Multicore World 2025
Sparsification

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umajin

2025 Roadmap

	Q1	Q2	Q3	Q4

Server / Cloud

kubernetes

Server V2 GUI

Airflow

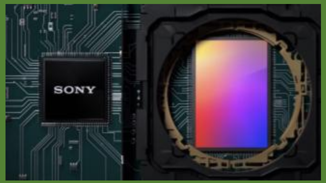
Cloud Next (V6)

Engine

Android XR

Meta Horizon OS

OpenXR



Native Camera

SPIR-V

PyTorch>SPIRV

KTX

JpegXL HDR + KTX

Editor/Runtime

XR editor

Umajin Next (V6)

Performance

Runtimes

> Java
> Python + QT
> .NET + MAUI *(Multi-platform App UI)*

Umajin

> Better memory usage & safety
> Improved compute (LLVM JIT & LLVM Compiled)
> Modern capability framework;
(rich media, 3D, VR, AR, geospatial, cloud first API's, AI, image processing, agents and more)

Browser + App frameworks

> Chrome
> Electron
> Flutter / ReactNative / Ionic

Umajin

> An order of magnitude lower memory usage
> Better graphical rendering & GPU usage
> Better CPU performance
> Better development & debugging

3D engines

> Unity
> Godot
> Unreal

Umajin

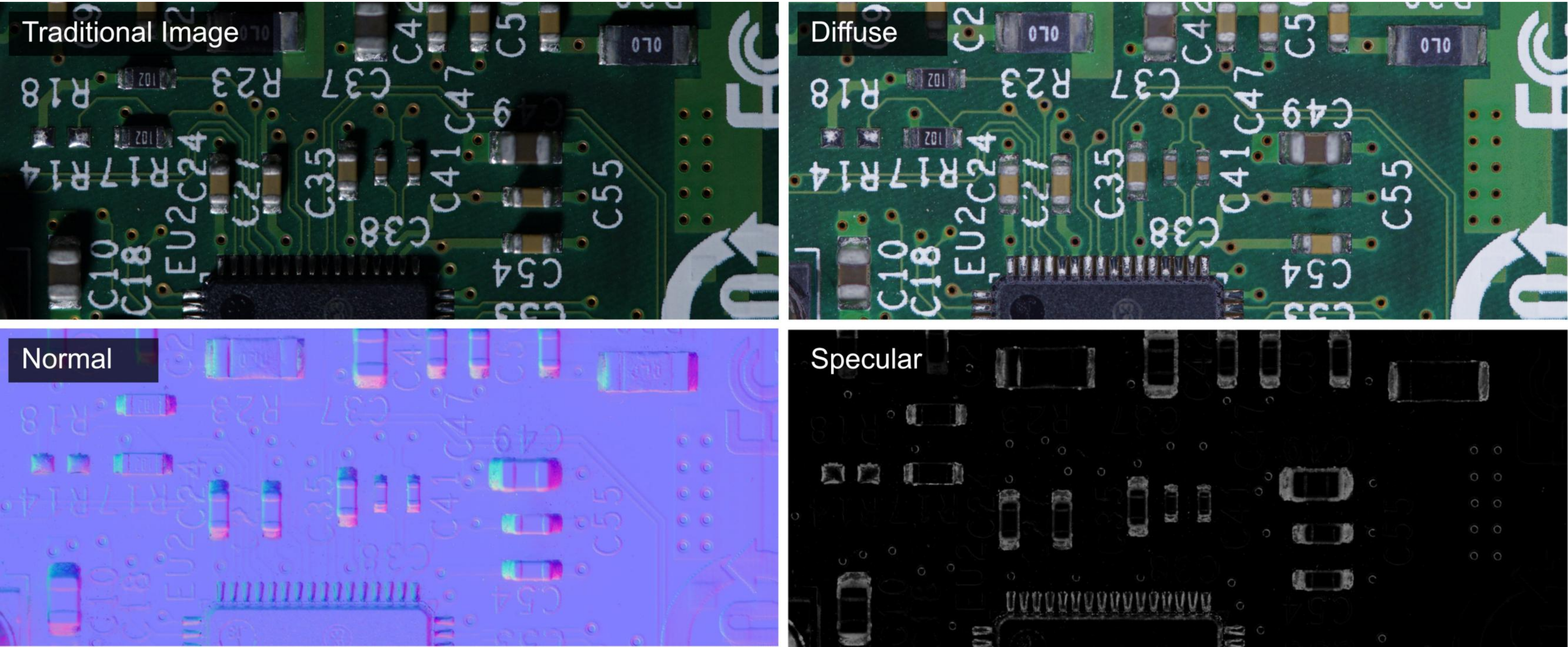
> For enterprise not game development
> Optimised for enterprise devices
> Long battery life, low power usage
> Significantly faster development & debugging

