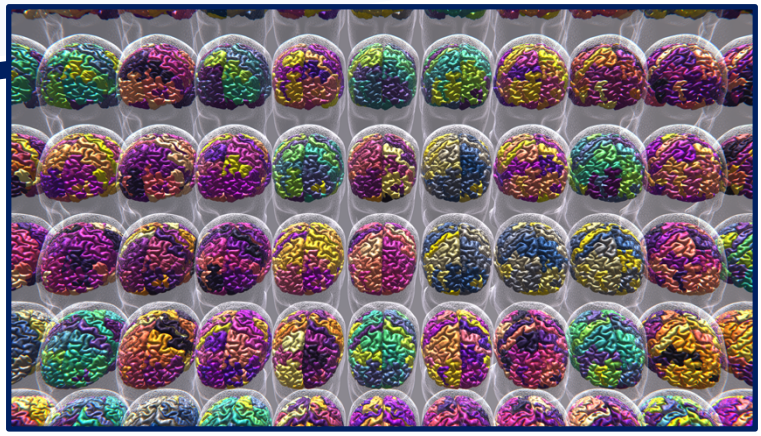
Ref. Ares(2023)1003462 - 11/02/2023

VirtualBrainCloud

Personalized Recommendations for Neurodegenerative Disease



www.VirtualBrainCloud-2020.eu

Public deliverable report

D5.5: Webinar with demonstration of personalized simulation ("case studies") using the integrated model in TVB

Date	January 2023
Authors	CHARITÉ (Petra Ritter)

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Dissemination level	**public**
Website	www.VirtualBrainCloud-2020.eu

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1. Introduction

The Virtual Brain Cloud (TVB-Cloud) has developed EU General Data Protection Regulation (GDPR) compliant cloud infrastructure that enables researchers for integrating sensitive multimodal multi-level health data in computational multi-scale brain models to run personalized simulations of human digital twins.

Several novel technological developments have been made. In this deliverable we demonstrate examples of our public outreach work. We provide links to various webinars that are available online demonstrating human personalized digital twin simulation case studies and the underlying technology.

2. Description of work performed

We chose various formats to demonstrate personalized simulation (case studies) using the integrated model in The Virtual Brain (TVB, thevirtualbrain.org, Ritter et al. 2013, Sanz-Leon et al. 2013, Schirner et al. 2022).

All Webinars have been announced on our project website (https://virtualbraincloud-2020.eu) and distributed via the project's twitter channel (https://twitter.com/tvb_cloud?lang=en) as well as via other social media channels.

Several of the webinars were organized jointly with EBRAINS (ebrains.eu) and the Human Brain Project (HBP) of which TVB-Cloud is a partnering project[1].

3. Results

Within the TVB-Cloud project, we have achieved the following major results concerning personalized human digital twin simulations:

- Provision of personalized brain simulation as a GDPR compliant cloud service[2] (Schirner et al. 2022) accessible by users via EBRAINS Research Infrastructure (RI)
- Extension of existing TVB software for multi-scale brain simulation (Schirner et al. 2022; Maier et al. 2022) accessible by users via EBRAINS Research Infrastructure (RI)
- Inclusion of Positron Emission Tomography (PET) results to constrain personalized brain network models (Stefanovski et al. 2019)
- Provision of proof of principle for simulation augmented classification of dementia (Triebkorn et al. 2022)

[1] https://www.humanbrainproject.eu/en/collaborate-hbp/partnering-projects/
[2] https://ebrains.eu/service/the-virtual-brain/

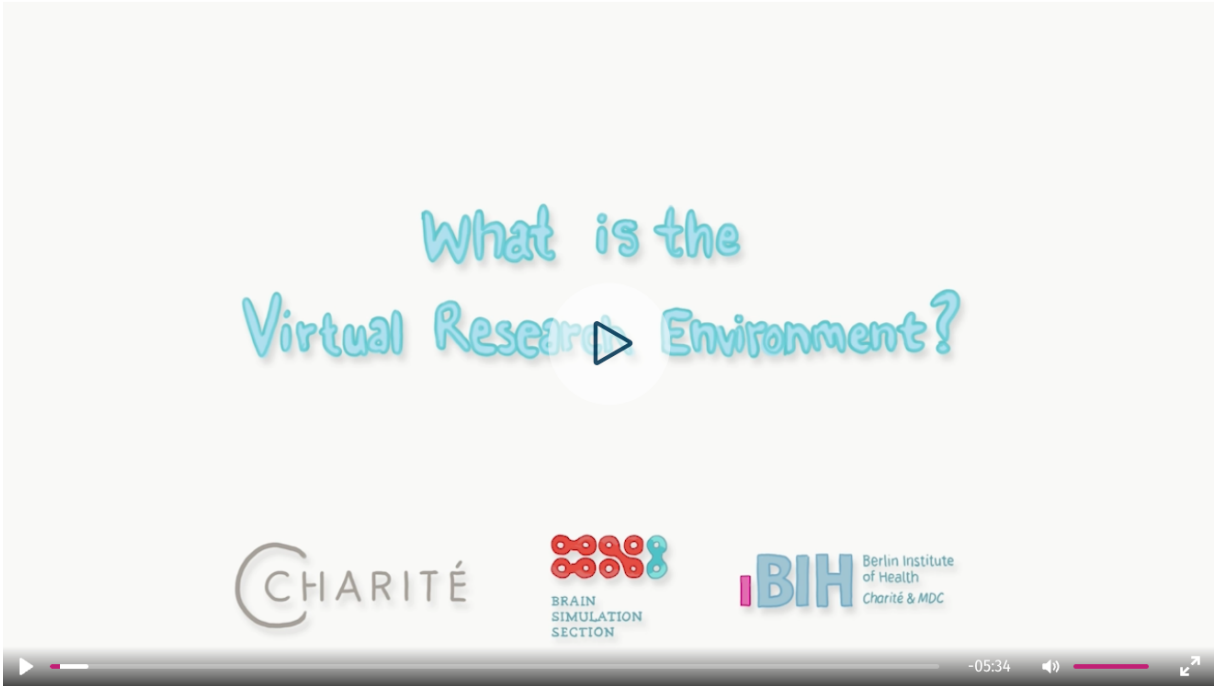
- Provision of secure Virtual Research Environment[3] for GDPR compliant management and processing of sensitive health data listed in the registry of research data repositories[4] (re3data)

These and additional results (see references) were presented as webinars for different target audiences.

