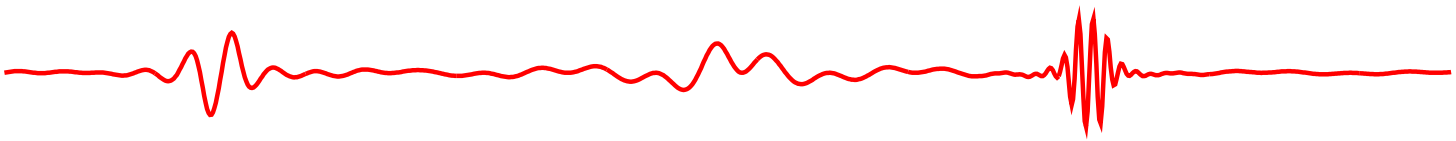
200 MHz RF system update



R. Tomás, O. Dominguez and S. White

Many thanks to G. Arduini, H. Bartosik, R. Calaga, E. Shapochnikova, H. Damerau, G. Rumolo and B. Salvant

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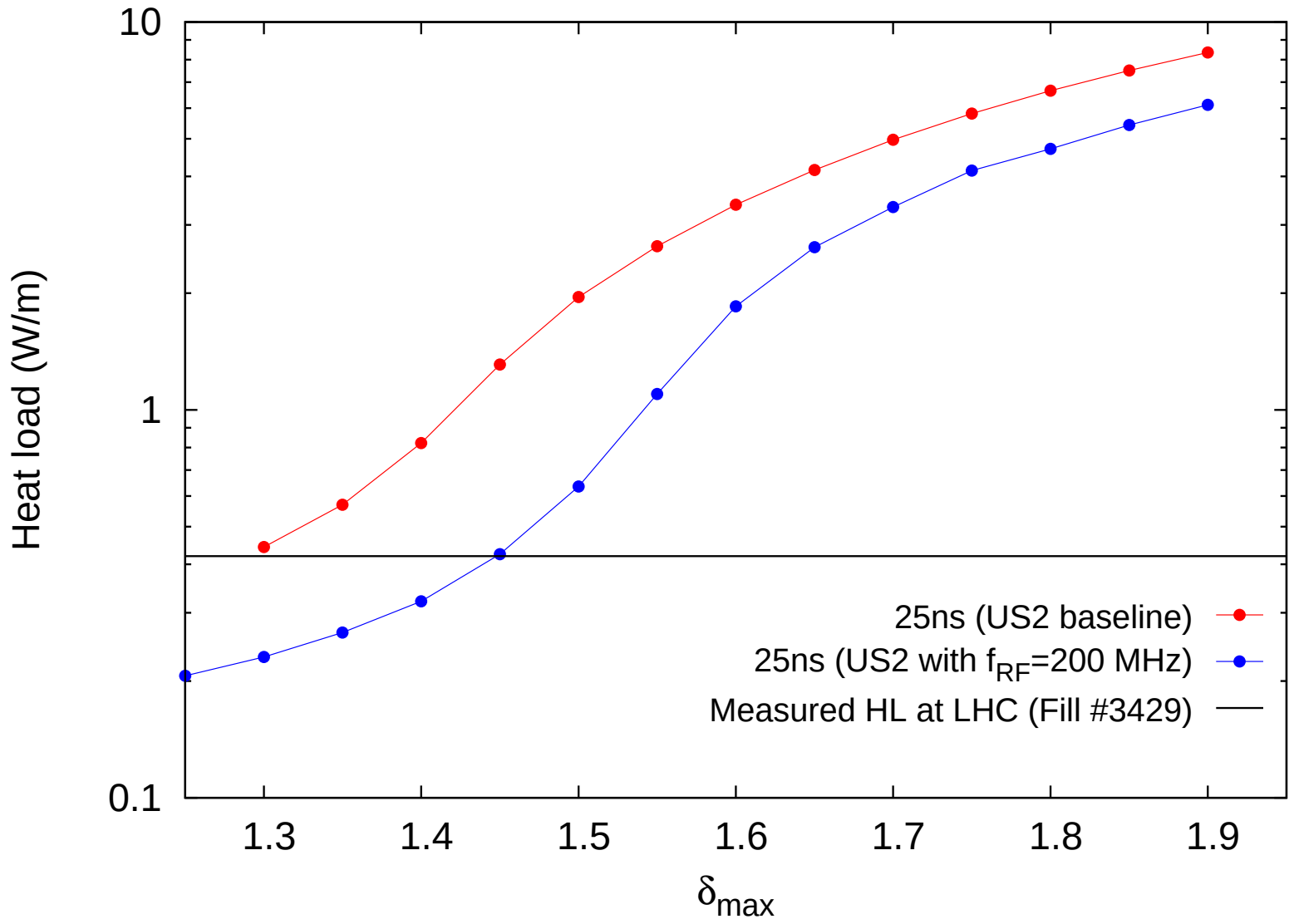
200 MHz, Parameters from Elena

