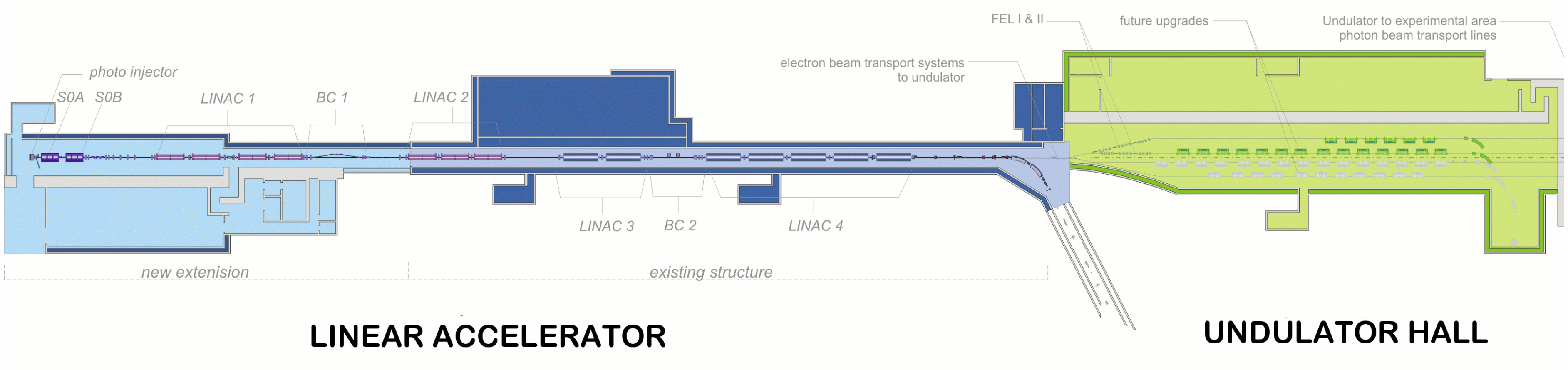
Beam Stabilization at FERMI@ELETTRA

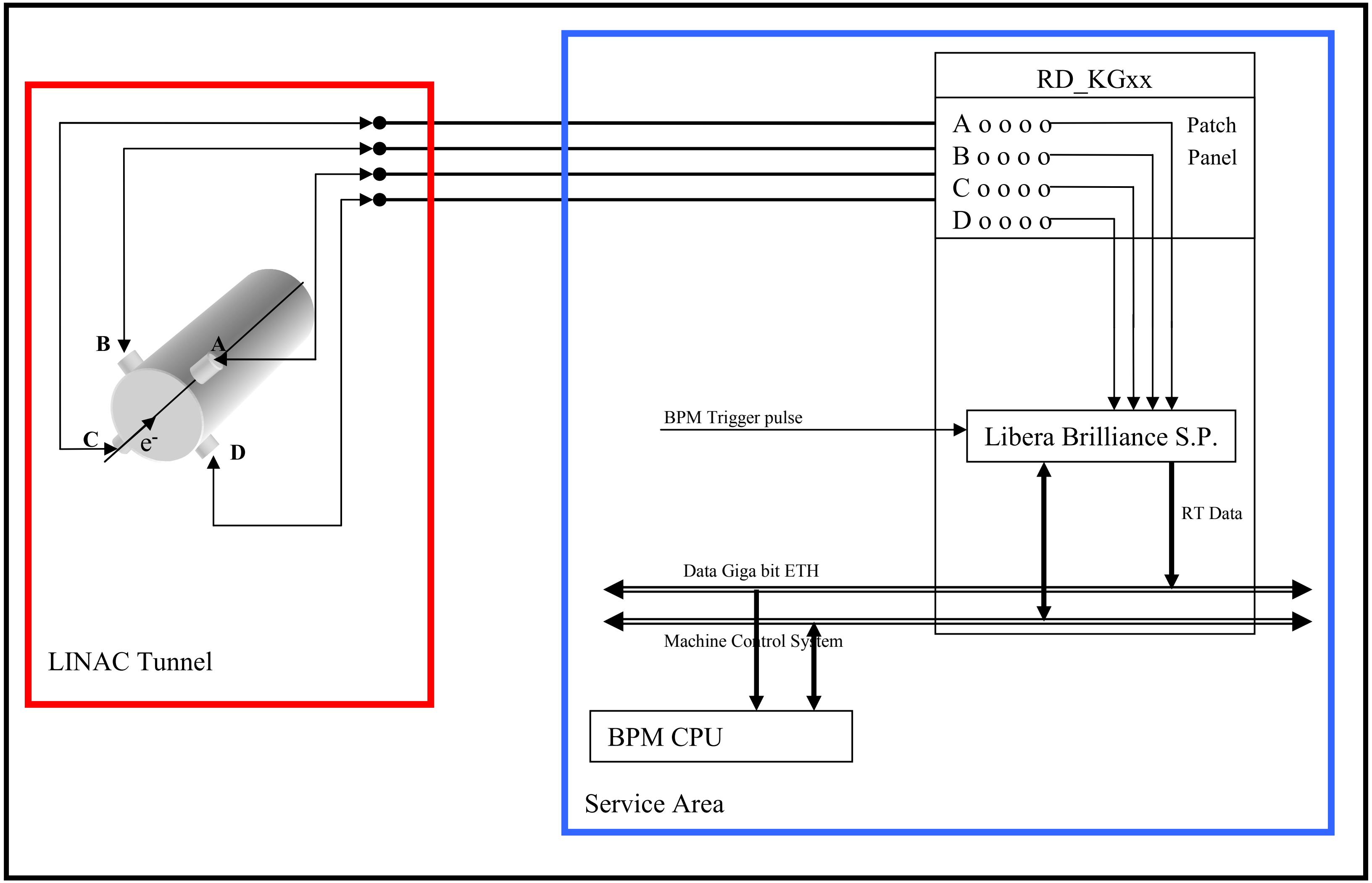
S.Bassanese

S.Cleva

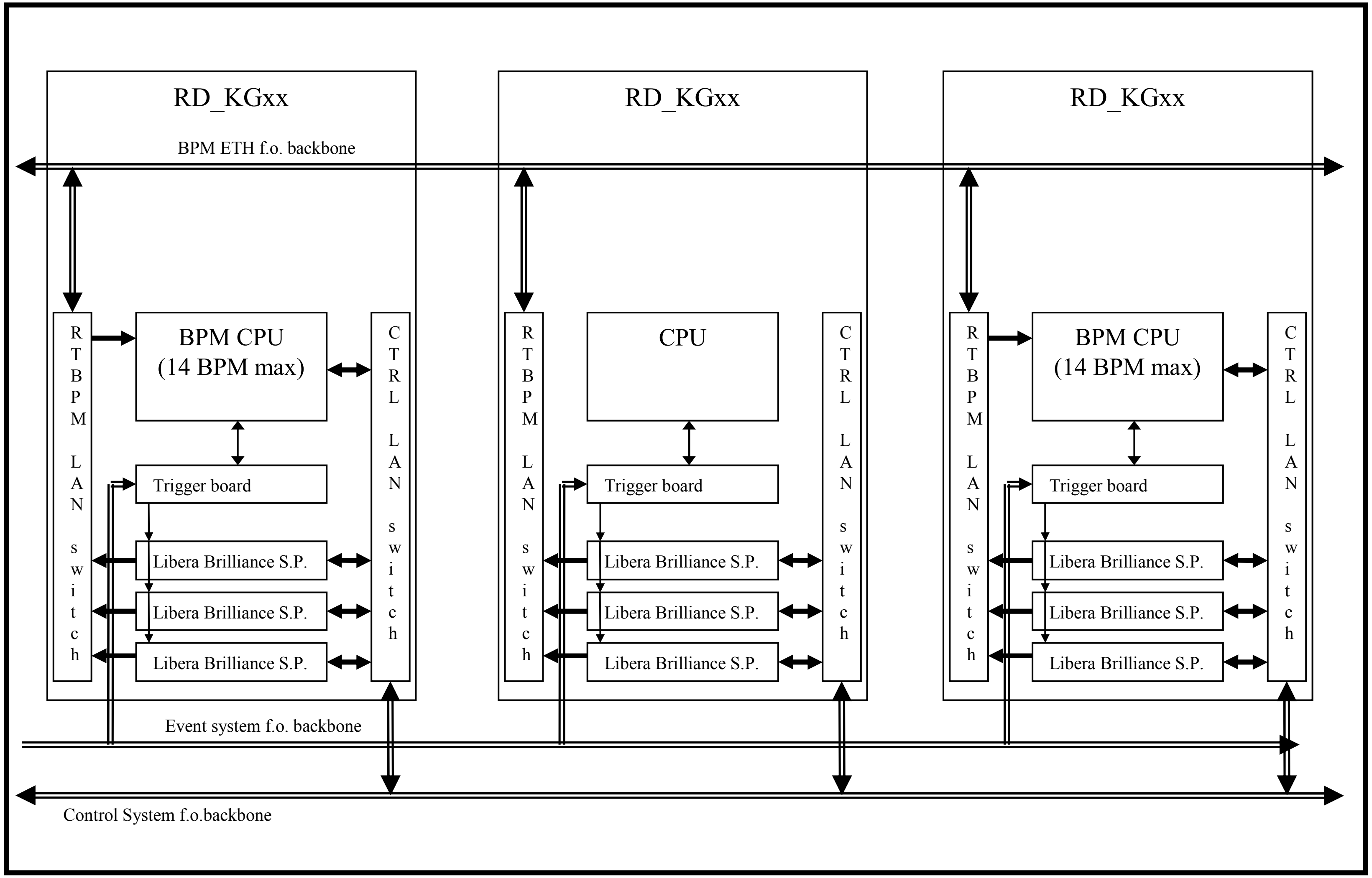
G.Gaio



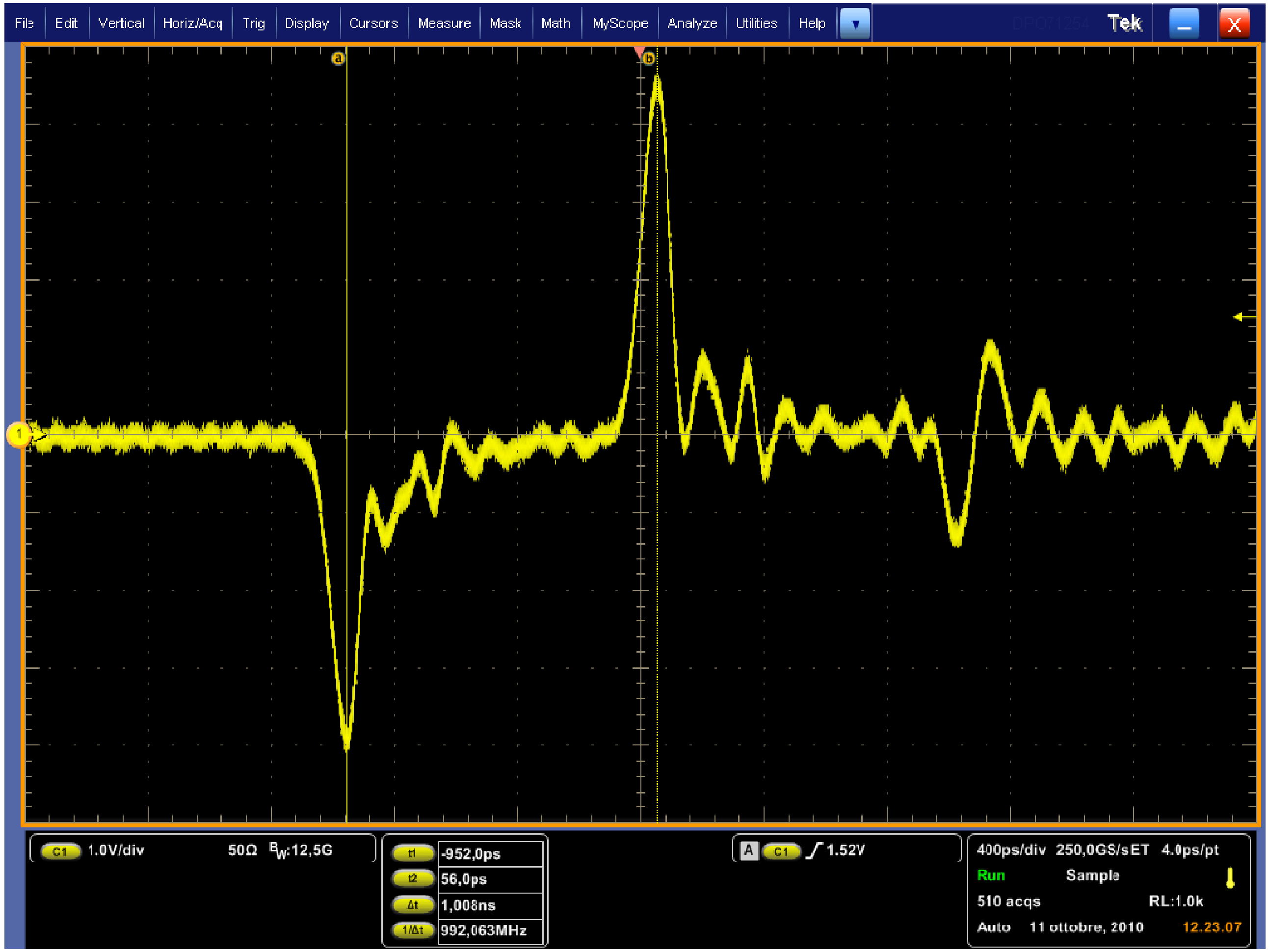
FERMI's BPM system layout



BPM System architecture



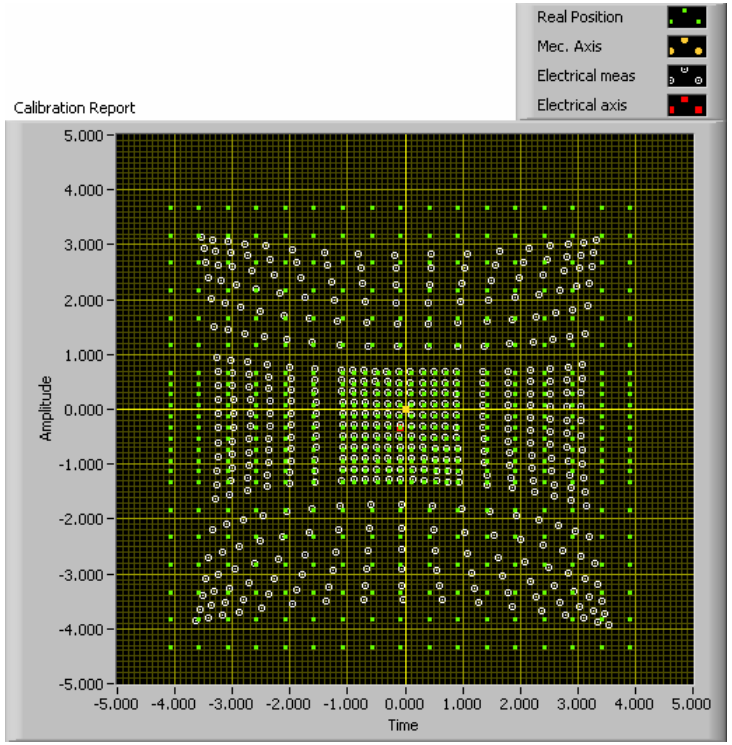
Scope signals



- Beam signal from the stripline BPM pickup as it arrives to the Brilliance electronics acquired with a Tek 12.5 GHz BW scope.
- The beam charge was 250 pC.
- 35 m length Aircom+ cable cascaded with 6dB attenuator.

Laboratory Calibration

A laboratory calibration of each pickup was done to verify the offset between mechanical and electrical axis of each BPM.



During the calibration a map of a 4x4 mm region around the electrical axis of the pickup was done

Field Calibration

Possible cable and attenuator mismatch in the same BPM can lead to error in the position measurement. To compensate this a field calibration was performed with a standard RF signal feeding a 1 to 4 splitter of known channel to channel mismatch.

Where Q-BPM pair available a Beam Based Alignment procedure is used to properly compensate machanical misalignment.

In addition to beam position measurement the system can be used to measure the charge along the machine using the signal intensity (sum)

To properly compare the signal intensity from different BPM an intensity calibration is needed: the same RF signal was applied to all the system measuring the sum signal then a normalization factor was applied.

Control system integration

The integration of the Brilliance SP BPM in the FERMI control system was obtained developing a embedded tango server running on each Libera Brilliance able to interface the equipment to the control system to properly setup parameters at startup and change them runtime.

