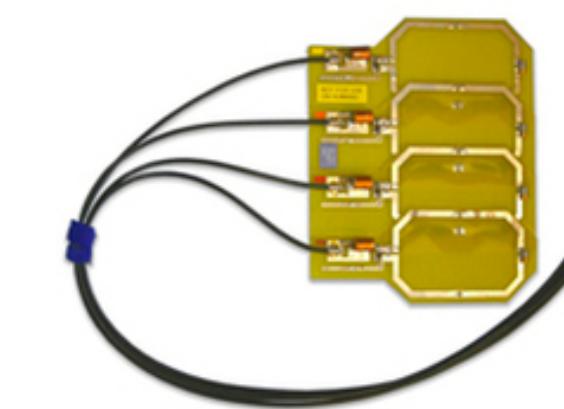


Imagerie Parallèle : SENSE



Antennes multi-canaux



R = 4



R = 6



R = 32

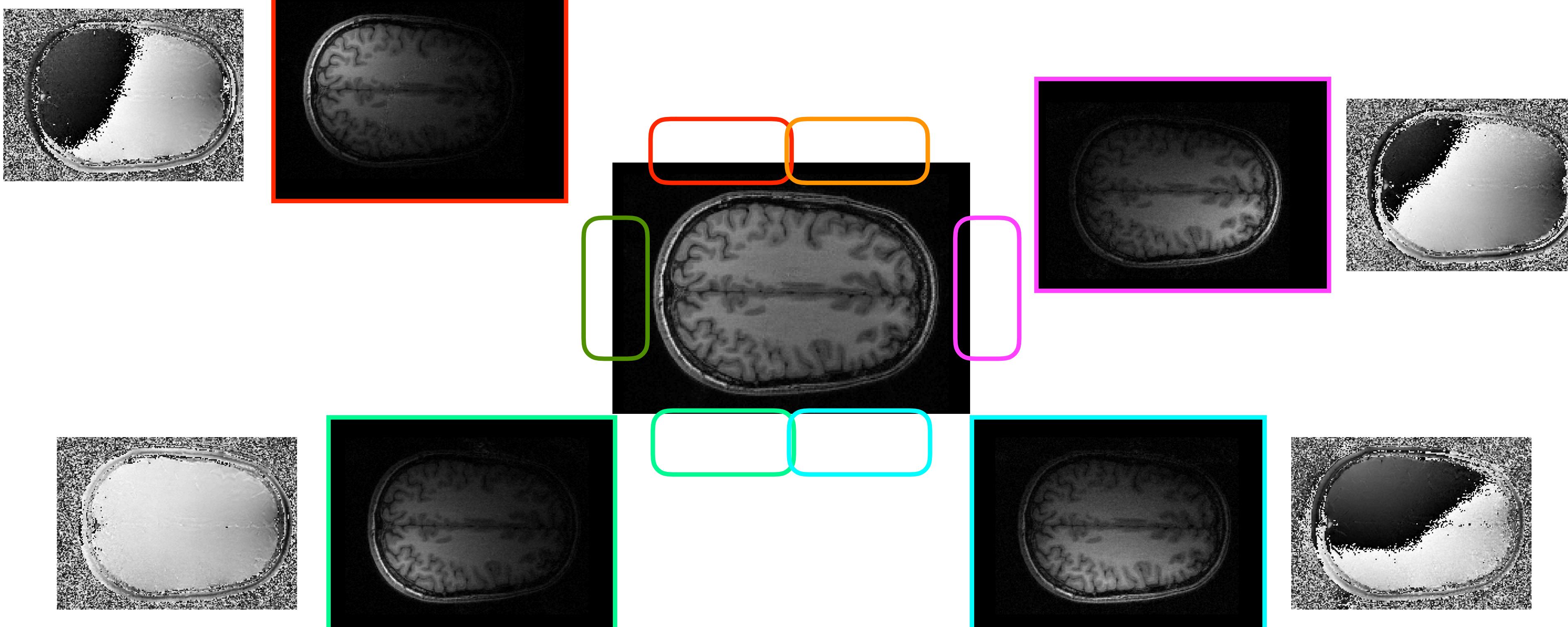
Intérêts :

