

Optimisation d'une séquence MPRAGE à 7T pour visualiser l'anatomie interne du thalamus

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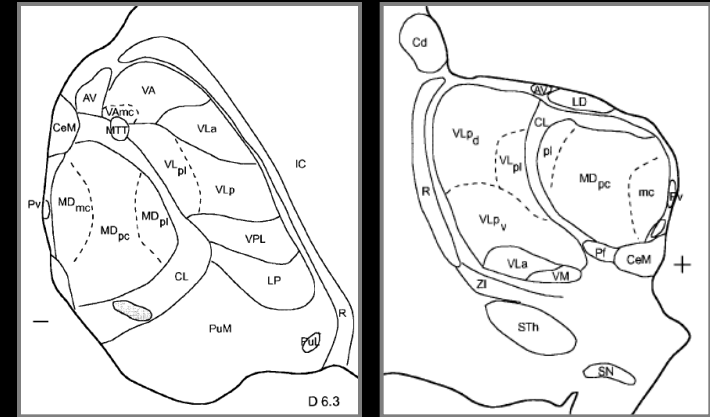
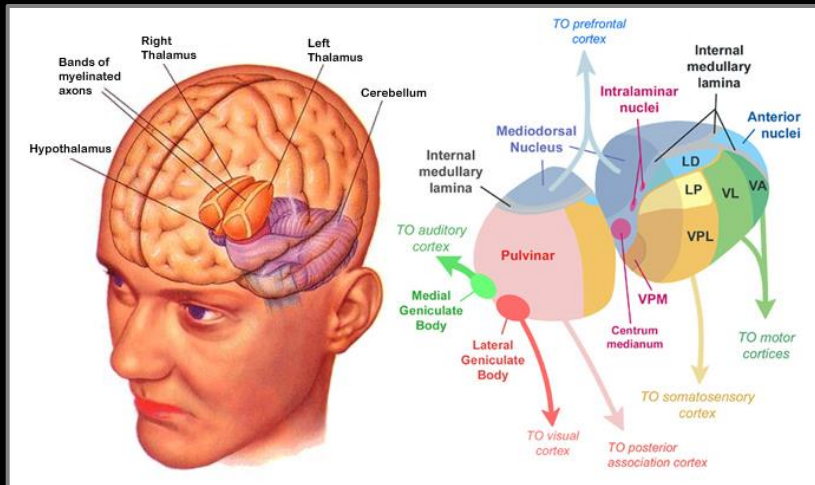
*(1) Service de NeuroImagerie Diagnostique et Thérapeutique, CHU
Bordeaux, Université de Bordeaux*

(2) Radiological Sciences Laboratory, Stanford University, CA, USA

Rationnel

Visualiser l'anatomie interne du thalamus

- Organe relai
- Complexité anatomique, nombreux noyaux thalamiques



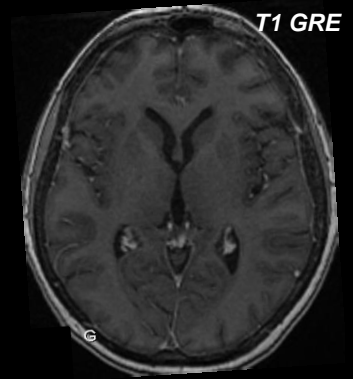
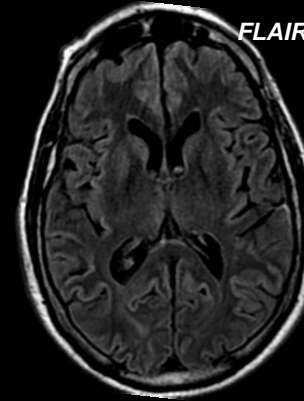
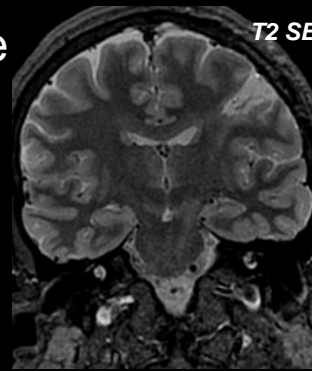
Morel *et al.* J Comp Neurol 1997; 387:588-630

- Visualiser l'anatomie interne du thalamus
 - Cibles pour la **stimulation cérébrale profonde** (tremblement essentiel, douleurs neuropathiques, sous type de Parkinson)

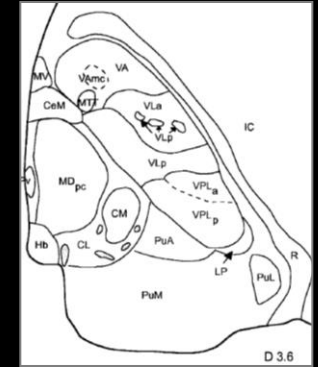
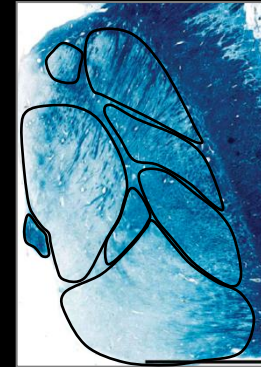
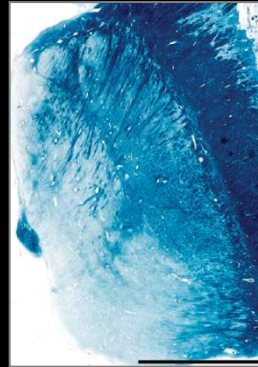
Rationnel

Visualiser l'anatomie interne du thalamus

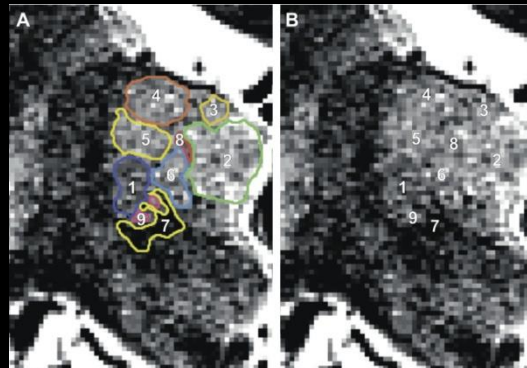
➤ Difficile en pratique quotidienne



➤ Variation du contenu de **myéline** d'un noyau à l'autre



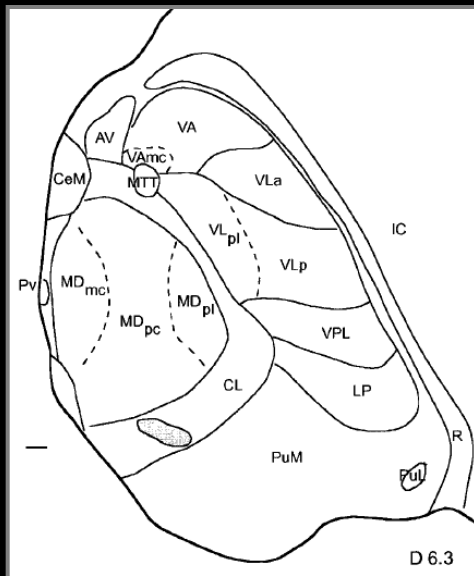
➤ Intérêt d'une séquence de type **T1 inversion récupération**



Hypothèse

Visualisation de l'anatomie interne du thalamus à 7Tesla en optimisant une séquence de type T1 MPRAGE

