How 3D printing technology can facilitate research and improve healthcare outcomes

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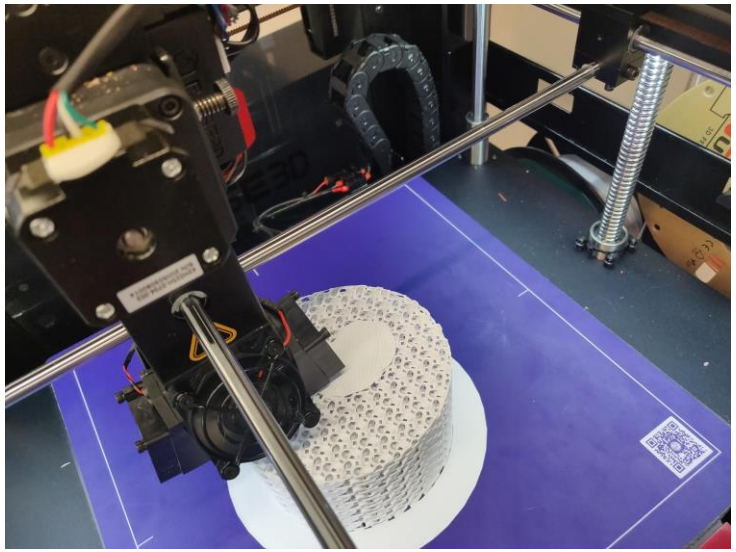
Introduction

3D printing is affordable and has a low barrier to entry.

It has led to a rise in point-of-care manufacturing.

It has led to application in research in our fields.



EPSM ENGINEERING + PHYSICAL SCIENCES IN MEDICINE • CONFERENCE 2021 •

Mon — 3D printing Proffered Papers 1

Wed — 3D printing Proffered Papers 2

Objectives of Better Healthcare Technology Foundation:

1. Promote research and development in medical physics, engineering, and associated sciences,
2. Promote safe and appropriate use of medical technology.

