

The next level in computed tomography

Software packages open up new horizons by optimizing X-ray methods for increased detail recognition and considerably higher throughput.

Jan Tamm

An enhanced software package from a CT manufacturer allows obtaining a three-dimensional image of the interior of a component quickly. The image quality increases significantly and turns 3D computed tomography into an efficient, fast inspection method.

X-ray technology is established as the optimal inspection method in many areas of industry. In particular, three-dimensional computed tomography, which provides a detailed, spatial image of the interior of the test part, experiences growing demand. Due to increasingly complex components in which functional structures overlap, two-dimensional radioscopy is not sufficient anymore. However, conventional computed tomography with the test part being scanned from many angles in a 360° circular scan is relatively time-consuming and costly. In particular, the scans of flat components suffer from

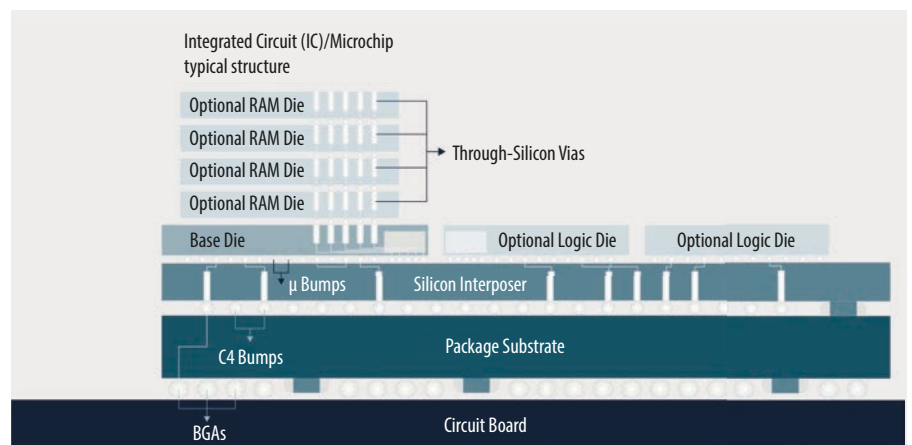
losses in detail detectability. Comet Xylon has packaged optimized X-ray methods that deliver up to ten times higher detail recognition and up to five times higher throughput for just these components.

Optimized processes

For some years now, the testing of integrated circuits in the semiconductor industry and of batteries as the basis for electromobility has

become particularly important. In addition to safety and functionality as well as the optimization of production processes with the help of extensive CT data, this development is based on the search for efficiency and productivity in development and production. In the case of microchips, the inspection addresses primarily the electrical connections, be they wire bonding, solder balls (BGA), or silicon vias (TSV). Even solder balls (bumps)

Typical structure of a microchip ►





Defects of solder balls can affect the function of electronic components.

might have several typical defects affecting the function of the electronic component.

After installation in modules and the modules in packs, X-ray technology can check a prismatic or pouch cell for cathode and electrode overhangs, deformations, foreign body inclusions, welds, and defects such as fractures and cracks. Defects in a battery might lead to performance degradation or shortened life as well as, in the worst-case scenario, to a fire due to a short circuit. Therefore, detailed and reliable testing before usage is essential for batteries. In addition, extensive CT data can identify trends about the production process and allow direct intervention and correction for optimization.

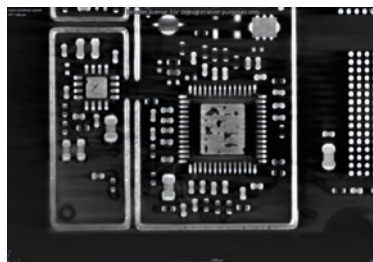
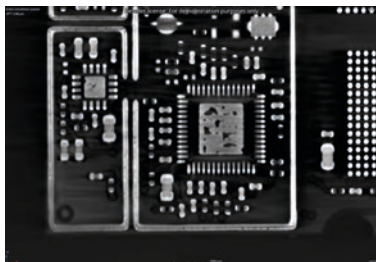
New software packages

Comet Yxlon has developed software packages specifically for use with its FF series high-resolution CT systems. They offer fantastic inspection results at maximum speed and efficiency as an integrated part of the intuitive Gemini software platform.

