

Visit Mid-Sweden University - November 2006



Optoelectronic Sensor Systems

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Overview

AutoScan: Online measurement in an agricultural harvesting process

Light curtains


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AutoScan: Online measurement in an agricultural harvesting process

Light curtains

Sensor „AutoScan“: Automatic cutting length variation

Online-measurement of the degree of maturity for maize plants



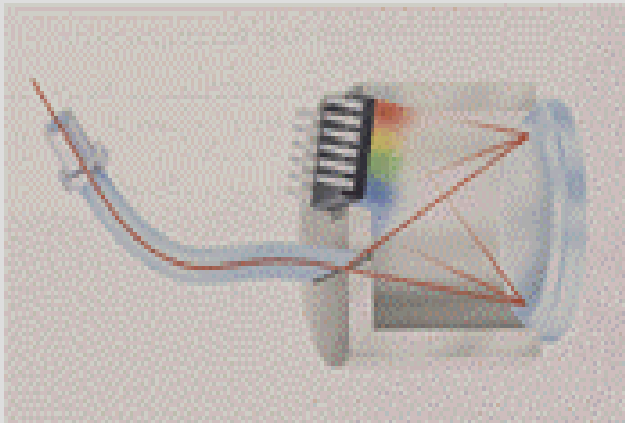
AUTO SCAN

<p><u>Grün</u> Länger häckseln bei geringen TS-Gehalten (hoher Feuchteanteil)</p>	<p><u>Ziel</u> ⇒ Strukturwirkung im Futter ⇒ Vermeidung der „Vermusung“</p>
<p><u>Braun-Gelb</u> Kürzer häckseln bei hohen TS-Gehalten (geringer Feuchteanteil)</p>	<p><u>Ziel</u> ⇒ Gute Verdichtung im Silostock</p>

Spectrometer

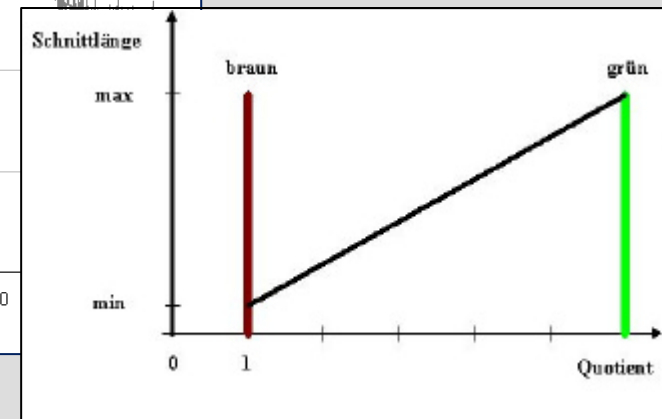
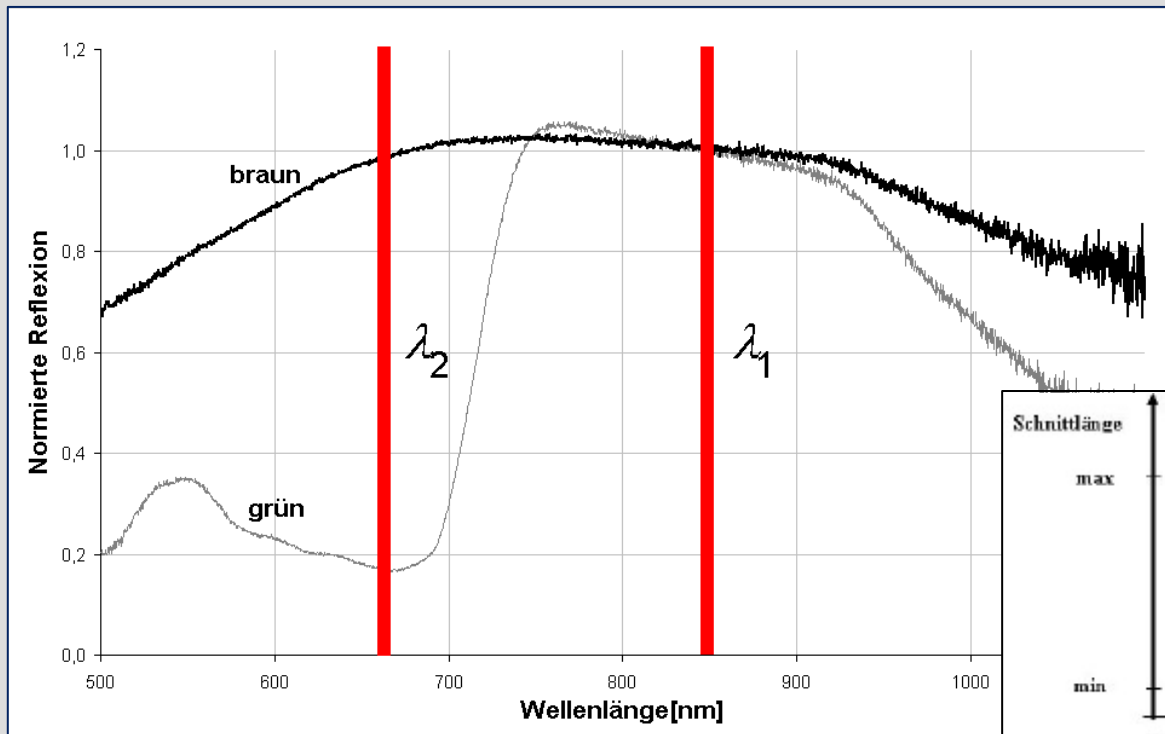
Measurement of the light intensity as a function of the wavelength

