ILC Damping Rings Lattices Evaluation

1. **Lattice design and dynamical properties.**
   a) Is the design complete? Does it include all necessary systems, such as injection/extraction optics, RF, wiggler, circumference chicane, tune trombone, etc?
   b) Is there sufficient margin in general dynamical parameters (damping times, equilibrium emittance and energy spread, etc.)?
   c) Does the momentum compaction factor provide a good compromise between RF requirements (at 6 mm and 9 mm bunch length) and instability thresholds?
   d) How does the lattice compare with others in terms of sensitivity to collective effects (such as impedance-driven instabilities, intrabeam scattering, space charge, ion effects, and electron cloud)?
   e) How much flexibility is there in tuning the momentum compaction factor?
   f) Is the dynamic aperture sufficient?
   g) Are there any particular benefits or concerns with the dynamics, specific to the lattice?

2. **Conventional facilities and services.**
   a) Is the layout technically feasible from point of view of:
      i) civil construction;
      ii) distribution of services, including air, water, cryogenics, power;
      iii) installation;
      iv) access for maintenance and repair.
   b) How would the cost for construction and installation compare with other lattices?
   c) Are there any particular benefits or concerns with the conventional facilities, distribution of services, or installation, specific to the lattice?

3. **Magnets, supports and power supplies.**
   a) How does the number of magnets, and the number of different styles of magnet, compare with the other lattices?
   b) Are the magnet parameters (length, field strength or gradient, spacing) reasonable?
   c) How do the alignment and stability sensitivities compare with other lattices?
   d) How do the numbers and types of supports required for the magnets compare with other lattices?
   e) How do the numbers and types of individually powered magnets compare with other lattices?

f) Are there any particular benefits or concerns with the magnets, supports and power supplies, specific to the lattice?

4. Vacuum system and radiation handling.

a) How do the aperture requirements compare with other lattice designs?

b) How does the difficulty of handling the radiation from the dipoles and wigglers compare with other lattice designs?

c) Are there any particular benefits or concerns with the vacuum system, specific to the lattice?

5. RF system.

a) How feasible is the RF voltage required, over the range of possible momentum compaction factors, to provide bunch lengths of 6 mm and 9 mm?

b) Is there sufficient space in the lattice for all required RF cavities (allowing some margin for klystron failure)?

6. Injection and extraction systems.

a) Do the injection/extraction optics meet the requirements?

b) Is there sufficient space for the number of required components (stripline kickers, septa…)?

c) Are there any particular benefits or concerns with the injection/extraction systems, specific to the lattice?

7. Instrumentation and diagnostics.

a) Can the BPMs and other instrumentation and diagnostics be readily accommodated?

8. Control system, availability and reliability, other.

a) How does the complexity and cost of the control system compare with other lattices?

b) How would the availability and reliability compare with other lattices?

c) Are there any other particular benefits or concerns, specific to the lattice?

Proposed Ranking System

Utilize a 1-5 ranking system for each key question in each topic. For questions where absolute evaluations are required, the following criteria should be used:

5 – Item has been addressed in the lattice design and fully meets the DR specifications. In cases where lattice flexibility is required, the range of parameters has been thoroughly explored and meets the DR specifications for the entire parameter range. In cases where technical systems impact is being evaluated, the lattice design results in a technically feasible design with minimum cost.

4 – Item has been addressed in the lattice design but some refinement is still required to meet the DR specifications. In cases where lattice flexibility is desired, work remains to ensure that the DR specifications can be met for the entire parameter range. In cases where technical systems impact is being evaluated, the lattice design results in a technically feasible design, but technical issues remain and/or cost is not the minimum. In all cases, there is a high expectation that a successful design can be completed.

3 – Item has only been partially addressed. Significant work remains in order to meet the DR specifications. In cases where technical systems impact is being evaluated, significant technical issues remain and/or significant cost optimization is required. In all cases, there is a reasonable expectation that a successful design can be completed.

2 – Item has not been directly addressed in the lattice design. There is a reasonable expectation that a successful design can be achieved which meets DR specifications. In cases where technical systems impact is being evaluated, there is a reasonable expectation that technical and/or cost issues can be successfully addressed.

1 – Item has not been directly addressed in the lattice design. Significant questions exist about achieving a successful design which meets DR specifications. In cases where technical systems impact is being evaluated, there are significant uncertainties that technical and/or cost issues can be successfully addressed.

For questions where relative rankings are required, the ranking of the *best* lattice should be calibrated with the above absolute rating scale.

Within each major evaluation item, a weighted average of the rankings for each sub-item will be used to generate the overall ranking for that item. Adjustments to these weightings will be considered as part of the lattice discussion. The overall lattice ranking will be based on a comparative analysis of the individual evaluation items.

Ranking/Scoring Table

Evaluation Item	Weight	OCS8	FODO4	FODO5	DCO
1. Lattice design and dynamical properties.					
Completeness	1.0				
Margin - general parameters	1.0				
α_p choice	1.0				
Compare lattice sensitivities to collective effects	1.0				
α_p flexibility	1.0				
Dynamic aperture	1.0				
Particular benefits/concerns	1.0				
Overall	1.0				
2. Conventional facilities and services.					
Technical feasibility	1.0				
Compare costs	1.0				
Particular benefits/concerns	1.0				
Overall	1.0				
3. Magnets, supports and power supplies.					
Compare magnet counts and types	1.0				
Reasonableness of magnet parameters	1.0				
Compare alignment & stability sensitivities	1.0				
Compare support counts and types	1.0				
Compare individual PS counts and types	1.0				
Particular benefits/concerns	1.0				
Overall	1.0				
4. Vacuum system and radiation handling.					
Compare aperture requirements	1.0				
Compare radiation load issues (dipole/wiggler regions)	1.0				
Particular benefits/concerns	1.0				
Overall	1.0				
5. RF system.					
RF voltage requirements	1.0				
Space in lattice for RF cavities	1.0				
Overall	1.0				
6. Injection and extraction systems.					
Suitability of inj/ext optics	1.0				
Space in lattice for inj/ext components	1.0				
Particular benefits/concerns	1.0				
Overall	1.0				
7. Instrumentation and diagnostics.					
Accommodation of diagnostics	1.0				
Overall	1.0				

8. Control system, availability and reliability, other.					
Compare cost and complexity	1.0				
Compare availability and reliability	1.0				
Particular benefits/concerns	1.0				
Overall	1.0				