

Geometry reconstruction and simulations

From the viewpoint of biomedical engineers

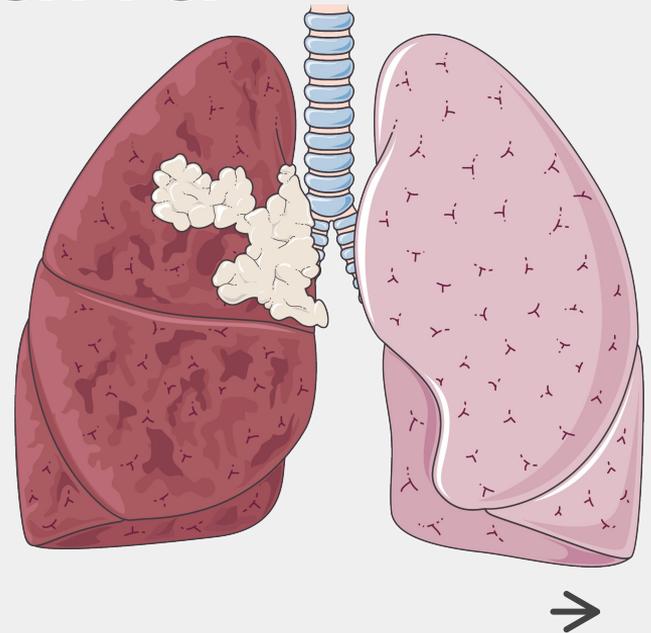


Illustration by Smart-Servier Medical Art



Our AI ducks



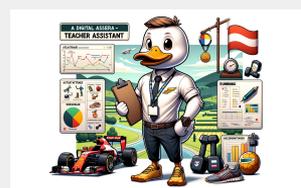
Argyrios



Rainer



Luca



Laura



Jana



Lana



Nelly



Julia



Paula



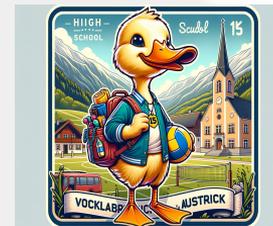
Felix



Lena



Emil



Niklas



Problem statement

- Female patient around 50 years
- Came to the emergency room
- Felt some discomfort and pain in her chest
- CT scan of the Thorax was made

Our task

- Identify the problem
- Make treatment suggestions to the doctors





01

Medical Imaging

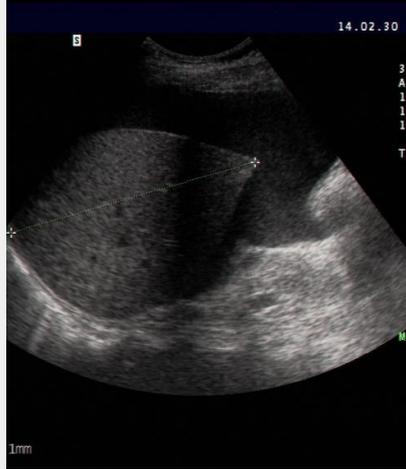
Different options for medical imaging, usages and risks

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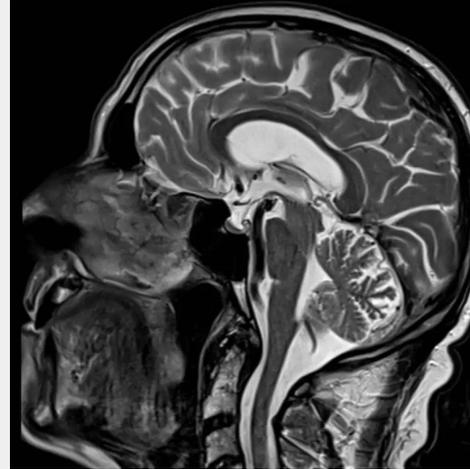
Imaging Methods



