The new radiation safety control system of GANIL and its extension to the rib SPIRAL facility

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Abstract

A new generation of radiation safety control system was carried out . Extending this VME-based system to encompass the forthcoming rib (radioactive ion beam) SPIRAL facility is in progress. This extension is being developed along several directions : hardware and software upgrades, graphical user interface enhancement, communication shielding, access badge system renewal. Requirements and choices are discussed. Results are presented.

1. Introduction

A major extension of the accelerating installation GANIL , named SPIRAL, is under construction to be operational in the year to come. The SPIRAL facility is targeted to on-line production and acceleration of radioactive ion beam, taking advantage of the Very High Intensity facility currently underway. SPIRAL features an energy range from 2 to 25 MeV per nucleon and intensity from a few pps to 10^8 pps. It will induce challenging condition for operation and for radiation safety control.

The radiation safety control systems provides means and ways to avoid radiological hazards for individuals in the accelerator rooms and experimental areas, as well as in the the storing room of actived devices.

The second generation control system currently in use [1] is being extended to take into account the SPIRAL facility. This extension in term of equipment is roughly one third of the existing installation. The system has to manage four additional gating locks, doors and seven controlled rooms (e.g. the Target Ion Source System TISS room , the cyclotron CIME room) distributed over two levels.[2]

2. The radiation safety control system

A schematic layout of the radiation safety control system is shown on Fig.1. Its different subsystems are emphasised hereafter.

2.1. Access control

Access control aims at averting radiological risks for personnel who attempts to enter a zone under control (noted ZC) of the INB (nuclear base installation) site. Beam penetration into a ZC is interlocked by general conditions of the room and its radiological level measured with specific detectors. It is achieved by mastering at least two upstream beam safety devices (e.g. beam stopper, bending magnet or accelerating RF device).

The operation of the SPIRAL facility will induce severe conditions for the access control, since different experimental modes may intricately exist : the current GANIL accelerator and SPIRAL may operate separately for stable ion beams, or they may operate in cascade as a joint accelerating complex with production, acceleration and experimentation of radioactive ion beam.

The control system achieves access control and reporting (online graphical display and event storing) as well. It is composed of two subsystems :

- a centralised and master subsystem named UGS2. It manages the databases of detectors and id-badges, checks the current status of the ZC and its radiological level and makes decision for access authorisation to be notified to the local gating controllers.
- local gating controllers named UGD are distributed along the accelerator and experimental gating locks for local access control. Each UGD is designed to take care of up to two ZCs.

UGS2 and UGD make use of VME standard processors, I/O and drive modules. Its application software runs under the pDOS operating system supplied by Eyring which provides services for real-time multitasking. The UGS2 software is built around an event bus. There are about one hundred event triggered tasks sorted into I/O tasks, processing tasks and ancillary tasks.

Access control will rely on the up-coming renewed id-badge control system. A contact-less badge with credit card format is adopted for robustness and compliance with the ISO standard. This badge shelters powerless chip, memory and an RF loop which are energised by induction, while reading.

Opportunity was taken to renew the campus access control with a derived technique. *A Central Platform* will provide a user friendly environment to produce personalised badges with id- and clearance- information (zones and time slices authorisation, ..), to manage the central badge database, to initialise and update the local databases of badge readers, to supervise the access on graphical colour screen, to log accesses with status and to provide whenever needed statistics. The Central Platform and badge readers will communicate via the LONWORKS fieldbus.

2.2. Radiological Control

Radiological level mapping is achieved by specialised detectors (neutron, gamma, gas) installed in the vicinity of the accelerator and experimental area. The laboratory is meshed by about one hundred detectors including 25 detectors for SPIRAL. The radiological levels are measured every three seconds.

The sampled data are collected by dedicated VME modules for processing and concentrated into 6 VME cubicles named UDE. The UDEs are linked via the private Ethernet to the Central Control console for further inspection, processing and long term logging. The UDEs are also wired to the UGS2 system for radiological level condition interlock.

2.3. Central Control

The Central Control provides the operator interface services for on-line and off-line operations : data processing and display on colour graphical console unit, data management (archiving and retrieval, sorting, presentation, ..) [3]

The Central Control system is composed of two parts, structured around a private Ethernet LAN :

- *The hub*. This device centralises synchronous data collected by the radiological control and *potentially* - via the LAN bridge- events from the Access Control as well as information from the Accelerator control system (e.g. beam parameters, acceleration conditions).

Also, the Hub is in charge of data filtering and storing of raw and processed data for short term presentation. Long term logging or archiving of data and events is an important issue in safety control, since information must be traced back over a ten year period .

- *The GUI.* User interface makes use of 21' large colour screen workstations and provides operators a comfortable environment to ease observation and decision. As examples of available services : -The radiological levels sampled over the INB site can be displayed at will in graphical synoptics or in alpha numerical presentation, both with real-time update. - The memorisation of maximal level reached by every detector is a sampled-and-hold system with colour coded display for early warning of operators, - Plotting the radiological level as a function of time with automatic time scaling, for evolution watching, may take into account up to three detectors.