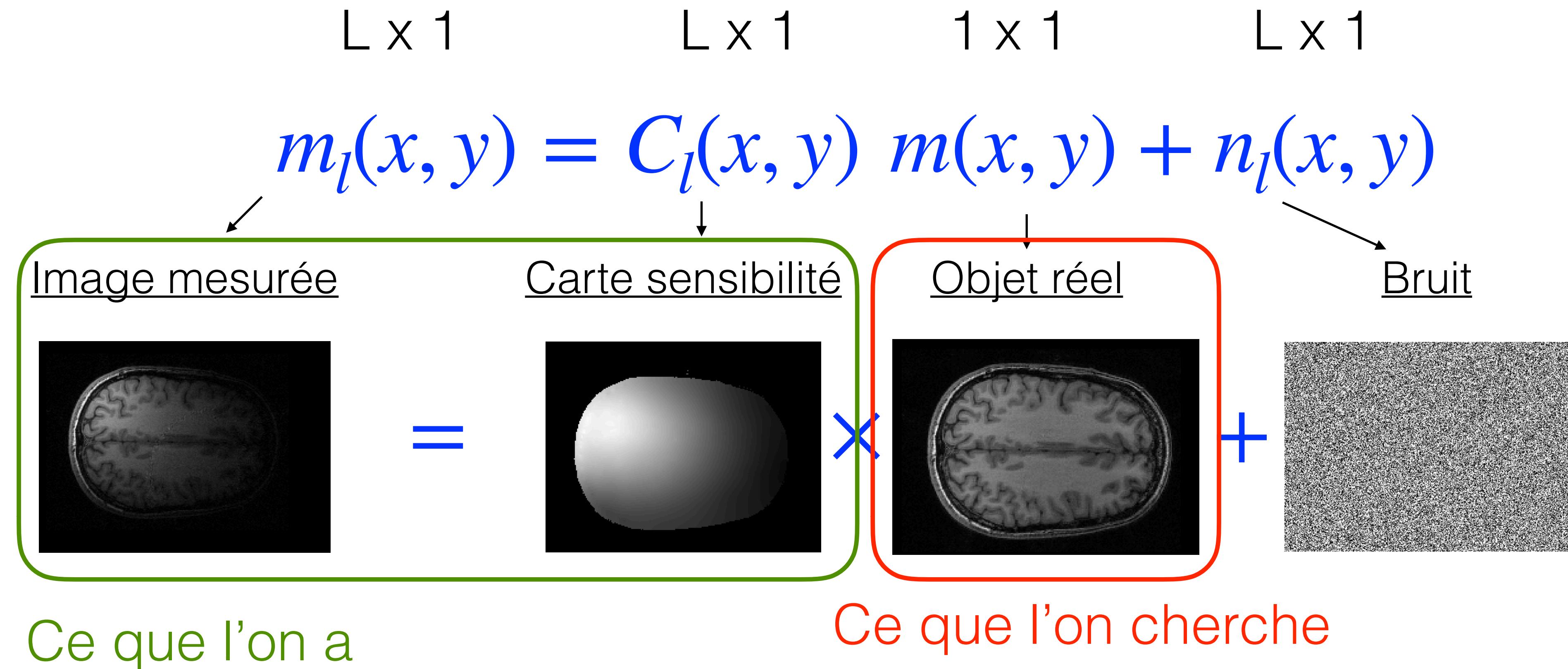
- Augmentation SNR
- Limitation FOV
- Imagerie parallèle

- Chaque antenne a une sensibilité différentes
 - Amplitude
 - Phase
- Antennes couplées -> bruit corrélé

