VOLSCAN PROFILER OVERVIEW

Rapid Volume and Density Measurement

Stable Micro Systems

Introduction: Bakery Products

Loaf volume is the principal component of, and is of paramount importance to, bread quality evaluation.

This is a vital aspect of the consumer's perception of value, because in bread and other leavened goods, higher volume – for the same weight – is invariably associated with more aerated crumb and superior texture.

For a baker or bread manufacturer, each batch of flour has to be evaluated by test baking to ensure that bread is made to a uniformly high quality.

One component of this quality control is measurement of the volume of the bread, which can give information relating to the density of the bread crumb and the strength of the gluten in the flour. Lack of volume generally indicates the use of a weak flour, or one low in enzyme activity. A very strong flour may also produce a loaf of small volume, which would indicate the need for a longer fermentation period during which the gluten would become ripened and so more extensible.

This volume information can then be used to modify the dough mix used in bread production, in order to produce bread of the appropriate quality. This procedure is important, not only for the inherent qualities of the bread, but to ensure that the selected dough-piece weight produces a loaf of the correct size for the standard tins used in the baking process. The baked product must also be capable of being handled by automatic slicing machines and packed into standard sized bags.

It is therefore important to have a precise and rapid method for the measurement of the volume of bread loaves, enabling control and monitoring of bread-making conditions and manufacturing operations.

Typical location of a sample

Alternative traditional bakery methods

Traditionally, volume measurements have been obtained by the technique of seed displacement, in which the amount of rape seed or pearl barley packing around the loaf in a standard container is measured.

However the following drawbacks which affect the efficiency, accuracy of the measurement and usability are commonly known in the baking industry:

- Repeated calibration necessary
- Operator dependence
- Loss of rapeseed due to spillage (and therefore seed all over lab floor)
- Adherence of seeds to the product or to static electricity
- Seed clumping due to moisture absorption
- Periodic sieving of the seed to remove food crumbs
- The potential crushing of freshly baked or soft products
- The inability to test small products (results are reported to be +/-40ml
- The limitation of recording one measurement only (i.e. volume, with no other dimensional analysis)
- Manual recording of results with no digital record

Seed used in displacement technique

Introduction: Other Materials

The measurement of density is necessary in the manufacture of many of today's products.

It is an extremely valuable and reliable tool to characterise the structure and quality of solid materials quickly and routinely, such as glass, plastics, ceramics, foams, minerals, cements, resins, food products and many more. Density measurements guide the formulation process and influence the overall quality of manufactured products.

A change in density can be the result of an altered material composition or the presence of a defect or void. It is often beneficial, for performance or cost saving reasons, to reduce the weight of products whilst maintaining the overall physical size of the product. The density of porous materials is affected by the quantity and size of pores. In fact, manufacturers often attempt to develop materials that are partially porous but still fulfil their technical function; however, this porosity can often affect other material qualities such as integral strength and therefore the accurate measurement of density is important. In such products as home insulating materials, the presence of closed air bubbles is desirable.

On the other hand, automobile and furnace filters require an open cellular structure. However, in products such as ceramic, concrete, frost resistant roof tiles and laminate structures, prevention of porosity is crucial to their structural integrity. Manufacturers can inspect both closed and open cells and the presence of unwanted voids in a product by measuring their density. If a decrease in density from a reference value is spotted, this can indicate a void within the product. An increase in density, on the other hand, may indicate that a process – such as a polymer approaching its crystalline state – is optimised.

