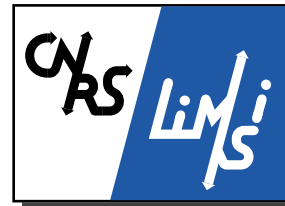

Slicing Techniques for Handheld Augmented Reality

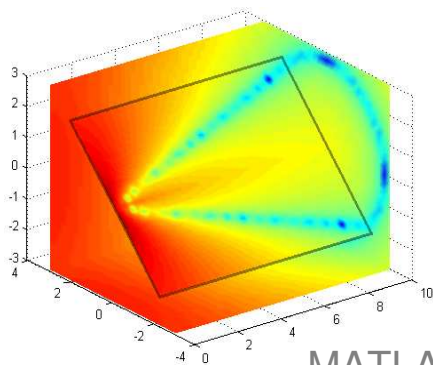
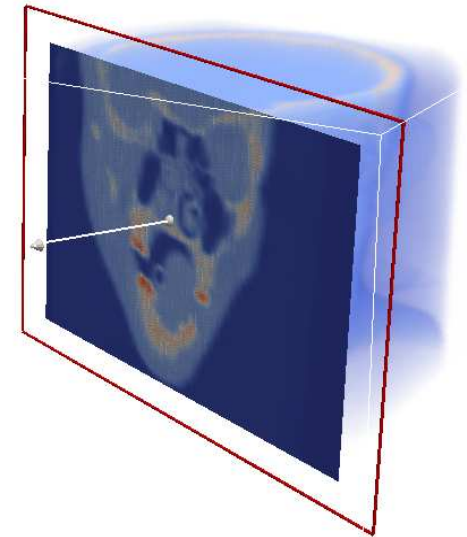
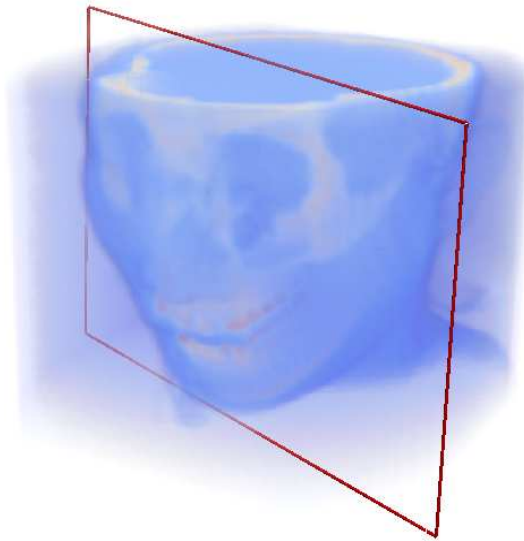
Paul Issartel, Florimond Guéniat and Mehdi Ammi

LIMSI-CNRS

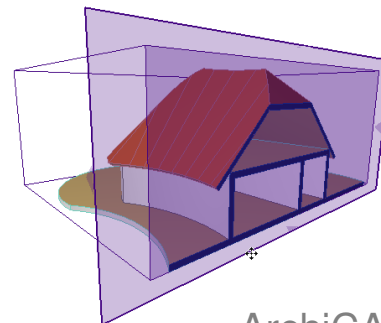


Slice plane manipulation

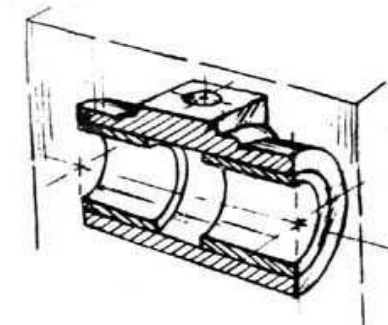
Positioning and **orienting** a plane to slice a 3D volume:



