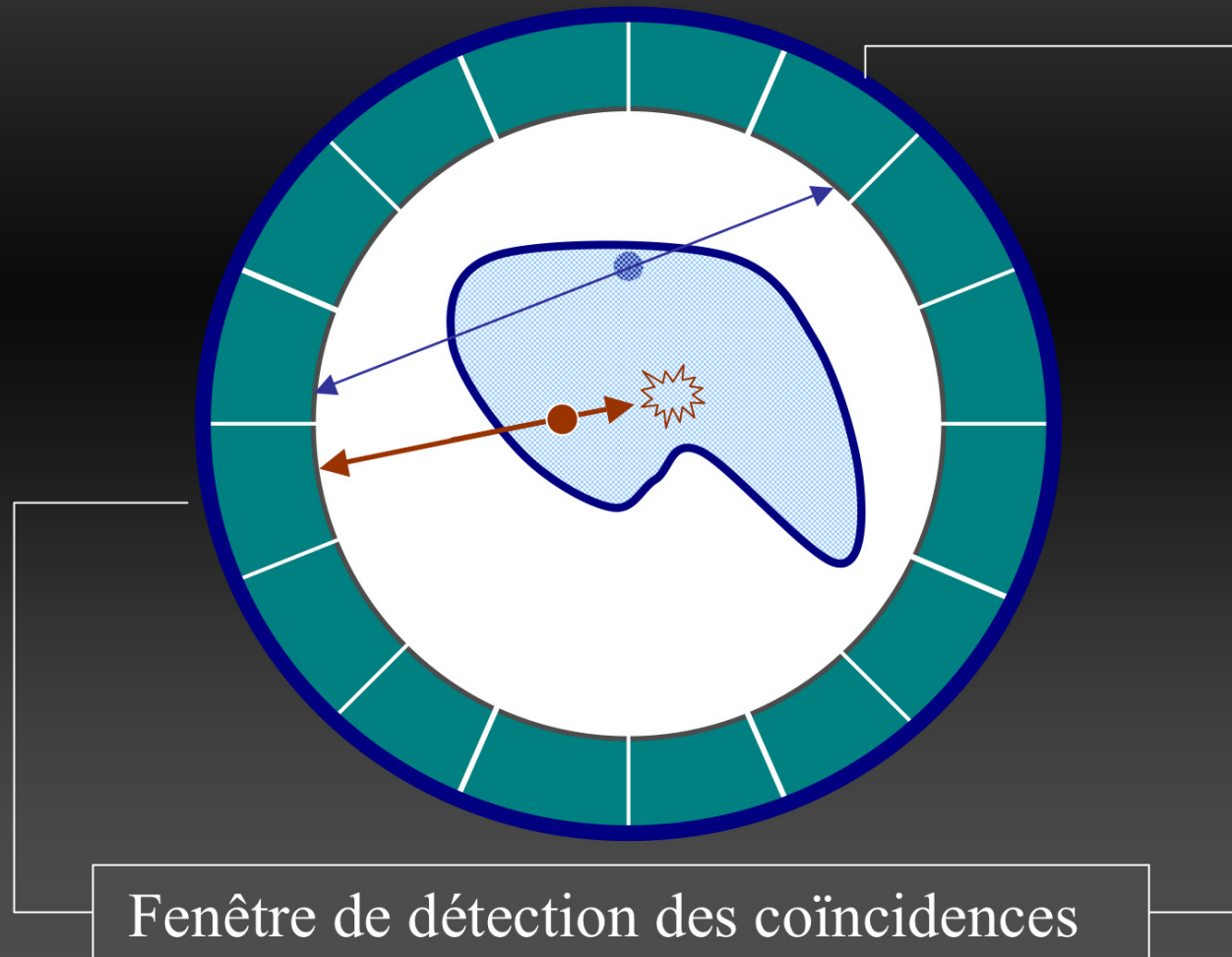
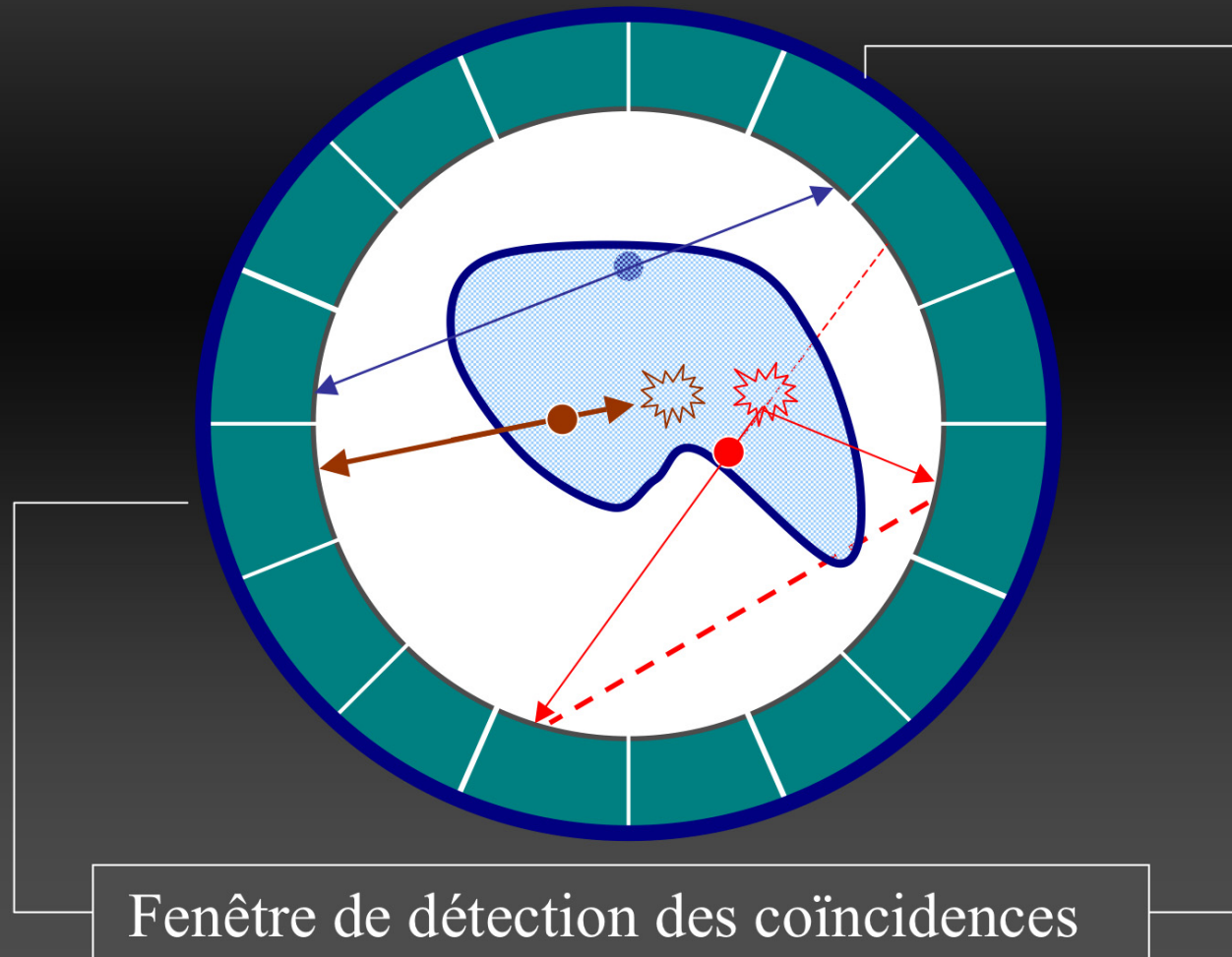


