

# DSB3 Lattice

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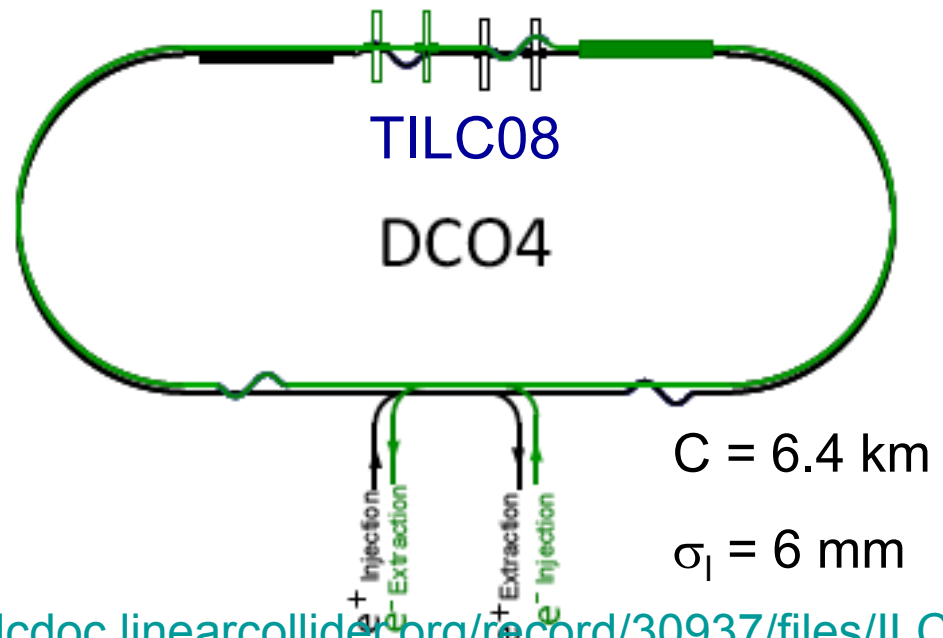
# Lattice for 3.2 km DR

Low Power option

$N_{\text{bunches}}$  2625  $\rightarrow$  1312

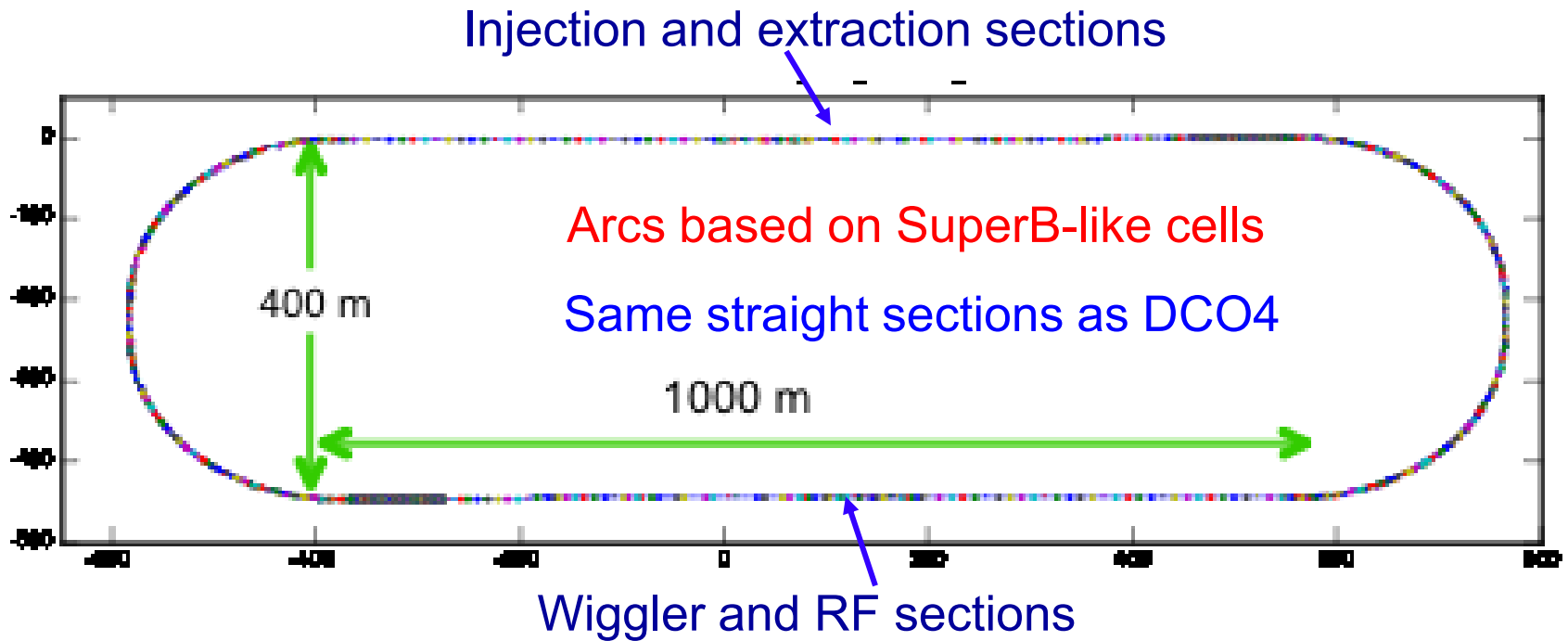
Circumference 6.4km  $\rightarrow$  3.2km

