Architecture and coordination with NeuroTools

cnrs

Institut Fédératif des Neurosciences LYON

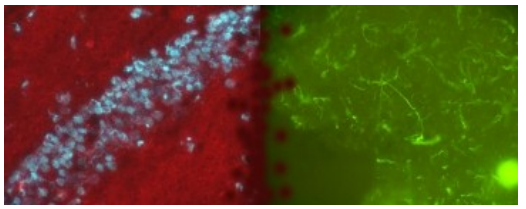
Lyon 1

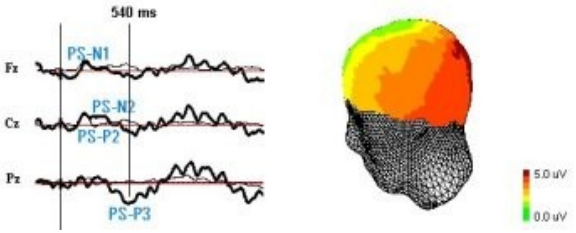
neurosciences · sensorielles · comportement · cognition

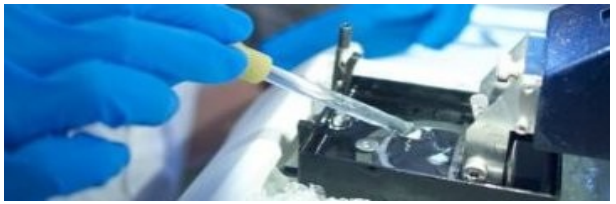
Labo Neurosciences Sensoriel Comportement Cognition, Lyon, France
Director : Rémi Gervais

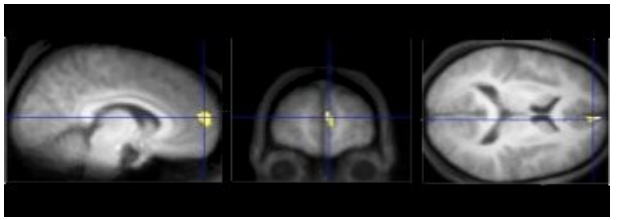
Samuel Garcia
Data processing ingineer, CNRS

Works : Olfaction and Audio systems







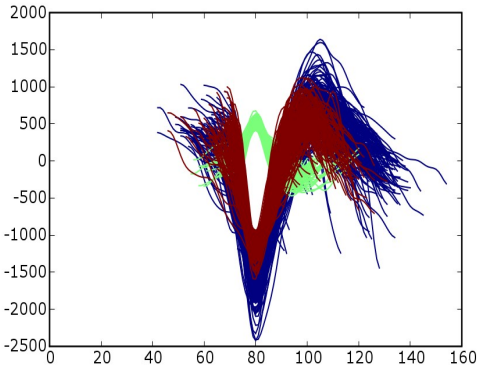


Open Electrophy

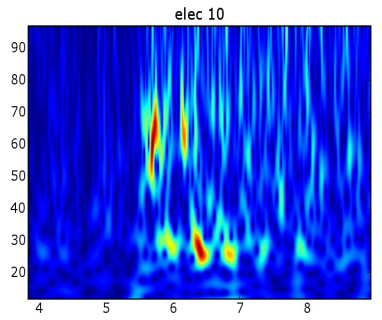
Type of user :
Biologists In vivo recording (intra or extra cellular)

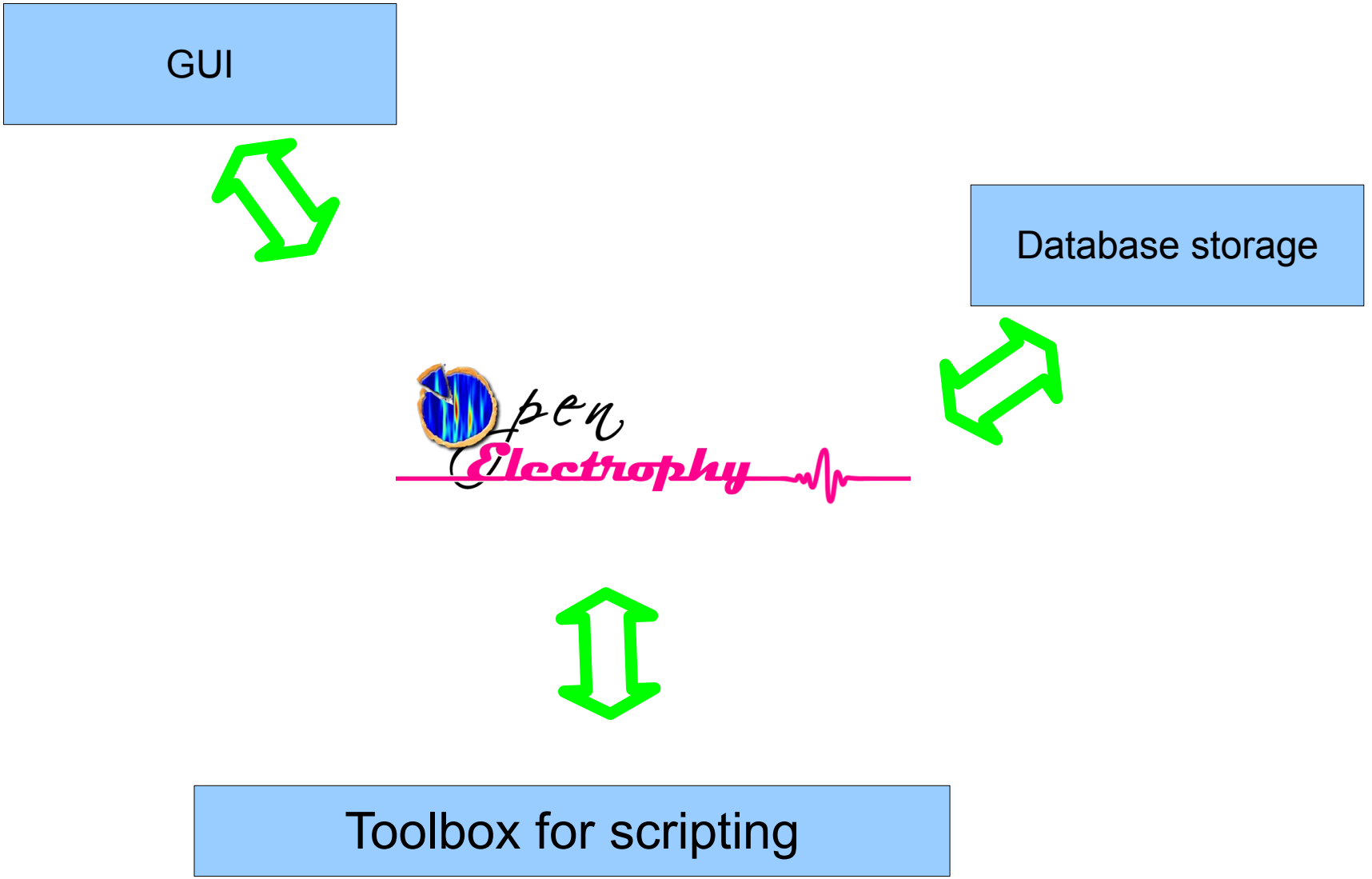
Type of analyses :

