

Follow-up

PSB H- chicane magnets: Inconel vacuum chamber option & consequences on beam dynamics

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LIU-PSB Meeting, 26/9/2013

Aim

- Evaluate differences wrt space charge between:
 - Ceramic chamber
 - Inconel chamber (eddy currents inducing multipolar errors)
- See presentation LIU-PSB on 30/5/2013
 - Very intense LHC beam (last presentation)
- Today results for:
 - LHC type beam, still with painting, $Ex^*=1.2\mu\text{m}$, $Np=160e10$
 - Isolde type beam, $Np=1e13$, $Ex^*=9\mu\text{m}$, $Ey^*=6\mu\text{m}$

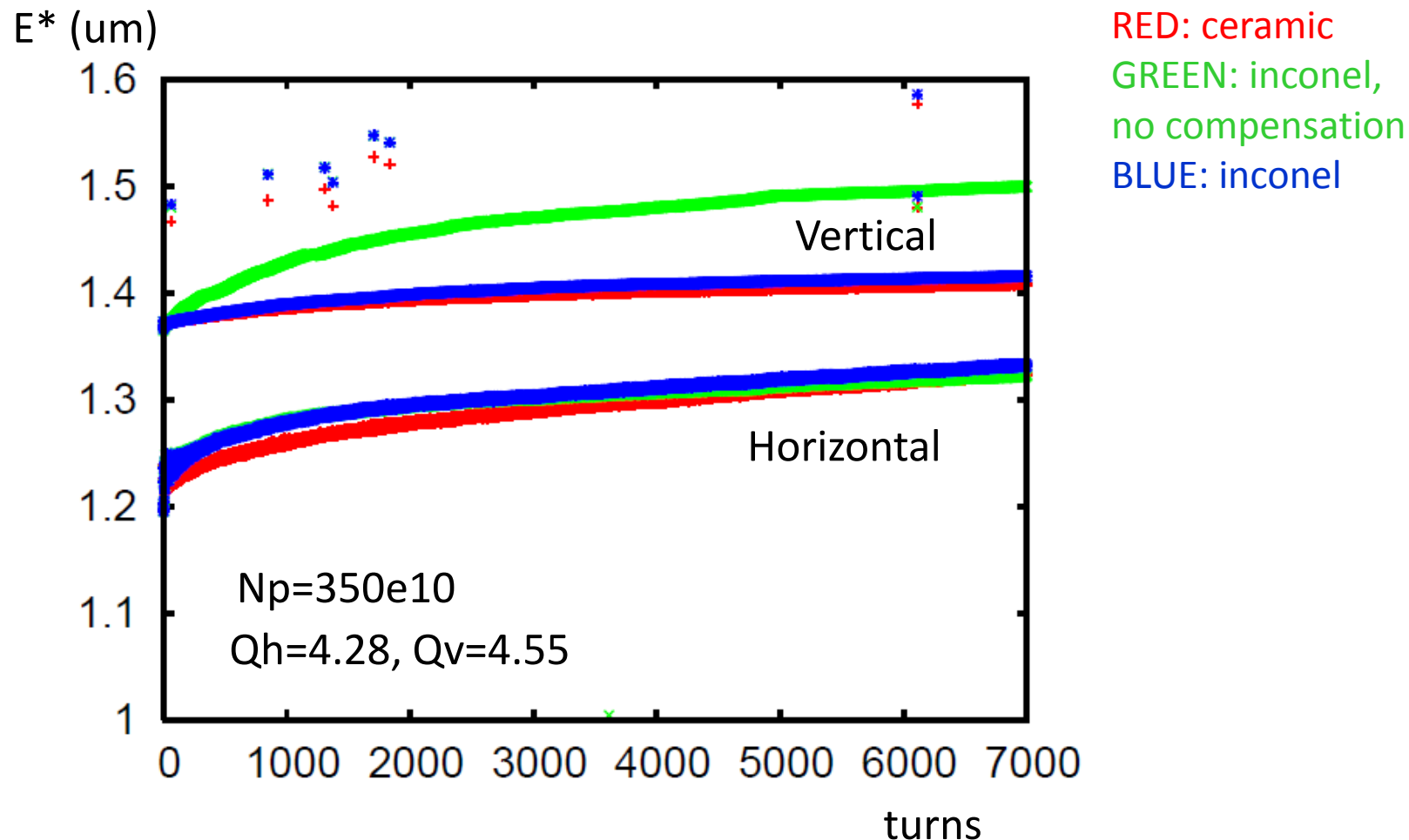
NB: THESE RESULTS ARE VALID IN RELATIVE, i.e. for our comparison, WHILE FOR THE ABSOLUTE VALUE MORE WORK IS NEEDED, both from the PSB optics modeling AND code debugging/benchmarking

