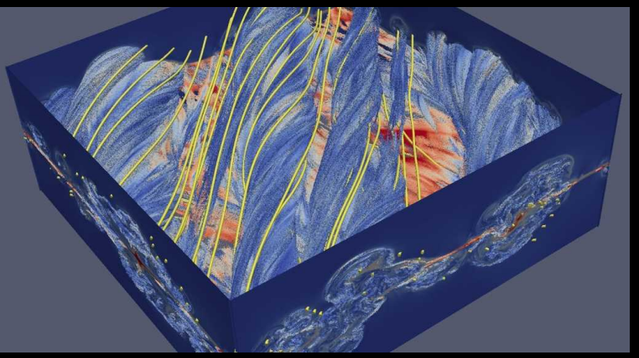
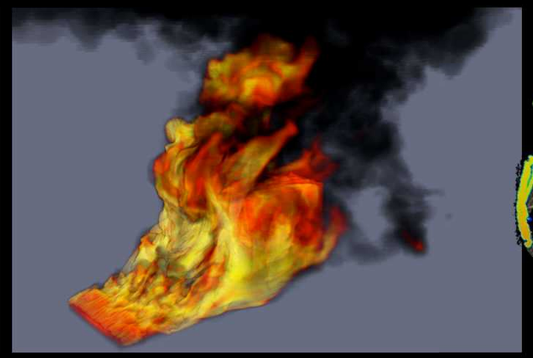
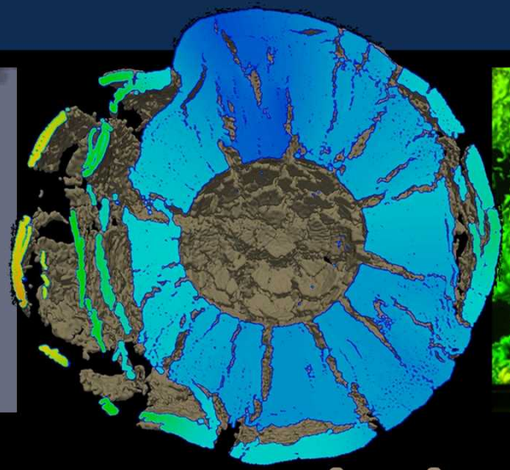
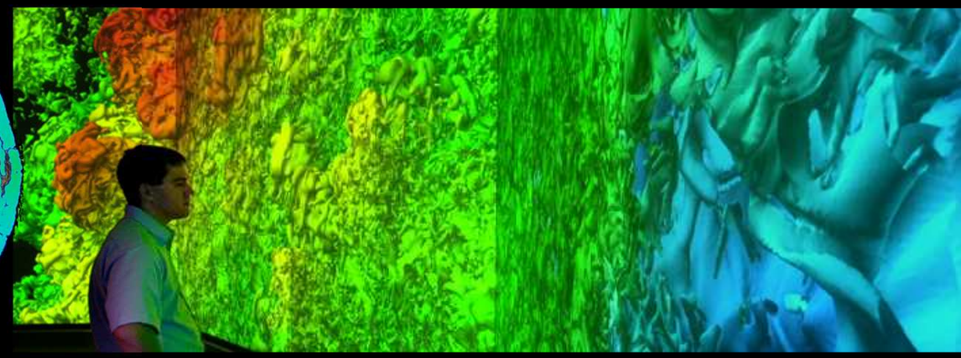
Exceptional service in the national interest

SAND2014-19533PE

Sandia National Laboratories

Maintaining Interactivity in ParaView

Kenneth Moreland Sandia National Laboratories

November 18, 2014

U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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ParaView 3.8.0

Momentum | Magnitude | Surface | Time: 0 0

Pipeline Browser

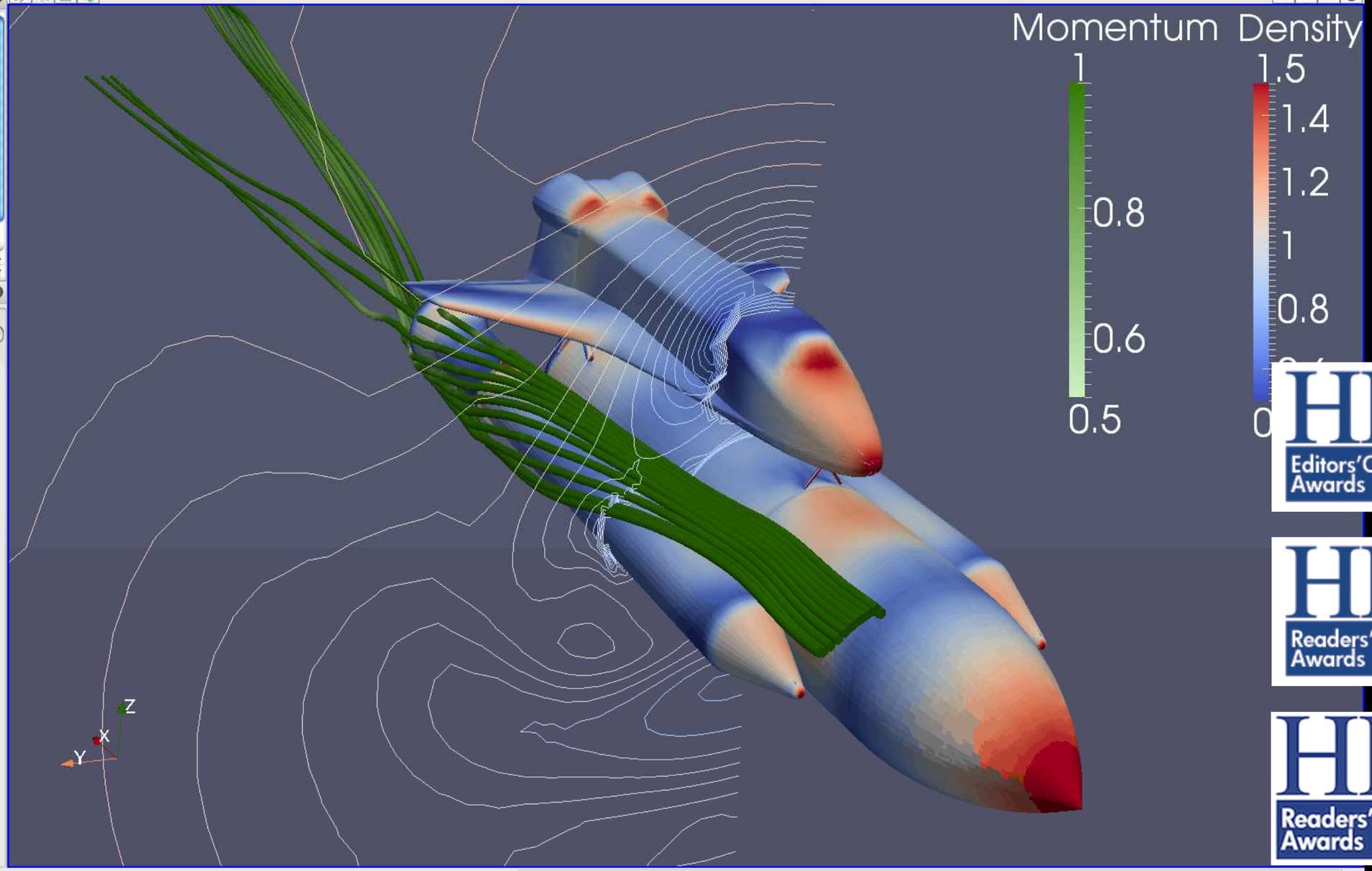
- builtin:
- shuttle_body.vtp
- Reflect1
- sslv_*
- Slice2
- StreamTracer1
- Clip1
- ExtractSurface2
- Tube1
- sslv.pvd
- Threshold4
- GroupDatasets1
- Threshold5
- GroupDatasets1

