IDENTIFICATION

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Productmanagement „Identification & Measuring“

April 2020

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NOTES ON THE WEBINAR

- The Webinar will be recorded!
- If you would like to receive the presentation and / or the recording afterwards you have to sign **GDPR**!

https://s.sick.com/newsletter_registration_at-de

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- **1. Barcode reading 1D (laserbased)**
  - Basics (working principle, versions, construction of 1D barcode, Focus technology, reading diagramm..)
  - Target applications
- **2. Barcodereading 2D (camerabased)**
  - Basics (operation principle, versions, construction of 2D barcode, reading diagramm..)
  - Target applications
- **3. Laser vs. Camera**
  - Laserbased barcodereader vs. camerabased barcodereader

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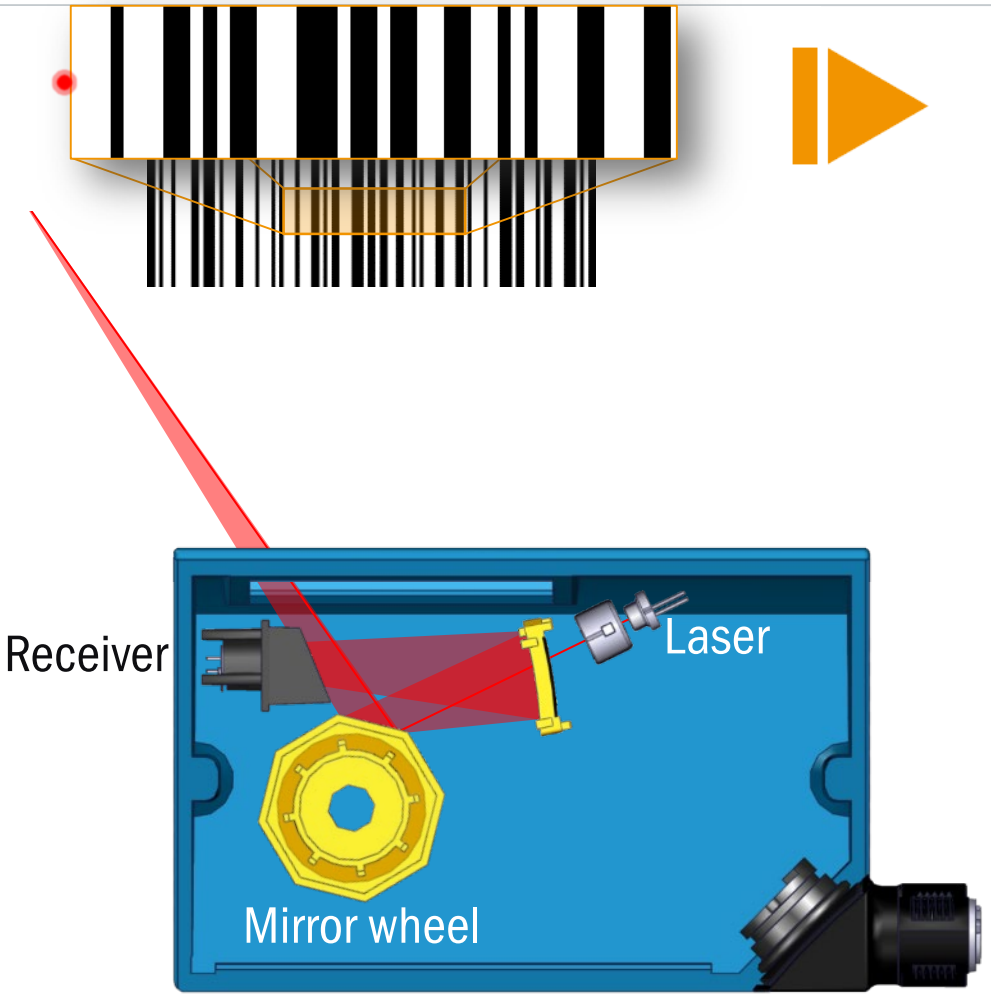
- **4. RFID**
  - Basics (operation principle HF/UHF, frequenzies, technology, transponders, readingfield diagramm..)
  - Target applications

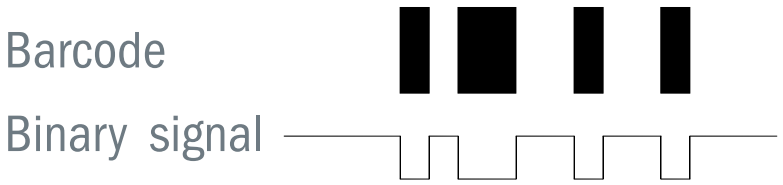
- **5. RFID vs. Barcode**
  - RFID Technology vs. Barcode Technology

- **6. Overview product portfolio Identification technologies**
  - Laser based
  - Camera based
  - RFID
  - 4D Pro- concept

1. BARCODE READING 1D (LASER BASED)
WORKING PRINCIPLE

- **Bar code scanners**
  - A laser spot is reflected by the mirror wheel onto the object (code)
  - By turning the mirror wheel, the laser spot is move through the field of view => “Scanning the barcode”
  - The remission of the laser spot is reflected into the receiver
  - The receiver evaluates the intensity of the received signal
  - ➔ The black and white bars of the code are read





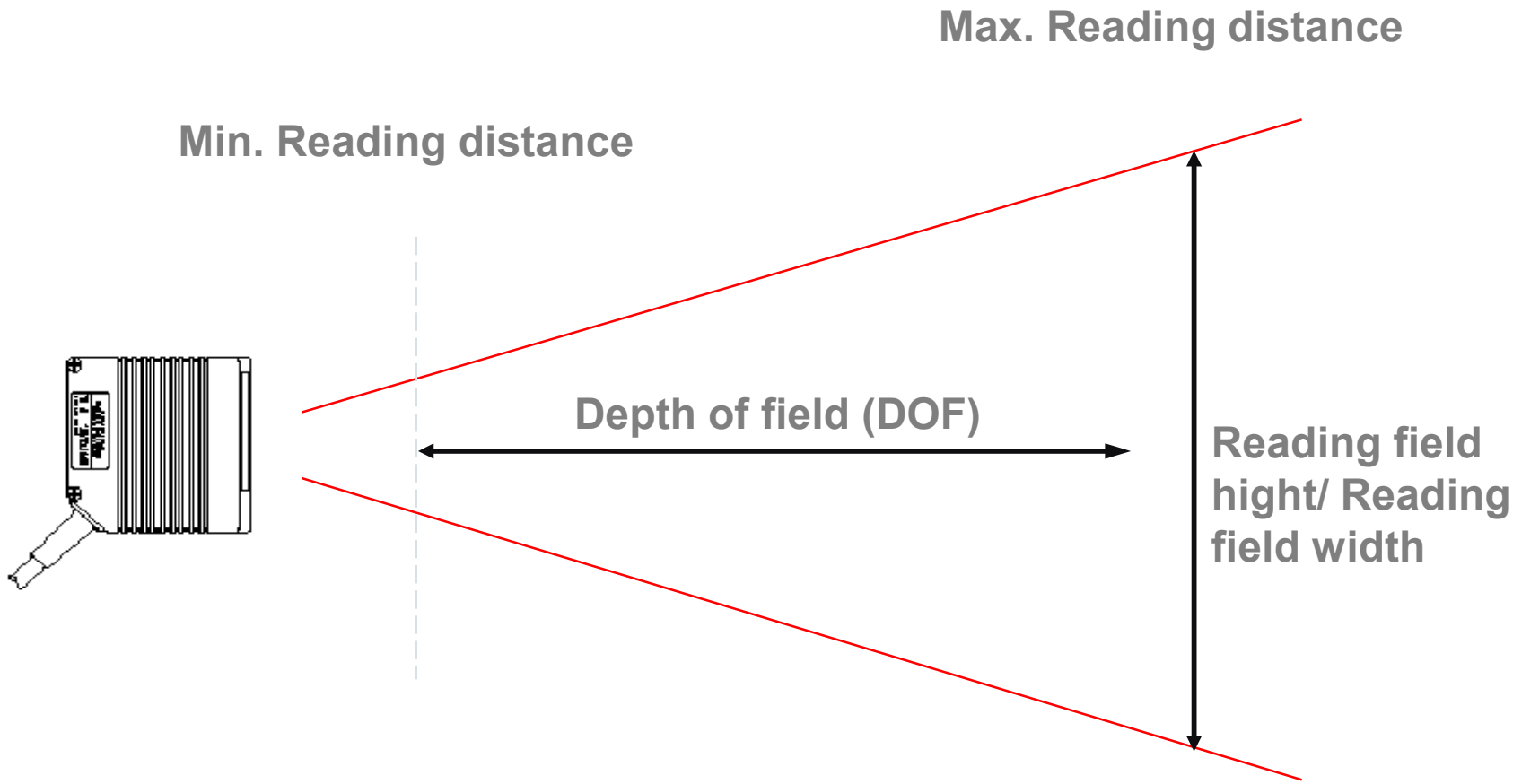
1. BARCODE READING 1D (LASER BASED)
LASERCLASS 2

- **Laserclass 2**
  - Lasbased barcodereader consists of a class 2 laser

Laser class	Hazards	Eyes				Skin	Power [3]	Spectrum λ
		Direct exposure		Diffuse reflection				
		w/o optical	with optical	w/o optical	with optical			
2	Safe for skin and eyes at direct exposure < 0.25 s (by closing the eyes consciously and active aversion) and diffuse reflection. Potentially hazardous for eyes at direct exposure > 0.25 s.	Safe at exposure time < 0.25 s	Safe at exposure time < 0.25 s	Safe	Safe	Safe	< 1 mW	400 nm ... 700 nm
							Class 1	other

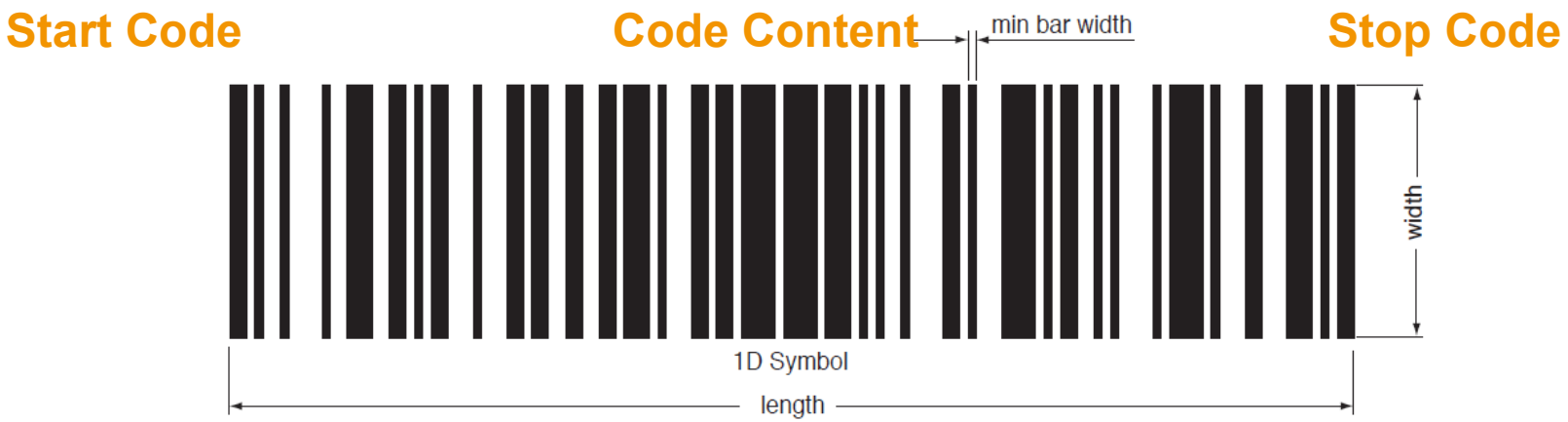
- **It is recommended to use a trigger (hardware or software based)**
  - To open the reading field only if a product is in front of the scanner (protects the eyes)
  - To save lifte time of the laser diode
  - Without trigger it is not possible to recognize a “NO READ“

