BDS AND CENTRAL REGION INTEGRATION

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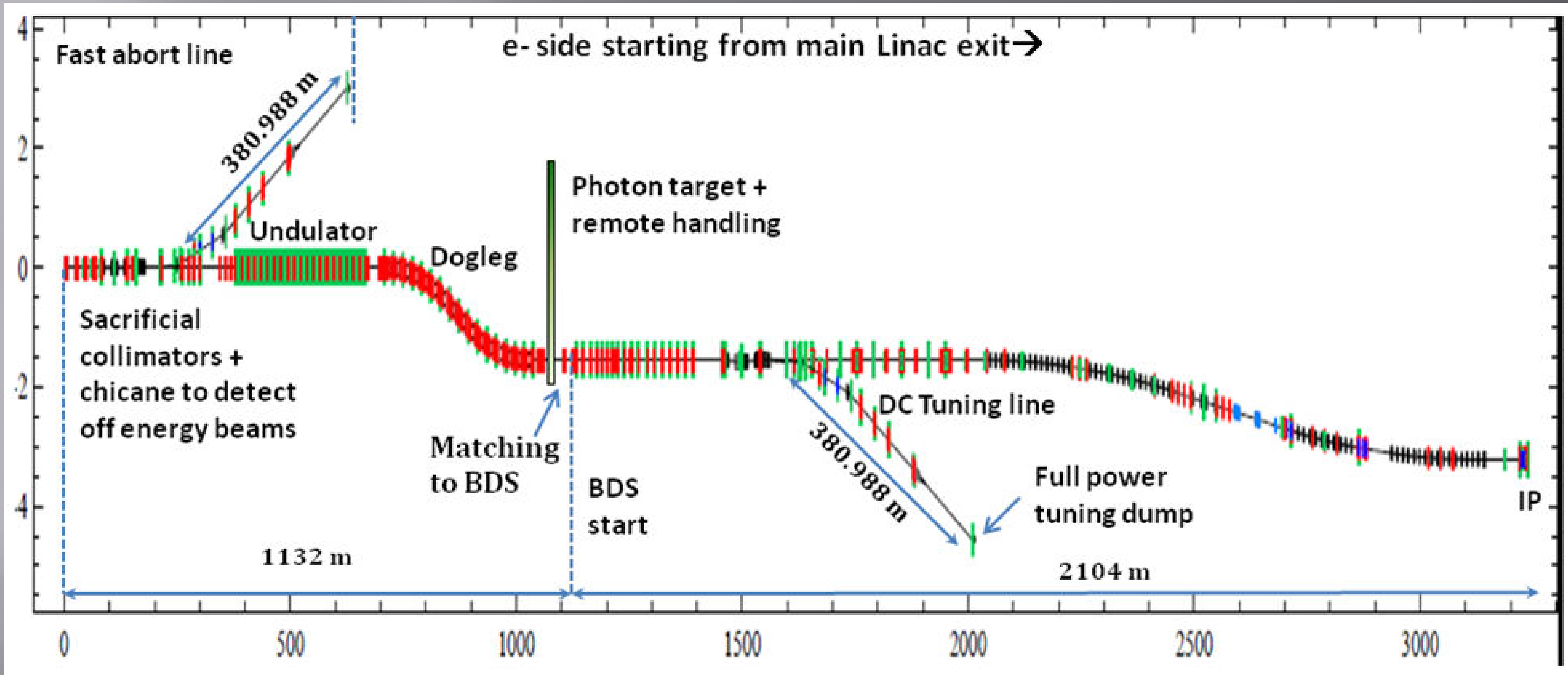
Main changes related to BDS

- Changes in the subsystem integration of the central region: As of the RDR, the BDS, the electron source and the damping rings are clustered in the central region of the ILC accelerator complex. The proposed changes in the baseline envisage relocation of the positron source system to the downstream end of the electron main linac, so that they also join this central region. This impacts the subsystem layout in ways that affect the implementation of electron side BDS.

