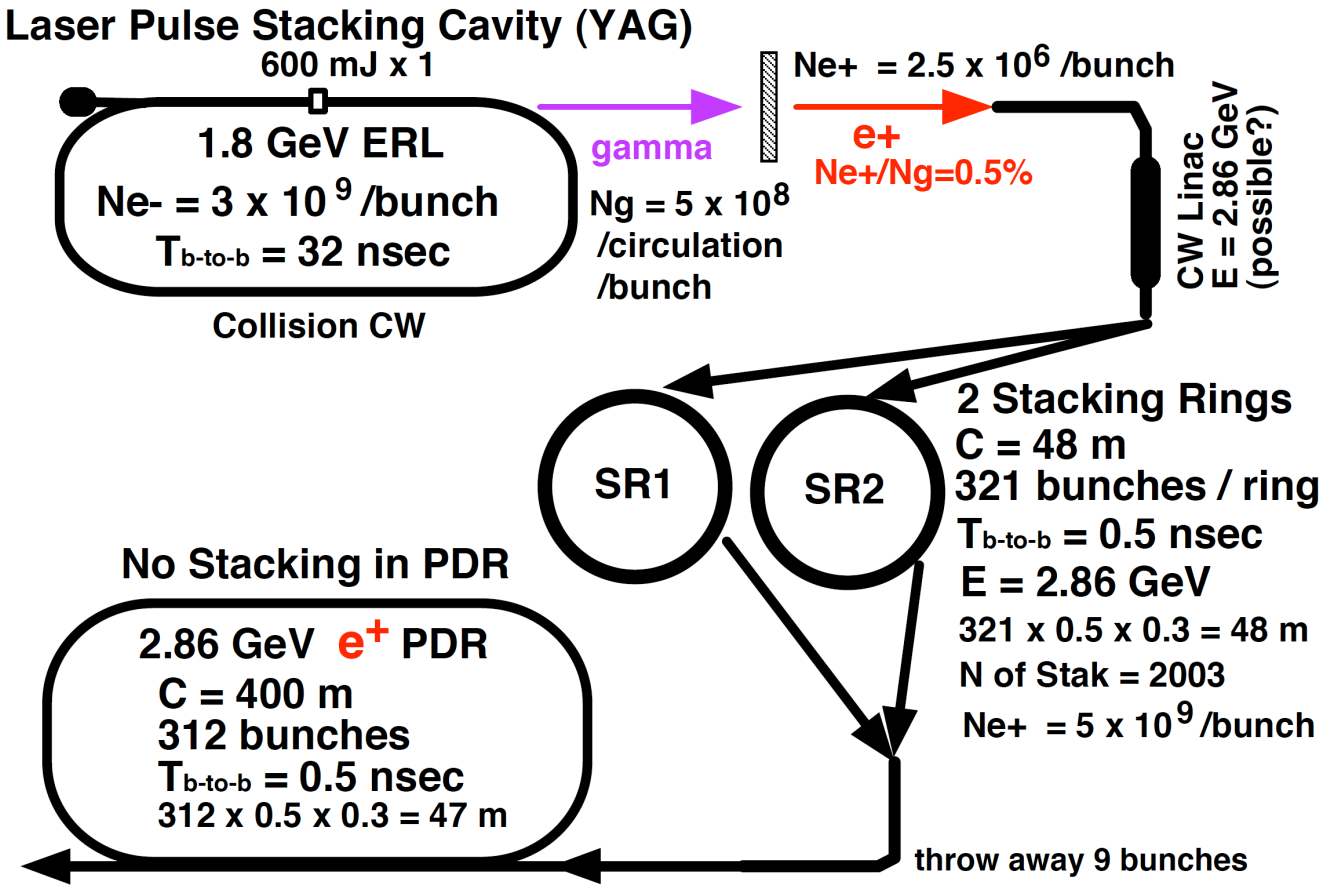
ERL Compton scheme for CLIC



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ILC-CLIC e+ studies