1. BARCODE READING 1D (LASER BASED)
EXPLANATIONS



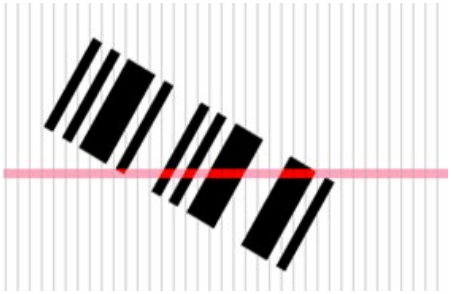
1. BARCODE READING 1D (LASER BASED)
CONSTRUCTION OF A BARCODE

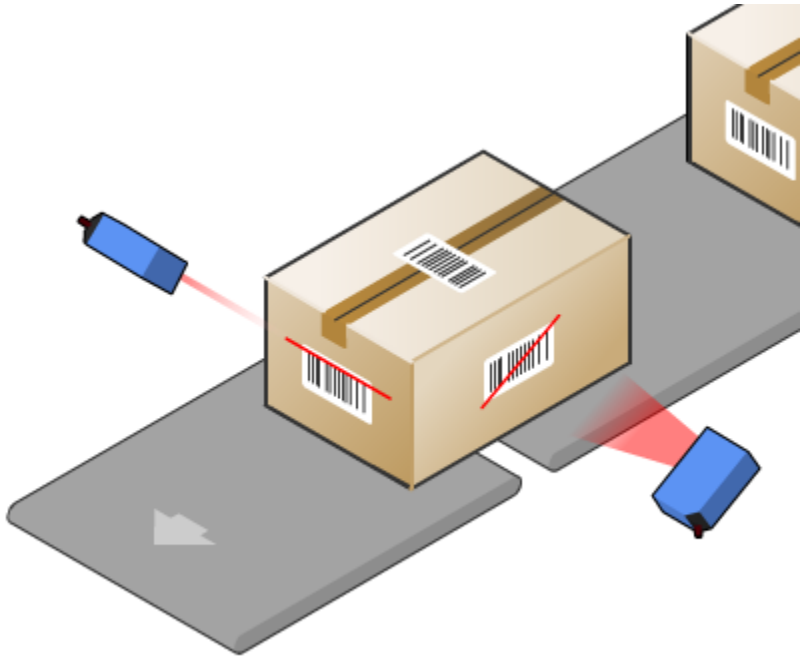
- **Modulwidth**
  - Is the narrowest dark bar in mm (min bar width)
  - Only if you know the modul width you can select the right barcodescanner !
- **Quit zone**
  - Is the area before and after the barcode, should be 10 times bigger than the modul width (necessary to have a good reading performance)
- **Start and Stop sign**
  - Defined the beginning and the end of the label, each barcode have theyr own start and stop sign.

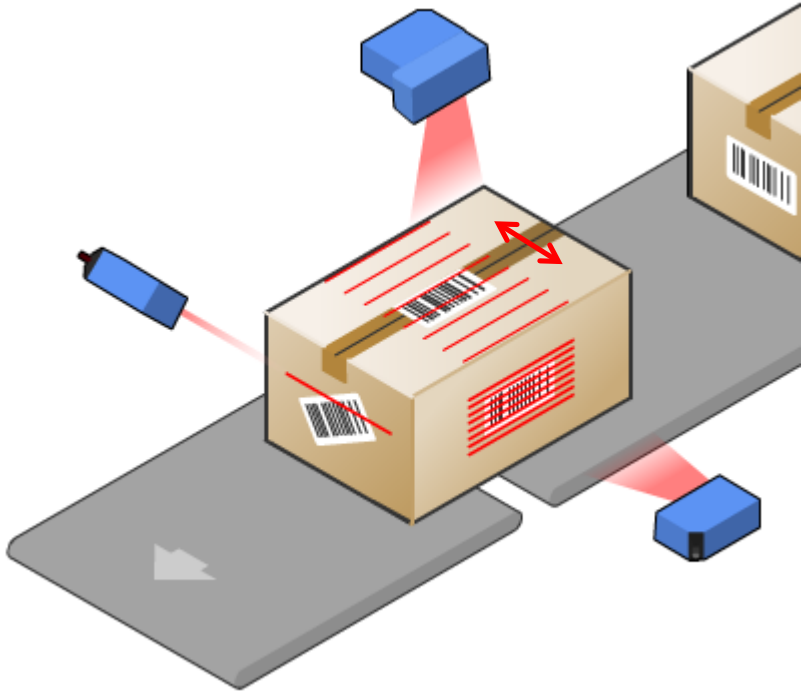


1. BARCODE READING 1D (LASER BASED)
VERSIONS

- 1D Code Reader as Line Scanner, Raster Scanner or Oscillating Mirror Version
- 1D Code Reader with Standard and SMART Decoder (coderecunstruction)

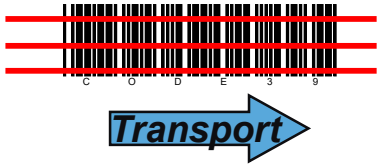






1. BARCODE READING 1D (LASER BASED)
BARCODE ORIENTATION

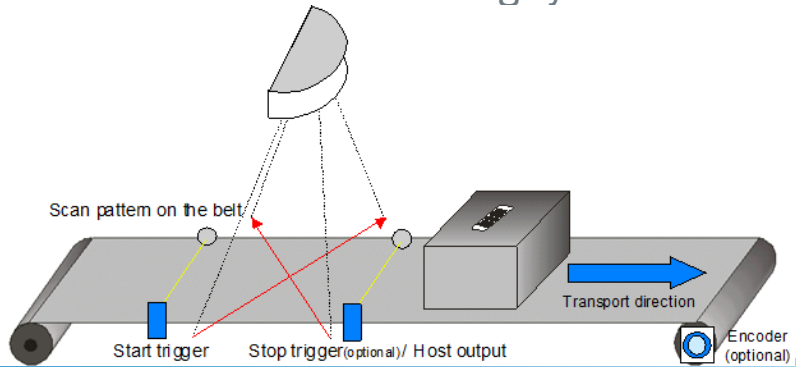
- **Fence oriented**
  - You have to use a Raster scanner > dynamic and stand still reading



- **Ladder oriented**
  - You have to use a Raster scanner > stand still reading
  - You have to use a Line scanner > dynamic reading

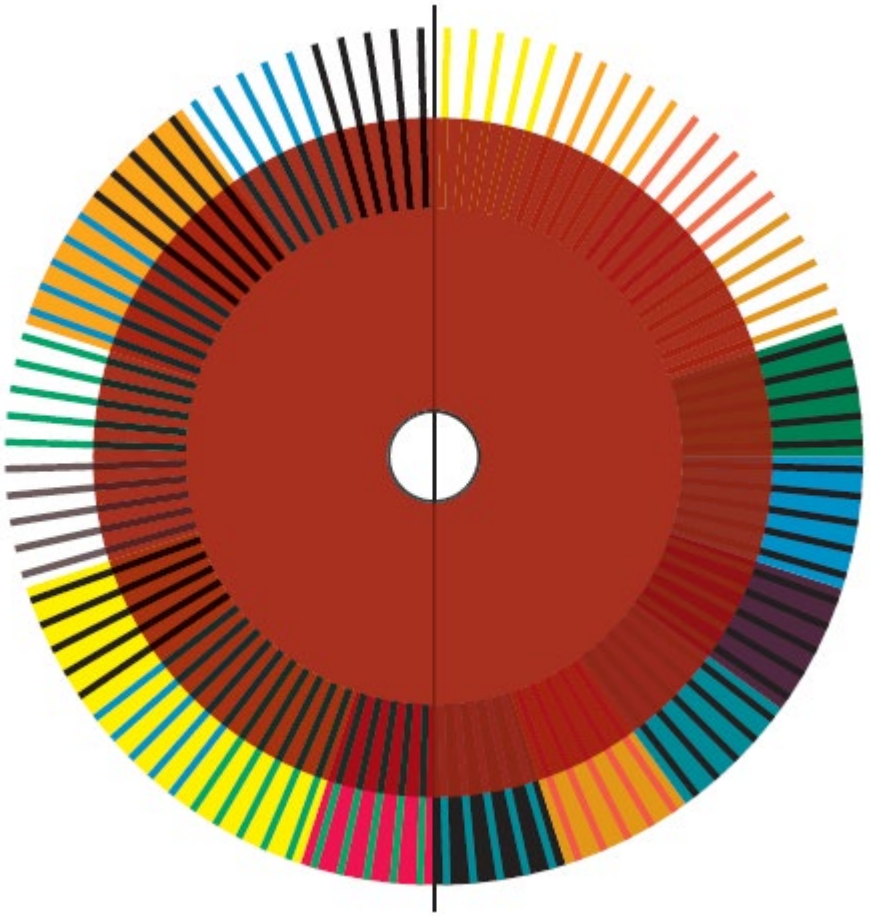
Dynamic Still stand

- **Not oriented**
  - You have to use a ‘’omnidirectional barcodereading system’’



1. BARCODE READING 1D (LASER BASED)
WHAT DOES A RED LASER SEES

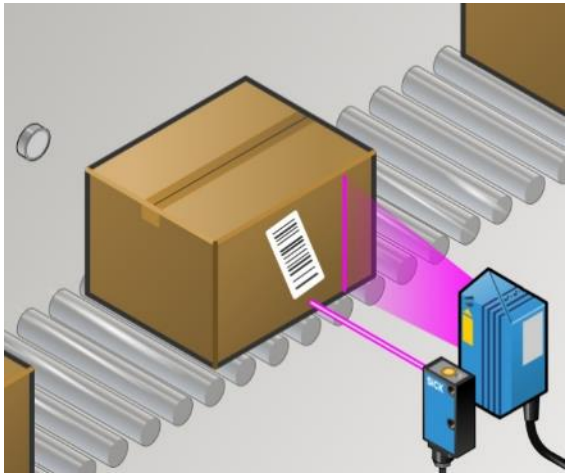
- **Colour combination's**
  - Suitable and unsuitable combinations

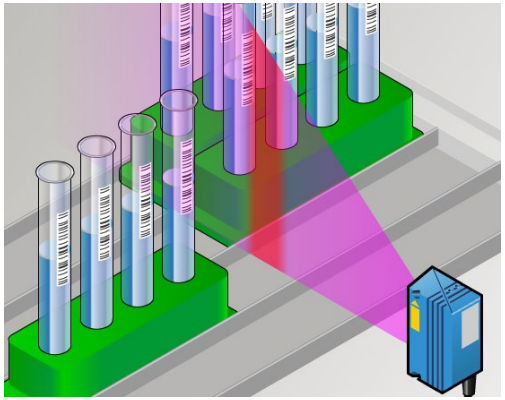


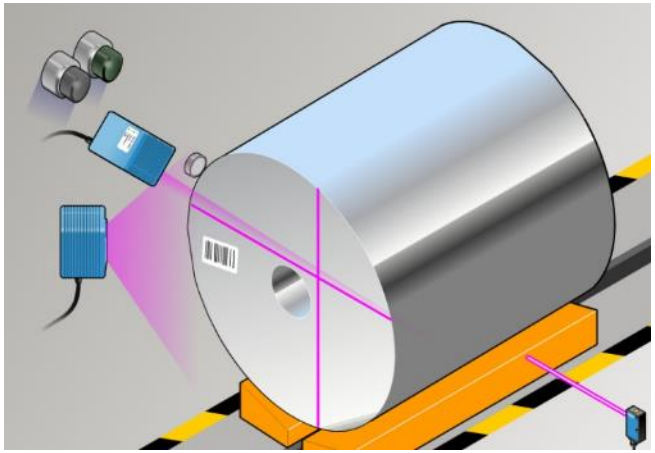
Suitable combinations	Unsuitable combinations
Black on white	Yellow on white
Blue on white	Orange on white
Black on orange	Red on white
Blue on orange	Light Brown on white
Green on white	Black on green
Dark Brown on white	Black on blue
Black on yellow	Black on dark brown
Blue on yellow	Black on blue-green
Green on yellow	Red on light brown
Green on red	Blue-Green on black

