進捗報告2014.07.04

- contents -

(1) Fiber Sheet 製作と性能評価測定

- ファイバーライトガイド製作
  - FLa37 … BYOR(6x10cm^2)
  - FLa38 … ScYOR(6x10cm^2)
  - FLa39 … ScSCYY(6x10cm^2)

製作完了！

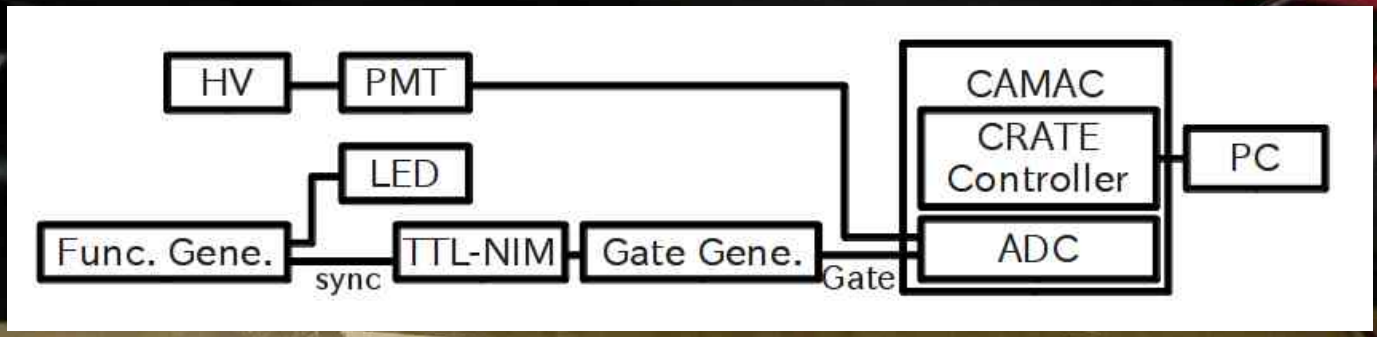
- ファイバーシート性質測定
  - Attenuation Length, Bending Loss

詳細 → ページ3

- ファイバーライトガイド宇宙線による性能評価測定
  - エアロゲル(1.05, 厚さ6cm)、PMT R9880U-210&20を使用

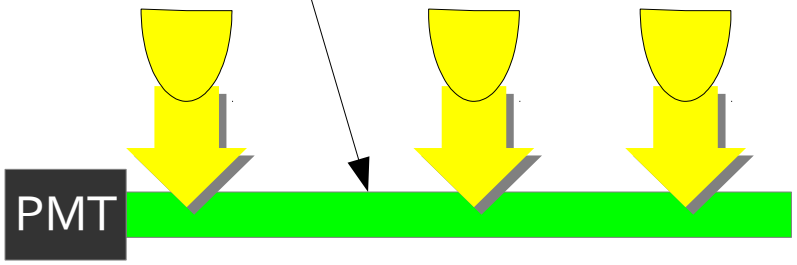
詳細 → ページ7

Setup for WLSF properties

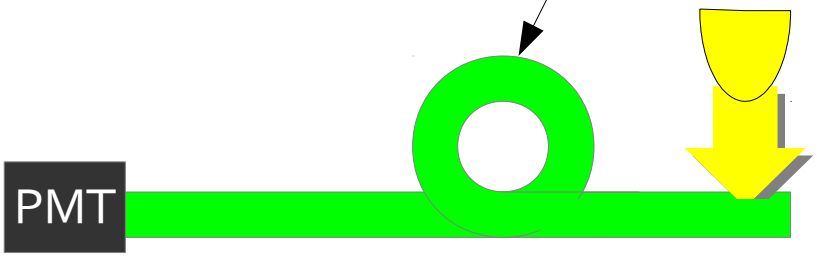


PMT

LED



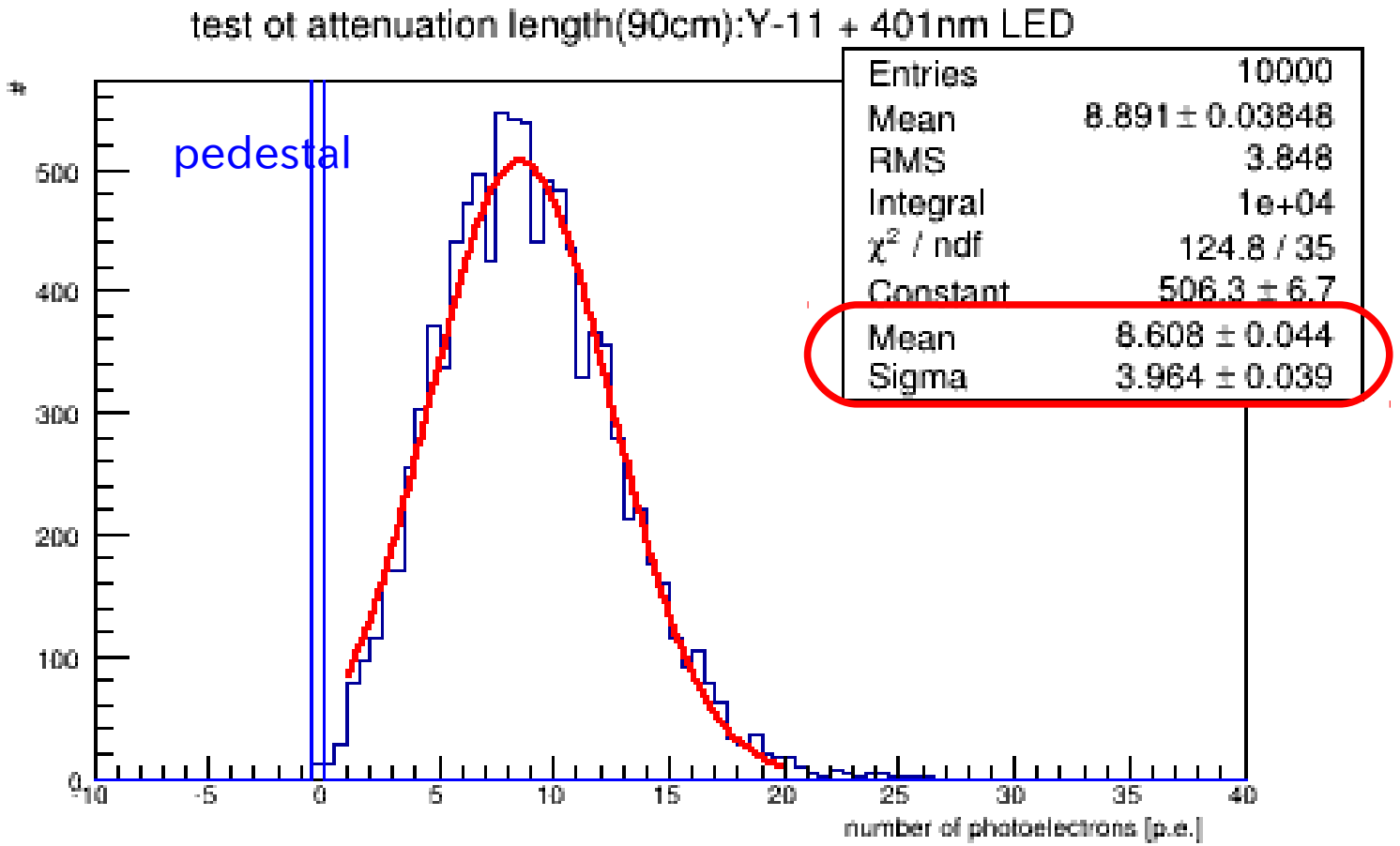
Att. Length



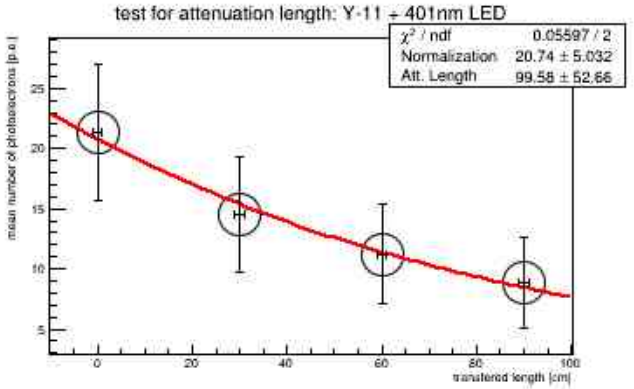
Bending Loss

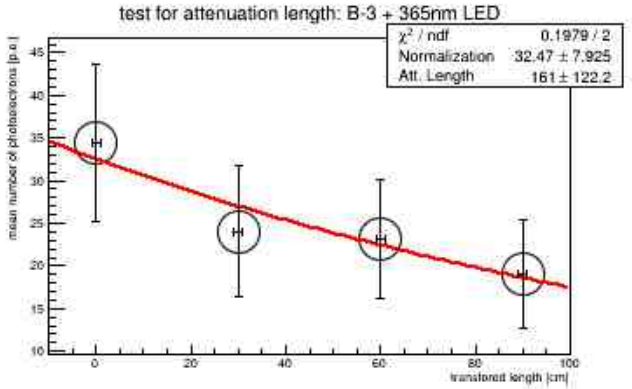
ADC distribution

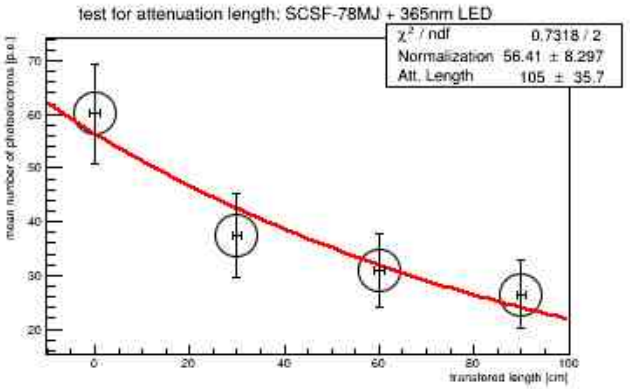
PMT: R9880U-210 BAC2397
Gain=3.62x10^7 @1300V
: R9880U-20 BCA6347
Gain=4.76x10^7 @1300V

