Longitudinal Acceptance

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TRIUMF
04/16/04

- **Introduction**
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- **Conclusion**

Introduction

Lattice parameters taken from Scott's Friday 27 Feb talk

$E_{\min}$ (GeV)	5		10	
$E_{\max}$ (GeV)	10		20	
$V/\omega\Delta T\Delta E$	1/8		1/12	
$A_{\perp n}$ (mm)	30			
L_0 (m)	2			
L_Q (m)	0.5			
V per cell (MV)	7.5			
Empty cells	8			
ν_x, ν_y at $E_{\min}$	0.35			
n	90		105	
C (m)	606.918		767.953	
V total (MV)	675.0		787.5	
	QD	QF	QD	QF
L (m)	1.612338	1.065600	1.762347	1.275747
ρ (m)	15.2740	-59.6174	18.4002	-70.9958
x_0 (mm)	-1.573	7.667	1.148	8.745
r (cm)	14.0916	15.2628	10.3756	12.6256
B_0 (T)	1.63774	-0.41959	2.71917	-0.70474
B_1 (T/m)	-9.1883	8.1768	-15.4948	12.5874

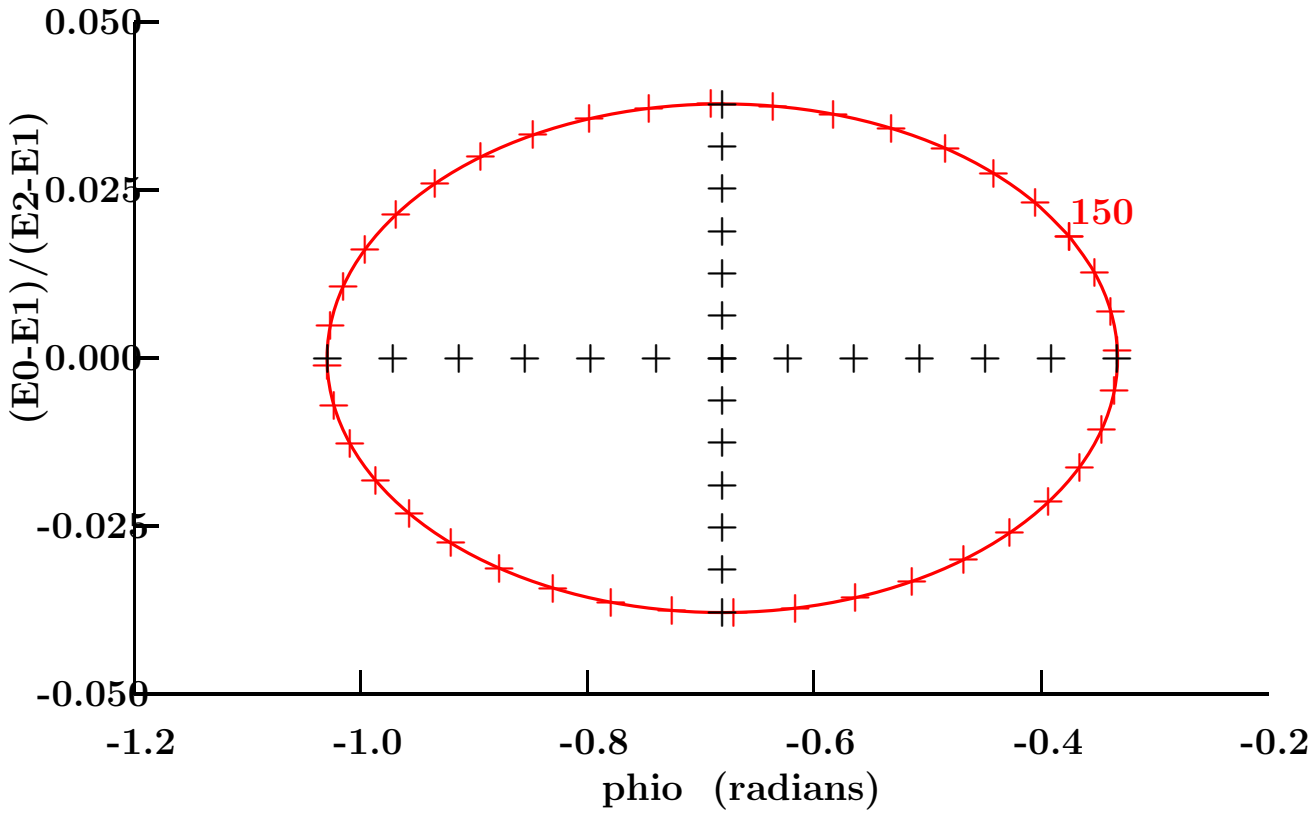
$$\frac{1}{\zeta} = \frac{V}{\omega\ \Delta t\ \Delta E}$$

