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THE RADIATION SAFETY ACCESS CONTROL AT GANIL AND THE Rib SPIRAL FACILITY

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The forthcoming rib (radioactive ion beam) SPIRAL facility will operate in conjunction with the current GANIL heavy ion accelerator, according to various intricate operating modes. This paper recalls the main principles of access control in our laboratory and the constraints induced (e.g. the running mode vs the topology of the rooms under radiation). A VME-driven control system is being undertaking to fulfil the requirements of the future GANIL-SPIRAL accelerating complex. This paper pin points the salient features of this control system and presents results.

1 Introduction

The radioactive ion beam facility for GANIL, named SPIRAL, is on the verge to be fully completed and its tests with stable ion beam are currently undertaken. SPIRAL aims at providing on-line production and acceleration of radioactive ion beam. The production targets, located in the Target Ion Source System TISS blockhouse (known as casemate ECS1), can be irradiated by primary heavy ion beams issued by GANIL, with energy up to 95 MeV per nucleon and power up to 6kW. The secondary radioactive ion beam extracted from the TISS can be then accelerated by the cyclotron of SPIRAL named CIME to obtain rib featuring energy from 2 to 25 MeV per nucleon and intensity from a few pps to 10^8 pps. Operating such a physics experimental facility is particularly demanding with respect to the radiation safety control. A schematic layout of GANIL and SPIRAL is shown on Fig. 1.

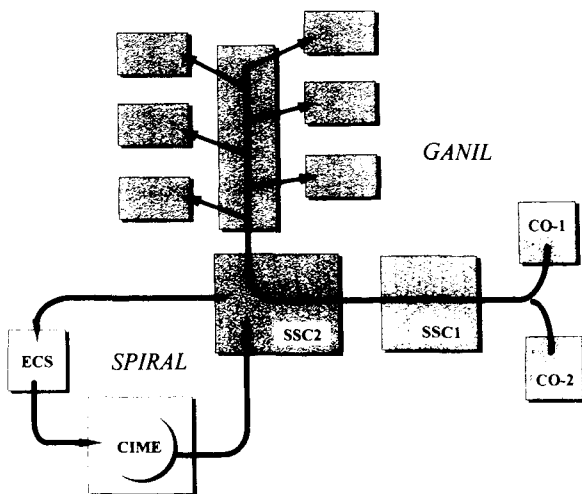


Fig.1 Schematic layout of the GANIL-SPIRAL complex

The GANIL and SPIRAL complex features two modes of operation : - the ALPHA mode which forbids any primary ion beam from the GANIL to penetrate into any room of SPIRAL (GANIL and SPIRAL can operate separately for stable ion beams) and - the Z mode which allows the ion beam from GANIL to enter the rooms of SPIRAL (GANIL and SPIRAL operate as a joint accelerating complex with production, acceleration and experimentation of radioactive ion beam), as shown in Fig.2.

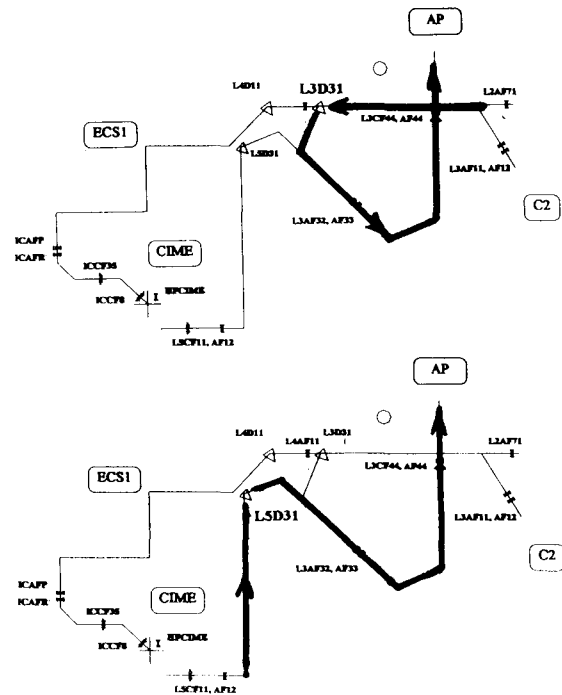


Fig.2 Modes of operation

2 The radiation safety control

The objective of the radiation safety control is to avoid dangerous situation for individuals, wherever radiological

hazards may exist, in the accelerator rooms, in the experimental areas, in the storing room of irradiated devices, in the source transport corridor as well.

