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LHC ACCESS SYSTEM: STATUS REPORT

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Abstract

The LHC complex is divided into a number of areas with different levels of access authorizations. The LHC interlocked areas are the ones where access is restricted, and not allowed during beam operation or equipment tests. Inside those interlocked areas, the personnel protection is ensured by the **LHC Access System**. This system is made of two parts: the **LHC Access Control System** and the **LHC Access Safety System**. The **LHC Access Control System** regulates the access to the tunnels and experimental areas by identifying the users and checking their authorisations. It allows a remote or automatic operation of the access control equipment and restricts the number of users working simultaneously in the interlocked areas. On the other hand, the **LHC Access Safety System** ensures the safety functions of the LHC Access System by interlocking the LHC key safety elements. This paper summarises the project status, organisation and main milestones up to final acceptance before the LHC start up.

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1 INTRODUCTION

The LHC Access Control project enters in 2004 in its realisation stage. An architecture modelling the functions of the LHC Access Safety System (LASS) and of the LHC Access Control System (LACS) has been designed. In order to meet the deadlines of the injection and of the Hardware Commissioning a strict roadmap and planning have been defined.

2 BACKGROUND

The LHC complex is divided into a number of zones with different levels of access controls. Inside the interlocked areas, the personnel protection is ensured by the LHC Access System. This system is made of two parts: the LHC Access Safety System and the LHC Access Control System Ref. [1] [2] [3].

During machine operation, the LHC Access Safety System ensures the collective protection of the personnel against the hazards arising from the operation of the accelerator. By interlocking the LHC key safety elements, it will permit access to authorized personnel in the underground premises during the accelerator shutdowns and will deny access during accelerator operation.

On the other hand, the LHC Access Control System regulates the access to the accelerator and the numerous support systems. It allows a remote, local or automatic operation of the access control equipment that verifies the users' authorization, identifies them, locks and unlocks access control equipment and restricts the number of users working simultaneously in the interlocked areas.

3 LHC ACCESS CONTROL SYSTEM REALISATION

The LHC Access Control System will be realized by an external contractor. The tender has been sent to the qualified company in early January 2004, and the offer were analysed during April 2004. The main roles of this contractor will be to integrate, install, commission, and maintain all the different systems and technologies that are necessary to build the LHC Access Control System.

The workflow of LHC Access Control System project is organised in two parts Ref. [4]:

The part 1 is divided in work packages and validation stages dealing with the specification, design and installation of a pilot LHC Access Control system. It will serve later as a validation and training platform. The next stage will be the installation of the control room computing infrastructure and of the access equipment of the sectors 8-1 and 7-8, necessary for the LHC injection tests. A synchronisation of the installation planning of the LHC Access Control and the planning of the hardware commissioning is under study. This synchronisation is possible but does not authorise any manufacturing or validation delays for the access control equipment.

The part 2 will cope with the installation of each individual sector, its integration in the central access computing infrastructure and testing. An overall site acceptance demonstrating the correct functioning of the LHC Access Control and Safety systems will terminate the workflow.

4 LHC ACCESS SAFETY SYSTEM REALISATION

The LHC Access Safety System will be designed by a CERN project team, however industrial support will be necessary to deal with it realisation, installation and commissioning. The evolution of this project is regularly checked by the French Authority IRSN and INB.

The design strategy is based on three axes:

- Integration of the LEP experience that demonstrated the importance of separating the Access operation functions with the purely safety functions.
- Strict application of the Functional Safety principles. This requires a total quality approach and full documentation of every stage of the project, as well as the necessary safety studies. The safety studies determines during the specification stage the safety integrity level required by the system and will demonstrate at the end of the installation stage that the defined objectives are met.

- Specific hardware: the market offers now specific hardware specially designed for safety or high reliability applications that will be used to build the system.

The project follows a total quality approach philosophy with a particular emphasis on the detailed documentation of all the life-cycle stages of the project. The roles, documents, life-cycle stages, safety studies, verification, validation are described in a set of managerial document ref. [5][6][7]. Two independent teams will be set up to build the system: one will cope with its design realisation and the other one will take care of the verification and validation activities. The on-site installation will be performed by a third team.

The workflow of LHC Access Safety System project is also organised in two parts and is synchronised with the one of the LHC Access Control System:

The part 1 is divided in the specification, design, realisation and installation of a pilot LHC Access Safety system. This pilot system will be integrated in the validation and training platform. The next stage will be the installation of the common control room Man Machine Interfaces and of the software and hardware that are necessary for the control of the sectors 8-1 and 7-8.