1. BARCODE READING 1D (LASER BASED)
FOCUS TECHNOLOGY

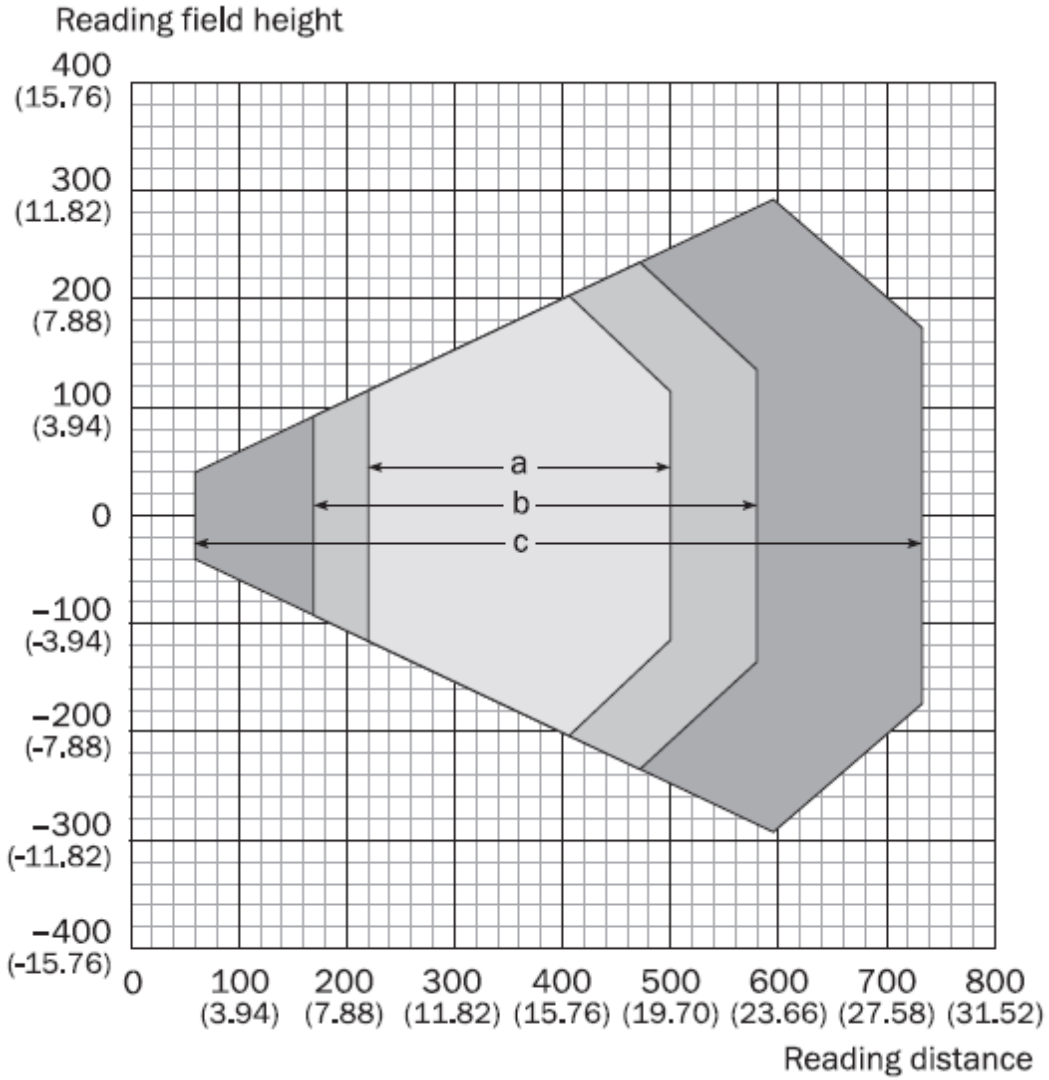
- **To read bar codes with specific resolution in different distances, orientations and positions, several types of focus technology are used:**
  - Fix-focus technology
  - Dynamic-focus Technology
  - Auto-focus Technology





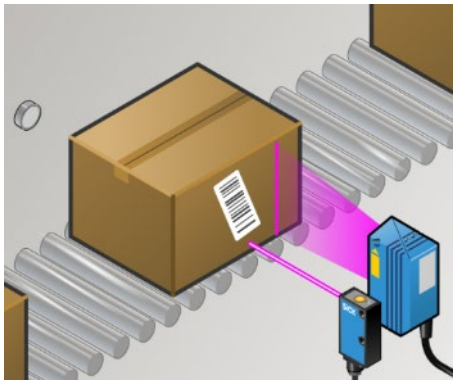


- **Example of a reading diagramm (fix focus device)**



Code resolution:

- a: 0.35 (13.8 mil)
- b: 0.50 (19.7 mil)
- c: 1.00 (39.5 mil)



Reading conditions:

Resolution	Scanning frequency
0.35 (13.8 mil)	750 Hz
0.50 (19.7 mil)	900 Hz
1.00 (39.5 mil)	1,200 Hz

1. BARCODE READING 1D (LASER BASED)
TARGET APPLICATIONS WITH ORIENTED BARCODE

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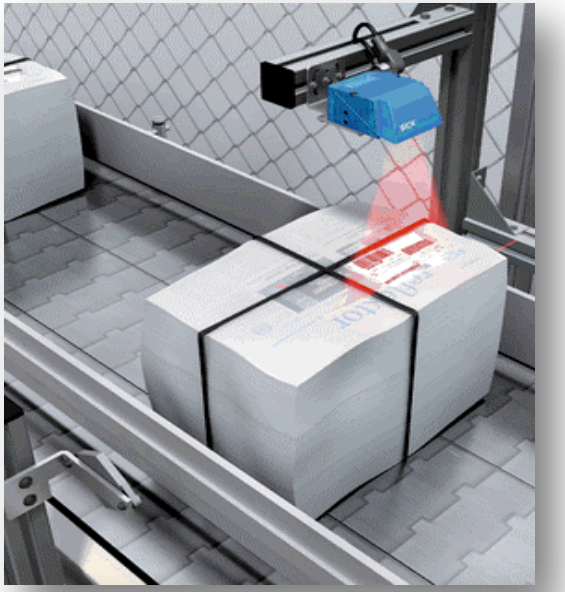
- **Storage and Conveyor**
  - tote reading
  - box reading

- **Challenges:**
  - Short reading distance with large reading field height
  - Large code length
  - Low contrast codes
  - Scanner close to conveyor

- **Benefits:**
  - CLV615 reading fields optimized on intralogistics systems
  - Mounting on all standard conveyor system profiles is possible
  - Available as kit: CLV615-F2000 with CDF600-2 PROFIBUS + PROFINET.



1. BARCODE READING 1D (LASER BASED)
TARGET APPLICATIONS WITH ORIENTED BARCODES

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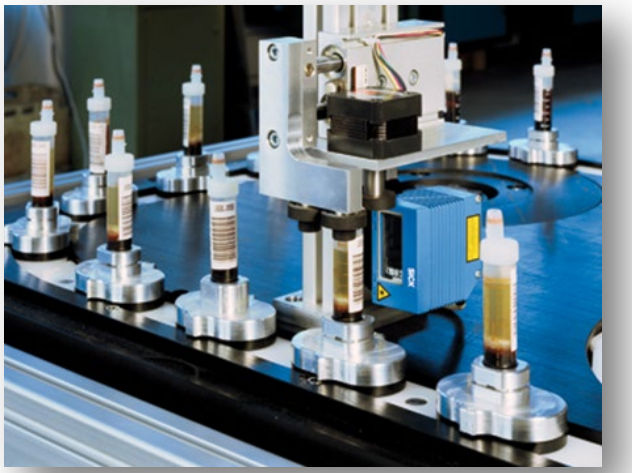
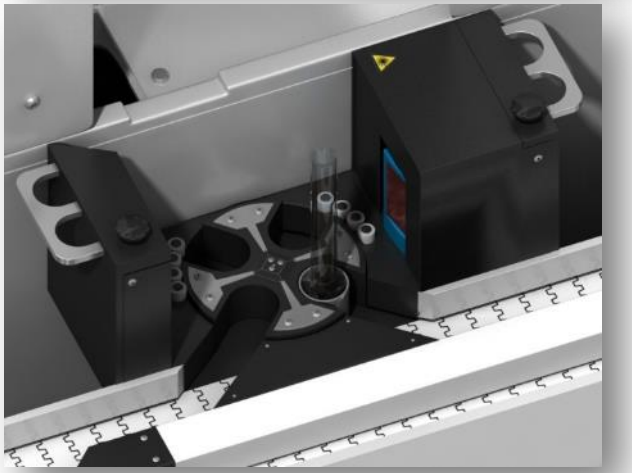
- **Medical analyzer**

- **Challenges:**
  - Code quality vary
  - Decoding of low contrast codes
  - Position of bar code varies
  - Short reading distance with large reading field height
  - Different specific integration requirements

- **Benefits:**
  - code reconstruction software SMART helps reading damaged codes
  - Optimized optics for low contrast applications
  - Optimized reading field in case of short distance and field height





1. BARCODE READING 1D (LASER BASED)
TARGET APPLICATIONS WITH ORIENTED BARCODES

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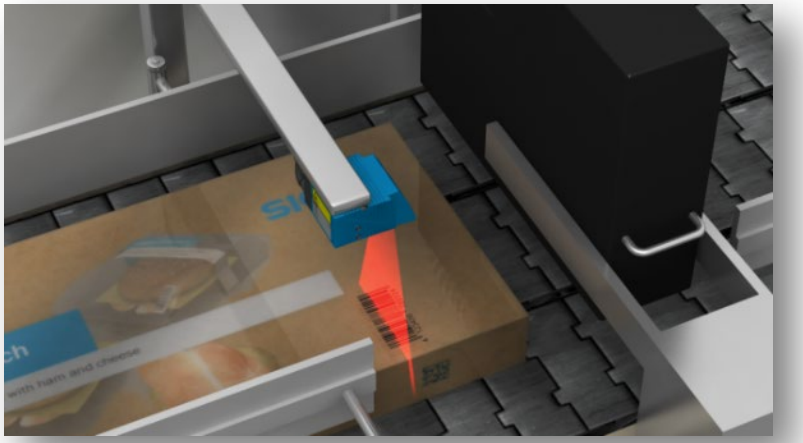
- **Commercial Goods**
  - read after print
  - Packaging

- **Challenges:**
  - Shiny material / low contrast codes
  - IP65 is required
  - Advanced match codes

- **Benefits:**
  - Compact design enables installation even in applications with limited space
  - Optimized optics for low contrast applications



