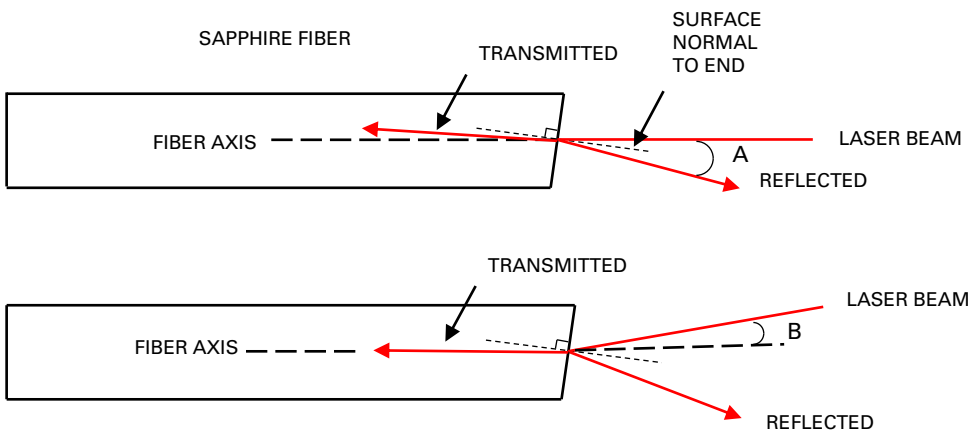
# TRANSMISSION MEASUREMENT

MMI's sapphire fibers are polished to have a surface normal which makes a small angle (a few degrees) relative to the fiber axis in order to minimize the effect of feedback. Thus, if one launches the laser beam so that in air it is co-axial with the fiber (as shown in the top sketch), it will make an angle with respect to the fiber axis once it is inside the fiber as a result of Fresnel refraction. This in effect increases the launch NA, which in turn leads to reduced transmission (see "NA of Sapphire Fiber" PDF file). At the same time one will see a reflected beam that makes an angle A with the incident laser beam. In order to compensate for the Fresnel refraction, one has to launch the laser beam so that in air it makes an angle B (as shown in the bottom sketch) with respect to the fiber axis, which can be calculated from $B = \sin^{-1}[n \sin(A/2)] - A/2$, where n is the refractive index of sapphire at the wavelength of the laser.




Before making the transmission measurement, the fiber should be carefully wiped with a folded acetone soaked lens tissue. The ends may be cleaned by touching them with glue-free cotton swabs lightly soaked with acetone. Finger cots or gloves should be worn while cleaning the fiber. It is recommended that a fiber chuck attached to a 4-axis stage (two translational and two angular) be used to hold the input end of the fiber. It may be supported by a few PTFE rods (or simply folded paper) along the rest of its length. It is helpful to first rotate the fiber by hand to make horizontal the plane containing the incident and reflected beams. For ease of visualization, it is also recommended that a nearly diffraction limited 780 nm laser be used and its beam focused to a spot approximately 30 % of the diameter of the fiber.