$$C_l(x, y) \quad l = 1 : R \text{ canaux}$$

$$E[n_i, n_j] = \Psi \quad \Psi \text{ est } R \times R$$





Moore-Penrose Pseudo-inverse

- Maximisation SNR

$$m_l(x, y) = C_l(x, y) m(x, y) + n_l(x, y)$$

$$\hat{m}(x, y) = (C^* \Psi^{-1} C)^{-1} C^* \Psi^{-1} m_s(x, y)$$

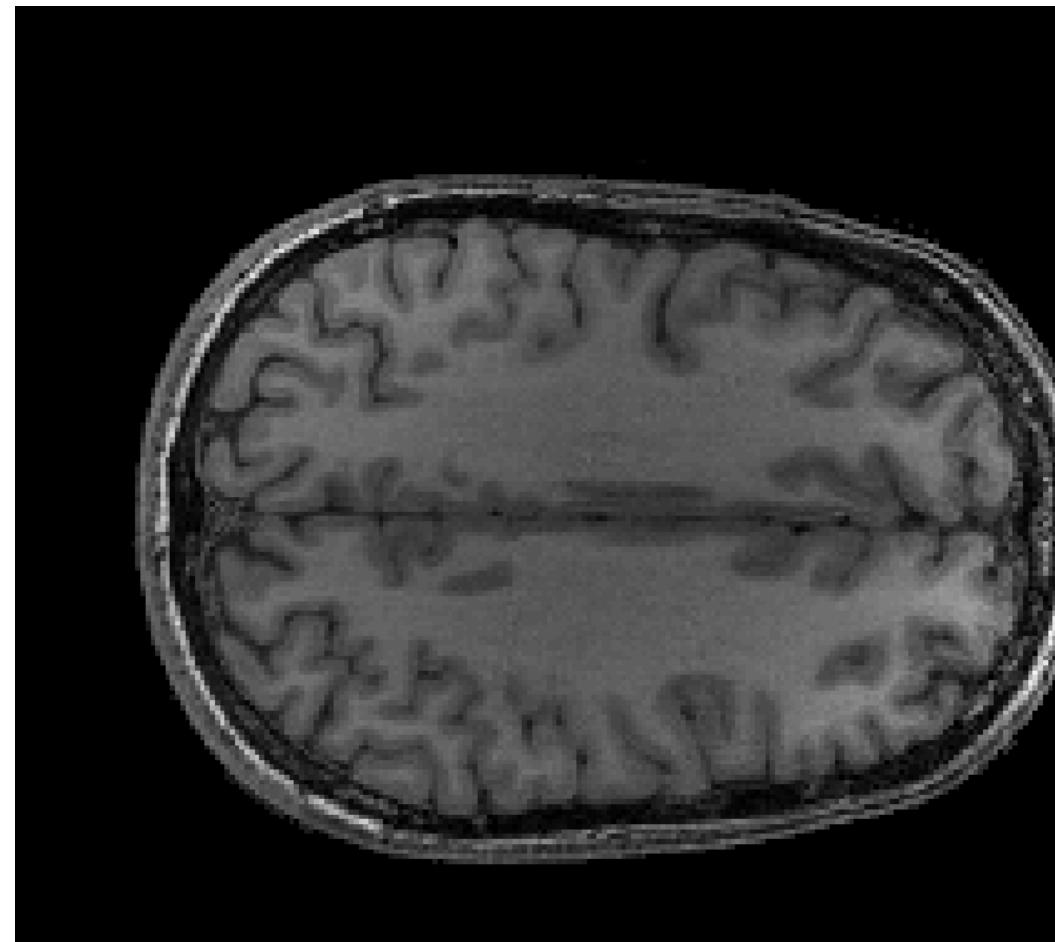
Si $\Psi = \sigma^2 I$

$$\hat{m}(x, y) = (C^* C)^{-1} C^* m_s(x, y) = \frac{1}{\sum_l |C_l(x, y)|^2} \sum_l C_l^*(x, y) m_{s,l}(x, y)$$