Technology Webinars

Explainer Video What is The Virtual Research Environment

https://www.bihealth.org/en/translation/network/digital-medicine/bihcharite-virtual-research-environment



Find many more related webinars on our BrainModes YouTube cahnnel:
https://www.youtube.com/@brainmodes3231/videos

18th Fenix Infrastructure Webinar Nov 2nd 2022
"How to implement a secure processing pipeline for human data"
https://www.brainsimulation.org/bsw/zwei/events/single/11026-18th-fenix-infrastructure-webinar

[3] https://www.bihealth.org/en/translation/network/digital-medicine/bihcharite-virtual-research-environment
[4] https://www.re3data.org/repository/r3d100014127

18TH FENIX INFRASTRUCTURE WEBINAR "HOW TO IMPLEMENT A SECURE PROCESSING PIPELINE FOR HUMAN DATA"

02 NOV 2022
Place: Online

The **18th Fenix Infrastructure Webinar "How to implement a secure processing pipeline for human data"** takes place on **Wednesday 2 November 2022 at 15:00 CET**.

Date and Time: Wednesday 2 November 2022, 15:00-16:00 CET

Cost: Free of charge

Speakers: Petra Ritter (Berlin Institute of Health at Charité - BIH)

Description:

This webinar will present existing solutions that enable secure and privacy-protecting processing of human health data in the cloud and on HPC. We will present secure research software solutions accessible via web interfaces with HPC backends and full-fledged Virtual Research Environments with data protection by design and default.

The presented solutions have been developed as part of HBP, EOSC project Virtual Brain Cloud, and EBRAINS Health Data Cloud and are further developed in the EC Infrastructure project EBRAIN-Health. Reference: Brain simulation as a cloud service: The Virtual Brain on EBRAINS.

Who should attend?

- Neuroscientists
- HPC infrastructure users
- EBRAINS service developers
- Other platform service developers

Main takeaways

- How scientific tool developers can make their services available using ICEI/Fenix Research Infrastructure
- How to provide GDPR-compliant compute and software services

Agenda

- Presentation
- Q&A

The webinar has been be recorded and the full recording is available on the Fenix Webinars page.

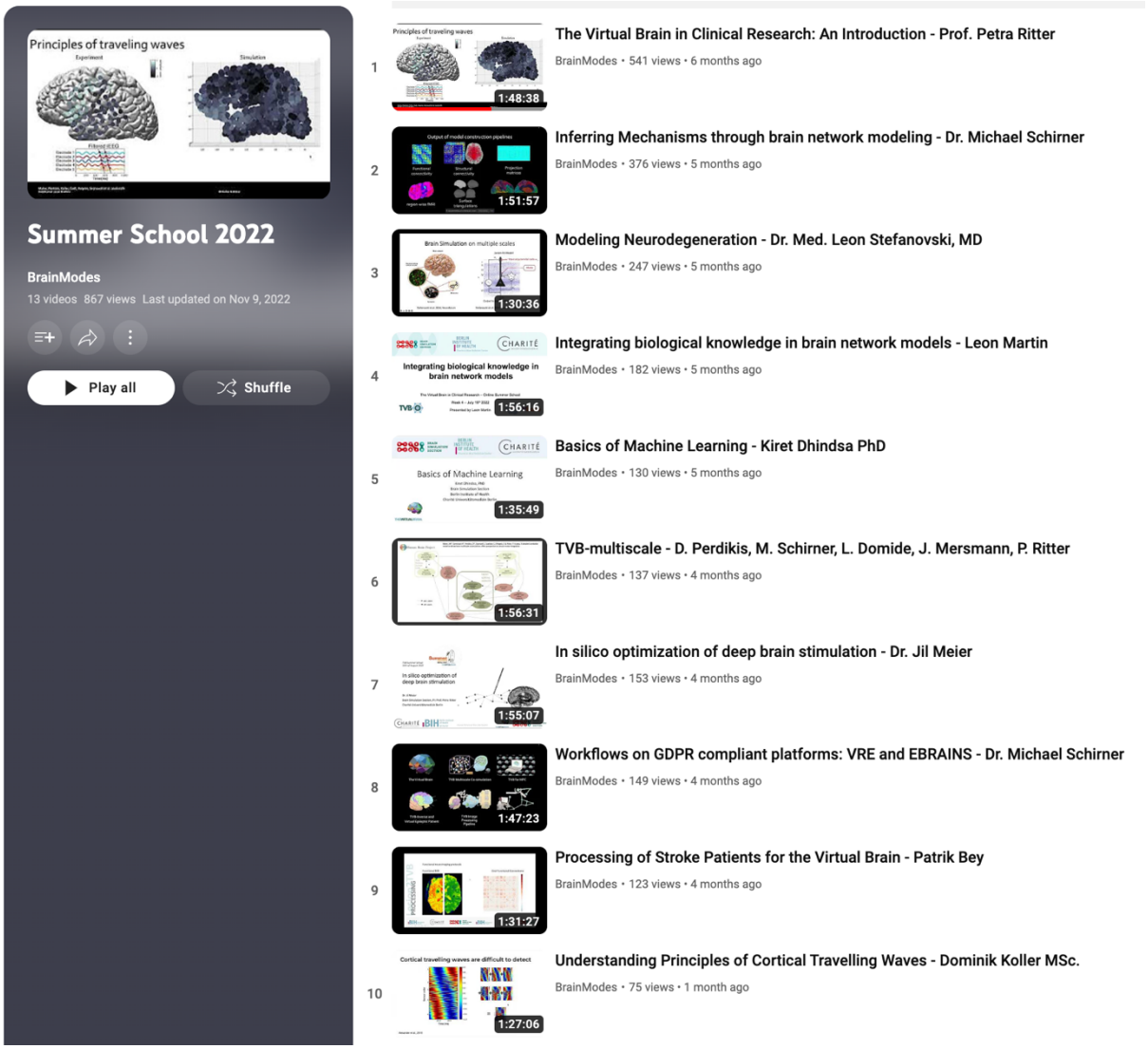
The Webinar “How to implement a secure processing pipeline for human data” is available online:
https://fenix-ri.eu/media/webinars
https://www.youtube.com/watch?v=G79vPahGkIc

