MOPB079

Analysis of the Test Rate for European XFEL Series Cavities

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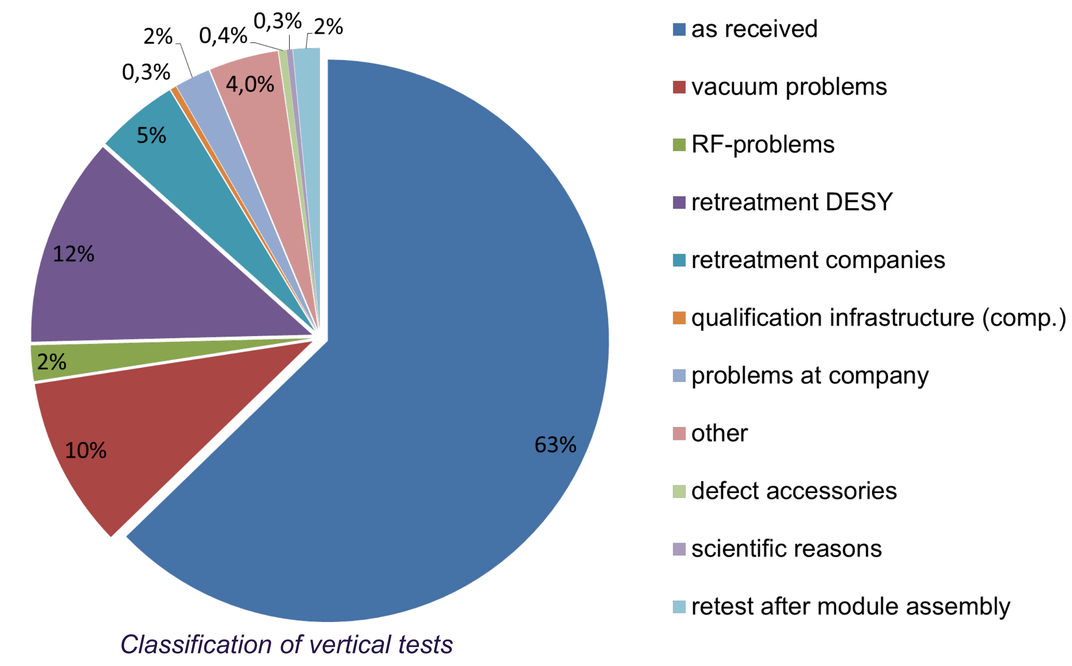
Abstract

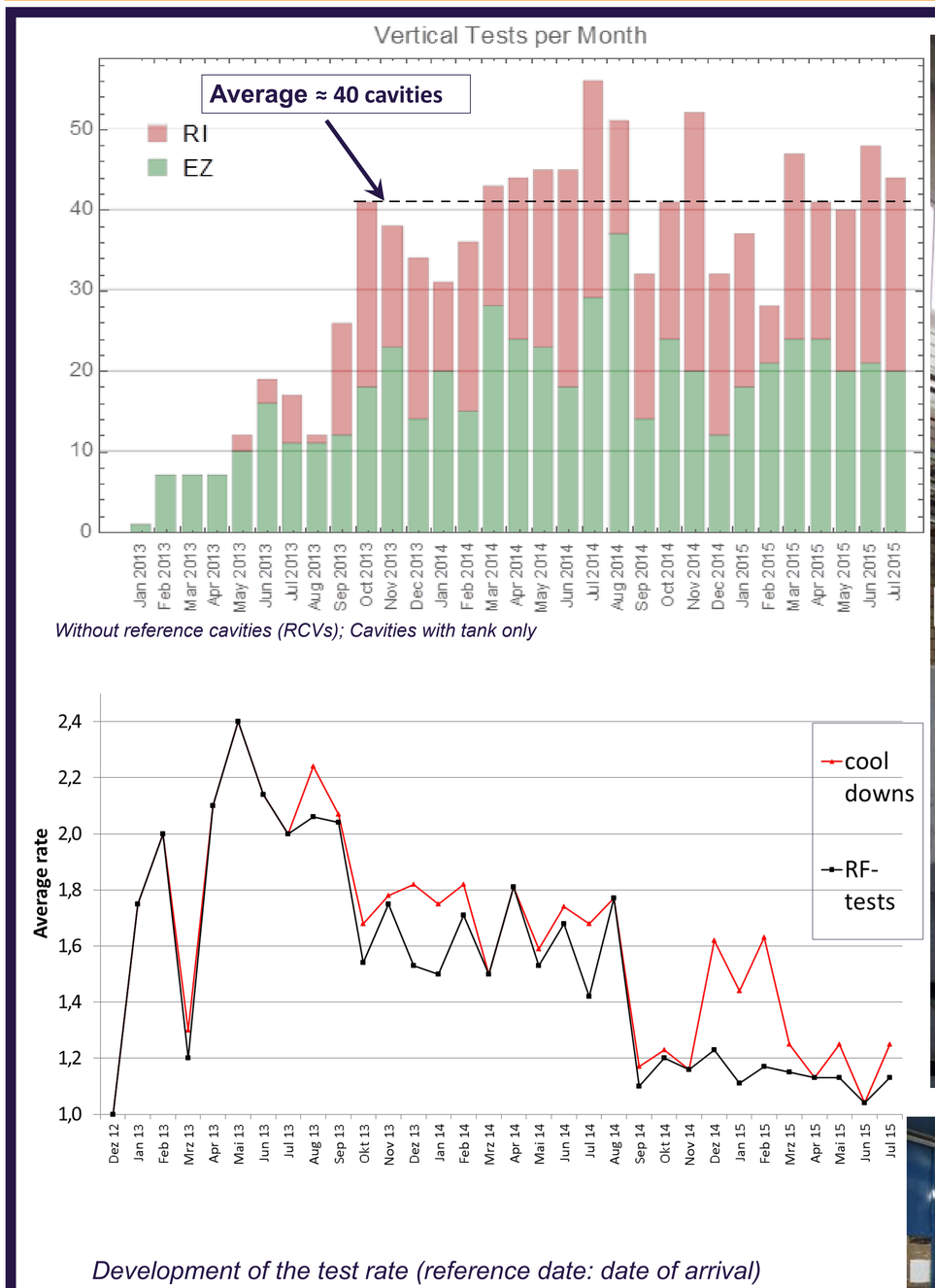
The main part of the superconducting European XFEL linear accelerator consists of 100 accelerator modules each containing eight RF-cavities. Before the installation to a module, all of these cavities will be tested at cryogenic temperatures in a vertical cryostat in the accelerator module test facility (AMTF) at DESY. This paper discusses the average vertical test rate at the present status. It should be 1 in the ideal case, but actually it's observed to be approximately 1.5. Classification and analysis concerning the reasons for this deviation are given as well as suggestions for a reduction of the test rate for future production cycles.

