

**Title** Time-resolved reflectance spectroscopy for the non-destructive detection of inner attributes and defects of fruit

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### **Abstract**

An overview of Time-resolved Reflectance Spectroscopy (TRS) applications for the detection of inner attributes and defects in fruit is presented. Common spectroscopy techniques employ continuous wave light and measure the diffusively remitted intensity which is determined by both the absorption and the scattering properties of the sample. Light absorption is related to chemical properties, while scattering to physical structure. Quantification of absorption and scattering may be obtained by space- or time resolved methods. TRS is a technique based on the measurement of the temporal delay and broadening experienced by a short laser pulse while travelling through a turbid medium and explores a volume of pulp at a depth of 1-2 cm with a negligible influence by skin properties. TRS has been used to detect some internal defects and disorders in the intact fruit, such as brown heart, internal browning, internal bruises, water soaked tissue, as well as internal attributes related to maturity, texture and cell wall Structure. Scattering coefficient was found to be related to translucency of tissue and was used to detect internal bruises and water soaked tissue (i.e. water core in apples and *Botrytis* decayed kiwifruits). Scattering coefficient was related to pectin mposition and textural properties of apples such as firmness and mealiness. Absorption coefficient in the 600-700 nm region been found to be related to brown heart in pears and internal browning in apples. The absorption coefficient at 670 nm has been related to maturity and it was used in nectarines to detect too immature fruit which are not able to ripen. Being non- destructive, TRS measurements can be repeated on the same fruit, following the development and the changes occurring with ripening or storage.