- Changes in the baseline parameter set…

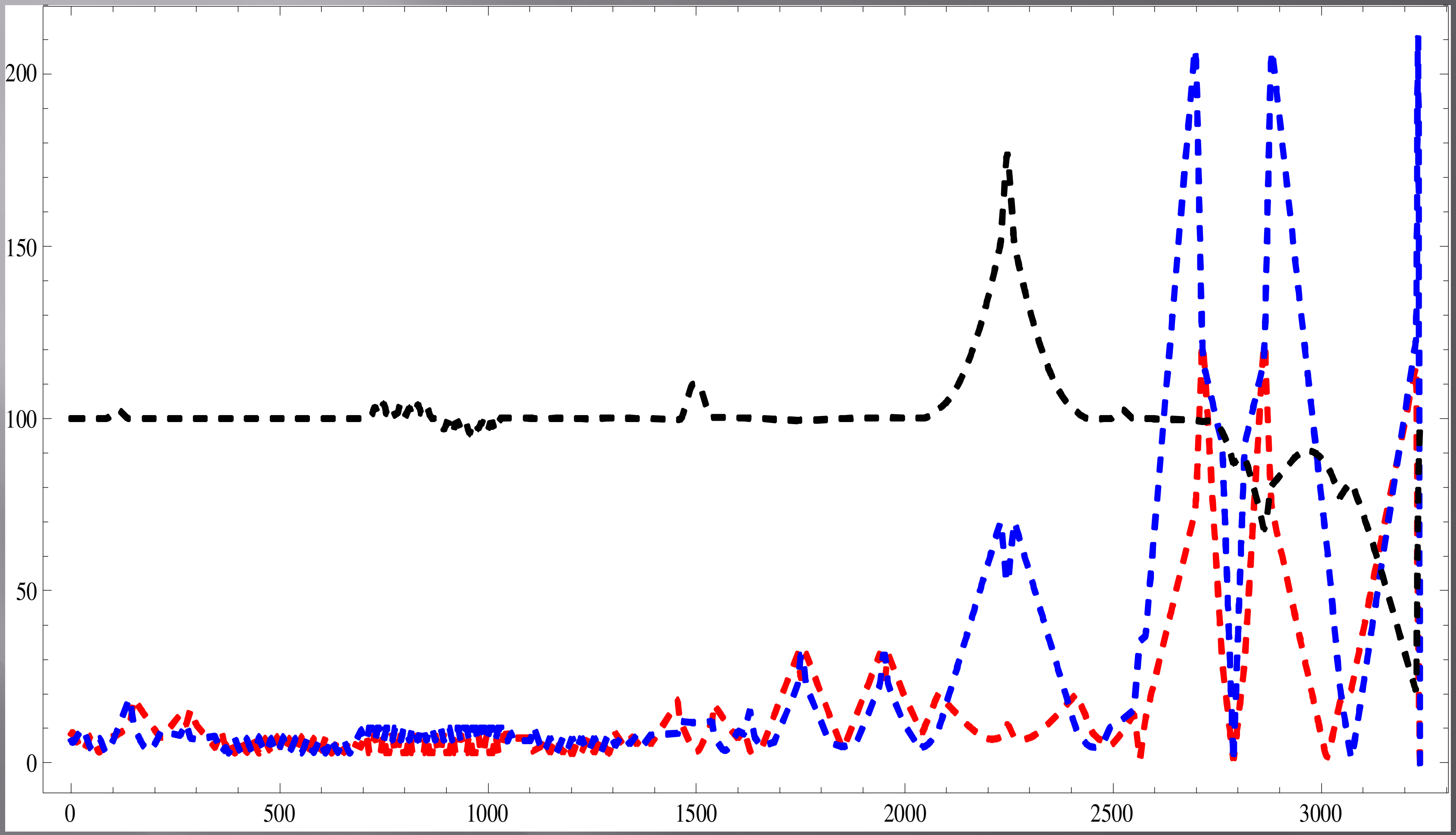
Max energy

- In terms of beam energy handling, similar to the RDR design, the BDS design remains compatible with 1 TeV CM upgrade which is expected to be accomplished by installing additional dipoles and replacing the final doublet