Spike

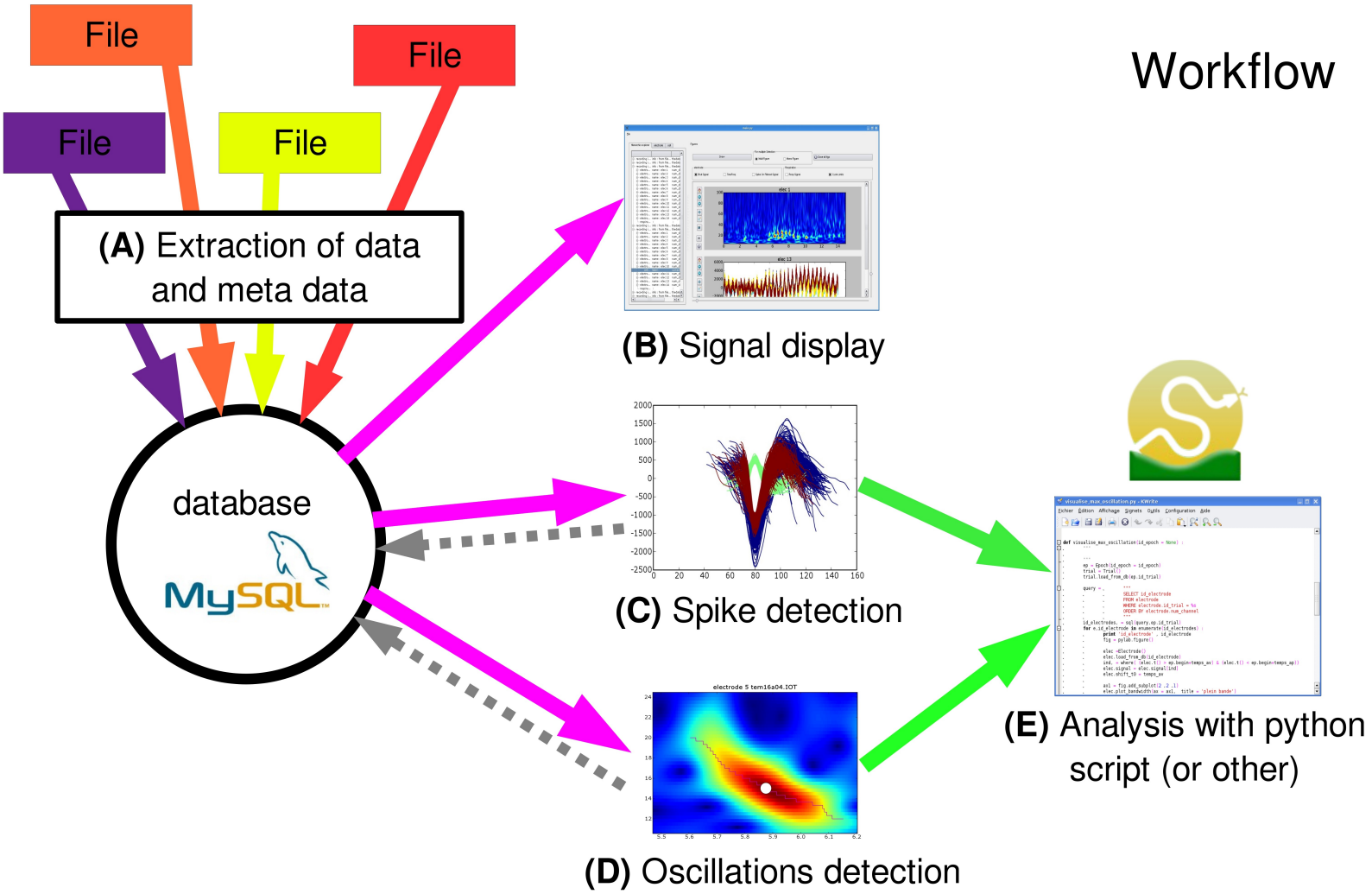


LFP oscillations




GUI
Database storage
Open Electrophy
Toolbox for scripting

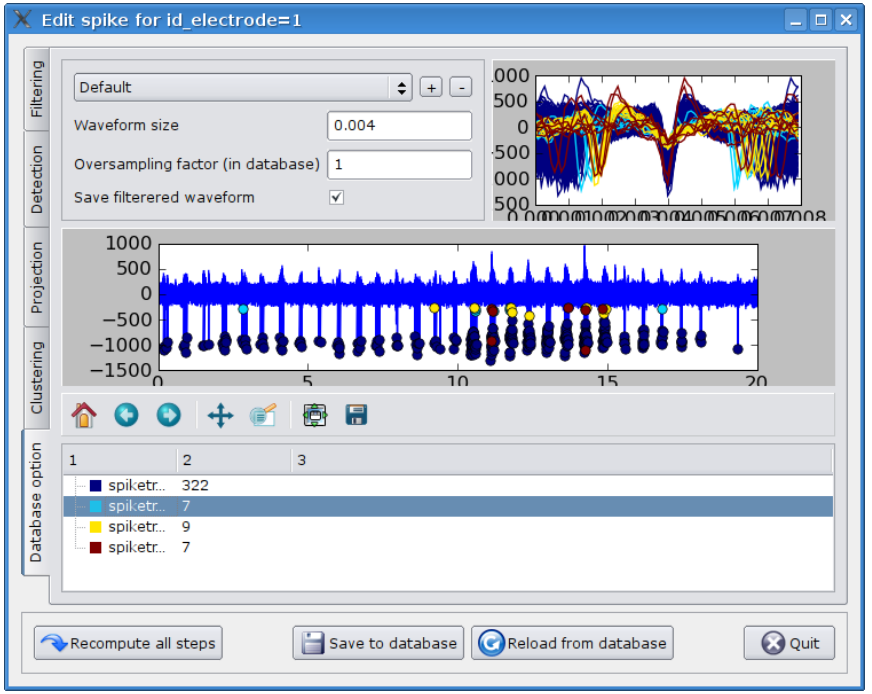
Workflow


File
File
File
File
(A) Extraction of data and meta data
database
MySQL
(B) Signal display
(C) Spike detection
(D) Oscillations detection
(E) Analysis with python script (or other)

