Efficiency of High Order Modes Extraction in the European XFEL Linac


Abstract

The serial production of components for the European XFEL linac was started in 2011 and reached the planned level of 8 cavities (1 module) per week in 2013. The measurements of High Order Modes (HOM) characteristics under cryogenic conditions (2K) are being done at the Accelerating Module Test Facility (AMTF) by the IFJ-PAN Team in collaboration with DESY groups.

More than 50 % of the cavities have been already produced and 30 % of the whole amount were measured during either cavity vertical tests or module tests.

We present first statistics of these measurements and analyze the efficiency of HOM extraction.

Summary

- The reduction of a HOM damping efficiency for the European XFEL cavities is caused by some critical changes in the field distribution on TM011 (zero mode).
- RF simulations show that these changes are possible even for geometry deviations of about ±0.2 mm in the equator radius within specific cells.
- Some geometry deviation influences could be reduced by an algorithm of parts sorting during cavity fabrication. However, such shape errors, generated during cavity welding, could not be compensated without expensive and time-consuming actions.
- Based on the European XFEL beam parameters, the HOM damping is not as critical as for the TESLA linac. Therefore it was decided to relax the HOM damping requirements for the monopole mode TM011_9: Q_{load} limit from 1×10^5 to 2×10^5.

The further work on the HOM damping improvement is going on in collaboration with cavities manufacturers.

References:


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