1. BARCODE READING 1D (LASER BASED)
TARGET APPLICATIONS WITH NON ORIENTED BARCODES

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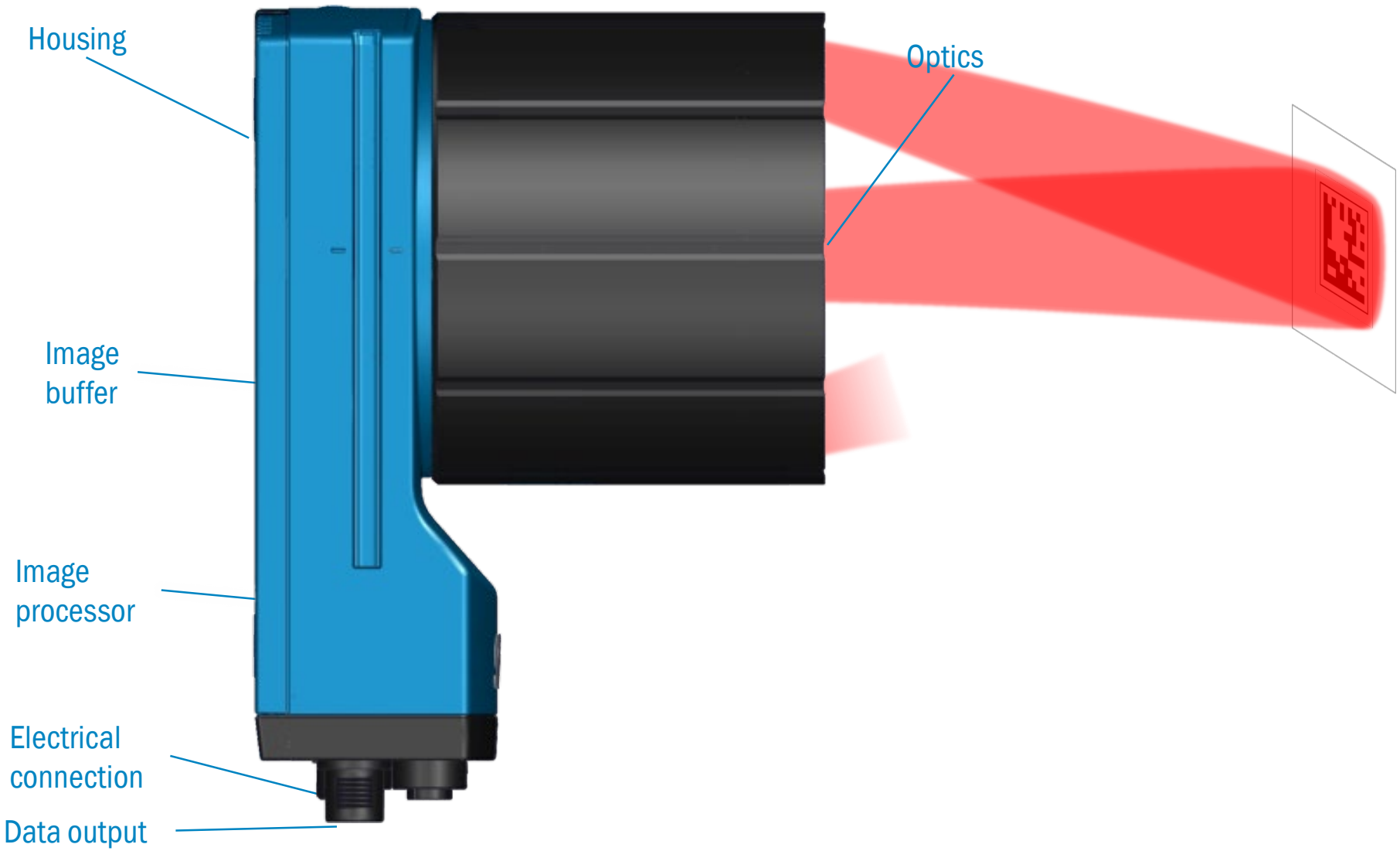
- **CEP (Courier express parcle)**
  - Omnidirectional reading

- **Challenges:**
  - The labels are not oriented
  - High DOF (depth of field)
  - High conveyour speed
  - No gap between the parcels (Tracking)

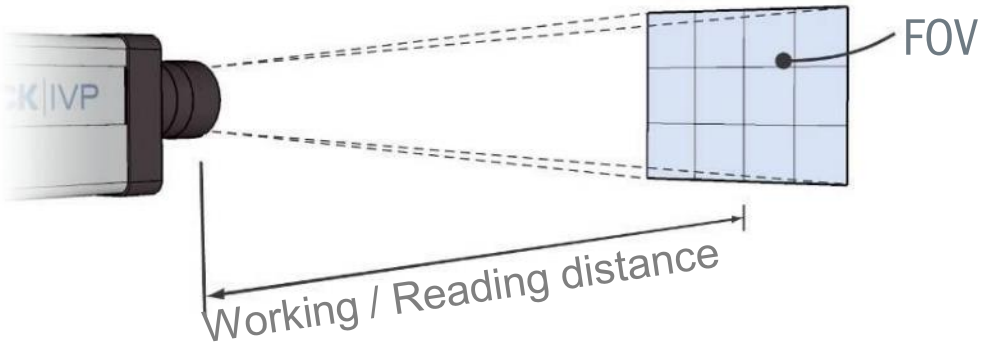
- **Benefits:**
  - Compact design enables installation even in applications with limited space
  - Optimized optics for low contrast

2. BARCODE READING 2D (CAMERA BASED)
WORKING PRINCIPLE

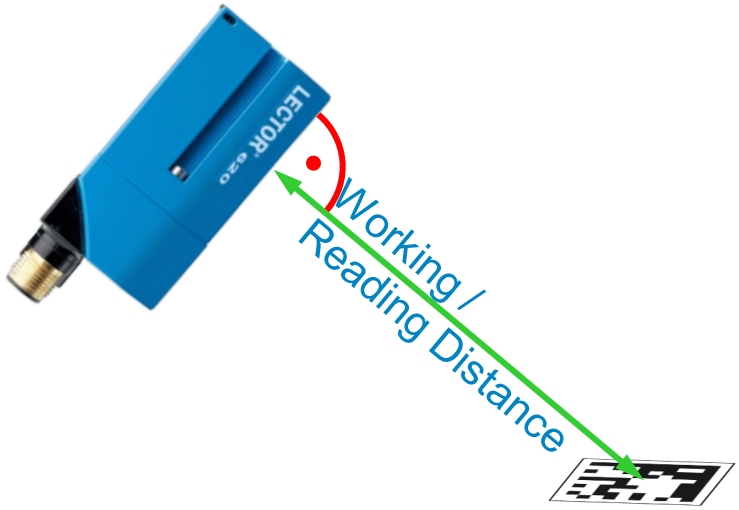


2. BARCODE READING 2D (CAMERA BASED)
EXPLANATIONS (FOV, WD/RD, DOF)

- **Field of view (FOV)**
  - Is what the camera sees (x & y)



- **Working or Reading Distance (WD/RD)**
  - The Working Distance (WD) or Reading Distance (RD) is the lens-to-object distance



- **Depth of Field (DOF)**
  - Is the range in which a sensor can read a code, without changing focal position or lens.

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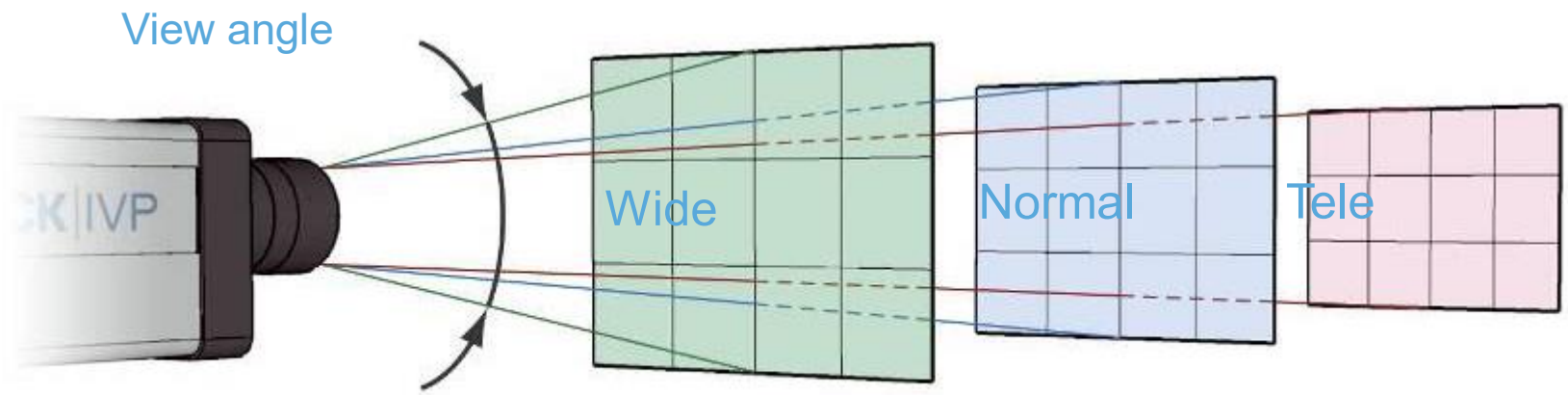
- **The view angle of the lens determines how much of the visual scene the camera sees**
  - Wide angle (short focal length) captures a large scene
  - Normal
  - Narrow angle, or tele (long focal length), captures a small scene



2. BARCODE READING 2D (CAMERA BASED)
EXPLANATIONS (FOCAL LENGTH AND LENS)

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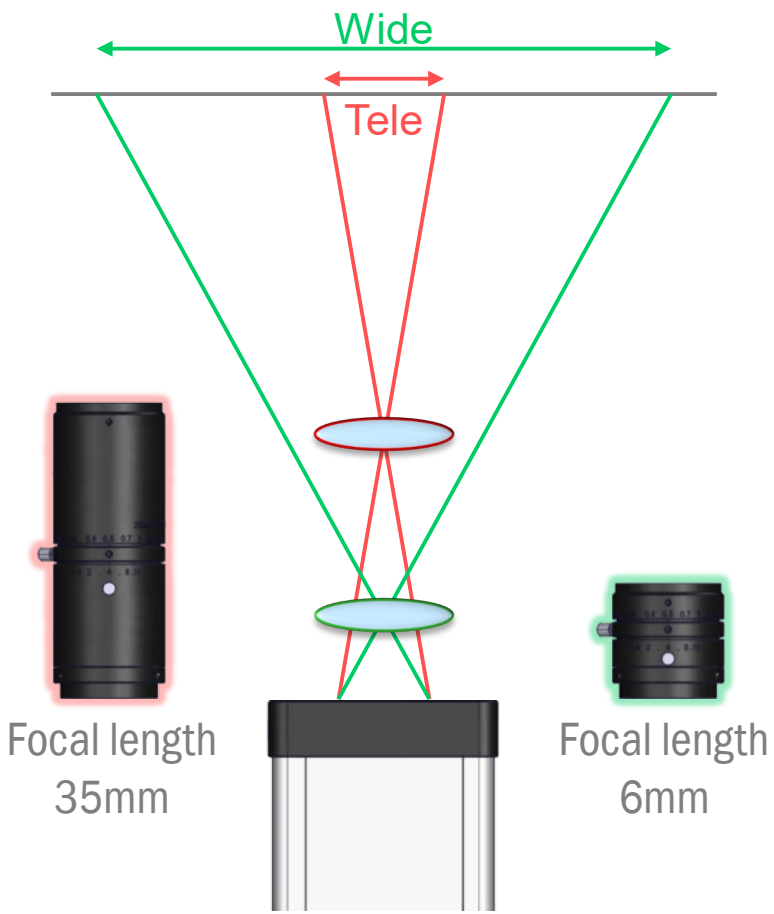
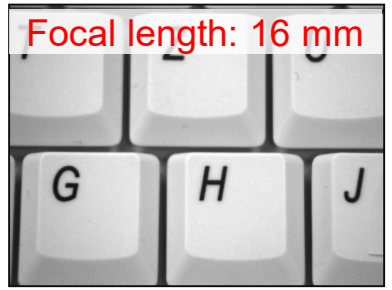
- **Dependency**
  - Focal length ↔ Field of view



Looking at a
computer keyboard
with different lenses



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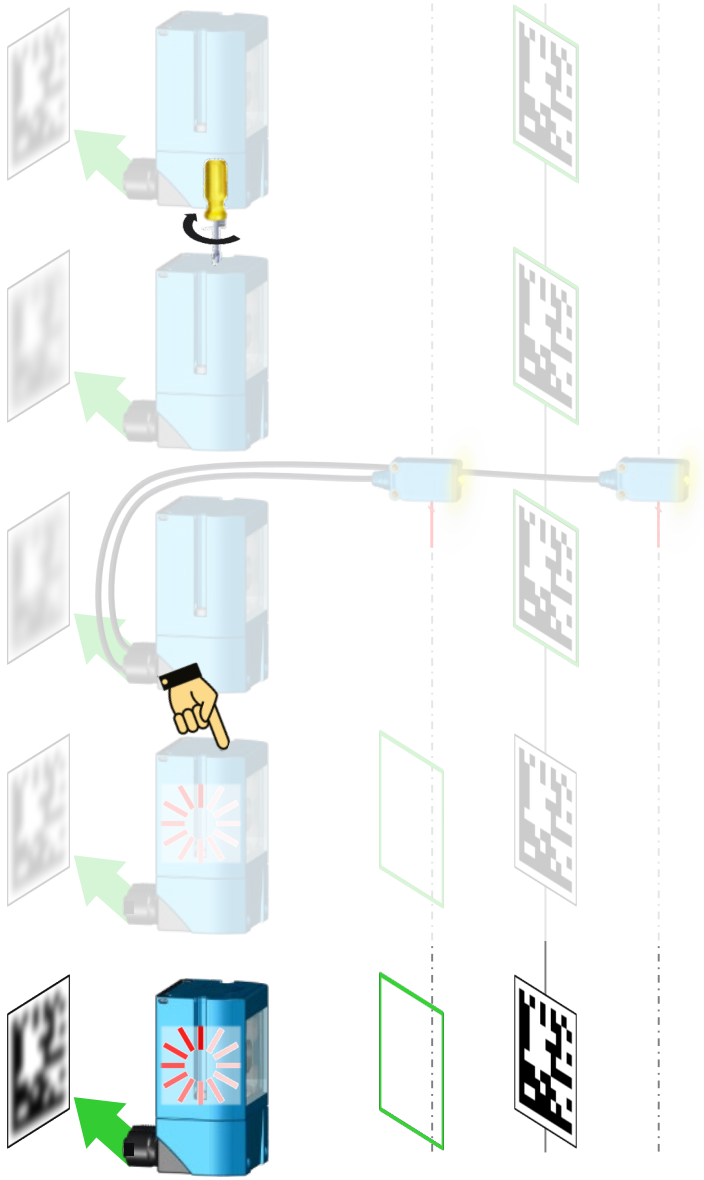
- **A sharp image is well focused**

- The focus is used to sharpen the image. There are various types of focuses.