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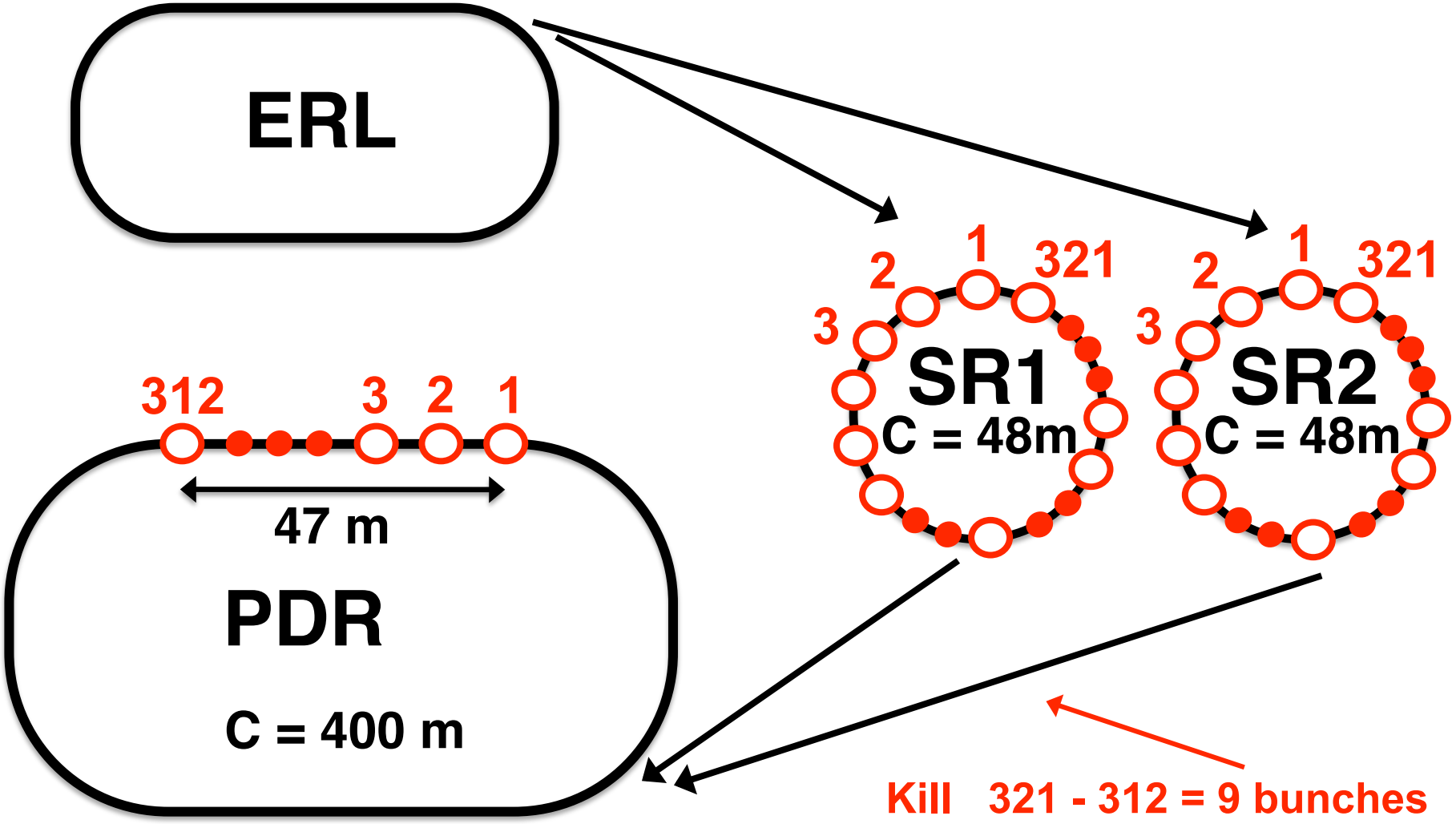
CLIC e^+ source parameters

