



## **Digital Tension Analysis in Yarn Mfg** from Extrusion to Warping

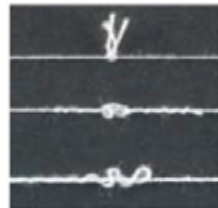
Our tension system is used to analyze all aspects of the yarn process that cause yarn instability and anomalies.

## YARN



### PACKAGE QUALITY

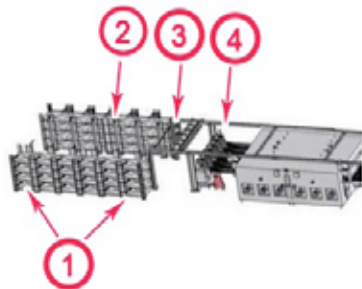
Overlaps in the package created from the winder in the twisting process causes very large yarn pulls at the creel up to 1000 grams for up to 25 seconds. Most creel pulls occur in the last 10% of the package.



### YARN QUALITY

Off twist yarn, especially with small denier or multi ply yarn, will cause snagging in the yarn process. Also, slubs & knots are more frequent when a package is created from skinner packages. Rewound packages have more connection points (knots) which increases anomalies & breakouts.

## YARN PROCESS



### CREEL

Vertical, horizontal, & proximity alignment are all important for yarn stability at the creel. Proper positioning allows for a more stable balloon.



### YARN PATH

Eyelets that are too small or have cracks/edges will cause a greater number of breakouts. Also, bad angles in the yarn path will have a negative effect on tension & stability.



### WINDER / TAKEUP

Speed, especially acceleration, has a negative affect on yarn tension.



### **DIGITAL SENSOR**

Mini computer per position

Fully programmable with unlimited styles/recipes

Tracks & records multiple readings per second

Every anomaly is labeled with 17 data fields

Parameters can be set around Avg Tension, Peak High, Peak Low, & no yarn with time variables to alert/stop/track each anomaly per position.

Full production tracking per position/machine/plant.

Can run independent of central computer/controller.

Has a analog output for sending tension signal to other controls, such as take up speed.

### **ANALOG SENSOR**

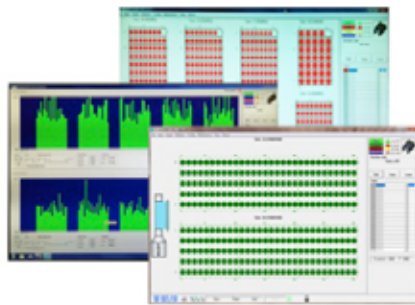
Has a analog output for sending tension signal.

No individual position control.

Much greater load on central processor

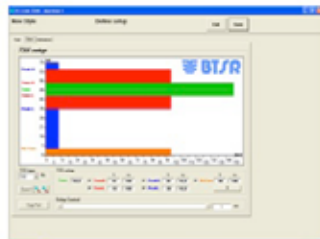
17 parameters, # positions, no instant decision making

Our automation capabilities give you greater visibility & control over both quality & production.



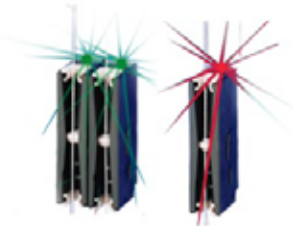
### LIVE GRAPHING / OPERATOR ASSIST DISPLAYS

Production monitoring screens allow the operator to quickly identify stops & problems. This display is fully customizable to match your specific layout and can be projected on any TV or monitor for easy viewing.



### CONTROL PARAMETERS

BTSR has the broadest offering of yarn sensors & controllers in the world. We allow you to monitor, control, & track every aspect of the yarn as it moves through your processes.



