

# A defect is more than just bits and bytes

**How camera inspection systems have become indispensable for quality control and efficiency**

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## INTRODUCTION:

In paper and tissue production, web breaks and substrate defects present significant challenges in all types of paper or tissue machines, converting and layering operations. Reducing breaks and surface defects is an important objective, given the increasing speed and operating complexities of present production environments.

Therefore, using cameras inside paper machines is nothing new. For decades, they were used for plain and isolated defect detection. However, machine vision is no longer isolated but has evolved to be an ecosystem. As technology evolves, the amount of information available grows and grows. What sets a good system apart these days is what the ecosystem around the cameras does with the huge amount of data they can collect and how you communicate with other downstream or upstream processes. The right information to improve operations is what's important and what makes machine vision indispensable to papermakers.

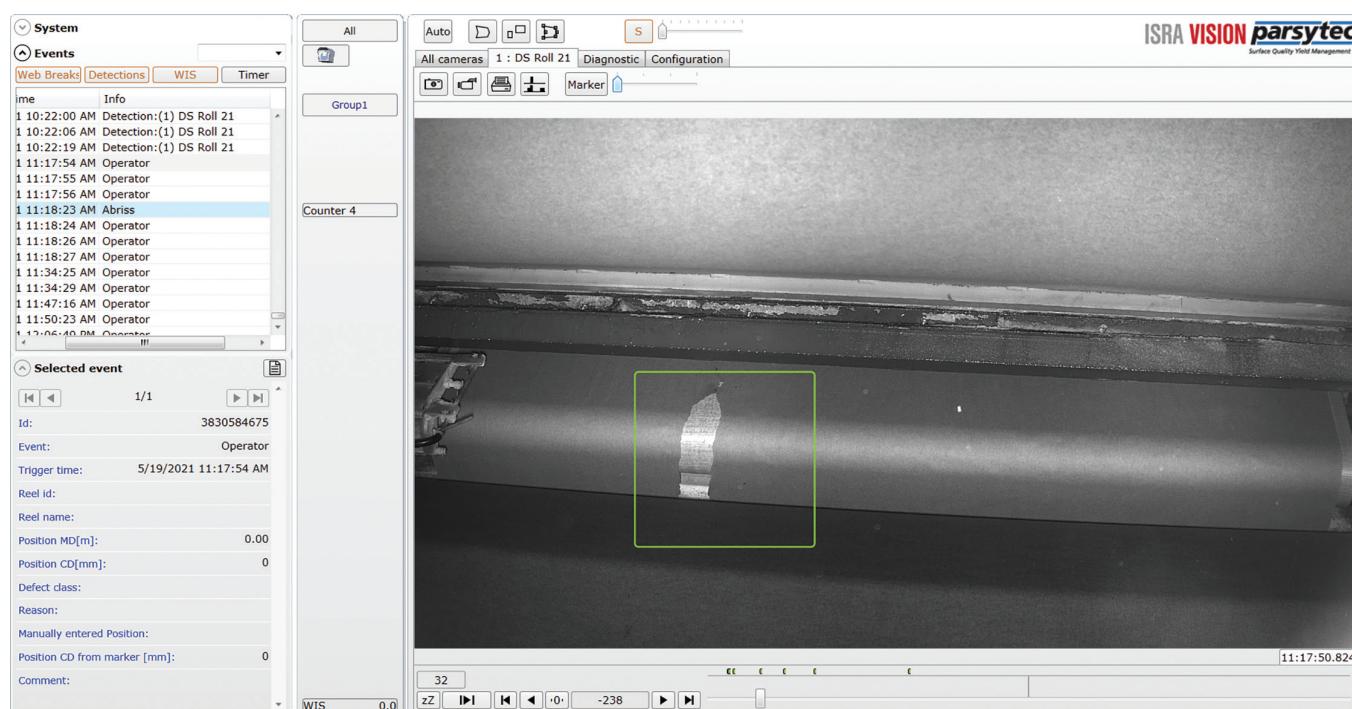
ISRA's systems allow a mill to handle data, correlate data by using ISRA's Paper Quality Management System and interface between ISRA's systems and the mill's quality control system. Another benefit is the potential to make predictive maintenance based on what data is collected and what can happen next.

## It's all about grading and classification

Everything today is about grading and detecting defects as soon as possible. ISRA's inspection system cameras can achieve a resolution of 0.25 mm on a 2,000-m/min machine. Thus, the systems can pick up the tiniest of defects not visible to the naked eye.

