

A FLEXIBLE DIALOGUE WITH THE COMPUTER IN THE CONTROL ROOM OF THE SACLAY'S LINAC

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Summary

In the Control Room of the 600 MeV Electron Linac of Saclay (ALS) the use of a powerful visual display (including its own computer) allows to make very simple and flexible the dialogue of the operators with the main computer. As an example we describe a program permitting to select every number of parameters among 320 in order to assign them to one of the functions of the system.

Introduction

The ALS, in operation since 1969¹, is controlled with conventional instruments. When installing a computer in the Control Room the first purposes were

- centralization of information and their display under a convenient mode.
- automatic supervision of the main parameters i.e the checking of their actual values against their values recorded once the linac is correctly tuned up.

We have paid great attention to the interface man/computer in order to convince the operators to use the new devices rather than the old ones.

The difficulty arose from the fact that a linac can have a great number of configurations according, for example, to the number of klystrons turned on or to the particle accelerated (e^+ or e^-). So the dialogue operator computer had to satisfy two contradictory requirements: flexibility and simplicity.

In this paper we shall describe the dialogue for the operation of the function SUPERVISION so as to demonstrate how we tried to reach this aim.

Description of the system

The system is based on a computer T1600 TELEMECANIQUE with a 40 k words core memory and a 5 M bytes disk. The visual display is a display computer IMLAC PDS-1 (fig. 1) with a 8 K words core memory.

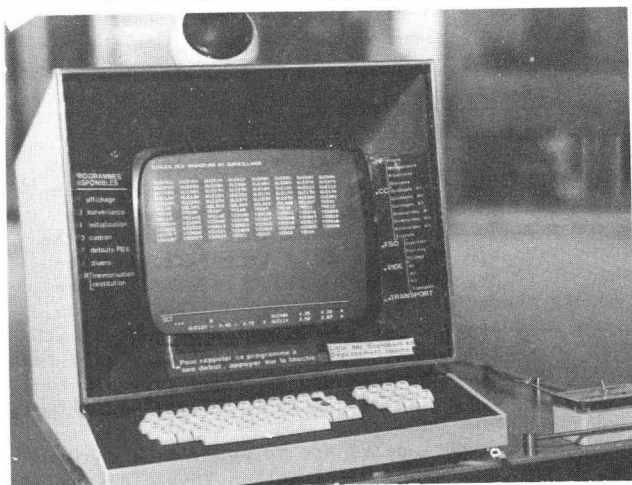


Figure 1.

The operator can interact by mean of a light-pen or an alphanumeric keyboard which includes 16 function keys.

The display computer is linked to the main one by a parallel link and uses the same disk unit as bulk memory.

This disposal permits to run sophisticated programs in the display for the dialogue without trouble for the tasks running in the same time in the main computer.

The graphic capability of the display computer permits to compose one's own set of characters and thus to make texts very legible and pleasant even when they include Greek or mathematical characters.

The other peripherals are a printer, a card reader, two teletypes. The data acquisitions are made by a relay multiplexed digital voltmeter (320 channels) used for DC measurements or by CAMAC plug-in for pulsed measurements as beam intensities (OCTAL ADC).

Dialogue for the function supervision

This function consists in checking every 30 seconds that a variable has remained inside a specified window centered on a reference value.

The operator must be able to perform the following operations:

- to compose the list of the variables under SUPERVISION
- to memorize a reference value for each variable
- to know immediately the name of variables at fault
- to adjust at will the width of the windows
- to check easily the list of variables under SUPERVISION.

As for other functions of the system the operator types two characters on the keyboard, here SU for SUPERVISION. This makes appear on the CRT the list of the tasks related to the function:

- SELECTION OF VARIABLES
- ADJUSTMENT OF WINDOWS
- LIST OF VARIABLES UNDER SUPERVISION.

An index can be moved in front of the names of the tasks by mean of function keys. When the desired one is indicated the operator presses the space-bar of the keyboard.