MATLAB



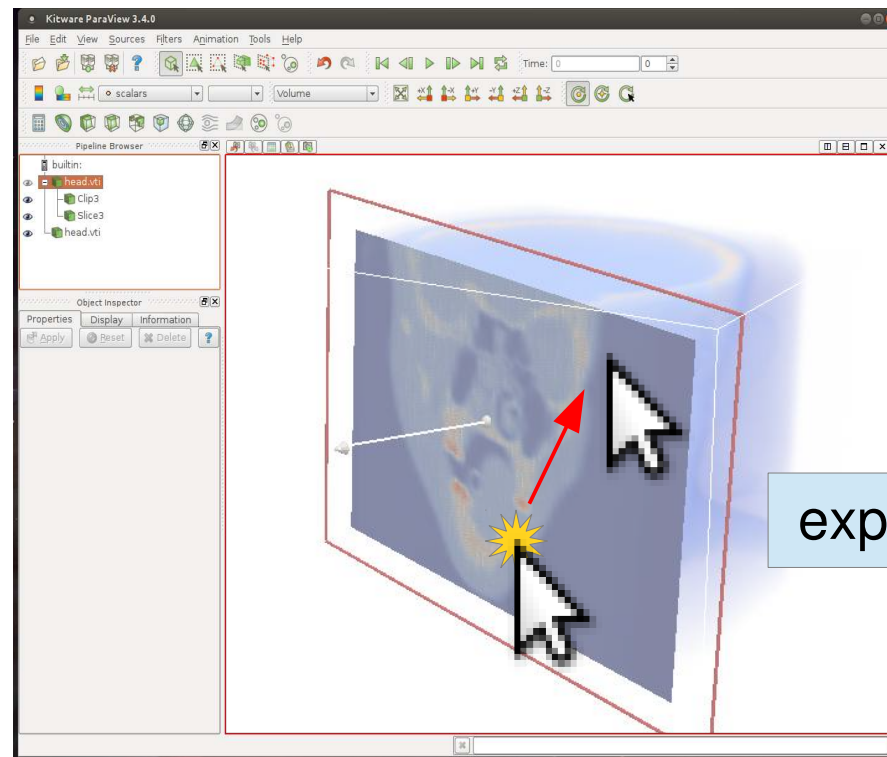
ArchiCAD



Blanco et al.

On desktop computers:

- **2D mouse**
- suboptimal 2D → 3D mappings



expected result?

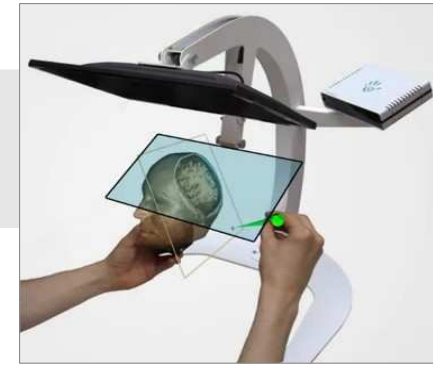
ParaView (www.paraview.org)

Using **tangible objects** as **3D input devices**:

Tangible slicing tool
+ external display



PassProps
Hinckley et al. (1994)



C-Station™
PS-Medtech (2013)

Spatially aware display



PaperLens
Spindler et al. (2009)



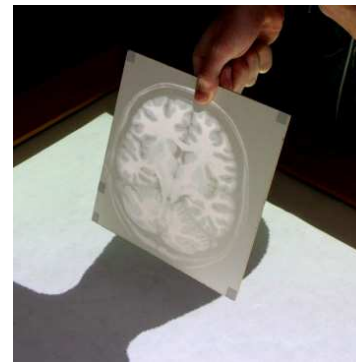
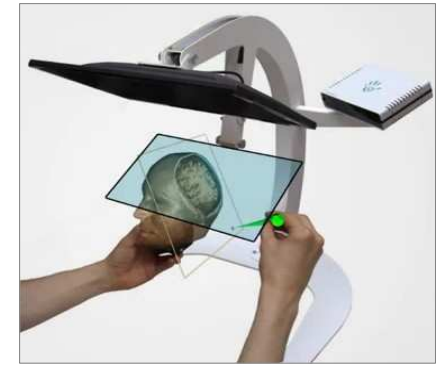
Bertelsen et al. (2012)

Using **tangible objects** as 3D input devices:

Limitations

- custom-made prototypes
- expensive hardware
- non-portable

⇒ not used in practice

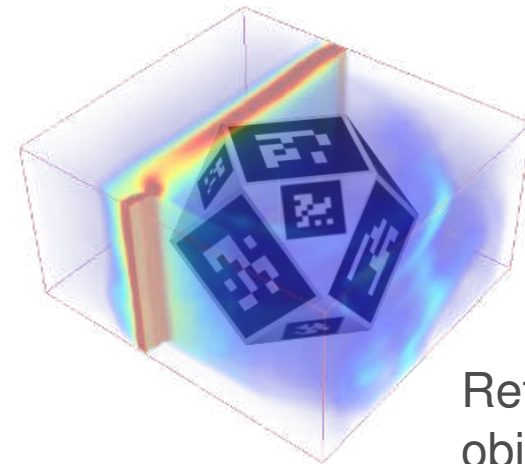


Proposed solution

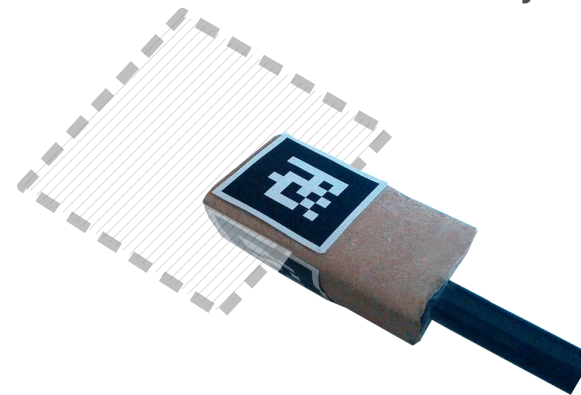
- hardware: off-the-shelf **tactile tablet**
- interaction: **augmented** tangible props
- portability: **inside-out tracking**