- Example:

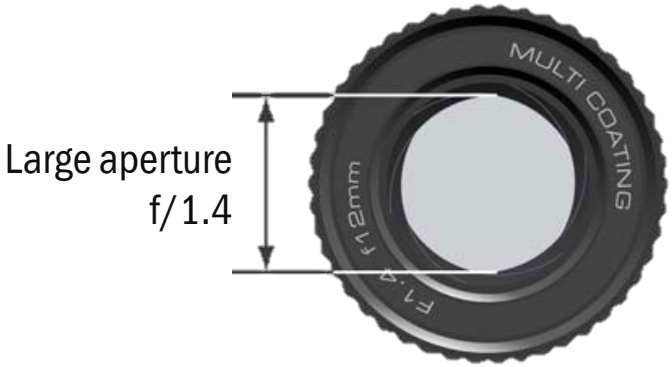
2. BARCODE READING 2D (CAMERA BASED)
EXPLANATIONS (TYPES OF FOCUSES)

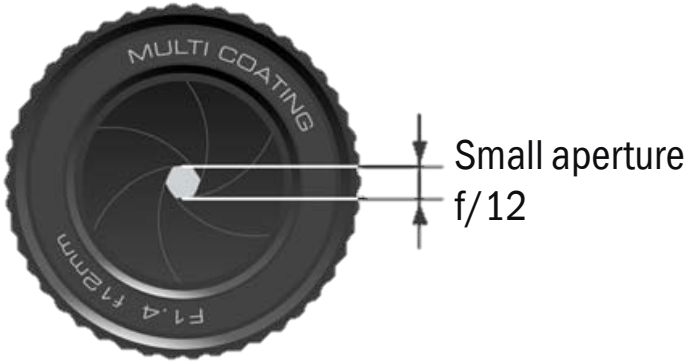
- **Fix Focus**
  - The focus is set to a certain reading distance and can not be changed.
- **Mechanical Focus**
  - The focus can be changed mechanically during commissioning.
- **Dynamic Focus**
  - The focus can be changed during the reading gate by command or incoming event such as hardware input.
- **Teach Auto Focus**
  - The focus can be set automatically by the device, but only when commissioning the device NOT during reading mode.
- **Auto Focus**
  - The focus is automatically done by the device even during reading gate / trigger



2. BARCODE READING 2D (CAMERA BASED)
EXPLANATIONS (APERTURE)

- **The aperture is the hole inside the optics through which the light enters the camera**
- **A small hole means a high aperture number (e.g. f/12)**





- Small hole → High aperture number → small amount of light → darker image
- Big hole → Small aperture number → big amount of light → brighter image

- Example

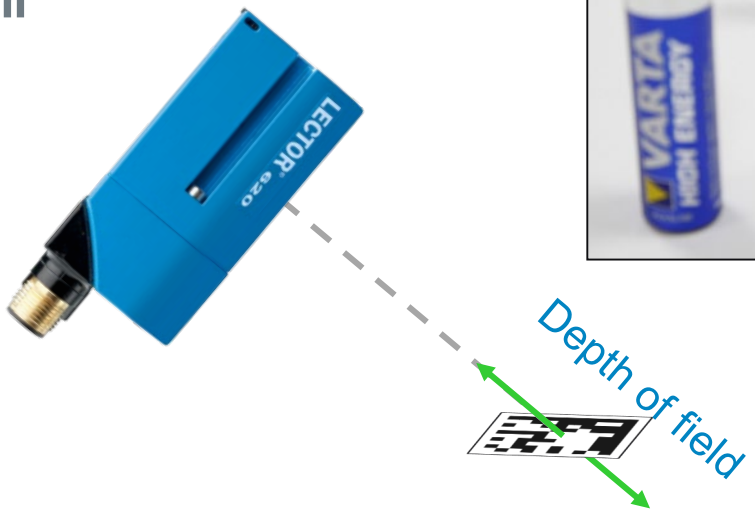
Aperture: f/4.5

Aperture: f/28

2. BARCODE READING 2D (CAMERA BASED)
EXPLANATIONS (DOF)

- **The “Depth of Field” (DOF) is the range in which a scene appears acceptably sharp.**
- **Within the DOF, a sensor can read a code or detect an object, without changing focal position or lens.**

- **The depth of field depends on**
  - Focal length / Focal position
  - Working / Reading distance
  - Lens
  - Aperture
  - Camera sensor resolution



- Main effects
  - Large aperture → small DOF / Small aperture → large DOF
  - Long focal length → small DOF / Short focal length → large DOF
  - Short working distance → small DOF / Long working distance → large DOF

2. BARCODE READING 2D (CAMERA BASED)
VERSIONS (LINE & MATRIX CAMERA)

- **1D (line camera)**
  - Collects gray or color profiles
  - Profiles can be assembled into an image => 2D
  - Scanning requires object movement

- **2D (matrix camera)**
  - Acquires an area image
  - Snapshot ”click”, no movement needed

- **Strtength 1D (line camera)**
  - Can read smaller code heights with high conveyer speed
  - Can read from botton through conveyour gap
  - Bigger FOV
  - Image output for videocoding and OCR (high res)

Strtength 2D (matrix camera)

/Reading in motion and as well stationary

/Easy to install – live image in station

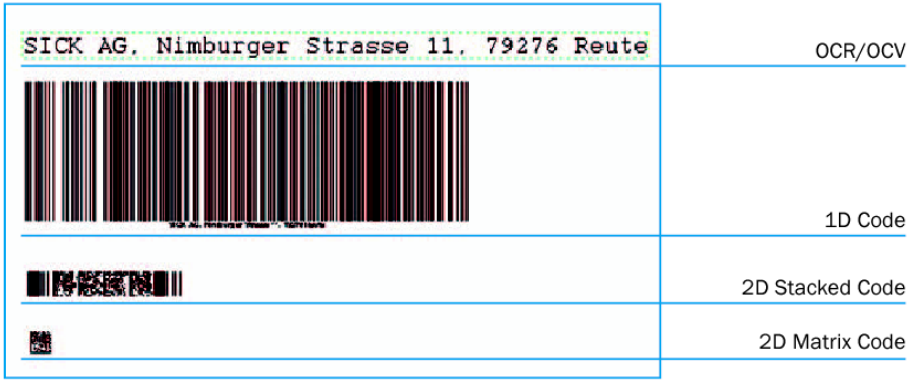
/More DOF without changing the focus

/Lower hardware price & installation costs

/Capture sevaral images, redundancy

2. BARCODE READING 2D (CAMERA BASED)
BARCODE 2D (WHY 2D BARCODE)

- **Most advantages of 2D Barcdoe**
  - Very high information density
  - Requires very small space
  - Redundance
  - Marking methods (DPM..)



Code Structure		Cost of Reader	Space Require-ments	Information Density	Reading Reliability	Human Readability	Industry
Optical Char-acters (OCR)		High	Very high	Low	Low	Yes	Pharmaceutical, food, automotive, aviation, and aerospace industries
1D		Low	High	Average	Average	With additional optical characters	Consumer goods industry, parcel and postal services
2D	Stacked Codes	Average	Average	High	Average	No	Pharmaceutical and consumer goods industries, parcel and postal services
	Matrix Codes	Average	Low	Very high	High	No	Automotive, electronic, pharmaceutical, aviation, aerospace, and food industries

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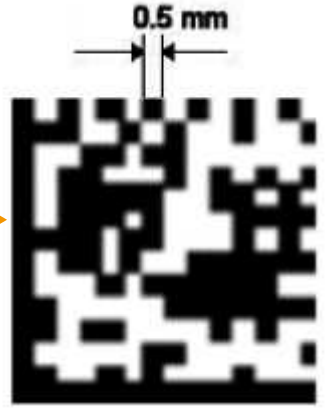
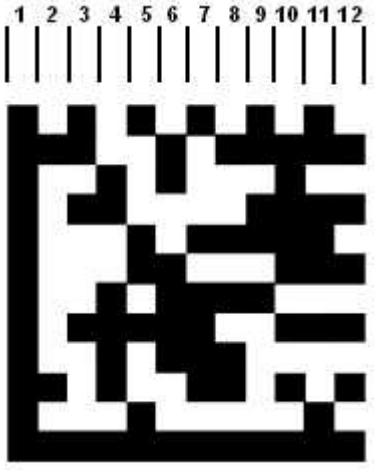
- **Characteristics**
  - Cell size > variable, typical values 0,1-1mm
  - Symbol size > depending on the content of the code typical values 12x12 - 32x32
  - Cell form > squared according to ISO/IEC16022
  - Finder pattern (L pattern) > as thick as one cell
  - Alignment > twice the size of one cell
  - Quiet zone > at least as thick as one cell, but thicker than 5 times the cell size recommended

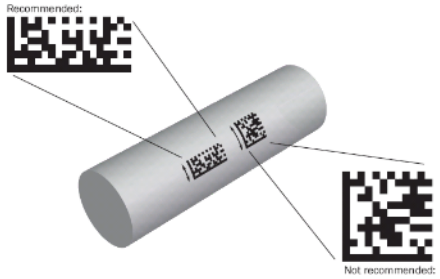
Cell size



Symbol size



- **Data Matrix ECC200**
  - The most common 2D Matrix code !



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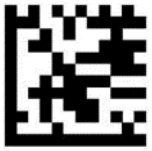
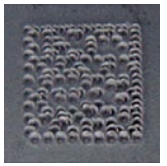
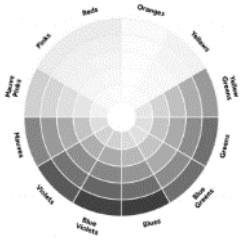
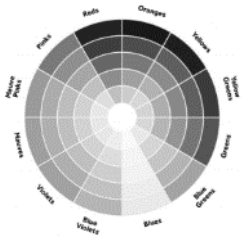
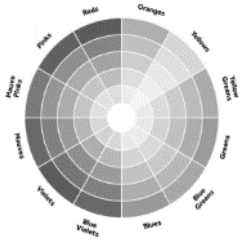
- **Examples of marking methods**

	Good	Bad
InjkJet		
Laser marking		
Dot peening (DPM)		
Electr. chem. etching		

2. BARCODE READING 2D (CAMERA BASED)
COMMON ILLUMINATIONS (WHITE, BLUE, RED)

Red | Blue | White



What lighting color for which task?

WHITE...

