Remarks on ILC Main Linac Alignment

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- Introduction
- Simulated case
- Correctors
- Conclusions

Premise: BC1+BC2

- All misalignments, cavity wakefields not considered, RF-kick:

$$k_{\text{rfkick, upstream}} = (-45.3 + 4.7i) \times 10^{-6}$$
$$k_{\text{rfkick, downstream}} = (38.5 + 13.7i) \times 10^{-6}$$

- Alignment Procedure

  1) 1-to-1 correction

  2) dispersion free steering using 25 degrees RF-phase offset bunches in BC1 and synchronization to BC2 RF-phase

$$\chi^2 = \sum_{i=1}^{n} y_{0,i}^2 + \sum_{j=1}^{m} \sum_{i=1}^{n} \omega_{1,j} \, (y_{j,i} - y_{0,i})^2$$

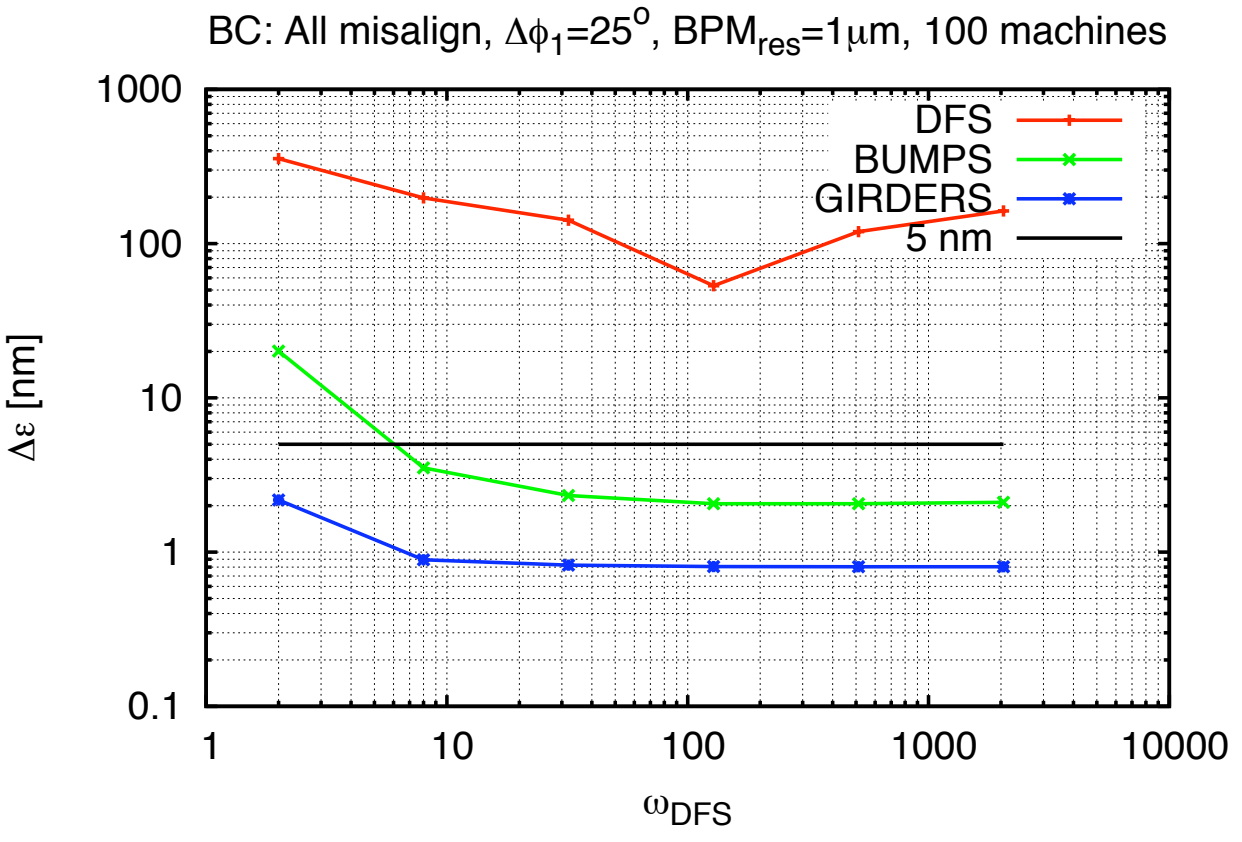
  3) *dispersion* bumps η, η' as global correctors

$$\begin{cases} y_i \Leftarrow y_i + \eta \frac{E_i - E_0}{E_0} \\ y_i' \Leftarrow y_i' + \eta' \frac{E_i - E_0}{E_0} \end{cases}$$

