Synchrotron Radiation and Photon Absorbers in the ILC Damping Ring

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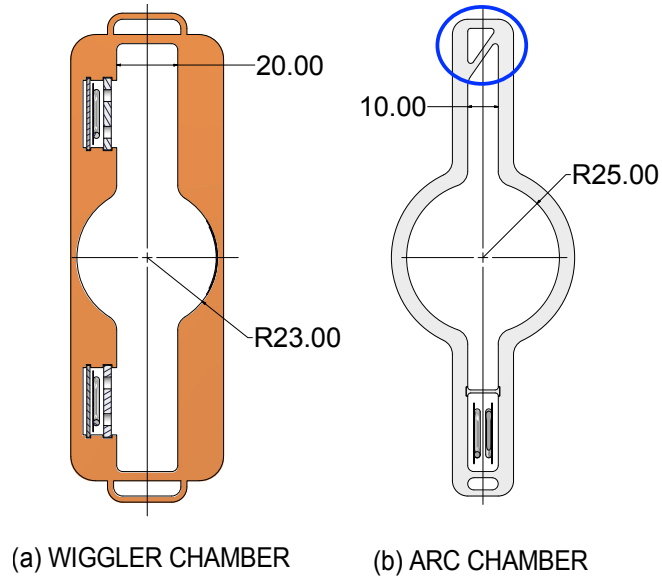
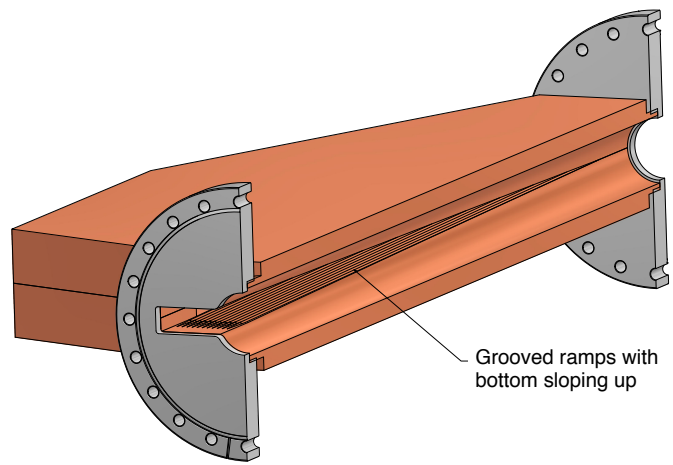
Update

- We revisited the damping ring synchrotron radiation simulations
- Using DTC04 lattice and 5 Hz, 10 Hz e^- and e^+ modes
  - Previous results were for DTC03 and 5 Hz mode

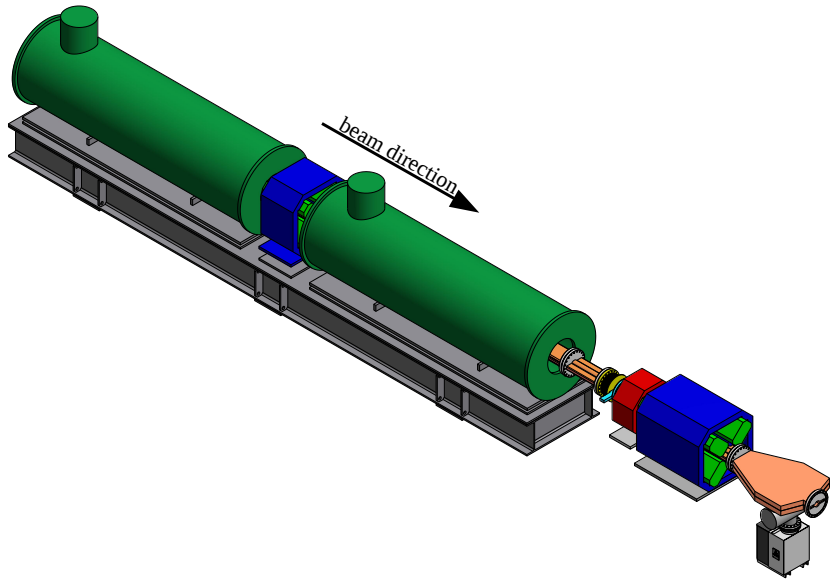
Vacuum chamber profile

- The vacuum chamber profile ('wall file') has been updated:
- Format conversion for new `Synrad3D`
  - Monte Carlo simulation program developed at Cornell for calculating where synchrotron radiation photons are absorbed, in 3D
- Antechamber slopes removed in wigglers to match TDR
- Antechambers implemented as subchambers, and now fully absorbing
  - Previous version was meant to have absorbing antechambers but not implemented correctly
- Photon absorbers now include longitudinal antechamber ramps

