



Date: February 20, 2017  
To: File  
From: S. Peggs

Subject: **A digest of the Technical Review report (January 30-31, 2017)**

See [https://www.classe.cornell.edu/CBETA\\_PM/170130\\_review\\_technical](https://www.classe.cornell.edu/CBETA_PM/170130_review_technical)

The following is a “digest” of 34 comments and recommendations in the final committee report.

1. p2 “It would be nice to see **a complete loop for the tolerance / specifications** discussion (alignment, temperature versus number and strength of the corrector elements) that demonstrates that the most cost effective solution has been adopted ...”
2. p2 “... recommend to include the **space reservations for the diagnostics boxes** in the splitter section ... and to mark the required space for these items in the layout drawings.”
3. p2 “We would recommend preparing a **simulation tool for testing the LLRF** system in multi-turn ERL operation mode.”
4. p2 “... nice to see a more complete discussion on the **maximum expected beta-beat** for the uncorrected quadrupole errors in the machine for different installation scenarios (e.g. random versus sorting) ...”
5. p2 “... nice to see a thorough **robustness study** (e.g. orbit & optics function range for various field errors & magnet alignment error implementations & with BPM errors) ...”
6. p2 “... useful to define early on the desired parameter range for such **an [high current] auxiliary program** to see if that all accelerator components are compatible ...”
7. p2 “... interesting to explore **the flexibility of the present lattice parameters**, e.g. tune vs momentum and  $\tau$  vs momentum, as a function of the correction circuits.”
8. p3 “...the review committee did not see a detailed description of the different ... for the **4-step commissioning of the splitter**: from a single pass ... to a 4 pass ERL operation.”
9. p3 “...it was stated that the ... **path length shifter does ... not require transverse displacements**. Is this also ... between the four commissioning steps of the splitter?”
10. p3 “...useful to define ... ‘how’ and with ‘what accuracy’ **these [lattice and twiss] parameters can be measured** at each commissioning stage ...”

11. p3 “A staged approach of developing **an online model** is recommended, starting ... single particle tracing [with] detailed hardware ... to intensity dependent effects ...”
12. p4 “Information on the **sensitivity of the path length on orbit errors** in each section (by simulation) would be useful for the machine tuning during the commissioning.
13. p4 “... an operation with a slightly different **energy gain in the MLC** could possibly cure **BBU** ... it is important to estimate **momentum jitter** and its effects on BBU ...”
14. p5 “This explicit assumption [about **Halbach magnet block overage**] should be based on empirical data and other estimating tools.”
15. p5 “Even the[**Halbach**] **magnets that can be split need to maintain field strength and quality**, and the assembly and disassembly needs to be done safely.”
16. p5 “... magnetic **measurement and shimming [capability] needs to be maintained** throughout ... [operations] ... in order to expediently replace a magnet if necessary.”
17. p5 “The required **resolution of path length measurement and adjustment** does not seem to be completely determined, and needs to be specified.”
18. p5 “The **cross-talk between all splitter-combiner magnets** has not been investigated yet, which is required for a proper functioning of the splitter-combiners.”
19. p5 “**Orbit corrections simulations** were done without BPM errors. This is easily correctable and will give a more realistic simulation.”
20. p5 “**Orbit correction** schemes with a **reduced number of correctors** (e.g. half) could provide guidance for scope reduction.”
21. p5 “... **mechanical noise** from water pumps, AC, and the Kinney pumps may interfere with operation ... [and] ... should be properly **evaluated, and mitigation** ... .”
22. p5 “**Large microphonic noise** on the unstiffened cavities in the MLC is a concern for stable operation of CBETA. A plan needs to be devised to **mitigate this noise**.”
23. p6 “The **margin on the HOM power** in MLC was not presented. A small margin can limit certain operational modes.”
24. p6 “The types, numbers, and location of **beam loss monitors** is ... necessary for both operation, and the final design of the **machine protection system**.”
25. p6 “... **passive insulation near the roll-up door** may improve temperature stability ...”
26. p6 “To **complete the requirement for the electrical infrastructure**, final design specification ... are needed.”
27. p6 “The MPS design was based on the melting temperature of the beam pipe. A more conservative approach is to **base the MPS design on yield strength** ...”

28. p7 “Designs for splitter combiner **support structure** as well as arc **girders** would likely be beneficially refined with a round of **critical value engineering**.”
29. p7 “The **splitter ... regions** are especially crowded ... **Drawings** that include all components, ... should be completed to demonstrate a practical solution ... .”
30. p7 “...re-evaluation of **alignment of [Halbach] magnets on girders** ... should be completed very soon so that final alignment of magnets on girders can be specified.”
31. p7 “The radiation shielding calculations should include **fault studies**. ... evaluate **effect of radiation on magnet field quality** in order to establish tolerance to beam loss.”
32. p8 “We recommend that the **[misalignment tolerance] study** be extended to include field errors and ... to specify; survey tolerance, BPM resolution, field quality and stability.”
33. p8 “The CBETA design requires that the **[Halbach] magnets be split** for installation. This feature, along with the standard magnetic properties **must be demonstrated**.”
34. p8 “The **design of the splitter ... magnets** should be finalized ... so that power supplies can be specified ... electrical power and cooling water requirements can be established.”