

CLIC 380 GeV Phase Stability Simulations

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Ideal Case

- Longitudinal bunch position (phase) and bunch length at the end of each section for the perfect machine:

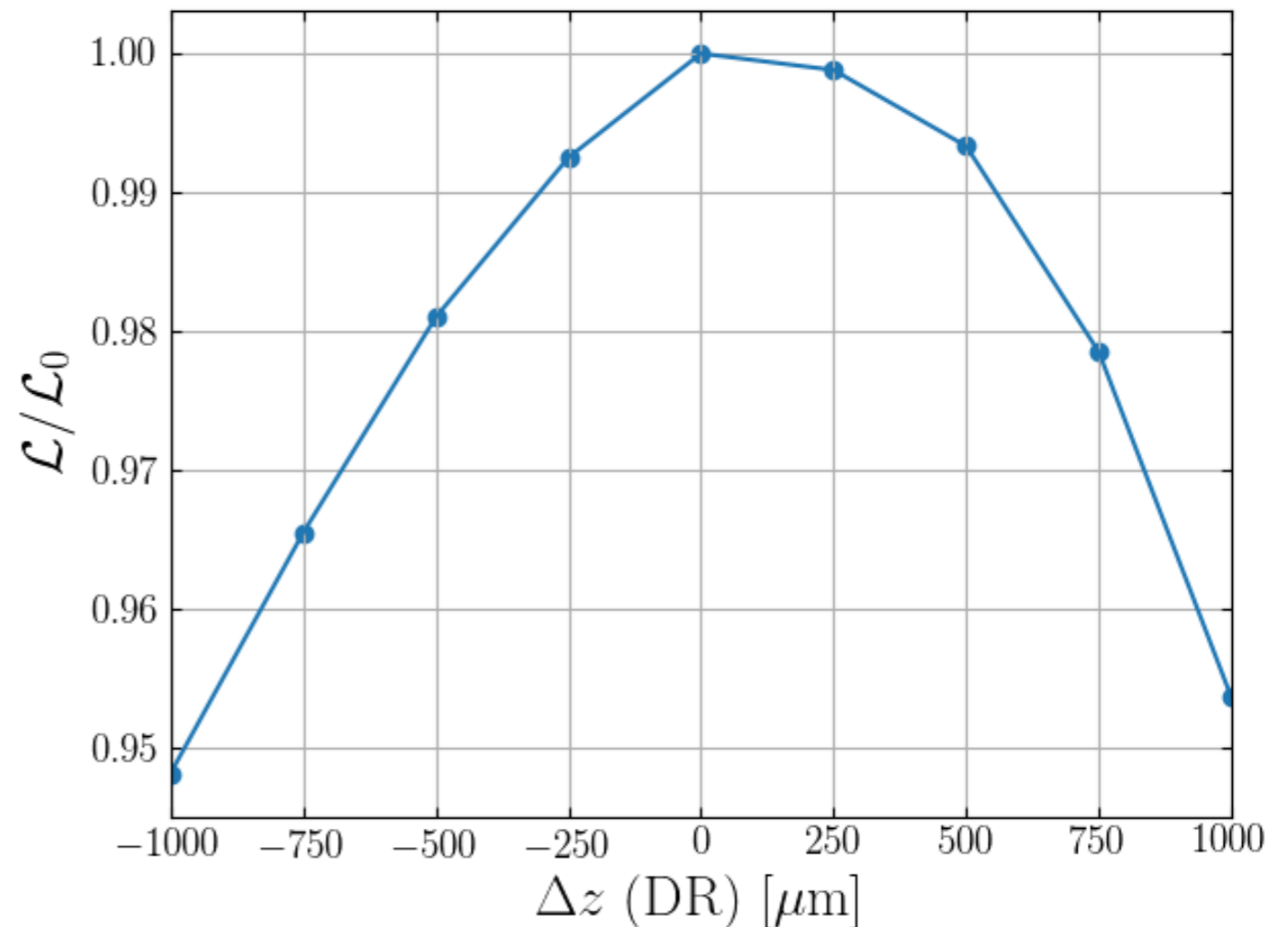
Section	z (um)	σ_z (um)
DR	0	1800
RTML	45.3	69.5
ML	45.3	69.5
BDS	45.3	69.5

