

Construire, contrôler et exécuter un jumeau numérique avec des outils de visualisation scientifique

2024-05-29 - François Mazen

Kitware?



Kitware / Leader in AI & scientific open source solutions

Software development

Based on open source tools
300+ active projects worldwide



Sustained Growth

Since creation of the company
100% employee-owned



230 employees Worldwide

6 offices across USA/Europe



65% staff with PhD or Master

High Level customer expertise



20+ years of expertise

Kitware USA, 1998
Kitware Europe, 2010

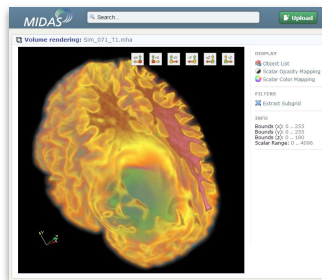


Revenue 2020

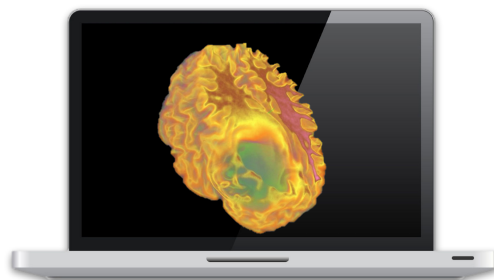
\$39M consolidated



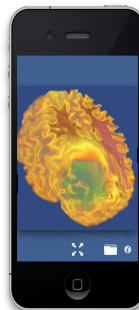
Applications / Universal Platforms



Web



Desktop



Mobile



Cloud /HPC

kitware
Platforms



3D Slicer



ParaView



KWIVER



mstk



Pulse
Physiology Engine



CMake



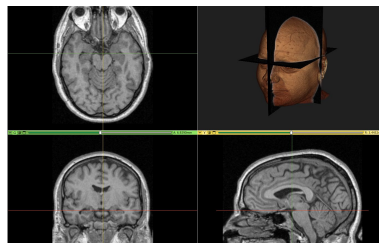
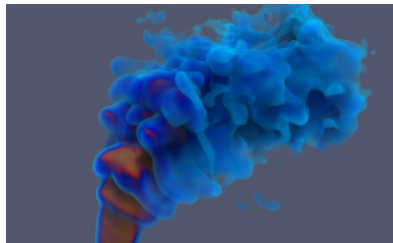
Resonant



tomviz



Areas of expertise / Built on open source



```
ceLists.txt
CMakeLists.txt x main.cp
1 cmake_minimum_requir
2 project(cmake_testap
3
4 set(CMAKE_CXX_STANDA
5
6 add_executable(cmake
soles
```



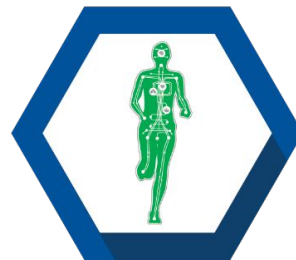
Computer
Vision



Data and
Analytics



Scientific
Computing



Medical
Computing



Software
Solutions

Kitware / Services



TRAINING



SUPPORT



DEVELOPMENT



GRANT
COLLABORATION

Qui suis-je ?

- François Mazen
- Directeur Visualisation Scientifique à Kitware Europe, France
- Carrière dans les logiciels pour la simulation scientifique (Ansys, Siemens PLM)
- Développeur de logiciels libres
- Mainteneur de la distribution linux Debian



Systeme Réel

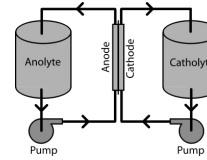


Systeme R el



Envoie des informations

Mod le Num rique

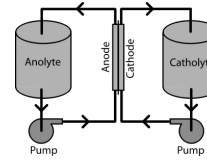


Systeme R el

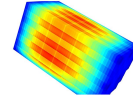


Envoie des informations

Mod le Num rique



Visualisation

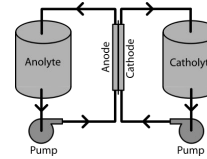


Systeme R el

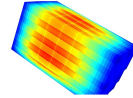


Envoie des informations

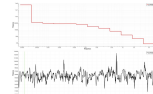
Mod le Num rique

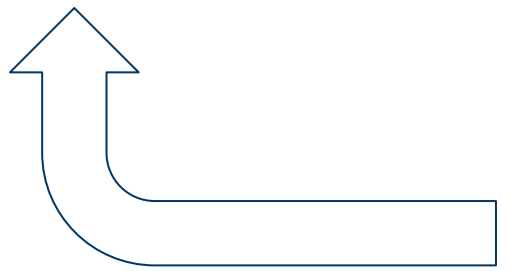
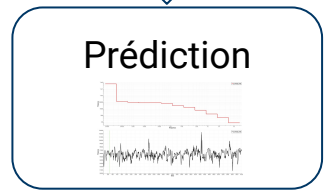
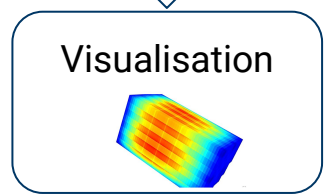
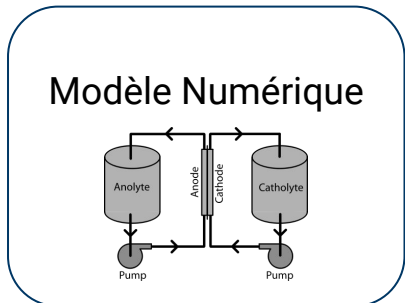


