

## DISPLAY SYSTEM FOR CONTROL CONSOLE OF KEK PF LINAC

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### Abstract

The PF 2.5 GeV Linac is controlled by a distributed system composed of eight minicomputers and many microcomputers through a communication network.

The console display system has been improved by introducing a local area network interconnecting workstations for CRT displays, file-servers and gateway computers.

In this paper, the configuration of the new console display system is described.

Since then many programs have been developed for console display, however We recently faced new needs: faster and more intelligent display, better program development environment, etc.

To meet these requirements a new display system was introduced : personal computers interconnected via a local area network (DS-Link). It was strictly taken into account that this new network system should be capable of executing most of the application programs already developed. The system construction started in July of 1987, and the system became operational in the end of September.

The commercial network is available but some functions were needed to be added. Detailed description of the system is given bellow.

### 1. Introduction

The control system for the Photon Factory 2.5 GeV electron linac was designed in 1978-9.[1,2] The system is based on a distributed computer system interconnected through a network. When the first beam was accelerated in the Spring of 1982, CAMAC modules were used as CRT drivers for the operator's console. The CRT driver has been graded up as shown in Table 1. The display system used so far has such configuration that personal computers are individually connected to a minicomputer for the main operator's console through serial ports at signaling rates of 2400-9600 bit/s.

Table 1. Console Display System

1982 : CAMAC CRT driver ( Graphics program is executed in the minicomputer.)
1984 : FM-11 (8bit personal computer without OS, Graphics program is executed in the personal computer.)
1985 : FM-16B (16bit, CP/M)
1987 : FMR-50FD (MS/DOS V3.1 L20a) & DS-Link

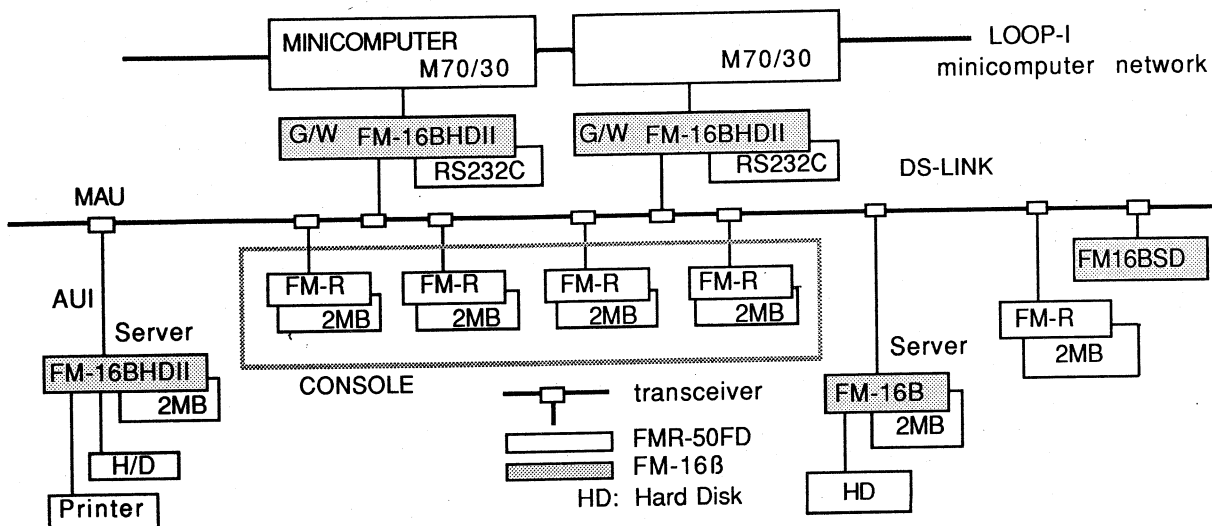


Fig.1 Console display system

## 2. System Description

As shown in Fig.1, The console display system is composed of several microcomputers which are connected to the DS-Link network. The system receives linac device data from the center minicomputers and processes them to display.

The system consists of Gateways(G/W), file servers, workstations(WS), coaxial cable, and transceivers.

The operator's console has four 20 inch CRT's for display with transparent touch panels. Most of informations about the linac status are displayed on them except for picture of screen monitors and some others.

The touch panel (TP) is a device of a resistive plate type and used to input operator's commands. It is Elographics Co. made. Touch panel controllers(MPU 6800) were laboratory made and have been used without any troubles. Response time of TP ( from touching by a finger to picture changing) is almost determined by firmware. So as to get more quick response when the TP is touched, the firmware built in the TP controller was graded up; its response time was changed from 350 ms to 150 ms.