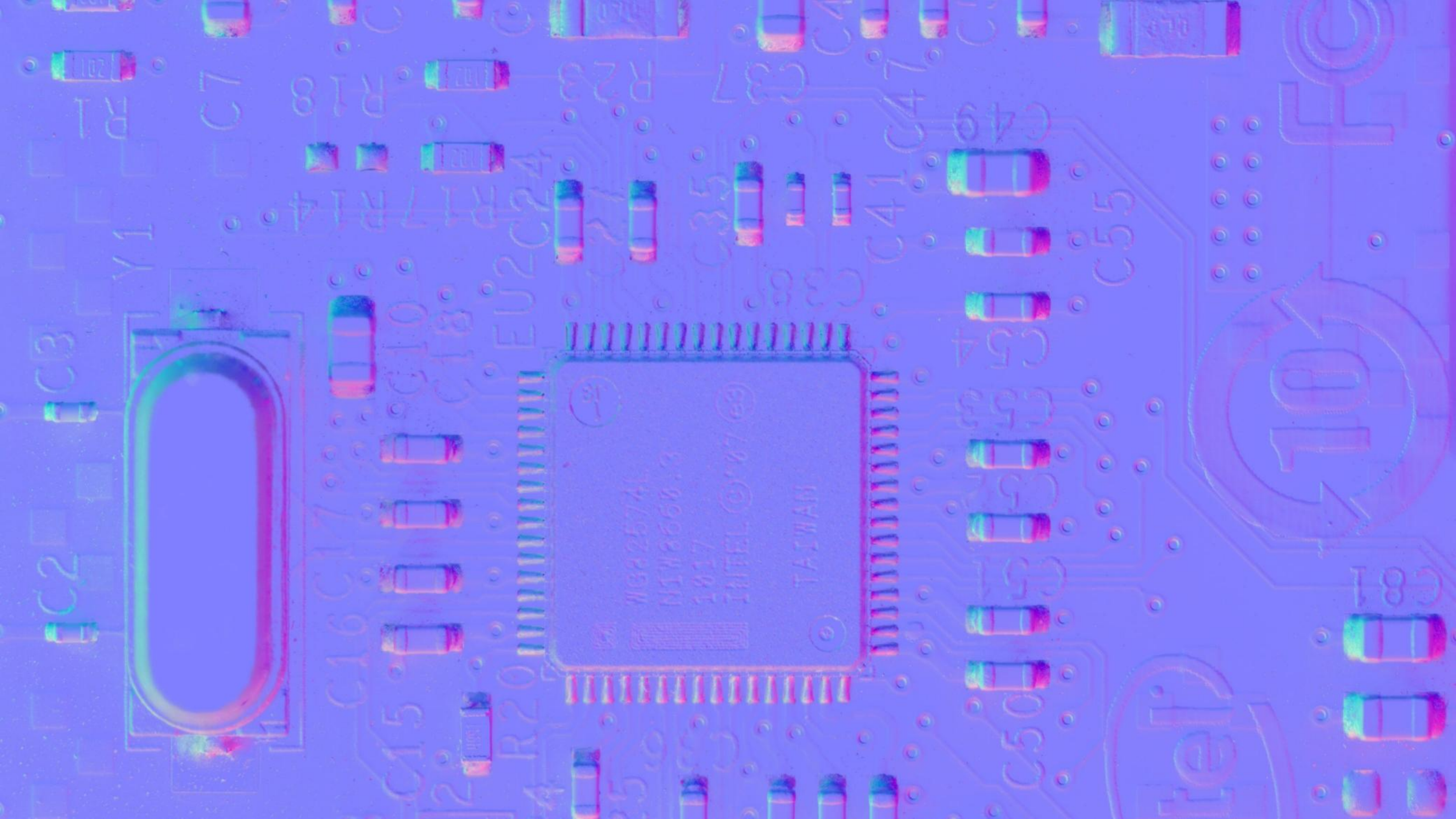
Context for Sparsification

- 3D data
- Time series data
- Generated simulation or AI extrapolated metadata

>>> Exponential data growth

Generated Data





Sparsification

- Orin Nano Super
  - I showed the Orin Nano last year
  - This year same hardware has been rebranded as “super”
  - Where has Moore's law gone for GPU’s?

- 3D time series data reduction
  - Reduce node count
  - 10,000x – 1,000,000x reduction over voxels
  - Pre computed connectivity
  - Allows for much faster simulation and analysis
  - We don’t want quantisation or compression

Sparsification

Voxel

For a **16384 x 16384 x 16384 voxel grid**, assuming 4 floats per voxel

Storage = $\mathbf{16384^3 \times 4}$ **floats**

≈ **17 x 10 ^ 12 floats**

(70 TB assuming a 32bit float)

Sparse Scaleable Point Cloud

Size depends on complexity, but assuming biological samples

1 billion volumetric scaleable points

Storage = **1b × ~13 floats ≈ 13 billion floats**

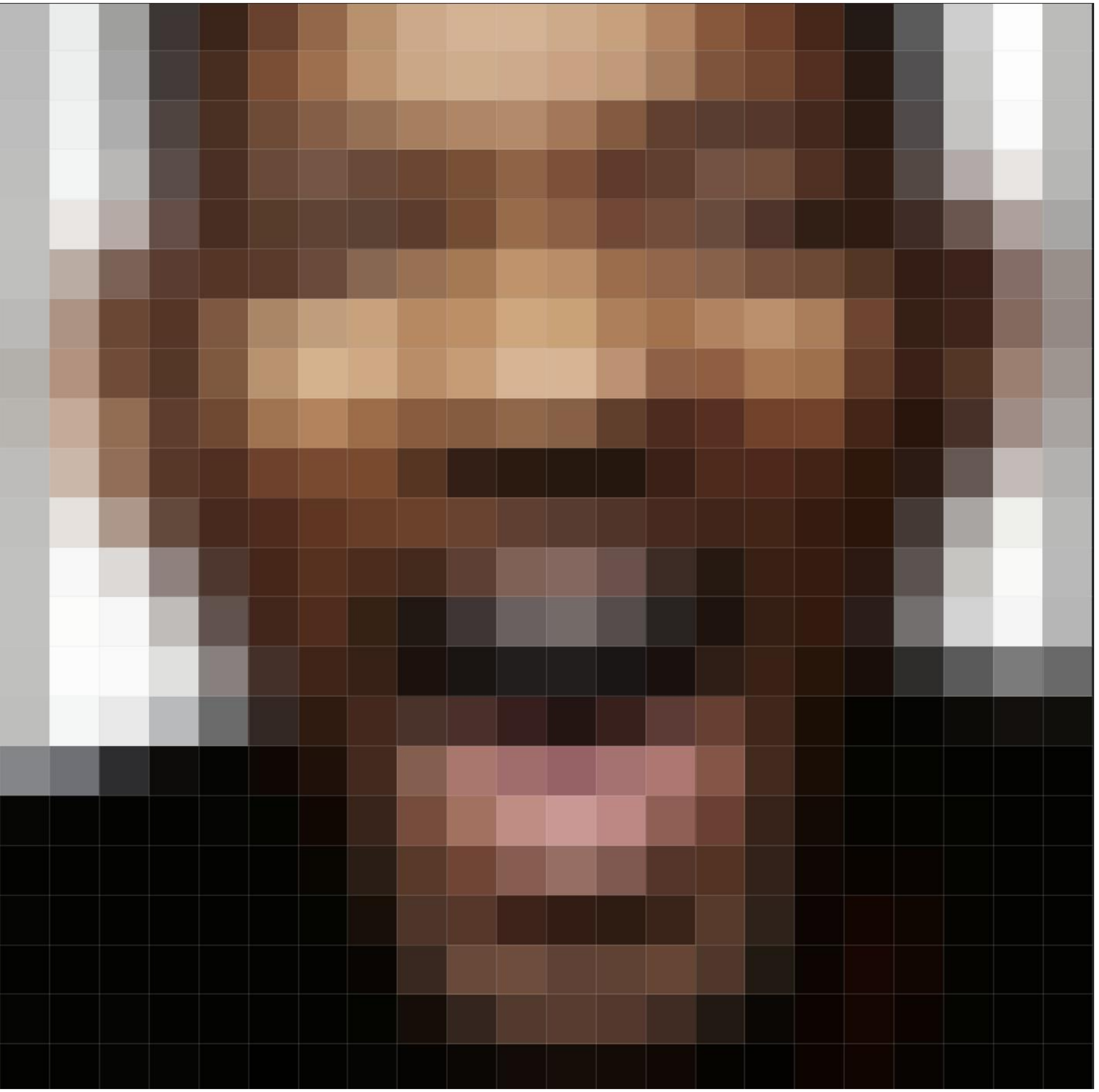
(52 GB assuming a 32bit float)

