

Emittance growth study in the existing ATF EXT

F. Zhou
SLAC

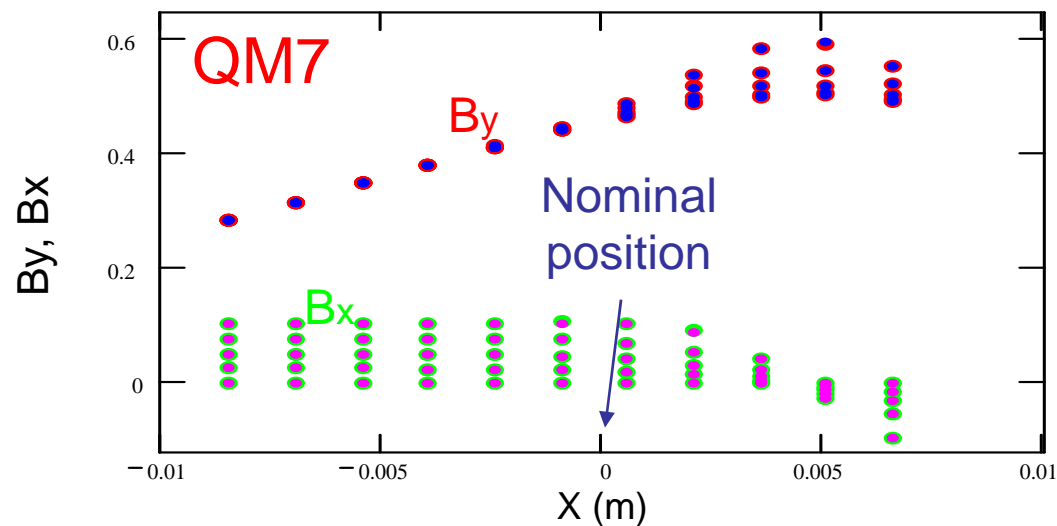
Other major contributors: S. Selestiky, A. Seryi, M. Woodley

Thank J. Amann, C. Spencer for magnetic modeling

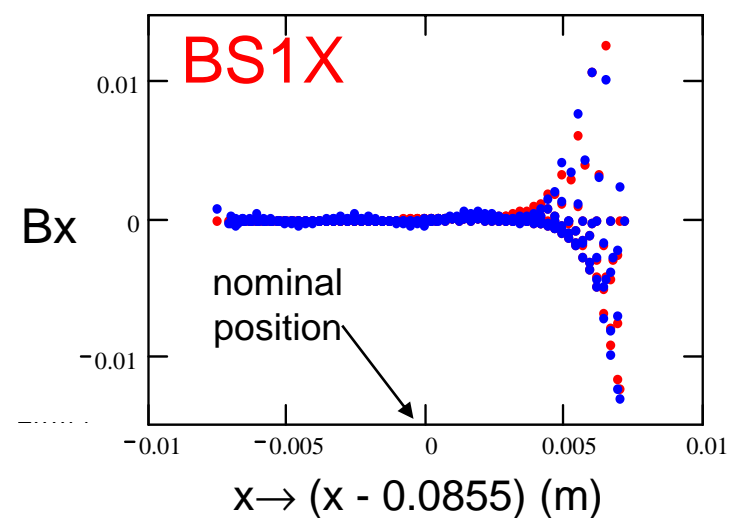
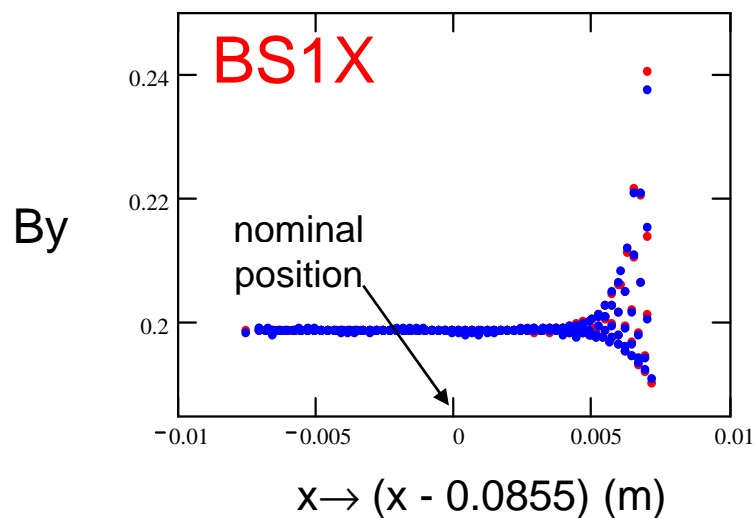
Outline

- Field mapping of the QM7 and BS1X
- Generation of local bumps in the EXT
- Simulation on emittance growth with the local bumps
- Discussion on beam experiment
- Summary

