Electron Ring with High Momentum Compaction $\alpha_c = 0.02 \rightarrow 0.034$

(Machine development shift on 13/04/2005)

Purpose

- To unterstand the nature of vertical beam size blow up
- To decrease possibly the vertical size blow up
- To shorten the bunch length

Participating people

- Predictions, simulations: *Gallo, Spataro, Zobov*
- Lattice preparation: *Milardi, Raimondi*
- Beam measurements: *Alesini, Ghigo, Stella, Zobov*
- Feedbacks tuning: *Drago*

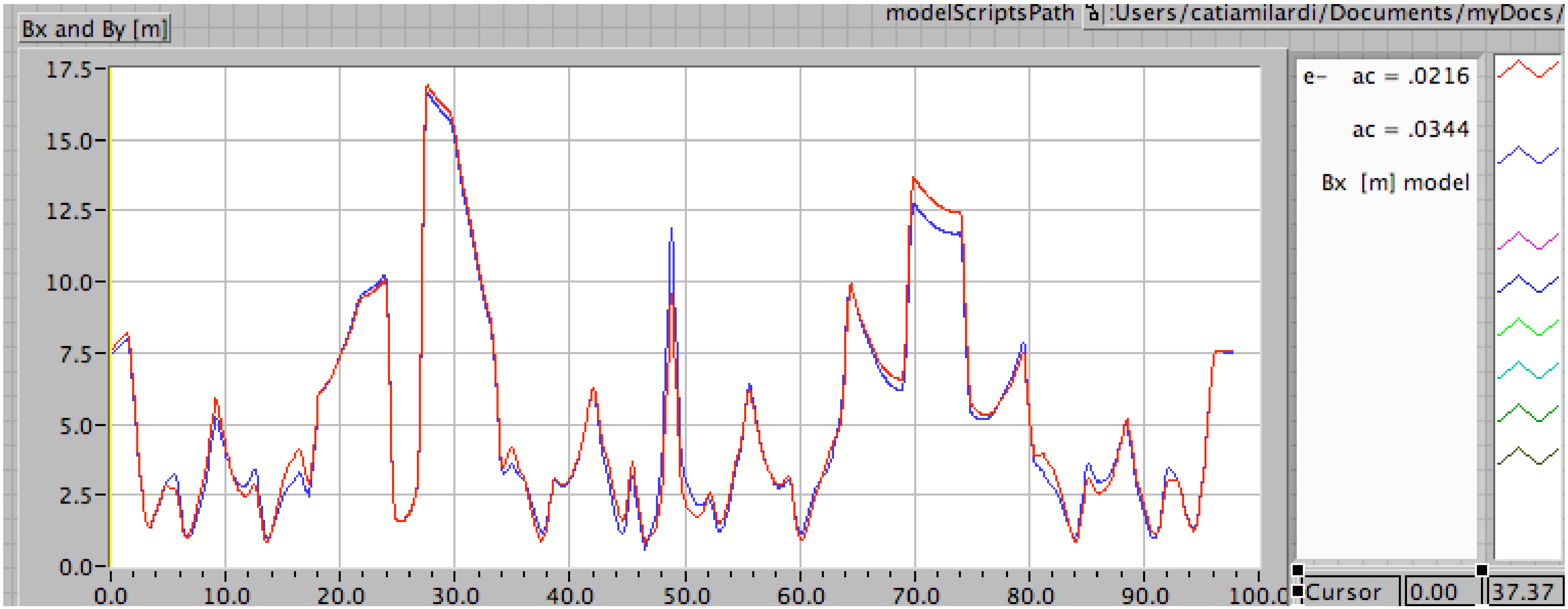
KLOE optics with higher α_c

$\alpha_c = .034$

β_x

comparison $\alpha_c = .02$

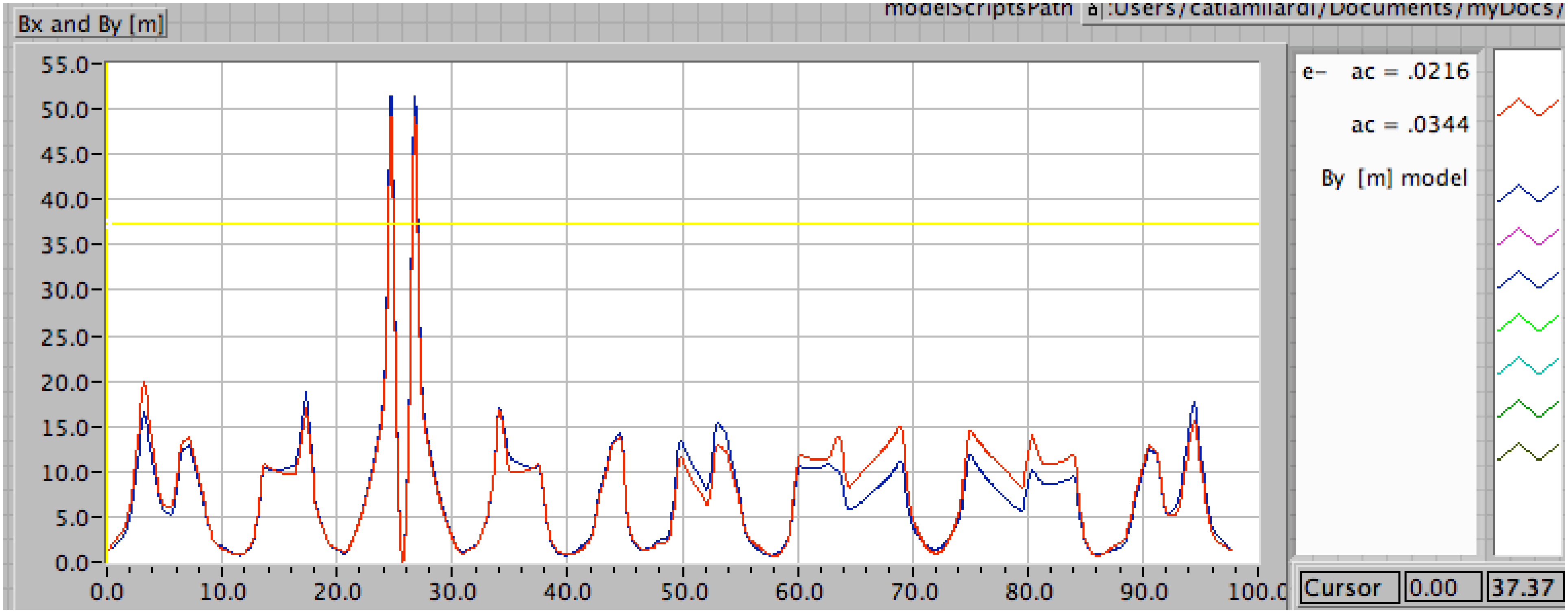
$\alpha_c = .03$



β_y

comparison $\alpha_c = .02$

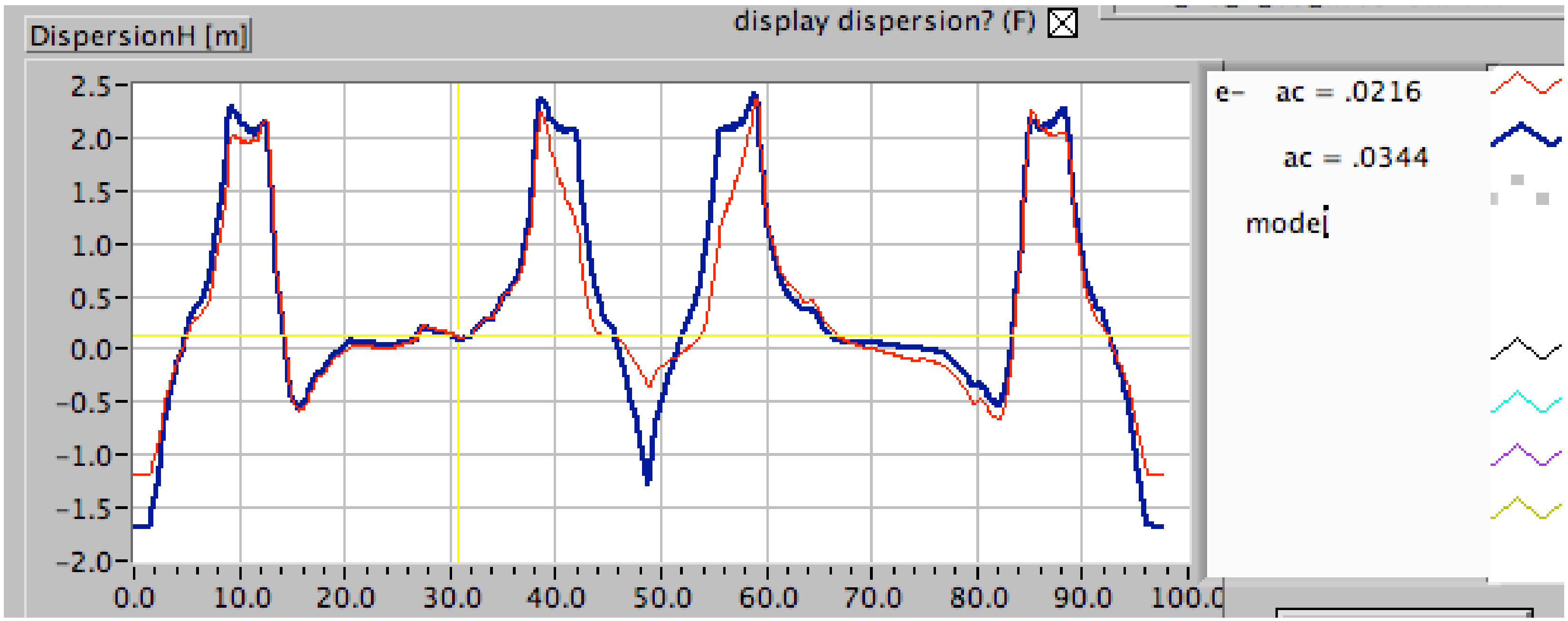
$\alpha_c = .03$



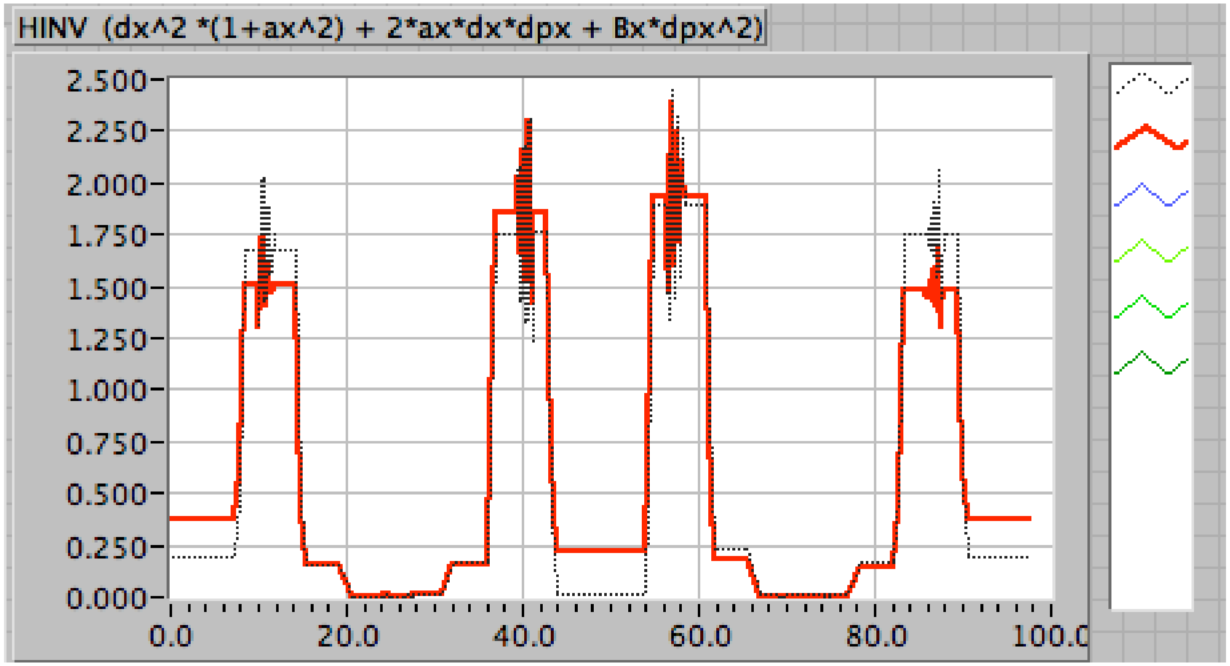
η_x

comparison $\alpha_c = .02$