1 million volumetric scaleable points

Storage = **1M × ~13 floats ≈ 13 million floats**

(52 MB assuming a 32bit float)

2D Intuition



22x22 pixels

500 Gaussians

Sparse Fuzzy Oriented and Scaled Blobs

- 3DGS -Three dimensional Gaussian Splatting
- Rendering is a type of ray-casting
- Generating blobs involves optimising to match the sample images from an estimated camera position


File Processing Reconstruction Render Extras Help
Model 2
Log
Clear
Fusing image [254/273]
in 1.545s (5451723 poi
Fusing image [255/273]
in 1.592s (5451723 poi
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Fusing image [273/273]
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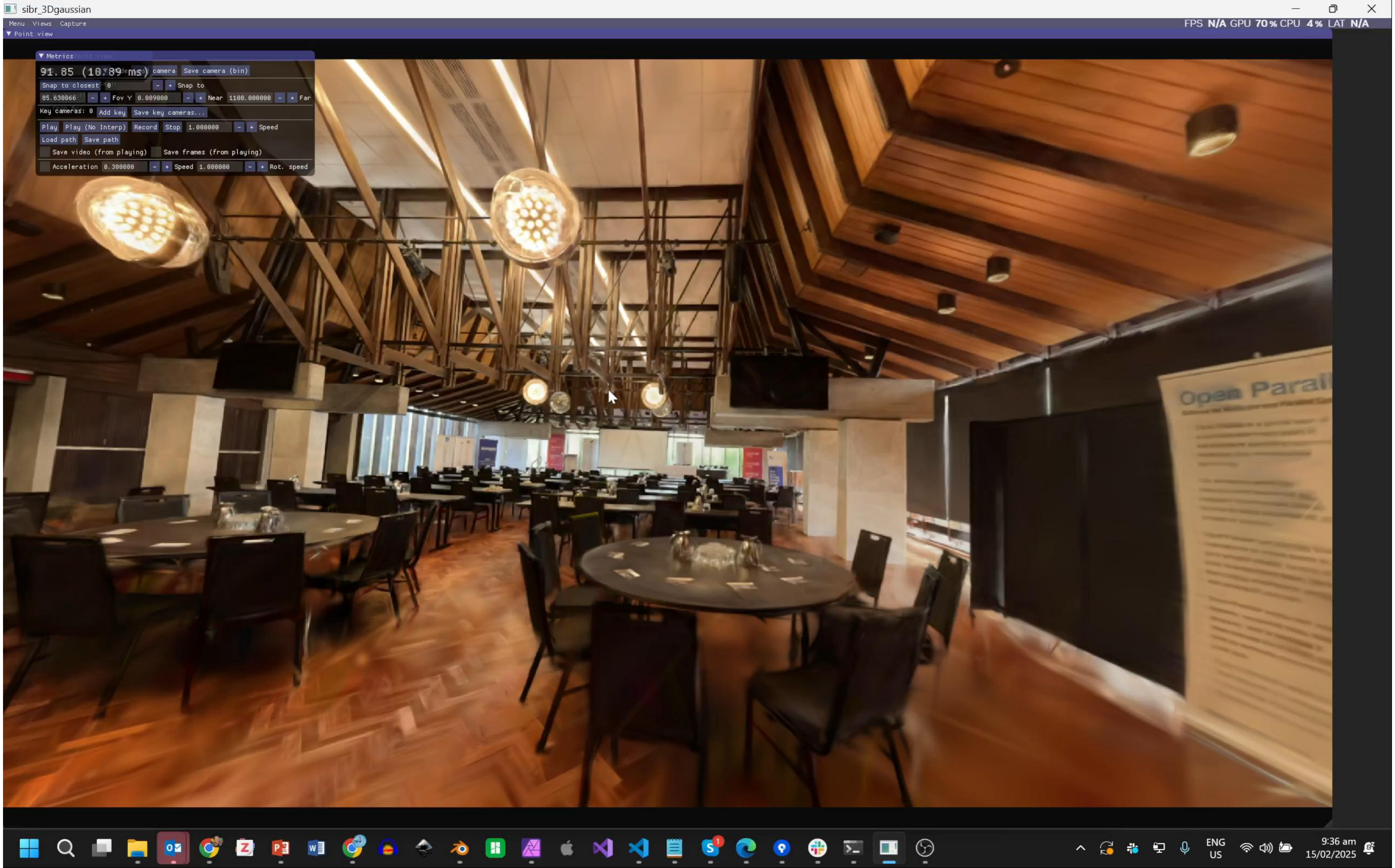
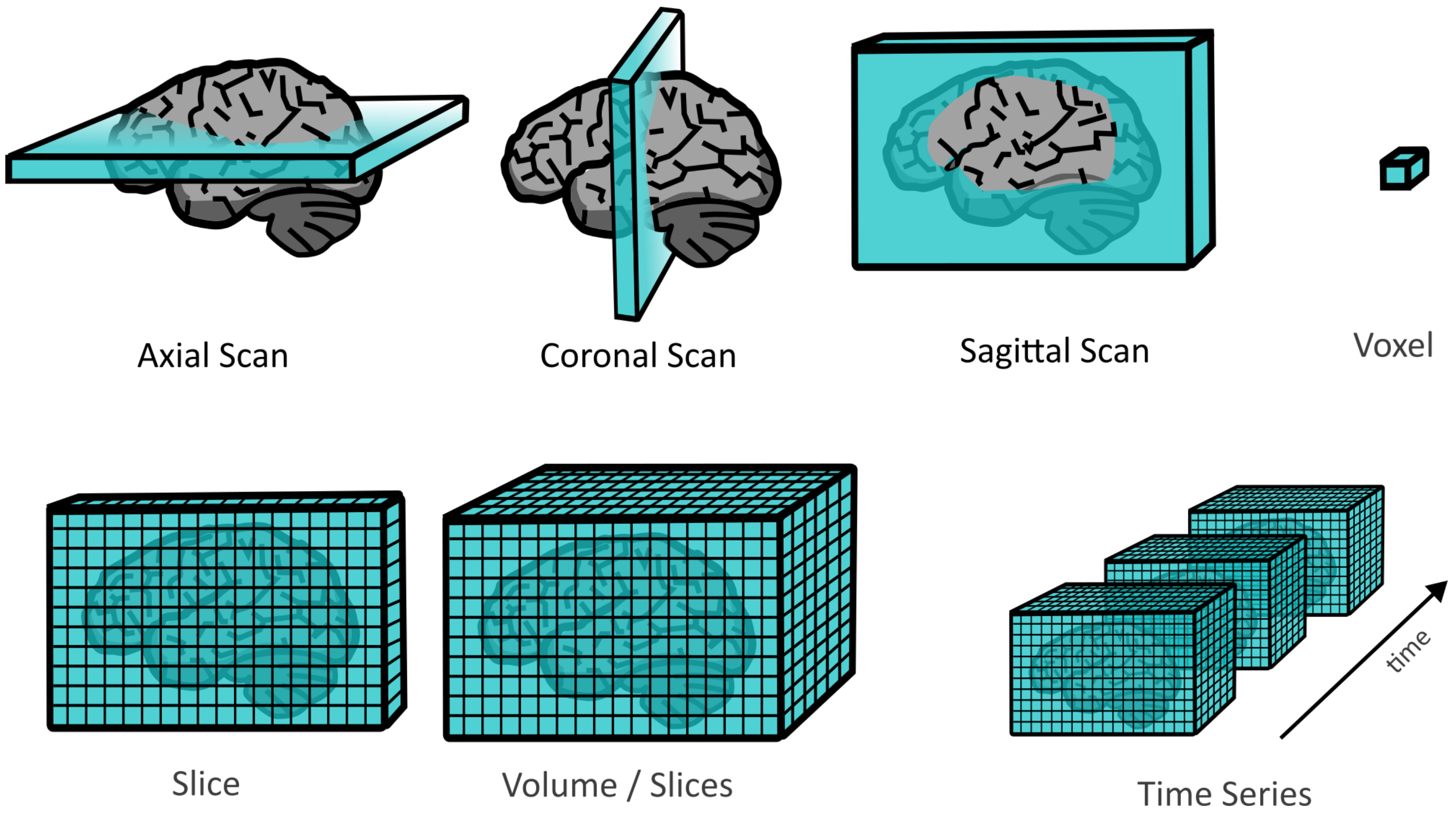
Number of fused points:
Elapsed time: 10.728 [m
Writing output: C:/User
Time 00:00:00:00
0 Images - 5500155 Points