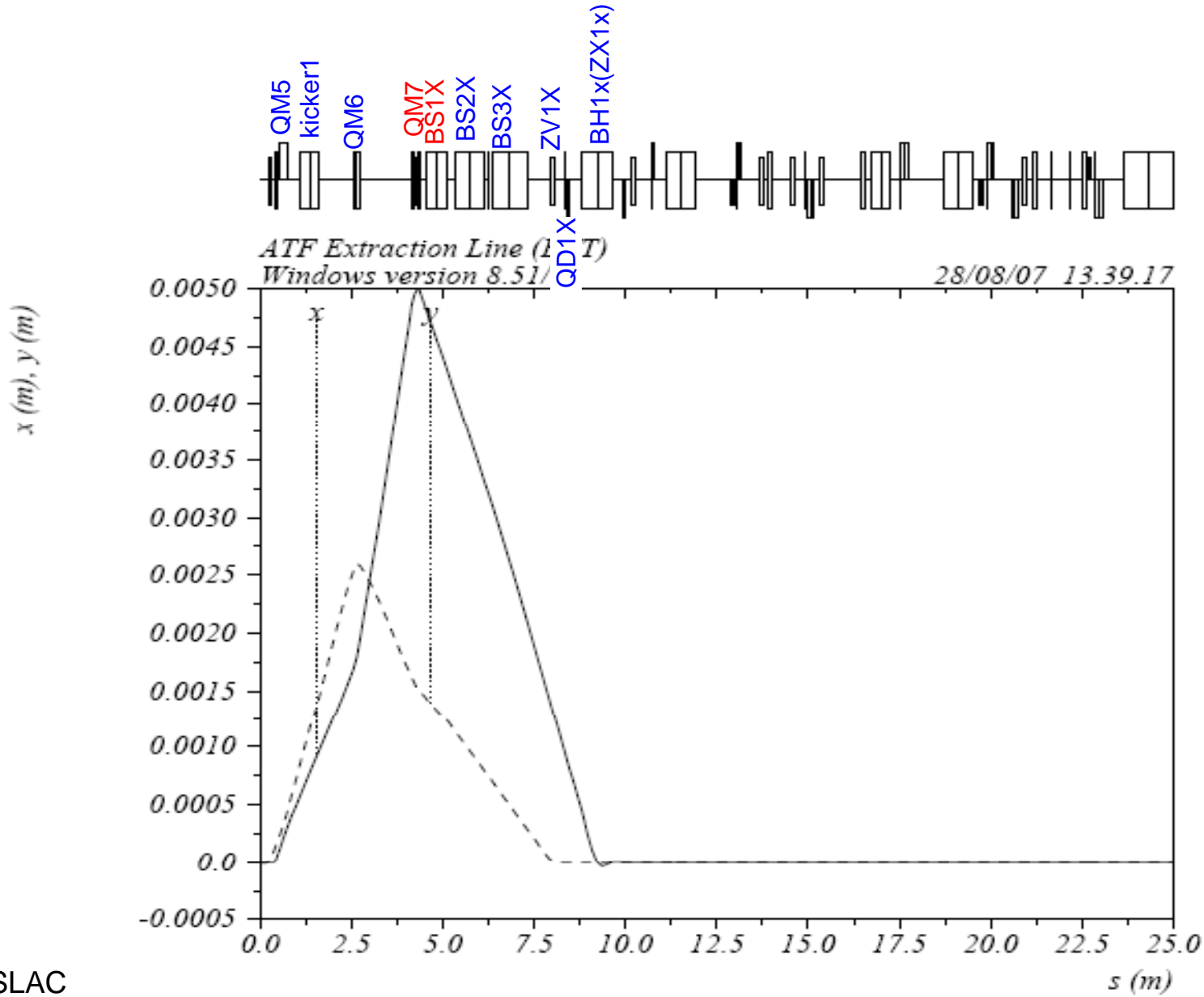
Field map of QM7 and BS1X



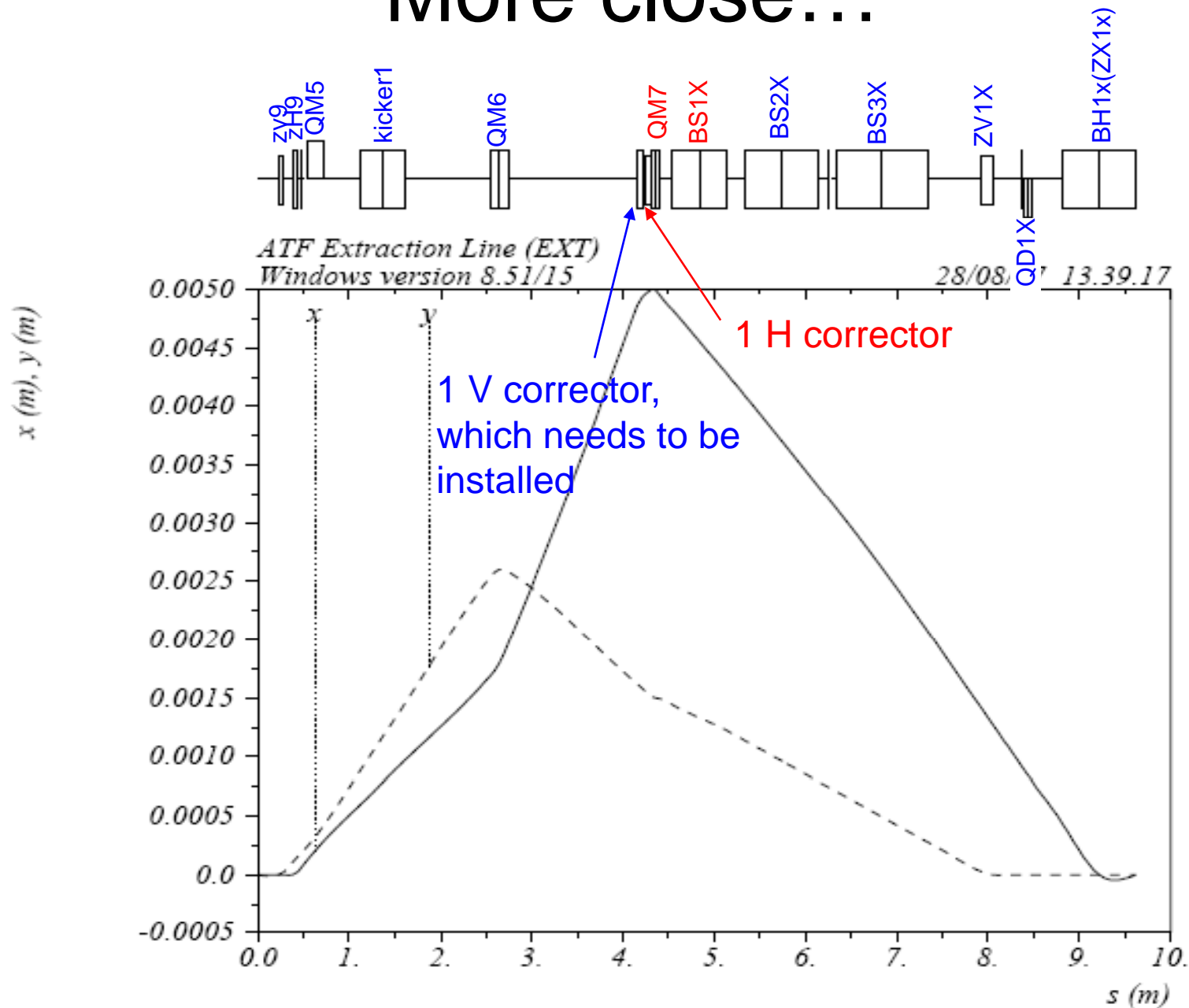
$$B_y + jB_x = B_0 \sum (a_n + jb_n)(x + jy)^n$$



