

Lessons Learnt from other Initiatives:

- TEF-HEALTH
- EOSC TVB-CLOUD
- EBRAIN-HEALTH



Prof. Dr. Petra Ritter



May 17, 2023 Rome
Deep Thinkers Meeting





BRAIN
SIMULATION
SECTION

Parcellations



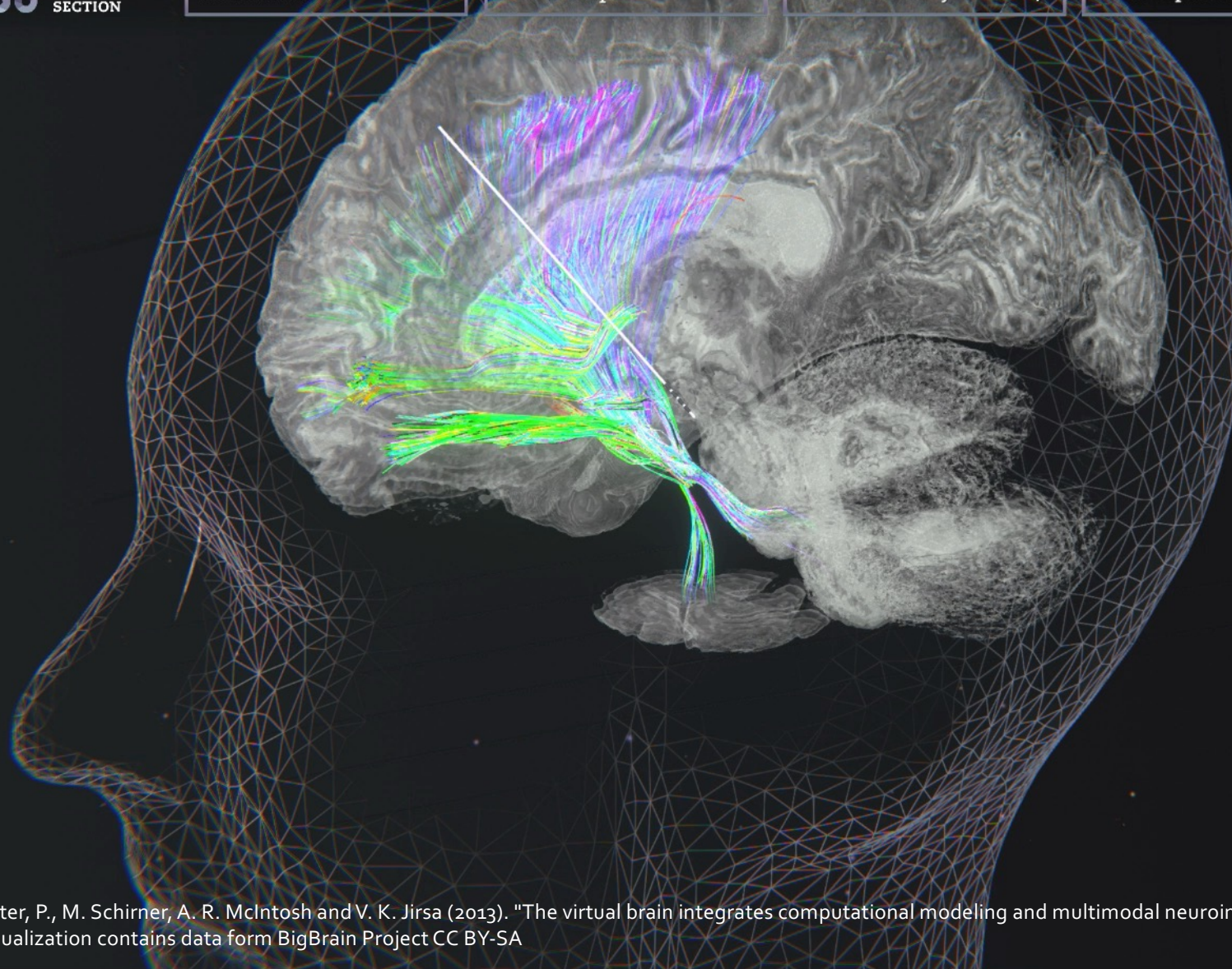
Color Maps



Brain Activity



View Options



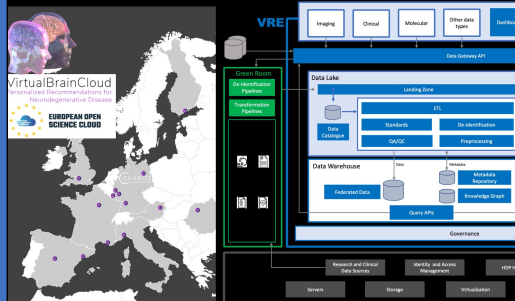
Ritter, P., M. Schirner, A. R. McIntosh and V. K. Jirsa (2013). "The virtual brain integrates computational modeling and multimodal neuroimaging." *Brain Connect* 3(2): 121-145.
Visualization contains data form BigBrain Project CC BY-SA

Human Digital Twin EU Projects led by Charité Berlin

eosc



Virtual Brain Cloud
Personalized Recommendations for
Neurodegenerative Disease



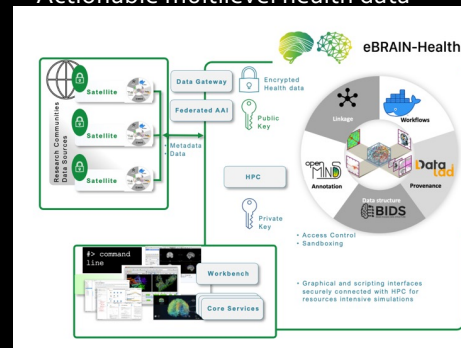
Lead: Charité, €15Mil
2018-2023

<https://cordis.europa.eu/project/id/826421>

<https://eosc-portal.eu/about/eosc-projects?page=5>

eBRAIN-Health

Actionable multilevel health data

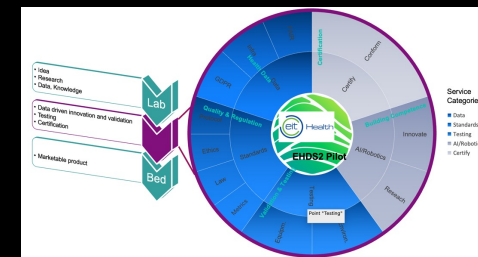


Lead: Charité, €13Mil
2022-2026

<https://cordis.europa.eu/project/id/101058516>

TEF-Health

Testing and Experimentation Facility
Health AI and Robotics



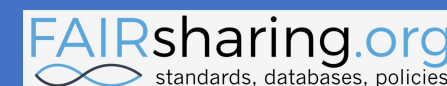
Lead: Charité, €60Mil
2023-2027

www.tefhealth.eu

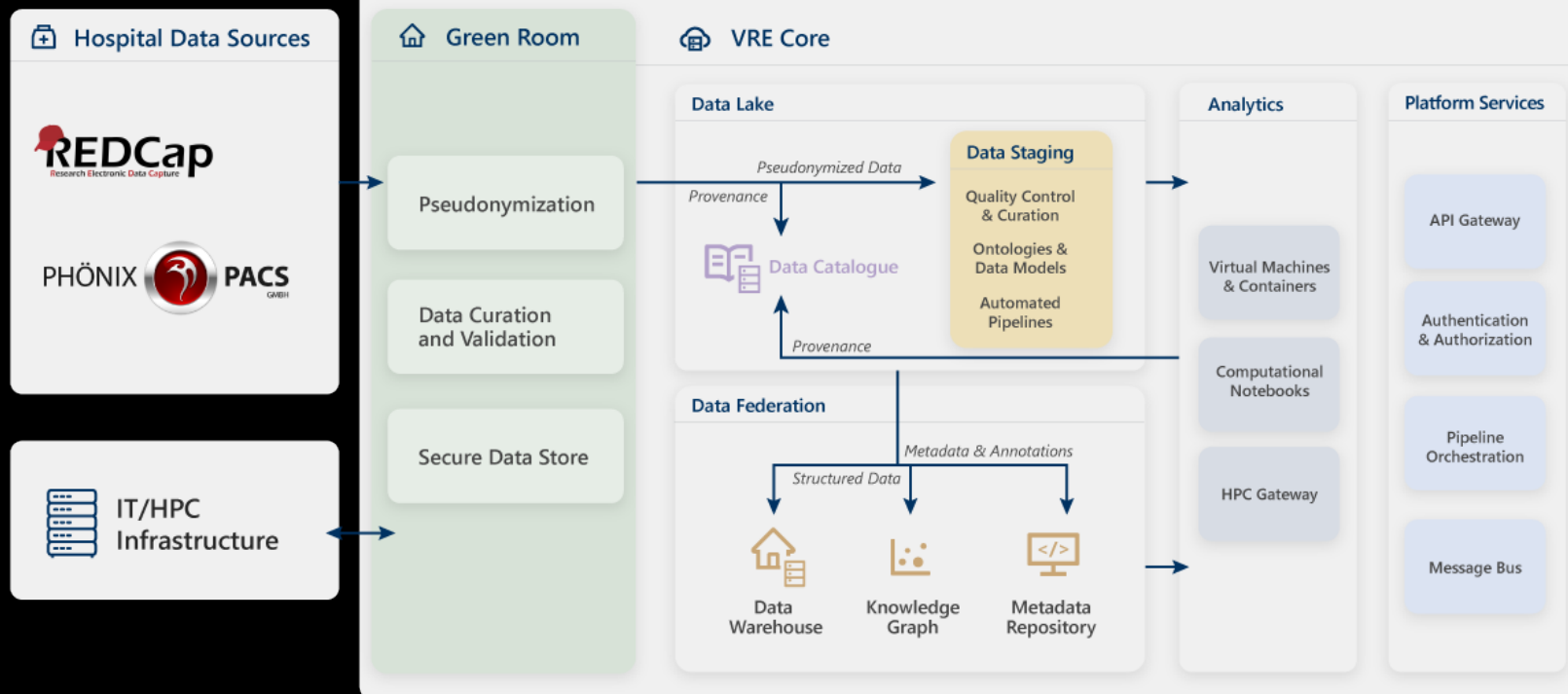
Secure Processing Environment



Access via:



VRE Virtual Research Environment
vre.charite.de



<https://marketplace.eosc-portal.eu/services/secure-virtual-research-environment-vre-for-sensitive-data>

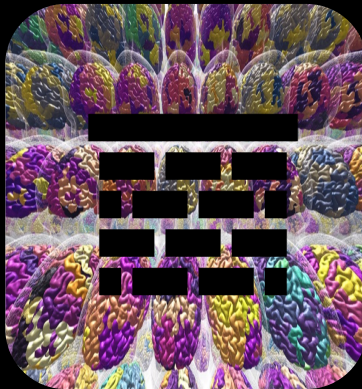
Technical and Organizational Measures

Critical infrastructure certification



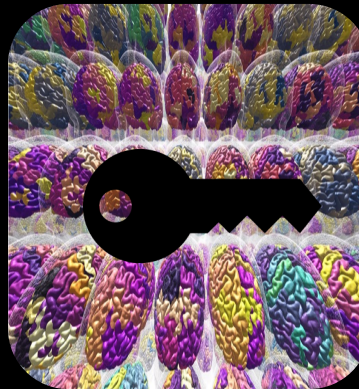
- ✓ IT Infrastructure with state of the art security measures and industry best practice

Isolation of data and resources



- ✓ Namespaces
- ✓ Filter
- ✓ Firewalls
- ✓ proxy nodes

Encryption



- ✓ Sensitive data is always encrypted by default and only decrypted during the actual processing
- ✓ Unencrypted data is sandboxed during processing

Authentication & authorization

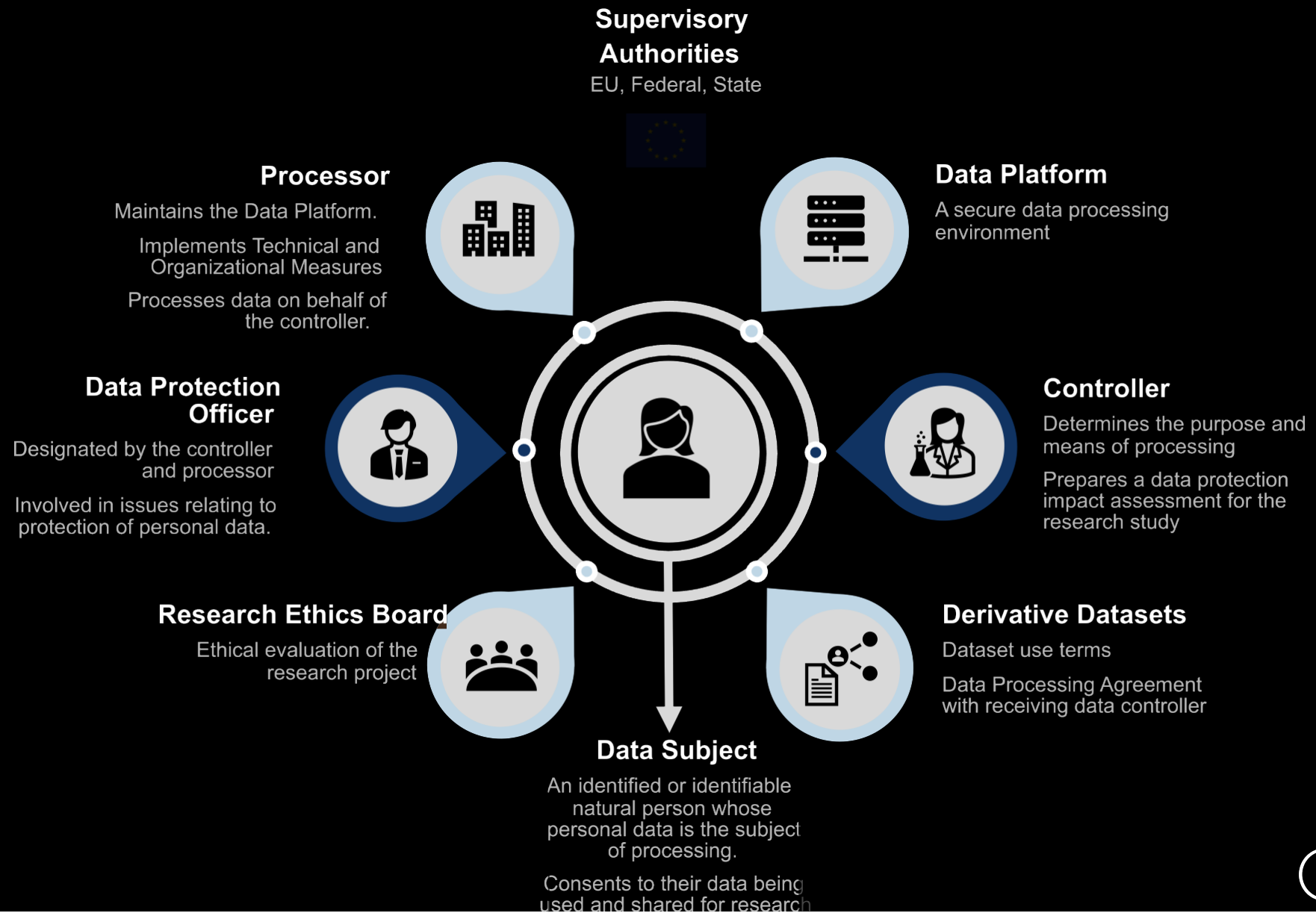


- ✓ Keycloak/OpenID Connect for single sign-on and to authenticate communications between the frontend, API Gateway (which connects all back-end services)
- ✓ Identity of users federated between nodes
- ✓ Registration with form of personal identification
- ✓ Password complexity and session inactivity timeouts

Access control

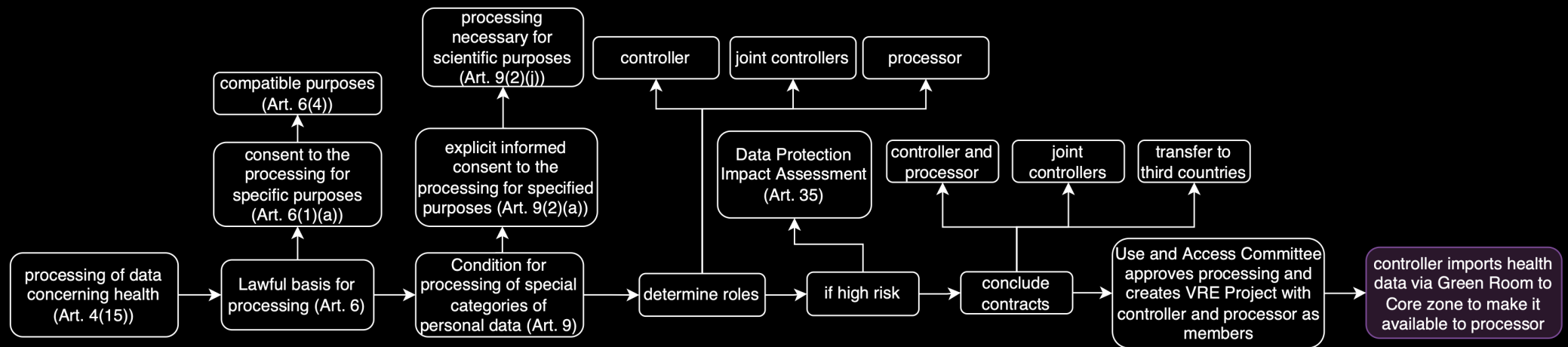


- ✓ Fine-grained role-based and project-based access control
- ✓ A user may be a member of multiple projects and may have different roles in each project
- ✓ Roles mapped to roles concept of GDPR



