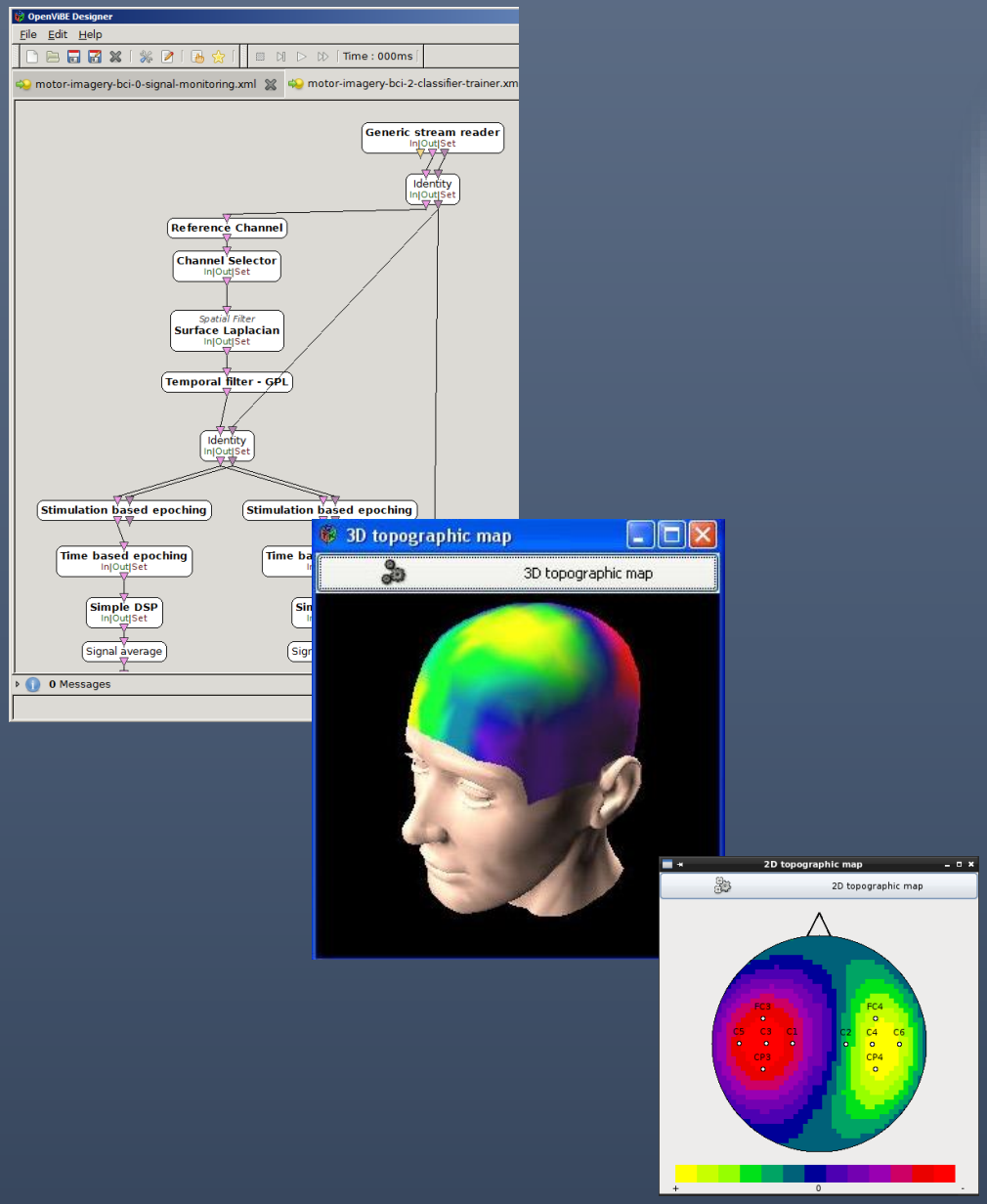
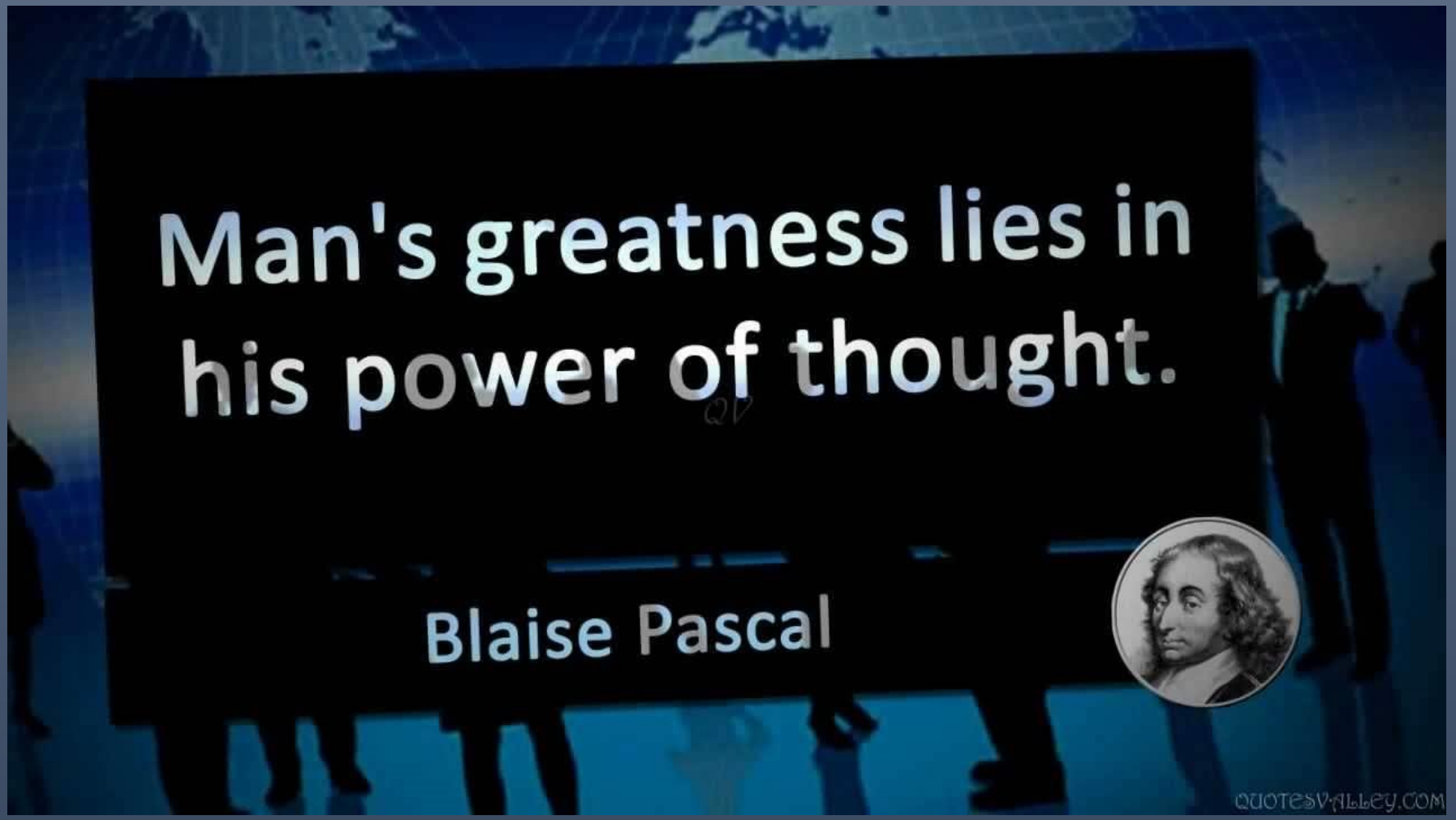