*Gain de signal
Gain de contraste*

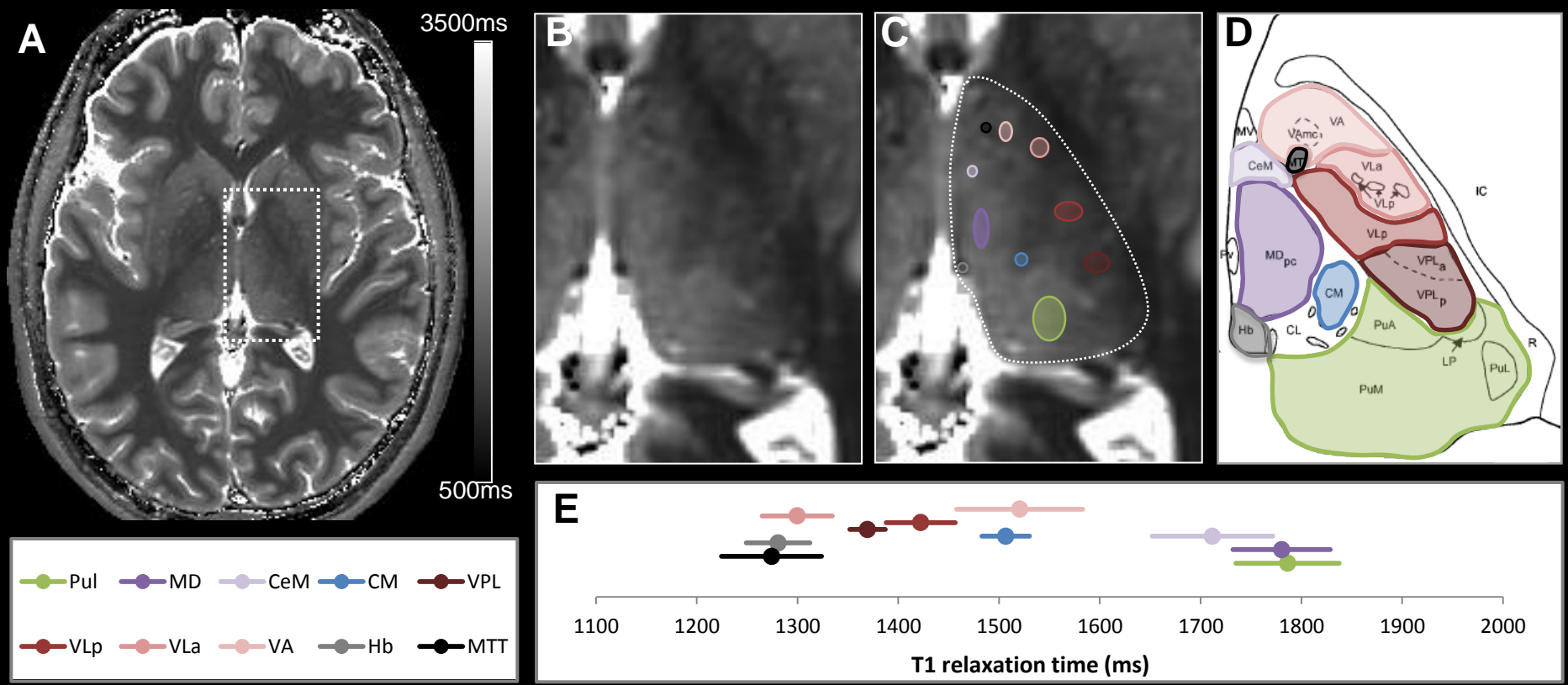


7Tesla, GE, MR950

Résultats

Mesures de T1 → Optimisation → Validation

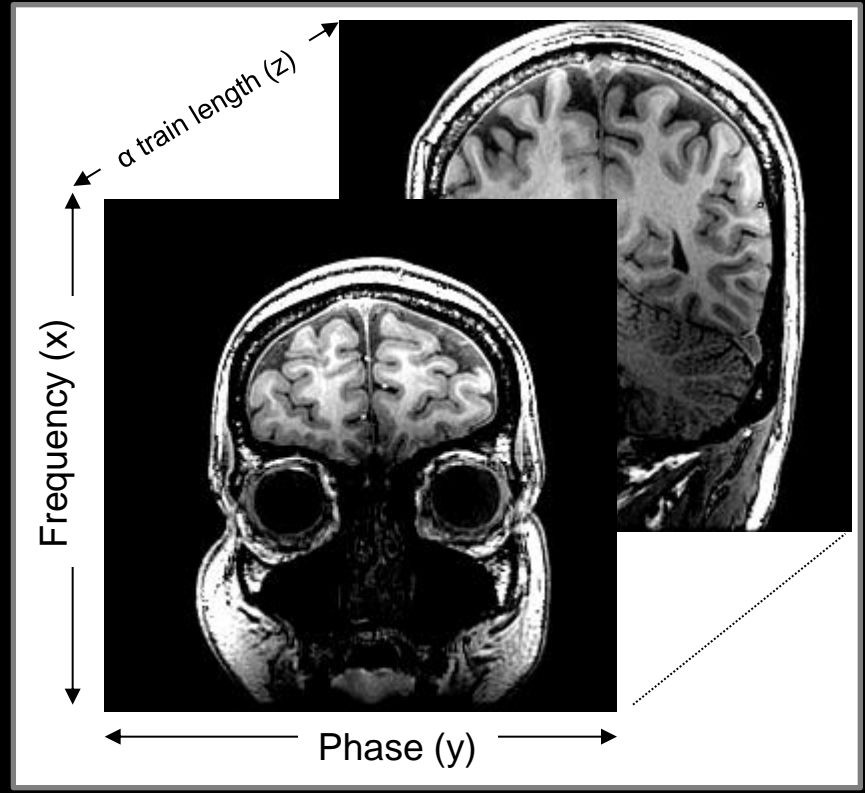
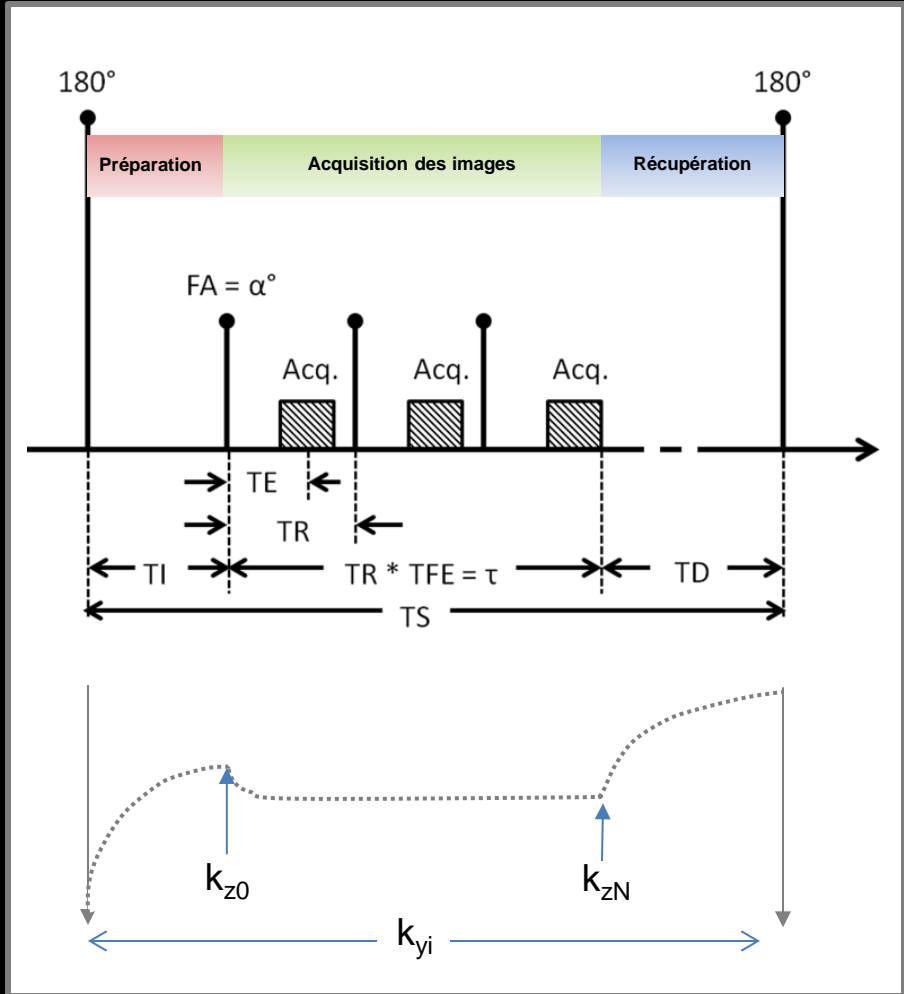
➤ Quantification des valeurs de T1 en IR-FSE (5 temps d'inversion), fit mono exponentiel (n=5 sujets).



