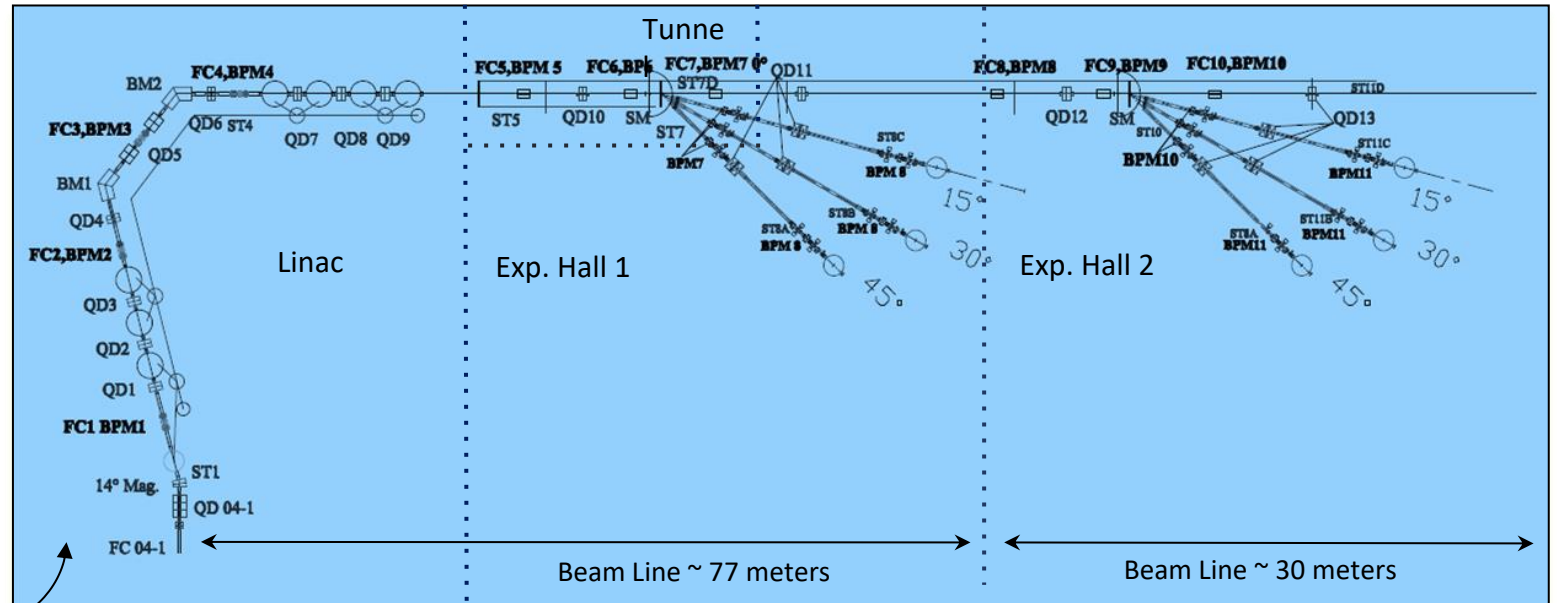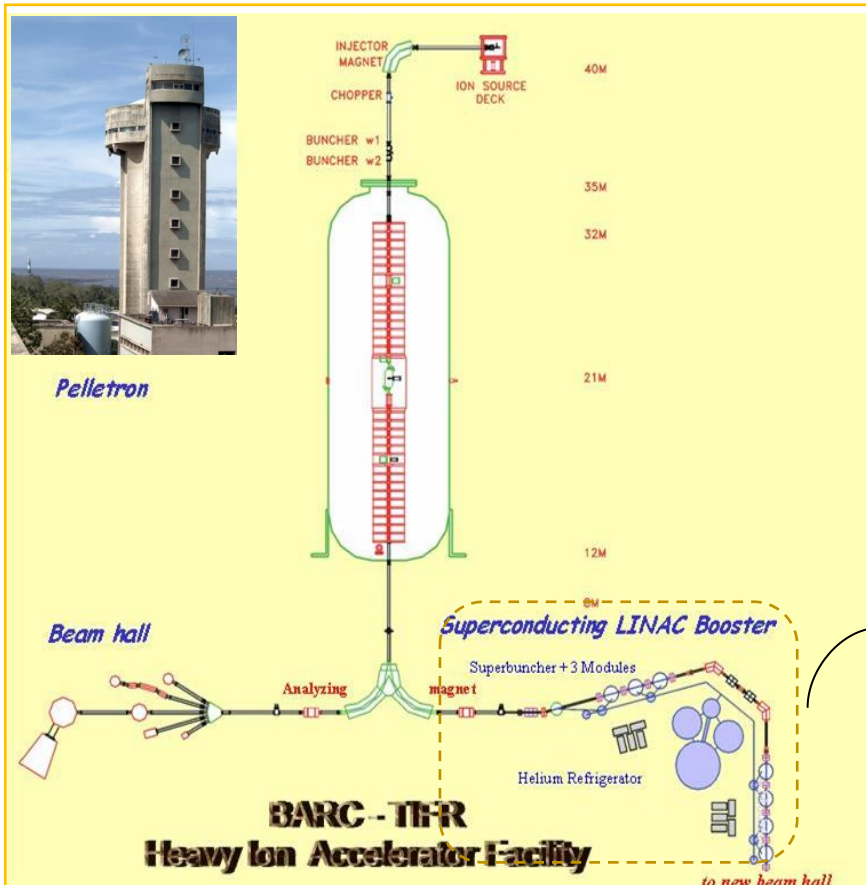# EPICS based Linac Beam Transport & Diagnostic System

