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What can we learn from the visualization?

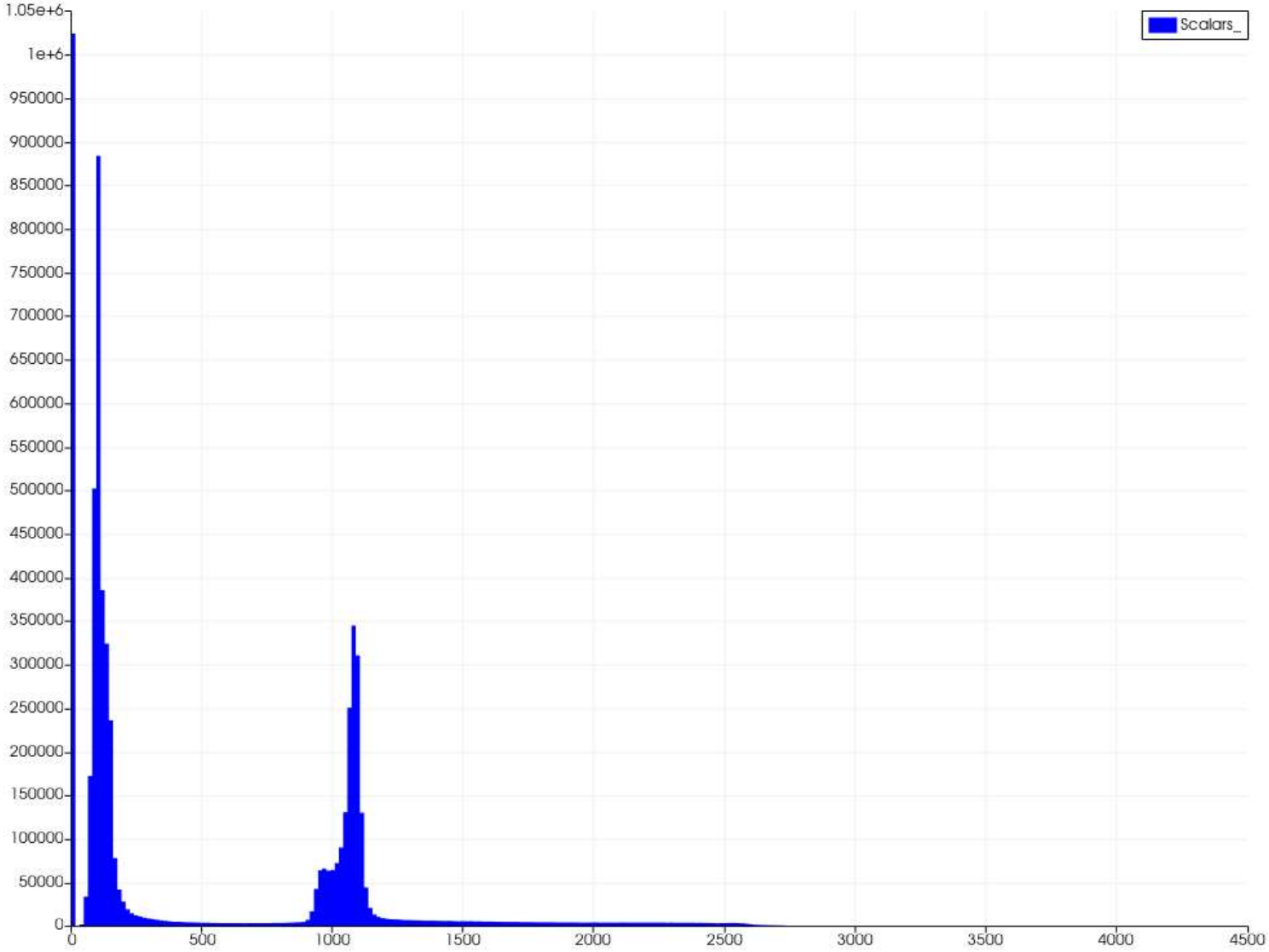
The aim of this visualization is to show the three surfaces of human head and some dentical concepts for the given dataset.

What is the name for the type of visualization(s) used?

For this visualization we used **isosurfaces**

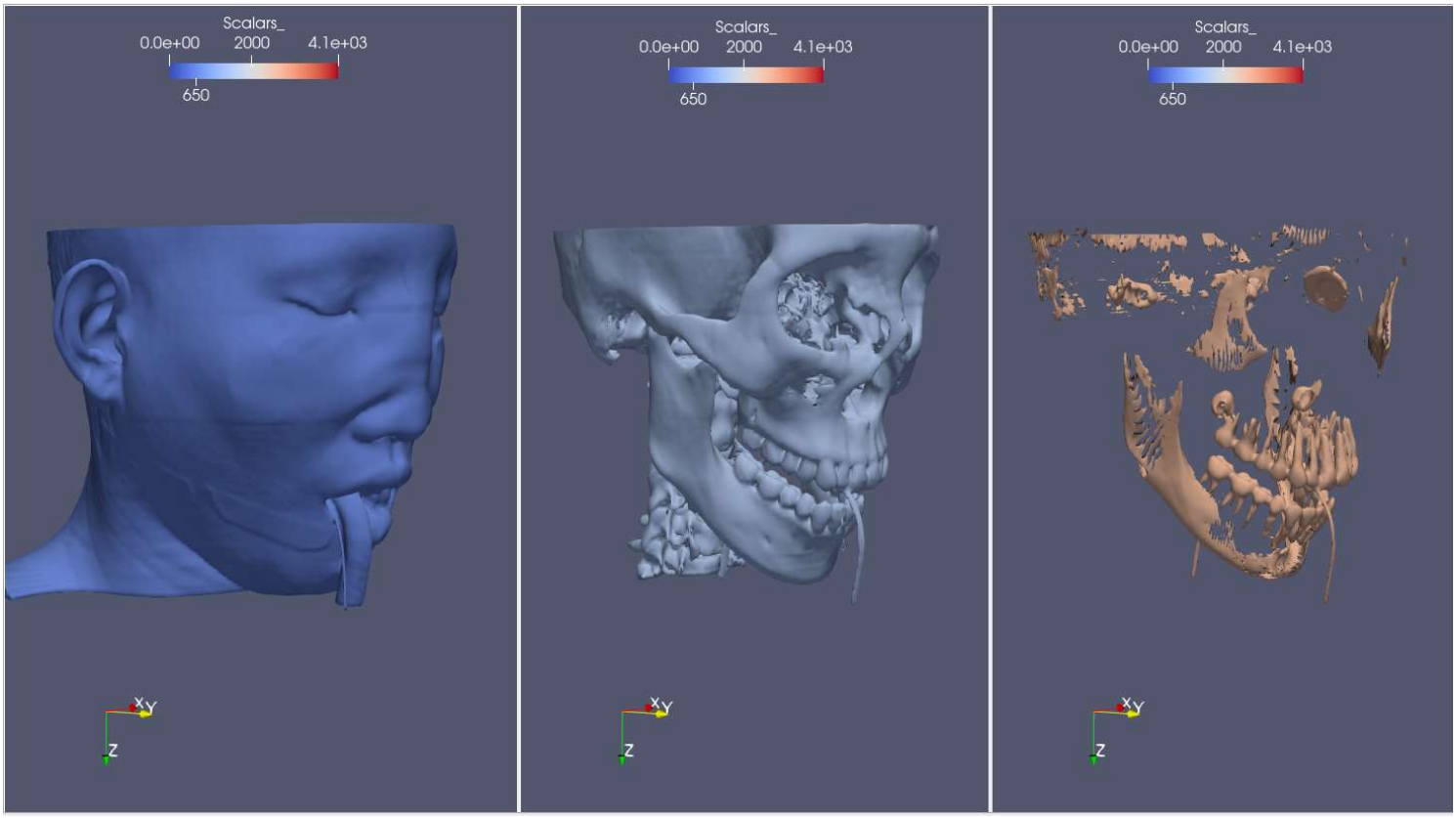
Data Preparation

For this visualization we firstly produce three different isosurfaces in order to see and understand the human head dataset. The isosurfaces produced after an understanding of the **histogram** of the dataset.



Three Isosurfaces

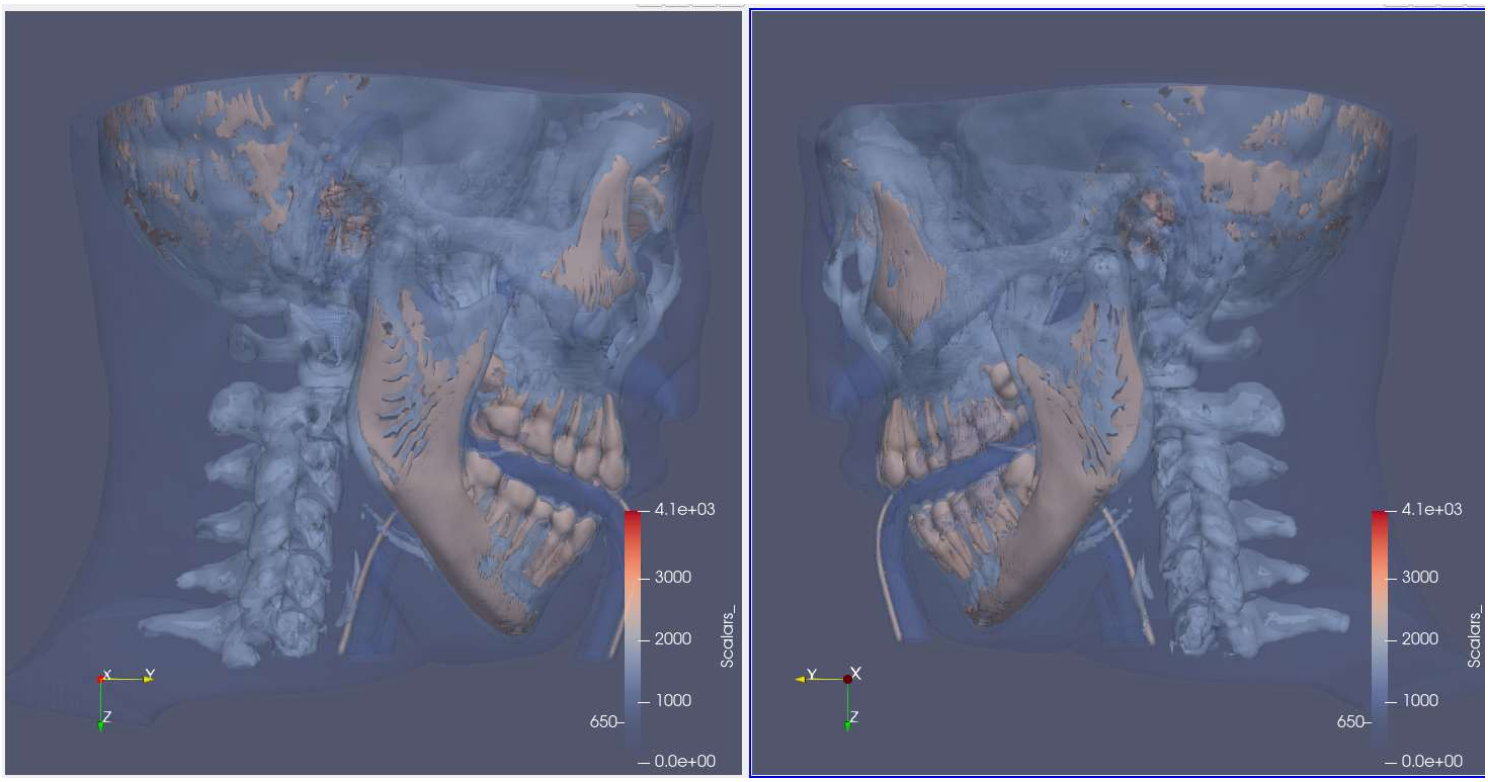
Using values 650 for the flesh, 1450 for bones and 2580 for teeth we can see the structure of the human head. The density for teeth are higher than density of bones and bones' density are higher than flesh. Thus we can seperate each one of them in three different visualizations.



From the tube in the mouth of the person we can assume that is under some sort of **gastroscopy**.

Combined Isosurfaces

For a better visualization of the dentical condition of the preson we produced a combined isosurface model using **contour filter** with the same values for each isosurface.



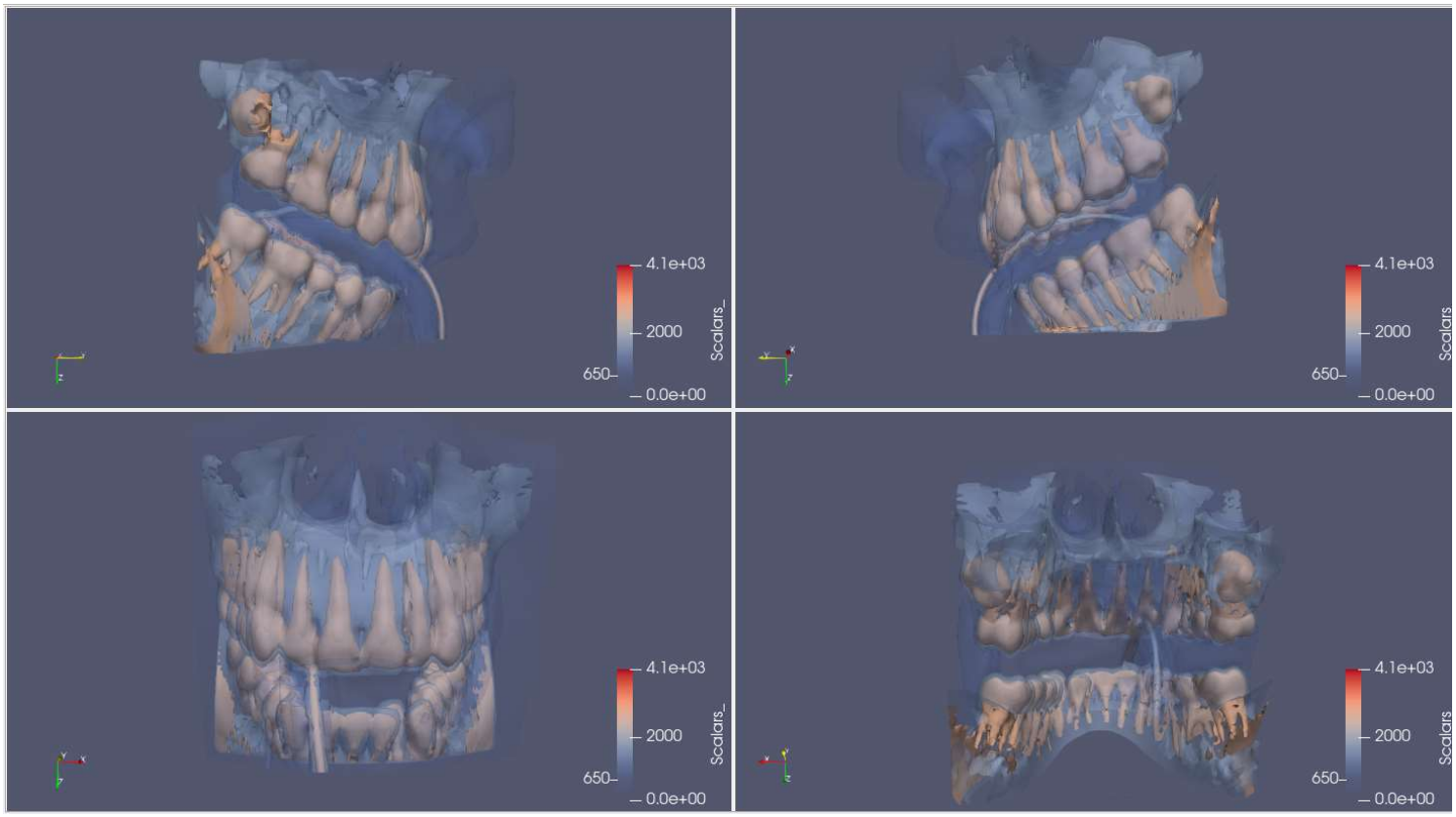
Reducing the opacity of flesh at 0.2 and the opacity of bones at 0.4 we can identify that wisdom teeth are not yet fully developed.