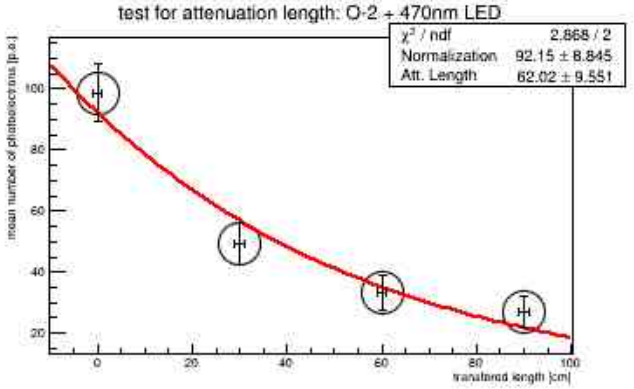


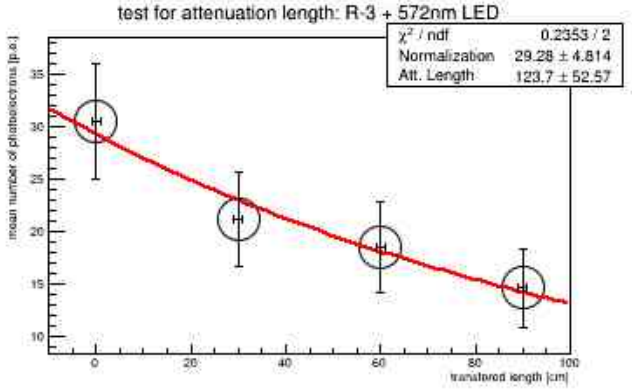
Attenuation Length











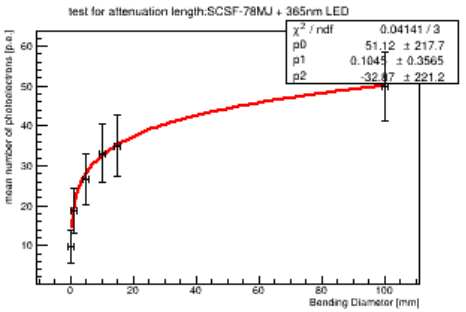
WLSF properties test (1) attenuation length using LED

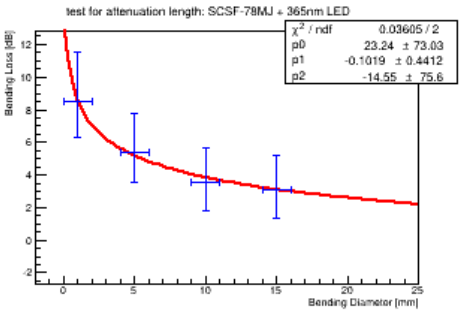
Y-11:	Att. Length = 99.6 ± 52.7 cm
B-3:	Att. Length = 161.0 ± 122.2 cm
SCSF-78MJ:	Att. Length = 105.0 ± 35.7 cm
O2:	Att. Length = 62.0 ± 9.6 cm
R-2:	Att. Length = 123.7 ± 52.6 cm

