Proceedings of the 9th International Conference on Cyclotrons and their Applications
September 1981, Caen, France

COMPUTER CONTROL FOR THE NEW COMPACT CYCLOTRON-INSTALLATION OF KARLSRUHE

J. Bialy, W.-R. Kappel, B. Kögel, H. Heinzmann, H. Schweickert, T.J. Thouw

Kernforschungszentrum Karlsruhe GmbH, Institut für Angewandte Kernphysik/Zyklotron
Postfach 3640, D-7500 Karlsruhe, FRG

Abstract.- The configuration and status of the computer control system for the new CP42H$^-$ compact cyclotron of Karlsruhe, is presented and discussed. The system uses a Nova 4 computer, Camac and touchpanels.

Introduction. - To meet the high demand of beam time, both for basic nuclear physics research and commercial application, a new compact cyclotron was bought to relieve the "old" Karlsruhe isochronous cyclotron. The compact cyclotron, which will be used for isotope production and activation of machine parts, is a CP42H$^-$ machine from The Cyclotron Corporation (TCC).

Hardware description. - This cyclotron and its external beam guiding system will be computer controlled and operated from a practical cyclotron control consol.

The parameter handling of the cyclotron will be performed by the TCC control system, consisting of a PDP-11/03 computer and its "Extended Unibus" system. In order to be compatible as far as possible with the "old" cyclotron control mechanism and beam diagnostic system (both in the hard- and software)[1] it was decided not to buy the TCC beam guiding system. The "old" and the new cyclotron use Data General NOVA 3, 4 computers and standard Camac for the beamline control and beam diagnostic systems. The PDP-11/03 and NOVA 4 computers will be coupled via a Camac teletype interface modul so that commands and data can be transfered bidirectionally. This enables the operator to control the cyclotron and the beam line parameters simultanously from the control consol, without touching the TCC console which contains the PDP-11/03.

Fig. 1 shows the hardware configuration of the control system. It consists mainly of two identical control consols, a parallel Camac branch and two NOVA-4 computers plus peripherals, part of which is used by both CPU's (the second NOVA 4 and second consol are backups).

Each control consol in the figure may alternatively be connected to both computers in a fast and easy way due to a keyboard/graphic-tv "switch" and a new Camac interface.

This new interface connects the parallel Camac branch to both NOVA 4 computers. The long distance between the control consoles and the Camac crates at the beamline is bridged by Camac transmitter/receivers.

The main features of the control consol (Fig. 2) are 3 touchpanels plus a "knob touchpanel" and 4 variable assignment potentiometer knobs. Beside that it contains a keyboard plus dasher display, a trackball and 2 colour tv's (an alphanumeric and a graphic tv). The graphic color tv is directly connected to the NOVA 4 computer through a newly developed interface board, whereas all the other non-computer elements of the consol and the beam line are connected via Camac.

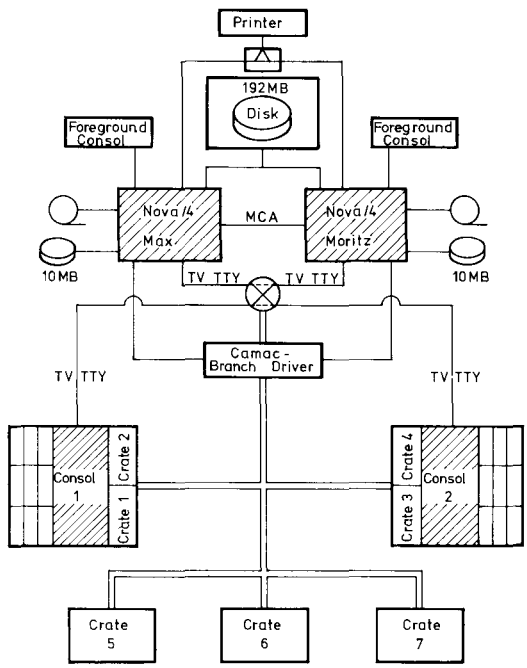
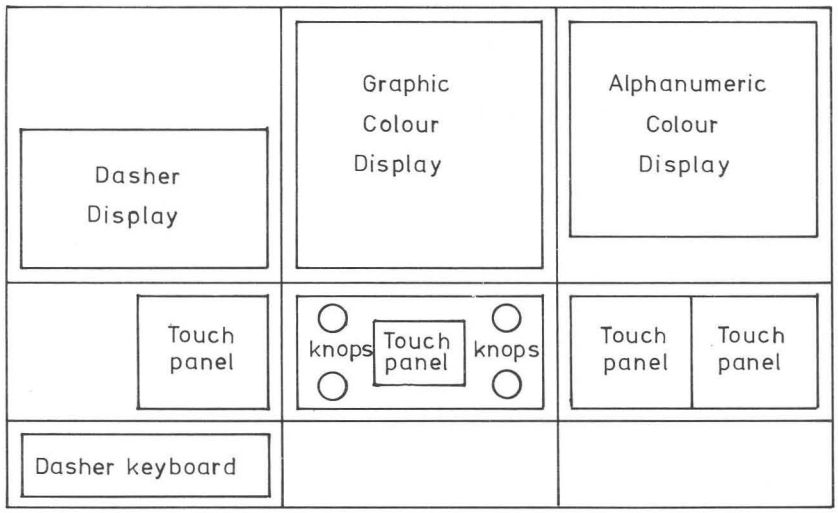


