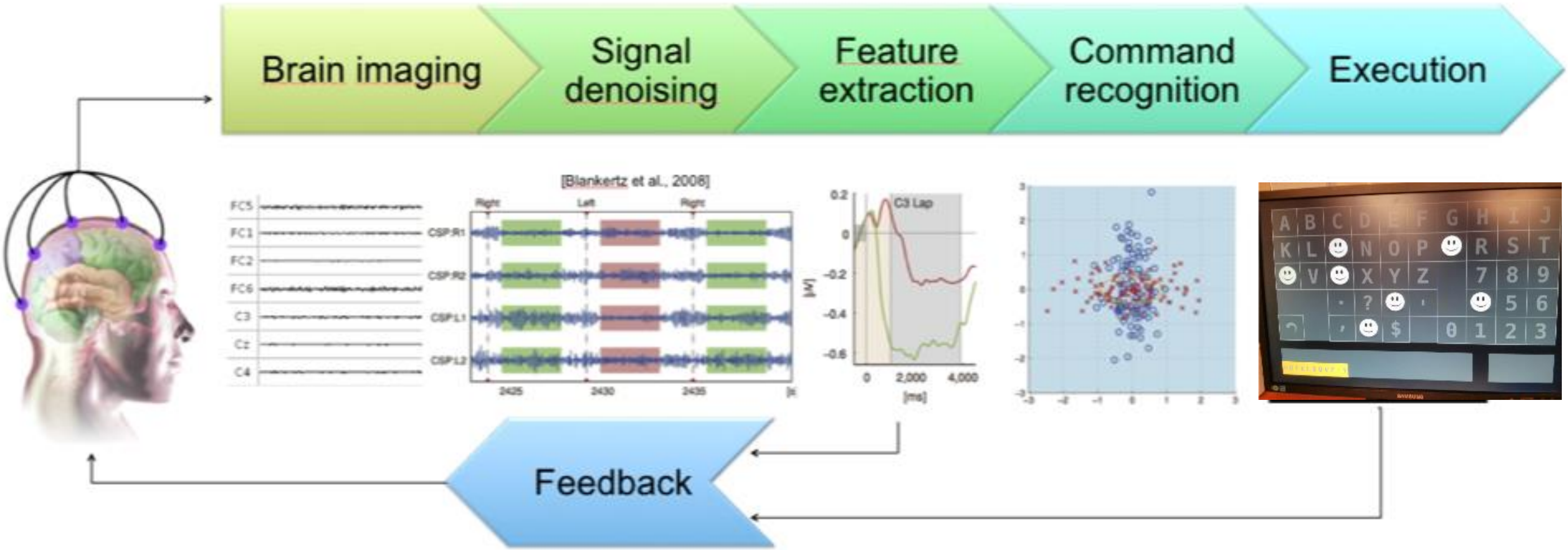
ARCHI 2017

Laurent.Bougrain@loria.fr

Nancy

Brain-Computer Interfaces



Brain imaging

Signal denoising

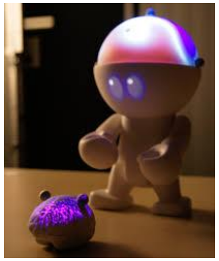
Feature extraction

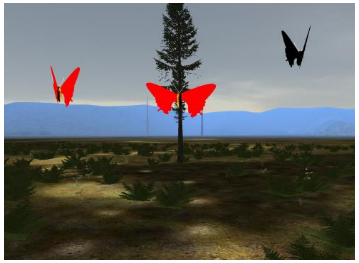
Command recognition

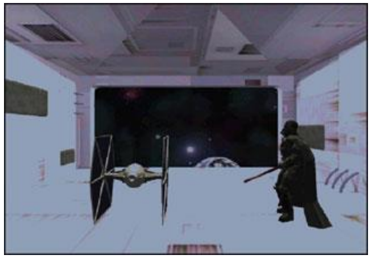
Execution

Feedback

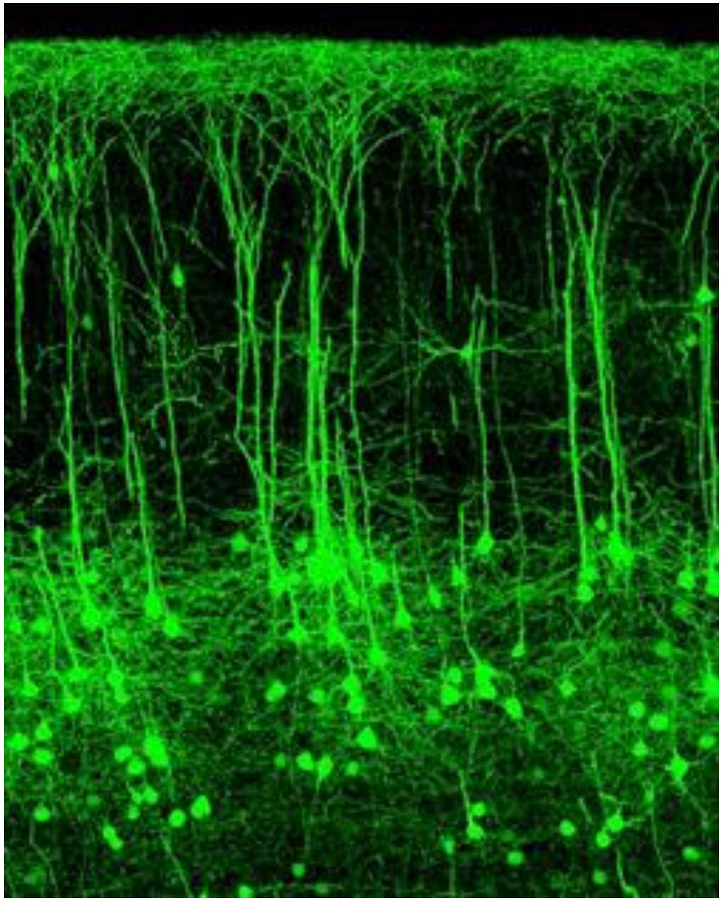
[Blankertz et al., 2008]



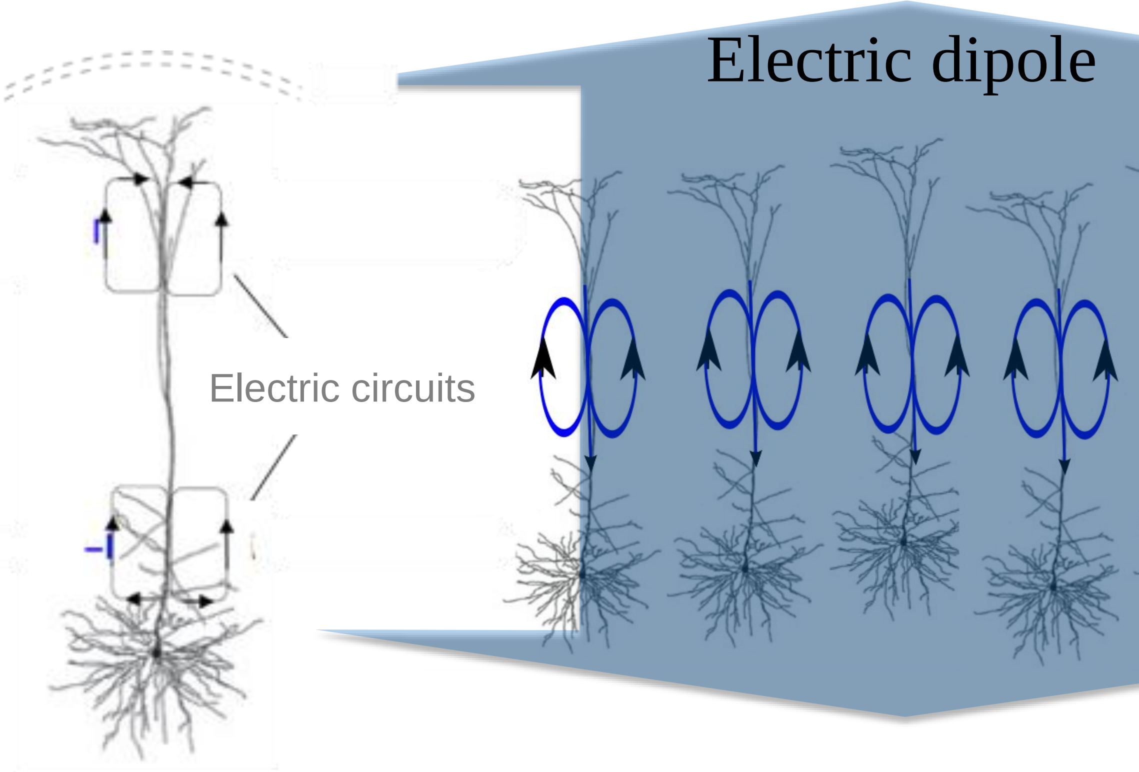




Neurophysiology: electromagnetic field



Pyramidal neurons



Electric dipole

Electric circuits

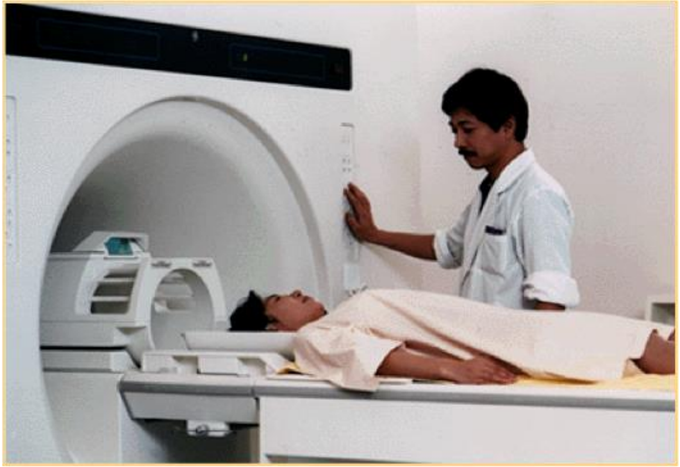
Nunez and Srinivasan, Electric Fields of the Brain:
The Neurophysics of EEG (2006)

