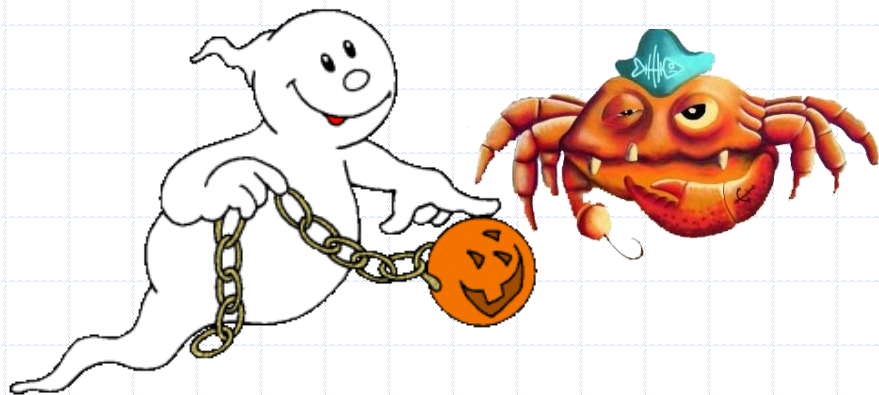


LA TOMOGRAPHIE PAR EMISSION DE POSITONS



Denis MARIANO-GOULART

Département de médecine nucléaire

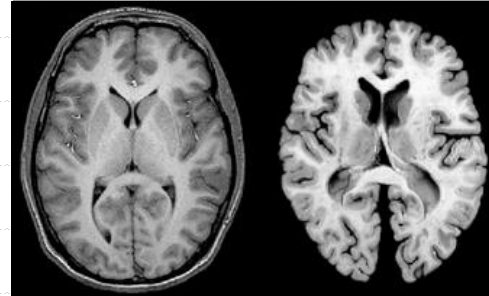
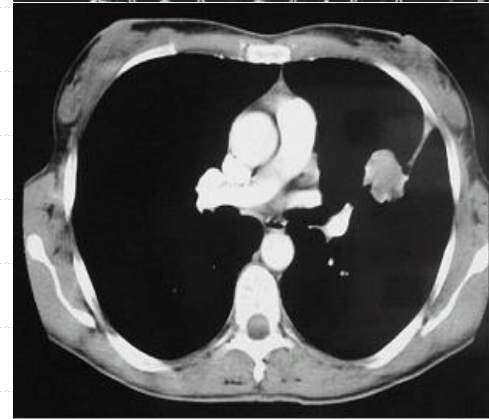
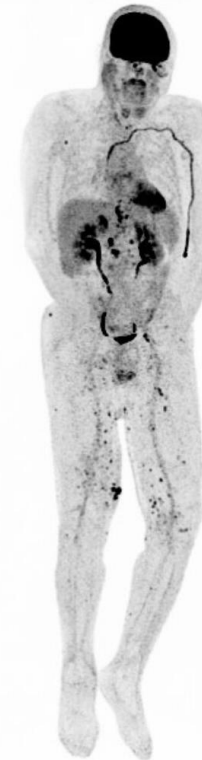
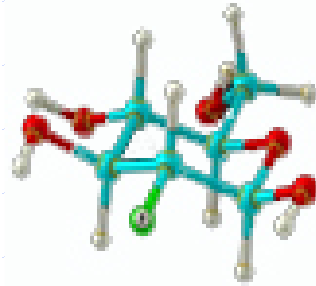
CHRU de Montpellier, France

<http://scinti.edu.umontpellier.fr>

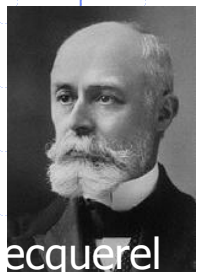
Imagerie médicale

ANATOMIQUE

METABOLIQUE



UN PEU D'HISTOIRE



Becquerel

Radioactivité

α



Anger

détecteur à
scintillation

1896



P & M Curie

Radium
Polonium

1934



Joliot-Curie

Radioactivité
artificielle et β^+

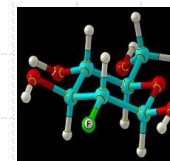
1940

1950

détecteur à
coïncidence

1979

FDG

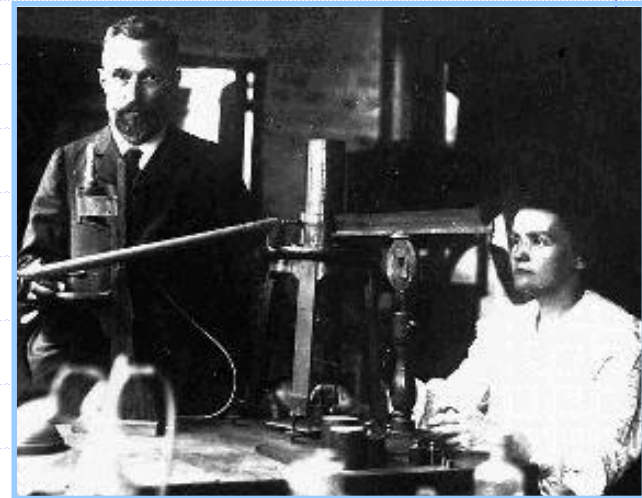
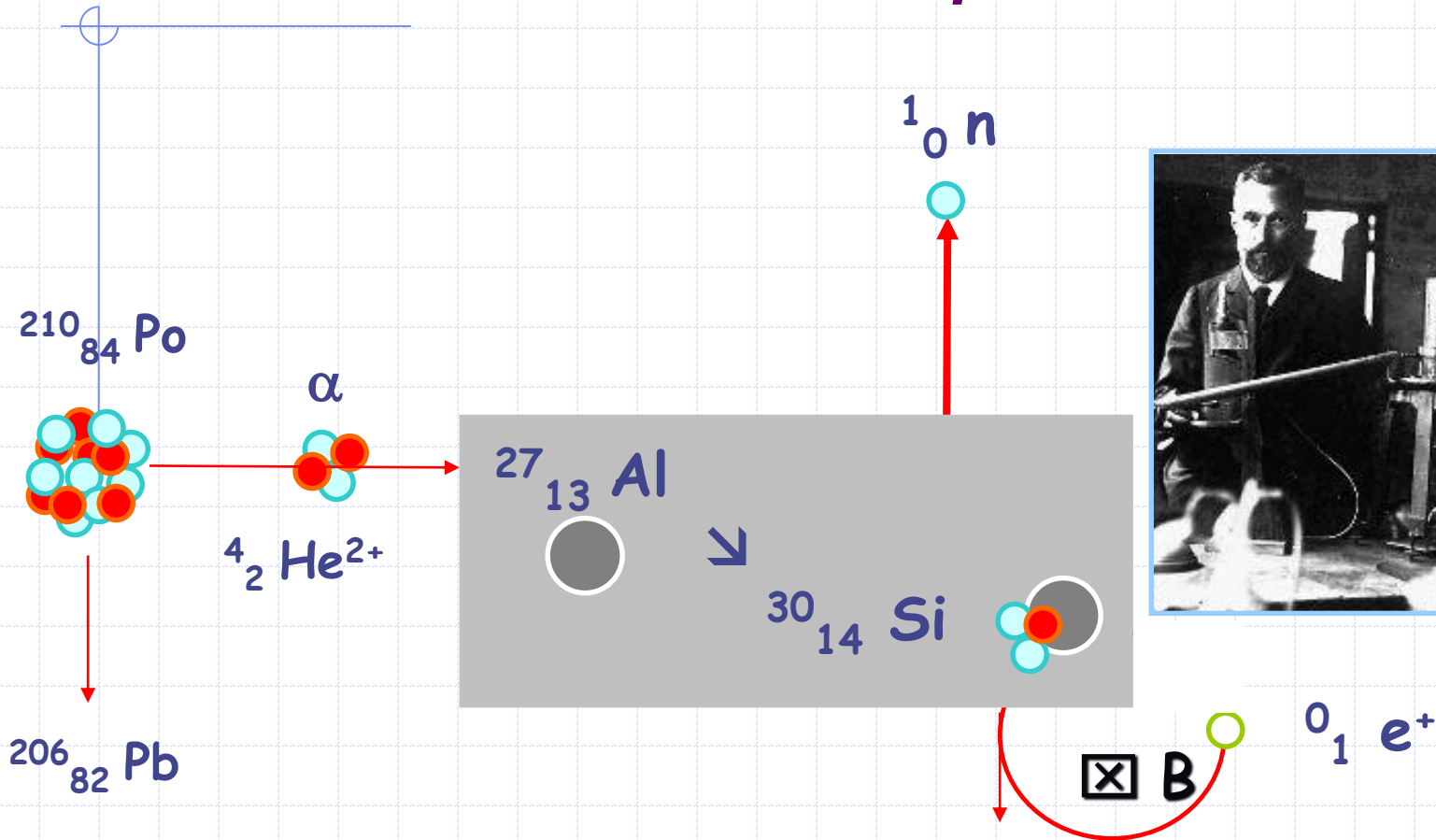