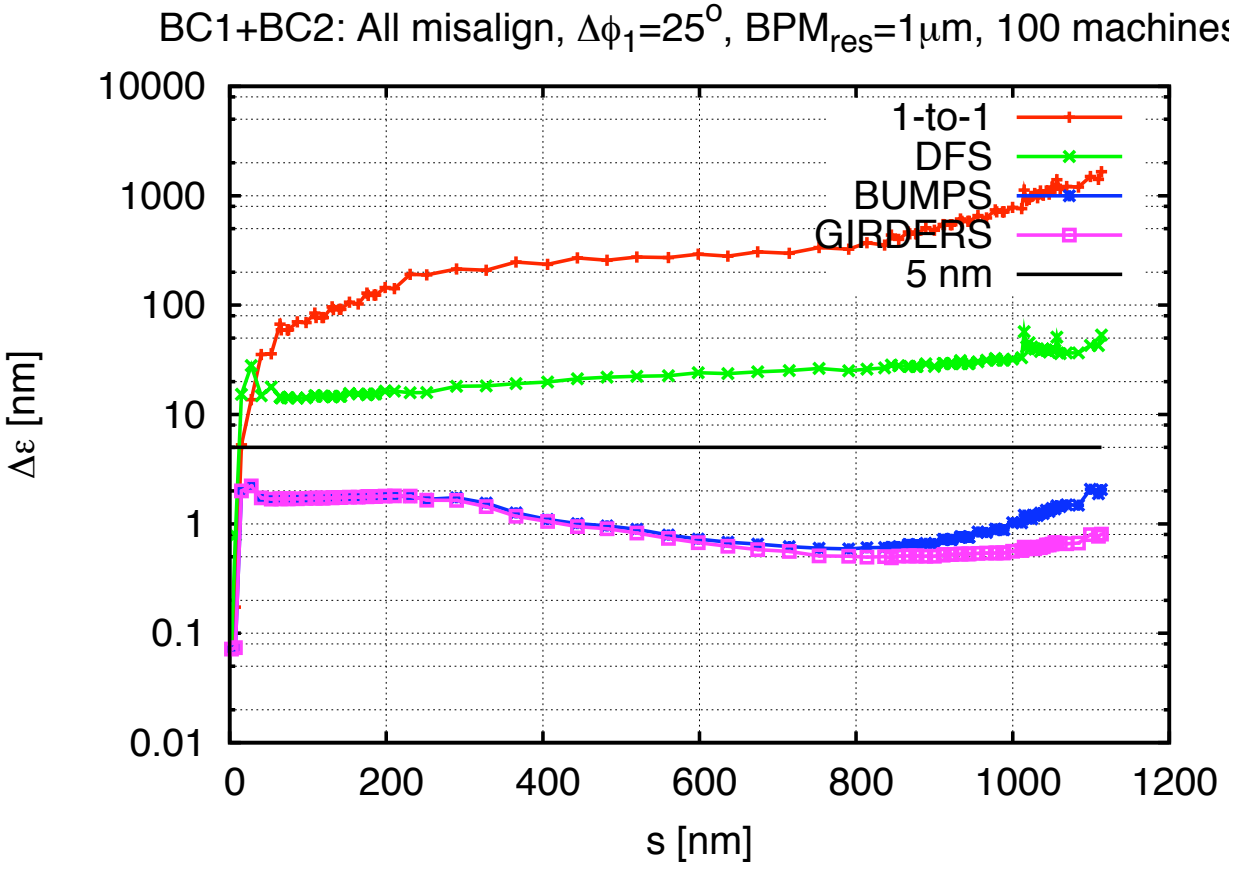
  4) girder pitch optimization: 3/3 CM in BC1, 3/45 CM in BC2