Physical Effect: Diffraction, optical grid

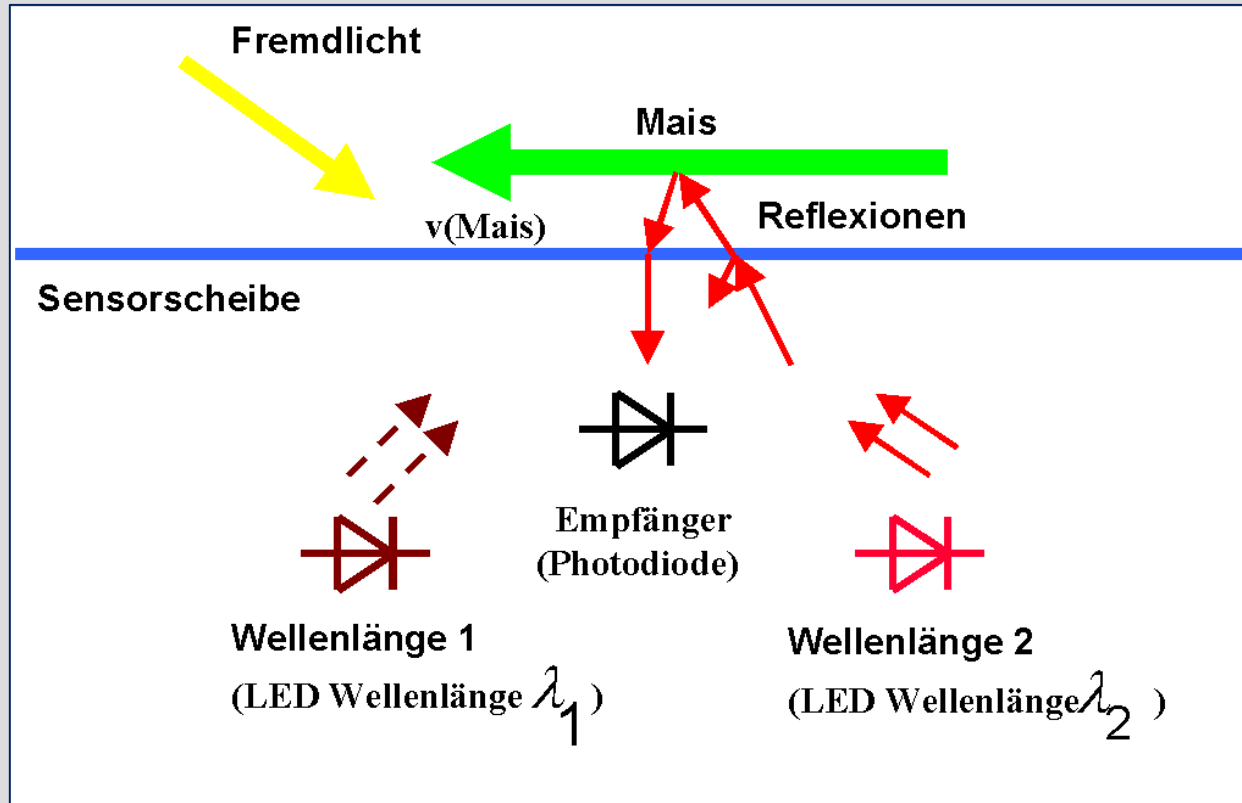


Spectral characteristics of maize plants

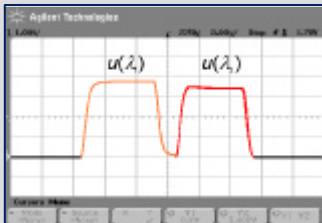
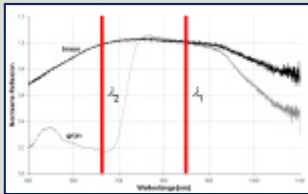
Method: Spectrometer measurements → selective wavelengths



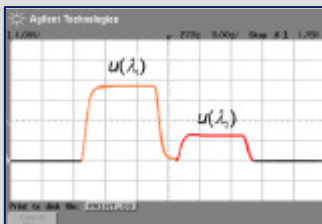
Realization of the measurement principle



