To Office of Experimental

Planning and Coordination

12/5 木村

Date 2002/Dec/5

MACHINE TIME EXECUTION

REPORT (4-2 CYCLE)

Experimental Group	T528	Reporter	Hiroaki Watanabe
Scheduled Period and Shift	Nov. 27th 9:00 ~ Dec. 4th 9:00 (20 shift)	Main, Sub, Para	Main
Experimenters H. Watanabe, Y. Sugaya, J. Nix, G. Perdue, E. Tanaka, Y. Shibata, T. Mizuhashi, K. Takahashi			

SUMMARY OF EXECUTION AND RESULTS

We entered in the Pi2 area around 15:00 on Nov. 26th.
It took about 1 shift to set trigger counters and a test counter.
Trigger tuning was taken about 2 shifts.
Beam turning was taken about 2 shifts.
After finishing these tuning, we started to test the three types of the counter.
We could take enough data until 9:00 on Dec. 4th, which was mentioned in the proposal.

Concerning the result, please refer the attached brief summary.

EXECUTED MACHINE TIME, BEAM CONDITION, DOWN TIME etc.

Accelerator and beam condition were quite stable. Down time was very small.

COMMENTS

Brief Summary of the T528 Test Experiment.

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1 Introduction

The T528 test experiment aims to study for the prototypes of veto counters, Collar Counter 2(CC02), Beam Catcher and $NaBi(WO_4)_2$ crystals for the KEK-E391a experiment. Fig. 1a shows the schematic view of this experimental setup. A particle identification is made by a T.O.F measurement and by using Gas-Čerenkov counters. It seems to be worked very well as shown in Fig. 1b. We have successfully collected these data under various kinds of conditions. In this report, the brief summary of the collected data are presented.

2 The Prototype of the CC02.

The light-yield measurement is most crucial point for the CC02-prototype counter. In order to determine the light yield, the CC02 were irradiated by π^- with momentum of 3 GeV/c and electron with momenta of 0.5, 0.7, 1.0, 2.0, 3.0 and 4.0 GeV/c. Fig. 2 shows typical ADC distribution for the electron data at 3.0 GeV/c. Based on an online analysis, we obtained the linearity curve as shown in the Fig. 3. By transfering the vertical axis from ADC counts to the number of photoelectron which was calibrated by using LED light, we can surely obtain the real light yield.

We also measured a position dependence of the light yield by changing the particle-incident position at 0.5 or 1 cm interval by using π^- beam. Fig. 4 shows the position dependence of the light yield obtained from the online analysis.

These data are very valuable to be finalized the design of the Collar-Counter 02 in the E391a experiment.

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3 The $NaBi(WO_4)_2$ Čerenkov Crystal.

For the $NaBi(WO_4)_2$ Čerenkov Crystal(NaBi), the light-yield measurement is the main concerning point in this test. The NaBi were irradiated by electron with momenta of 0.5, 0.7, 1.0, 2.0, 3.0 and 4.0 GeV/c and π^+ and proton with momentum of 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.5, 2.0, 2.5, 3.0 and 4.0 GeV/c. Fig. 5 shows the energy spectrum at 3 GeV/c and the linearity curve calculated from an online analysis. The measurement of the light yield as a function of momentum (or β) is also very important to understand the light yield and its optics.

We also measured the light-attenuation effect (or an uniformity of longitudinal direction) by using π^- beam, where the NaBi crystals was set to be perpendicular to the beam axis. This data will be very useful to understand its optics and to optimize the crystal length to obtain better an energy resolution. Fig. 6 shows the incident-position dependence of the light yield calculated from MIP's peak.

I think this test is very nice start point for the study of the NaBi crystal.

4 The prototype of the Beam Catcher.

The purpose of this test for the BC is to measure the electro-magnetic and hadron shower propagation and to measure the Čerenkov-light yield generated in the Quartz bar for various momenta. These data are essentially requried to estimate the n/γ-separation with good accuracy.

We then collected the electron and hadron data with momenta of 0.5, 0.7, 1.0, 1.5, 2.0, 2.5, 3.0 and 4.0 GeV/c. As is shown in Fig. 7, the EM-shower propagation can be seen clearly. By using these data, we can start the detail study for the EM- and hadron-shower propagation.

