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PRELIMINARY DESCRIPTION OF THE SOFTWARE OF THE MICROSCOPES CONNECTED ON LINE TO A TPA SMALL COMPUTER

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ABSTRACT

We give the description of the software of the microscopes connected on-line to a TPA small computer.

KIVONAT

Leirjuk egy TPA kisszámitógéphez on-line kapcsolt buborékkamra-felvételek mérésére alkalmas mikroszkóp software-jét.

РЕЗЮМЕ

Даётся описание системы программ, которая обслуживает измерение снимков пузырьковых камер на цифровом микроскопе, работающем в режиме "он-лайн" с малой ЭВМ ТРА.

INTRODUCTION

The measuring of bubble Chamber pictures is an important part of the work of the High Energy Physics Department at the Central Research Institute for Physics, Budapest. Most part of the measuring time is needed for finding the pictures to be measured /about 80 per cent/. We have connected a microscope on line to a TPA small computer in order to decrease the number of remeasurings to a minimum.
We hope to increase the efficiency of the measurements by about 60-100 %, as compared to the present off-line method.
We present the software of that system in this article.

THE DESCRIPTION OF THE SYSTEM

At present we have one microscope which is connected on line to a TPA small computer. There is also a telex at the microscope /Fig.1/.

The computer can accept messages from the control board of the microscope electronics as well as from the associated telex.

The computer may test the messages or process them but for the time being after testing it transmits the good data in unchanged form to the output medium.