Traitement et analyse multimodal

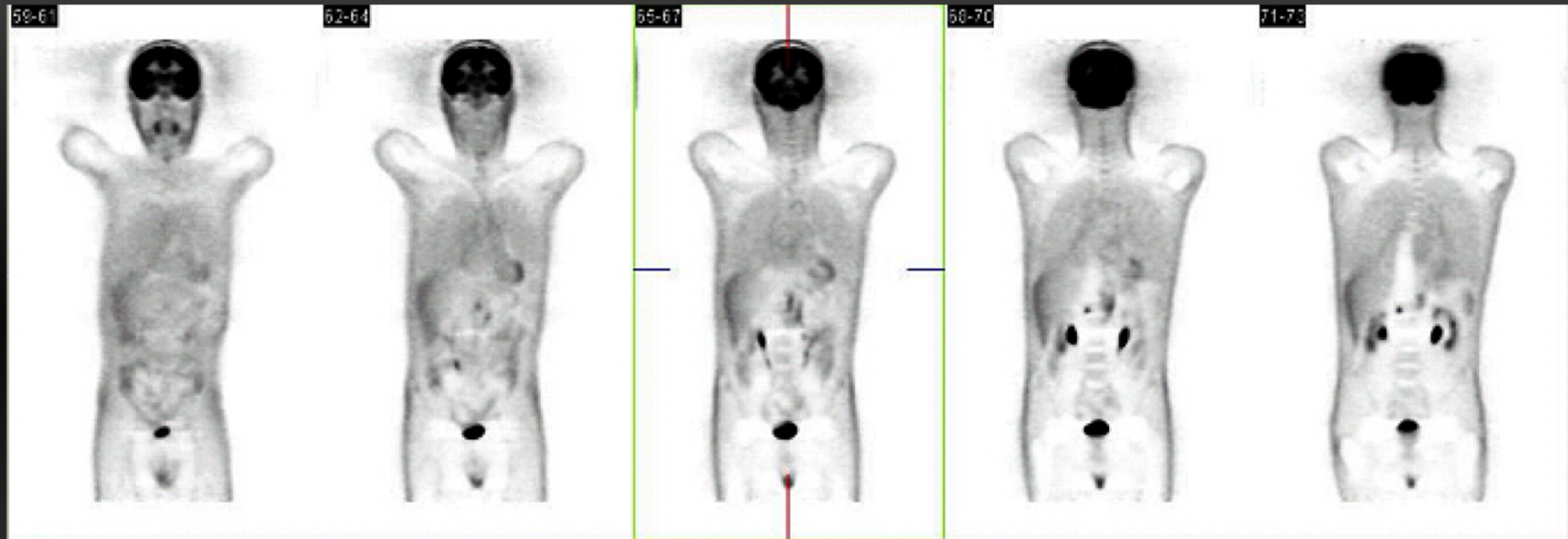
Interactions Photons-Matière en TEP



Interactions Photons-Matière en TEP



Atténuation photo-électrique



$$\mu_{PE} \approx k \frac{Z^3}{E^3} \rho$$

Sous-estimation des activités «profondes»