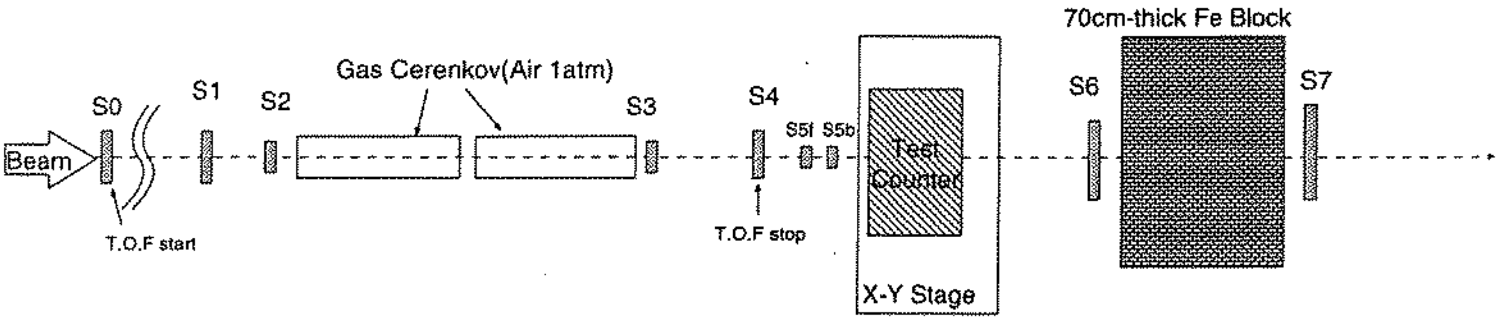
The BC is required very high photon-detection efficiency. Sicne the photon identification will be made by Čerekov light, the Čerekov-light yield in the Quartz bar is also very crucial. Fig. 8 shows the spectra of the Quartz bar for the MIP's events. There are only small number of events in the pedestal region, which means the light yield might be large enough. Also, in order to understand its optics, an angle dependence and a momentum dependence of the light yield for a single-Quartz bar have been measured.

5 Summary

The T528 experiment have been successfully carried out. We can enjoy this test and will enjoy an analysis of these rich data. Finally, we would like to thank all persons who help us.

