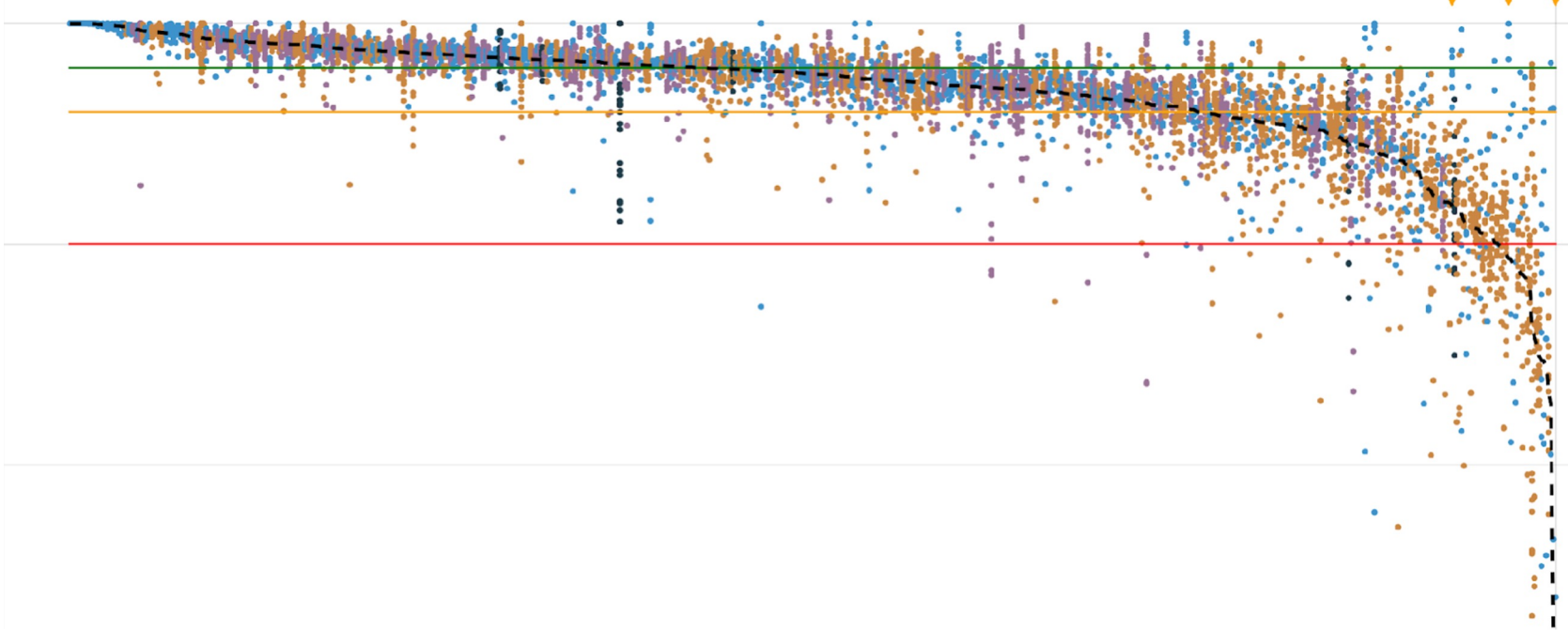

Dose evaluation on daily CBCTs for breast cancer patients

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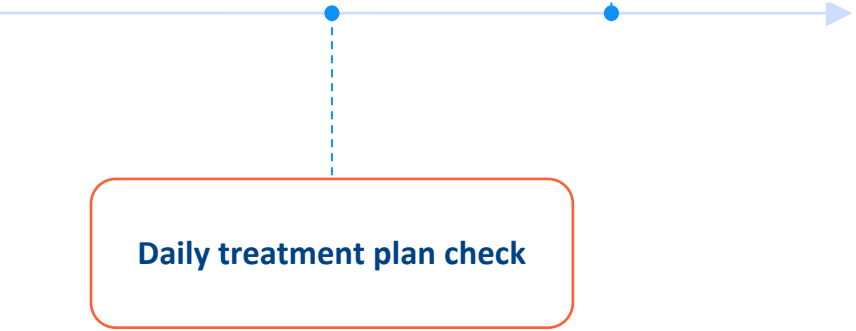
Disclosure

Our department has a research agreement with Elekta AB on the development of adaptive strategies for the CBCT-linac. This project is partly financed by Elekta AB. Elekta AB had no role in the preparation, review, or approval of the manuscript and the decision to submit the manuscript nor in any part of this presentation.

Introduction



Why:

- Patient anatomy changes daily
- It is feasible

Benefit:

- Base decision to treat on the dose
- Removes the need for additional CT scans
- Unburdens the staff

Checklist:

- Completely automatic
- Dosimetric output

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Conclusion (for the Uppsala group)

- Yes it works
- Individual patient statistics
- Patient population overview
- Extended to new treatment sites
- Working towards clinical implementation

How?

