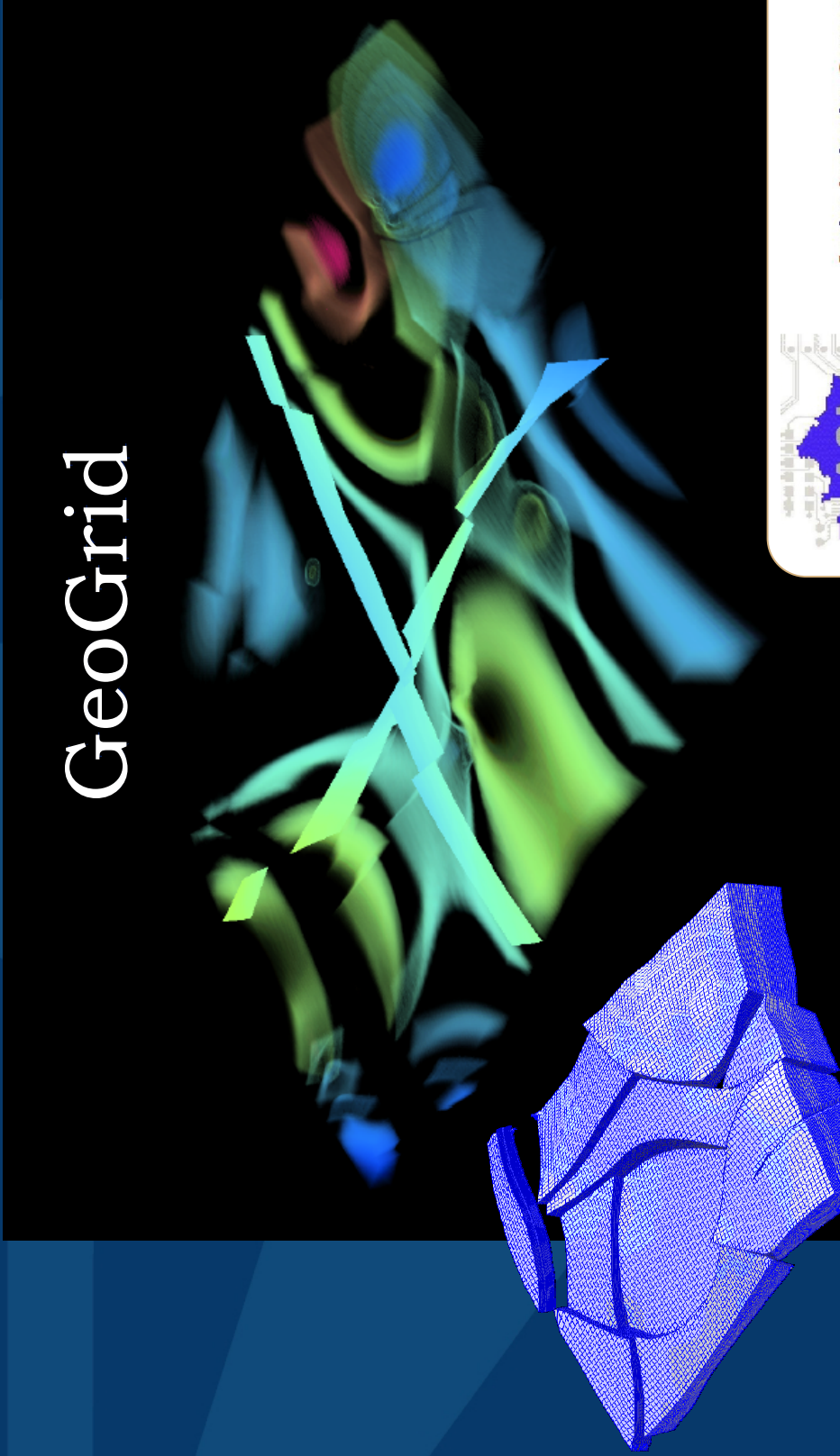


French/UK Grid Workshop

London, November 3-4

GeoGrid



*Bruno Lévy, Project ISA
INRIA Lorraine & CNRS*



Action Incitative Concertée [ACI]
Globalisation des Ressources Informatiques
et des Données [GRID]

Overview

I Presentation of the project, goals

II Modeling AND Visualizing

III Communicating

- **Future work**

Academic Partners

I

- **CRPG – Nancy (Gocad)**
- **ECOO – Nancy (Cooperative work)**
- **LABRI – Bordeaux (Graphics)**
- **Geometrica (Prisme) – Sophia**

Industrial Partners

I

- **Petrobras, ChevronTexaco, TotalFinaElf**
- **SGI (Volumizer 2, VizServer)**
- **Earth Decision Sciences (Gocad)**
- **VSP-Technology (Cristal Earth, gOcad VR)**

Geomodeling

Oil companies: many activities

I



Exploration



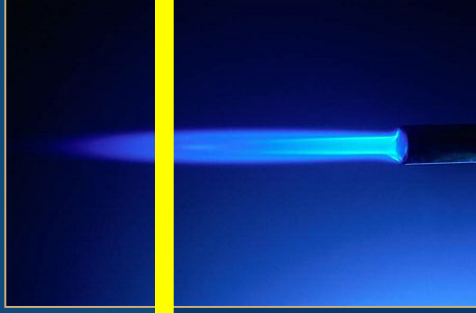
Production



Retail



Energy



Gas



Refining & Petrochemicals



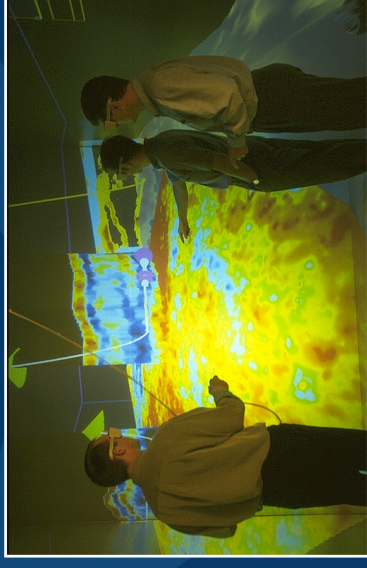
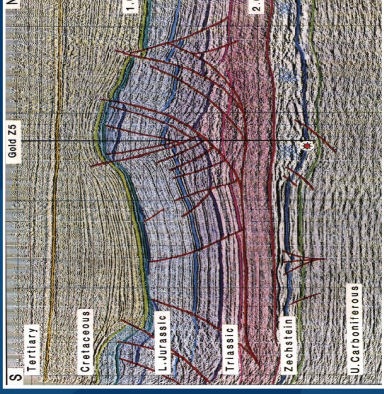
Transportation