Résultats

Mesures de T1 → Optimisation → Validation

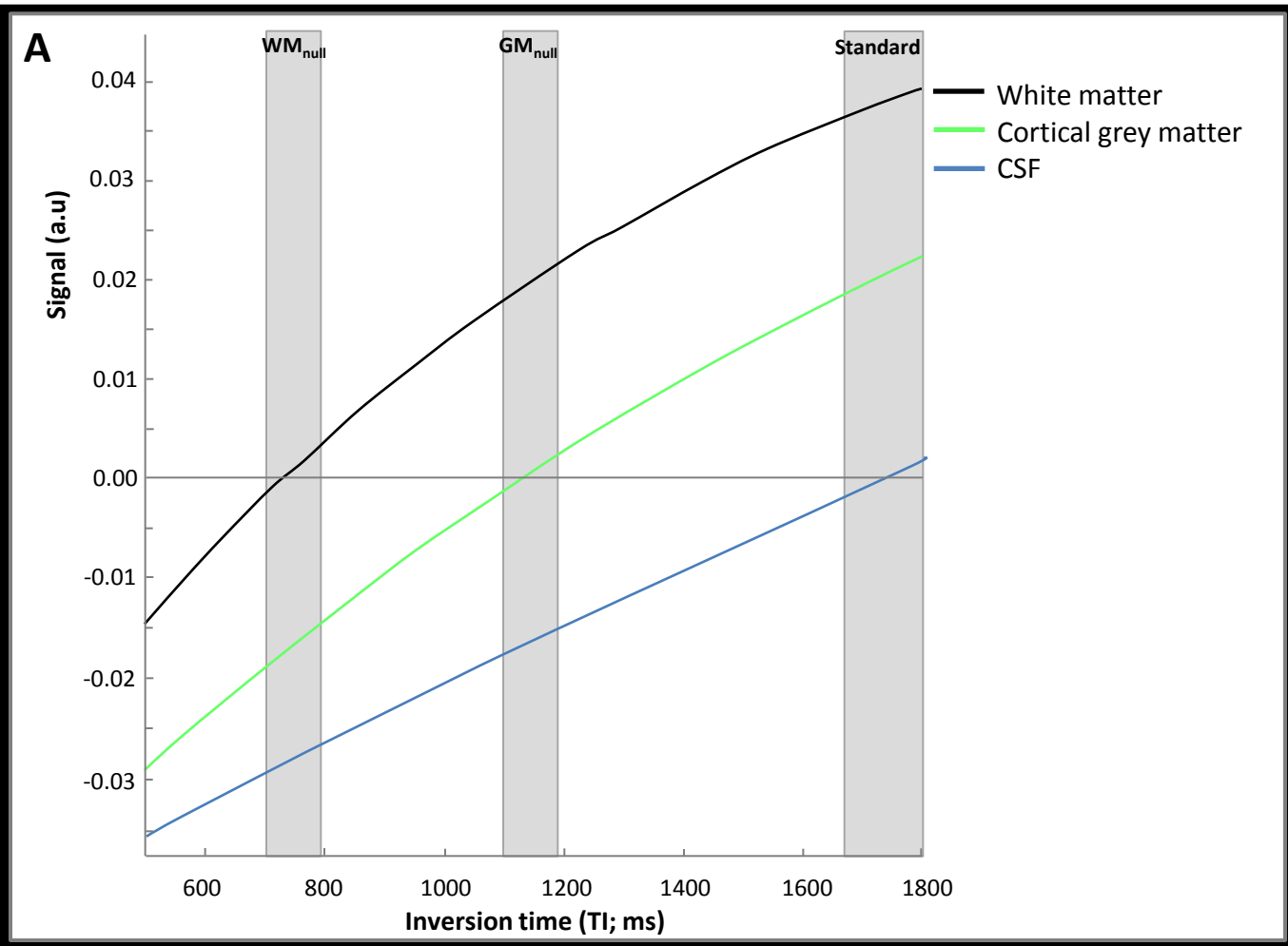
➤ Séquence MPRAGE - Principe



- Simulation (approche théorique)
- Expérimentation (approche empirique)

Résultats

Mesures de T1 → Optimisation → Validation

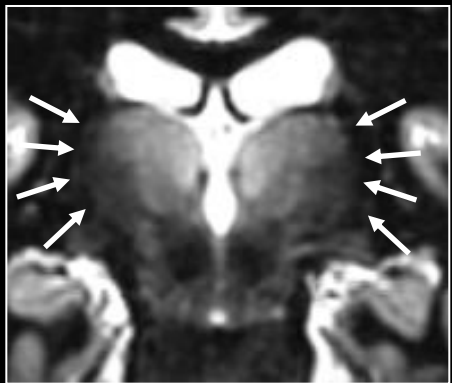
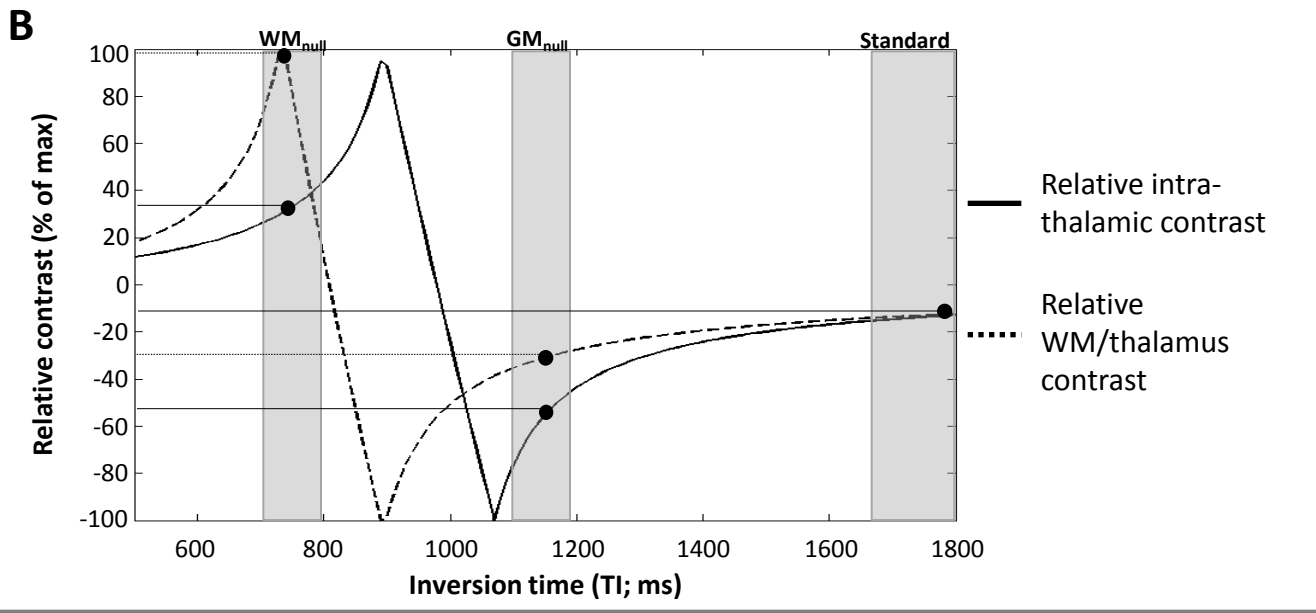
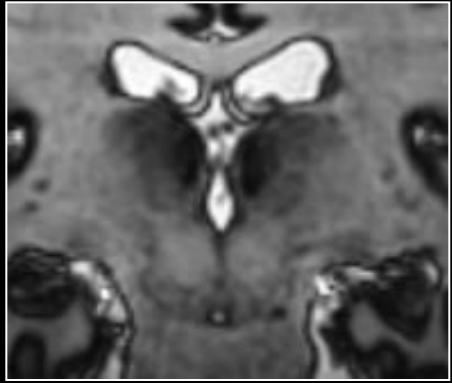
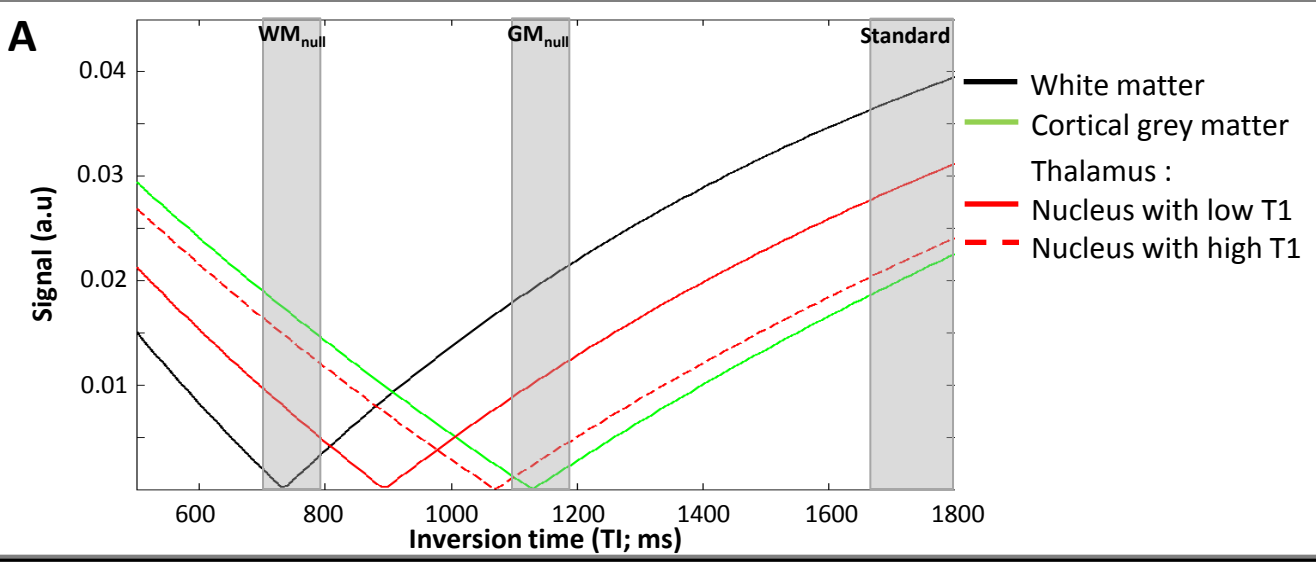