Fig. 1

Schematic Setup View



Raw TDC distribution at +2.0 GeV/c

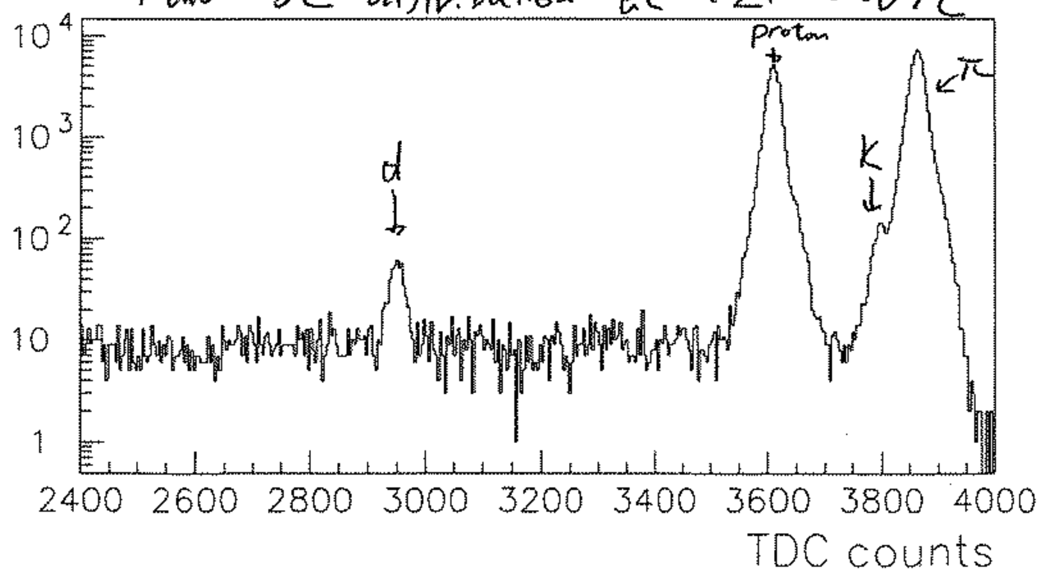
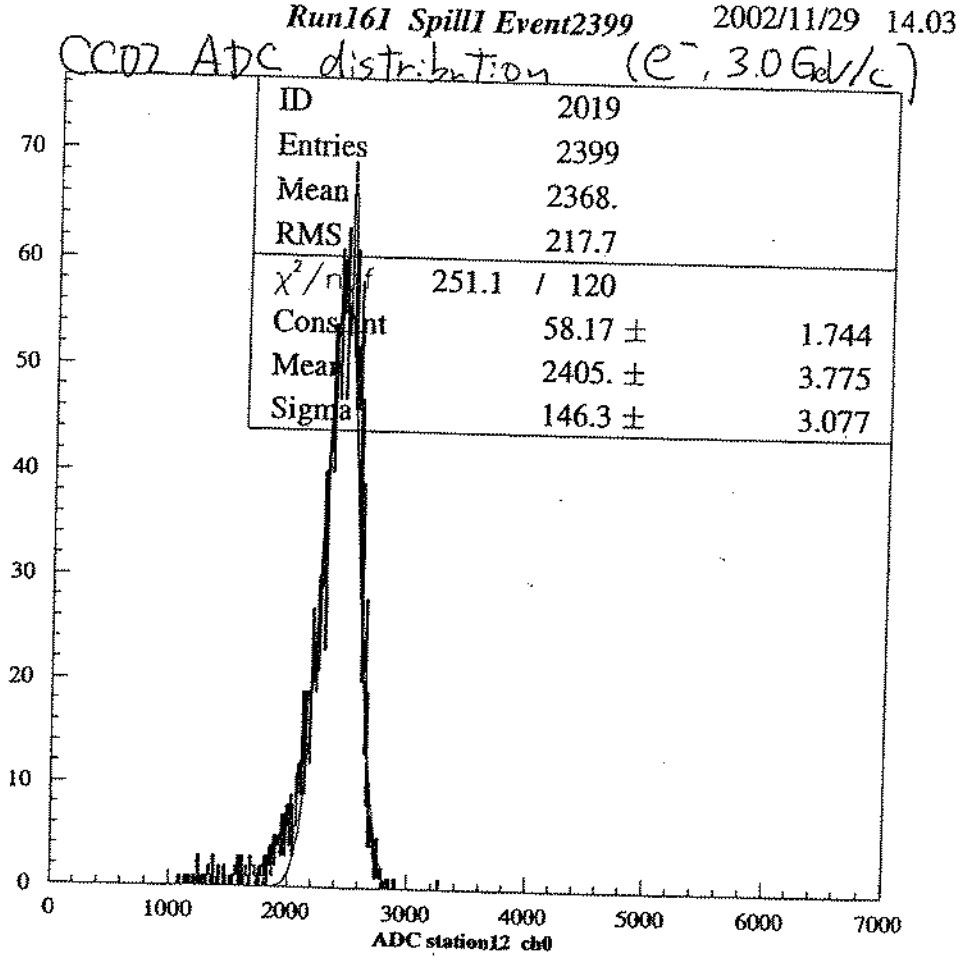
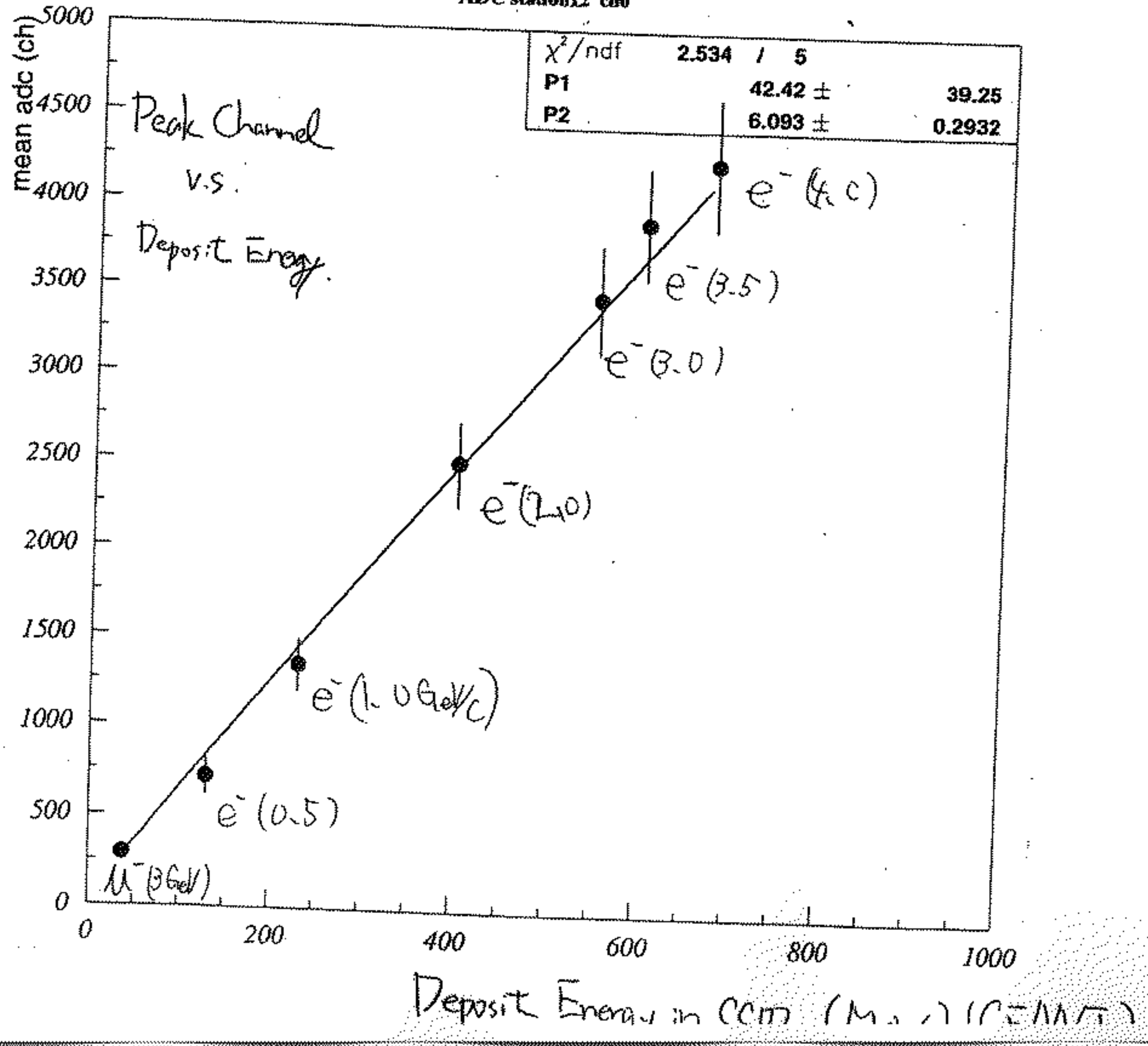