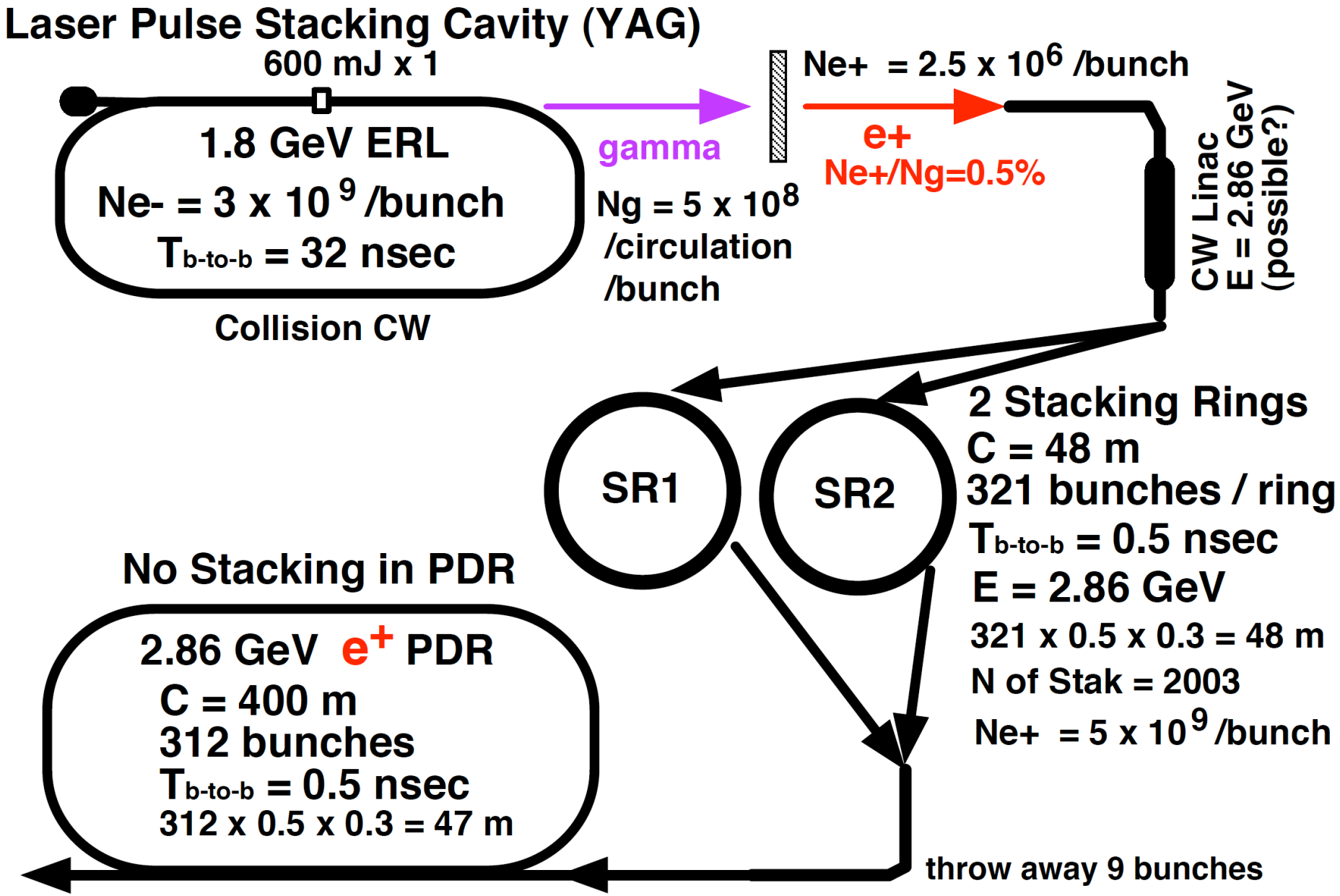
- 4.2 x 10^9 e^+/bunch (exit of Pre Damping Ring:PDR)
- E (PDR and DR) = 2.86 GeV
- $T_{b\text{-}to\text{-}b}$ = 0.5 ns
- $C_{DR} = C_{PDR} \sim 400$ m
- N_{bunch} = 312 / trian
- F_{rep} = 50 Hz (N_{train} = 50/sec)

Solution

Put 2 stacking rings (SRs) between ERL and PDR to separate stacking and damping functions.



