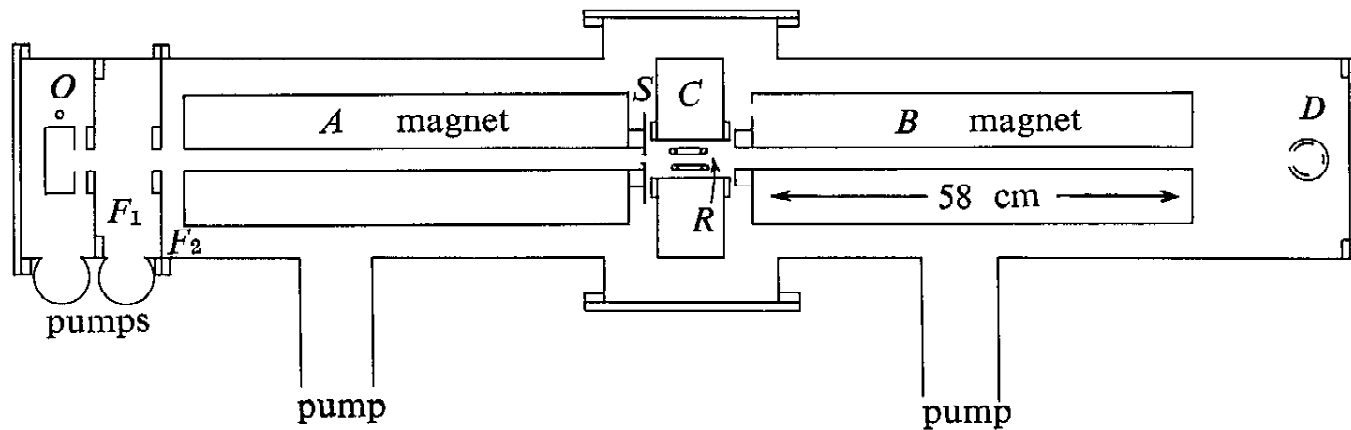
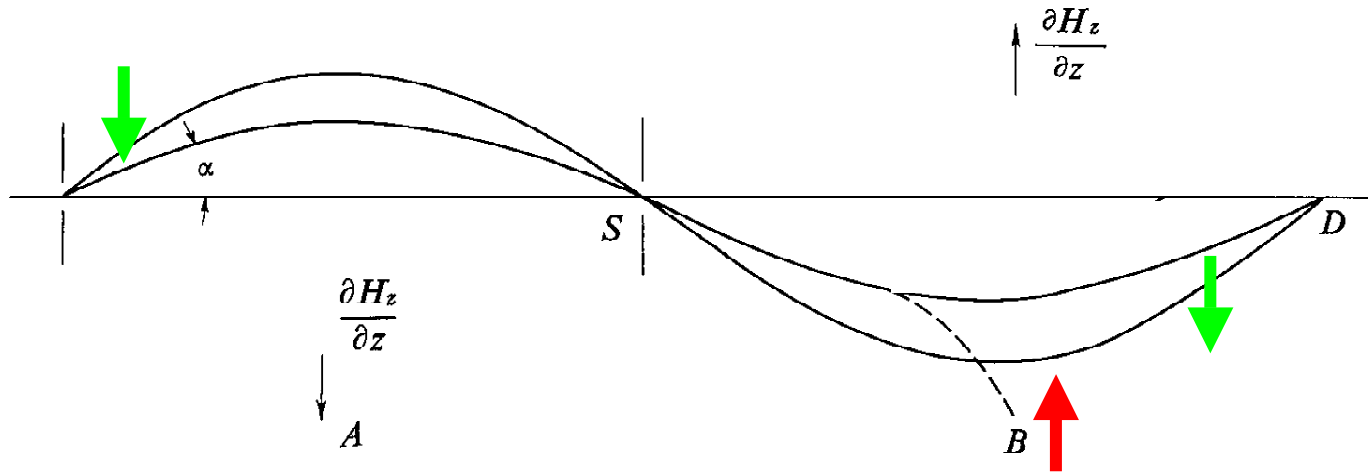


