ACCELERATOR SEMINAR

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CERN

Thursday, 20. May 2021 at 4 pm

Online-Seminar via Zoom
(ID: 933 0510 4930/ PW: 992609)

Studies on X-band dielectric accelerating structures

A potential alternative to conventional RF disk-loaded copper structures is dielectric accelerating structures, which utilizes dielectrics to slow down the phase velocity of travelling wave in the vacuum channel. A dielectric accelerating structure comprises a simple geometry where a dielectric tube is surrounded by a conducting cylinder. The simplicity of dielectric accelerating structures offers great advantages for fabrication of high frequency (>10 GHz) accelerating structures, as compared with conventional RF structures which demand extremely tight fabrication tolerances. This is of a great importance in the case of linear collider where tens of thousands accelerating structures have to be built.

This talk investigates numerically an efficient X-band dielectric assist accelerating (DAA) structure operating in a higher order mode of TM02-π. This accelerating structure consists of dielectric disks with irises arranged periodically in a metallic enclosure. Through optimizations, the RF power loss on the metallic wall can be significantly reduced, resulting in an extremely high quality factor $Q_0=134525$ and a very high shunt impedance $r'=781$ MΩ/m. The RF-to-beam power efficiency reaches 51% which is significantly higher than previously-reported CLIC-G structures with an efficiency of only 33.5%. The optimum geometry and wakefield studies of the DAA structures are described in detail. In addition, the talk also includes the design, fabrication and cold-testing of an X-band dielectric-lined accelerating (DLA) structure which has a uniform and linear dielectric tube surrounded by a conducting cylinder. These studies are moving forward the practical use of dielectric structures in the realistic accelerator applications.

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