# JOSO 2016

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# Agenda

- INT
  - Savoir-faires
  - Produits

- Rendu volumique
  - États des lieux
  - Problèmes
  - Solutions
  - C’est super

# INT

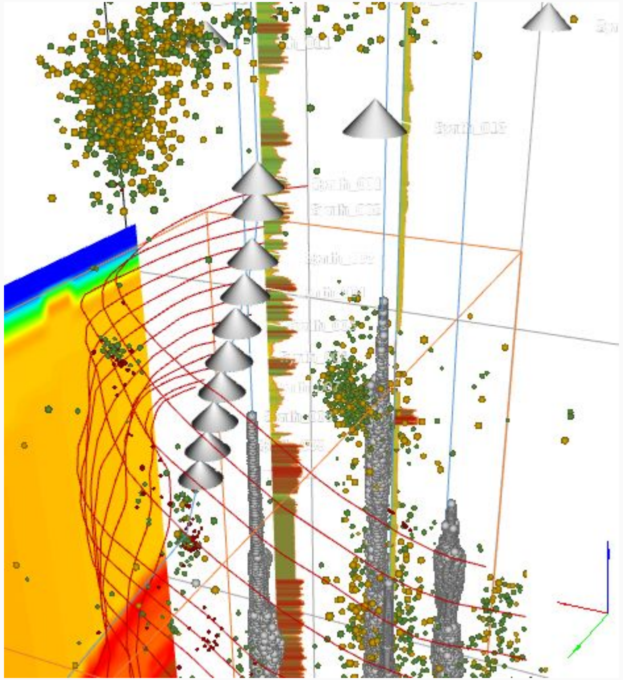
INT:

- fondée à Houston il y a bientôt 25 ans
- bureau à Pau depuis 2006
- 20 personnes à Pau, 80 dans le monde

Spécialiste mondial de la visualisation de données scientifiques et en particulier geosciences.

Plus de 50% des compagnies pétrolières et para-pétrolières parmis nos clients.

Savoir faire métier et technologique démontré.



# INT - Nos clients

## E&P Oil Companies

- ExxonMobil
- bp
- REPSOL
- TOTAL
- ConocoPhillips
- eni
- TALISMAN ENERGY
- OXY
- Anadarko Petroleum Corporation
- devon
- bhpbilliton
- HESS
- MAERSK OIL

## National Oil Companies

- CNPC
- ارامكو السعودية Saudi Aramco
- BR PETROBRAS
- CNOOC
- شركة نفط الكويت Kuwait Oil Company A Subsidiary of Kuwait Petroleum Corporation
- PEMEX
- ecopetrol

## R&D Institutes

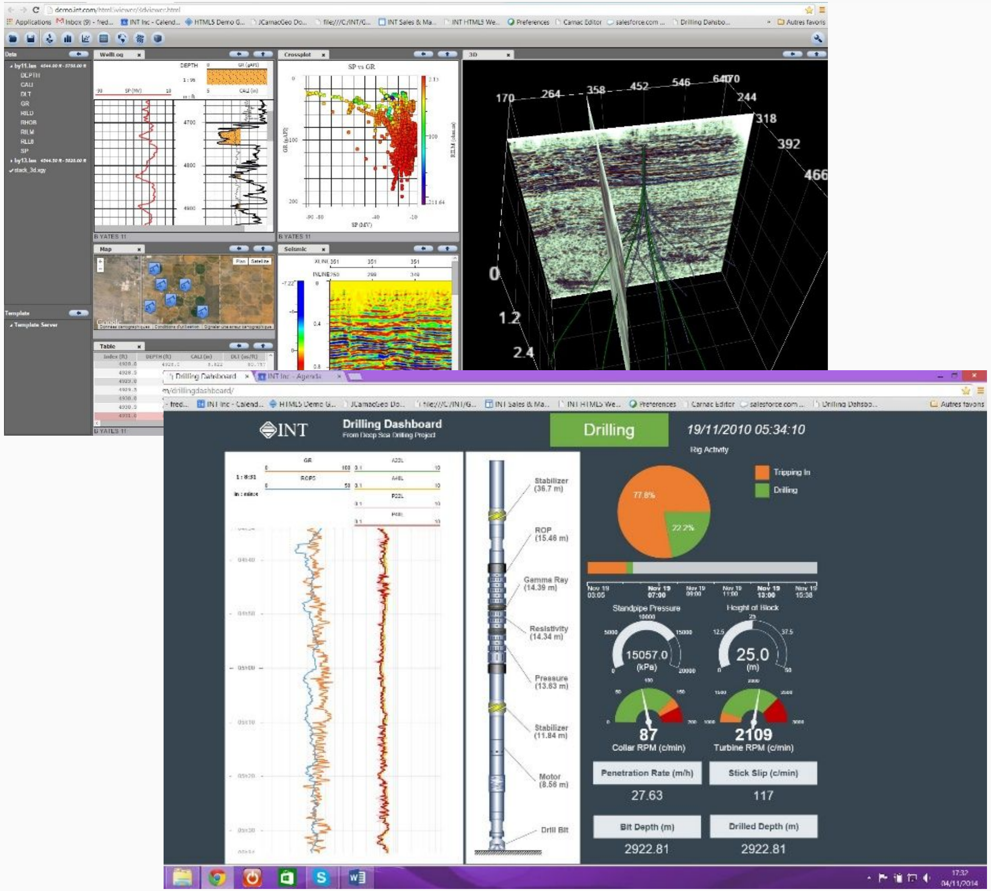
- BGS 1835
- The Scripps Research Institute
- CINECA
- CSIRO
- ifp Energies nouvelles

