# Further increase of the LHC impedance

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# Impact on stability at 450 GeV

Higher-order modes of the present impedance model cannot drive longitudinal coupled-bunch instabilities (too weak growth rate)

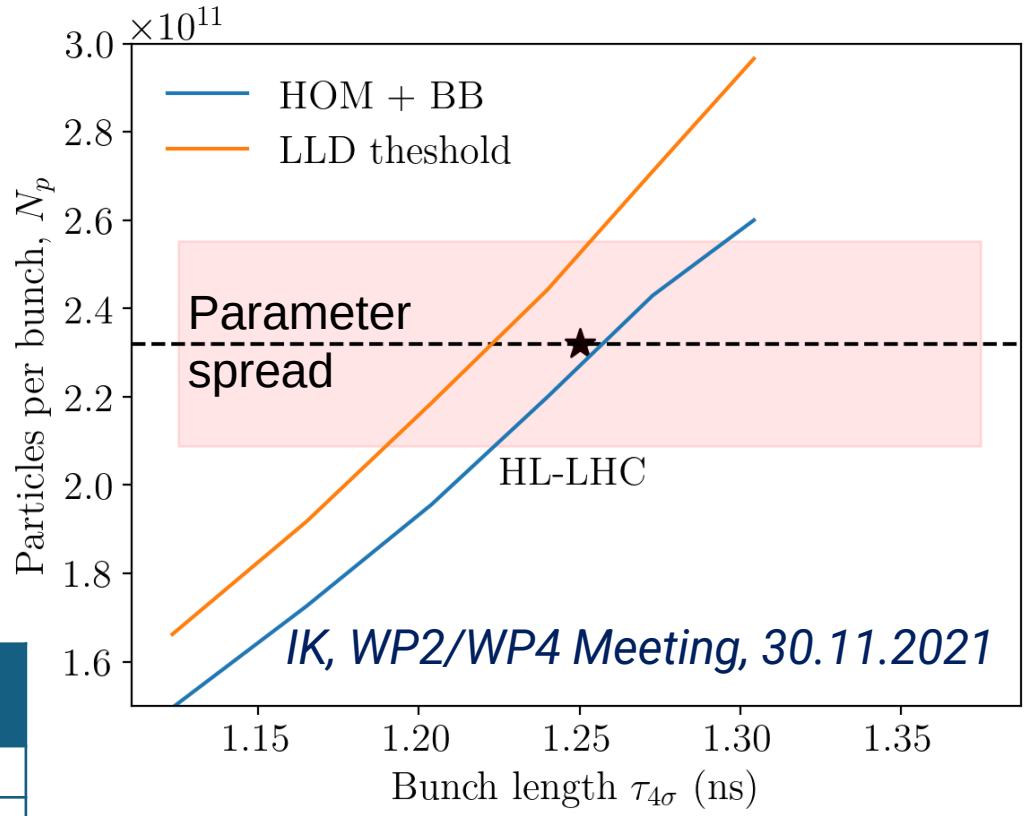
Loss of Landau damping was observed for beam parameters beyond the present operational parameters ($> 1.6 \times 10^{11}$)

For HL-LHC there is no margin according to the present understanding of the (HL-)LHC impedance model

→ Any significant impedance increase (~1%) should be minimized (possibly avoided)

