A simple method to cut a single crystal in any desired direction

A simple and efficient method to cut a single crystal of any shape along any desired crystallographic direction with a disk diamond saw without angular adjustments has been developed and used in this laboratory. The crystal plane is aligned in a (horizontal) single-crystal diffractometer by means of the multiple diffraction technique, with error much less than 0.01°. The detector arm is then rotated to coincide with the normal to the reflecting plane and independently around the ω axis, it is easy to align it to be cut along any prescribed non-crystallographic direction.

The method has been used to cut Ge crystals along the (301) plane and rutile (TiO₂) along (201). In both cases the deviation of the final surface with respect to the crystalline plane was about 0.2°, which is enough for most crystallographic purposes. The major part of this error is most probably due to lack of precision of the rotating diamond saw disk (wobbling, parallelism and so on).

Professor M. Hart (1982) has kindly reminded us of the method due to W. Bond (1961). This method is capable, according to the author, of providing finished surfaces with a misorientation of about 2°, orienting them with a diffractometer and grinding the crystal which is attached to a specially designed gadget, provided the initial error of the cut is within 5° of the desired direction. Bond's method could then very well complement the new method described here when a highly accurate cut is needed. Alternatively, a precision wobbling-free disk saw might be able to attain precision similar to that in Bond's method. Finishing of the surface is then achieved by the usual methods.