- Initial bunch length 6 mm, initial vertical emittance 20 nm

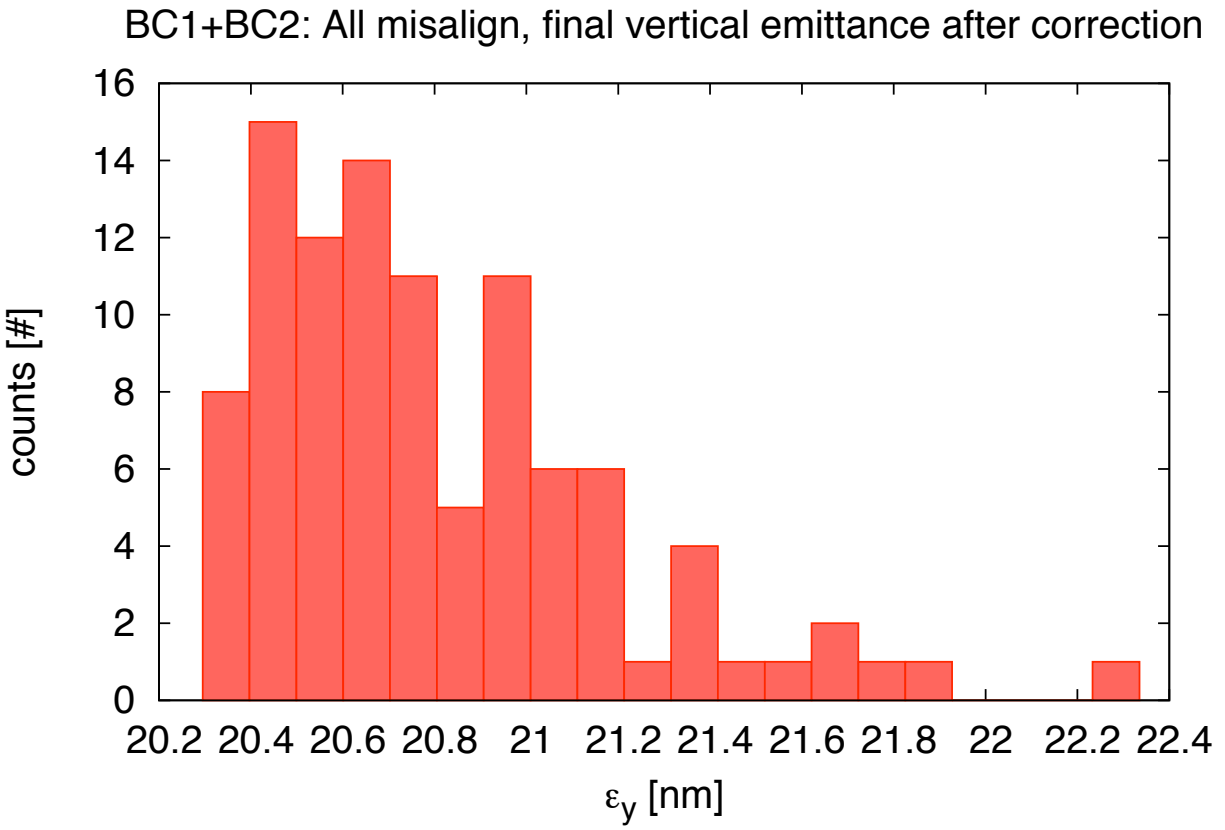
BC1+BC2: all misalignments, no couplers



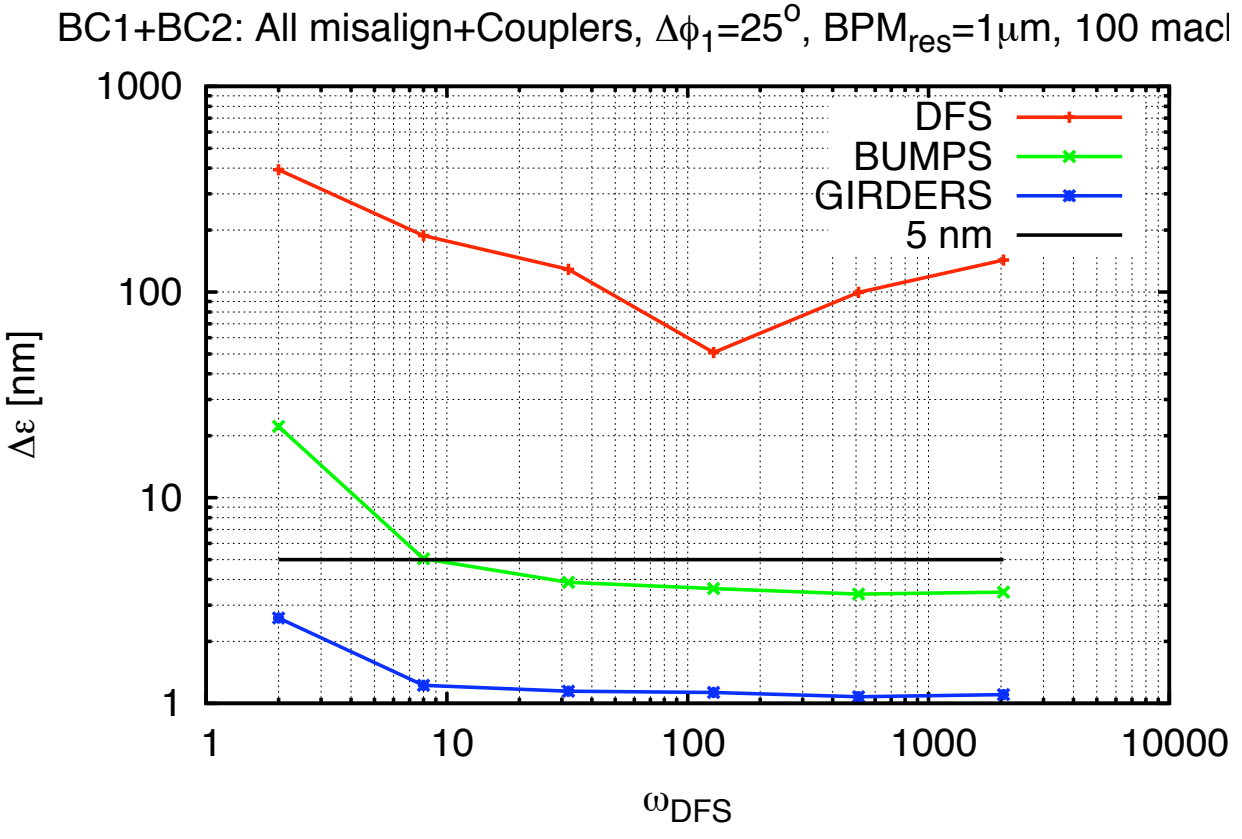
