Sim4Life User Workshop @ ISMRM 2023 ZMT Zurich MedTech AG



Welcome to the Sim4Life User Workshop @ ISMRM 2023

Cutting-Edge Solutions for Medical Technology

Agend

Sim4Life User Workshop @ ISMRM 2023

Tuesday, June 6, 18:30 – 22:00 hrs Venue: Kensington Junior Ballroom, Delta Hotels by Marriott Toronto, 75 Lower Simcoe St, Toronto, ON M5J 3A6, Canada

Agenua	
18:30 – 18:40	Novelties Unraveled – Features in Sim4Life that Advance your R&D Melina Bouldi & Habib Bousleiman, ZMT Zurich MedTech AG, Switzerland
18:40 – 19:00	Peripheral Nerve Stimulation Analysis of MRI Head Gradient Coils with Human Body Models <i>Yihe Hua, GE Global Research, USA</i>
19:00 – 19:20	Applications of Gradient Array Coils Ergin Atalar, Bilkent University, Turkey
19:20 – 19:40	Parallel Transmit RF Simulation Workflows Joseph Rispoli, Purdue University, USA
19:40 – 19:55	Break



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18:40 – 19:00	Peripheral Ne with Human B <i>Yihe Hua, GE</i>	
19:00 – 19:20	Applications of <i>Ergin Atalar, E</i>	
19:20 – 19:40	Parallel Transr Joseph Rispo	
19:40 – 19:55	Break	
		A

TELS	19:55 – 20:15	Are We There Already Angle on Safe Implant <i>Bernd Ittermann, Phys</i>
	20:15 – 20:35	RF Heating of Epicarc <i>Kagayaki Kuroda, Toka</i>
	20:35 – 20:55	Heart Failure Monitori <i>Nico van den Berg, U</i>
	20:55 – 21:00	Next in Sim4Life! <i>Michael Oberle, ZMT</i>
	21:00 – 22:00	Networking Reception
		To register, please send
		Directions to the Delta I



2 ISMRM 2023

or Can We Do Better? A Slightly Different Scanning sikalisch-Technische Bundesanstalt (PTB), Germany

dial Lead and Abandoned Lead ai University, Japan

ing with Radiofrequency Sensing JMC Utrecht, The Netherlands

Zurich MedTech AG, Switzerland

l an email to <u>s4l-sales@zmt.swiss</u>

Hotels by Marriott Toronto



us tonight!

Sim4Life User Workshop at ISMRM 2023, ZMT, Toronto, Canada, 20230606



Thank you for being with

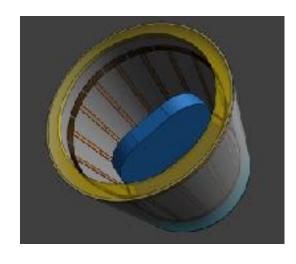
ZMT Zurich MedTech AG

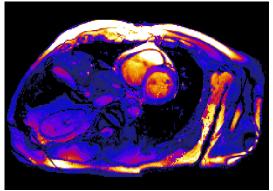


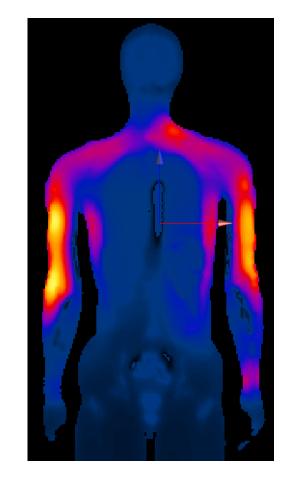


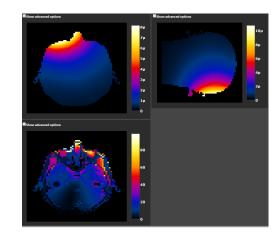
Sim4Life - What's Next?