## Service Companies

- Schlumberger
- BAKER HUGHES
- CANRIG Drilling Technology Canada Ltd.
- fairfieldnodal
- Geokinetics
- Landmark HALLIBURTON Drilling, Evaluation and Digital Solutions
- P2
- ion
- Paradigm
- KONGSBERG
- PGS Petroleum Geo-Services
- FUGRO
- CGG Passion for Geoscience
- BeicipFranlab
- Weatherford

# INT - Nos savoir faire

- éditeur de logiciel
  - visualisations & interactions
  - performances
  - ergonomie
- compétences métiers
  - geosciences
  - traitement du signal
- ingénierie logiciel
  - architecture
  - industrialisation
  - gestion du cycle de vie



Penetration Rate (m/h): 27.63

Stick Slip (c/min): 117

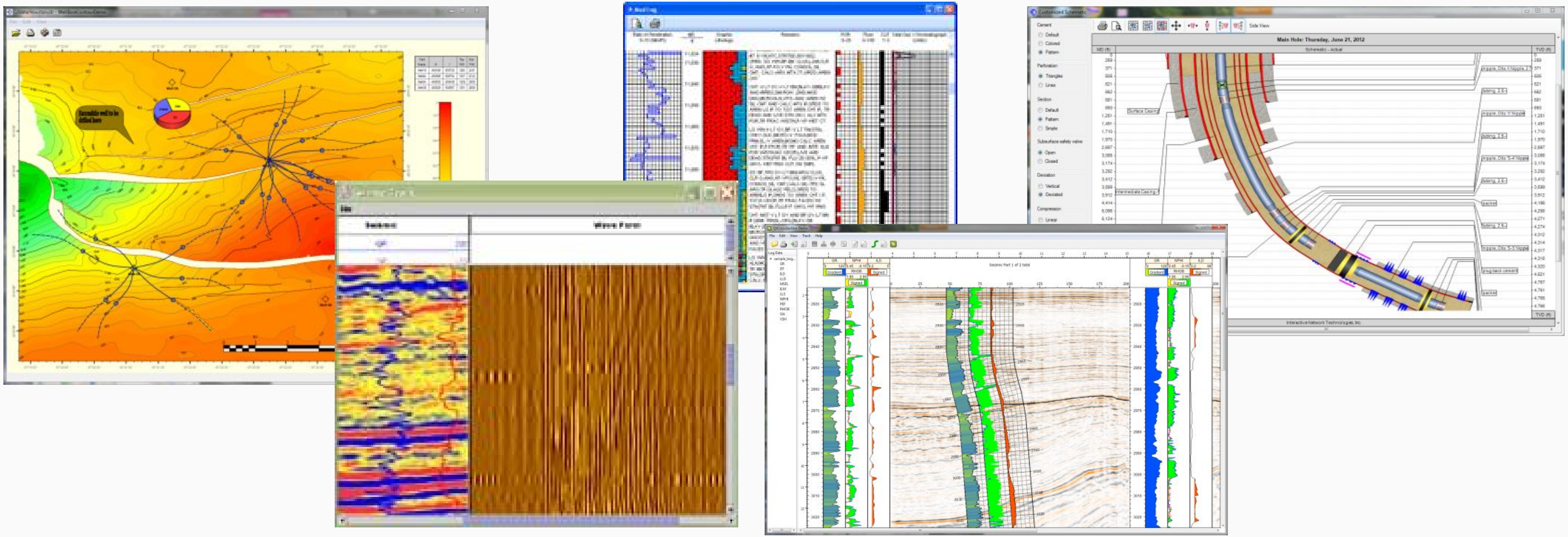
Bit Depth (m): 2922.81

Drilled Depth (m): 2922.81

# Nos produits - Geotoolkit

Geotoolkit :

