TU Graz

Endorsed by BCI SOCIETY

7th Graz Brain-Computer Interface Conference

GRAZ BCI

FROM VISION TO REALITY

18-22 SEPTEMBER 2017
GRAZ, AUSTRIA

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Institute of Neural Engineering ■ Graz University of Technology

Program Book

bci.tugraz.at @GrazBCI

Participants of the 6th Graz BCI Conference 2014

From Vision to Reality

We have chosen our this year's conference title to summarize the current situation of BCI research in a very brief statement. On the one hand, we see that some of our ideas are still visions, far from any applications. Basic research is the state of those visions and we still need to lay the foundation to transform those visions into working systems. On the other hand, we see that first BCI systems come to patients in clinics and that they are used on regular basis. However, it is important to discuss the needs in the BCI field to bring more of our ideas, our visions into reality. Is it research funding? Do we have too few people in the field? Is it too interdisciplinary? Do we need big industry partners? All these questions are vivid and need to be addressed to achieve progress in the field of BCI research. This 7th Graz Brain-Computer Interface Conference (GBCIC2017) offers the opportunity for extensive discussions and exchange of ideas among BCI experts from more than 30 countries. We received more than 100 scientific contributions from roughly 300 authors. The scientific contributions have been peer-reviewed by at least two reviewers and collected in this present open access ebook.

For the Conference itself, we have been able to setup a colorful and multifaceted program. We are very happy that the GBCIC2017 has been officially endorsed by the BCI Society and that we will have an official Meeting of the BCI Society at the Conference. Further, we are lucky that outstanding experts in the field, Dr. A Bolu Ajiboye (Case Western Reserve University, & Louis Stokes Cleveland VA Medical Center, Cleveland, OH, USA), Prof. Benjamin Blankertz (Technische Universität Berlin, Germany), Dr. Fabien Lotte (Inria Bordeaux Sud-Ouest, France), and Dr. Natalie Mrachacz-Kersting (Aalborg University, Denmark), accepted our invitation to present keynote addresses at the Conference. As a special keynote, we present Prof. Fred D. Davis (Texas Tech University, Rawls College of Business, USA). He is a senior researcher in the field of user acceptance of information technology, technology supported decision making, skill acquisition, and NeuroIS. With his talk he will make a link between the BCI field and his research disciplines.
Additionally, we have several Satellite Events prior and after the Conference. New in the program: the BCI Science Slam, an event where researchers can present their work in an entertaining way. Finally, we end the GBCIC2017 with a tour to the South Styrian Vineyards, like we did in the past years.

We hope that this conference contributes towards a strong scientific cooperation among our field, and we wish all participants an exciting, stimulating and productive Graz BCI Conference 2017!

Gernot R. Müller-Putz
Conference Chair

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Interventionspsychologie am
Lehrstuhl für Psychologie I
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Germany
(BCI Society Board)

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MSc
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INE - TU Graz, Austria