SB2009 lattice has same layout, bunch length and momentum compaction as TILC08 DCO lattice



DCO4: ILC-NOTE-2010-057 <http://ilcdoc.linearcollider.org/record/30937/files/ILC-NOTE-2010-057.pdf>

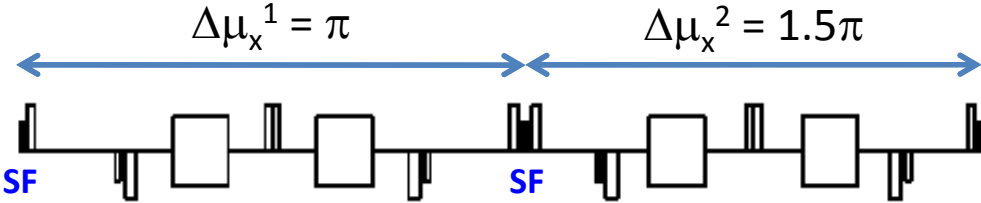
# Layout of the DSB3 damping ring



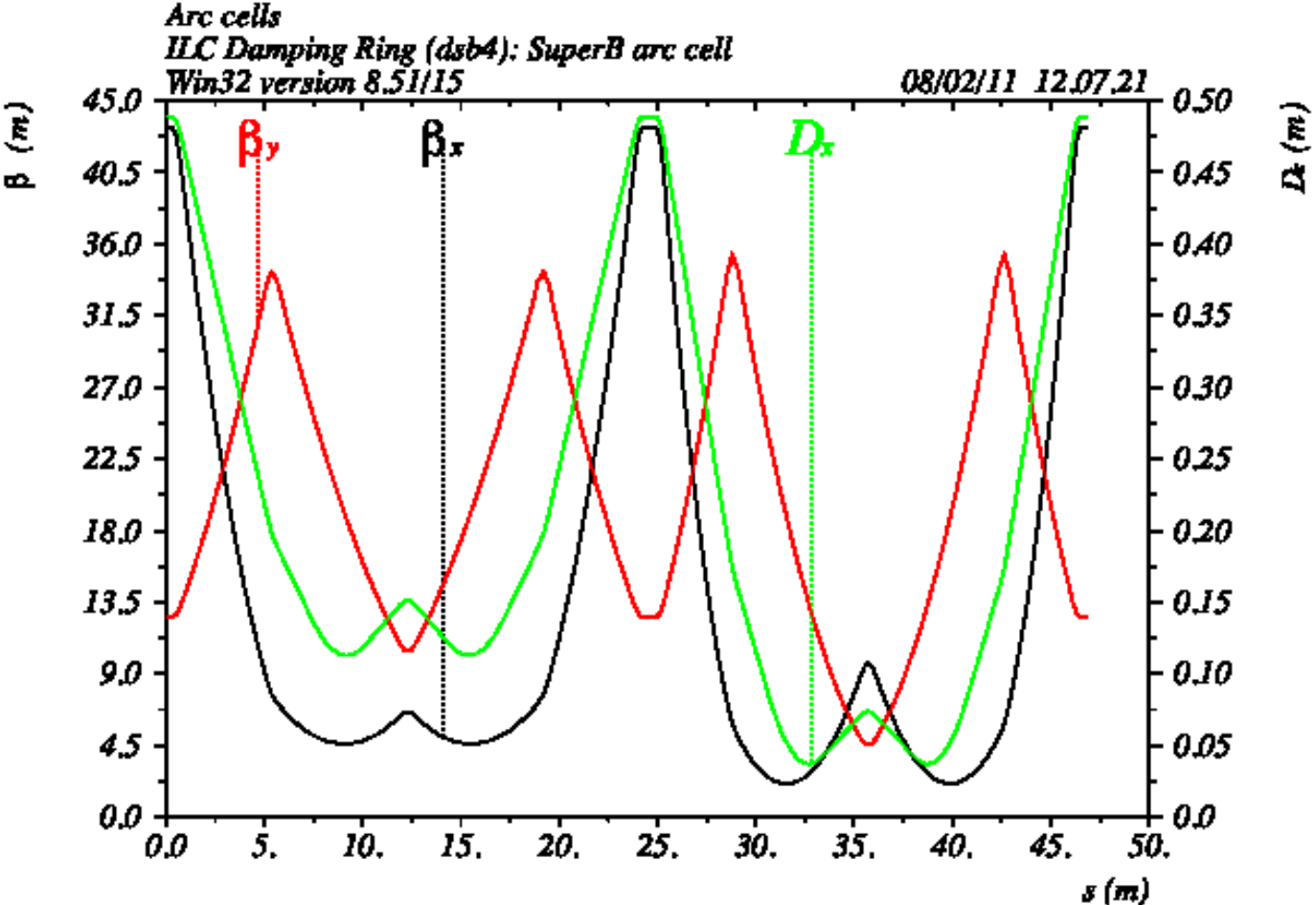
Injection/extraction lines of the two rings are superimposed

