THE OPERATORS' CONSOLES FOR KEKB ACCELERATORS

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Abstract

The operators' consoles of KEKB accelerators will be described in comparison with the former TRISTAN accelerator control consoles. The construction policy of the KEKB operators' console is the flexibility. For TRISTAN, there were several sets of identical console desk made of iron frames in which two touch-panels, two graphic display monitors, and ten TV monitors are packed. Each set of console was directly controlled by a mini-computer in the TRISTAN control computer network. On the contrary, in the KEKB control system, all the man-machine interface devices are based on X-window system and application software runs on a UNIX server workstation. Therefore, the number of X-window devices such as X-terminals, Macintosh and PC/AT compatible PCs with X-server software is limited only by the capacity of the UNIX server and the space. Low-cost Network Stations are introduced as X-terminals with single screen. A Macintosh or a PC can have multi-screen up to four and works as multiple X-terminals with only a set of a mouse and a keyboard. For the space and ergonomic reasons, we adopted TFT flat-panel displays, which are thin and light in weight, and they reduce reflection of lights. For the same reason, cordless keyboard/mouse are also introduced.

1 INTRODUCTION

1.1 The TRISTAN control computer system and control consoles

The TRISTAN control computer system[1] was based on the distributed mini-computer system with an optical-fibre token-ring network. There were 25 mini-computers (HIDIC-80) placed around TRISTAN accelerator. The devices controlled by the system are connected mainly via CAMAC modules through 2.5Mbps serial highway. The mini-computers were allocated to the hardware groups as shown in Table 1. The computing speed of the mini-computer is about 1 MIPS with 16-bit word architecture. There were 6 sets of operators' consoles in the central control room. Each set was connected to corresponding mini-computer and had two 14-inch touch-panels, two 20-inch colour graphic displays and ten 10-inch TV monitors. The touch-panels were used as the data input devices and connected to a mini-computer via CAMAC modules (character display controllers and touch-panel interface controllers). The graphic display controller can display 4096*3072 pixels with 12-bit colours.

Three sets of TRISTAN control consoles are left and used as the consoles for the AR which was converted to an SOR(Synchrotron Orbit Radiation) facility with energy of 6.5 GeV. The abbreviation AR stands for Advanced Ring, now.

Table 1: Number of mini-computers for TRISTAN

Groups	**AR**	**Common**	**MR**	**Total**
Magnet	1	-	4	5
RF	1	-	2	3
Vacuum	1	-	1	2
Monitor	1	-	1	2
Transport	1	-	1	2
Consoles	-	6	-	6
Library	-	1	-	1
General Purpose	-	2	-	2
Alarm	1	-	1	2
Total	**6**	**9**	**10**	**25**

MR: TRISTAN Main Ring AR:Accumulation Ring

1.2 The KEKB control computer system

The KEKB accelerator complex consists of an 8 GeV electron / 3.5 GeV positron injector linac, 3.5 GeV positron ring - LER(Low Energy Ring), and 8 GeV electron ring - HER(High Energy Ring). Control computer system for the KEKB accelerators consists of two systems. One is the linac control computer system[2] and the other is KEKB control computer system[3], [4]. The former was designed and constructed before KEKB project started and upgraded just before the construction of KEKB. The KEKB control computer system is based on EPICS(Experimental Physics and Industrial Control System)[5]. A portable channel access server was introduced for communication between linac and KEKB control systems[6].

In the EPICS environment, the system is centralized as far as operation is concerned, X-terminals are used as man-machine interface devices. Application programmes using MEDM, SAD[7] and Python[8] run on the server workstation in the system and they output information on the X-terminals. Therefore, operators' consoles for the KEKB accelerator complex are composed basically of X-terminals. Network Stations[9] and PCs(PC/AT

compatibles and Macintoshes) are used with X-terminal emulation software because of their flexibility. More than two monitor screens are connected to one PC to get as much information as they can handle.