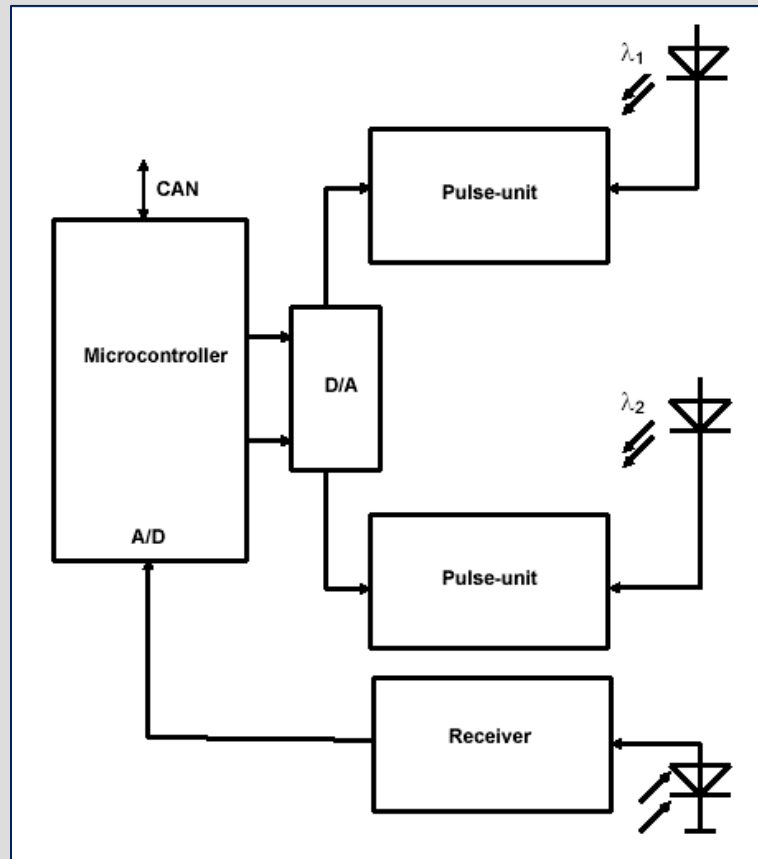
Block diagram: AutoScan-Sensor



„brown“ maize



„green“ maize



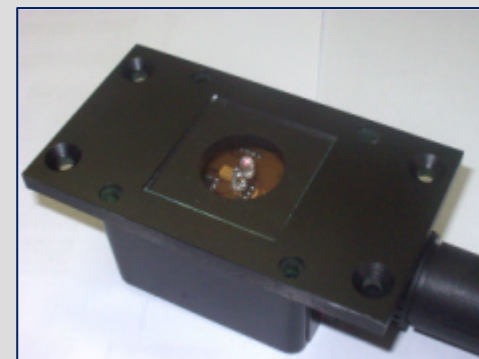
LED

LED

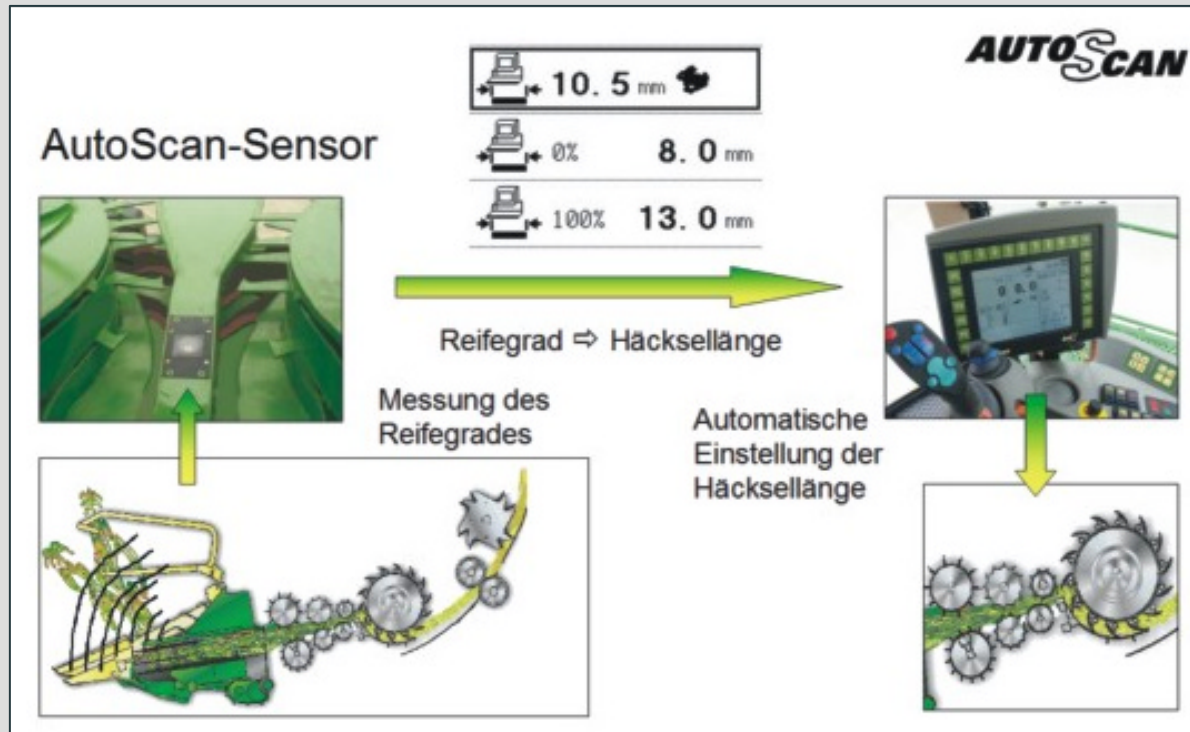
Photo diode

Boundary conditions and solution concept

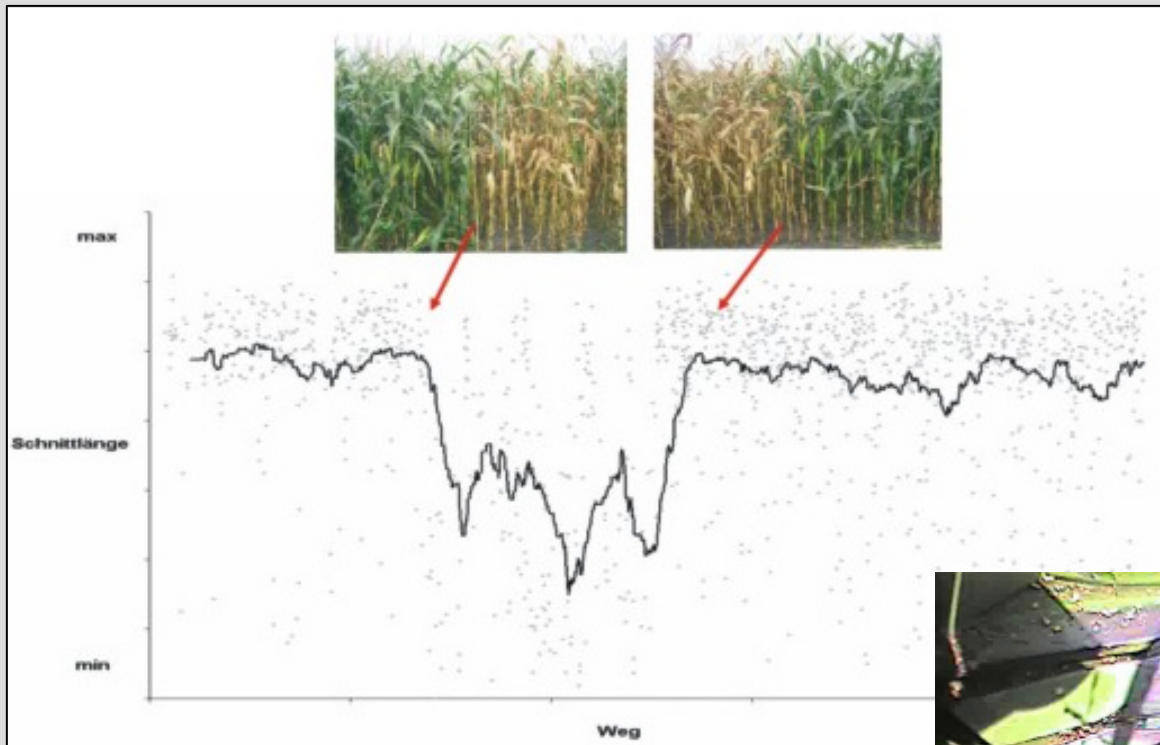
- Measurement position
- Covering
- Optical measurement: feasibility
- Fast measurement: 2 wavelengths
- Software for statistical analysis
- Microcontroller-based solution
