

Niobium defect behavior around electron beam welds

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Cornell University is one of the foremost leaders in superconducting radio-frequency technology. We have extensive infrastructure for the design, fabrication, testing, and trouble-shooting of state-of-the-art superconducting cavities. We currently are active members of the International Linear Collider (ILC) collaboration where we are developing the techniques necessary to fabricate the required 16,000 superconducting cavities. All of these cavities have to operate with surface electromagnetic fields that are only rarely achieved in the lab. One of the limits to achieving the desired electromagnetic field level is defects on and around the high-precision electron beam welds, which join the subcomponents of the niobium cavities. This project will involve you in the study of the formation of and the life cycle of defects on and around niobium electron beam welds. This will be accomplished by making test welds, looking for defects in test welds with different pedigrees, observing the response of defects to different surface treatments, and the experimental techniques involved in supporting this research. In this project you will be exposed to a wide range of common experimental physics techniques, useful in any experimental physics career: surface characterization measurements (e.g. SEM, XPS, etc), metallurgy, cryogenics, data acquisition, data analysis, chemical etching/polishing, mechanical fabrication, and high-temperature vacuum processes.