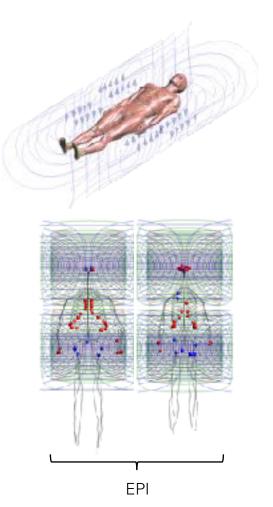
Sim4Life - Delivering a Comprehensive MRI Simulation Platform











RF Transmit Technology Design & Optimization

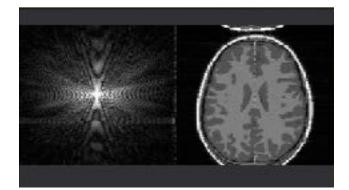
Safety Evaluation

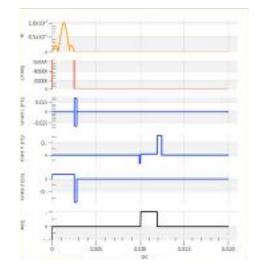
RF Receive Technology Design & Optimization

Gradient Technology

PNS

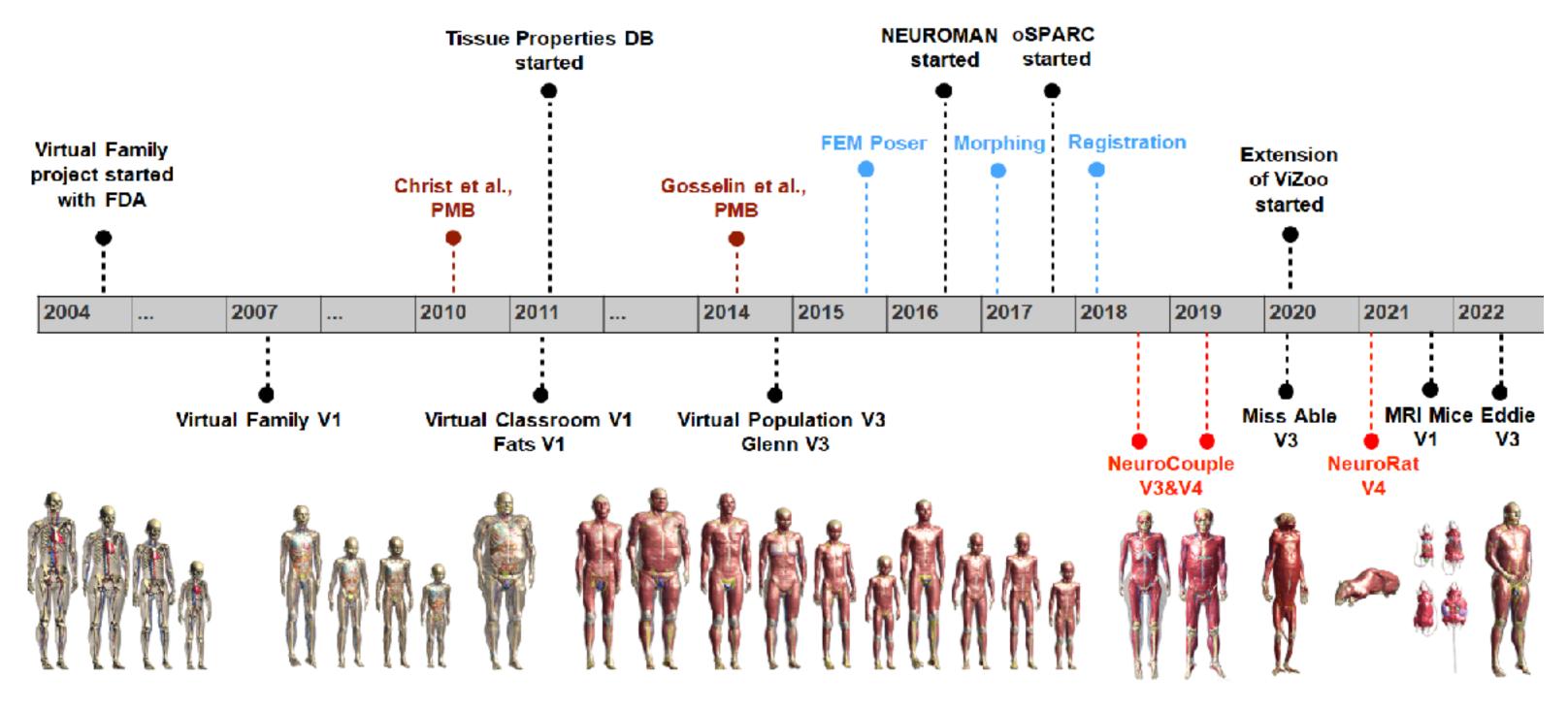






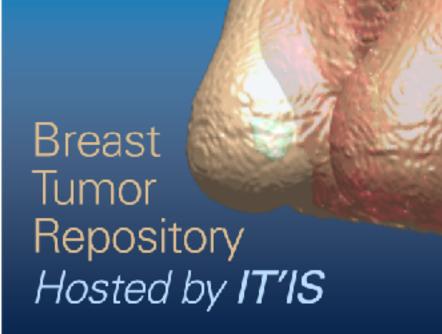
Imaging Technology

Virtual Family / Virtual Population - The Benchmark in MedTech





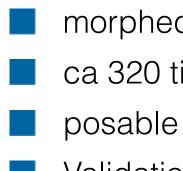
Continued Expansion of Virtual Population





Erasmus Medical Center, NL 22 breast models with tumors for hyperthermia simulations

3.5-year-old girl
267 tissues