The degradation of the secondary fiber quality has led to decreased yield and quality which you can see in the increase in the number of defects, for example, dirt count

A web inspection system will help determine the quality. But communicating that information to the producer requires a good defect classification system. It's key to define the nature of the defect: streak, impurities, oil drops. Defects are automatically classified according to the papermaker's specifications and,



**Figure 1a: The Web Break Monitoring detected a defect that will lead to a web break.**

depending on the defect type, size or frequency, actions can be initiated if desired. For example, defects at the edge of the web are evaluated differently, as they are more critical, than defects in the middle of the web. This reliable classification of all defects found by the web inspection system is mandatory not only to deliver surface quality information but as well to gain information concerning the production process stability.

In the past and even in the present in rudimentary Inspection Systems, the Classification is only based on decision rules also known as rule-based classification or box classification. With this approach, the user defines the rules for classification manually.

The next level is called image-based classification method—today’s standard for most classification approaches used in modern web inspection systems. Here, the user does not need to define rules any more, but is defining defect classes and teaching those classes with defect samples. The classifier would then define a feature set for the classification which would distinguish the defects in the best way.

With the growing demand regarding surface quality, more data is needed to find process relevant defects. This makes the classification more complex, time consuming and error prone needing more advanced classification methods.

Therefore, ISRA is now providing an AI-based classification approach based on deep-learning and multi-layer neural networks, making classification more reliable and less time consuming for the user. The Inspection system does recognize different defects completely on its own, without any defect training or rule generation by a user. ISRA’s system defines defect classes based on the defect appearance. The only work left is naming the defect classes. Even if the detection run is still extracting features, the classification system uses optimized multi-parallel layer neural networks to distinguish defects and assign them to groups (classes). Processing resources to define the right set of selected features to distinguish classes from each other are now allocated to the AI algorithms. This way the classification of defects is much more precise; reliable and quicker.

**Benefits to the production line**

PAPER MASTER 4.0 - ISRA's latest iteration of the inspection management platform – is the first browser-based platform for surface analysis to access the data of the ISRA system from anywhere, whether it be directly at the production line, in a meeting room, or on the road, by simply using mobile devices such as a tablets or smartphones.

Another new feature is sync code marking based on laser technology. This mark, done on the paper machine, can be detected on the winder, which then specifies the position in the web. For example, if there is an edge crack or other defect, the laser mark coding tells the winder control to slow down to avoid a web break. If a reel is going from a rewinder to a coater, it can be stopped; the defect patched and then sent on to the coater. Today, about 25 installations with the laser marking technology benefit from the technology where defects can be assigned by location on the sheet in the next production stage, regardless of paper losses incurred in the process.

With the Reel Release module ISRA also offers a solution for winders that can give an exact quality report for each roll cut. This setup can also tie in other data to ISRA’s software (e.g., moisture measurement), so a producer can decide whether or not the end product is saleable to a specific customer.

An additional new development is the introduction of color cameras. They provide significantly more information about the defect. For example, color cameras can distinguish between oil and water drips on the web. For recycled mills, it can also identify bacteria to identify whether a mill’s deinking system is working well or not.



Figure 1b: With no actions taken, the web break has ultimately developed.

In addition to PAPER MASTER, EPROMI production analytics can display a huge amount of data that the mill can use for condition monitoring or predictive maintenance. The information is easy to access, either in the mill or remotely. It can also be used to collect and coordinate data from all kinds of quality control systems from any type of paper machine and/or mill.

**Every system is unique**

ISRA VISION’s product portfolio caters all paper grades from the lightest tissue to heavy board and has grown following the industry’s conversion from graphic grades. With machine conversions, particularly from graphic to board grades, there is a need to ensure the legacy web inspection system meets the new needs of the client. The number of cameras, the implementation of web break monitoring and web inspection is fully customizable to suit the individual mill’s or production line needs.

