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Copper Measurements with High Frequency Ultrasound Microscope

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Field emission and electrical breakdowns play a central role in the RF conditioning process of particle accelerating structures. However, actual mechanical changes in the copper surface and just beneath the surface are unclear. Ultrasound microscopy is an advanced method to measure mechanical properties point-by-point from the sample surface. High lateral resolution, 3.5 μm, can be achieved by using focused 250 MHz ultrasound. By amplitude calibration both bulk and Young's moduli can be extracted from ultrasound echoes, as well as from time of flight imagines that describe the topology of the sample surface.

To understand how breakdowns and the field emission affect the copper sample, we measured copper electrodes of the CERN DC-spark-system, before and after breakdowns. Similarly, we have studied the field emission effect.

We are currently developing a method to image subsurface features of the sample based on synthetic aperture focusing technique (SAFT). Whereas, traditional focused high frequency ultrasound is mostly limited only short focus distance, 50 μm –700 μm and only suitable for surface imaging, SAFT allows one to move numerically the focus beneath the surface.

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