UNIVERSITY OF CALIFORNIA

Ernest O. Lawrence

Radiation Laboratory

BERKELEY, CALIFORNIA

Letter to the Editor
of the R. S. I.

UCRL-8971

UNIVERSITY OF CALIFORNIA

Lawrence Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

HODOSCOPE DESIGN TO MINIMIZE PHOTOMULTIPLIER USE

Luis W. Alvarez

November 9, 1959

Printed for the U. S. Atomic Energy Commission

HODOSCOPE DESIGN TO MINIMIZE PHOTOMULTIPLIER USE

Luis W. Alvarez

Lawrence Radiation Laboratory

University of California

Berkeley, California

November 9, 1959

High energy experiments involving the use of scintillation counters are tending to become very elaborate--hodoscopic arrays of 80 to 100 counters are now quite common. This note describes a simple technique that can drastically reduce the number of photomultipliers required to yield a given resolution. For example, to determine which of the 1024 squares in a 32-by 32-element hodoscope was hit by a particle, 64 photomultipliers are normally required. With the binary hodoscope described in this note, only 10 photomultipliers are required to give the same information. In view of the modern trend toward computer reduction of the data from complex counter arrays, the immediate existence of the output data in binary form may simplify the coding.

Figure 1 shows the basic idea. For an 8 by 8 array, two orthogonal sets of three elements are used. The six elements are arranged as a sandwich. Each of the counter elements is in the form of a rectangle, with half of its area made of scintillating plastic (1), and the other half made of non-scintillating plastic (0). It is coupled to the photomultiplier (P. M.) with a standard light pipe (L. P.). Which of the eight strips was hit by the particle is specified by the binary code output of the three photomultipliers.

Because the boundaries between the scintillator and non-scintillator are directly under each other at certain places, an incorrect signature can arise from an inclined track. Tracks A and B have the signatures 001 and 011 respectively. Track C has the signature 111, which makes it appear to be close to track D, rather than close to track B. The arrangement shown in Fig. 2 avoids the errors due to inclination of the tracks. The arrangement is appropriate to a 16 by 16 array, and the generalization of the scheme to any number of elements is obvious.