- Self-cleaning effect (maize plants)



Mechatronic System



Field tests



Results „AutoScan“

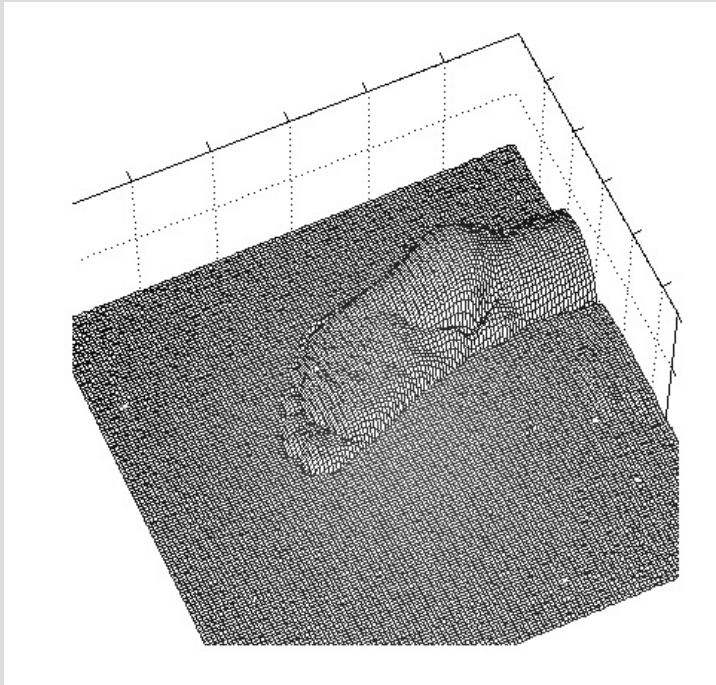
- Automatic online detection of the degree of maturity
- Automated optimization of the cutting length
- Stabile silage
- Automatic optimization of the animal food structure
- Electronic documentation (including GPS)
- Application of an optoelectronic system in rough boundary conditions
- Driver assistance