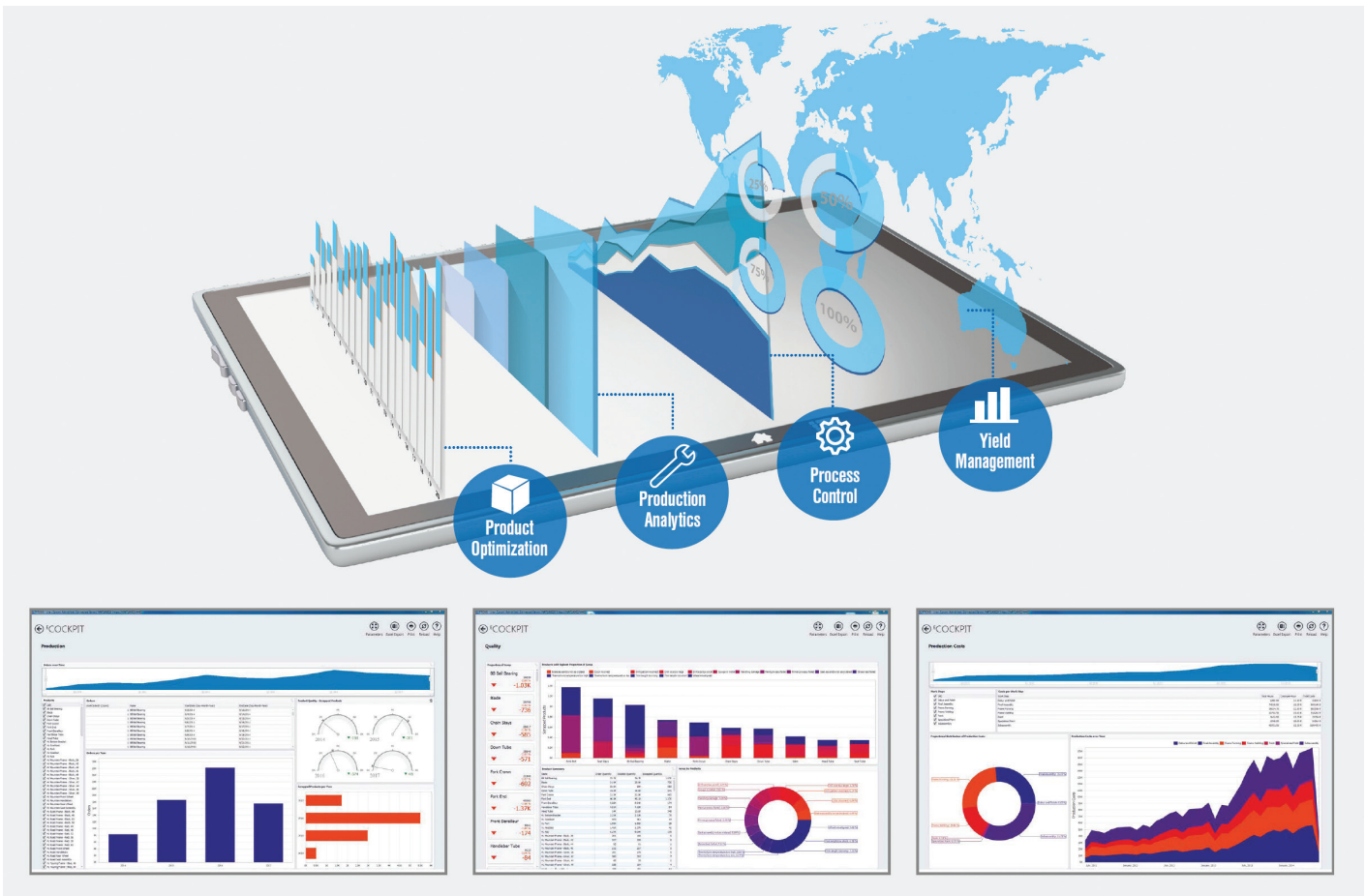
There are specialized systems offered for specialty machines that are custom designed depending on space and configuration. How the producer does final surface treatment also

has an influence on the kind of optical set-up it needs. For example, coating on high-end broke will need a high-resolution system and the correct camera angle for the installation is essential.

The greatest savings potential results from the reduction of the number of web breaks. Even a 20% reduction saves an enormous amount or increases the output of a paper machine.

We all know how important it is to avoid downtime, especially in the low-margin paper industry. In addition to this obvious cost saving, however, paper manufacturers can also significantly reduce the costs that arise from customer complaints. The use of PAPER MASTER and the associated software tools ensure that only perfect paper rolls will be shipped to customers to eliminate complaints.

**By using ISRA VISION’s PAPER MASTER Platform, papermakers will be able to optimize their entire production process by reliable process efficiency and quality control.**



**Figure 2: ISRA’s Paper Quality System makes hidden facts visible and ultimately helps to save time, improve processes and save costs.**