

## **MANAGING A SPINNING MILL WITH QUALITY IN MIND**

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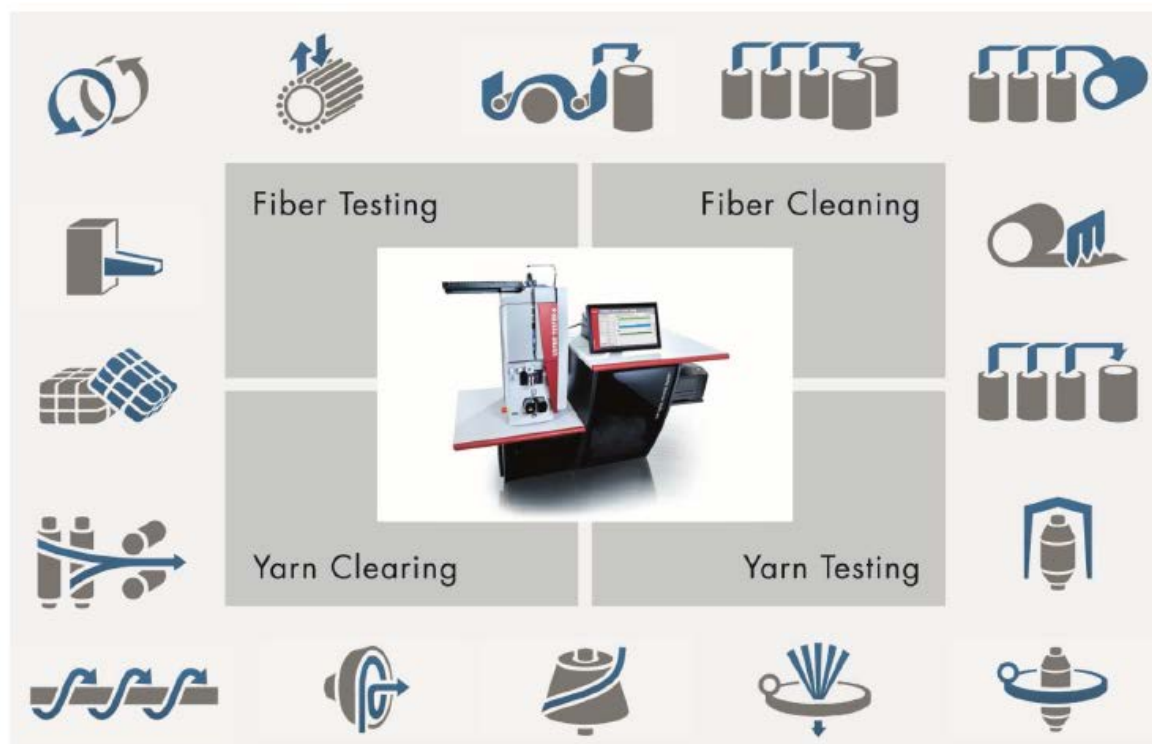
### **ABSTRACT**

The combination of accurate laboratory testing data with information from online monitoring of the entire mill production is a huge breakthrough. Spinners can build their own tailored quality network and analyse and optimise mill performance. Each new instrument extends the possibilities as it connects to the network, offering features such as long-term quality trends, impacts of fibre to yarn quality and predictions of fabric appearance, pilling resistance and weaving performance.

### **INTRODUCTION**

In today's spinning mills quality testing of the production has become a standard. The acquired data per week, per shift, per hour are piling up on the quality managers desk. This new mill management system brings quality analysis to a new level, introducing a wide range of analytical possibilities, helping to draw conclusions and optimising processes within a spinning mill.

One eminent reason is to give valuable support to mills, as today experienced quality managers, people with found textile background are becoming more and more scarce. From all process steps – from fibre to fibre processing up to yarn spinning - the data is consolidated into a single system (see Figure 1) – into the Total Testing Center<sup>TM</sup>.



**Figure 1. System overview: Data of whole mill is collected**

Decades of USTER's application knowledge have formed Assistant Q, another element and a valuable intelligent support for the spinners. Assistant Q takes over 24/7 and monitors the trend of all critical quality parameters continuously. He identifies deviations during the regular yarn production instantly. Exceptions trigger alerts and the user will be informed. He analyses the measurements of laboratory equipment in combination with online measurements, based on this comprehensive and indispensable decision-making tool.