Brain imaging

Metabolic

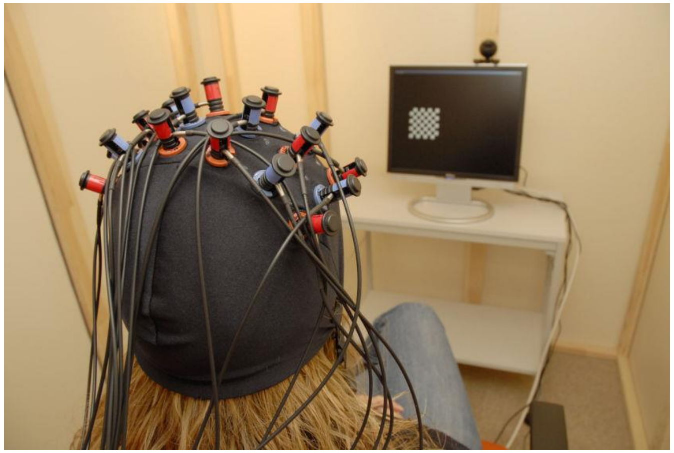
electromagnetic

fMRI



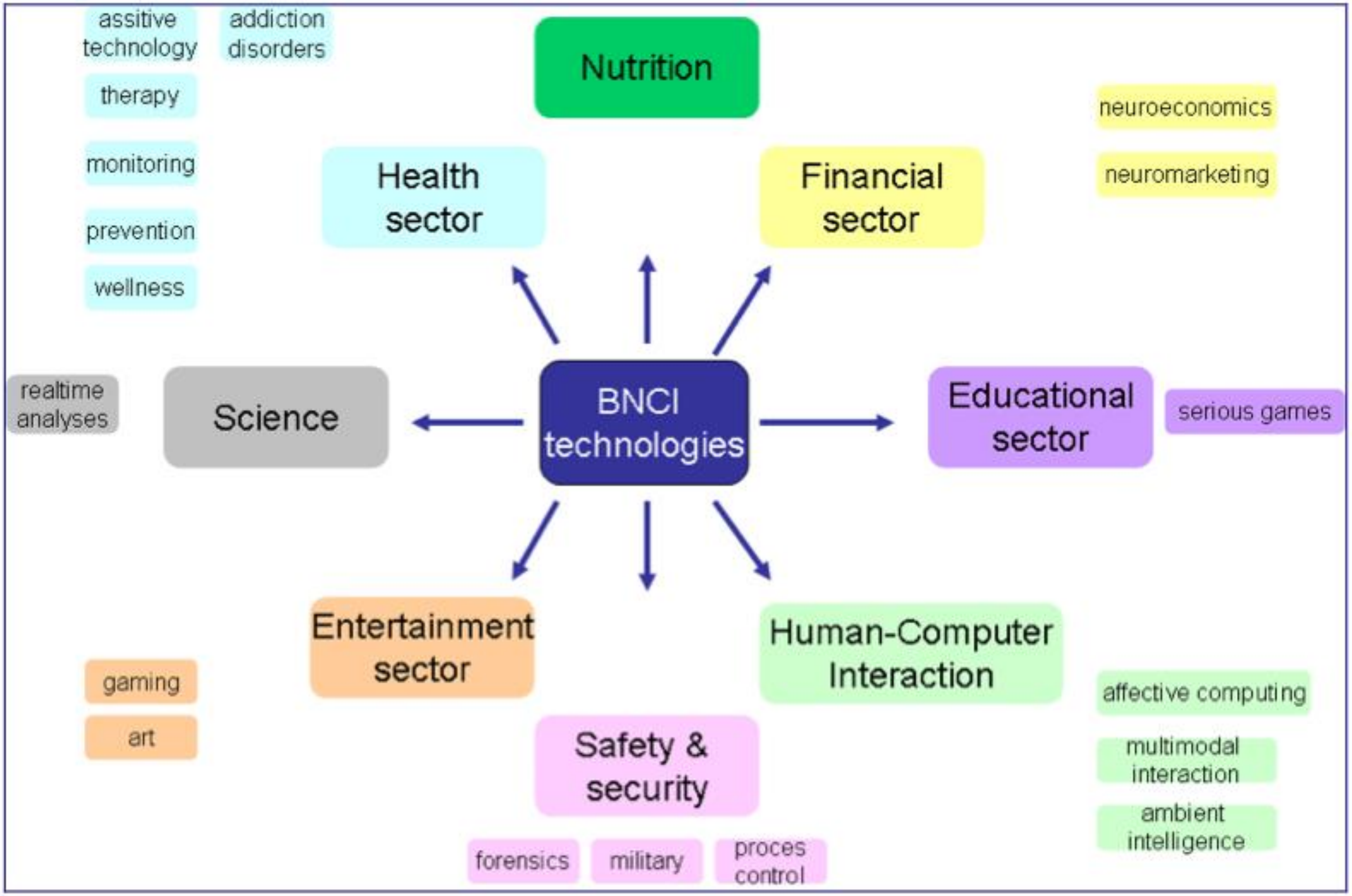
MEG

NIRS



EEG

BCI applications



assitive technology

addiction disorders

therapy

monitoring

prevention

wellness

Nutrition

Health sector

Financial sector

neuroeconomics

neuromarketing

realtime analyses

Science

BNCI technologies

Educational sector

serious games

Entertainment sector

gaming

art

Human-Computer Interaction

affective computing

multimodal interaction

ambient intelligence

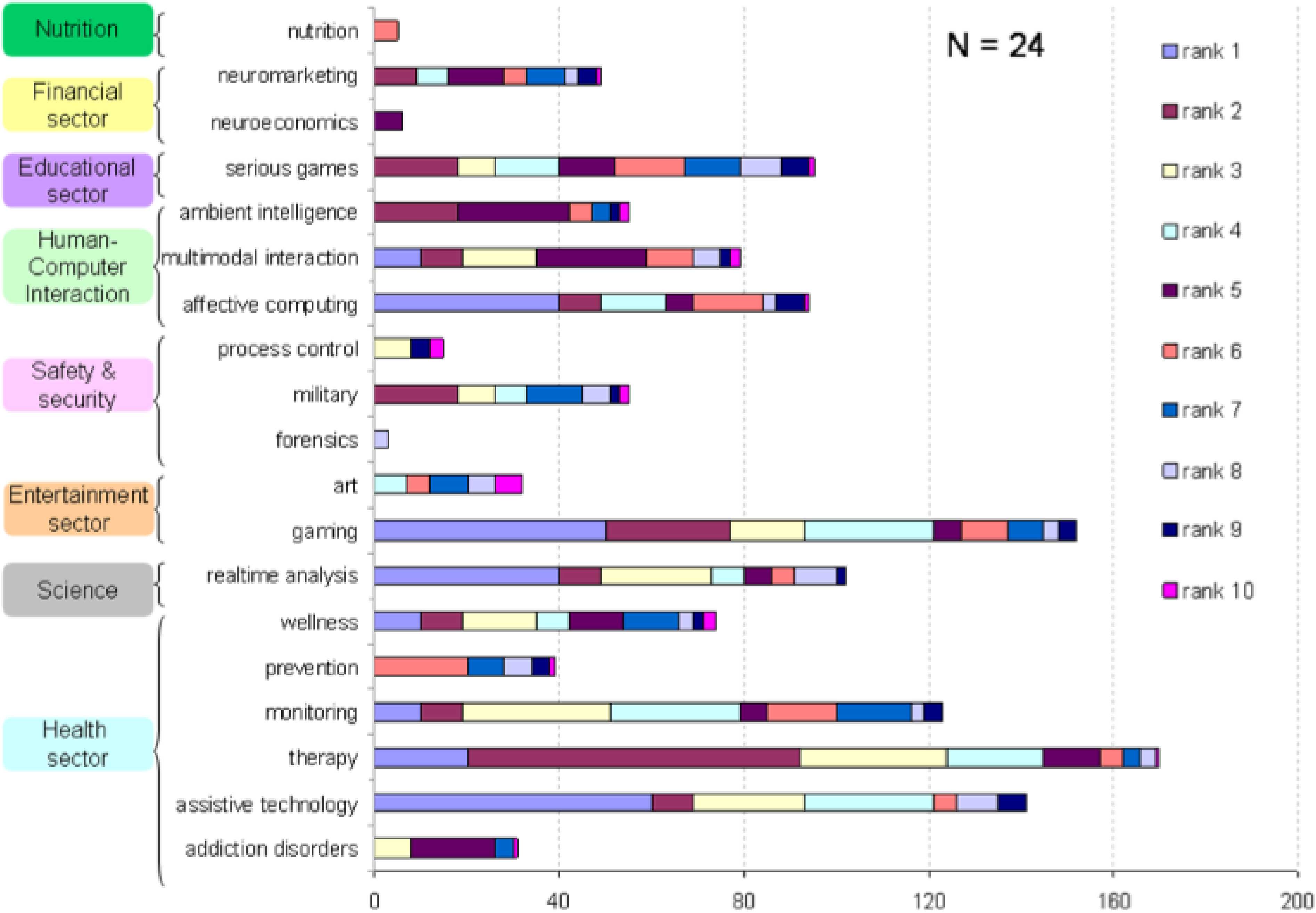
Safety & security

forensics

military

proces control

Future BNCI


Nutrition
Financial sector
Educational sector
Human-Computer Interaction
Safety & security
Entertainment sector
Science
Health sector
nutrition
neuromarketing
neuroeconomics
serious games
ambient intelligence
multimodal interaction
affective computing
process control
military
forensics
art
gaming
realtime analysis
wellness
prevention
monitoring
therapy
assistive technology
addiction disorders
0
40
80
120
160
200
N = 24
rank 1
rank 2
rank 3
rank 4
rank 5
rank 6
rank 7
rank 8
rank 9
rank 10

Types of BCI applications

BCIs can replace natural CNS output that has been lost as a result of injury or disease. Examples include communication (through a spelling system and voice synthesis) and motorized wheelchair control.

BCIs can restore lost natural CNS output. Examples include functional electrical stimulation of muscles in a paralyzed person and stimulation of peripheral nerves to restore bladder function.

BCIs can enhance natural CNS output. Examples include monitoring brain activity during prolonged demanding tasks such as driving a car and detecting lapses of attention, which alerts the person and restores attention.

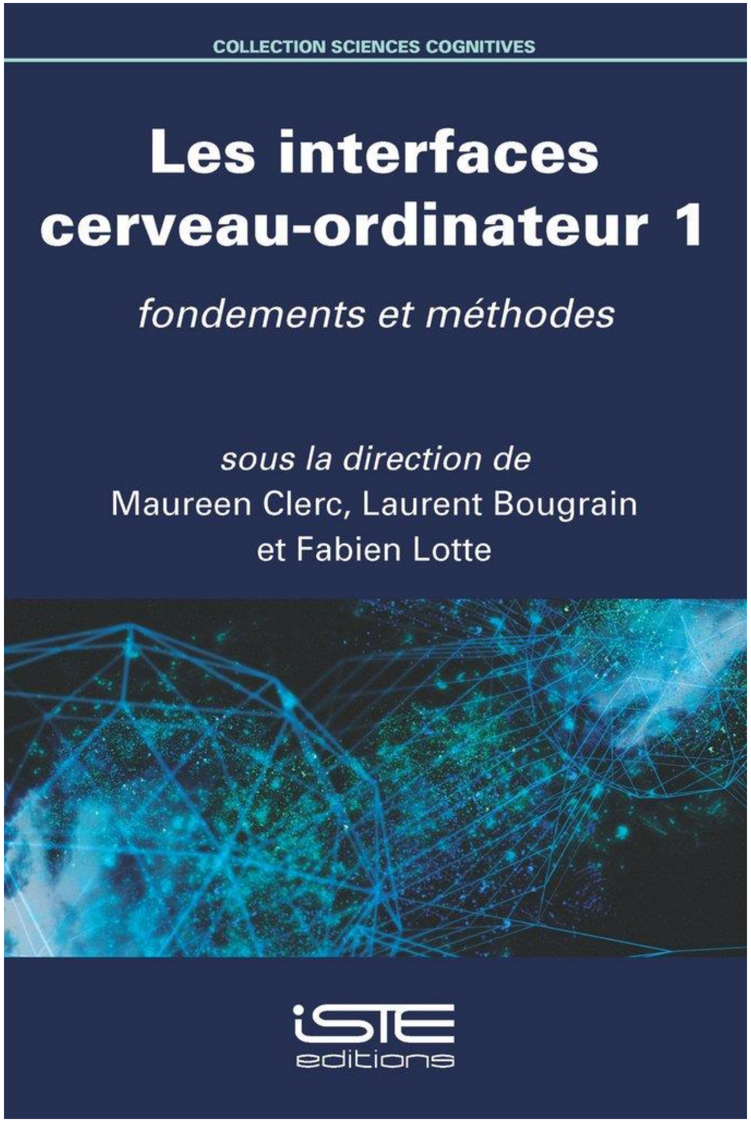
Types of BCI applications

BCIs can supplement natural CNS output. Examples include providing a third (robotic) arm to a person and providing a selection function for people using a joystick.

BCIs can improve natural CNS output. Examples include using a BCI in stroke rehabilitation that detects and enhances signals from a damaged cortical area and stimulate arm muscles or an orthosis to improve arm movements.

BCIs can be used as a **research tool** to investigate CNS functions in clinical and non-clinical research studies.

