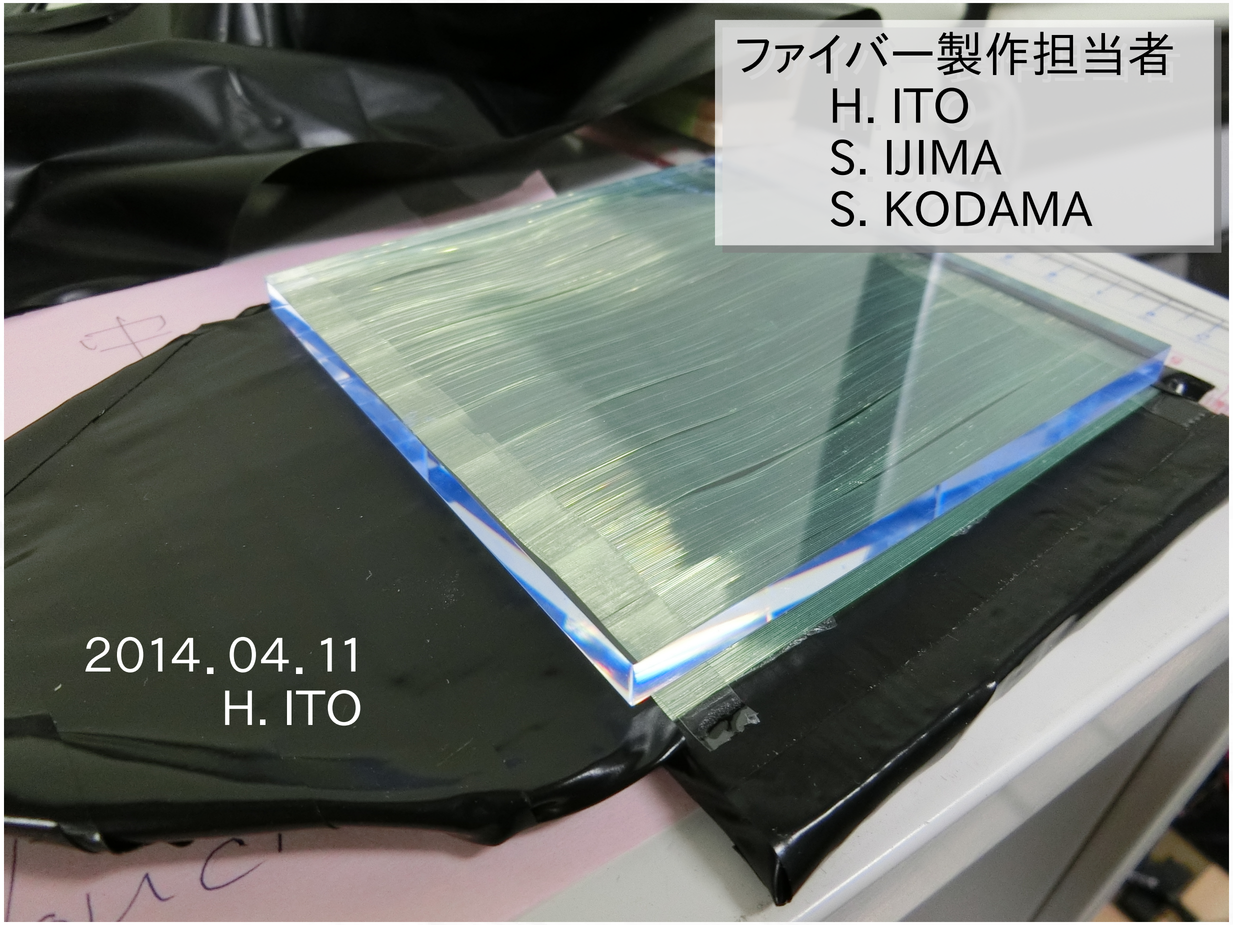
vetoシンチ用WLSFライトガイド評価測定



WLSFシート製作

WLSF(波長変換ファイバー)

