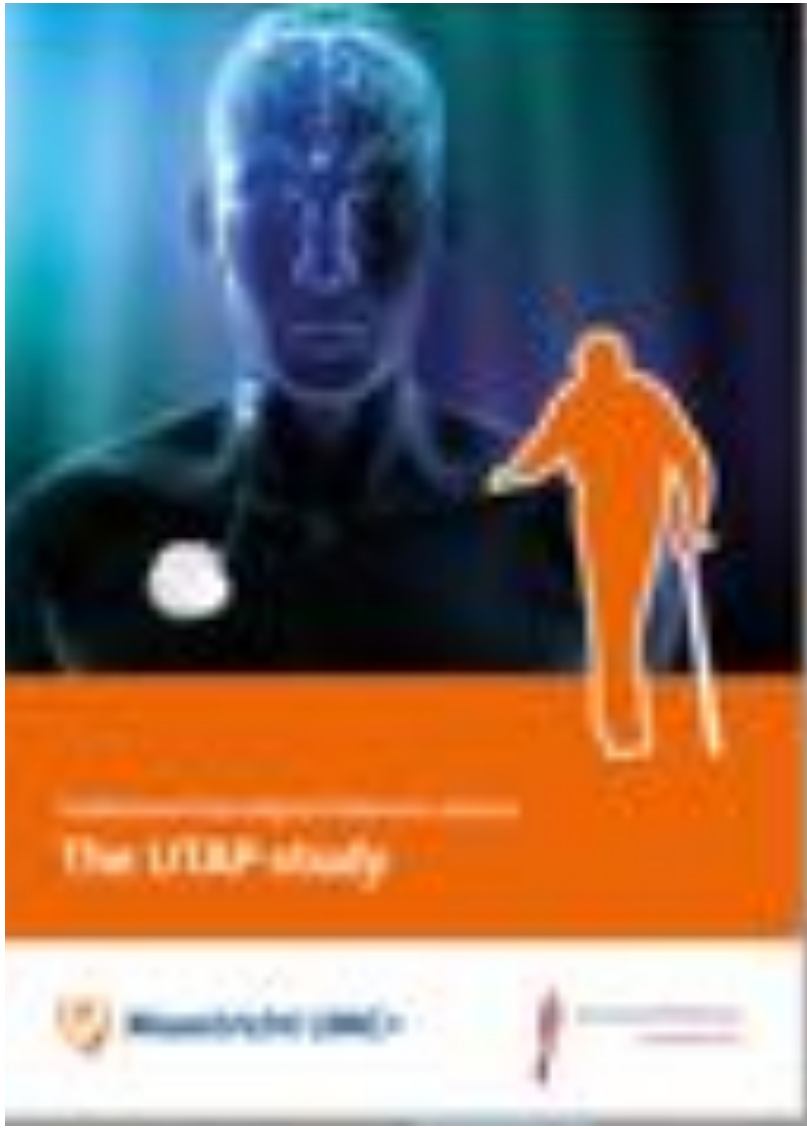
The Maastricht PD MRI cohort

Stijn Michielse PhD
Department of Neurosurgery
Maastricht University
@stijnimaging

UTAP

- **U**nderstanding
  - 9.4T post-mortem
- **T**racking
  - TRACK-PD, 7T
- **A**djustment
  - sensors and adaptive DBS
- **P**arkinson's Disorder



Work Package 1 – Understand PD

- Focus on changes in the microcircuit of the basal ganglia and brainstem
- Diffusion Weighted Imaging
- White matter visualisation and quantification
- Quantitative T2 mapping

Brain container - development

Brain container

Work Package 1 – Understand PD

- Post-mortem PD
- Brains from UK biobank
  - 2-3 years old, fixed in formaldehyde PBS solution

MRI protocol

- T2
  - 0.25mm isotropic GRadient Echo; entire hemisphere
  - Six echo's
    - 6.98ms, 11ms, 16.21ms, 20.23ms 24.46ms and 30ms

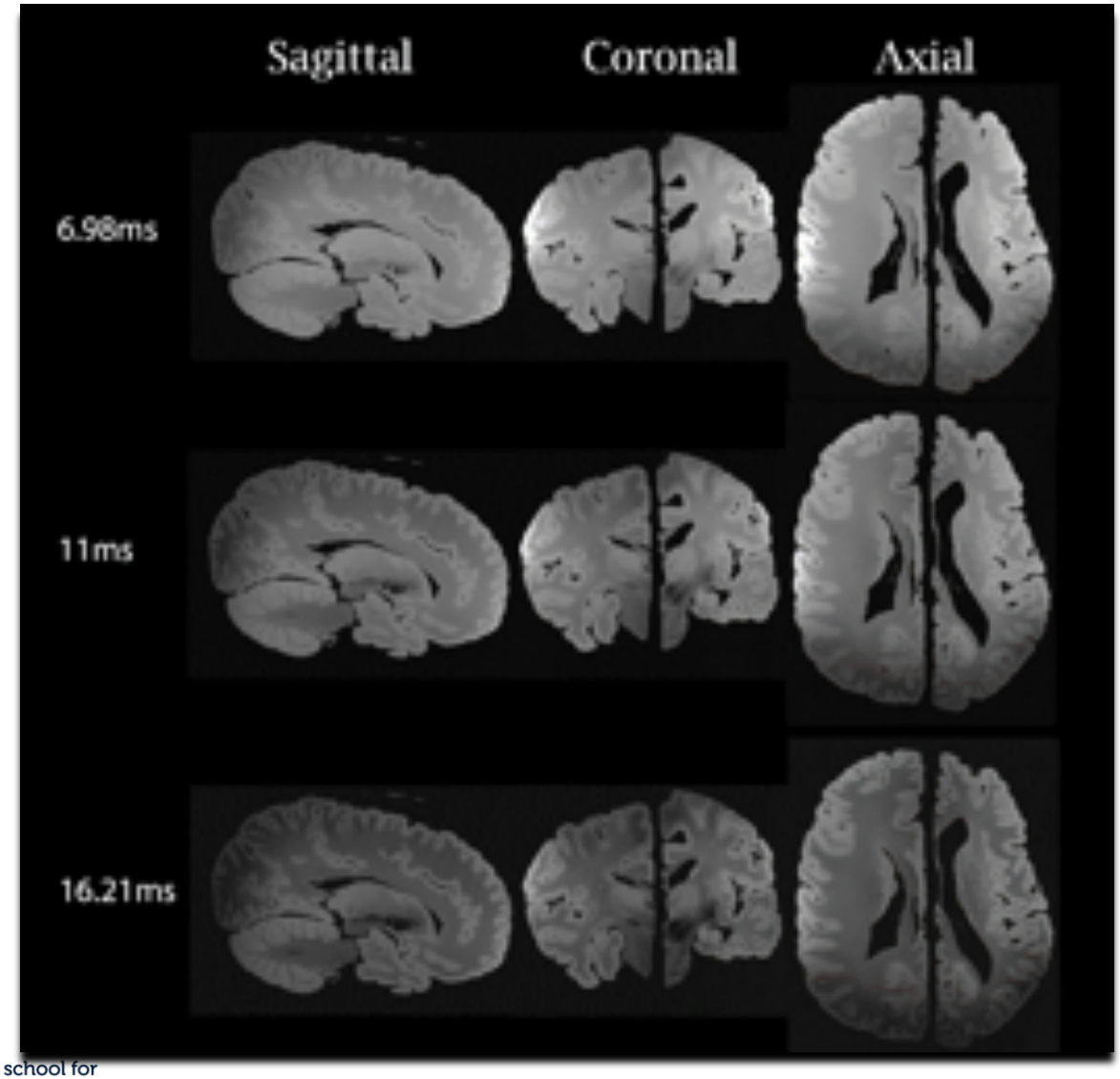
- Diffusion Weighted Imaging
  - 1mm isotropic; entire hemisphere
  - 48 random directions b-value 5009s/mm^2
  - 5 low b-value volumes at 279s/mm^2
  - Field of view; 144x132x180mm, TR=450ms