Density and dimensional measurement of example materials

Alternative methods for other materials

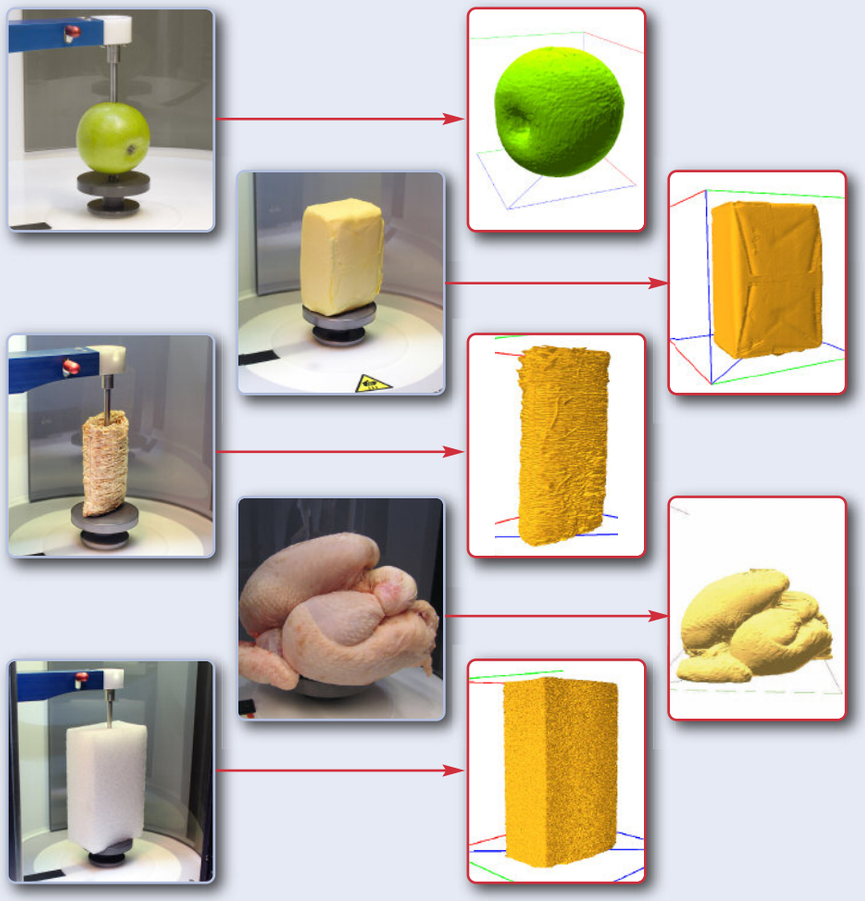
Amongst the many displacement techniques each has a restriction for volume measurement.

Fluid displacement techniques are not suitable for porous materials. Mercury displacement techniques represent a toxic risk to the environment and are therefore illegal in many countries. Gas displacement techniques usually measure very small samples or otherwise attract a high instrument price.

Besides offering rapid 3-dimensional digitisation of products, laser-based volume measurement has the ability to measure objects that, due to their texture, porosity or size, is not possible with displacement techniques. Soft, thin, or brittle products with vulnerable structure that could be easily altered by the compressive or wetting nature of displacement techniques are easily mounted in the instrument by a variety of support options.

Whilst X-ray techniques are also available they are expensive and present a health and safety issue and therefore require fully trained operators. The *VolScan Profiler* uses an eye-safe laser and therefore is the safest procedure for density determination. It also gives the most comprehensive set of dimension-based parameters available, with the largest measurement envelope in its class.

Why settle for a measurement technique that gives only one value? The *VolScan Profiler* gives the most comprehensive set of dimension-based parameters available, that can be visually shown in 2D and 3D and then digitally archived for future retrieval in a variety of data formats.



Density and dimensional measurement of example materials

Advanced Volume Measurement

VolScan Profiler – allows measurement, analysis and comparison

The *VolScan Profiler* is a benchtop laser based scanner that measures the volume of bread and bakery products with maximum dimensions of 600mm long and 380mm diameter, with a typical test time of less than 60 seconds.

Instead of just assessing the a single volume measurement as with displacement methods the *VolScan Profiler* has the ability to automatically calculate an additional 19 related parameters, such as height, width, length and weight.

It also enables the rapid 3-dimensional digitisation of products which can be archived and then treated mathematically to yield detailed dimensional information for immediate use or future retrieval.

This instrument rapidly provides the accurate data essential in the fields of both Quality Control and Product Development.

