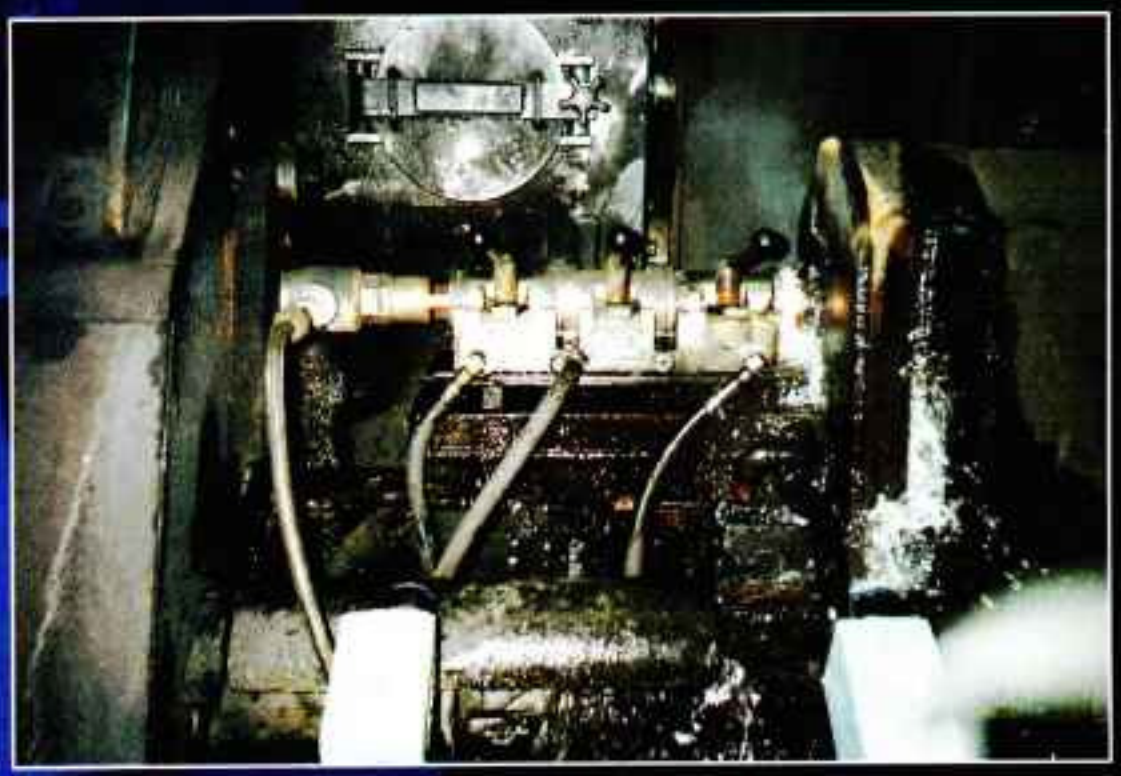
SOFRATEST

CASTEL*

Eddy Current



UP TO 1200 °C

non-contact, on-line
***C**ontinuous **A**ssessment*
*of **S**urface a**T** **E**levated*
temperatures for rod
& bar products up
to 160 mm diameter

