### CHALLENGE

To be the go-to supplier of guitar strings for the music industry.

### SOLUTION

Use JMP® for the basic statistics, statistical process control, design of experiments and communication of complex interactions needed to consistently design and manufacture premier strings.

### RESULTS

The most demanding performers in the music industry laud Elixir® Strings for the high quality, great tone and long life of its products.

### MORE INFORMATION

www.jmp.com

www.elixirstrings.com

# Elixir® Strings Offers the Cure for the Common Guitar String

## JMP® statistical discovery software backs Elixir Strings' efforts to help guitarists make beautiful music

Bassist Kasim Sulton first made a name for himself with Todd Rundgren's achingly exuberant progressive-pop-rock band, the legendary Utopia. He's since played with artists ranging from Patti Smith to Meat Loaf, and on Broadway in the Twyla Tharp-choreographed musical *Movin' Out*.

For a long time, Sutton had a problem with strings incessantly breaking or destroying the frets on his guitar. He couldn't find a string that felt just right.

Today, he swears by Elixir Strings, praising the strings for the way they feel, their smoothness and the way they hold their brilliance.

None of which, of course, happens by accident. Elixir Strings' John Allen will tell you that a number of factors go into making a consistent guitar string with great tone and a long life – that there are complex interactions between the material selection, dimensions and process conditions that affect performance attributes. He'll also tell you that JMP statistical discovery software plays a decisive role in arriving at optimal performance attributes.

Allen is a research and development leader for the Elixir Strings business team, based in Elkton, MD. He has been using JMP for about six years after being introduced to it by José Ramírez, an industrial statistician with W.L. Gore & Associates, Elixir Strings' parent company. As a trained mechanical engineer, not a statistician, it was the ease of use that first attracted Allen to JMP.

Ease of use is one reason why JMP is now the corporate statistical software standard at Gore. Elixir Strings' engineers and scientists use JMP for everything from early product development – where screenings and design of experiments take place – to validation efforts and production process monitoring.

"I'm involved in the early development of products for the business and also in ongoing technical support of existing commercialized products," Allen says. "A large portion of my time is focused on new areas for development and doing the required testing and groundwork to produce either groundbreaking or derivative products."

" On our team, we have folks who are completely unfamiliar with statistics and folks who are more advanced, and one of the values we see with JMP is the ability to use it to communicate, to everyone on the team, simple or complex interactions that we uncover during the design cycle."

**John Allen**
**Elixir® Strings**

### IN ANY LANGUAGE

**Elixir® Strings is a business unit of W.L. Gore & Associates, a global company with 8,000 associates in more than 45 locations. Probably best known for its GORE-TEX® fabrics, Gore produces medical equipment, dental floss, filtration products and quite a bit more.**

**JMP® software from SAS is used in the statistics courses taught at W.L. Gore & Associates.**

**When Elixir Strings' parent company, W.L. Gore & Associates, opened facilities in China, it was faced with a critical need to provide training despite the language barrier it faced. The SAS China office stepped in to assist, delivering the basic statistics training W. L. Gore & Associates required.**

One example of a groundbreaking product is the new electric guitar cable recently introduced by Elixir Strings, while a derivative product would be a variation on one of its already-commercialized guitar strings.

"On our team, we have folks who are completely unfamiliar with statistics and folks who are more advanced," Allen explains, "and one of the values we see with JMP is the ability to use it to communicate, to everyone on the team, simple or complex interactions that we uncover during the design cycle.

"JMP is graphical and a perfect tool for communication that helps shorten our design cycles. I also think its ease of use is a really powerful attribute. I mentor new hires, and I've seen them come up to speed on JMP quickly, and thereby contribute to the team almost at the get-go."

## A complex route to simplification

Nathan Watts has played bass with Michael Jackson (going all the way back to Jackson 5 days), Diana Ross, the Pointer Sisters, the Spinners, the Temptations and Gladys Night & the Pips. He may be best known as Stevie Wonder's longtime sideman.

Watts says the strings he gets from Elixir Strings are "amazing" – lauding them for their strength, resonance and purity of sound.

"In the music industry, we try to simplify things as much as possible," John Allen says, "and to do that is fairly complex."

Allen explains that while to most people strings may just seem like a wire, there are quite a number of complex interactions involved and that there are many different varieties.

"Over the history of guitar strings, making them has been considered sort of a mysterious art," he says. "We're trying to make it more of a science, and leave the art to the musician."

Toward that end, Allen and his Elixir Strings team strive to better understand how raw materials and the interaction of manufacturing processes can contribute to a consistent, quality product. Their credo is "great tone, long life."

"The process boils down to a lot of different development initiatives and, basically, communication," Allen says, "and JMP is our primary means for understanding, showing and describing interactions from development all the way to mature commercialized products."

Allen and his team analyze string attributes – string diameter, for example – using the JMP distribution platform.

The tension of a string is a product of its diameter. Generally speaking, Allen says, smaller diameter strings are low in tension and are thus frequently used by beginners. As the diameter of the string increases, it becomes higher in tension and harder to press down, and so more suitable for players who have developed calluses. The feel of a string, its response, is critical. It translates directly into how a guitarist plays the instrument and, consequently, into how it sounds.

"But diameter is just one of many attributes," Allen says. "JMP makes it easy to produce distributions quickly for each attribute. This helps us very quickly analyze performance and then communicate what we've learned throughout the team."

JMP software's distribution platform is instrumental in determining if a string is resilient or if it produces the right tone, examining every aspect of the string to ensure it will perform well.

Allen is also impressed with the design of experiments capabilities available in JMP.

"We need to know what settings in our manufacturing process are going to produce a great-sounding string. We run designed experiments to understand what factors affect tone. We use surface plots to illustrate the sweet spots in a design and then adjust knobs in the JMP profiler tool to optimize.

"The accurate and easy-to-use design of experiment capabilities in JMP help us determine what makes a string with great tone and long life. Once we find these set points, we use JMP to develop specifications and monitor the process."

## JMP®, for whatever we do

George Jones, Toby Keith, Patty Griffin, Emmylou Harris, Bob Seger, Mark Knopfler – these are among the superstars for whom Glenn Worf has laid down a solid rhythm.

Right out of the bag and onto the instrument, says Worf, strings from Elixir Strings are always ready to play. Worf says that, to his ear, they always sound exactly right. Moreover, he adds, what really surprised him was how long those strings last.

The Elixir Strings team is continuously testing and working to improve. Quite regularly, they go out to hear what their customers have to say. Over time, they learn from those voices and get better at making the highest quality strings.

"What we do in the lab on the strings is definitely informed by what we learn from musicians about their applications," Allen says.

But it's not just all about strings. Elixir Strings recently launched an instrument cable that transmits the most transparent audio signal for electric guitars. Essentially, Allen explains, this cable is the product of having established key design attributes that then needed to be tailored and specified to meet their objectives.

"For this cable, JMP software is also used to analyze and communicate these designs from the early stages of development to production after commercialization."

Quite understandably, Elixir Strings keeps word of what might be next on the horizon pretty close to the cuff. But be assured, says Allen, "JMP is going to play a role in whatever we do."

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