Location of sample ready for testing

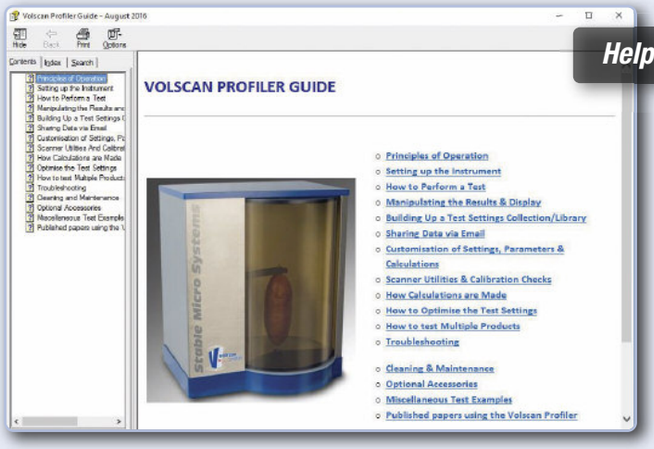
Archived scan of sample

How the *VolScan Profiler* test works

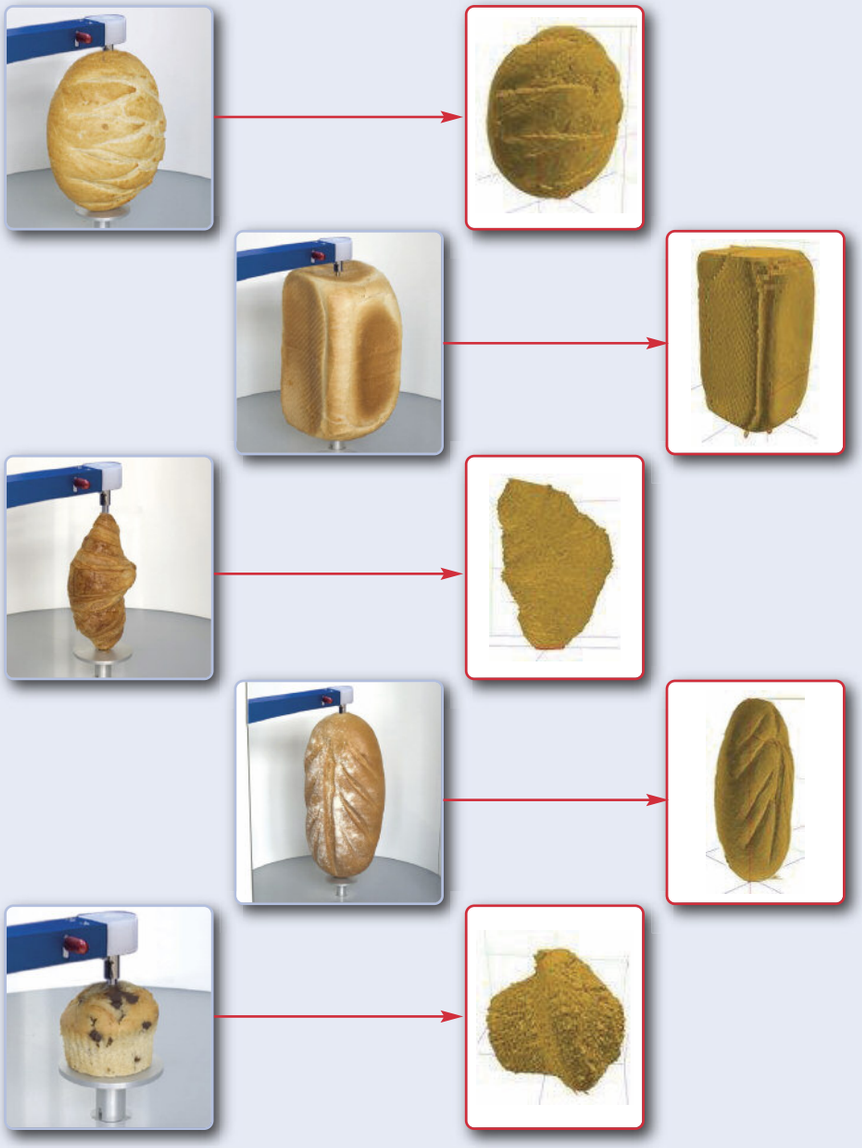
The product is speared at each end or located by a suitable mounting device tailored to the specific product.

Parameters for each batch under test which are entered into the software by the operator include: sample ID name and date. The product is then automatically weighed and an eye-safe laser device is scanned vertically to measure the contours of the product at selectable intervals whilst it rotates.

Each interval consists of 400 data points providing a detailed profile of the product. This assessment can be done rapidly, the results being obtained in a period ranging from a few seconds to a few minutes depending upon the chosen interval (0.05mm to 50mm) and the preferred precision.



