



Personal information

Surname(s) / First name(s)

Nationality(-ies)

Date of birth

Gender

Work experience

Date

Occupation or position held

Main activities

Name and address of the employer

Type of business or sector

Date

Occupation or position held

Main activities

Name and address of the employer

Type of business or sector

Date

Occupation or position held

Main activities

Name and address of the employer

Type of business or sector

Vallone, Fabio

2019 – 2020

Post Doc.

Analysis of neural signals and machine learning methods for Neuroprosthetics and Bioelectronic Medicine applications.

BioRobotics Institute and Department of Excellence in Robotics & AI, Scuola Superiore S. Anna, Pisa (Italy).

Neural Engineering, Bioelectronic Medicine and Data Analysis.

2017 – 2018

Post Doc.

Analysis of neural signals to study the neural circuit controlling the timing of stimulus evoked spikes recorded from the primary somatosensory cortex of awake and anesthetized mice during active touch and passive stimulus conditions combined with optogenetic stimulations.

, Genova (Italy).

Theoretical Neuroscience and Data Analysis for Neuroscience.

2016 – 2017

Post Doc.

Analysis of neural signals to study the neural circuit controlling the timing of stimulus evoked spikes recorded from the primary somatosensory cortex of anesthetized animals during passive stimulus conditions combined with optogenetic stimulations. ,

Rovereto (Italy).

Theoretical Neuroscience and Data Analysis for Neuroscience.

Date 2015 – 2016
Occupation or position held Fellow.
Main activities Analysis of Local Field Potentials for the characterization of circuit rearrangements within and between mouse cortical motor areas in normal condition and photothrombotic model of stroke during freely moving behavior. Study of the properties of Local Field Potential signals and computational modeling of integrate and fire point neurons to assess plasticity phenomena in a mouse visual cortex TenT model of epilepsy during freely moving behavior.
Name and address of the employer Institute of Biophysics CNR-National Research Council, Pisa (Italy).
Type of business or sector Nonlinear Time Series Analysis and Modeling for Neuroscience.

Date 2014 – 2015
Occupation or position held Fellow.
Main activities Analysis of Local Field Potentials for the characterization of circuit rearrangements within and between mouse cortical motor areas in normal condition and photothrombotic model of stroke during freely moving behavior.
Name and address of the employer Institute of Neuroscience CNR-National Research Council, Pisa (Italy).
Type of business or sector Nonlinear Time Series Analysis and Modeling for Neuroscience.

Date 2013 – 2014
Occupation or position held Apprentice.
Main activities Study of the memory properties of Local Field Potentials recorded from mouse visual and motor cortex in normal and environmental enrichment condition during freely moving behavior. Computational modeling of interacting thalamic and cortical point neurons using Hodgkin-Huxley formalism to study the generation and termination of seizure like behavior.
Name and address of the employer Institute of Biophysics CNR-National Research Council, Pisa (Italy)
Type of business or sector Nonlinear Time Series Analysis and Modeling for Biological Complex Systems.

Date 2011 – 2012
Occupation or position held PhD
Main activities Theoretical analysis and numerical simulations for light matter interaction models.
Name and address of the employer University of _____, Department of Chemical-Physics, Bilbao (Spain)
Type of business or sector Circuit and Cavity Quantum electrodynamics.

Education and training

Date 2013 – 2016
Title of qualification awarded PhD in Biorobotics.
Main professional subjects / competences held Time series analysis and modeling for preclinical studies of neuroplasticity in normal and pathological brain conditions. Characterization of circuit rearrangements within and between mouse cortical areas in normal, environmental enrichment protocols and pathological brain condition such as stroke and epilepsy.
Name and type of organization providing education and training BioRobotics Institute, Scuola Superiore S.Anna, Pisa (Italy).

Date 2008 – 2010
Title of qualification awarded MSc in Physics.
Main professional subjects / competences held Theoretical physics, path integrals for classical and quantum mechanics.
Name and type of organization providing education and training Faculty of Mathematical, Physical and Natural Sciences, University of Pisa, (Italy).

Date
 Title of qualification awarded
 Main professional subjects /
 competences held
 Name and type of organization
 providing education and training

2005 – 2008
 BSc in Physics
 General physics, mathematical physics.

Faculty of Mathematical, Physical and Natural Sciences, University of Pisa, (Italy).

**Personal skills
 and competences**

Mother tongue(s)
 Other language(s)

*Self-assessment
 European level^(*)*

**English
 Spanish**

Italian

English, Spanish

Understanding		Speaking		Writing
Listening	Reading	Spoken interaction	Spoken production	
independent	independent	independent	independent	independent
independent	independent	basic	basic	basic

^(*) Common European Framework of Reference (CEF) level

**Organisational skills and
 competences**

Organizer of the Workshop *Theoretical, Computational and Experimental Methods in Neuroscience*. Institute of Biophysics-CNR, May 20, 2016 Pisa (Italy).