The firmware was customized requiring the availability of all the main signal to the dedicated gigabit ethernet port so the control system receives all the signals bunch by bunch:

- **Channel amplitude (Va, Vb, Vc, Vd)**
- **Intensity (Sum)**
- **Q**
- **Position (X,Y)**
- **Status**
- **Counter**
- **Raw data (150 sample of each ADC channel)**

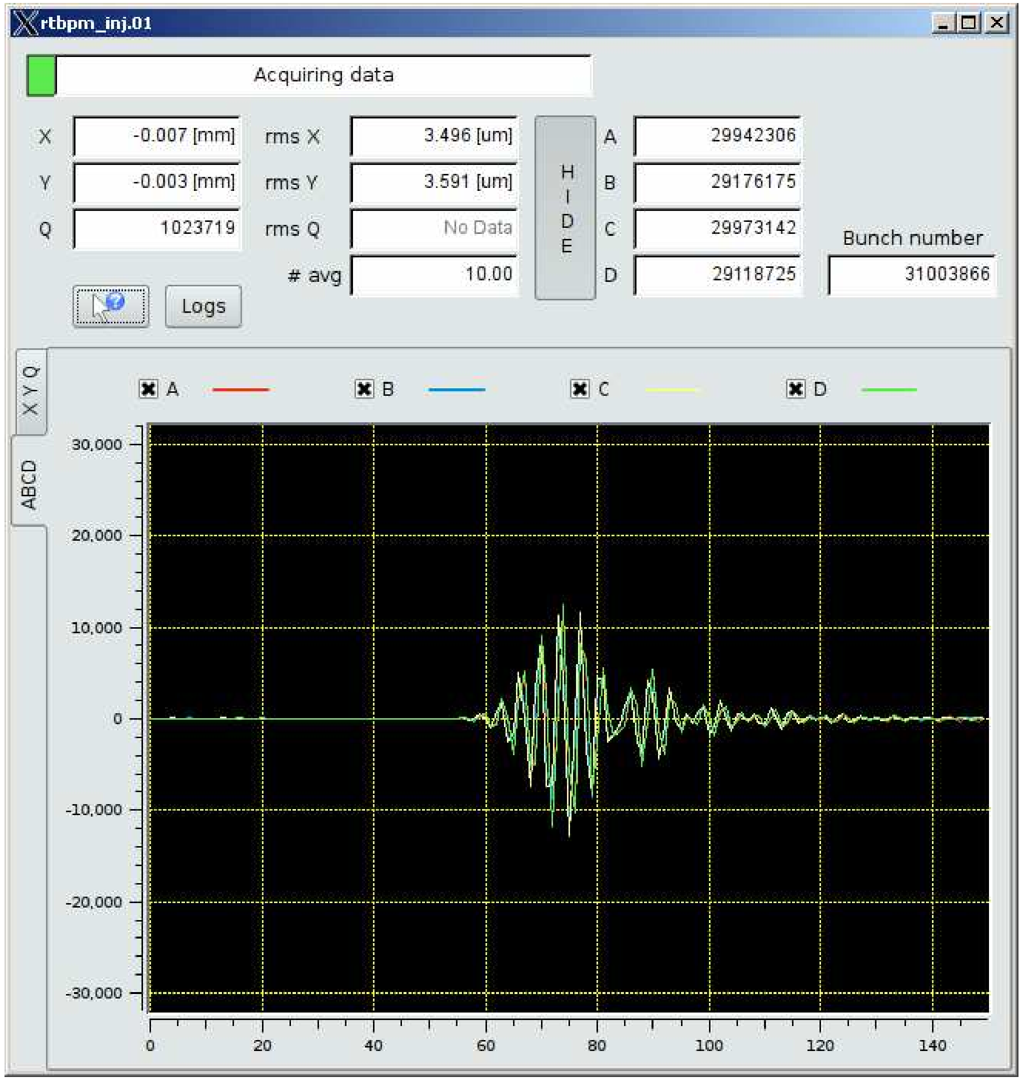
The main use of BPM system is in the trajectory feedback in which a set of selectable horizontal and vertical correctors are used to maintain the beam trajectory measured by BPM.

A secondary application is the charge measurement obtained from the intensity of the signal.