Atomic beam method of Rabi



Example of a measurement using Rabi's method

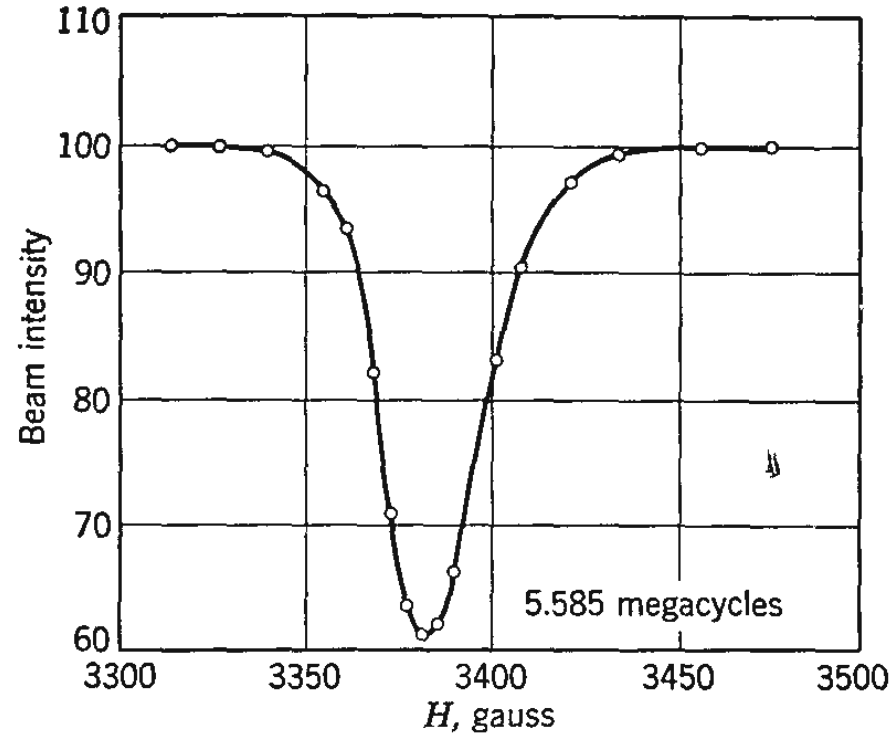
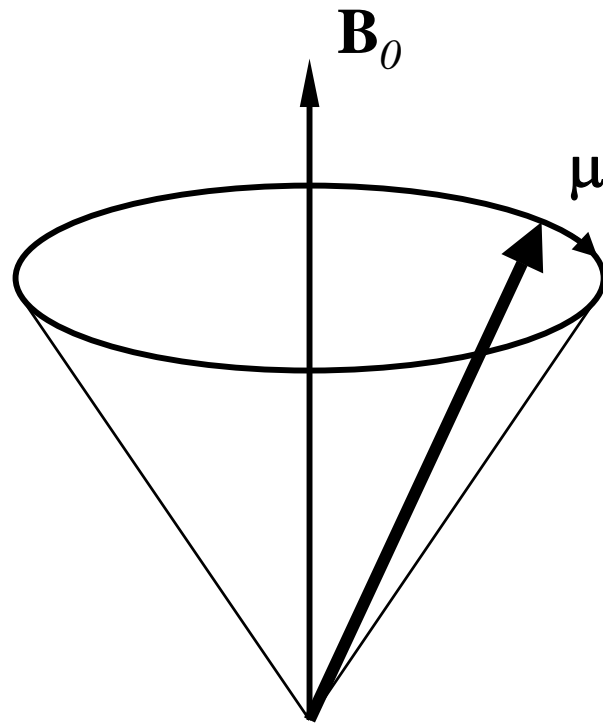
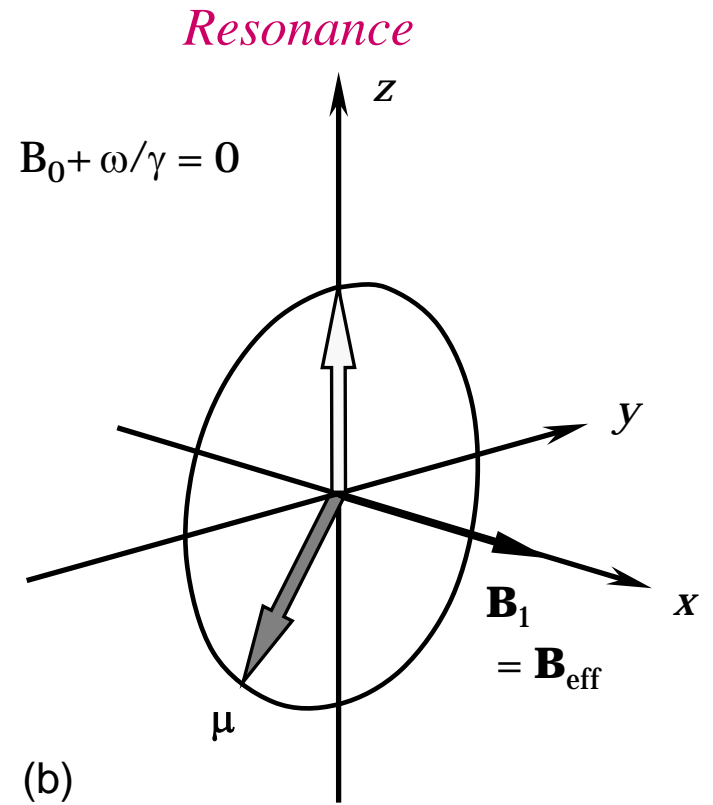
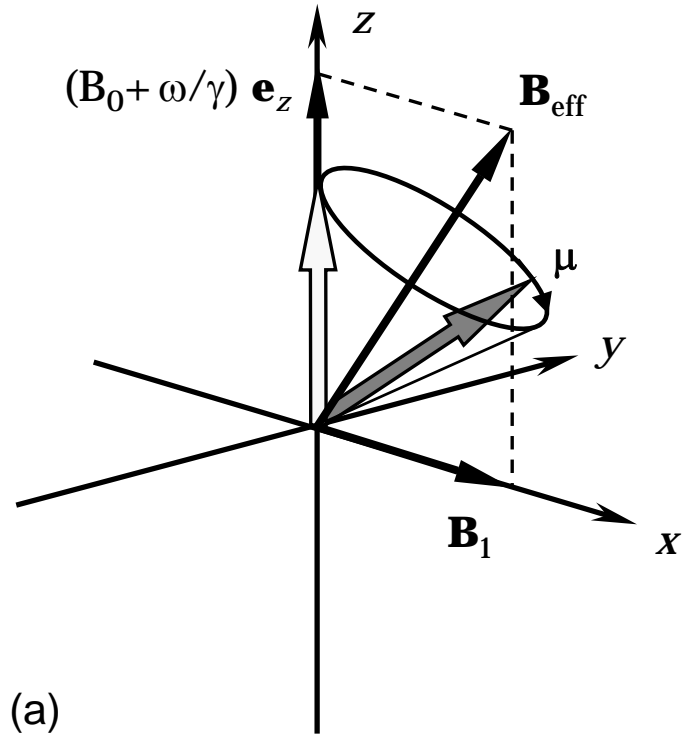