Selection of variables :

To compose a list of let us say 150 variables among 320 possible it would be tedious to specify them one by one. However one must be able to do it for adding or withdrawing a little number of them. It may be also convenient to be able to add or to withdraw a group of variables e.g. those related to a klystron or to a part of the linac not used. To do that we proceed as follow: when the task SELECTION OF VARIABLES is asked for, the name of the large groups of variables appears on the CRT:

RF DC CURRENTS BEAM VACUUM SWITCHYARD
and aside the following table (fig. 2)

```

IN
OUT
NULL
Δ
▽
END
    
```

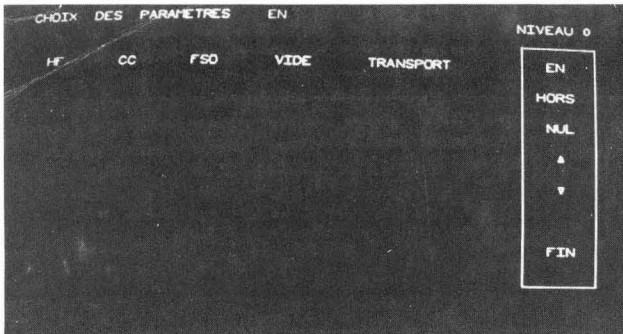


Figure 2

The operator points with the light-pen one or various options. He may then end his selection by pointing END, e.g. if he has selected DC CURRENT then END all the DC CURRENTS (steering, solenoids, triplets) will be introduced in the list of SUPERVISION (or withdrawn if he has specified OUT). But he may also refine his selection. Instead of END he will point

▽

and a new set of options will be presented : the name of the groups of variables pertaining to the group previously selected. In the present case :

STEERING SOLENOIDS TRIPLETS

Once again the operator may select one or more options and then end or refine the selection. The following set of options will be:

A1 A2 A3

which designate 3 parts of the linac which can work independently. The following and last set will be the list of individual variables pertaining to the group selected just before (fig. 3).

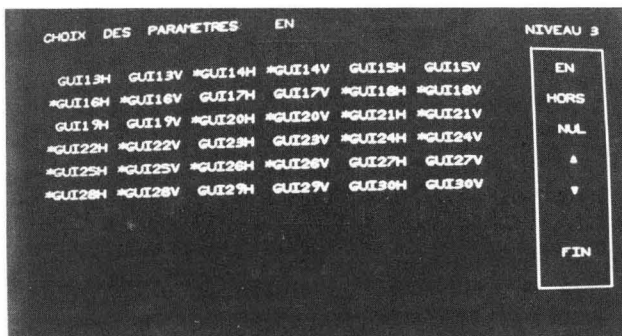


Figure 3

The operator can select one or various among them.

For another initial group of variables, the succession of the options would be different but in any case it would be logical and rather obvious for an operator of the linac.

The operation is more easy to execute than to explain. Of course the corresponding software is rather complicated but it is run by the display computer only. The main computer is involved only when the selection is ended. Then it has nothing to do but receive few words and arrange them. This dialogue can be used whenever the same condition of selection are required, e.g. in the functions permitting to display any set of values, or to compose a list of data to be logged.

Initiation of supervision :

In our linac it is impossible to memorize once for all the reference values since all values may change from an adjustment to another. When a beam has been adjusted the full set of values of the variables involved have to be memorized so that each value serves as reference. But we also must be able to memorize values one by one or by groups in case of partial readjustment. Therefore the same procedure as before is to be used. Only the name of the function changes and the two characters the operator must type to run it.

Warning messages :

In the lower part of the CRT screen a horizontal little zone has been defined by a continuous permanent line and is dedicated to the edition of warning messages. Thus messages can appear without interrupting a display on the main zone.

A message includes the name of the variable in fault, the reference value and the actual value refreshed at 2Hz. The message zone can contain 3 of them. If more variables are in fault, their number is indicated and the complete list can be obtained on the main zone by pressing a function key.

