MOP051

The statistics of industrial XFEL cavities fabrication at Research Instruments

A. Sulimov[1], M. Pekeler[2], J.-H. Thie[1], D. Trompetter[2],
[1] – Deutsches Elektronen-Synchrotron, DESY, Notkestrasse 85, 22607 Hamburg, Germany,
[2] – RI Research Instruments GmbH, RI, Friedrich-Ebert-Straße 1, 51429 Bergisch Gladbach, Germany.

Abstract

The serial production of superconducting cavities for the European XFEL was successfully started at RI Research Instruments GmbH (RI) at the end of last year. The current status of fabrication is 4 cavities per week. It allows us to summarize the results and present the statistics of industrial cavity fabrication at RI. Many parameters have been traced during different steps of cavity production. The most interesting of them, as cavity length, frequency, field flatness and eccentricity, are presented and discussed.

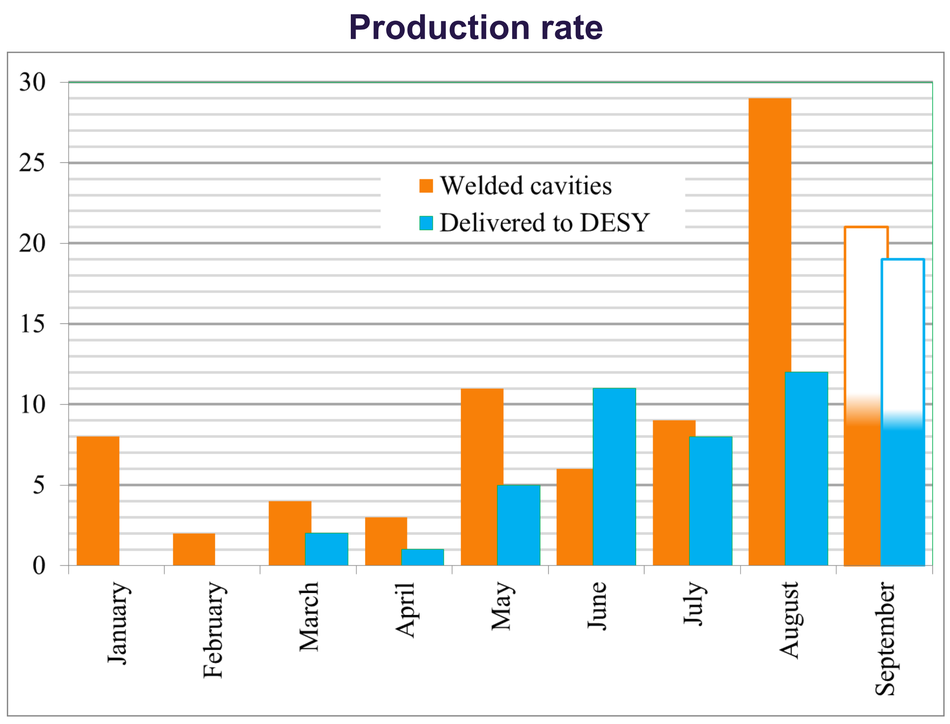

Figure 1. Production rate at RI in 2013

Mechanical Characteristics: Shrinkage / Length / Eccentricity

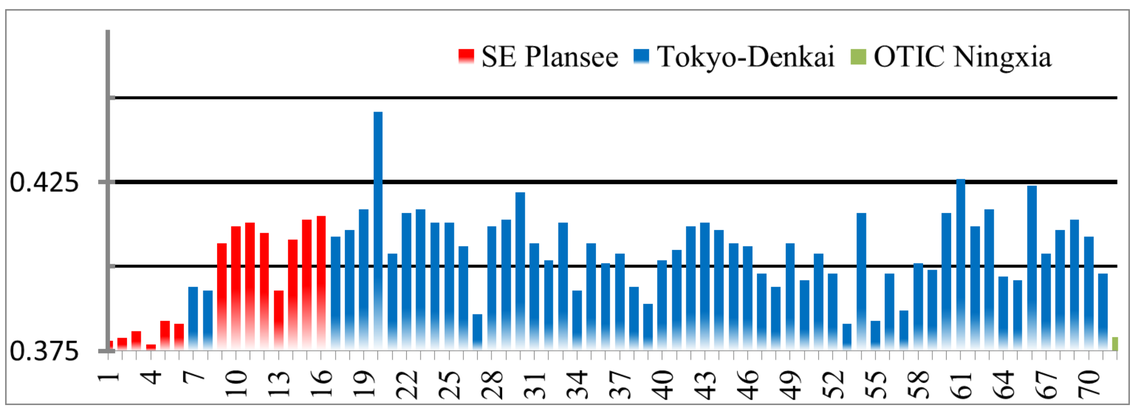