Diffusion Compton

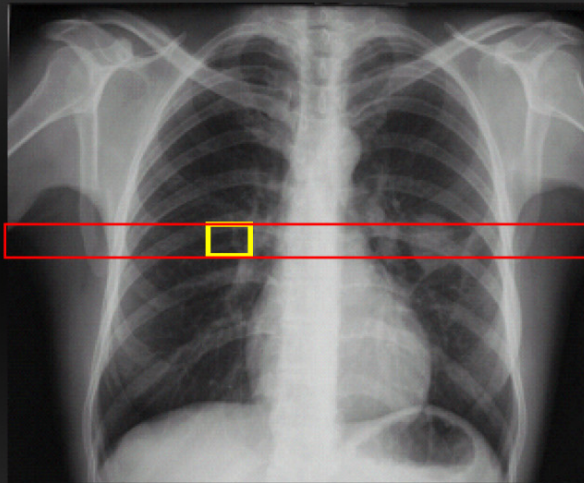
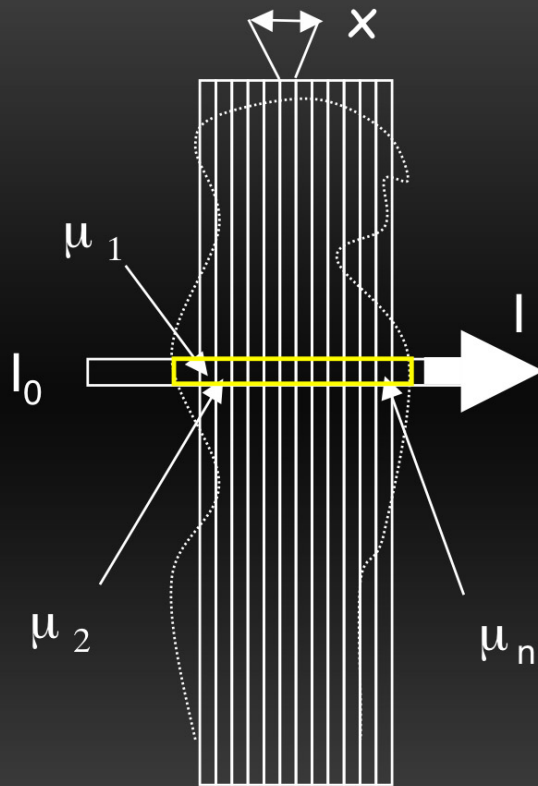
20% (2D) à 50% (3D) des détectations

Médiocre résolution en énergie (15-20%)

Activité du cerveau et de la vessie

Pour des photons de 10 à 500 keV : $\mu_c \approx k' \rho$

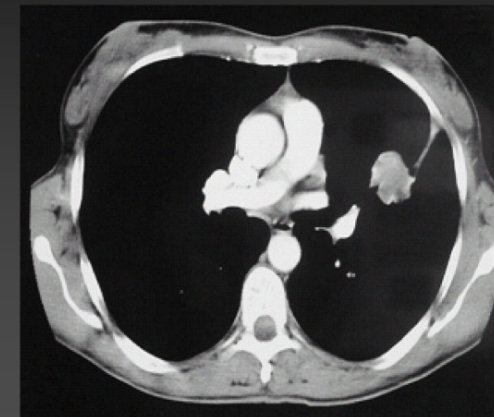
Tomographie de transmission

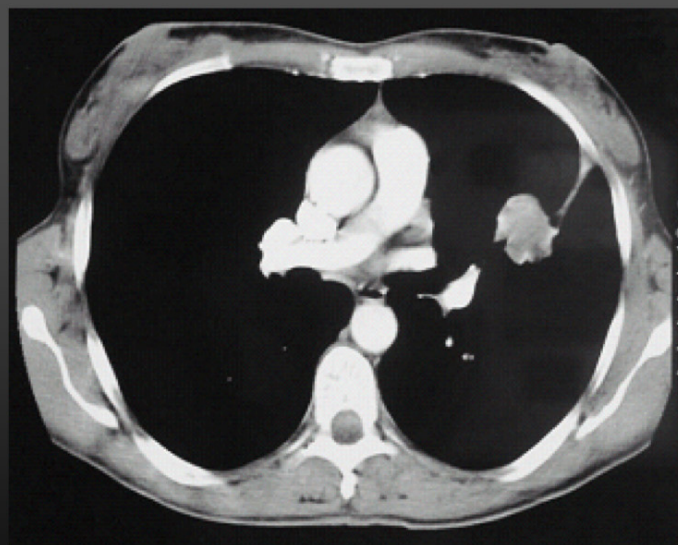


$$I = I_0 e^{-x \sum_i \mu_i}$$

$$p = -\frac{1}{x} \ln\left(\frac{I}{I_0}\right) = \sum_i \mu_i$$

$$\left. \begin{aligned} \mu_{PE} &\approx k \frac{Z^3}{E^3} \rho \\ \mu_C &\approx k' \rho \end{aligned} \right\}$$