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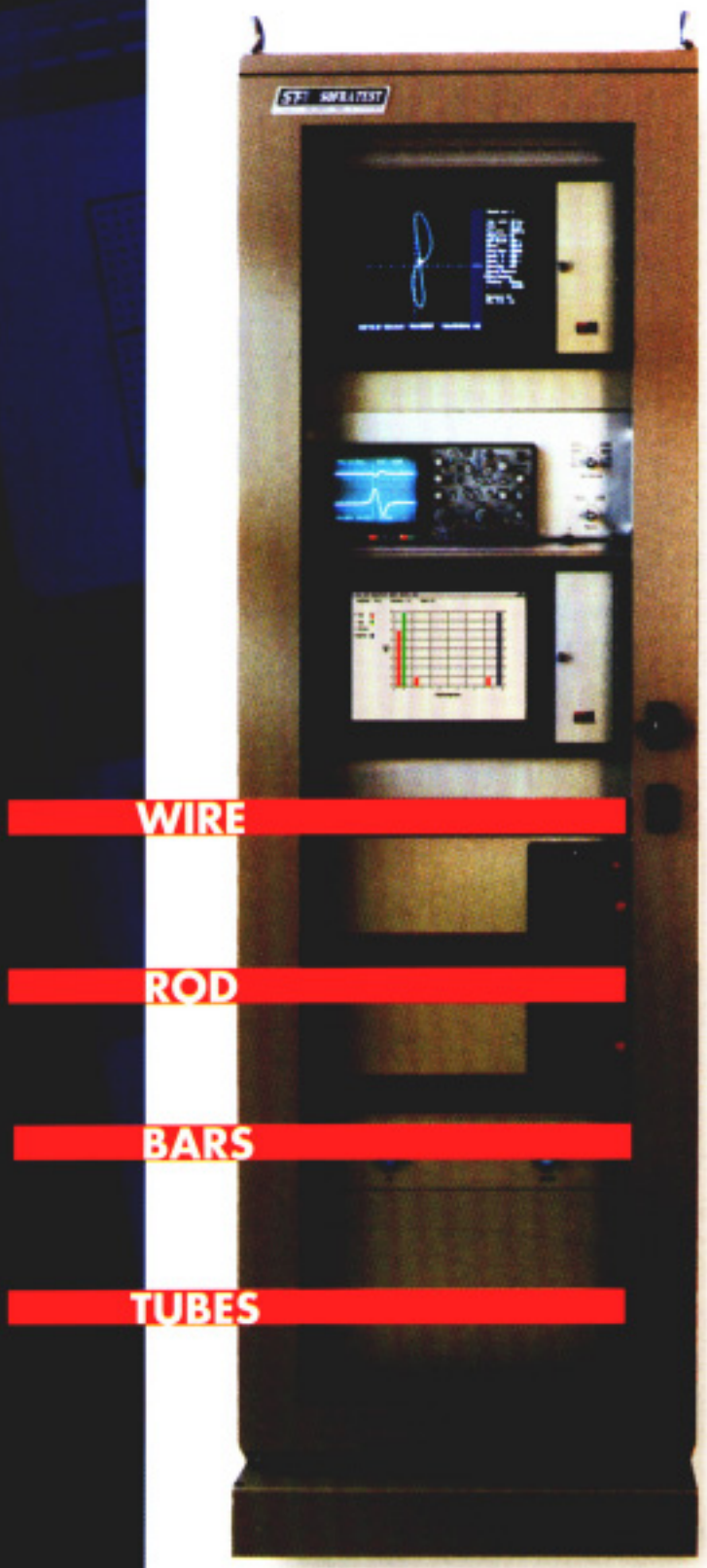
The most advanced fully featured Eddy Current system for hot rod and bar testing



CASTEL is a family of fully automated Eddy Current systems developed for the harsh operating conditions found in rod and bar mills.

At the heart of CASTEL is a defect classification algorithm defined by one of the leading steel producers in the world - Usinor. This technology has been used continuously in steel mills for over a decade. It is fully proven.

CASTEL systems have many robust and user friendly features. Such as the industry standard IBM PC / AT compatible computer platform it is built on. This well understood and supported platform offers ever increasing processing power. Today, a single Pentium®* powered CASTEL system can deliver asynchronous Eddy Current testing for up to four strands where each strand is running at 120 meters per second !

To complement this processing power, CASTEL uses industry standard user friendly software, Microsoft's Windows 95/NT, as the delivery vehicle for controlling and displaying testing results. Various connectivity features allow distribution of testing results to different parts of the mill. Data displays have been optimised to use some of the most useful features of the Windows environment. Operators can choose to display testing data in accordance with their individual preferences both in terms of what is displayed and how it is displayed.

The Eddy Current test head assembly located on the strand has received praise from mill personnel for its design, which delivers rapid size change-over in a robust package. Virtually no maintenance is necessary since there are no moving parts.