Overview

AutoScan: Online measurement in an agricultural harvesting process

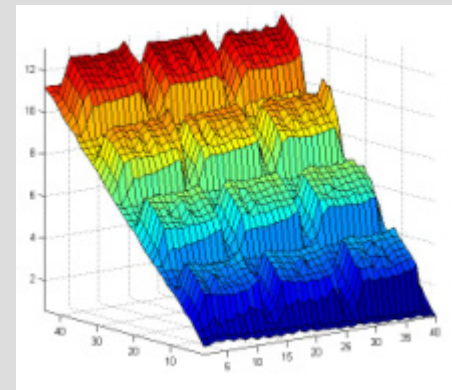
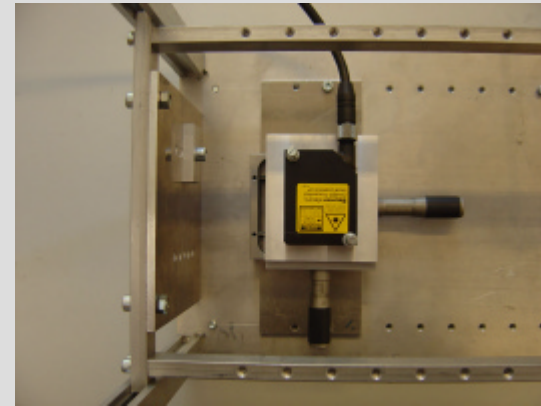
Light curtains