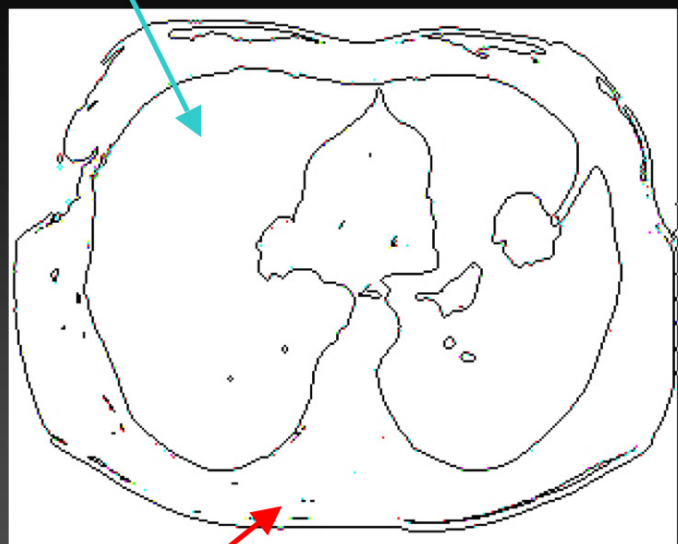




Correction des
artefacts
d'atténuation et
de diffusion

Segmentation

$\mu_{511}(\text{air})$

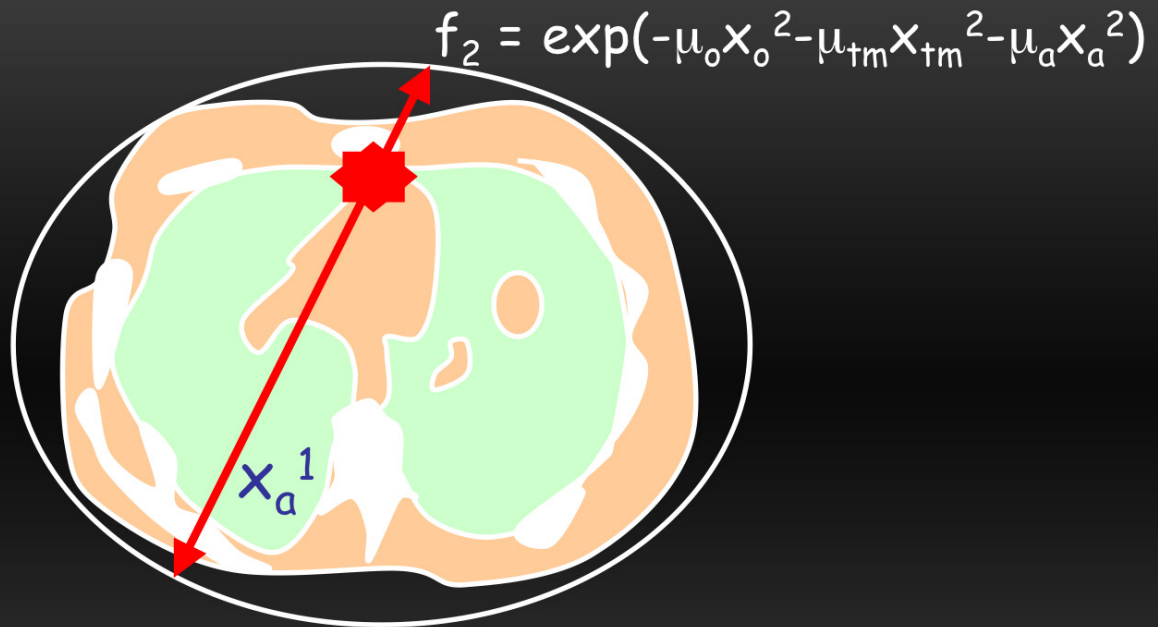


$\mu_{511}(\text{tissu mou})$



$\mu_{511}(\text{os})$

Corrections de l'atténuation P.E.