sibr_3Dgaussian
Menu Views Capture
FPS N/A GPU 70% CPU 4% LAT N/A
Point view
Metrics
91.85 (10.89 ms)
camera Save camera (bin)
Snap to closest 0 - + Snap to
85.630066 - + Fov Y 0.009000 - + Near 1100.000000 - + Far
Key cameras: 0 Add key Save key cameras...
Play Play (No Interp) Record Stop 1.000000 - + Speed
Load path Save path
Save video (from playing) Save frames (from playing)
Acceleration 0.300000 - + Speed 1.000000 - + Rot. speed
ENG
US
9:36 am
15/02/2025

Sparse Fuzzy Oriented and Scaled Blobs

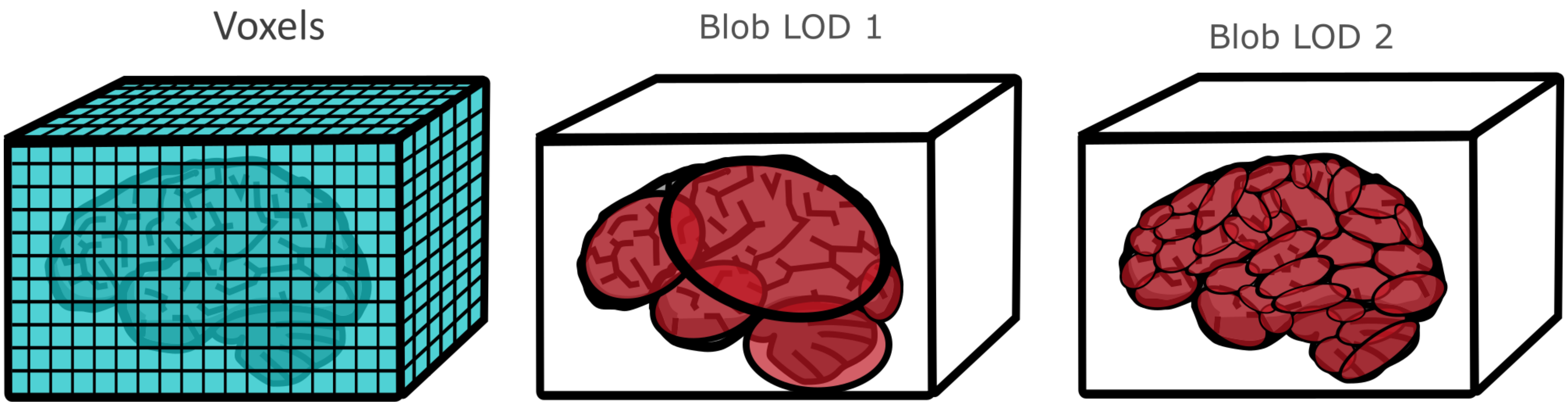
- Known ‘camera position’
- Volumes not surfaces
- Voxel Homogeneity
- Voxel Variation Frequency