Introduction

RBWH Radiation Oncology

Raise 3D Pro 2
Dual nozzle FDM

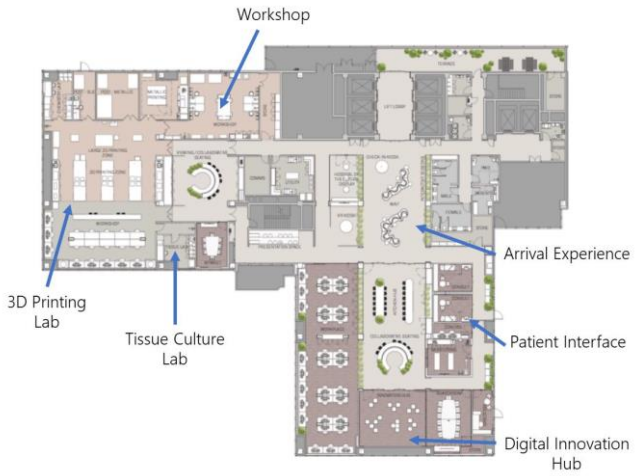
Ultimaker 2+
Single nozzle FDM

FormLabs 1+
SLA resin

Consumables
PLA, composites, TPU, nylon, CF, resins

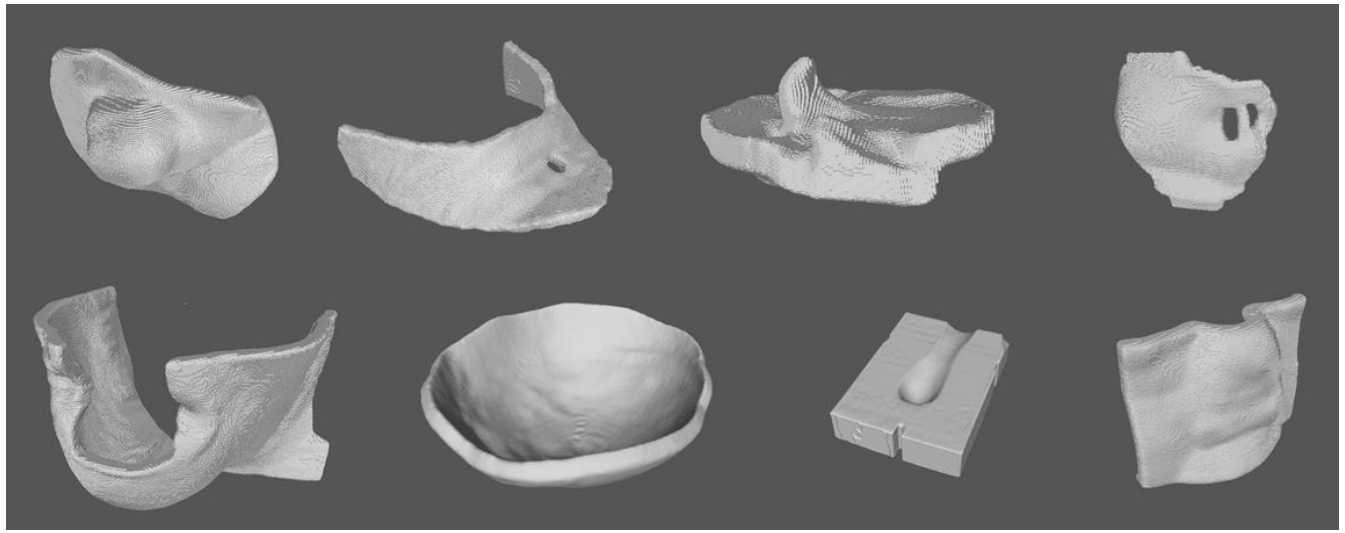
Herston Biofabrication Institute

Anaesthesia & Intensive Care
Burns Surgery, Skin & Wounds
Cancer Care Services
CranioFacial Surgery
Orthopaedic Surgery
Urology Surgery
Vascular & Endovascular Surgery

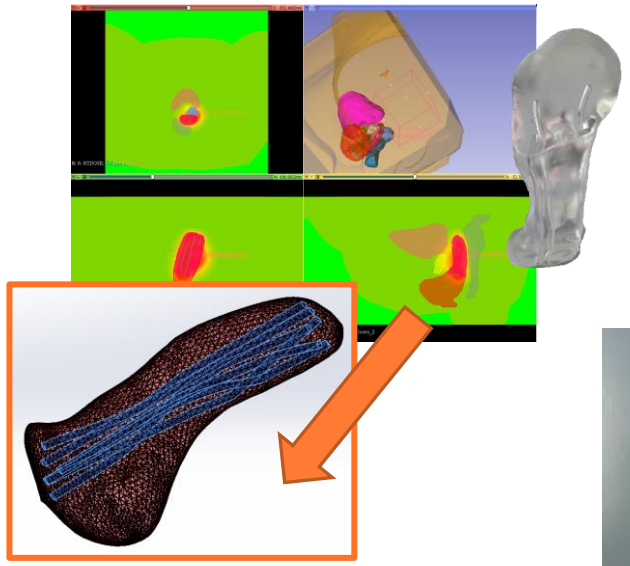


Radiation oncology

Bolus, shielding, brachytherapy applicators, positioning and immobilisation, mouthpieces.



