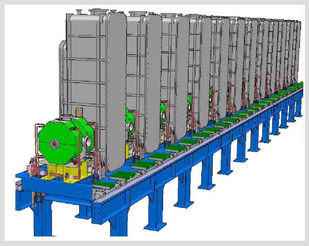
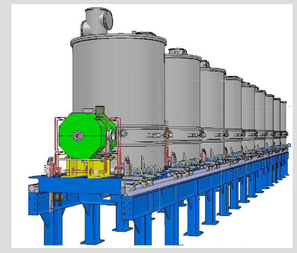


# Preliminary implementations for the new Spiral2 project control system



E. Lécorché, P. Gillette, C. Haquin, D. Touchard and the Ganil control group (Ganil / Caen, France)
J.F. Denis, F. Gougnaud, J.F. Gournay, Y. Lussignol, P. Mattei (CEA-IRFU / Saclay, France)
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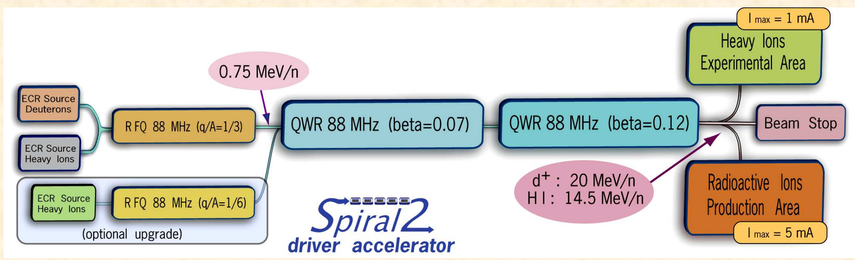
## The Spiral2 project

The aim of the new Spiral2 facility is to produce radioactive isotope beams (RIB), so extending the possibilities offered at GANIL to heavier radioactive beams, with much higher intensities. It will provide intense beams of neutron-rich exotic nuclei ($10^6$–$10^{11}$pps), created by the ISOL production method, in the mass range from A=60 to A=140. The extracted exotic beam will be used either in a new low energy experimental area called DESIR, or accelerated by the existing SPIRAL 1 cyclotron (CIME).

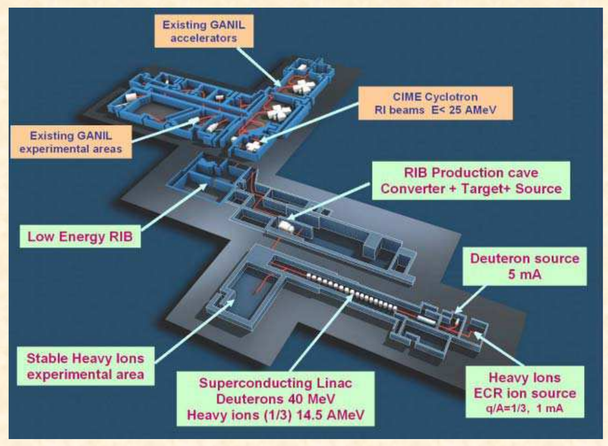
The intense primary stable beams (deuterons, protons, light and heavy ions) will be produced by an accelerator (RFQ followed by a superconducting Linac) and sent to target ion source assembly systems to generate the radioactive beams. It will also be used at various energies for neutron-based research, irradiation and activation studies and multi-disciplinary research, all these experiments taking place in a new area.

| Beam | Protons | Deuterons | Ions | Ions |
|---|---|---|---|---|
| Q/A | 1 | 1/2 | 1/3 | 1/6 |
| I (mA) max. | 5 | 5 | 1 | 1 |
| $W_o$ min. (Mev/A) | 2 | 2 | 2 | 2 |
| $W_o$ max. (Mev/A) | 33 | 20 | 14.5 | 8.5 |
| CW max beam power (KW) | 165 | 200 | 44 | 48 |

