

ADDITIONAL CLEARING PARAMETERS ON MODERN ELECTRONIC YARN CLEARERS

Vardhaman B. Chougule¹, Prof (Dr.) U. J. Patil²

¹Assistant Professor, Department of Textiles, D.K.T.E .Society's Textile & Engineering Institute, Ichalkaranji-416115(M.S), India.

²Professor, Department of Textiles, D.K.T.E .Society's Textile & Engineering Institute, Ichalkaranji-416115(M.S), India.

Abstract - It is still difficult to produce a fault free yarn from ring spinning due to various reasons. A Continuous incoming yarn inspection guarantees a constant satisfactory quality of end product. In this respect yarn clearing and classifying systems are playing an important role. At the beginning however, the clearer was only designed for the elimination of disturbing thick places. In the past 50 years, the yarn clearer became a multi-functional **sensor** with capabilities to minimize remaining quality problems on the cone. Modern clearer are equipped as tool to monitor 100% of all bobbin along with basic clearing (NSLT), additional clearing parameters available are Cluster faults or Pearl chain fault removal, foreign fiber clearing (Clearing and classification of foreign matter, dark and bright and Clearing of synthetic foreign matter PP, PE foils, PES) and separation of off quality bobbins through lab pack options like SFI/D, Variable Coefficient of variation (VCV) and various options like online Imperfections, Surface Index SFI, OFFCOLOR (Options) Shade variations, Computer Aided Yarn Clearing, 'Yarn Body' concept, Smart Clearing Technology, Core Yarn Clearing etc.

Key Words: Electronic yarn clearer, Imperfections, Yarn Faults, Foreign Fiber, Splice, and Cluster faults, Surface Index, yarn body, Smart Clearing, Core Yarn Clearing, Shade variations.

1. INTRODUCTION:

The yarn produced in spinning that is on ring frame has a lot of neps, short thick, long thick, long thin and other faults which affects in the subsequent process. The yarn exhibits a yarn fault every 1 to 5 km. More faulty yarn causes breakages in subsequent processing machines. Machine stops caused by yarn breakage are expensive, especially in the subsequent processes after winding, because all the other yarns need to wait for the joining up of the broken yarn. When comparing the cost of one single yarn breakage in winding to the other subsequent processes, it can be found that warping is about 700 times more, sizing is about 2100 times more and weaving is about 490 times more. Therefore the yarn processing industry demands a fault free yarn. As a result, spinners must do everything possible to produce packages with good quality at winding to increase the efficiency of the subsequent processes and reduce the cost caused by yarn breakage. A Continuous incoming yarn inspection guarantees a constant satisfactory quality of end product. In this respect yarn clearing and classifying systems are playing an important role. In the past 50 years the yarn clearer became a multi-functional sensor with capabilities to minimize remaining quality problems on the cone with the help of additional clearing parameters added to modern electronic clearer.

1.1 Functions and Types of Electronic Yarn Clearer

Richard further summarized that today's electronic clearers on the winding machine are not only capable to detect and eliminate seldom occurring disturbing yarn faults but also separate bobbins with quality characteristics beyond pre-set limits.

Electronic Yarn Clearer available in the market is principally of two types -capacitive and optical. Clearers working on the capacitive principle have '**mass**' as the reference for performing its functions while optical clearers function with '**diameter**' as the reference.

1.2 Yarn Fault classification

Based on the average yarn diameter (basic diameter), the following Yarn faults can be detected and cleared:

- i. **Thick and thin places:** are defined, depending on whether there is an increase or a decrease in diameter. Within the thick places further distinctions are **Neps**, as extremely short (up to a few mm) and extremely thick faults (several times the base diameter). **Short faults**, as faults of limited length (of about 0.5 to 10 cm) but of considerable thickness (1.1 to 4.0 times the

base diameter). **Long faults** and **double ends**, as faults of considerable length (from 5 to 200 cm) but of limited thickness (1.04 to 2.0 times the base diameter).

- ii. **Faulty splices**
- iii. **Yarn count deviation** (positive / negative) :Reference length 10 – 50 m.
- iv. **Yarn count deviation** (positive / negative): In the short count range (1–32 m).
- v. **Accumulations of Faults**(Clusters):
 - Periodic clusters (moiré),
 - Non-periodic clusters.



Figure1 Cluster Faults

In the short, long or thin fault range which repeat themselves several times within a Short distance.