DR Phase Scan

- Varying longitudinal position from the DR.
- Luminosity was calculated with a reference beam.
- Can tolerate

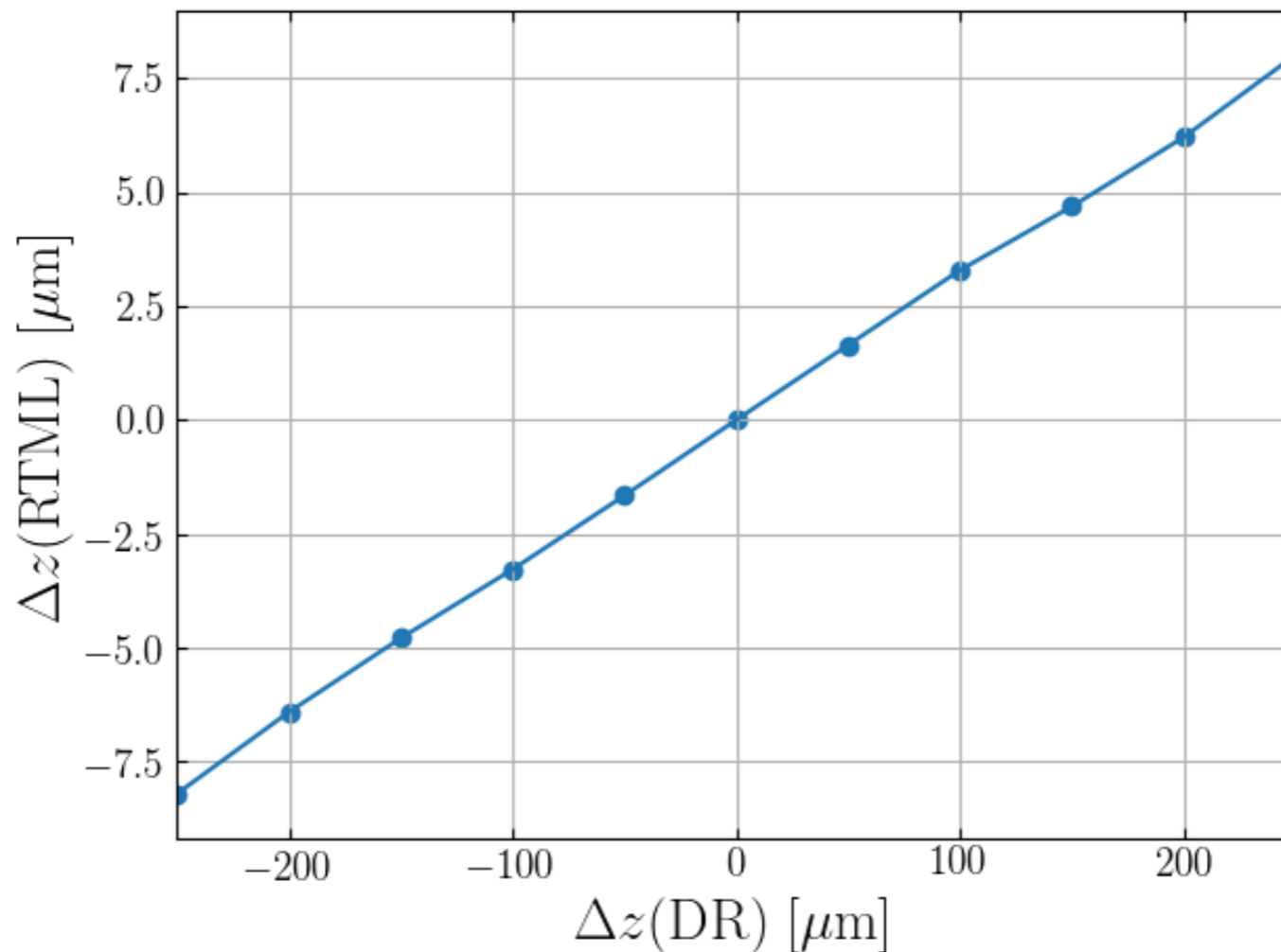
$-200 \text{ } \mu\text{m} < \Delta z < 375 \text{ } \mu\text{m}$

to remain within a 0.5 % luminosity loss budget.