ACI GeoGRID

Images courtesy of Petrobras

Geomodeling ... many different locations

I



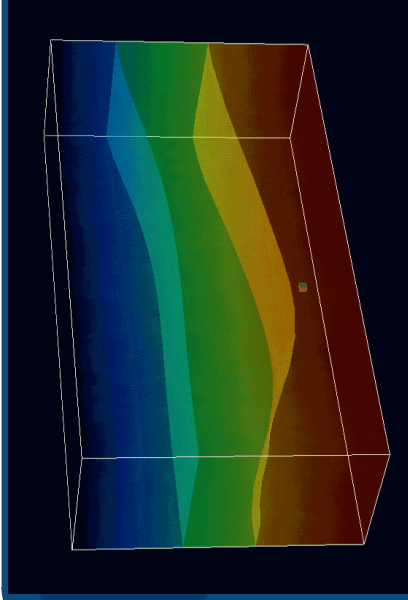
ACI GeoGRID

Images courtesy of Petrobras

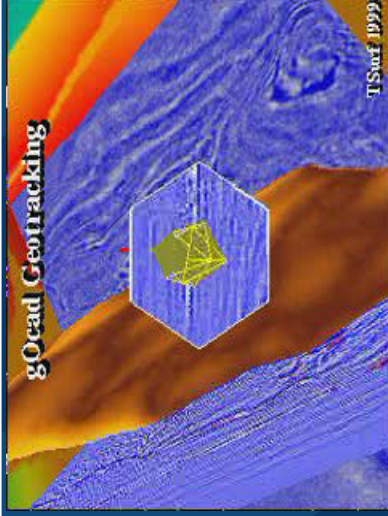
Geomodeling

...many different areas of expertise

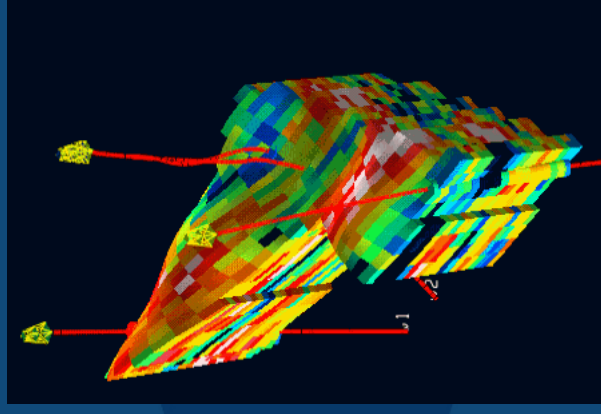
I



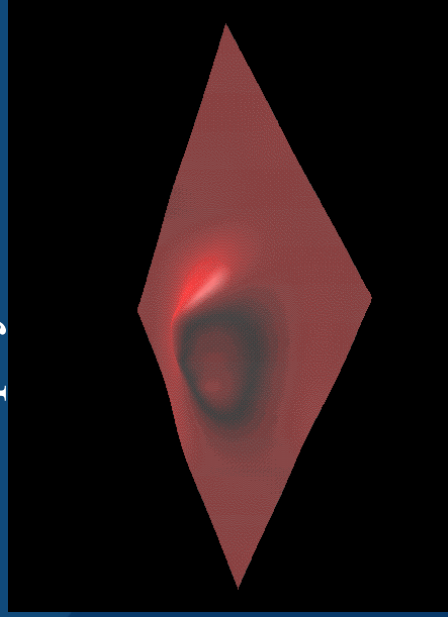
Geophysics



Seismic processing



Geostatistics



Structural geology

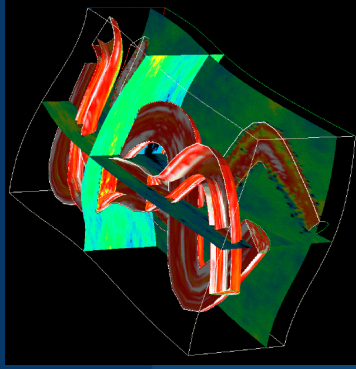
ACI GeoGRID

Images courtesy of Gocad

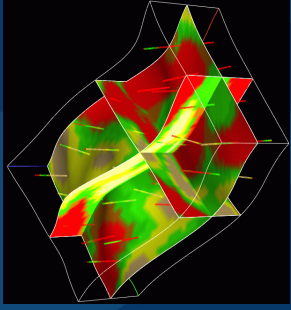
Geomodeling

...many different areas of expertise

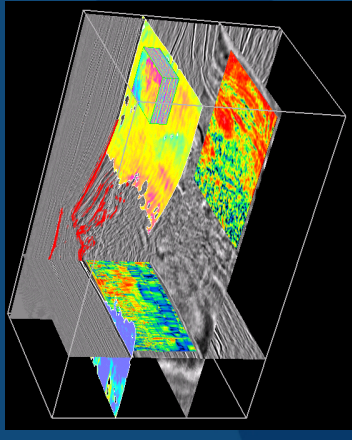
I



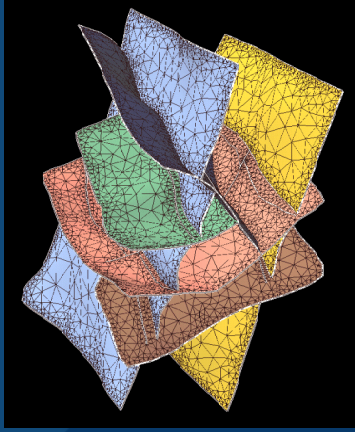
Structural geology



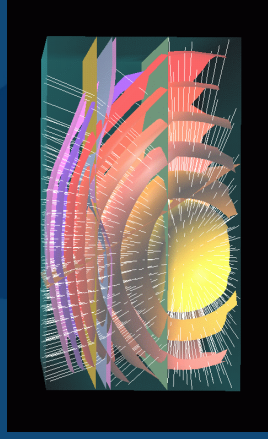
Reservoir engineering



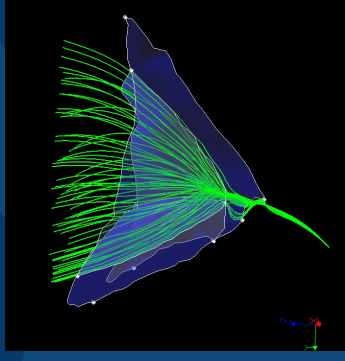
seismic processing



Large data



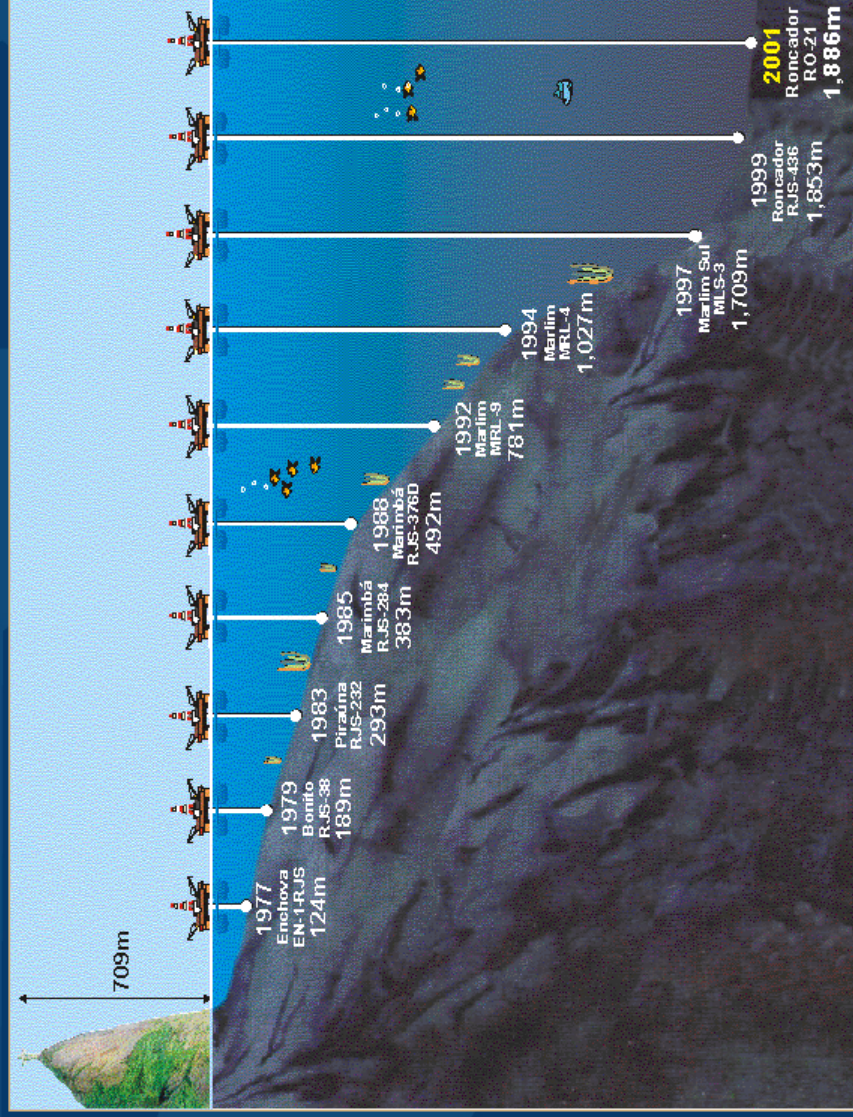
geophysics



Complex data

Geomodeling

New challenges



Deep water wells
Polyphasic pumps
4D seismic



GrID Goals

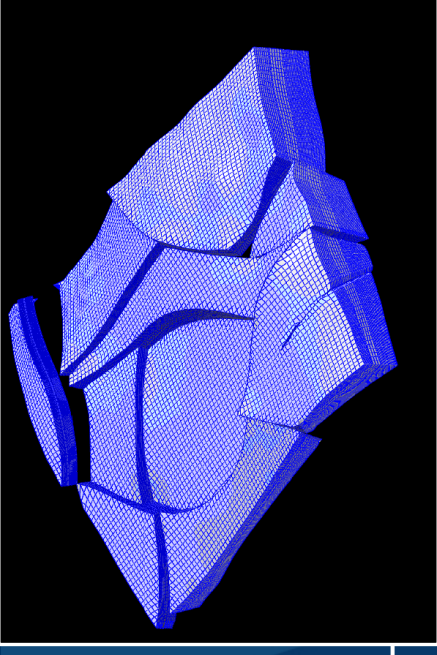
I

- Combined Modeling and Visualization
 - Real-time interactive visualization provides a better understanding of the modelling process
 - Enhanced modeling to improve the precision of what needs to be visualized
- Communication
 - Share the same view, different views and different representations of the same object
 - Modifying, editing shared versions of the same object