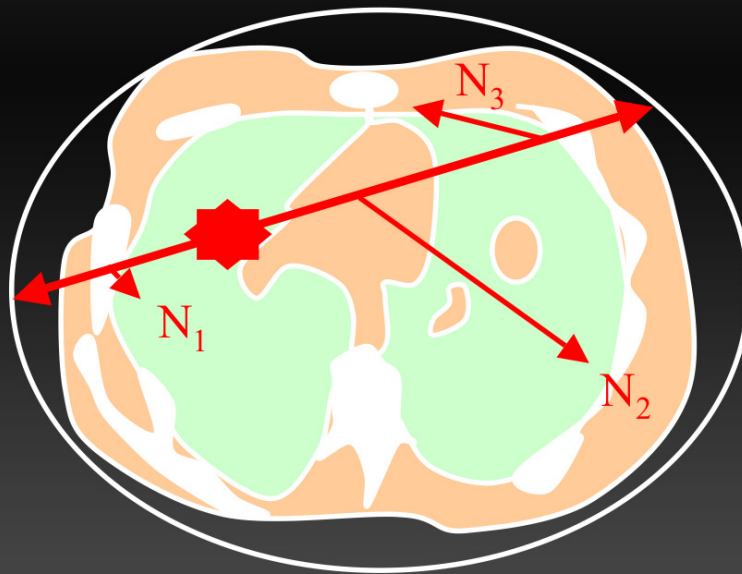
$$f_1 = \exp(-\mu_o x_o^1 - \mu_{tm} x_{tm}^1 - \mu_a x_a^1) = I_1/I_o$$

⇒ Simple division par une constante f sur chaque projection

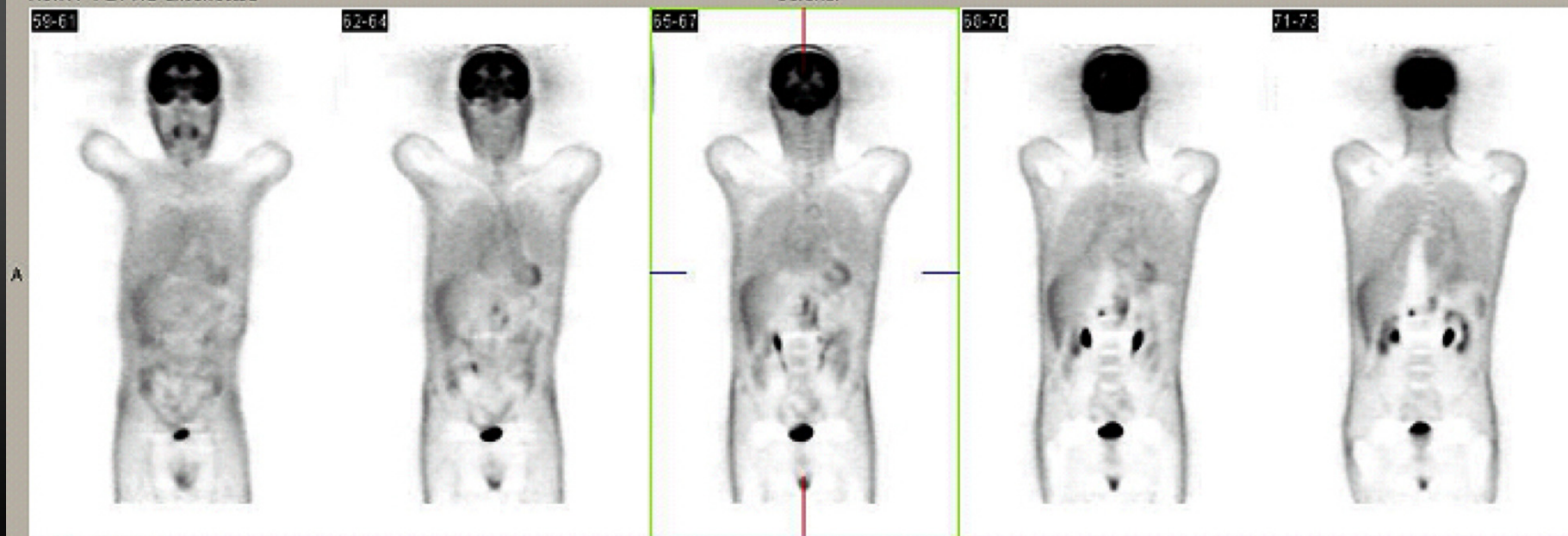
$$f = f_1 \times f_2 = \exp(-\mu_o x_o - \mu_{tm} x_{tm} - \mu_a x_a)$$

