Answer to Questions 1 and 4 (1)

Period	Date	Duration	Tasks and Milestones
Down 1	4/1/08	15 days	1) Install instrumented copper wiggler chambers a. One with diagnostics (control) b. One with diagnostics and TiN coating*
CesrTA Run 1	6/3/08	28 days	1) Beam tests of wiggler chambers at 2-2.5 GeV 2) Low emittance operation and alignment studies in CESR-c configuration
Down 2	7/1/08	92 days	1) Reconfigure CESR for low emittance a. Wiggler moves (from arcs to L0) b. Vertical separator removal (L3) 2) Instrumented vacuum chambers (RFAs) a. Wiggler chambers with additional EC mitigation techniques* (L0 installation) and adjacent drift chambers b. Dipole and drift chambers in arcs (regions where wigglers removed). At least one dipole control and one coated chamber (likely NEG)* c. Drift chambers in L3 3) Optics line for X-ray beam size monitor (positrons) 4) Deploy upgraded BPM system around ~25% of ring (half of vertical quadrupole locations) 5) Upgraded leveling and adjustment system on quadrupole stands

* Mitigation techniques planning still underway with ILC DR group

Answer to Questions 1 and 4 (2)

Period	Nominal Start Date	Nominal Duration	Tasks and Milestones
CesrTA Run 2	11/18/08	42 days	1) Tests of EC growth in vacuum chambers at 2-2.5 GeV. Characterize growth as a function of bunch spacing, intensity, train configuration, emittance. 2) Continue beam-based and instrumental alignment program to achieve ultra low emittance 3) Experiments at low emittance to explore instability thresholds and emittance dilution due to the ECI and FII 4) Begin commissioning of positron X-ray BSM
Down 3	1/6/09	43 days	1) Install photon stop for 5 GeV wiggler operation in L0 2) Complete a large fraction of alignment/survey upgrade 3) Install 2 additional instrumented dipole chambers with EC mitigation* 4) Install 3 instrumented quad chambers (L3) with EC mitigation* 5) Install upgraded BPM readout at remainder of vertically focusing quadrupole locations 6) Install solenoid windings in drift regions

* Mitigation techniques planning still underway with ILC DR group

Answer to Questions 1 and 4 (3)

Period	Nominal Date	Nominal Duration	Tasks and Milestones
CesrTA Run 3	4/7/09	42 days	1) Complete commissioning of positron X-ray BSM 2) EC growth measurements in chambers in 2-5 GeV range 3) Continued work to achieve ultra low emittance 4) Instability and emittance dilution experiments
Down 4	7/7/09	49 days	1) Install optics line for electron X-ray beam size monitor 2) Complete longitudinal feedback upgrade 3) Installation of additional vacuum chambers with EC diagnostics and mitigation as determined by results of CesrTA runs 1-3
CesrTA Run 4	8/25/09	42 days	1) Complete evaluation of electron cloud growth in wiggler, dipole and quadrupole chambers. Compare with simulation and prepare evaluations for ILC EDR 2) Continue program to achieve ultra low emittance 3) Detailed experiments at the lowest achieved emittance to characterize EC and FII instability thresholds and emittance dilution

Answer to Questions 1 and 4 (4)

Period	Nominal Date	Nominal Duration	Tasks and Milestones
CesrTA Run 5	11/24/09	49 days	1) Continue program to achieve ultra low emittance 2) Experiments to characterize instability thresholds and emittance dilution and prepare evaluations for the ILC EDR 3) Start commissioning of electron x-ray beam size monitor
Down 5	1/18/10	51 days	1) Install BPM upgrade at all horizontally focusing quads 2) Install additional vacuum chambers with EC diagnostics and mitigation as determined by results of CesrTA and other ILC experimental programs
CesrTA Run 6	5/4/10	42 days	1) Complete program to achieve ultra low emittance 2) Characterize electron and positron instability thresholds and emittance-diluting effects in the 5-10 pm vertical emittance regime for electrons and positrons
Down 6	6/15/10	15 days	1) Install wiggler with ILC prototype vacuum chamber
CesrTA Run 7	8/17/10	42 days	1) Experimental studies at ultra low emittance (ECI, FII, IBS,…) 2) Test ILC prototype wiggler vacuum chamber (2-5 GeV)

Answer to Questions 1 and 4 (5)

Period	Nominal Date	Nominal Duration	Tasks and Milestones
Down 7	9/28/10	15 days	Flexible down for hardware work
CesrTA Run 8	11/30/10	49 days	Continue studies begun in Run 7
Down 8	1/18/11	49 days	1) CesrTA available for installation and testing of ILC prototypes 2) Ongoing experimental program at ultralow emittance 3) Explore unexpected discoveries from 2008-2010 program
CesrTA Run 9	4/26/11	42 days	
Down 10	6/7/11	15 days	
CesrTA Run 10	8/9/11	42 days	

Question 2

- What is the risk that critical results are delayed until after the deadline for input into the EDR?
  - Measurement of emittance dilution due to electron cloud depends on achieving low emittance.
    - There is a risk that because critical instrumentation is not available at the start (upgraded BPM system and xray beam size monitor) that we will be unable to reach target emittance on a useful time scale.
  - Demonstrating e cloud mitigation depends on the development and construction of an effective design
    - There is a risk that none of the concepts now under consideration will work and that clever ideas will be in short supply.