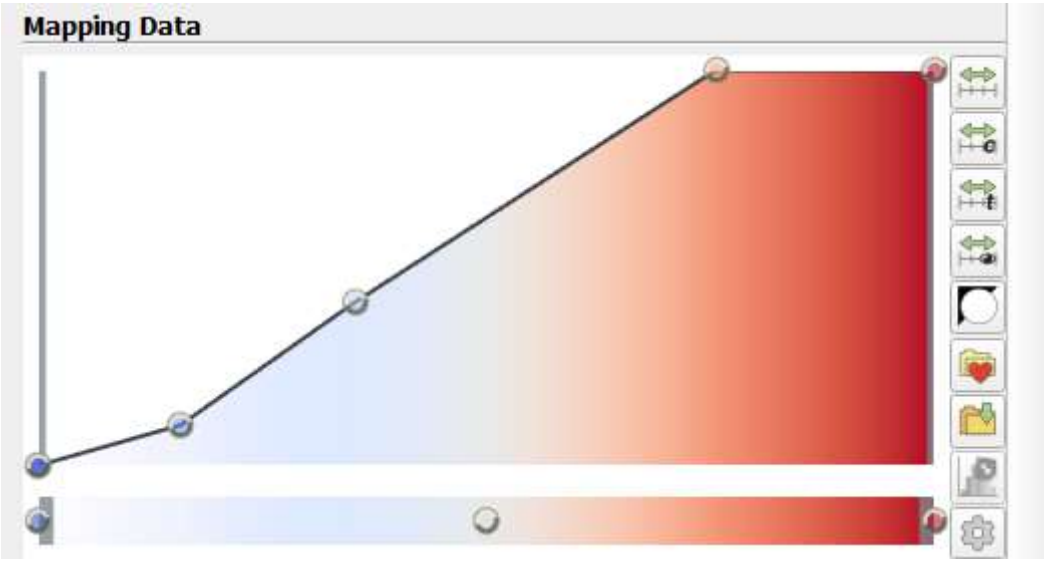
Final visualization

For a closer and more clear visualization, using **clip filter** we try to focus on the area that we are mostly interest. So for the final visualization we produced several views of the clipped mouth of the patient.

Final Visualization

From the final visualization we can see that the right wisdom teeth is developping on the other tooth that is next to it. We can also see that the left wisdom tooth is not yet developed and is also developing on wrong direction. One of the down incisors is not at the same deepth as the others and therefore there is also problem there.





What are all visual mappings used?

	Final Visualization
threshold	0-4095
color	Image Color: **Cool to Warm** Custom manipulations of the transfer function to change opacity on core values

	Final Visualization
opacity	**Surface 650**: 0.2 (*Flesh*) **Surface 1450**: 0.4 (*Bones*) **Surface 2580**: 1 (*Teeth*)

Was there any special data preparation done?

Initially using the **histogram** of the dataset we decide to produce three different isosurfaces using **contour filter**. Afterwards we combined the isosurfaces an we identified some problems with the dentical development of the person. Finally, reducing the opacity and clipping only the box we were interested we created our final visualization that is the mouth of the person from 4 different views.

What are the limitations of your design?

Having a general dataset about the head of a person the color mapping was not optimal to indentify some issues with a dentical prospective. A better contradiction between bones and teeth and a series of filters to produce a panoramic version of mouth from several view would lead to more robust result regarding our aim.

What can we learn from the visualization?

This visualization shows the material difference of teddy bear. The three different isosurfaces match 3 materials for outer layer of the teddy bear, the material inside the teddy bear and the material for the eyes and nose.

What is the name for the type of visualization(s) used?

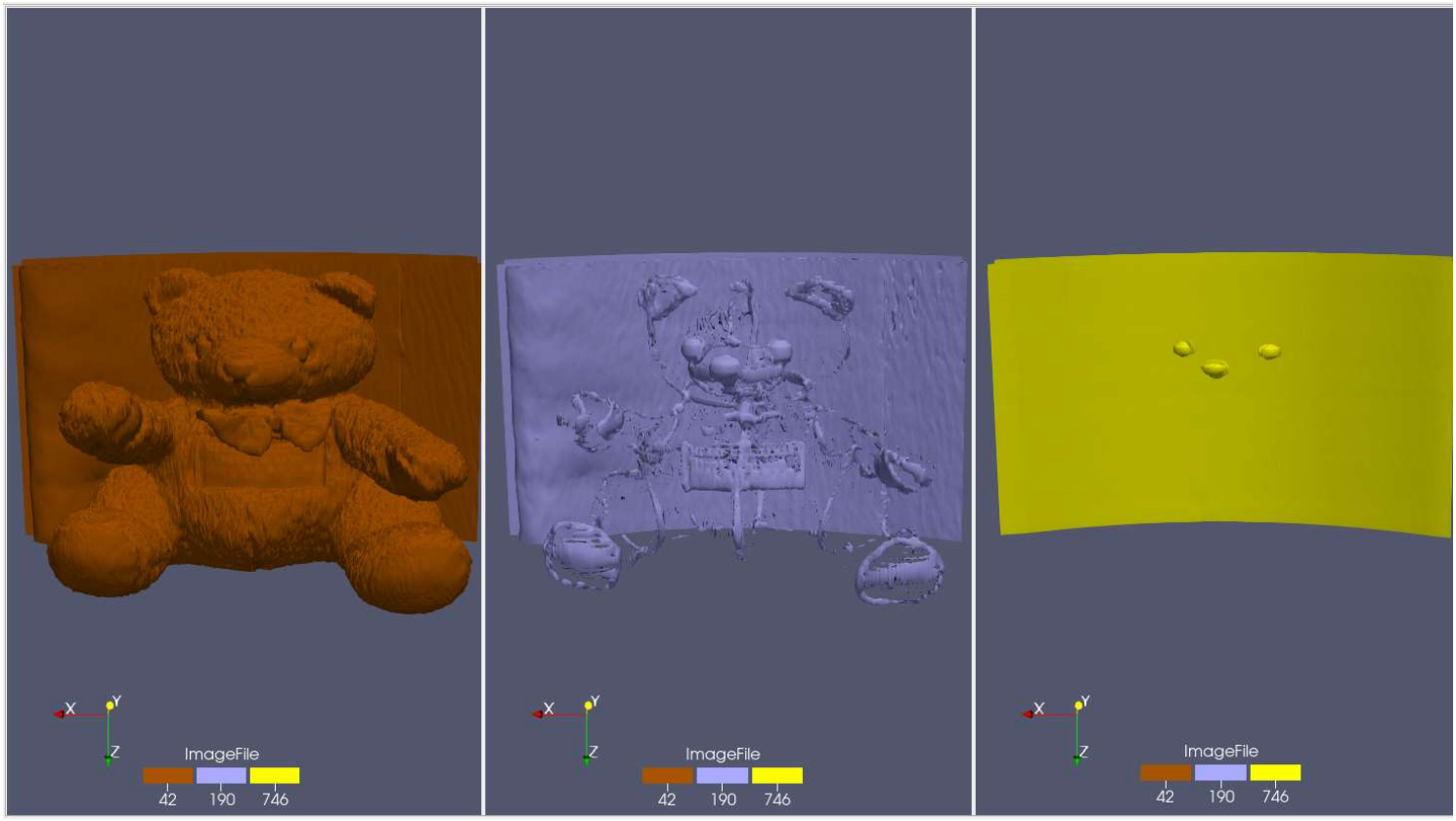
For this visualization we used **isosurfaces**

Data Preparation

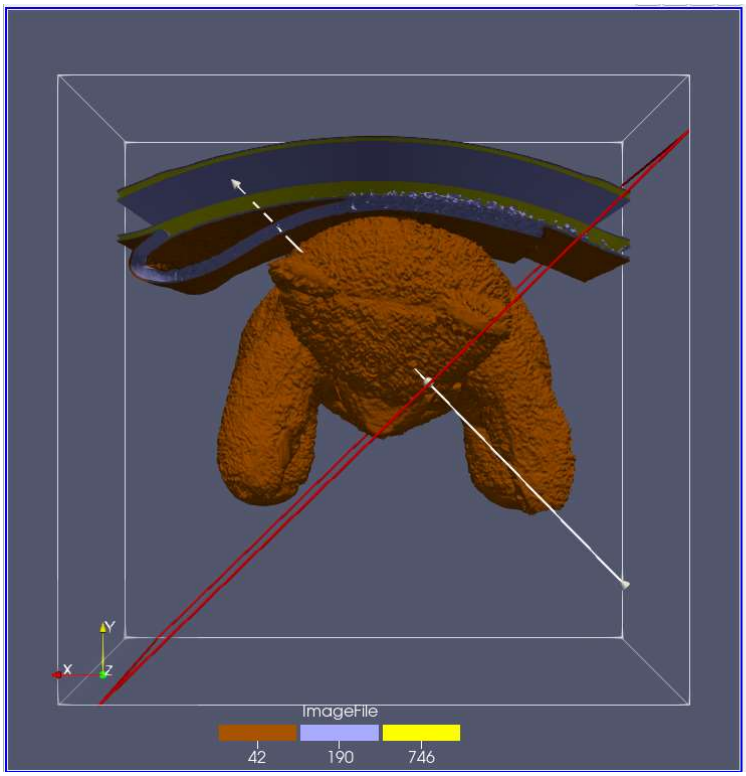
For this visualization we extended our dataset by setting the data spacing of z axis to 5. Afterwards we used **contour filter** to identify the three different values that best describe the layers of the teddy bear.

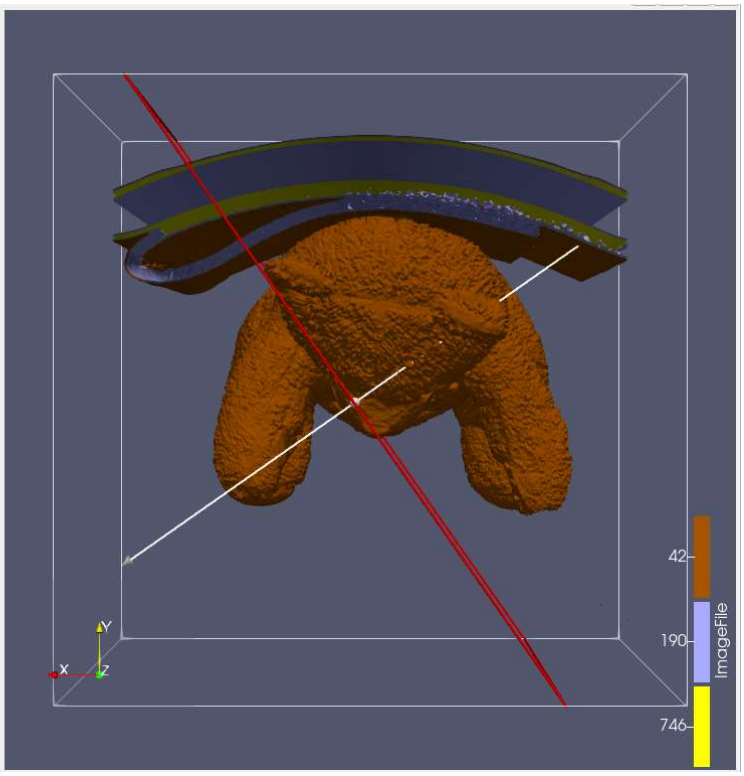
Three Isosurfaces

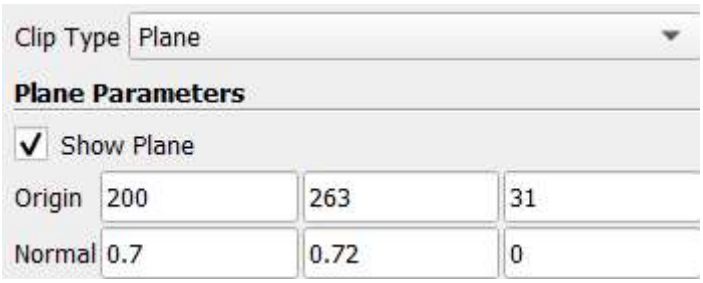
We produced 3 different isosurfaces for outer layer the inside and eyes and nose with values **42, 190** and **746** respectively. As we can see the density for eyes and nose are much higher than the other two indicating that the material was much harder than the outer and inside materials.

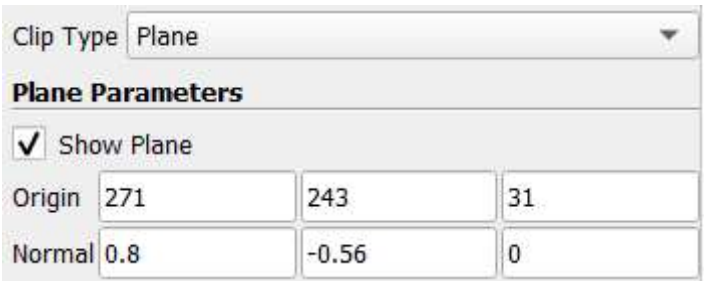


Afterwards, we merge the three isosurfaces and using a **clip filter** we produce our final visualization.



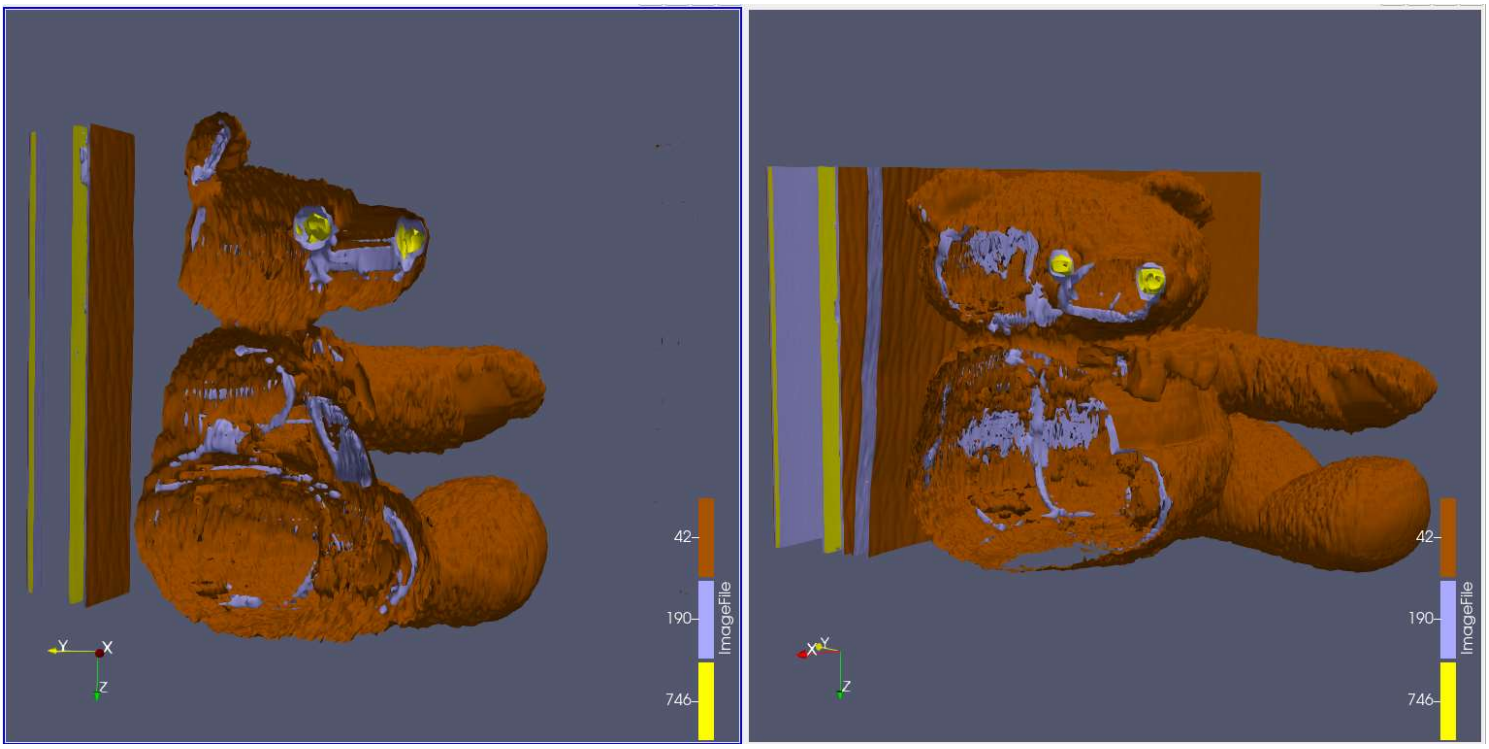






Final Visualization

In the final visualization we can dinstinguish the 3 different layers and which one is above the other. The inside material is used to give the shape of the teddy bear.



What are all visual mappings used?

	Final Visualization
threshold	0-1492
color	**Surface 42**: #AA5500 (*Outer Layer*) **Surface 190**: #AAAAFF (*Inner Layer*) **Surface 746**: #FFFF00 (*Eyes & Nose*)
data spacing	**x** : 1 **y** :1 **z** :5
representation	surface **for all**

Was there any special data preparation done?

Initially we **extend** the dataset on **z axis by 5**. Using the **contour filter** we created three seperate isosurfaces. Visualizing the seperated isosurfaces we then create a signle visualization containing all of them. Afterwards, we found two **clips** between the dataset in order to cut it through the eyes in order for all layers to be visible.

