CHANGE REQUEST NO. ILC-CR-XXX	EDMS No: **D*xxxxxxx**	Created: 0**1-30-2017**
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KAMABOKO-SHAPED POSITRON BDS TUNNEL

The positron BDS tunnel is designed in TDR as a twin tunnel between the ML end and the LTR entrance, and as a single tunnel between LTR entrance and the detector hall. The present change request is to change the entire positron BDS tunnel to the Kamaboko-shaped tunnel like the main linac tunnel. The request includes the relocation of the electron source to upstream of the positron BDS tunnel. It should be noted that the electron BDS tunnel, which includes the positron source, has a different structure and will come as a separate CR.

RATIONALE

By changing BDS tunnel between ML and LTR from twin tunnel to Kamaboko tunnel, it becomes easy to make waveguide and cable penetrations between the service tunnel and accelerator tunnel. By extending the service tunnel down to the detector hall we will be able to have the space to put a high voltage AC power line and cooling water pipes all though the tunnel. The Kamaboko tunnel can make easy to have both accelerator tunnel and service tunnel simultaneously in this section. Furthermore, the cold box for the electron booster linac is located in the ML access tunnel, and the electron source in the positron BDS tunnel is relocated to the upstream to make the Helium transfer line shorter.

SCOPE: POSITRON BDS TUNNEL

This change would affect the electron source group because of the additional transport line and the CFS group. The length of the tunnel will be determined by BDS lattice and will not be changed. .

COST IMPACT

Since the tunnel volumes are same both for old and new positron BDS configurations, the request has only a small impact to the construction cost even though we have a lot of benefits by these design changes. A preliminary estimation shows a slight increase of the construction cost but this is because TDR did not include the cost for penetration between the service and accelerator tunnels. The total cost of new positron BDS is cheaper than TDR with the penetrations by a couple MILCU.

DETAIL OF THE CHANGE

Figure 1 shows the schematic drawing of the TDR and the proposed positron BDS tunnel. The TDR BDS tunnel is designed as a twin tunnel between ML to LTR, and as a single tunnel between LTR to detector hall. In this proposal the positron BDS tunnel is Kamaboko-shaped tunnel all along the positron BDS beamline. Furthermore, the electron source is relocated to upstream (about 1200m) of the positron BDS tunnel.

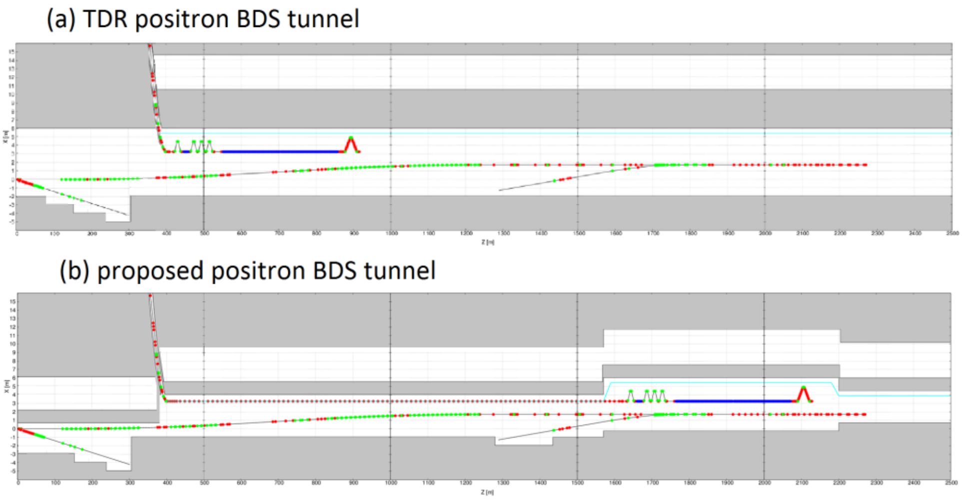

Fig. 1: Schematic figures of (a) the TDR and the proposed positron BDS tunnel layout and (b) the proposed configuration.

Since the service and the accelerator tunnels are separated by 6.75m thickness hard-rock material in TDR tunnel configuration, it is difficult to drill the waveguide and cable penetrations between the tunnels, and the penetration costs are expected to be expensive. However, it is easy to make the penetrations in Kamaboko tunnel (see Fig.2). The shield wall will be 1.5 meters under the same condition as for the ML (i.e., no human access during beam operation). Need more explanation on the human access principle.