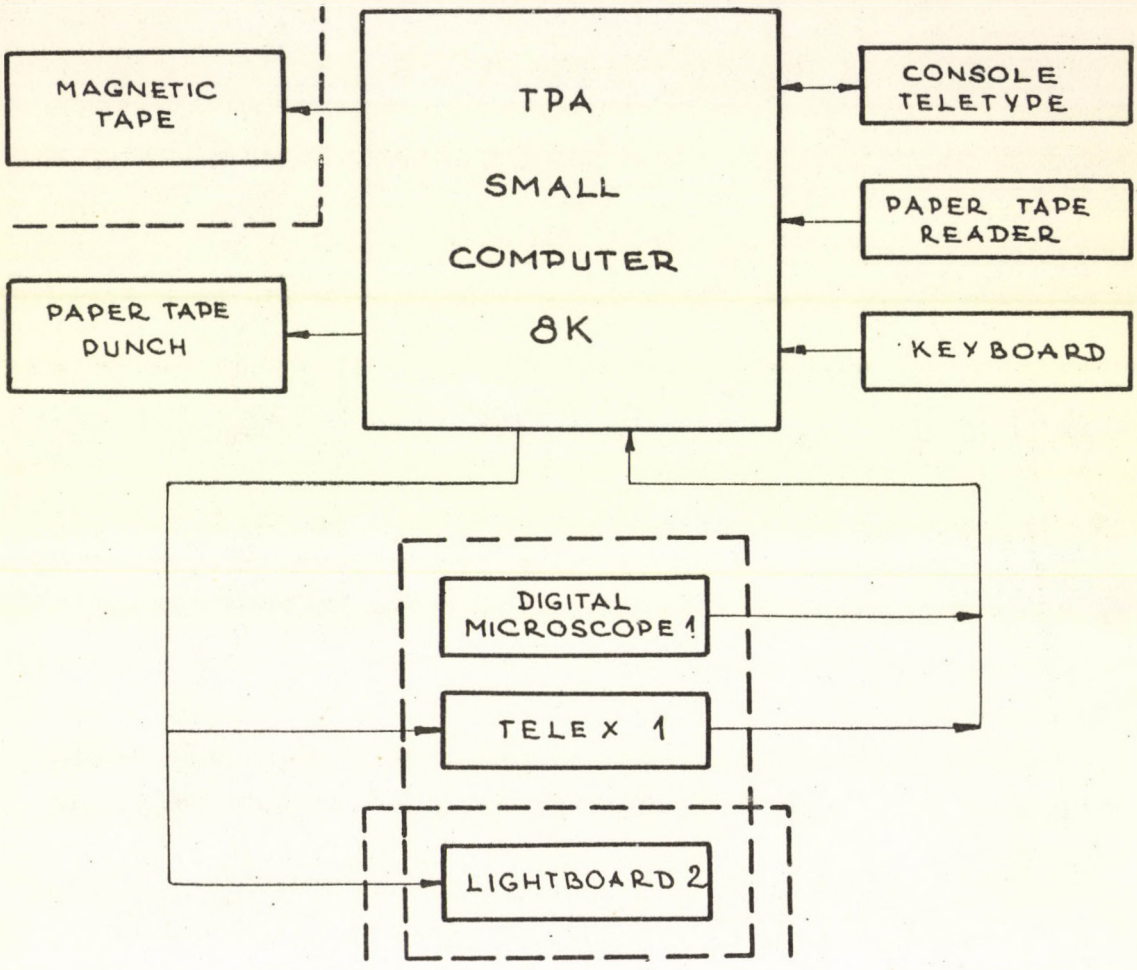


Fig. 1

At present the computer punches the corrected data on paper tape, but we want to exchange the paper tape punch for a magnetic tape recorder.

INPUT/OUTPUT

All input/output is organized by a supervisory program, called MANAGER.

Each equipment /measuring microscope/ has a double buffer in the memory of the TPA small computer. The program selects one of the two buffers as the input buffer of the equipment. Both the telex and the digital microscope deposit the data into the input buffer. When a complete message is collected into the input buffer the TPA small computer prohibits any further input from that particular equipment and tests the message. If it is correct then the input buffer becomes the output buffer of the equipment and the computer begins the output. In the same time the other buffer becomes available for the new input. Due to the interrupt organization the input and output may take place simultaneously in an autonomous way /Fig.2/. The computer sends messages to the measuring operator using the telex and possibly a lightboard, which now is not available. /For example error detection./

Various codes may be chosen for the output data /telex code, ASCII code or ICT internal code/. The changing of output code is described in Appendix I.

SUBROUTINE SYSTEM DIRECTOR

The Subroutine System DIRECTOR calls the various programs. The Flow Diagram may be seen on Fig.3. The first character of the message is characteristic of the message. The message is terminated by a line feed. A coordinate string is followed by a letter 'V'. The DIRECTOR reads the first letter of the message and according to that it looks for the address of the suitable processing program in a dictionary /table/ and calls for it.

Several functional levels can be determined for the measuring procedure and different tables may be used