- Ideal case: test rate = 1 test/cavity ("as received")
- 1103 RF-tests were performed on 741 European XFEL series cavities until July 31, 2015
  => average test rate 1.49 tests/cavity
- 1181 cavities were in cool down cycle => some aborted
  => average cool down rate 1.59 cool downs/cavity



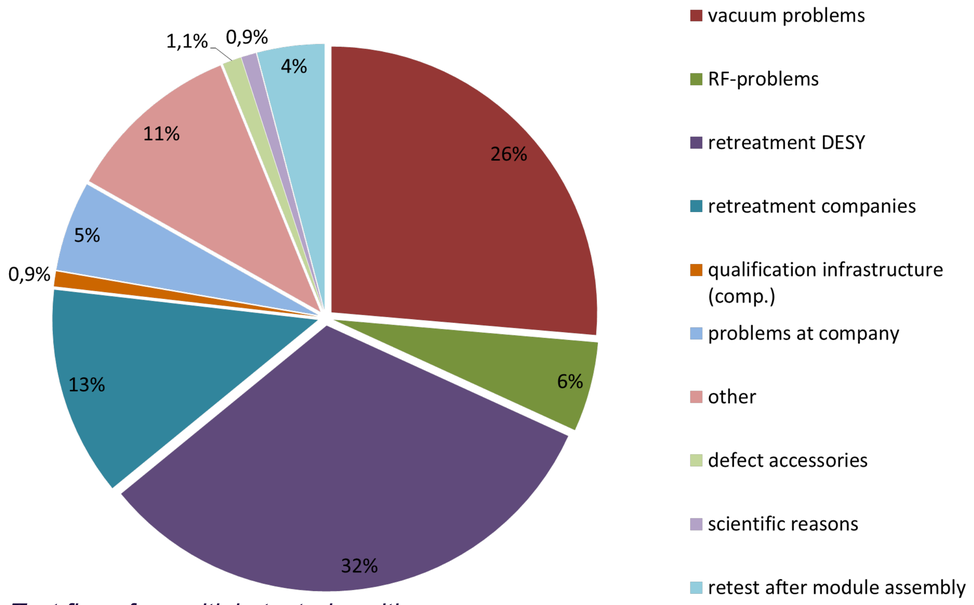
Classification of vertical tests

Classification according to cavity performance (RF-test & incoming check): "as received", "retreatment DESY", "retreatment companies" and "problems at company" => 82%; other ones related to infrastructure & accessories => 18%



Without reference cavities (RCVs); Cavities with tank only

Development of the test rate (reference date: date of arrival)



Test flags for multiple tested cavities

- Flags "retreatment at DESY" and "vacuum problems" are dominating
  - "Retreatment at DESY": usable gradient below 20MV/m (26 MV/m at the beginning)
  - "Vacuum problems": points to insufficient vacuum setup
    => Most time was spend to fight against these two problems
- "Other": summarizes all tests required for QC after transport (companies & module assembly), measurement or performance after repair work.
- "problems at company": welding problems, tuning, etc.

- 50% of all cool downs for multiple tested cavities are related to the cavity performance (RF-test & incoming check)
- The other 50% are related to problems at AMTF infrastructure, accessories and repair work

- Beginning of 2014 and end of 2014/start of 2015 significant amount of cold leaks
  => cool downs stopped before RF-testing started
  => caused by missing QC at connection flange and defect accessories (feedthroughs).
- Since Sep. 2014 the test rate for the RF tested cavities improved to 1.20
  => Caused by several improvements at the companies

- Tests for the qualification of the infrastructure at the vendors were made with the reference cavities (RCVs)
- Not covered in the data above.
- The test flag „qualification infrastructure" at vendor enters with < 1%.
- In total (with RCVs) 36 tests were needed for the qualification of the infrastructure at the companies.

Summary

The development of the test rate over the period of the cavity production was presented and a classification procedure for all tests is described. The tests can be related to the cavity fabrication (vendor) or to the handling at the user site. Main reasons for additional cavity tests are "Retreatments" and "vacuum problems". A short overview of cavity tests during the commissioning phase at the vendors is presented, too.

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