TUPV016

DESIGN AND DEVELOPMENT OF THE NEW DIAGNOSTICS CONTROL SYSTEM FOR THE SPES PROJECT AT INFN-LNL

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Fig.1: Diagnostic box

- Possible mounted instruments: Beam Profilers, Faraday Cups and Collimators
- Analogic boards converting and multiplexing BP current signals to voltage ones

- Digital boards digitizing Beam Profilers and Faraday Cups signals
- Forward clock and gain signals to the analog boards
- Host the VxWorks station with the Legacy EPICS IOC


Fig.2: Rack VME

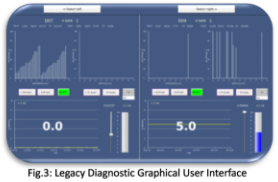

Fig.3: Legacy Diagnostic Graphical User Interface

- CSS Based
- Split Beam Profiler horizontal and vertical profiles
- Faraday Cup current trend
- Adaptable graphical full-scale
- Motion control

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Fig.4: Grids Pre-Amplifier box

- It replaces the Rack VME
- Can control up to 4 Beam Profilers and 4 Faraday Cups
- Backward compatibility
- Can Host an OS
- FPGA
- Generates the clock signal


Fig.5: Custom Controller

- 1 box replaces 2 analog boards.
- Increased performances.
- Backward compatibility.

Fig.6: Legacy Diagnostic Graphical User Interface

- CSS Based
- Beam Profiler horizontal and vertical profiles: Split and Unified mode
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EPICS IOC main tasks:

- Use IPBUS protocol and a custom EPICS module to communicate with the controller FPGA
- From raw values calculate the real current values

$$I_{BP,i} = \left(\frac{X_{BP,i} \cdot S_{BP}}{G_{BP}} + O_{BP}\right) \cdot \frac{S_{PA,i}}{G_{PA,i}} + O_{PA,i}[A]$$

$$I_{FC} = \frac{X_{FC,bit}}{G_{FC}} \cdot S_{FC} + O_{FC}[A]$$

Current values retrieval

- Users can detect broken wires and select the correction to apply:
  - Linear correction
  - Polynomial correction
- Remove noise
- Signal moving average

Signal cleaning

- Communication with multiple IOCs devoted to motion control
- Motion control standardization
- Roto-translation system to calculate instruments position in the beam line reference system
- Collimators control standardization

Handling control

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Fig.9: Emittance meter

- 2 identical slit-grid type instrument that scan the beam in 2 orthogonal planes
- For each grid it requires 2 channels of the pre-amplifier box and 2 channels of the new controller

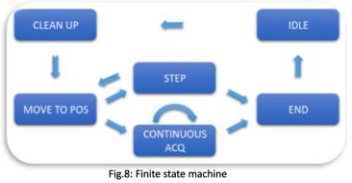

Fig.8: Finite state machine

- FSM parameters control with start and and stop commands
- Scuubex parameters control
- Emittance graphs

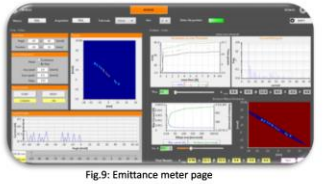
Fig.9: Emittance meter page

- Python script based on **pyepics** and **pysmlib**
- Read and write access to the EPICS IOC PVs
- Temporized motion along the X and Y axis to scan the beam emittance
- Usage of the Scubeex-Ghostbuster method to detect emittance

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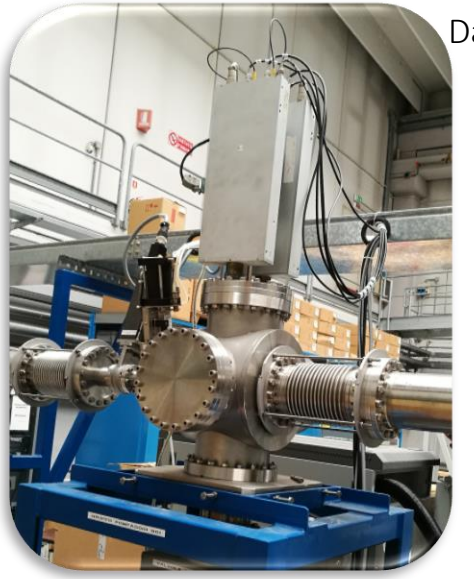

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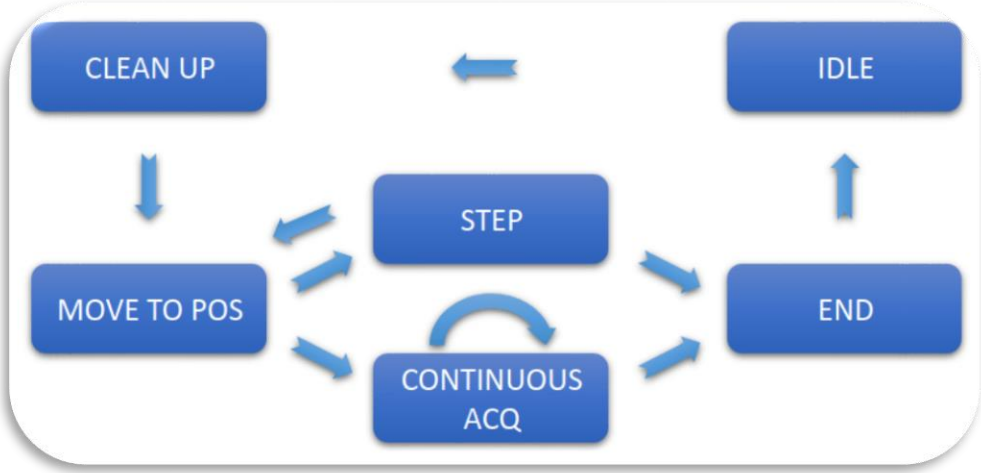

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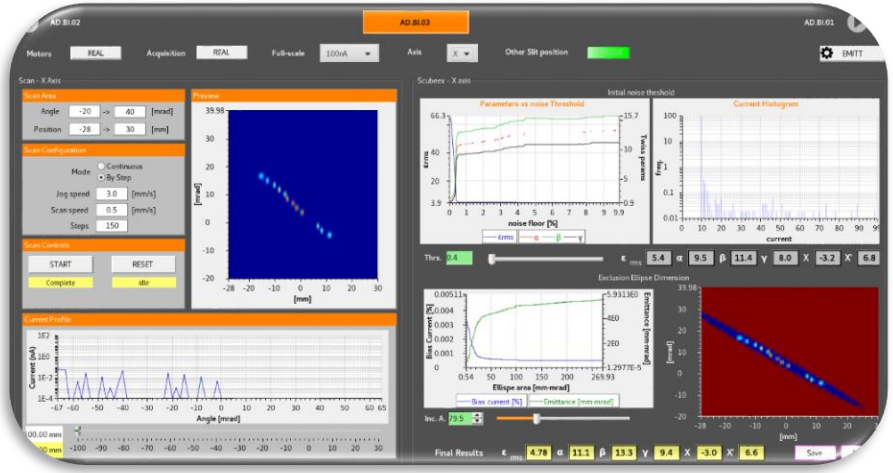

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