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A New Plotting Concept for Data
from Bubble Chamber Experiments

by

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A NEW PLOTTING CONCEPT FOR DATA FROM BUBBLE CHAMBER EXPERIMENTS

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A new concept has been developed for plotting^{†)} one- and two-dimensional distributions of kinematic quantities in bubble chamber experiments in connection with plotting programs such as ULTRAN (1) or SUMX with a great saving of time. Applied to an experiment with large statistics (2), the new program (HYBRID-ULTRAN) has yielded a saving of time of more than 90 % as compared to conventional methods.

The reason for long computing times with ULTRAN and SUMX for experiments with large statistics is, above all, the limited storage space which is available for two-dimensional plots. With ULTRAN and 2⁴ K of storage it was only possible to build up 5 two-dimensional and 20 one-dimensional plots. Owing to the new concept it is merely necessary to provide the storage space for one one- and one two-dimensional plot (about 2000 places each). In the HYBRID-ULTRAN program 200 one- and two-dimensional plots each can be accommodated. This would require 350 000 storage locations with the conventional programs.

a) Conventional method (ULTRAN, SUMX, etc.)

1st part: The kinematics output tape (CUT, SLICE, etc.) is read and several tests are made. At the same time a new tape with these tested data is written.

†) Plot is used here as an abbreviation for a one- or two-dimensional histogram ("scatter diagram").

2nd part: The tape written in the 1st part is read and a limited number of plots is built up in core storage.

3rd part: The plots built up in the 2nd part are written on output tape.

4th part: The 2nd and 3rd part are repeated until all plots are produced.

b) New concept (HYBRID-ULTRAN)

1st part: Same as in a)

2nd part: The newly written tape with the tested data is read. When an event has been read in, the plot indices for all wanted plots are calculated for the data of this one event. The plot number and plot indices for each plot are combined in one machine word together with further information such as laboratory-number, data group, and weight of event. Thus one of these words contains all information necessary to plot one event on one plot; there will generally be several words (one for each plot) corresponding to one event. These "plot events", blocked to 1500 words, are written on an intermediate tape. The intermediate tape is written in a way which allows for very simple processing in the 3rd part.

3rd part: Sorting. The intermediate tape produced in the 2nd part essentially contains the plots but the information is inconveniently ordered by event number. In Part 3 it is re-arranged according to plot number by a tape sorting program (in this case IBM-7044 IBSORT). The large block length in the intermediate tape reduces tape motion.

4th part: The intermediate tape sorted according to plots from the 3rd part is read and the corresponding one- and two-dimensional plot built up in core storage. The change of plot number signals the completion of a plot and causes it to be outputted.

The saving of time by the new method is due to the fact that the sorting of the short intermediate tape takes much less time than the repeated reading of the kinematical data tape.

(1) ULTRAN - a kinematical program for reduction of bubble chamber data, V. Blobel, H. Butenschön, P. v. Handel, P.K. Schilling, Hamburg 1964.

(2) γ -p-Aachen-Berlin-Bonn-Hamburg-Heidelberg-München Collaboration

Example of time saving: For the reaction $\gamma p \rightarrow p \pi^+ \pi^-$ with 8000 events, the production of 180 two-dimensional and 30 one-dimensional plots takes about 540 minutes with ULTRAN. With the new HYBRID-ULTRAN it takes only 40 minutes.

