Paraview Jour 2

Calcul Québec

Slides: http://bit.ly/paraviewday2

Github:

https://github.com/calculquebec/paraview.git

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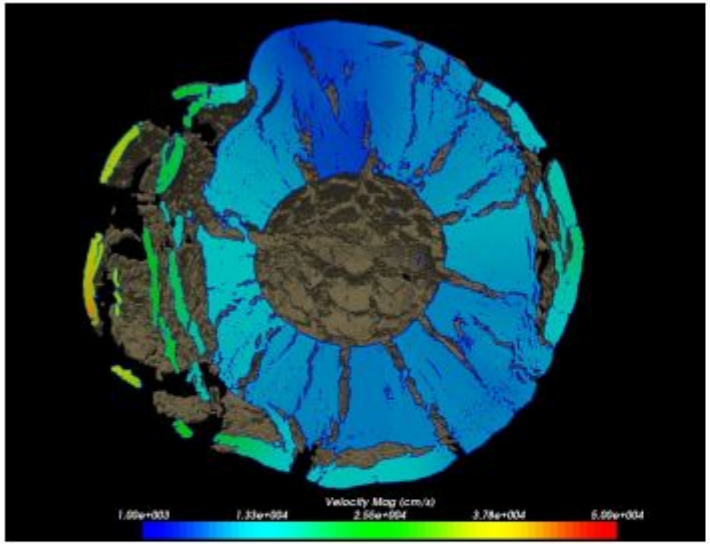
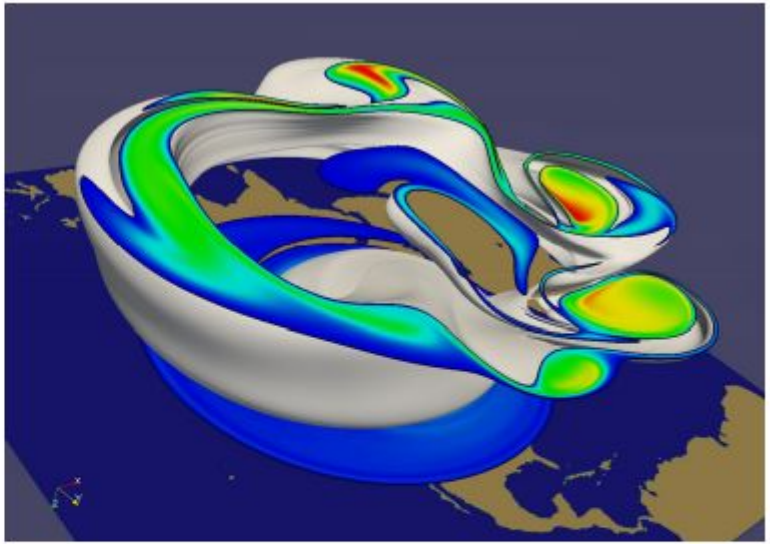
Paraview for large models

https://www.paraview.org/gallery/



CTH shock physics simulation with over 1 billion cells of a 10 megaton explosion detonated at the center of the Golevka asteroid.



SEAM Climate Modeling simulation with 1 billion cells modeling the breakdown of the polar vortex, a circumpolar jet that traps polar air at high latitudes.

Turbulence + fire

https://youtu.be/RG0G0VCd41Y?t=69

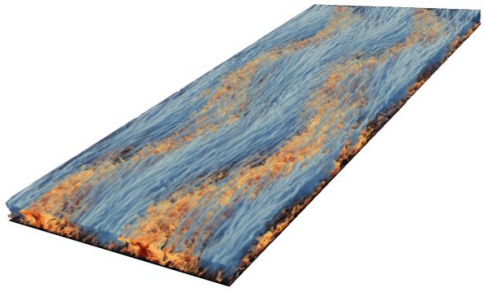


Figure 1: Instantaneous snapshot of the three-dimensional temperature field of sheared thermal convection at $Ra = 4.6 \times 10^6$ and $Re = 6000$ [3].

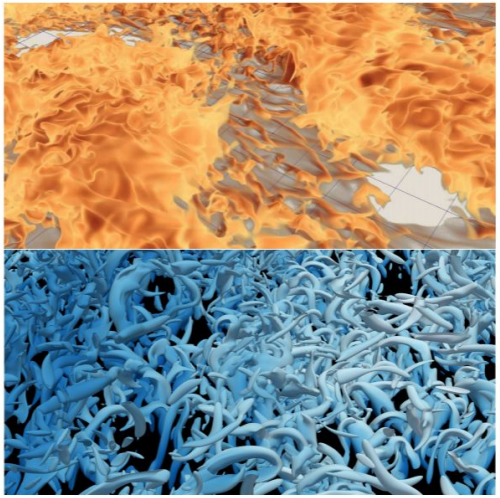


Figure 3: Zoom of an instantaneous snapshot of the temperature field (top) and the vorticity structures (bottom) at $Ra = 2.2 \times 10^6$ and $Re = 6000$.

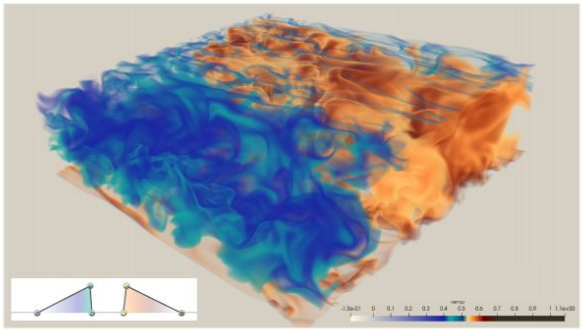
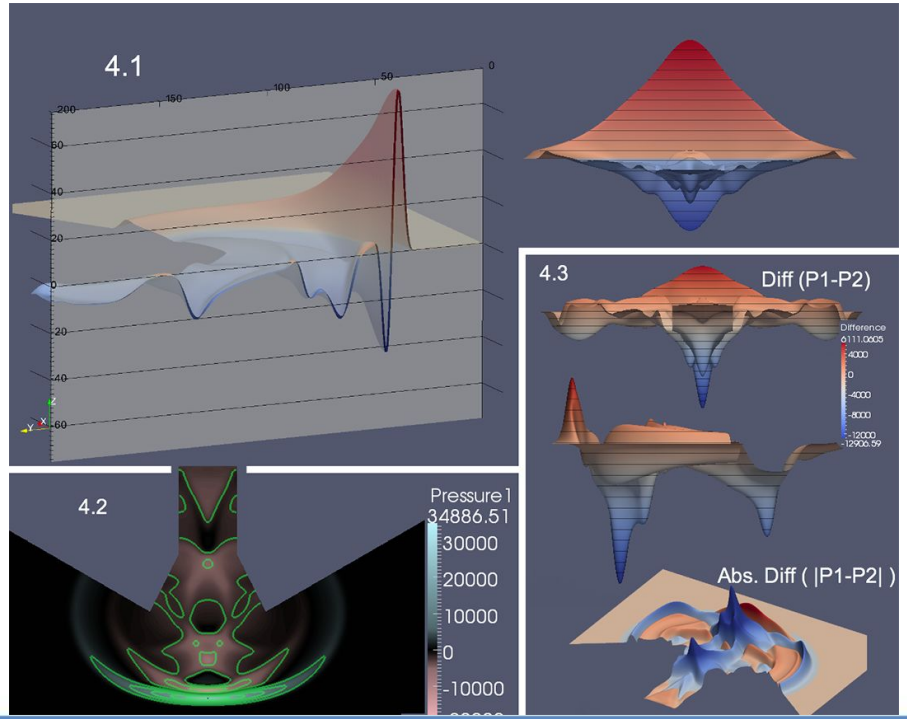


Figure 5: Example of a color and opacity transfer functions to highlight hot and cold plumes.