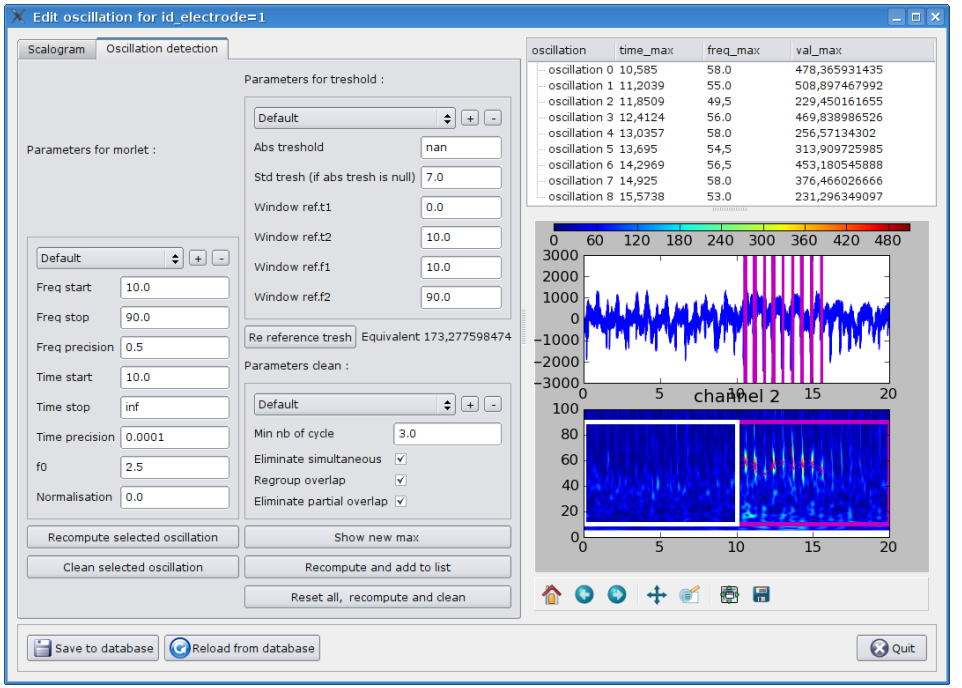
Central piece of work

Open Electrophy

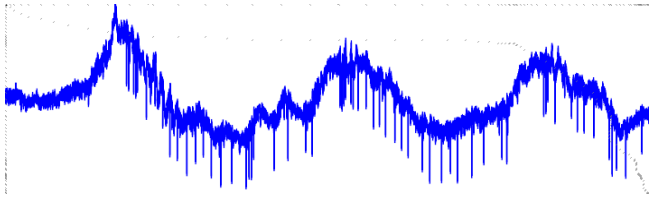
Generic multi methods
spike sorting

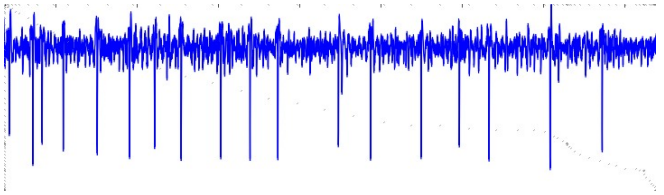


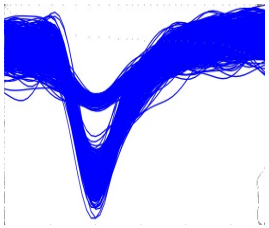
Non stationary Oscillation
detection

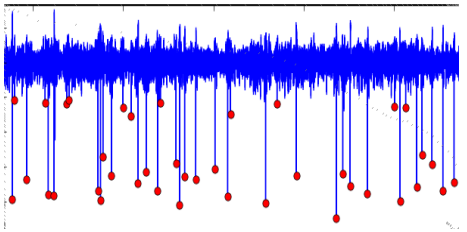


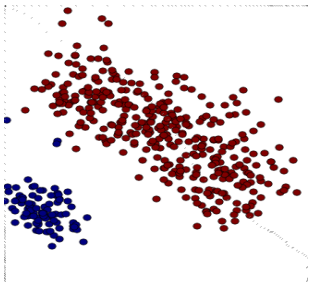
Spike detection and spike sorting : methods compilation

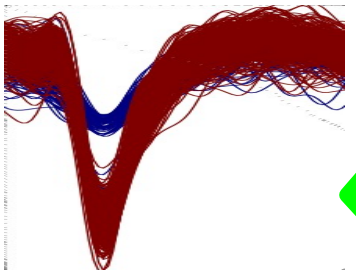












Filtering

FFT
Médian windowed
Butterworth