Tablet



Reference
object

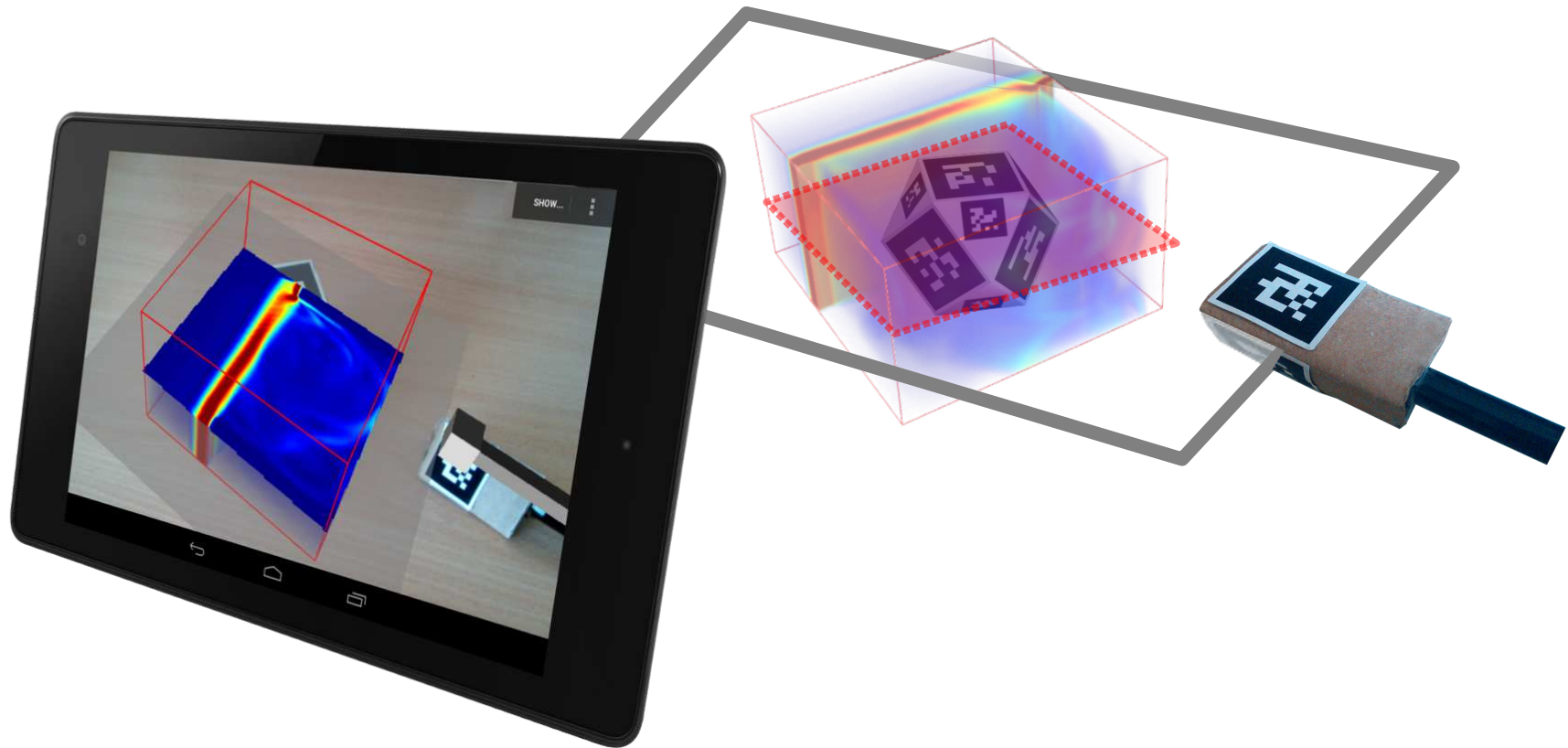


Stylus

Stylus slicing

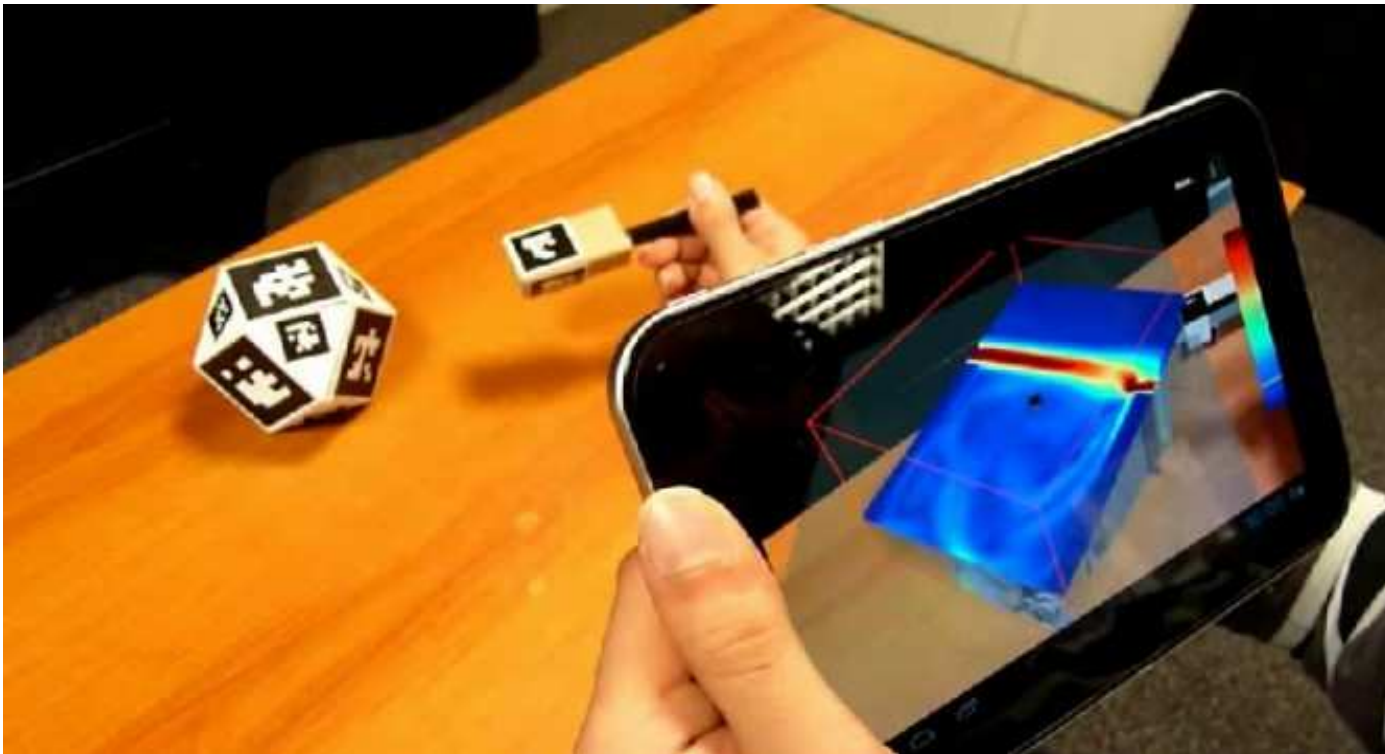
Tangible slicing tool: **stylus**