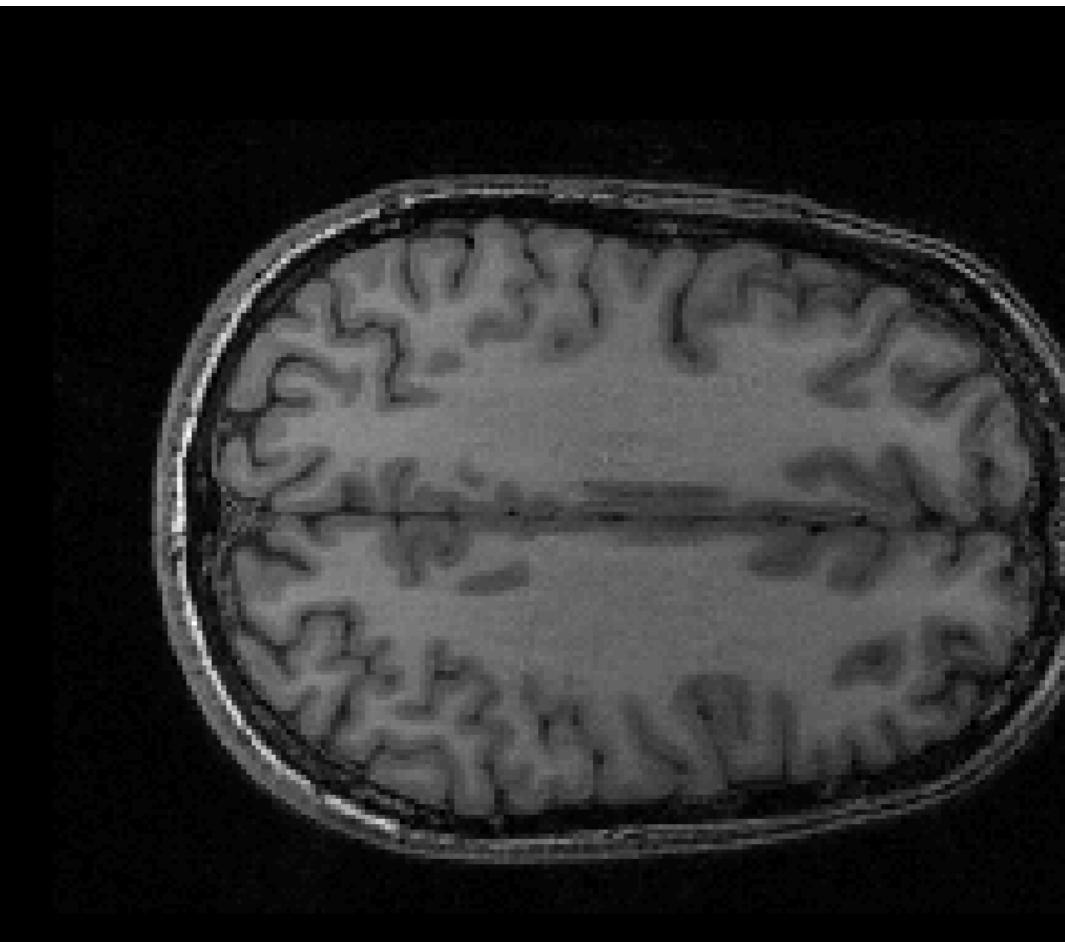
Correction
intensité

Correction
phase

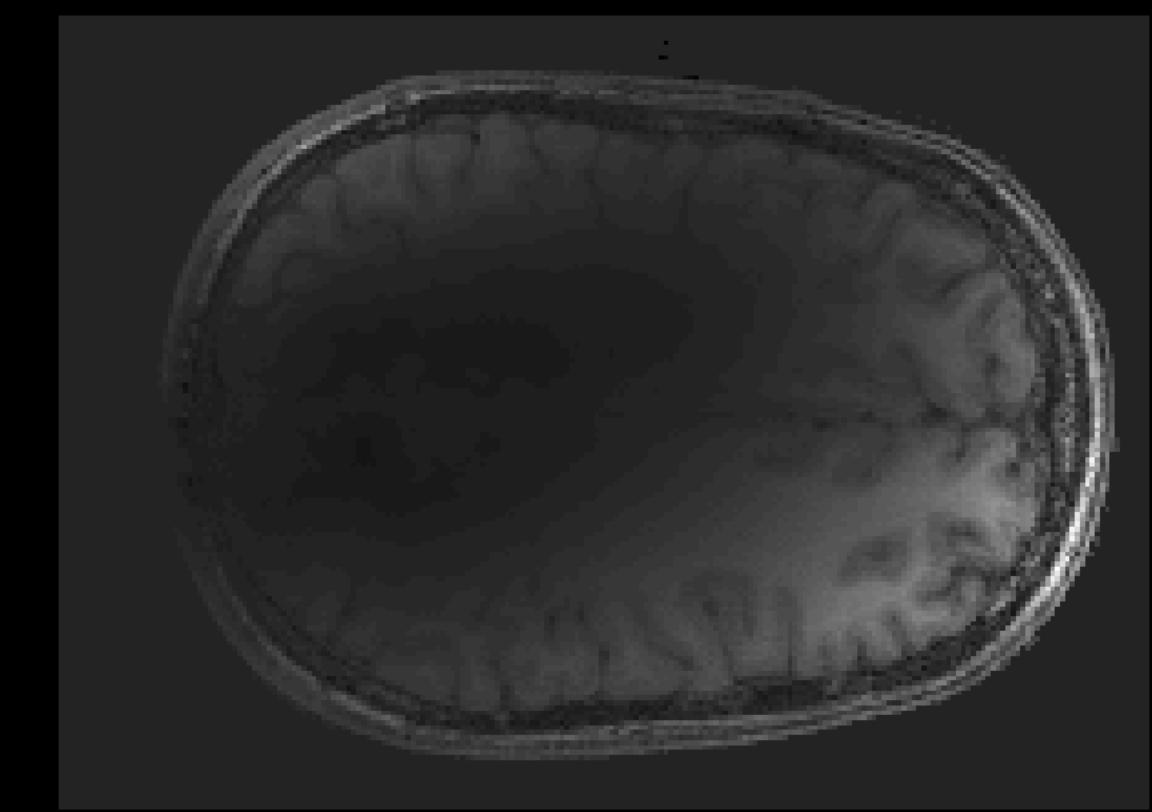
SENSE



