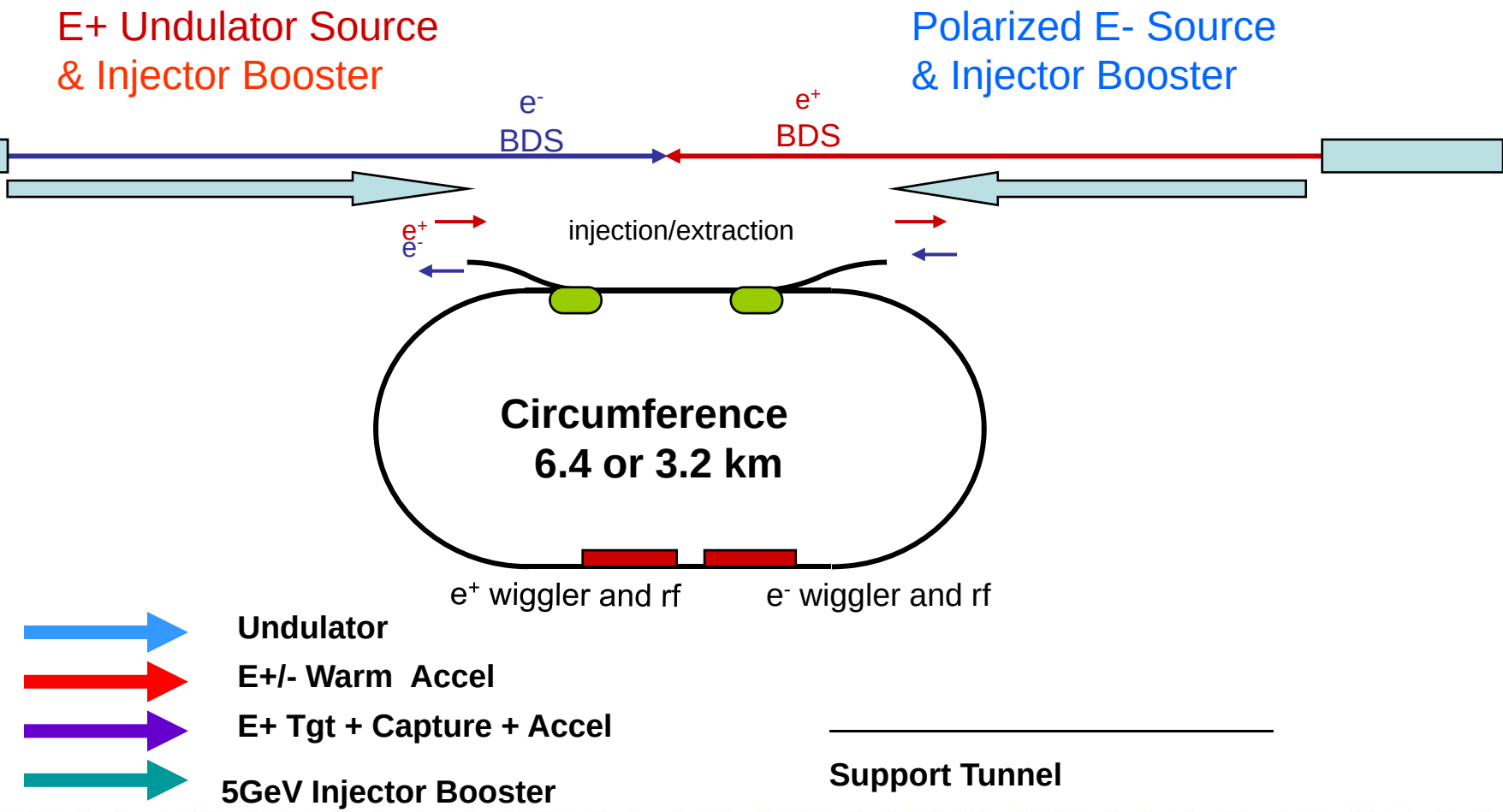
AD&I on CENTRAL SYSTEMS

JMP May 2009

- Description of systems
- Case studies
- Proposed study plan
- Required working decisions
- Required information from systems
- Discussion

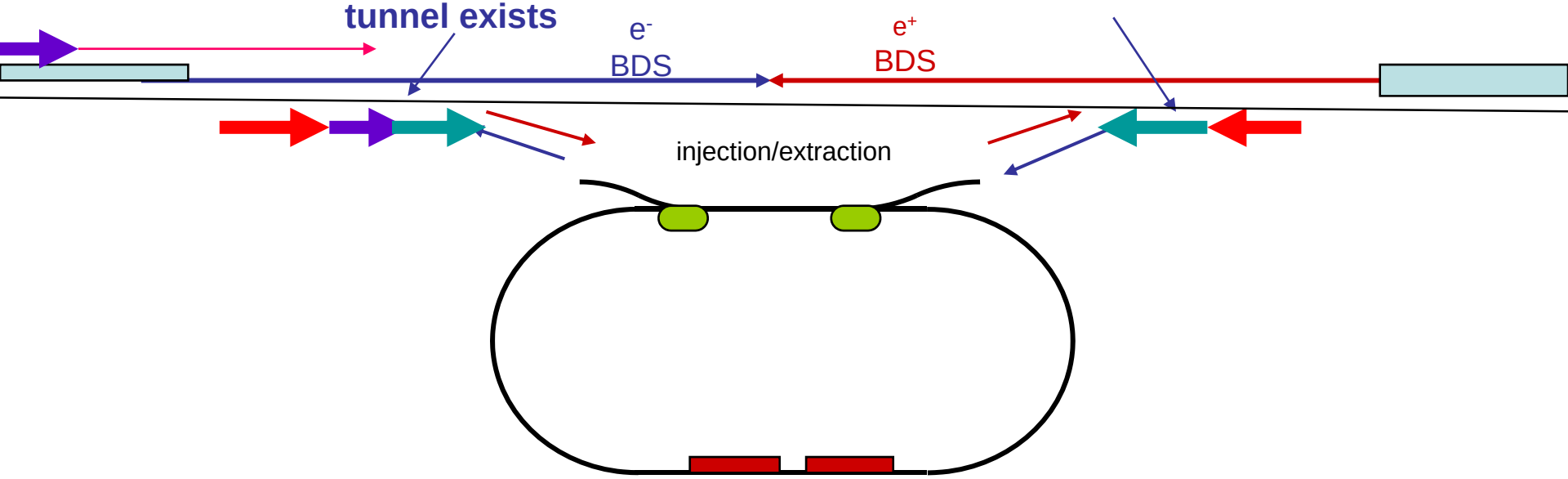
Central Region Systems



Central Region RDR Case (Updated)

Undulator + E+ tgt + 400Mev accelerator in 1.2km insert in linac

Keep Alive source + Booster and E- Injector + Booster are in a third tunnel out of plane with the linac. i.e support tunnel exists



