Medical imaging - Gamma Camera

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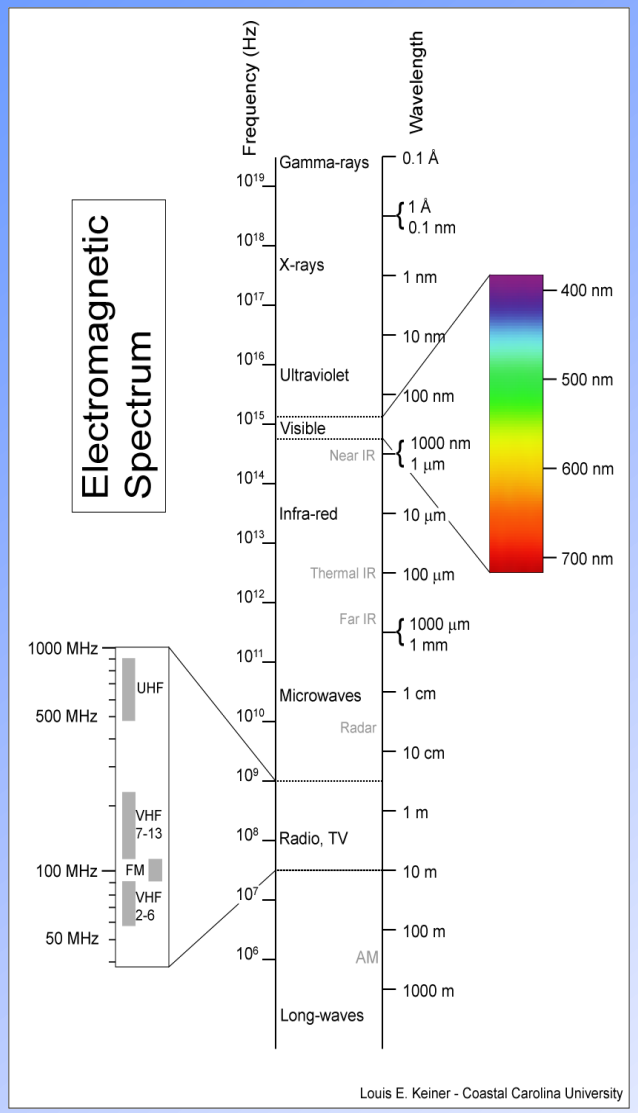
HIL July 2013

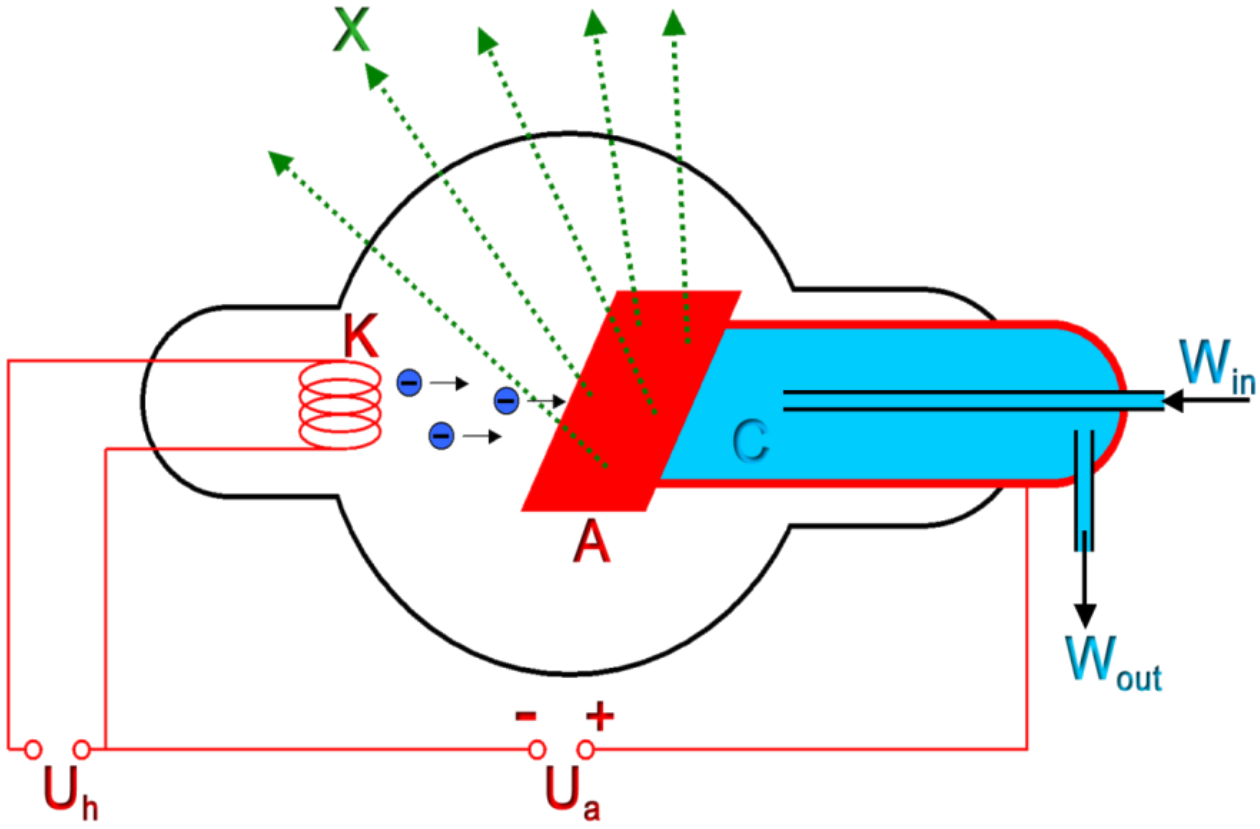
X rays



Energy region:
radiation of energy E>400eV (λ<3nm).

Two energy regions:
- 400eV<E<10keV - **soft X rays.**
- E>10keV **hard X rays.**

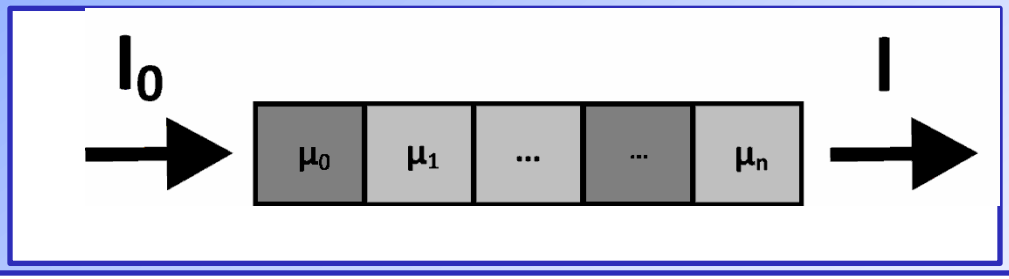
X – rays (Bremsstahlung).