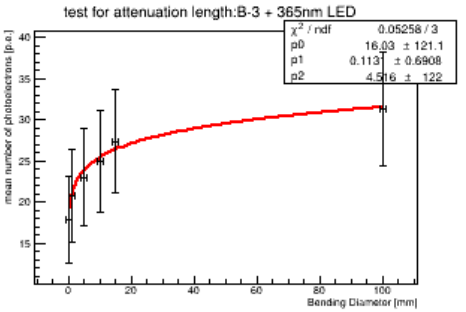
減衰長(Att. Length)は光量が1/eになる
長さと定義される。

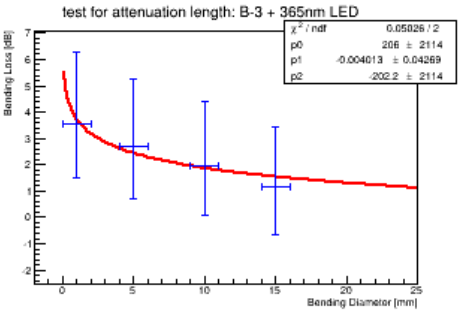
$$I(x)=I_0*\exp[-x/\lambda]$$

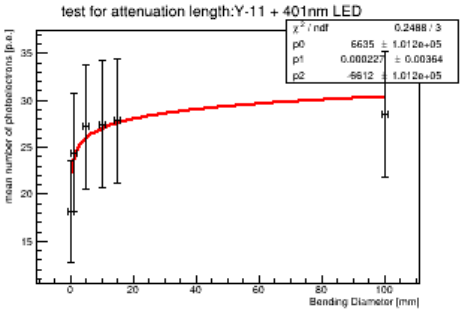
Bending Loss

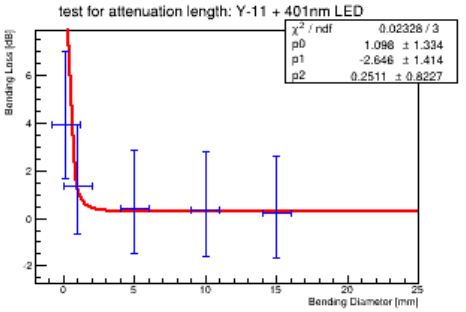


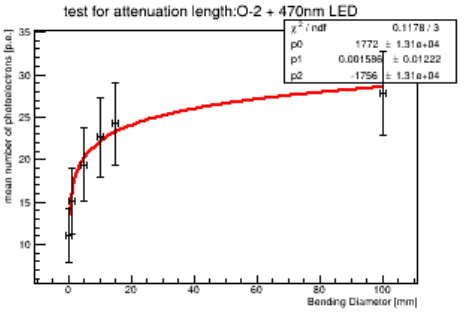


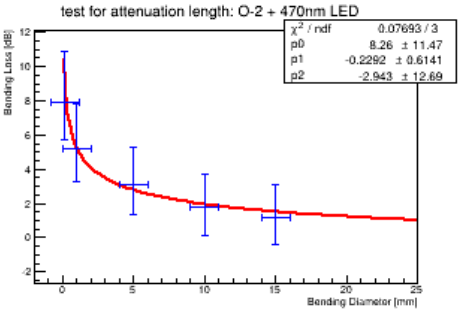


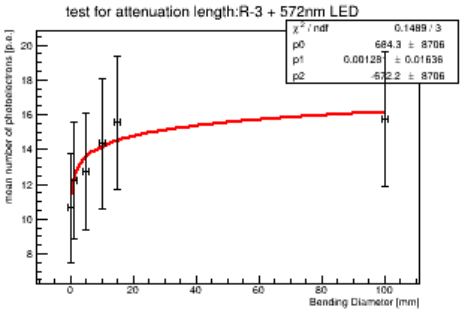


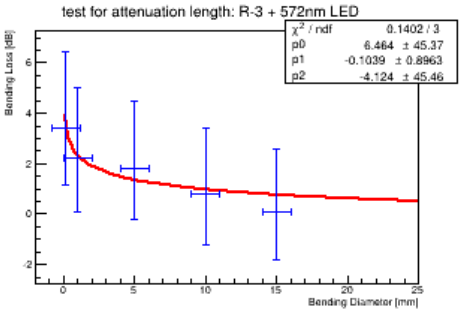












WLSF properties test

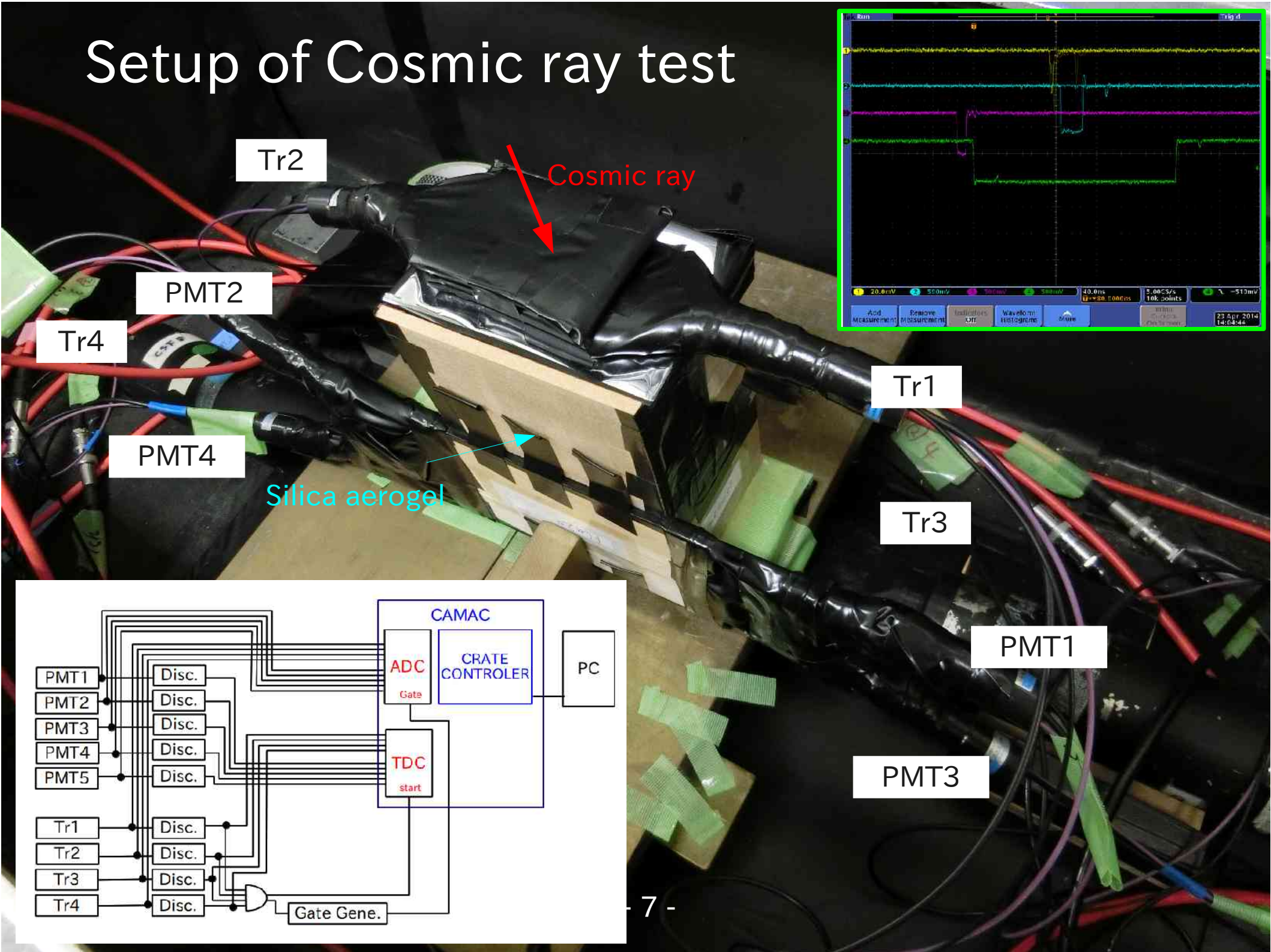
(2)Bending Loss for ϕ 0.2mm fiber sheet

minimum diameter of the loss less than 1dB

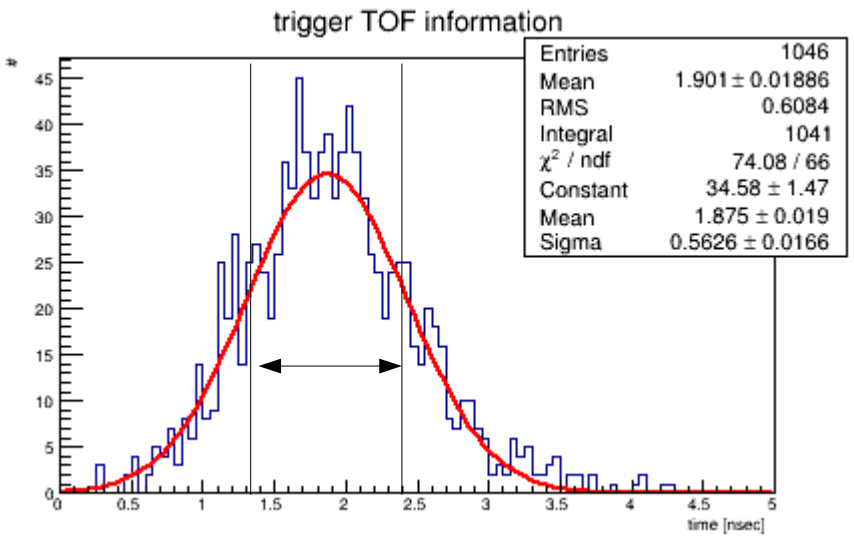
SCSF-78MJ:	**51.5 mm**
B-3:	**28.7 mm**
Y-11:	**1.2 mm**
O-2:	**25.2 mm**
R-3:	**9.3 mm**

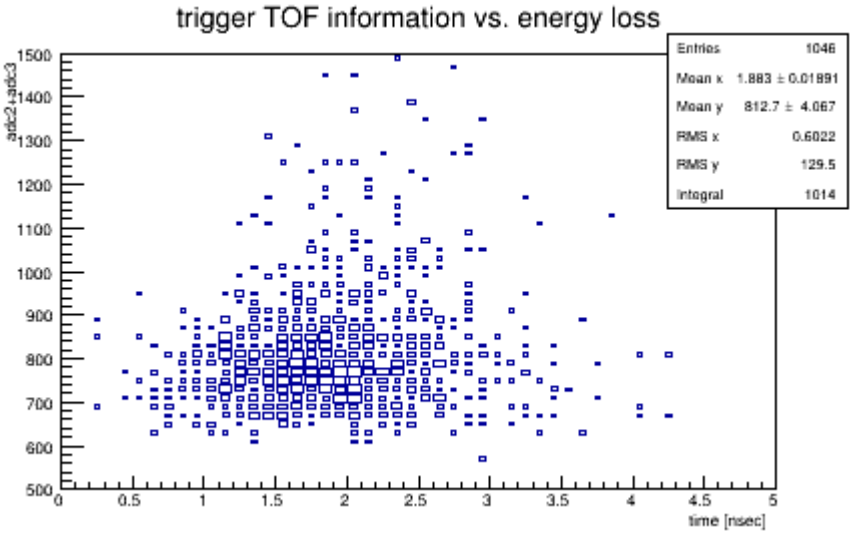
曲げ損失が1dB未満である最小の直径で評価する。

Setup of Cosmic ray test



TOF information: {(tdc[3]+tdc[4])-(tdc[1]+tdc[2])}x0.025/2 nsec

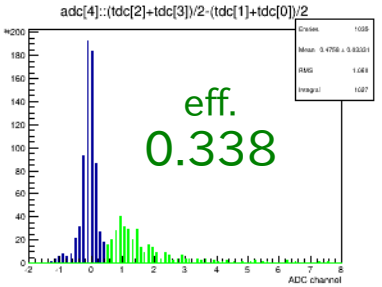
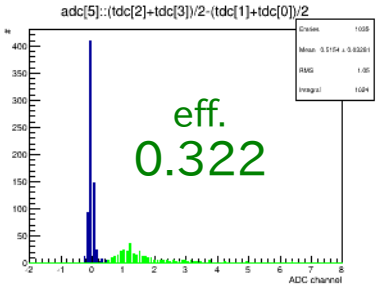
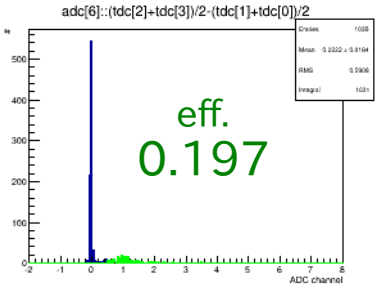
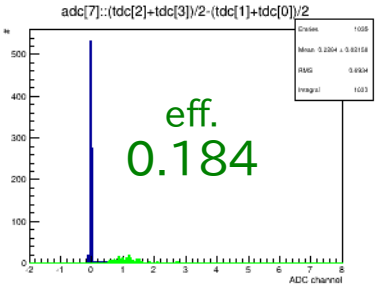
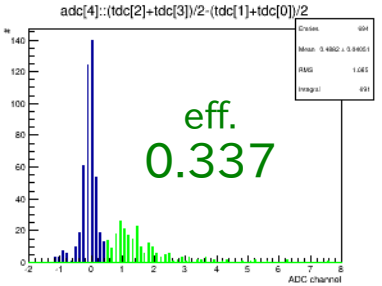
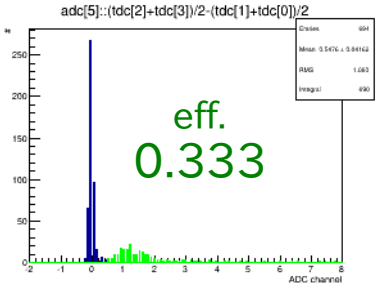
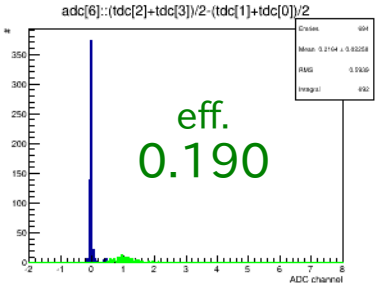
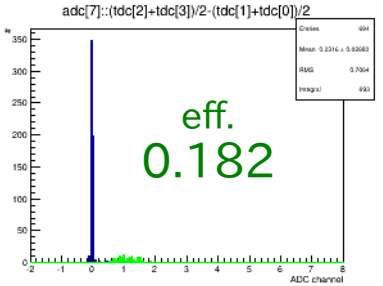


