A BEAM PROFILER AND EMITTANCE METER FOR THE SPES PROJECT AT INFN-LNL

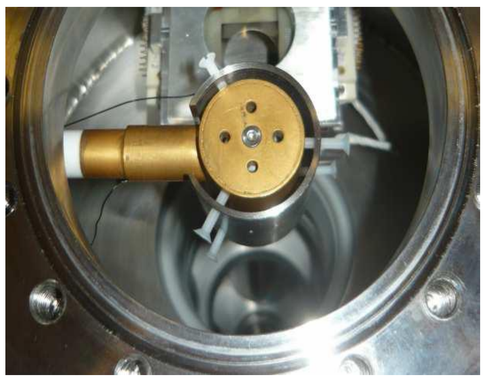
G.Bassato, A.Andrighetto, N.Conforto, M. Giacchini, J.A.Montano, M.Poggi, J.A.Vásquez
INFN-LNL, Legnaro (PD), Italy

Abstract

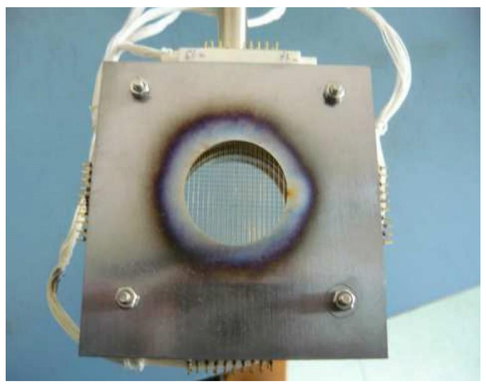
New beam diagnostics devices were developed for SPES project [1]. The grid profiler and the faraday cup were derived from ALPI LINAC instrumentation, while the emittance meter is a completely new design.

The control software has been rewritten from scratch using EPICS. We briebly describe the major enhancements of this system and focus on features provided by the new software design.

THE DIAGNOSTIC DEVICES



The faraday cup



The grid profiler

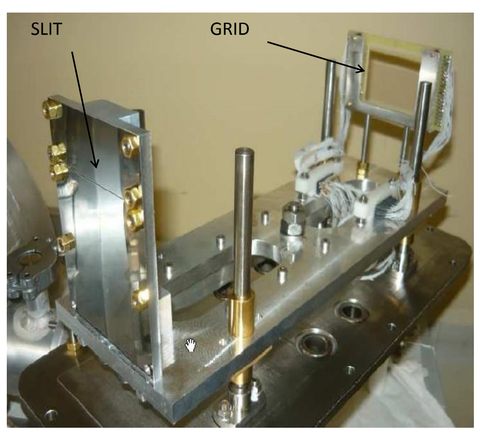
- The beam profiler is based on a couple of grids (horizontal and vertical) each one made of 40 wires.
- The faraday cup is inserted /extracted by a pneumatic actuator
- Grids are moved by stepper motors

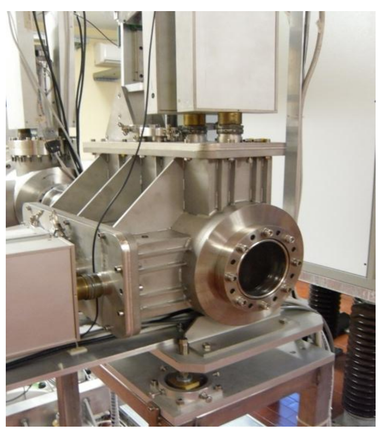
THE DATA ACQUISITION SYSTEM

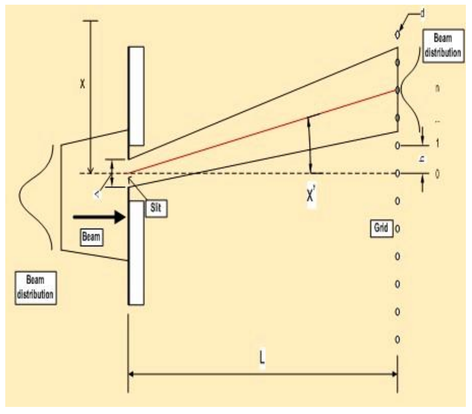
- Currents collected by grids and faraday cups are converted to voltage signals by conventional analog electronics.
- Grid signals are multiplexed and serialized before being sent to the data acquisition system over coaxial cables.
- A 40 wire grid requires only one ADC channel
- The A/D conversion takes place in a VME card (XYCom566)
- The crate controller is an Emerson MV3100
- The stepper motor controllers are VME cards developed in house

THE EMITTANCE METER

The emittance meter [2] is based on two identical moveable slits (collimators) placed in front of a couple of horizontal and vertical grids.