= slice plane attached to the stylus



Tangible slicing tool: **stylus**

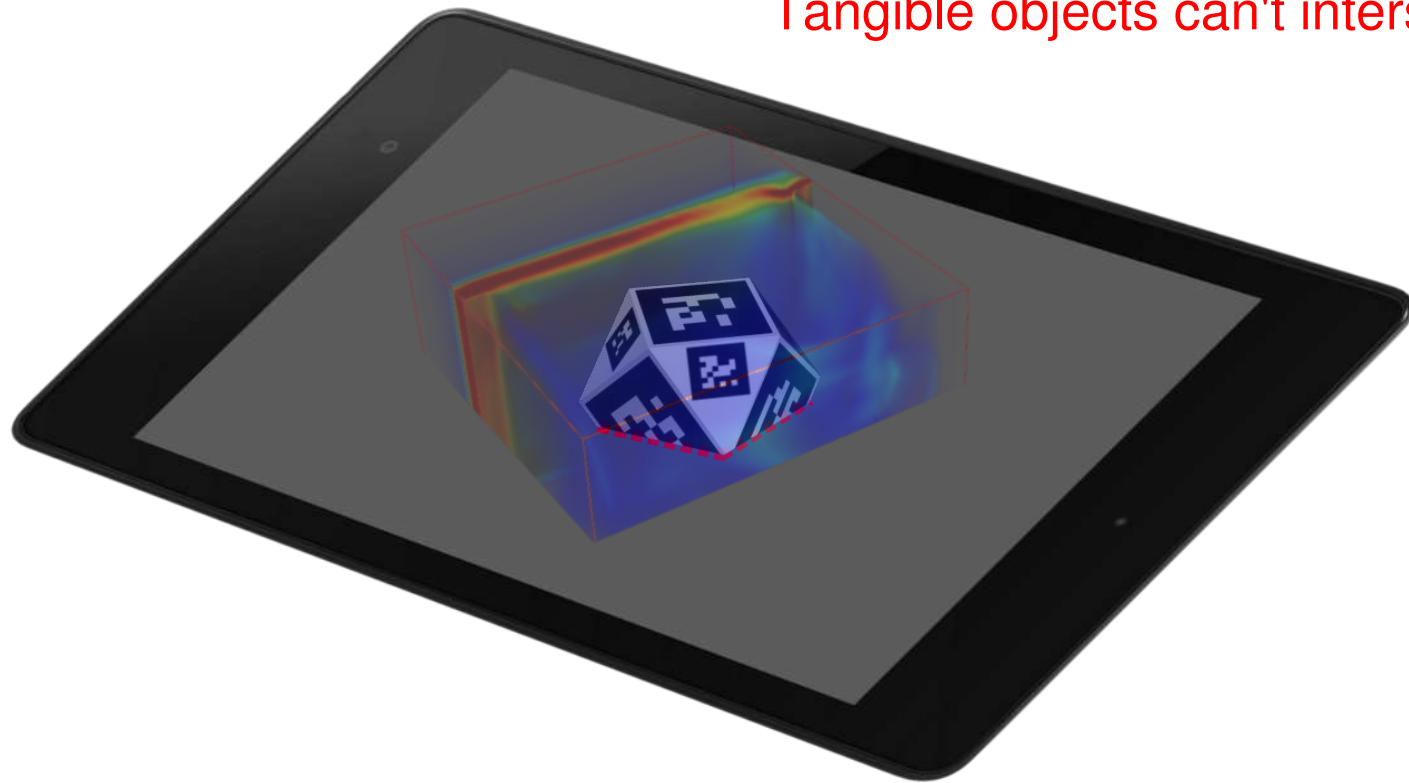
= slice plane attached to the stylus