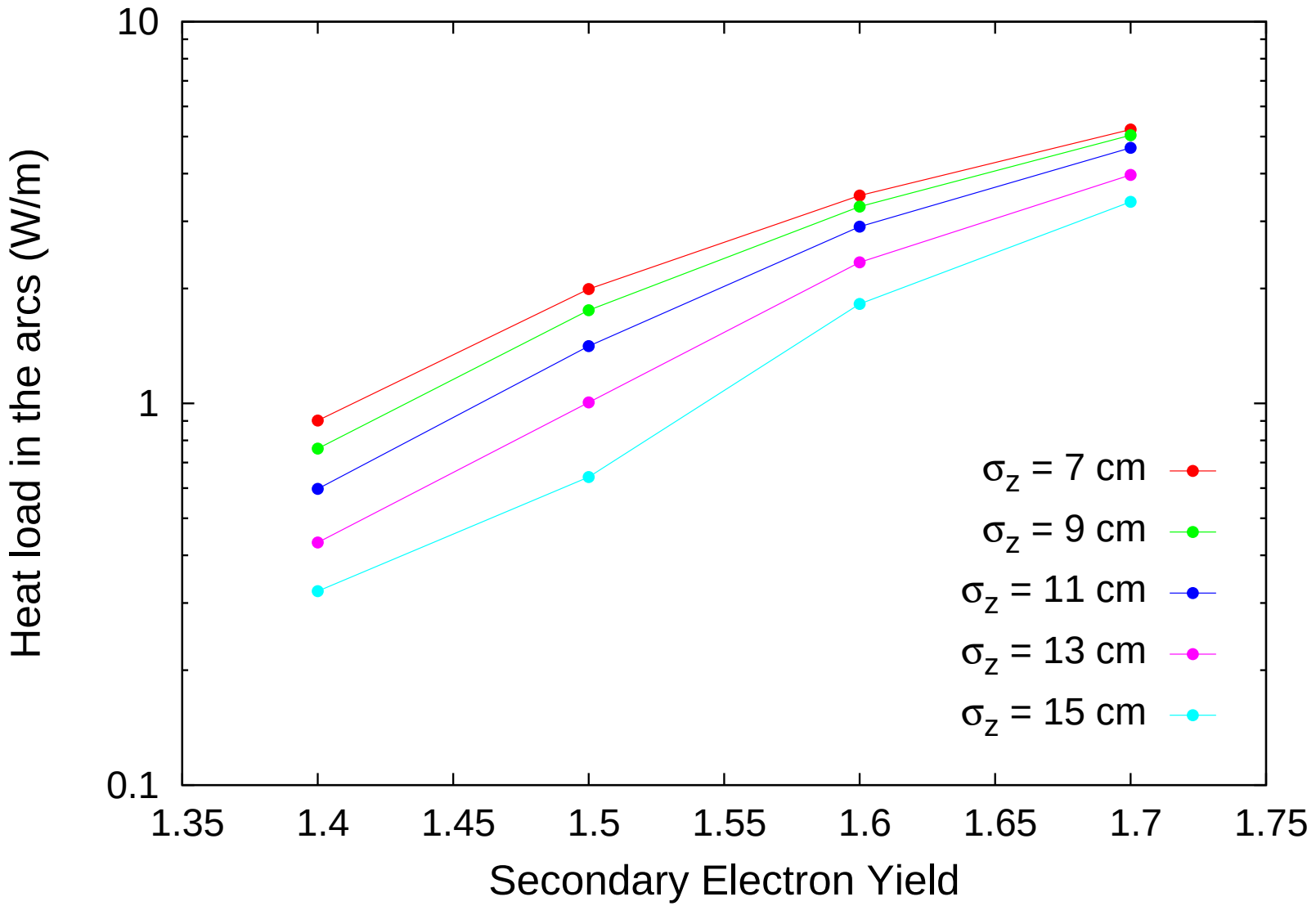
ϵ_s [eVs]	200 MHz [MV]	400 MHz [MV]	σ_z [cm]
3	0	16	8.77
3	3	0	15.7
2	6	0	12.6
2	6	1.5-3	14-15.5