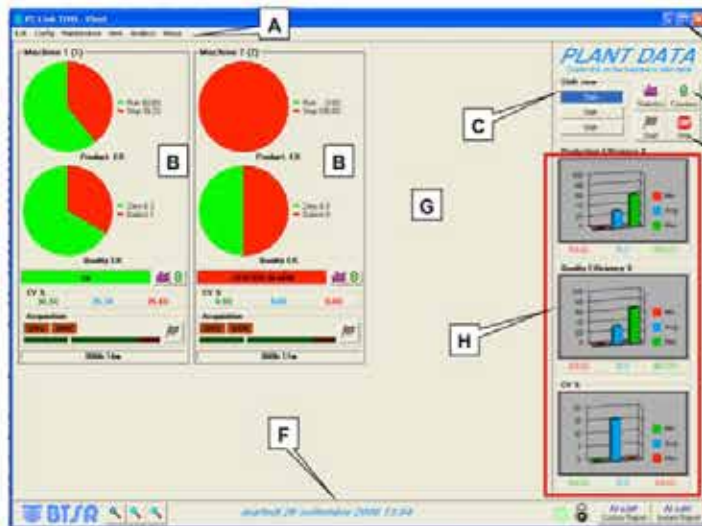
### ALERT/STOP SIGNALS

All BTSR sensors incorporate LED lights to alert the operator which position needs to be addressed. Every BTSR system can be customized to send alert signals to numerous devices in your plant, such as lights, sound alarms, or stops for the individual position or machine.



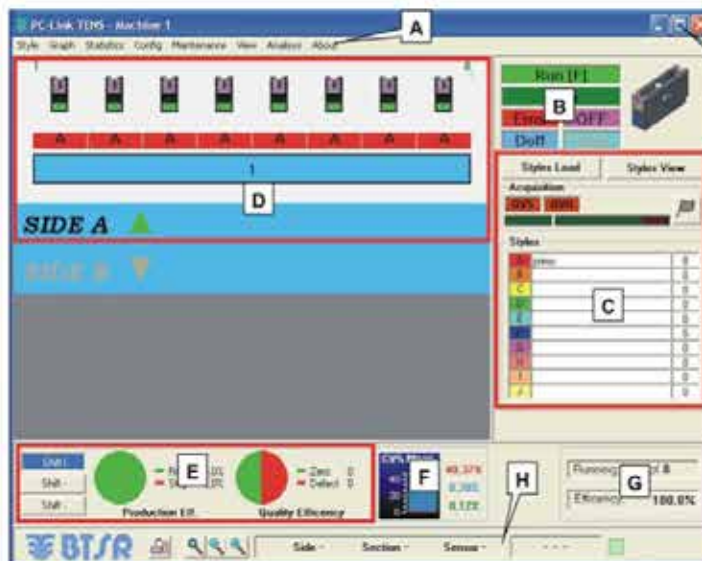
### CUSTOM REPORTS

Quick reports give management detailed visibility on production output & quality. There is extensive data to give you a clear picture of your operation.



## PRODUCTION MONITORING

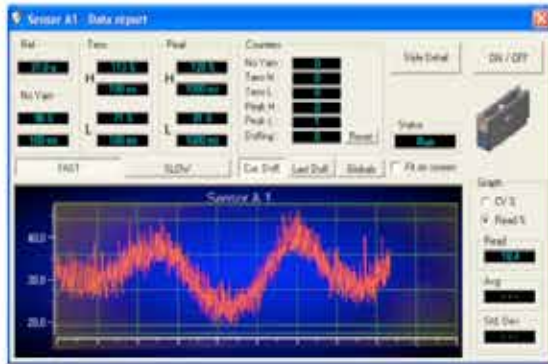
The system shows the production efficiency & “real time” efficiency of each machine. At the bottom, plant statistics for the last 3 shifts are shown, as well as the number of full bobbins, short bobbins, & breaks that occurred. Automated error signals alert to which machine is experiencing anomalies & the type of anomaly that is occurring.



## QUALITY MONITORING

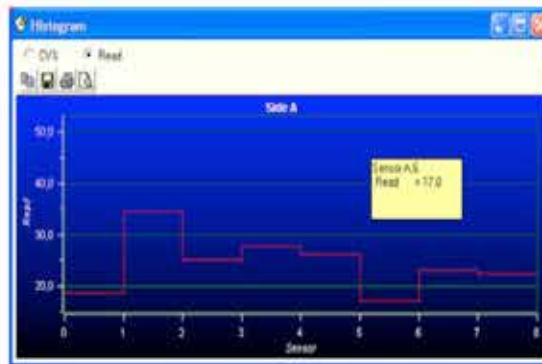
The status & progress of each position is displayed for each side of the machine. Fully customizable, this display shows detailed information which tracks:

- position location
- yarn style/recipe
- lot production
- position status (run, stop, broke)
- tension
- production efficiency
- # stops & breakouts
- # anomalies (when parameters are exceeded)



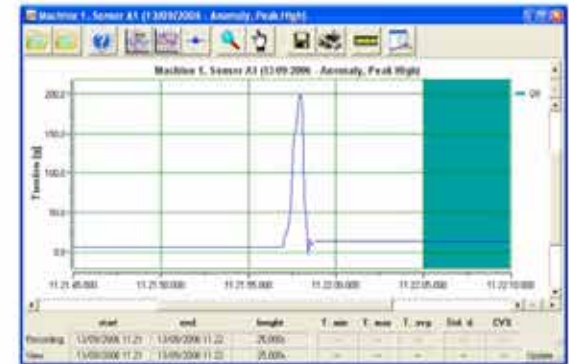
### LIVE GRAPHING

View the tension, avg tension, & std deviation LIVE. You can also see the recipe/style information as well as anomaly counters.



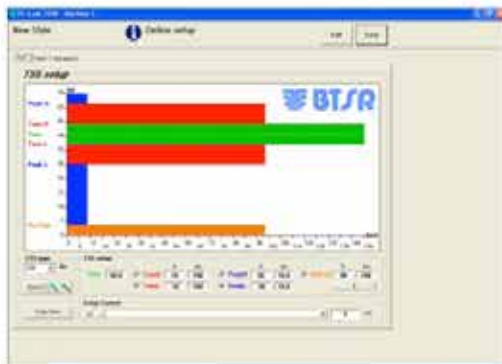
### FULL TENSION VISIBILITY

The histogram display allows you to visualize all machine positions at a single glance.



### DETAILED TENSION ANALYSIS

Fast analysis can be performed on any recording to show quick views & calculations. You can zoom in & out to perform analysis on any time set within the recording.



### SET TENSION PARAMETERS

Parameters can be programmed in both grams & time to track anomalies & send alert/stop signals. Can track each doff: Avg tension, Peak high tension, Peak low tension, No yarn

Machine #	Date / Time	Device / Side	Device / Position	Styles	CV	CV Min	CV Max	Status	Description	# Doffs	Tension High	Tens Low	Peak High	Peak Low	No Yarn
Machine 1	13092008 11:21:14	CV	CV	CV	CV	CV	CV	CV	CV	CV	CV	CV	CV	CV	CV

### TRACK MULTIPLE DATA FIELDS

Event #  
Machine #  
Date / Time  
Device / Side  
Device / Position  
Styles

CV  
CV Min  
CV Max  
Status  
Description  
# Doffs

Tension High  
Tens Low  
Peak High  
Peak Low  
No Yarn



### QUICK REPORT GENERATION

Detailed Report  
Position Report  
Doffing Report  
Shift Efficiency  
Anomalies Report

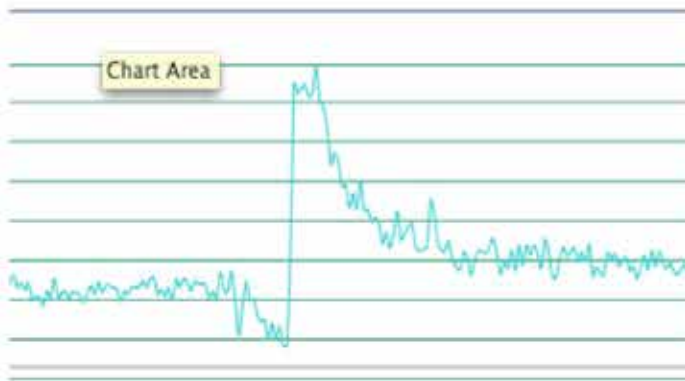


Tension Sensor

## EXTRUSION ANALYSIS OVERVIEW

From the analysis, there were 2 major things causing problems with their quality control. One, at the start of each package, acceleration was too high. When tension spiked too high, off quality would occur. Also, there was up to 200 grams tension variation between positions. The greater the tension variation, the greater the color variation & reduced quality control.