Scanning

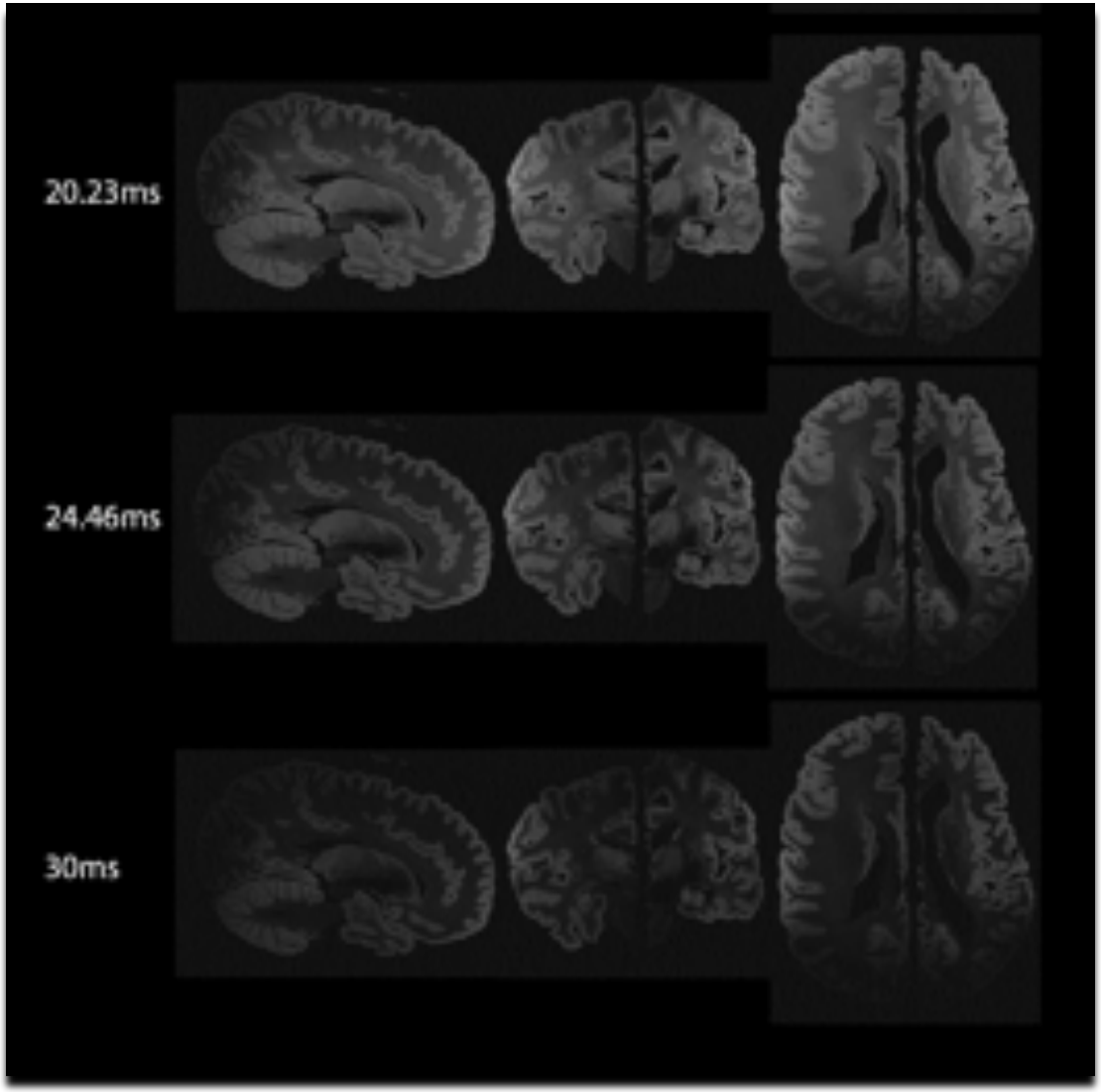
- T2 weighted; 3h (2x)
- Low b-value diffusion; 20min (5x)
- 2h per set of four directions (12x)
- Total 32h (including scan cooldowns)

- Raw data reconstruction (500Gb of data)
- Berkeley Advanced Reconstruction Toolbox (BART) in MatLab