BPM panels

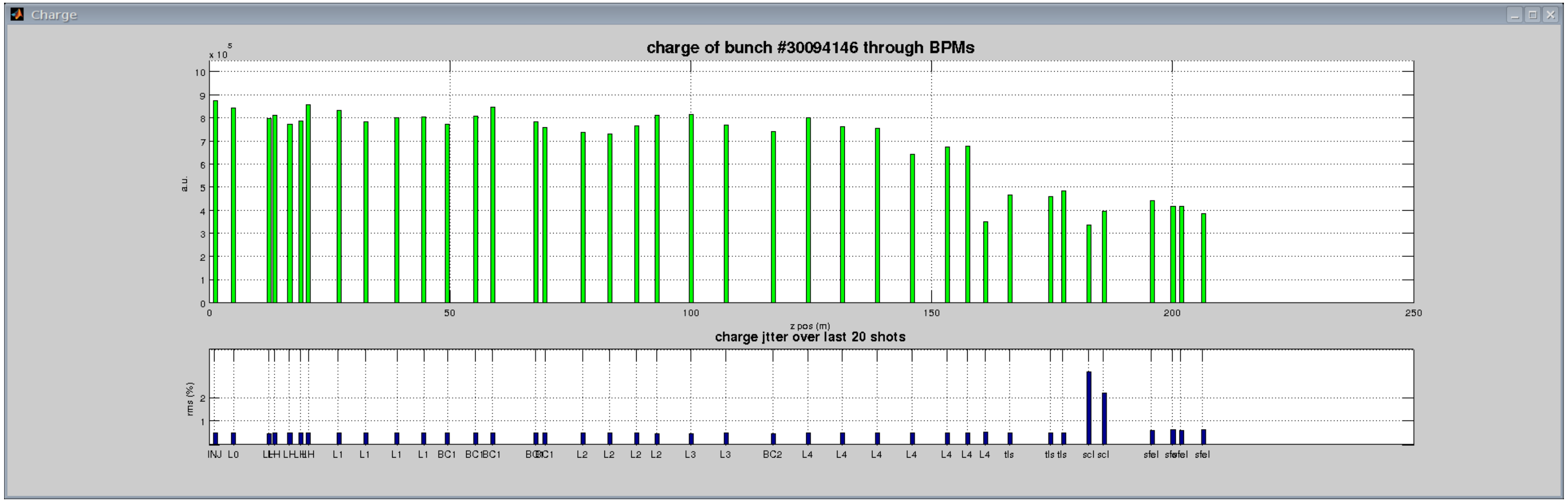
The results of beam position measurement are available in a workstation "atomic" panel that reports all the data from a single BPM.

The most interesting data are visible in the standard panel while clicking on the "MORE" button a more detailed view of the data acquired are available



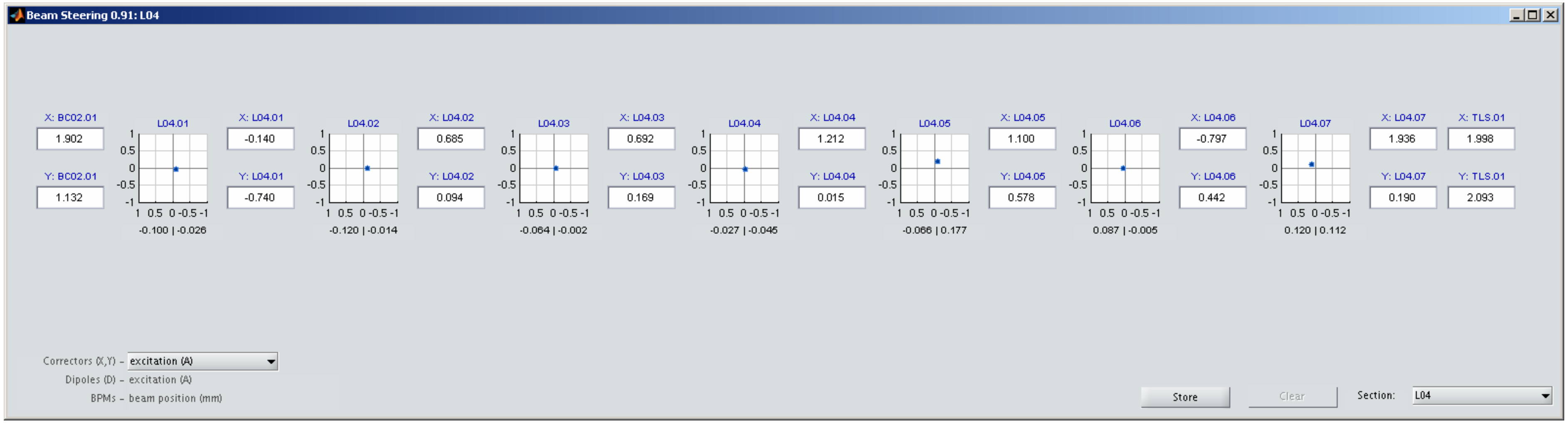
Using BPM as beam charge monitor

A Matlab High Level sw application read the charge of each BPM and plot it versus the machine "z" coordinate (M.Trovò)



