2.1.1.A Injection and Extraction Beam Line Design and Characterisation

Required for Baseline

Status as at 17/08/2007: Active

Description:

• Optics design of injection and extraction lines for damping rings.
• Tracking studies to characterize dynamics in injection/extraction lines (particle loss and sensitivity to errors).

Addresses Objectives:

2.1.1.5 Lattice design for injection/extraction lines

Investigators:

* Ina Reichel, LBNL
Michael Zisman, LBNL

2.1.1.C Damping ring lattice design and optimization

Required for Baseline

Status as at 17/05/2007: Active

Description:

Optimize the dynamic aperture including alignment errors and wiggler nonlinearities (using the 100-CPU "Weed" cluster at APS). Track with realistic particle distribution to determine the injection efficiency. Design a lattice for the electron ring.

Addresses Objectives:

2.1.1.1 Lattice design for baseline positron ring
2.1.1.2 Lattice design for baseline electron ring
2.1.2.1 Characterize damping rings acceptance
2.1.2.2 Optimize the damping rings acceptance
2.1.2.3 Specify magnet field quality required to ensure good acceptance

Investigators:

*Louis Emery, ANL
Aimin Xiao, ANL

2.1.1.E Damping rings optics design

Required for Baseline

Status as at 28/04/2006: Proposed

Description:

Damping rings optics design with low beta functions to mitigate ion effects.

Addresses Objectives:

2.1.1.1 Lattice design for baseline positron ring

2.1.1.2 Lattice design for baseline electron ring

Investigators:

* Eun-San Kim, KNU

2.1.1.F Damping rings optics design

Required for Baseline
Status as at 12/05/2007: Inactive

Description:

Development of FODO-type lattice with two wiggler sections.

Addresses Objectives:

2.1.1.1 Lattice design for baseline positron ring
2.1.1.2 Lattice design for baseline electron ring

Investigators:

Jie Gao, IHEP
* Yi Peng Sun, IHEP

2.1.1.G Alternative ring designs

Required for Alternate

Status as at 11/08/2006: Proposed

Description:

Explore alternative damping ring designs, e.g. a dog bone lattice with harmonic sextupoles.

Addresses Objectives:

2.1.1.3 Lattice design for alternative positron ring
2.1.1.4 Lattice design for alternative electron ring

Investigators:

*Louis Emery, ANL
Aimin Xiao, ANL

2.1.1.H Modelling of alternative injection/extraction techniques - RF deflection schemes and other techniques

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Specifications for stripline kickers with fast pulsers, which are the baseline injection/extraction technique for the damping rings, are quite challenging. This project will explore techniques to ease the specifications on the kicker system such as RF deflection schemes with bypass lines.
Milestones and deliverables:
FY2007-08 – Further evaluation of the Cornell RF deflector scheme with particular attention to beam dynamics impact.

Addresses Objectives:

2.1.1.6 Optics designs for injection/extraction sections in damping rings

Investigators:

* David Rubin, Cornell

2.1.2.A Characterize baseline damping rings dynamic aperture

Required for Baseline

Status as at 17/08/2007: Active

Description:

Characterization of dynamic aperture in damping ring lattices. This will include studies of the efficiency of injection into the ring, because of the strong overlap of this acceptance with dynamic aperture questions.

Addresses Objectives:

2.1.2.1 Characterize damping rings acceptance

2.1.2.3 Specify magnet field quality required to ensure good acceptance

Investigators:

Gregg Penn, LBNL

Ina Reichel, LBNL

* Michael Zisman, LBNL

2.1.2.B Dynamic aperture studies

Required for Baseline
Status as at 17/05/2007: Proposed

Description:

Specify magnet and alignment errors. Model nonlinear wigglers. Understand the nonlinear characteristics of the lattices. Map out the local beam loss during injection. Simulate injection and damping process.

Addresses Objectives:

2.1.2.1 Characterize damping rings acceptance
2.1.2.3 Specify magnet field quality required to ensure good acceptance

Investigators:

* Yunhai Cai, SLAC
Yukiyoshi Ohnishi, KEK

2.1.2.C Study of beam dynamics with wigglers

Required for Alternate

Status as at 10/08/2006: Proposed

Description:

Evaluation of the effect of wigglers on beam dynamics at DAFNE. Optimization of the dynamic aperture with wigglers. Comparison of simulations with beam measurements at DAFNE. Study of possible modifications to the wiggler pole shape to improve the dynamic aperture.

Addresses Objectives:

2.1.2.1 Characterize damping rings acceptance
2.1.2.2 Optimize the damping rings acceptance
3.4.6.1 Develop physics designs for damping wigglers
4.1.1.4 Experimental studies at DAFNE

Investigators:

Marica Biagini, INFN-LNF
* Susanna Guiducci, INFN-LNF
Miro Preger, INFN-LNF

2.1.2.D Wiggler studies in PETRA-III

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Study wiggler effects on beam dynamics in PETRA-III (very low emittance, wiggler dominated storage ring).

Addresses Objectives:

2.1.2.1 Characterize damping rings acceptance

4.1.1.7 Experimental studies at PETRA-III

Investigators:

* Winfried Decking, DESY

2.1.3.A Specify correction systems

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Identify locations for correctors and beam position monitors. Improve precision measurement for linear optics. Develop realistic correction schemes for linear optics. Study tuning procedures to achieve ultra-low emittance.

Addresses Objectives:

2.1.3.1 Develop techniques for optics measurement and correction
2.1.4.1 Develop strategies for low-emittance tuning
2.1.4.2 Specify requirements for survey, alignment and stabilization
2.1.4.5 Specify orbit and coupling correction scheme

Investigators:

* Yunhai Cai, SLAC

2.1.3.B Orbit and coupling correction and tuning studies

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Add orbit and coupling correction schemes to the lattice design. Simulation of vertical emittance evolution. Studies of operational reliability under various machine errors.

Addresses Objectives:

2.1.3.1 Develop techniques for optics measurement and correction
2.1.4.1 Develop strategies for low-emittance tuning
2.1.4.5 Specify orbit and coupling correction scheme

Investigators:

* Louis Emery, ANL
Vadim Sajaev, ANL
Aimin Xiao, ANL

2.1.4.A Low-emittance tuning techniques and requirements

Required for Baseline

Status as at 17/05/2007: Active

Description:

Develop techniques for low-emittance tuning, using simulation techniques and experimental studies. Specify requirements on alignment, instrumentation and coupling correction systems.

Addresses Objectives:

2.1.4.1 Develop strategies for low-emittance tuning
2.1.4.2 Specify requirements for survey, alignment and stabilization
2.1.4.3 Demonstrate < 2 pm vertical emittance
2.1.4.5 Specify orbit and coupling correction scheme

Investigators:

James Jones, ASTeC
Kosmas Panagiotidis, Liverpool/CI
* Andy Wolski, Liverpool/CI

2.1.4.B Develop low-emittance tuning strategies with validation in CesrTA

Required for Baseline

Status as at 17/05/2007: Active

Description:

Develop low-emittance tuning strategies and algorithms. Apply these techniques both to the ILC Damping Ring and CesrTA designs. The ability to validate the techniques in CesrTA will validate the techniques for ILC DR use. This work is being carried out in collaboration with Andy Wolski (Cockcroft Institute/U. Liverpool).
Milestones and deliverables:
FY2006 – Simulation codes implemented in BMAD framework. Preliminary evaluations for CesrTA and the ILC Damping Rings.
FY2007 – Final evaluation of expected performance of CesrTA and the ILC Damping Rings and implementation in the standard machine correction and control tools for CESR.
FY2008 – FY2011: Operational testing and development to take place in CESR-c and CesrTA.

Addresses Objectives:

2.1.4.1 Develop strategies for low-emittance tuning
4.1.1.3 Experimental studies at CesrTA

Investigators:

Richard Helms, Cornell
* Mark Palmer, Cornell
David Rubin, Cornell

2.1.4.C Specify the alignment tolerances and stabilization requirements for the damping rings

Required for Baseline

Status as at 17/05/2007: Active

Description:

Specify the alignment tolerances and stabilization requirements for the damping rings. Explore survey techniques required to achieve the specified tolerances. Implement and test these techniques using CesrTA. Evaluate the balance between alignment tolerances and the corrector complement required for the ILC damping rings.
Milestones and deliverables:
FY2006 – Review the impact of alignment tolerances on low emittance operation and evaluate the balance between alignment capabilities and magnetic correction. Review required alignment and survey techniques with particular attention on the size of the ring and the impact of most magnets being independently mounted.
FY2007 – Complete evaluations for CesrTA and the ILC Damping Rings.
FY2008 – FY2009 Preparation and installation of prototype ILC survey hardware in CesrTA.
FY2009 – FY2011 Evaluation in conjunction with ultra-low emittance operation in CesrTA.

