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# White Matter Changes and Cognitive Performance in the Oldest Old: a DTI Analysis from the Fibratlas Cohort

Eva Sizaret (1)(2), Lucie Angel (1), Christophe Destrieux (2), Ilyess Zemmoura (2),  
 (1) UMR 7295 CeRCA, Université de Tours, Université de Poitiers, France. (2) UMR 1253 iBrain, Université de Tours, France.

## Introduction

### Normal aging

- Modification of cognitive functions (especially in processing speed, working memory, executive functions, and long-term episodic memory).
- Microstructural changes in the white matter of the brain (observable using diffusion tensor imaging<sup>1,2</sup>

**Significant role of white matter** in processing speed, executive function, and episodic memory : important role of the cingulum and corpus callosum in tasks involving executive function<sup>3</sup>.

Few studies on correlation brain microstructure and cognitive function **on very old individuals** (over 80 years old)

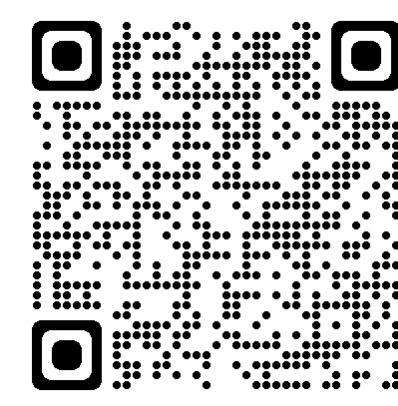
**Research issues :**  
 investigate correlation with cognitive performance in processing speed, executive functions, and episodic memory in very old age

## Methodology

### Participants

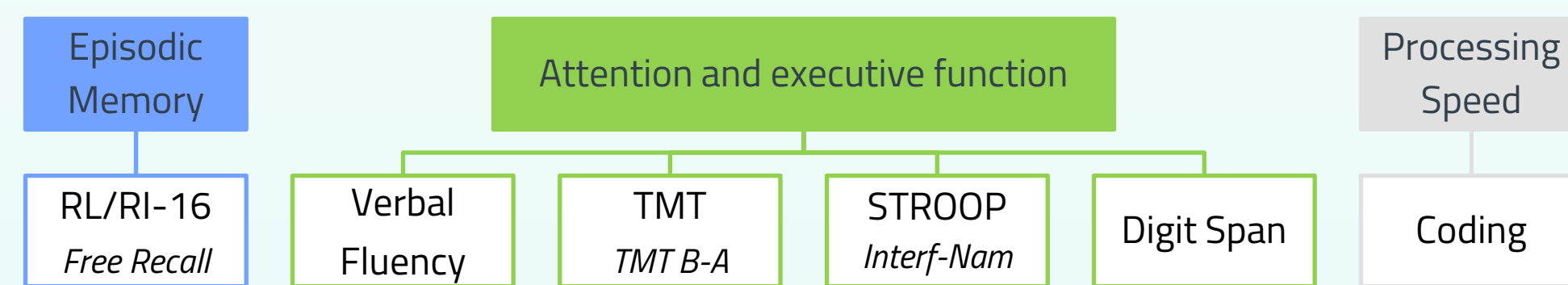
Sample of 30 participants aged 82 to 94,5 (m= 85,9 ± 3,7) from **FIBRATLAS cohort**

- Healthy french participants
- No history of neurologic or neurosurgical disease
- No major impairment
- IADL ≥ 4