For further information



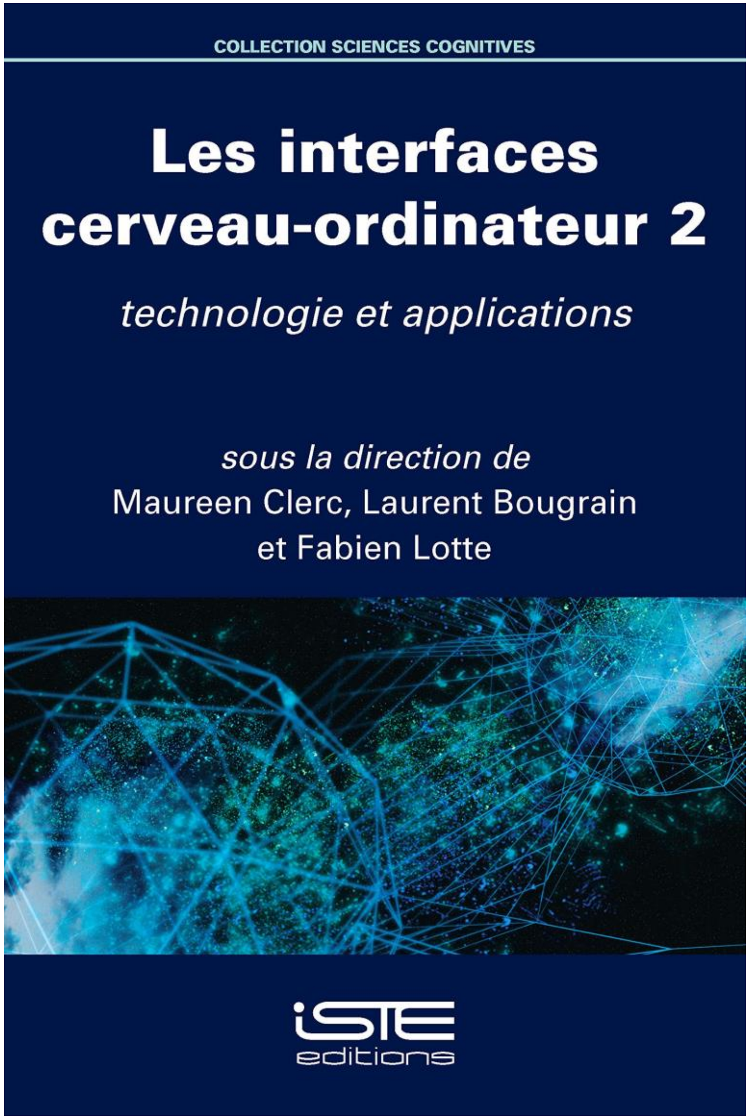
COLLECTION SCIENCES COGNITIVES

Les interfaces cerveau-ordinateur 1

fondements et méthodes

sous la direction de
Maureen Clerc, Laurent Bougrain
et Fabien Lotte

iSTE editions



COLLECTION SCIENCES COGNITIVES

Les interfaces cerveau-ordinateur 2

technologie et applications

sous la direction de
Maureen Clerc, Laurent Bougrain
et Fabien Lotte

iSTE editions

An open source software platform

for Brain-Computer Interfaces

and real-time neurosciences

http://openvibe.inria.fr

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

ANR project OpenVIBE

”Open-ViBE : an Open-Source Software Platform for Brain-Computer Interfaces and Virtual Reality”

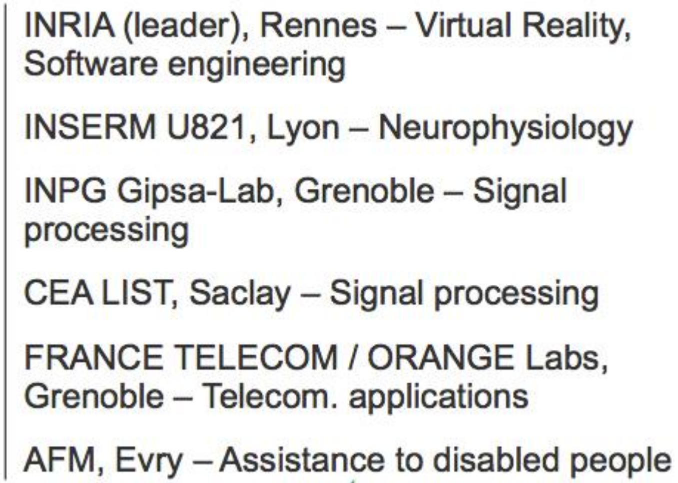
The first French National Project on BCI!

Funding: French National Agency of Research (ANR)

December 2005 – May 2009

Objective: develop open-source software components with innovative techniques for more efficient brain-computer interfaces

Applications : Multimedia, Disabled people



INRIA (leader), Rennes – Virtual Reality, Software engineering

INSERM U821, Lyon – Neurophysiology

INPG Gipsa-Lab, Grenoble – Signal processing

CEA LIST, Saclay – Signal processing

FRANCE TELECOM / ORANGE Labs, Grenoble – Telecom. applications

AFM, Evry – Assistance to disabled people

Main funded projects using OpenViBE

- 2005-2009 : ANR OpenViBE (free software for BCI)
- 2009-2012 : ANR OpenViBE2 (BCI and videogames)
- 2009-2012 : ANR CoAdapt (Dynamic BCI)
- 2009-2011 : ADT Immersive BCI (BCI with immersive displays)
- 2009-2012 : ANR RoBIK (Speller used in hospital)
- 2009-2012 : ANR GAZE&EEG (BCI and eye-tracking)
- 2010-2012 : FP7-ICT MINDWALKER (exoskeleton)
- 2011 : Google Science fair
- 2012-present : LIRA (Stress & Relaxation)
- 2013-2015 : ARSLA P300-speller
- 2013-2016 : Labex cominlabs hemisfer
- 2013-2017 : IPL BCI LIFT (Plug&Play BCI)
- 2014-2017 : Labex cominlabs SABRE
- 2015-2017 : H2020 ADHD@Home

Key features

A high level framework to design, test and use BCI

Modularity and reusability

Different types of users

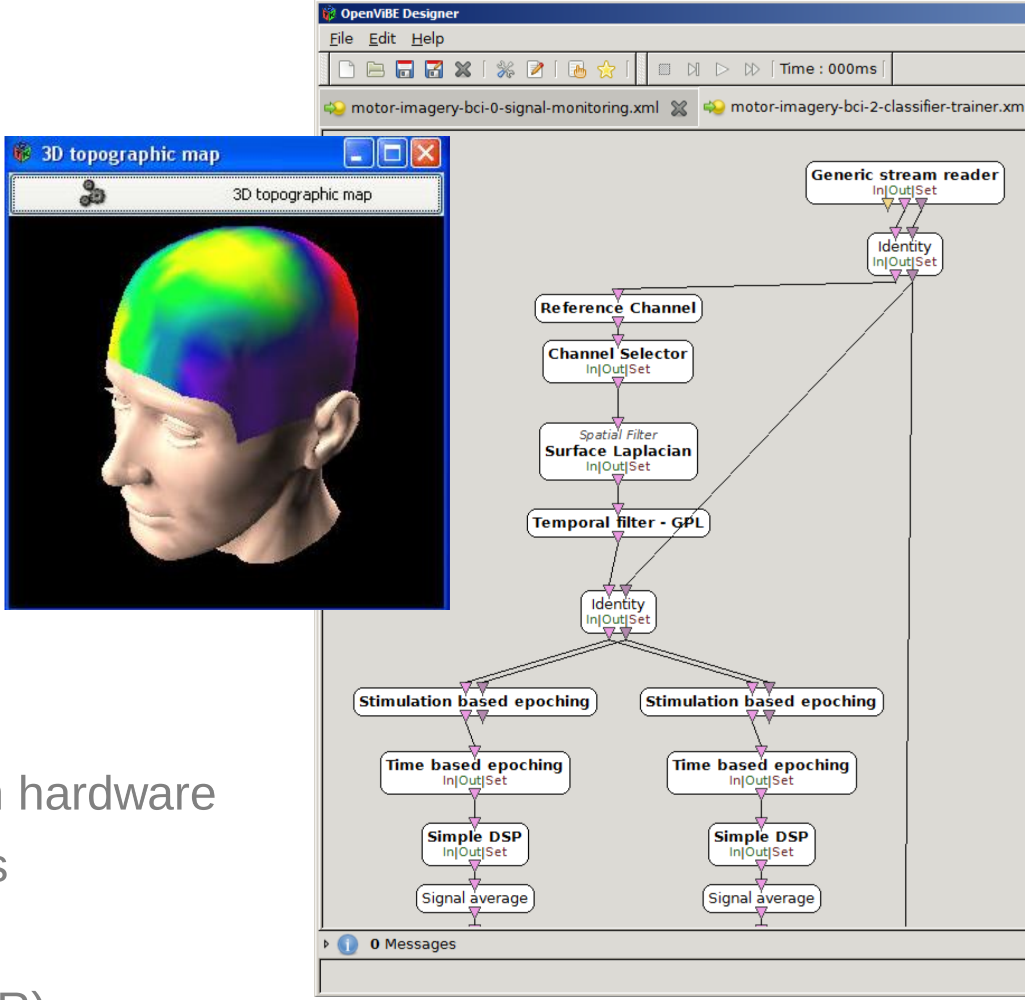
- Programmers
- Non programmers
- Clinicians

Free and Open-source software

Portability

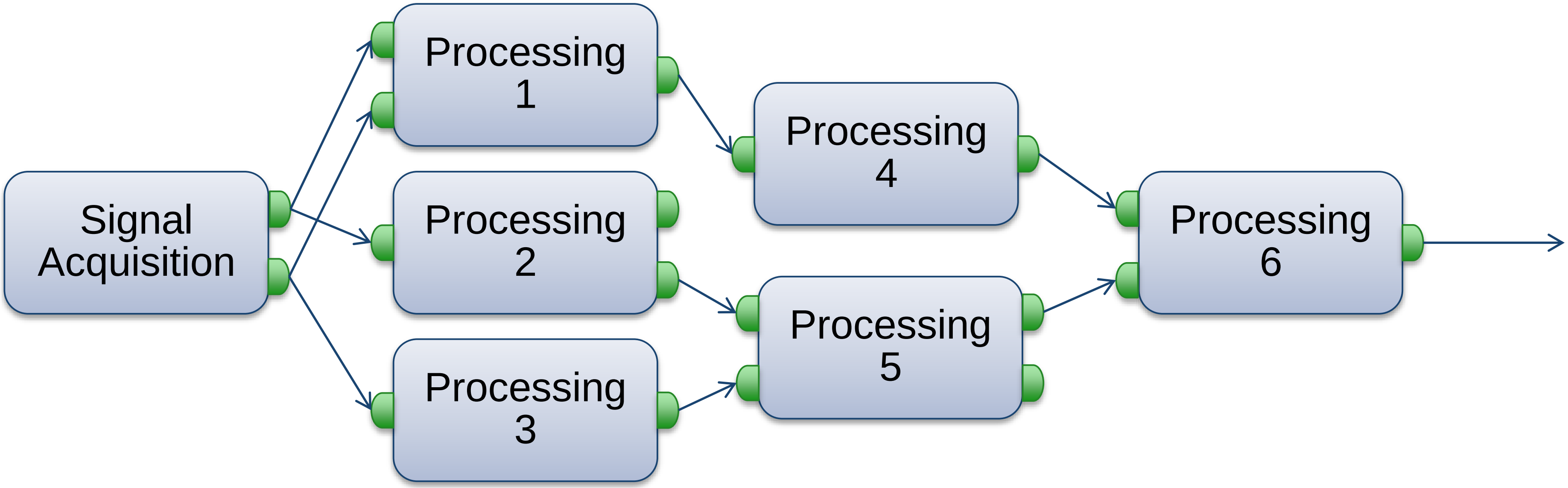
- Independant of acquisition hardware
- Works on Linux / Windows

Connection with Virtual Reality (VR)



Concepts: modularity and reusability

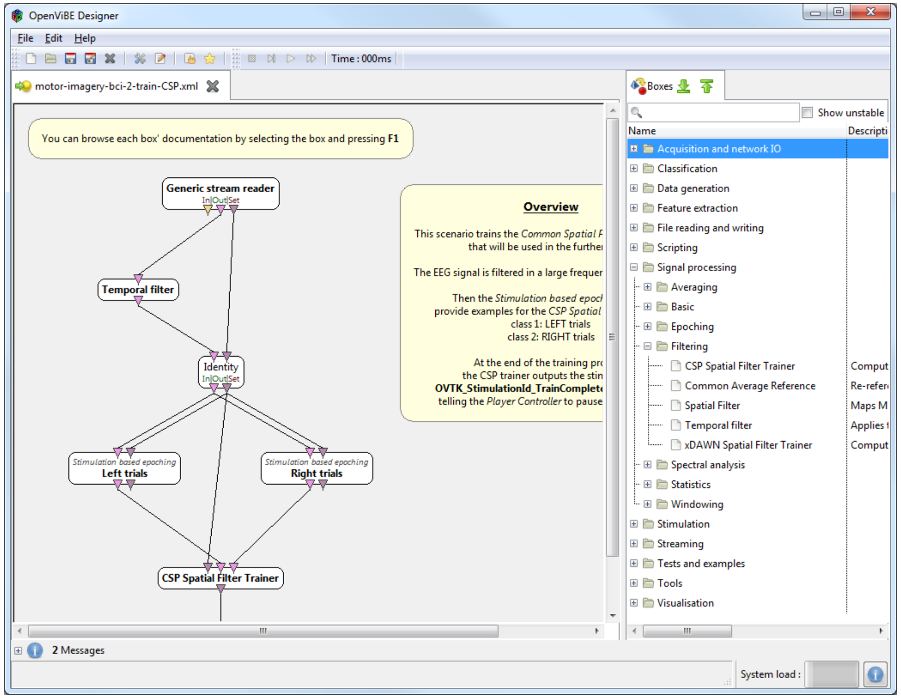
- quickly and efficiently arrange small processing components into a high level / complex composition