Addresses Objectives:

2.1.4.2 Specify requirements for survey, alignment and stabilization
2.1.4.4 Specify support schemes for damping rings magnets
3.10.1.1 Specify alignment techniques appropriate for different sections o
4.1.1.3 Experimental studies at CesrTA

Investigators:

Scott Chapman, Cornell
Don Hartill, Cornell
Richard Helms, Cornell
* Mark Palmer, Cornell
Maury Tigner, Cornell

2.1.4.D Low emittance tuning

Required for Baseline

Status as at 17/08/2007: Proposed

Description:

We propose to investigate and validate techniques for coupling correction in the damping ring lattices, leading to a robust procedure for obtaining and maintaining low emittance. This task will include specifying steering magnets and skew quadrupoles for coupling.

Addresses Objectives:

2.1.4.1 Develop strategies for low-emittance tuning
2.1.4.5 Specify orbit and coupling correction scheme

Investigators:

Gregg Penn, LBNL
* Michael Zisman, LBNL

2.2.1.A Develop an impedance budget and specify feedback systems

Required for Baseline

Status as at 17/05/2007: Active

Description:

Develop a solid impedance budget and specify feedback systems to control the conventional instabilities in the damping rings.

Addresses Objectives:

2.2.1.1 Develop single-bunch impedance models
2.2.2.1 Develop long-range wakefield models
2.2.2.2 Characterize multi-bunch instabilities
3.8.1.1 Specify bunch-by-bunch feedback systems

Investigators:

* Karl Bane, SLAC
Sam Heifets, SLAC
Alexander Novokhatski, SLAC

2.2.1.B Develop single-bunch impedance models and characterize instabilities

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Use technical designs of vacuum system components to calculate short-range wakefields. Use wakefield models to calculate single-bunch instability thresholds.

Addresses Objectives:

2.2.1.1 Develop single-bunch impedance models

2.2.1.2 Characterize single-bunch impedance-driven instabilities

Investigators:

Roger Jones, Manchester/CI

* Andy Wolski, Liverpool/CI

2.2.1.C Characterize single-bunch collective effects

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Calculate impedance, and characterize the effects on the beam, including bunch lengthening, transverse instability etc.

Addresses Objectives:

2.2.1.1 Develop single-bunch impedance models
2.2.1.2 Characterize single-bunch impedance-driven instabilities

Investigators:

* Jie Gao, IHEP
Yi Peng Sun, IHEP

2.2.1.D Calculate impedance of vacuum chamber components

Required for Baseline
Status as at 17/05/2007: Proposed

Description:

Make analytic estimate of the impedance of small vacuum components in the damping rings.

Addresses Objectives:

2.2.1.1 Develop single-bunch impedance models

Investigators:

Karl Bane, SLAC
* Sam Heifets, SLAC
Alexander Novokhatski, SLAC
Gennady Stupakov, SLAC

2.2.1.E Simulate vacuum chamber and beamline components

Required for Baseline

Status as at 10/08/2006: Proposed

Description:

Calculate wakefields and impedances of beamline components including cavities, BPMs, kickers, tapers, bellows, vacuum ports etc.

Addresses Objectives:

2.2.1.1 Develop single-bunch impedance models
2.2.2.1 Develop long-range wakefield models

Investigators:

* Kwok Ko, SLAC

2.2.1.F Single bunch impedance

Required for Baseline

Status as at 21/08/2006: Proposed

Description:

Use high-performance cluster to calculate short-term wake-fields. Track beam with the wake-fields with parallel tracking code elegant.

Addresses Objectives:

2.2.1.1 Develop single-bunch impedance models
2.2.1.2 Characterize single-bunch impedance-driven instabilities

Investigators:

* Yong-Chul Chae, ANL

2.2.2.A Impedance-driven coupled-bunch instabilities

Required for Baseline

Status as at 17/05/2007: Active

Description:

Calculate resistive-wall and cavity long-range wakefields. Characterize coupled-bunch instabilities.

Addresses Objectives:

2.2.2.1 Develop long-range wakefield models
2.2.2.2 Characterize multi-bunch instabilities

Investigators:

Kai Meng Hock, Liverpool/CI
* Andy Wolski, Liverpool/CI

2.2.2.C Characterize the effects of transients during the injection/extraction process on the damped bunches

Required for Baseline

Status as at 17/08/2007: Active

Description:

We propose to characterize the effects of injected bunches on damped bunches in the positron damping rings. The transients induced during injection will be studied, and their potential impact on beam stability and feedback system performance analyzed.

Addresses Objectives:

2.2.2.3 Characterize the effects of injection transients

Investigators:

* Gregg Penn, LBNL
Michael Zisman, LBNL

2.2.2.D Fast feedback system specifications

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Perform simulation and system modeling of transverse and longitudinal instabilities, giving estimates of modal growth rates determining required performance for fast feedback systems.

Addresses Objectives:

2.2.2.2 Characterize multi-bunch instabilities
3.8.1.1 Specify bunch-by-bunch feedback systems

Investigators:

* John Fox, SLAC

2.2.2.E Multi-bunch instability with Monte Carlo HOM modeling

Required for Baseline

Status as at 21/08/2006: Proposed

Description:

Using RF cavity dimensions, estimate a set of probable HOM frequencies, add designed-in staggering of HOM frequencies and some randomness to reflect actual construction error. Estimate distribution of growth rates over possible sets of HOM frequencies. Adjust staggering and necessary de-Q-ing until a reasonable set of HOMs is obtained. (Following approach used for APS in 1992).

Addresses Objectives:

2.2.2.1 Develop long-range wakefield models
2.2.2.2 Characterize multi-bunch instabilities

Investigators:

* Louis Emery, ANL

2.2.2.F Multibunch impedance

Required for Baseline

Status as at 17/08/2007: Active

Description:

We will estimate the multi-bunch instability growth rates in the baseline and alternative damping rings, based on a realistic model of the long-range wake fields. We also will characterize the effects (induced jitter, emittance growth, etc.) of injected bunches on damped bunches, mediated by long-range wake fields, feedback systems, etc. In the positron damping ring, the stored beam current will fall by 10% at the start of the extraction cycle, before new bunches generated by the electron beam can arrive. The current will stay at a reduced level until the end of the extraction cycle, when it will return to its full value. The changes in current will generate transient beam loading effects in the transverse impedance. These transient effects have a potential for impacting the projected transverse beam size of the multibunch beam.

Addresses Objectives:

2.2.2.1 Develop long-range wakefield models
2.2.2.2 Characterize multi-bunch instabilities
2.2.2.3 Characterize the effects of injection transients

Investigators:

* John Byrd, LBNL

2.2.3.A Model electron cloud instability

Required for Baseline

Status as at 17/08/2007: Active

Description:

Use WARP/POSINST to compare 2D and 3D electron cloud instability code validity, with focus on the wiggler region. Begin studies of fast head-tail instability threshold.

Addresses Objectives:

2.2.3.1 Characterize electron-cloud build-up
2.2.3.3 Develop modeling tools for electron-cloud instabilities

Investigators:

* Christine Celata, LBNL
Marco Venturini, LBNL

2.2.3.B Model electron-cloud build-up and instabilities

Required for Baseline

Status as at 17/05/2007: Active

Description:

Develop a self-consistent simulation code for generating electron cloud and studying the instability. Benchmark the results of the simulation against control experiments in a positron ring.

Addresses Objectives:

2.2.3.3 Develop modeling tools for electron-cloud instabilities
2.2.3.4 Determine electron-cloud instability thresholds

Investigators:

* Mauro Pivi, SLAC
Lanfa Wang, SLAC

2.2.3.C Model electron-cloud build-up and instabilities

Required for Baseline

Status as at 12/05/2007: Proposed

Description:

Assess thresholds of instability in more realistic simulations applied to various damping ring configurations.

Addresses Objectives:

2.2.3.1 Characterize electron-cloud build-up
2.2.3.3 Develop modeling tools for electron-cloud instabilities
2.2.3.4 Determine electron-cloud instability thresholds

Investigators:

Aleksandar Markovik, Rostock
Gisela Poplau, Rostock
Ursula van Rienen, Rostock
* Rainer Wanzenberg, DESY

2.2.3.D Studies of electron-cloud build-up and instabilities with simulation and experiment

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Model electron cloud effects in CESR-c/CESR-TA for experimental support of the ILC damping rings program. Measure electron cloud effects in CESR-c/CESR-TA (note: CESR-TA hardware and diagnostics upgrades for these experiments are not costed as part of this item - see item 4.2.1).
Collaboration with other institutions:
R. Holtzapple (and students), Alfred Univ. (measurements and analysis)
M. Pivi and L. Wang, SLAC (simulation support and prototype vacuum chambers for wigglers and bends).
C. Celata, S. Marks, R. Schlueter, M. Venturini, M. Zisman (ILC DR wiggler vacuum chamber development and simulation effort)
K. Harkay, ANL (electron cloud diagnostics and measurements)
K. Ohmi and J. Flannagan, KEK (electron cloud measurements)
P. Spentzouris, J. Amundsen, L. Michelotti, FNAL (full dynamics simulations)
Milestones and deliverables:
FY2006 – Initial measurements and simulations for CESR-c.
FY2007 – Evaluation of effects in CESR-c and implications for ILC DR. Conceptual planning for CESR-TA.
FY2008 – Locally measure electron cloud growth in CESR-c wigglers with modified vacuum chambers. First tests of suppression techniques in wigglers meeting ILC specifications.
FY2009-2011 Measurements and simulations associated with electron cloud impact on low emittance operation using CESR-TA. Detailed comparisons with full dynamics simulation packages.