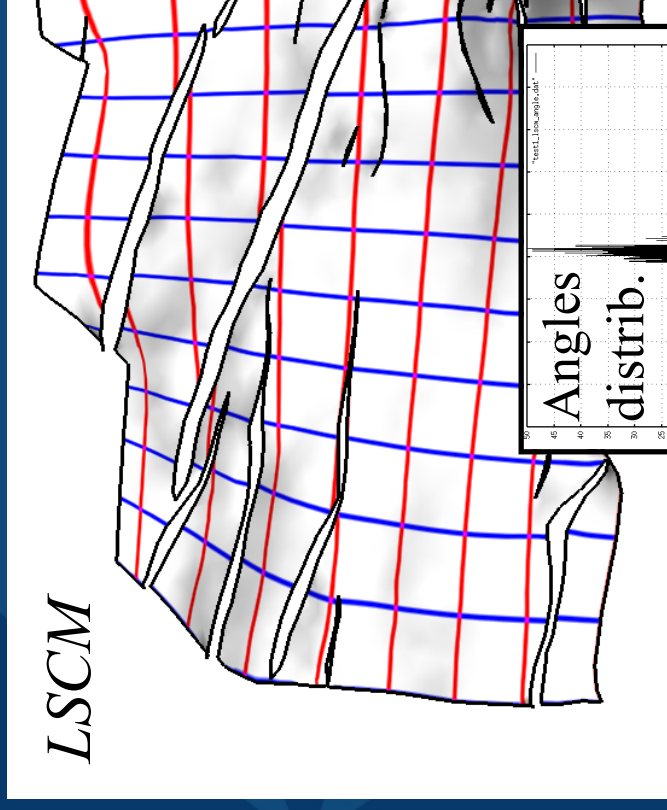
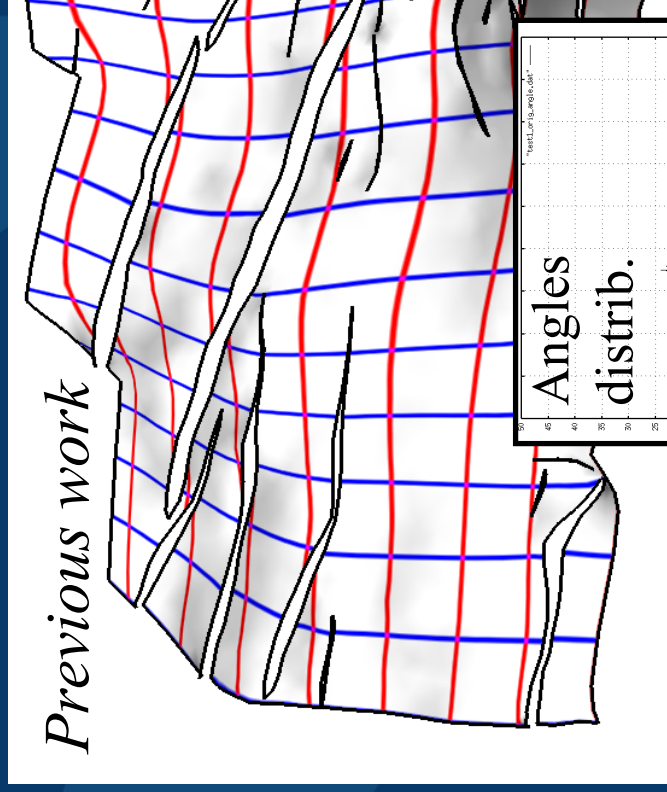
Modeling ...

$$\frac{\partial v}{\partial x} + i \frac{\partial v}{\partial y} = i \left(\frac{\partial u}{\partial x} + i \frac{\partial u}{\partial y} \right)$$

II

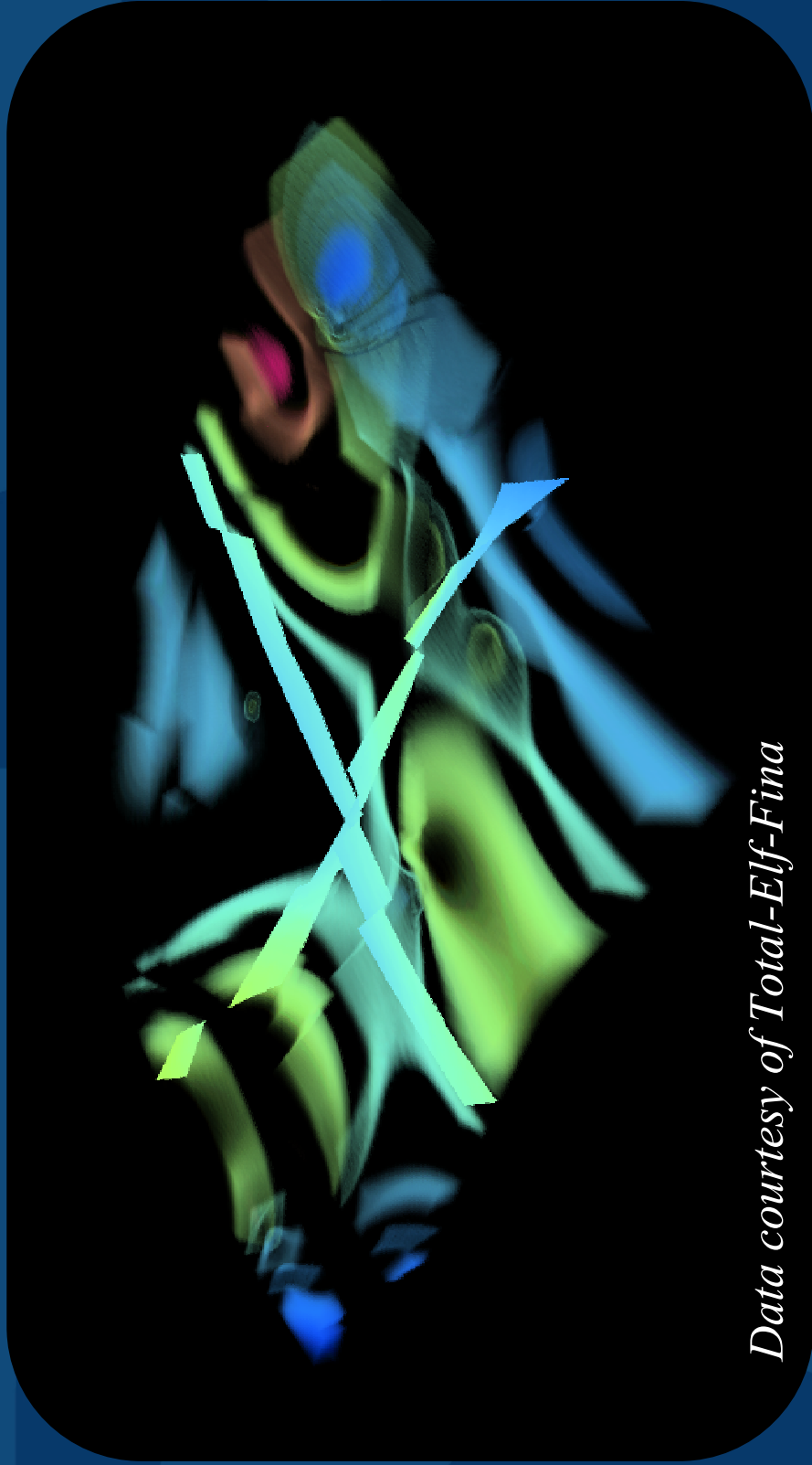
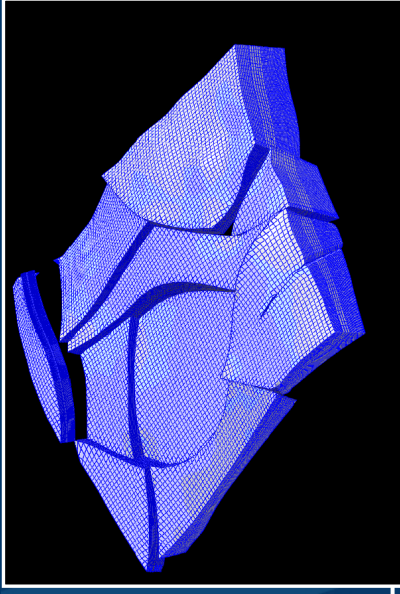