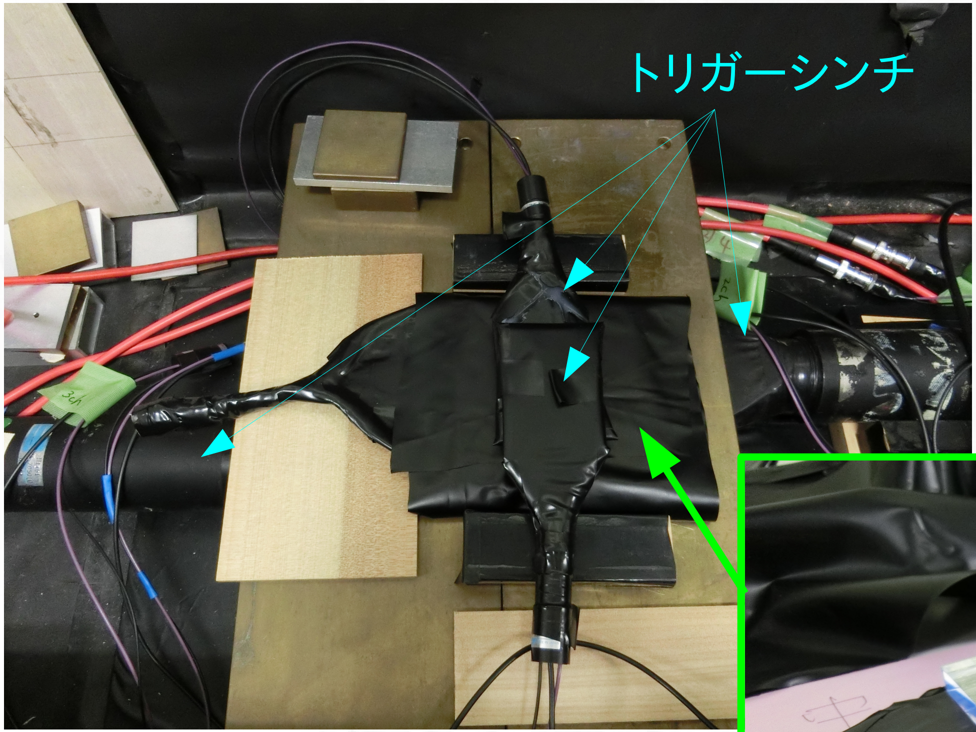
Type:	Y-11(0.2 mm 直径, ダブルクラッド)
有効面積:	10 x 10 [cm^2]
断面:	7 mm 直径
本数:	500本
PMT:	片側読み出し
製作日数:	5日