X-Ray



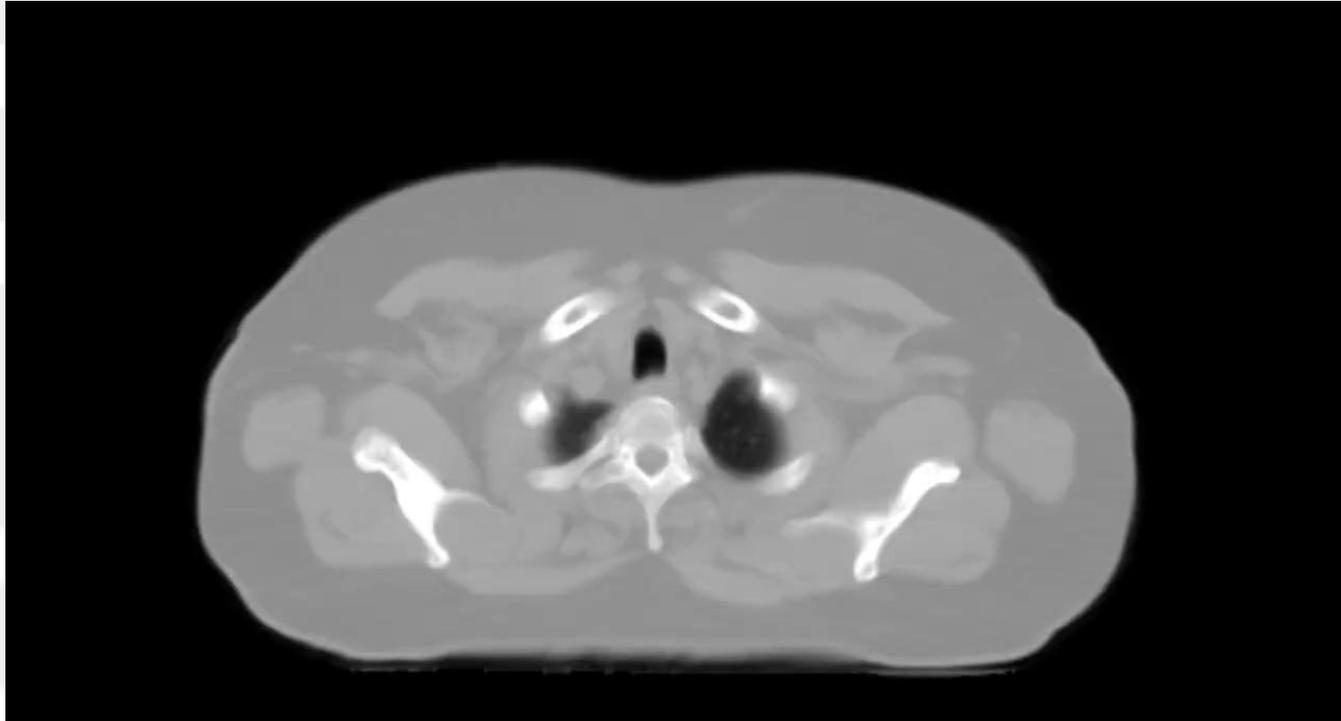
Sonography



MRI



CT



Our given
Image

The Problem

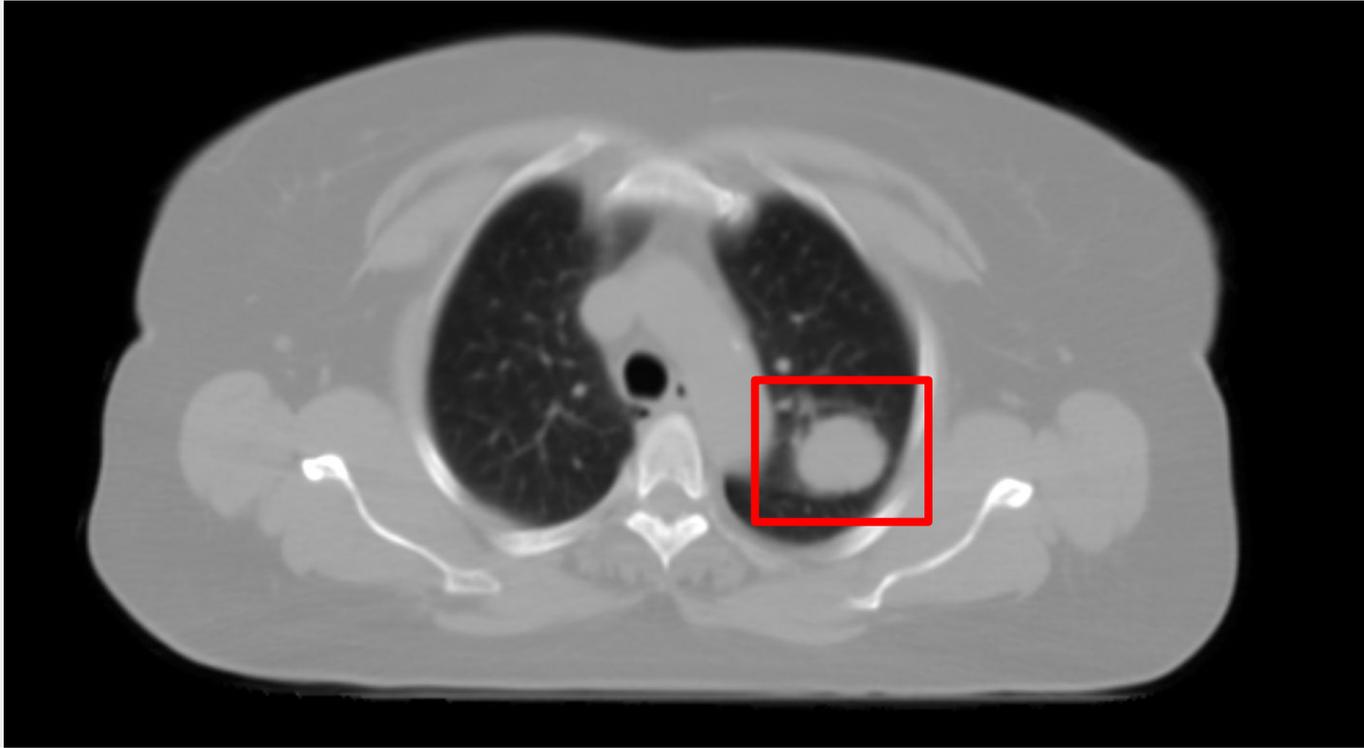
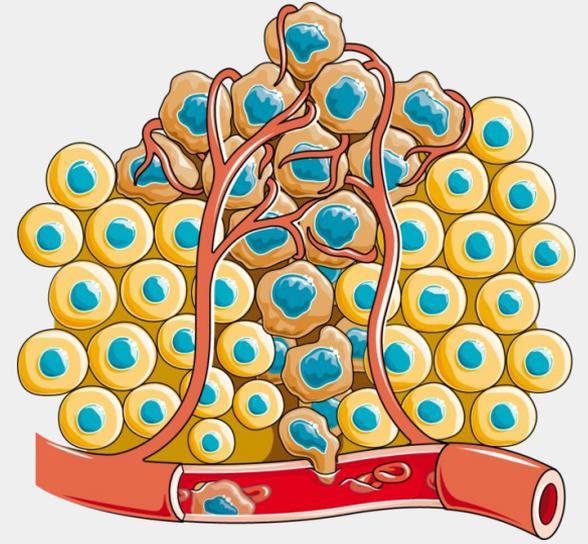