Dipl.-Ing.
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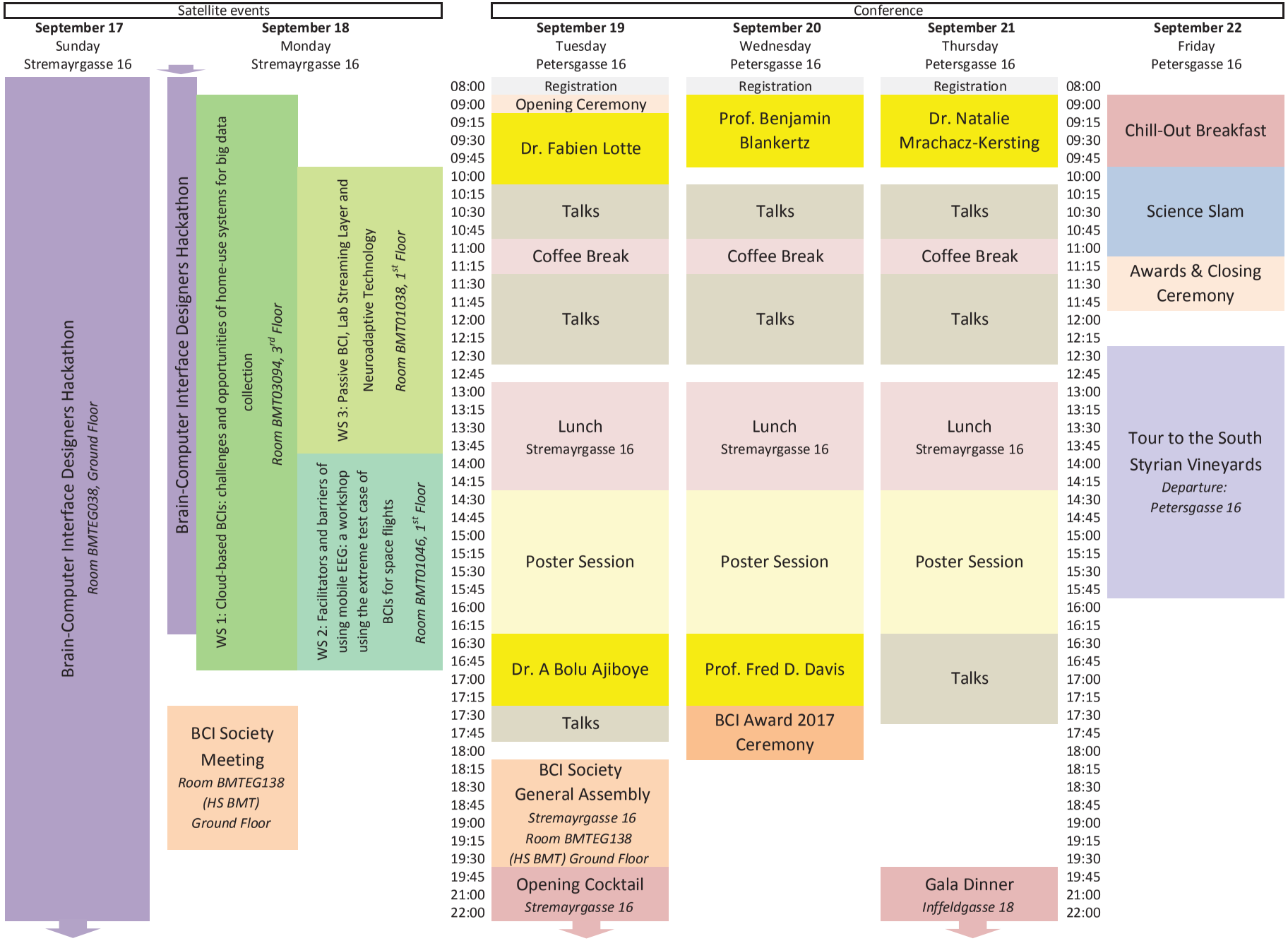
Satellite events
Conference
September 17
Sunday
Stremayrgasse 16
September 18
Monday
Stremayrgasse 16
September 19
Tuesday
Petersgasse 16
September 20
Wednesday
Petersgasse 16
September 21
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Friday
Petersgasse 16
Brain-Computer Interface Designers Hackathon
Room BMTEG038, Ground Floor
Brain-Computer Interface Designers Hackathon
WS 1: Cloud-based BCIs: challenges and opportunities of home-use systems for big data collection
Room BMT03094, 3rd Floor
WS 3: Passive BCI, Lab Streaming Layer and Neuroadaptive Technology
Room BMT01038, 1st Floor
WS 2: Facilitators and barriers of using mobile EEG: a workshop using the extreme test case of BCIs for space flights
Room BMT01046, 1st Floor
BCI Society Meeting