- RF cavities: 16  $\Rightarrow$  6
- Wigglers: 88  $\Rightarrow$  32

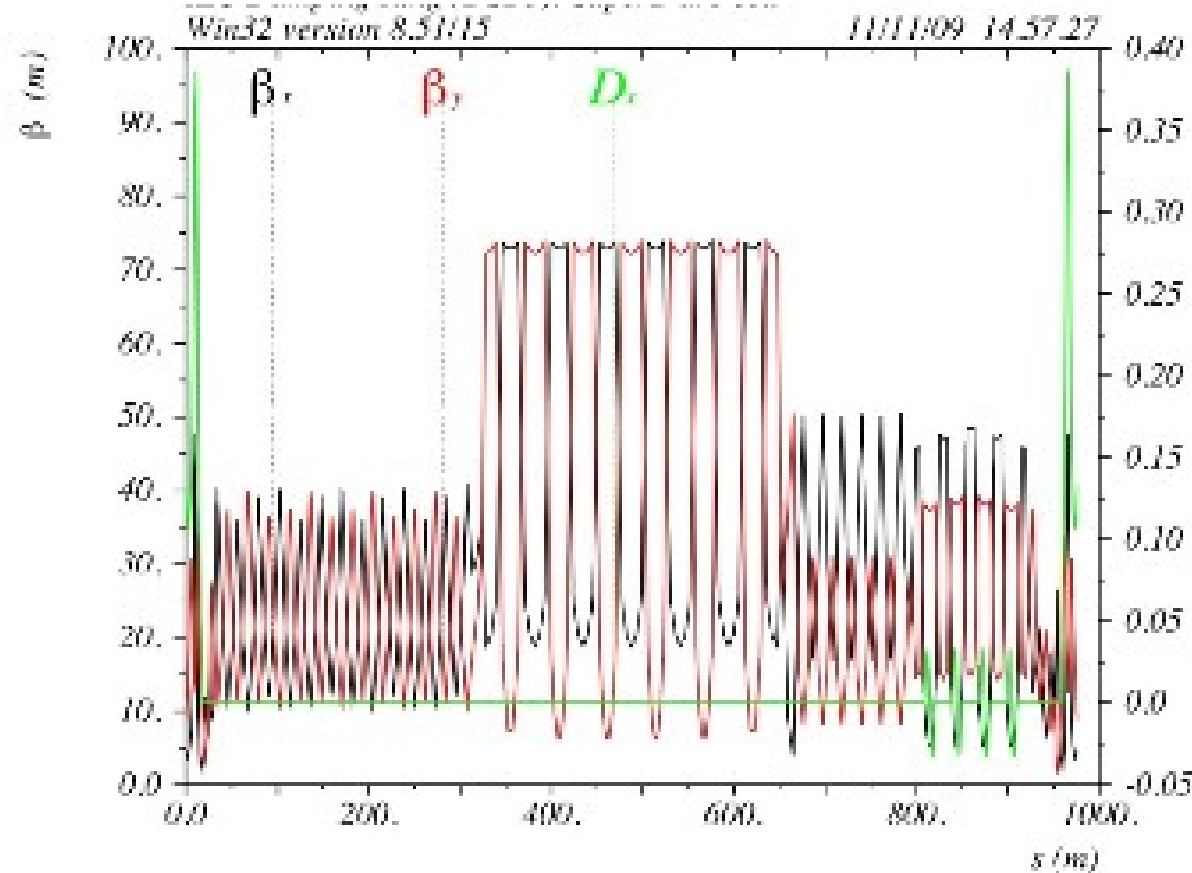
# Arc cells



$$\Delta\mu_y^1 = \Delta\mu_y^2 = \pi/2$$



# Optical functions in the Inj/Extr straight section

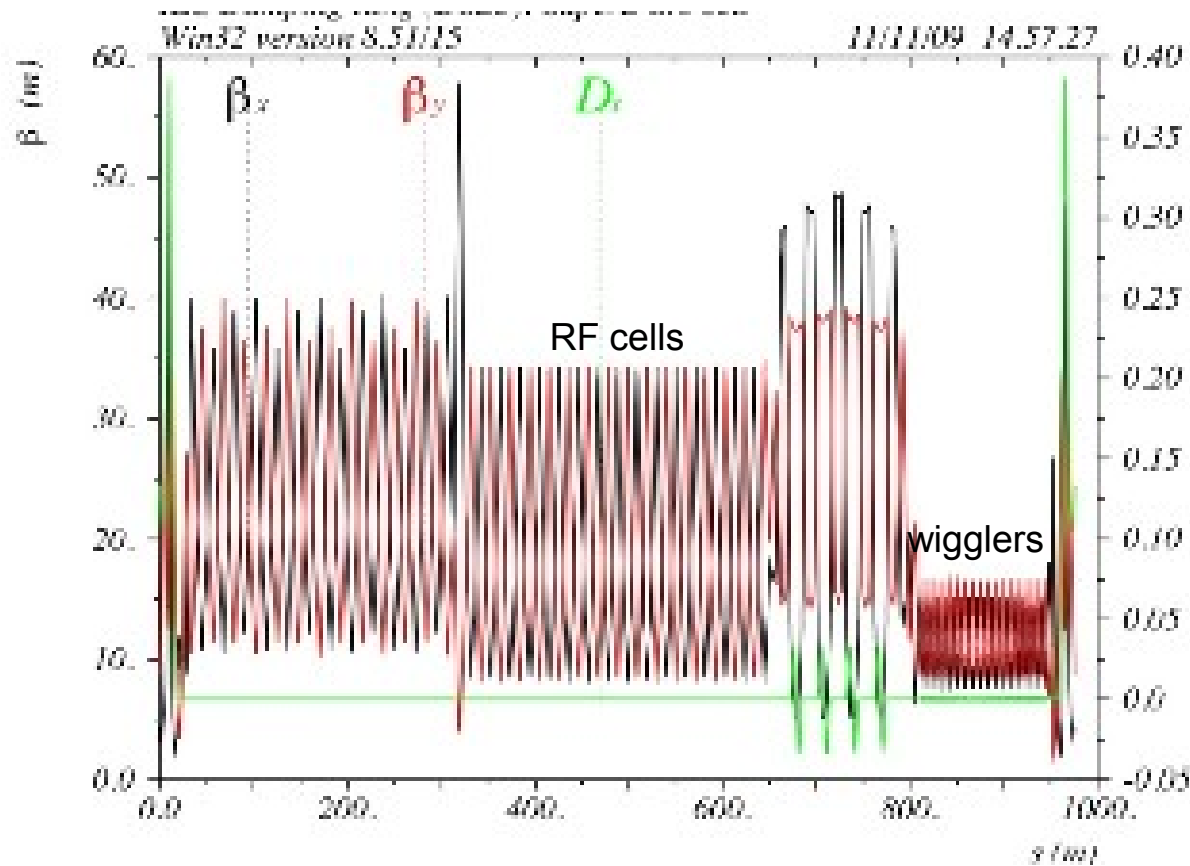


The  $e^-$  and  $e^+$  ring are one on top of the other with counter-rotating beams