Détection

Threshold : std, abs

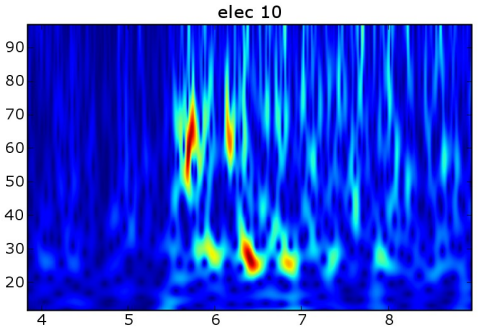
Projection

No
ICA
PCA
(Wavelet ...)

Clustering

K-Mean
Superparamegnetic

LFP Oscillations analysis : new approach



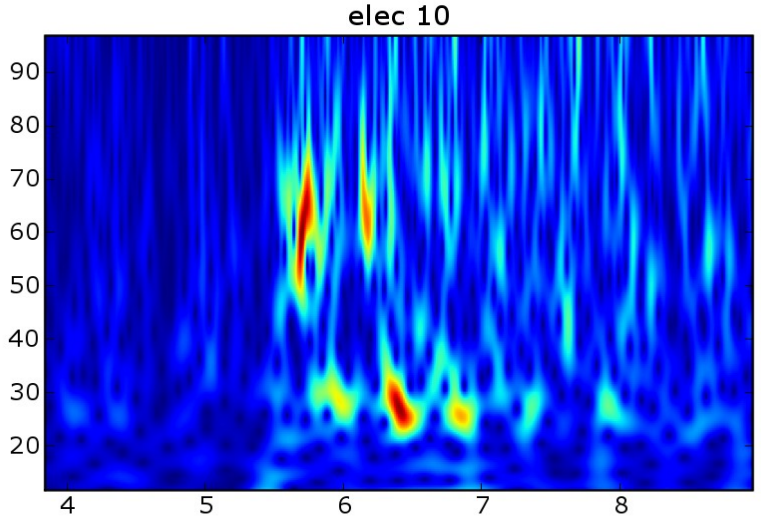
Classical analysis : FTT or
Morlet wavelet time frequencie map (scalogram

New approach :
Use the scalogram for extracting oscillations
Each oscillation is stored in the database

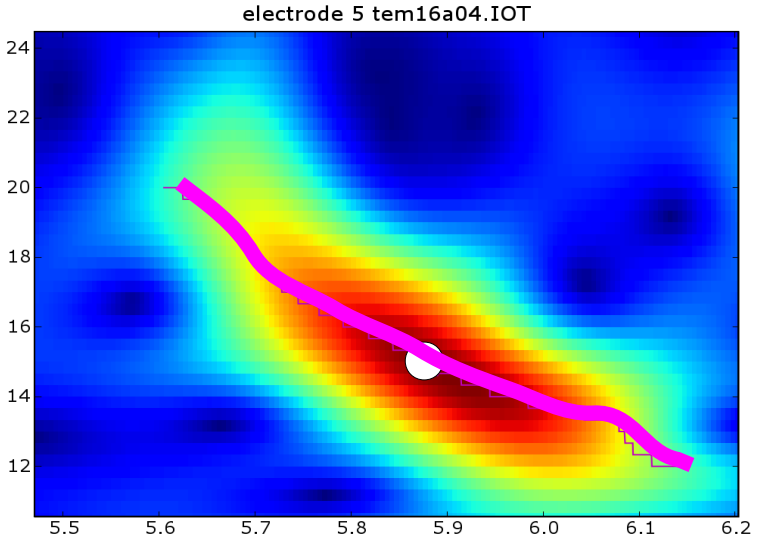
Avantage : Quantitative study (length, energy, phase , frequencie ...)