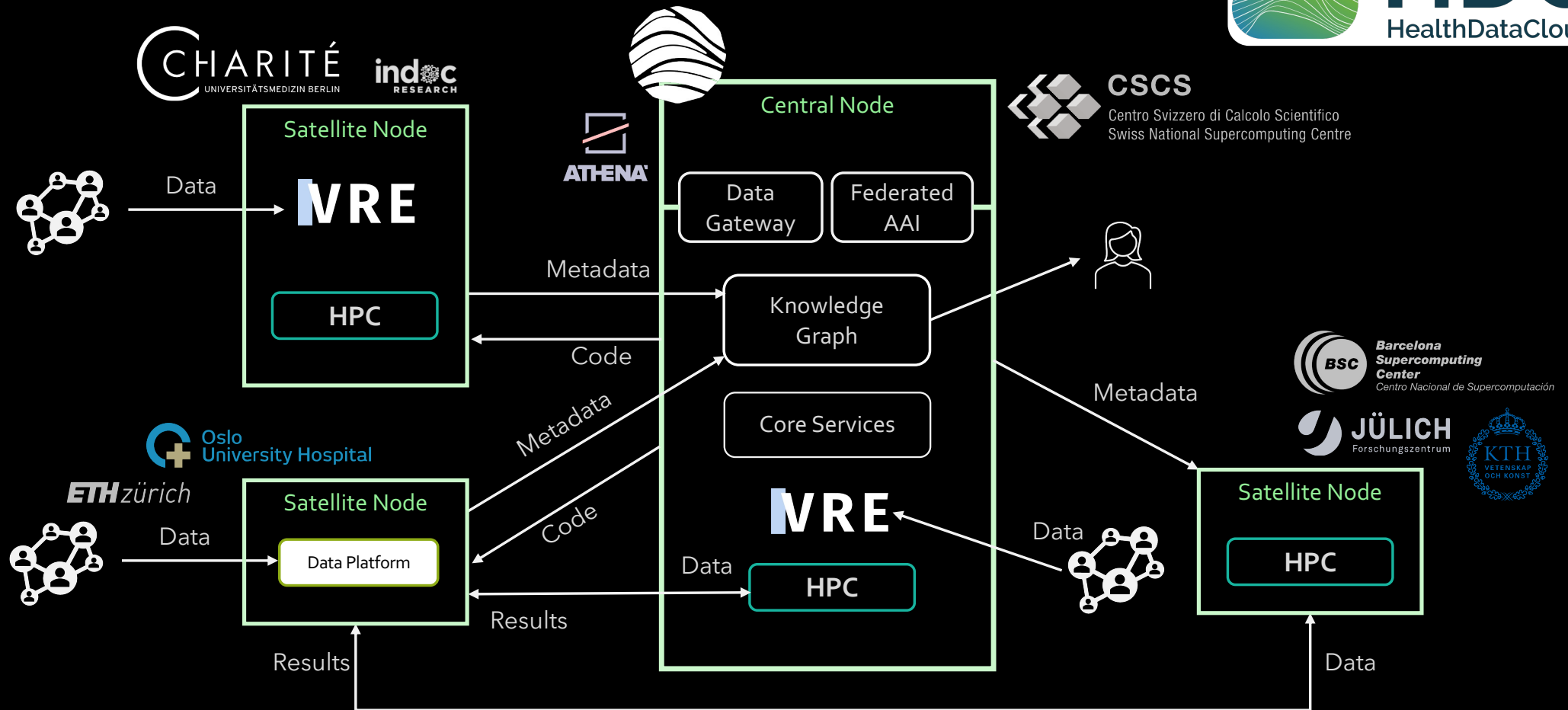
Technical and Organizational Measures

Roles of actors map to legal framework & governance model



- Only after the **Legal Controller** approved all necessary contracts a dedicated VRE Project is created by a **Platform Administrator** and adds the specified controller and processor as team members
- Controller can make it available to processors for performing the processing operation

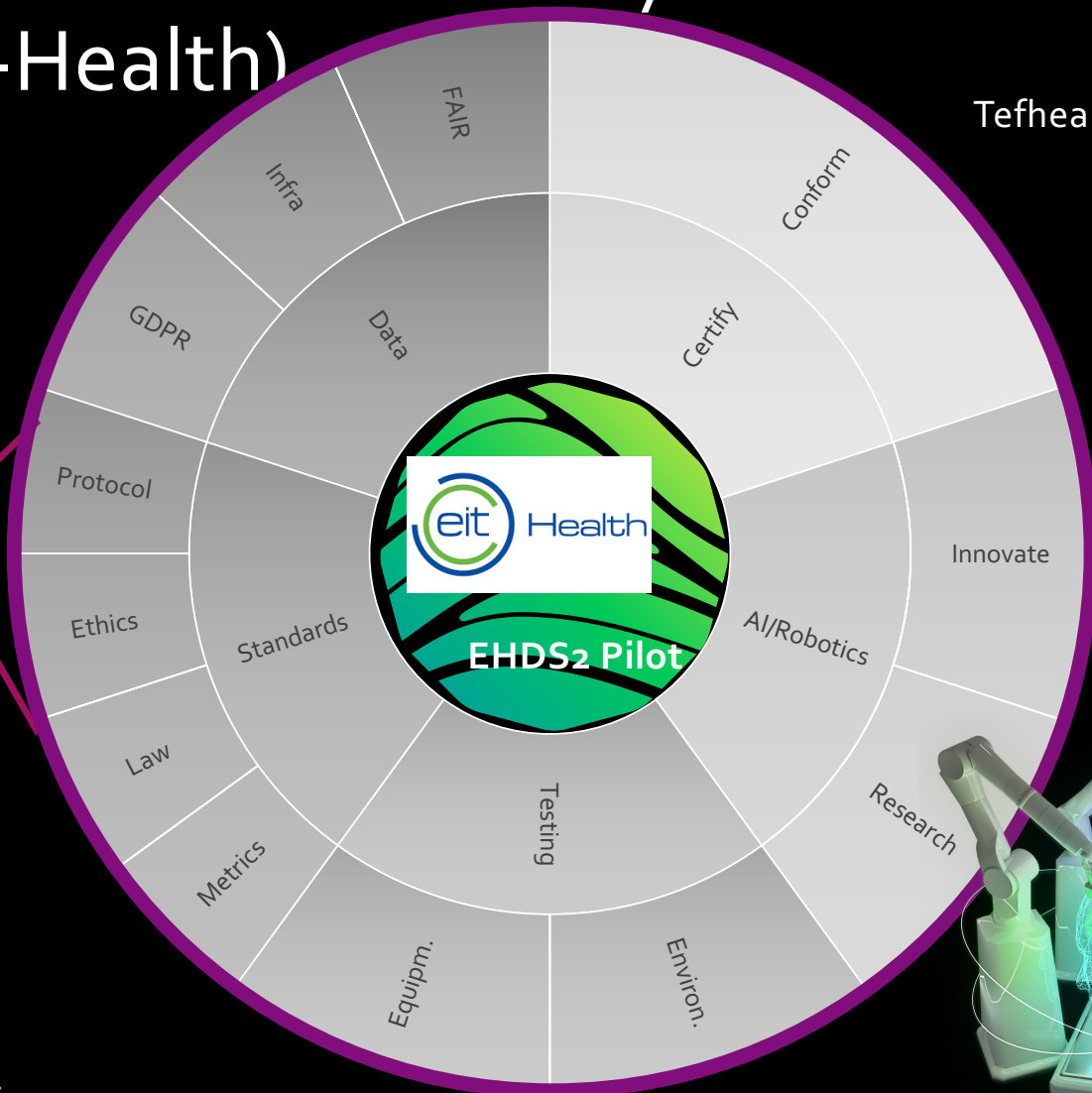
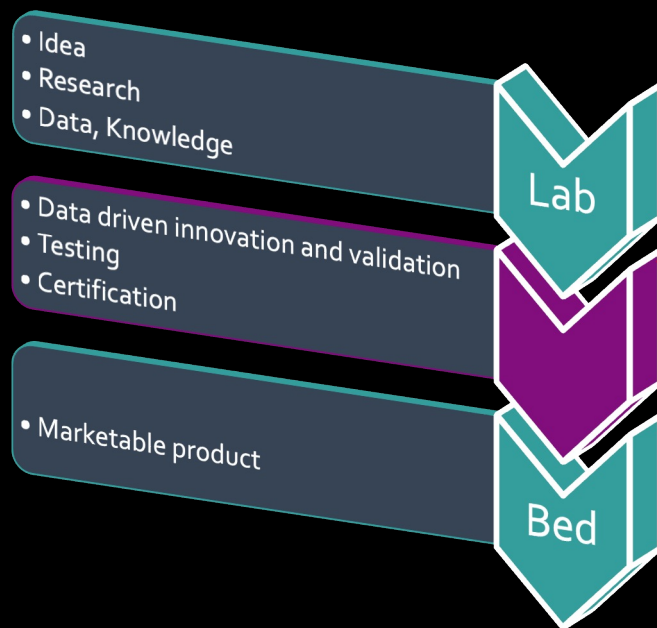
EBRAINS Health Data Cloud



www.healthdatacloud.eu

Testing and Experimentation Facility for Health AI and Robotics (TEF-Health)

Tefhealth.eu



€60 Mill

2023-2027 lead: Charité; 51 partner entities

Testing and Experimentation Facility for Health AI and Robotics (TEF-Health)

GERMANY

Berlin [CHARITÉ*](#), BPWT*, VdTÜV*, KI Park*
 Braunschweig [PTB*](#)
 Erlangen [FAU*](#)
 Heidelberg [EIT H SI GmbH*](#)
 München [TUM*](#), FHG*, EIT HEALTH EV*

BELGIUM

Charleroi [ISPPC*](#), CETIC, BIOWIN*
 Liège [WSL*](#)
 Mol [VITO*](#)
 Mons [MULTITEL*](#)
 Namur [UNamur*](#), POLEM*

FRANCE

Grenoble [CHUGA*](#), UGA*
 Lyon [HCL*](#)
 Paris [LNE*](#), CEA*, EIT Health Fr*, HDH*
 Rennes [CHU RENNES*](#)
 Strasbourg [IHUS*](#)

ITALY

Genova [IGG*](#), IIT*
 Lecce [INNOVAAL*](#)
 Milano [POLIMI*](#)
 Pavia [UNIPV*](#)
 Povo [FBK*](#)
 Roma [ISS*](#)

PORTUGAL

Coimbra [IPN*](#), CHUC EPE*
 Lisboa [SPMS*](#), InnoStars*
 Porto [CHSJ*](#), HCP*

SLOVAKIA

Bratislava [UK BA*](#), STUBA*
 Martin [UHM*](#)
 Zilina [UNIZA*](#)

SWEDEN

Boras [RISE*](#)
 Stockholm [KI*](#)