**SOLUTION:** Tension variation between positions is eliminated by tightening parameters & alerting the operator and/or stopping the position. The system can also be set to catch the large tension spikes & alert/stop when startup tension is too high.



## ANOMALY ANALYSIS

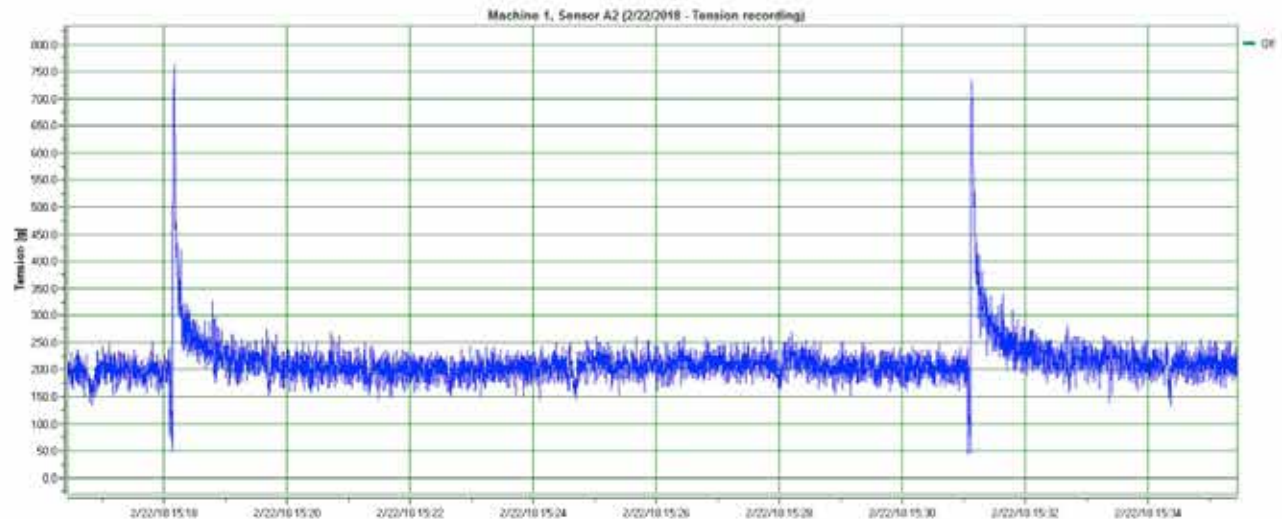
Lasts 15 seconds

T max = up to 1000g

If the tension goes above 700g, off quality is created in the yarn and the package.

## TENSION VARIATION

Positions vary between 50g to 200g



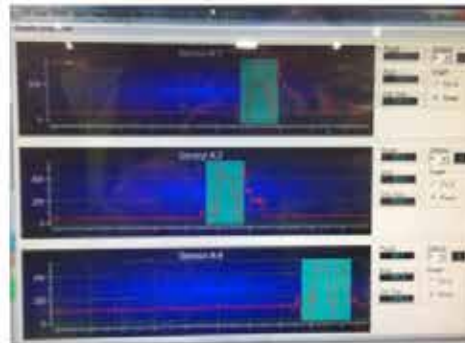


Tension Sensor

## AIR ENTANGLEMENT ANALYSIS OVERVIEW

Like our extrusion trial, the problems were very similar. If the start up acceleration was too fast, it would cause off quality in the yarn & the package. The "off quality" package was causing production problems downstream. Also, tension varied up to 400 grams between positions because of the lack of visibility.

**SOLUTION:** Tension variation between positions is eliminated by tightening parameters & alerting the operator and/or stopping the position. The system can also be set to catch the large tension spikes & alert/stop when startup tension is too high.