Conceptual MRI Data

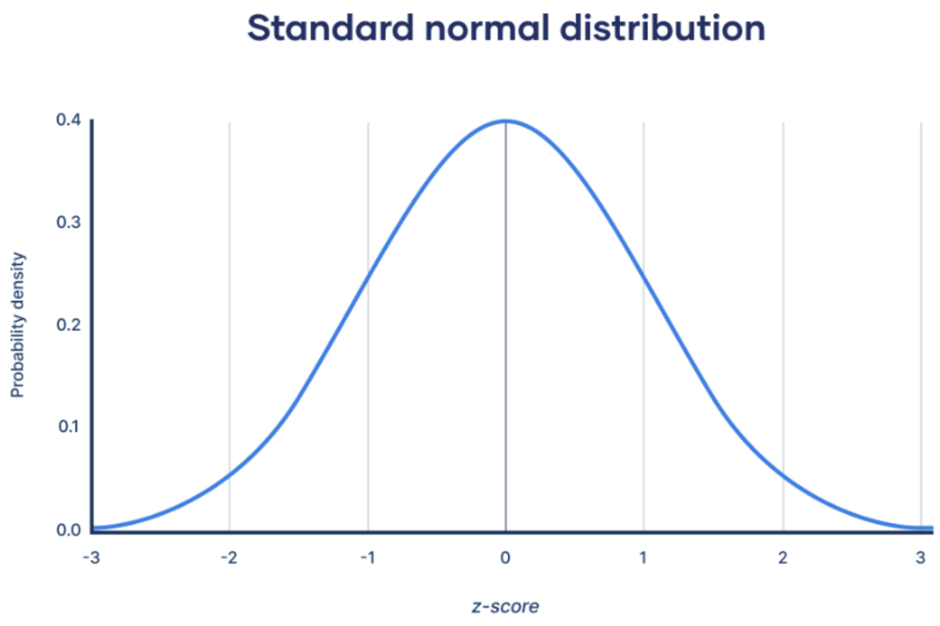
Sparse Fuzzy Oriented and Scaled Blobs

- Voxels converted into sparse, fuzzy, oriented and scaled blobs that represent the voxel values in 3D shape not just surface
- Different levels of detail of fidelity are able to be precomputed

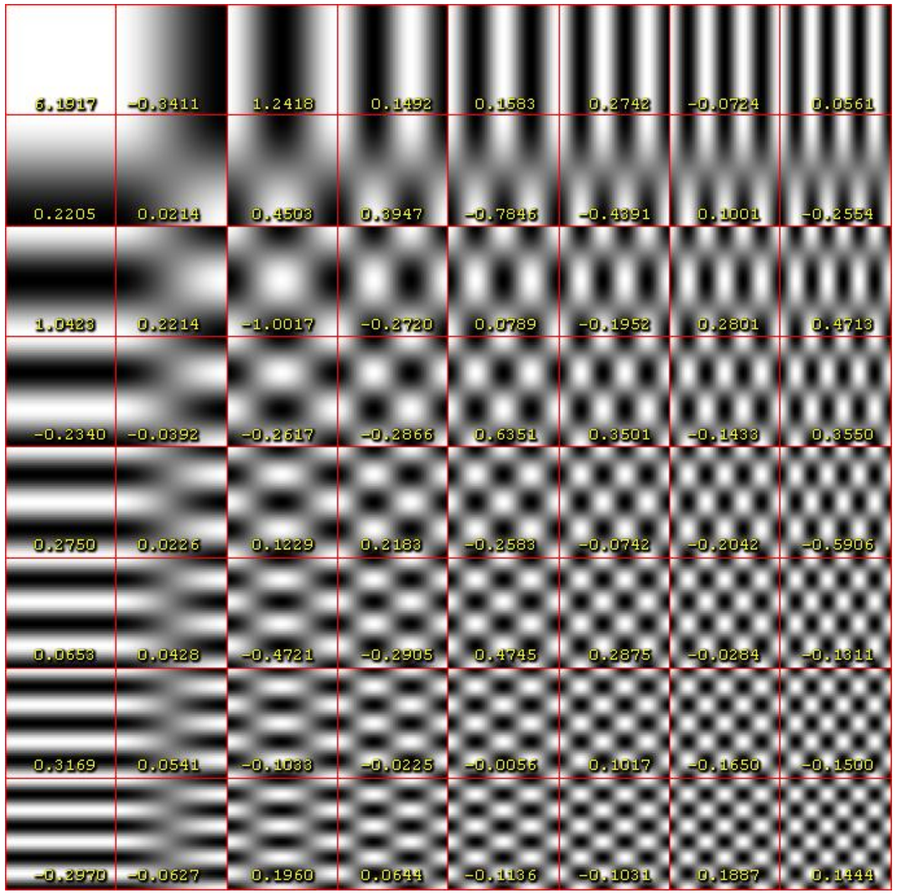


Adding more complexity to blobs

- DCT is the basis for JPG and VarDCT for JpegXL – we have added DCT rather than just a ‘normal’ Gaussian

