Despite its widespread use, traditional MRI (Magnetic Resonance Imaging) is qualitative, meaning that the contrast between tissues in the acquired images depends on many influence quantities, including the scanner model. As a consequence, the acquired images have to be interpreted by visual inspection by a trained specialist, and this does not allow results obtained at different times and locations to be compared objectively and quantitatively. To address these issues, approaches to perform quantitative MRI are under development, to eliminate interobserver variability, reduce the need for invasive quantitative procedures (e.g. biopsies) and optimise the clinical path.

Electric Properties Tomography (EPT) is a quantitative MR-based technique that aims at transforming each pixel of the MR image into the measurement of local electrical conductivity and dielectric permittivity, to be used as biomarkers. Due to the complexity of the measurement pipeline, metrological reliability of EPT outcomes remains an issue. In addition, physiological variability plays as a confounding factor, which superposes to uncertainty and may mask pathological changes.

To become clinical tools, EPT methods must be equipped with automatic uncertainty estimators, embedded within the EPT algorithms and processing the same inputs. Since accuracy and precision may change from point to point in EPT maps, the trustworthiness of the measured biomarkers must be estimated pixel by pixel, to foster the adoption of EPT results as non-invasive biopsies.

The candidate will have the opportunity to develop and implement EPT uncertainty estimators, and to verify the validity of the developed methods by comparing the estimated uncertainty with the results of multiple short-term in vivo intra-subject measurements. Then, the developed methods will be applied to inter-subject, inter-protocol and longitudinal intra-subject observations. Besides extending the validation of the methods, this will allow to identify optimal working configurations and normal ranges of variations, with a direct clinical impact of the research outcomes.

The candidate will carry out their activity in a research group with a strong experience on EPT and will have the opportunity to found their activity on a pre-existing background, including the availability of open tools (e.g. EPTlib, https://eptlib.github.io/) and datasets (e.g. ADEPT, https://doi.org/10.34894/V0HBJ8). The activity will be performed in the framework of the European research project 24DIT01 “Trustworthy and quality-assured quantitative magnetic resonance imaging” (APULEIO), whose consortium is composed of nine members based across Europe, featuring two European clinical research centers. This will provide the candidate with the opportunity to grow in an interdisciplinary and international network.

Some relevant references regarding EPT can be found at the following link: https://www.emtphub.org/.