EXT local bump generation

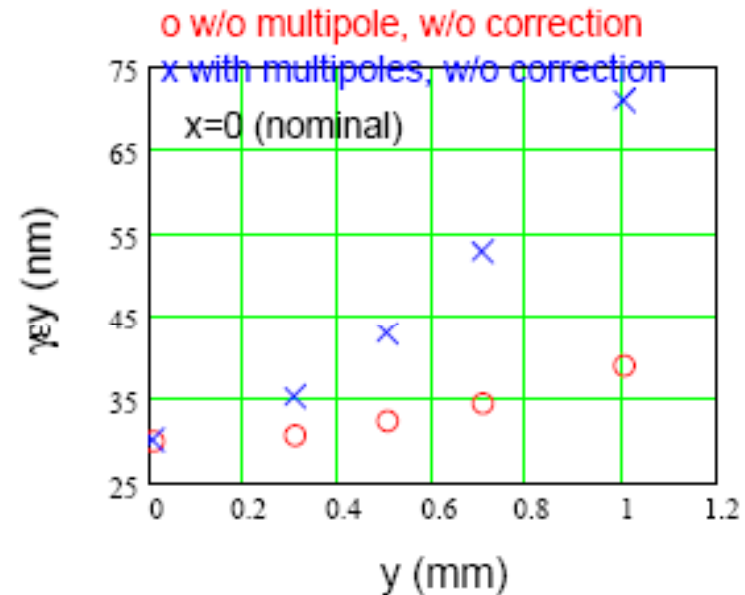
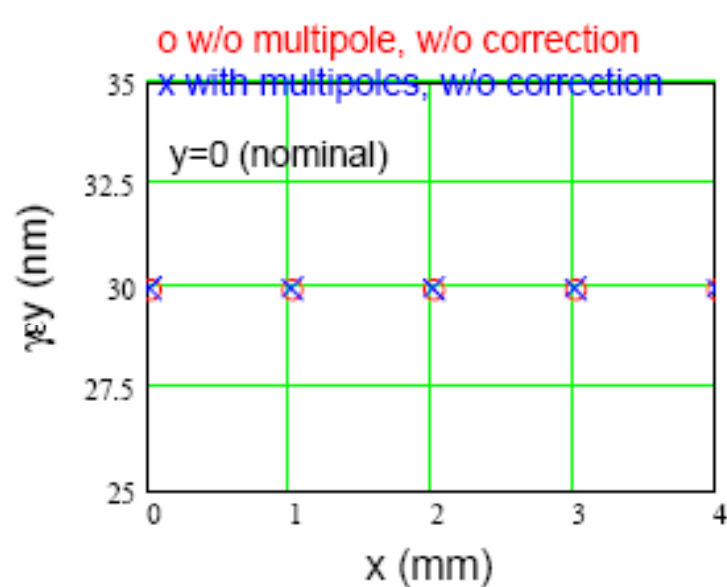


More close...



