USTER® *QUANTUM 3*

Application Report

Description of the features

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Think quality

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Contents

1 Introduction

The USTER® *QUANTUM 3* is the successor of the USTER® *QUANTUM 2.* This new clearer generation is focused on simplifying the complexities of yarn clearing and thereby enable the user to easily and fully exploit all clearer capabilities an to optimize production costs every day. The USTER® *QUANTUM 3* interprets and displays the yarn characteristics within minutes and proposes a starting point for clearing limits with a cut forecast by pressing a single button.

One of the key highlights is the integration of the well-known USTER® knowhow in the system on the winder. Another exciting new innovation is a completely new foreign fiber clearing technology with vegetable clearing which is able to distinguish all colors and separates foreign matter into two separate pools foreign fibers and vegetables. This separation improves the foreign fiber clearing efficiency significantly by reducing cuts for the same quality or gets a better quality for the same cuts.

We believe that with the combination of this know-how with smart, reliable and modern technology, the user will be able to deliver significantly better yarn quality and post spinning performance while most likely maintaining productivity.

In this document, we would like to explain these new features and to show the user a smart way of the optimization of yarn clearing step by step.

2 The new features of the USTER® *QUANTUM 3*

2.1 Yarn Body

The "yarn body" represents the nominal yarn with its tolerable, frequent yarn faults. Yarn body is a new yarn characteristic, and we know from the experience so far that the yarn body changes according to the raw material and the spinning process. By analyzing the shape of the yarn bodies out of different raw material varieties and process changes, we can discover patterns, and build up references. Based on the references, the operator can identify changes. The yarn body becomes always wider in the direction of the short yarn events, e.g. short faults occur more frequent. On the contrary, the yarn body becomes smaller in the direction of the long yarn events
The yarn body is a great tool to help finding the optimum clearing limits for thick places (NSL), thin places (T), yarn count deviations (C) and (CC).

The yarn body is composed of two parts:

- Dark green area representing the real yarn body.
- Light green area representing yarn body variations.

Active clearing limit of the selected channel (here NSL thick places) = brown color

Active clearing limit of the non-selected channel (here T thin places) = grey color

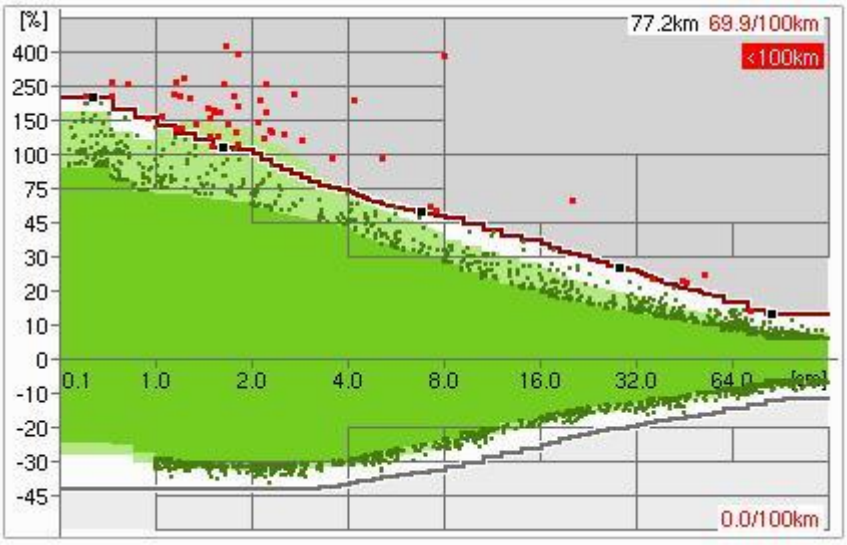


Fig. 1 Display of the yarn body, the scatter plot of the eliminated faults, the remaining events and the number of expected cuts per 100 km

Since both dark and light green areas together constitute the yarn body, it is recommended that the clearing limit should not cut into the yarn body. If the clearing limit is laid within these green areas, the cuts will increase significantly and the productivity will be lower.

2.2 Dense Area

Another new, innovative and unique feature of the USTER® *QUANTUM 3* is the “Dense Area”. Optimum clearing is always a balance between removal of all disturbing yarn and foreign fiber faults and the production efficiency. The dense are is the display of the range where foreign fibers are occurring very frequently. The blue colored dense area is used to visualize the distribution and frequency of clearing limits for the Foreign Matter (FD). By this means a quality analysis of the degree of contamination for different yarns can be easily done.

2.2.1 Dense area for foreign matter (FD)

This display of the dense area helps the user in setting of a clearing limit easier with an optimal balance between quality and productivity. The dense area depends on the raw material. If a yarn produced from a raw material having a lot of foreign material or vegetable material is used, then the dense area will be wider and a high number of cuts should be expected.

Similar to the yarn body, after running only a few kilometers of yarn, the first impression of the dense area and the events will appear.

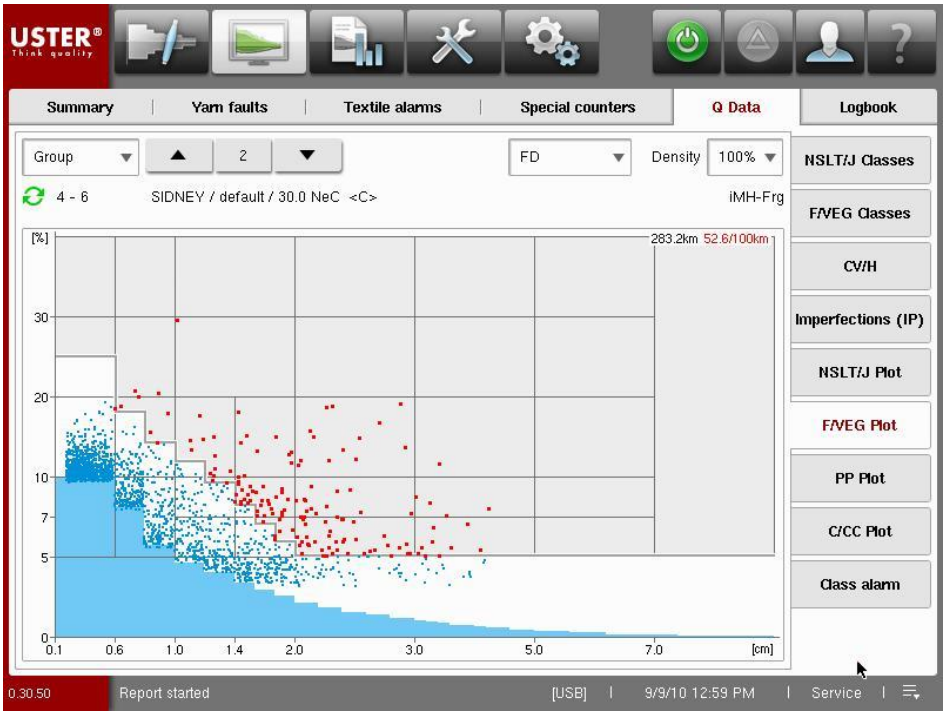


Fig. 2
Display of the dense area and the scatter plot for foreign matter

2.2.2 Dense area for vegetable matter (VEG)

The Vegetable Clearing is a very useful tool to distinguish between organic (vegetable) and foreign fibers. Since vegetables disappear during the bleaching process, they can often remain in the yarn. The result is a reduction of foreign fiber cuts.

