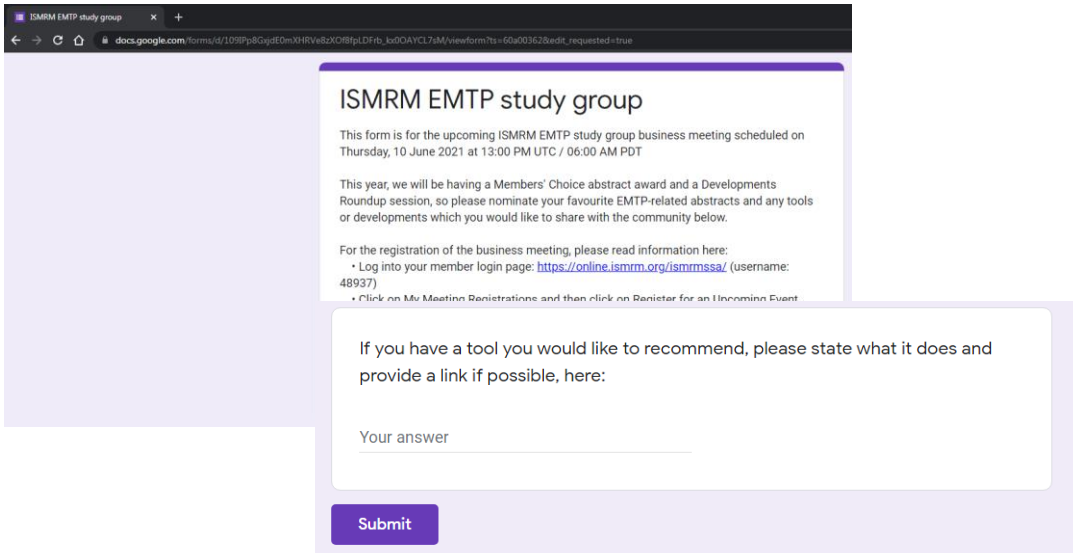
Tools Roundup



New feature: tools roundup

These are Study Group requests in answer to the questionnaire which Jongho sent to the SG mailing list near the end of May 2021.

We received 14 methods recommendations.

Tools Roundup

Acquisition
- 3D-EPI Siemens WIP 1043A
- ASPIRE online coil combination for Siemens (C2P)

Pre-processing
- SEGUE phase unwrapping
- ROMEO phase unwrapping

SWI
- CLEAR-SWI

QSM
- SMWI (for nigrosome 1), QSMnet, QSMnet+
- AutoQSM & MoDL-QSM
- FANSI
- TKD etc
- QSMxT
- LPCNN - DL QSM for arbitrary magnetic direction
- SEPIA

Conductivity:
- UCL
- EPTlib

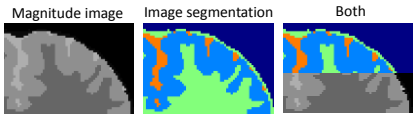
These are the tools we will be looking at, arranged into Acquistion, Pre-processing, SWI, QSM and ETP-related.

An abbreviated version of the authors‘ text appears with each slide.

Acquisition methods: 3D-EPI WIP from Siemens Australia and UQ, on-console coil combination with ASPIRE
Phase unwrapping with SEGUE from UCL, ROMEO from the Medical University of Vienna
CLEAR-SWI, a multi-echo SWI method for UHF from the Medical University of Vienna
Susceptibility Map Weighted Imaging, QSMnet and QSMnet+ from Seoul National University
AutoQSM from Shanghai Jiao Tong University
Fansi from Carlos Milovic
TKD methods from UCL
QSMxT from the University of Queensland
LPCNN QSM tool for arbitrary magnetic field direction from Johns Hopskins and the meta QSM tool
SEPIA from Kwok-shing Chan and Jose Marques from Radboud University Nijmegen
And we finish with conducitivity tools from Anita Karsa and Karin Shmueli
And EPTlib from Alessandro Arduino and Ulrich Katscher

MRI Conductivity (UCL)

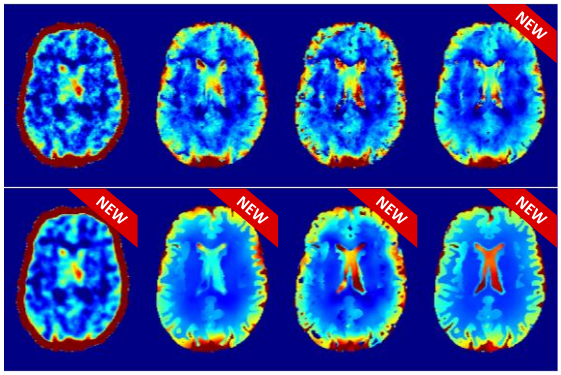
Anita Karsa and Karin Shmueli



$$\sigma = \frac{1}{\mu_0 \omega} \nabla^2 \varphi_0$$

Phase-based EPT:

$$\sigma = \frac{1}{\mu_0 \omega} \oint \int \nabla \varphi_0 \, d\boldsymbol{s}$$

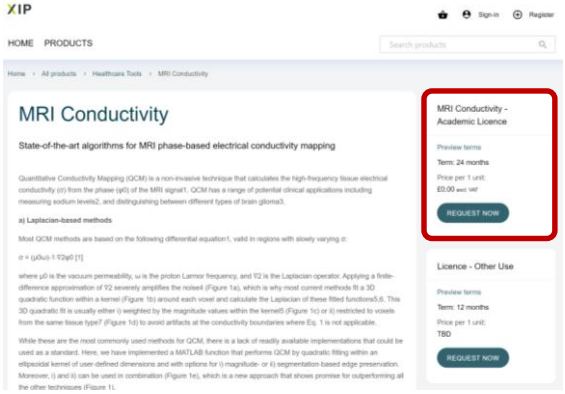


Abstract:
Karsa et al. "New Approaches for Simultaneous Noise Suppression and Edge Preservation in Quantitative Conductivity Mapping From Low-SNR Data." Proceedings of the 29th Annual Meeting of ISMRM. p.3774. 2021.