The part 2 will cope with the installation of each individual LHC sector, its integration in the central access computing infrastructure and testing. An overall site acceptance demonstrating the correct functioning of the LHC Access Control and Safety systems will terminate the workflow.

5 SYSTEM ARCHITECTURE

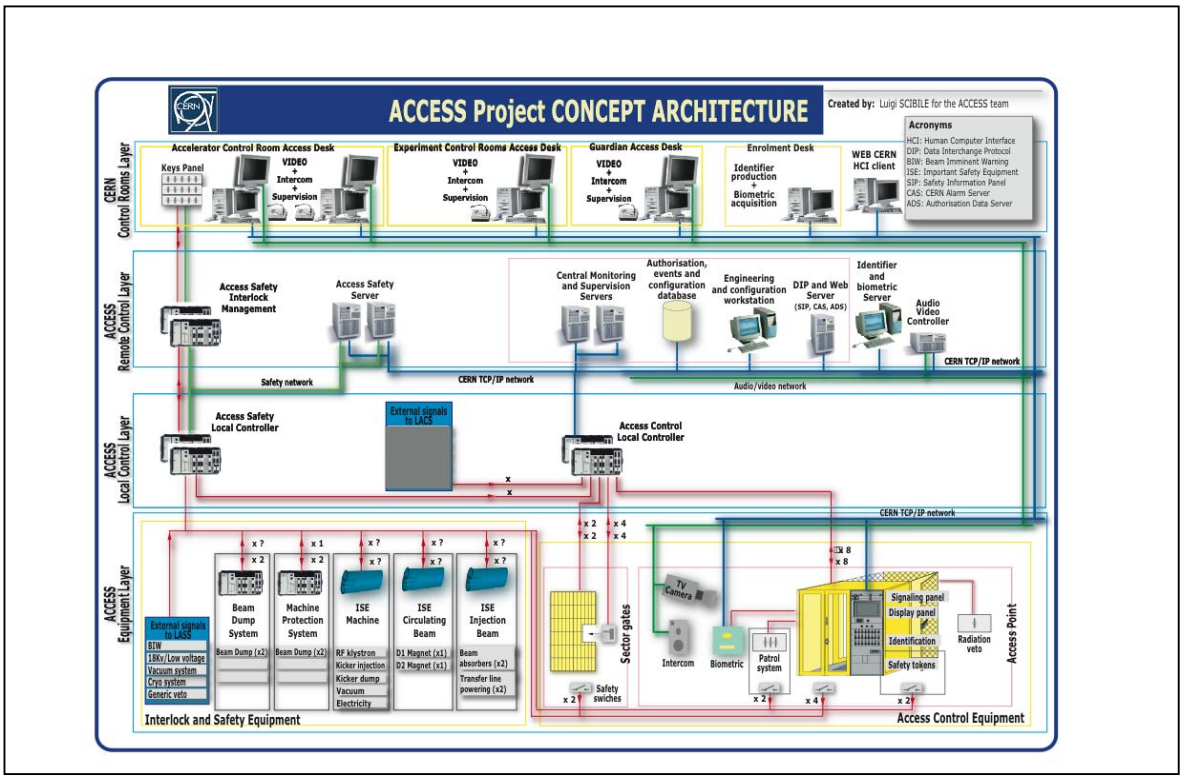

Figure 1, Overview of the LHC Access System

As shown in Figure 1, the LHC Access System is conceptually divided in four layers:

- The Control Room layer is made of the Man Machine Interface that will permit the operation, and supervision of the LHC access systems, the external interfaces to the alarm system, Man Machine Interfaces for the experiments and guardian control rooms, as well as the enrolment desks.
- The Access Remote Control layer gathers the central servers, the database for authorisation and archiving, audio and video controllers, maintenance and configuration workstations, and the access safety interlock management system.
- The Access Local Control layer ensures the control of the access equipment of each LHC points and the management of the local safety chains.
- The ACCESS Equipment layer gathers all the access equipment and the interface to the access, beam and machine Important Safety Elements (ISE).