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02

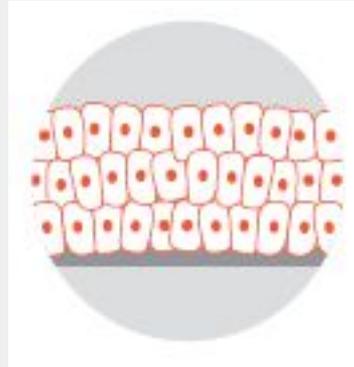
Excurs Cancer & Cancer Treatment



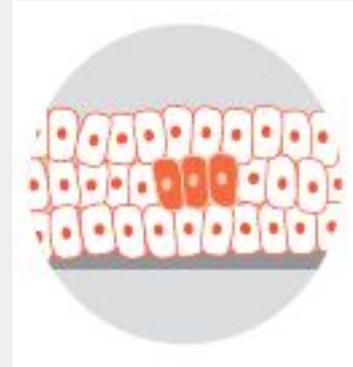
Excurs Cancer



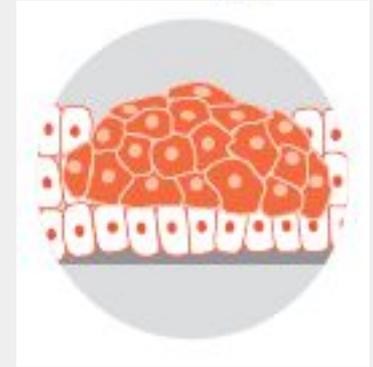
Gene
Mutation



Normal
Cells



Abnormal
Cells

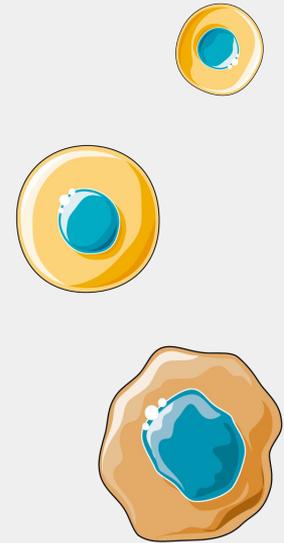
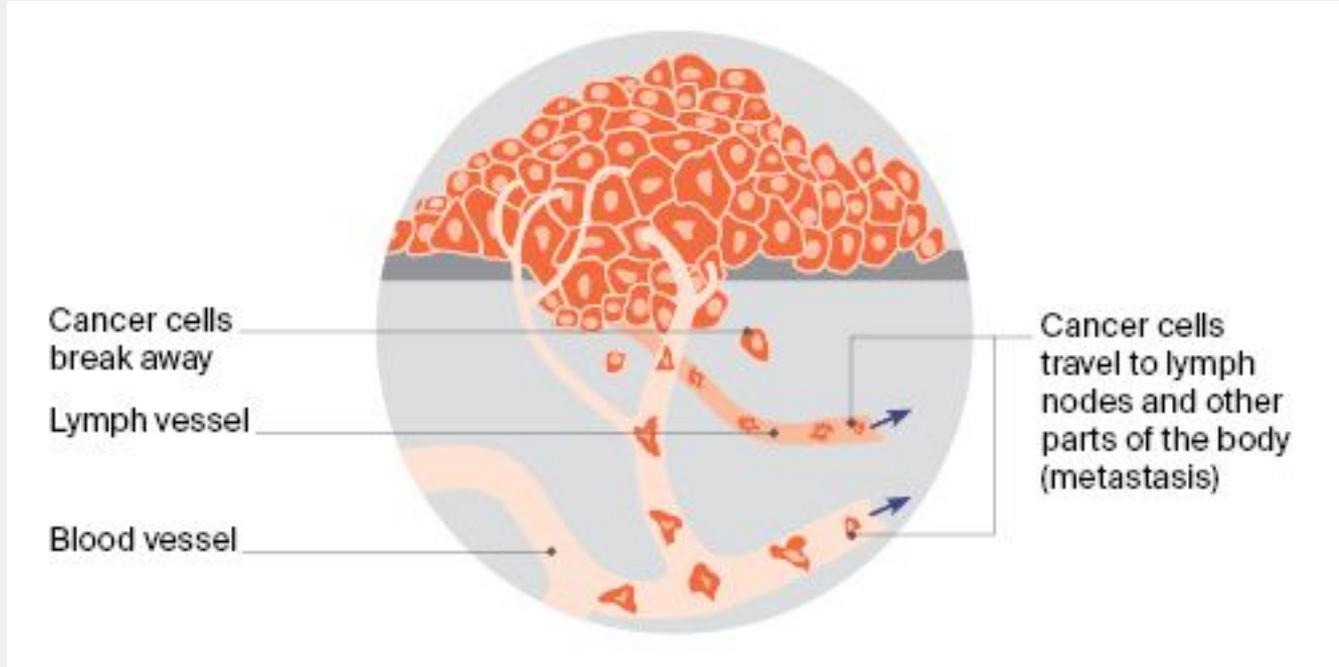


