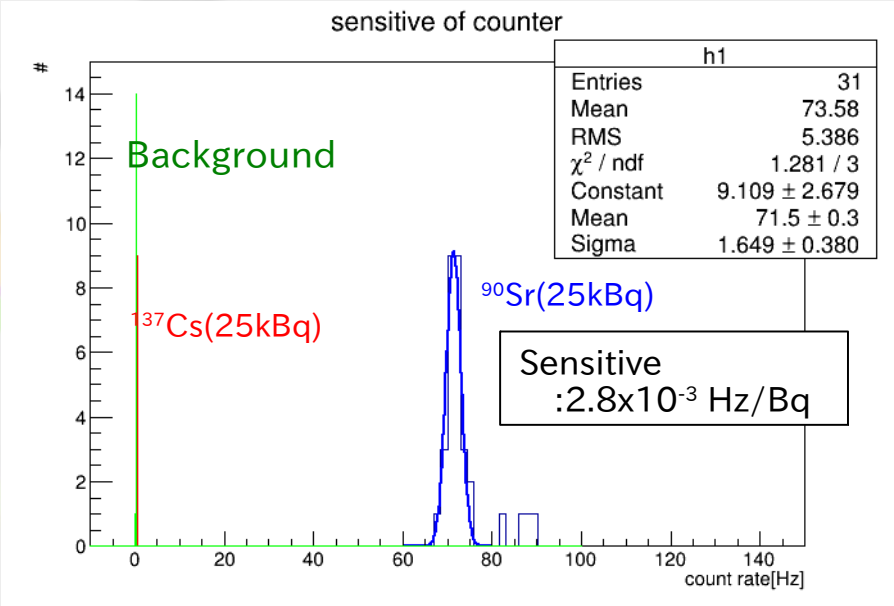
In order to not react on beta-ray from ^{137}Cs with the maximum energy of 1.17 MeV, aerogel radiator requires index of between 1.017 and 1.049.

