

# DFS simulation in Bunch Compressors of ILC

--- following report at DESY GDE Mtg---

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# Previous reports

Reported in ILCWS2007 at DESY, May-June 2007.

Andrea Latina also reported his work on DFS in Bunch Compressors in the same workshop

- There are apparent discrepancies.
- This work tried to solve the difference.

# New DFS

- Look three orbits instead of two, same as Latina's.
  - i-th BPM reading for nominal setting:  $z_{i0}$
  - i-th BPM reading for different phase  $+\Delta\phi$ :  $z_i(+)$
  - i-th BPM reading for different phase  $-\Delta\phi$ :  $z_i(-)$
  - Using steering magnets, minimize

$$\text{Sum}_i \{ w^2 (z_i(+) - z_i(-))^2 + z_{i0}^2 \}$$

$w$ : weight factor

- Same phase change for all cavities in BC1 and BC2
- All BPMs and all steering magnets were used.
- Scan  $\Delta\phi$  and  $w$  and look at final vertical emittance

# Errors (RMS)

- Quad and Bend offset: 150 micron
- BPM offset
  - w.r.t. quad: 7 micron, or
  - independently 150 micron
- BPM resolution: 1 micron
- Cavity offset: 300 micron
- Cavity tilt: 150 micro rad. (effectively 300 micro rad.)

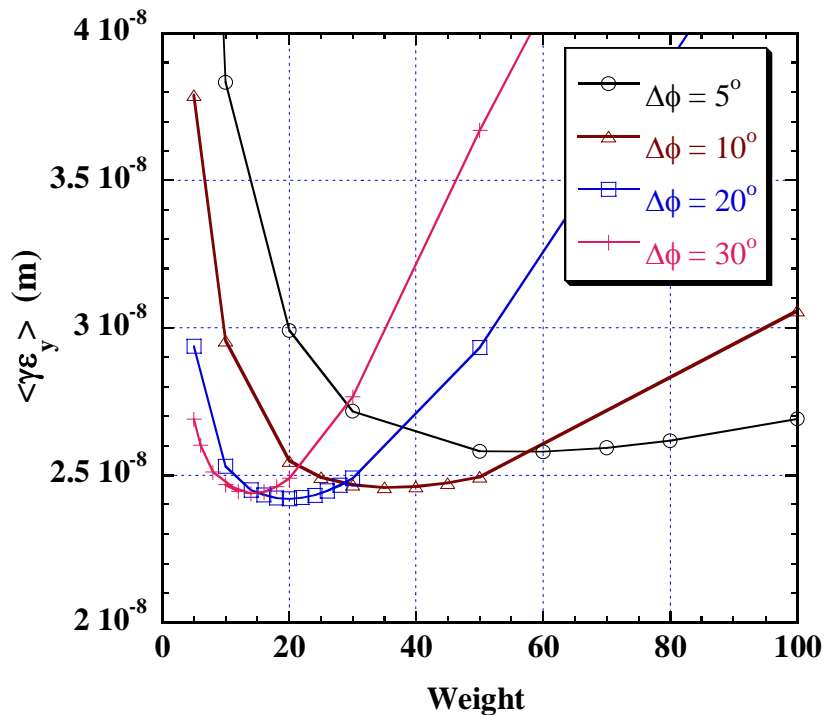
## NOTE:

- Edge (de)focus cancel approximately a half of the vertical kick due to cavity tilt.
- Edge focus of accelerating cavities are not readily included in the simulation code SAD.
- The effect should be included in SAD, hopefully sometime soon.