Fig. 2



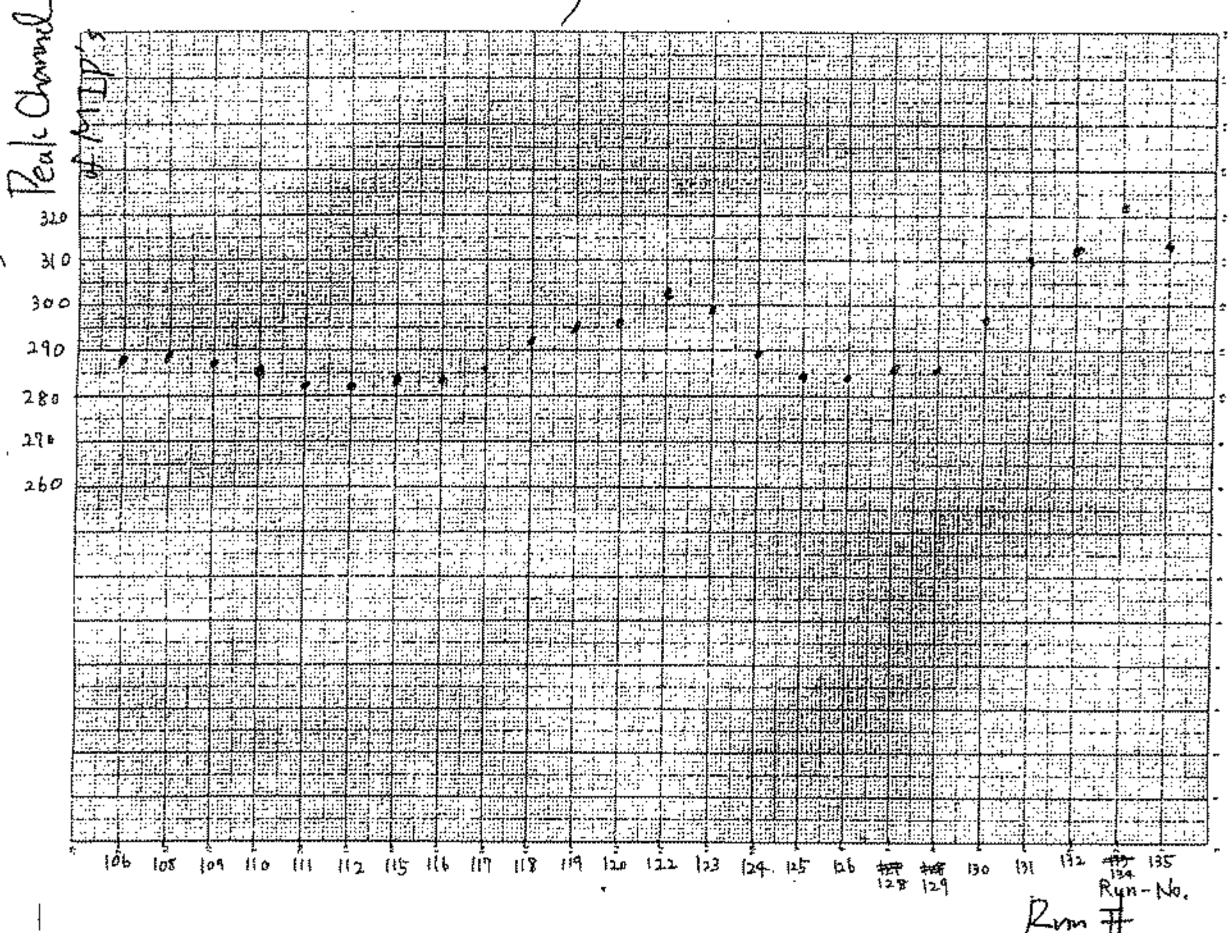
Run161 Spill1 Event2399
2002/11/29 14.03
CC02 ADC distribution (e⁻, 3.0 GeV/c)
ID 2019
Entries 2399
Mean 2368.
RMS 217.7
χ²/ndf 251.1 / 120
Constant 58.17 ± 1.744
Mean 2405. ± 3.775
Sigma 146.3 ± 3.077
ADC station12 ch0

Fig. 3



χ²/ndf 2.534 / 5
P1 42.42 ± 39.25
P2 6.093 ± 0.2932
mean adc (ch)
Peak Channel v.s. Deposit Energy
e⁻ (4.0)
e⁻ (3.5)
e⁻ (3.0)
e⁻ (2.0)
e⁻ (1.0 GeV/c)
e⁻ (0.5)
μ⁻ (3 GeV)
Deposit Energy in CC02 (MeV)