2 DESIGN CONCEPTS

2.1 TRISTAN control consoles

The TRISTAN accelerator control consoles were shown in Figure 1. Various devices such as touch-panels, graphic display monitors and TV monitors were mounted on the rigid iron-framed racks.

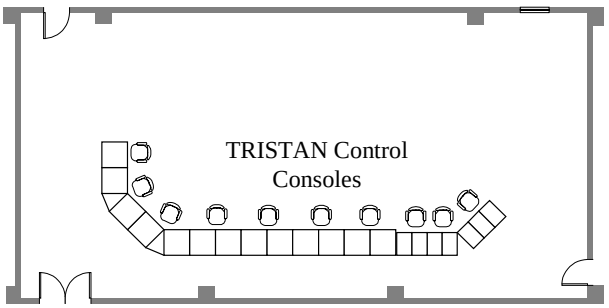

Figure 1: TRISTAN control consoles.

2.2 KEKB control consoles

On the contrary, in the KEKB control system, the consoles are provided as flexible as possible to reply to the requests from the KEKB accelerator commissioning team. Only several large tables are distributed in the central control room as shown in Figure 2. PC based X-terminals are placed on the large tables(4.0m x 1.6m) and the latest 15-inch and 18.1-inch TFT(Thin-Film Transistor) LCD(Liquid Crystal Display) monitors and keyboards are placed on the table. These LCDs are light in weight and thin so that they require only a little space. As many LCD monitors as we could afford to buy are put on the table and you can easily compare with CRT monitors. Wireless keyboard and mouse sets are also used partially and they make the table clean and simple.

As the nature of a new accelerator like KEKB many people want to operate and make studies about the accelerator during the commissioning period. All of them want to use their own X-terminals in the CCR. There are more than 30 general purpose X-terminals and 4 PCs dedicated to the injector controls with Microsoft Windows NT.

2.3 Environmental conditions

Previous TRISTAN consoles are made of iron-framed racks and various devices are mounted in them. In order to keep the operators from the reflected images of the light source on the round surface of the monitors, the lighting in the control room was limited in strength and direction. It was so dark and the operator needed to have a lamp stand when he wrote the log.

By using flat display monitors like LCDs, the reflection problem has gone and we can make the room as bright as in the office room. The brightness gives us benefit of easiness and comfort of reading and writing. Those who have dark eyes require more brightness than those who have bright coloured eyes. At present, the central control room is also divided into two parts that have different brightness due to reflections of the lights.