Addresses Objectives:

2.2.3.1 Characterize electron-cloud build-up
2.2.3.3 Develop modeling tools for electron-cloud instabilities
2.2.3.4 Determine electron-cloud instability thresholds

Investigators:

* Jim Crittenden, Cornell
Robert Holtzapple, Alfred U
Mark Palmer, Cornell
David Rice, Cornell
Eugene Tanke, Cornell

2.2.3.E Model electron cloud build-up and instabilities

Required for Baseline

Status as at 28/04/2006: Active

Description:

Model electron cloud build-up and instabilities.

Addresses Objectives:

2.2.3.3 Develop modeling tools for electron-cloud instabilities

Investigators:

* Kazuhito Ohmi, KEK

2.2.3.F Electron cloud lab measurements and PEP-II studies

Required for Baseline

Status as at 17/05/2007: Active

Description:

To demonstrate the reduction and stabilization of the surface secondary electron yield below the threshold for the onset of the electron cloud in the damping ring. Ongoing projects for installation of dedicated chambers in the PEP-II LER beamline include: chambers with rectangular grooves; and secondary electron yield (SEY) tests, including tests of the combined electron and photon conditioning in an accelerator environment, electron flux, beam spectra along trains and growth times.

Addresses Objectives:

2.2.3.2 Develop electron-cloud suppression techniques
4.1.1.6 Experimental studies at PEP-II

Investigators:

Gerard Collet, SLAC
Bob Kirby, SLAC
Nadine Kurita, SLAC
Bob Macek, LANL
* Mauro Pivi, SLAC
Tor Raubenheimer, SLAC
John Seeman, SLAC
Cristina Vaccarezza, INFN-LNF
Lanfa Wang, SLAC
Andy Wolski, Liverpool/CI

2.2.3.G Studies of clearing electrodes for suppressing electron cloud build-up

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Perform feasibility studies for the use of clearing electrodes for suppressing the build-up of electron cloud. Design of vacuum chambers with clearing electrodes. Calculation of impedance.

Addresses Objectives:

2.2.3.2 Develop electron-cloud suppression techniques

Investigators:

Karl Bane, SLAC
Stefano de Santis, LBNL
Brett Kuekan, SLAC
Alexander Novokhatski, SLAC
* Mauro Pivi, SLAC
Pantaleo Raimondi, INFN-LNF
Lanfa Wang, SLAC

2.2.3.H Electron cloud studies in DAFNE

Required for Baseline

Status as at 10/08/2006: Proposed

Description:

Installation of a TiN coated chamber in the DAFNE positron ring. Installation of three electron detectors in DAFNE: one in the electron ring; one in a TiN coated section of the positron ring; one in an uncoated section of the positron ring. Compare the electron cloud density measured in DAFNE with the predictions of various codes. Study electron cloud in wigglers.

Addresses Objectives:

2.2.3.1 Characterize electron-cloud build-up
4.1.1.4 Experimental studies at DAFNE

Investigators:

* Roberto Cimino, INFN-LNF
Alberto Clozza, INFN-LNF
Cristina Vaccarezza, INFN-LNF

2.2.3.I CesrTA wiggler and electron cloud studies

Required for Baseline
Status as at 17/05/2007: Proposed

Description:

Study wiggler vacuum performance and electron cloud effects.

Addresses Objectives:

2.2.3.1	Characterize electron-cloud build-up
3.1.1.1	Specify vacuum chamber material and geometry
3.1.1.2	Develop technical designs for principal vacuum chamber compo

Investigators:

* John Byrd, LBNL
Stefano de Santis, LBNL
Mauro Pivi, SLAC
Marco Venturini, LBNL
Lanfa Wang, SLAC
Michael Zisman, LBNL

2.2.3.K Studies of grooved vacuum chamber surfaces for electron cloud suppression

Required for Baseline

Status as at 17/05/2007: Active

Description:

Determine the optimum size and shape (including rectangular and triangular) grooves in the vacuum chamber surface for suppressing the development of electron cloud in different regions (e.g. field-free region, dipole, and wiggler). Demonstrate suppression capabilities of grooved chamber surfaces. Understand the technical and physical implications of grooved chamber surfaces.

Addresses Objectives:

2.2.3.2 Develop electron-cloud suppression techniques

Investigators:

Bob Kirby, SLAC
* Mauro Pivi, SLAC
Tor Raubenheimer, SLAC
Lanfa Wang, SLAC

2.2.3.L Experiments on suppression of electron cloud effect

Required for Baseline

Status as at 19/09/2006: Proposed

Description:

Development of a beam duct with ante-chambers. Survey of surfaces with a low secondary electron yield, and development of a clearing electrode. Measurement of electron density in a vacuum pipe.

Addresses Objectives:

2.2.3.2 Develop electron-cloud suppression techniques

Investigators:

Hitoshi Fukuma, KEK
Ken-ichi Kanazawa, KEK
Kyo Shibata, KEK
* Yusuke Suetsugu, KEK

2.2.3.M Measurement of electron cloud instabilities

Required for Baseline
Status as at 19/09/2006: Proposed

Description:

Measurement of beam spectrum, beam size and so on.

Addresses Objectives:

2.2.3.1 Characterize electron-cloud build-up
2.2.3.3 Develop modeling tools for electron-cloud instabilities
2.2.3.4 Determine electron-cloud instability thresholds

Investigators:

* John Flanagan, KEK
Kazuhito Ohmi, KEK

2.2.3.N Benchmarking of electron-cloud build-up simulations

Required for Baseline

Status as at 20/09/2006: Active

Description:

Perform electron-cloud build-up simulations for the DAFNE wiggler and perform qualitative comparison with measurements (pressure rise, beam instability, possibly designated electron detectors). (Run simulations at CERN using field maps from LNF.) Study efficiency of various proposed electron-cloud countermeasures in simulations.

Addresses Objectives:

2.2.3.1 Characterize electron-cloud build-up
2.2.3.2 Develop electron-cloud suppression techniques

Investigators:

Roberto Cimino, INFN-LNF
Oleg Malyshev, ASTeC
Ron Reid, ASTeC
Cristina Vaccarezza, INFN-LNF
Rainer Wanzenberg, DESY
* Frank Zimmermann, CERN

2.2.3.O Improvement of electron-cloud simulation codes

Required for Baseline

Status as at 20/09/2006: Active

Description:

Implement an antechamber geometry and, if foreseen by ILC design, also synchrotron radiation stops and/or clearing electrodes in ECLOUD code. Update ECLOUD model parameters based on the results of code benchmarking.

Addresses Objectives:

2.2.3.1 Characterize electron-cloud build-up

Investigators:

Roberto Cimino, INFN-LNF
Oleg Malyshev, ASTeC
Ron Reid, ASTeC
Cristina Vaccarezza, INFN-LNF
Rainer Wanzenberg, DESY
* Frank Zimmermann, CERN

2.2.3.P Predict electron-cloud effect in the damping rings

Required for Baseline

Status as at 20/09/2006: Active

Description:

Simulate instability thresholds with HEADTAIL for a 3 km, 6 km and 17 km damping ring and compare them with predicted electron densities. Estimate the importance of incoherent emittance growth due to electron cloud for the different damping ring designs. Repeat electron-cloud build-up and instability simulations using updated chamber material properties and vacuum chamber layout.

Addresses Objectives:

2.2.3.4 Determine electron-cloud instability thresholds

Investigators:

Roberto Cimino, INFN-LNF
Oleg Malyshev, ASTeC
Ron Reid, ASTeC
Cristina Vaccarezza, INFN-LNF
Rainer Wanzenberg, DESY
* Frank Zimmermann, CERN

2.2.3.Q Experimental determination of surface parameters for electron-cloud build-up

Required for Baseline

Status as at 20/09/2006: Active

Description:

Study the dependence on electron and photon doses of the experimentally determined values of SEY and their relevance for simulations of electron-cloud build-up. Compare DAFNE Al surface properties with other possible materials.

