

## Report from CCPi for the Period 24 June 2015 to 7 December 2015

Prof Philip Withers – 7 December 2015 <http://www.ccp.ac.uk/>

### Background

The CCP in Tomographic Imaging has now transitioned to Phase Two within a new five-year EPSRC network, funded from 1 September 2015; this has built on the previous activities to deliver new versions of the core codes, as well as support defined dataflow frameworks. Recently we have built a new Drupal CMS (Content Management System) website setup to promote the coding and network activities ([www.ccp.ac.uk/](http://www.ccp.ac.uk/)).

The CCPi now prioritises the three areas of; image capture including pre-processing, reconstruction and quantitative analysis; as well as assisting in building frameworks connecting and looping these together. The aim remains to provide the UK tomography community with a toolbox of algorithms that increases the quality and level of information that can be extracted by computer tomography. Key is an increase in the number of components available to the community, usage, training and software deposits.

The core team within STFC now includes Srikanth Nagella, Ron Fowler, Evgueni Ovtchinnikov and Martin Turner. The core team is funded with a core of 1.16 FTE where Martin Turner (0.08 FTE) has a secretariat position coordinating certain networking aspects.

We had two extra funded posts, and an extra income source, over this period;

1. Erica Yang had an extension (0.10 FTE) to develop further collaborations with the new IMAT tomographic beamline on the ISIS neutron spallation source.
2. Handover for iterative reconstruction methods built by Barry Searle (about 0.125 FTE) is ongoing.
3. 0.25 FTE has been allocated for extra IMAT/ISIS tomographic dataflow framework integration within the Mantid system.

The Flagship project, with Daniil Kazentsez, was continued until September 2015 to complete a further set of example use cases for iterative reconstruction methods, and we funded a short term fellowship, Nicola Wadson, to create reconstruction code specifically for the Rapiscan Helical scanner (originally for baggage handling and now for experimental research).

Formal links have been made with the recently funded CCP PET/MR that employs similar iterative solutions for positron emission tomography (PET) and magnetic resonance (MR) imaging. This has initially involved shared attendance at Working Groups and a shared secretariat role.

### Highlights for the Current Reporting Period

Core highlights within the CCPForge software repository:-

1. Reconstruction Core algorithms: optimisation work of the iterative code for Diamond data sets has been completed and ownership handed over, with ongoing patches in development, and all available via a ccpforge download.

2. Quantitative visualisation algorithms: new Avizo algorithms including contributions by Erwan Plougonven (Bordeau University) are incorporated and code to correct for beam hardening is available (Queen Mary, University of London / RCaH).
3. Flagship project software outcomes: a final set of code has been being developed to compare algorithms and made available within CCPForge.

The coding work is now producing three different Frameworks for researchers, depending on the imaging system used:

1. Diamond framework 'Savu': Nicola Wadeson is working with Mark Basham and demonstrators are being used in the Diamond Light Source.
2. ISIS IMAT framework: Srikanth Nagella's testbed is now available for linking within a production service: <http://stfc.ac.uk/SCD/research/data/44593.aspx> - research paper and poster have been produced.
3. Avizo framework (University of Manchester): a complete framework is available within the commercial Avizo scientific visualisation system with interfaces for reconstruction code and segmentation.

We hosted our main Annual Event, and had Partner Status at the annual ToScA (Tomography for Scientific Advancement) symposium, which including three days of packed activities with over 120 attendees. This year it was held in the University of Manchester with dinner and poster display within various parts of the Manchester Museum.

### **Outreach and networking:**

Outcomes after the exceptional role in the Cheltenham Science Festival (699 interactive users out of the 13,000+ visitors) has continued with a similar momentum:

1. Presence of the CCPi Interactive Kiosk (now three are available) at conferences and open days include; stand at the University of Manchester's EMiT "EMerging Technology" conference (30 June-1 July); School Visits and RAL Open Days (8-10 July) with 95 school visitors and ~560 public visitors saw various CCP presentations; and 31 October 2015 MOSI (Museum of Science and Technology) stand at the Manchester Science Festival.
2. 31 July 2015 CLF demonstration for HPL results from a set of Vulcan image acquisition experiments.
3. Paper/poster at The IEEE Big Data 2015 conference recently took place at Santa Clara from Oct 29-Nov 2 (Federico Montesino Pouzols, Genoveva Burca, Winfried Kockelmann, Martin Turner, Srikanth Nagella, Derek Ross, and Erica Yang).

Our main annual conference was on 3-4 September 2015 ToScA Symposium number 3: held in Manchester. This is a major event with 120+ attendees and included industrial stands, posters and had a full extra day of training courses.

### **Workshops / Training;**

1. We continue to support training courses within the network, from minor software license management to full training provision: seven courses occurred during this period - FEI at RAL 3 November and gave a short tutorial on Avizo in the AVF (14); Avizo course at Manchester, 3 November (18); 18 September 2015 Brian Bay and Loic Courtois organising a DVC workshop in the Atlas Visualisation Facility (12); 2 September 2015 Avizo training course

- (22); 2 September 2015 Drishti/Prayog training course - New topics and advanced use within version 2.6 (26); MXIF Avizo course at Manchester 18-19 August (10); Diamond Manchester Collaboration et al. Visualisation and quantification of tomographic data 28-29 July 2015 (20)
2. The series of social meetings at RAL (coffee-and-tomography) continues and there have been 27 monthly meetings (total attendance is now at 407).
  3. Developer workshops occur each quarter considering a specific focus; 2 September 2015 hosted a joint open workshop with Avizo quantification and Drishti segmentation; as well as an Interactive Visualisation subGroup meeting.