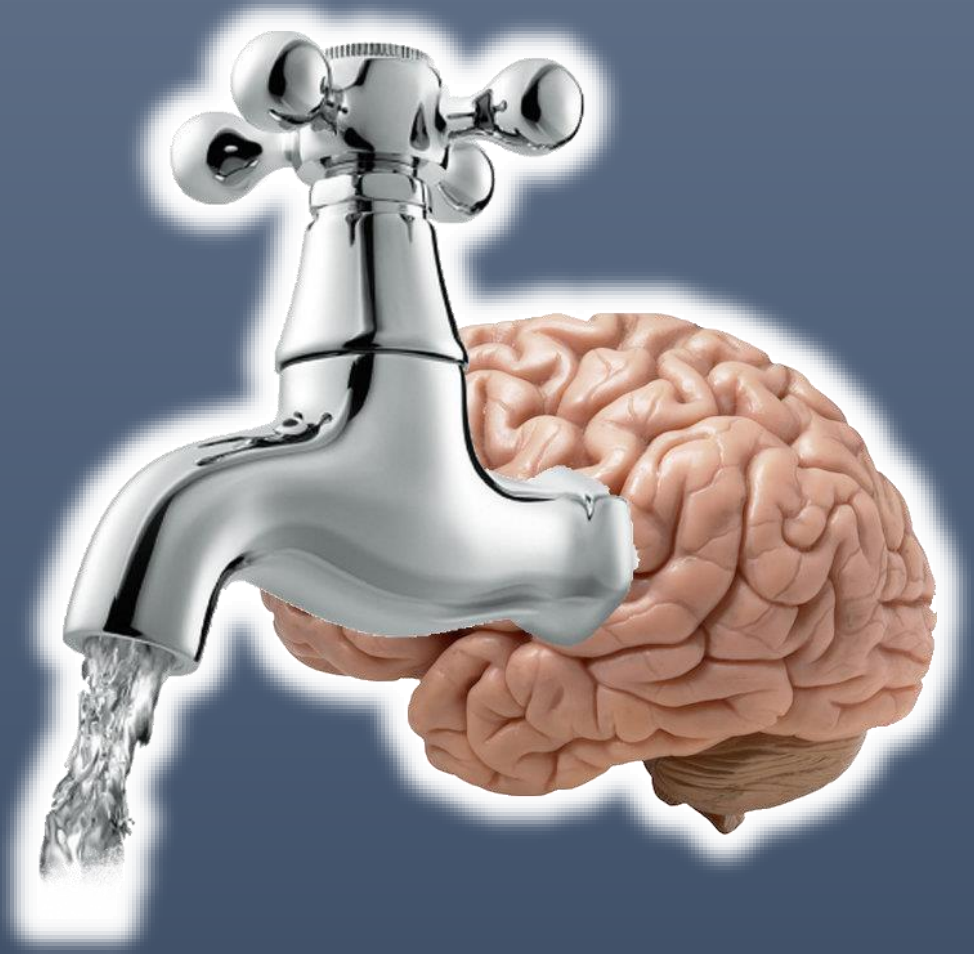