from MRI and CT
Martinos Center, Boston



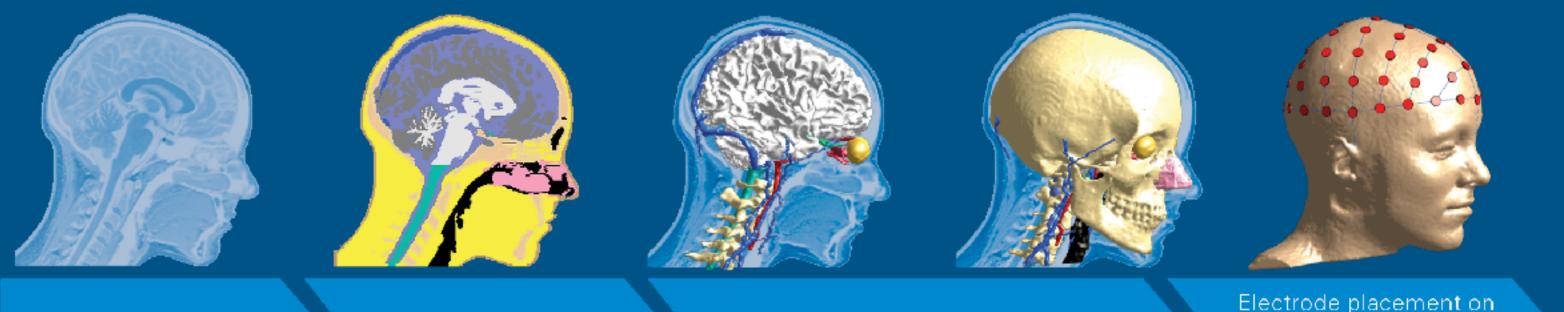


Heavy Weight Yet Light on Their Feet New Class III Obese ViP Models



- morphed models with BMI > 65ca 320 tissues
- Validation: University Hospital Zurich

Personalisation of Brain Stimulation Applications



Magnetic resonance image of patient

Automatic segmentation of head tissues

Surface-based head model

- personalized/precision medicine
- treatment planning and optimization
- "personalized" safety assessment
- registration approach
- find transform that maps "template model" to new patient images

machine learning approach

- train network (e.g., UNet) to predict tissue segmentation in new patient images