Correction du diffusé Compton

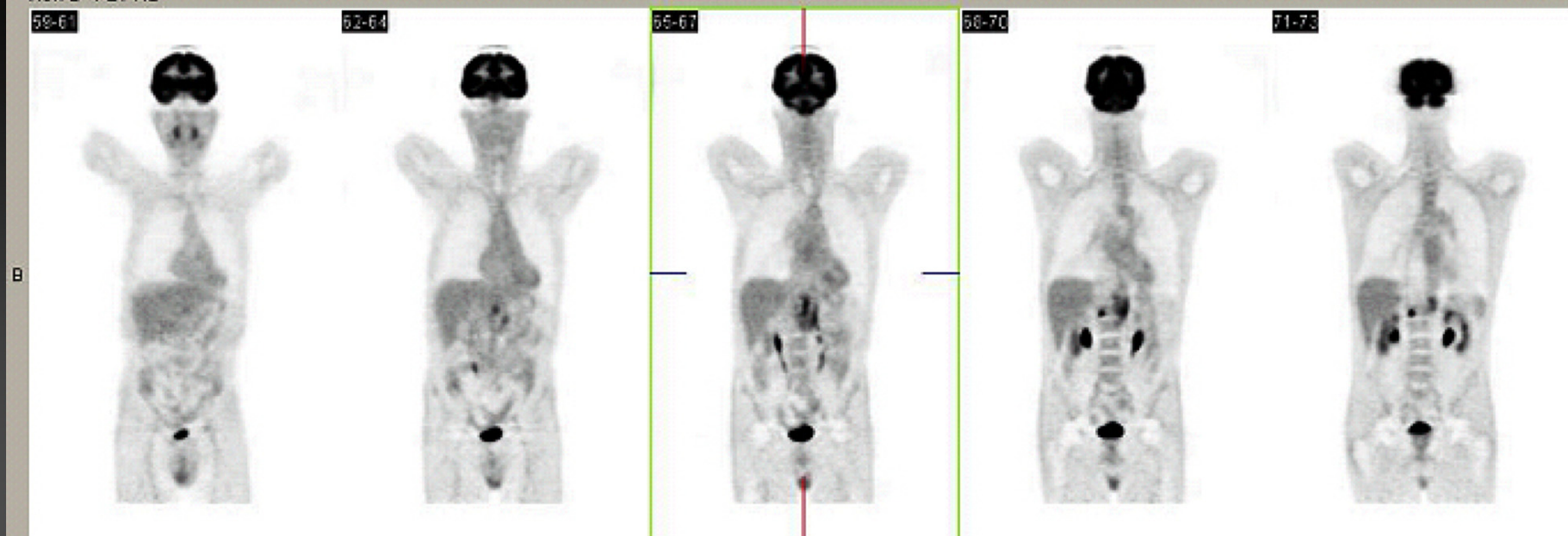
- ✓ Simulation (Monte-Carlo) à partir des μ_C à 511 keV