Limitations

- The model is very simple
 - Double harmonics
 - Acceleration
 - No errors & non-linearities in the lattice except...
- The only errors are in the chicane magnets, i.e. $<1/16$ machine (and QNO correctors)

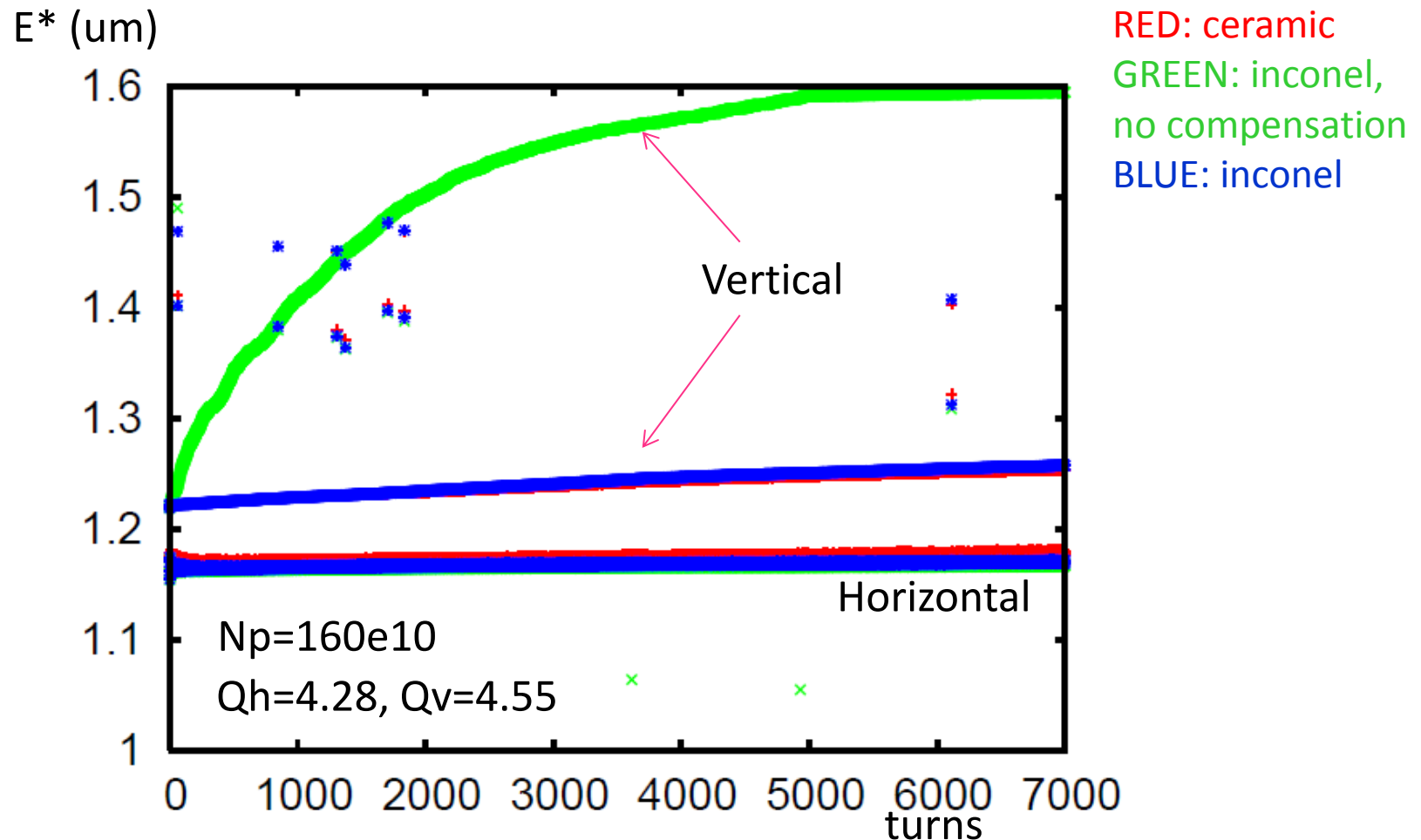
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``Very intense`` lhc beam (see 30/5/13)