Secretary of the Eighth International Workshop DICE2016, September 12-16, 2016 /Castiglioncello (Italy).

**Technical skills and
 competences**

Linear and nonlinear time series analysis applied to neural signals such as Local Field Potentials (LFPs), Multi Unit Activity (MUA), Single Unit Activity recorded from different cortical mouse areas (Somatosensory, Primary and Secondary Motor cortices, Visual Cortex) in various experimental condition (passive whisker stimulation or active sensing protocols combined with optogenetic activation of layer specific sub-population of cortical neurons, stroke and epilepsy animal model during freely moving behavior, environmental enrichment protocol). Extraction of LFPs, MUA and Single unit from Extracellular signals recorded throughout multi channels electrodes (linear probes). Artifact removal, Signal to Noise Ratio measures, Current Source Density analysis (inverse methods), Fourier analysis (spectral band power content), Scaling properties (inverse frequency relation of power spectra, detrended fluctuation analysis, fractal dimension), Correlation measures (cross correlation, detrended cross correlation, coherence and mutual information) and Causality relation (Granger analysis and transfer entropy) between bivariate LFPs. Spike sorting techniques using wavelet based clustering algorithm (Wave clus software). Raster plots, estimation of Firing Rates using Kernel Smoothers, Peri-Stimulus Time Histograms and Synchronization measures of spike trains used to estimate the accuracy of the encoding of stimuli times. Descriptive Statistics and Statistical Hypothesis Testing using parametric and non-parametric tests such as Student t-test (paired and unpaired), N-way ANOVA, one way and two way ANOVA repeated measures, Mann Whitney U test, Wilcoxon signed-rank test, Kruskal Wallis, Friedman test. Modeling of cortical and thalamic neuronal population using point neurons at various level of complexity, i.e. integrate and fire/Hodgkin-Huxley. Noise based modeling (Langevin equation) of LFPs from unit activities. Statistical data assimilation of single neuron biophysical properties from simulated soma voltage recordings using path integral formulation. Decoding algorithms based on machine learning techniques for Bioelectronic Medicine applications. Wavelet decomposition and denoising of intraneural and epineural signals. Dimensionality reduction techniques and ensemble learning systems for regression and classification problems.

Programming

MATLAB, Python, R, C++, Fortran.

Version Control System

Git, GitLab, GitHub.

Software

Wave clus, Origin, Sigmaplot, TeXMaker, GIMP.

Operating Systems

Microsoft Windows, Apple OS X, Linux.

Additional information

References

Contact Persons

(), ()

Publications

Journal papers in Neuroscience

M. Cracchiolo, M. M. Ottaviani, A. Panarese, I. Strauss, **F. Vallone**, A. Mazzoni, S. Micera, A roadmap toward the bioelectronic medicine revolution. *Submitted to Journal of Neural Engineering.*)

F. Vallone, M. M. Ottaviani, F. Dedola, ..., A. Mazzoni, F. Recchia, S. Micera, Simultaneous decoding of cardiovascular and respiratory functional changes from pig intraneural vagus nerve signals, *BioRxiv (2020)* (under revision in *Journal of Neural Engineering*).

D. Vecchia, R. Beltramo, **F. Vallone**, et al., Excitatory neurons in layer 5 control the encoding of whisker deflection time in the mouse somatosensory cortex, *Current Biology*, **30**,9,4 May 2020,1589-1599.e10.

C. Alia, C. Spalletti, S. Lai, A. Panarese, G. Lamola, F. Bertolucci, **F. Vallone**, A. Di Garbo, C. Chisari, S. Micera, M. Caleo, Neuroplastic changes following brain ischemia and their contribution to stroke recovery: impact of robotic rehabilitation, *Frontiers in Cellular Neuroscience*, 11: 76 (2017).

F. Vallone, E. Vannini, A. Cintio, M. Caleo and A. Di Garbo, Time evolution of inter-hemispheric coupling in a model of focal neocortical epilepsy in mice, *Physical Review E*, **94**, 032409 (2016).

F. Vallone, S. Lai, C. Spalletti, A. Panarese, C. Alia, S. Micera, M. Caleo, A. Di Garbo, Post-Stroke Longitudinal Alterations of Inter-Hemispheric Correlation and Hemispheric Dominance in Mouse Pre-Motor Cortex, *PLoS ONE* 11(1): e0146858 (2016).

F. Vallone, A. Cintio, M. Mainardi, M. Caleo and A. Di Garbo, Existence of anticorrelations for local field potentials recorded from mice reared in standard conditions and environmental enrichment, *Physical Review E*, **91**, 012702 (2015).

F. Vallone, A. Cintio, S. Chillemi, and A. Di Garbo, Thalamic inputs modulate cortical activity: Possibility to control the generation and the termination of seizure-like behaviour, *Neurocomputing*, 151, 2015, 34-48.