$\alpha_c = .03$



Invariant comparison



α_c = .02

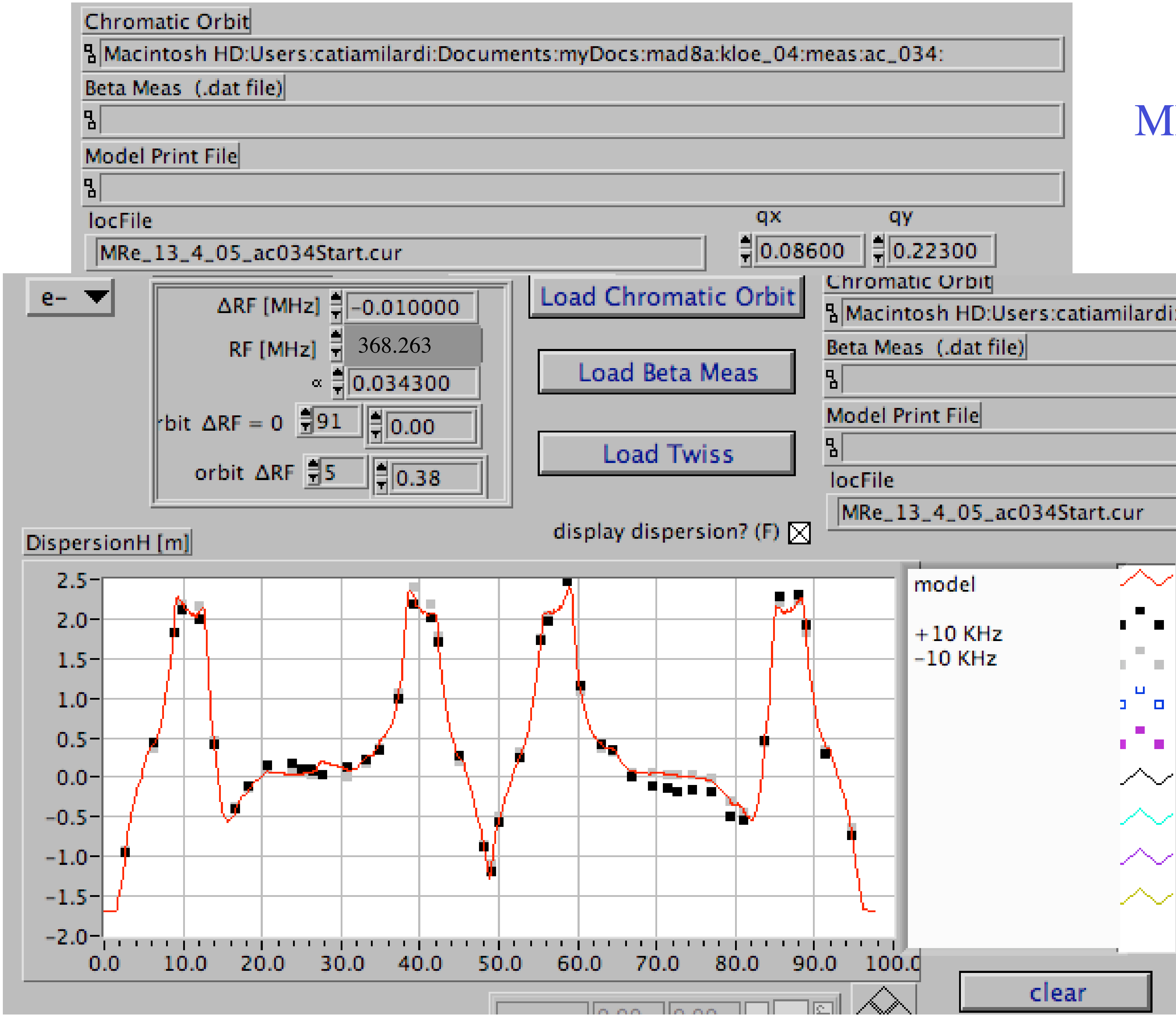
α_c = .03

@ Sinchrotron Light monitor :

β_x= 3.56 [m] β_y = 9.46 [m] α_c = .02

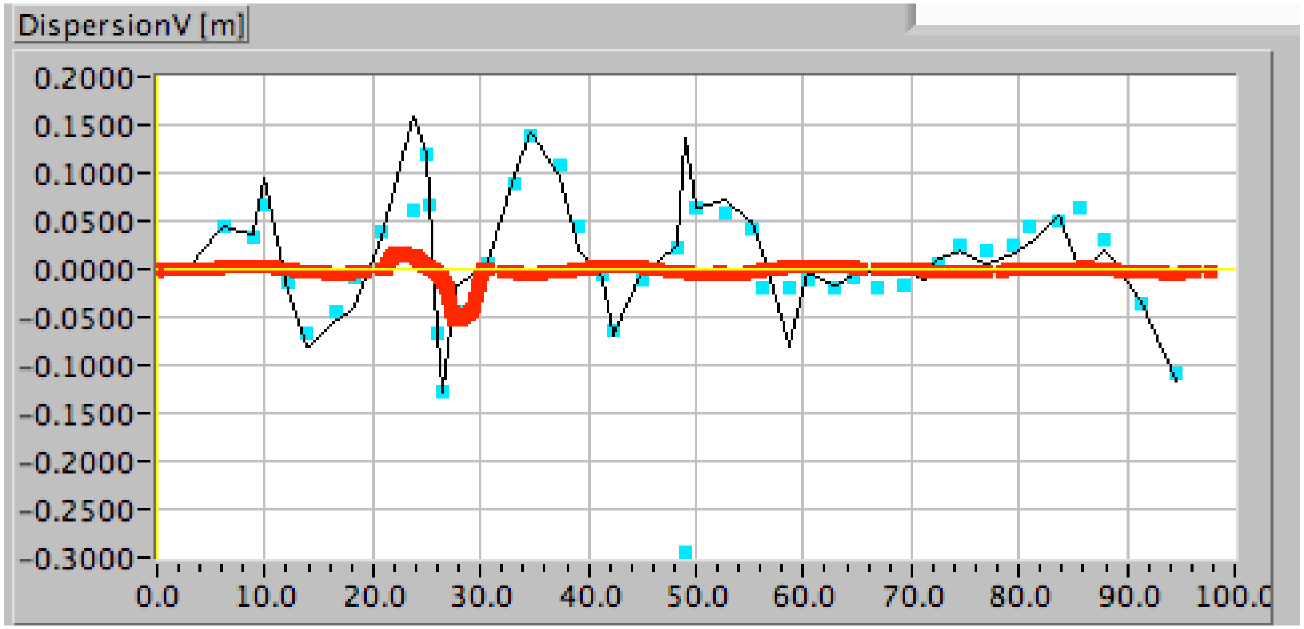
β_x= 3.32 [m] β_y = 10.6 [m] α_c = .03

emittance unchanged

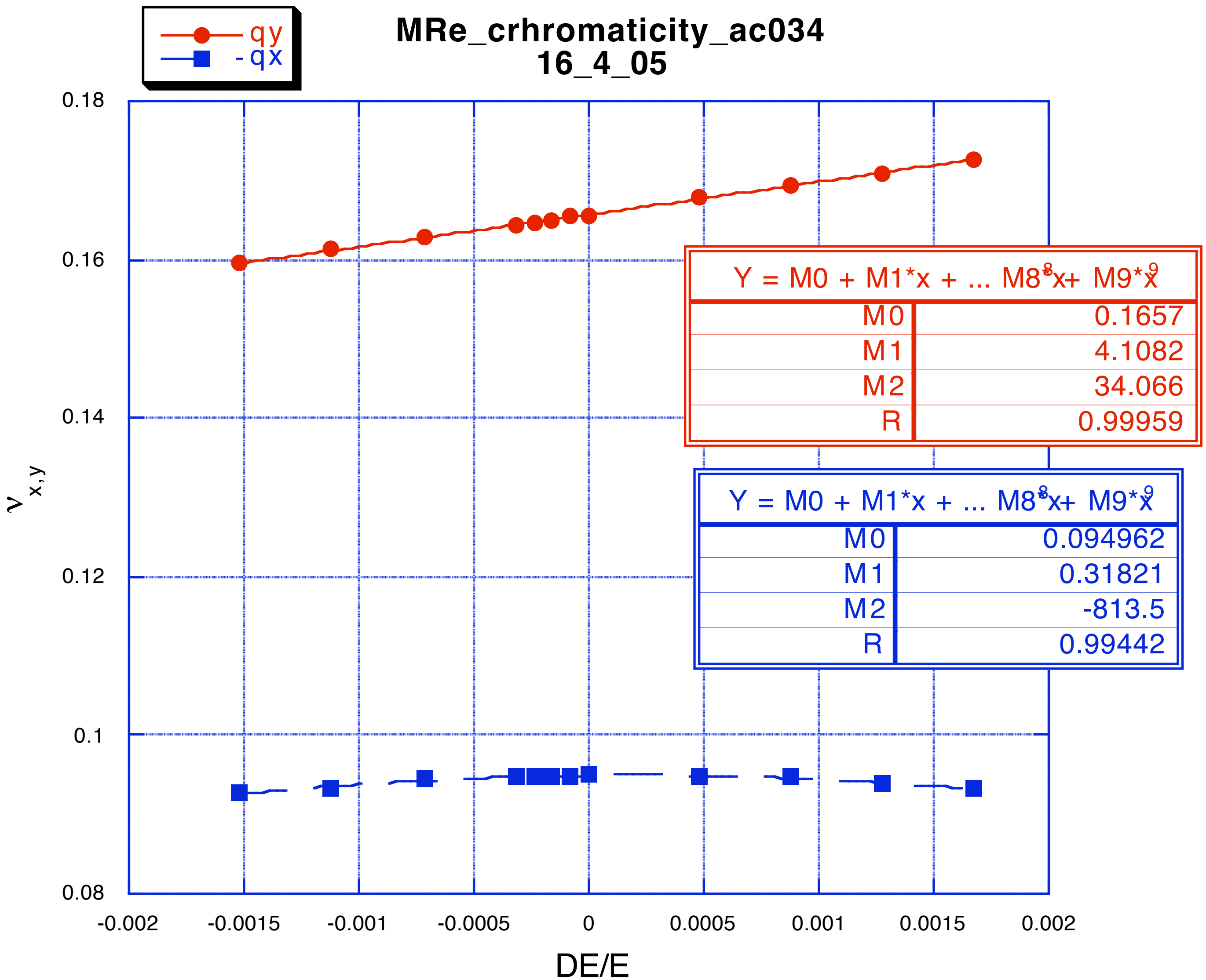

Chromatic Orbit
Macintosh HD:Users:catiamilardi:Documents:myDocs:mad8a:kloe_04:meas:ac_034:
Beta Meas (.dat file)
Model Print File
locFile
MRe_13_4_05_ac034Start.cur
qx
0.08600
qy
0.22300
e-
ΔRF [MHz]
-0.010000
RF [MHz]
368.263
α
0.034300
rbit ΔRF = 0
91
0.00
orbit ΔRF
5
0.38
Load Chromatic Orbit
Load Beta Meas
Load Twiss
display dispersion? (F)
DispersionH [m]
model
+10 KHz
-10 KHz
clear
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0

MRe

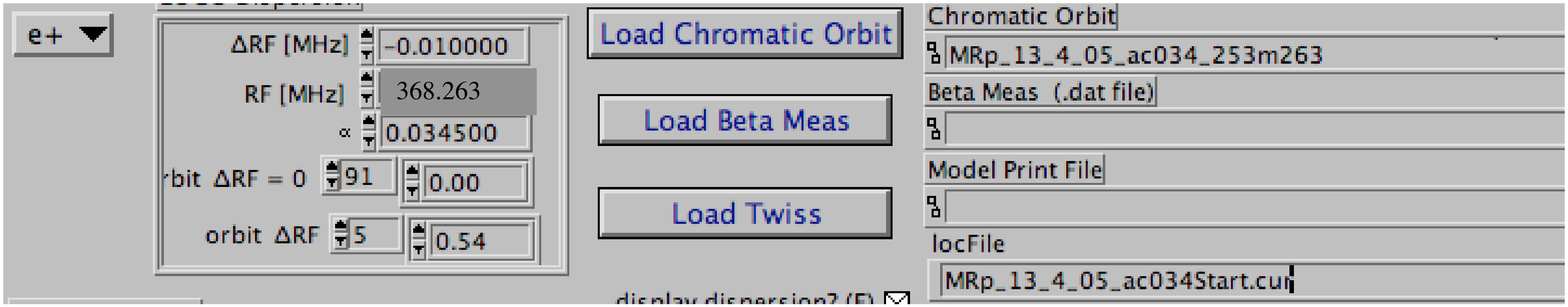
e^{-} η_y [m]



