Mixing Virtual Reality and 2D Visualization – Using Virtual Environments as Visual 3D Information Systems for Discussion of Data from Geo and Environmental Sciences

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Successful application of immersive visualization in many areas

This technology has been used for a long time now in:

- Automotive
- Architecture
- Mechanical Engineering

Since 1999 it is also often used by Oil & Gas companies to discuss their complicated reservoir data sets.

It is rarely used in environmental sciences and geosciences outside these industries and the question is why.

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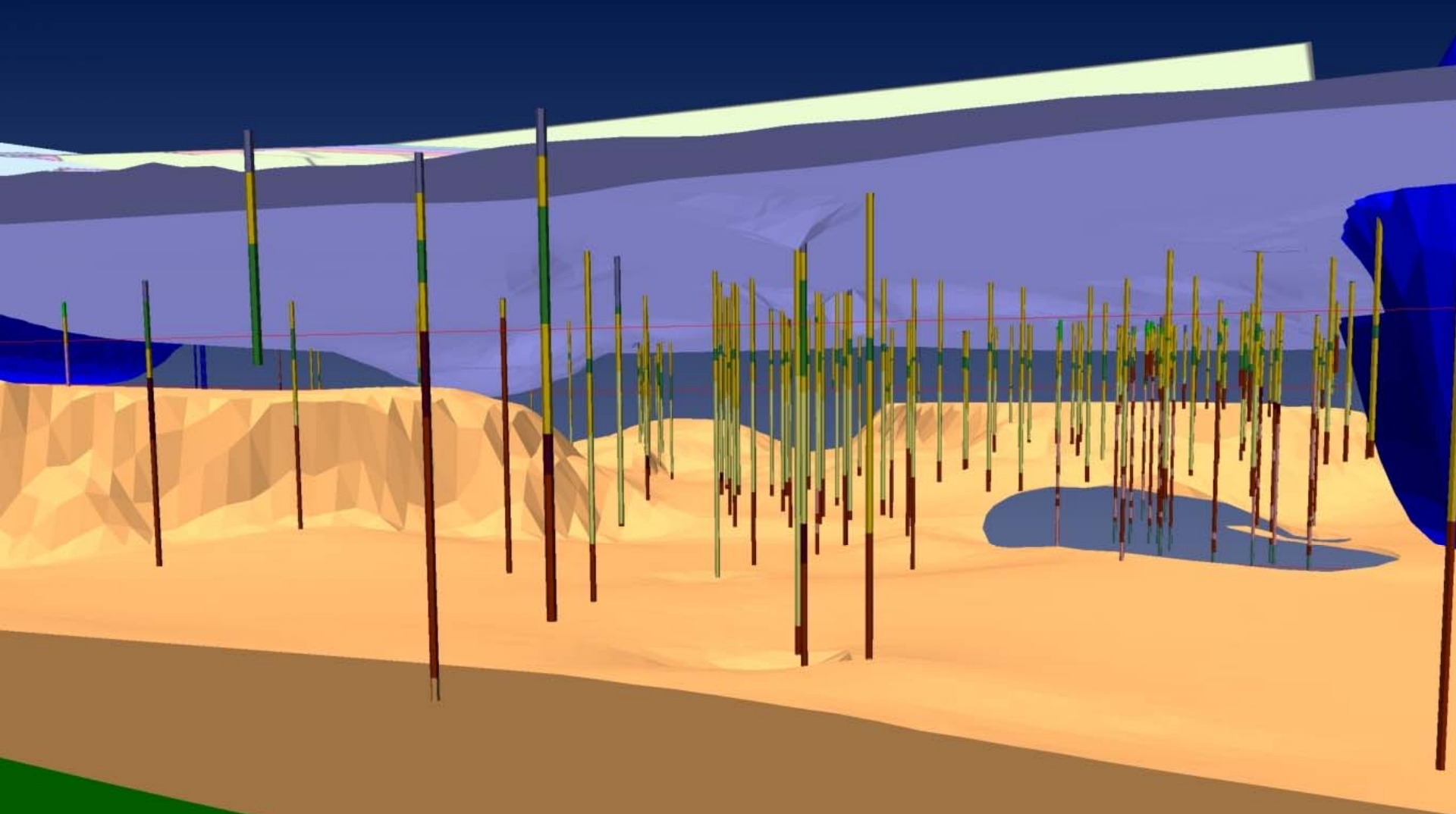
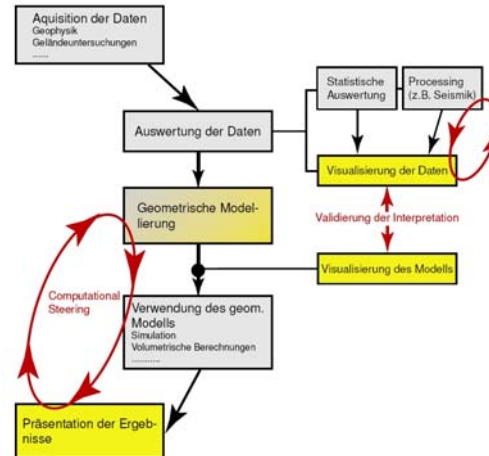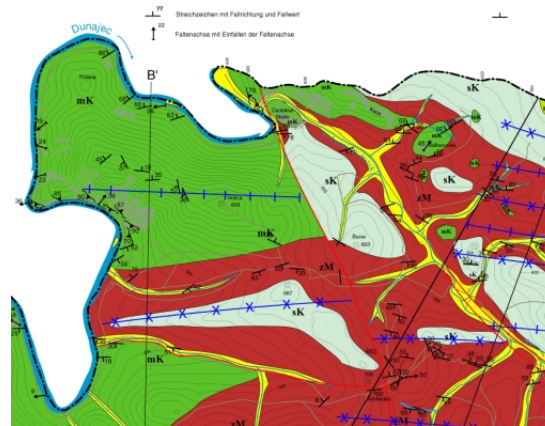The Bitterfeld site in East-Germany is
an example for a very complicated
data set from environmental geoscience.

What do we do with these data?
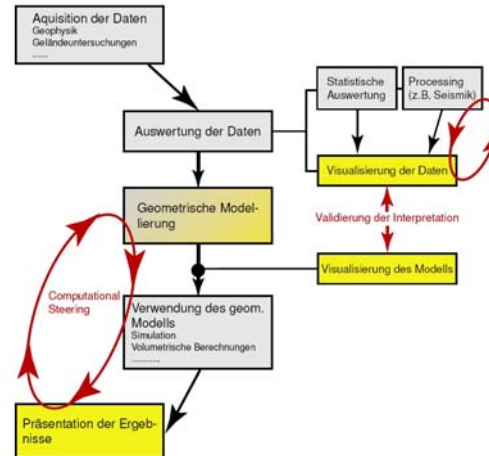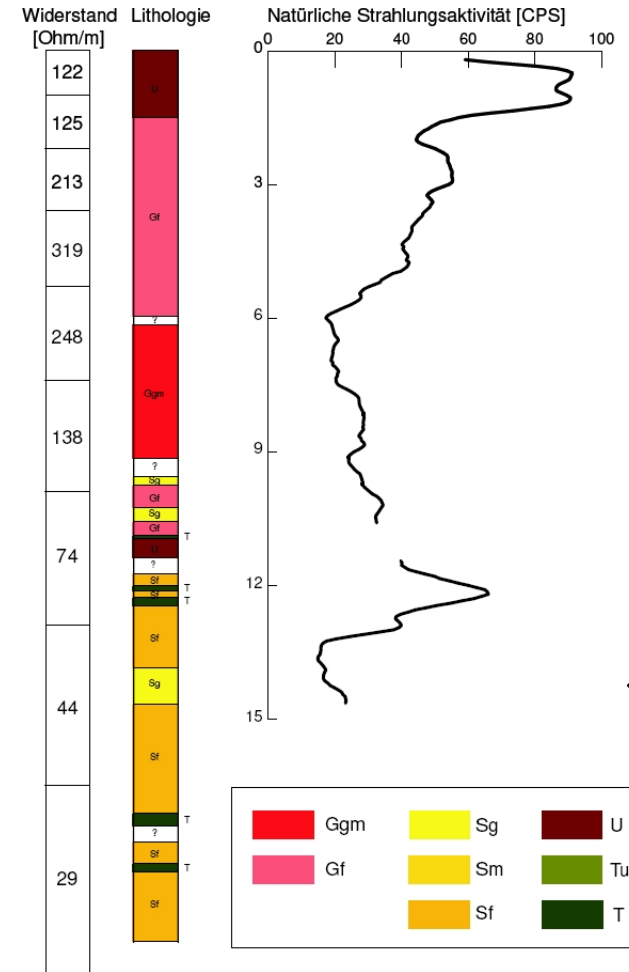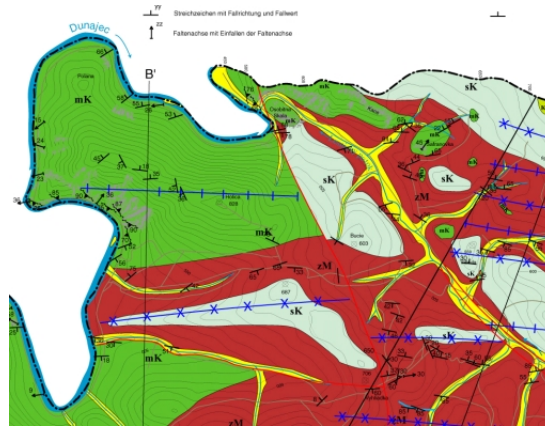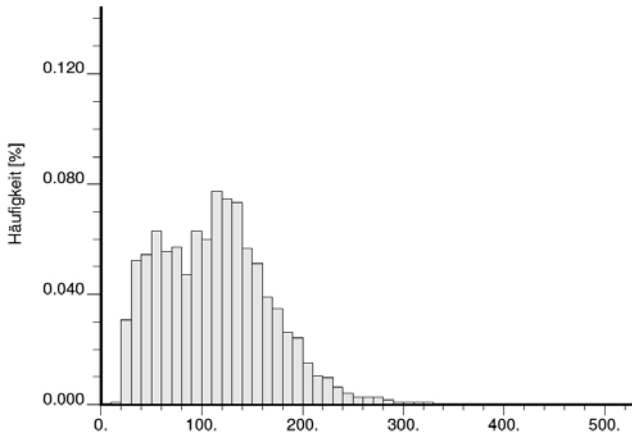
Source: Google maps (bottom left) and Zehner, 2002/1998.

