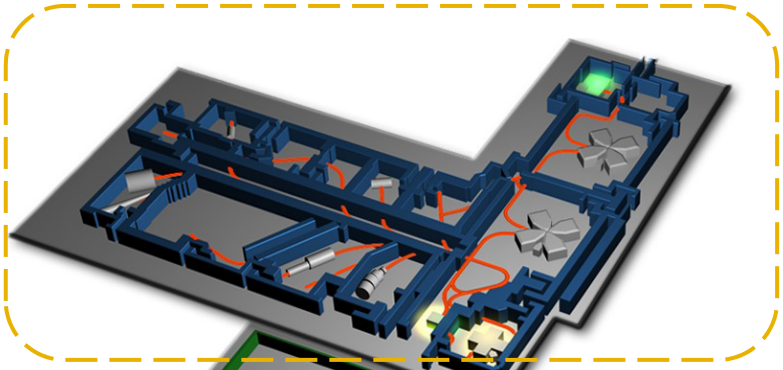
Development of a Safety Classified System with LabView and EPICS

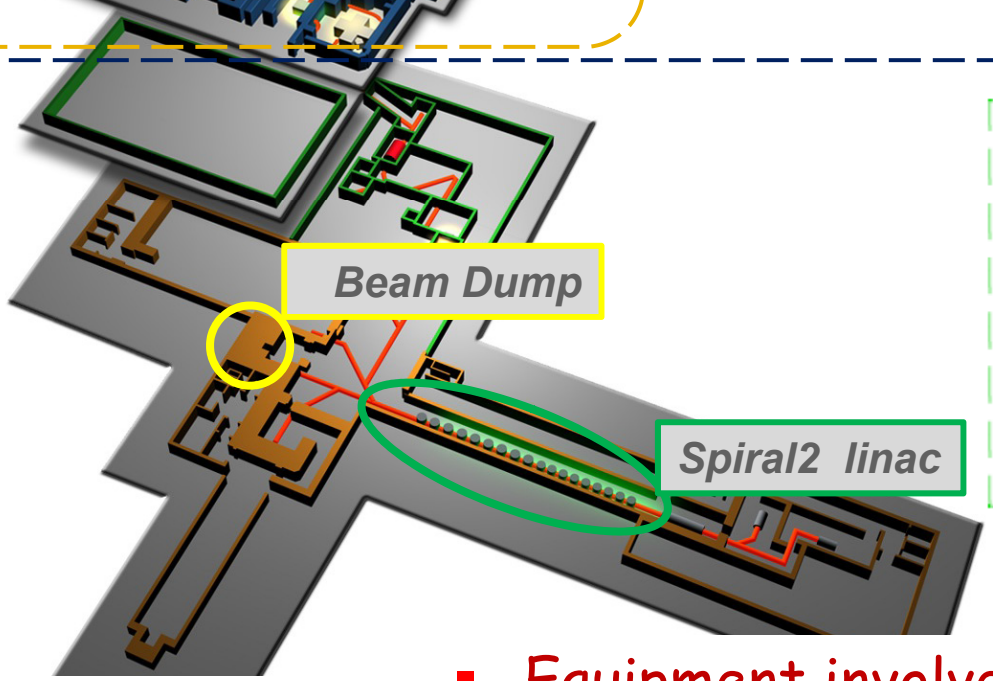
SLAAF in French, could give in English …

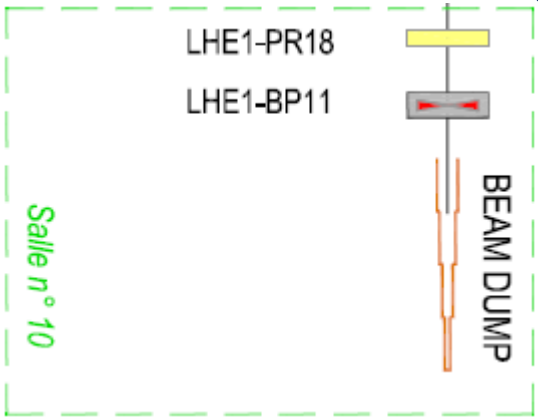
System for the Limitation of the Activation of the Beam Dump