Visualisation

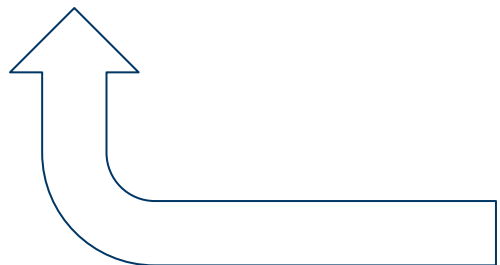
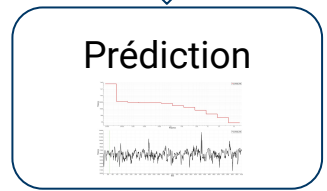
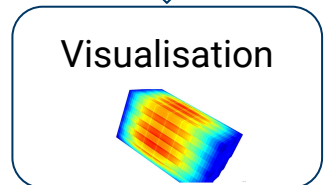
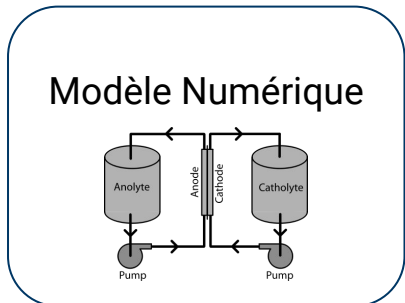


Pr diction

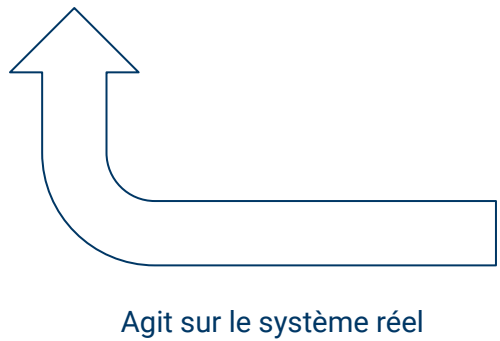
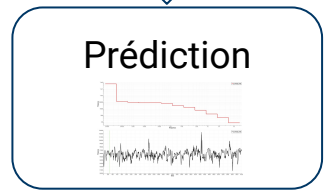
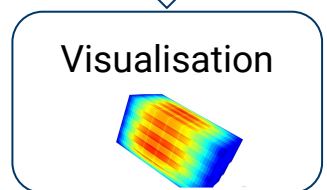
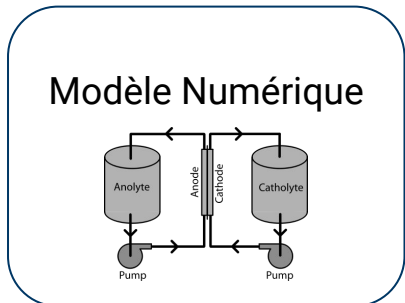




Agit sur le système réel



= Jumeau Numérique

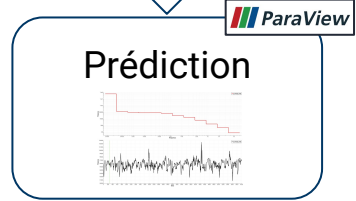
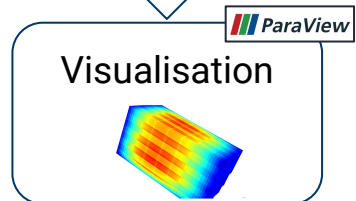
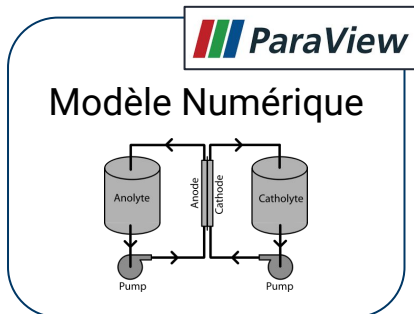


= Jumeau Numérique





Envoie des informations



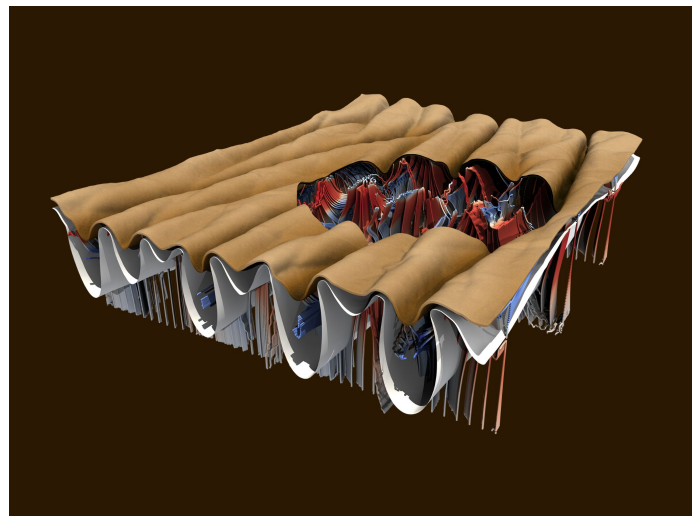
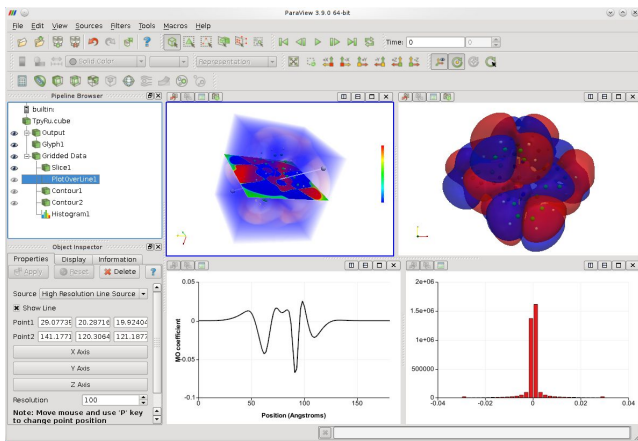
Agit sur le système réel

