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## **Brain hemodynamic and electrical activity during functional upper limb movements in chronic stroke**

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## INTRODUCTION

Two-thirds of stroke survivors suffer from **persistent functional limitations** of their paretic upper limbs (UL). To cope with this persistent sequel, a good understanding of UL recovery mechanisms is needed. Portable functional neuro-imagery could be easily used for **brain-movement evaluation** to highlight **neuroplasticity mechanisms during rehabilitation**.

**Objective:** To fuse fNIRS and fEEG methods to evaluate sensorimotor cortical (SMC) activity during UL movements

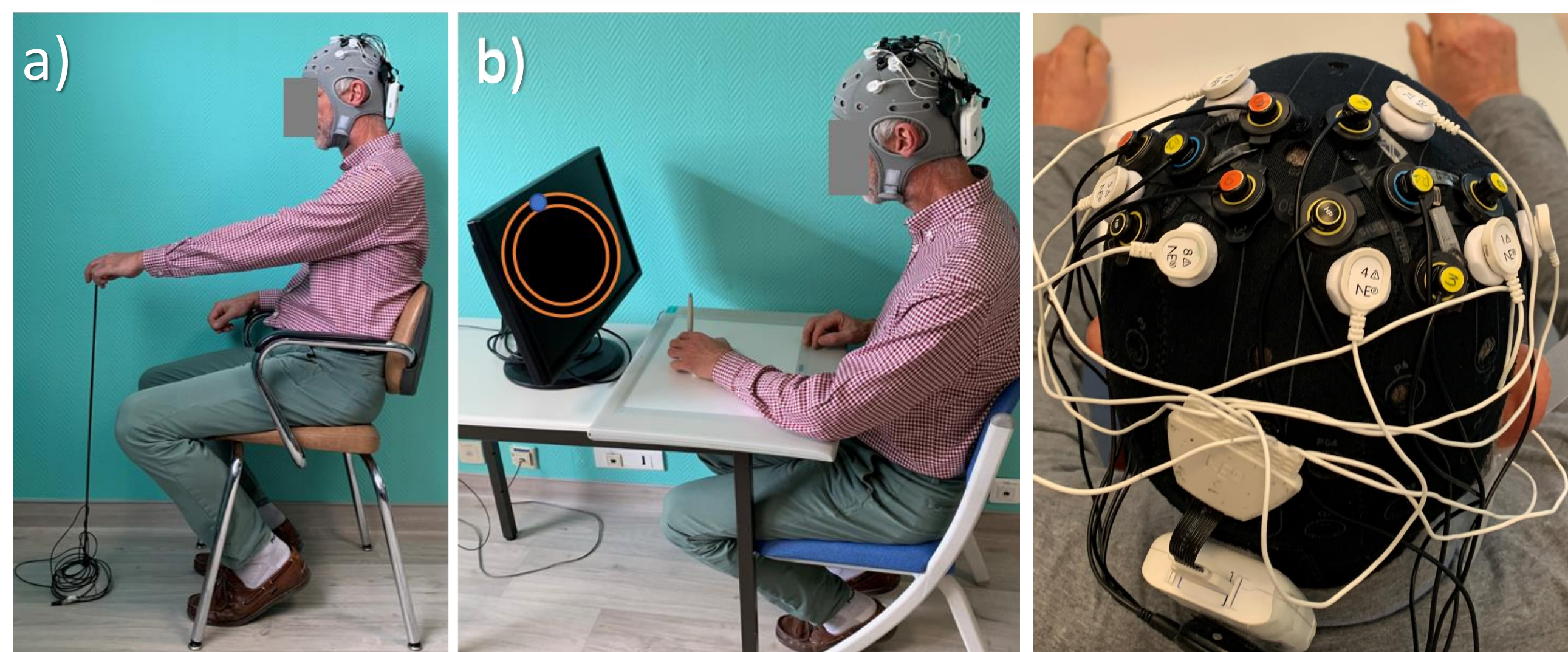
## METHODS

### Participants:

- 3 chronic stroke patients (mean age = 59 years, >6 months post-stroke)
- Upper limb impairment (mean FM-UE = 48/66)

