### **SPES Control System**



#### M. Bellato

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- Update on LLRF
- Update on CB controls
- Update on network infrastructure
- Update on Software infrastructure
- Update on Software developments

#### • Update on LLRF

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### LLRF Developments

- LLRF for RFQ/LINAC cavities control
- Existing analog controllers have maintainability problems
- Need for higher resolution phase control
- New controller based on HF sampling/ digital control
  - More versatile, adapts easily to 40 MHz, 80 MHz, 160 MHz and 352 MHz cavities
  - An EPICS IOC is embedded in each LLRF controller



#### LLRF Controller Block Diagram



#### LLRF pre-production boards



# RF I/O conditioning



#### LLRF in beam tests



- Firmware 70% ready
- EPICS interface in progress
- Power monitors missing
- Embedded scope missing
- The target is : ready for Q3 2015

## **Bandpass filters**







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### **Charge Breeder Control**



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#### **ECR Control System Architecture**

- The control system is being developed using a prototype of the new LNL EPICS IOC
- Full replacement of the existing
- This control system will be easy adapted to the SPES Charge Breeder
  - Plan for CB operation on Q1 2016



### The ECR EPICS IOC

- The new standard IOC developed at LNL has been adapted for this application
- A prototype is being used, which has:
  - 32 analog inputs (16bits, 250ksps)
  - 16 analog outputs (16 bits)
  - 48 digital inputs
  - 48 digital outputs
  - 8 UART RS232
- Later, the prototype will be replaced with the final version of the IOC; the software will remain unchanged



### The ECR Vacuum Control System

- Adapted to the new standard controller developed at LNL
- A prototype will be used initially for this application
- The IOC will communicate with the PLC using the PROFINET protocol for reading the status and sending commands



## **ECR IOC Implementation**

- Many instruments are controlled using analog signals with PID algorithms implemented on the IOC
- Other instruments are controlled through serial communication port using stream commands



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#### **ECR Graphical User Interface**

• The GUI is being developed using CSS



#### **Control Network General Architecture**



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Control network layout



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#### Network Architecture



### **Control network status**

- Network is 70% cabled
- Extension to SPES building when available in 2015
- Server cluster installed in data center
- 60TB Fibre Channel storage installed
- Epics archiving in deployment
- NTP, DNS, net management will be installed soon
- VDI installation in progress



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### **Operator Interface**



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### LNL IOC development

- Rationale:
  - Build once, use it everywhere
  - Reliable and easy to maintain
  - Affordable(< 400E target), low power</li>
  - Runs standard X86 code
    - Core CPU is a COM-EXPRESS industry standard
  - Fits the needs of : Magnets & Lenses PS, BPM, Tape Sys, EM, FC, etc
- Design is complete
- PCB Routing & prototype on Q1-2015

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#### **Beam Diagnostics**

- New Control SW
  - EPICS based
- Installation on the whole ALPI/PIAVE/Tandem complex completed.
- Reuse of legacy VME HW and new IOC's
- Ready for SPES HW



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#### Magnets & Lenses PS Control





New EPICS based magnet control SW on recently installed beam transfer Line for :

- Quadrupoles
- Dipoles
- Steerers
- Teslameters

### Summary

- LLRF is progressing but still ~1 year of developments before mass production
- CB is far from being addressed, ECR control is a pale surrogate
- IT support for control is on track, we expect a benefit in a short time
- Concern about building infrastructure for controls on SPES, CB and new transfer lines