Catarina Rozario

Pelletron Linac Facility, TIFR Mumbai
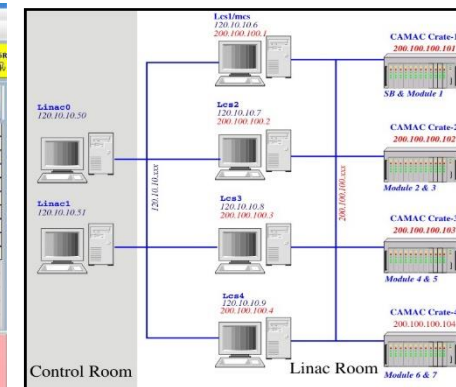
Pelletron Linac Facility at TIFR Mumbai

LINAC Specifications
Energy gain 14MV/q
Resonators 28 nos
Heavy ions   upto A ~80
E/A   ~ 5 to 12 MeV
Optimum velocity   ~0.1
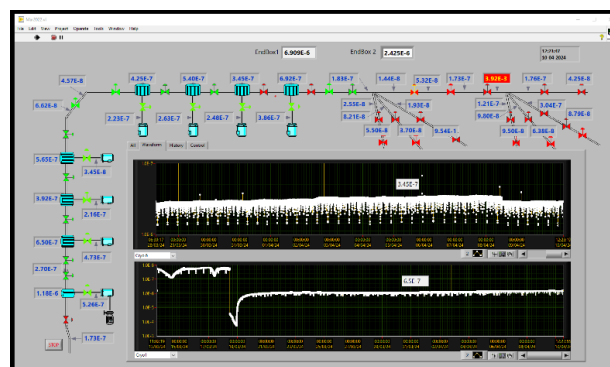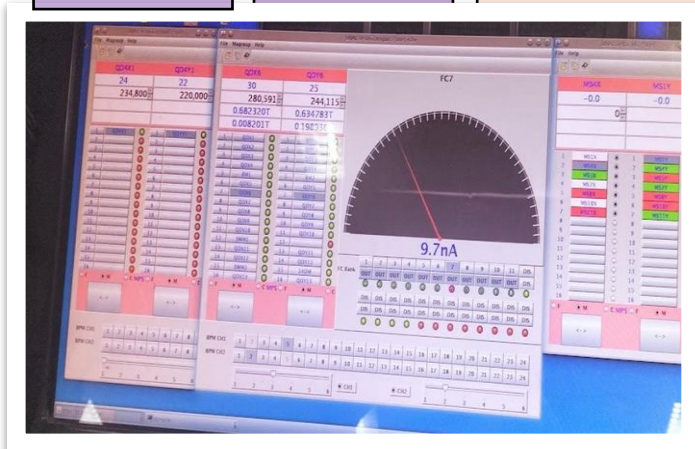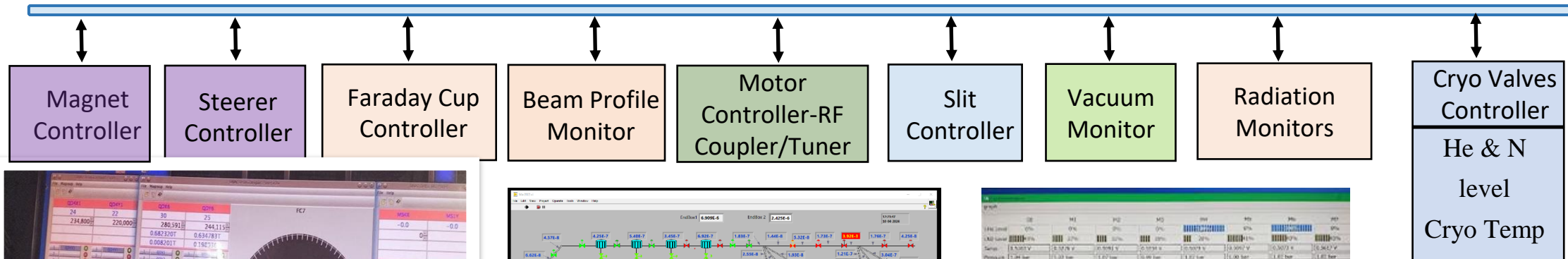Bunch width   200 to 1000ps
Beam Intensity 0.1 to 10 pnA