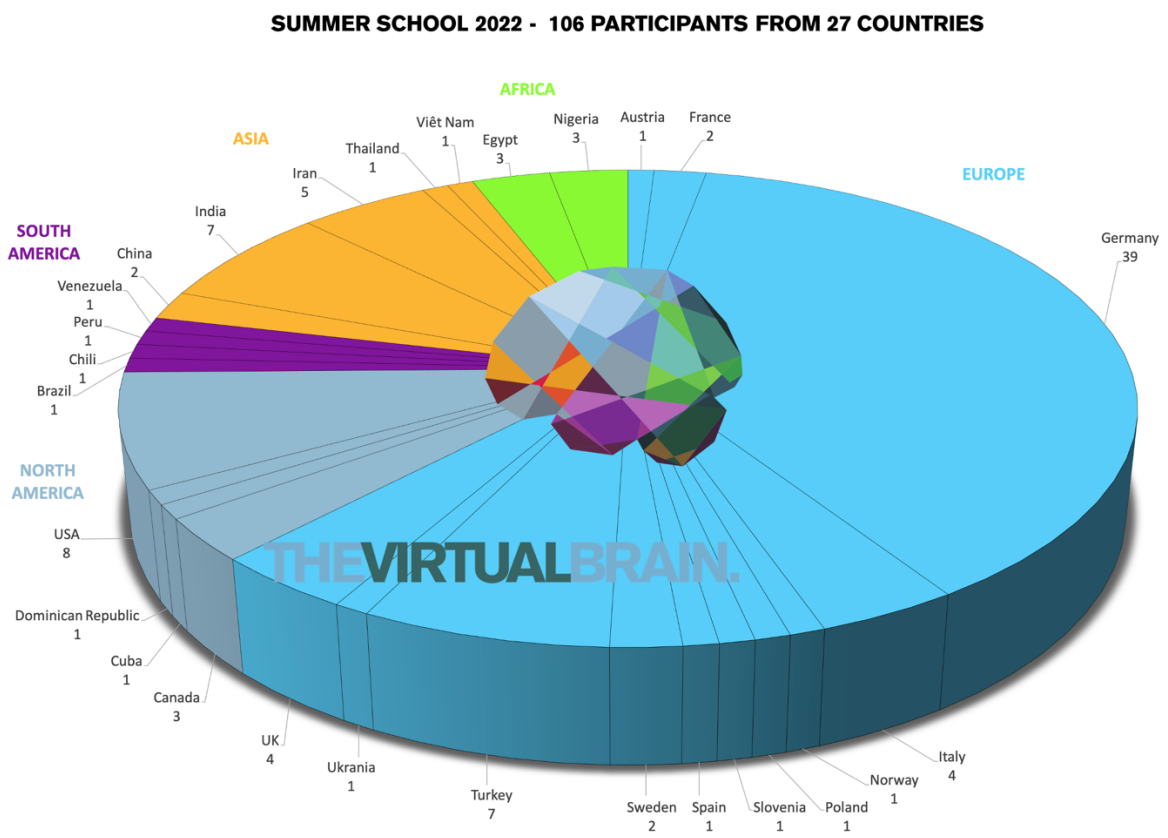
Scientific Webinar Series

Summer School 2022: The Virtual Brain in Clinical Research June 28 - Sept 13, 2022

https://www.brainsimulation.org/bsw/zwei/events/single/9651-summer-school-2022-the-virtual-brain-in-clinical-research