Article :
A wavelet-based method for local phase extraction from a multi-frequency oscillatory signal
J Neurosci Methods
Stéphane G. Roux , Tristan Cenier, Samuel Garcia, Philippe Litaudon,Nathalie Buonviso

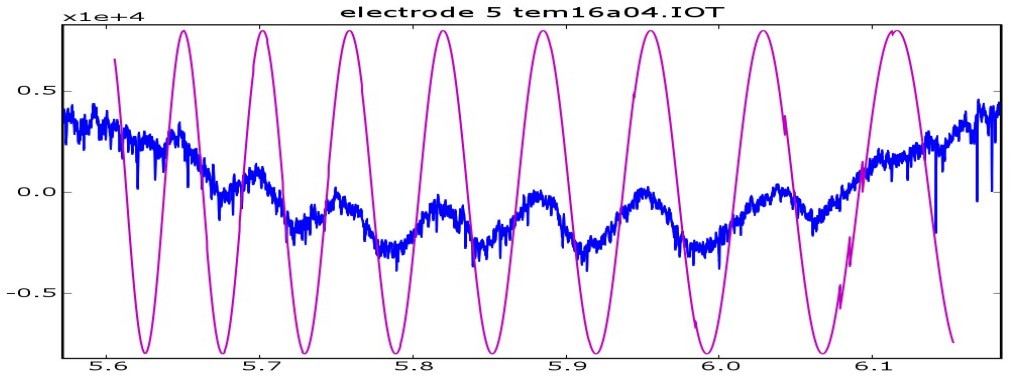
Oscillation detection : principle