Geological data

Data courtesy of Jonathan Lees and Keehoon Kim, UNC Geological Sciences



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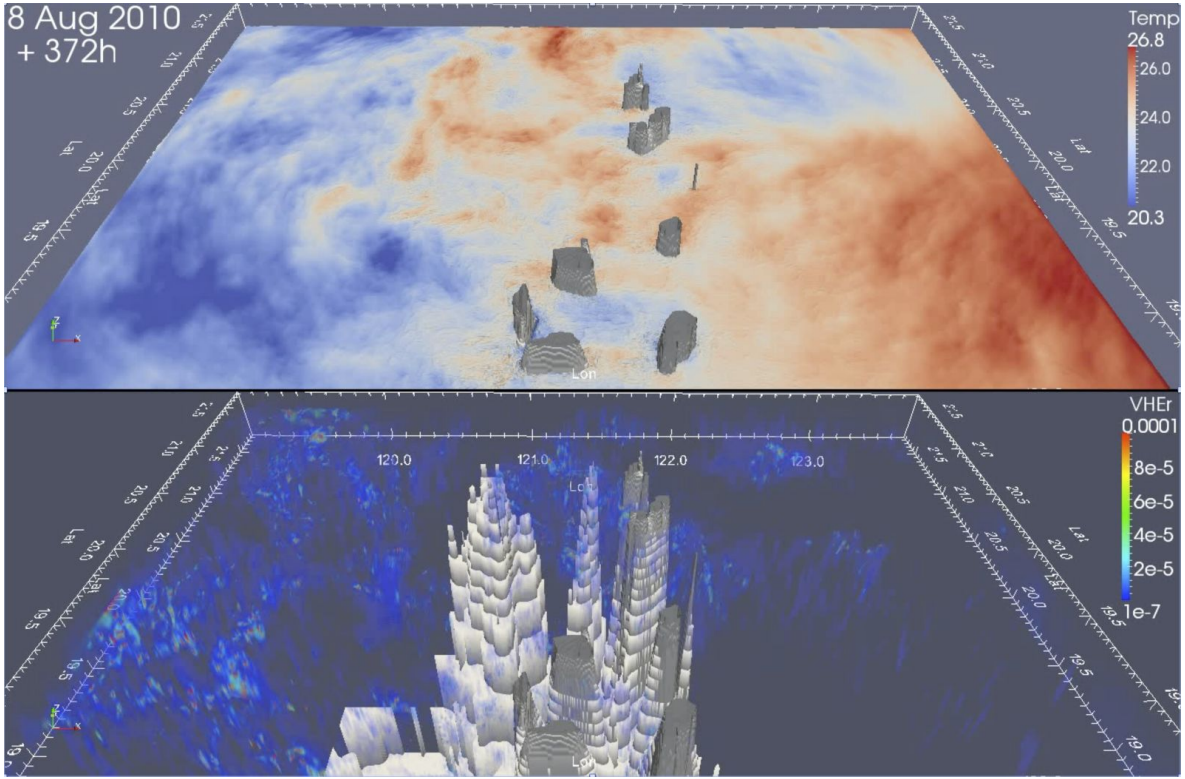

Visualization of MIT General Circulation Model data showing surface temperature, VHEr and bathymetry.

Computational fluid dynamics

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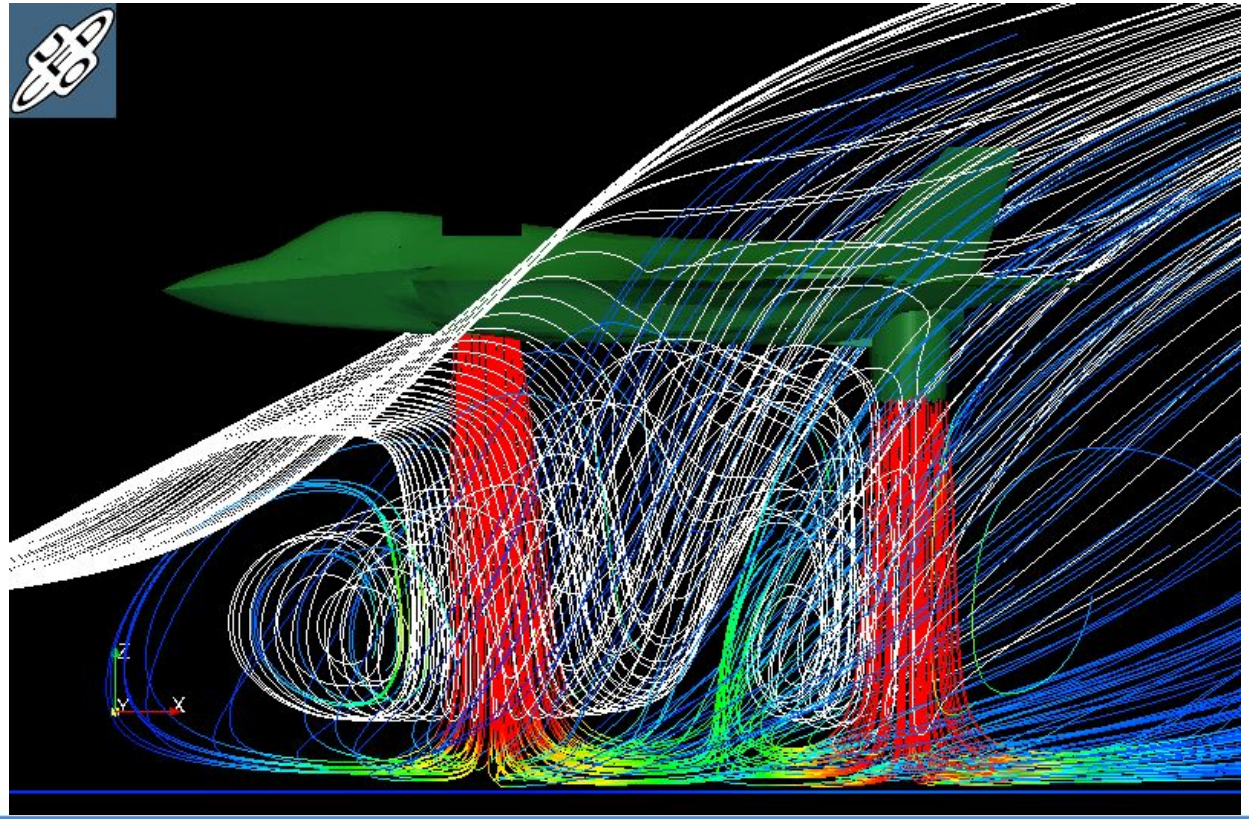

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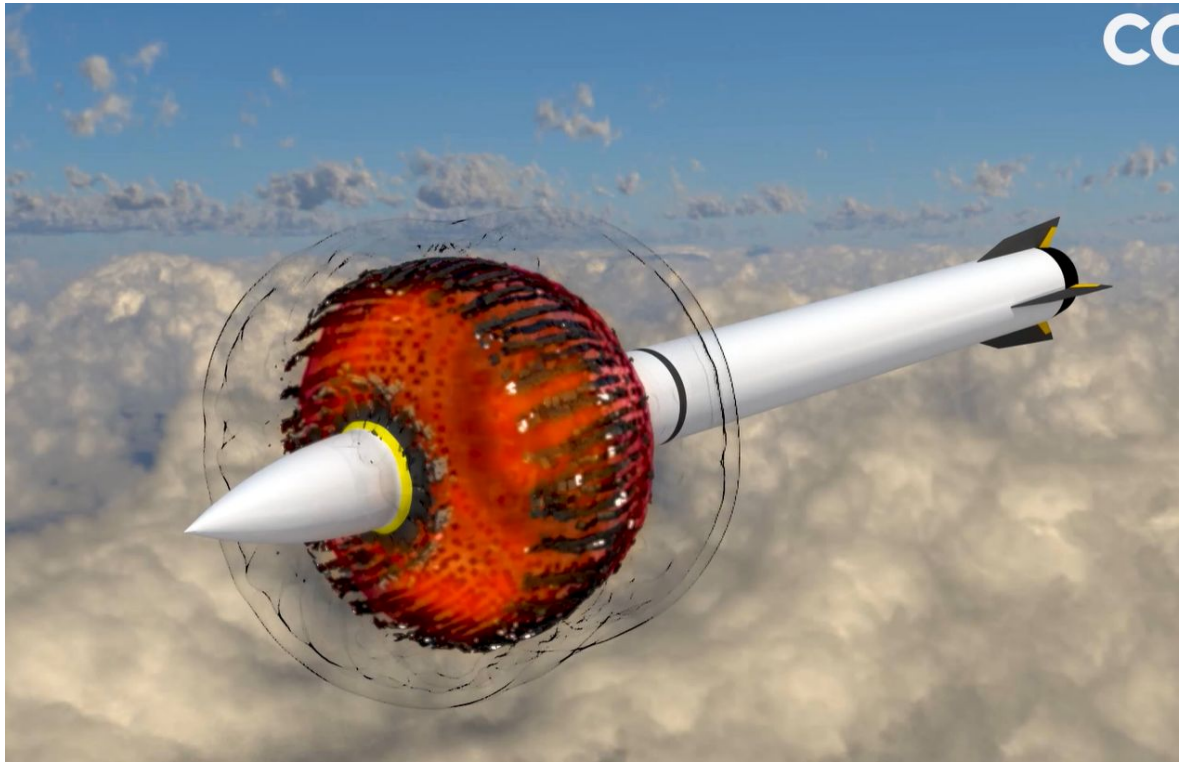
Notional Missile Warhead Detonation on Vimeo