In order to optimise resource, the equipment required for SPIRAL is downsized as hereafter indicated: five controlled rooms (e.g. Target_Ion_Source room, cyclotron CIME room, ...), two gating locks equipped with access badge readers for individual counting purpose and ten doors with electrical contact sensing.

As already presented [1], the current **radiation safety control system** which is controlling GANIL for over eight years is being upgraded and extended to include the control of SPIRAL. Let's recall that extension is approximately one third of the existing installation.

This paper attempts to illustrate some noteworthy aspects of the control system and starts with its architecture [Fig.3]

2.1. Access control

The access control principle stipulates that any ion beam entering a controlled room is interlocked by general conditions of the room and its radiological level. It is achieved by mastering at least two upstream beam safety devices (e.g. beam stopper, bending magnet or accelerating RF device). As an example, the beam safety layout of GANIL is shown on Fig.4.

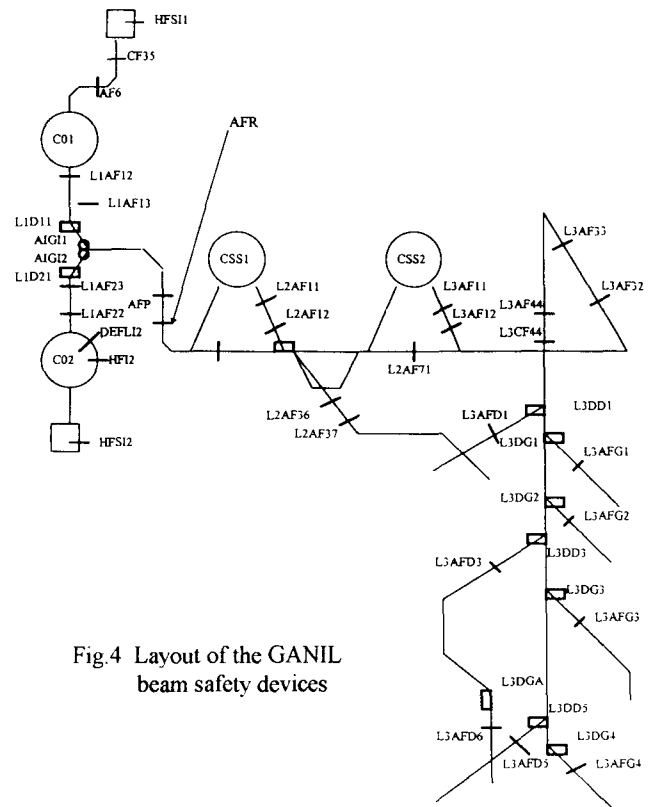


Fig.4 Layout of the GANIL beam safety devices

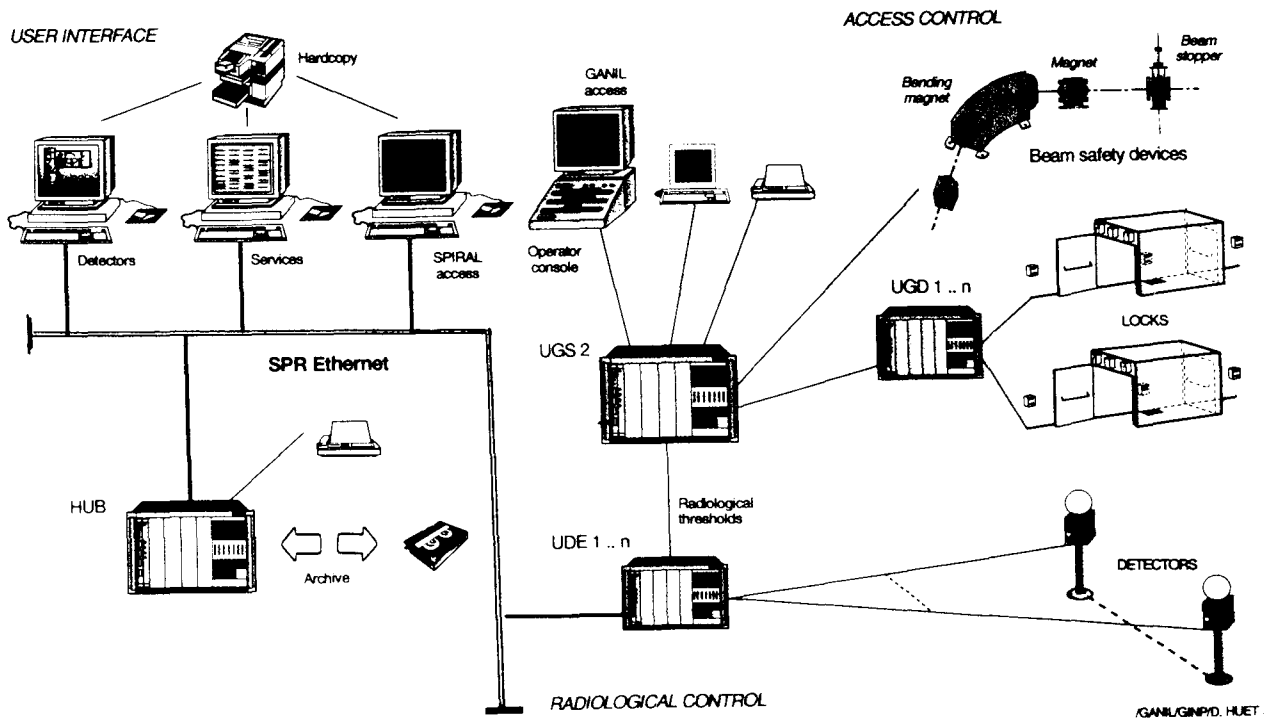


