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SPARTA
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The Research Council of Norway

IP simulations for HALHF 2.0 with GUINEAPIG

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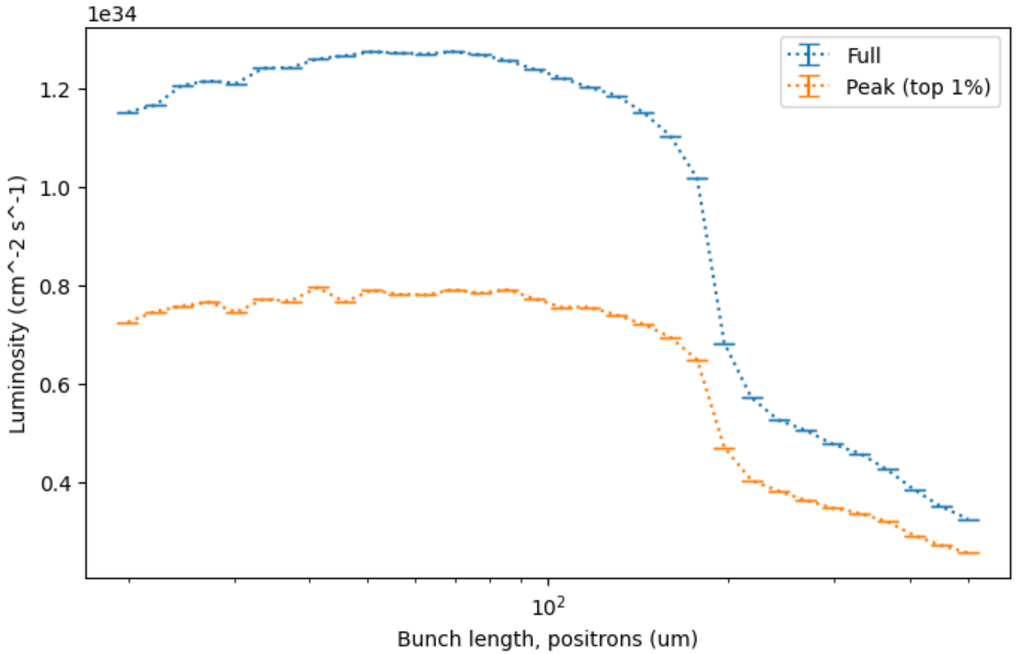
250 GeV CoM simulations

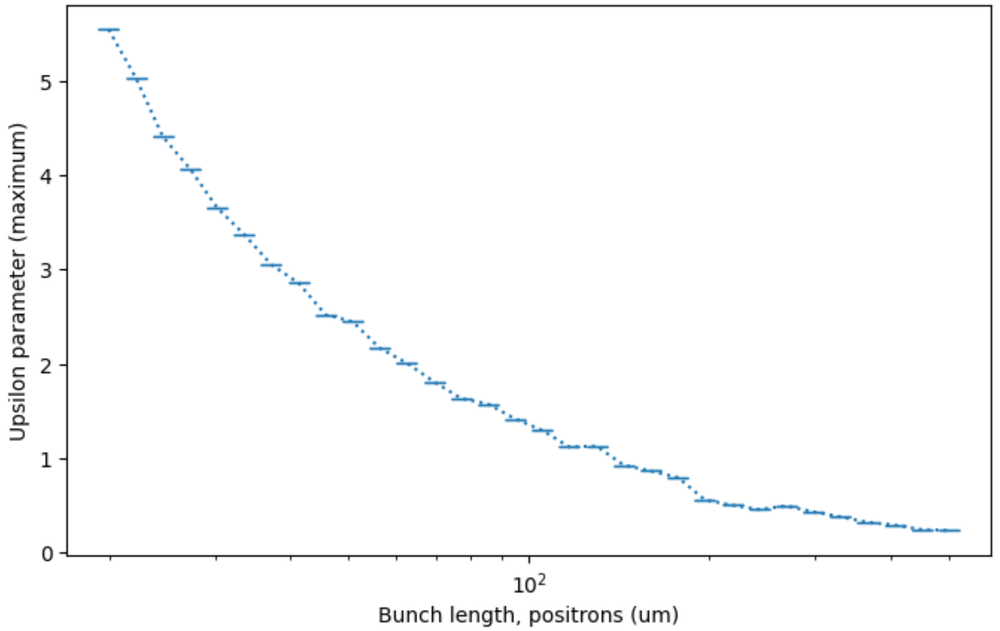
(41.7 GeV, 4.8 nC e^+ and 375 GeV, 1.6 nC e^-)

Scan of positron bunch length (e^- bunch length 150 μm rms)

Luminosity and maximum field strength

- No major disruption of the electron beam (field increases).
- Maximum luminosity around 60–70 μm rms, but plateau until ~150 μm.
  - Stay at ~150 μm for reduced beam loading in e^+ linac.
- Falls off for bunch lengths above 200 μm. Is this the hour-glass effect?