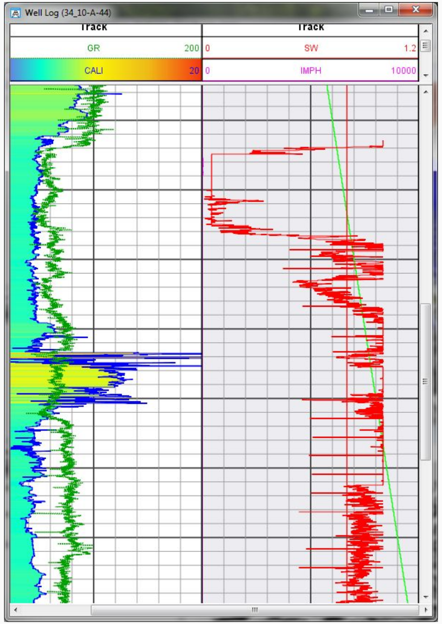
- librairie de visualisations spécialisée incluant une série de composants permettant la réalisation rapide d'application O&G,
- déclinée en C, C++, Java, C# et tout récemment Javascript/HTML5

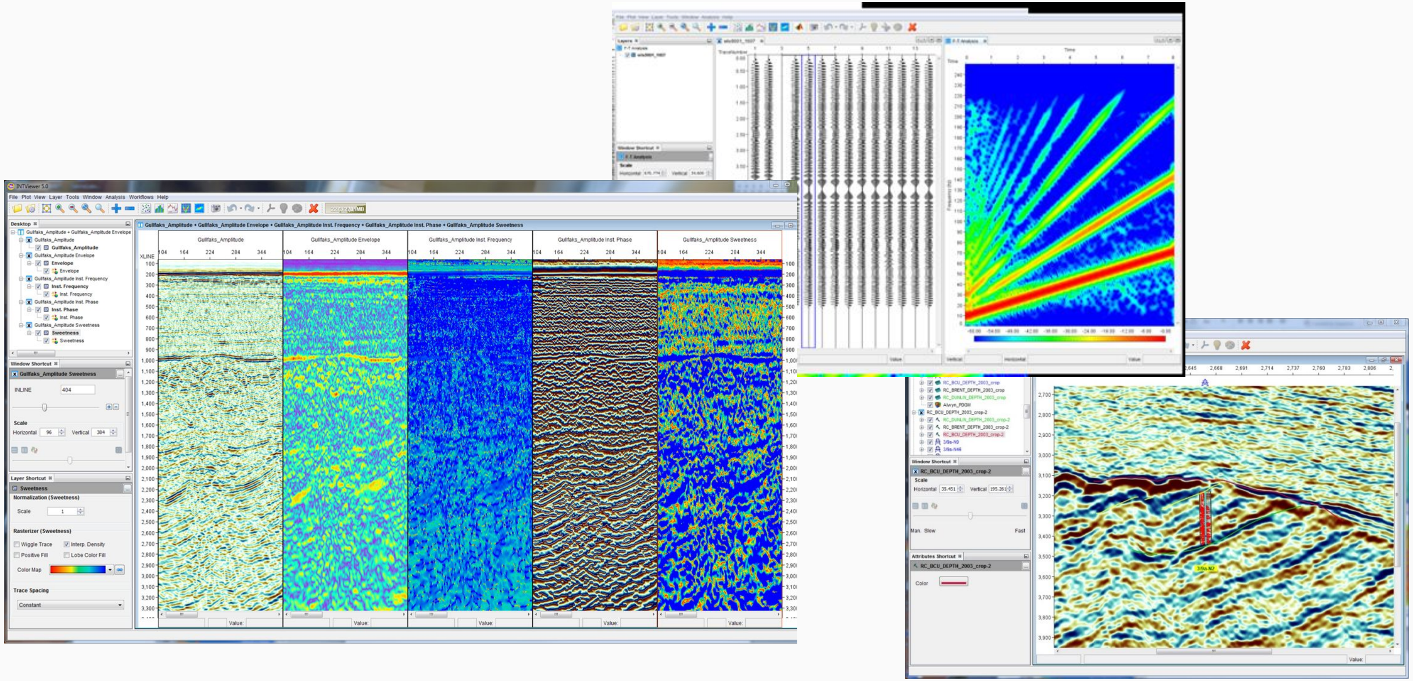


# Nos produits - INTViewer

INTViewer :

- application de type desktop basé sur notre librairie pour la visualisation rapide et le QC de données métier
- très extensible




INTViewer 5.0
File Plot View Layer Tools Window Analysis Workflows Help
Desktop
Gullfaks_Amplitude
Gullfaks_Amplitude Envelope
Gullfaks_Amplitude Inst. Frequency
Gullfaks_Amplitude Inst. Phase
Gullfaks_Amplitude Sweetness
Window Shortcut
Layer Shortcut
Sweetness
XLINE
Value
F-T Analysis
Attributes Shortcut
RC_BCU_DEPTH_2003_crop-2

INLINE 404

Scale

Horizontal 96 Vertical 384

Normalization (Sweetness)

Scale 1

Rasterizer (Sweetness)