Jussi T. Lindgren, PhD
jussi.lindgren@inria.fr
Lead Engineer
Hybrid @ Inria

Jozef Legeny, M. Eng
jozef.legeny@mensiatech.com
Lead Architect
Mensia Technologies

informatics mathematics
Inria


Man's greatness lies in his power of thought.
Blaise Pascal
quotesvalley.com

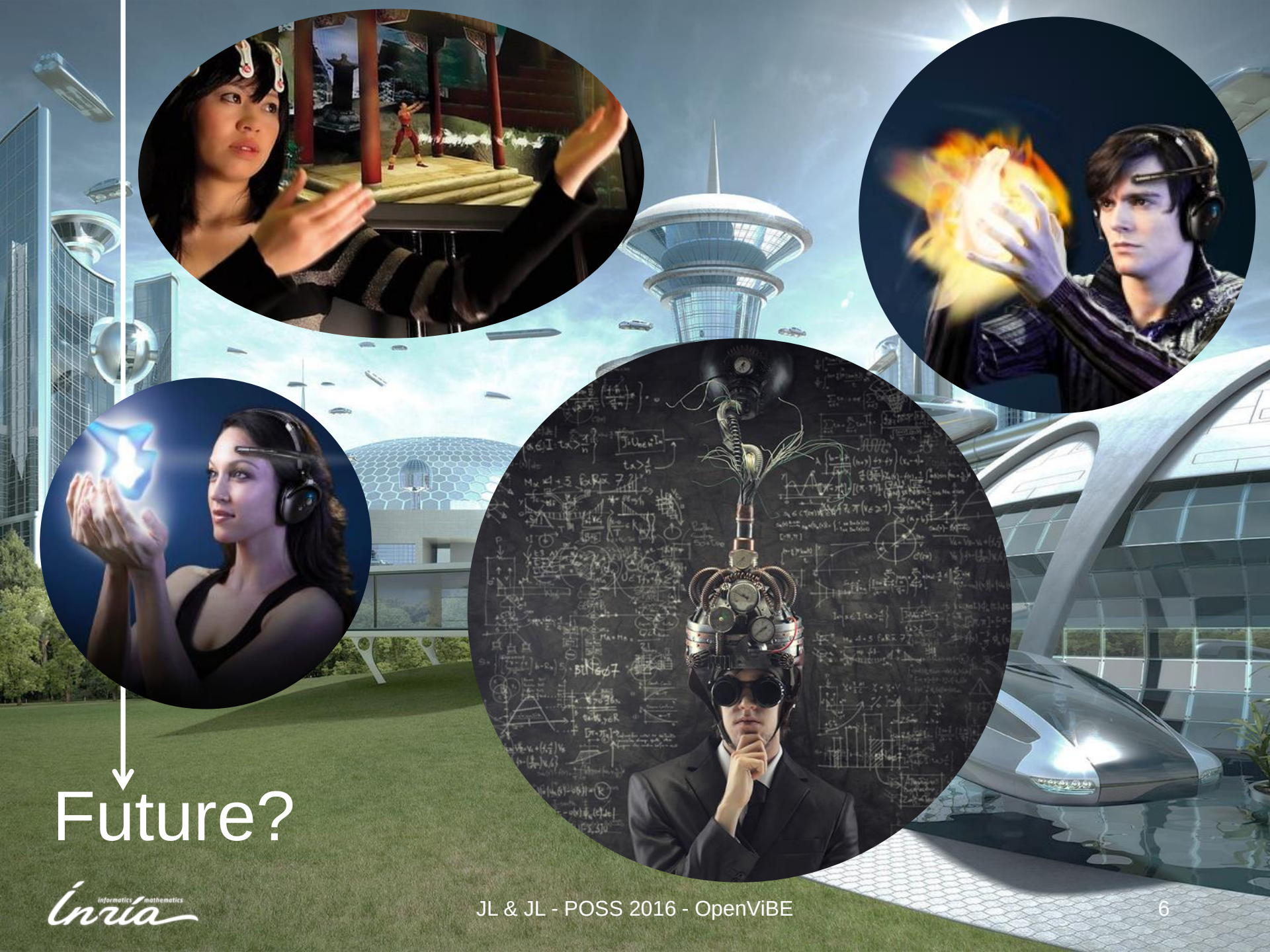


Tapping that power

Past

Hieronymous Bosch, ca. 1400-1500

Present


Future?

Software for Brain-Computer Interfaces (BCI)

Enjoyed by research labs, clinicians, teachers, game developers and hobbyists worldwide

Powered by Inria & Mensia

A necessity : Who’s in it

- Many Inria projects since 2005
- Mensia Technology startup
- Open Source community

- Collaborators have included : teams Hybrid, Athena, Potioc and Neurosys @ Inria, Gipsa Lab, CEA, INSERM, Orange, AFM, …

OpenViBE history (2005-2016)

Ø **2005-2009 : ANR OpenViBE** (RNTL, BCI and disabled people, partners : Inria-Rennes, INSERM, CEA, Orange, AFM, GIPSA-LAB)
Ø **May 2009 : First public release**

Ø **2009-2011 : ADT LOIC** (Rennes-Nancy, OpenViBE support and dev)
Ø 2009-2012 : ANR OpenViBE2 (Rennes, BCI and videogames)
Ø 2009-2012 : ANR Co-Adapt (Sophia, dynamic BCI)
Ø 2009-2011 : ADT Immersive BCI (Sophia, BCI and immersive display)
Ø 2009-2012 : ANR RoBIK (CEA/GIPSA, speller for disabled people)
Ø 2010 : First OpenViBE int. tutorial (BCI Meeting, Monterey, US)
Ø 2011 : Google Science Fair (student project congratulated by Obama)
Ø 2012-2013 : LIRA (Rennes-Bordeaux-Nancy, Stress and Relaxation)

Ø **2012-2015 : ADT OpenViBE-NT** (Rennes-Bordeaux-Nancy-Sophia)
Ø **Nov 2012 : Creation of Mensia Technologies**
Ø 2013-2016 : Labex CominLabs HEMISFER (Rennes, Neurofeedback)
Ø 2014-2017 : Labex CominLabs SABRE (Rennes, inverse models & BCI)
Ø 2014 : First OpenViBE int. workshop (BCI Conference, Graz, Austria)
Ø **2014 : First contributions from Mensia**
Ø **2014-2016 : ADT OpenViBE-X** (Sophia)
Ø 2015 : Release of OpenViBE v1.0 (= the 19th release)

