Non-sequential ray tracing

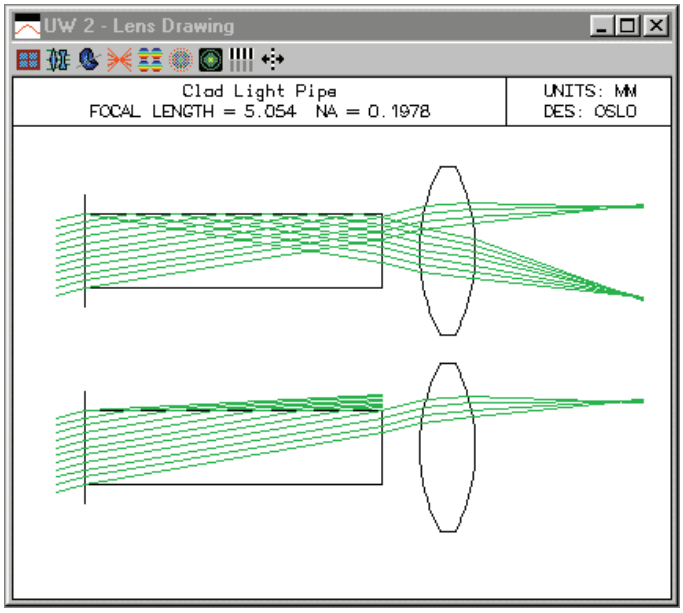
Light pipes/fibers

In general the term non-sequential ray tracing is applied to systems where the ray trace algorithm must decide not only where a ray strikes the next surface, but also which surface of several possibilities is the one actually intersected. A special case of non-sequential ray tracing occurs when a ray strikes the same surface an indeterminate number of times.

OSLO (all versions) contains a special surface for handling a *light pipe* or *fiber,* in which rays enter a tube and repeatedly reflect from the wall until they emerge from the far end. Only a straight elliptical or circular tube is permitted, and the ends of the tube must be perpendicular to its axis. A surface may be extruded to form a rod by entering the command **rod on** at the surface. To disable this feature, use the command **rod off.** Control of this surface property is also available from the Special >> Surface Control >> General spreadsheet.

An extruded surface consists of two parts: (a) the surface defined by the usual specifications, limited by the defined aperture boundary, and (b) the surface generated by *pulling* the aperture boundary in the *z*-direction by the distance specified by the thickness variable, **th**. The effect is to generate a rod shaped object whose cross section conforms to the aperture. If an elliptical special aperture is specified, this is used to define the cross-sectional shape of the rod. Otherwise, the circular aperture specified by the **ap** command is used.

The glass specification for the surface defines the medium of the rod. Normally, rays are confined to the interior of the rod by total internal reflection (which may take place several times before the ray encounters the next surface). If a ray exits the rod by refraction, it refracts into the original incident medium. The rod is terminated by the next surface in sequence.



All of the usual ray trace commands are available for systems employing light pipes. However, for single ray tracing, only the ray data for the entrance and exit faces is displayed, and much of the other ray trace data (e.g., ray-intercept curves) is essentially meaningless because of the variable number of reflections in the light pipe.

Although the light pipe routine in OSLO is a form of non-sequential ray trace, it differs in that it does not take into account the fact that surfaces have two sides. There is no way, for example, in the above trace to have light re-enter the core from the cladding. Light that is lost into cladding is normally blocked at the far end of the pipe by using a checked aperture, as shown above.