The injection line entering the electron ring is superimposed on the positron extraction line and vice versa

The lattice of the straight sections is made of the same building blocks as the 6.4km racetrack lattice (DCO4)

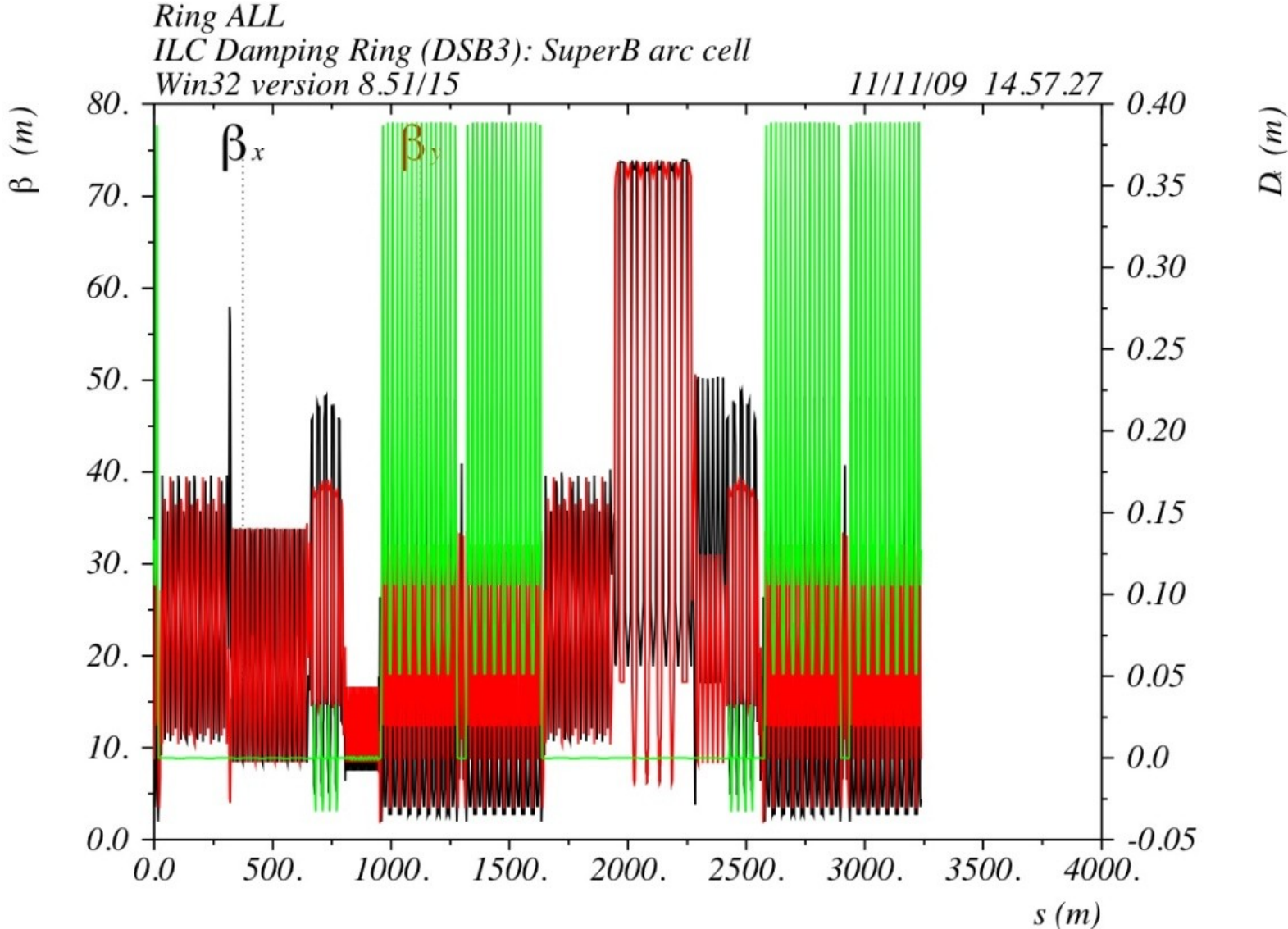
# Optical functions in the RF/wiggler straight section



