



Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office using the **Electronic Report Submission Application**:

<http://193.49.43.2:8080/smis/servlet/UserUtils?start>

Reports supporting requests for additional beam time

Reports can now be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.



	Experiment title: Studies of lung function by synchrotron radiation bronchography	Experiment number: LS1831
Beamline: ID17	Date of experiment: from: 7.4.2001-14.4.2001 and 6.6.2001-16.6.2001	Date of report: 15.3.2002
Shifts: 18+27	Local contact(s): William Thomlinson	<i>Received at ESRF:</i>
Names and affiliations of applicants (* indicates experimentalists): *A.R.A. Sovijärvi, Helsinki University Central Hospital *S. Bayat, Faculte de Médecine, Université Joseph Fourier, Grenoble *G. Le Duc, ESRF *S. Monfraix, ESRF *L. Porra, Department of Physics, University of Helsinki *P. Suortti, Department of Physics, University of Helsinki		

Report:

The experiments were continuation of projects LS 1699, LS-1546 and LS-1246. The purpose of these experiment was to develop methods for functional imaging of lungs using animal models. In many pulmonary diseases such as chronic obstructive pulmonary disease (COPD) or asthma there are pathologic and functional alterations of small airways (i.e. bronchi with diameter below 2 mm) even at early stages. In such diseases it has been found that ventilation distribution becomes less uniform, and ventilation/perfusion mismatching is increased. However, techniques allowing in vivo assessment of both structure and function of lung airways with high spatial resolution are lacking.

The advantages of the use of synchrotron radiation in imaging the lungs has been demonstrated recently [1]. Stable xenon gas was used as contrast agent, and the distribution of the gas was obtained by the K-edge subtraction (KES) imaging. KES allows visualising small anatomic structures carrying the contrast agent, while removing practically all the features due to the other structures.

The goal of the present study was to extend this method to test the feasibility of functional imaging of lungs and the small bronchi in experimental asthma. Histamine is a major airway-constricting mediator that is involved in asthmatic airway narrowing. A quantitative description of histamine aerosol-induced airway constriction was measured in normal rabbit lung at baseline and after histamine inhalation. Regional ventilation showed significant heterogeneity and redistribution from poor to well-ventilated zones (Figure 1). More experiments are needed to find suitable histamine dose and timing for imaging to complete this study. Results will be published later.