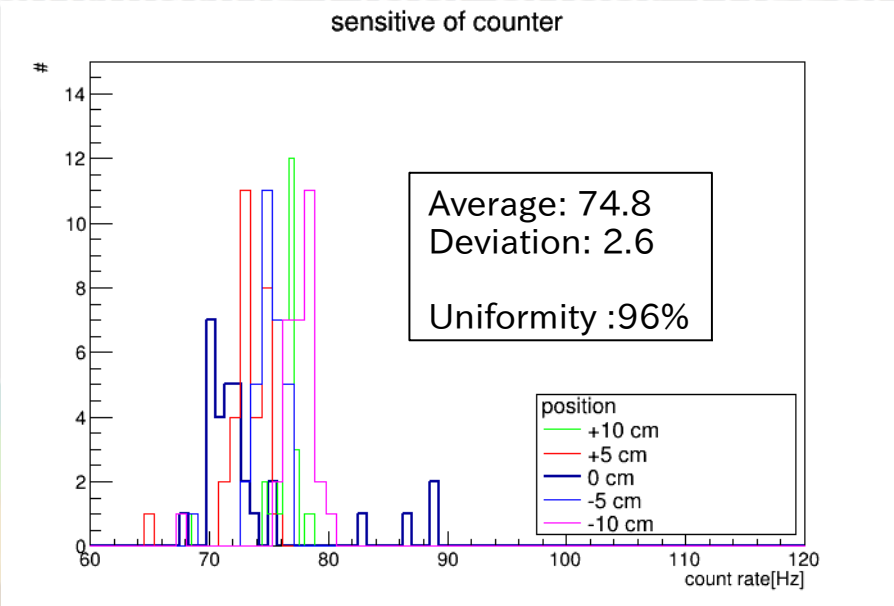
WLS fiber

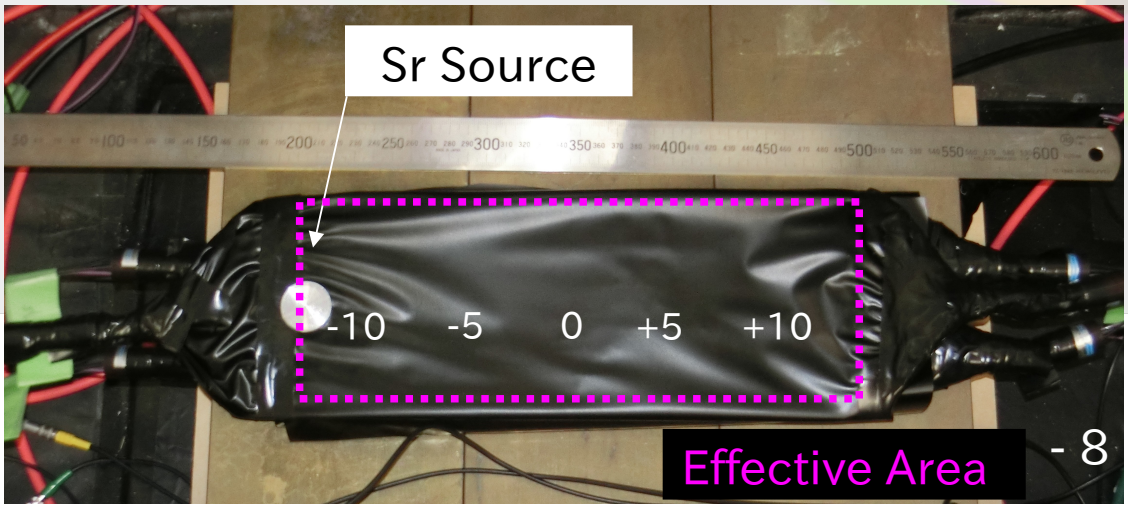


The light guide using WLS fiber to read Chernekov light perform to use small PMTs and to reduce gamma-ray noise.

Development of ^{90}Sr Counter Performance







Prototype

Effective area :	30 x 10 cm^2
^{90}Sr sensitivity :	2.8 x 10^{-3} Hz/Bq
^{137}Cs sensitivity:	6 x 10^{-6} Hz/Bq
BG noise ratio	0.28 Hz
Sr/Cs ratio:	500
Position uniformity :	96%

Discussion1

Prototype

Effective area :	30 x 10 cm^2
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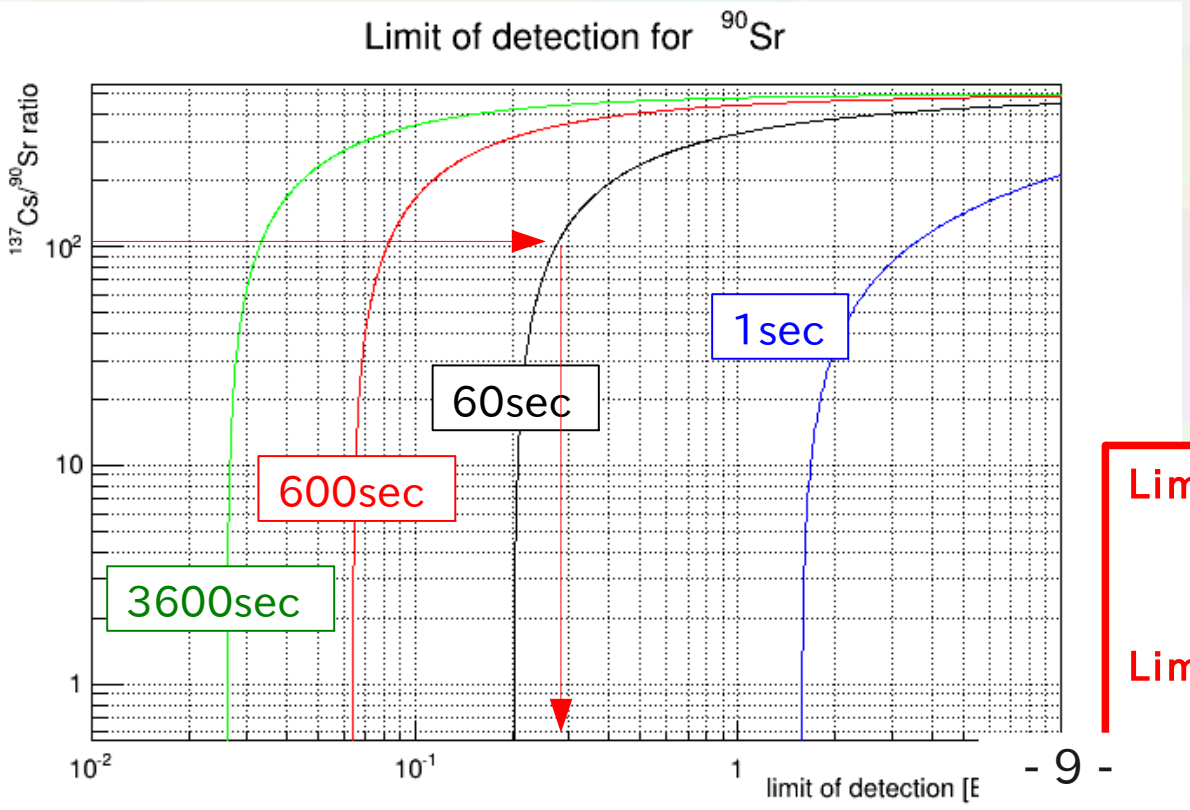
Position uniformity :	96%

$$N_{Sr} = aSxt + ct$$
$$N_{Cs} = bkSxt + ct$$
$$N_{Sr} > N_{Cs} + 2.58\sqrt{N_{Cs}}$$

