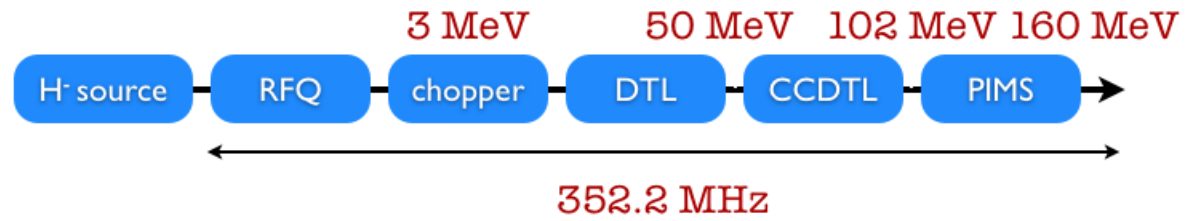
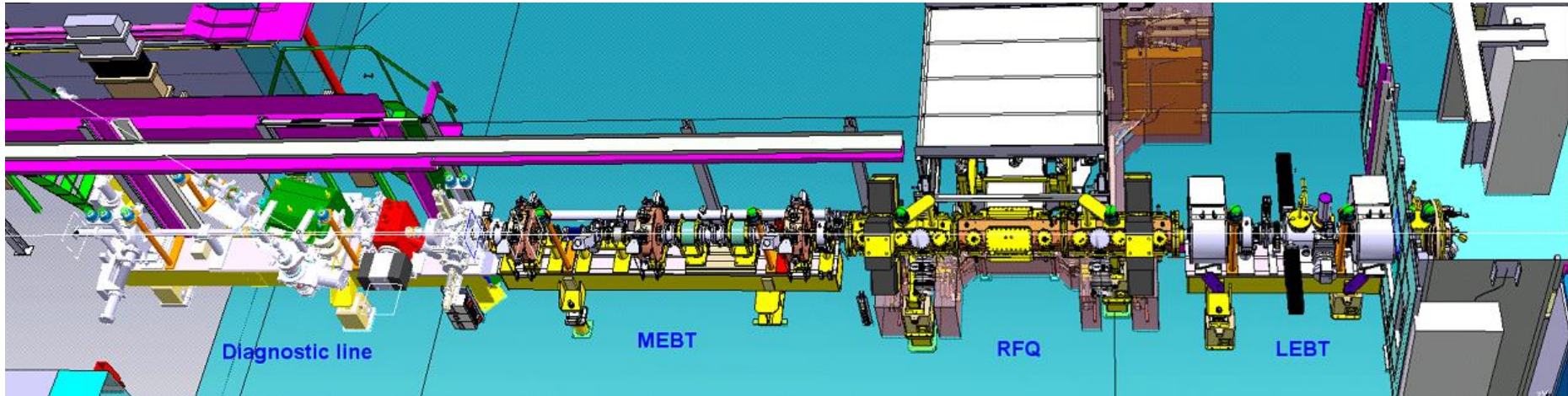