Object Inspector

Properties | Display | Information

Apply | Reset | Delete

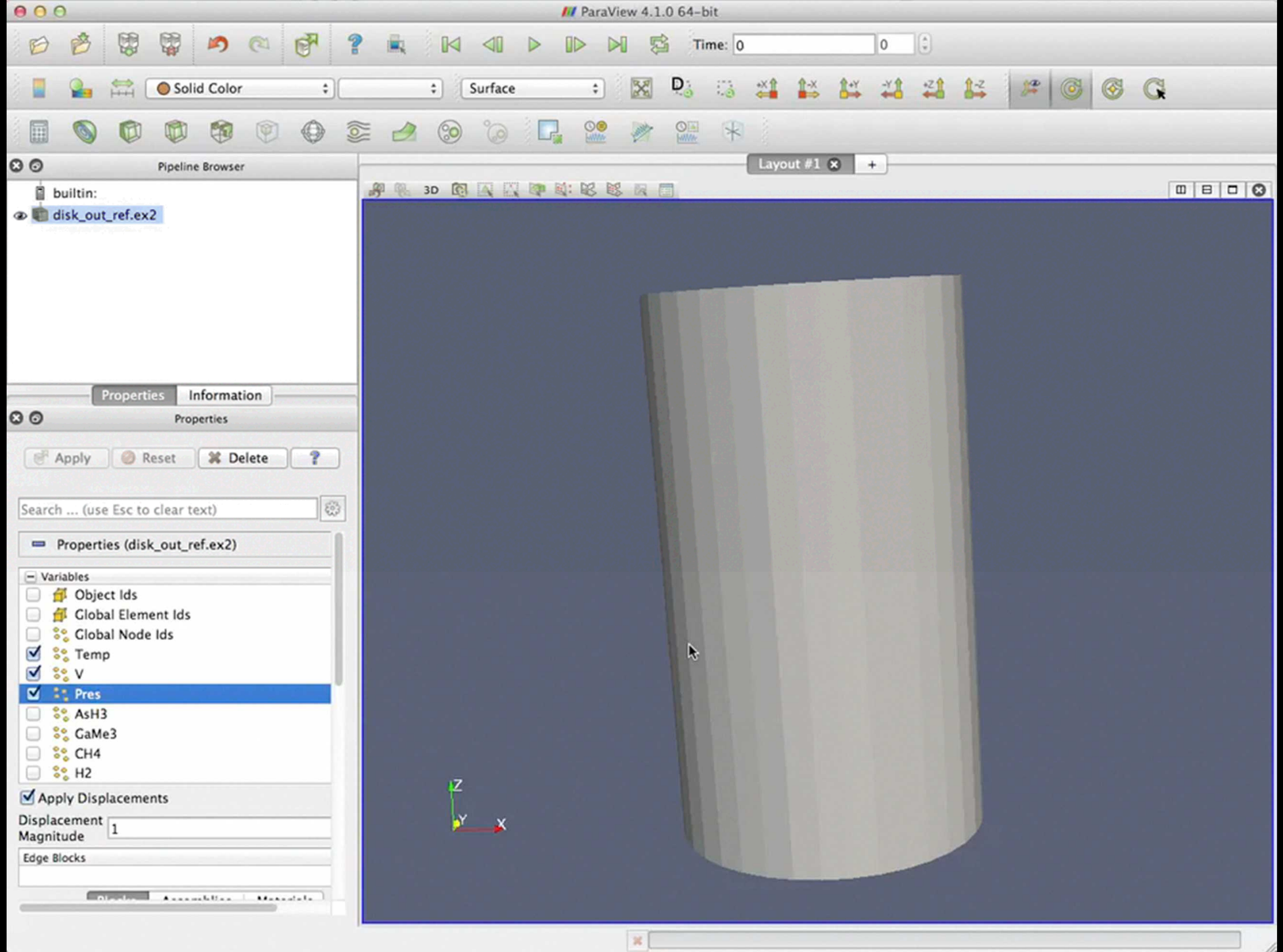
Scalars: Density
Vectors: Normals
Number of Sides: 6
Capping
Radius: 0.01
Vary Radius: Off
Radius Factor: 1
Use Default Normal
Default Normal: 0 0 1

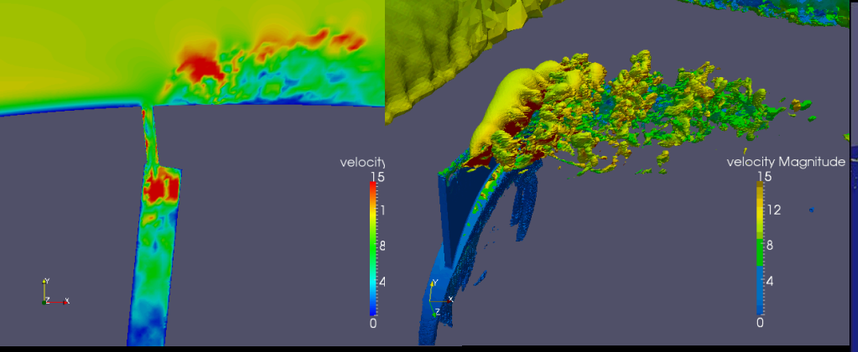


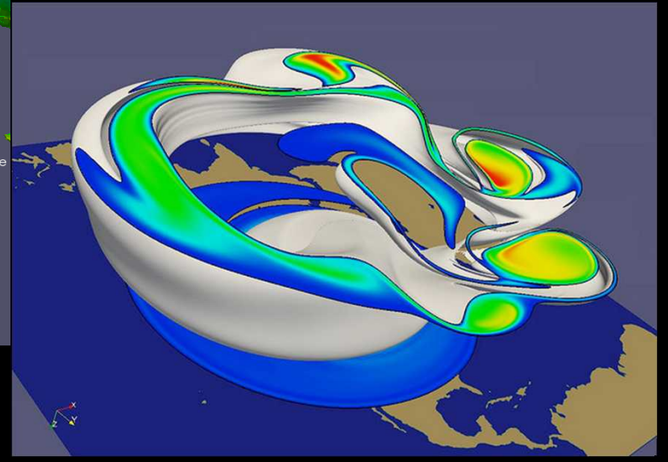
HPC wire Editors' Choice Awards 2010

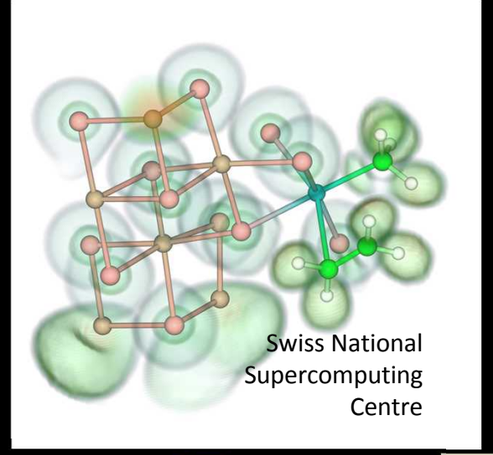
HPC wire Readers' Choice Awards 2010

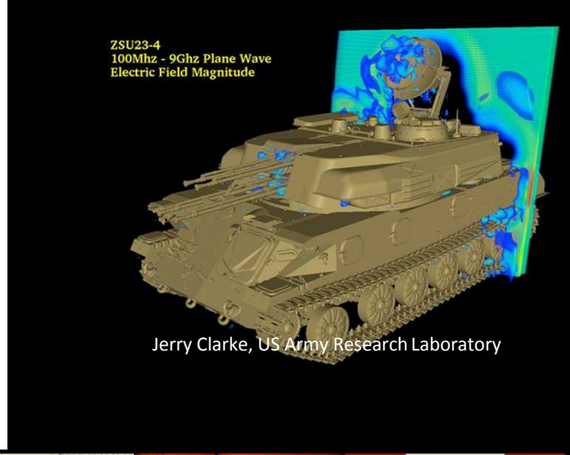
HPC wire Readers' Choice Awards 2012

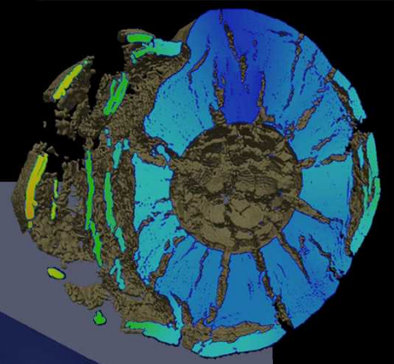

ParaView 4.1.0 64-bit
Time: 0
0
Solid Color
Surface
Pipeline Browser
builtin:
disk_out_ref.ex2
Properties
Information
Properties
Apply
Reset
Delete
Search ... (use Esc to clear text)
Properties (disk_out_ref.ex2)
Variables
Object Ids
Global Element Ids
Global Node Ids
Temp
V
Pres
AsH3
GaMe3
CH4
H2
Apply Displacements
Displacement Magnitude
1
Edge Blocks
Layout #1
3D
Z
Y
X