Proposed workflow

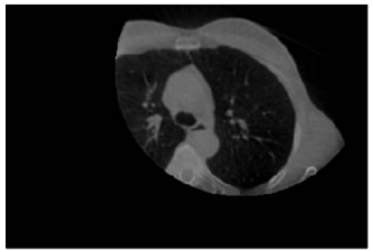
DICOM Server:

- CBCTs
- pCTs
- RTStructs
- RTPlans

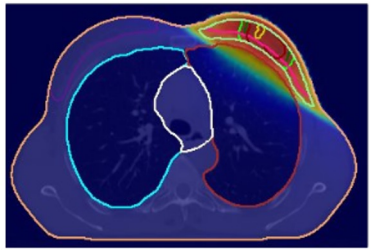
Inputs:

PCT + Contours

CBCT



Planned dose



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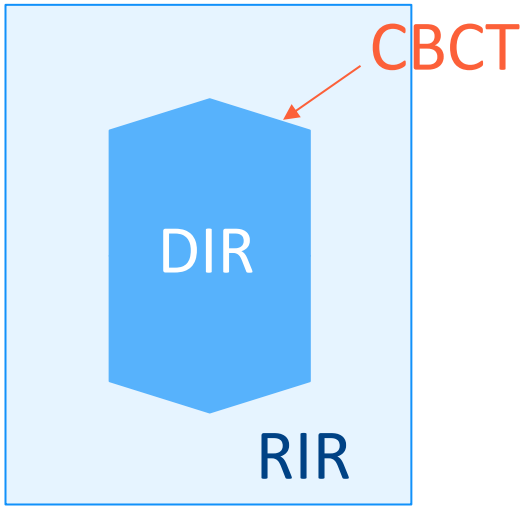
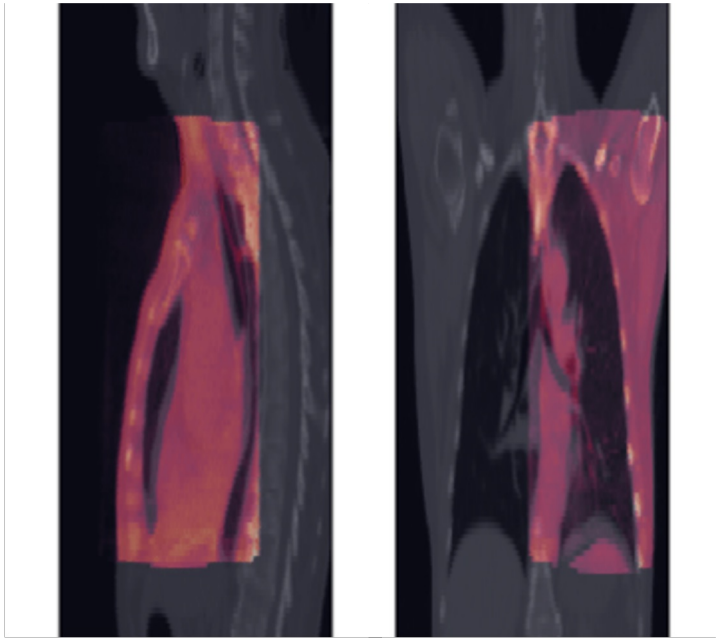
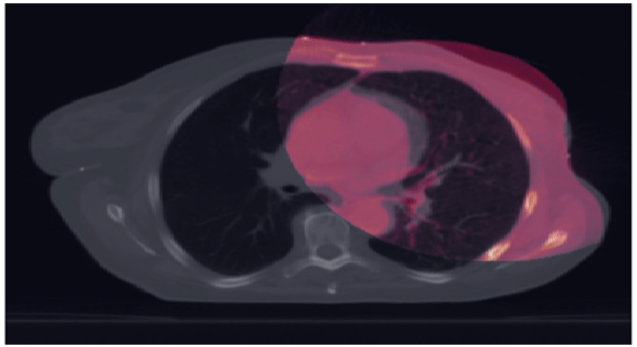
Generating synthetic CT



Fill 1 cm inside body contour with –120 HU





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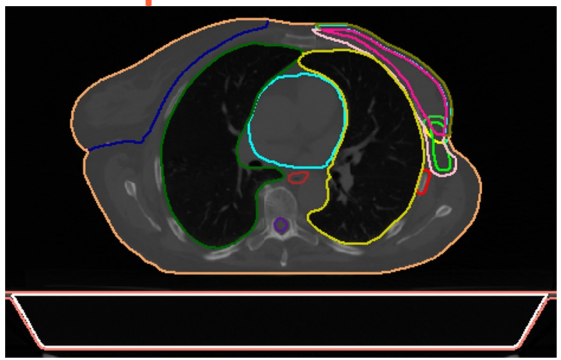
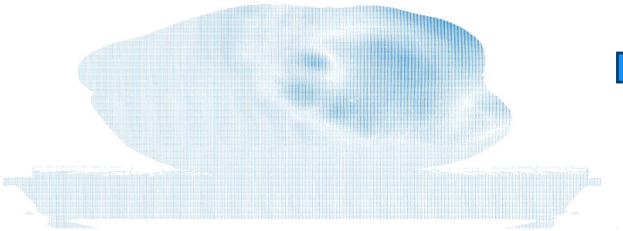
Daily contours