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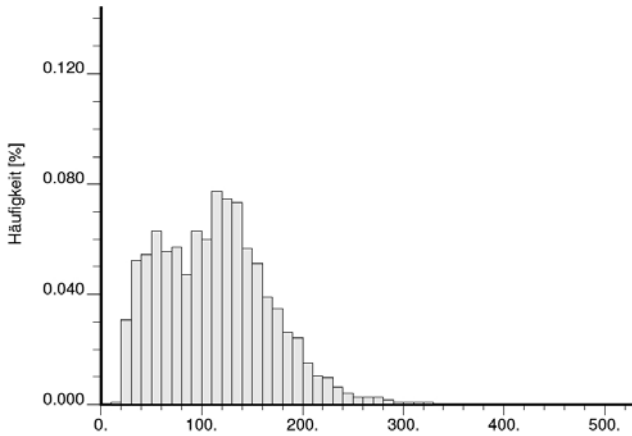
GIS Systems
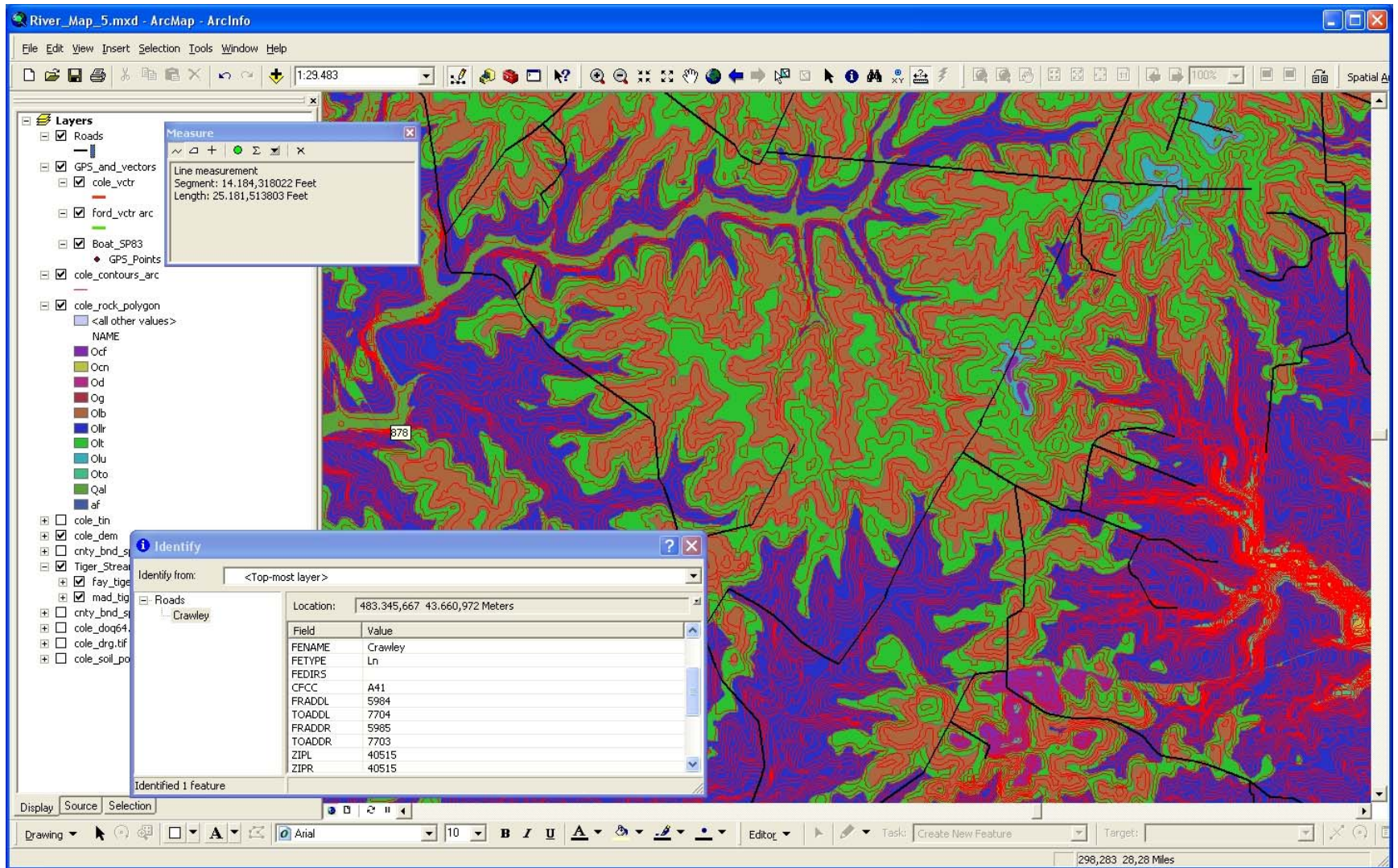
Related/former work

- Using additional Gadgets, such as PDFs

- Using 2D widgets (WIMP interfaces), projected

  on planes in 3D space - an example is the

  InsideReality software from Schlumberger.

- Using Video Wall Controllers (explained later)

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The target:

Providing an example system as proof of concept how a 2D/3D visual information system could look like in terms of interaction and visualization.

- In terms of hardware

- In terms of software

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Display design considerations?

