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PROJECT ABSTRACT

Marta Maggioni

#55472 : MRI TogetherThon 2026: A Community-Driven Open-Source Hackathon for Building an End-to-End MRI Pipeline

Preferred format : Lightning Talk

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Introduction

The MRI community has developed many open-source tools for sequence programming, reconstruction, motion correction, and data analysis, but these are often created in isolation. Researchers frequently must build custom, non-open-source bridges to construct a complete workflow, hindering reproducibility. While integrated pipelines exist, such as Nipype, or QSIprep/QSIREcon[1,2] complete multi-tool workflows are rarely shared leading to redundant development and reliance on in-house software. MRI TogetherThon 2026 online event bridges this gap by bringing developers of established open-source MRI tools together with early career researchers to build a full pipeline on a state-of-the-art application. The event features expert tutorials and hands-on sessions followed by a hackathon to integrate these tools into an end-to-end workflow. For this first edition, the main application was elected to be prenatal

imaging. Placental diffusion MRI[3] was chosen because other prenatal imaging areas and quantitative parameters already have established pipelines[4,5]. Participants will be introduced to open-source tools such as Pulseseq[6,7], KomaMRI.jl[8], Dipy[9], and MRtrix[10], while learning how to connect them into a coherent pipeline. The event will also highlight key challenges in prenatal and diffusion-weighted imaging.

Methodology :

The objectives of the event are to: (1) explore and connect existing open-source MRI tools into a reproducible and end-to-end workflow for placental diffusion MRI, (2) develop and extend the open-source tools needed for this workflow, and (3) bring together early-career researchers from diverse backgrounds to foster further collaboration and open-source development. A 5-day fully online hackathon is planned. Each day will address different aspects of a typical MRI pipeline such as sequence programming, reconstruction and simulation, motion correction and post-processing, and analysis. For the fifth day, a special session on the pipeline assembly will take place. All sessions will combine educational introductions with hands-on development. Participants will work in teams of 3 to 5 people, matched by skills and preferences, to adapt and develop selected open-source tools with guidance from mentors. Introductions to these tools will be offered live in two time zones and recorded. Teamwork will combine synchronous and asynchronous work, with a Linux virtual machine provided for a consistent development environment. As multiple teams will work in parallel on each topic, the developed packages will be reviewed collectively, with one package selected for each topic to be integrated into the final pipeline. The integrated pipeline will be tested using numerical phantoms developed during the hackathon. The resulting workflow will be saved in an open repository to support transparency, reuse, and further development. A diagram of the planned workflow is presented in Figure 1 and the provisional program is available online[11].

Current Status and Preliminary Results :

The MRI TogetherThon was initiated in early 2026 by senior committee members to host the community's first online MRI open-source hackathon. In early 2026, a new organizing committee (OC) was recruited. Members of the current OC helped refine the proposed format, chose the topic, and sketched the program. A list of potential speakers and mentors for every tool and topic was assembled, and emails are being sent out to invite them. Given its online format, the event is inexpensive. The only costs are a hosting platform and a few prizes, which can be covered by the MRI Together Working Group's existing funds. Sponsorship outreach is nevertheless underway to support future editions. A registration form was crafted to screen participants' interest and assess their skills to form functional teams. It is being promoted through social media, the ESMRMB 2026 Open Science Fair, newsletters, and podcasts. As per 17.08.26, one participant already registered and 2 speakers/mentors confirmed their participation. An ISMRM endorsement process has been started, which, if successful, would allow the initiative to reach additional members of the MR community.

Plan and Outlook :

The project will bring together expertise in many aspects of open-source MRI development, with placental MRI serving only as the use case. Expertise in fetal imaging is therefore not required to participate, and we welcome contributions from people with different backgrounds and levels of experience. We particularly invite community members interested in contributing their expertise or open-source development skills to join the hackathon. Participants are expected to actively support the project's two core outputs: building and releasing an open-source placental diffusion pipeline and submitting at least one research abstract to a major conference. We also invite expressions of interest from anyone eager to organize future editions.

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Geethanath, and J. T. Vaughan, "PyPulseq: A Python Package for MRI Pulse Sequence Design," J. Open Source Softw., vol. 4, no. 42, p. 1725, Oct. 2019, doi: 10.21105/joss.01725. [8] C. Castillo-Passi, R. Coronado, G. Varela-Mattatall, C. Alberola-López, R. Botnar, and P. Irrazaval, "KomaMRI.jl: An open-source framework for general MRI simulations with GPU acceleration," Magn. Reson. Med., vol. 90, no. 1, pp. 329–342, Jul. 2023, doi: 10.1002/mrm.29635. [9] E. Garyfallidis et al., "Dipy, a library for the analysis of diffusion MRI data," Front. Neuroinformatics, vol. 8, p. 8, Feb. 2014, doi: 10.3389/fninf.2014.00008. [10] J.-D. Tournier et al., "MRtrix3: A fast, flexible and open software framework for medical image processing and visualisation," NeuroImage, vol. 202, p. 116137, Nov. 2019, doi: 10.1016/j.neuroimage.2019.116137. [11] "Program Book," MRI Together. Accessed: Aug. 18, 2026. [Online]. Available: <https://mritogether.esmrm.org/26m/programbook.html>

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7. Authorship M. Maggioni and M. Mora contributed equally to this work as joint first authors. A. Artiges and G. Sahonero-Alvarez contributed equally as joint last authors

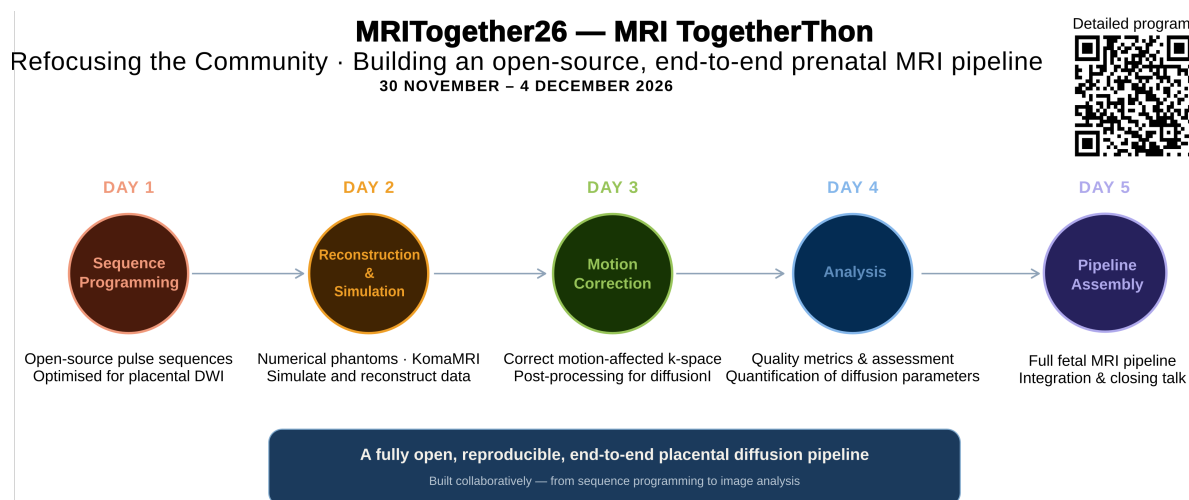


Figure 1: Workflow of the MRI TogetherThon. Days 1 to 4 will be focused on presenting tools and using them to build parts of the pipeline. The last day will be used to assemble the final pipeline by connecting the tools together. All sessions will happen twice each day to cover most time zones.