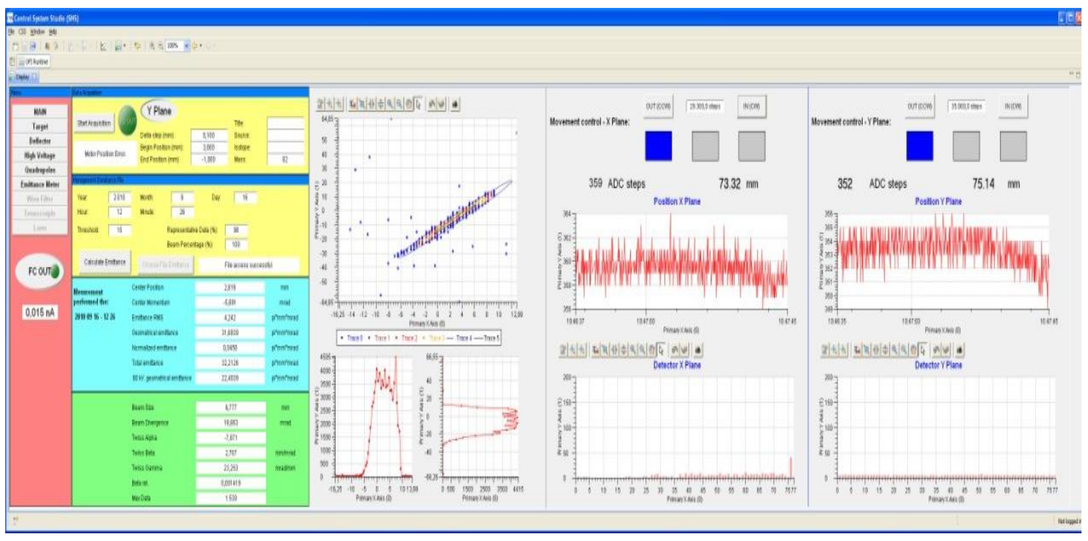


- Slits aperture: 0.3 mm.
- Distance between grid wires: 1 mm.
- Collimator distance from grids: 300 mm.
- Angular resolution 60 mrad
- Collimator position read out from a linear encoder

By moving the collimators up and down (or right to left) it is possible to scan the whole beam area and evaluate the beam divergence by measuring the grid currents for different collimator's positions.

THE CONTROL SOFTWARE

- The software of beam diagnostics system is based on EPICS
- Used platforms: VxWorks 6.8 for IOC on Emerson MV3100, Linux for supervisor functions and emittance calculations.
- Drivers for XYCom I/O boards adapted for EPICS R3.14.10
- New drivers written for stepper motor controllers.
- The graphic interface has been realized using CSS [3].
- EPICS archiver configured to work with mySQL.



The graphic user interface: snapshot of CSS screen

THE EMITTANCE MEASUREMENT PROGRAM

- Measurement cycle controlled by user defined-parameters (number of steps, correction factors, noise filtering thresholds, etc.)
- Emittance calculation performed on a Linux PC by a stand-alone EPICS client application written in C++
- Only minimal pre-processing done in IOC database on raw data, mainly using C-sub records
- Samples of acquired waveform records sent to the EPICS Archiver for subsequent review.

CONCLUSION

- The new emittance measurement system is now in routine operation in SPES Ion Source and Target laboratory. It resulted to be a very sensitive, low noise, instrument.
- EPICS provided a powerful environment for software realization. It will be the base for all SPES controls.
- CSS has proven to be a very flexible tool and will be used for future developments of client applications.
- The software realized for SPES will be ported with minimal adaption to ALPI beam diagnostics.

ACKNOWLEDGMENTS

We are grateful to M. Davidsaver (BNL) for rewriting the XYCOM566 driver and to D. Chabot (BNL) for developing the EPICS device support for our stepper motor controller.

REFERENCES

[1] http://www.lnl.infn.it/~spesweb/
[2] J. Montano, J. Vasquez et al. "Off line emittance measurements of the SPES ion source at LNL", N.I.M.-A, vol. 648, aug. 2011
[3] http://ics-web.sns.ornl.gov/css/