2000

TEP-TDM

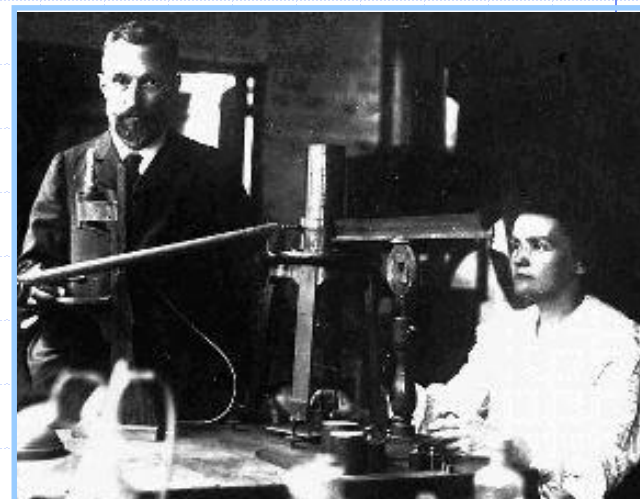
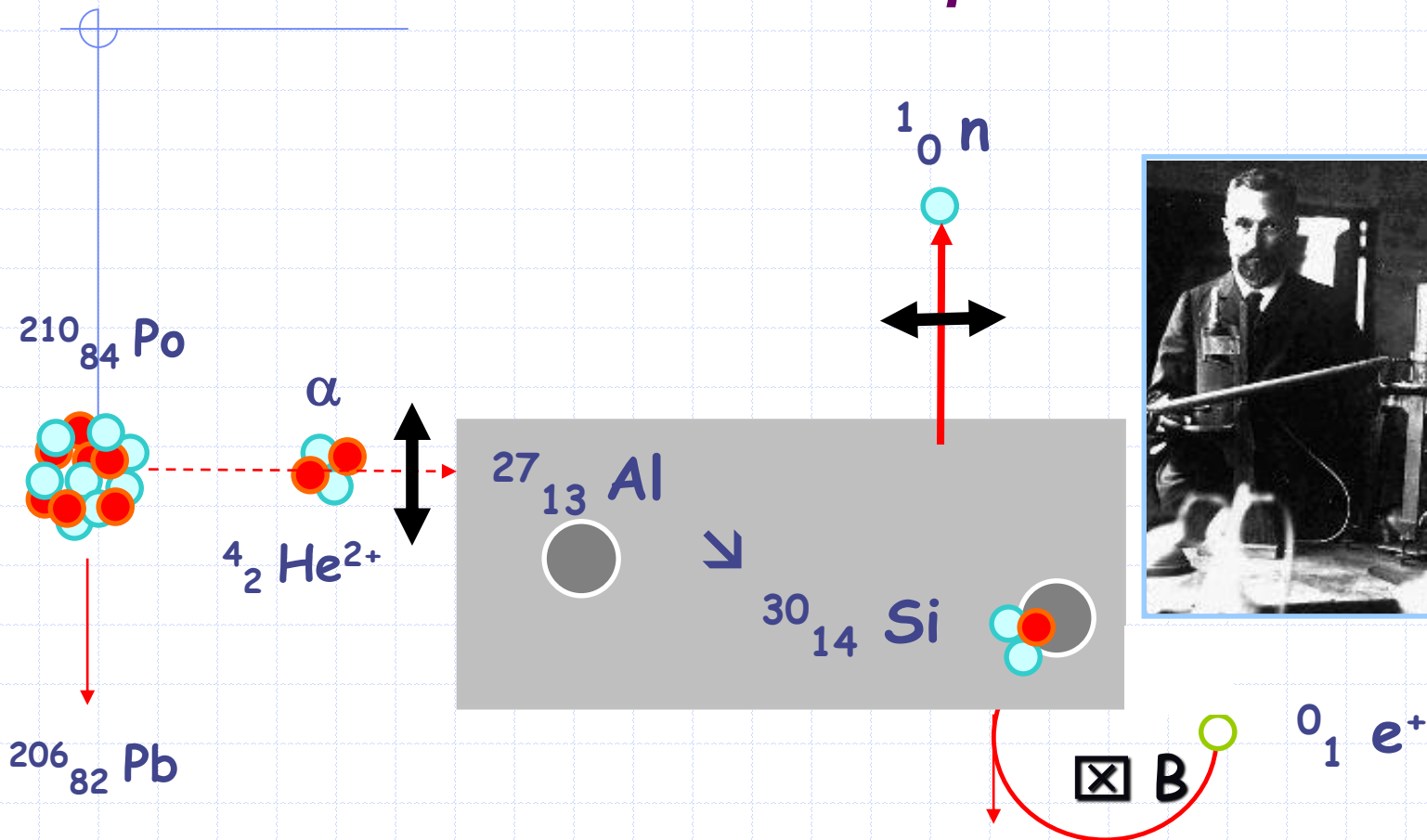


RADIOACTIVITE β^+

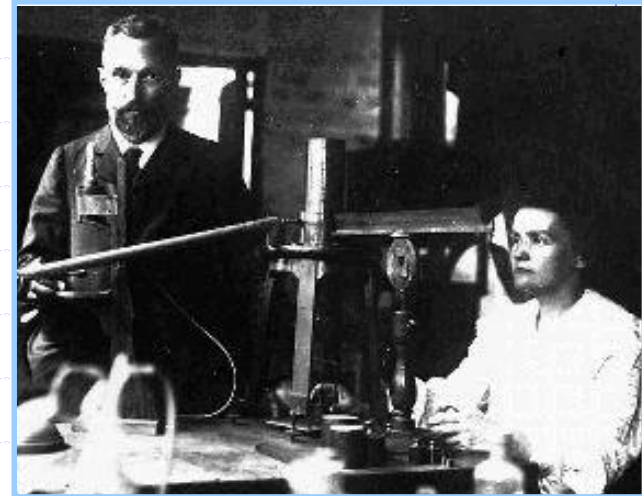
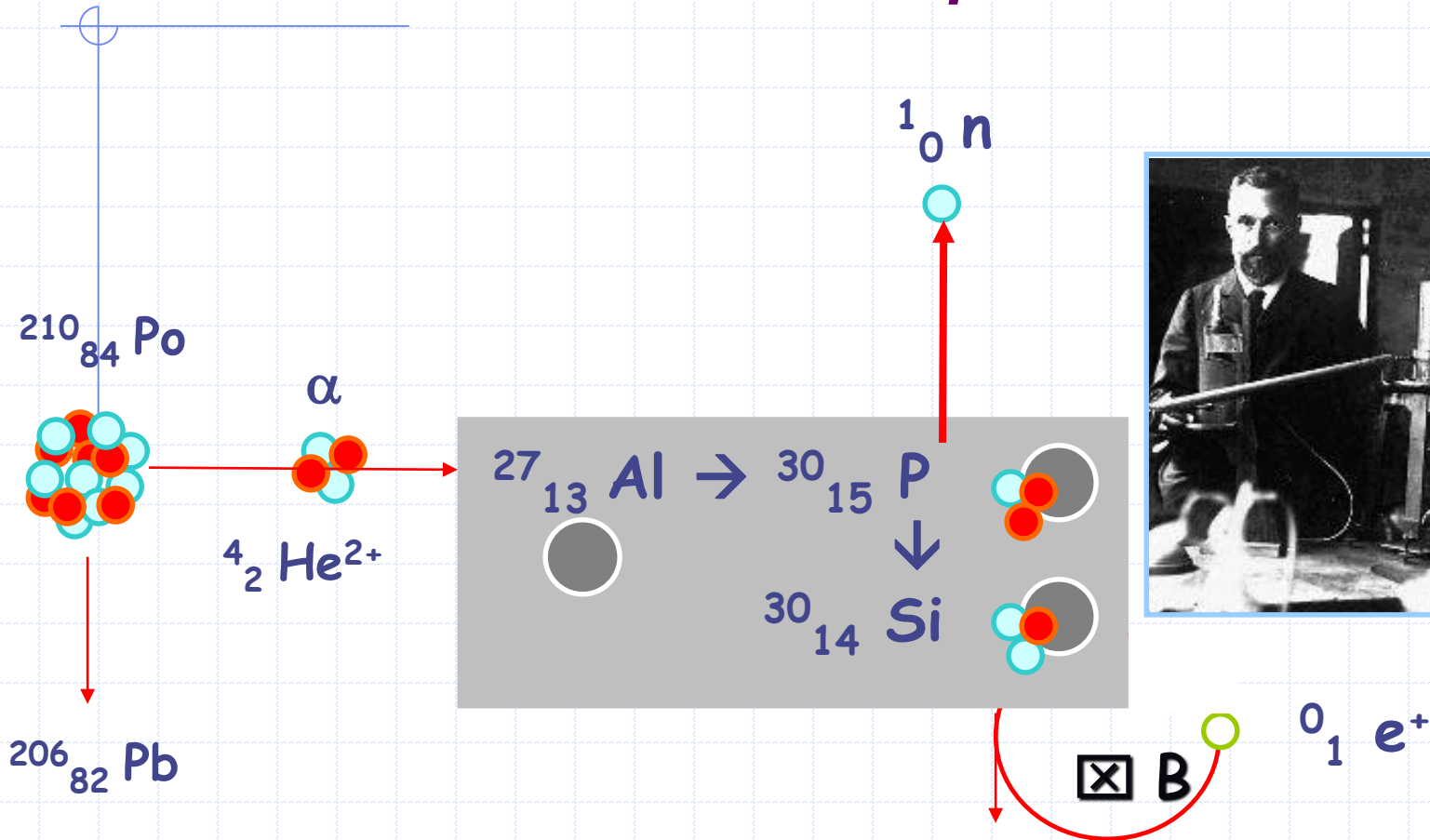


Reprise de l'expérience initiale de Bothe et Becker (1930)
par Irène et Frédéric Joliot Curie (1934)