Electrode placement on personalized head model based on international 10-10 system

Al-Based Anatomical Model Generation

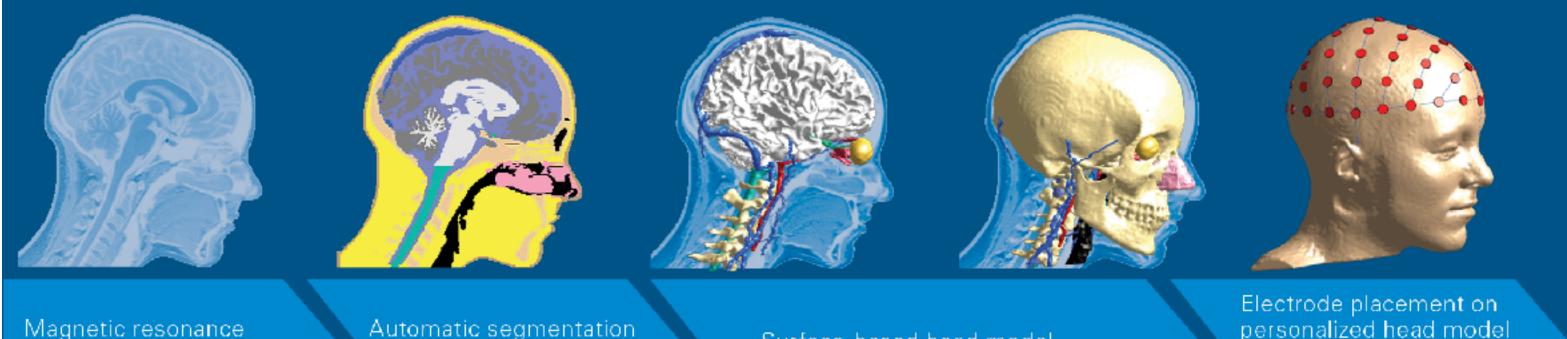


image of patient

Automatic segmentation of head tissues

Surface-based head model

next version will include additional tissues

- tongue, muscle, glands
- deep brain structures
- and improved blood vessels
- ▶ target: 26+ tissue classes



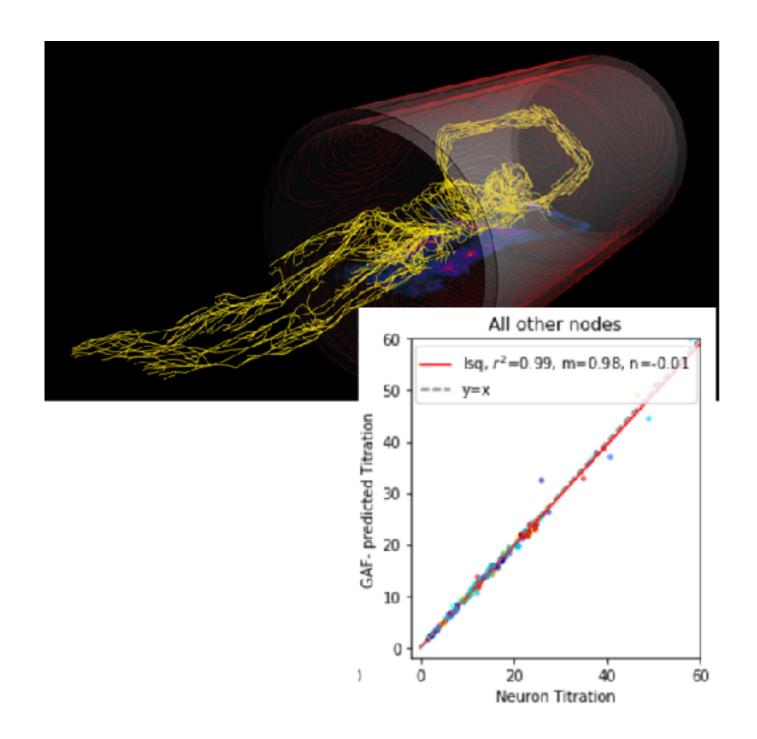
personalized head model based on international 10-10 system