Fig.3 Schematic architecture of the radiation safety control system

The access control system is composed of two VME based subsystems :

- the master subsystem named UGS2 which handles the databases and makes decision for access authorisation according to the current status of the controlled rooms and their radiological level, to be executed by the UGD
- the ancillary controllers named UGD which are installed in the vicinity of the gating locks for local access control.

To fulfil the requirements of SPIRAL and to overcome the harsh mismatch between hardware and the pDOS operating system, decision was made to quit pDOS and to use of the real-time Unix and Posix compliant LynxOS (which is already running the radiological Central Control system).

Access control will rely on the new id-badge based on contact-less badge with credit card format.

To augment the reliability of the safety access control, a *redundant* system named UGS-R was realised to operate in parallel with the UGS2 / UGD. The UGS-R system is *slimmed down to strictly serve the safety access control* and is built upon wired equipment and PLC. Its functional scope is much more frugal than the UGS2 one, as shown on Fig.5.

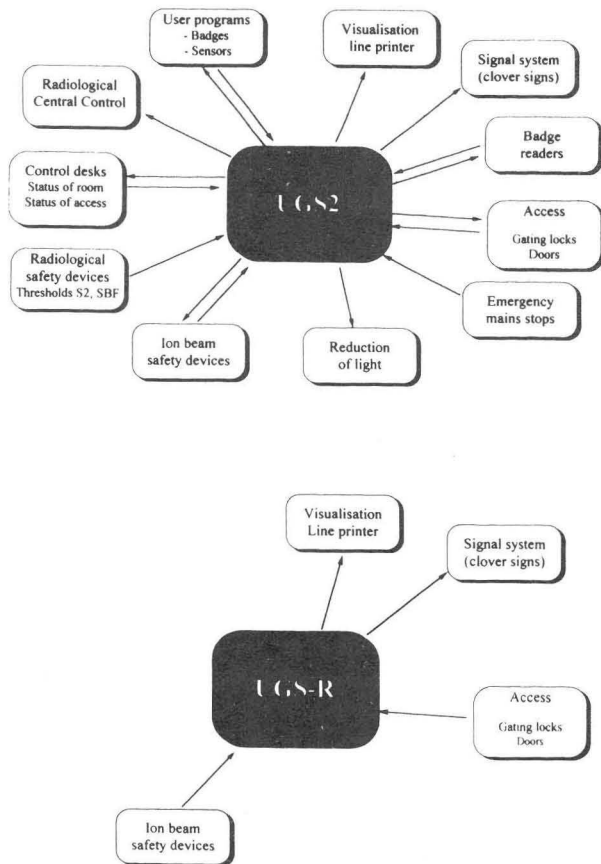
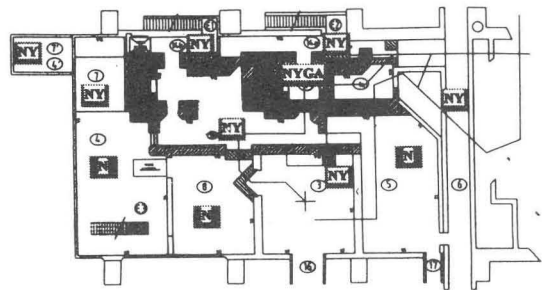