Morlet scalogram : local maxima extraction



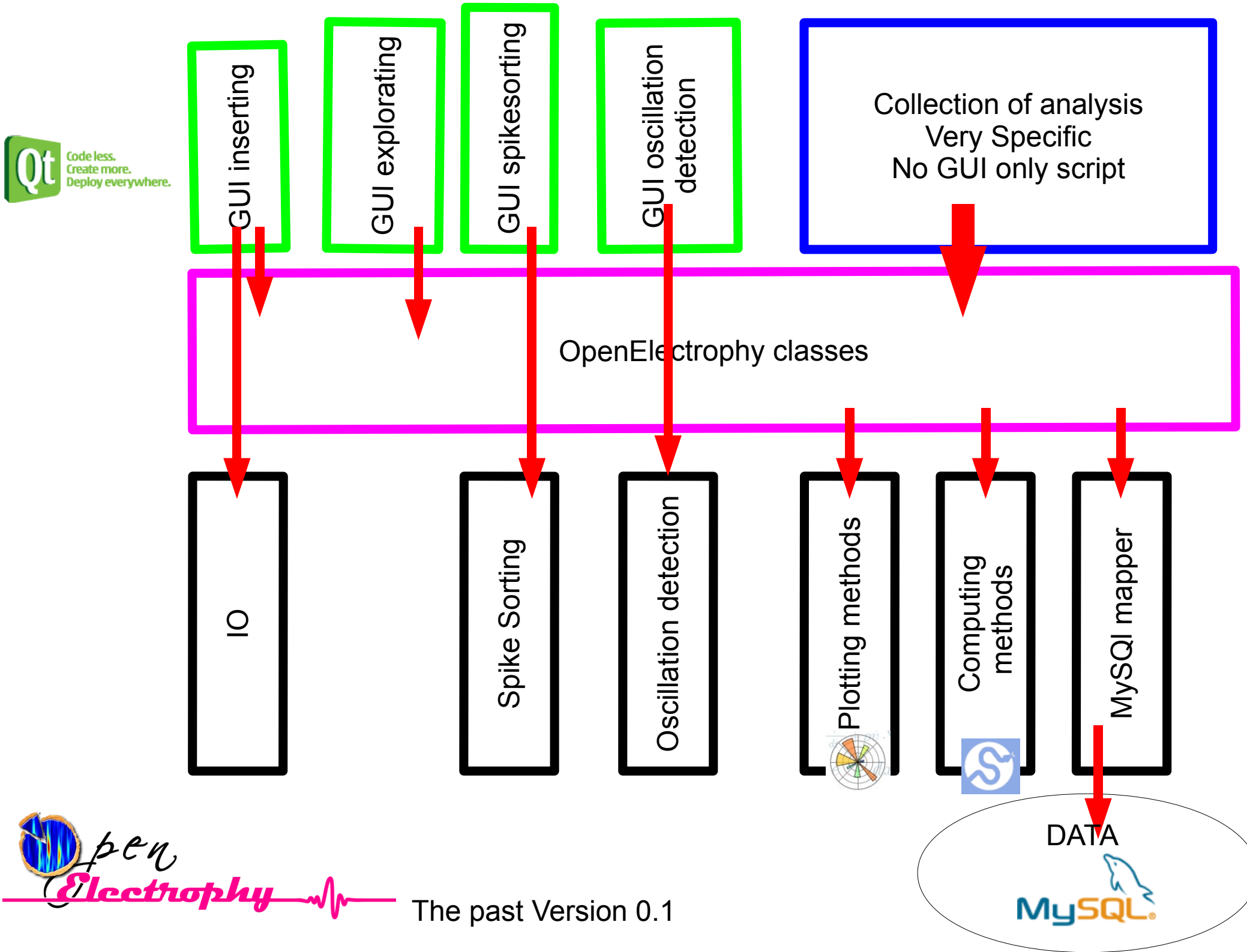
Ridge extraction : time-frequencie line



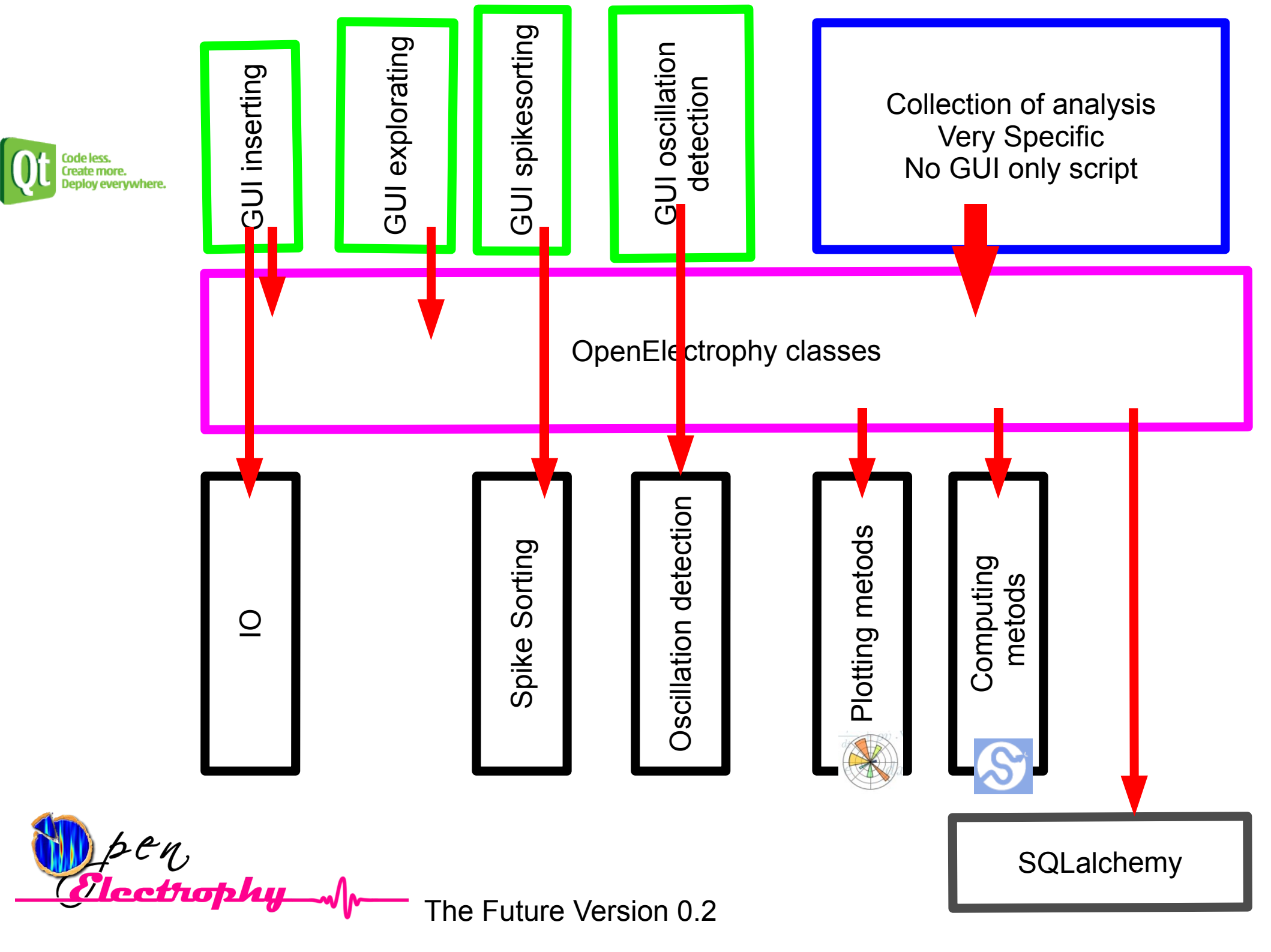
Oscillation in time domain

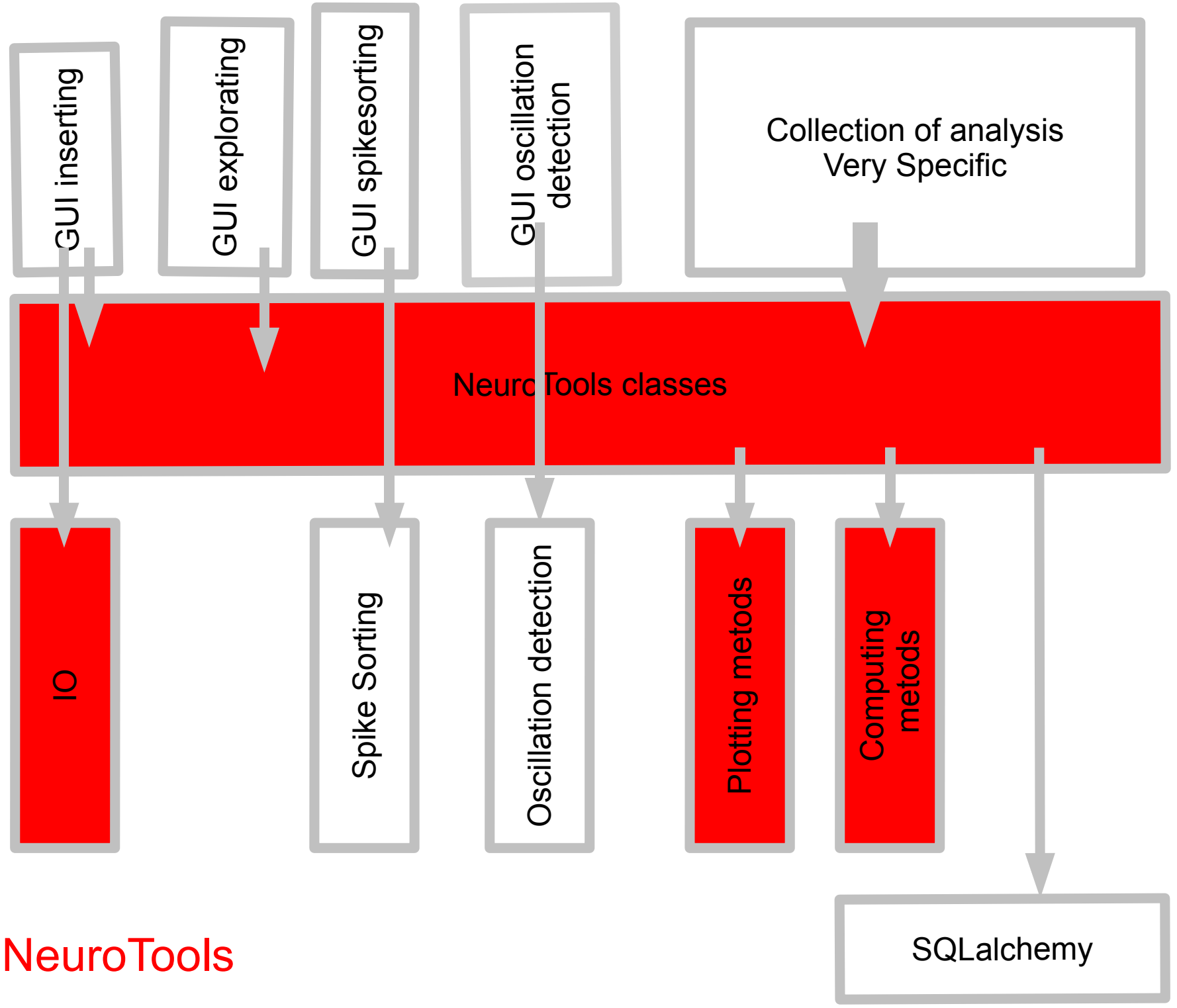
Fusion or modules in common ?