Addresses Objectives:

2.2.3.1 Characterize electron-cloud build-up

Investigators:

Roberto Cimino, INFN-LNF
Oleg Malyshev, ASTeC
Ron Reid, ASTeC
Cristina Vaccarezza, INFN-LNF
Rainer Wanzenberg, DESY
* Frank Zimmermann, CERN

2.2.3.R Develop a PIC code for computing electron cloud and ion effects

Required for Baseline

Status as at 20/09/2006: Active

Description:

Develop FAKTOR2, a PIC code for computing multiple effects of nonrelativistic charges.

Addresses Objectives:

2.2.3.3 Develop modeling tools for electron-cloud instabilities
2.2.4.1 Characterize ion effects

Investigators:

* Warner Bruns, CERN
Daniel Schulte, CERN
Frank Zimmermann, CERN

2.2.3.S Model electron cloud instability

Required for Baseline
Status as at 18/05/2007: Proposed

Description:

Model electron cloud instability

Addresses Objectives:

2.2.3.3 Develop modeling tools for electron-cloud instabilities
2.2.3.4 Determine electron-cloud instability thresholds

Investigators:

* Louis Emery, ANL

2.2.3.T Model electron cloud dynamics including modelling for CesrTA

Required for Baseline

Status as at 18/05/2007: Proposed

Description:

Model electron cloud dynamics including modelling for CesrTA

Addresses Objectives:

2.2.3.3 Develop modeling tools for electron-cloud instabilities

2.2.3.4 Determine electron-cloud instability thresholds

Investigators:

* Panagiotis Spentzouris, FNAL

2.2.4.A Experimental studies of fast ion instability at the LBNL-ALS

Required for Baseline

Status as at 17/08/2007: Active

Description:

Measure fast beam-ion instability growth rate as a function of emittance. Study effects of mini-gaps in bunch train.

Addresses Objectives:

2.2.4.1 Characterize ion effects

Investigators:

* John Byrd, LBNL
Stefano de Santis, LBNL
Gang Huang, LBNL
Marco Venturini, LBNL
Michael Zisman, LBNL

2.2.4.B Numerical and analytical studies of two-stream (beam-ion) instabilities

Required for Baseline

Status as at 17/05/2007: Active

Description:

Perform numerical and analytical studies of two-stream (beam-ion) instabilities, including: realistic model of gas species; realistic lattice model; effects of radiation damping; effects of fast feedback systems; resistive-wall wake fields. The aim is to specify the vacuum pressure necessary to avoid instability, and to understand effects such as the nonlinearities in the lattice. The simulation studies will be benchmarked with the analytical approach.

Addresses Objectives:

2.2.4.1 Characterize ion effects

2.2.4.2 Specify techniques for suppressing ion effects

Investigators:

*Lanfa Wang, SLAC

2.2.4.C Studies of fast ion instability

Required for Baseline
Status as at 28/04/2006: Active

Description:

Characterize ion effects in the damping rings.

Addresses Objectives:

2.2.4.1 Characterize ion effects

Investigators:

Eun-San Kim, KNU
* Kazuhito Ohmi, KEK

2.2.4.D Studies of fast ion instability

Required for Baseline
Status as at 11/08/2006: Active

Description:

Perform analytical study of the fast ion instability.

Addresses Objectives:

2.2.4.1 Characterize ion effects

Investigators:

Eckhard Elsen, DESY
* Guoxing Xia, DESY

2.2.4.E Studies of fast ion instability (modelling and experimental)

Required for Baseline

Status as at 17/05/2007: Active

Description:

Studies of fast ion instability (modelling and experimental). Work will largely focus on characterization of fast ion effects in CESR-c and CESR-TA alongside the electron cloud studies.
Collaboration with other institutions:
Mauro Pivi and Lanfa Wang, SLAC
Milestones and deliverables:
FY2006 – Initial measurements and simulations for CESR-c.
FY2007 – Evaluation of effects in CESR-c and implications for ILC DR. Conceptual planning for CESR-TA.
FY2008-2011 Measurements and simulations associated with ion impact on low emittance operation using CESR-TA. Detailed comparisons with full dynamics simulation packages.

Addresses Objectives:

2.2.4.1 Characterize ion effects
2.2.4.2 Specify techniques for suppressing ion effects
4.1.1.3 Experimental studies at CesrTA

Investigators:

Gerry Codner, Cornell
* Jim Crittenden, Cornell
Robert Holtzapple, Alfred U
Mark Palmer, Cornell
David Rice, Cornell
Eugene Tanke, Cornell

2.2.4.F Studies of suppression techniques for fast ion instability

Required for Baseline

Status as at 17/05/2007: Active

Description:

Study techniques for suppressing the fast ion instability, and specify an appropriate remedy for the damping rings. Techniques to be studied include: variation of bunch train pattern; clearing electrodes; beam shaking; fast feedback systems.

Addresses Objectives:

2.2.4.2 Specify techniques for suppressing ion effects

Investigators:

* Lanfa Wang, SLAC

2.2.4.G Experimental studies of fast ion instability

Required for Baseline
Status as at 12/05/2007: Proposed

Description:

Experimental studies of fast ion instability, if opportunities arise.

Addresses Objectives:

2.2.4.1 Characterize ion effects

Investigators:

* Lanfa Wang, SLAC

2.2.4.H Measure fast ion instability in KEK-ATF

Required for Baseline

Status as at 12/05/2007: Active

Description:

Make quantitative measurements of fast ion effects in KEK-ATF.

Addresses Objectives:

2.2.4.1 Characterize ion effects

4.1.1.2 Experimental studies at KEK-ATF

Investigators:

Takashi Naito, KEK

Nobuhiro Terunuma, KEK

* Junji Urakawa, KEK

2.2.4.I Characterize ion effects in the damping rings

Required for Baseline

Status as at 20/09/2006: Completed

Description:

Estimate ion trapping, rise time of fast beam-ion instability, and ion-induced incoherent tune shifts, taking into account the different regions in each ring. Compare analytical calculations with simulation results.

Addresses Objectives:

2.2.4.1 Characterize ion effects

Investigators:

Warner Bruns, CERN
Daniel Schulte, CERN
* Frank Zimmermann, CERN

2.2.5.A Characterize selected single-bunch instabilities

Required for Baseline

Status as at 17/08/2007: Active

Description:

Conclude initial studies of IBS, microwave instability, space-charge.

Addresses Objectives:

2.2.1.2 Characterize single-bunch impedance-driven instabilities
2.2.5.1 Characterize space-charge effects
2.2.5.3 Estimate emittance growth from IBS

Investigators:

* Marco Venturini, LBNL
Michael Zisman, LBNL

2.2.5.B Self-consistent modeling of space-charge effects

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Use the 3D, parallel code Synergia to to study potential emittance growth and halo creation for different operational parameters of the baseline design.

Addresses Objectives:

2.2.5.1 Characterize space-charge effects

Investigators:

Leo Michelotti, FNAL
King Ng, FNAL
* Panagiotis Spentzouris, FNAL

2.2.5.C Self-consistent modeling of CSR effects

Required for Baseline
Status as at 12/04/2006: Proposed

Description:

Self-consistent modeling of CSR effects.

Addresses Objectives:

2.2.5.2 Estimate the impact from CSR

Investigators:

* Panagiotis Spentzouris, FNAL

2.2.5.D Characterize injection/extraction transients

Required for Baseline
Status as at 17/05/2007: Active

Description:

Characterize the effects of injection/extraction transients.

Addresses Objectives:

2.2.2.3 Characterize the effects of injection transients

Investigators:

Kai Meng Hock, Liverpool/CI
* Andy Wolski, Liverpool/CI

2.2.5.E Characterize classical single- and multi-bunch instabilities

Required for Baseline

Status as at 17/05/2007: Active

Description:

Calculate the thresholds, growth rates and other collective effects of classical single- and multi-bunch instabilities.

Addresses Objectives:

2.2.1.2 Characterize single-bunch impedance-driven instabilities

2.2.2.2 Characterize multi-bunch instabilities

Investigators:

* Sam Heifets, SLAC

Alexander Novokhatski, SLAC

2.2.5.G Estimate the impact from CSR

Required for Baseline

Status as at 12/05/2007: Active

Description:

Evaluate CSR effects for the ILC damping rings. Work is collaborative with the Cornell ERL effort.
Milestones and deliverables:
FY06 – Implement algorithms in BMAD
FY07 – Initial evaluation
FY08 – Completed evaluations for ILC damping rings

Addresses Objectives:

2.2.5.2 Estimate the impact from CSR

Investigators:

* David Sagan, Cornell

2.2.5.H Simulation of the Touschek lifetime and intrabeam scattering effects with measurements in CesrTA

Required for Baseline

Status as at 17/05/2007: Active

Description:

Implement algorithms to model the Touschek effect and intrabeam scattering. Evaluate these effects for the ILC damping rings and CesrTA. Explore impact on ultra-low emittance operation and measurements.
Collaboration with other institutions:
A. Wolski (Cockcroft/Liverpool)
Milestones and deliverables:
FY06 – Implementation of necessary algorithms in BMAD
FY07 – Evaluation of impact on the ILC damping rings and CesrTA
FY08-11 – Measurements in CesrTA

Addresses Objectives:

2.2.5.3 Estimate emittance growth from IBS
2.2.5.4 Determine the Touschek lifetime

Investigators:

Mike Ehrlichman, Minnesota
* Mark Palmer, Cornell
David Sagan, Cornell
Maury Tigner, Cornell

2.2.5.I Estimate impact of intrabeam scattering on extracted (non-equilibrium) emittances

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Calculate the impact of IBS on the extracted (non-equilibrium) beam emittances.