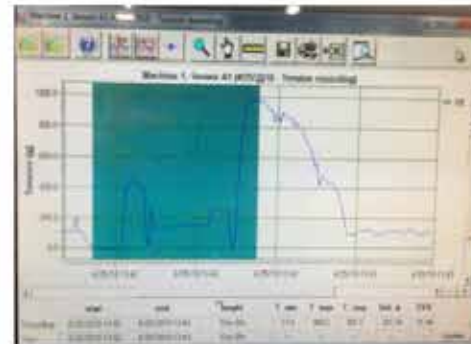
## AVERAGE TENSION VARIATION

Positions vary between 50g to 400g  
Tension increases 50g throughout doff cycle  
Manual tension controls = no visibility

## DOFF ANALYSIS

Lasts 25 seconds

Control can be set to initiate stop at start of cycle when tension peak is above acceptable levels.



## ANOMALY ANALYSIS

Lasts 18 seconds

T max = 980g

If the tension goes above 600g, off quality is created in the yarn and the package.





## TWISTING ANALYSIS OVERVIEW

We have performed tension analysis on multiple setups (Volkman, ICBT, Yichang) & were able to catch every problem that was recreated. One of the biggest problems with cable twisting is lack of visibility & awareness when anomalies are occurring. Though many think their production efficiency is good (> 95%), they are unaware of the amount of time they are producing off quality yarn. The bad “skinner” yarn will cause extra time in rewinding and has a negative affect on production efficiency in the downstream processes.

**SOLUTION:** Tension variation between positions is eliminated by tightening parameters & alerting the operator and/or stopping the position. The system can also be set to catch & identify all the various anomalies that occur.