PAN-UE

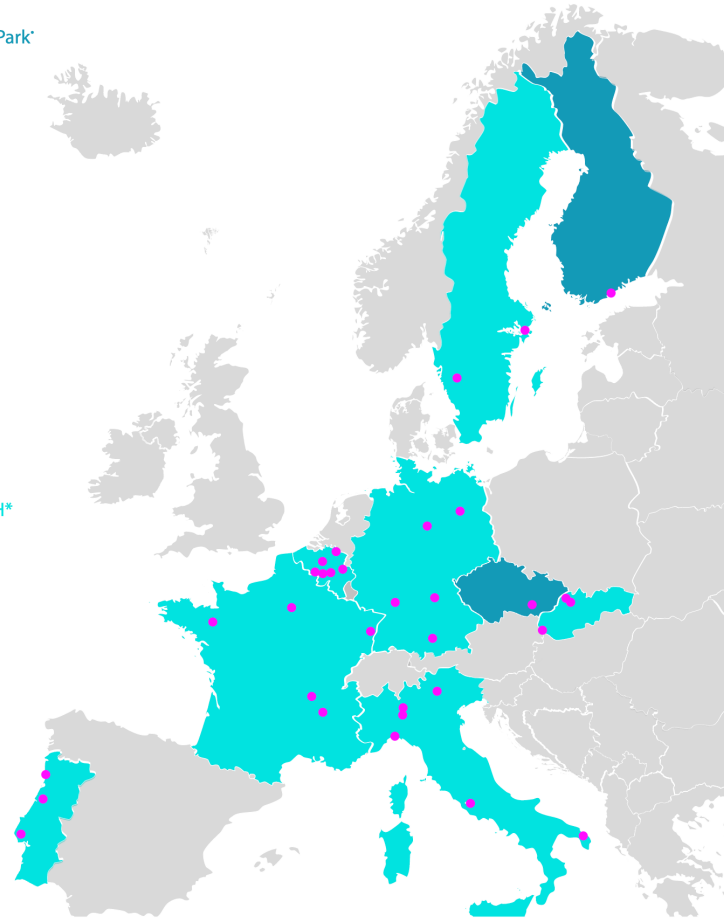
Brussels [EBRAINS*](#)

CZECHIA

BRNO [MU*](#)

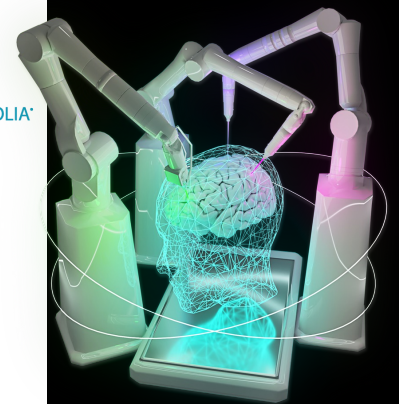
FINLAND

Helsinki [HELSINGFORS*](#), HUS*, METROPOLIA*

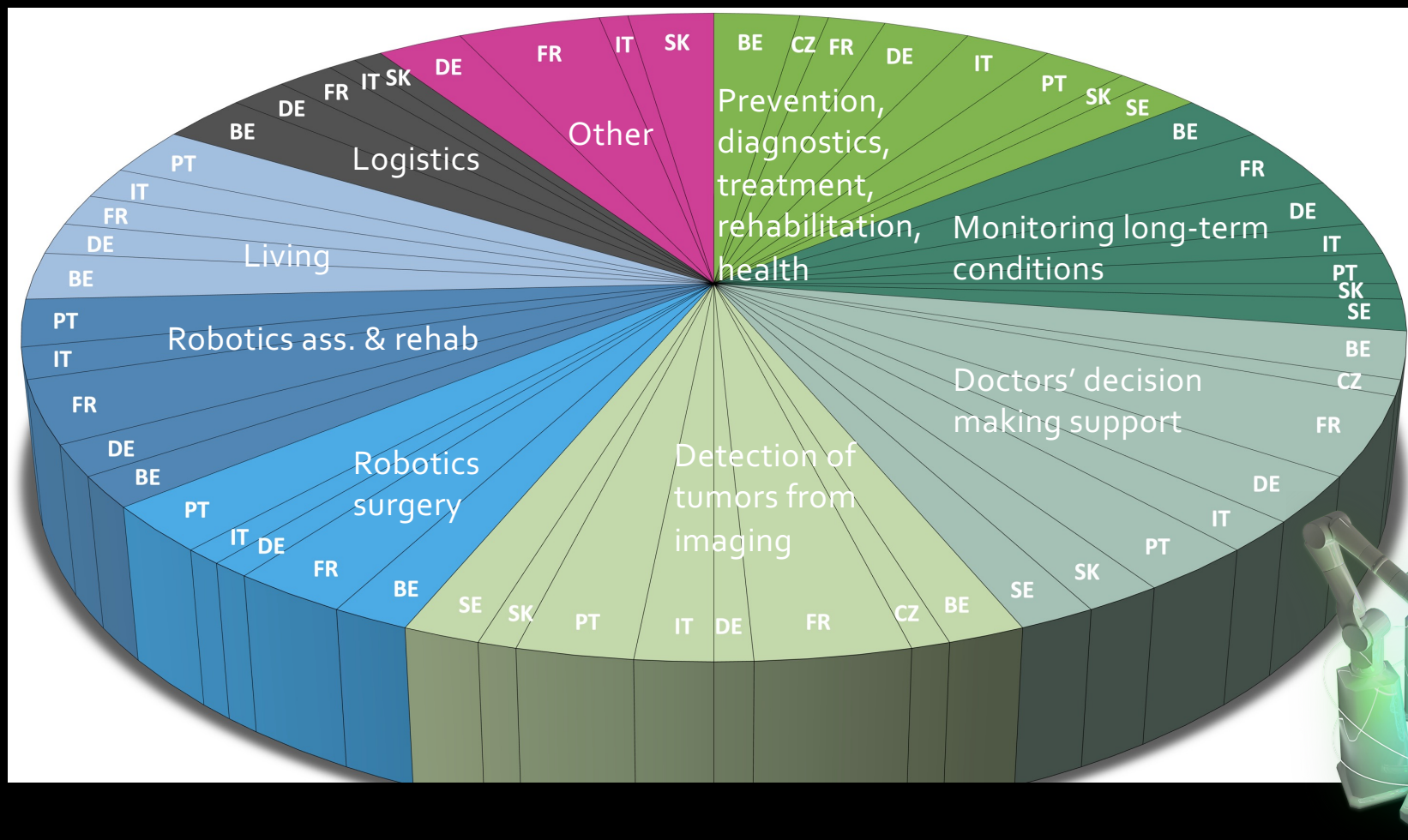


● Node & Node Lead
● Associated & Associated Lead

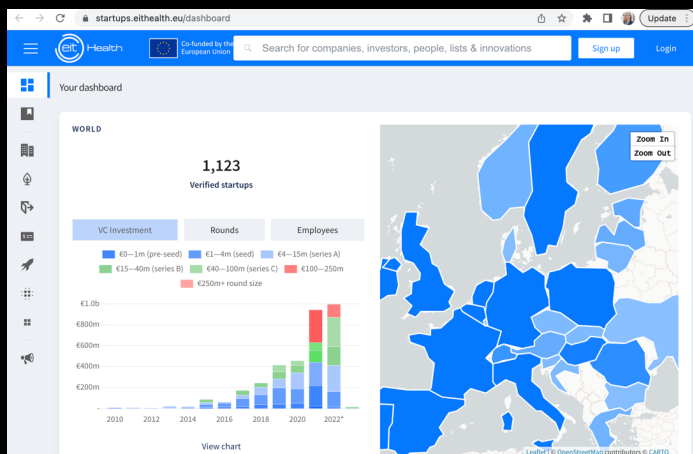
* Public, Non-profit
 • Private, Non-profit
 ◦ Private, Profit



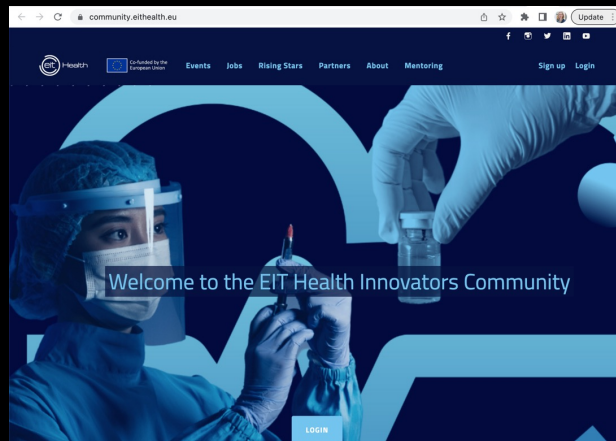
TEF-Health Use Cases



Services for Startups and SMEs



<https://startups.eithealth.eu>



<https://community.eithealth.eu/>



Partnering with European Digital Innovation Hubs (EDIH)