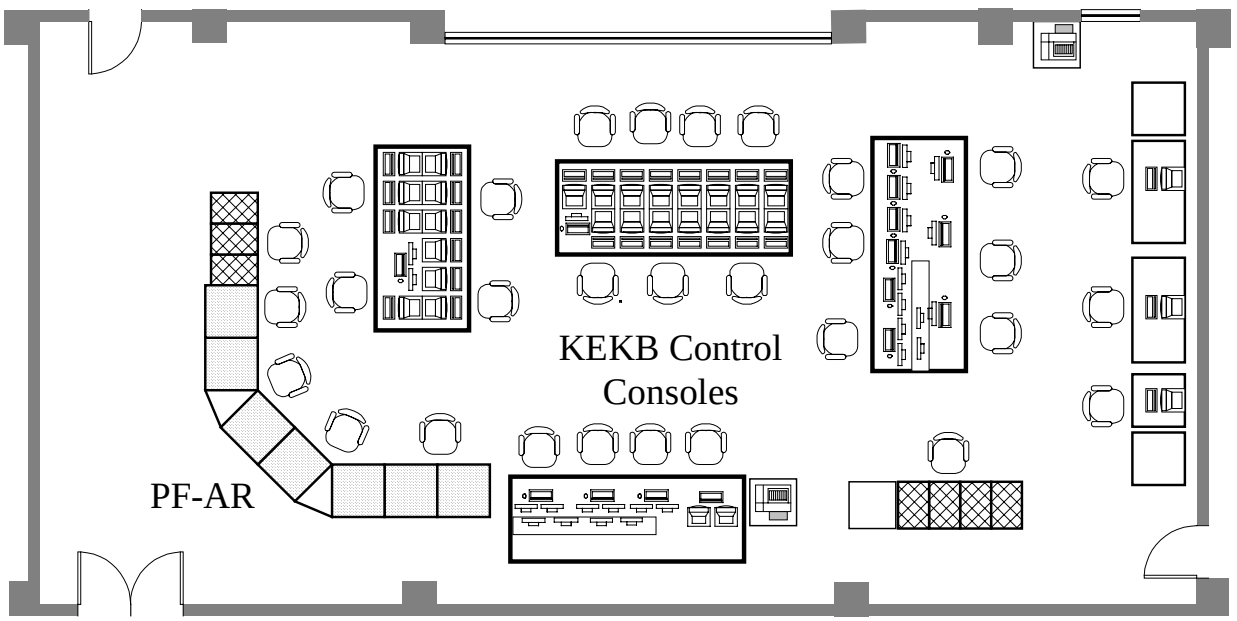

Fig.2. Layout of the KEKB control consoles.

3 EQUIPMENT USED

3.1 PCs

There are many PCs(IBM PC/AT compatibles and Macintoshes) used as X-terminals. Multiple-video-display controllers can be installed into PCs and one can use two to four screens. By using multiple-screens, you can display much more information than single-screen not by overlapped but by separated windows. The most beneficial merit we get is that the use of multiple-screen decreases the number of keyboards and mice and you can get more space for log-books, etc.

3.2 Network Stations

Low-cost X-terminals are realised by using Network Station. It is a thin PC and various protocol emulation software such as X-Window, IBM 3270, etc. are downloaded and operated. Network Station has no disk drive or fan and it is completely maintenance free.

3.3 LCD monitors

Various types of TFT colour LCD monitors are used. An 18.1-inch monitor displays an SXGA(1280 x 1024 pixels) screen and a 15-inch monitor displays an XGA (1024 x 768 pixels) screen. There are NTSC colour TV monitors to display usual TV signals. Latest LCD monitors have characteristics of wide viewing angles of more than 120 degrees.

3.4 Multiple-screen display controllers

For IBM PC/AT compatibles, we adopted a PCI-bus graphic display controller board. It can display one to four SXGA screens at on time and you can have a Windows screen with 2560 x 2048 pixels with true colour. For a Macintosh, conventional PCI graphic cards can be added to get more screens.

3.5 Wireless keyboards and mice

As we have many keyboards and mice with connecting cables, sometimes they are tangled or tied together. We adopted a set of wireless keyboard and mouse for IBM PC/AT compatibles. For a Macintosh, a USB to PS/2 converter can be used to utilize the same set of keyboard and mouse.

3.6 Large screen plasma display monitors

For the common display use in the central control room, we have been using 27-inch colour TV monitors for years. Some of them were damaged and we can not get the same monitor any more. Therefore, we replaced them by 40-inch plasma display monitors. A plasma display monitor is thin(about 15 cm thick) and light(about 30 kg) compared to a CRT display of 27 inches(about 60 cm deep and 50 kg in weight).

3.7 Video matrix switches

As in the TRISTAN case, we have video matrix switches to multiplex video signals from such as security supervisoring, synchrotron light monitors, digital oscilloscopes, and spectrum analysers. By using these matrix switches, you can select any signal on the TV screen.

3.8 Multiple screen TV encoders

There were ten TV monitors on each console desk of TRISTAN consoles. But the number of TV monitors is limited for the KEKB accelerators. We use multiple window display encoder to divide one TV monitor into 1, 4 and 16 parts. We can put 16 signals into the encoder and we get one multiple-screen output and two spot multiplexed outputs.

4 CONCLUSION

For commissioning of the KEKB accelerators, the simplest and versatile console tables and up-to-date equipment recently available are provided. By using these devices, we get freedom of designing consoles and flexibility in modification. Console desks are in the chaos now, but it will be settled someday in the proper state.

5 ACKNOWLEDGMENT

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