Fig. 4. Uniformity of the Light Yield of the CCO2



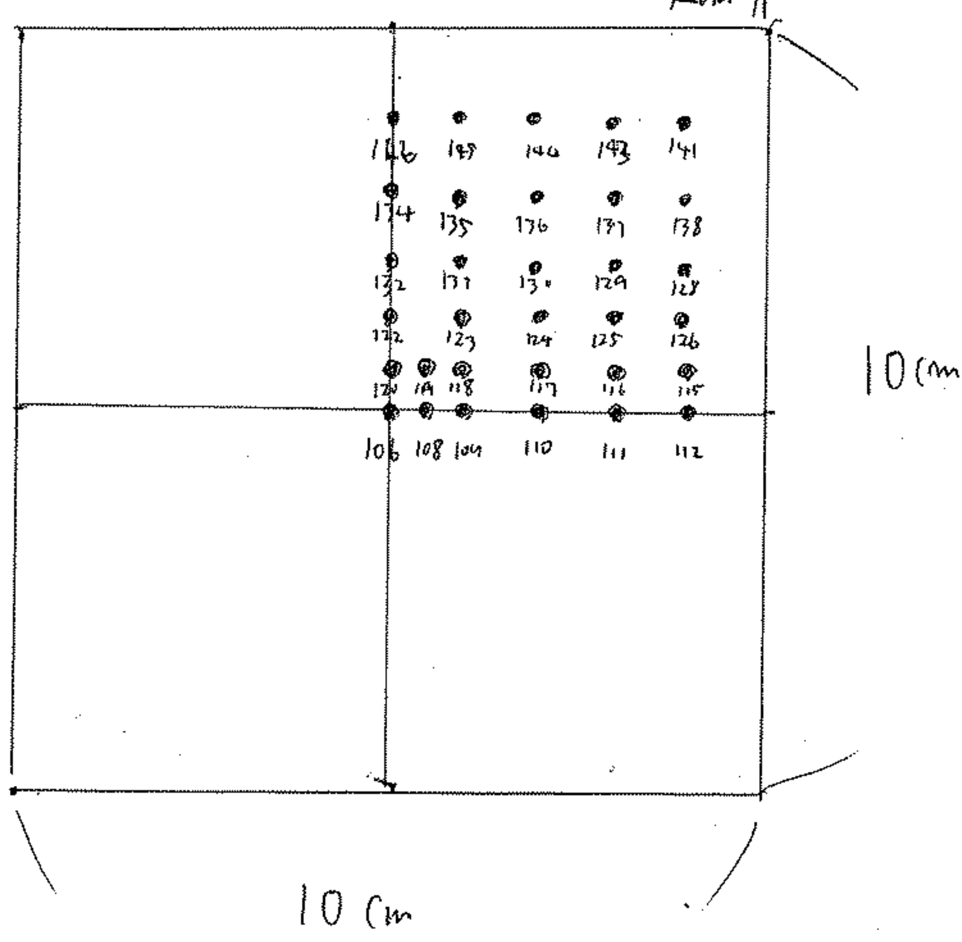


Fig. 5a

Energy Spectrum of the NaBi crystal (e⁻, 3.0 GeV/c)

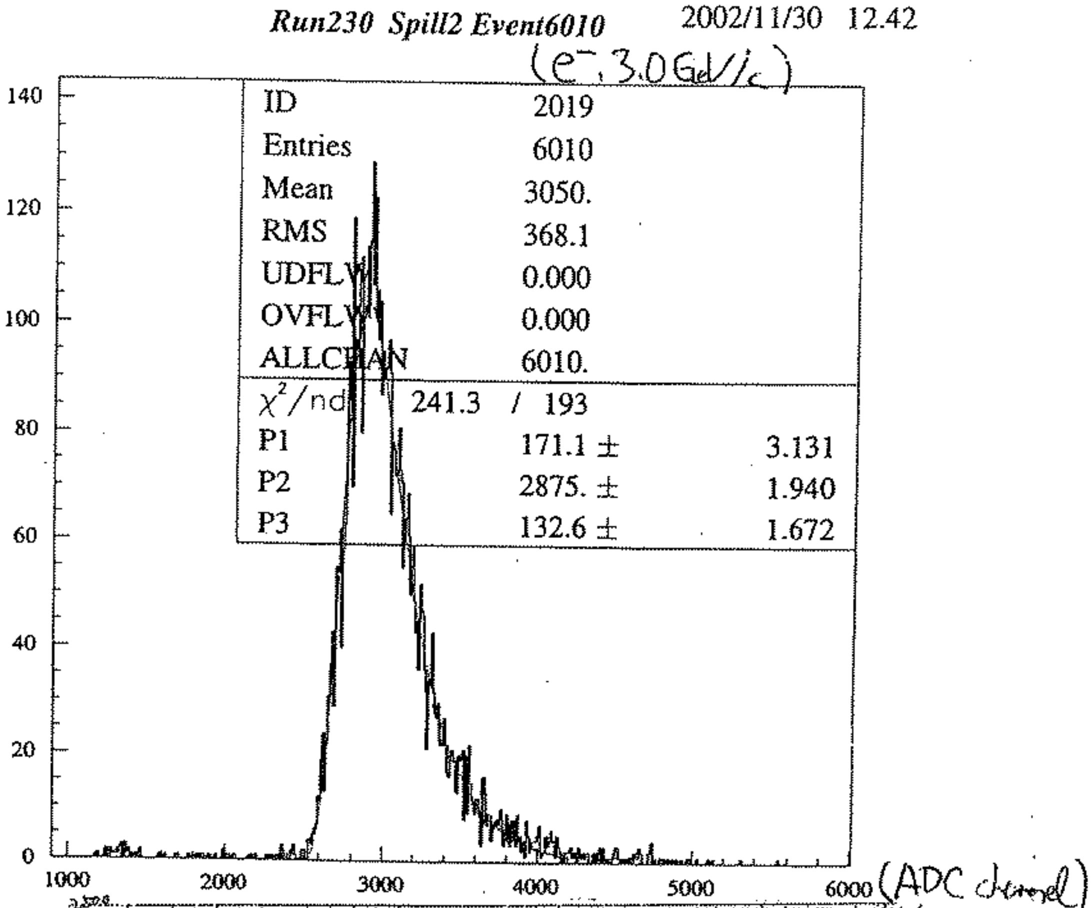


Fig. 5b

Peak channel v.s. Energy Deposit.