Adjustment of the windows :

The changes of the width of the window can be done at will, by the operator for each variable individually. Windows can be expressed in % or in absolute value. For some variables as vacuums there is no window but a maximum value independent on the reference value.

Another dialogue : Analog meter

In some cases, and rather often practically the analog presentation of the values is better than the digital one. This function makes an analog representation of the values on the CRT. The abscissa of an index on a scale is proportional to the value of the measured variable (fig. 4,ab). Its position is refreshed at 20 Hz. The digital value is also indicated in big characters and refreshed at 2Hz only. On the same graduation appears a dotted line index which represents the analog reference value. It can also represent a value coming from a previously recorded adjustment and thus restored. To readjust a value or to reproduce a set of values one has to control the variable until both indexes are coincident. The operation is very eased by this function. This dialogue is very successful among the operators.

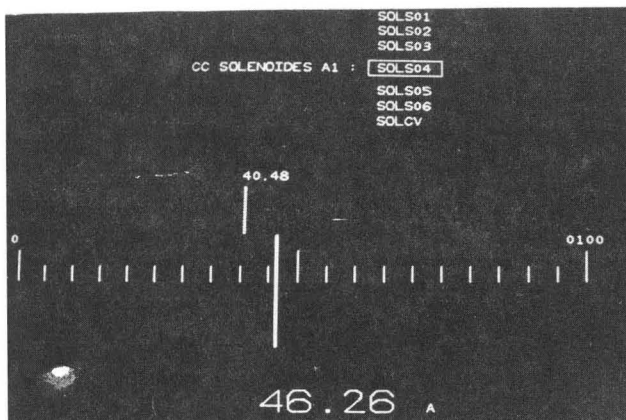


Figure 4a

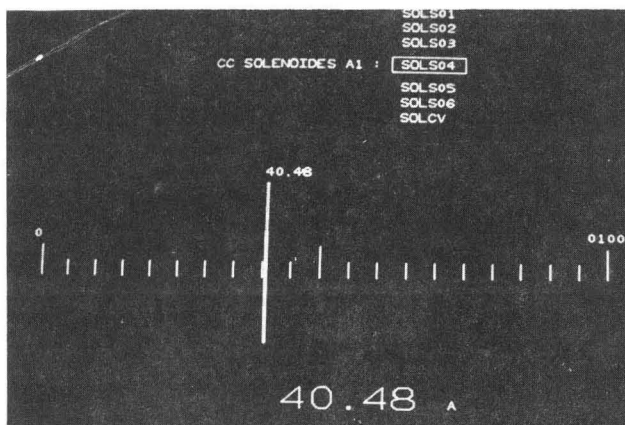


Figure 4b

It is the most convenient of the analog readout meters, large scale, inertia free and connectable to any variable without manual ranging. To connect a variable one only has to move a list appearing on the screen until the name of the desired one is in a rectangle. This dialogue requires a big amount of software, but mainly in the display computer. The main computer is only asked to make acquisitions at the maximum rate and to continue the SUPERVISION.

Other functions

Memorization of set of values :

The operator can memorize all the parameters of a beam for ulterior use. The dialogue permits him to arrange the set in predefined categories, to give it a title, a number and comments. For reproduction, the function "ANALOG METER" is used as explained above.

Display of status :

All the interlocks of the linac are managed by a programmable automate. This one sends to the computer the numbers of the status in fault. The computer translates them into meaningful terms and sends them to the display computer for displaying on the CRT.

Control of devices :

So far, all magnets and quads of one beam line can be automatically set up at a specified energy.

Other beam lines will be soon equipped in this manner and we intend to control through the computer also many devices of the linac itself.

Acknowledgments

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Reference

- 1 - H. Leboutet et al. IEEE Trans. on Nucl. Sc 16, 3 (1969) 299.