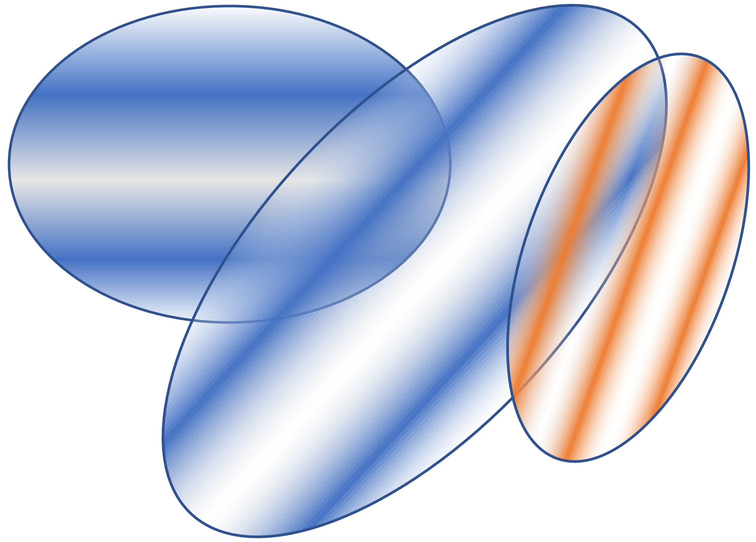


Discrete Cosine Transform



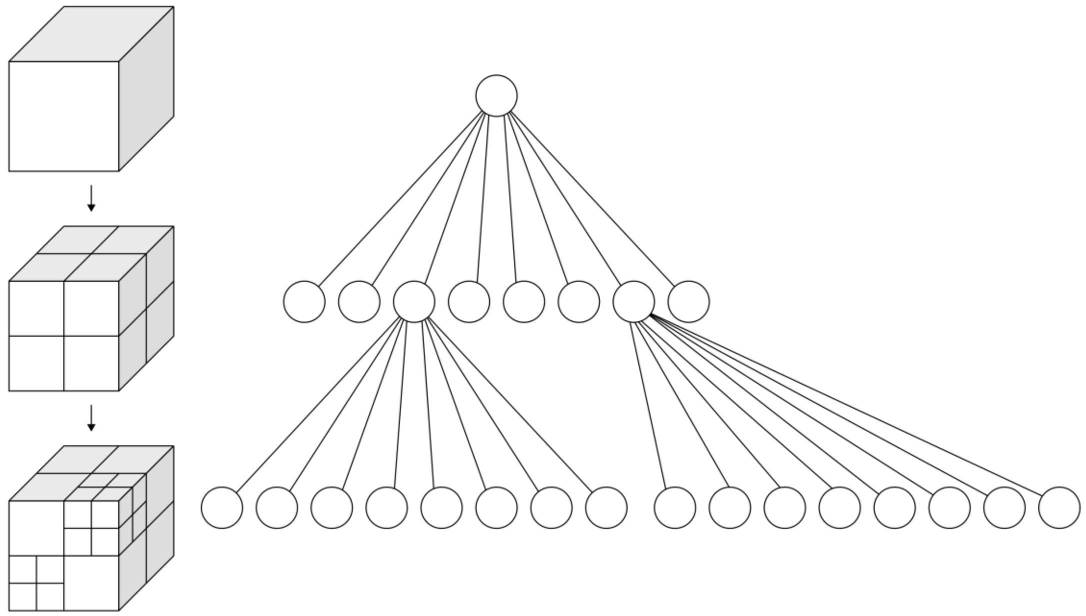
Adding more complexity to blobs

- Great compression – but requires convolving the blobs together for the final result so this is less useful for simulation where you would like your nodes to be independent



Managing variable complexity with spatial partitioning

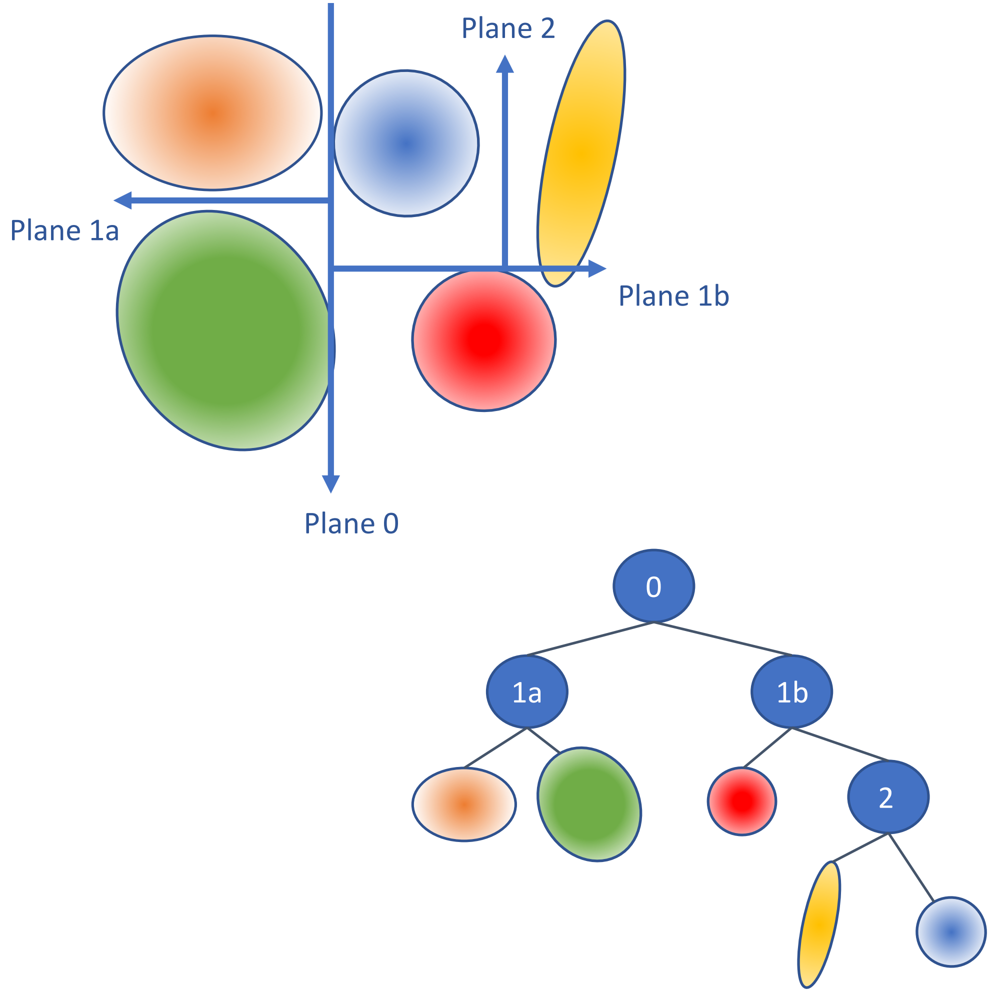
- OctTree allows for variable resolution and storing multiple levels of detail
- Deltas calculated per cube in the octree – allows for time series data to be variably spatially run length encoded for unchanging regions
- Spatial partitioning allows for parts of the data set to be processed in parallel



Simulation & processing using trees

- KD Trees for homogenous nodes
- KD Trees for connected nodes

- Replace per voxel style marching algorithms with significantly faster approaches using 10,000x 1,000,000x fewer nodes with precomputed connectivity
- Connectivity of different classifications (bone, tissue, material properties)
- Connectivity of variable density



Volume not surface optimisation

R^2-Gaussian: Rectifying Radiative Gaussian Splatting for Tomographic Reconstruction