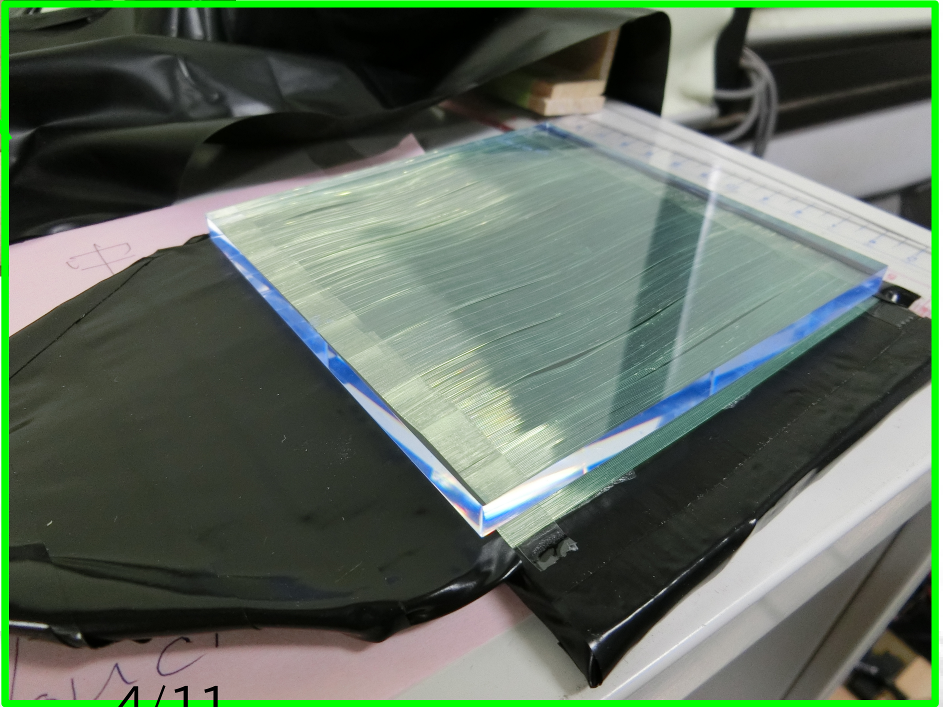
目的

- ストロンチウムカウンターのvetoカウンター製作
- 10 x 10 [cm^2]トリガー製作
- ファイバーPETのライトガイド部分の製作練習

シンチのWLSFシートを貼る面の違いを検出効率や時間分解能などを調べ、性能と製作の容易さコストなどについて議論したい

実験setup





