Customer Story

Challenge

To locate the source of a very low level of contamination generated in Kodak's clean manufacturing facility in the production of motion picture films.

The Race to Zero

Kodak gets a boost from JMP® in its drive for zero-defect performance

Geoff Beatham didn't need to be convinced of the power of JMP – not after some 20 years of employing it as an indispensable tool in his work as a quality-improvement engineer. But a recent project hammered that reality home and made new believers among his colleagues.

Beatham is Quality Director for Kodak's Film Capture business, which includes the motion picture business as well as consumer and commercial products. He and his team discovered that a very low level of contamination was being generated in the base-roll manufacturing process: microscopic black particles, which would then get coated over in the next stage and result in particles in the final product.

Beatham is responsible for driving zero-defect manufacturing across the organization. Armed with JMP, he and his colleagues set out to eradicate black particles from Kodak's products. "JMP has been significant in allowing us to unravel the key facts from all the noise in our complex manufacturing process," Beatham says.

Kodak uses analytics to identify the source of production defects

"We suspected that the problem was occurring in our base coating operation, on the substrate the product is manufactured on," Beatham says. "It was these microscopic black particles that were then being coated over when we applied the photosensitive layers. When customers processed the film, they occasionally ended up with those same particles."

But the precise origin was elusive. The size and frequency of the particles were such that they fell beneath the detection capabilities of the inline film-inspection process. Compounding the difficulties in detecting the problem was that it was occurring only intermittently.

"During the manufacturing process, we were blind to the source of the problem," Beatham says. "We were finding one occurrence approximately every 10 million linear feet of product. It was a very difficult problem to get our heads around." Past efforts to make improvements had yielded little gain, says Rob Bettin, the Kodak Manufacturing Engineer in charge of this project. "One of the problems was that we didn't have a good feedback loop," Bettin says. "Our only recourse was to get customer feedback."

So they developed a camera system to look at the edge of the film, taking three images a second on each side of the product. "That's tens of thousands of images an hour," Bettin says, "and this was where JMP was particularly useful."

jmp
Statistical Discovery.™ From SAS.

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>
> Geoff Beatham
> Quality Director, Kodak

JMP allowed Bettin to analyze 20 million records, which revealed non-uniformity on the edge of the film. He then used a JMP phase control chart to examine changes he made at given points in the process. "Then I could do a Tukey-Kramer analysis," he says, "and was able to show when we made improvements. We were able to continuously make small improvements and then eventually show some very significant differences."

The team made process upgrades to the coating technology, and enhanced edge controls resulted in improved process performance. In addition, material and formulation changes improved the consistency of the materials used in the substrate layer. They soon began seeing only one occurrence of the problem every 300 million linear feet of film – a thirtyfold improvement. And in 12 months, there have been no occurrences at all. "So we really are at our goal of running this at zero-defect performance," Beatham says.

Exploring and communicating complex process control data

"We have very extensive process control data sets across our organization," Beatham says. "JMP gives us the ability to look at that data and look for correlations across it. I'm not aware of any other process tool that would allow us to get the degree of statistical analysis that we can get with JMP across those large data sets."

JMP is also powerful as a communication tool. "It is key for people like Rob to be able to present his data in a way that is clearly visual to the management groups, as they're reviewing projects and trying to understand why we need to spend money to review roadblocks," Beatham says. "It's very easy to show the impacts of what the data is showing in JMP."

Bettin agrees: "Once I was able to demonstrate what was going on, having looked at millions of records – which we'd never been able to do very effectively before, just looking at printouts – I was able to convince management that, yes, we can do better. And then we were able to find those little things that allowed us to improve." After senior managers saw the data in JMP visualizations, they understood the need for remedies with almost no hesitation, Beatham confirms.

"JMP is a key tool for our technical and engineering experts as we continue to focus on zero-defect manufacturing," he says. "We had just stellar success on this project. It really has been exciting, and it's nice to be able to share it."

Solution

Using JMP, the Kodak Film Capture Manufacturing team easily manipulated data generated by millions of images taken during the production process, allowing the team to find the source of the problem and correct it.

Results

Kodak reduced occurrences of the contaminant from one in every 10 million linear feet of motion picture film to only one in every 300 million linear feet, and has seen no defects at all in 12 months.

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