ESRF	**Experiment title: Heavy element sensitive tomography: dynamics.**	**Experiment number**: MI-263
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Report:

Following our first experiment on heavy-element sensitive tomography using synchrotron radiation [1-4], this second experiment served to investigate several applications of our new method. Special emphasis was put on the following subjects:

-) the use of masks to modify the distribution of the beam when strongly absorbing samples are used;

-) the possibility to study dynamics;

-) the study of uranium and lead concentrations in samples from the natural self-sustaining nuclear reactor of Oklo, which operated 2 billion years ago.

For the experiments monochromatic synchrotron radiation around 115 keV (for uranium) and 88 keV (for lead) was created using the superconducting wavelength shifter and two asymmetric-cut Si crystals working in fixed Laue-Laue mode. The set-up was similar to the one used in the first experiment and described in [2,3].

Our results indicate that adapted masks improve the quality of the data for the reconstruction of strongly absorbing samples. Because they had to be adapted to

each sample their use is, however, rather time consuming. The figure shows the results of the tomography of one of the Oklo samples [5]. One sees that it was possible to extract both the uranium and lead distribution in this sample. Finally, we did perform some first tests on dynamics by studying the interaction of lead nitrate with an ion exchanger.

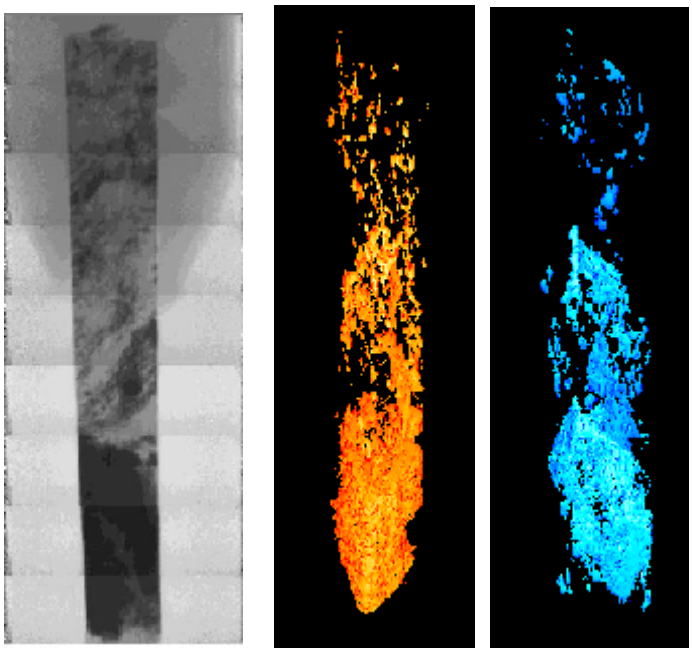

Figure: Shown are the result of one projection of the Oklo sample taken with a photon energy of 87 keV (left side). The center part shows the reconstructed isodensity surface at 1.0 g/cm^3 uranium and the right side the same distribution but corresponding to 0.4 g/cm^3 lead.

References.

[1] Th. Materna, J. Jolie, W. Mondelaers, B. Masschaele, V. Honkimaki, A. Koch, T. Tschentscher ESRF Highlights 1997/1998 p.94.

[2] Th. Materna, J. Jolie, W. Mondelaers, B. Masschaele, V. Honkimaki, A. Koch, T. Tschentscher in Applications of Accelerators in Research and Industry AIP CP475 (1999) p.615.

[3] Th. Materna, J. Jolie, W. Mondelaers, B. Masschaele, V. Honkimaki, A. Koch, T. Tschentscher, acc. for publ. in Journal of Synchrotron Radiation (1999).

[4] J. Jolie, Th. Materna, W. Mondelaers, B. Masschaele, V. Honkimaki, A. Koch, T. Tschentscher, ESRF Annual Report 1998 MI219.

[5] S. Baechler, Diplom work Université de Fribourg 1999, unpubl. and S. Baechler et al. to be publ.