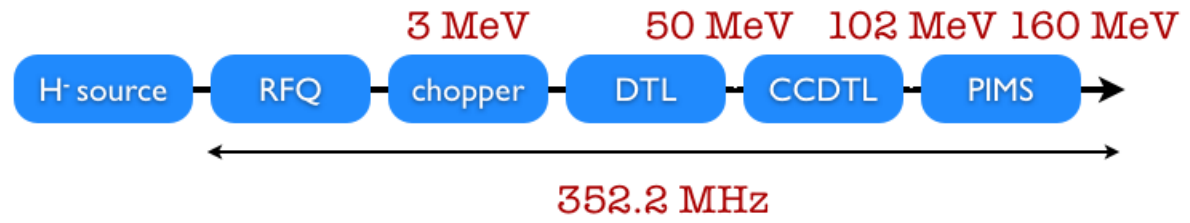
3 MeV instrumentation commissioning

U. Raich, Federico Roncarolo, F. Zocca
Linac-4 Beam Coordination Committee
10.1.2013

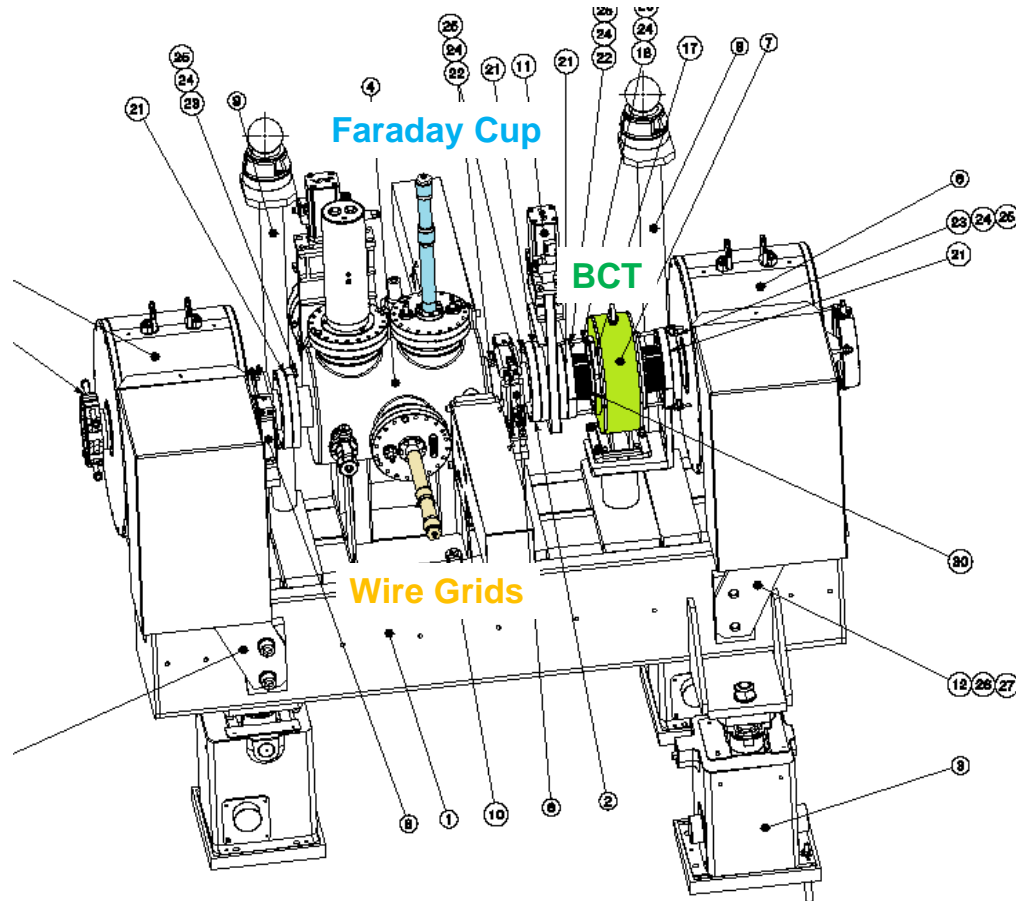


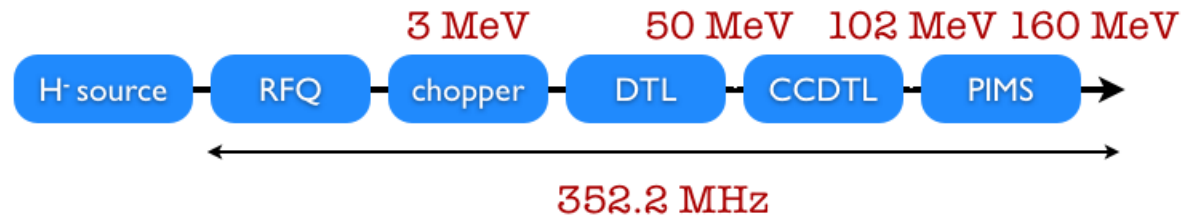
Current Setup



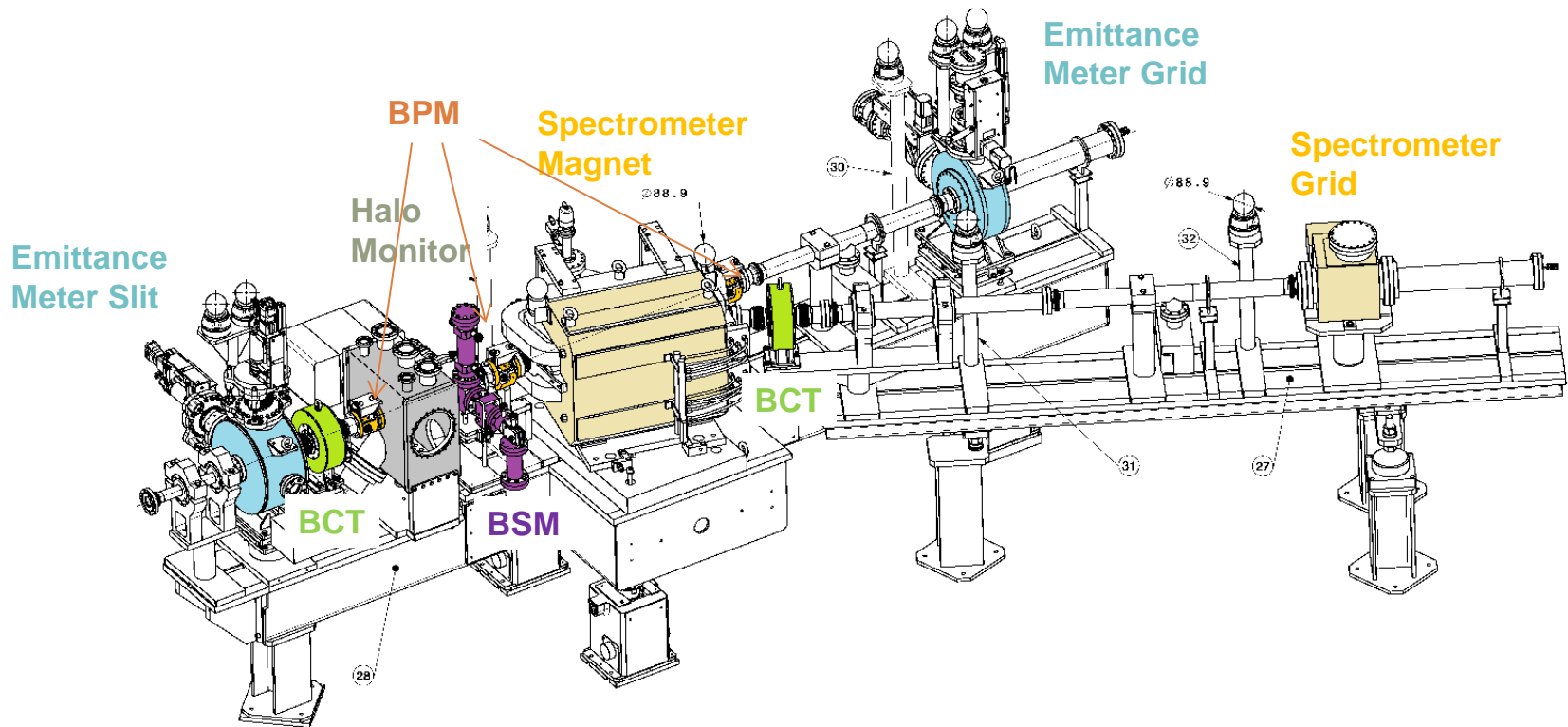


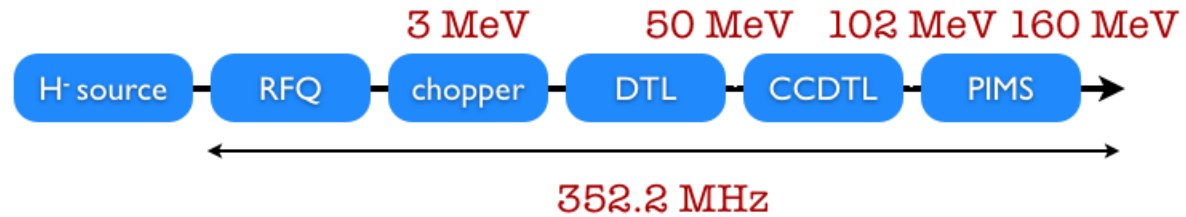
LEBT





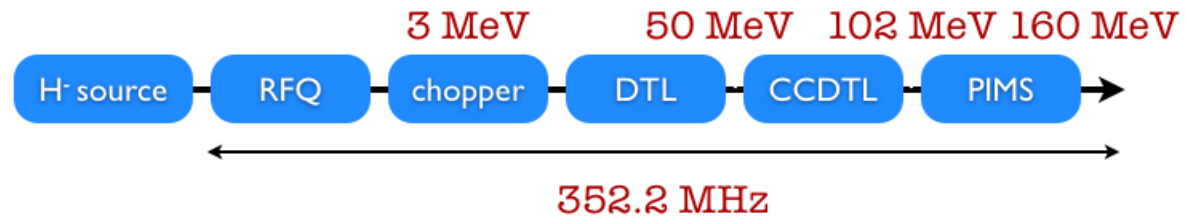
Measurement Bench





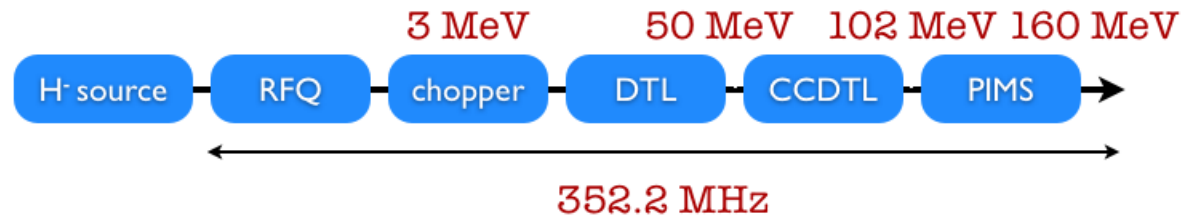
Instruments installed

- LEBT:
 - Faraday Cup
 - Wire Grid
- MEBT (chopper line)
 - 2 wire scanners
 - 2 Beam Current Transformers (BCTs)
- Measurement Line
 - Slit/Grid Emittance meter
 - 2 BCTs
 - 2 (3) Beam Position Monitors (BPMs)
 - Bunch Shape Monitor
 - Spectrometer
 - Halo Monitor