Concepts: different users

Author's view

Make your own DSP chains



You can browse each box' documentation by selecting the box and pressing **F1**

Overview

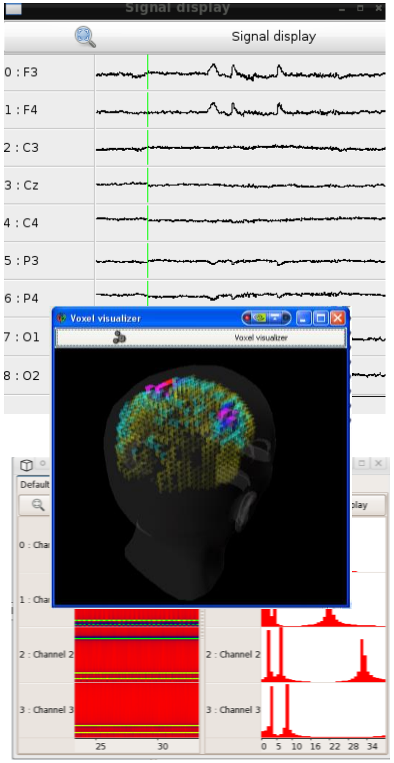
This scenario trains the *Common Spatial F*
that will be used in the furthe

The EEG signal is filtered in a large frequer

Then the *Stimulation based epoch*
provide examples for the *CSP Spatial*
class 1: LEFT trials
class 2: RIGHT trials

At the end of the training pr
the CSP trainer outputs the stin
OVTK_StimulationId_TrainComplete
telling the *Player Controller* to pause

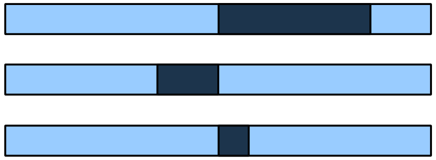
Operator's view



Subject's view

Interactive Application

Neurofeedback



- No programming skills required
- A scenario designer
- Graphical User Interface
- WYSIWYG (What You See Is What You Get)

Functionalities: An acquisition device abstraction

- Allows any device to be integrated, through the development of a C++ driver
- Already supported :
  - All Brain Products devices (VAmp, Brainamp series, Quickamp)
  - Brainmaster (Atlantis, Discovery)
  - EGI (Netamps 300)
  - Emotiv (EPOC)
  - g.Tec (g.USBam, g.Mobilab+)
  - All Micromed devices (through SystemPlus Evolution s/w)
  - OpenEEG (modularEEG, monolithEEG)
  - Neurosky (Mindset, MindWave)
  - Most TMSi devices (including Porti, Refa, and derived Mindmedia NeXus, ANT Neuro ASALAB...)

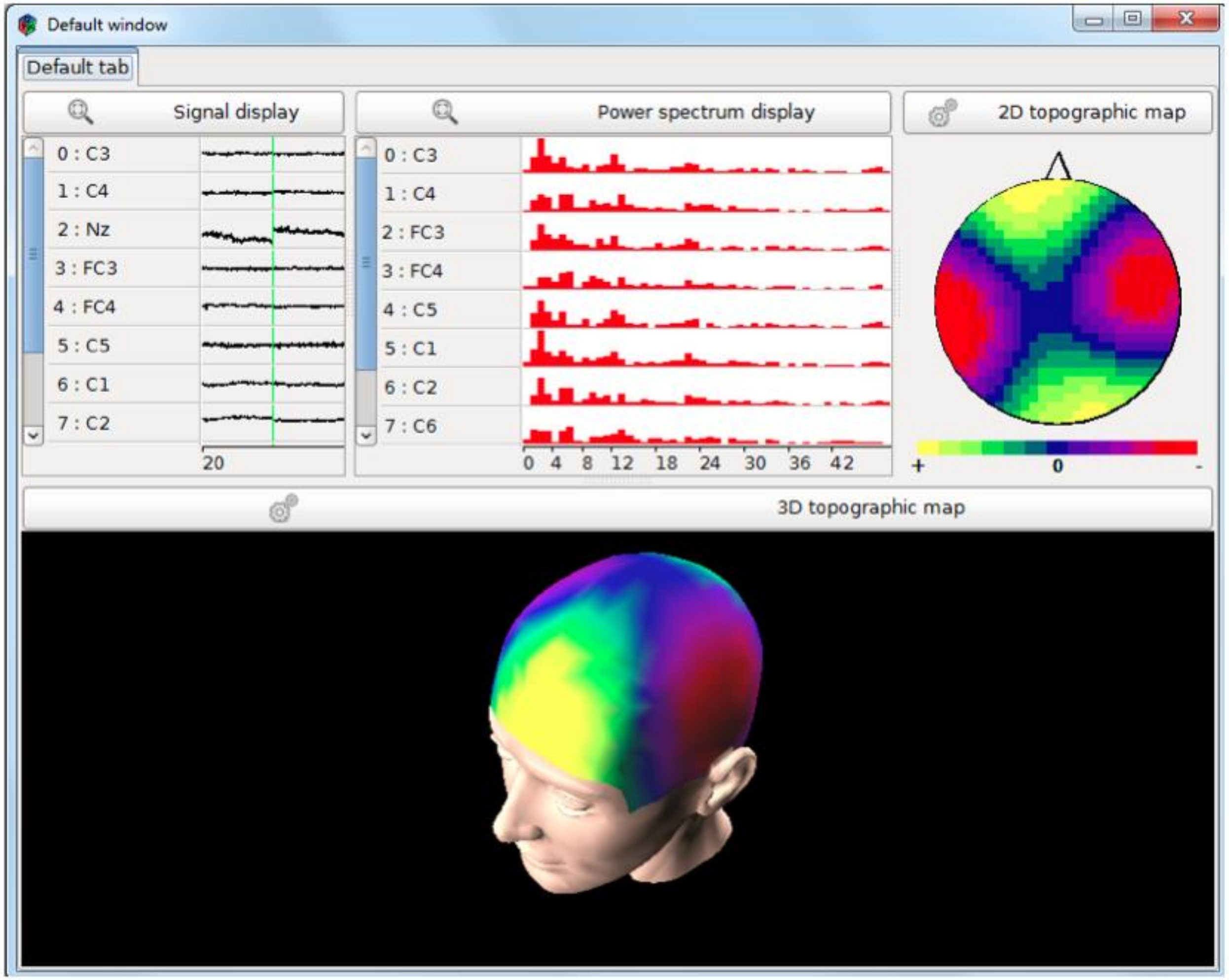
+ many others (check the full list on http://openvibe.inria.fr/supported-hardware)
)

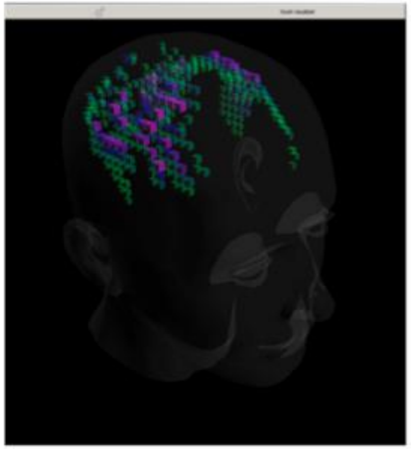
Functionalities: Plugins

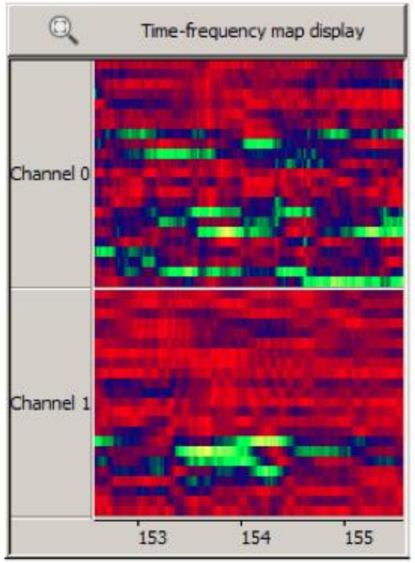
GDF file writer/reader	Temporal filtering	Spectral analysis	Signal and spectral visualisation	Matlab scripting
EDF file writer	Spatial filtering xDAWN, CSP	Classification LDA/SVM	2D and 3D topography map	Python scripting
CSV file writer/reader	Universal DSP	Auto-Regressive coefficients	Voxel display	Lua scripting
Generic network acquisition	Signal epoching	Windowing	Time/frequency mapping	VRPN input/output

+ many more such as LSL, multiclass classifiers…

Functionalities: Various real-time displays





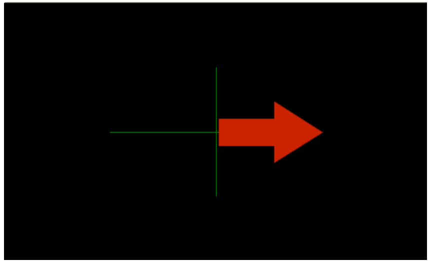


Functionalities: stimuli

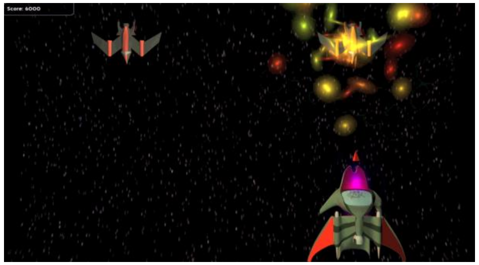
- Visual Stimulus:

Included in the release

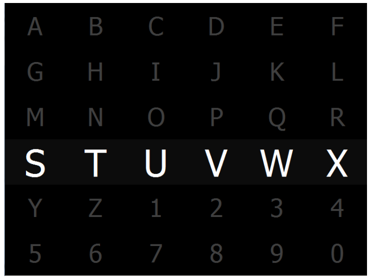
Motor Imagery



SSVEP



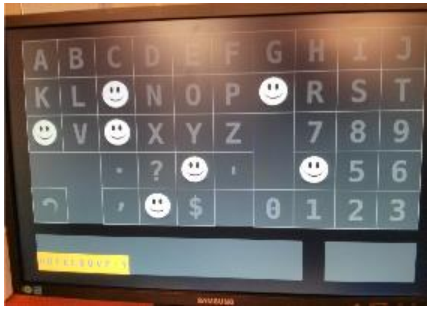
P300



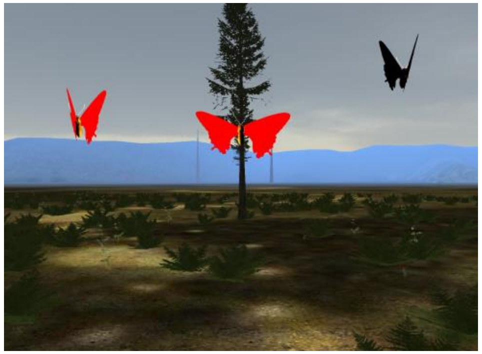
A	B	C	D	E	F
G	H	I	J	K	L
M	N	O	P	Q	R
S	T	U	V	W	X
Y	Z	1	2	3	4
5	6	7	8	9	0

done by users

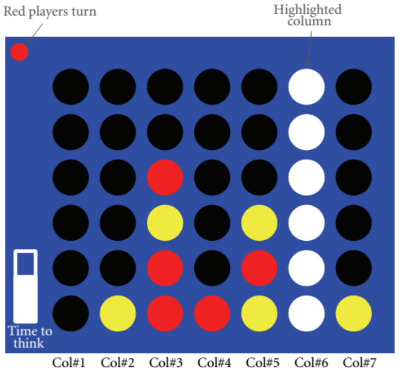
P300



SSVEP



P300



- Audio Stimulus:
  - Sound Player box

- Keyboard Stimulus

Functionalities

- Interaction with other software :
  - VRPN plug-in
    - OpenViBE can be considered as an external peripheral
    - Immediate compatibility with most VR software / tools
  - Matlab plug-in
    - OpenViBE can call Matlab code
  - Lua plug-in
    - Experiment protocol can be implemented with Lua scripts
  - Python plug-in
    - OpenViBE can call Python code for signal processing as well a implementing experiment protocols
  - File reader / writer plug-in
    - The signals can be imported / exported with different formats (gdf, edf, csv, ...)
  - External configuration files
    - Each box configuration can be defined in a file

