



Annual report 2011

1. Date	14-11-2011
2. Institute and address	University Medical Center Utrecht Department of Radiology P.O. Box 85500 3508 GA Utrecht
3. Principle Investigator	Prof. dr. P.R. Luijten and Dr. W.B. Veldhuis
4. Contact	Dr. Wouter B. Veldhuis; w.veldhuis@umcutrecht.nl
5. Project Title	High field 7 Tesla breast MRI for patients with ductal carcinoma in situ
6. How many patients are involved in the project / others involved	<p>The project started with imaging of healthy volunteers on 7T. After this initial period, the first clinical trail was initiated and with that the inclusion of patients. To date, 18 out of 20 planned patients are included. Consent was obtained of the Medical Ethics Committee (METC) of the UMC Utrecht to image both volunteers and patients. All subjects signed informed consent prior to MR imaging.</p> <p>In the implementation of the project MD, PhD-student BL Stehouwer is involved.</p>
7. Project progress	<p>To become familiar with the 7 Tesla (7T) MRI, we started with the imaging of healthy volunteers. Furthermore, the scan protocol was developed which is currently being used in the first patient study: the 7T feasibility study. The main research question of the feasibility study is whether a breast examination, with the administration of a contrast agent, can be technically performed on the 7T MRI. A second question that need to be answered is whether the exams can be analyzed using the BI-RADS-MRI criteria, as is done in clinical practice. To date, 18 patients are included. In total, 20 patients should be scanned to answer the questions properly. The results so far seem promising for a positive result. The second step of the project is a one-on-one comparison of a breast MRI exam at 7T with the standard clinical examination conducted on 3T MRI. This study will start after the completion of the feasibility study. The protocol for this 7T versus 3T comparison is already written and approved by the METC of the UMC Utrecht.</p> <p>Simultaneously with the clinical patient study, the first phase of step 3 of the project was started: the image of DCIS (a precursor of breast cancer) with 7T MRI. DCIS is, in most cases, discovered only by very small calcifications that are visible on mammography. However, whether there really is DCIS, how extensive it is, and whether there is a small invasive component (DCIS under-estimate), cannot be determined based on mammography. To date, these small calcifications are not visualized with standard MRI protocols. In a experimental setting, patient inclusion is prepared for this final step of the project. Micro-calcifications are simulated in a gel phantom to work on a imaging protocol for the 7T detection of micro-calcifications. It is in this setting that calcifications have been detected successfully to a weight of 0.4 milligrams. Furthermore, the next step has been taken to visualise calcifications in ex-vivo breast tissue that has become available after planned surgery. The detection of calcifications in ex-vivo breast tissue will be further explored before taken the step to in-vivo imaging.</p>