= Jumeau Numérique



ParaView / High-Performance Post-Processing (2002)

- Open-source, multi-platform, data analysis and visualization application
- Analysis of extremely large datasets using distributed memory computing resources

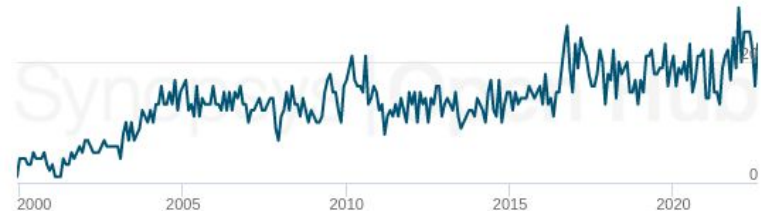


ParaView Community

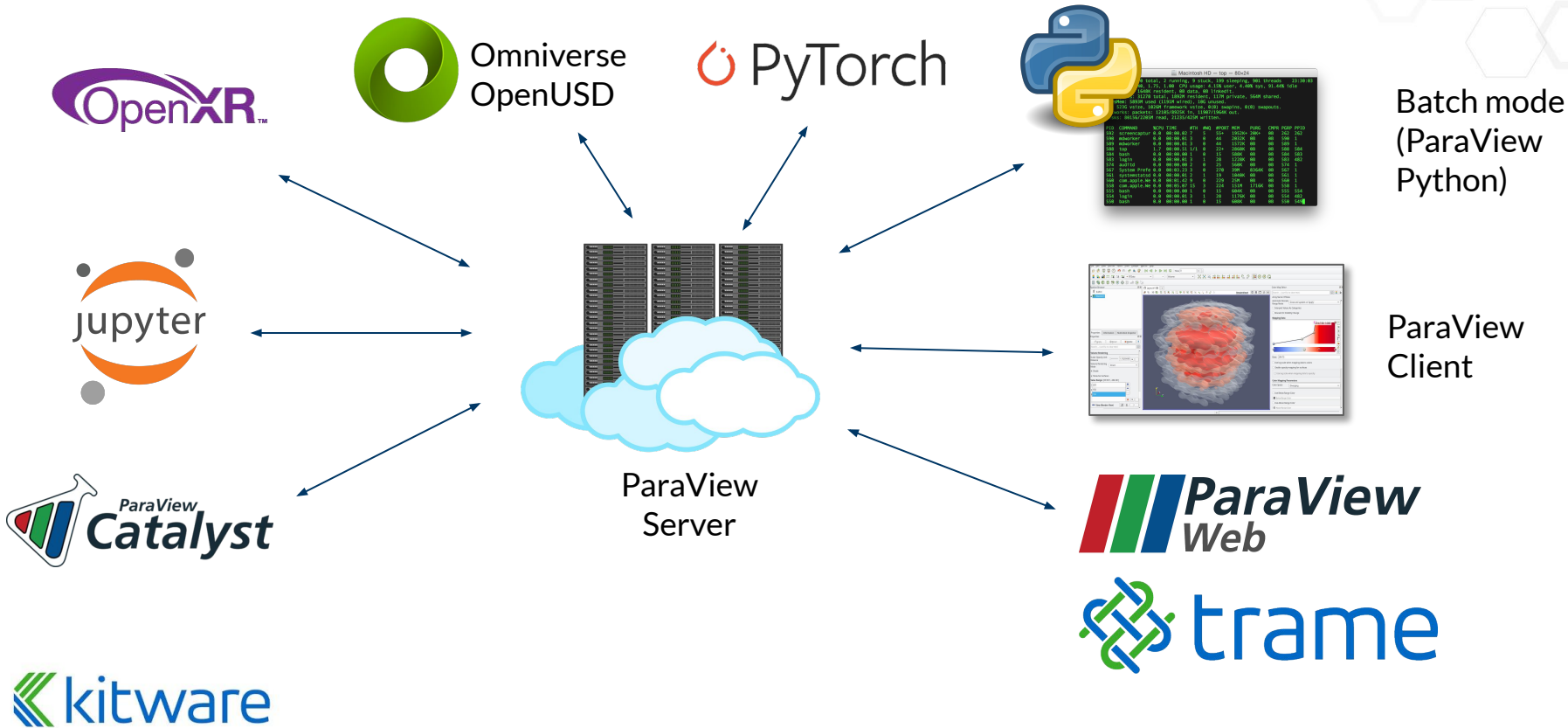
- **Open Source Software (BSD license)**
- **Run on most of Top500 HPC**
- **300000+ download yearly from Kitware servers**
 - More users via other unknown download channel (Linux packaging, Enterprise distribution...)
- **157k commits made by 339 contributors since 2000**
- **1.6M lines of code**



Contributors per Month



ParaView Ecosystem



ParaView / Nvidia



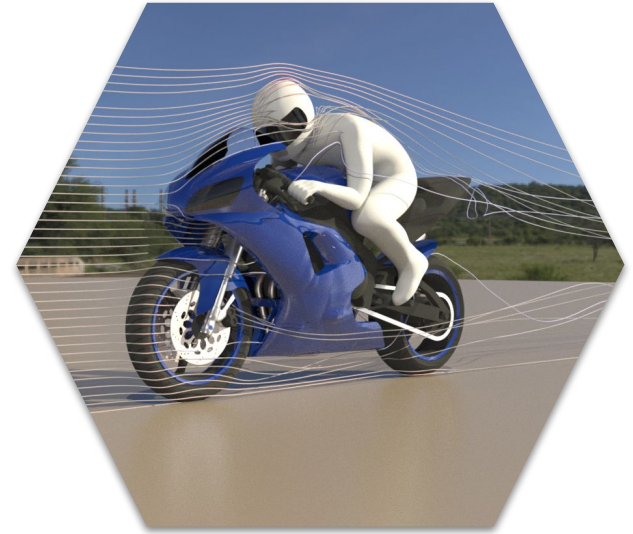
- ◆ **On-Demand rendering**
 - Omniverse ParaView Connector
- ◆ **3D Volumetric visualization**
 - ParaView plugin for Index
- ◆ **Ray-tracing**
 - OptiX integration with ParaView