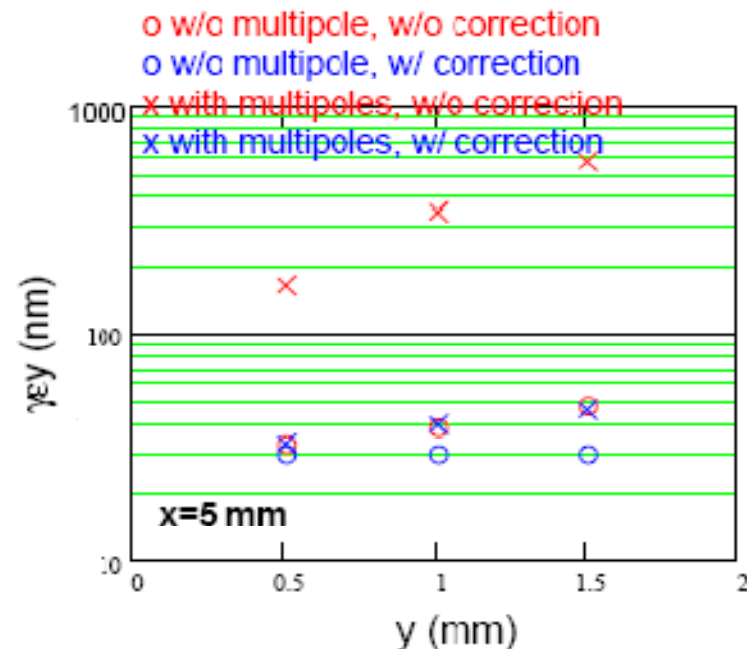
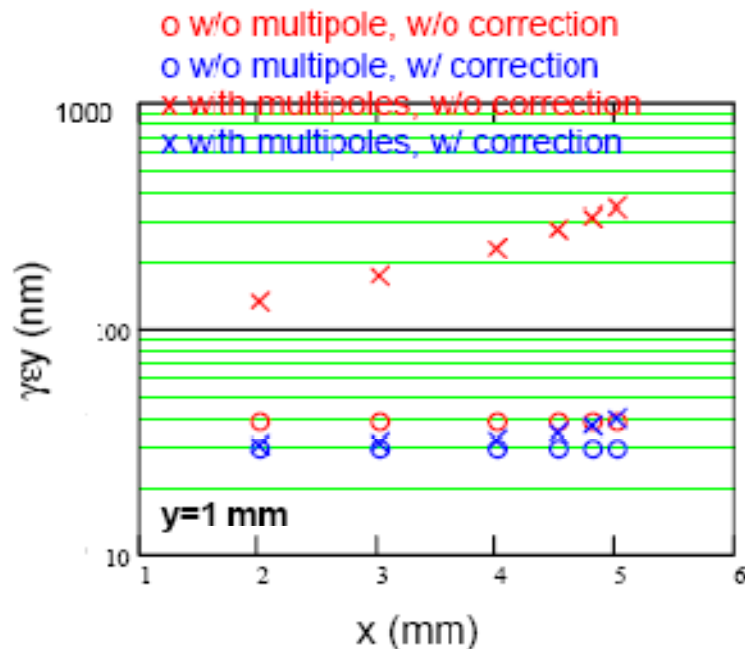
Either x or y offset: vertical emittance growth

- Either x or y offset in the existing EXT channel
- Includes QM7+BS1X multipoles