BC1+BC2: all misalignments, no couplers



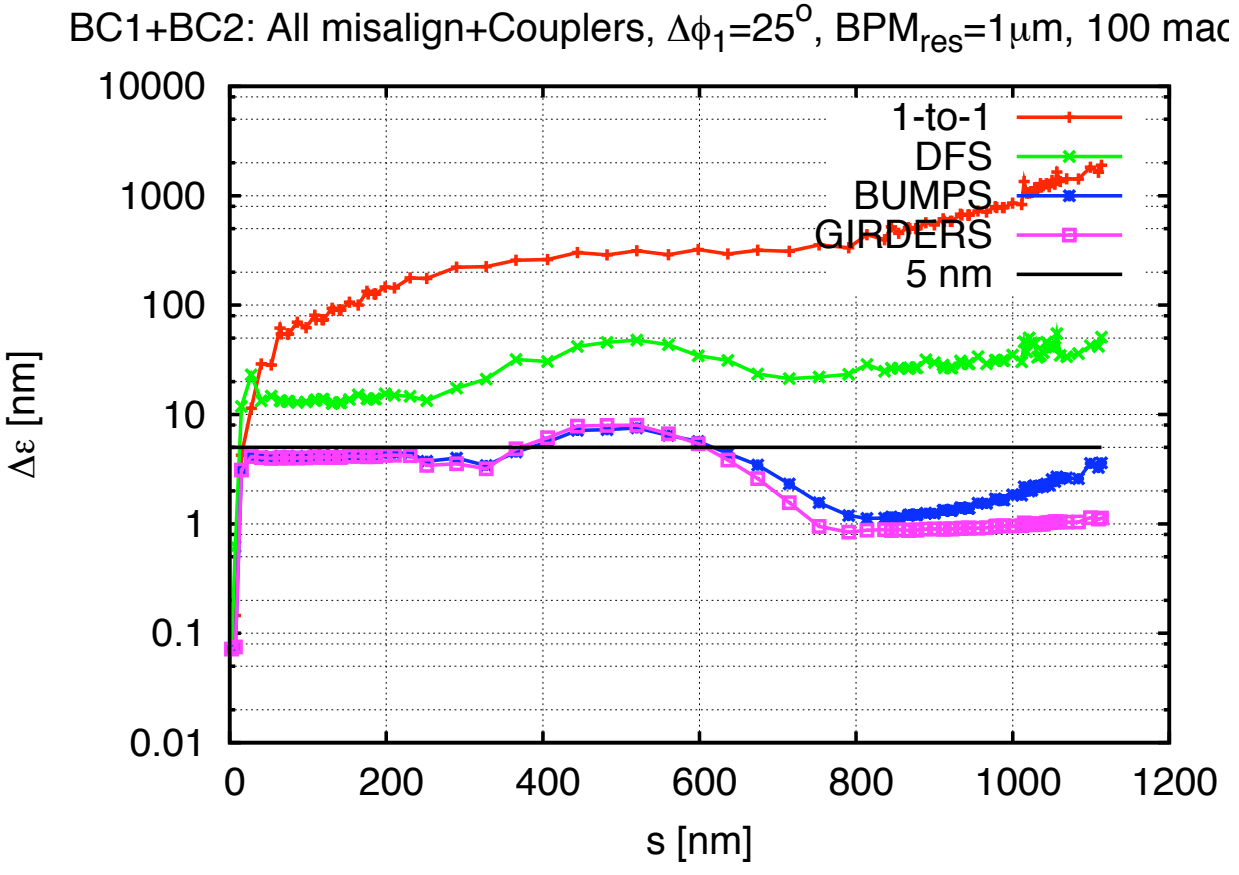
BC1+BC2: all misalignments, no couplers



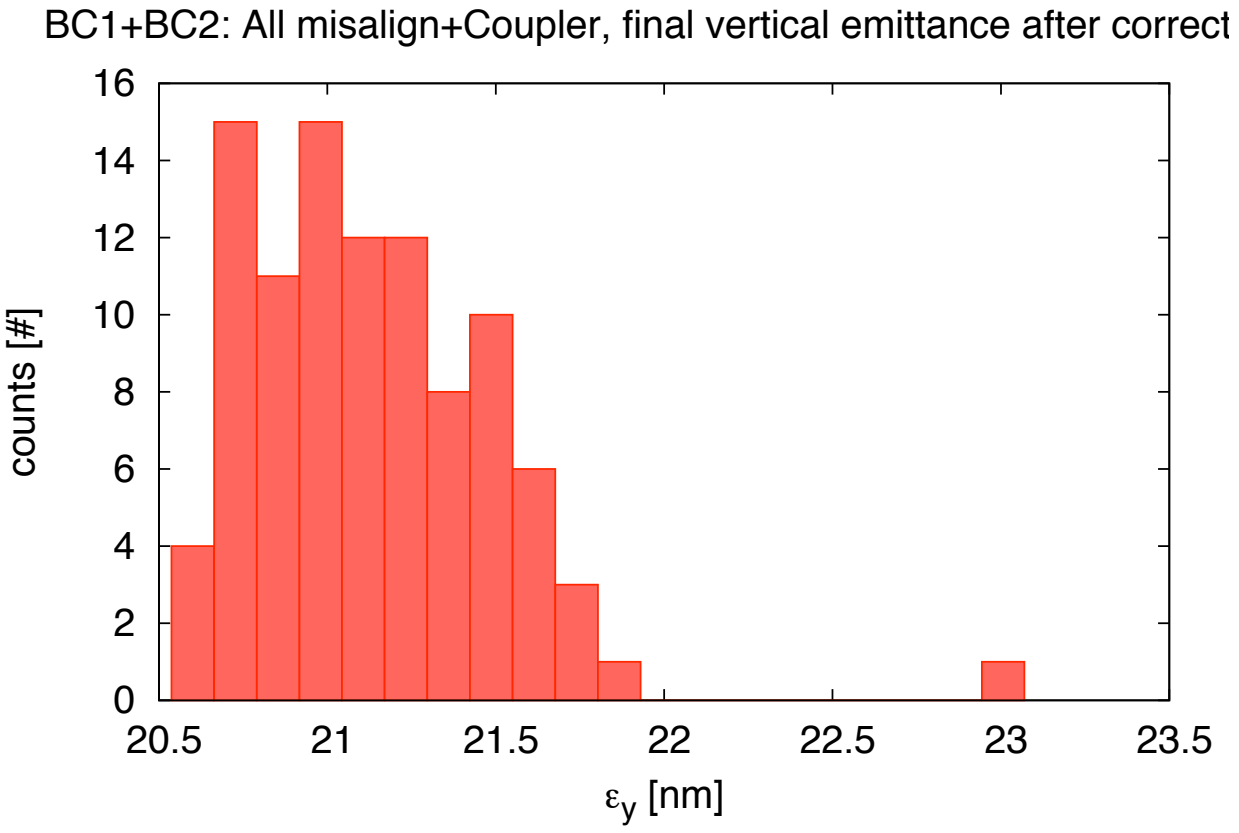
BC1+BC2: all misalignments, couplers