Fig. 1: Hardware Configuration of the control system.



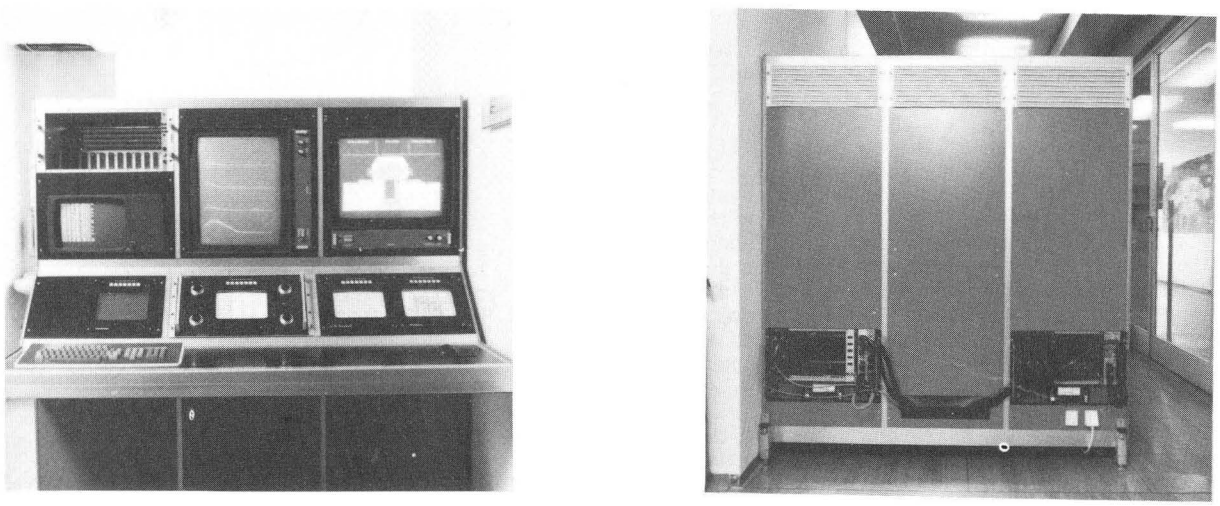


Fig. 2: Control console for the compact cyclotron CP42H$^-$

Control method / beam diagnostic elements

All actions are initiated by either entering commands at the dasher keyboard or by touching a touch-panel field. The "software assignment" of the knobs to the beam line parameters and changing the sensitivity of the knobs is acomplished by touching the "knob touch-panel" fields. Beam diagnostic hardware such as beam-scanners, capacitive probes, ZnS-screens and the 2 color tv's are also handled via the touchpanels. Malfunctions of the cyclotron or beam line system and blockdiagrams will be displayed on the alphanumeric color tv, utilizing the added information gained by defining distinct colors for the possible different status of the parameter.

Beam diagnostic information/results, curves, parameter values etc. will be on the graphic color tv. Fig. 3 shows the beam scanner, which has a modified drive mechanism/readout method compared to the older models.

Software discription . - The software configuration consists mainly of an Operating System (OS), to be written in Assembler and Fortran 5, which controls/supervises the environment and performs beam diagnostics.

Control is done by changing the operation conditions with single actions or a series of actions. It means that each switch, valve etc. to be controlled is attachable from the OS. The combinations of single steps to simple "procedures" will also be implemented in the system.

All alarms, parameters/process conditions will be reported to and handled by the OS.

