Aalto NeuroImaging

7 T Survey in 2021

Ultra-High Field MRI: Transition to Human 7 T in Finland

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Aalto University
SCIENCE + TECHNOLOGY
REPORT

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7 T Survey in 2021

Ultra-High Field MRI: Transition to Human 7 T in Finland

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Objective, background and synopsis

Neurocenter Finland (neurocenterfinland.fi) and Finnish Biomedical Imaging Node (FiBI; eurobioimaging.fi/FiBI) conducted a survey at the end of 2021 to map potential users and project types that would importantly benefit from the availability of a national-level, open-access ultra-high field (UHF; ≥ 7 T) human magnetic resonance imaging (MRI) facility in Finland. In addition, this survey established a starting point to form a collaborative network aiming towards this target and to collect preliminary information for realistic budget planning, estimated usage in basic and clinical research, and preferred facility location.

The present *7 T Survey in 2021* (*Ultra-High Field MRI: Transition to human 7 T in Finland*) was implemented by Aalto University during October 6th – November 19th, 2021 on the Webropol platform. The link to the survey was released and delivered via appropriate e-mailing lists that cover key personnel of Finnish MRI community in hospitals, universities, and other connected institutions. The survey link was encouraged to be forwarded by the recipients to their MRI colleagues in their institutions and to any other interested party in Finland. Furthermore, the representation and number of respondents from Finnish universities/hospitals were monitored during the survey. Based on this, response time was extended from the original as well as additional reminders sent to make sure that as many interested people as possible would get enough time to participate in the survey if they chose to do so. The survey was conducted following the privacy notice guidelines of Aalto University when processing personal data such as name, email, and affiliation.

This report presents an overview of the responses obtained from the *7 T Survey in 2021* prepared by Neurocenter Finland and FiBI. Based on the survey, it is evident that a national, open-access human 7 T MRI facility in Finland is considered very relevant. One of the most potential locations for such facility, based on anticipated volume of potential users and patients, would be in the greater Helsinki area. However, very exquisite clinical and research environments benefitting from UHF human MRI exist also elsewhere in Finland and clear arguments supporting other locations were presented by the respondents.

As a perspective to the evolution of the 7 T human MRI facility in Finland this report includes a synopsis of the 7 T human MRI workshop that took place in 2015. The workshop, organized jointly by Aalto University and the Finnish Infrastructures for Functional Imaging (precursor of FiBI), aimed at a 7 T human MRI facility operated as part of the Aalto NeuroImaging (ANI, ani.aalto.fi) research infrastructure. Unfortunately, the funding applied in 2016 by Aalto University was not secured as planned. The synopsis with potentially useful background information about the workshop and 7 T usage in Finland can be found in the appendix of this report.

National collaboration towards establishing the 7 T human MRI facility in Finland should be continued with high priority. In the near future, we suggest that a multi-site work group is assembled to portray and discuss the situation in all potential locations (*e.g.*, Espoo, Helsinki, Kuopio, Oulu, and Turku). Neurocenter Finland is one suitable candidate to initiate the organization of the work group by inviting interested individuals and institutes to participate in the 7 T human MRI project in Finland.

7 T Survey in 2021

The following questions were presented in the *7 T Survey in 2021*:

1. *Background information (First name, Last name, Email, Affiliation)*

2. *What would be your main interest in using a 7 T MRI facility in Finland?* (1 or more can be selected)
    a. Basic research
    b. Clinical research
    c. Diagnostic use
    d. Methods development
    e. Other, please specify.

3. *What is your specific area of interest?* (1 or more can be selected)
    a. Microstructure and anatomy of the brain
    b. Neuroimaging applications (fMRI, DTI)
    c. Spectroscopy
    d. Musculoskeletal tissues (*e.g.* cartilage imaging, ligaments)
    e. Internal organs other than the brain
    f. Other, please specify.

4. *What requirements do you consider especially important for an open-access 7 T human MRI facility and environment?* (*e.g.* permanent staff, close location to methods development groups, close location to hospital, ...)

