

# Delay Notification for D3.1 Cross-calibrated MRI/US acquisition

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	X

## **Summary of the delay**

Electronic noise generated by the ultrasound system creates artifacts in the MRI during ultrasound operation. Changes to the shielding and electrical grounding of the ultrasound system have been made as remedy but have not yet been evaluated. We anticipate a delay of deliverable D3.1 by two months. We expect that this will not delay other deliverables as explained below.

## **Reasons for the delay**

An essential prerequisite to accomplish task 3.2 (correlation of MRI and US-based motion imaging) is the use of a dedicated MR compatible ultrasound system which enables the simultaneous acquisition of MR and US images. This device was developed by the mediri GmbH in close cooperation with the Fraunhofer IBMT (St. Ingbert) during the past months. The first version of this system was tested at mediri/DKFZ MRI facility in Heidelberg in September 2011. These measurements revealed substantial residual noise in MRI acquisitions during US operation. These artifacts are created by electronic noise generated by the ultrasound system which then is picked up by the MRI RF coil.

Due to these findings, changes in the shielding and electrical grounding of the newly developed ultrasound system became necessary. These are currently undertaken at the IBMT St. Ingbert. Delivery of the corrected system is scheduled for the 2012-01-04. At this date further MRI/US compatibility tests will be run.

## **Implications on the project**

### **For Task 3.1 (Development of a generic 4D respiratory motion model of the relevant anatomy)**

It was planned to improve the temporal resolution of 4DMRIs by ultrasound-navigated MRI acquisitions. A delay of task 3.2 (see below), will delay the availability of high temporal resolution 4DMRIs. This can be compensated by the use of 4DMRIs of lower temporal resolution.

So far, previously acquired 4DMRIs of the right liver lobe have been used for task 3.1. Abdominal 4DMRIs with a larger coverage will be necessary to allow extension of the method to the whole abdomen. Task 3.1 will be delayed if collection of volunteer 4DMRIs has not started by March 2012.

### **For Task 3.2 (Correlation of MRI and US-based motion imaging)**

Deliverable 3.1 is part of Task 3.2.

If the additional tests on the 2012-01-04 show noise free MR images, the research on the generation of ultrasound-navigated 4DMRIs can be continued. In this case the task can presumably be accomplished by 2012-02-29. If this approach is not feasible, 2D MR navigators could be employed, with the drawback of lower temporal resolution and longer acquisition times.

All simultaneously acquired MRI/US images should be cross-calibrated to avoid errors due to the different distortions of the two modalities. First experiments can be conducted with consecutive acquisition by using static physical phantoms and hence are not affected by this delay.

The comparison of the appearance of anatomical structures in MR and US dynamic images for individualization is interesting, but not strictly necessary for an environment where the ultrasound coordinates can be related to the MR scanner coordinates and both have been cross-calibrated.

### **For Task 3.3 (Real-time motion extraction from US images)**

The new shielding might change the ultrasound appearance. As this will be known at the beginning of January 2012, it will not cause a delay to task 3.3.

### **For Task 3.4 (Patient-specific, intra-operative prediction of organ motion)**

It is planned to validate task 3.4 with the help of simultaneously acquired MRI/US dynamic images. If this is not possible, then the individual components will be evaluated. If the ultrasound acquisition interferes with other MRI measurements (e.g. MR thermometry) during FUS treatment, then a strategy shall be devised to enable acquisitions to run consecutively (e.g. use of other motion surrogates for short time prediction).