

CT-based method to investigate the effects of additive manufacturing process interruption for sensor integration

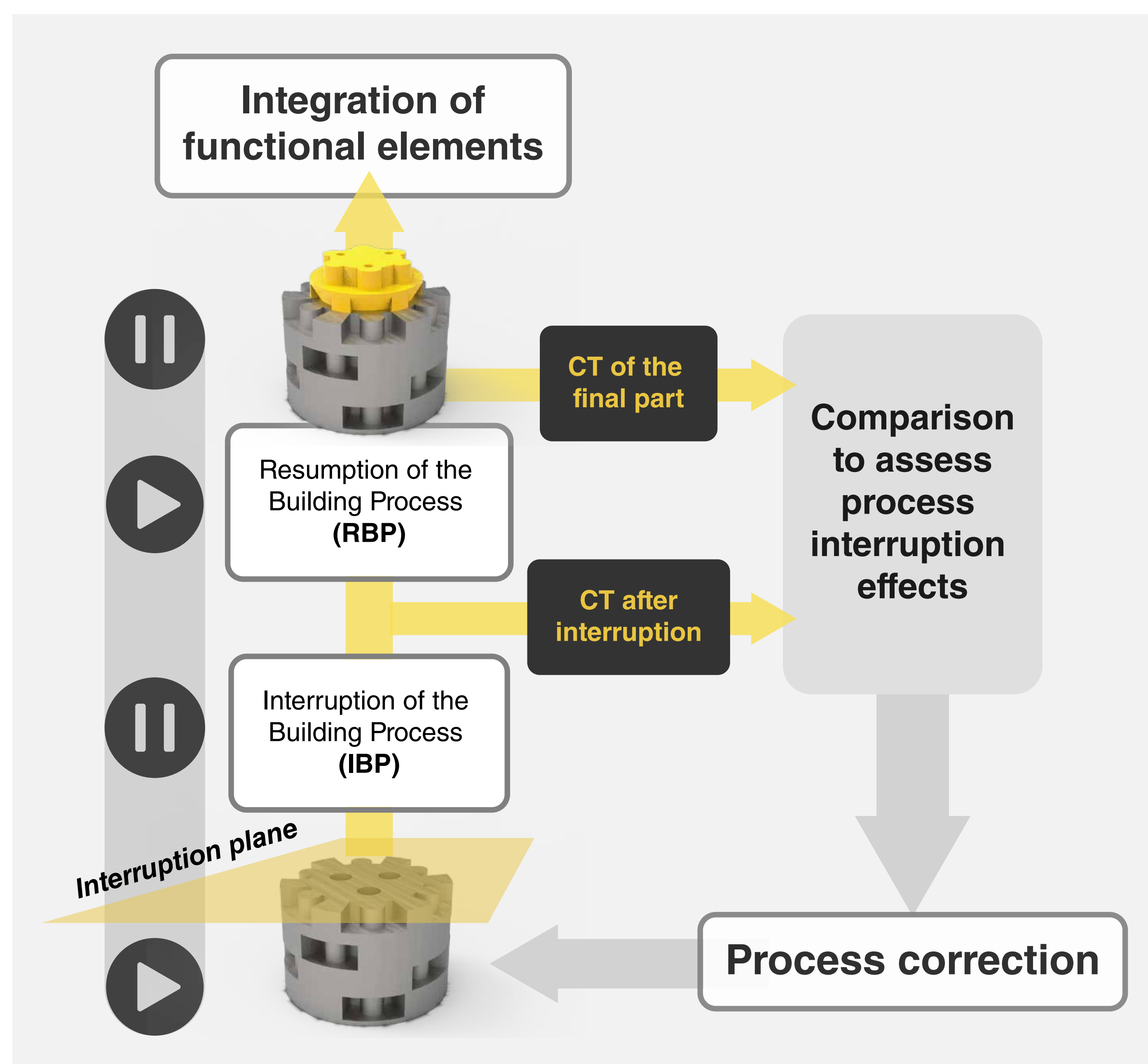
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Introduction

Laser Powder Bed Fusion (LPBF) takes advantage of the geometric flexibility of its manufacturing method to produce highly customizable parts. This work delves into one way of functionalizing 3D printed parts by, for instance, assembling devices inside (e.g., a Sensor/Actuator System). This requires the interruption of the building process, which is enabled by the LPBF layer-wise production. The overall effects of this event are currently under study, e.g., in terms of defects generation and geometrical deviations. In particular, a method based on the use of X-ray computed tomography (CT) and specifically designed geometries inspired by previous work at University of Padova [*] is developed to investigate such effects by comparing the fabricated parts before and after the interruption.