The FMR-50 has a 512kB VRAM(2 color screens), 80286 CPU, 1MB main memory and optional 2MB. It supports HG(high grade)BASIC, C, and assembler under MS/DOS V3.1 L20a.

## 3. DS-Link (Local Area Network)

The DS-Link is a baseband local area network for communication between microcomputers. It is made by FUJITSU on the basis of the Ethernet(Xerox) and MS-network. It consists of transceiver controller, two file servers, a print server, and workstations. Collision detection and recovery during normal operation is unnecessary. The protocol admits server-remote and remote-remote communication in full-duplex.

The features of Ethernet are well known as follows:

- 1) Coaxial cable bus and transceiver are easy to install.
- 2) Flexibility is good.
- 3) The effective communication speed becomes slow when traffic is heavy.
- 4) System trouble in any workstation does not affect the others.

Table 2. Physical topology

Net work	:	Baseband Bus
Access	:	CSMA/CD
Transmission line	:	Coaxial cable
Cable length	:	200 m
Transmission speed	:	10Mbps
Number of nodes	:	10 (Sept.1987.)

## 4. Gateway

A personal computer is used as a gateway for communication between the host(MELCOM70/30) and a remote node or nodes in the console display system. The message from the minicomputer is distributed over the entire nodes or a selected node of which flag is set. The gateway provides the following functions:

- 1) protocol conversion  
(MELCOM70 -- DS-Link),
- 2) mailing, broadcast (G/W -- any WS),
- 3) data processing.

A compiler language is used in the gateway.

## 5. Server

The file server is very important in this system. Graphics data, operational information, control programs and linac device data file are all stored in a 2MB RAM disk or 60MB Hard Disk of the server. These files are called as common file and available at random from every workstations, but only operation programs are protected against rewriting. The system provides two servers and printers.

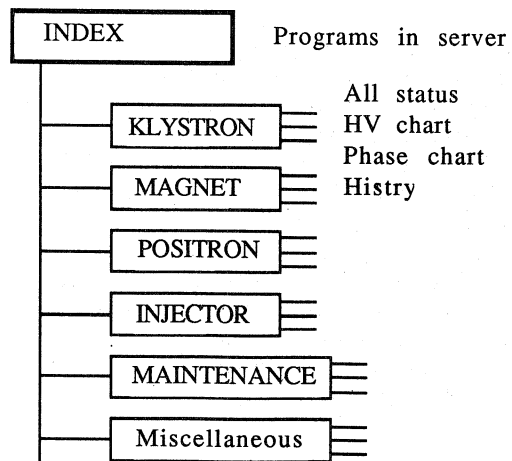


Fig.2 Common program file in server

Random data file  
in server

klystron status	DIM(7,9)
Magnet status	(30,16)
Phase table	DIM (7,9)
High Voltage table	(7,9)

Sequential file

time / data

Fig.3 Data file which are stored in server

## 6. Workstation for Console Display

There are four 20 inch color CRT's on the console which have been used since 1982. The workstations are connected to these CRT's and the touch panels. The touch position on the touch panel is sent from its controller to the associated workstation through an RS232C interface(4800baud).

Each workstation is able to receive data selectively from G/W by setting a corresponding flag on. Operator's commands can be input by the TP only; there is no keyboard on the operator's console.

Since each workstation of the console has a 2MB optional RAM on which most of the programs reside, programs do not have to be reloaded every time. Their execution can be initiated quickly.

## 7. Workstation for Maintenance & Development

There are several workstations for program development and maintenance; they are distributed in different rooms and connected to the DS-Link. It is always accessible by any programmer even when the accelerator is running.

## 8. Software

[Workstation] : The interpreter language is useful for development. Each application program is made as a subprogram and the size is almost under 9 k bytes.

Basic and machine language module is used on the workstation.

[Gateway] : At the first stage Basic and assembler were used for developing programs. Each function was tested and then converted to a compiler language(C and assembler language) for improving the executing speed.

One of the program and data file configuration is shown in Figs.2 and 3 .

## 9. Summary

we started this plan on July and the installation was finished by October. At the first stage there was a problem on the Xport program of the MS-network.

The program development environment, program architecture and the execution speed have been remarkably improved

The network characteristic will be measured in the linac operation.

The concern of usage of the expert system is currently the subject of much debate. While the probability of usage of the expert system may be small, it would be helpful in such a system.

## Acknowledgement

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