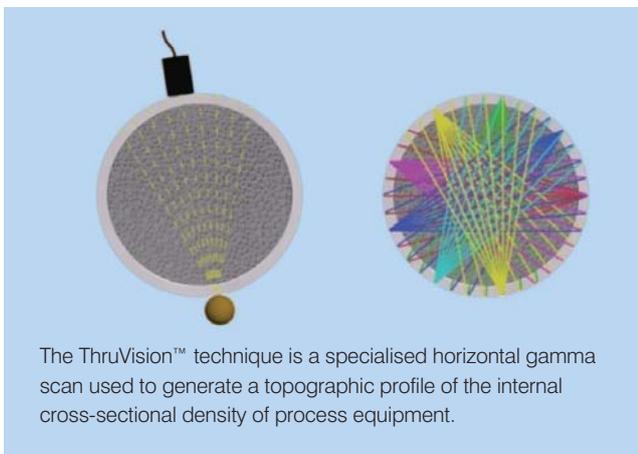


Packed Column - Distribution

A challenge to process engineers is diagnosing liquid maldistribution problems inside packed beds that can cause severe mass transfer efficiency loss. In industrial distillation columns, common examples of the cause of liquid maldistribution are design, manufacture or installation defects of distributors as well as damage, plugging and process disturbance of packed beds.

The first step to determine liquid maldistribution in a packed column is to perform a Tracerco Tru-Grid™ Scan to provide an initial look at the liquid distribution in the packing. (Figure 1) A grid scan consists of four equal-distant chords, one through each quadrant of the tower. Under ideal conditions and uniform liquid loadings, each scan plot will overlay closely with all others. If more quantitative information about liquid distribution is desired or if there is reasonable suspicion that the bed is experiencing annular liquid maldistribution then a ThruVision™ scan is recommended.

The ThruVision™ technique is a specialised horizontal gamma scan used to generate a topographic profile of the internal cross-sectional density of process equipment. This profile is useful for the detailed study of liquid flow distribution through packed columns as well as having applications beyond distillation columns.



The ThruVision™ technique is a specialised horizontal gamma scan used to generate a topographic profile of the internal cross-sectional density of process equipment.

Project Field Test

A petrochemical plant had just performed a major revamp of one of their most critical distillation towers. This tower was over 45m tall, more than 6m in diameter, and contained several large beds of structured packing. The scope of the revamp included removing all of the old distributors and packed beds and replacing them with a more efficient design.