velocity
15
1
8
4
0
velocity Magnitude
15
12
8
4
0



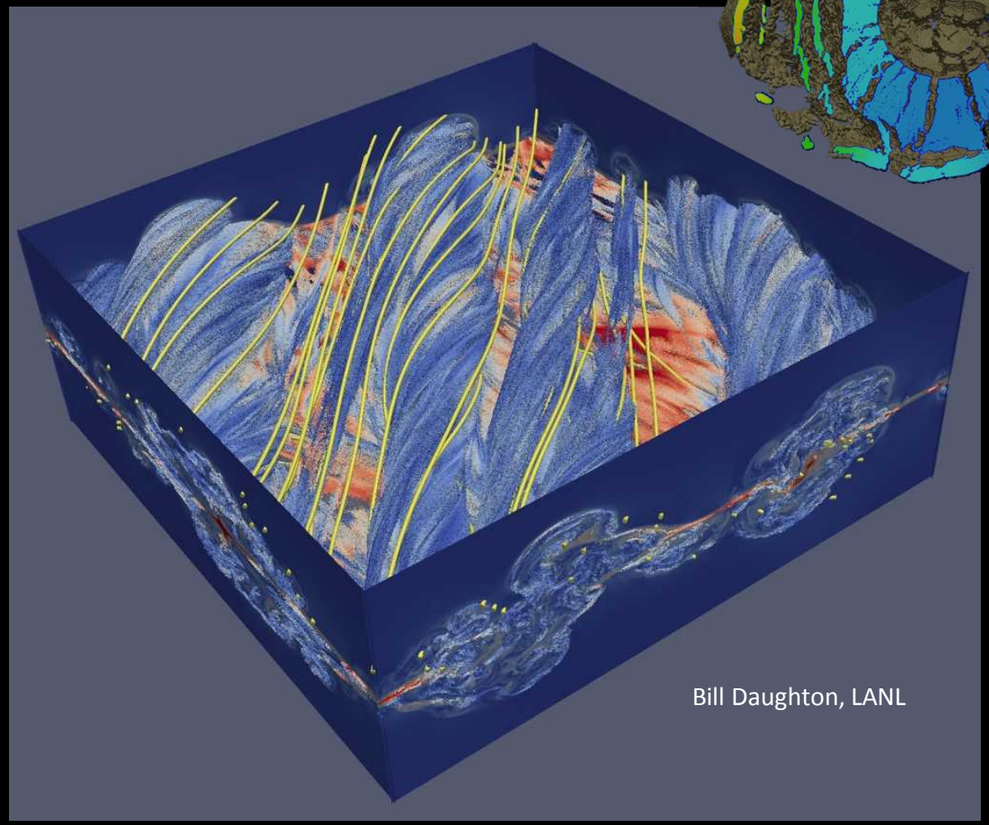

Swiss National
Supercomputing
Centre

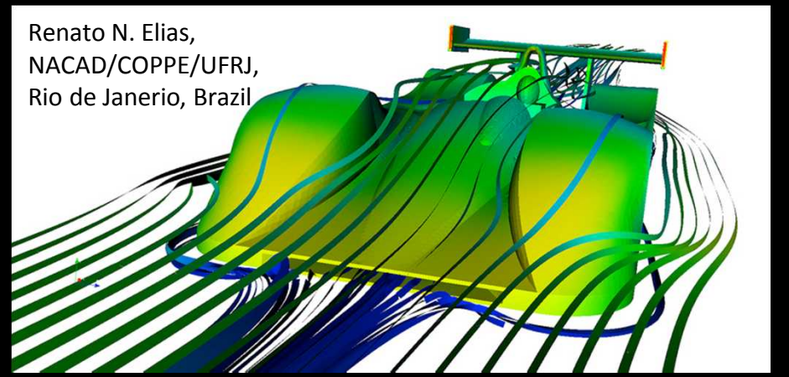

ZSU23-4
100Mhz - 9Ghz Plane Wave
Electric Field Magnitude
Jerry Clarke, US Army Research Laboratory




Swiss National
Supercomputing
Centre


nature
The trajectory, origin and airburst behaviour
of the Chelyabinsk fireball


Bill Daughton, LANL


Renato N. Elias,
NACAD/COPPE/UFRJ,
Rio de Janerio, Brazil

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What is Interactive?

Interactive is “fast”

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What is Interactive?

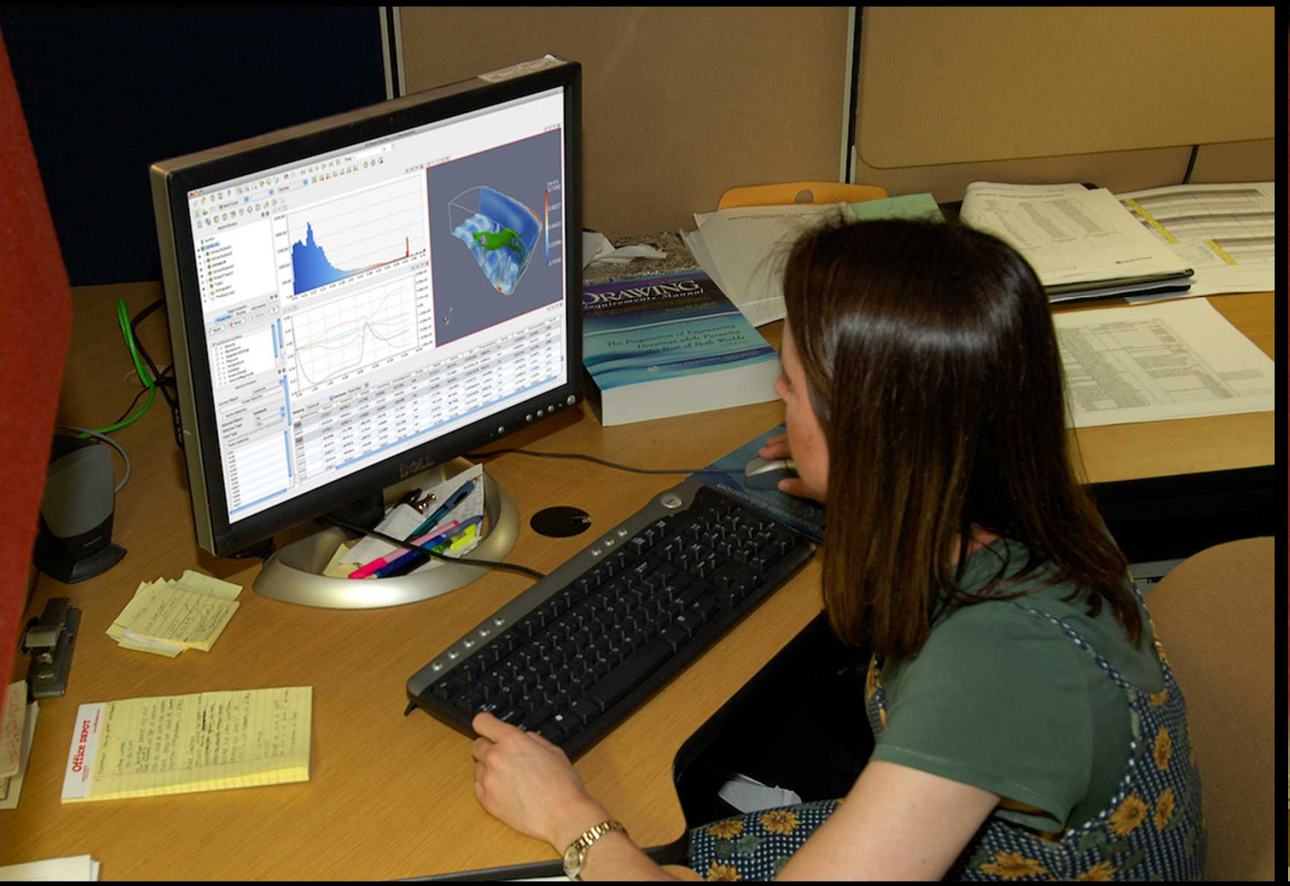
At a minimum, interactive is accessible.


Sun
microsystems
Sun
microsystems
Sun
microsystems
Making HPC
Accessible

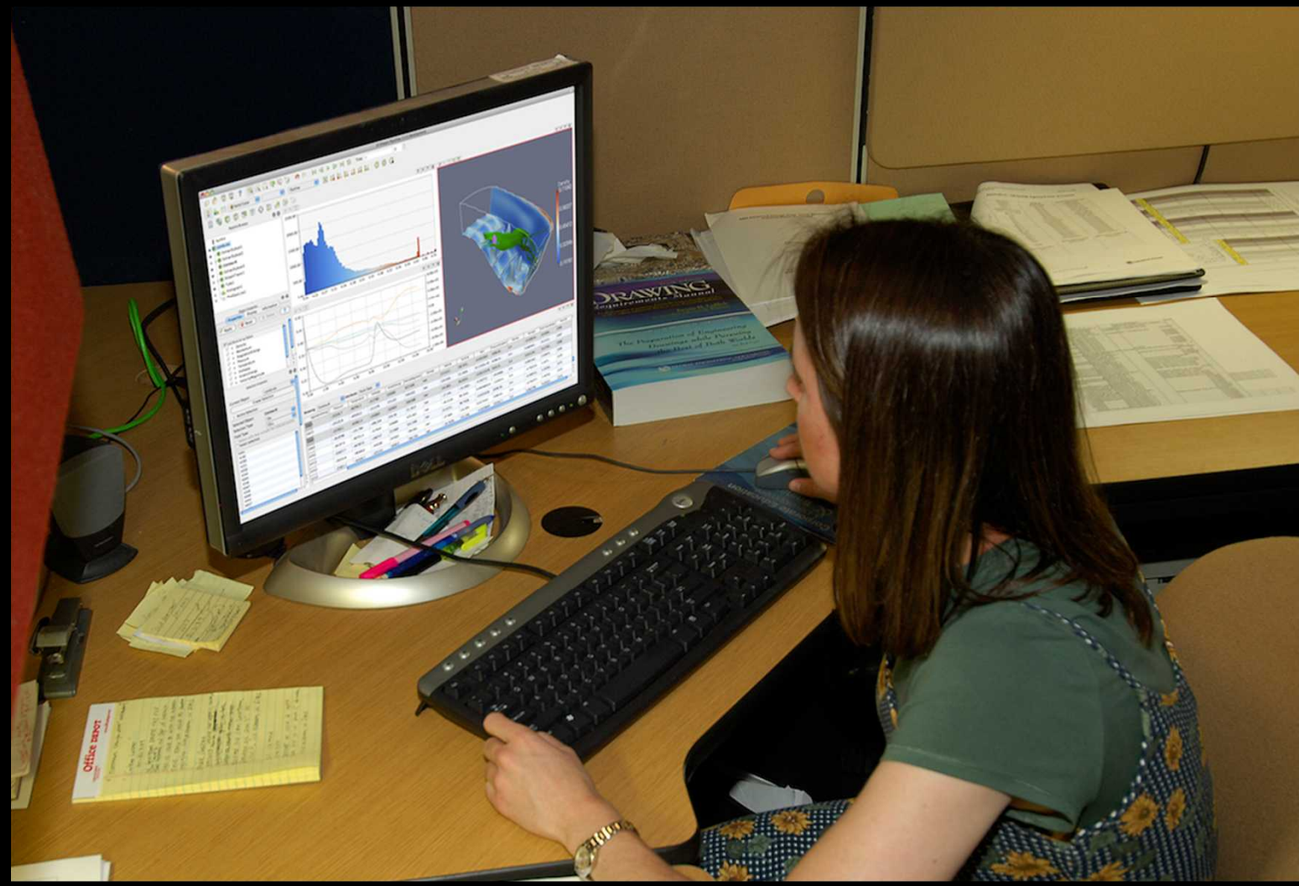
Sitting in an HPC facility is not accessible

The ParaView HPC User Experience

Sandia National Laboratories



Using ParaView on a small dataset run locally on your desktop or laptop.