There is a comprehensive list of CASTEL options. For example the "EC expert" data analysis package. This allows users to record and later playback a complete data file of raw Eddy Current signals from a tested coil. Quality assurance personnel will find such a tool particularly useful when optimising defect detection settings.

CASTEL can be fitted with trimming lamps to help maximise yield. The head and tail section of every EC inspected coil is separately analysed to allow yield optimisation.

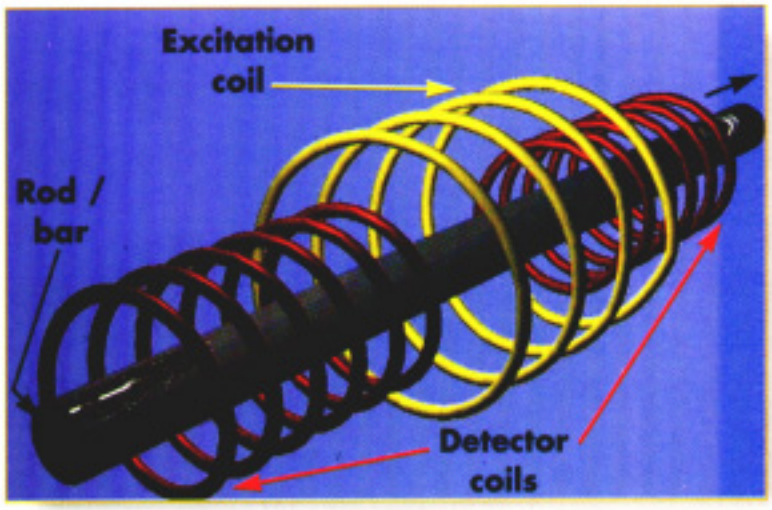
Results are separately displayed by a set of head and tail trimming lamps. These lamps are normally sited at the coil inspectors station to tell the inspectors how much to cut from the head and/or tail of a coil thereby raising its quality ranking.

An often neglected need is that concerning field verification of system performance. Many users need to verify system performance as part of their quality compliance procedures. To meet this need there is DYNATEST - an apparatus fully integrated with CASTEL, designed to deliver a repeatable excitation source to test the entire system starting from the Eddy Current probe, through the signal processing electronic circuitry, software processing and finally data presentation - the complete measurement chain.

CASTEL has been developed to meet the Eddy Current testing needs of most rod and bar mills. For those customers with special or additional requirements, Sofratest offers a flexible approach to ensure every CASTEL system meets the precise technical and budgetary needs of our customers.

* *Registered Trademark of Intel corp.*

Principle of Eddy Current testing



The underlying principle behind Eddy Current testing is illustrated in the drawing above. Eddy currents are generated in the product under test when an alternating voltage or current flows through the excitation coil. Surface and sub-surface defects result in perturbations of the field. These perturbations are detected by the detector coils.

DYNATEST® - an apparatus fully integrated with CASTEL, designed to deliver a repeatable excitation source to test the entire system starting from the Eddy Current probe, through the signal processing electronic circuitry, software processing and finally data presentation - the complete measurement chain.

