

CURRENT AND FUTURE PERSPECTIVE IN ULTRASOUND THERAPY – MAGNETIC RESONANCE GUIDED FOCUSED ULTRASOUND IN MOVING ORGANS - FUSIMO Project

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HIFU (High-Intensity Focused Ultrasound / FUS / HIFUS) is a highly precise medical procedure using high-intensity focused ultrasound to heat and destroy pathogenic tissues. Clinical HIFUS procedures are typically image-guided to permit treatment planning and targeting before applying a therapeutic or ablative level of ultrasound energy. Applications include tissue ablation (HIFU) (for tumor treatments, for example), hyperthermia treatments (low-level heating combined with radiation or chemotherapy), or the activation or enhanced delivery of drugs.

Magnetic Resonance-guided Focused Ultrasound, often shortened to MRgFUS are involving MRI as guidance support, due to its high accurate diagnosis potential in detecting tissue tumors. MRgFUS is accepted by FDA as treatment in uterine fibroids since 2004. Current clinical trials are underway, examining the possible use of HIFU in the treatment of cancers of the brain, breast, liver, bone, and prostate. All those procedures depend of general anesthesia, being performed in deep apnea in order to annihilate the breathing movements of the targeted structures.

FUSIMO Project, based on a multicentre group formed by 11 European Partners is coming with a designed strategy to obtain a new capacity in focusing lesions in moving organs. FUSIMO will develop, implement and validate a multi-level model for moving abdominal organs for use with FUS and Magnetic resonance-guided focused ultrasound surgery. The integrated model will consist of:

- Abdominal organ model to simulate motion and the influence on ultrasound application
- Target organ/tumor model to capture organ/tumor physiology, and organ/tumor reaction to therapy
- Microscopic tissue model to simulate direct heat ablation, model energy distribution, tissue heating and cooling
- Model to evaluate first steps to simulate drug delivery, microbubble distribution and dynamics

The FUSIMO developments in the field of hardware and software will be combined into an integrated system, which will allow both abdominal FUS application to moving organs, and also other treatment modalities such as radio frequency, laser or cryotherapy or other types of interventions based on particles or fields in radiation therapy.