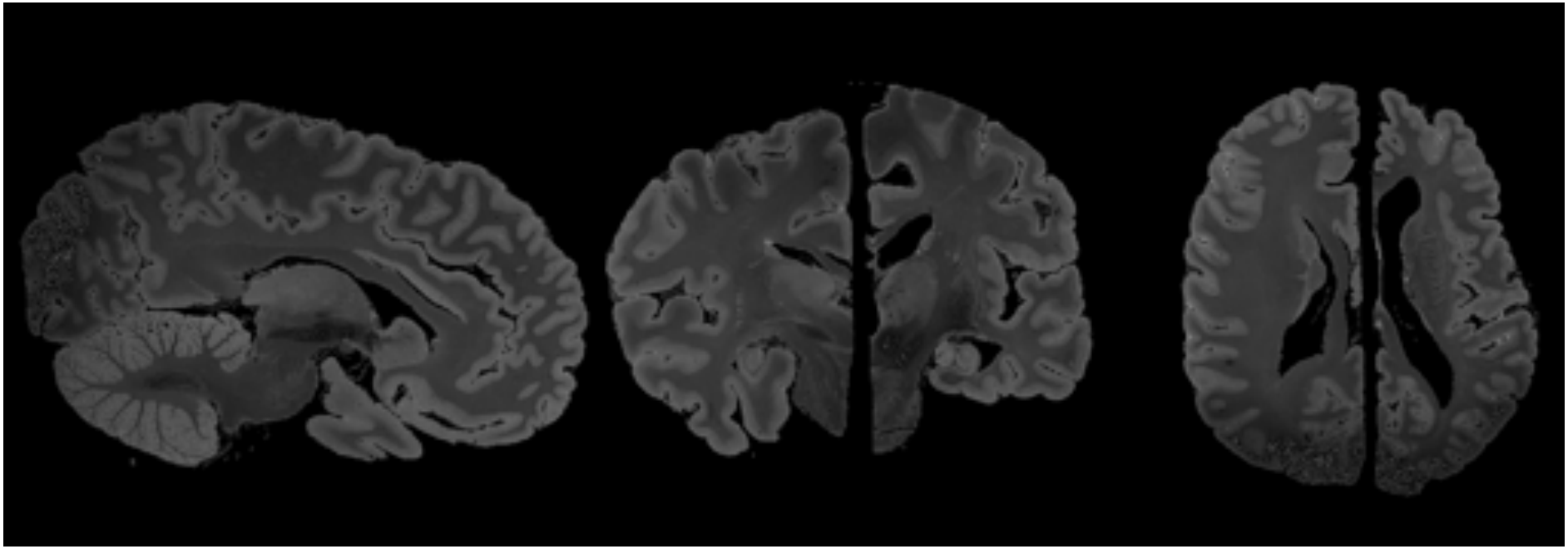
T2 weighted – 250µm resolution



T2 weighted – 250µm resolution



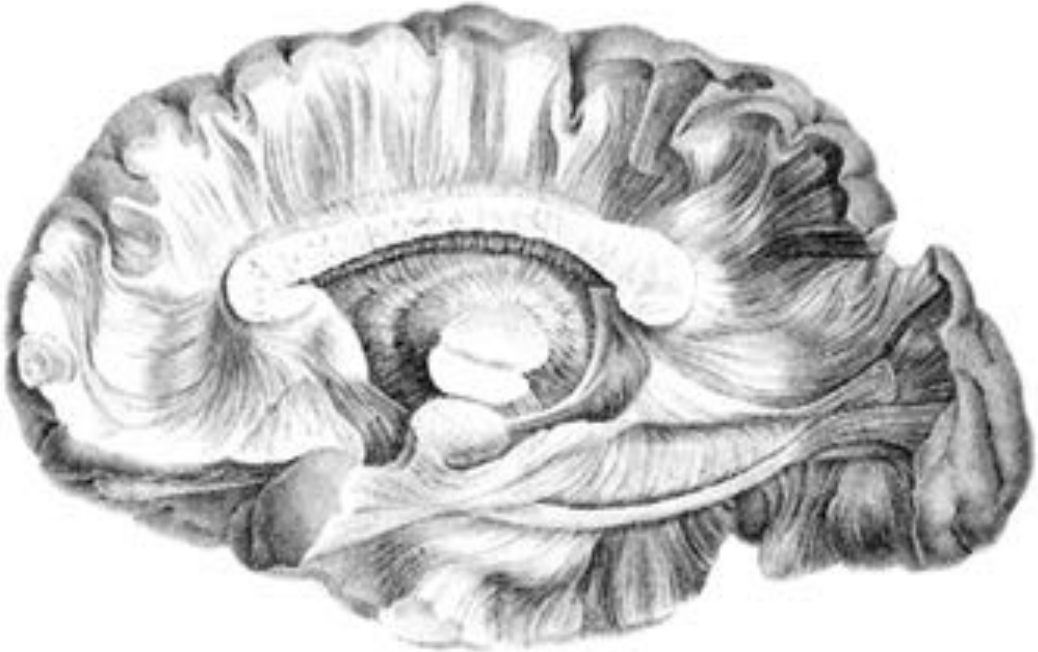
Quantitative T2* map



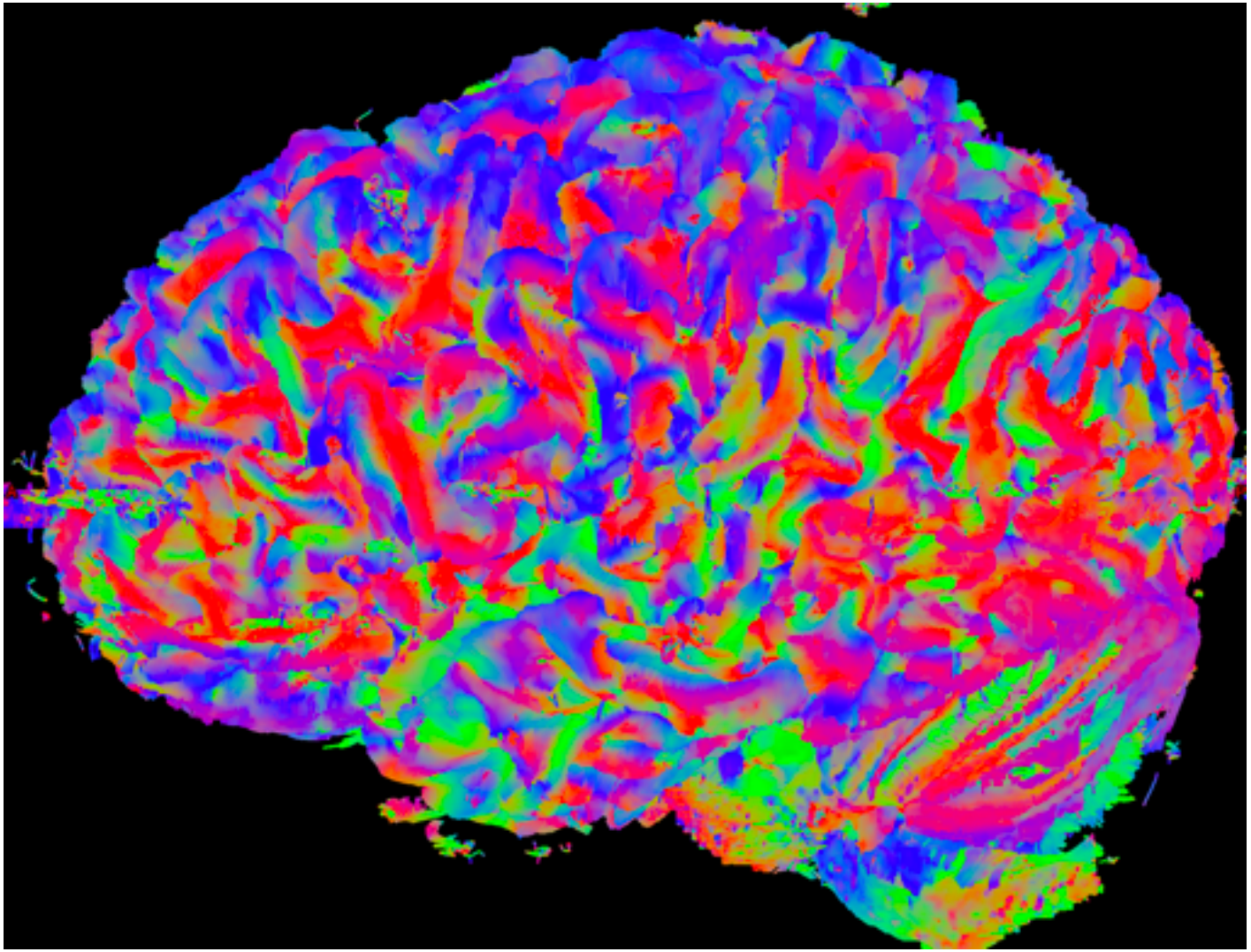
Diffusion Weighted Imaging

- Create contrast, based on b-values (gradient strength)
- Goal; white matter quantification
- White matter tracking → tractography
- Focus on cortico-spinal tract, limbic system and basal ganglia

