Development of a 2D and 3D Coded Aperture X-ray Phase Contrast Imaging System

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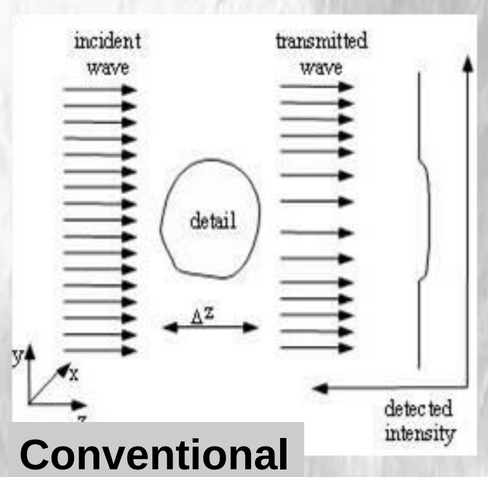
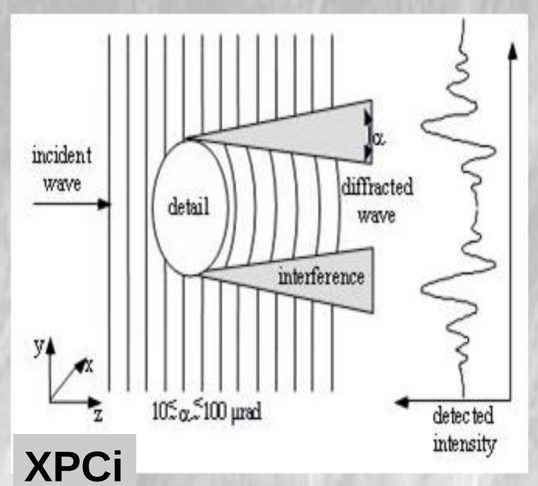
What is X-Ray Phase Contrast Imaging (XPCi)?

Image contrast is generated by a phase shift rather than by attenuation



Conventional

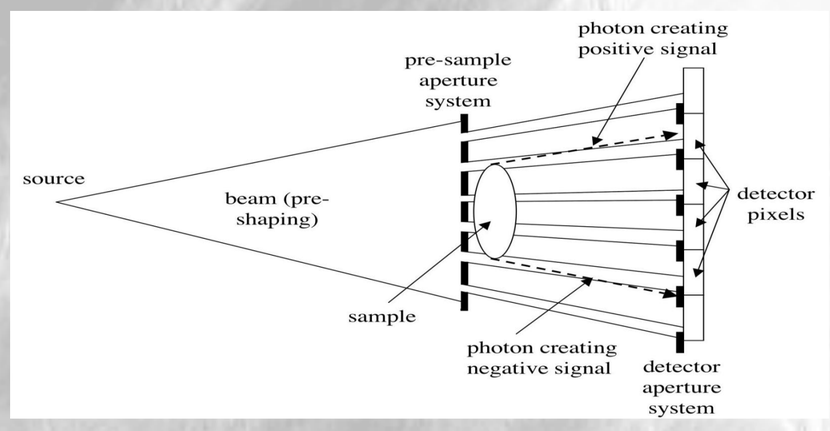


XPCi

The physical quantity causing a phase shift can be up to 1000 times larger than the one responsible for attenuation.

In case of low absorbing materials higher contrast and improved feature detectability can be expected.

Developed at UCL:



The use of coded apertures makes XPCi feasible in the lab

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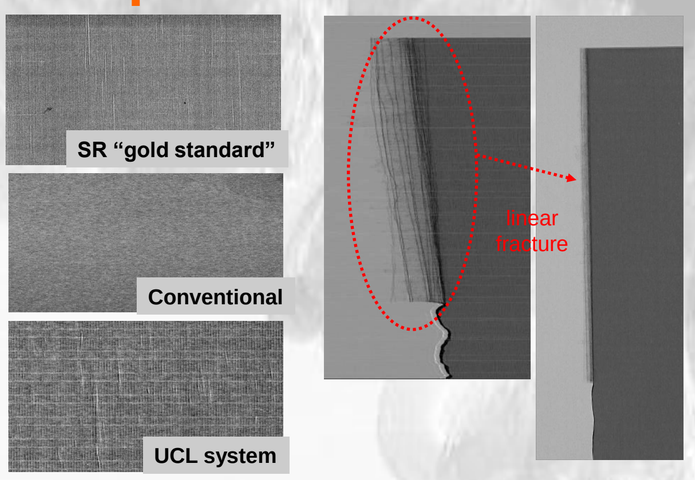
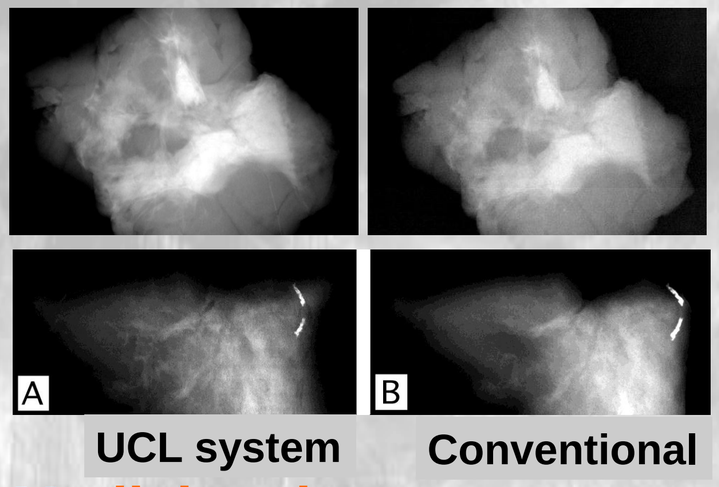
2D Imaging: Detecting the Invisible