Attenuation of X rays

$$I = I_0 e^{-\mu x}$$

When different attenuation coefficients μ,

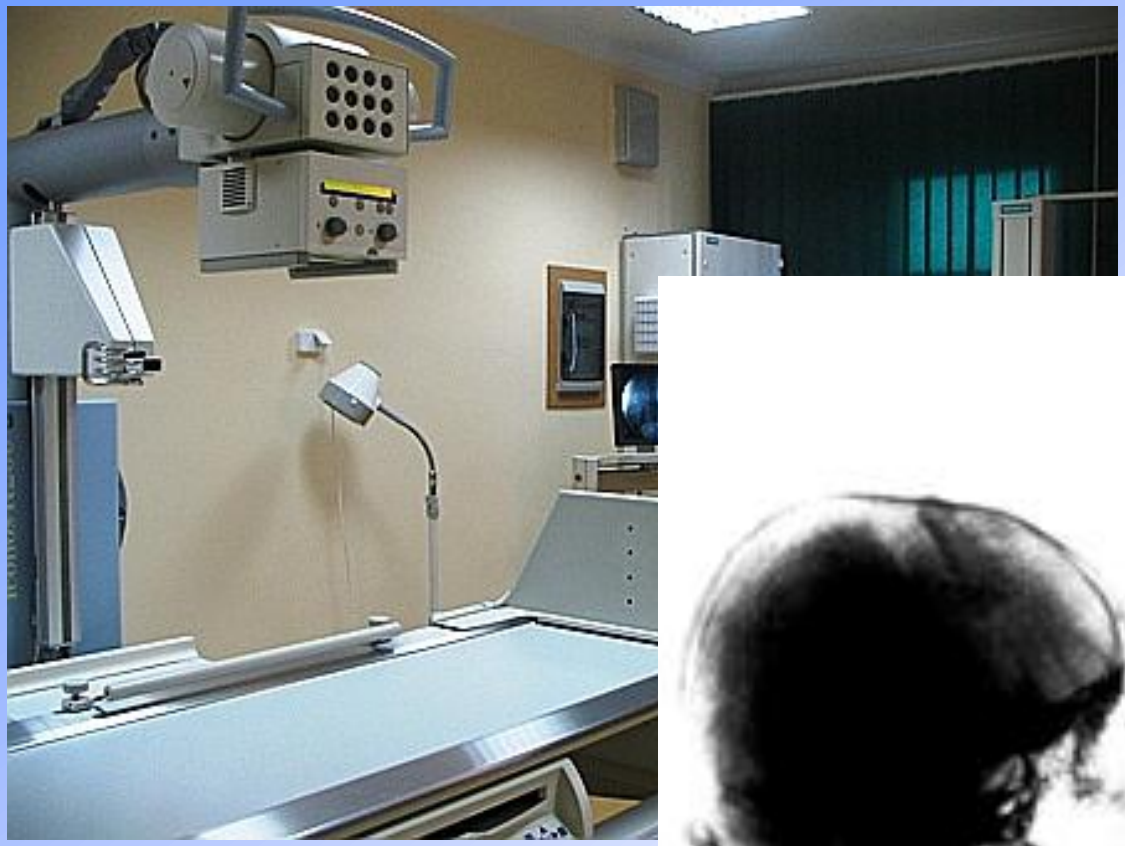


$$I = I_0 e^{-\mu_0 x} \cdot e^{-\mu_1 x} \cdot \ldots e^{-\mu_n x} = I_0 e^{-\sum_{i=1}^{n} \mu_0 x}$$

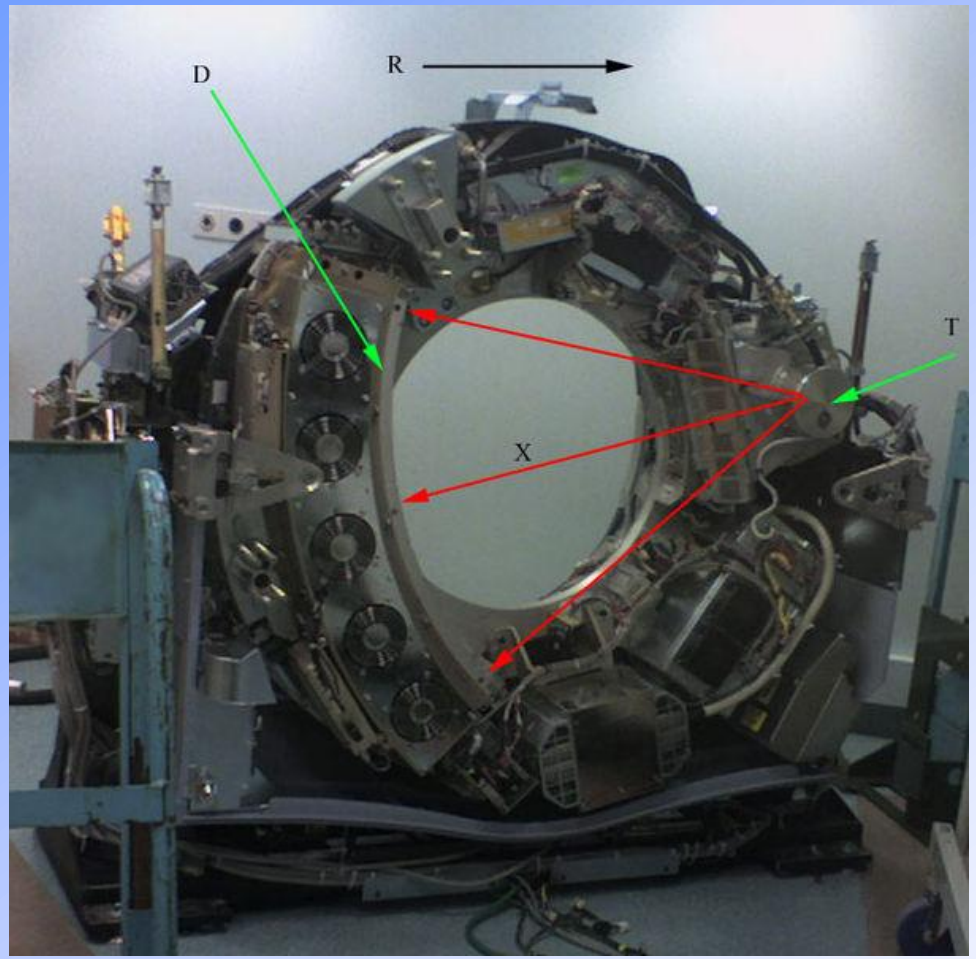
In the case of continuous changes of attenuation

