**University of Stuttgart**
**Institute for Theory of Electrical Engineering**

# COMSOL CONFERENCE
# 2017 ROTTERDAM

University of Stuttgart
Institut for Theory of Electrical Engineering
Pfaffenwaldring 47, 70569 Stuttgart, Germany
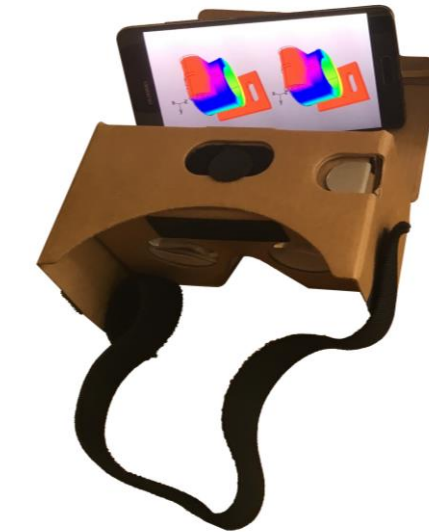www.ite.uni-stuttgart.de
matthias.juettner@ite.uni-stuttgart.de

# A Standalone Interface for Web-Based Virtual Reality of Calculated Fields

**Matthias Jüttner,**
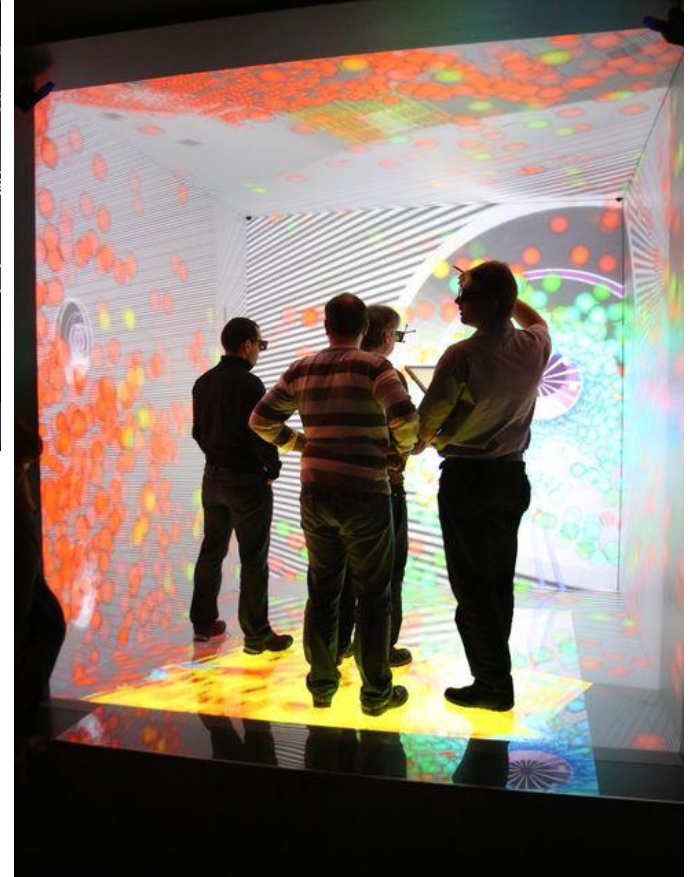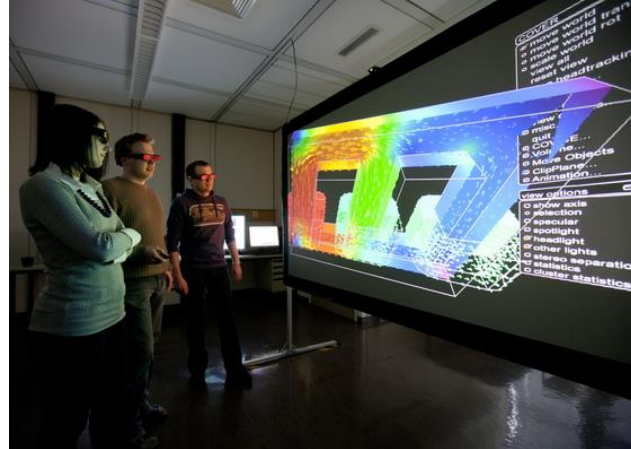**Nan Zhao,**
**Sebastian Grabmaier**