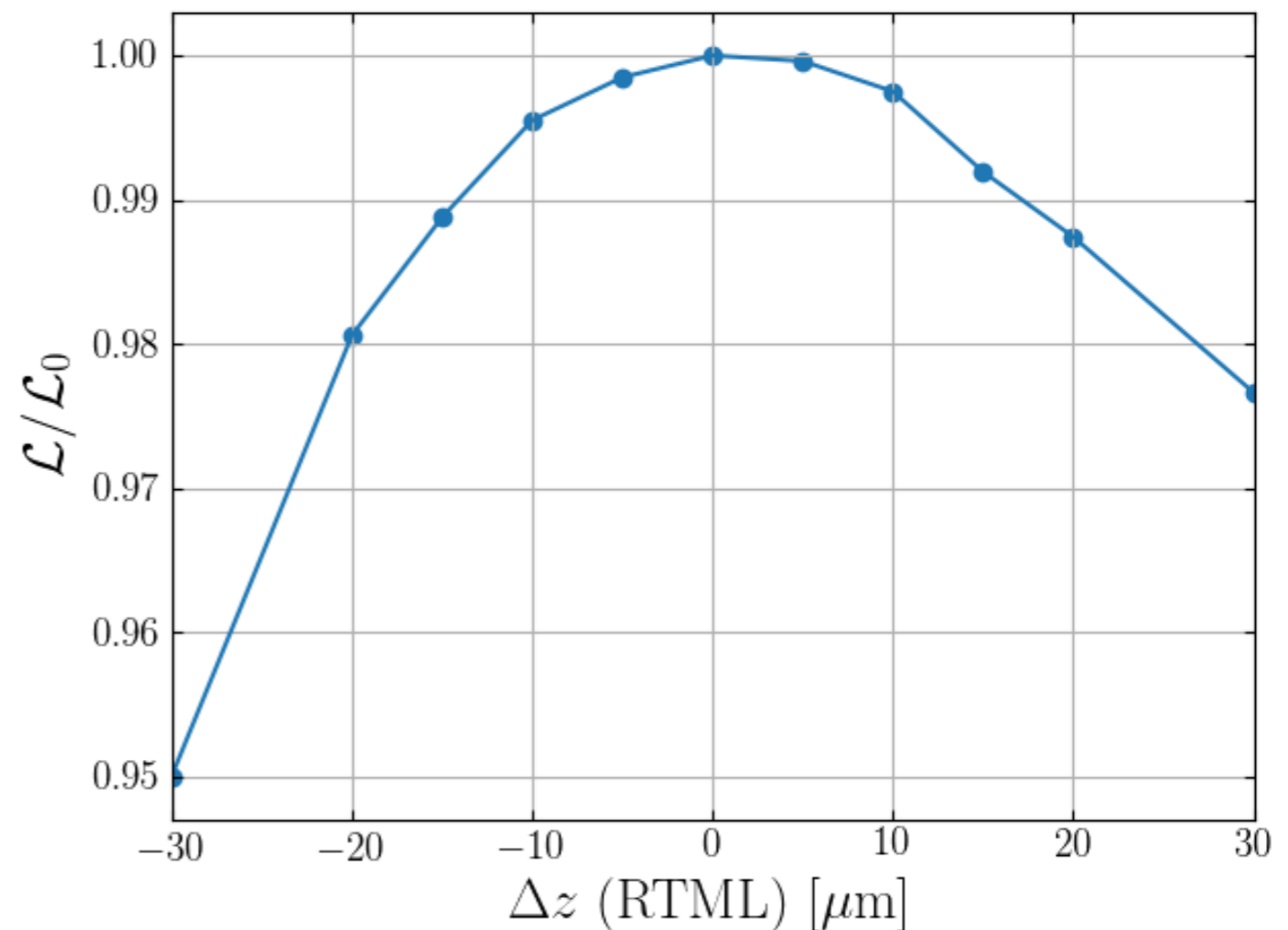
RTML Phase Scan

- The bunch length is compressed by a factor ~ 26 in the RTML.
- A similar reduction occurs in the longitudinal position:



ML+BDS Phase Scan

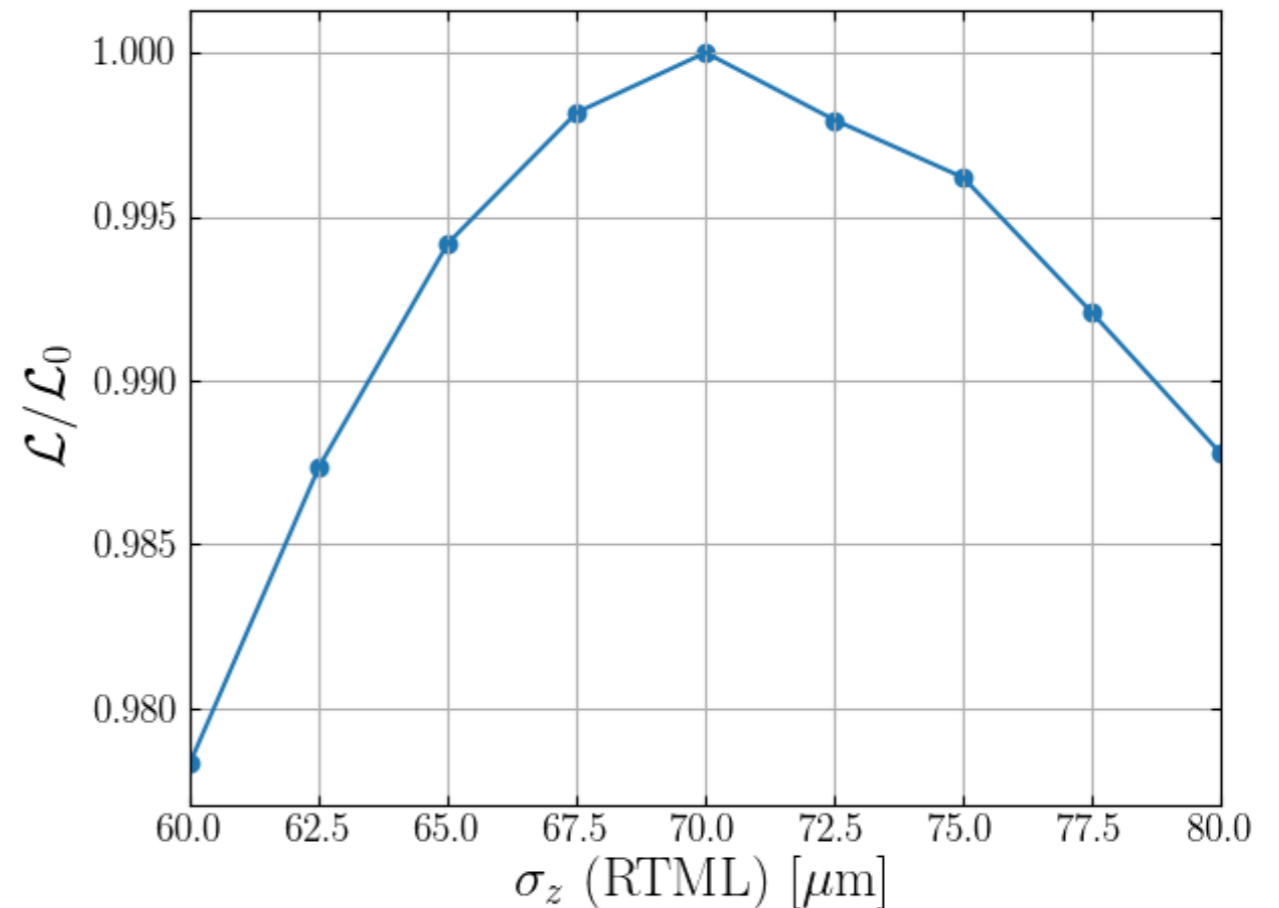
- The longitudinal bunch position entering the ML was scanned.
- Luminosity was calculated with a reference bunch.
- There is a phase tolerance of $\pm 0.15^\circ$ to remain within a 0.5% luminosity loss budget.