10 Webinars are available online:
https://www.youtube.com/playlist?list=PLVtblERyzDeLNHXIPxPVosUxaz8fuFqHE



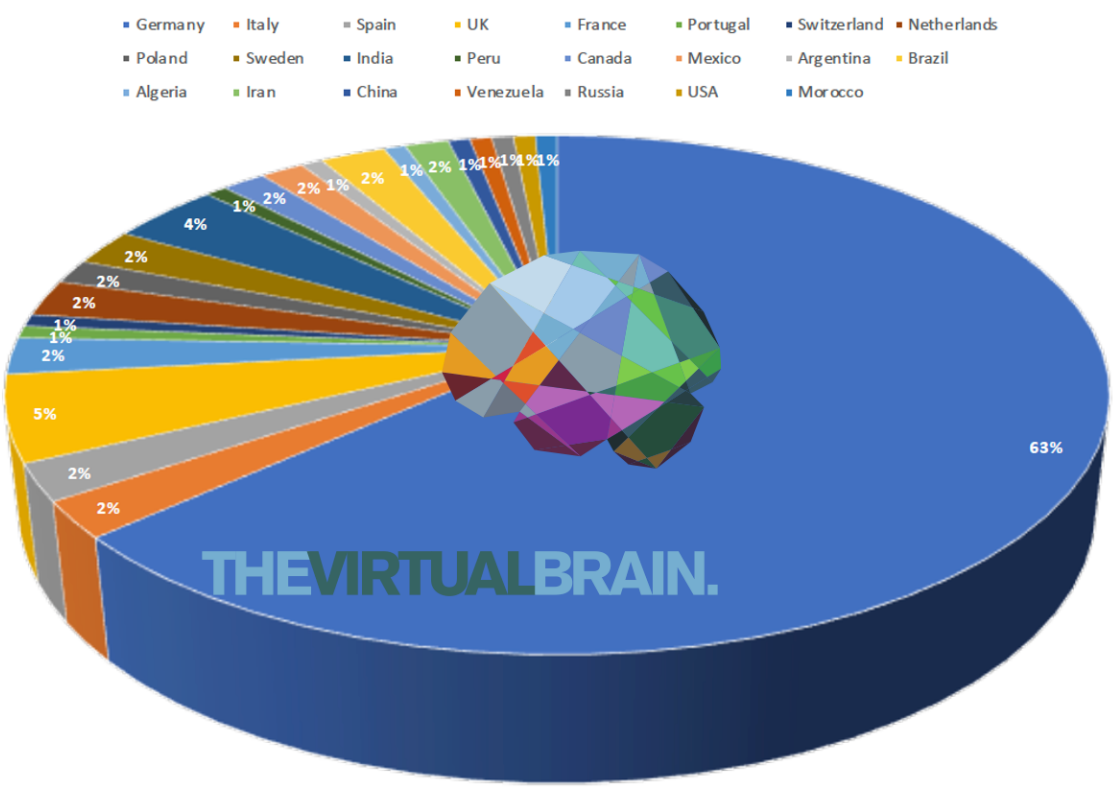


Fall School 2021: The Virtual Brain in Clinical Research: An Introduction
Oct 5, 2021-Feb 1, 2022

https://www.brainsimulation.org/bsw/zwei/events/single/7420-the-virtual-brain-in-clinical-research-an-introduction

All 15 Webinars are available online:
https://www.youtube.com/playlist?list=PLVtblERyzDeKQHHciFUB7paIZ-MHTcn3w

The Fall School 2021 had 86 participants from 23 countries:

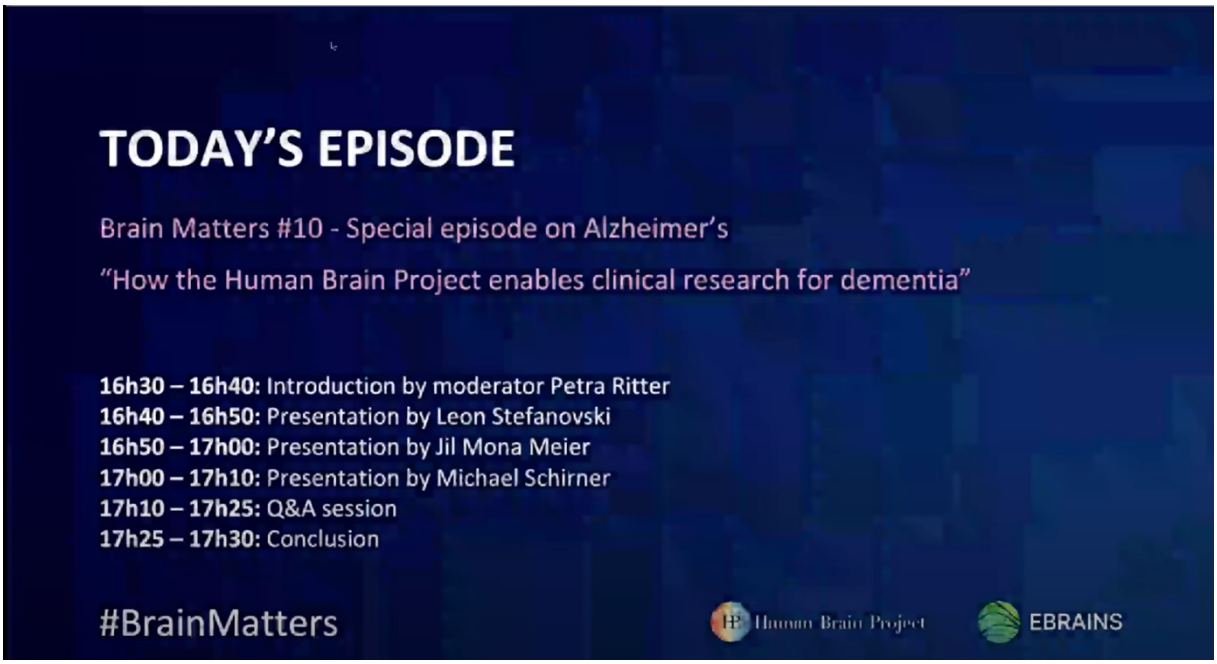


Scientific Webinars

HBP Brain Matters #10 Webinar
Topic: Special Episode on Alzheimer's Disease - How the Human Brain Project enables clinical research for dementia

https://www.brainsimulation.org/bsw/zwei/events/single/10052-hbp-brain-matters-10-webinar

The Webinar can be watched here:
https://www.youtube.com/watch?v=hbpVX6VUy14



Codejams (online)

EBRAINS/HBP CodeJam #13 22-24 November 2022
TVB-EBRAINS integrated workflows and Health Data Cloud

Target audience: Developers

https://www.brainsimulation.org/bsw/zwei/events/single/11217-ebrains-hbp-codejam-workshop-13

https://flagship.kip.uni-heidelberg.de/jss/HBPm?mI=243&m=showAgenda

Thursday, 24 November 2022		
CET: 10:00 **UTC**: 09:00	**Morning session, day III** (dial in)	
CET: 10:00-10:45 **UTC**: 09:00-09:45 (45 min)	Talk / demonstration: TVB-EBRAINS integrated workflows (TVB-Cloud with Unicore, CWL, control via collab and multiscale simulation)	Petra Ritter (Charite - Universitaetsmedizin Berlin)
CET: 10:45-12:15 **UTC**: 09:45-11:15 (90 min)	Coding in parallel break-out rooms • One of the parallel sessions: TVB-Cloud Coding TVB-Multiscale (Jil Meier, Dionysios Perdikis, Valery Bragin)	
CET: 12:15-13:45 **UTC**: 11:15-12:45 (90 min)	(Lunch)	
CET: 13:45 **UTC**: 12:45	**Afternoon session, day II** (dial in)	
CET: 13:45-14:30 **UTC**: 12:45-13:30 (45 min)	Talk / demonstration: Health Data Cloud (HDC): Knowledge Graph (KG) and IAM integration	Michael Schirner (Charite - Universitaetsmedizin Berlin)
CET: 14:30-16:00 **UTC**: 13:30-15:00 (90 min)	Coding in parallel break-out rooms • one of the parallel sessions: HDC / Health Data Cloud workflows (Patrik Bey, Marc Sacks)	
CET: 18:00 **UTC**: 17:00	**End of the CodeJam**	