- Large growth in horizontal, due to (too) large ΔQ & integer crossing

LHC type beam (produced with 20t painting)



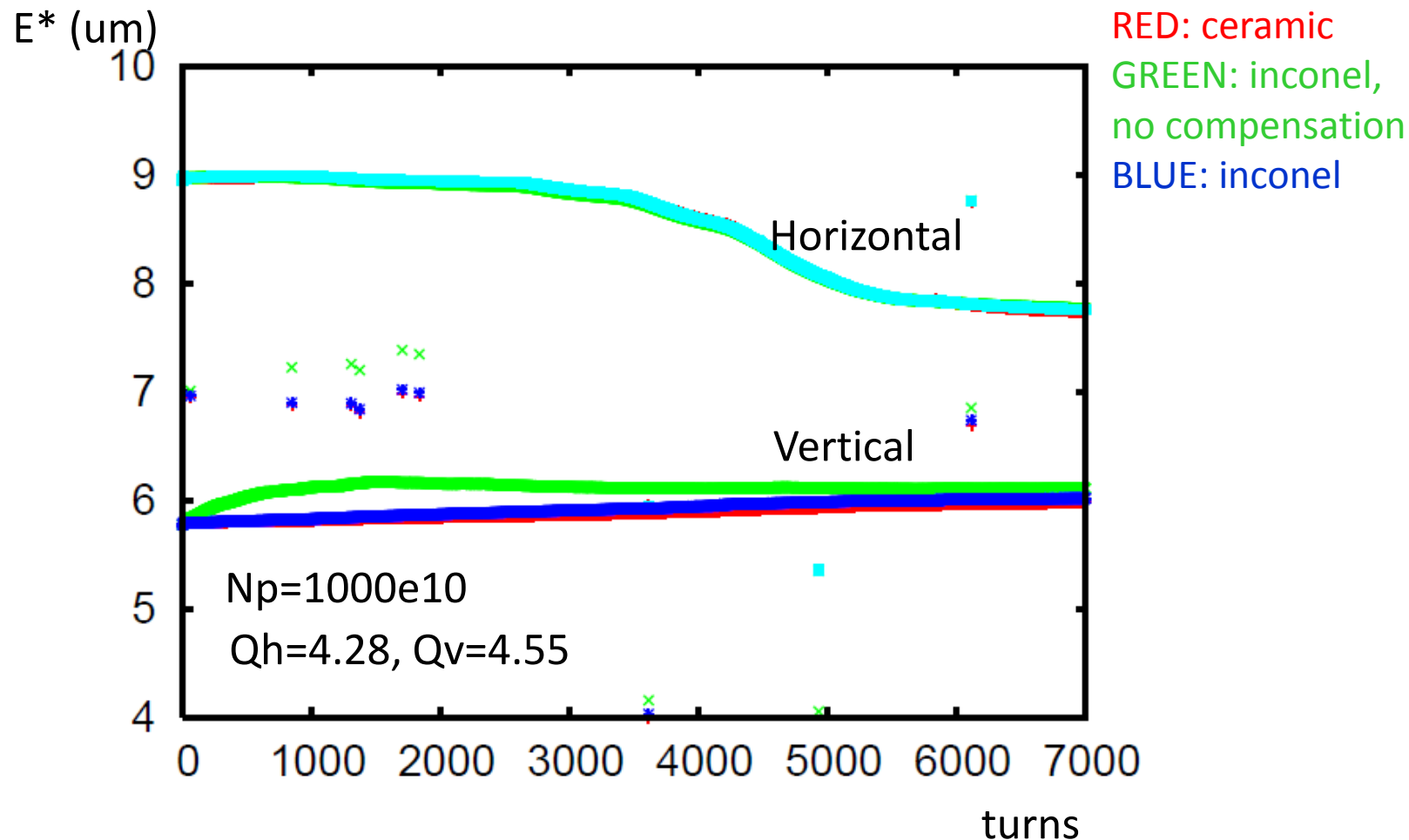
- No more growth in horizontal

Isolde beam (1/4)

- Produced by C.Bracco with optimized painting bump function (see Follow-up H- injection review: <https://indico.cern.ch/conferenceTimeTable.py?confId=158153#20111109>)
- With Orbit (by Chiara) up to turn 159, to have complete fall of painting bump → then converted (EB) in PTC-Orbit coordinates:
 - Small differences in bucket shape and residual phase offset
 - produce artificial losses in the code of ~12%

