MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2008A0035 実験課題名 Title of experiment: Determination of shape and intensity distribution of muon beam by imaging plates 実験責任者名 Name of principal investigator 堂山昌男 Masao Doyama 所属 Affiliation 帝京科学大学 Teikyo University of Science and Technology	装置責任者 Name of responsible person 三宅康博 Yasuhiro Miyake 装置名 Name of Instrument/(BL No.) D2 実施日 Date of Experiment 2009 年 2 月 14 日～2 月 15 日 Feb. 14, 2009 ～Feb. 15, 2009

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

[1] We have used a new D2 Channel. To obtain the shape and positive muon beam intensity distribution, we used imaging plates (Fuji Film Co.: BAS-SR2040).
[2] Tungsten foils (40μm thick), nickel foils (30μm thick), copper foils (40μm thick) were piled.
[3] Wings of cicadas, plant leaves, aluminum-nickel alloys were used.

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。)
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

Imaging plates were used as recording materials. The type was BAS-SR2040 made by Fuji Film Co. The size was 20cm x 40cm. An imaging plate was put in a plastic envelope coated with aluminum to prevent disappearing of exposed images. Samples were mounted with scotch tapes. The assembly was irradiated with positive muons. The reader or analyzer used was BAS-2500.

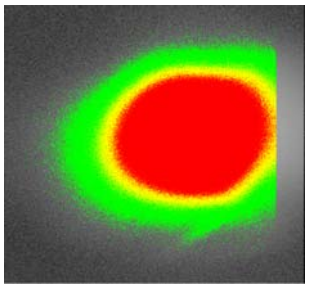
Fig 1 30 MeV/C

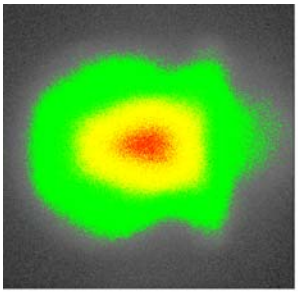
Fig. 2 40 MeV/C

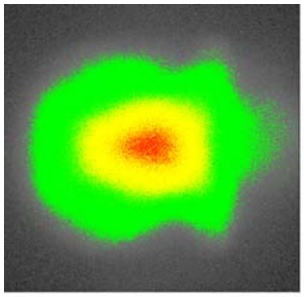
Fig. 3 60 MeV/C

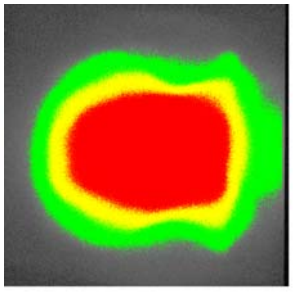
Fig. 4 90 MeV/C

2. 実験方法及び結果（つづき） Experimental method and results (continued)

Figures 1, 2, 3, and 4 show the shapes and positive muon intensity distributions of 30 MeV/C, 40MeV/C, 60MeV/C and 90 MeV/C, respectively.

When a thin sample was put on the envelope, PSL (Photo Stimulated Luminescence, defined by Fuji Film Co.) value became larger, but the values of PSL for thicker samples became smaller due to the absorption of muons.

Figure 5 shows the PSL image of muon beam (30 MeV/C) with copper foils. The copper foils are shown at the upper left corner of the red ellipse.

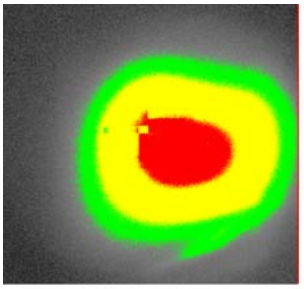

Fig. 5. Copper foils were set on the envelope.

Figure 6 is a clearer image of copper foils. Analyzing these images, PSL value passed one sheet of copper foil (40 μm) was 2.67 times of the straight beam, PSL value passed 2 sheets was 2.36 times, PSL passed three sheets was 0.46 of that of straight beam. This is probably due to the following reasons: When muon beam passed copper foils, muons lost their energies, and the slower muons pushed up the PSL values. When muons beam passed three copper foils, the absorption was high and the PSL values dropped.

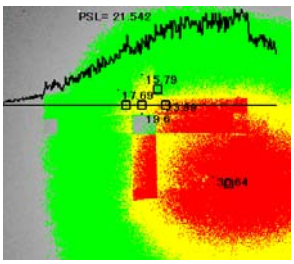

Fig. 6 Image of copper foils

The red part of Fig 5 is close to an ellipse shape. The positive muon Intensity of 30 MeV/C is assumed to be expressed by

$I(x, y) = \exp[-(1/s^2)(x-x_0^2 - (1/s^2)(y-y_0)^2]$.

Figure 7 is a corrected positive muon beam intensity.

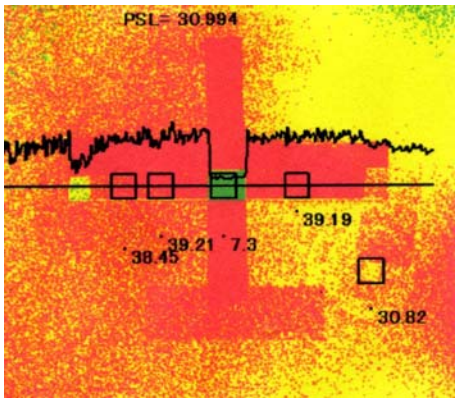

Fig. 7.

Similar effect was found in transmission muon images of wings of cicadas(Fig. 8) , and plant leaves (Fig. 9).

The images of sample should be lighter because less muons passed through the samples.

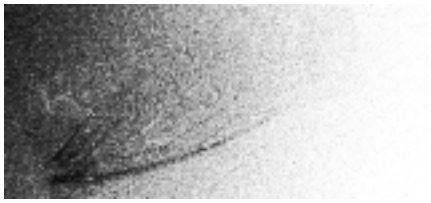

Fig. 8. Wing of cicadas

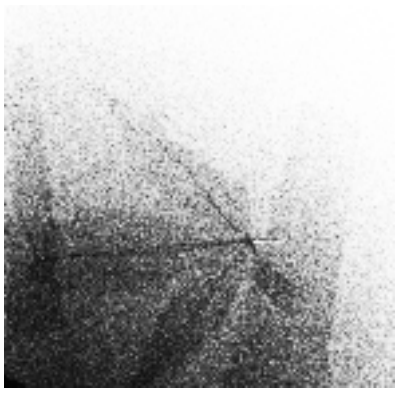

Fig. 9.