RADIOACTIVITE β^+

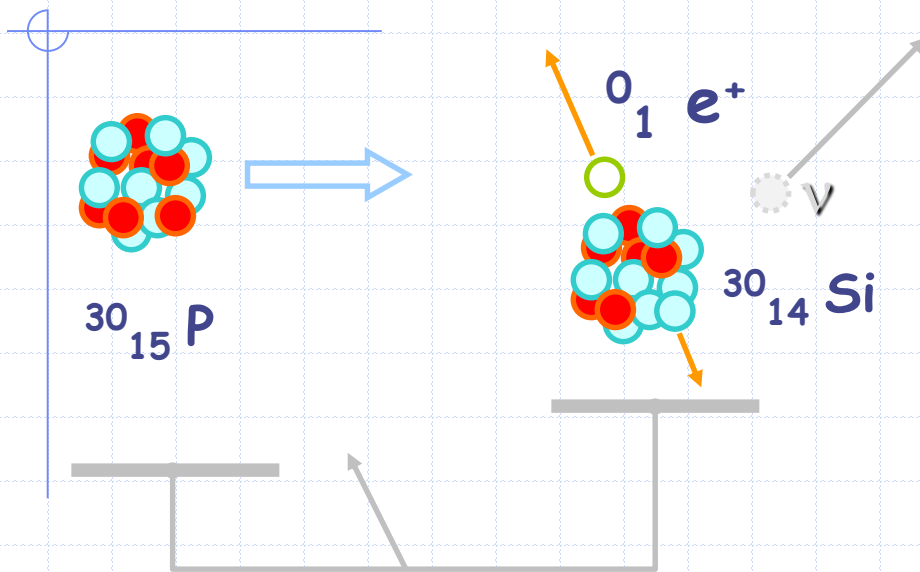


RADIOACTIVITE β^+

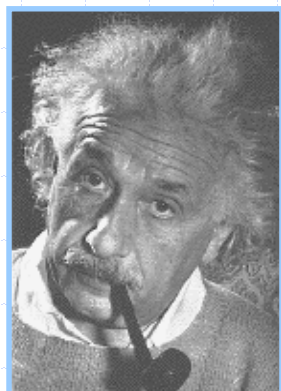


CRAS 15/1/1934 : RA artificielle et désintégration β^+

RADIOACTIVITE β^+



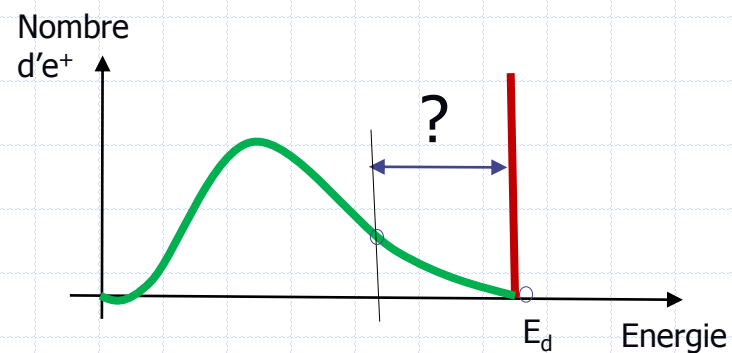
W. Pauli : 1930



$$E_d = (M_P - M_{Si} - m_{e^+})c^2$$

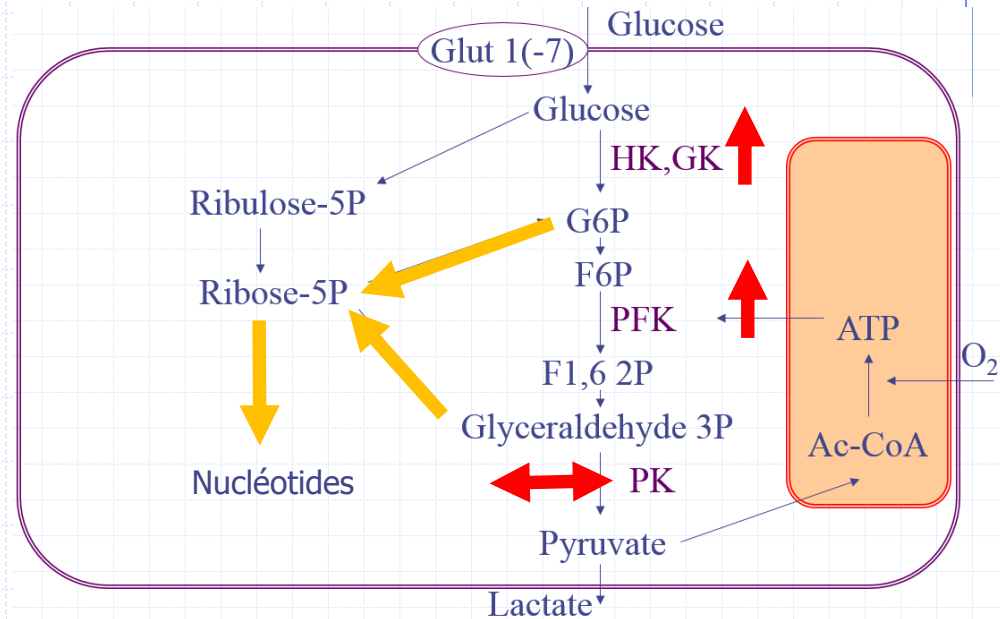
\Rightarrow

$$E_{e^+} = \frac{M_{Si}}{M_{Si} + m_{e^+}} E_d \approx E_d$$



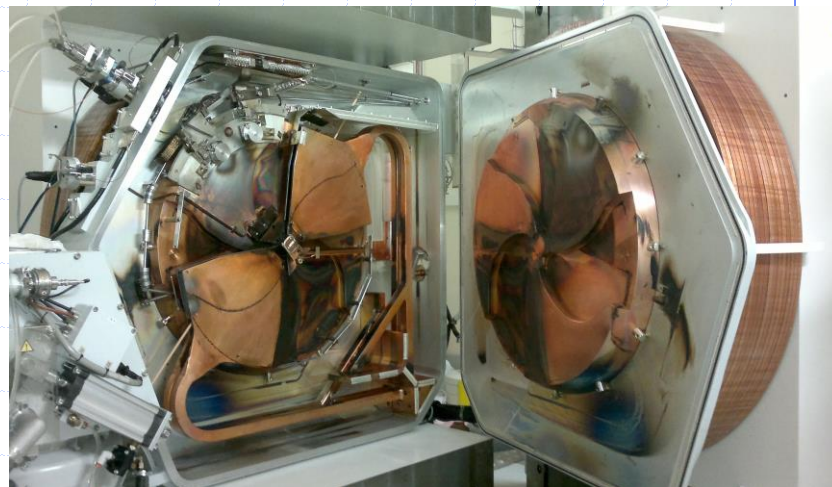
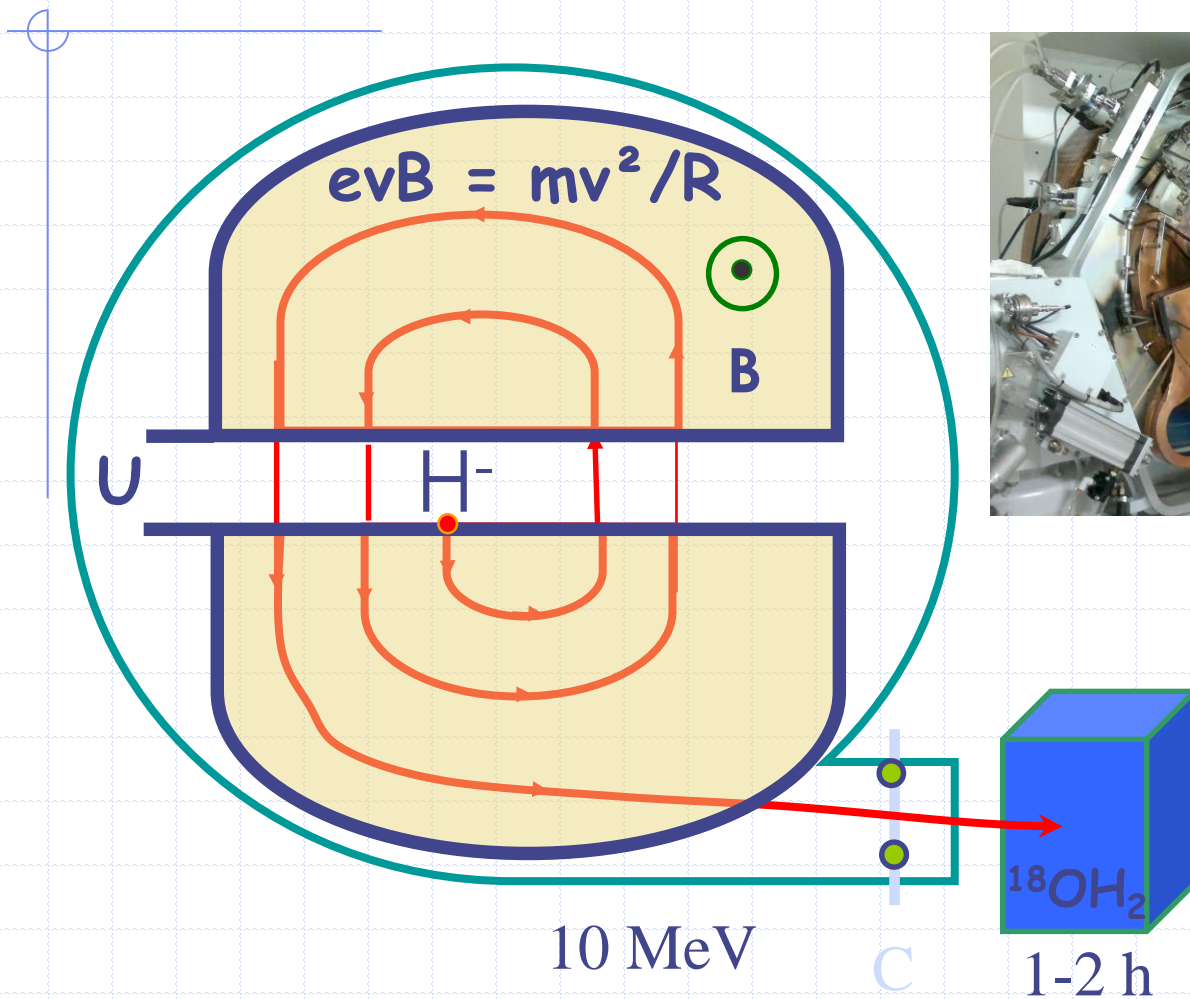
Les radiotraceurs fluorés (^{18}F)

- F-deoxy-Glucose
cancer, infection,
inflammation,

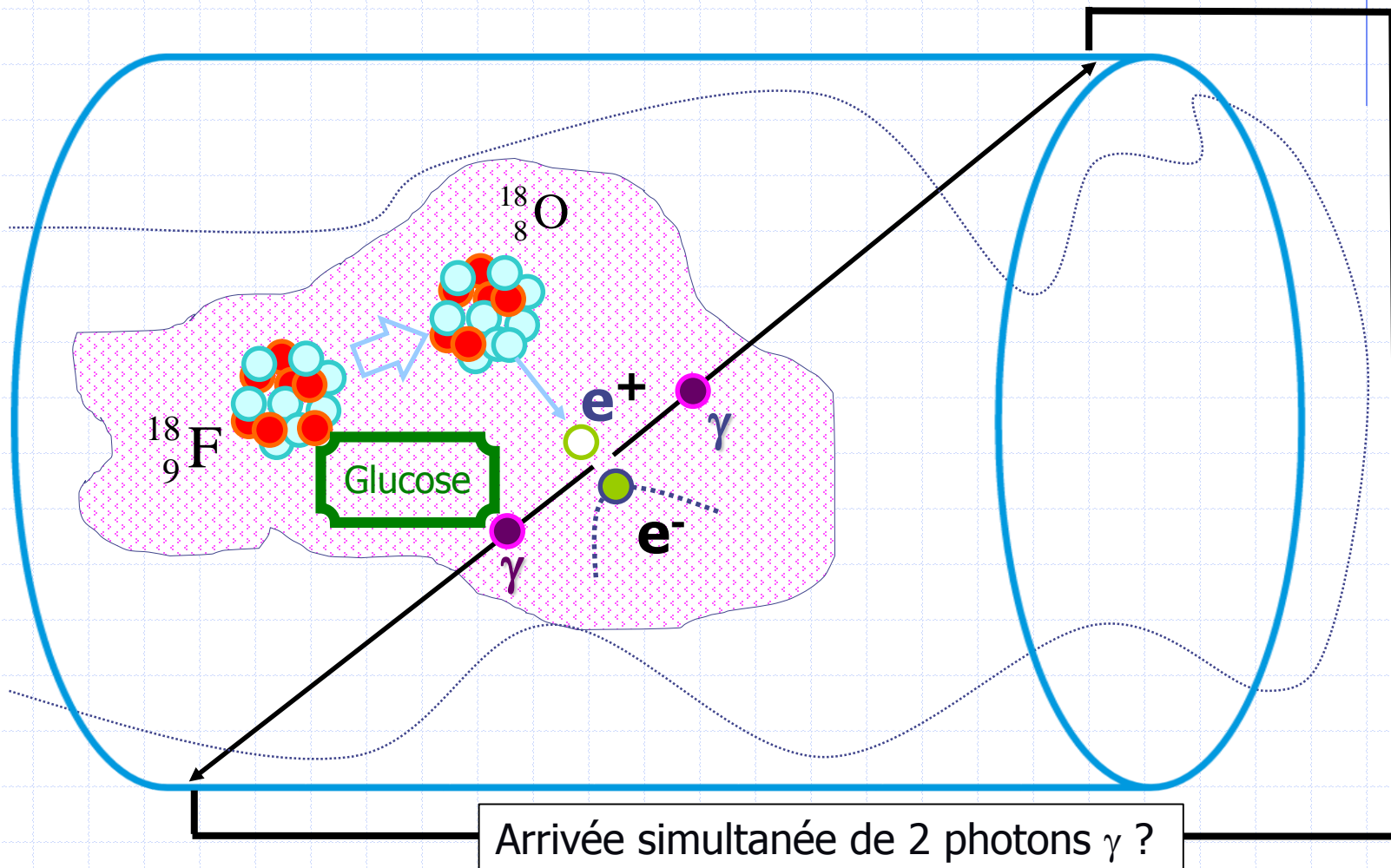


- DOPA (cancers neuroendocrines)
- Choline (phospholipides Mb: cancers)
- Traceurs de plaques amyloïdes, tau (MA)
- FNa (os)