Spatially aware display: **tablet**

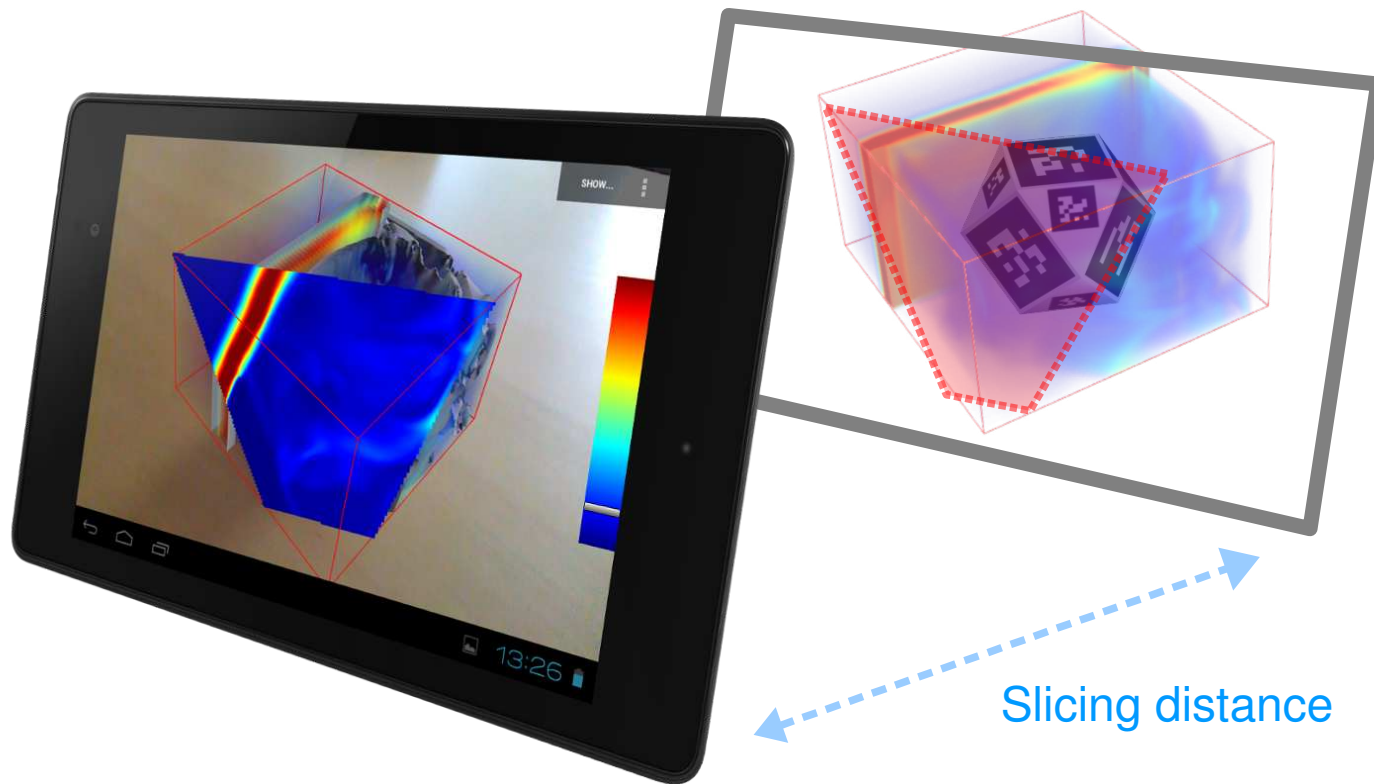
= slice plane attached to the tablet

Tangible objects can't intersect...

