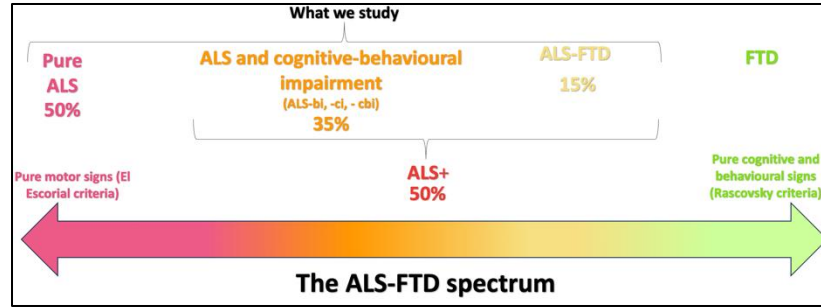


# Contribution of quantitative MRI in the preclinical detection of early neurodegeneration of fronto-temporal dementia in patients with amyotrophic lateral sclerosis.

Geron, C.<sup>1,2</sup>, Lamalle, L.<sup>1</sup>, Philips, C.<sup>1a,1b</sup>, Vandewalle, G.<sup>1</sup>, Collette, F.<sup>1,3</sup> & Maquet, P.<sup>1,2</sup>

<sup>1</sup> University of Liège, GIGA Research, GIGA-CRC Human Imaging Unit, Lab, <sup>2</sup> Neurology Department, CHU of Liège, Belgium, <sup>3</sup> University of Liège, Psychology and Cognitive Neuroscience Research Unit

## introduction

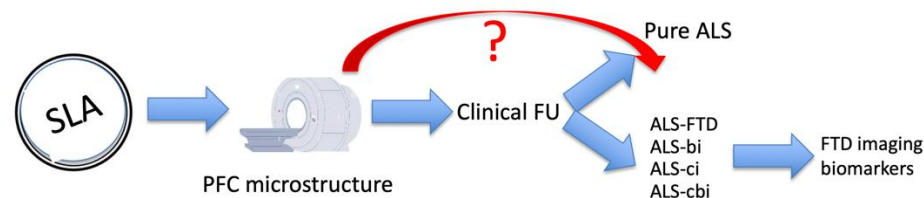


Currently : **no validated biomarkers** for **early detection** of FTD and ALS+  
 ⇒ Misdiagnosis and delays  
 ⇒ Impact disease management and prognosis  
 ⇒ Shortened survival

**Urgent need for validated biomarkers**

## Aim of the study

Identify early microstructural changes in ALS+ patients using quantitative MRI (qMRI) and **use the derived parameters as imaging biomarkers for FTD.**

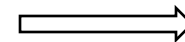


## Hypothesis

**Early neurodegenerative microstructural changes can be identified before clinical symptoms**

- ⇒ Precise quantification and localisation of the neurodegenerative processes
- ⇒ Early diagnosis in FTD and ALS+
- ⇒ Presymptomatic diagnosis (in familial forms)

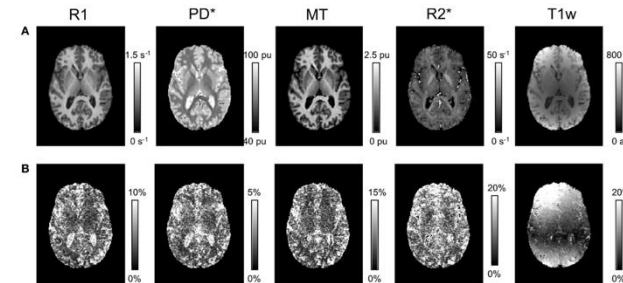
Predicted changes in ALS+ vs. pure motor ALS & controls :



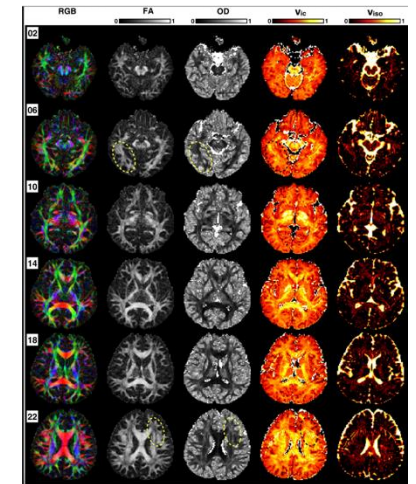
## Study Design

### 3T- quantitative MRI Protocol

- **Multiparameter mapping** : R1, R2\*, MTsat, PD, QSM for **microstructural tissue characterization**
- Diffusion imaging (**NODDI**) to estimate **axonal diameter & neurite density**
- Optimization : **Spatial resolution adjusted** (0.80 mm → 1.07 mm), reducing scan time by ~6 min (not negligible for patients)



Weiskopf et al, 2013.



Zhang et al, 2012

## Statistical analysis

- **PARTICIPANTS**: 5 groups of patients and Healthy controls.
- **MANOVA model** in **MSPM toolbox**, with **F-test** to assess the overall multivariate effect.

Values	Peptide accumulation	Inflammation	Neuronal ⇒ myelin loss
R1			↓
R2*		↑	↓
QSM		↑	↓
MT sat	Focal ↑		↓
Neurite density + orientation			↓