Addresses Objectives:

2.2.5.3 Estimate emittance growth from IBS

Investigators:

* Andy Wolski, Liverpool/CI

2.2.5.J Study of CSR effects at KEK-ATF

Required for Baseline
Status as at 17/05/2007: Proposed

Description:

Study dependence of CSR instability thresholds on wiggler fields. Characterize growth in energy spread.

Addresses Objectives:

2.2.5.2 Estimate the impact from CSR

Investigators:

* John Byrd, LBNL
Stefano de Santis, LBNL
Andy Wolski, Liverpool/CI

2.2.5.K CSR studies at KEK-ATF

Required for Baseline
Status as at 11/08/2006: Active

Description:

Achieve quantitative understanding of CSR effects in the ATF.

Addresses Objectives:

2.2.5.2 Estimate the impact from CSR
4.1.1.2 Experimental studies at KEK-ATF

Investigators:

* Alexander Aryshev, KEK
Pavel Karataev, RHUL
Takashi Naito, KEK
Nobuhiro Terunuma, KEK
Junji Urakawa, KEK

2.2.5.L Theoretical studies of intrabeam scattering

Required for Alternate

Status as at 11/08/2006: Active

Description:

For CLIC: Ab initio design of magnet lattice; study potential benefits from harmonic cavity to reduce particle density and IBS in the bunch core; computation of phase space density distributions in the presence of strong IBS (for beam core and beam halo); computation of wiggler field tolerances; study combined function wiggler with integrated transverse focusing.

Addresses Objectives:

2.2.5.3 Estimate emittance growth from IBS

Investigators:

* Jean-Pierre Delahaye, CERN

2.2.5.M CSR modeling

Required for Baseline
Status as at 21/08/2006: Proposed

Description:

Estimate the effect of CSR.

Addresses Objectives:

2.2.5.2 Estimate the impact from CSR

Investigators:

* Michael Borland, ANL

2.3.1.A Integrated modeling of damping ring beam dynamics

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Studies of bunch-to-bunch and cycle-to-cycle variation in the extracted beams (using Elegant and Synergia), including errors, jitter, collective effects, feedback systems etc. Implement additional parallel software for collective effects. Implement electron cloud modeling.

Addresses Objectives:

2.3.1.1 Perform integrated beam dynamics simulations

Investigators:

James Amundson, FNAL
Michael Borland, ANL
Yong-Chul Chae, ANL
* Louis Emery, ANL
Leo Michelotti, FNAL
King Ng, FNAL
Vadim Sajaev, ANL
Panagiotis Spentzouris, FNAL
Aimin Xiao, ANL

3.1.1.A Damping rings wiggler and straights vacuum system design

Required for Baseline

Status as at 17/08/2007: Active

Description:

We propose to develop design concepts for the damping ring straight section vacuum systems in order to provide required vacuum performance and minimize impedance from geometric wake fields. Synchrotron radiation fans and heat loads, particularly from the wigglers, will be analyzed, and vacuum chamber apertures and any antechambers required will be designed such that all direct synchrotron radiation impinges only on cooled photon stops. The work will involve close communication with those working on impedance and collective effects, lattice design, and magnet design.

Addresses Objectives:

3.1.1.1 Specify vacuum chamber material and geometry
3.1.1.2 Develop technical designs for principal vacuum chamber compo
3.1.1.3 Characterize vacuum system performance

Investigators:

Jin-Young Jung, LBNL
Steve Marks, LBNL
Dave Plate, LBNL
* Ross Schlueter, LBNL

3.1.1.B Damping rings vacuum studies

Required for Baseline

Status as at 17/05/2007: Active

Description:

Calculate the average pressure and pressure profiles in the damping rings, and in the context of the results of these calculations, evaluate the technology options for the damping ring vacuum systems.

Addresses Objectives:

3.1.1.1 Specify vacuum chamber material and geometry
3.1.1.3 Characterize vacuum system performance

Investigators:

* Oleg Malyshev, ASTeC

3.1.1.C Coordinate design of damping ring vacuum system and control the impedance budget

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Coordinate the design of the damping rings vacuum system with the analytical and numerical estimate of the damping ring impedance. Control the impedance budget.

Addresses Objectives:

2.2.1.1 Develop single-bunch impedance models
3.1.1.2 Develop technical designs for principal vacuum chamber compo

Investigators:

* Sam Heifets, SLAC
Alexander Novokhatski, SLAC

3.1.1.D Vacuum chamber studies

Required for Baseline
Status as at 11/08/2006: Proposed

Description:

Study coatings for damping rings vacuum chamber.

Addresses Objectives:

3.1.1.1 Specify vacuum chamber material and geometry

Investigators:

* Dong Hai Yi, IHEP

3.1.1.E Vacuum design of damping rings

Required for Baseline

Status as at 20/09/2006: Active

Description:

Report on collated results of survey of secondary emission yields, psd, esd and isd yields, and develop work programme required to fill gaps in data. Report on pressure requirements (gas number densities) in the damping ring due to effects of electron cloud and other pressure-related instabilities, and projected means of mitigating any deleterious effects.

Addresses Objectives:

3.1.1.1 Specify vacuum chamber material and geometry

3.1.1.3 Characterize vacuum system performance

Investigators:

Roberto Cimino, INFN-LNF
Oleg Malyshev, ASTeC
Ron Reid, ASTeC
Cristina Vaccarezza, INFN-LNF
Rainer Wanzenberg, DESY
* Frank Zimmermann, CERN

3.1.1.F Arcs vacuum system technical design

Required for Baseline

Status as at 17/05/2007: Active

Description:

Develop technical designs for chamber and other components in arcs vacuum system, suitable for impedance modelling.

Addresses Objectives:

3.1.1.1 Specify vacuum chamber material and geometry

3.1.1.2 Develop technical designs for principal vacuum chamber compo

Investigators:

Neil Bliss, Daresbury

Alan Grant, Daresbury

* Oleg Malyshev, ASTeC

3.2.6.A Optimize design of permanent magnet wiggler

Required for Alternate

Status as at 10/08/2006: Active

Description:

Continue to optimize the design of a permanent magnet wiggler, including optimization of the pole shape to improve a field quality. Study a possible increase of the wiggler gap from 25 mm to 32 mm (allowing beam pipe aperture of 28 mm) for the electron damping ring while maintaining the weight and cost of the wiggler at reasonable levels. Estimate the cost of the permanent magnet wiggler with 32 mm gap.

Addresses Objectives:

3.4.6.1 Develop physics designs for damping wigglers

Investigators:

* Albert Babayan, YerPhI

3.3.2.A Damping rings magnet design

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Magnet design and model magnet fabrications. Develop magnet power sources.

Addresses Objectives:

3.3.2.1 Develop physics designs for main dipoles
3.3.2.2 Develop engineering designs for main dipoles
3.3.3.1 Develop physics designs for quadrupoles
3.3.3.2 Develop engineering designs for quadrupoles
3.3.4.1 Develop physics designs for sextupoles
3.3.4.2 Develop engineering designs for sextupoles

Investigators:

* Shi Cai Tu, IHEP

3.3.3.A Damping ring magnet design

Required for Baseline
Status as at 18/05/2007: Proposed

Description:

Damping ring magnet design

Addresses Objectives:

3.3.3.1 Develop physics designs for quadrupoles

Investigators:

* Ross Schlueter, LBNL

3.3.8.A Damping ring power system design

Required for Baseline
Status as at 18/05/2007: Proposed

Description:

Damping ring power system design

Addresses Objectives:

Investigators:

* Ray Larsen, SLAC

3.3.8.B Damping ring power system design

Required for Baseline
Status as at 18/05/2007: Proposed

Description:

Damping ring power system design

Addresses Objectives:

Investigators:

* Marc Ross, FNAL

3.4.6.A Develop physics design for damping wigglers

Required for Baseline

Status as at 12/05/2007: Inactive

Description:

Study physics optimizations for the ILC damping wigglers based on the CESR-c design.
Collaboration with other institutions:
A. Wolski (Cockcroft/Liverpool)
S. Marks and R. Schlueter (LBNL)
Milestones and deliverables:
FY06 – Optimized set of modifications of the CESR-c damping wigglers for ILC damping ring use. Conclusion of activity.

