Linac studies with SLEPT

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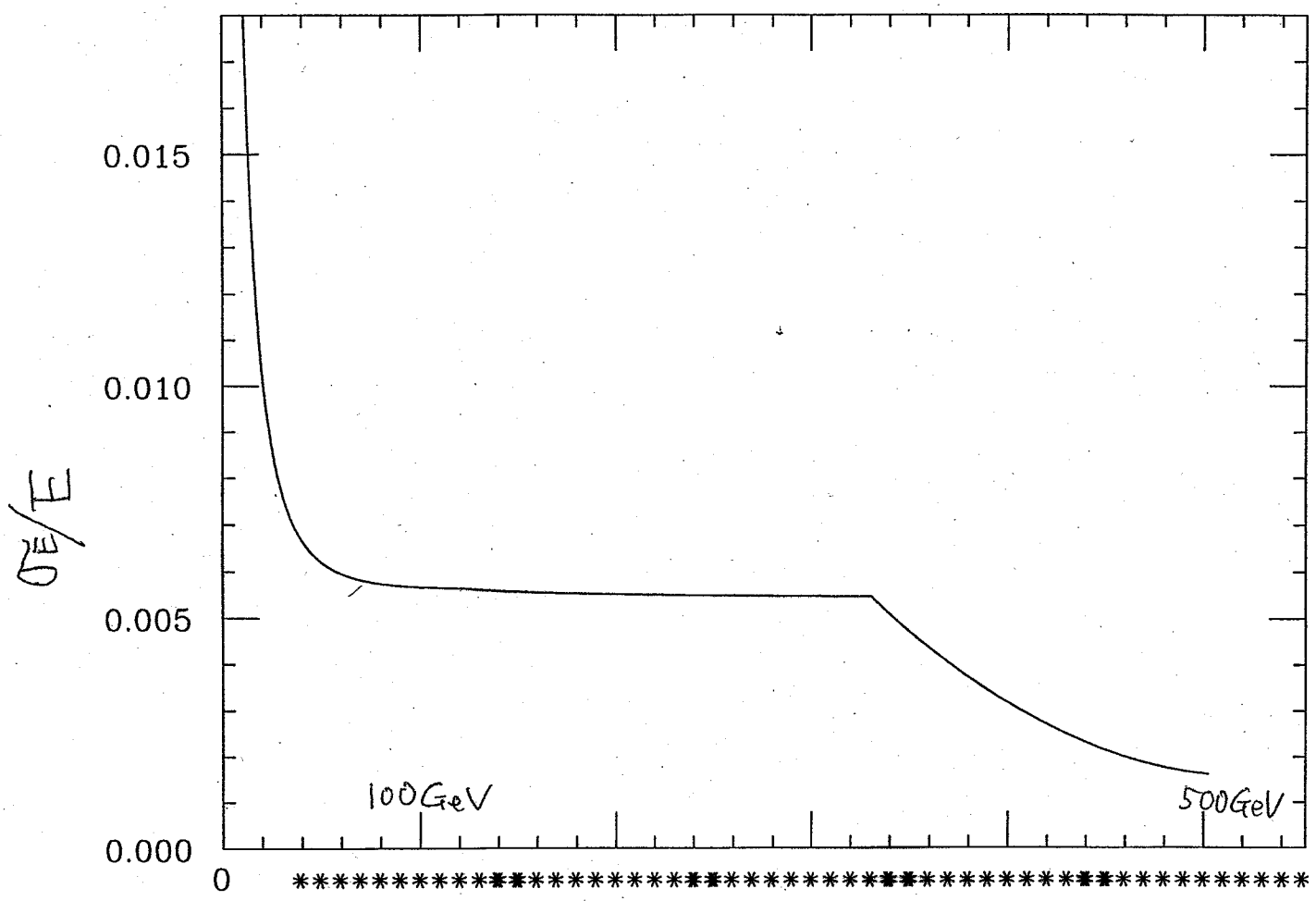
SLEPT:*
Linac tracking simulation program.
Named recently.
Original version was written in 1993~1995.
(NLC-Note-14)
It had been used sometimes since then,
but mostly sleeping.

We are trying to connect it with other codes for other parts of LC. (SAD, CAIN, etc., from DR exit to IP)
"SAD script" is used for this purpose.
(No results from the connection yet.)