Figure 16.15 Measurement of resonance of ${}^7\text{Li}$ using apparatus of Figure 16.14. From I. I. Rabi et al., *Phys. Rev.* **53**, 318 (1938).

Simplest Case...



Precession of the magnetic momentum in the rotating reference system



Spin precession at resonance in the lab-frame

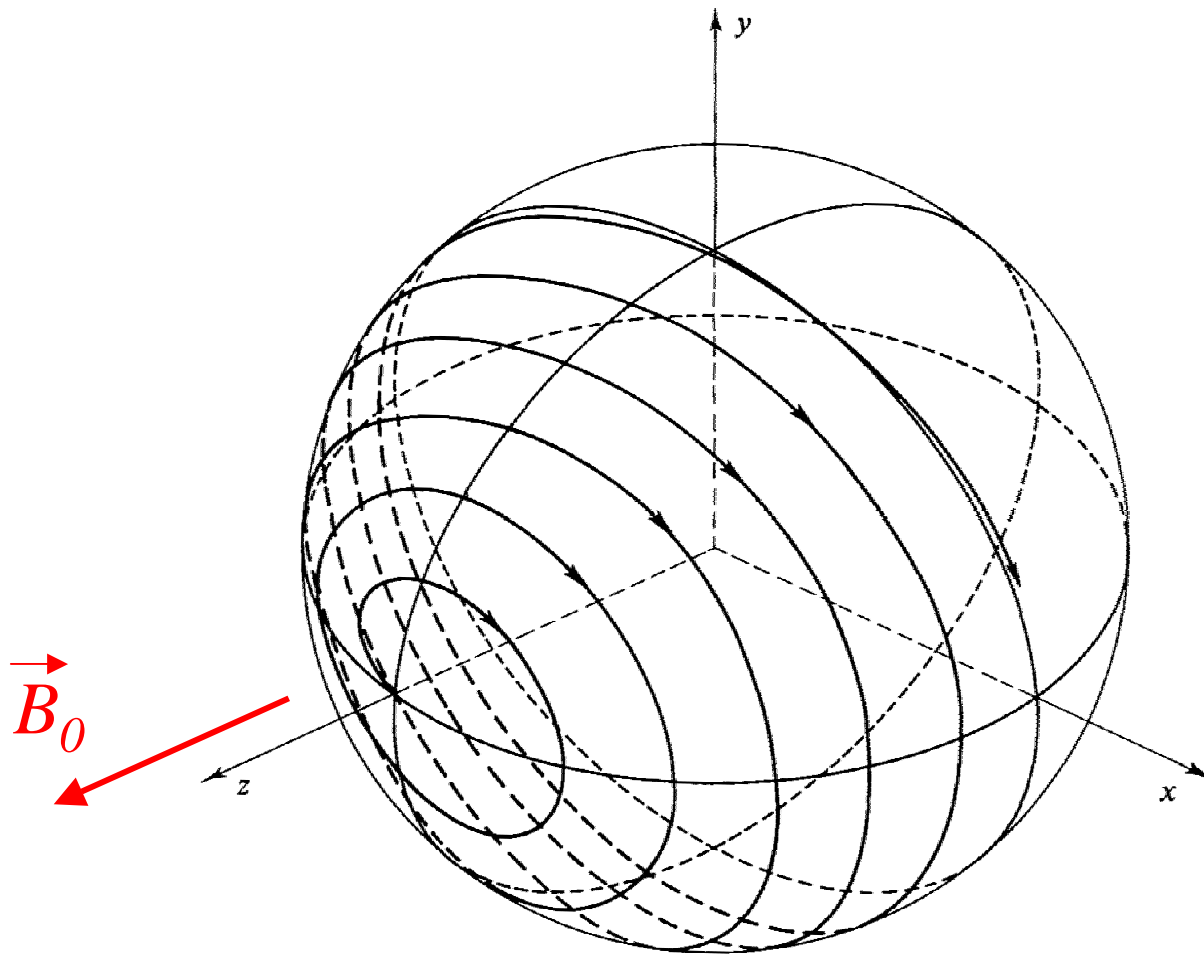