Preferred bunch length before collision might be 15cm. During collision bunch length maybe left constant or shortened (σ_z leveling). Only 6 MV of 200 MHz allows flexibility.

200 MHz (σ_z=15 cm) has lower e-cloud

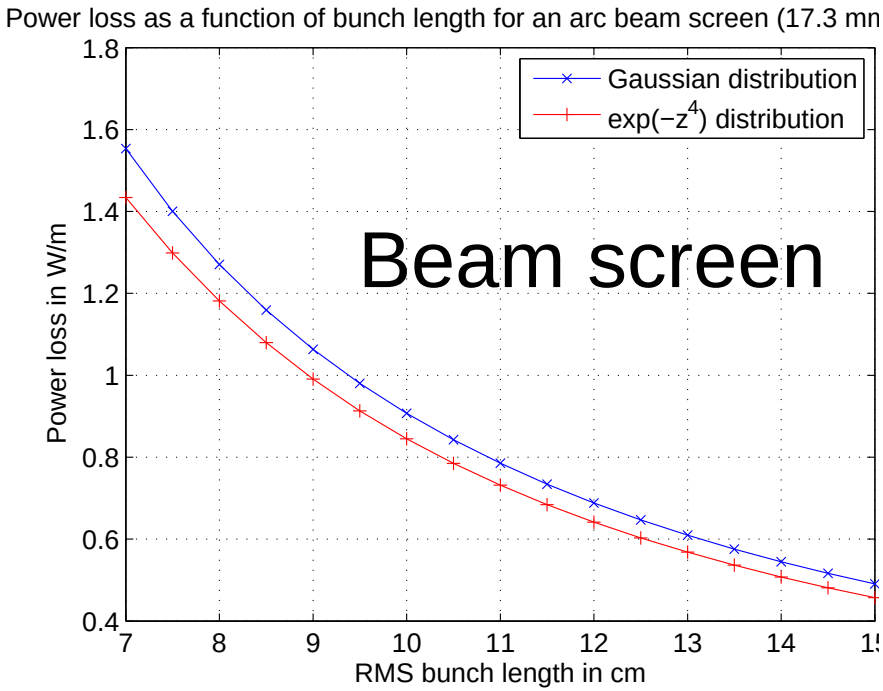


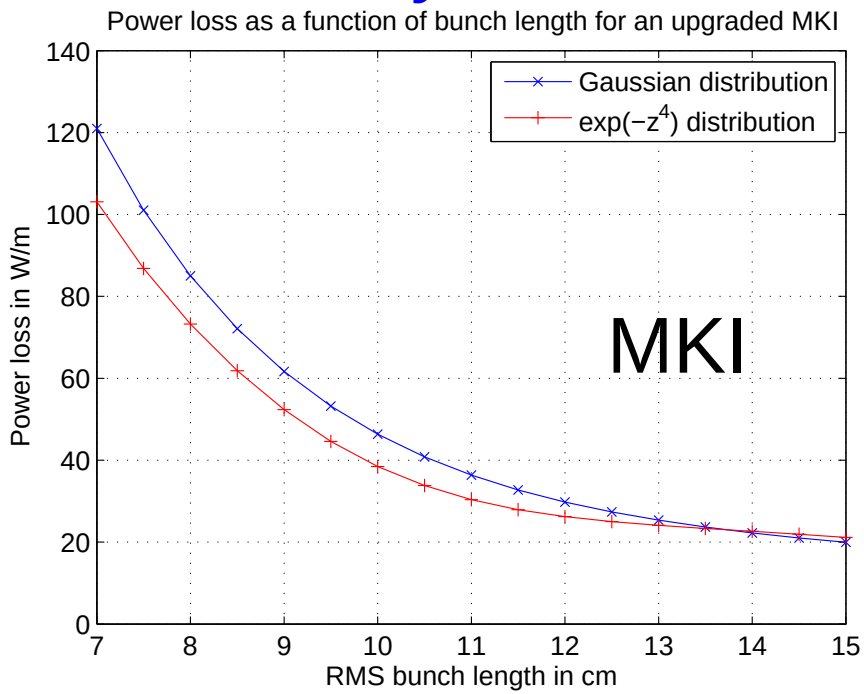
e-cloud scaling with bunch length



Power loss vs. σ_z (impedance)