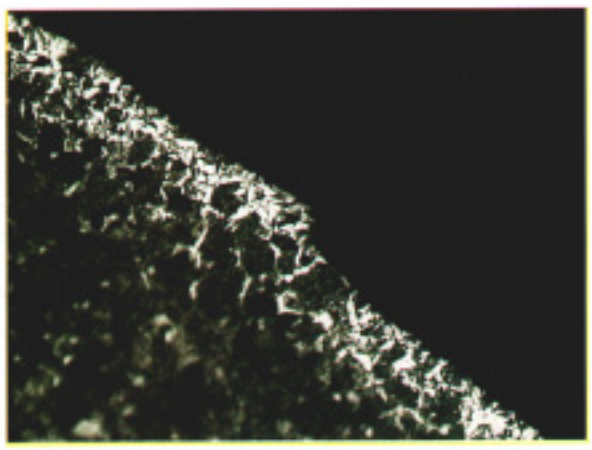
Typical defects detectable

Products surface and sub-surface defects

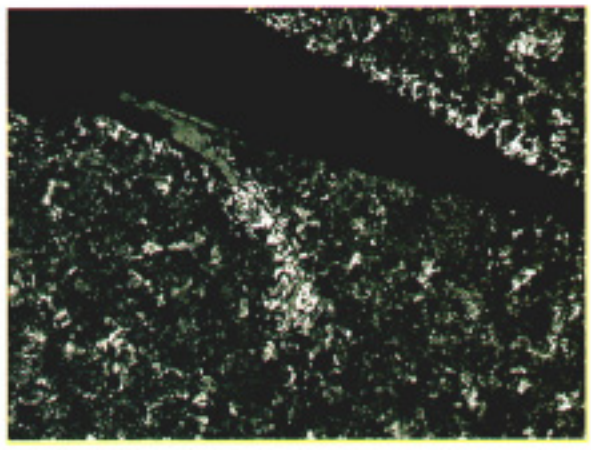
- ❑ OVERLAPS
- ❑ SCALE
- ❑ ROLLED IN REFUSE
- ❑ SLAG ENTRAPMENTS

Process related damage

- ❑ DAMAGED ROLLERS



One side overfill (x300)



Surface crack .008" x .005" (x300)
(0.2 x 0.12 mm)

For each elemental unit length (EUL) :
- defect map, level 1-2-3

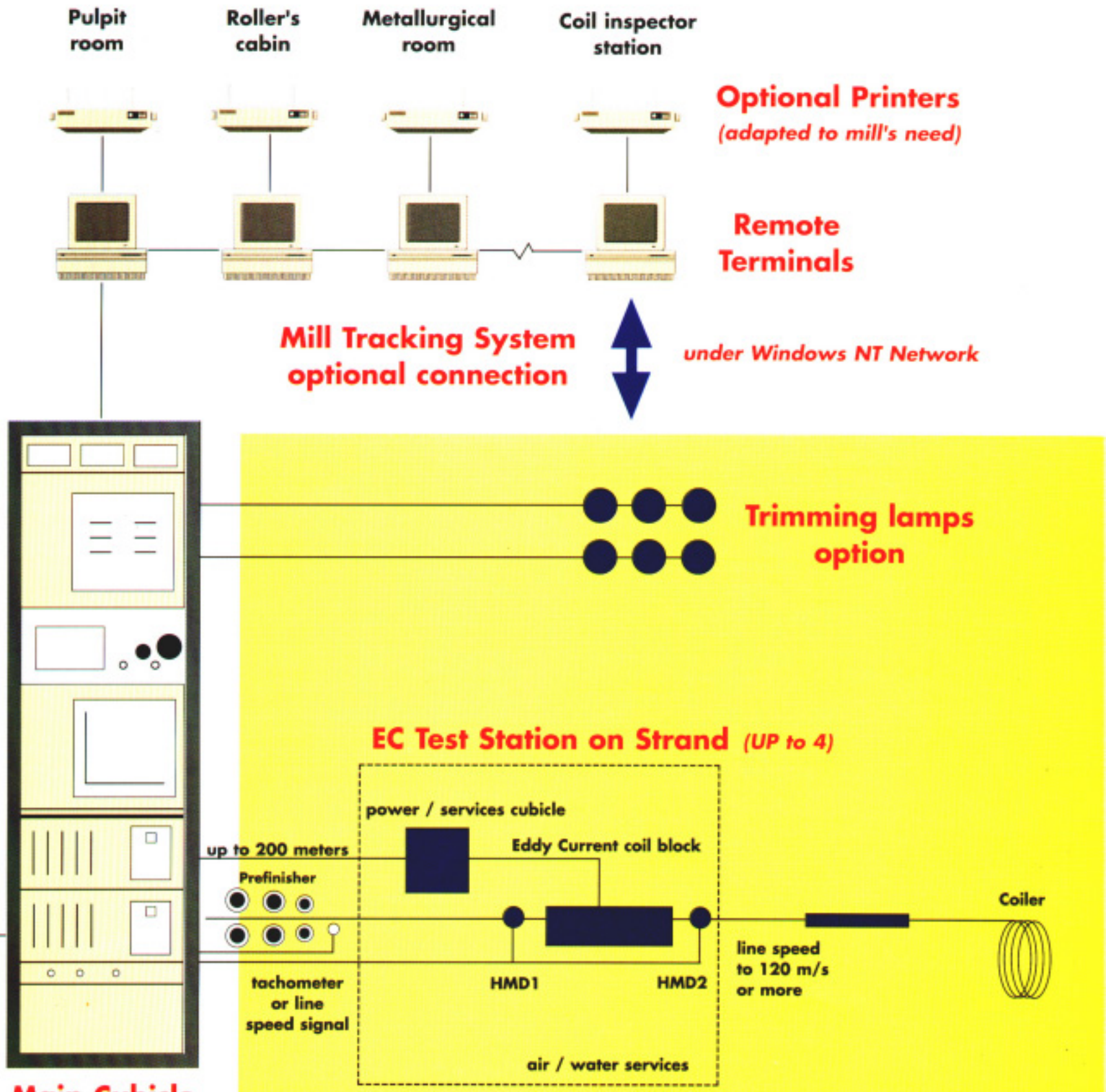
For each coil :
- %EUL with defects above preset levels 1-2-3
- counts above preset alarm level 1-2-3 for first and last 10 EUL
- number of EUL to be trimmed from head & tail
- quality index before trim
- quality index after trim