Abnormal
Cells Multiply

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Excurs Cancer



Cancer Treatments



Radiotherapy



Electrochemotherapy



Chemotherapy

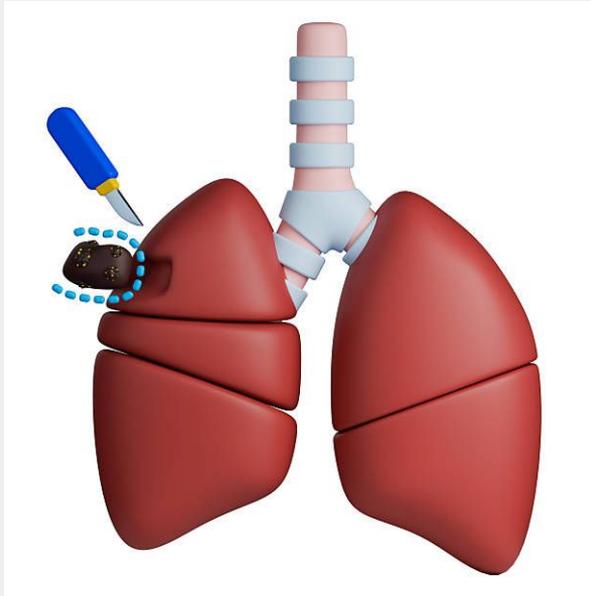


Resection



Ablation





Resection



Ablation

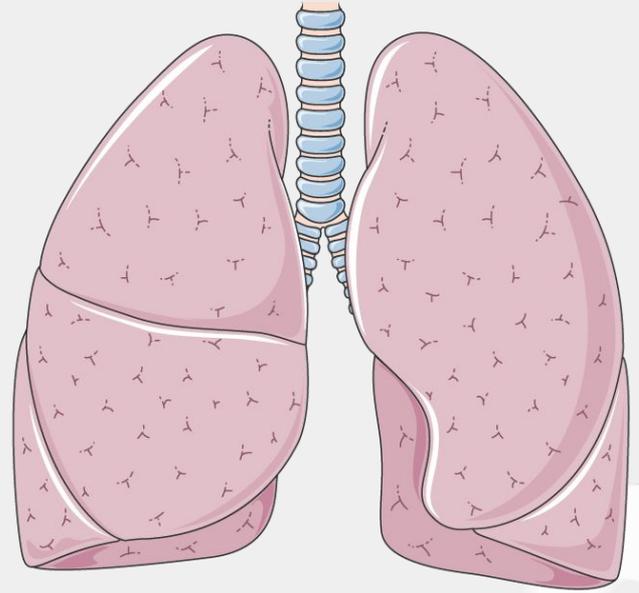


03

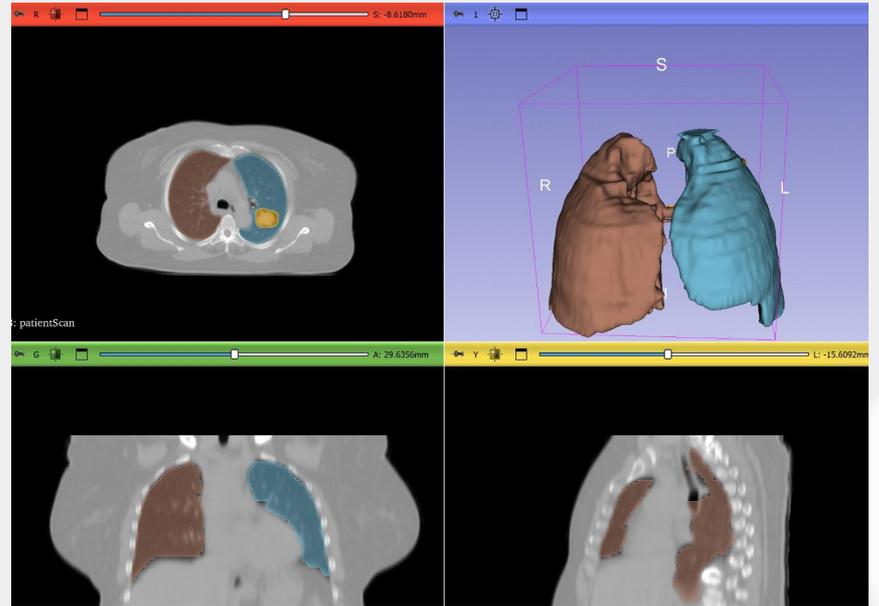
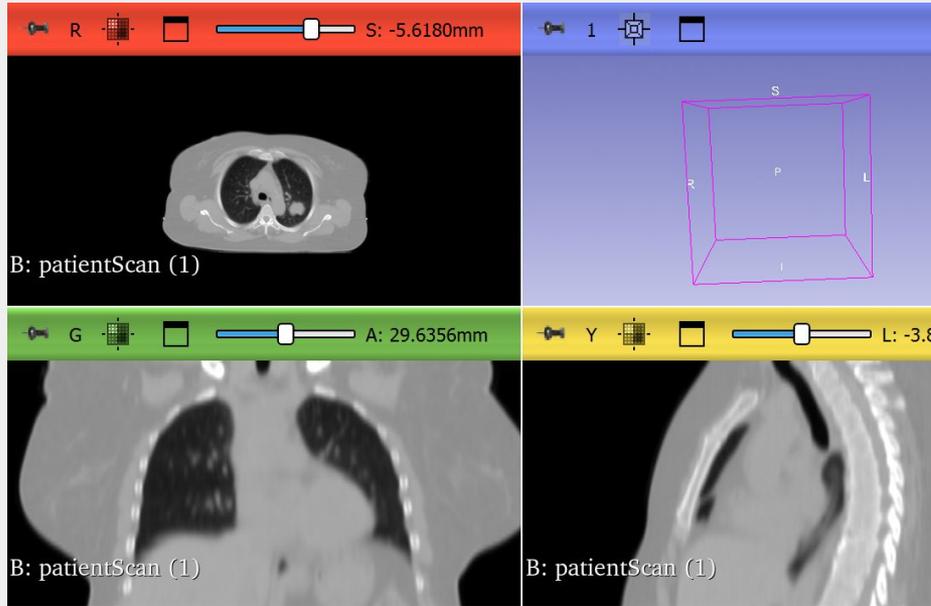
Segmentation

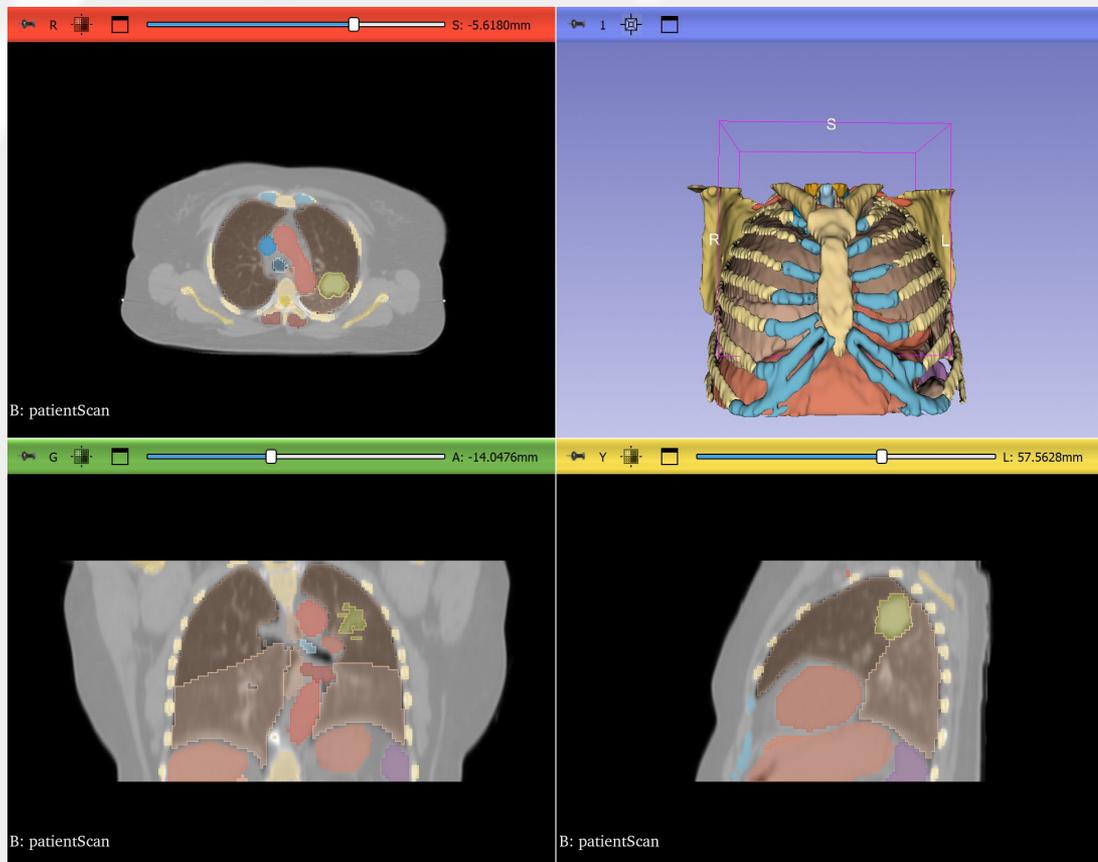
What is segmentation and what do we use it for?

