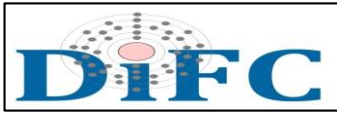


# rs-fMRI analysis on patients treated with trans-cranial Magnetic Resonance guided Focused Ultrasound Surgery (tcMRgFUS): preliminary results

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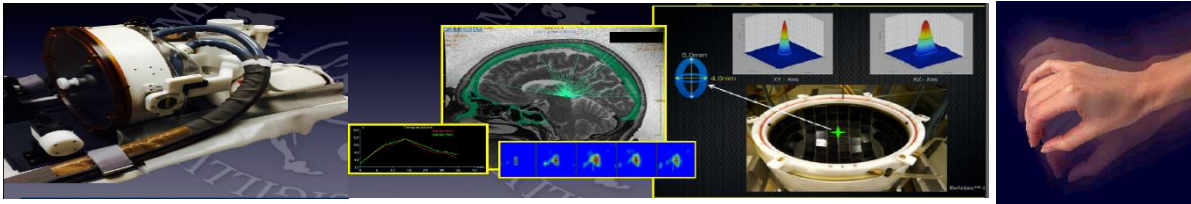
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## tcMRgFUS & Essential Tremor

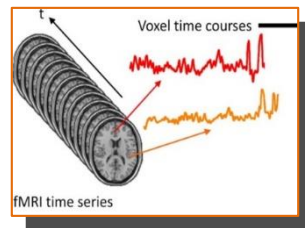
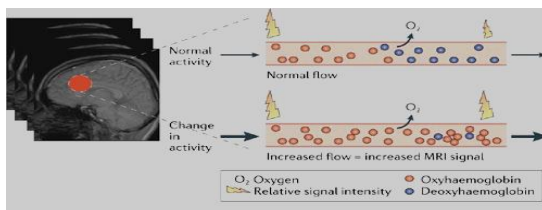
**Surgical therapy** using **magnetic resonance-guided focused ultrasound (MRgFUS)** is a modern and **non-invasive** ablative technique. Recent technological developments enabled MRI-guided therapeutic application of HI-FU to the brain (transcranial MRgFUS - **tcMRgFUS**)



**tcMRgFUS** offers an **incisionless** approach to treat movement disorders like **Essential Tremor**. **Essential Tremor** interferes with main daily activities such as: eating, drinking, writing, typing, personal hygiene...

## fMRI Analysis(ICA) & Method

**Functional magnetic resonance imaging (fMRI)** is a safe and noninvasive MRI technique, used to estimate and localize **neuronal activation** in the gray matter. This technique provides detailed information about the **metabolic** and **functional processes** of the human brain.



**MELODIC**  
Multivariate Exploratory Linear Optimised Decomposition into Independent Components

**Fifteen** patients with indication for functional neurosurgery and evidence of medication-refractory disease were enrolled



**10-minutes rs-fMRI before treatment**



**tcMRgFUS treatment**

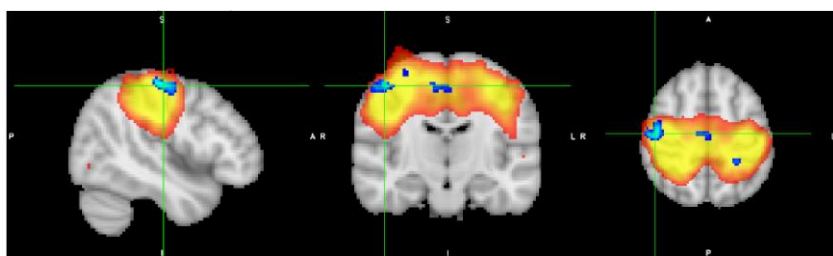


**10-minutes rs-fMRI six months after treatment**

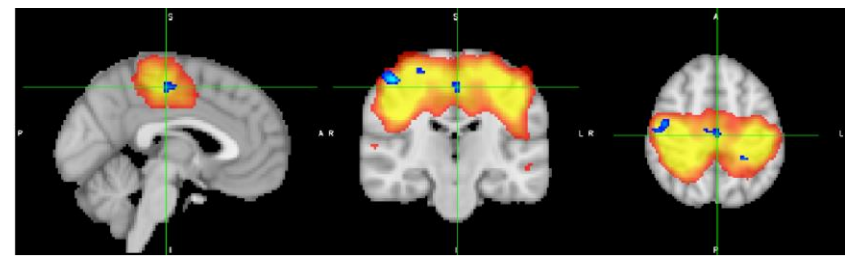
**Independent Component Analysis (ICA)**: starting from the registered signal it allows to extract the original spatial and temporal sources (**time course**), exploiting the hypothesis of **statistical independence** and non-gaussianity of the sources.

## RESULTS

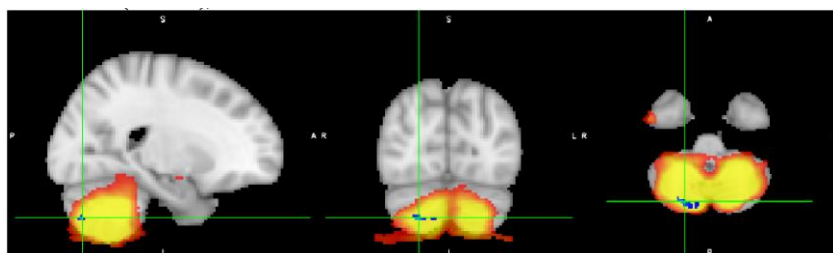
Increased resting state functional connectivity in patients with essential tremor undergoing left thalamotomy using high intensity focused ultrasound guided by MRI in:



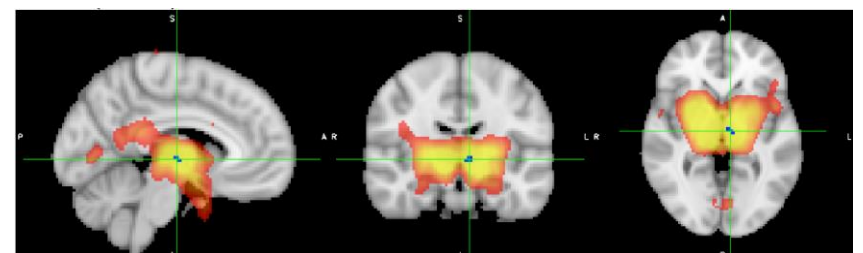
right precentral gyrus (primary motor area, M1)



(Supplementary motor areas, SMA)



Crus II of the right cerebellar hemisphere



left thalamus

## CONCLUSIONS AND PERSPECTIVES

We have observed that all the networks, where an **increased functional connectivity was found** after the tcMRgFUS treatment, belong to the **extra-pyramidal circuits responsible for controlling the voluntary movements** of the contralateral limb to that treated

The data obtained, for a correct interpretation, must be correlated with the results of the clinical evaluations

These analyses will be applied **in a predictive way** during the planning of the **tcMRgFUS** treatments and could allow the **temporal optimization**