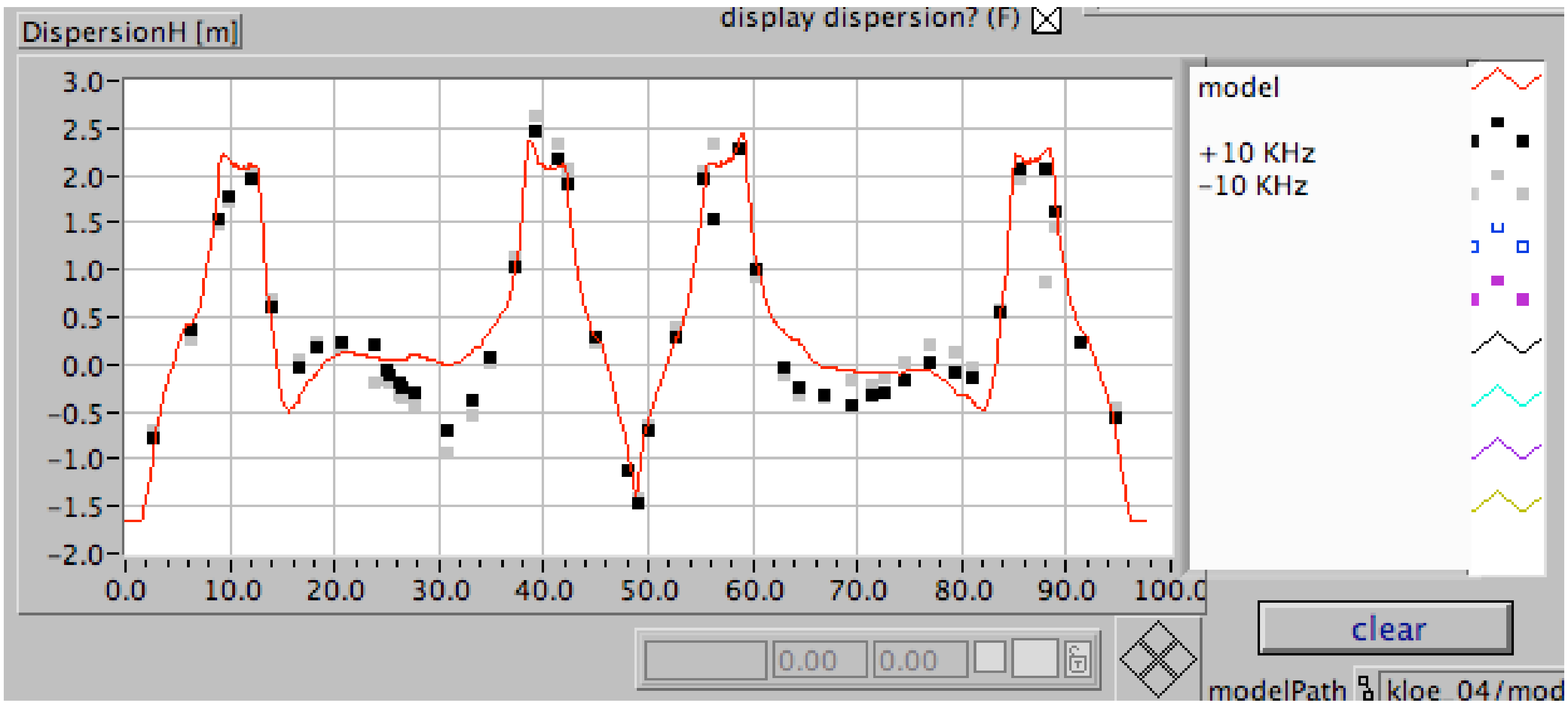
DispersionV [m]
0.2000
0.1500
0.1000
0.0500
0.0000
-0.0500
-0.1000
-0.1500
-0.2000
-0.2500
-0.3000
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0



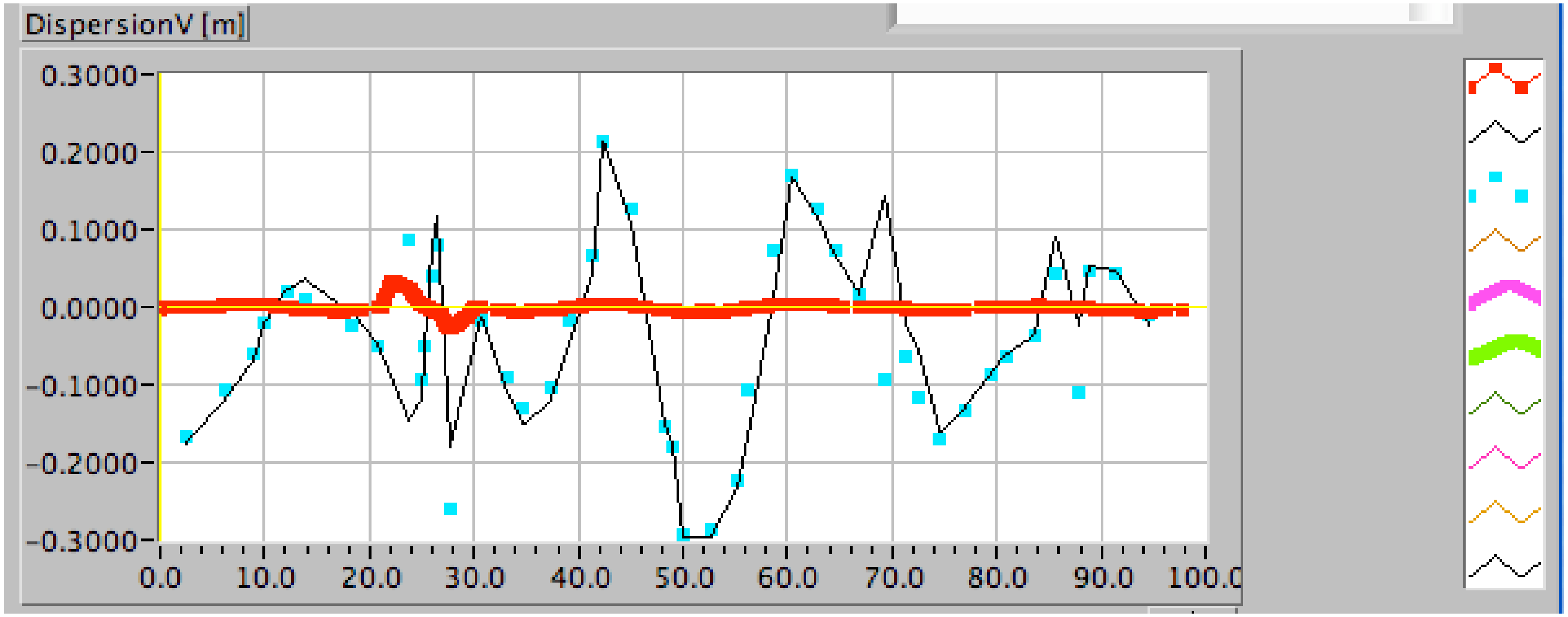
MRe_crhromaticity_ac034
16_4_05
qy
- qx
0.18
0.16
0.14
0.12
0.1
0.08
-0.002
-0.0015
-0.001
-0.0005
0
0.0005
0.001
0.0015
0.002
DE/E
ν x,y
Y = M0 + M1*x + ... M8*x8 + M9*x9
M0 0.1657
M1 4.1082
M2 34.066
R 0.99959
Y = M0 + M1*x + ... M8*x8 + M9*x9
M0 0.094962
M1 0.31821
M2 -813.5
R 0.99442


e+
ΔRF [MHz]
-0.010000
RF [MHz]
368.263
∝
0.034500
rbit ΔRF = 0
91
0.00
orbit ΔRF
5
0.54
Load Chromatic Orbit
Load Beta Meas
Load Twiss
Chromatic Orbit
MRp_13_4_05_ac034_253m263
Beta Meas (.dat file)
Model Print File
locFile
MRp_13_4_05_ac034Start.cur

MRp


DispersionH [m]
display dispersion? (F)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
model
+10 KHz
-10 KHz
clear
0.00
0.00
modelPath
kloe_04/mod

$e^{+}\ \eta_y$ [m]



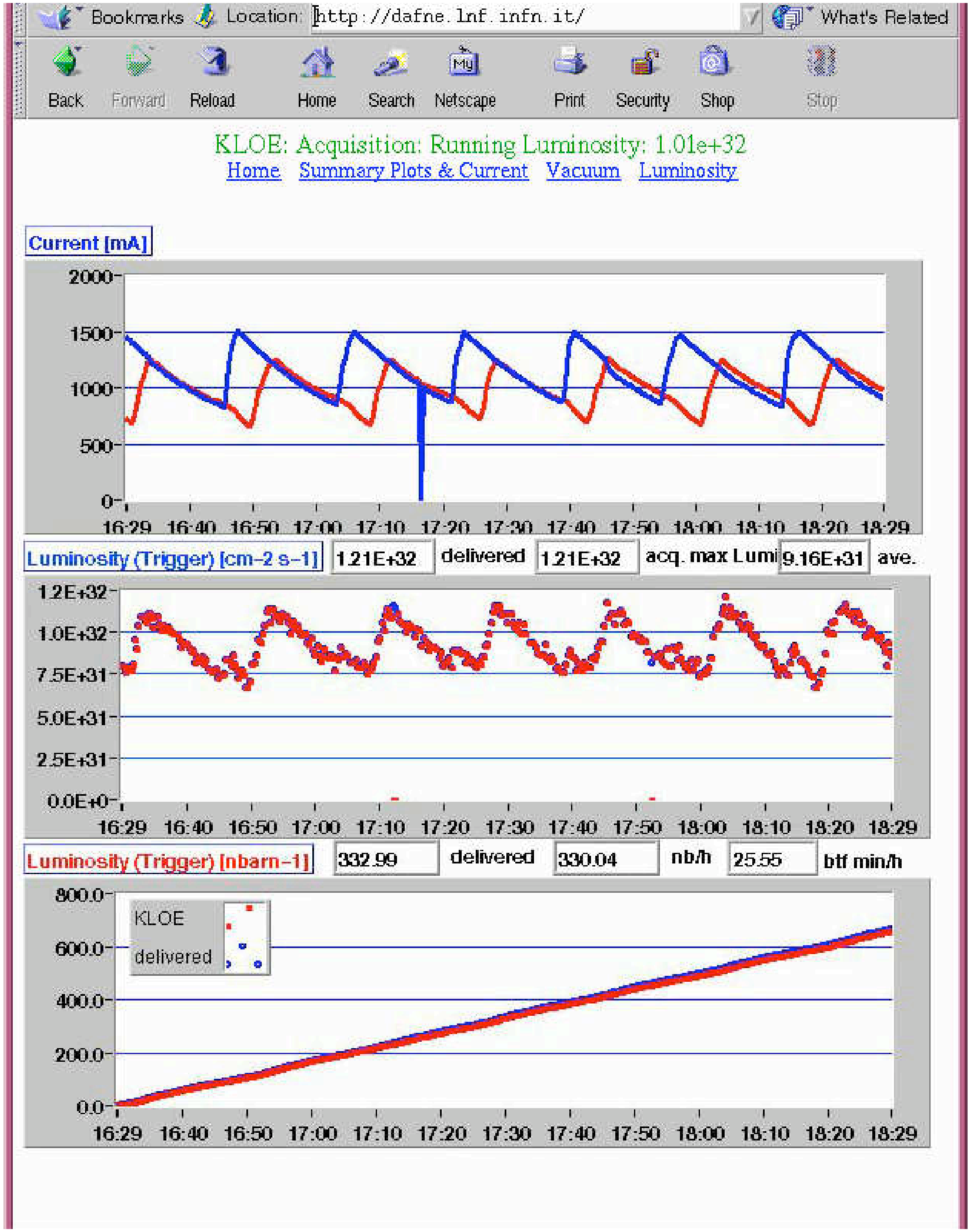
DispersionV [m]
0.3000
0.2000
0.1000
0.0000
-0.1000
-0.2000
-0.3000
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0