Book chapters/Proceedings papers in Neuroscience

F. Vallone, M. Caleo and A. Di Garbo, Characterization of neural signals in preclinical studies of neural plasticity using nonlinear time series analysis, *In: Corinto F., Torcini A. (eds) Nonlinear Dynamics in Computational Neuroscience, PoliTO Springer Series. Springer, Cham. 2019, 33-52*

F. Vallone, S.Chillemi, M. Barbi, and A. Di Garbo, Thalamo-cortical network and seizure dynamics: a computational study, *Lecture Notes in Computer Science*, 7930, 2013,48-61.

Journal papers in Quantum Physics

F. A. Wolf, **F. Vallone**, G. Romero, M. Kollar, E. Solano, D. Braak, Dynamical correlation functions and the quantum Rabi model, *Phys. Rev. A* **87**, 023835 (2013)(*Preprint arXiv:1211.6469*).

H.-T.Elze, G.Gambarotta and **F. Vallone**, A path integral for classical dynamics, entanglement, and Jaynes-Cummings model at the quantum-classical divide, *Int. J. Qu. Inf. (IJQI)* **9** Suppl. **1**, 203 (2011) (*Preprint arXiv:1006.1569*).

Book chapters/Proceedings papers in Quantum Physics

H.-T.Elze, G.Gambarotta and **F. Vallone**, General linear dynamics- quantum, classical or hybrid, *J. Phys.: Conf. Ser.* **306**, 012010 (2011) (*Preprint arXiv:1103.3589*).

Editorial Activities

Peer Review Activities

Outstanding Reviewer for .

Reviewer for

Reviewer for

Reviewer for

Periods abroad

Visiting student at the The European Institute for Theoretical Neuroscience (EITN), March 3 - May 6, 2016, Paris, (France)

Specific field of research: Scaling properties of local field potentials.

Supervisor: Dr. A. Destexhe.

Visiting student at the Biocircuits Institute, University of California San Diego, October 19 - November 19, 2015, La Jolla, California (USA).

Specific field of research: Nonlinear statistical data assimilation.

Supervisor: Prof. Henry D.I. Abarbanel.

Talks, conferences and workshops

D. Vecchia, R. Beltramo, A. Forli, N. Binini, M. Molano, **F. Vallone**, C. Moretti, S. Panz-eri, T. Fellin, *Excitatory neurons in layer 5 control the encoding of whisker deflection time in the mouse somatosensory cortex*, Poster at FENS, July 7-11 2018, Berlin (Germany)

Attendance at the Workshop *Experimental and Theoretical Analysis of Cortical Dynamics*. Italian Institute of Technology, September 22, 2017 Rovereto (Italy).

F. Vallone, B.Teleńczuk, A.Destexhe, *Scaling of Local Field Potentials from multi site unit spike activities*. Talk at The European Institute for Theoretical Neuroscience (EITN), May 2, 2016, Paris, (France).

F. Vallone, S.Chillemi, A. Di Garbo, *Thalamic inputs modulate cortical activity: Possibility to control the generation and the termination of seizure-like behaviour*. Poster at School of Brain Cells and Circuits "Camillo Golgi", November 30 - December 2, 2015, Erice (Italy).

F. Vallone, *Nonlinear time series analysis of local field potentials and biophysical modelling of neural networks*. Talk at conference Bioinformatiha, October 2, 2015, Siena (Italy).

F. Vallone, *Nonlinear time series analysis of local field potentials*. Talk at conference Biophys'15 from physics to biology and beyond, September 9-11, 2015, Florence (Italy).

Attendance at the MURI Winter School 2015: *Dynamics of Multifunction Brain Networks*. University of California San Diego, January 7-9, 2015, La Jolla, California (USA).

F. Vallone, *Existence of anticorrelations for local field potentials recorded from mice reared in standard conditions and environmental enrichment*. Talk at FQXi Workshop on Quantum Sequential Measurements and Complexity, September 22-25, 2014, Siegen (Germany).

F. Vallone, *Nonlinear time series analysis and modelling in biological physics* (2013). Talk at Institute of Neuroscience, National Research Council (CNR), Pisa (Italy).

F. Vallone, *Biophysical modelling of epigenetic landscapes for developmental processes* (2013). Talk at Institute of Biophysics, National Research Council (CNR), Pisa (Italy).

F. Vallone, *A path integral for classical dynamics* (2010). Invited talk at CNR-IMM MATIS University of Catania, Catania (Italy).

F. Vallone, *A path integral for classical dynamics* (2010). Invited talk at Max Planck Institute for Nuclear Physics, Heidelberg (Germany).

H.-T.Elze, G.Gambarotta and **F. Vallone**, *General linear dynamics- quantum, classical or hybrid*. Invited talk at conference DICE 2010, Castiglioncello (Italy).