☐ Wiggle Trace ☑ Interp. Density

☐ Positive Fill ☐ Lobe Color Fill

Color Map

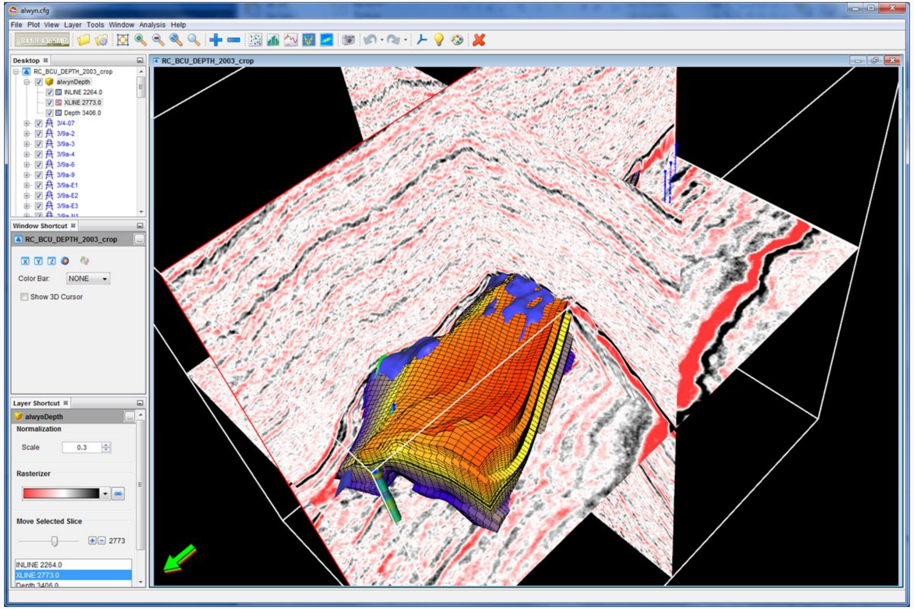
Trace Spacing

Constant

# Nos produits - JCarnac3D-OGL

JCarnac3D-OGL :

- librairie de rendu 3D Java/JOGL
- rendu génériques
- rendu de composants métiers
- rendu “gigagrilles”
- rendu volumique