UFZ's display system is mainly used for presentations and discussions:

- Large screen

- High resolution for showing much detail

- VR capability (tracking, stereo)

- Option to show 2D information, e.g. areal images

- Option to mix 2D and 3D

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Mode 1: Virtual Reality (cluster based)

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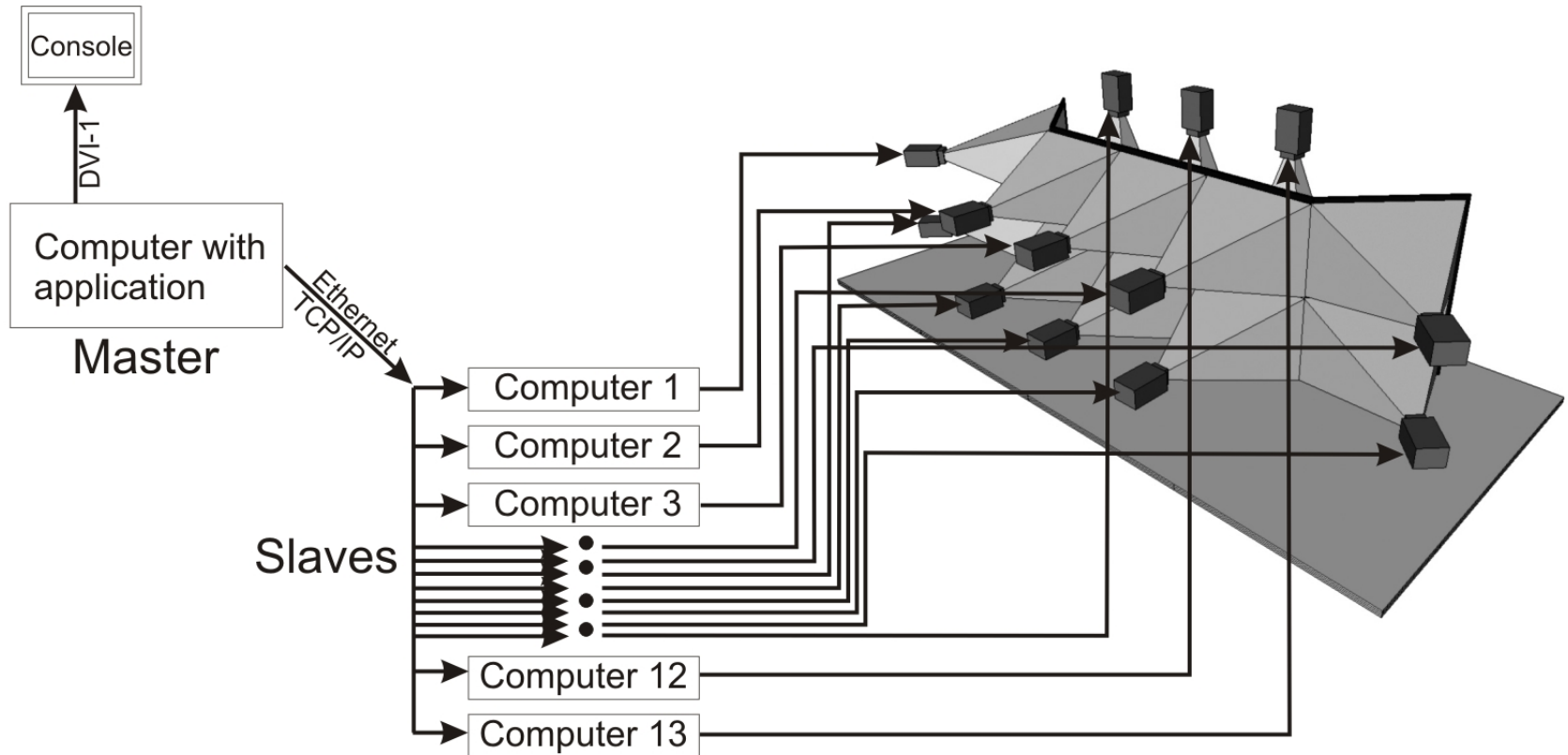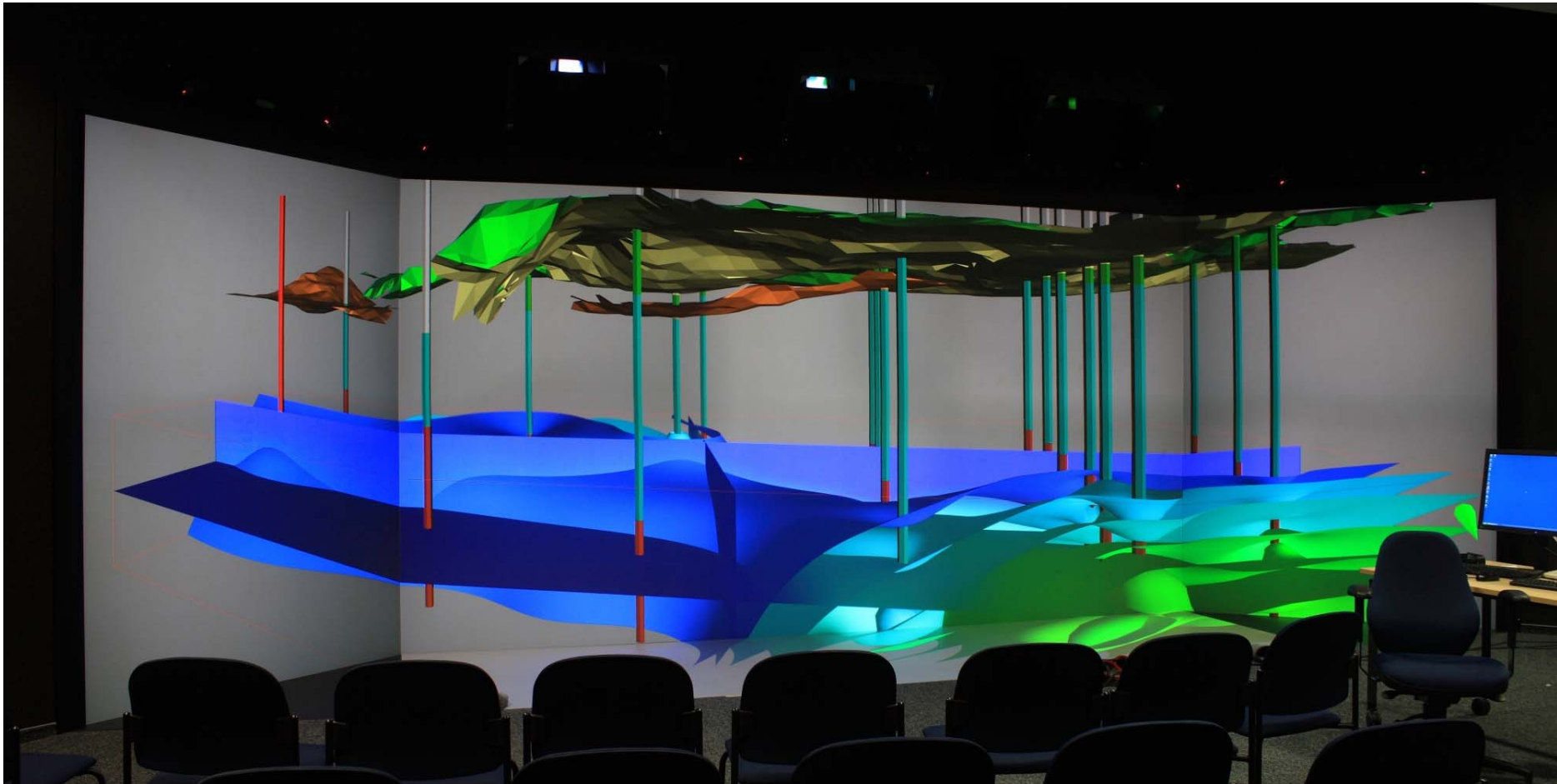
Mode 2: Using a video wall controller