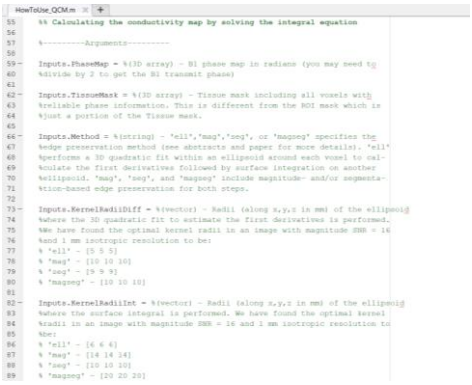
We're into the home straight now in the ETP section.

The MRI conductivity mapping tool developed at UCL contains MATLAB implementations of all methods presented in the abstract below. These methods are based on two different formulations of the phase-based Helmholtz equation and include edge preservation based on the magnitude image and/or the image segmentation.

MRI Conductivity (UCL)



HowToUse_QCM.m



Links:
https://xip.uclb.com/product/MRI_conductivity
(https://xip.uclb.com/i/software/MRI_conductivity.html also redirects here)

Email: anita.karsa.14@ucl.ac.uk or segueUCL@gmail.com

The MATLAB functions are licenced for free for academic use and can be downloaded from the UCL XIP website. The HowToUse_QCM.m file contains a detailed list of all the necessary inputs and their descriptions.

EPTlib

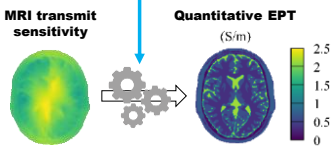
Alessandro Arduino

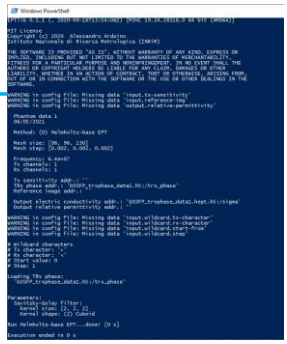
EPTlib has been developed in the framework of the 18HLT05 QUIERO Project. This project has received funding from the EMPIR Programme, co-financed by the Participating States and from the European Union's Horizon 2020 Research and Innovation Programme.

https://eptlib.github.io/

EPTlib:

- is an open-source, extensible C++ library collecting EPT methods.
- implements 3 methods:
  - Helmholtz-EPT
  - Convection-reaction-EPT
  - Gradient-EPT
- includes a terminal application.
  - Input data in HDF5 format
  - Configuration file in TOML format
- is an ongoing project distributed by an MIT license
  - Everybody can contribute to its development!





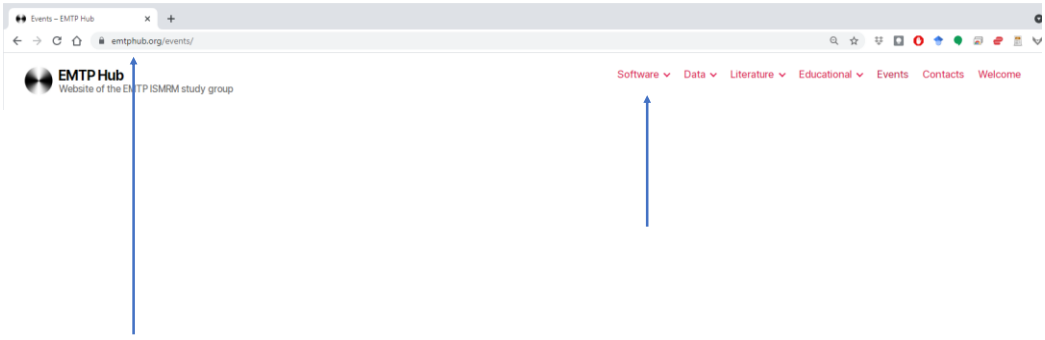
Links:

- https://eptlib.github.io/
- A. Arduino. EPTlib: An Open-Source Extensible Collection of Electric Properties Tomography Techniques. *Applied Sciences*, 11(7):3237, 2021.

Finally, EPTlib is an open-source, extensible C++ library collecting EPT methods. Currently, EPTlib implements 3 methods: Helmholtz-EPT, Convection-reaction-EPT and Gradient-EPT. It also includes a terminal application for a ready-to-use adoption of the implemented methods with standardized file formats.
EPTlib is an ongoing project. The currently implemented methods can be optimized and new methods can be introduced in the near future.

Everybody are invited to contribute to EPTlib by reporting issues, suggesting improvements or by forking the Github repository.

Tools Roundup



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I'd like to thank all the authors who contributed their slides and methods. With their permission, we'll be including these slides in the software section of the emtphub.org website