Room BMTEG138 (HS BMT) Ground Floor
08:00 Registration
09:00 Opening Ceremony
09:15 Dr. Fabien Lotte
09:30
09:45
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10:15 Talks
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11:00 Coffee Break
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11:30 Talks
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13:00 Lunch
13:15 Stremayrgasse 16
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14:30 Poster Session
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16:30 Dr. A Bolu Ajiboye
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17:30 Talks
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18:00
18:15 BCI Society General Assembly
18:30 Stremayrgasse 16
18:45 Room BMTEG138
19:00 (HS BMT) Ground Floor
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19:45 Opening Cocktail
21:00 Stremayrgasse 16
22:00
08:00 Registration
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17:30 BCI Award 2017 Ceremony
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08:00 Registration
09:00 Dr. Natalie Mrachacz-Kersting
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19:45 Gala Dinner
21:00 Inffeldgasse 18
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09:00 Chill-Out Breakfast
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10:00 Science Slam
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11:15 Awards & Closing Ceremony
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13:00 Tour to the South Styrian Vineyards
13:15 Departure: Petersgasse 16
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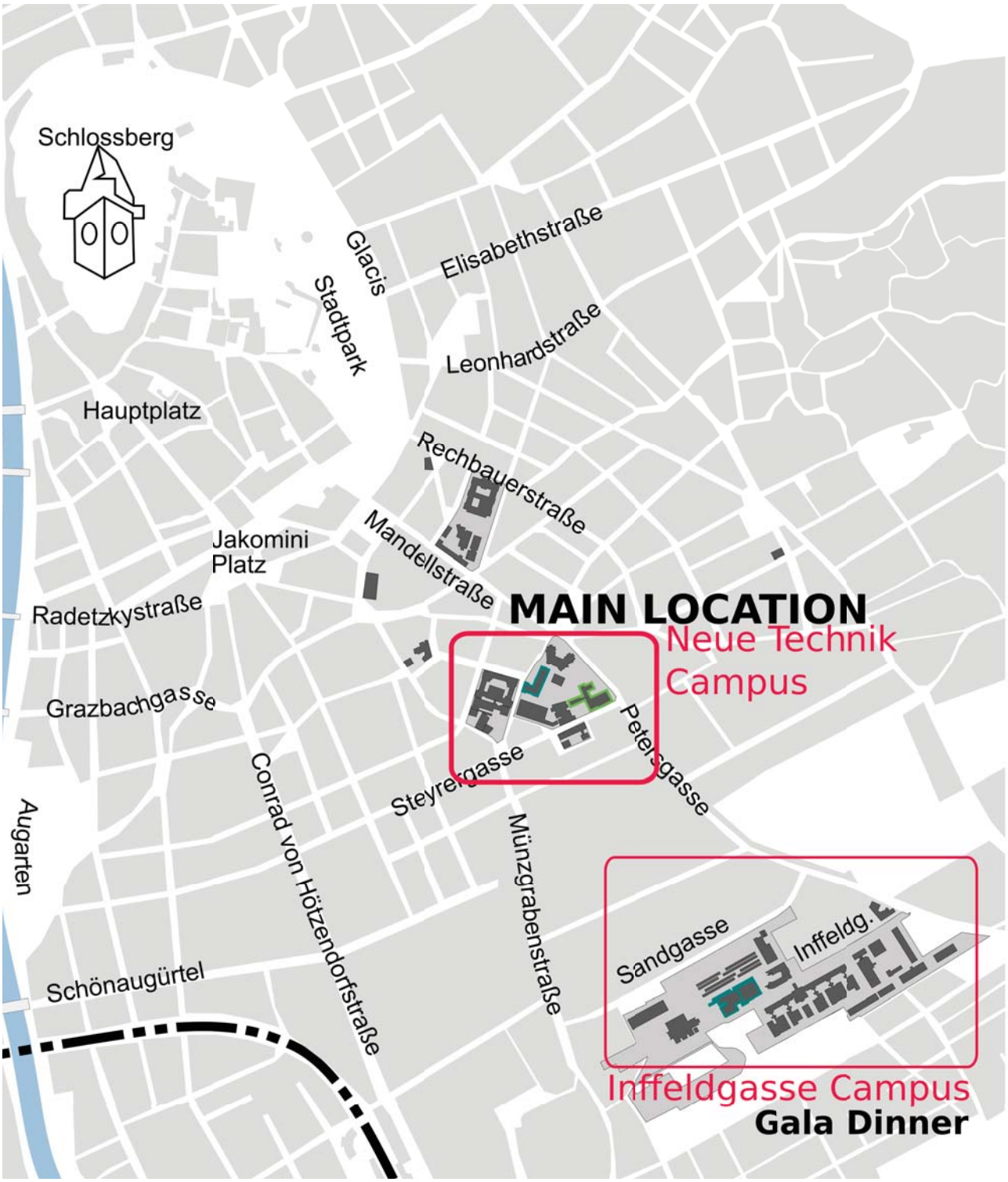
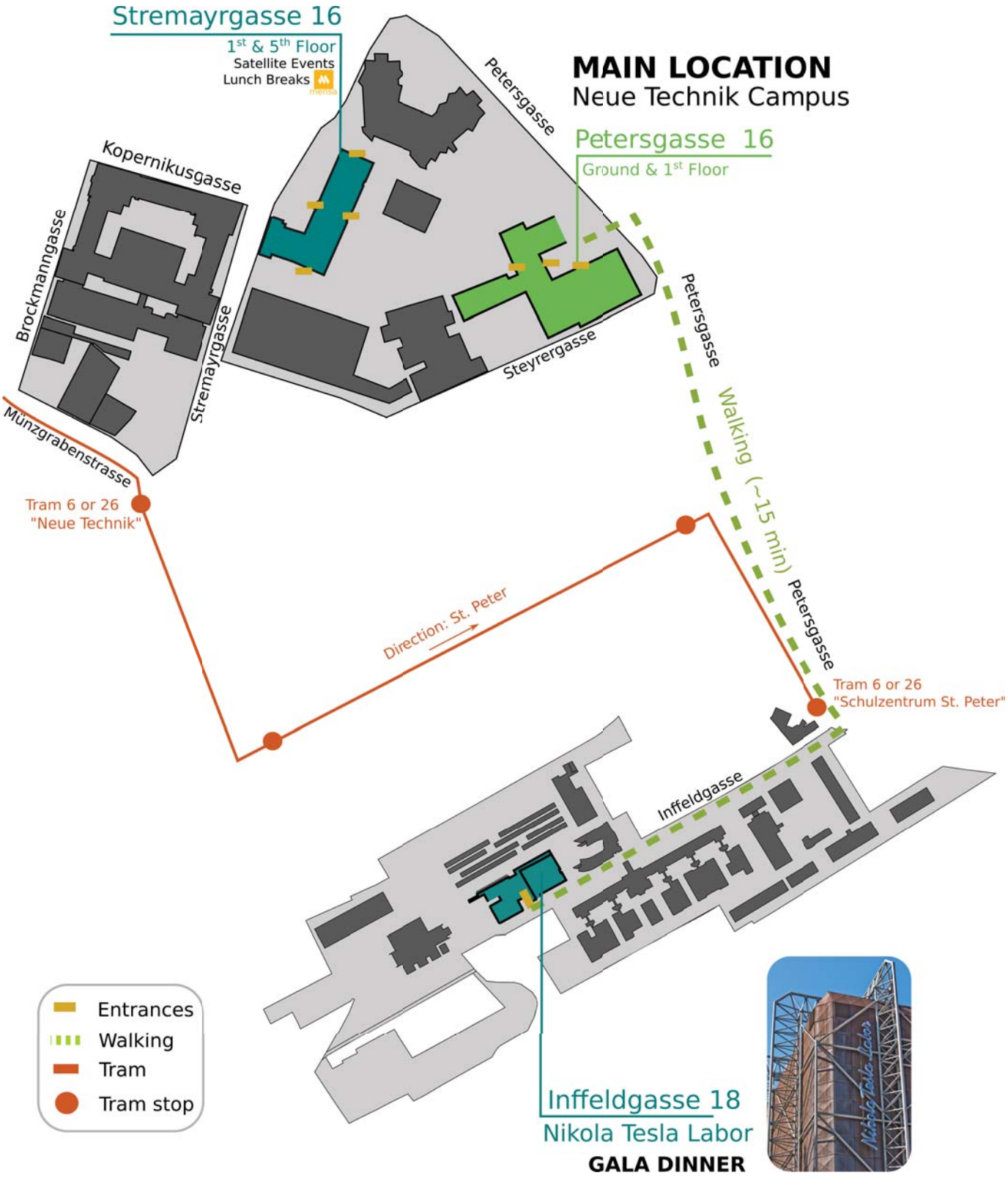
Conference Venue