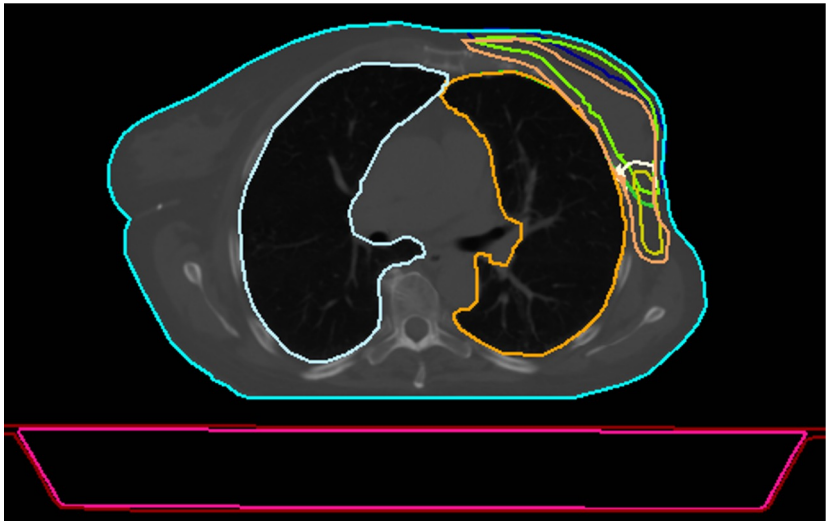
pCT + contours



Deformation vector field



sCT + daily contours



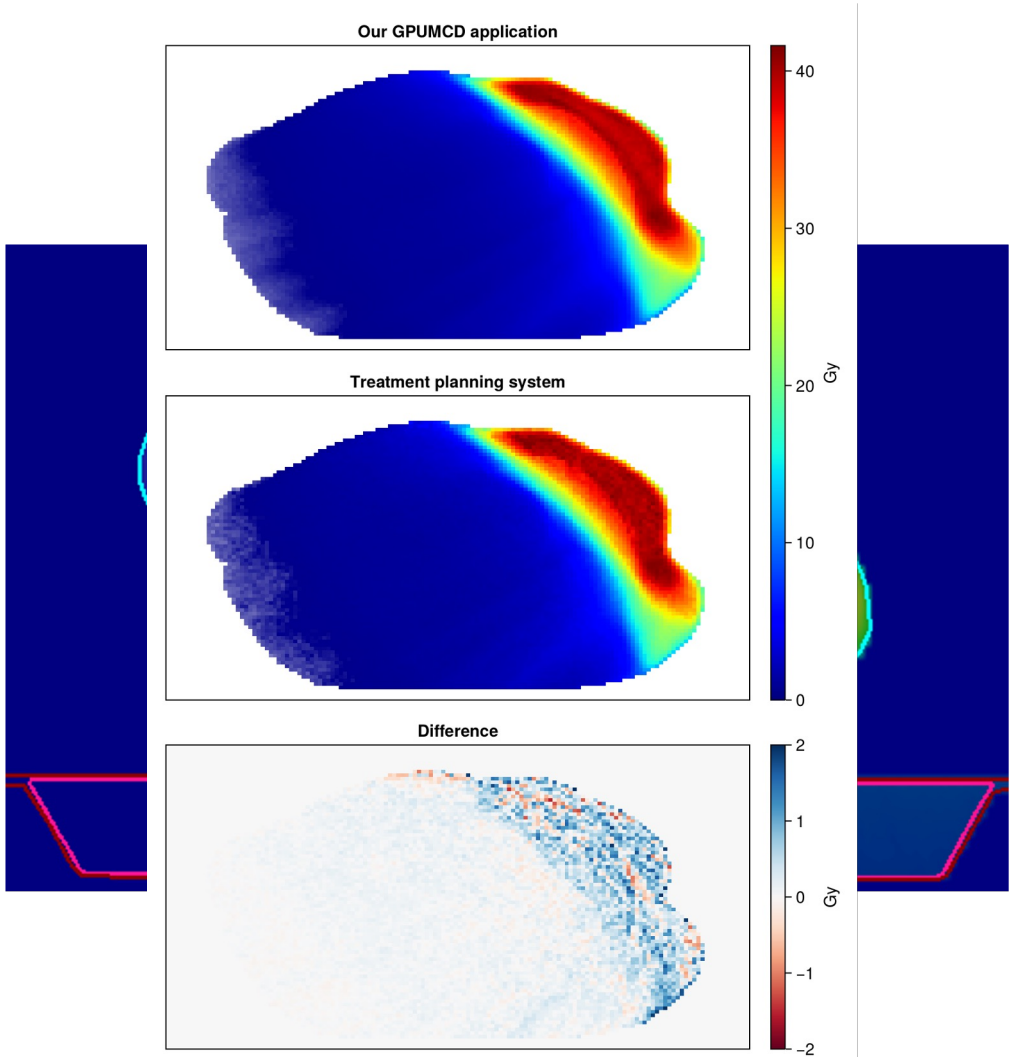
Dose calculation

Input:

1. sCT
2. daily contours
3. current treatment plan

Output:

1. Daily dose distribution
2. Patient specific report



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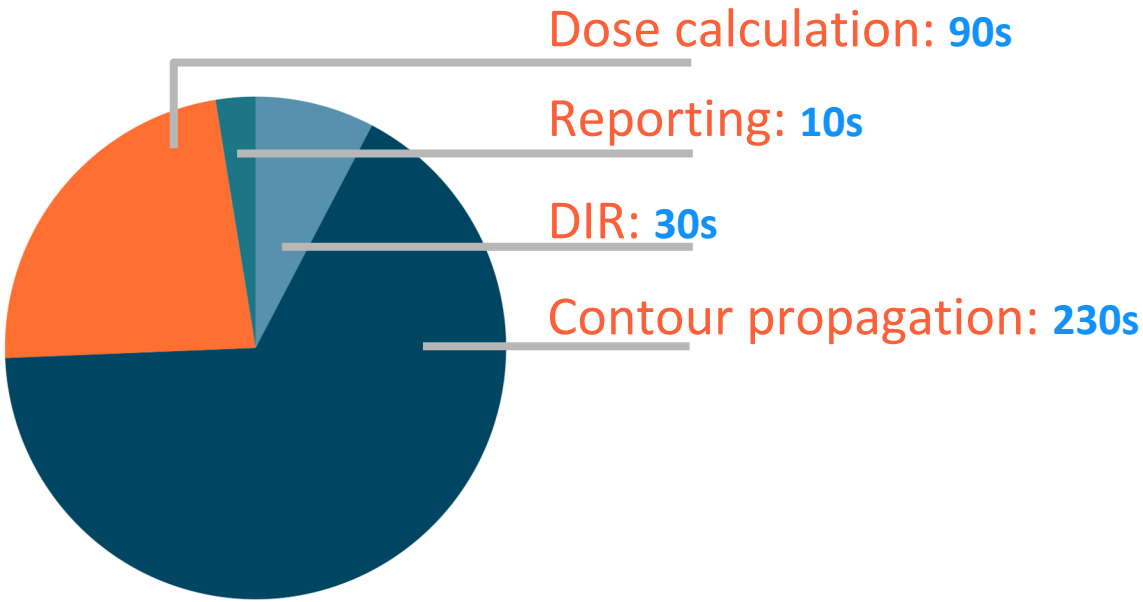
Average time per fraction



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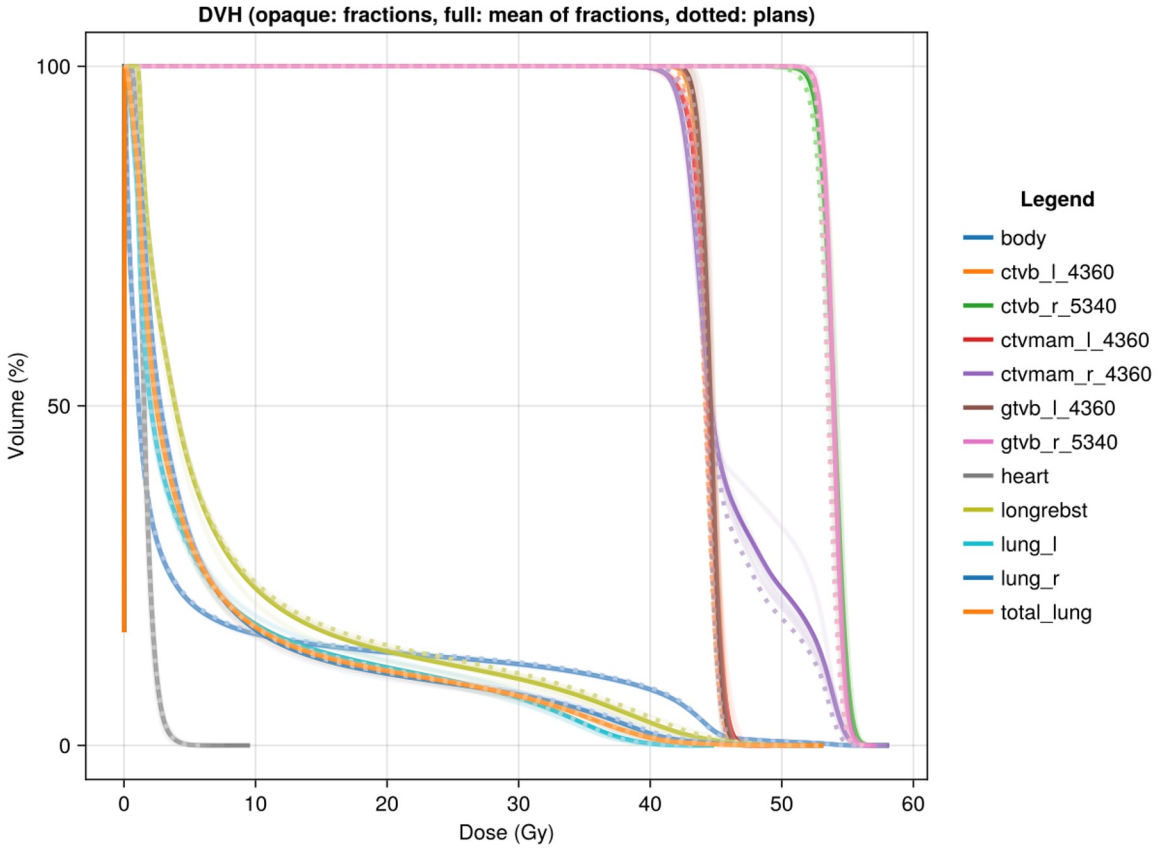
Automatic report generation



