

Preparatory information for the DESY AD&I meeting 28-29.05.09

12.05.2009

Dear Colleagues,

A primary deliverable for this calendar year is the publication of a [ILC Baseline Proposal](#) in December 2009.

This document will then be released to the community for feedback and discussion, and will be reviewed by the AAP in January 2010. The final consensus baseline document will be subsequently published in July 2010.

The primary goal of the DESY AD&I meeting is to establish WORKING ASSUMPTIONS (WA) for the proposed strawman baseline (referred to as Strawman Baseline 2009, or SB2009).

The project management proposes the following top-level WA for SB2009 as a focus for the initial discussions (incremental to the RDR baseline):

1. Single-tunnel solution for the Main Linacs and RTML, with two possible variants for the HLRF
 - a. Klystron cluster scheme
 - b. DRFS scheme
2. Single-stage bunch compressor
3. Undulator-based e+ source located at the end of the electron Main Linac (250 GeV)
4. Reduced parameter set (with respect to the RDR) with $n_b = 1312$ and a 2ms RF pulse.
5. ~3.2 km circumference damping rings at 5 GeV, 6 mm bunch length
6. Single-stage bunch compressor with a compression factor of 20.
7. Integration of the e+ and e- sources into a common "central region beam tunnel", together with the BDS.

For the positron source (3), an alternative independent electron-driven source based on a 300Hz s-band linac will also be discussed and reviewed.

Many of the aspects outlined in 1-7 are detailed in the [ILC Minimum Machine Study Proposal](#) document, which you are encouraged to review before the DESY meeting in May. It is expected that the final published proposal at the end of the year will evolve from this document (but will be separate from it).

It is not the purpose of the DESY meeting to finalise the WA for SB2009, but to begin the process of finalising it which should conclude at the ALCPG meeting in Albuquerque 29.09-03.10.

The DESY meeting will be structured around presenting a comparison of the above proposal with respect to the current Reference Design. Specifically we hope to produce a list of questions on Working Assumptions that can be relatively quickly agreed upon. Plans for studies for those top-level WAs that cannot be resolved at the May meeting will be developed with the view to addressing these final issues at ALCPG.

The identified conveners for the May meeting should come prepared with the following information (general questions) for their respective systems:

1. A reviewed and updated Risk Register for both the RDR and the proposed SB2009.
2. An overview (as detailed as possible) of the impact of the changes to the RDR design, with a focus on CFS.
3. Summary of the pros and cons of SB2009 with respect to the RDR.
4. A concise (as possible) status of the answers to the general questions below (and any additional questions that you identify).

Nicholas J. Walker 09/5/13 2:36

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Note that we do not want a complete description of the proposed solutions for SB2009, as these have already been extensively made in the MM document and elsewhere (TILC09). Instead the focus should be on a comparison with the RDR, and outstanding questions that need to be raised.

In addition to the updated Risk Register, we intend to produce a comprehensive table of the SB2009 which summarise this information. An initial draft version is attached for guidance.

Specific Details of SB2009 and Questions for the DESY May meeting

Note that unless explicitly stated, the existing RDR baseline solution are assumed, together with the top-level proposals as described in 1-7 above.

Note also that the criticality of specific components (e.g. e+ rotating target) should be addressed qualitatively in the risk register. They are not in general explicitly noted here as questions.

1. Electron Source

WA:

- housed in integrated central-region beam tunnel.

Questions:

1. Location of non-beamline components (klystrons, power-supplied etc.) *See Central Region Integration below.*
2. Impact on commissioning & availability
3. Impact on construction schedule (installation)

2. Positron Source

WA:

- Undulator-based (photon-driven) source located at end of electron Main Linac (250 GeV)
- Undulator length optimised for a yield of 1.5-2.0 (TBD) assuming a QWT Optical Matching Device at an electron beam energy of 250 GeV
- A warm-linac electron driven auxiliary source, using same target and capture section, with a $\leq 10\%$ yield.

Questions:

1. What are the options on positron yield with $E_{\text{beam}} < 250$ GeV. What is the associated projected luminosity from 200-500 GeV centre-of-mass.