Luminosity 17 Apr 2005

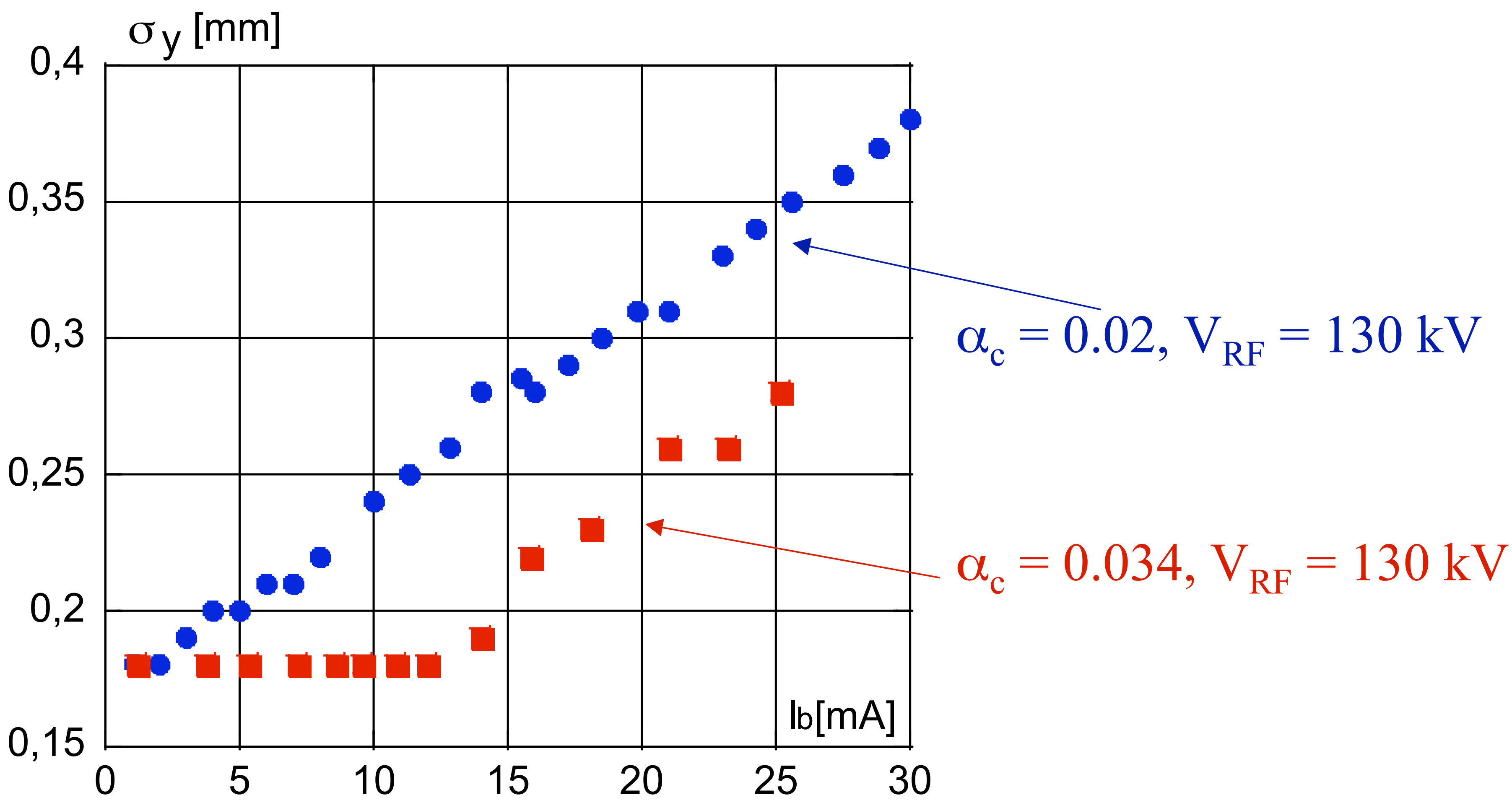
Collision:

$e^- = \alpha_c$ .03

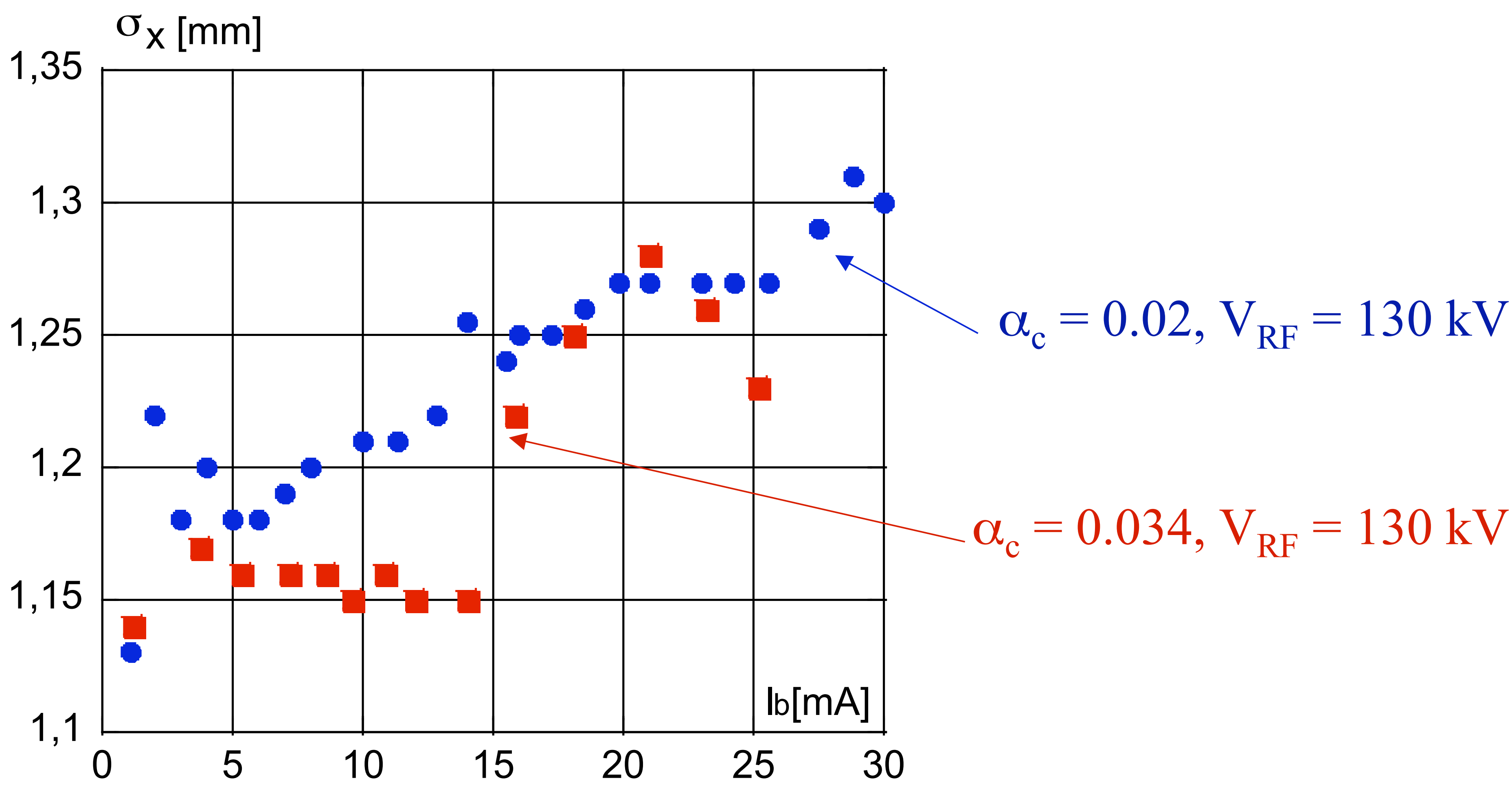
$e^+ = \alpha_c$ .02



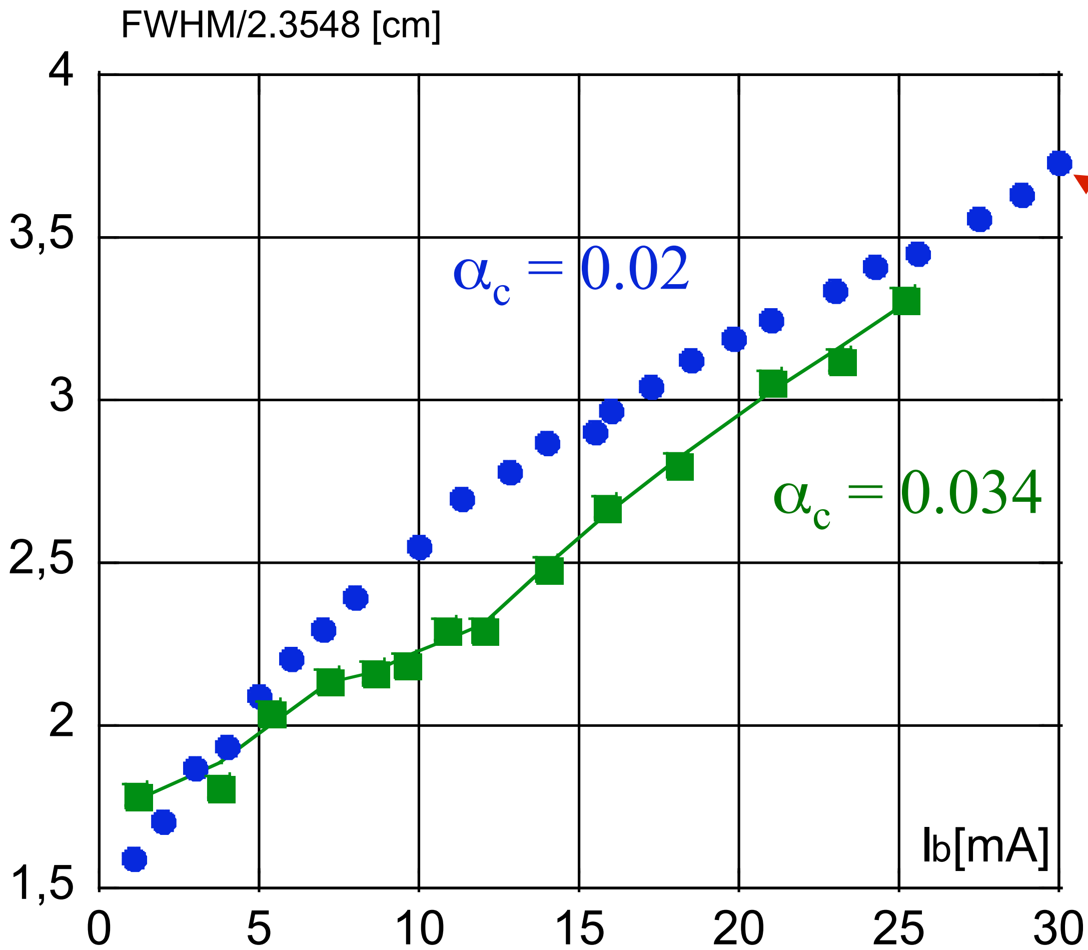
Vertical Size Blow Up with High and Low Momentum Compaction Factor