Above: Bolus

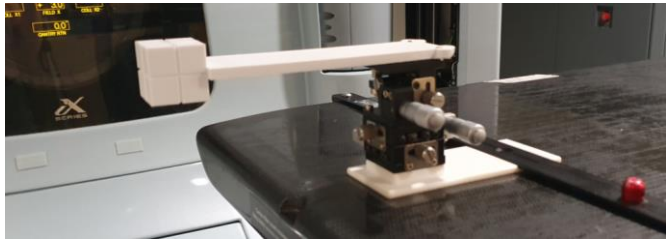


Above: Gynae mould

Right: Shielding

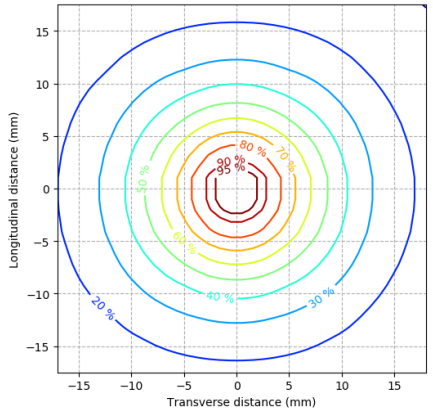
Below: Mouthpiece

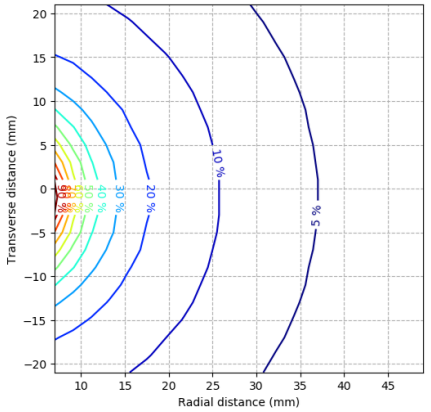
Medical physics

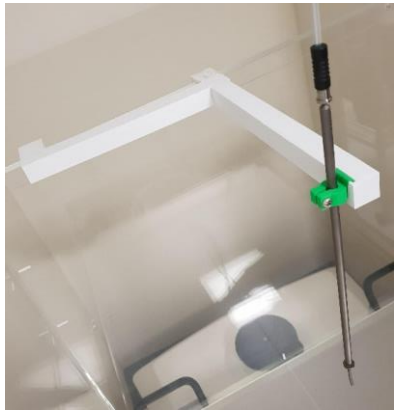


Above: Winston Lutz phantom

Right: Water tank accessory

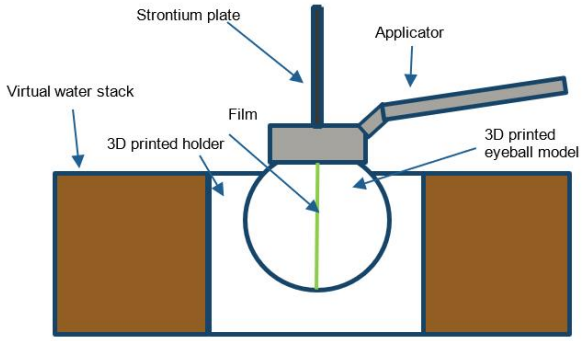






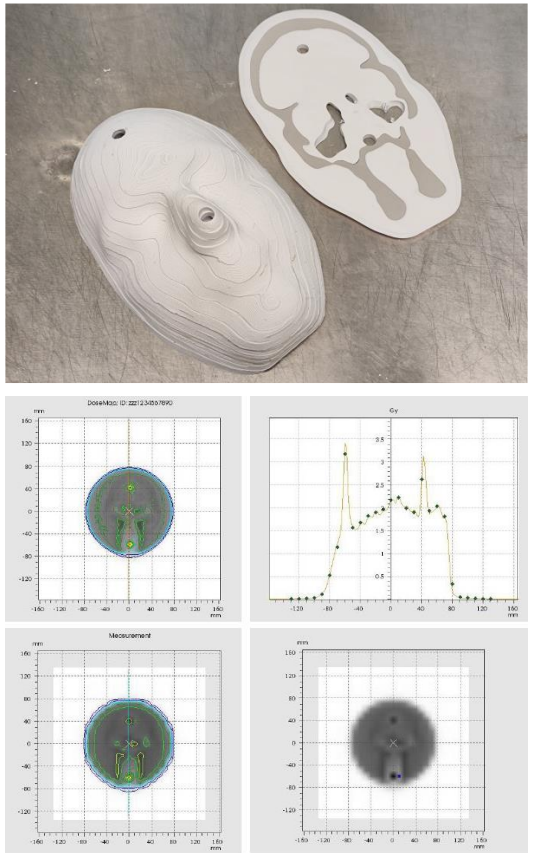
Above: Brachy holder for water tank, and measurements performed using it