Contact: bjoern.kindler@kip.uni-heidelberg.de

Training Events (online)

EBRAINS Infrastructure Training Event – Simulate with EBRAINS 7-10. Nov 2022
The Virtual Brain & Health Data Cloud: Processing with data protection by design and by default

https://www.brainsimulation.org/bsw/zwei/events/single/9750-ebrains-training-event-simulate-with-ebrains

https://flagship.kip.uni-heidelberg.de/jss/HBPm?m=showAgenda&meetingID=242

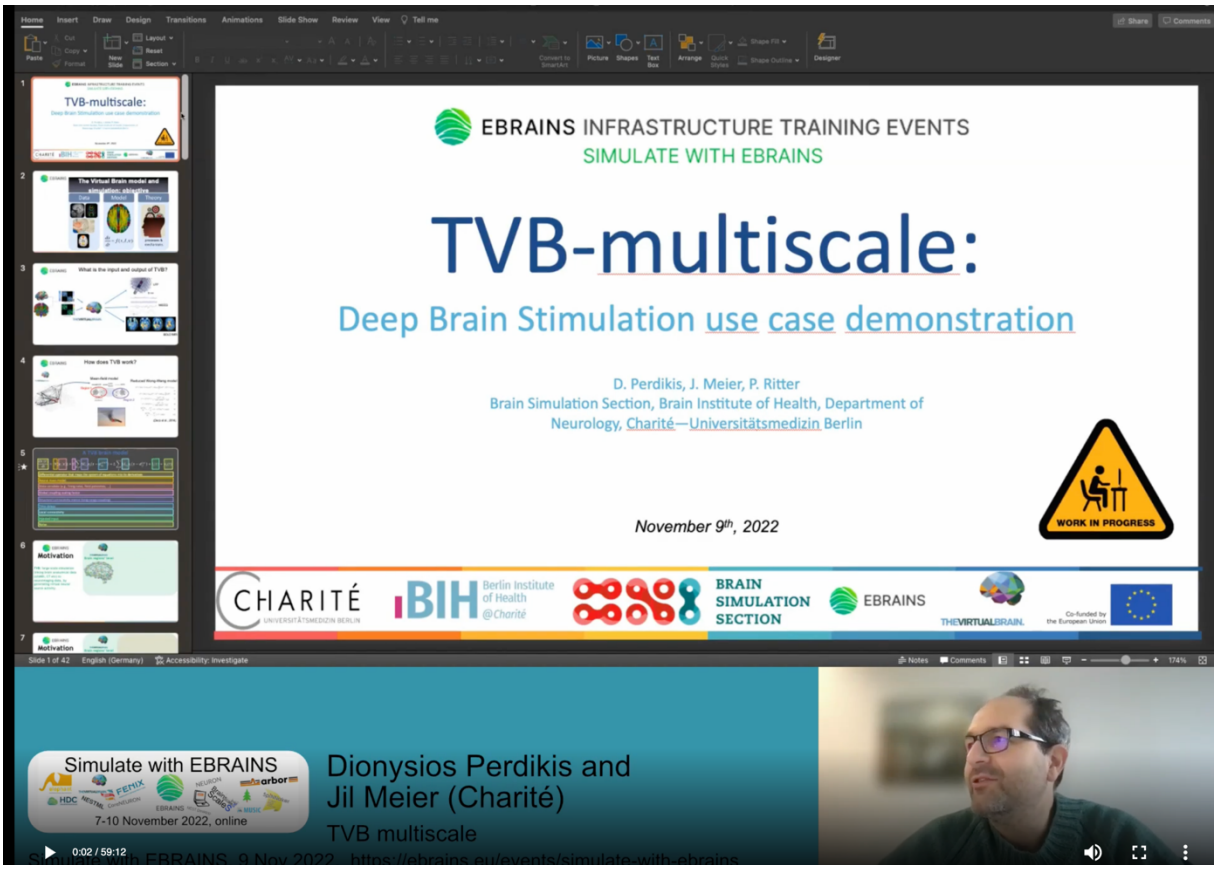
CET: 10:25 **UTC**: 09:25	**Introduction: whole brain level simulation**		
CET: 10:25-10:30 **UTC**: 09:25-09:30 (5+1 min)	TVB (The Virtual Brain)	.ics	Petra Ritter

CET: 11:42-11:47 **UTC**: 10:42-10:47 (5+1 min)	Health Data Cloud: processing with data protection by design and by default	.ics	Petra Ritter

