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Imaging and Beyond with High Speed AFM.[1]

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It is now possible to operate Atomic Force Microscopes (AFMs) at speeds of up to 6000 lines per second over scan ranges exceeding 10 microns. For a 100 x 100 pixel image this gives frame rates of 60 frames/second: faster than video rate. This has required small cantilevers, new scanners, new high voltage amplifiers, and a new scan control system. The small cantilevers are from SCL Sensor-Tech (Deutsch-Wagram, Austria). The new scanner is based on a sophisticated system of flexures that constrain the motion of each separate piezo stack to one dimension in a three-dimensional scanner. It has a scan range of 15 microns and a lowest resonance frequency of about 27 kHz. The new high voltage amplifier, built in collaboration with TechProject (Vienna, Austria), can deliver up to 8 amps over the entire output range from 0 to 150 volts with the challenge of having the piezo as a capacitive load. The new scan control system is built around a commercially available DAQ board in a Windows environment. One of the major challenges is now to move beyond imaging to Force-Volume imaging, which involves taking an array of force curves over a sample and then reconstructing a zero force image as well as a map of local mechanical properties.

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