

MY PLAN (DMP)

DMP TITLE

DMP: Subject-specific MRI passive shims and receive coils through 3D printing

ADMIN DETAILS

Project Name: Subject-specific MRI passive shims and receive coils through 3D printing

Grant Title: FWO 1SD9423N

Principal Investigator / Researcher: An Vanduffel

Project Data Contact: an.vanduffel@kuleuven.be

Description: Magnetic resonance imaging (MRI) is a non-invasive imaging technique that is widely used in both clinical practice and research. In an MRI scan, the subject is placed in a static magnetic field. To obtain undistorted images, it is critically important that the applied magnetic field is as homogeneous as possible. However, the subject itself induces distortions that are highly subject-dependent. For instance, air-tissue boundaries cause local field inhomogeneities. These distortions often exceed the capabilities of current field homogenization methods. Additionally, MRI data acquisition is signal-to-noise ratio (SNR) starved. One of the most efficient ways to improve the SNR is by making the receive coils closely fit the subject to be imaged. However, the high cost of such coils prevents a tailored design. Because of the resulting large gaps between the currently used standard coils and the subject, much of the signal is lost.

This project proposes a strategy to address both issues in a subject-specific manner through the computer-controlled fabrication of personalized passive shims that sculpt the magnetic field and close-fitting receive coils at a cost two orders of magnitude lower compared to commercial solutions. The efficient and low-cost digital workflow will cause a paradigm shift towards a subject- and application-specific approach in both research and clinical work, enabling higher-quality data and unlocking new types of studies.

Institution: KU Leuven

1. GENERAL INFORMATION

Name applicant

An Vanduffel

Project Number & Title

1SD9423N Subject-specific MRI passive shims and receive coils through 3D printing

Affiliation

- KU Leuven

2. DATA DESCRIPTION

Will you generate/collect new data and/or make use of existing data?

- Generate new data

Describe the origin, type and format of the data (per dataset) and its (estimated) volume, ideally per objective or WP of the project. You might consider using the table in the guidance.

The expected data volume generated within the FWO project is 1-2 Gb per month.

Objective 1: Design & development of subject-specific passive shims.

Data related to this objective are mostly the characterization of used materials, plug flow, simulations and NMR field mapping. The details of raw and exported data formats are listed below.

equipment	raw format	exported format
Elveflow	XLS	CSV
COMSOL	txt	CSV/GIF
CT scanner	TIF	
X-ray diffraction	XRDML	CSV
MRI scanner	TIF/txt	CSV

Objective 2: Subject-specific coils.

Data related to this objective will come mostly from material characterization, plug flow, simulations and from coil characterization. The details of raw format and exported format are listed below.

equipment	raw format	exported format
Elveflow	XLS	CSV
Impedance analyser	txt	CSV
COMSOL	txt	CSV/GIF
Network analyzer	CSV	CSV
MRI scanner	TIF/txt	CSV

Objective 3: Hardware integration and MRI testing.

The data generated for this objective will mainly come from MRI scanners (both pre-clinical and clinical) for the quantification of SNR and magnetic field. The obtained data will be converted to a CSV file.

3. LEGAL & ETHICAL ISSUES

Will you use personal data? If so, shortly describe the kind of personal data you will use (add the reference to your file in your host institution's privacy register - not relevant yet)

- No

Privacy Registry Reference: /

Short description of the kind of personal data that will be used: /

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, add the reference to the formal approval by the relevant ethical review committee(s)

- Yes

Experiments on non-human primates will be performed at the Laboratory of NEURO- AND PSYCHOPHYSIOLOGY, under the supervision of Prof. W. Vanduffel. Their ethical approval code is: P173-2020.

Does your work possibly result in research data with potential for tech transfer and valorisation? Will IP restrictions be claimed for the data you created? If so, for what data and which restrictions will be asserted?

- Yes

If the proposed concept works, a meeting will be planned with the KU Leuven tech transfer office to investigate patentability. The base technology of the approach is already protected by a granted patent. In case a patent application will be filed directly resulting from this project, the related data will not be freely shared at least until the patent filing.

Commented [AV1]: Is dit al zo? In het C3 project staat wel dat het al is ingediend, maar nog niet of het aanvaard is.

Do existing 3rd party agreements restrict dissemination or exploitation of the data you (re)use? If so, to what data do they relate and what restrictions are in place?

- No

4. DOCUMENTATION & METADATA

What documentation will be provided to enable reuse of the data collected/generated in this project?