Résultats

Mesures de T1 →

Optimisation →

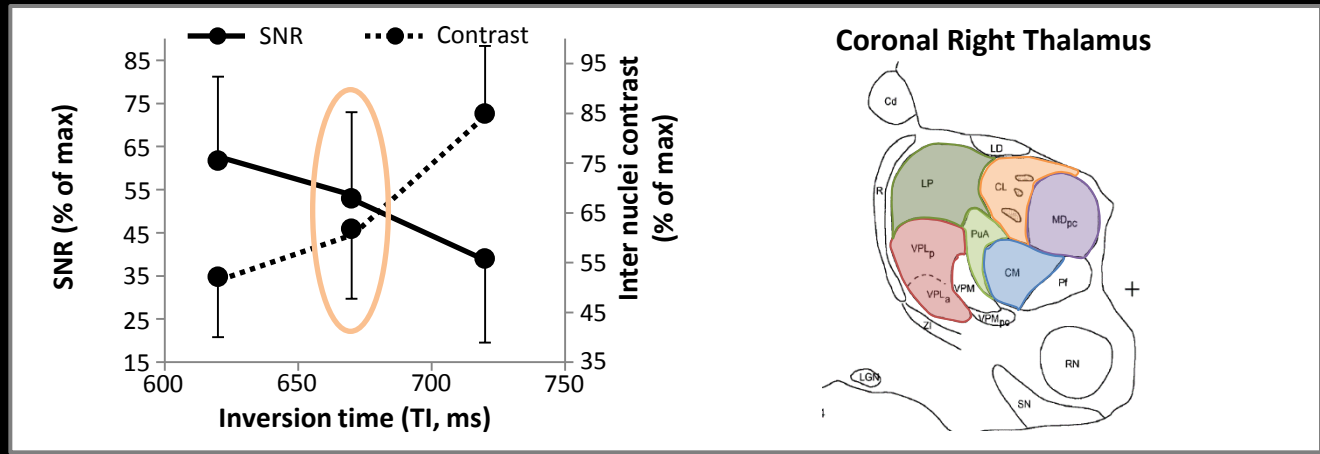
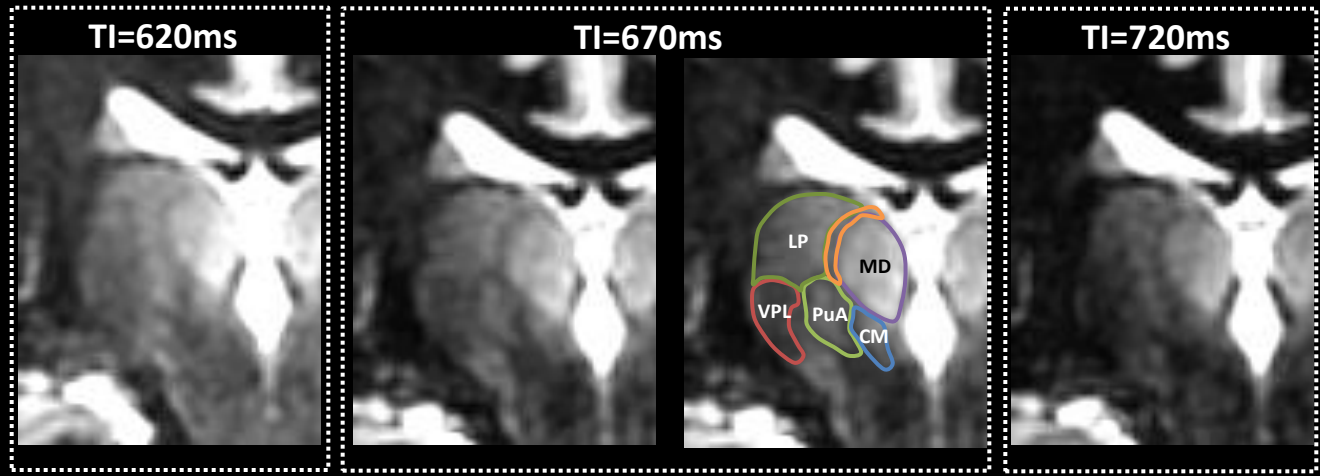
Validation



Résultats

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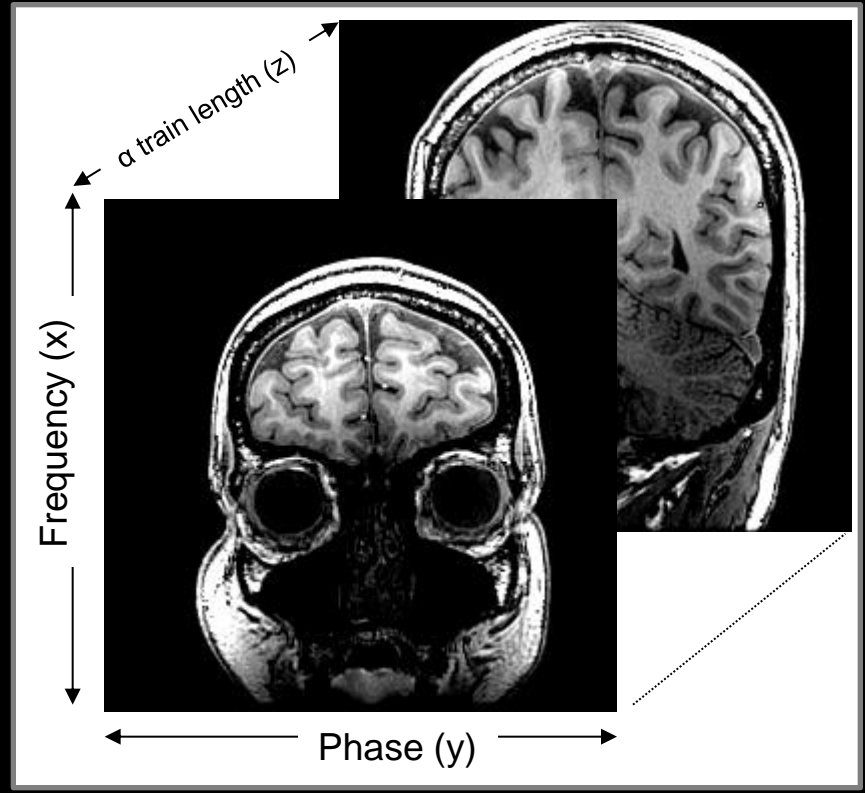
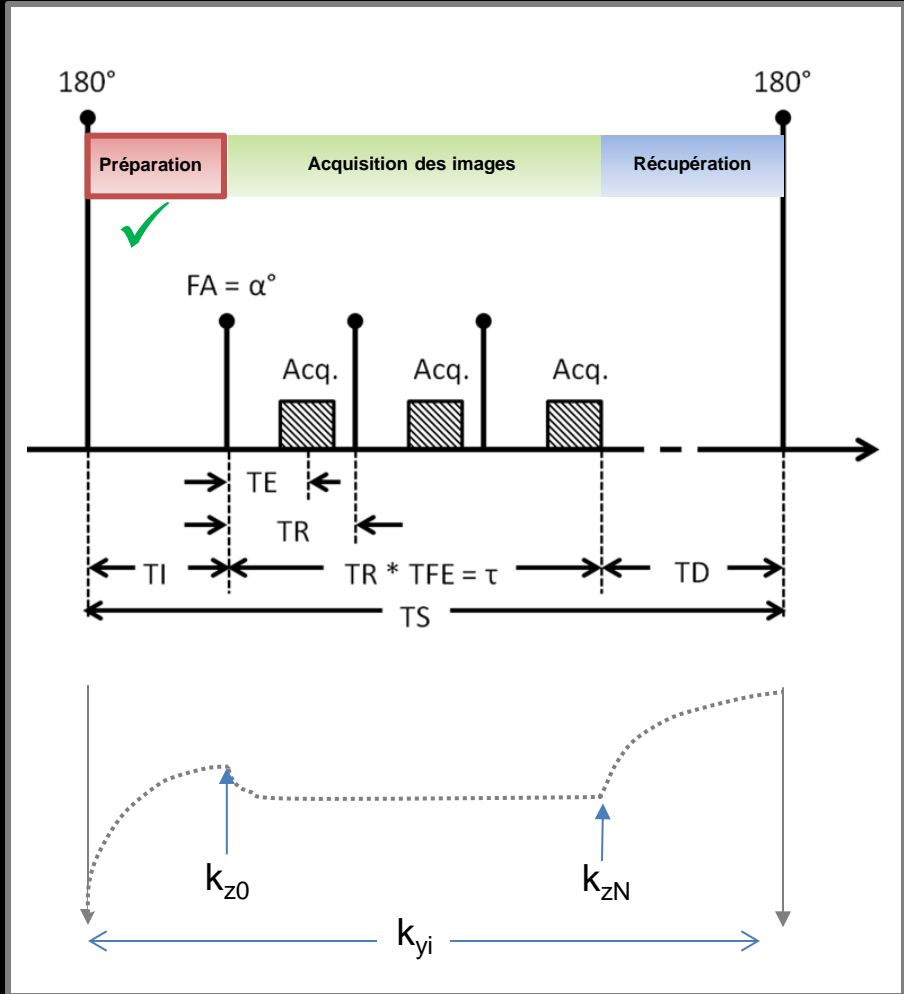
Coronal Right Thalamus