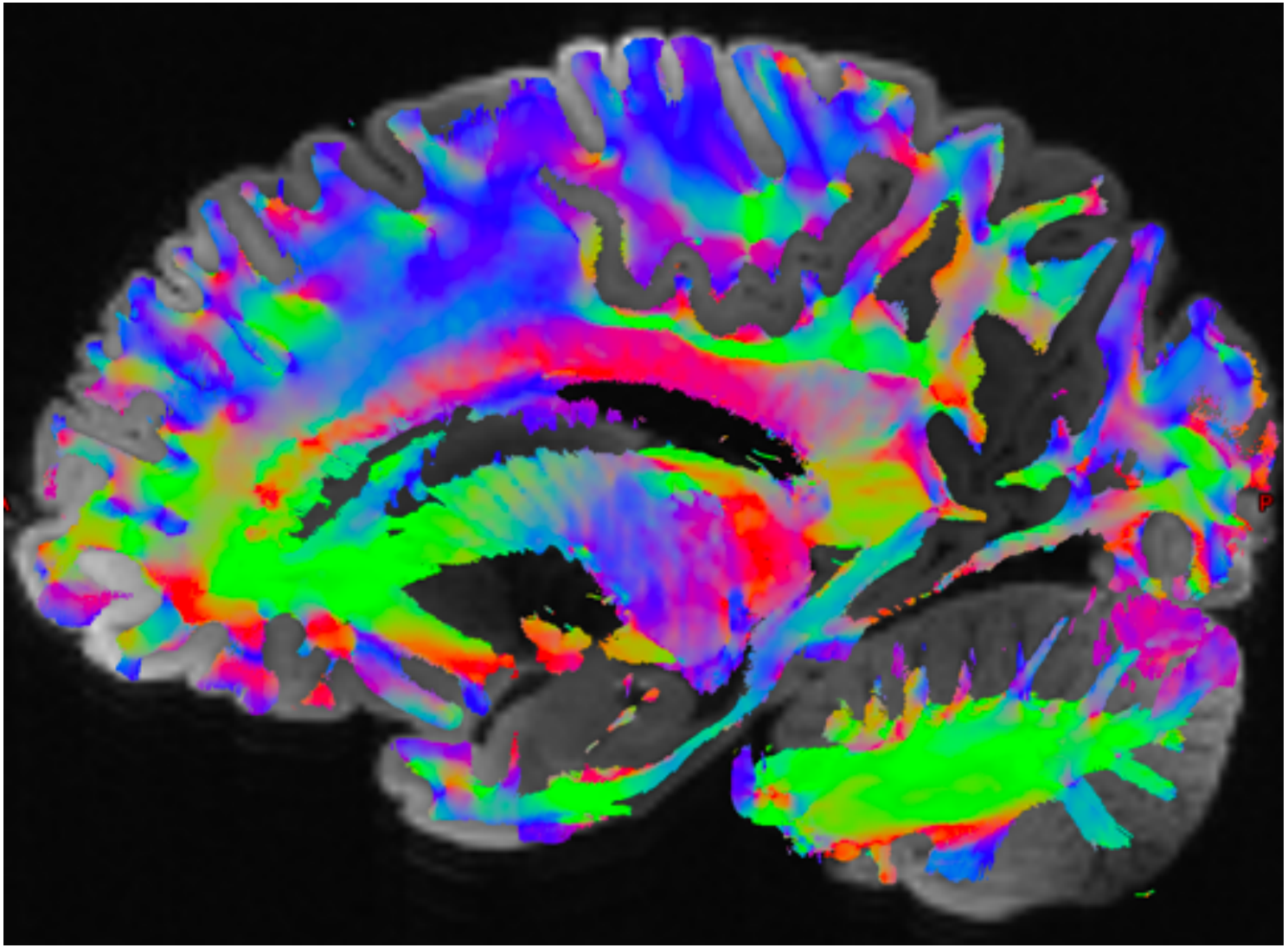
White matter bundles



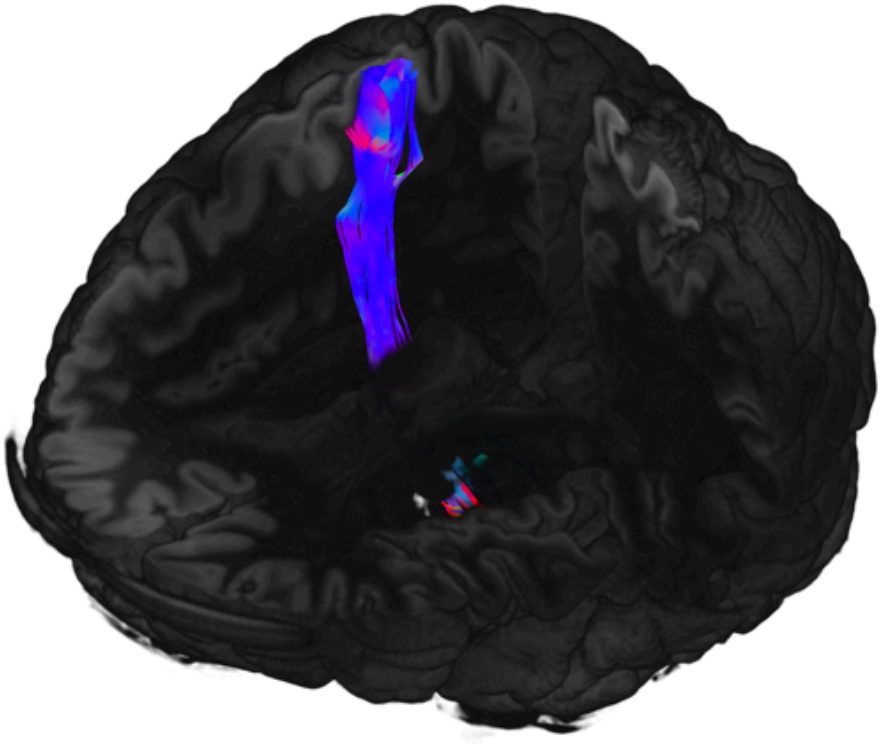
Fiber tracking



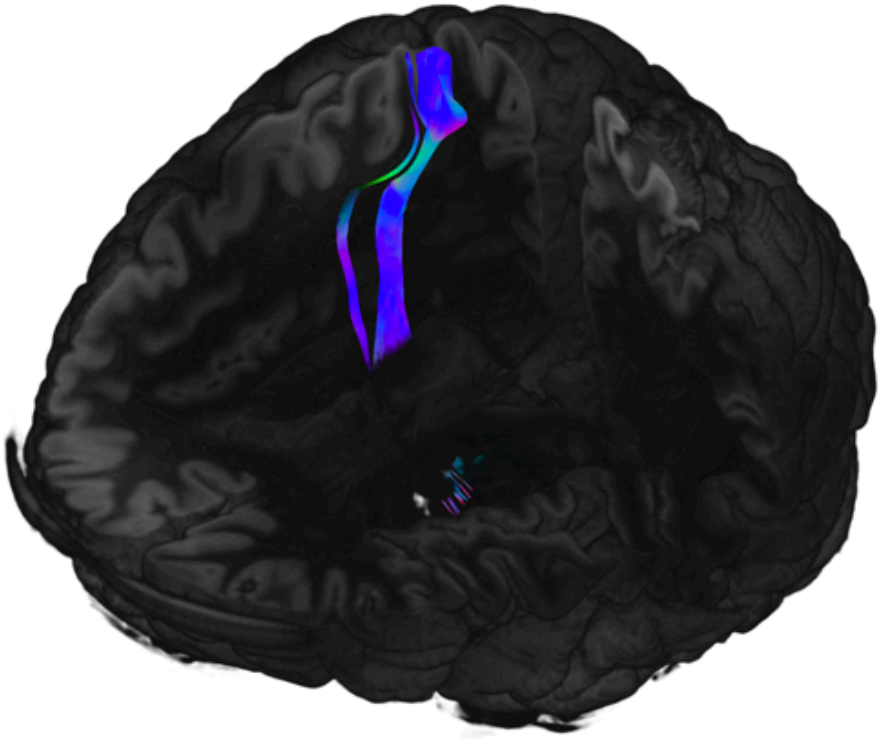
Fiber tracking (2)



Pre and post central gyrus



Motor cortex

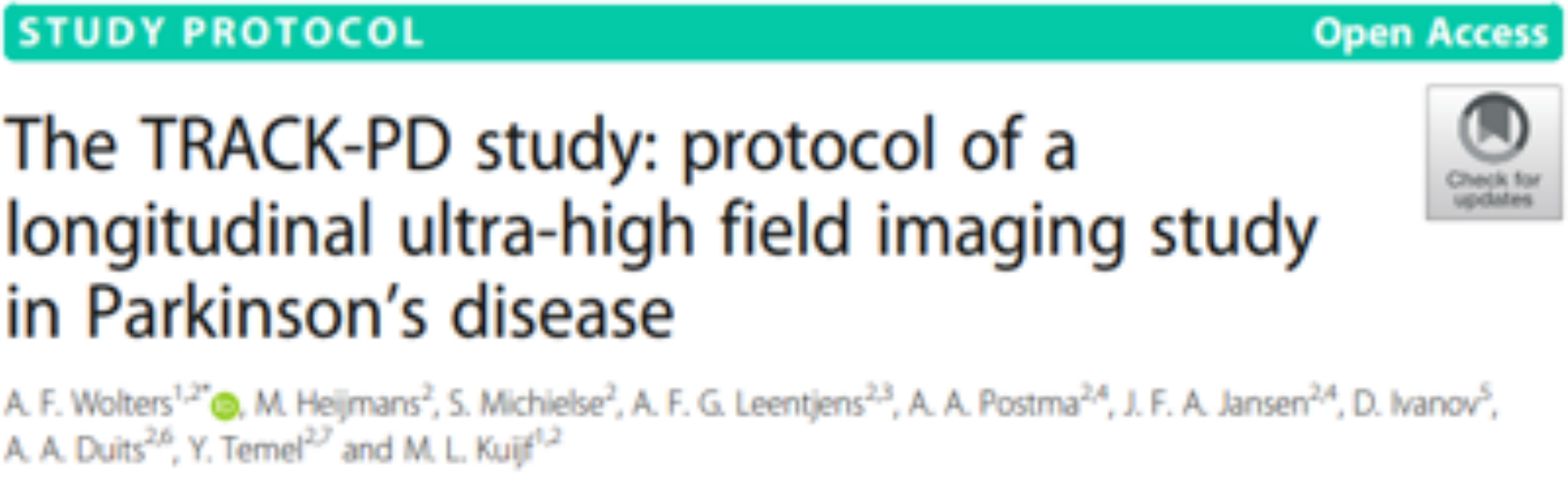


Sensory cortex

Work Package 2 - TRACK-PD

TRACK-PD
MUMC+

- Tracking of Parkinson's Disease
- Longitudinal study
- Protocol has been published in BMC Neurology


STUDY PROTOCOL Open Access

The TRACK-PD study: protocol of a longitudinal ultra-high field imaging study in Parkinson's disease

A. F. Wolters[1,2*], M. Heijmans[2], S. Michielse[2], A. F. G. Leentjens[2,3], A. A. Postma[2,4], J. F. A. Jansen[2,4], D. Ivanov[5], A. A. Duits[2,6], Y. Temel[2,7] and M. L. Kuijf[1,2]

MHeNS school for mental health and neuroscience

Maastricht University | Maastricht UMC+

TRACK-PD: Objectives

- Primary
  - Detection of MRI alterations in early diagnosed PD patients and the development of a diagnostic model.

- Secondary
  - Correlate MRI findings with clinical phenotypes and subtypes (TD and nTD)
  - Determine radiological biomarkers for disease progression over time.