Existing LINAC Control System

- RF Control System – CAMAC hardware JAVA
  Beam Transport System -JAVA
- Beam Diagnostic System – JAVA
- Cryogenic Control Station –Qt
- Vacuum Monitoring System -LabVIEW
- Slit Controller- EPICS Qt
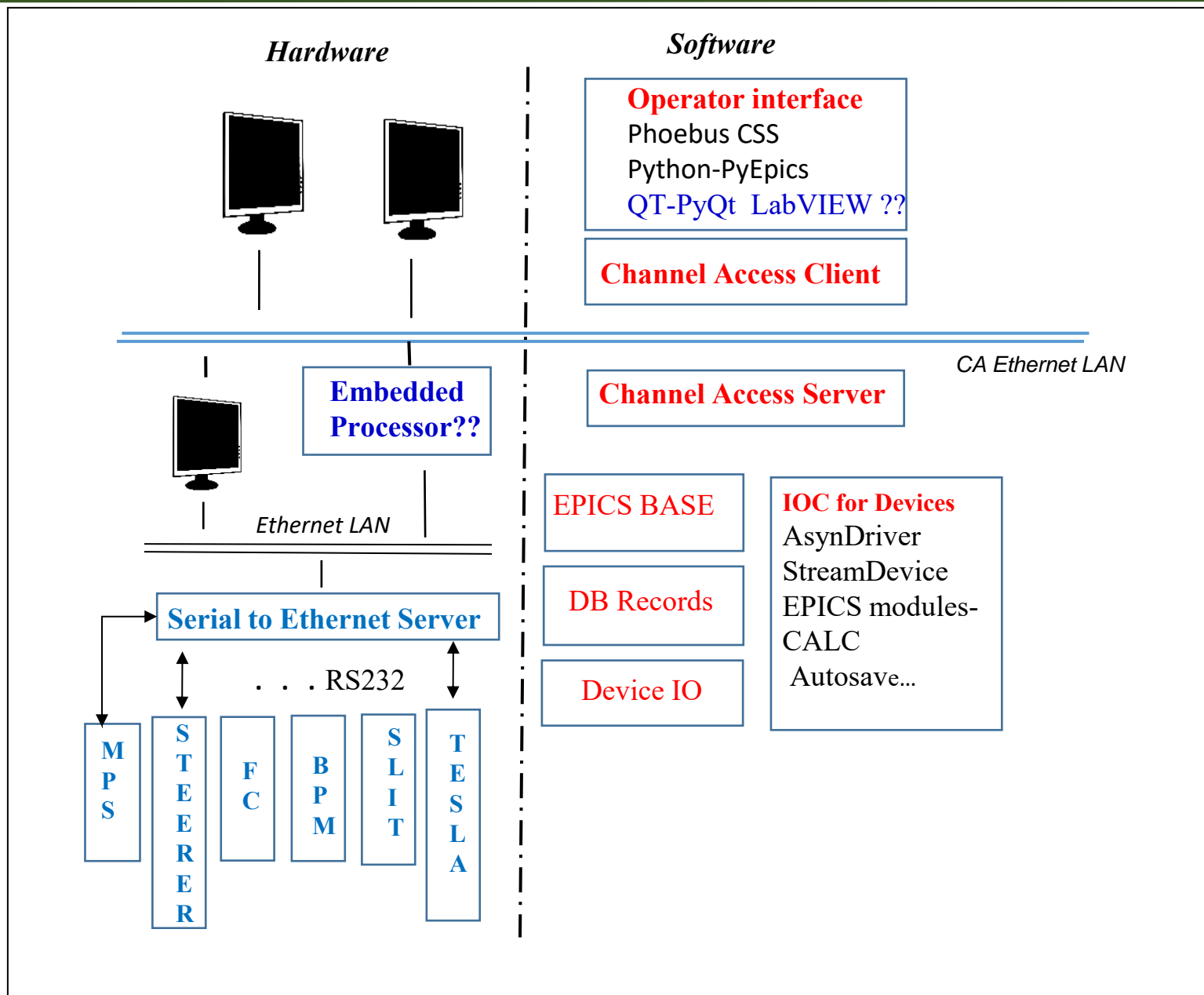- Motor Controller for Coupler –EPICS Qt
- Radiation Monitors -LabVIEW