Paraview Web

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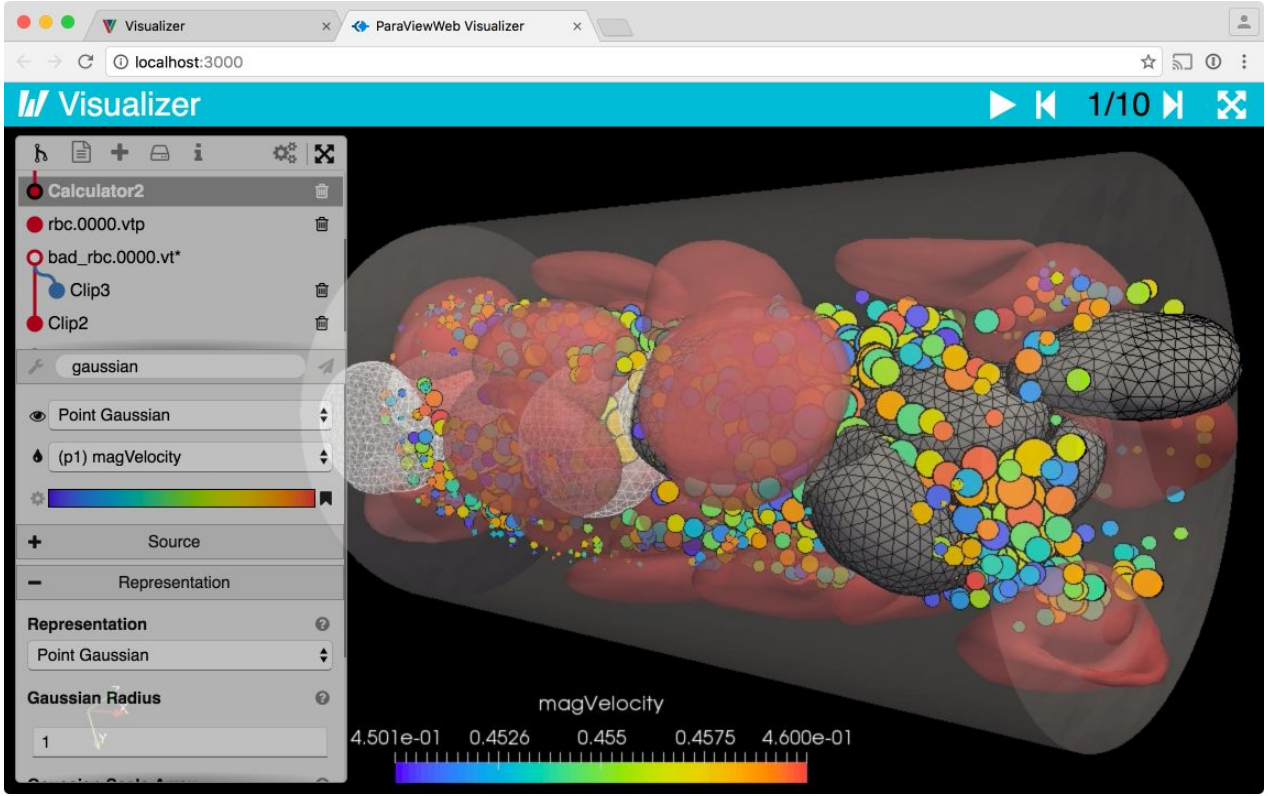

DataViewer (beta, big data)

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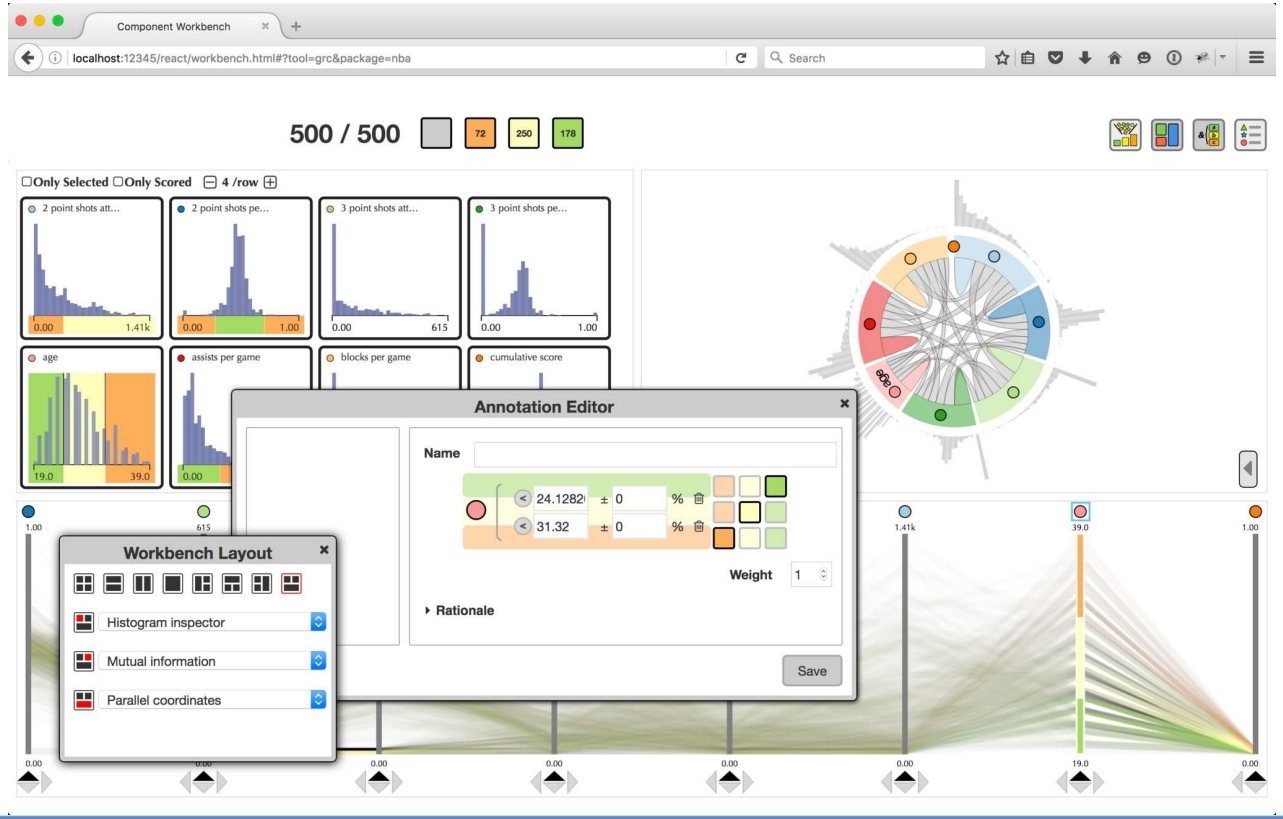

Parallel computing to achieve more

Large tasks: needs performance

One step at a time takes time!

If you can’t split your data, you’ll fill up the RAM

-> can cause errors and delays

But, but my computer is lame...

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Use a supercomputer!

