

Statements on Crab Cavities from CERN

(Steve Myers, Director of Accelerators and Technology)

1. Following the success of KEKB, CERN must pursue the use of crab cavities for the LHC, since the potential luminosity increase is significant.
2. A final crab-cavity implementation for the LHC has not yet been settled. Both “local” and “global” crabbing schemes are still under consideration for the LHC upgrade phase II. Future R & D should focus on compact cavities which are suitable for both schemes.
3. One possible show-stopper has been highlighted: machine protection, which is critical for LHC. The effect of fast cavity changes needs to be looked at with high priority. Mitigation schemes such as raising the Q value of the cavity to $\sim 10^6$ (from $\sim 10^5$ at KEK) will be studied.
4. Another important issue is the impedance. Since the LHC revolution frequency changes during acceleration, the detuning of the cavity may be more difficult than was the case for KEKB, and other measures (like strong damping of the dipole mode) need to be examined.
5. High reliability of the crab cavities is essential; the trip rate should be low enough not to perturb LHC beam operation.
6. Validation cavity tests in the LHC itself are not deemed essential. It is considered plausible to install a new system in the LHC without having tested a prototype in the LHC beforehand. As in all new colliders, this has been done with many other components.
7. Demonstration experiments should focus on the differences between electrons and protons (e.g. effect of crab-cavity noise with beam-beam tune spread; impedance; beam loading) and on reliability & machine protection which are critical for the LHC.
8. A beam test with a KEKB crab cavity in another proton machine is considered useful, meaningful and sufficient (for deciding on a full crab-cavity implementation in LHC) if it addresses the differences between protons and electrons.
9. Possible modifications of LHC Interaction Region 4 during the 2013/14 shutdown should be studied to evaluate the feasibility of installing and testing crab-cavity prototypes, and of accommodating a possible global crab-cavity scheme.
10. The timing of the crab-cavity implementation should be matched to the short and long-term goals and to the overall CERN schedule, and be in phase with the experiment upgrades.
- 11. The crab-cavity infrastructure should be included in all other LHC upgrades scenarios.**
- 12. Crab cavities can increase the LHC luminosity without an accompanying increase in beam intensity, thereby avoiding negative side effects associated with high intensity and high stored beam energy. This opinion has been endorsed by the general-purpose high-luminosity experiments.**