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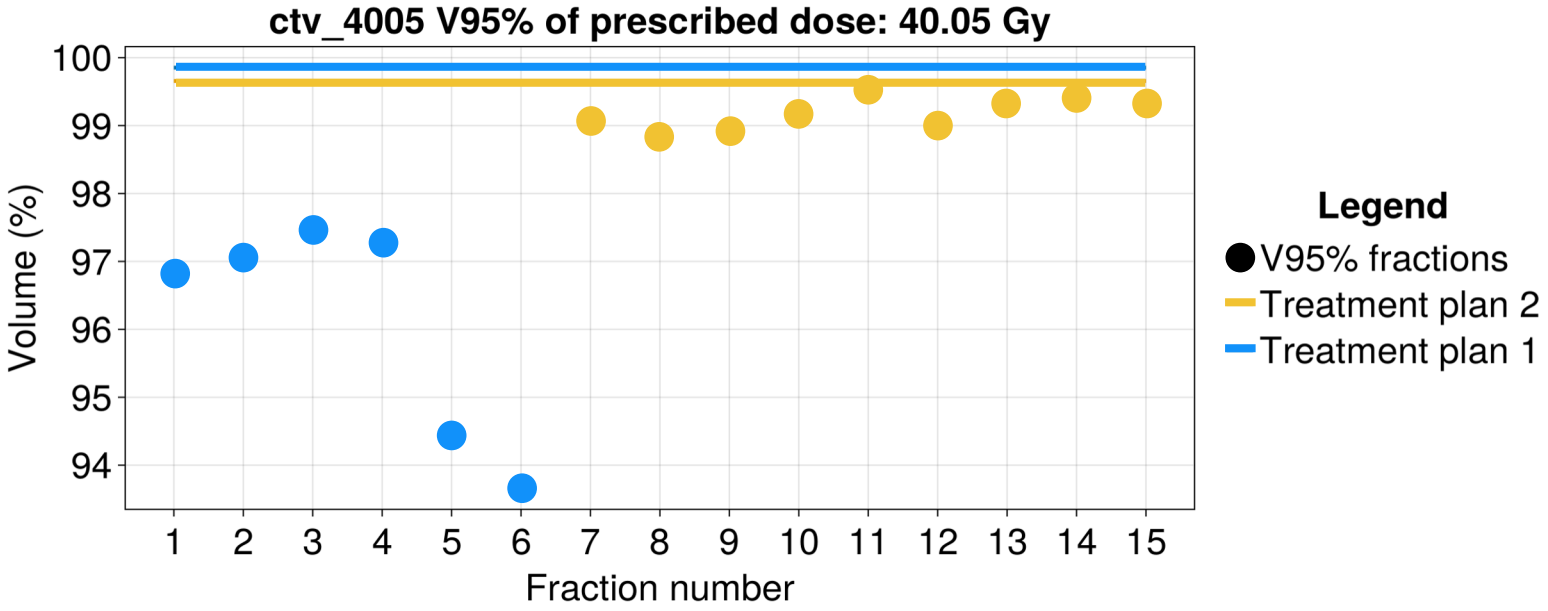
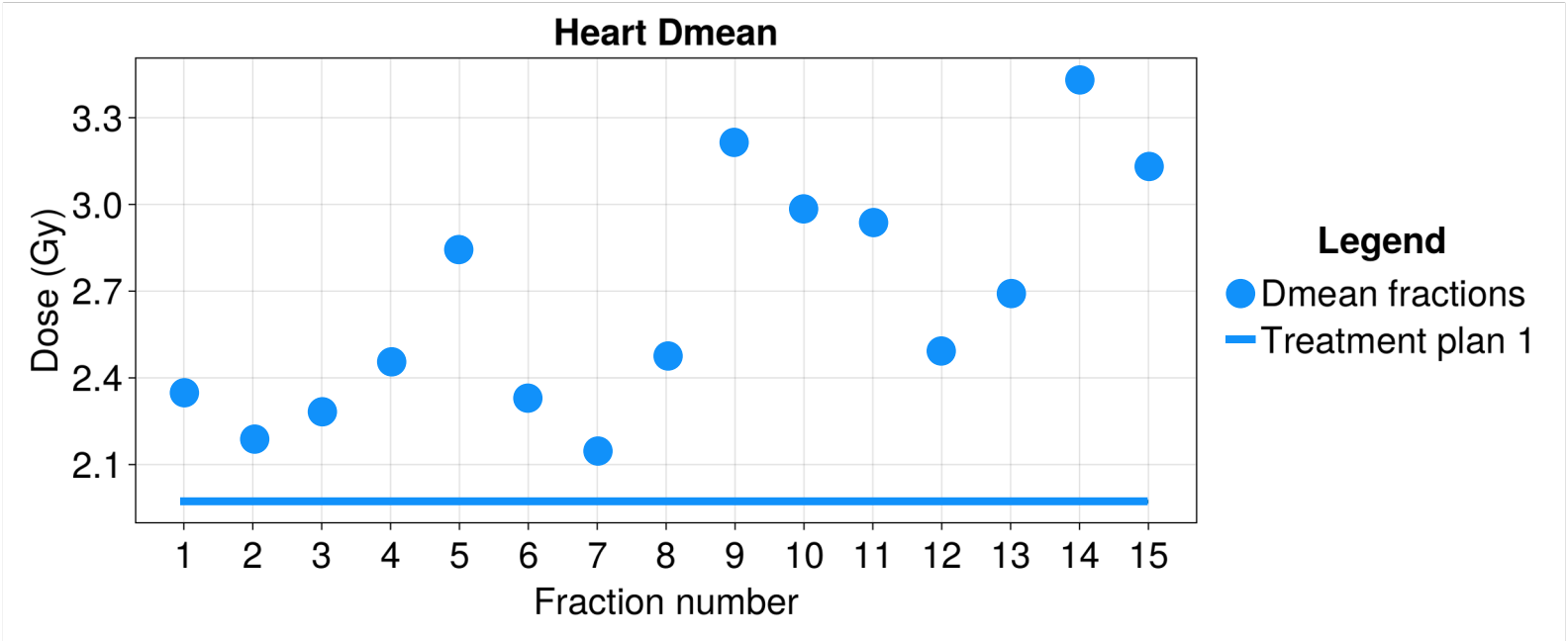
Automatic report generation