V is defined as fundamental frequency Voltage gain per turn

Δt max slip per turn assumed parabolic

Scott's 1/w=ζ = 8 and 12 for 5-10 and 10-20 respectively

Initial Particles



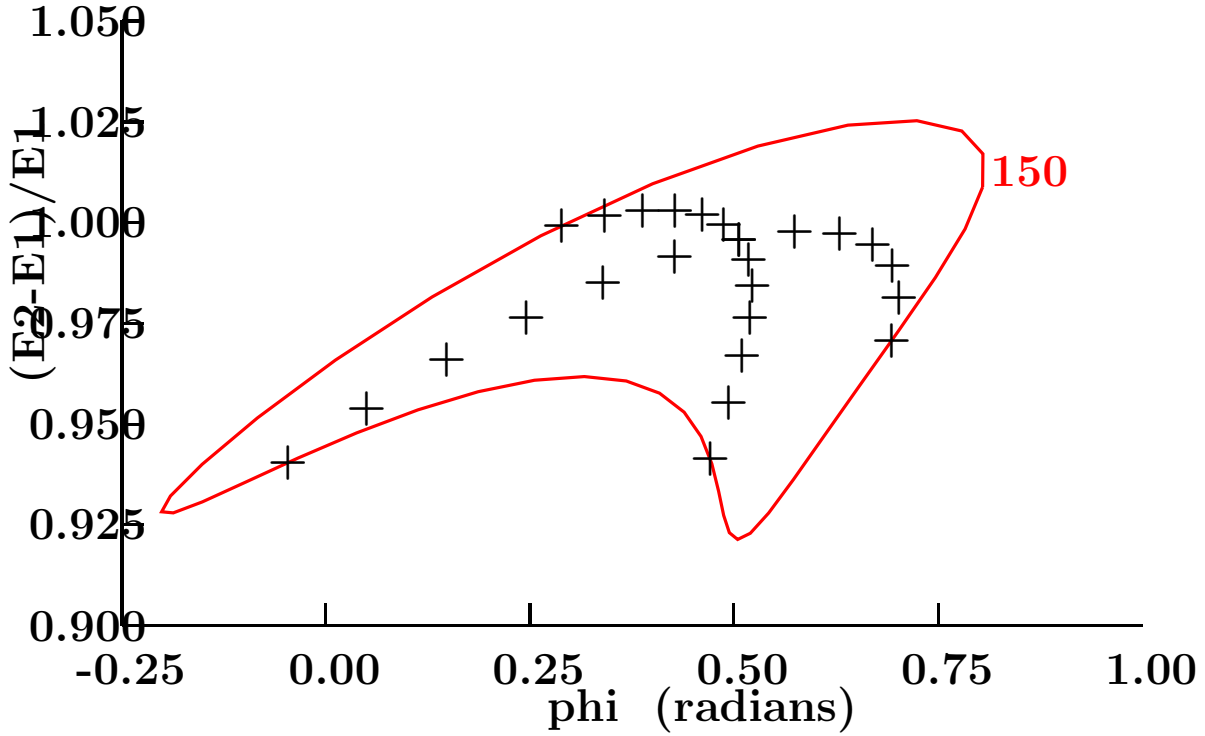
Track using 1 D code, ignoring amplitude effects

Without Harmonic RF 5-10 Scott's zeta=8

After adjusting:

- Long beta ($\Delta\phi/\Delta E$)
- Starting Phase
- Number of turns
- Offset of phase slip vs. E