Addresses Objectives:

3.4.6.1 Develop physics designs for damping wigglers
4.1.1.3 Experimental studies at CesrTA

Investigators:

Gerry Dugan, Cornell
* Mark Palmer, Cornell
Jeremy Urban, Cornell

3.4.6.B Development of superconducting wiggler

Required for Baseline

Status as at 11/08/2006: Active

Description:

CLIC study has established a collaboration with BINP for wiggler issues. BINP has studied various wiggler options and the problem of radiation absorption. Mid term goal (for 2007): BINP completes short prototype superconducting wiggler for verification of design and field mapping. Future goals: try alternative designs and materials (Nb3SN..?) to push performance; address questions of resistive wall and radiation heating in small wiggler gaps; develop fully-fledged prototype for test with beam.

Addresses Objectives:

3.4.6.1 Develop physics designs for damping wigglers
3.4.6.2 Develop engineering designs for damping wigglers

Investigators:

* Jean-Pierre Delahaye, CERN

3.4.6.C Develop engineering design for ILC damping wigglers based on CESR-c superconducting wiggler design

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Modify the CESR-c superconducting wiggler design for use in the ILC damping rings.
Modifications for the ILC design are likely to include:
- Increased wiggler length
- Shorter wiggler period for optics (lattice cell) and emittance optimization
- Indirect cooling for simplified cryostat construction and manufacturing cost savings
- Increased vertical pole separation for simpler support plate with larger aperture
- Changes for separate bakeable vacuum chamber
- Modifications for He gas heat shield (vs LN2 in CESR design)

Test ECE suppression techniques using modified CESR-c wigglers.
Collaboration with other institutions:
M. Zisman, S. Marks, R. Schlueter (LBNL)
Milestones and deliverables:
FY2008-2009 – Test indirect cooling modifications using 7-pole spare wiggler
FY2010-2011 – Build ILC damping ring wiggler prototype in collaboration with SLAC and LBNL for vacuum chamber.
FY2009 – Upgrade North IR region for wiggler operation and testing at 5 GeV

Addresses Objectives:

3.4.6.2 Develop engineering designs for damping wigglers

Investigators:

Richard Ehrlich, Cornell
* Mark Palmer, Cornell
David Rice, Cornell
Eric Smith, Cornell

3.5.1.A Development of high-availability injection/extraction kicker (SLAC/LLNL)

Required for Baseline

Status as at 17/05/2007: Active

Description:

Full system demonstration of high-availability injection/extraction kicker. FY06: original unit extended with more cells to produce +/- 8 kV output; test at KEK-ATF. FY07: Full power 3 MHz unit. FY08: Multiple unit performance, timing, calibration, diagnostics. Issues to be addressed include: architecture; prototyping of single units and multiple units; system control of timing; background calibration; fast diagnostics; high reliability.

Addresses Objectives:

3.5.1.1 Develop a fast high-power pulser for injection/extraction kickers

Investigators:

Craig Brooksby, LLNL
Ed Cook, LLNL
* Ray Larsen, SLAC
Marc Ross, FNAL

3.5.1.B Development of high-availability injection/extraction kicker (SLAC/KEK)

Required for Baseline

Status as at 18/08/2006: Active

Description:

Full system demonstration of high-availability injection/extraction kicker. FY06: original unit extended with more cells to produce +/- 8 kV output; test at KEK-ATF. FY07: Full power 3 MHz unit. FY08: Multiple unit performance, timing, calibration, diagnostics. Issues to be addressed include: architecture; prototyping of single units and multiple units; system control of timing; background calibration; fast diagnostics; high reliability.

Addresses Objectives:

3.5.1.1 Develop a fast high-power pulser for injection/extraction kickers
4.1.1.2 Experimental studies at KEK-ATF

Investigators:

Ray Larsen, SLAC
Takashi Naito, KEK
* Marc Ross, FNAL
Nobuhiro Terunuma, KEK
Junji Urakawa, KEK

3.5.1.C Development of fast injection/extraction kickers

Required for Baseline

Status as at 17/05/2007: Active

Description:

Work has focused on testing a fast pulser from FID Technologies which nominally has properties meeting the ILC damping ring baseline specifications (note: the unit was not specified for the low-Q repetition rate requirements) except for the voltage level (1 kV instead of 10 kV). Unit was characterized and beam tested using the A0 beamline at FNAL.
Collaboration with other institutions:
G. Gollin (UIUC)
Milestones and deliverables:
FY06 – Tested a dual channel 1 kV pulser
FY07 – Intend to terminate local project given level of interest and support elsewhere
FY07-FY09 – Expect to maintain a modest level of involvement with work at other labs. If kicker testing desirable at CESR-TA, will ramp up CESR-TA support accordingly.

Addresses Objectives:

3.5.1.1 Develop a fast high-power pulser for injection/extraction kickers

Investigators:

Bob Meller, Cornell
* Mark Palmer, Cornell

3.5.1.D Development of fast injection/extraction kickers

Required for Baseline

Status as at 17/05/2007: Active

Description:

Determine acceptable electrode geometries for injection and extraction stripline kickers of various strength impulses. Develop high voltage pulse injection and extraction geometries that minimize disruption of adjacent bunches. Characterize the speed and stability of commercially available switches. This work will be in collaboration with FNAL.

Addresses Objectives:

3.5.1.1 Develop a fast high-power pulser for injection/extraction kickers
3.5.1.2 Develop physics designs for kicker striplines
3.5.1.3 Develop engineering designs for kicker striplines

Investigators:

* George Gollin, UIUC

3.5.1.E Development of stripline electrodes for fast kickers

Required for Baseline

Status as at 10/08/2006: Proposed

Description:

Develop stripline electrodes for fast kickers: short (<6 ns) pulse duration; low impedance; large aperture; good field uniformity. Use stripline to test fast pulsers in collaboration with other laboratories (e.g. Cornell and KEK-ATF).

Addresses Objectives:

3.5.1.2 Develop physics designs for kicker striplines
3.5.1.3 Develop engineering designs for kicker striplines
4.1.1.2 Experimental studies at KEK-ATF
4.1.1.3 Experimental studies at CesrTA

Investigators:

* David Alesini, INFN-LNF
Fabio Marcellini, INFN-LNF

3.5.1.F Laboratory test of FID fast high-power pulser

Required for Baseline

Status as at 10/08/2006: Active

Description:

Perform laboratory tests with an FID pulser: 50 kV, pulse duration <6 ns, repetition frequency 50 Hz. Test different feedthroughs. Install two kickers (separated by pi phase advance) at DAFNE for beam tests: temporal pulse shape; field uniformity; time jitter; cancellation of kicks with pi phase advance.

Addresses Objectives:

3.5.1.1 Develop a fast high-power pulser for injection/extraction kickers
4.1.1.4 Experimental studies at DAFNE

Investigators:

David Alesini, INFN-LNF
* Fabio Marcellini, INFN-LNF

3.5.1.G Development of DSRD-based fast high-power pulser

Required for Baseline

Status as at 18/08/2006: Active

Description:

Development of a fast high-power pusler based on a delay step recovery diode.
Ultimately demonstrate 6 MHz rep rate with 10 kV output, and good amplitude stability.

Addresses Objectives:

3.5.1.1 Develop a fast high-power pulser for injection/extraction kickers

Investigators:

* Anatoly Krasnykh, SLAC

3.5.1.H Development of reduced beam impedance kicker structure

Required for Baseline

Status as at 17/05/2007: Active

Description:

Develop a reduced beam impedance kicker structure (matching odd and even impedances). A well-designed kicker structure is important for reducing the residual energy in the kicker structure between pulses, as well as for reducing the beam impedance.

Addresses Objectives:

3.5.1.2 Develop physics designs for kicker striplines

Investigators:

* Anatoly Krasnykh, SLAC

3.5.1.I Saturating ferrite pulse-sharpener for damping ring kickers

Required for Baseline
Status as at 18/05/2007: Proposed

Description:

Saturating ferrite pulse-sharpener for damping ring kickers

Addresses Objectives:

3.5.1.1 Develop a fast high-power pulser for injection/extraction kickers

Investigators:

* Thomas Mattison, UBC

3.6.1.A RF cryogenic system specification

Required for Baseline
Status as at 17/05/2007: Active

Description:

Provide further details for the specification of the 650 MHz RF system.

Addresses Objectives:

3.6.2.1 Develop conceptual design for 650 MHz RF cavities, cryomodul

Investigators:

* Roberto Boni, INFN-LNF
Giorgio Cavallari, CERN

3.6.1.B RF system test in KEKB

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Beam test of RF system-related issues in KEKB.