The wiggler straight is located downstream of the RF cavities in order to avoid damage by synchrotron radiation

The RF cavities for each ring are offset from the center of the straight so that they are not superimposed on top of each other

# Optical functions of the 3.2km damping ring



# Magnet counts

	<b>DSB3 (3.2km)</b>	<b>DCO4 (6.4km)</b>
<b>Arc dipole length</b>	<b>2.7 m</b>	<b>2.0 m</b>
<b>Arc dipole field (2 types)</b>	<b>0.26/0.36 T</b>	<b>0.27 T</b>
<b>Number of arc dipoles</b>	<b>128</b>	<b>200</b>
<b>Chicane dipole field</b>	<b>0.27 T</b>	<b>0.27 T</b>
<b>Number of 1 m dipoles (in chicanes)</b>	<b>48</b>	<b>48</b>
<b>Total number of quadrupoles</b>	<b>494</b>	<b>692</b>
<b>Quadrupole length</b>	<b>0.6 - 0.3 m</b>	<b>0.3 m</b>
<b>Maximum quadrupole gradient</b>	<b>17 T/m</b>	<b>12 T/m</b>
<b>Total number of sextupoles</b>	<b>280</b>	<b>392</b>
<b>Maximum sextupole gradient</b>	<b>150 T/m<sup>2</sup></b>	<b>215 T/m<sup>2</sup></b>
<b>Total number of correctors (same as RDR)</b>	<b>300</b>	<b>300</b>
<b>Total number of skews (same as RDR)</b>	<b>240</b>	<b>240</b>



# Parameters

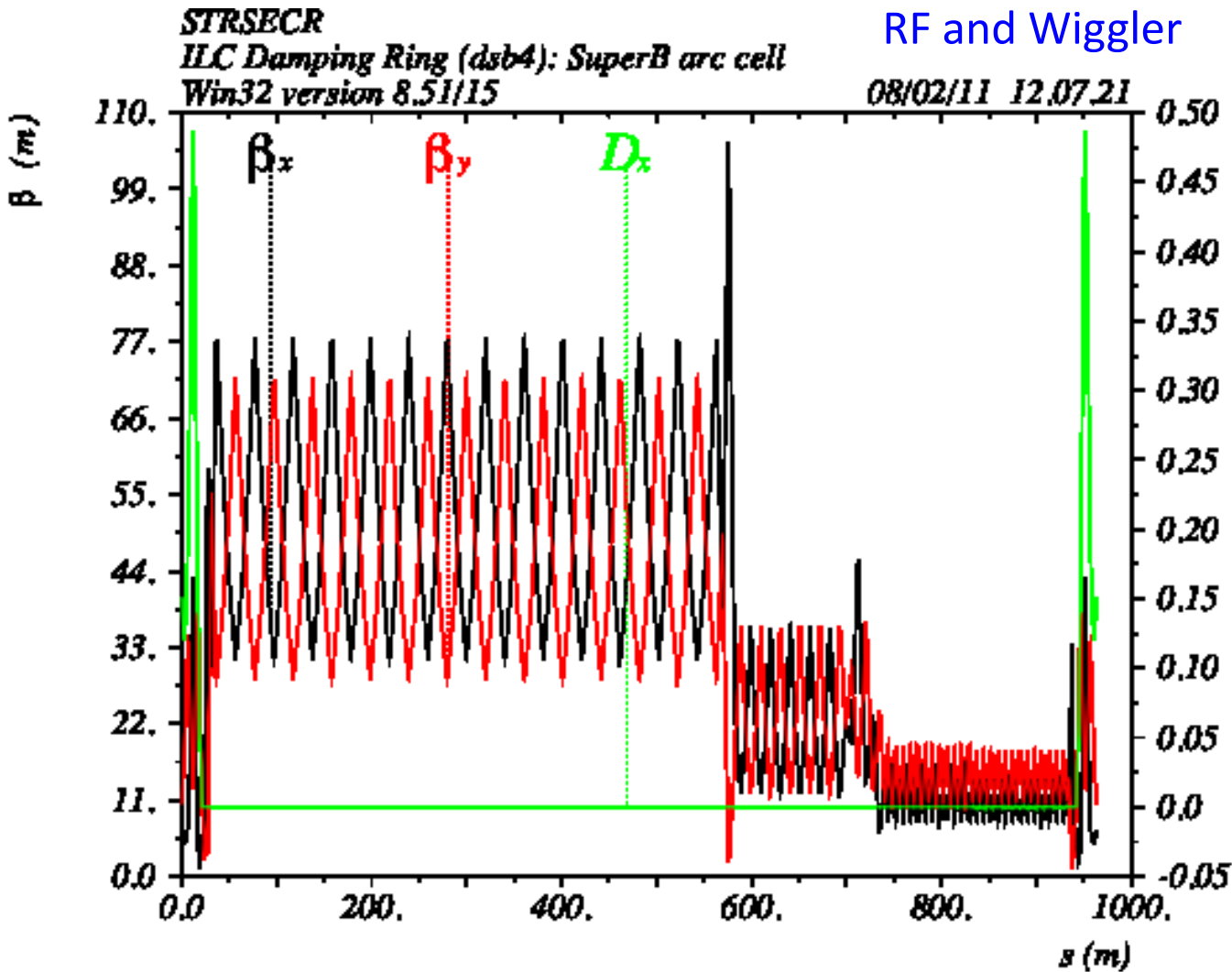
Circumference (m)	<b>3238.22</b>	RF frequency (MHz)	<b>650</b>		
Energy (GeV)	<b>5</b>	RF voltage (MV)	<b>7</b>		
Bunch length (mm)	<b>6</b>	Harmonic number	<b>14042</b>		
Natural X chromaticity	<b>-102</b>	Natural Y chromaticity	<b>-66</b>		
X phase advance/cell#1	<b>0.72</b>	<b>0.6</b>	<b>0.65</b>	<b>0.75</b>	<b>0.78</b>
Normalized $\varepsilon_x$ ( $\mu\text{m}$ )	<b>3.4</b>	<b>4.3</b>	<b>3.5</b>	<b>3.9</b>	<b>5.5</b>
Momentum compaction $\times 10^{-4}$	<b>1.8</b>	<b>1.4</b>	<b>1.5</b>	<b>2.1</b>	<b>2.7</b>
Transverse damping time (ms)	<b>20.6</b>	<b>21</b>	<b>21</b>	<b>20.2</b>	<b>19.6</b>
Max $\beta_x$ in cell #1 (m)	<b>50</b>	<b>80</b>	<b>60</b>	<b>45</b>	<b>45</b>
Max $D_x$ in cell #1 (m)	<b>0.4</b>	<b>0.3</b>	<b>0.3</b>	<b>0.5</b>	<b>0.6</b>

