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Towards clinical imaging and radiotherapy of human patients: An overview of IMBL techniques and programmes

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The Imaging and Medical beamline provide facilities for imaging, including phase contrast and in vivo movies, computed tomography (CT), including physio-triggered CT, radiotherapy, and with

- samples from 1mm³ to 1m³ and weight up to 100kg
- beam width up to 50cm
- energies from 20keV to 120keV (monochromatic) and 350keV (pink)

It is a unique research tool applicable to many fields, from engineering to life sciences, paleontology to new materials, food science, cultural heritage, volcanology, minerals, industrial processes, and of course in vivo research with translational applications, clinical programmes, veterinary research and other work, especially the study of physiological processes.

IMBL leads the field of large animal imaging by combining robotic positioning with an extensive support infrastructure and an experienced veterinarian on the staff. As many programmes are well established and bringing in new users, we are now concentrating on two new programmes: clinical imaging of human patients and canine radiotherapy.

For clinical imaging we have installed a 'patient positioning system' to be used from 2020 for phase contrast breast CT with human patients. This newly funded programme includes the addition of a beam expander to deliver a 10cm high, 20cm wide beam to our satellite building bunker at 140m. Combined with a high efficiency, large area detector, this new feature will enable new applications of imaging and CT in many fields besides our clinical programmes.

The canine programme will validate the full treatment process - treatment planning, dosimetry and image guided dose delivery - using a broad beam and patients supplied by veterinarians. After validation this process will be reliably established to move to micro-beam radiotherapy treatments to quantify the response of spontaneous tumors to micro-beams and gather long term toxicology data. This work is a critical and necessary step towards validation with human patients.

This presentation will include descriptions of the techniques available on the IMBL, examples of the most exciting work done by users across the fields listed above and an overview of our clinical imaging and canine RT programmes.

Figure caption: Imaging bunker at 140m with the large sample positioning robot, the standard CT stage (middle) and the patient positioning robot.

Primary authors: Dr BUTLER, Duncan (ANSTO - Australian Synchrotron and ARPANSA); HALL, Chris (Australian Synchrotron); HAUSERMANN, Daniel (Australian Synchrotron); KLEIN, Mitzi (Australian Synchrotron); LIVINGSTONE, Jayde (Australian Synchrotron); MAKSIMENKO, Anton (Australian Synchrotron)

Presenter: HAUSERMANN, Daniel (Australian Synchrotron)

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