### Experimental protocol (Fig.1):

- 3 blocs of 20s of each functional task (Fig. 1) with paretic and non-paretic UL
- Synchronized recording of brain (fNIRS, fEEG, Fig. 2) and movement (Kinect, graphic tablet pad) parameters



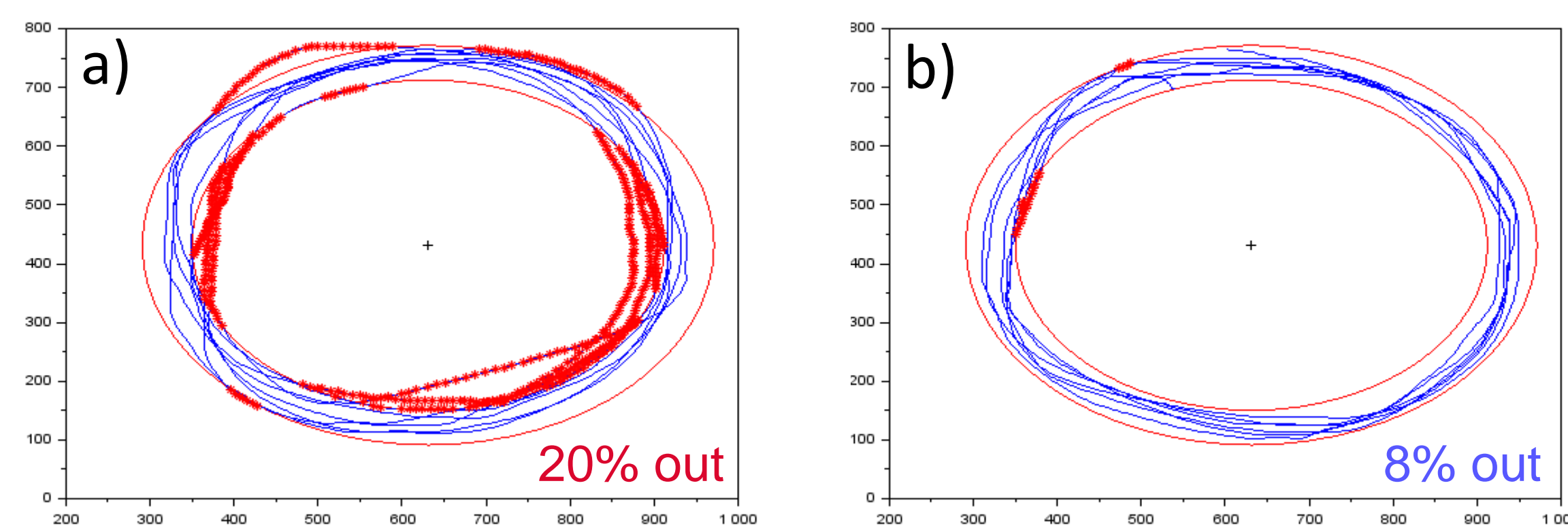
**Fig 1.** a) Reaching and b) Circular steering tasks