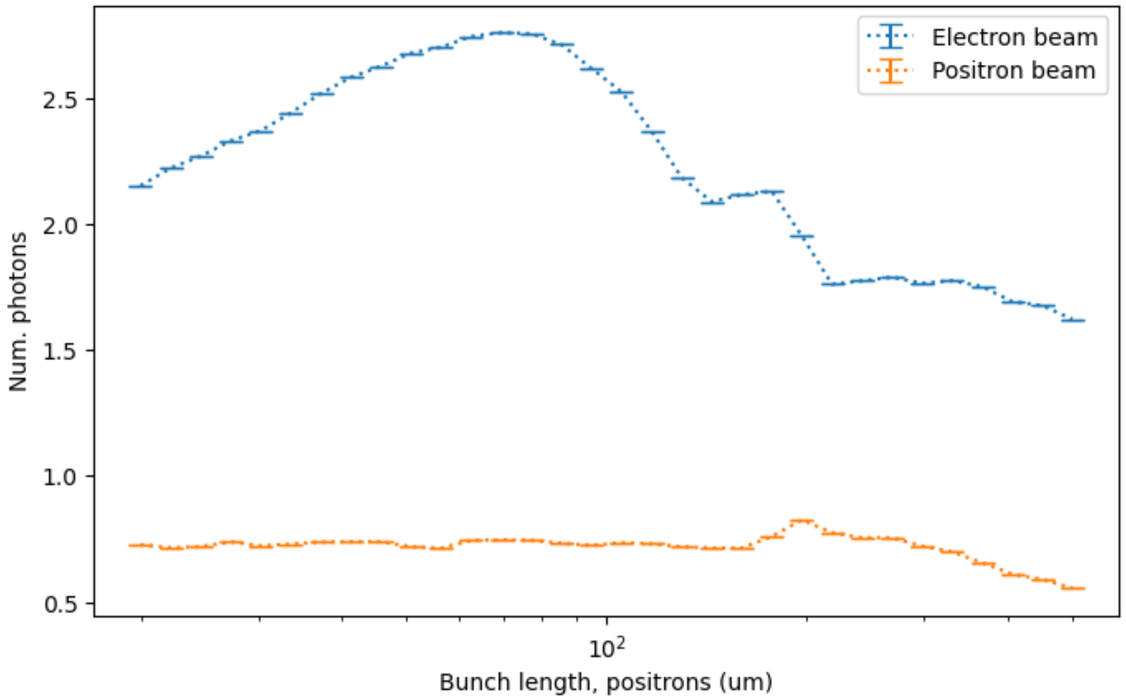


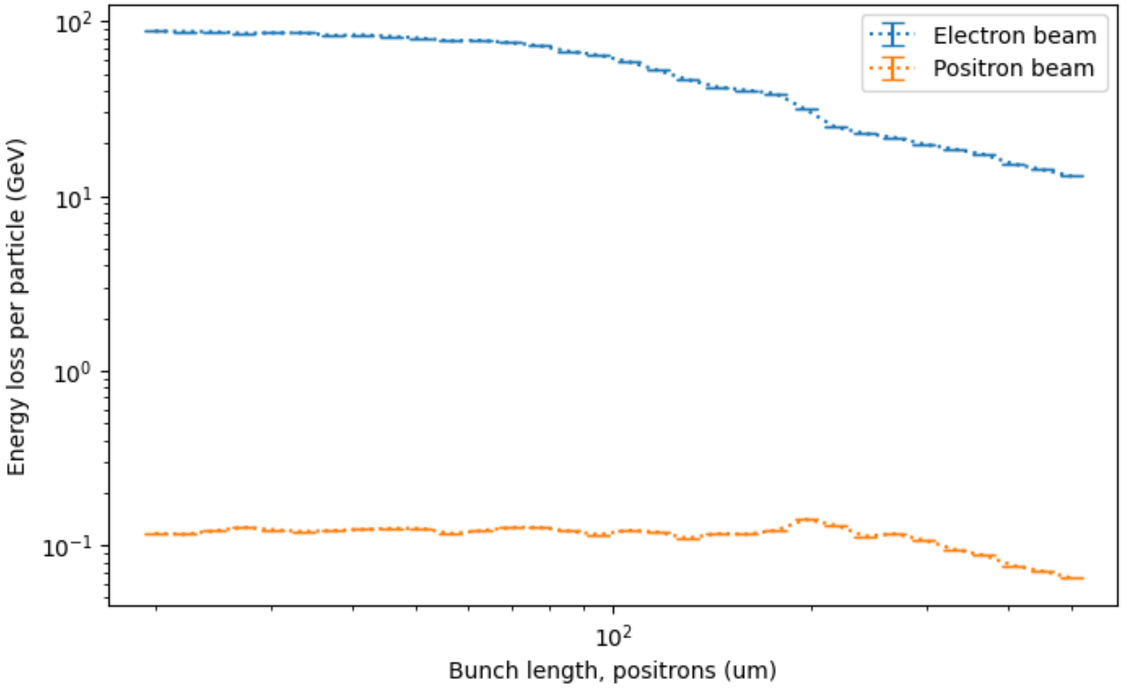


Scan of positron bunch length (e^- bunch length 150 μm rms)

Synchrotron photons produced

> Maximum interaction seems to occur for ~70 μm rms positron bunch length.