What are the limitations of your design?

The limitations of this visualization is that because the isosurfaces are not complete, there are some points that the layers are not visible. Also we only distinguish the materials but we do not exactly know what are they and we colored them with random colors.

What can we learn from the visualization?

This visualization aims to show that the datasets contains a **teddy bear**. With a series of slices we will visualize the **teddy bear** that is hidden in the file.

What is the name for the type of visualization(s) used?

For this visualization we used **slices**

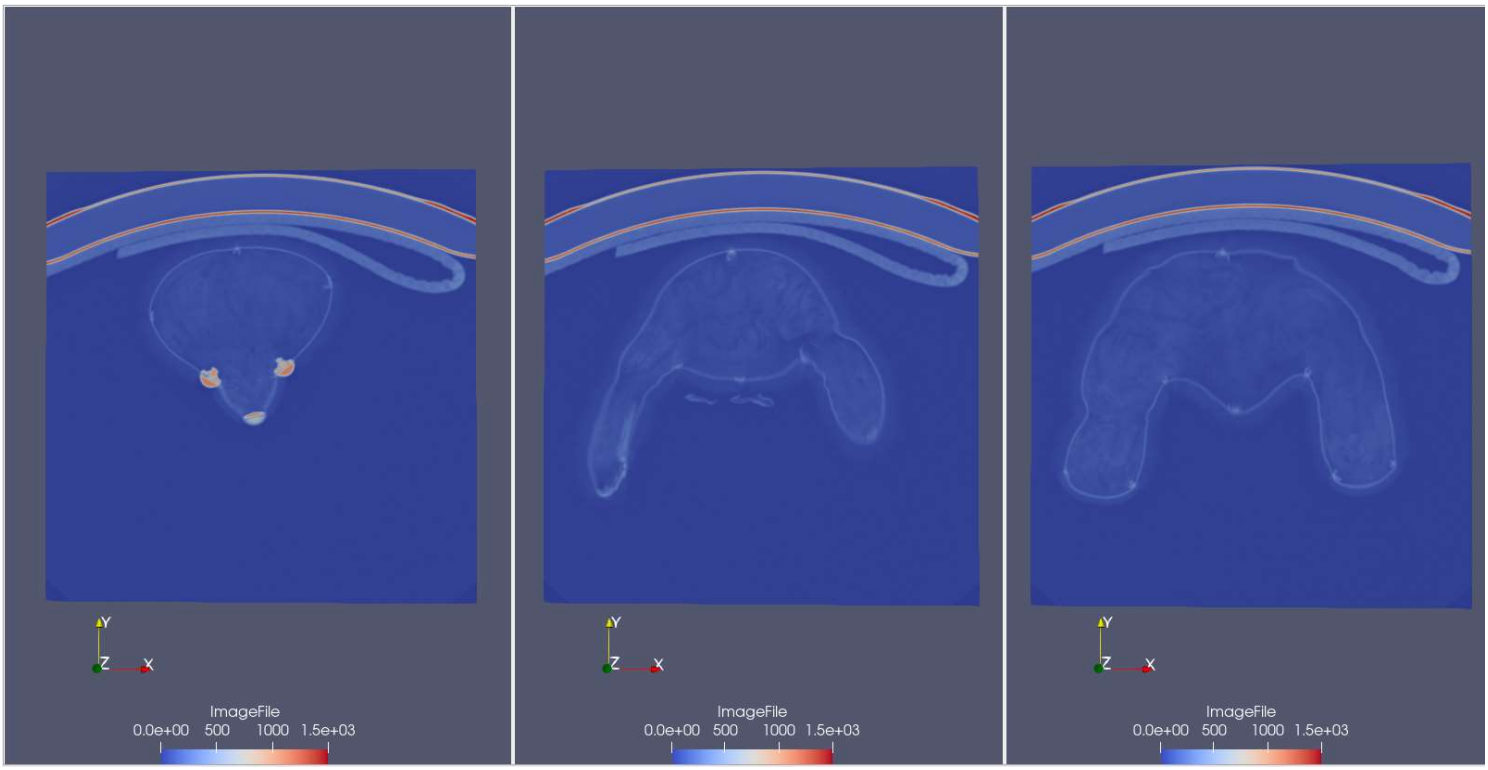
Data Preparation

The process we followed for this visualization was a continuous slice of the dataset at several x,y,z coordinates in order to find the optimal slices for the understanding of the dataset.

All slices below keep the middle value to the other two remaining axis.

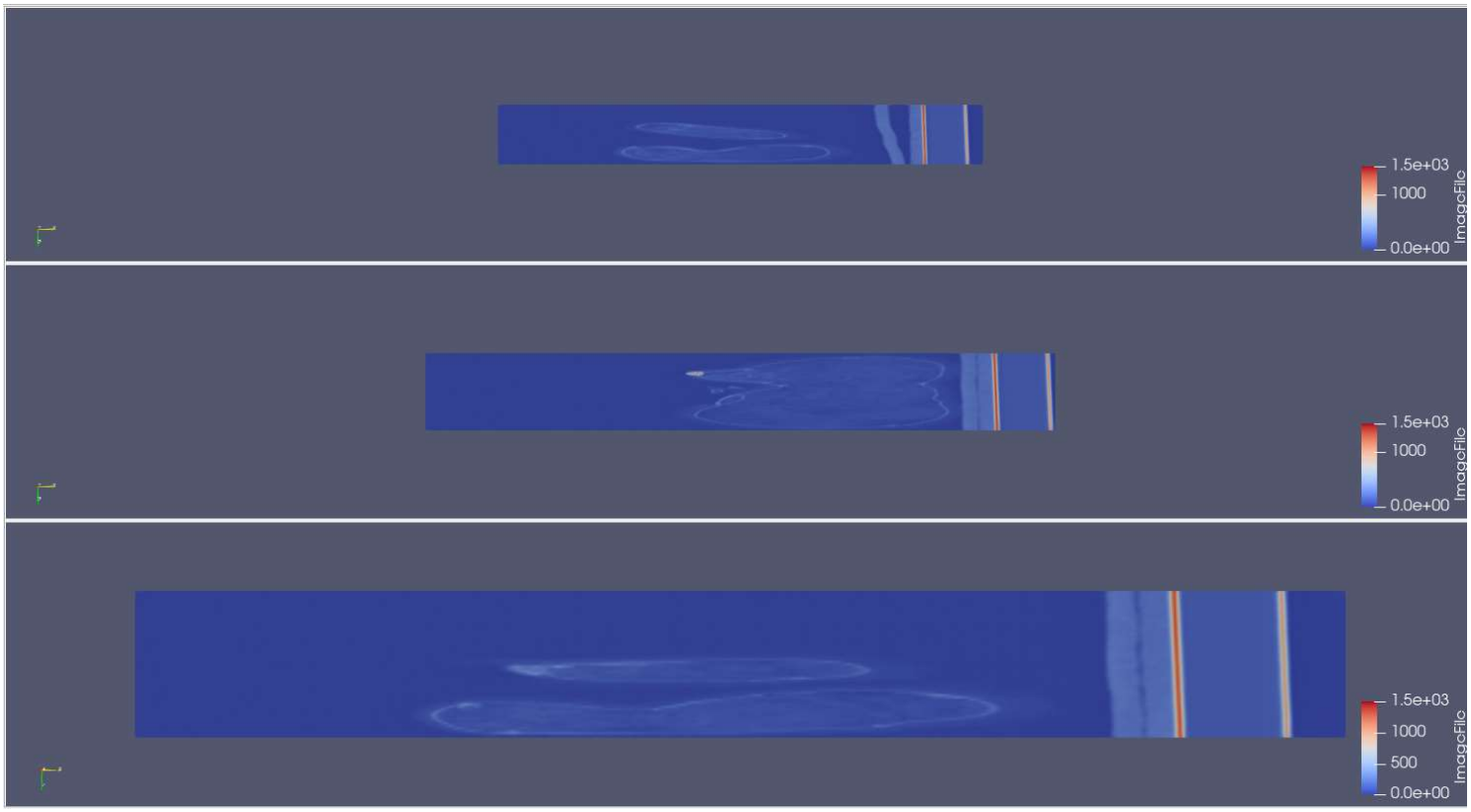
Slices on Z axis

Firstly we sliced the dataset through **z axis** and we found three interesting slices that provides information about the insight of the dataset. In the following picture we show the slices on z axis for values **15, 31, 54** respectively. From the first slice we can obviously see that there is a head that looks like a bear. The second and third slices shows something like arms and legs respectively.



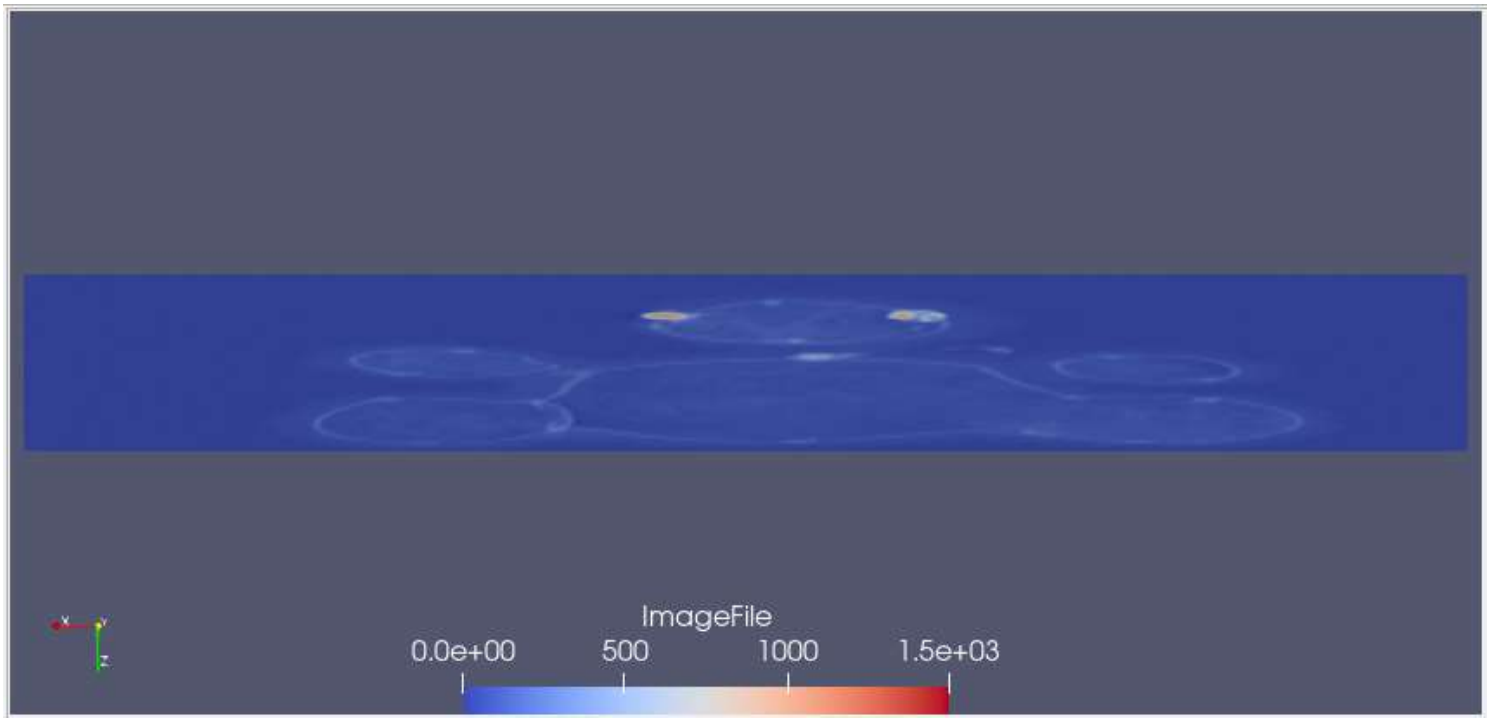
Slices on X axis

By slicing the dataset on x axis we identified and confirmed that it is a bear. First slice at value **375** shows the one side of hand and leg, while another cut at value **100** also shows the hand and leg. The second slice confirm the shape of the head of the bear.



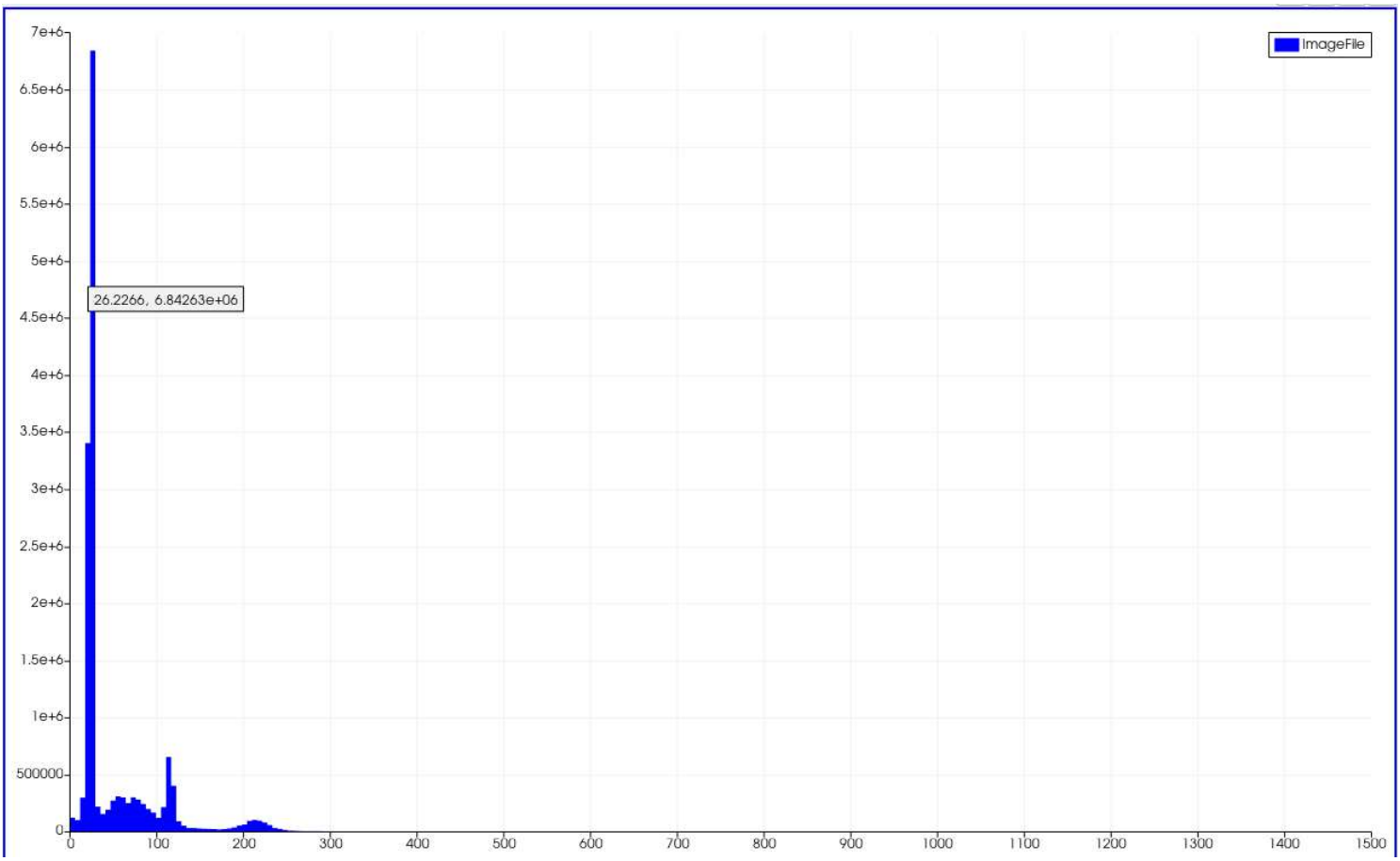
Slice on Y axis

Just one slice on Y axis at value **270** shows all parts of the bear.