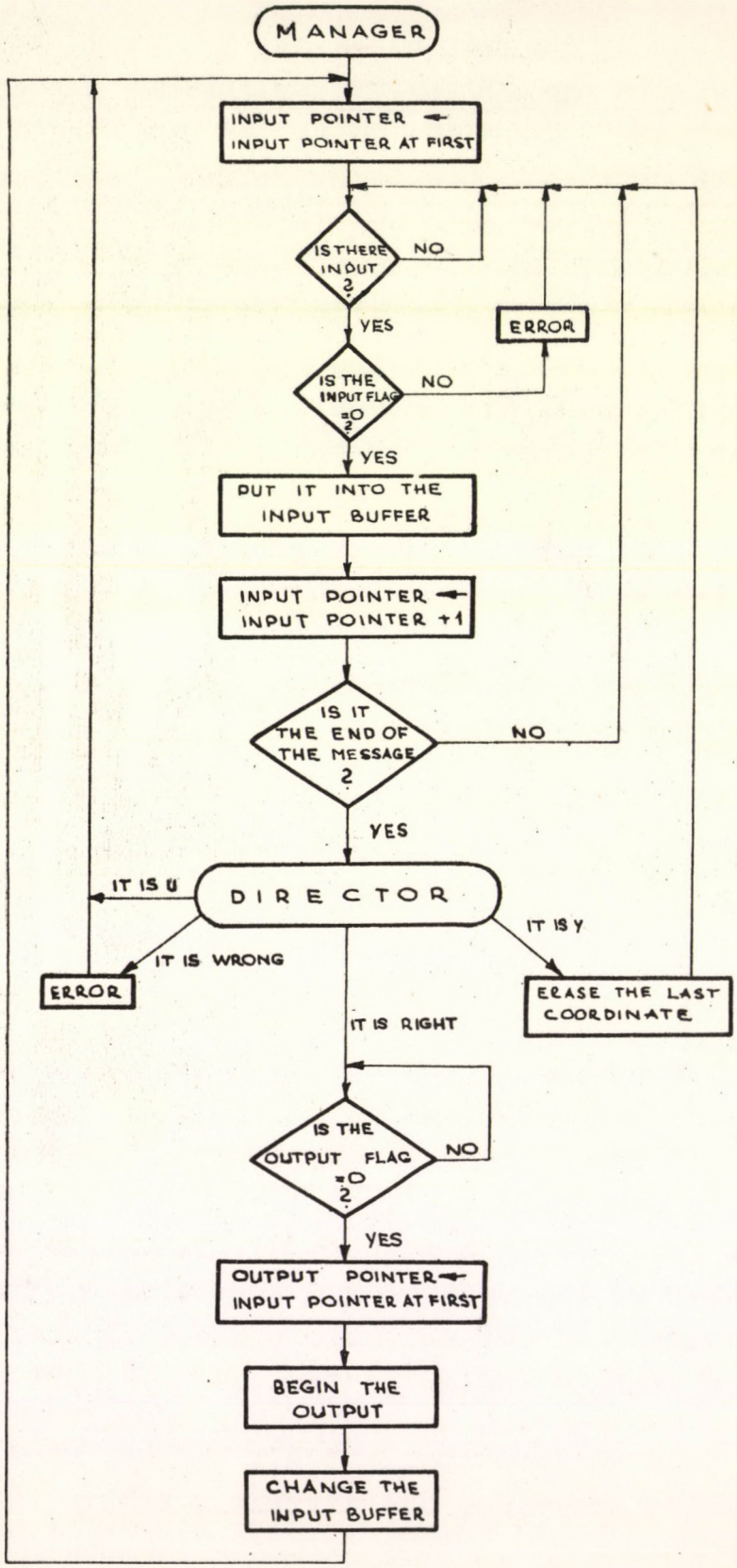

MANAGER
INPUT POINTER ← INPUT POINTER AT FIRST
IS THERE IN OUT Z
NO
YES
ERROR
IS THE INPUT FLAG =0 Z
NO
YES
PUT IT INTO THE INPUT BUFFER
INPUT POINTER ← INPUT POINTER +1
IS IT THE END OF THE MESSAGE Z
NO
YES
IT IS U
DIRECTOR
IT IS Y
IT IS WRONG
ERROR
ERASE THE LAST COORDINATE
IT IS RIGHT
IS THE OUTPUT FLAG =0 Z
NO
YES
OUTPUT POINTER ← INPUT POINTER AT FIRST
BEGIN THE OUTPUT
CHANGE THE INPUT BUFFER