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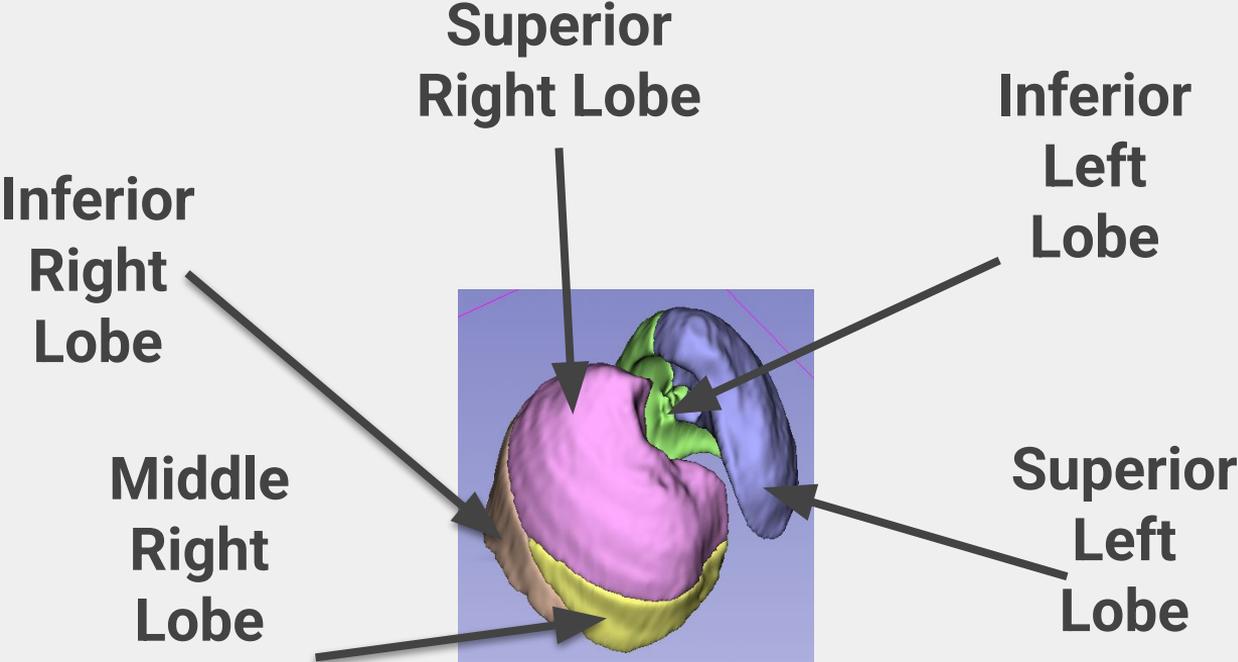
Segmentation





AI Segmentation using Total Segmentator

Lung Separation



3D-Slicer into Paraview

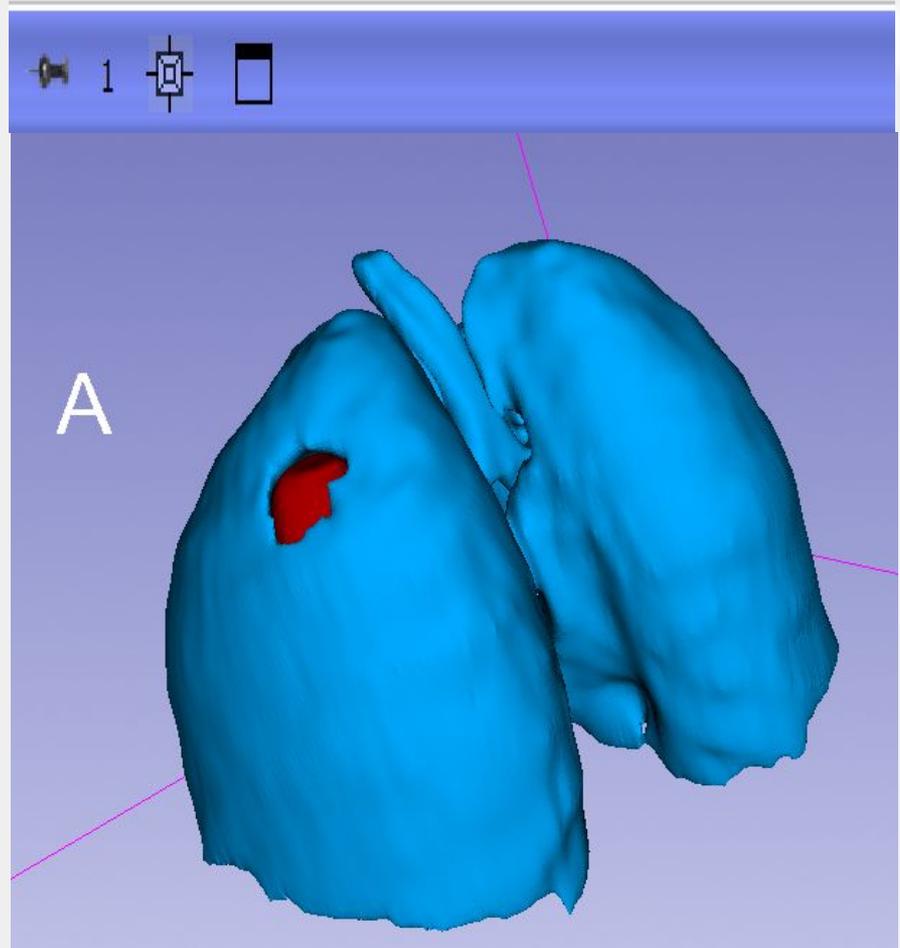
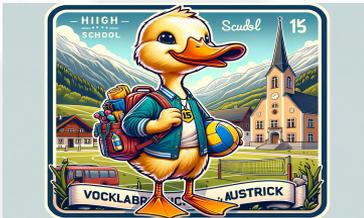


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04

Program Paraview

What's Paraview and how did it help with calculating the tumor?