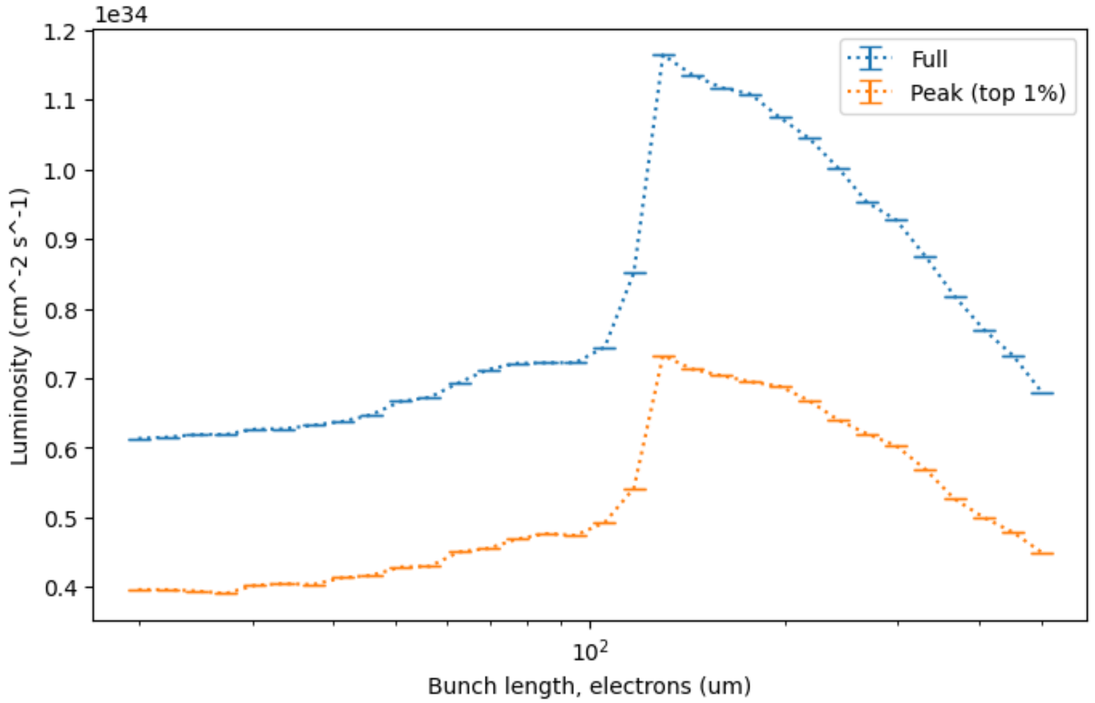


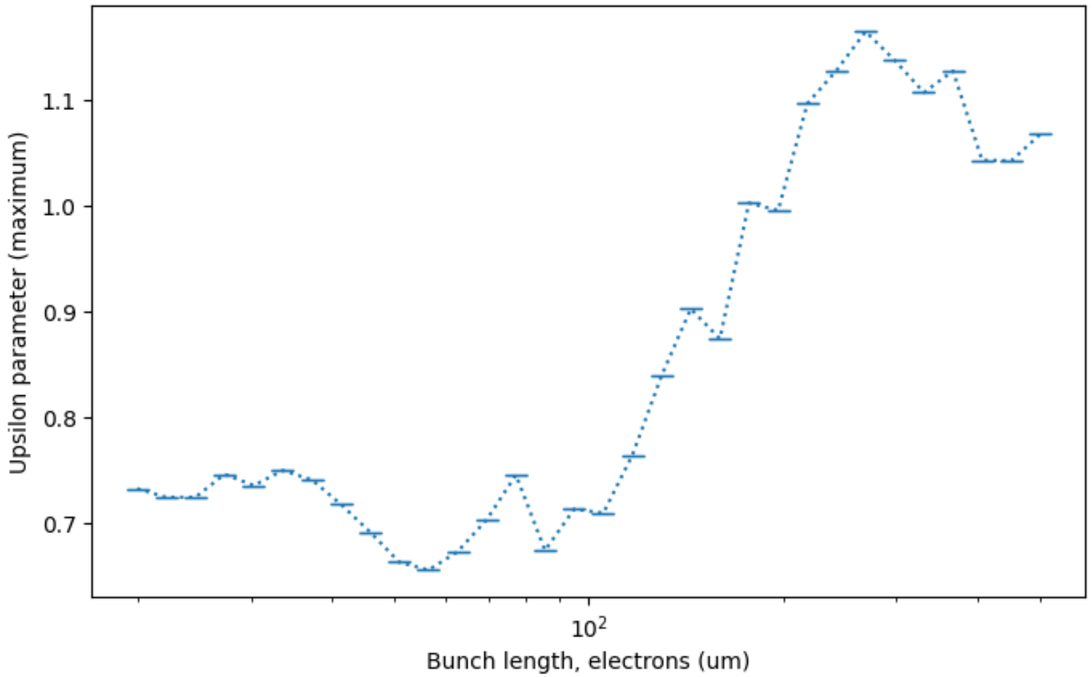


Scan of electron bunch length (e^+ bunch length 150 μm rms)

Luminosity and maximum field strength

- Maximum luminosity at ~130 μm rms.
- Falls rapidly for shorter e^- bunches (not currently well understood)