Conformal Gridding for flow PDEs (data courtesy of ChevronTexaco)



... and Visualizing

II

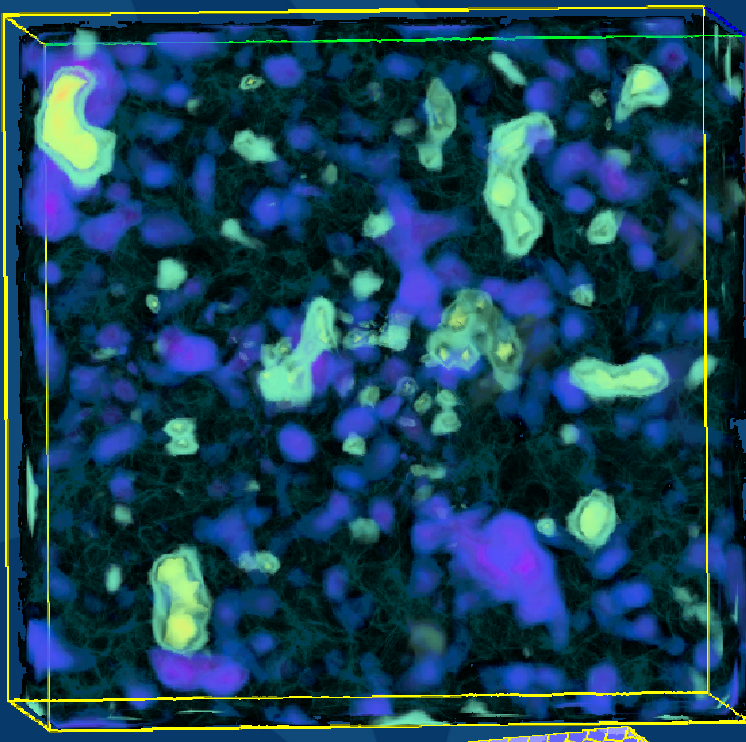
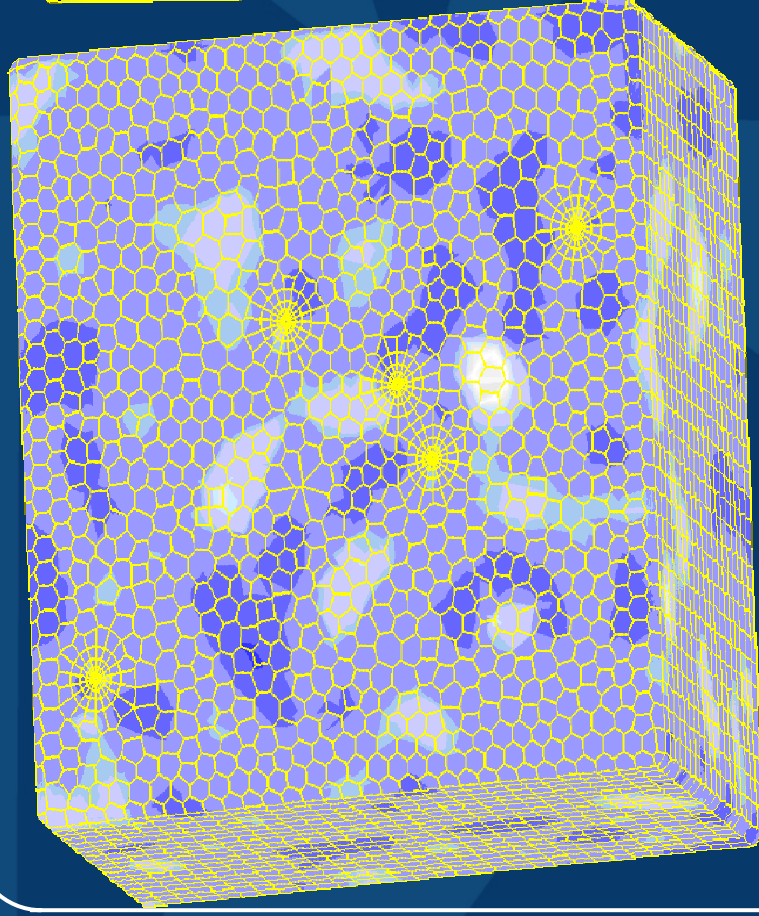


Data courtesy of Total-Elf-Fina

ACI GeoGRID

Modeling and Visualizing Unstructured adaptive models

II

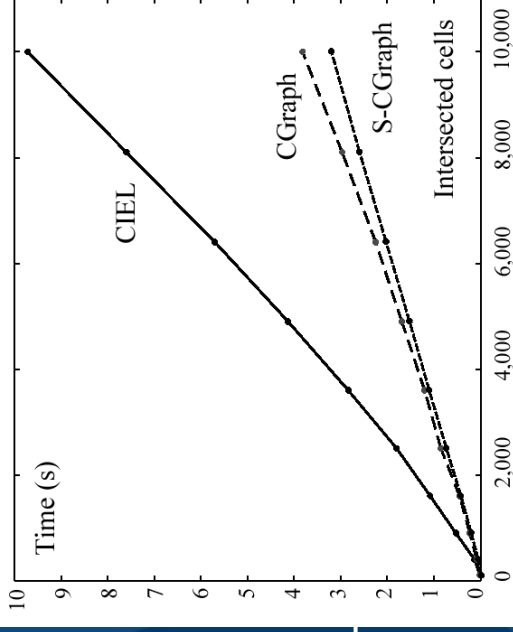
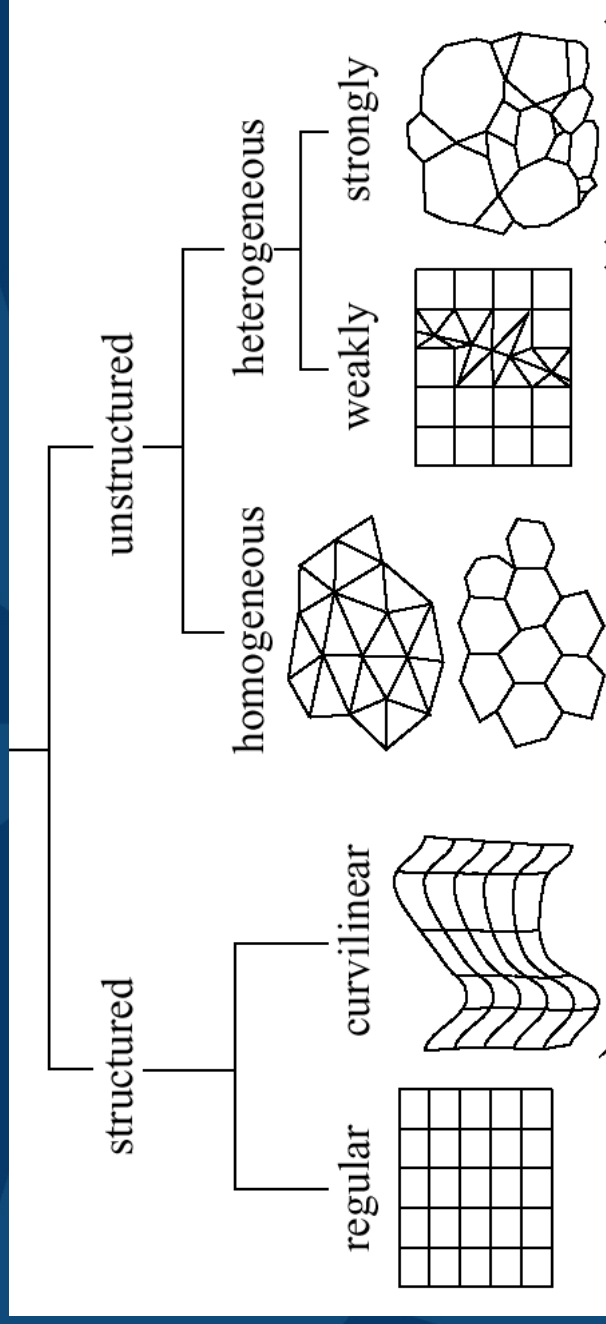