- vi. **Off-standard Bobbins** (SFI/D): Irregularities of the surface structure such as hairiness, neppiness, irregularity and Imperfections (IPI).
- vii. **Yarn irregularities** (VCV): Disturbing diameter variations or sporadic irregularities, for example: Neppiness, Irregularity (CV), Imperfections (IPI). Check length adjustable between 1–50 m.
- viii. **Foreign Matter** (F): Foreign matter with a color that is different from the base color of the yarn: Bright foreign matter in the dyed yarn and Dark foreign matter in the raw-white yarn.
 - Synthetic Foreign Matter** (P): Synthetic foreign matter (e.g. polypropylene), Irrespective of the color of the yarn and the foreign matter, for example, white and transparent polypropylene in raw-white yarn.

2. Additional clearing parameters:

2.1 Colored Foreign Matter (F):

Cotton can be contaminated with foreign material from the cotton field to the spinning mill in different ways. Already during harvesting, materials like e.g. plastic, human animal hair, feathers, strings, packing material, stems, leaves and oil contamination can get into the cotton.

The classification of foreign fibers is based on the evaluation of differences in contrast. Foreign matters are classified as follows: The length classes on the horizontal axis are divided into S–I–R–O, the darkness levels on the vertical axis into 1–2–3–4. In addition, each class is divided into four subclasses. (= total 128 classes).The darkness scale is divided into a positive area (darker color positions) and a negative area (for brighter color positions).

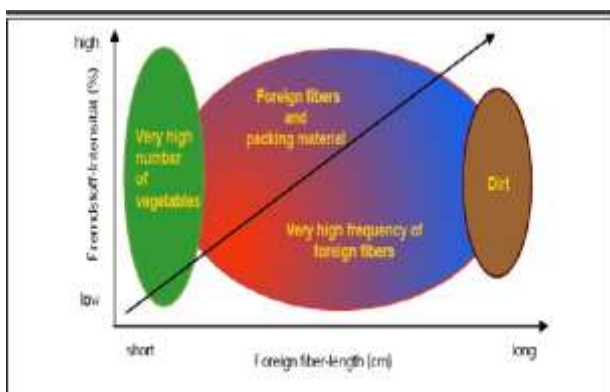


Figure 2 Distribution of foreign fibers

Dark	DS4	DI4	DR4	DO4	4
	DS3	DI3	DR3	DO3	3
	DS2	DI2	DR2	DO2	2
	DS1	DI1	DR1	DO1	1
Bright	BS1	BI1	BR1	BO1	1
	BS2	BI2	BR2	BO2	2
	BS3	BI3	BR3	BO3	3
	BS4	BI4	BR4	BO4	4
	S	I	R	O	

Figure 3 Classifications of foreign fibers

2.1.1 Foreign Fiber Detection Principle:

Yarn gets illuminated from various angles (2a, 2b, 2c).The various light sources are controlled in such a way, that the receiver (1) considers the regular yarn as transparent. Once a Foreign Fiber is detected within the yarn, this balance (light distribution) is disturbed. Depending on the respective contrast condition a certain differential signal is generated by the receiver (1).

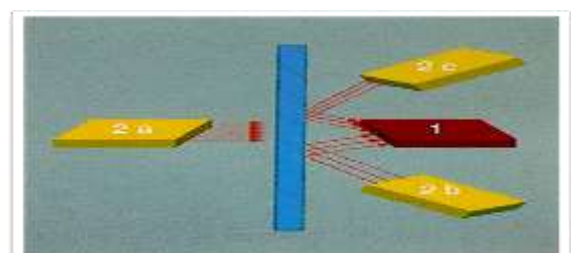


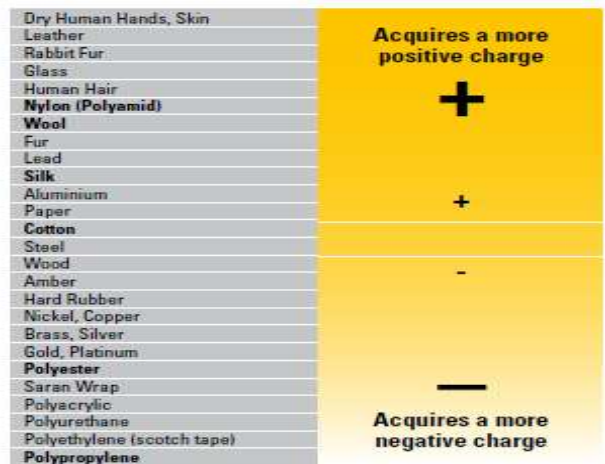
Figure 4 Foreign Fiber Detection Principle

2.1.2 Synthetic Foreign Matter (P):

The detection of synthetic foreign matter as polypropylene, polyamide (nylon) etc. is based on triboelectricity. The different electrical charging of materials (e.g. cotton and polypropylene) caused by the winding process is evaluated.