Proposed method

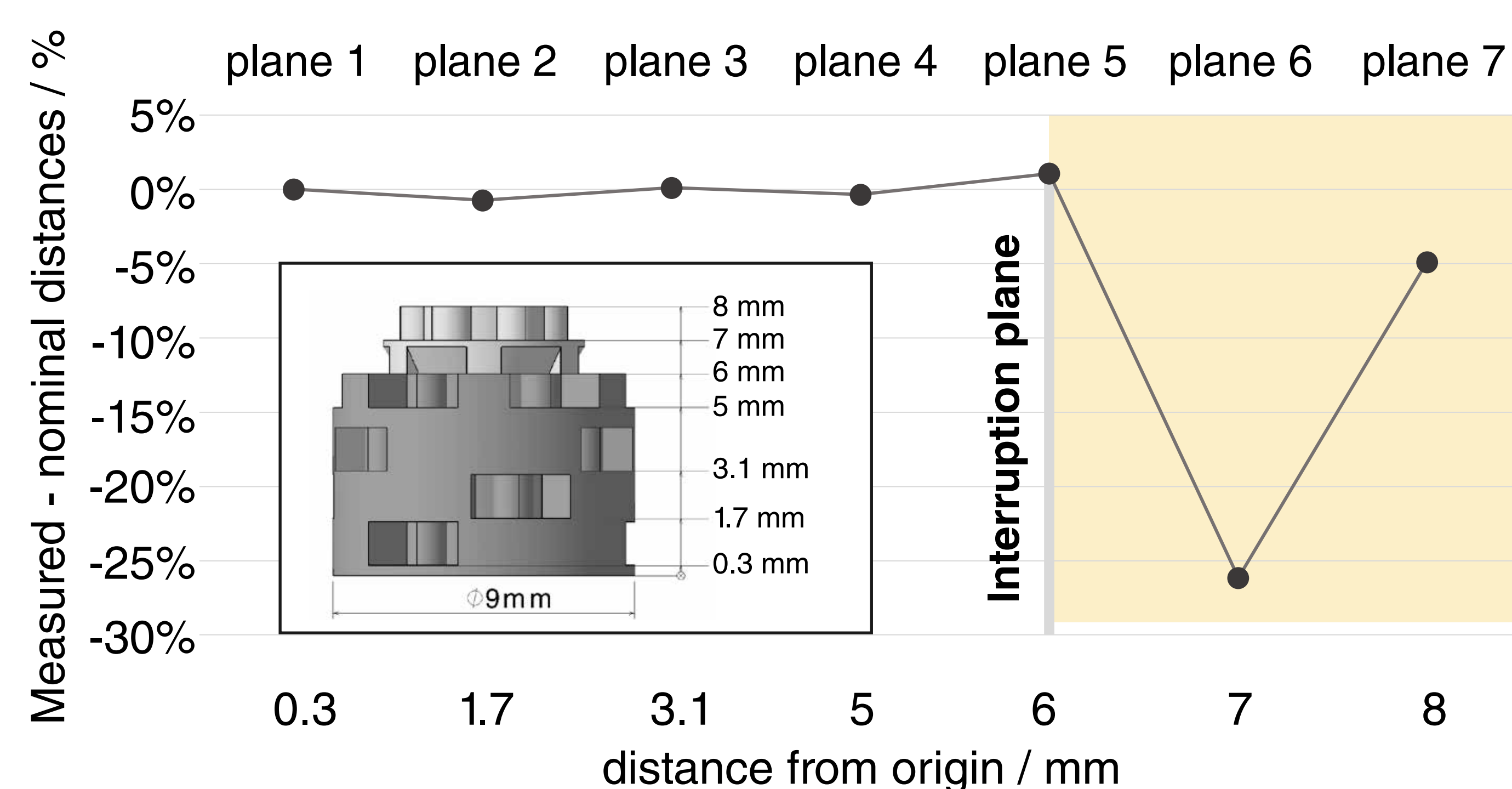
The method aims at improving the functionalization of additively manufactured parts through CT by assessing the effects of interrupting (IBP) and resuming a building process (RBP). The geometry used in the experiment [*] allows the analysis of the building process through a set of fiducials.



