NLC Damping Rings R&D

Note: Most of this work will be performed by LBNL, so has a Berkeley-centric flavor to it
The goal is to have a complete pre-conceptual design for the Damping Rings

- Accelerator physics developed to provide an optimized lattice that we are sure we can build
- Technology developed to
  - Lower technical risk
  - Lower cost risk, or at least understand the costs
- Design documented to
  - Provide understanding of the design
  - Make sure nothing’s been forgotten
  - Provide models that can be picked back up and used later
  - Provide enough detail to do a realistic cost model
- There are things we consider low priority until evidence to the contrary
  - The Positron Pre-damping Ring
    - Assuming the work done on the Damping Rings will easily apply
    - There is risk from the larger aperture required in the PPDR
  - Kickers are assumed to be low risk or technology-in-hand
The Accelerator Physics is true R&D

- Calculations and studies to optimize the DR lattice
  - Determine the optimum wiggler field and dynamic aperture including wiggler
  - Optimize lattice to meet physics requirements (damping time, bunch length, emittance)
  - Assess and minimize lattice sensitivity
  - Look at R/Q options in RF cavity to minimize phase gradients
  - Look at collective effects for single- and multi-bunch
  - Calculate electron cloud effects

- Experiments
  - Measure intra-beam scattering and min. achievable $\varepsilon$ on ALS
  - Study low $\varepsilon$ accelerator physics and do technical demos on ATF
The technology development is important to prove we can build the DR’s.

- **Vacuum technology**
  - Experiments to determine if low-outgassing Al is viable
    - Could reduce technical and cost risk
  - Study ways of reducing cost of vacuum systems, a big $ driver

- **RF cavity work**
  - Windows being prototyped for LANL, apply to NLC
  - Experiments with flame sprayed copper for forming cooling channels
    - Could replace expensive electroplating process

- **Permanent magnets - generic, but first aimed at Linac**
  - Tuning options development and evaluation
  - In-situ field position monitor
  - Radiation stability - an important issue for wigglers
The design documentation is important to record what we do and as a sanity check:

- **Vacuum systems**
  - Chambers - Arc sections and wiggler sections
    - These change as the requirements and designs of magnets and wigglers change
  - Pumping systems and photon stops

- **RF systems**
  - The cavity will be preserved as a 3D model that can be used later
    - Includes the window, coupler, coupler box, tuner, and HOM load
  - The machining of the cooling channels will be simulated in Pro-E

- **Hybrid wiggler** will evolve from an initial design to a more complete design as the Accelerator Physics work is done

- An overall model of the DR will be developed and maintained in Solid Edge