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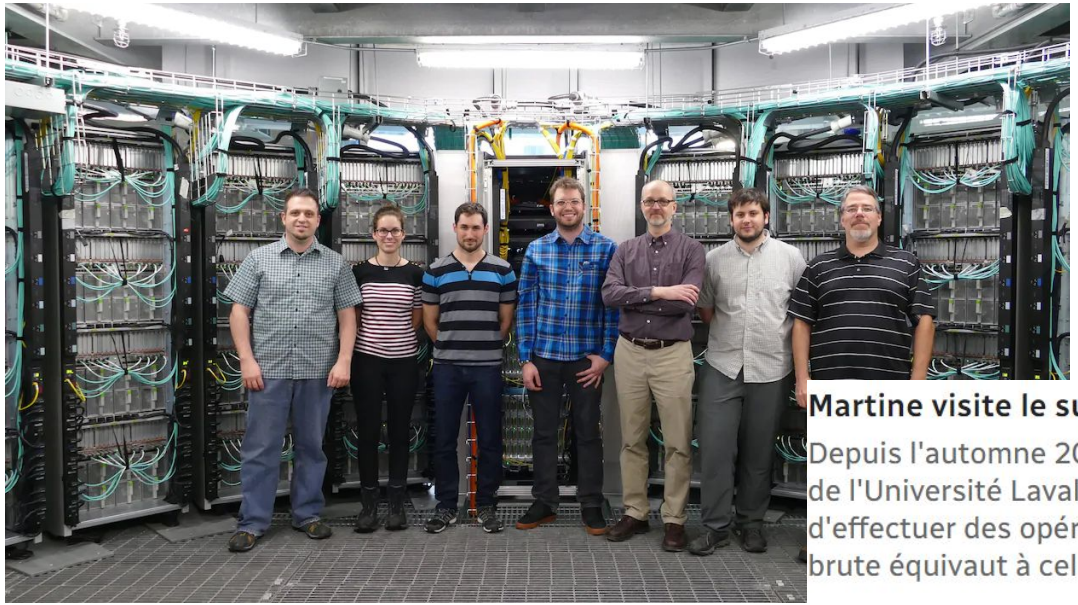

Martine visite le supercalculateur de l'Université Laval

Depuis l'automne 2009, un superordinateur est en fonction sur le campus de l'Université Laval. Il permet à des chercheurs du Québec et du Canada d'effectuer des opérations de calcul de haute performance. Sa puissance brute équivaut à celle de 3 800 ordinateurs personnels.

https://ici.radio-canada.ca/premiere/emissions/premiere-heure/segments/chronique/67273/colosse-ul-supercalculateur-martine

Maybe she's born with it, maybe it's ParaView

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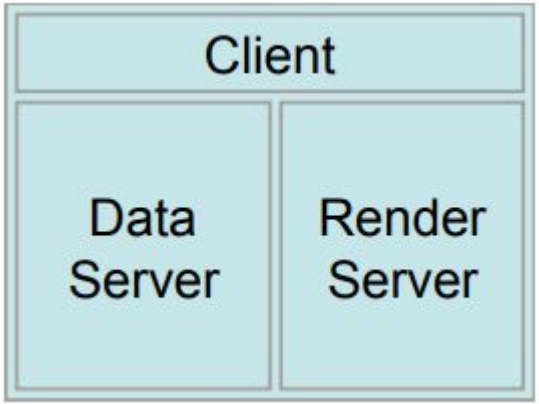
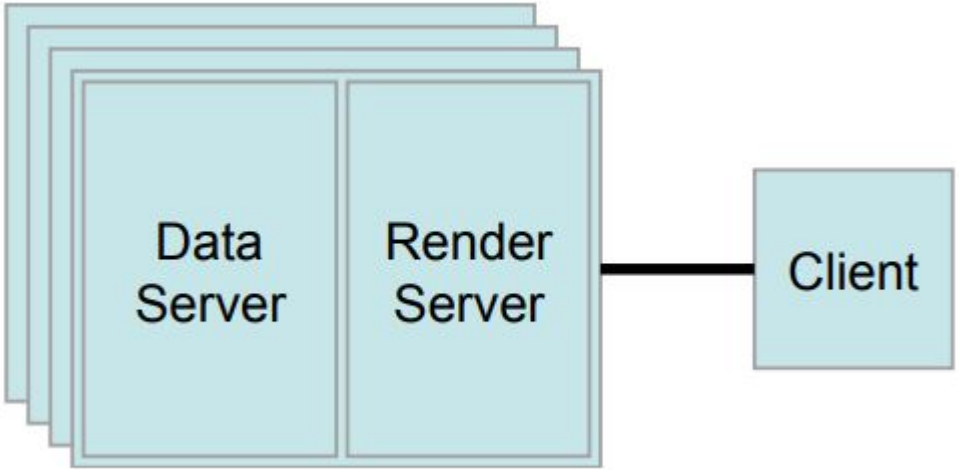
Local mode



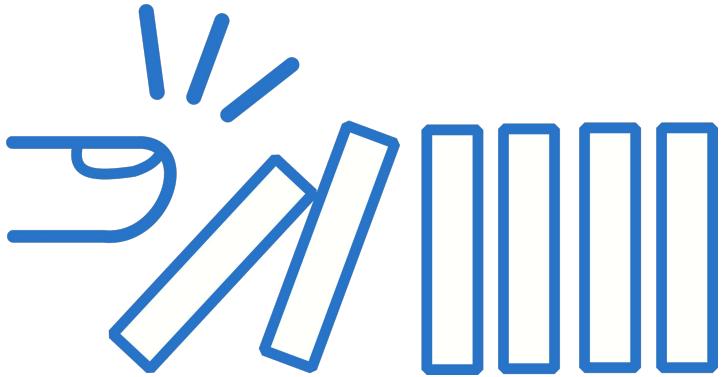
Remote mode



Sequential tasks

Use one node, one core

DON’T benefit from clusters



Parallel tasks

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Can use multiple cores and multiple nodes at once

Parallel rendering

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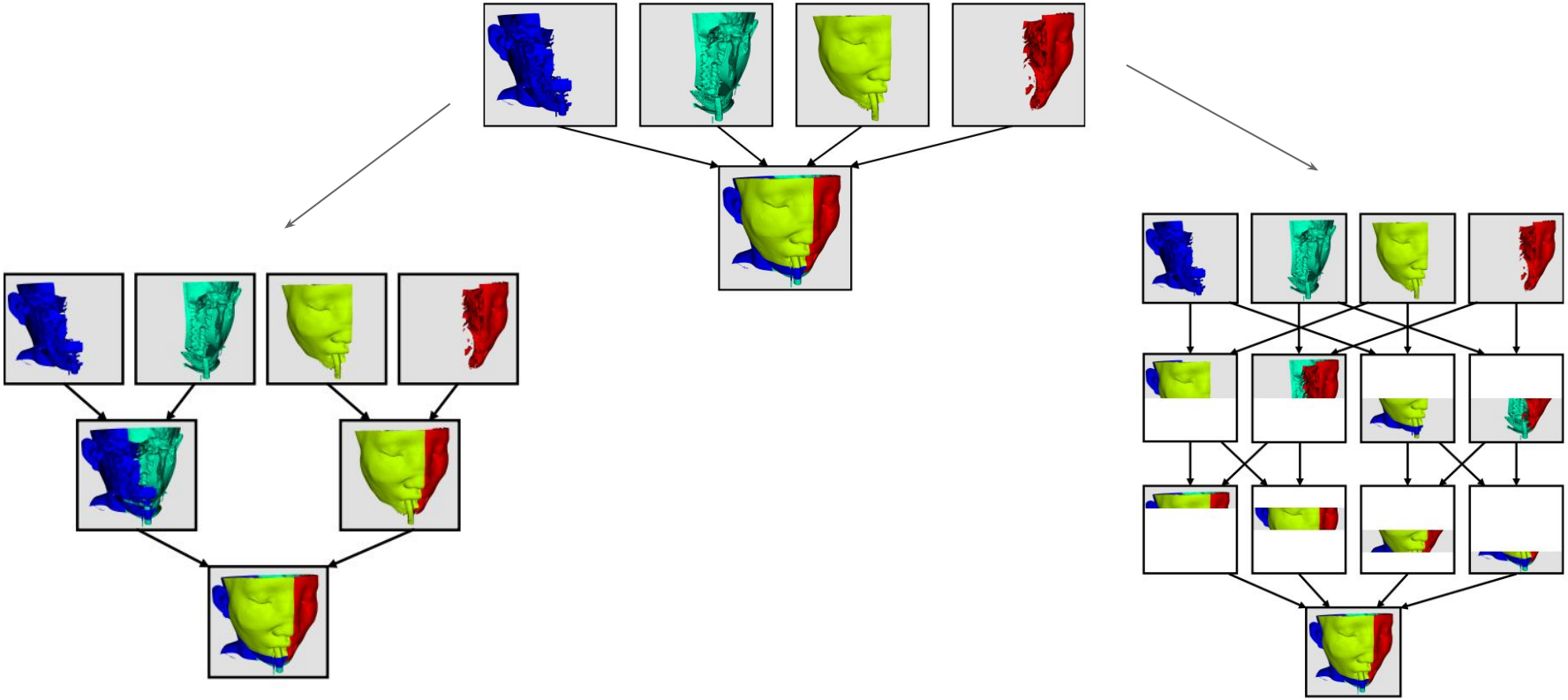