      For example, write your own spatial filter in Matlab and use it in OpenViBE

OpenViBE Software

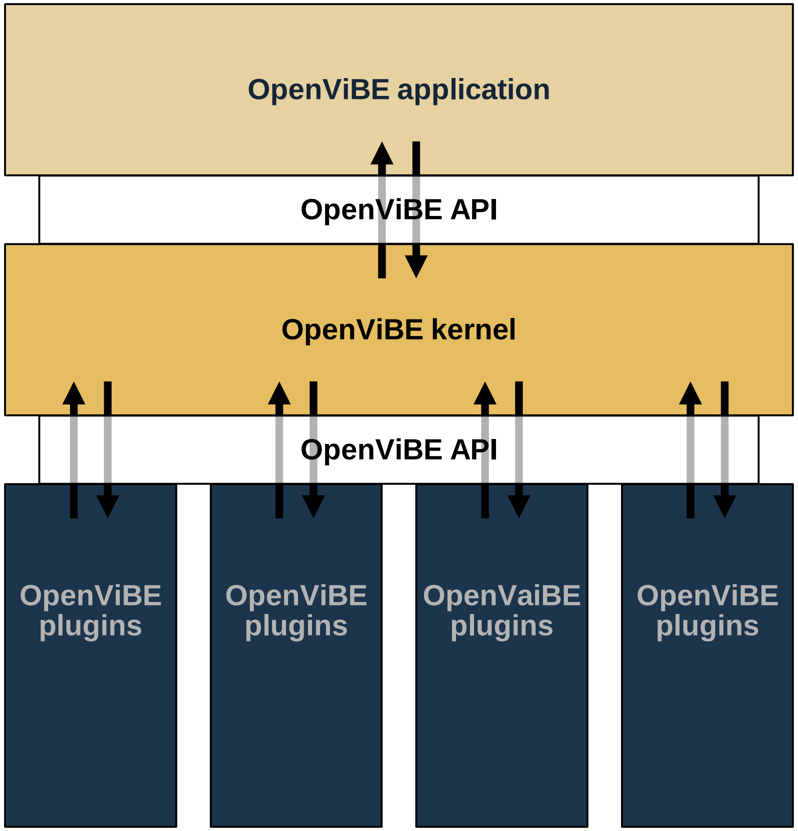
Internals

OpenViBE software: internals

- General software architecture
- The designer
- The acquisition server
- Dependencies

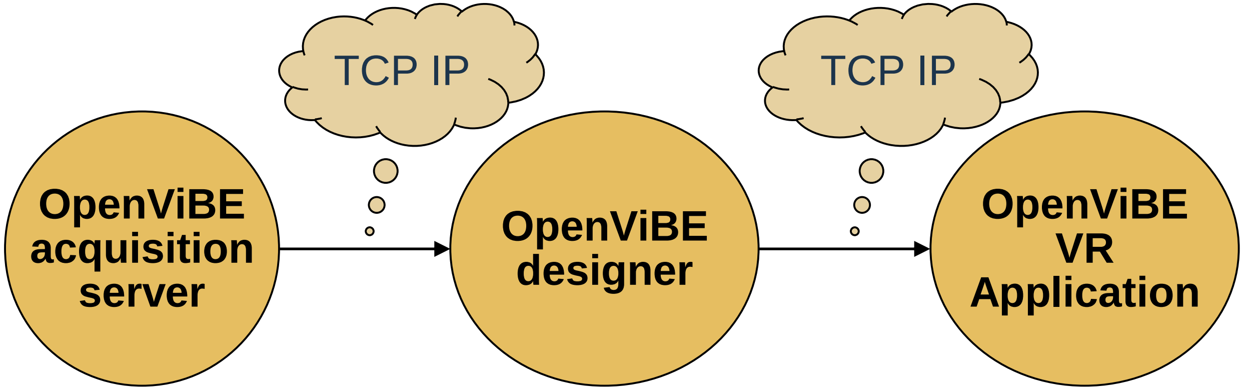
General Software Architecture

- An OpenViBE application is based on a kernel which proposes services
- The kernel relies on plugins to achieve its services



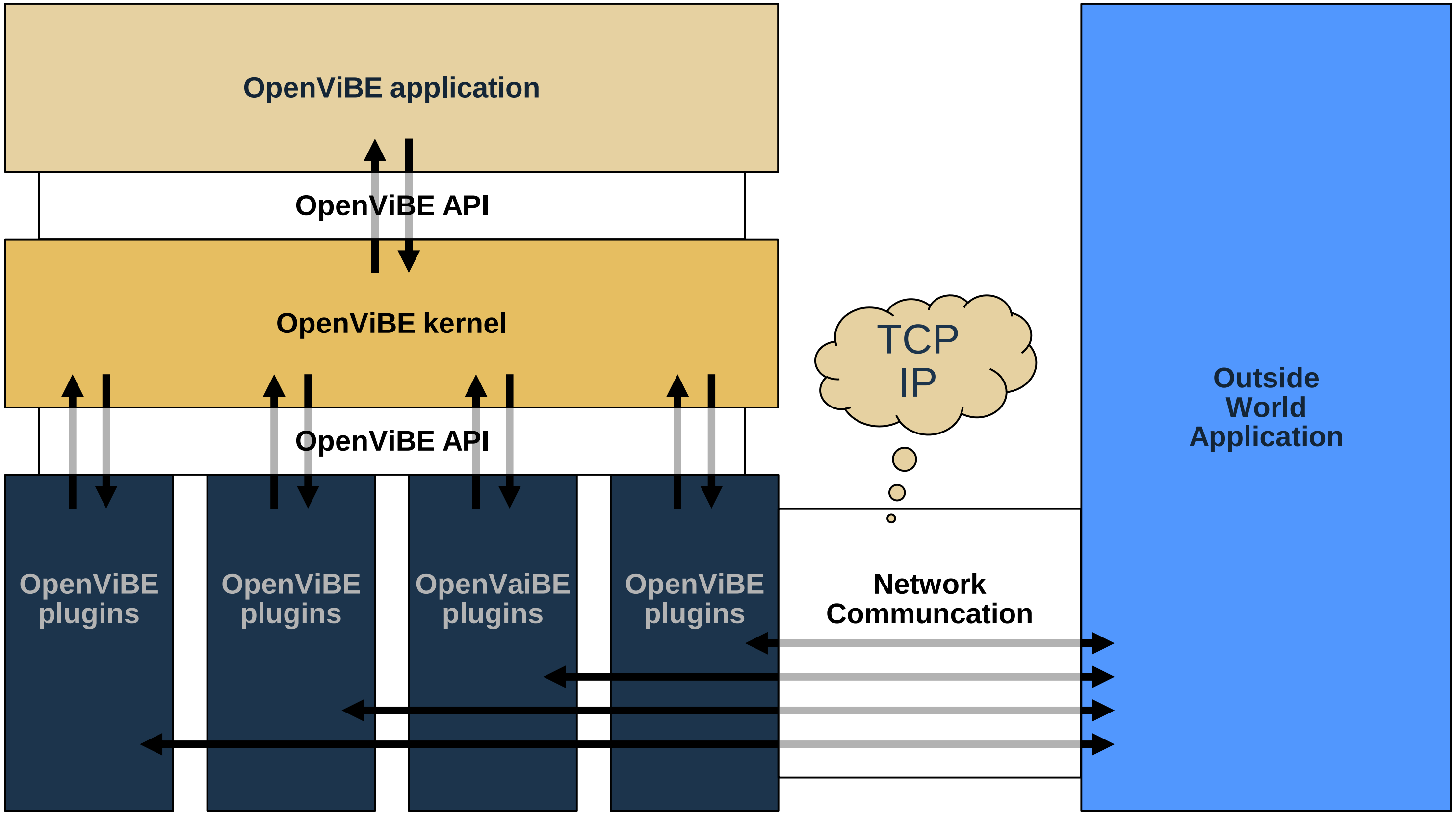
General Software Architecture

- There are usually three applications involved, communicating through network
  - OpenViBE acquisition server
  - OpenViBE designer
  - OpenViBE virtual reality application



General Software Architecture

- Structure of an OpenViBE based application and communication with outside world



OpenViBE software: internals

- General software architecture
- The designer
- The acquisition server
- Dependencies

OpenViBE software: internals

- General software architecture
- The designer
  - Facts about the designer
  - Understanding the scheduling
  - Understanding the data flows
- The acquisition server
- Dependencies

Facts about the designer

- The designer
  - is an authoring tool
  - handles a collection of scenarios / boxes / links
  - includes a « *player* » for online use of the scenarios

- It knows almost nothing about « what » each box should do
- It just knows « how » each box should do it :
  - how it communicates with other boxes (inputs / outputs)
  - the parameters the user can modify to adapt the box' behavior (settings)
  - ...

Understanding the scheduling

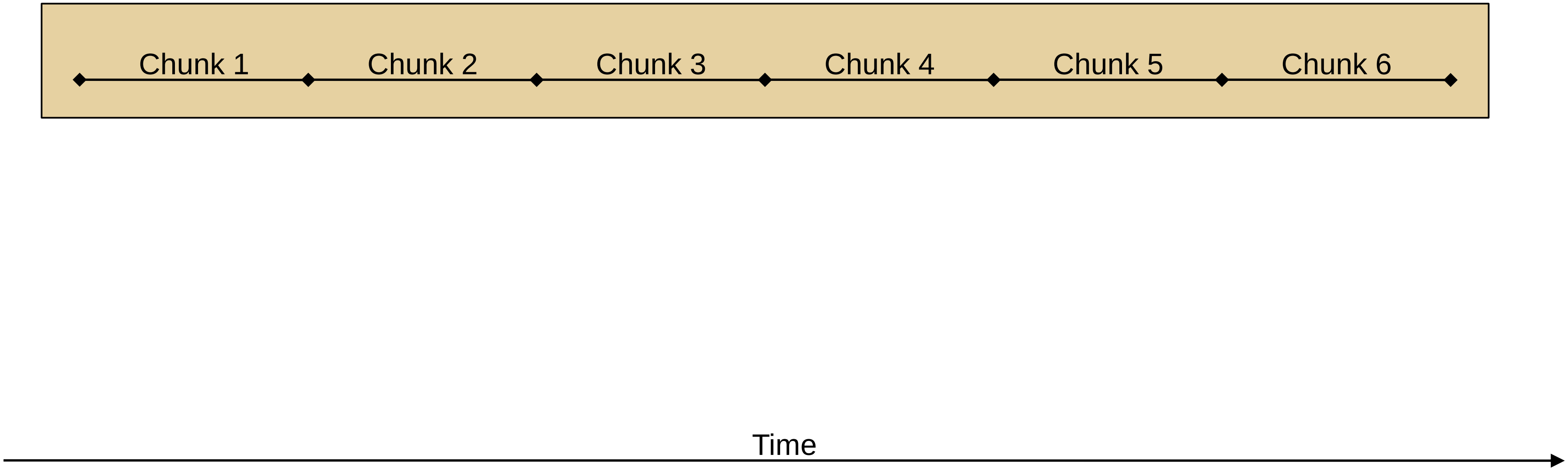
- The graphical representation suggests that boxes are running in parallel
- This is ***not true*** !

- Each box' processing :
  - is scheduled by the player
  - is executed for as short as possible by the box

- In fact, the player is repeatedly requesting for boxes to process
- Generally, the first box (e.g. « Acquisition Client ») causes the other boxes to be scheduled by the player

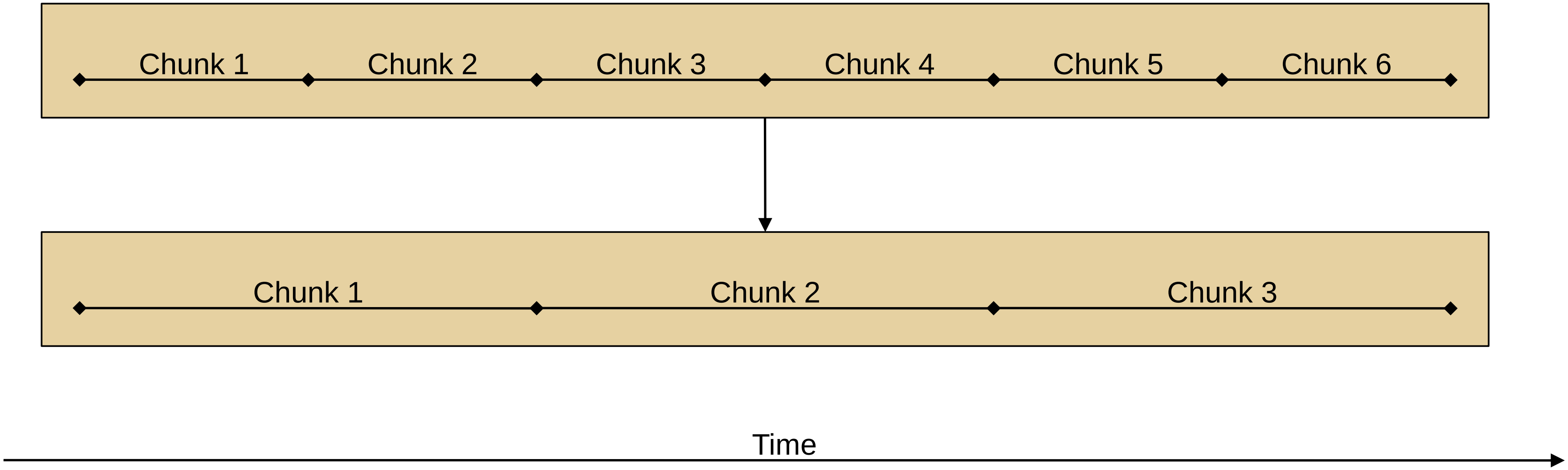
Understanding data flow

- The data streams are divided in blocks or « chunks »
  - Each chunk is dated with a « start time » and an « end time »
    - Those dates are used by the boxes to synchronise the streams altogether