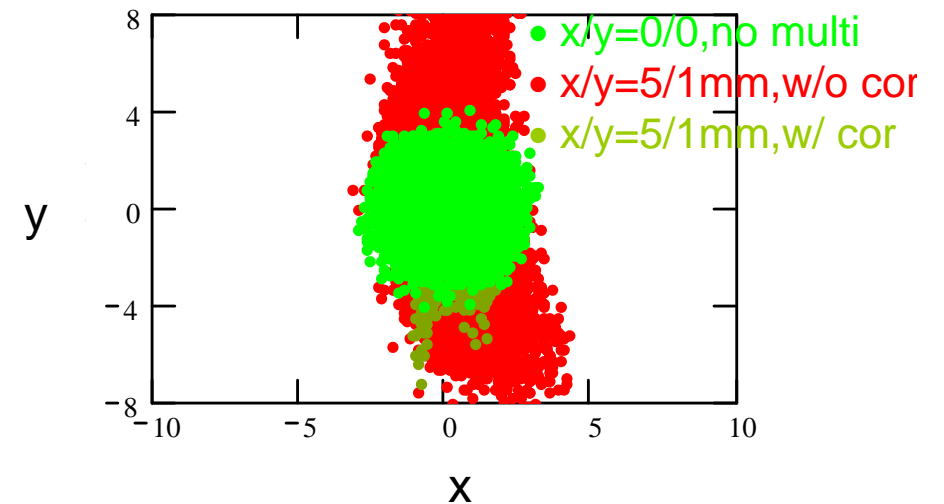
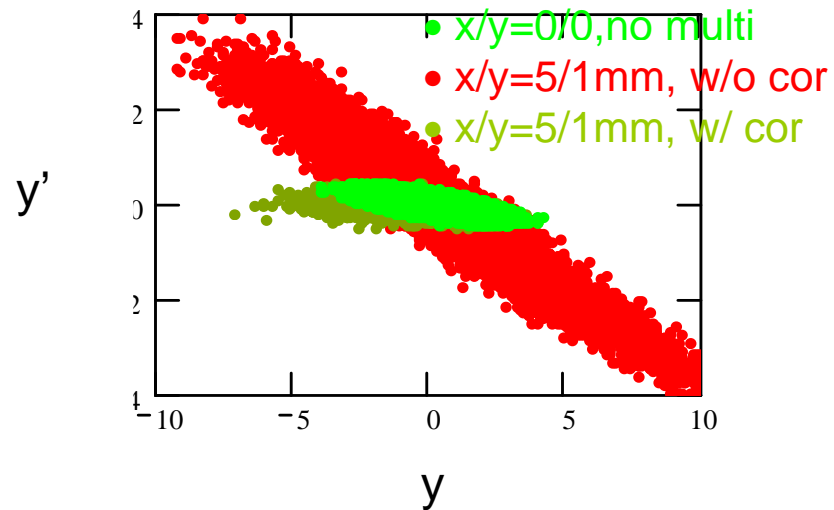
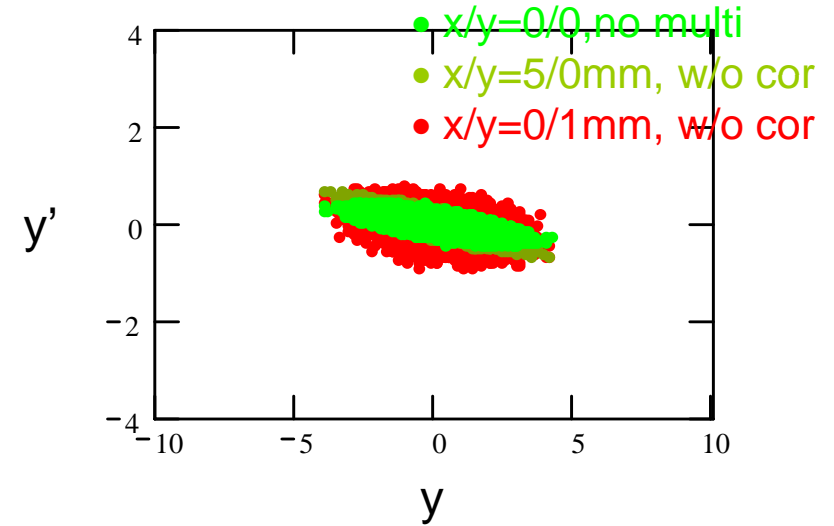
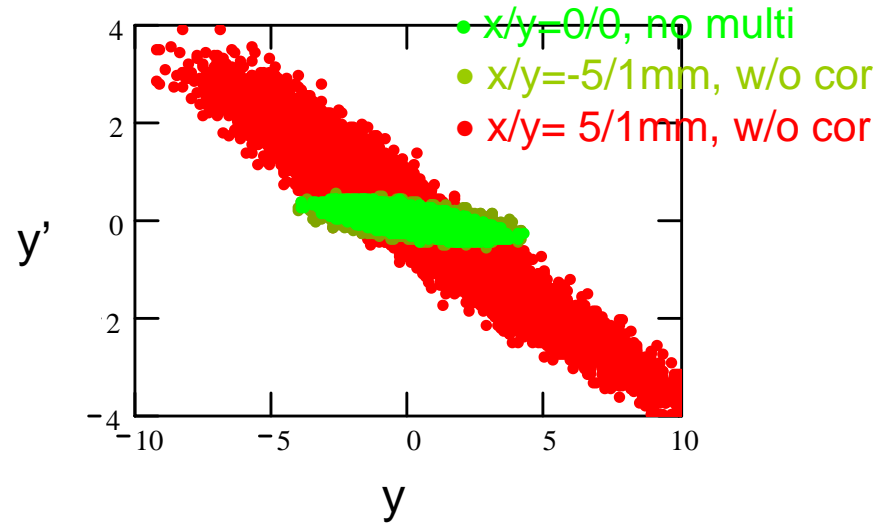