Reliability of 99% or more

N_{Sr} : Number of counts for Sr
N_{Cs} : Number of counts for Cs
a : Sr sensitivity $[Hz/Bq]$
b : Cs sensitivity $[Hz/Bq]$
c : Noise ratio $[Hz]$
S : Effective area $[cm^2]$
k : Sr/Cs ratio
t : time of measurement $[sec]$
x : lomit of detection $[Bq/cm^2]$



Limit of detection : ～0.3 [Bq/cm²]

Monitoring time : 60 sec
Allowable ratio of Cs/Sr : 100

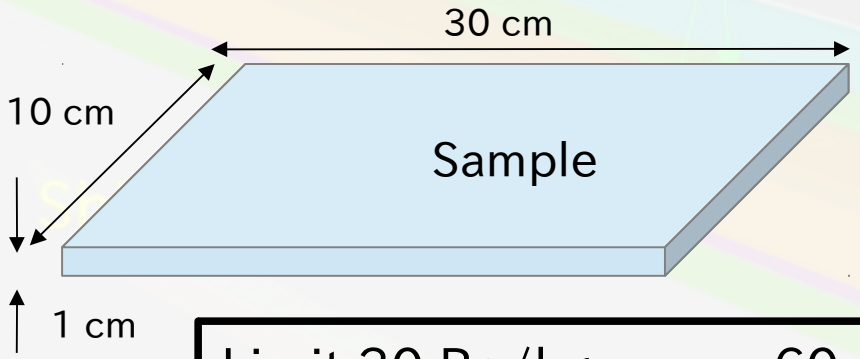
Limit of detection : ～0.08 [Bq/cm²]

Monitoring time : 600 sec
Allowable ratio of Cs/Sr : 100

Discussion2

New reference value: 10 Bq/kg of ^{90}Sr in foods
by Ministry of Health, Labour and Welfare in Japan.

Beta-ray is measured only the surface of the sample.



Improving the performance

(1) PMT logic optimization
(2) Extending effective area
...and so on.

Limit 30 Bq/kg ··· 60 sec
Limit 8 Bq/kg ··· 600 sec

The limit of detection satisfies the reference value with monitoring of 10 minutes.

Summary

Srカウンターの試作製作と性能評価を行った。

Effective area :	30 x 10 cm^2
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^{137}Cs sensitivity:	6 x 10^{-6} Hz/Bq
BG noise ratio:	0.28 Hz
Sr/Cs ratio:	500
Position uniformity :	96%