3D-Imaging : Combining optical and distance information

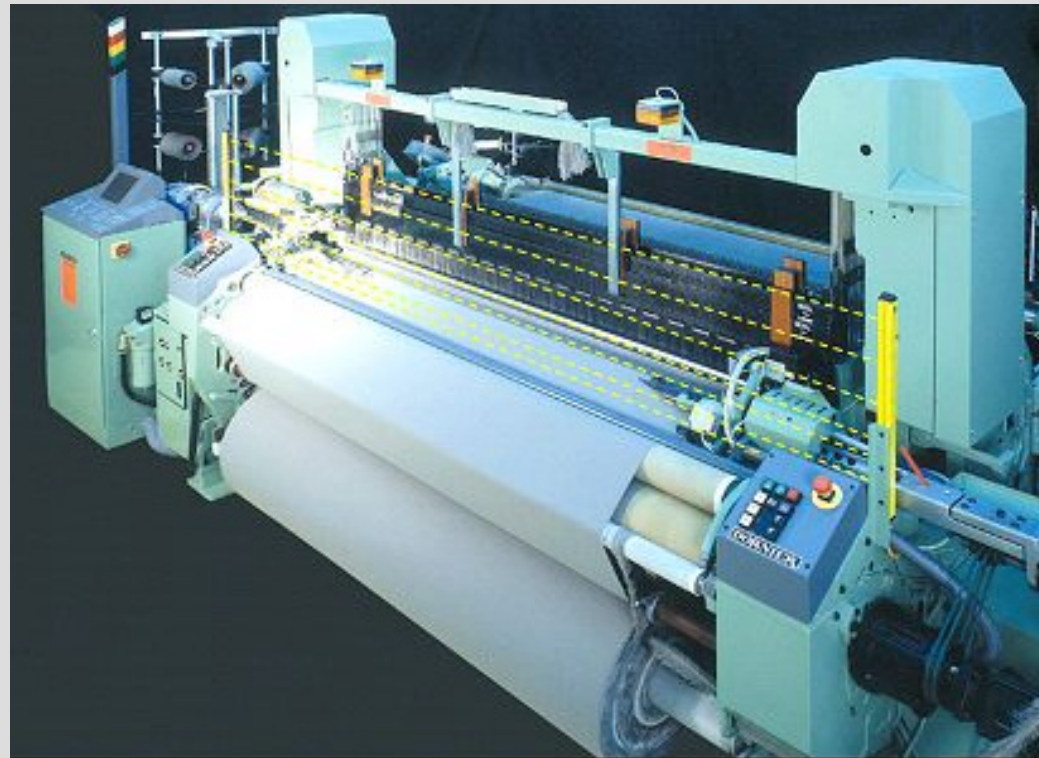


2D-Scanning of surfaces

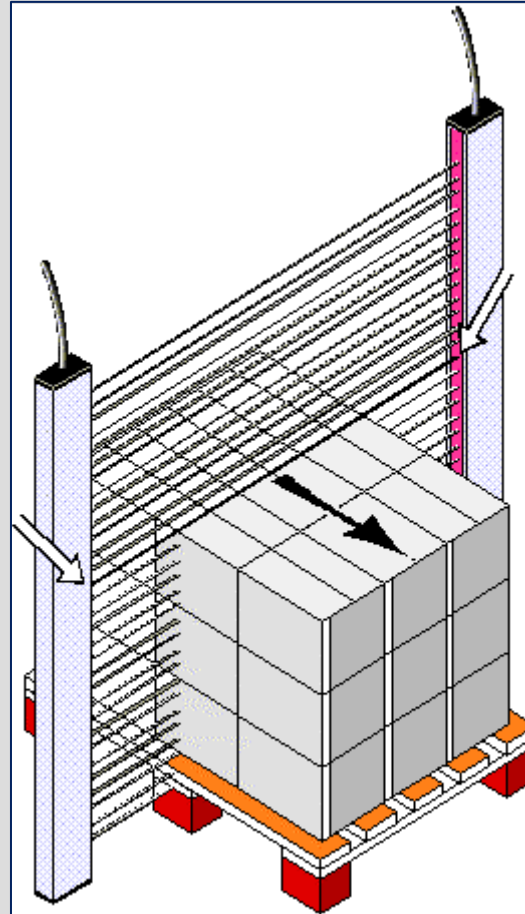
- Coupling: Robot – optical distance sensor



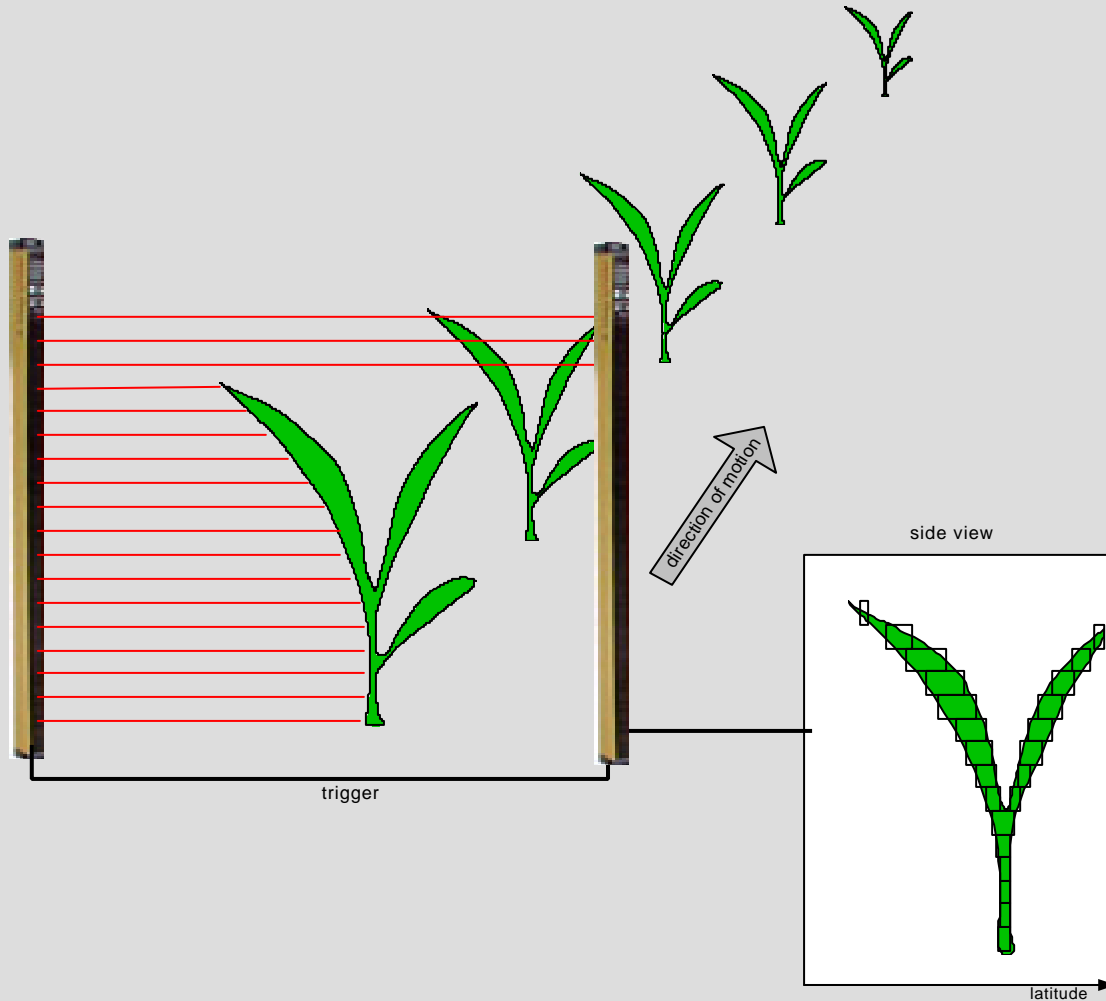
History of light curtains (1): Security / Safety