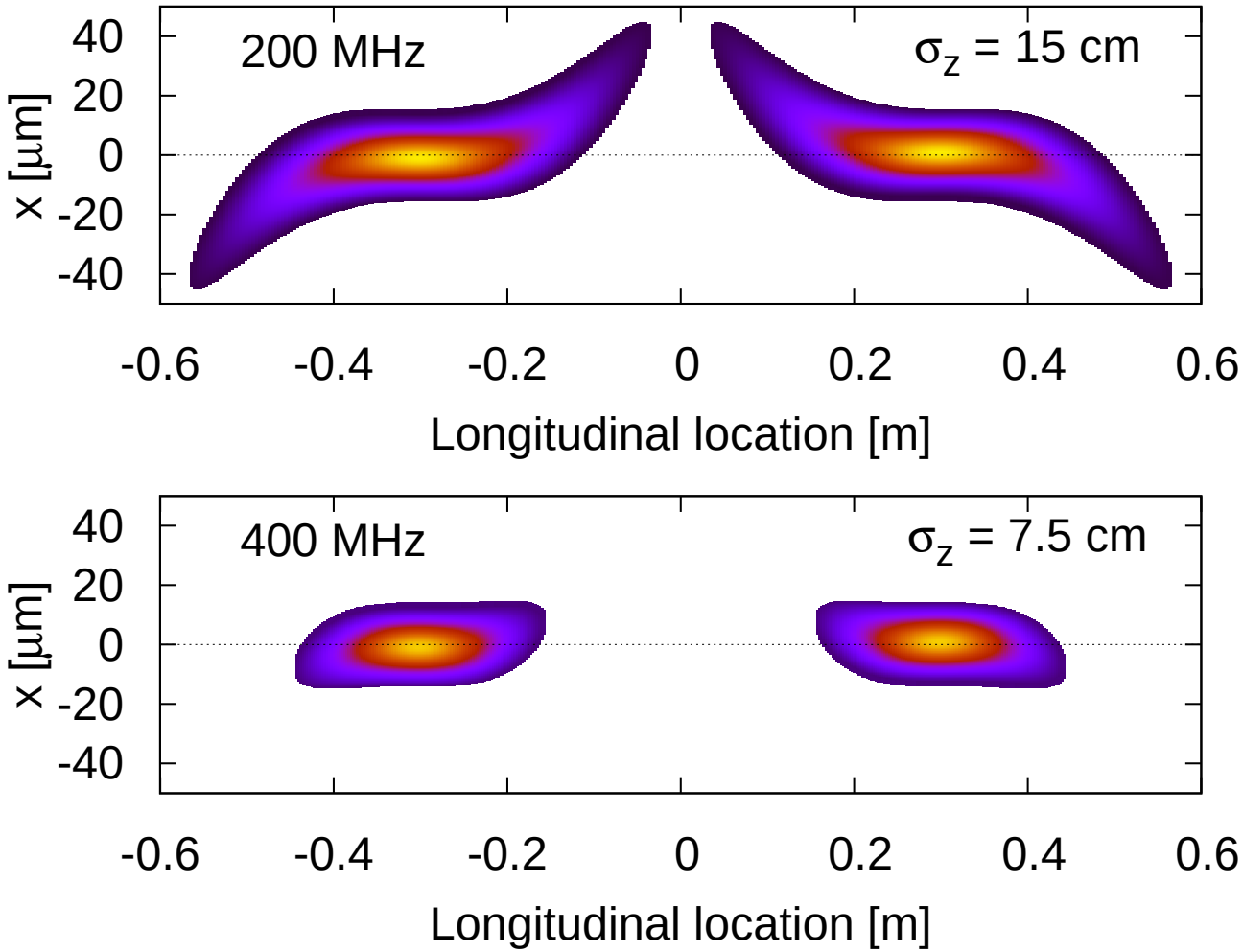
B. Salvant, H. Day, C. Zannini





Important reduction factors on power loss by going to σ_z=15 cm both for the beam screen and the MKI.

400 MHz CC with 200 MHz main RF



2σ envelopes with β^*=15 cm. CC RF curvature reduces overlap above 1σ for 200 MHz.

US2 performance (RLIUP)

	N	ϵ	$\beta^*_{x,y}$	$L_{year}[fb^{-1}]$		fill	Pile-up	
	10^{11}	$[\mu m]$	[cm]	Opt.	6h	[h]		$[\frac{1}{mm}]$
US2	2.2	2.5	15,15	261	232	9.3	140	1.2
200MHz	2.56	3.0	15,15	**276**	234	11	140	1.3
200MHz (no CC)	2.56	3.0	10,50	255	233	10	139	1.6

200 MHz with CC gives the best performance and it is robust against non-working CCs.

1^{st} peak pile-up density optimization

Capturing in the 400 MHz RF before collision?