Some results using SLEPT alone are presented here.

*may stands for
Simulation program for Low Emittance by Phase space Tracking

BNS overhead $\simeq 3\%$



Errors.

- Injection
- Quad, Cavity misalignment
  - Independent (σ)
  - 'ATL' (ΔT)
- Q – BPM_Q misalignment (unknown offset)
  - Independent (σ)
- Cavity – BPM_C
  - Independent (σ)
- BPM_Q resolution

Corrections (Feed back)

Simulated

- Quad 'simple' alignment

  make Σ(BPMQ read)^2 minimum.

- Cavity alignment

  make BPMc read zero

- Fast orbit beed back

  pairs of steerings at several places / linac

Not simulated yet

'Advanced' correction, feed back

Dispersion free

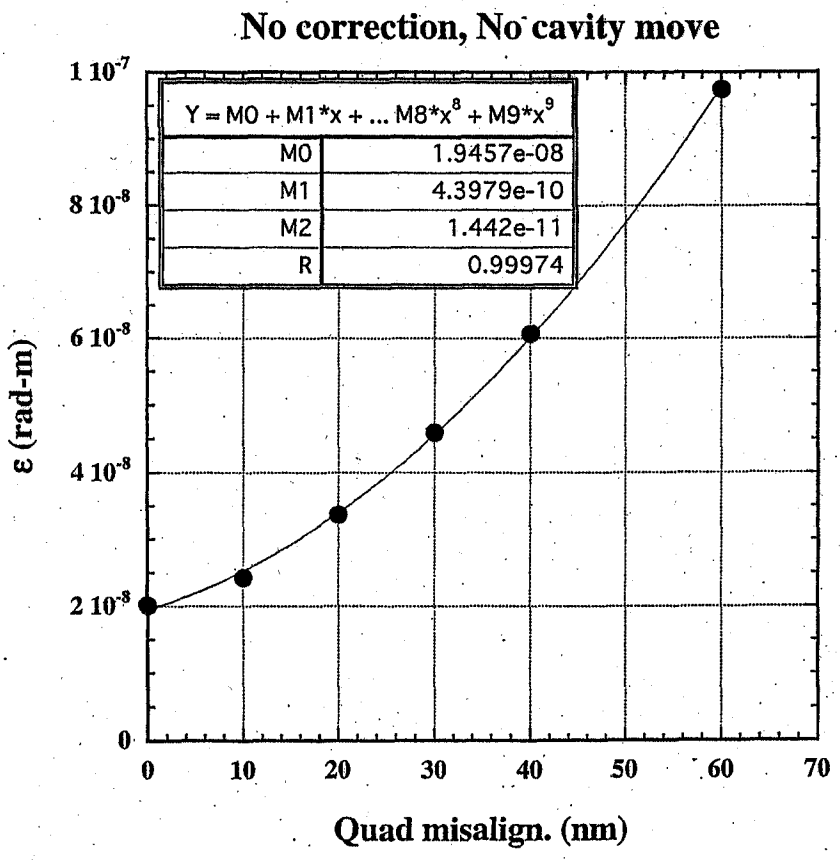