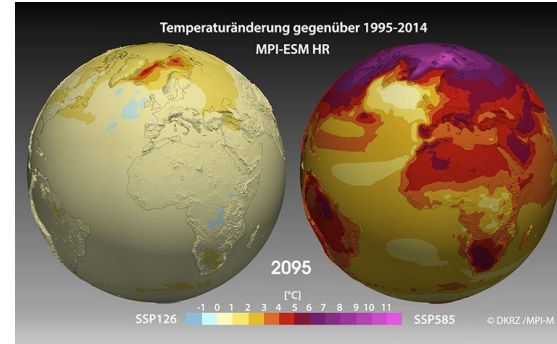
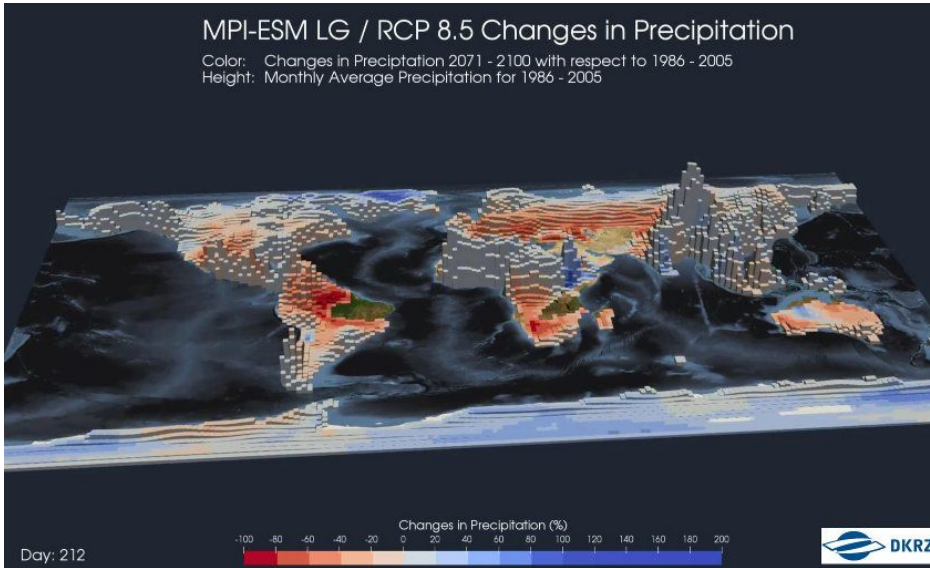
ParaView / Intel



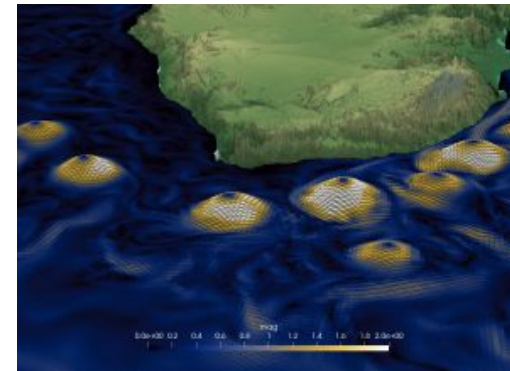
- ◆ **Distributed Rendering on CPUs**
 - The Open, Scalable, and Portable Ray Tracing Engine (OSPRay)
- ◆ **Code parallelization**
 - Threading Building Blocks (TBB)
- ◆ **Intel GPU support**



ParaView Use Cases: Climate Simulation (DKRZ)

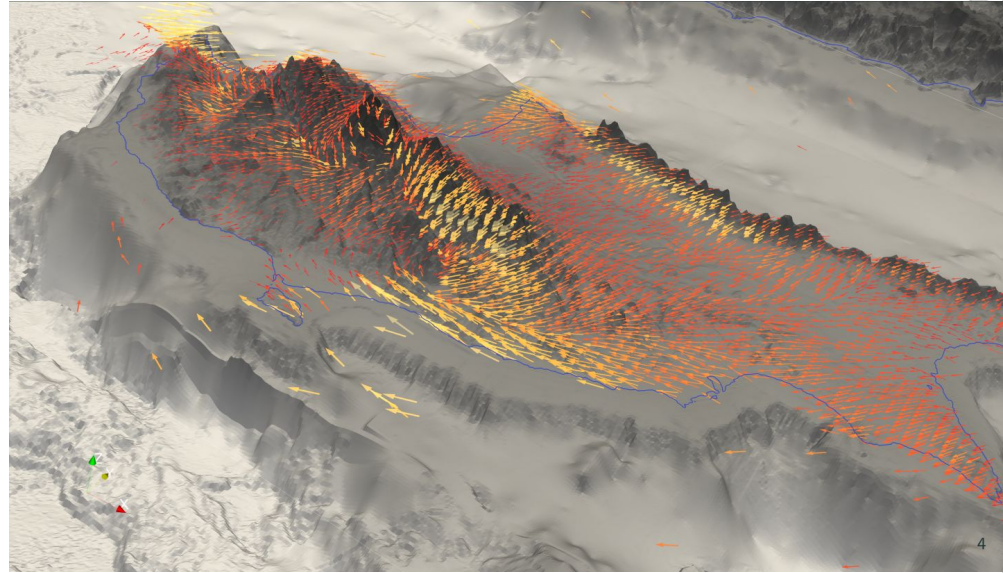
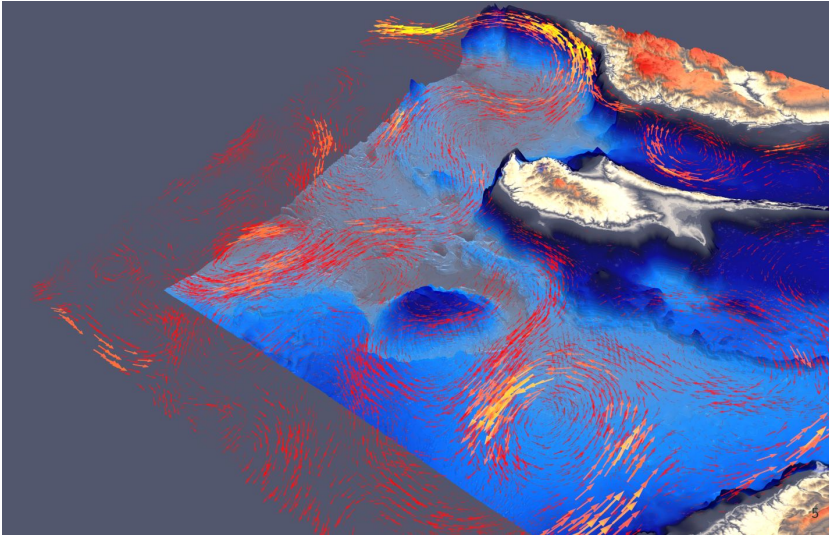


