

Electron Damping Ring Bypass Scheme for the 10 Hz option

DR Technical Baseline Review

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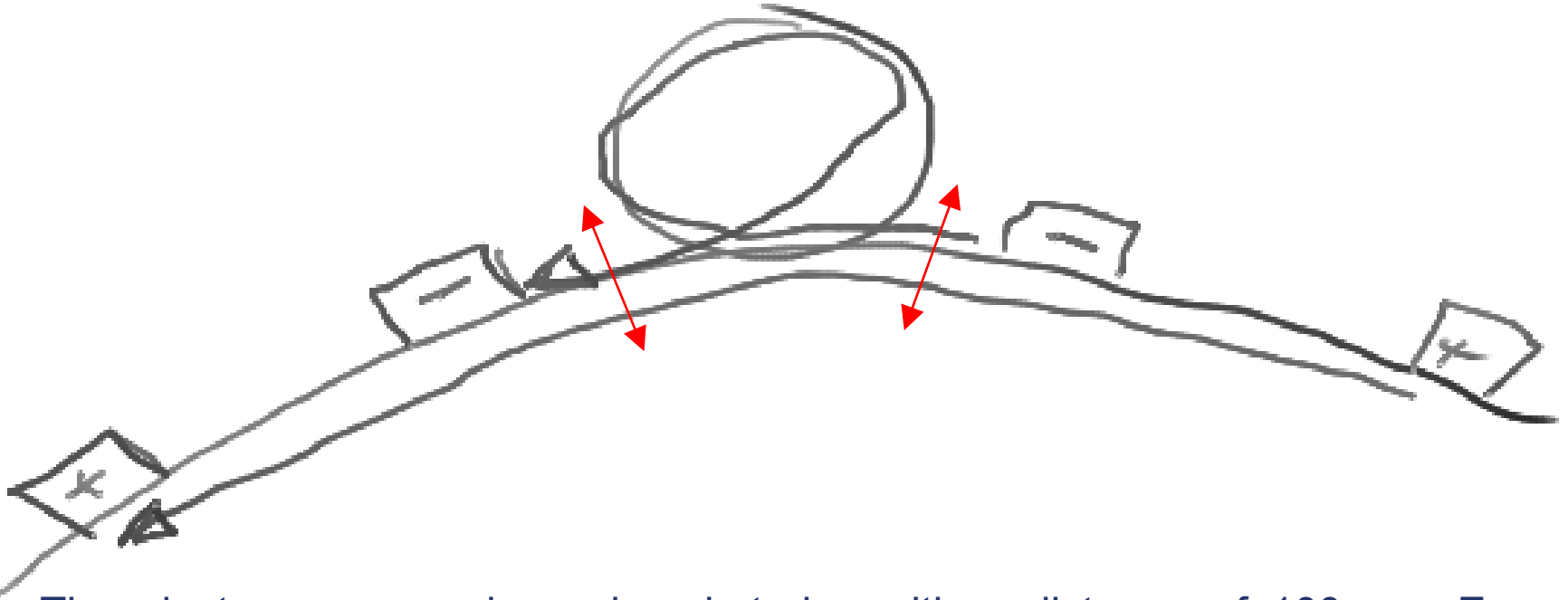


- 10 Hz Proposal from Ref. 1 (Ewan P.)
 - A relocation of the positron source systems from the nominal 150 GeV point of the electron Main Linac to the exit of the electron Main Linac (≤ 250 GeV depending on physics scenario), and integrated into the beginning of the Beam Delivery System.
 - The new baseline proposal includes a description of a possible low energy operating scheme. The scheme (10 Hz running, alternate pulse) is consistent with the RDR.
 - “Physics runs are possible for center of mass energies above 200 GeV.”
 - Electron source, Damping Rings and Electron Linac operate at 10 Hz.

- 10 Hz Proposal from Ref. 1
 - DR's Damping time reduced to $\frac{1}{2}$ of RDR value.
 - Positron DR operates with 50 % duty cycle.
 - All are technically feasible but (Red) indicates increased cost.
- With a bypass the Electron Damping Ring could operate at 5 Hz and the RDR values.
- This saves cost and electrical power.
- The Positron DR still operates with 50 % duty cycle.