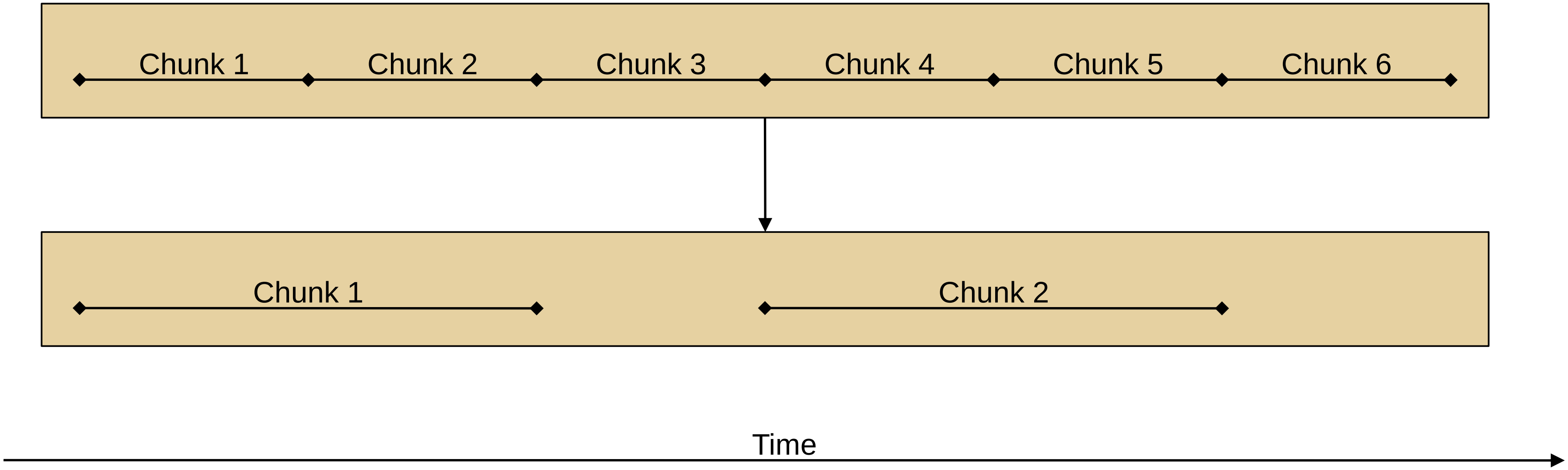
Understanding data flow

- The data streams are divided in blocks or « chunks »
  - Each chunk is dated with a « start time » and an « end time »
    - Those dates are used by the boxes to synchronise the streams altogether
  - The stream structure can be modified using epochers, e.g :
    - Chunk resize



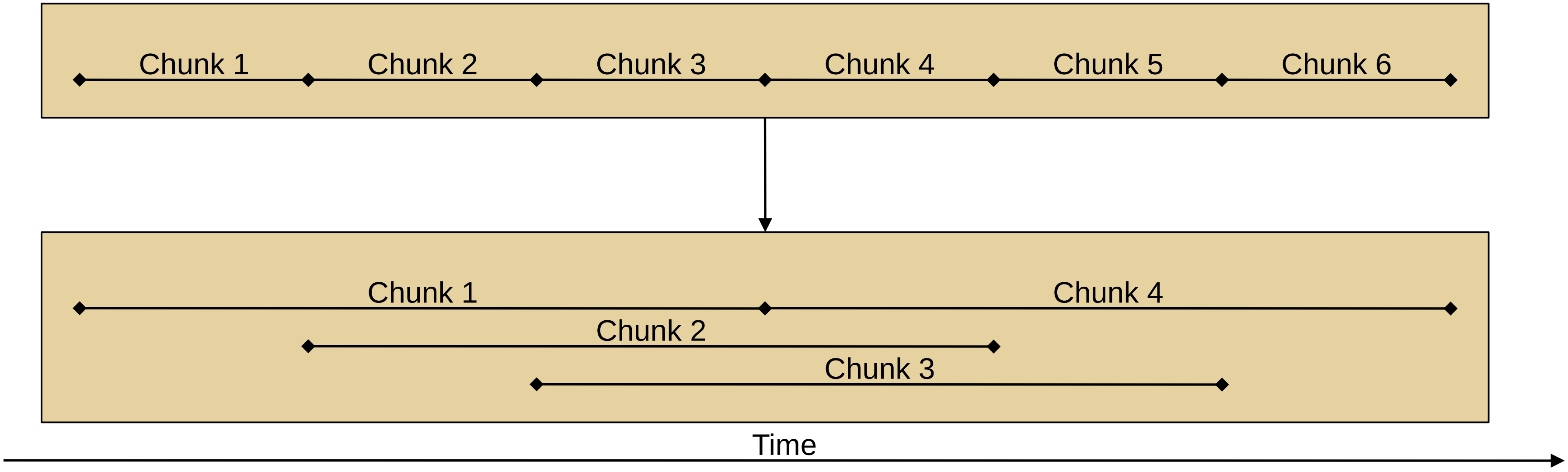
Understanding data flow

- The data streams are divided in blocks or « chunks »
  - Each chunk is dated with a « start time » and an « end time »
    - Those dates are used by the boxes to synchronise the streams altogether
  - The stream structure can be modified using epochers, e.g :
    - Regular chunk selection



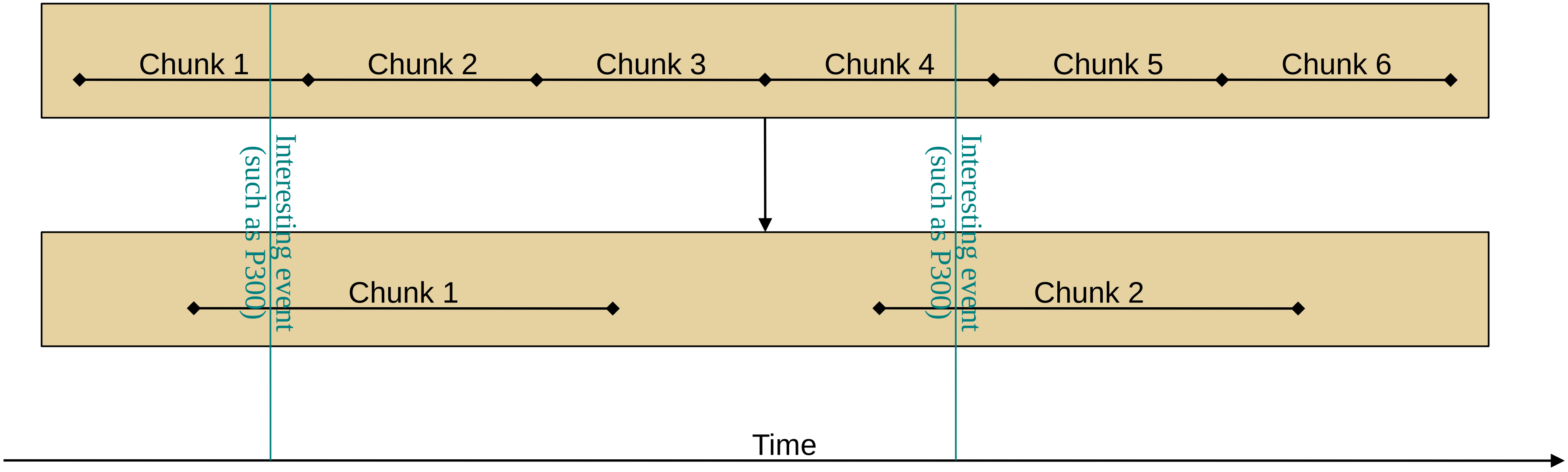
Understanding data flow

- The data streams are divided in blocks or « chunks »
  - Each chunk is dated with a « start time » and an « end time »
    - Those dates are used by the boxes to synchronise the streams altogether
  - The stream structure can be modified using epochers, e.g :
    - Overlapping chunks (for moving averages etc...)



Understanding data flow

- The data streams are divided in blocks or « chunks »
  - Each chunk is dated with a « start time » and an « end time »
    - Those dates are used by the boxes to synchronise the streams altogether
  - The stream structure can be modified using epochers, e.g :
    - Signal selection around events



Understanding data flow

- The data streams are divided in blocks or « chunks »
  - Each chunk is dated with a « start time » and an « end time »
    - Those dates are used by the boxes to synchronise the streams altogether
  - The stream structure can be modified using epochers
- In any circumstances, each stream can be « spied » thanks to the « *EBML Stream Spy* » box
- Demonstration
  - Use case 1 : resizing chunks
  - Use case 2 : moving average
  - Use case 3 : signal selection near an interesting event
  - Use case 4 : EBML stream spy

OpenViBE software: internals

- General software architecture
- The designer
  - Facts about the designer
  - Understanding the scheduling
  - Understanding the data flows
- The acquisition server
- Dependencies

OpenViBE software: internals

- General software architecture
- The designer
- The acquisition server
  - Facts about the acquisition server
  - Different driver families
- Dependencies

Facts about the acquisition server

- The OpenViBE Acquisition Server proposes a device abstraction
- New devices can be added with new « drivers », developped in C++
- Each driver :
  - gets the signal samples from the device
  - sends them to the acquisition server
- The acquisition server :
  - sends those samples to connected application

  (e.g. the OpenViBE designer)
  - transforms the samples in a standard way
- There are several ways to implement a new driver
- It mostly depends on what the manufacturer provides

Different driver families

- Direct hardware communication
    - trough an API (great !)
    - trough a low level hardware interface (serial port, parallel port, USB, TCP/IP...)
- Communication with a proprietary acquisition software
    - through network
    - through a file (very bad !)
    - through a COM component or other proprietary technologies (bad !)

- Pros / cons to consider :
    - performances (latency, jittering...)
    - code quantity
    - code maintainability
    - code portability
- We have many contributions on this part of the software

OpenViBE software: internals

- General software architecture
- The designer
- The acquisition server
  - Facts about the acquisition server
  - Different driver families
- Dependencies

OpenViBE software: internals

- General software architecture
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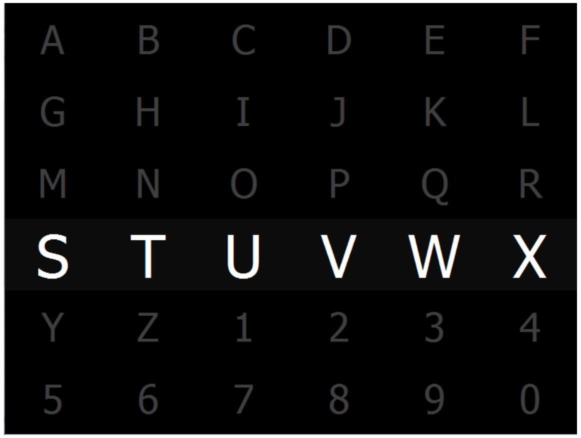
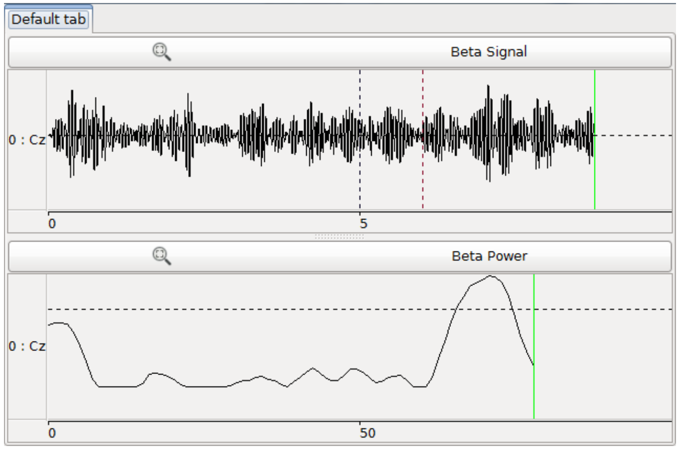
Dependencies

- Interested developers should know that OpenViBE currently relies on the following open-source technologies :
  - Cmake (for building)
  - Boost (General purpose library, e.g. threading)
  - GTK (Graphical User Interface Toolkit)
  - IT++ (for signal processing – only in plugins)
  - Ogre3D / CEGUI (3D library)
  - Lua (Scripting language)
  - Expat (XML parsing)