IPCC Report



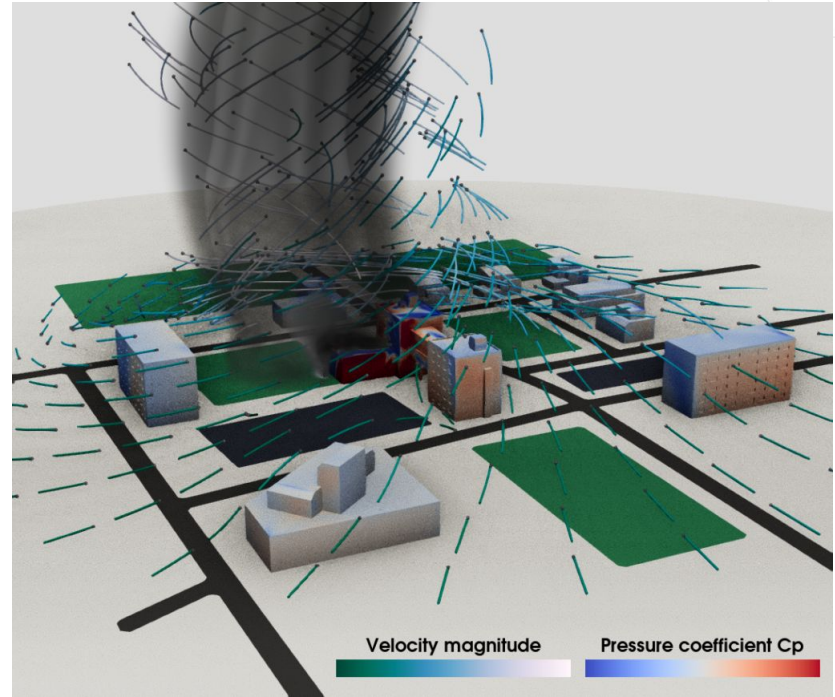
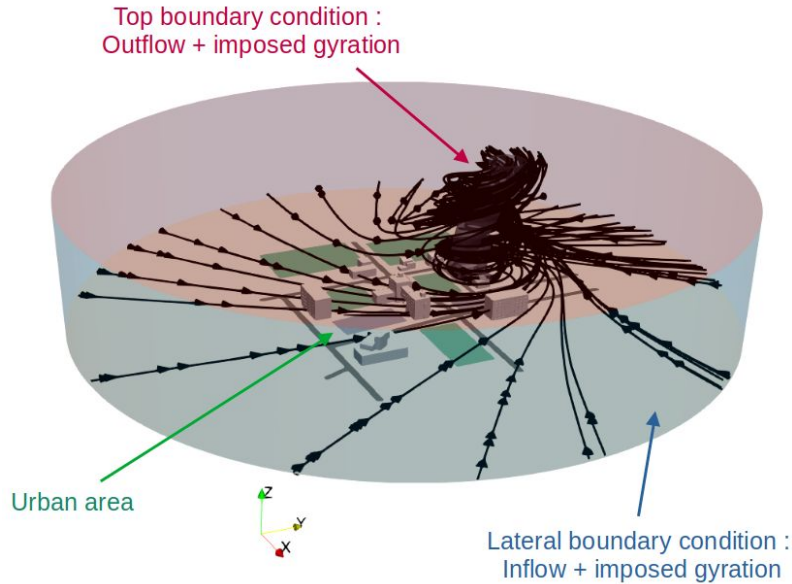
<https://www.dkrz.de/de/kommunikation/klimasimulationen>

ParaView Use Cases: Weather Forecast (The Cyprus Institute)