Generalized Activation Function - Instant & Accurate Prediction

- prediction of PNS thresholds and site of activation for fast switching MRI gradients - investigation related to MRI safety & MRI gradient
 - coil design & optimization
- 2500 whole body axons

Results

- electrophysiological simulations required ~6h using MPI acceleration, with 64 cores
- GAF calculation and prediction ~seconds, single CPU
- enables large scale investigations: multiple anatomical models, scanning positions, body postures, pulse shapes

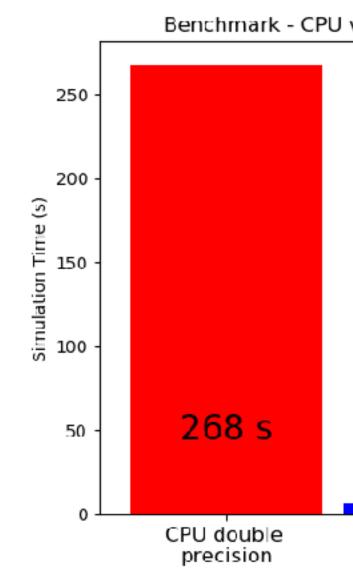




Thermal Solver for GPU Acceleration - Multiple GPU Next

- enabling thermal solver to run on modern graphical processing units (GPUs)
 - wide range of NVIDIA GPU architectures and models supported
 - substantial speed-up of simulations
 - higher simulation throughput, ideal for iterative and optimization processes

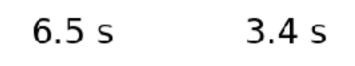
massively cutting down development time and cost



zurich med tech

Benchmark - CPU vs. 1xGPU - 12 MCells - 20s Heating

CPU: AMD Ryzen 9 5950X GPU: NVIDIA RTX 3070

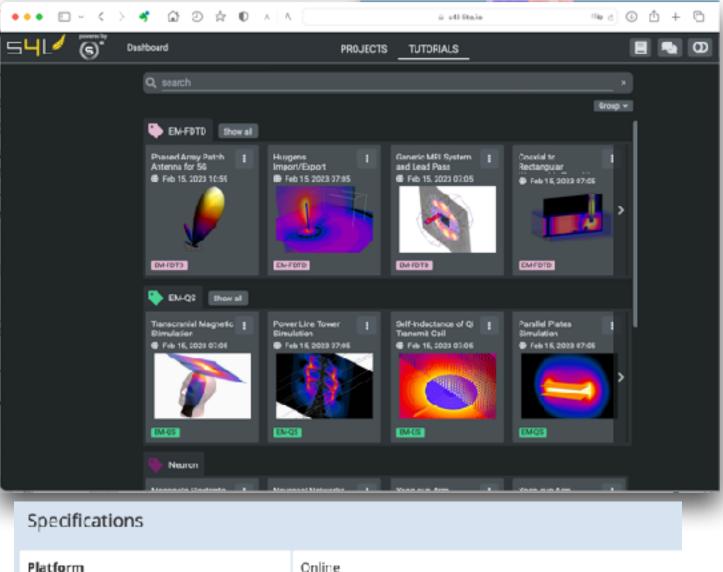


GPU double precision

GPU single precision

S4L^{lite}

- online student edition of Sim4Life
 https://s4I-lite.io/
- allows students to easily access, run, and share simulations in the cloud from any web browser
 - free of charge
 - flexible, maintenance-free
- does not require powerful in-house computational resources: it relies on scalable cloud-computing infrastructure.
- simulation of modeling projects up to 20 million grid cells
 - far more than provided in any other competitor "student" version