Using ParaView on a large dataset of billions of cells run on thousands of cores at a remote leadership class facility.

Client-Server Architecture Makes Large Data Computation Accessible

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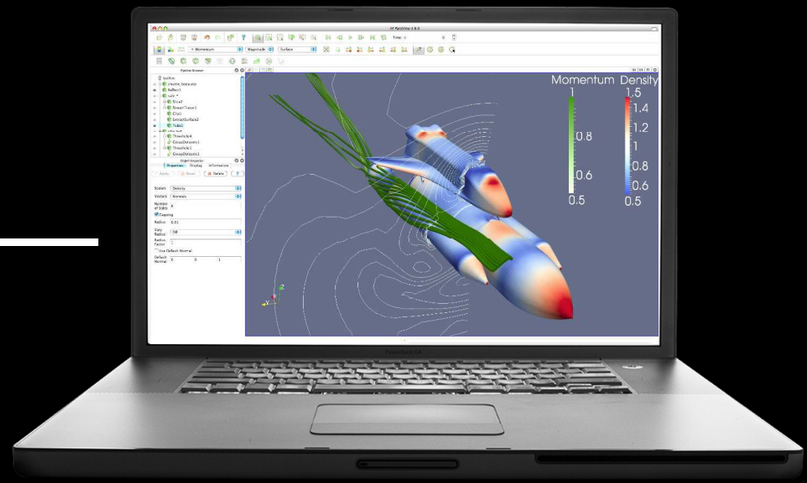
pvserver

LAN/WAN

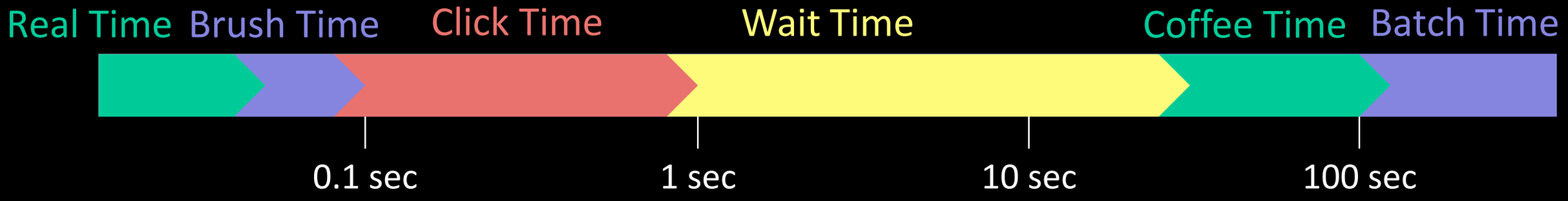


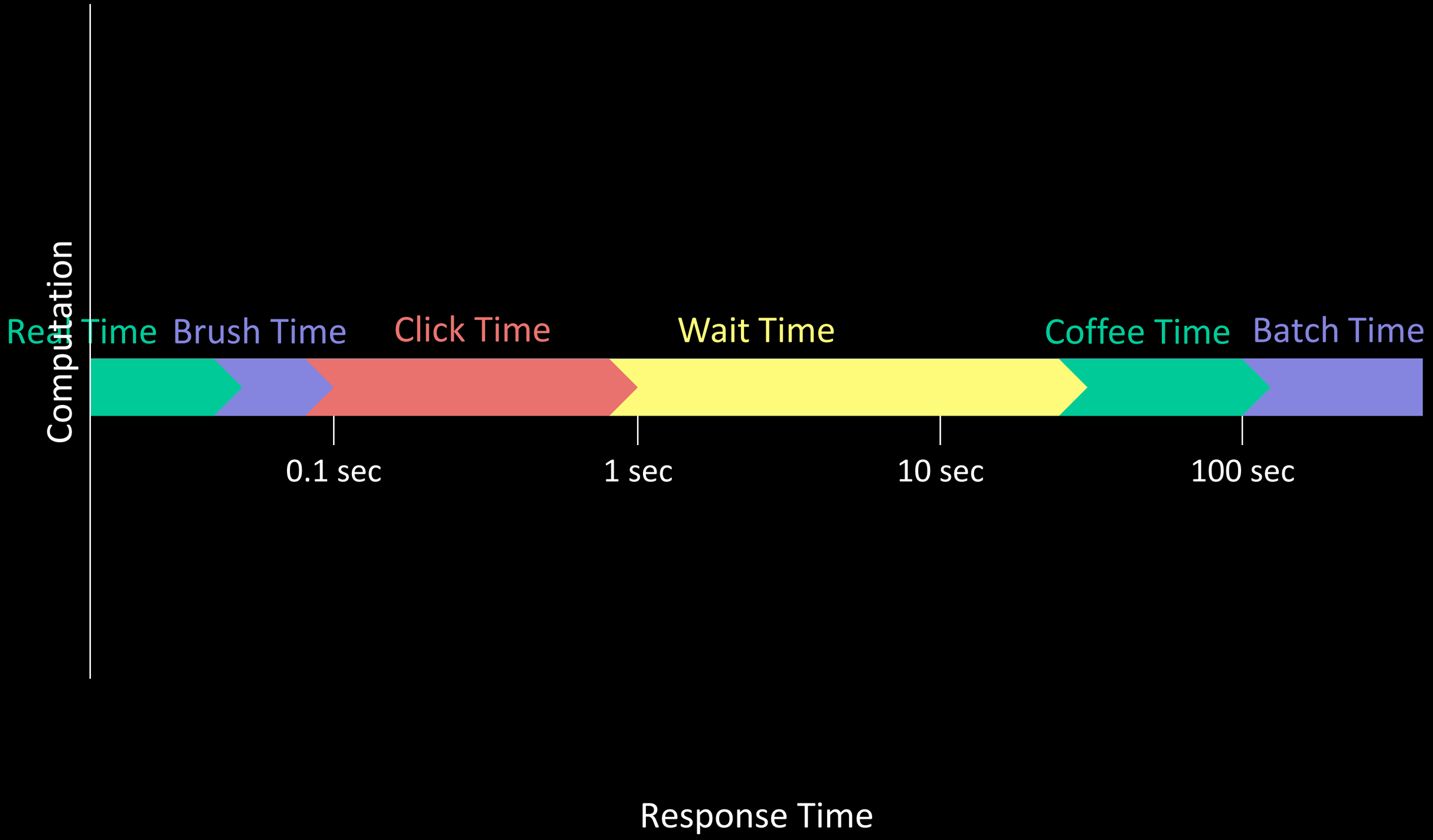
ParaView GUI
(client)