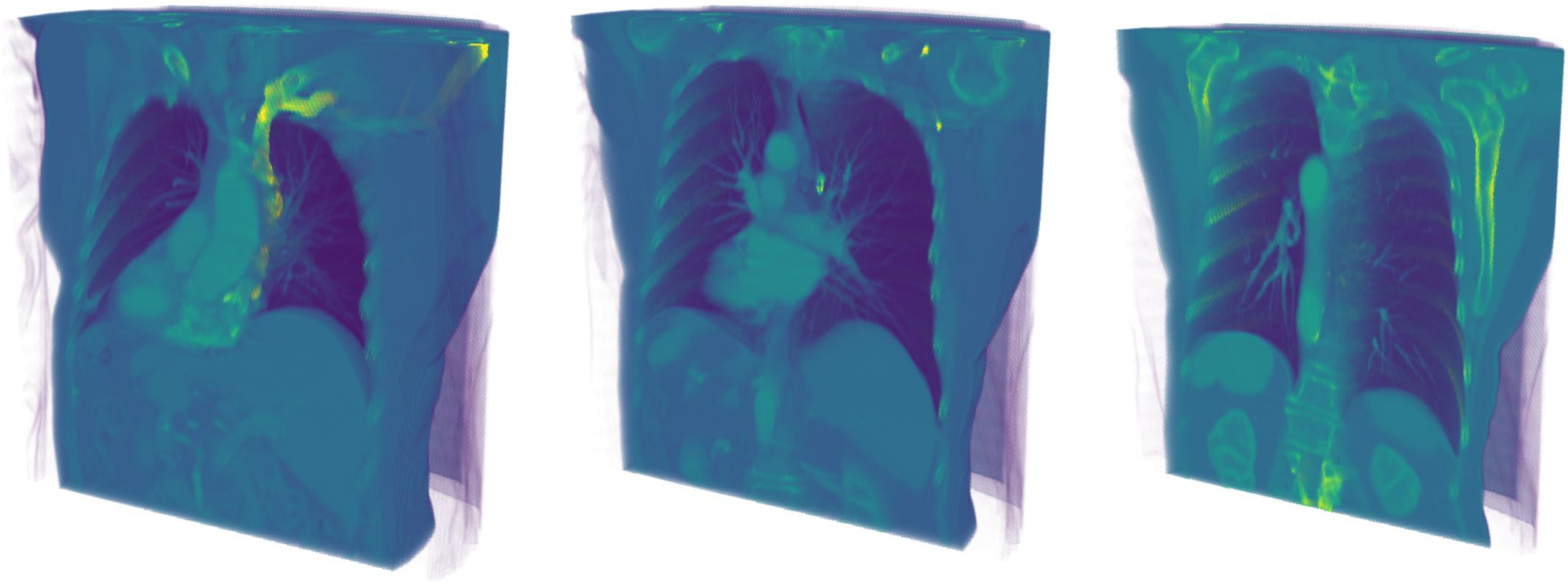
Ruyi Zha[1,] Tao Jun Lin[1] Yuanhao Cai[2] Jiwen Cao[1]

Yanhao Zhang[3] Hongdong Li[1]

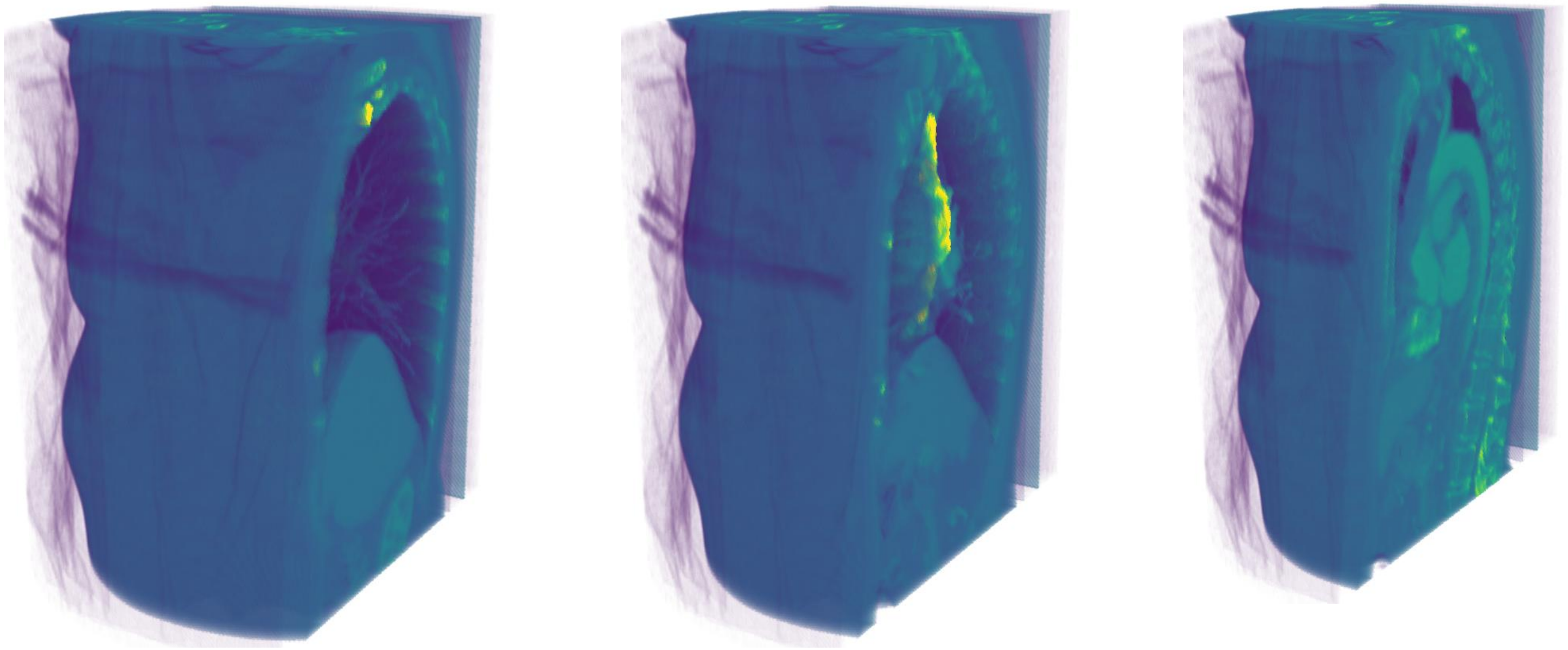
[1]Australian National University [2]Johns Hopkins University