**Fig 2.** fNIRS and fEEG layout over the SMC region

## DISCUSSION

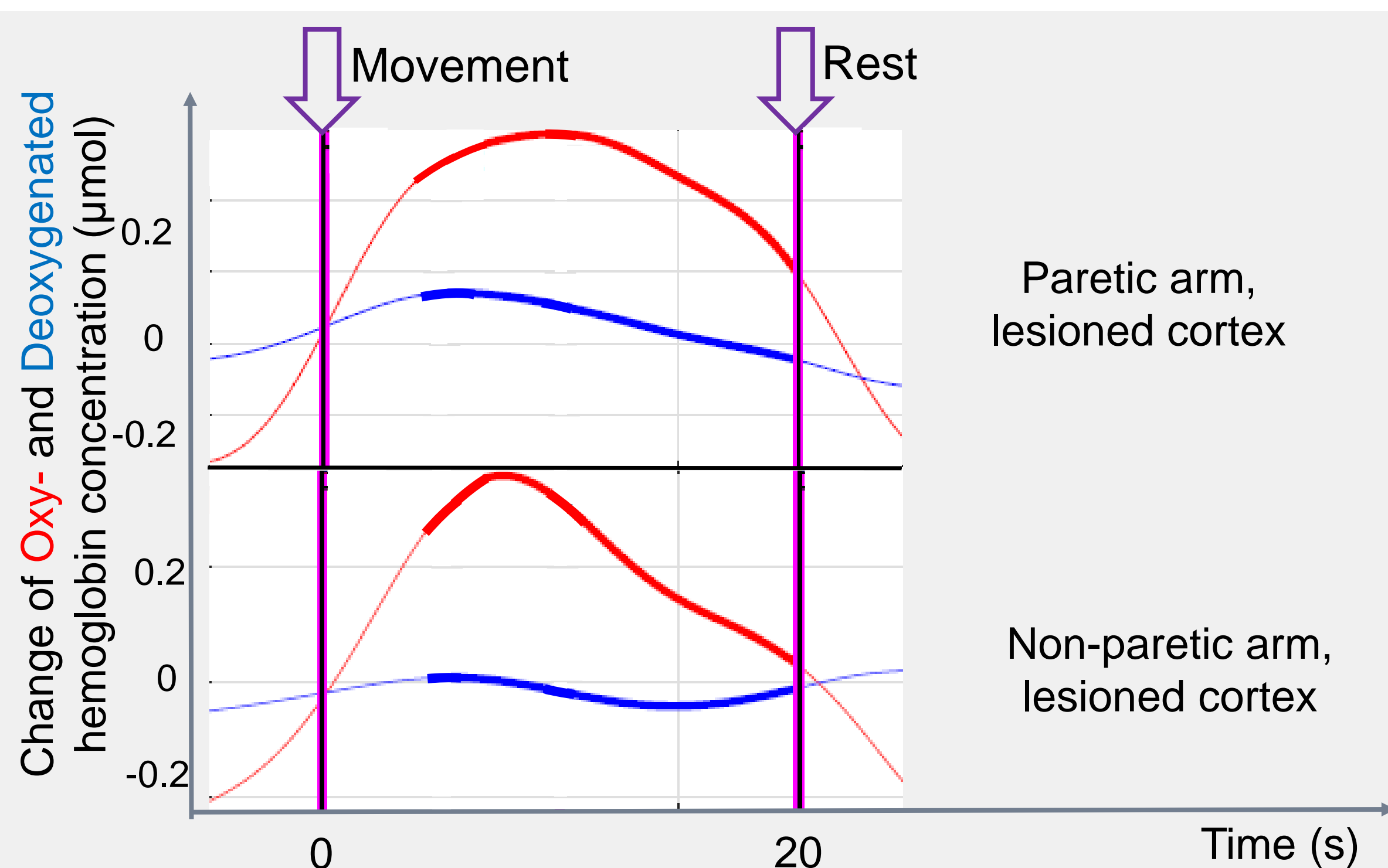
- **Neuromonitoring** platform to explore movement-related neurovascular coupling mechanisms
- **Relative ease of installation** provides a **routine** way to explore level of neuroplasticity during stroke rehabilitation
- Long term objective: **precision medicine**