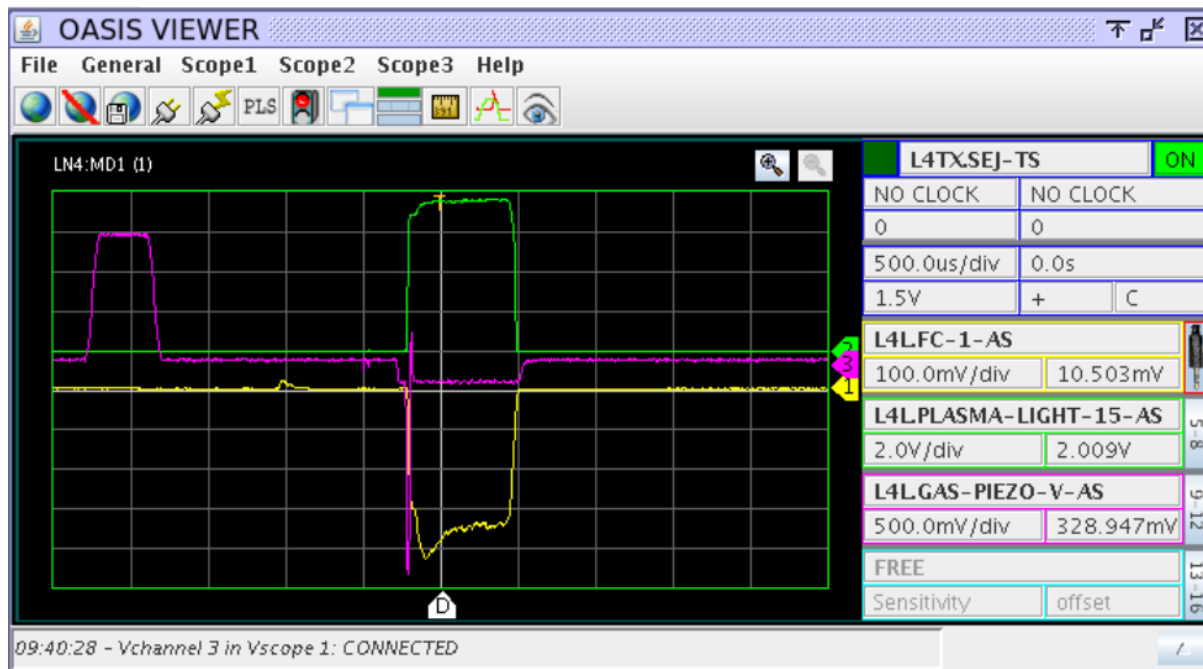
Measurement campaigns

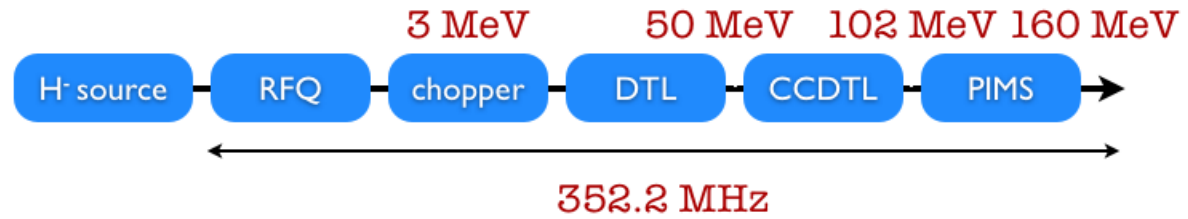
- ~ 3 months at the 3 MeV test stand
- May – October move and re-installation into the L4 tunnel
- Since November ~ 3 weeks of measurements



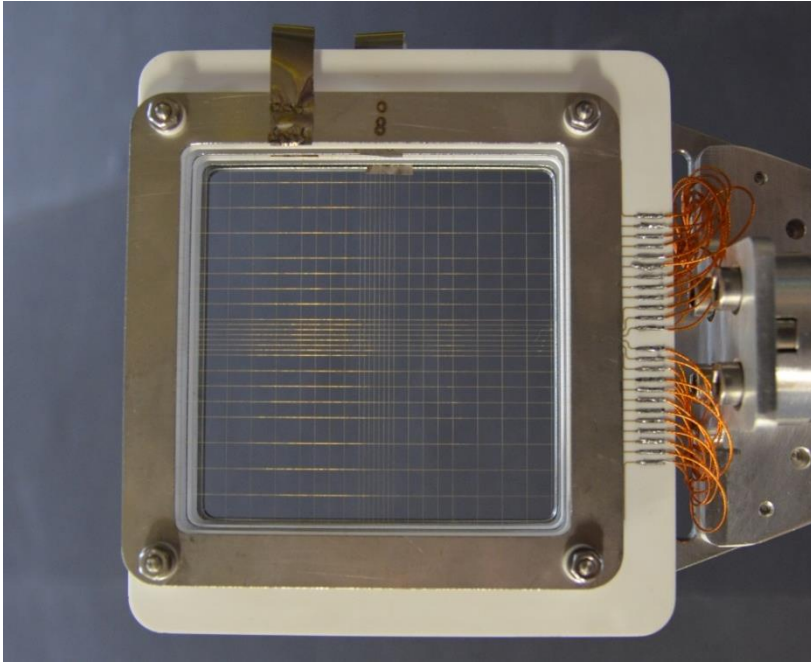
Faraday Cup

- Connected to remotely accessible Oscilloscope
- Guard ring polarization set to -1000V