Fig.5 UGS2 vs UGS-R functions

2.2. Radiological Control

The radiological level is measured by dedicated *neutron, gamma, gas and aerosol detectors*, so-called 'balises'. Balises are distributed in the INB (Nuclear Base Installation) and in the accelerator and experimental areas. The laboratory is mapped by about one hundred detectors including 14 detectors for SPIRAL. The radiological levels are sampled every three seconds. Data are collected and pre-processed by the UTM VME modules and concentrated into 6 VME cubicles named UDE. The UDEs are hooked to a private Ethernet to communicate with the Central Control console and wired to the UGS2 system for radiological level condition interlock. Fig 6 shows how the SPIRAL facility is meshed by its balises.



N : balise Neutron
 Y : balise Gamma
 G : balise Gaz
 A : balise aerosol.

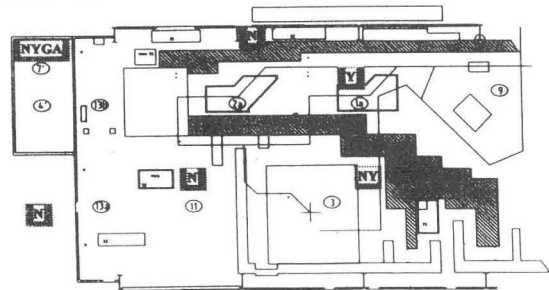


Fig.6 Layout of radiological 'balises' for SPIRAL.

2.3. Central Control

The Central Control provides the operator GUI and services for on-line and off-line operations : data processing

data management and display. Also the Central Control system provides the long term archiving of data and events which is an important issue in safety control, since information must be traceable back over a decade. CDROM is adopted as archiving medium, with a storage capability of one semester of operation.

A redundant system is already in operation on site. It is based on a PC microcomputer running under LynxOS

2.4. Communication

The radiation safety control system is linked to a private Ethernet LAN which provides the backbone communication medium.

Bridging this private LAN to the General Ethernet LAN to allow information interchange is presently postponed to avoid security risks, whilst GANIL is thinking at some strategy or firewall to secure its communication.

The UGS2 can be protected against intruding commands by shielding its CPU1 with an additional CPU2 which is hooked to the LAN for filtering purpose (with only limited read commands permitted).

3 Current status

3.1. Sub contracts

- The porting LynxOS on the Force CPU60 was carried out satisfactorily by SYSGO. The porting of the UGS2 and UGD software from pDOS onto LynxOS, undertaken by OCTAL, is expected in the course of July 1998.

3.2. Systems

- The Central Control System is running from the onset of 1997, with its redundant companion implemented in the same year.

- The first tests of CIME were achieved on December 1997 with a dedicated and provisional subset (hardware and software) of the radiation control system.

- The extension of the radiation safety control system to SPIRAL is scheduled for the year to come. Hardware is in progress. Software design has begun on the basis of the current updated requirements which still have to be approved. The whole system is expected to be in on-site tests and validation status during the next winter shut-down of the GANIL.

3.3. New badge readers

The new badge readers are installed and first tests are satisfactory. A test platform based on the Labview system is being developed with nice results [2].

3.4. Resource

Obviously, considering the tasks our group is involved in, the lack of manpower remains a key concern.

References

- [1] T.T.Luong, J.C.Deroy, P.De St Jores, L.Martina 'The new radiation safety control system of GANIL and its extension to the rib SPIRAL facility' ICALEPCS'97, Beijing, China, Nov 1997
- [2] J. Laforge 'A test bench for the new badge reader of GANIL' (in French). Training report. June 1998