

# Practical Aspects of HOM Suppression Improvement for TM011

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## Abstract

Some Higher Order Modes (HOM) pass bands were controlled during cryo-tests at DESY for the European XFEL cavities. The second monopole mode (TM011) showed most instabilities and suppression degradation [1].

The authors will explain this phenomenon on the example of cavity CAV00553 and present the practical method of TM011 damping improvement.

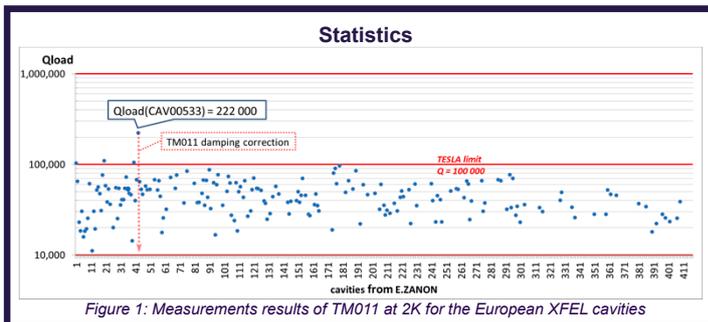


Figure 1: Measurements results of TM011 at 2K for the European XFEL cavities

## Repair

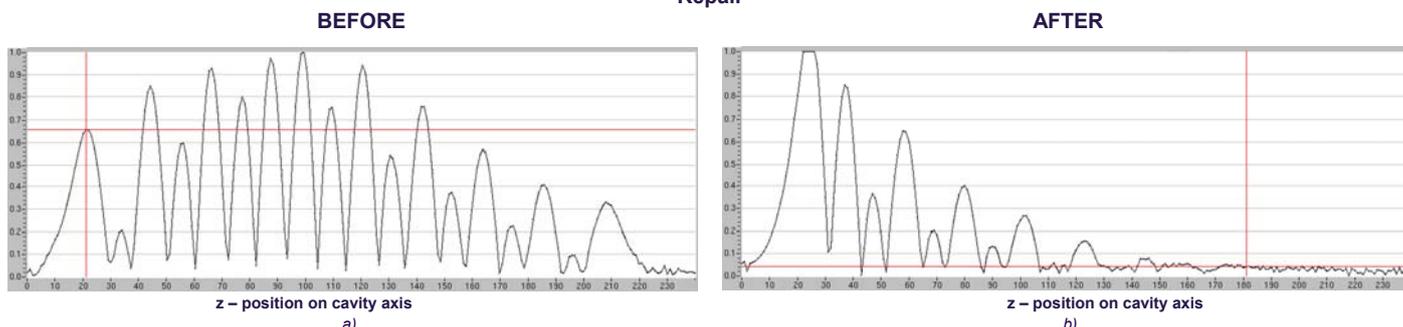


Figure 2: Normalized field distribution of TM011 |E| (r=0, z) for CAV00553: a) with long cell #1 (dL ≈ 2 mm); b) after the length reduction for cell #1.

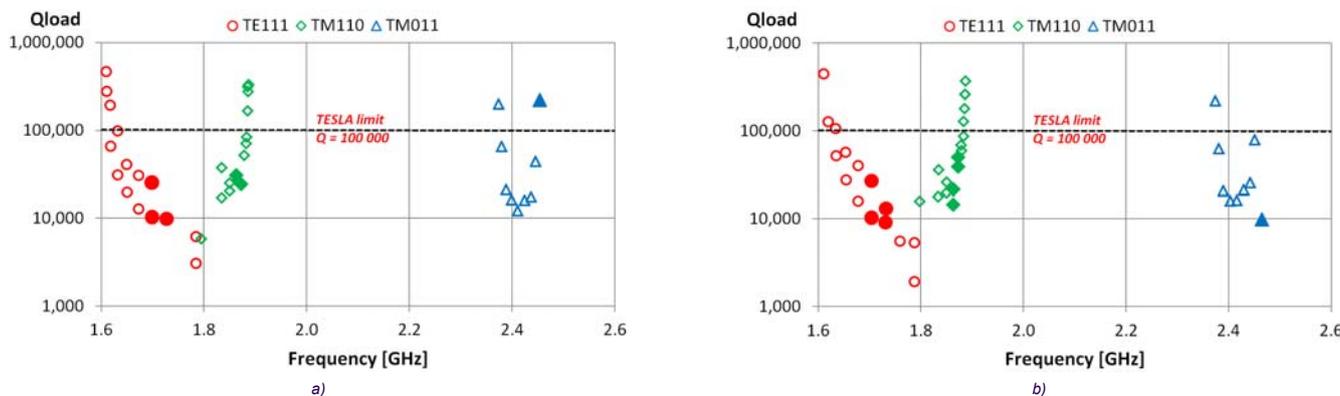


Figure 3: HOM suppression for CAV00553: a) with long cell #1 (dL ≈ 2 mm); b) after the length reduction for cell #1.

## Deformation

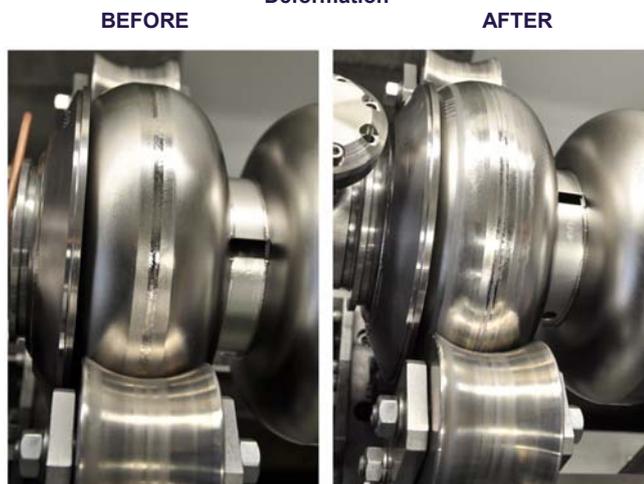


Figure 4: Equator diameter reduction of the cell#1, with rollers [2]

## Summary

Almost all cavities from company E.ZANON correspond to TESLA HOM suppression criterion, but we found that operation of trimming for a cavity part was omitted and cell #1 of CAV00553 became 2 mm longer than usual after field flatness fundamental mode tuning.

This accident allowed us to check on our simulations and measurements done in [1]. Thus the influence of geometry inaccuracy and field distribution on HOM damping efficiency was practically approved.

It was shown that TM011 suppression improvement is possible without damping degradation of dipole modes (TE111 and TM110).

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

### References:

- [1] A. Sulimov et al., "Efficiency of High Order Modes Extraction in the European XFEL Linac", Proceedings of LINAC2014, Geneva, Switzerland, 2014, pp. 883-885
- [2] W. Singer, X. Singer, I. Jelezov, P. Kneisel, "Hydroforming of elliptical cavities", Physical review special topics - accelerators and beams 18, 022001, 2015.