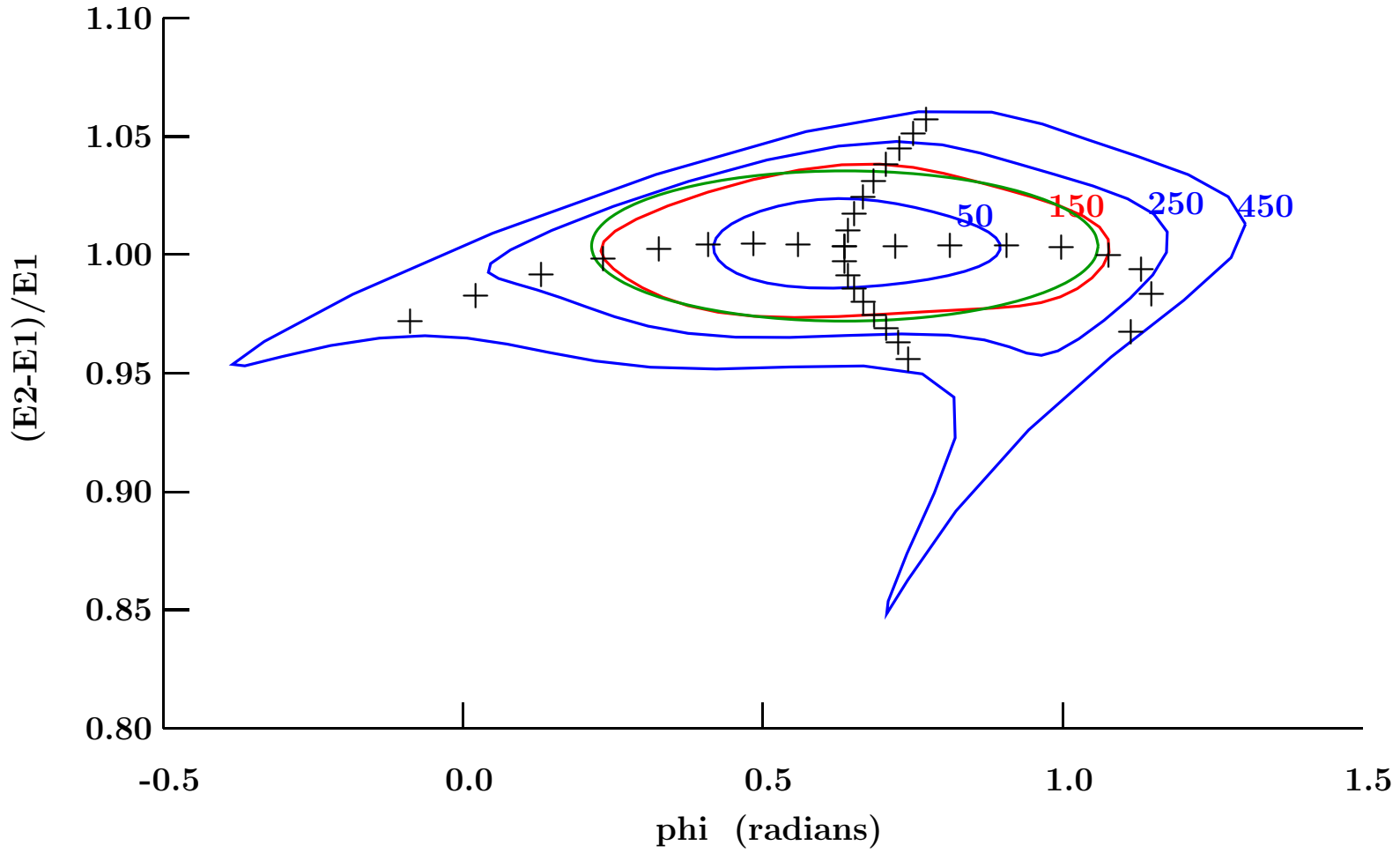
n/n0=1.02 zeta= 8.0 phi0=-.68 shift=0.19 2nd= 0.000 3rd= 0.000



