ILC DR Implementation Planning Overview

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overview

- To Do:
  - **Update R&D plan**
  - **Choice of new Baseline SB2009**
  - **Process from e-cloud R&D results to DR vacuum system design (choice of mitigation techniques)**
  - **Organization and preparation of TDP2 plans:**
    - 5 WGs as now? We need coordinators for WG4 and 5
    - Update the list of objectives
    - Ask plans and resources to the interested labs

AAP review at TILC09

- Talks at:

http://ilcagenda.linearcollider.org/conferenceOtherViews.py?confId=3154&view=standard&showDate=all&showSession=1&detailLevel=contribution

- Report on the AAP review at:

http://ilc-edmsdirect.desy.de/ilc-edmsdirect/file.jsp?edmsid=*879165

- *The AAP notes that … the impact of the e-cloud must be reevaluated for the 12 ns and 6 ns bunch spacings … with half the number of bunches in the 6-km configuration, i.e. 12 ns bunch spacing would operate in a safer regime with regard to electron cloud. Reducing the positron ring circumference to 3-km may risk losing this back-up solution.*
- *The AAP would like to see a plan laid out showing how the damping ring group plans to arrive at a decision for the viability of the ILC damping ring choice with respect to electron-cloud immunity. A clear set of criteria for the vacuum system should be developed that will lead to the choice of a baseline solution. Alternates along with required R&D can also be specified. A schedule for establishing the criteria and the baseline should be shown.*

AD&I meeting at DESY May 28-29

- Talks at:

http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=3526

- Cut from the Summary Report:
  - **The proposal and options to reduce the circumference of the DR were discussed.**
  - **A discussion on the 'upgrade' potential from the SB2009 proposed 1312 bunches back to the current RDR nominal value of 2623 (doubling the current) immediately identified bottlenecks.**
  - **The Working Assumption is to continue with the 3.2km option, but attempt to quantify the current limits due to e-cloud (on-going R&D).**
- Action Items for DR
  - **For 3.2km ring, what are the estimated limits on bunch charge and number?**
- Update risk register (bunch distance and current)
- Discussion at ALCPG, 28 September-3 October 2009

Number of bunches and Circumference

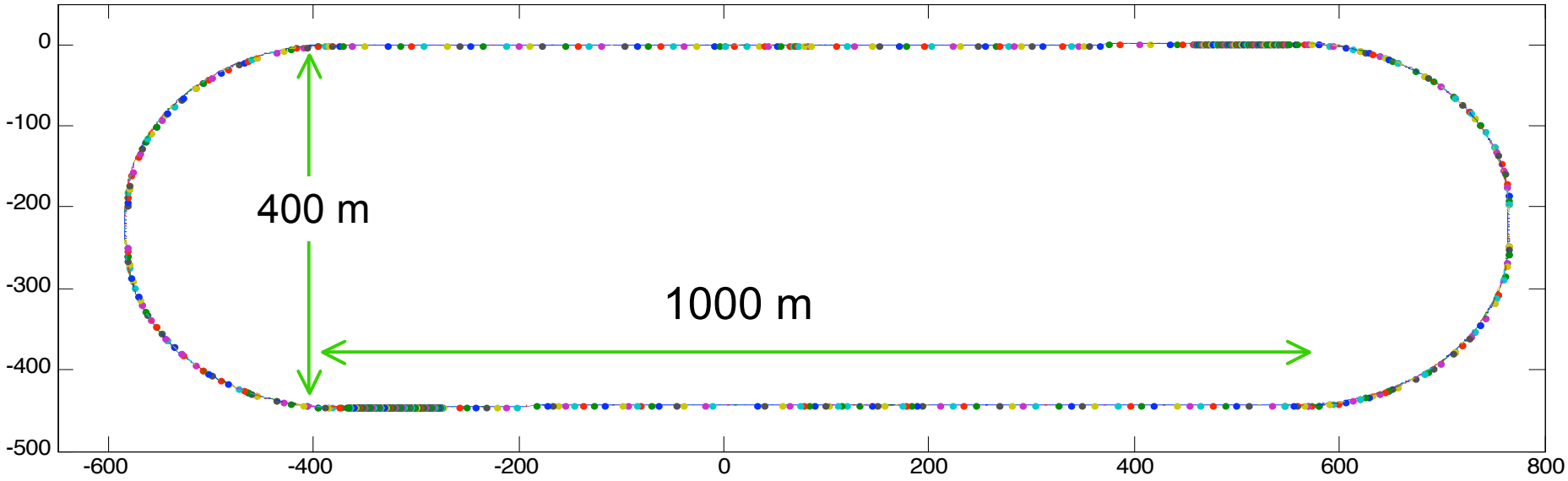
	RDR 2007	TDP TILC08	SB2009	?
# of bunches	2684-5412	2610-5265	1305-2632	**1300**
Bunch population N_b	2-1 · 10^{10}	2-1 · 10^{10}	2-1 · 10^{10}	2 · 10^{10}
Bunch distance (ns)	6.2-3.1	6.2-3.1	6.2-3.1	3.1
C (m)	6695	6476	3238	**1600**
h	14516	14042	7021	3500
Kicker frep MHz (1ms linac pulse)	2.8-5.5	2.7-5.4	1.4-2.7	1.4