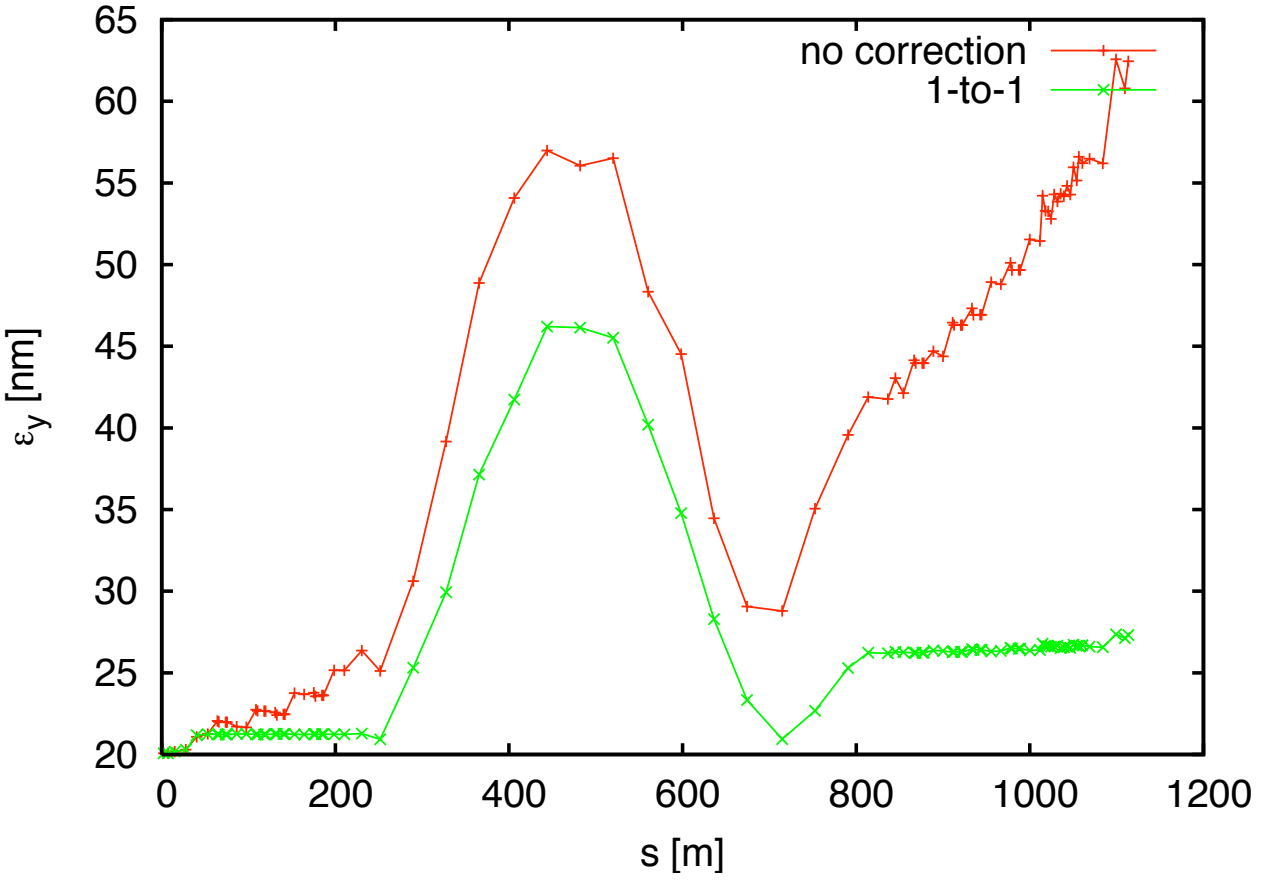
BC1+BC2: all misalignments, couplers



BC1+BC2: all misalignments, couplers



BC1+BC2: couplers



Main Linac that follows the Earth Curvature

- Lattice ILC2007b, curved linac

- All misalignments, no couplers
- Alignment procedure

  1) 1-to-1 correction

  2) Dispersion Matched Steering, using two test beams : $G_1 = 1.05G_0$, $G_2 = 0.8G_0$