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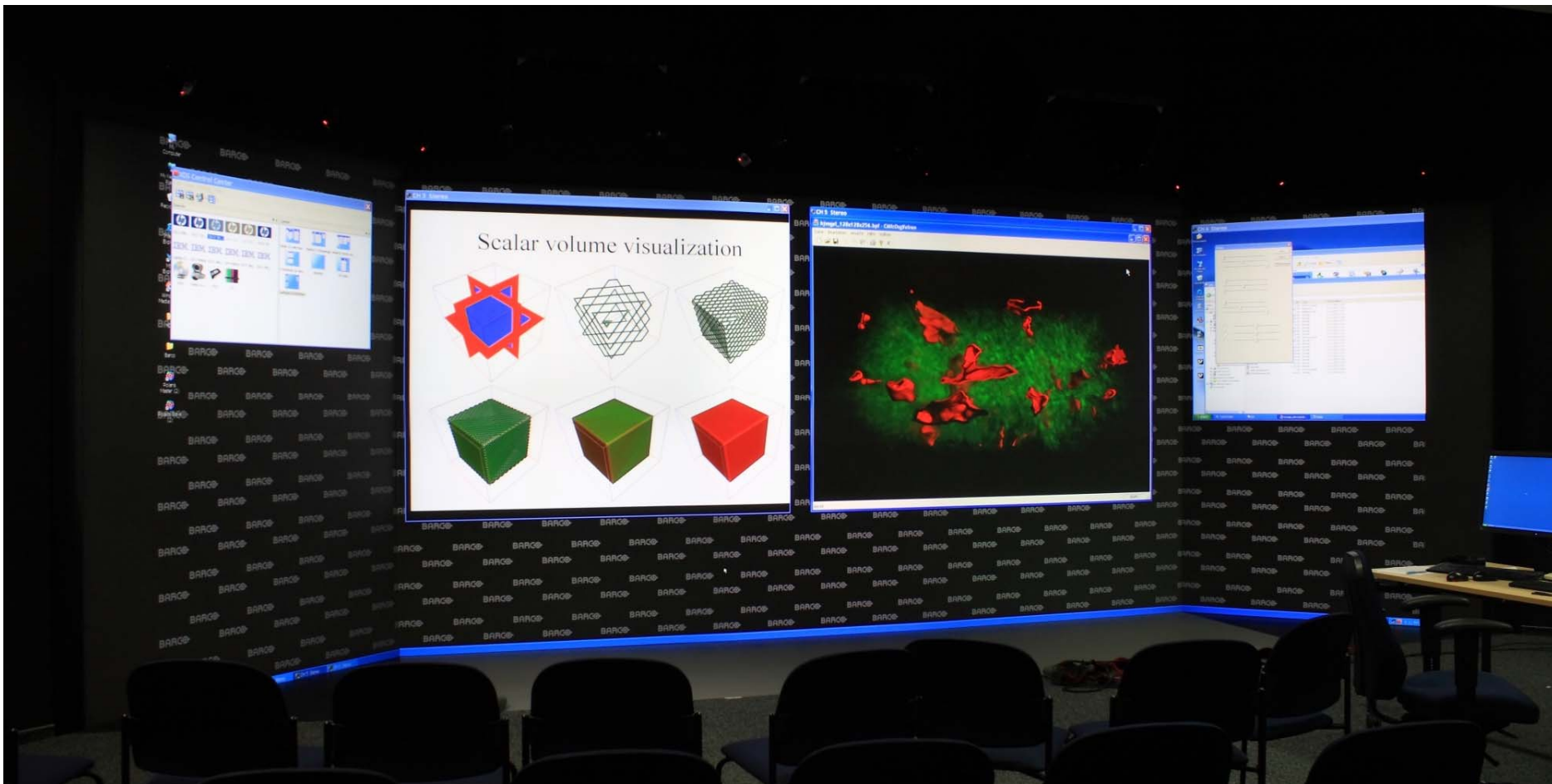
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Mode 3: Cluster and video wall controller

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Mode 3: Cluster and video wall controller

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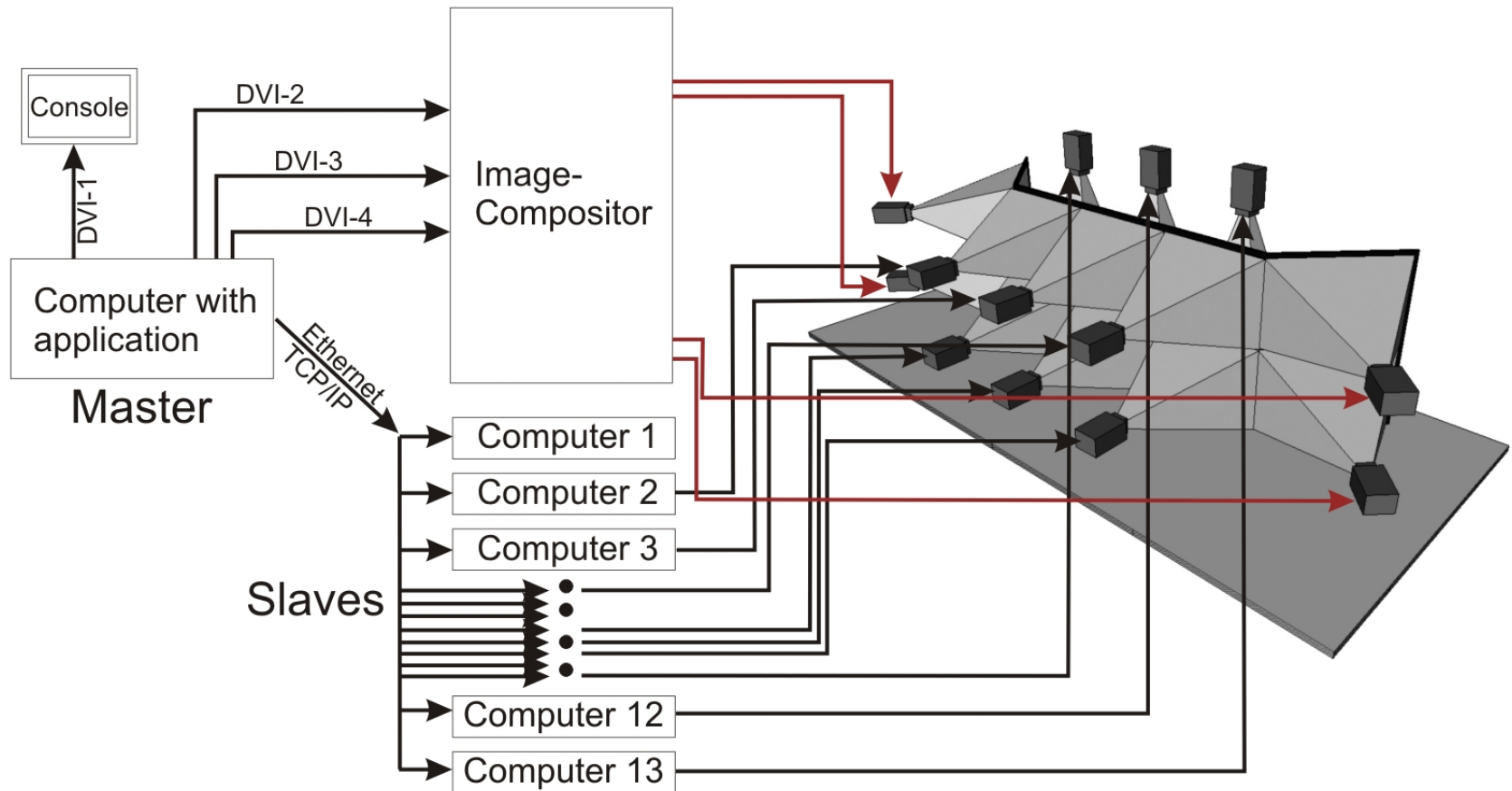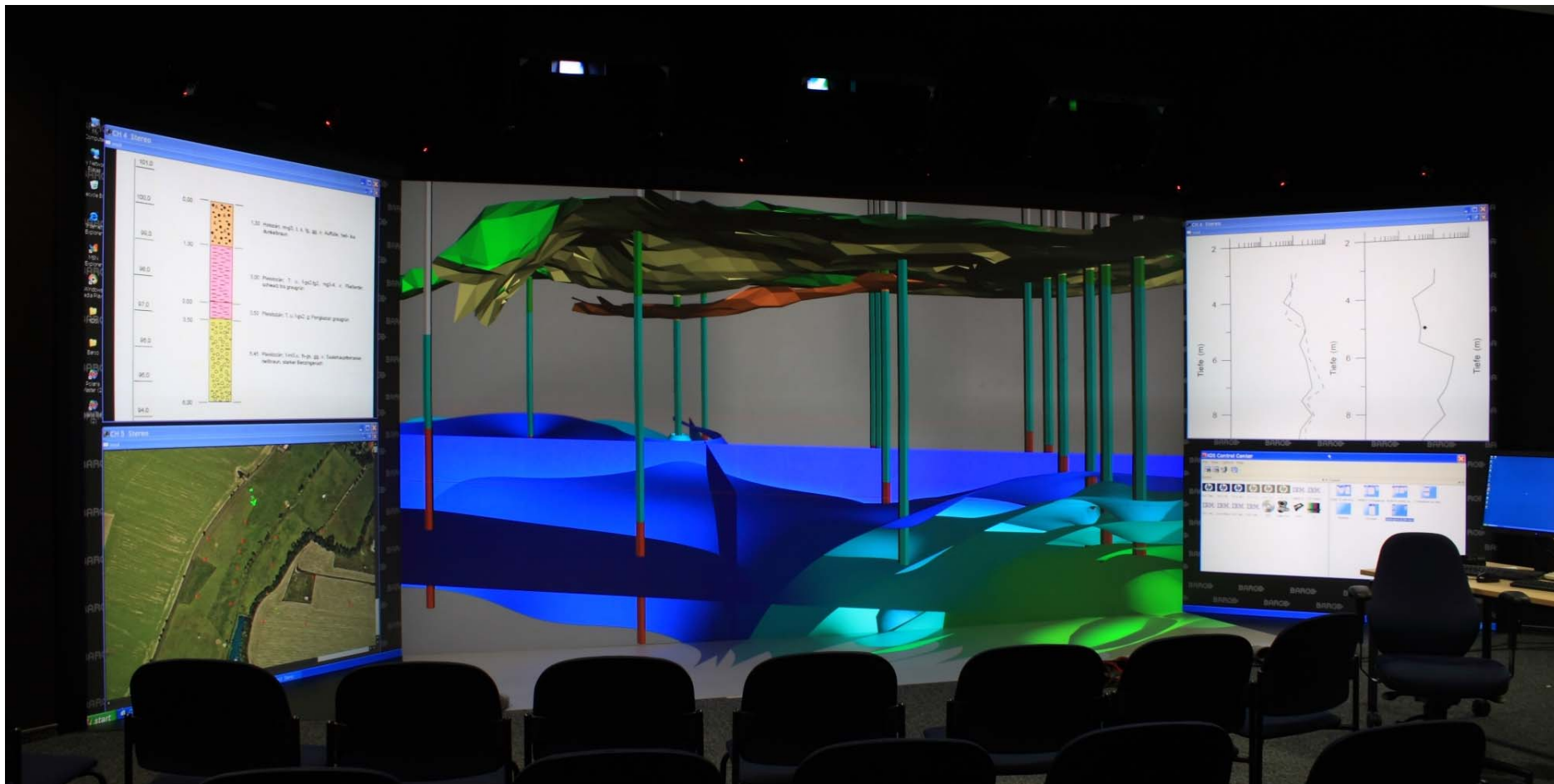
The OpenSG scenegraph