5. *If there would be only one 7 T human scanner in Finland during the next 5–10 years, which university/hospital/other should assume responsibility for providing this service and where should it be located?* (Location, Arguments for this suggestion)

6. *Would you be tentatively willing to collaborate in the launching phase?*
    a. If yes, and you wish to be contacted about this later on, please specify how? (*e.g.* project planning, project management, securing funding, …)
    b. If no, leave this answer empty.

7. *I want to receive information later on and be added to a mailing list in the possible planning/launching phase of this project: Yes / No*

Overview of the affiliations (Question #1)

A total of 103 individuals answered to the survey. All the major universities in Finland were represented in the survey although the majority (53%) of the respondents were affiliated with institutions and hospitals located in the capital region, namely, Aalto University (Aalto), Helsinki University Hospital (HUS), and University of Helsinki (UH) as depicted in Figure 1. Institutions outside the capital region were merged together according to the city of the respondents' affiliation. Category *'Other'* included commercial affiliations and other institutions mainly in the capital region.

The largest respondent group were affiliated with the Hospital District of Helsinki and Uusimaa (23%) and the second largest groups were individuals affiliated with Aalto University (15%), University of Helsinki (15%), and Kuopio (University of Eastern Finland and Kuopio University Hospital; 14%).

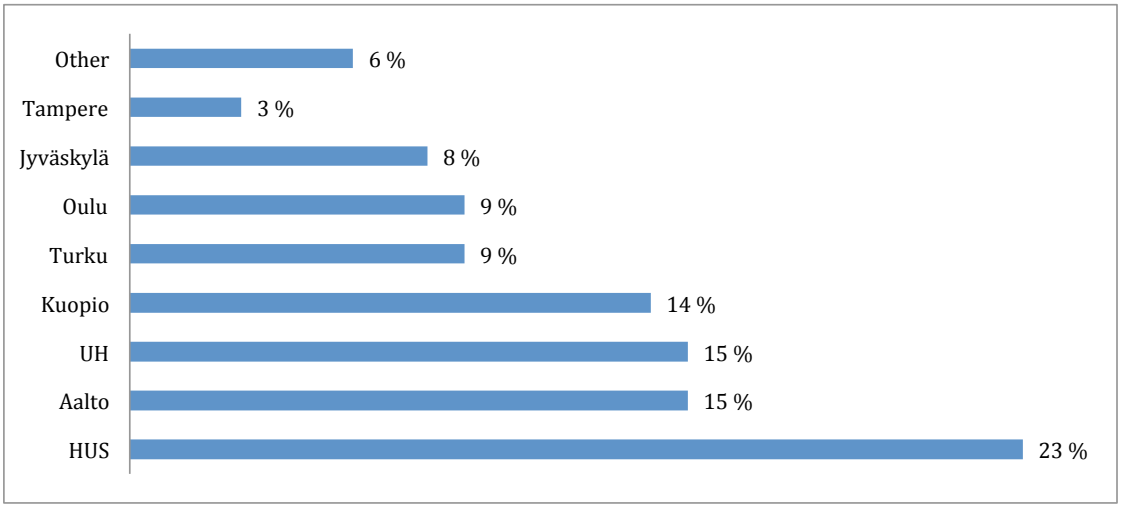

Figure 1. Institutions and cities represented in the survey based on the affiliations.

Main interest and specific area in using a 7 T human MRI (Questions #2 and #3)

Basic research and clinical research were indicated as one of the main interests (Figure 2) by more than 60% of the respondents. Methods development was indicated as an interest by nearly 40% of the individuals whereas diagnostic use was indicated by about 30%. *'Other'* answers included clinical drug development, applied research and applications, such as ultrafast neuroimaging, as well as ethical aspects of the project.