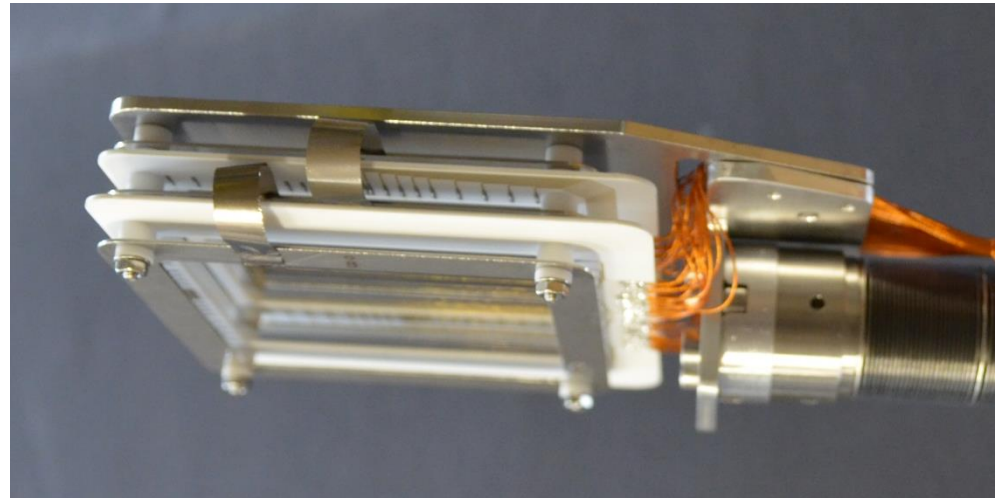


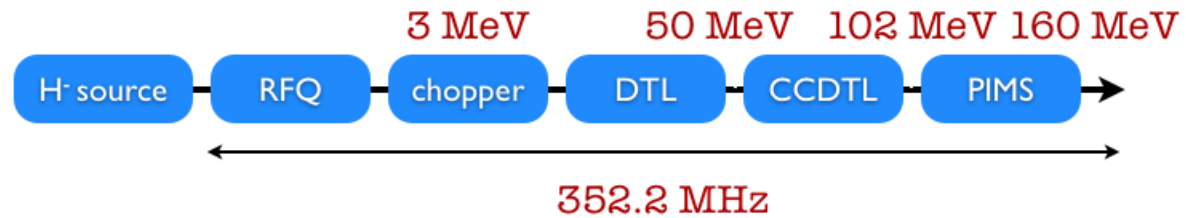


Wire Grids in LEBT



24 wires per plane with spacing 1mm, 3mm, 5mm
Wire signals sampled with 250 kHz

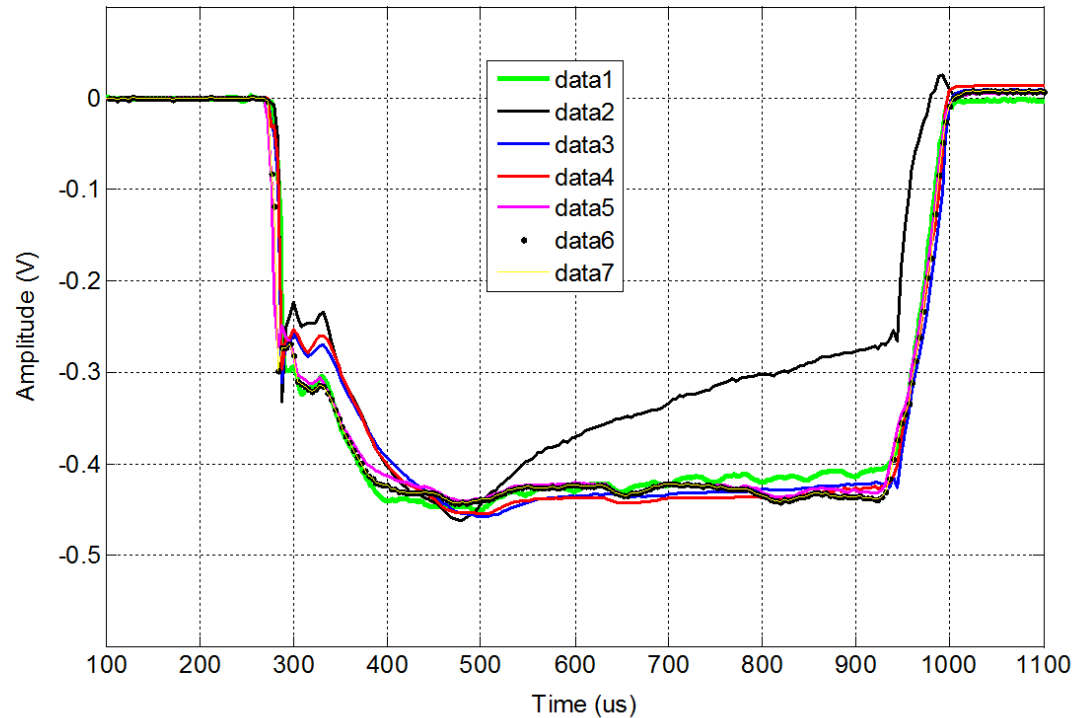


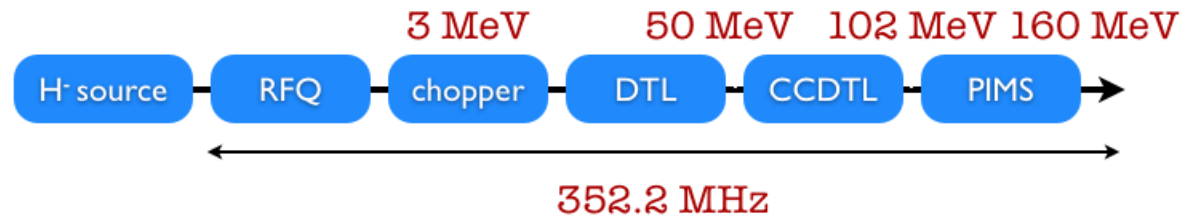


Wire Grid in LEBT

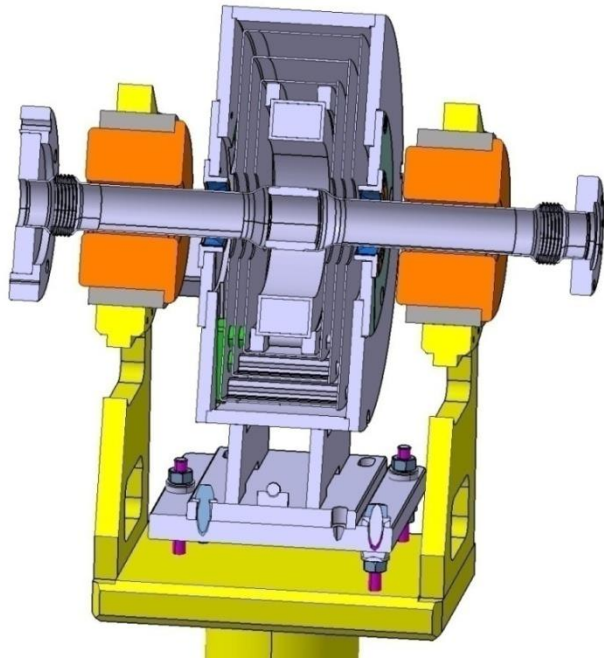
- Can polarize frame and wires
- Measurements for different solenoid settings
- Add wire signals and compare to FC
- Frame needs to be polarized, wire polarization is less important

H-plane sol110 FCin

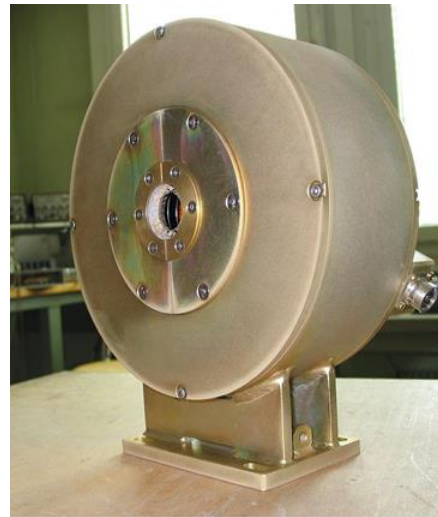


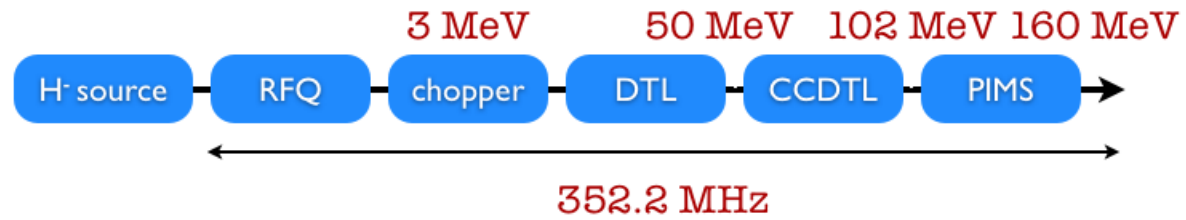


Beam Current Transformers

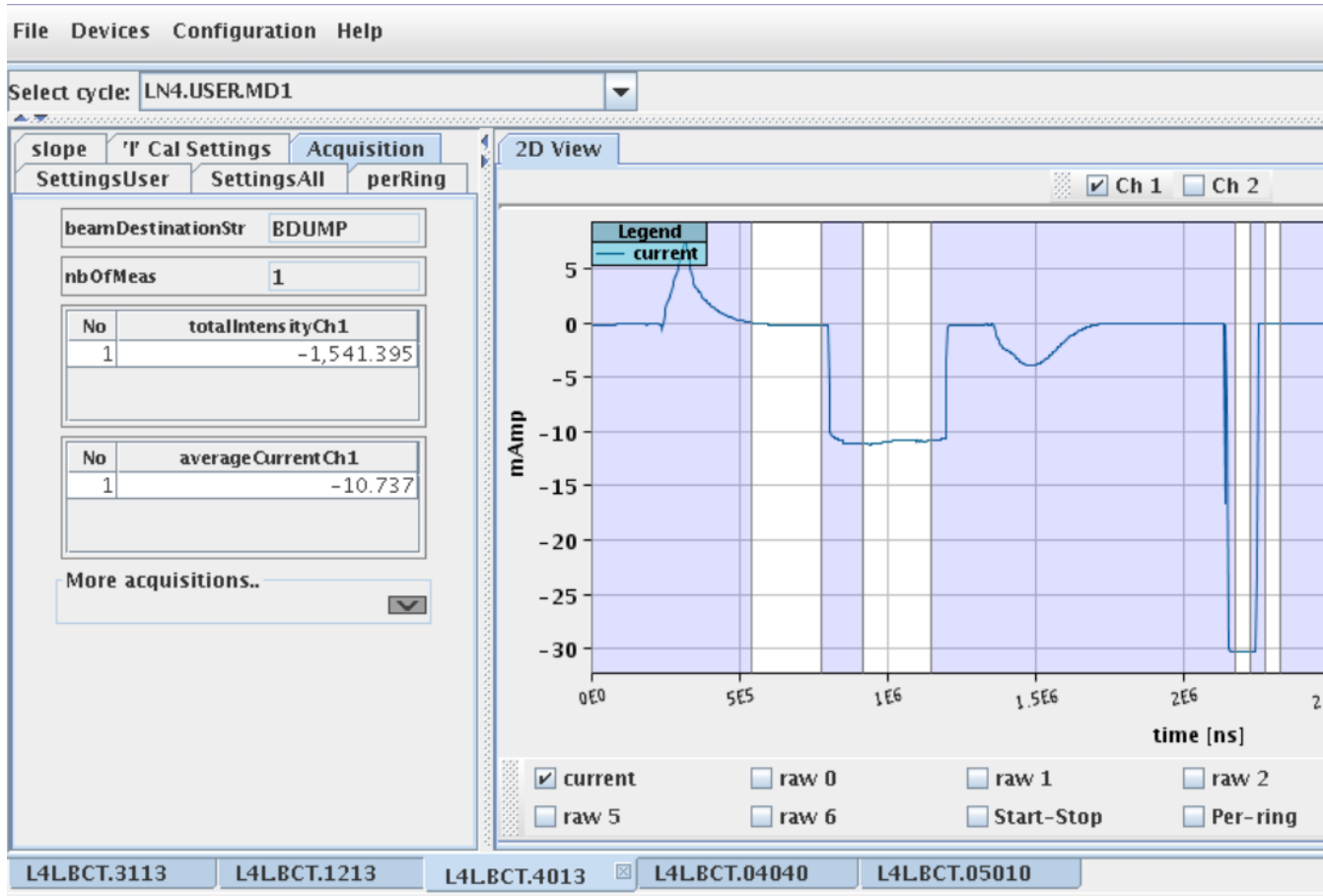


Instrument mostly used to see if beam arrives
Signal sampled at max. 200 MHz (2 samples added -> 100 MHz)
Multiple level shielding
Calibration after each beam pulse