An overview file that contains references to the raw data files will be kept. Regular reports based on the data will be generated using Microsoft Word. PowerPoint files will be used for presentation at regular internal meetings between the WP leaders and researchers involved in the project. In both the Word reports and Powerpoint presentations, the file names of the raw data files will be included.

Will a metadata standard be used? If so, describe in detail which standard will be used. If no, state in detail which metadata will be created to make the data easy/easier to find and reuse.

- No

The details of each experiment will be kept in an electronic lab notebook. In this notebook, also the names of the raw and processed datafiles will be mentioned. Files will be named according to a pre-agreed convention. This working method obviates the need for a separate INFO.txt file in each directory yet ensures that the data can be understood by other team members and can be reused in the future.

For published papers, the subset of the raw and processed data discussed in that manuscript will be copied and organized according the paper structure. Likely, this is the data subset that will be most frequently revisited and shared afterwards.

5. DATA STORAGE & BACK UP DURING THE PROJECT

Where will the data be stored?

The data will be stored via a cloud storage solution that allows sharing with the WP leaders and researchers involved in the project.

How is backup of the data provided?

The data on the cloud storage server are automatically backed up. Unlimited versioning is included in the selected plan so that accidental erasing or modifying does not pose a risk.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely. If no or insufficient storage or backup capacities are available then explain how this will be taken care of.

- Yes

The total amount of data generated during the project should not exceed a few TB and is therefore compatible with the selected cloud storage solution.

What are the expected costs for data storage and backup during the project? How will these costs be covered?

The costs for saving the data to the cloud storage server (including regular backup) should not exceed a few hundred euros. These costs will be covered by the project.

Data security: how will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

The data generated during the project will be systematically transferred to the cloud storage server. Only the WP leaders and researchers involved in this project will have access to the shared folders where the data, reports and presentations will be stored.

6. DATA PRESERVATION AFTER THE PROJECT

Which data will be retained for the expected 5 year period after the end of the project? In case only a selection of the data can/will be preserved, clearly state the reasons for this (legal or contractual restrictions, physical preservation issues, ...).

All the generated data will be stored on the cloud storage server for a period of 5 years after the end of the project.

Where will the data be archived (= stored for the longer term)?

All the generated data will be stored on the cloud storage server for a period of 5 years after the end of the project.

Beyond 5 years after the end of the project, one of the following options will be picked (1) continuation of storing the data on the cloud storage server or (2) transferring the data to the KU Leuven central servers for archiving.

What are the expected costs for data preservation during the retention period of 5 years? How will the costs be covered?

The annual cost for long-term storage of the data, either through a cloud storage service or the university's central servers, is estimated at a few hundred euro. Since the budget of the current project will no longer be available, creative solutions will have to be found.

7. DATA SHARING AND REUSE

Are there any factors restricting or preventing the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)?

- Yes. Specify:

The data will remain accessible among the WP leaders and the researchers involved in the project.

Access to the data can be granted to other persons, upon request and agreement among the leaders. A patent application can be a limiting factor in granting access to the data.

Which data will be made available after the end of the project?

In case no restrictions apply, the written reports and Powerpoint presentations summarizing the results obtained can be made available. The (raw) data used in publications can be made available on a repository, if e.g. requested by the Editors or Publisher of a scientific journal.

Where/how will the data be made available for reuse?

- Upon request by mail or by depositing research data in the KU Leuven RDR

The data that will not have been uploaded in a repository such as 'Scientific data' (<https://www.nature.com/sdata/>) to accompany a publication can be requested via email.

When will the data be made available?

- Upon publication of the research results

Description of the full scientific method and results will be made available with journal publications.

Who will be able to access the data and under what conditions?

Upon request, access to the samples and data can be granted, upon agreement of the project leaders. Commercial reuse will not be allowed.

What are the expected costs for data sharing? How will the costs be covered?

Because of the choice for a cloud storage solution for the data, no additional costs will be booked for data sharing.

8. RESPONSIBILITIES

Who will be responsible for data documentation & metadata?

The project leaders and the researchers involved in this project will be jointly responsible.

Who will be responsible for data storage & back up during the project?

The project leaders and the researchers involved in this project will be jointly responsible. Because of the choice for a cloud storage solution, no additional action is needed for data backup.

Who will be responsible for ensuring data preservation and reuse ?

The project leaders and the researchers involved in this project will be jointly responsible.

Who bears the end responsibility for updating & implementing this DMP?

The project leaders bear the end responsibility of updating & implementing this DMP.