

### **Three Dimensional X-ray Diffraction Microscopy**

The three dimensional x-ray diffraction (3DXRD) microscope (located at ID11, ESRF) is a unique instrument which combines the use of high energy x-rays generated at a synchrotron source with a "tomographic" approach to acquisition of diffraction data, enabling a fast 3D structural characterization of mm-cm sized samples. The position, volume, orientation, grain boundary morphology, elastic and plastic strain, and structural refinement can be derived for hundreds of grains simultaneously. The spatial resolution is on the order of 2 microns, while diffracting units of sizes down to 50 nm can be observed. 3DXRD microscopy for the first time enables dynamic studies of the individual grains and sub-grains in polycrystals. Hence, it is possible to observe how the structural elements nucleate, grow, deform or transform and in general how they interact with their local environment. The methodology will be presented and the potential applications illustrated by examples ranging from in-situ deformation and recrystallization to phase transformations.