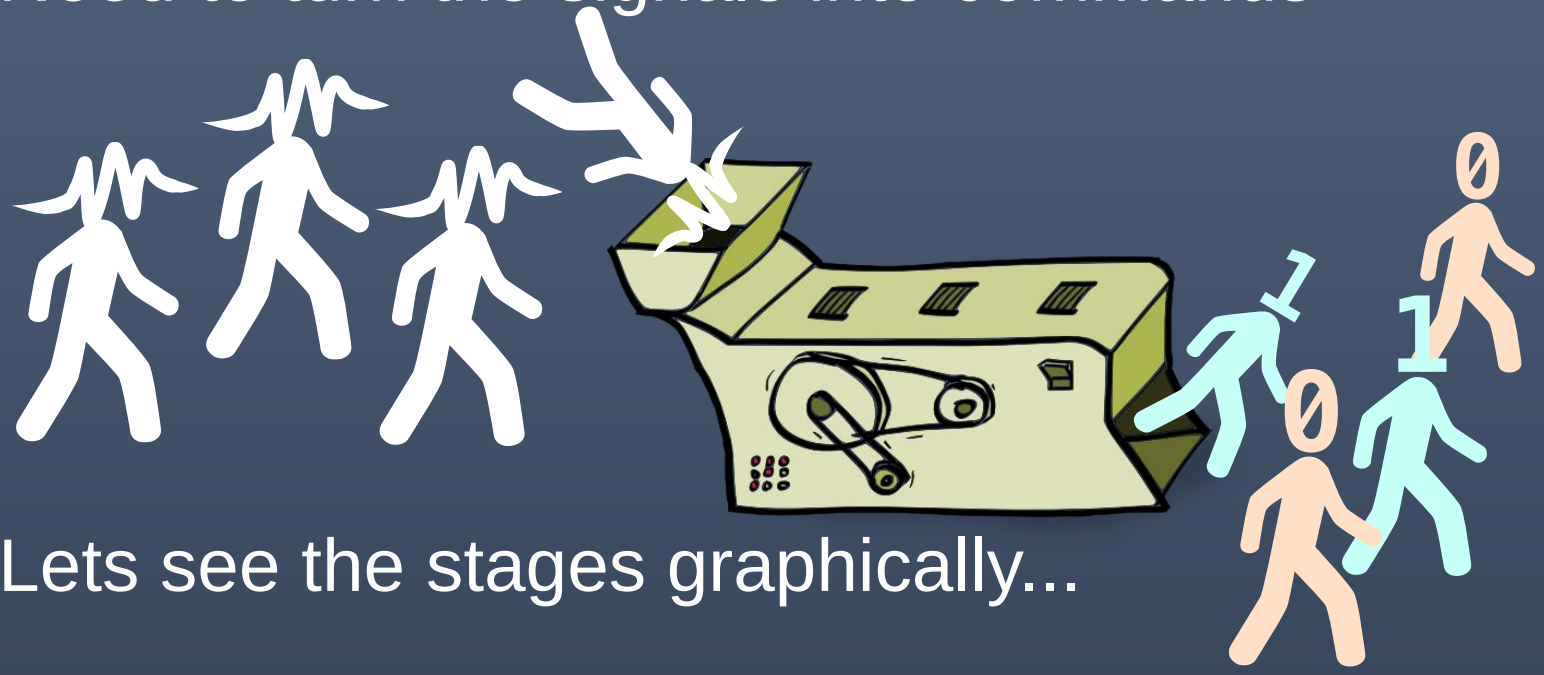
Ø 2015-2019? : AEN BCI-LIFT (Sophia-Rennes-Nancy-Bordeaux)
Ø 2016 : Second OpenViBE int. workshop (BCI Meeting, Monterey, US)
Ø 2016-2017 : CertiViBE (Rennes-Mensia)

Brain-computer interfaces

- Control computer by the power of the brain
  - Drive apps, games, virtual reality, ...
  - Command prostheses
  - Communicate
  - Enjoy neurofeedback & neurorehabilitation
- Active research area
  - (read: work in progress)

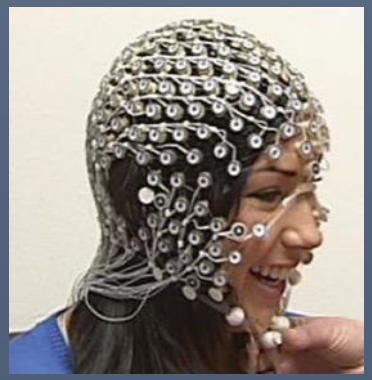
Why OpenViBE?

- Computers understand ’commands’, not ’brainwaves’
- Need to turn the signals into commands



- Lets see the stages graphically...

