



CHANGE REQUEST NO. ILC-CR-0011	EDMS No: D*xxxxxxx	Created: 1-12-2015
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THE REARRANGEMENT OF UNDULATOR POSITRON SOURCE

Relocate the positron booster (PBSTR), ECS (Energy Compressor Section), and PLA (Path Length Adjuster) for the undulator positron source for a better system integration. One cryomodule is added to PBSTR for the operational margin.

RATIONALE

In TDR design, 400 MeV positron after PPA is transported to PBSTR through the 470m long transport line (PTRAN). After it is boosted up to 5 GeV by PBSTR, 5 GeV positron beam is transported to DR through PTRANH and PLTR. PLA and ECS are placed in PTRANH and PLTR, respectively. In this configuration, PTRAN (400 MeV transport line) requires high density quadrupoles. In PTRANH and PLTR in upstream of ECS, the energy spread could be up to 3 or 4 %, but it is less than 0.75%

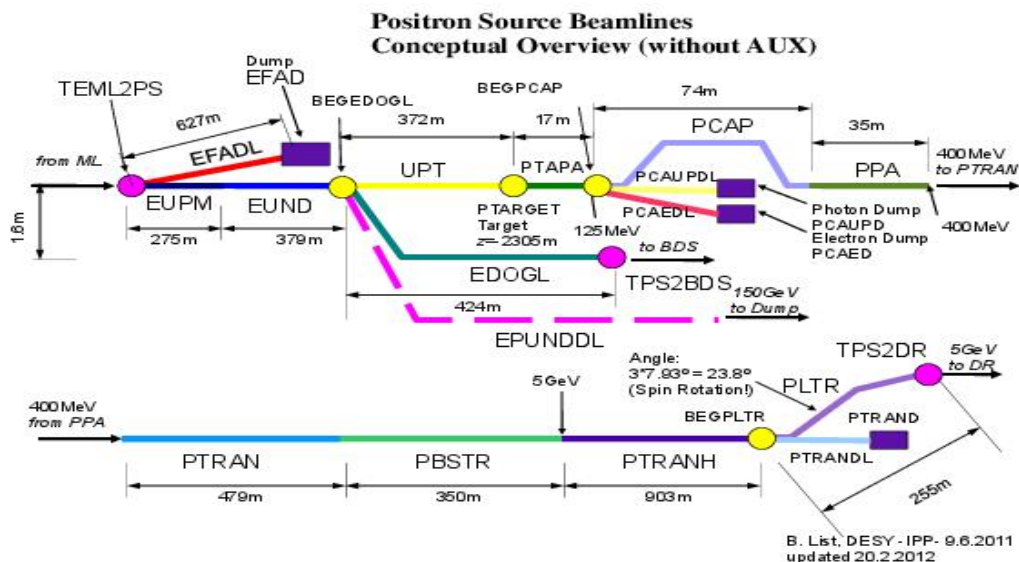


Fig.1: Undulator positron source layout in TDR.

after ECS. The operation could be complicated because PLA (chicane) and ECS (chicane + RF) are fully coupled. By moving PBSTR at the downstream of PPA, we can omit PTRAN. ECS and PLA are placed after PBSTR in this order to suppress the energy spread in PTRANH and PLTR. It solves also the coupling between PLA and ECS. This rearrangement gives a long vacant (less busy) area which is reserved for further optimization. We propose additional cryomodule for PBSTR for an operational margin. R_{56} of ECS should be 1.4 m instead of 0.7m for better performance.

SCOPE: ELECTRON BDS TUNNEL AND POSITRON SOURCE

PBSTR, PLA, and ECS are relocated to the upstream as shown in Fig. 2. PTRAN from PPA to PBSTR was set when the undulator positron source was in the middle of ML (150 GeV place), because PBSTR was placed at the downstream of ML. In the relocation of the undulator section to the end of ML, the location of PBSTR did not change and 470m PTRAN was remained. There is no any reasons to keep PTRAN anymore and omit PTRAN is better from the beam optics point of view because the beam

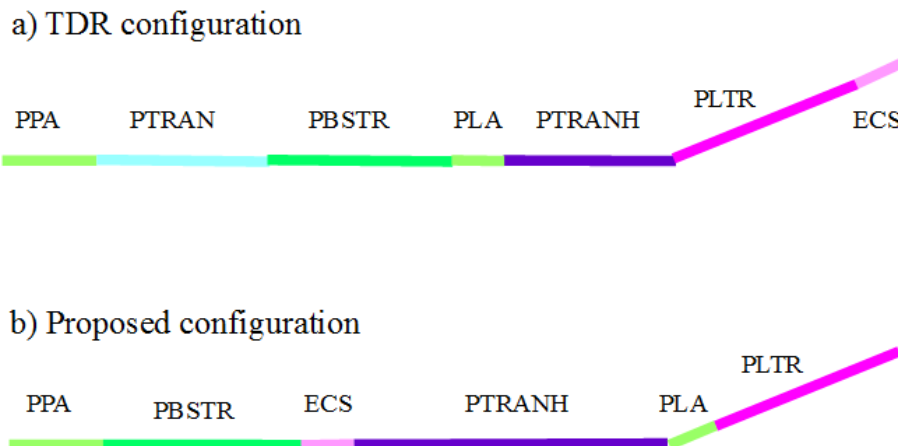


Fig. 2: Undulator positron source layout in the electron BDS, a) current configuration and b) proposed configuration.

energy in PTRAN is 400 MeV which requires larger bore radius and higher density of quadrupoles. In PTRAN, 119 quads/km is assumed and



it should be compared to 79 quads/km in PTRANH. ECS is originally placed after Spin rotator (PTRANH and PLTR). In this configuration, e+ bunches with larger energy spread ($\pm 2\%$ typically) pass through PTRANH and PLTR and beam quality is degraded by chromatic effects. If ECS is placed in the downstream of PBSTR, the energy spread of the positron beam is compressed and the effect can be much suppressed. In the relocation, PLA should be in downstream of ECS. In TDR configuration, PLA is in upstream of ECS. In this case, PLA and ECS is fully coupled, so that the operation could be complicated. By changing order of ECS and PLA, they are almost decoupled and the operation could be much simpler. The relocation gives about 1km vacant (less busy) area where can be reserved for further system integration. If PLA can be accommodated in PLTR section as shown in Fig. 2(b), the section length can be longer. We propose R_{56} of ECS is 1.4m instead of 0.7m for better performance. We propose to increase 3 cryomodule (1 RF unit) for the operational margin. TDR PBSTR design does not have any margin on the energy.

The list of changes:

- Move PBSTR to upstream.
- Move ECS to downstream of PBSTR.
- R_{56} of ECS is 1.4m instead of 0.7m.
- Move PLA to PLTR.
- Add one RF module to PBSTR as a margin.

COST IMPACT

This CR is expected to be cost neutral for CFS. For the component and subsystem, number of quadrupole magnet is decreased by 8. One additional RF unit which contains one 10MW klystron, one modulator, three cryomodule (8 cavities + one quadrupole) is required. This estimation is summarized in XXXXX.pdf.

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Attachments:

Number:	modified:	by:

Change History:

Version:	modified:	by:	what:
1.0	10-12-2015	WG	creation



IMPLEMENTATION PLAN

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

WG / Area	
Sources (e+)	Lattice and layout design
CFS	Adjustment of housing / drawings etc.
BDS	Shifted axis solution (layout etc). Beam dynamics
RTML	Lattice design and layout

Affected documents

EDMS ID	Title	Remark