Figure 6-30 Trajectory of the end point of the magnetic polarization vector of hydrogen nuclei subject to an alternating field at the resonance frequency. The strong field is in the z direction, the alternating field in the x or y direction. The relaxation time is infinite. [From (F1 E).]

Layout of an NMR apparatus (Haken/Wolf, Atomphysik)

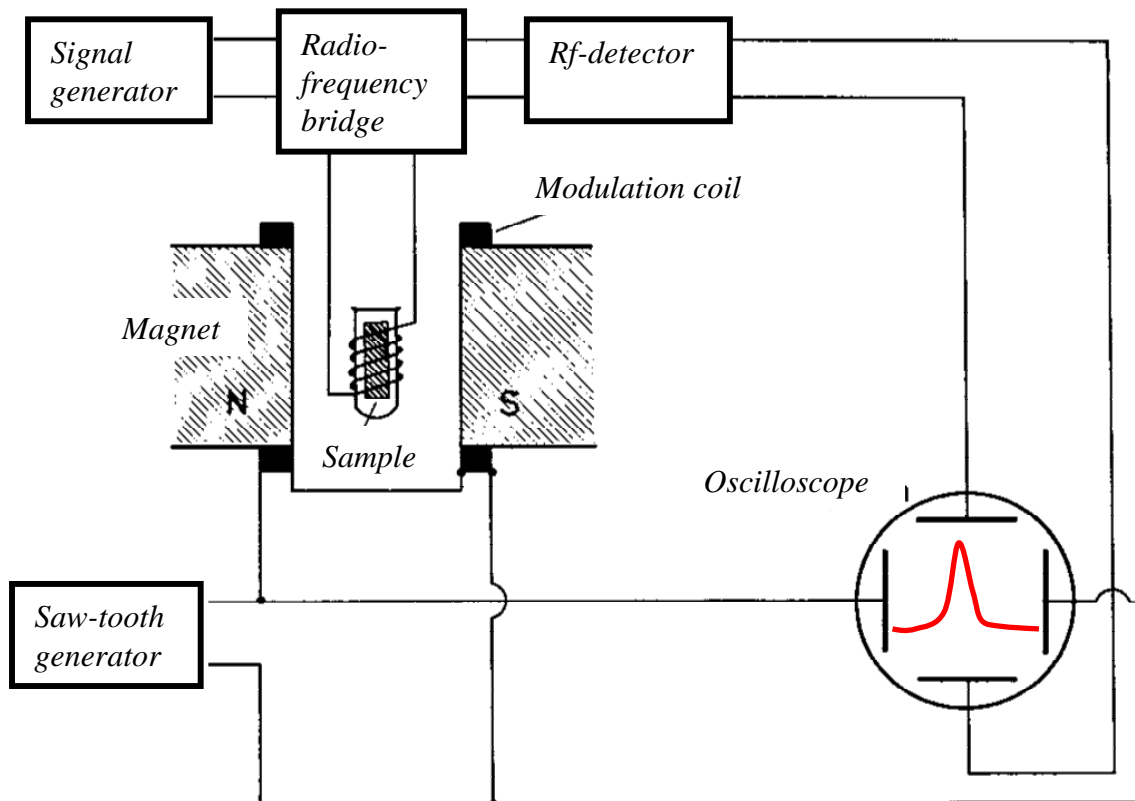
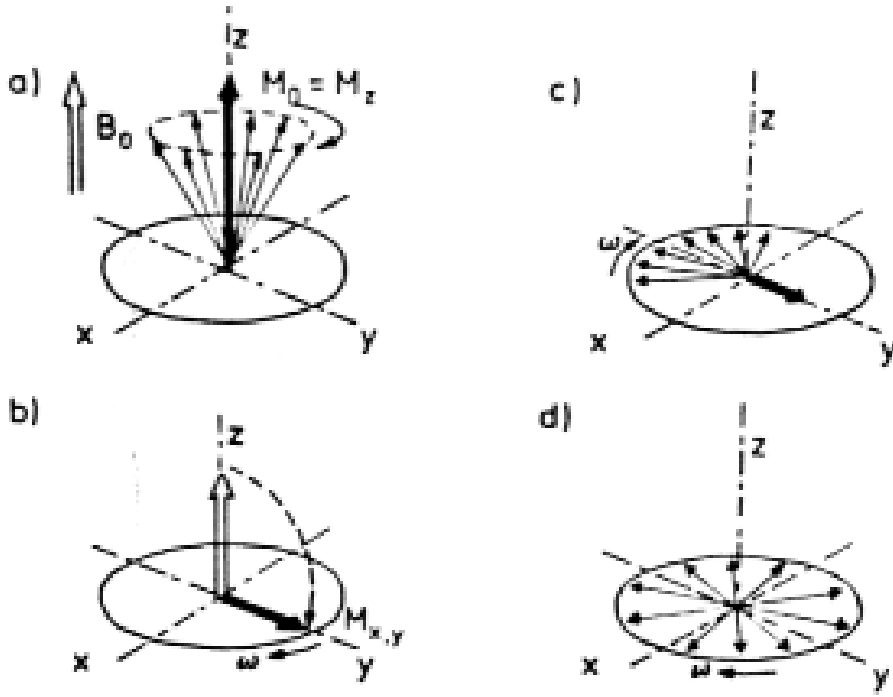