The triboelectric effect is an electrical phenomenon where certain materials become electrically charged after coming into contact with another, different, material. The polarity and strength of the charges produced differ according to material and surface smoothness. That means: The further the materials lie off each other in the series, the more definitely they can be detected.

It is observed that for making Foreign Fiber (FF) controlled yarn the recognized mills in India allow to cut 7 to 15 FF Cuts per 100 Km in Imported cotton and 40 to 70 FF cuts per 100 Km in Local cotton

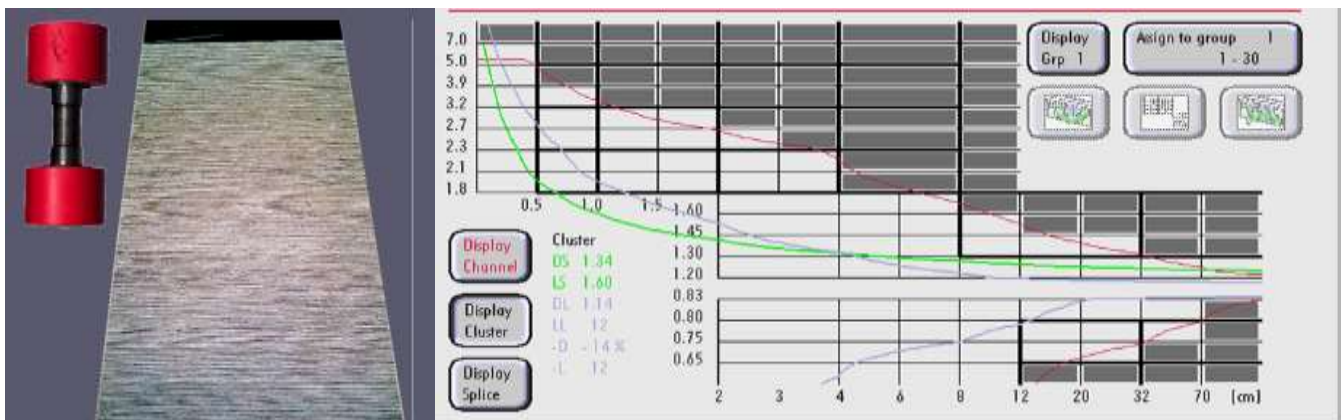


Triboelectric Series

Figure 5 Triboelectric Effect

2.2 Fault Cluster:

Fault cluster means the accumulation of un-cleared /unobjectionable yarn defects in a shorter length. The accumulation of yarn defect may be inneps, short thick, long thick, thin yarn defect. These accumulated yarn defects are below the desired clearing curve; hence these are called as un- objectionable yarn defect. Fault cluster becomes an objectionable yarn defect when no. of un-objectionable yarn defects accumulated in shorter yarn length.



Clearing Curve N, S, L, T = red; Cluster Short = green; Cluster Long =yellow; Cluster Thin = green;

Figure 6 Fault Cluster

These kinds of faults are found disturbing in the Fabric Appearance. It is possible to detect such type of accumulated CLOUDED yarn defects using the Fault cluster channel. Modern clearers detect such clouded short, long, thin, nep cluster defects at a length from 1 meter to 80 meter. It is possible to detect un-defined Periodical and non Periodical defects using this channel.

2.3 OPTIONS:

2.3.1 Imperfections:

Frequent yarn faults are described as Imperfections in the language of the textile industry. The source of these faults is found in the raw material or in a non-perfect spinning process. The raw material, card wires, eccentric top rollers/bottom rollers, defective aprons, rings and ring travellers have a significant influence on the imperfections. LOEPFE's quality assurance system LabPack delivers, online, the number of imperfections (neps, thick and thin places) per 1000 m as well as the irregularities (small per m) of a yarn.

2.3.2 Surface Index SFI:

In order to predict yarn behavior during processing in weaving or knitting, it is not sufficient to simply consider individual quality characteristics (e.g. yarn irregularity) to assess a yarn. Only a combination of different quality criteria (e.g. hairiness and irregularity) supports making a definite conclusion. These quality characteristics are combined in the surface index SFI enabling the user to monitor the quality level easily and efficiently. This statement has been confirmed by comprehensive investigations carried out by Loepfe Brothers Ltd.