<p>8. Results so far</p>	<p><u>1. Validation studies on breast 7T</u> The first patient study is almost completed; 18 of 20 planned patients are included. The results seem promising for a reliable execution of 7T CE-MRI of the breast. Furthermore, the exams seem BIRADS-MRI analysis compliant, as is the current standard in clinical practice of breast MRI analysis. Final confirmation of this preliminary results will be an important basis for the realization of 7T breast MRI in the clinical setting. The follow-up study is already planned and approval from the Medical Ethical Committee UMCU is obtained. The purpose of this second step in the investigation is to determine the diagnostic value of breast MRI 7T CE relative to the current standard of 3T MRI and histopathology, on a intra-individual basis. In this study, 60 patients will be enrolled with a suspected abnormality in the breast on mammography or ultrasound.</p> <p><u>2. Detection and staging of ductal carcinoma in situ</u> Initially we started with the detection of calcifications in gel phantoms. So far we found calcifications to a weight of 0.4 milligrams can be detected. The next step is to detect calcifications in ex vivo breast tissue that has become available after surgery. This situation is closer to the clinical practice of in-vivo measurements on patients, only without the influences of heart rate, breathing and possible motion. Up to date we accomplished the detection of calcifications in ex-vivo breast tissue in one case that was our first case. We would like to further explore this technique before moving to patients.</p>
<p>9. Short description in Dutch</p>	<p>Betere beoordeling van voorstadia van borstkanker (DCIS) met ultra-hoogveld 7 Tesla MRI</p> <p>De beste behandeling van borstkanker is er een die op maat gesneden is: agressief wanneer dat nodig is, minder-agressief wanneer dat kan. Dit onderzoek wil bijdragen aan het bepalen wát voor wie de beste behandeling is.</p> <p><i>Eerste stap richting klinisch borstonderzoek op de 7 Tesla MRI</i> Als eerste stap is er een patiëntenstudie opgezet om de technische haalbaarheid van de 7 Tesla borst MRI te onderzoeken. Tot nu toe zijn 18 van de beoogde 20 patiënten onderzocht. De tot nu toe behaalde resultaten zien er veelbelovend uit. Wij verwachten in 2011 nog een uitspraak te kunnen doen over de uiteindelijke studie-uitkomst van deze eerste stap in het project. De volgende patiëntenstudie staat in de startblokken. Hierbij zal de diagnostische waarde van 7T CE-MRI van de borst ten opzichte van de standaard 3T MRI worden onderzocht, op intra-individuele basis.</p> <p><i>Beoordeling van DCIS</i> DCIS wordt in de meeste gevallen op het spoor gekomen door hele kleine calcificaties die te zien zijn op een mammogram. Echter, of er écht sprake is van DCIS, hoe groot het is en of er al een kleine kwaadaardigheid bij zit, wordt vaak niet gezien op het mammogram. Tot op heden kunnen deze calcificaties niet in beeld worden gebracht met de MRI. Op dit moment wordt de detectie van calcificaties onderzocht, in een experimentele setting waarbij calcificaties worden nagebootst in een gel. Vervolgens wordt gekeken of het mogelijk is deze met de 7T MRI zichtbaar te maken. Tot nu hebben we zeer kleine calcificaties kunnen detecteren. Als volgende stap wordt er onderzocht of kleine calcificaties van borstweefsel zichtbaar kan worden gemaakt. Dit borstweefsel is beschikbaar gekomen na een geplande borst operatie.</p> <p>In het afgelopen jaar is veel bereikt op het gebied van borstkanker onderzoek op de 7 Tesla MRI, en op het gebied van micro-calcificatie detectie. Wij hopen komend jaar deze resultaten uit te bouwen en zullen hierover ter zijne tijd berichten.</p> <p>Dit onderzoek heeft financiering van Stichting A Sister's Hope gekregen in 2010.</p>
<p>10. Awarded grant</p>	<p>100.000 EURO</p>

11. Amount received	100.000 EURO
12. Financial accountability	<p>1.5 x 0.5 fte AIO-0 = €55,764 17 x €250 7T MRI exams = €4,250 1.0 x 0.1 fte Data management (B09-0) = €4560 1.0 x 0.1 fte Pathology-Radiology correlation (UMS-0) = €11661 1.0 x 0.1 fte Radiologist reading/processing (UMS-0) = €11661</p> <p>Continuation of the employment of MD, PhD-student BL Stehouwer is guaranteed by means of direct funding ('eerste geldstroom').</p>
13. Preview of next year	<p>For next year we expect to complete the first patient study and have finished a large part of the 7T versus 3T study. We will also continue working on the detection of calcifications in ex-vivo breast tissue and hopefully subsequent in patients.</p>
15. Publications	<p>Multiple abstracts have been presented at conferences regarding this research project: see attached the most recent – confidential – PDFs.</p> <p>One article has been submitted to the Journal of Magnetic Resonance Imaging. 7T versus 3T contrast-enhanced breast Magnetic Resonance Imaging of invasive ductulolobular carcinoma: first clinical experience.</p>