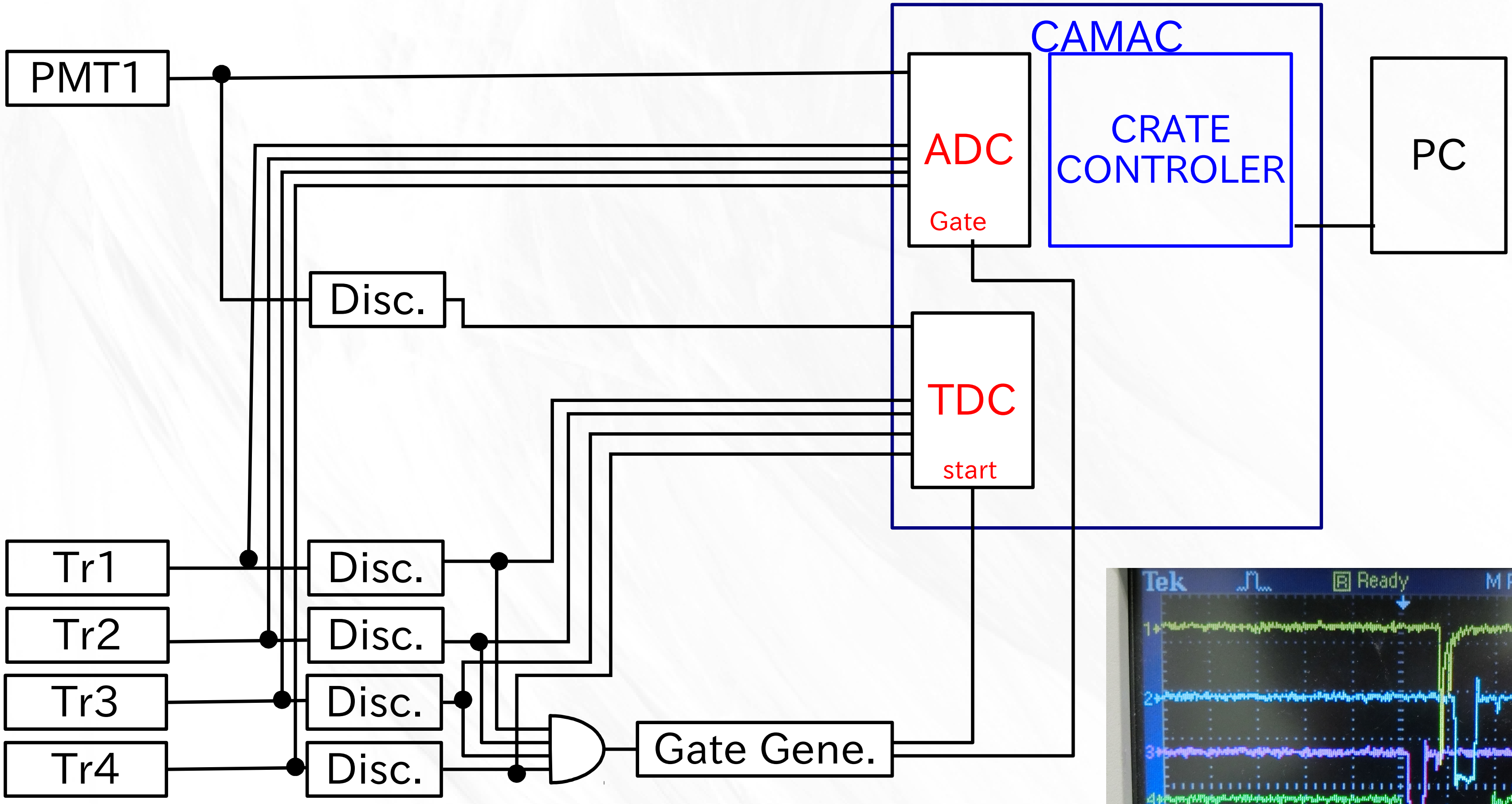
4つのシンチが同時に反応したイベントは宇宙線が通過したはず。

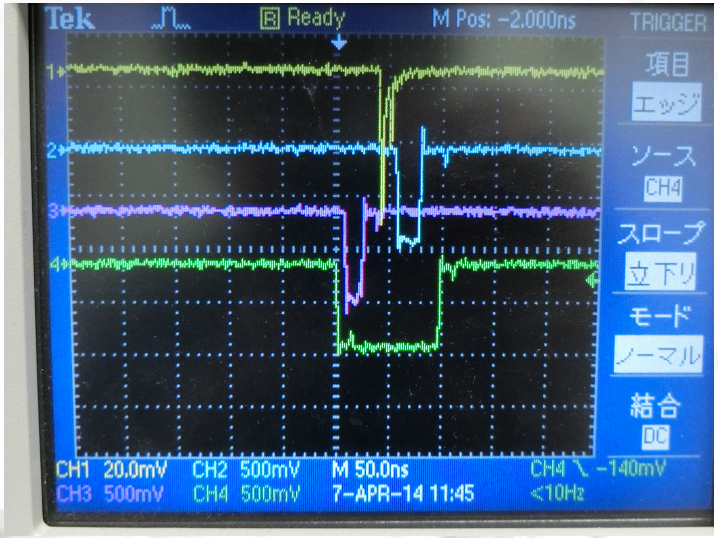
トリガー
- 面積　:55 cm^2
- 立体角　:〜0.08

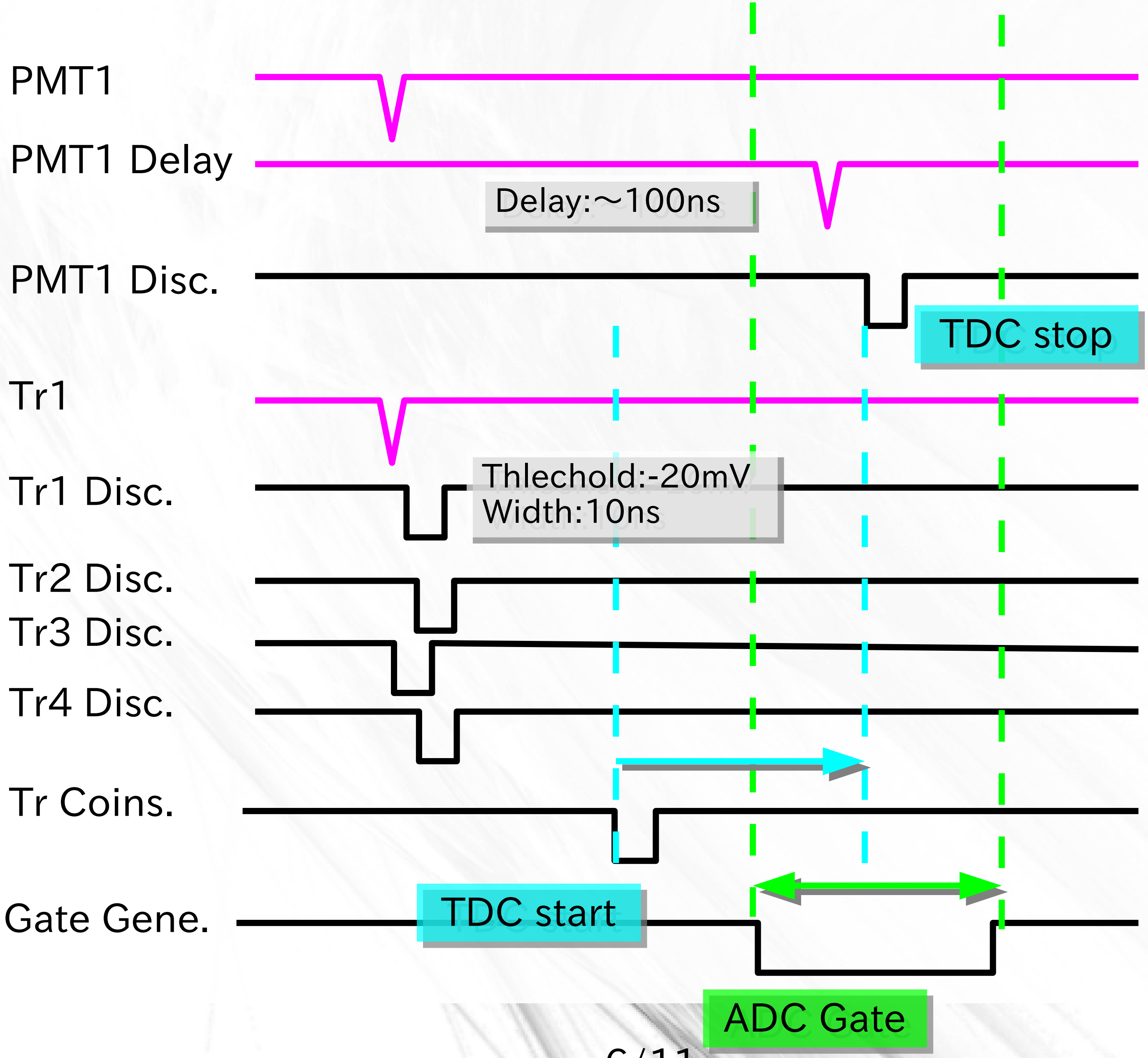
シンチ面積:10X10 cm^2