SOS



Différence



Peu de différence pour fort SNR

Utilisation pour l'accélération

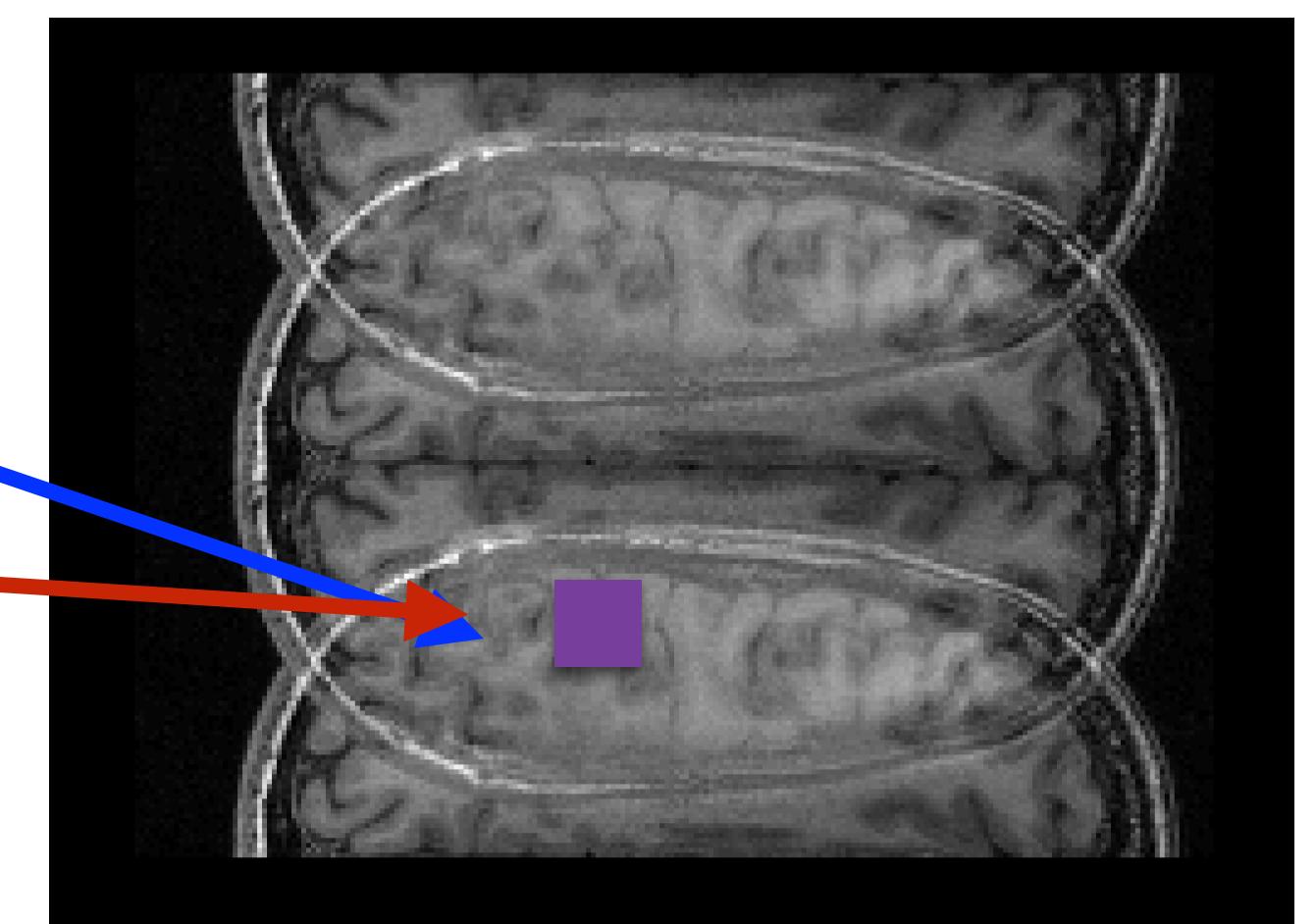