ε - bump

intra pulse (train) feed back at IP

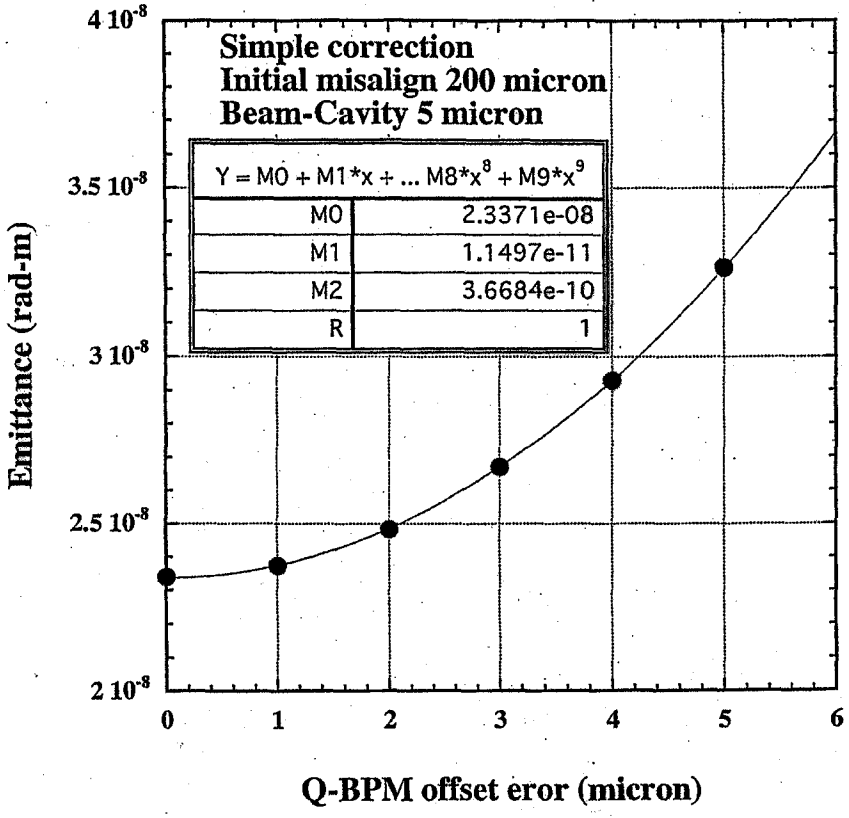
. ... — — — — — .

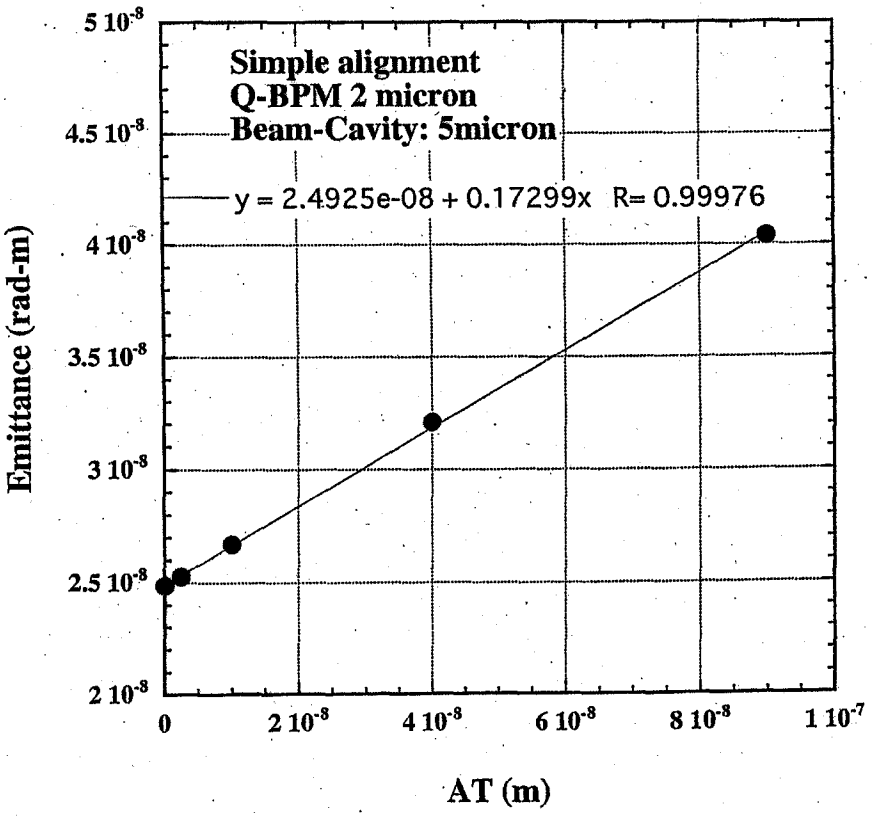
Initial $\varepsilon = 2 \times 10^{-8}$

Error	Correction	<Emitt> (E-8 m-rad)
Injection 0.5 sigma	None	2.411
Q misalignment 10 nm	None	2.430
Cavity-BPM 5 micron	Beam-Cavity alignment	2.348
Q-BPM 2 micron	1-to-1 steering	2.269
Q-BPM 2 micron Cavity-BPM 5 micron	Simple Q alignment Beam-Cavity alignment	2.483
AT=2.5E-9 (ATL law) Q-BPM 2 micron Cavity-BPM 5 micron	Simple Q alignment Beam-Cavity alignment	2.528
Q mis alignment 30 nm (BPMQ resolution 0)	Fast orbit steering 10 pairs/linac	2.644