Abb. 20.16. Schema einer Kernspin-Resonanz-Apparatur. Die Probe befindet sich im Reagenzglas zwischen den Polschuhen eines homogenen Magneten. Das hochfrequente B_1 -Feld wird über eine Brücke eingestrahlt. Zum besseren Nachweis der Resonanz kann das B_0 -Feld durch eine Zusatzspule moduliert werden

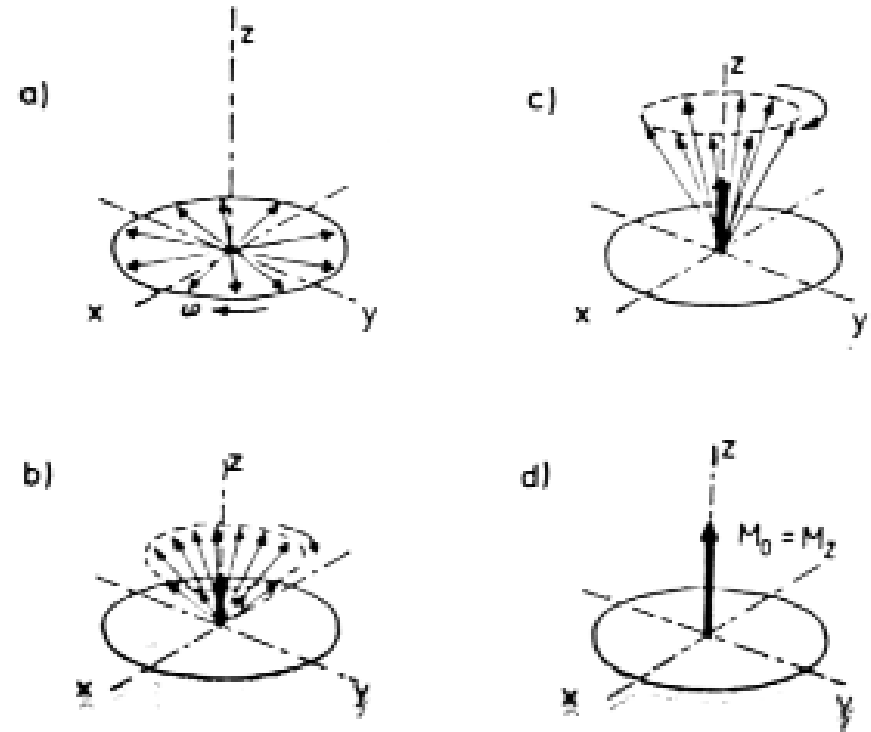
T_2 - relaxation



$$\frac{dM_T}{dt} = -\frac{M_T}{T_2}$$

$$M_T(t) = M_T(0) \cdot e^{-\frac{t}{T_2}}$$

T_1 - relaxation



$$\frac{dM_Z}{dt} = \frac{M_0 - M_Z}{T_1}$$

$$M_Z(t) = M_0 \left(1 - e^{-\frac{t}{T_1}} \right)$$

T_1 and T_2 measurement identify the tissue

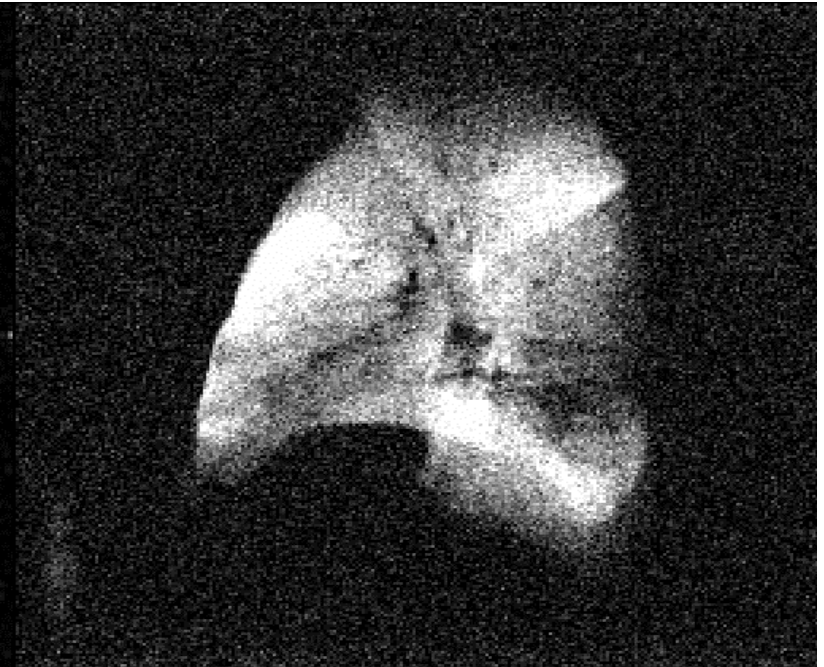
Imaging of the human lung

Choosing a different B_0 different inhaled substances can be selected

Wasserstoff (^1H)



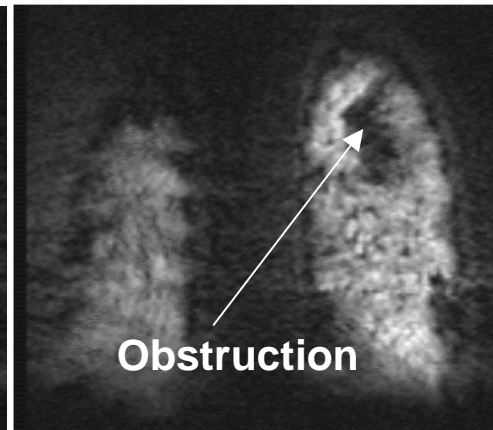
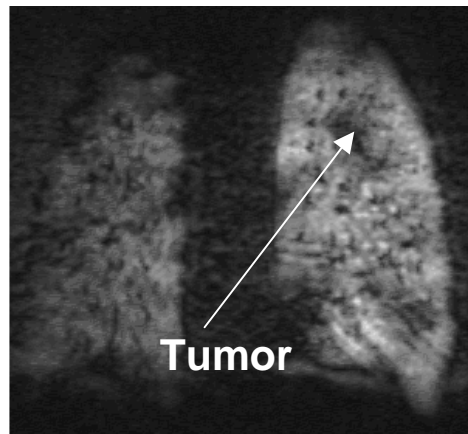
Helium-3 (^3He)