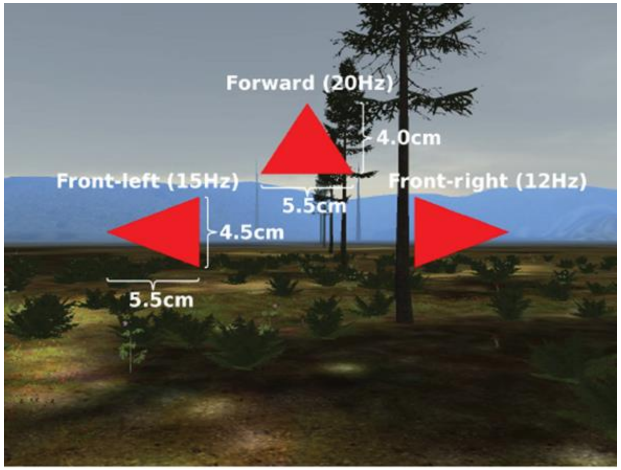
Functionalities: Paradigms



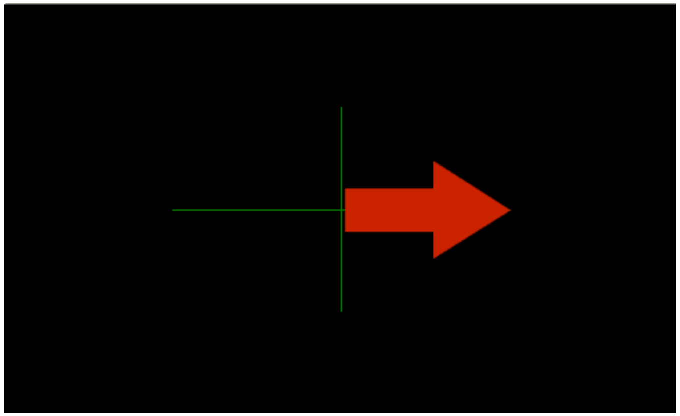
P300



Neurofeedback



SSVEP

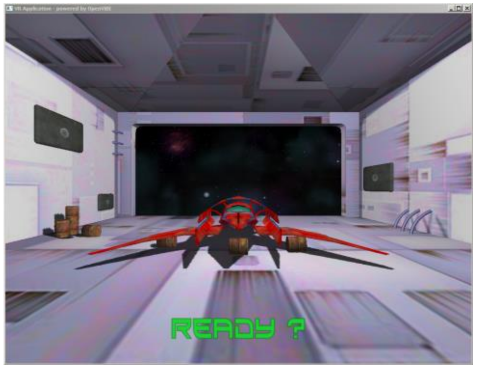


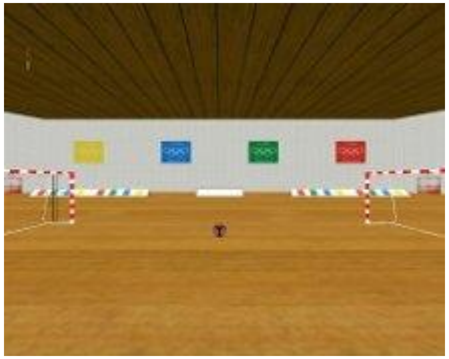
Motor Imagery

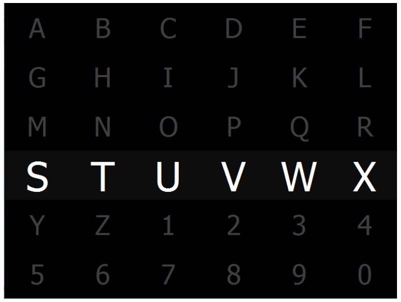
Functionalities: Applications

- Several predefined and ready to use scenarios:
  1. Neurofeedback with the *Tie Fighter* VR game
  2. BCI based on motor activity (Graz-BCI, handball)
  3. BCI based on P300 (*Speller, Magic Card*)
  4. BCI based on SSVEP (*Spaceship Shooter*)

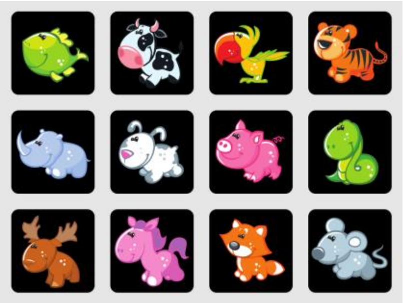
- Lots of *box tutorials* scenarios to showcase specific features (read EEG from a file, compute a topographic map, filter signal, etc.)

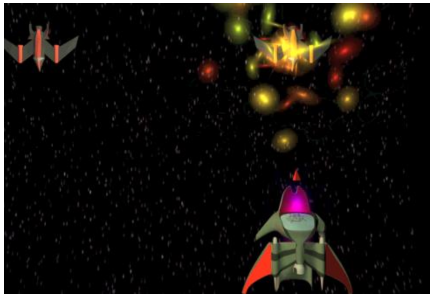






A	B	C	D	E	F
G	H	I	J	K	L
M	N	O	P	Q	R
S	T	U	V	W	X
Y	Z	1	2	3	4
5	6	7	8	9	0





Current Status

A-GPL v3 license : anyone can use, study and modify the software.
Commercial usage is restricted (modifications must be open-source as well).

Releases :

- Every 6 months for 5 platforms
  - Windows 7
  - 2 Fedora versions
  - Latest Ubuntu and latest LTS Ubuntu

Statistics :

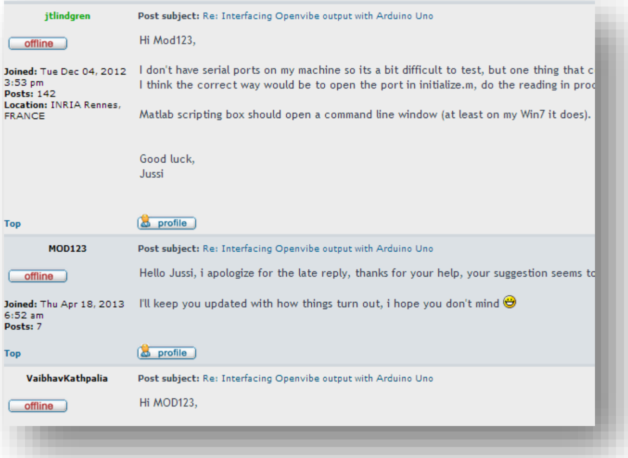
- 3000 single visitors per month on the project website
- 10000+ downloads of the Windows installer since the first release in 2009
- 80+ users on the forum
- 300 000 lines (C++)

THE COMMUNITY

What is Free Software?

- Free software supposes 4 basic rules :
  - You are free to use the software for any purpose
  - You are free to study the source code and modify it for your own needs (that is the software must be open-source)
  - You are free to re-distribute copies of the software
  - You are free to distribute modified versions of the software but you have to keep them free as in freedom !

- Usually there is a community and an ecosystem around the free software that can
  - Provide Support
  - Share experience and ideas
  - Help in solving scientific or technical challenges
  - Give continuous guidelines



jtlindgren

Joined: Tue Dec 04, 2012 3:53 pm
Posts: 142
Location: INRIA Rennes, FRANCE

Post subject: Re: Interfacing Openvibe output with Arduino Uno

Hi Mod123,

I don't have serial ports on my machine so its a bit difficult to test, but one thing that c
I think the correct way would be to open the port in initialize.m, do the reading in proc

Matlab scripting box should open a command line window (at least on my Win7 it does).

Good luck,
Jussi

MOD123

Joined: Thu Apr 18, 2013 6:52 am
Posts: 7

Post subject: Re: Interfacing Openvibe output with Arduino Uno

Hello Jussi, i apologize for the late reply, thanks for your help, your suggestion seems to

I'll keep you updated with how things turn out, i hope you don't mind 😃

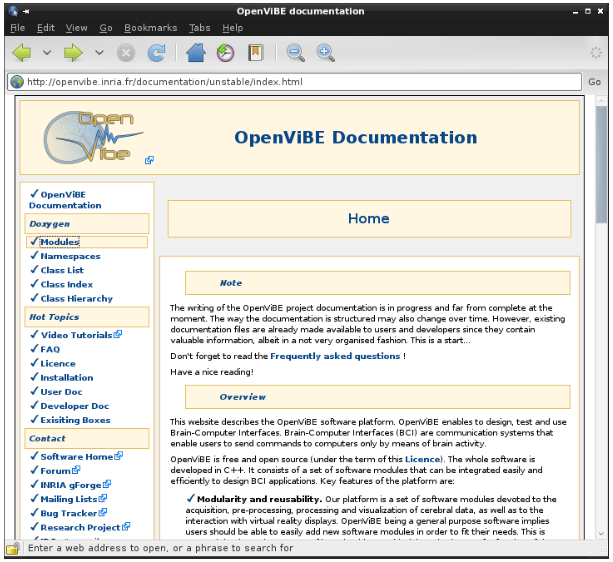
VaibhavKathpalia

Post subject: Re: Interfacing Openvibe output with Arduino Uno

Hi MOD123,

http://openvibe.inria.fr

- News
- Made with OpenViBE
- Job offers
- Support :
  - Documentation for users and developers (Starter, Tutorials, Tips & Tricks)
  - Forum, mailing list, bug tracker



http://openvibe.inria.fr/documentation/unstable/index.html

OpenViBE Documentation

- ✓ OpenViBE Documentation
- *Doxygen*
- ✓ Modules
- ✓ Namespaces
- ✓ Class List
- ✓ Class Index
- ✓ Class Hierarchy
- *Hot Topics*
- ✓ Video Tutorials
- ✓ FAQ
- ✓ Licence
- ✓ Installation
- ✓ User Doc
- ✓ Developer Doc
- ✓ Exisiting Boxes
- *Contact*
- ✓ Software Home
- ✓ Forum
- ✓ INRIA gForge
- ✓ Mailing Lists
- ✓ Bug Tracker
- ✓ Research Project

Home

Note

The writing of the OpenViBE project documentation is in progress and far from complete at the moment. The way the documentation is structured may also change over time. However, existing documentation files are already made available to users and developers since they contain valuable information, albeit in a not very organised fashion. This is a start...

Don't forget to read the **Frequently asked questions** !

Have a nice reading!

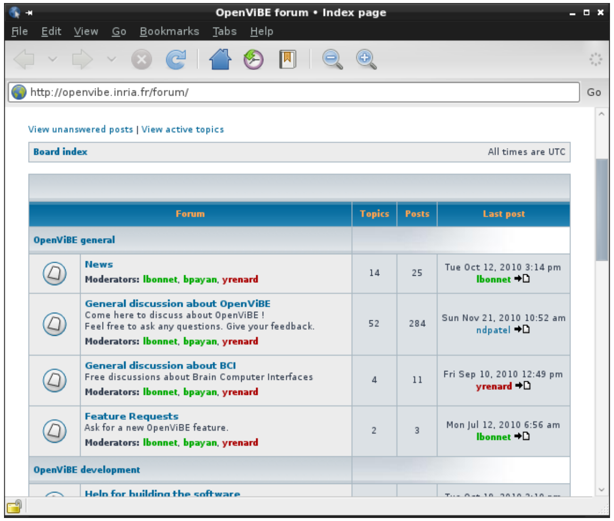
Overview

This website describes the OpenViBE software platform. OpenViBE enables to design, test and use Brain-Computer Interfaces. Brain-Computer Interfaces (BCI) are communication systems that enable users to send commands to computers only by means of brain activity.