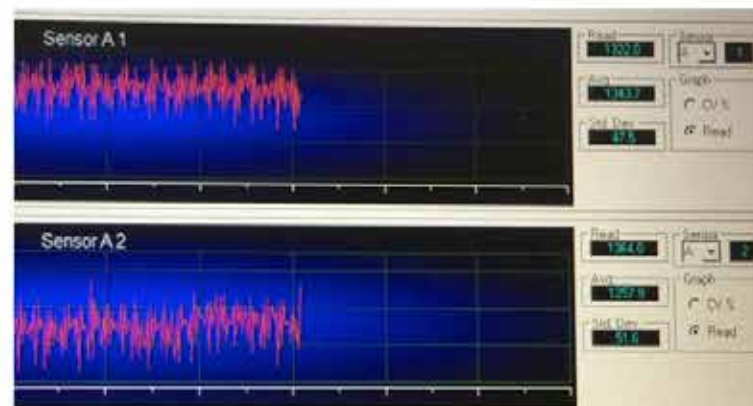
### AVERAGE TENSION VARIATION

Volkman 1

Varies between 1150g to 1350g

Avg variation betwn positions = 300g

Calibration goes out on dials



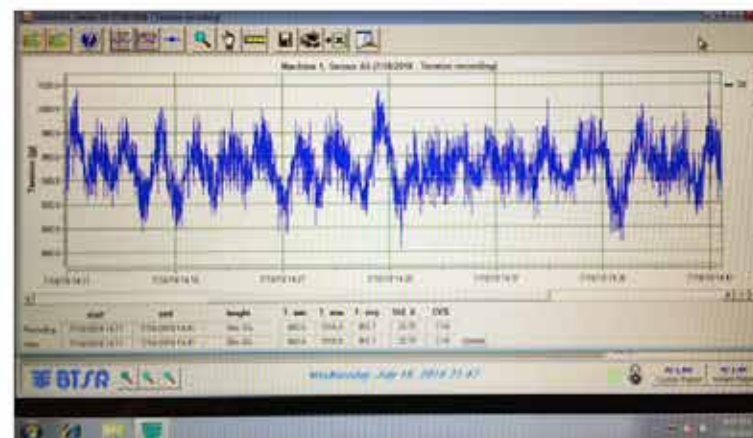
### AVERAGE TENSION VARIATION

Volkman 2

Varies between 882g to 1016g

Avg variation betwn positions = 300g

Calibration goes out on dials





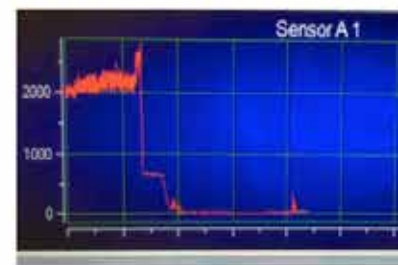
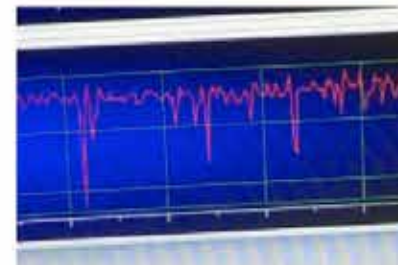
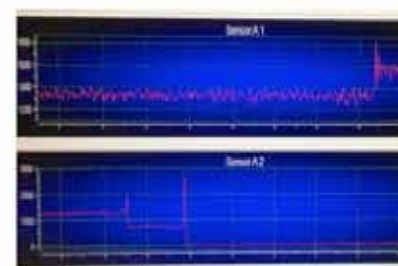
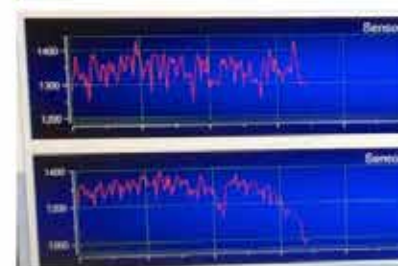
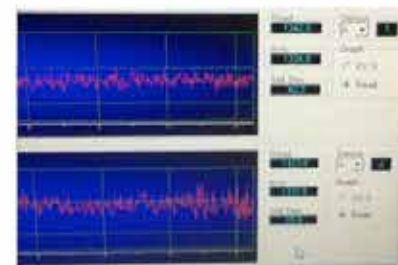
**DRAG AT CREEL**  
Increased tension 200g  
Standard deviation doubled

**BRAKE AT TAKEUP**  
The more the brake is applied, the  
Larger the drop in tension.

**CROSS THREAD / BLOW OVER**  
Tension drops over 95% on one position.  
The added yarn increases tension 200g

**TAKEUP SLIPPAGE**  
When slippage occurs, tension drops  
causing "peak low" spikes.

**SWITCHING POT LIDS**  
When a bad pot lid was put on a running  
position, tension dramatically increased  
before it finally broke out.



