Exercises - Future Circular Collider – Parts 1 & 2

A) To achieve horizontal emittance of 1 nm, what should be the **half cell (~bending length l_b) of an arc FOCO cell at a beam energy 45.6 GeV and at 120 GeV?**

B) Beam current - Assume the SR power is limited to 50 MW / beam - For a bending radius ρ=10 km, **what is the maximum e^- beam current at 45.6 GeV and at 120 GeV?**

C) #bunches - For a charge of $N_b=2x10^{11}$ e/bunch and a circumference of 90 km, **how many bunches do we need per beam** at the two energies?

D) Scenario: crab waist / crossing angle collision scheme, with large Piwinski angle $\Phi \gg 1$. Consider a maximum beam-beam tune shift ξ_y=0.1, take β_y^*=1 mm and flat beams: **What is the luminosity ?**

E) Beam lifetime due to radiative Bhabha scattering - With a radiative Bhabha scattering cross section of $\sigma\sim$ 200 mb and 4 collision points, **what is the beam lifetime at 45.6 GeV and at 120 GeV?**

F) Higgs production: **How many Higgs bosons are produced per day and per collision point at 120 GeV beam energy** with an e^+e^- Higgs production cross section ("Higgsstrahlung", see image below) of $\sigma\sim$ 230 fb ; how many will be produced over 3 years in 4 experiments with 120 effective days of running per year?