Combined x and y offset: vertical emittance growth

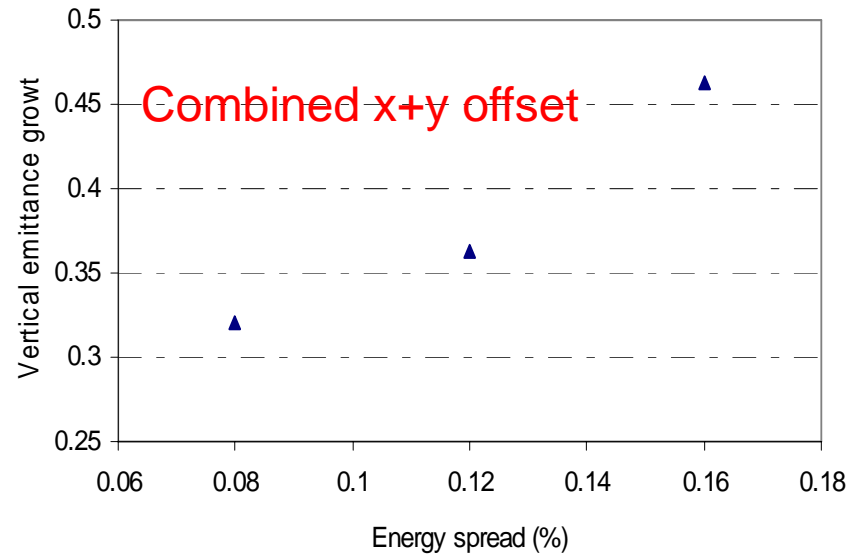
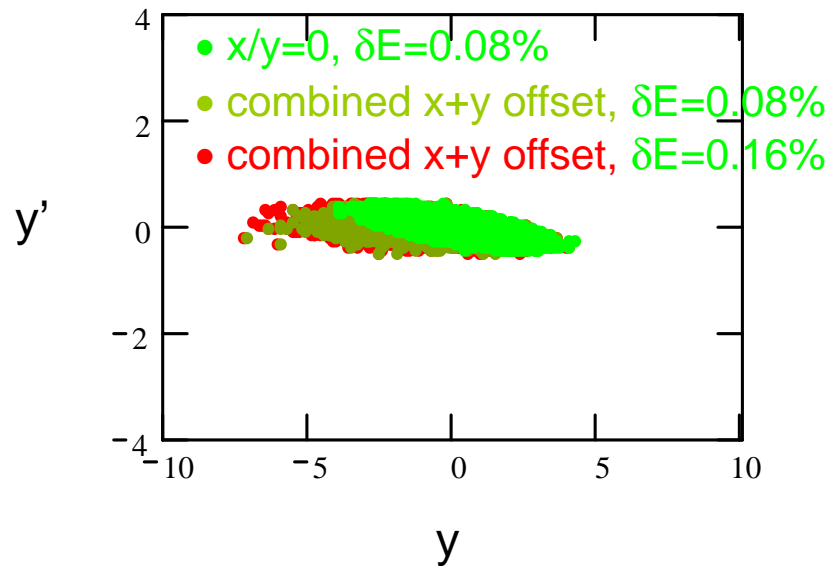
- Combined x and y offset in the EXT channel
- QM7+BS1X multipoles.



