Operation Experience with Half Cell Measurement Machine & Cavity Tuning Machine in 3 Years of the European XFEL Cavity Series Production


Introduction

For the European XFEL superconducting cavity series production at both cavity vendors’ four manufacturing machines for production key functions, Half Cell Measurement Machine (HAZEMEMA) and Cavity Tuning Machine (CTM), are supplied by DESY. Among three years of cavity production in two companies, Research Instruments GmbH (Germany) and Ettore Zanon SpA. (Italy) a lot of experience is gathered about influence of surroundings and production quality on cycle times, machine drop outs, general stability time of machines and parts subject to wear.

Maximum drop out time 3 days!

- No large defects within 3 years except wear-parts.
- Complete spare machine available for exchange.
- Regular maintenance & calibration all 6 Month.
- RF Measurements for all cavity cells, end groups & dumb-bells.
- Incredible number of 22,000 performed measurements.
- Helpful experience and statistics about production quality.
- Full RF measurements on CTM before TM011 Measurements performed.
- Main elongation factor: ...up to infinite time for tuning...
- Temperature stability during tuning & measurement is most important surrounding factor!
- Generally high mechanical production quality is necessary to hit targets for European XFEL cavity series production:
  - Cavity straightness before tuning.
  - Geometrical factors like deviations of cell shape.
  - Inhomogenous welding shrinkage distribution.

See: THPB066
RF Analysis of Equato Welding Instabilities for E-XFEL Cavities by A. Sulimov

Summary

- About 95% machine availability within over 2500 operating days for entire European XFEL superconducting cavity production for all four machines together.
- No production “bottle Neck” by HAZEMEMA’s or Cavity Tuning Machines caused.
- About 22,000 successful measurement operations done on HAZEMEMA’s.
- More than 2000 tuning operations successful done on CTM’s.
- More than 1000 additional measurement operations performed on CTM’s.
- Over 150 “hard” cavities straightened without annealing by CTM.
- Well approved service & repair concepts for allover machine mechanics, electronics and software support even via remote access on machines.
- All machines, service & repair concepts and service teams among the collaboration have proven their ability for large industrial series productions at first rate.