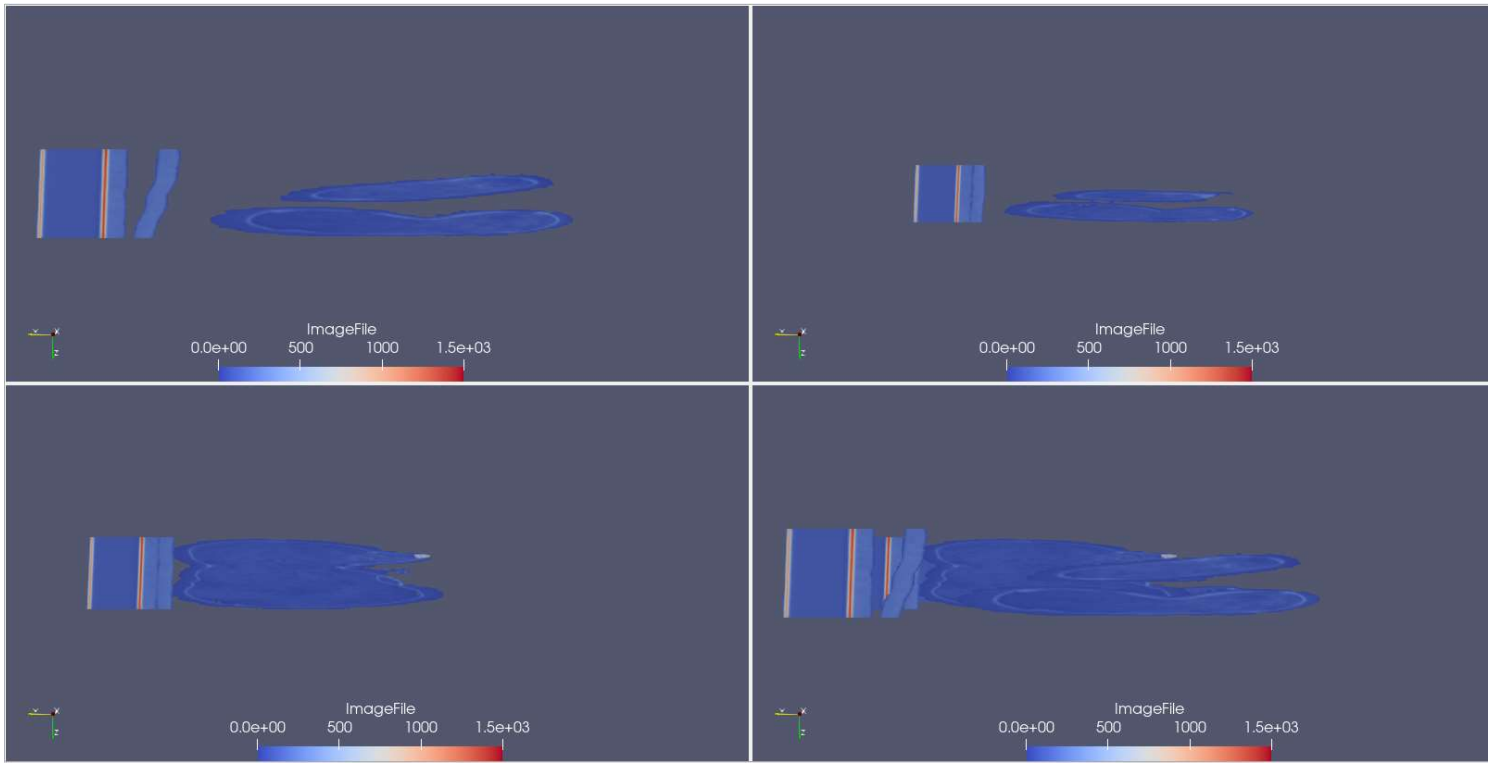


Final Visualization

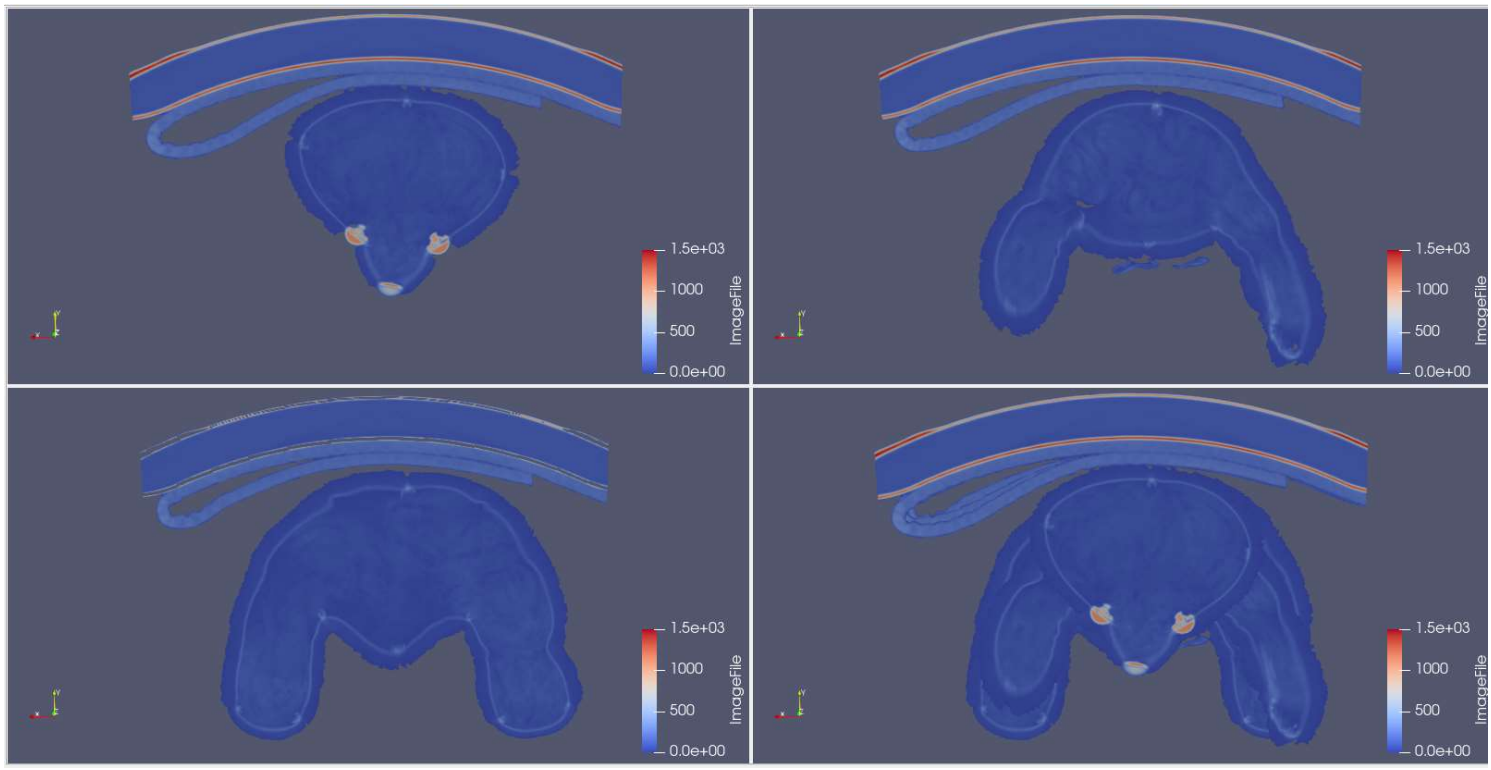
Having a look at the **histogram**, for the final visualization we firstly applied a threshold filter on the slices and then we merged them together for a clearer representation of the teddy bear.



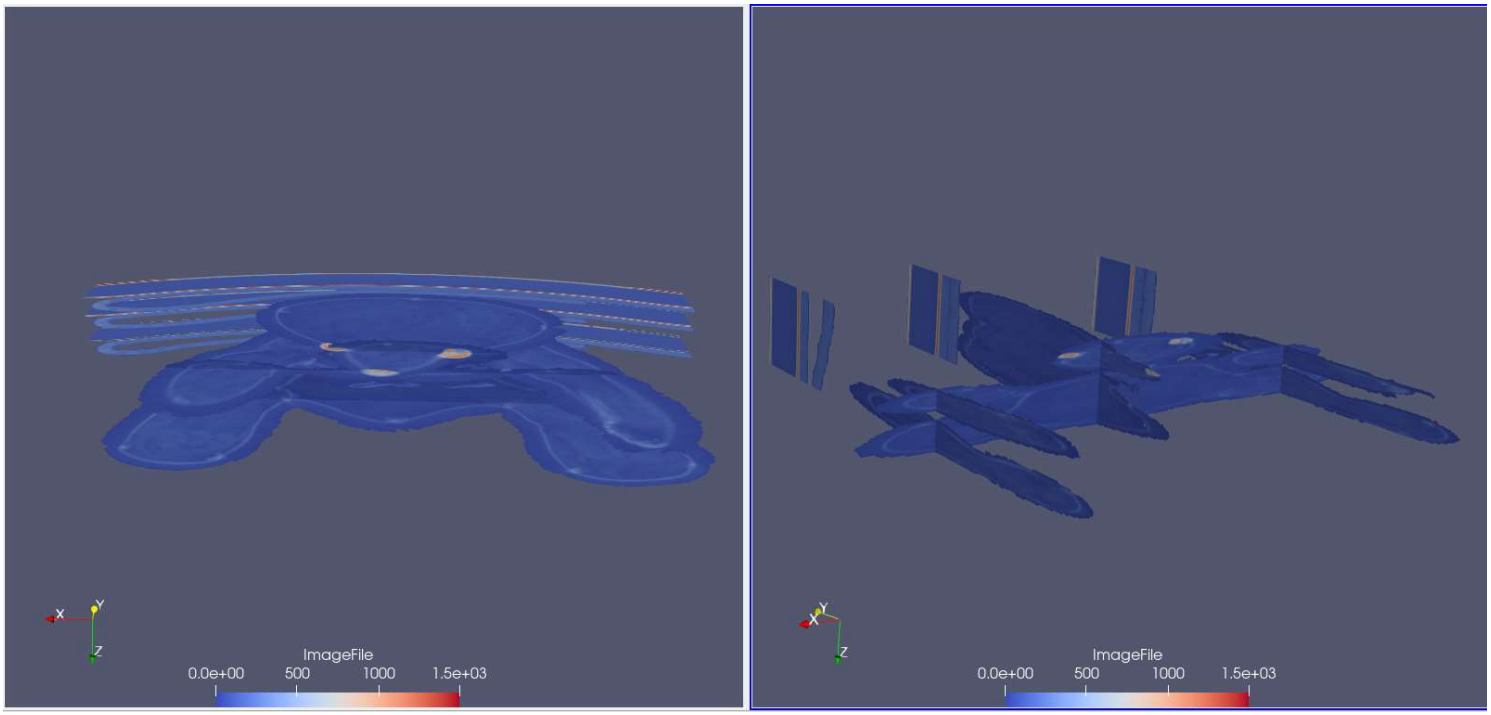
X axis from both sides



Z axis visualization



Y axis combined with the other two



What are all visual mappings used?

	X axis Visualization	Z axis Visualization	Y axis Visualization
threshold	30-1492	30-1492	30-1492
color	ImageFile: **Cool to Warm**	ImageFile: **Cool to Warm**	ImageFile: **Cool to Warm**
slice1	**x:** 100 **y:** 255.5 **z:** 31	**x:** 255.5 **y:** 255.5 **z:** 15	**x:** 255.5 **y:** 270 **z:** 31 and combination of the previous two
slice2	**x:** 260 **y:** 255.5 **z:** 31	**x:** 255.5 **y:** 255.5 **z:** 31	**N/A**
slice1	**x:** 375 **y:** 255.5 **z:** 31	**x:** 255.5 **y:** 255.5 **z:** 54	**N/A**

Was there any special data preparation done?

For this visualization we firstly found the optimal slices for each of the three axis. For Z axis we sliced the dataset 3 times to identify the head, arms and legs. For the x axis we sliced the dataset 3 times to identify left arm and leg, right arm and leg and the head of the teddy bear. Afterwards, based on the histogram we used **threshold filter** to remove the areas around the bear by removing voxels that its value was under 30. At the final step we combined the slices for each axis to identify the bear.

What are the limitations of your design?

For this visualization we used **slice filter**. Having a volume datasets, slices might not be the optimal way to represent what it is inside. This visualization also limit us to understand the actual size of the bear. For instance how big it is the arm and leg. Filter to identify the volume of the bear or using several slices at the begining and end or each arm and leg may lead to better results.

What can we learn from the visualization?

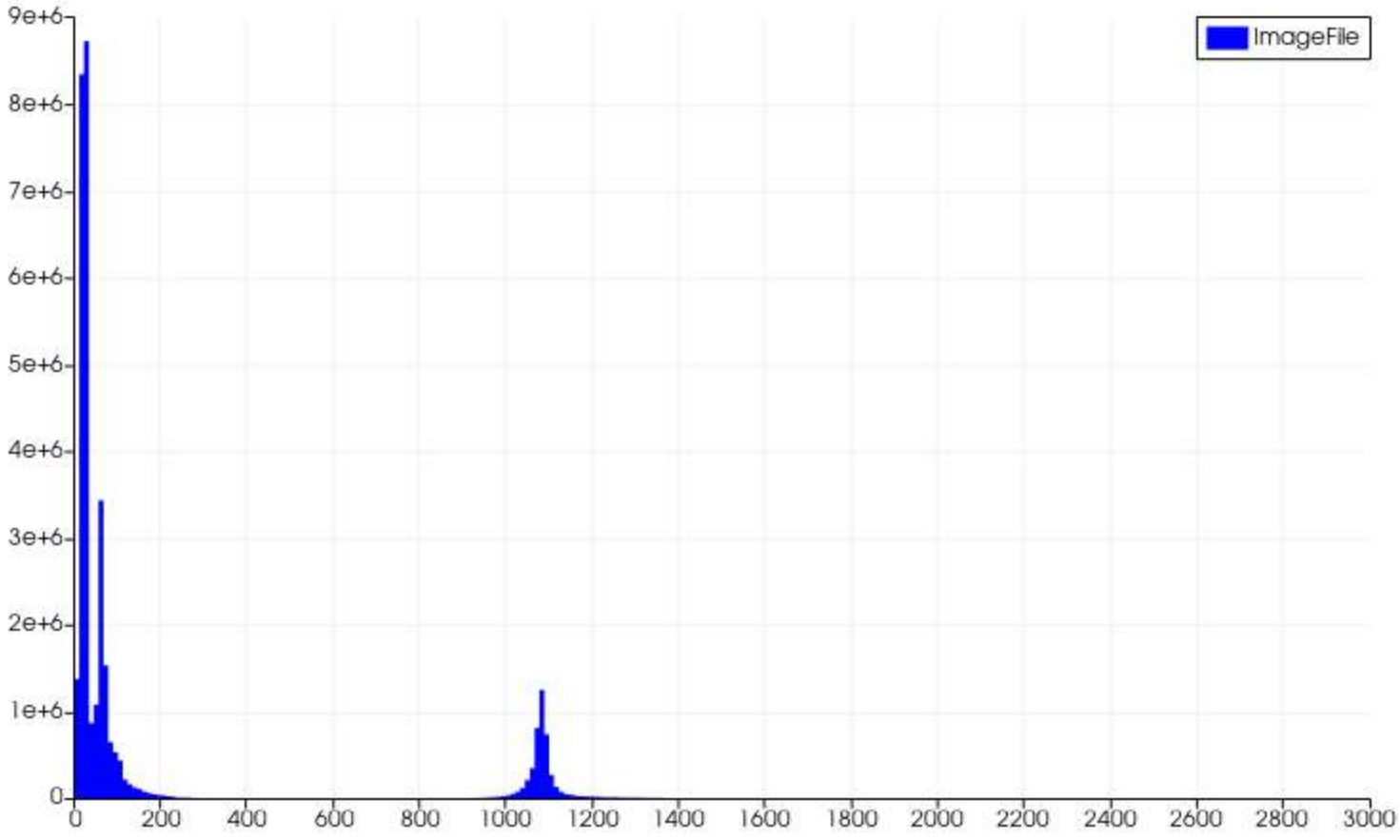
This visualization illustrates the **bones** and **flesh** of the fish in two distinct `isosurfaces` for a better understanding of its **anatomy**.