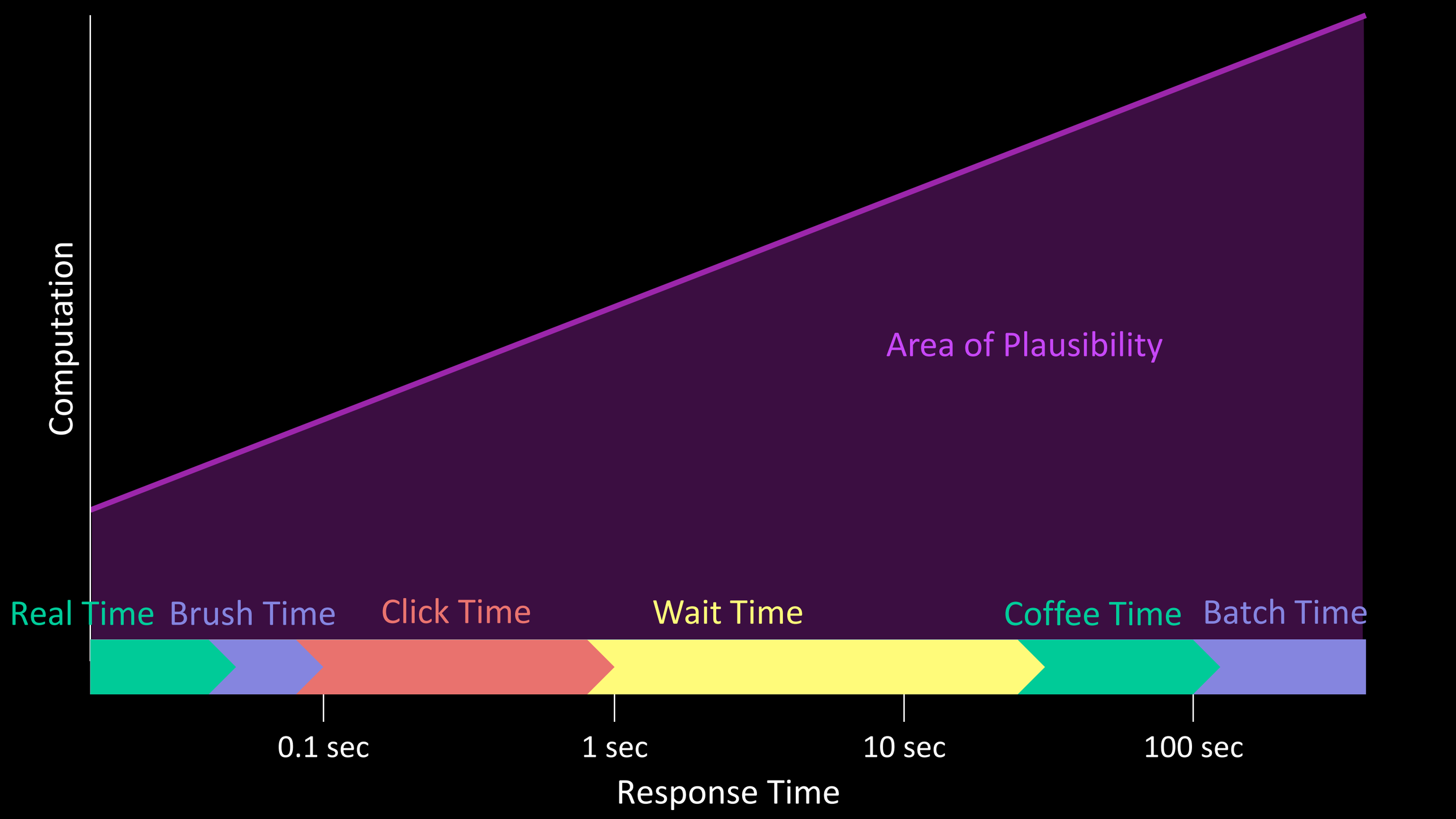
Sandia National Laboratories

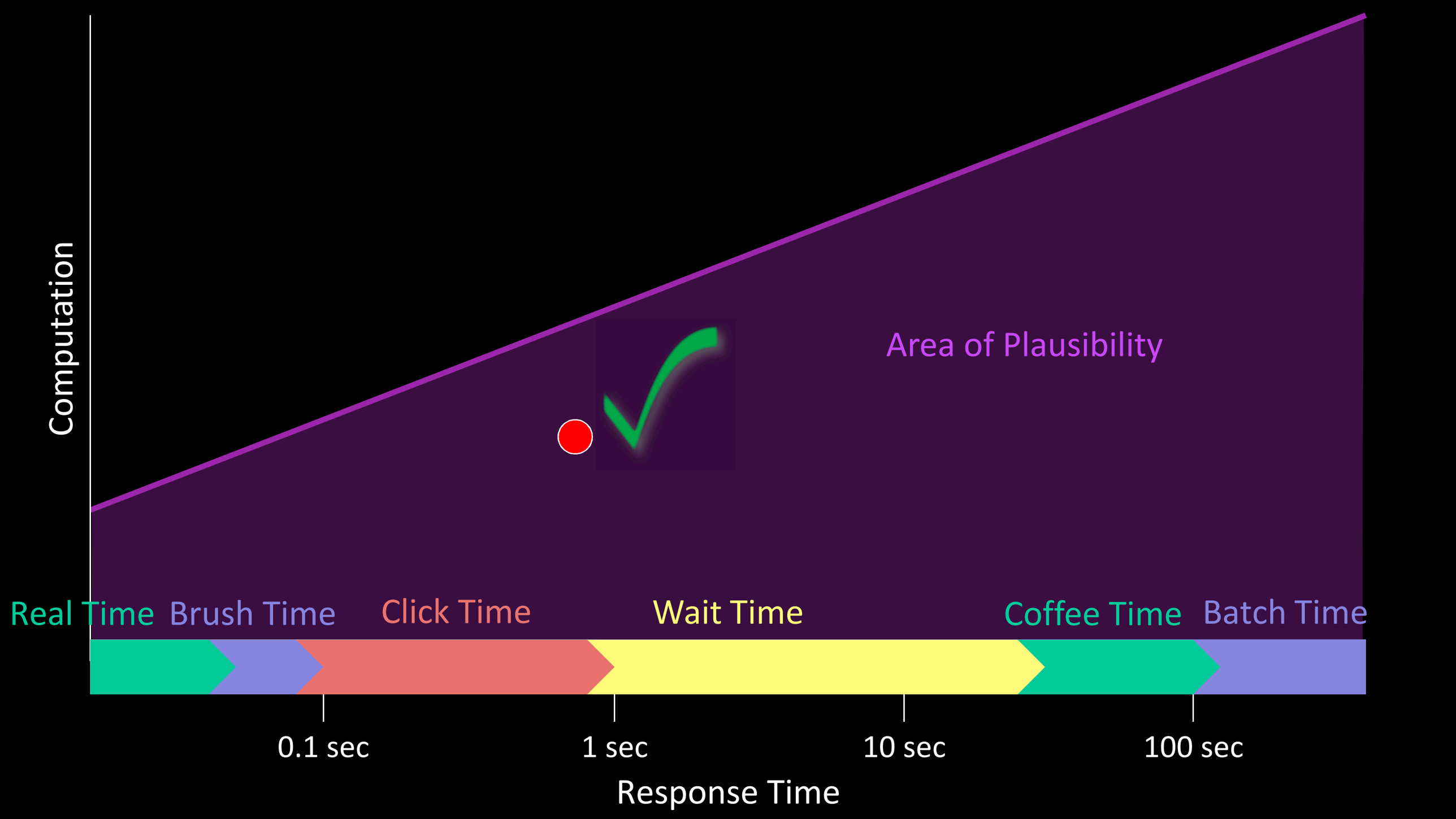
What is Interactive?