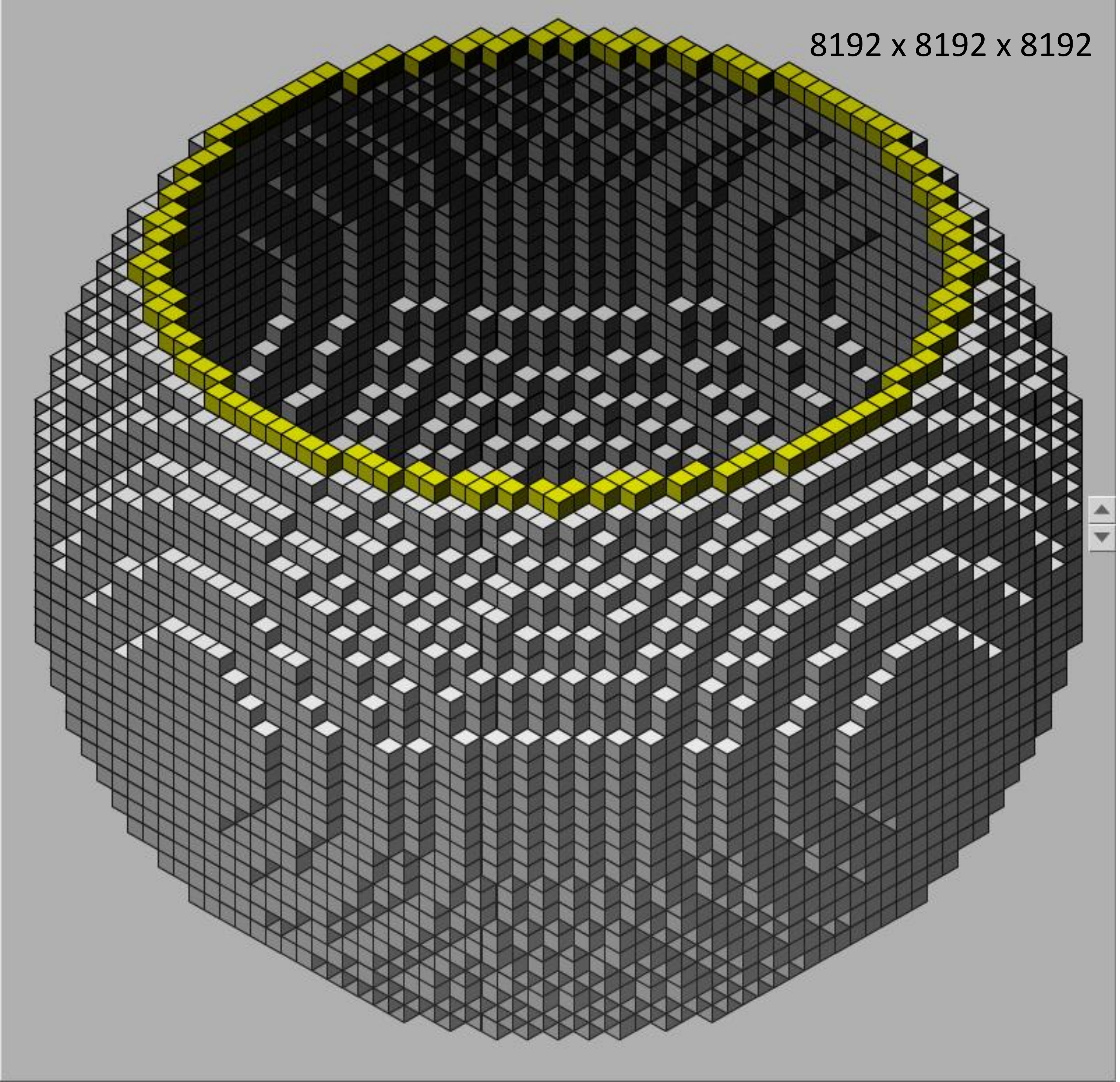
[3]University of Technology Sydney

Volume not surface optimisation

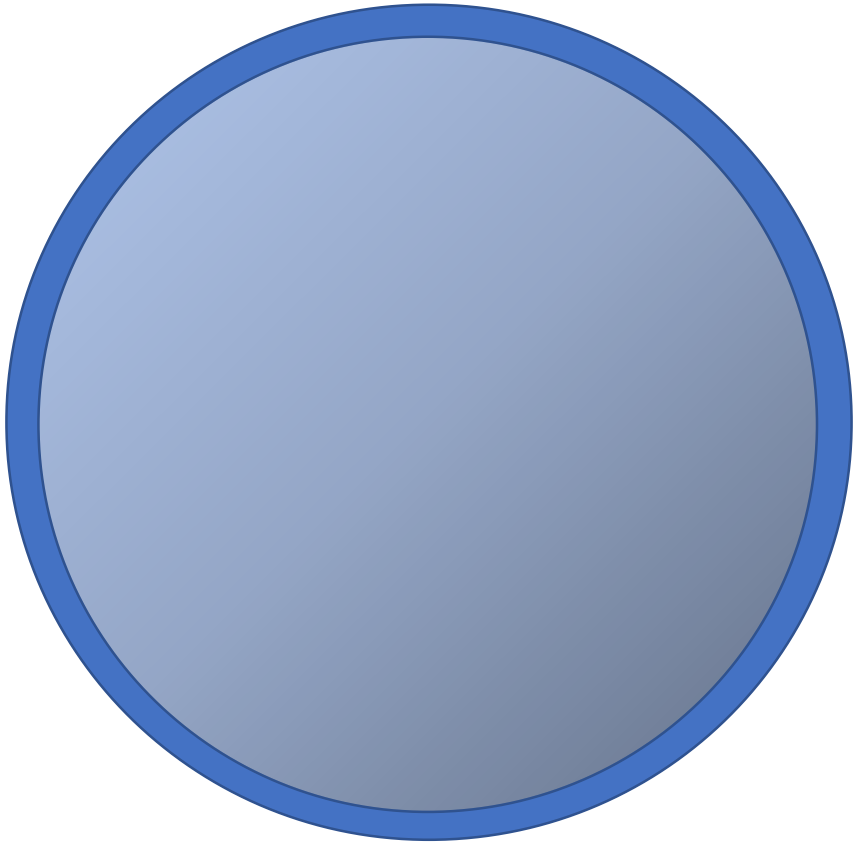


Volume not surface optimisation





2 gaussian ellipsoids



Nanoscanner