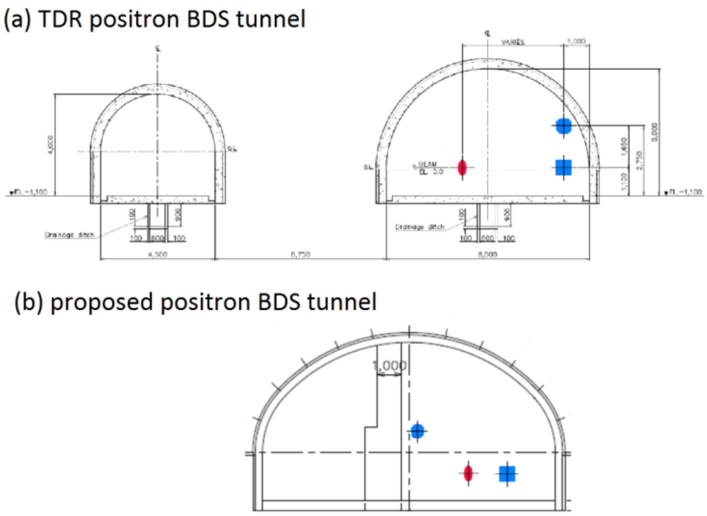

Fig. 2: Schematic figures of the tunnel cress section of (a) TDR and (b) proposed positron BDS tunnel layout.

The main high voltage AC power line (66kV) will be distributed all along the LC tunnel. By making the service tunnel along the BDS beamline all the way from LTR to the detector hall, the high voltage power line can be distributed in the service tunnel. Especially when the main electrical station is located at the utility hall in the central region, the service tunnel is useful to distribute the high voltage power line to main linac tunnel (see Fig.3).

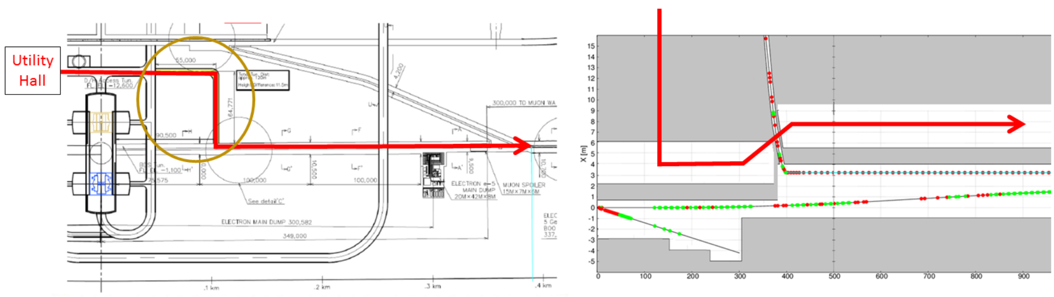

Fig. 3: Schematic figure of the high voltage power line distribution from the utility hall in the central region to the main linac tunnel.

There is a Helium cold box and a compressor in the ML access tunnel for main linac cryomodules. When the electron source will be relocated to upstream, the distance between the electron booster linac to ML access tunnel will be shortened. Therefore, we can use the facilities of main linac cryomodules with shorter Helium transfer line (see Fig.4). The relocation of the electron booster will make longer the 5GeV electron transfer line from the source to the damping ring by 1200m (Magnet; 100×10k ILCU=1M ILCU, Vacuum Component; 1k ILCU/m×1200m=1.2M ILCU, Total; 2.2M ILCU), but this disadvantage will be comparable with the cost reduction by the short helium transfer line of 500m (5k ILCU/m×500m=2.5M ILCU). Also, the relocation has a benefit that the radiation from the collimator would not make shower on the cryomodules.

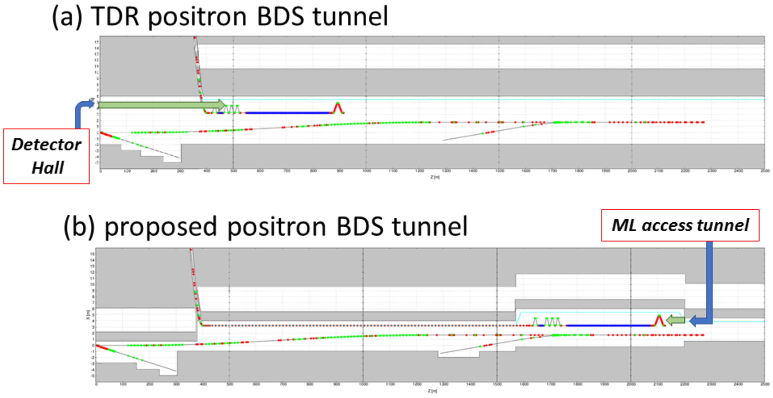

Fig. 4: Schematic figure of the helium transfer paths.

Requested and prepared by:	

Attachments:

Number:	modified:	by:

Change History:

Version:	modified:	by:	what:

IMPLEMENTATION PLAN

Concerned Parties (Work Packages, Coordinators, Suppliers etc.)

WG / Area	

Affected documents

EDMS ID	Title	Remark