Question 3

- Is this program viable if CHESS is not funded and if it is not, what remedies are required.
  - If CHESS is not funded, the viability of the CesrTA program can be maintained if such information is available in a timely manner and only with significant additional resources to provide:
    - the remainder of the full yearly operating budget
    - the services of an X-ray optics expert and technical support to replace the lost CHESS resources for the precision X-ray beam size monitor.
  - in addition, if the availability of the additional operations time is to be exploited to advance the CesrTA schedule:
    - capital funds to move forward the implementation of instrumentation
    - support of 3-4 additional technical support staff (including 1 engineering level person) to implement the instrumentation
      or
    - equivalent collaborator participation

Question 5

What are the plans for finding additional global collaborators, both for resources and techniques?

- Guidance for the structure and goals of the ILC collaboration is provided by the GDE.
- The current ILC-GDE Damping Rings Area System leaders have identified institutions interested in ILC damping ring R&D activities which can form the basis of future collaborations. In the electron cloud research area, in addition to Cornell, the institutions include Alfred U., ANL, AsTEC, CERN, DESY, Fermilab, INFN, KEK, LANL, LBNL, Liverpool/CI, Minnesota, Rostock, and SLAC. Many of these are already involved with Cesr-TA, and we will involve additional institutions as the program develops.
- During the EDR phase, ILC-GDE project management will coordinate ILC damping ring work. Plans for the EDR phase are currently being developed.
- We will work with GDE project management to bring new institutions into the global ILC collaboration, in order to provide additional resources and techniques in pursuit of the R&D objectives which are the focus of the CesrTA program.

Question 6

- What resources, if available in FY08, would speed up answers to some of the critical questions?

  Advanced funds for capital equipment and for additional effort in FY08 to implement the following:

  - Full beam position monitor upgrade $350k + 2.6 F.T.E. (65% engineering&computer, 35% technician)
  - Full implementation of laser tracker, targets, magnet movers $267k + 0.5 F.T.E. surveyor/engineer
  - Advance installation of instrumented vacuum chambers $150k + 2 F.T.E. vacuum engineer/designers
  - X-ray beam beam size monitor $125k + 1.8 F.T.E. engineer/physicist
  - Longitudinal feedback upgrade $185k + 0.5 F.T.E. RF engineer

  If less additional effort is available, the program can still be advanced in FY08 with some delay.

Question 7

- What are the consequences if the total funding goes up or down by 30%?

(This is assumed to mean to apply only to the total integrated funding.)

- If the funding were to rise by 30% it could be used to reduce risk of insufficient information in time for the EDR one vs two ring decision by

  Speeding up

  – The provision of the BPM electronics
  – The construction of the x-ray beam size monitor beamline infrastructure
  – The delivery of the wiggler and dipole chambers with the several mitigation approaches built in
  – Providing more of the instrumented dipole and quadrupole chambers for sampling the various environments in the ring.

Question 7

- If the funding were to fall by 30%, it would result in shortening the program by one year, thereby
  - eliminating the possibility of testing ILC DR chamber designs in CesrTA
  - increasing the technical risk that unexpected discoveries of a nature detrimental to potential damping ring performance could not be followed up and mitigated.

Question 8

- Are the measured tuneshift and beam size adequate to fully understand EC behavior in the absence of detailed knowledge of the distribution around the ring?
  - No. KEK-B measures horizontal and vertical tune shifts that depend differently on the excitation of solenoids. CESR measures a vertical tune shift and no significant horizontal tune shift. This difference is presumably because the cloud distribution depends on details of the respective guide fields. Evidently details of the distribution matters.
  - We plan to instrument CESR so that we will be able to determine the distribution around the ring.
    - Representative chambers of every type in CESR will be instrumented with RFAs including
      - drift, quadrupole, wiggler, and 3-4 types of dipole chambers
    - Measurement of the cloud distribution in each of the representative chambers as a function of various beam parameters will allow a reconstruction of the distribution around the ring
    - We will use simulations to complement the direct measurements and as a consistency check.
    - Measurement of witness bunch tune shifts vs driving train current and witness bunch delay will provide an additional consistency check.
    - Other methods to characterize cloud distribution

Question 9

- What are the three biggest technical risks?
  - Failure of all of the proposed E cloud mitigation techniques to be effective
  - Inability of the RFAs to measure electron cloud density and/or energy distribution, thereby making it impossible to determine the cloud distribution around the ring.
  - There is a risk that near term progress in low emittance tuning will be compromised by the limitations imposed by the analog BPM system and visible light beam size monitor. We may, for example find some unexpected instability of the guide field too late to understand and address.