NeuroTools
OpenElectrophy
FIND



The past Version 0.1


Code less.
Create more.
Deploy everywhere.
GUI inserting
GUI exploring
GUI spikesorting
GUI oscillation detection
Collection of analysis
Very Specific
No GUI only script
OpenElectrophy classes
IO
Spike Sorting
Oscillation detection
Plotting metods
Computing metods
SQLalchemy
Open Electrophy
The Future Version 0.2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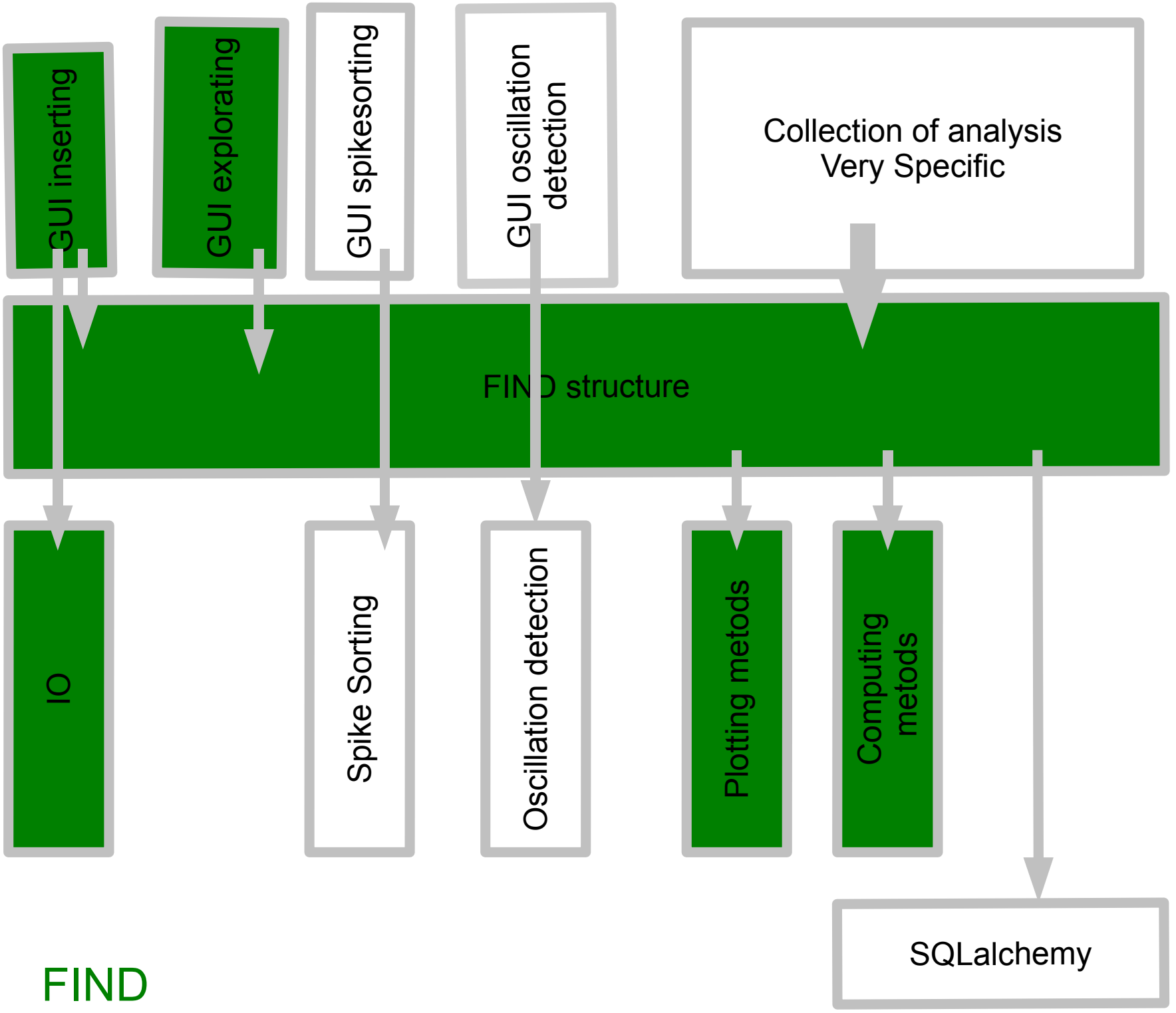
NeuroTools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IO
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FIND

Important work to do for merging or getting closer :

Work 1 : Same technologies

Work 2 : Same classes and variables name/convention

Work 3 : Same layer for datastorage

Work 1 : choosing the technologies

Language : Python

Dependencies : SciPy, MatplotLib, MDP, QT4, ...

