

# Crucial control for (ultra) lightweighting

Paul Schreuders argues that any variation of loading position should remain within +/- 2mm to make (ultra) lightweight bottles. Current practice is still far from this situation, however.

**G**lass container manufacturers throughout the world face some important challenges:

- Living up to customers' expectations, which are continuously moving towards lower costs and higher quality.
- Remaining competitive, among one another but most importantly among manufacturers of other packaging materials like cans, cartons and PET.
- Contributing to the environmental needs of lowering energy usage and (carbon) emissions.

In this context, the industry is slowly working towards using less glass for a bottle, while making the bottle stronger. To date, although some successes have been realised overall, weight reduction is a slow process and one that generates many negative impacts. In most cases, while weight has been reduced, production speed and/or pack rate decreased, making the (ultra) lightweight bottle more expensive. Moving forward in this direction will not

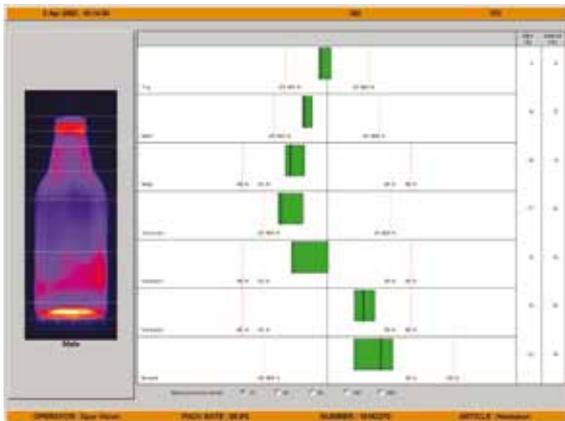


Figure 1: Vertical distribution, with less glass in the upper part and more glass in the lower part.

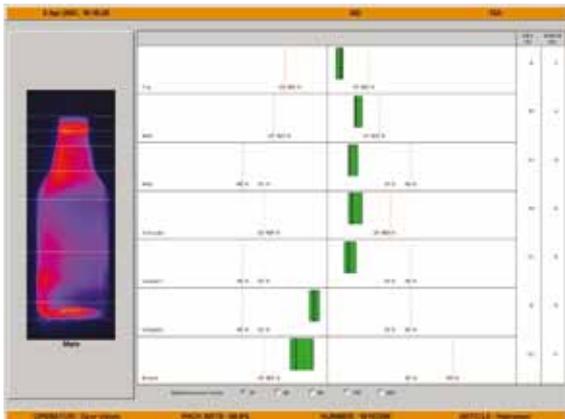


Figure 2: Vertical distribution, with more glass in the upper part and less glass in lower part of the product.

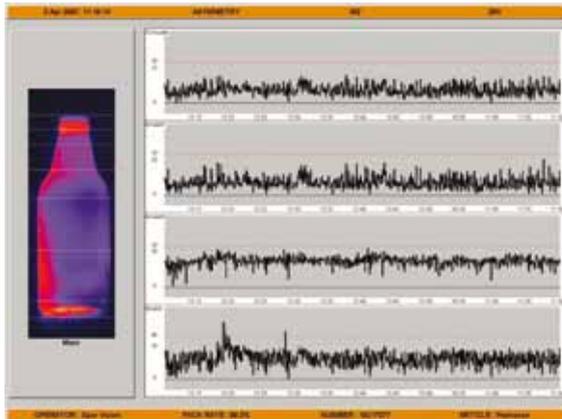


Figure 3: Example of horizontal distribution.



Figure 4: Example of horizontal distribution, with low strength characteristics.

help the glass container industry to face its challenges. On the contrary, in the long run moving forward in this direction and using the same process capabilities will kill the industry; Japan is a good example.

The challenge, therefore, is to reduce the weight of the product, while improving strength levels and not losing out on production speeds and/or pack rate. In this respect, among others (eg glass homogeneity), even and controlled glass wall distribution is of the utmost importance. Controlled glass wall distribution implies measurement and steering.