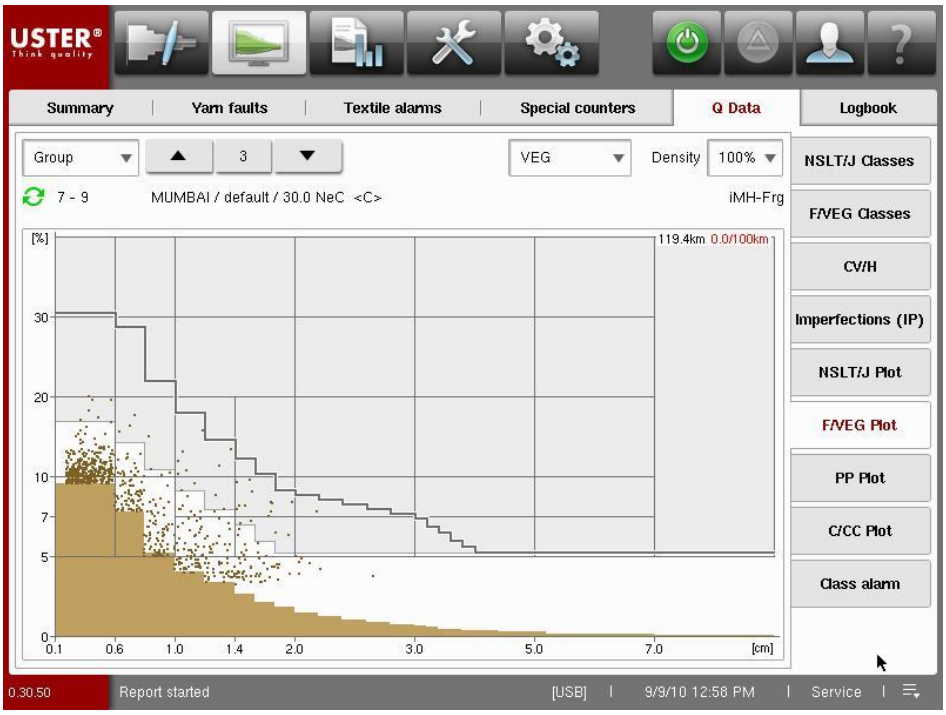


Fig. 3
Display of the dense area for Vegetable Clearing

2.3 Scatter Plots

The scatter plots are used to visualice the optimum clearing limits for both the polypropylene (PP) and Splice Clearing (Jp/Jm). In such cases about the concepts of the yarn body or the dense area do not make sense. For such events the graphical display of a scatter plot matches the demands of the customers best.

2.3.1 Scatter Plot for Polypropylene (PP) Clearing

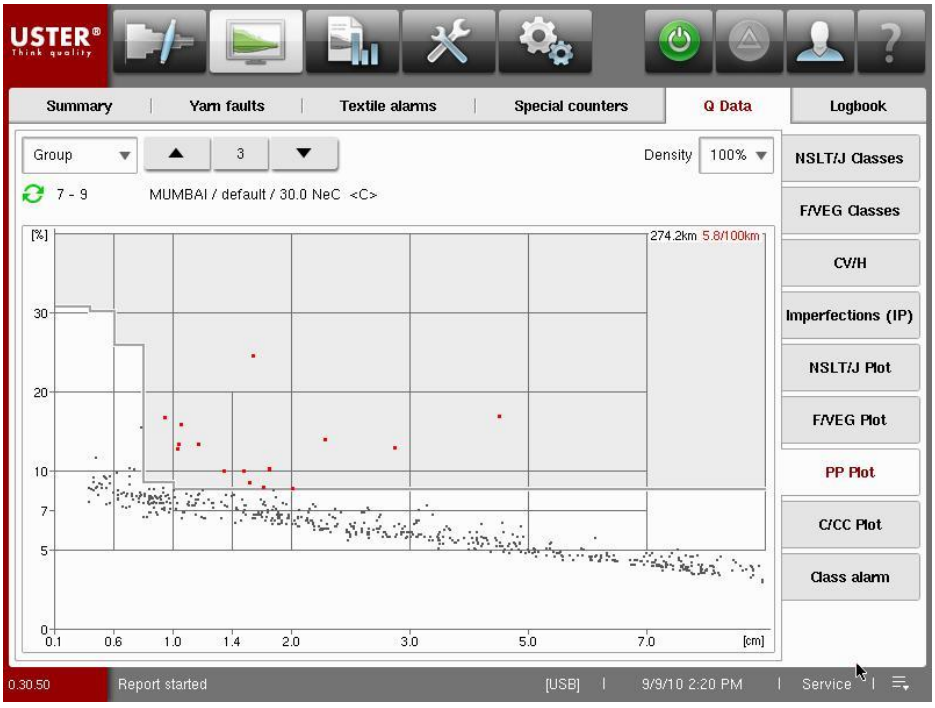


Fig. 4
Display of the scatter plot for PP polypropylene clearing

2.3.2 Scatter Plot for Splice Clearing (Jp/Jm)

The scatter plot for Splice Clearing (Jp/Jm) represents the classified splice events. The active clearing limit of the selected channel (here Jp/Jm splice clearing limit) are highlighted with brown color on the setting page.

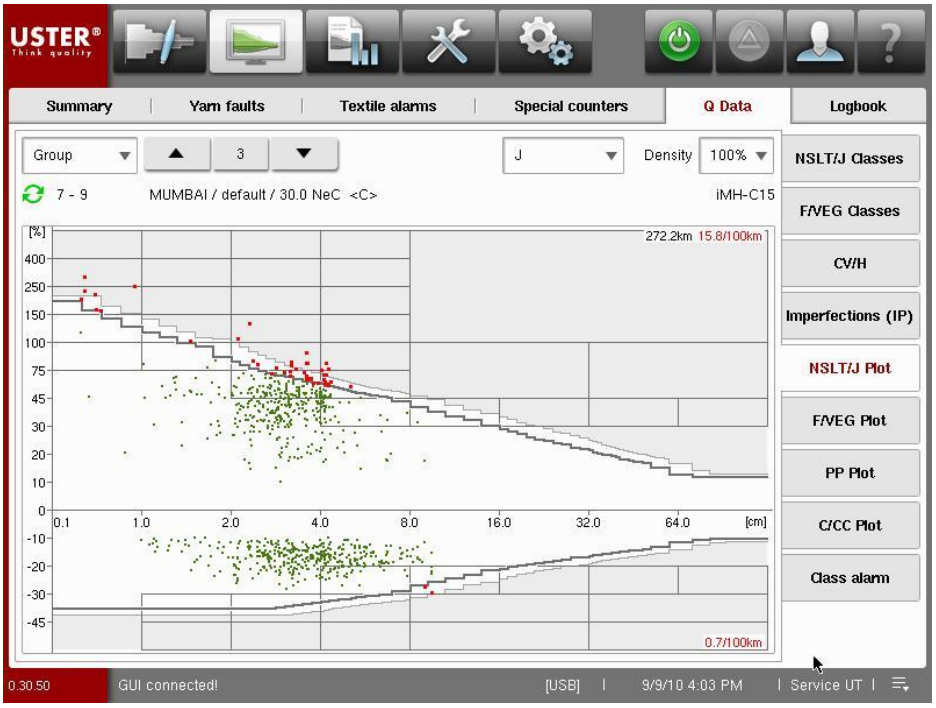


Fig. 5
Jp and Jm settings based on the scatter plot of NSLT/J

2.4 Smart Limits

The conventional way of optimizing the clearing limits is checking the existing ones by looking at the yarn test results and entering the new ones manually based on our own experience. However this procedure is time consuming, especially for a new user, and needs some experience.