6 SAFETY FUNCTIONS OF THE LHC ACCESS SYSTEM

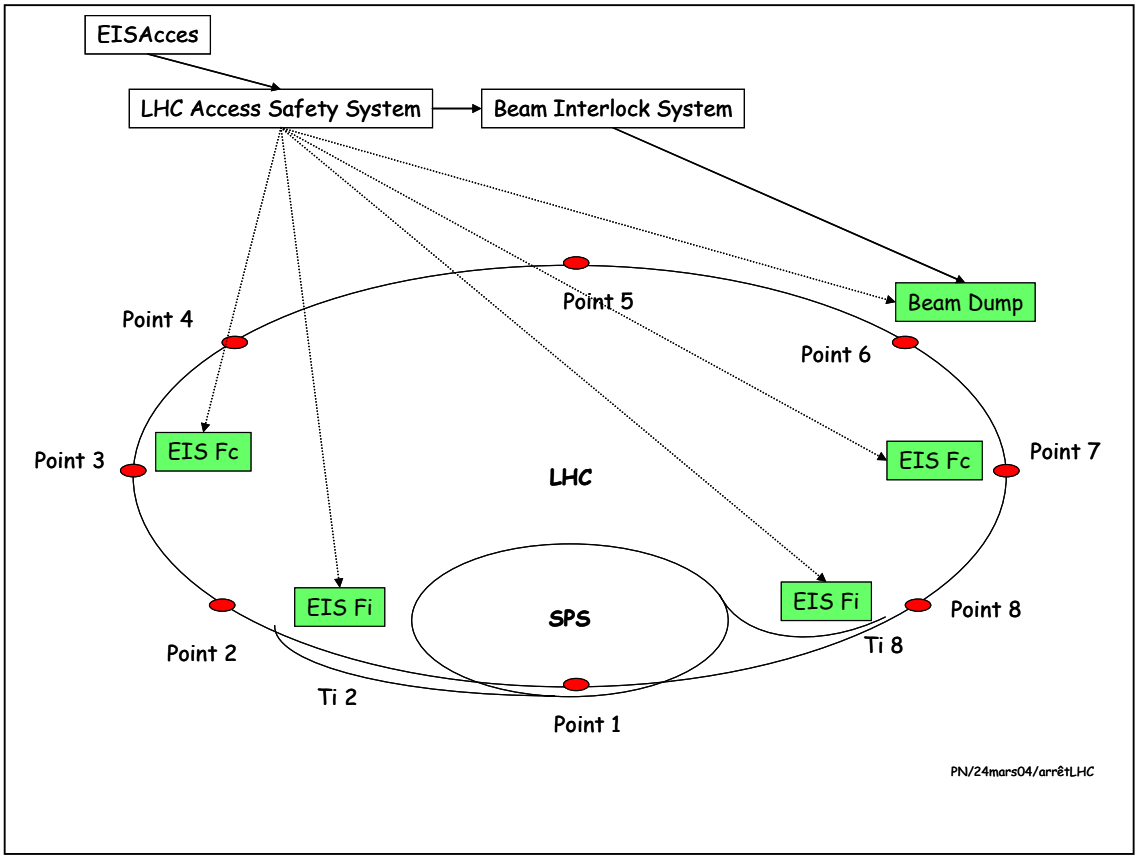

Figure 2, safety functions of the LHC Access Safety System

One of the aims of the LHC Access System is to protect the personal against the electrical and radiation hazards raised by the LHC beam operation. Those safety functions will be performed by the LHC Access Safety System that will act on devices named “Important Safety Element” (EIS). The EIS are mainly the:

- EIS access such as personal and material access devices, grids, doors, walls,
- EIS Circulating Beam (EISFc) such as D3, D4magnets located at point 3 and 7,
- EIS Injected Beam (EISFi) such as mobile elements located in the injection tunnel,

- Beam Dump system
- EIS Machine such as Power Converters and RF equipment.

During beam operation, if a door is forced or an emergency stop is pushed the system will trigger the beam dump, will act on the EIS Circulating Beams to prevent the circulation of the beams and will prevent the injection of the beams by acting on the EIS Injected Beam.

During access operation, the system will forbid the powering of all the hazardous equipment of the LHC.

The functional safety method that will be applied is described in the reference [7]. The safety functions ensured by the system are described in the reference [8].

7 CONCLUSION

Since the summer 2003 a new organisation and additional resources have been injected to support the LHC Access Control project. The technical specification of the contract that will design and install the LHC Access Control system has been prepared, approved by the LHC specification committee, a contractor is currently selected and the contract will be presented to the June 2004 Finance Committee. During the first semester of 2004, the project team has concentrated its work on the detailed specification of the LHC Access Safety system, and on the identification of the equipment (Important Safety Elements) that will be interlocked. A methodological framework was also defined, documented and accepted by the project team. During the second semester of 2004 the conception and detailed design of both systems will be tackled as well as the preparation of the installation that is foreseen to start mid 2005.

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