Résultats

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➤ Séquence MPRAGE - Principe



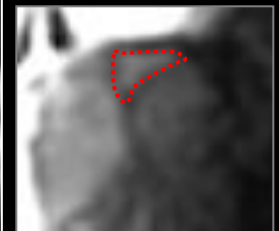
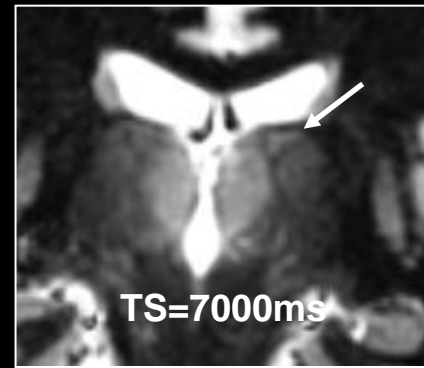
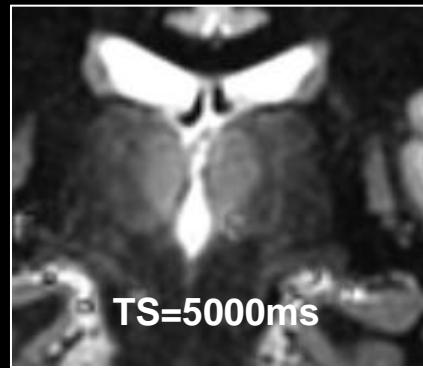
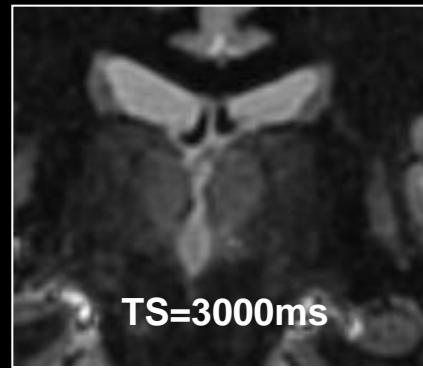
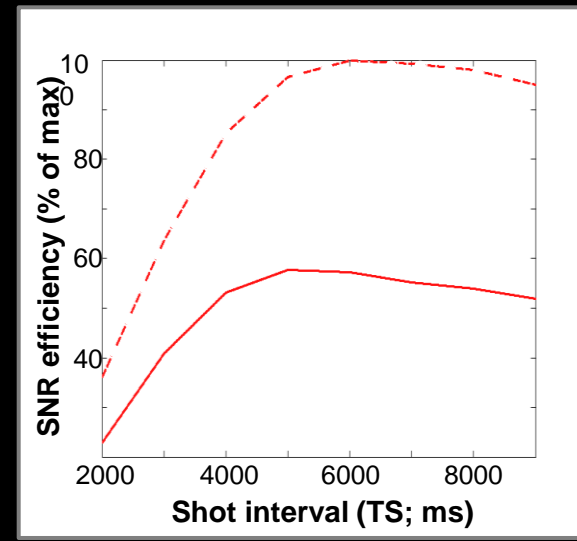
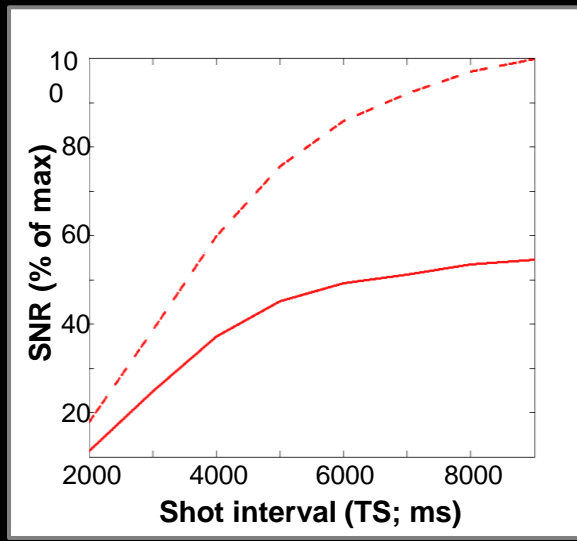
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- Expérimentation (approche empirique)