Protocol

7T-MRI
- T1
- T2*
- MTW TFL
- DWI
- rs-fMRI

Domain	Test	Baseline	2 years	4 years
Imaging	7T MRI	X	X	X
Motor function	MDS-UPDRS I-IV	X*	X*	X*
	Wearable sensors	X	X	X
Cognition	MoCA	X	X	X
	NPO	X	X	X
Mood	BDI	X	X	X
	PAS	X	X	X
	PDQ-8	X*	X*	X*
	QUIP-RS	X	X	X
Autonomous	SCOPA-AUT	X	X	X
Sleep	RBD-Q	X	X	X
Blood	DNA / RNA	X	-	-

* PD only

Study population

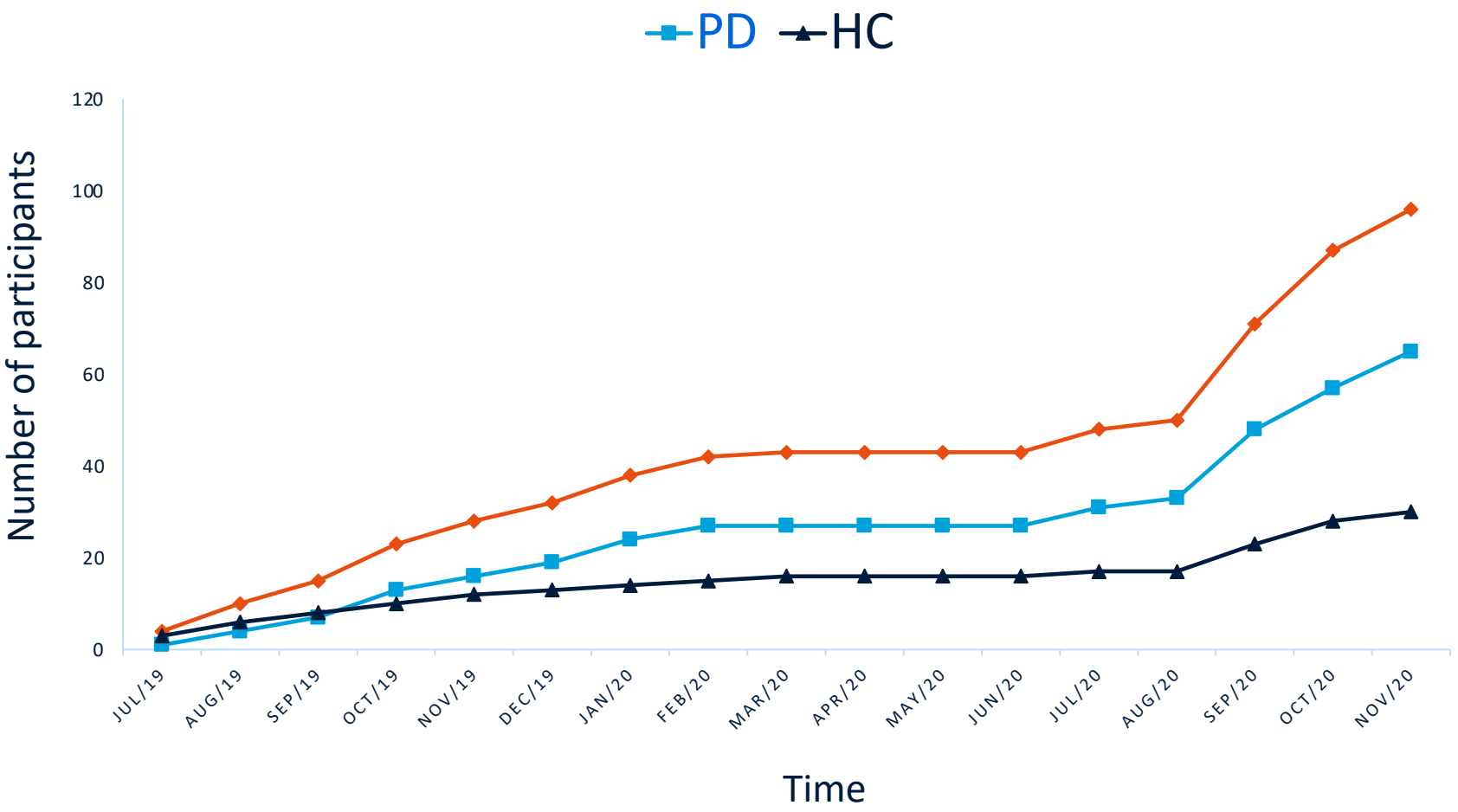
TRACK-PD
MUMC+

- Inclusion criteria
  - Recent diagnosis idiopathic PD (≤3 years after diagnosis)
  - Age ≥ 18 years

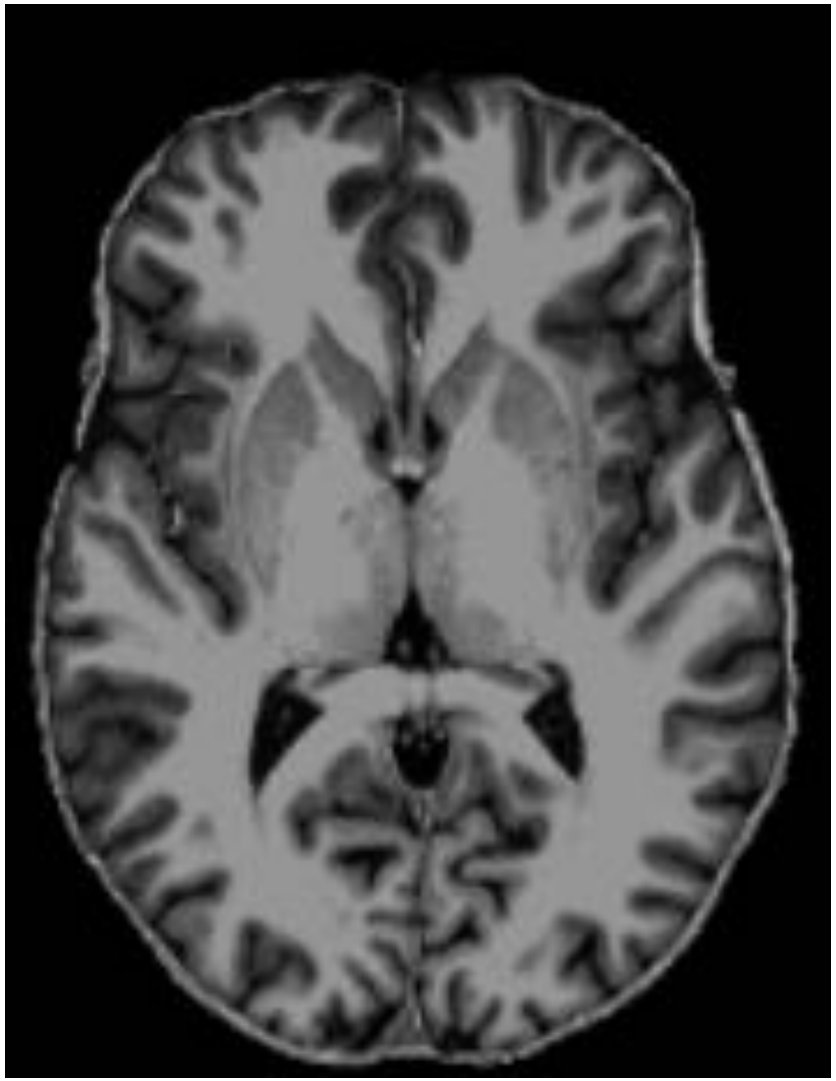
- Exclusion criteria
  - MRI contra-indication
  - Dementia or advanced cognitive impairment (MoCA <24)
  - Other neurodegenerative comorbidity

