QUIERO

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EMPIR EURAMET

QUantitative Imaging Enables Reproducible Outcomes

18HLT05 – Quantitative MR-based Imaging of Physical Biomarkers

Welcome to the first newsletter of the European EMPIR project 18HLT05 QUIERO, whose aim is to evaluate the suitability of two MR-based emerging techniques, Electrical Properties Tomography (EPT) and Magnetic Resonance Fingerprinting (MRF), to contribute to the "quantitative revolution" in MRI. The project started in June 2019 and will run for three years.
Our consortium is composed of six European metrology institutes, two clinical centres and three universities.

The second formal meeting of the project, organized by the Institute of Metrology of Bosnia and Herzegovina, took place on 27-28 February 2020 in Sarajevo. In the last months, the stakeholder committee grew and now it counts experts from 14 different affiliations, including relevant international societies, scanner manufacturers, scientific and clinical institutes.
Here you can find a summary of the last scientific achievement.

Happy reading!

We are on the web!

Visit our website and take a look at our pages on LinkedIn and ResearchGate

Watch the video that explains QUIERO's work plan.

Highlights

The EPT algorithms implemented by the consortium will be made available through EPTlib, an extensible, open-source, C++ library currently under development on GitHub. For the first time ever, EPTlib will give open access to EPT codes, fostering their further development and adoption in clinical practice.

Contacts

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Consortium

INRiM Istituto Nazionale di Ricerca Metrologica · PTB Messen · Forschen · Wissen · TÜBİTAK UME · LNE Laboratoire National de Métrologie et d'Essais · LGC · Charité Universitätsmedizin Berlin · IRCCS Fondazione Stella Maris · University of Ljubljana Faculty of Computer and Information Science · Technische Universität Dresden · Università degli Studi di Torino

WP1

Development of the reconstruction techniques

Four EPT algorithms (Helmholtz-based EPT, dictionary-based EPT, convection-reaction EPT, gradient EPT) have been selected and their implementation is under way. The algorithms will be all applied at 1.5 T in conjunction with a 3D SSFP sequence; some of them will be also tested at 7 T (using pTx technology), in conjunction with BSF and AFI acquisition sequences.
A standard dictionary-based MRF approach based on Bloch simulations and an extended phase graph (EPG)-based parameter estimation method have been implemented.

In addition, work has commenced on the implementation of a MRF approach that does not rely on a pre-calculated dictionary but directly estimates the parameters from MR raw data. MR sequences suitable for cardiac MRF have been selected.

WP2

Metrological characterisation of reconstruction techniques in silico

A dataset of transmit and receive sensitivities is under development by means of electromagnetic simulations performed on virtual phantoms and digital human models exposed to the field produced by realistic RF coils. The output of these simulations give the input for in silico EPT experiments and are also used to carry out Bloch simulations required by MRF. The intrinsic bias and the measurement uncertainty of the B1-mapping sequences selected for EPT purposes are under investigation by means of synthetic MR acquisitions and will be propagated through the EPT algorithms.

WP3

Experimental characterisation of EPT and MRF in phantoms

The consortium has developed a protocol for the preparation of tissue mimicking materials (TMM), focusing the attention on three target tissues: white matter, grey matter and the cardiac muscle. Besides the preparation of simple-geometry phantoms, the development of an anthropomorphic brain phantom via 3D-printing has begun. The electric and magnetic characterizations of the TMM has started; uncertainty evaluation and time stability checks are in progress.

WP4

In vivo quantitative differentiation of tissue

The selection of the most appropriate patients for the two clinical studies, one on brain diseases and the other on cardiac diseases, has been finalized. The former will involve children with severe lesion burden of the white matter. The latter will involve patients with cardiomyopathies and known fibrosis, systemic disorders and coronary artery diseases with different stages of myocardial infarction.

Recent publications

A. Arduino, O. Bottauscio, M. Chiampi, L. Zilberti, *Uncertainty propagation in phaseless electric properties tomography*, Proceedings of the 2019 International Conference on Electromagnetics in Advanced Applications (ICEAA).

SEE YOU SOON

The third formal meeting of the project is planned for November 2020, in Ljubljana. The next newsletter will be issued after such meeting. In the meantime, you can follow our work on the project website, on LinkedIn and on ResearchGate.

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.