## CONTROLLED WALL DISTRIBUTION: MEASUREMENT

With the XPAR Vision InfraRed Dual camera system (IR-D), every product is measured just after the forming machine. Besides visualising

critical defects (inspection), the IR-D measures glass distribution (horizontally and vertically) in terms of variations in intensity and asymmetry of every product made. Tolerance settings are created for every product type, according to customer requirements. These tolerance settings (warning, alarm and reject) are the basis for measurement and thus steering.

## EXAMPLES OF INTENSITY AND ASSYMETRY VARIATION

Figure 1 provides an example of vertical distribution, with less glass in the upper part and more glass in the lower part. In comparison, figure 2 shows more glass in the upper part and less glass in lower part of the product.

Assuming that there are no surface irregularities for both bottles, >

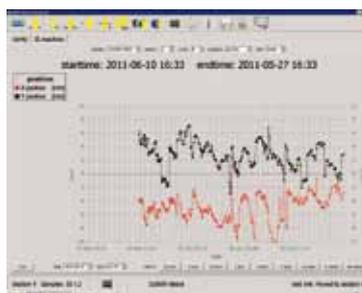


Figure 5: Gob loading performance of a 'well organised' production line in terms of position (left) and speed (right) over a two week production period.

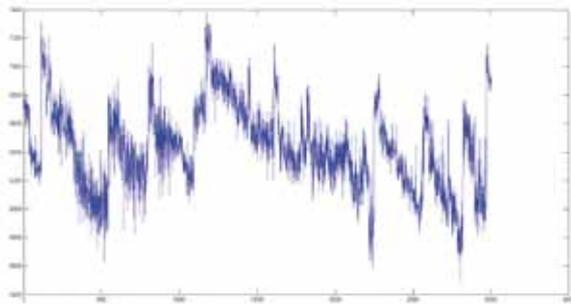


Figure 6: Gob speed variations.

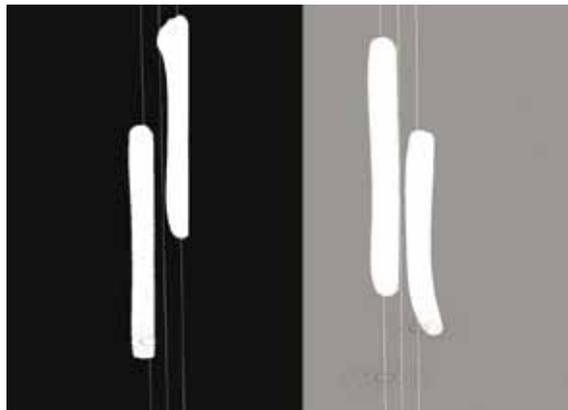


Figure 7: Examples of strange gob shapes due to bad alignment and condition of the deflectors.

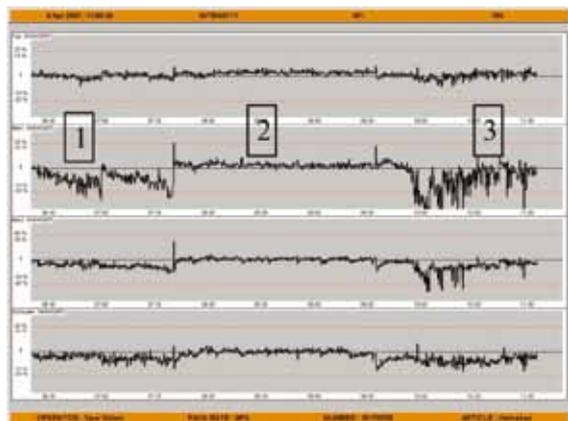


Figure 8: (1) loading is not perfect, (2) loading has been optimised and (3) status has been re-adjusted to bad loading.

the bursting strength of the bottle shown in figure 2 will be lower due to the thin(ner) base (assuming that the highest tensile stress is in the base/heel).