Conference Venue



Satellite Events

Brain-Computer Interface Designers Hackathon
Sunday, September 17, 8:00 - Monday, September 18, 16:30
Stremayrgasse 16, BMTEG038, ground floor

Inspired by the unique “Agent Unicorn” headpiece from Fashion-Technology- Artist Anouk Wipprecht (NL), this hackathon challenges young geeks to build and design a unique, playful and wearable headpiece which is able to measure useful EEG signals in real-time to create any sort of interaction.
With the intended purpose in mind, the teams plan and produce their own fully functional headpiece. 3D printers are on-site, so the teams will be able to give their headpieces an individual design that fits on participants’ head. The goal of this hackathon is to bring people of different professions together, such as engineers, programmers, physicians, or graphic designers. As an interdisciplinary team, they learn from each other and merge well established hardware and software in order to create a new, innovative and exceptional idea. The participation only requires basic knowledge in Brain-Computer Interfaces, machine learning, programming, signal processing or designing.

BCI Society Meeting
Monday, September 18, 17:30
Stremayrgasse 16, room BMTEG138 (HS BMT), ground floor

BCI Society General Assembly
Tuesday, September 19, 18:15
Stremayrgasse 16, room BMTEG138 (HS BMT), ground floor

Opening Cocktail
Tuesday, September 19, 19:45
Stremayrgasse 16, 5th floor

Gala Dinner
Thursday, September 21, 19:45
Inffeldgasse 18

Chill-Out Breakfast and BCI Science Slam
Friday, September 22, 09:00
Petersgasse 16

Tour to the South Styrian Vineyards
Friday, September 22, 12:30
Departure: Petersgasse 16

Workshops

Cloud-based BCIs: challenges and opportunities of home-use systems for big data collection
Monday, September 18, 9:00 - 17:00
Stremayrgasse 16, room BMT03094, 3rd floor

Bringing brain-computer interfaces from the lab environment into the homes of patients and consumers requires three components: 1) Cloud-based realtime signal processing and machine learning that generalises across large datasets, 2) Low-cost, wireless EEG hardware with sufficient signal quality for scientific and clinical purposes, 3) User-friendly, cross-platform software applications to make the system directly accessible to endusers. Tackling this challenge may be the key to enabling robust communication and control for patients, and breaking the limitations of current research in terms of sample size and longitudinal data. With this workshop we aim to bring experts from both inside and outside the BCI community together to inspire future work that will allow us to overcome existing boundaries, both in research and in clinical practice.

Passive BCI, Lab Streaming Layer and Neuroadaptive Technology
Monday, September 18, 10:00 - 14:00
Stremayrgasse 16, room BMT01038, 1st floor

This workshop is aimed at participants interested in applications of BCI technology in Human-Computer Interaction for users without disabilities. It is intended to represent the Society for Neuroadaptive Technology (SNAT) and to support the communication between this society and BCI researchers. Dr. Thorsten O. Zander will present and discuss the aims of passive BCI research, Neuroadaptive Technology and modern Human-Computer Interaction. This part represents a forum to identify synergies and develop new ideas. Dr. David Medine and Ratko Petrovic, will present technological developments for passive and hybrid BCIs. Dr. Medine will present the LabStreamingLayer (LSL), an open-source software project for synchronized, multi-modal data streaming and recording. Mr. Petrovic will present recent hardware developments compatible with LSL. The third part is a hands-on demonstration with Neuroadaptive Technologies. In several groups, participants use an application combining passive BCI, gaze control and dry electrodes.

Facilitators and barriers of using mobile EEG: a workshop using the extreme test case of BCIs for space flights
Monday, September 18, 14:00 - 17:00
Stremayrgasse 16, room BMT01046, 1st floor

Since the advent of EEG in which the subject is mobile, facilitated by enabling technology available since 2013, an increasing number of application areas are opening up for investigation into cognitive, motor control and other neurological and behavioral processes outside of the lab in a realistic environment. While faced with new challenges compared to classical experiments in the lab, this has spread the use of EEG as a measuring method into Sports and Movement Science, Entertainment, Neuromarketing and even more fundamental Cognitive Neuroscience. During our workshop, expert speakers in their respective fields will touch upon the possibilities this new technology has enabled and also explain how one can perform ecologically valid experiments in less controlled environments. By the means of a group discussion we will try to identify which barriers still exist and what methods are being developed to aid in understanding the brain outside the confines of the lab.

