

# **Development and Design of a RF-Measurement Machine** for the European XFEL Cavity Fabrication J. Iversen\*, Th. Buettner, A. Goessel, D. Klinke, G. Kreps, W.-D. Moeller, C. Mueller

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#### Abstract

Radio frequency measurements on parts and subassemblies of superconducting cavities during its fabrication are a proper method of quality management and quality assurance. During the fabrication of 1.3 GHz cavities for FLASH, a simple device was used for measuring the half cells, dumb-bells and end groups. Because of the long test duration the device is not applicable for mass production of 800 cavities. A semiautomated RF measurement machine was designed and built. This machine performs an easy load of the parts, consistent RF contacts, automated RF measurements and documentation. We describe the functionality of the RF-measurement machine and performance of the prototype during fabrication of 40 cavities for FLASH.



Figure 1) A simple device was used for the production of 72 Cavities for FLASH, manual clamped, undefined contact



Figure 2) Measurable parts and subassemblies of the 1.3GHz cavity

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Figure 3) Prototype machine (called HAZEMEMA)



Figure 4) Clamping of a dumb-bell

	Clamping	Test duration for dumb-bell	Required manpower
Simple device	manual	5 min	2
New machine	automated	2 min	1

Table 1) Main differences

	Parts per cavity	Measurements done for 41 cavities
Normal half cell	16	656
Short half cell Long half cell	2	82
Dumb-bell	8	656
End half cell unit	2	82
Short end group Long end group	2	164
Summary	30	1640

Table 2) Experiences (amount of measurements done during the fabrication of 41 cavities)

## **Development phases**

- Developed and designed in 2006
- Fabricated in 2007 and 2008
- series production
- (not completed finally)

# The challenge

geometry!



### Summary

• The prototype machine was successfully used for the recent cavity production for FLASH • "one-man" operation realized Considerable decreased test duration Software automated measurement and documentation • Minor changes of the design are necessary for industrial use during series cavity fabrication for European XFEL • Requirements in accordance with EC directive of machinery are fulfilled • EC conformity operation is running



#### THPPO071

• Used during the production of 41 cavities for FLASH in 2007

• Improvements and redesign done in 2008/2009 because of e.g. safety aspects and CE declaration of conformity in accordance with the EC directive of machinery for the application for mass

Fabrication of two machines for XFEL cavity fabrication in 2009

Clamping of the half cells with appropriate electrical contact! > Clamping of the half cells without deforming the RF-Perturbation bead for asymmetry measurement RF-Antenna 0-Ring Contact plate (Niobium)

• Two more machines are under fabrication

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