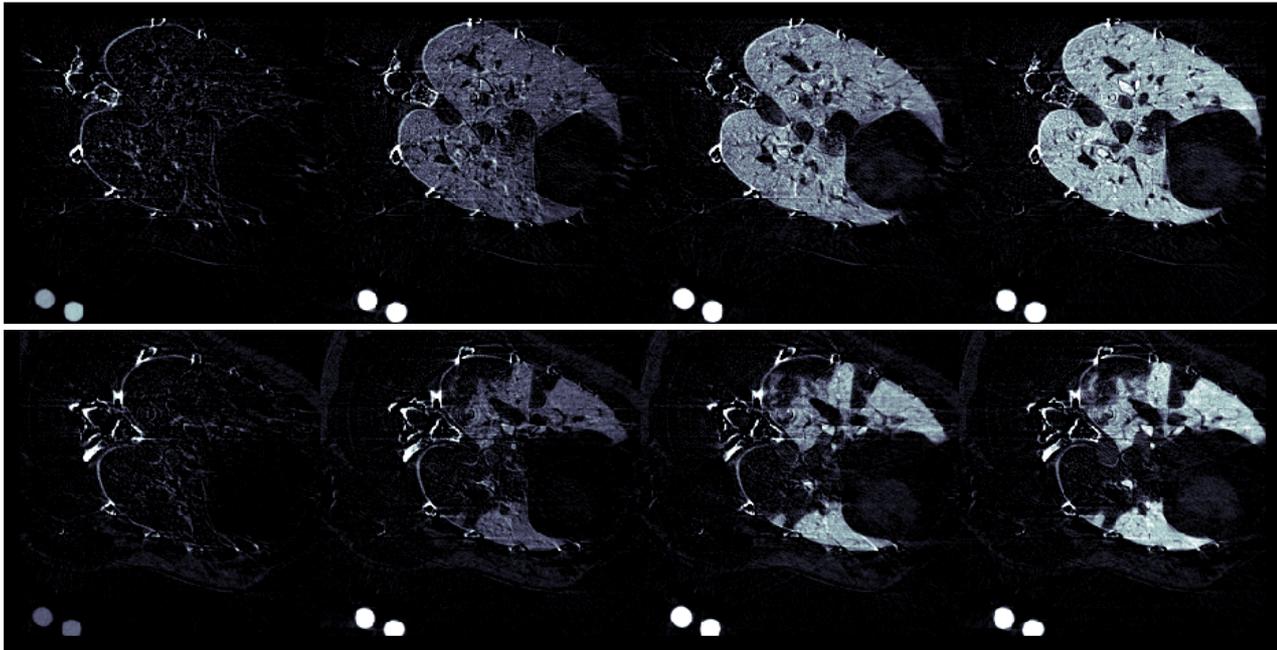


Fig 1. Upper panel: A series of subsequent KES tomograms were performed. The heart and blood vessels appear as lucencies. The round opacities in the left corner of each image are due to the gas inlet tube. During imaging the rabbit breathed a 60% Xe 40% O₂ gas mixture. Time interval between images was 7.5 sec, and the actual size of the image field is 88 x 88 mm. Lower panel: Bronchoconstriction was induced by introducing vaporized histamine solution in the inhaled gas. CT-images demonstrates very non-uniform distribution of ventilation.

The work was presented in following conferences:

1. L. Porra, S. Bayat, S. Monfraix, G. Le Luc, W. Thomlinson, P. Suortti, C.-G. Standertskjöld-Nordenstam and A.R.A. Sovijärvi. Effect of histamine on regional lung ventilation studied by synchrotron radiation computed tomography (SRCT). **XXXVI Annual Conference of the Finnish Physical Society**. 14-16.3 2002, Joensuu, Finland. Poster, abstract 6.30.
2. S. Monfraix, L. Porra, S. Bayat, G. Le Duc, T. Brochard, G. Berruyer, C. Nemoz, A. Eberhard, W. Thomlinson, P. Suortti, C.- G. Standertskjöld-Nordenstam, A. R. A. Sovijärvi. Effect of histamine on regional lung ventilation using inhaled stable xenon computed tomography. **12th ESRF Users' Meeting**, 13.2 2002, Grenoble, France. Poster.
3. S. Monfraix, L. Porra, S. Bayat, G. Le Duc, W. Thomlinson, P. Suortti, C.-G. Standertskjöld-Nordenstam and A.R.A. Sovijärvi. Functional lung imaging by synchrotron radiation using stable xenon as contrast agent. E.S.R.F., **Experiment Division Internal Meeting**, 9-11 May 2001 and May 2002, Aussois, France. Presentation
4. S. Bayat, G. Le Duc, L. Porra, G. Berruyer, T. Brochard, S. Fiedler, S.Monfraix, C. Nemoz, W. Thomlinson, and P. Suortti. Effect of histamine on regional lung ventilation using inhaled stable xenon computed tomography. **European Respiratory Society, Annual congress 2001**, 22-26.9 2001, Berlin. Poster.

References

1. Bayat S, Le Duc G, Porra L, Berruyer G, Nemoz C, Monfraix S, Fiedler S, Thomlinson W, Suortti P, Standertskjold-Nordenstam CG, Sovijarvi AR. Quantitative functional lung imaging with synchrotron radiation using inhaled xenon as contrast agent. *Phys Med Biol*. **2001** Dec;46(12):3287-99.