Platform : Linux , Win32/64, OSX, WEB, ..

Documentation : Sphinx, wiki ?

Packaging : .egg, .exe , .deb ?

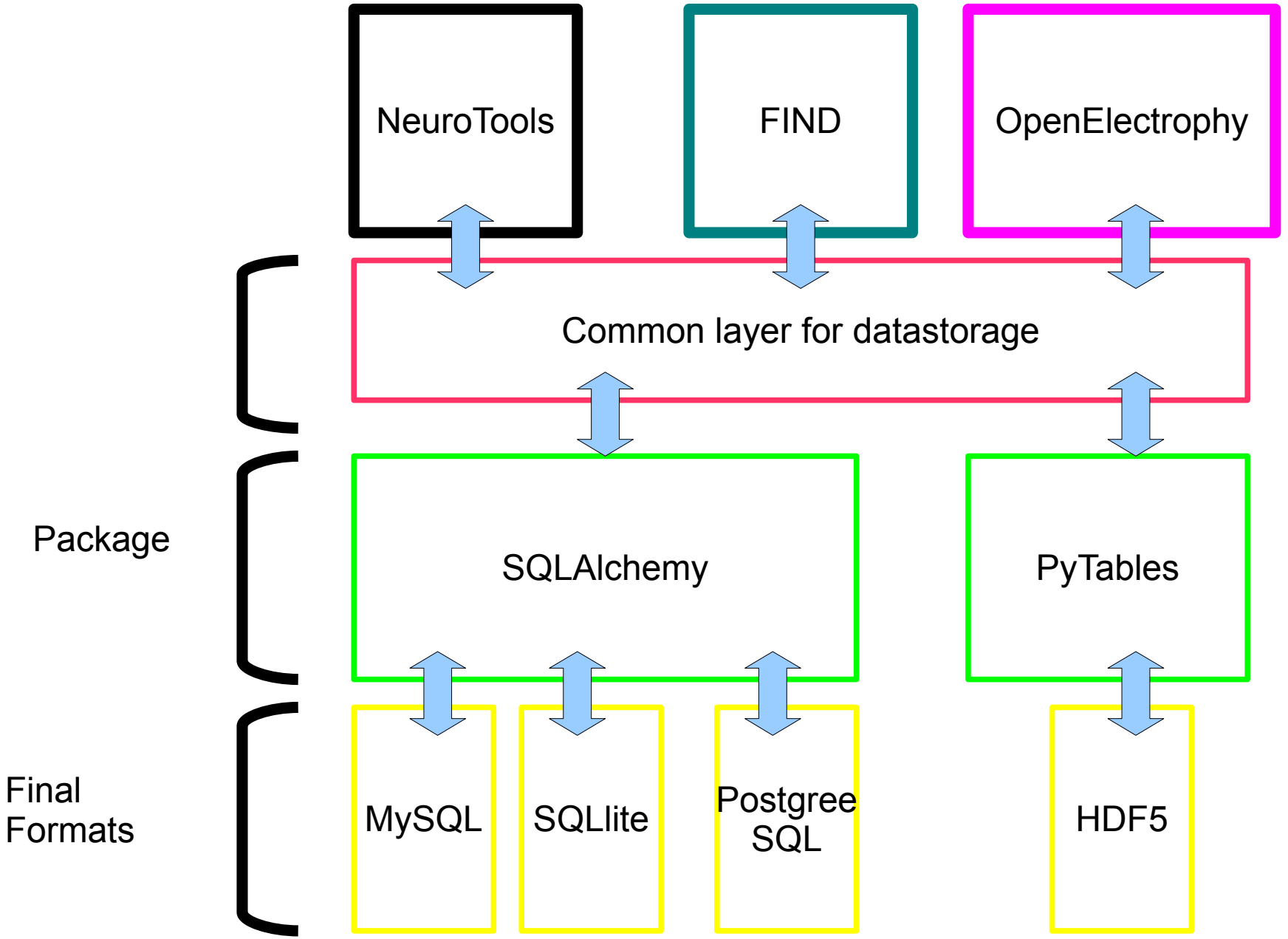
Version system : svn, GIT, Ag

Work 2 : Convention for classes

NeuroTools	FIND	Old OpenElectrophy	Proposal
AnalogSignal	Analog	Electrode	AnalogSignal
AnalogSignalList		Trial ?	
	Event	Epoch	Event
		Epoch	Epoch
	Segment	Trial	Segment
	Neural	Spike	Spike
SpikeTrain		SpikeTrain	SpikeTrain
SpikeList		Cell	Neuron
	Entitiy	Serie	Block

Work 3 : datastorage

Proposal



Work has started yersterday :

https://neuralensemble.org/trac/neo

Thanks to:

Nicolas Fourcaud-Trocmé for helping in code

Eilif Muller for encouragement for writing a paper