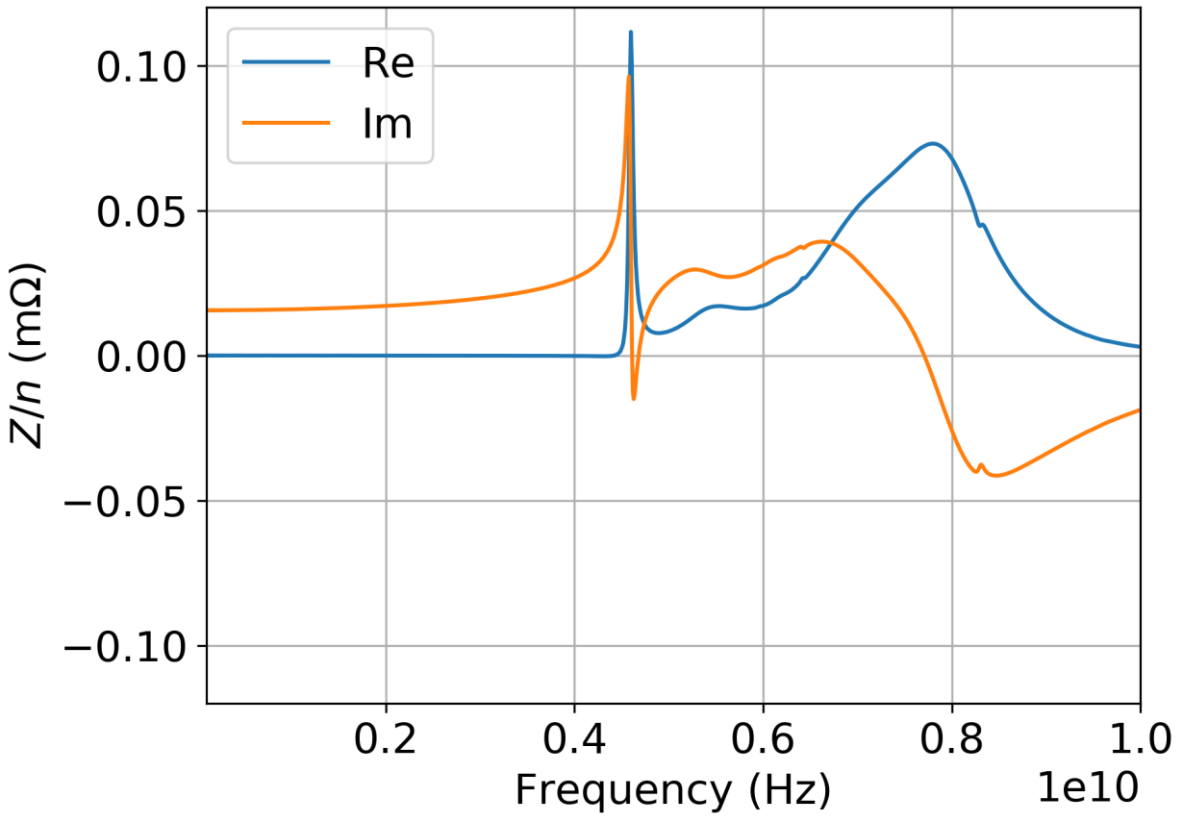
| **Configuration** *value in brackets refers to the amount of convolutions | **Comparison total impedance budget** |
|---|---|
| 2x VMZAR (17)+ 2x VMLGC (29)+ 2xVMBGA (17) | 0.90 % |
| 2x VMZAR (17)+ 2x VMLGC (29) | 0.74% |
| 2x VMZAR (6)+ 2x VMLGC (29)+ 2x VMBGA (10) | 0.65 % |
| 2x VMZAR (6)+ 2x VMLGC (29) | 0.46 % |

Instability thresholds at $E = 450$ GeV for $V_{\mathrm{rf}}$ = 8 MV:
HOM - $R_{\mathrm{sh}} = 4 \times 71\ \mathrm{k\Omega}$, $f_r$ = 582 MHz
BB - $(\mathrm{Im}Z/k)_{\mathrm{eff}} \approx 0.075\ \Omega$, $f_r$ = 5 GHz