Material science: testing composite materials



Unpublished, collaboration with Imperial College & QinetiQ

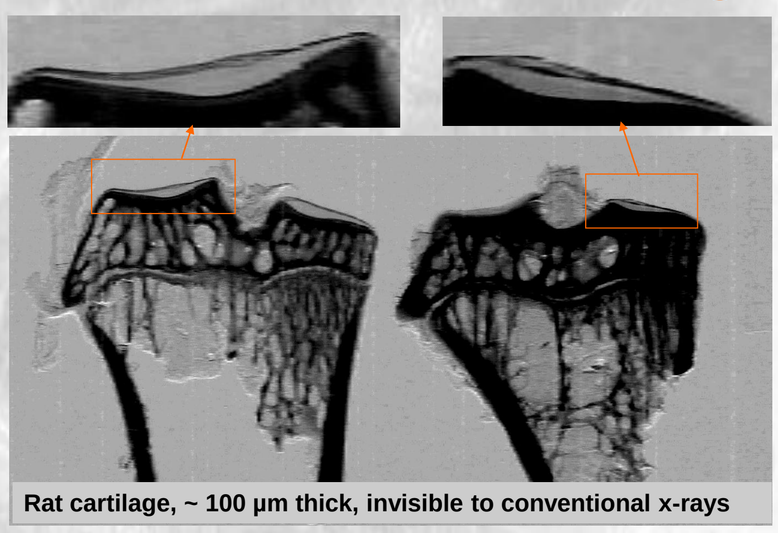
Unpublished, funded by the Wellcome Trust



UCL system **Conventional**

Medicine: breast tumours in mammography

Biomedical imaging: visualisation of rat cartilage



Rat cartilage, ~ 100 μm thick, invisible to conventional x-rays

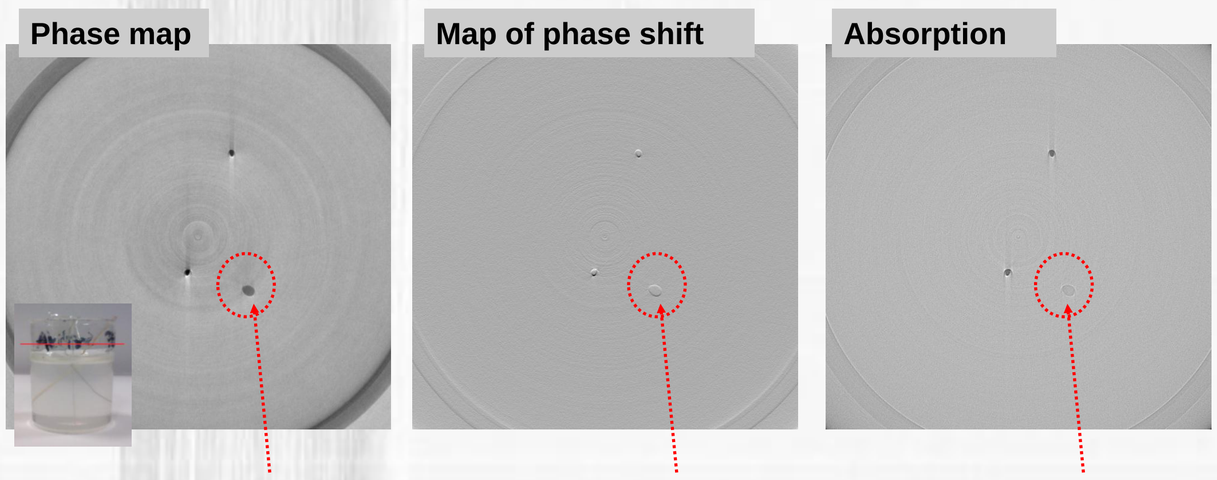
3D Imaging: Preliminary studies in Phase Contrast CT

The UCL coded aperture XPCi setup contains a sample rotation stage.

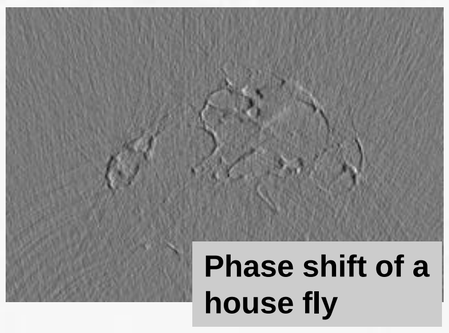
After some processing the recorded data is proportional to the Radon transform of the phase shift.

CT reconstruction can be performed along the lines of the conventional FBP algorithm, yet a Hilbert filter is used for the recovery of the phase map.

New options: 3D maps of the object's phase and phase shift using synchrotron radiation



40% contrast **40% contrast** **11% contrast**



Phase shift of a house fly

Future work

We will consider the synchrotron images our "gold standard" and aim for a reproducibility of image quality in our UCL radiation physics lab.

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