- mill operator warning

for each order :
- quality index distribution

Eddy current testing - some advantages

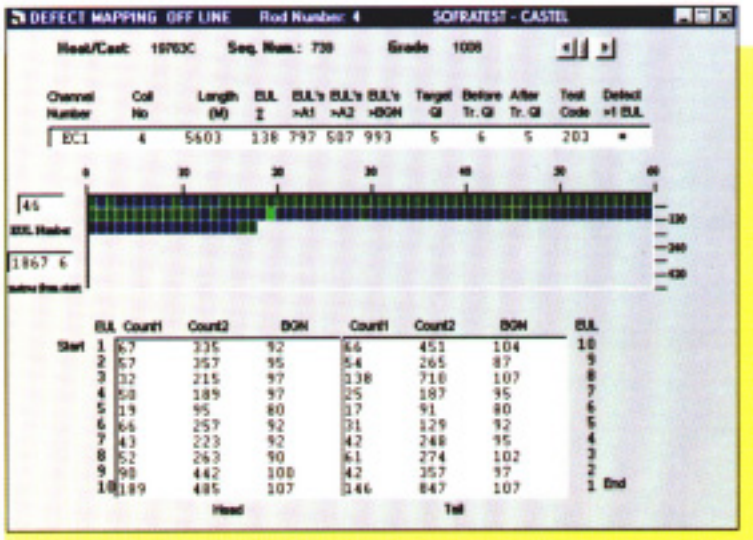
- REAL TIME 100% INSPECTION OF SURFACE QUALITY
- PERMANENT RECORD OF EVERY COIL TESTED
- REDUCED CUSTOMER COMPLAINTS AND LOSSES FROM REJECTED MATERIALS
- NONE OR REDUCED VISUAL INSPECTION
- PROCESS MONITORING AID
- IMPROVES COMPETITIVENESS