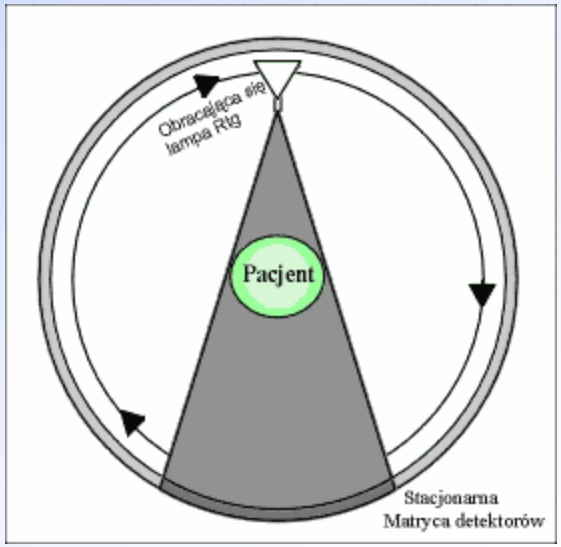
$$I = I_0 e^{-\int \mu(x) dx}$$

Planar radiography – RTG

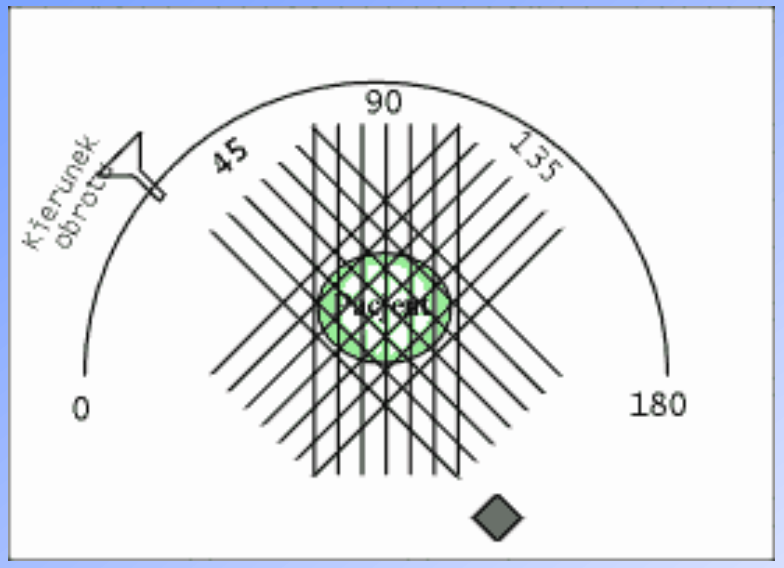


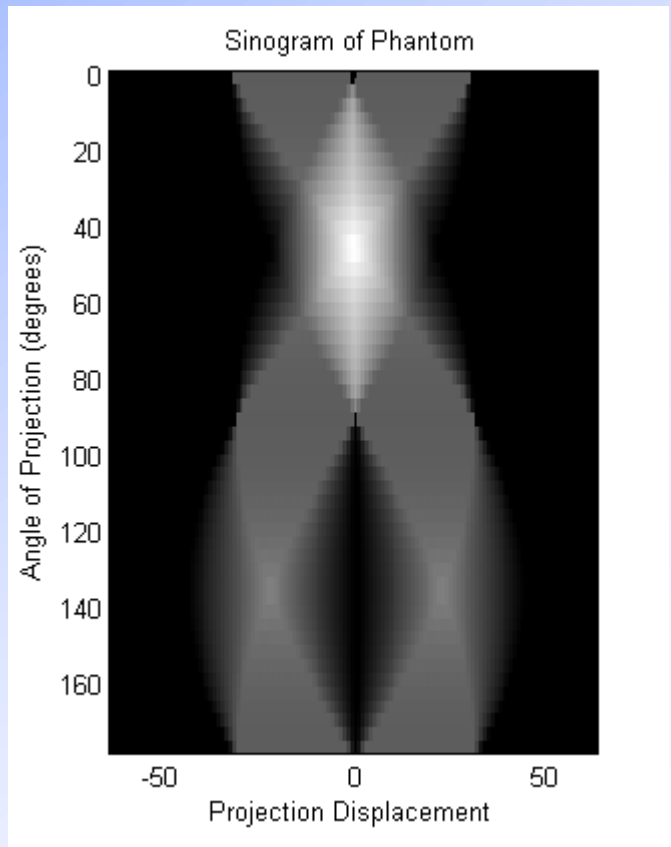
Pronciples of CT





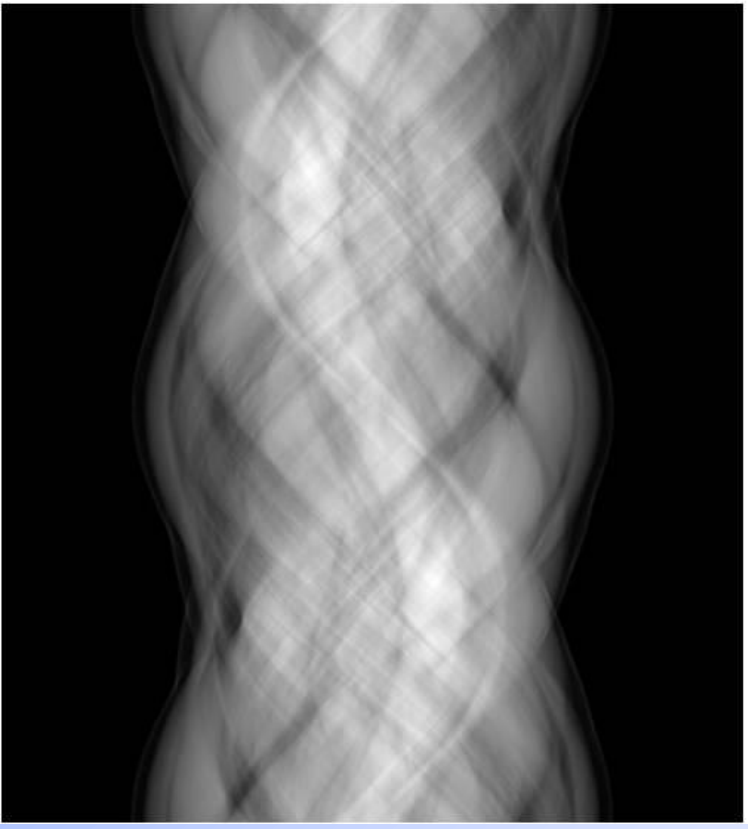
What we get from scan?