トリガー頻度:67 cph

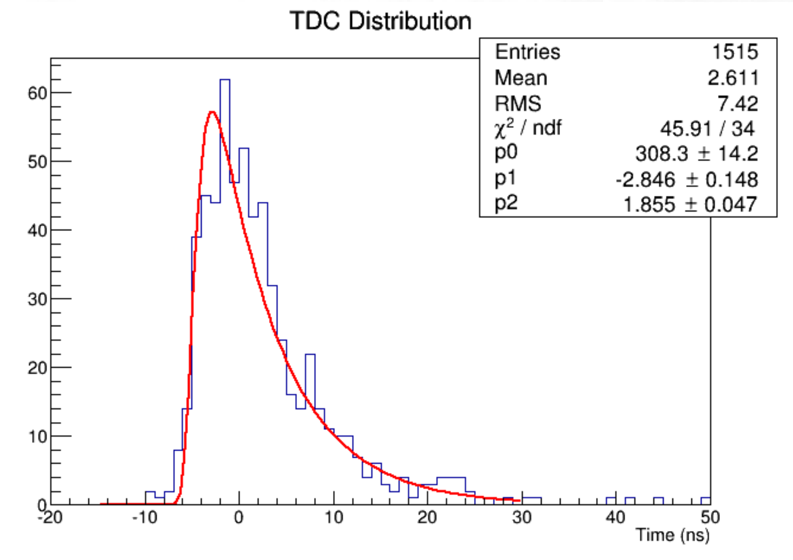
実験setup DAQ回路

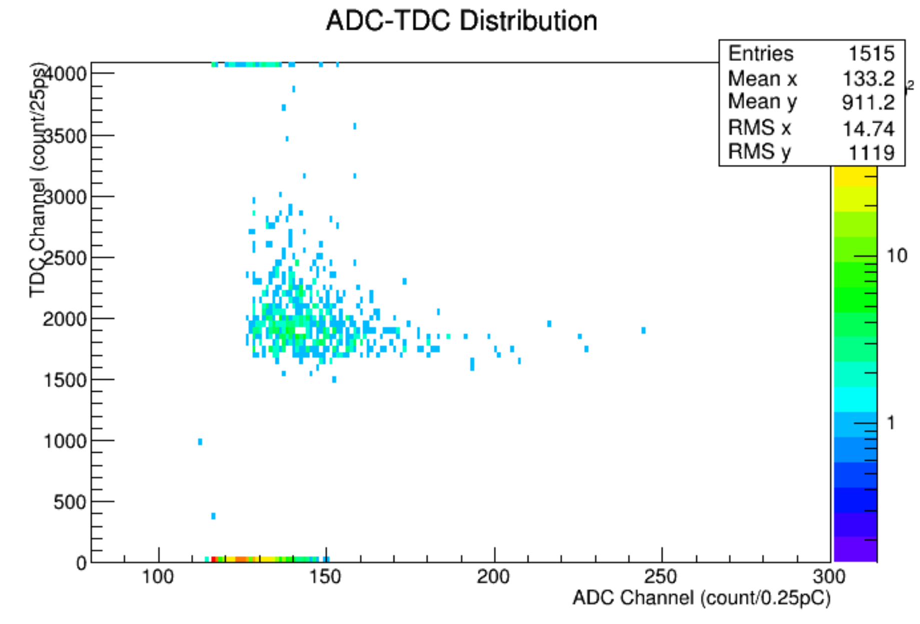





PMT1
PMT1 Delay
Delay:∼100ns
PMT1 Disc.
TDC stop
Tr1
Tr1 Disc.
Thlechold:-20mV