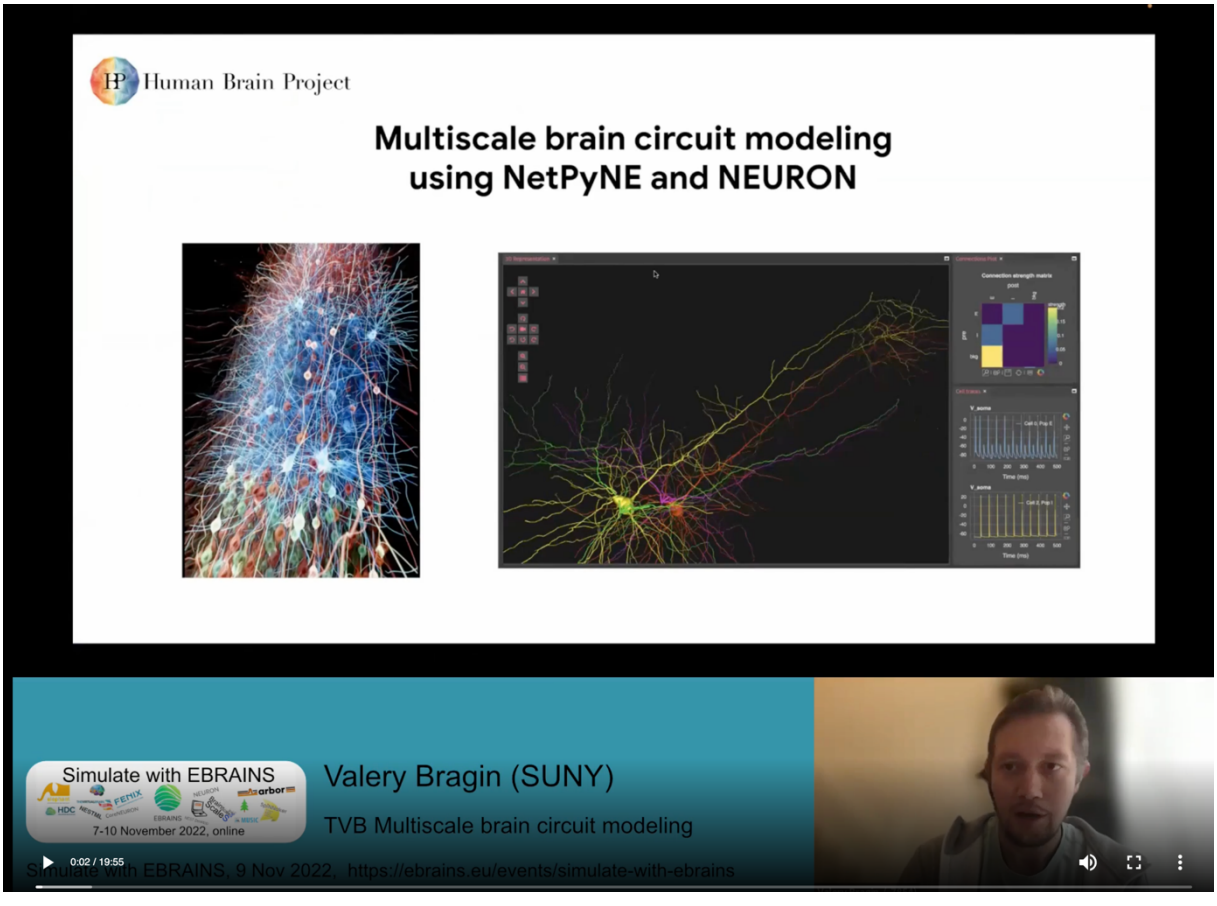
Session 2: The Virtual Brain (TVB)
TVB Multiscale
Dionysios Perdikis (Charite - Universitaetsmedizin Berlin) Jil Meier (Charite - Universitaetsmedizin Berlin) show talk video
Multiscale brain circuit modeling using NetPyNE and NEURON
Valery Bragin show talk video
TVB-NRP
Dionysios Perdikis (Charite - Universitaetsmedizin Berlin) Krzysztof Lebioda (Technische Universitaet Muenchen)
TVB in EBRAINS
Lia Domide (Codemart SRL) Paula Popa (Codemart SRL) show talk video

The Webinars have been recorded and are available online via the respective links below.

TVB-multiscale:
https://flagship.kip.uni-heidelberg.de/jss/HBPm?mI=242&publicVideoID=9263



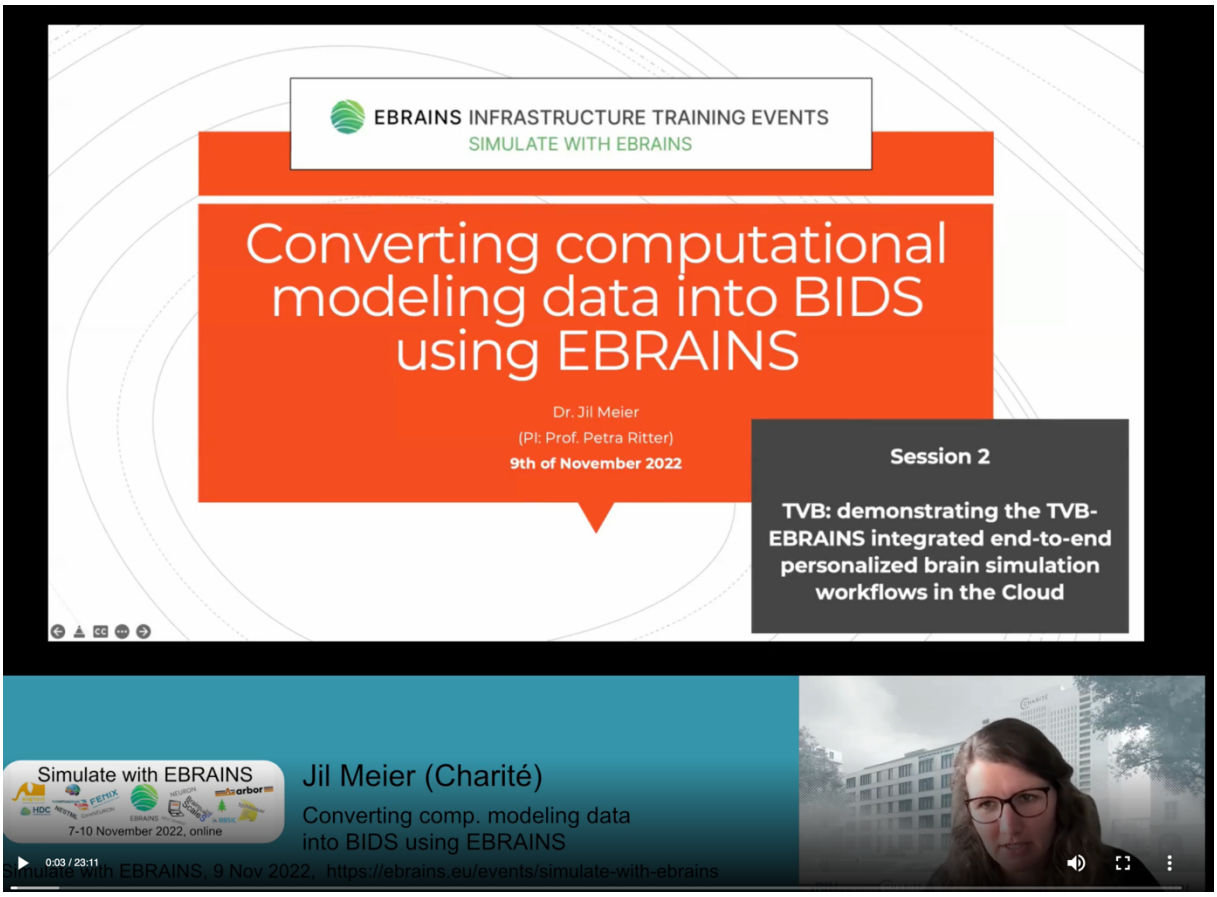
Multiscale brain circuit modeling using NetPyNE and NEURON
https://flagship.kip.uni-heidelberg.de/jss/HBPm?mI=242&publicVideoID=9268