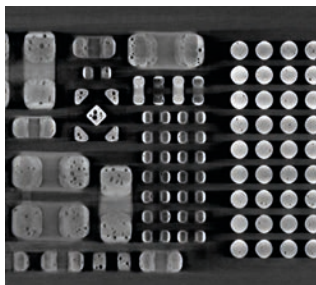
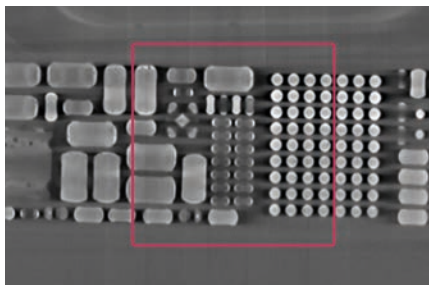
The basic Vista package includes both the Quickscan mode for an initial overview of the test part and the Qualityscan for high-resolution depth analysis. A virtual rotation axis saves a lot of time when the region of interest (ROI) is not in the center of the rotary table. The system calculates the required movements to reposition the ROI in the center without the user's help.

However, for chips and batteries, the aspect ratios are 1:5 to 1:20 and the required information is located behind the large areas of the component. A customary circular scan needs the same time for each angle: the narrow sides are observed with great depth, the informative wide sides with shallow depth. Using the new Speedmode in the Vista package, it is up to the user to define the number of projections for each side to get a meaningful result, thus, shortening the scanning process up to a factor of three. The pictures show scan results of a smartphone.

In the usual circular scan, the test part's widest side determines the minimum distance of the device to the X-ray components defining the diameter of the inspected volume as well as the detail detectability. This is usually unfavorable for the application since the flat side would achieve a higher magnification and, thus, a higher detail detectability. In addition to the Vista features described above, the Vista-X-package includes the so-called ZoomScan trajectory which takes advantage of the SmartGuard available as standard in the high-resolution Comet.



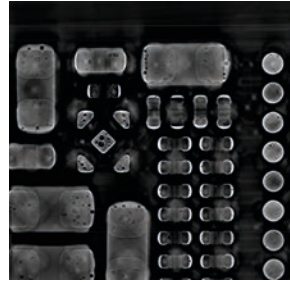
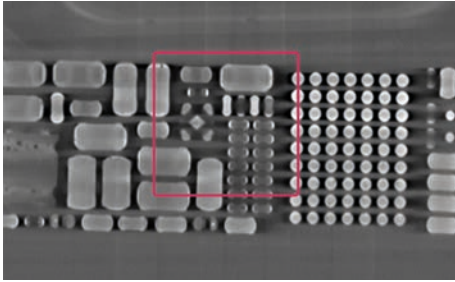
Qualityscan with 42 minutes scan time (left) vs. Vista with 21 minutes scan time (right): the shorter scan time does not result in a loss of quality.



Qualityscan with 14 µm voxel size and 40 minutes scan time (left) vs. Vista X with 2 µm voxel size and 30 minutes (right): the higher resolution requires less time.

Defining exact dimensions

Originally developed as a tool for intelligent crash protection when positioning parts to be inspected, SmartGuard is used to define the exact dimensions of the inspection part. During subsequent scanning with ZoomScan, the system follows the concrete outline of the test part



Qualityscan with 14 μm voxel size and 40 minutes scan time (left) vs. Vista X Pro with 0.9 μm voxel size and 12 minutes (right): layer images provide higher resolution and more scanning speed.

and achieves up to ten times the resolution of a simple circular scan. If Speedmode is activated in addition, the highest resolution is achieved at maximum speed.

The Vista-X-Pro-package additionally offers the feature Layerscan for optimum productivity. Layerscan is a special Comet Yxlon computed laminography solution. This efficient technology can produce high-resolution layer images of flat parts without requiring 360° rotation of the test part. The result is a scanning speed up to five times faster while providing higher detail detectability. For some applications, it is disadvantageous that the resolution is lower in the beam direction. However, the typical artifacts that

occur when radiating through the long edges in the usual circular scan are reduced, resulting in significantly more homogeneous layers in the image.

Increased performance

In summary, users who inspect flat and complex components such as batteries or electronic components experience a significant increase in performance for X-ray inspection with the Comet Yxlon Vista-X-packages, scalable to their requirements. The sophisticated software features – intelligently used and combined – ensure the best image quality with the shortest scan times and, thus, the highest possible effici-

ency of the inspection process. Thanks to continuous further developments, a high-priced inspection technology such as computed tomography can help developers and producers to achieve maximum throughput and minimum scrap and “open up new horizons”.

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