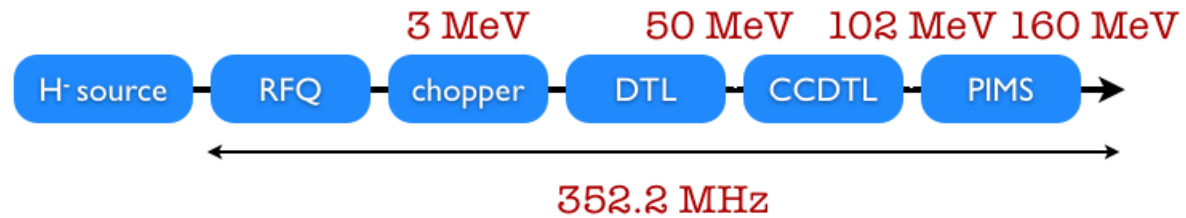




BCT signals

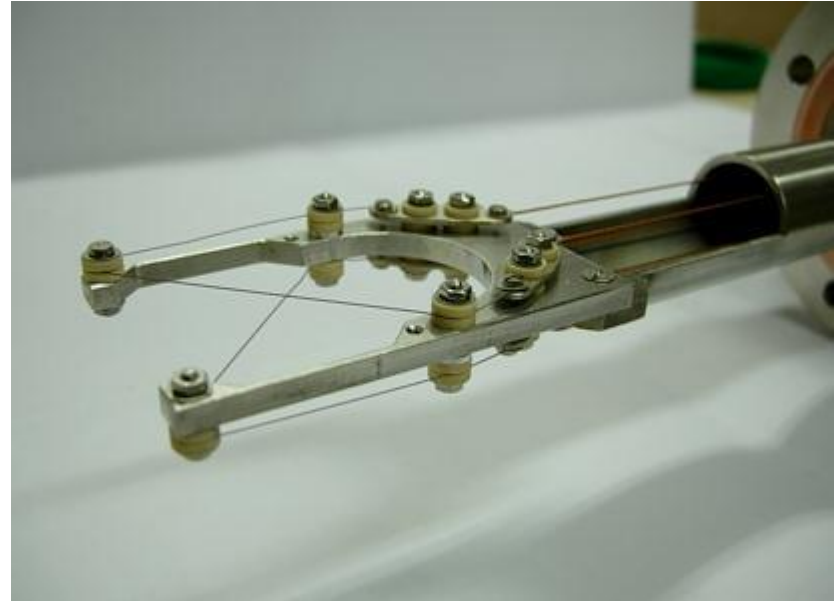


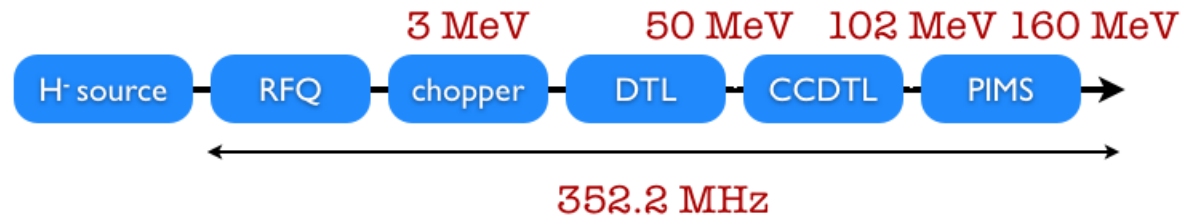
White areas show integration windows



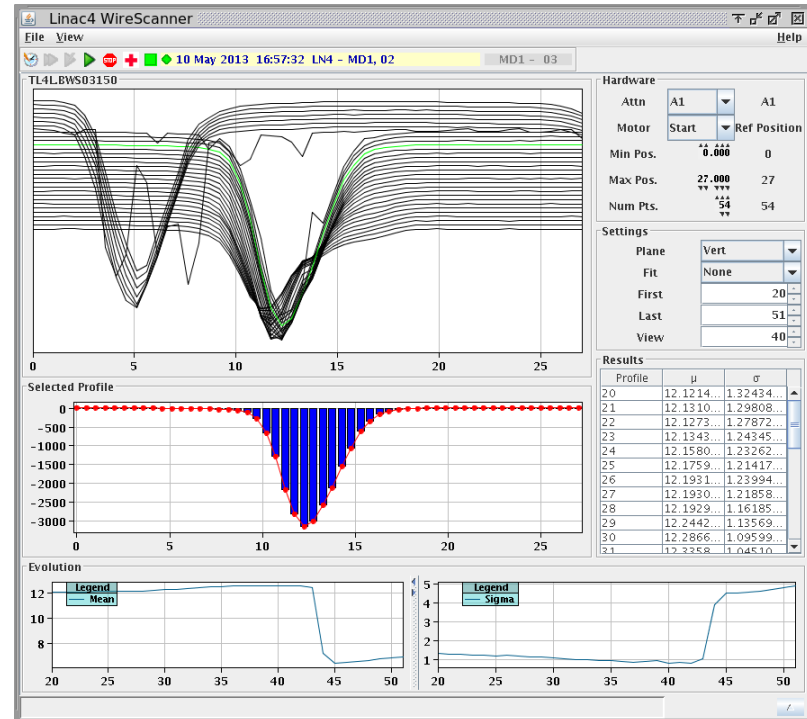
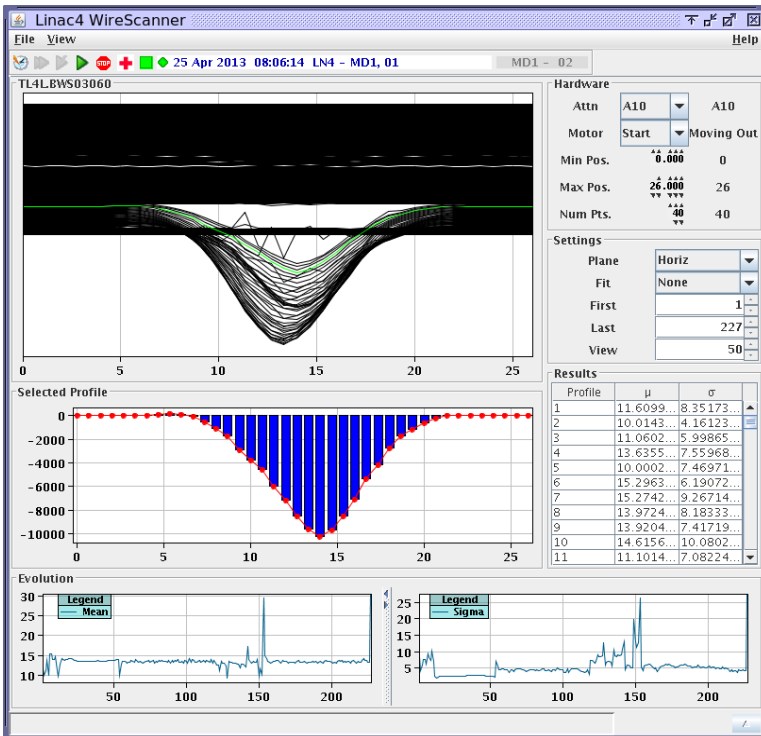
Wire scanners