CAMAC RF Controller

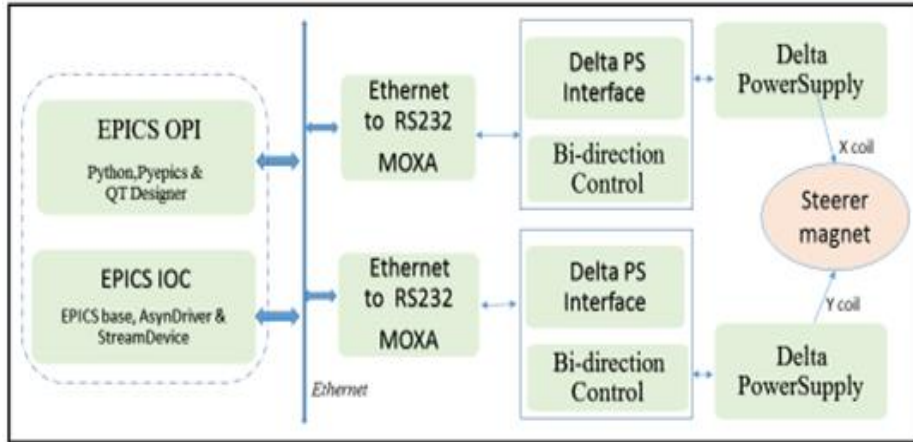*Ethernet LAN Network*

Magnet Controller	Steerer Controller	Faraday Cup Controller	Beam Profile Monitor	Motor Controller-RF Coupler/Tuner	Slit Controller	Vacuum Monitor	Radiation Monitors	Cryo Valves Controller
								He & N level Cryo Temp

EPICS – Hardware Software Layout

Development of Steerer Control using EPICS
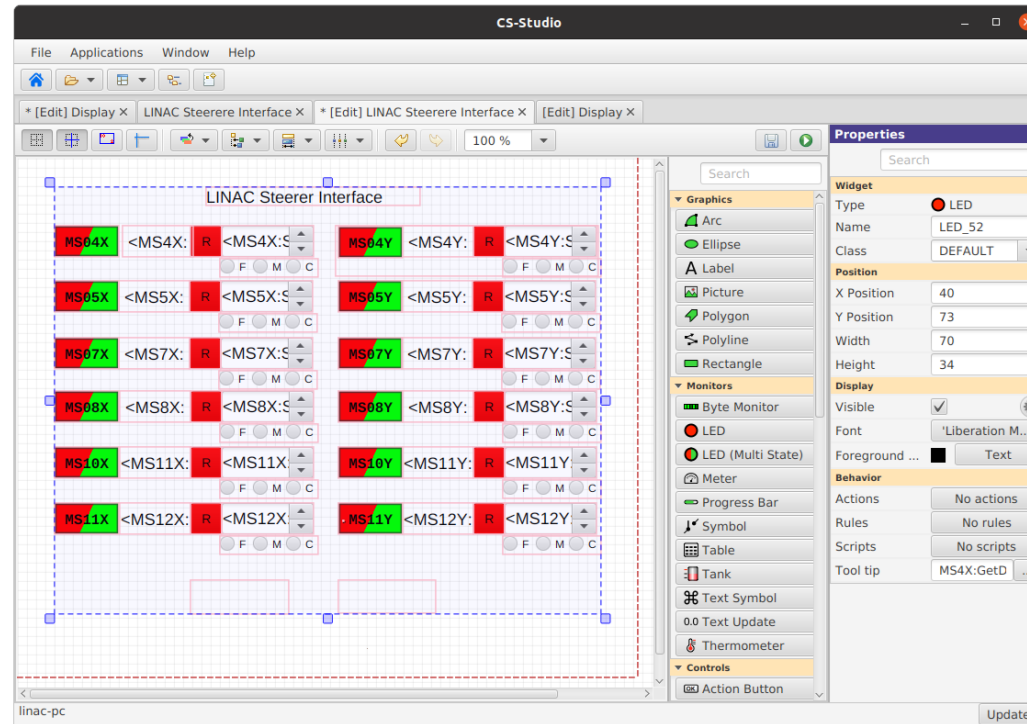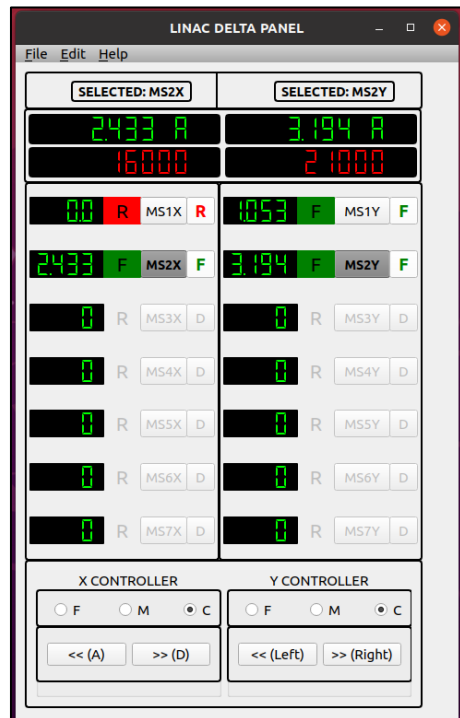