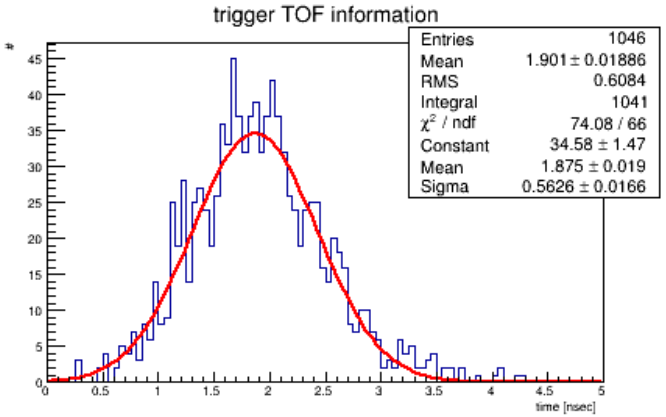


Kinds of Fiber Sheets
(1) FLa37: (BYOR) [6x10cm²]
(2) FLa38: (ScYOR) [6x10cm²]
(3) FLa39: (ScScYY)[6x10cm²]

Analysis
(1) TOF cut: Mean±Sigma
1.31 ns < TOF < 2.44 ns

FLa37(BYOR)[6x10cm^2]

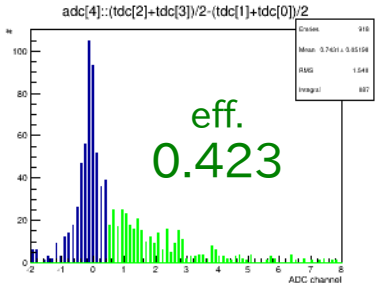
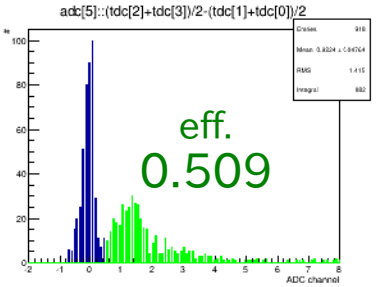
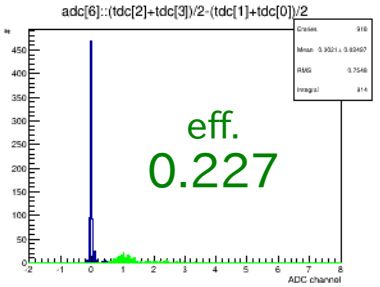
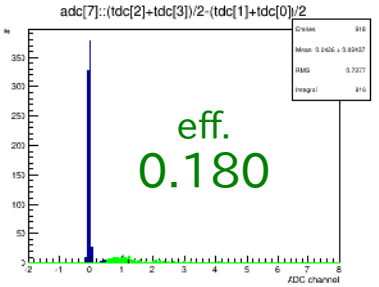
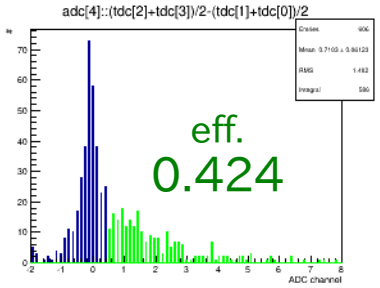
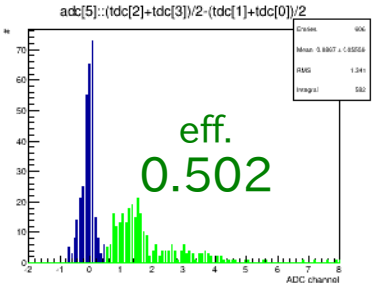
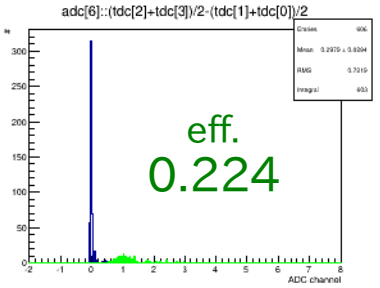
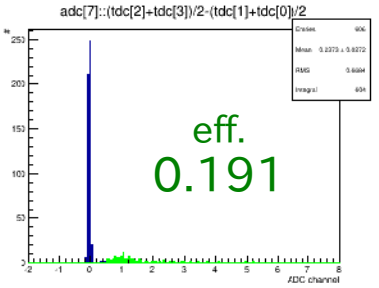
TOF cut	1ch	2ch	3ch	4ch
before				
after				

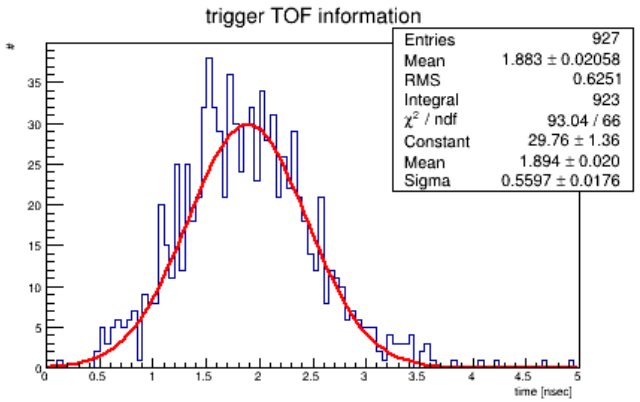


"or" logic efficiency & number of photoelectrons
@ FLa37,aerogel(1.05, 6cm)
Threshold level 0.5 p.e.

Before: eff.=0.648, 1.045 p.e.
After: eff.=0.659, 1.074 p.e.

FLa38(ScYOR)[6x10cm^2]

TOF cut	1ch	2ch	3ch	4ch
before				
after				

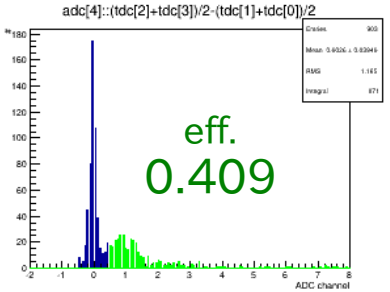
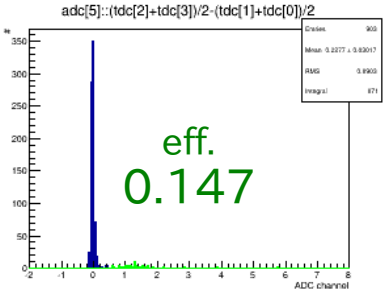
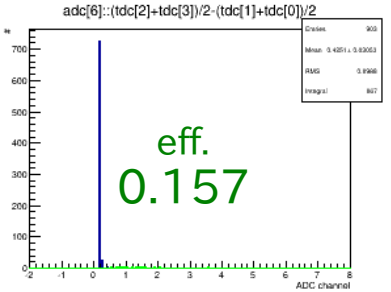
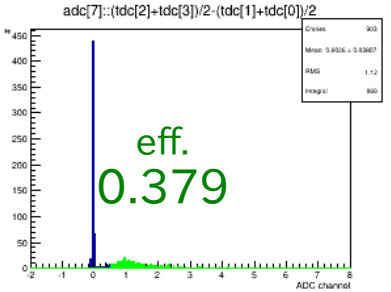
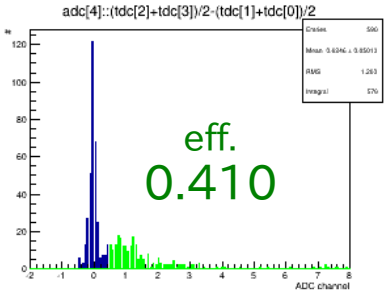
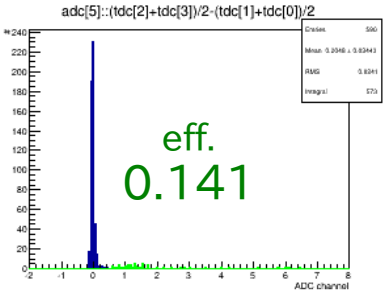
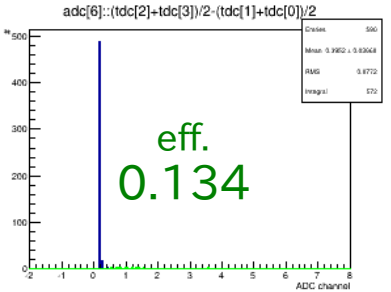
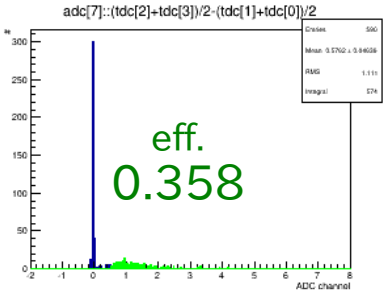


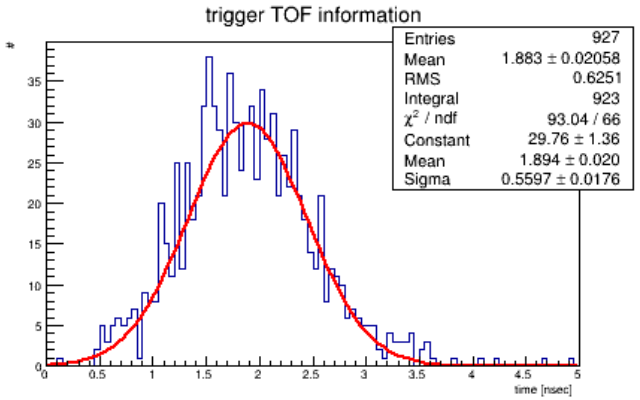
"or" logic efficiency & number of photoelectrons
@ FLa38,aerogel(1.05, 6cm)
Threshold level 0.5 p.e.