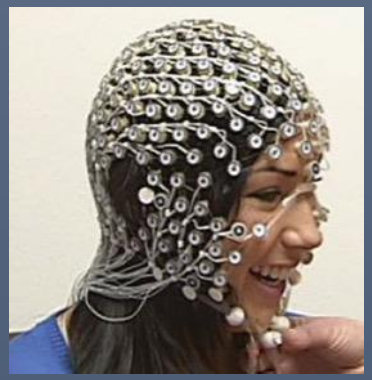
Obtain signal



User

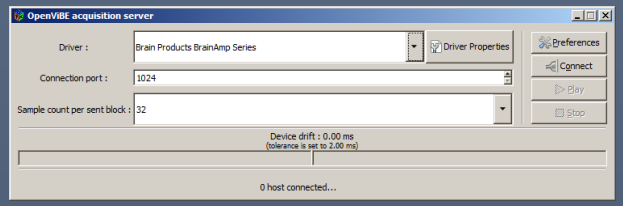
Amplifier

Translate signal

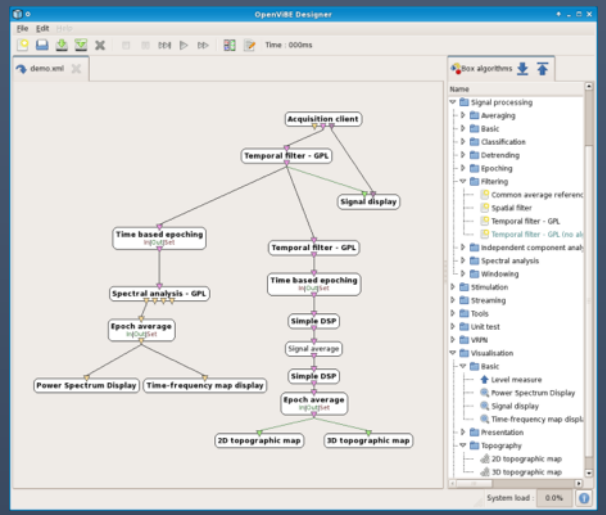


User

Amplifier

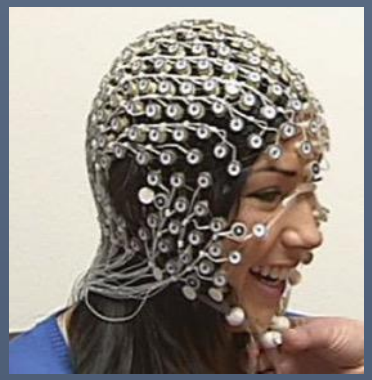


Record signal



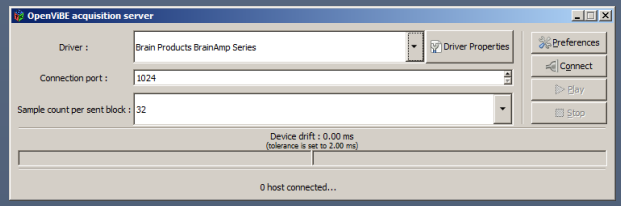
Signal processing

Control application

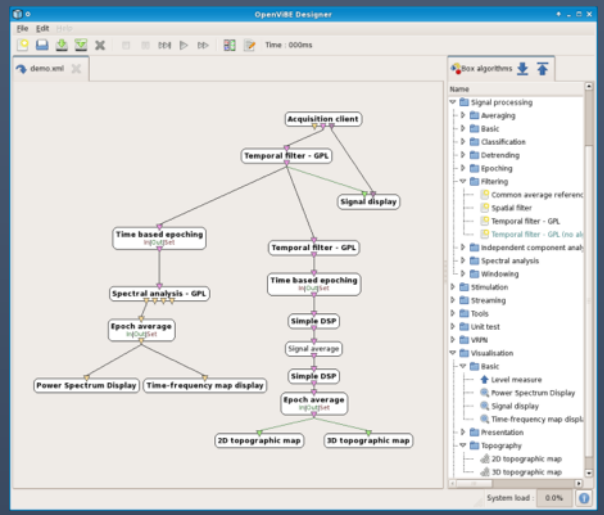


User

Amplifier



Record signal



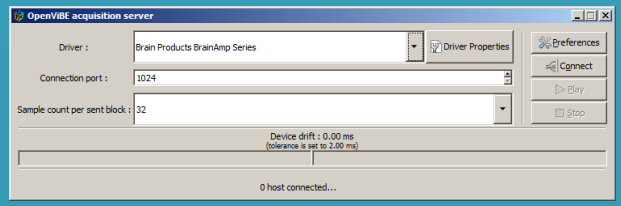
Signal processing

Application

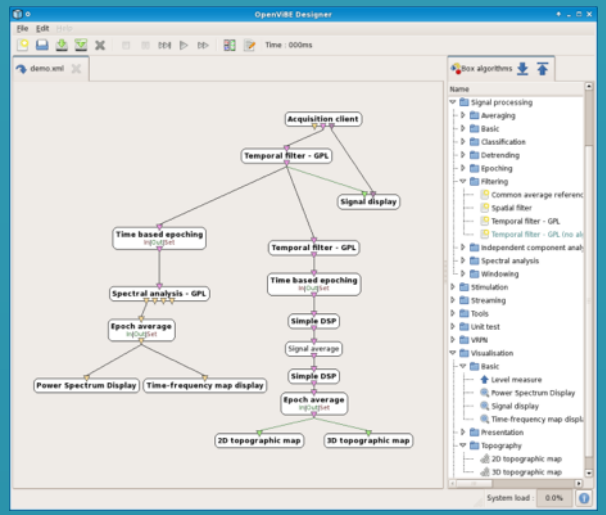
OpenViBE

User

Amplifier



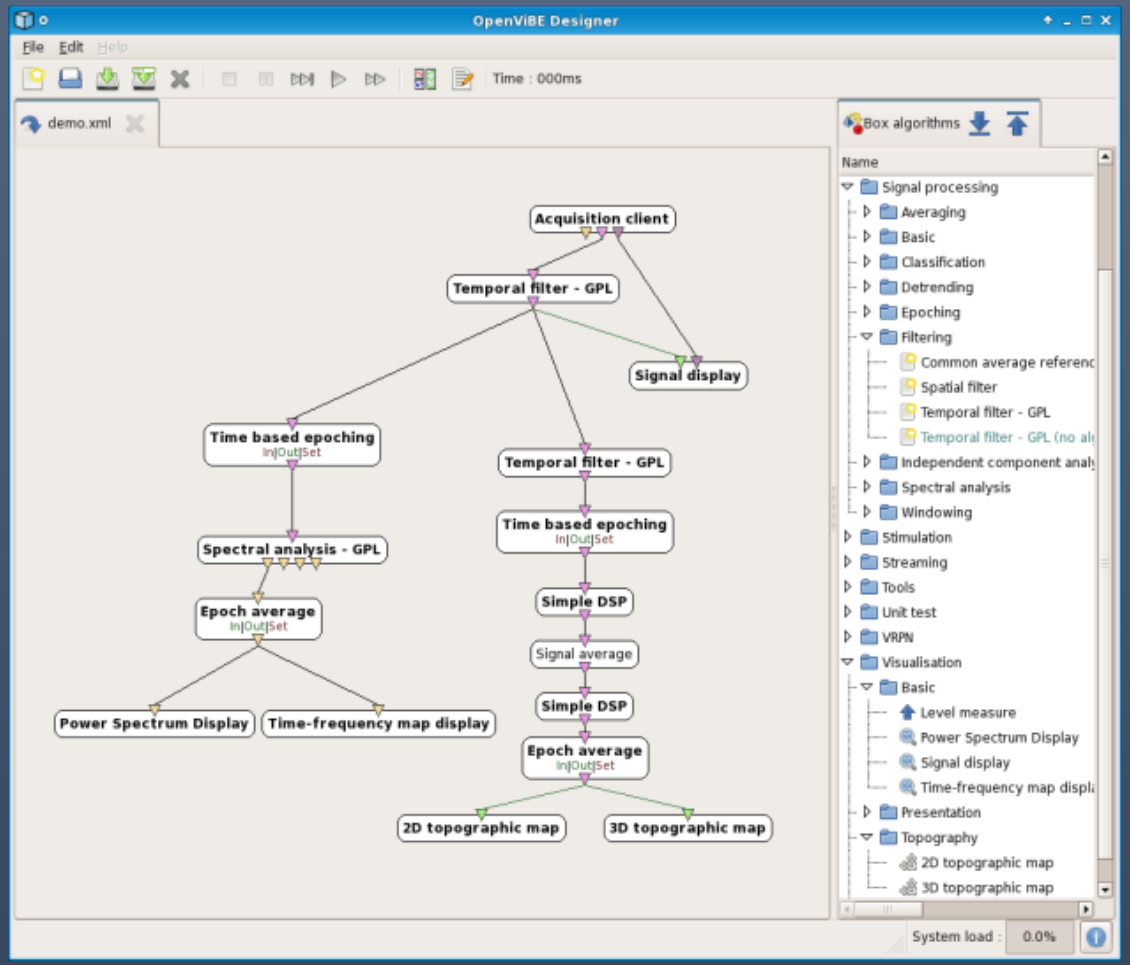
Record signal



Signal processing

Application

Closeup: Signal Processing

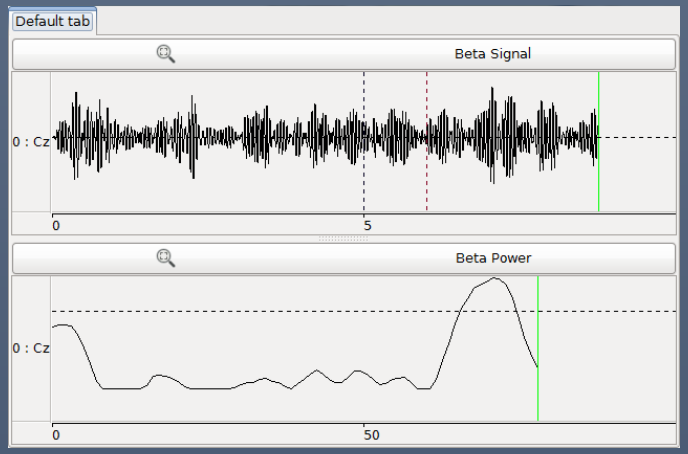


With OpenViBE, you get

- A unifying framework for EEG amplifiers
- Graphical organization of signal processing
- Plugins for DSP, classification and visualization
- Formats for sharing BCI solutions and data
- Reproducible research
- Exciting demos!

