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EJECTION, A COHERENT SYSTEM

In the past years, several ejection magnets of different makes and functions have been installed in the PS (FK 97, SM 1, SM 58, SM 62, SM 74, SL 79) and an extension of this number (FAK 66, SM 16, SL 13, a new set of FK's in connection with ISR) and an increased use of ejected beams are planned for the immediate future.

Each of these magnets with its supplies represents in fact a more or less complicated system in itself. They have been designed or are being planned by several teams working independently and to different standards. The magnets are located in straight sections scattered around the PS ring, and one chose in most cases to install the supplies near the magnets.

This development is unobjectionable and harmless as long as these installations are new, small in number, and rarely used, and, to a certain extent, if the design groups are still available to operate the systems. The situation at the CPS, however, will develop in a rather different direction: ejection installations are supposed to be highly reliable, their number approaches the dozen, they are important in present day operation, and they will become the backbone of CPS, ISR, and West Hall operation in a few years. Last not least, the amount of radioactivity deposited in the CPS depends entirely on efficient ejection of the accelerated beam. Utmost reliability and care of adjustment are required when several of these installations have to run simultaneously on complicated cycling schemes. The designers, however, are involved in new jobs and cease to take care of the installed apparatus.

A number of installations as complicated and delicate as the ejection apparatus, ranging from lowlevel electronics to high current and high voltage equipment, can only be maintained effectively if viewed as parts of a coherent system and standardized accordingly. Only then staff numbers, maintenance facilities and spares stocks can be kept at reasonable levels while maintaining a degree of understanding and care that is essential for high reliability. Similarly, effective operation depends on uniform, straightforward, and unambiguous indications.

It is clear that the transition to a coherent ejection system will take time and that whatever equipment available must be used to meet the immediate requirements of the experimental programme. The long-term development of ejection facilities, and particularly the design and installation of the planned new installations should, however, be guided by the following principles:

- to minimize the number of component types
- to centralize the equipment as far as possible
- to install a uniform system of controls and interlocks
- to install a uniform and versatile system of communication with the MCR.

In terms of hardware, these lead to the following recommandations:

1. Kicker magnets

Development of a coherent system of kicker magnets based on modules of which several will be installed in several straight sections at approximately half a betatron wavelength's distance (e.g. 5, 97, 88, 82, 81). Enough of them should be installed to satisfy the requirements of the experimental programme, including spares. (Kickers in F (odd) sections are at an advantage since all fast channels (16, 58, 74) can be served with equal efficiency.)

2. Septum magnets

Development of magnet and supply systems for fast slow and slow ejection, or combinations of those and fast ejection. Also here identical modules should be used where possible. Procedures for the replacement of radioactive components must be examined closely.

3. Supplies

Wherever possible, only the magnets should be installed in the ring tunnel. All pulse generators for the various kicker and septum magnets should be installed in a room near the ring center.

3.1 The septum magnets for slow ejection channels will then be supplied by bus-bars from one or two central rectifiers, which can serve as each other's spare in emergency. Alternatively, the rectifier in the EEB can be considered as spare.

Also the supplies for septum magnets in fast ejection channels should be in the ring center, but capacitor banks in resonant circuits might be left in the tunnel.

3.2 A set of versatile pulse generators and charging units matched to the kicker modules, including spares, should supply the latter via coaxial pulse cables from the central equipment room.

4. Electronics

The development of a uniform system for the observation of fast ejection efficiency is under way (part of "Operation Straight Flush"). However, this will have to be supplemented by information circuitry that permits the operator to obtain information on the function of all subsystems and components in a

uniform way. For this reason the bulk of the information should be displayed in the equipment room, with selection facilities for the transmission to the MCR of whatever information is requested.

The interlocks of the various present systems will have to be brought up to uniform standards using, where possible, identical components or plug-in chassis.

It is clear that this programme cannot be realized within a short delay. However, it is important to orient the present developments in a direction such that in a few years, by say 1972, the CPS be equipped with a reliable ejection system.

CERN has invested a large capital in the development by several groups of various technological alternatives of ejection facilities. It is also clear that the experience of all the groups who have developed the different solutions in this field must be used when specifying the equipment for the future.

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