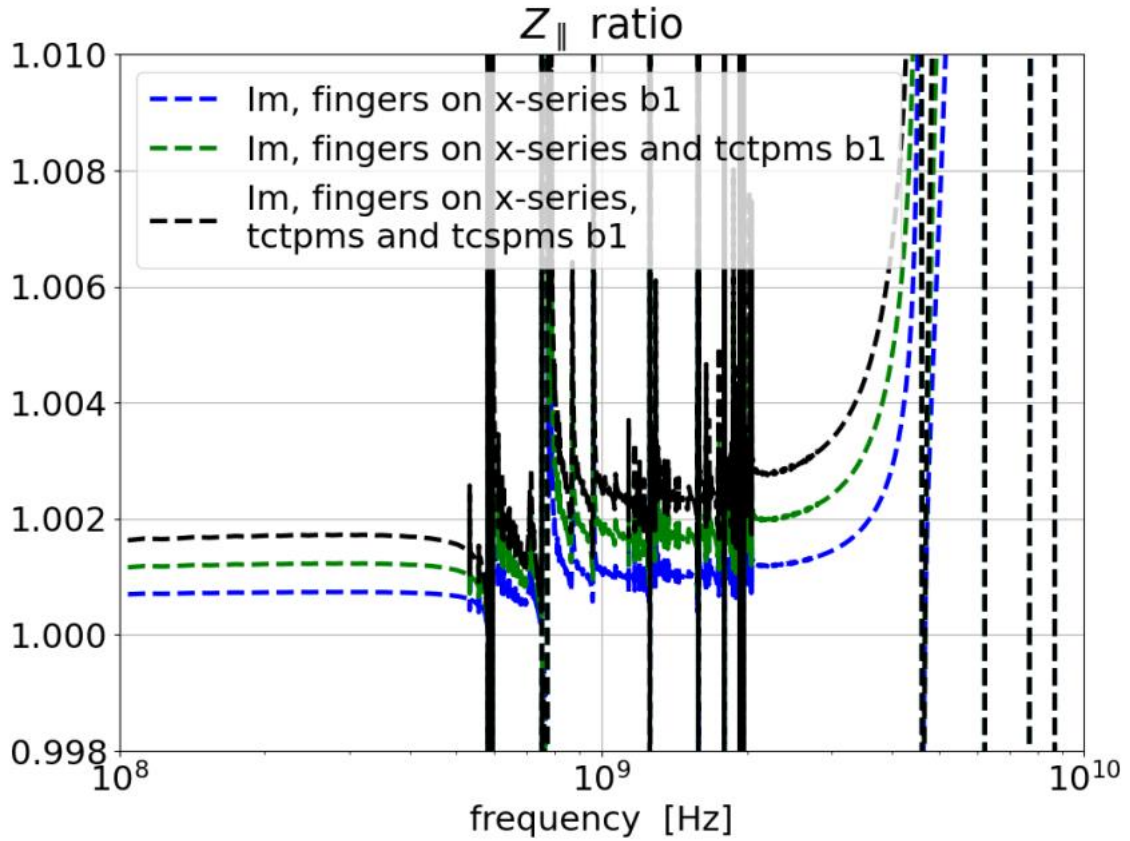



← Preferred and selected solution

# Impedance increase due to collimators




*Input from B. Salvant*

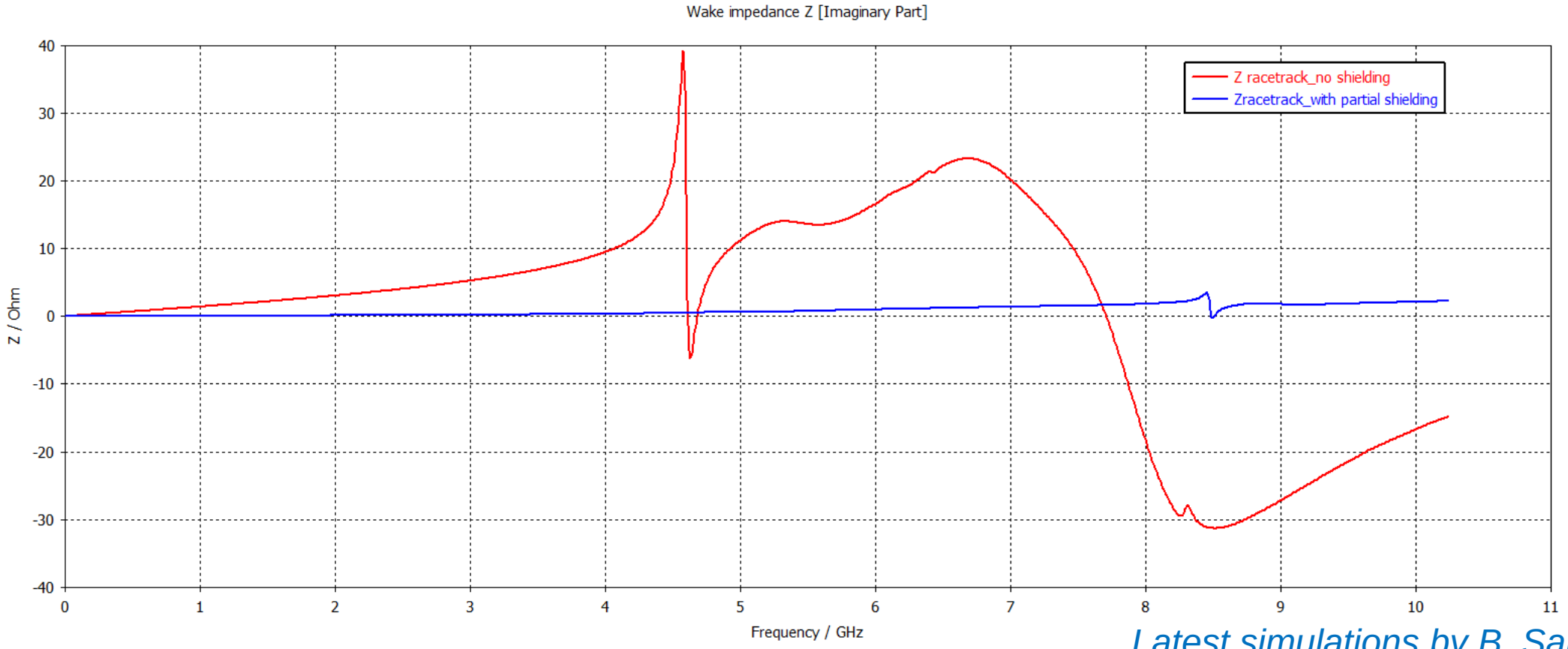



*L. Giacomel, IWG, 04.06.2024*

Relative impedance increase is at least 0.2% depending on the frequency
Small, but not negligible contribution

# Partial shielding

3 fingers on top and on bottom per side, i.e. 12 fingers per collimator as suggested by Luca




*Latest simulations by B. Salvant*

We gain at least an order in magnitude in all impedance contributions