Width:10ns
Tr2 Disc.
Tr3 Disc.
Tr4 Disc.
Tr Coins.
Gate Gene.
TDC start
ADC Gate

解析方法





検出効率(0.5 p.e. threshold)

90 ± 2 %

平均光電子数

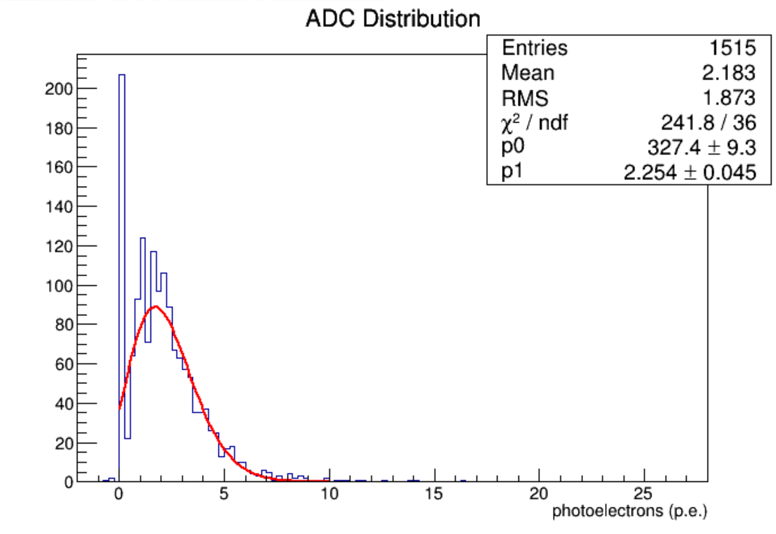
2.25 ± 0.06 p.e.