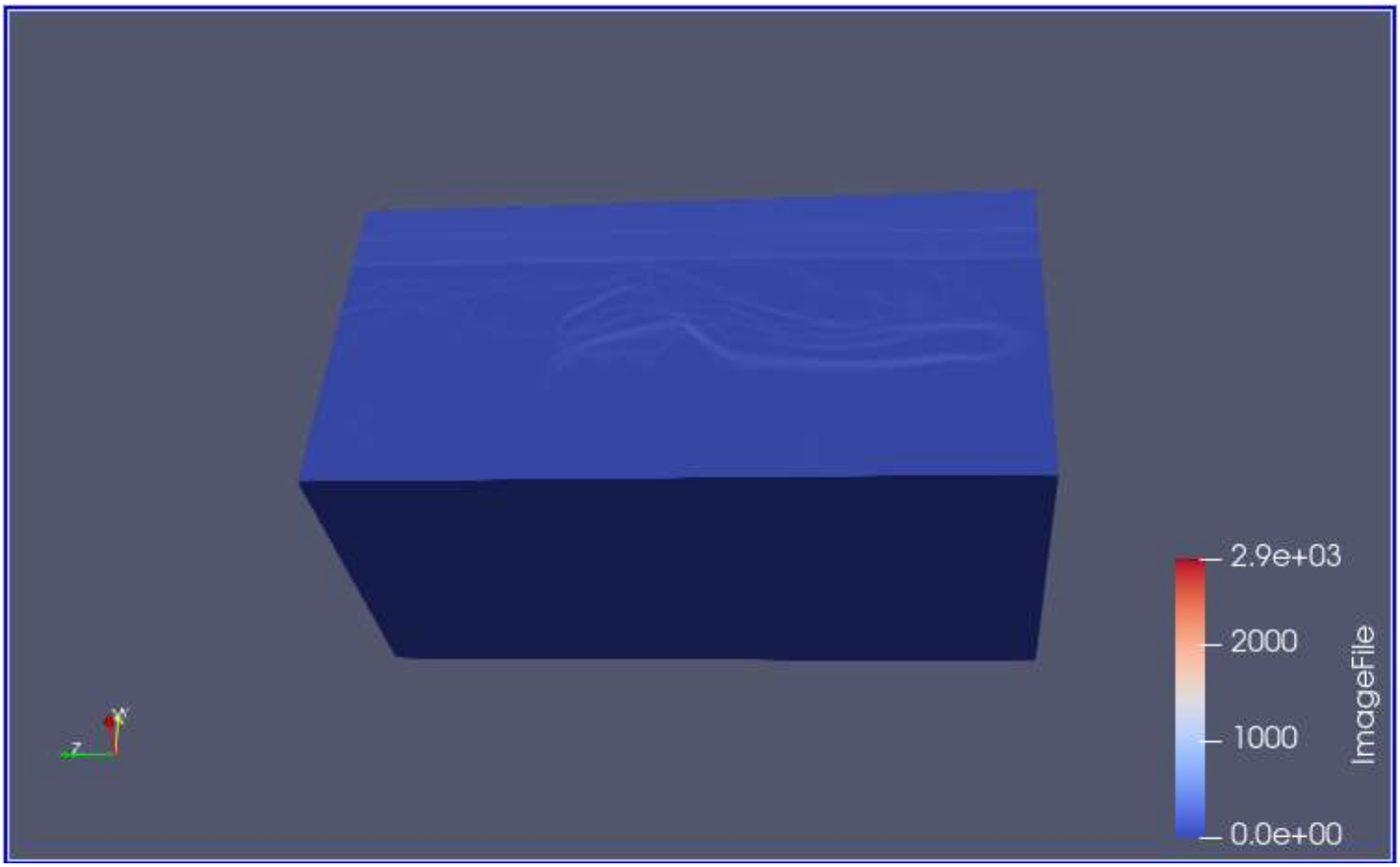
What is the name for the type of visualization(s) used?

For this visualization we used **isosurfaces**

Data Preparation

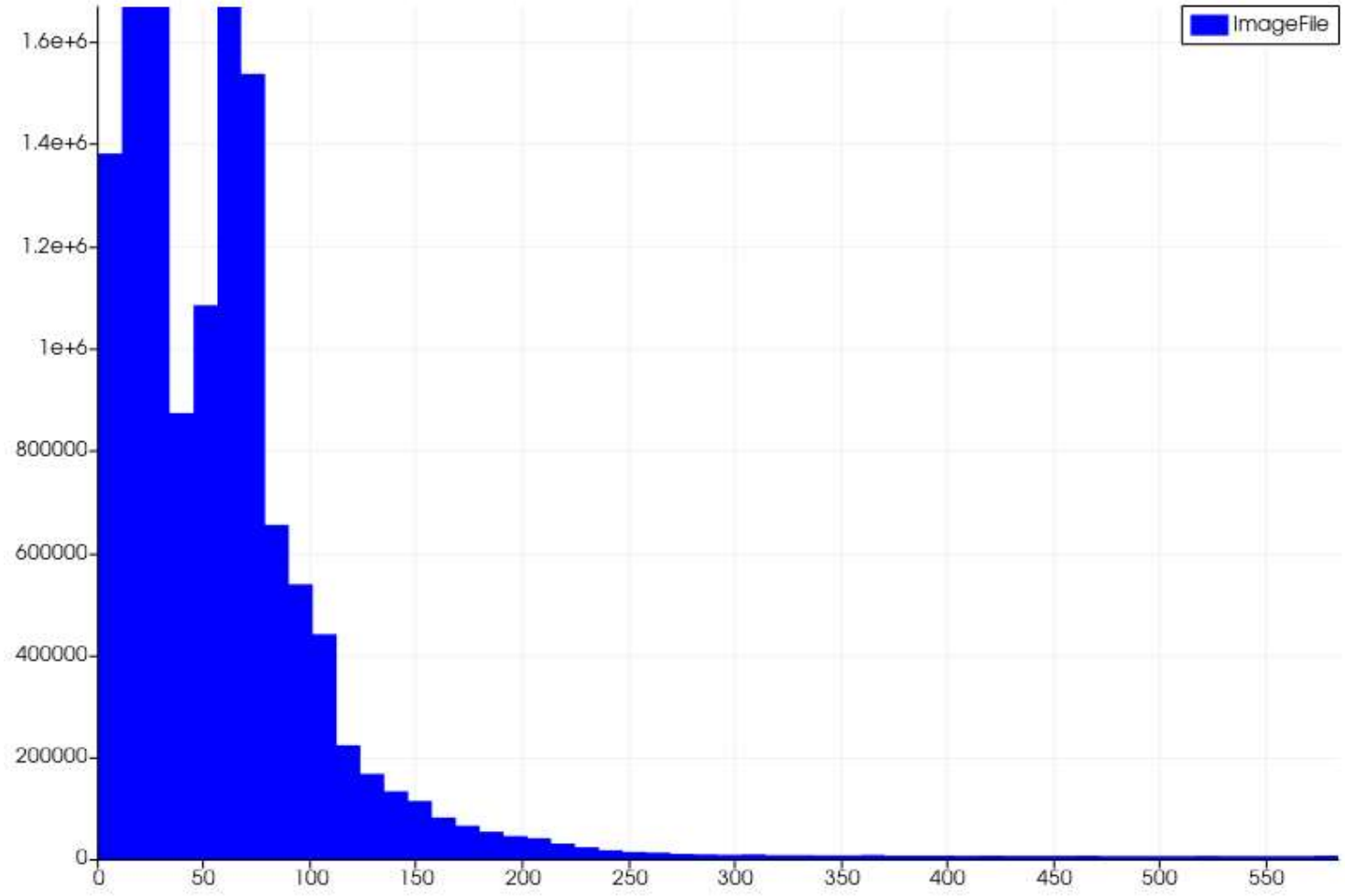
Firstly we produced a **histogram** in order to see the distribution of the numerical data of the dataset. From the following histogram we can distinguish two different density curves.

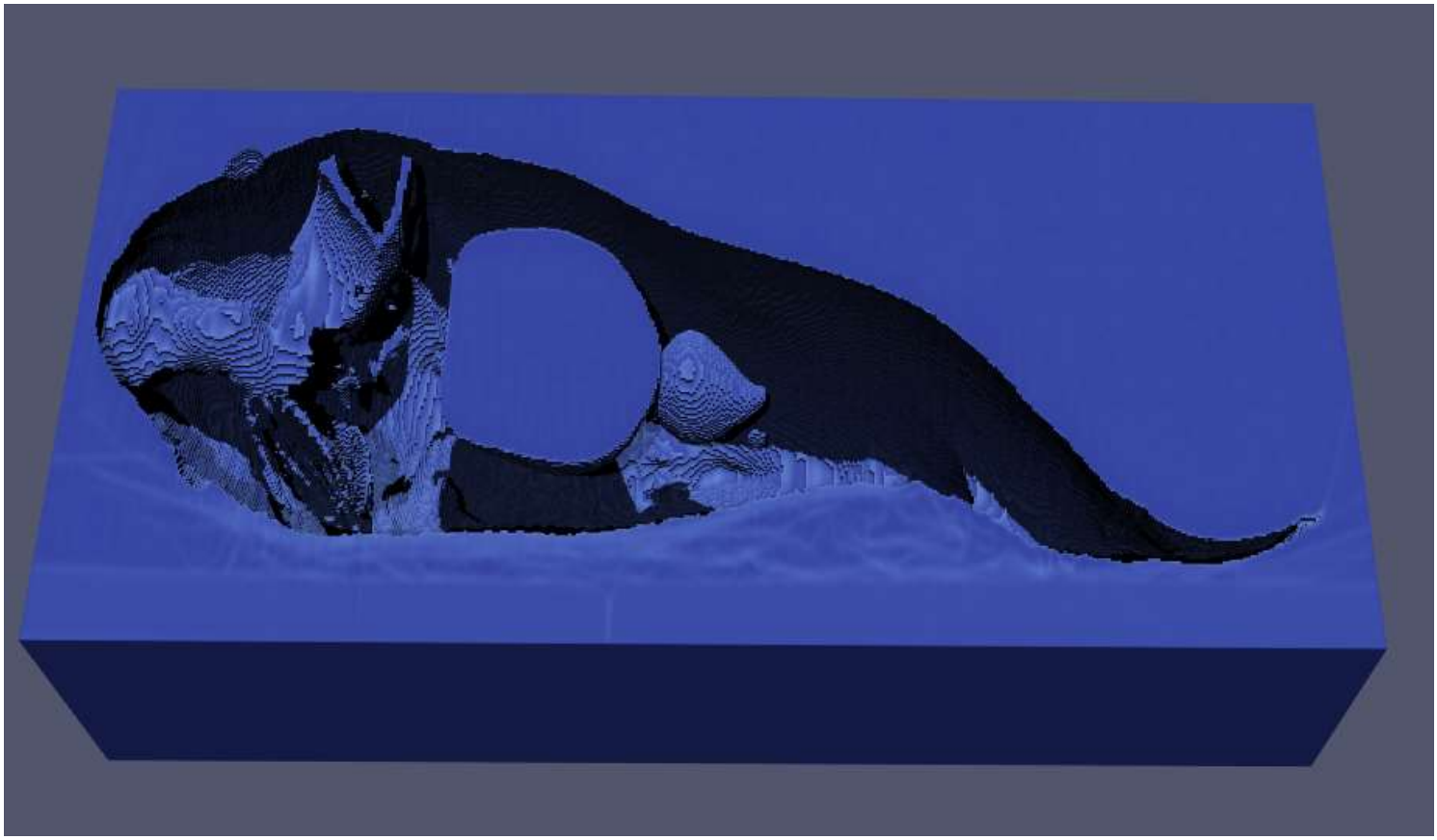




Threshold from 0 to 500

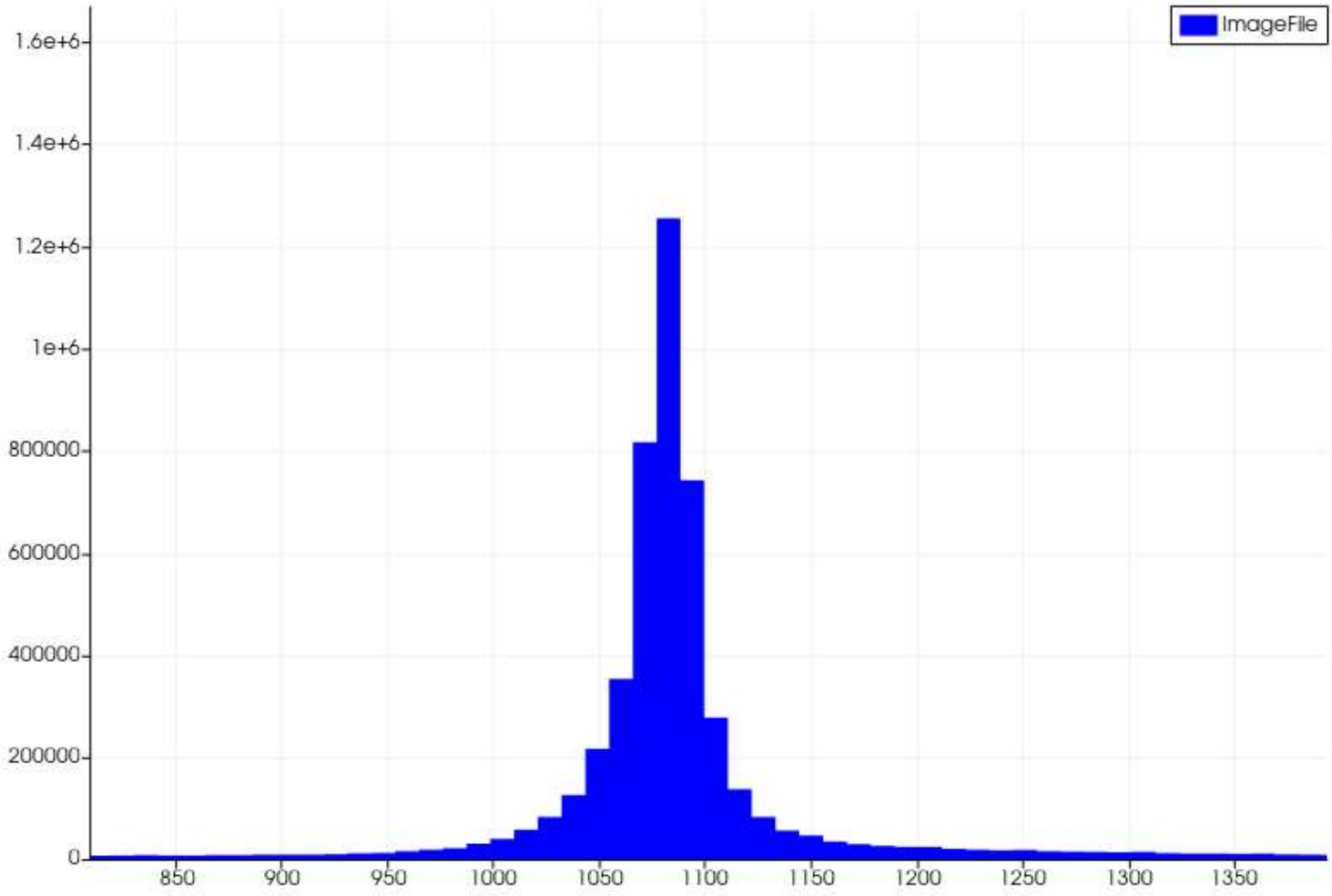
By setting a threshold ranging between **0** and **500**, and then using **clip** and enabling **ray tracing with shadows** we notice that there is a fish volume inside the dataset represented by the inverse of the threshold.

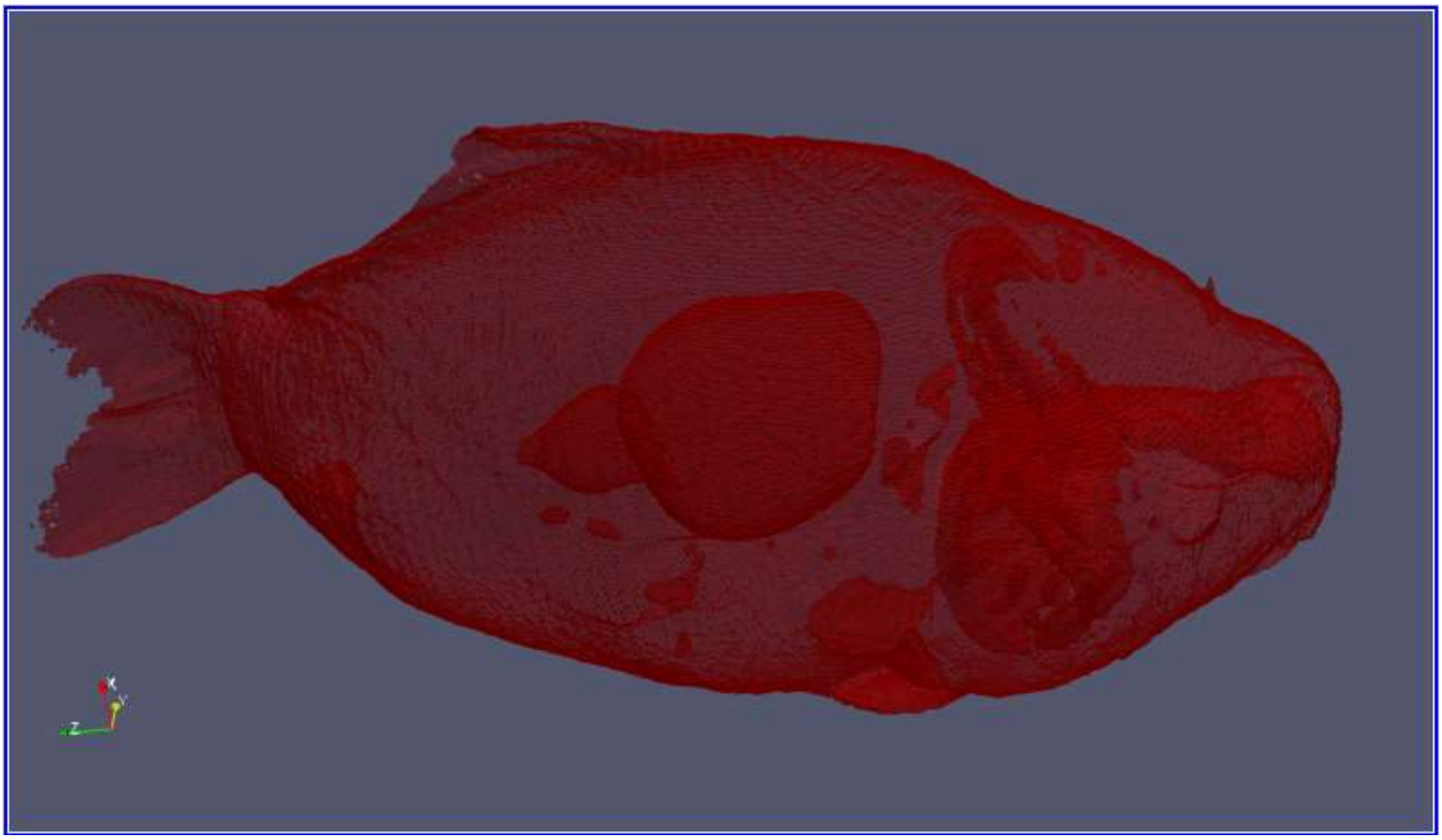

ImageFile
1.6e+6
1.4e+6
1.2e+6
1e+6
800000
600000
400000
200000
0
0
50
100
150
200
250
300
350
400
450
500
550



Threshold from 500 to 2871

Using the invert of the threshold we visualized the fish in the dataset. Setting a **solid color** and the **opacity** to **0.4** we found that inside the fish there are some organs as well. Knowing all the above we produce our final visualization.

