ESRF	Experiment title: 3D microtomographic imaging of bone samples using synchrotrons radiation	Experiment number: LS 351
Beamline: D5/BLl0	Date of experiment: from: 3 nov 95 to: 4 nov 95	Date of report: 20 feb 96
Shifts: 3	Local contact(s): José BARUCHEL, Per SPANNE	*Received at ESRF:*

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Report:

A computed microtomography (CMT) system allowing high resolution three-dimensional (3D) imaging of bone samples has been implemented and tested at ESRF. The 3D CMT setup includes a single crystal monochromator selecting the appropriate energy from the white synchrotrons radiation parallel beam, a translation / rotation stage on which the sample is mounted and an area detector. The detector, which was developed by the ESRF Detector Group, consists of a $Gd_2O_2S:Tb$ screen converting x-rays to light, light optics magnifying the screen image and a thermoelectrically cooled *1024 x 1024* elements CCD camera (Photometries) (for details, see [l]). The detector was characterized in terms of spatial resolution by its Modulation Transfer Function (MTF), which describes the contrast response of the system as a function of spatial frequency. The spatial resolution at 10% contrast was found to be $9\mu m$.

A sample of human vertebra embedded in methyl methacrylate (4 x 4 x 8 mm^3) was imaged. 600 two-dimensional projections of the sample were acquired over 180° at 23 keV. 2D and 3D images of the distribution of the linear attenuation coefficient within the sample was reconstructed from this data set using a filtered backprojection algorithm (see figure 1 and figure 2).

The good contrast and suitable spatial resolution of the images seem promising for the extraction of structural parameters quantifying bone trabecular network. Further beam time has been allocated to this project in May to investigate a larger data set of ten human vertebra samples. This experiment should help demonstrate the correlation between structural parameters and bone mechanical properties, and understand the evolution of bone structure with aging.

[1] M. Pateyron, F. Peyrin, A.M. Laval-Jeantet, P. Spanne, P. Cloetens, G. Peix, "3D microtomography of cancellous bone samples using synchrotrons radiation", SPIE Medical Imaging 1996.

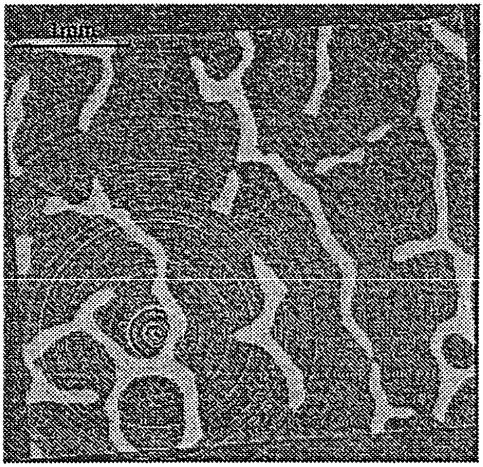

Figure 1 : Reconstructed cross-section of a human vertebra sample, 512 x 512 array, spatial resolution: 9 µm.

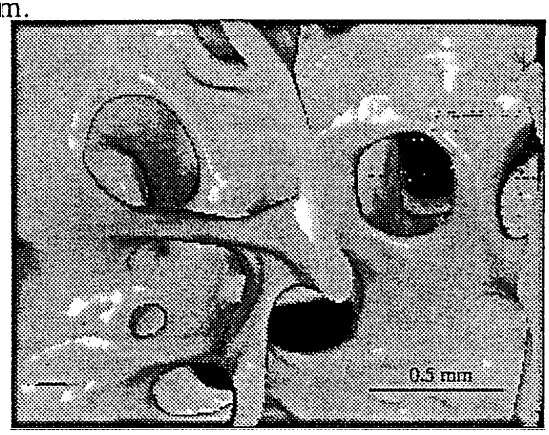

Figure 2: 3D image of a human vertebra sample, 256 x 256 x 200 array, isotropic spatial resolution :9 µm.