FIGURE 2

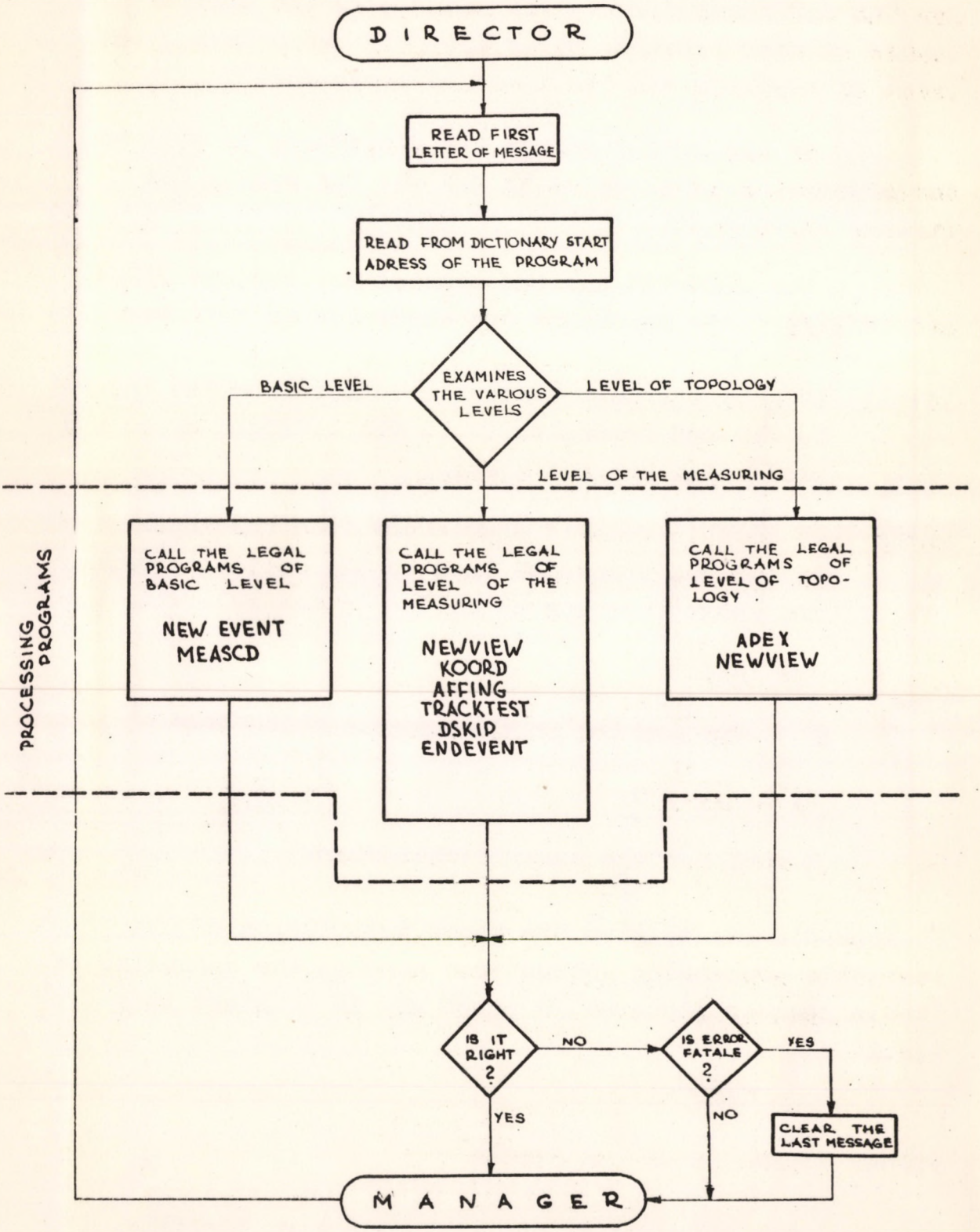

DIRECTOR
READ FIRST LETTER OF MESSAGE
READ FROM DICTIONARY START ADRESS OF THE PROGRAM
EXAMINES THE VARIOUS LEVELS
BASIC LEVEL
LEVEL OF TOPOLOGY
LEVEL OF THE MEASURING
PROCESSING PROGRAMS
CALL THE LEGAL PROGRAMS OF BASIC LEVEL
NEW EVENT
MEASCD
CALL THE LEGAL PROGRAMS OF LEVEL OF THE MEASURING
NEWVIEW
KOORD
AFFING
TRACKTEST
DSKID
ENDEVENT
CALL THE LEGAL PROGRAMS OF LEVEL OF TOPOLOGY .
APEX
NEWVIEW
IS IT RIGHT ?
NO
IS ERROR FATALE ?
YES
YES
NO
CLEAR THE LAST MESSAGE
MANAGER

FIGURE 3.

for the different levels. For example in the case of bubble chamber pictures these are: the basic level, the level of topology and the level of measuring.

We can easily change the dictionary as well as the processing programs so we can use the system for various experiments.

The DIRECTOR has two special subroutines /INEG and INVEZ/; their functions are described as follows:

INVEZ; it gets the next available letter from the input buffer and transmits it to the DIRECTOR or to the processing program system.

INEG; it gets in numeric characters from the input buffer and transmits them to the calling program. The subroutine may be called in the following way:

JMS INEG

X the numbers of the numeric characters

0; 0; ...; 0

X word for the numeric characters

In Appendix II. we give the short description of the available processing subroutines used in the measuring of bubble chamber pictures. A pilot use is to start this month.

FUTURE EXTENSION OF THE SYSTEM

The software of the system is very flexible. It can be extended to handle more than one microscope. In

this case the MANAGER should be modified as it is shown in Fig. 4.

In the future some other processing programs too will be incorporated into the system and the present ones will be rendered more sophisticated.

We are obliged to J. Koch and I.T. Szüts for the realization of the on-line connection and to F. Telbisz for the valuable advise and discussions and to I. Wagner for the routine to solve linear equations.

APPENDIX I.

a/ The characters for the output may be transformed into the ICT internal code using the transformator which is originally in the memory.

b/ If we want to convert the characters into the ASCII code then we have to exchange the tables of the translator and the content of the following words:

KC + VEZER + 61_8

INVEZ + 3_8 + JMS INEG + 44_8

INVEZ + 24_8 + - 61_8

INEG + 13_8 + JMS INEG + 44_8

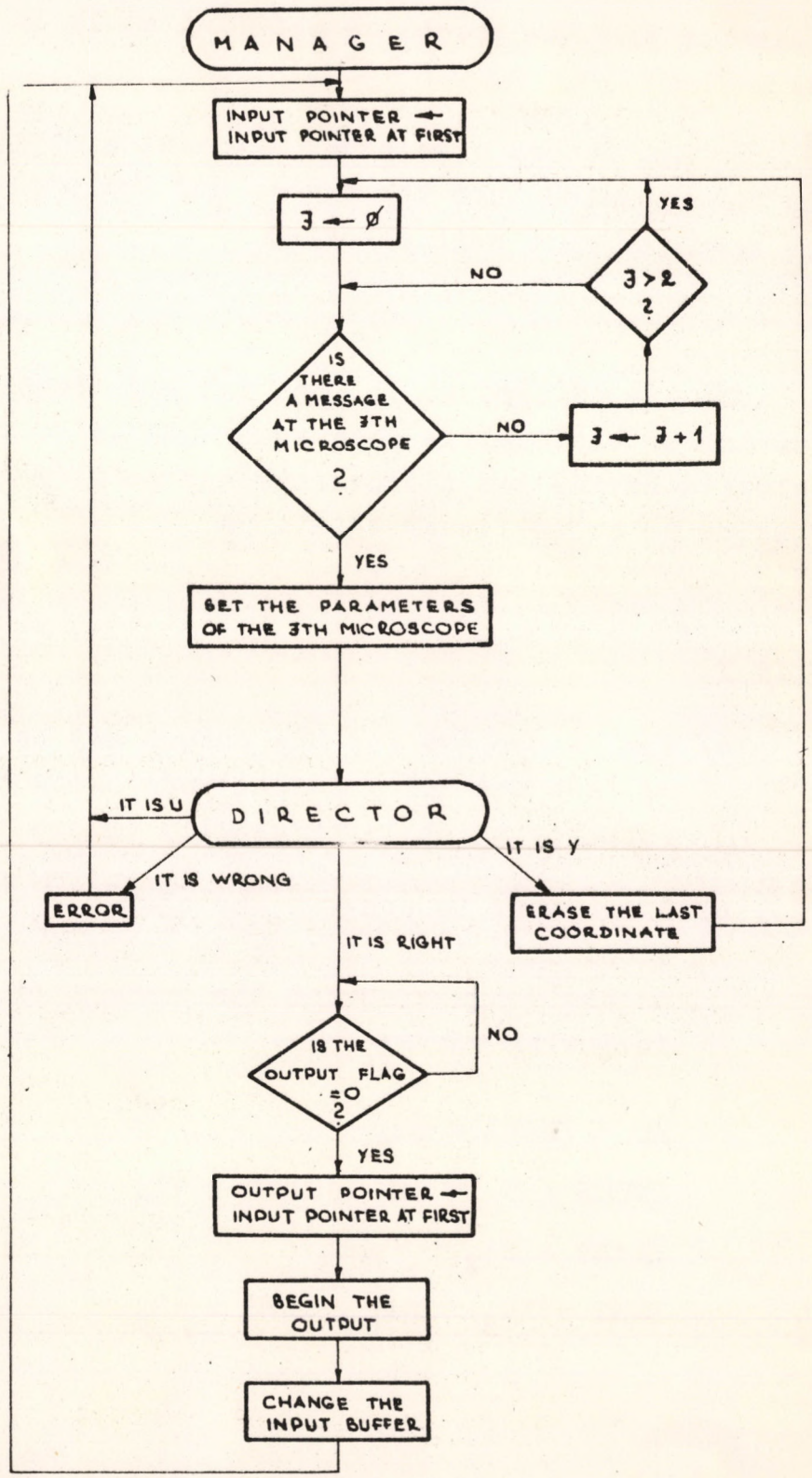

MANAGER
INPUT POINTER ← INPUT POINTER AT FIRST
J ← Ø
YES
NO
J > 2
2
IS THERE A MESSAGE AT THE JTH MICROSCOPE
2
NO
J ← J+1
YES
SET THE PARAMETERS OF THE JTH MICROSCOPE
IT IS U
DIRECTOR
IT IS WRONG
IT IS y
ERROR
ERASE THE LAST COORDINATE
IT IS RIGHT
IS THE OUTPUT FLAG =O
2
NO
YES
OUTPUT POINTER ← INPUT POINTER AT FIRST
BEGIN THE OUTPUT
CHANGE THE INPUT BUFFER

FIGURE 4

APPENDIX II.