Below: Sr-90 applicator phantom

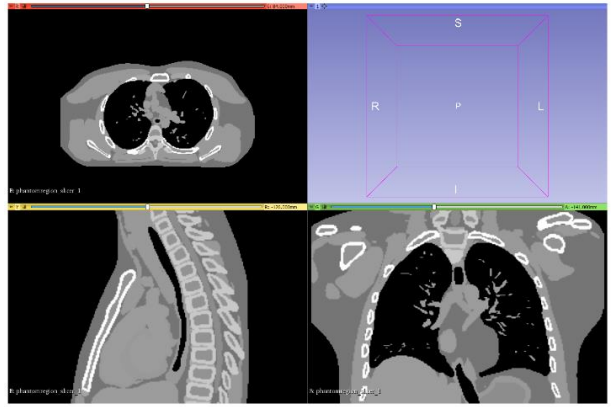


Below: Supplemental insert for CIRS head

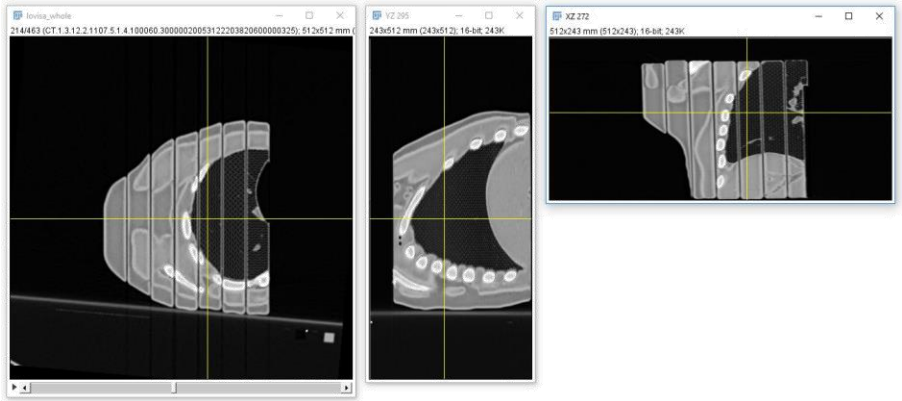
Medical physics



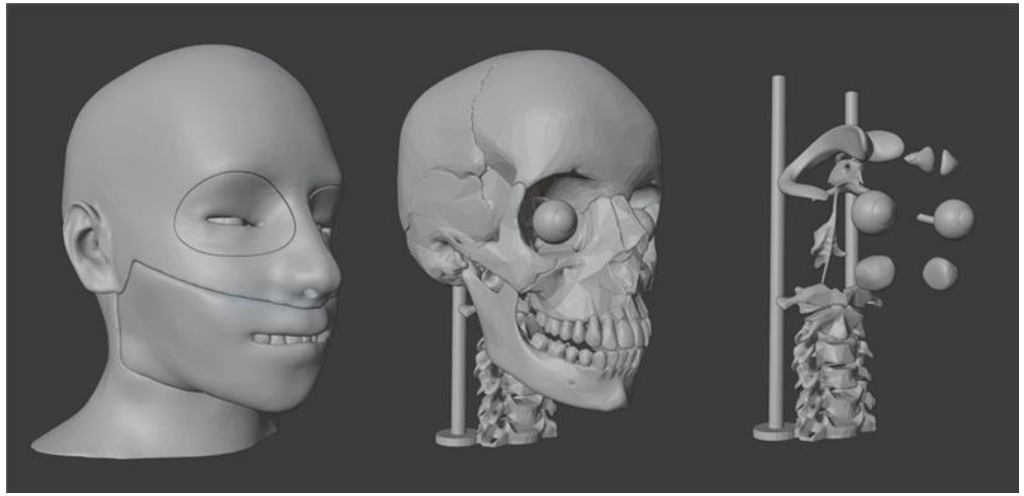
Left: coronally sliced head phantom and planar dose measurements.



Right: Synthetic CT from XCAT and CT of 3D printed phantom printed from it.

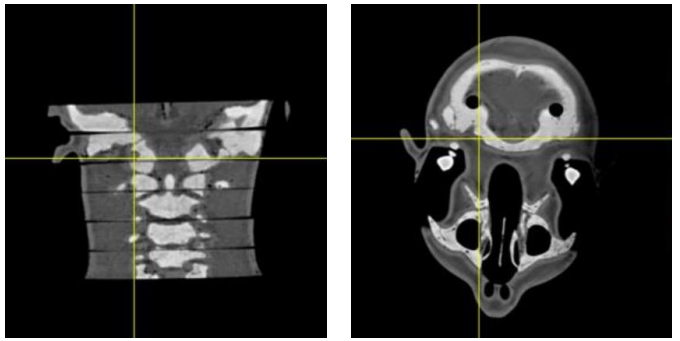


Medical physics



Above: Designed phantom

Right: CT images



Safety and quality

Manufacturing Plan - *Patient Matched Radiotherapy Bolus*

7.2 Manufacturing and Inspection Process Overview

Figure 1 provides a visual overview of the manufacturing and inspection of Patient Matched Radiotherapy Bolus. Further details on the quality assurance measures will be provided in Quality and Packaging Plan - Patient Matched Radiotherapy Bolus (3DM-TFD-005).