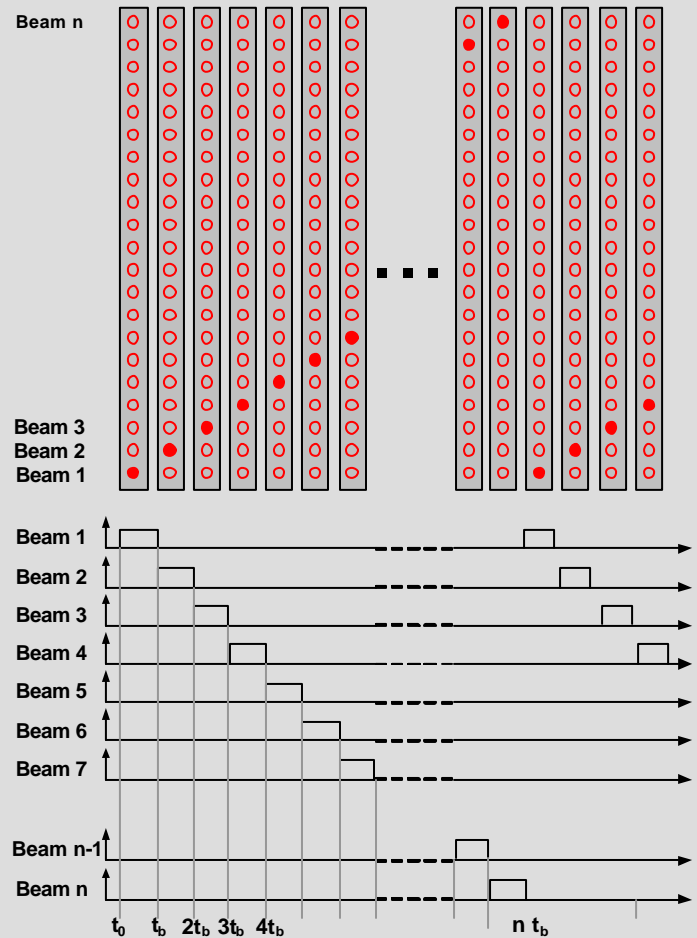
History of light curtains (2): Extended data analysis



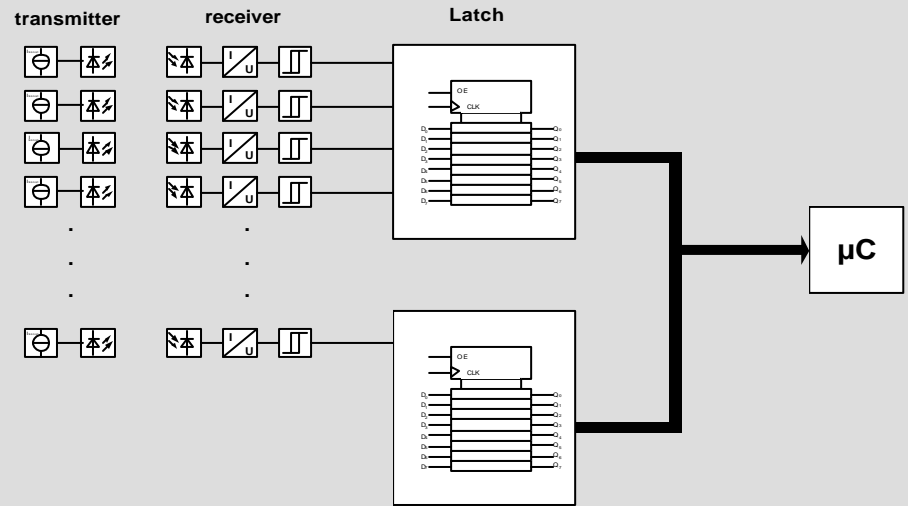
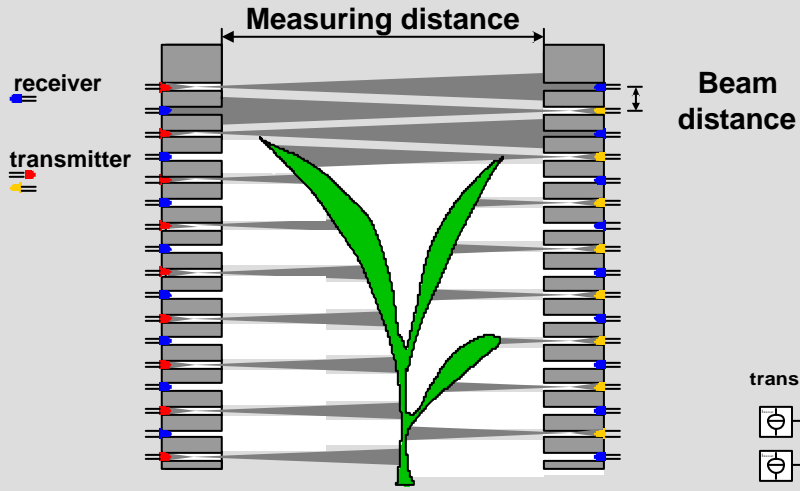
New application of light curtains: Sensor-based imaging



Pulsed version of a light curtain



Architecture of the "HPS-HR" (Height Profile Sensor / High Resolution)

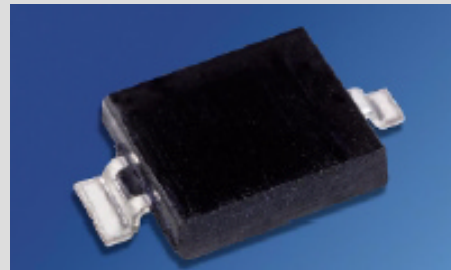


Data sheets (examples)