- Is the all-purpose version due to widest spectrum
- Is most suitable for codes printed on cardboard boxes
- Suits best for presentation camera applications as most people feel white light is least harmful

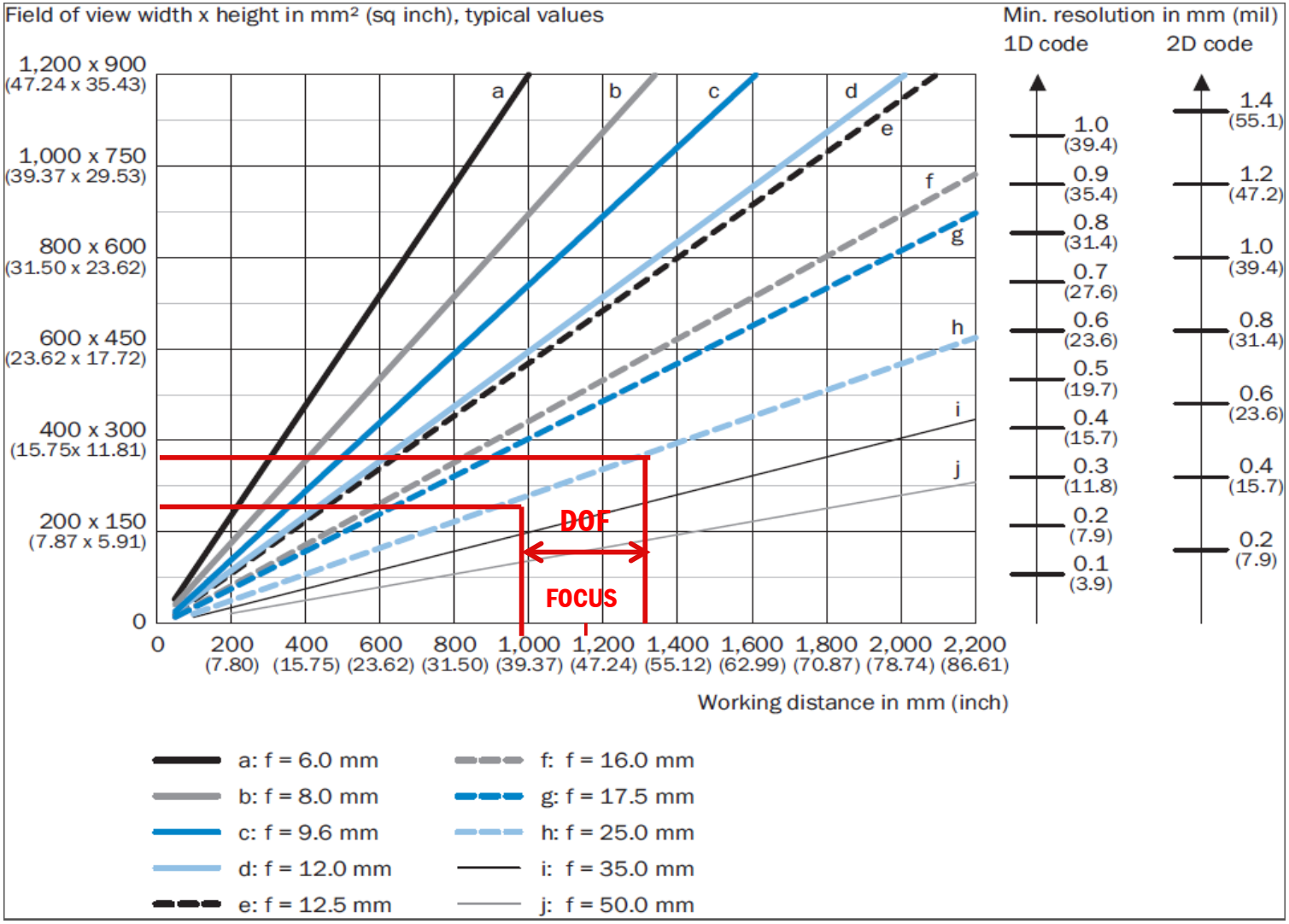

BLUE...

- Is the perfect choice if maximum optical DOF is required (f = >11...16)
- Offers best performance if the pixel resolution is challenging (1D <1.5 ppm & 2D < 2.0ppm)
- Is not well-suitable for colored codes printed on cardboard boxes as the brown background turns black

RED...

- Is used if label with white, yellow and red background need to be read
- Can be used if black barcodes are printed on cardboard boxes

- **Example for a reading diagramm**



2. BARCODE READING 2D (CAMERA BASED)
TARGET APPLICATIONS FOR 2D (MATRIX CAMERA)

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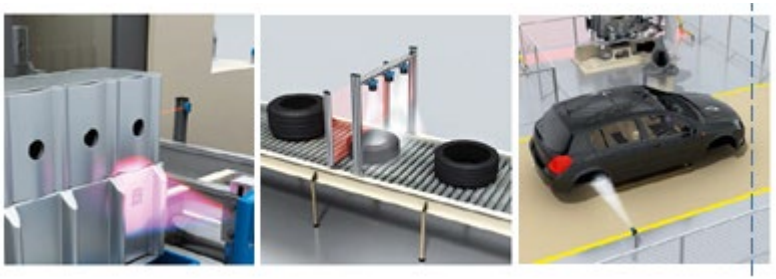
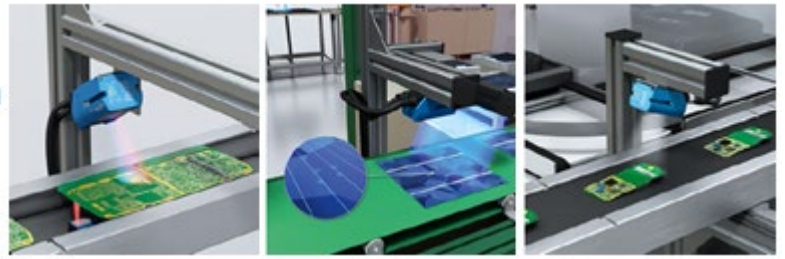
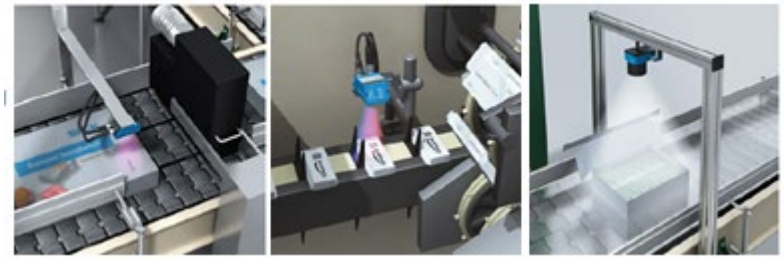
- **Automotive**
  - Power train (DPM)
  - Tire manufacturer
  - Final assembly



- **Electronic & Solar**
  - PCB production
  - Waver production
  - ...



- **Consumer goods**
  - Production
  - Packaging
  - ...



2. BARCODE READING 2D (CAMERA BASED)
TARGET APPLICATIONS FOR 2D (LINE CAMERA, SYSTEM)

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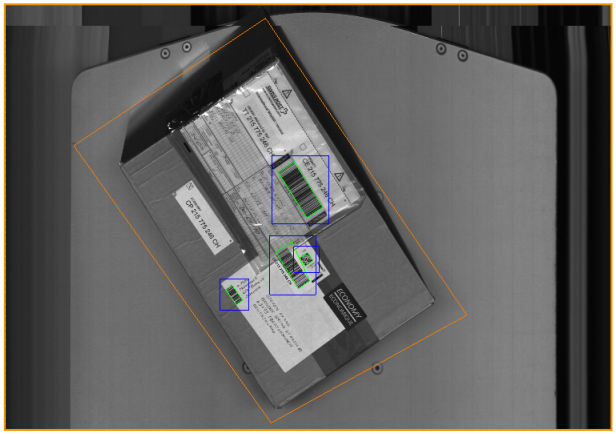
Sensor Intelligence.

- **CEP (courier express parcle), Tire Industrie...**
  - Omnidirectional reading of 1D and 2D codes
  - Image output options for diagnostics and analysis
  - Can read smaller code heights with high conveyer speed
  - Can read from botton through conveyour gap



3. LASER VS. CAMERA

LASERBASED BARCODEREADER VS. CAMERABASED BARCODEREADER

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Laser	Task	Camera
+	1D Code	++
-	2D Code	+
- (+)	Omnidirectional reading	+
+	Speed	+
+	Start-/Stop and standstill	-
+	Required Space	-
+	DOF (Depth of Field)	-
+	FOV	-
-	Images	+
+	Costs	-

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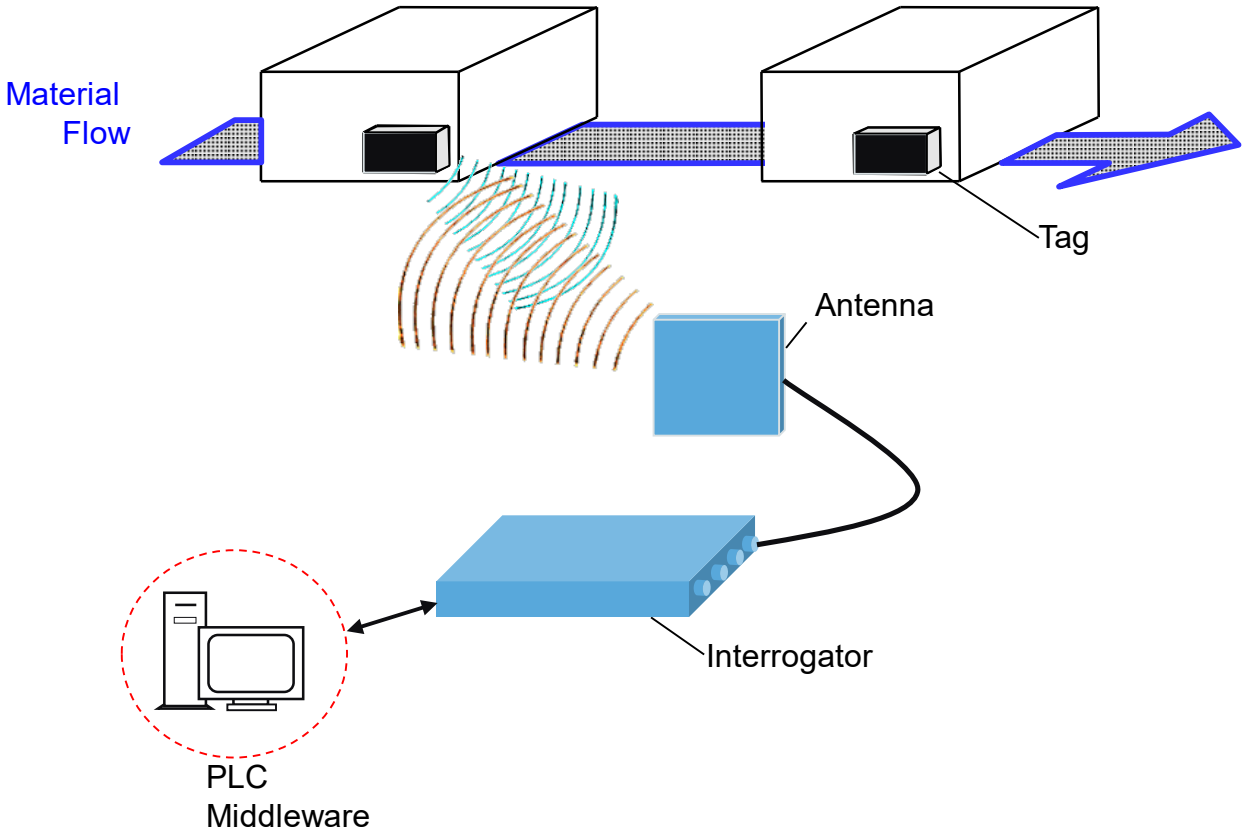
Meaning

- Because of the procedures used for the transfer of power and data, contactless ID systems are called RFID systems (Radio Frequency Identification)



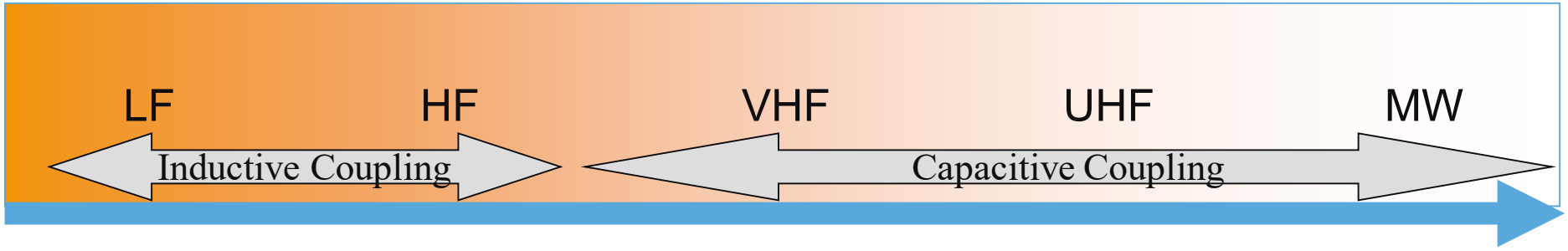
: **Principle of an RFID System**

: The Tag applied to an object carries data along the logistic process.
: The Interrogator supplies energy and data to the Tag by using the antenna.
: The Interrogator may read from or write onto the Tag.
: The Interrogator is controlled by a PLC or a higher level System like ERP or WMS via a LAN.