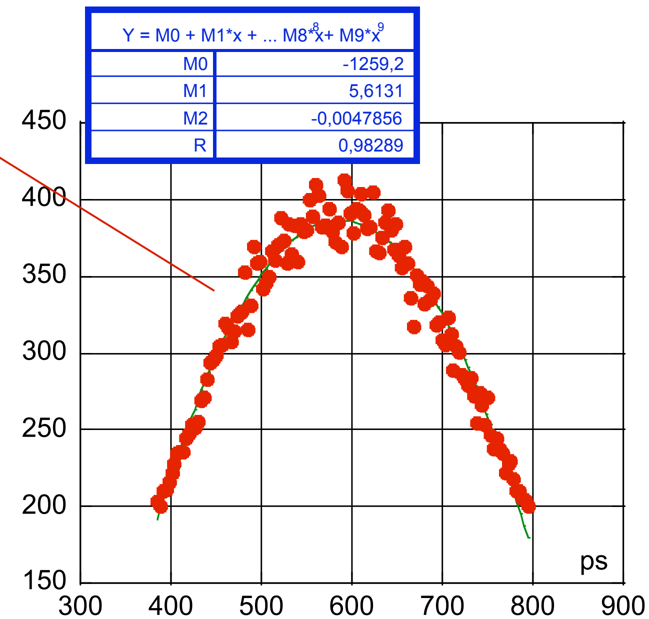


Horizontal Size Blow Up with High and Low Momentum Compaction Factor



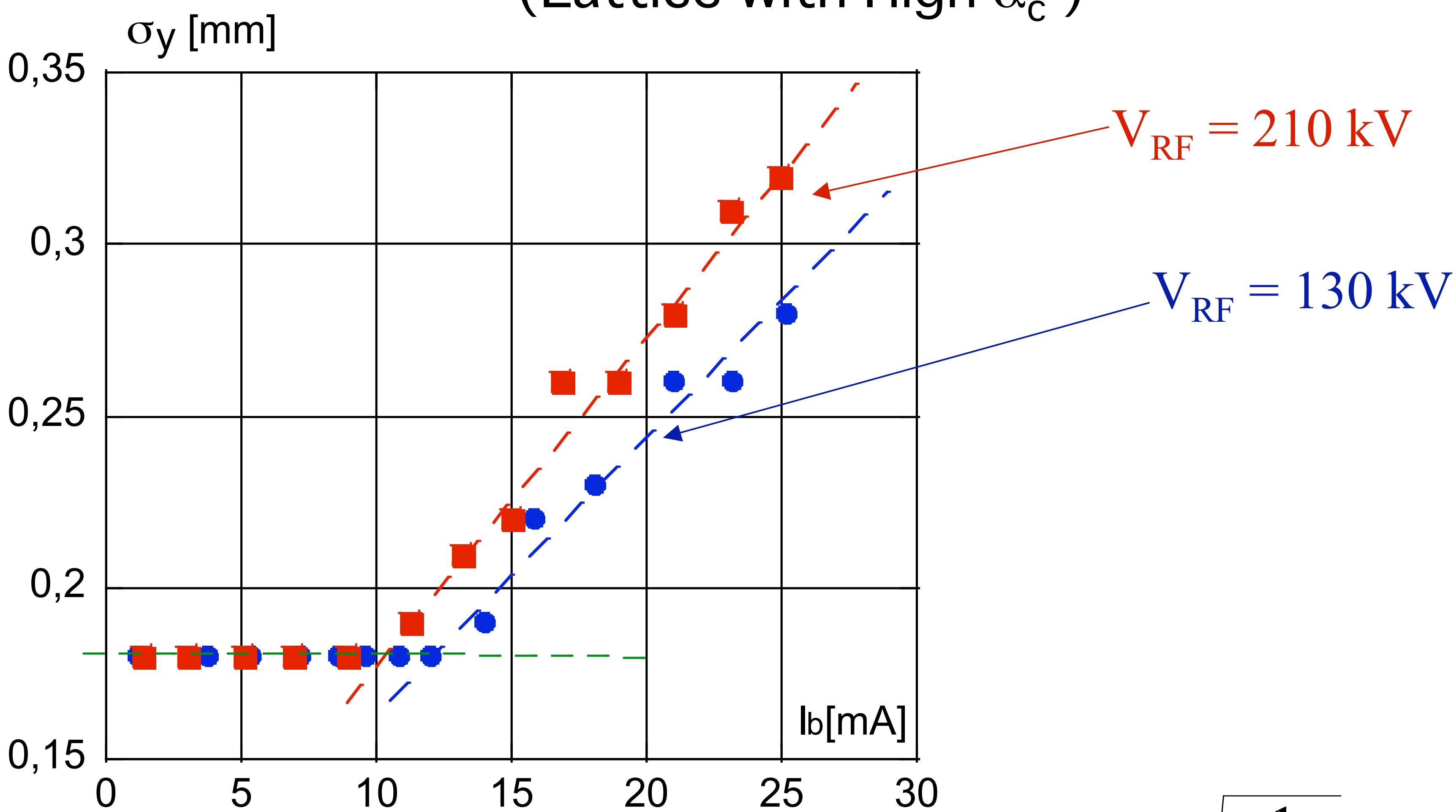
Bunch Lengthening at V_{RF} = 130 kV





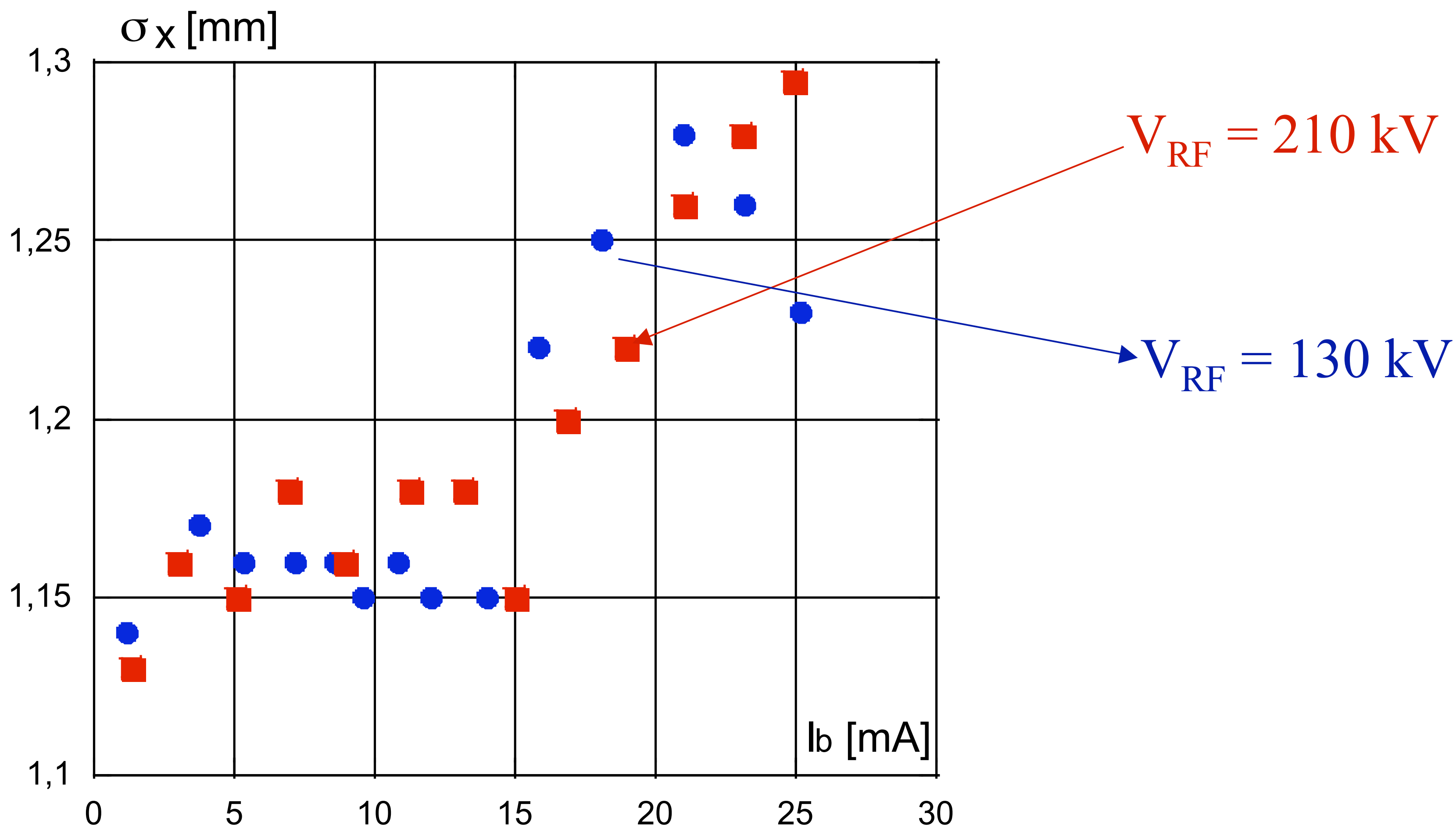
$I_b = 30$ mA

Vertical Size Blow Up as a Function of Single Bunch Current
(Lattice with High α_c)

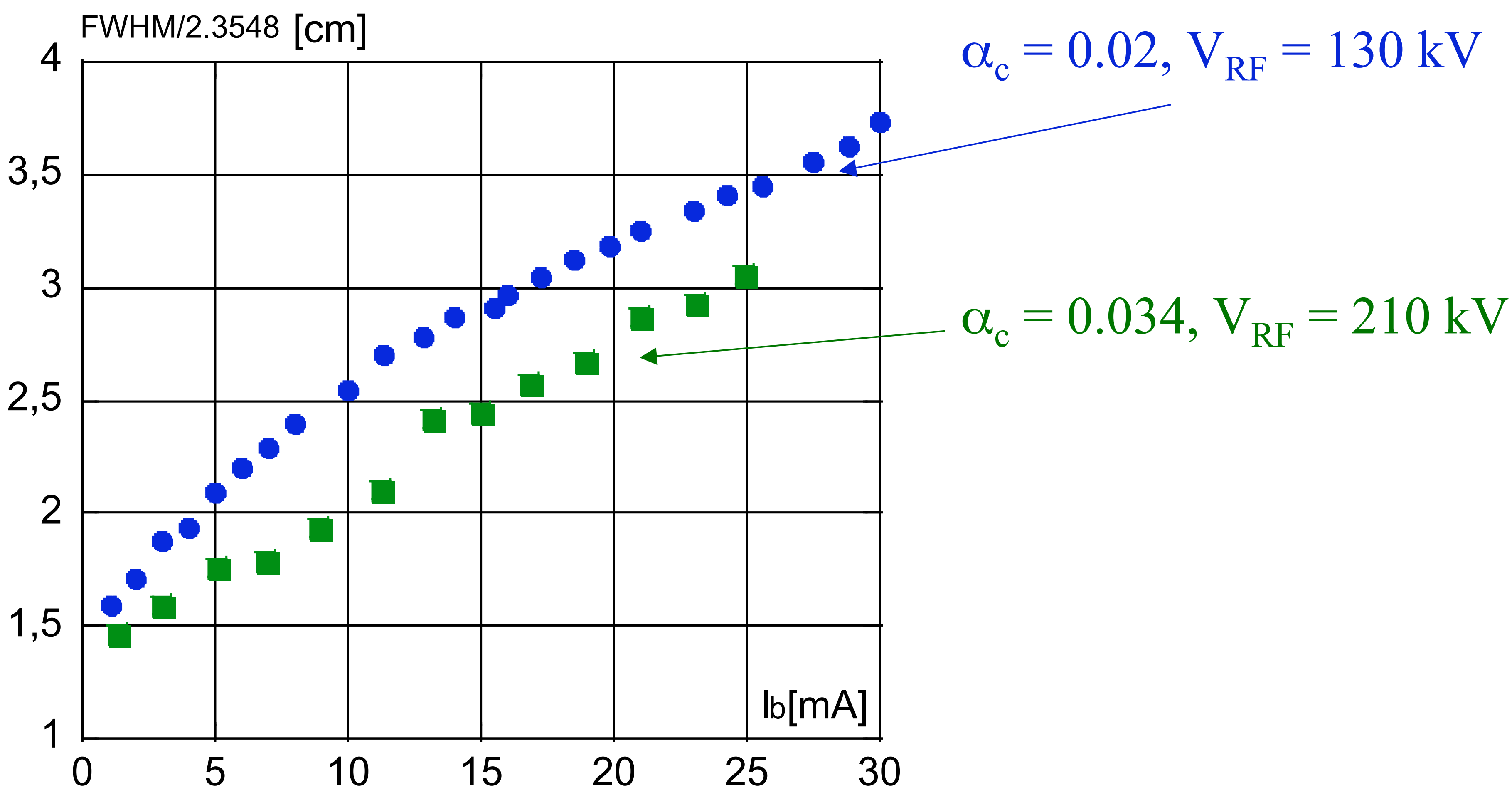


$$Threshold \quad scales \approx \sqrt{\frac{1}{V_{RF}}} \propto 1.27$$

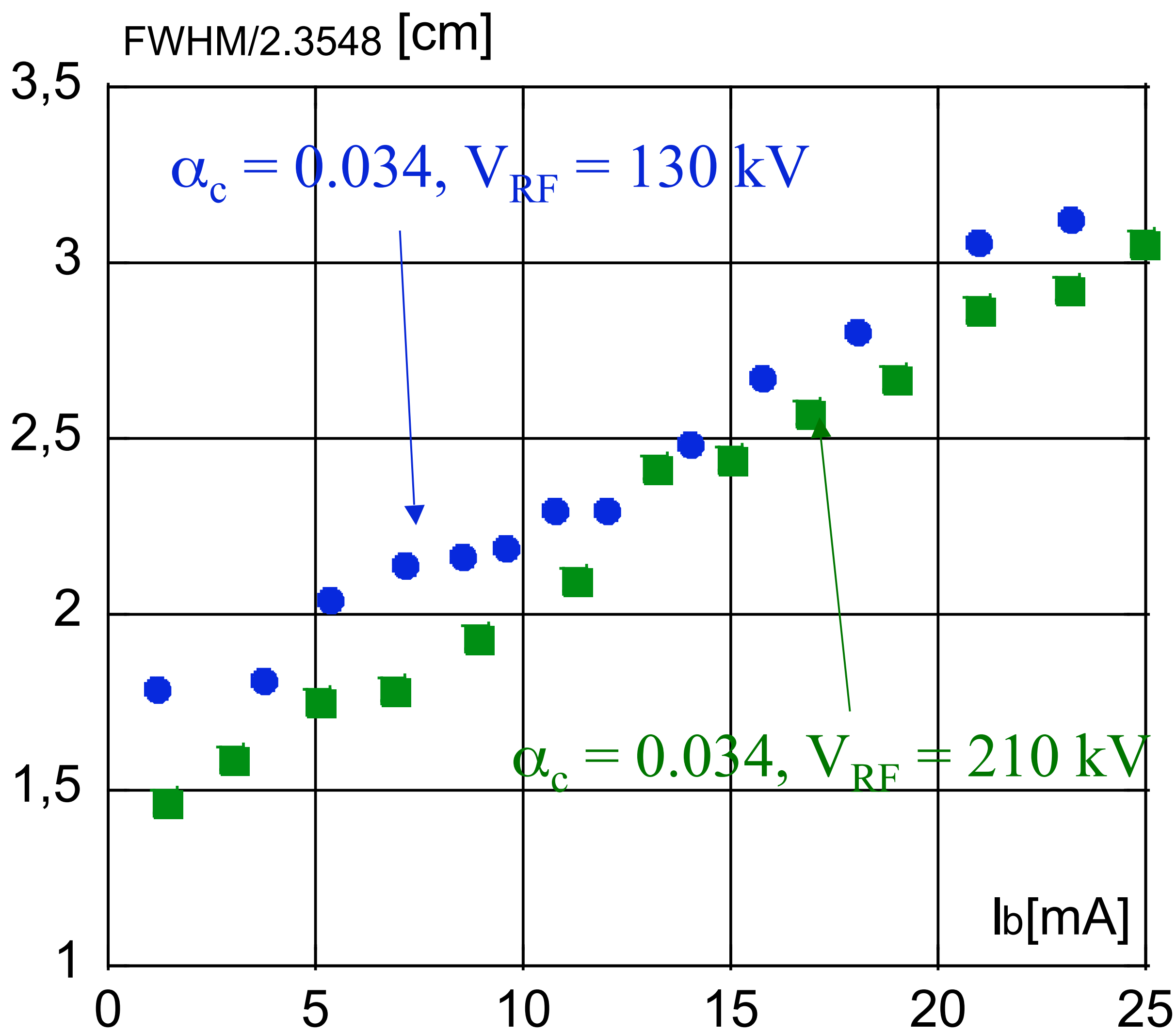
Horizontal Size Blow Up as a Function of Single Bunch Current
(Lattice with High α_c)



