CONTROL SYSTEM OF TRISTAN

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1. Basic Design Concepts

The control system of TRISTAN (an electron-positron colliding beam facility at KEK) is based on the following design priciples:

(1) Distributed control - TRISTAN is a complicated and large facility. It consists of a number of sub-accelerators and storage rings, which cover a large area. These complexity and size make it reasonable for us to adopt a scheme of the distributed computer control system. The advantages of the distributed control system are its flexibility, extendability and ease of construction.

About twenty minicomputers (Hitachi HIDIC-80E's) are connected by optical fiber cables to form an N-to-N ring network. The transmission rate on the cables is 10 Mbps. There is no central node for switching. The function of message switching on the network is distributed among the nodes; each node recognizes and accepts the message addressed to it. This method ensures an effective transmission; the overall transmission capacity of the TRISTAN network is estimated to be 300 kwords/sec. Figure shows the schematic diagram of the network.

(2) NODAL system - Controlling TRISTAN necessitates great software efforts, since elaborate operation of it and thorough investigation of its nature are possible only by means of good control programs. Therefore it is advisable that the device designers and the accelerator operators, who know the algorithm better than the other people, write the control programs. In order to familiarize these people with writing control programs, we have decided to adopt the NODAL interpreter[1], which was devised and has been successfully used in CERN SPS. The main characteristics of NODAL are:

(a) We can easily debug programs written in NODAL, since it is an interpreter language.
(b) NODAL has the clear idea to incorporate device handlers as data modules.
(c) NODAL is a multi-computer language; it allows a program to be expressed as a number of separate tasks that can be executed on different computers on the network. This greatly simplifies programs that run on a multi-computer environment.

(3) CAMAC - We adopt serial CAMAC as the interface standard for the control of TRISTAN. The reasons are: (a) CAMAC is the only commercially available dataway standard that can connect devices to computers over long distances with sufficient transmission speed. (b) Bypass and loop collapse functions of serial CAMAC are useful for the system maintenance. (c) The test of prototype devices is possible before the commissioning of the control system, since CAMAC can be connected to any computers. The use of low-cost personal computers as a controller of a CAMAC test bench is very effective.

The adopted serial highway is 2.5 Mbps bit-serial one.

(4) Linkage to mainframe computers - There are some tasks that cannot be managed by the minicomputer network owing to the lack of computing power or memeory capacity. Examples of them are the execution of large size programs for accelerator simulation and the management of large database of accelerator history. Such tasks are managed on the central computers of our laboratory, HITAC M200H's; the network of TRISTAN control is linked to them by means of the KEKNET[2].

2. Present Status of the Construction

The construction of the control system has started in spring of 1981. We have been developing the NODAL interpreter on HIDIC-80E and the first version has been implemented on it in September 1982. The multi-computer facility is not implemented in this version. The implementation of it is scheduled in next spring, about half a year before the commissioning of the accumulation ring of TRISTAN, which is an injector for the TRISTAN main ring. Using the first version NODAL we are now making prototype data modules and testing the prototype devices.

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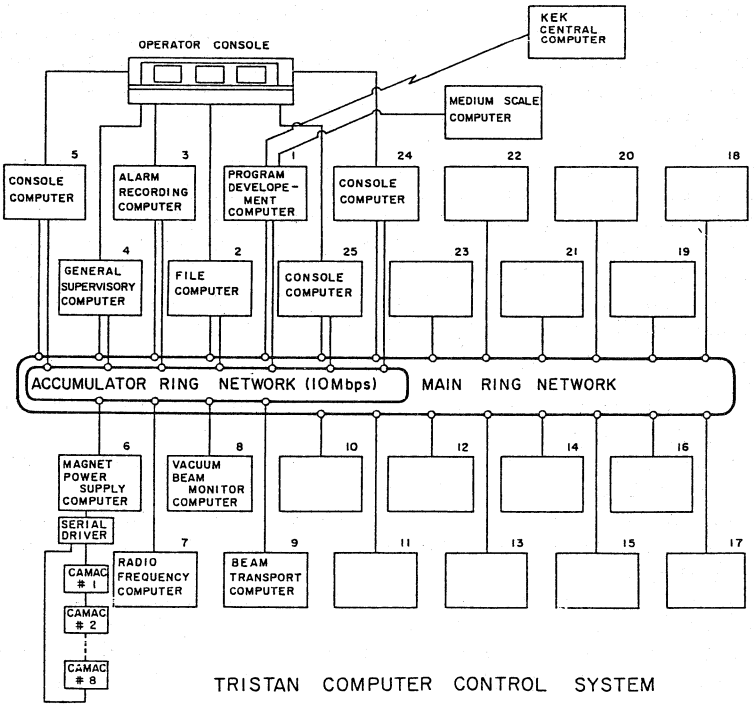

TRISTAN COMPUTER CONTROL SYSTEM