- Open source (www.opensg.org)

- Implements distributed rendering via a cluster

- Separates the structure of the scenegraph
  and the content (e.g. materials, geometry)

- Nodes of the scenegraph are named

  - Names are used for this work
    to link to further information

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Software setup

Window for 2D navigation display

Window for 2D data display

Child windows

Window for 2D data display

Database Files ...

Mediator

3D Vis. App (VRED from PI-VR GmbH)

Managing the scenegraph

In case of rendering via cluster acting as master

Tools - 3D/2D interaction

Info on which object has been picked
Info on required data window navigation

2D window-manager

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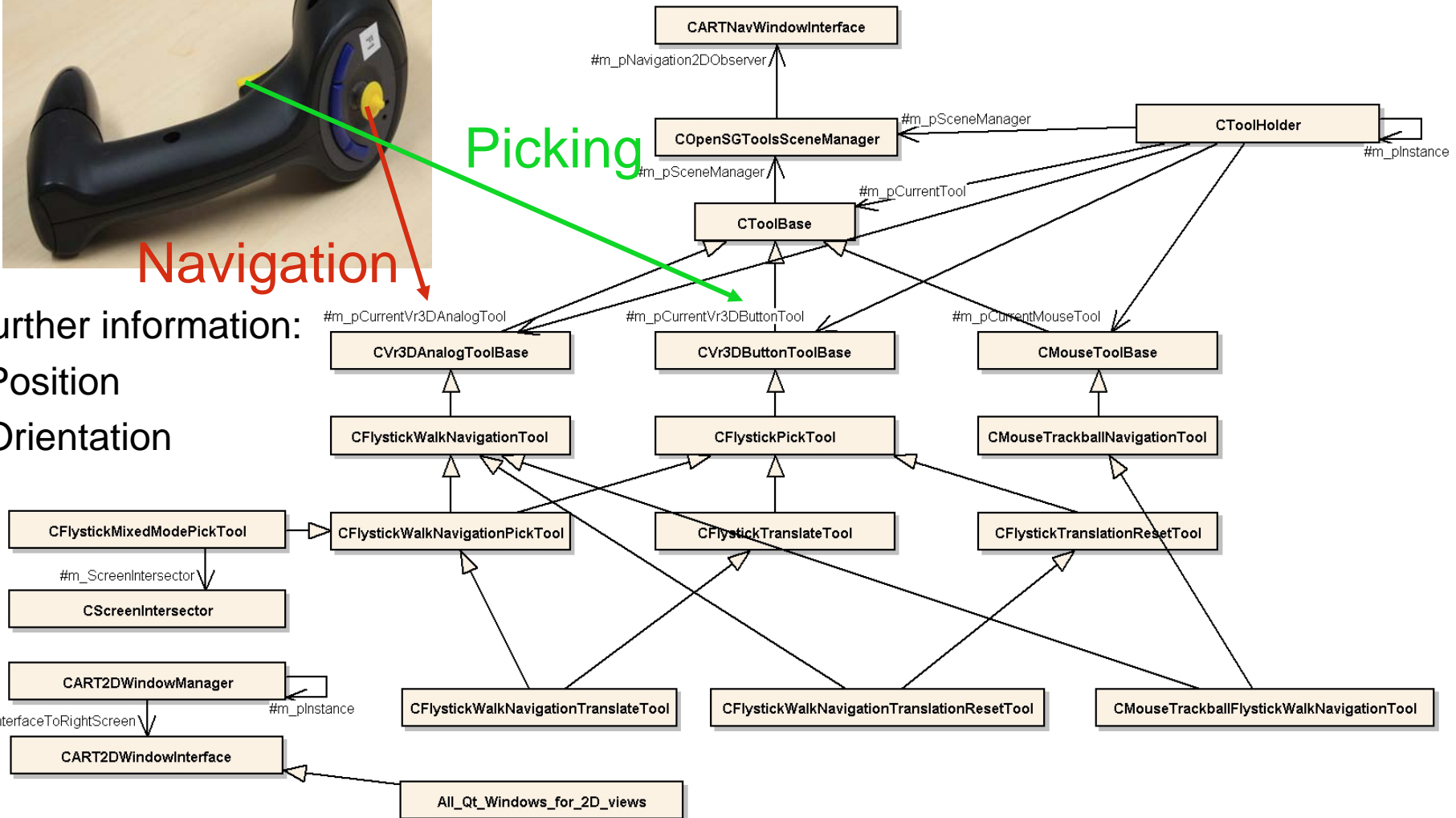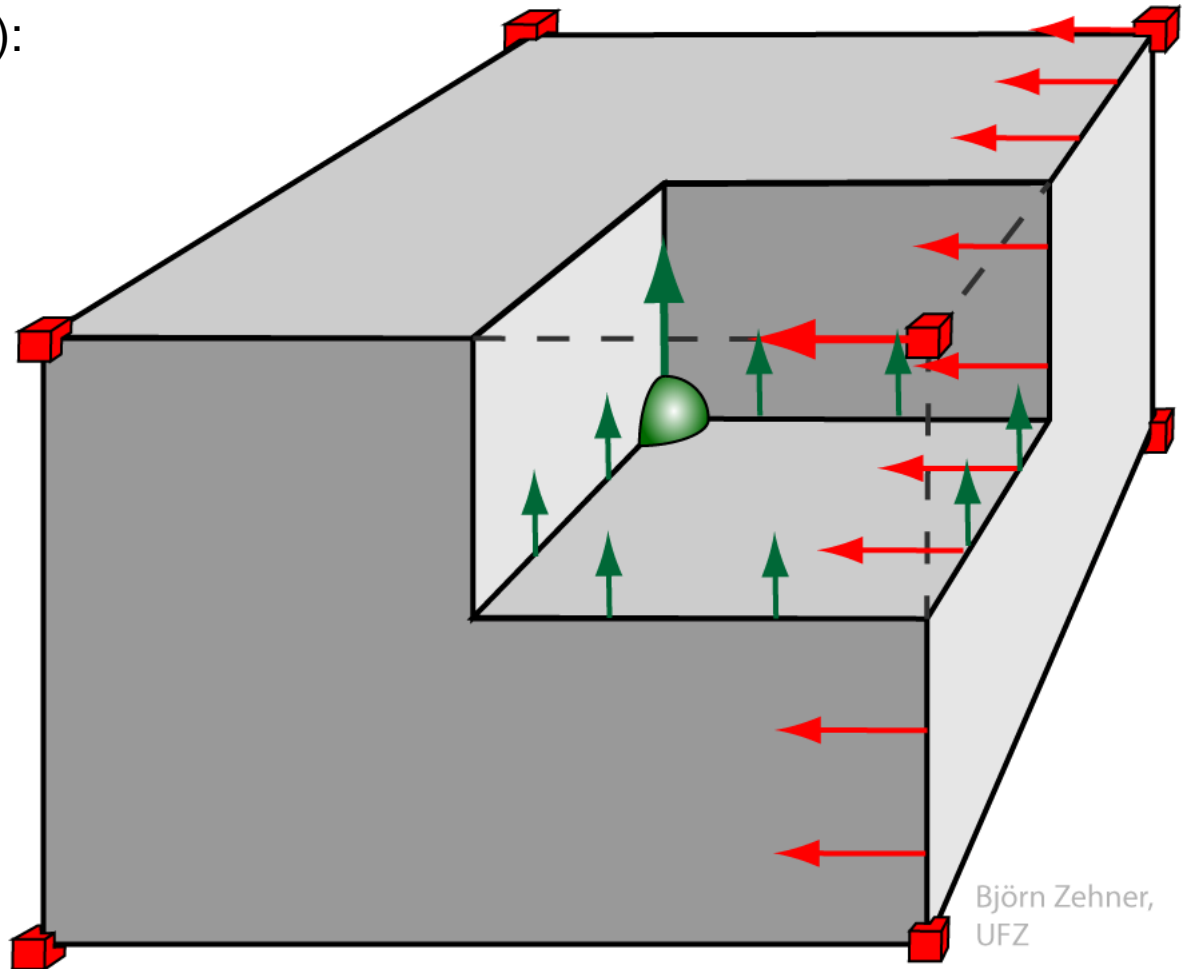
Tools for 3D interaction