Targets:

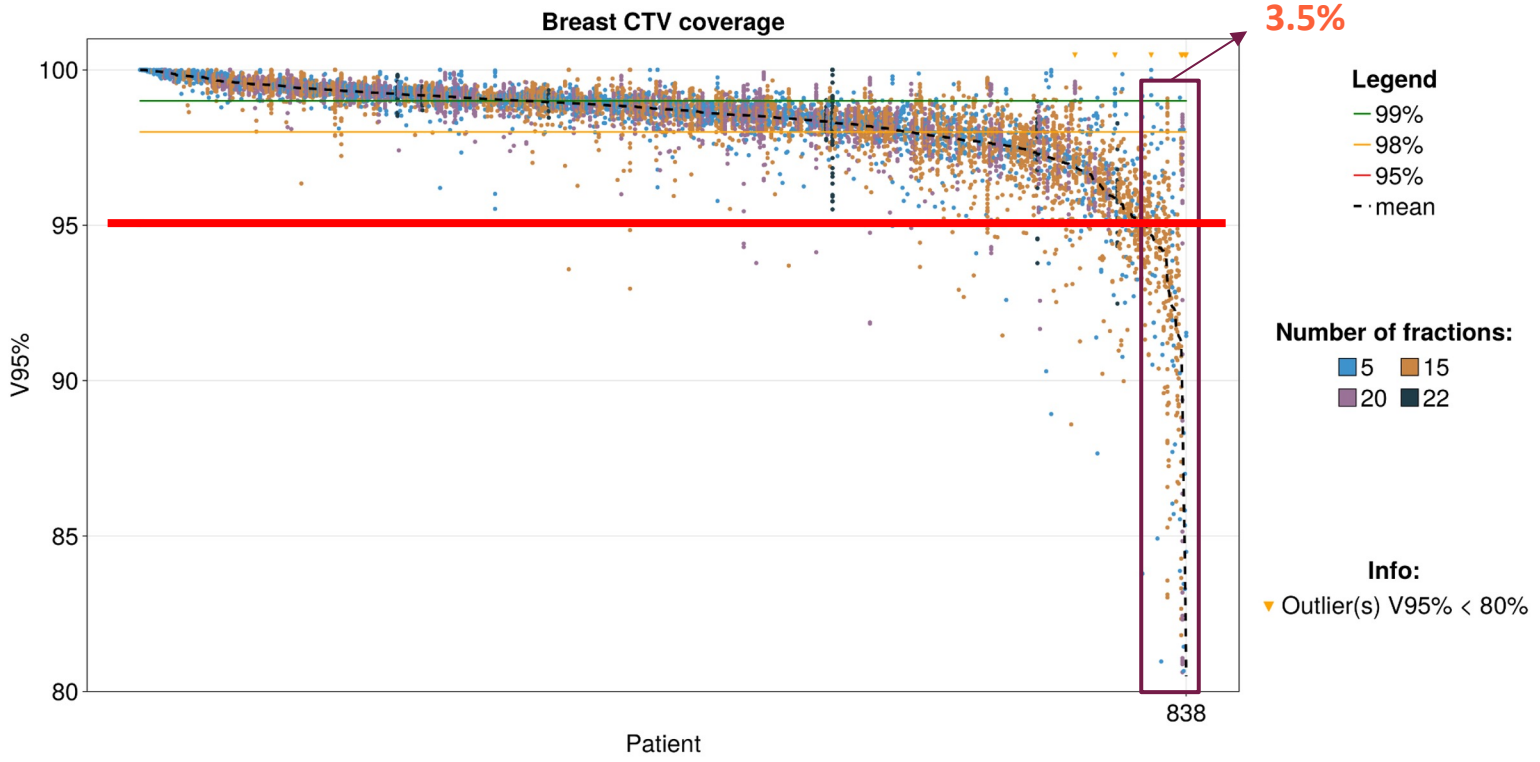


Automatic report generation

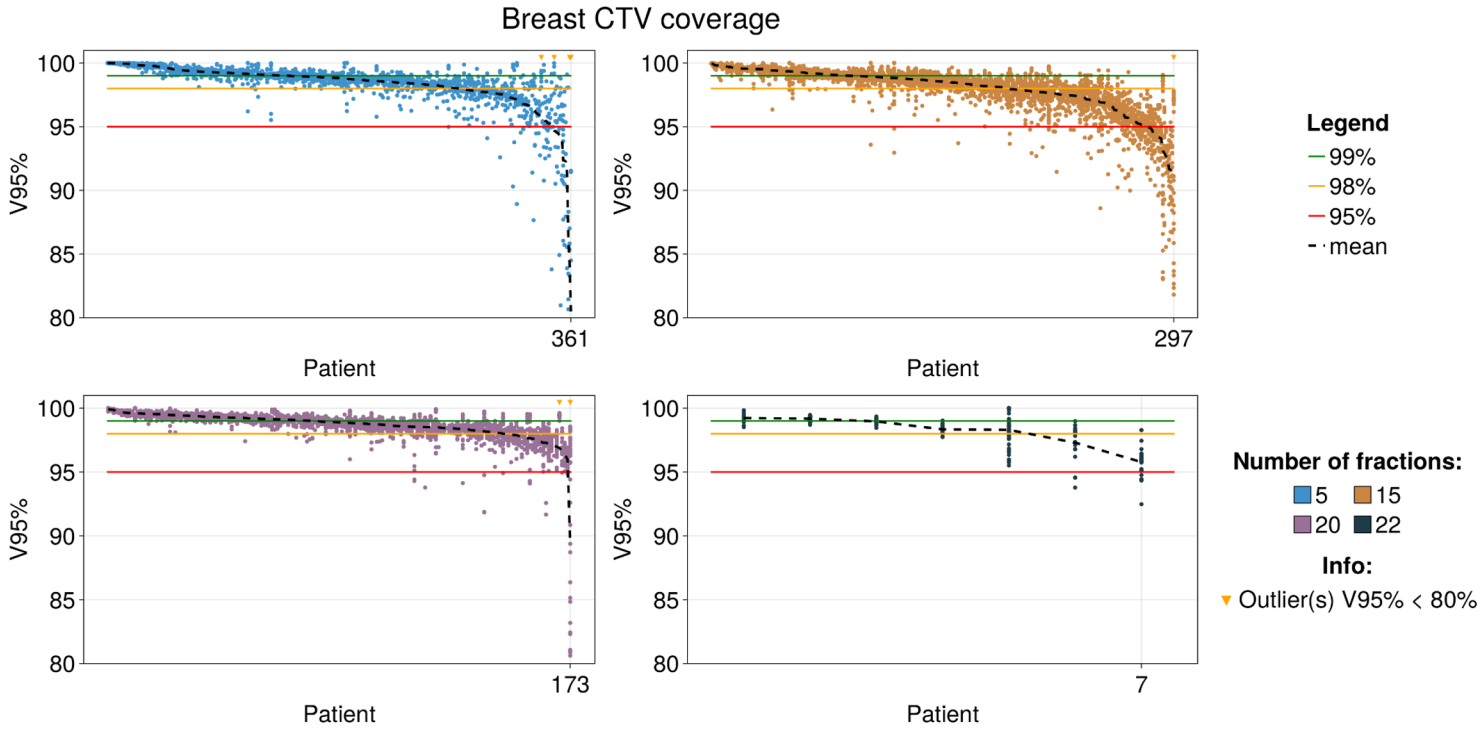
Organs at risk:



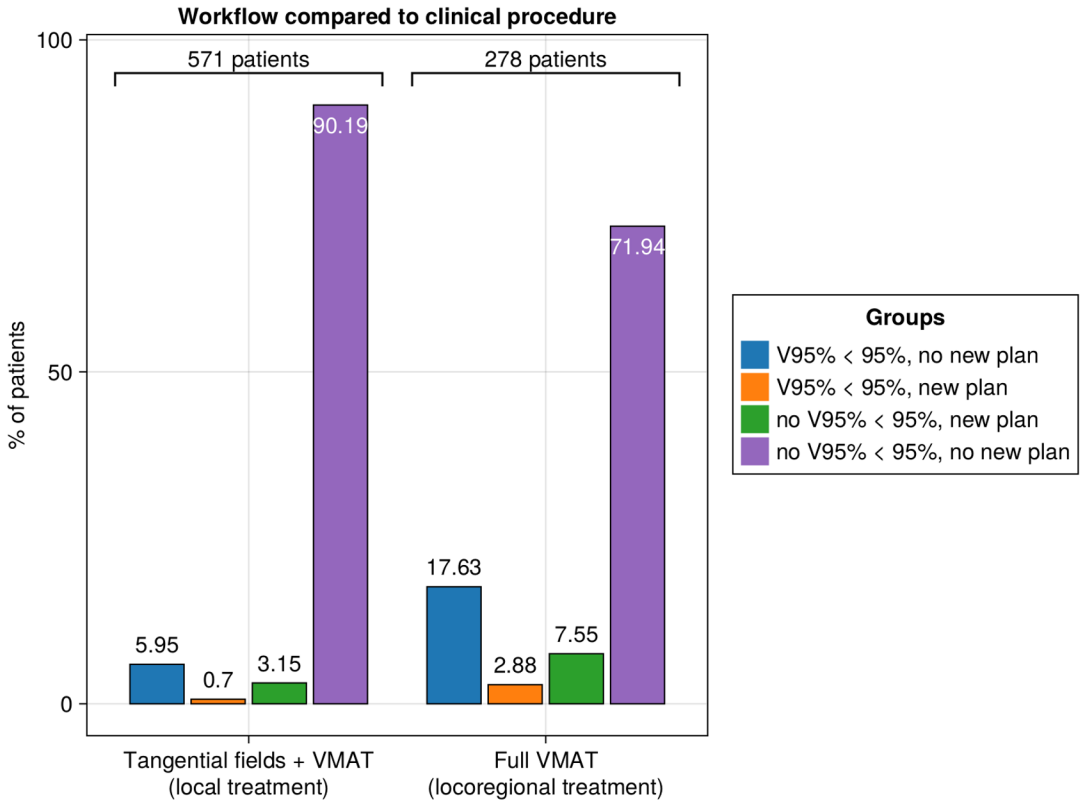
Population results



Population results



Triggers based on under or overdosage



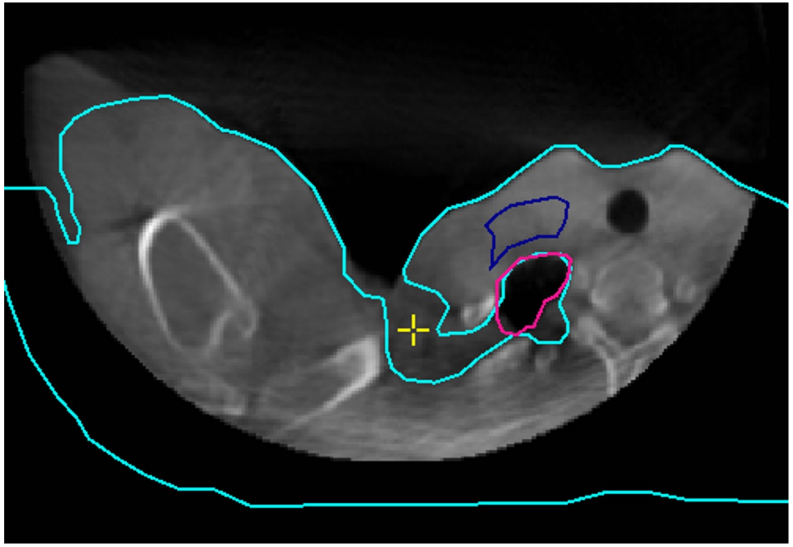
Example of a trigger:

- Three fractions V95% < 95%
- Heart Dmean < X Gy
- V10Gy Lung < X ml
- …
- …
- …

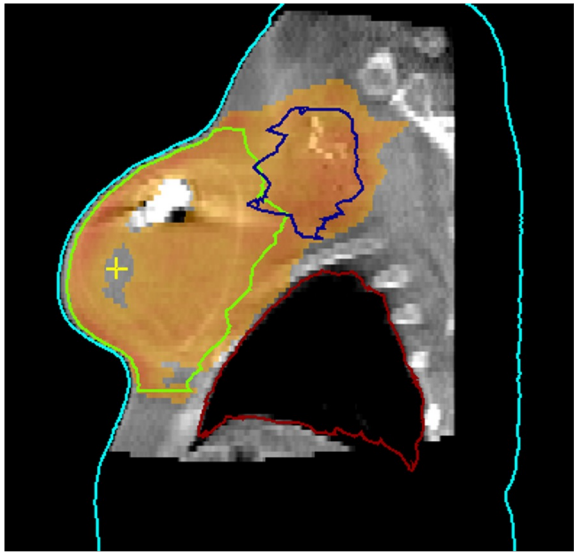
Retrospective use case:
Check robustness of different plans

Difficulties

CBCT quality cranial direction

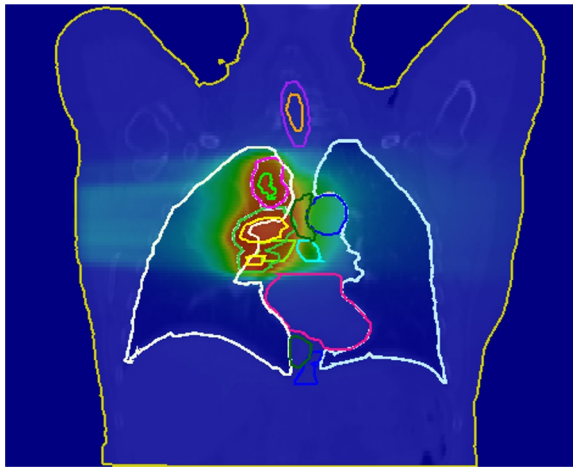