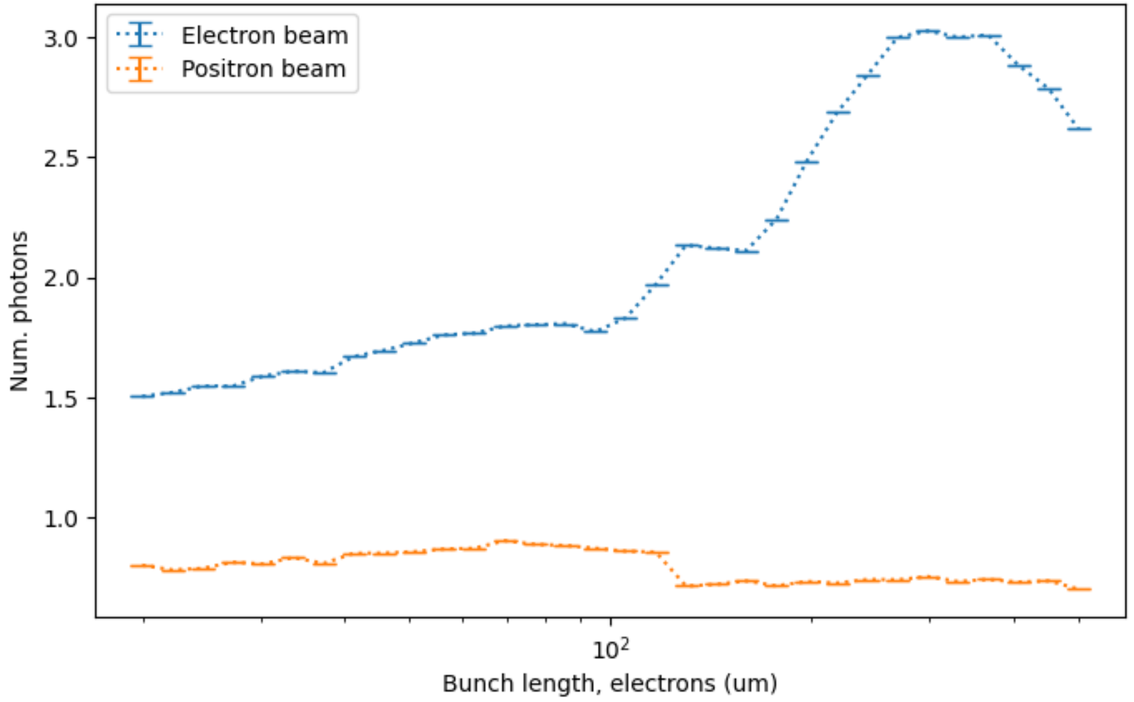


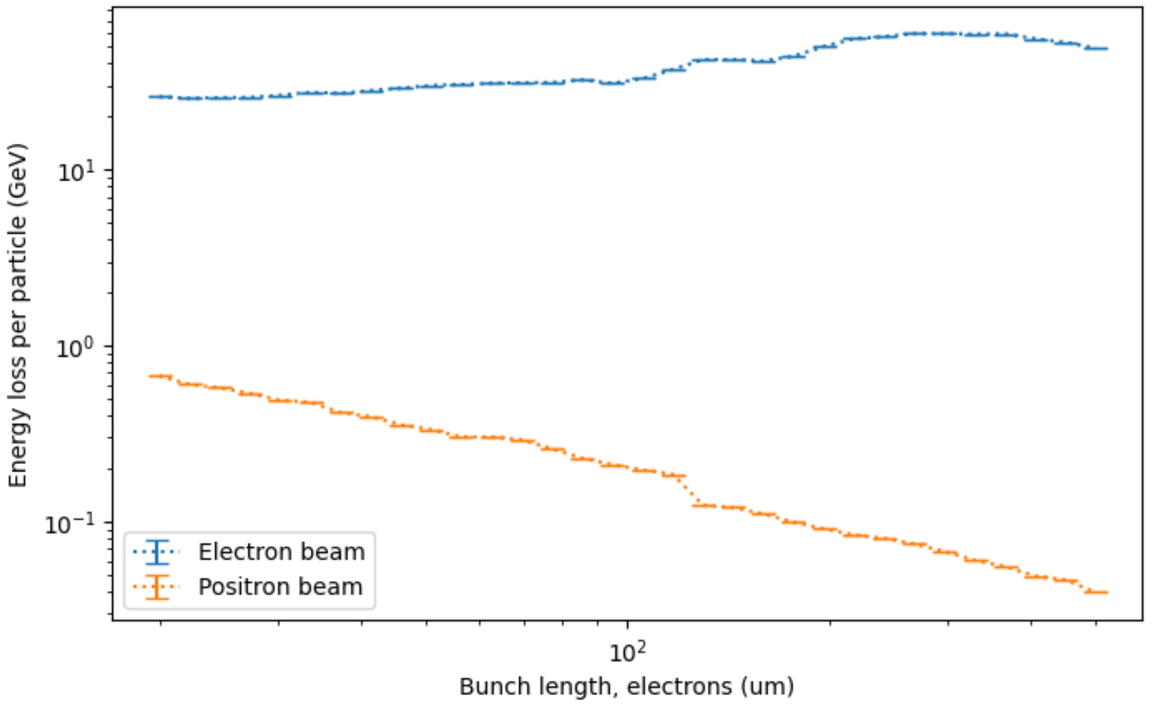


Scan of electron bunch length (e^+ bunch length 150 μm rms)