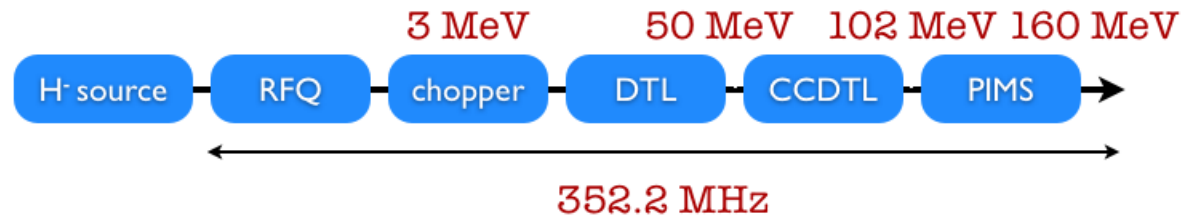
- 40 um carbon wires
- First X-shaped, now L-shaped
- Wires can be polarized
- Readout at 205 kHz
- Now configured in L-shape





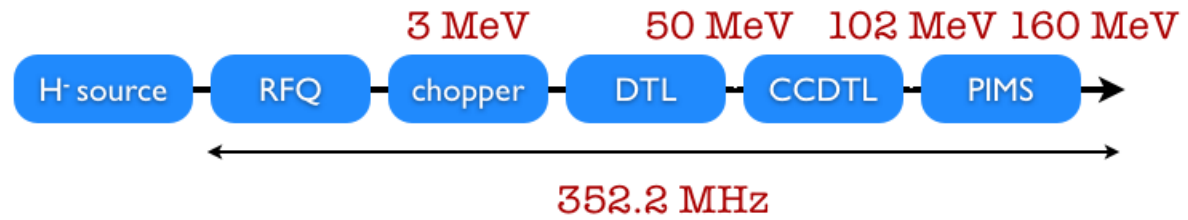
Wire Scanners and Chopper





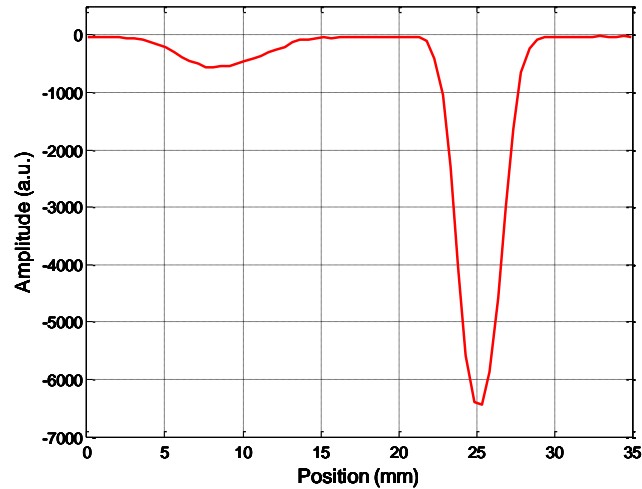
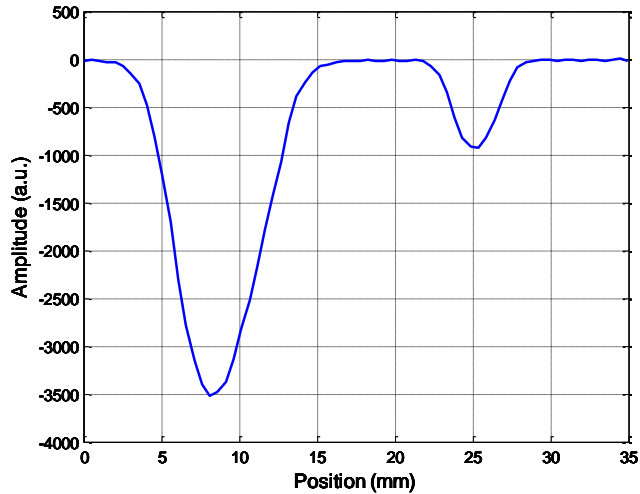
Crosstalk between wires

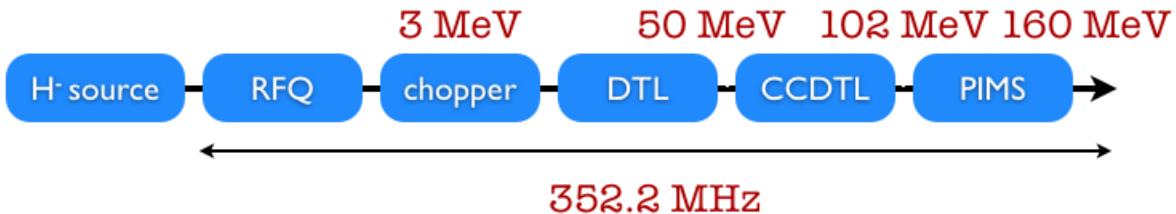
- On L-shaped wire scanners crosstalk from one wire to the next can be separated
- Measured crosstalk when increasing positive wire polarization
- Profile size shows ~ 2% dependence on wire polarization up to ~ 40V.



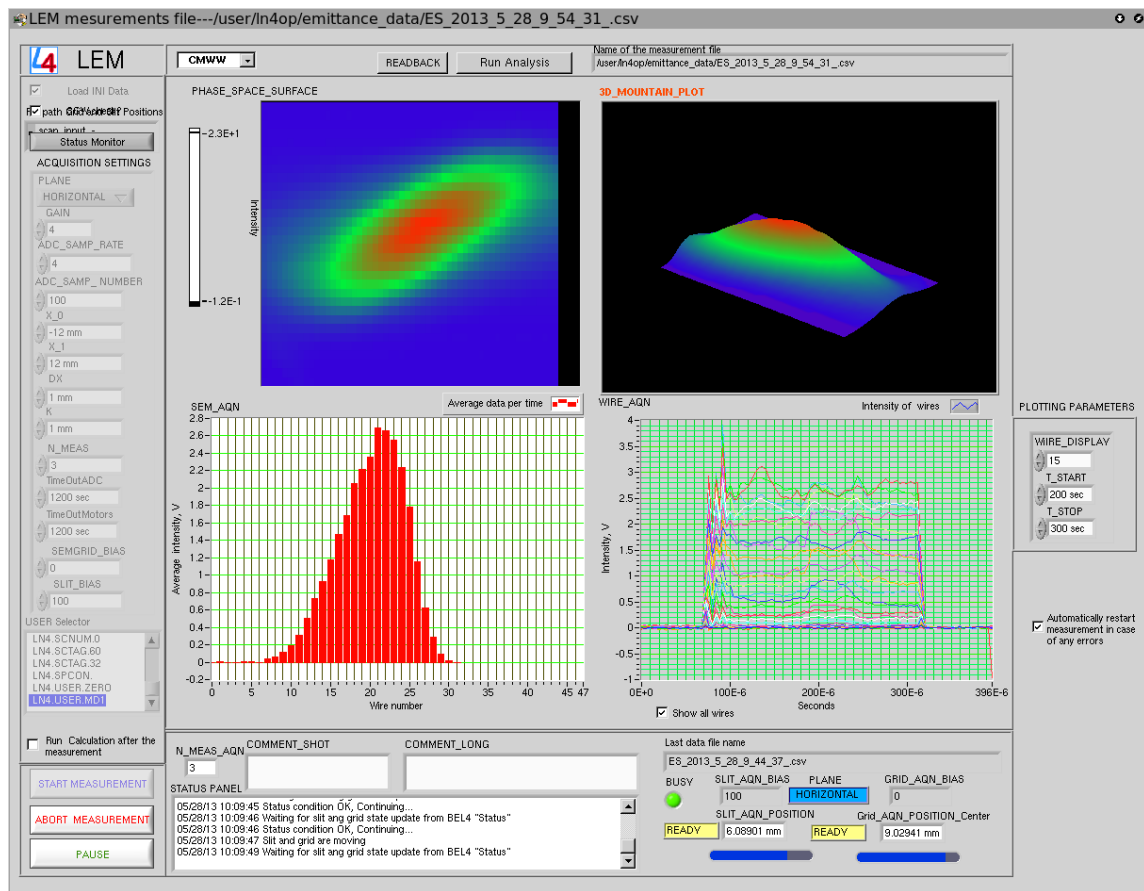
Crosstalk versus polarization

WS2 – ~~100W~~





Emittance Meter

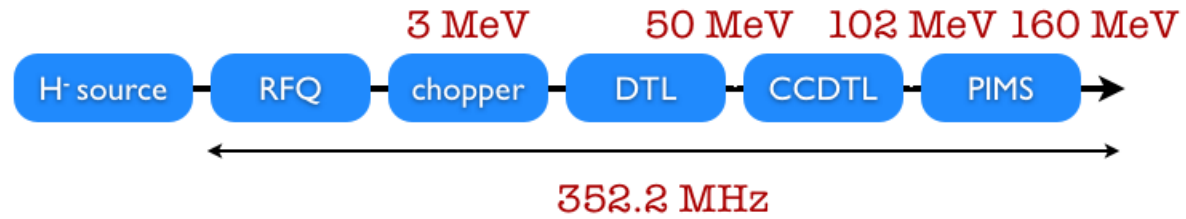


Labview program sets
Motor position of slit and grid
(controlled by PLC and FESA)