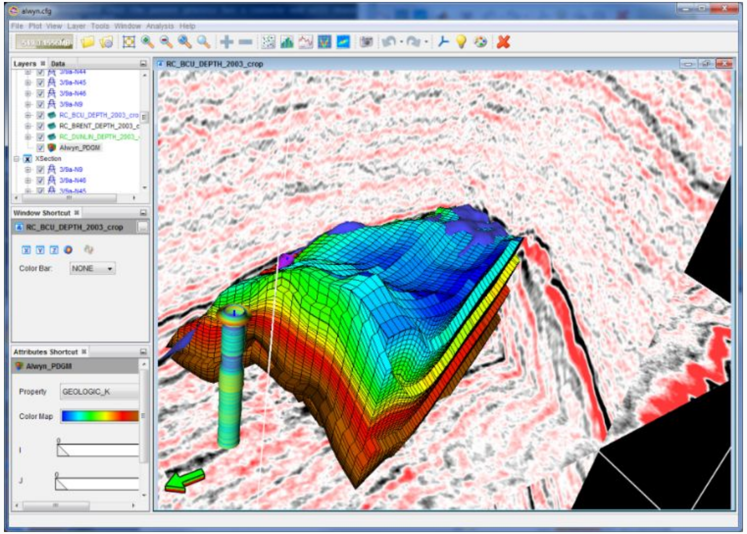
Color Bar: NONE

□ Show 3D Cursor

Scale 0.3

2773

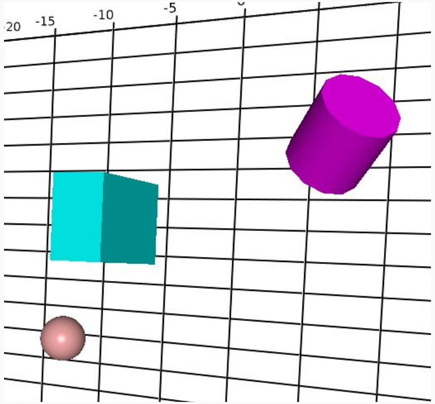
INLINE 2264.0
XLINE 2773.0
Depth 3406.0

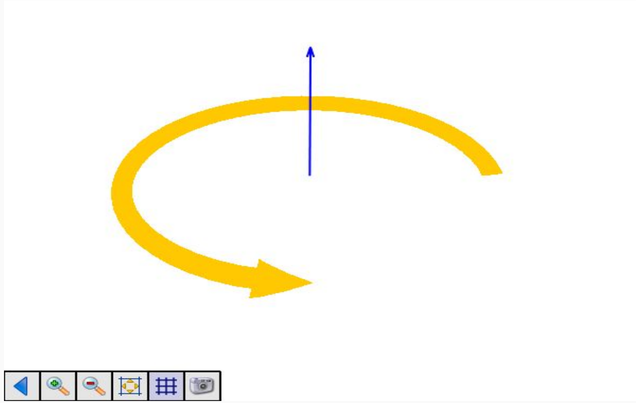


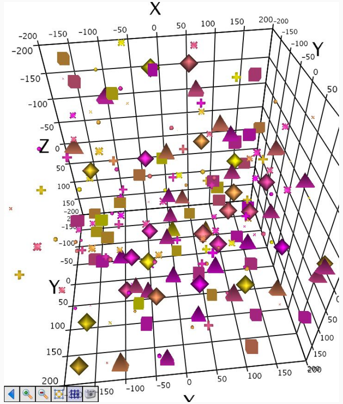
Color Bar: NONE

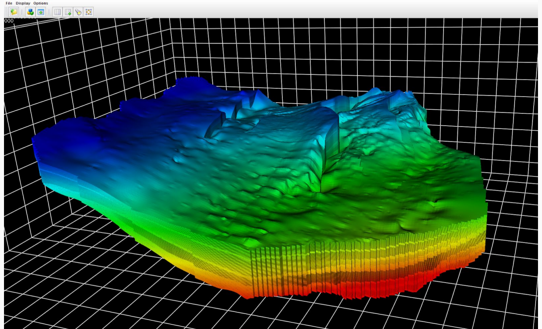
Property GEOLOGIC_K

# Volume Rendering : INT Library JCarnac3D-OGL

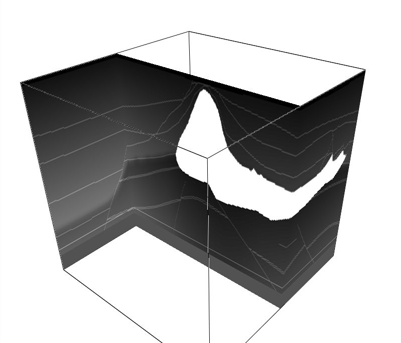








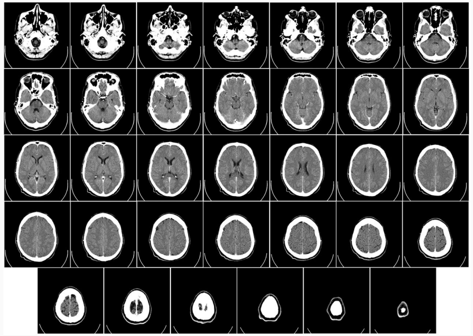
*Reservoir grid rendering (hexahedral cells)*



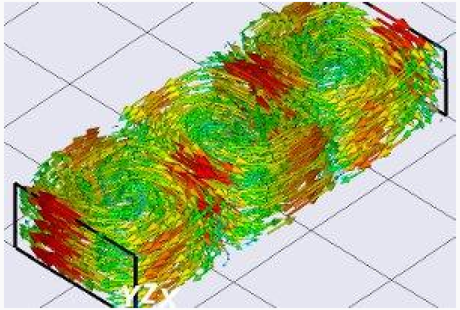
*Seismic slice rendering*

# Direct Volume Rendering

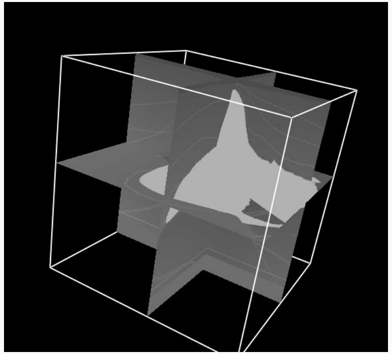
- Purpose : render a 3D scalar field on a 2D view
- Data : the data is a sampling of a 3D scalar field
  - Series of images (eg : medical scanner)
  - 3D array (eg : simulation, 3D acquisition)
- Samples do not contain visual information (such as colors) but can be anything (temperature, wave amplitude, …)



CT Scan (wikipedia)



Magnetic field simulation (emGine)