Synchrotron photons produced

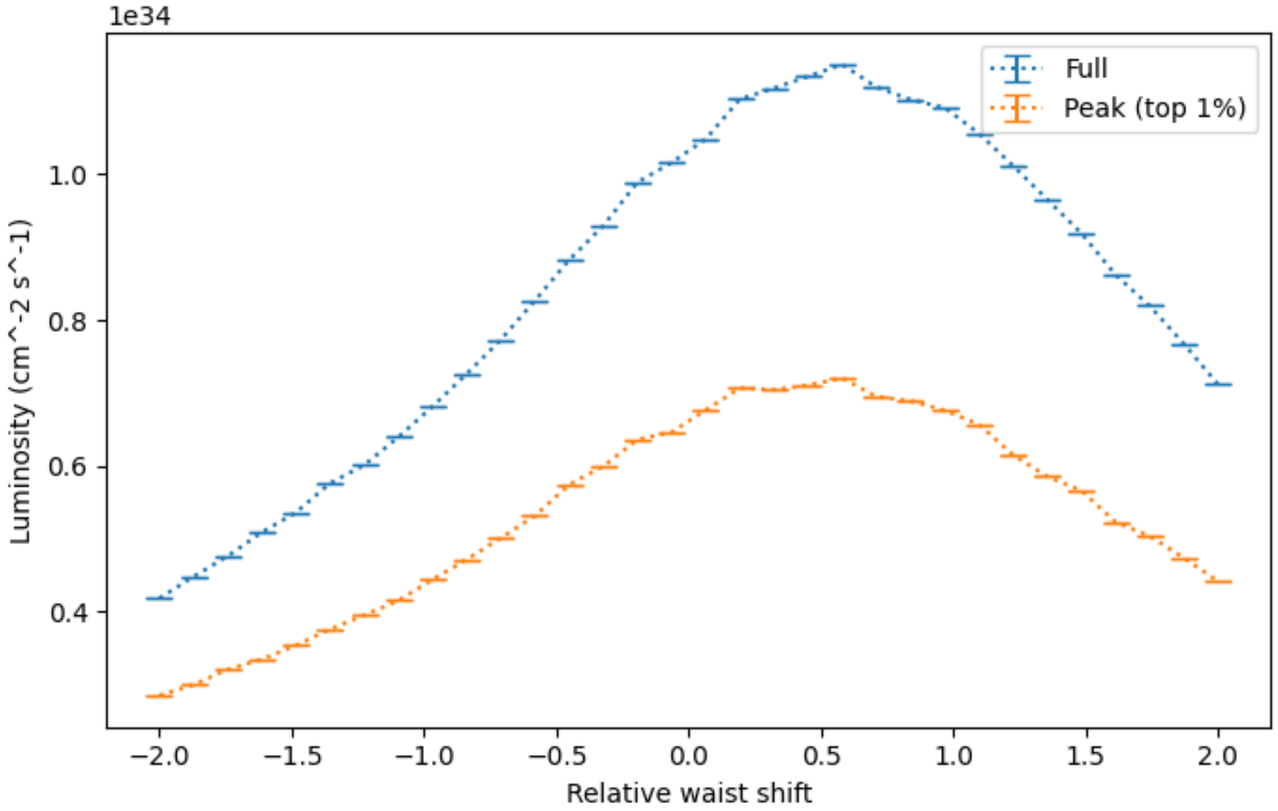
> Maximum interaction seems to occur for 300–400 μm rms electron bunch length.

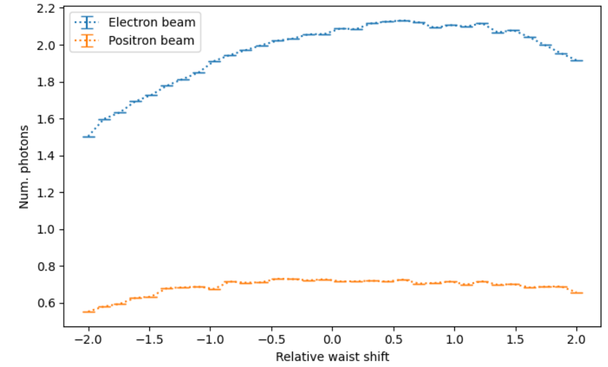


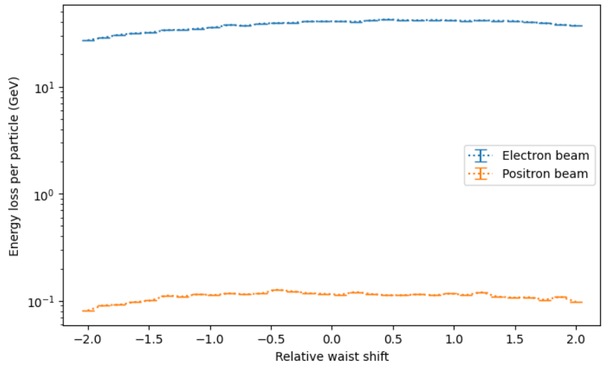


Scan of the waist location (e^- and e^+ bunch length 150 μm rms)

> Optimal value = 0.5 x bunch length (75 μm before the IP for both bunches)