Program

Tuesday, September 19

	Paper no.	
09:00		**Opening Ceremony**
09:15		**Keynote: Understanding and Improving BCI User Training to Boost Brain-Computer Communications** Dr. Fabien Lotte
10:15	7	**Adaptive Spatial Filtering: Increasing the Effectiveness of Motor Imagery Based BCI** Bartosz Binias
10:30	77	**No Training, Same Performance!? – a Generic P300 Classifier Approach** Andreas Pinegger and Gernot R. Müller-Putz
10:45	78	**Approaches to Zero-Shot Stimulus Decoding in ECoG and Potential BCI Applications** Christopher Ratto, Carlos Caceres, Matthew Roos, Kyle Rupp, Griffin Milsap, Nathan Crone and Michael Wolmetz
11:00		*Coffee Break*
11:30	75	**The PROMOTŒR: a Successful Story of Translational Research in BCI for Motor Rehabilitation** Floriana Pichiorri, Emma Colamarino, Febo Cincotti and Donatella Mattia
11:45	89	**EEG-Based Graph Theory Indices to Support the Clinical Diagnosis of Disorders of Consciousness** Jlenia Toppi, Laura Astolfi, Monica Risetti, Rita Formisano and Donatella Mattia
12:00	52	**Error-Related Potentials with Masked and Unmasked Onset During Continuous Control and Feedback** Catarina Lopes Dias, Andreea Ioana Sburlea and Gernot Müller-Putz
12:15	92	**Headgear for Mobile Neurotechnology: Looking into Alternatives for EEG and NIRS Probes** Alexander von Lühmann, Surjo Soekadar, Benjamin Blankertz and Klaus-Robert Müller
12:30	69	**Vibro-Tactile Evoked Potentials for BCI Communication of People with Disorders of Consciousness and Locked-In Syndrome** Rupert Ortner, Rossella Spataro, Josef Scharinger, Brendan Zachary Allison, Alexander Heilinger and Christoph Guger
12:45		*Lunch Break*
14:30		*Poster Session*
16:30		**Keynote: Re-thinking Paralysis: Brain Computer Interfaces and Functional Electrical Stimulation for Movement Restoration in Persons with Chronic Tetraplegia** Dr. A. Bolu Ajiboye
17:30	30	**Investigating Music Imagery as a Cognitive Paradigm for Low-Cost Brain-Computer Interfaces** Lukas Großberger, Matthias R. Hohmann, Jan Peters and Moritz Grosse-Wentrup
17:45	62	**MoreGrasp: Restoration of Upper Limb Function in Individuals with High Spinal Cord Injury by Multimodal Neuroprostheses for Interaction in Daily Activities** Gernot Müller-Putz, Patrick Ofner, Andreas Schwarz, Joana Pereira, Granit Luzhnica, Cecilia di Sciascio, Eduardo Veas, Sebastian Stein, John Williamson, Roderick Murray-Smith, Carlos Escolano, Luis Montesano, Björn Hessing, Matthias Schneiders and Rüdiger Rupp
		Evening Break
19:45		**Opening Cocktail** Stremayrgasse 16, 5th floor

Program

Wednesday, September 20

	Paper no.	
09:00		**Keynote: Applications of BCI Technology Beyond Communication and Control** Dr. Benjamim Blankertz
10:15	49	**The P300 BCI: on Its Way to End-Users?** Andrea Kübler, Klaus-Robert Müller and Cuntai Guan
10:30	40	**Towards a Cognitive Model of MI-BCI User Training** Camille Jeunet, Bernard N'Kaoua and Fabien Lotte
10:45	44	**A Comparison of Ocular Artifact Removal Methods for Block Design Based Electroencephalography Experiments** Reinmar J. Kobler, Andreea I. Sburlea and Gernot R. Müller-Putz
11:00		*Coffee Break*
11:30	46	**Passive BCI-Based Neuroadaptive Systems** Laurens R. Krol and Thorsten O. Zander
11:45	84	**Spatial Filtering of EEG as a Regression Problem** Martin Spüler
12:00	91	**Evaluation of BCI Researchers' Opinions Regarding the Future of BCIs: Results of BCI Roadmap Questionnaire 2014** Mariska J. Vansteensel, Erik Aarnoutse, Gert Kristo and Nick Ramsey
12:15	16	**Dimensionality Reduction for BCI Classification Using Riemannian Geometry** Pedro Luiz Coelho Rodrigues, Florent Bouchard, Marco Congedo and Christian Jutten
12:30	58	**Multi-Timescale Spectra as Features for Continuous Workload Estimation in Realistic Settings** Daniel Miklody, Patrick Moessmer, Thorsten Dettmann, Kerstin Klinkenberg and Benjamin Blankertz
12:45		*Lunch Break*
14:30		*Poster Session*
16:30		**Keynote: NeuroIS: Information Systems Research Meets Cognitive Neuroscience** Dr. Fred. D. Davis
17:30		**BCI Award 2017 Ceremony**