**In red baseline parameters (see plots)**

# DSB3 RF parameters options

	SB2009 Low Power 5Hz	SB2009 High Power 5Hz	SB2009 Low Power 10Hz	
Particle	e <sup>+</sup> /e <sup>-</sup>	e <sup>+</sup> /e <sup>-</sup>	e <sup>+</sup>	e <sup>-</sup>
Circumference (m)	3238	3238	3238	3238
N bunches	1305	2610	1305	1305
N part./bunch	2 x10 <sup>10</sup>	2 x10 <sup>10</sup>	2 x10 <sup>10</sup>	2 x10 <sup>10</sup>
Damp. time $\tau_x$ (ms)	24	24	13	18
Emittance $\varepsilon_x$ (nm)	0.53	0.53	0.57	0.45
Emittance $\varepsilon_y$ (pm)	2	2	2	2
En. loss/turn (MeV)	4.5	4.5	8.4	6.2
Energy spread	1.2x10 <sup>-3</sup>	1.2x10 <sup>-3</sup>	1.5x10 <sup>-3</sup>	1.4x10 <sup>-3</sup>
Momentum comp.	1.3x10 <sup>-4</sup>	1.3x10 <sup>-4</sup>	1.3x10 <sup>-4</sup>	1.3x10 <sup>-4</sup>
B wiggler (T)	1.6	1.6	2.4	2.0
Wiggler period (m)	0.4	0.4	0.28	0.28
Wiggler length (m)	2.45	2.45	1.72	1.72
Tot. wigg. len.(m)	78	78	75	75
Numb. of wigglers	32	32	44	44
Bunch length (mm)	6	6	6	6
Overvoltage	1.7	1.7	1.6	1.7
RF Voltage (MV)	7.5	7.5	13.4	10.4
Average curr. (A)	0.39	0.78	0.39	0.39
Beam Power (MW)	1.76	3.51	3.28	2.42
N. of RF cavities	6	12	12	9
Power/cavity (kW)	293	292	273	269
Voltage/cav. (MV)	1.25	0.63	1.12	1.16
Klystron/ring	2	4	4	3
Power/klystron (kW)	880	880	820	807