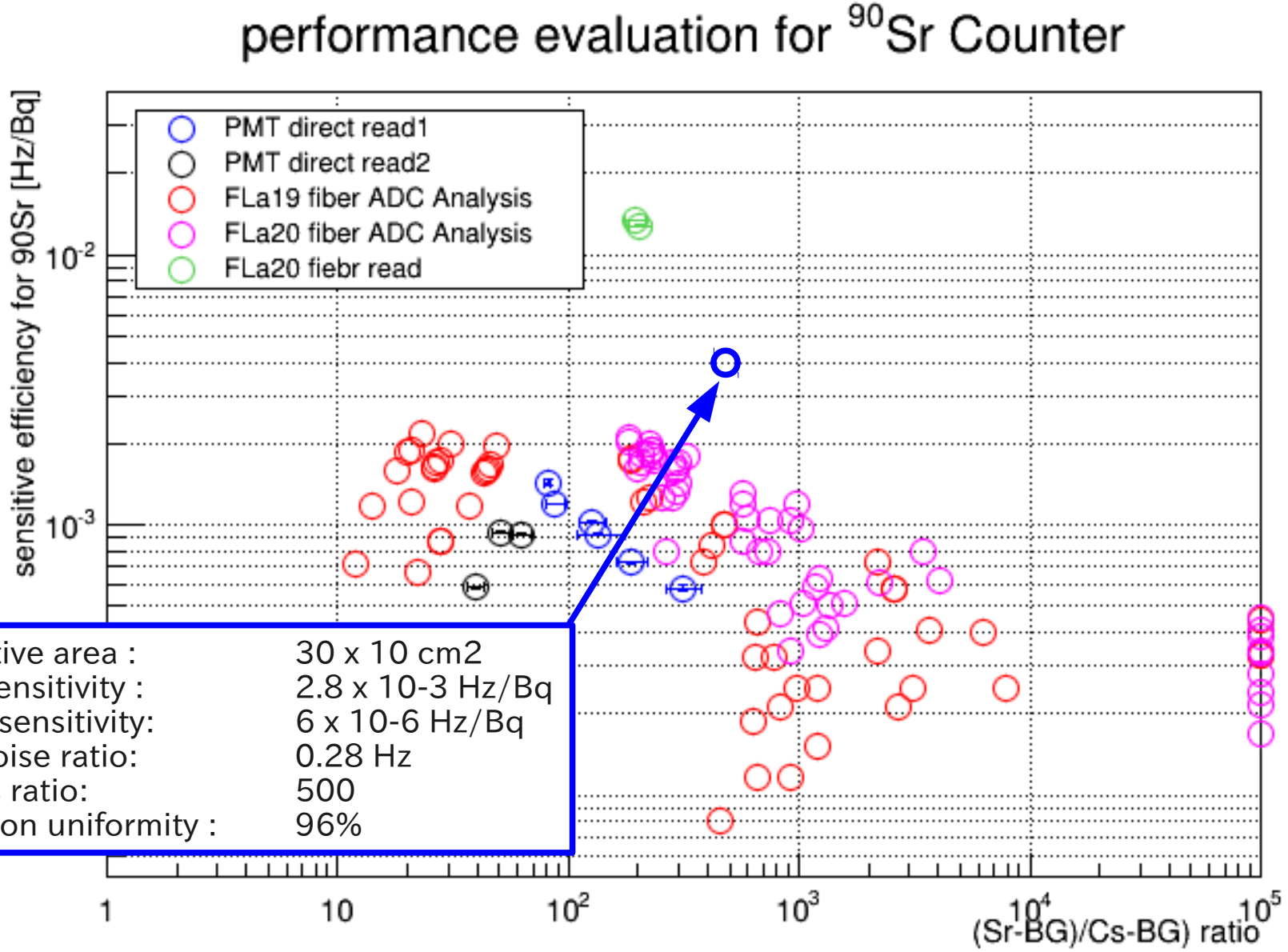
検出限界：8 [Bq/kg]

Sample size:	30 x 10 x 1 cm^3
Monitoring time:	600 sec
Allowable ratio of Sr/Cs:	100

Reliability of 99% or more

10分間モニタリングでは99%以上の信頼性のある^{90}Sr汚染濃度の測定限界10Bq/kgを達成した。

Summary



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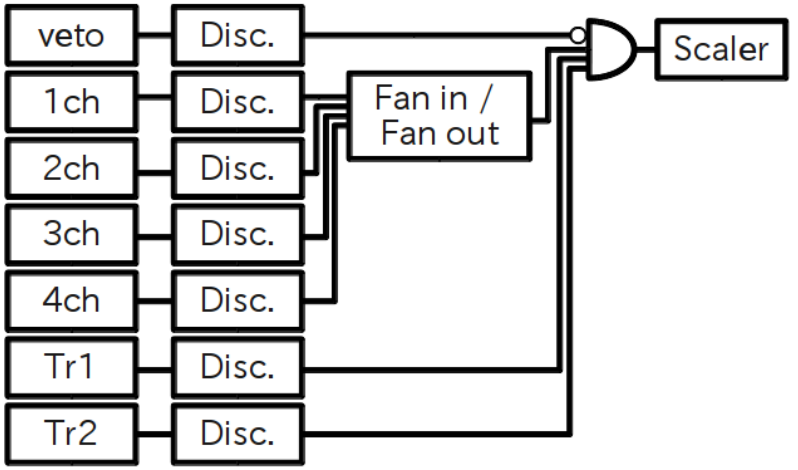
^{90}Sr sensitivity :	2.8 x 10-3 Hz/Bq
^{137}Cs sensitivity:	6 x 10-6 Hz/Bq
BG noise ratio:	0.28 Hz
Sr/Cs ratio:	500
Position uniformity :	96%

中部電力デモンストレーションに向けて

- [30cm x 10cm]試作器を使用
  ファイバー, PMT, エアロゲル...
- アルミ板で外箱の製作@千葉大
- 読み出し回路@REPIC

アルミ板で遮光＆遮蔽

回路ユニット
REPIC用意出来なかった
ときのBackup



回路について
(1) Disc. のthreshold, width調節
(2) タイミング調節
(3) ScalerからNIM出力
→ PCでのモニタリング可