Program

Thursday, September 21

	Paper no.	
09:00		**Keynote: Development of an Associative BCI for the Restoration of Lost Motor Function** Dr. Natalie Mrachacz-Kersting
10:15	87	**Using Recurrent Neural Networks for P300-Based Brain-Computer Interface** Ori Tal and Friedman Doron
10:30	39	**Decoding of Walking Intention Under Lower Limb Exoskeleton Environment Using MRCP feature** Ji-Hoon Jeong, No-Sang Kwak, Min-Ho Lee and Seong-Whan Lee
10:45	5	**Steady State Visual Evoked Potentials at the Boundaries of Visual Perception** Gustavo Berumen and Tsvetomira Tsoneva
11:00		*Coffee Break*
11:30	14	**Brain Computer Interface Based Communication in the Completely Locked-In State** Ujwal Chaudhary, Aygul Rana, Azim Malekshahi, Stefano Silvoni and Niels Birbaumer
11:45	4	**Electroencephalography (EEG)-Derived Markers to Measure Components of Attention Processing** Alessandra Anzolin, Laura Astolfi, Jlenia Toppi, Angela Riccio, Floriana Pichiorri, Febo Cincotti and Donatella Mattia
12:00	90	**Utrecht Neuroprosthesis: from Brain Signal to Independent Control** Max van den Boom, Meron Vermaas, Erik Aarnoutse, Sacha Leinders, Elmar Pels, Zac Freudenburg, Mariana Branco, Mariska Vansteensel and Nick Ramsey
12:15	32	**Tactile Brain-Computer Interface Control of a Mobile Platform in a Real World Environment Using a Low-Cost Electroencephalography Headset** Sebastian Halder, Johanna Räderscheidt, Robin Heß, Daniel Eck, Klaus Schilling and Andrea Kübler
12:30	34	**A Pleasant Auditory Brain Computer Interface Using Natural Environment Sounds** Minqiang Huang, Daly Ian, Xingyu Wang and Jing Jin
12:45		*Lunch Break*
14:30		*Poster Session*
16:30	65	**Yes or No? – Binary Brain-Based Communication Utilizing Motor Imagery and FNIRS** Laurien Nagels-Coune, Denizhan Kurban, Niels Reuter, Amaia Benitez, Louisa Gossé, Lars Riecke, Rainer Goebel and Bettina Sorger
16:45	28	**Optimal Transport Applied to Transfer Learning for P300 Detection** Nathalie T. H. Gayraud, Alain Rakotomamonjy and Maureen Clerc
17:00	37	**Mixing Two Unsupervised Estimators for Event-Related Potential Decoding: an Online Evaluation** David Huebner, Thibault Verhoeven, Pieter-Jan Kindermans and Michael Tangermann
17:15	45	**Decoding Hazardous Events in Driving Videos** Henrich Kolkhorst, Wolfram Burgard and Michael Tangermann
17:30	6	**Brain-Computer Interfacing with Emotion-Inducing Imagery: a Pilot Study** Alain Desire Bigirimana, Nazmul H Siddique and Damien Coyle
		Evening Break
19:45		**Gala Dinner** Inffeldgasse 18

Program

Friday, September 22

09:00	**Chill-Out Breakfast**
10:00	**Science Slam**
11:15	**Awards and Closing Ceremony**
12:30	**Departure for the South Styrian Vineyards**

Posters

Tuesday, September 19

Paper no.

2 **Detection of Attention Alteration of BCI Users Based on EEG Analysis**
Susan Aliakbaryhosseinabadi, Ernest Nlandu Kamavuako, Ning Jiang, Dario Farina and Natalie Mrachacz-Kersting

8 **Controlling False Positives on a BCI Implant for Communication**
Mariana Branco, Zachary Freudenburg, Elmar Pels, Sacha Leinders, Max van den Boom, Timothy Denison, Mariska Vansteensel, Erik Aarnoutse and Nick Ramsey

10 **SigViewer - Current Status and Recent Developments**
Clemens Brunner, Yida Lin, Paul Sajda and Josef Faller

11 **Increasing Stroke Patients Motor Imagery Classification by Selecting Features with Particle Swarm Optimisation**
Jessica Cantillo-Negrete, Ruben I. Carino-Escobar, Paul Carrillo-Mora and Josefina Gutierrez-Martinez

12 **Closed-Loop Deep Brain Stimulation System for an Animal Model of Parkinson's Disease: A Pilot Study**
Sebastian Castaño-Candamil, Soheil Mottaghi, Volker A. Coenen, Ulrich G. Hofmann and Michael Tangermann

13 **Subspace Decomposition in the Frequency Domain**
Sebastian Castaño-Candamil and Michael Tangermann

20 **Time to Relax: No Effects to the Stress Response After Short-Term Use of a Brain-Computer Interface**
Amelia Cole, Bernhard Riecke and Alissa Antle

21 **Sensory Threshold Electrical Stimulation Enhances Classification of Motor Imagery**
Tiffany Corbet, Iñaki Iturrate, Michael Pereira, Serafeim Perdikis and José Del R. Millán

