5 March 2009

Report on DR activity

This report is based on the presentations given at the ILC DR Webex meeting held on March 4th. The talks on the status report of the ILC DR activity at the various labs are listed below, the slides are at:
https://wiki.lepp.cornell.edu/ilc/bin/view/Public/DampingRings/TeleConference.

```
KEK    ;  J. Urakawa
CI       ;  A. Wolski
DESY  ;  E. Elsen
SLAC - e-cloud;  J. Ng
CesrTA ;  M. Palmer
SLAC - Fast kickers;  C. Burkhart
LNF    ;  F. Marcellini, T. Demma
LBNL  ;  S. De Santis
```

CESRTA Test Facility

The CesrTA Test Facility has a dedicated report, here it is just worth mentioning that this activity is very well integrated with the rest of the DR activity.
The main subjects of CesrTA are e-cloud studies and low emittance tuning. The laboratories participating to the collaboration include: CERN, CI, KEK, FNAL, LBNL, SLAC.
During the experimental run completed on 2/2/2009 were performed: low emittance correction in baseline optics, X-ray Beam Size Monitor commissioning, e-cloud measurements, instrumentation and feedback tests.
The second upgrade down is just concluding (first beam in CESR stored March 4th). All major CESR layout modifications are now complete, four experimental areas for e-cloud build-up and mitigation studies are available. Objectives of the program are detailed beam dynamics studies at ultra low emittance to characterize instability thresholds and incoherent emittance growth.
•

e-cloud studies at other labs
Besides CesrTA e-cloud studies are in progress at KEK, LBNL, LNF, SLAC.
KEK e-cloud activity has been reported at LCWS08:
http://ilcagenda.linearcollider.org/contributionDisplay.py?contribId=235&sessionId=11&confId=2628

Goal of the e-cloud R&D program at SLAC: Reduce the SEY below instability threshold: SEY < 1.1. ECloud 1, 2, & 3 experiments in PEP-II have been performed on: conditioning effect on SEY, test of grooved chambers, effect in dipole magnetic field. Electron distributions in dipole chambers have been measured and compared with simulations for uncoated and TiN coated aluminium chamber. TiN-coated chamber shows orders of magnitude lower signal. ECloud 1, 2, & 3 have been relocated to Cesr-TA. A grooved chamber for dipole has been fabricated, expect completion early May. Continue to investigate remaining issues at SLAC: TiN long term durability (measure PEP-II TiN chamber samples), SEY measurement in magnetic field and continue on-going simulation efforts.
At LNF Coupled-bunch instability has been simulated using PEI-M for the DAFNE parameters. Preliminary results are in qualitative agreement with grow-damp

measurements. Future plans are: explore a wider range of beam/chamber parameters, compare the results with other codes, modify the code to include more realistic (rectangular?) boundaries, modify PEI-M and Ecloud to compute e-cloud induced coherent tune shift and compare results with measurements. Recently, on the DAFNE positron ring a second horizontal feedback to contrast the e-cloud instability has been installed. The damping time of a single feedback has been halved, achieving a value of 4.3 μs (13 machine turns) and the maximum stored current has been increased from 0.8 A to 1.1 A.

At LBNL simulations and theoretical studies have been performed, in particular code development (WARP□POSINST) and application to e-cloud formation studies, cyclotron resonances and witness bunch measurements in Cesr□TA.
TE Wave measurements of e□cloud density in Cesr□TA have been performed. New sets of measurements have been taken in January with the implementation of new techniques and have been used for different applications.
The Wiggler/RFA vacuum chamber is under fabrication at LBNL with the implementation of e□cloud suppression techniques (grooved chamber, clearing electrodes).

Low Emittance Tuning

The low emittance tuning is done both at CESR and at ATF with collaboration from CI. This week at KEK ATF a 12-20pm vertical emittance has been measured by X-SR monitor. This value has to be confirmed value by laser wire. The objective is to get stable beam with emittance lower than 10pm, by April or May.
CI is collaborating on ATF emittance tuning with a plan based on systematic application of: correction of beta-beat, beam-based alignment, orbit, dispersion and coupling correction.

Fast kickers

At KEK the design of the beam extraction from ATF is ready and preliminary beam tests have been carried out. A kick angle of 0.7mrad has been measured by using a test strip-line electrode (30cm long) and a +/-10kV pulse generator. This kick is enough to get 2mrad by using 2 units of the pulse generator and a 60 cm long strip-line. Beam extraction test, January 2009, failed due to broken pulsers by high radiation level near the extraction area. After being repaired at the firm, the pulsers will be installed behind a concrete shielding block and the beam extraction test will be done again in this year (May).

At LNF a similar problem occurred with FID pulsers with different characteristics (24 kV voltage). Two of these pulsers have been installed on the DAFNE kickers and the expected time duration has been measured with beam. After one month of continous operation, at a rate of ~5 10^4 shots per day, the first pulser was broken; the second, kept under test in laboratory, survived one more week. Two other pulsers are kept under test at FID and will be sent to LNF when they will be proved to be more reliable.
The tapered kicker 30 cm long designed at LNF for tests at ATF will be ready by the middle of April.

The FID people is collaborating with LNF and KEK to improve the reliability of their pulsers. Anyway, in view of these problems becomes really crucial the work in progress on fast modulators at SLAC.

SLAC program is investigating two approaches: MOSFET array (adder) topologies and DSRD (opening switch) topologies.
The Adder Program foresees “Scale assemblies” to investigate high bandwidth adder topologies with MOSFET/Driver hybrid switches (transmission line adder).
The DSRD Program will provide a DR Kicker modulator for ATF2 with ±5 kV, flat top 4 ns, fise/fall time 4ns. Promising reslts have been achieved on a prototype with 2 ns flat top. Present activity is focused on the optimized design of the 4 ns prototype and on higher power pump development. A prototype will be ready by the end of 2009.

Study on the fast ion instability at ATF
The objective of the experiments is to distinguish the two ion effects: beam size blow-up and dipole instability, to quantify the beam instability growth time, tune shift and effect of bunch train gap, to provide detailed data to benchmark simulations with experiment.
Fast ion instability experiments will be repeated again when a stable beam with emittance lower than 10pm will be available (April or May).

Desy will continue to collaborate to fast ion instability simulations and experiments at ATF.

Work on other BD and Technical issues at CI
Vacuum design
Goal: to design and cost vacuum system and vacuum/bpm/magnet supports.
Design and costing for the arc cells will be complete by end of April, work will then begin on the straight sections.
Design work includes components expected to make dominant contributions to the machine impedance, e.g. bpms and bellows. Studies in 2008 raised concerns about the impedance from the bellows. A new bellows design with improved rf shielding, based on a design from INFN-LNF, has been implemented in the model, and is now being studied.

Wake field modelling
Goal: to develop an impedance model as vacuum designs become available, and evaluate beam stability.
Initial impedance computation was done using HFSS. Experience showed that it was difficult to obtain reliable results in the high frequency regime required to generate the wake function. We are now starting to use Microwave Studio: experience so far is more positive than with HFSS for the parameter regime of interest.

Lattice design
Modifications have been made to the straight sections, so that injection and extraction are now in a single straight in each ring. Beams circulate in opposite directions in the two rings.

Minimum Machine

LNF will continue lattice and DA optimization for the 3 km lattice.
The idea is to use a SuperB type arc lattice and the same straight sections as the RDR 6.4 km lattice. In this way it is easy to apply to this lattice the cost estimate performed for the RDR lattice and to make comparisons.