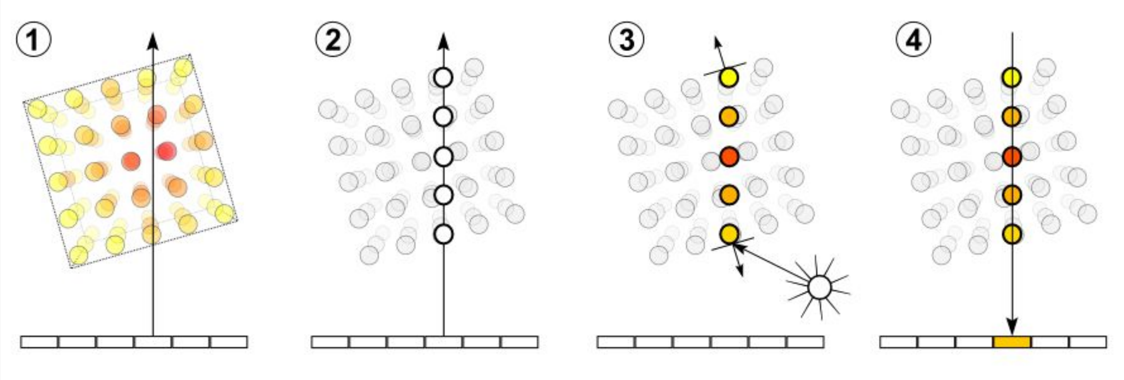
# Volume Rendering : Ray casting

1. **Ray casting**. For each pixel of the final image, a ray of sight is shot ("cast") through the volume.
2. **Sampling**. Along the part of the ray of sight that lies within the volume, equidistant sampling points or samples are selected
3. **Coloring and Shading**. For each sampling point, a gradient of illumination values is computed. A color value is retrieved from the transfer function
4. **Compositing**. After all sampling points have been shaded, they are composited along the ray of sight, resulting in the final colour value for the pixel

$$C = \sum_{i=1}^{n} C_i \prod_{j=1}^{i-1} \left(1 - A_j\right)$$

$$A = 1 - \prod_{j=1}^{n} \left(1 - A_j\right)$$

Composition equation



source : Wikipedia Ray casting, NVidia GPUGems

# Volume Rendering : Ray casting

- High quality rendering
- Performance is very dependent of :
  - The dataset size
  - The number of steps computed along the ray :
    - Stop the computation if the accumulated opacity as reach a threshold
    - Decrease the number of steps, reduces the quality but can be used during interaction
  - The hardware :
    - buy a bigger CPU / GPU : $$$$
    - Use shared resources to perform remote rendering

# Volume Rendering : INT Library JCarnac3D-OGL

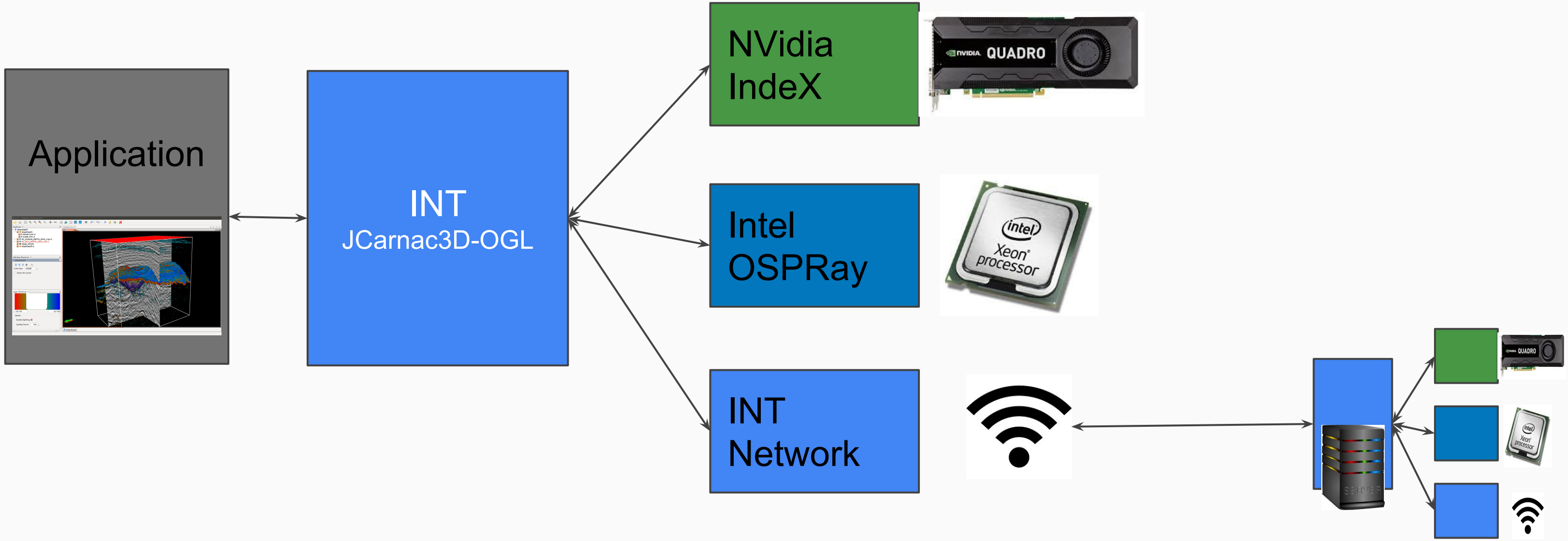
- In 2015 Volume rendering capabilities were added
    - INT own implementation of the Volume Ray casting algorithm
    - Run on GPU
    - Not limited in size
    - Supports basic lighting

    - Basic implementation of a ray casting, with few optimisation

- Other companies provides volume rendering library with dedicated products.
  => Integration of 3rd party libraries in INT toolkit
    - Intel OSPRay :
        - CPU based
        - MPI support
        - Open source
    - NVidia Index :
        - GPU based
        - Clustering mode
        - Commercial license : partnership to become a reseller of the library

# Volume Rendering : INT Library JCarnac3D-OGL

- The final user should not see the complexity
- He could write an application and use any available renderer without changing his code.