With the USTER® *QUANTUM 3,* we have a very useful and smart tool to find the right starting point for the new clearing limits.

The Smart Limit function proposes a starting point for the clearing limits based on the yarn body and also provides a cut forecast to facilitate faster setup of clearing limits.

After pressing the smart limit key, a small window with the two appropriate keys to adapt and optimize the smart limit for NSL thick places appears. The Smart Limit has been developed to propose a starting point for the clearing limits by pressing one button. This proposal can be altered by up and down keys to optimize the settings according the individual quality requirements and productivity. Every change of setting will automatically initiate a new calculation of the cut forecast. It is recommended to use the Smart Limit function after a minimum of 30 km of yarn has already been wound.

Of course all settings recommended by smart limit can also be altered manually. Even in this case the new cut forecast is calculated after pressing the viewing button once.

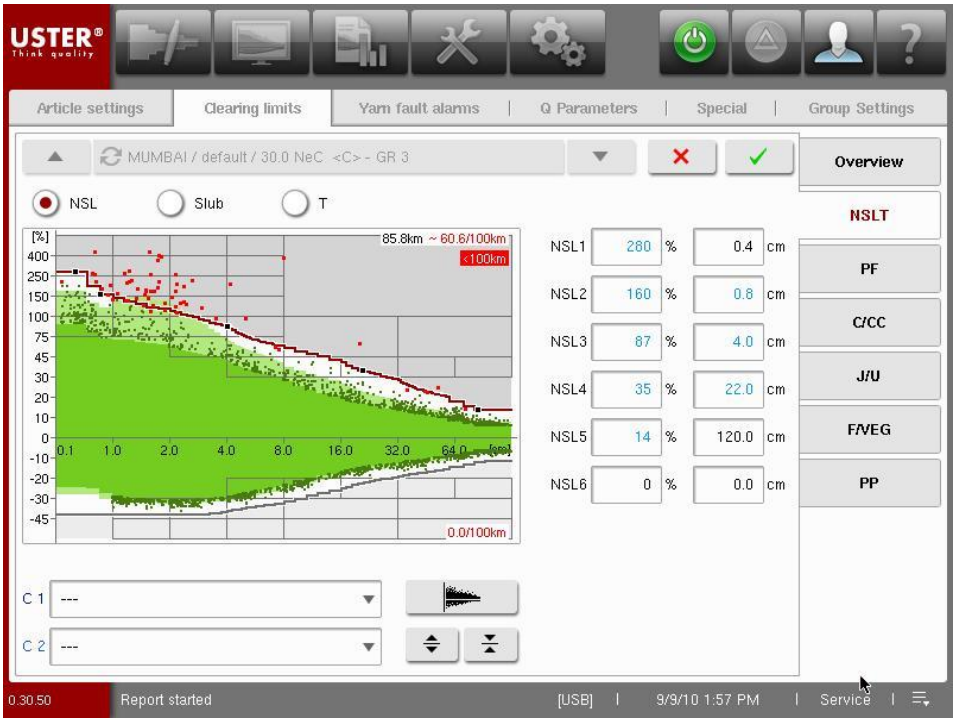


Fig. 6
Proposed setting is a starting point for optimization

As soon as the button at the smart limit window is pressed, the yarn body and the expected cut figure per 100 km is displayed on the same setting page.

The sensitivity of the smart limit can be changed stepwise by pressing up and down keys, whereupon the limit moves away from or closer to the yarn body. At the same time, the new calculated setting point values appear in blue color. Every time this key is pressed, the limit movesfurther away or approaches, and the adapted setting limits are presented in blue color. Simultaneously, the expected cut figure is calculated based on the real yarn events.

3 Overview of the clearing functions of the USTER® *QUANTUM 3*

Window 1: Thick places (NSL), Thin places (T), Periodic Faults (PF), Count Deviations (C) / Continuous Count (CC), Splice Clearing (Jp), Dark Foreign Matter (FD), Vegetable (VEG), Polypropylene (PP)

Window 2:, Light Foreign Matter (FL), Slub yarn clearing (Slub), Splice Clearing (Jm)

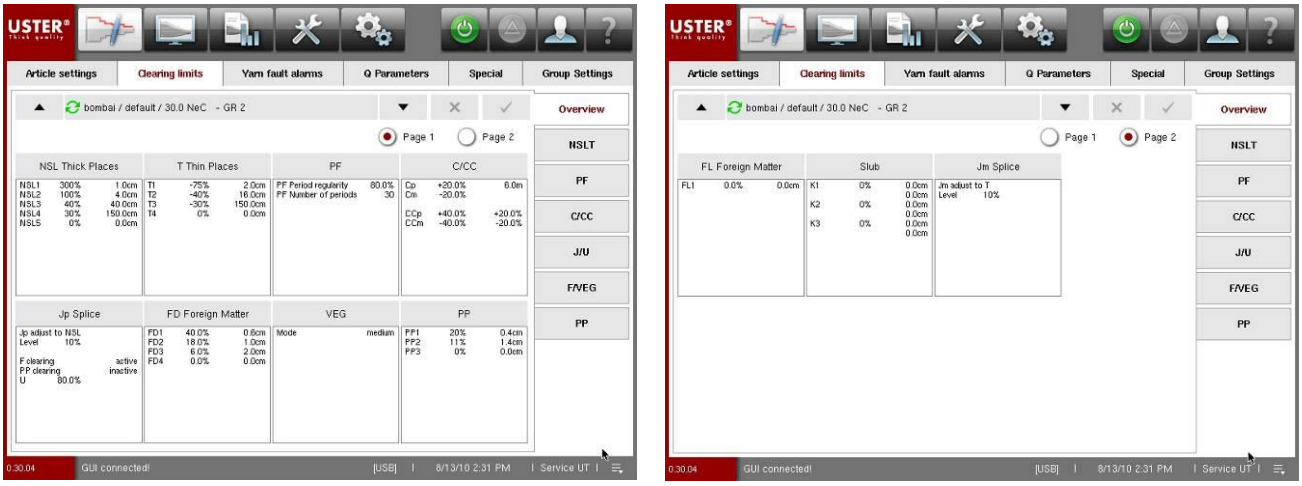


Fig. 7 Overview of the different clearing limits available with USTER® QUANTUM 3 (Windows 1 and 2)