Implementation

EPICS IOC: Runs on Linux PC.
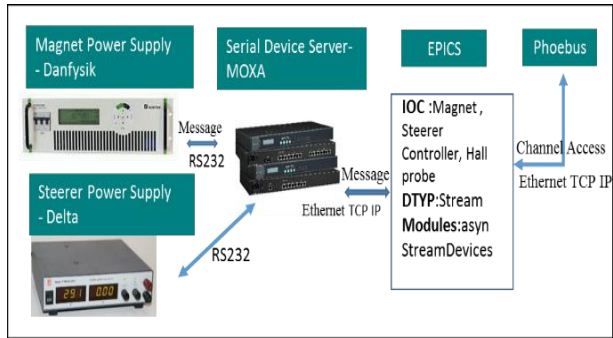   DB and Protocol files using Delta SCPI

EPICS OPI: PyEpics: Interface for CA library to Python
            QT Designer tool was used for creating GUI for python App

Limitations: Expertise to write, diagnose the python support code

Control – Linac Beam Transport System

EPICS database for Magnets

- Current Setting, limits, ranges(C,M,F) of 20 bit value
- Status Interlocks, readback Current
- Control function(on/off, reset)
- Per IOC-Multiple devices

- Dipole Quadrupole Magnets control using Danfysik Power Supply (9100 and 8500)
- Steerer magnet control using Delta PS
- Hall Probe Monitoring
- Implemented 20+ IOCs for 50 devices
- Configured Phoebus CSS Save & Restore tool – user defined PVs by snapshot

Beam and energy configuration file – Boron 11 +4, 50 MeV

Control – Beam Diagnostic System

20 + Linac Beam Diagnostic units - Faraday Cup (FC), Beam Profile Monitors(BPM) and adjustable X-Y slits communicate through serial port

FC

- Measures beam current (0.1nA to 1uA)
- Single packet data
- Records-Calc, mbbo,ai,bi,bo,Compress ..
- Achieved operator friendly dynamic full range meter movement

BPM Selector

- Scope Display of shape + position of beam
- 2 BPMs can be selected
- Gain selection
- Records-Calcout, mbbo,ao,bo