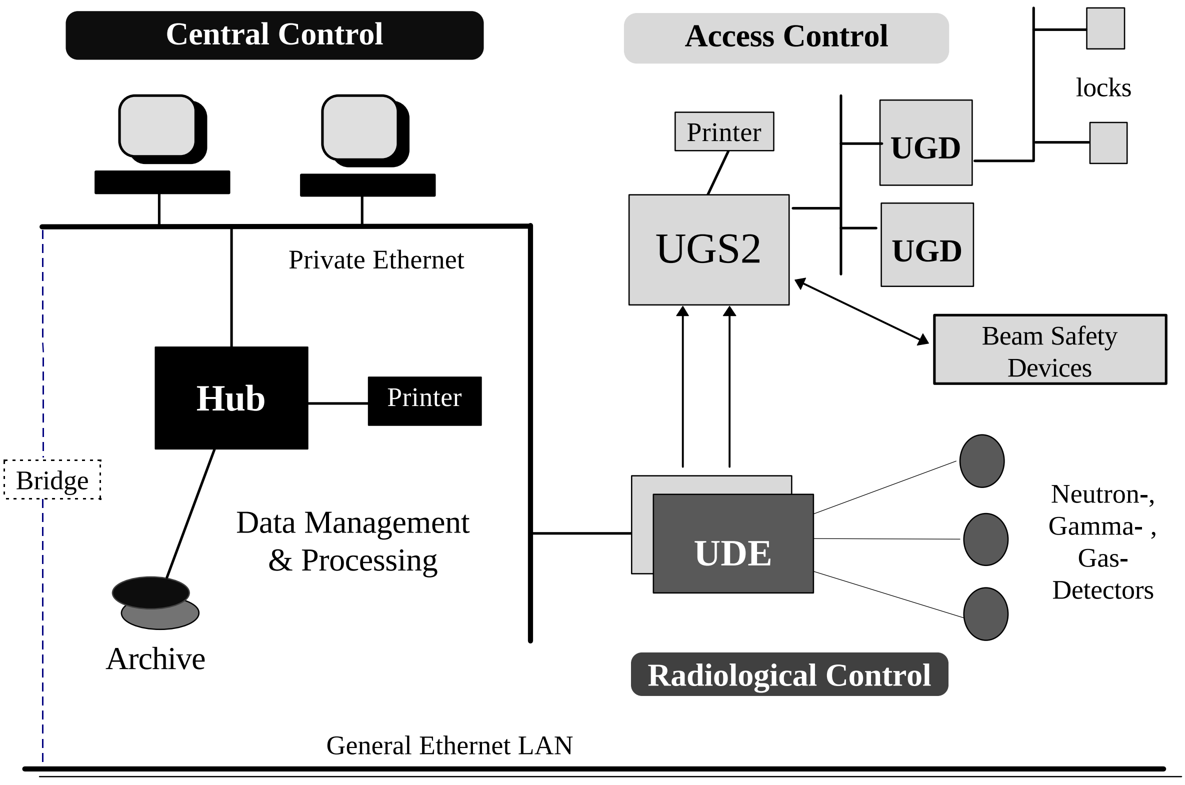

Fig.1 Schematic layout of the radiation safety control system

Technical choices are guided by security of operation, homogeneity in hardware and software to target compatibility and adoption of open standard for easy and cost effective evolution. The VME standard is therefore adopted. Applications are written in C language and run under the UNIX real time operating system LynxOS which complies to the POSIX standard. Hewlett Packard workstations are used for GUI with Motif/Xwindow and programming was carried out with the uims (user interface management system) XFACEMAKER from NSL. Archiving medium is CDROM suitable for six month operation .

Also a backup system is presently operating in parallel. Its is based on a PC microcomputer operating under LynxOS.

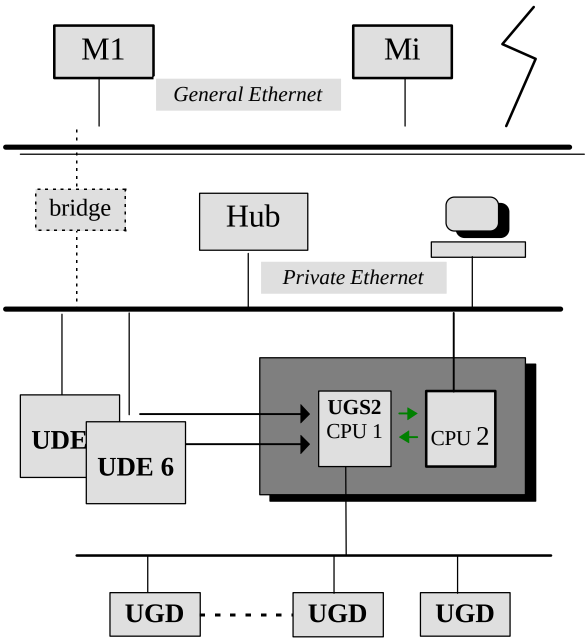

Fig.2 : Shielding the UGS2

2.4. Communication

Communication relies on Ethernet LAN and TCP/IP protocole , NFS, etc.. The radiation safety control system is hooked to a private Ethernet LAN which provides a backbone communication medium. Bridging this private LAN to the General Ethernet LAN of the GANIL will allow filtered information interchange with other systems (e.g. accelerator control system), following TCP/IP protocole.

To shield more securely the UGS2 against intruding commands, its VME CPU1 is not directly hooked to the LAN but 'screened' by a second VME CPU2 . CPU2 which shares the same crate as CPU1 is linked to the Ethernet LAN for filtering mission with limited read commands allowed (Cf.Fig.2).

3. Current status

A subset of the radiation safety control system is built up to control the first tests of the cyclotron CIME. On site installation of hardware and software is underway.

The Central Control System is currently in operation from the onset of this year.

The extension of the control to SPIRAL is scheduled for the year to come. Hardware is in progress, software will be designed within the quarter to come. The new badge system is expected for spring'98.

4. References

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