Help file screen



Various bakery product samples

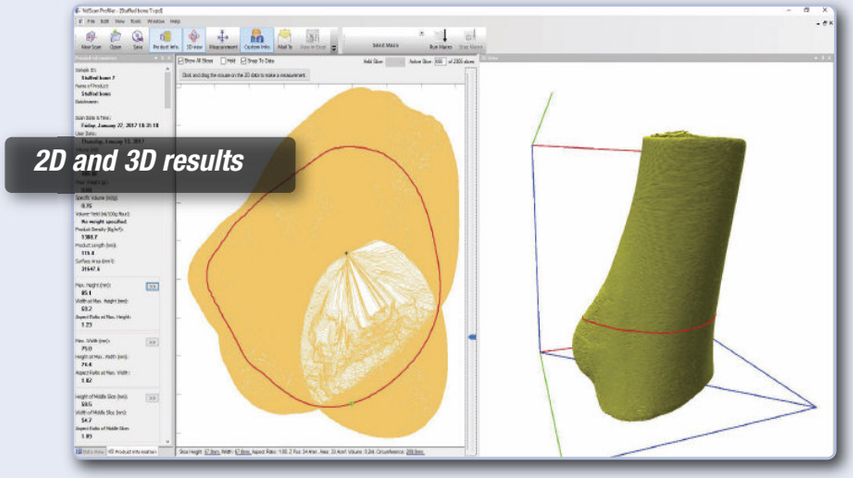
Data analysis, manipulation and viewing options

Due to the samples being scanned by the laser in a linear manner, the mounted sample can be analysed in 'slices'.

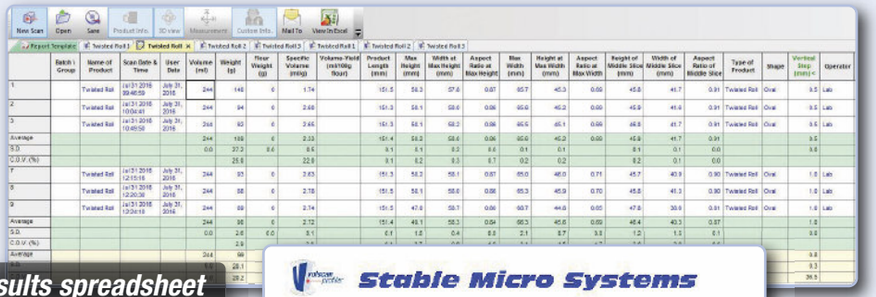
This means that every measurement step increment possesses data and statistics of its own such as circumference, average radius and minimal enclosing circle. This provides more detailed dimensional analysis than any other similar measuring instrument.

All data is saved in spreadsheet files for easy access and analysis.

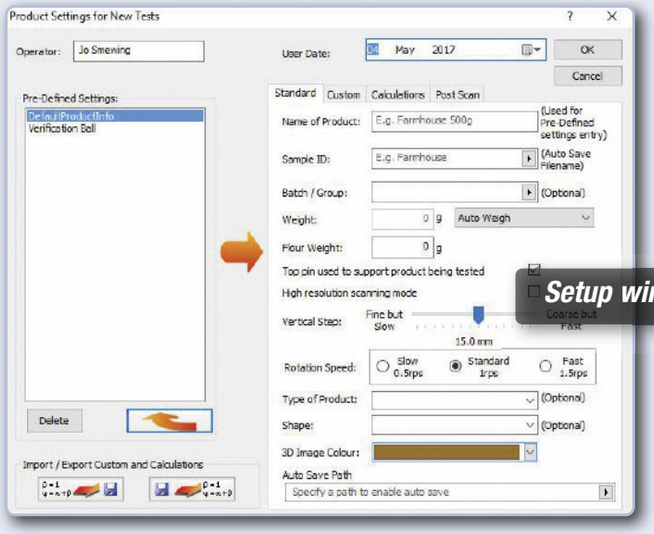
The scanned data can be viewed in both 2D and 3D representations to allow comparisons with previous archived measurements. Within the 2D sectional view, additional manual measurements can be made on chosen intervals. 3D views of the product are rotatable in all planes providing flexibility of viewing for visual comparison and presentation.