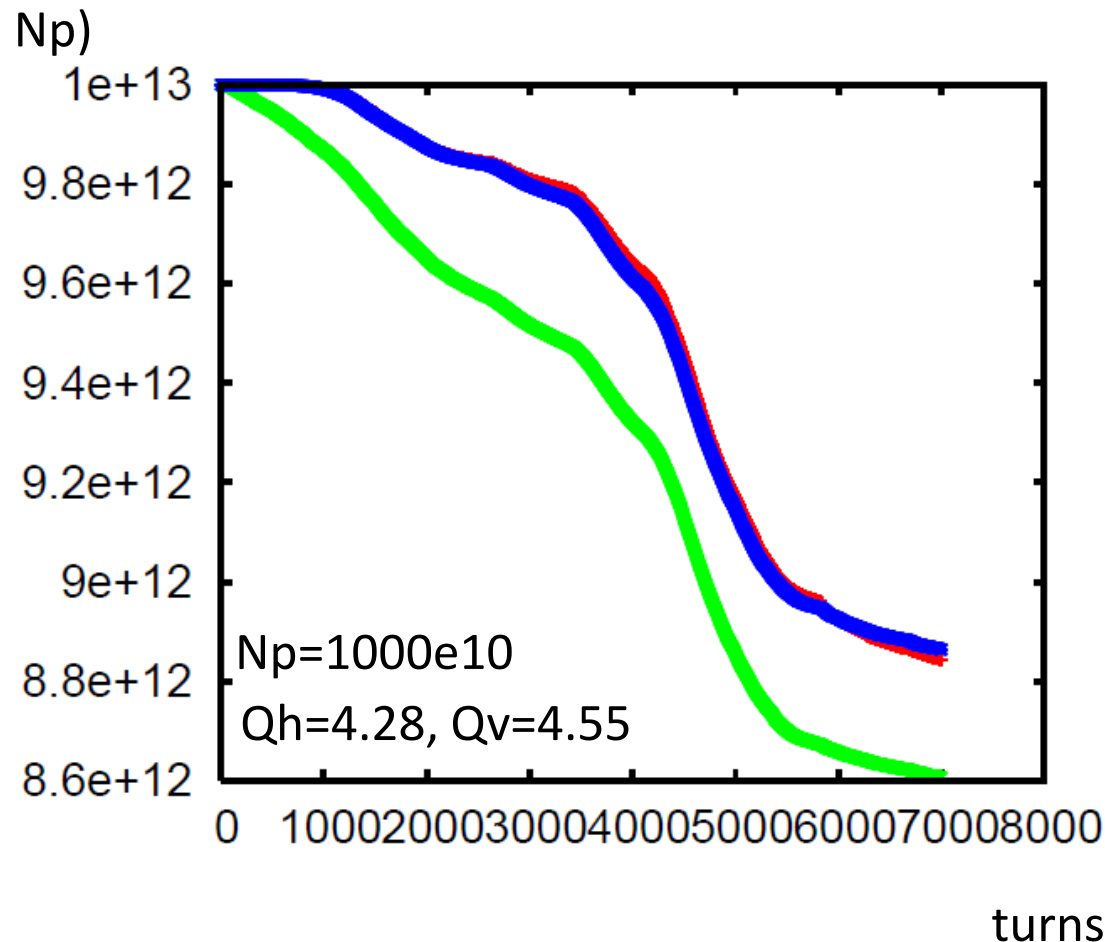
Needs optimization

Isolde like beam (2/4)