Dictionary of the processing programs

Letters Programs

Q	MEASCD	examines the operator's code number and stores the operator's code to the MQT word. The operator is obliged to start her work with this message and it is recomended to finish her work with the Q 00 message.
F	NEWEVENT	is called when the number of a new event occours: it sets the initial values of the parameters, reserves the number of the event and types it out on the telex. The NEWEVENT punches the operator's code on the paper tape punch.
T	APEX	describes the event. The structure of the topology is the following:

$$1000\ d_1 + 100\ d_2 + 10\ d_3 + d_4$$

d_1 = is the number of the reactions caused by charged particles

d_2 = is the number of the reactions caused by neutral particles

d_3 = is the number of $/V^0/$-s

d_4 = is the number of γ -decays

APEX fills in the ABO array. The L-th

element of the ABO array contains the type of the L-th formation:

-1 stands for the reference points
0 stands for a track
1 stands for a reaction caused by charged particle
7 stands for a reaction caused by neutral particle

The maximum allowed number of the formations is 40 and the maximum allowed number of the vertices is 20.

N NEWVIEW — reads in the numbers of the view, sets the initial values of the variables which are needed for a view and examines if the number of the last view was legal and whether every element of the last view is measured.

K KOORD, — according to the ABO array it calls the AFFIN6 program or the TRACKTEST program, examines the number of the coordinates for the view and prevents this number to surpass the present maximum value.

AFFIN6 — projects the measured coordinates with a linear transformation:

$$\xi = \alpha_1 + \alpha_2 \xi + \alpha_3 \eta$$

$$E = \alpha_4 + \alpha_5 \xi + \alpha_6 \eta$$

onto the reference plane. The plane may be the surface of the bubble chamber. We know

the 'apparent' positions of the reference points in this plane and we measure their projections on the film. We can determine the matrix of the transformation from these data. In the case of more than 3 reference points we may use the method of least squares, in case of a bad fit a remeasurement is requested.

TRACKTEST — examines the number of the coordinates for a track. The number of the coordinates is legal in the following cases: N = 2 or

$$N_{min} \leq N \leq N_{max}.$$

This subroutine examines the distances between the neighbouring measured points. The distance is legal if

$$d_{min} \leq d \leq d_{max}.$$

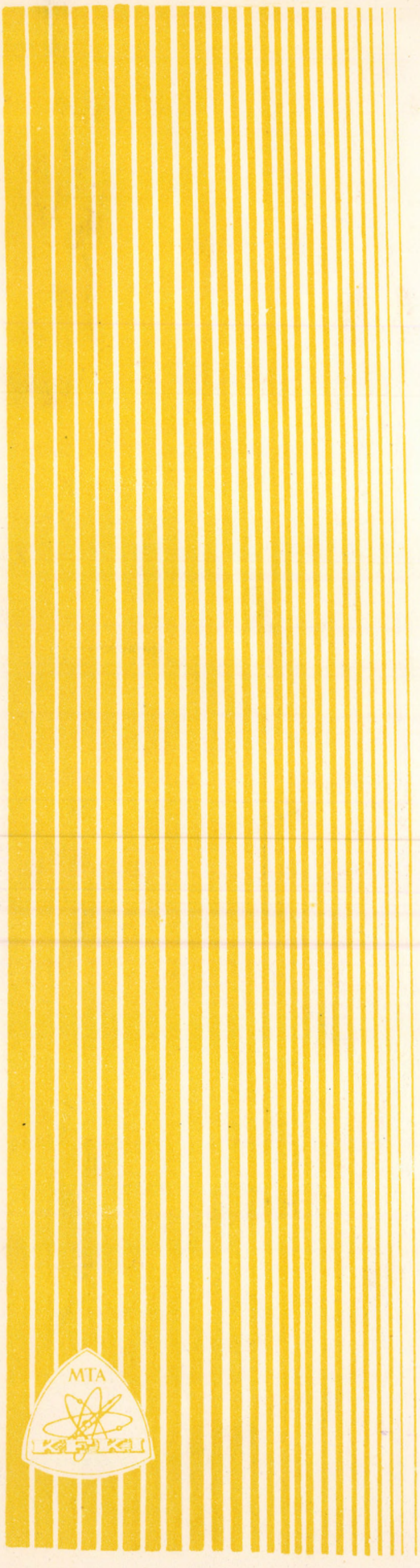
It examines the deviation of the measured points from a fitted curve. The fitted curve may be a straight line or a circle. In case of a bad fit a remeasurement is requested.

P DSKIP — is called when the operator does not want to measure every formation of the view; this is useful when a formation is not measurable.

W ENDEVENT — examines whether the last number of view is legal /0 < J < NUIEWS/, whether every part of the last view is measured and examines if the number of the measured views is enough.

U	Erase the last message or all the coordinates of the last element.
Y	Erase the last coordinate.
Z	End of the work.

61.948



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