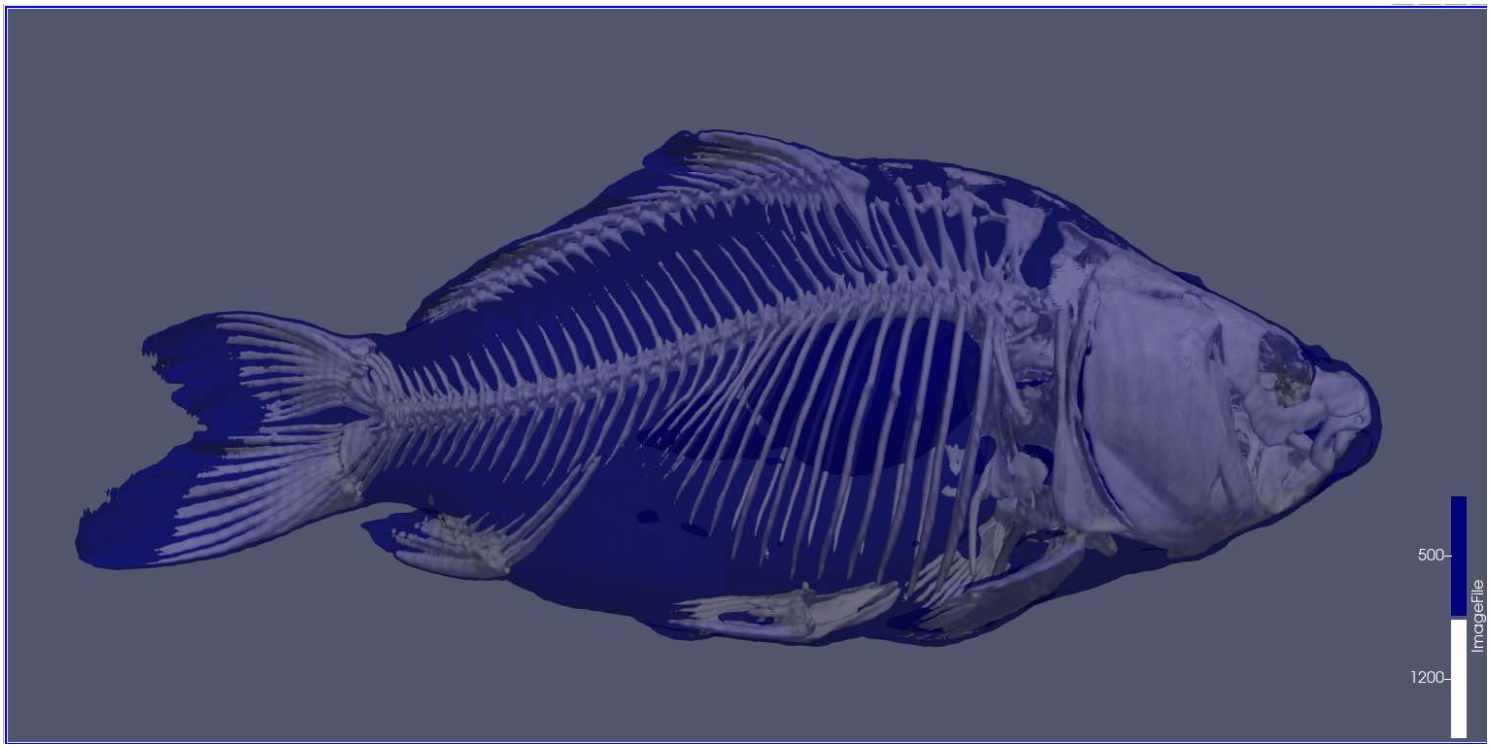




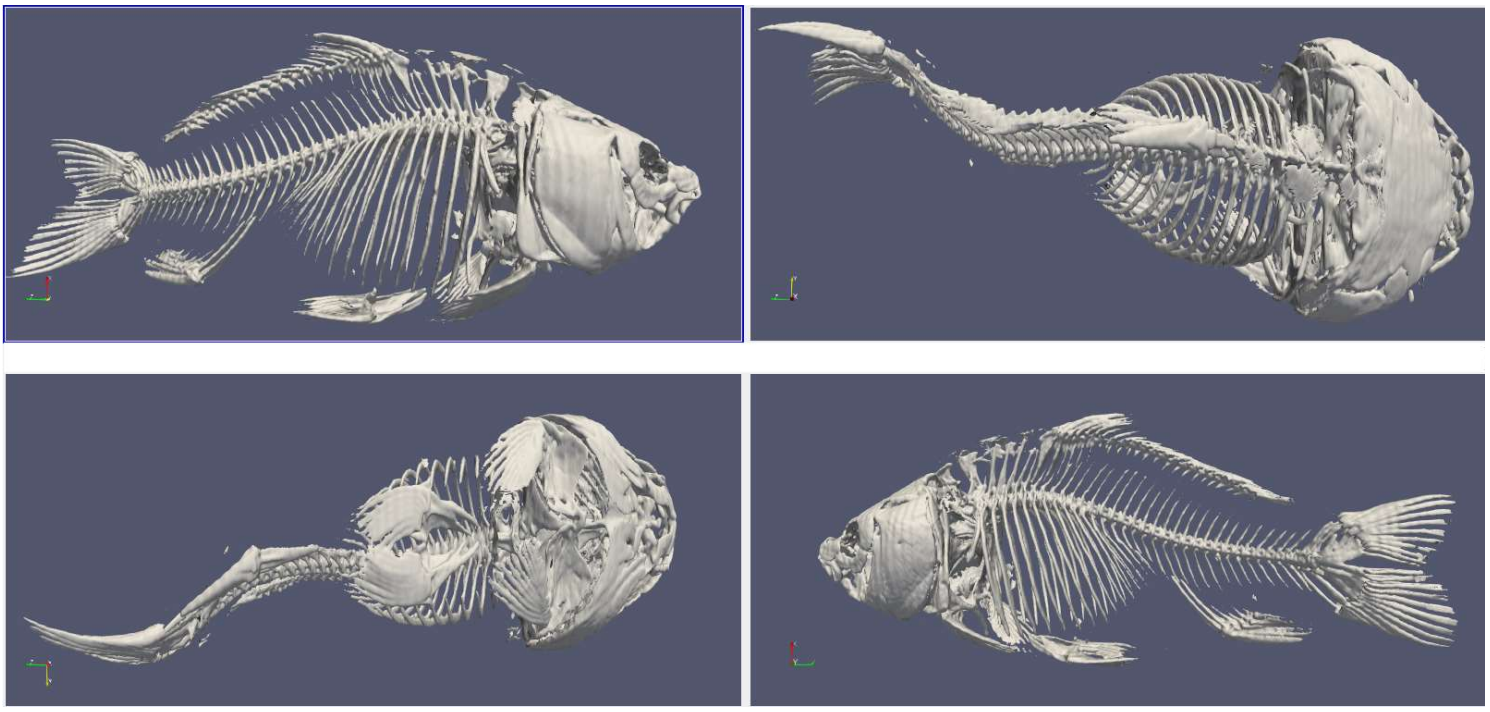
Final Visualization

For the final visualization we aim to show the **anatomy** of the specific fish. Using two distinct isosurfaces we present the bones anatomy and some organs that are visual from our dataset.

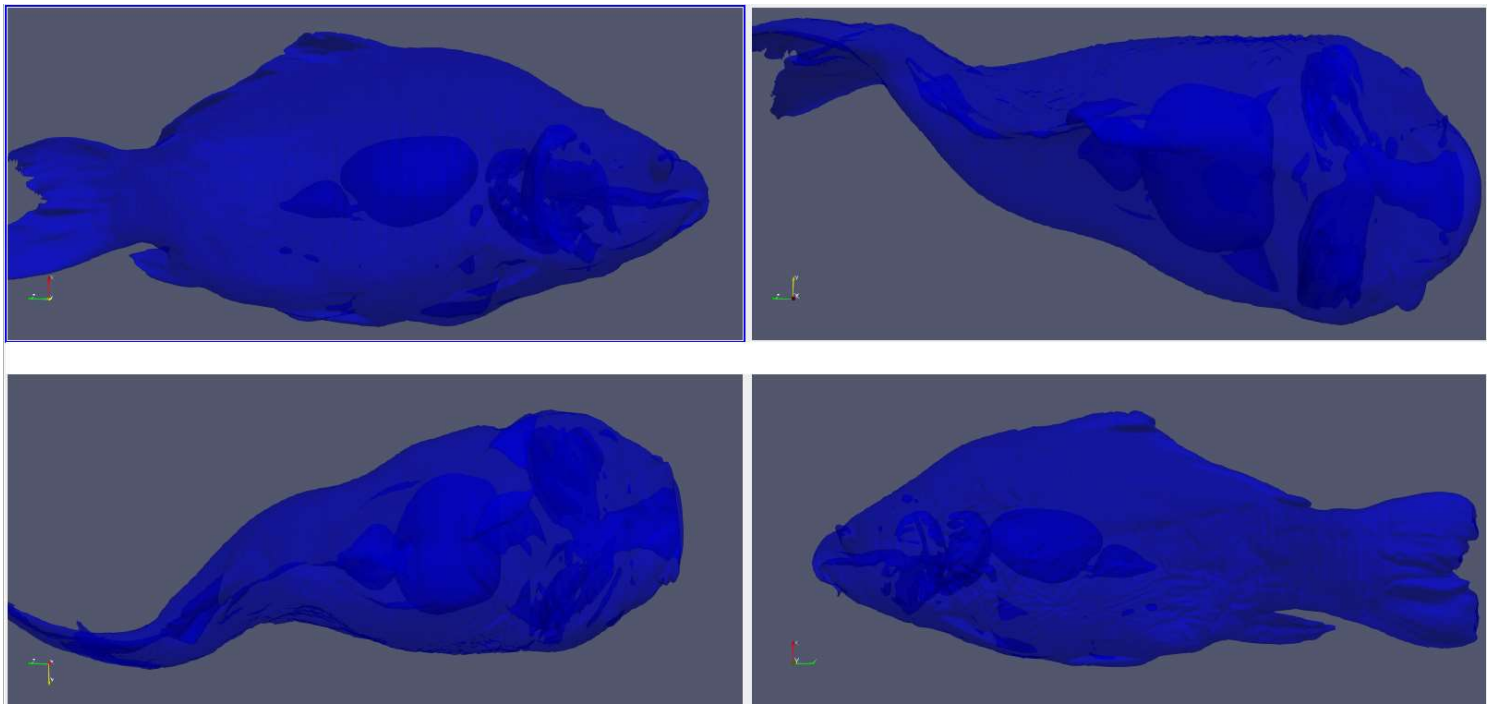
Bones and flesh surfaces



Bone surface



Flesh surface



What are all visual mappings used?

	0-500 Threshold	**500-2871 Threshold**	**Bones and Flesh**	**Bones surface**	**Flesh surface**
threshold	0-500	500-2871	0-2871	0-2871	0-2871
color	**Image File**: Cool to Warm	**Solid Color**: #AA0000	**Surface 1200**: #FFFFFF (*Bones*) **Surface 500**: #0000FF (*Flesh*)	**Solid Color**: #FFFFFF (*Bones*)	**Solid Color**: #0000FF (*Flesh*)
opacity	1	0.4	**Surface 1200**: 0.7 (*Bones*) **Surface 500**: 0.5 (*Flesh*)	1	0.5
representation	surface	surface	surface	surface	surface
shadows	enable	disable	disable	disable	disable

Was there any special data preparation done?

Firstly we visualized the dataset using histogram in order to extract some usefull information. After the understanding of the dataset, for the final visualizations we used **contour filter** with two isosurfaces to

distinguish **bones** and **flesh** at **1200** and **500** respectively. Using a transfer function we coloured bones with solid white color and flesh with solid blue color. The opacity is set to 0.7 for bones and 0.5 to flesh to have a clear insight of our isosurfaces.

What are the limitations of your design?

Despite the fact the with this visualization we can see the anatomy of the bones and some organs, we cannot have a clear insight of these organs and what they might be or how they connect to each other. Also an interactive approach to remove specific bones or organs would lead to better visualization.

What can we learn from the visualization?

This visualization shows the position of several **fins** of the fish and the **swim bladder** (fish organ).

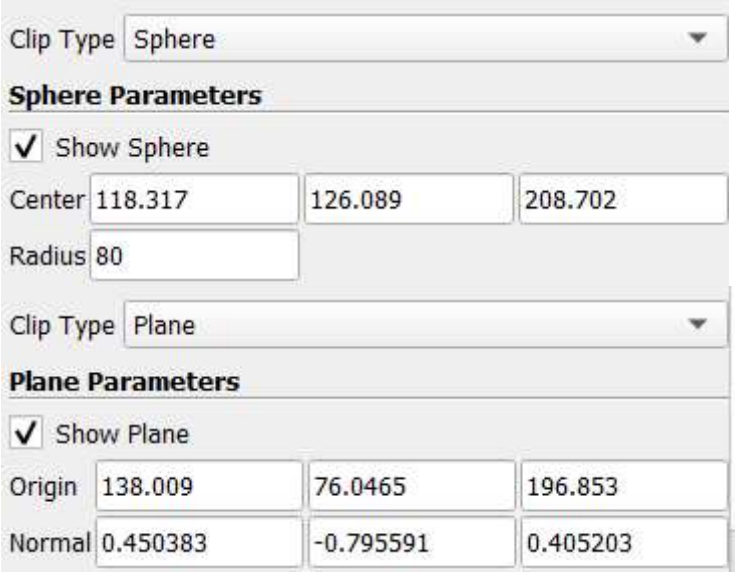
What is the name for the type of visualization(s) used?

For this visualization we used **clips**

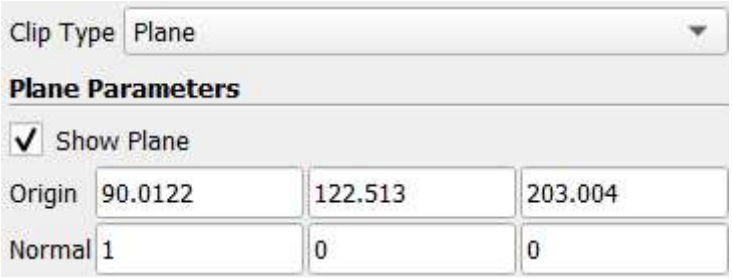
Data Preparation

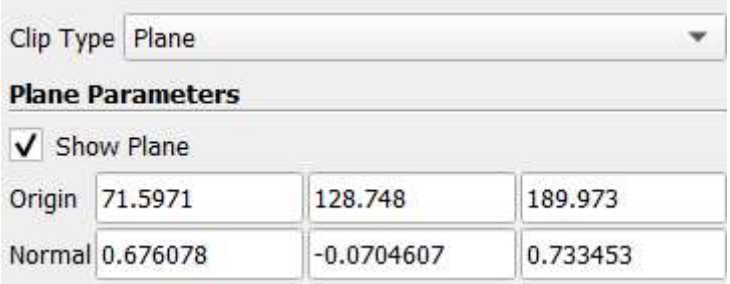
Firstly using the **contour filter** we produced an isosurface using the flesh of the fish (**value 500**). Afterwards with a series of clip filters we extracted the organ of the fish seperatly as shown in the following pictures (order of clips matches the images below).

