





DR Location

What must be taken into account?

- Main linac location in Phase 1 (500GeV CM)
- DR shape (shared tunnel or independent tunnel)
- Undulator for positron (simple if conventional method)
- Else
 - spin rotator
 - BC1, BC2
 - turn-around for feedforward

Linac Location in Phase 1

4 cases of linac location in 500GeV phase

- F : Fill 1TeV tunnel, run at half gradient ✕
- U : Linac at upstream in 1TeV tunnel ✕
- D : Linac at downstream in 1TeV tunnel ✕
- D' : Only 500GeV tunnel constructed in phase 1 ✕

D' has the advantage

- Cost of phase 1 minimum
- Phase 2 construction/installation during phase 1 operation

Vibration/ground motion tolerable during operation?

If not, this is a disadvantage.

(long shutdown of tunnel construction for upgrade)

DR Shape and Location

2 cases of DR shape

S : Shared tunnel (dogbone)

I : Independent tunnel (incl. surface) (circular ring)

Assume

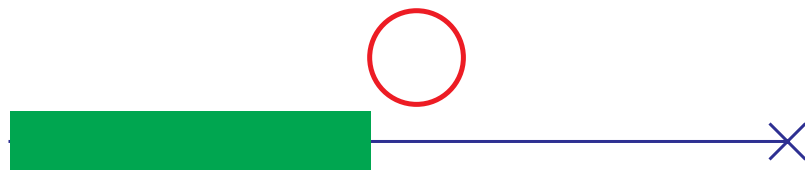
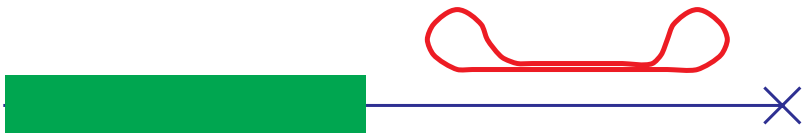
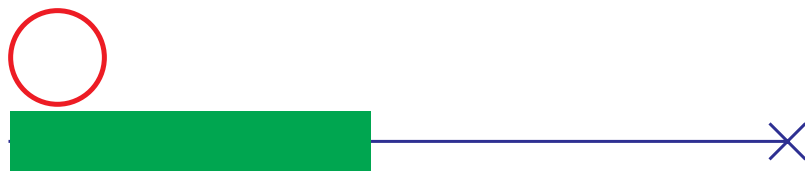
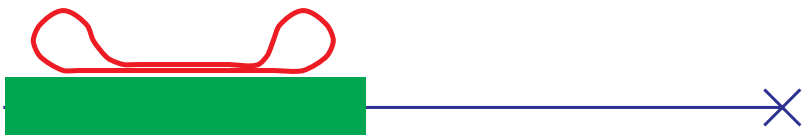
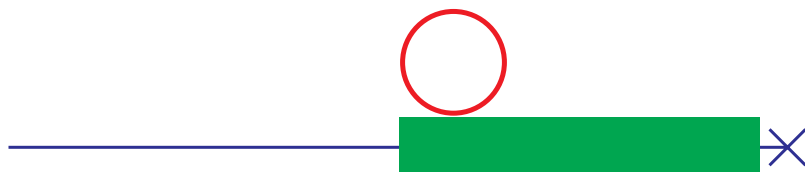
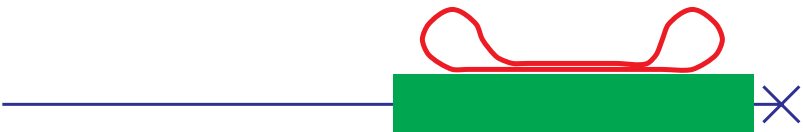
- Do not move the location of DR for upgrade

For each of S and I, possible locations are specified by

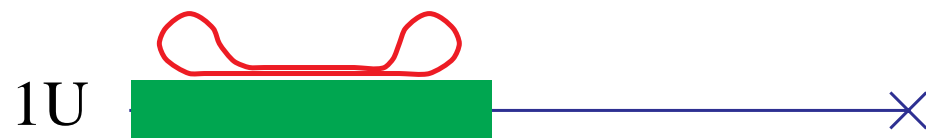
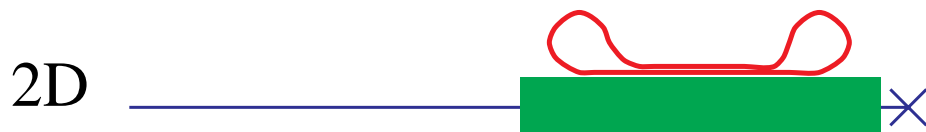
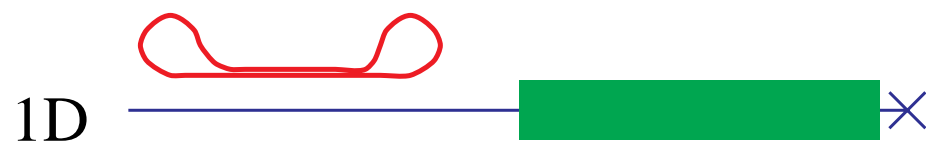
1. DR at upstream tunnel
2. DR at downstream tunnel
3. near BDS (only for case I. Share DR tunnel for e^+ and e^-)

Let's exclude some of the cases

- Exclude F
 - Phase 1 most expensive
 - Low gradient not preferable for dynamics
 - Need RF distribution change in upgrade
- Exclude D'
 - Upgrade perhaps may take time though phase 1 least expensive
 - but actually similar to D for DR location consideration
- Exclude Location 3 (near center)



- Perhaps, among these 8, dogbone and circular ring will not make difference so long as DR location problem is concerned
- except that the interference problem must be taken into account for dogbone
- Choose dogbone figures here in order not to forget about interference.



Criteria

May include insignificant items

1. tunnel length
2. beamline length
3. require linac module movement at upgrade ^{a)}
4. require e⁺ undulator movement at upgrade ^{b)}
5. stray field onto DR
6. upgrade installation during phase1 operation
7. feedforward turn-around
8. commissioning scenario
9. Others?

- a) when low energy part must have different quad configuration
- b) needed if e⁺ to be generated always at same energy

Input from WG1

- High grad from the beginning is preferred (exclude F)
- When DR injects to upstream tunnel
 - BC must be immediately before linac
 - Prefer linac in upstream tunnel
- When DR injects to downstream tunnel
 - No consensus
- Minimize low energy transfer in any case
- Turn-around for feedforward recommended

Pros of Upstream Linac

- Can change optics for low E to high E
 - Constant E positron generation (undulator)
 - No low E long transport (if upstream DR)
 - Bunch compressor right before linac
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- Downstream linac (with downstream DR) can minimize the shutdown at upgrade

Pros of Upstream DR

- Shorter transfer line (or no need to reconstruct transfer line at upgrade)

Recommendation ?

- Prefer upstream linac
- Prefer upstream DR
 - Unless dogbone is selected and the stray field problem turns out to be too serious
- Surface or underground
 - Site-dependent

DR Location in Tunnel Cross-section

1. Ceiling
2. Under cryomodule