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# Motivation
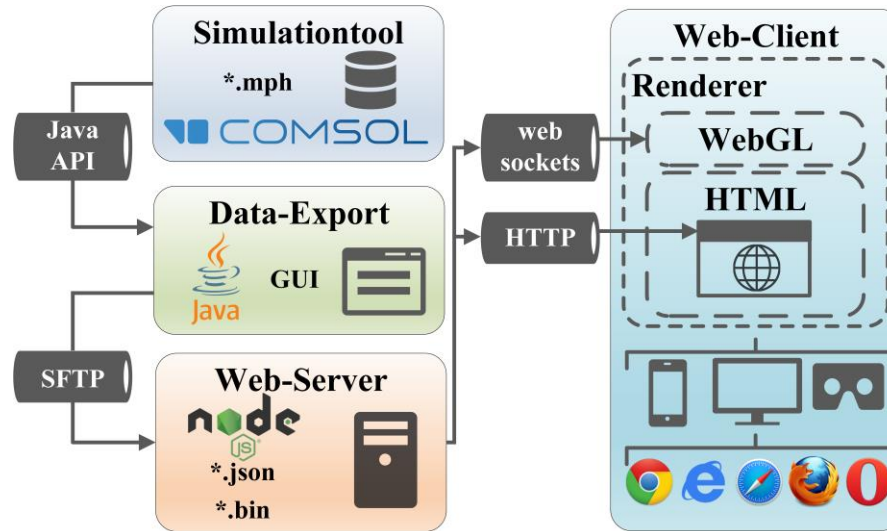
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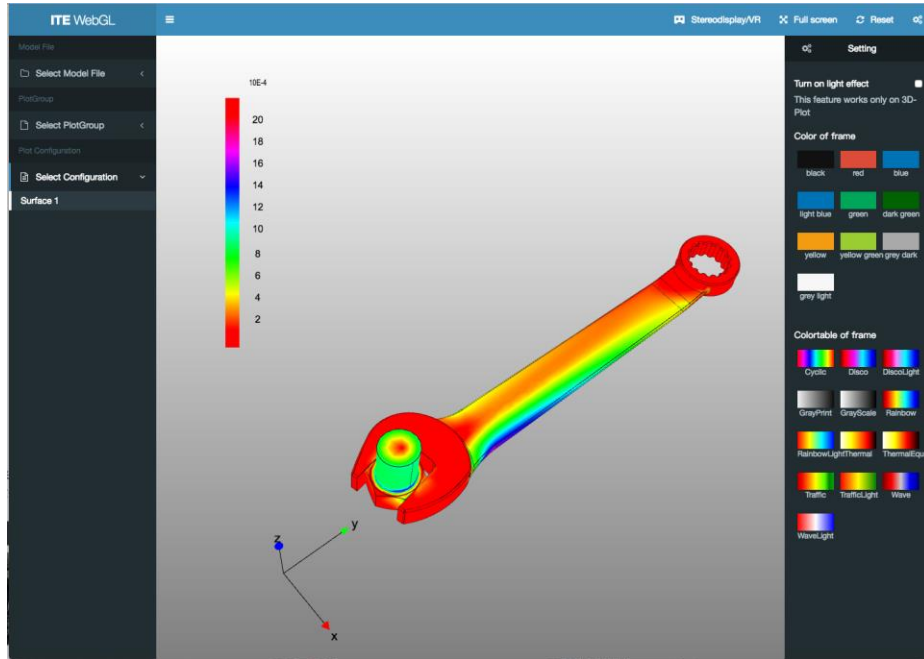M. Jüttner