Digital Innovation Hubs

DIHs **European DIHs**

Search

Countries

Technologies

Services Provided

Sectors

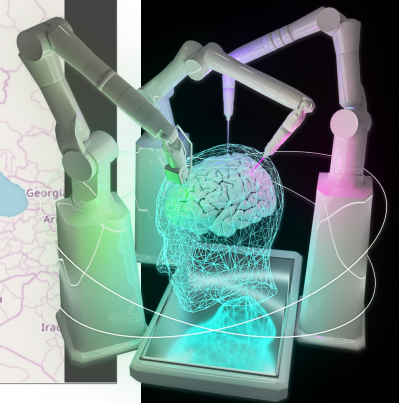
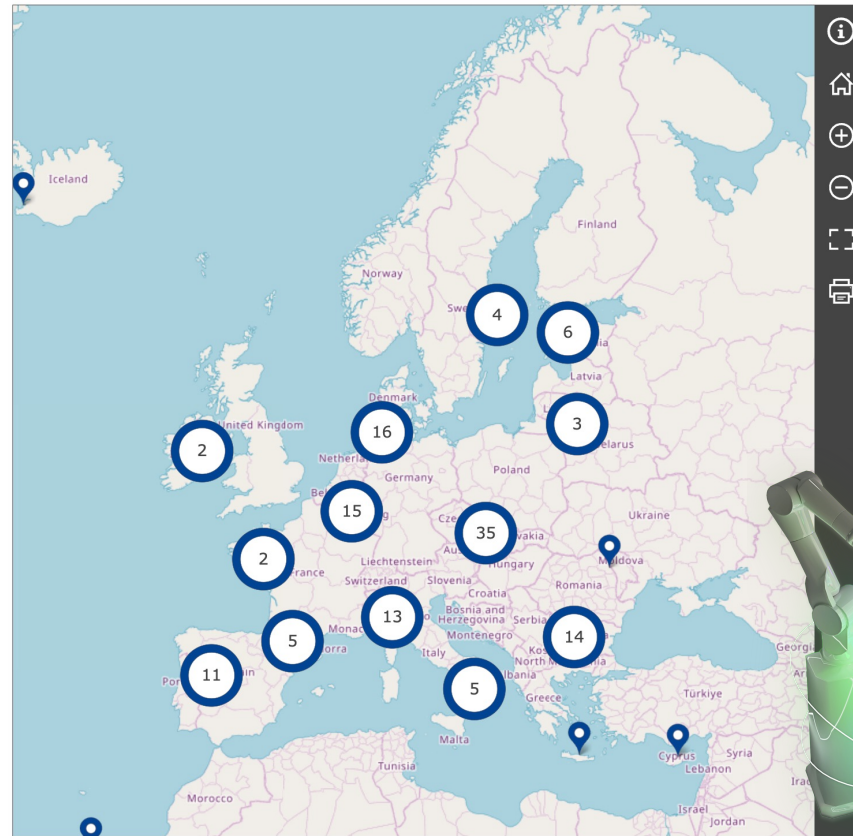
Type

Internal Hub Id

Refine results

Contact us in the following email: JRC-DIH@ec.europa.eu

Clear all



<https://s3platform.jrc.ec.europa.eu/>

Partnering with #euCancerImaging



The screenshot shows the European Commission website. At the top, there is the European Commission logo and a language selector set to 'English'. Below this is a navigation bar with the heading 'Shaping Europe's digital future' and links for Home, Policies, Activities, News, Library, Funding, Calendar, and Consultations. The main content area has a breadcrumb trail: 'Home > Policies > European Cancer Imaging Initiative'. The title 'European Cancer Imaging Initiative' is prominently displayed. Below the title, a paragraph states: 'The European Cancer Imaging Initiative will unlock the power of imaging and Artificial Intelligence for the benefit of cancer patients, clinicians and researchers.' Another paragraph follows: 'The **European Cancer Imaging Initiative** is one of the flagships of the Europe's Beating Cancer Plan (EBCP). One of the objectives of the Plan is to make the most of the potential of data and digital technologies such as Artificial Intelligence (AI) or High-Performance Computing (HPC) to combat cancer.' A small version of the initiative's logo is shown in the bottom right corner of the content area.

European Commission

English

Search

Shaping Europe's digital future

Home Policies Activities News Library Funding Calendar Consultations

Home > Policies > European Cancer Imaging Initiative

European Cancer Imaging Initiative

The European Cancer Imaging Initiative will unlock the power of imaging and Artificial Intelligence for the benefit of cancer patients, clinicians and researchers.

The **European Cancer Imaging Initiative** is one of the flagships of the Europe's Beating Cancer Plan (EBCP). One of the objectives of the Plan is to make the most of the potential of data and digital technologies such as Artificial Intelligence (AI) or High-Performance Computing (HPC) to combat cancer.



<https://digital-strategy.ec.europa.eu/en/policies/cancer-imaging>

AI Regulatory Sandboxes

‘AI regulatory sandboxes established by one or more Member States competent authorities or the European Data Protection Supervisor shall provide a controlled environment that facilitates the development, testing and validation of innovative AI systems for a limited time before their placement on the market or putting into service pursuant to a specific plan [...] under the direct supervision and guidance by the competent authorities with a view to ensuring compliance with [...]this Regulation and, where relevant, other [...] legislation supervised within the sandbox.’

Art. 53(1) AI Act (Commission proposal)

Promote trust & excellence in AI

- Art. 53 AIA – Framework and legal basis for AI regulatory sandboxes
- Art. 53(6) AIA – Implementing acts on the modalities for operation
- Art. 54 AIA – Legal basis for further processing of personal data



EBRAINS

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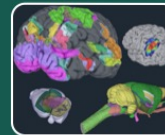
6000

EBRAINS is powering a new era
in Brain Research



Data and Knowledge

- Online solutions to facilitate sharing of and access to research data, computational models and software



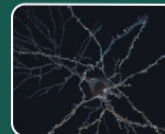
Atlases

- Navigate, characterise and analyse information on the basis of anatomical location



Simulation

- Solutions for brain researchers to conduct sustainable simulation studies and share their results



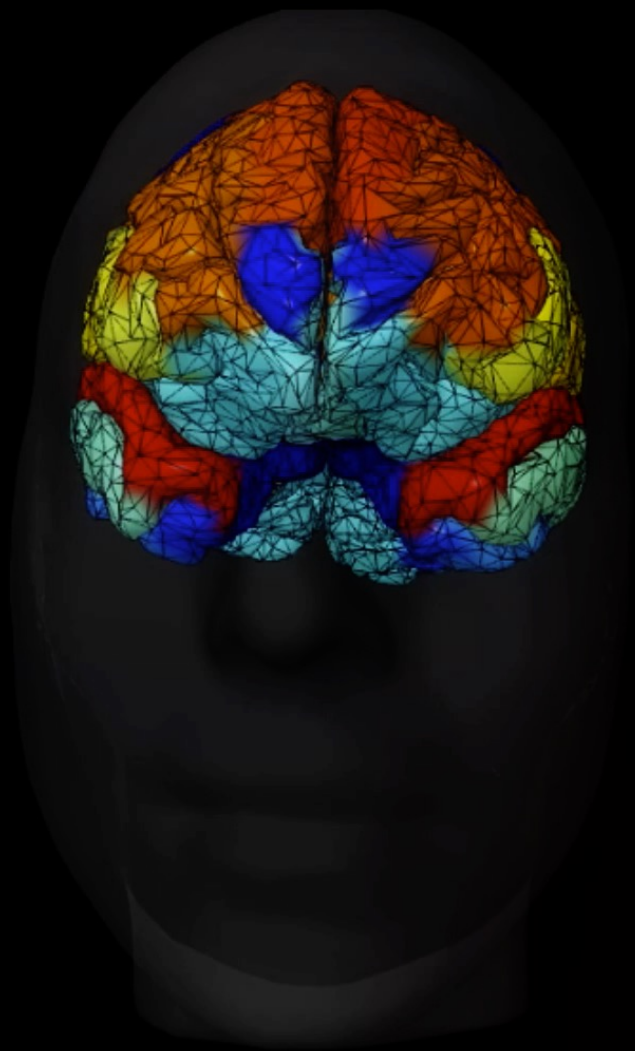
Brain-Inspired Technologies

- Understand and leverage the computational capabilities of spiking neural networks



