

This note contains only brief descriptions of decisions on the five cost reduction proposals discussed at the RDR_MGMT meeting at KEK on 31aug-1sept06, with no discussion of all the arguments considered, and no cost impact information.

This note does not report on further discussions that did not result in a decision on the cost reduction proposals.

A preliminary version of these notes was verbally presented at the conclusion of the KEK meeting. Corrections, suggestions, and other feedback were provided by the participants. A draft version was circulated to the RDR Management Team. Their suggestions were included in this distributed note.

Centralized Damping Rings – Ewan Paterson, coordinator

A change request for going to a single positron DR has been submitted and the CCB “hearing” is scheduled for Friday, 8sept, 1300 GMT.

Can you fit 3 machines (1e- 2e+) in one tunnel? Maybe need to grow from a 4 m diameter to a larger tunnel. In considering a single positron ring, we always reserved the option to go back to 2 positron rings if the problem with electron cloud isn't solved. Andy Wolski said that it would be very big deal to install 2nd e+ ring later. Mike Zisman said they need ~ 2 meter vertical separation between beams to clear cryostats which may be difficult for 3rd ring in a single tunnel. It may also be possible to redesign the RF insertions to reduce the interference between cryostats.

Action items: Make plan for a Centralized DRs and optimized BDS – then go to CCB. This Centralized DR effort also impacts e- and e+ sources and RTML. Andy Wolski would be lead person in preparing change request with lots of help from e- and e+ Sources, CF&S, and Ewan. CCB will require crude cost estimates of the savings.

Ewan mentioned further considerations for a single DR tunnel which would allow parts of the same electron source to also feed the e+ KAS (maybe splitting the e- and e+ bunches at 2 Hz at 3 Hz respectively. The e- Source and e+ Source groups are presently exploring several options.

Jean-Luc Baldy already has a drawing (1.1649.000) with single tunnel centralized DRs

Undulator and Conventional Positron Source – Ewan Paterson, coordinator

Proposal under consideration was to replace the undulator source with an independent injector, no timing problems or trombone would be needed. We wouldn't need the KAS but would need a new 1 km conventional e⁺ source.

Undulator couples operation and commissioning dependence on operation of e⁺ linac.

There is more radiation on conventional positron production station => remote handling.

A conventional source also produces a larger emittance positron beam.

What about moving undulator to end of linac, which would only impact at running at Z⁰?

Decision: Maintain undulator positron source. This preserves the polarization option.

Also encourage people to think about reducing costs of both the undulator and conventional positron source options.

2 vs. 1 Tunnel – Wilhelm Bialowons, coordinator

Discussed alternate tunnel geometries, radiation hardness impacts, availability, additional energy overheads, egress, cost impacts of all of these.

Barry Barish - Optimized (smaller diameters) two tunnel seems like the way to go.

Not a strong case to change from 2 to 1 tunnel,

not enough savings to offset reliability issues,

but should look at optimizing tunnel sizes.

Will things fit in 3.5 and 4.5 meter diameter tunnels?

Priority job for CF&S will be to do the optimizations of diameters of twin tunnels.

Decision – stay with two tunnels but optimize diameters, i.e. try to fit in smaller tunnels.

Wilhelm – what if no savings less than 5+5? Do we re-evaluate single tunnel?

Do we continue to do radiation hardness studies?

CF&S asked for tunnel diameter cost optimization feedback by MAC meeting.

In addition to the Main Linac Area Systems Leaders, after EC approval, members of the RDR_MGMT were given “take-away access” electronic copies of the CF&S cost comparison table for the 3 sites (not including DESY site) as a function of diameter that was shown by Vic Kuchler.

Half-Current in Main Linac and Damping Rings – Kaoru Yokoya, coordinator

Propose that each MR Klystron would drive 6 Cryomodules. Install only every other RF station, but would require additional 36 m waveguide per active station. Impact on Cryogenics since a longer fill time for RF cavities would be required. This would reduce luminosity by up to a factor of 2, but could be recovered if the missing RF stations were added at a later stage (is it politically correct to already be discussing upgrades?). The immediate reduction in luminosity by a factor of 2 can potentially be regained by a shorter bunch length and reducing β^* at the interaction point, the so-called low-P luminosity set. In addition, it was noted that the impact on the first few years of operation would not be large, as increasing the number of bunches over time is a likely ramp-up strategy.

The DR had two possible configurations to the half number of bunches:

- a. Minimal impact if 6.7 km circumference DRs are retained since the RF requirement is dominated by voltage to produce short bunch lengths which is independent of number of bunches, but overall RF power which depends on synchrotron radiation (proportional to beam current) but that power isn't a major factor in the RF costs. Increasing the bunch spacing by a factor of 2 reduces the risk of ion- or electron-cloud effects and kicker rise time.
- b. Reduce circumferences 6.7 km/2 (but Andy Wolski's spreadsheet already had to 2.8 km each from a previous study). This would have substantial cost savings but would not be readily recoverable later without a lot of effort such as $1e^- \Rightarrow 2e^-$ and $1e^+ \Rightarrow 2e^+$ (using vertically stacked rings).

Action items: Propose installing one-half of the Linac RF drivers (upgradeable later).
Is this acceptable to Parameters Committee and physics community?
Need more design and cost estimate information on cryogenics, electrical, water.
What do you need initially and for upgrade (cost benefit)?
How do you reduce those costs?
Defer consideration of smaller DRs at this time.
Chris Adolphsen will lead effort to prepare the change request.
We have to get this also to physics community
– Gerry Dugan will write a draft on the luminosity impact and dependence on energy to be sent to WWS and Parameters Committee either before or in parallel with the change request to CCB.
Need plan for upgrading luminosity as function of time.

Beam Delivery System – hosted by Nick Walker – more status discussion than decisions

- with Andrei Seryi, Deepa Angal-Kalinin, and Hitoshi Yamamoto
- presenting cost reduction elements via telephone link

prior decision: $20+2 \Rightarrow 14+14$ mrad crossing angles

- submitted change request and had CCB “hearing” last week

Andrei circulated a draft change request for reducing two muon spoiler wall stations (18 meters long + 10 meters long) for each of the four BDS legs by a single 5 meter long muon spoiler for each BDS leg.

BDS will also be preparing change request for surface assembly of detectors as for CMS. Facilities on the surface are considerably less expensive than underground facilities.

BDS is evaluating replacing service tunnel with alcoves for power supplies and electronics and placing lasers on surface with only small diameter shafts. Tom Himel asked why alcoves? Andrei said both there is no space in tunnel and for radiation shielding. Tom asked whether a larger tunnel is more cost effective than alcoves every 100 meters. Tor Raubenheimer said electronics are simple and can be made radiation hard more easily than for Main Linac.

So far Andrei has both experimental halls sized to cover the largest and most difficult detector installation.

Andrei requested cost estimate parameter (unit costs) for Civil Construction be given to a representative of each of the detector groups in order to optimize overall cost of the detectors, experimental halls, and related infrastructure. Does this optimization include the BDS costs? After preparation and consideration of a formal proposal, the Executive Committee could choose to extend “take-away” access under confidentiality agreement to this unit cost information (without DESY cost parameters) to representatives of each detector group.

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