2. What is the incremental impact of a high-field pulsed solenoid (Flux Concentrator) assuming such a device is feasible.
3. What is the current summary understanding of the impact on the undulator section on the electron beam emittance. What outstanding questions are there?
4. Location of non-beamline components (klystrons, power-supplied etc.) *See Central Region Integration below.*
5. Impact on commissioning & availability
6. Impact on construction schedule (installation)

For the positron source, an alternative 300Hz s-band linac electron-driven target system will also be considered. A risk register for this source should also be included for the May meeting. While not currently being considered as the WA for SB2009, a solution that could replace the undulator source in same accelerator housing in a similar tunnel length should be pursued.

3. Damping Rings

WA:

- Two 3.2 km (TBC) circumference rings housed in the same central location tunnel.
- Bunch length of 6mm
- Ejection and extraction in the same straight section (consistent with Central Region Integration).

Questions:

1. Is there any benefit in reducing the energy of the rings?

4. RTML

WA:

- Single-stage compressor with compression ration of 20.
- Single tune-up dump line (and fast abort system) at exit of compressor.
- Single tunnel solution.

Questions

1. Is the vertical emittance growth of the single-stage compressor acceptable?
2. What are the advised requirements for the tune-up dump (full-power?)
3. What are the mandatory diagnostics required.
4. Location of non-beamline components (klystrons, power-supplied etc.)

5. Main Linac

WA

- Single-tunnel housing
- Two variants for HLRF:
 - Klystron Cluster

- DRFS

Questions:

1. What are the primary impact / difference with respect to the RDR of the two proposed WA for the HLRF. Specifically for the main linac tunnel, shaft and support CFS.
2. What are the implications for availability and operability.
3. What are the implications (CFS) of the two currently proposed tunnel layouts (specifically location of cryomodules – see also 4b below).
4. What are the set of common baseline assumptions that can be agreed upon (simplification)
 - a. Tunnel diameter
 - b. Location of the cryomodules (beamline components) in the tunnel
 - c. Location and number of main utility shafts / caverns (e.g. cryogenic plants)
 - d. ...

Gradient: although for the DESY meeting it is assumed that the RDR choice of an average of 31.5 MV/m is maintained, and important TDP1 deliverable is a re-evaluation of the baseline gradient. Part of the DESY meeting therefore will be dedicated to preparing the data for this discussion and eventual decision. The approach for this session at the DESY meeting will be dealt with in a separate email.

For the time being, we assume that any change in gradient is likely to be at the 10% level, and to first-order will affect the length of the linac. For the remainder of the discussions at DESY, the WA of 31.5 MV/m will be assumed.

6. BDS

WA:

- Maintained support for the 1TeV geometry (missing magnet or some other suitable scheme)
- Assuming 10-15% (tbd)¹ synchrotron radiation emittance growth at the top (upgrade) energy of 1 TeV.
- Support for travelling focus IP parameter set ($L \sim 2 \times 10^{34}$ with $n_b = 1312$).

Questions:

1. What is the status of a compact lattice design with the above WA.
2. Location of non-beamline components (klystrons, power-supplied etc.)

7. General: Central Region Integration

Aspects of the Central Region Integration scheme have been touched on the relevant sections above. A general question is the location of support infrastructure (non-beamline components). Possible solutions are:

1. Separate (continuous) service tunnel with penetrations

¹ This should include the e+ target dogleg.

2. Distributed alcove system or
3. Localised alcoves and/or shafts

Additional aspects are impact on operations, commissioning and installation. Ewan Paterson will take the lead in these discussions.

8. Luminosity Upgrade Potential

As part of the discussions, we would like to include the possibility of upgrading the machine to restore the original RDR nominal parameter set number of bunches (~2624). This has primarily implications for the DR and the HLRF installations. Possible scenarios should be broken down into schemes which could be done adiabatically (during operations), and those which would require a shutdown to install. The scope of the upgrade should be discussed.

9. CFS Specific questions

The primary driver for the proposed SB2009 WA is the reduction of the requirements for the CFS. In addition to the CFS impact of the items outlined above (specifically the single tunnel and HLRF), there are two additional themes that should be discussed:

- What is the role of near surface studies?
 - Should the new baseline include single tunnel in the Central Region area
 - What defines CR differences and how are these prioritized
 - How should we measure progress on a generic shallow site (as a site concept is moved closer to the surface, we expect surface – related differences to dominate the design).
- CFS – regional siting issues
 - Were the different utility, cryo and safety considerations identified and evaluated as part of the RDR?
 - How important are these differences
 - What are the important regional siting topics?