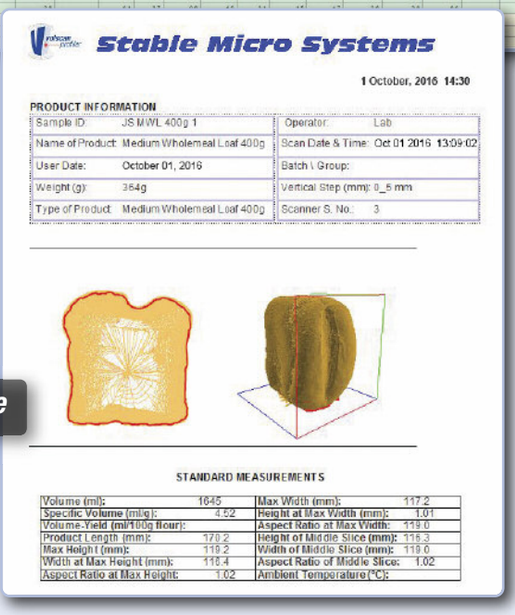
2D and 3D results



Results spreadsheet



Setup window



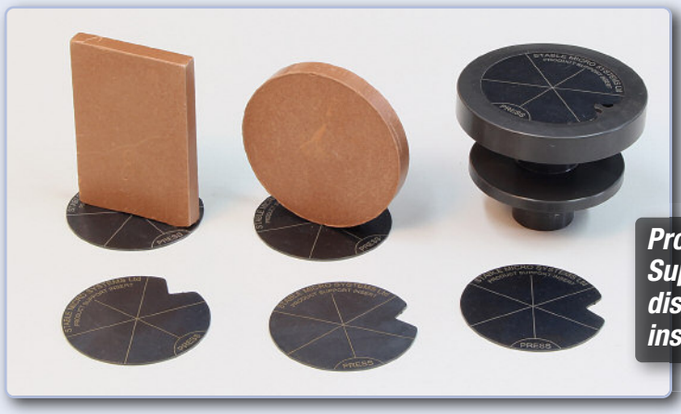
Standard Report template

Product Support options

As the *VolScan Profiler* provides the largest sample testing envelope[1] in comparison to other laser volume measuring instruments, the scope of potential test samples extends much wider.

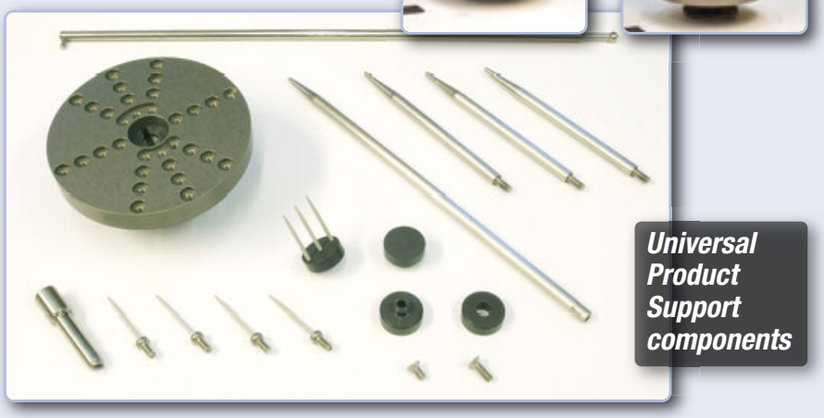
The choice and configuration of spikes and skewers (examples shown below) for product support depend on the dimensions and texture (e.g. brittleness, softness), weight, centre of gravity and contact area with the base. The aim is to provide vertical stability without damaging the sample structure and thereby allowing an accurate measurement of its dimensions and volume to be recorded during the test. For customers who are looking for ways to support solid materials, or types of products, that cannot be supported by an array of spikes they can choose to have an additional alternative product support which accommodates circular disposable inserts magnetically. These provide the means to 'adhere' their sample to the insert and allow for quick removal and replacement between tests. Disposable inserts are provided in batches of 50 and may or may not be reusable, according to the chosen adhesive for sample anchoring.

A few examples of various products, with their differing recommended support arrangements, are shown below.