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What's ParaView

Open-source multiple platform application for visualisation

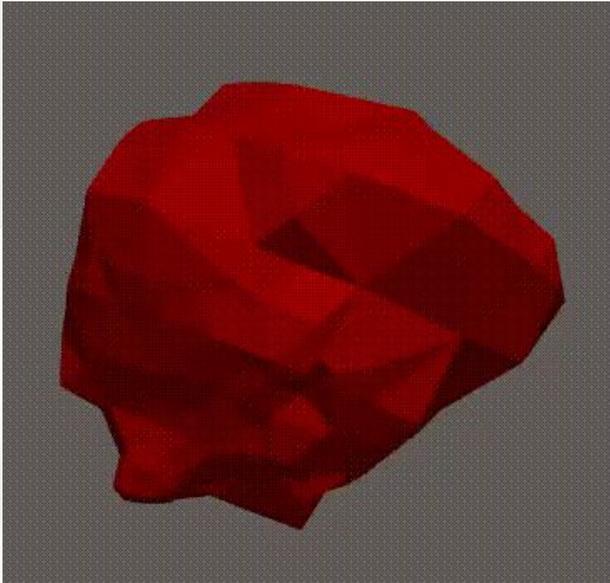
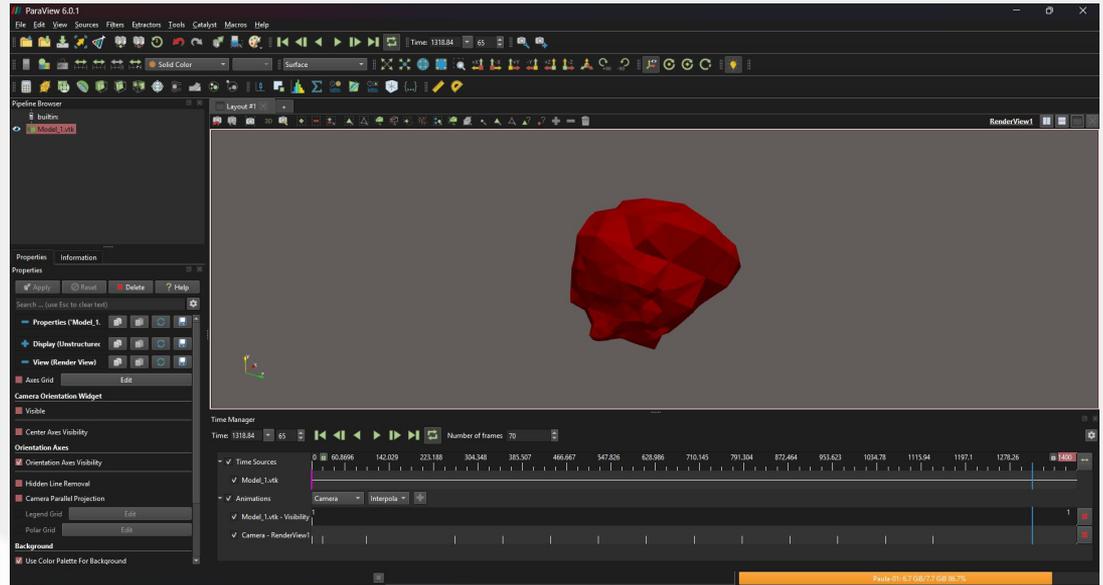
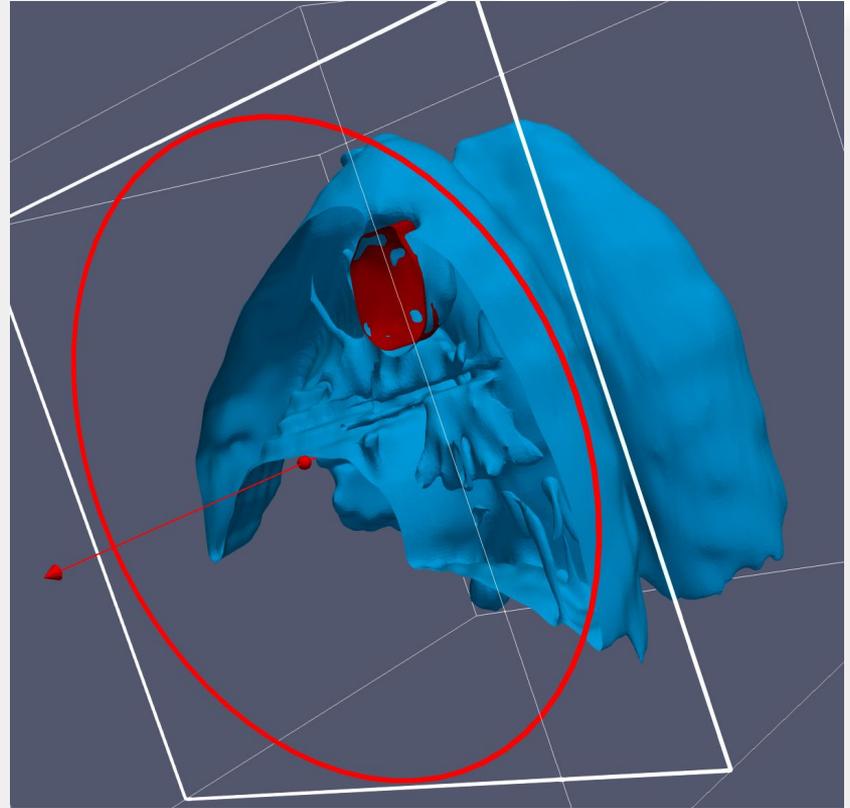
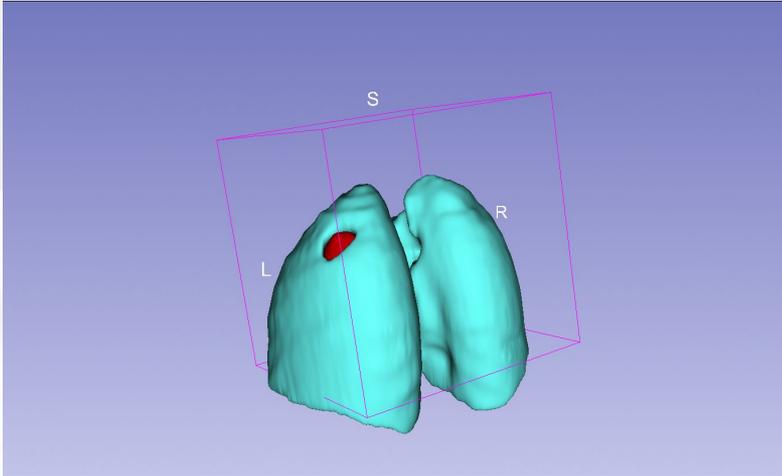