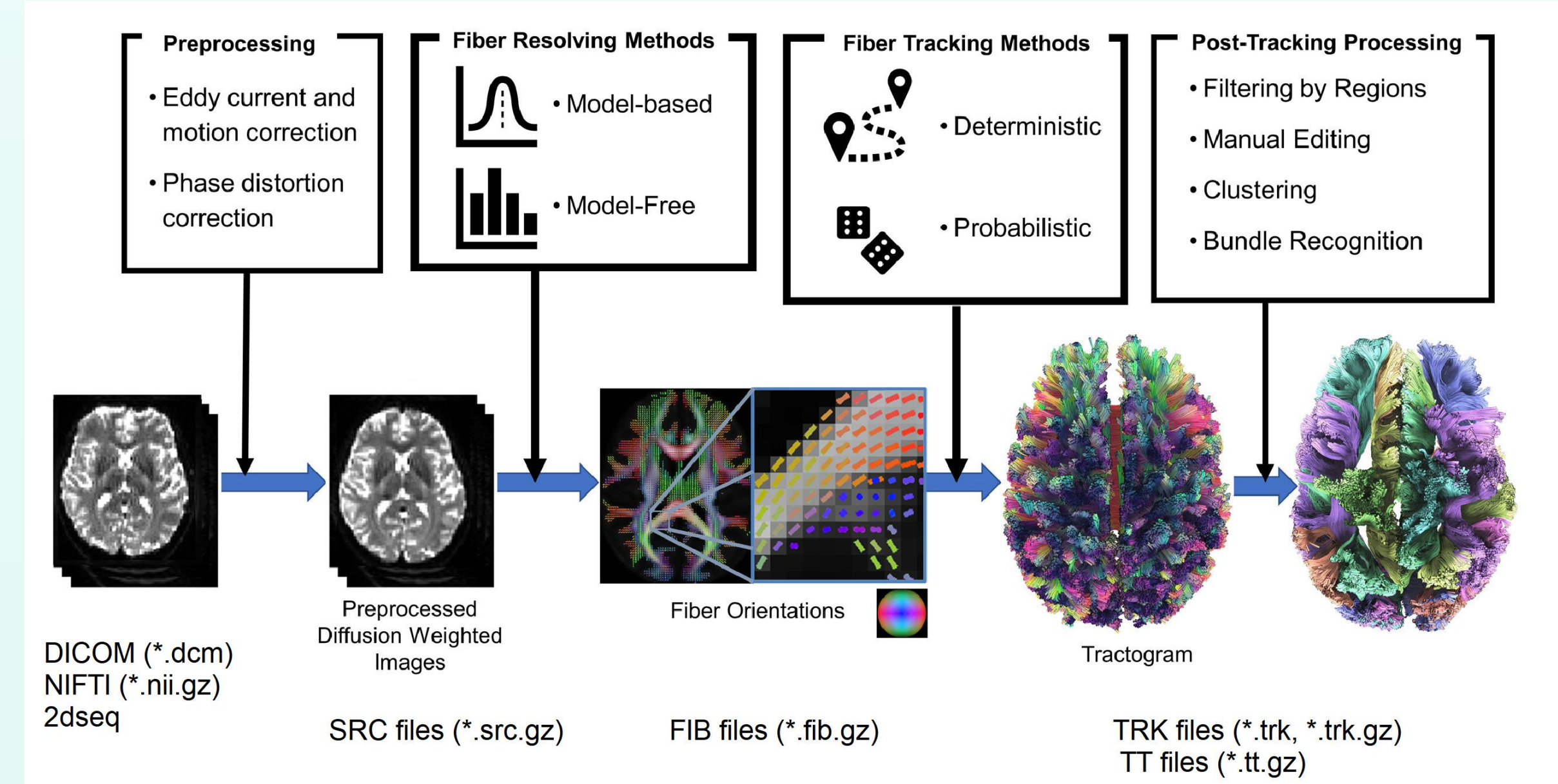
### Materials & Methods

1 Analysis of **cognitive measures** extracted from the neuropsychological assessment performed at inclusion



2 Reconstruction of **cingulum bundle** and **corpus callosum** using **DSI Studio**

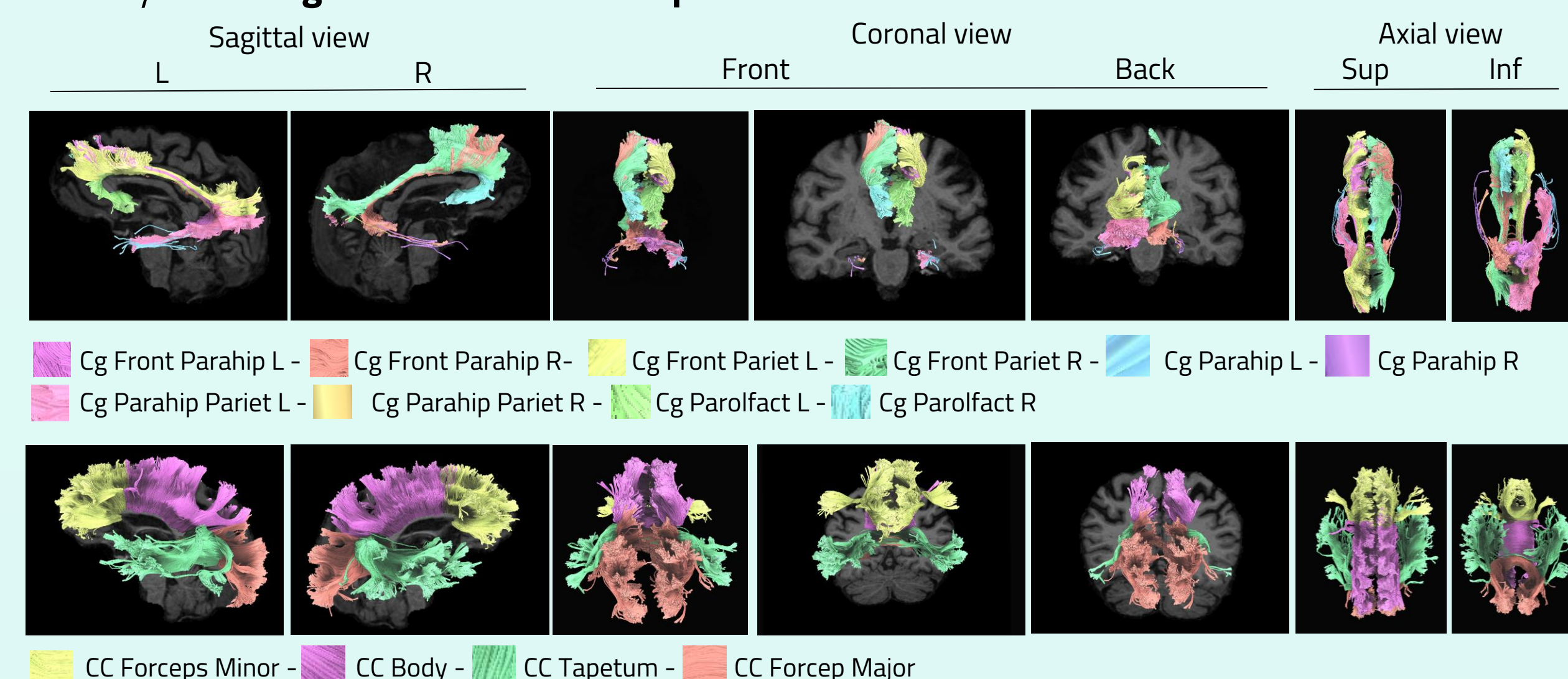
A deterministic fiber tracking algorithm<sup>4</sup> was used with augmented tracking strategies<sup>5</sup> to improve reproducibility



