# COST mini-workshop on "Finding approaches to eliminate artefacts in x-ray phase contrast computed tomography"

September 16-18, 2015

Department of Medical Physics and Biomedical Engineering, University College London, Malet Place, London WC1E 6BT, UK

Local organizers: Charlotte Hagen, Anna Zamir (UCL X-Ray Phase Contrast Imaging Group)

**Background & aim of the workshop:**

X-ray phase contrast (PC) computed tomography (CT) has been heavily investigated over the last two decades. It holds potential to overcome the major limiting factor of conventional CT: poor contrast for soft biological tissues. This is because contrast in PC-CT is driven by phase effects rather than attenuation ones, which can be several orders of magnitude stronger than the latter. PC-CT is typically implemented using propagation-based, crystal-based or grating-based approaches. These methods, however, rely either on spatially or temporarily coherent or quasi-parallel beams. These conditions are only met at synchrotrons, or, to some extent, by micro-focal x-ray tubes. The use of synchrotrons and micro-focal x-ray tubes is not suited to many practical applications due to accessibility and x-ray flux constraints, respectively. At UCL, we have developed a new approach to PC-CT, named edge illumination PC-CT, which has been demonstrated in several instances to work well with x-ray tubes with relatively large focal spots, i.e. in a scenario that is closer to practical reality. Although it was shown that edge illumination PC-CT can yield quantitatively accurate images with improved contrast-to-noise ratio compared to attenuation-based CT, it is still in its early stages of development. For example, CT images are often corrupted by artefacts, the origin of which is still not understood. In some cases, these artefacts can be very strong, to a degree that they completely mask the sought for information in the image. This workshop is primarily aimed at a) identifying the origin of artefacts in edge illumination PC-CT images and b) at finding approaches towards their elimination, but also at c) gaining insight about image acquisition and reconstruction techniques employed by other groups, and d) at identifying possible future collaborations.

**Workshop programme:**

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| *9 am – 10 am:* | Arrival, distribution of access cards, setting up internet connection |
| *10 am - 11 am:* | Welcome and introduction by head of the UCL X-Ray Phase Contrast Imaging Group (Prof. Sandro Olivo) |
| *11 am – 12.30 pm:* | Introductory talks on "Edge Illumination X-Ray Phase Contrast Tomography" by Charlotte Hagen and Anna Zamir |
| *12.30 pm - 2 pm:* | Lunch break |
| *2 pm - 4 pm:* | **Presentations by participants on their own CT-related work (~ 20-25 minutes each + 5-10 minutes Q&A)** |

- Mareike Toepperwien (Uni Göttingen, GER): "Propagation-based phase-contrast tomography of neuronal tissues"
- Francesco Brun (Elettra, IT): "Quantitative analysis of micro-CT images: an effective way to evaluate your imaging technique"
- Pierre Paleo (ESRF, FR): "Phase Contrast Tomography at ESRF : algorithms"
- Nghia Vo (Diamond Light Source, UK): "Pre-processing techniques for tomographic data"

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| *4 pm – 5 pm:* | Discussion on potential overlap of problems and strategies for problem solving |

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| *9.30 am – 10 am:* | **Presentations by participants on their own CT-related work (~ 20-25 minutes each + 5-10 minutes Q&A)** |

- Daniel Pelt (Centrum for Wiskunde and Informatika (CWI), Amsterdam, NL): "Recent advances in filter based tomographic reconstruction methods"

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| *10 am – 12.30 pm:* | Lab session and introduction to data processing and image reconstruction in edge illumination PC-CT |
| *12.30 pm* | Fire Safety Briefing by Vikki Crowe |
| *12.30 pm - 2 pm:* | Lunch break |
| *2 pm - 5 pm*: | Hands on problem solving |
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| *Evening:* | Dinner |

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| *9.30 am – 12.30 pm:* | Hands on problem solving |
| *12.30 pm - 2 pm:* | Lunch break |
| *2 pm to 4.30 pm:* | Presentation/discussion of results, summarising potential for future collaborations |
| *4.30 pm to 5 pm:* | Closing remarks |
| *Around 5 pm:* | Departure (followed by walk around the local area/ trip to the pub) |