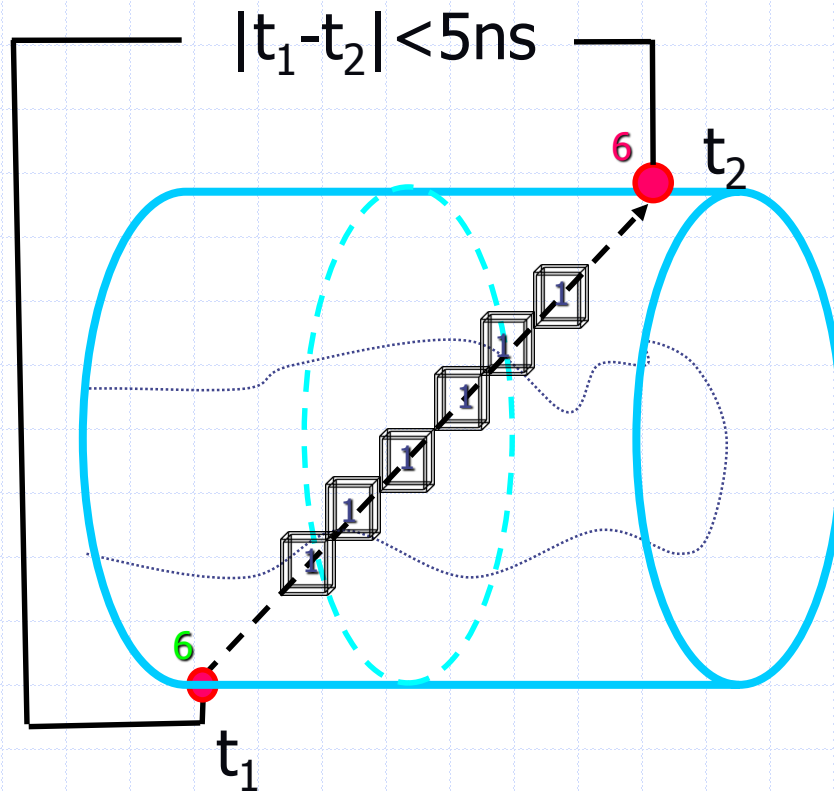
Production de ^{18}F



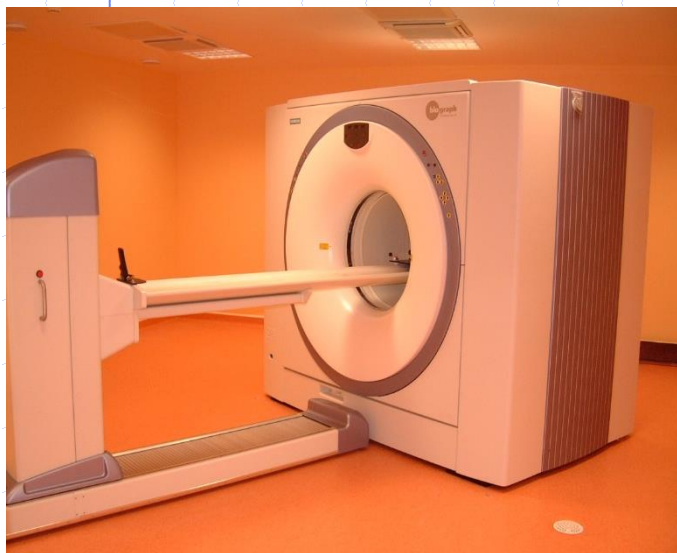
RADIOACTIVITE β^+



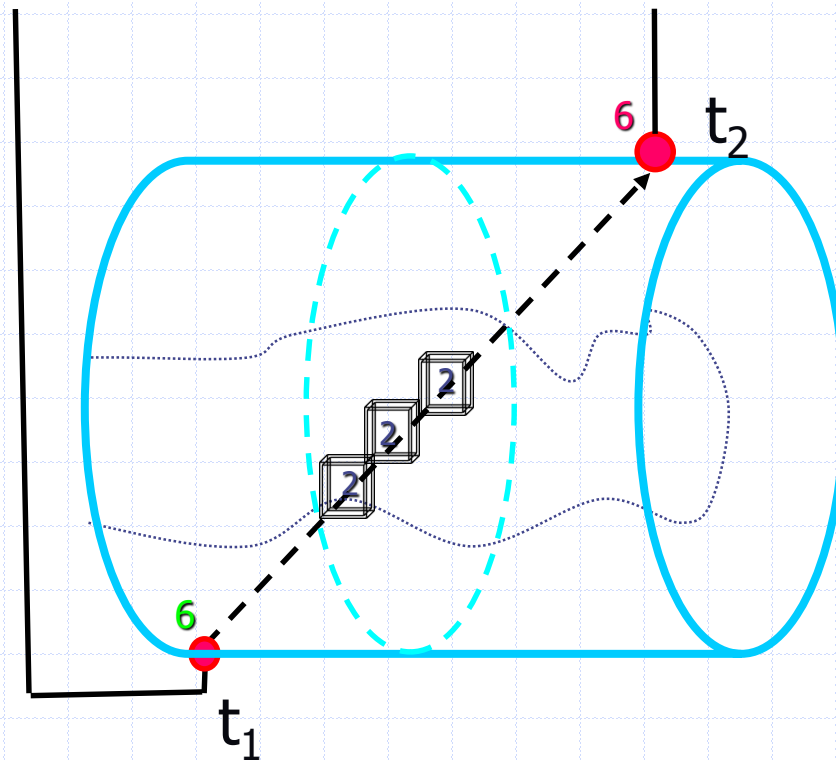
Tomographie par émission de positons



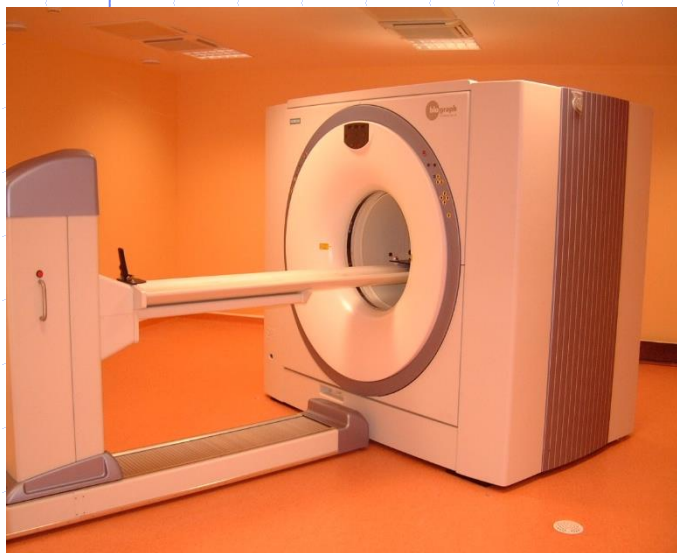
Tomographie par émission de positons



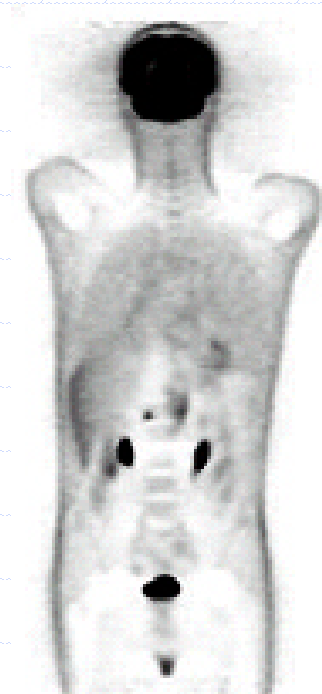
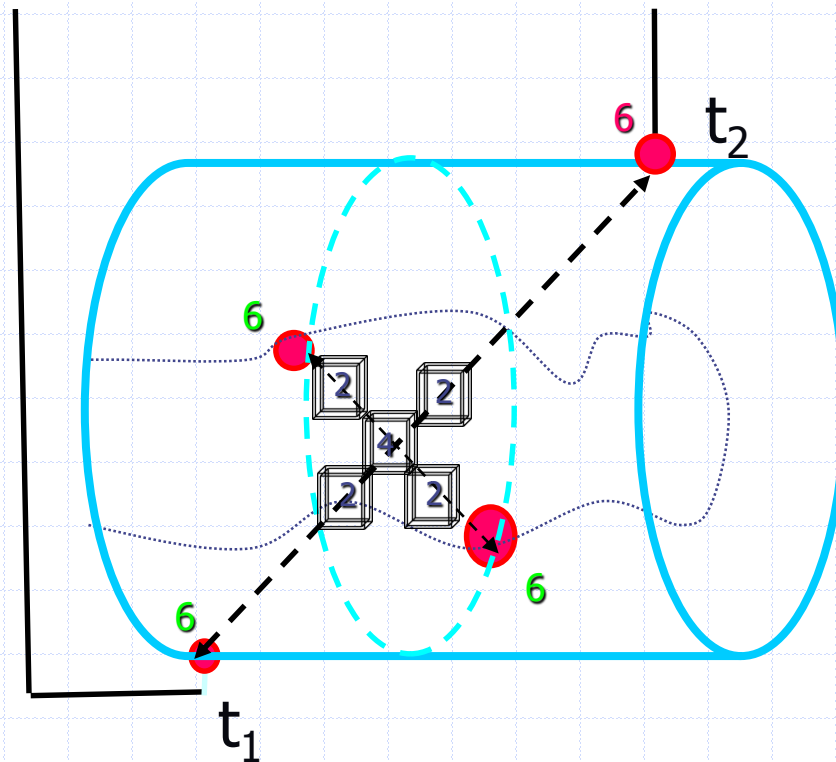
$$|t_1 - t_2| = |L_1 - L_2| / c < 5 \text{ ns}$$