22 **Affective Brain Computer Music Interfacing: a Case Study of Use by an Individual with Huntington's Disease**
Ian Daly, Aileen Ho, Julien Marcon, Faustina Hwang, Duncan Williams, Alexis Kirke, Eduardo Miranda and Slawomir Nasuto

24 **Towards a Non-Invasive System for Trans-Humeral Amputee Motion Restoration**
Jacobo Fernandez-Vargas, Kahori Kita and Yu Wenwei

29 **How Many Electrodes Are Needed for Multi-Target SSVEP-BCI Control: Exploring the Minimum Number of Signal Electrodes for CCA and MEC**
Felix Gembler, Piotr Stawicki and Ivan Volosyak

36 **Challenging the Assumption That Auditory Event-Related Potentials Are Independent and Identically Distributed**
David Huebner and Michael Tangermann

38 **Preliminary Results of Testing a BCI-Controlled FES System for Post-Stroke Rehabilitation**
Danut Constantin Irimia, Marian Silviu Poboroniuc, Rupert Ortner, Brendan Zachary Allison and Christoph Guger

42 **Resting EEG-Based Subject Identification System: a Practical Scenario for Offline Analysis**
Donghyeon Kim and Kiseon Kim

43 **Aphasia Rehabilitation After Stroke – Why P300 Brain-Computer Interface (BCI) Training May Be Beneficial**
Sonja Kleih

47 **Online-Capable Cleaning of Highly Artefactual EEG Data Recorded During Real Driving**
Laurens R. Krol, Thorsten O. Zander, Matthew Jaswa, Oded Flascher, Anne Snelting and Anne-Marie Brouwer

Posters

Tuesday, September 19

Paper no.

48 **Non-Stationarity and Inter-Subject Variability of EEG Characteristics in the Context of BCI Development**
Tanja Krumpe, Katrin Baumgärtner, Wolfgang Rosenstiel and Martin Spüler

50 **Using a One-Dimensional Control Signal for Two Different Output Commands in an Implanted BCI**
Sacha Leinders, Elmar Pels, Mariska Vansteensel, Mariana Pedroso Branco, Zac Freudenburg, Max van den Boom, Meron Vermaas, Erik Aarnoutse and Nick Ramsey

53 **Online Classification Accuracy Is a Poor Metric to Study Mental Imagery-Based BCI User Learning: an Experimental Demonstration and New Metrics**
Fabien Lotte and Camille Jeunet

55 **Brain Activation Map During BCI Communication in Complete Locked in State**
Azim Malekshahi, Aygul Rana, Stefano Silvoni, Niels Birbamuer and Ujwal Chaudhary

57 **Tikhonov Regularization Enhances EEG-Based Spatial Filtering for Single-Trial Regression**
Andreas Meinel, Fabien Lotte and Michael Tangermann

60 **A Guided Task for Cognitive Brain-Computer Interfaces**
Julia Moser, Matthias Hohmann, Bernhard Schölkopf and Moritz Grosse-Wentrup

63 **Movement Decoding from EEG: Target or Direction?**
Gernot Müller-Putz, Lukas Peicha and Patrick Ofner

64 **Random Visual Evoked Potentials (RVEP) for Brain-Computer Interface (BCI) Control**
Sebastian Nagel, Wolfgang Rosenstiel and Martin Spüler

67 **Visual Input Affects the Decoding of Imagined Movements of the Same Limb**
Patrick Ofner, Philipp Kersch and Gernot Müller-Putz

71 **A Gaze-Independent Audiovisual Brain-Computer Interface and its Application in Awareness Detection**
Jiahui Pan and Yuanqing Li

73 **Event-Related Potentials in Externally and Internally-Driven Target Selection: a Preliminary Study**
Joana Pereira, Andreea Ioana Sburlea and Gernot R. Müller-Putz

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+ BCI Award nominees posters
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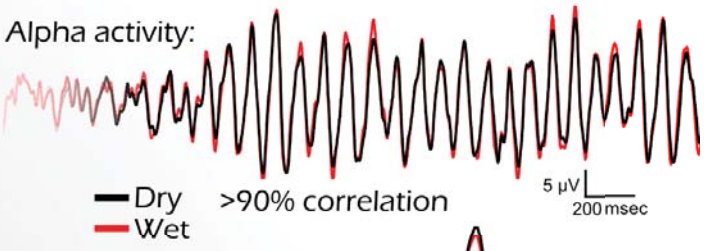

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