Typical testing results

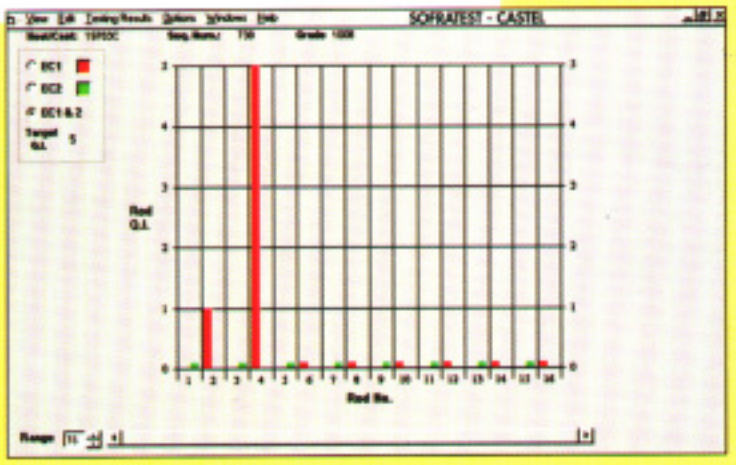
➤ Defect Map (on-line & off-line)

The defect map display provides (from top to bottom) an alphanumeric summary of EC testing results, a colour coded (user definable) defect map and detailed testing results for both the head and tail of a single rod/bar. The data boxes to the left of the colour coded defect map displays the EUL number and distance from start of the coil when the user moves the cursor to any EUL position on the defect map. The scroll arrowheads at the top right corner of the display enables the user to view previous and following (off-line mode) rod/bar testing results by simply pressing on either arrowhead. The detailed head and tail results are useful both for monitoring noise / defect density and are used by the trimming algorithm to optimise trimming / yield.



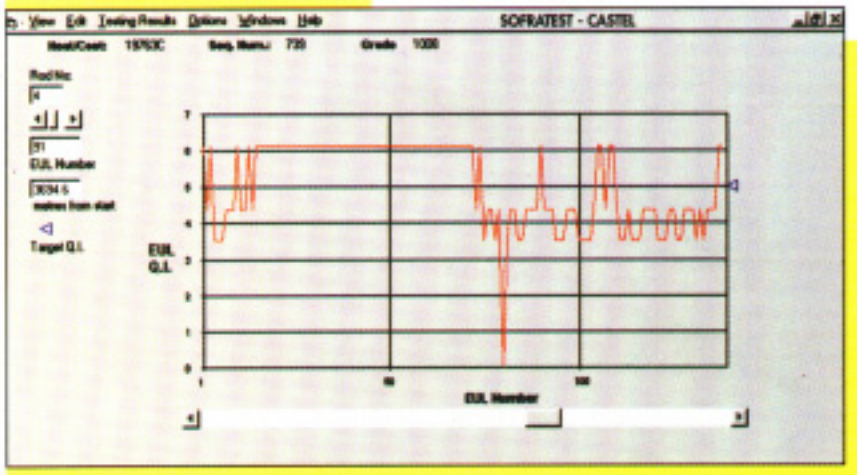
➤ Quality Index Trend (on-line & off-line)

This display allows mill personnel to observe product surface quality (rod/bar Quality Index) variations over time (Rod Number). Higher QI numbers indicate lower quality. Example shown here is for a two strand mill. User can select to view strand 1 (EC1), strand 2 (EC2) or both strands. The required target QI is 5 in this case. QI values greater than 5 are below the required target QI. The Range value sets the number of rods/bars displayed while the lower scroll bar allows the user to scroll backwards and forward in time.



➤ Rod/Bar Quality Index Profile (on-line & off-line)

This display shows the Quality Index value against EUL (user definable Elemental Unit of Length) for rod number 4 in this case. The target QI value of 5 is also displayed. Users can quickly determine the EUL number and distance from start of rod/bar by moving the cursor to any part of the QI trace of interest. Both EUL and distance are displayed in data boxes to the left of the trace. The scroll bar at the bottom of the screen can be used to scroll forward and backward.



➤ Quality Index History (on-line & off-line)

The QI History display shows the QI distribution for a particular Heat/Cast. Also displayed is the Target QI. Rod/Bar QI values less than the Target QI meet the quality requirement while rod/bar QI values greater than Target QI do not meet the required quality. As with all CASTEL EC displays, colours are used to maximum effect to allow users to quickly understand and respond to EC testing results.