OpenViBE is free and open source (under the term of this **Licence**). The whole software is developed in C++. It consists of a set of software modules that can be integrated easily and efficiently to design BCI applications. Key features of the platform are:

✓ **Modularity and reusability.** Our platform is a set of software modules devoted to the acquisition, pre-processing, processing and visualization of cerebral data, as well as to the interaction with virtual reality displays. OpenViBE being a general purpose software implies users should be able to easily add new software modules in order to fit their needs. This is

Enter a web address to open, or a phrase to search for


OpenViBE forum • Index page
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Go

http://openvibe.inria.fr/forum/

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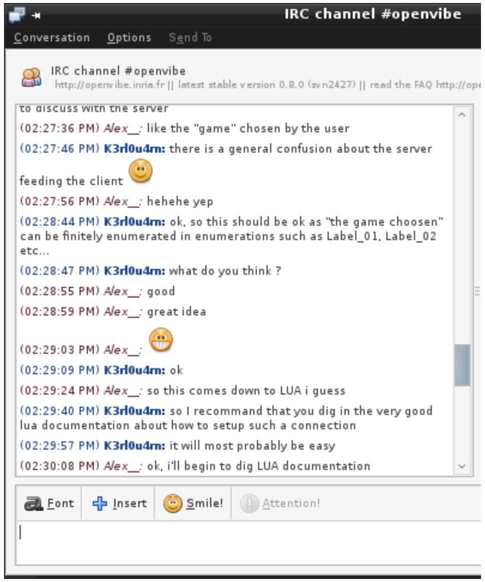
Board index — All times are UTC

Forum	Topics	Posts	Last post
OpenViBE general			
News **Moderators:** lbonnet, bpayan, yrenard	14	25	Tue Oct 12, 2010 3:14 pm lbonnet
General discussion about OpenViBE Come here to discuss about OpenViBE ! Feel free to ask any questions. Give your feedback. **Moderators:** lbonnet, bpayan, yrenard	52	284	Sun Nov 21, 2010 10:52 am ndpatel
General discussion about BCI Free discussions about Brain Computer Interfaces **Moderators:** lbonnet, bpayan, yrenard	4	11	Fri Sep 10, 2010 12:49 pm yrenard
Feature Requests Ask for a new OpenViBE feature. **Moderators:** lbonnet, bpayan, yrenard	2	3	Mon Jul 12, 2010 6:56 am lbonnet
OpenViBE development			
Help for building the software			

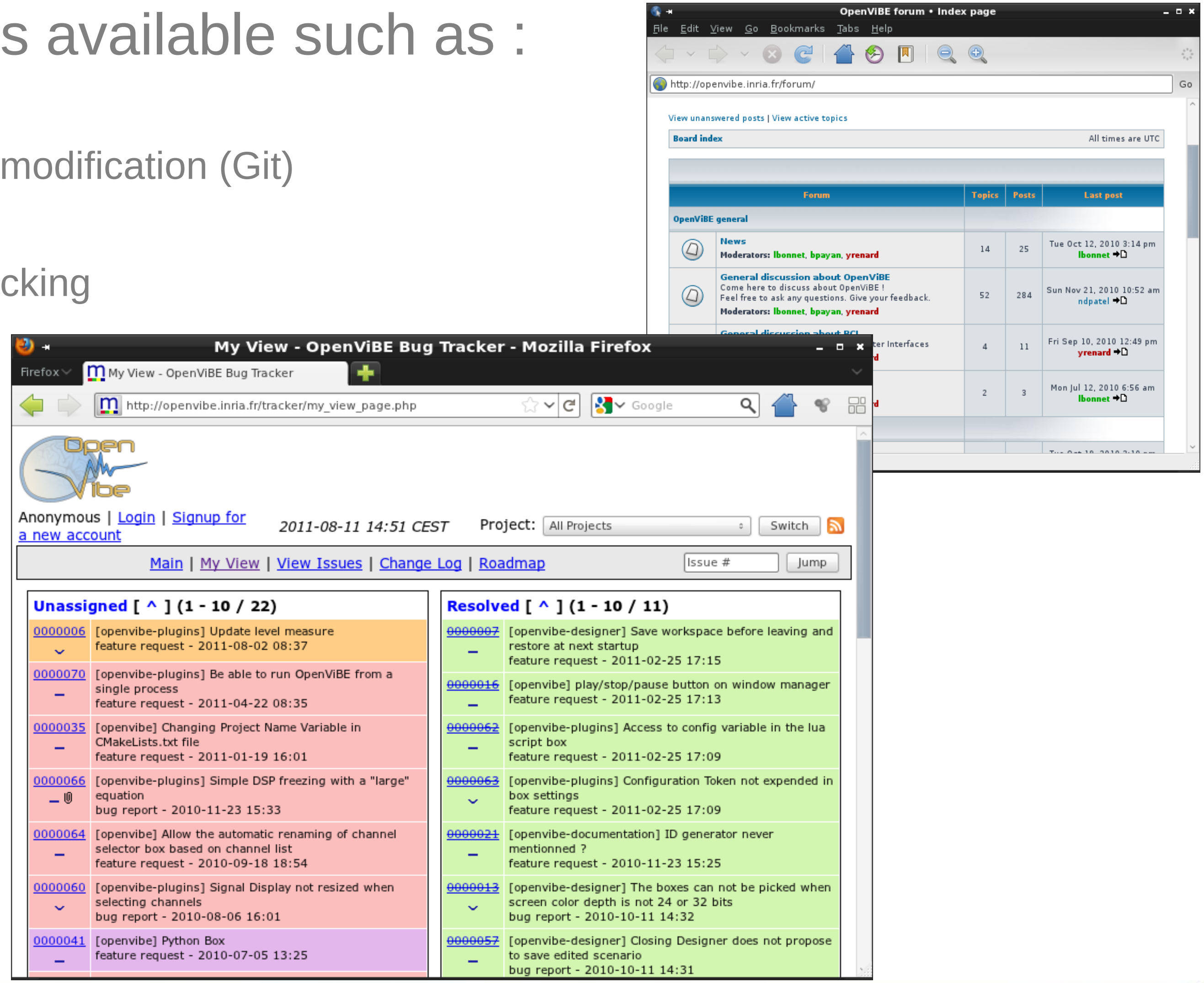


IRC channel #openvibe
http://openvibe.inria.fr || latest stable version 0.8.0 (svn2427) || read the FAQ http://ope

```
to discuss with the server
(02:27:36 PM) Alex__: like the "game" chosen by the user
(02:27:46 PM) K3rl0u4rn: there is a general confusion about the server
feeding the client
(02:27:56 PM) Alex__: hehehe yep
(02:28:44 PM) K3rl0u4rn: ok, so this should be ok as "the game choosen"
can be finitely enumerated in enumerations such as Label_01, Label_02
etc...
(02:28:47 PM) K3rl0u4rn: what do you think ?
(02:28:55 PM) Alex__: good
(02:28:59 PM) Alex__: great idea
(02:29:03 PM) Alex__:
(02:29:09 PM) K3rl0u4rn: ok
(02:29:24 PM) Alex__: so this comes down to LUA i guess
(02:29:40 PM) K3rl0u4rn: so I recommand that you dig in the very good
lua documentation about how to setup such a connection
(02:29:57 PM) K3rl0u4rn: it will most probably be easy
(02:30:08 PM) Alex__: ok, i'll begin to dig LUA documentation
```

Community

- The project is hosted by the INRIA gForge
- Multiple services available such as :
  - Website hosting
  - Concurrent source modification (Git)
  - Bug tracking
  - Feature request tracking
  - Mailing lists
  - Several statistics
  - Automatic builds



OpenViBE forum • Index page

http://openvibe.inria.fr/forum/

View unanswered posts | View active topics

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	2	3	Mon Jul 12, 2010 6:56 am lbonnet

My View - OpenViBE Bug Tracker - Mozilla Firefox

http://openvibe.inria.fr/tracker/my_view_page.php

Anonymous | Login | Signup for a new account — *2011-08-11 14:51 CEST* — Project: All Projects — Switch

Main | My View | View Issues | Change Log | Roadmap — Issue # — Jump

Unassigned [^] (1 - 10 / 22)

0000006	[openvibe-plugins] Update level measure feature request - 2011-08-02 08:37
0000070	[openvibe-plugins] Be able to run OpenViBE from a single process feature request - 2011-04-22 08:35
0000035	[openvibe] Changing Project Name Variable in CMakeLists.txt file feature request - 2011-01-19 16:01
0000066	[openvibe-plugins] Simple DSP freezing with a "large" equation bug report - 2010-11-23 15:33
0000064	[openvibe] Allow the automatic renaming of channel selector box based on channel list feature request - 2010-09-18 18:54
0000060	[openvibe-plugins] Signal Display not resized when selecting channels bug report - 2010-08-06 16:01
0000041	[openvibe] Python Box feature request - 2010-07-05 13:25

Resolved [^] (1 - 10 / 11)

~~0000007~~	[openvibe-designer] Save workspace before leaving and restore at next startup feature request - 2011-02-25 17:15
~~0000016~~	[openvibe] play/stop/pause button on window manager feature request - 2011-02-25 17:13
~~0000062~~	[openvibe-plugins] Access to config variable in the lua script box feature request - 2011-02-25 17:09
~~0000063~~	[openvibe-plugins] Configuration Token not expended in box settings feature request - 2011-02-25 17:09
~~0000021~~	[openvibe-documentation] ID generator never mentionned ? feature request - 2010-11-23 15:25
~~0000013~~	[openvibe-designer] The boxes can not be picked when screen color depth is not 24 or 32 bits bug report - 2010-10-11 14:32
~~0000057~~	[openvibe-designer] Closing Designer does not propose to save edited scenario bug report - 2010-10-11 14:31

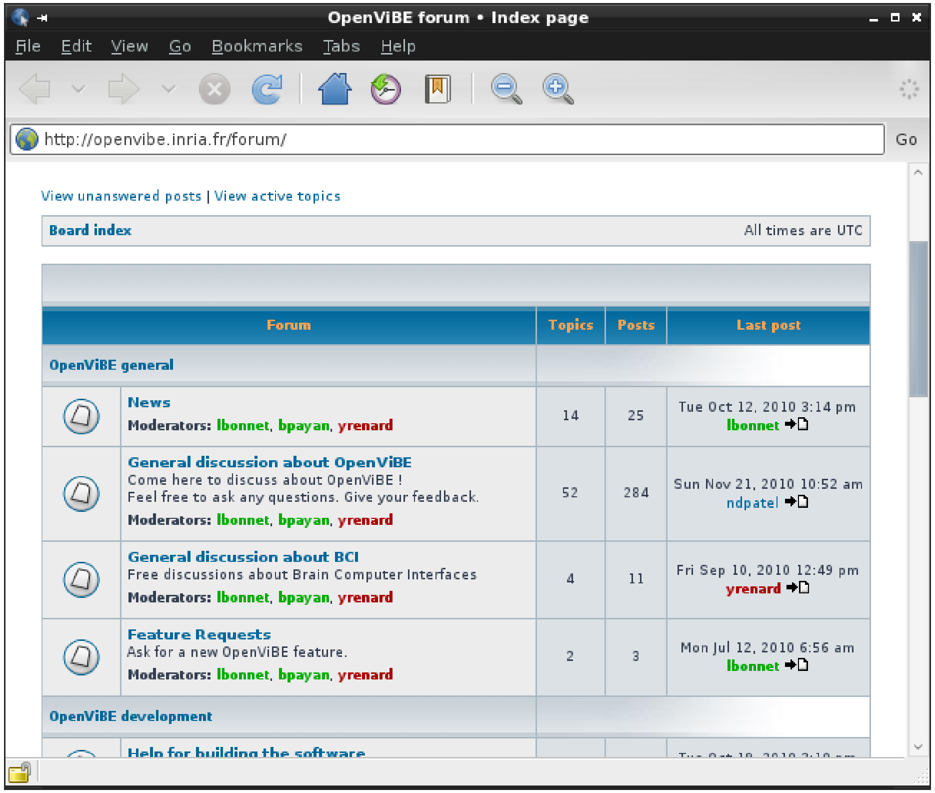
Community

- Benefits of bug tracking / feature request tracking :
  - Report information about what does not work
  - Report information about what should work in a different manner
  - Report information about what could be added to make the software better
  - Following how those issues are solved by the developers
  - This tool becomes more and more valuable as the community grows

- The Forum now replaces the mailing lists

Community

- The OpenViBE forum
  - (http://openvibe.inria.fr/forum)
    - General discussion about OpenViBE
    - General discussion about BCI
    - Feature Requests
    - OpenViBE development
    - OpenViBE use
    - OpenViBE scenarios



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	Help for building the software			

Community

- What OpenViBE can do for you?
  - Acquire, process and visualize brain activity in real-time
  - Extract, analyze and visualize evoked potentials in real-time
  - Offer flexibility for designing, testing and using new brain signal pattern detection
- How you can contribute and get involved in OpenViBE?
  - Provide feedback about your use of the software
  - Express needs for adapting the tool to your field
  - Support the developments by funding OpenViBE experts for creating the features you need
  - Create and share OpenViBE additions with the community

Community

Contributors/Users

- Université de Mons (Belgium)
- Ghent University (Belgium)
- GIPSA-Lab (France)
- Clinatec / LETI Minatec (France)
- Inria (France)
- INSERM (France)
- Neurospin (France)
- University of Lorraine (France)
- Oldenburg university (Germany)
- Universidad de Pavia (Italy)
- Universitat Pompeu Fabra in Barcelona (Spain)
- Université de Bristol (UK)
- …

Future

- Steering committee -> Consortium (Inria’s Foundation/InriaSoft)
- OpenViBE release (twice a year)
- Support engineers
- Mensia technology (www.**mensia**tech.com)
- CertiViBE project for medical certifiable solutions (OpenViBE kernel + core modules)
- BCI Book with practical chapters using OpenViBE (ISTE-Wiley, 2016)