Undulator e+ wiggler and rf e- wiggler and rf

E+/- Warm Accel

E+ Tgt + Capture + Accel

5GeV Injector Booster

Comments on RDR Case

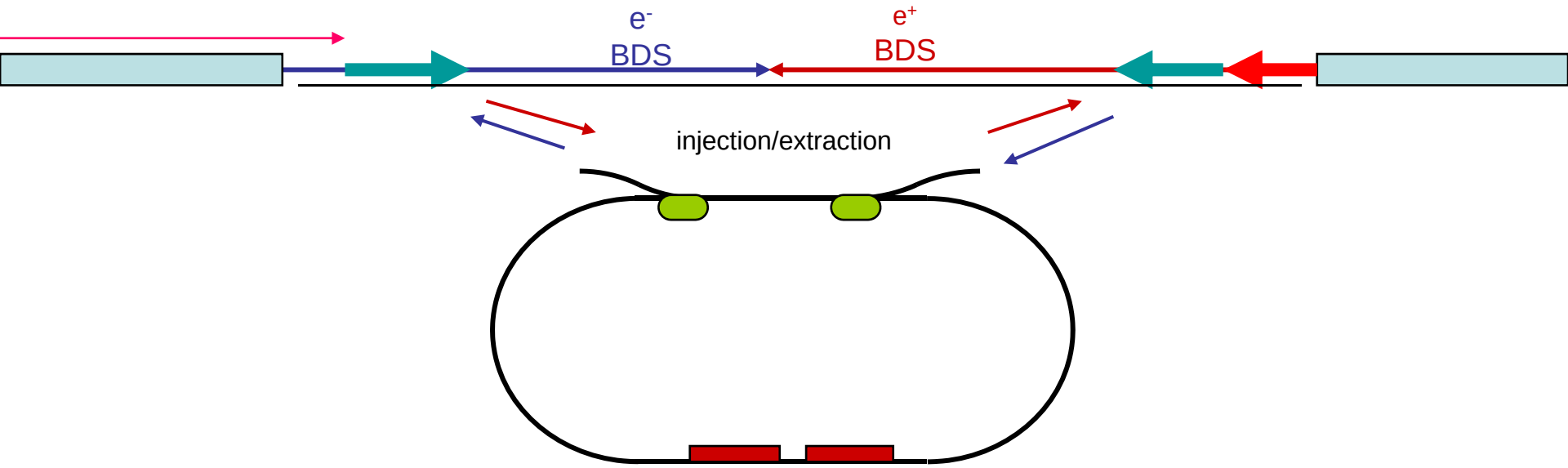
- In this Central Region there are 3 tunnels

- 1) The BDS from the linac end to IR, both sides
- 2) Tunnel containing E+ and E- sources including 5 GeV injector booster accelerators and KAS
- 3) One support tunnel shared between Sources and BDS

- To allow independent commissioning and or operation the sources and DR's are offset either horizontally or vertically from the BDS and the IR.

Central Region Case Study 1

5 GeV Boosters share tunnel with BDS
E- Gun and injector share tunnel with BDS
Undulator + Aux Injector + E+ Tgt-Capture-Accel in 1.2 km insert in linac
No Keep Alive source and two tunnels, beam + support



Undulator e^+ wiggler and rf e^- wiggler and rf

E+/- Warm Accel

E+ Tgt + Capture + Accel

5GeV Injector Booster

Comments on Case (1)

- There are now 2 tunnels, approx 4km less
- E- injector and both Boosters share tunnels with early part of the BDS's and there is still a support tunnel which these systems share.
- The Auxiliary E+ source is not as useful as the old KAS as in traverses half of the linac tunnel before getting to the Booster and DR.

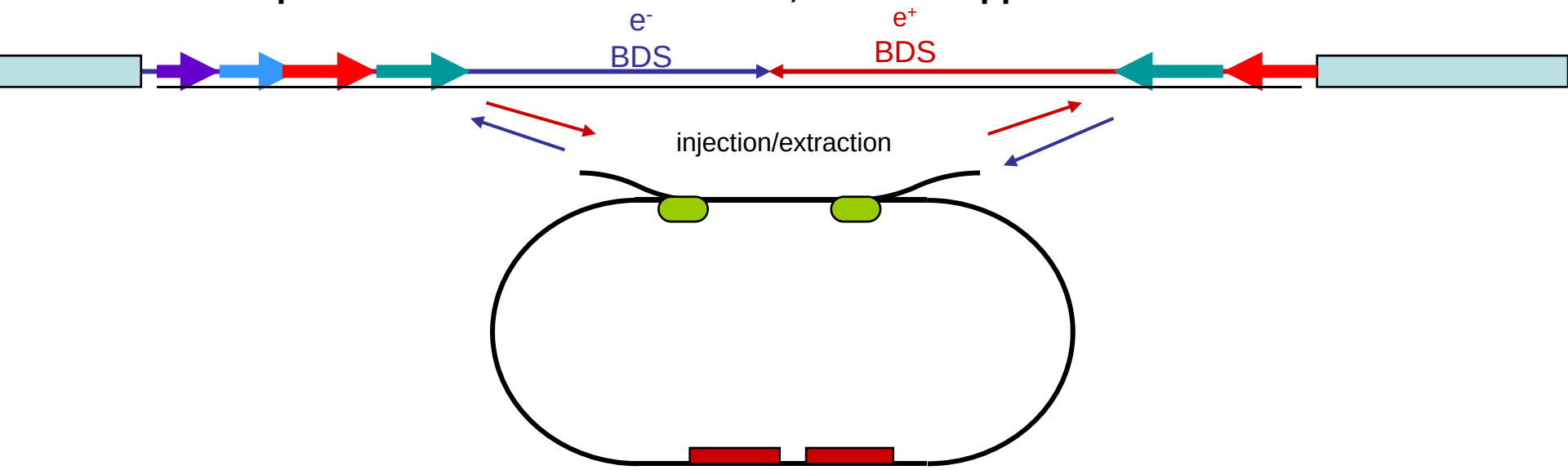
Central Region Case Study 2

5 GeV Boosters share tunnel with BDS

E- Gun and injector share tunnel with BDS

Undulator + Aux Injector + E+ Tgt-Capture-Accel + Booster share tunnel with BDS

No Keep Alive source and two tunnels, beam + support



Undulator e^+ wiggler and rf e^- wiggler and rf

E+/- Warm Accel

E+ Tgt + Capture + Accel

5GeV Injector Booster

Comments on Case 2

- If there is NO overlap between E+ source systems and BDS components, then total tunnel length remains as in case (1) but Aux E+ source can serve the same function as KAS, i.e. independent of the linac access, but with lower power.

- With Varying Amounts of overlap, the length of the beam tunnel and support tunnel on the E+ side can shrink by up to 2 X 1km and perhaps the E+ target vault and the end of linac services vault can be combined?