Configuration



Stacking Ring (SR)

SR makes stacking and pre^2 damping

- C = 48.15 m
- 0.156 μs / turn
- 321 bunches in a ring

  321 x 0.5 ns x 0.3 m/ns = 48.15 m

match

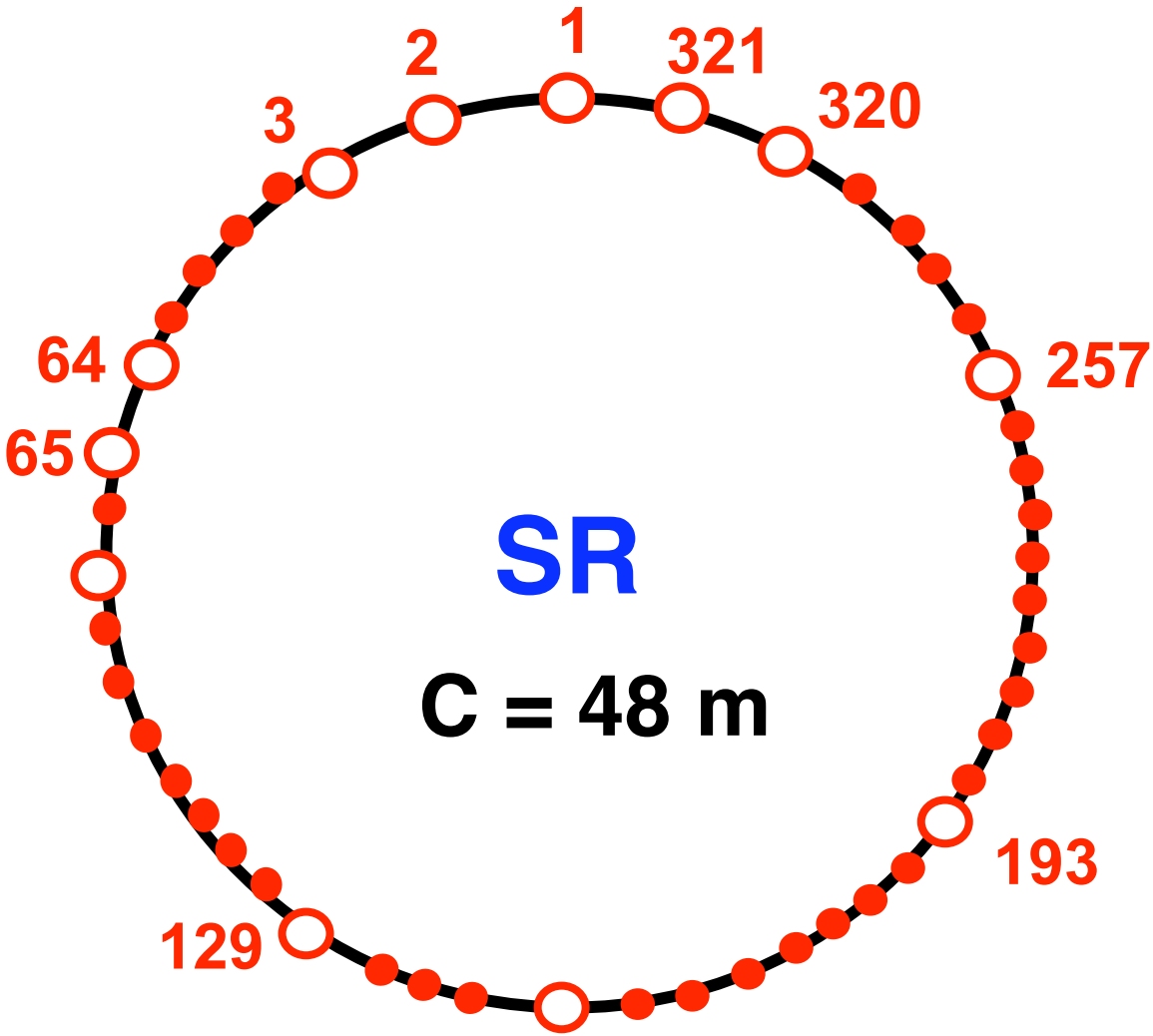
- stack in the same bucket every 64th turn
- N of stacking in the same bucket = 2003