4 Basic functions of the USTER® *QUANTUM 3*

4.1 Setting a clearing limit for thick places NSL and T

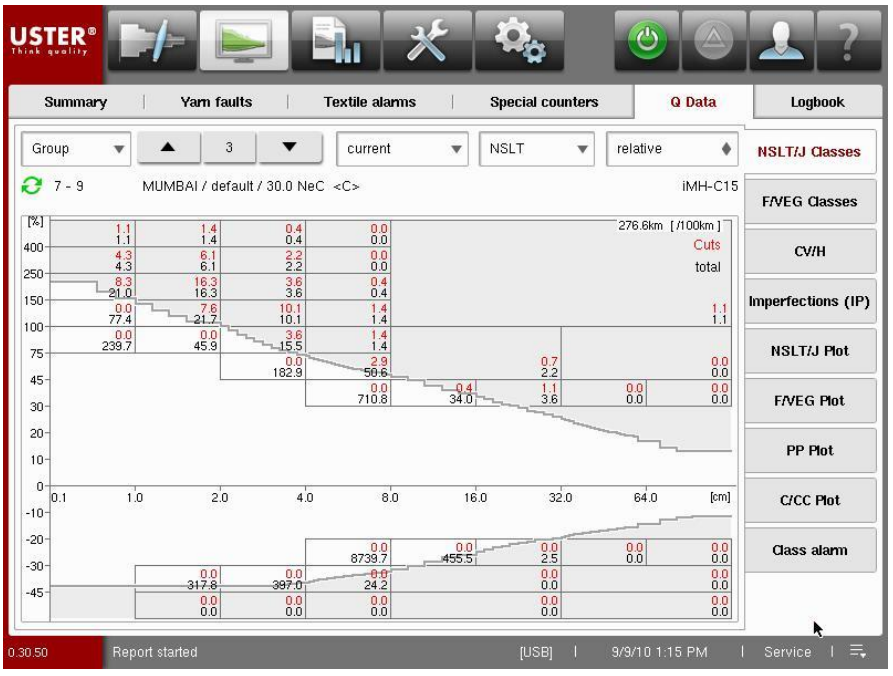
Seldom-occurring yarn faults are classified in the classification matrix of the USTER® *CLASSIMAT*. Besides the classification matrix, the cut thick places are divided in three groups

- N – faults: thick places from 2 mm to 1 cm → very short thick places
- S – faults: thick places from 1 cm to 8 cm → short thick places
- L – faults: thick places over 8 cm → long thick places

The conventional way of optimizing the clearing limits is checking the existing ones by looking at the yarn test results and entering the new ones manually based on our own experience. However this procedure is more time consuming and needs more experience, especially for a new user. Now with the USTER® *QUANTUM 3,* we have a very useful and smart tool to find the right starting point for the new clearing limits. Smart Limit function proposes a starting point for the clearing limits based on the yarn body and also provides a cut forecast to facilitate faster setup of clearing limits.

Fig. 8
Use of smart li its for a running article

Besides the smart limit function, of course the thick places (NSL) classification is still a very powerful tool where we can base our last decision.



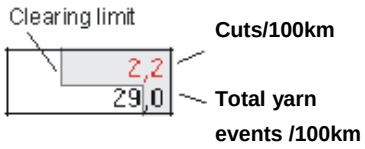


Fig. 9
NSL T online classification

4.2 Setting for Periodic Faults (PF) (Option Q Data)

Periodic yarn faults are thick places, which always occur with the same distance from each other. Such faults are caused in the spinning process, when yarn guiding elements are defective. For example, an eccentric front roller of the ring spinning machine leads to a periodic fault with a wave-length of 8 cm, as this roller always causes faulty drafts in the draw-box within the same time intervals. An effective way of detecting periodic thick places is the application of the periodic faults (PF) channel. Here a cut takes place if thick places in a regular distance and for a given number of periodicities are detected.

The recommended setting for FP Periodic faults is:

- Period regularity: 75%
- Number of periods: 30

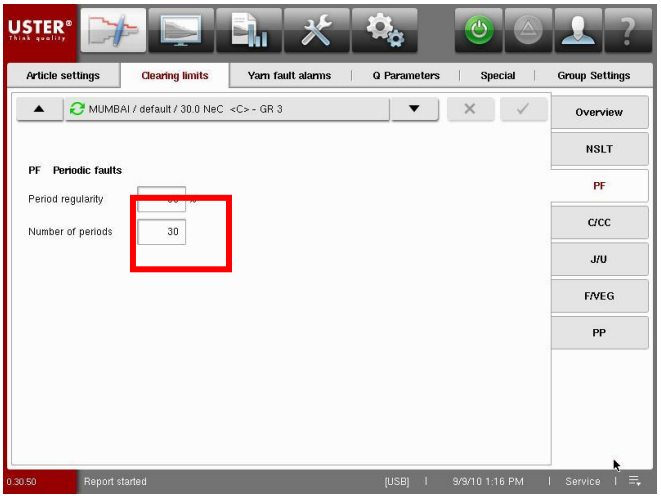


Fig. 10 PF settings for detecting periodic defects

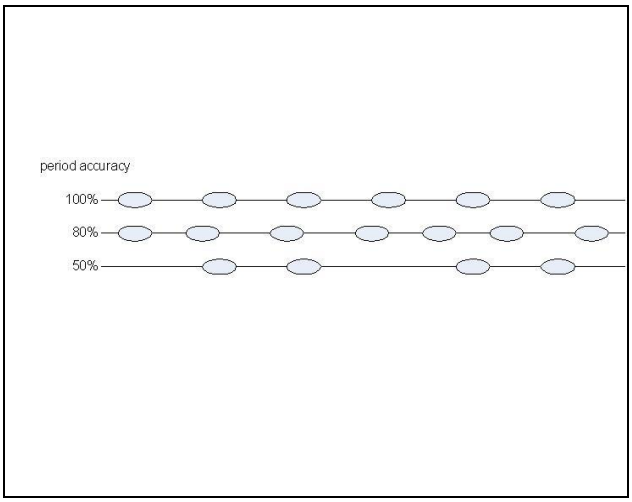


Fig. 11 Disturbing defects (s- called periodic defects)

4.3 Yarn count deviations (C and CC) settings

Deviations of the yarn count within a yarn lot lead to high costs for complaints. The fact that the faulty yarn deviates over several meters or even longer from the nominal count can cause quality problems in the end product.

The C-channel monitors the yarn count in the start-up phase after the splicing process. During this phase, mainly bobbins with the wrong count are registered and the winding position must be stopped and the bobbin must be ejected by activating the corresponding alarm functions.

The CC-channel monitors the yarn count during the whole winding process. Depending on the setting very long yarn faults with a small mass or diameter increase can be detected.

4.3.1 Yarn count deviations at start up (C) settings

The C-channel monitors the yarn count in the start-up phase after the splicing process. After the start-up phase, the C-channel is not active anymore.