Some BCI implementations made with OpenViBE

Motor Imagery

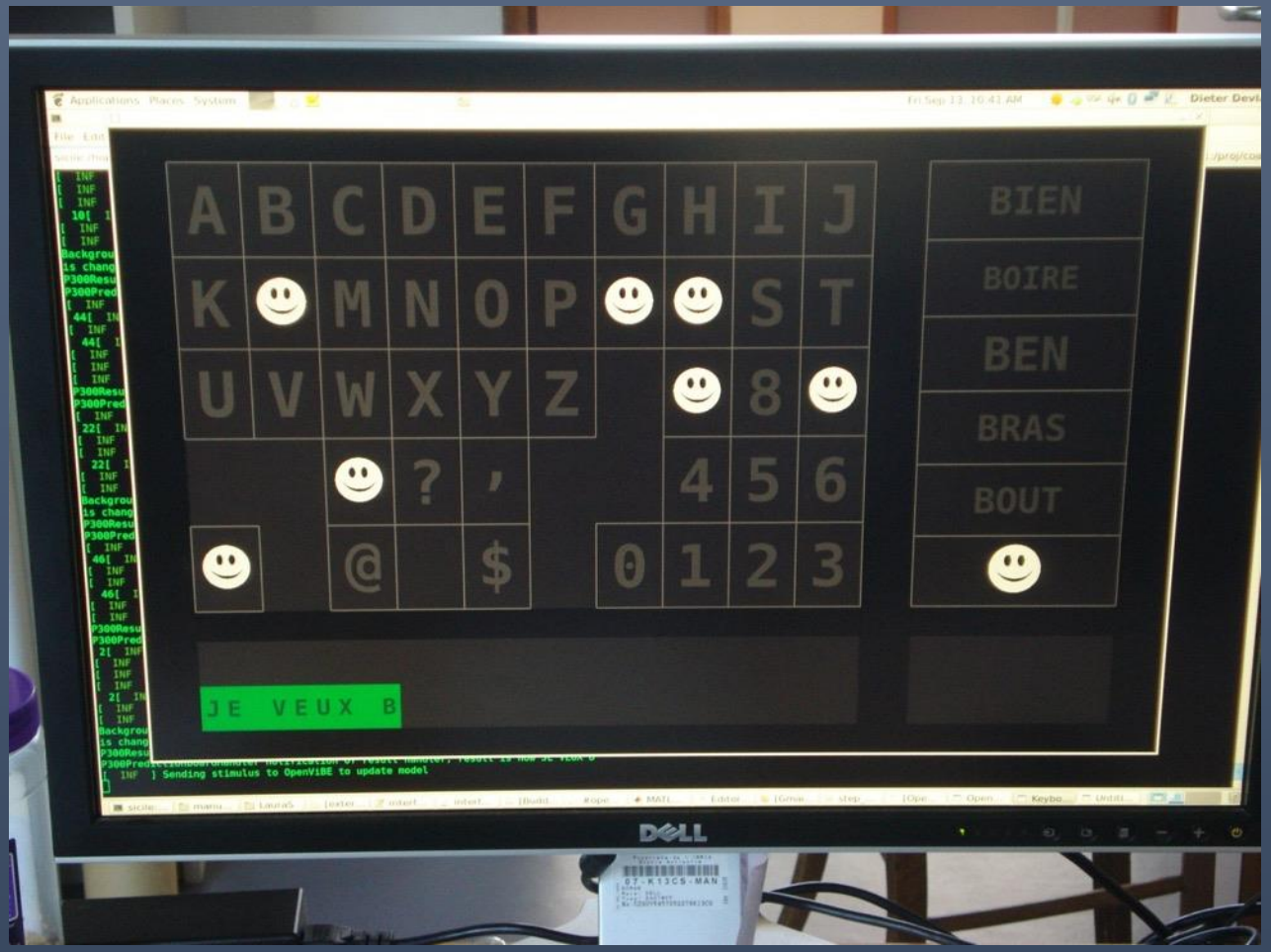


Neurofeedback

SSVEP

Concentration

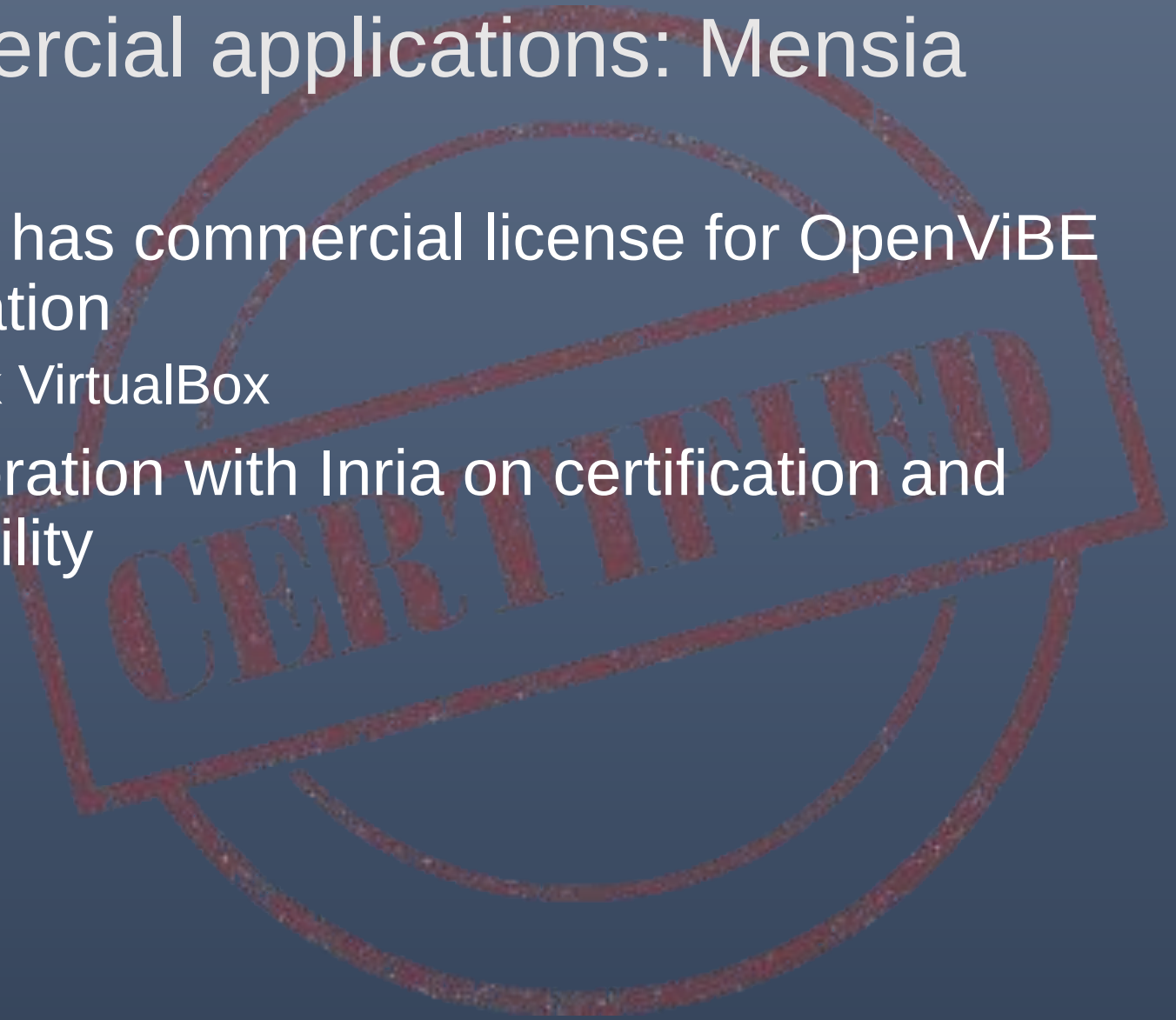
CoAdapt P300 Speller (ATHENA/Inria)



Robotic arm control (NEUROSYS/Inria)