Tomographie par émission de positons



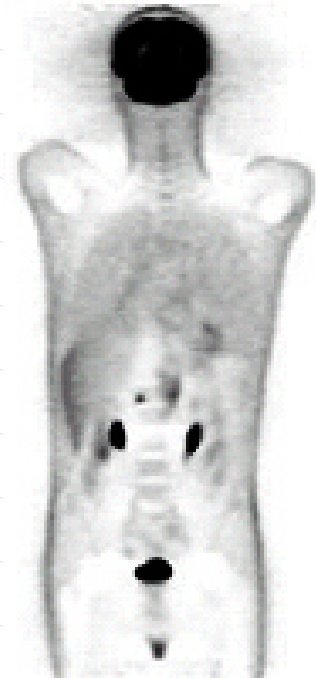
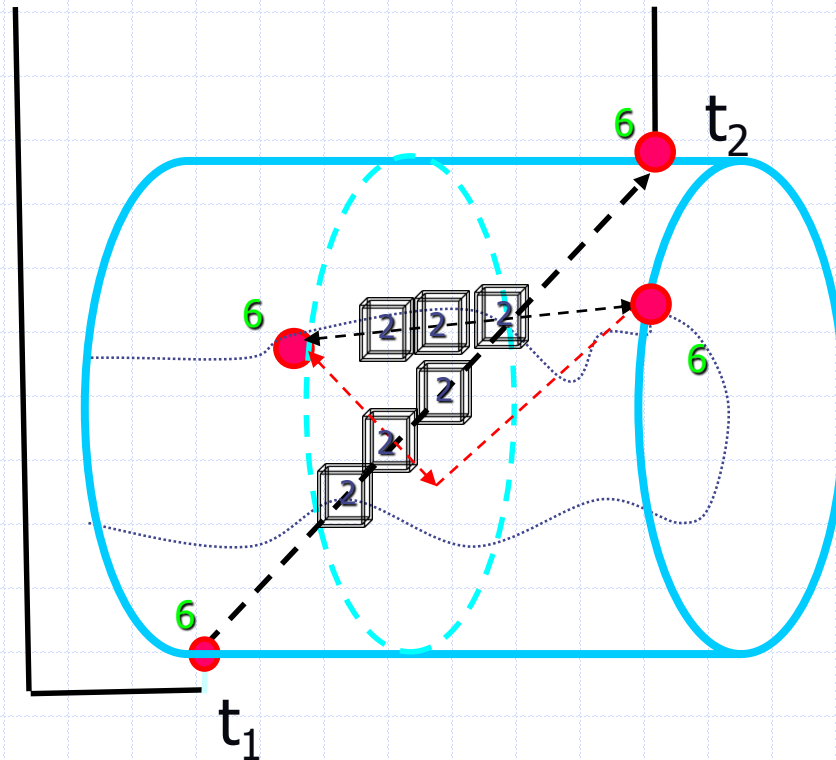
$$|t_1 - t_2| = |L_1 - L_2| / c < 5 \text{ ns}$$



Tomographie par émission de positons

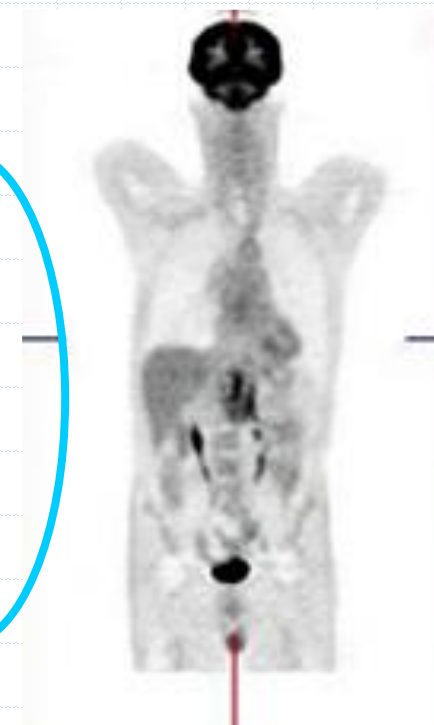
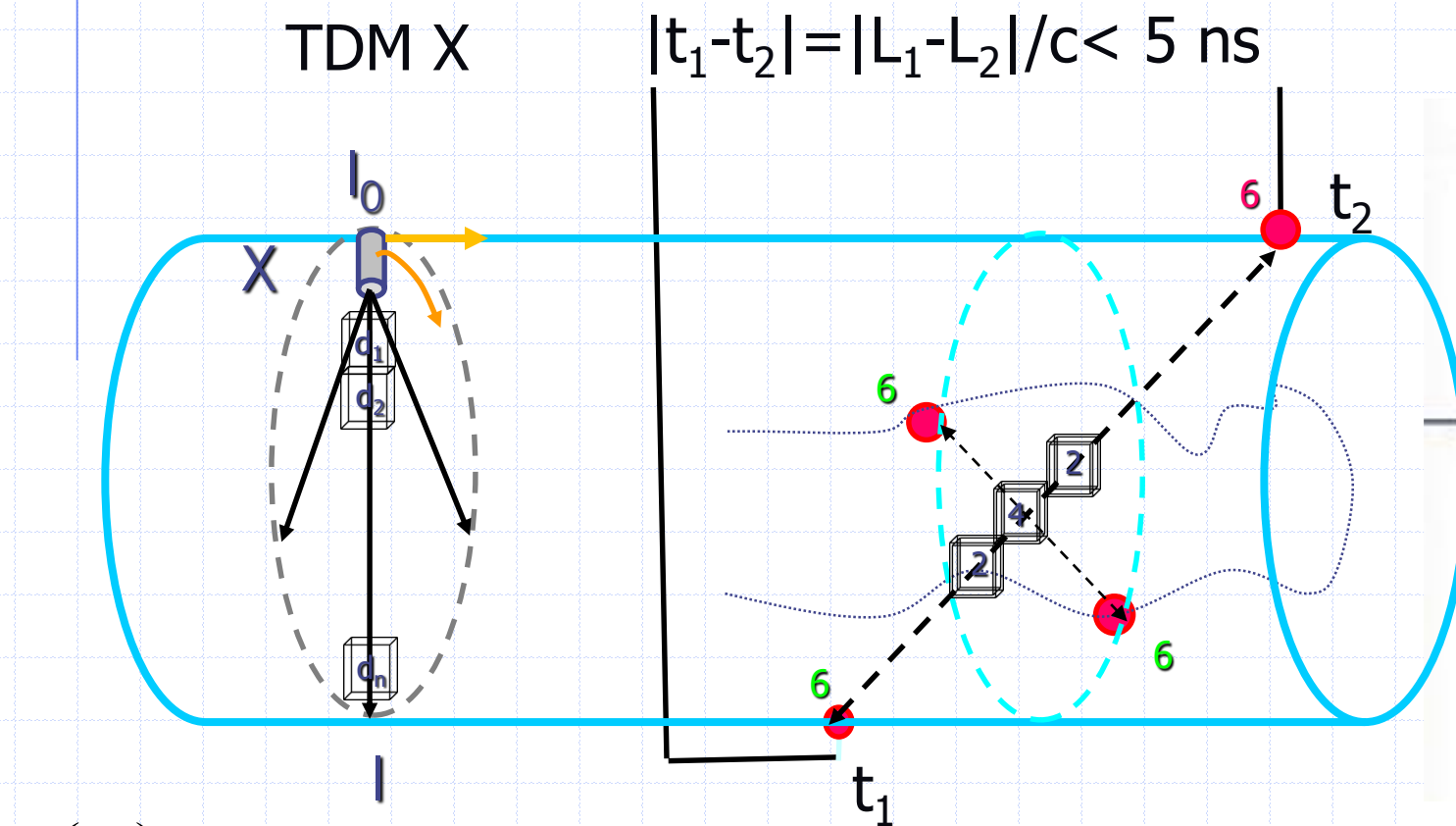


$$|t_1 - t_2| = |L_1 - L_2| / c < 5 \text{ ns}$$



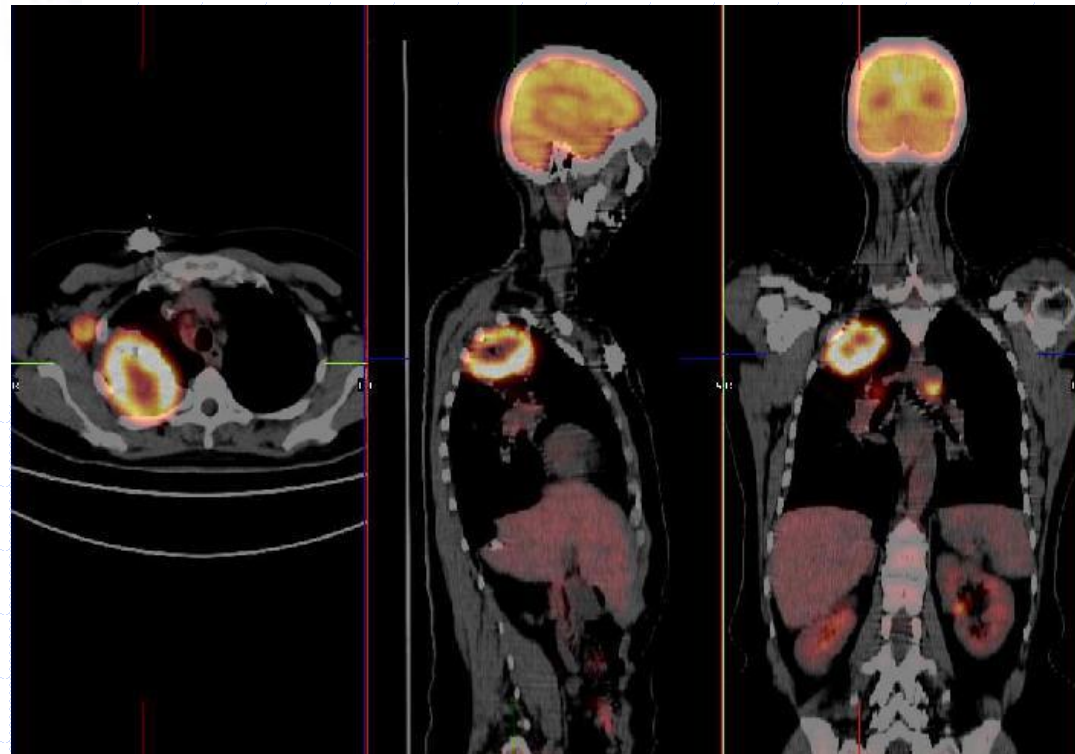
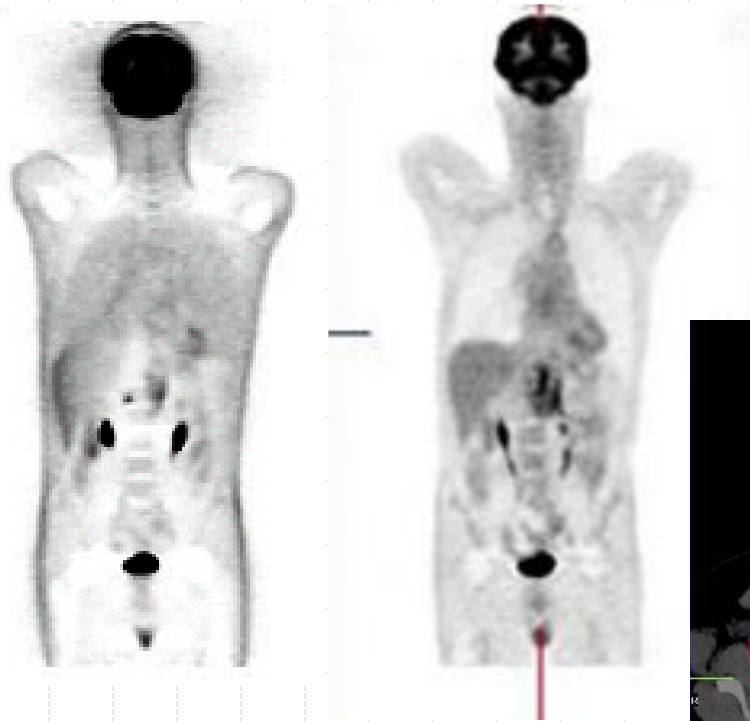
La probabilité de ces diffusions dépend de la densité des tissus traversés

