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Combining 3-D X-ray Velocimetry with ultra-fast tomography at TOMCAT

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The capabilities of the ultra-fast tomography endstation at TOMCAT to visualise the 3-D structure of rapidly moving objects at high resolution, provide also the requirements for the accurate quantitative determination of motion. This is a very important ability in many areas of research, such as in the fields of materials and biomedical science. Whilst visible light velocimetry methods have long been used for the measurement of flow, X-ray velocimetry is a relatively new method. Its primary advantage is the penetrating power of X-rays which allows transmission through opaque samples, and also gives a measurement that is volumetric (rather than planar). Combining X-ray velocimetry with tomography is an even more recent advance. Fast image sequences may be obtained at multiple projection angles, and depending on the rate of movement, statistical cross-correlation analysis and/or more simple particle-tracking algorithms may be used to determine motion in 3-D. Here we present some examples, and the first results of such measurements newly incorporated into the TOMCAT beamline.

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