six sigma

The way we work

Improving Productivity with six sigma *methodology*

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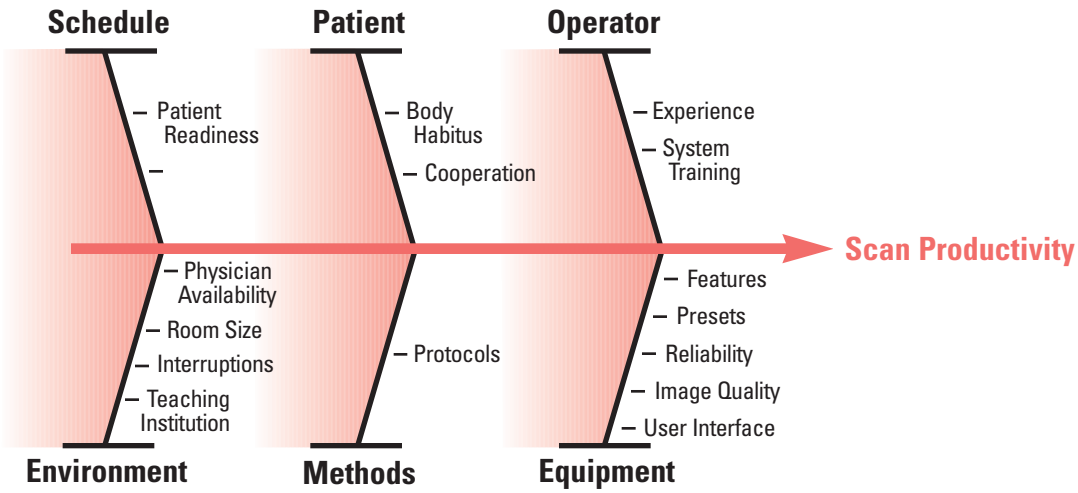
When we ask our customers what's important to them in an ultrasound system, excellent image quality has always been the #1 response. But in this increasingly cost-constrained managed-care climate, improved productivity is achieving equal stature as a primary criterion. As a result, we've put even greater emphasis on enhancing our equipment's contributions to the high-throughput clinical environment.

Factors Affecting Productivity

In the ultrasound lab, a number of factors can affect lab productivity. Some of them are illustrated below:

Contributing Factors To Lab Productivity



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The GE Solution: Six Sigma

A relatively new methodology called Six Sigma is now making major contributions to productivity here at GE. It's being applied to all aspects of the business, everywhere from new product development to installing and servicing equipment.

To understand its impact, consider that all processes vary. Whether it's driving to work in the morning or bringing in and scanning a patient, there will always be deviations caused by human error or other circumstances. "Sigma," which means standard deviation from a mean, is a statistical unit of measure used to measure these deviations. The quality or capability of a process can be measured in units of sigma. A three sigma process has over 66,800 defects per million opportunities. "Six Sigma" is a process designed to reduce these deviations to no more than 3.4 defects per million operations–in other words, to achieve 99.9997% perfection.

The Six Sigma process involves identifying a problem…analyzing its causes…developing a solution…implementing that solution by making it a part of your standard procedure… and then measuring the results.

Applying Six Sigma to the Ultrasound Lab

Taking an example from the diagram on page one, let's say that you've identified lack of patient readiness as a primary obstacle to achieving optimal productivity in your lab; they aren't always ready for an exam when you are.

To overcome this problem, first collect some data by tracking several week's worth of patients. Make note of how many were not available when you were ready to scan them. Identify the possible causes and determine which one or two are the most prevalent and controllable. Develop a solution and apply it to your patient-scheduling protocol. Then assess the results: Determine if there's been an improvement by tracking a few week's worth of patients who've been managed under the new procedure.

Applying Six Sigma to Product Design

Six Sigma is precisely the approach we take to product design here at GE. And using it to improve our customers' scan productivity has become one of its primary applications.

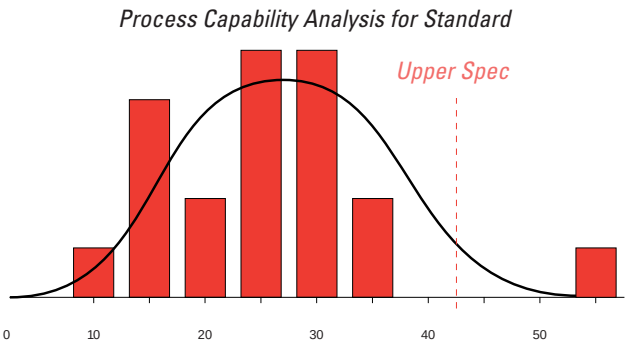
For example, in working with customers we determined that sonographers spend a great deal of time optimizing image parameters. The GE solution: Automatic Tissue Optimization (ATO), a rapid B-mode optimization feature developed for the LOGIQ 700 MR system.