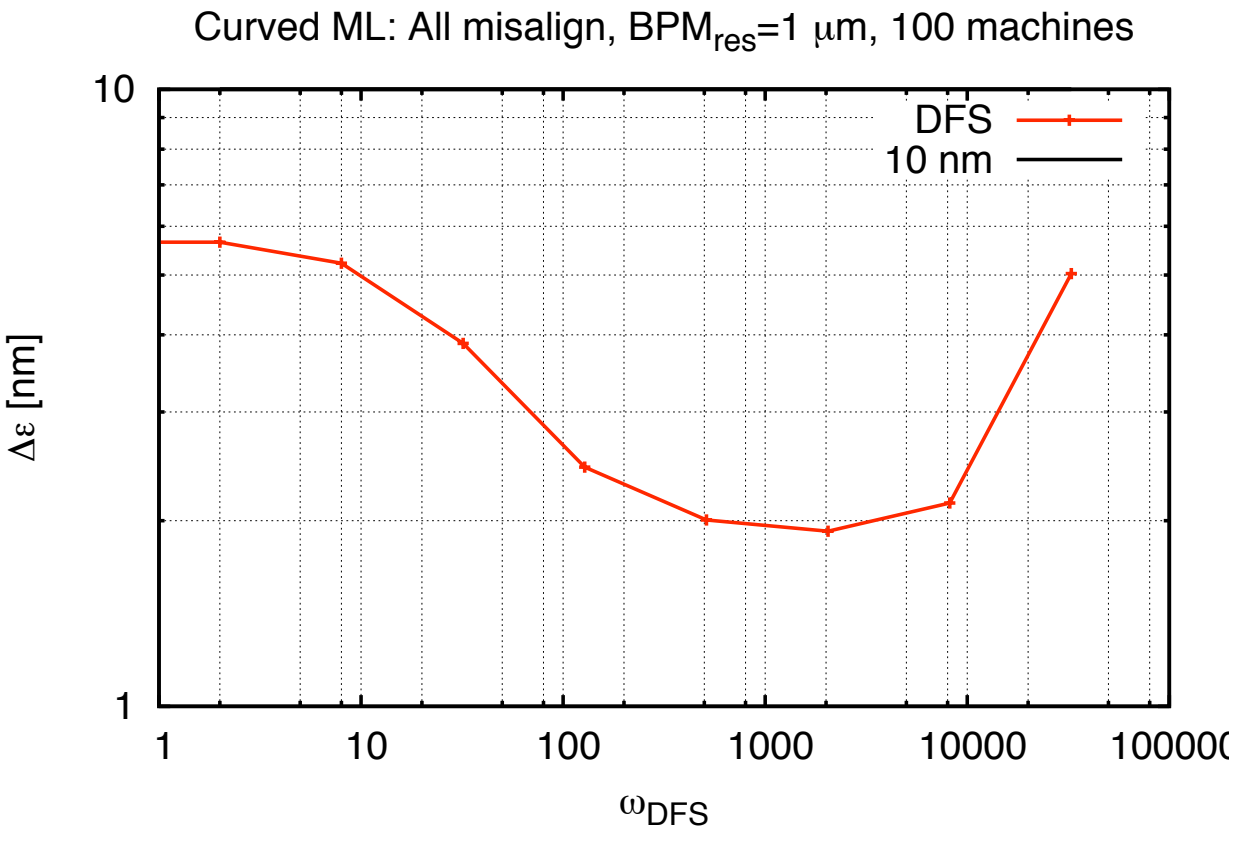
$$\chi^2 = \sum_{i=1}^{n} y_{0,i}^2 + \sum_{j=1}^{m} \sum_{i=1}^{n} \omega_{1,j} \, (y_{j,i} - y_{0,i} + \Delta_{1,j})^2$$

  one single bin

- Initial emittance 40 nm

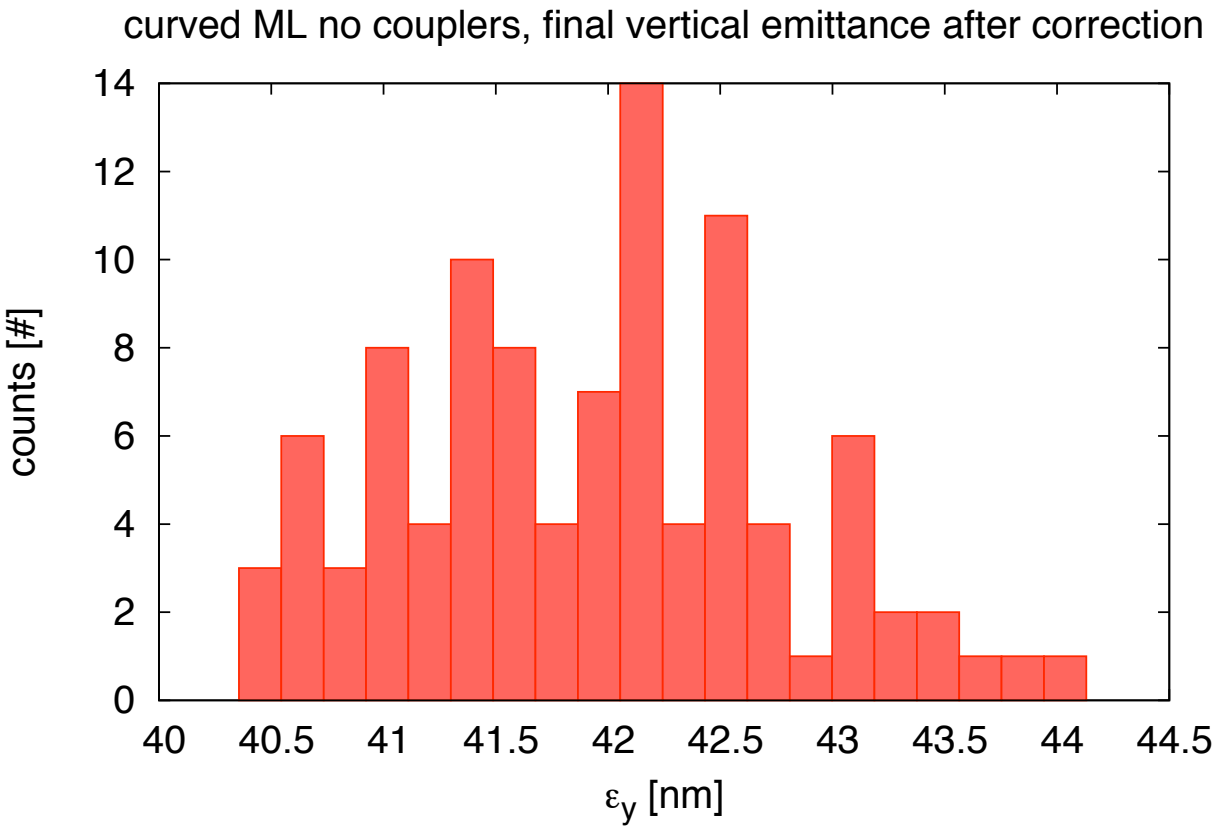
$\Rightarrow$ We want to study the distribution of the corrector values