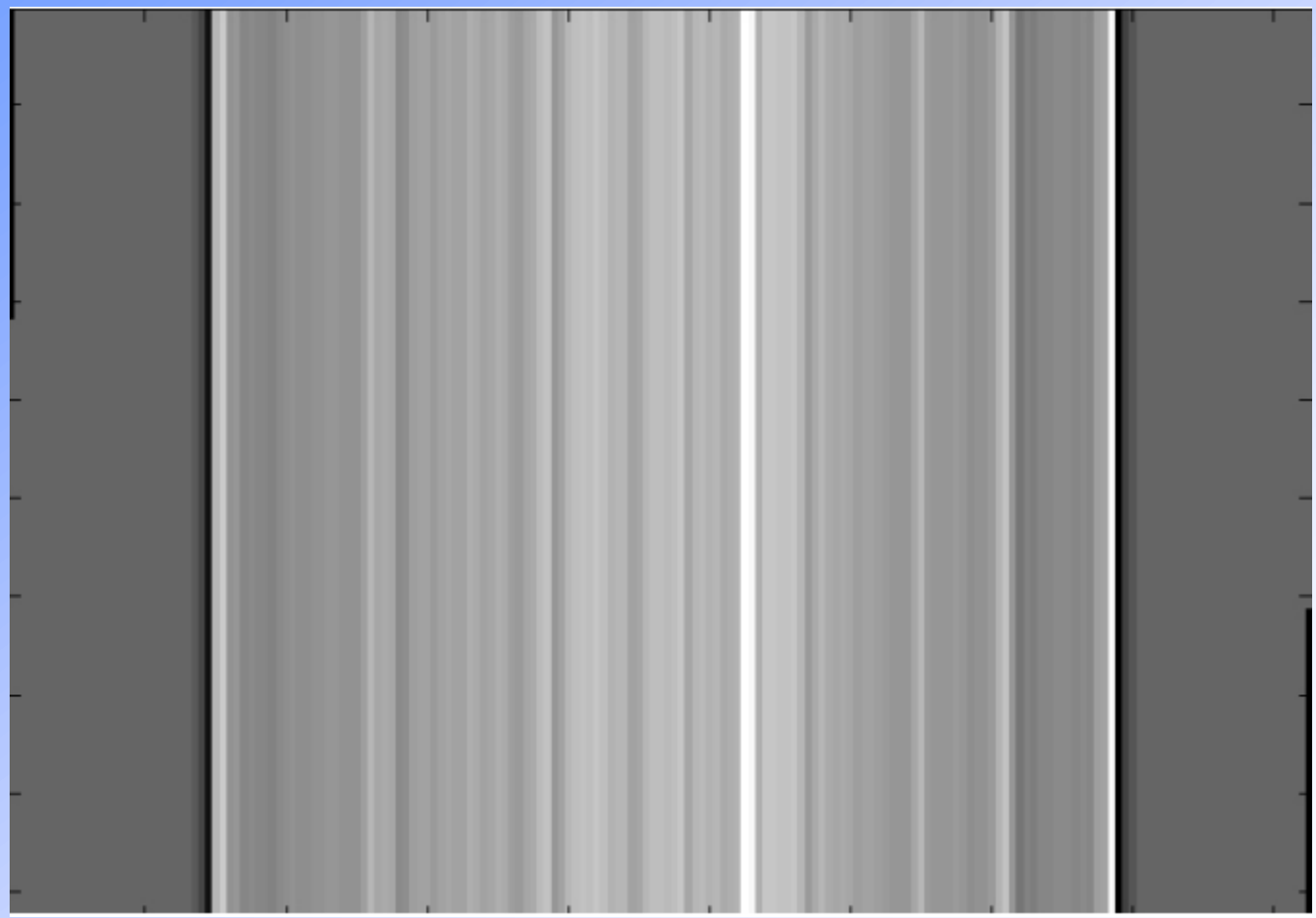
Reconstruction

Sinogram

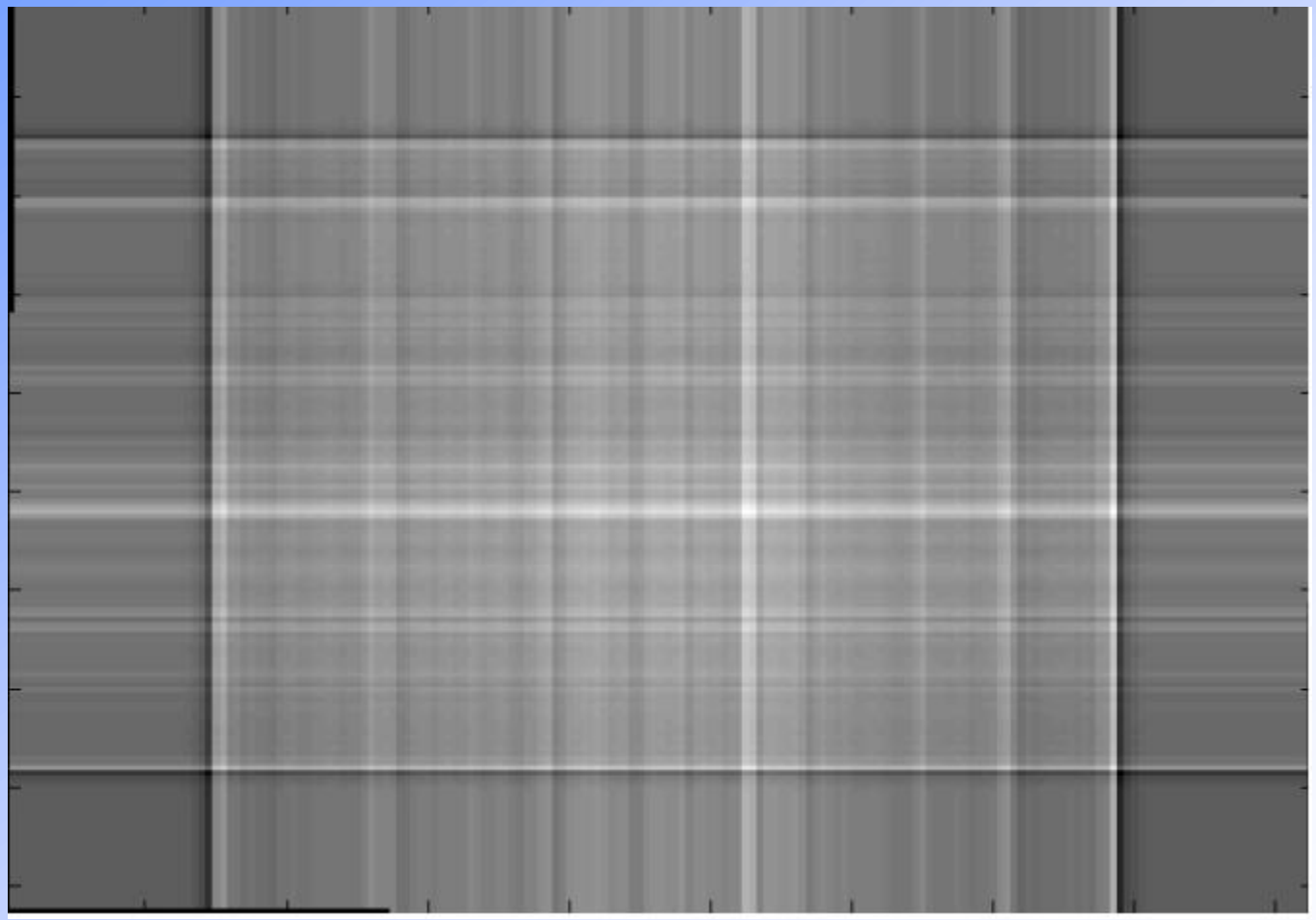


Reconstruct

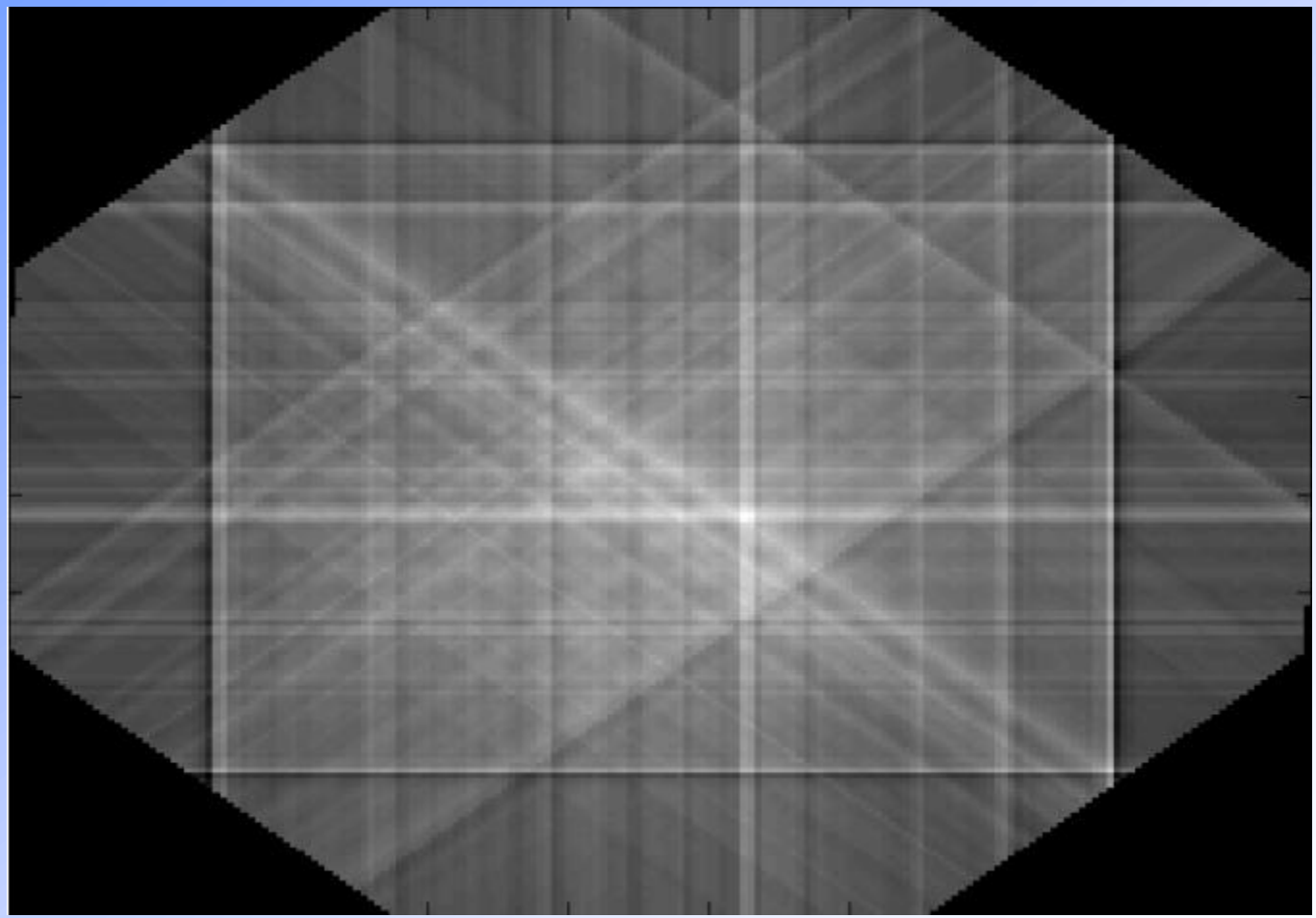
reconstruction 1 angle



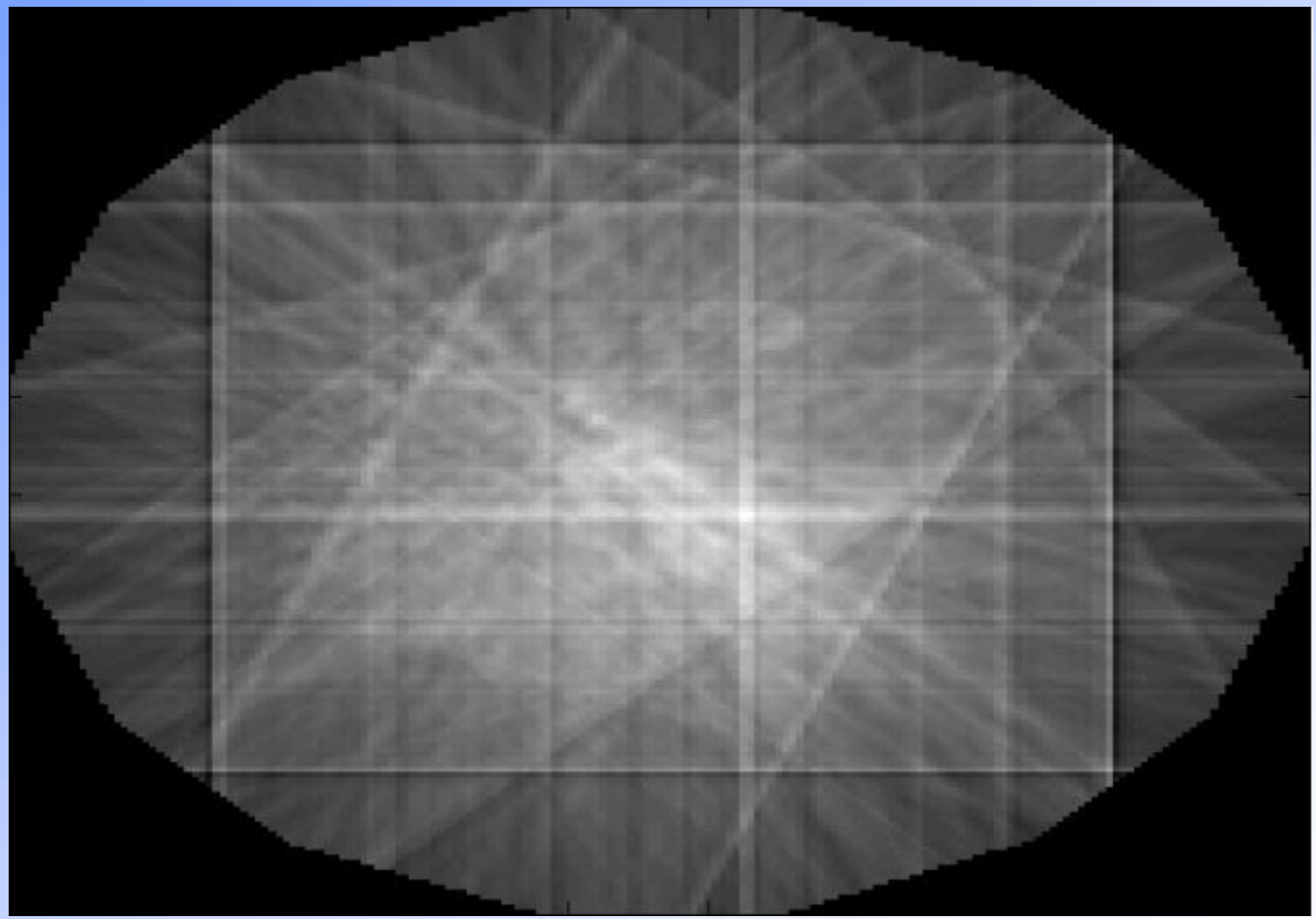
reconstruction 2 angles