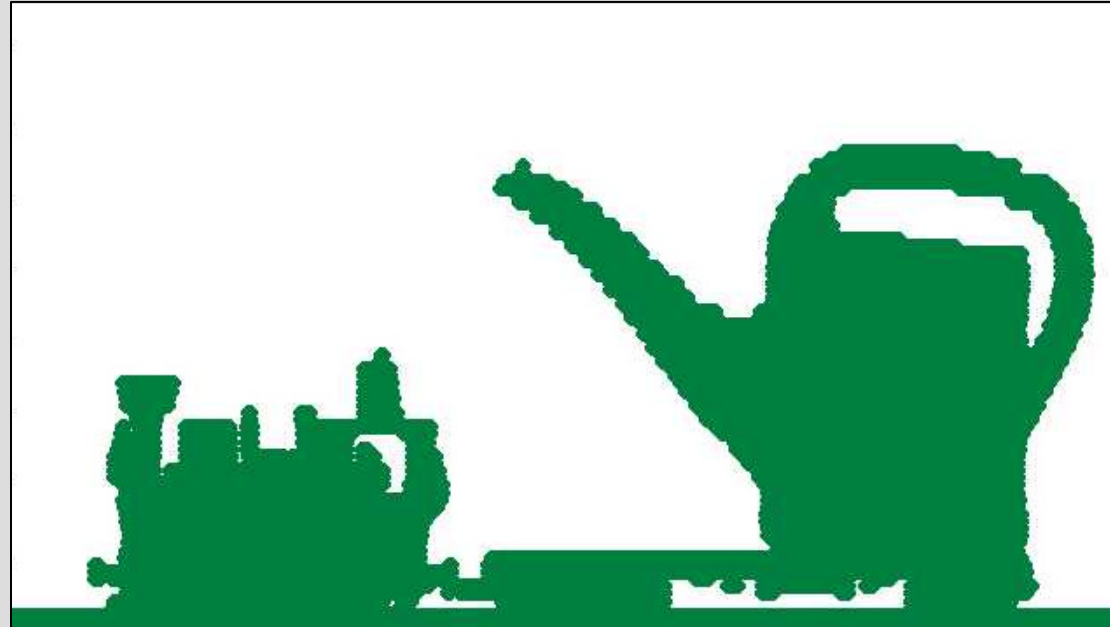
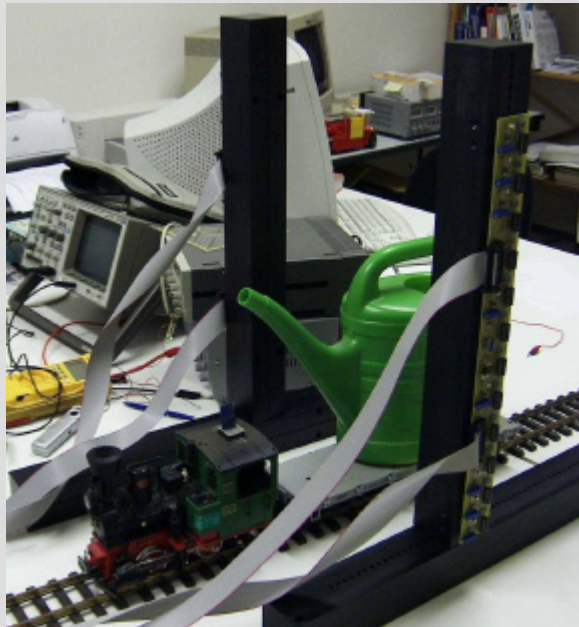
LED: SFH4501



Photo diode: BP104FS



“1 bit imaging” or “Height profile sensor (HPS)”



	Baumer INFRASCAN 5000	Leuze KONTURflex K5-480	Height Profile Sensor HPS-HR
Working height (measuring field)	475 mm	475 mm	475 mm
Measuring distance	≤4 m	≤4 m	≤ 0,7 m
Beam distance	5 mm	5 mm	5 mm
Resolution with double scanning	2,5 ¹	-	-
Number of beams (light barriers)	96	96	96
Clock speed per beam t_b	11 μs	50μs	
Clock speed per frame t_f	1056 μs	4800μs	30μs
Switching output	-	pnp	-
Serial interface	RS 422 / SSI (optional)	RS485 Profibus-DB	-
Configuration interface	RS232 ²	RS232	-
Parallel interface	10 Bit (optional)	-	16 bit
Analog output	Yes ³	-	-
Data format ⁴	normal / over all / largest blocked area		
Voltage supply	24 VDC ±10%	19 – 40 V DC	12 - 14 V DC
Light source	Infrared	Infrared	Infrared
Light emission	950 nm	950 nm	950 nm
Reverse polarity protection	Yes	no	no
Temperature range	-25...+50 °C	0 ... 65 °C	0 ... 50 °C
Dimensions			
Sensor height	630 mm	510 mm	550 mm
Sensor length	40 mm	40 mm	65 mm
Sensor width	80 mm	40 mm	50 mm
Min. perceiving height	130 mm / 25mm ⁵	10 mm	10 mm
Protection class	IP67	IP65	-