# DSB3\_2 New version in progress

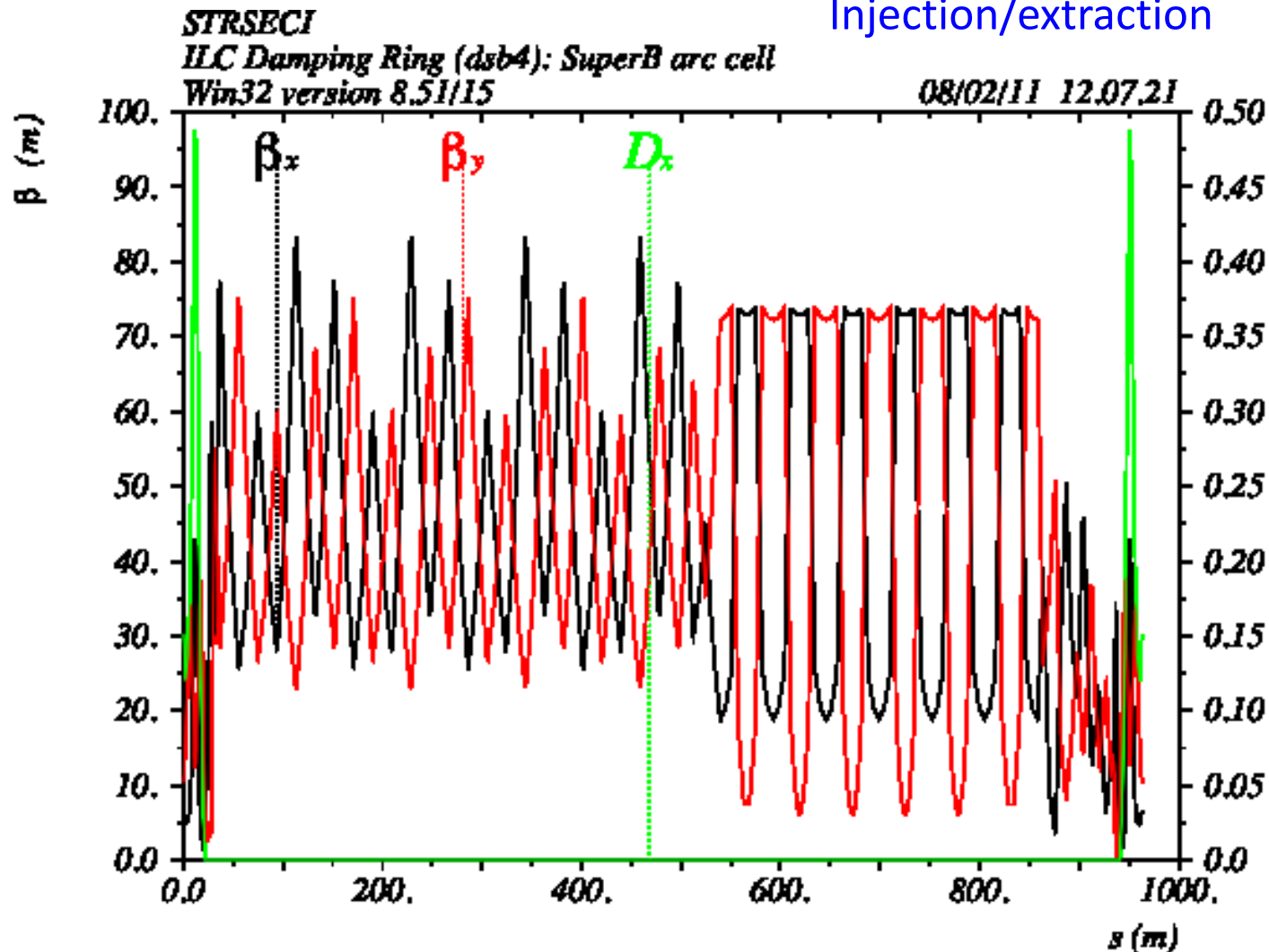


To allow for 10 Hz  
operation:  
50 wigglers (24 off)