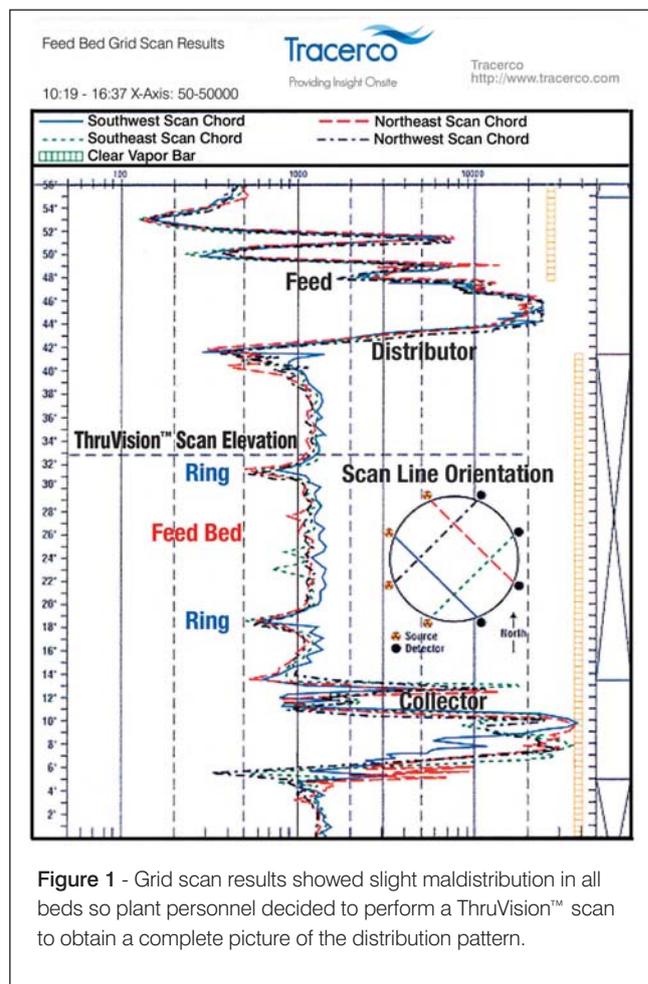


Figure 1 - Grid scan results showed slight maldistribution in all beds so plant personnel decided to perform a ThruVision™ scan to obtain a complete picture of the distribution pattern.

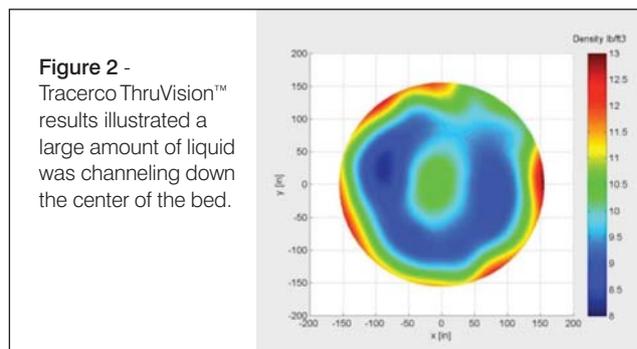
Upon start-up, the tower was unusually unstable. The customer could not increase the feed to design rates while maintaining desired product quality. Both the overhead and bottoms products were off specification, even when the tower was running at reduced rates.

The first diagnostic step taken by plant personnel was sample analysis. Samples were collected at each packed bed, and the analysis of these samples indicated that all of the beds were performing poorly. What could not be determined by the samples was the reason that the beds were performing poorly. One possibility was liquid maldistribution through all beds. If the liquid distribution was good, then the packing was falling well short of its designed efficiency. Another possibility was that some type of mechanical damage might have occurred during start-up.

In order to help diagnose the cause of the problem, Tracerco was called. The first step was to perform a Tru-Grid™ Scan of this tower. The results of the grid scan showed that all distributors, collectors, and packed beds were in place with no evidence of mechanical damage. (Figure 1) The grid scan also showed slight liquid maldistribution in all of the beds, but it did not appear severe enough to cause the very poor efficiency of the tower. Liquid maldistribution had been strongly suspected and since the Tru-Grid™ Scan indicated that maldistribution could be an issue, plant personnel wanted to get as complete a picture of the distribution pattern as possible. In order to obtain a more detailed liquid distribution profile a ThruVision™ Scan was performed. The most advantageous place to perform a ThruVision™ Scan is as near the top of the bed as possible (shown in Figure 1).

Project Analysis

The Tracerco ThruVision™ Scan results (Figure 2) showed that a large amount of liquid was channeling down through the centre of the bed. This was not detected by a Tru-Grid™ Scan due to its pattern as all chords showed similar density profiles. This confirmed that a liquid maldistribution problem, rather than poor packing performance, was the cause of the efficiency reduction in the tower.



Customer Conclusion

With the information provided by the Tracerco scans, plant personnel decided to shut down the tower and inspect the liquid distributors. Upon inspection, an error in distributor installation was discovered. This error was causing a large portion of the liquid to channel down the center of the packing. The problem was corrected, and the tower was restarted without incident. The tower was pushed to maximum design rates, and the desired separation efficiency of the new packing was achieved.

For further details email: process.diagnostics@tracerco.com or visit: www.tracerco.com/processdiagnostics

For our worldwide offices: www.tracerco.com/processdiagnostics/our-people