Emittance growth at 150 pi mm: approx 22%

With 3rd Harmonic and Scott zeta=8

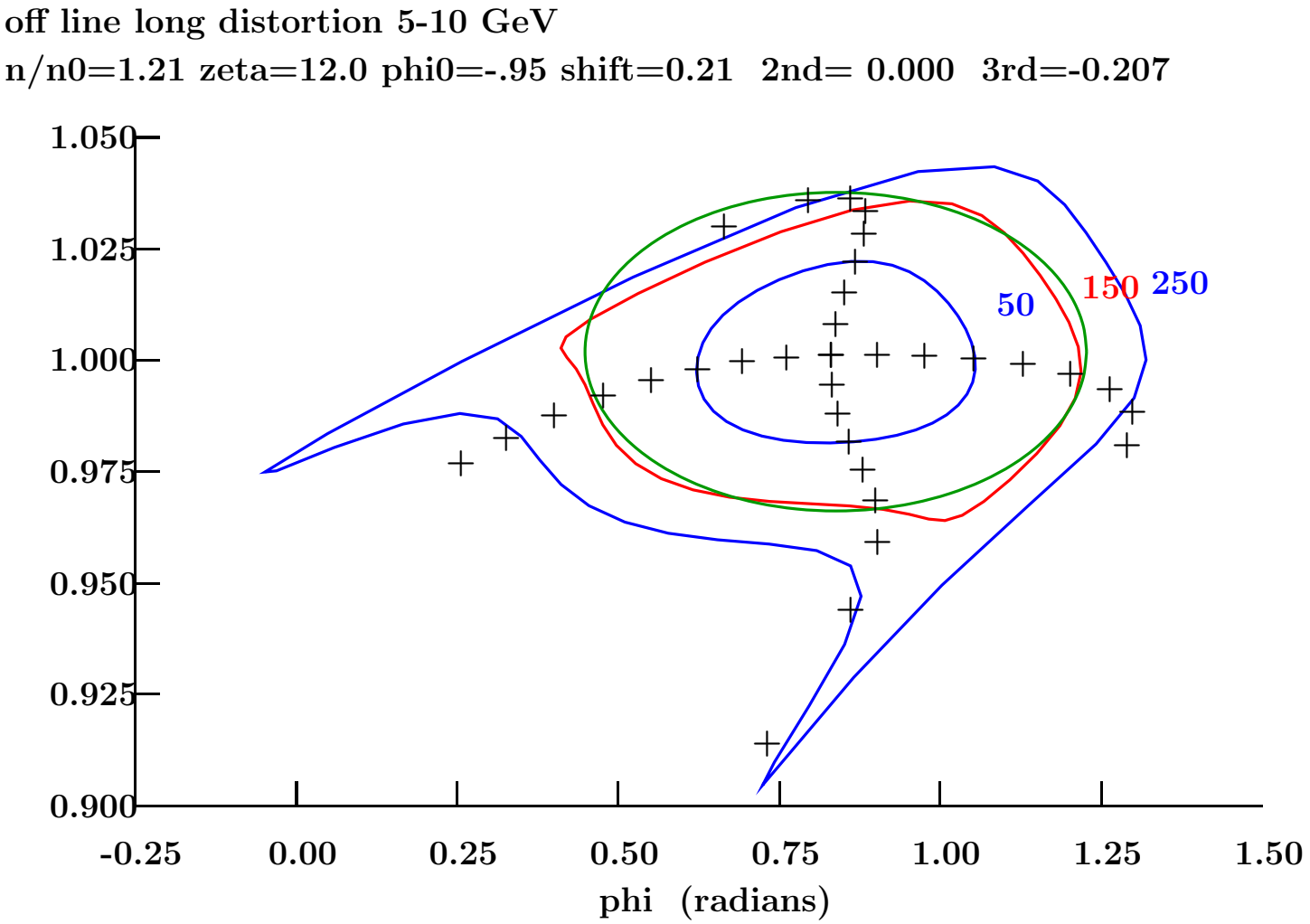
n/n0=1.17 zeta= 8.0 phi0=-.68 shift=0.19 2nd= 0.000 3rd=-0.150