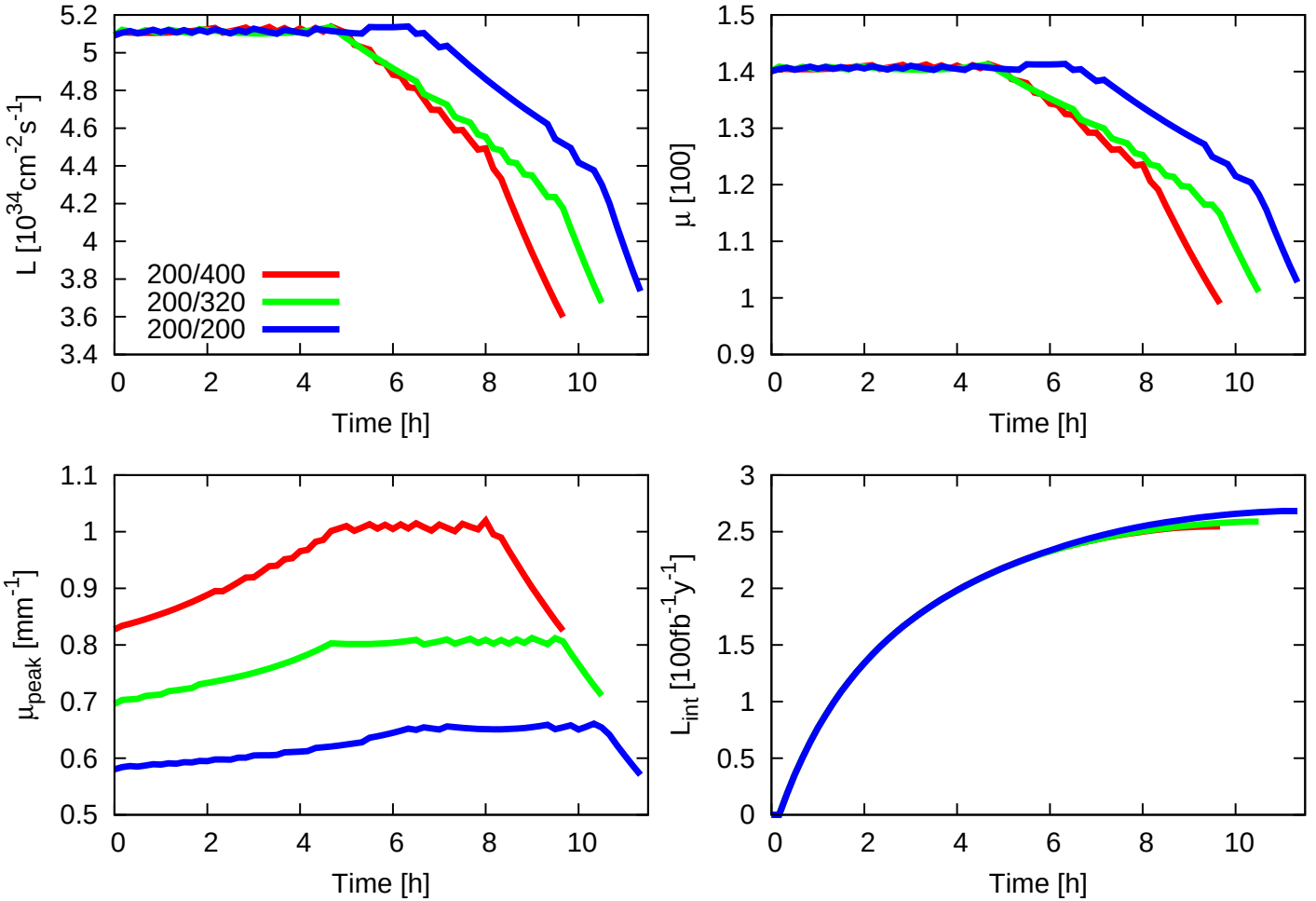
	N	ϵ	$\beta^*_{x,y}$	L$_{year}[fb^{-1}]$		fill	Pile-up	
	10^{11}	$[\mu m]$	[cm]	Opt.	6h	[h]		$[\frac{1}{mm}]$
200MHz	2.56	3.0	15,15	276	234	11	140	1.3
σ_z10cm	2.56	3.0	7.5,30	272	233	11	140	1.1
β^*-level	2.56	3.0	7.5,30	272	233	10	141	1.0

Pile-up density can be leveled to 1 mm^{-1} with 200 MHz (σ_z=10cm, β^*-leveling).