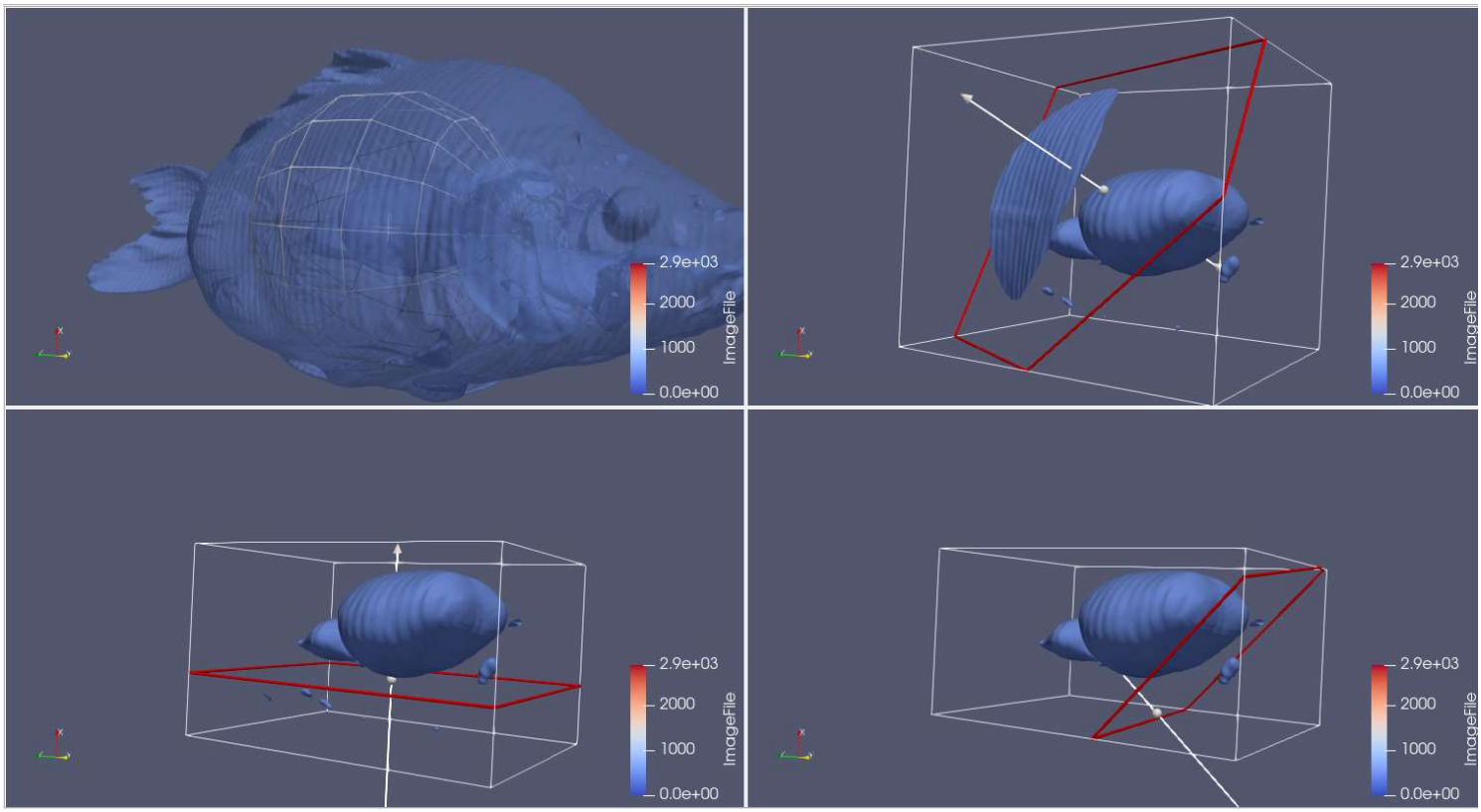
Clip 1 & 2



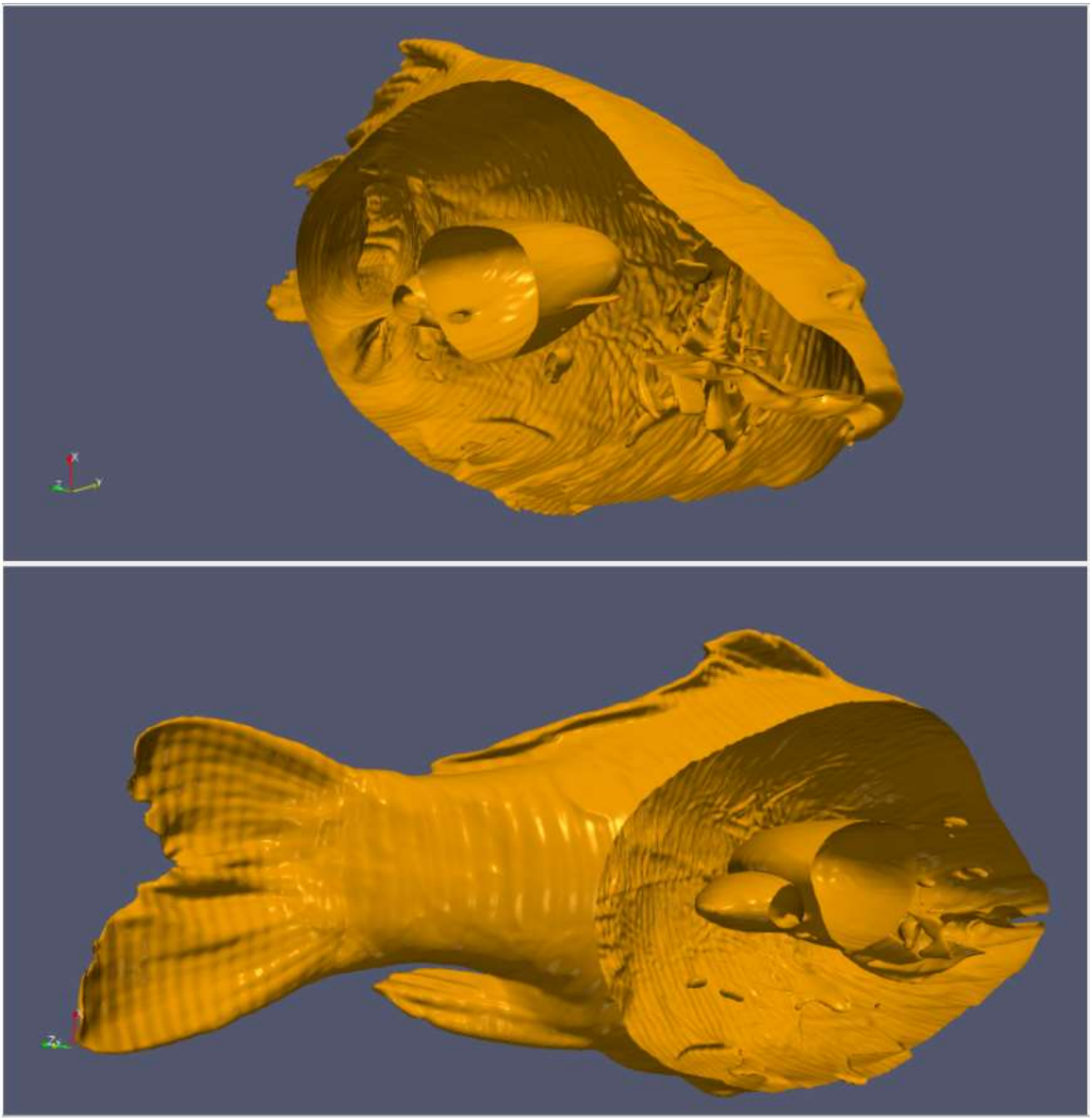
Clip 3 & 4

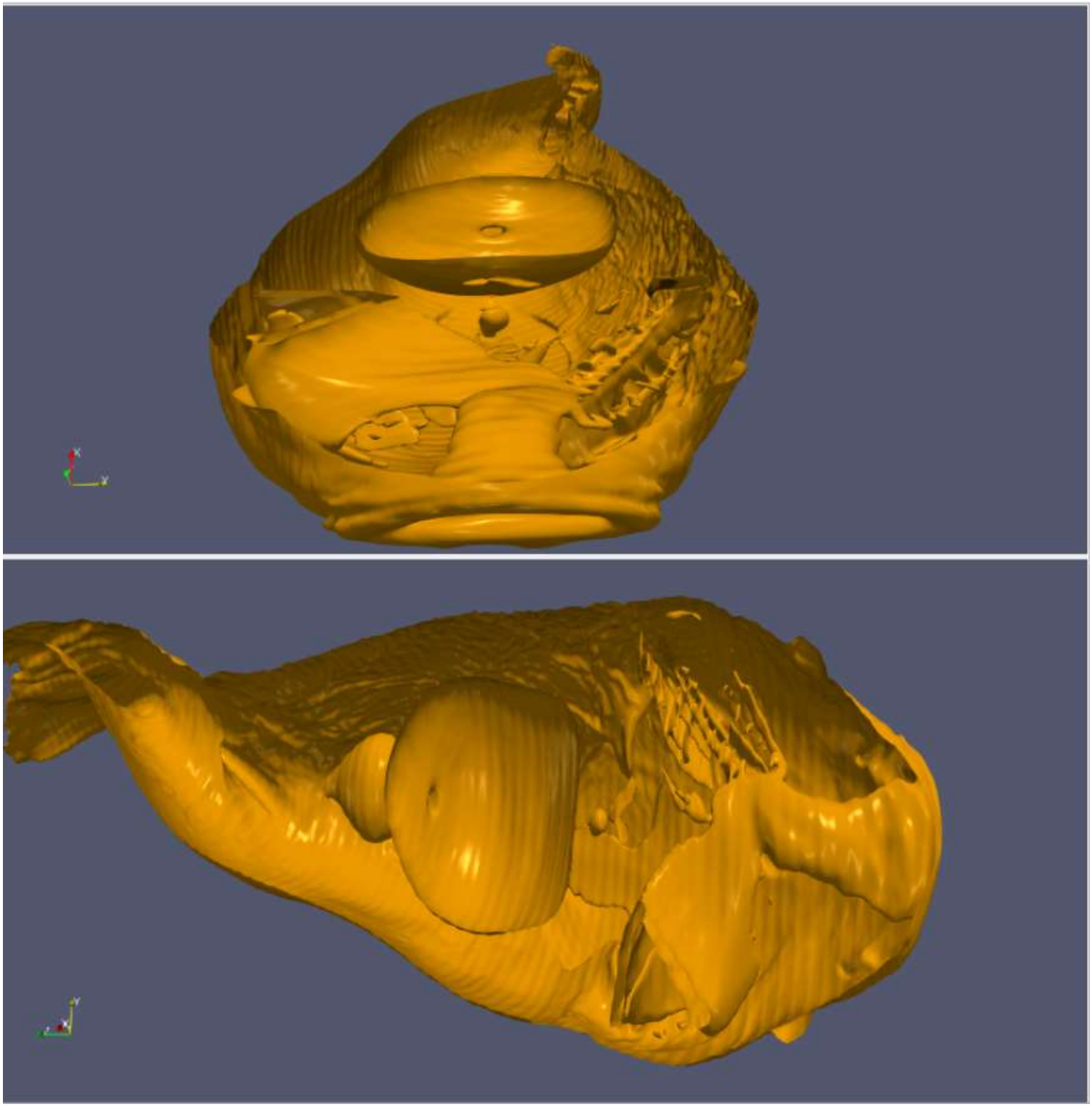


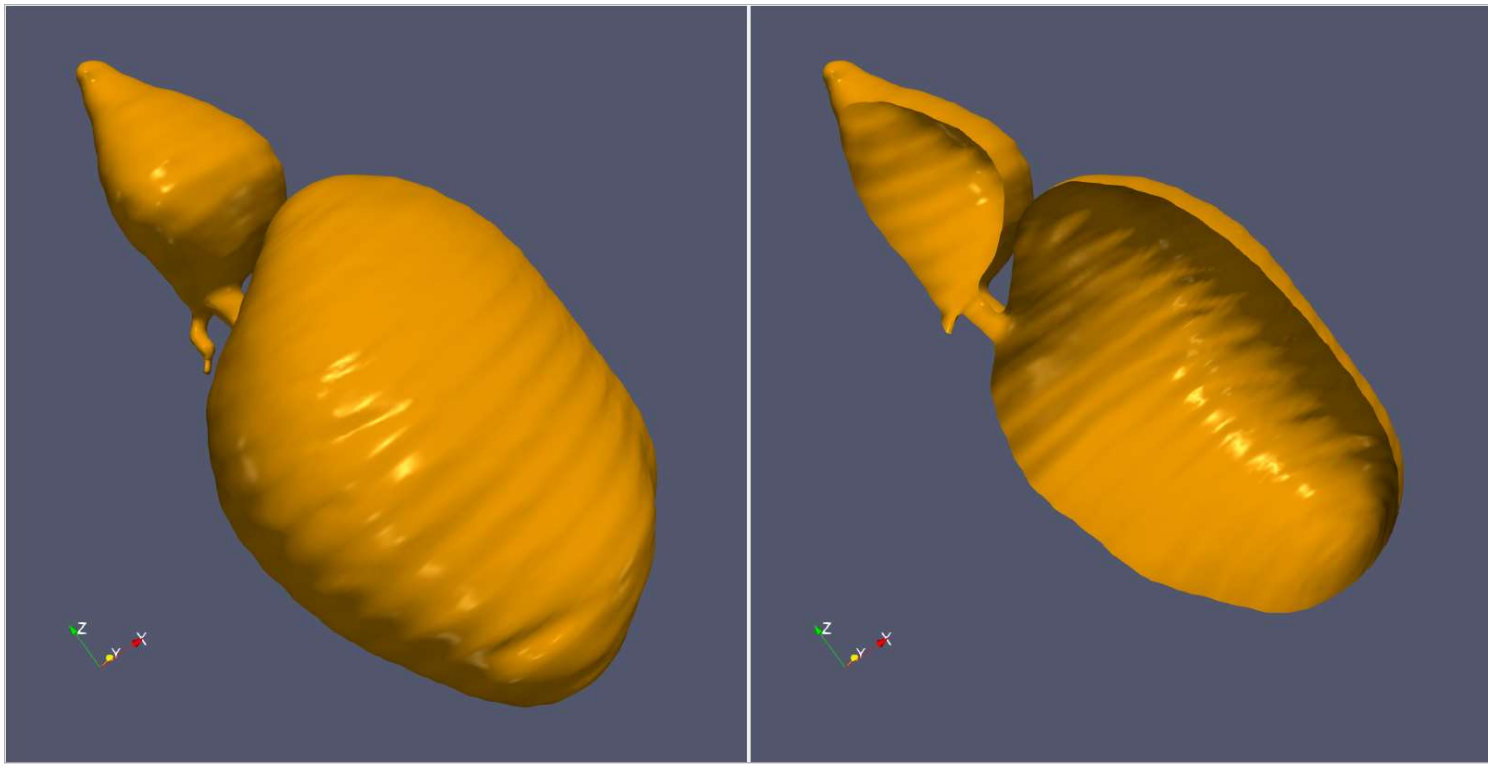




At the end using **clip we cut** the organ in **half** as shown in the following picture. We also noticed a connection between the two mass indicating that this must be the **swim bladder**.