ML+BDS

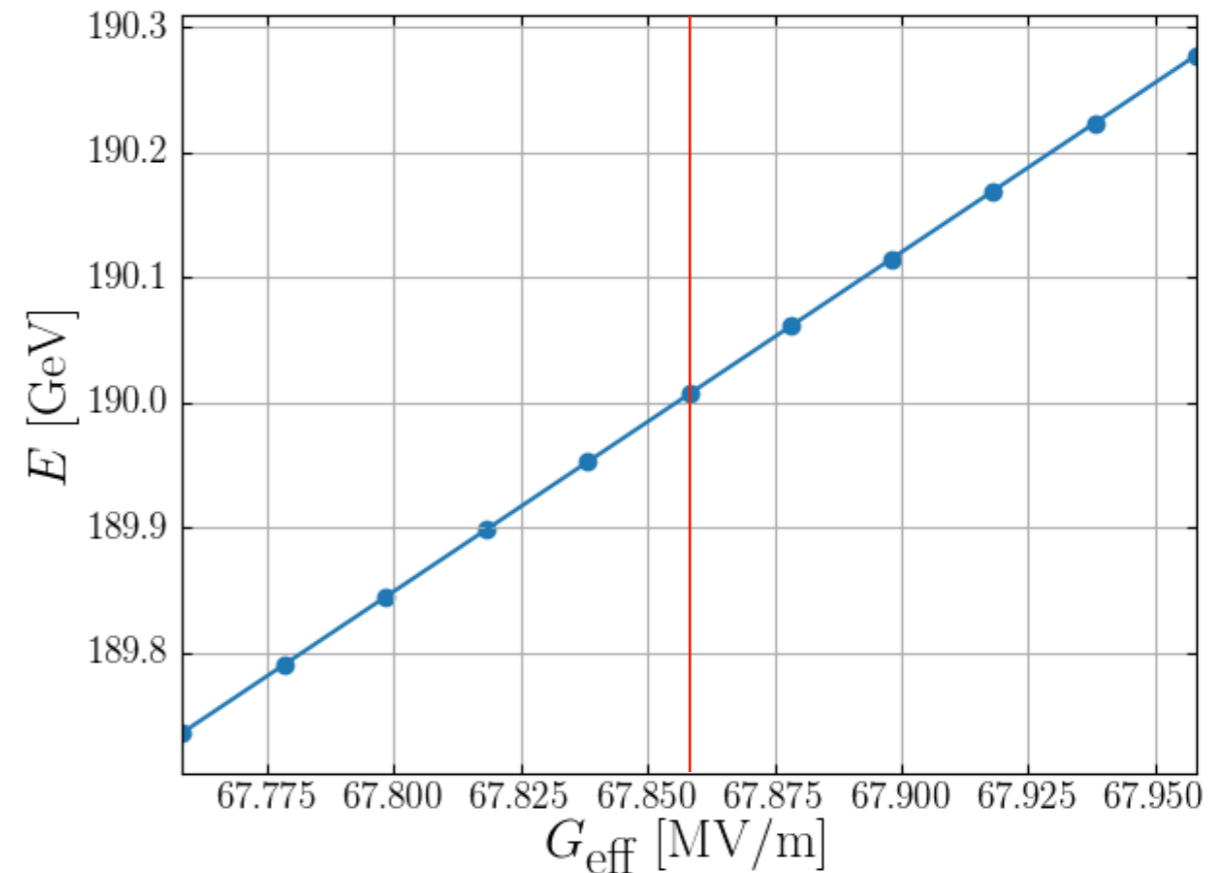
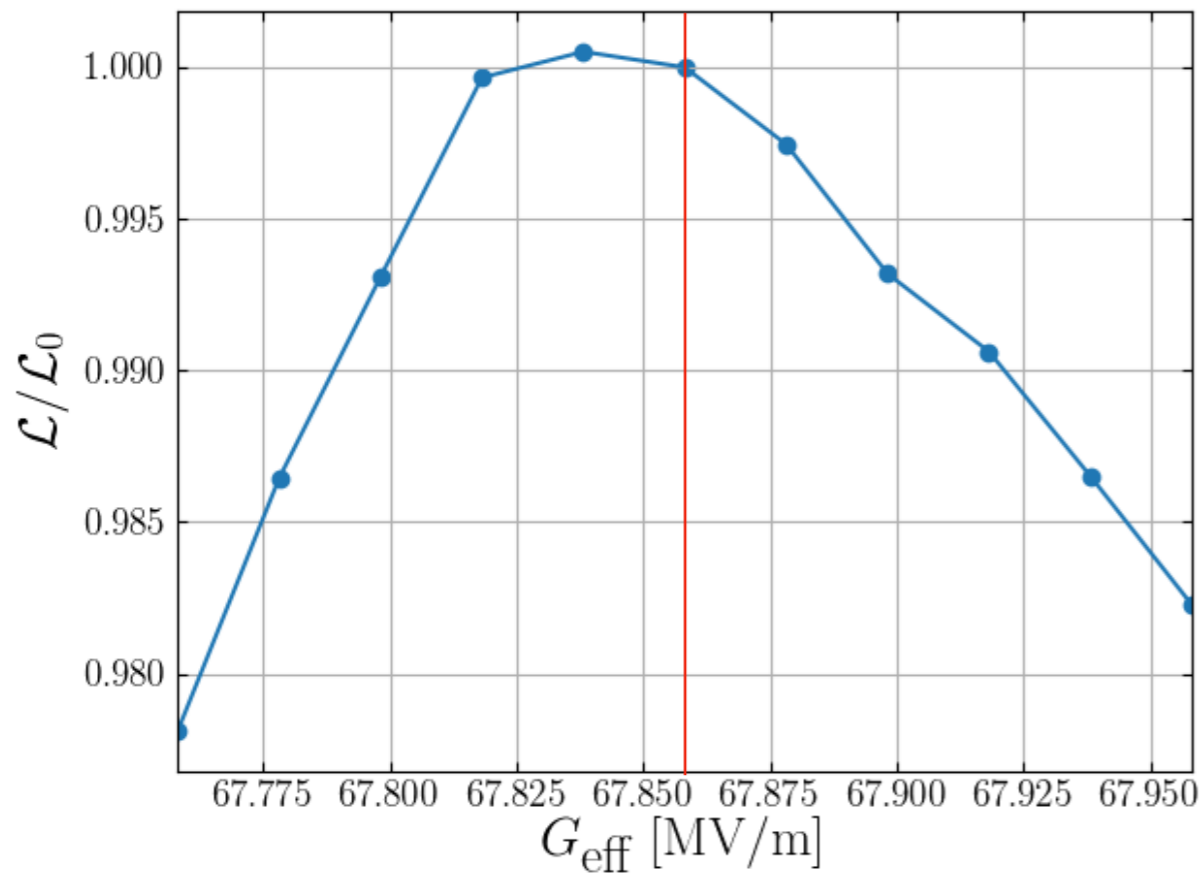
Bunch Length Scan

- The bunch length from the RTML was scanned.
- Can tolerate a bunch length error of $\pm 5 \mu\text{m}$ to remain within a 0.5% luminosity loss budget.
- Direct effect on luminosity of a bunch length error is limited.



ML Gradient Scan

Design Gradient = 67.858 MV/m



- Can tolerate an effective gradient error:

$$67.805 \text{ MV/m} < G_{\text{eff}} < 67.888 \text{ MV/m}$$

$$= -0.08\% < G_{\text{eff}} < 0.04\%$$

Summary

Parameter	Error Tolerance
Longitudinal position from DR	$-200 \mu\text{m} < \Delta z < 375 \mu\text{m}$
Longitudinal position from RTML	$\Delta z = \pm 10 \mu\text{m} = \pm 0.15^\circ$
Bunch length from RTML (direct effect)	$\Delta\sigma_z = \pm 5 \mu\text{m}$
ML Cavity Gradient	$67.805 \text{ MV/m} < G_{\text{eff}} < 67.888 \text{ MV/m}$ $-0.08\% < G_{\text{eff}} < 0.04\%$