Tomographie par émission de positons



$$\ln\left(\frac{I}{I_0}\right) = k \cdot (d_1 + d_2 + \dots + d_n)$$

Tomographie par émission de positons



Les étapes d'un examen



Préparation de
la seringue

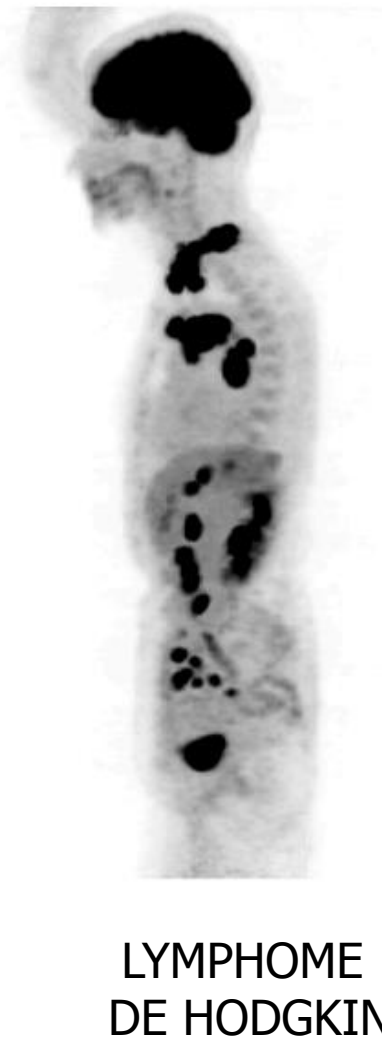
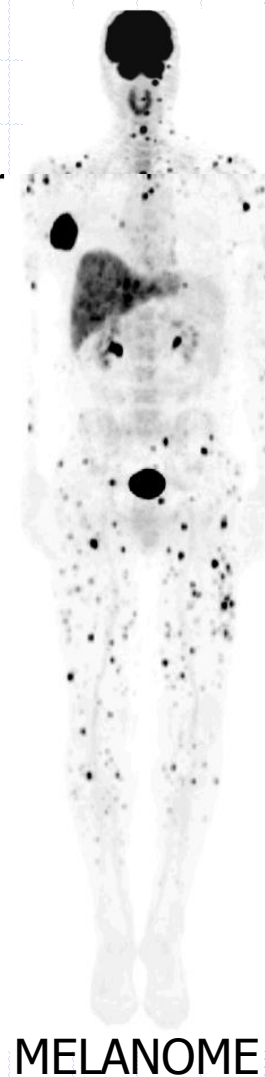
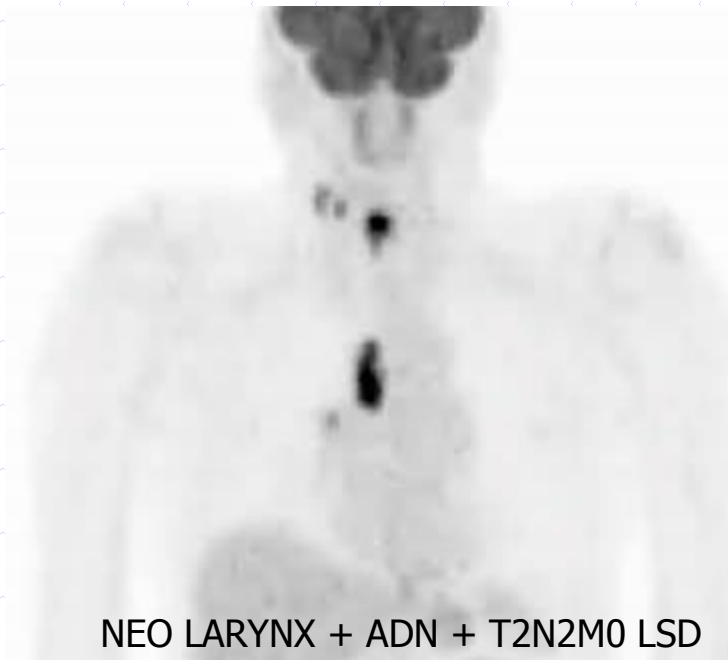


Injection IV
Attente 30-60'

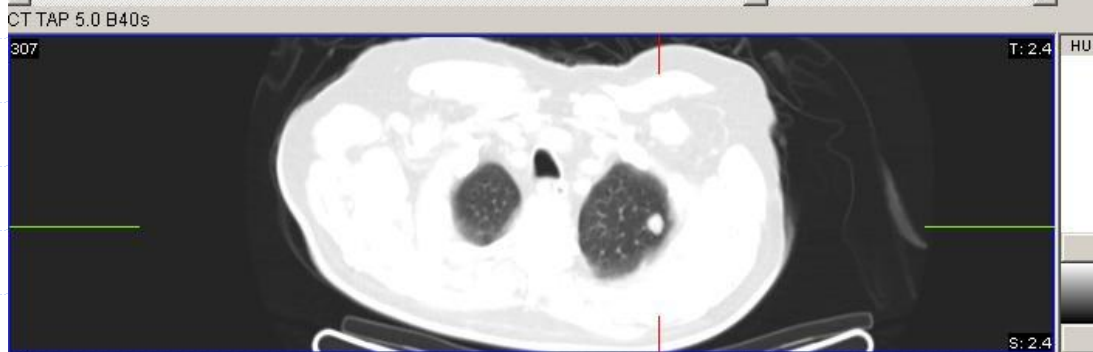
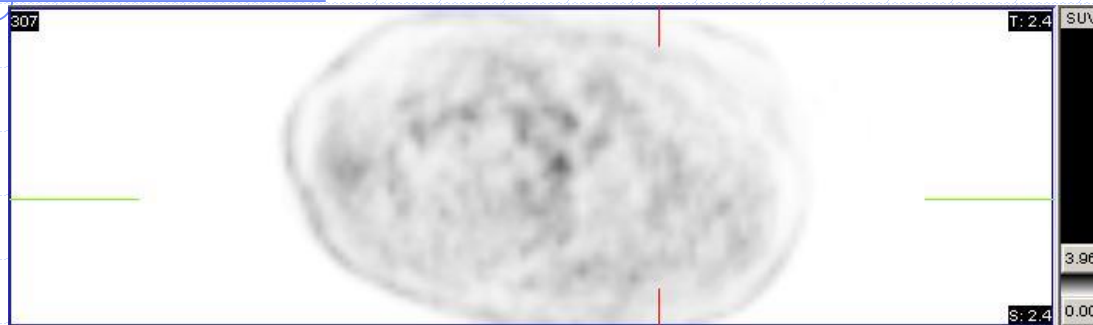


Acquisition
10-15'

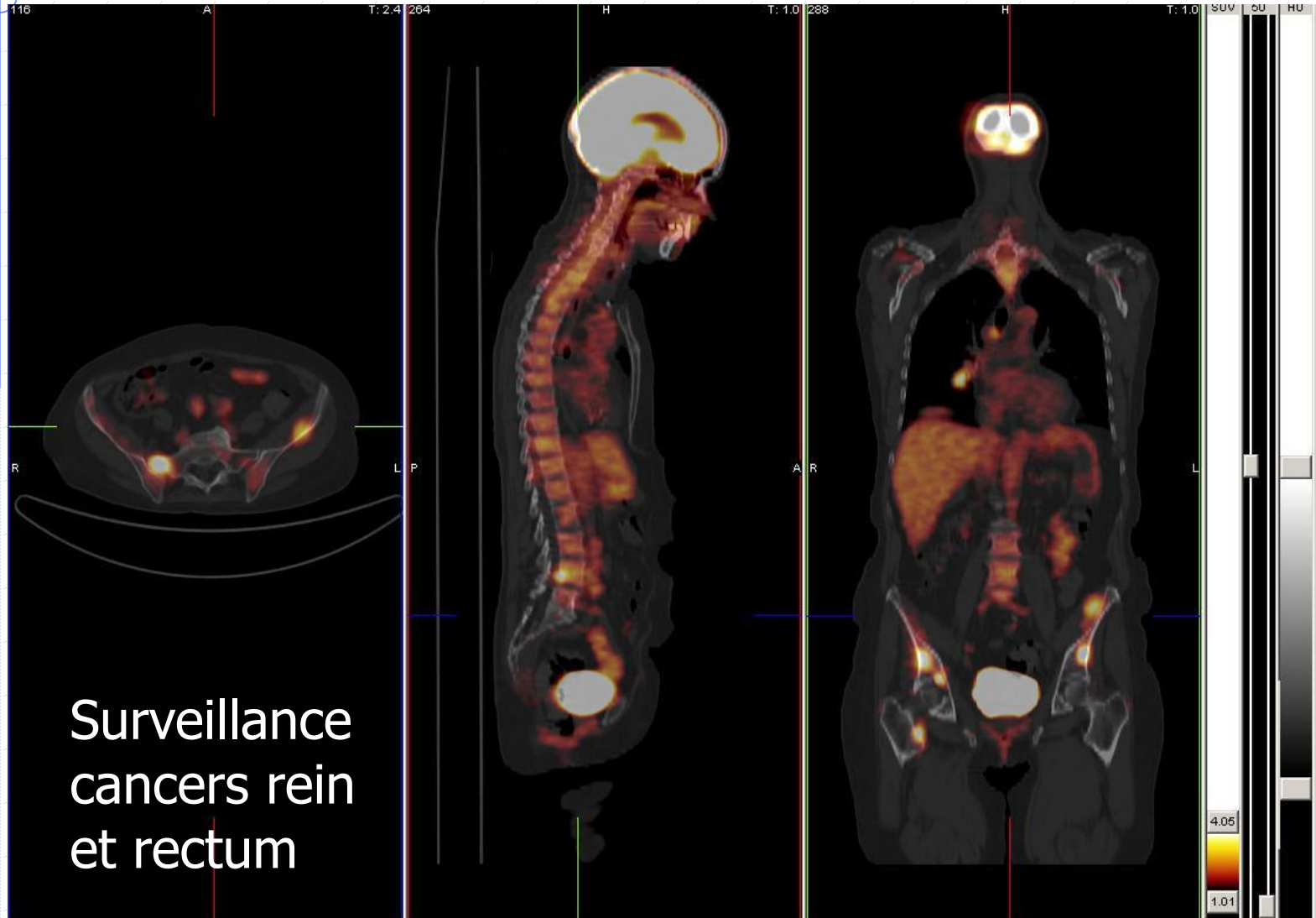
Diagnostic de cancers (^{18}F -DG)