Addresses Objectives:

3.6.2.1 Develop conceptual design for 650 MHz RF cavities, cryomodul

3.6.2.2 Develop engineering design for 650 MHz RF cavities, cryomodu

3.6.4.1 Develop RF controls

Investigators:

* Kazunori Akai, KEK

3.6.2.A Development of 650 MHz superconducting RF cavity and cryomodule

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

At present one industry is providing the CESR SRF units at 500 MHz. They have made about 10 for Cornell, CLS, Tawian, DIAMOND, and now Shangai. BNL and Taiwan are considering to order 3 more each. We propose to work with ACCEL to develop the design and the first prototype, if there is sufficient funding available in 08 - 11 to support industrial effort and the Cornell liason and final testing effort.
A particular area of development will be to design the cryomodule for 2K operation to allow higher operating voltage and reduced power requirements.
Collaboration with other institutions:
We intend to develop the unit directly in collaboration with ACCEL utilizing engineering, design, and fabrication support from their staff.
Milestones and deliverables:
2008 Scope of Work: Conceptual design : Cornell and ACCEL
650 MHz cavity 0.5 FTE
Input coupler 0.5 FTE (may need to adapt KEK coupler to CESR cryostat design)
HOM coupler 0.25 FTE
Cryostat 1 FTE
Valve box 0.25 FTE
Controls and electronics 0.25 FTE
2009 Scope of Work:
On the basis of conceptual design in 08, carry out detailed engineering design at ACCEL
ACCEL will take 6 months to complete detailed design and charge about 0.5 M$
Cornell person will monitor progress at ACCEL 0.5 FTE
Issue order to ACCEL to fabricate a complete cryomodule with electronics and valve box
estimated cost for prototype : 2 M$,
Cornell person will monitor progress at ACCEL 0.5 FTE
2009 - 2010: fabricate and assemble cryomodule, cold box, electronics and klystron
Procure 650 MHz 350 kW klystron in parallel 0.25 FTE
2011: Test finished unit at Cornell at 650 MHz and 4.2 K
Install and commission RF power at CESR (shielded area has to be found) 0.5 FTE
Install and commission = refrigeration at CESR (shielded area has to be found) 0.5 FTE
Install prototype and test at high power 1 FTE (total of various tasks)

Addresses Objectives:

3.6.1.2 Prototype complete 650 MHz RF unit and test at high power
3.6.2.1 Develop conceptual design for 650 MHz RF cavities, cryomodul
3.6.2.2 Develop engineering design for 650 MHz RF cavities, cryomodu
3.6.4.1 Develop RF controls

Investigators:

* Hasan Padamsee, Cornell

Mark Palmer, Cornell

3.6.4.A Develop low-level RF systems

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Develop systems for low-level RF, and RF signal distribution (addressing timing and synchronization issues) for entire ILC.

Addresses Objectives:

3.6.4.1 Develop RF controls

Investigators:

* John Byrd, LBNL
Larry Doolittle, LBNL
Russell Wilcox, LBNL

3.6.4.B Design studies for damping rings low level RF system

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Modeling of low level RF (LLRF) system and beam dynamics. Implications for LLRF system topology. Design study of low latency digital LLRF system for damping rings.

Addresses Objectives:

3.6.4.1 Develop RF controls

Investigators:

* John Fox, SLAC

3.7.2.A KEK-ATF BPM electronics

Required for Baseline

Status as at 17/05/2007: Active

Description:

To apply digital receiver technology to all 100 ATF damping ring BPM's. This will result in 100 nm (multi-pass) resolution for emittance and beam dynamics studies.

Addresses Objectives:

3.7.2.1 Develop beam position monitors
4.2.1.2 Development of KEK-ATF

Investigators:

Maria Carballo, SLAC
Joe Frisch, SLAC
Masao Kuriki, KEK
Justin May, SLAC
Takashi Naito, KEK
* Marc Ross, FNAL
Steve Smith, SLAC
Tonee Smith, SLAC
Nobuhiro Terunuma, KEK

3.7.2.B Single-pass, high-resolution RF BPM

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Develop single-pass, high-resolution RF BPM with wide dynamic range. Based on X-band cavity BPM constructed at APS for LCLS (<1 micron resolution for bunch charges between 0.2 nC and 1 nC).

Addresses Objectives:

3.7.2.1 Develop beam position monitors

Investigators:

* Robert Lill, ANL

3.7.2.C Damping rings instrumentation

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Develop instrumentation for damping rings (BPMs etc.)

Addresses Objectives:

3.7.2.1 Develop beam position monitors

Investigators:

* Cao Jian She, IHEP

3.7.3.A Development of time-resolved photon diagnostics

Required for Baseline

Status as at 12/05/2007: Proposed

Description:

Development of time-resolved diagnostics using synchrotron radiation in the wavelengths from optical through X-ray. For first-turn diagnostics and early-stage damping, use optical synchrotron radiation (large field of view, streak and gated cameras). For late-stage damping and fast beam size monitor, use X-ray synchrotron radiation from bend magnet and undulator for improved spatial resolution.

Addresses Objectives:

3.7.3.2 Develop precision bunch-by-bunch beam size monitor
3.7.3.4 Develop instrumentation for monitoring emittance damping

Investigators:

Alex Lumpkin, ANL
* Bingxin Yang, ANL

3.7.3.B Develop instrumentation for monitoring emittance damping (including testing and operation in CESR-c and CesrTA)

Required for Baseline

Status as at 17/05/2007: Active

Description:

Develop a fast X-ray camera capable of bunch-by-bunch and turn-by-turn measurements for use in emittance damping and bunch-to-bunch studies in the ILC damping rings. Implement and test this hardware as part of CesrTA.

Addresses Objectives:

3.7.3.2 Develop precision bunch-by-bunch beam size monitor
3.7.3.4 Develop instrumentation for monitoring emittance damping

Investigators:

* Jim Alexander, Cornell
John Dobbins, Cornell
Mark Palmer, Cornell
Charles Strohman, Cornell
Eugene Tanke, Cornell

3.7.3.C Instrumentation development

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Develop instrumentation for static measurements of ultra-low emittance (horizontal, vertical and longitudinal) beams. Develop instrumentation for dynamic measurements of ultra-low emittance (horizontal, vertical and longitudinal) beams. Improve BPM technology for orbit control. Develop technologies for alignment and vibration damping.

Addresses Objectives:

3.7.2.1 Develop beam position monitors
3.7.3.1 Develop high-precision beam size monitor
3.7.3.2 Develop precision bunch-by-bunch beam size monitor
3.10.1.1 Specify alignment techniques appropriate for different sections o

Investigators:

* Jean-Pierre Delahaye, CERN

3.7.5.A Develop methodology for fast dispersion measurements (including testing and operation in CESR-c/CesrTA)

Required for Baseline

Status as at 12/05/2007: Inactive

Description:

Study methods for obtaining Fast Dispersion measurements in a storage ring. This will include measurements at CESR and CesrTA using multi-turn beam trajectories while exciting the beam with an energy oscillation. A study of the instrumental and systematic effects for changes in various parameters for the excitation, measurement and analysis will be performed. Comparisons with other techniques will be included.
Studies to be performed:
- Measure vertical dispersion effect of changing a vertical bump across the south interaction region in CESR (This is a good source of vertical dispersion.)
- Compare turn-by-turn measurements with conventional dispersion measurements
- Include the effects of BPM imperfections (rotation of beam pipe, pin cushion & button gain differences, etc.)
- Consider different measurement techniques
  -- Turn-by-turn trajectory during a CW energy oscillation
  -- Turn-by-turn trajectory during a pinged energy oscillation
  -- Compare with orbit displacement from change in RF frequency
- Consider other analysis techniques
  -- Model Independent
  -- Special code for amplitude analysis
  -- Understand systematic effects of BPM tilts and other distortions

Addresses Objectives:

3.7.5.2 Develop instrumentation for fast dispersion measurements

Investigators:

* Mike Billing, Cornell
Richard Helms, Cornell

3.7.5.B Development of betatron tune monitor and coherent signal receiver

Required for Baseline
Status as at 17/05/2007: Proposed

Description:

Specify receiver frequencies for coherent signal detection. Fabricate prototype betatron tune monitor and coherent signal monitor.

Addresses Objectives:

3.7.4.1 Develop coherent signal receivers
3.7.5.1 Develop tune monitors

Investigators:

Walter Barry, LBNL
* John Byrd, LBNL
Larry Doolittle, LBNL
Alessandro Ratti, LBNL

3.8.1.A Development of the transverse broadband multibunch feedback systems

Required for Baseline

Status as at 17/08/2007: Active

Description:

We propose to study the technical issues associated with transverse broadband multibunch feedback system operation, such as allowable system noise and gain, and phase margins. If appropriate, these studies will be accompanied by experimental tests on the Advanced Light Source. This also includes modeling bunch-by-bunch feedback systems to determine limits of beam stability, including all relevant effects (instability growth rates, pick-up and amplifier noise, etc.), in both the baseline and alternative damping rings under a range of conditions (including variations in fill pattern, effects during injection and extraction, etc.).