Résultats

Mesures de T1 →

Optimisation →

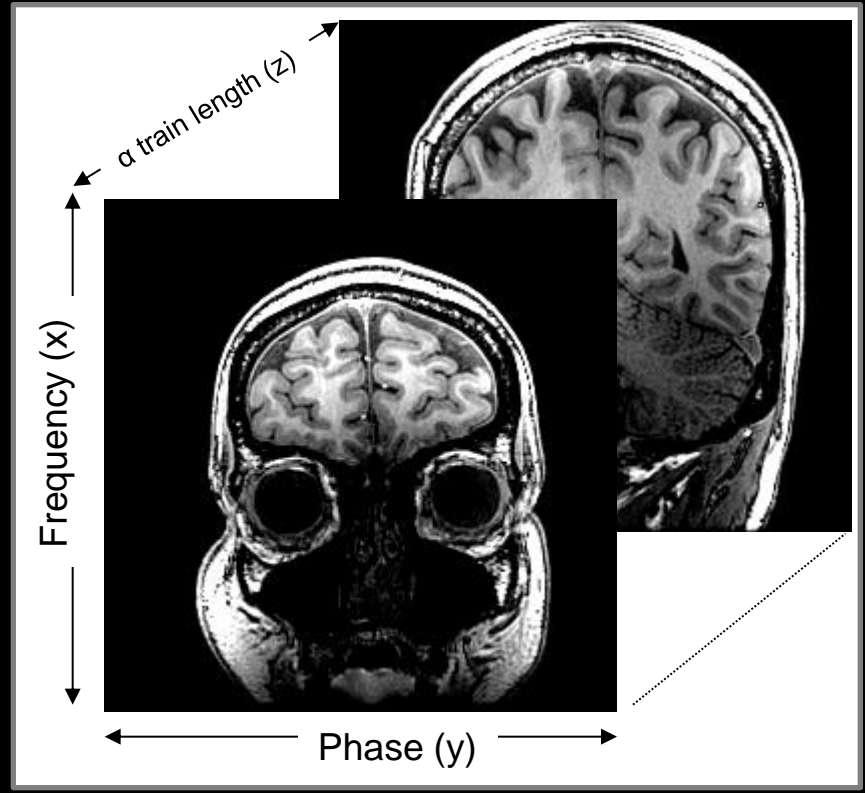
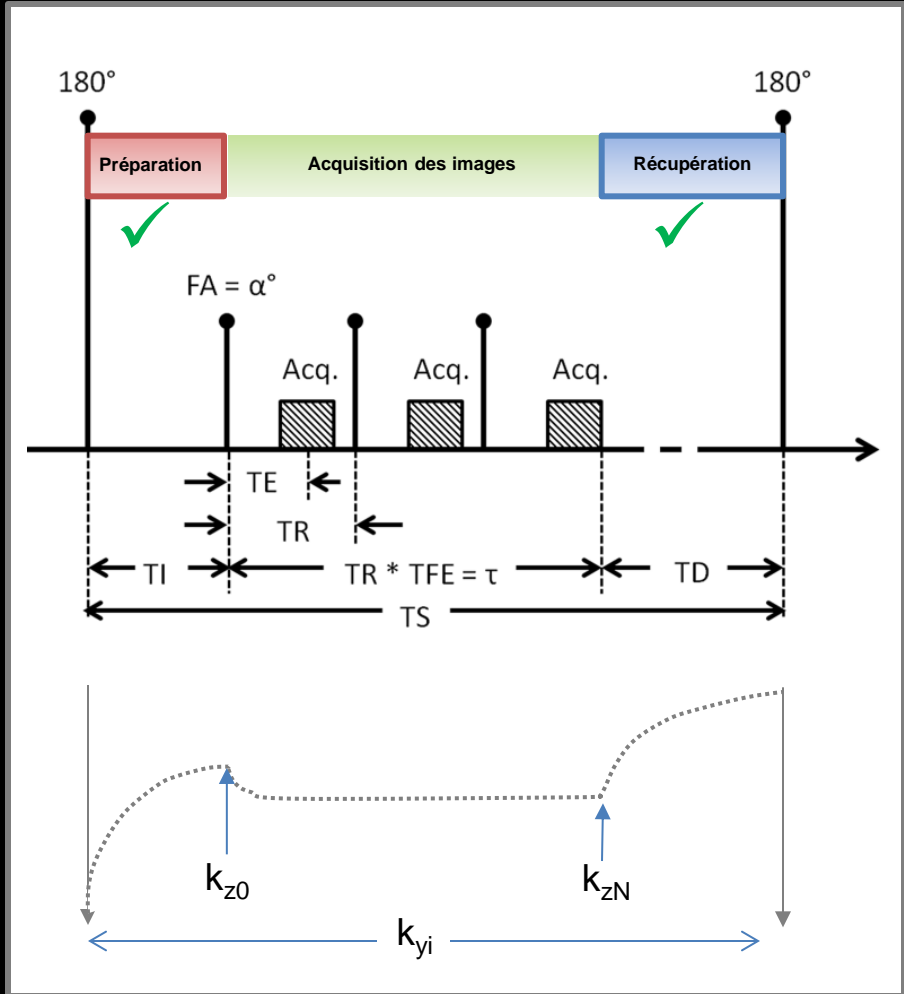
Validation



Résultats

Mesures de T1 → Optimisation → Validation

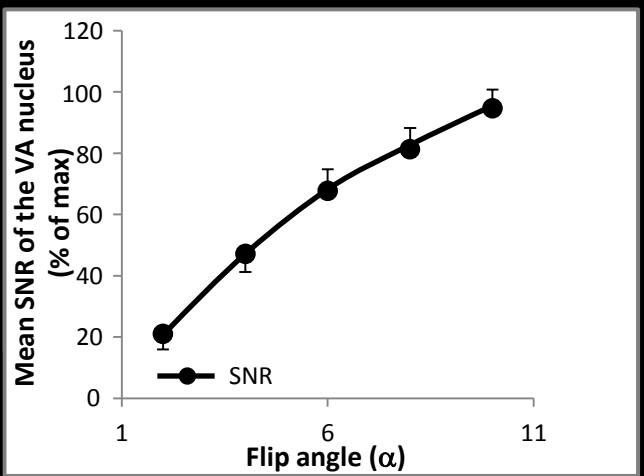
➤ Séquence MPRAGE - Principe



- Simulation (approche théorique)
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Résultats

Mesures de T1 → Optimisation → Validation



$\alpha=2^\circ$



$\alpha=4^\circ$



$\alpha=6^\circ$



$\alpha=8^\circ$



$\alpha=10^\circ$



Résultats

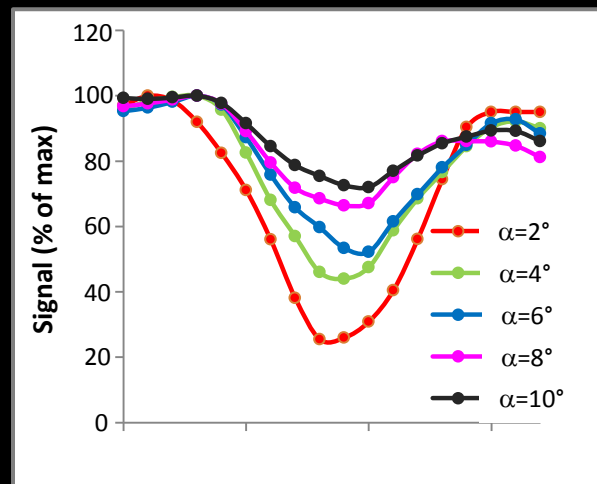
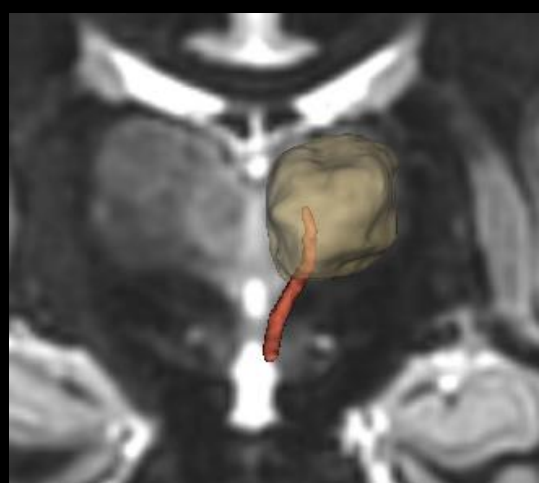
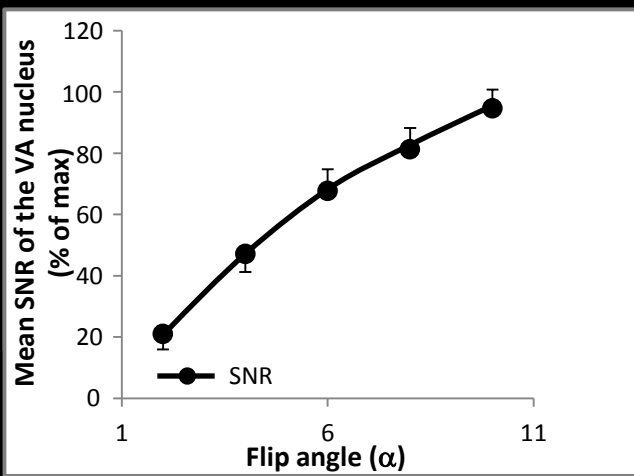
Mesures de T1