Phase spaces at EXT end

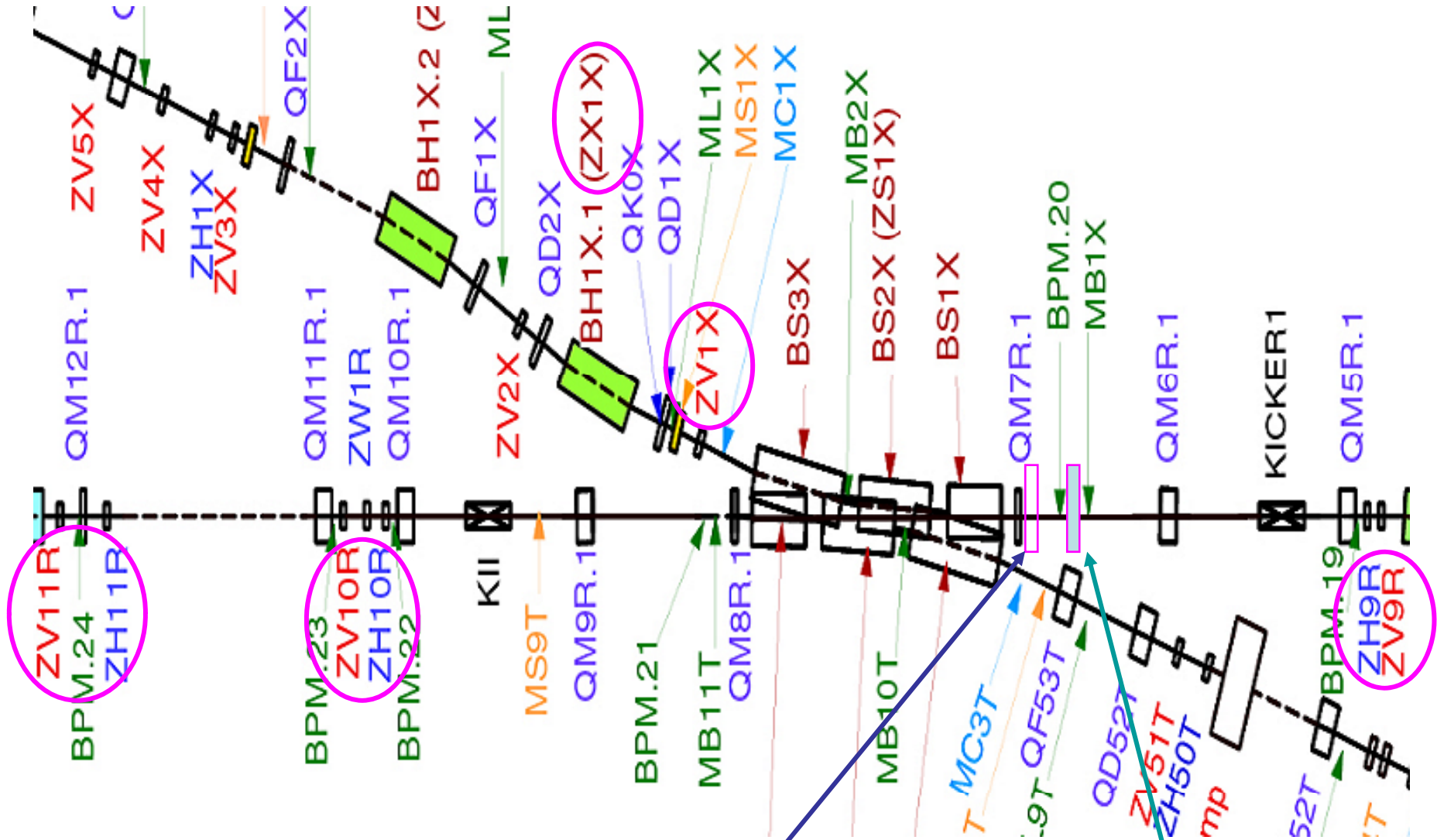


Vertical emittance dependence of energy spread



Beam experiment

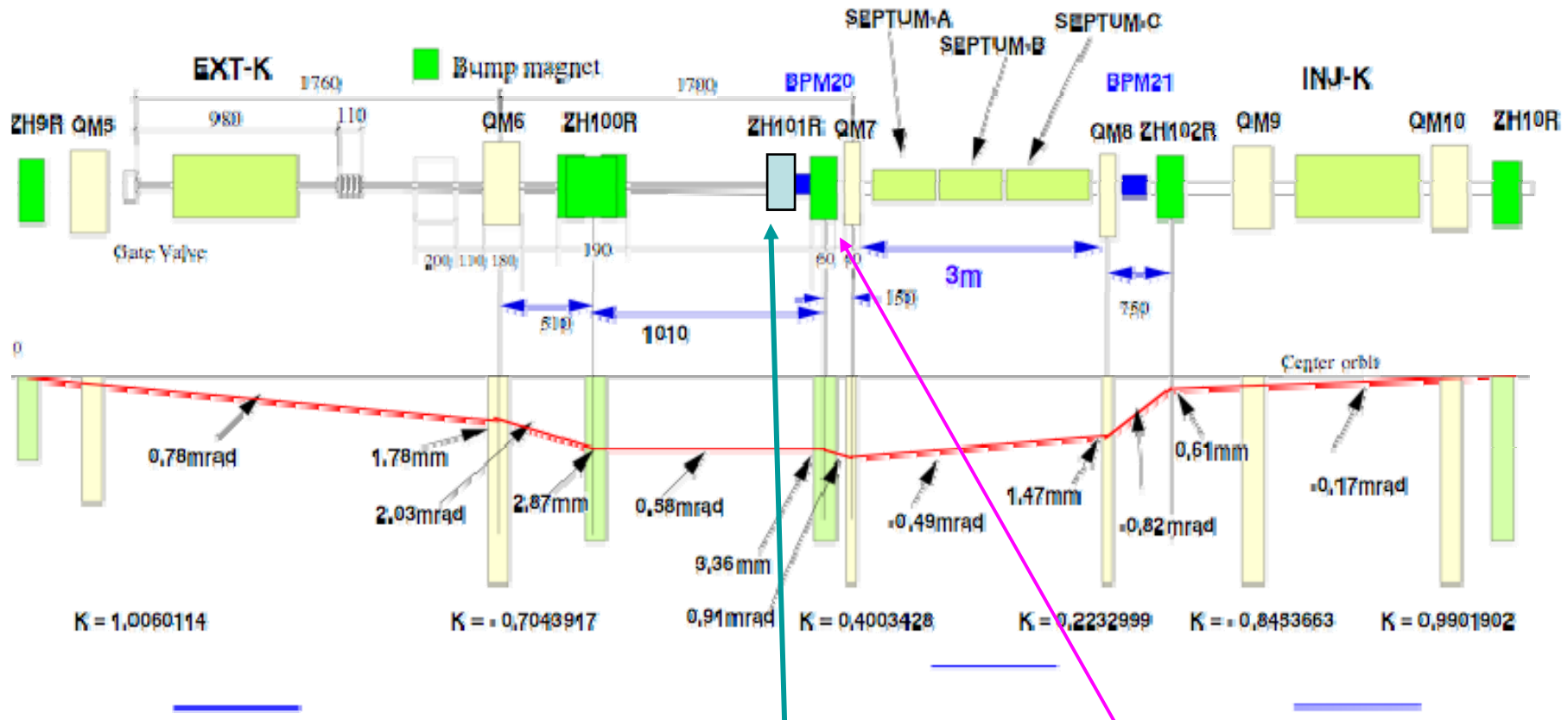
- Observe the effects vs different bump amplitude; it can help us to understand the emittance growth source, and also how well the coupling correction:
 - Only x or y bumps
 - W/o correction
 - W/ correction
 - Combined x+y bumps
 - W/o correction
 - W/ correction
- Total 6 correctors needed to generate local bumps; 4 correctors (2 H and 2 V) already exist, another H corrector probably already exists.