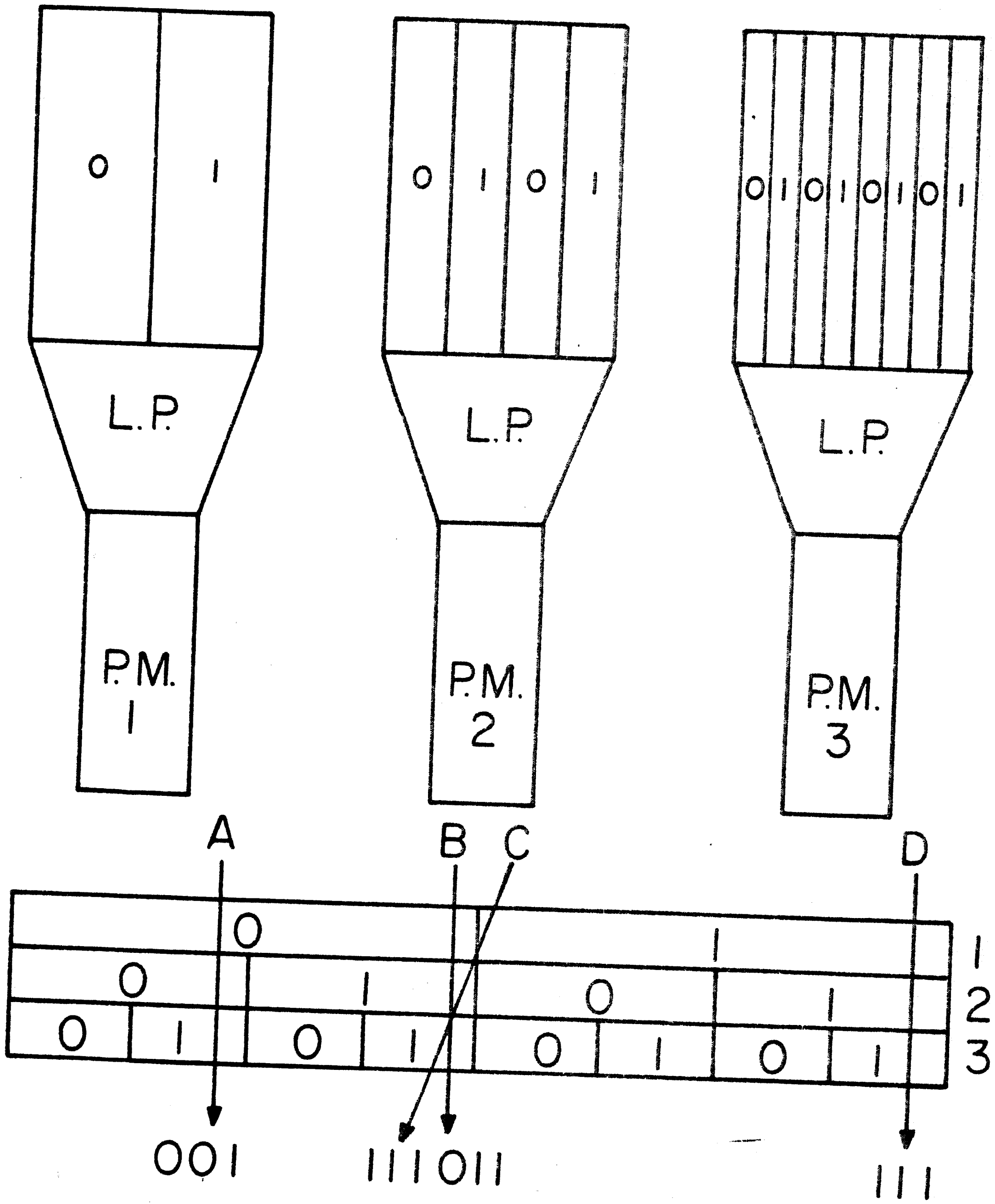
A binary hodoscope of the type described in this note was constructed and tested two years ago at the Lawrence Radiation Laboratory by Dr. Harold Ticho. It had been planned to use the hodoscope to identify the K^- mesons which passed through a liquid hydrogen bubble chamber. The beam consisted largely of π^- mesons, and the K^- mesons were to be first identified by time of flight, and then looked at with the hodoscope. The device was not employed in the experiment, but for reasons that had nothing to do with its basic design.

This work was supported by the Atomic Energy Commission.

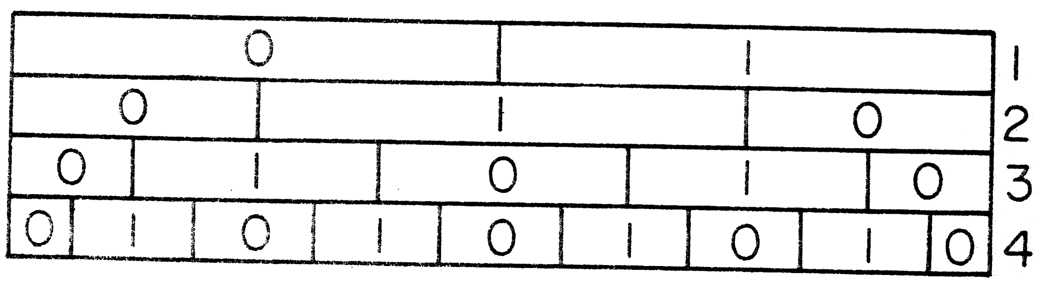
Figure Captions

Fig. 1. 8 element hodoscope unit.

Fig. 2. 16 element non-ambiguous hodoscope unit.


0 1
0 1 0 1
0 1 0 1 0 1 0 1
L.P.
L.P.
L.P.
P.M. 1
P.M. 2
P.M. 3
A
B
C
D
0
1
0
1
0
1
0 1 0 1 0 1 0 1
1
2
3
001
111011
111

1 56,224-1


0 1 1
0 1 0 2
0 1 0 1 0 3
0 1 0 1 0 1 0 1 0 4