It needs reliable and accurate test equipment to be able to base important decisions on the collected data and rely on it. With the integration of a data evaluation into the new USTER<sup>®</sup> TESTER 6 a powerful and intelligent mill management system the Total Testing Center<sup>™</sup> is supporting spinners in managing their mills with quality in mind today and tomorrow.

### **THE WAY TO THINK QUALITY<sup>™</sup>**

Spinning mills need to deliver yarn of the right quality every time. The yarn must meet the expectations of customers, be free of unacceptable defects, and be produced with optimum use of resources and cost-effectiveness.

Quality – for USTER it's a way of life. Think Quality<sup>™</sup> means helping textile producers to improve their control of quality, with the ultimate aim of turning quality into profitability. The principles are simple.

We suggest a simple but effective way in 5 easy to remember steps (see Figure 2).



**Figure 2.** The way to Think Quality

### **Specify**

To produce the right quality a clear specification is required. Agreed specifications give the focus for measurement and control in all processes. For spinning mills, proper quality agreements allow optimization of raw material use and production of the required yarn quality, as cost-effectively as possible.

### **Measure**

USTER recommends regular, systematic lab testing at the spinning mill, combined with 100% online quality control. It is also essential to have the end application in mind. Specific quality profiles can show clearly which test parameters within which range are important for a specific application.

As spinning mills need to rely on accurately determined data for their specifications.

### **Control**

Online control systems ensure the production of material within the defined limits, and measure the quality constantly. Rigorous process control and optimized processes are required for the production of consistent quality. Using online and offline control systems can help mills to analyse data quickly and react fast with corrective actions. Speed of response is important in reducing the amount of off-quality yarn produced and consequently saving costs.

### **Improve**

It is important to recognize Key Quality Indicators as tools to improve quality by setting achievable goals and following them continually. The use of an intelligent and powerful quality control system for immediate data analysis provides alerts together with suggested actions. Quality improvement is an ongoing process. In-depth application understanding from our experts and feedback from users allow spinning mills to adjust the raw material mix, optimise processes and improve yarn quality.

## Sustain

The spinning mills can make better decisions based on data and analysis. Installing systems and integrating continuous training of people is vital to sustain success. These mills need to stay in constant dialogue with their customers and implement their needs, to stay successful over time.

## ROUTINE TESTING

USTER<sup>®</sup> *QUALITY EXPERT* allows connection of many test instrumentation from fibre to yarn into a single database. When the mill follow certain naming rules and updates processing machinery the data is saved corresponding to the mill's product and used production machinery.

The spinning mills define their routine test plan based on their own requirements and quality needs (see Figure 3). However still today many mills re-write the data either on cellulosic sheets or re-type some of the data in a computer system.

Important quality tests for fibers in the bales			
Test parameters	Instruments	Test frequency*	
1 Fiber fineness (micronaire)	USTER <sup>®</sup> HVI 1000	100% – 20% of all bales used per lot is the recommended quantity for testing.	
2 Neps	USTER <sup>®</sup> AFIS PRO 2		
3 Maturity	USTER <sup>®</sup> HVI 1000		
4 Fiber length (upper half mean length)	USTER <sup>®</sup> HVI 1000		
5 Short fiber index	USTER <sup>®</sup> HVI 1000		
6 Strength	USTER <sup>®</sup> HVI 1000		
7 Elongation	USTER <sup>®</sup> HVI 1000		
8 Color (reflectance, yellowness, grade)	USTER <sup>®</sup> HVI 1000		
9 Trash (count, area, grade, amount)	USTER <sup>®</sup> HVI 1000		
10 UV reflectance	USTER <sup>®</sup> HVI 1000		
* The test frequency is influenced by the quality requirements of the mill and the variation within lots. Uster Technologies recommends to test at least 20% of the bales per lot.			
Important quality tests as routine test* & after cotton recipe change & maintenance			
Test parameters	Instruments	Test frequency I*	Test frequency II*
1 Fiber fineness of infeed sliver	USTER <sup>®</sup> AFIS PRO 2	weekly	every 2nd week
2 Fiber length of infeed sliver	USTER <sup>®</sup> AFIS PRO 2	weekly	every 2nd week
3 Lap linear density – count	USTER <sup>®</sup> AUTOSORTER 5	weekly	every 2nd week
4 Fiber length of lap	USTER <sup>®</sup> AFIS PRO 2	weekly	every 2nd week
5 Short fiber content of lap	USTER <sup>®</sup> AFIS PRO 2	weekly	every 2nd week
6 Neps in lap	USTER <sup>®</sup> AFIS PRO 2	weekly	every 2nd week
* The test frequency is influenced by production speed, machinery age and the quality level to be achieved. For high production machinery, older machines and high quality level, Uster Technologies recommends test frequency I.			