Source : [https://dsi-studio.labsolver.org/doc/how\\_to\\_analyze\\_dmt.html](https://dsi-studio.labsolver.org/doc/how_to_analyze_dmt.html)

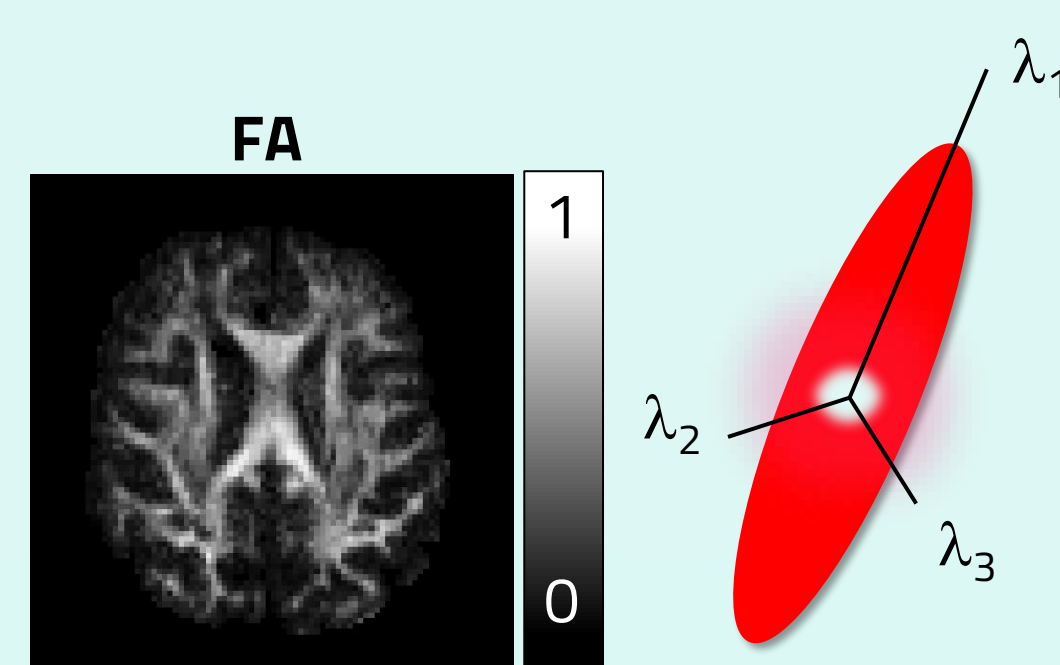


3 Analysis of **cingulum bundle** and **corpus callosum**



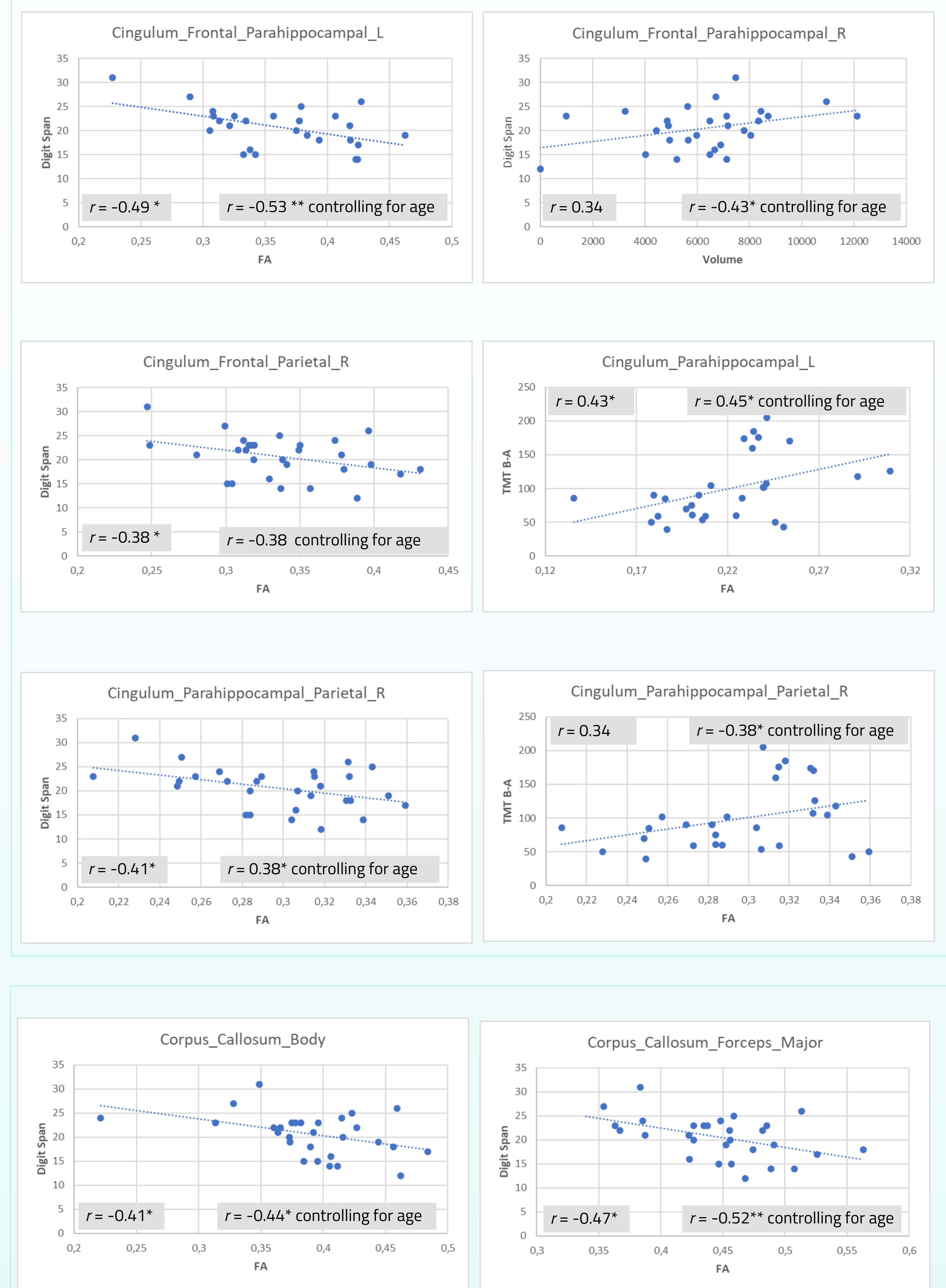
4 White matter bundles metrics analysis

Number of tracts	
<b>Volume</b>	mm <sup>3</sup>
<b>FA</b> Fractional Anisotropy	measure of the directional dependency of a diffusion process (value 0 to 1)
<b>MD</b> Mean Diffusivity	average of the three eigenvalues of the diffusion tensor (mm <sup>2</sup> /s)
<b>AD</b> Axial Diffusivity	diffusion speed of water molecules along the main diffusion direction (mm <sup>2</sup> /s)
<b>RD</b> Radial Diffusivity	diffusion speed of water molecules perpendicular to the primary diffusion direction (mm <sup>2</sup> /s)



## Results

Correlations between scores and white matter bundles metrics were examined. Partial correlations were performed to control the effect of age. Only significant correlations are reported below.



## Conclusion

- ✓ **No role for the cingulum and corpus callosum in verbal episodic memory performance**
- ✓ **No association between the left and right cingulum frontal parahippocampal and corpus callosum forceps minor bundles and cognitive function examined.**
- ✓ **Fractional Anisotropy : relevant measure for investigating links between white matter bundles and executive function**
- ✓ **Questionable small negative correlation between FA and digit span**
- ✓ **This preliminary study needs to be continued and there are several possible areas for improvement:**
  - increasing the number of participants
  - controlling gender and level of education
  - analysis of bundles whose role in episodic memory performance, executive function and processing speed has already been demonstrated (fornix, uncinate fascicle, inferior and superior longitudinal fascicles)

## References

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