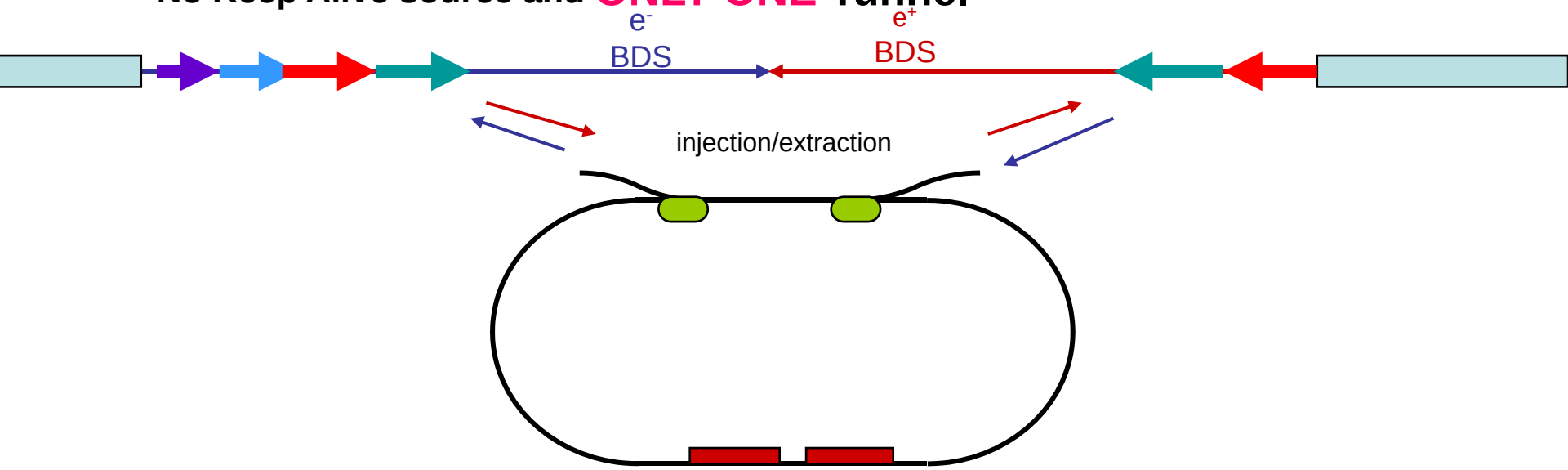
Central Region Case Study 3

5 GeV Boosters share tunnel with BDS

E- Gun and injector share tunnel with BDS

Undulator + Aux Injector + E+ Tgt-Capture-Accel + Booster share tunnel with BDS

No Keep Alive source and ONLY ONE Tunnel



Undulator e^+ wiggler and rf e^- wiggler and rf

E=/- Warm Accel

E+ Tgt + Capture + Accel

5GeV Injector Booster

Comments on Case 3

- Here the approx 4 km of support tunnel has also been removed.
- In other cases the HLRF, PS.s etc for the Injectors plus Booster Linacs were in the support tunnel but here they need shafts, Klystron Clusters, alcoves or some other solution such as a larger tunnel. There is now much more active equipment and beamline components sharing a single tunnel than in the Linac!

- Which cases should we study for AD&I in 2009?
- See next slide(s) for discussion.

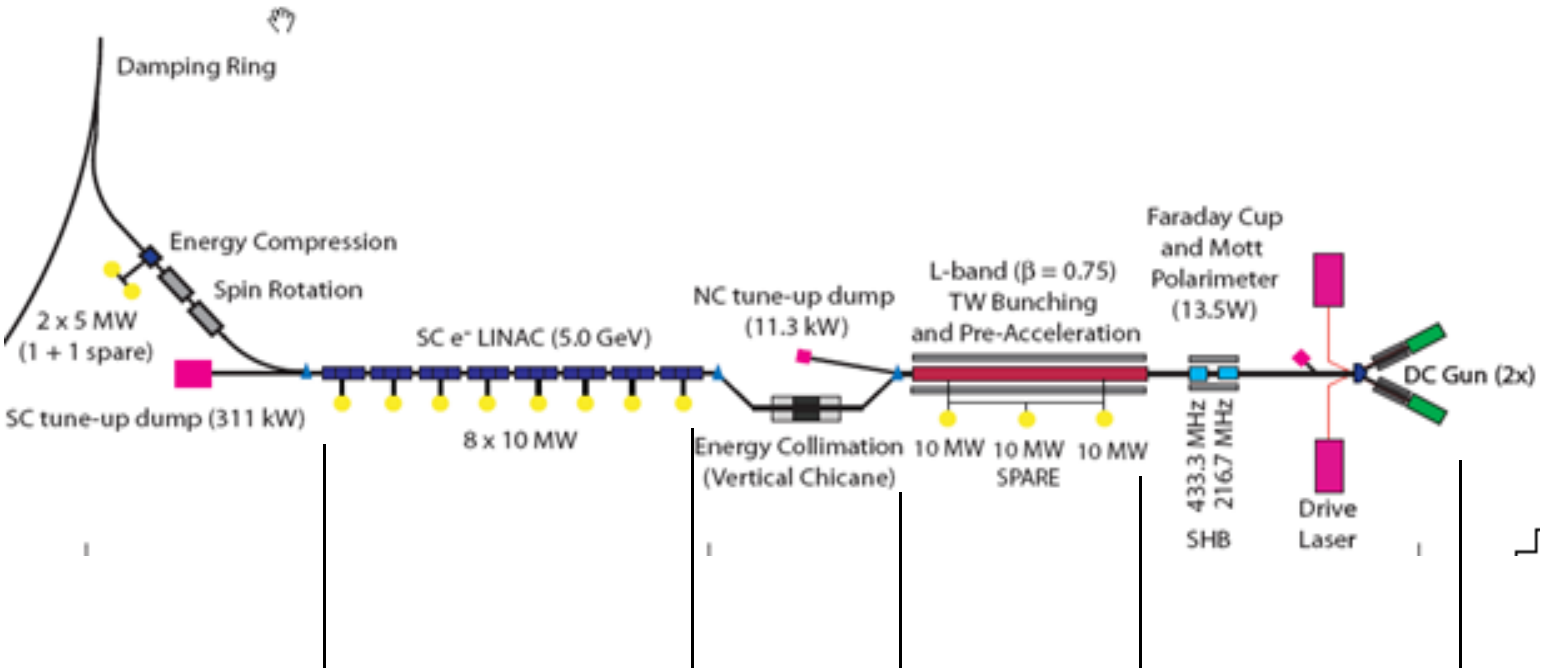
Proposal for studies

- Case 3 would be the "ideal" most compact solution but we must understand the technical impacts on design, commissioning and operation.