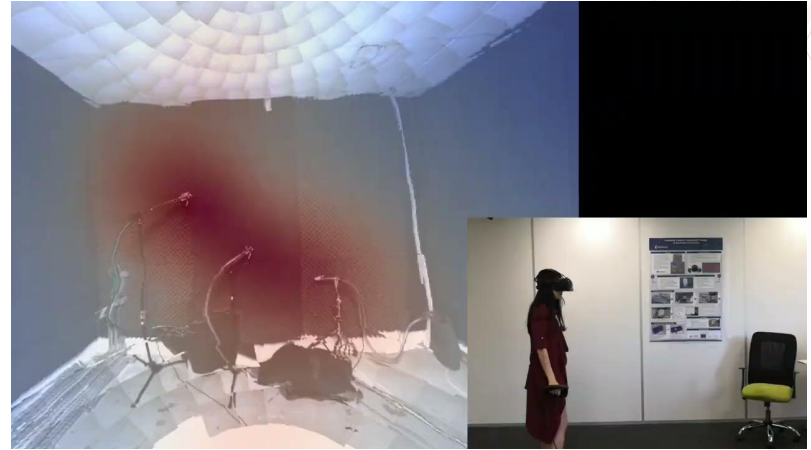
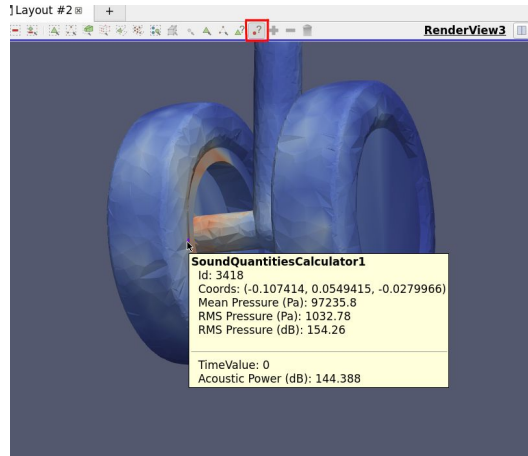
<https://www.kitware.com/scientific-visualization-of-weather-research-and-forecasting-model-output-in-paraview/>

ParaView Use Cases: impact of tornado wind on buildings (NemosFlow)



CALM-AA: Tooling for Aeroacoustic Studies

convergence of digital simulation approaches and experimental tests during work on the reduction of aeroacoustic noise



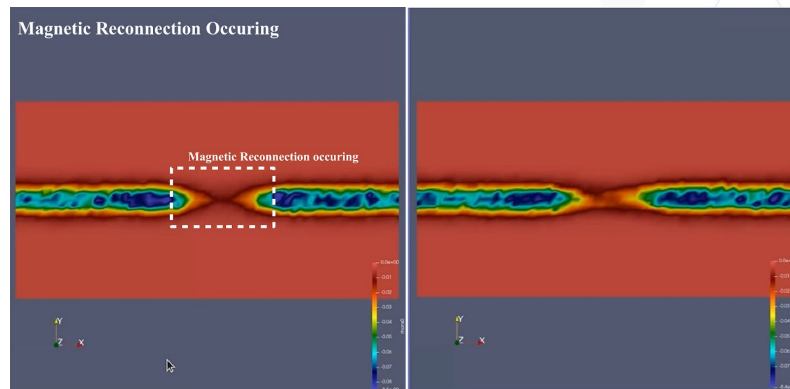
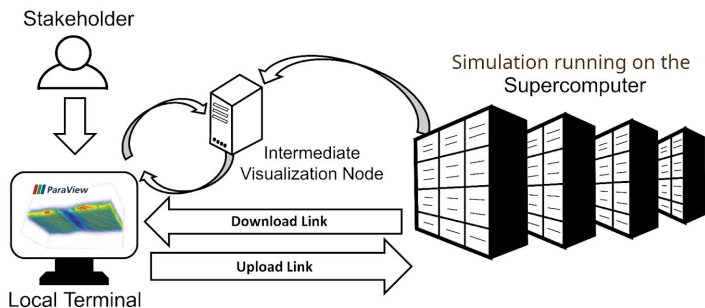
Acoustic Data Visualization using VR in ParaView

<https://www.kitware.com/explore-large-acoustic-data-with-the-digital-signal-processing-plugin-in-paraview/>

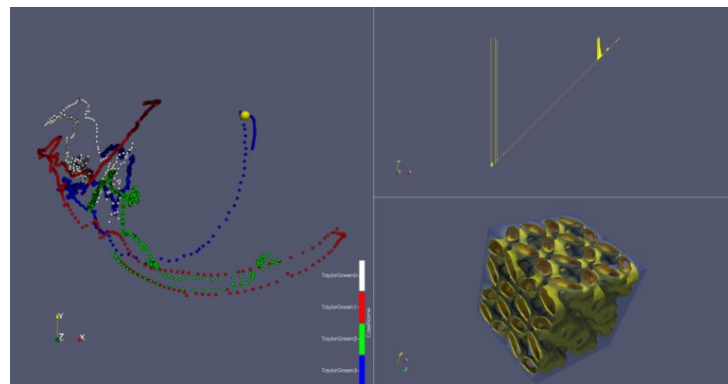
VESTEC: Visual Exploration and Sampling Toolkit for Extreme Computing

Urgent decision making using ensemble simulation and *in-situ* analysis with ParaView Catalyst

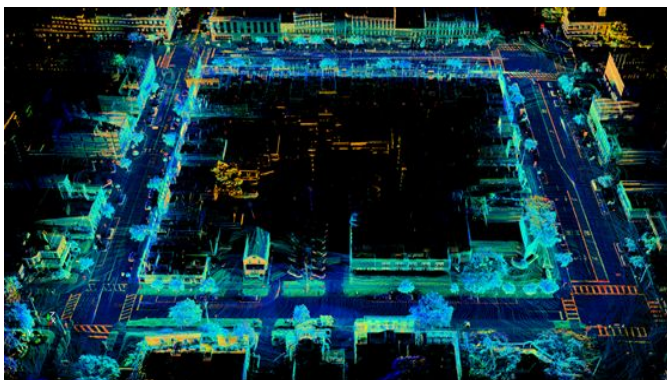
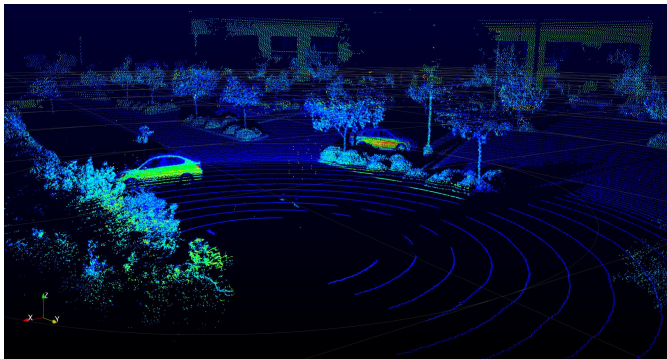
Generic Use-Case Workflow