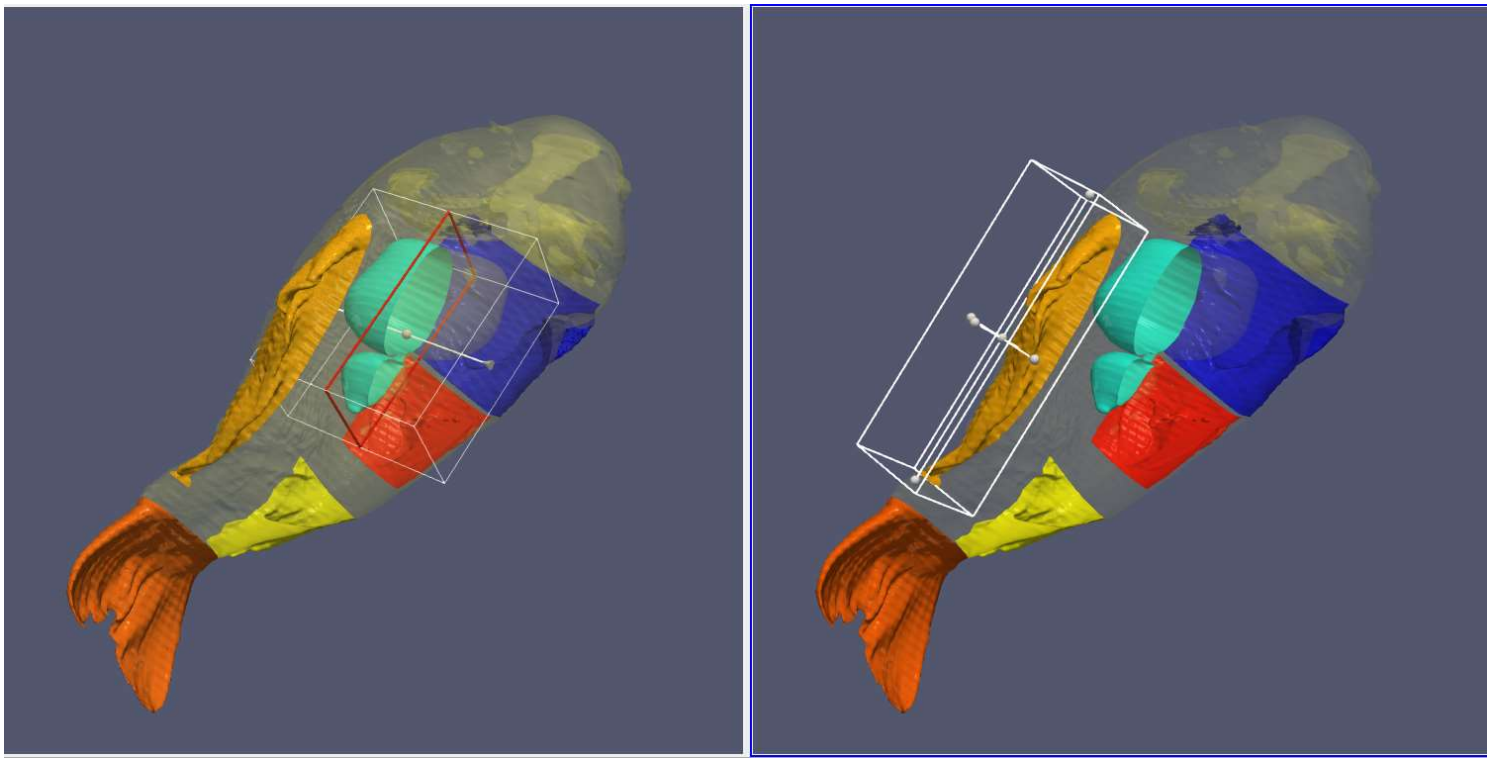




Seperate fin clips

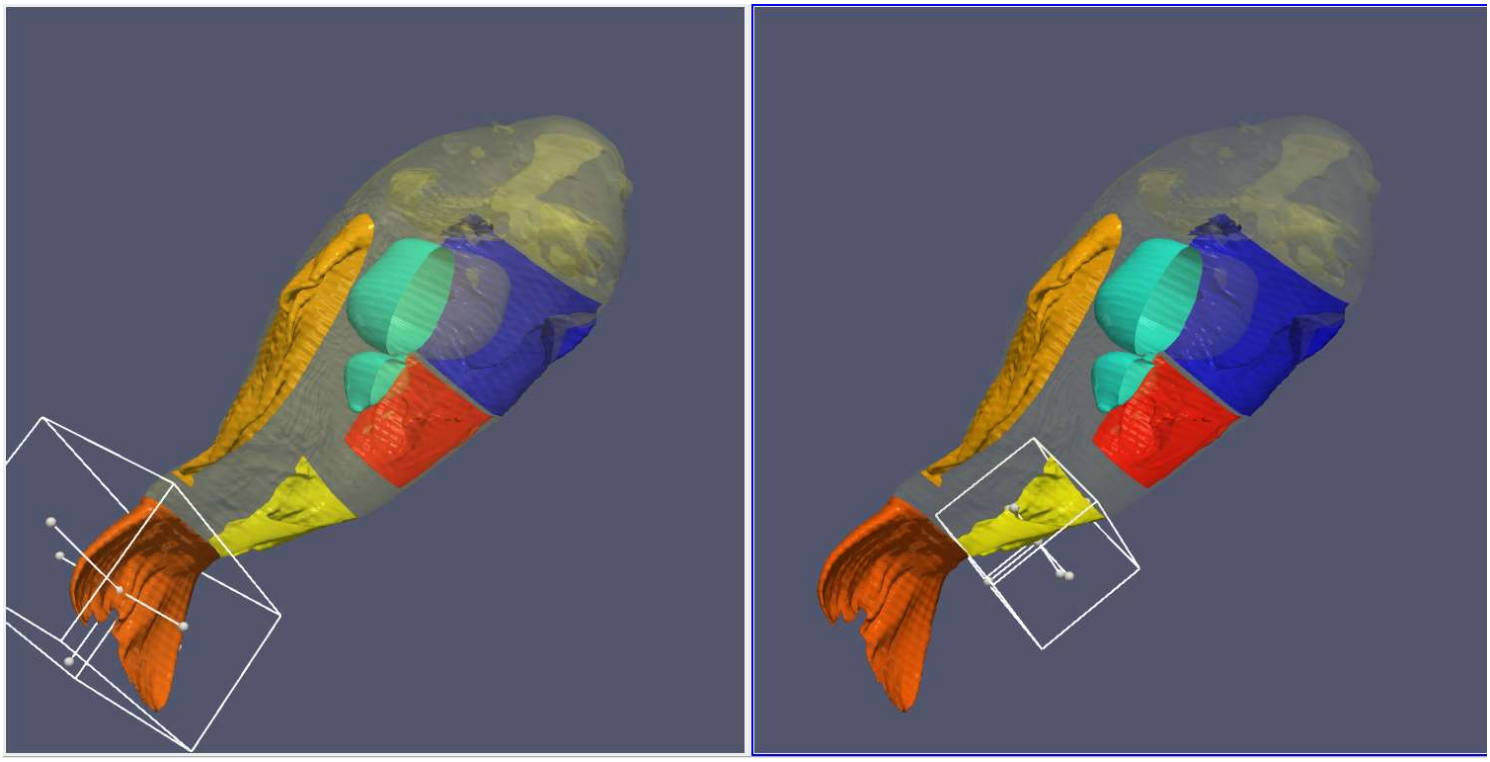
Afterwards we on the contour filter, using several clips we are cutting every fin of the fish in a seperate fin.

Organ and Dorsal fin



Clip Type	Plane		
Plane Parameters			
☑ Show Plane			
Origin	116.514	126.415	211.76
Normal	0	1	0
Clip Type	Box		
Box Parameters			
☑ Show Box			
Position	144.932	208.323	379.459
Rotation	17.3131	78.2679	-81.5058
Length	211.039	39.2833	72.1943

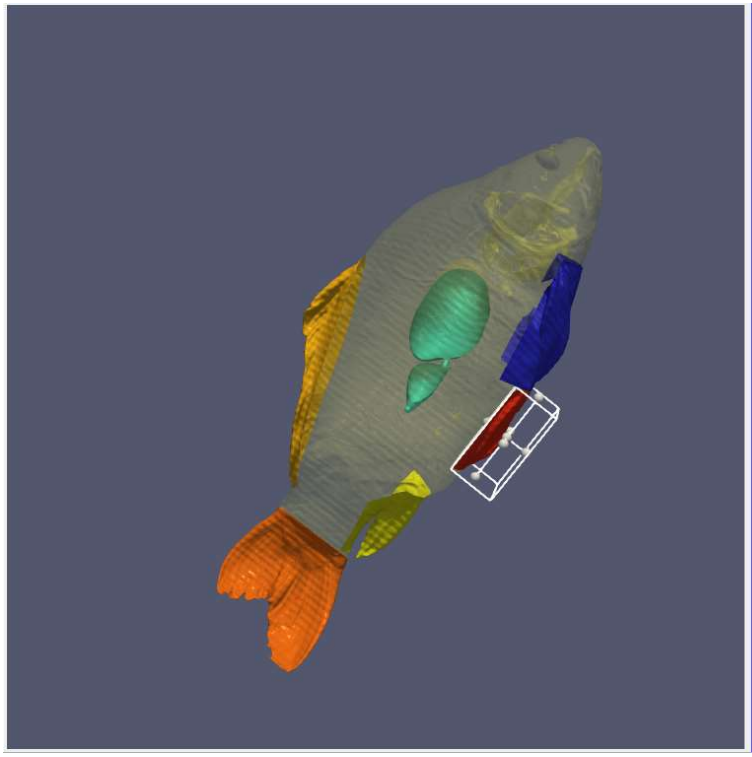
Caudal and Anal fin

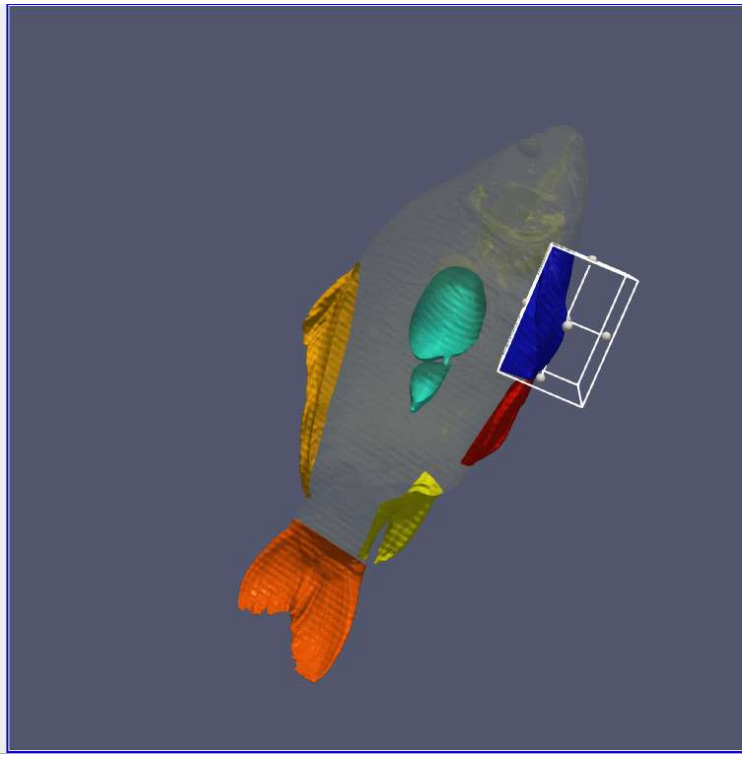


Clip Type	Box		
Box Parameters			
☑ Show Box			
Position	163.137	147.752	403.826
Rotation	0	0	87.3463
Length	78.5385	117.919	112.14

Clip Type	Box		
Box Parameters			
☑ Show Box			
Position	83.4474	112.505	328.926
Rotation	5.62187	18.5168	98.9233
Length	90.4019	37.2503	89.2091

Pelvic and Pectoral fin





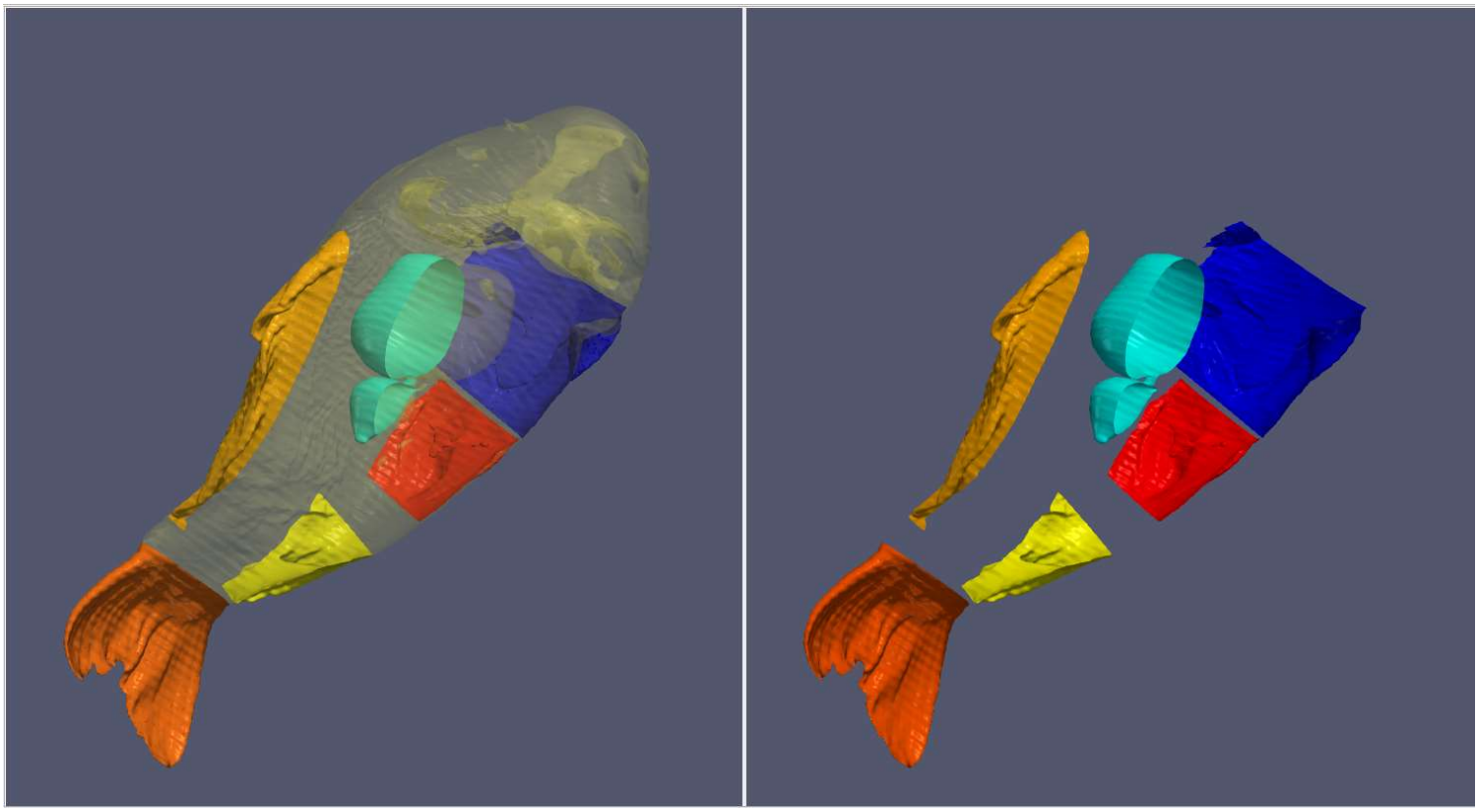
Clip Type	Box		
Box Parameters			
☑ Show Box			
Position	21.7661	164.97	190.749
Rotation	-1.57364	-14.6168	-90.7771
Length	92.3792	23.1645	85.1515

Clip Type	Box		
Box Parameters			
☑ Show Box			
Position	47.501	170.69	72.7238
Rotation	9.38612	-15.8078	-92.6089
Length	153.073	39.8763	106.721

Final Visualization

For the final visualization we aim to show the several **fins** of the specific fish along with the **swim bladder** that was extracted from the dataset. Using all distinct clips in a single visualization we achieved the following.

Fins and swim bladder



What are all visual mappings used?

	Left Visualization	Right Visualization
threshold	0-2871	0-2871
color	**contour filter**: #FFFF7F **clip5**: #00FFFF **clip6**: #FFAA00 **clip7**: #FF5500 **clip8**: #FFFF00 **clip9**: #FF0000 **clip10**: #0000FF	**clip5**: #00FFFF **clip6**: #FFAA00 **clip7**: #FF5500 **clip8**: #FFFF00 **clip9**: #FF0000 **clip10**: #0000FF
opacity	**countour filter**: 0.2 **all clips**: 1	**all clips**: 1

	Left Visualization	Right Visualization
specular	0.5 **for all**	0.5 **for all**
representation	surface **for all**	surface **for all**

Was there any special data preparation done?

Firstly we used the **contour filter** with one isosurface at value 500 to extract the **flesh** of the fish. Afterwards, using a **series of consecutive clips** on one another we extracted the **swim bladder**, the only visible organ of the fish. Next, on the initial contour filter using clip filter (mostly `box` type) we extracted all visible and known fins of the fish.

What are the limitations of your design?

Due to the lack of interactivity on the components of the fish, this visualization cannot stand alone in order to provide infomration about the name of each individual fin. Also the length of each of this fins is not visible. Hence we cannot identify the actual scale of this fish.