- Therefore I propose a two step approach, that studies cases 1and 2 in parallel then after achieving self consistent solutions move on to 3. We do NOT need a complete impact analysis for each step but rather viable solutions.

- The goal would be to be ready to present and discuss a first cut at a final step 3 layout in Albuquerque and begin a final cost and impact analysis!

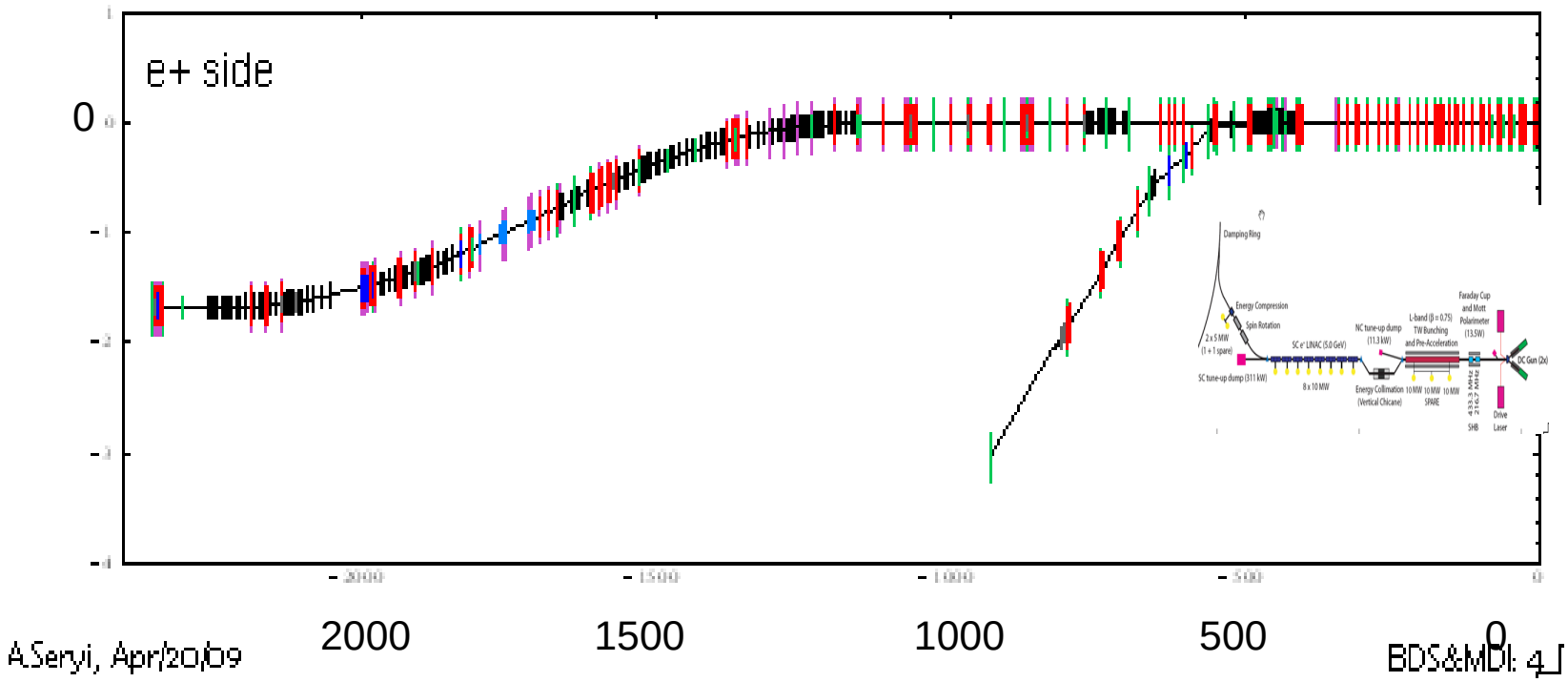
RDR E- INJECTOR (Not to scale)



245 m 54 m 14 m 7 m

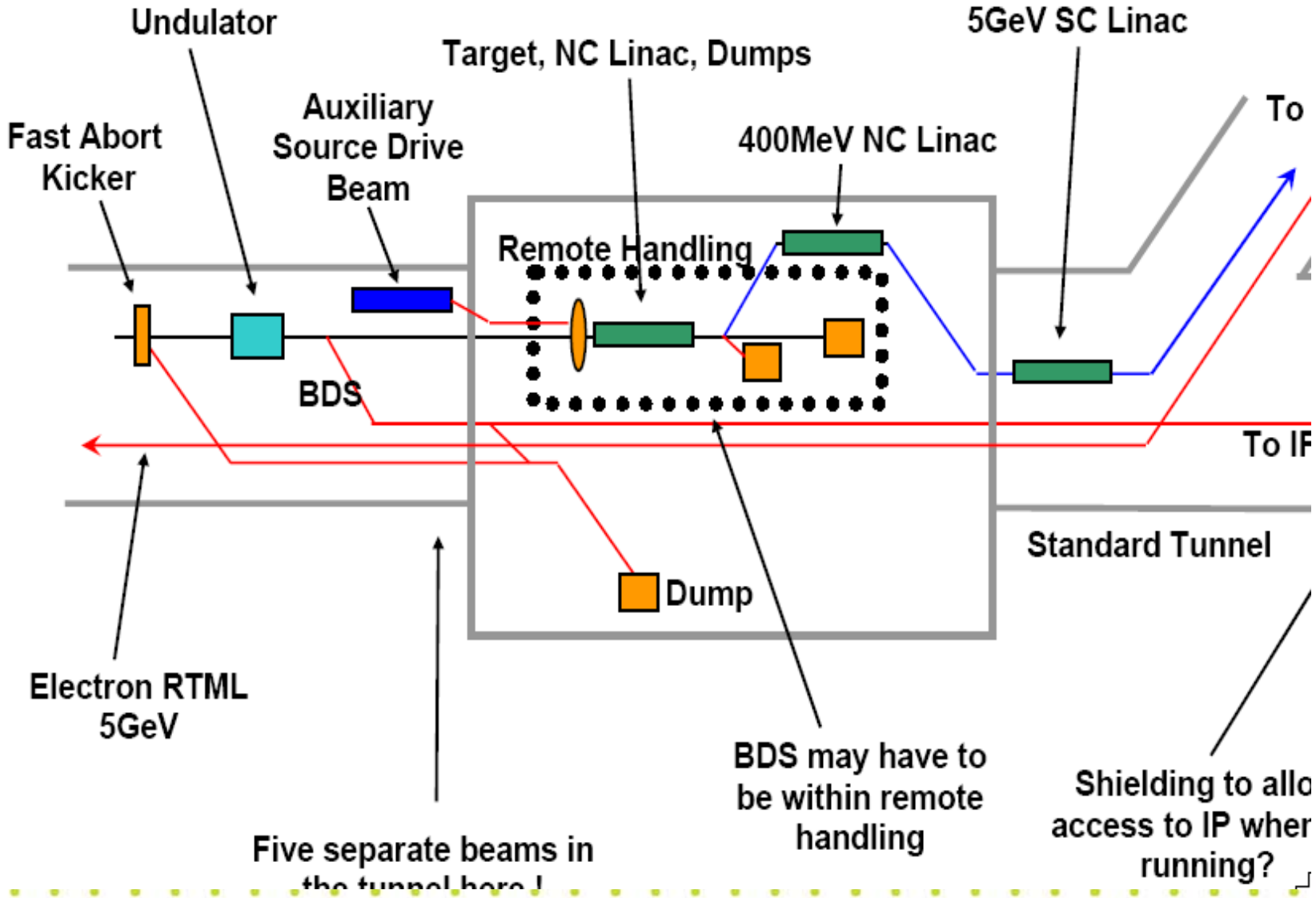
Reference Fig 2.2-1 and 2.2-4 in RDR and Lattice Files have not changed