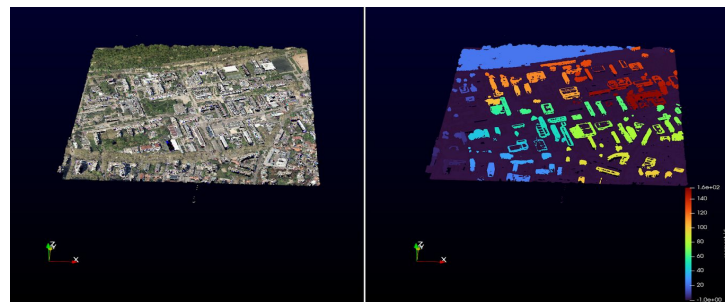
space weather event using the iPIC3D simulator



LidarView A Visualization and Analytics Toolkit



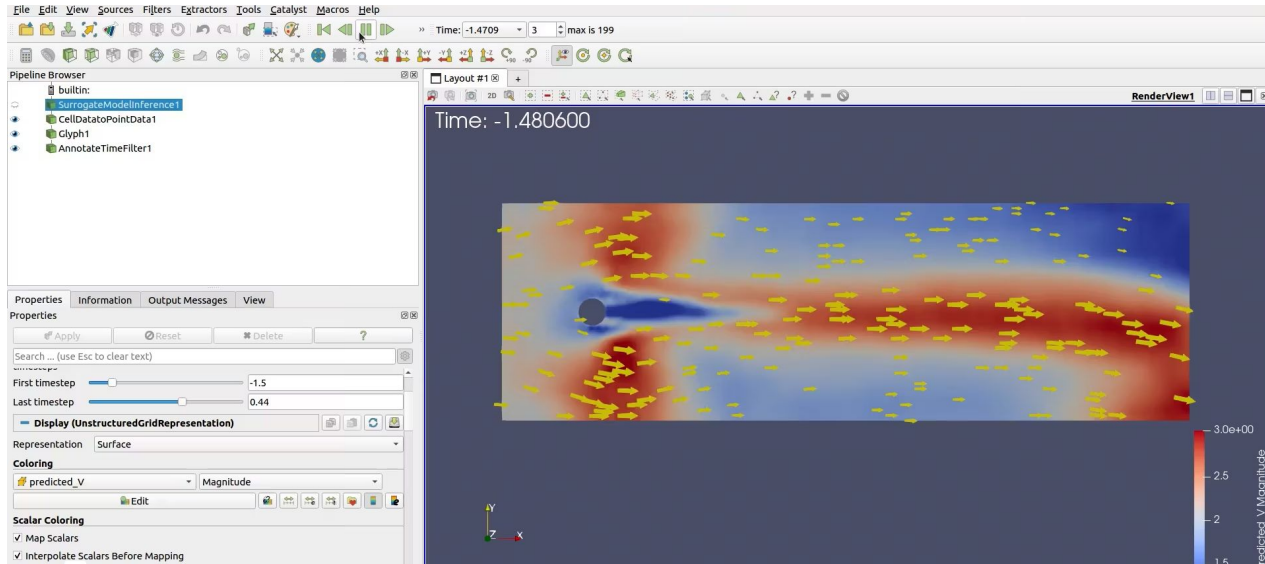
Deep Learning with Lidar Data



IA + HPC = ParaView ?

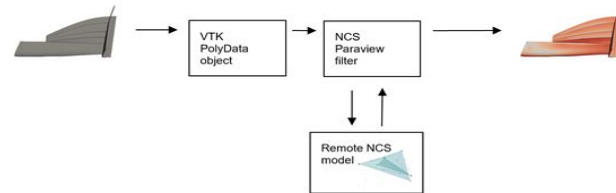
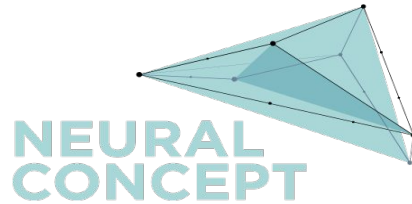
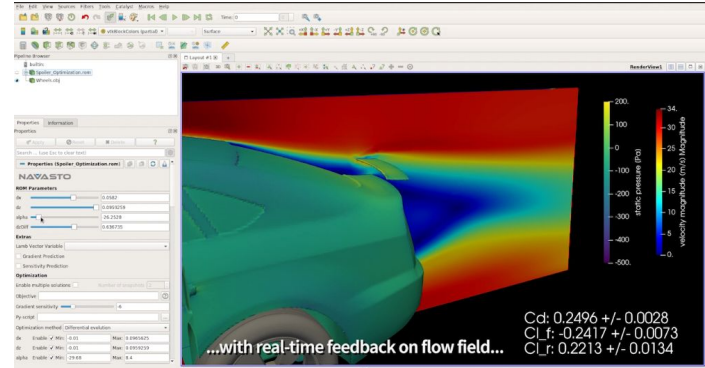
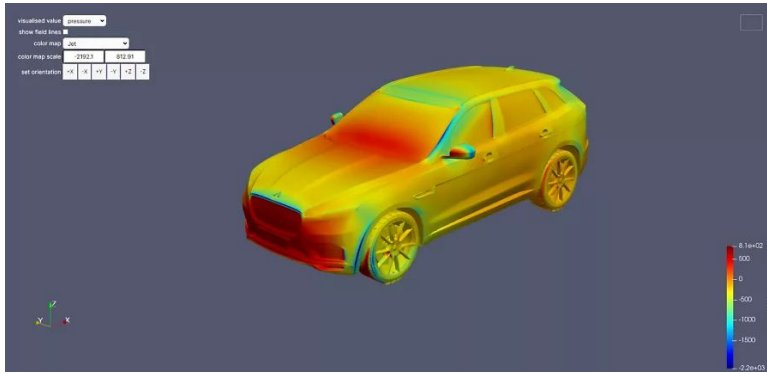