Medical Data Analytics

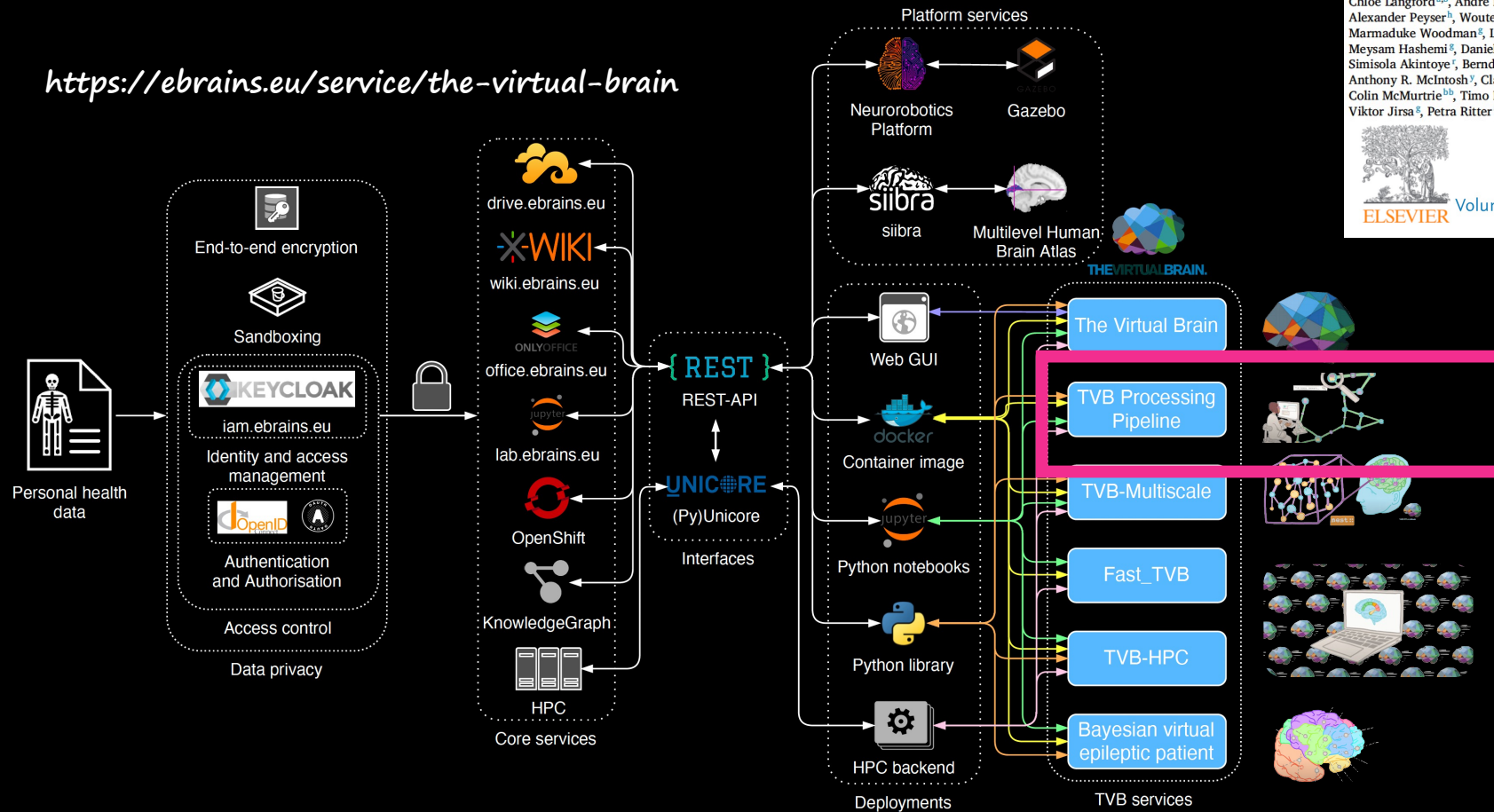
- The Medical Data Analytics service provides two unique EBRAINS platforms, covering key areas in clinical neuroscience research



Ritter, P., M. Schirner, A. R. McIntosh and V. K. Jirsa (2013). "The virtual brain integrates computational modeling and multimodal neuroimaging." *Brain Connect* 3(2): 121-145.

EBRAINS ESFRI Research Infrastructure

<https://ebrains.eu/service/the-virtual-brain>



Access control, encryption and sandboxing

Brain simulation as a cloud service: The Virtual Brain on EBRAINS

Michael Schirner^{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}, Lia Domide^f, Dionysios Perdakis^{a,b}, Paul Triebkorn^{a,b,g}, Leon Stefanovski^{a,b}, Roopa Pai^{a,b}, Paula Prodan^f, Bogdan Valean^f, Jessica Palmer^{a,b}, Chloé Langford^{a,b}, André Blickensdörfer^{a,b}, Michiel van der Vlag^h, Sandra Diaz-Pier^h, Alexander Peyser^h, Wouter Klijn^h, Dirk Pleiter^h, Anne Nahmⁱ, Oliver Schmid^k, Marmaduke Woodman^k, Lyuba Zehl^l, Jan Fousek^k, Spase Petkoski^k, Lionel Kusch^k, Meysam Hashemi^k, Daniele Marinazzo^{m,n}, Jean-François Mangin^o, Agnes Flöel^{p,q}, Simisola Akintoye^r, Bernd Carsten Stahl^l, Michael Cepic^l, Emily Johnson^l, Gustavo Deco^{u,v,w,x}, Anthony R. McIntosh^y, Claus C. Hilgetag^{z,aa}, Marc Morgan^k, Bernd Schuller^l, Alex Upton^{bb}, Colin McMurtrie^{bb}, Timo Dickscheid^l, Jan G. Bjaalie^{cc}, Katrin Amunts^{l,dd}, Jochen Mersmann^{ee}, Viktor Jirsa^g, Petra Ritter^{a,b,c,d,e,f,g,h,i}