In the example the Cp (plus) setting is 20% and the Cm (minus) setting is -20%, respectively. Here the reference length (C) is given as 6 m.

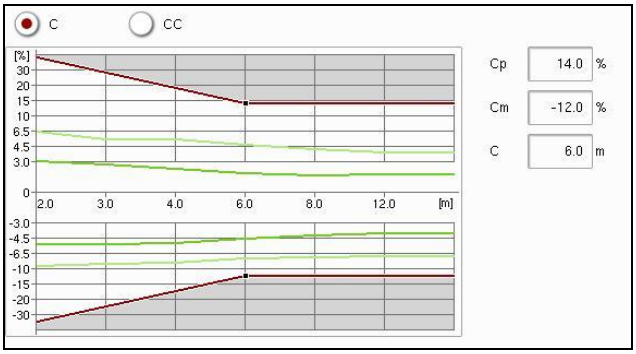


Fig. 12 Cp, Cm and C settings

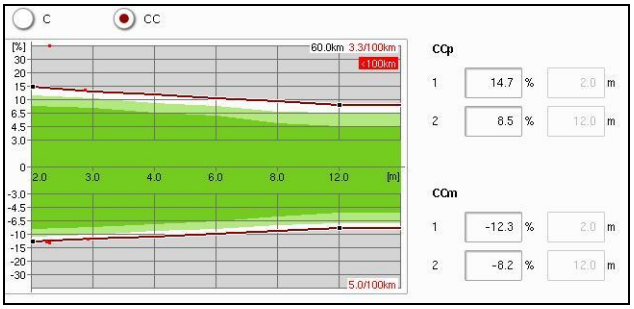


Fig. 13 Setting points and the clearing limit for CC settings (yarn count deviations)

4.3.2 A smart clearing limit for Yarn count monitoring (CC)

The CC-channel monitors the yarn count during the whole winding process. Depending of the setting long yarn faults with a small mass or diameter increase can be detected. This new CC-channel is able to detect and remove count variations at different cut lengths between 2 m and 12 m. The setting points are:

- 2 Set points: CCp +% at 2 m and 12 m
- 2 Set points CCm -% at 2 m and 12 m.

The lines between the set points represent the clearing limit.

By pressing Smart Limit function a proposed starting point for the CC settings will be selected. According to the need of the customer this proposal can be accepted or modified with the smart limit function or manually.

4.4 Splice Clearing settings (Jp and Jm)

The splice channel J checks the yarn joint when passing the clearer just after it has been made by the splicer device. The evaluation of J follows the principle of channel-clearing. It has to be kept in mind that the length as well as the increase has to correspond approximately with the actual yarn joint. The evaluation of the yarn joint starts when the pre-defined limit in percent is exceeded.

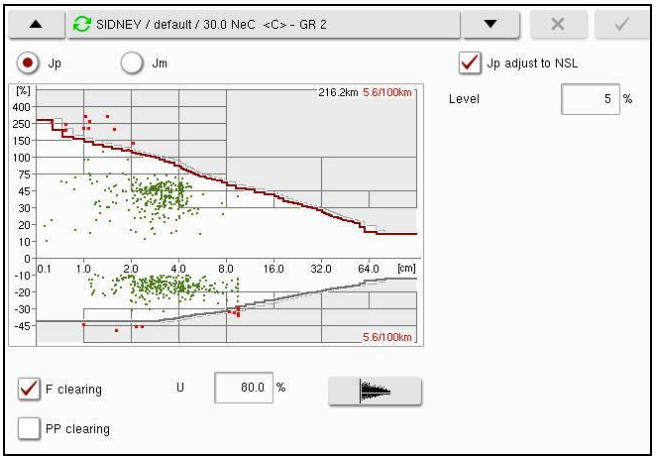


Fig. 14 Jp settings adjustment to the scatter plot of NSLT

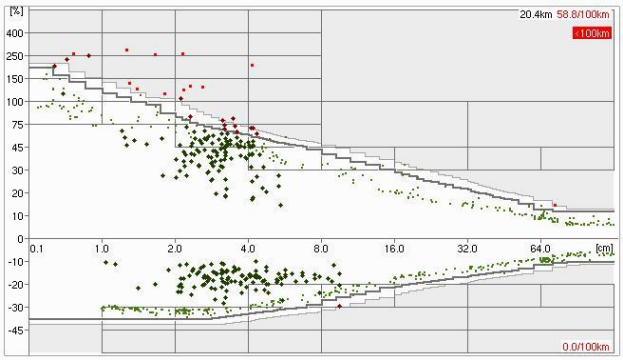


Fig. 15 Display of splices and yarn events on the same screen

Recommendations:

The new setting possibilities will help to ensure that the splice should always be better than the removed yarn fault. Depending on the mechanical settings of the splicer, we recommend to start with the splice adjusted to the thick places (NSL) and thin places (T) limits. For high quality requirements we also can use a setting closer than the clearing limits. This depends on the accepted Jp/Jm cut level / 100 km and of course of the splice quality possible.

4.5 Foreign Fiber (FD) (Option: Foreign matter)

Foreign fibers are one of the major problems in spinning mills. These fibers can be of different origin, character, structure, or color other than the original fibers of the yarn. It is obvious that foreign matter in textile fabrics can no longer be accepted. Therefore, the fight against foreign material in cotton has to cover all the areas where this type of contamination can occur.

Foreign fibers of different origin, composition, structure and color can be detected with the FD channel. By selecting a limit only the disturbing foreign fibers are removed from the yarn. By using FD, dark foreign fibers in light-colored yarn are detected during production. For all types of colored or dyed yarns the USTER® *QUANTUM 3* provides the setting FL which is working the same way as FD.

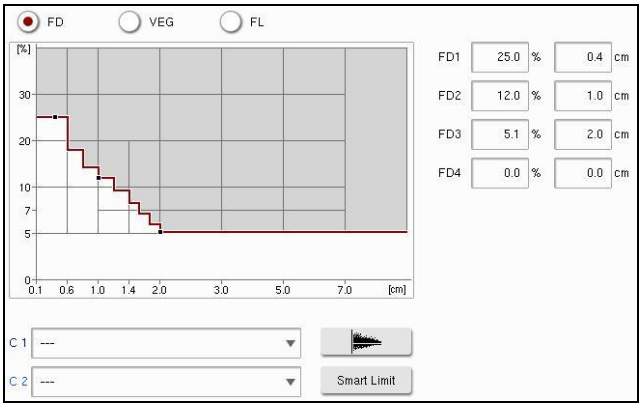


Fig. 16 Setting of the clearing limit for FD foreign matter

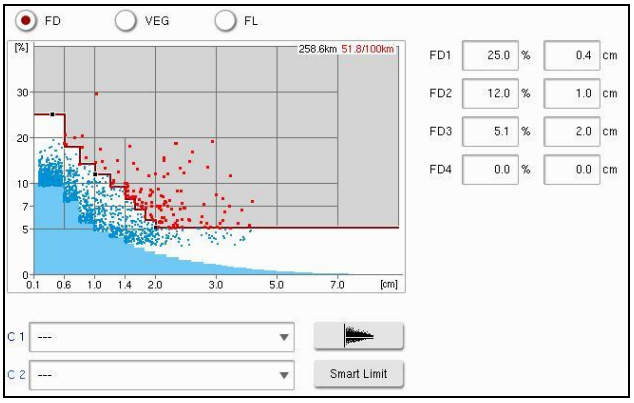


Fig. 17 Display of the dense area for FD foreign matter

After pressing smart limit key, we can see a window with appropriate keys to adapt and optimize the clearing limit. Smart limit gives us a proposed starting point for the foreign matter clearing (FD).

