

- Beam instabilities were a key issue in the SLC Damping Rings.
- Damping Rings for an X-Band linear collider are similar to 3rd generation light sources: this gives confidence in the estimates of collective effects.
- A wide variety of effects have been studied, and found to be safe.
 - o Threshold for CSR instability is >6 times the design current.
 - o Threshold for microwave instability is orders of magnitude above design current.

SLC Experience: small fluctuations out of damping rings...

Left: Measured fluctuation in bunch charge distribution at exit of SLC DR. The deviation from the equilibrium is $\sim 3\%$.

Right: Correlation between charge distribution and beam position through linac. The DR instability causes transverse jitter ~ 40% of the beam size.





Evolution of bunch charge distribution in longitudinal phase space above instability threshold. For the X-Band LC Damping Rings, the threshold is more than an order of magnitude above the specified operating current.

X-Band LC Damping Rings: Thresholds are significantly above operating current

Effects of vacuum chamber impedance. The impedance has been calculated using a 3D EM modeling code. The instability threshold is orders of magnitude above the nominal bunch charge.



Effects of CSR. The instability threshold is >6 times the nominal bunch charge.

