Scaling Behavior of Circular Colliders Dominated by Synchrotron Radiation

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The natural next future circular collider is an e+e- Higgs Factory and, after that, a post-LHC p,p collider in the same tunnel. For now the single most important parameter is the ring radius R, since all other parameters can be established later. Using only scaling laws to exptrapolate from existing colliders, this paper investigates ring circumferences two, or three, or four times greater than LEP's. (Excpt for cost) the paper shows that "bigger is better", both for e+e- and (obviously) p,p. For a radiation dominated collider like the Higgs Factory, the luminosity is shown to depend on R and the rf power P only through their product RP. This makes it possible for the same tunnel circumference to be optimal for both e+e- and p,p, without much increase in initial cost. For example, doubling R, compared to what might be marginally adequate for single Higgs production, and cutting P in half, say from 50 MW to 25 MW. The increase in start up cost associated with the increase in R is largely compensated by the decrease in cost associated with the reduction in P. Other scaling laws are also derived, and their luminosity implications discussed.