You can do more with your laptop

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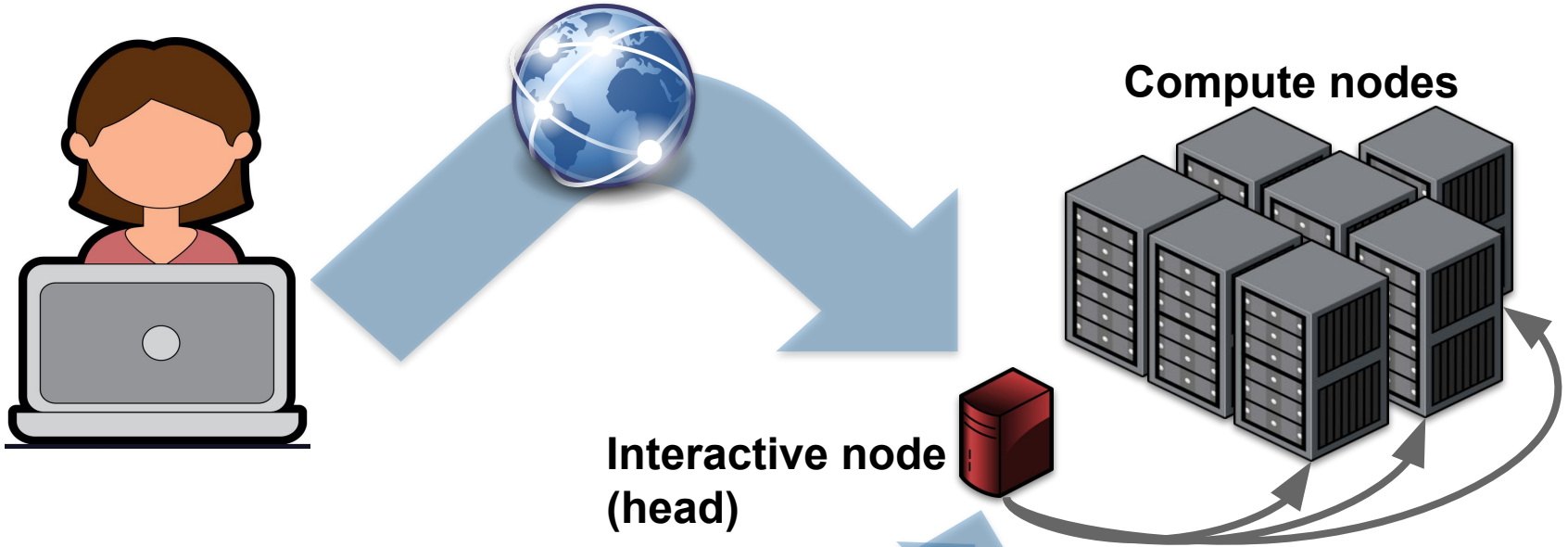

All is managed automatically

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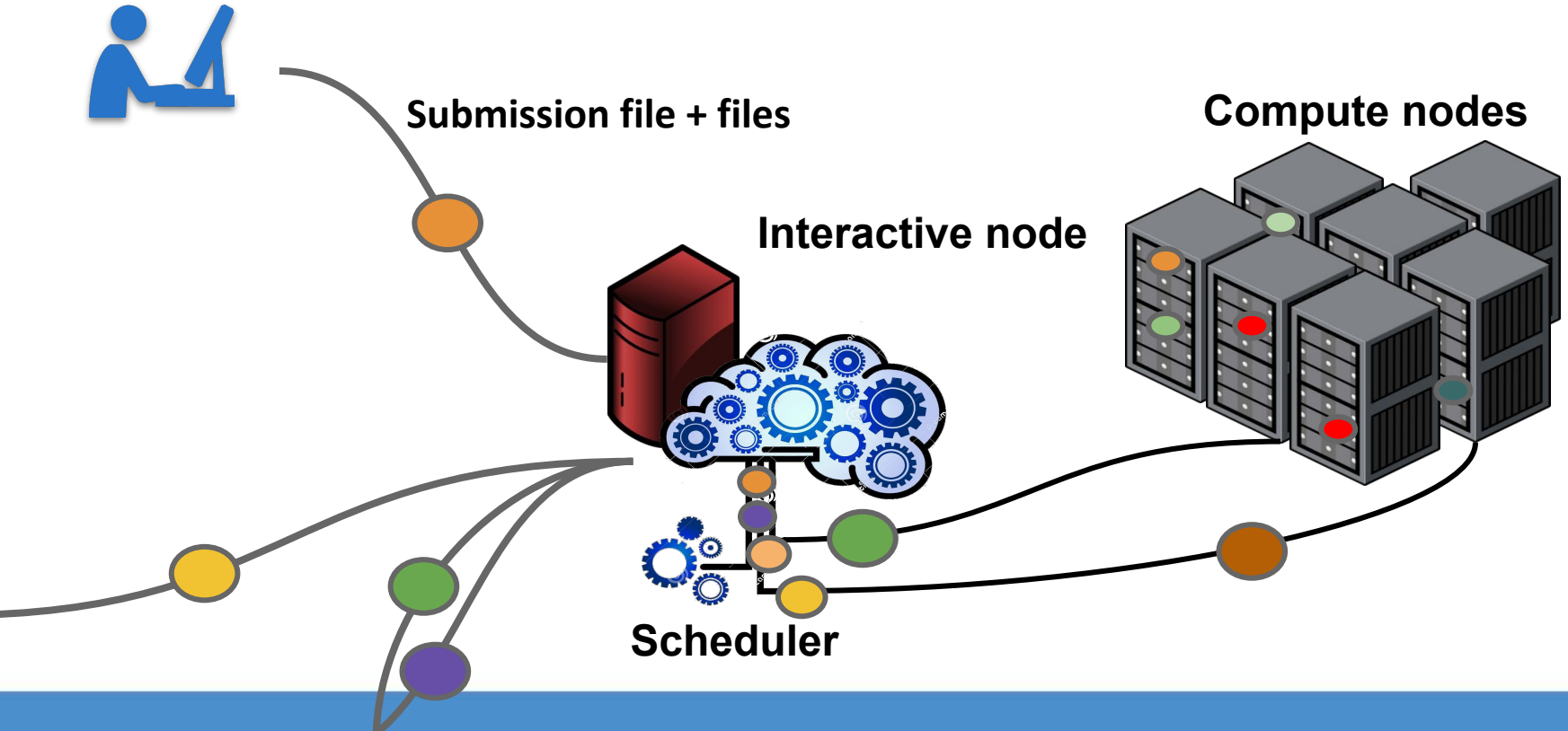