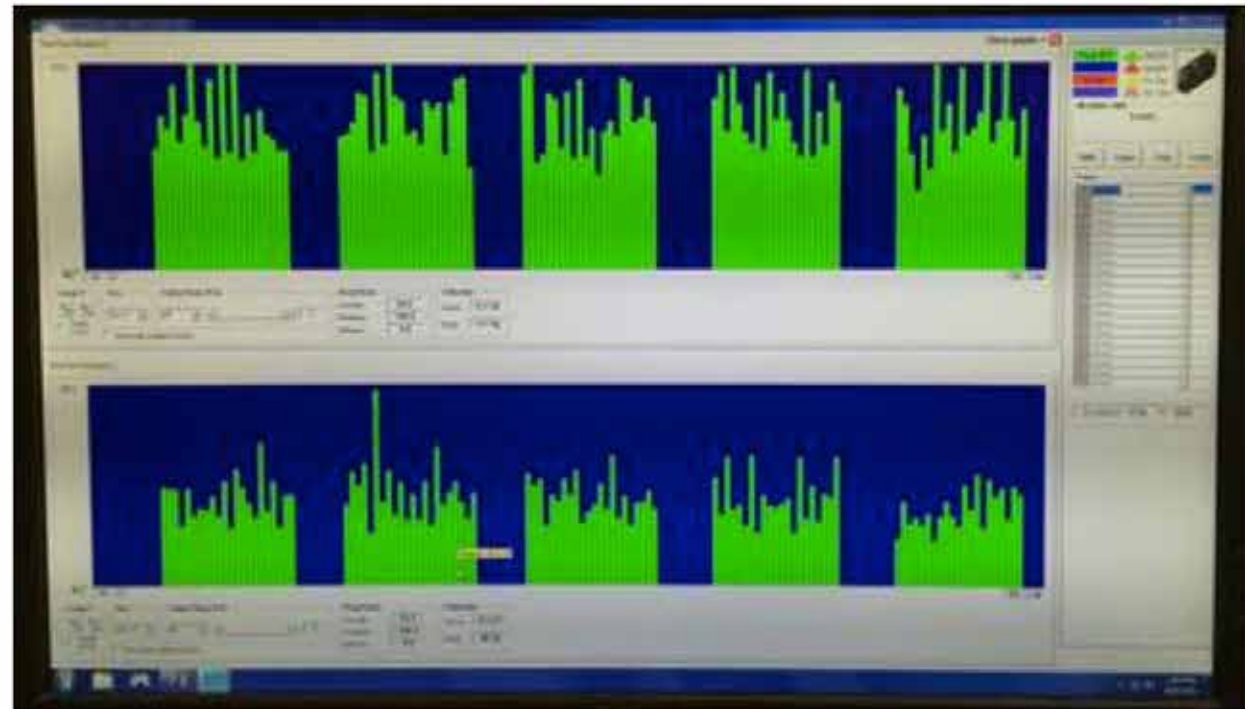
## WARP ANALYSIS OVERVIEW

Variation in distance and creel positioning will affect tension variation in any yarn process, especially on a 600 position warper. Our customer has validated that performance in tufting will be greatly improved if tension can be monitored & anomalies prevented in warping. Warping is required to always have the tension system running & not send a single beam to tufting that has not been tension monitored.

**SOLUTION:** Because of the creel size & setup, different tension parameters can be configured for positions & rows to account for the varying distance & yarn paths. The operator has complete visibility over the entire setup and can be alerted the moment it falls outside parameters or it can stop the process. In doing so, they increase their warp production, as well as tufting production downstream.



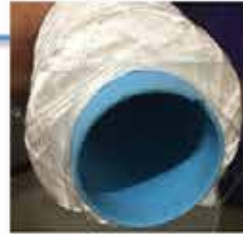
Tension Sensor



Analysis of the major components of the yarn process that cause yarn instability and tension variation.

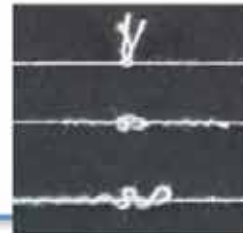


## YARN



### PACKAGE QUALITY

Overlaps in the package created from the winder in the twisting process caused very large yarn pulls at the creel up to 1000 grams for up to 25 seconds. It was especially troublesome when they ran their 3 ply yarn. The package problem accounted for over 50% of all downtime.



### YARN QUALITY

Slubs are frequent when small skinner packages are rewound. Since the package was created from a breakout where tension was "off", it typically has more irregularities in the package. The more "bad" yarn is used on the line, the more slubs / knots are going through the entire process, from creel to winder.

## YARN PROCESS



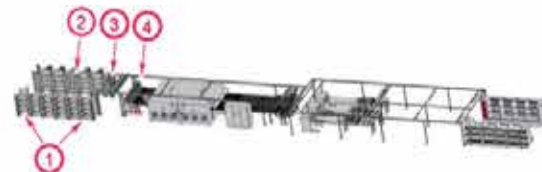
### CREEL

Vertical, horizontal, & proximity alignment are all important for yarn stability at the creel. Proper positioning allows for a more stable balloon. If anyone of these parameters is off, it will create added friction & tension.



### YARN PATH

The eyelets being used were too small & had cracks/edges caused a greater number of breakouts.



### **TENSION AUTOMATION INCREASES QUALITY**

The tension system uses tension & time parameters to improve your quality. It is customizable to determine your tolerance levels. Through continuous monitoring, we can catch & prevent any anomaly that occurs. By being able to identify, alert, and prevent when anomalies (problems) occur, we drastically reduce off quality & waste. If you are NOT monitoring quality with automation, you do not know what your production efficiencies really are because the amount of time producing waste is not accounted for. Spot checks are proven not to work because of operator error and extremely small time sampling per position. A typical manual check provides only 60 to 100 seconds of information per position per day. Our system can offer 86,400 seconds of data monitoring at a baud rate of 100 times per second per position per day (8,640,000 data points).

### **TENSION AUTOMATION INCREASES PRODUCTION**

By decreasing the time producing off quality & waste, it's effect on production increase is 2 fold. You are simultaneously decreasing waste time and increasing production time. By alerting and/or stopping the position when the anomaly first occurs, it prevents hours of "waste production".