Picking

Navigation

Further information:
- Position
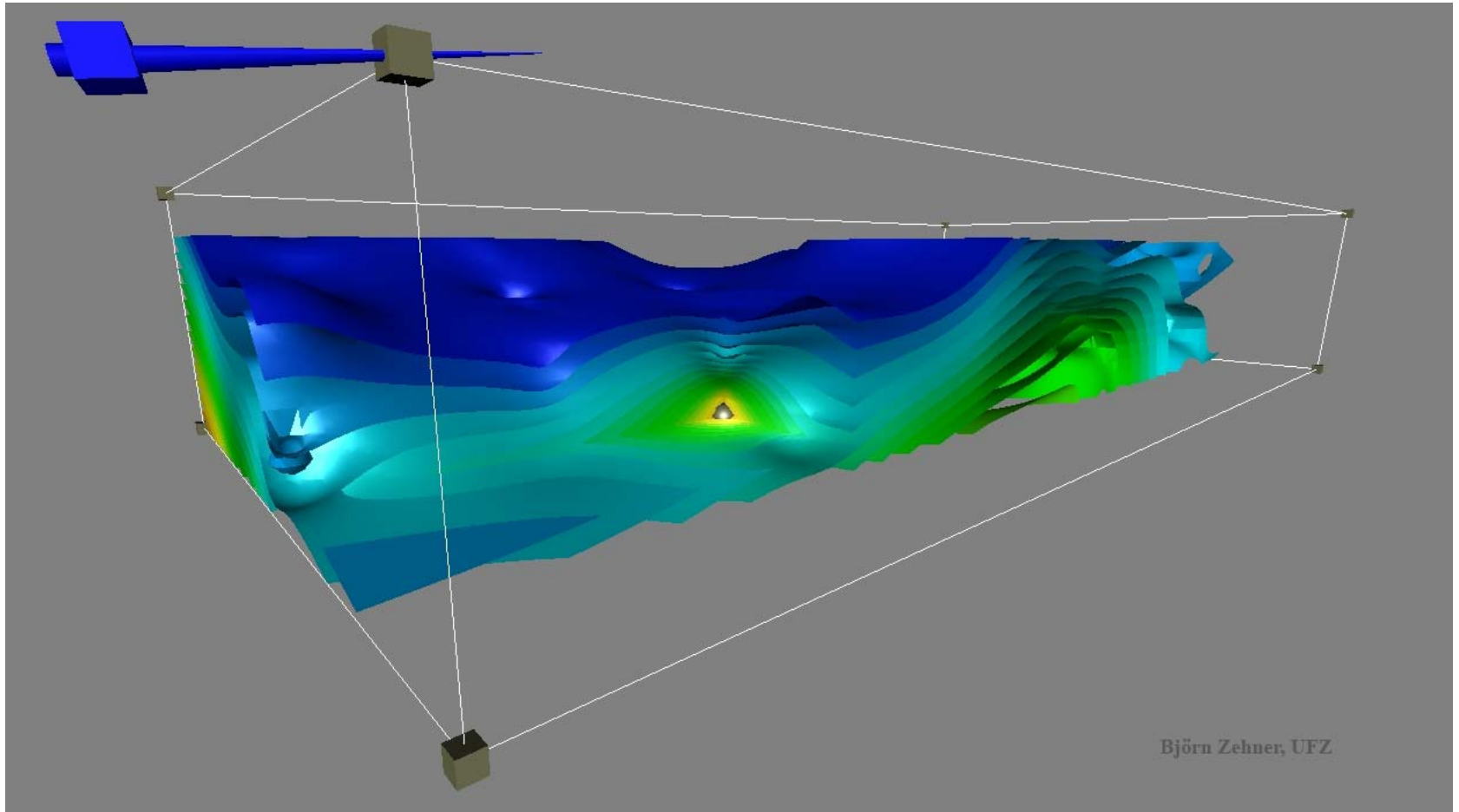- Orientation

Examples for 3D interaction

- Volume of interest (VOI): 6 clip planes clip all information outside of the box.

- Chair-cut: 3 perpendicular clip planes clip an octant of the volume.

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Example for 3D interaction - VOI

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Example for 3D interaction - VOI

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Example for 3D interaction – chair-cut