Mind Shooter game (Hybrid/Inria)

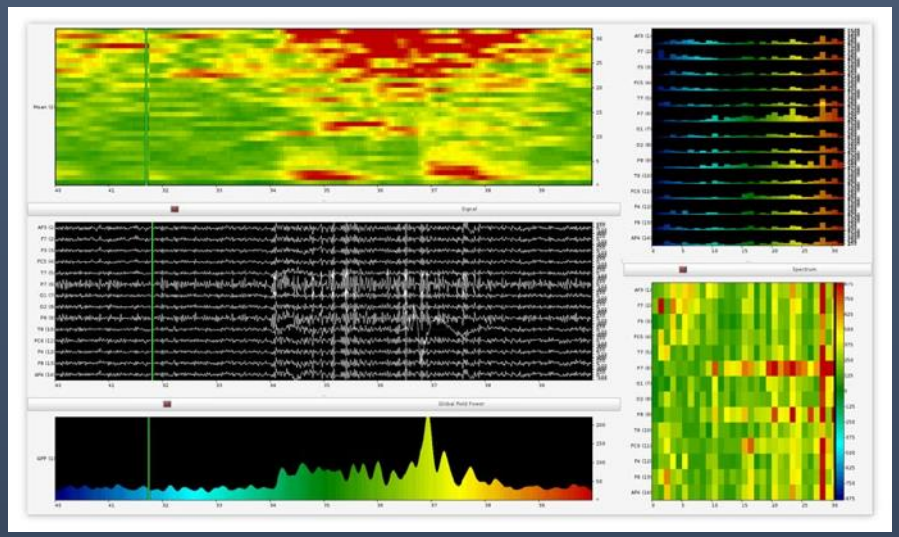
Commercial applications: Mensia

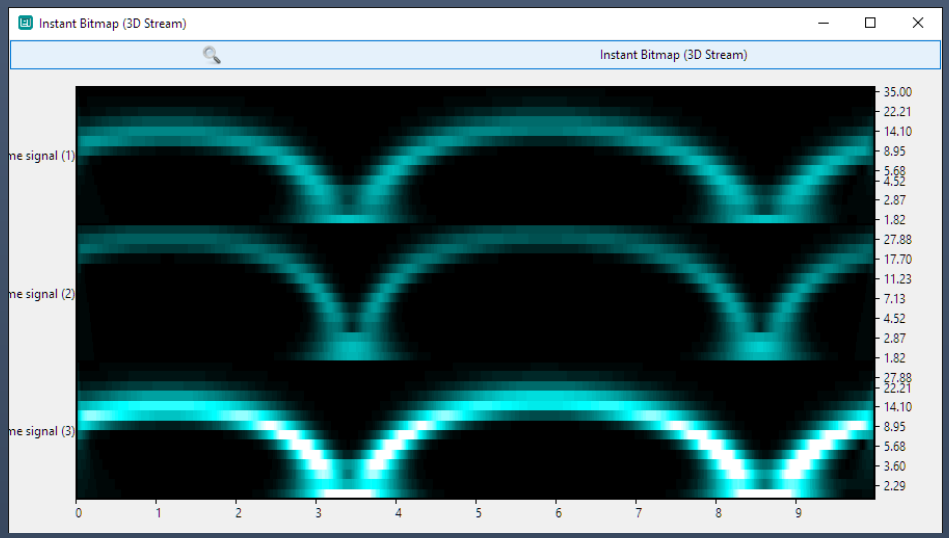


- Mensia has commercial license for OpenViBE exploitation
  - Think VirtualBox
- Collaboration with Inria on certification and traceability