XY Slit

- Adjustment to collimator
- 15mm displacement range
- Controls direction & operation of motor
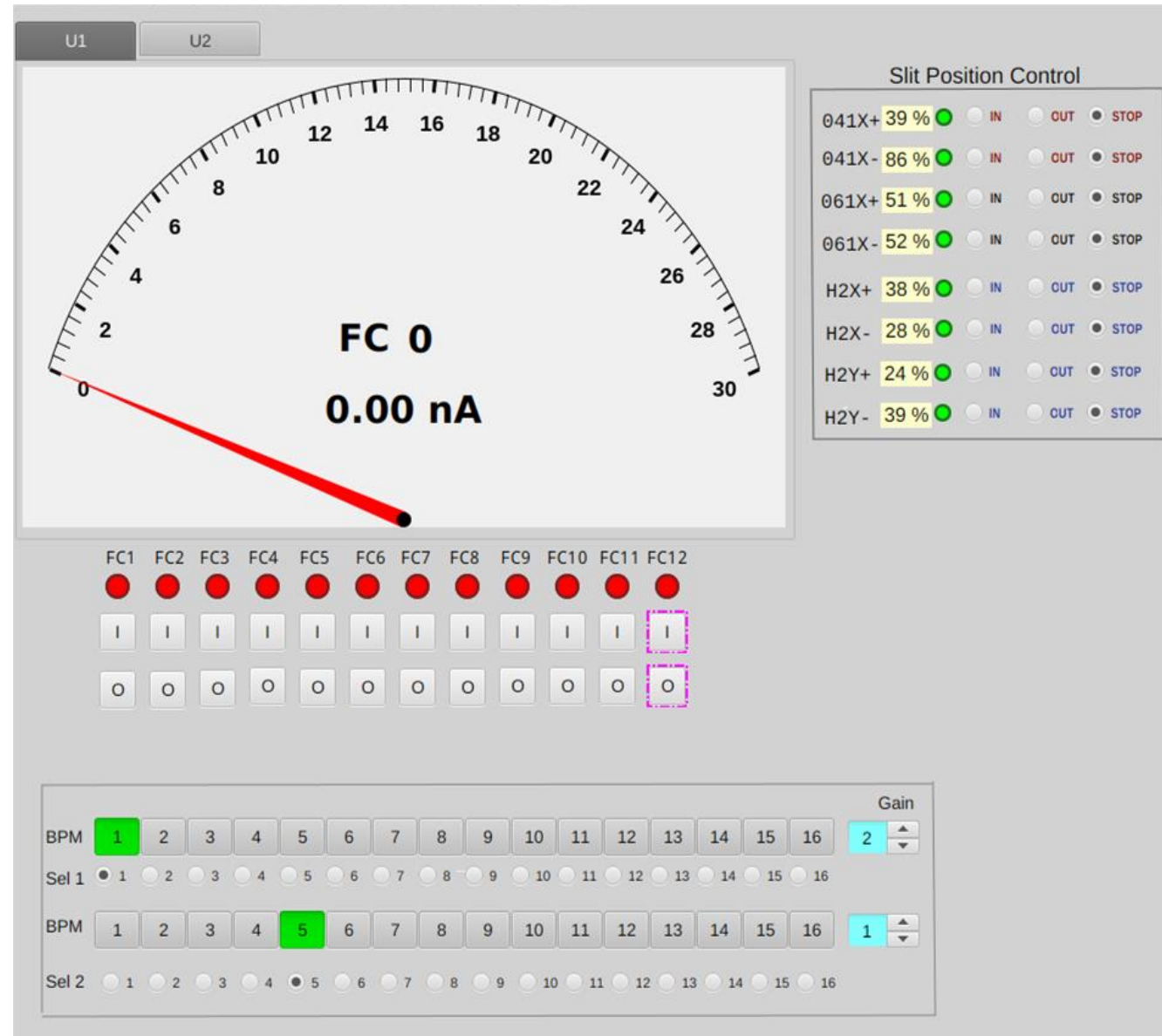
Summary

- Tested LINAC Beam Transport System with the Beam, thus, achieved EPICS integration to one phase of our system
- Preliminary testing to validate –Diagnostic System (Beam Profile Monitor, Faraday Cup, Slit controller.)
- Future Plan to integrate are
  - Vacuum System (monitoring of the gauges and gate valves)
  - Radiation Area Monitors
  - Cryogenic Distribution valve controls
  - PLC based Cryogenic Refrigeration
  - PLC based Vacuum Furnace
  - Beam Line Component of Electron Cyclotron Resonance (ECR)

Summary

- Tested LINAC Beam Transport System with the Beam, thus, achieved EPICS integration to one phase of our system
- Preliminary testing –Diagnostic System (Beam Profile Monitor, Faraday Cup, Slit controller.)
- Future Plan to port these system to EPICS
    - Vacuum System (monitoring of the gauges and gate valves)
    - Radiation Area Monitors
    - Cryogenic Distribution valve controls
    - PLC based Cryogenic Refrigeration
    - PLC based Vacuum Furnace
    - Beam Line Component of Electron Cyclotron Resonance (ECR)

Thanks to Prof Vandana Nanal, Prof R Palit and my colleagues at PLF TIFR

Special thanks to Mr. Sandeep Malu