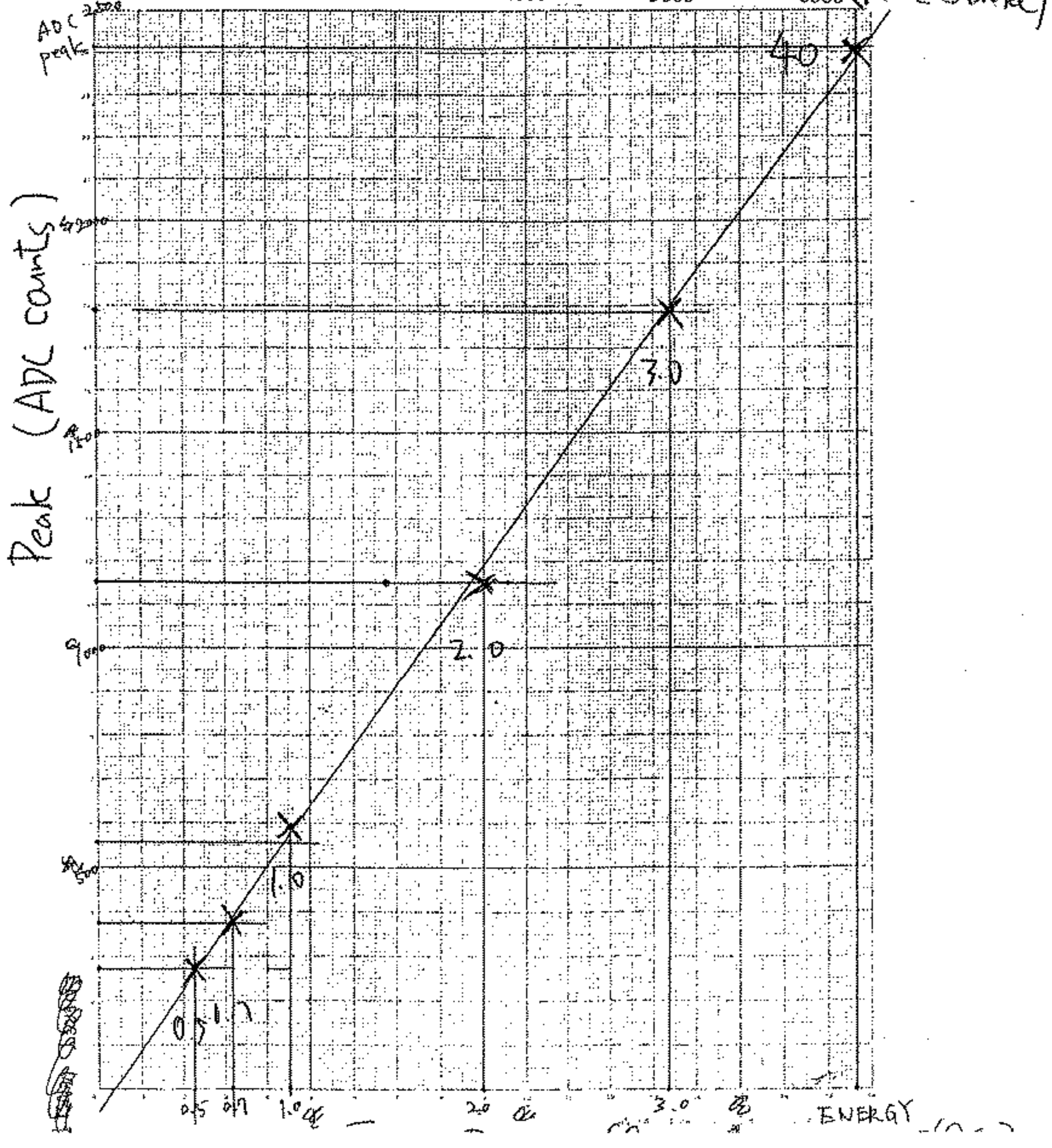


Fig. 6

Position dependence of the Light Yield for NaBi crystal

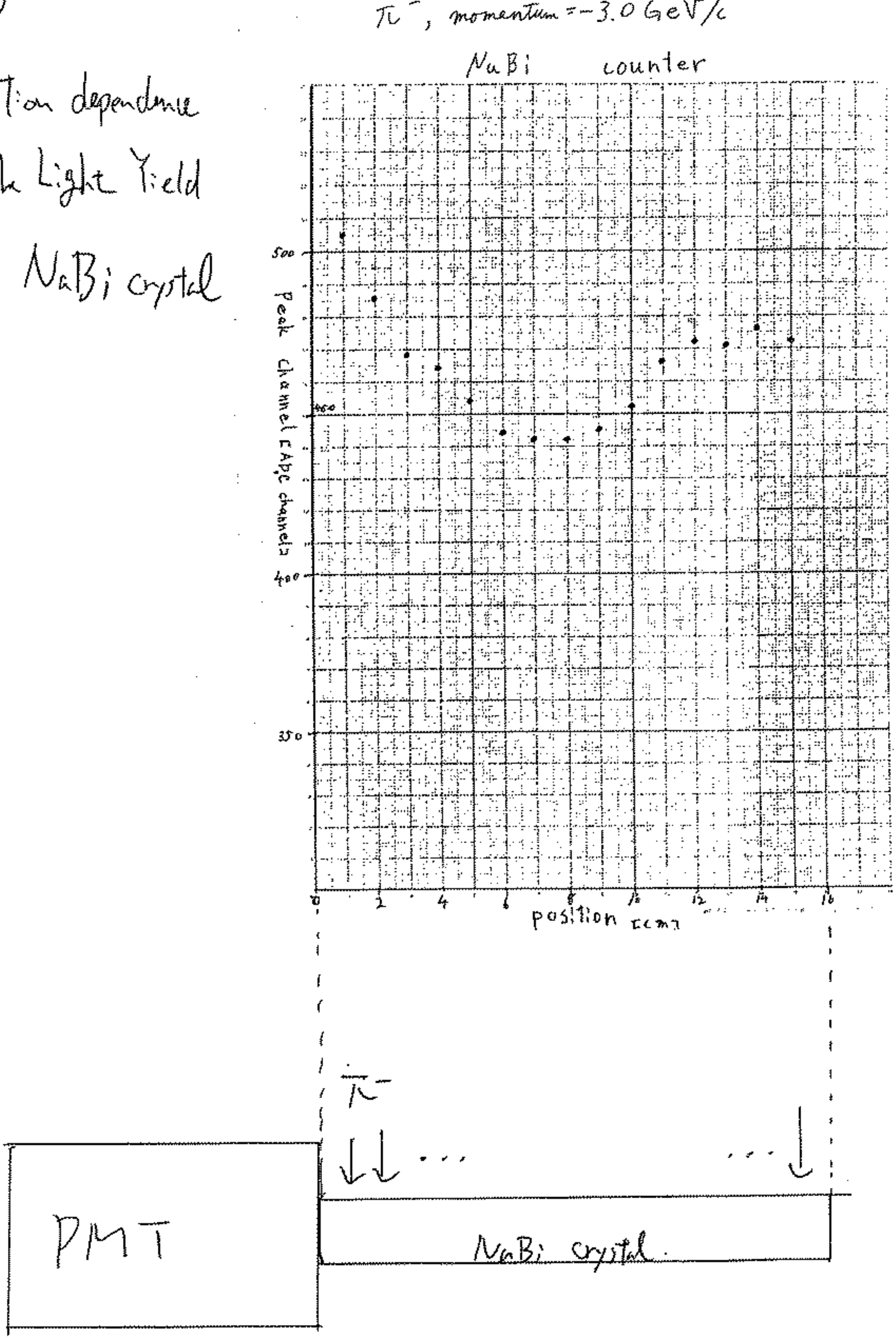
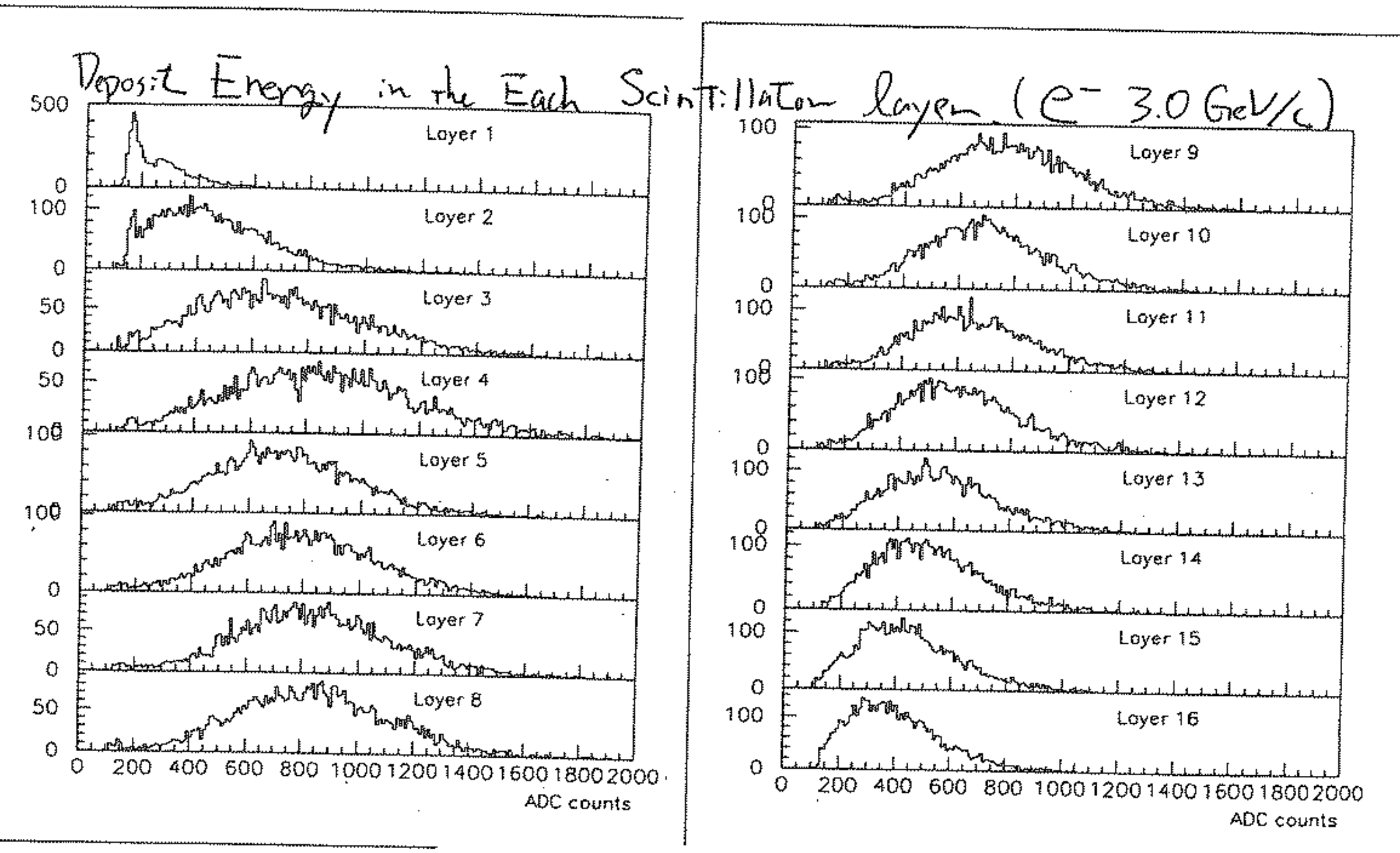