# Visualization Framework
## System Overview



[1] M. Jüttner, S. Grabmaier and W. M. Rucker, Web Based 3D Visualization for COMSOL Multiphysics, Cambridge, UK: European COMSOL Conference, 2014.
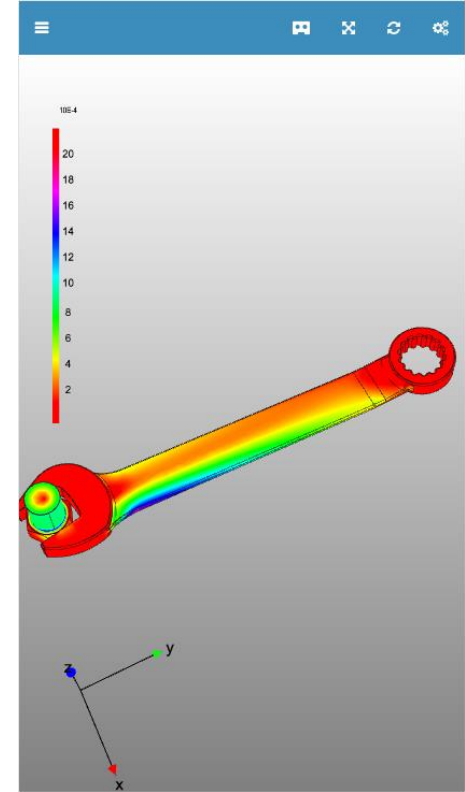
# Visualisation Results
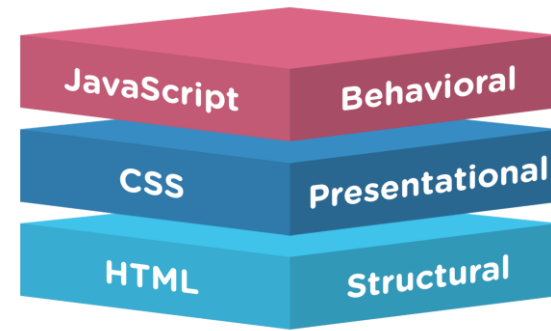Impressions on the Application

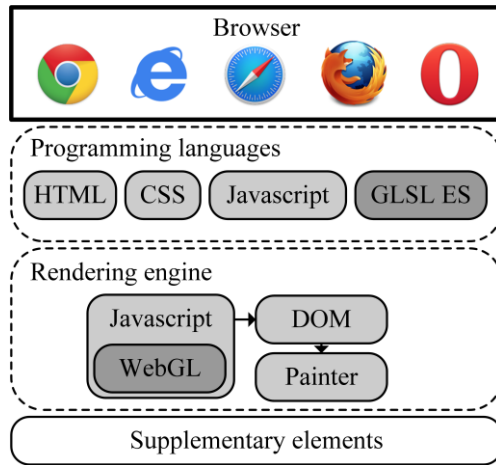- On a Desktop Computer



- On a Mobile Phone

# Visualization Framework
## Web Application

- Application Setup:





- Behavioural: Interaction, Animation, …
- Presentational: Layout, Color, Font,…
- Structural: Document Object Model (DOM)

- Adaptive Implementation:

  @media not | only media type and ( media feature ) {
  CSS−Code ;},

- Resulting logo elements:

# Visualisation Results

## 3D Visualisation and Inputs



CardBoard-Support



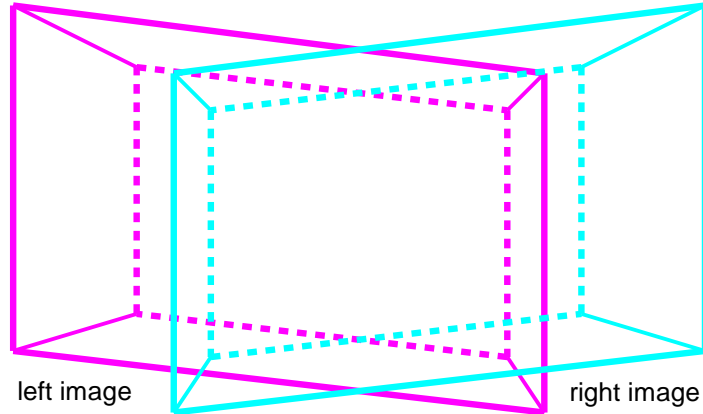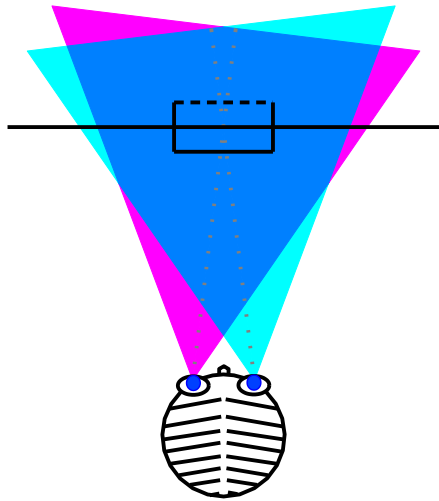3D-TV-Support

