Free Water DTI at high and standard spatial resolution: Optimal parameters and fitting procedures

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INTRODUCTION

DIFFUSION TENSOR IMAGING (DTI) is a classic approach to extract parameters related to tissue microstructure. **FREE WATER (FW)** elimination models aims to evaluate **FRACTION OF FREE WATER** inside a voxel.

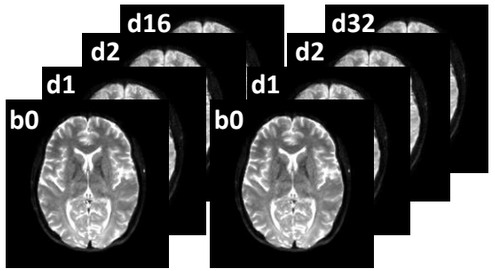
Two-shell acquisitions and fitting procedure with nonlinear least squared **(NLS)**[1] are recommended[2] .

Another procedure has been used in clinical studies with regularized gradient descent **(RGD)**[3] to manage single-shell acquisitions.

Our work aims to investigate differences between the two fitting procedures as well as the influence of the partial volume and the angular resolution to estimate accurately **FW MAPS.**

MATERIALS and METHODS

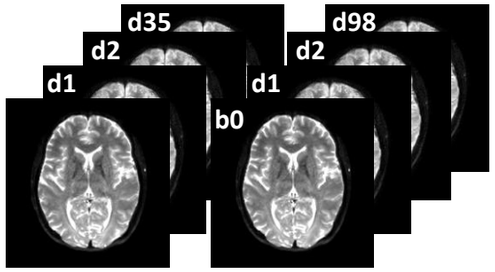
STANDARD RESOLUTION



DWI b500$_{s/mm^2}$ 1.8x1.8x2 mm^3 — 1 SET DIRECTION

DWI b1000$_{s/mm^2}$ 1.8x1.8x2 mm^3 — 1 SET DIRECTION

HIGH RESOLUTION



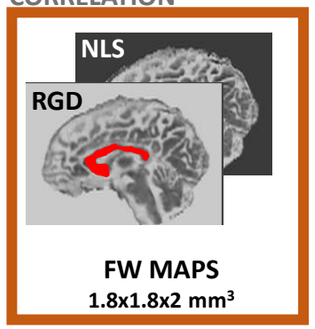
DWI b500$_{s/mm^2}$ 0.9x0.9x2 mm^3 — 2 SETS DIRECTION

DWI b1000$_{s/mm^2}$ 0.9x0.9x2 mm^3 — 4 SETS DIRECTION

1. **LPCA** Filter[4]
2. **DISTORSIONS**[5]
3. **EDDY CURRENT**[6]

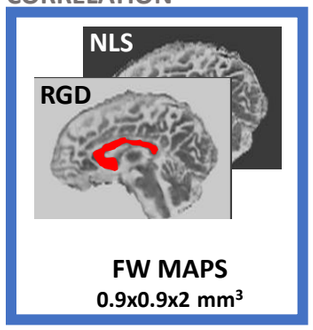
SEGMENTATION
CORPUS **C**ALLOSUM
CEREBRO**S**PINAL **F**LUID

CORRELATION



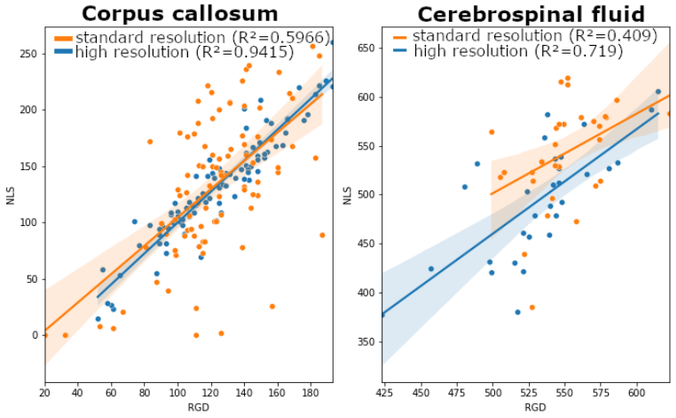
FW MAPS
1.8x1.8x2 mm^3

CORRELATION



FW MAPS
0.9x0.9x2 mm^3

RESULTS



DISCUSSION/CONCLUSION

- 1 set is enough to estimate **FW MAPS**, at **HIGH** resolution.
- **RGD** results should be interpreted carefully (overfitting).
- Correlation is stronger in CC than CSF: **FREE WATER** contamination.
- Correlation is stronger at **HIGH** resolution than at **LOW** resolution: **PARTIAL VOLUME EFFECT**.

[1] Hoy & al. (2014) NI [2] Henriques & al. (2017) NS [3] Golub & al. (2021) MRM [4] Manjón & al. (2013) PO [5] Jezzard & al. (1995) MRM [6] Jenkinson (2012) NI