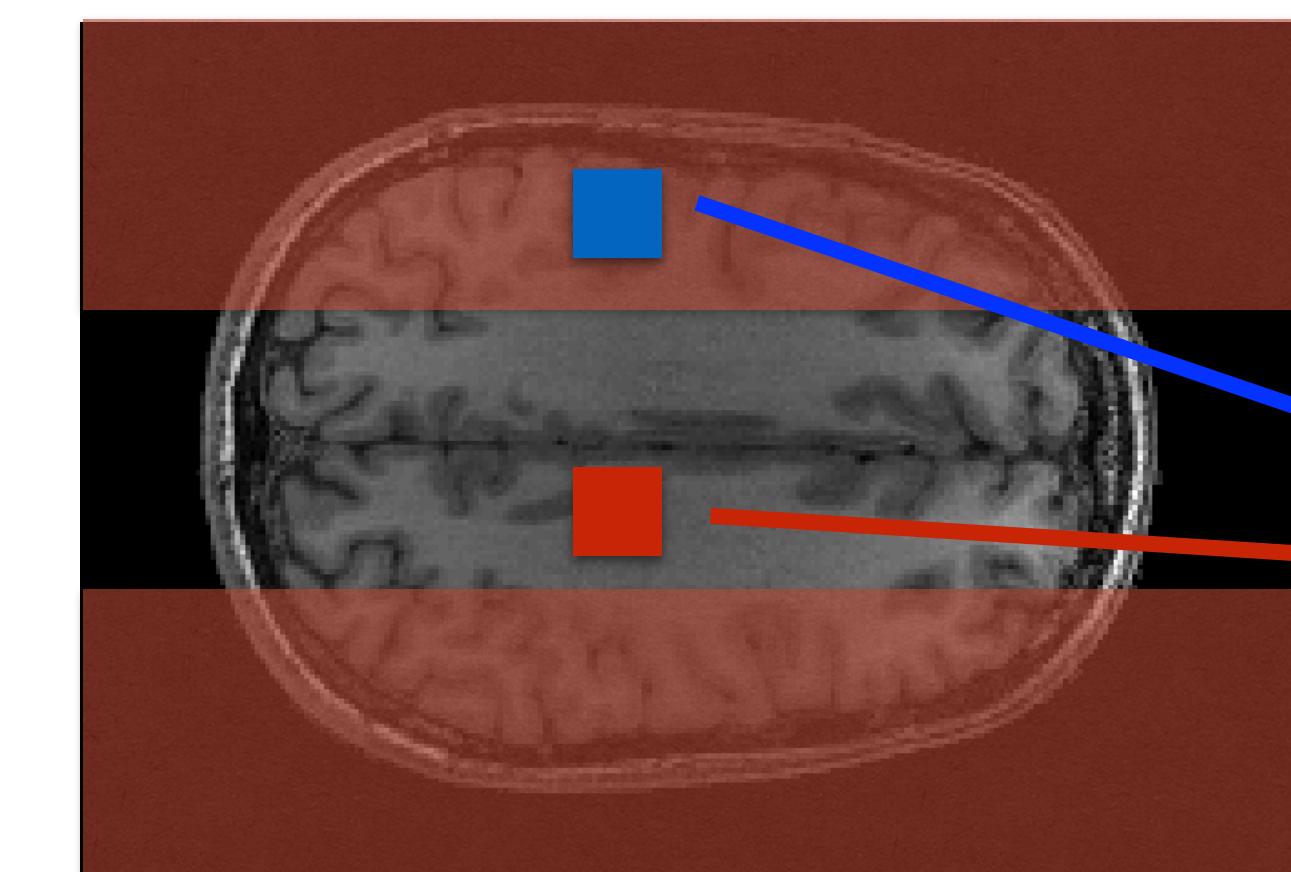
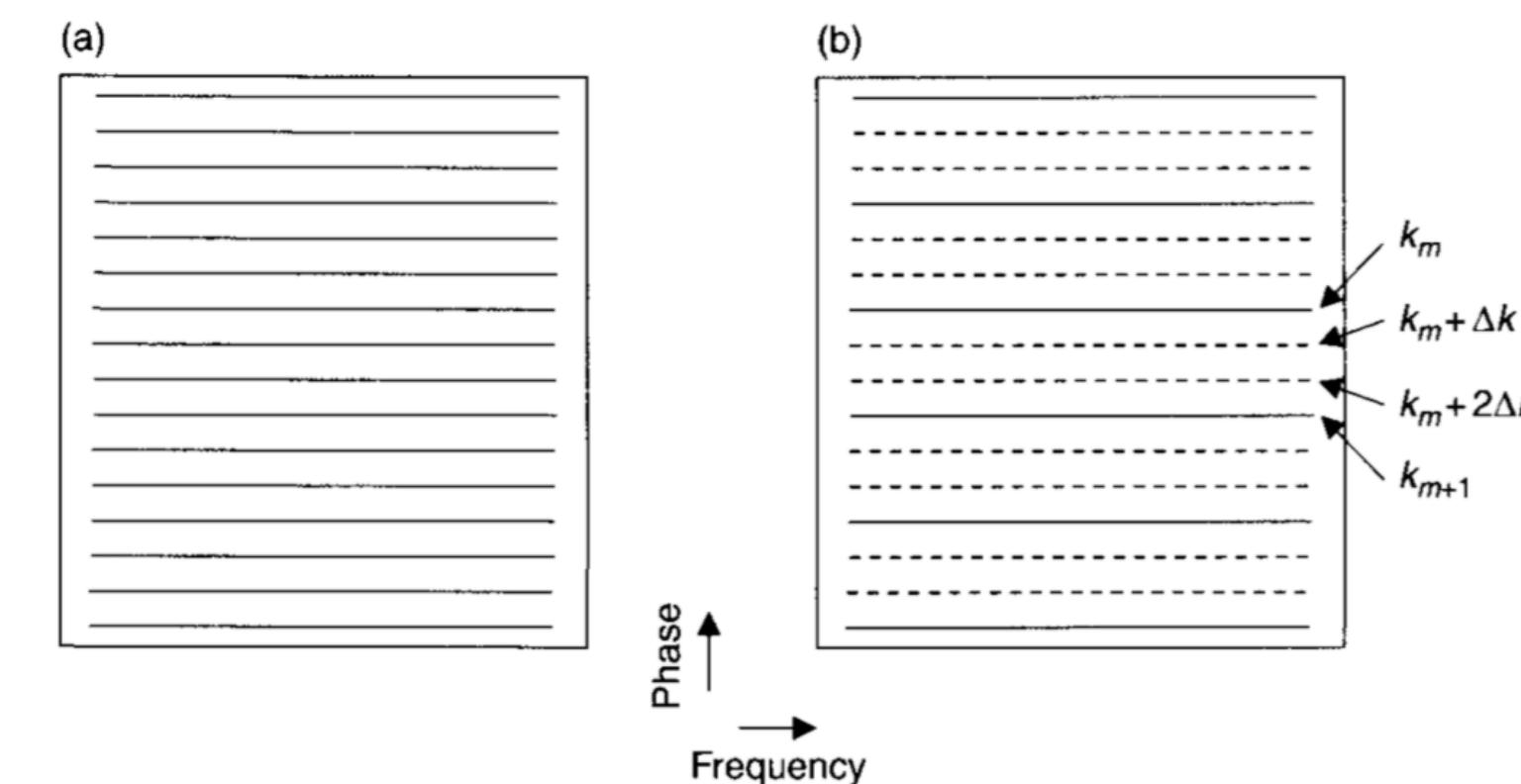
- Accélération 2 :
 - Lecture 1 ligne sur 2