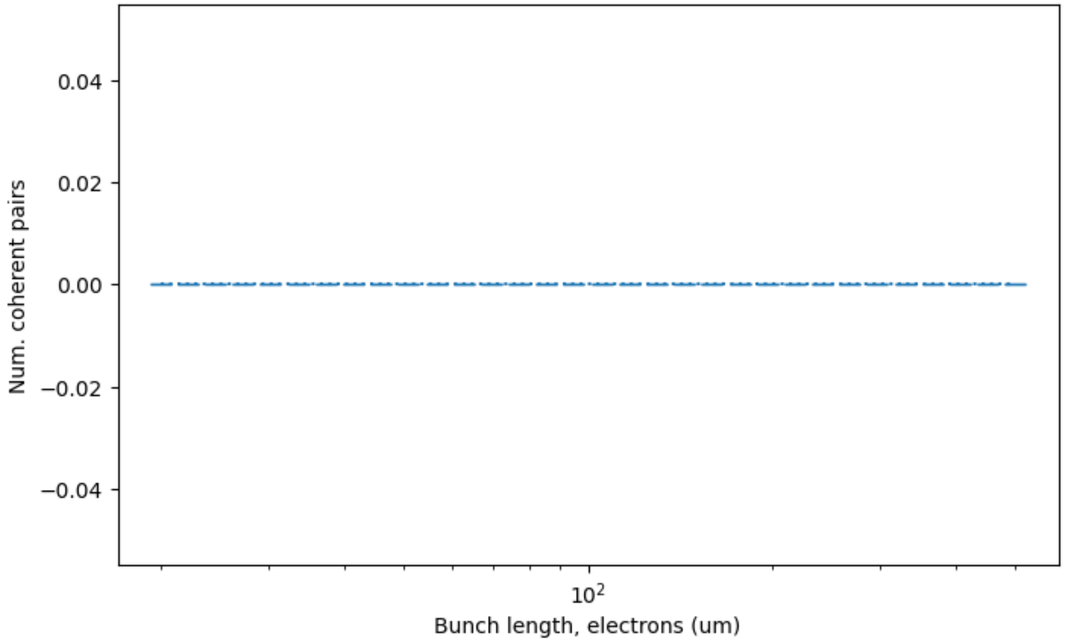


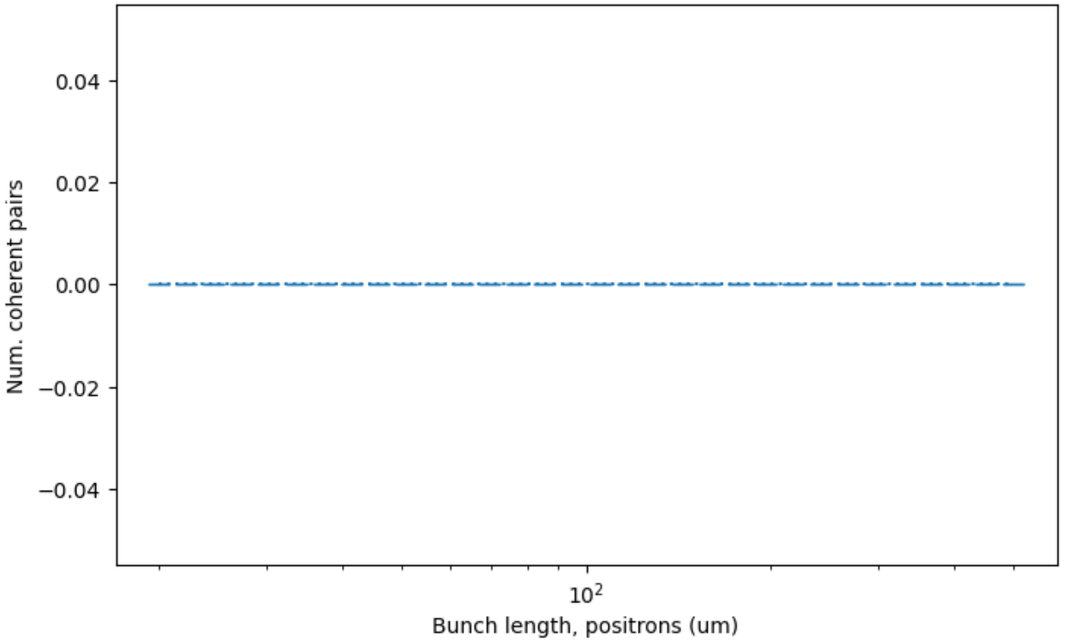


No coherent pairs produced

For any simulation at 250 GeV CoM

> Consistent with expectation from CLIC (where it is only seen at multi-TeV collisions)