Before: eff.=0.758, 1.420 p.e.
After: eff.=0.766, 1.451 p.e.

FLa39(ScScYY)[6x10cm²]

TOF cut

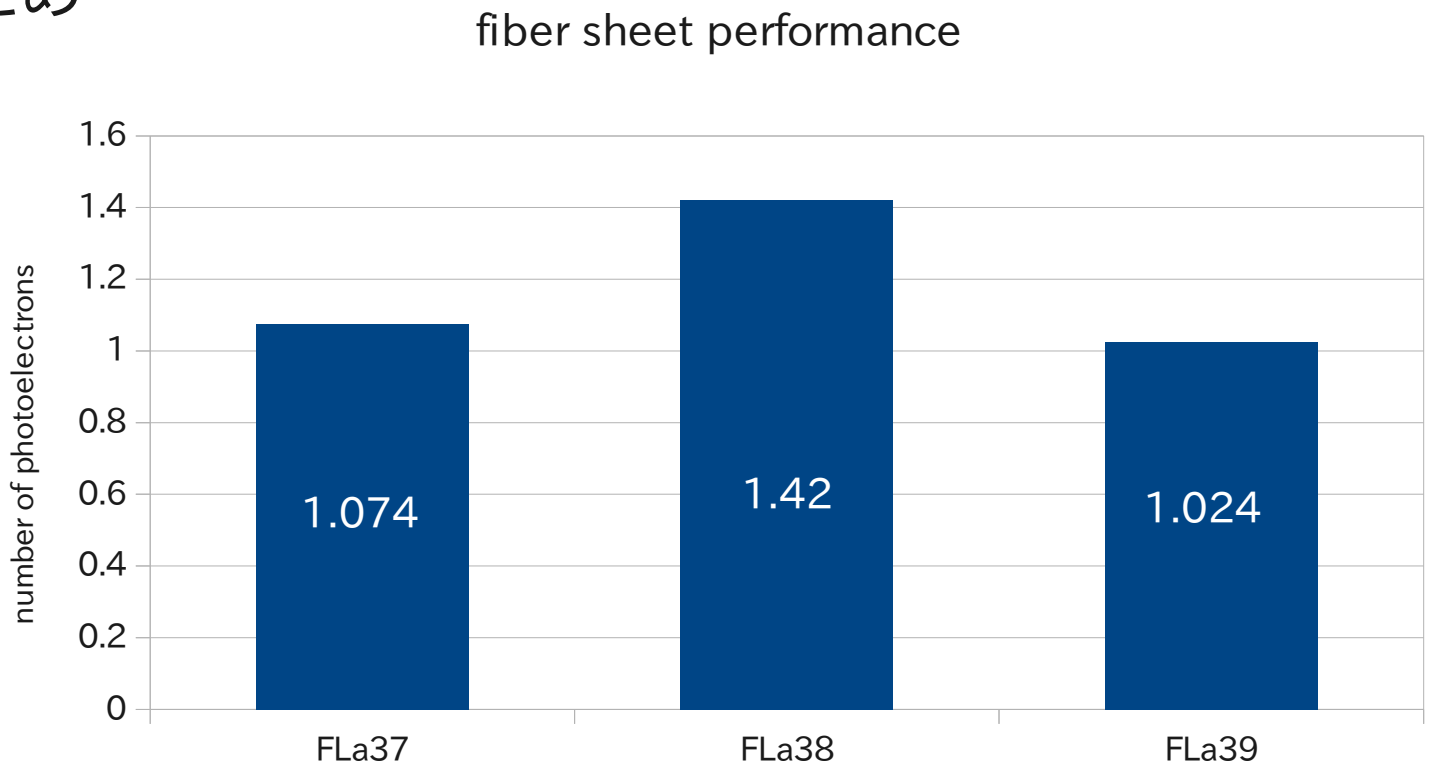
	1ch	2ch	3ch	4ch
before				
after				



"or" logic efficiency & number of photoelectrons
@ FLa39,aerogel(1.05, 6cm)
Threshold level 0.5 p.e.

Before: eff.=0.654, 1.063 p.e.
After: eff.=0.641, 1.024 p.e.

まとめ



シンチファイバーがチェレンコフ光のライトガイド
として向いている？

(2) 論文読

V.V. Anisimovsky, et al., Phys. Lett. B 562(2003) 166-172.

論文紹介
2014.07
H.ITO

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Physics Letters B 562 (2003) 166–172

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First measurement of the T-violating muon polarization in the decay $K^+ \to \mu^+ \nu \gamma$

KEK-PS E246 Collaboration

V.V. Anisimovsky [a,*], A.N. Khotjantsev [a], A.P. Ivashkin [a], M. Abe [b], M. Aliev [a], M. Aoki [c], Y. Asano [b], M. Blecher [d], P. Depommier [e], M. Hasinoff [f], K. Horie [g], H.C. Huang [h], Y. Igarashi [g], J. Imazato [g], M.M. Khabibullin [a], Yu.G. Kudenko [a], Y. Kuno [c], A.S. Levchenko [a], G.Y. Lim [g], J.A. Macdonald [i], O.V. Mineev [a], N. Okorokova [a], C. Rangacharyulu [j], S. Shimizu [c], Y.-M. Shin [i], N.V. Yershov [a], T. Yokoi [g]

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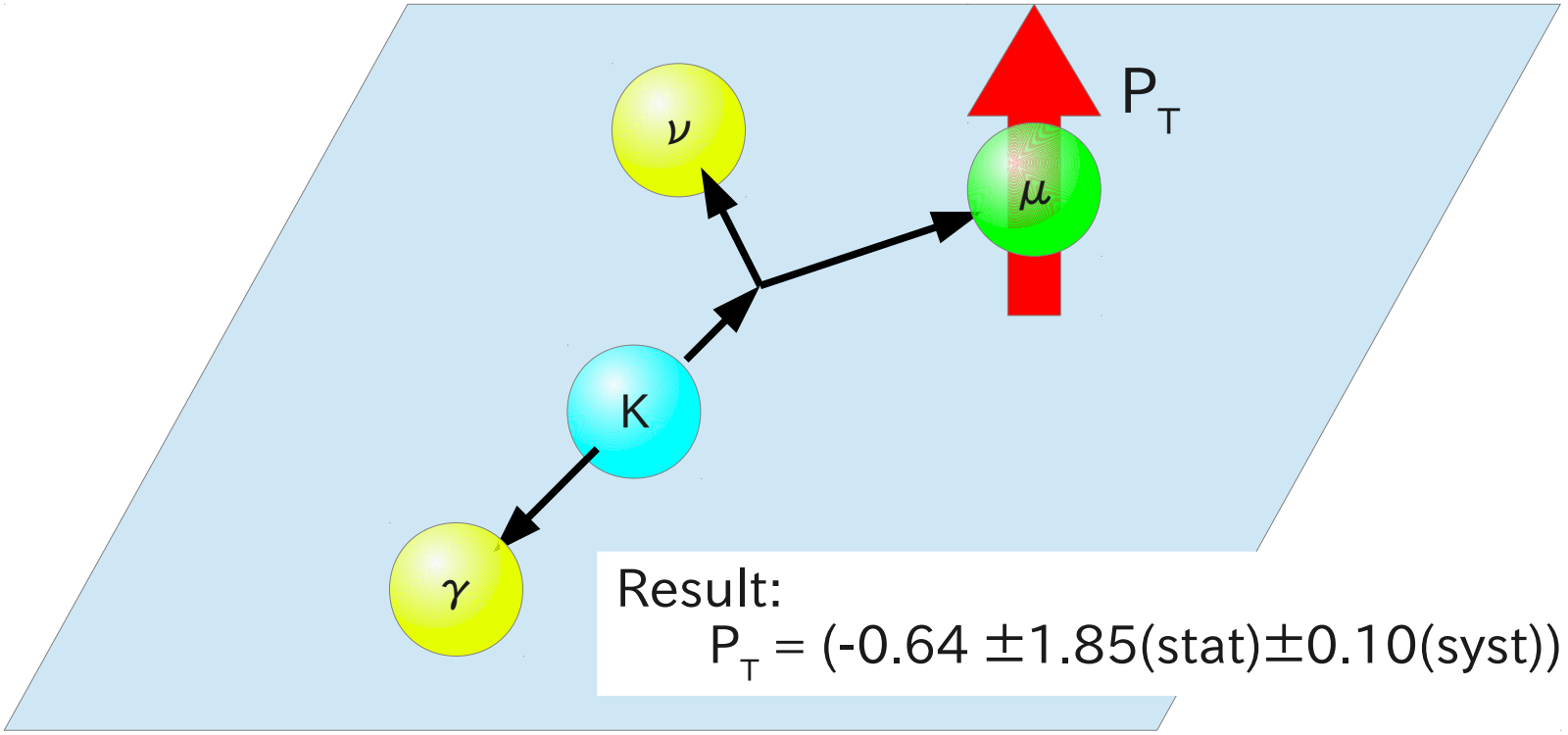
V.V. Anisimovsky, et al., Phys. Lett. B 562(2003) 166-172.