TVB in EBRAINS
https://flagship.kip.uni-heidelberg.de/jss/HBPm?mI=242&publicVideoID=9265

Session 2: TVB (continued)
Converting comp. modeling data into BIDS using EBRAINS
Jil Meier (Charite - Universitaetsmedizin Berlin) show talk video
TVBase and TVB Ontology
Leon Stefanovski () Leon Martin (Charite - Universitaetsmedizin Berlin)

Converting computational models into BIDS data standard
https://flagship.kip.uni-heidelberg.de/jss/HBPm?mI=242&publicVideoID=9266



Panel Discussions

World Health Summit in Berlin (broadcasted online) Oct 16-18, 2022
How to achieve a global health data space
Audience: Policy makers

https://www.worldhealthsummit.org/

WORLD HEALTH SUMMIT

OCTOBER 15-17, 2023
BERLIN, GERMANY & DIGITAL
SCIENCE · INNOVATION · POLICIES

REGIONAL MEETING
WASHINGTON DC, USA
APRIL 13, 2023 & DIGITAL

ABOUT | PARTNERS | INITIATIVES | M8 ALLIANCE | NEWSROOM | LOOK BACK: WHS 2022 | REGIONAL MEETINGS

WORLD HEALTH SUMMIT

3 DAYS - 100+ NATIONS - 300+ SPEAKERS - 4,000+ PARTICIPANTS ON-SITE - 50,000+ PARTICIPANTS ONLINE

PD 11 - How to Achieve a Global Health Data Space

Oct. 18, 2022, CEST: 09:00 AM - 10:30 AM / UTC: 07:00 AM - 08:30 AM

Digital Session: https://youtu.be/z3CiGouR0jM

Panel Discussion (PD 11) - Europe

Breaking the data silos is essential to reshape the future of healthcare and crisis preparedness. With the growing opportunities of digital health and Artificial Intelligence (AI), we are, more than ever before, in the pole position for a Global Health Data Space that could help to treat and govern data for health as a global public good. However, across and within countries there is a stark divide in the capacity to effectively work with data. The 2021 I-DAIR Global Research Map reveals, the divide between data use leaders based in a small number of countries and the rest of the world is growing. Additionally, biases in data relating to gender, race, and age limit the universal benefit and the trust in data use.

Only when used equitably and ethically, the work with data can offer an unprecedented possibility to improve global health and well-being and achieve Universal Health Coverage (UHC) 2030. Impact at the global level will thereby only be possible with shapers and decision makers from different disciplines including from countries of relatively lower income and/or with smaller populations. With this session we wish to spark stakeholder engagement for a transparent data system that protects citizens' data and facilitates their use for healthcare and research.

Chairs:

Prof. Dr. Petra Ritter

Charité - Universitätsmedizin Berlin | Berlin Institute of Health (BIH) | Professor for Brain Simulation | Germany

Speakers:

Dr. Marlies Dorlöchter

DLR Project Management Agency | International Health Research | Head of Division | Germany

Dr. Ruxandra Draghia Akli

Johnson & Johnson | Global Head of Global Public Health R&D | United States of America

Dr. Steve MacFeely

World Health Organization (WHO) | Data Analytics | Director

Dr. Mehdi Snène

International Digital Health and Artificial Intelligence Research Collaborative (I-DAIR) | CEO ad interim | Switzerland

Paweł Świeboda

Human Brain Project | Director-General | Belgium

EBRAINS Research Infrastructure | CEO

European Parliament Lunch Debate on Sept 27, 2022 in Brussels
Topic: The role of AI and big data in dementia research

https://www.brainsimulation.org/bsw/zwei/events/single/10182-european-parliament-lunch-debate

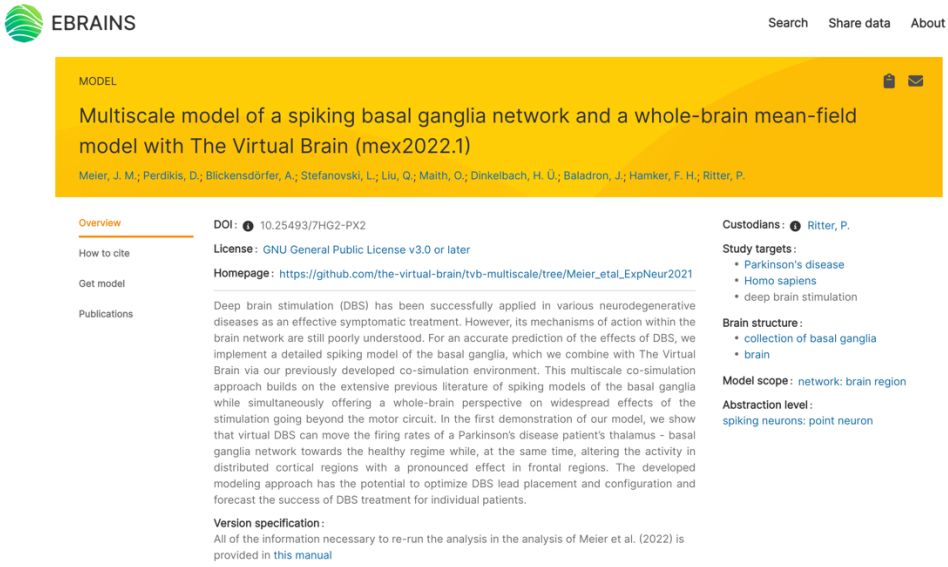
The video recording can be watched here:
https://www.alzheimer-europe.org/news/alzheimer-europe-hosts-lunch-debate

