Summary of AD&I Webex meeting on Low-P Option
15.07.2009

Agenda: http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=3726

Chair: Nick Walker
Notes provided by John Carwardine

Opening remarks (NJW)

- This webex meeting is the first of three dedicated to AD&I / SB2009 work
- The meetings are intended to compliment the SB2009 technical discussions on the relevant action items which are part of the regular TAG leaders meetings
- Primary focus of these meetings is providing the correct cost basis to PHG, and for general communication exchange (Q&A)
- Meetings are thematically focused rather than TAG orientated:
    - Low-P option – this meeting
    - Single-tunnel issues – 12.08.09 [TBC]
    - Central Region Injector – 09.09.09 [TBC]
- This meeting (Low-P) will focus on single-tunnel HLRF solutions (not the DR, which is considered rather straightforward from a cost point of view).
- Important aspect of this meeting is to discuss possible scenarios for 'lunminosity upgrade' (i.e. restoring RDR beam power) after initial construction is complete.
- All members of AD&I team are encouraged to attend the meetings.

Peter Garbincius - introduction to the Low Power option

Presentation can be found here on InDiCo.

- Note that it was agreed at the DESY meeting that HLRF solutions (KCS, DRSF) would be worked-through for all three RDR sample sites.
- Need to make sure component counts and specs are fixed to allow estimation to proceed for all three sites.
- When considering restoration of beam power (upgrade), do not include perceived constraints of a 3km DR
    - The issue of the DR upgradeability will be discussed separately.
    - For this meeting assume a cost-effective solution can be found.
- Keep dumps & collimators at RDR levels
    - Not cost drivers – do not worry about them now.
    - Part of the DESY meeting agreed Working Assumptions.
- A possible low-P option for the RDR HLRF/tunnel solution will not be studied at this time
    - SB2009 is the focus for this period.
- For the three (RDR) site options, a question remains about the practicaility of the KCS for a mountainous site (e.g. the Asian sample site).
    - *NJW: I believe the issue is not strictly one of a mountainous region, but*

rather the practicality of having surface installations (or similar) every ~2km. This may prove difficult in the Japanese mountain site. KCS with a longer 'baseline' of ~5km (nominal RDR) would result in higher WG losses and larger cluster installations, as well as operational issues. These issues were presented/discussed in S. Fukuda's talk at the DESY May meeting.

- Note that proposed half-current parameter set has RF pulse length of 2-2.1ms (31% more average power per klystron compared to RDR).
  - (See proposal by C. Adolphsen.)
- HLRF solutions discussed todate where for full RDR spec. beam power:
  - prelim cost estiates for full-power KCS in Aug 08 and half-power RDR in Aug 06. Assume low-P requires ½ no. klystrons and modulators per cluster.
  - DRFS: half number of klystrons and modulators – 1 "RF unit" drives 4 cavities.
- Possible upgrade scenario for KCS would add an extension to the RF pipe in the cluster area (sruface building) to increase number of klystrons from 15 to 30.
  - All effectively surface work.
- DRFS adds more klystrons in tunnel.
- Information still needed (by PHG):
  - Updated estimates for over-moded waveguide and couplers for KCS
  - Understand cost impact on cryo-plants (mostly dynamics loss, RF pulse length driven: see presentation from CA.)
  - Which of the two low-p DRFS options to chose?
  - Better developed DRFS cost estimates
  - How do CFS estimates scale for low-power option?
  - Do we need to change to a larger tunnel diameter because of single-tunnel solution?

Chris Adolphsen - KCS

CA compared parameters and costs of two possible low-power options to the RDR:

- Half-current (~4.5mA) but same ~1ms pulse length (current SB2009)
  - Reduces the number of modulators/klystrons by a factor of 2
  - Increases pulse length to ~2ms – impact on modulator/klystrons costs as well as cryogenics cooling.
- ~Full RDR current but ½ beam pulse length (~500μs)
  - Shortens RF pulse length (converse argument as above: reduced average heat lowed

Both options significantly reduce the overall RF-to-beam power efficiency (wrt to the RDR).

The SB2009 uses the half-current option (reduces the number of bunches by half, but the train length remains the same). The half-train length option was presented as an alternate way of getting to low power - prompted by some concerns about having to run the longer RF pulse.

CA's estimates: costs are reduced by half current option ~$270M, half train length saves ~$219M.

Discussion:

- Some discussion was had on the upgrade path (restoration of RDR beam power). It was noted that the upgrade path for half-current scenario is to simply add more klystrons/modulators. Worst Case for the half-pulse scenario would be to replace or upgrade the existing hardware (restore RDR pulse length).
- CA agreed to re-consider the scanarios and update his presented table.
- NJW asked if were possible to carry both options trhough to Albuquerque.
    - Need to understand the second-order impact, but it does not seem to be too difficult to scale from one to the other.

Vic Kuchler - CFS SB2009 Working Assumptions

Vic showed a template spreadsheet that will be used to keep track of the CFS related working assumptions.

CFS group will be at SLAC next week, primarily to discuss Central Region Integration, but they will use the opportunity to discuss the HLRF solutions with CA.

It was noted that a stable DRFS conceptual design is not yet available (still being iterated).

Guidance is still needed from PMs on in-tunnel installation issues, including supporting CMs from the ceiling (as proposed for DRFS scheme).

Plan to finish up HLRF issues for the low-p options next week at the SCRF monthly webex meeting 22.07.09, 13:00 GMT.

Shigeki Fukuda – DRFS issues
Presentation can be found here on InDiCo.

- Low-P option is to have one MA Klystron driving 4 cavities
- Current study activitiy is being driven by Availability Task Force discussions, i.e. looking for high-availability solution for DRFS
- Two HA schemes currently being studied
- Note that more design revision and R&D is required for MA modulator & klystron.
- For an upgrade solution, two possibilities were presentated (under discussion): current proposal for upgrading is to use single DC supply to feed 26 cavities (with a backup).
- Reevaluated costs following the Availability Task Force meeting on 08.07.09
    - previously assumed cost of modulator scaled as the sqrt of the power. This is probably an underestimate.
- Slide 8 of SF presentation shows the estimated cost impact for low-power option. Slightly changed from previous table shown at Availability Task Force meeting

(08.07.09)

- Atsushi Enomoto is working with Shigeki on CFS related topics for the DRFS.