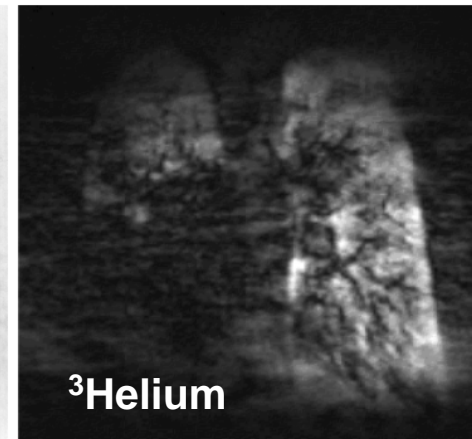
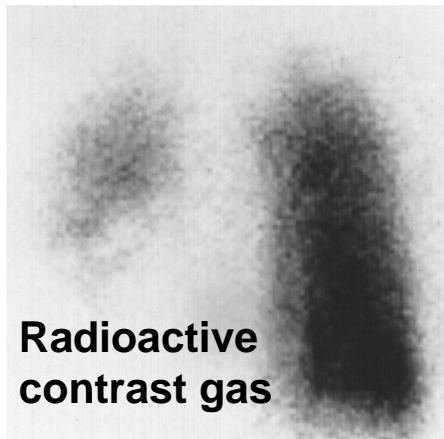
Universität Mainz und DKFZ Heidelberg, November 1995

