Input to ILC Dump Discussion - 5 December 2007

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A first try at a list, there must be more to add, work needs to be prioritized

Design projects for systems that are understood to be needed and already conceptually designed:

1. Make a complete physics-driven mechanical design of the dump vessel with water flow, heat removal, choice of materials, manufacturing techniques etc

2. Make a complete physics-driven mechanical-, thermal-, flow-, and radioactive-handling-design of cooling loops, heat exchangers, pumps, filters, et

3. Make a mechanical design of the dump window and a window changer mechanism that satisfies the many constraints of reliability and performance.

4. Design the sweep magnet and power supply system (being done by other groups

5. Design the doughnut collimators.

6. Design the location, size and configuration of the dump caverns.

7. Design the dump vessel shielding enclosure.

Analysis projects with the goal of setting the parameters that define the dump systems

1. Establish the level of reliability required in the design (how reliable is reliable enough?). Establish acceptable mean-time-to-failure.

2. Establish the regulatory environment (pressure vessel codes, radiation safety requirements environmental rules, seismic codes, OSHA).

3. Analyze window materials for strength and lifetime in high temperature shock and high-density electron bombardment.

4. Analyze the expected phase space of the beam parameters – bunch charge, spot size, beam position, number and spacing of bunches, and sweep radius -- that is possible at all the high powered dumps and identify regions of phase space where the dump windows w unless protected by some system.

5. Identify the systems and methods needed to protect the windows in those regions of the parameter space where windows are vulnerable. What instruments are required (ion char magnet field and current measurements, fast beam kill signals, fast kick to the tune-up du and what is the required performance of these instruments (how fast, to what level of prec stability, reliability, etc.)

Analysis projects with the goal of setting the parameters that define the dump systems

6. Analyze the potential failure modes of the dump water containment (window burst, weeping, pipe leaks, air contamination, etc) and identify devices and methods to deal with the failure (fast valves, sumps, air driers, etc

7. Analyze the methods for recovery from containment failures to see that necessary equipment is designed in at the right places.

8. As the systems and configurations get established (e.g. three devices protect at all tim do a complete risk analysis to establish overall failure probabilities.

9. Continue the analysis of neutron background that might damage the silicon vertex det and explore ways to reduce the flux (collimators, absorbers in the dump area). Establish with realistic collimator designs whether or not neutrons are a serious irreducible background that demand design changes (bend in the extraction li

10. Do a thorough analysis (by modeling with FLUKA, MARS, etc) of the sources and distribution of prompt radiation from collimators, beam pipes and dump to establish th expected levels that may need mitigation to protect equipment performance (signals) a survivability from radiation damage (electronics, cables etc).

Analysis projects with the goal of setting the parameters that define the dump systems

11. Do a thorough analysis (by modeling with FLUKA, MARS, etc) of the expected locations, levels and lifetimes of residual radiation . Identify potential problems with activation of critical equipment (magnets, movers, sensors, safety equipment, etc).
Look for clever ways to minimize residual radiation.

12. Do an analysis of the vibrations produced by the cooling water flow and mechanical systen to see if they are a problem for stability of the adjacent beam line. If so, what level of mitiga (calm the water flow, move the dump, move the pumps, add absorbers) might be required.

13. Work with the designers of the BCS and MPS systems to evaluate the needs, performance options for instruments and electronics that will be desirable or required to prevent dump fa (for detection and action for magnet failures, beam excursions, dump systems excursions, -- water flow, pressure, vacuum, etc). Establish the design philosophy (software in the loo how many devices are needed, how fast do they act, what is the logic?)

14. Analyze the installation scenarios for the major dump equipment in the cavern in conjunctio with installation scenarios of the nearby beam lines.

15. Analyze the scenarios for maintenance and repair taking into account radiation sources anc required cool down times. What equipment would need to be inspected, and possibly repl how often, and how long would it take to get access and do the work?

Analysis projects with the goal of setting the parameters that define the dump systems

16. Analyze the potential for beam induced boiling in the dump water. Continue the analy possible problems from beam induced pressure waves in the water.

17. Reassess the RDR preliminary concepts to see if larger design changes may be need to ensure windows do not break, such as moving the dump farther from the IP, putting more active and passive components in (beam expander, more quads, …).

18. Analyze the dump cavern and systems for compliance with OSHA type rules: access, egress, noise, lighting, confined spaces, required stay-clear (for cabinet door power panels), electrical safety (access to panels front and back, grounding), etc.

19. Analyze the hoist and rigging requirements (weight capacity, coverage, hook height) for installation, and for maintenance and repairs and specify the parameters for any cranes that may be needed.

20. Analyze the expected lifetime of major components that would be difficult or costly to repair (dump vessel, major piping system, pumps, pressure tanks, etc) and think about what would happen if it were necessary to remove and/or rebuild them. Do we need spares? How will the dump systems be decommissioned

Hardware and software prototyping projects that may be needed to establish feasibility or preferred solutions.

1. Design and build a prototype of the dump window and changer and test it.

2. Design and build a prototype of the sweep magnet and power supply and test it.

3. Make damage tests of potential window materials in high intensity electron beams. Test for strength after irradiation. Look for potential failure modes (modification of alloys by dislocation and temperature shocks, formation of cracks, erosion, etc)

4. Make measurements of backward neutron production at SLAC BDE to compare with modeling codes (FLUKA, MARS), and verify the reliability of the neutron background estimates. (Note, not sure about this one.)

5. Build a complete model of the dump cavern and systems in 3-D CAD for use in analyzing mechanical problems and for input to radiation and vibration modeling code