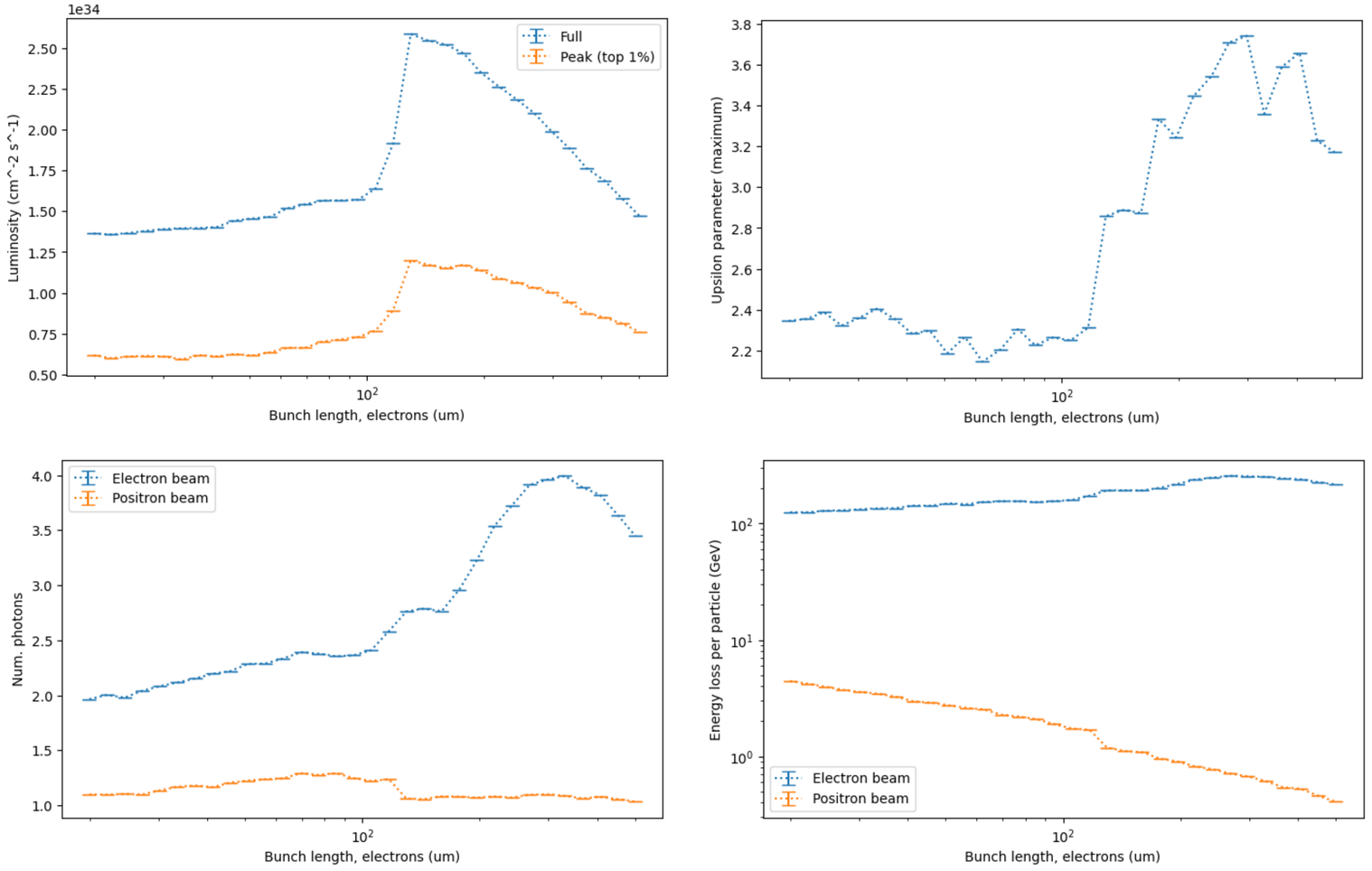
550 GeV CoM simulations

(91.7 GeV, 4.8 nC e^+ and 825 GeV, 1.6 nC e^-)

Scan of electron bunch length (e^+ bunch length 150 μm rms)

Luminosity and maximum field strength

- Similar result to those at 250 GeV, but higher field values (from smaller bunches).



Scan of positron bunch length (e⁻ bunch length 150 μm rms)

Luminosity and maximum field strength

- Similar result to those at 250 GeV, but higher field values (from smaller bunches).