Q: We don't have AXI, this was an introduction to me, what's the cost?

A: $300-$600K for this type of capital equipment. Operational costs are typically about the same as AOI if the system keeps up with the beat rate of the line.

Q: Does Teradyne's current AXI product line implement optical (non-x-ray) inspections? Such as part marking and polarity. Separate from solder joint analysis.

A: No currently we only supply a AXI solutions, which, depending on part types can provide inspection for polarity.

Q: Is there a difference in the amount of x-ray energy exposure with the different acquisition techniques? (I'm nervous about damaging/wounding components)? Is it a significant issue?

A: X-Ray's do not affect electronics' unless the board is powered up and extreme power is used over a long time period. All three types of systems, laminography, tomosynthesis and transmission, use X-Ray energy measured in KV of about 80-160KV

Q: What about cracks between BGA/CGAs and board pads. Which technology is better if at all?

A: In theory, to detect a crack you need to focus the X-Rays on the area or slice that contains the crack. With laminography that is a manual process unless you are lucking to "slice" on the crack. With tomosynthesis you can digitally slice at any plane.
The reality is that if the crack is small then it is very difficult to resolve against the mass of the solder joint.

Q: How is this affected by lead free solders? Are some alternatives better than others?

A: Lead free solder is almost as dense as lead based solder. Make very little difference to the measurements. Normally the system is recalibrated to the slightly less dense material to take advance of the gray scale resolutions.

Q: What about boundary scan as a replacement for AXI to test for structural defects?

A: Boundary Scan is not a replacement but a complimentary test strategy. Boundary Scan tests the electrical connectivity between boundary scan cells but cannot test the solder joint quality. Boundary Scan is also a powered test, whereas defects such as shorts are found under power that can potentially cause defects in the devices connected to the faulty net. Also we may wish to test the leads not connected by boundary scan such as power and ground.

Q: How do you get such a large detector? Is it actually multiple detectors?

A: Real-time Medical X-Ray systems do have large detectors but they are very expensive and low resolution, but may be an option in the future.

Q: On the Laminography system, what's the slice thickness?

A: This varies by solution but would generally be between 1 and 10mils.

Q: Could you elaborate at bit about automation of the pass/fail call (vendor s/w, algorithms).

A: Teradyne produced the First Automated X-Ray solutions in the late 80s. And have been developing automated algorithms for the

Q: What is the test development time?

A: I can only talk about Teradyne's current XStation 4000 series which normally takes 1-3 days to develop a test program from CAD but can be up and running within hours.

Q: Can you explain why the acquisition time is longer for Tomosynthesis

A: Acquisition time is a function of the exposure time for the X-Ray detector. Depending on detectors used the acquisition time for Tomosynthesis can be faster than that of Laminography. This will vary from X-Ray system to system.

Q: Are you familiar with any AOI/AXI combination machines?

A: AOI/AXI Combinational systems are a compromise between the performance of both AOI and AXI. Speed, Image Quality, Image Warping, Image Calibration and Programming times for X-Ray cannot be optimized in these solutions.

Q: 5DX user, problem taking slices of a void, never sure where you are in terms of height in relationship to the void? Does tomosynthesis address this problem?

A: Laminography does require the focal plane to be in the void and normally in the center of the void to calculate the size. The techniques used by Laminography Average the void area with the good solder diminishing the capability to measure smaller voids. As Tomosynthesis uses offset transmission images it can resolve the maximum diameter of a void for any of the images and calculated the relative size.

Q: Digital tomosynthesis, is that a new technology that you are coming up with and when is it available?

A: Teradyne will make announcements when this technology is available to the market.

Q: Where does Teradyne stand with the development of a tomosynthesis system?

A: The AXI system that Teradyne has is a transmission system that is fast enough to acquire images, run algorithms and keep up with the beat rate of the line. We have tested digital tomosynthesis systems and hold the patents for the technologies but as yet 3D technologies have been unable to match the throughput, uptime or false fail requirements for modern production line. Also we have developed a number of new patents that we believe will provide a solution to the throughput, uptime and false failure issues.

Q: How do actual Laminography vs. Tomosynthesis test times compare?
A: With current technologies, the throughput of the two systems is about the same. For a board that takes just 30Sec's on a transmission system would take 2-4 minutes on either a laminography or tomosynthesis system

Q: What's the acceptable false call ratio for AXI systems?

A: < 100ppmJ

Q: False call issue on 5Dx soldering insufficient solder …setting the limits measuring thickness of 79% and have set limit at 80%…

A: Because you're not using an averaging technique, you have much more accurate image with transmission vs. laminography. Thus when you're close to your pass/fail points, you can have a clearer definition on boundaries with the transmission technique. We expect false failure rates of about 0.01% (100ppmJ) range. Some systems have a false failure rate of between 0.4% and 1% (up to 10,000ppmJ)