Definitions Surface Index SFI

- The yarn core diameter is hidden
- Sum signal SFI

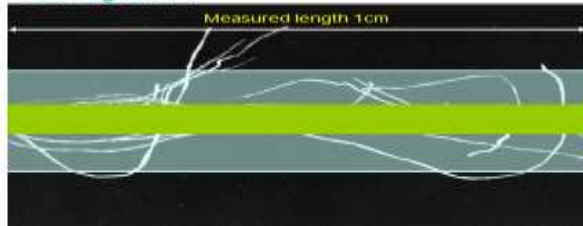


Figure 7 SFI

Definitions Surface Index SFI/D

- Yarn core diameter 100%
- Sum signal SFI/D

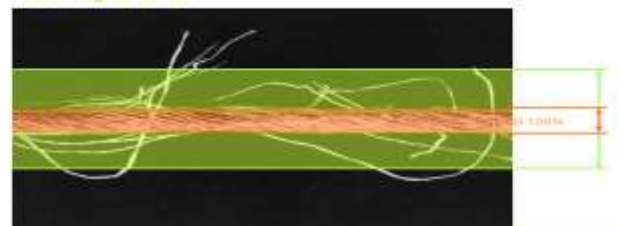


Figure 8 SFI/D

The SFI is the sum signal of the fibers protruding from a yarn over a measured length of 1 cm. The SFI statistics are neutral with regard to dimensions. The SFI/D is the sum signal of the fibers protruding from the core diameter of the yarn. The core diameter of a yarn is defined as 100%. Its statistics therefore relate to 100. The diameter-related surface index SFI/D serves for reliable detection of quality changes relative to the surface characteristic of the yarn to be wound. This can, for example, prevent strong variations of the yarn hairiness which can cause a cloudy appearance of a knitted fabric after finishing. When the values are above or below the set limits in percent (+/-), relative to the SFI/D reference value, off-standard bobbins are detected and eliminated from production.

Table-1 Reference values SFI/D

SFI / D		
Insensitive setting	Limit	+/- 30%
Sensitive setting	Limit	+/- 25%
Very sensitive setting	Limit	+/- 20%

2.3.3 Variable Coefficient of variation Channel (VCV):

Disturbing diameter variations caused by draft faults, soiled cylinders or sporadically occurring irregularities can be detected. As opposed to laboratory practice where check lengths of 400 or 1000 m are normally used for CV determination, the check length of the VCV can be varied continuously between 1 and 50 m. This allows for the specific detection of diameter variations in this length range.

Table-2 Reference values VCV

VCV				
Insensitive setting	Limit	+/- 30%	Length	50 m
Sensitive setting	Limit	+/- 25%	Length	20 m
Very sensitive setting	Limit	+/- 20%	Length	10 m

2.3.4 Computer Aided Yarn Clearing (CAY):

“Computer Aided Yarn Clearing” “CAY” in USTER QUANTUM CLEARER is an easy-to-use tool to optimize the clearer limits for yarns which are not yet available in the data bank. Furthermore, the systems offers further advantages like Setting are visualized and their effects on the number of cuts are displayed directly. Various forms of representation, as e.g. the scatter plot or the density lines are an aid for the choice of the clearing limit. Clearing limits can be downloaded to the control unit at the machine in order to avoid wrong inputs at the machine.

Scatter Plot:

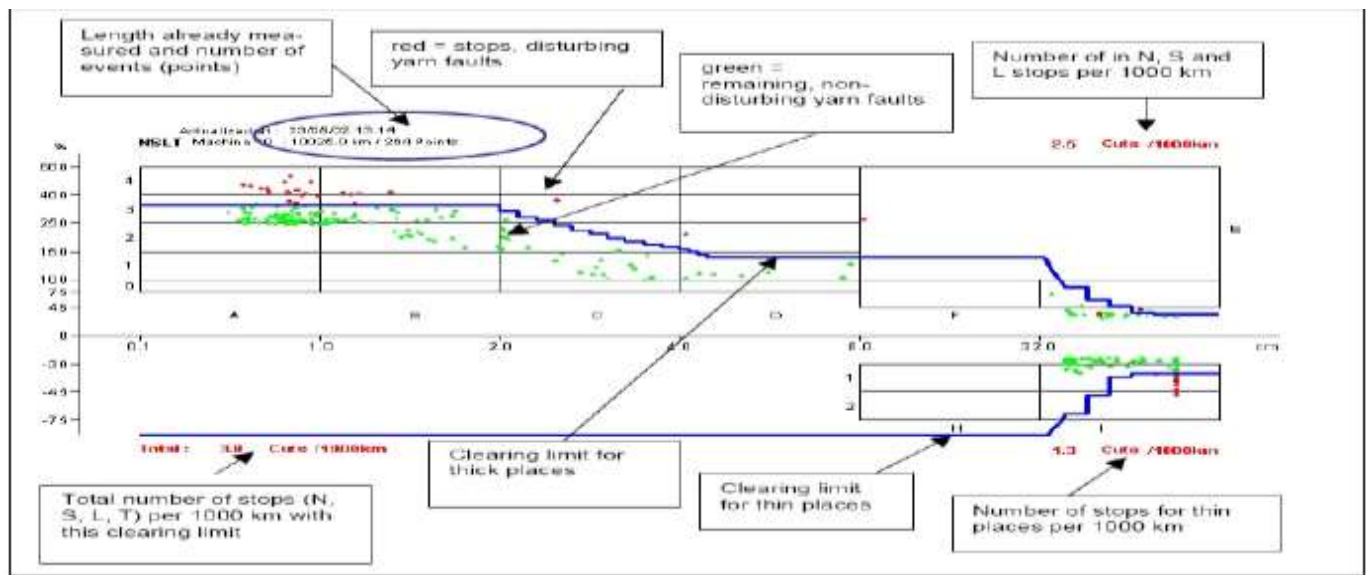


Figure 9 Scatter Plot Clearing limits and explanations

For each print in the scatter plot, the yarn fault can be simulated on the computer screen as an individual fault or in a woven or knitted fabric. These simulations are possible for thick places, thin places and foreign fibers.

2.3.5 The yarn body:

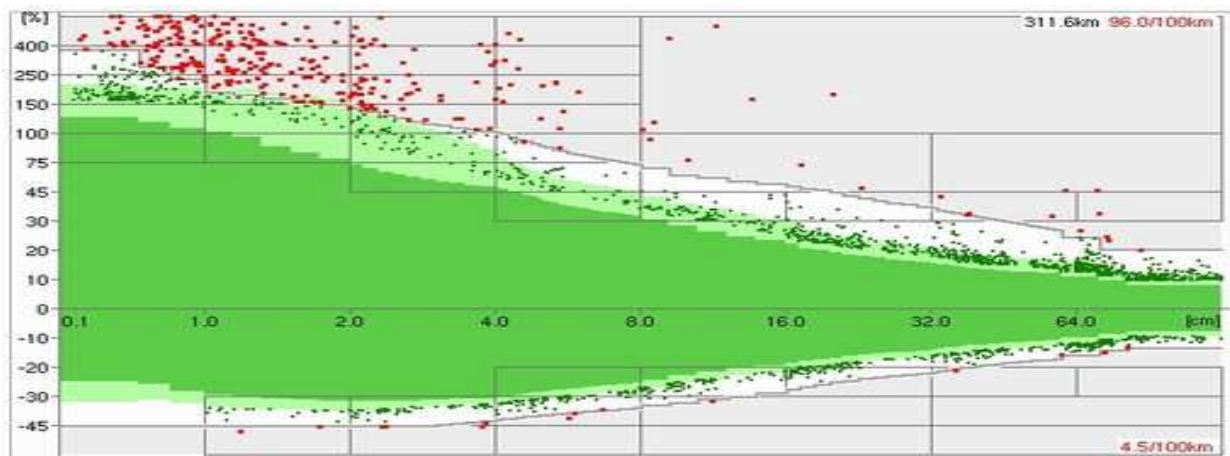


Figure 10 The yarn body graphically

A key element of the USTER QUANTUM 3 is the 'Yarn body' concept. This allows the removal of only the really disturbing faults, while also optimizing the number of cuts. The yarn body is a new visual parameter – effectively a 'picture' of the yarn and its quality characteristics. The concept takes account of the yarn unevenness; the count; raw material; and the spinning process used.

