As a final result for the set of cutting angles chosen, a graph similar to the one in Fig. 2 is produced. Here the brightness of the table and the total brightness of the crown have been plotted as a function of the angle "w", between the direction to the observer and the symmetry axis of the gem. For the situation that the light falls from all sides on the stone, brightness values are also shown in the graph. This simulates viewing of a gem outdoors with light from a bright sky or indoors when many light sources are present. This kind of light is similar to what physicists call "isotropic" light. In the graphs the relevant values are labeled "iso". I think that the brighteners in the light of one lamp and those under "iso" light together will describe the brilliance quality of a gem adequately!

Now for the results. In Fig.2 the data for the Standard Quartz Brilliant (with the angles normally advised) are shown. In Fig.3 similar data can be found, but now for a larger table size (60%) and a lower crown mains angle (30^{0}). The results are slightly better in the latter case. Stones were cut with these angles and the results were not contradicting the calculations. Therefore I would now recommend to use a crown mains angle of 30^{0} and a table size of 60% when making quartz brilliants! Of course the "fire" might be somewhat less but fire can hardly be noticed in quartz anyway.

In Fig.4 results for a Cubic Zirconia Standard Brilliant are given. Of course many runs were made with other sets of pavilion and crown angles, but in Fig.4 the best results obtained are shown. In the first place the difference with quartz is evident: the brighteners are higher, certainly so when looking under large angles with respect to the symmetry axis. And when lit with more lamps (see "iso" light) the brighteners are much higher as well. For CZ the influence of the table size is remarkable: a small 40% table shows the best performance. Again stones with the set of angles of Fig.4 were cut and it was surprising to see the improvement that could be obtained. In Fig.5 the results for a diamond brilliant are given: they are not much better than those for CZ. Many other angle combinations have been tried but they did not give better results. Larger table sizes are less favorable here as well.

Also the Square Barion Cut as mentioned in Vargas & Vargas, Diagrams For Faceting Volume I, page 150 was investigated and the best results for quartz are shown in Fig.6. As already mentioned by Vargas, the brilliance is better than that obtained by the Standard Brilliant Cut. It should be pointed out, however, that it is important to have only small "cut corners". It was found that a corner cut of about 10% gave the best results. The results for this Square Barion Cut were also calculated for CZ, but surprisingly the results were always worse than those obtained with a CZ brilliant: no sets of angles, etc. could be found to obtain better results. More work has to be done to see whether another shape would be of advantage. This takes time, however, as with my existing computer (which is a very fast home computer) it takes 5 to 10 hours for a complete output run for one set of angles for one particular cut (involving 30,000 to 40,000 ray paths). On other more sophisticated computers this time may be shorter, however.

Anyway, I believe that applying such computer studies is a considerable, quantitative, help to optimize cuts or to find new and better ones. I hope that the results shown will have convinced you as well.

Note: Pieter G. vanZanten lives in Reithoven a village in south central the Netherlands. He has a doctorate in Physics and a deep interest in lapidary. He is now retired from the industrial giant Philips Electronics. When he was active in industry he was internationally involved with development and engineering of products like TV-broadcast, camera pick-up tubes, image intensifiers, night viewing devices etc.

He is a past President of Z.N.L.V. (South Netherlands Lapidary Society) which conducts an annual Mineral Show, has classes in cabochon cutting, carving, faceting , and silversmithing.