No correction, No cavity move
Y = M0 + M1*x + ... M8*x^8 + M9*x^9
M0 1.9457e-08
M1 4.3979e-10
M2 1.442e-11
R 0.99974
ε (rad-m)
1 10^-7
8 10^-8
6 10^-8
4 10^-8
2 10^-8
0
0
10
20
30
40
50
60
70
Quad misalign. (nm)

Simple Quad alignment



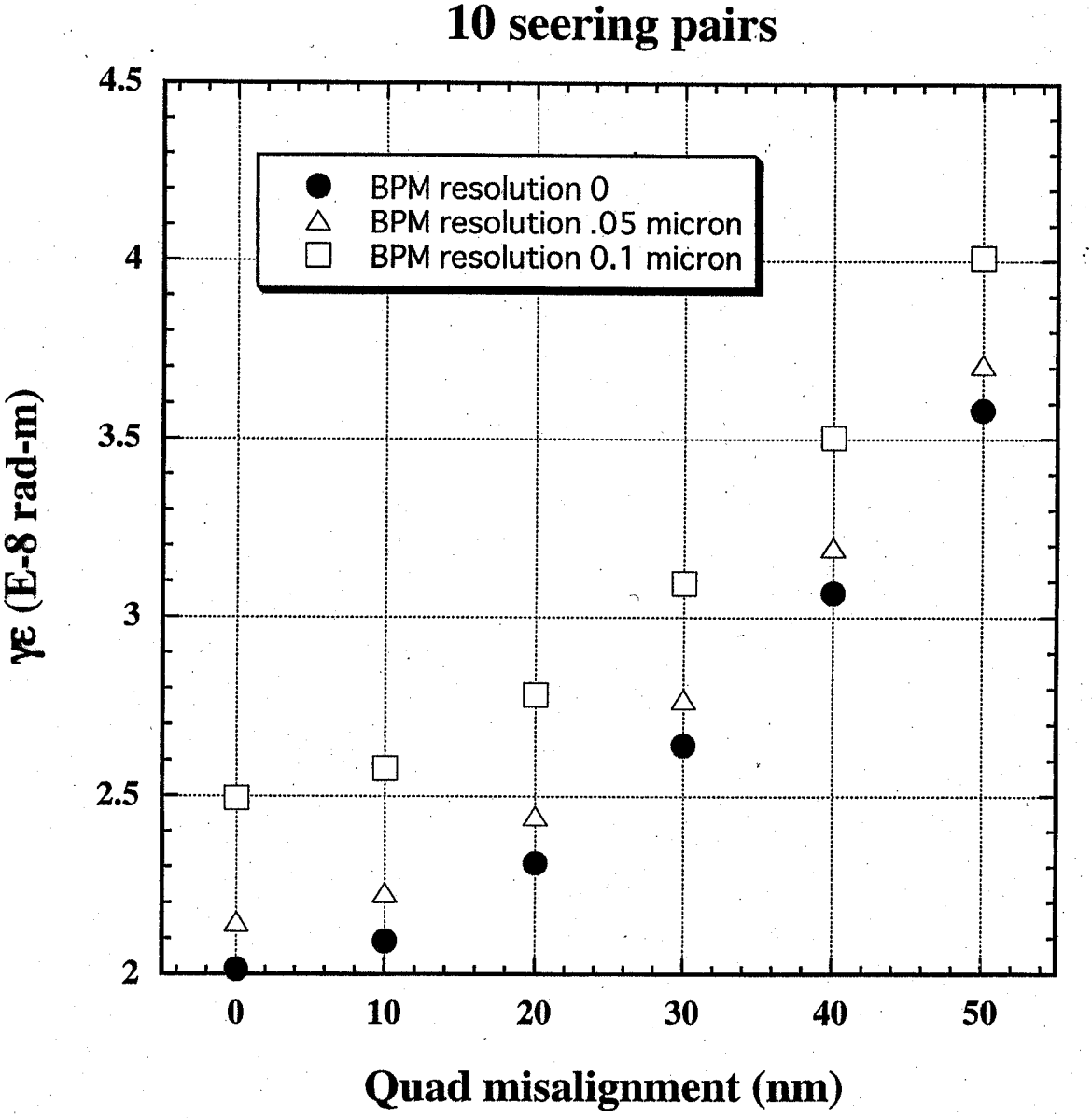


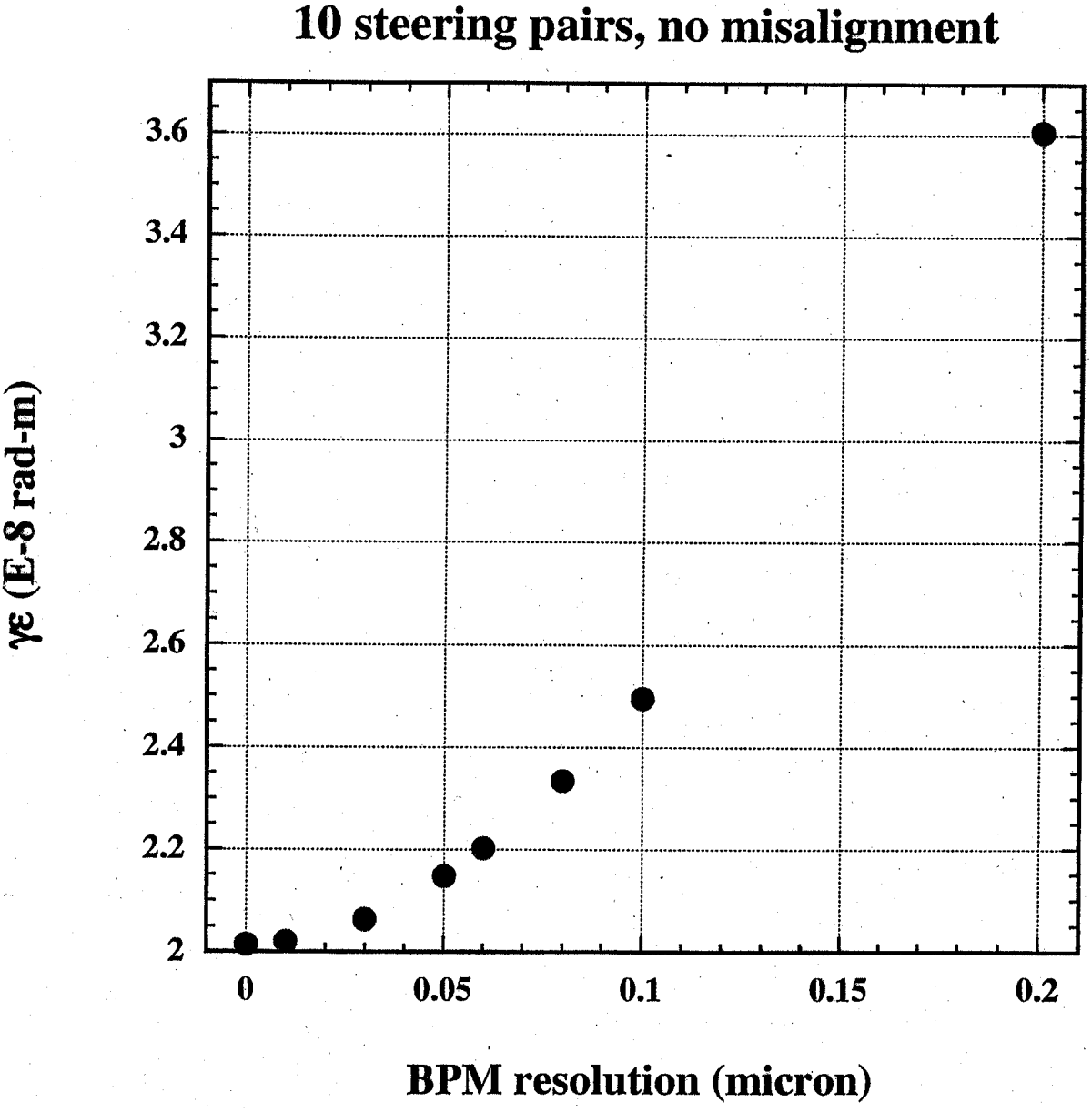
Linac divided into 10, same phase advance.