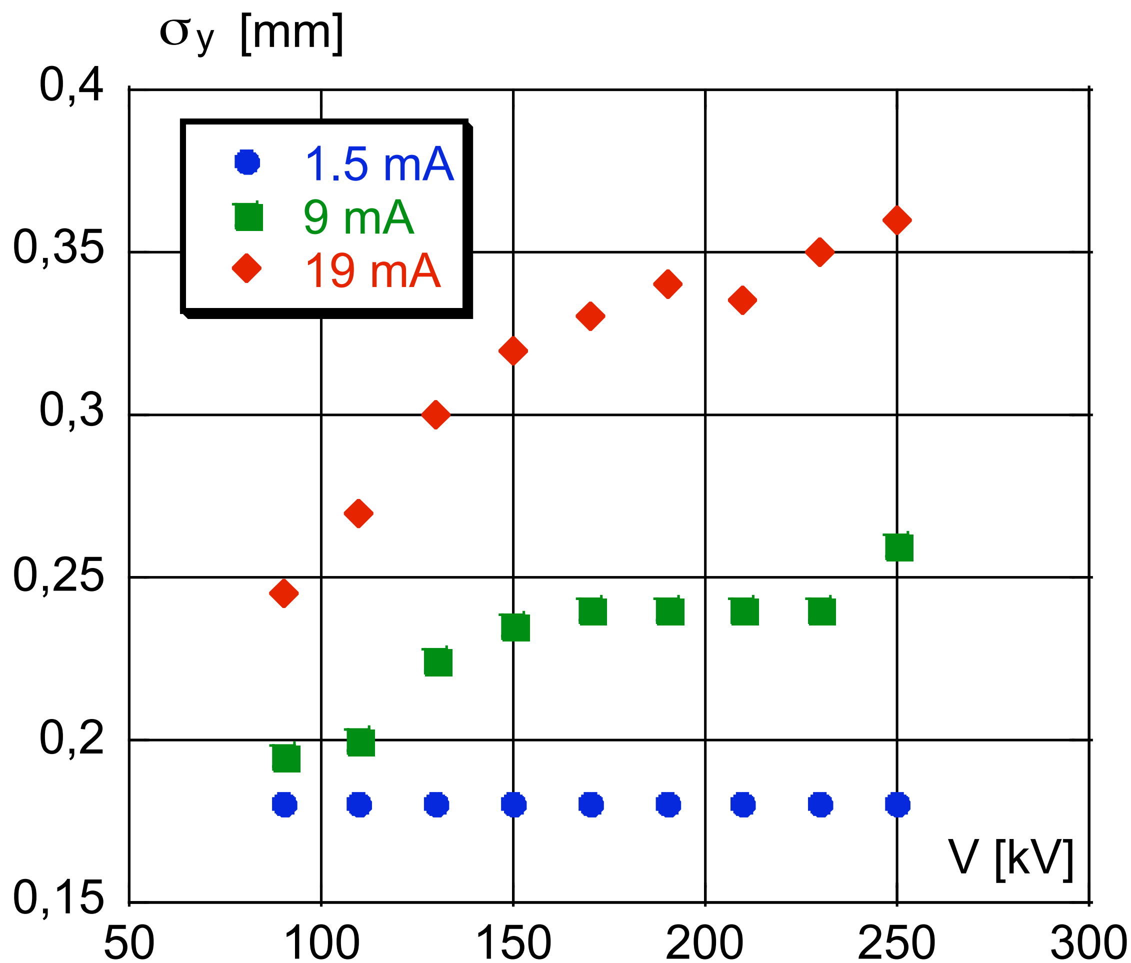
Bunch Lengthening with Different Momentum Compactions



Bunch Lengthening with Different RF Voltages

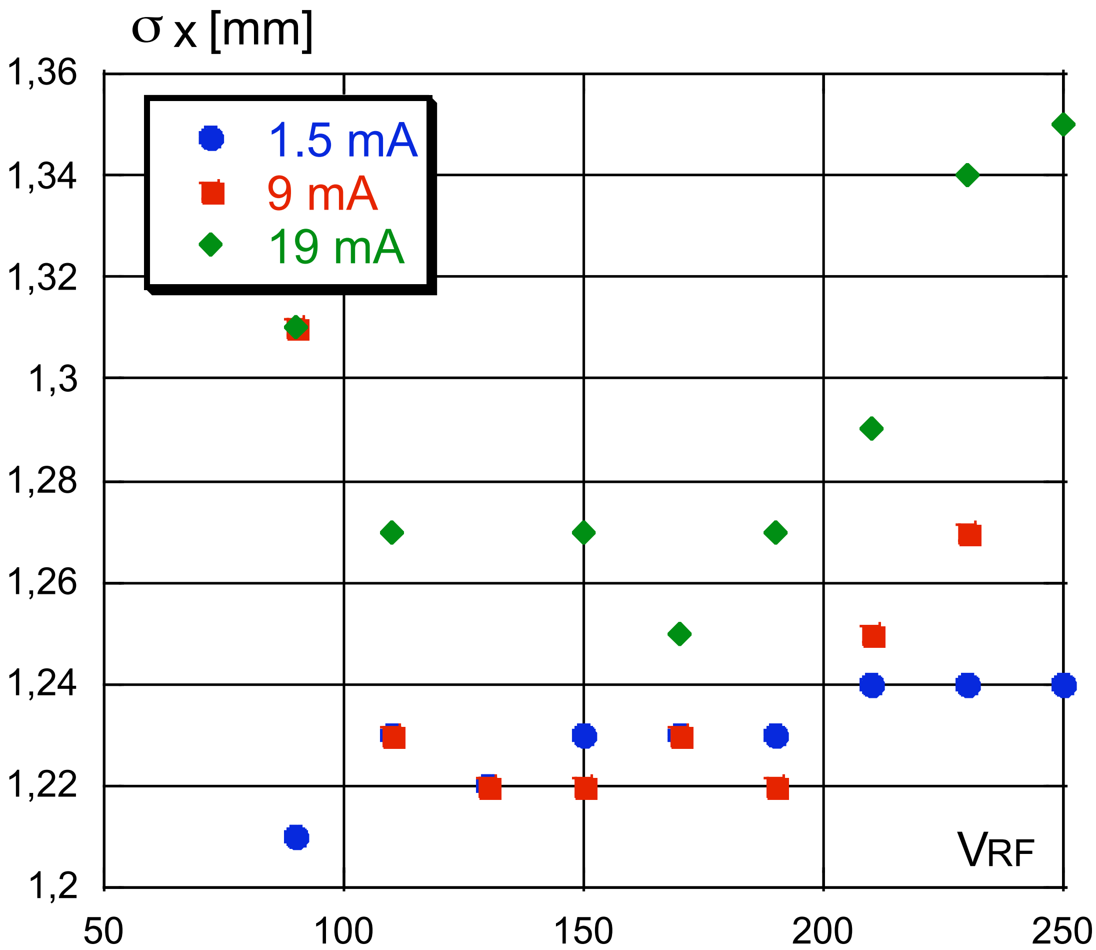


Bunch Vertical Size as a Function of RF Voltage for Different Bunch Currents

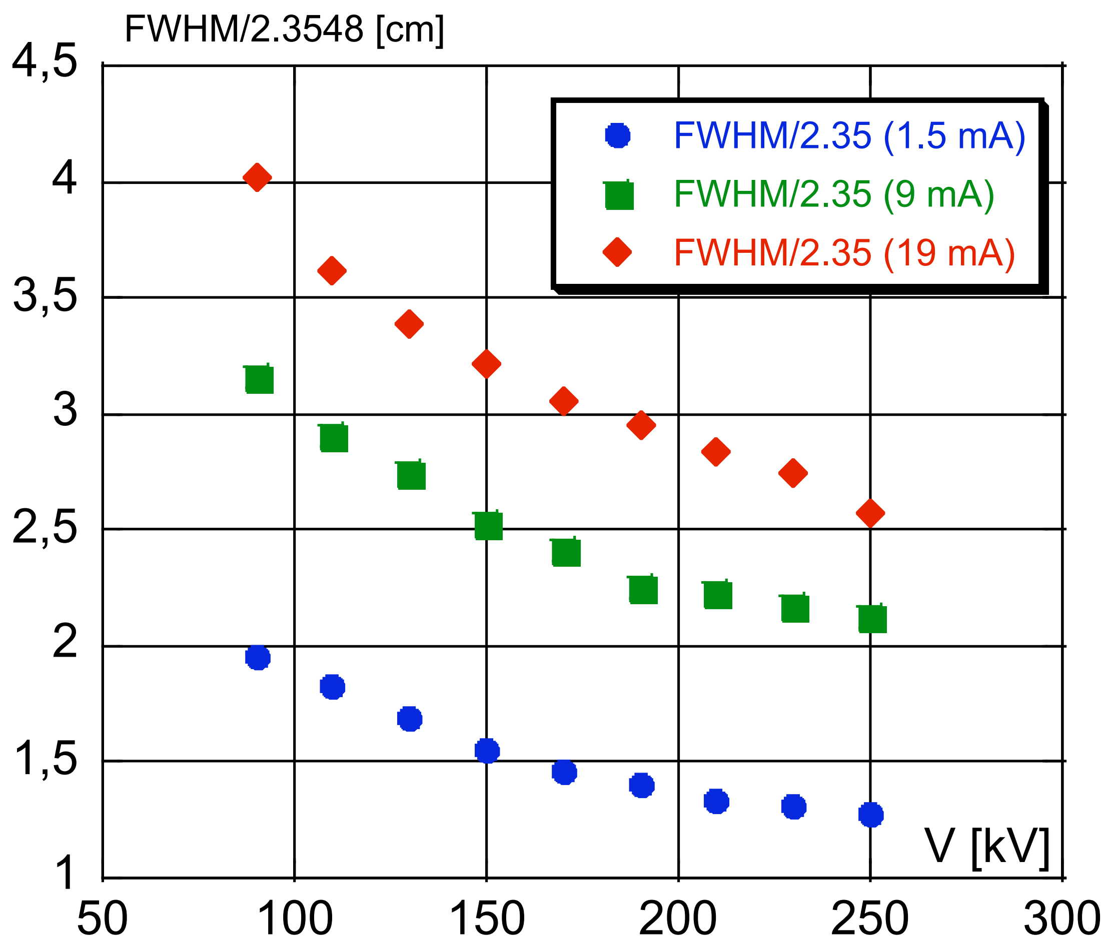


$\alpha_c = 0.02$

Bunch Vertical Size as a Function of RF Voltage for Different Bunch Currents $\alpha_c = 0.02$