Bypass Scheme for Electron DR

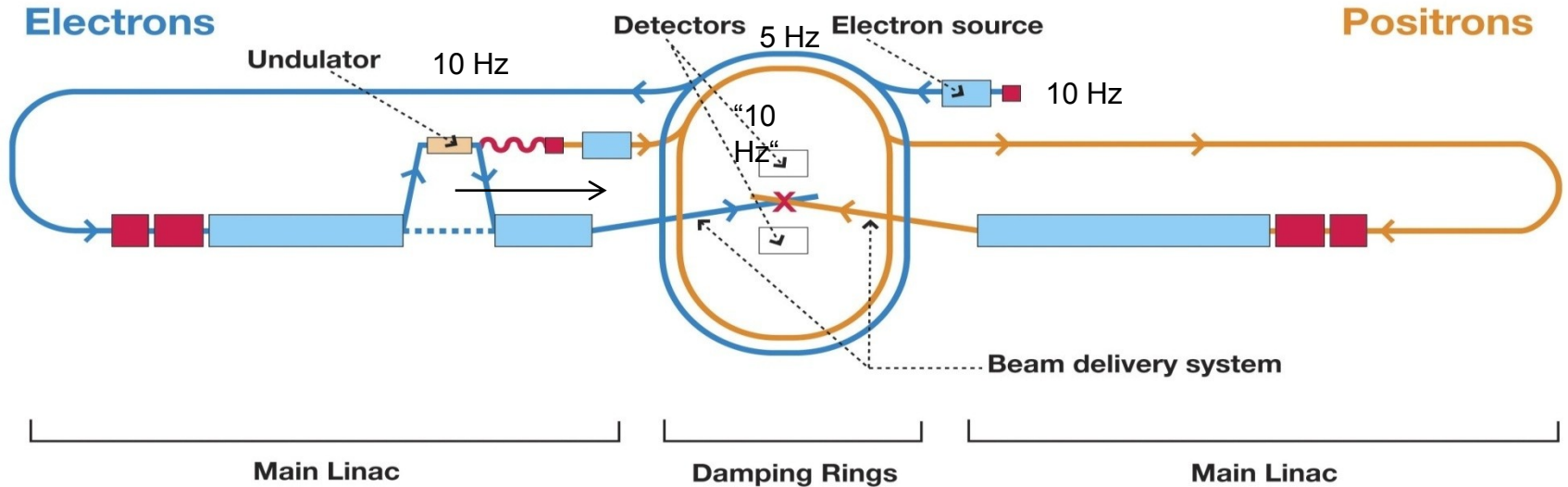
- Sketch of Electron Damping Ring Bypass Scheme.



- The electron gun produces bunch trains with a distance of 100 ms. Every second bunch train will be damped in the damping ring for 200 ms. The other bunch trains will be bypass to the damping ring. The effect is that the sequence of two consecutive bunch trains will be reversed. The distance is the same and if you are comparing the bunch trains before and after the damping ring you cannot distinguish between 5 and 10 Hz DR operation except the emittance.

Bypass Scheme for Electron DR

- ILC RDR baseline “Schematic” of Major Subsystems



- It must be considered that the Ring to Main Linac, the Main Linac and the Positron source could handle the higher emittance electron beam



Bypass Scheme for Electron DR

- Invariant emittance: 8 mm mrad x 0.02 mm mrad vs 1 mm mrad in both planes (for a state of the art laser gun).
- I discussed this scheme briefly with Susanna. She recommended to ask the RTML and Main Linac Accelerator Physicist if the high emittance beam could cause problems. I extended this question also to the positron source.
- Do you see any problems for this option?



Bypass Scheme for Electron DR

- Kiyoshi Kubo: “Positron beam is produced by the bypassed electron beam. The positron beam is stored in DR for about 200 ms. Then, it cannot collide with damped electron beam. The timing difference is about 100 ms.”
- In the bypass schema the positron DR isn't changed. The positron damping time is as it is for the full schema 100 ms.
- Kiyoshi Kubo: “I think the larger emittance of the electron beam is fine in the main linac. Probably longitudinal parameters are also OK.”



Bypass Scheme for Electron DR

- Kiyoshi Kubo: “But required beam parameters for the e⁺ production and parameters of the bunch compressors should be checked.”
- Wei Gai: “This is very interesting idea and probably will work. Only impact on us would be the lattice for the electron beam in undulator, which is optimized for electron beam from the damping ring.”
- Lager beam size and round beam makes the power density handling in the positron target easier.
- Nikloday Solyak: No reply up to now.



Additional Advantages

- Synchronization can be adjusted independent of the Damping Ring revolution time by shifting the gun trigger of the Electrons for producing Positrons.
- This trick can also be used for extending the Positron DR damping time slightly.

- From Susanna's slides presented at BAW11 (Ref. 2) page 4 to 7 you can estimate the savings (roughly one third of the cavities, klystrons, wigglers, subsystems, and half of the electrical power and process water cooling in the Electron DR).
- And one can avoid a lot of confusion in the CFS group.



Summary

- The bypass scheme works as in a first careful look.
- Therefore I like to recommend this scheme.
- If time and manpower will be available further investigations should be done.
- Thanks for your attention!

1. Ewan Paterson, [*Positron Source Overview and Layout*](#), Second Baseline Assessment Workshop, SLAC, Menlo Park, California, January 20, 2011.
2. Susanna Guiducci, [*Positron Source Relocation Damping Ring @ 10Hz*](#), Second Baseline Assessment Workshop, SLAC, Menlo Park, California, January 18, 2011.