NeuroImage

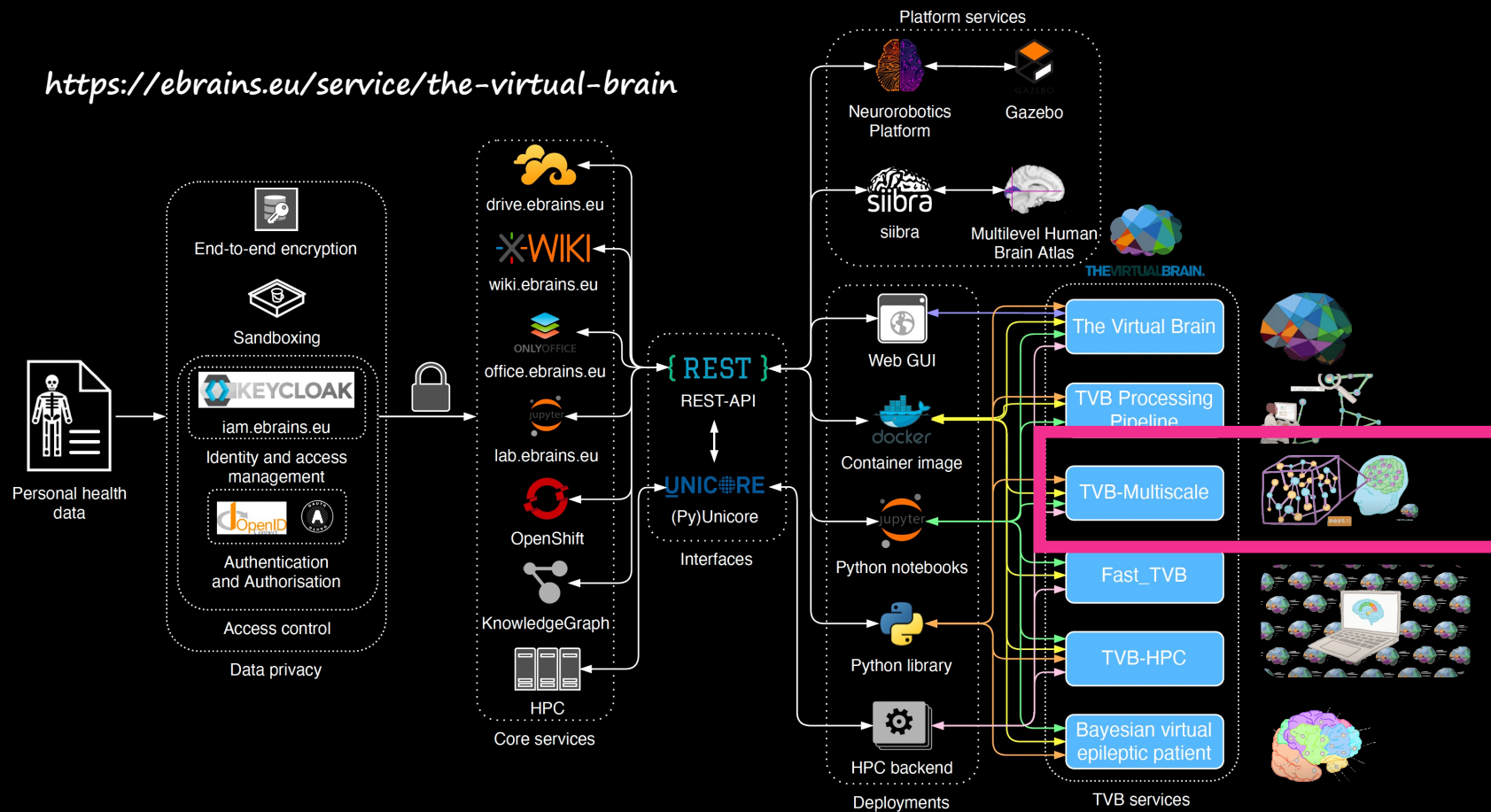
Volume 251, 1 May 2022, 118973

Container workflows for building digital twins



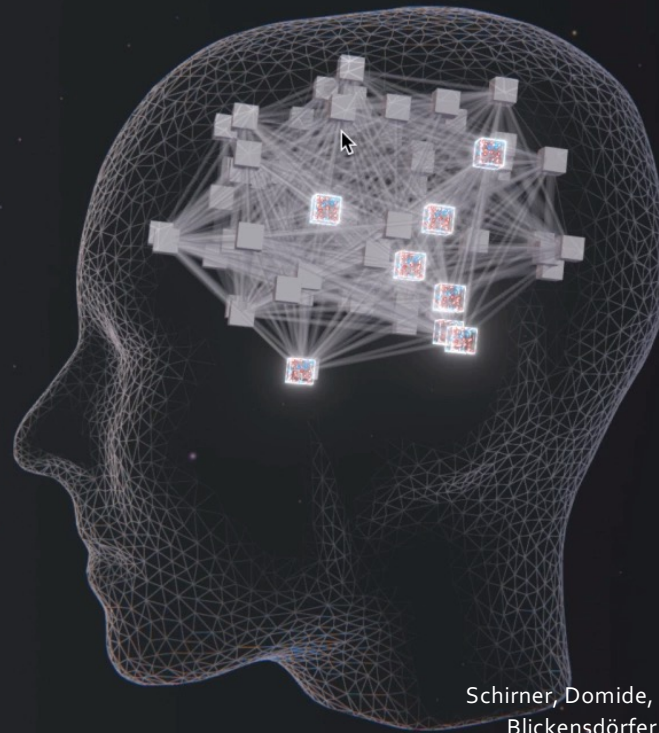
EBRAINS ESFRI Research Infrastructure

<https://ebrains.eu/service/the-virtual-brain>



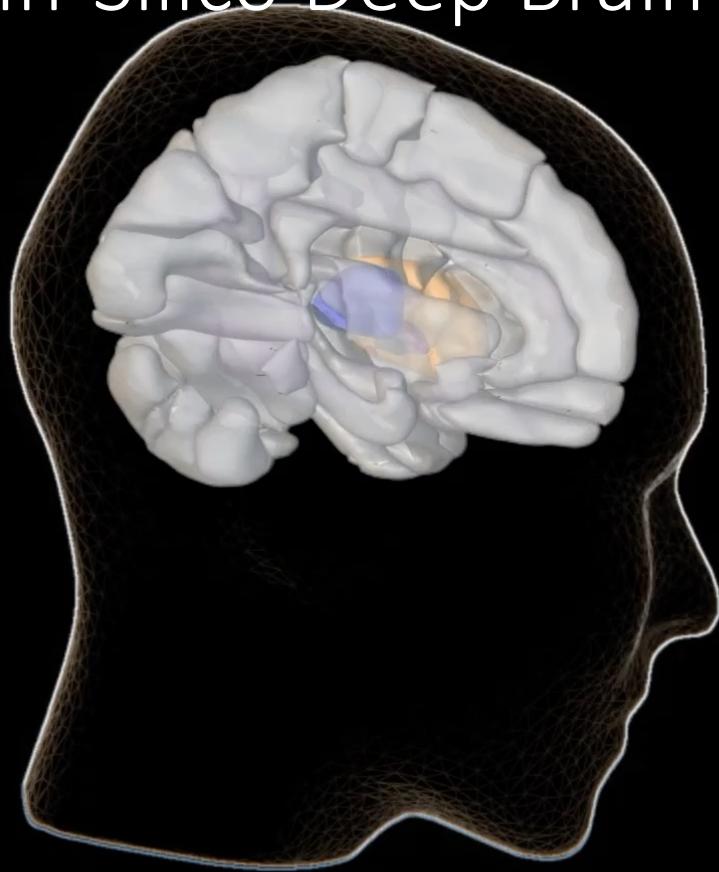
Access control, encryption and sandboxing

Multiscale Co-Simulation



Schirner, Domide, Perdakis, Triebkorn, Stefanovski, Pai, Popa, 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 Service: The Virtual Brain on EBRAINS**. (2022) Neuroimage

In-Silico Deep Brain Stimulation

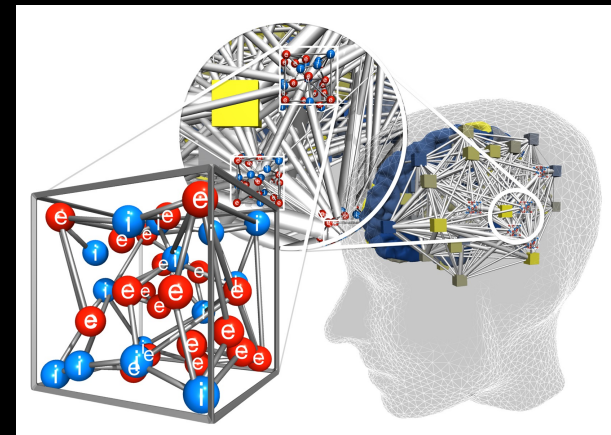


EJN

European Journal
of Neuroscience

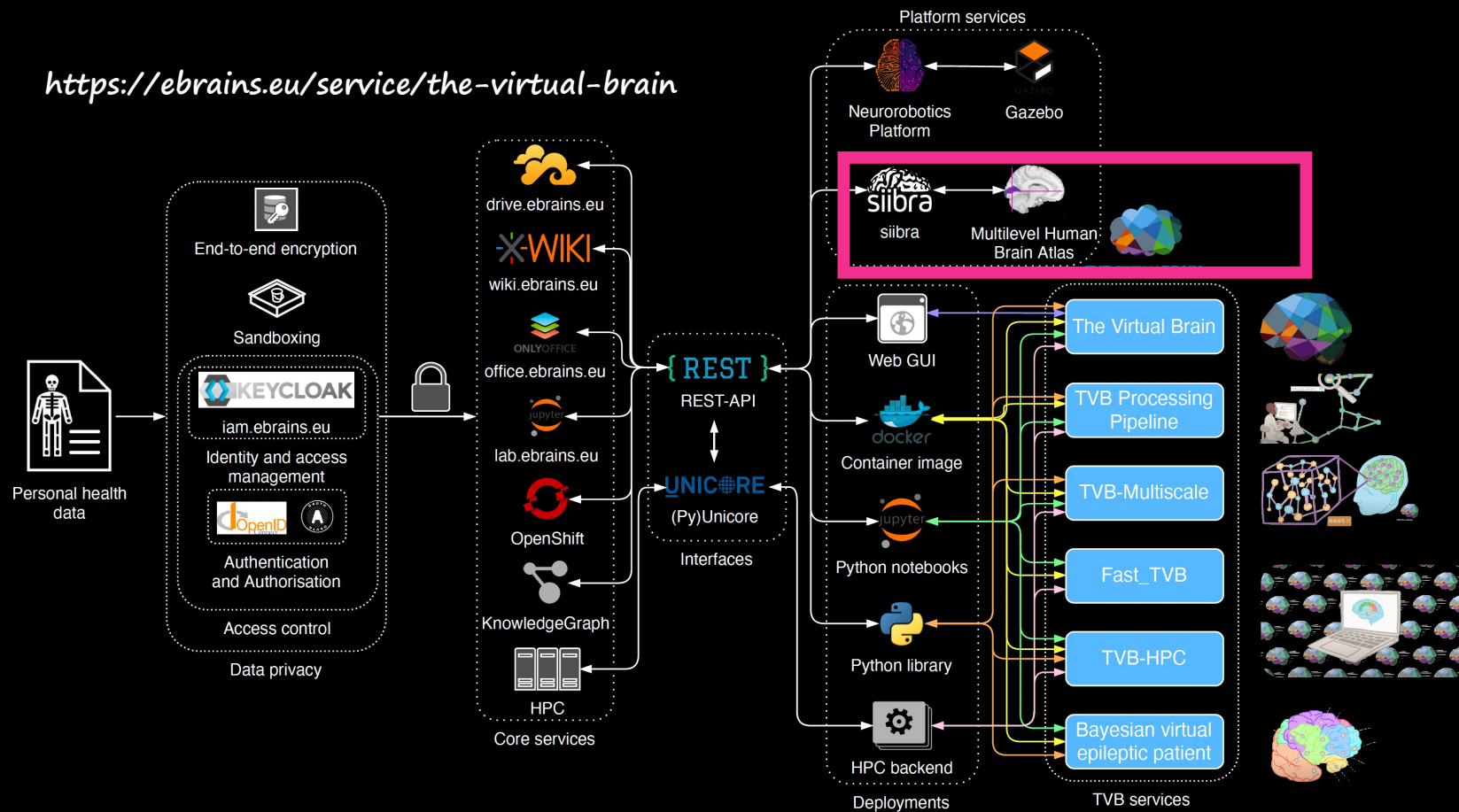
Virtual deep brain stimulation: Multiscale co-simulation of a spiking basal ganglia model and a whole-brain mean-field model with The Virtual Brain

Jil M. Meier, Dionysios Perdikis, André Blickensdörfer, Leon Stefanovski, Qin Liu, Oliver Maith, Helge Ü. Dinkelbach, Javier Baladron, Fred H. Hamker, Petra Ritter