  64 x 2003 = 128 192 turns = 1.2 x 10^5 turns

  0.156 μs x 1.2 x 10^5 = 19.9979 ms ≅ 20 ms
- "Stacking = 20 ms" + "Damping in SR = 20 ms"
  --> total 40 ms /cycle (25 Hz)

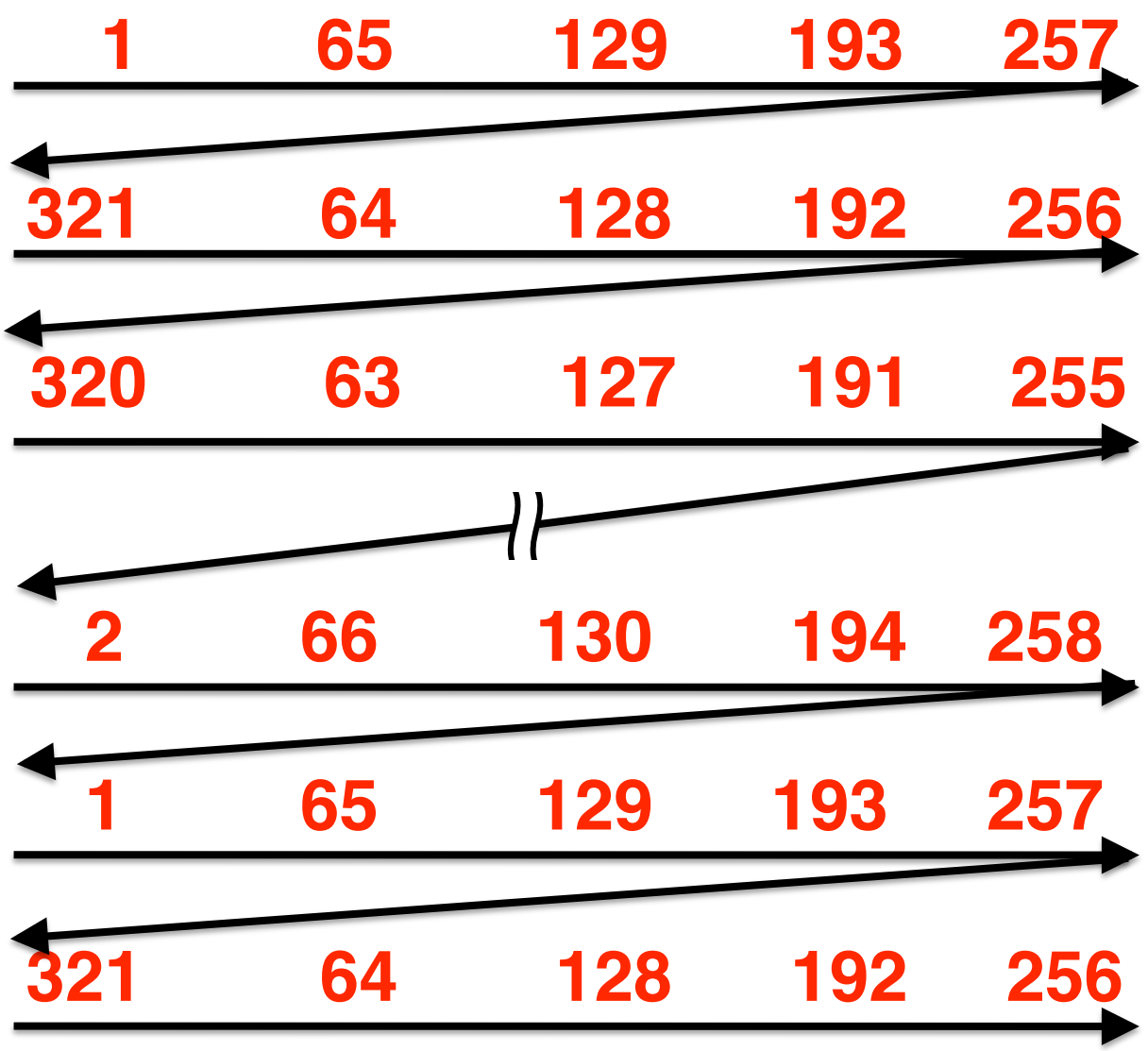
Stacking in a SR : part 1

We give labels "1" to "321" to the buckets in the SR.