Accesses FESA class to control
Amplifier gain, plane ...

Reads ADCs and saves data in
.csv format for further evaluation

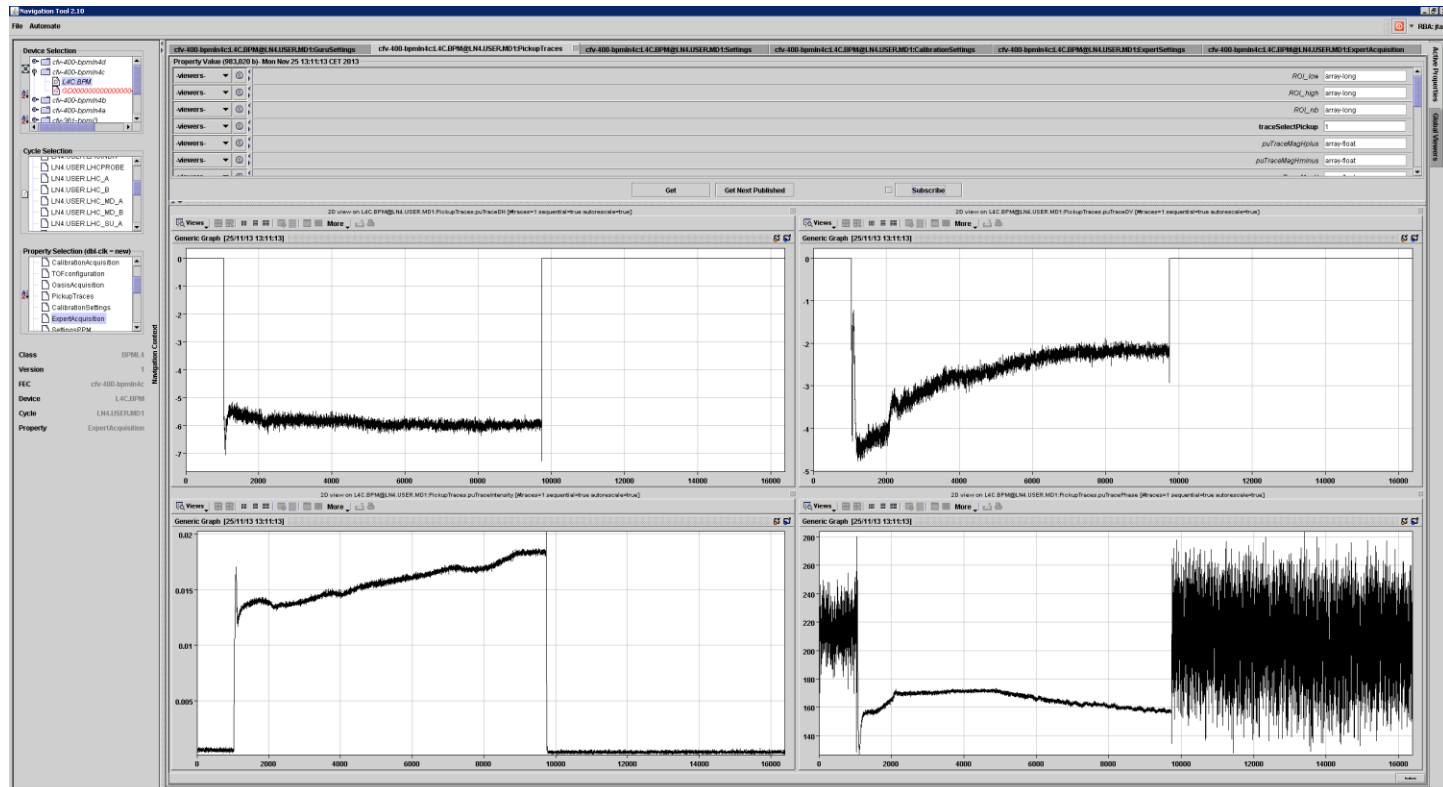
1 emittance plot every 4 μ s

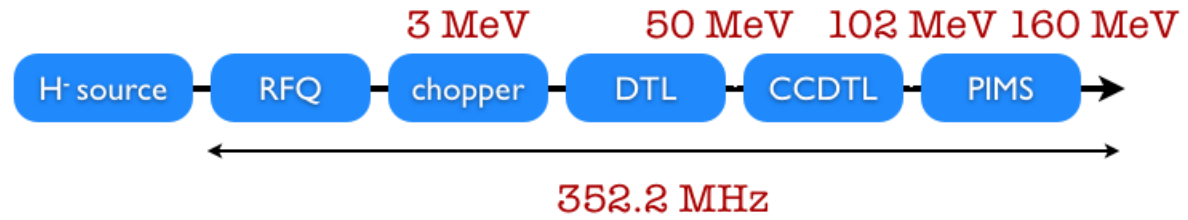


Beam position monitors

BPMs measure

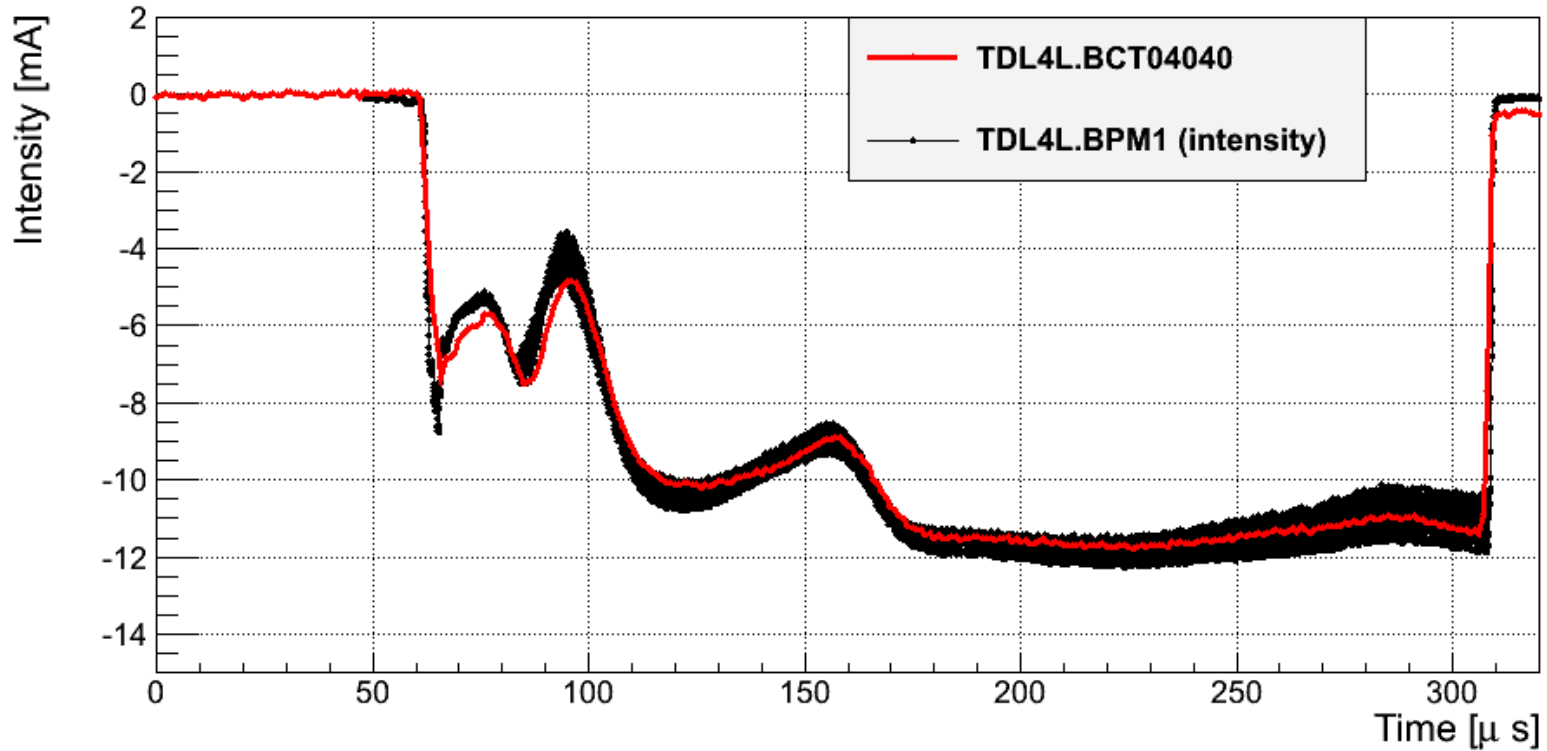
- Position
- Intensity
- Phase

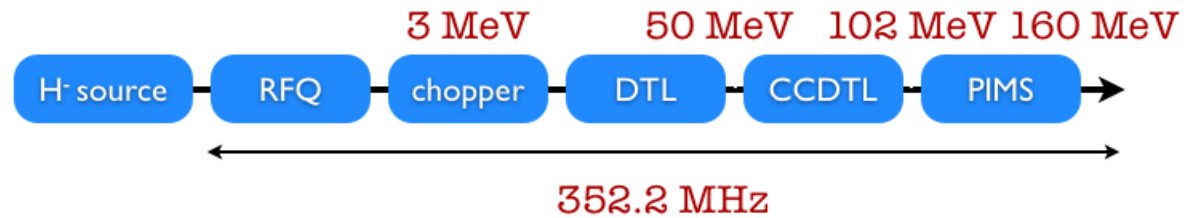




Intensity BCT-BPM

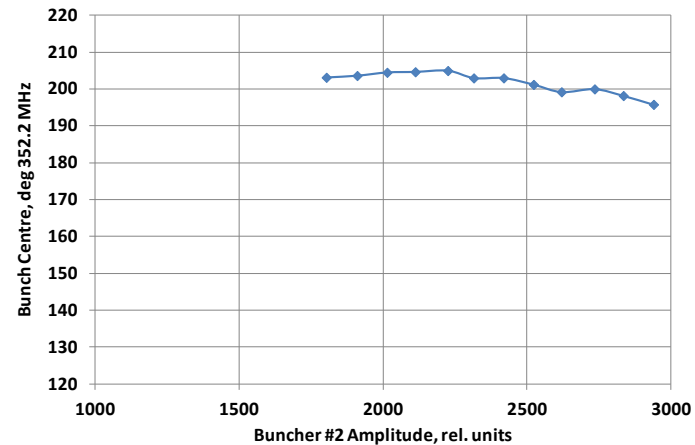
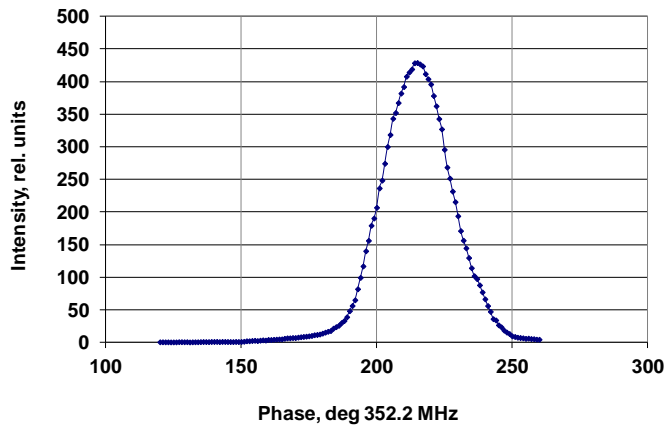
BCT vs BPM (intensity), RFQ exit

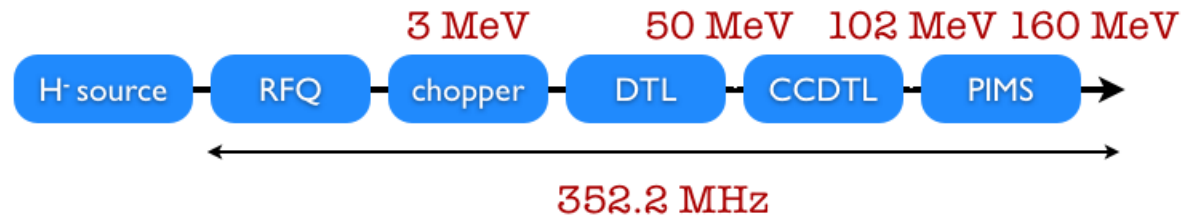