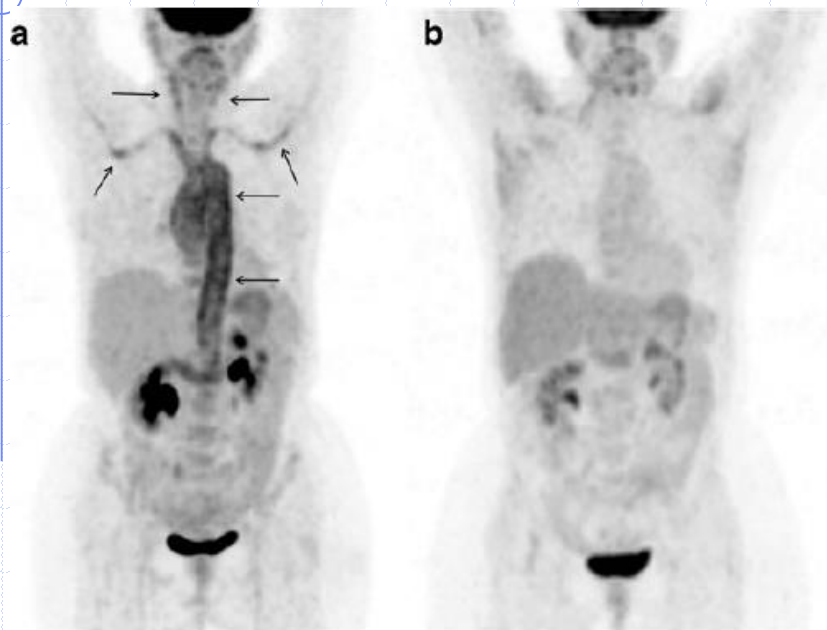
Diagnostic de cancers (^{18}F -DG)



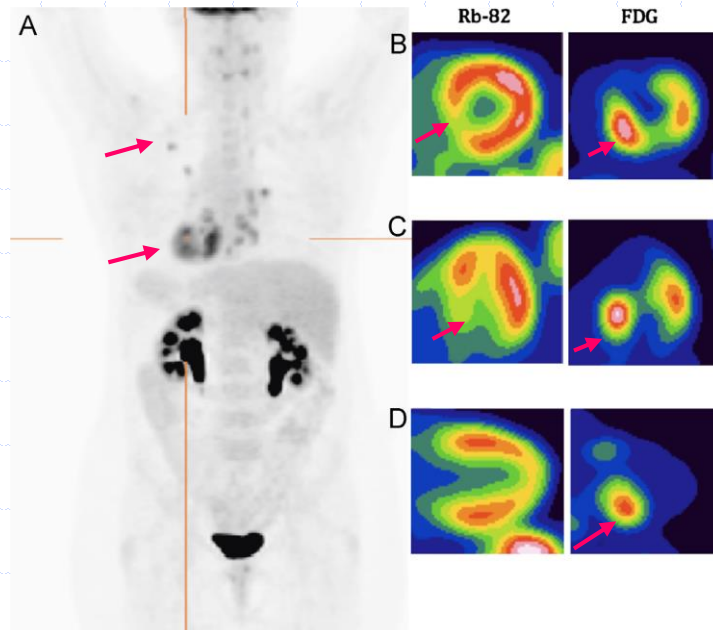
Surveillance de cancers (^{18}F -DG)



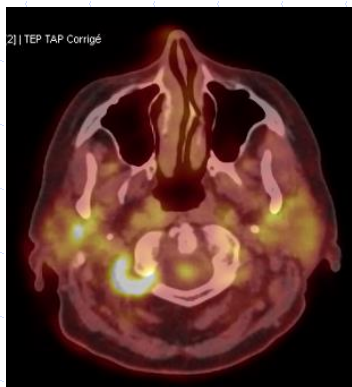
^{18}F -DG hors cancers



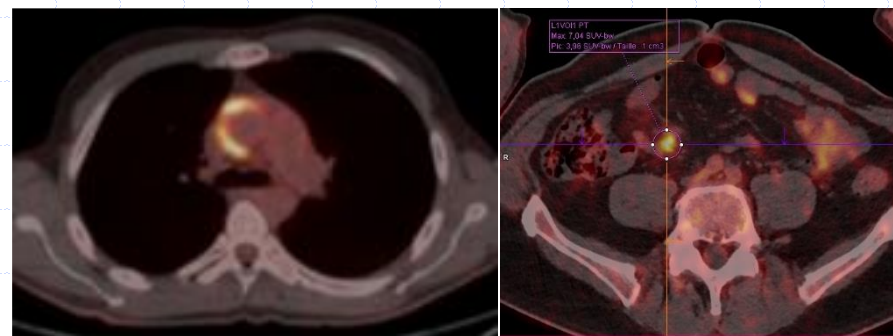
Maladie de Horton



Sarcoïdose



Fièvre



Diagnostic de cancers



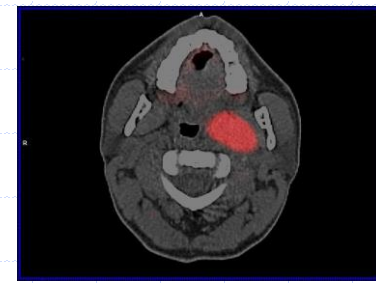
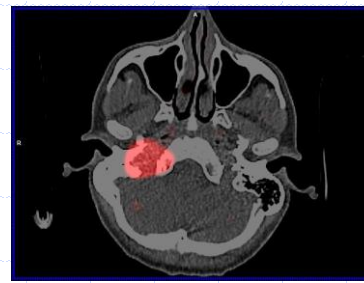
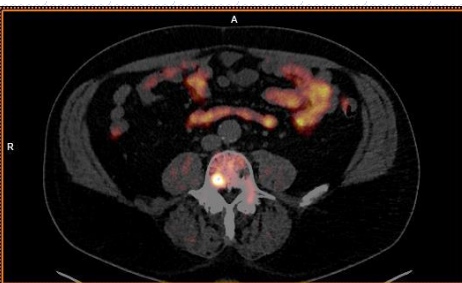
18F-CHOLINE



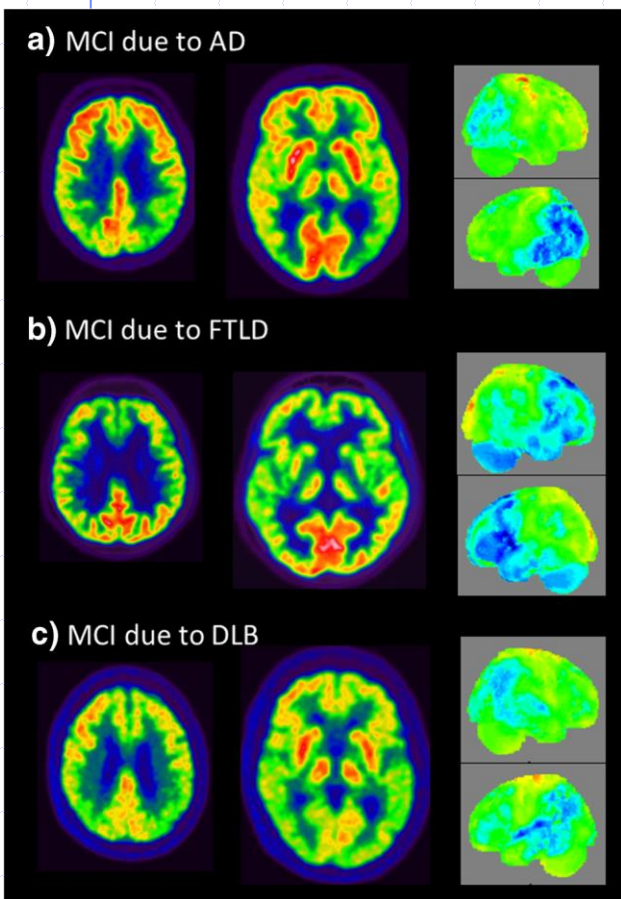
18F-FDOPA

18F-CHOLINE: AA traceur de division cellulaire (Mb)
Récidives de cancers de prostate, foie,...

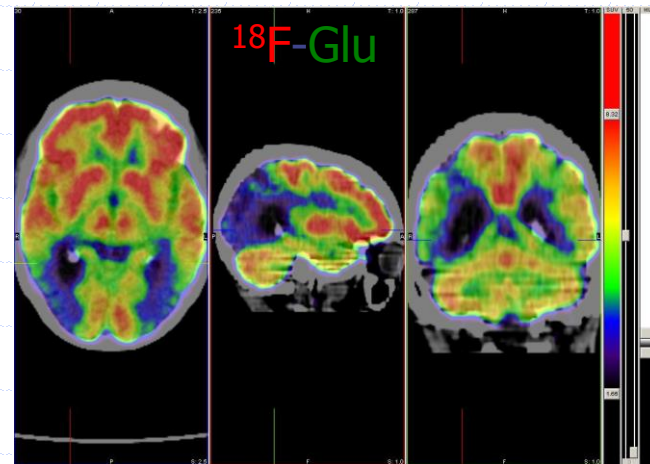
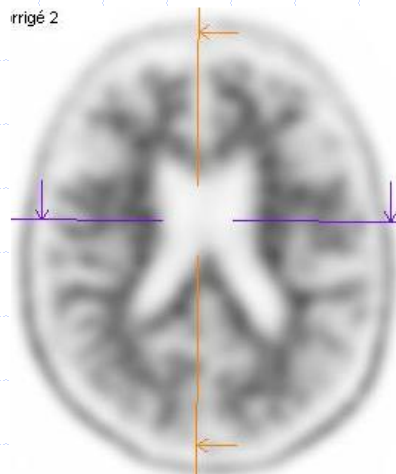
18F-DOPA : AA traçant le métabolisme de la DOPA
Paragangliomes, phéochromocytomes



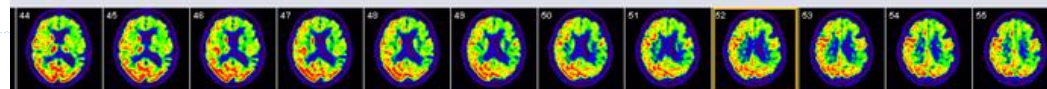
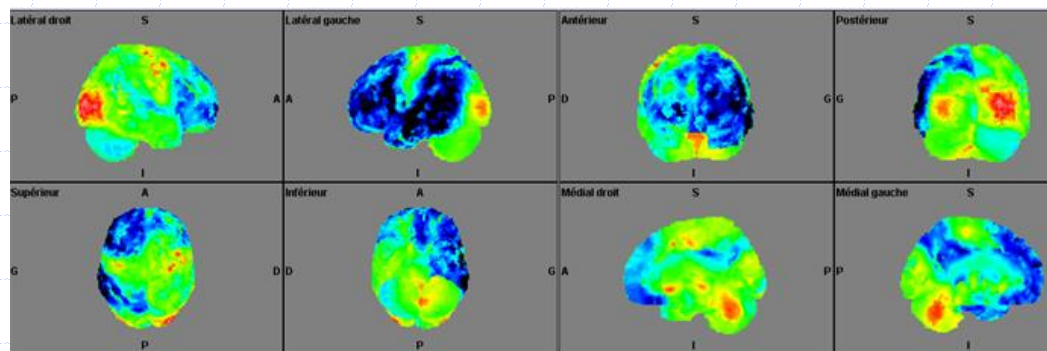
Scintigraphies cérébrales



