



	Experiment title: Studies of lung function by synchrotron radiation bronchography	Experiment number: LS-1246
Beamline: ID 17	Date of experiment: from: 6.10.1999 to: 11.10.1999	Date of report 25.2.2000
Shifts: 18	Local contact(s): G. Le Duc	<i>Received at ESRF:</i>
Names and affiliations of applicants (* indicates experimentalists): A.R.A. Sovijärvi, Lab. of Clinical Physiology, Helsinki University Central Hospital C.G. Standertskjöld-Nordenstam, Dept. of Radiology, HUCH * P. Suortti, Dept. of Physics, University of Helsinki		

Report:

The objective of the study was to evaluate the feasibility of in vivo measurements of the size of bronchi and filling of alveoli using stable Xe gas as the contrast agent. The method is that developed for coronary angiography, where iodine solution is used for contrast. Two wide x-ray beams, which have energies bracketing the absorption edge, are focused and they cross at the subject being imaged, and the beams are separated at the dual-line detector, where the two images are acquired line by line. The patient or animal moves vertically through the beams, so that 2-dimensional images are formed. In tomographic imaging the animal rotates about an axis perpendicular to the beam, and section images are obtained by reconstruction. The distribution of the contrast agent is seen when the image corresponding to the lower energy is subtracted from that taken with the higher energy. The resolution is better than 0.5 mm, and absolute concentrations of the contrast agent can be calculated. These features make the present method unique in lung imaging.

The experiment was performed on anesthetized and mechanically ventilated New Zealand rabbits. Inhaled air was switched to an 80% xenon – 20% oxygen mixture (3.4 mg/ml) prior to imaging. A series of radiographs was acquired at 1.3 sec intervals (Fig. 1), and they show the bronchial tree, and subsequent filling of the alveoli. Tomographic images (Fig. 2) were reconstructed from 720 projections taken in 2 sec during full rotation of the animal. Four seconds after introduction of the Xe gas its concentrations were 2.2 mg/ml at the carina, and

1.5 mg/ml (average) in the peripheral lung. It is important that motion artifacts are not significant, so that temporal subtraction of the images allows to assess dynamic changes with time.

The imaging sequence was not gated with introduction of the contrast agent, and mixing of the gases was set manually. Future experiments are designed with a more precise control of the experimental parameters, and also more complete monitoring of the physiological indicators during the experiment will be introduced. However, even this first experiment demonstrated that K-edge subtraction imaging of lungs using stable Xe gas as the contrast agent is a quantitative method for the assessment of the regional distribution of ventilation, and regional lung volume. The long-term goal of the studies is diagnostic imaging of human subjects.



Fig. 1

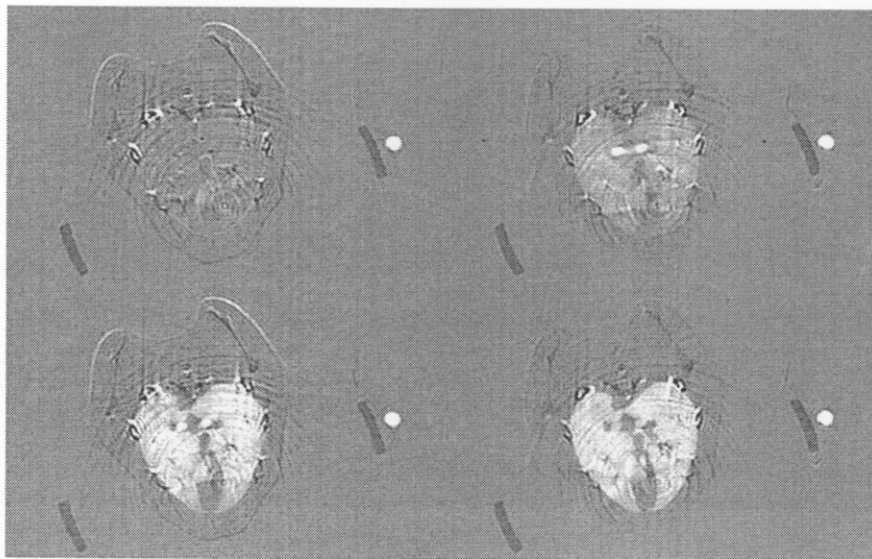


Fig. 2