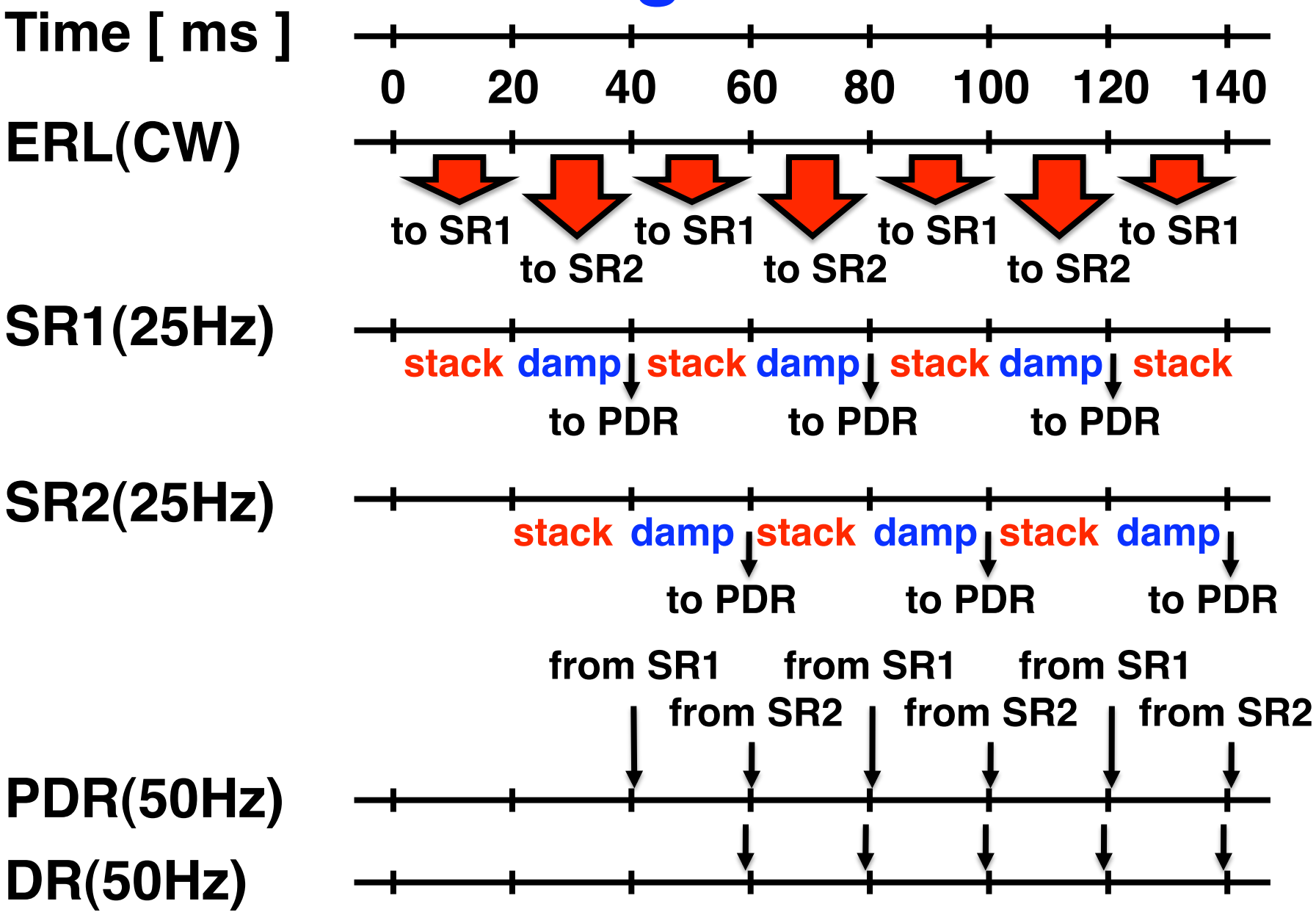


Stacking in a SR : part 2

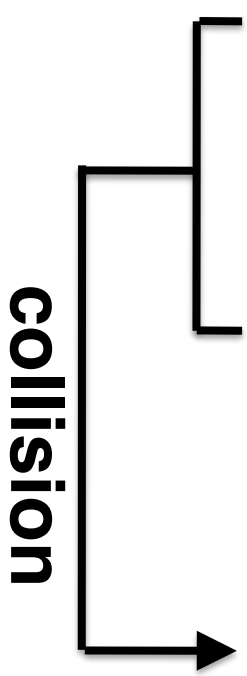
- 1st turn
- 2nd turn
- 3rd turn
-
-
- 64th turn
- 65th turn
- 66th turn
-



Timing Chart



Number of γ-rays/ e^+s



- e^- beam (ERL)
  - 3 x 10^9 e^-/bunch
  - E = 1.8 GeV
- Laser
  - 600 mJ / cavity
  - 1 cavity in ERL
- 5 x 10^8 γ-rays/bunch

↓ thin conversion target: yield 0.5 %

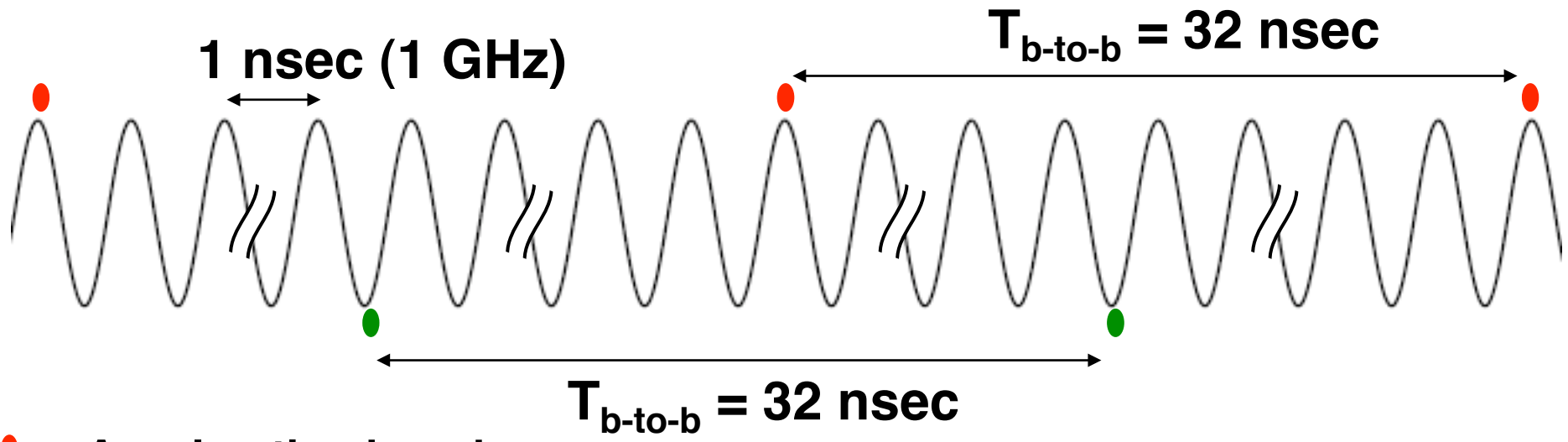
- 2.5 x 10^6 e^+/bunch

↓ 2003 stacking in the same bucket

- 5 x 10^9 e^+/bunch (CLIC requires 4.2 x 10^9)

ERL

- 3 x 10^9 e^-/bunch
- E = 1.8 GeV
- $T_{b\text{-}to\text{-}b}$ = 32 ns
- F_{ref} = 31.25 MHz
- F_{RF} = 1 GHz (for example)



Summary

- A solution where stacking and damping are decoupled seems possible to fulfill CLIC requirements with an ERL scheme

- Challenge remains to be demonstrated in order to make 2000 stacking in a same bucket

- Stacking ring with 48 m circumference and 2.8 GeV is also a challenge.

- The cost increase with 2 storage rings is not an issue compared to the rest of the complex.

Backup slides

Configuration (b)