Lungs Imaging via Nuclear Medecine

Tumor blocks the emission of the ^3He

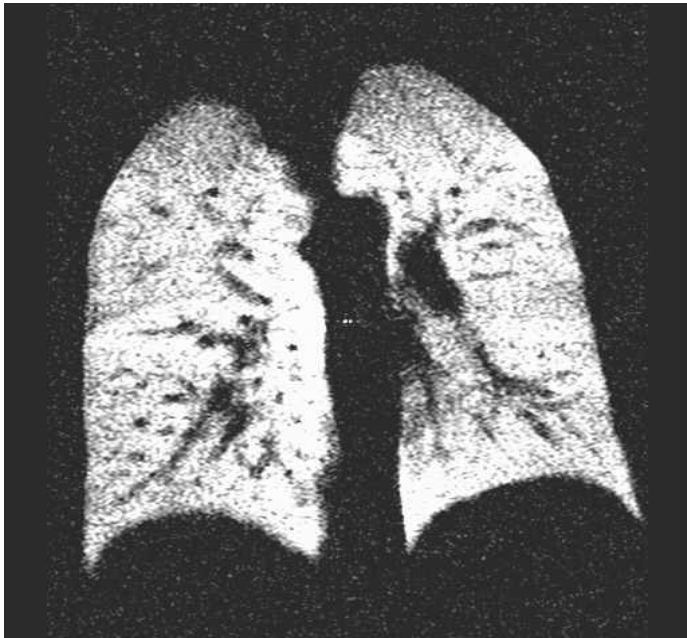


Scintigraphy and ^3He -Emission of a TBC patient

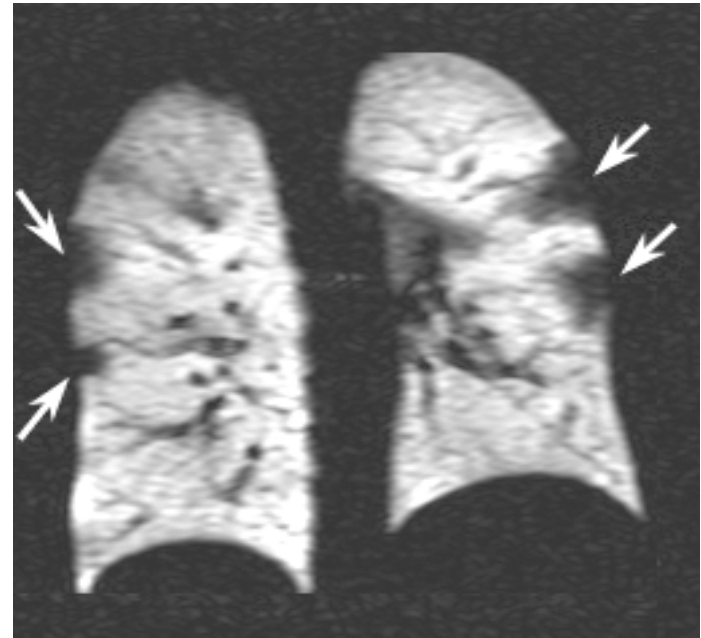


Morphologische Bildgebung mit hoher Ortsauflösung