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Surface



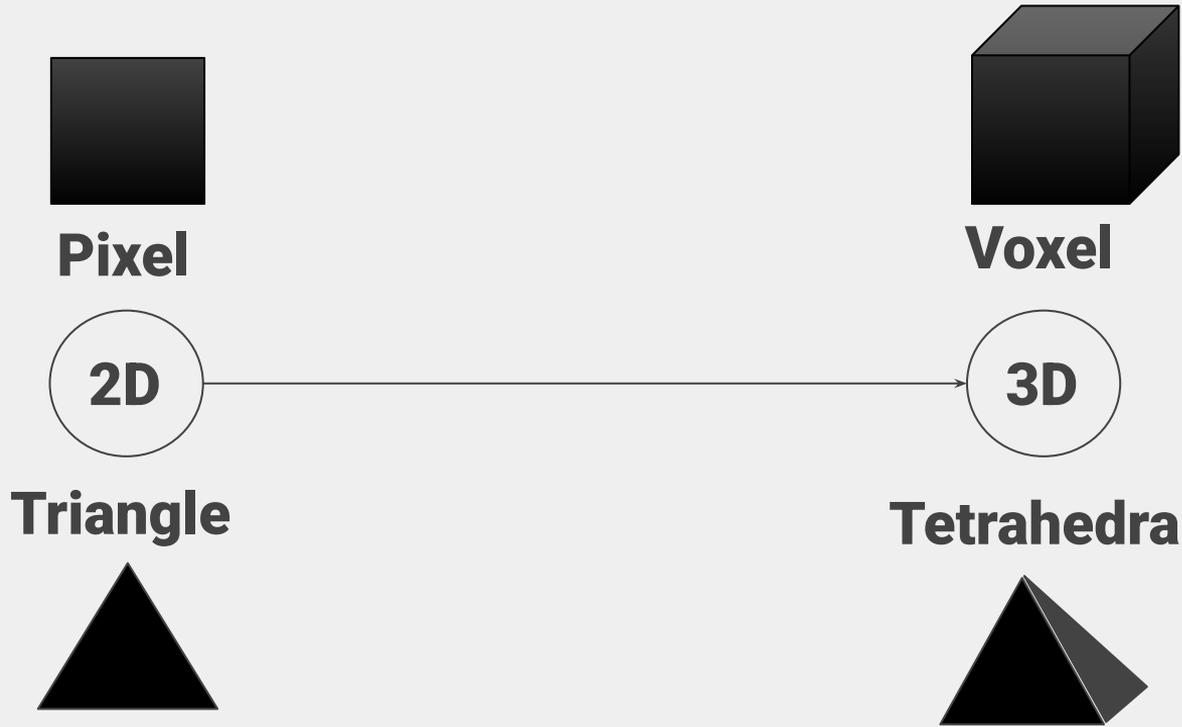


05

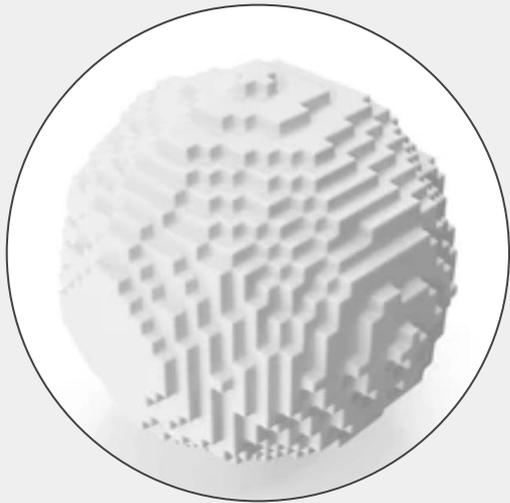
Meshing & Geometry Reconstruction



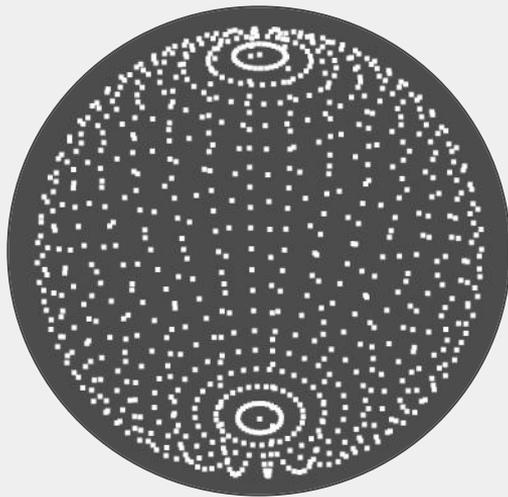
Representation



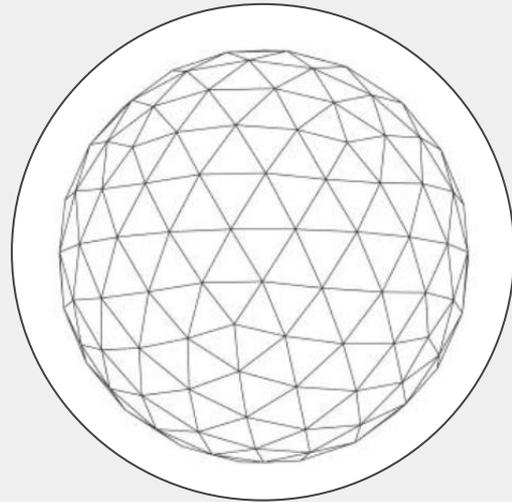
Volume representation



Voxelized image



Pointclouds



Tetrahedralized

Our Calculations

Volume [mm3]	Width [mm]
21 529.4	38.1
26 470.1	41.1
17 191	38.7
17 059.2	42.9
18 900	41.5
16 000	41.6
12 145.3	43.1
18 500	36.4
19 800	40
18 621	40.4