Heterogeneous unstructured meshes – CIEL

Control Volume Finite Elements (CVFE)
ACI GeoGRID

Modeling and Visualizing II

Volumic meshes typology

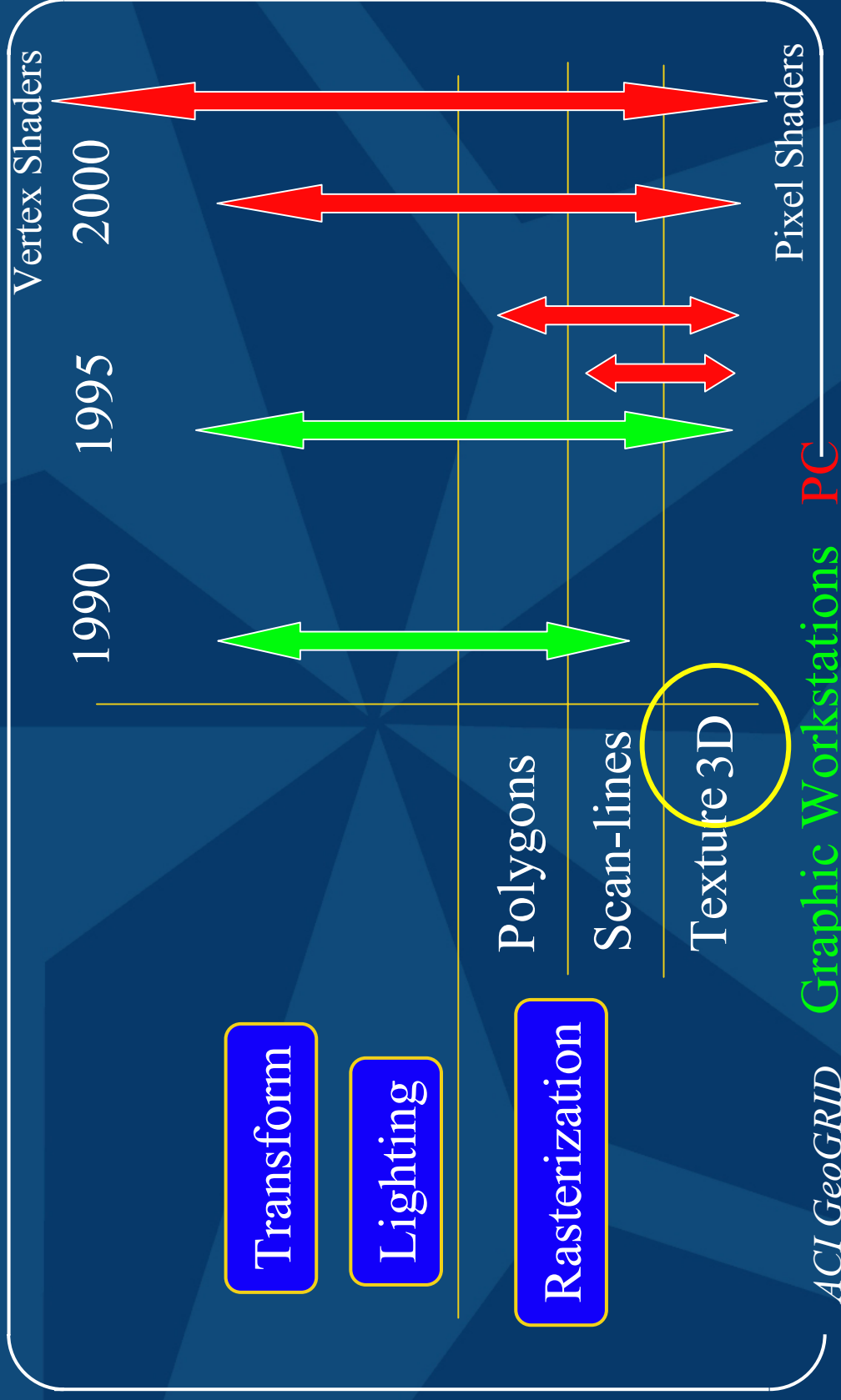


Modeling and Visualizing

II

Computer Graphics Hardware:

15 years of evolution

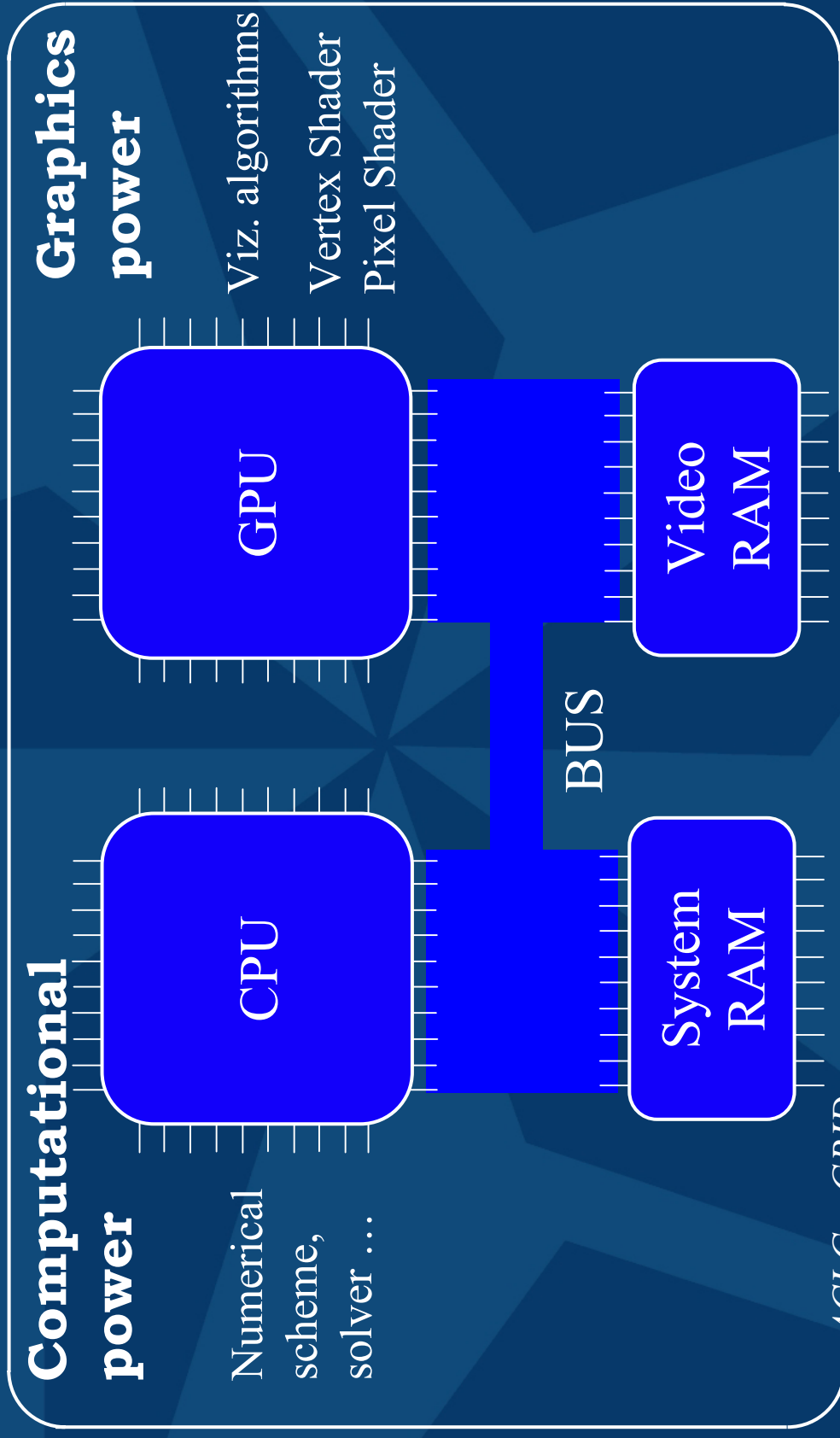


Modeling and Visualizing

II

Computer Graphics Hardware:

The new picture in the 2Ks



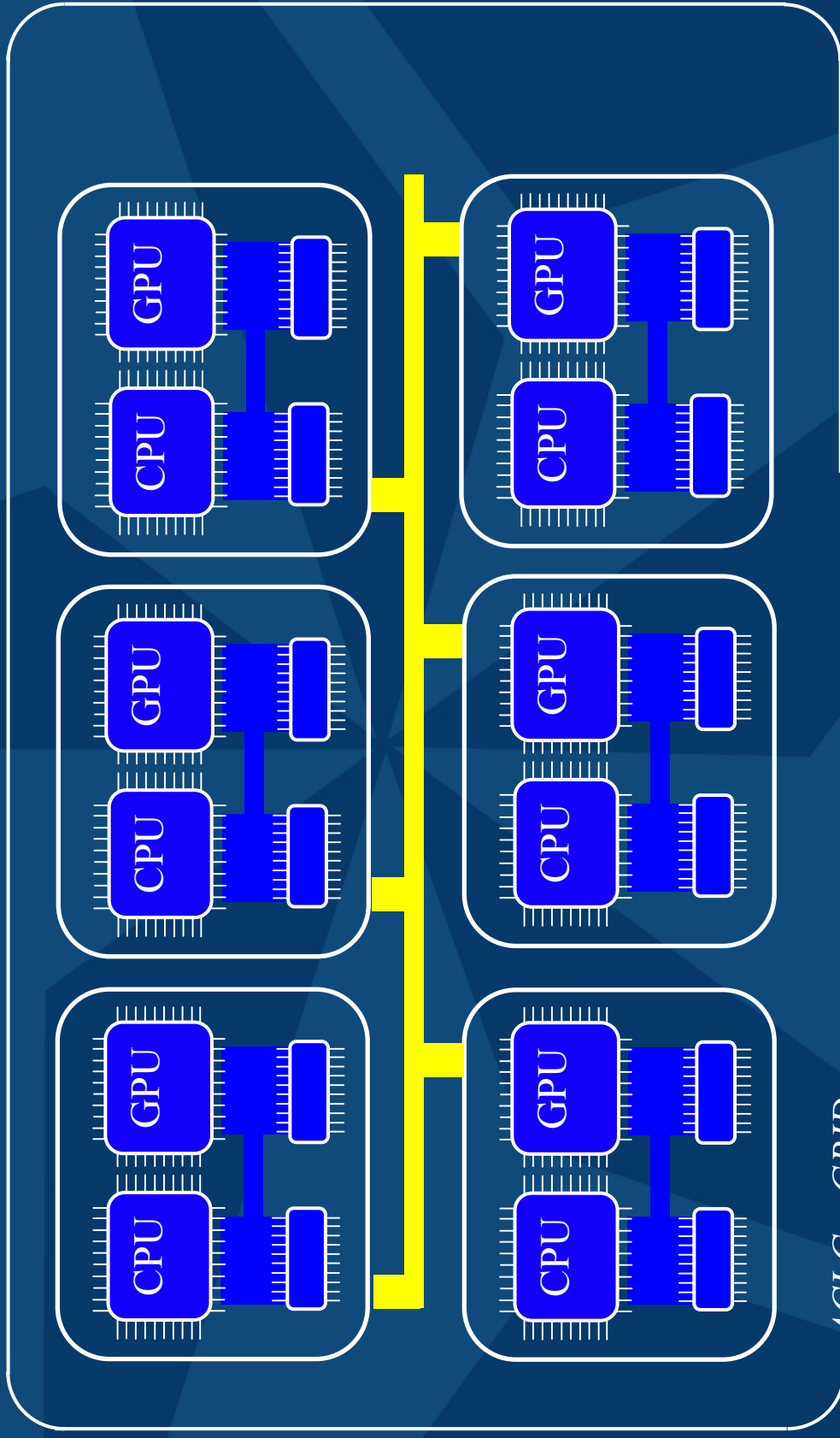
Modeling and Visualizing

II

III

Graphic grids

Xavier Cavin, PC Cluster



ACI GeoGRID

Modeling and Visualizing

II

Computer Graphics Hardware

Towards non-scalar dynamic visualization ...



© 2000 Konrad-Zuse-Zentrum Berlin (ZfB)

ACI GeoGRID

Modeling and Visualizing publications

II

VISUALIZING

- *Circular Incident Edge Lists*, B. Lévy, S. Conreux, G. Caumon & X. Cavin , *Visualization 2001*
- *Cellular Graphs*, G. Caumon, B. Lévy & J.C. Paul, *IEEE Trans. on Viz. And C.G.*, submitted

MODELING

- *Real-time raytracing with the GPU*, R. Toledo & B. Lévy, *to be submitted*
- *Least Squares Conformal Maps*, B. Lévy, S. Petitjean, N. Ray & J. Maillot, *Siggraph 2002*
- *Dual Domain Extrapolation*, B. Lévy, *Siggraph 2003*
- *Anisotropic Remeshing*, P. Alliez, D. Cohen-Steiner, O. Devillers, B. Lévy, M. Desbrun, *Siggraph 2003*
- *Differentially Constrained Parameterization*, B. Vallet, A. Sheffer, B. Lévy, *to be submitted (Siggraph 2004)*

ACI GeoGRID

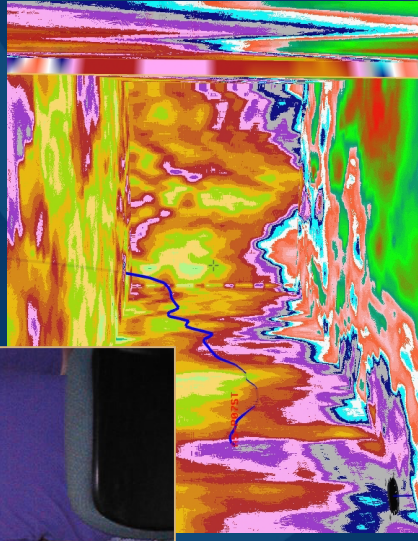
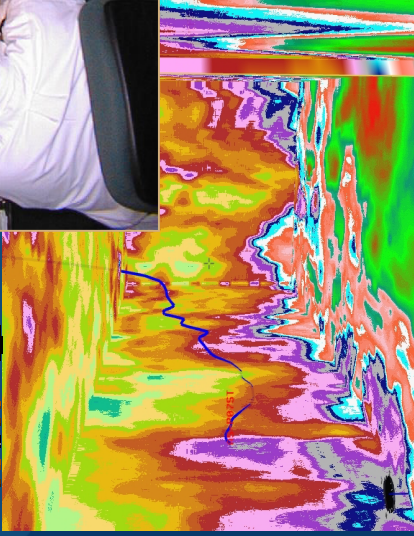
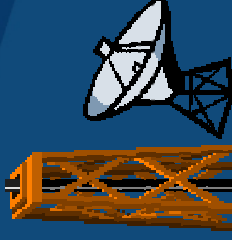
Communicating Cooperative work

