

A NEW HIGH RESOLUTION OPTICAL SYSTEM FOR INSPECTION OF GUN – AND MULTI-CELL RESONATORS IN ISO-4 CLEANROOMS.



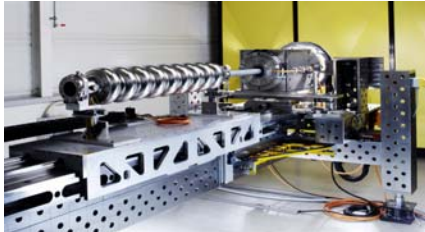
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Abstract

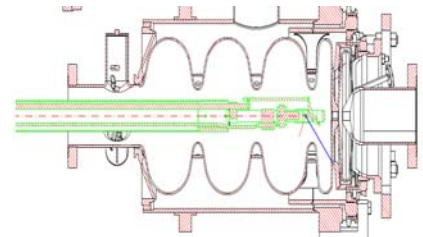
Optical inspection of the inner surface of superconducting resonators was established during European XFEL cavity production by usage of the so called OBACHT optical inspection. In addition to the surface inspection by OBACHT a new optical inspection system with integrated high resolution camera is set up at DESY. It allows inspection of multi-cell resonators as well as gun resonators with only single side accessibility to the inner surface. A prototype was commissioned and optical inspections done with OBACHT and the new system in parallel. Two SRF gun cavities were inspected by this optical system and origin of limitations of the resonator were identified.

Requirements



- Existing system is installed in a non- cleanroom area
- Transport over DESY plant needed
- Ultrasonic and UPW rinsing after inspection is necessary

- Installation of the new system in a cleanroom.
- Get a free view on a back plate of a SRF gun cavity or with blind flange closed cavities.



SRF gun cavity of HZDR and the optical system

First experience with inspection of cavities

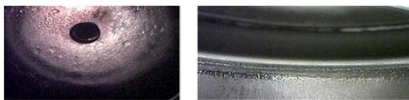


- First test set up for the inspection of the 3,5 cell SRF gun Cavity of HZDR



- Better camera system was installed

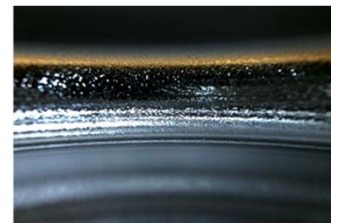
See3CAM_CU130 - 13MP USB 3.0 e-con Systems,



- Set up was unsatisfactory, resolution of pictures had low quality

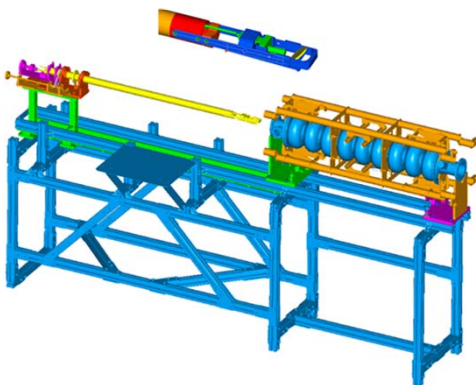


Inspection of the back plate with new camera



Inspected weld with new camera

Construction of a new setup



- Adjustment of mirror during inspection (inspection of the whole surface possible).
- A stiffer rod avoid vibrations. (stable focus)
- Axial lightening (better illumination of the inner surface.
- support which can capture cavities up to nine cells, with or without helium vessel, will be included to guaranty a better horizontal orientation.



Connection of cavity to inspection device, horizontal adjustment partly possible



Adjustment of the focus via vernier height gauge



Measurement and orientation tools

Defect on SRF - gun cavity was found



1,6 cell DESY SRF gun



The inspection of the 1,6 cell DESY SRF gun cavity has shown irregularities. In the middle of the back plate at the cathode hole, damages were found. Closer investigations showed indium which is used for sealing of the lead plug.

Summary

- To preserve cleanliness of cavities, whose inner surface should be inspected, a new high resolution optical inspection system for non-standard Cavities was set up in a cleanroom at DESY. Since the optical inspection system was built, four single cell and two SRF gun cavities (1.6 and 3.5 cell) have been inspected.
- Visible defects on one SRF gun cavity have been detected. It should be noted, the OBACHT system and the new one are not comparable. OBACHT is fully automated and has higher resolution and the new system is manually operated
- All goals have been achieved. Various improvements took place during the first experiences. A suitable device for the compliance of the quality is under construction.
- The comprehensive work done for the OBACHT system enabled us to develop an usable optical inspection unit for cleanrooms in a quickly, cost-efficient manner and with little implementation difficulties.