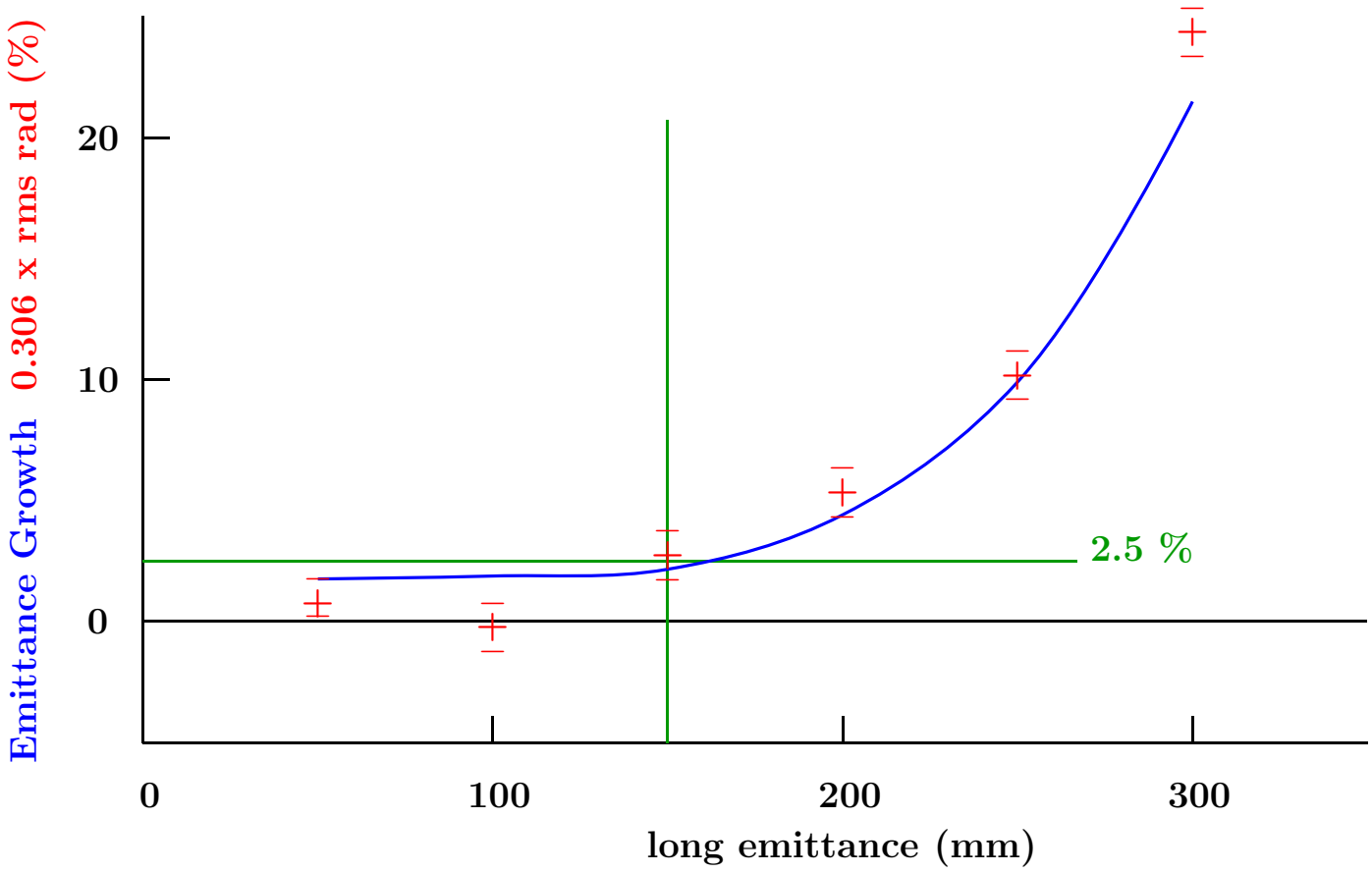
Emittance growth at 150 pi mm: approx 1%

Increase Zetas till growth about 2.5%

5-10 GeV $\zeta = 12$ (8)