Curved ML: all misalignments, no couplers



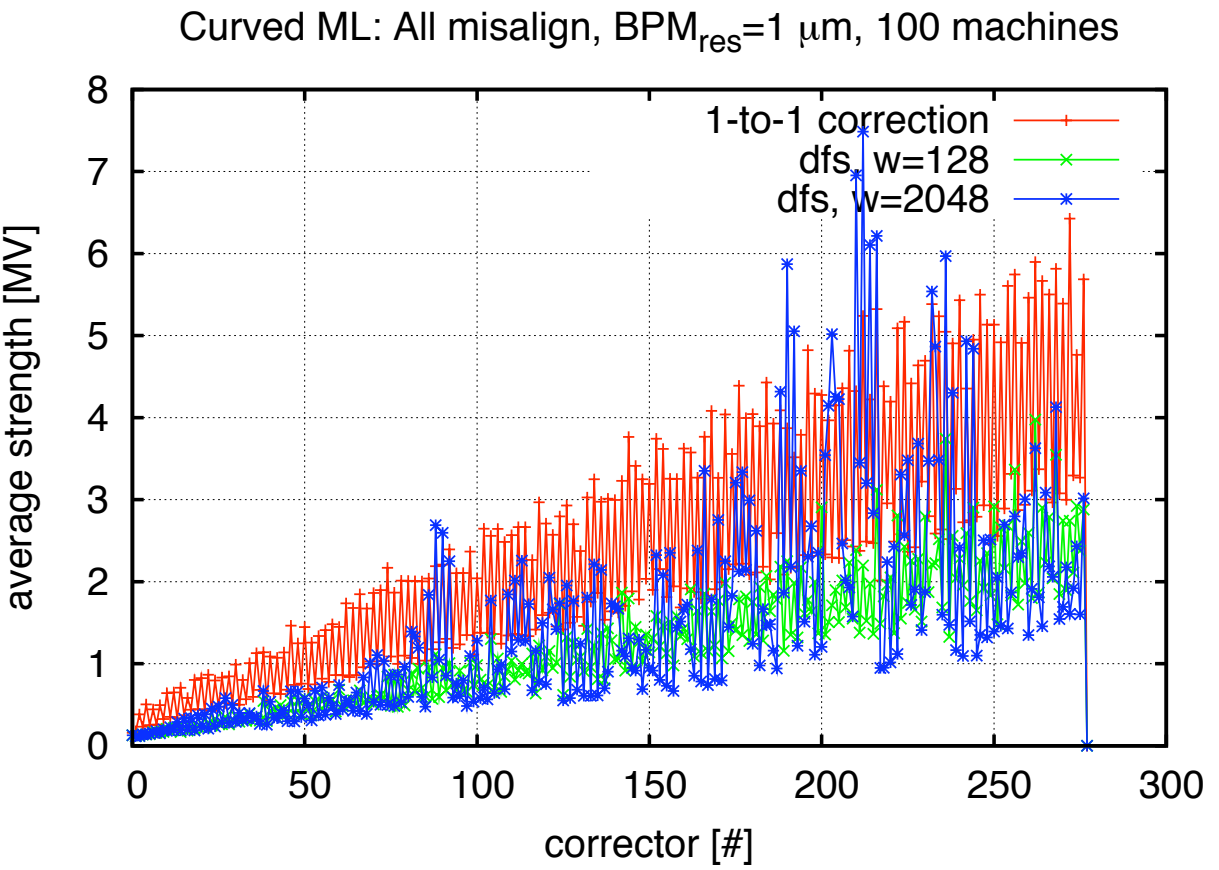
- Optimum at $\omega = 2048$, emittance growh 1.9 nm

Curved ML: all misalignments, no couplers



Curved ML: all misalignments, no couplers

- Average corrector values in MV



Curved ML: all misalignments, no couplers

- Average kick per corrector, in μrad