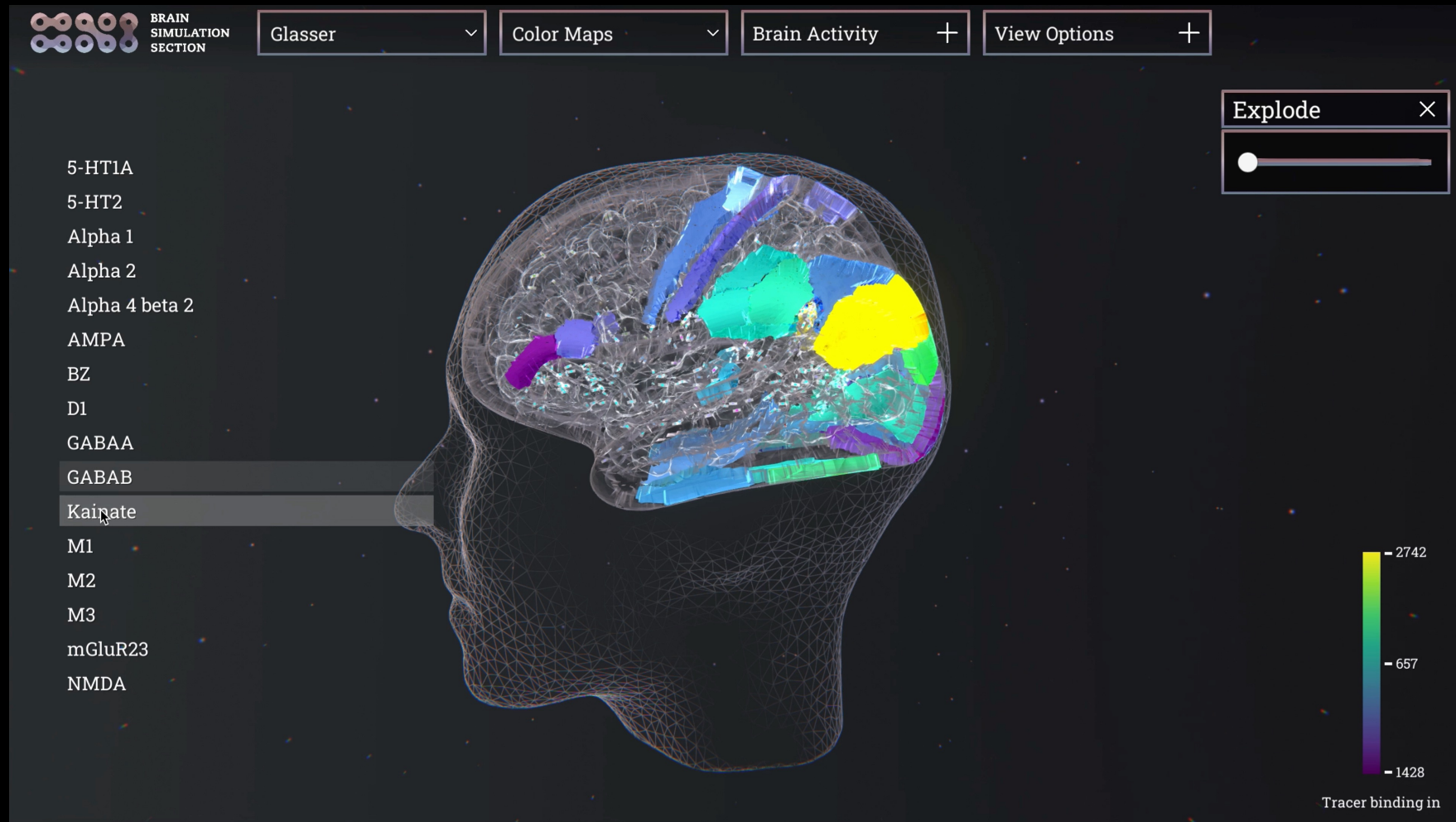
Linking TVB and Digital Atlases

<https://ebrains.eu/service/the-virtual-brain>



Access control, encryption and sandboxing

Integrating data from digital atlases into brain models – using standardized spatial reference spaces



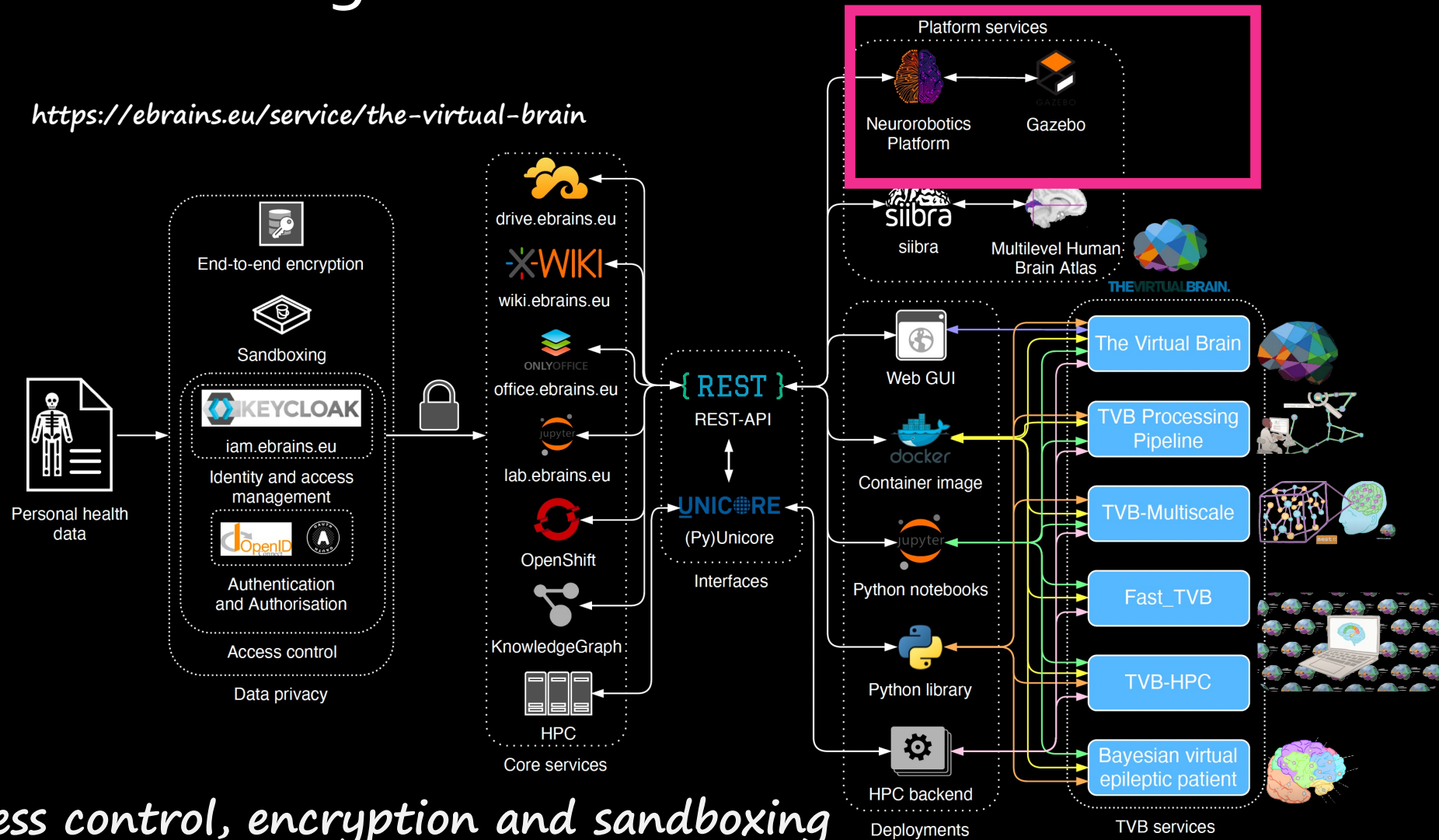
Integrating data from knowledge graphs into brain models – using standardized spatial reference spaces



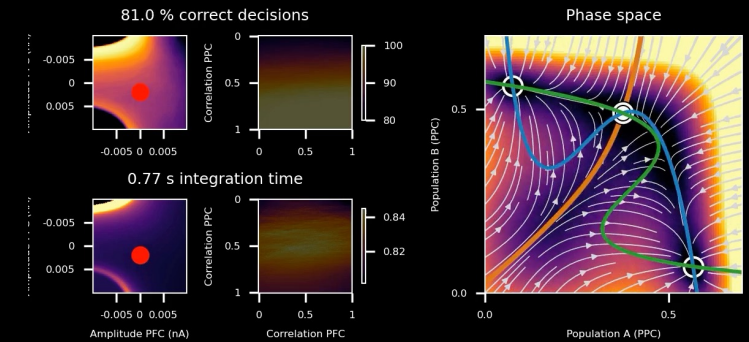
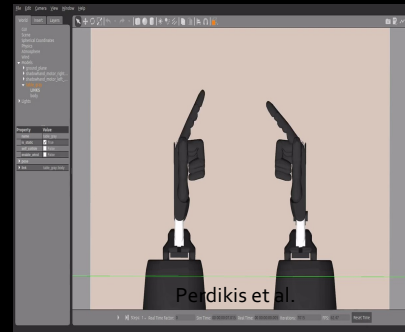
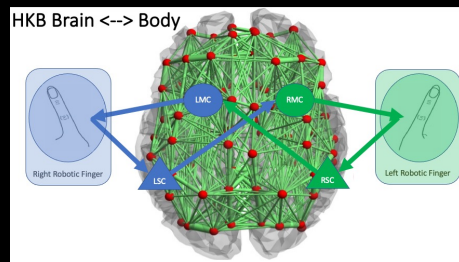
Stefanovski, Triebkorn, Spiegler, Diaz-Cortes, Solodkin, Jirsa, Randal McIntosh, Ritter; for the Alzheimer's Disease Neuroimaging Initiative (2019). Linking molecular pathways and large-scale computational modeling to assess candidate disease mechanisms and pharmacodynamics in Alzheimer's disease. *Frontiers Computational Neuroscience*

Connecting The Virtual Brain to a Virtual Robot

<https://ebrains.eu/service/the-virtual-brain>



Robotics & Behavior



Schirner, Deco & Ritter (2023) Learning how network structure shapes decision-making for bio-inspired computing.
Nature Communications (in press)

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Advanced neurotechnology

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High-tech EEG/brain sensing devices and software solutions for real-world human behaviour research, health and neurotechnology development.

We help research, tech and health professionals to leverage neuroscience in a practical and reliable way.

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Technology for Neurorehabilitation

Ethics and Outreach



EU Parliament Lunch Debates

2021



Digital Data for Dementia Research and Innovation




"World-wide exchange of data is crucial. Data privacy is also crucial. There is no simple solution to simultaneously and efficiently meet both these needs. The solution proposed by Virtual Brain Cloud is to use encryption, sandboxing and access control as technical means to protect personal data."

Professor Petra Ritter
Berlin Institute of Health
Charité – Universitätsmedizin Berlin


 #AEPParliamentWorkshop

2022




European Parliament Lunch Debate

The role of artificial intelligence and big data in dementia research



"Trustable digital twin technologies and AI applications in health rely on the large-scale availability of interoperable health data, and data infrastructures that meet GDPR requirements for patient privacy. In Virtual Brain Cloud and EBRAIN-Health, we are developing solutions to meet these needs."

Petra Ritter
Project Coordinator, VirtualBrain-Cloud; Berlin Institute of Health at Charité University Hospital

 #AELunchDebate

Thank you!

