A NEW UNIT ACCESS CONTROL FOR GANIL AND SPIRAL 2

J. L. Baelde, C. Berthe, F. Chautard, F. Lemaire, S. Perret-Gatel, E. Petit, E. Pichot, B. Rannou, J. F. Rozé, G. Sénécal, GANIL, Caen, France

INTRODUCTION

For the GANIL safety revaluation and the new project of accelerator SPIRAL 2, it was decided to replace the existing access control system for radiological controlled areas. These areas are all cyclotron rooms and experimental areas. The existing system is centralized around VME cards. Updating is becoming very problematic. The new UGA (access control unit) will be composed of a pair of PLC to ensure the safety of each room. It will be supplemented by a system UGB (radiological control unit) that will assure the radiological monitoring of the area concerned.

This package will forbid access to a room where the radiological conditions are not sure and, conversely, will forbid the beam if there is a possibility of presence of a person. The study of the system is finished and the record of safety in preparation. At GANIL, the ions are accelerated by cyclotrons (C01 or C02, CSS1, CSS2, CIME) and are transported through beamlines towards the rooms of experiments (D1-D6, G1-G4). A first named extension SPIRAL was brought into service in 2000. It makes it possible to produce and post-accelerate, via the cyclotron CIME, the radioactive ion beams obtained by fragmentation of stable ions resulting from CSS2 in a carbon target. The project SPIRAL2 will arrive soon and has the same need in safety.

Each room must thus remain confined (without human presence) when potentially dangerous ionizing radiations are present. This protection was identified as an important function for safety and is provided by EIS (Important Equipment for Safety). The EIS of GANIL are referred and described in the RGE (General Rules of Exploitation). It was decided to replace the current systems of security management by four distinct but inter-connected systems.

DESCRIPTION

TCR (Control board of Radiations)

This system controls, visualizes and stores the radiological state of the INB areas via radiation detectors. This system already exists but must be renewed in order to fulfil the current requirements of safety and to upgrade its electronics and its interfaces. This project is in phase of realization. It generates thresholds on its measures. This project is studied at the GANIL.

UGB (Unit of Management of the Radiation detectors)

This system ensures the safety of people in the event of detection of ionizing radiations in the controlled zones. It is inter-connected with the TCR which informs about measurements and thresholds of the radiation detectors and with the UGA (definite below) which informs the possibility of presence of people in the rooms. It acts on the possibilities of decreasing or of stopping the radiations in question. This project is studied at the GANIL.

UGA (Unit of Management of the Access)

This project is planned to prevent the possibility that people can be in the presence of ionizing radiations in the controlled areas. That involves two precepts:

- No staff in a room if it can exist an ionizing ray exceeding a threshold considered as unacceptable for health.
- Stop all of the accelerated beams which can create an ionizing ray exceeding the threshold of 25µSv/h in a room where remains someone.

Thus, the access should be forbidden:

- To prohibit the entry, the rooms to be supervised will have manual or automatic doors and “security vestibules” with “one by one” passage to count and deduct the number of people in a room.
- To prevent the radiations in a room, this system will command 2 beam-stops by beamline at the origin of the radiation. A second barrier is made up by SAAF
- Information of presence of ionizing radiations will come via the associated system UGB.

This project is studied by industrial companies.

SAAF (Automatic system to stop the beam)

If a problem is detected by the UGB or the UGA, this system stops all the beams of the facility before acceleration. This project is studied by industrial companies.

The poster treats of the UGA. This system manages the room status. If someone may be in the room, the UGA should stop the beam(s). If a beam can create radiation in a room, the UGA locks the doors and forbids the access.

To do that, the UGA can control:

- all the doors, closing and locking, of a room
- the 2 doors of a “security vestibule”
- the pair of beam-stops on each way of beam which can create radiations in the room
- evacuation signals (sound and visual)

It manages the different status of the room and the passage between them.

It dialogues with the UGB, SAAF and the Access Control System (biometric system)

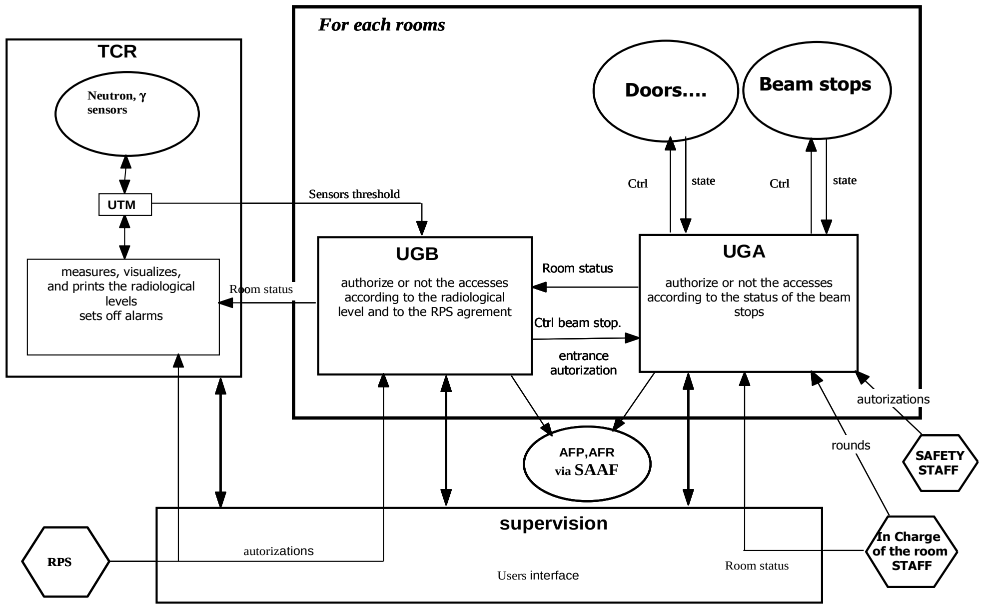

Figure 1: Interconnection between the systems.