- The central integration includes the sources in the same tunnel as the BDS. Relocation of the positron production system to the downstream end of the electron linac means placing it just before the beginning of the electron BDS. These changes need suitable design modifications to the layout of this area. Figure above shows the proposed new layout of the electron BDS

SB09 optics of e- BDS from exit of Linac to IP



Features in the new e- BDS:

- Sacrificial collimator now located at the linac end rather than in the BDS upstream end
  - The RDR has sacrificial collimators in the beginning of e- and e+ BDS to protect the BDS from any beam with error to enter from the large aperture of the main linac (r=70mm) into small aperture (r=10mm) of the BDS.
  - In the new layout, the small aperture undulator (~8mm full) is located immediately after the linac and thus it needs to be protected against any error beam entering the undulator. This is done by moving the sacrificial collimator section and an energy chicane to detect the off energy beam in front of the undulator which reduced the electron BDS length to 2104m from 2226m as shown in Figure on slide 4.
  - Any beam entering this section with errors will be detected and sent to the fast abort line just before entering the undulator. The fast abort line is presently the same length as the RDR abort line, which was designed as a fast abort + tuning line (the positron BDS side still has this combined functionality), however the fast abort beam dump needs to be able to take only the number of bunches between abort signal and stopping the beam at the extraction of the damping ring and does not need to be a full power beam dump. The exact rating for this dump remains to be determined

Features in the new e- BDS:

- Matching line after the fast abort detection energy chicane into the undulator and design requirements for positron target location
  - The matching line to the undulator needs to allow sufficient transverse separation for the abort line and then matches into the undulator FODO cells.
  - The photons generated in the undulator will pass through a drift length of 400m up to the positron target (~1070m point in Figure in slide 4).
  - To implement the positron target and the remote handling of the components in this area, a transverse offset of 1.5m is required between the electron beamline and the photon target.
  - The remote handing area needs a drift space of approximately 40m in length. No BDS component are placed in this space. This is achieved by using a matching section after the undulator to match into a dogleg, a dogleg itself giving a transverse offset of 1.5m and a 40m long drift at the end.

Features in the new e- BDS:

- Dogleg lattice to create the required separation between the photon target and the electron beamline
  - The dogleg lattice has been designed to be a TME (Theoretical Minimum Emittance) lattice. This keeps the emittance growth due to synchrotron radiation at 1 TeV CM to be within few percent. The dogleg provides an offset of 1.5m in 400m as required and the emittance growth at 1 TeV CM is ~3.8%. The dipoles in the dogleg are presently not decimated but can be decimated similar to the rest of the BDS so that only few dipoles are installed at 250 GeV. The beam dynamics and tuning effects on the BDS due to the presence of the dogleg need to be assessed
- Matching section into the BDS diagnostics section
  - The 40m long drift is followed by a matching section into the skew and coupling correction section, chicane for detection of the laser wire photons and a slow tune-up (DC tuning) line leading to a full power beam dump. Since the fast abort functionality is being taken care of by the fast abort line before the undulator, the energy acceptance of the DC tuning line is much reduced and thus the DC tuning line can be shortened using only DC magnets. This optimisation will be done during the TDP2 phase.

Features in the new e- BDS:

- Polarimeter chicane, collimation, energy spectrometer and final focus
  - The polarimeter chicane will be located just after the take-off section for the tuning line, which is not shown in the layout. This will need some additional length but will be accommodated by slightly reducing the final focus length allowing some emittance growth at 1TeV CM. The polarimeter chicane will be followed by the betatron and energy collimation, energy spectrometer and final focus sections similar to the RDR.
- Post collision extraction line and main dump
  - Similar as in RDR

Summary

- The layout and optics changes needed for implementation of the BDS integration into the Central Region has been identified
- Layout and optics has been created and plans for detailed work for TDP2 has been defined