[*] Bonato, Zanini, Carmignato. On the use of X-ray computed tomography for the improvement of metal laser powder bed fusion process monitoring. iCT 2023.

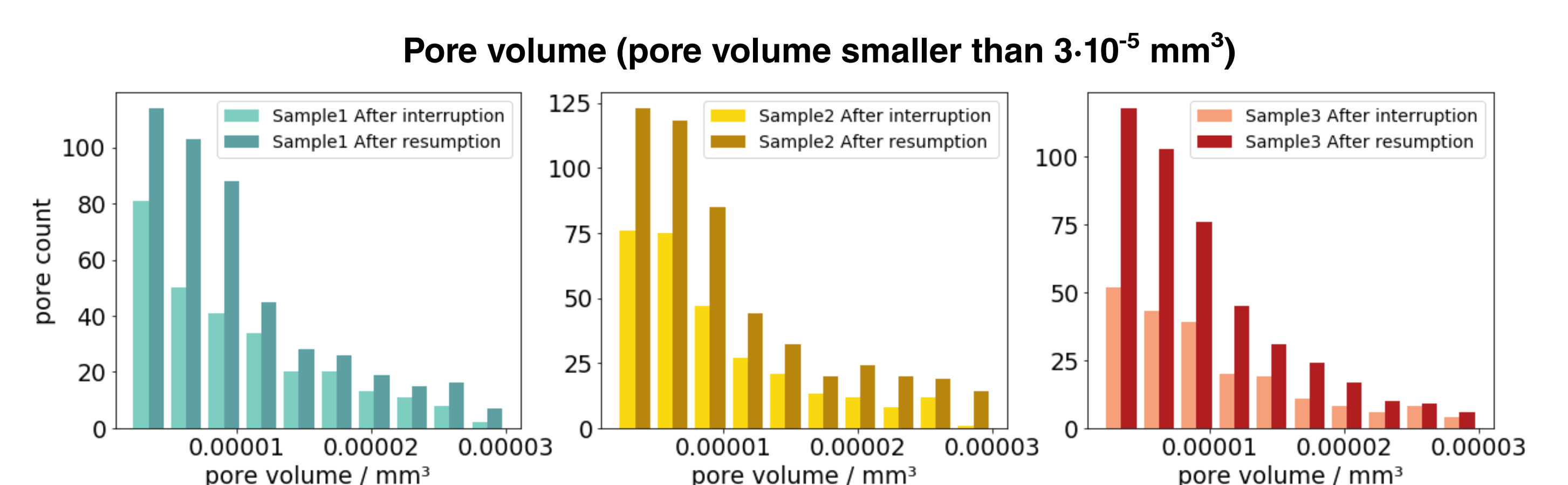
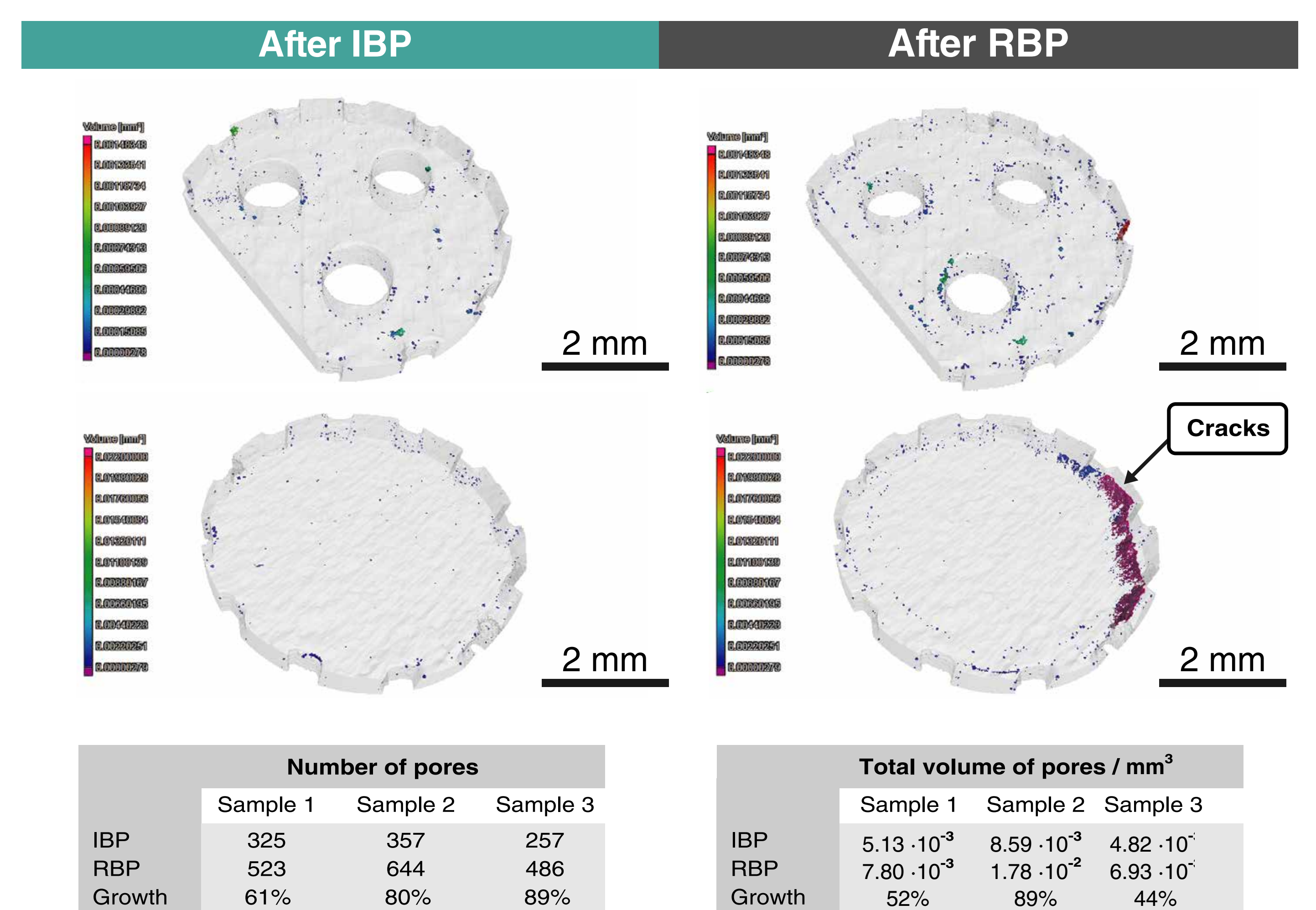
Dimensional deviations

Layer-to-layer distance average deviation



Internal defects

- Region of interest (ROI) from the interruption layer to 1 mm below.
- Pores inside the ROI increased after the whole process.
- Some pores were no longer detected after RBP.
- Cracks were detected after RBP.



Conclusions

- Process Interruption is a crucial step towards part functionalization and entails dealing with both dimensional deviations and internal defects, as demonstrated in this work.
- The proposed method enables the CT-based evaluation of LPBF process interruption effects by comparing the fabricated parts before and after process interruption.
- Future developments will be focused on the investigation of the method accuracy as well as on exploiting the method results to improve the use of LPBF for process interruption and sensor integration.

Acknowledgments

xCTing
Innovative training network

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