1. The Spiral2 Linac Beam Dump
2. Activation limitation Principle
3. Use of the labView EPICS gateway in Spiral2 CC
4. Software Design
5. Development Status

Spiral2 : a new Rare Ion Beam facility





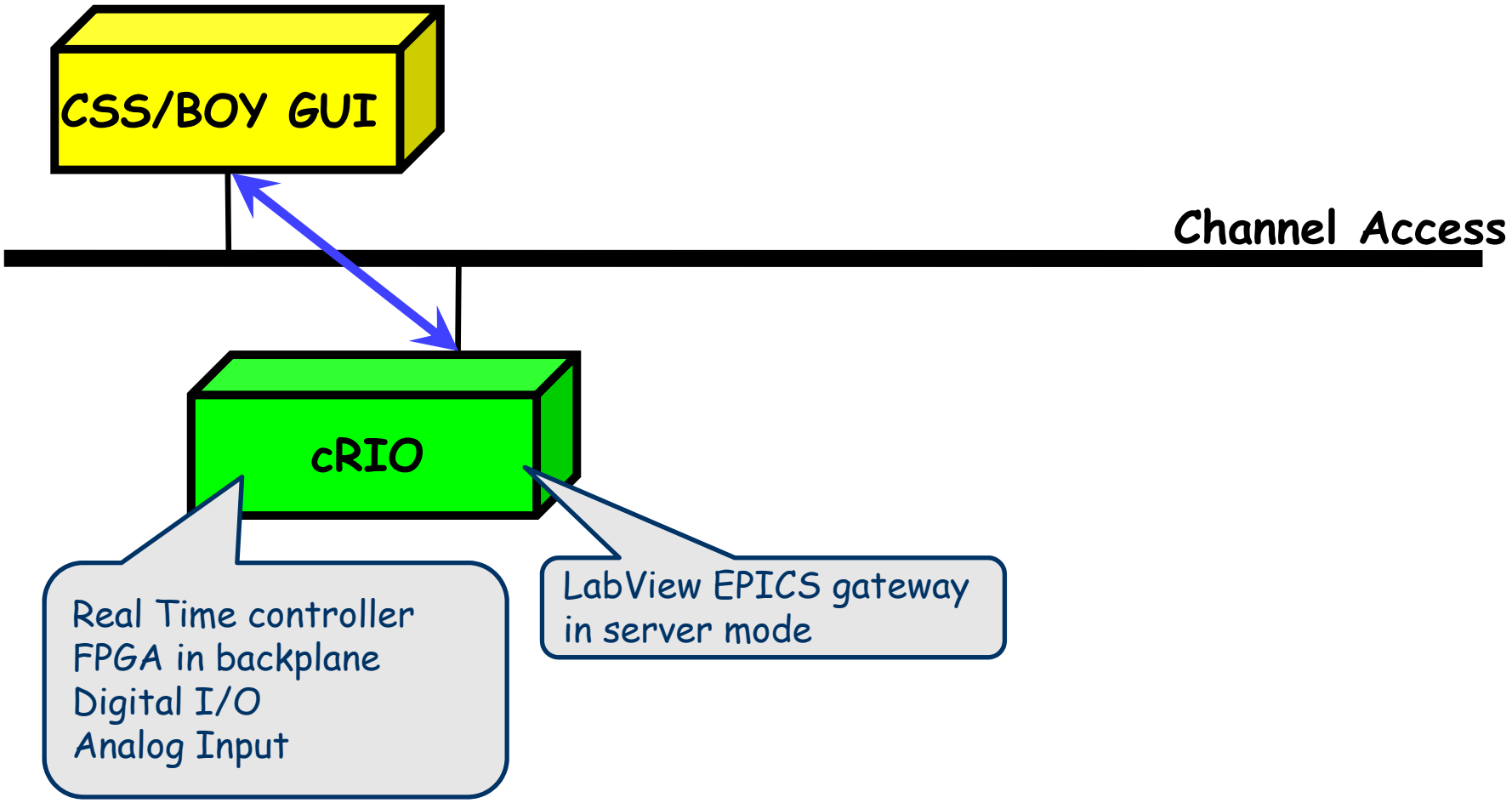


- Equipment involved in the safety

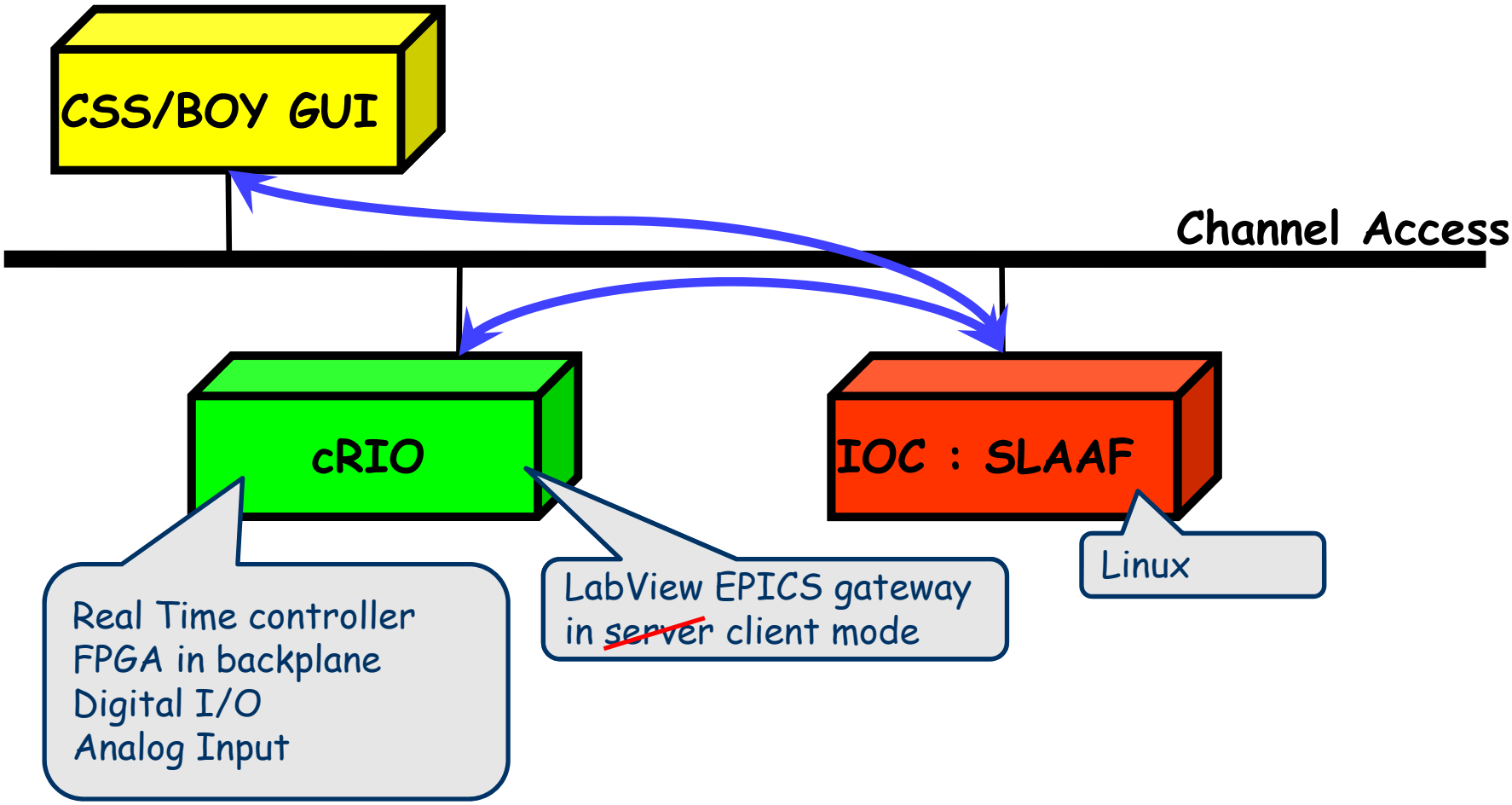
Limitation activation principle

- Limitation the activation of the beam dump
  - Limit the number of particles dropped into it per 24h
  - Define a Threshold in number of particles
- The threshold depends on ions type and energy
  - Threshold will be defined for each beam
- Number of particles calculation
  - Measure beam intensity
  - Convert intensity in number of particles per second (PPS)
  - Accumulate every seconds the number of PPS
- Request a beam cut-off when the threshold is reached