Straight sections simplified - new wiggler model

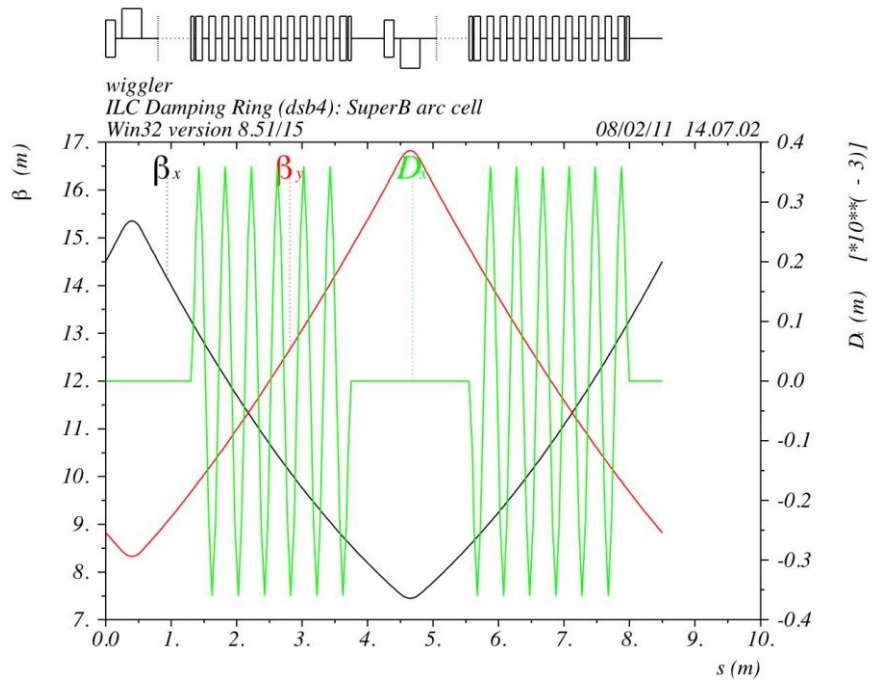
# DSB3\_2 New version in progress

Injection/extraction

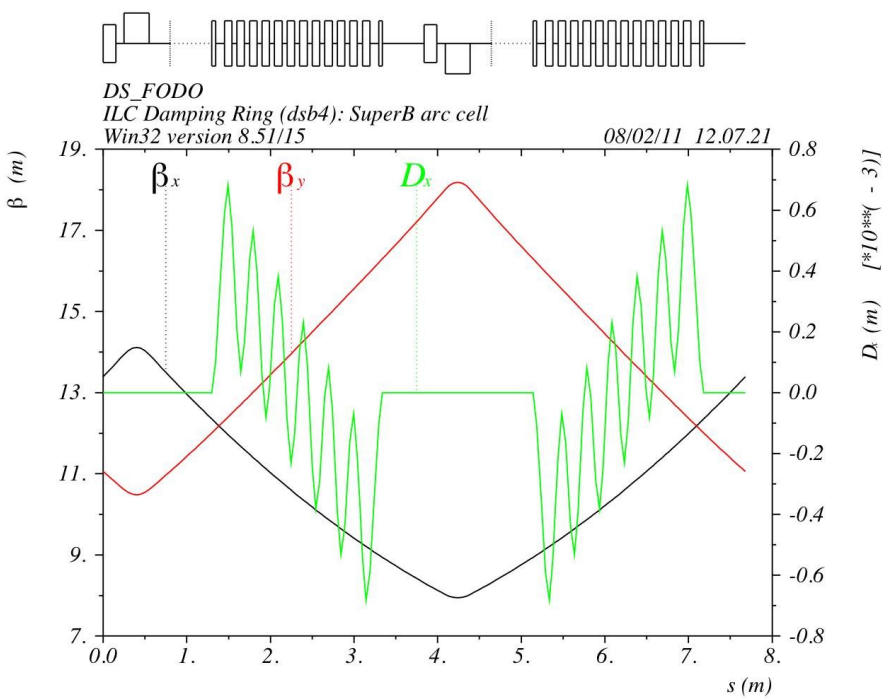


Straight sections simplified - new wiggler model

# New wiggler model



DSB3  
Period = 0.4 m  
Field B = 1.6 T  
Pole length 0.1 m  
Pole distance 0.1 m



New  
Period = 0.3 m  
Field B = 1.9 T  
Pole length 0.09 m  
Pole distance 0.06 m

# Arc and straights

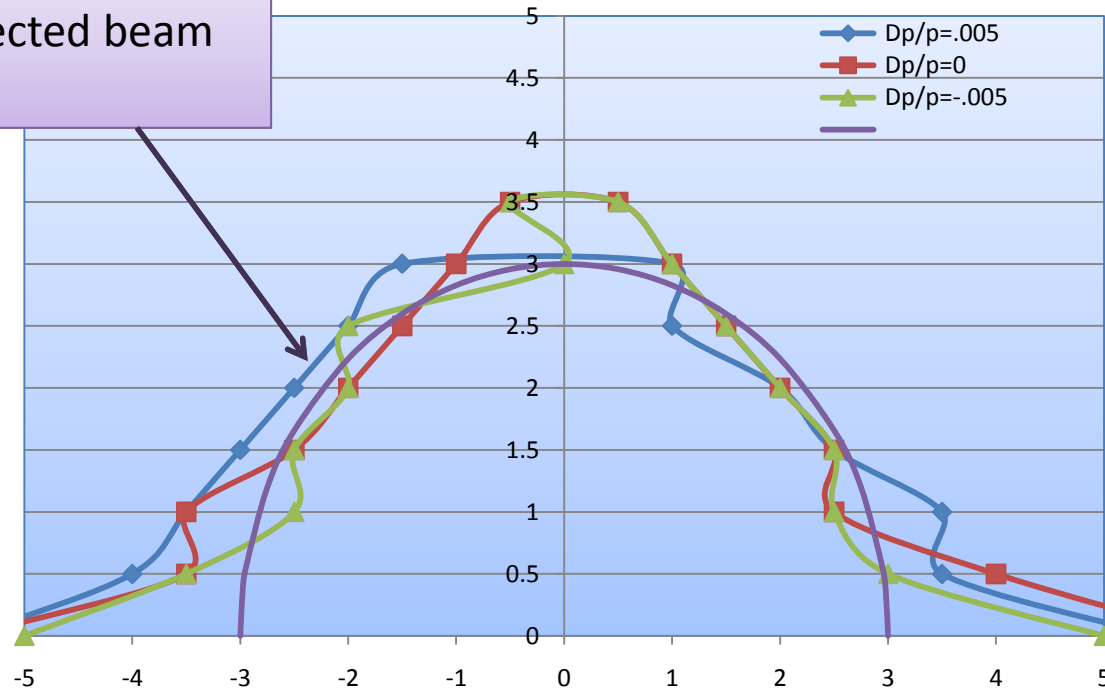
	arc	Straight RF/wiggler	Straight inj/extr	Total
Qx	34.244	7.390	5.555	47.189
Qy	13.013	7.110	6.118	26.241
Cx	54.6	-11.1	-9.3	75
Cy	37	-7.5	-6.5	51
S (m)	1311.3	963.4	963.3	3238

No chicane in the straights

The tunes in the straights are slightly different from the DSB3\_2 version uploaded on 28/2/2011

# Dynamic aperture

The violet line is the maximum beam size of the injected beam  
 $3\sigma_{inj}$



The horizontal acceptance is reasonable

The vertical acceptance is too small