Optimisation



Validation



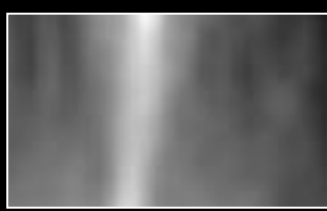
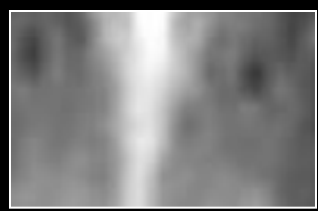
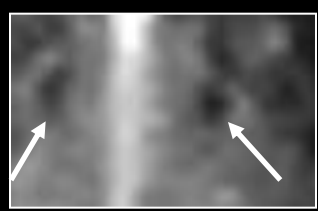
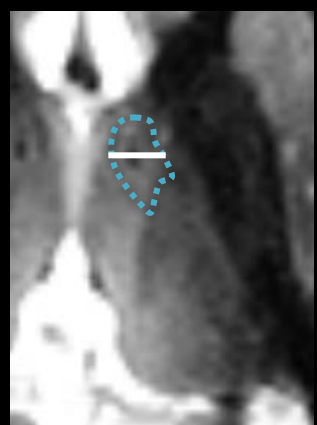
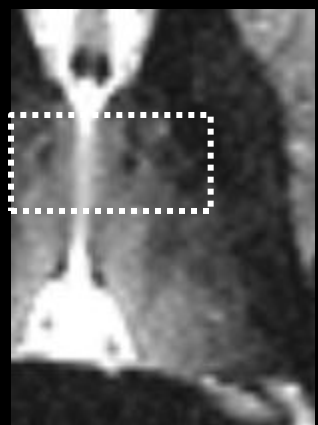
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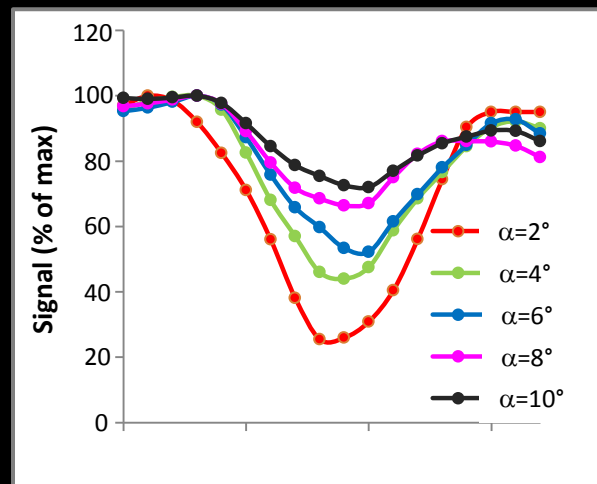
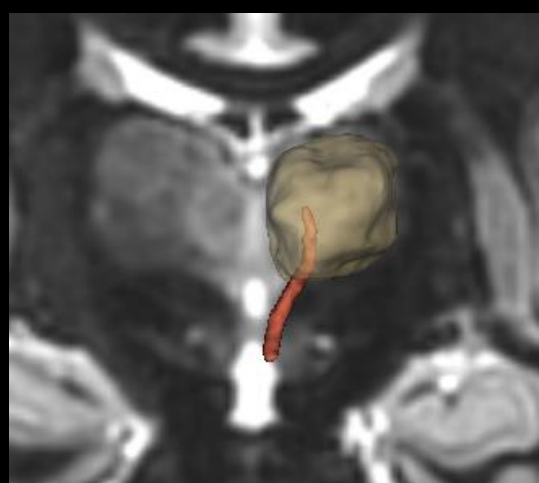
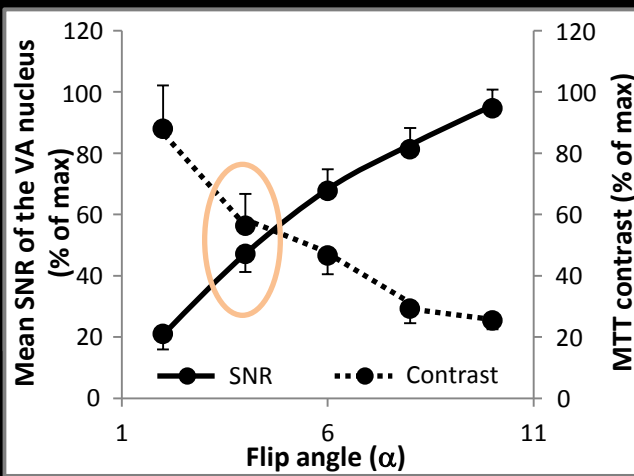
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Résultats

Mesures de T1 → Optimisation → Validation



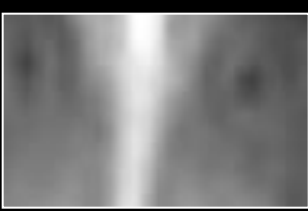
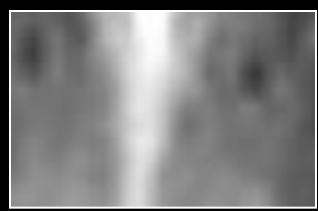
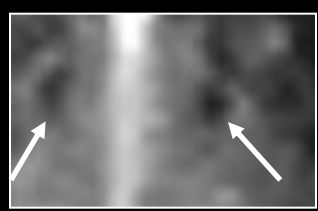
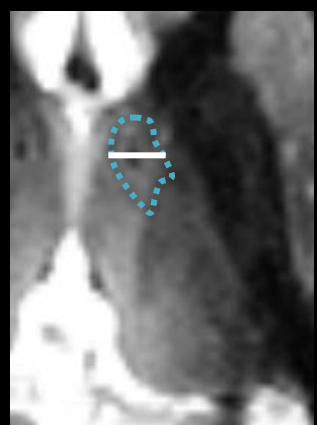
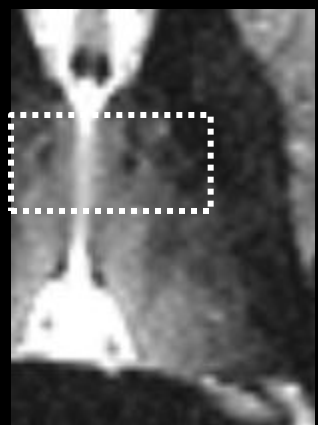
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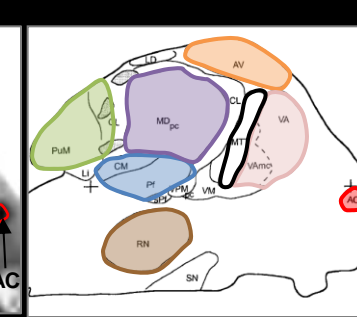
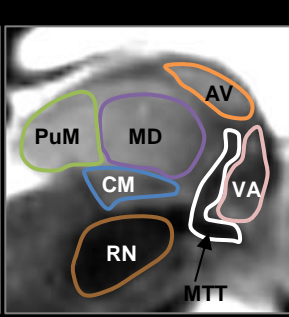
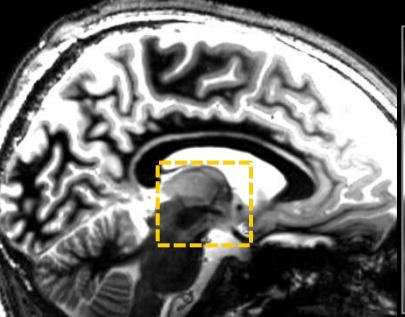
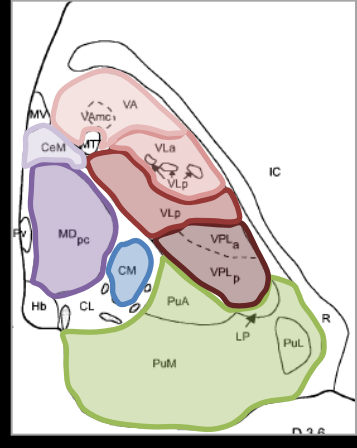
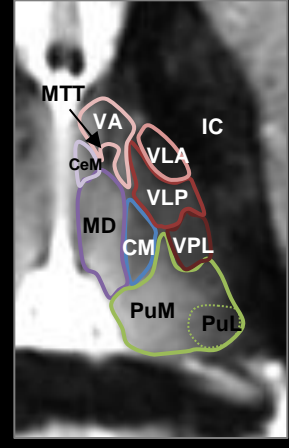
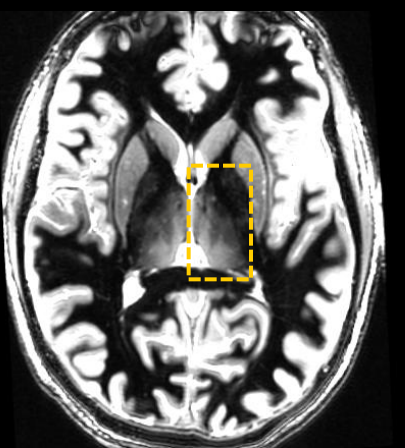
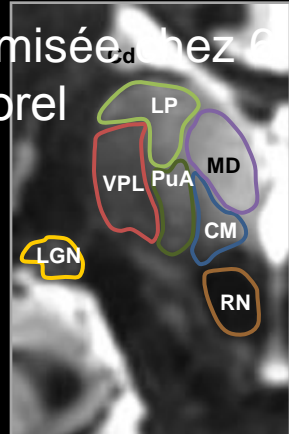
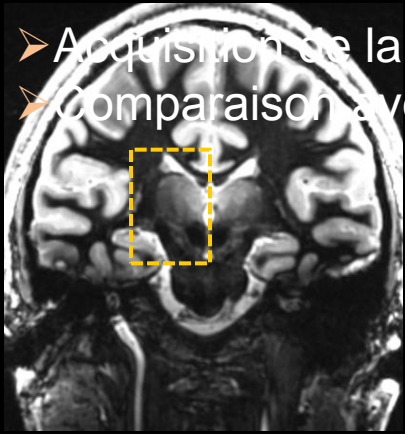
Résultats