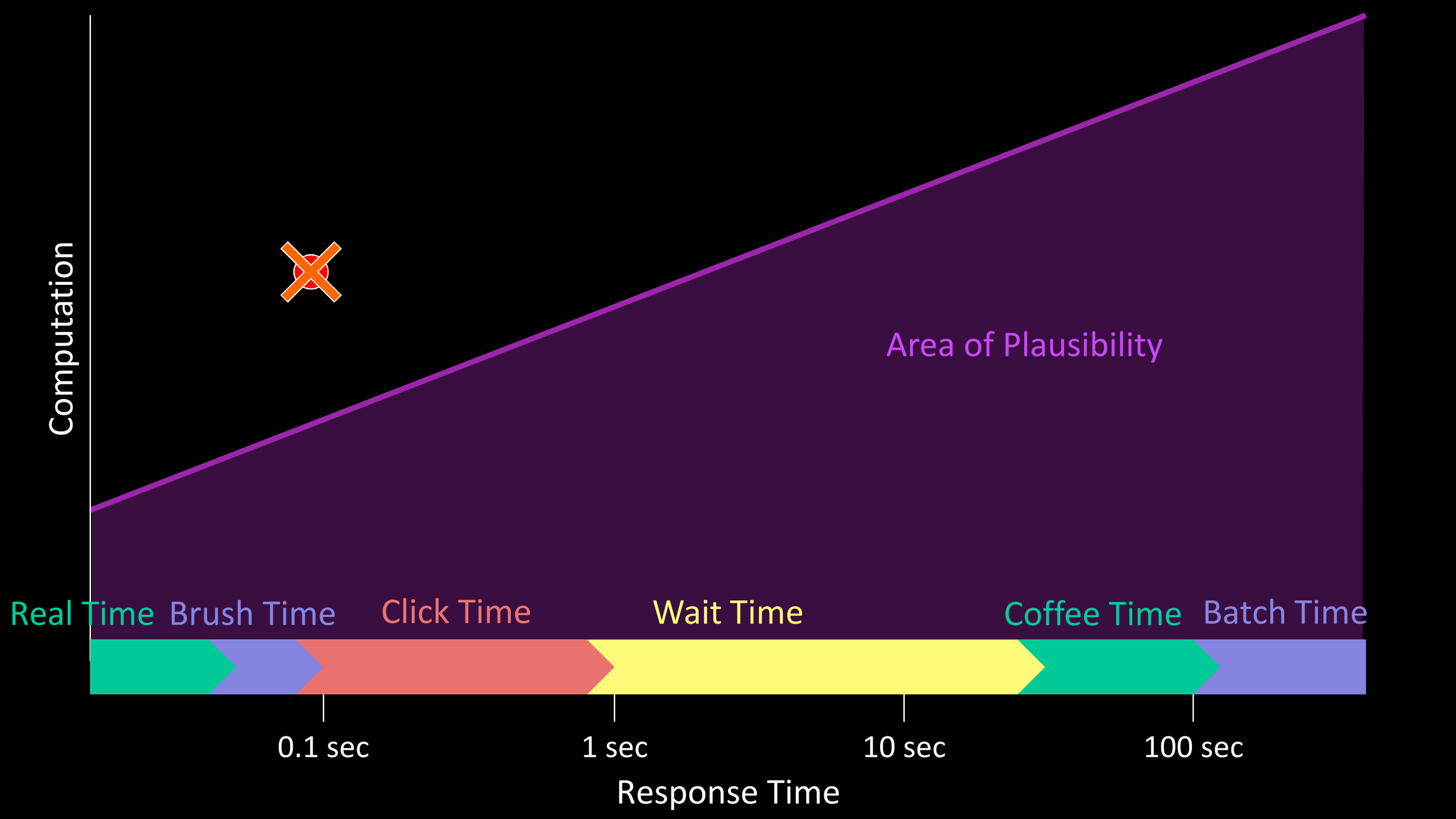
Interactivity demands responsiveness

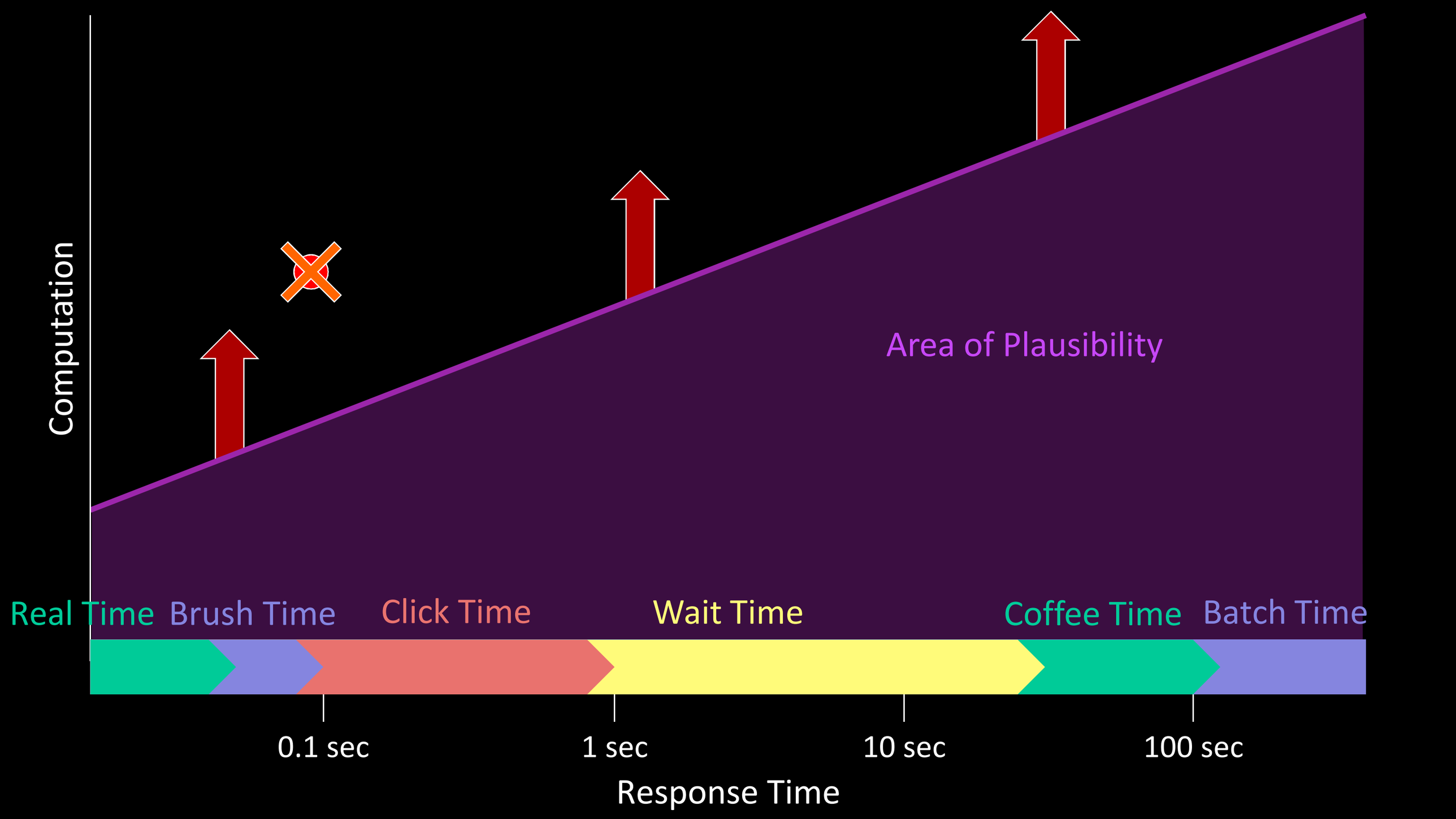

Real Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec

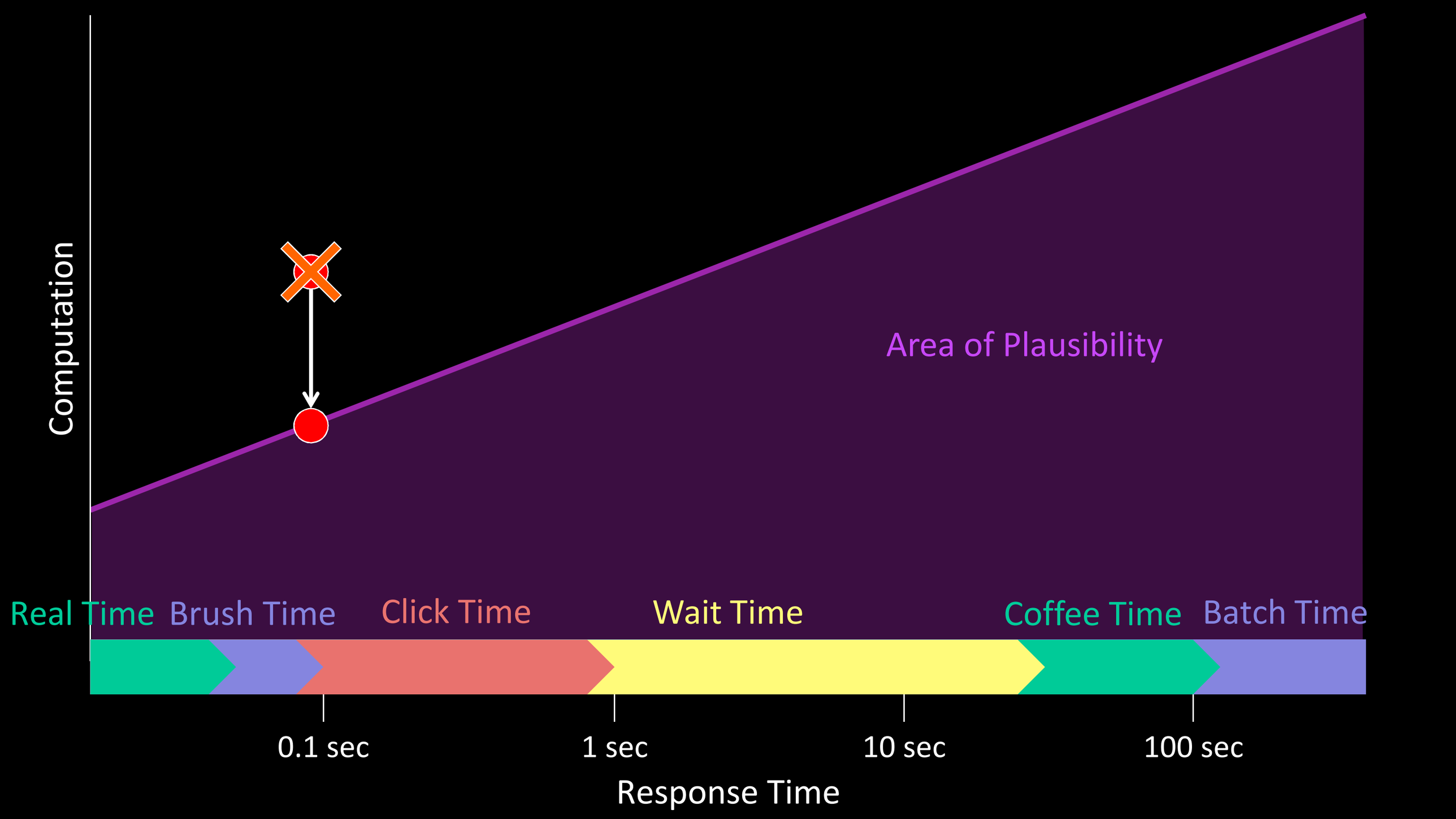

Computation
Reaction Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec
Response Time

