New Control System for the SPES Off-Line Laboratory at LNL-INFN Using EPICS IOCs Based on the Raspberry Pi

J. Vasquez[1,2], A. Andrighetto[1], G. Prete[1], M. Bertocco[2]

[1]INFN - Laboratori Nazionali di Legnaro. V.le dell'Università 2, 35021, Legnaro (PD), Italy

[2]Università degli Studi di Padova. Via Gradenigo N. 6b, 35131, Padova (PD), Italy

Istituto Nazionale di Fisica Nucleare
Laboratori Nazionali di Legnaro
Viale dell'Università 2, I-35020 Legnaro (PD), Italia
Tel: +39 049 8068 311 - Fax: +39 049 641925
http://www.lnl.infn.it

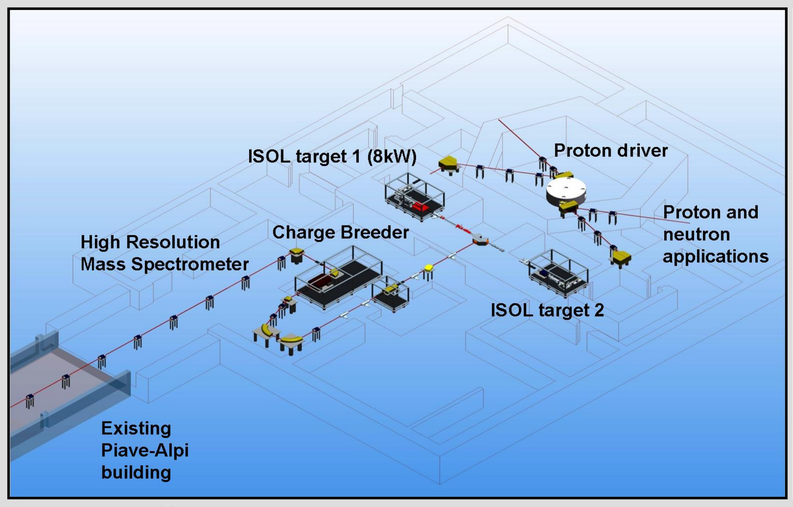
http://www.lnl.infn.it/~spes_target

jesus.vasquez@lnl.infn.it

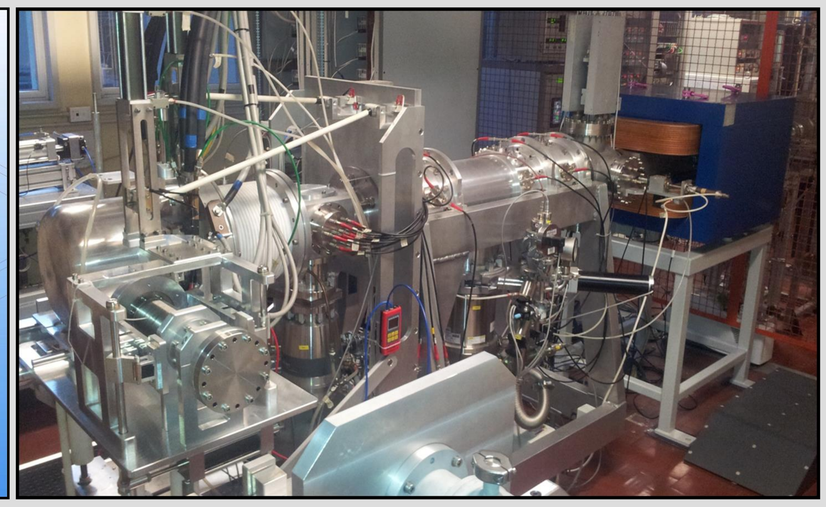
The SPES Project

SPES (Selective Production of Exotic Species) is an ISOL type RIB facility for the production of neutron-rich radioactive nuclei by uranium fission. The RIBs will be produced by proton-induced fission on an UCx multi foil direct target at a rate of 10^{13} fps, more than one order of magnitude larger than the currently available beam intensities. The facility is currently under construction at LNL-INFN (Italy).

An Off-line laboratory has been under operation for the last four years at LNL. In this laboratory, the SPES front-end apparatus has been tested. In particular, it has been a test bench for new instrumentation, detectors and control systems.