Row A - PET WB-uncorrected



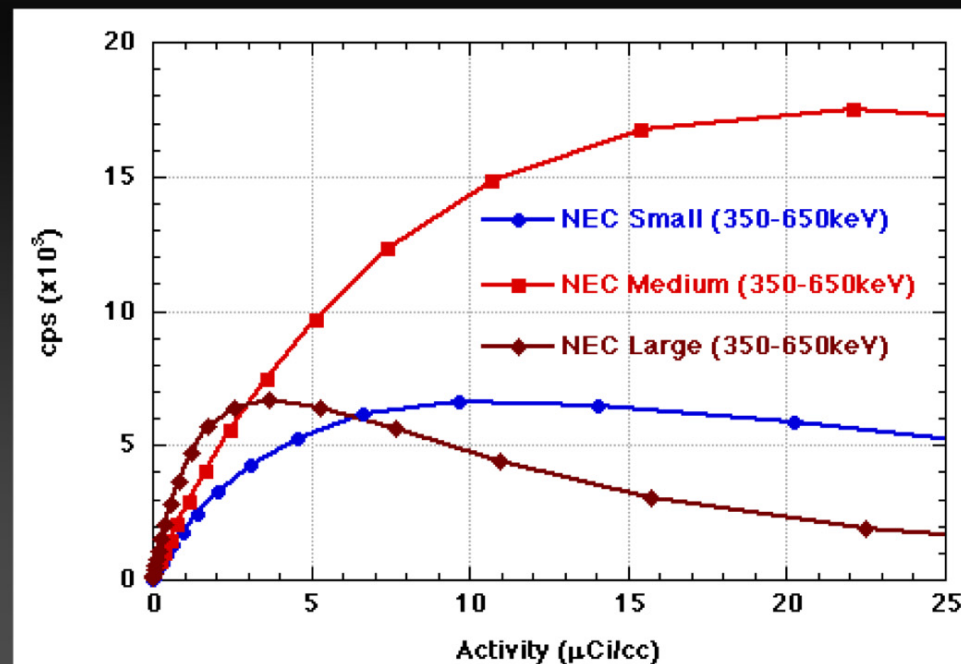
Row B - PET WB



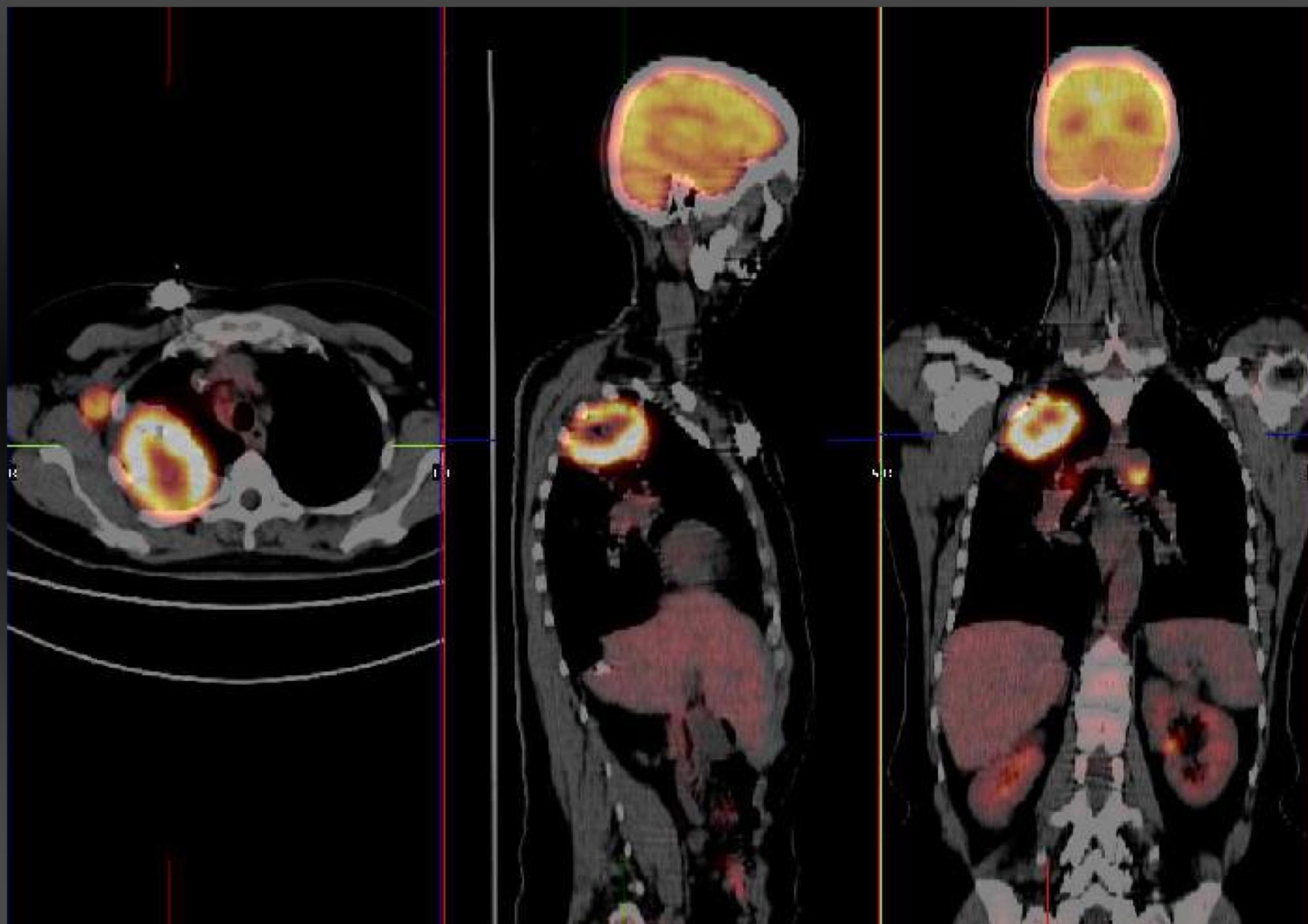
Qualité globale d'un TEP

$$\text{NECR} = \left(\frac{S}{B} \right)^2 = \frac{V^2}{V + D + k \cdot F} = f \left(\frac{iCi}{mL} \right)$$