Use of the labView EPICS gateway



Use of the labView EPICS gateway



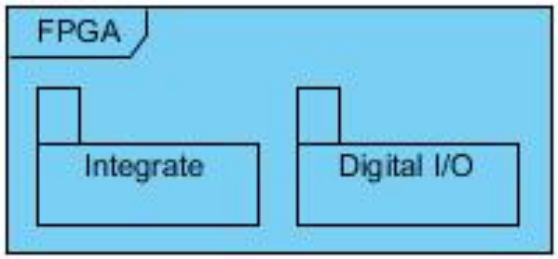
Software Design

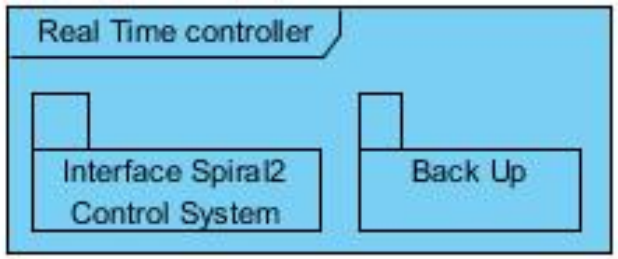
- Implementation Guidelines to strengthen the safety
  - Minimize the probability of the "feared event"
    - ✓ Activation of the beam dump above threshold
  - Maximize testability to prove the correctness & robustness
    - ✓ Split in labView subprograms with dedicated test application
- Execution environments capability

	Real Time controller	FPGA
Minimum possibility of a Crash		✓
I/O modules access	✓	✓
Network access	✓	
Able to run the labView Epics gateway	✓	

Software Design

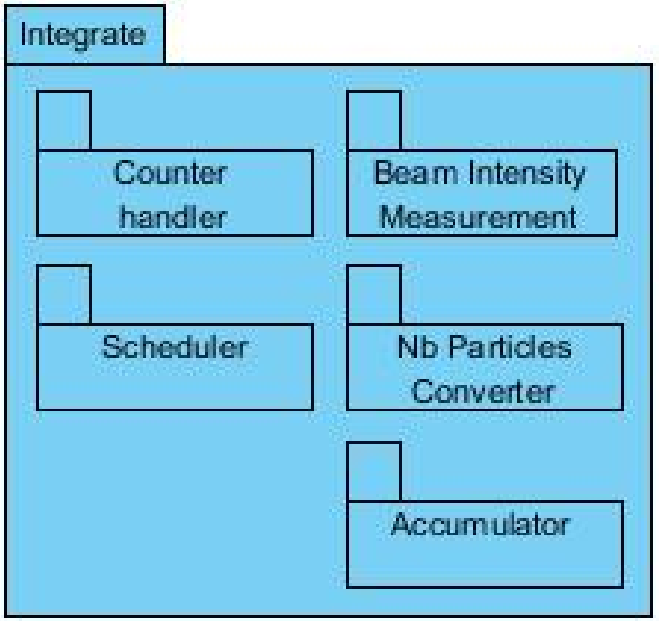
- Confine in FPGA critical processing
  - All I/O implemented in the FPGA
  - Integration process fully implemented in the FPGA
    - ✓ Integration continue even if the real time controller is crashed
- Use of the real time controller
  - Access the network and run the labView EPICS gateway
- Important tasks in the real time controller
  - Reading integration parameters
  - Trig the reset of the integral at defined time





Design of the integration package

- Minimize processing changes when machine mode change
  - All the 4 signals permanently acquired an converted to PPS
  - PPS taken into account or ignored if integral is frozen
  - The same process always executed
- Three main integration components with test applications
  - Beam Intensity Measurement
  - Nb Particles/s Converter
  - Accumulator
- System components
  - Scheduler
  - Counter



Status

- The development of the system
  - Development finished end 2016
  - Component test applications developed
- Important testing effort was required in 2017
  - Writing test procedure
  - Build test board to simulate the machine signals
  - Test executions
  - Bug correction
- We are preparing the reception tests:
  - Selecting the most relevant tests for safety
  - Writing procedures
- Reception tests, planned for summer 2018

Thank you for your attention !