### **Fellowships:**

Fellowships and Grants: Nicola Wadeson updated work creating source code to make the Rapiscan RTT x-ray CT Machine usable as an experimental system (Feb-May 2015); Daniil Kazantsev extended fellowship (May-Aug 2015) to create new case studies; core staff setup and installed new equipment for visualisation facilities within ICAL (Interdisciplinary Centre for Ancient Life, with Russell Garwood) at Manchester Museum (Aug-Oct 2015); funded the Drishti author Ajay Limaye to visit UK for tutorials (Sep 2015); linked with DREAM.3D "Analysing Data with Ease" author Mike Groeber to give a distributed and recorded presentation (viewed 10 times; Oct 2015); and paid for an exchange trip to Harwell Labs by Antoniu Pop and Graham Riley (University of Manchester) to enable Diamond to act as a case-study for an HPC EPSRC proposal (Oct 2015).

EU involvement: There has been staff exchanges with the EU e-COST programme (EXTREME) with collaborating through workshops and conferences (links through Bill Lionheart, Mark Basham and Daniil Kazantsev). Formal meetings have been extended to specific industrial contacts (see below).

### **CCP and other Network Cross-collaborations:**

The SLA EPSRC funded survey on visualisation user needs is continuing for a second year with new survey announced at: <https://www.surveymonkey.com/r/VLFM7XH>

Linked with a 2-Day Workshop on 'Compressive Sensing and Sparsity: Theory and Applications in Tomography': School of Mathematics, The University of Manchester, 12-13 November 2015. (Organisers: Oliver Dorn and Martin Lotz).

### **Industrial Projects:**

We have a series of industrial connections formed in this period:

1. The TSB (UK Innovate) project (code 37972-241197) for Towards Zero Prototyping programme. The 'In silico evaluation of manufacturing concepts for non-Newtonian products' is a collaborates with Rob Prosser (University of Manchester), Charles Moulinec and Rob Allan (STFC/SCD), Adam Kowalski (Unilever) and CDDMtec aim to integrate computer CFD simulation, with tomographic 3D image capture; that will add the human-in-the-loop with EIT (Electrical Impedance Tomography).
2. License agreement for multi-site is in negotiation with Avizo developers (FEI) involving RCaH (Research Complex at Harwell), DLS (Diamond Light Source), CLF (Central Laser Facilities) and ISIS, as well as coordinated and integrated within SCD/STFC. Multi-token license will include three years access, allowing for multiple permanent virtual reality setup, as well as an AvizoToGo license free facility.
3. Supported an industrial exhibition at the ToScA symposium including North Star Imaging.

4. Linked with the Industrial Tomography Workshop (into2015), a scientific conference organized at University of Antwerp, Belgium, on 4-6 November 2015. The event highlighted industrial needs and expertise: <http://astra.ua.ac.be/into2015> and included a tour of the Bruker (Skyscan) facilities (<http://bruker-microct.com/>).

## Workshops and New Opportunities

Future networking and sustainability opportunities include stronger links with industrial and laboratory based resources. This includes;

1. September 2016 ToScA Symposium number 4 will include further CCPi activities and is to be hosted in the University of Bath. Partnership Status is being applied for.
2. July 4-10, 2016 Daresbury Labs., Open Days including Tomography vis tools from CCPi and CCP PET/MR will be demonstrated.
3. Synergistic workshop planned by Bill Lionheart and Julian Matthews to link the developers' of the two CCP\_PET-MR and CCPi together.
4. Invitation to host a quantitative tomography across multiple scales workshop, has been proposed from other CCPs notable; CCP5 and CCP\_EM.
5. Links with the tomography standards panel (NPL/BSI cttee membership) are to be continued.
6. Training and developer's days are to continue as normal. The next "away-day" developers' day is proposed to be at the Warwick University Manufacturing group - 10 December 2015 and future planned session in Birmingham is planned for 2016 to link with the SESC.
7. A touchtable volume visualisation content discussion mini workshop is to continue with links to the NHM (Natural History Museum).
8. A ParaView training day and software show-and-tell Kitware Inc (Marcus Hanwell) when author of TomView visits.
9. Expand the new data archive community space <https://zenodo.org/collection/user-ccpi?ln=en> and incorporate interactive visualisation within the Drupal website.

## Issues and Problems

There is a still need to foster inter- and intra-networking between the developers group and the user community. We have drastically increased levels of outreach with the Interactive Visualisation subGroup (IVG) but more project and research proposals for core development need to be submitted. Applications for 'good' new Fellowships and exchange visits are difficult and needed.

The next CCPi Working Group meeting is planned to be held in May/June 2016.

Ed. Martin Turner - 06 Dec 2015