For 2632 bunches $N_b = 2 \cdot 10^{10}$

Number of bunches and Circumference

- For 1300 bunches one could design a very short ring, as the SuperB one (~1600 m) **without wigglers**
- Wigglers give the main contribution to the e^- cloud density
- Cost would be reduced by ~1/4

Minimum Machine: New 3 Km layout



Arcs based on SuperB-like cells

Same straight sections as the 6 km ring

Cost estimate for TDP-2: straight sections scale directly from the 6 km ring, for the arcs use information from the SuperB TDR

RDR Risk analysis

Needs Update

Concern		RISK	COST	r*C	MITIGATION
(1) Secondary Emission Yield too high. >1.2	Q	High	200	100	Return to two e+ ring design after extensive R&D programs
(2) Vacuum system design not robust		Med	20	5	Redesign vacumm system with more distributed pumping
(3) High impedance of vacuum chamber components		Med	10	3	More engineering design or DR re-optimization
(4) RF Margin	Q	Med	50	13	Increase klystron/cavity system by 50%
(5) Combination of concerns with RF and Wiggler layouts	Q	Med	100	25	Increase in number of shafts and alcoves
(6) Plan for having room for future double ring, later decision	Q	Low	20	2	Increase tunnel diameter and include above (5)
(7) General concern with injection/extraction kicker performance		Med	20	5	Increase no of kicker units and/or restrict parameter ranges

Concern	COMMENTS/NOTES	UPDATES (my evaluation)	
(1) Secondary Emission Yield too high. >1.2	Assumes CF&S designs have been changed to allow this possibilty. Ref JMP 3/27/07	Mitigation Techniques can lower e-cloud density below instability threshold. Effect of MT on vacuum system design, cost and impedance not yet evaluated, see 2,3.	Very low
(2) Vacuum system design not robust	Early decision is less expensive and less impact on other systems Ref JMP 3/27/07	Present vacuum system design includes antechamber in dipoles (1) and more pumping speed. Cost will be available in few weeks.	High
(3) High impedance of vacuum chamber components	Could be input to review of design parameter range Ref JMP 3/27/07	recent estimates indicate that nominal parameters are below the thresholds for microwave and other instabilities	Very low
(4) RF Margin	Coupled with items,5,6, has large impact on CF&S Ref JMP 3/27/07	Not needed since momentum compaction has been reduced	Very low
(5) Combination of concerns with RF and Wiggler layouts	CF&S impact coupled with 4,6 Ref JMP 3/27/07	risk of 4,6 is reduced	Med
(6) Plan for having room for future double ring, later decision	Ref JMP 3/27/07	double ring is unlikely	Very low
(7) General concern with injection/extraction kicker performance	Ref JMP 3/27/07	I kickers satisfy most specifications but still there are concerns on the reliability. The cost per unit should be lower.	Med

e-cloud: from R&D results to DR design

- The process of making the choice of e-cloud cures for DR design, in my opinion, should be similar to that adopted for the choice of the Baseline Configuration recommendation:
- A working group, coordinated by an expert, that defines the work/resources needed for a reliable evaluation and assigns the tasks to the available resources.
- At the conclusion of the work the results will be discussed at a DR meeting and a selection procedure will be setup in order to arrive to a widely accepted decision.
- I would like to hear your comments and suggestions

Comment from Mauro Pivi at DR Webex, 06/22/09:

- The proposed working group on electron cloud could start soon the work on the evaluation of mitigation techniques, simulations and code benchmarking for the AD&I option.
- A lot of work has been already done and information available on mitigations such as on coatings, clearing electrodes and grooves from SLAC, KEK, CERN, etc.
- In any case, it would be important to wait for CesrTA input.
- The time scale for the working group to produce a recommendation on mitigations should then be middle of 2010, or after the CesrTA runs will be completed.

DR session at ALCPG

28 September-3 October 2009

- **Update R&D and TDP2 plans**
  - Process from e-cloud R&D results to DR design (choice of mitigation techniques)
- **Discussion of new Baseline choice SB2009**
- **Presentations on R&D and Design work**

Backup slides

What changes with the number of bunches

	EDR	SB2009
	DCO	DSB
Energy (GeV)	5	5
Circumference (m)	6476	3238
Bunch number	2610 - 5265	2610 - 1305
N particles/bunch	2x10e10	2x10e10
Damping time tx (ms)	21	21
Emittance ex (nm)	0.48	0.37
Emittance ey (pm)	2.0	2.0
Momentum compaction	1.7x10-4	1.8x10-4
Energy loss/turn (MeV)	10.3	5.3
Energy spread	0.0013	0.0013
Bunch length (mm)	6	6
RF Voltage (MV)	21	11
RF frequency (MHz)	650	650
B wiggler (T)	1,6	1,6
Lwig total	215,6	107,8
Number of wigglers	88	44

Half circumference

Half RF cavities

Half wigglers