Important quality tests as routine test* & after article change & after maintenance			
Test parameters	Instruments	Test frequency I*	Test frequency II*
1 Yarn count	USTER® <i>TESTER 5</i> /USTER® <i>AUTOSORTER 5</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
2 Twist	USTER® <i>ZWEIGLE TWIST TESTER 5</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
3 Evenness	USTER® <i>TESTER 5</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
4 Thin places	USTER® <i>TESTER 5</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
5 Thick places	USTER® <i>TESTER 5</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
6 Neps	USTER® <i>TESTER 5</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
7 Yarn diameter	USTER® <i>TESTER 5 OM Module</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
8 Yarn shape	USTER® <i>TESTER 5 OM Module</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
9 Hairiness	USTER® <i>TESTER 5 OH Module</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
10 Hairiness	USTER® <i>ZWEIGLE HL400</i>	2-3 times/week 8-10 bobbins	weekly 8-10 bobbins
11 Yarn strength	USTER® <i>TENSORAPID 4</i> /USTER® <i>TENSOJET 4</i>	weekly 8-10 bobbins	weekly 8-10 bobbins
12 Yarn elongation	USTER® <i>TENSORAPID 4</i> /USTER® <i>TENSOJET 4</i>	weekly 8-10 bobbins	weekly 8-10 bobbins

\* The test frequency is influenced by production speed, machinery age and the quality level to be achieved.  
 For high production machinery, older machines and high quality level, Uster Technologies recommends test frequency I.  
 Some mills even carry out daily tests and increase the amount of bobbins to be tested.  
 Additionally some mills carry out studies on the number and causes of end-breaks as a quality check.

**Figure 3. Routine test plans in a cotton spinning mill at the stages of bale combing and ring spinning**

Today's possibilities offer faster and more reliable analysis.

USTER® *QUALITY EXPERT* will show if the regular test cycles are performed on time or if some testing of certain machines is missing. The mill user will see if an alarm was triggered and the test data overstepped warning or alarm limits.

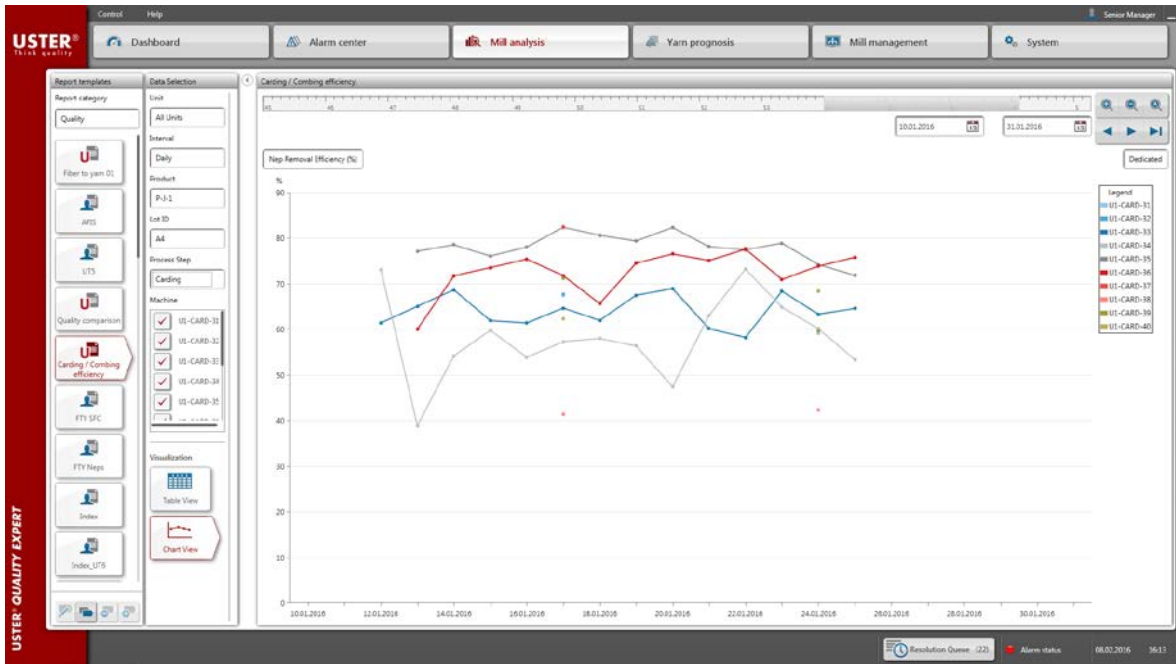
With the integrated textile knowhow the system can detect even subtle changes or drifts in fibre quality, intermediate product or end product quality. Assistant Q gives hints on what might have caused the exception, and gives reasons why the limits were overstepped.