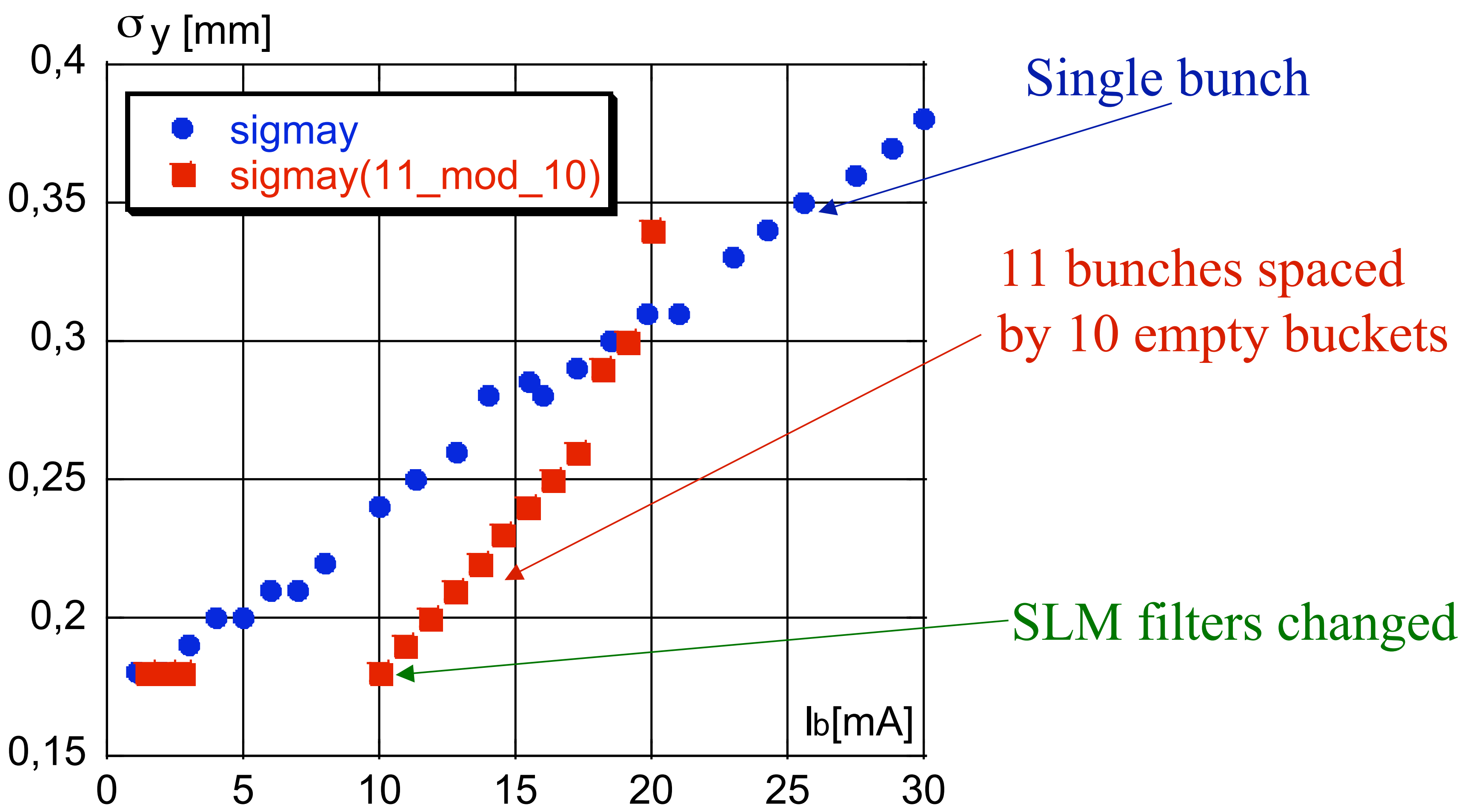
Bunch Length as a Function of RF Voltage for Different Bunch Currents



$\alpha_c = 0.02$

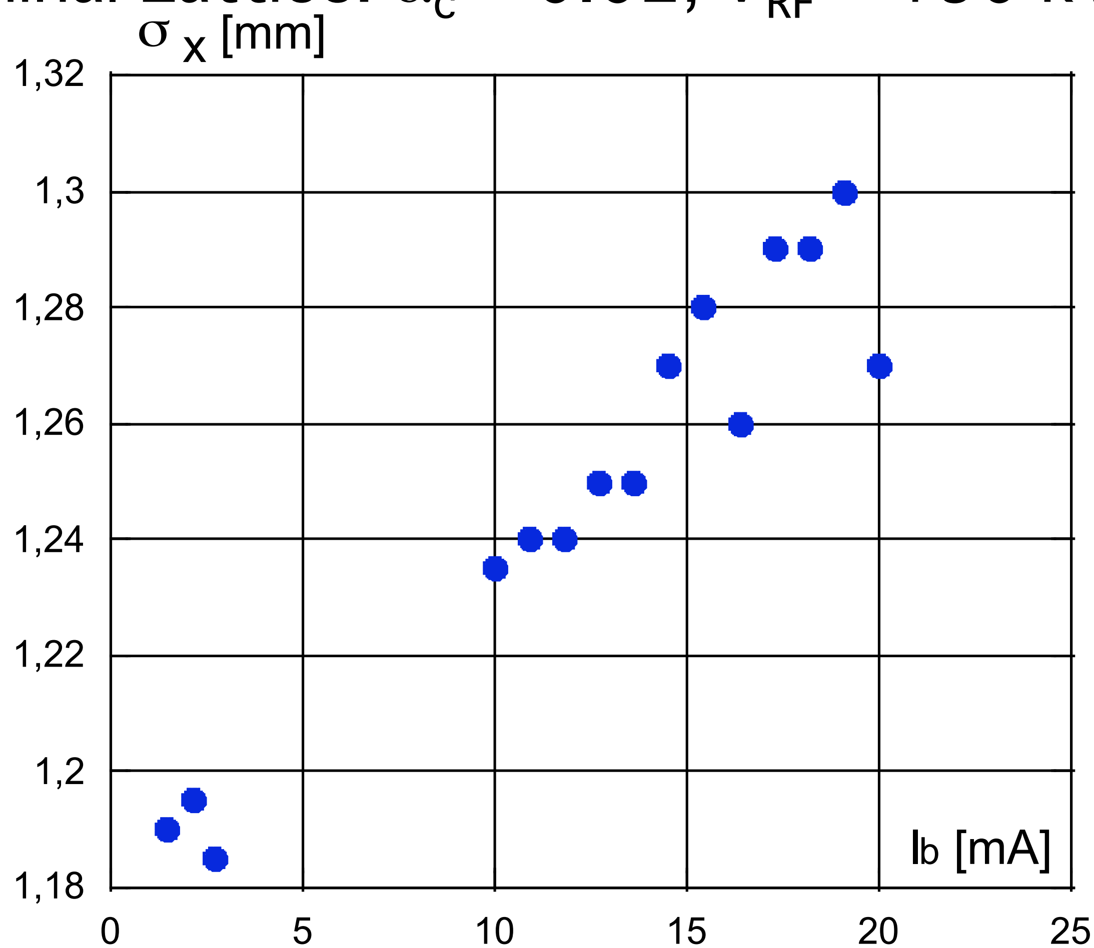
Vertical Size Blow Up as a Function of Single Bunch Current

(Nominal Lattice: α_c = 0.02, V_{RF} = 130 kV)

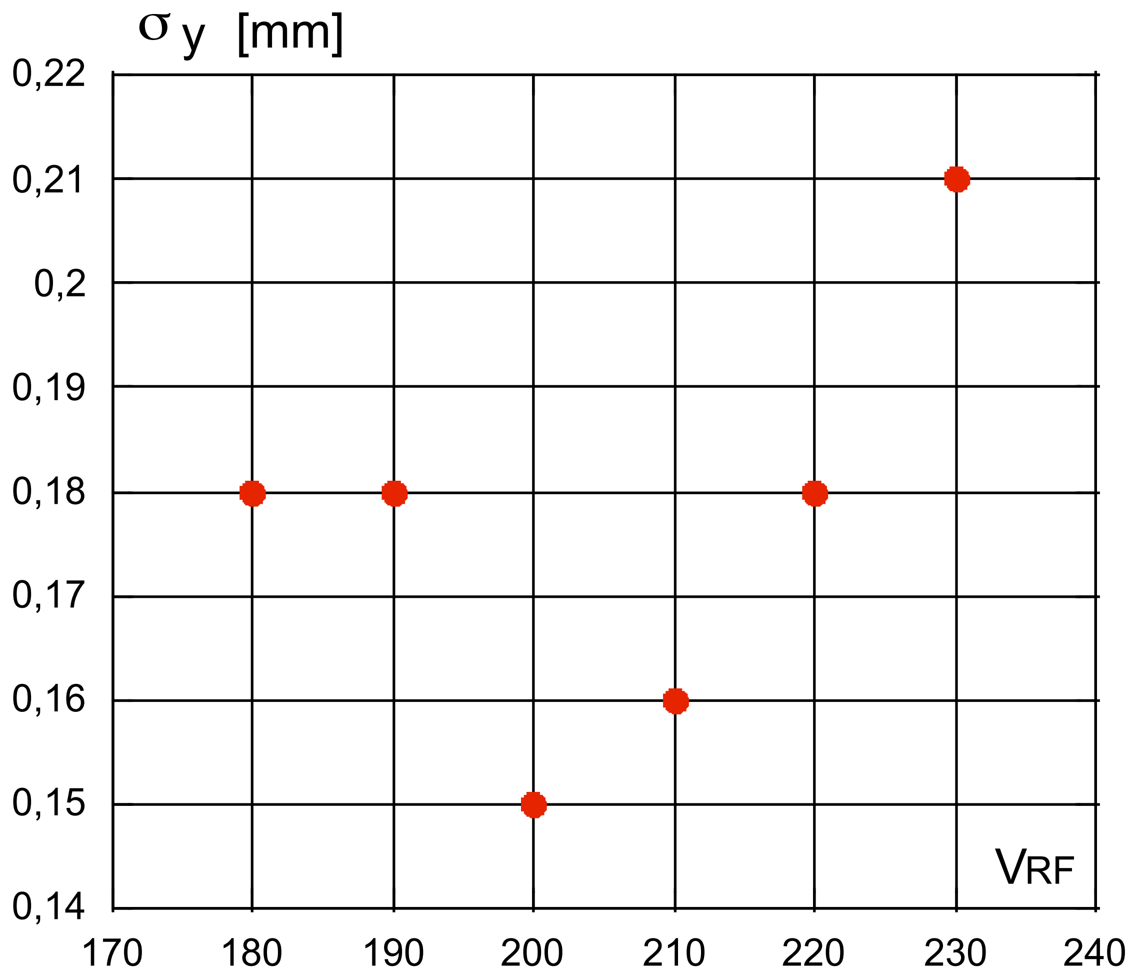


Horizontal Size Blow Up as a Function of Single Bunch Current

(Nominal Lattice: α_c = 0.02, V_{RF} = 130 kV)