III



Communicating Cooperative work

III



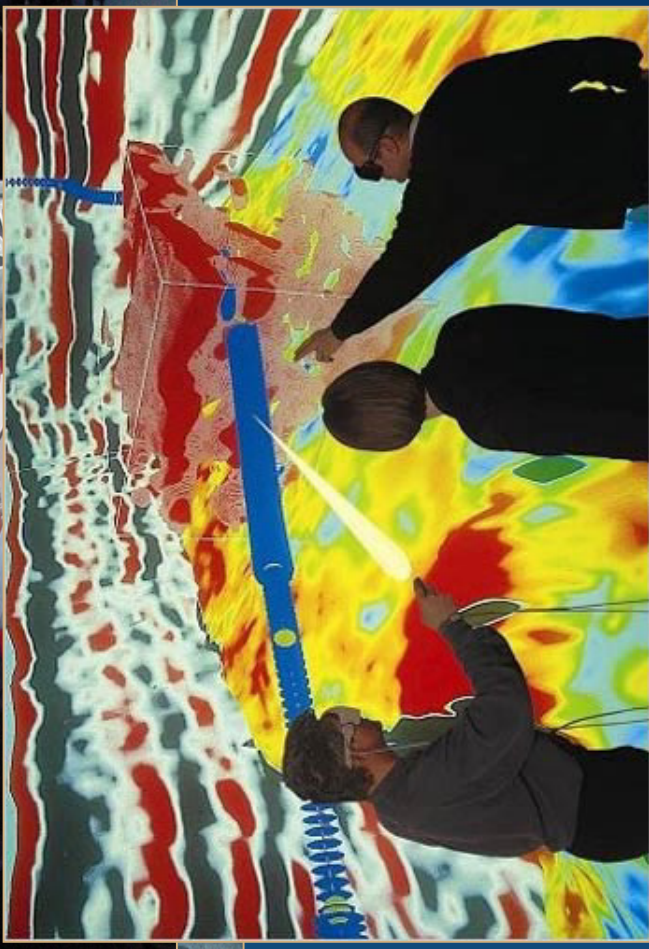
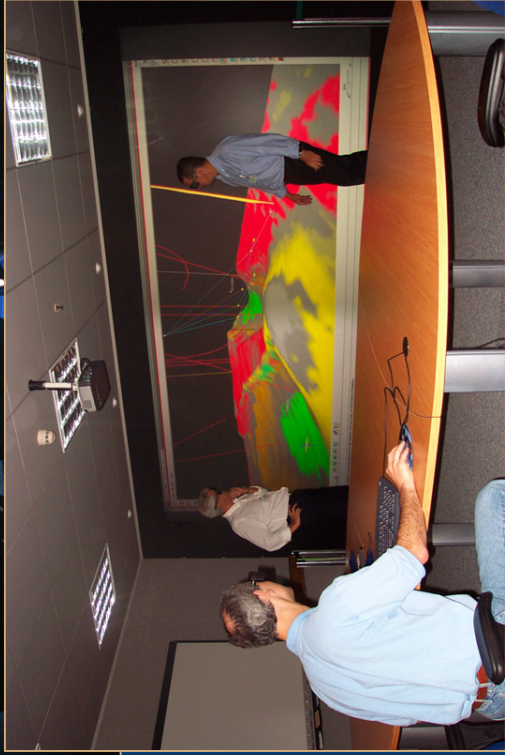
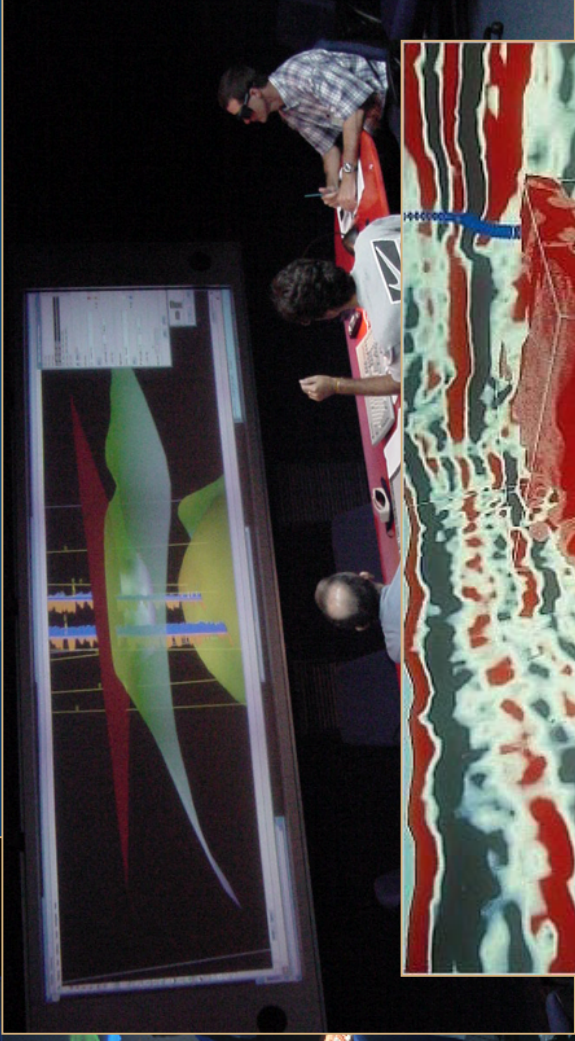
ACI GeoGRID

Luciano dos Reis, Petrobras

Communicating Cooperative visualization

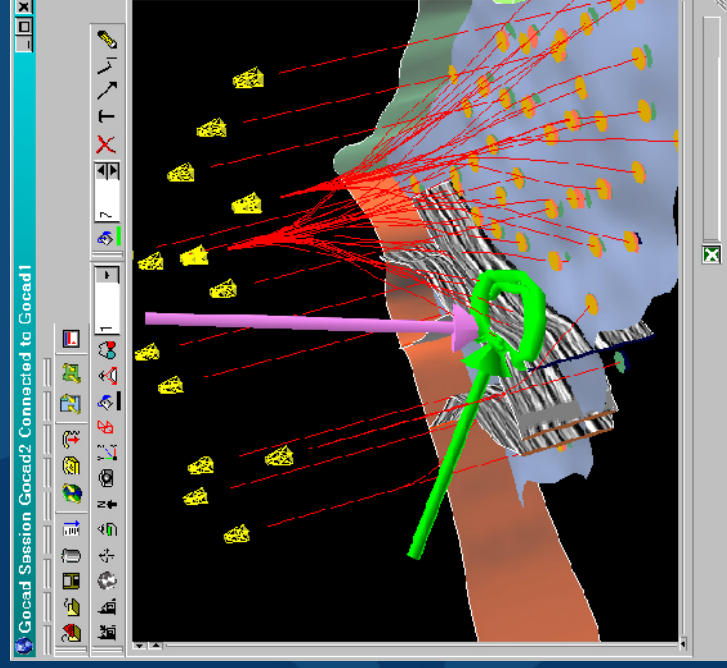
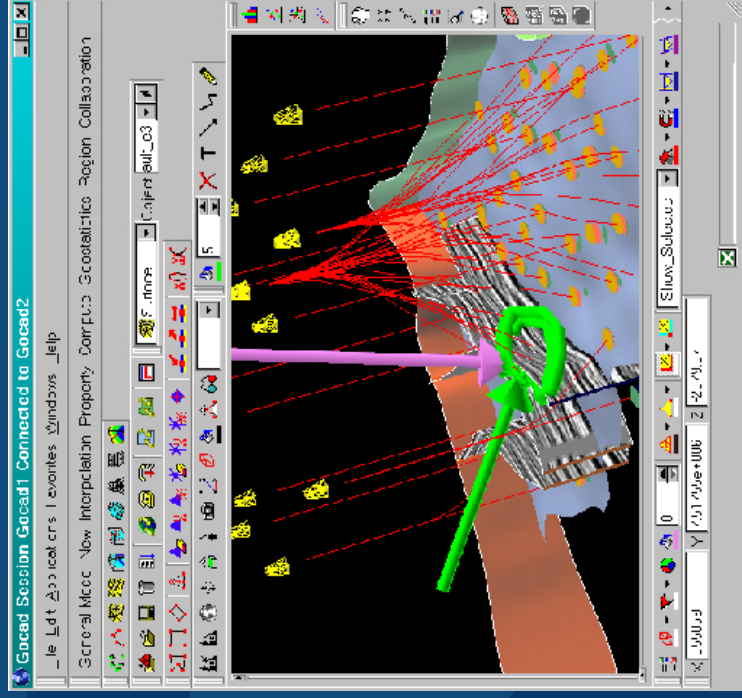
III

Gocad VR (VSP and EDS)