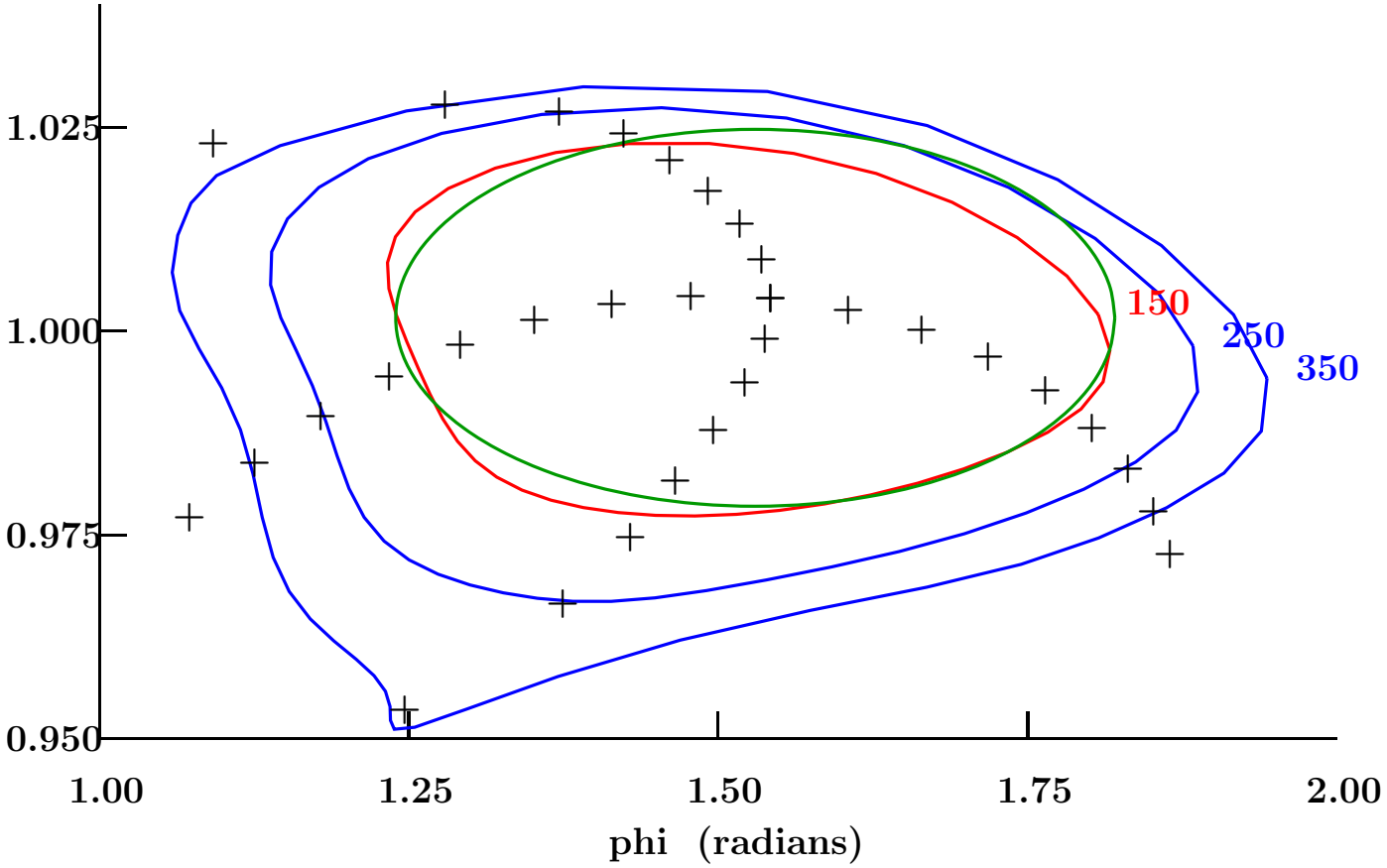


Emittance growth at 150 pi mm: approx 2.5%

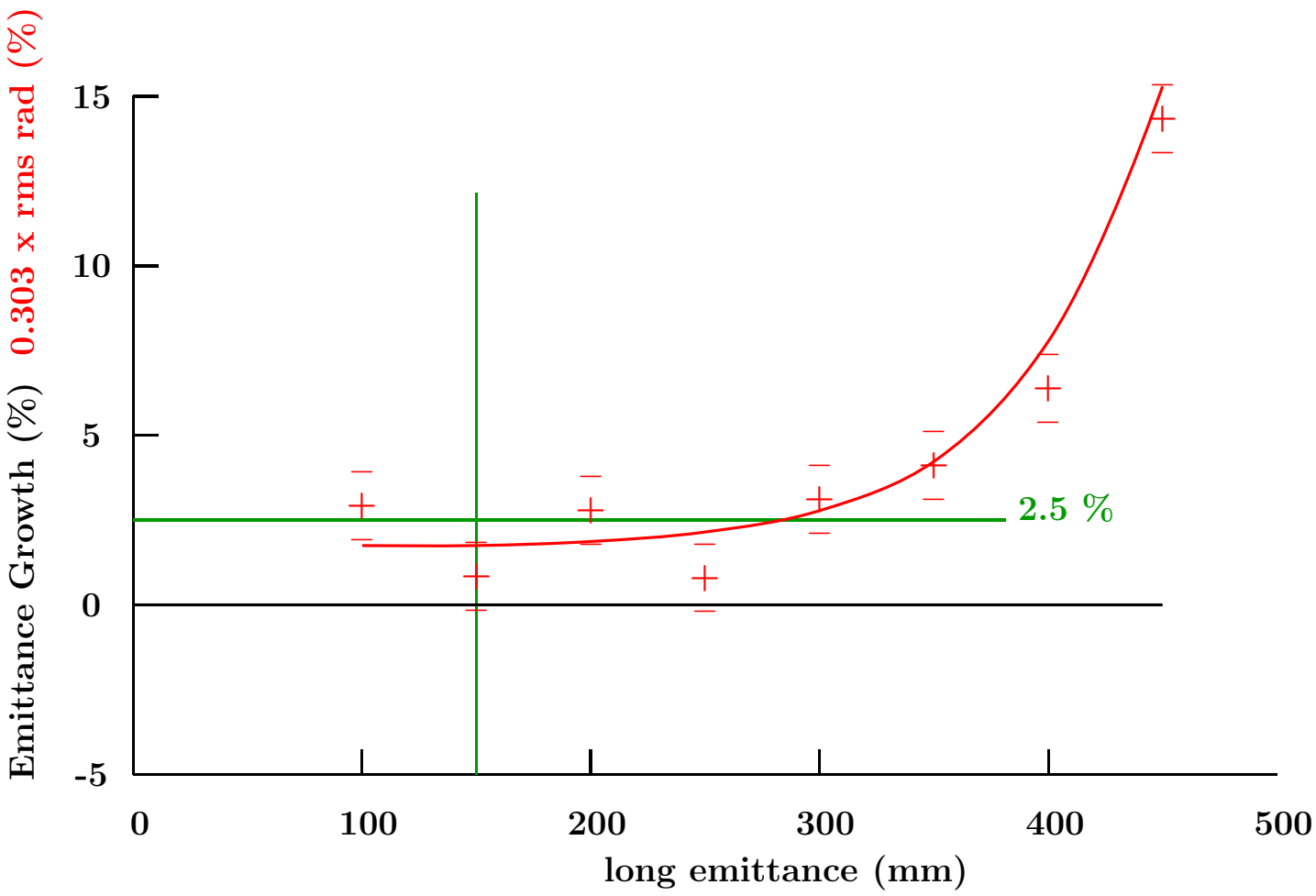

Emittance Growth 0.306 x rms rad (%)
20
10
0
2.5 %
0
100
200
300
long emittance (mm)

10-20 GeV $\zeta = 16$ (12)

off line long distortion 10-20 GeV
n/n0=1.26 zeta=16.0 phi0=-1.45 shift=0.20 2nd= 0.000 3rd=-0.300



Emittance growth at 150 pi mm: approx 2%


Emittance Growth (%) 0.303 x rms rad (%)
15
10
5
0
-5
0
100
200
300
400
500
long emittance (mm)
2.5 %

Conclusion

- **For 5-10 Gev $\zeta = 12$ ok (8)**
- **For 10-20 Gev $\zeta = 16$ conservative (12)**
  should try even higher
- **Conditions found:**

E1 GeV	zeta	n/n0	A3/A1	shift	phi0 deg
5	12.0	1.21	-0.21	0.21	-54.50
10	16.0	1.26	-0.30	0.20	-83.00