4.6 Vegetable Clearing (VEG) (Option Foreign matter)

The Vegetable Clearing is a very useful tool to distinguish between organic (Vegetable) and foreign fibers. Since vegetables are not visible after the bleaching process, they can often remain in the yarn. The result is a reduction of foreign fiber cuts. There might be a need to cut long or intense vegetables to avoid warping or knitting breaks afterwards.

The USTER® *QUANTUM 3* has a Vegetable Clearing features displaying a dense area and three different setting possibilities. These are named (close, medium and open). The USTER® *QUANTUM 3* also provides vegetable classification.

The Vegetable Clearing is only available in combination with the capacitive clearer.

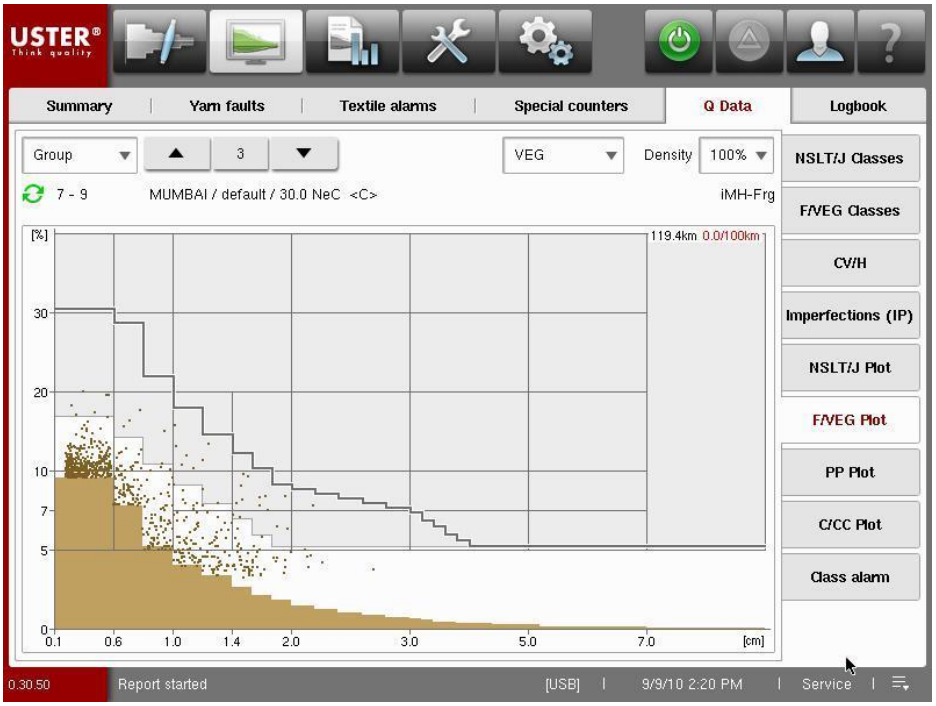


Fig. 18
Display of the scatter plot for VEG Vegetable Clearing

The USTER® *QUANTUM 3* has vegetable clearing with a dense area and three setting possibilities.

- Close: Only small vegetables are remains in the yarn. Of course this will only give a small saving of FD cuts.
- Medium: Small to medium vegetables remains in the yarn. This will reduce the number of FD cuts to a good extend.
- Open: Most of the vegetables remain in the yarn and the highest saving of cuts will be reached.
- Off: The vegetable clearing is switched off.

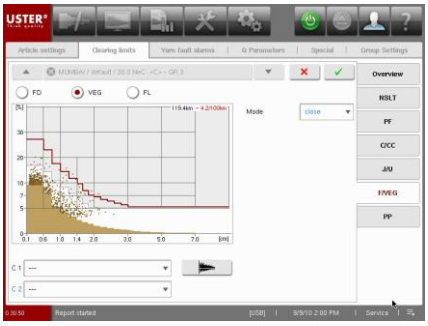


Fig. 19 Vegetable settings close

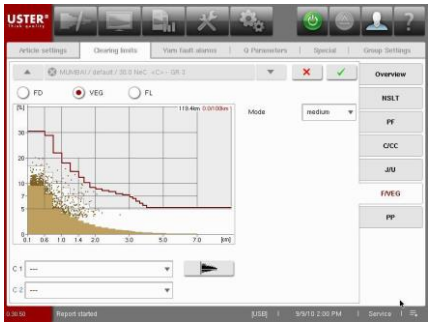


Fig. 20 Vegetable settings medium

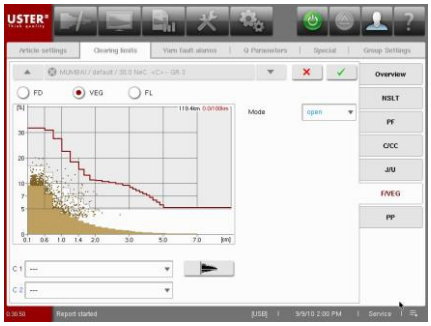


Fig. 21 Vegetable settings open

Recommendations:

Generally, we are recommending using “Medium” level, if the used raw material (cotton) contains vegetables. If the user is sure that the used raw material does not contain any vegetables, then vegetable filter should not be used. For other raw material types like synthetics or worsted yarns the use of this function is not recommended.

4.7 Polypropylene (PP) detection (Option Polypropylene)

White polypropylene fibers can hardly be recognized in grey fabrics, because they cannot be distinguished from the point of view of color. However, they can easily be recognized after dyeing because polypropylene fibers do not absorb dyestuff.

White polypropylene fibers cannot be recognized with sensors which use a difference in color as a means of distinction. Therefore, a specific sensor technology is used to eliminate polypropylene fibers. Polypropylene can be detected only by means of a capacitive or electrical signal, not by an optical signal.