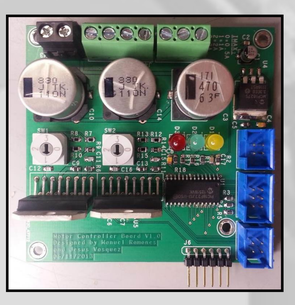
Layout of the SPES facility



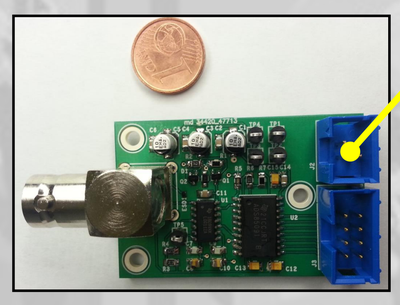
SPES off-line front-end laboratory at LNL

The New Epics IOCs Devices

1. Tailored home-made expansion boards (GPIO port):
   - 16 bit AI
   - 16 bit AO
   - DI/O
   - Stepper motor drivers
2. USB converter (UART RS232, Ethernet)

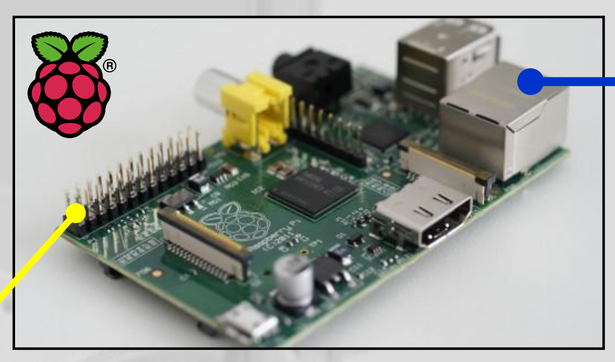


Stepper motor driver



1-ch current AI

The core of the IOC is the computer board Raspberry Pi (Model B, rev. 2)



- Broadcom BCM2835 SoC:
  - ARM1176JZFS (@700 Mhz)
  - Videocore 4 GPU
- 512 MB of RAM
- 2 USB 2.0 ports
- 1Ethernet port
- 1 low-level peripheral GPIO port

Channel Access

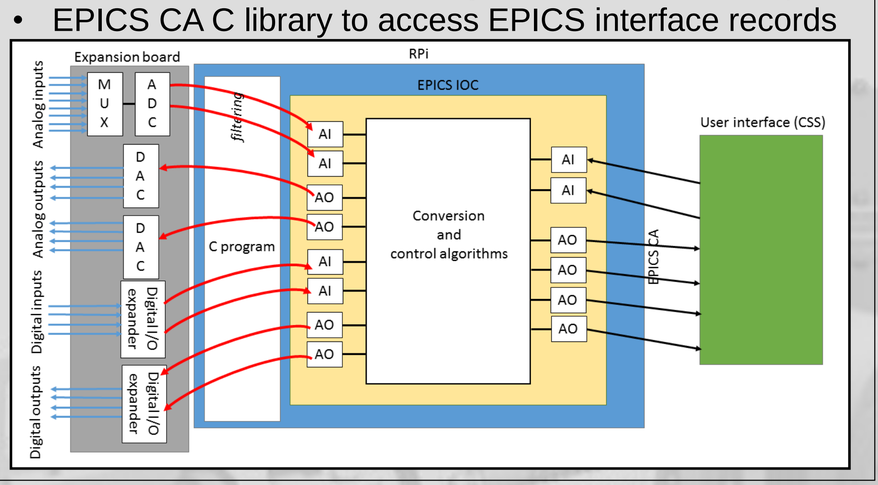
EPICS

Software: Raspbian OS with EPICS soft-IOCs using:

- EPICS (R3.14.12.3)
- Asyn driver (4.20)
- StreamDevice (2.6)

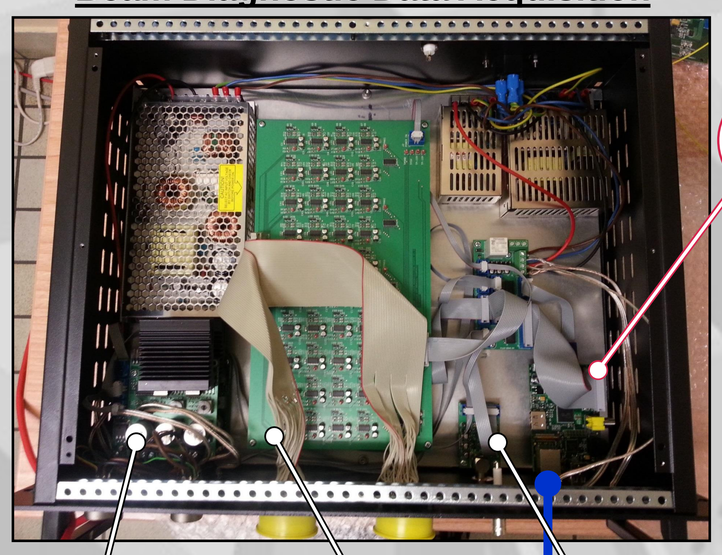
The interface between the expansion boards and the soft-IOC is done using a program written on C