Product Support – disposable inserts

Universal Product Support examples



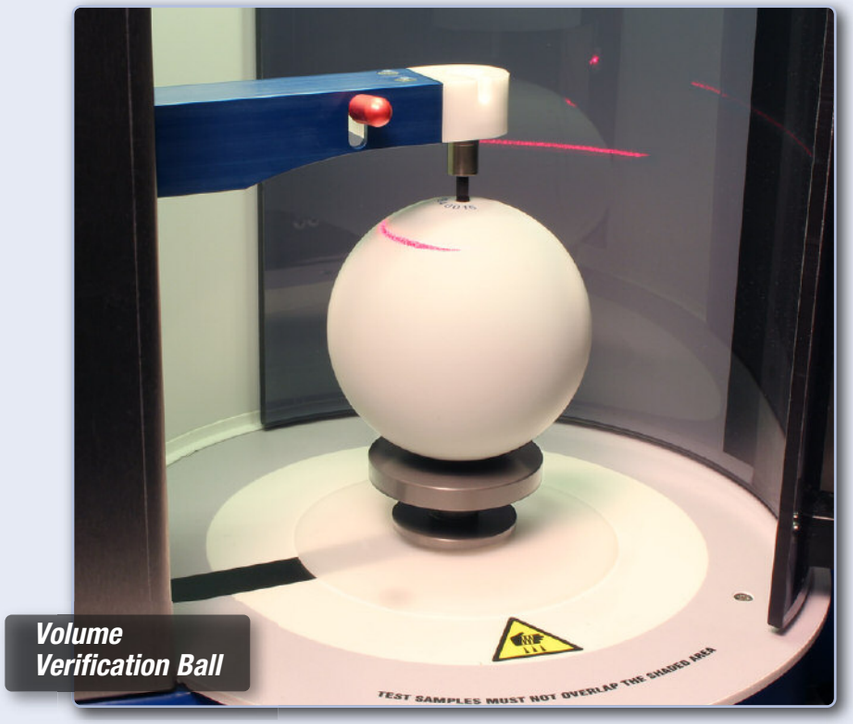
Universal Product Support components

[1] Maximum product height 600mm; maximum product diameter 350mm

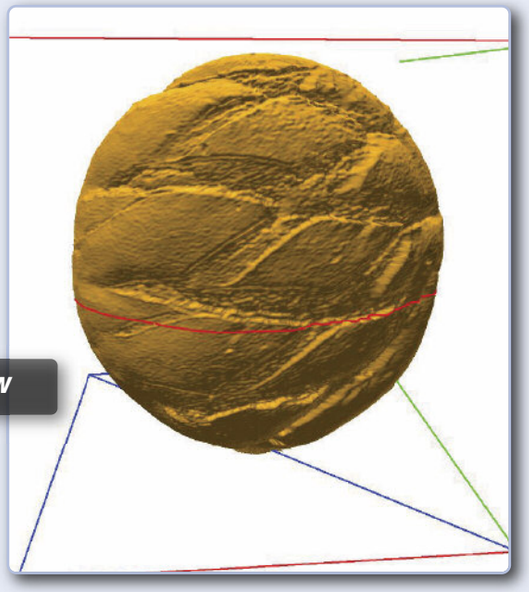
Unique Features and Benefits

A summary of reasons why you'll benefit from using the *VolScan Profiler...*

- **Leave old operator-dependent displacement techniques behind** and say goodbye to inaccuracy, mess and frustration. The *VolScan Profiler* enables the rapid 3-dimensional digitisation of products which can be archived and then treated mathematically to yield detailed dimensional information for immediate use or future retrieval. Why measure Volume alone, when you have the ability to automatically calculate 19 related parameters?
- **Check and Verify your *VolScan*** – a measurement is only worth performing if it's accurate. This is why you'll want to have control of instrument calibration and the means of verifying that the instrument is measuring accurately by testing a *Known Volume Verification* ball. The instrument will verify that the ball correlates with the measurement values as provided by the manufacturer, so that you can continue your product testing feeling confident that your instrument performance has been checked.
- **Fully rotatable test files** – to appreciate the scan detail in every plane. The scanned data can be viewed in both 2D and 3D representations to allow comparisons with previous archived measurements. Within the 2D sectional view, additional manual measurements can be made on chosen intervals. 3D views of the product are rotatable in all planes providing flexibility of viewing for visual comparison and presentation.