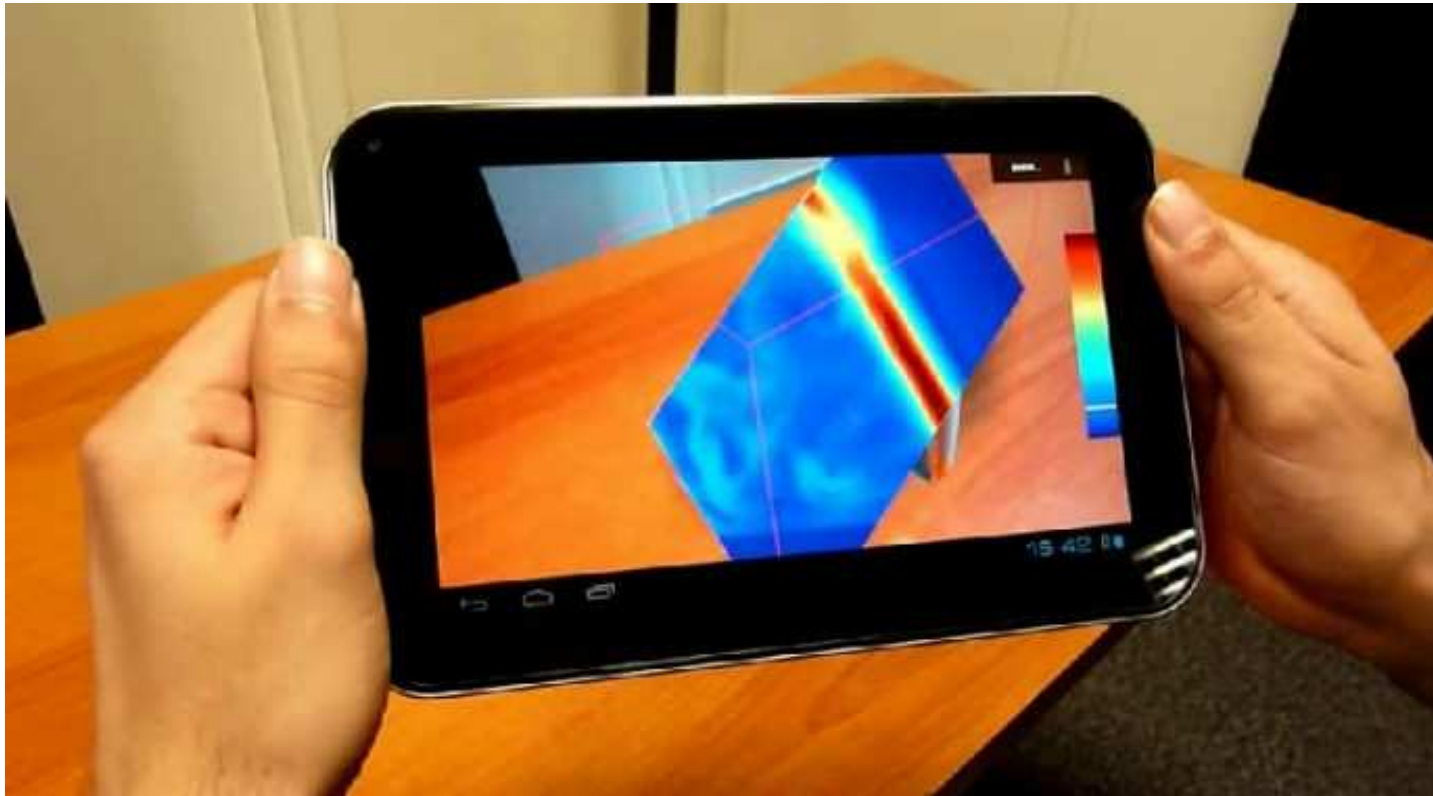


Tablet slicing

Spatially aware display: **tablet**
= slice plane attached to the tablet



Spatially aware display: **tablet**
= slice plane attached to the tablet



Goal: evaluating **performance** and **usability** in this new handheld configuration

Task:

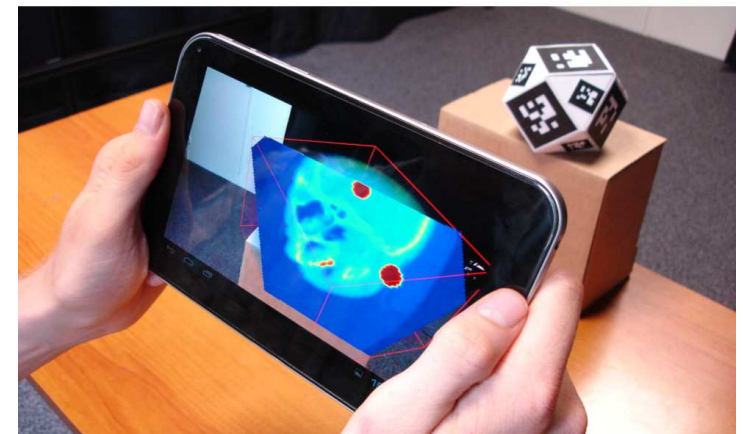
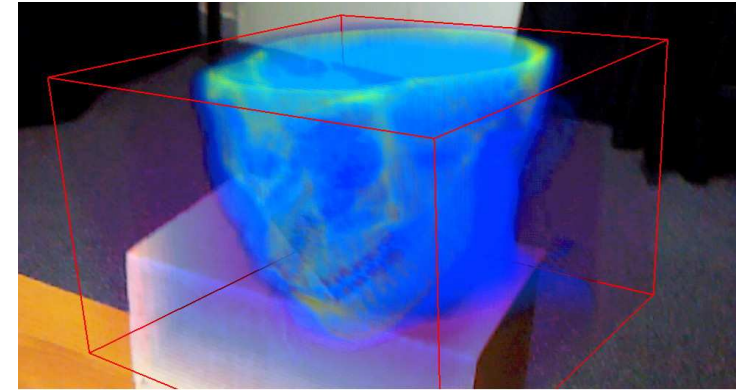
1. finding the 3 targets in the data volume
2. making a slice plane through all targets

Conditions:

- tablet slicing
- stylus slicing
- mouse technique from ParaView (baseline)

Measures:

- completion time
- slice plane trajectory
- questionnaire



Experimental platform:
Toshiba AT270 tablet (Android 4.0)

Stylus slicing

- **more efficient** than other techniques
- **preferred** by users
- manipulating two objects is cumbersome