2.3.6 Smart Clearing:

With conventional yarn clearers, spinning managers need to spend a lot of time and effort finding the right clearing limits for a new article. The USTER QUANTUM 3 handles this automatically – within only a few minutes. This unique feature, called Smart Limit, suggests optimum clearing limits based on the yarn body. Every change to the settings will automatically produce a new

cut forecast. In the example for a Ne 40 yarn if we reduce the cut level by 1 cut per 100 km for all machines without changing any other settings. This alone will result in savings of over USD 40,000 per year in a typical 600-position winding installation.

2.3.7 Sensing Head:

The 7- Segment Sensing head displays number or alphabet according to fault. So that we can able know which fault is cut or which operation is going on.

2.3.8 Other Features:

During calibration of group when lot starts or during piloting the yarn wound on the cones is uncleared in case of optical clearing. So to avoid this modern clearer suck that uncleared yarn by reverse rotation of drum.

The classification of the splice connections is performed relative to groups and also to spindles. All cleared and remaining yarn faults are classified according to internationally applicable standards. The reference lengths (for example per 100 000 m) can be freely selected. Classification is performed relative to groups and also to spindles.

The premier *iQON* clearer uses a combination of “Visible Light” and “Infra Red” technologies. Visible Light – Used to detect contaminants that are different in colour compared to parent yarn. Infra Red – Used to detect contaminants that are same in colour ex. White poly propylene. High sampling resolution of 1mm length and 1% amplitude enables accurate yarn clearing. Classification for White PP Faults is possible in 12 classes to analyse and optimise the setting process. Zoom-in tool available for Mass and FF which enables to visualise the distribution of faults resulting in accurate and quicker optimization of clearing curves.

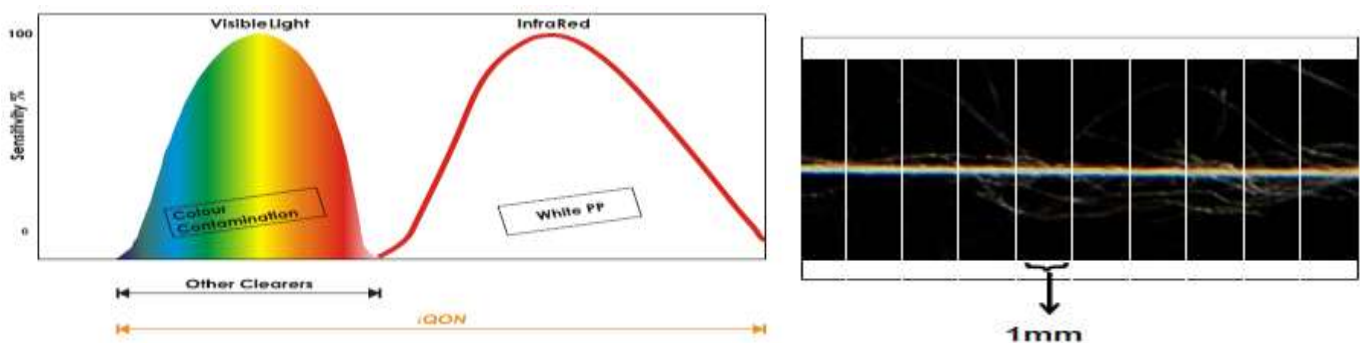


Figure 11 “Visible Light” and “Infra Red” technologies with high resolution for contamination detection.

2.3.9 Core Yarn Clearing

Core yarn produced with sections of missing or off-center elastane is a serious problem, potentially causing huge waste of fabric downstream. Core Yarn Clearing uses unique USTER® sensor combinations to identify significant problem areas with the core component. The Core Yarn feature is only available with the Foreign Matter option.

2.3.10 Shade Variation

For fabrics made of mélange and colored yarns, variations in color and shade are critical. USTER’s advanced foreign matter sensor avoids such defects with its Shade Variation feature, available with USTER® *QUANTUM 3* Anniversary Edition

3. CONCLUSION

Today’s Modern electronic yarn clearer became a *multi-functional sensor* along with Basic yarn clearing. Additional clearing parameters such as Cluster faults or Pearl chain fault removal, foreign fiber clearing (Clearing and classification of foreign matter, dark and bright and Clearing of synthetic foreign matter PP, PE foils, PES) and separation of off quality bobbins through lab pack options like SFI/D, Variable Coefficient of variation (VCV) and various options like online Imperfections, Surface Index SFI, OFFCOLOR (Options)Shade variations, Computer Aided Yarn Clearing, ‘Yarn Body’ concept, Smart Clearing Technology , Core Yarn Clearing etc made it *multi-functional sensor*. It also monitors and controls machine functions.

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