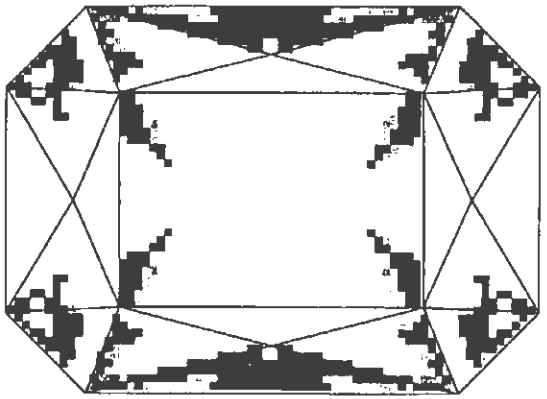

Fig.1 BRIGHTNESS PLOT Design 4.101A
Average Brightness 80
Main Angles 41.0 P / 37.0 C
Corner Girdle Indexing (12-36-60-84)

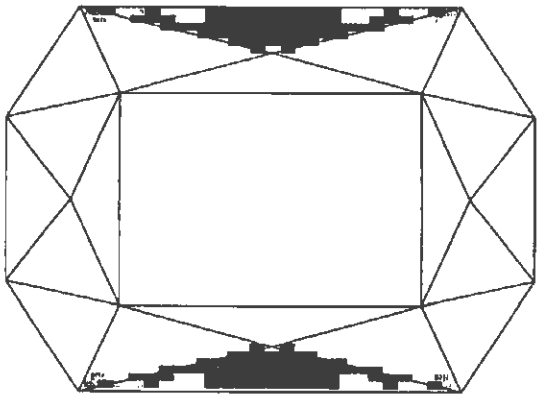

Fig. 2 BRIGHTNESS PLOT Design 4.101
Average Brightness 89
Main Angles 41.0 P / 37.5 C
Corner Girdle Indexing (15-33-63-81)

CUT-CORNER RECTANGLE DESIGN PROBLEM

by Robert H Long

One of the problems frequently encountered with a cut corner rectangular facet design is the presence of dark bands approximately 1/3 of the way in from each end of the cut stone. We decided to use the analytical capability of ray tracing to find the cause and if possible eliminate these dark areas. Although we had noticed the effect on several categories of design when L/W exceeded 1.00, *Cut-corner rectangles* seem to consistently show the problem, so it was the category tackled first.

The cause of the dark areas immediately became evident. Since the corners are usually cut with an index that gives a 45 degree angle, the *associated facets on opposite corners are not aligned and do not constitute a mirror pair.* Such facets will only be perfectly aligned on a square design. On an elongated design the rays are reflected off the corner facet and across to a facet with some unrelated indexing. The ray bounces around inside the stone a few times, and then exits from the pavilion. It is only in very unusual orientations that these non-aligned facets permit light rays to exit thru the crown.

The obvious solution to the problem is to try to align the opposing corner facets. This requires using indexing for the corner facets different from that which produces 45 degree corners. Ideally the corner facets would have a *direction perpendicular to the diagonal of the basic rectangle* before the corners have been cut and with a *CED sufficient to make the girdle segment of the corner facets symmetrical to the diagonal.* This is a function of L/W and the decision of whether the simple ECED cutting sequence is to be used or not.

To verify that this analysis could lead to a design improvement in the special case of an ECED design, I prepared a pair of simple L/W=1.40 cut corner rectangle designs with essentially the same design pattern, except for the adjustments needed to compensate for different corner facet indexing. These were then checked with raytracing (BRIGHTNESS PLOTS).

For a stone with an L/W = 1.4 the indexing for the corner facets was set at 15-33-63-81 (96 Index Gear) rather than the customary 12-36-60-84. It was possible to use an ECED END cutting sequence with either indexing. A BRIGHTNESS PLOT comparison of these designs is shown in Figures 1 and 2.

Figure 1 the BRIGHTNESS PLOT for design 4.101A shows dark areas in the corners as well as the "dark bands"and an average 80 brightness value.

Figure 2 the BRIGHTNESS PLOT for design 4.101 NOBANDS (so named because it proved to almost free of the troublesome bands) shows clean corners and complete absence of the "dark bands"along with an 89 average brightness. This is a significant improvement compared to the 45 degree corner version (4.101A).

Cutting instructions for Design 4.101 NO-BANDS is shown on page 1.