Addresses Objectives:

3.8.1.2 Model bunch-by-bunch feedback systems

Investigators:

Walter Barry, LBNL

* John Byrd, LBNL

3.8.1.B Characterize injection noise

Required for Baseline

Status as at 10/08/2006: Proposed

Description:

Characterize sources of jitter and develop tools for transient analysis. Assess implications for feedback system design.

Addresses Objectives:

3.8.1.1 Specify bunch-by-bunch feedback systems
3.8.1.2 Model bunch-by-bunch feedback systems

Investigators:

Walter Barry, LBNL
* John Byrd, LBNL
Larry Doolittle, LBNL
Alessandro Ratti, LBNL

3.8.1.C Fast feedback system development

Required for Baseline

Status as at 17/05/2007: Proposed

Description:

Technological development of transverse and longitudinal processing channels for fast feedback systems. Continuation of KEK-ATF machine physics measurements, including study of feedback damping on extracted energy spread and transverse beam size. Development of beam diagnostics and front-end, back-end processing channels.

Addresses Objectives:

3.8.1.3 Develop bunch-by-bunch feedback systems

4.1.1.2 Experimental studies at KEK-ATF

Investigators:

* John Fox, SLAC

3.8.1.D Development of fast feedback systems

Required for Baseline

Status as at 10/08/2006: Proposed

Description:

Development of transverse and longitudinal fast feedback systems. Tests of new FPGA board at DAFNE and ATF. Design of a cavity kicker for the longitudinal feedback system, to be tested at ATF.

Addresses Objectives:

- 3.8.1.3 Develop bunch-by-bunch feedback systems
- 4.1.1.2 Experimental studies at KEK-ATF
- 4.1.1.4 Experimental studies at DAFNE

Investigators:

* Alessandro Drago, INFN-LNF

3.8.1.E Bunch-by-bunch feedback systems and related diagnostics systems

Required for Baseline

Status as at 19/09/2006: Proposed

Description:

Development of next-generation digital filter systems for bunch-by-bunch feedback. Development of front-end and rear-end analogue signal processors for bunch-by-bunch feedback and diagnostics. Development of ultra-wide pickups and kickers.

Addresses Objectives:

3.8.1.1 Specify bunch-by-bunch feedback systems
3.8.1.2 Model bunch-by-bunch feedback systems
3.8.1.3 Develop bunch-by-bunch feedback systems

Investigators:

Masaki Tejima, KEK
* Makoto Tobiyama, KEK

3.13.1.A Mechanical systems design and integration

Required for Baseline

Status as at 17/08/2007: Active

Description:

We are developing integrated systems design concepts for the damping rings magnetic lattices in order to provide required stability and performance. Magnets, together with vacuum systems, diagnostics, and other systems will be integrated onto supports, movers and girders.

Addresses Objectives:

3.3.3.1	Develop physics designs for quadrupoles
3.3.4.1	Develop physics designs for sextupoles
3.13.1.1	Develop integrated mechanical design

Investigators:

Steve Marks, LBNL
Dave Plate, LBNL
* Ross Schlueter, LBNL

4.1.1.A ATF beam dynamics and instrumentation studies

Required for Baseline

Status as at 11/08/2006: Active

Description:

The study program at ATF is focused on development of the ILC low emittance source and development of precision beam instrumentation for position and profile measurements.

Addresses Objectives:

2.1.4.1 Develop strategies for low-emittance tuning
2.1.4.3 Demonstrate < 2 pm vertical emittance
3.7.2.1 Develop beam position monitors
3.7.3.1 Develop high-precision beam size monitor
4.1.1.2 Experimental studies at KEK-ATF

Investigators:

Eun-San Kim, KNU
Kiyoshi Kubo, KEK
Janice Nelson, SLAC
* Marc Ross, FNAL
Nobuhiro Terunuma, KEK
Junji Urakawa, KEK
Glen White, SLAC
Mark Woodley, SLAC

4.1.1.B Operation of KEKB LER in a low-emittance mode

Required for Baseline

Status as at 19/09/2006: Proposed

Description:

KEKB can be operated with a horizontal emittance of approximately 1.4 nm at 2.3 GeV. Perform studies of orbit and optics control, effects of machine errors, tuning methods against emittance growth etc.

Addresses Objectives:

2.1.3.1 Develop techniques for optics measurement and correction
2.1.4.1 Develop strategies for low-emittance tuning

Investigators:

* Haruyo Koiso, KEK
Akio Morita, KEK

4.1.1.C Effects of wiggler

Required for Baseline
Status as at 19/09/2006: Proposed

Description:

Study the effects of wiggler field strength on damping time, beam size, luminosity etc.

Addresses Objectives:

3.4.6.1 Develop physics designs for damping wigglers

Investigators:

* Kazumi Egawa, KEK
Mika Masuzawa, KEK

4.2.1.A ATF kicker development

Required for Test Facility
Status as at 17/08/2007: Active

Description:

Physics design of stripline kickers for single-bunch extraction at KEK-ATF.

Addresses Objectives:

3.5.1.2 Develop physics designs for kicker striplines
4.2.1.2 Development of KEK-ATF

Investigators:

* John Byrd, LBNL
Stefano de Santis, LBNL
Anatoly Krasnykh, SLAC

4.2.1.B Development of fast rise/fall time kicker for ATF/ATF2

Required for Test Facility

Status as at 11/08/2006: Active

Description:

Develop fast rise/fall time kicker for stable multibunch extraction from ATF with ILC-like bunch timing for ATF2.

Addresses Objectives:

3.5.1.2 Develop physics designs for kicker striplines
3.5.1.3 Develop engineering designs for kicker striplines
4.2.1.2 Development of KEK-ATF

Investigators:

Hitoshi Hayano, KEK
* Takashi Naito, KEK
Nobuhiro Terunuma, KEK
Junji Urakawa, KEK

4.2.1.C Development of HERA-DR

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Stage I: Prepare existing e- accelerator for use as a damping ring. Stage II: Demonstrate the most pressing accelerator physics issues of the damping rings with moderate R&D scale investments. Stage III: Modify HERA into one of the ILC damping rings, commission it and demonstrate the required performance. Stage IV: Disassemble and reinstall the ring at the ILC site, recommission and operate as one of the damping rings of ILC.

Addresses Objectives:

4.2.1.5 Development of HERA-DR

Investigators:

* Ferdinand Willeke, DESY

4.2.1.D Development of CesrTA

Required for Baseline

Status as at 11/08/2006: Proposed

Description:

Configure CESR in a fashion suitable for damping ring R&D. Operate CESR for approximately one-third of each calendar year from 2008 to 2013 for ILC damping ring experiments.
Collaboration with other institutions:
A. Wolski – Cockcroft Institute
J. Urakawa – KEK
C. Celata, M. Venturini, S. Marks, R. Schlueter, M. Zisman – LBNL
J. Amundsen, L. Michelotti, P. Spentzouris – FNAL
M. Pivi, L. Wang – SLAC
A. Reichold, D. Urner – Oxford
Milestones and deliverables:
FY2007 – Complete design studies for operation of CESR-TA.
FY2008 – Modify 2 spare CESR-c wigglers with vacuum chambers that are equipped for electron cloud suppression and measurement. Install wigglers with upgraded vacuum chambers in arcs and test electron cloud growth and suppression during CESR-c/CesrTA transition period. Complete vacuum chamber modifications for North IR set of wigglers and install along with electron cloud diagnostics.
FY2008-2013 – Operation of CesrTA as a damping ring test accelerator.
Note on resources:
FTEs listed are those in direct support of accelerator upgrades and operations associated with ILC damping ring research. During the CesrTA period, we anticipate ½ of each year will be devoted to ILC efforts with approximately 4 months of accelerator running time. CesrTA conversion and operations will begin midway through FY08.

Addresses Objectives:

4.2.1.3 Development of CesrTA

Investigators:

* Mark Palmer, Cornell
David Rubin, Cornell

4.2.1.E ATF instrumentation and hardware development

Required for Baseline

Status as at 17/05/2007: Active

Description:

Support hardware and instrumentation development efforts and corresponding experiments for ATF and ATF2.
Collaboration with other institutions:
M. Ross – FNAL
J. Urakawa – KEK
Milestones and deliverables:
FY2006 – Provide extraction line BPM timing system.
FY2007-2008 – Provide timing system for ring BPM system
FY2009- – Continued support of ring and extraction line hardware and instrumentation

Addresses Objectives:

4.2.1.2 Development of KEK-ATF

Investigators:

Bob Meller, Cornell

4.2.1.F ATF multibunch feedback

Required for Baseline
Status as at 25/05/2007: Active

Description:

ATF Multibunch Feedback

Addresses Objectives:

4.2.1.2 Development of KEK-ATF

Investigators:

* Tor Raubenheimer, SLAC