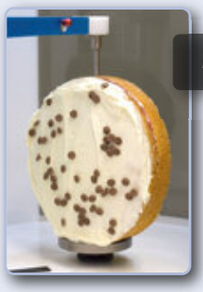


Volume Verification Ball



Rotatable 3D view

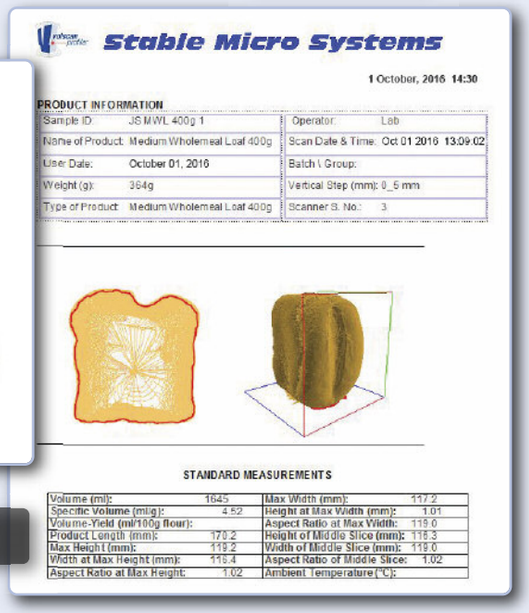
- **All of your data in one place** – provided by a built-in spreadsheet for data collection and statistical manipulation. There is no need to export data to another spreadsheet program, as the *VolScan Profiler* software has its own integral spreadsheet, but *Exporting to Excel* is also an available option if preferred.
- **Presentation of your results** – a report template is available into which your data can be dropped and automatically positioned with test data fields or modified using full *Report Editing* tools. Alternatively, images and data can be copied and pasted into other applications.
- **Barcode Scanner compatability** – allowing quick product information entry and reducing user error. This device would attach via the USB port on the PC.
- **Choice of Rotation Speed** – for heavy soft samples (e.g. sandwich cake) or delicate samples, the centrifugal force created during the rotation can distort the sample or cause it to fragment or wobble and therefore a slower rotational speed is recommended. The fast speed provides the quickest scan times, but can affect the integrity of some products and produce less accurate results.
- **Stacking products for faster testing** – by customer request, we implemented a means of testing multiple products simultaneously, followed by post-test analysis of the data of each sample piece. One such example is in the testing of multiple bread rolls, the objective being to save time, to give an average volume and weight and then create individual scan files of each roll.
- **Operate in another Language** – using the *Language Editor*.



Heavy soft sample

Multiple product scan

Barcode scanner



Detailed Report

VolScan Profiler Marketplace

- **Research and development**
- **Quality Assurance**
- **Process Control**
- **Academic Research**

The *VolScan Profiler* is a precise and rapid method for the measurement of the volume, density and dimensional profiles of solid products in order to:

- Determine the effects of ingredients, formulation or processing variables on end product dimensions
- Characterise the structural integrity and quality of solid materials quickly and routinely from density measurement
- Determine the dimensional properties of your 'gold standard' product for future consistent quality control
- Assess dimensional changes during storage or transportation
- Substantiate your product claims
- Compare with competitive products
- Provide an objective quantifiable result which can be archived and retrieved for future viewing should you ever need to check back and compare with historical data

VSP600

VSP300

Two models are available

Why Buy a Stable Micro Systems *VolScan Profiler*?

The *VolScan Profiler* sits comfortably within a market place in which Stable Micro Systems are already established measurement experts.

The measurement of volume provides a complementary product and diversifies the range of measurement options that Stable Micro Systems already have – such as the TA.XT*plus* for texture analysis.

As with all Stable Micro Systems products, the instruments are supplied with lifetime application and technical support.

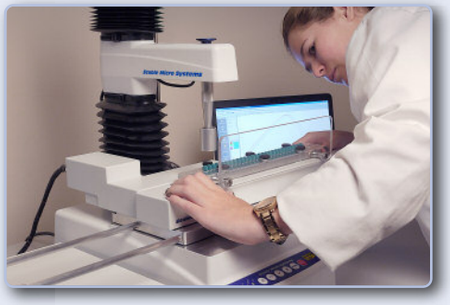
AACCI Approved Method 10-16.01

The *VolScan Profiler* has been awarded the certificate of approval as an AACCI Standard Method with reference 10-16.01.

This is good news for all operators in the cereal science and bakery product testing world who are encouraged to use (or have greater preference for) methods that are approved by the AACCI.

The measurement of Volume, Length, Height and Width are all part of the Standard Method, making it the most accurate approved method with more scope in parameters and breadth of bakery samples than any similar method using competitive equipment.

TA.XTplus Texture Analyser



Stable Micro Systems

Stable Micro Systems has long been acknowledged for its in-house mechanical and software development and manufacture of accurate instrumentation.

Shown here are some of the accessories and attachments available for use with the Texture Analyser range in various industry applications.

Bread V Squeeze

Kieffer Dough Extensibility

AACC Method

Packaging Tensile

Soap penetration

Pack compression

Material Fracture