Abstract

KEK E246(1996-1998) Fast result
P_T obtained in the analysis of the $K_{\mu 2\gamma}$

$K_{\mu 2\gamma}$: $K+ \rightarrow \mu^+ \nu \gamma$

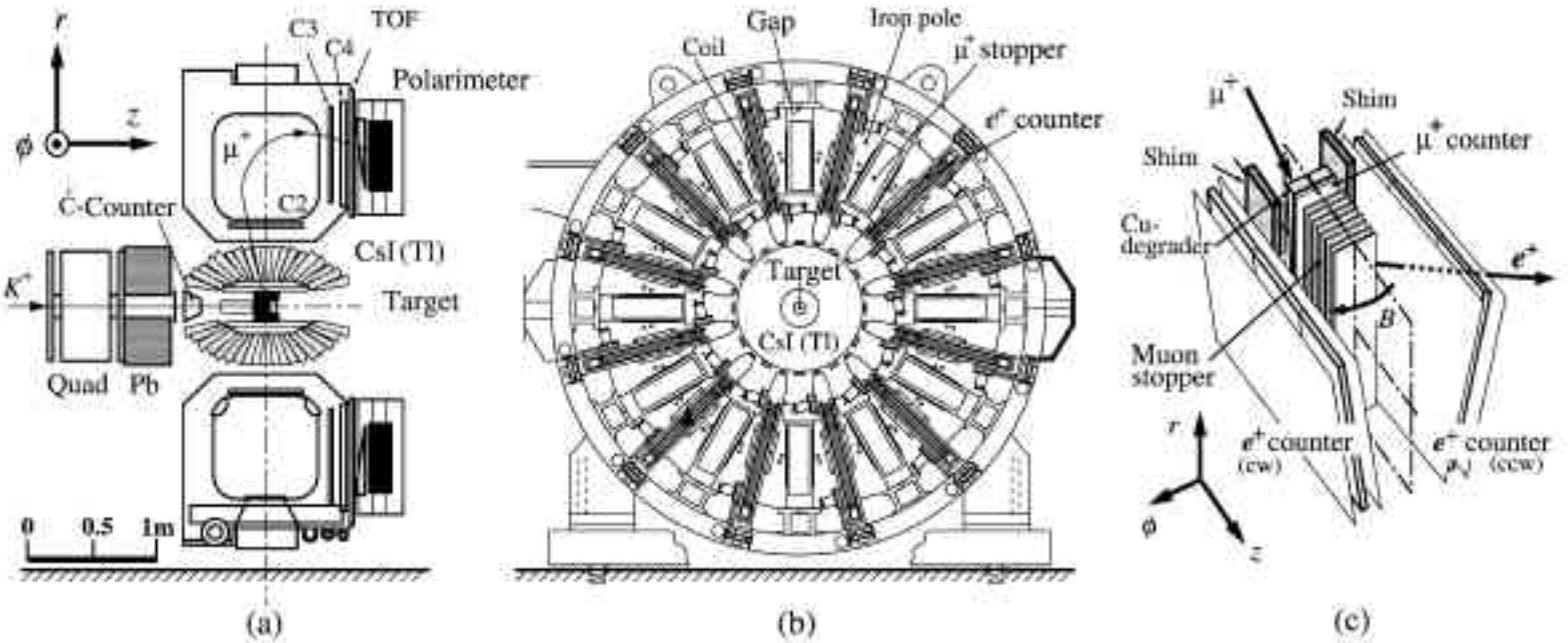


Result:

$P_T = (-0.64 \pm 1.85(\text{stat}) \pm 0.10(\text{syst})) \times 10^{-2}$

V.V. Anisimovsky, et al., Phys. Lett. B 562(2003) 166-172.

Experiment



Detector

- Beam: stopped kaon
- AC: K/ π, trigger eff.~99%
- Target: 256 Scint. Fibers
- Spectrometer: 12 sectors toroidal super conductor magnet
- γ-ray Colorimeter: 768 CsI(Tl)s, 0.75 x 4π sr (solid angle)
  σ_E/E~2.7% @200MeV
- Tracking: C2, C3 and C4, multi wire drift chamber
  σ_p~2.6 MeV/c @205MeV/c
- PID: TOF & μ^+ counter, $e^+/\mu^+/\pi^+$

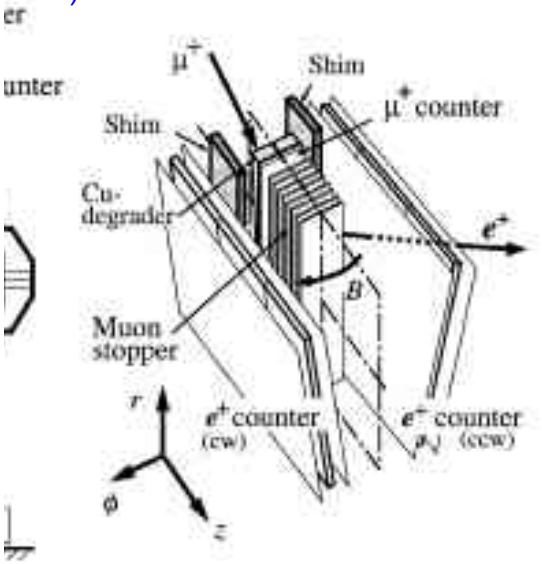
V.V. Anisimovsky, et al., Phys. Lett. B 562(2003) 166-172.

Experiment

The T-violating asymmetry was extracted using a double ratio as:

$$A_T = \frac{1}{4}\left[\frac{(N_{cw}/N_{ccw})_{fwd}}{(N_{cw}/N_{ccw})_{bwd}} - 1\right]. \quad (1)$$

Here, N_{cw} and N_{ccw} are the sums over all 12 sectors of counts of clockwise (cw) and counter-clockwise (ccw) emitted positrons. Indices 'fwd' and 'bwd' denote two classes of events: forward events (fwd) when the angle between the photon and the beam direction (z-axis) was less than 70° and backward events (bwd) when the angle between the photon and the beam direction was more than 110°. The signal values N_{cw} and N_{ccw} were extracted by integrating the positron time spectrum in the polarimeter after subtraction of the background.



(c)

The value of P_T is related to A_T by

$$P_T = \frac{A_T}{\alpha f (1-\beta)}, \quad (2)$$

where α is the analyzing power of the polarimeter, f is an angular attenuation factor and β is the overall fraction of all backgrounds.

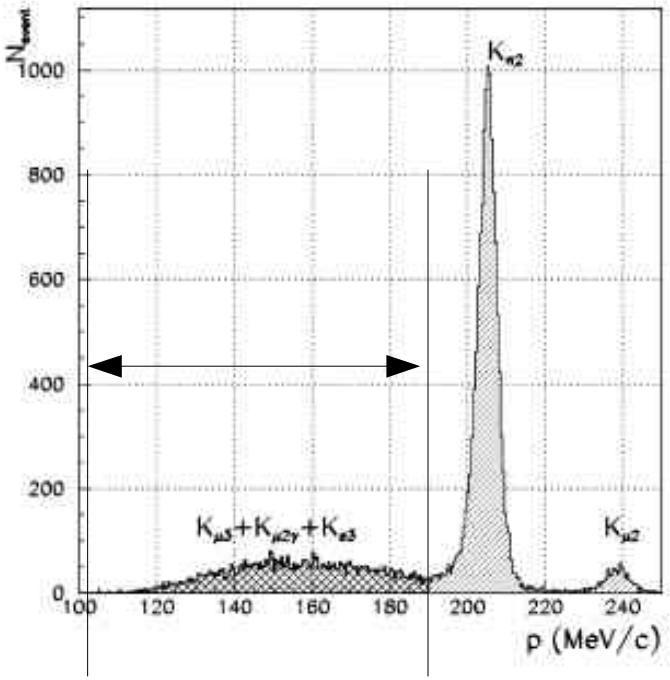
まず、αとβを調べる必要がある

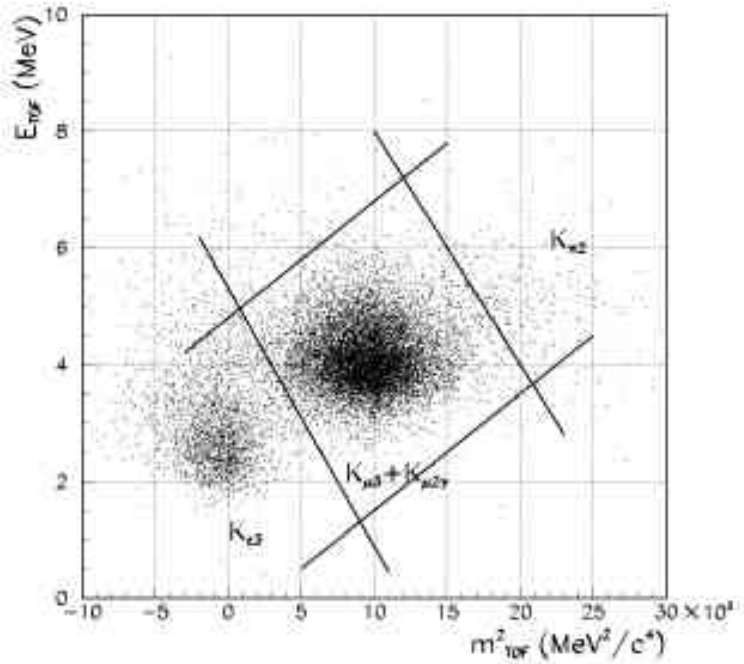
fwd bwd

V.V. Anisimovsky, et al., Phys. Lett. B 562(2003) 166-172.