Figure 2: Shrinkage [mm] *of equator welding seams for different materials*

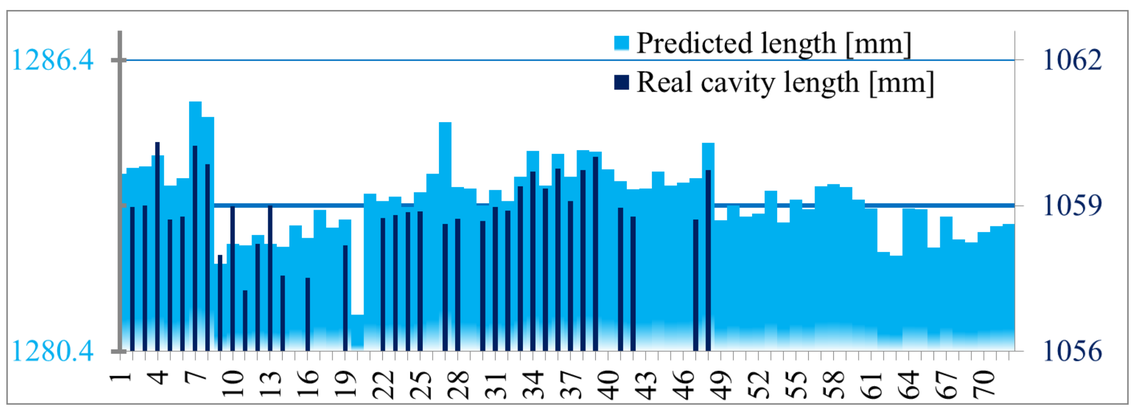

Figure 3: Predicted (light blue) and real (blue) cavity lengths

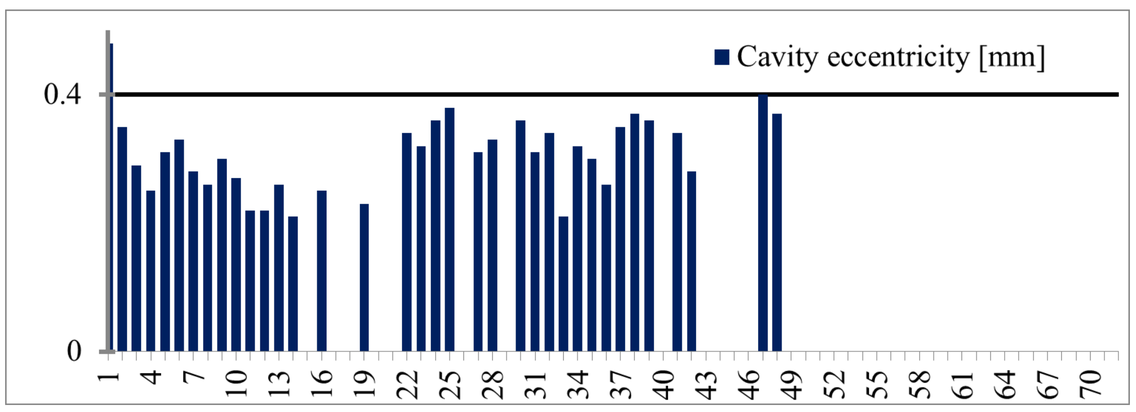

Figure 4: Maximum of cavity eccentricity before welding in helium tank

RF Characteristics: Frequencies / Field flatness

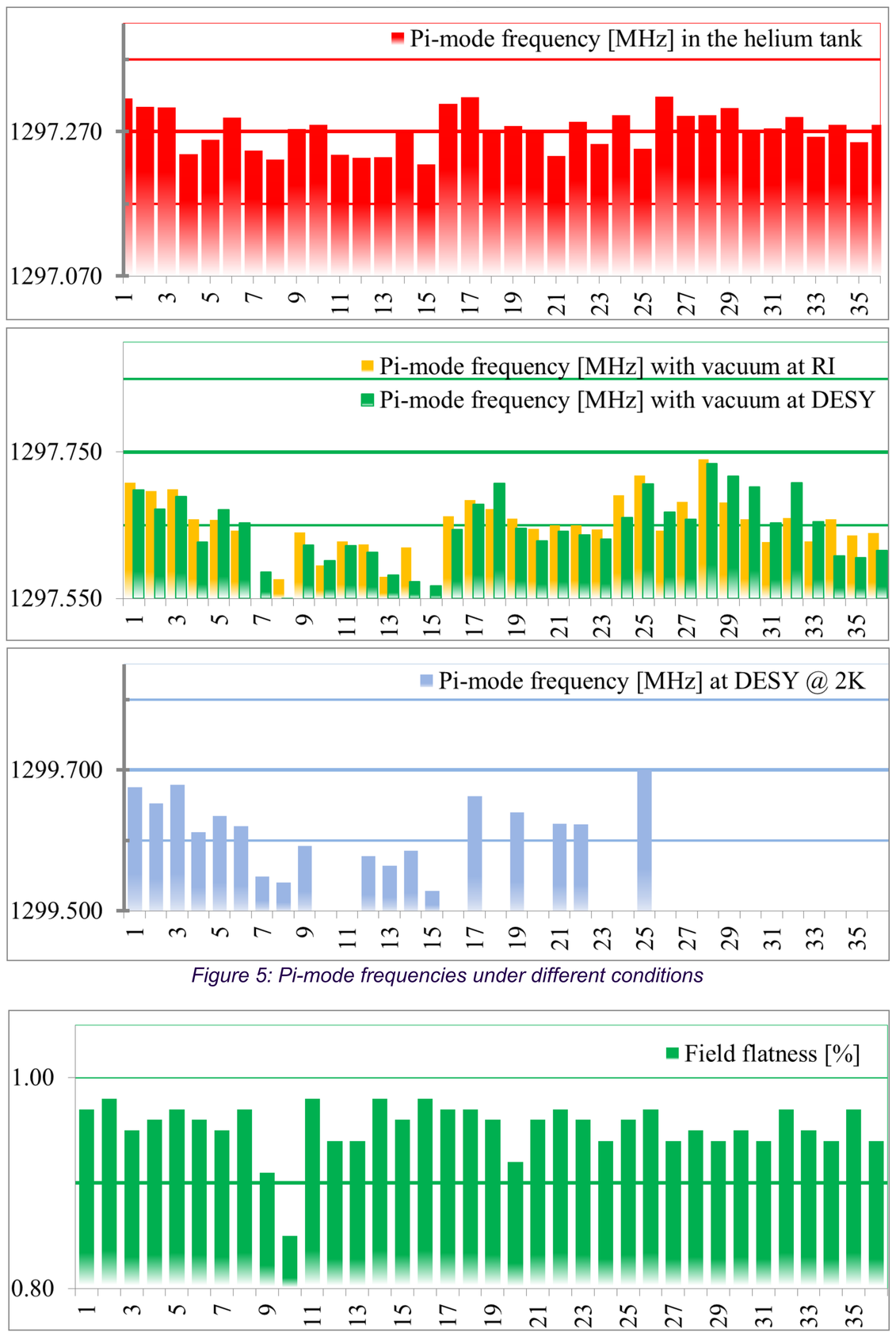

Figure 5: Pi-mode frequencies under different conditions

Figure 6: Flatness of E-field distribution after a pressure test

Summary

- For 36 calendar weeks in 2013:
  - RI Research Instruments (RI) produced 76 cavities;
  - 36 cavities were welded into the helium tanks by RI and sent to DESY;
  - 23 cavities were tested under cold condition at DESY;
  - 15 cavities were sent to CEA (Saclay) for module assembly.
- The main results of the statistics analyzes are:
  - welding shrinkage parameter is very stable for the two material suppliers (Tokyo Denkai and SE Plansee). The mean value is (0.404 ± 0.010) mm. For OTIC Ningxia material we do not have enough statistics yet;
  - the average length between reference rings of produced cavities is 1058.96 mm, as required by the XFEL specification (1059 mm);
  - real cavity lengths are very close to predicted values. So we can define the length reduction to 1 mm according the additional requirements from DESY;
  - the average maximal eccentricity value for cavities is 0.3 mm. So the cavities are straighter than it's required by the XFEL specification (0.4 mm);
  - after the cold measurement results for pre-series cavities the pi-mode frequency was increased, correcting the target values during the tuning. Further control and correction are planned;
  - the average field flatness of produced cavities after a pressure test is 95 % (required more than 90 %).

References:
[1] A. Sulimov et al., "Description and First Experience with the RF Measurement Procedure for the European XFEL SC Cavity Production", 2nd IPAC'11, San Sebastian, Spain, 2011, pp. 277-279.
[2] A. Sulimov et al., "First RF Measurement Results for the European XFEL SC Cavity Production" Proceedings of LINAC2012, Tel-Aviv, Israel, 2012, pp. 195-197.
[3] http://xfel.desy.de/cavity_database/cavity_production/