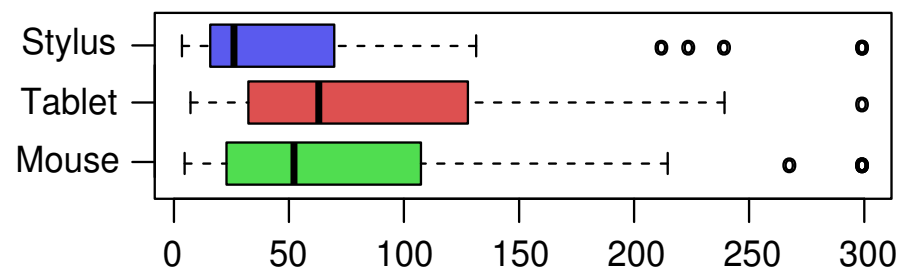
Tablet slicing

- **slightly worse** than the baseline (!)
- covers a **larger volume**
- issues with precise manipulation
- better for initial exploration of the dataset

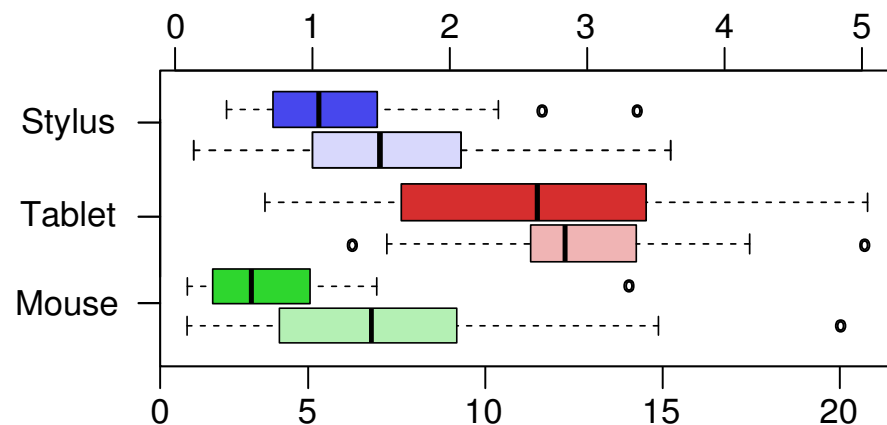
Fatigue

- no significant difference
- **tablet's weight** (in all conditions)

Task completion time (seconds)



■ Mean speed (cm/s) of the slice section
■ Trajectory expansion (cm) of the slice section



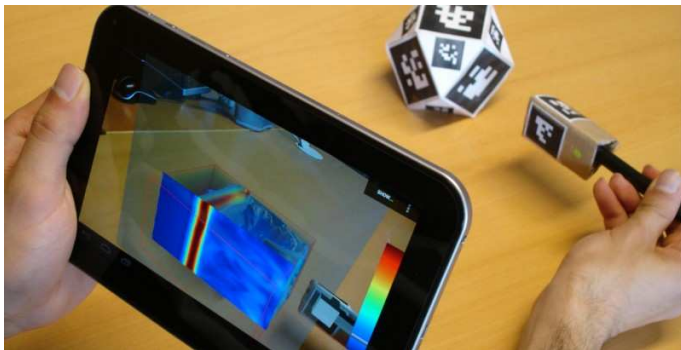
In this work:

- we **adapted two tangible slicing techniques** to handheld AR
- using **readily available** hardware
- we **evaluated performance and usability** in this new environment

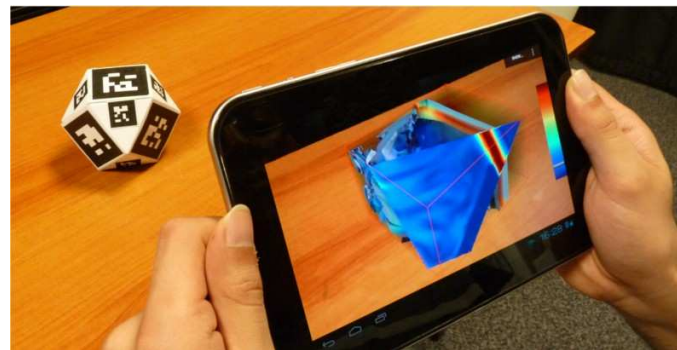
Slicing Techniques for Handheld Augmented Reality

Paul Issartel, Florimond Guéniat and Mehdi Ammi

 paul.issartel@limsi.fr



Stylus slicing



Tablet slicing