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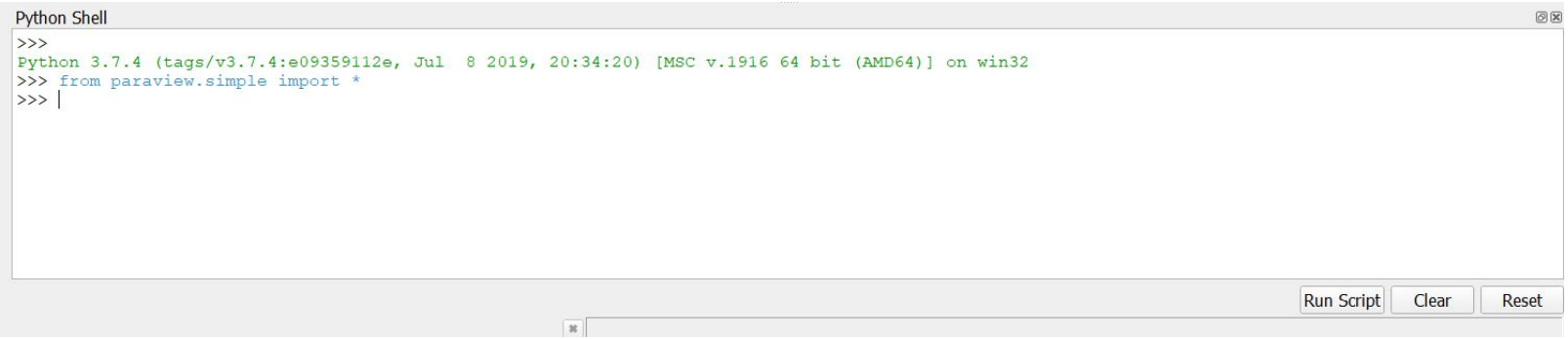
Extreme visualizations require some code

Two ways to create code

1. Let ParaView record your actions

2. Write it yourself! (i.e. Python code)



1. Let ParaView record

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- PV can keep track of every step towards your desired visualization
- Similar to macros in office
  - There’s even a specific way to write macros!

Trace: intuitive approach

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- Very readable generated code
- A good way to start learning or if you're just dabbling
  - "file -> save state" if you didn't start tracing right away
- If you want to save just a part and not the whole thing, you can save as macros

2. Writing your own pipeline

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- Better control
- Add your own comments right away
- You can be specific about your parallel code
- More liberty to use other python modules

2 types of pipelines i PV

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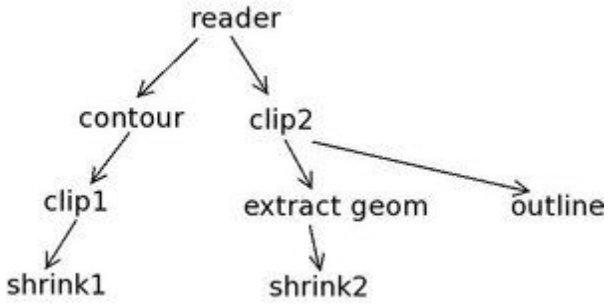
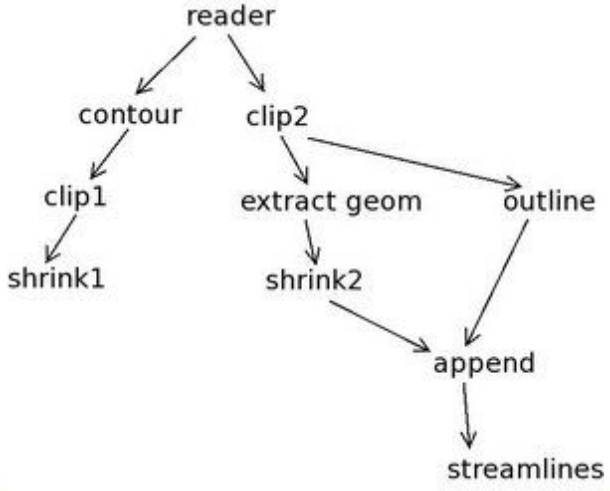
Fan out:



Fan in:



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Let’s try it!

Connect to the cluster

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1. Go to the list of usernames

   http://bit.ly/pvusernames

2. Find your username, be careful to pick the right one!

3. When it’s done, write OK in the confirmation column

Now head over to

paraview.calculquebec.cloud

Username:
Username you copied
Password:
I'll type it

Once you get there, stop!

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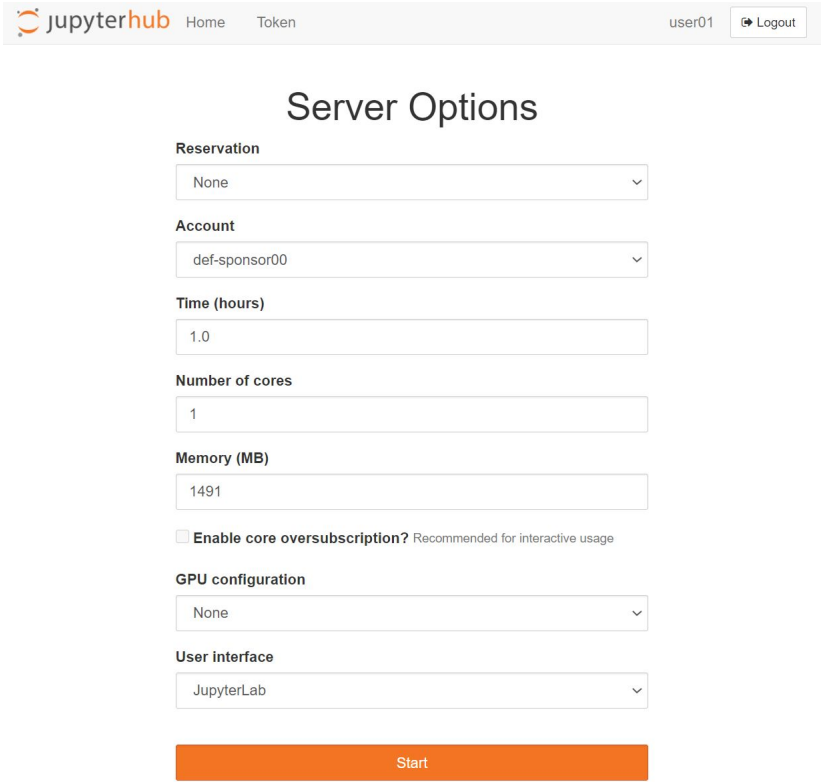

Make sure to set these

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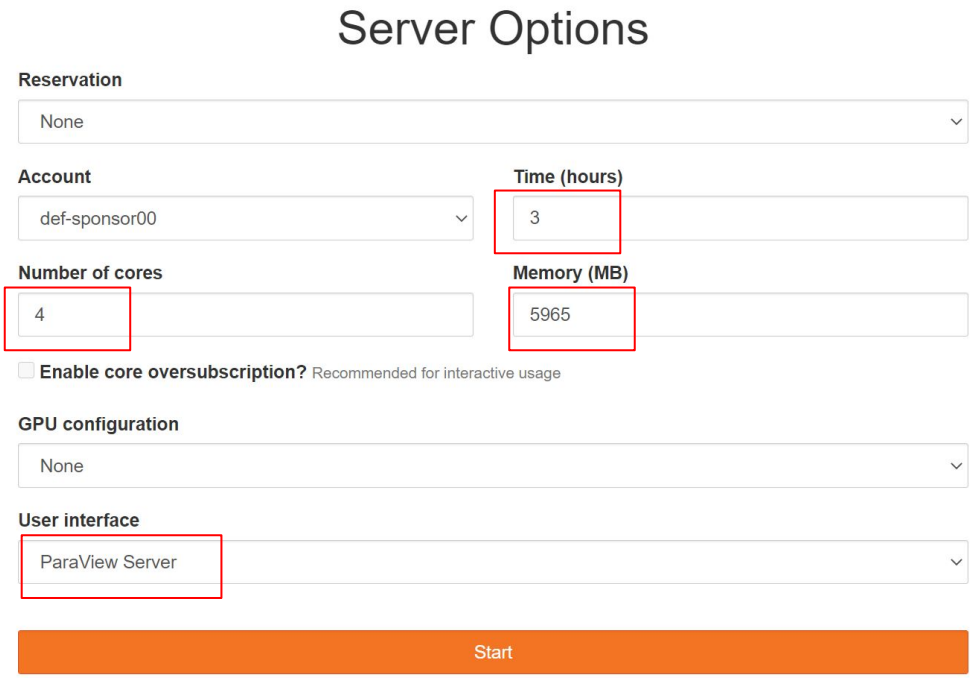

In terminal/MobaXterm

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Instructions

1. In a terminal on your computer, create an SSH tunnel between the compute node and your computer using the following command:

```
ssh user40@paravi                                    node1.int.paraview.calculquebec.cloud:44480
```

Copy and paste this part

2. Start ParaView 5.8.0 on your computer
3. Go to File -> Connect
4. Click on Add Server
5. Enter:
    - Name: `paraview.calculquebec.cloud`
    - Server Type: `Client/Server`
    - Host: `localhost`
    - Port: `11111`
6. Click on Configure, select Manual
7. Click on Save
8. Select the server from the list and click on Connect.
9. If you refresh this page, you should see "Client connected" in the command-line output section.
10. Open a file in ParaView (it will point to your remote filesystem) and visualize it as usual.