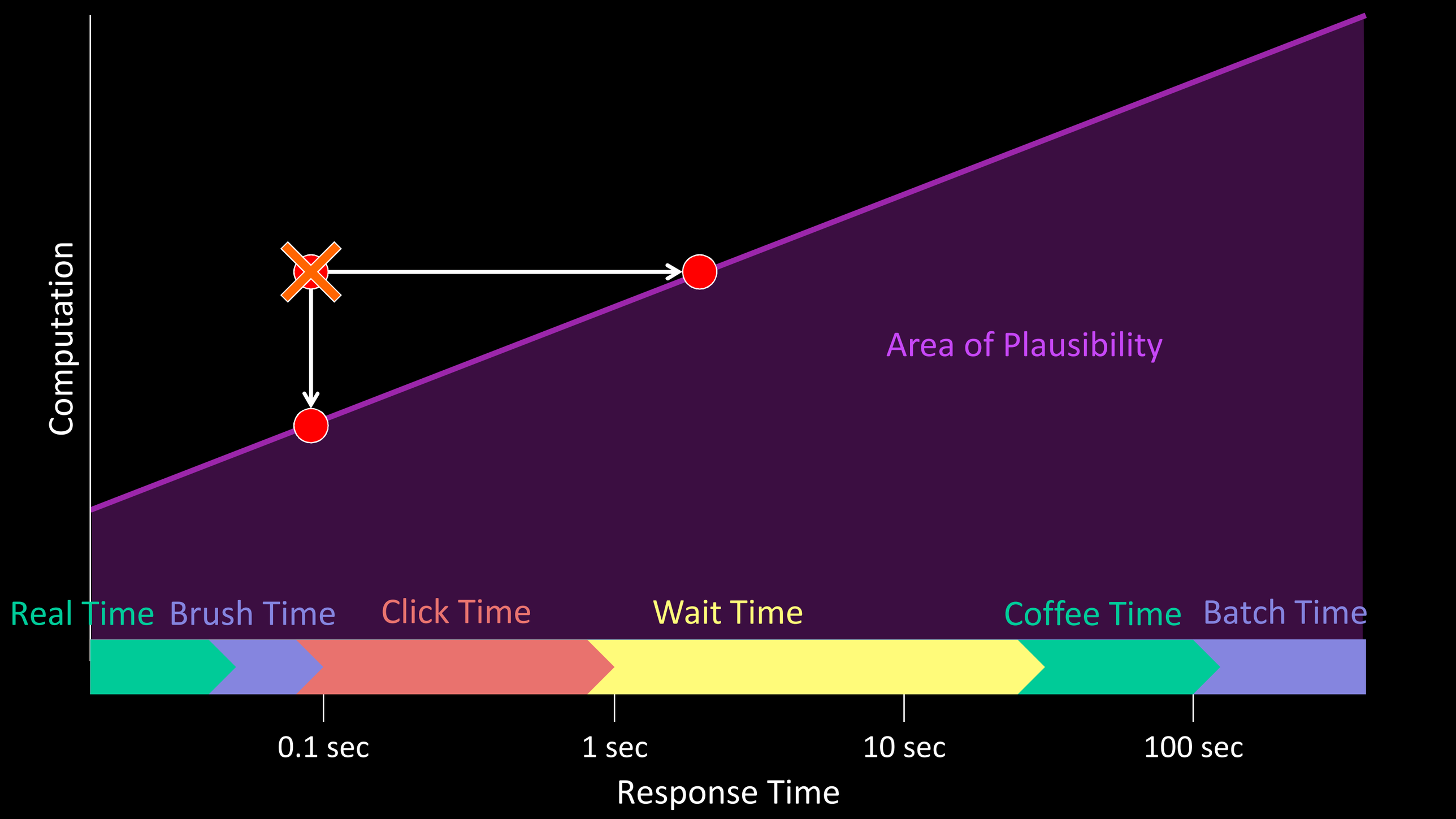

Computation
Area of Plausibility
Real Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec
Response Time

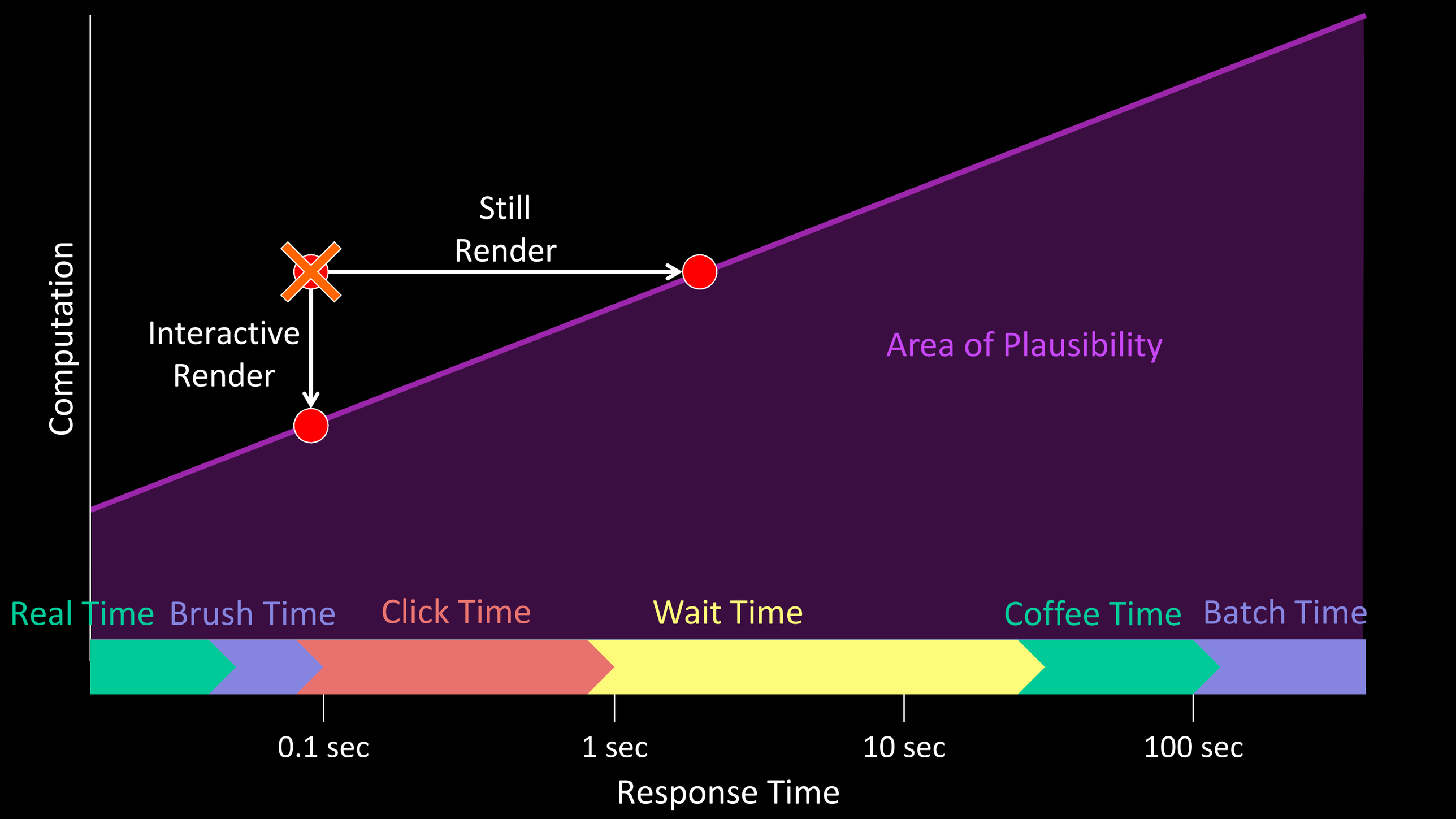

Computation
Area of Plausibility
Real Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec
Response Time


Computation
Area of Plausibility
Real Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec
Response Time

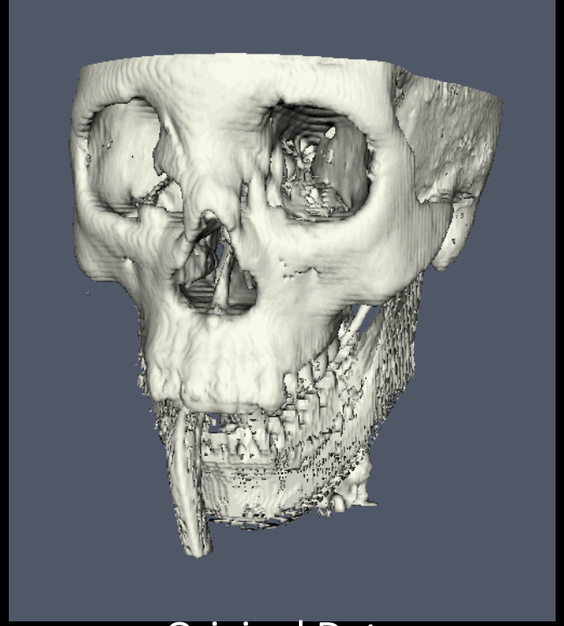

Computation
Area of Plausibility
Real Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec
Response Time


Computation
Area of Plausibility
Real Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec
Response Time

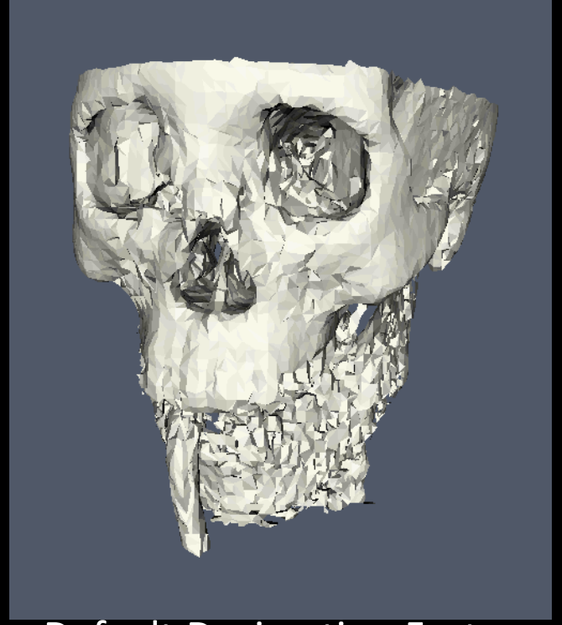

Computation
Area of Plausibility
Real Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec
Response Time


Computation
Still
Render
Interactive
Render
Area of Plausibility
Real Time
Brush Time
Click Time
Wait Time
Coffee Time
Batch Time
0.1 sec
1 sec
10 sec
100 sec
Response Time