The customer can also make use of flexible established limits for quality exceptions, so that a warning or an alarm can be triggered (see Figure 4).



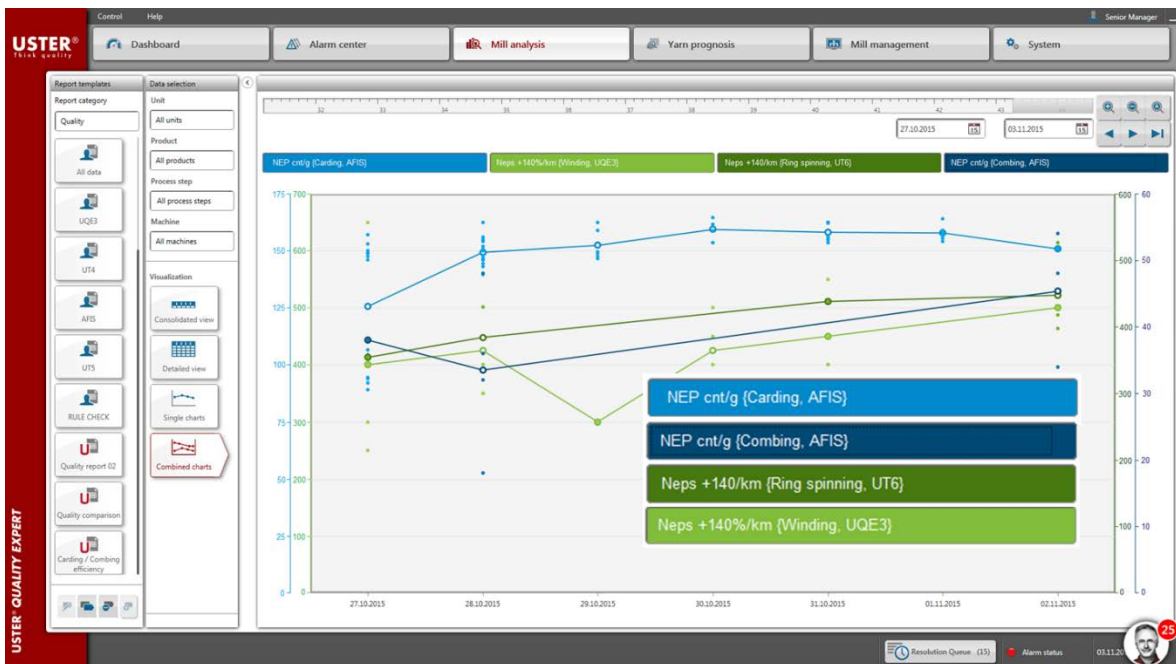
**Figure 4.** Mill production setup with Alarms

As an example – a fixed nep removal efficiency of e.g. 75% would not suit all mills (see Figure 5). Nep removal efficiencies are the classical way to judge the heart of the spinning mill – the carding process. The Efficiencies are usually monitored based on mill established experience values. These will depend on the card wire state, on the production speed, machine age, but also on the quality level to be achieved. But it depends also on the fibre type a Shankar 6 cotton will reach a nep removal efficiency of 65% - a Pima cotton of 85-90%



**Figure 5.** Analysis of data: Nep removal efficiency

The user based limits and exceptions for each individual mill are thus established. All parameters can be displayed in table or graphical format and filtered by product, process and machine in addition to the user selectable time frame. An analysis of the short fibre content in card or comber compared to the yarn hairiness is only a mouse click away (see Figure 6).