Surrogate Model Inference in ParaView



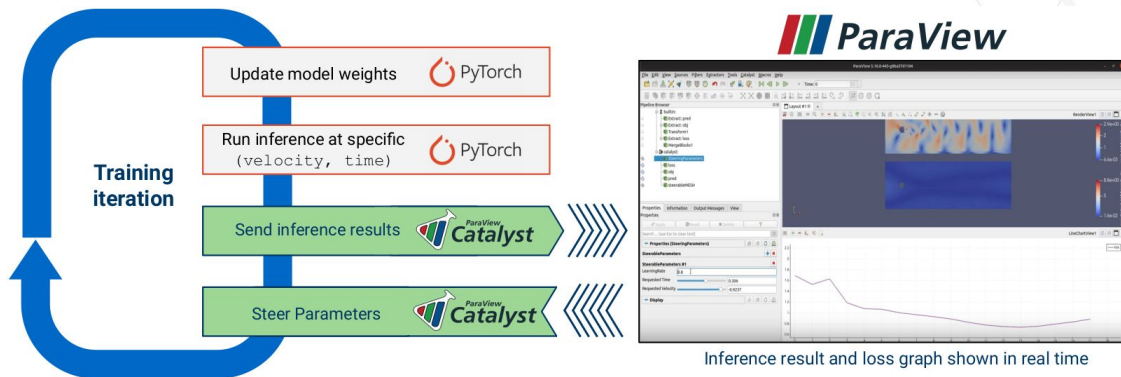
https://player.vimeo.com/video/681359142?h=256ce5d59f&dnt=1&app_id=122963

AI in ParaView



Surrogate Model Training Monitoring with ParaView

- ◆ Live visualization
- ◆ Steering to interact with the training



A. Ribes, F. Mazen, L. Meyer. In Situ Monitoring and Steering Deep Learning Training from Numerical Simulations in ParaView-Catalyst. Talk at In Situ Infrastructures for Enabling Extreme-Scale Analysis and Visualization (ISAV'22), November 13, 2022, Dallas, TX, USA.

F. Mazen, A. Schieb, A. Ribes, L. Meyer. Visualize, Monitor and Control the Training Process of a Deep Surrogate Model in ParaView. ISC HPC 2022 Project Poster Session. Hamburg, Germany. May-June 2022.

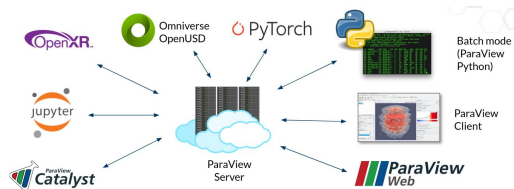
Jumeaux Numériques / Visualisation Scientifique



Jumeaux Numériques / Visualisation Scientifique



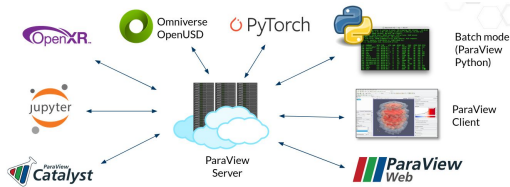
Construire



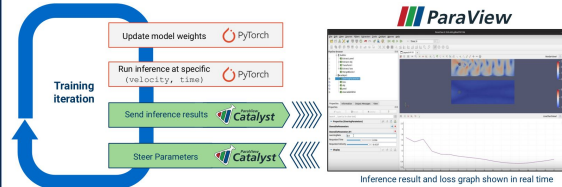
Jumeaux Numériques / Visualisation Scientifique



Construire



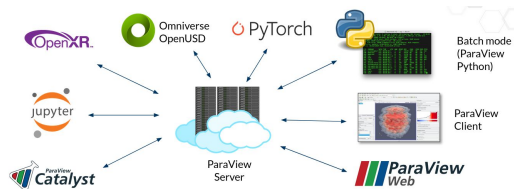
Contrôler



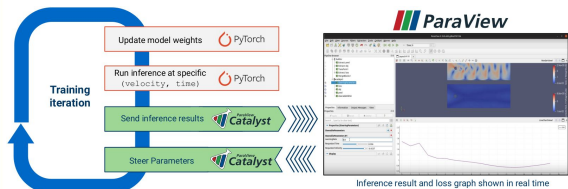
Jumeaux Numériques / Visualisation Scientifique



Construire



Contrôler



Exécuter





Take Part in the ParaView User Day Europe!

Lyon, France - September 26th, 2024

- Inspiring keynotes
- Lightning talks by users
- Kitware one-to-one hands-on sessions
- Demo space
- ParaView dinner (optional)

Join the experience and present!

We understand the value of your expertise, if you want to share with the community, we welcome you to submit a presentation title and summary to present during the event.





Kitware Europe
kitware@kitware.eu
+33 (0)4 37 45 04 15

Kitware USA
kitware@kitware.com
+1 (518) 371-3971