We'll do this later

Command-line output

Control panel

In terminal/MobaXterm

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git clone https://github.com/calculquebec/paraview_eng.git

Copy the output into ParaView

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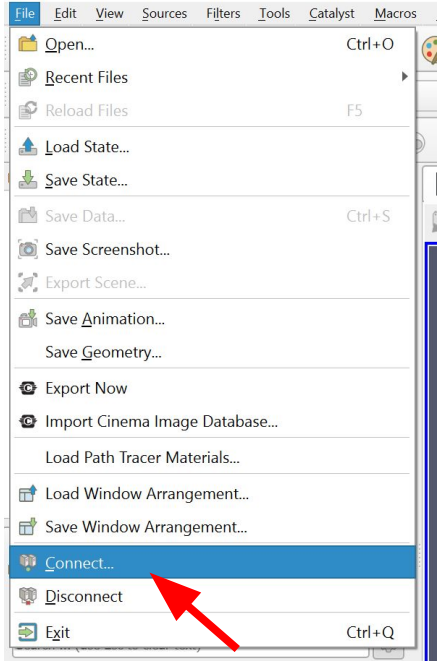
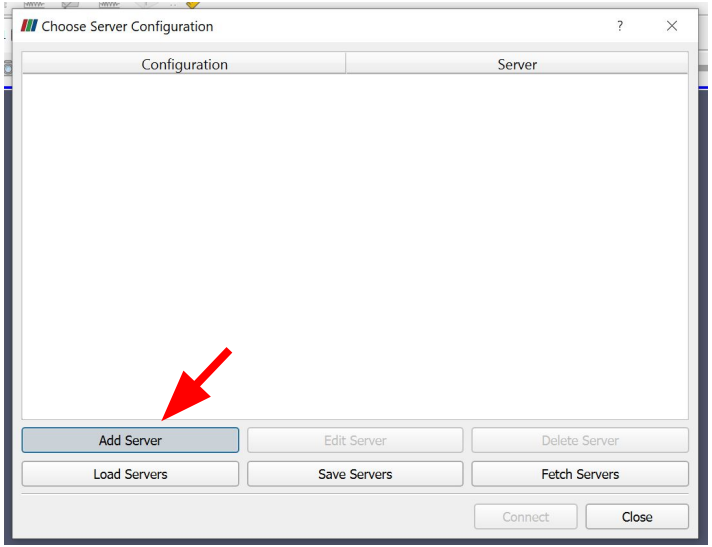
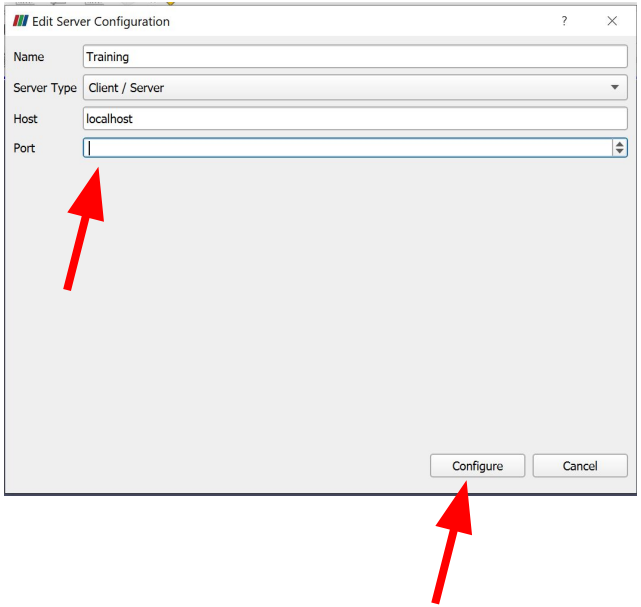
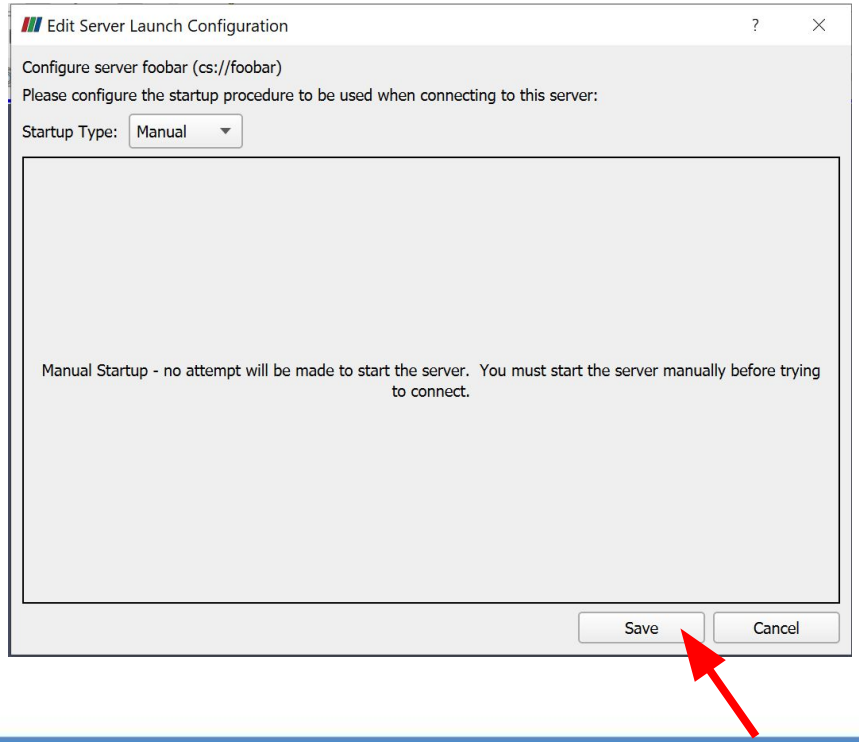
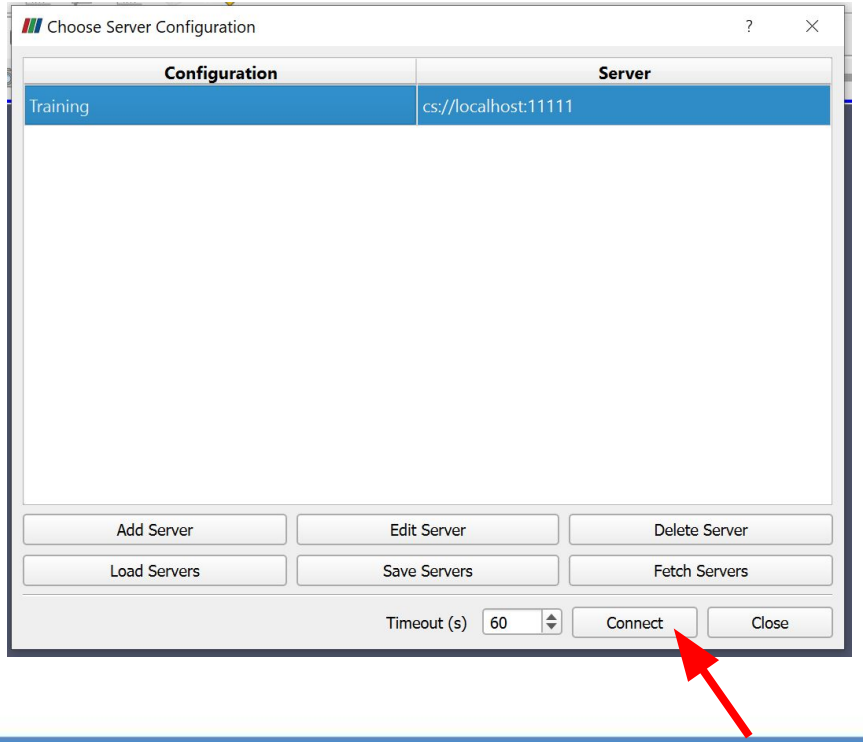







