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1954, 1° Gennaio
Il Nuovo Cimento
11, 100-102

A Punched Card System of Recording of Events in Nuclear Emulsion Work.

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(ricevuto il 2 Dicembre 1953)

During the scanning of cosmic ray plates, a considerable amount of information is accumulated in numerous scanning books on many types of events. In order to select special events for measurement or to make statistics, it is convenient to have events recorded in some way by which the selection can be automatic. When events are recorded on cards, the sorting of these cards by hand is very tedious.

We have therefore made a preliminary trial of a system of punched cards, which carry much of the physical description of the event in the form of perforations, enabling the events to be selected according to various parameters (1). For simplicity we have chosen a system of cards with a double row of holes round the edges, in which events are selected by passing knitting needles through the holes. Using a special clipper a certain number of these holes (depending on the type of event) is cut away to the edge. To select events of a chosen type the needles are passed horizontally through a stack of cards, through the relevant holes. On lifting the needles the cards which have been cut at these holes fall away, while the others remain hanging on the needles. The principal information carried on the card is repeated in writing on the centre to avoid errors in cutting passing unnoticed.

In the system we have adopted the events are classified in 4 categories: 1) stars; 2) electromagnetic events; 3) fundamental particles; 4) events associated with the preceding events.

For most of the sections we have adopted a triangular enumeration (2). A number is indicated by two cuts. It lies in the diamond determined by the intersection of the two diagonal rows ending at the cuts. The upper digit is indicated when the cut on the right includes both holes, the lower one if the left cut is long.

To indicate the number of branches in a star, we have a different system of enumeration. The selection most frequently required is that N_s should be greater than a certain number and N_h

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(1) We are indebted to Dr. A. BONETTI of the University of Milan for certain suggestions which we hawe adopted in the design of the card.

(2) COX, CASEY and BAILEY: *Journ. of Chem. Educ.*, **24**, 65 (1947).

less than a certain number. A differential method such as used for the other sections would require a large number of sortings to draw all the stars

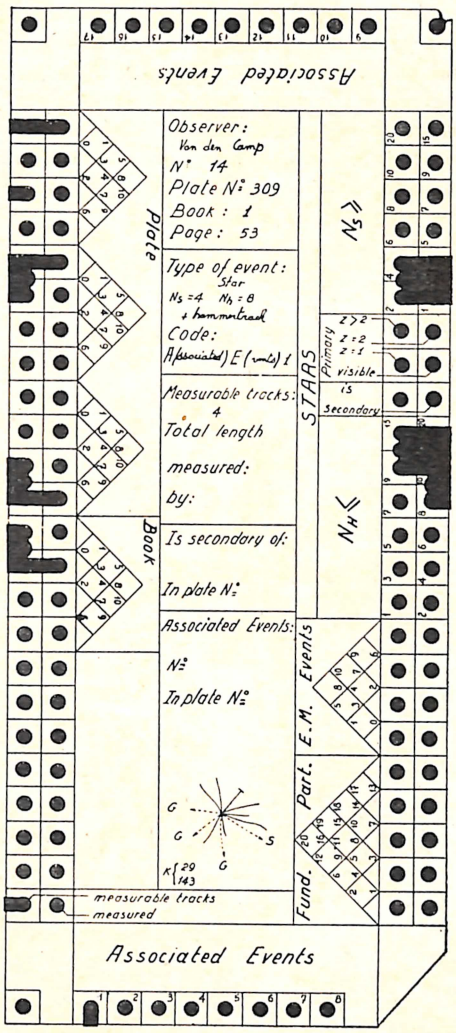

Fig. 1.

required. We use therefore an integral system. With this system one sorting gives all stars with $N_s \geqslant x$ and $N_h \leqslant y$ and two sortings suffice to give all stars with $N_s = x$ and $N_h = y$.

The system can be most simply explained by an example. Fig. 1 represents a card which describes a star of twelve branches of which four are shower particles. ($N_s = 4$), the eight others being grey or black tracks ($N_h = 8$). One of the black branches is a hammer track. N_s has been cut away up to and including 4 (Integral classification) and N_h from 20 to 8 included. The existence of a hammer track is indicated under « associated events »; this code contains 20 spaces, the code number of the hammer track being 1.

This section is represented by a single row of holes, so that any number of associated phenomena can be represented simultaneously.

Another information on stars is contained in the section « primary » in which is indicated the presence of a visible primary and its nature when determined (integral numeration). In our example, there is no definite primary and the section has not been cut.

The hole « is secondary » is cut when the event on the card is secondary to an event registered on another card.

The fundamental particles and the electromagnetic events are classified by the triangle system in compartments of 20 and 10 places respectively, part of which are empty to leave room for new types of events.

The hole « measurable tracks » is cut when one or more tracks are measurable. The hole « measured » is cut when some of the tracks have actually been measured. In the example described there were 4 measurable tracks but no measured tracks.

The plate number (309) is given again on a decimal classification using three triangles with room for 1000 plates.

The classification of cosmic ray events in nuclear emulsions on punched cards seems to us useful and the cards described adequate to carry the necessary

information. There is a section left open in which can be inserted any information which may become necessary to include in the card.

About one hundred cards can be handled in a single selection process. Wearing of the cards does not seem to be prohibitive if the cards are of good quality. Cuts to be made near the corners have been avoided to prevent « hooking ». The holes existing in three of the corners are not to be cut. They allow the extraction of the cards which are wrongly orientated with respect to the stack.

Given the simplicity of the method, it is easy to change the model during the course of work. If the colour of the cards is also changed, the old ones can still be used. Although it is not essential to the usefulness of the system in a given laboratory, uniformity between laboratories would be an advantage. Information could be more easily exchanged, and cards could be made at a single centre, so reducing cost.

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