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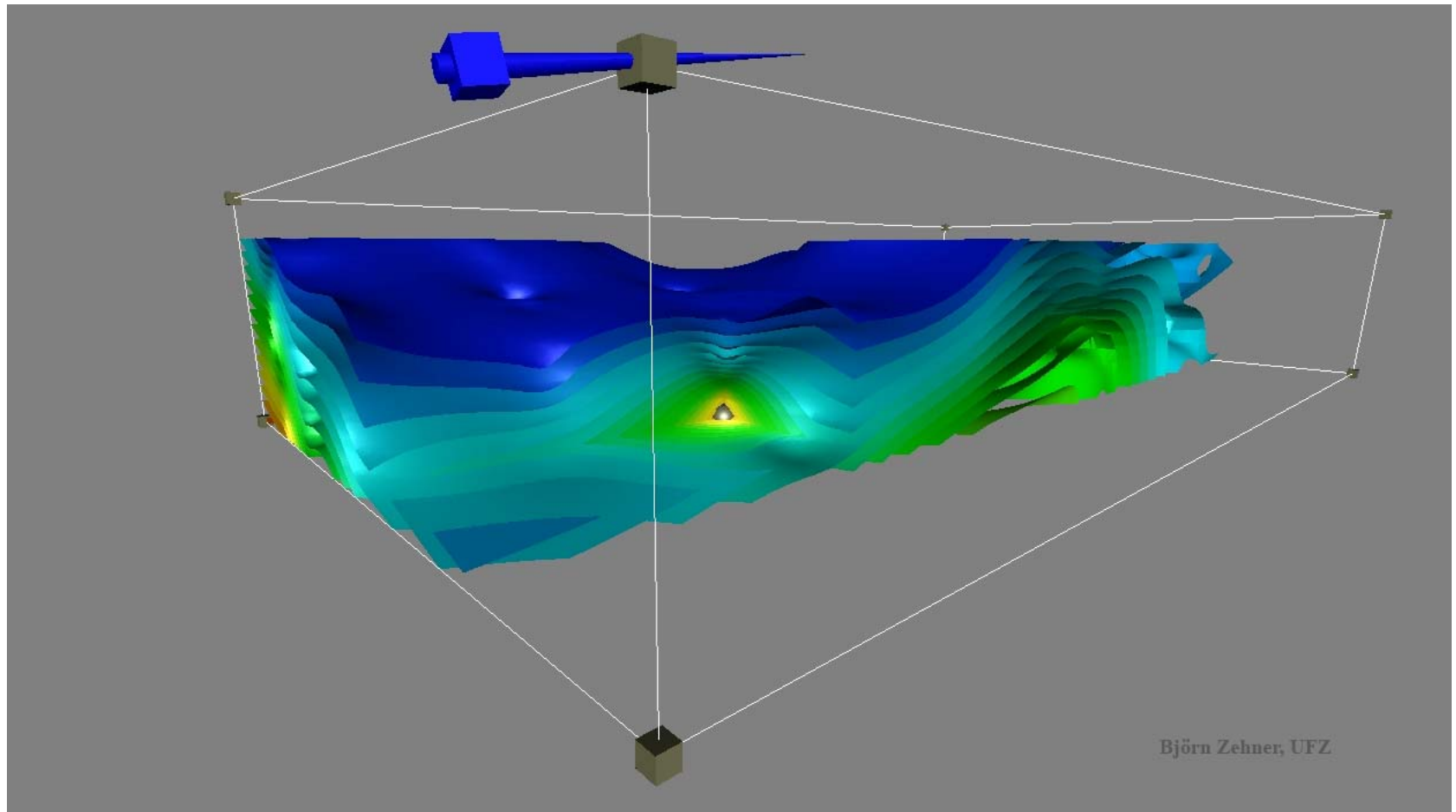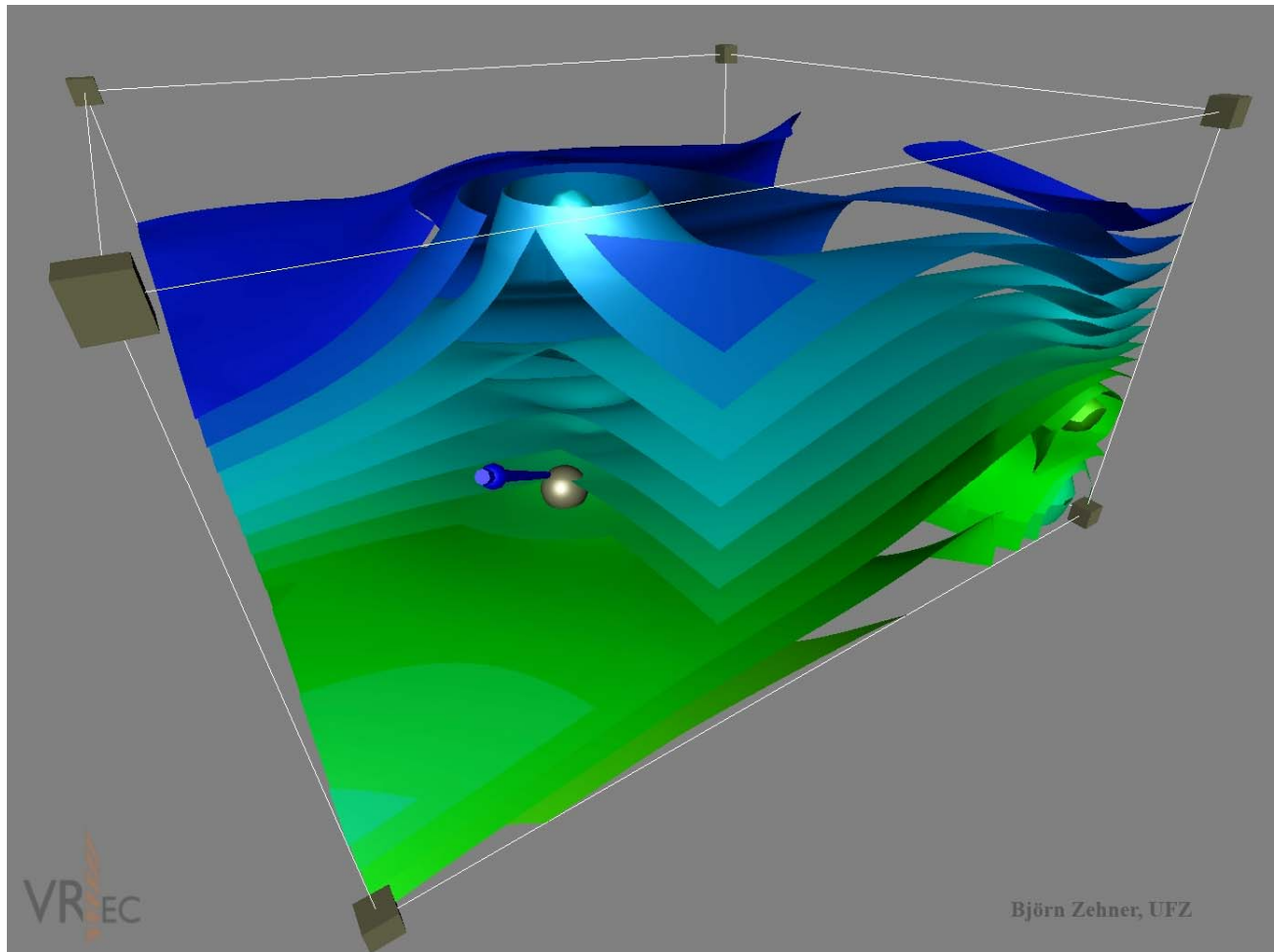
Example for 3D interaction – chair-cut