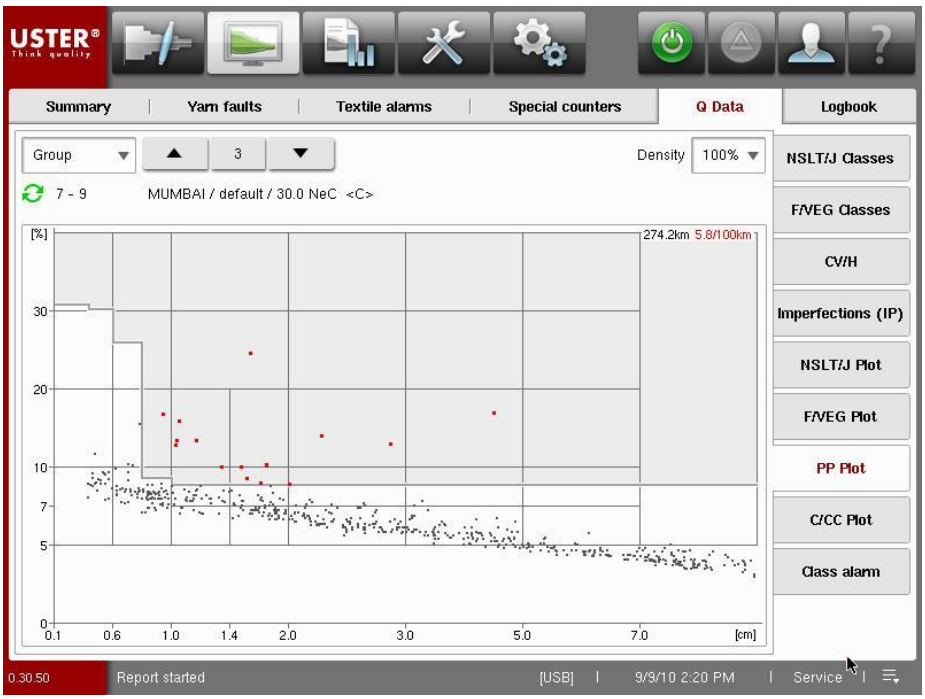


Fig. 22
Display of the scatter plot for PP polypropylene

For the PP detection USTER® *QUANTUM 3* provides the smart limit function as well as the manual setting abilities.

Recommendations:

The first adjustment taken will be the number of cuts accepted in addition to the FD cut level. The second part of optimization is to learn about the efficiency on yarn board. We recommend having at least 70% – 75% of PP defects on the yarn board (colored and white polypropylene). There is mostly no need to set the PP closer than 0,8 cm.

4.8 Q Data Settings (Option Q Data)

Uncompromising quality management in all production stages guarantees a constant quality of the product and, at the same time, cost optimization. In order to react immediately to changes of the yarn quality, it is important to monitor the quality parameters during production on-line.

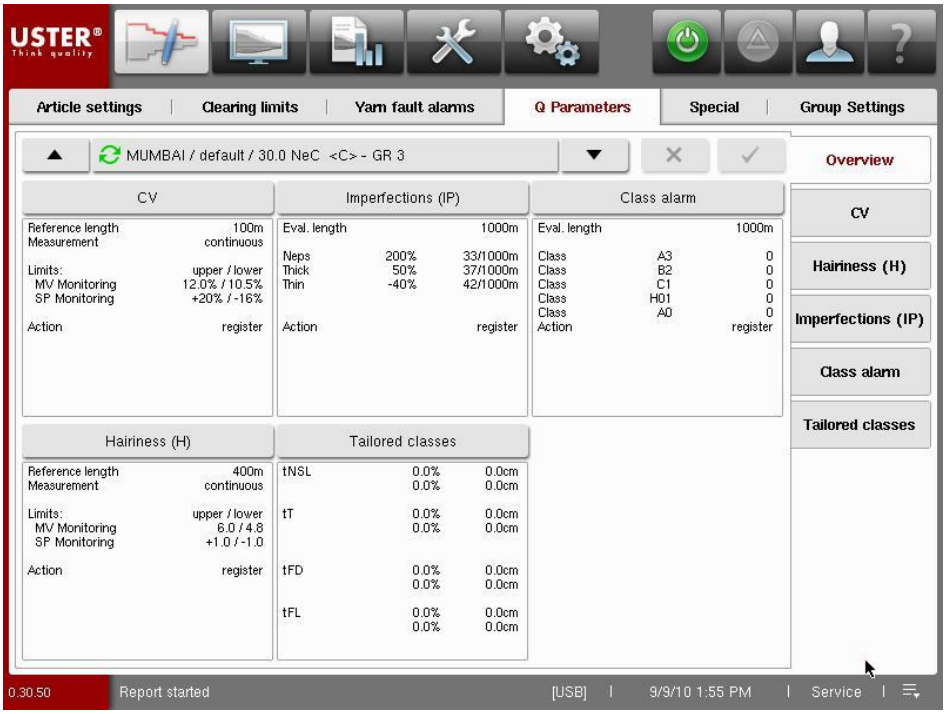


Fig. 23
Overview of Q Parameters

The values of the yarn evenness, of the hairiness and of the imperfections are important information to understand the structure of a yarn. Through their results, it is possible to control the complete course of production. The analysis of the single value makes it possible to carry out countermeasures without any time delay.

4.8.1 Yarn evenness settings (CV)

The USTER® *QUANTUM 3* determines the overall irregularity by calculating the coefficient of variation value CV according to the laws of statistics. With this value, it is possible to determine small differences with respect to mass variations.

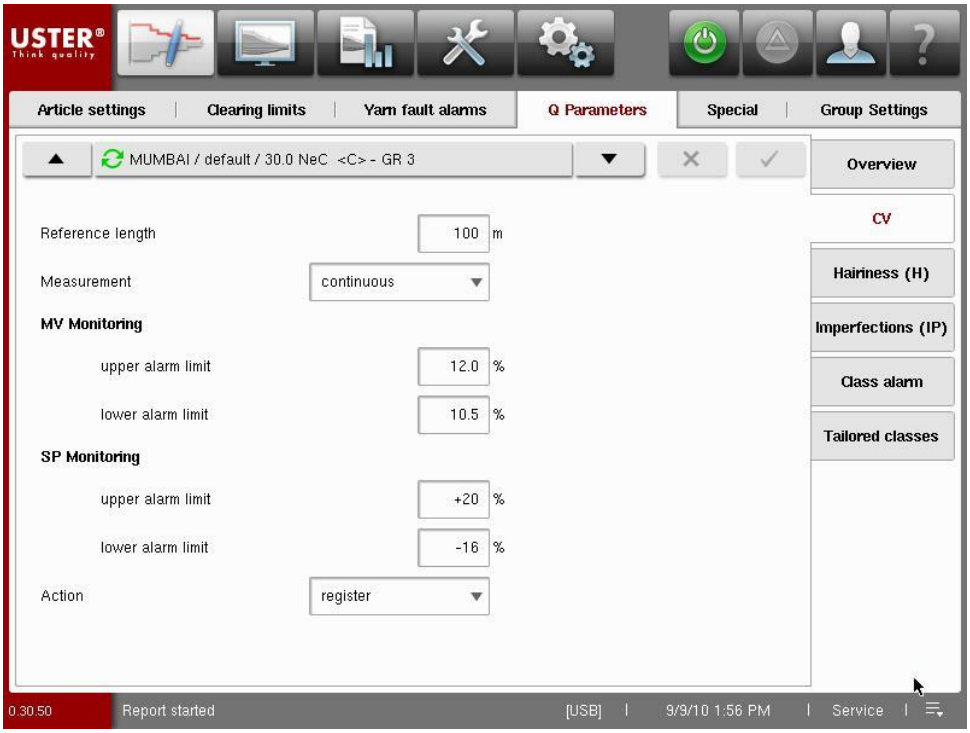


Fig. 24
Setting for Yarn evenness (CV)

Recommendations:

In general, below mentioned limits can be given as are recommendation for CV limits:

CV limits: +20% and -16% of the mean value for the chosen evaluation length for spindle (standard value is per 100 m)

For optical clearers the correlation to the well-known USTER® *TESTER* is not given, due to the different sensor principle. But still it can be used for the identification of outlier bobbins.