Combined E- Injector and E+ BDS

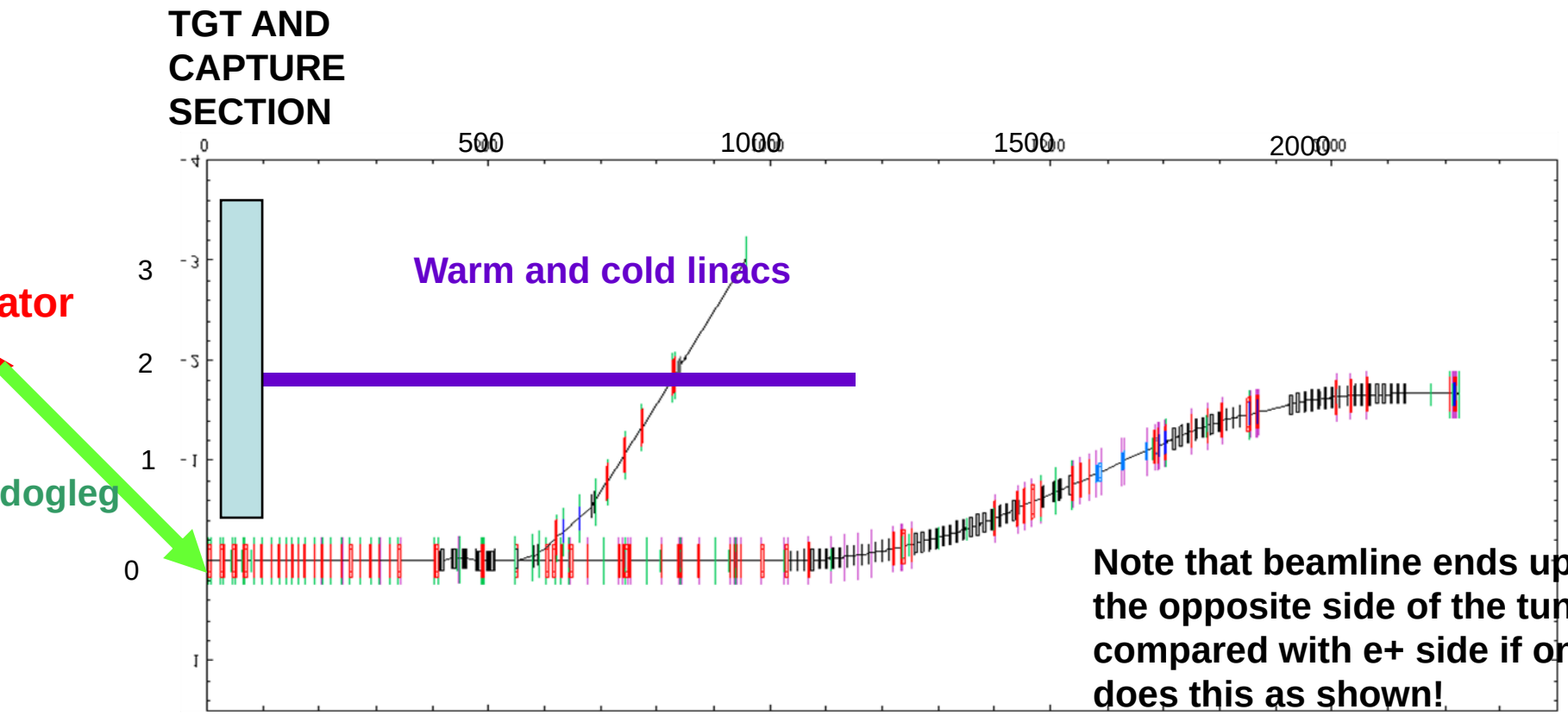


Lattice files exist for both of the systems in the above sketch. Longitudinal scale is roughly correct but in the transverse plane the injector components are cryostats or of similar transverse size.