Edit Server Launch Configuration
Configure server foobar (cs://foobar)
Please configure the startup procedure to be used when connecting to this server:
Startup Type:
Manual
Manual Startup - no attempt will be made to start the server. You must start the server manually before trying to connect.
Save
Cancel


Choose Server Configuration
Configuration
Server
Training
cs://localhost:11111
Add Server
Edit Server
Delete Server
Load Servers
Save Servers
Fetch Servers
Timeout (s)
60
Connect
Close

1. Use trace to animate can

- Start trace: tools > start trace + ok
- Can.ex2 + all variables + apply
- Color by EQPS
- Play + rescale + play
- Animation view
- Camera + follow data + “+”
- Stop trace
- File > save as macro
- Reset + click macro

2. Thorax: DICOM

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- Unzip data
- Open DICOM file: DICOM reader (directory) + apply
- Rendering: Dicomimage
  - 1. Surface
  - 2. Volume
- Coloring > edit > presets > yellow - gray
- Invert

3. Multiple pipelines: lake

- Pipeline 1: Lac_terrain.csv
- Filter: table to points (set x,y,z)
- Close table + open eye
- Color: ombre
- Edit: presets > shades of green
- Invert color

3. Multiple pipelines: lake

- Pipeline 2: lac_full_volume.csv
- Filter: table to points (set x,y,z)
- Close table + open eye
- Color: elevation2
- Edit: presets > black, blue, white
- Adjust gradient

3. Multiple pipelines: lake

- Move terrain down
  - Advanced > transforming > translation
  - Z = -159
- Make video
  - Animation : orbit + “+”
  - Double click orbit + Path
  - Adjust camera position + ok
  - Mode: Real time - Duration: 20s

4. Run parallel script

- Open Python Shell
- Open automatic.py
- Copy lines of code into shell
- Clear
- Click run script

Good to know

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1. Ask as much as you'll need

    a. Structured data
        i. 1 core/20 million cells 
        ii. 1 coeur/5-10 million cells ★★★★
    b. Unstructured data
        i. 1 core/5-10 million cells 
        ii. 1 core/250-500k cells ★★★★

Good to know

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2. Avoid data explosion
   - PV tries to avoid making copies: “fake” copies that point to the original
   - Some filters: can’t escape it! <= avoid if you are about to run out of RAM!

Good to know

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3. Cull data

- Right at the beginning!
- Start with a volume, make a surface
- Clip if what you need is inside
- “Extract subset” if you aren’t too sure

Rendering options

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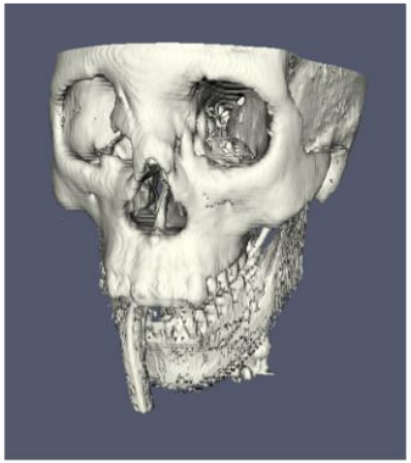
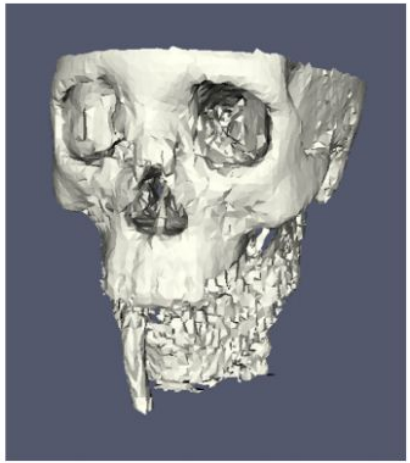
“Level of detail” (LOD)

Edit -> settings -> Render View

Pleine résolution



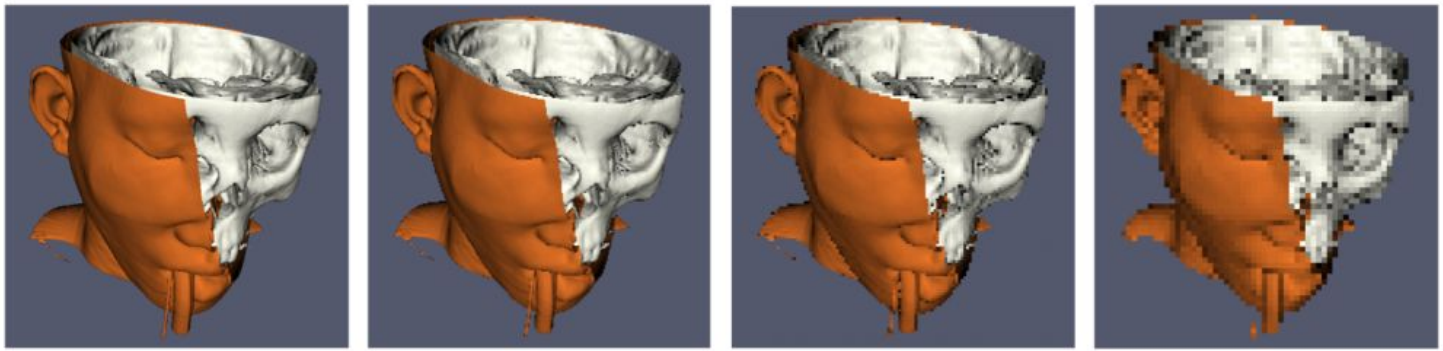
Interactif



Minimal

Compressing and shipping data

Algorithms that allow image compression and extraction locally according to your computer’s capacities.

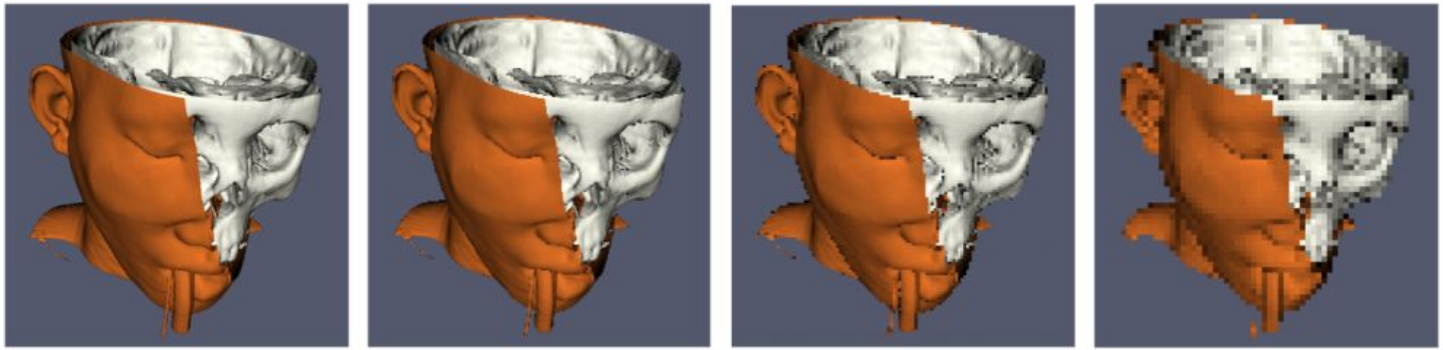


Compression et expédition de l’image

Squirt - réduit profondeur des couleurs

Zlib - meilleur résultat, plus lent

LZ4 - récent, rapide



Final exercise

Fill out the survey!

More information

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Wiki - ParaView

https://www.paraview.org/Wiki/ParaView

Wiki - Compute Canada

https://docs.computecanada.ca/wiki/ParaView