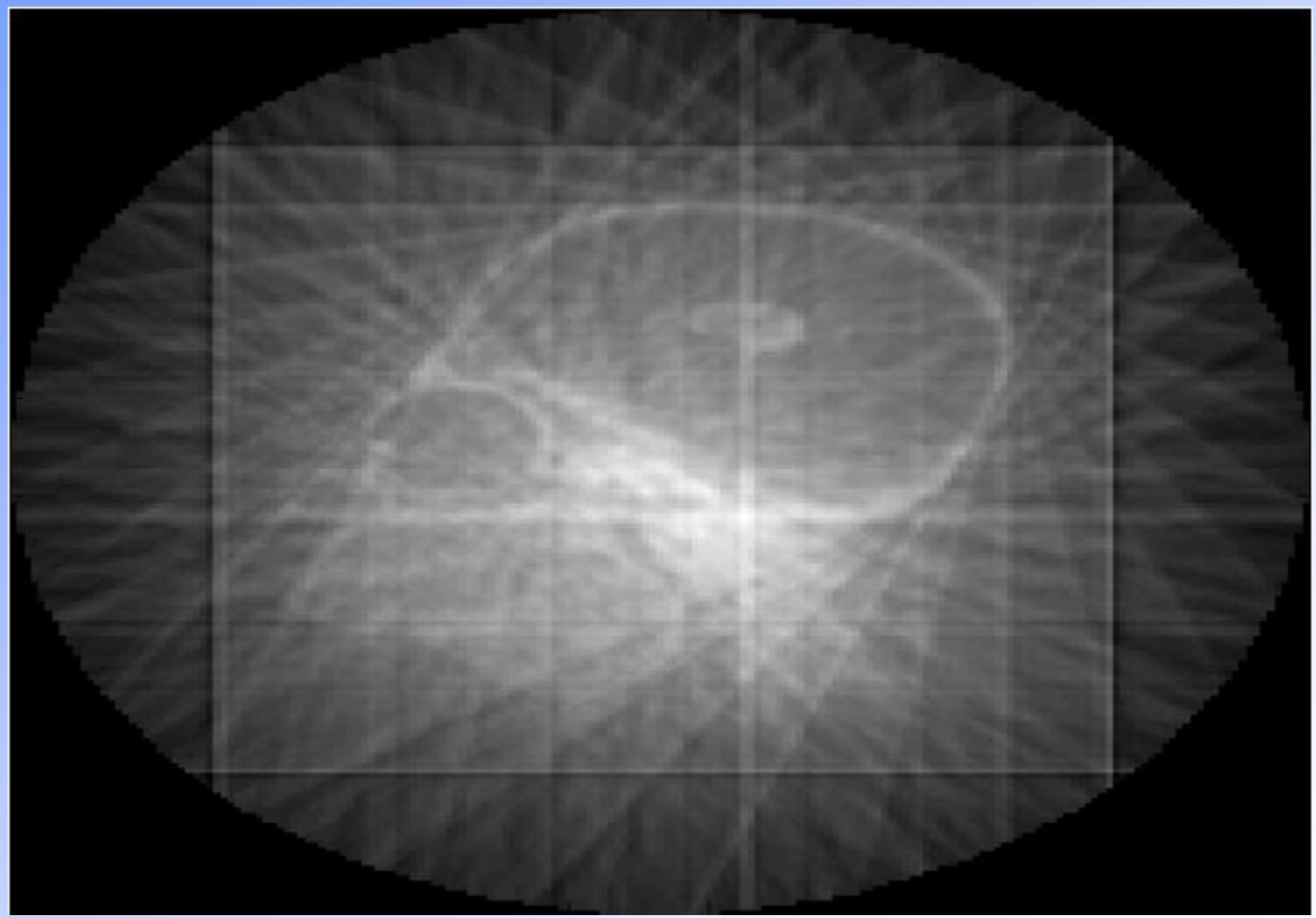
reconstruction 4 angles



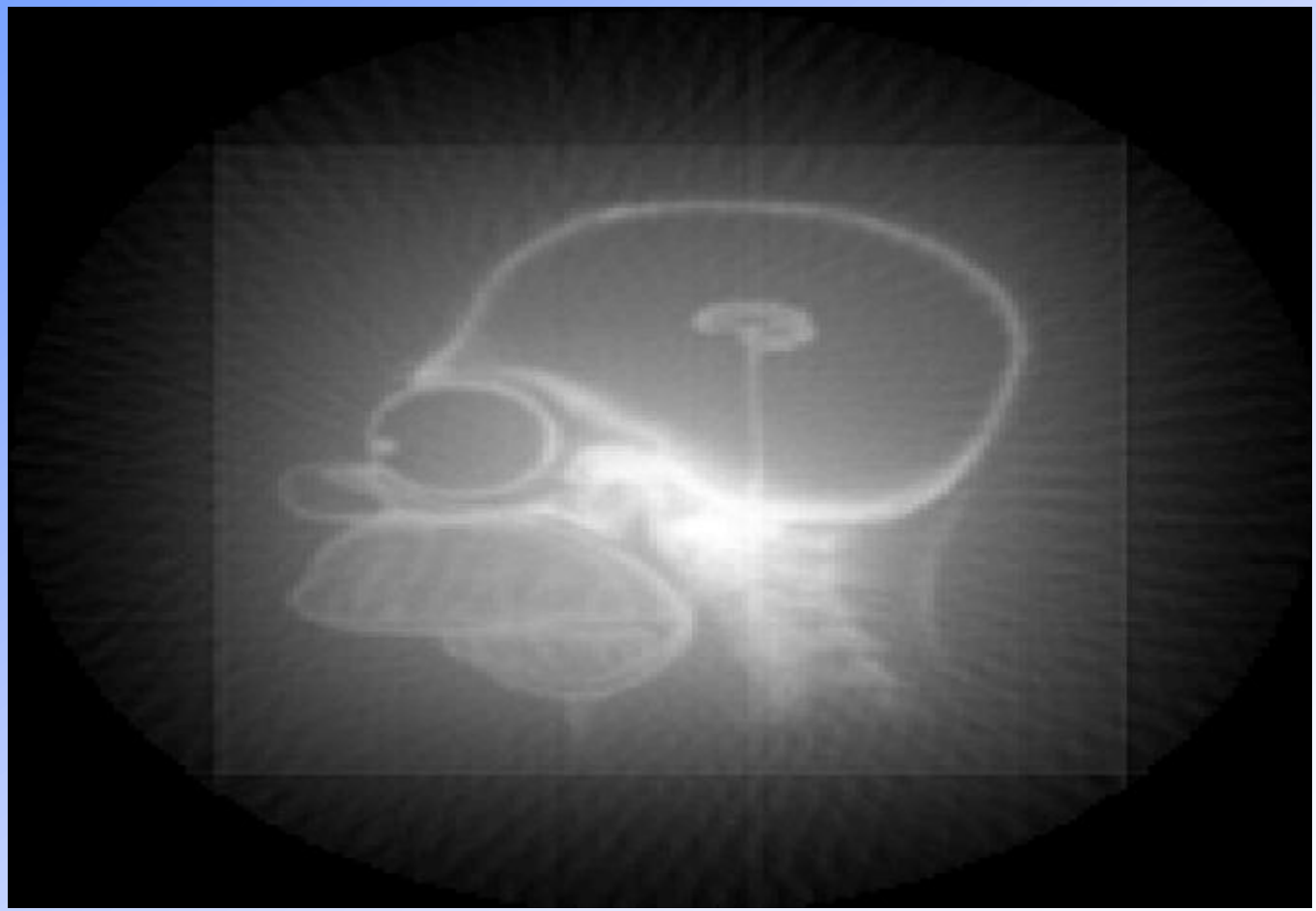
reconstruction 8 angles



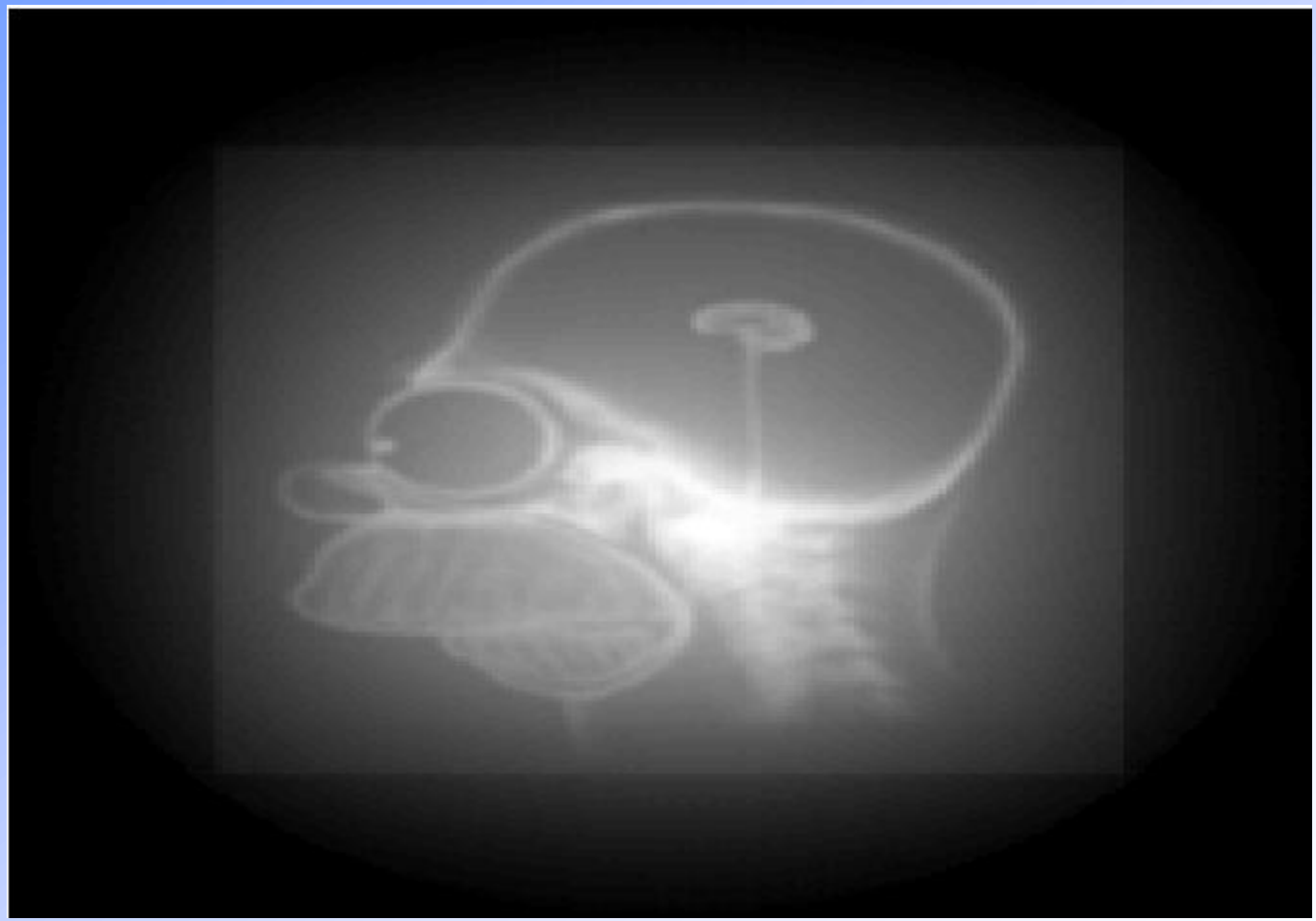
reconstruction 16 angles



reconstruction 60 angles



reconstruction 180 angles



Imaging in Nuclear Medicine