# Visualisation Results

3D Visualisation and Inputs

- Binocular Vision

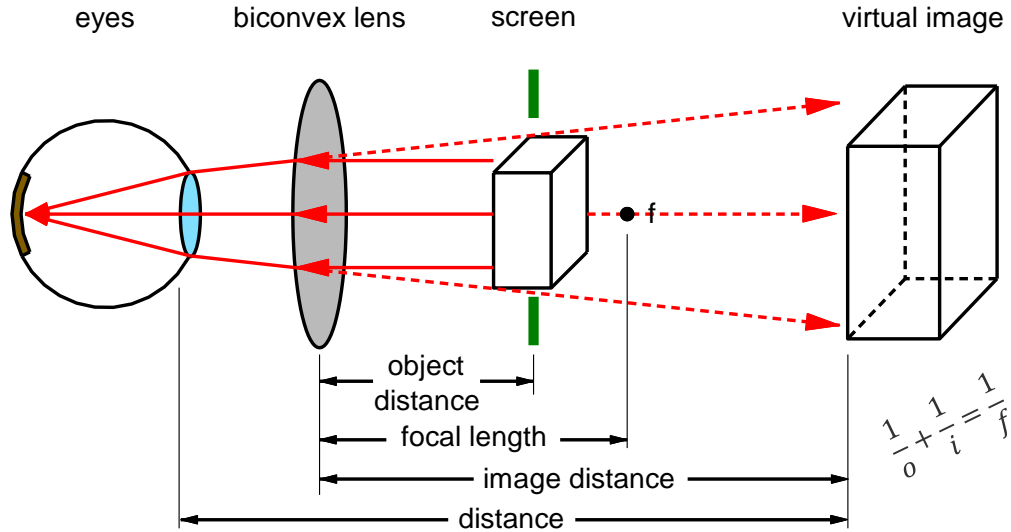left image                                    right image

- Visualization:

- Render 2 Images

- Some Content

- Different Perspective

- Side by Side Positioning

# Visualisation Results

Hardware Influence



- Hardware influences by

  - Magnification

  - Distortion correction by filters

- Head tracking requires:

  - Coordinate mapping

  - Screen resolution und sensor update rates

# Visualisation Results

Performance

| Device | Browser | Screen (pixel) | FPS |
|---|---|---|---|
| Mate 9 Pro | Chrome | 2560×1440 | 60 |
| Mate 9 Pro | Firefox | 2560×1440 | 60 |
| iPhone 6 + | Chrome | 1920×1080 | 60 |
| iPhone 6 + | Safari | 1920×1080 | 60 |
| iPhone 6 | Chrome | 1334×750 | 60 |
| iPhone 6 | Safari | 1334×750 | 60 |

- Performance evaluation



17ms

Idle 14.2ms
WebGL 1.4ms
Painting 0.1ms
Other 1.3ms
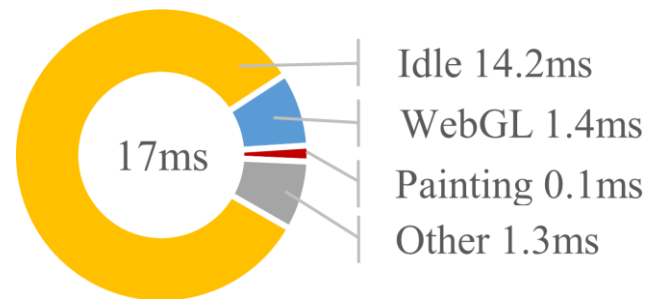
# Summary and Future Works

✓ Light and customer friendly visualisation environment

✓ Easy to install and maintain

✓ Running on most platforms

⚙ Adaption for 3D – 360° Visualisation

⚙ Support of 6D Input devices as browser input

? Augment Reality Support

! Visualisation framework will be sold! Offers possible!