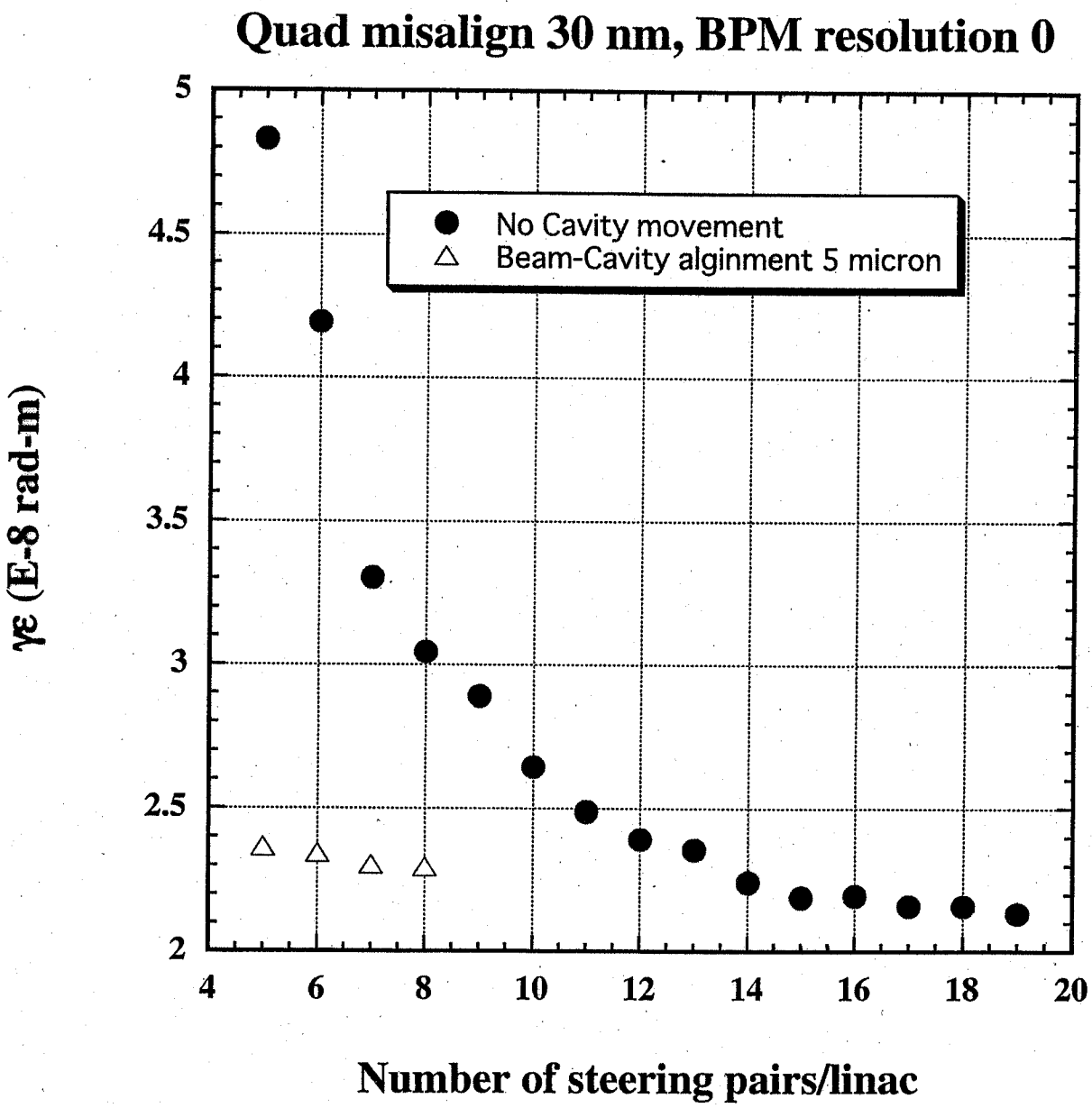
End of each section.

2 steers + 4 BPM

for orbit correction.




10 steering pairs, no misalignment
γε (E-8 rad-m)
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
0
0.05
0.1
0.15
0.2
BPM resolution (micron)


Quad misalign 30 nm, BPM resolution 0
No Cavity movement
Beam-Cavity alginment 5 micron
γε (E-8 rad-m)
Number of steering pairs/linac
5
4.5
4
3.5
3
2.5
2
4
6
8
10
12
14
16
18
20