Coated and laser structured surface characterization for particle accelerators

In new generation particle accelerators and storage rings, high energy, high intensity and ultra-high vacuum requirements may lead to particle instabilities. In particular, the finite conductivity of the vacuum pipe walls could be a major source of impedance, which describes the coupling between the beam and the surrounding environment. Therefore, a reliable electromagnetic (e.m.) characterisation of coated and laser structured surfaces is mandatory and required up to hundreds of GHz due to very short bunches. We propose two different measurement techniques for an extended frequency characterization from GHz to THz. A resonant one, based on dielectric cavities, to evaluate the surface resistance of laser structured conducting surfaces at low frequencies. A THz time domain setup based on the signal transmission response of a tailored waveguide to infer the coating e.m. properties of NEG and Amorphous Carbon coated samples from 100 to 300 GHz or even further. From these measurements, and using numerical and analytical tools, we model the real and imaginary part of both longitudinal and transverse resistive wall beam impedance.