# Report from CCPi for the 30/09/18 to 01/04/19

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## 1. Background

Non-destructive 3D X-ray, Neutron, PET and MR imaging are essential tools in many areas of science with diverse applications from Energy, to Healthcare to Security and across all Materials Science topics.

The CCPi network was established in 2012 to support the emerging UK computed tomography community with a toolbox of algorithms to increase the quality and level of information. There are four major open source software parts supported: pre-processing techniques for image calibration and noise reduction; reconstruction techniques to create a 3D volume data set from projections; segmentation/quantification techniques that can extract relevant objective values from these 3D volumes; and a software framework enabling the exploitation across a wide range of imaging devices.

The number of imaging devices has grown with many academic groups around the UK taking up tomographic imaging and purchasing new lab based x-ray CT scanners as well as exploiting new national facilities – first Neutron Tomography results processed by CCPi in Feb 2019. The size of our community has subsequently risen from ~250 in 2013 to over 400 in 2019; 60+% growth. Our primary focus is through developing, maintaining, and prompting the CCPi toolbox, the "Core Imaging Library", http://www.ccpi.ac.uk/CIL

## 2. Highlights for the Current Reporting Period

The CCPi team has joined code base and development with the RTMCT (Flagship grant) developer group and combining this structure with the CCPPETMR code base in terms of naming schema. This choice was made to integrate with relevant third party software and allow users to migrate between platforms. CCPi code is integrated within ISIS/IMAT beamline structure and through the Savu framework used within the DLS (Diamond Light Source). Plans for integration with HPL facility from 2020 are ongoing "Project-Tomographic imaging using intense laser-driven radiation sources".

Good software development practices have been updated; including software code project management, version control, issue tracking, and systematic code testing and builds. We now make public releases through Anaconda of the Python software CIL; http://cil.readthedocs.io/en/latest/

Held a joint workshop for 40 participants on Digital Fingerprinting of microstructures and Data Centric Engineering (May 14/15th) jointly with the Alan Turing Institute and the Henry Royce Institute. This attracted over 100 applications to attend and was very successful with a number of CCPi network members attending. The BBSRC, MRC and NERC CCP steering group members assisted with finding speakers from the life, medical and earth sciences.

Over the last period;

- Received funds for beamline time on ISIS–IMAT neutron tomography (10-16 Feb 2019) including two Hackathon events (13-14 Feb and 8-9 Apr 2019) and renewed applications.

- Three funded short-term fellowships; **Catherine Disney** (DVC code, Jan 2019 at DLS), **Sarah Fisher** (Laminography code at Manchester); **Parmesh Gajjar** (code representation at ToScA USA and Swansea)

- Publications; Laminography in the lab: Imaging planar objects using a conventional X-ray CT instrument, https://doi.org/10.1088/1361-6501/aafcae; Analyzing reconstruction artifacts from arbitrary incomplete X-ray CT data, https://doi.org/10.1137/18M1166833 and CCPi-Regularisation toolkit for computed tomographic image reconstruction with proximal splitting algorithms (SoftwareX 9, 317-323) https://doi.org/10.1016/j.softx.2019.04.003

- Network training activities included; two Avizo courses (27-29 November 2018, 26-27 February 2019, UoM) and an Xray Hacking event (21-22 January 2019, Swansea).

- Collaborated on the creation of the EPSRC Roadmap on XCT (https://epsrc.ukri.org/files/research/epsrc-x-ray-tomography-roadmap-2018/ Dec 2018) and on the governance board for Warwick, WMG "EPSRC Strategic Equipment - High Speed CT" EP/S010076/1 Nov 2018.

-Refreshed the statement of need for a UK National Laboratory CT Facility and submitted to EPSRC in March 2019.

## 3. Forthcoming Workshops and New Opportunities

The following events are being organised for the coming year:

- One events has occurred over the period, with CCPi presence at ToScA-USA (6-8 March 2019); now five Spring and Summer events are planned (ATI/Royce data session; Fringe event; Advances in Xray; dimensional-XCT; ToScA).

- University of Manchester, run monthly Lunch-and-Learn sessions, complementing the visitors and software-show-tell events at RAL (Harwell Campus). Seven events, 15 speakers, with total attendance 135.

- Industrial Metrology sessions at UoM continue ( 8-9 January 2019, next 6 June 2019) and culminating with Royce Institute hosting the dXCT 2020 event.

- Supported links to ImagingBioPro network https://mecheng.ucl.ac.uk/imagingbiopro/ 25-26 March 2019 (DLS event) "Technology network awarded funding to capture musculoskeletal degeneration"

## 4. Issues and Problems

Continual good support for CCPi has been from Edoardo Pasca and Gemma Fardell; who have covered extra administration effort, during SCD restructure and recruitment,