Can we improve pile-up density or luminosity by **reducing**

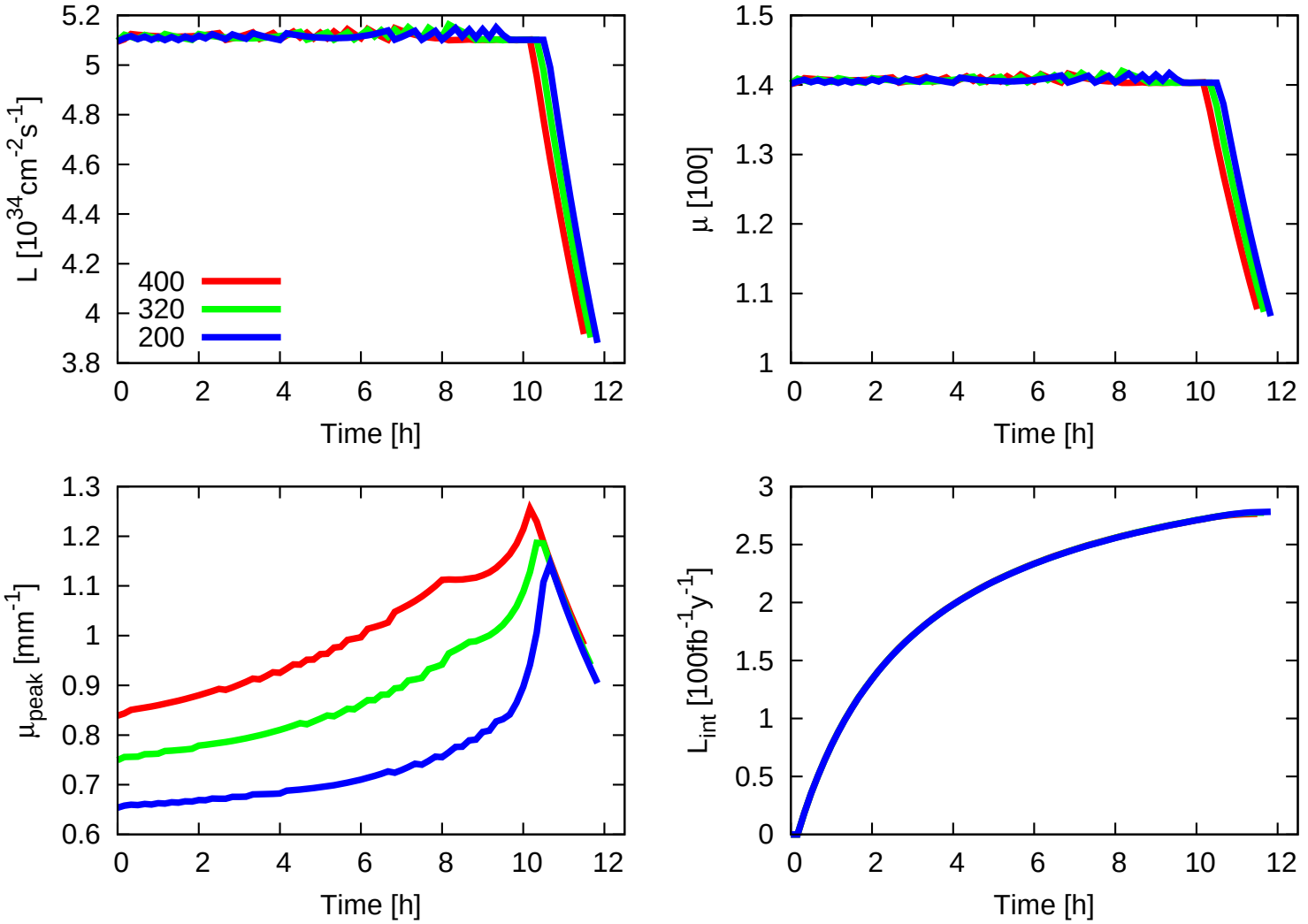
CC frequency?

Optimizing for pile-up density



β^* leveling for pile-up density, constant σ_z=14 cm. 0.8 mm^{-1} with 320 MHz CC (rms luminous region=8 cm, lumi=259 fb^{-1}/y).

Optimizing for luminosity



β^* plus σ_z leveling for peak-lumi but CC freq. has a negligible impact on integrated luminosity.

Summary

- ⋆ 200 MHz (6 MV preferred) allows to inject more charge with longer bunches
- ⋆ yielding lower e-cloud and lower power loss from impedance
- ⋆ 400 MHz CC is OK for largest integrated luminosity (peak pile-up density between 1-1.3 mm^{-1}, int. lumi. $>$ 270 fb^{-1}/y).
- ⋆ 320 MHz CC allows to reduce the pile-up to 0.8 mm^{-1} with int. lumi of 259 fb^{-1}/y