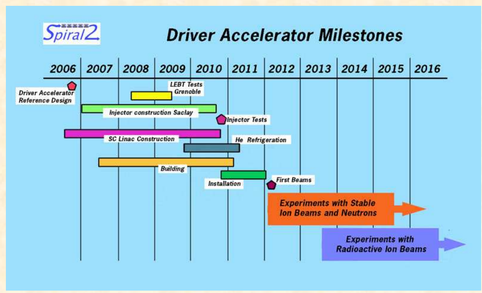
*Primary beam characteristics*




*Accelerator schematic layout*




*Ganil implementation*




## The Accelerator Control system

### Main options

| | |
|---|---|
| EPICS | 3.14.9 |
| Consoles / serveurs | Red Hat Enterprise Linux 5.2 |
| VME IOCs | VME / VxWorks 6.5 |
| VME CPUs | Motorola MVME 5500 (PPC 7457 @ 1GHz, 512 Mo) |
| GUI | EDM & Java (Eclipse)<br>Use of CSS ? |
| VME standard I/O boards | ADC : Adas ICV 150 ⇨ 32 channels * 16 bits<br>DAC : Adas ICV 714 ⇨ 16 channels * 12 bits<br>Binary I/Os : Adas ICV 196 ⇨ 96 channels |
| VME triggered acquisition | Adas ICV 108 & ICV 178 set ⇨<br>8 analog inputs up to 1,2 MSample/s<br>*under evaluation* |
| PLCs | Siemens S7 ⇨<br>s7plc or Modbus/TCP communication |

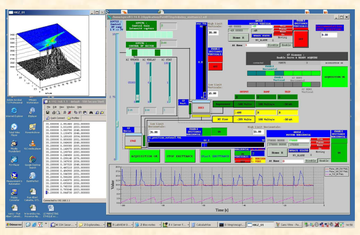
As resulting from a collaboration between several institutes, the Spiral2 accelerator control system will be built upon the standard Epics framework. The first technical options were adopted and a common software platform is now available for the three laboratories to more easily share their developments.

Although the basic blocks of the control system are under way, many topics are still to be envisioned :

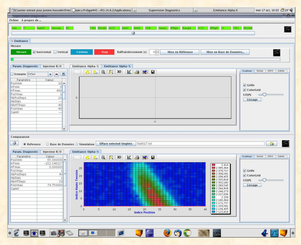
- ✓ Integration of diagnostics such as the Beam Position Monitors, the Beam Losses Monitors …
- ✓ Interface with the low level RF system (for the RFQ, rebunchers, Linac cavities), implemented as a VME64x board (CEA-IRFU design)
- ✓ Interaction with the global timing system
- ✓ Management of the Epics records databases (Irmis which has been yet tested will be used in a first phase then generation from a relational database is planned to be evaluated)
- ✓ High level applications

Also, as the RIB production process of the new Spiral2 facility will have to be connected to the existing Ganil machine driven by the so-called Ganiciel control system (home-made design within the Ada language, using TCP-IP sockets for communication), a careful study has to be done to define how the two different control systems should have to be interconnected and coupled together.

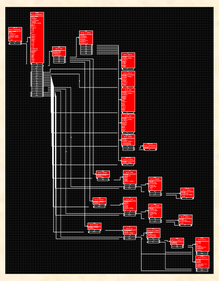
### First tests and evaluations



EDM configuration



Java emittance display



Power supply interface database design

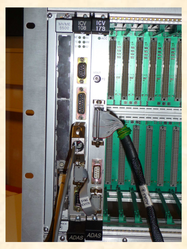

EDM screen test



Accelerator hierarchy viewer (XAL based)



Magnet cycling (XAL based)



Triggered fast acquisition test bench

#### *Emittance measurement*

An emittance measurement system (Allison scanners) has been designed and tested with a real beam. The VME IOC configuration is achieved by an EDM screen while the emittance is displayed using a Java application addressing the IOC through the CAJ package. Interlocks and vacuum are controlled by a Siemens PLC reached through the s7plc protocol.

#### *Power supplies interface*

Power supplies will be interfaced using the Modbus/TCP protocol over Ethernet. Primary tests were performed (first on a soft IOC running on a Linux PC, then within the VME/VxWorks environment) using existing Ganil power supplies implementing a Modbus/RTU interface then followed by a Cometh gateway (Modbus/RTU ⇨ Modbus/TCP). The adequate Epics record database design allowed to follow a first approach and makes use of Sub and Gensub records to implement data conversion as well as the local / distance commutation modes.

#### *High level applications*

High level applications written in Java will have to be developed to fulfill the tuning requirements and to follow the commissioning procedures. So a technical work is in progress to study how to implement and to design the architecture and basic framework for the high level applications. Within this context, an investigation of the XAL environment is currently been carried out and, as a test bench, some existing applications were slightly modified or adapted to some of our specifications in order to know in which extend it could be transposed to the Spiral2 specificities (needs and requirements, connection with the CEA TraceWin simulation code …).

#### *Evaluation of a triggered fast acquisition system*

To measure the beam intensity through Faraday Cups on the beam pulse width, two coupled VME boards were selected:

- ✓ An analog ADAS ICV 178 board with 16 bits resolution, 8 inputs and up to 1,2 MSamples/s
- ✓ A controller ADAS ICV 108 with external trigger, one RAM buffer of 4Mbytes and running in "single event" or "flip flop" modes.

Evaluation and software development are in progress.