**Figure 6.** Analysis of data: Combination of fiber and yarn data

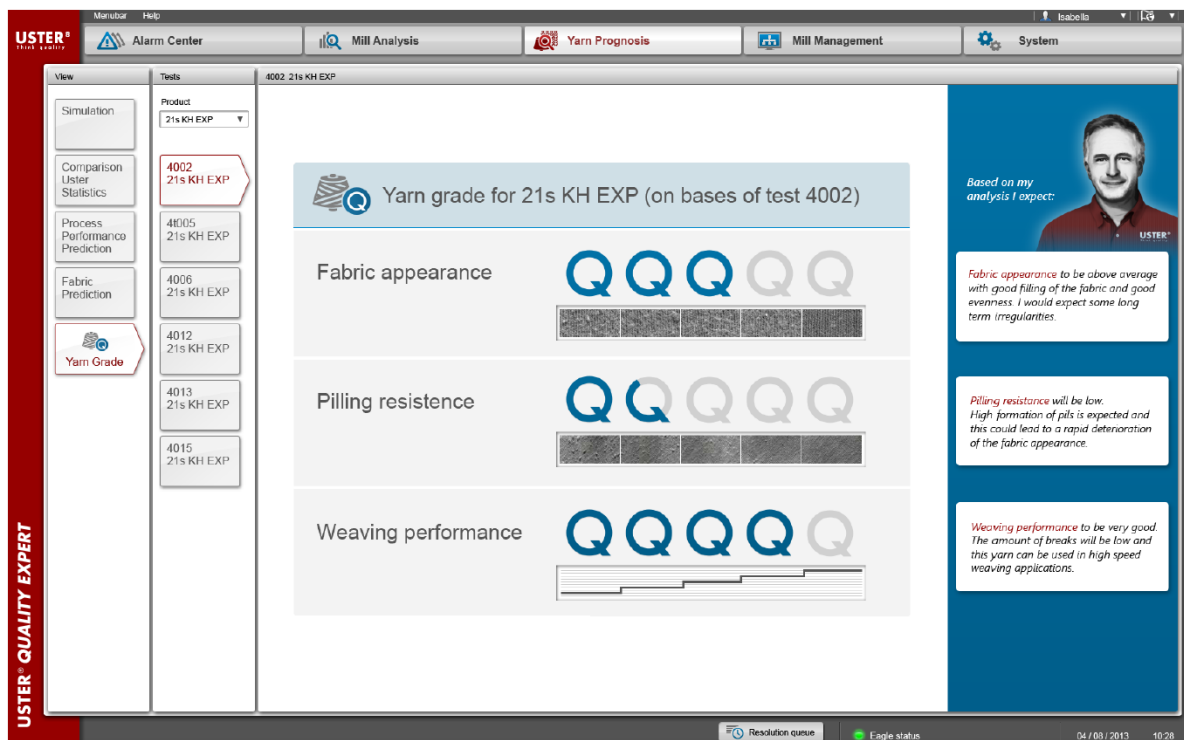
The Quality manager, no longer has to go daily through the mentioned piles and piles of papers, seeking for the exceptions, trying to find the outliers. This is done by his Assistant Q, supporting him 24/7.

## THE END PRODUCT IN MIND

The analysis does not end at the level of yarn quality. In the *Mill Analysis* part the user-friendly analysis from fibre to yarn is provided. The results of quality parameters from preparation, spinning and winding are utilized with the aim of optimizing the processes and product quality. While the *Alarm Center* supports the user to develop preventive strategies to avoid defects and be informed in real-time.

The possibility to compare products in a comprehensive manner with integrated USTER<sup>®</sup> STATISTICS facilitate to check the performance of the mill units and compares against global quality standards.

In Figure 7 we see an example of the Yarn Prognosis of carded cotton yarn for the three currently available grades: Fabric appearance, Pilling resistance and Weaving performance.

**Figure 7.** Yarn Prognosis with fabric grades



An Indian mill using 100 % cotton checked their final fabrics for pilling and appearance. They compared the given grades from the Total Testing Center™ with their subjective judging and obtained a subtle deviation of 0.5 points. The *Yarn Prognosis* allows spinners to assess the overall quality of yarns and their expected performance in the downstream process.

## **SUMMARY**

The analysis of data in a spinning mill with the help of the USTER® *QUALITY EXPERT* was never easier.

The user obtains at a glance his quality level and gets support in optimising the production depending on the end product. In addition he gains knowledge on the downstream behaviour by *Yarn prognosis*.

The forecast to the end product performance allows better to customise the current production to the specific orders. Quality in mind is not only a slogan, but optimises performance in the spinning mills of the future.

## **REFERENCES**

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