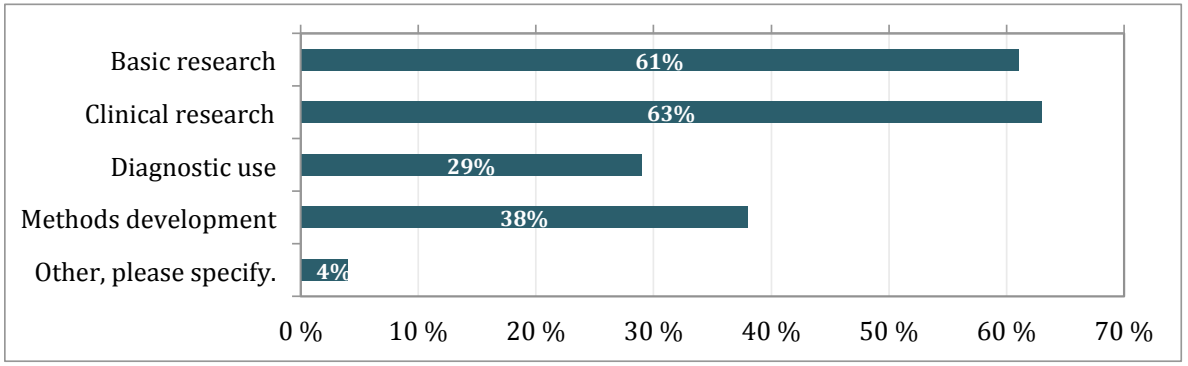

Figure 2. Question #2: *What would be your main interest in using a 7 T MRI facility in Finland? (1 or more can be selected)*

Out of the specific areas of interest (Figure 3), neuroimaging applications (functional magnetic resonance imaging, fMRI and diffusion tensor imaging, DTI) were indicated the most common with more than 80% of the respondents selecting this. In addition, microstructure and anatomy of the brain was chosen by almost 60% of the respondents, while other prelisted areas of interest in the survey were selected roughly by about 10% of the respondents. *'Other'* answers indicated more specific and detailed topics out of which cardiovascular imaging, CEST (chemical exchange saturation transfer) and pathology of cerebral vessels were mentioned more than once. In addition, *e.g.* MRI methods development, multimodal imaging, brain stimulation, acquisition related artefact correction, muscle composition, and oncological applications were specified.

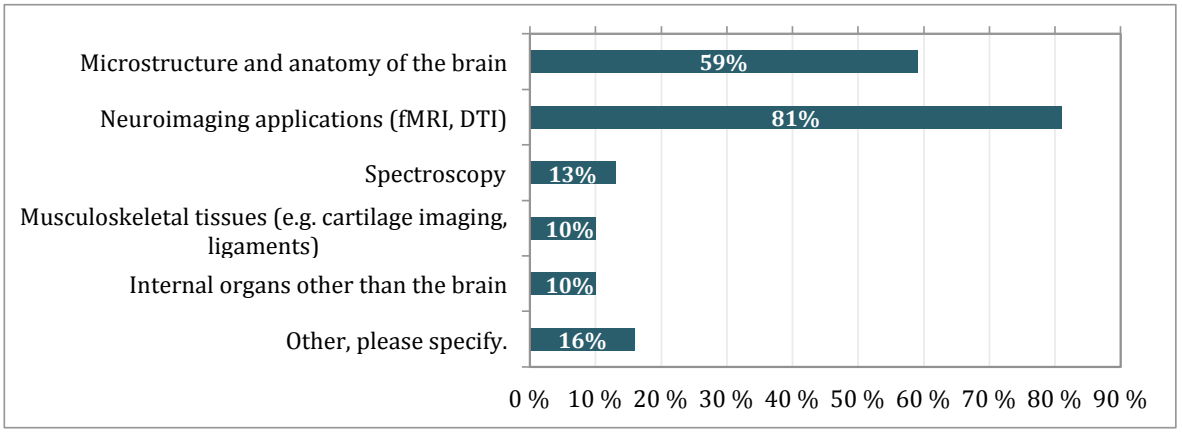

Figure 3. Question #3: *What is your specific area of interest? (1 or more can be selected)*

Requirements indicated as important (Question #4)

Altogether 95 (out of 103 respondents) detailed answers were received for the question regarding the important requirements for an open-access human 7 T MRI facility. This question was answered by many people in great detail with certain aspects recurring throughout the responses. The detailed answers are available upon request and internally in the planning phase of the national 7 T project. Synopsis of the distribution (in percentage) of the abovementioned recurring answers is presented in Table 1.