E+ SOURCE from TIL09

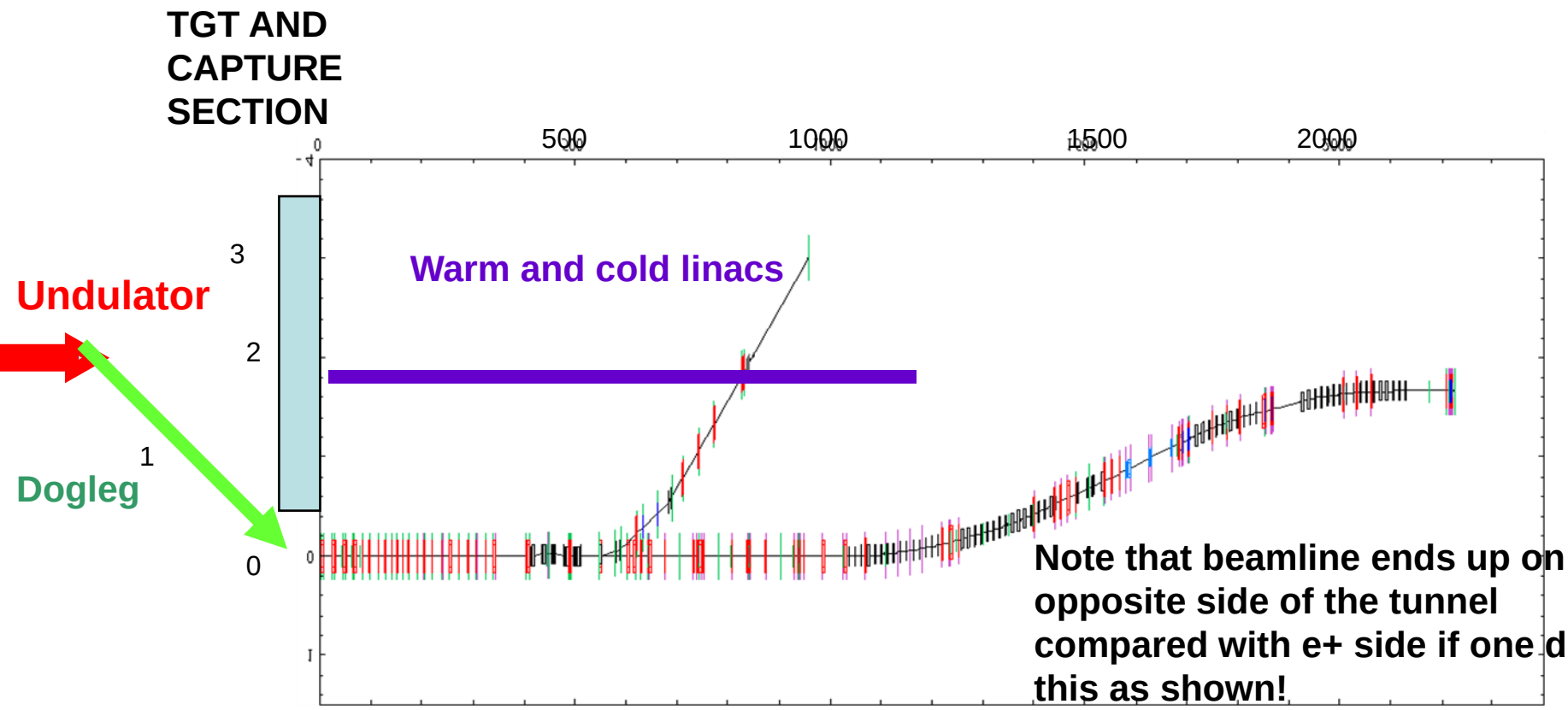


E- BDS Shown as a reflection of E+ side



Undulator plus (TME) dogleg could be of the order of 500m total

E- BDS Shown as a reflection of E+ side



Undulator plus (TME) Dogleg could be of the order of 500m total

What is needed for the 3D CAD study to implement this proposal

- *We need lattice and component outlines for*
- LINAC…….**USE RDR FOR COMPONENT LAYOUTS?**
- BDS.. **NEED WORKING OPTICS AND GUIDANCE ON E+/- GEOMETRY**
- **SOLUTION TO USE IN CASE 3**
- E- Source/Booster .**USE RDR BUT COMPONENT SIZES ?**
- Undulator and Dogleg……**WHAT DO WE ASSUME?**
- E- Bypass of target **HOW LARGE AN OFFSET, 1.5, 2.5 m?**
- Auxiliary source linac, **BEST GUESS LAYOUT and SIZE?**
- TGT and Capture Section…**COULD BE BLACK BOX WITH OUTSIDE DIMENSIONS**
- Section from above thru booster…**SIMILAR TO E- SIDE**

CAN WE TRY FOR ANSWERS BY END OF TOMORROW ??

What we do NOT need to begin the study but need to have before Albuquerque

- 3.2 km Damping Ring Layouts with INJ/EXT
- RTML Lattice and layouts which match the above to Case 3 Central Region, i.e modified versions of RDR
- As much information on e+ Target/ Capture system as possible to add to Central Region
- Final? BDS lattice to be used in re-baseline, with 'fix' for the E+/- symmetry question?
- List and outline sizes of "one off" equipment, eg polarimeters, collimators, muon shielding walls, etc which are in the central region.
- Some working decision on which HLRF system is being used in single tunnel linac.
- Rough cost comparisons for options which can be used in evaluations.