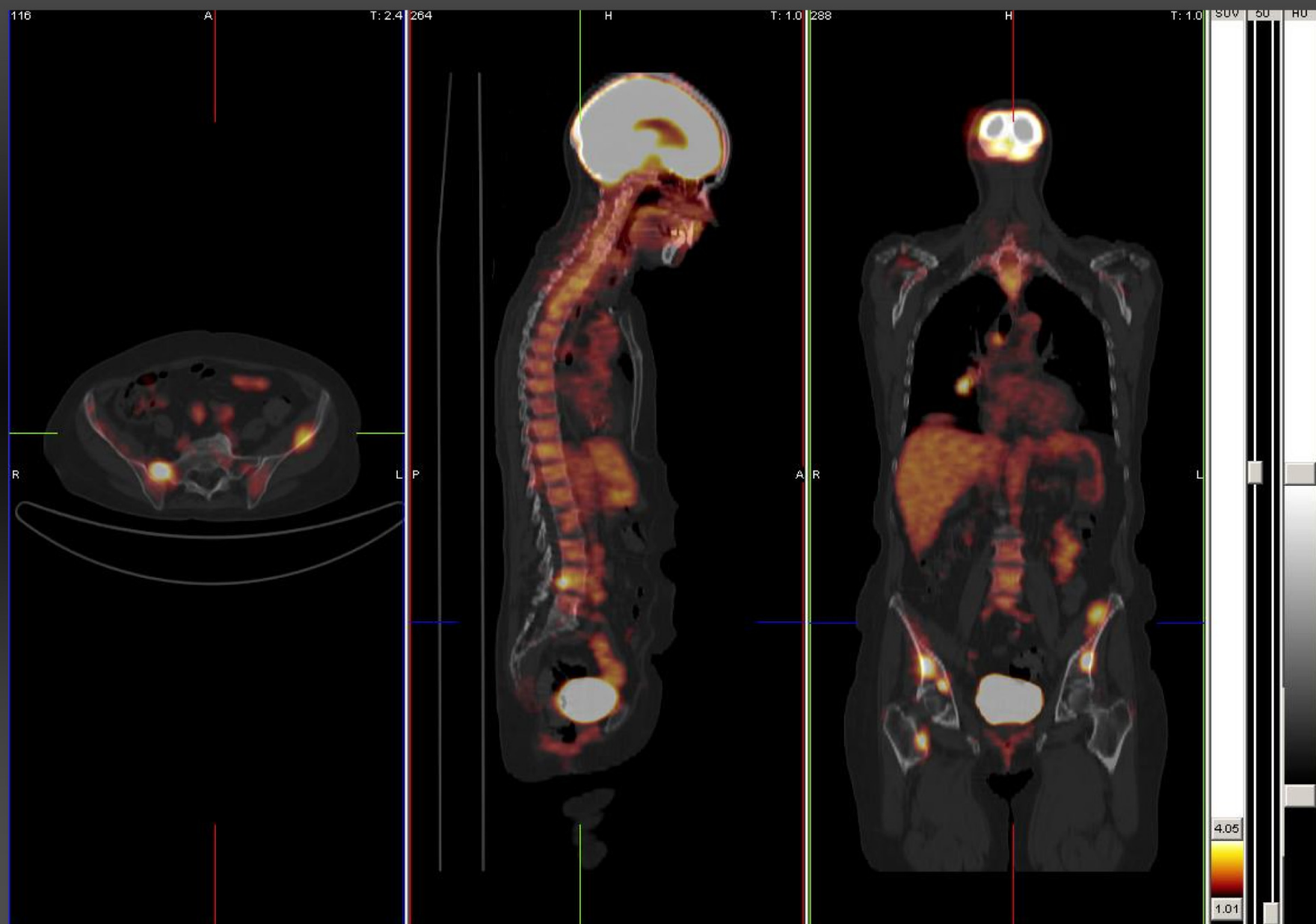
k=1 sauf si F sont mesurés (k=2)



Fusion TEP-CT

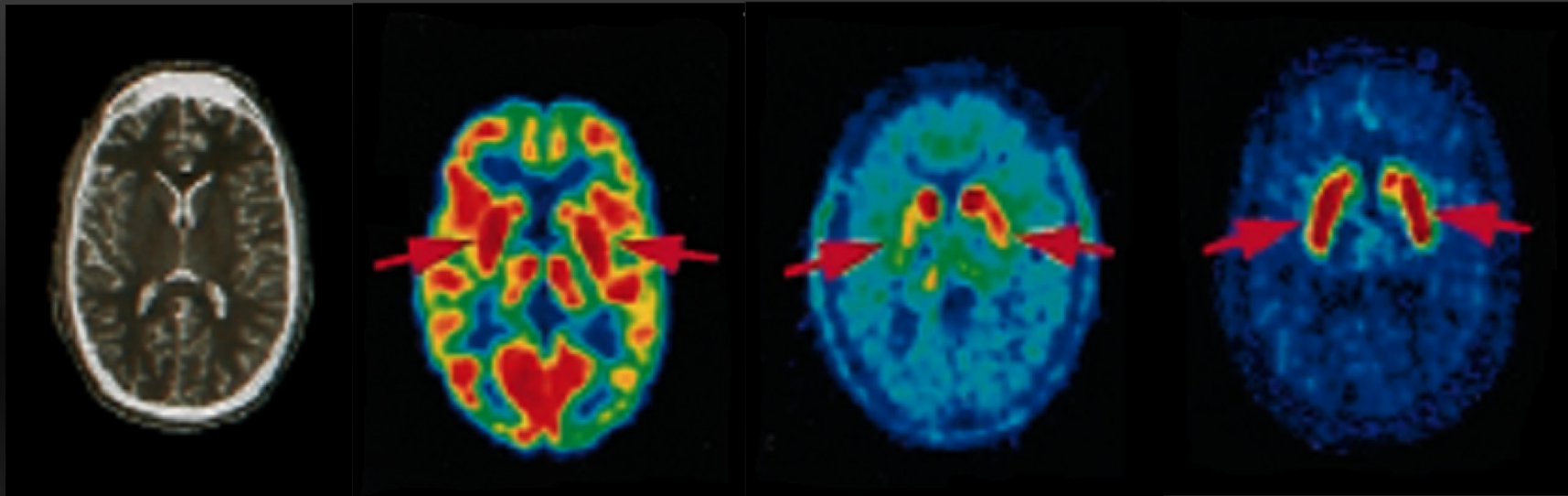


Fusion TEP-CT



« L'imagerie moléculaire »

Hémi Parkinson cliniquement gauche



IRM
 ^1H

Métabolisme
 ^{18}F FDG

^{18}F -DOPA, voie
Pré-synaptique

Perte
fonction
DaT
Putamen D

^{18}F -Ethyl
Spipérone, voie
Post-synaptique

Pas
d'atteinte
RD2