Permanent, educated and alert staff	66 %
Close location to hospital/clinical settings	52 %
Close location to methods development groups and/or the execution of (basic) research	36 %
Easy-to-use, standard and fair operating procedures, affordability	21 %
Convenient location to own functions and/or easy accessibility from elsewhere in Finland	14 %

Table 1 Synopsis of the recurring requirements considered as important by the respondents and their distribution throughout the detailed answers.

About 66% indicated permanent, educated and alert staff as an important aspect in a 7 T facility. This includes, for example, measurement assistance, consultation about sequences/protocols, general support in other technical issues, training, strong MR physics expertise, and support in state-of-the-art advanced use of the environment. The involvement of permanent staff was a crucial consideration in many responses.

More than 50% of the respondents indicated a close location to a hospital as an important requirement due to ensuring patient flow for clinical research and access to other diagnostic methods, for instance. More than one third (36%) of the answers indicated a close location to methods development groups and execution of basic research as an important requirement for the facility. Noteworthy, close location to hospital and methods groups were both indicated as important in approximately half of the abovementioned answers, indicating a strong need for both hospital environment but also accessibility to groups and staff performing research with basic research methodologies and healthy volunteers as well.

Other important requirements for the environment were related to the easy usage, standard and fair operating procedures for different user groups, and affordability of the use (21 %) whereas close location in general and access from other parts of Finland were also indicated important in more than every tenth answer (14%). Note, that this question did not have any assumptions about the location of the facility (*i.e.*, is it close to the respondent or not).

Location of the 7 T facility (Question #5)

96 individuals suggested a location for the 7 T facility in their responses (some indicated more than one location). The distribution of suggested location is merged by city/area in Table 2. Majority of the respondents provided very detailed arguments on behalf of their suggestion. Some common arguments supporting the capital region (Helsinki/Espoo) were the largest patient volume, accessibility and proximity to clinical and basic high-level research groups. Very important aspects supporting other locations such as Kuopio (*e.g.,* pre-clinical high-field community, collaboration between university and hospital), Turku (*e.g.*, synergy and long experience with brain imaging and PET), and Oulu (*e.g.*, strong MR physics in hospital setting) were also presented. Detailed reasoning and arguments are internally available for the 7 T project.

Helsinki/Espoo	63 %
Kuopio	16 %
Turku	9 %
Oulu	7 %
Jyväskylä	5 %
Tampere	3 %

Table 2 Locations suggested by the respondents (merged by city/area).

Willingness to collaborate in the project (Questions #6 and #7)

52 respondents indicated their preliminary willingness to collaborate in the 7 T project especially in the planning phase of the project, but also in the applying of funds and planning of future research projects, for example. Approximately 95% of the respondents wanted to be added to a mailing list and receive information of the project in the planning/launching phase.

Summary

This report presents an overview of the responses obtained from the *7 T Survey in 2021* (*Ultra-High Field MRI: Transition to human 7 T in Finland*) conducted by Neurocenter Finland and Finnish Biomedical Imaging Node. Based on the survey it is evident that a national, open-access human 7 T facility is very important in advancing both the top clinical applications and state-of-the-art research settings in Finnish MRI community. Therefore, national collaboration towards the target should be continued with high priority. Meanwhile, accumulating and increasing knowhow and experience from various 7 T projects by Finnish researchers/clinicians abroad is fundamental and should be started as soon as possible to enable new projects and demand already in the launching phase.