Analysis

The first stage of the analysis





Rejection of Ke3 using the time-of-flight technique. The “cloud” in the bottom-left corner corresponds to positrons, the events inside the rectangle are muons.

Main $K_{\mu 2\gamma}$: $K^+ \rightarrow \mu^+ \nu \gamma$

BG

$K_{\mu 3}$: $K^+ \rightarrow \pi^0 \mu^+ \nu$

$K_{\mu 2}$: $K^+ \rightarrow \mu^+ \nu$

K_{e3} : $K^+ \rightarrow e^+ \nu \gamma$

$K_{\pi 2}$: $K^+ \rightarrow \pi^0 \pi^+$

$K_{\pi 3}$: $K^+ \rightarrow \pi^+ \pi^+ \pi^-$

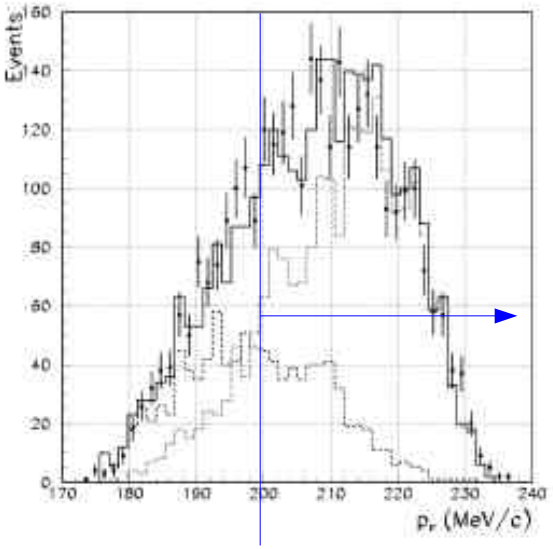
: $K^+ \rightarrow \pi^+ \pi^0 \pi^0$

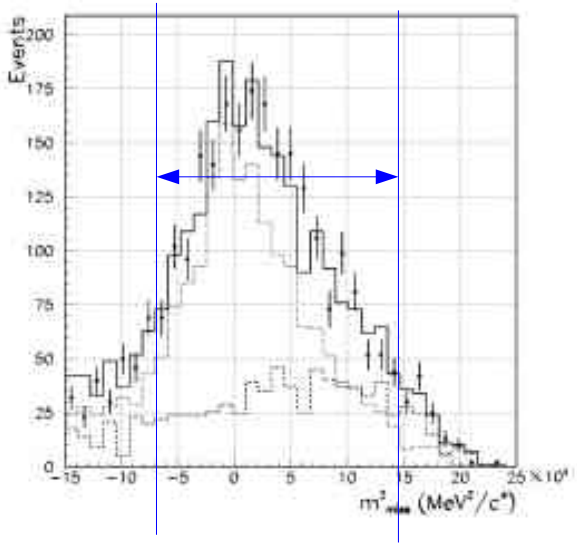
$K\mu 2\gamma$と$K\mu 3$を抽出した

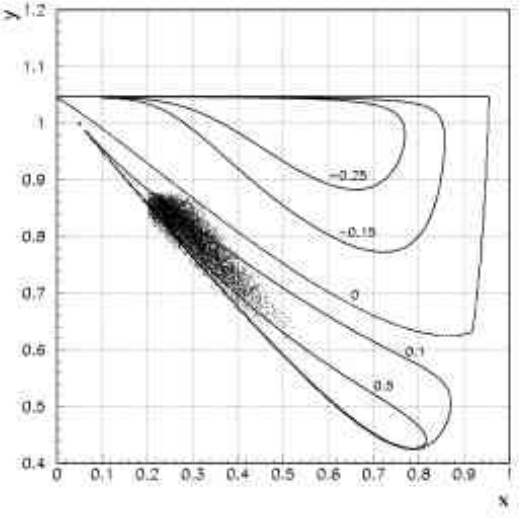
V.V. Anisimovsky, et al., Phys. Lett. B 562(2003) 166-172.

Analysis

The second stage of the analysis







Exp data
MC simu K$\mu 2\gamma$
MC simu K$\mu 3$
MC simu K$\mu 2\gamma$ + K$\mu 3$

K$\mu 2\gamma$とK$\mu 3$を区別する方法はνのmissing mass

MCシミュレーション

K$\mu 2\gamma$ … Fv= -0.095

F_A= -0.043

f_K= -159 MeV

J. Bijnens, G. Ecker, J. Gasser, Nucl. Phys. B 396 (1993) 81.

$A_N(K_{\mu 2\gamma}) = (4.06 \pm 1.14) \times 10^{-2}$ ⟷ $A_N(K_{\mu 2\gamma}) = (3.59 \pm 0.56) \times 10^{-2}$ exp

$\alpha = 0.289 \pm 0.015$

$\beta \sim 0.25$

f= 0.80±0.03

M. Abe, et al., hep-ex/0211049.

V.V. Anisimovsky, et al., Phys. Lett. B 562(2003) 166-172.

Analysis

データ量:1.14×10^5
(fwd+bwd $K_{\mu 2\gamma}$) @1996-1998

exp
$A_T=(-0.099\pm0.320)\times10^{-2}$

$P_T \sim -0.57 \times 10^{-3}$

$\alpha = 0.289\pm0.015$
$\beta \sim 0.25$
$f= 0.80\pm0.03$

$P_T \rightarrow P_T(FSI)$
理論的不確定性～15%, $F_V= -0.095$, $F_A= -0.043$

$P_T(FSI)=(-0.64\pm1.85(stat))\times10^{-2}$

Systematic error
12セクターでとった。
$\delta P_T^{sys} \sim 1.0\times10^{-3}$

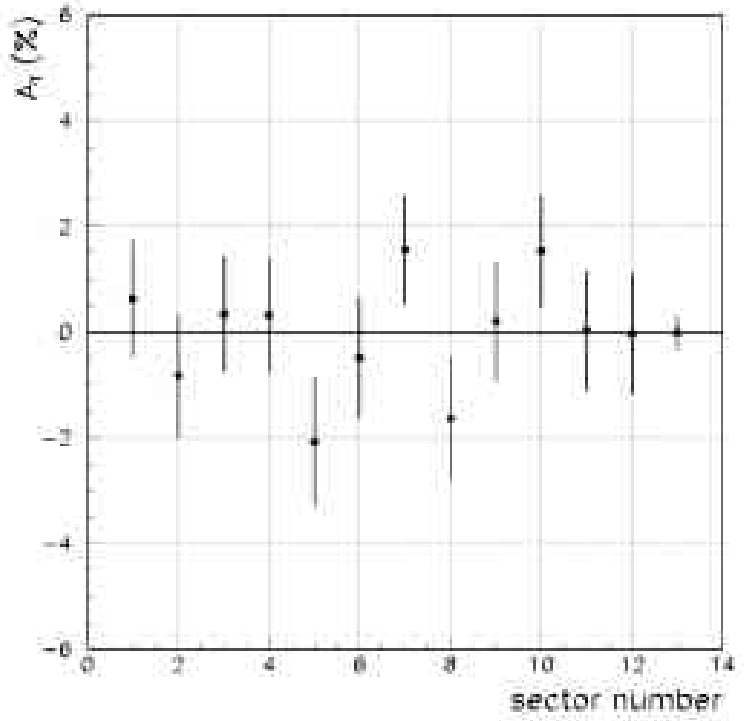


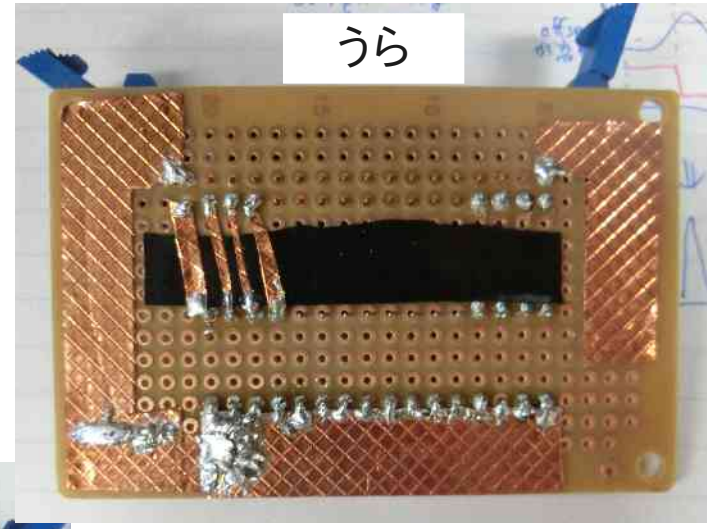
Fig. 8. The dependence of the transverse asymmetry (A_T) on the sector number. The rightmost point represents the sum of the asymmetries over all 12 sectors. The error bars show the statistical errors.