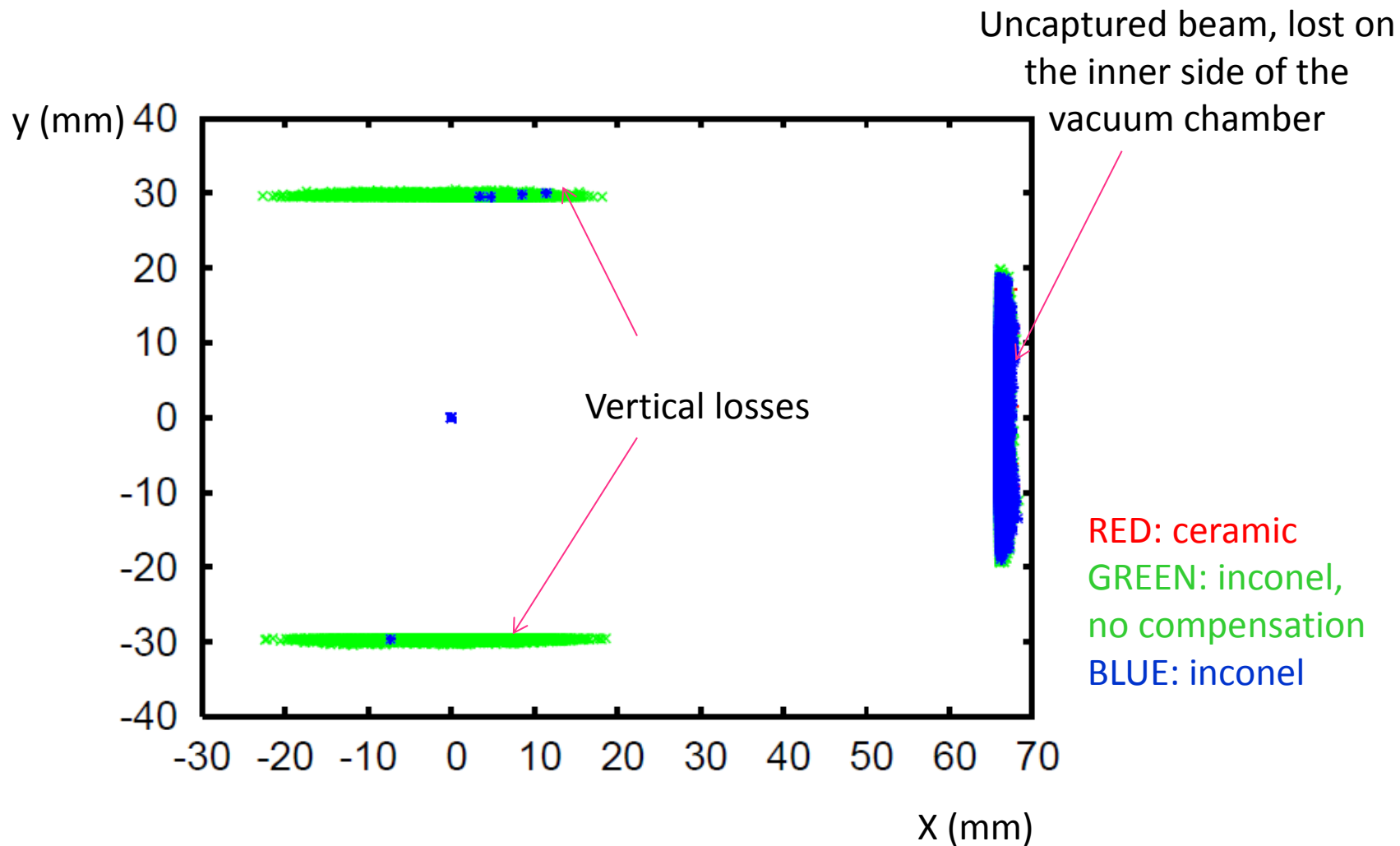
- Horizontal emittance dominated by losses

Isolde like beam (3/4)



- >12% losses, mostly artificial, due to non-perfect RF capture → relative is OK!

Isolde like beam (4/4)



- >12% losses, mostly artificial, due to non-perfect RF capture

PSB Space-Charge activities ongoing

- Evaluate impact of new H- injection @ 160MeV
 - LHC beams: Find optimum WP for max brightness, Effect of integer, resonance compensation, machine model
 - Losses & halo for high intensities/large emittance
- Code consolidation (**Highest priority!** within SC study-group)
 - Injection chicane (discussed in Friday's Injection meetings)
 - Add quadrupolar component in the BSW1 model
 - Optimum shape for bump decay
 - Benchmark with 160 MeV measurements (part of V.Forte's Thesis)
 - Add alignment & quads errors (V. Forte, with input from M. Mc Ateer)
 - High intensity beams: set-up PTC-Orbit simulations (past work done with Orbit) and losses localization (M. Kowalska, TS starting next week)

Conclusions: inconel vs. ceramic ?

- Confirmed conclusions of presentation 30/5/13: (<http://indico.cern.ch/conferenceDisplay.py?confId=254489>) for the beams of interest
- **No showstoppers** for the inconel chamber are found, but compensation is required
- Simulations results are valid **only in relative**, to discriminate between ceramic and inconel chamber
 - optics model as simple as possible,
 - no errors except in BSW magnets
- A document is in preparation