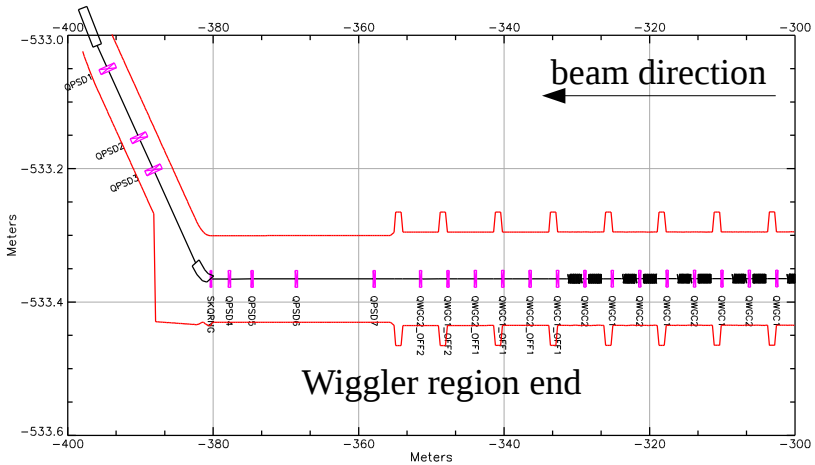


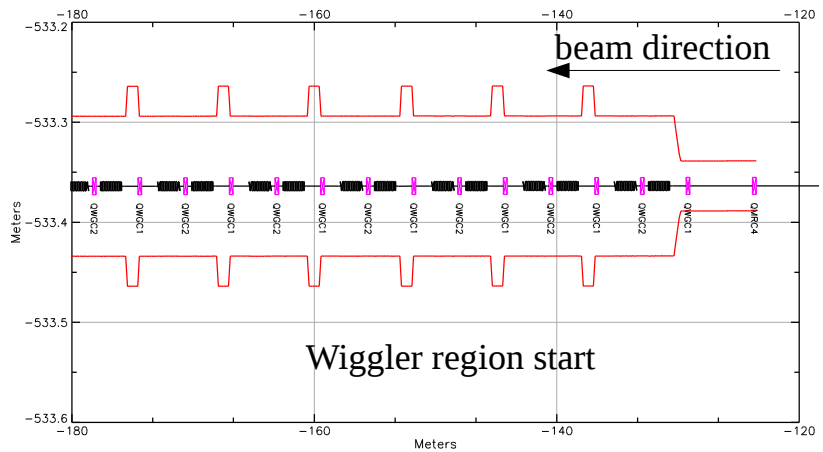


Wiggler region layout

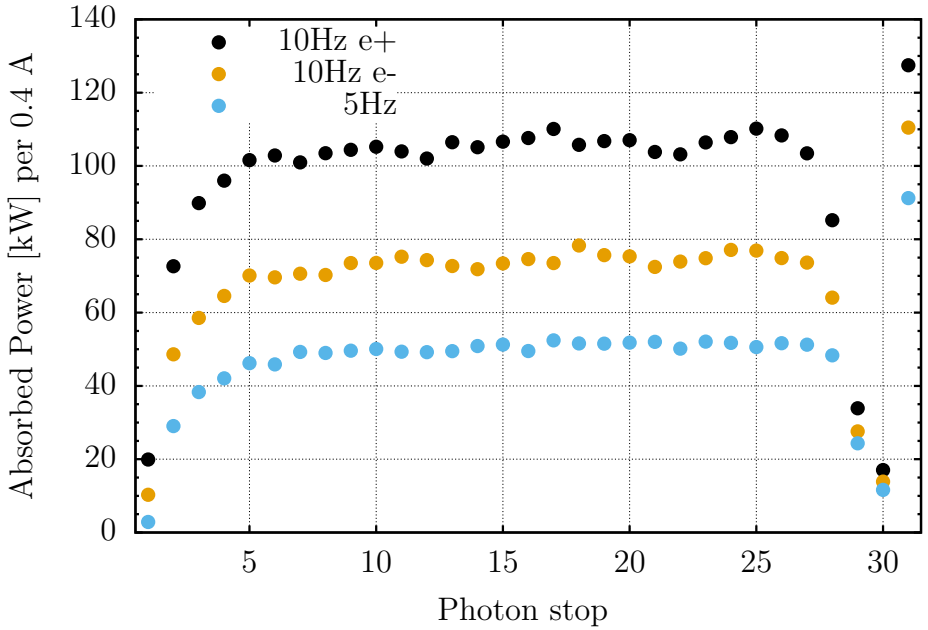