ATO works by creating an internal histogram of the patient specific tissue data within a region of interest (ROI) and expands the shades of gray available. The result of these tissue-specific adjustments is a significant improvement in contrast, as well as improved consistency from operator to operator. And because it minimizes the time required to optimize settings, ATO also makes a major contribution to patient throughput.

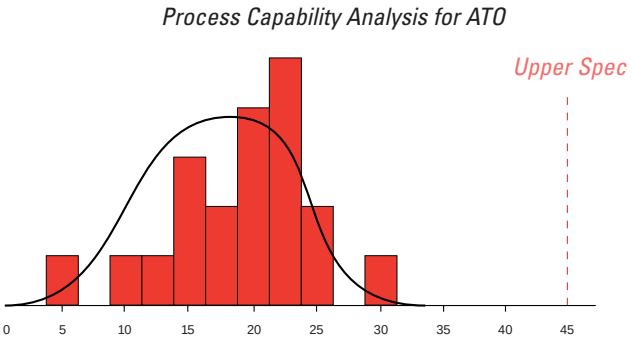
This, at least, was the theory. But our Six Sigma process would not be complete until we had measured the results.

Quantifying the Improvements

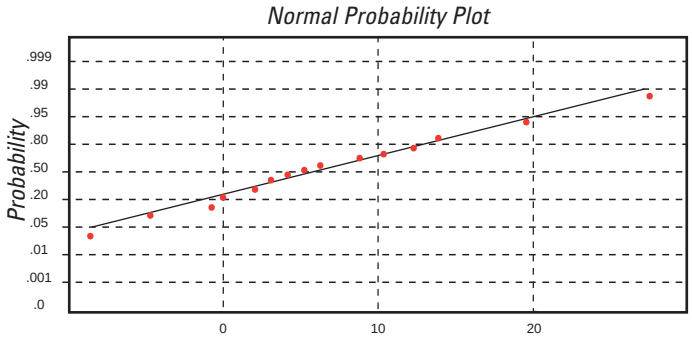
Using Six Sigma methodology, we conducted 20 pancreas scans using both standard system imaging presets and ATO. A single operator performed all scans and randomized the use of ATO and the standard system imaging presets. We recorded, to the second, the time required to optimize the settings for each study. The results of each type of scan are illustrated below:



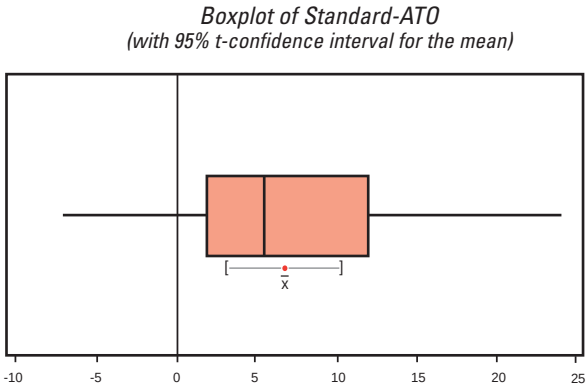
Histogram showing the time distribution of 20 pancreas scans. Note that one scan lies above the 45 second upper specification.



Automatic Tissue Optimization histogram shows a tighter distribution with no scans exceeding 30 seconds.



A plot of the time difference between the standard settings and ATO shows a normal distribution with a P value of 0.8.



A paired t-Test boxplot of the time differences shows the mean time savings to be 6 seconds per image. Scans below zero were due to gas obscuring the pancreas.

Our findings: ATO improved average time-to-optimization from 25.7 seconds to 19.1 – an improvement of nearly 26%. ATO also decreased the range of variation. With standard presets, the operator took anywhere from 10 to 54 seconds to achieve the optimal parameters. With ATO, it took from 6 to 30 seconds. Using statistical analysis to evaluate the two techniques, we determined that the standard imaging presets had a sigma value of 1.9; ATO's sigma value was 4.6. Remember, the higher the sigma value, the greater the control over a process.

These results were similar to a study that was done at a large ultrasound department using multiple operators. Their results in renal image optimization on over 35 patients also showed a decrease in scan times when using ATO. Consider the impact this apparently simple improvement, universally applied, could make over the course of a week or a year. A typical abdominal scan consists of imaging the aorta, pancreas, both kidneys, liver, gallbladder and spleen. If ATO is applied to each organ in every study you conduct, the result could be substantial improvements in patient throughput.

In Conclusion

GE Ultrasound is committed to helping our users enhance both their productivity and diagnostic accuracy. Toward that end, we're applying Six Sigma methodology to virtually every aspect of product development, from system design to clinical evaluation. As a result, you can depend on us to provide equipment and capabilities that offer real customer value.

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