rigé 2



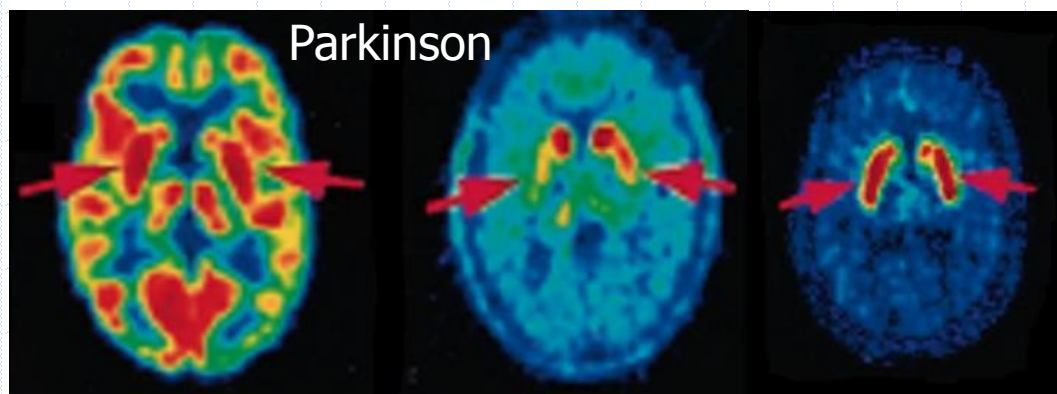
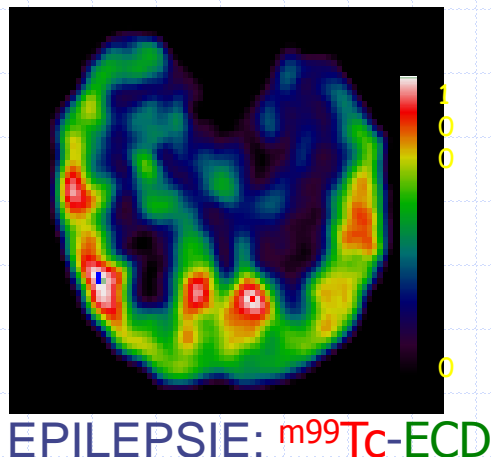
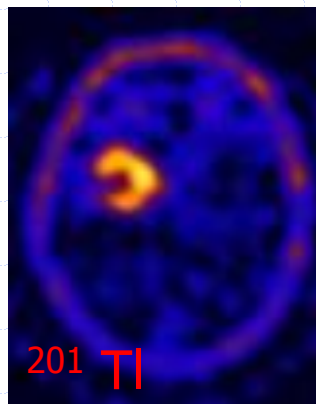
TEP amyloïde normal Paralyse psychique du regard



DEMENCES ^{18}F -Glu

Aphasie primaire progressive ^{18}F -Glu

Scintigraphies cérébrales



^{18}F -DG

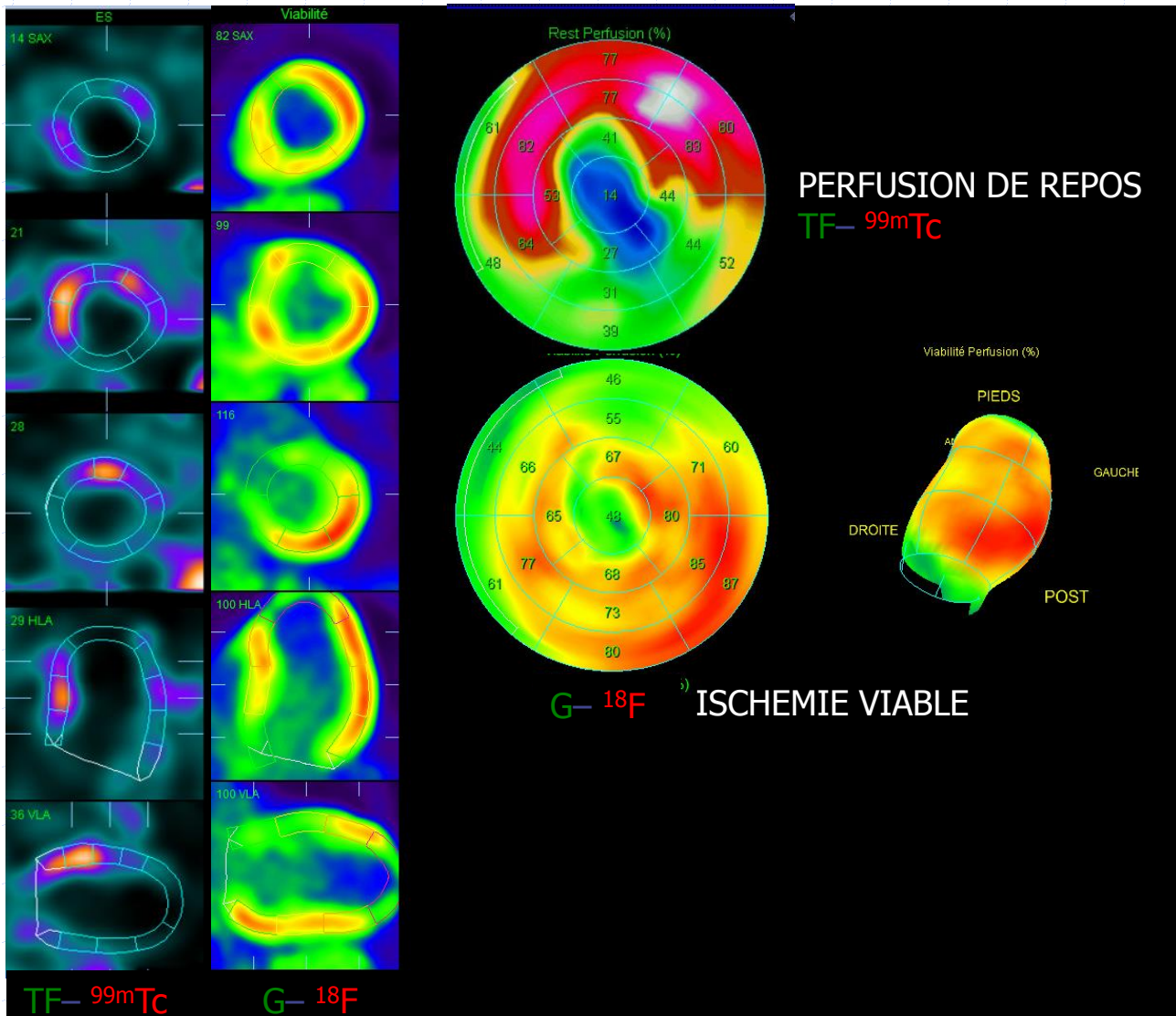
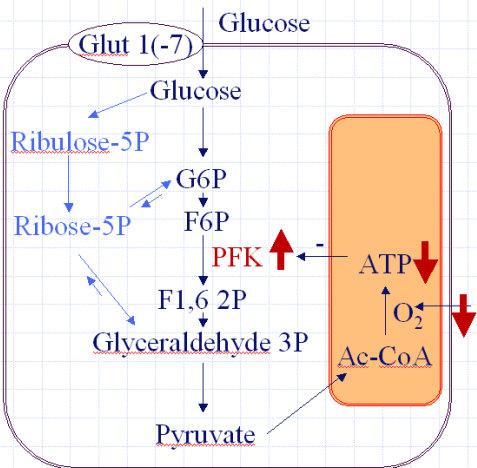
^{18}F -DOPA

Atteinte des Récep.
présynaptiques

^{18}F -Ethyl Spiperone

RD2 normaux

Viabilité myocardique (^{18}F -DG)



DOSIMETRIE

Quelques références :

Irradiation naturelle moyenne :
2,5 mSv / an

France : 1-6 mSv

Ramsar (Iran) : 250 mSv/an

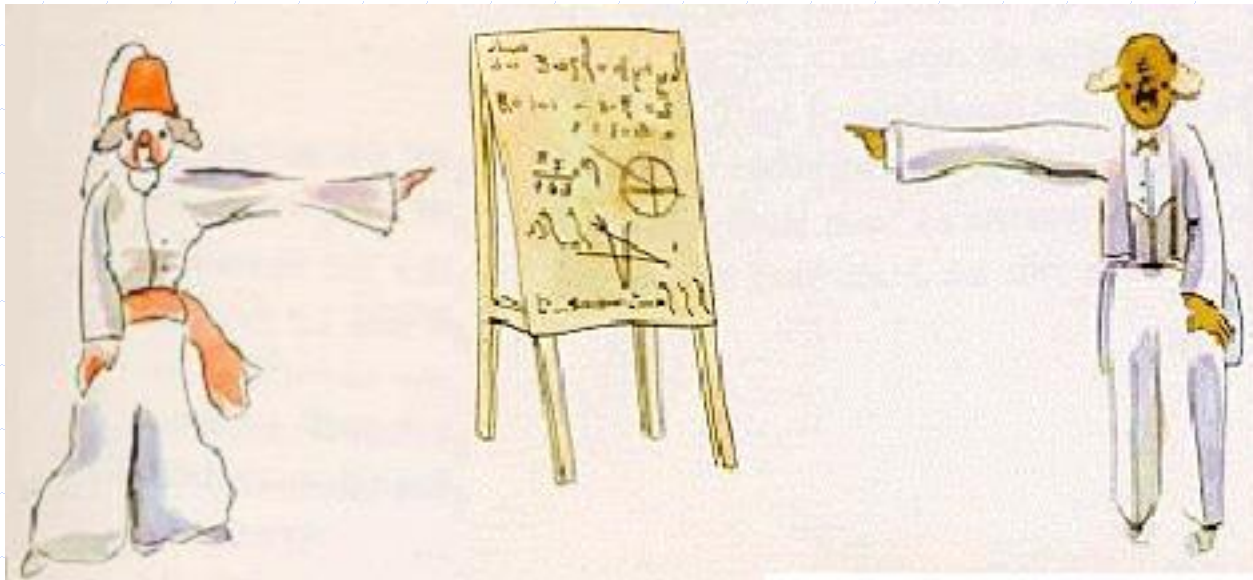
Vol Paris-New-York : 0,05 mSv

Au niveau mondial :

202 10^3 homme.Sv pour 33 . 10^6 scintigraphies (5 %)

4000 10^3 homme.Sv pour 3600 . 10^6 radiographies (95 %)

Procédé	Dose efficace (mSv)
<i>Rayons X: 0,01 – 10 mSv</i>	
Membres et articulations (sauf hanche)	<0,01
Thorax (vue PA simple)	0,02
Crâne	0,07
Rachis dorsal	0,7
Rachis lombaire	1,3
Hanche	0,3
Bassin	0,7
Abdomen	1,0
UIV	2,5
Déglutition barytée	1,5
TOGD (transit oeso- gastro-duodénal)	3
Transit du grêle	3
Lavement baryté	7
TDM crânienne	2,3
TDM thoracique	8
TDM abdominale ou pelvienne	10
TDM TAP non diagnostique	7
<i>Scintigraphie:</i>	0,3 – 20 mSv
Ventilation pulmonaire (Xe-133)	0,3
Perfusion pulmonaire (Tc-99m)	1
Rein (Tc-99m)	1
Thyroïde (Tc-99m)	1
Os (Tc-99m)	4
Exploration dynamique cardiaque (Tc-99m), MIBG	6
TEP pour crâne (18F-FDG)	5
OCTREOSCAN	12
Thallium, rubidium	20



Merci pour votre attention...