Communicating Cooperative modeling - Whiteboards

III



« Gocad Meeting » : Collaborative geomodeling

ACI GeoGRID

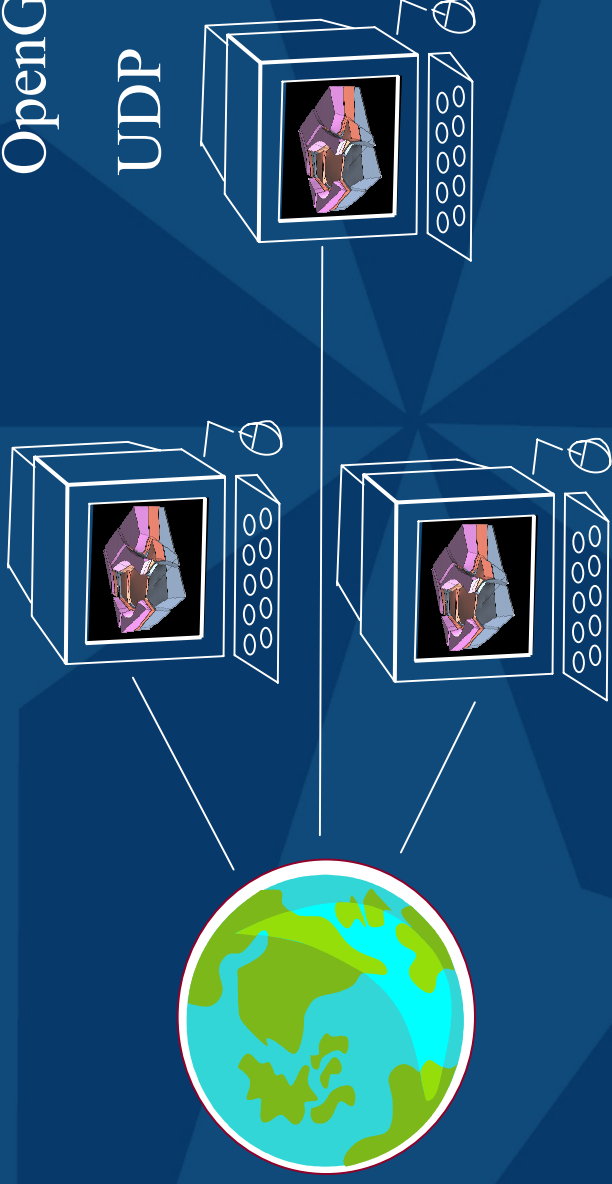
Luciano dos Reis (Petrobras) Fabien Bosquet (EDS)

Communicating Grid-Visualization

III

OpenGL – Chromium

UDP



- *Unreliable Transport Protocol for Commodity Based OpenGL Distributed Visualization.* S. Thibault, X. Cavin, O. Fester et E. Fleury, Workshop on Viz. Clusters – Visualization 2002

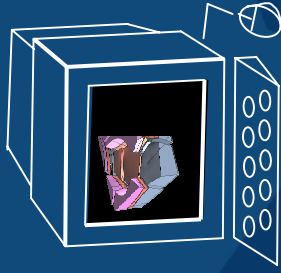
ACI GeoGRID

Communicating Grid-Visualization

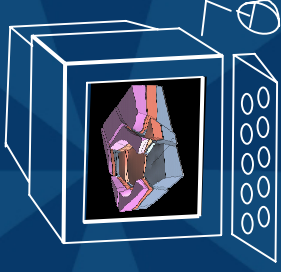
III

- **SGL Viz-Summit, La Villette**
(February 2003)

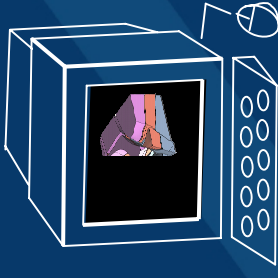
Loria



La Villette



Montpellier



Distrib. Vis.

Renater 2



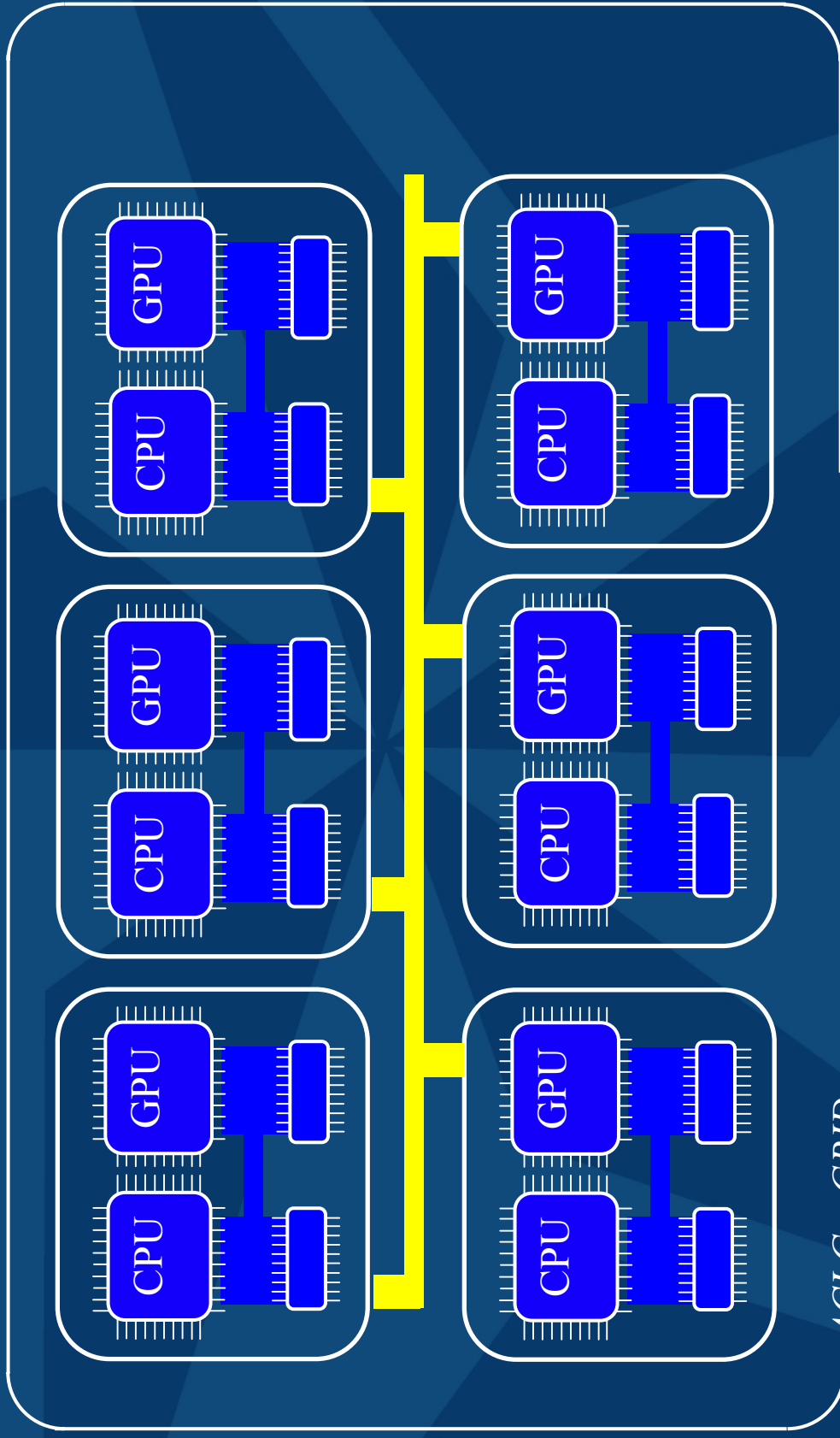
OpenGL – Chromium

ACI GeoGRID

Communicating Graphic grids

III

Xavier Cavin, PC Cluster



ACI GeoGRID

Communicating Computations and Network

III

- **Jérémie Turbet**
 - Visualizing on the grid (Chromium)
- **Alain Filbois : High-performance Viz.**
 - Parallel player for ultra high res. & stereo videos
- **Frédéric Wagner : Ph.D candidate Resedas (E. Jeannot) and ISA**
 - Computation on the grid (graph algo., data management and balancing)

Future work

- **Modeling & Computation**
 - High-performance numerical optimizations
 - (Multi-res. LSCM, // LSCM, // DSI)
 - Adaptive heterogeneous meshes
- **Visualizing**
 - Graphic grid, Graphic PC Clusters (3D Texture, Vertex & Pixel Shaders)
 - // CIEL, // C-Graph