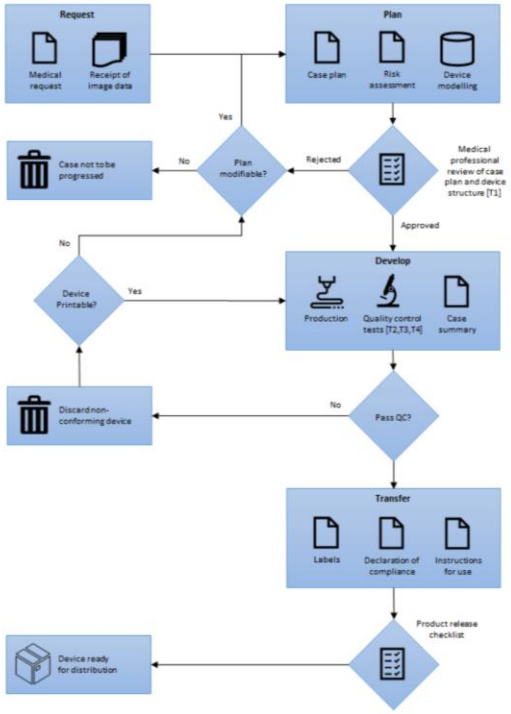
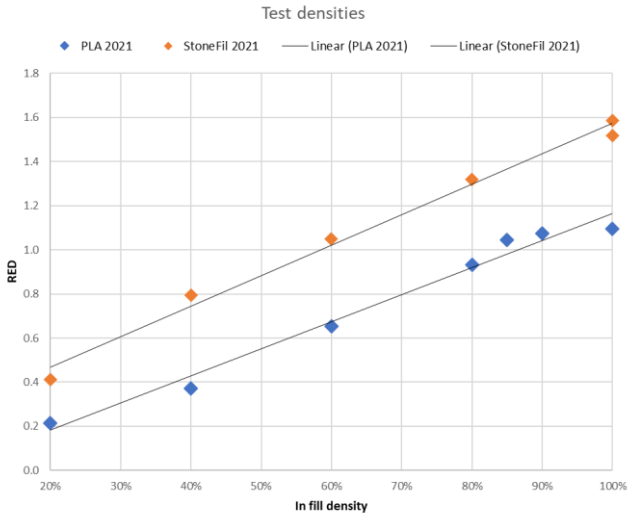
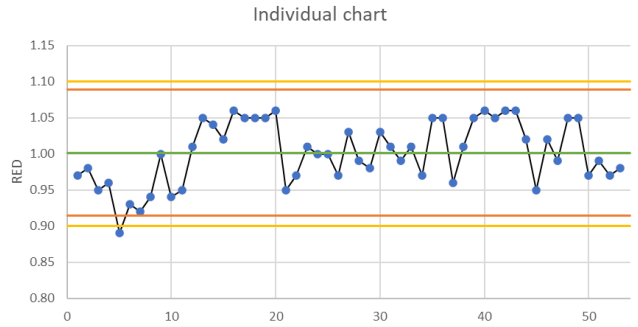
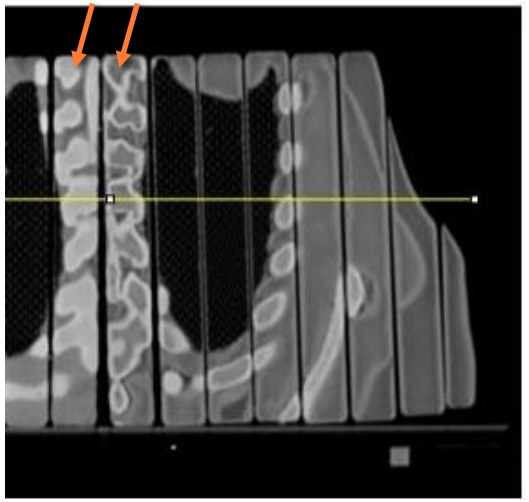


Figure 1 Manufacturing and Inspection flow chart.