4.8.2 Imperfections settings (IP)

Yarns spun from staple fibers contain "imperfections" which can be subdivided into three groups:

- Thin places
- Thick places
- Neps

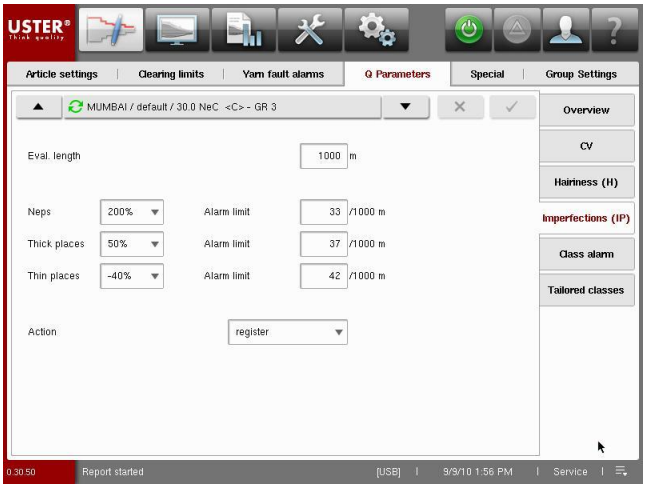


Fig. 25 Imperfection (IP) settings

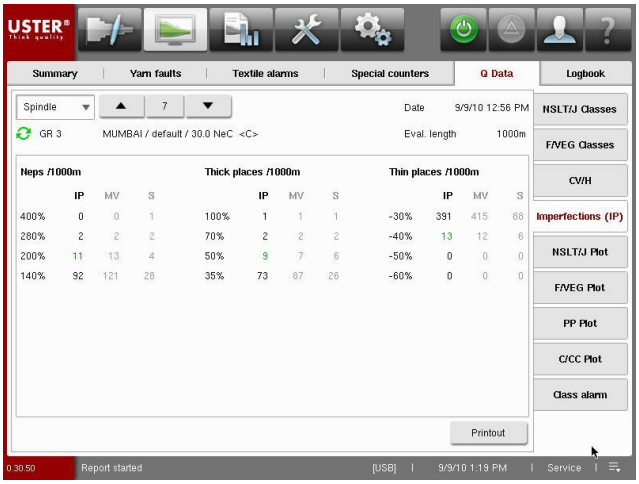


Fig. 26 Imperfections, measured values

Recommendations:

In general, below mentioned limits can be given as a recommendation for IP.

IP limits: Mean (MV) +5 times the standard deviation for the chosen evaluation length for a winding position (standard value is per 1000 m)

For capacitive and optical clearers the same settings are used, but the values are different. Only the results of the capacitive clearer can be compared to the USTER® *TESTER.*

4.9 Hairiness settings (H) (Option Hairiness)

The USTER® *QUANTUM 3* gives also the results of the hairiness per winding position as well as the hairiness mean value of the group and the absolute alarm limit for the hairiness alarm.

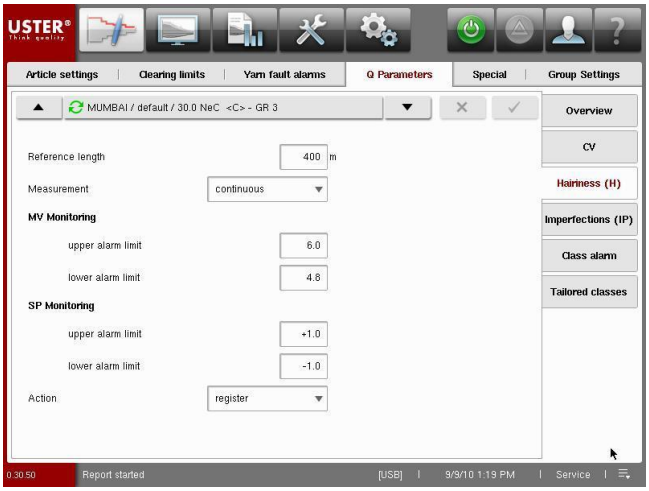


Fig. 27 Hairiness (H) settings

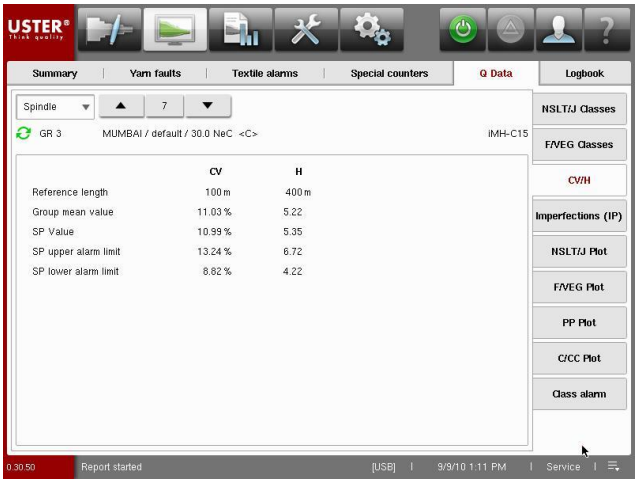


Fig. 28 Display of Yarn evenness (CV) and hairiness (H) for the running article

Recommendations:

In general, below mentioned limits can be given as recommendation for Hairiness:

Hairiness MV +1.0 / -1.0 (standard value is per 400 m)

Hairiness values will be measured with the optical sensor F30 only.

5 Appendices

5.1 Main Menu Keys

Main Menu Keys	Definition
	**Settings:** Definitions for article parameters, clearing limits, Q parameters, alarm limits and group settings
	**Displays:** Viewing yarn fault events, yarn fault alarms and quality data, log book
	**Reports:** Configuration of the printed reports, display of the clearer and quality data, event and special reports
	**Service:** Call up of different service functions for checking the system
	**Start-up:** Basic setting of the installation

Table 1

5.2 Function Keys

Function Keys	Definition
	**Article control** Start and stop of an article / group Clear counters Assigning an article to a group, article change create / delete an article
	**Alarm** Display of textile and technical alarms
	**Login** Password entry
	**Help** Up to now there is no help text available

Table 2

5.3 Control Keys

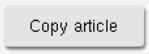
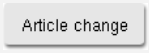
Function Keys	Definition
	Copy an existing article including the settings
	Change an article assigned to a group
	Start an article
	Display the scatter plot and calculate the expected cuts / 100 km
	Proposes the starting point for the clearing limits based on the body / yarn dense area
	Smart Limit one step less sensitive
	Smart Limit one step more sensitive

Table 3

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