- Target: 130 patients + 60 controls

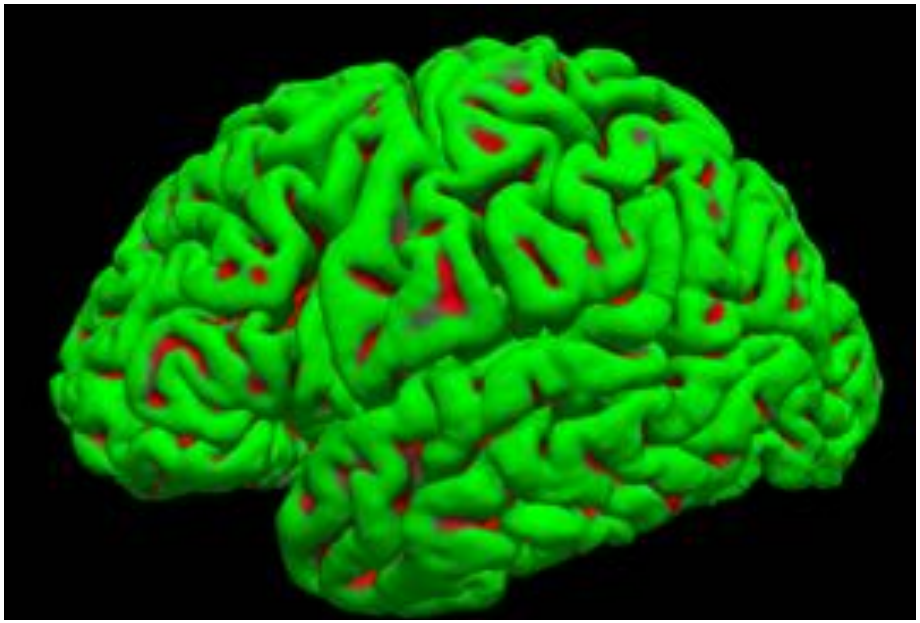
Participant inclusion

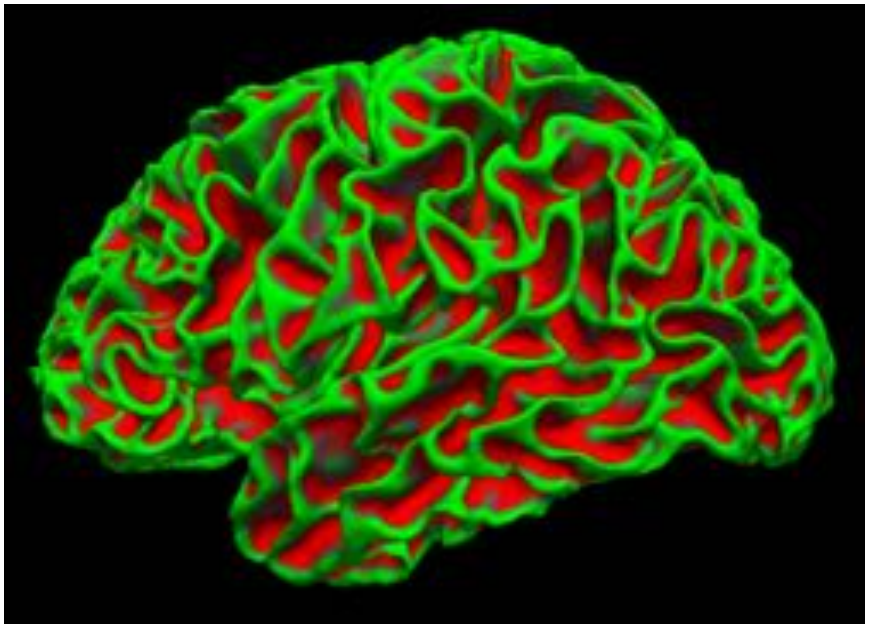


7T anatomical - 650µm resolution



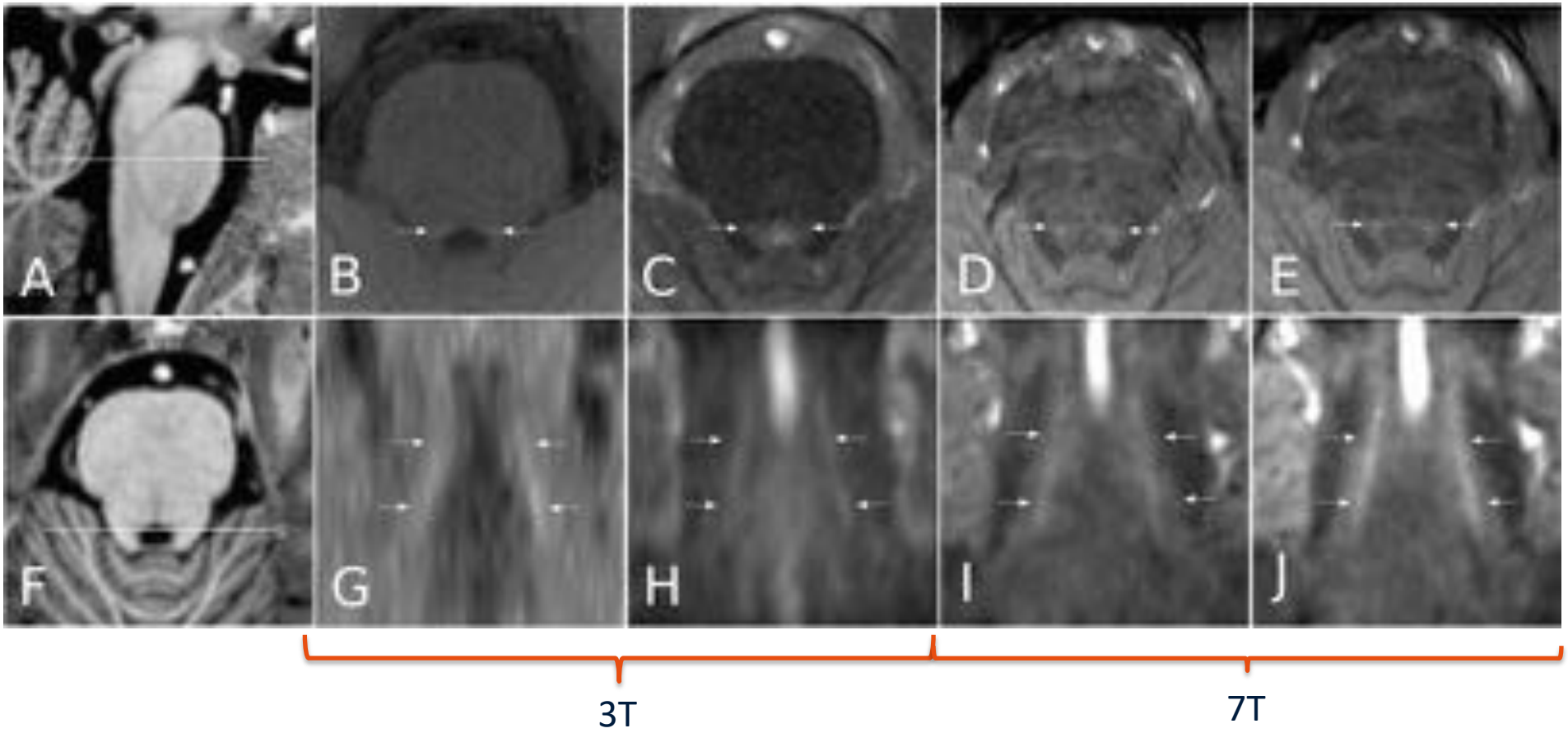
Cortical surface and white matter





Parcellation

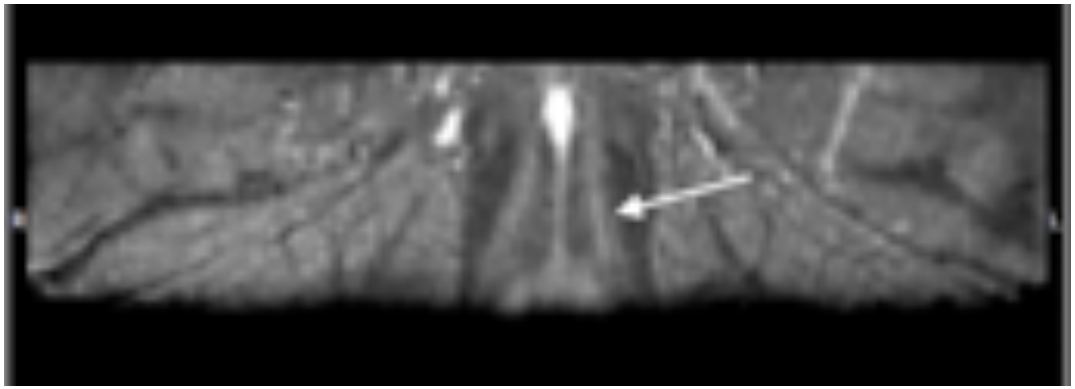
Neuromelanin – Locus coeruleus



Priovoulos et al. 2018

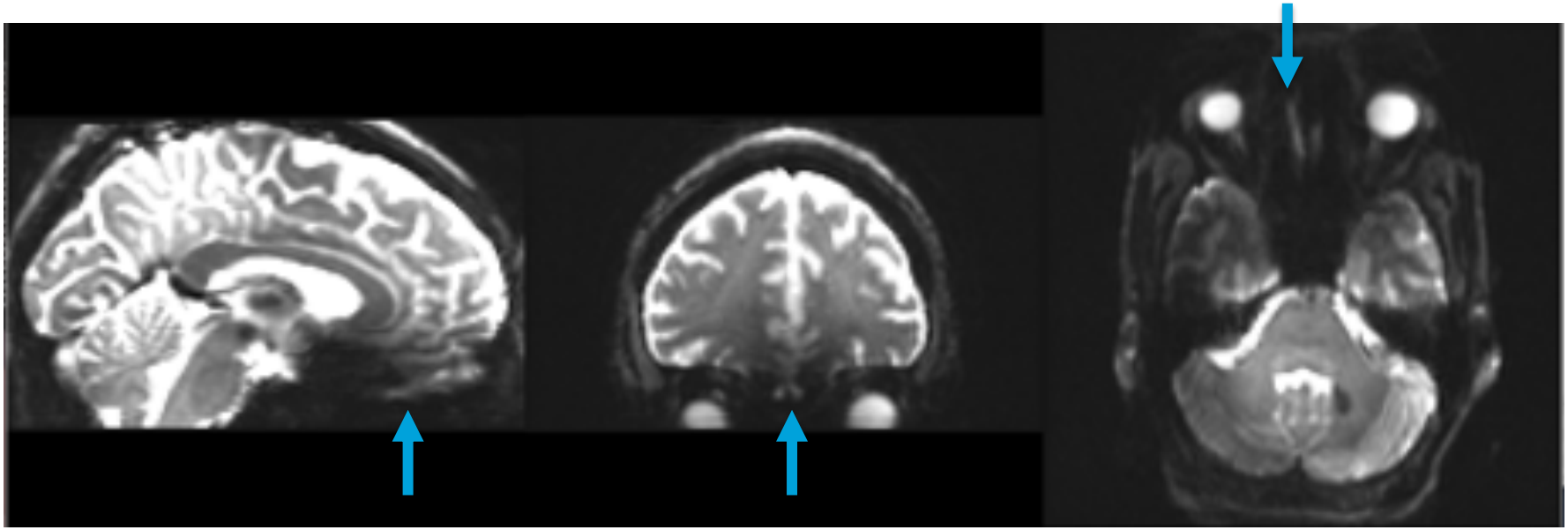
Neuromelanin - 500µm

- Signal intensity in the SN & LC
  - Comparison PD - HC



Olfactory tract – 1mm resolution

- Compared to previous work
  - Larger cohort
  - Recently diagnosed PD patients
  - Ultra-high field 7T MRI




WORK IN
PROGRESS

Thanks for your attention

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Imperial College London

scannexus


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de stuwende kracht

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