Supposed to be the same density …



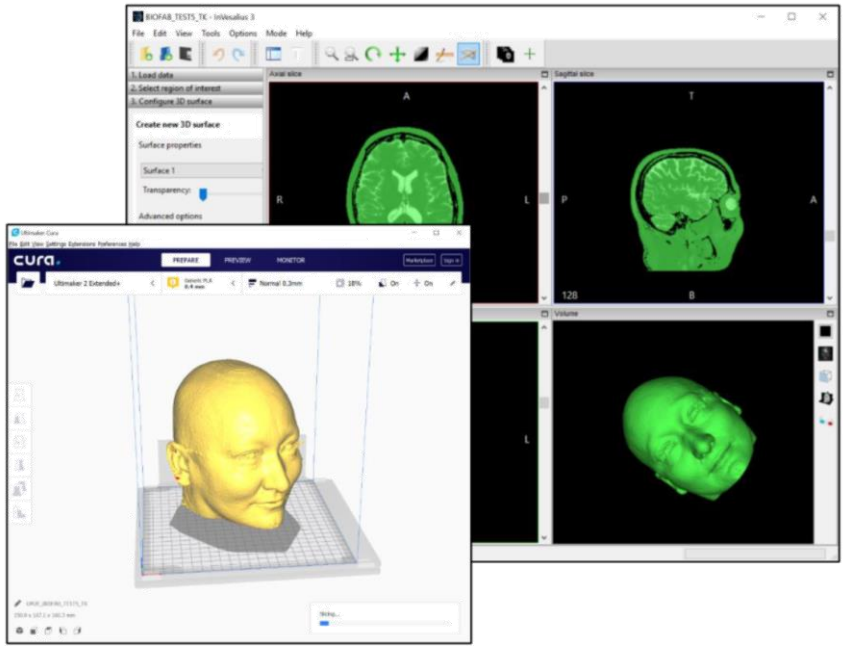
Conclusion

The barriers to 3D printing are effectively non-existent.

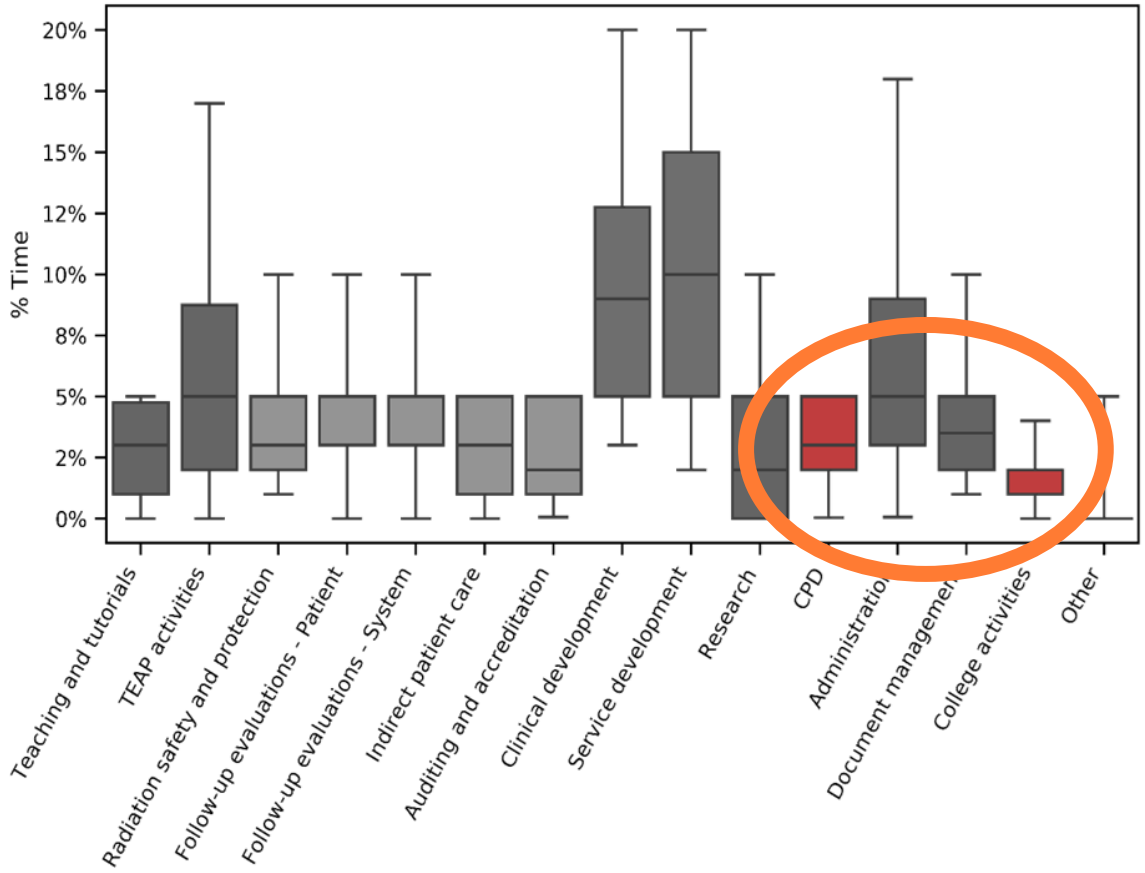
Free software allows modelling of simple devices, and combined with clinical systems or Slicer, production of patient-matched devices. Solutions exist to optimise these workflows.

You'll need to do calibration and test prints. For geometries requiring high precision (e.g. chamber cavities with minimal air gaps, brachy catheter channels), you may need to experiment with tolerances.

All of this is described in the literature already!



Conclusion



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