Mesures de T1 →

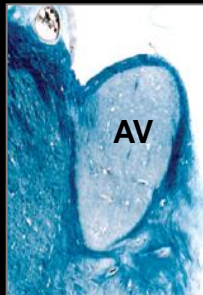
Optimisation →

Validation

- Acquisition de la séquence optimisée chez l'homme
- Comparaison avec l'atlas de Morel



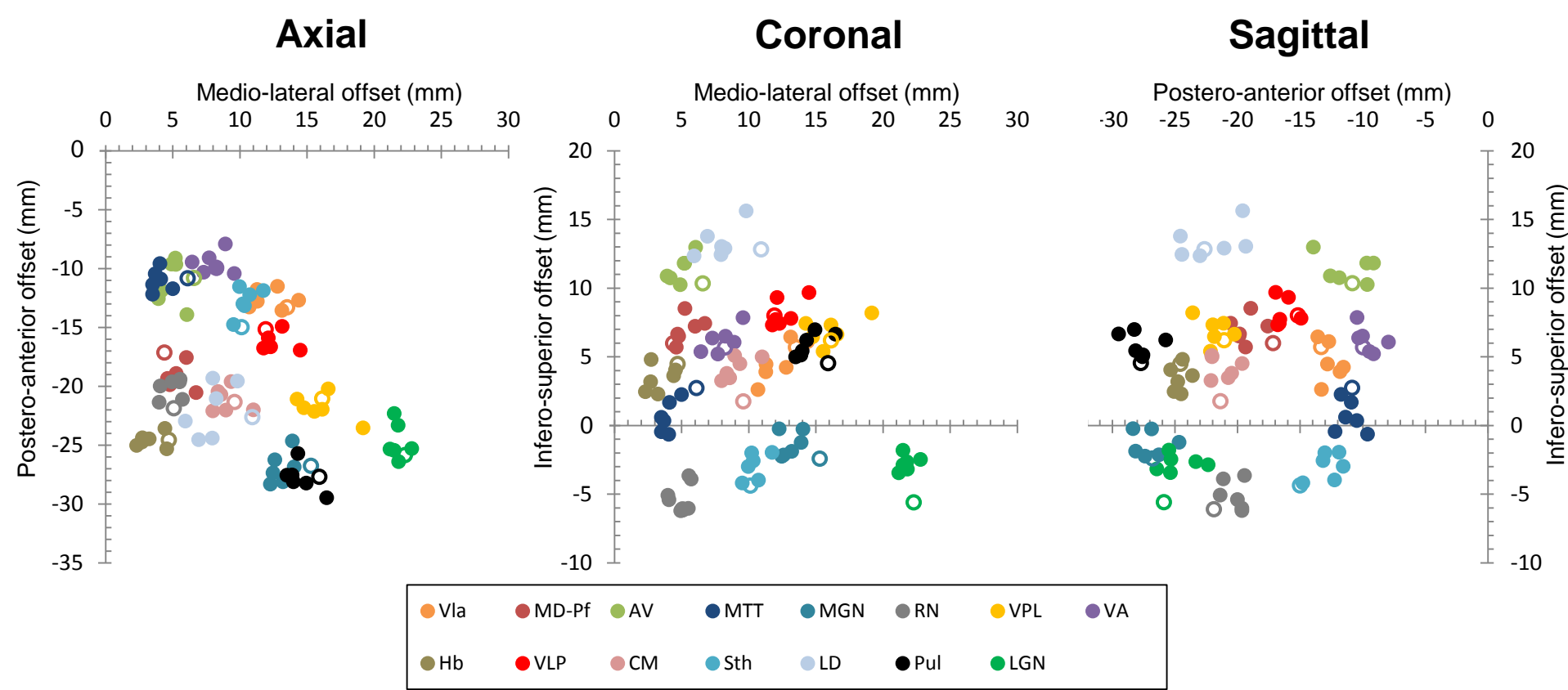
- **Contraste** entre noyaux adjacents
- **Fines bandes hypointenses** autour des noyaux: fine couche de myéline décrite histologiquement



Résultats

Mesures de T1 → Optimisation → Validation

- Projection des centres de masse de 15 noyaux chez 6 sujets par rapport à l'atlas
- **Reproductibilité**: coefficient de corrélation intra-classe = 0.997 (95% CI 0.996 < ICC < 0.998)



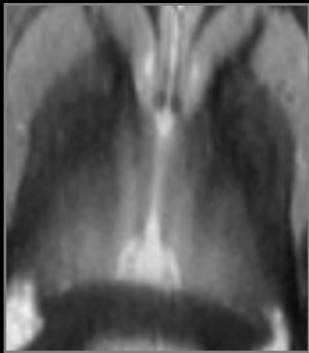
Conclusion

➤ Optimisation

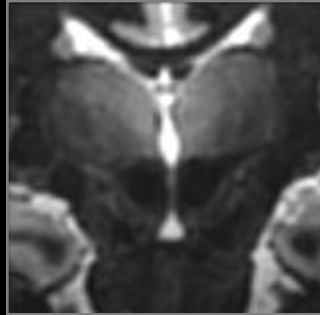
Acquisition coronale



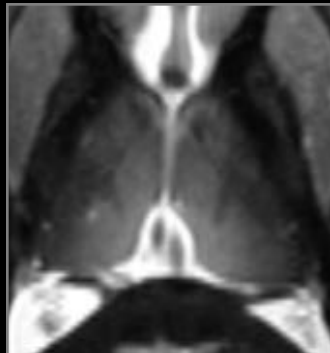
Reconstruction axiale



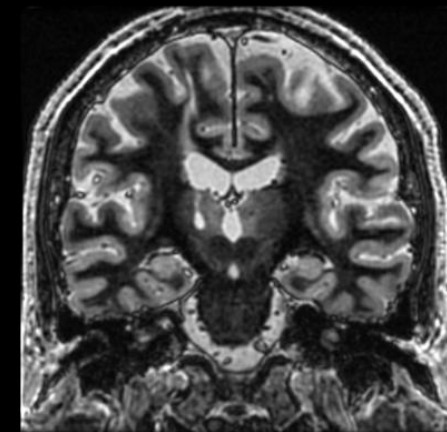
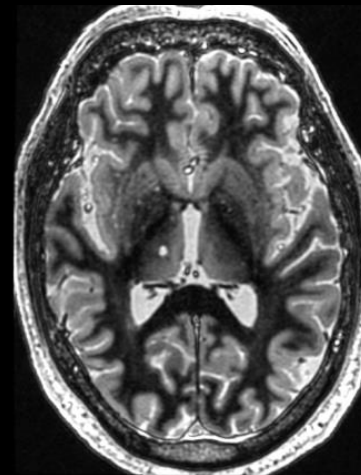
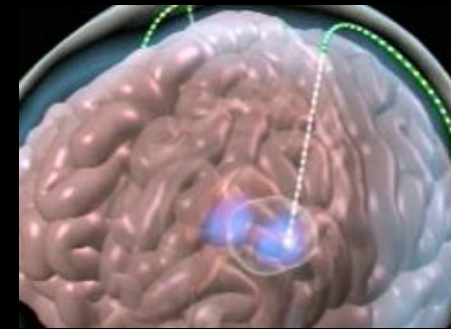
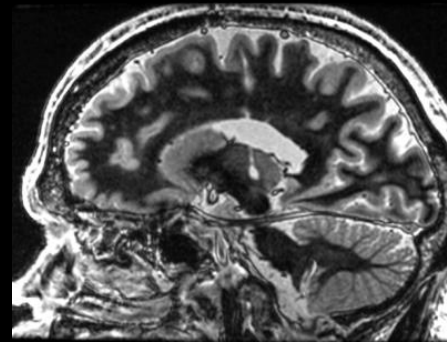
Acquisition coronale



Reconstruction axiale



➤ Utilisation



MERCI !

➤ **Service de Neuroimagerie: Pr Dousset, Bordeaux**

X.Barreau; J.Berge; E.De Roquefeuil; M.Durieux; S. Molinier; P.Ménégon

➤ **Radiological Sciences Laboratory, “Ultra high Field Program”: Pr RUTT, Stanford**

M Saranathan; I Levesque; M Zeineh; J Su; M Khalighi; J Mcnab; S Winkler

➤ **Neurology departments, Stanford**

M Han; G Kerchner

FINANCIAL SUPPORT

ARSEP (Association pour la Recherche contre la Sclérose en Plaques;

CHU de Bordeaux; Fondation Bordeaux Université; LabEx TRAIL (Translational Research and Advanced Imaging Laboratory); Institut Servier; France-Stanford Center for Interdisciplinary Studies

