Studies of ILC 10Hz Operation AD&I Meeting June 23

Models and Questions for 10Hz Operation

Starting point Assumptions and

Possible Model for AD&I Study

JMP June 23, 2010

Starting Definitions and Assumptions

- e+ production pulse refers to the electron pulse (150GeV) that is used to make positrons.

- lumi production pulse refers to the electron pulse (100-150GeV) that is used for collisions at the IP.

- Consider 10 Hz only for lumi operation (8 Hz later)

- Assume full power, 2600+ bunches (lowP later)

- For first round assume two options, 2 X 6,4 km DR's or 4 X 3.2 km rings in one tunnel and that e-cloud suppression is not an issue with either case.

- Assume two options where Lumi beam goes through undulator or through a bypass. See later slides

Questions which could reduce the number of options and therefore future workload

- Is a 10 Hz, 6.4 km DR technically feasible and affordable? **OR SHOULD WE DROP IT AND HAVE 4 RING SOLUTION!**

- Are there problems that only have solutions for the LowP (1300+ bunches)? **POWER ON COLLIMATORS, TARGETS ETC**

- Is a 5 Hz pulsed photon beam absorber for the lumi pulse worth considering and feasible? **SEE SLIDE**

- Is it worthwhile having parameter sets with and without lumi beam going through the undulator? **LOW ENERGY SPREAD**

- If 3 nsec kicker capability is assumed then 4 X 3.2 rings can be 3 X 3.2 km **E- RING WITH 2600 BUNCHES**

Questions continued.
To Bypass Undulator or not?

- Bypass for Lumi beam would be long. At energies ≈ 150 GeV it has to separate from beamline, pass the undulator and photon drift before catching and matching into BDS

- Kicker jitter could be removed by kicking only prod beam and DC for lumi.

- Is smaller energy spread a big deal not just nice! Should try to get quantitative answers? How long will that take –'months' is too long?

E- Injector Systems at 10Hz Reviewed by Axel & Ewan on June 14

- Assuming full power at 10 Hz we reviewed
  Laser Systems, Photo-Cathode, Warm capture and accelerator systems and booster linac.

- Power handling capabilities or limits are determined by power in the 1 msec, 2600 long bunch train, NOT repetition rate. Will need ≈ doubling of average cooling capacity and input power but no technical issues.

- Made no attempt to optimize RF systems which will deliver double the power at full gradient. Not a technical problem but will be required for cost estimations.   **Q**

- No changes in the laser/cathode R&D program required.

SUGGESTED MODEL for STUDY of LOW ENERGY OPERATION with 2600 Bunches and ???'s

- **E- Injector thru Booster operating at 10 Hz**

- **One 3.2 km E- DR with shortened damping time and 3 nsec kickers ? for 2600 bunches**

- **E- Compressor and E- linac operating at 10 Hz, 5 for E+ prod at ≈ 150 GeV at end of linac and 5 Hz for Lumi at ≤ 150 GeV through standard BDS path.**

- **Both Prod and Lumi beams through undulator at end of linac. Photons from prod beam incident on target where all systems including booster operate at 5Hz.**

  Photons from Lumi beam absorbed before tgt ? And dump 150 GeV prod E- beam conveniently ??

- **E+ to 2 DR's (1300 bunches each) ? (RF systems modified for 50% duty cycle operation) ? and then to RTML, e+ linac and BDS all operating at 5 Hz.**

A pulsed photon beam absorber?

- Next slide is a crazy idea or an interesting concept for a pulsed photon absorber that needs more study and discussion at a later meeting. The details are left to the student!

- The original idea was for a similar fixed field permanent magnet device which moved a cm or two at 5 Hz with flexible vacuum and water connections.

- The device in the next slide is 'electromechanical' but no moving vacuum or cooling connections, just vibration!!

A pulsed photon beam absorber?

- **Consider a 10 to 20 radiation length absorber which is made up of 100 x 0.05 to 0.1 rl foils ,of say Boron Carbide, spaced by 10 cms, inside a water cooled vacuum pipe all of which is in a pulsed, few Kg, magnetic field. SOME OLD SYNCHROTRON MAGNETS?**

- **Mode of operation. At 5Hz rate (could be half sine wave) the magnetic field turns on and activates a mechanism that pulls the foils into the photon beam path. The shower is spread by the field over the 10 meters into the water cooled pipe walls (or fixed absorbers) and controls (lowers) the power density on the foils.**

- **Somewhere there is an optimum distribution of foil thickness, spacing and magnetic field which absorbs all the power (300kw) in a 10 m long device! PHOTON DUMP DOES THIS IN 1m of PRESSURIZED H2O**

- **With field off, foils are out and photons have clear path through system which could be placed in the drift ahead of the E+ target system.**