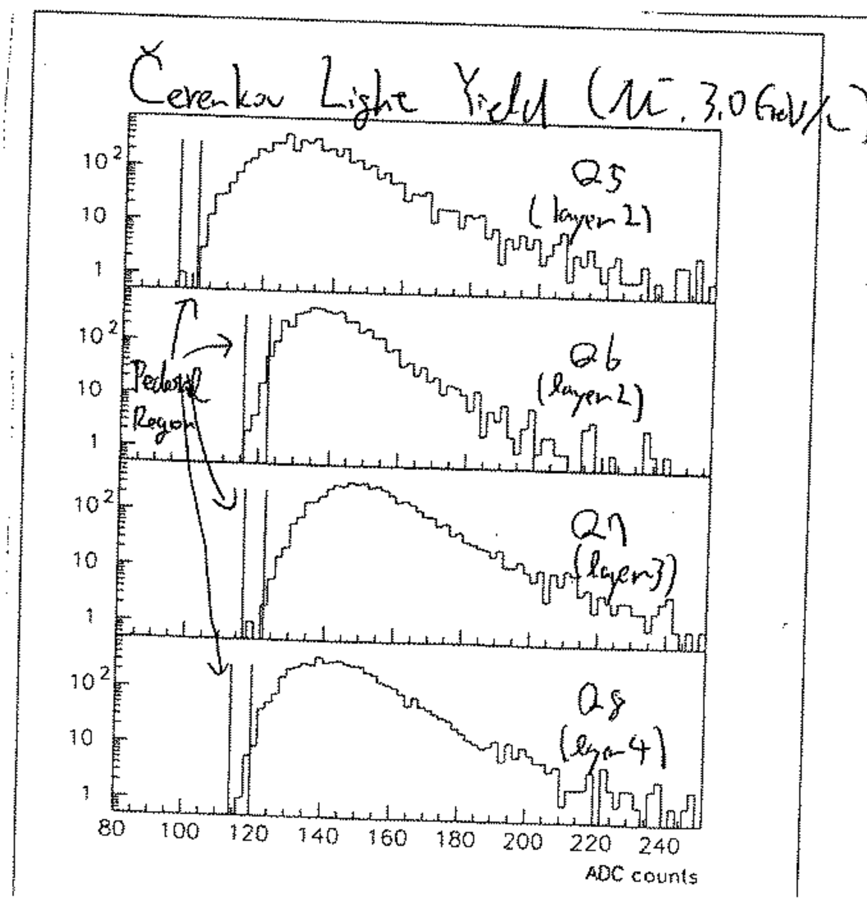


Fig. 7



Deposit Energy in the Each Scintillator layer (e^- 3.0 GeV/c)
Layer 1
Layer 2
Layer 3
Layer 4
Layer 5
Layer 6
Layer 7
Layer 8
Layer 9
Layer 10
Layer 11
Layer 12
Layer 13
Layer 14
Layer 15
Layer 16
ADC counts
ADC counts

Fig. 8



Čerenkov Light Yield (μ^-, 3.0 GeV/c)
Q5 (layer 1)
Q6 (layer 2)
Q7 (layer 3)
Q8 (layer 4)
Pedestal Region
ADC counts