Radionuclid, typical ^{99m}Tc

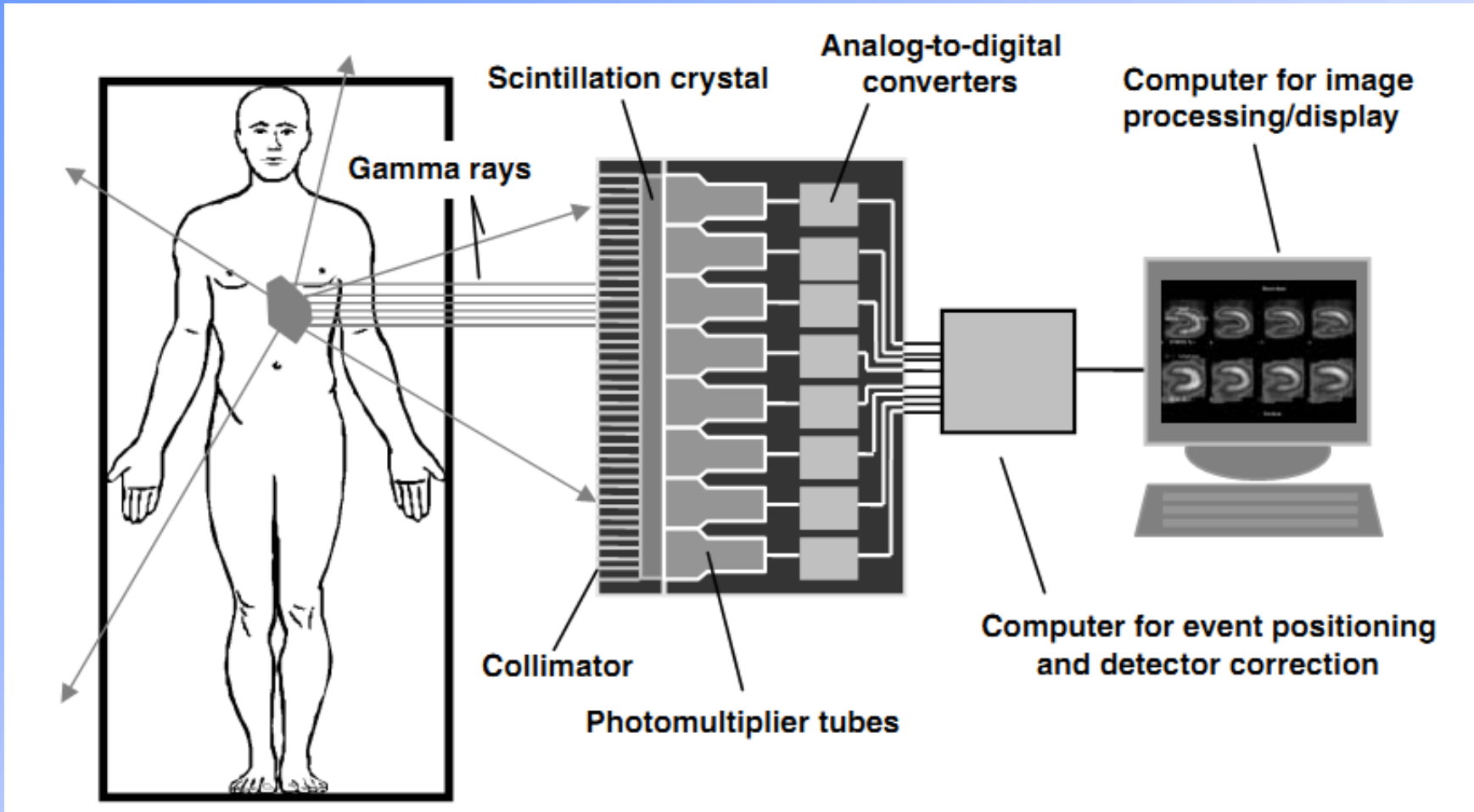
Substitution of radionuclid

Radiopharmaceutical

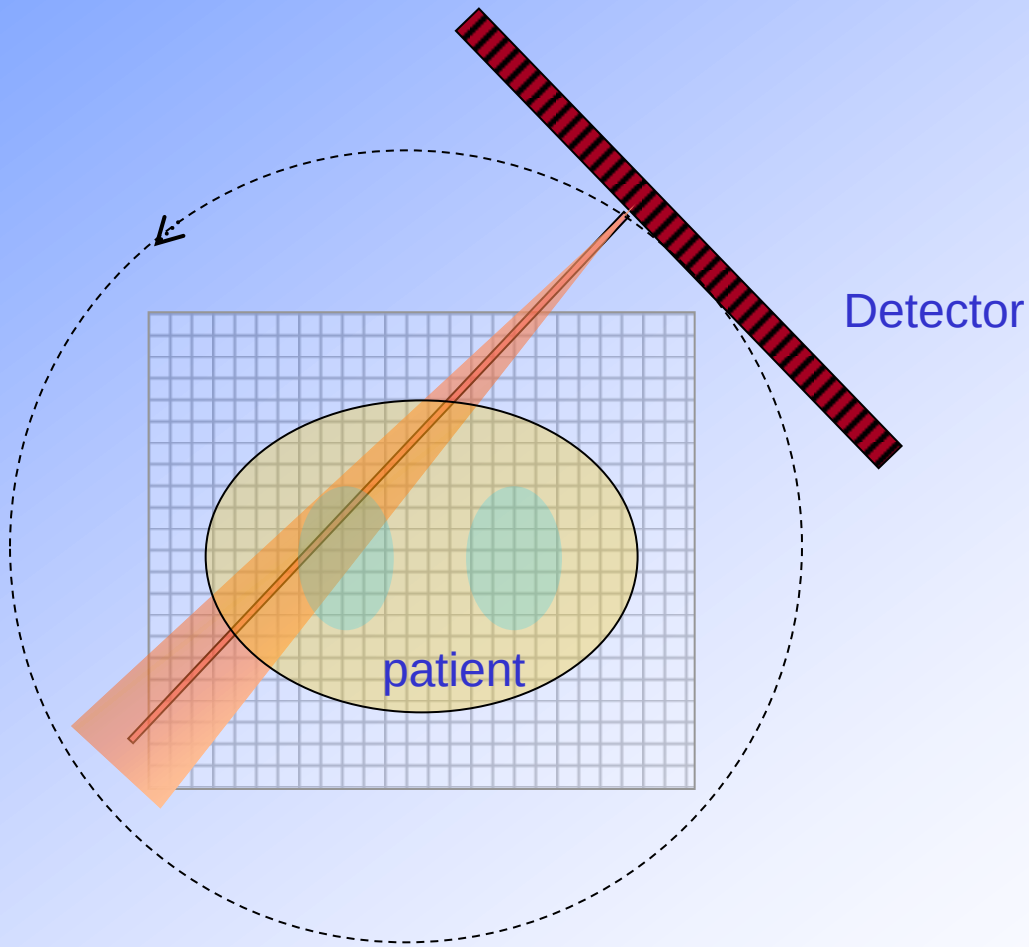
Gamma Camera

Our Gamma Camera

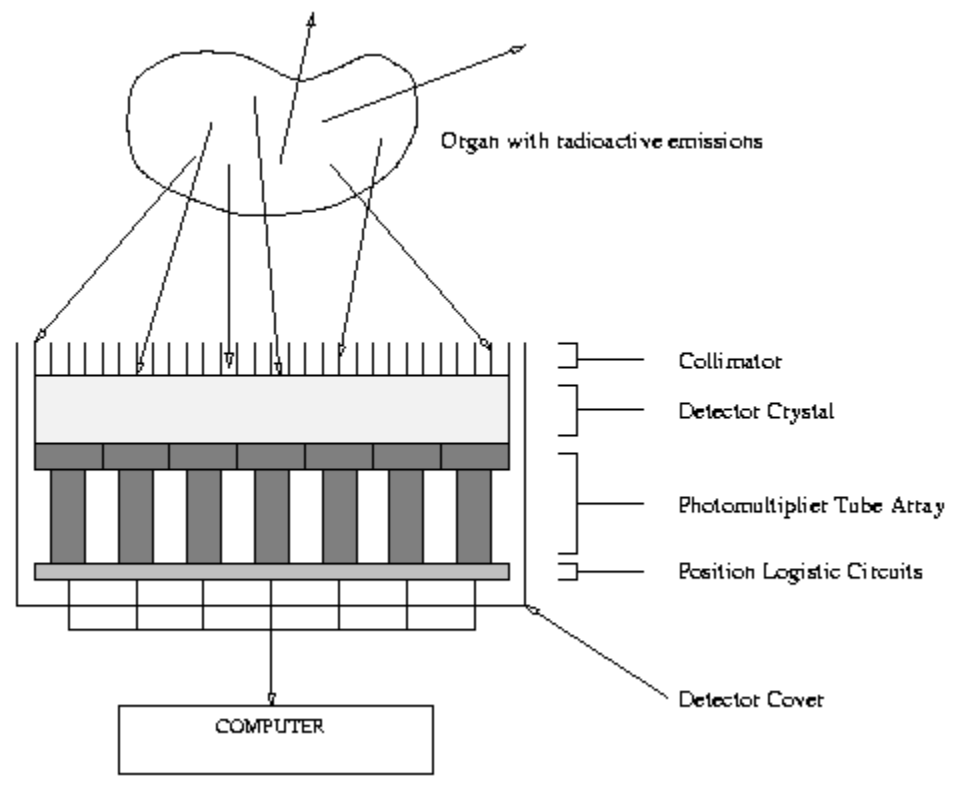
Gamma Camera