$$\Delta k = \frac{1}{FOV}$$

- FOV / 2
 - Repliement

$$m_v = m_b + m_r$$

- 1 équation / 2 inconnues

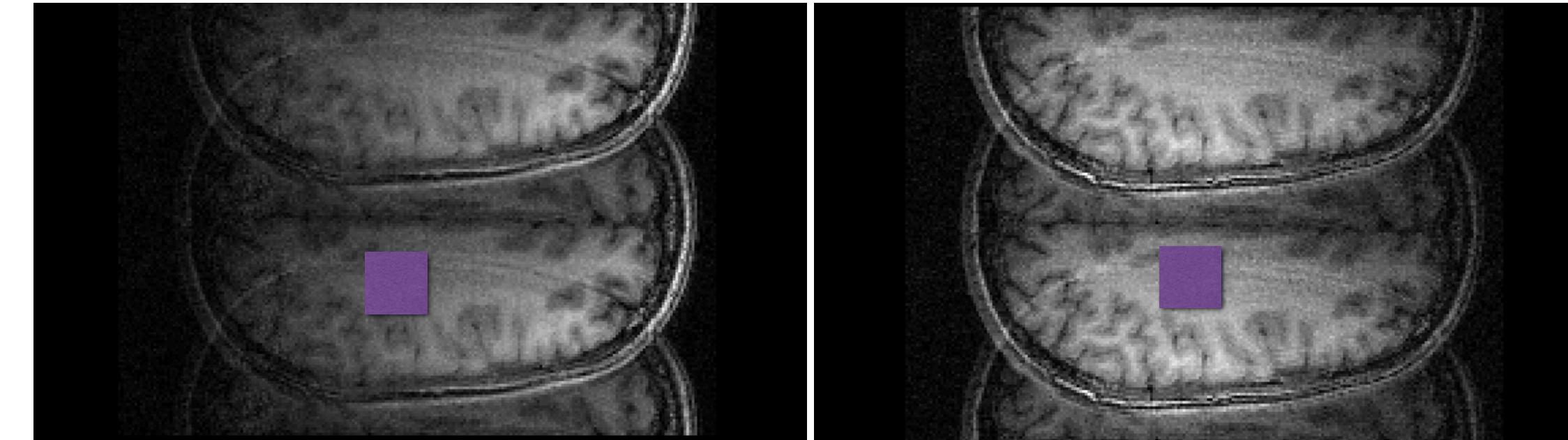


Utilisation des antennes

Utilisation pour l'accélération

Canal 1

- Repliement pour chaque antenne



Canal 2



$$\begin{bmatrix} m_1(p_v) \\ m_2(p_v) \end{bmatrix} = \begin{bmatrix} C_1(p_r) & C_1(p_b) \\ C_2(p_r) & C_2(p_b) \end{bmatrix} \begin{bmatrix} m(p_r) \\ m(p_b) \end{bmatrix} + \begin{bmatrix} n_1 \\ n_2 \end{bmatrix}$$

$$\begin{bmatrix} m_1(p_v) \\ m_2(p_v) \end{bmatrix} = \begin{bmatrix} C_1(p_r) & C_1(p_b) \\ C_2(p_r) & C_2(p_b) \end{bmatrix} \begin{bmatrix} m(p_r) \\ m(p_b) \end{bmatrix} + \begin{bmatrix} n_1 \\ n_2 \end{bmatrix}$$

- Forme matricielle

$$\begin{matrix} m_l \\ L \times 1 \end{matrix} = \begin{matrix} C \\ L \times 2 \end{matrix} \begin{matrix} m \\ 2 \times 1 \end{matrix} + \begin{matrix} n_l \\ L \times 1 \end{matrix}$$

$$\hat{m}(x, y) = \begin{matrix} (C^* \Psi^{-1} C)^{-1} C^* \Psi^{-1} m_s(x, y) \\ 2 \times 1 \end{matrix}$$

