Working Group 3b: Damping Rings
Goals and Organization

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Plenary Organization Session

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Contents

1. Outline of key configuration options for the damping rings.
2. Key issues for making the configuration decisions.
3. Organization for working towards a configuration recommendation.
   - "Reference" lattice designs
   - Task forces for studying the key issues
4. Goals and schedule for Working Group 3b during this workshop.
5. Final comments: SLC experience and technical risk.

Configuration choices for the damping rings

"Global" parameter choices set the damping ring specifications:

- Train structure (total number of bunches)
- Repetition rate
- Injected emittances and energy spread
- Extracted emittances, bunch length and energy spread

"Local" configuration, parameter and technology choices are needed to specify damping rings that will meet the specifications:

- Circumference and layout, for example:
  - If we choose a dogbone, can we have vertical bends?
  - Can we put two rings in the same tunnel?
- Beam energy
- Lattice type
  - TME, PI-cell, FODO…
- Injection and extraction scheme, and **kicker technology**
- Technology options for other subsystems
  - Wiggler, RF, vacuum etc.

Key issues for the configuration selection

Beam dynamics

- Acceptance must be large enough to allow excellent injection efficiency.
- Extreme levels of beam stability are needed.
- Ultra-low vertical emittance must be achieved on a routine basis.
- Beam polarization must be maintained.

Cost

Operability

- Rapid commissioning must be possible.
- High levels of reliability must be achieved.
- Flexibility is desirable.
  - Variations in fill pattern, bunch charge…
- Damping rings should be upgradeable.

Seven “reference” lattices span the configuration space

Lattice Name	Energy [GeV]	Circumference [m]	Cell Type
PPA	5.0	2824	PI
OTW	5.0	3223	TME
OCS	5.0	6114	TME
BRU	3.7	6333	FODO
MCH	5.0	15935	FODO
DAS	5.0	17014	PI
TESLA	5.0	17000	TME

Note: cell type is important because of the potential impact on sensitivity to magnet misalignments, sensitivity to collective instabilities etc.

Task forces have been charged to study the key issues

The task forces (and co-ordinators) are:

- Acceptance (Y. Cai, Y. Ohnishi)
- Emittance (J. Jones, K. Kubo)
- Classical Instabilities (A. Wolski)
- Space-Charge (K. Oide, M. Venturini)
- Kickers and Instrumentation (T. Naito, M. Ross)
- Electron Cloud (K. Ohmi, M. Pivi, F. Zimmermann)
- Ion Effects (E.-S. Kim, D. Schulte, F. Zimmermann)
- Cost Estimates (S. Guiducci, J. Urakawa, A. Wolski)
- Polarization (D. Barber)

The various configuration options are being studied, using the seven “reference” lattices as a basis, and applying a consistent set of analysis techniques and tools.

The goals of the task forces are to produce information that can be used to inform the configuration selection.

Work is in progress. There are roughly 30 active participants altogether.
All three regions are strongly represented.

Task Force communication and co-ordination

http://www.desy.de/~awolski/ILCDR/

- *follow link to "Configuration Study"*

Mailing List: ilcdr@lbl.gov

Primary goals for WG3b during this workshop

Week 1 - Review and plan for recommending a configuration

- Review progress to date of each of the task forces.
- Decide configuration recommendations where sufficient information is already available.
- Identify the tasks that need to be completed (and who will do them) before recommendations can be made for all configuration decisions.
- Agree dates and location for a meeting to finalize the configuration recommendation.

Week 2 (Monday and Tuesday)

- Prepare the outline for a report that will:
  - detail the work of the task forces;
  - recommend a configuration for the damping rings to the GDE.

Schedule Outline

All WG3b sessions are in the Crestwood Terrace.

<table>
<tr><th>Tuesday</th><th>Wednesday</th><th>Thursday</th></tr>
<tr><td>Acceptance</td><td></td><td>Ion Effects</td></tr>
<tr><td colspan="3">Coffee</td></tr>
<tr><td rowspan="2">Classical Instabilities</td><td rowspan="2">Kickers & Instrumentation</td><td>Cost Estimates</td></tr>
<tr><td>Discussion/Planning</td></tr>
<tr><td colspan="3">Lunch</td></tr>
<tr><td>Emittance</td><td rowspan="2">Electron Cloud</td><td rowspan="2">Test Facilities</td></tr>
<tr><td>Space-Charge</td></tr>
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Damping ring designs must be relatively conservative

"The SLC experience emphasized the importance of low particle losses and the suppression of collective instabilities [in the damping rings].

Beam instability and jitter can make the machine inoperable."

(ILC-TRC Second Report, 2003, p.304)

The beam is stored for a relatively long time in the damping rings, where it is sensitive to a wide range of destabilizing effects.

The SLC experience was that even very small effects in the damping rings were amplified in the downstream systems and had a big impact on the overall machine performance.

If other systems in the ILC are to be technically ambitious, the damping ring designs must be relatively conservative.