Figure 3 provides an example of horizontal distribution, where the right side of the bottle has less glass (expressed in % asymmetry). Figure 4 shows a low strength example that could represent a potential customer complaint.

### CONTROLLED WALL DISTRIBUTION: STEERING

Glass wall distribution has vertical and horizontal dimensions. Both horizontal (circumferential) and vertical glass wall distribution are highly influenced by gob loading into the blank mould. Controlled glass wall distribution requires controlled gob loading into the blank mould. In turn, this requires measurement (and steering) of the gob loading process.

### CONTROLLED GOB LOADING: MEASUREMENT

XPAR Vision's Gob Assist (GA) monitors the speed, length, position, shape, orientation, time of arrival and trajectory of gobs falling into the blank moulds.

Via customer trials, it has been concluded that speed and position are highly critical parameters for controlled horizontal glass wall distribution and that a change in speed results in a change of position (and as a result as an SOP, which causes a change in gob speed, which should always be followed by a gob position correction).

### GOB LOADING: CURRENT PRACTICE

Through customer trials with the Gob Assist, XPAR Vision has gathered quantitative information on how the gob loading is (negatively) affected, for example, by delivery system alignment, operator intervention, ambient temperature, worn equipment (deflector, trough), different sections (IS machine construction), swabbing etc.

Nowadays, the gob loading performance of even a 'well organised' production line shows huge variations of position and speed during loading (position deviation in a range of 10mm).

Figure 5 shows the gob loading performance of a 'well organised' production line in terms of position (left) and speed (right) over a two week production period.

Figure 6 shows variations of gob

speed (the deflector is frequently swabbed by the operator but the effect changes rapidly). This swabbing action will cause extra variations in glass distribution, while a speed change will cause a position change; the position is never stable or ideal.

Figure 7 gives examples of strange gob shapes due to bad alignment and condition of the deflectors. Without a camera system, these shapes will cause problems and are not understood by glassmakers. The normal measurement system of the glassmaker 'the human eye' can never spot such problems.

Using Gob Assist, the three elements of figure 8 illustrate positions where (1) loading is not perfect, (2) loading has been optimised and (3) status has been re-adjusted to bad loading. Speed change results in position change are presented in figure 9.

### GOB LOADING VERSUS GLASS DISTRIBUTION

Via experiments with Gob Assist in relation to the InfraRed Dual camera system, the relationship between loading and glass distribution has been analysed. Through these experiments, XPAR Vision has proved that a change in loading position of more than +/- 2mm has a significant negative effect on (horizontal) glass distribution.

### CONCLUSION

In the knowledge that a change in loading position of more than +/- 2mm has a significant negative effect on glass distribution and that the current practice involves loading results of up to +/- 10mm, it should be concluded that a lot can be gained. Moreover, nowadays and with Gob Assist, a tool is available that allows for measurement and steering of loading position within a range of +/- 0.25mm.

Using IR-D and GA allows glass container manufacturers to make step-wise changes towards (ultra) lightweighting, without losing out on other critical variables, such as speed and pack rate. ■

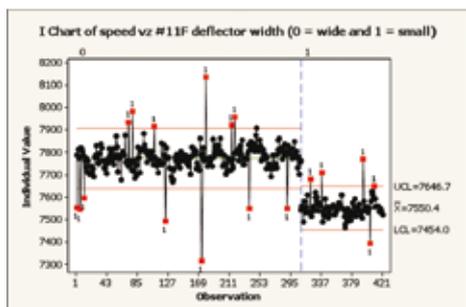
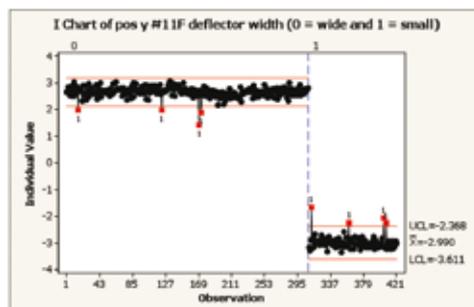


Figure 9: Speed change results in position change.



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