Steering what is shown in the 2D windows

Button is pressed

Ray intersects left or right side of the display

Ray intersects main screen or floor of the display

Report to the 2D-Window-Manager

Joystick is used for scrolling 2D windows

Next slide

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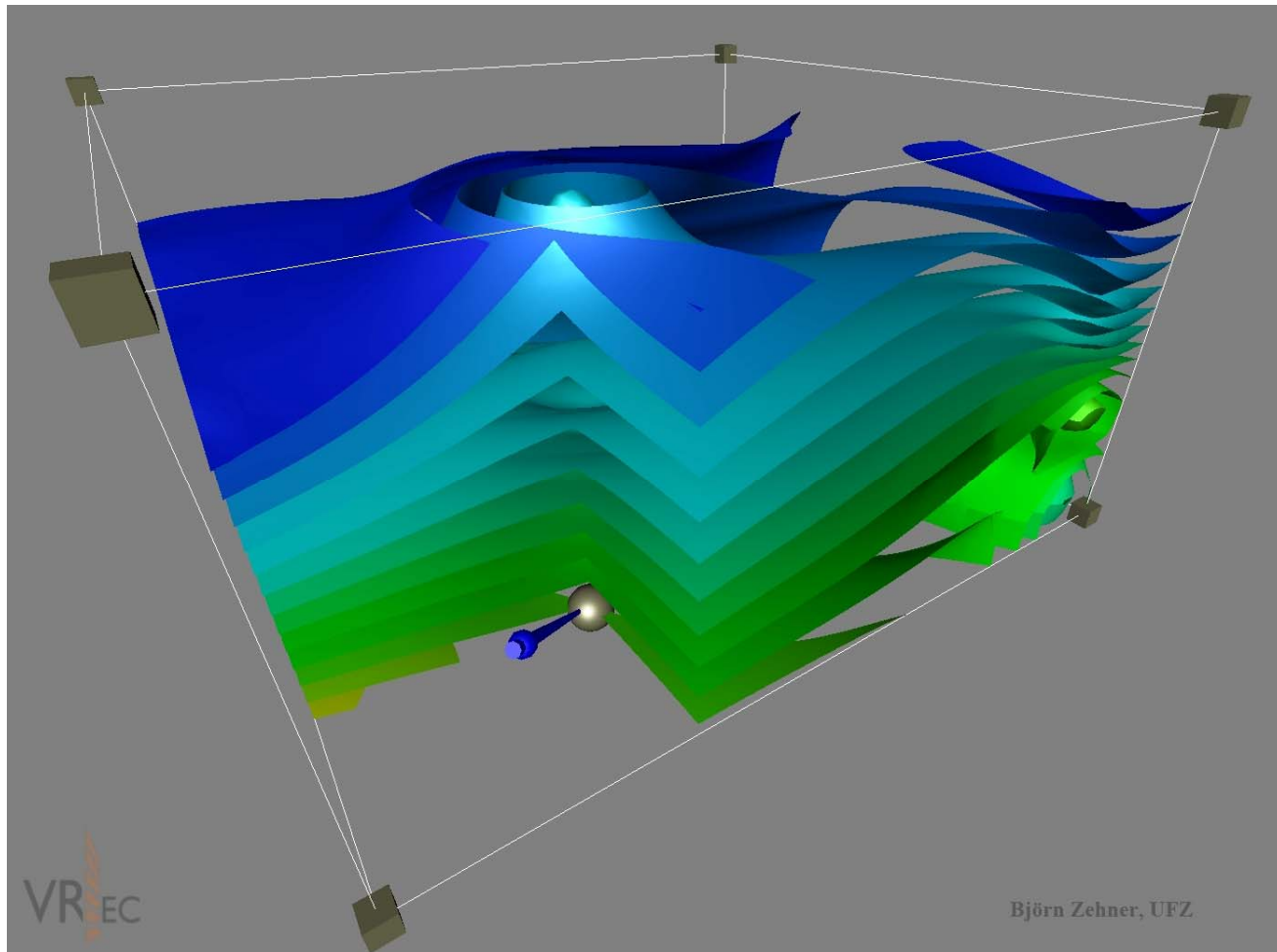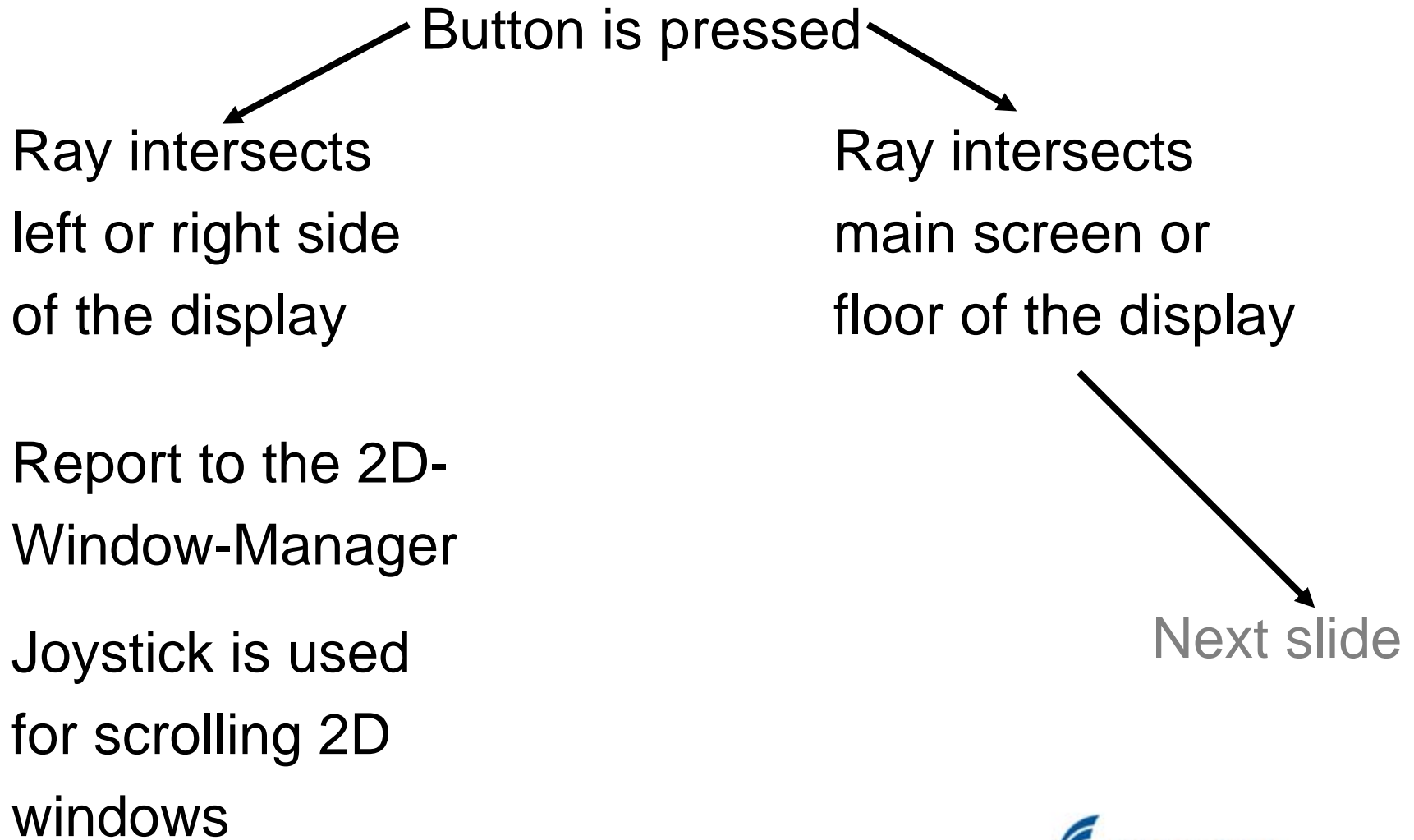
Steering what is shown in the 2D windows

Ray intersection with the scenegraph

„Bor_1" has been picked

Root
Group „Boreholes"
Geom „Bor_1"
:
Geom „Bor_13"

Group „Geology"
Geom „Tertiary"
:
Geom „Perm"

Group „VTK-Data"
Geom „Iso_Pb"
:
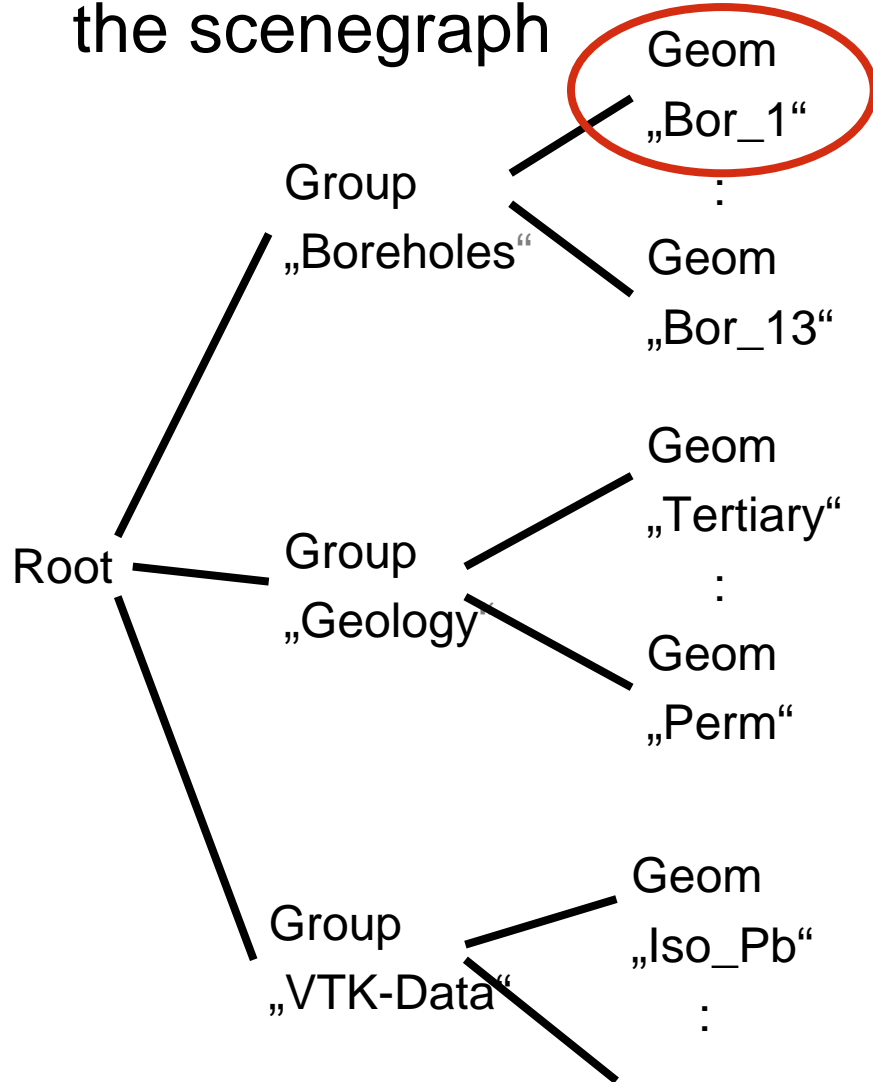
2D Window Manager

„Bor_1" -> show X on left window

„Bor_2" -> ……..

:

„Bor_14"-> show Y on left window

-> show Z on right window

Left Window

showing X

Example: Selection of a borehole

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Conclusions/Problems/Outlook

Overall feedback was good so far. The 2D navigation window helps when people are lost.

Problems:

-The wide angle of view allows only to view
 one side screen at a time, possibly an advantage of using
 additional gadgets or 2D widgets in 3D space.

-Datamanagement

Next step: Incorporating the system into a large project

at the UFZ for evaluation and comparison to other approaches.

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