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First high quality DTL cavity additively manufactured from pure copper

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Recently presented RF cavity prototypes printed entirely from pure copper illustrate the potential of additive manufacturing (AM), and particularly laser powder bed fusion (L-PBF), for accelerator technology. Thereby, the design freedom of L-PBF is only limited by overhanging geometries, which have to be printed with supporting structures to ensure sufficient accuracy. However, subsequent removal of these support structures is a major challenge for cm-sized GHz cavities. Therefore, our approach is to design self-supporting geometries. In this contribution we present a DTL cavity geometry as used in e.g. proton therapy linac systems that can be fabricated by L-PBF without support structures. A 5-cell prototype was manufactured from high-purity copper using L-PBF. It is shown that the developed geometry allows a print accuracy sufficient to reach the defined resonance frequency. A chemical, as well as dynamic electrochemical finishing process, was applied to optimize the prototypes surface quality. Thus, the CST simulated figures of merit (e.g., Q_0, Z_{eff}) were obtained for the first time with a printed cavity.

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Footnotes

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