Platform
Application
Number of Objects
Grid Size
Solvers
GPU Acceleration
ViP Human Models
Python
3rd-Party Tools
Pricing

Online
self-directed study
unlimited
max. 20 Mio cells
EM-FDTD, EM-QS, Thermal. Neuro. Acoustic
no
Yoon-sun
yas
no
free-of-charge

S4L lite, 20230601 12

S4L *lite* Student Competition 2023

For more information: https://s4l-lite.io/

54/* **Student Competition 2023**

Access, run and share your simulations in the cloud! ZMT invites you to submit your modeling project to the "S4L^{lite} Student Competition 2023", which recognizes the outstanding use of numerical simulations in various research areas at universities.



Who may participate?

Undergraduate, graduate and PhD students

How to participate?

- Define your specific problem to be solved with numerical simulations
- Get an account for S4L^{lite} (register here)
- Model and solve you problem with S4L^{lite}
- Share your project with us along with a short explanation

Deadline

October 31, 2023

Prizes

1st Student: US\$ 1000 Prize Institute: Permanent Sim4Life license & 1 Solver 2nd Student: US\$ 750 Prize Institute: 3-year Sim4Life license & 1 Solver 3rd Student: US\$ 500 Prize Institute: 1-year Sim4Life license & 1 Solver

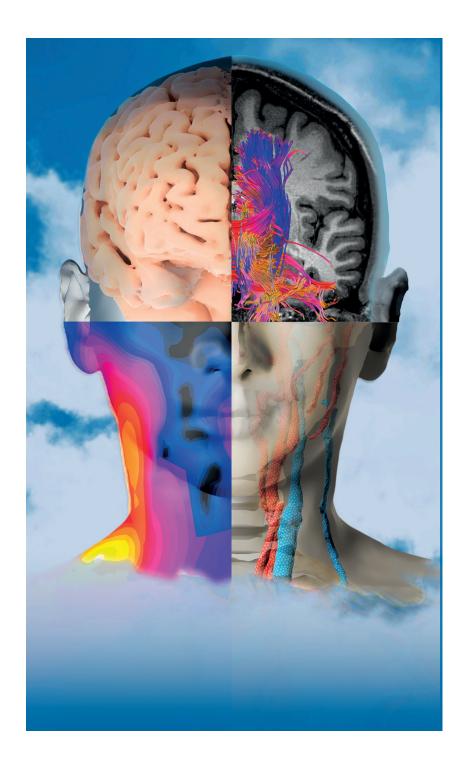
The winning projects will be announced, published and documented as S4L^{lite} tutorials on https://s4l-lite.io/.

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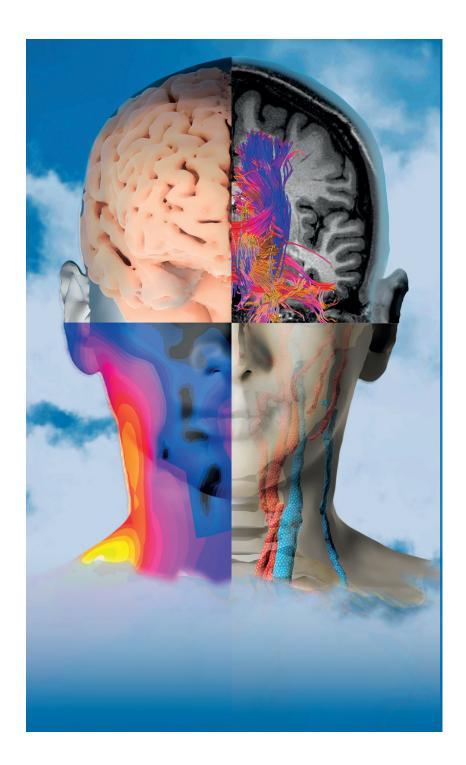




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sed November 2023!

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Thank You! ZMT Zurich MedTech AG

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