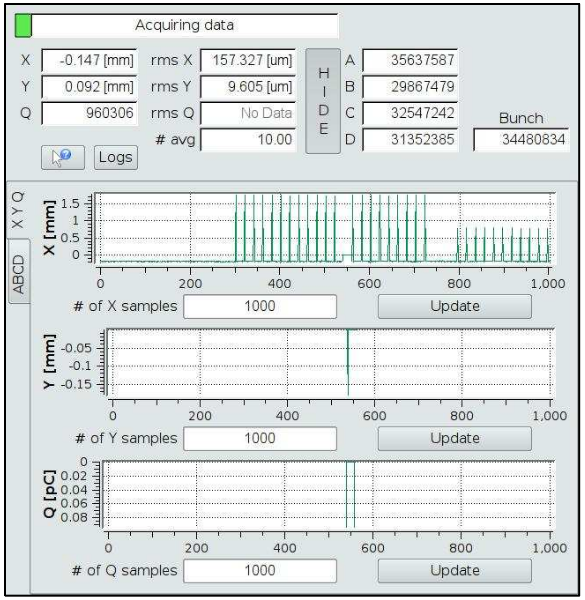
High Level SW application
Beam Steering tool

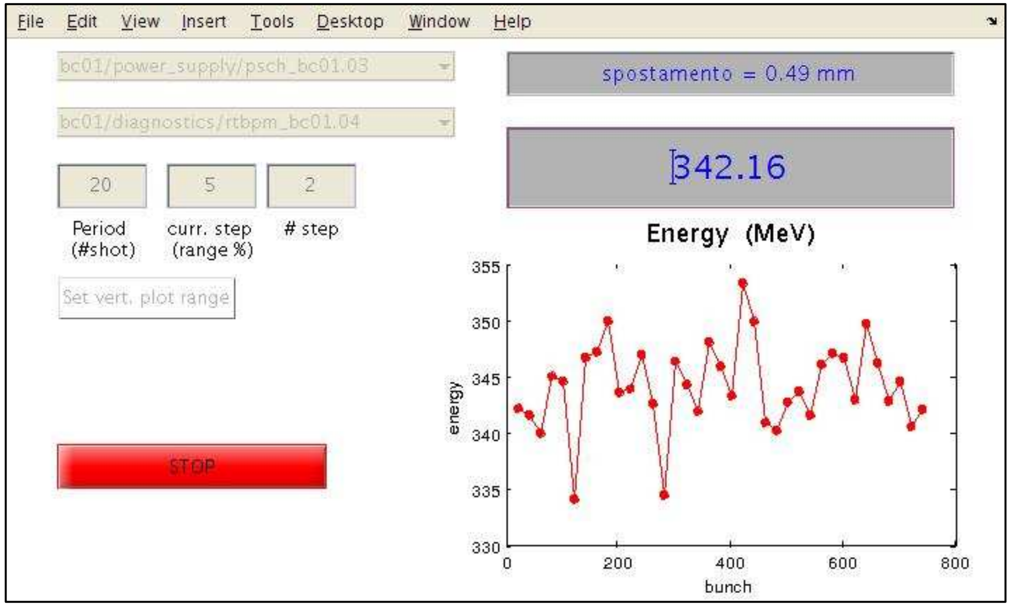
Some Matlab High Level software application have been developed to represent the BPM data in a convenient way for phisics studies or to operate the machine (L.Froehlich).



High Level SW application
Energy measurement

Another interesting application is the possibility to measure the beam energy along the machine using a corrector – BPM pair. From the Matlab GUI the operator can select the corrector to move the beam, the BPM to read the position, the current variation; then the application measure the beam displacement and from the strength of the corrector and the distance between corrector and BPM calculate the beam energy. The obtained result are in good agreement with spectrometer beam energy measurements. (M.Trovò)





Thank you