*ERP: Enterprise Resource Planning
*WMS: Warehouse management System

4. RFID
MOST FAMOUS RFID FREQUENCIES

	LF - 125 kHz	HF - 13,56 MHz	UHF - 860...960 MHz	MW - 2,45 GHz
Write-/ Read Range	up to 0,7 m	up to 0,5 m	up to 5 m	up to 10 m
Object speed	max. 2 m/s	max. 6 m/s	max. 10 m/s	max. 25 m/s
Material penetration	all except Metal	all except Metal	low	Reflexions
ISO-Standards	11784	15693/18000-3, 14443	18000-6	10374
Main applications	Access control, Tool-ID, Animal-ID	Tote-ID, Library, Laundry, e-passport	Parcel-ID, Pallet-ID, Luggage-ID	Traffic (Maut) Container
Market share	high	medium, growing	medium, growing	low



RFID-Systems < 135 kHz

RFID-Systems 13.56 MHz

RFID-Systems 860 - 960 MHz

RFID-Systems 2.45 GHz

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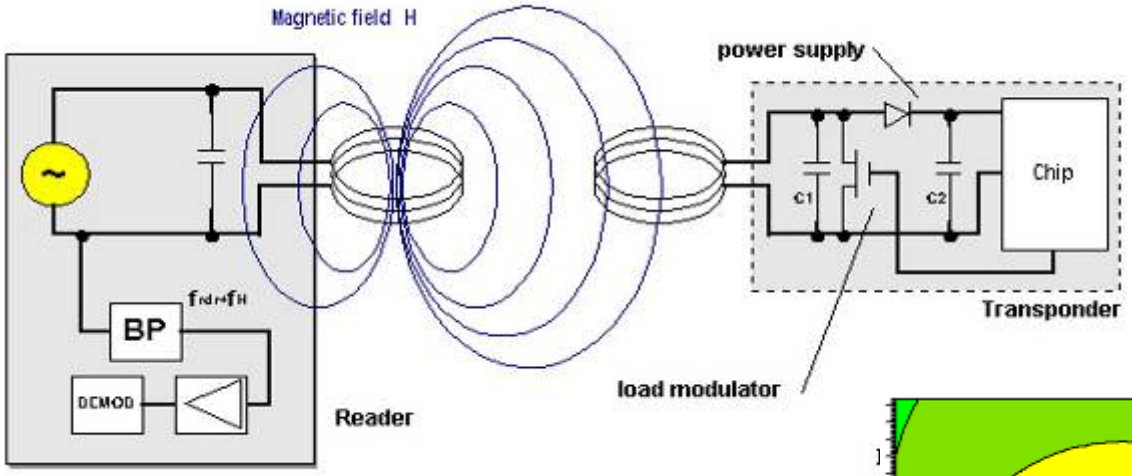
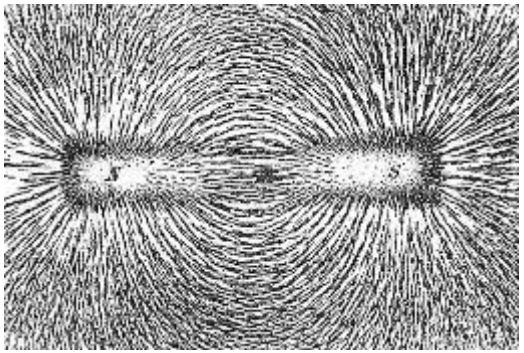
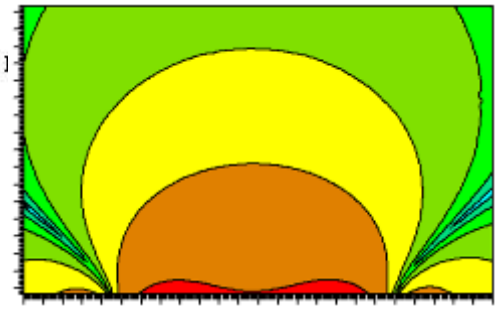
Technical view - magnetic Coupling

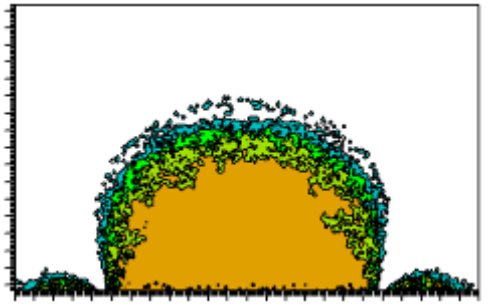
- Low and high frequency systems are based on the magnetic coupling principle to transfer energy and data. The interrogator generates a magnetic field. The transponder is able to store and transmit data. The achievable read write performance is closed to the theoretic values.







Field strength measured



Tested communication range

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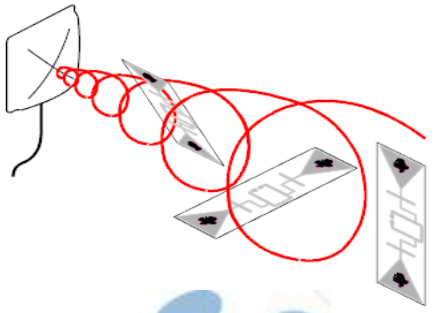
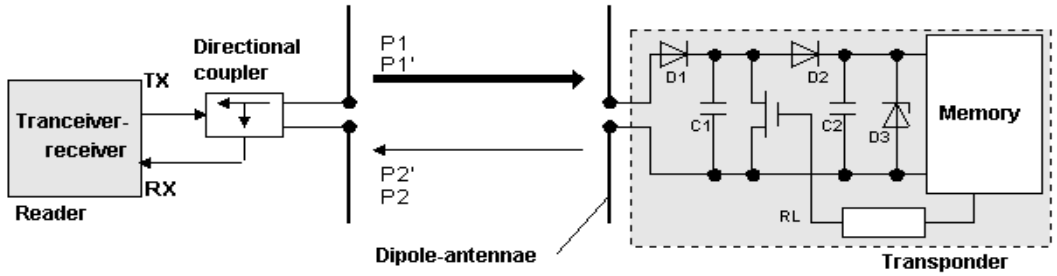
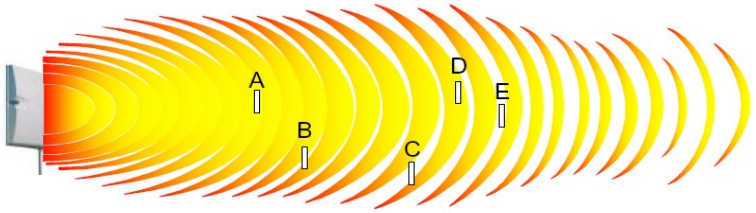
Technical View – electro magnetically principle

- Ultra high frequency RFID systems uses an electrical field to transmit energy and data
  The Interrogator generates an electromagnetic field
  The transponder is able to send and store data
  Transponder gets his energy out of the field
  The Transponder sends data using backscatter technique





- The UHF field is complex and electro dynamic
  The field distribution is comparable to light
  The characteristic is similar to a cell
  The usage of circular polarized antennas is preferred
  The movement of a transponder is preferred



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The general rule

- HF > Metal absorb, water causes no problems
- UHF > Metal reflectet, water acts dampen, regional differences in frequency !!

Länder	UHF Frequenz Bänder
Europe	865 – 868 MHz
USA	902 – 928 MHz
Korea	908 – 914 MHz
Singapore	923 – 925 MHz
Australia	923 – 928 MHz
Japan	950 – 960 MHz
China	ungefähr 900 MHz

!! Message !!

HF (13,56MHZ)

- magnetic coupling
- near field technology
- suited for static use

!! Message !!

UHF (860-960MHZ)

- capacitive coupling
- far field technology
- dynamic applications preferred

Additional Information

- UHF can also be used in near field applications by using special transponders
- UHF is the preferred technology for open systems
- HF is suitable for intralogistic applications (short-range)

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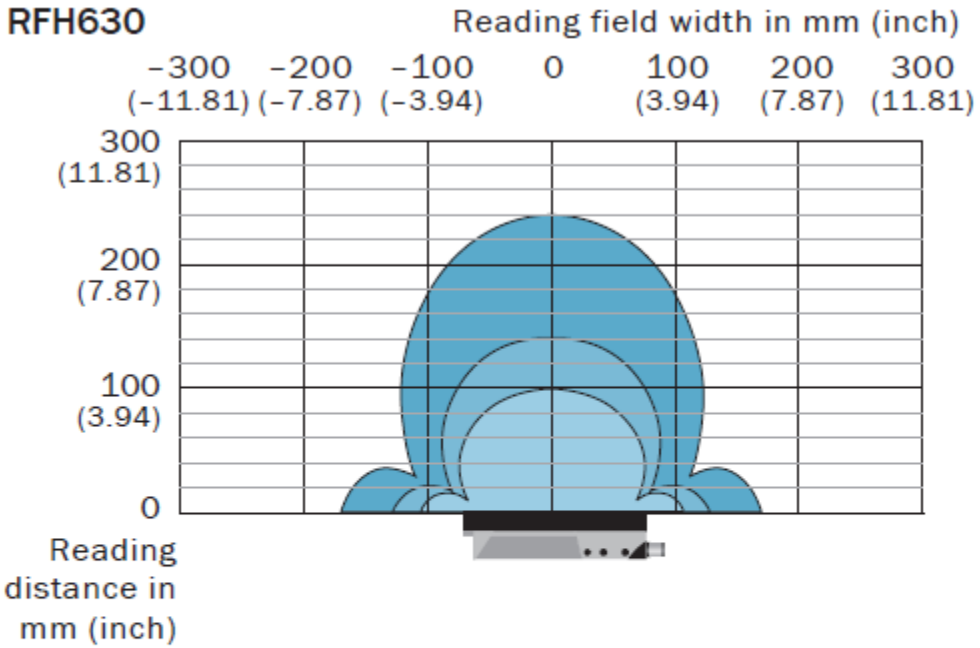
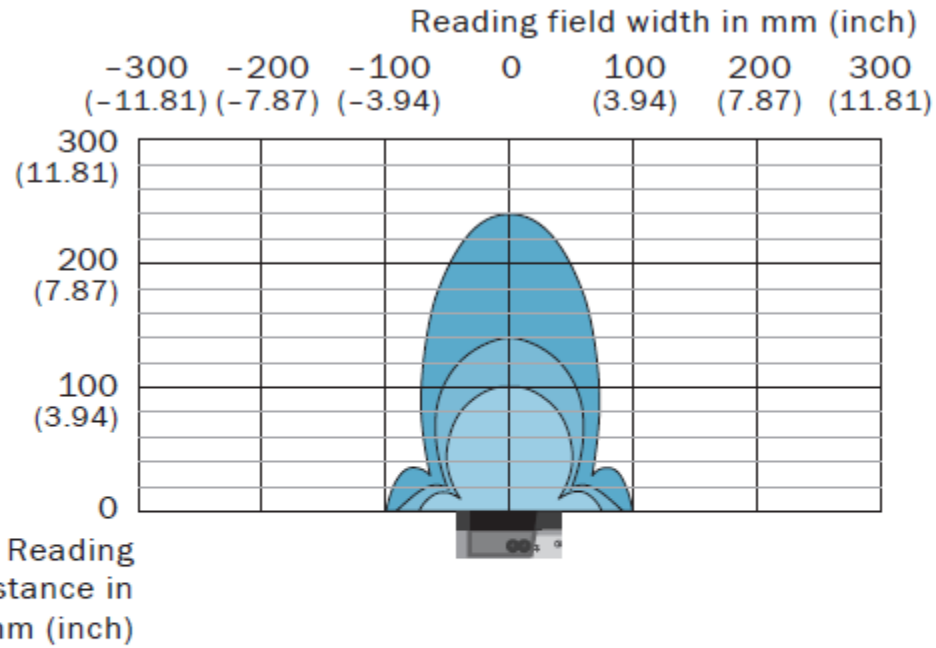
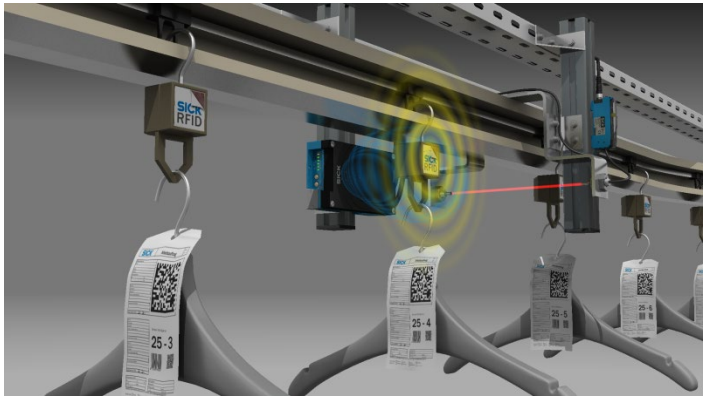
- **Example of a readingfield diagramm for HF**
  - With different transponders