*Poisson distribution

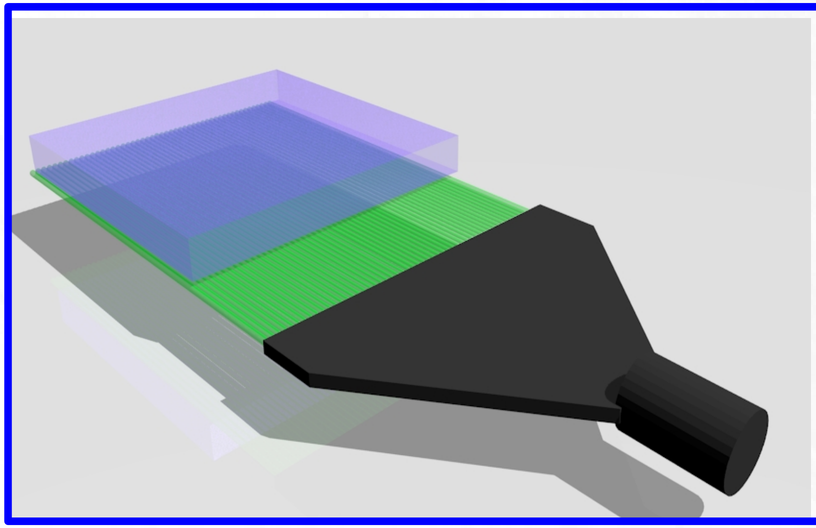
時間分解能

1.86 ns

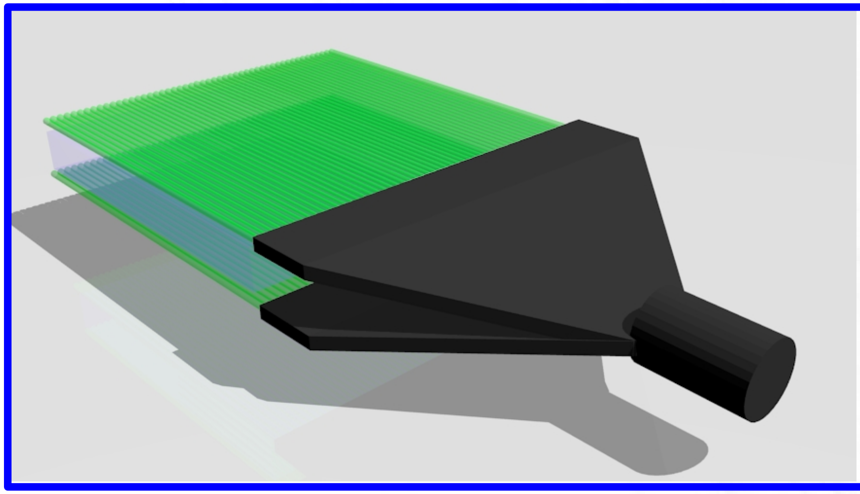
*Landau distribution



結果

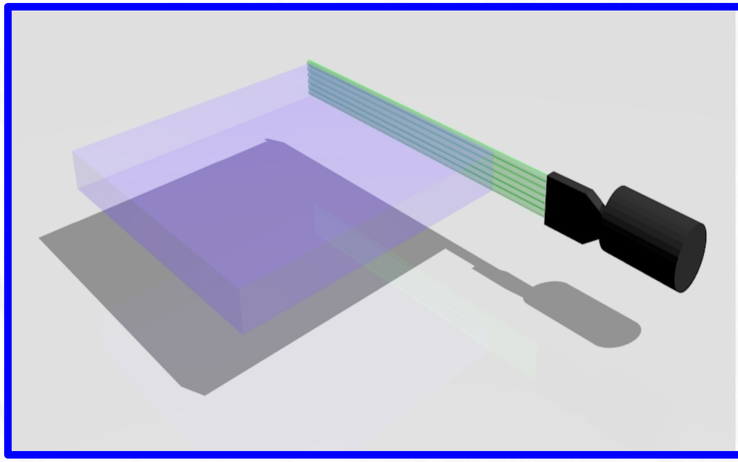


poisson fitting	[p.e.]
mean of photoelectrons	2.25
error p.e.(stat.)	0.06
efficiency of 0.5 p.e. threshold	
efficiency	**0.90**
error eff.(stat.)	0.02
timing resolution	[ns]
timing resolution	1.86



poisson fitting	[p.e.]
mean of photoelectrons	3.60
error p.e.(stat.)	0.09
efficiency of 0.5 p.e. threshold	
efficiency	**0.98**
error eff.(stat.)	0.02
timing resolution	[ns]
timing resolution	1.65