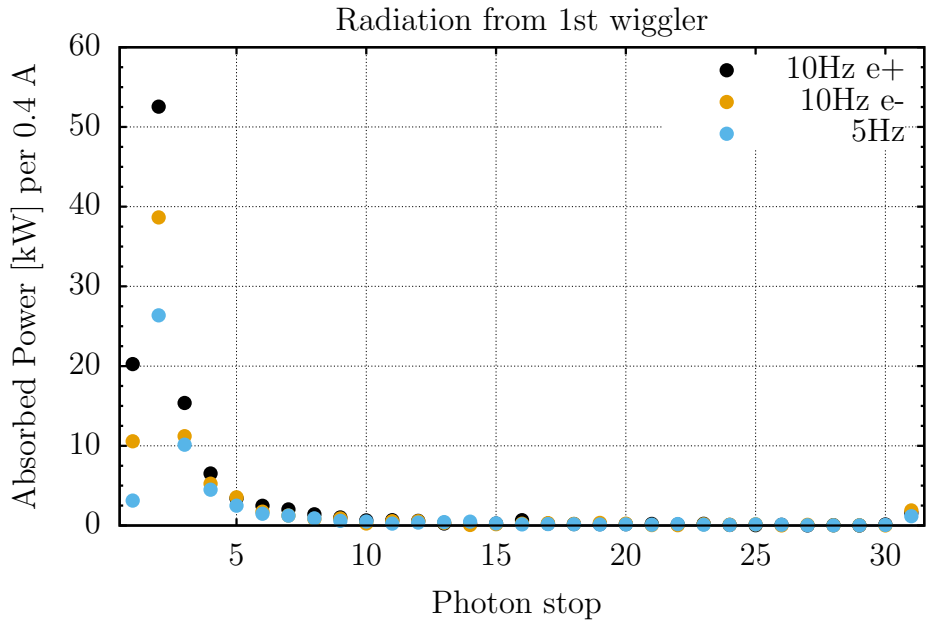
- There are 27 wiggler pairs and 30 photon absorbers with one special downstream photon absorber after the first bend (#31 in plots below)