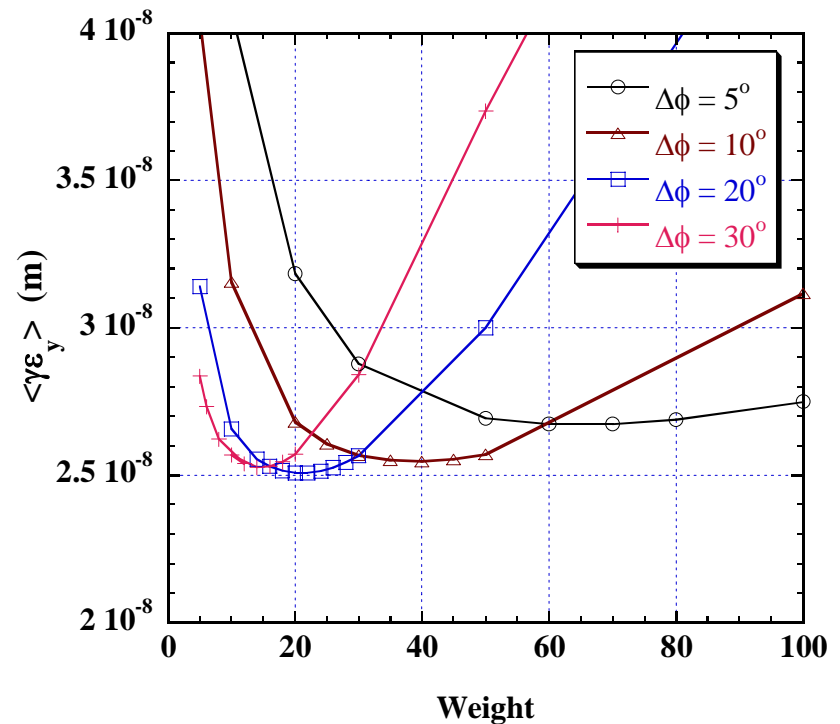
# Dependence on Weight factor

Emittance (average of 50 seeds) vs. Weight

BPM aligned wrt Quads

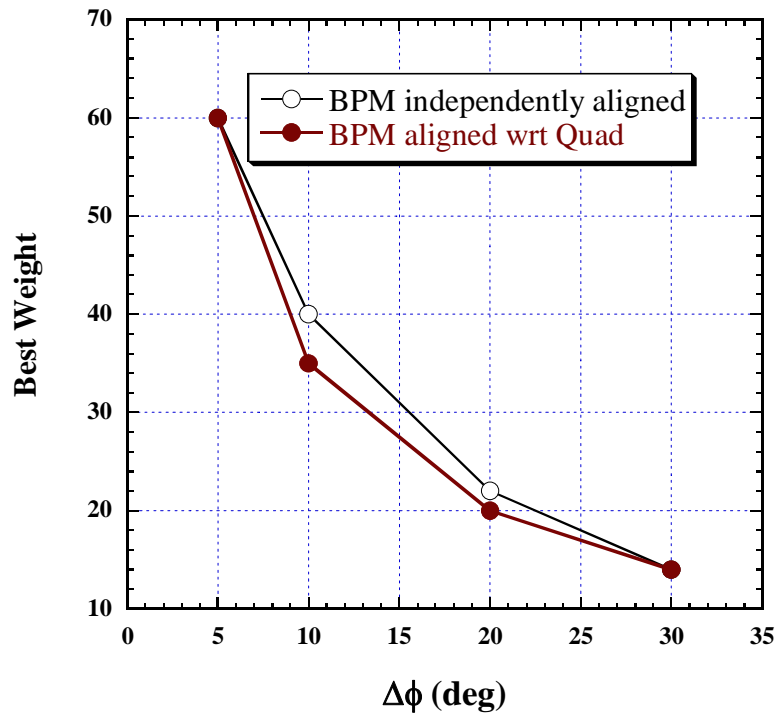


BPM aligned Independently

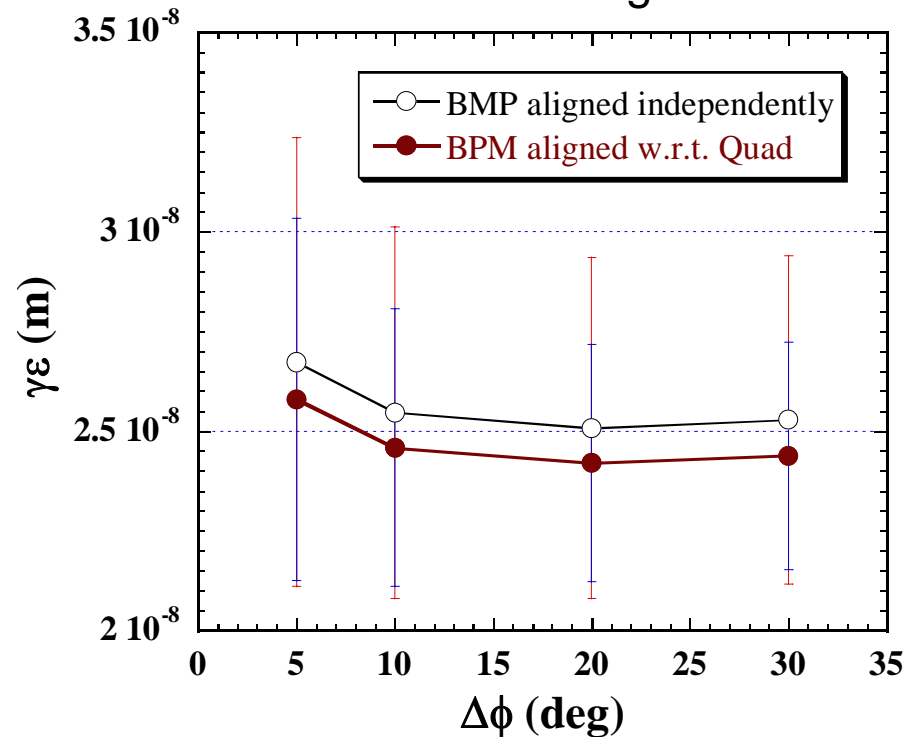


# Dependence on phase shift

Best Weight vs.  $\Delta\phi$

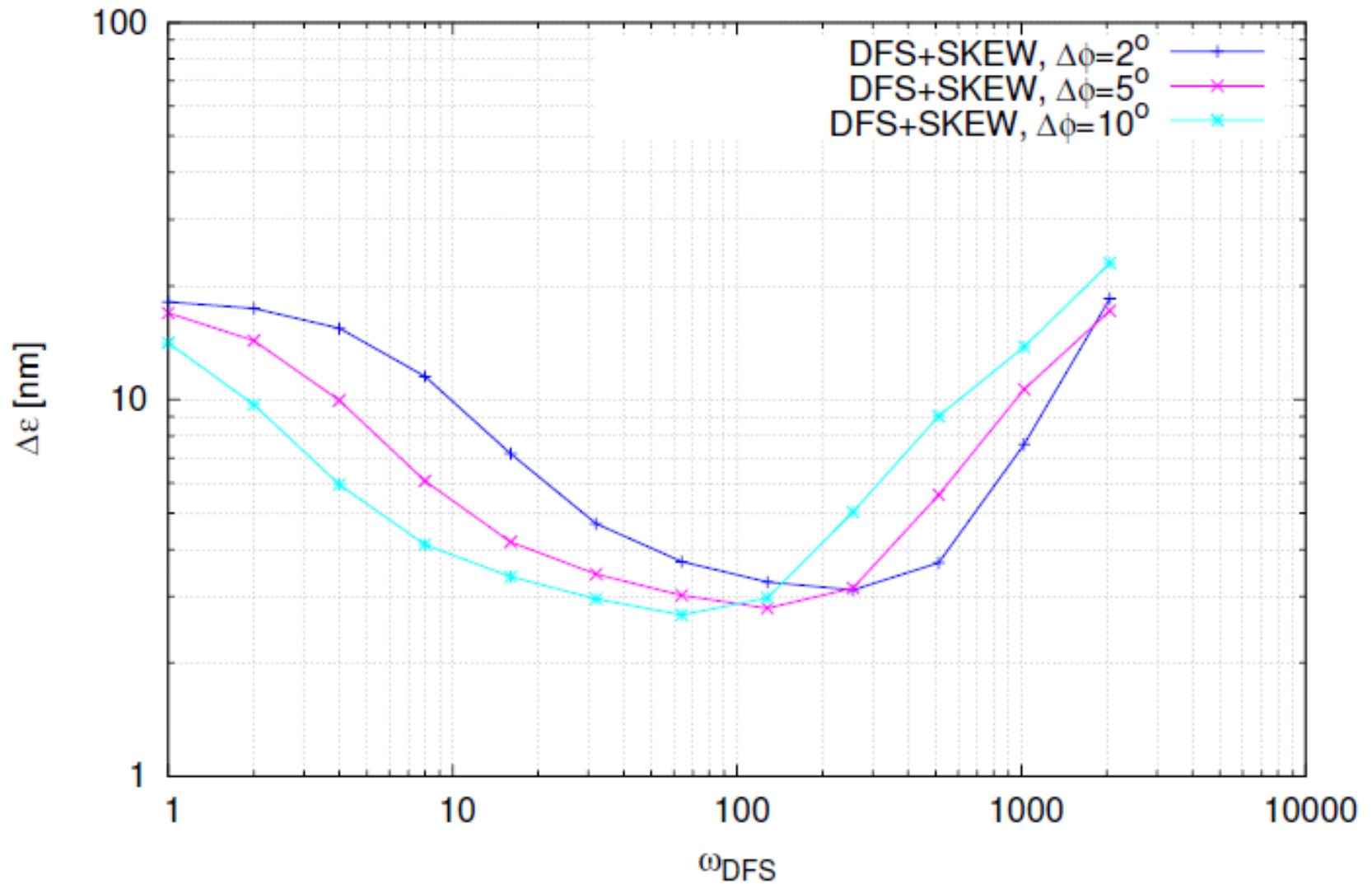


Average emittances.  $\Delta\phi$  with the Best Weight



From Andrea Latina, 2007 International Linear Collider Workshop

ILC BC Alignment:  $\text{BPM}_{\text{res}}=1\mu\text{m}$ , 50 machines



# SUMMARY

- The results are much better than expected from the previous report.
- Choice of Weight factor was the most important for the difference
  - In previous report:  
 $w = (\text{BPM misalignment}) / (\sqrt{2} * \text{BPM resolution})$   
which is about 100. (misalignment 150  $\mu\text{m}$  and resolution 1  $\mu\text{m}$ )  
This is far from the optimum.
- It is not clear why  $w$  should be so small.
  - Maybe nonlinearity is still significant even if using  $\pm \Delta\phi$ .
- The expected emittance is not satisfactory.
  - Probably bump tuning will be effective.