Non-smoker

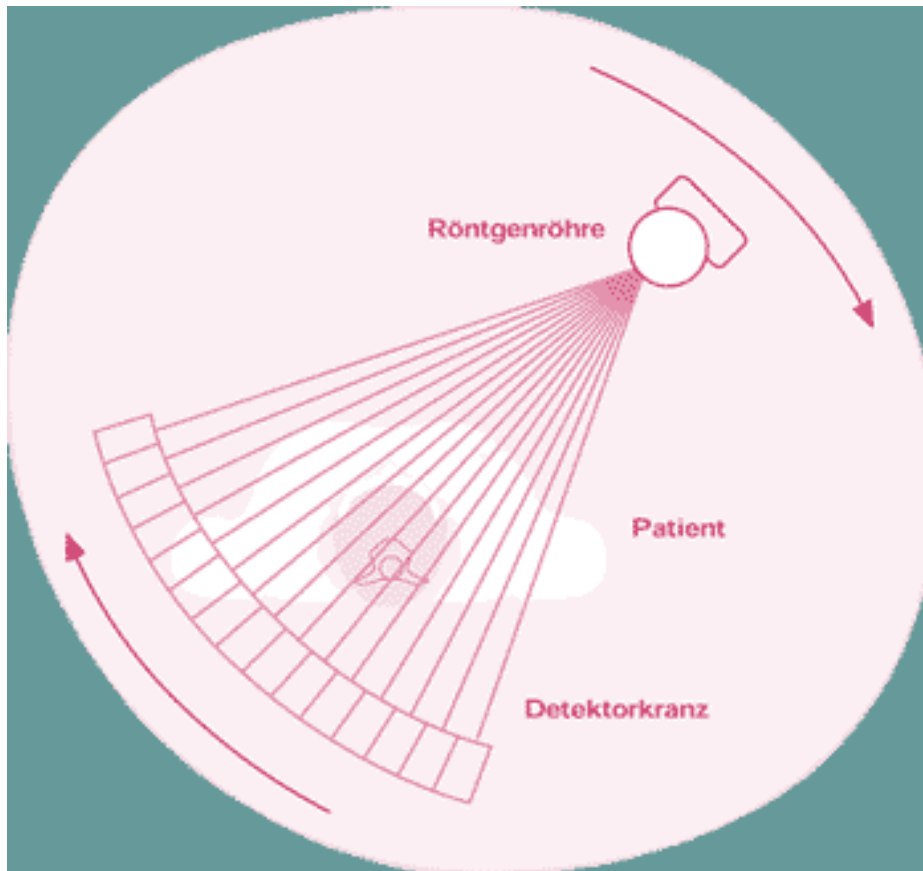


Light smoker

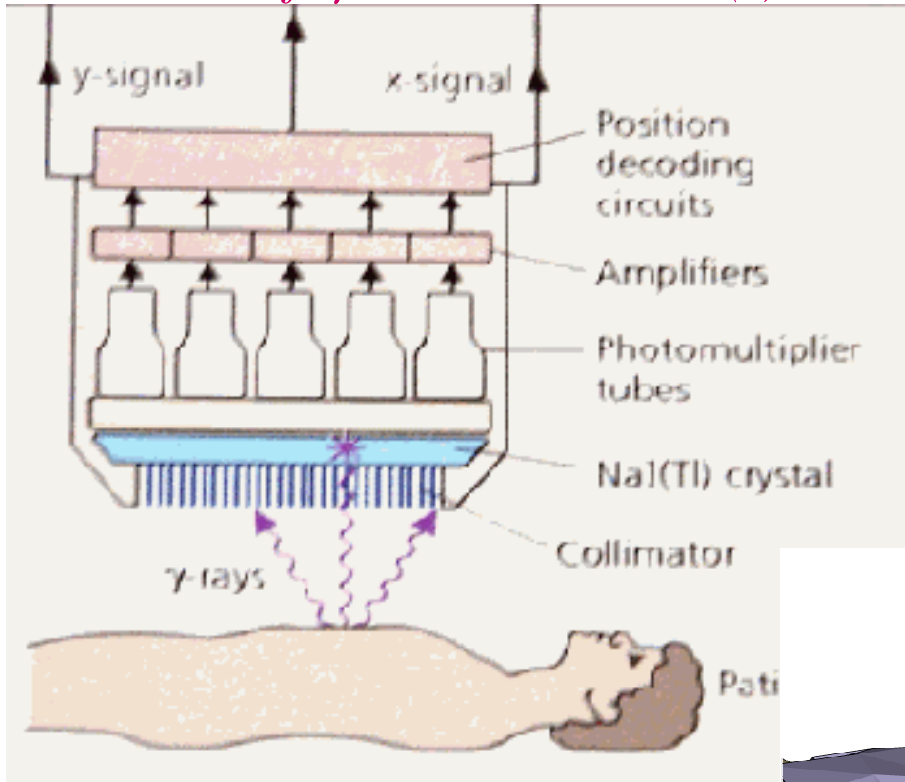


Universität Mainz und Uniklinik Mainz, 1999

Computer Axial Tomography



Detection of γ -emitter material (I)



Positron Emission Tomography