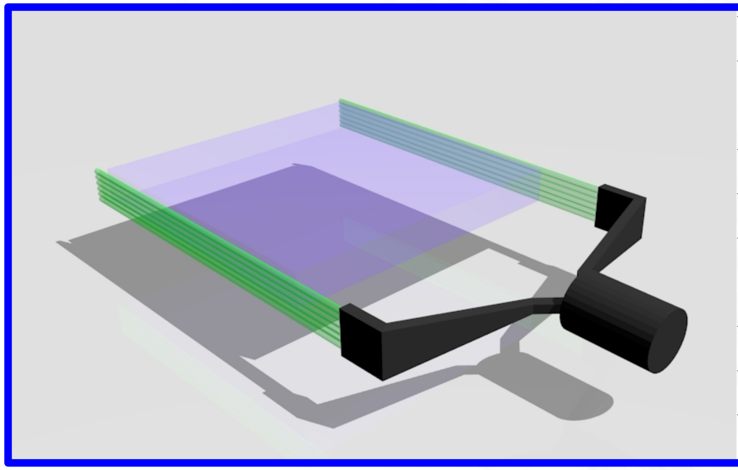
結果



poisson fitting	[p.e.]
mean of photoelectrons	1.17
error p.e.(stat.)	0.03

efficiency of 0.5 p.e. threshold	
efficiency	**0.76**
error eff.(stat.)	0.02

timing resolution	[ns]
timing resolution	2.07

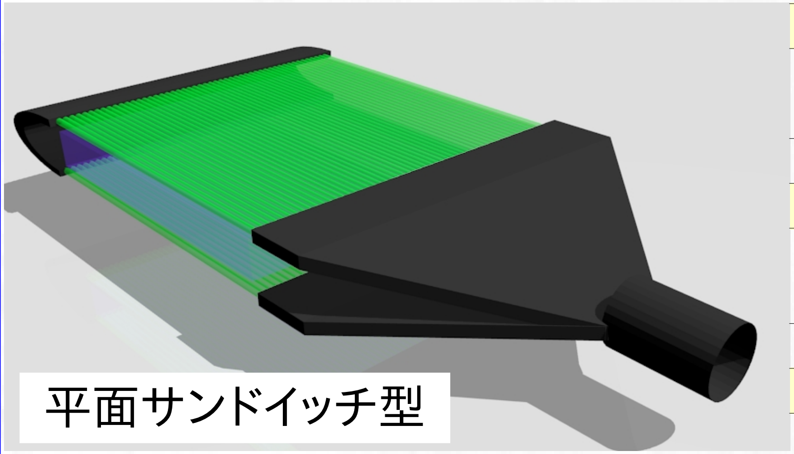


poisson fitting	[p.e.]
mean of photoelectrons	1.88
error p.e.(stat.)	0.05

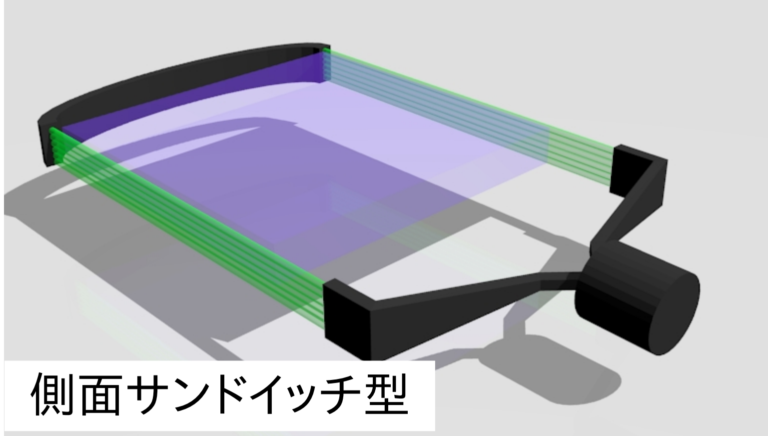
efficiency of 0.5 p.e. threshold	
efficiency	**0.87**
error eff.(stat.)	0.02

timing resolution	[ns]
timing resolution	1.87

結果



poisson fitting	[p.e.]
mean of photoelectrons	7.01
error p.e.(stat.)	0.21
efficiency of 0.5 p.e. threshold	
efficiency	**0.996**
error eff.(stat.)	0.03
timing resolution	[ns]
timing resolution	0.71



Fiber layers number	1	2
poisson fitting	[p.e.]	[p.e.]
mean of photoelectrons	2.89	3.62
error p.e.(stat.)	0.08	0.09
efficiency of 0.5 p.e. threshold		
efficiency	**0.95**	**0.97**
error eff.(stat.)	0.03	0.02
timing resolution	[ns]	[ns]
timing resolution	1.12	0.986

考察・議論

有効面積 10 x 10 [cm^2]で厚さ5mmのシンチ用のライトガイドは

平面サンドイッチ型 …	WLSF 0.2 mm Dia.	: 500本, 30 cm = 5 cm^3
	cross section	: 9 mm Dia.
	Efficiency	: 99.6%
	Time resolution	: ～0.7 ns
側面サンドイッチ1型 …	WLSF 0.2 mm Dia.	: 25本, 50 cm = 0.4 cm^3
	cross section	: 1.3 mm Dia.
	Efficiency	: 95%
	Time resolution	: ～1.2 ns
側面サンドイッチ2型 …	WLSF 0.2 mm Dia.	: 50本, 50 cm = 0.8 cm^3
	cross section	: 2.5 mm Dia.
	Efficiency	: 97%
	Time resolution	: ～0.9 ns