Bunch Shape Measurements

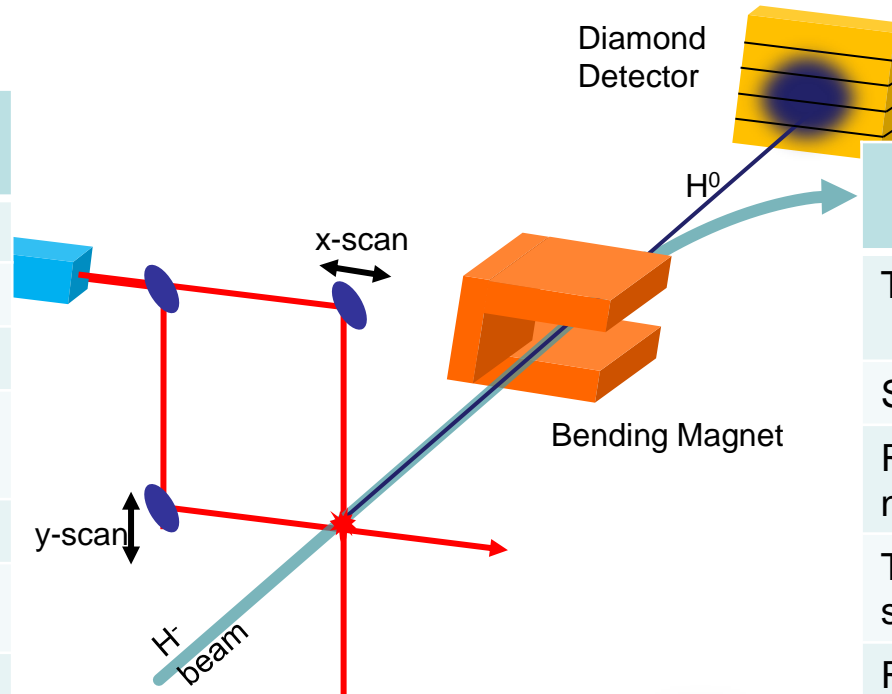
- Has been used to adjust the bunchers in the test stand
- Brought back into operation in the L4 tunnel
- No bunch shape measurements yet because of missing buncher control





Concept of Laser Emittance Meter

	Pulsed fiber-laser
Wavelength	1080 nm
Energy	0.9 mJ
t_{pulse}	110 ns
Beam quality – M^2	1.7
Repetition rate	30kHz
Beam transport	Fiber
Particles _{strippe} d / bunch	< 4e5



	Diamond Detector
Type	Polycrystalline
Size	18 x 18 mm
Resolution	5 channels
Thickness	500 μm
Readout	5 GS/s Scope

