Material Characterizations in the Sub-THz Region for Particle Accelerators

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Coatings play a crucial role for the functionality of vacuum chambers in particle accelerators, serving dual purposes by efficiently facilitating pumping and mitigating electron cloud effects. However, their impact on the surface resistance of chamber walls raises concerns, potentially influencing machine performances and imposing limitations on achievable energies and currents. Therefore, an electromagnetic characterization is essential for a comprehensive study of accelerator structures, particularly in the context of the next generation of particle accelerators where the demand for extremely short bunches accentuates the importance of assessing material responses in the sub-THz region.
In this presentation, we focus on the electromagnetic characterization of three different types of Non-Evaporable Getters (NEG) coatings. Specifically, we examine the CERN standard, a densified film using HiPIMS, and porous, high-pressure coated. NEG coatings are particularly utilized to achieve conditions of ultra-high vacuum. Additionally, we explore the characterization of Amorphous Carbon (a-C), necessitating a modification of the setup. a-C is primarily employed for mitigating the electron cloud effect. We will showcase the electromagnetic characterization of these coating materials using a time-domain method based on THz waveguide spectroscopy. This advanced methodology allows for a comprehensive exploration of the electromagnetic properties of coatings, providing valuable insights into their behavior within the sub-THz frequency range. The findings contribute to a deeper understanding of the intricate interactions between coatings and accelerator structures, with the aim of optimizing performance and efficiency in the evolving landscape of particle acceleration technologies.