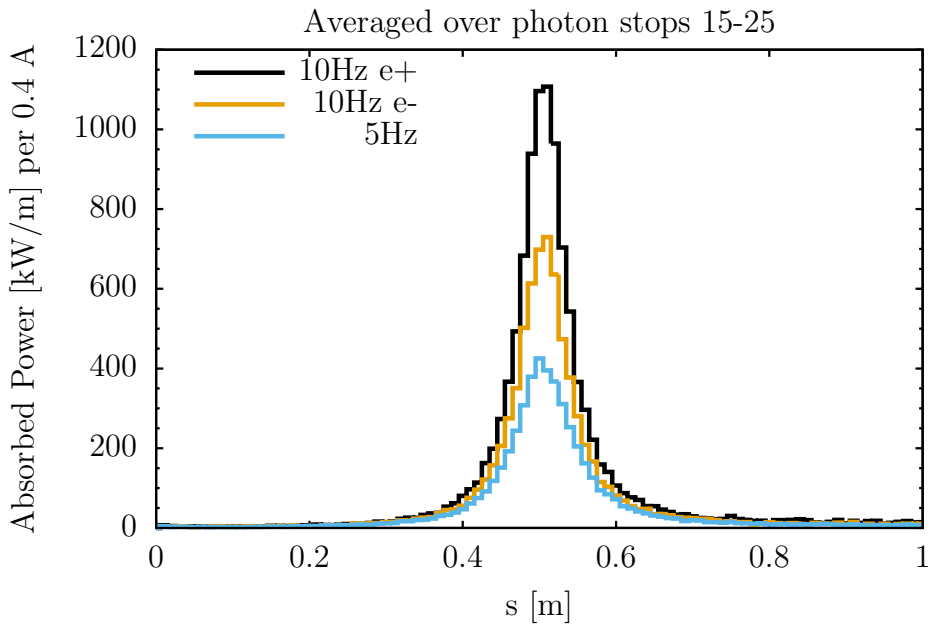


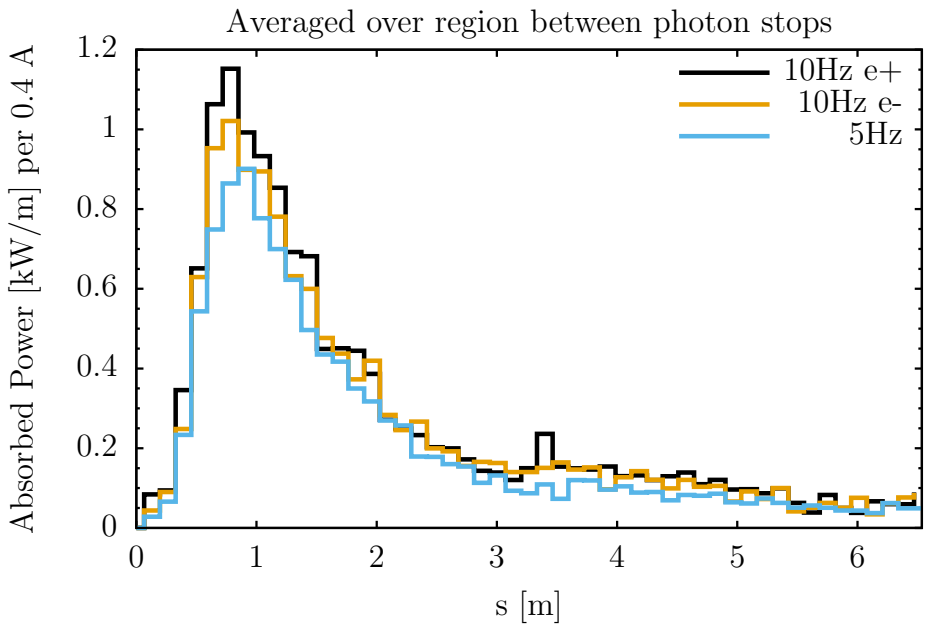


Results


10Hz e+
10Hz e-
5Hz
Absorbed Power [kW] per 0.4 A
Photon stop


Radiation from 1st wiggler
10Hz e+
10Hz e-
5Hz
Absorbed Power [kW] per 0.4 A
Photon stop


Averaged over photon stops 15-25
10Hz e+
10Hz e-
5Hz
Absorbed Power [kW/m] per 0.4 A
s [m]


Averaged over region between photon stops
10Hz e+
10Hz e-
5Hz
Absorbed Power [kW/m] per 0.4 A
s [m]

Results

Mode	Max photon stop absorbed power [kW]	Downstream photon stop absorbed power [kW]	Total wiggler region absorbed power [MW]
5Hz	50	89	1.5
10Hz e^-	75	108	2.1
10Hz e^+	105	124	3.0

- These are per 0.4 A of beam current
  - To get the luminosity upgrade numbers, multiply by 2 (except for e^+ if 2nd positron ring is built)
- The average power absorbed in one arc region is 0.18 kW/m (a total of 150 kW)

Conclusion

- Antechambers and photon absorbers result in very little radiation absorbed outside of the photon absorbers
- First photon absorber is not necessary for 5Hz mode but is for 10Hz
- Peak power load on photon absorbers may be very large, especially on bottom ramp
  - Can the design handle this?