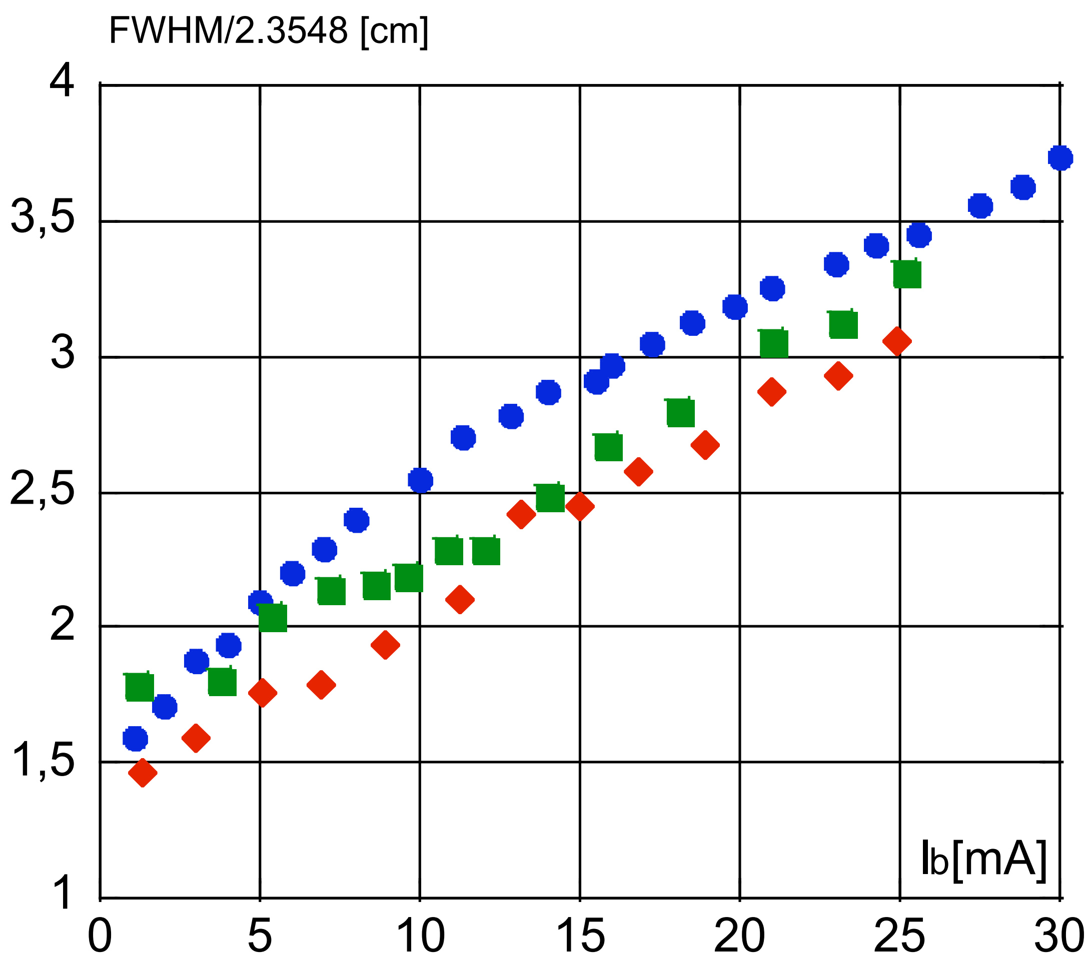


Vertical Size as a Function of V_{RF} in Multibunch Regime

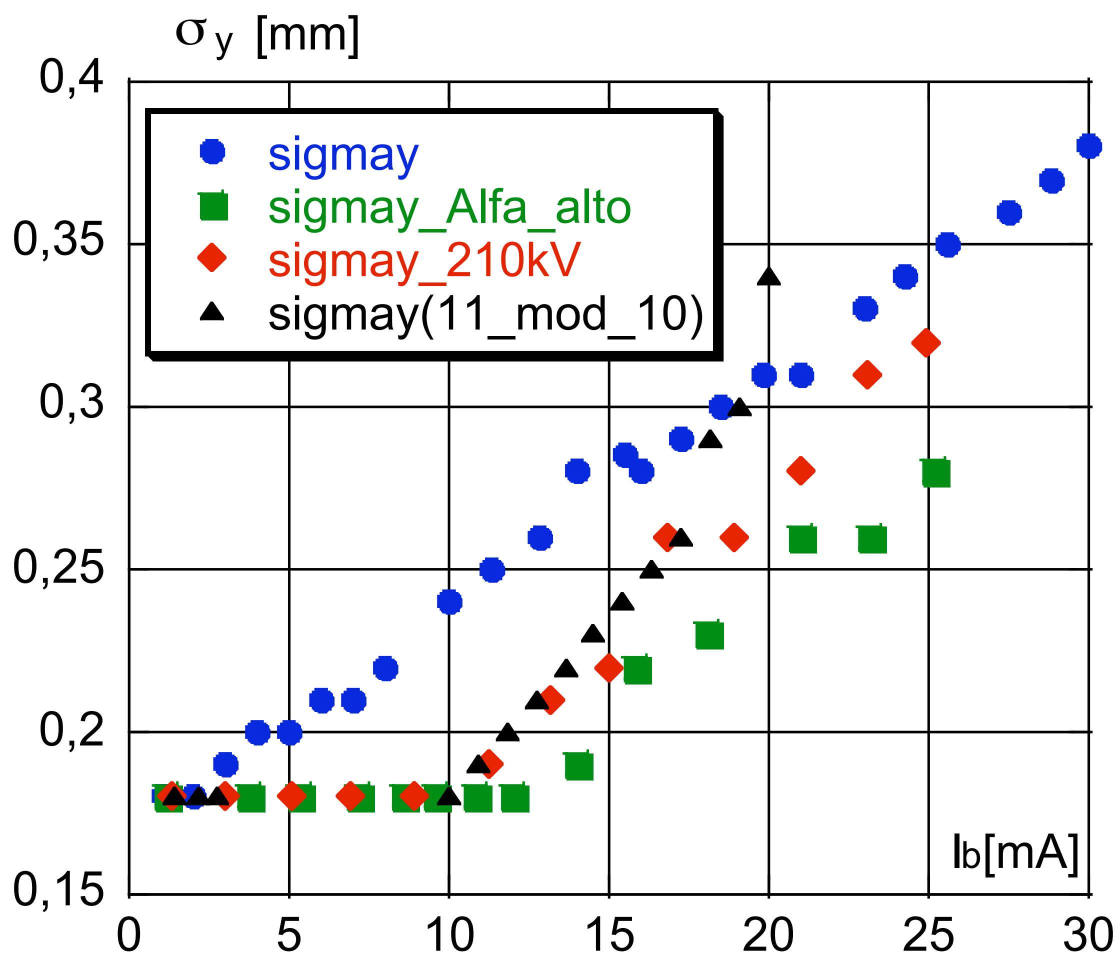


1420 mA

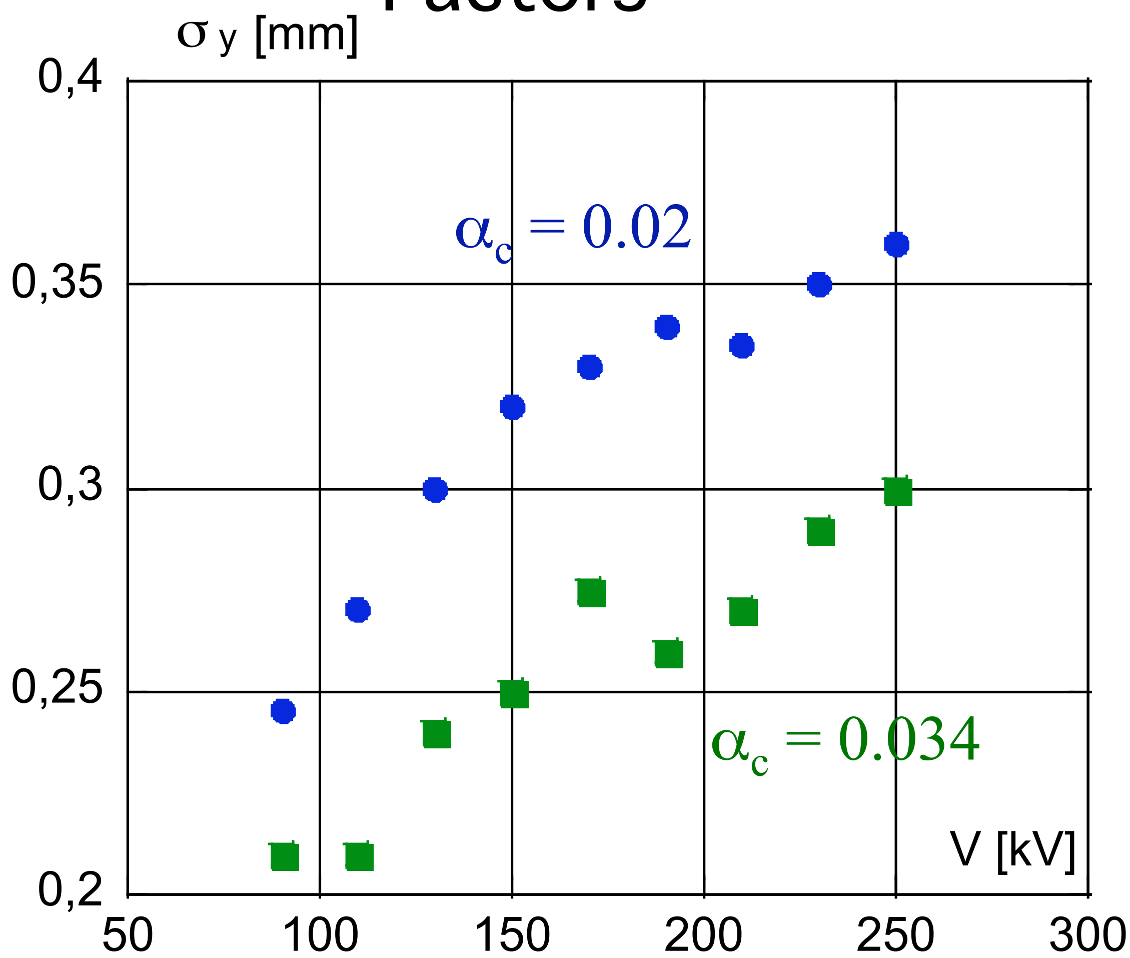
107 bunches


FWHM/2.3548 [cm]
4
3,5
3
2,5
2
1,5
1
0
5
10
15
20
25
30
Ib[mA]

Vertical Beam Size as a Function of Bunch Current (Summary Plot)

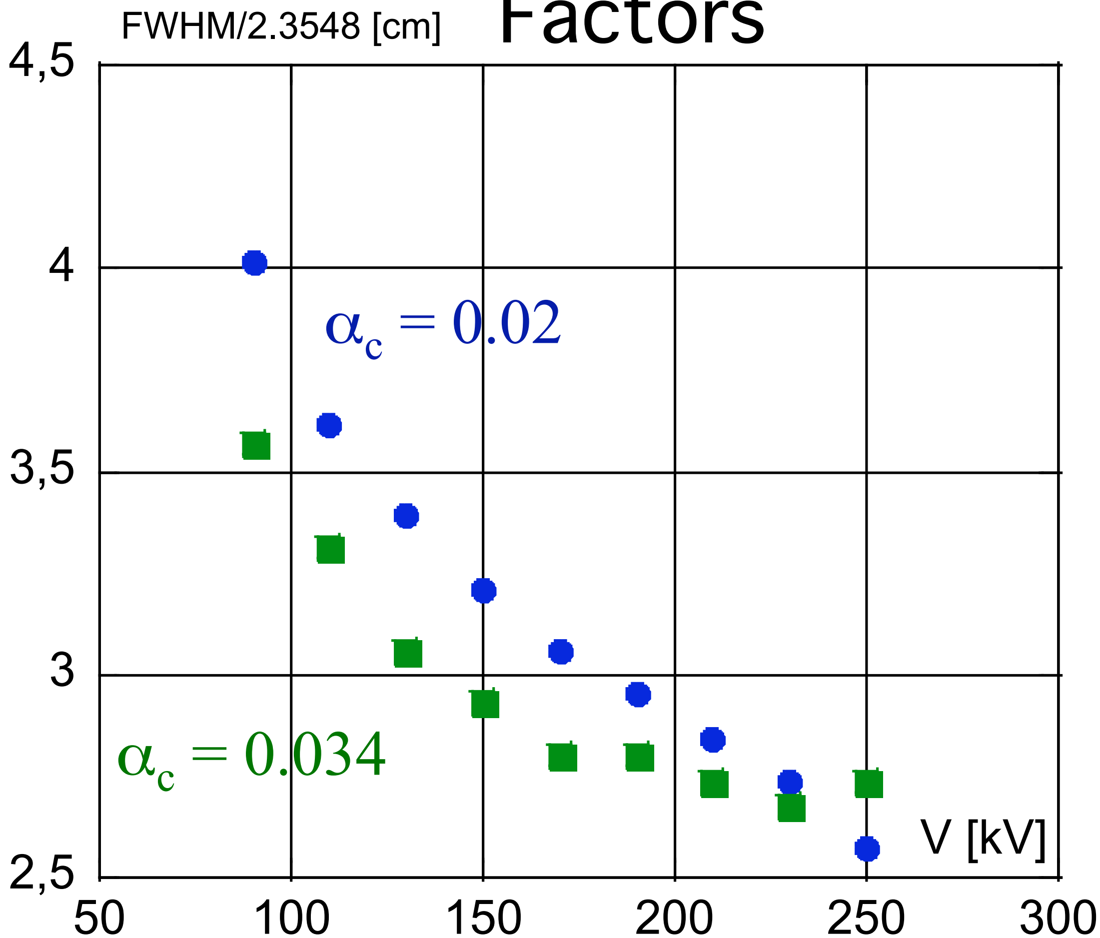


Vertical Size as a Function of RF Voltage for Different Momentum Compaction Factors



Bunch current = 19 mA

Bunch Length as a Function of RF Voltage for Different Momentum Compaction Factors



Bunch current = 19 mA

Conclusions

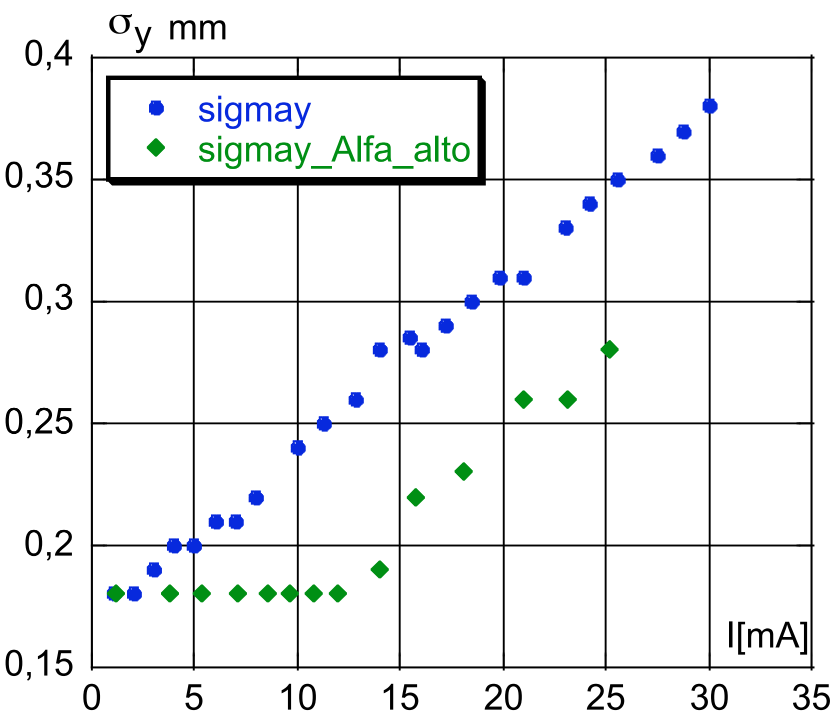
- Transverse beam size blow up is correlated with the longitudinal microwave instability: *the same threshold and the same dependence on RF voltage, smaller for higher momentum compaction*
- With high momentum compaction: the treshold is higher and the blow up is smaller
- Bunch is *shorter*.

See the last transparency

WE NEED TIME for FINE TUNING!

Lattice with High Momentum Compaction

Vertical beam size
blow up threshold



Bunch lengthening