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06

Bounding Box and Mean Center



Mean Center

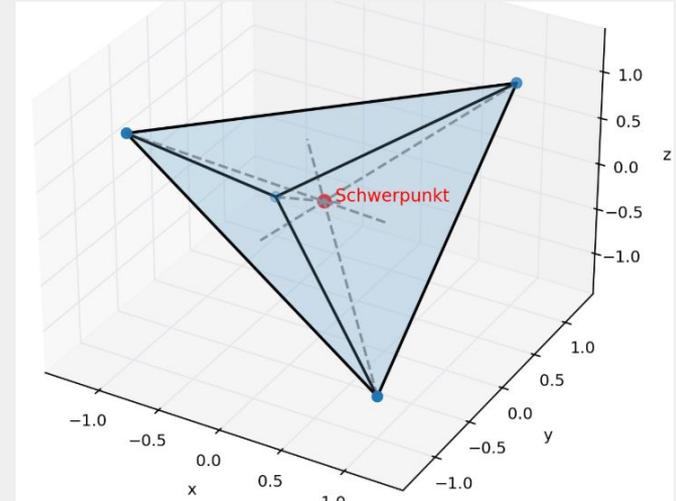
Mean Center (Mittelpunkt):

The center of density of different Points

arithmetic middle of each coordinate

Mean Center of a Tetrahedron:

$$S = \frac{1}{4}(x_1+x_2+x_3+x_4) \dots \frac{1}{4}(z_1+z_2+z_3+z_4)$$





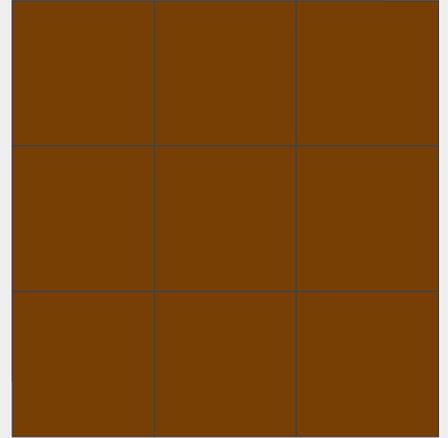
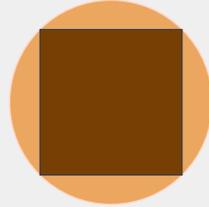
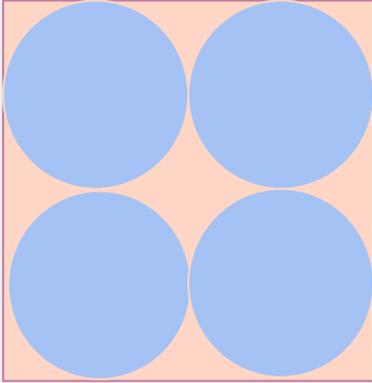
07

Algorithm



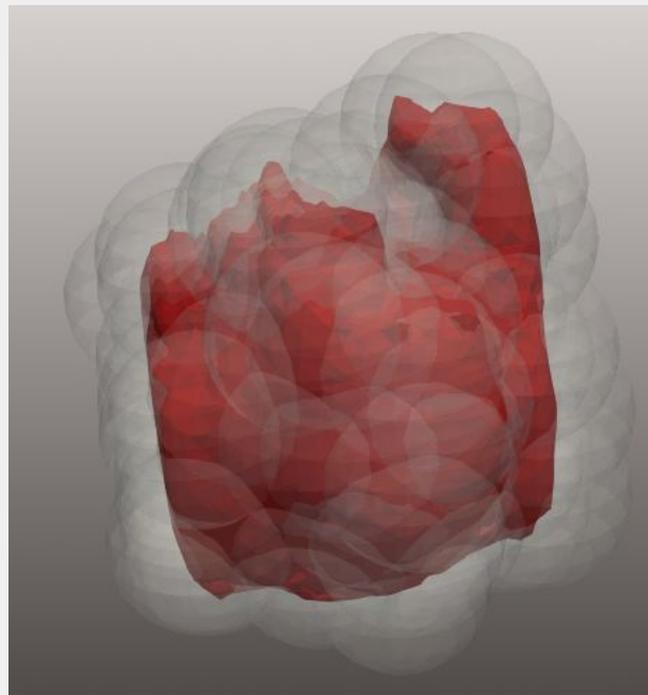
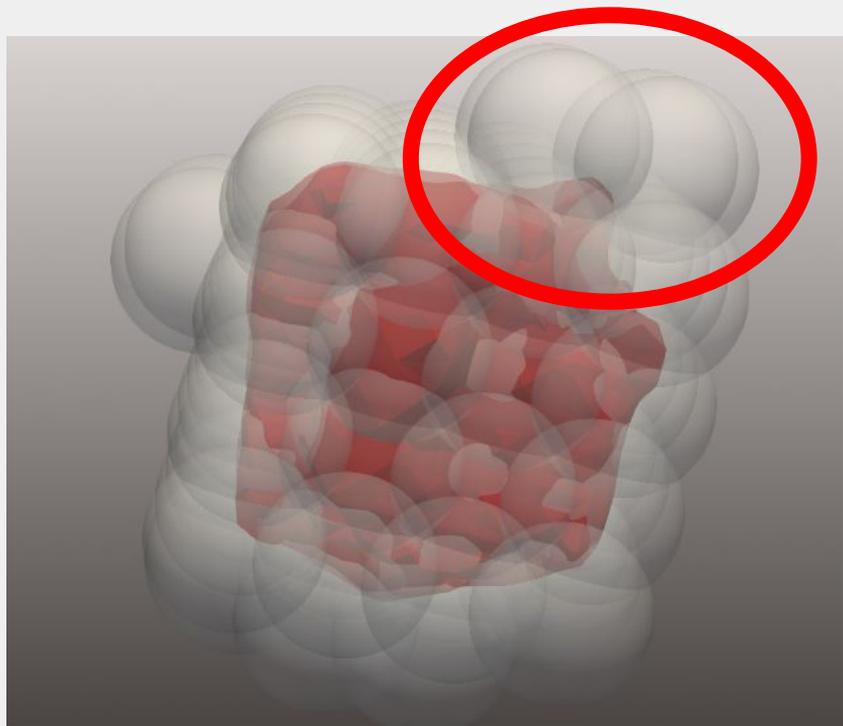
The Idea

Cubes instead of spheres



The Result

Ready to ablate



Thank you for your attention!

Do you have any questions?