The survey brings forth open questions regarding, *e.g.*, location of the facility, which institution(s) will take the hosting responsibility of the facility as well as how efficient and fair open-access operation can be guaranteed both financially and with continuity of supporting staff and national user base. It is apparent that many university and hospital sites in Finland are well motivated with necessary qualification and capability in running a national 7 T MRI facility. Consequently, a multi-site national work group is needed to assess all the open questions so that a shared national decision can be made. Neurocenter Finland is one suitable candidate to initiate the organization of the work group by inviting interested individuals and institutes to participate, for example via the mailing list obtained in this survey.

Information in this report is considered public information after publication. More detailed, anonymized answers and arguments by the respondents as well as information needed for the creation of a *'7 T project in Finland'* -mailing list are available from Toni Auranen (toni.auranen@aalto.fi) for internal purposes of the project.

Appendix: 7 T workshop in 2015

This workshop (October 8th – 9th, 2015 at Aalto University) brought together a group of top-level scientists for two days to give presentations and immerse in discussions both in a panel debate and also more informally. The purpose of the workshop was to demonstrate scientific achievements and possibilities enabled by UHF human MRI, as well as the challenges. The workshop memorandum can be downloaded from aaltodoc.aalto.fi/handle/123456789/20121. Objective of this record was not only to document the meeting, but also to pave the way for making the first human 7 T scanner operational in Finland. Unfortunately, the funding applied for the 7 T MRI in 2016 by Aalto University was not secured as planned, but the preparatory steps managed to raise national interest in the possibility of getting a 7 T human scanner in Finland. Information gathered in this meeting may be helpful in the current efforts of launching a national 7 T project in Finland.

The workshop attracted more than 120 participants. Out of the 110 pre-registered participants who answered to a question about their primary interest in the workshop, 75% identified themselves as potential users (basic research, clinical research, diagnostic use) of a 7 T facility, fewer than 5% were from research administration and one fifth attended the symposium for other purposes. To a question regarding whether the participant or his/her group would be willing to use a 7 T scanner installed in Otaniemi, Espoo, 44 replies were received, out of which more than 90% were either 'yes' or 'maybe' (Figure 4). Participants (excluding the speakers) arrived from 13 different national institutions/hospitals and 2 institutions from abroad. The Finnish institutions and corresponding percentages are shown in Table 3.

Affiliation of the workshop (2015) participants	
Aalto University	53%
Hospital District of Helsinki and Uusimaa	15%
University of Helsinki	14%
Others*	18%

Table 3 Participant institutions (national) of the 2015 workshop. *Others include: Folkhälsan, Laurea University of Applied Sciences, North Karelia Central Hospital, Oulu University Hospital, Tampere University of Technology, University of Jyväskylä, University of Oulu, University of Turku, Validia Rehabilitation Helsinki, and Åbo Akademi University.

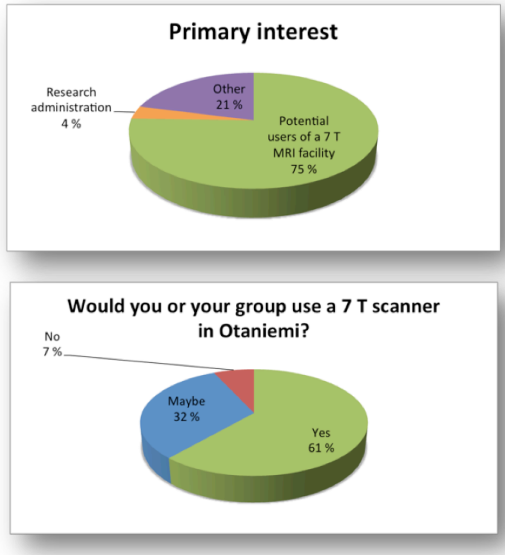

Figure 4. Primary interest of the workshop participants in 2015 and their willingness to use a human 7 T MRI scanner based in Otaniemi, Aalto University.

Neurocenter FInland and Finnish Biomedical Imaging Node have prepared a survey to map potential users and project types that would importantly benefit from availability of a national-level, open-access human 7 T facility in Finland. The purpose of this survey is to establish a collaborative network aiming towards this target and to collect information for planning of budget, estimated usage and location. The survey was conducted by Aalto NeuroImaging.

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