QUESTIONS

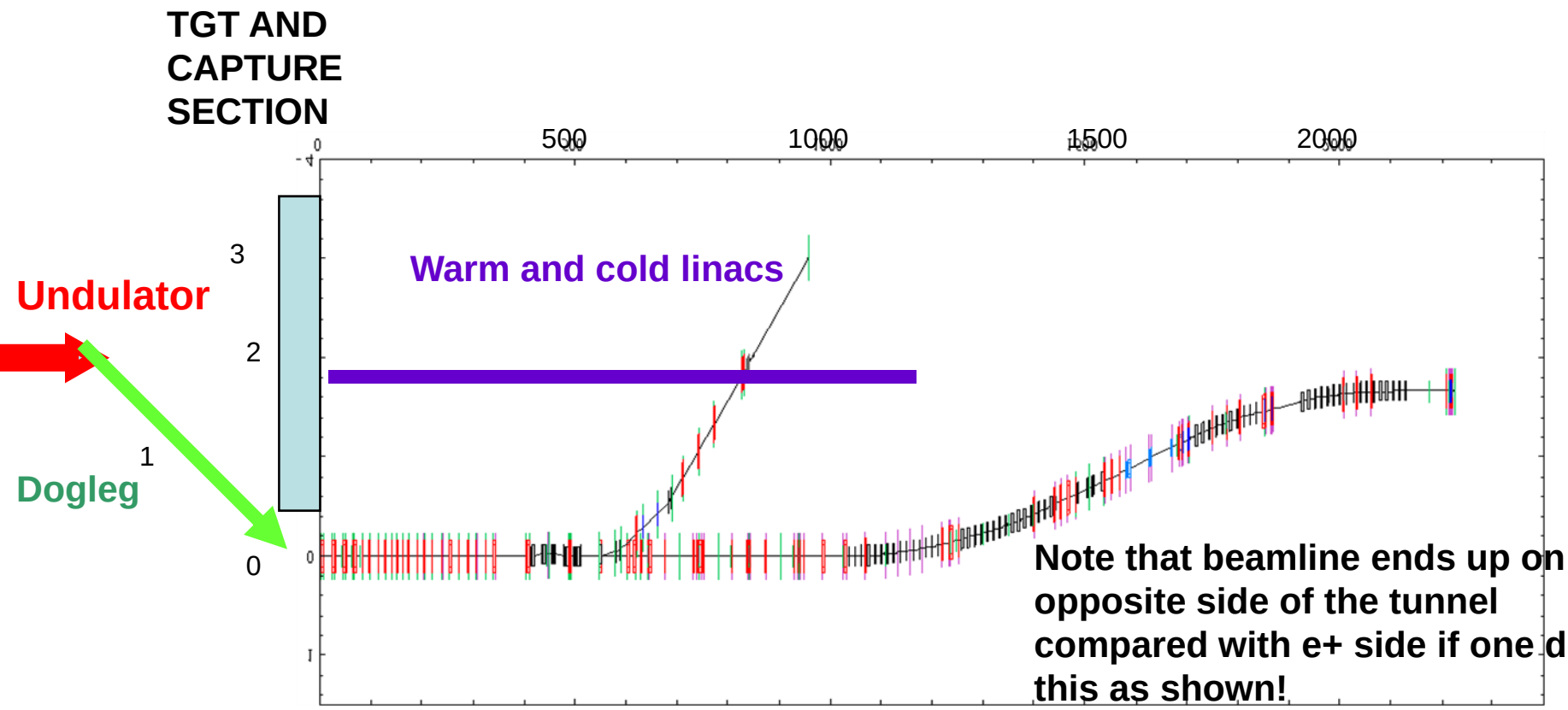
and

DISCUSSION

BACKUP MATERIAL

- Material on injectors
- BDS Options
- Dogleg

E- BDS Shown as a reflection of E+ side

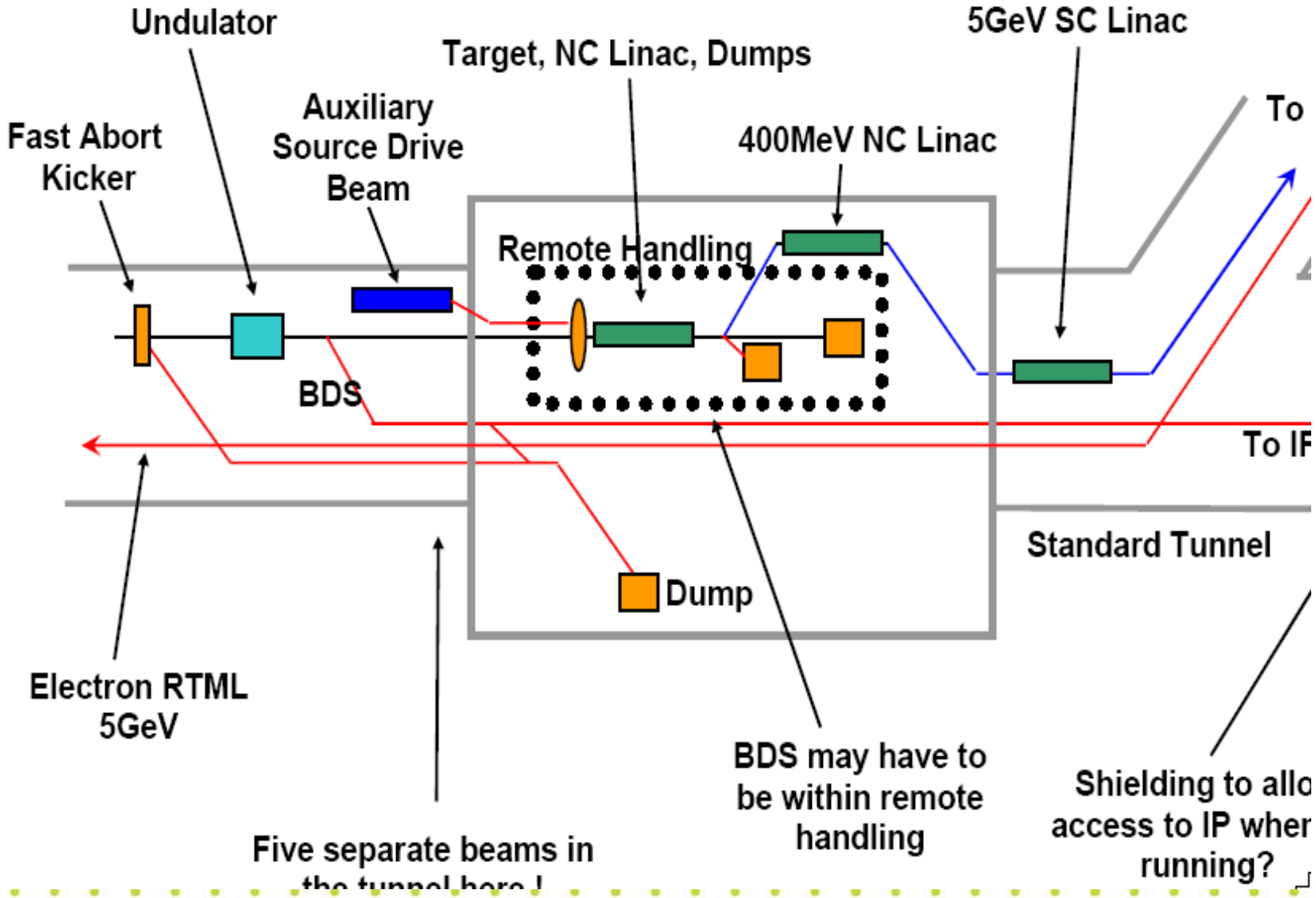


Undulator plus (TME) Dogleg could be of the order of 500m total

This raises questions even without 3D

- This minimum component count and tunnel length uses one dogleg for e+ source (two were needed in the RDR layout) but this leads to e- beam being on the opposite side of the BDS exit from the e+ side. There are many possible fixes (nothing elegant?) but what do we choose as the working plan?
- Assume installation equipment passage and interferences can be solved with scheduling. How, during operation, does equipment (and personnel) pass through doglegs and BDS bending regions?

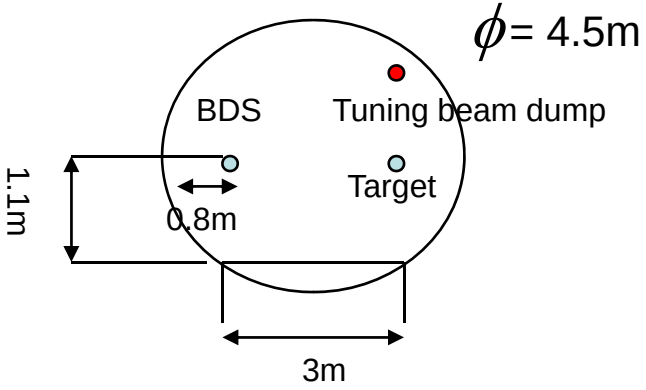
E+ SOURCE from TIL09

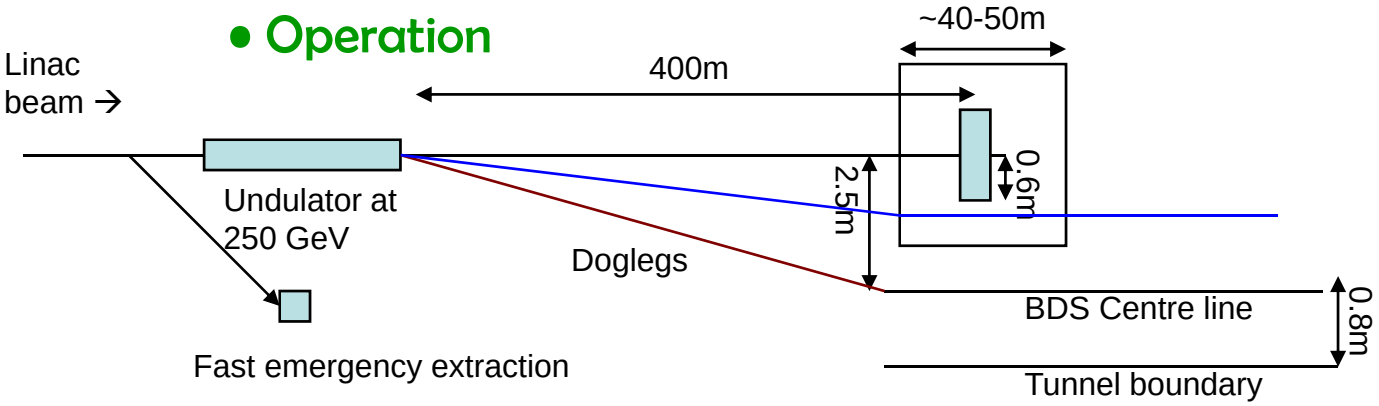


Central region integration : Minimum Machine, BDS

Integration studies needed:

- Radiation
- Optics
- Engineering
- Installation
- Commissioning
- Operation

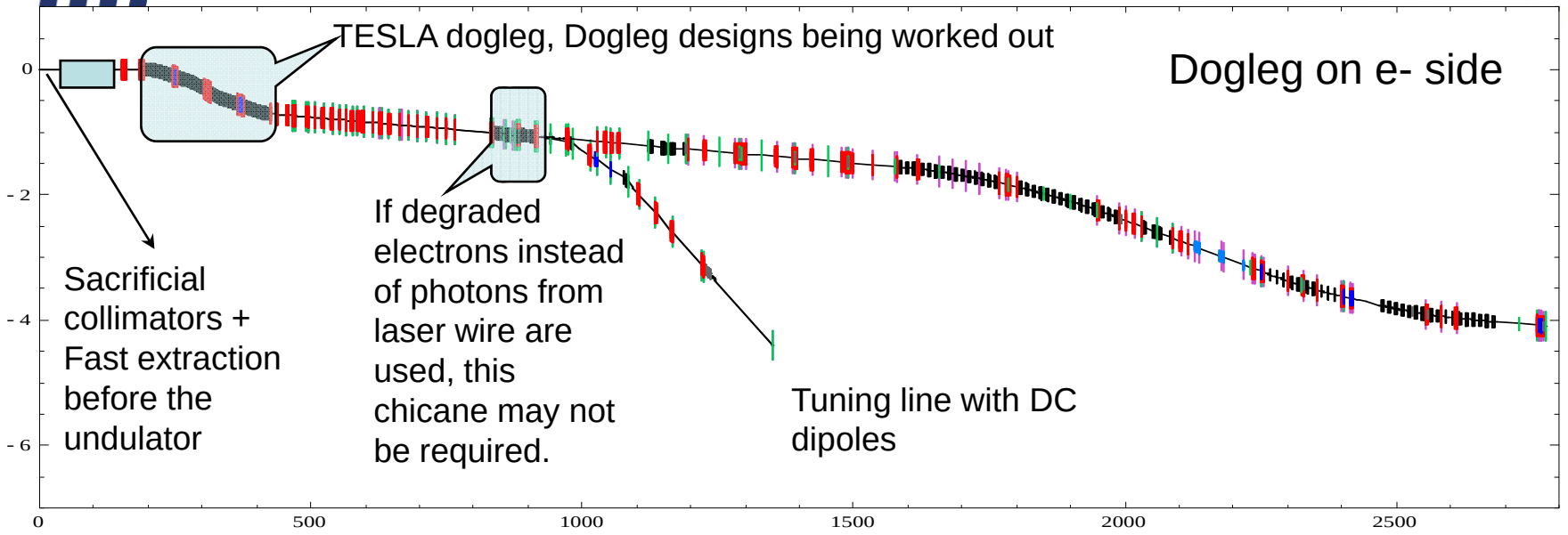


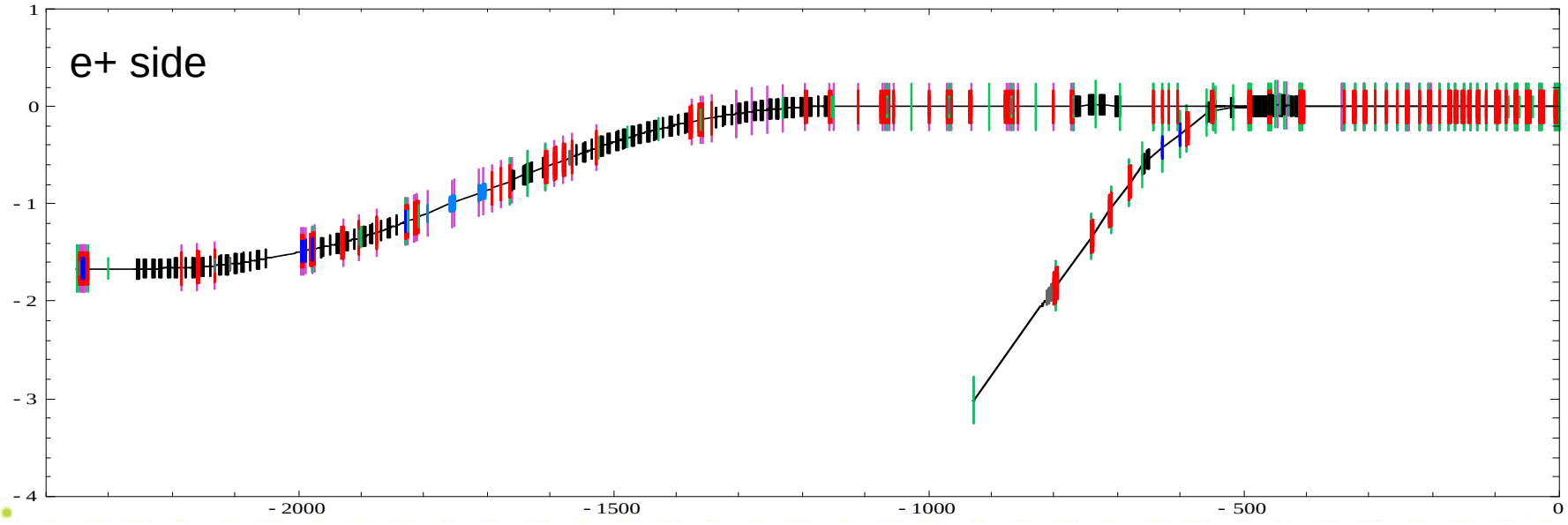


- 2.5m can be reduced to up to 1.5m if beam passes through a drift space for ~40-50m without any components through the remote shielding block of the target.
- If 2.5 m, not enough space for tuning beam line. Take the beam vertically to beam dump?

Based on discussions with positron source team

Minimum Machine





Example of compact dogleg

A.Seryi, J.Jones

TILC09

- **Studying TME (Theoretical Minimum Emittance) lattices for dogleg with different offsets and missing magnet schemes for smaller offsets. Example shows 2.5 m offset in less than 400m**