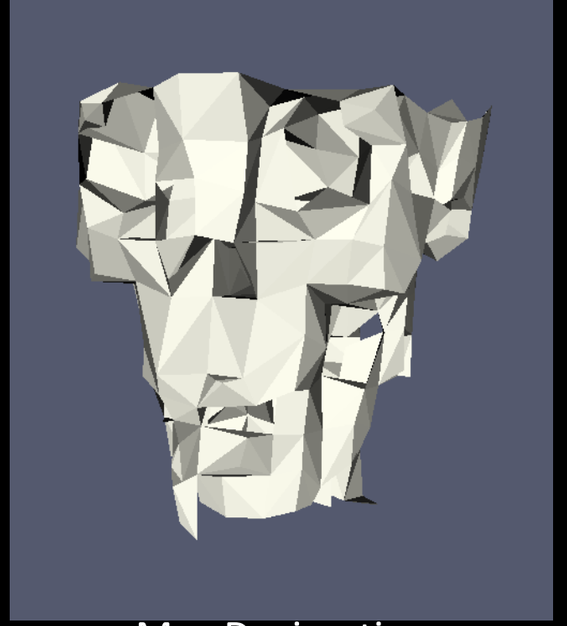
Geometric Levels of Detail



Original Data

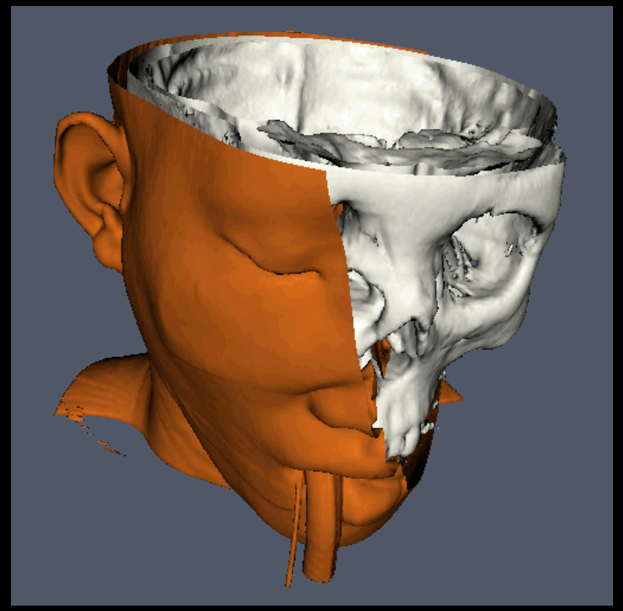


Default Decimation Factor

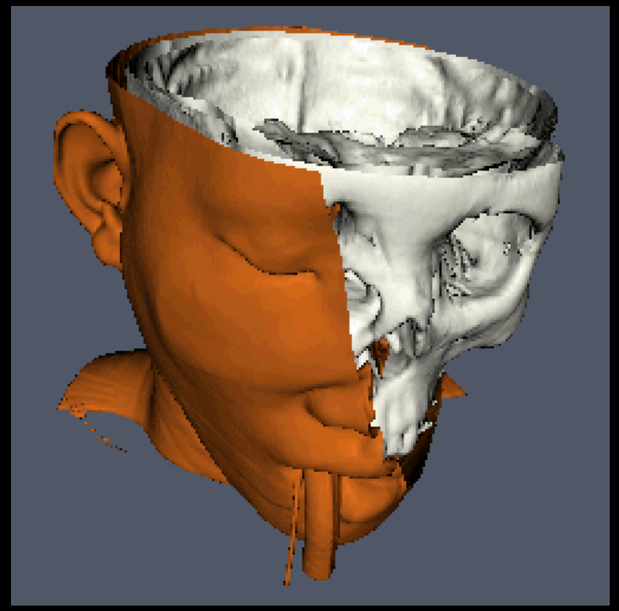


Max Decimation

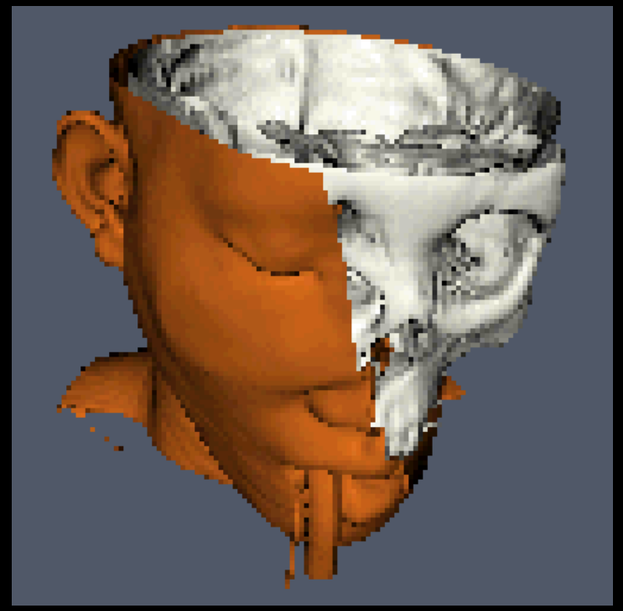
Image Levels of Detail



Original Data

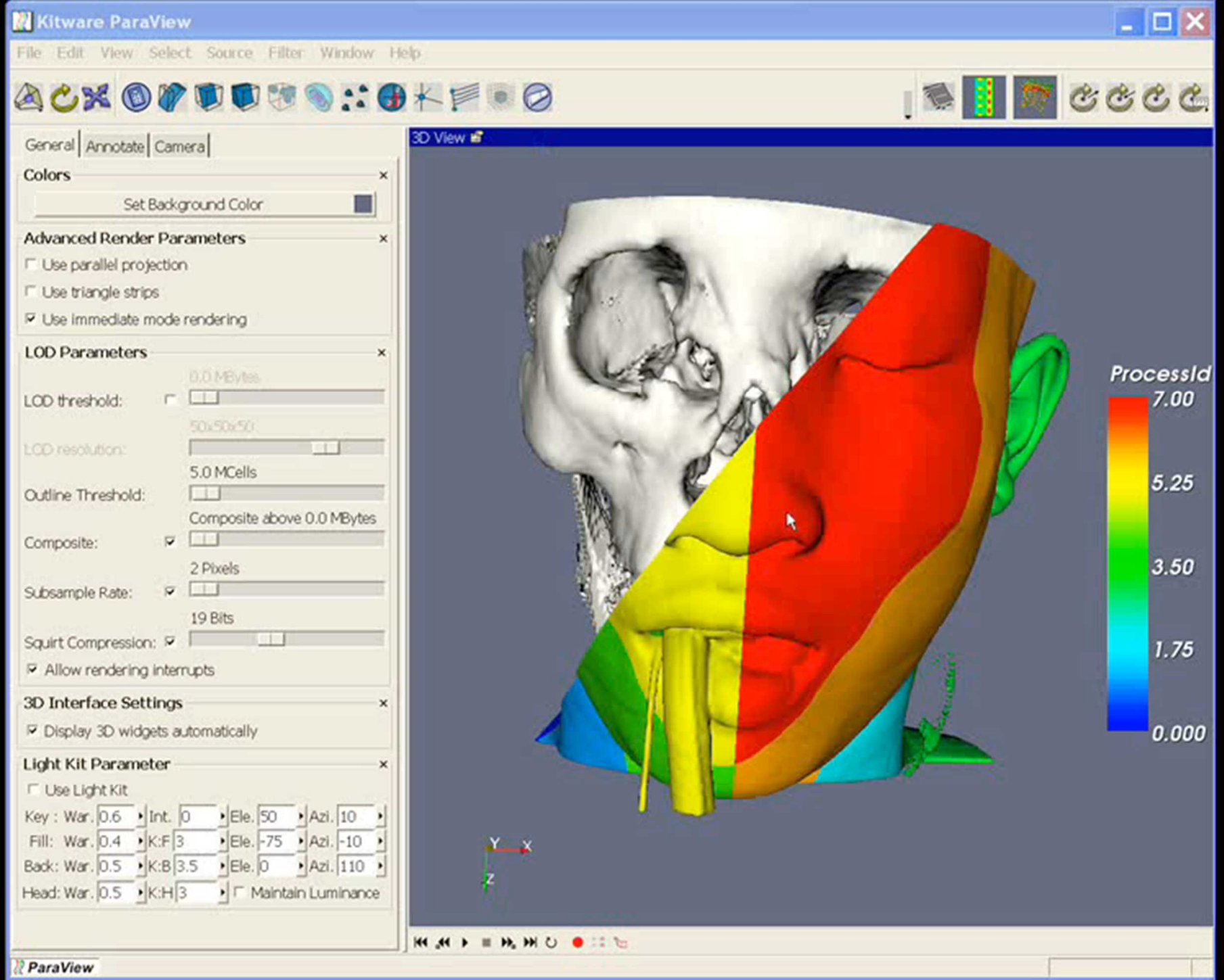


Subsample Rate: 2 pixels



Subsample Rate: 4 pixels

Subsample Rate: 8 pixels


Kitware ParaView
File Edit View Select Source Filter Window Help
General Annotate Camera
Colors
Set Background Color
Advanced Render Parameters
Use parallel projection
Use triangle strips
Use immediate mode rendering
LOD Parameters
0.0 MBytes
LOD threshold:
50x50x50
LOD resolution:
5.0 MCells
Outline Threshold:
Composite above 0.0 MBytes
Composite:
2 Pixels
Subsample Rate:
19 Bits
Squirt Compression:
Allow rendering interrupts
3D Interface Settings
Display 3D widgets automatically
Light Kit Parameter
Use Light Kit
Key : War. 0.6 Int. 0 Ele. 50 Azi. 10
Fill: War. 0.4 K:F 3 Ele. -75 Azi. -10
Back: War. 0.5 K:B 3.5 Ele. 0 Azi. 110
Head: War. 0.5 K:H 3 Maintain Luminance
3D View
ProcessId
7.00
5.25
3.50
1.75
0.000
Y
X
Z
ParaView

Acknowledgements

- Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.
- This work was supported in part by the DOE Office of Science, Advanced Scientific Computing Research, under award number 10-014707, program manager Lucy Nowell.
- Additional support by the Director, Office of Advanced Scientific Computing Research, Office of Science, of the U.S. Department of Energy under Contract No. 12-015215, through the Scientific Discovery through Advanced Computing (SciDAC) Institute of Scalable Data Management, Analysis and Visualization.