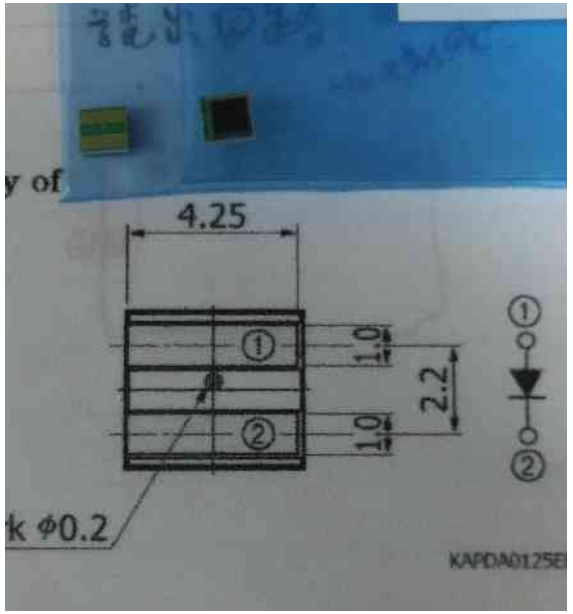
Result

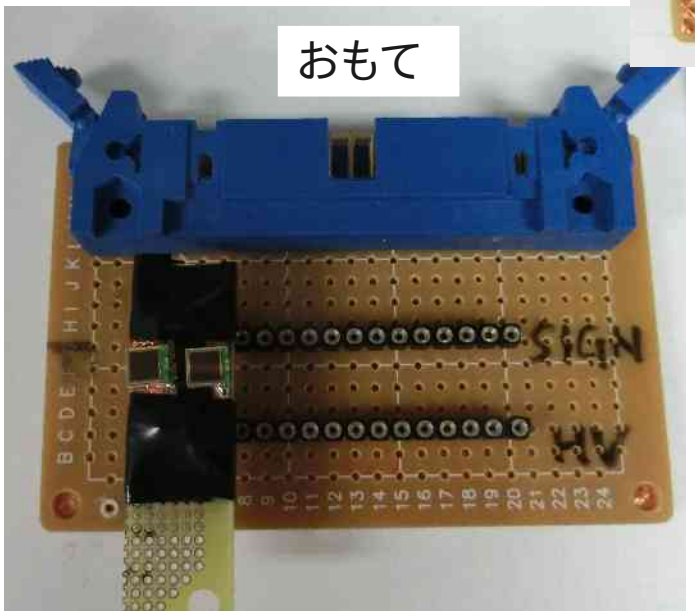
$P_T(FSI)=(-0.64\pm1.85(stat)\pm0.10(syst))\times10^{-2}$

(3) MPPC + EASIROC module制御

EASIROC module制御
- PC + LAN制御
- MPPC読出コネクタ作成
- ダークカレント検出

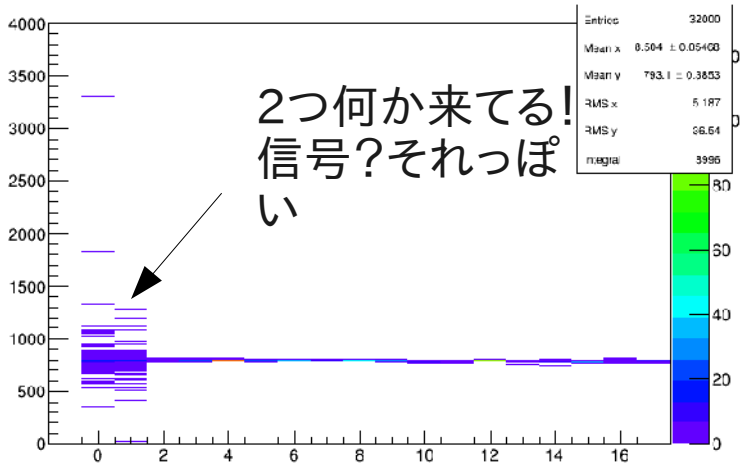


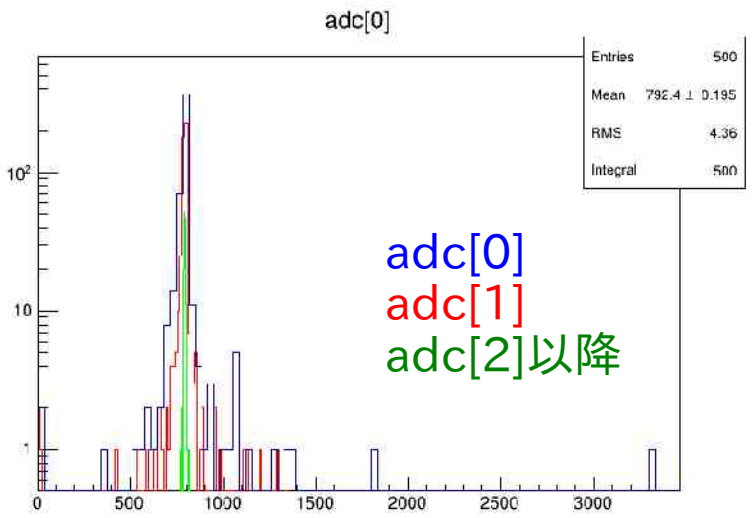


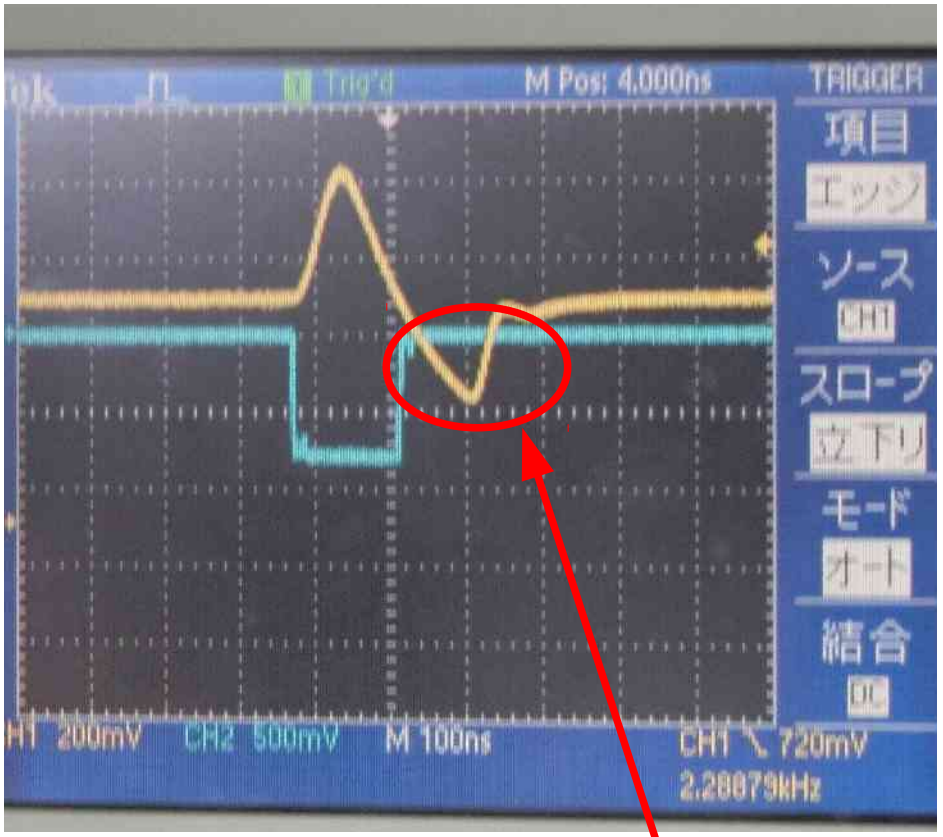


(3) MPPC + EASIROC module制御

ダークカレント検出







この部分がゆらぎの原因

(3) MPPC + EASIROC module制御

今週のまとめ

・MPPC2チップの読出環境作り
・EASIROC モジュールの制御入門
・ダークカレント測定
　ペデスタルが太い、統計数少ない

課題

・ペデスタルが大きくなる原因の解消。
・ダークカレントの測定のやり直し。
・LED光源による測定開始。

(4) 次週スケジュール

博士後期課程願書提出：書類作成+プレゼン作成
- (1) 研究過程報告書
- (2) 研究計画書書
- (3) プレゼンスライド構成考案

論文読み(x1)
- KEK E246, TREK, time reveres symmetry vioration

MPPC + EASIROC制御
- (1) LED test, Dark current, Scinti. Test
- (2) CAMACとの連動
- (3) ADC + TDC読出し

Fiber Sheet 製作
- FLa40 … SCSF(x4)position[5x5] to MPPCs
- FLa41 … ScYOR(5x20cm^2 x4辺) to PMTs
- FLa42 … ScYOR(5x20cm^2 x2辺)x2 to PMTs