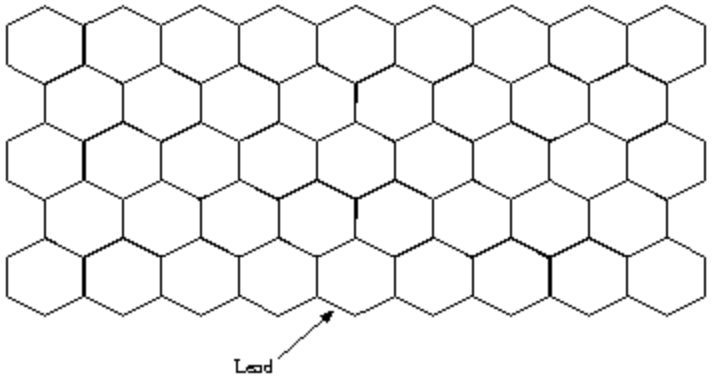
SPECT
(Single Photon Emission Computed Tomography)



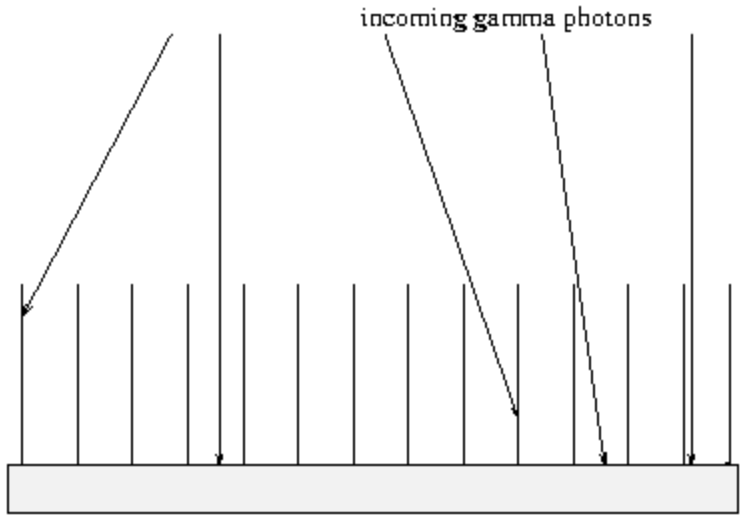
Role of collimator in Gamma Camera



View of collimator from above:

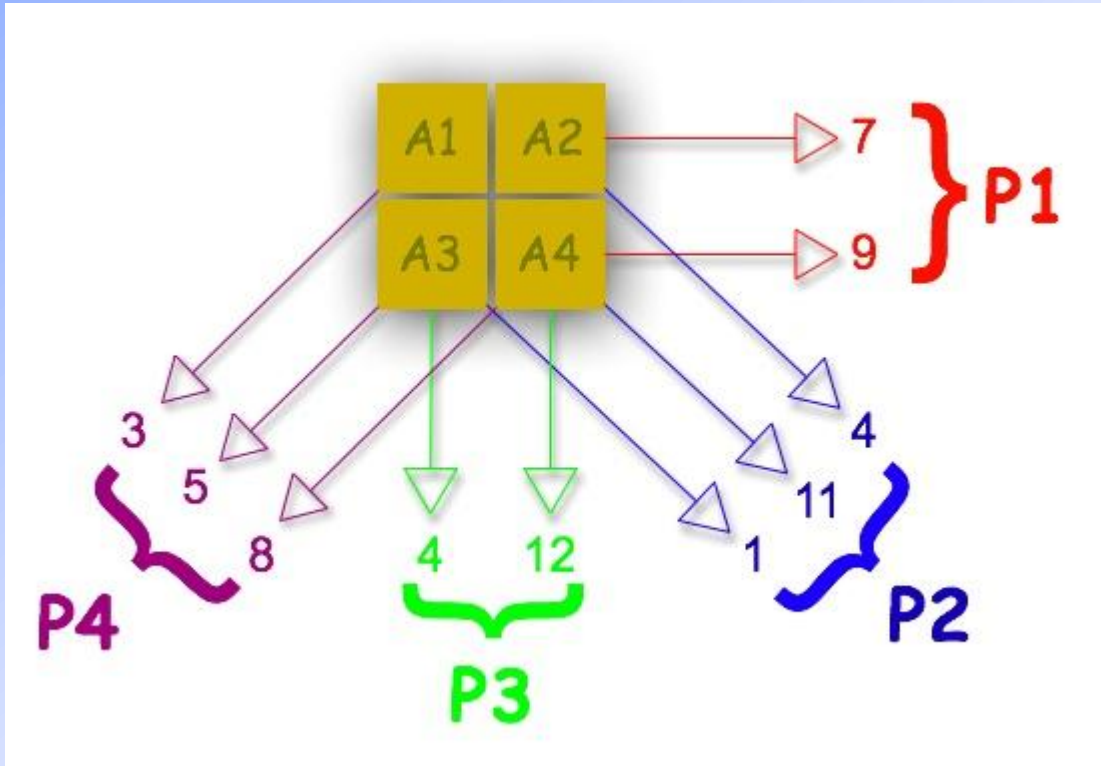


View of collimator from the side:



Reconstruction in SPECT

Assume that we register radiation from four voxels with relative intensities A1, A2, A3 and A4.
PI – registred projections of intensities.



Images from Gamma Camera

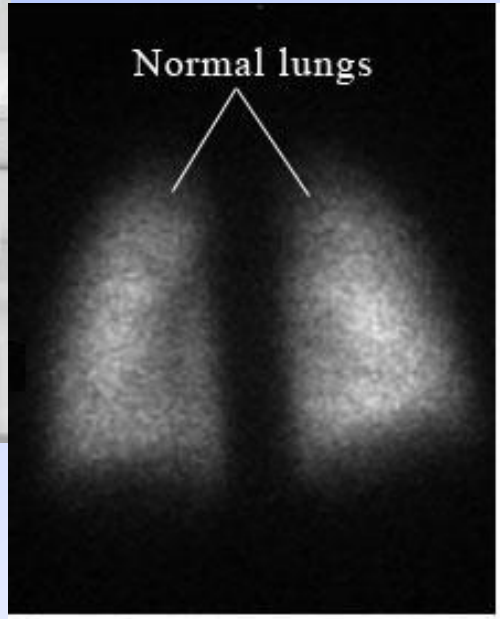


Figure 1

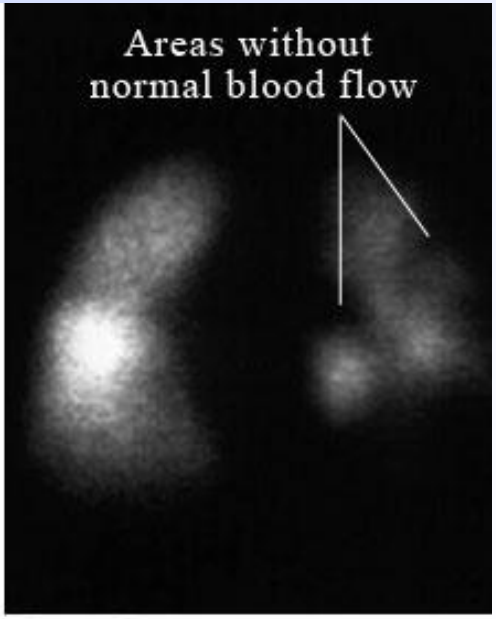
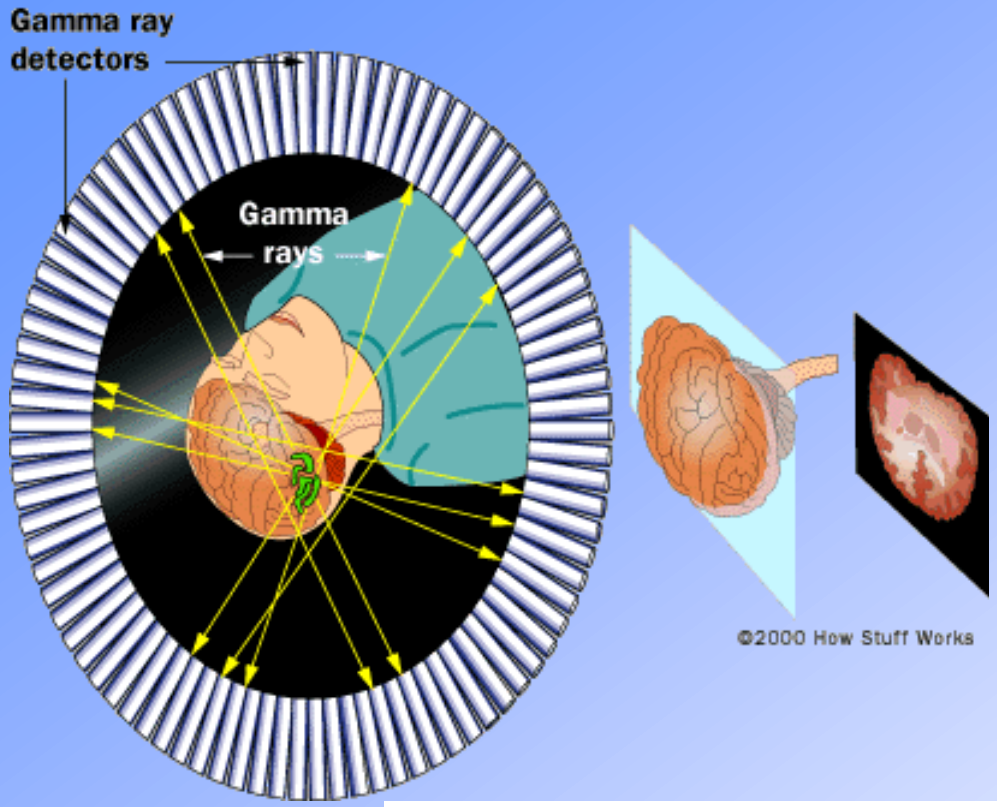


Figure 2


Gamma ray
detectors
Gamma
rays
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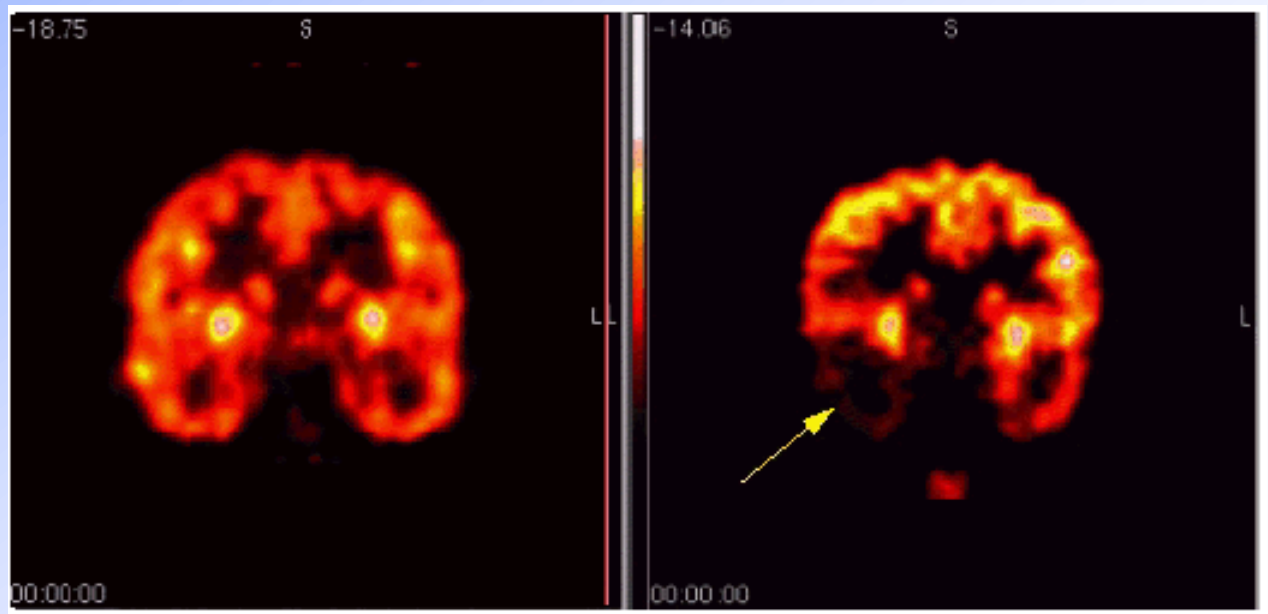
PET imaging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