Basically the OS consists of two parts: a "consol management" running in the background and a "simple database management" in the foreground (see. Fig. 4).

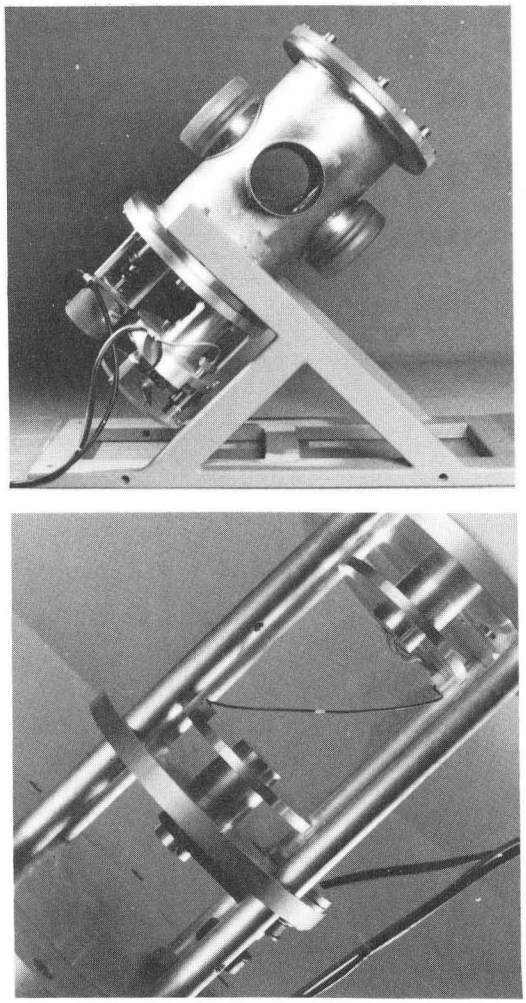


Fig. 3: Beam scanner* plus details of the sense wire.

* Beam guiding elements and diagnostics are manufactured by Bruker Analytische Meßtechnik GmbH, Germany

Both grounds run on equal priorities and communicate with each other through the NOVA computer "MCA" and/or fore-background dialog calls.

Both ground programs are multi-tasking-programs and the tasks priorities depend on the respond time wanted for that task. Some tasks are job specific whereas others are "table driven".

This ensures program flexibility for the possible growth of the OS responsibility in the future.

All Camac alarms will be intercepted by the consol management and if necessary it contacts the database management, which is responsible for the actual action such as supervising, checking and changing the parameter/process condition.

Status and further development plan. - Both control consols and most of the Camac hardware has been delivered, tested and installed.

Also ready and tested are the CAMAC software for NOVA RDOS and the color tv-driver/character-generator programs. Realistic "test programs" for the consol/database management have been completed recently.

The elements of the beamline/diagnostics hardware will be delivered at the end of 1981.

A first version of the OS can be expected in April/Mai 1982.

The possibility of steering and controlling the entire cyclotron/beam line system by the NOVA-4 computer only, using a second parallel or a serial Camac branch for the cyclotron parameters, is being studied.

References

1) W. Kneis et al., IEEE Transactions on Nuclear Science, Vol. NS-26, No. 2, April 1979, p. 2366

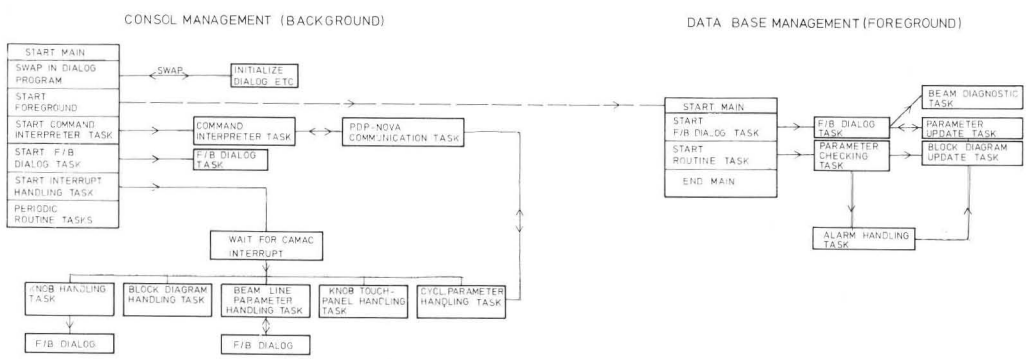


Fig. 4: Block diagram of the Operating System (OS)