4. Conclusion, next steps

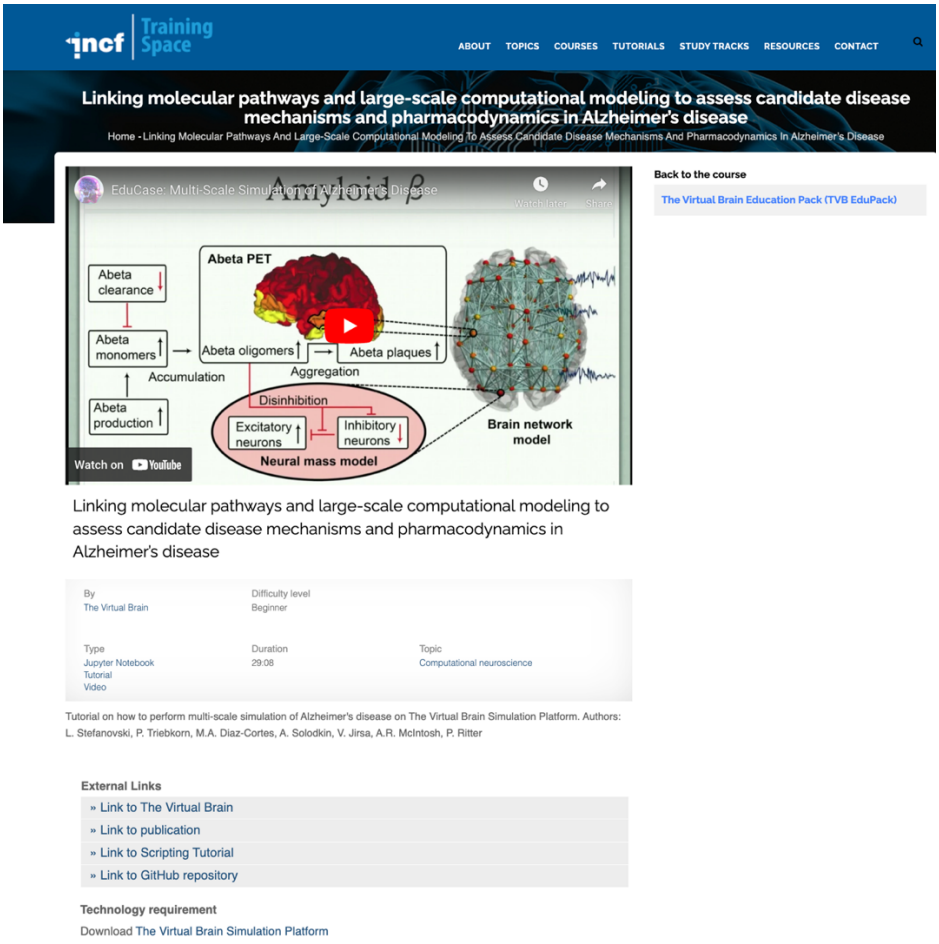
The TVB-Cloud project has delivered multiple webinars on the personalized simulation technologies and case studies.

In addition to the webinars also additional materials have been provided for selected case studies. These packages contain scripting tutorials, code and data to reproduce published case studies

1. In silico optimization of deep brain stimulation
   https://search.kg.ebrains.eu/instances/4efb127d-8393-4c97-b955-90f2c492b526



2. Linking molecular pathways and large-scale computational modelling to assess candidate disease mechanisms and pharmacodynamics in Alzheimer's disease https://training.incf.org/lesson/linking-molecular-pathways-and-large-scale-computational-modeling-assess-candidate-disease



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Sanz Leon, P., S. A. Knock, M. M. Woodman, L. Domide, J. Mersmann, A. R. McIntosh and V. Jirsa (2013). "The Virtual Brain: a simulator of primate brain network dynamics." Frontiers in Neuroinformatics 7(10).

Schirner, Domide, Perdikis, Triebkorn, Stefanovski, Pai, Prodan, Valean, Palmer, Langford, Blickensdörfer, van der Vlag, Diaz-Pier, Peyser, Woodman, Zehl, Fousek, Petkoski, Kusch, Hashemi, Marinazzo, Mangin, Flöel, Akintoye, Stahl, Deco, McIntosh, Hilgetag, Morgan, Schuller, Upton, McMurtrie, Dickscheid, Bjaalie, Amunts, Mersmann, Jirsa, Ritter. Brain Simulation as a Cloud Service: The Virtual Brain on the European Research Platform EBRAINS (2022) Neuroimage

Schirner, Kong, Yeo, Deco, Ritter (2022) Dynamic primitives of brain network interaction. Neuroimage

Stefanovski, L., K. Bülau, L. Martin, J. Courtiol, M. A. Diaz-Cortes, C. Langford, J. Palmer, P. Ritter and A. s. D. N. Initiative (2021). "Spatial mapping of subcellular disease pathways and cytoarchitecture to anatomical brain regions for multi-scale brain simulation with The Virtual Brain." Alzheimer's & Dementia 17: e052311.

Stefanovski, L., J. M. Meier, R. K. Pai, P. Triebkorn, T. Lett, L. Martin, K. Bülau, M. Hofmann-Apitius, A. Solodkin, A. R. McIntosh and P. Ritter (2021). "Bridging Scales in Alzheimer's Disease: Biological Framework for Brain Simulation With The Virtual Brain." Frontiers in Neuroinformatics 15(9).

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