STATUS

There is 3 status for the standard rooms:

- “PROHIBITED ACCESS”: there is nobody in the room and the entries are prohibited. The doors are locked by the UGA. The “beam stops” can be put OUT.
- “ACCESS CONTROLLED BY UGA”: the doors are locked by the UGA but the accesses are authorized via the “Entrance control” in order to count-deduct the people inside the room. Consequently, the “beam stops” are maintained IN.
- “ACCESS REGULATED”: the access is authorized and not controlled by the UGA. Consequently, the “beam stops” are forced IN. In order to recall this status, these rooms remain radiological controlled areas; all the doors are basically closed but not locked.

Safety Integrity Level	DEMAND MODE ("Low Demand Mode")		CONTINUOUS MODE ("High Demand Mode")	CONSEQUENCE OF A FAILURE
Level	AVAILABILITY	Probability of a failure on demand	Probability of a dangerous failure per hour	
SIL 4	>99.99%	$>= 10^{-5}$ to $< 10^{-4}$	$>= 10^{-9}$ to $< 10^{-8}$	Potential for fatalities in the community
SIL 3	99.9%	$>= 10^{-4}$ to $< 10^{-3}$	$>= 10^{-8}$ to $< 10^{-7}$	Potential for multiple fatalities
SIL 2	99% - 99.9%	$>= 10^{-3}$ to $< 10^{-2}$	$>= 10^{-7}$ to $< 10^{-6}$	Potential for major injuries or one fatality
SIL 1	90% - 99%	$>= 10^{-2}$ to $< 10^{-1}$	$>= 10^{-6}$ to $< 10^{-5}$	Potential for minor injuries
SIL 0	No Requirement			N/A

Figure 2: SIL Levels.

Industrials Standard IEC 61508

From the extent of the project, it was decided to sub-contract the study and the system realization UGA and SAAF to industrial companies.

To do that, a GANIL working group realized a "functional terms of reference" and the choice of safety Standard was naturally the IEC 61508 and the FMECA (Failure Modes, Effects and Criticality Analysis).

IEC 61508 covers all safety-related systems that are electro technical by nature (i.e. electromechanical systems, solid-state electronic systems and computer-based systems). For the UGA, the asked Safety Integrity Level is SIL3 (Figure 2).

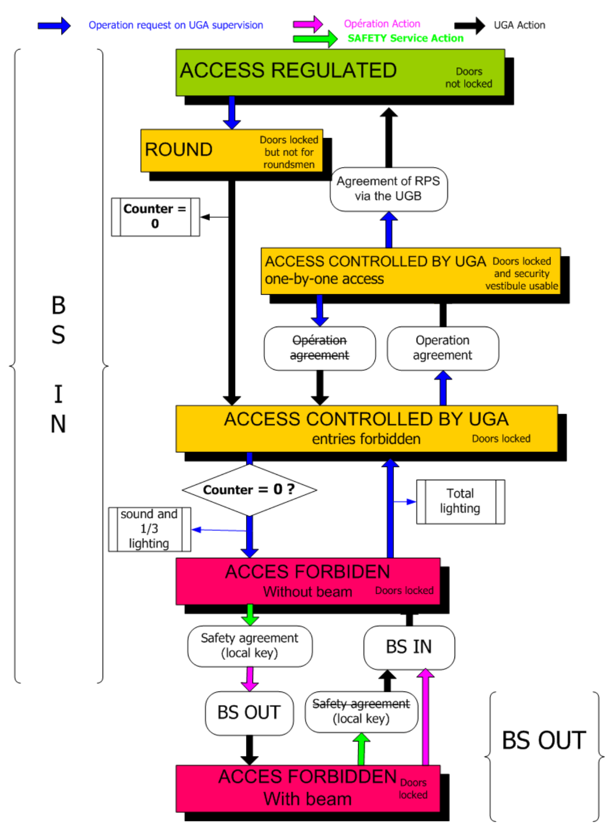

Figure 3: synoptic of status changes.

This Standard gives recommendations for the development of hardware and software:

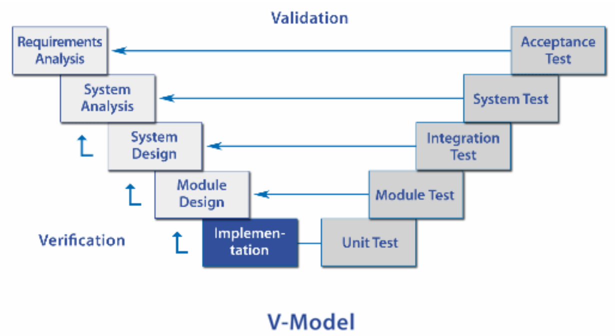

Figure 4: development V-model.

The redundancy of the hardware is needed to have the SIL3 level.

Materials

The UGA retained structure for each room is:

- Two PLC (1 safety PLC and 1 standard PLC).
- All sensors have three contacts: NO (Normally Open) and NL (Normally Locked) for the safety PLC and NO for the standard PLC.
- Two beam-stops by beam line.

The Access Control System (biometric system) and the supervision are not important for safety. They are centralized systems and they dialog with the PLC via a private network.

CONCLUSION

The test of the prototype will begin at the end of June. The ASN (French Nuclear Safety Agency) will agree the systems during few months. The UGA, UGB and SAAF will be installed in 2011 for GANIL and later for SPIRAL 2.

REFERENCES

[1] Industrials Standard IEC 61508.