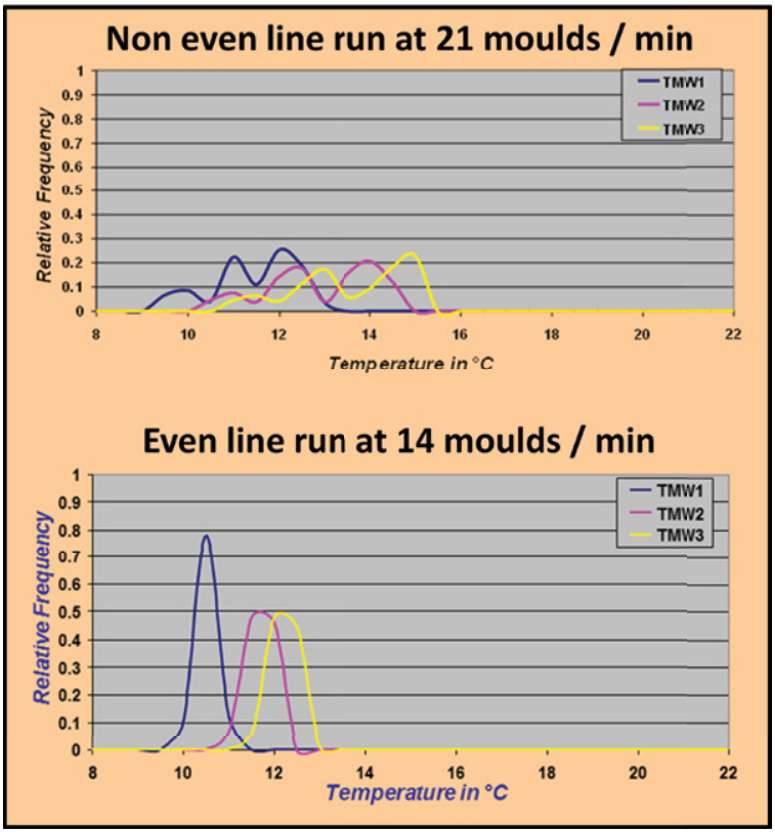

Figure 24.27 Typical surface temperature tracks measured along three virtual lanes (left: TMW1; centre: TMW2; right: TMW3) in full-scale production. A dedicated pyrometer was mounted above each track. They were all connected to a control unit which could identify chocolate surface area over run time. Reproduced with permission of Kraft Foods R&D Inc. Munich, Germany.

Metal detectors are always coupled with reject devices to divert non-conforming products. The product is carried on a non-metallic conveyor through an aperture around which are wound three coils. An operating and analysis system enables ferrous metals, non-ferrous metals and stainless steel to be detected within the chocolate. In addition a magnetic field method is capable of distinguishing ferrous metals in products packaged in aluminium foil.

When using the differential transformer method to detect pieces of metal, three coils encircle the detection aperture. An oscillator drives the signal voltage in the primary coil. Two secondary coils, on a common axis with the primary, are coupled into the field of the primary coil in such a manner that the system is in balance and the induced voltage in the two secondary coils cancel each other out. A piece of metal introduced into the detection aperture will distort the primary

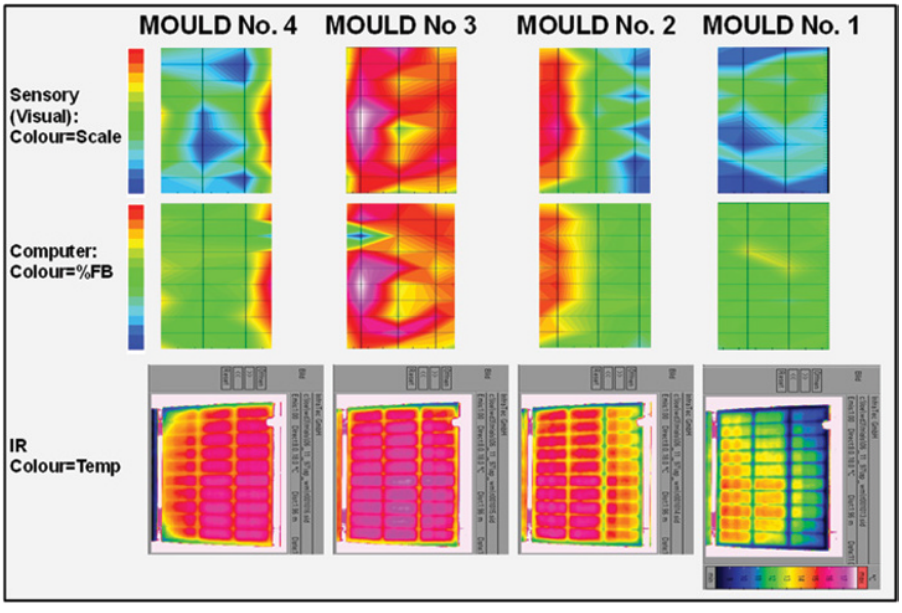

Figure 24.28 Typical test results. *Upper level*: Traditional sensory test and fat bloom results of a product"s top side visualised by intensity graphs of chocolate surfaces after 264 days storage at 18 °C. *Centre*: Results of a computer aided fat bloom assessment of same samples as were taken for the upper level (FB = fat bloom). *Lower level*: IR pattern of mould set containing filled chocolate tablets (here shown bottom side) after leaving last cooler of a moulding line. Reproduced with permission of Kraft Foods R&D Inc. Munich, Germany.

field and cause a difference in induced voltage in the secondary coils. This voltage difference constitutes a signal that is amplified and manipulated to extract the amplitude and phase angle with respect to the oscillator input signal. This information is used to decide whether the signal represents metal or the product. If it represents the product, it is ignored and if it represents metal and if the signal exceeds a pre-set level, the metal detector generates a signal which is used to activate the reject mechanism.

24.3 Laboratory analysis

The examples of laboratory analysis presented in this chapter are as would be found in the laboratories of a large chocolate manufacturer. Smaller production sites may have to out-source analytical testing and to rely on suppliers to deliver raw materials to certified standards. This chapter is designed to give the reader an overview of the complexity of the quality assurance measurements that are