## RESULTS



**Fig 3.** Movements of the paretic arm (a) and non-paretic arm (b) for the circular steering task in one patient

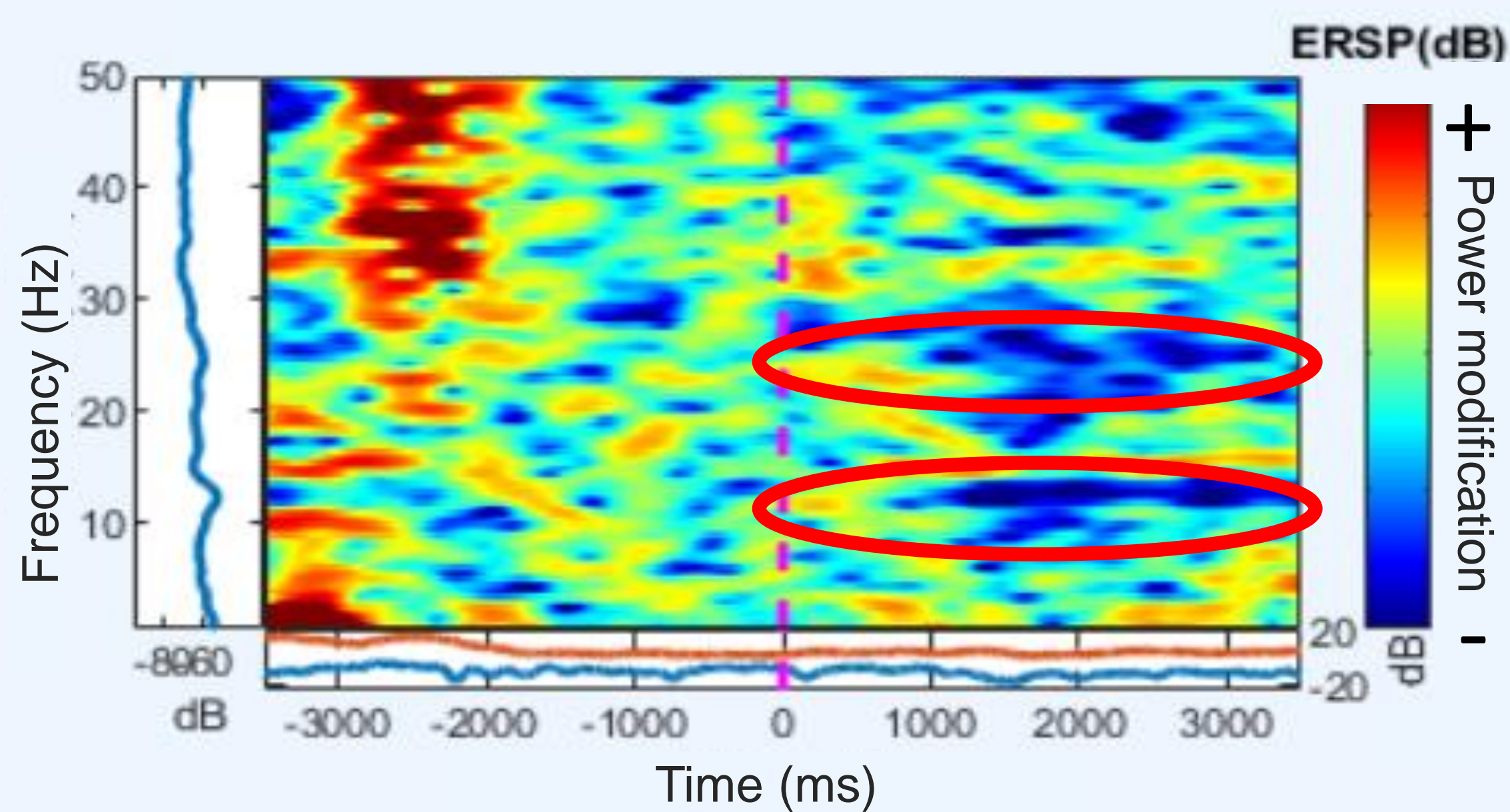
**Kinematics** (Fig. 3): lower performances with paretic UL



**Fig 4.** fNIRS hemodynamic response during circular movements

fNIRS provides (Fig. 4) information about:

- Level of SMC activation (**↑ oxygenated blood**)
- **Ipsilateral and contralateral SMC** difference



**Fig 5.** Power modification in Alpha and Beta bands during circular movements

fEEG provides (Fig. 5) information about:

- Level of **SMC excitability** (**↓ Alpha (8-13Hz) and Beta (14-35Hz) power**)
- **Ipsilateral and contralateral SMC** difference