Metal artefacts

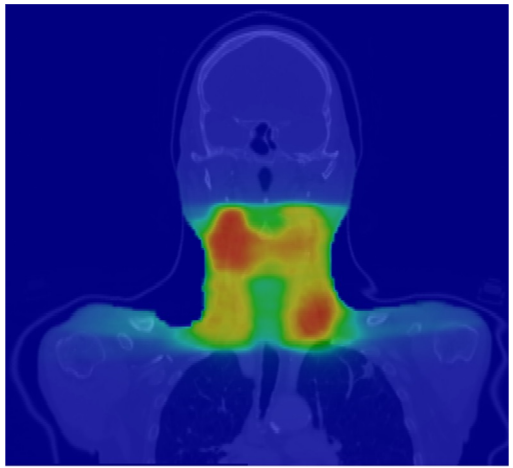


Extending to other treatment sites

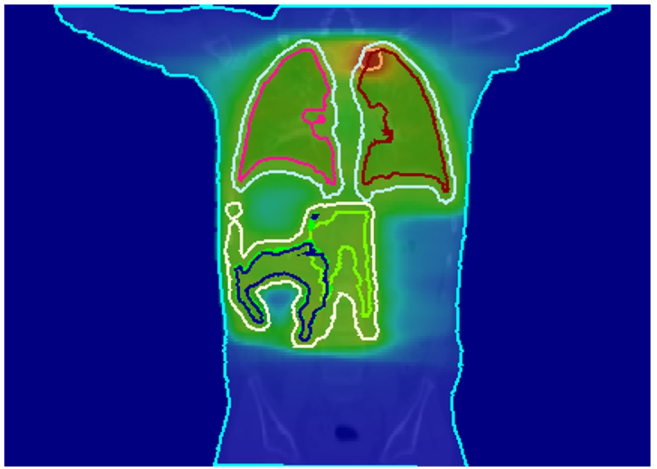
Lung



Head & Neck



Pediatric



Conclusion (Part 2)

- Workflow to calculate the dose on the daily anatomy
- Trigger system for individual patients
- Patient population overview
- Extended to new treatment sites
- Working towards clinical implementation

A big thank you to

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