H corrector

V corrector, which needs to be installed

Stripline kicker test layout



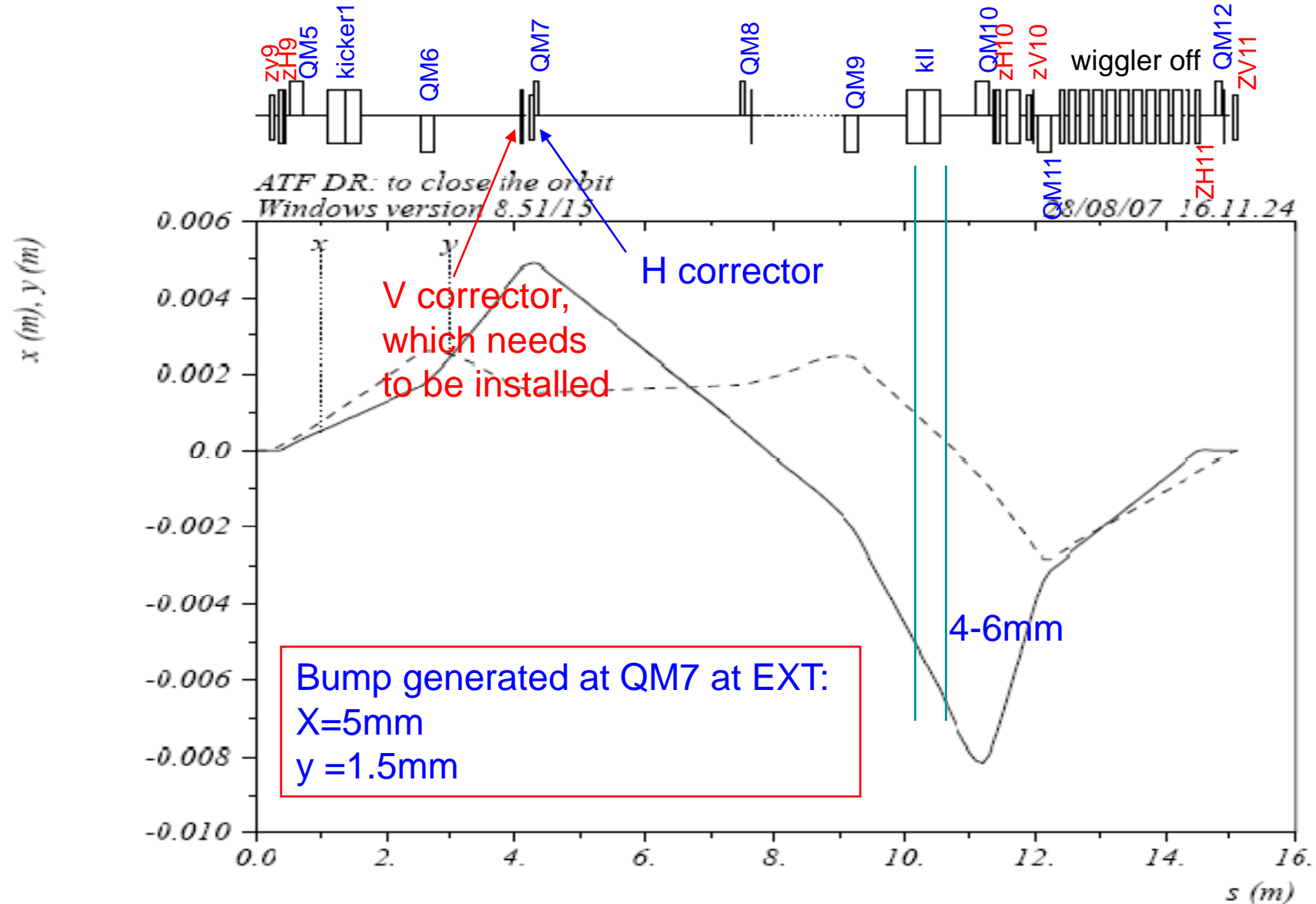
Suggest to install V corrector for this test

H corrector ready by Naito group?

Hardware requirements

- Corrector parameters:
 - Horizontal 5 mm offset
 - 1.5mrad (max);
 - $B \cdot L = 6 \times 10^{-3}$ T.m; $B \sim 0.14$ T assume $L = 5$ cm (probably ready by the Naito experiment)
 - Vertical offset 1.5 mm offset
 - 0.3 mrad (max)
 - $B \cdot L = 1.3 \times 10^{-3}$ T.m; $B < 0.03$ T assume $L = 5$ cm (suggest to install it)
 - Spaces look available
- Suggest to install 1 V (+ 1 H) corrector.

Need to close the ring orbit



Summary

- Initial $\gamma\varepsilon_y$ is 30 nm. Final emittance and phase spaces are measured at the existing EXT end. No magnet errors employed except the QM7 and Septum1 multipoles.
- Tracking results:
 - At the nominal position: only x-offset does not create vertical emittance growth while only y-offset create vertical emittance growth w/o corrections.
 - Combined both x and y offsets create severe vertical emittance growth w/o corrections; combined offsets x/y=5/1mm and 5/1.5mm can create 30% and 50% vertical emittance growth after all corrections.
- The beam test will be helpful to understand the emittance growth source and also how well the coupling correction.
- What we need to do:
 - To install 1 V (+ 1 H) corrector
 - Mark is investigating to close up orbit in BT line