Application

INT
JCarnac3D-OGL

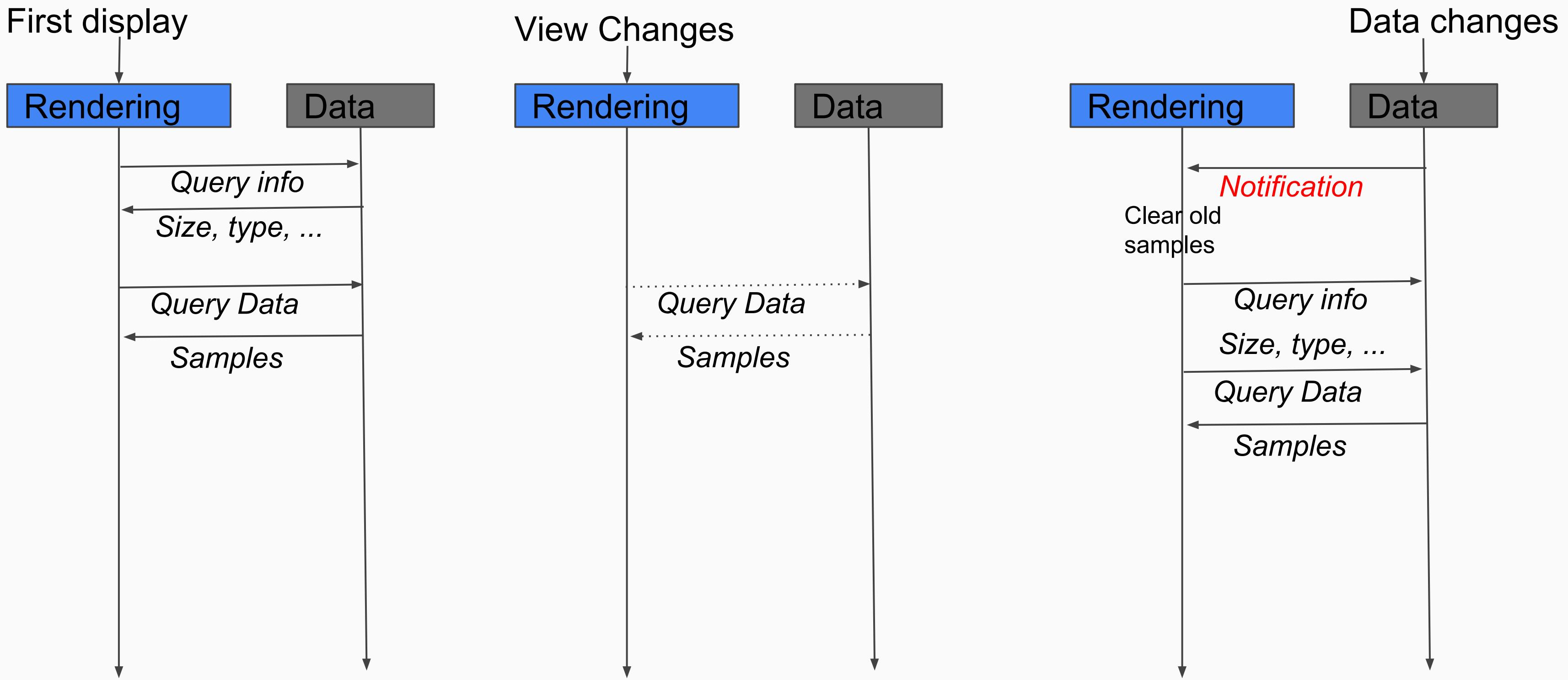
NVidia
IndeX

Intel
OSPRay

INT
Network

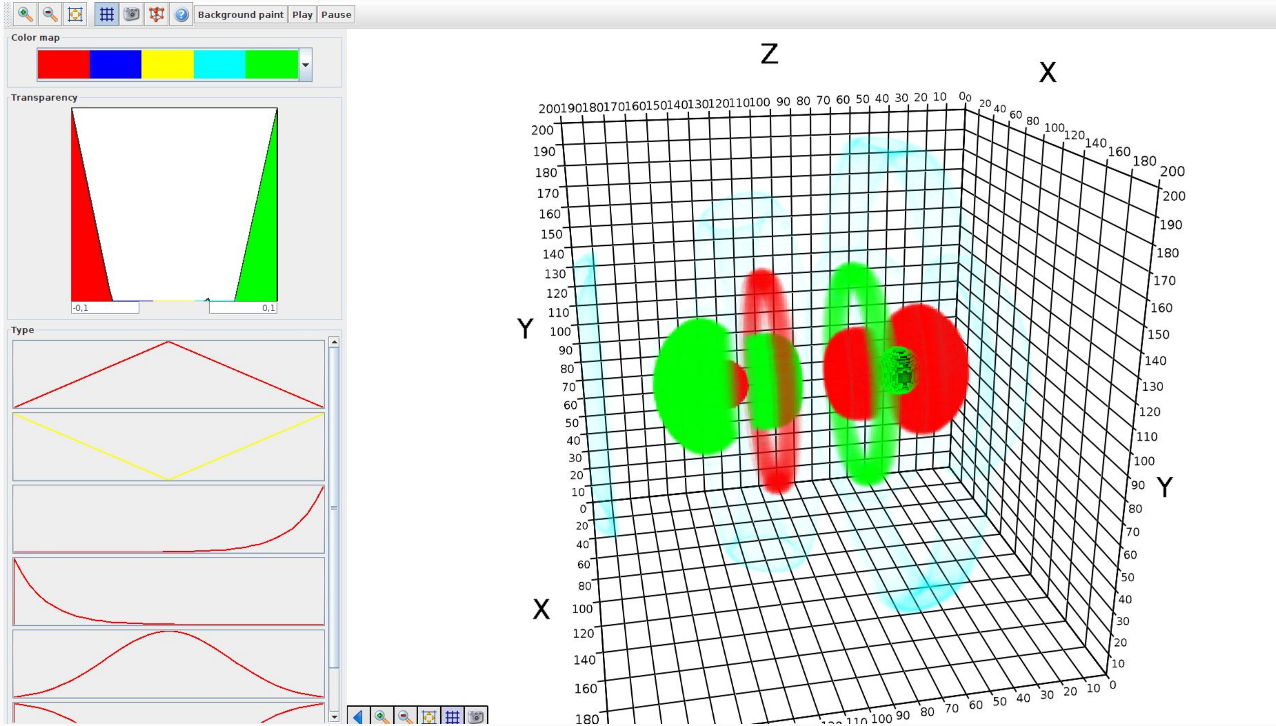
# Volume Rendering : INT Library JCarnac3D-OGL

- Application developers must write code to provide a Data object to the library.
- 4D and Real-time are manage at the data level



# Volume Rendering : INT Library JCarnac3D-OGL

- Simplicity to use
- Comes with demo which can be customized
  => Simple demo application developed in less than a day

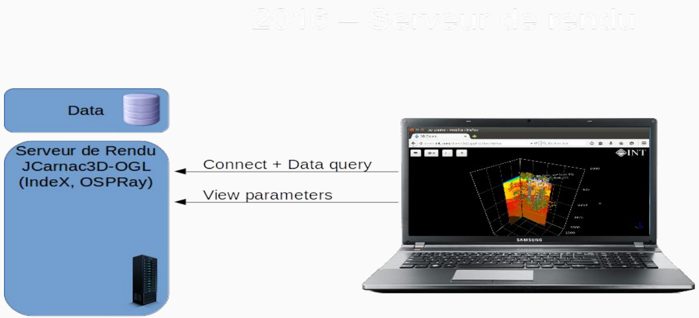


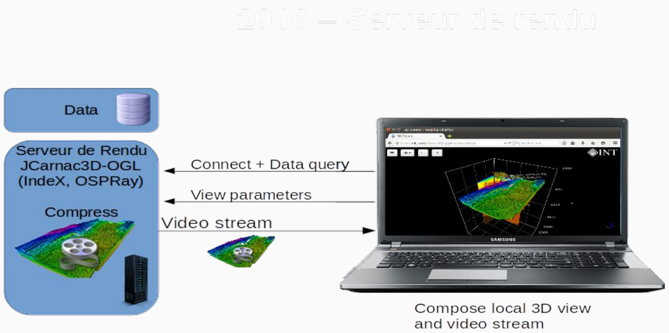
# Volume Rendering : 2016 Rendering Server

INT provides library to perform 3D rendering in a web browser using the WebGL API but we face some limits

- WebGL API is not as rich as OpenGL API
- Client hardware is not design to render big volume of data
  - low-end GPU
  - limited bandwidth to access the data (storage location)
  - Browser implementation dependant.

Solution => Create a rendering server running on high-end hardware to perform the rendering of big data object while the in browser rendering will have in charge the smaller and more dynamic objects.


2016 – Serveur de rendu
Data
Serveur de Rendu
JCarnac3D-OGL
(IndeX, OSPRay)
Connect + Data query
View parameters


2016 – Serveur de rendu
Data
Serveur de Rendu
JCarnac3D-OGL
(IndeX, OSPRay)
Compress
Connect + Data query
View parameters
Video stream
Compose local 3D view
and video stream