- Broadcom BCM2835 C library to access the GPIO port
- EPICS CA C library to access EPICS interface records



Implementation of the IOCs in the off-line laboratory

Beam Diagnostic Data Acquisition

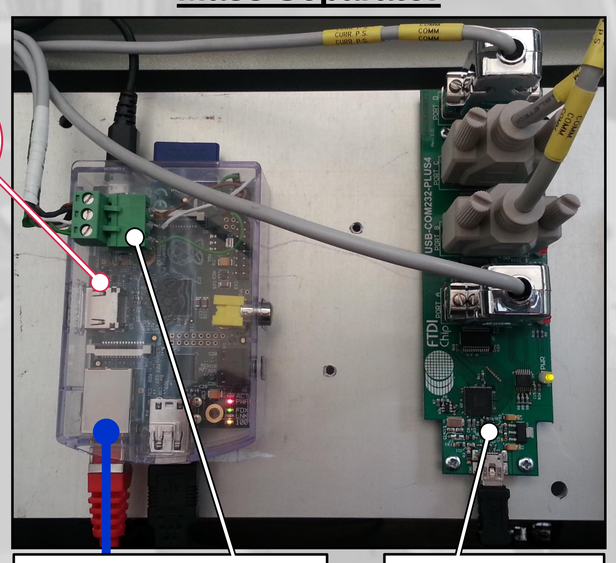


Stepper motor driver (x2) [Positioning]

40-ch current AI (x2) [Beam Profiler]

1-ch current AI [Faraday Cup]

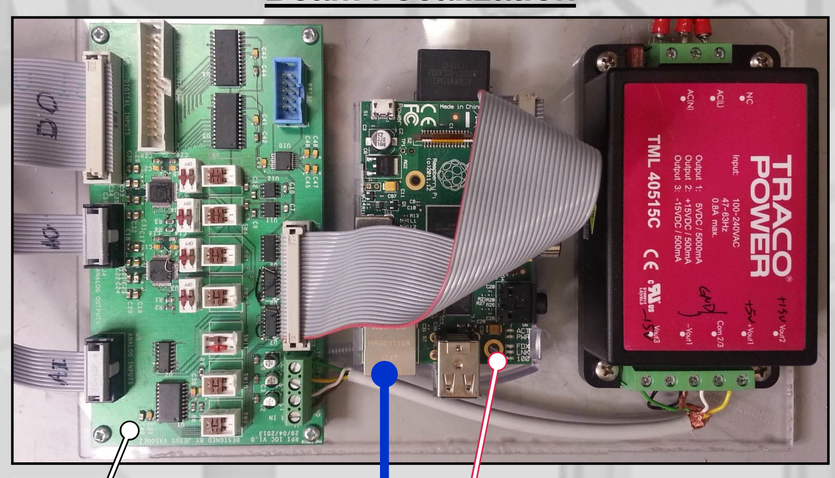
Mass Separator



1-Wire temperature sensors [Cooling]

Serial-to-USB converter [Instruments]

Beam Focalization



AI + AO + DI/O [Power Supplies]

Channel Access

EPICS

Future Implementation of the IOCs in the off-line laboratory

Beam Emittance Meter

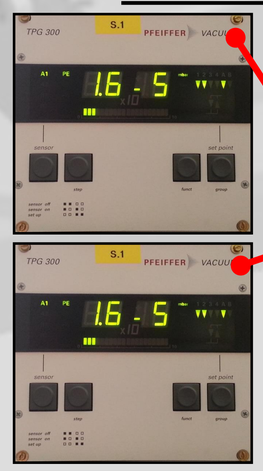
Expansion Board

40-ch current AI (x4) [Grid Detectors]

Stepper motor driver (x2) [Positioning]

1-ch AI (x2) [Positioning]

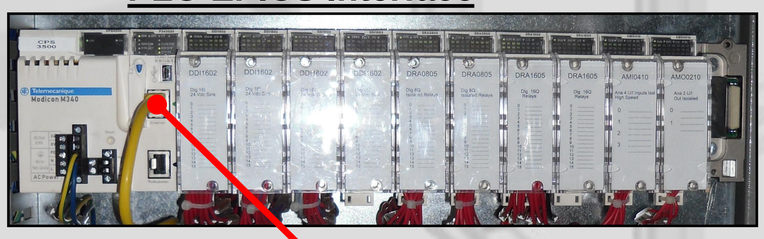
Vacuum Data Acquisition



Expansion Board

Serial-to-USB converter [Instruments]

PLC-EPICS Interface



Ethernet-to-USB converter [PLC]

Expansion Board

14th International Conference on Accelerator & Large Experimental Physics Control Systems
October 6-11, 2013. San Francisco, California.