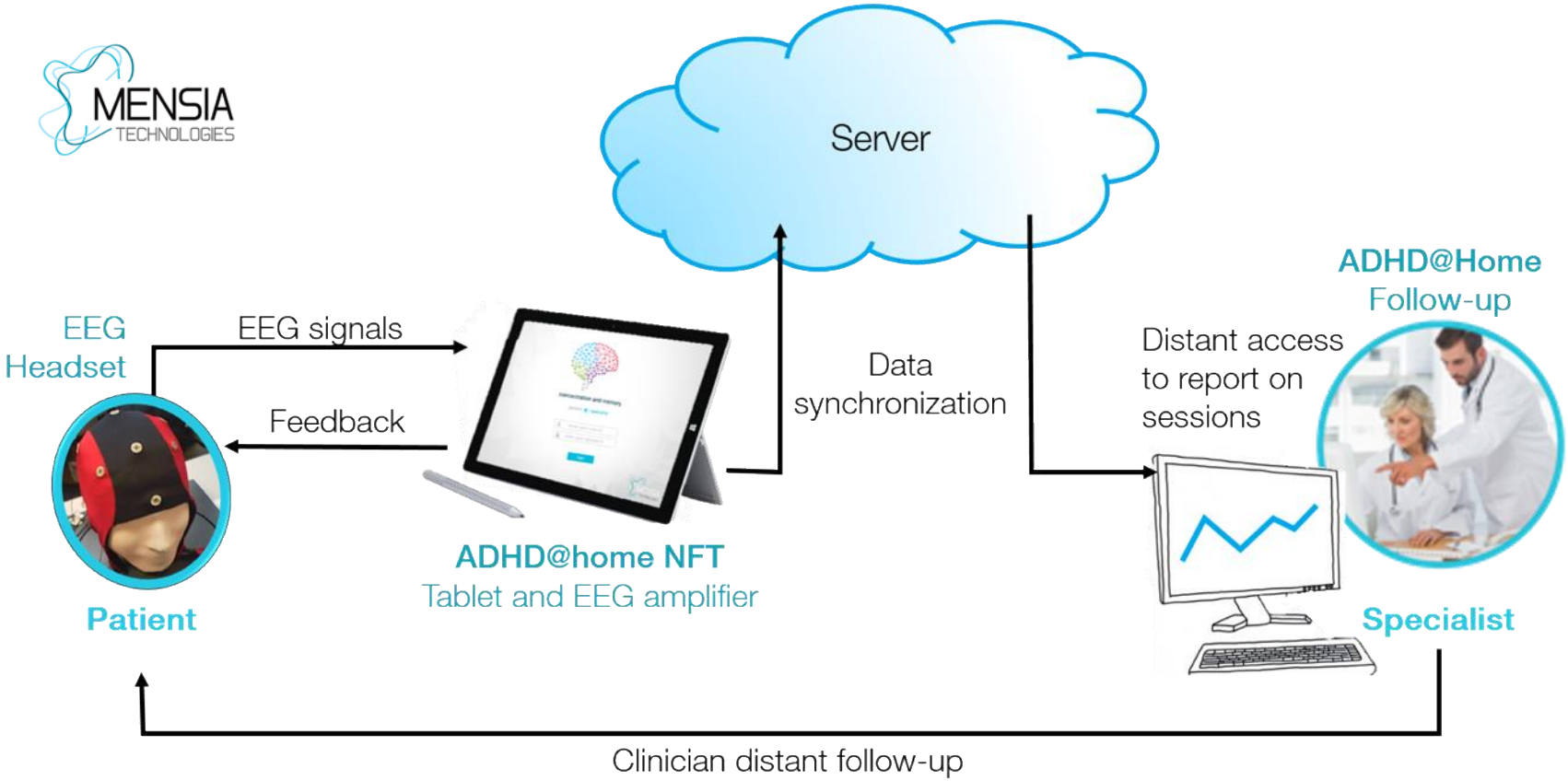
Commercial applications: Mensia

- Research tool based on OpenViBE: NeuroRT Studio
  - High resolution graphics
  - More signal processing (gifts from Mr. Riemann)

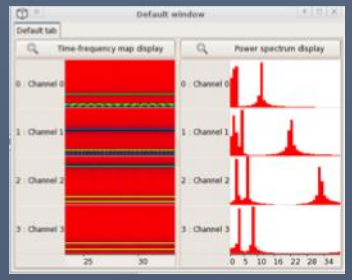




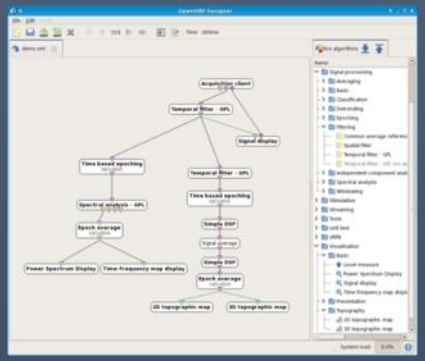
Commercial applications: Mensia



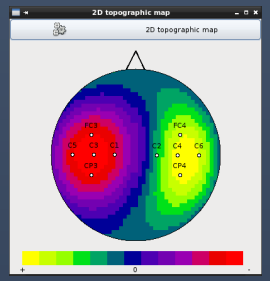
Now behold the fully operational OpenViBE



- Open source (AGPL3)
- On Linux & Windows
- Core in C++. Python, Matlab & Lua as plugins.
- ≈ 25 hardware devices supported
- Many plugins for DSP, visualization, interfacing, ...
- ≈ 250.000 lines of code (headers counted)



Past development effort: ≈ 30 man-years at Inria
(and various multi-partner projects since 2005)

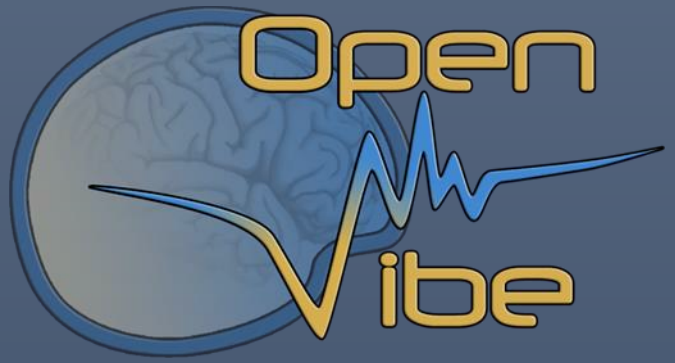


- For 2012 – 2015: ≈ 500k page views, 24000 downloads

Future?

- Research at Inria: BCI Lift, SABRE
- OpenViBE medical certification project
- Mensia ADHD treatment product now in clinical trials
- The direction you like to develop it to …

Thank you for listening!



More information at

http://openvibe.inria.fr

http://mensiatech.com