2 × 2

2 × L

L × 1

Effet sur l'image

Image initiale

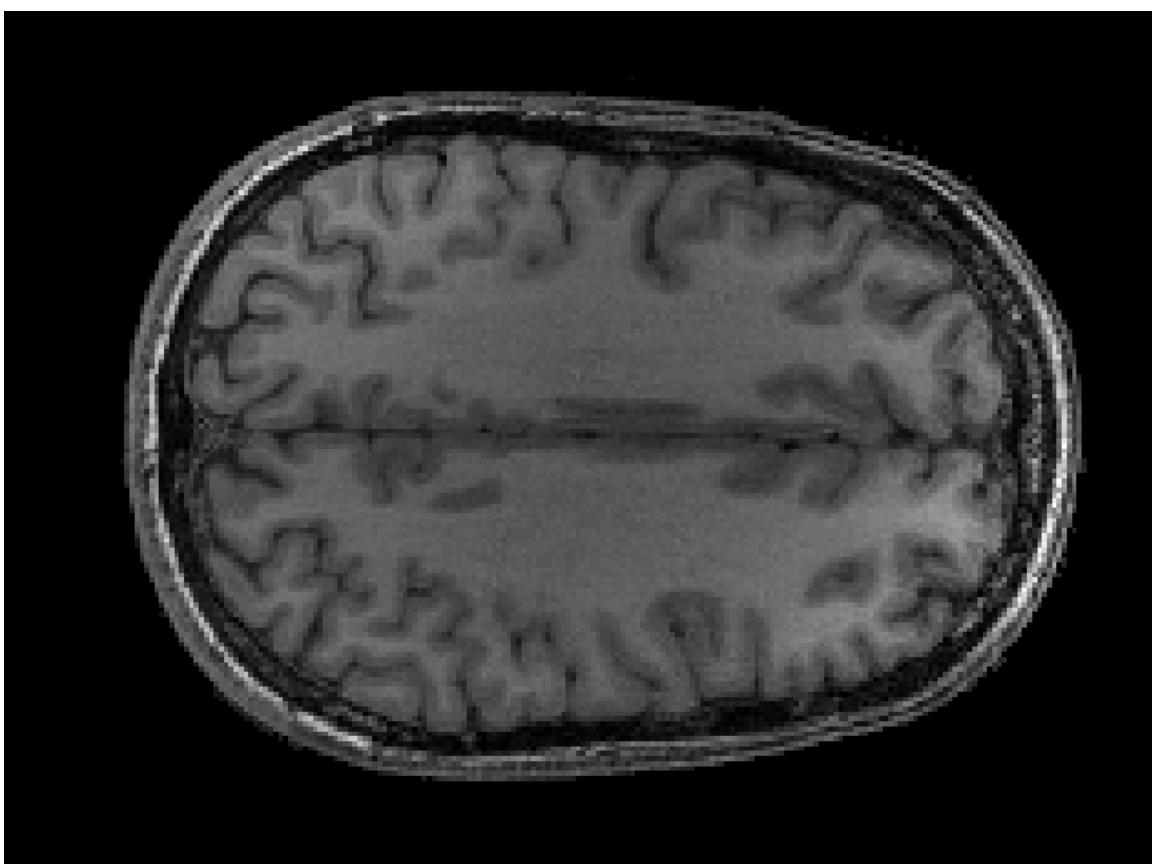


Image sous-échantillonnée

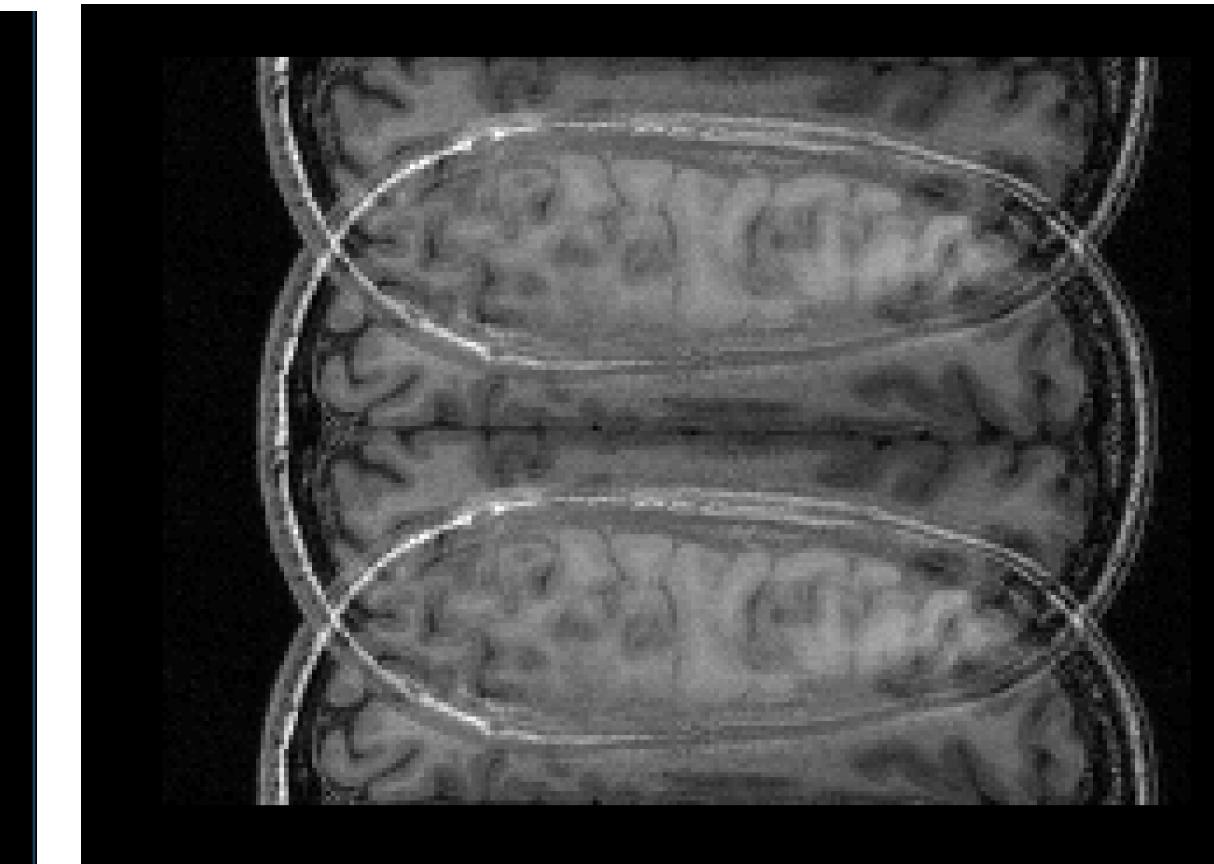
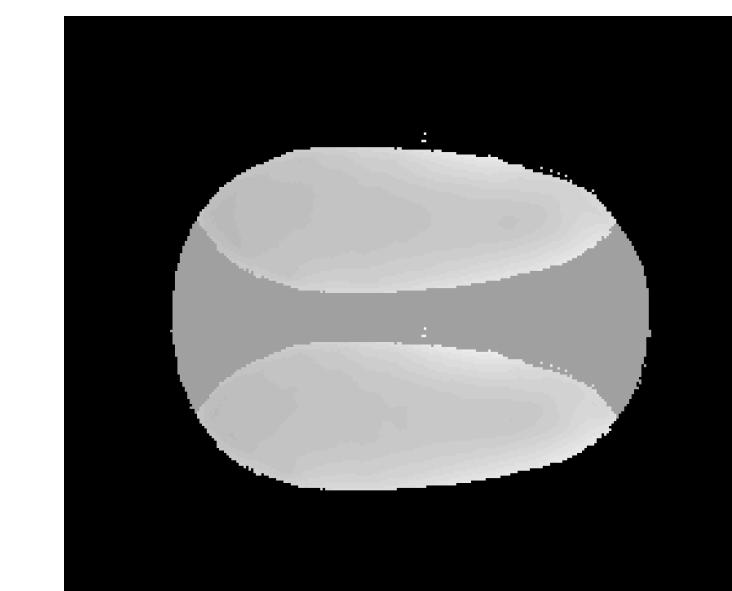


Image SENSE x 2



Artefacts résultats

- Diminution SNR
 - Facteur = \sqrt{Accel}
 - Facteur géométrique : **gmap**
Dépendant du taux de repliement



$$\frac{SNR_{sense}}{SNR_{full}} = \frac{1}{g(x, y) \sqrt{Accel}}$$