

LINAC Cavities Made by Additive Manufacturing

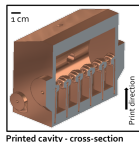
Radio frequency cavities for LINACs are made in one piece using additive manufacturing and are followed by suitable post-processing methods. This reduces process complexity and allows the production of previously unfeasible cavity geometries for a new generation of even more powerful LINACs.



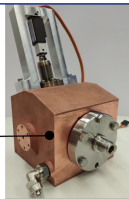
Cost reduction of 70 %

This manufacturing approach has the potential to reduce the manufacturing costs for cavities by approximately 70 % while at the same time increasing their performance by at least 25 %.

- 01 Relevant reduction of manufacturing costs
- 02 Freedom in cavity design due to additive manufacturing
- 03 Optimized cavity geometries reduce LINAC operating costs while increasing operating time and lifetime
- 04 Innovation can be used in particle accelerators for e.g. radiation therapy, cargo scanning or food



Printed cavity - cross-section



LINAC based on printed cavity

IP RIGHTS

EP and US application filed

2021

CHALLENGE

Basically, LINACs are based on high-frequency cavities, which are assembled from many individual parts in a complex manufacturing process. This conventional manufacturing process is responsible for up to 20 % of the investment costs for LINACs. Moreover, it prevents the realisation of innovative cavity concepts for a new generation of resource-saving LINACs with higher performance, lower energy consumption, longer operating times and smaller dimensions.

INNOVATION

The additive manufacturing processes suitable for the creation of copper cavities are laser powder bed fusion and electron beam powder bed fusion. There are no restrictions regarding the cavity geometry except the difficulty of printing overhangs with an angle of less than 45° between them and the building platform. This limitation can be overcome by using the design guide which is part of the patent application. Different post processing options have been tested to achieve suitable surface roughness.

TRL 08

TRL 07

TRL 06

TRL 05

TRL 04

TRL 03

TRL 02

TRL 01

Technology Readiness Level (TRL)

01 Basic principles observed · 02 Technology concept formulated · 03 Experimental proof of concept · 04 Technology validated in lab · 05 Technology validated in relevant environment · 06 Technology demonstrated in relevant environment · 07 System prototype demonstrated in operational environment · 08 System complete and qualified



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