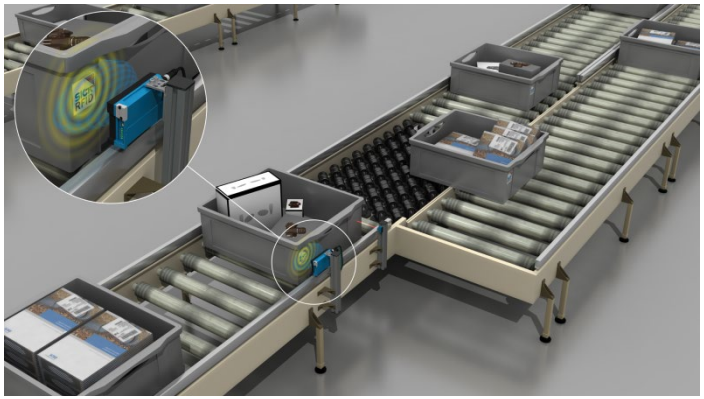


TARGET APPLICATIONS FOR HF (STAND ALONE DEVICES)

- **Textil industry**

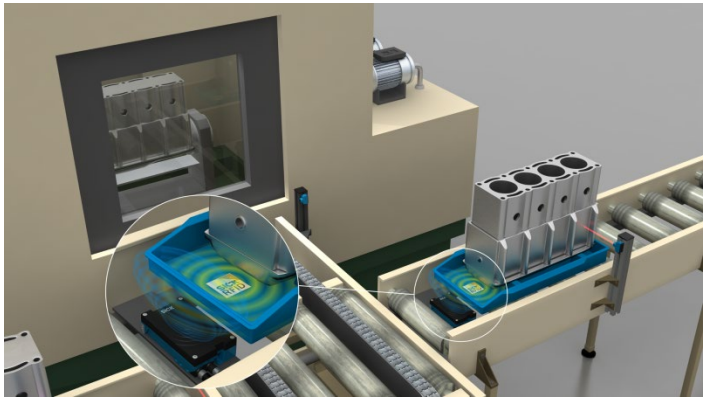


Intralogistic



- **Warehouse (Forklift)**

Automotive



TARGET APPLICATIONS FOR UHF (STAND ALONE DEVICES)

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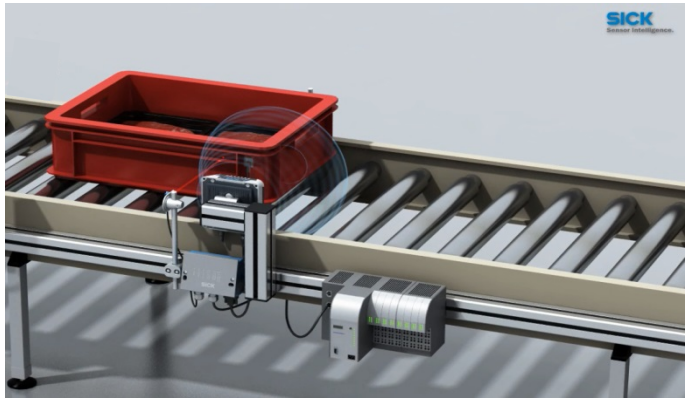
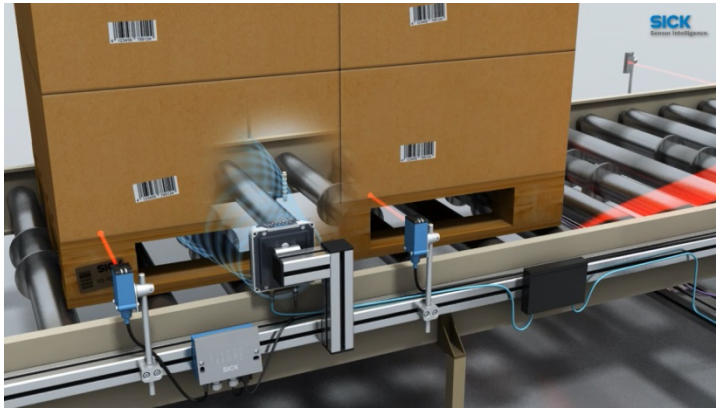
- **Intralogistic**

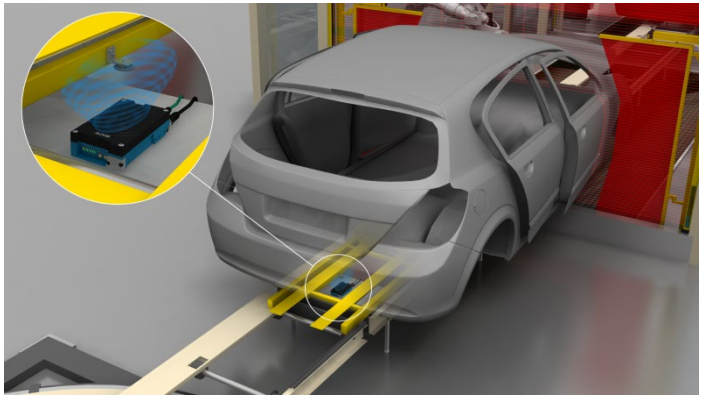


Storage & Conveyour



- **Warehouse (Forklift)**

Automotive



5. LASER VS. CAMERA
RFID TECHNOLOGY VS. BARCODETECHNOLOGY

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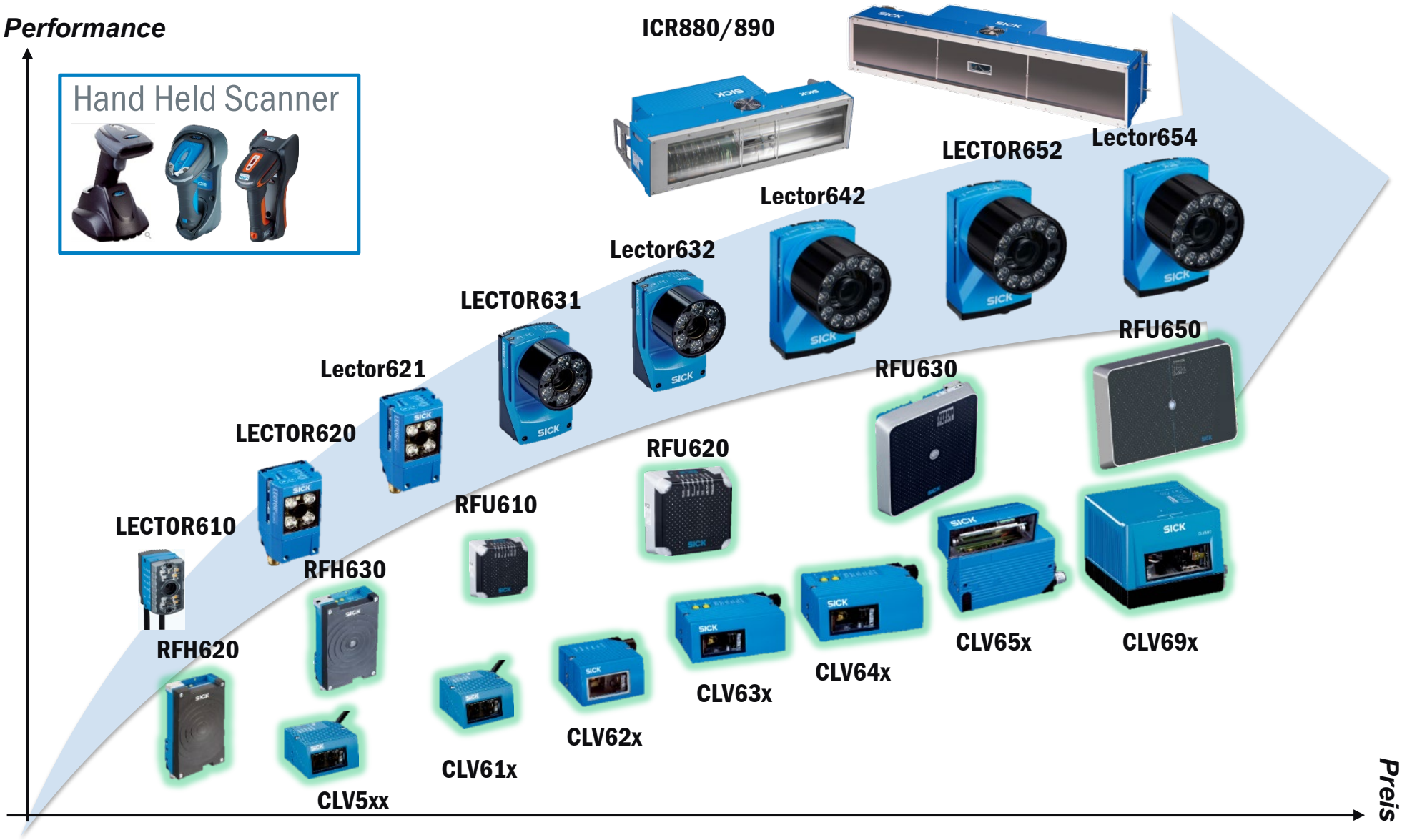
RFID	Task	Barcode
+	Read without visual contact	-
+	Environmental resistance	-
+	Bulk Reading	-
+	Rewriteable transponder/label	-
+	Large data memory transponder/label	-
+	Lifetime	-
+	Maintenance	-
-	Technology not visible	+
-	Costs transponder/label	+
+	Range	-

6. OVERVIEW PORTFOLIO - IDENTIFICATION
LASER / CAMERA / RFID (SERIAL PRODUCTS)



6. OVERVIEW PORTFOLIO - IDENTIFICATION
LASER / CAMERA / RFID (SYSTEME)

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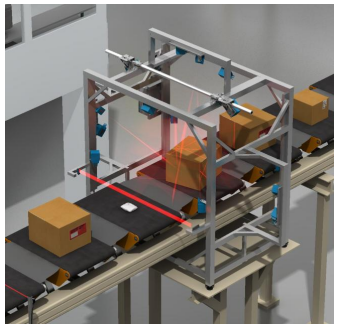
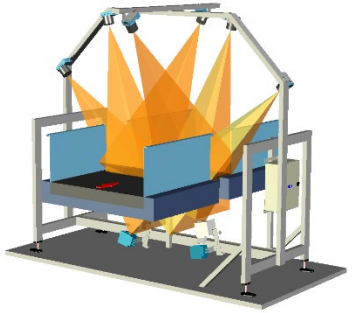
Twin Head (Omnilesung - 1 Seite)

OPS (Omnilesung, bis zu 6 Seite)



DWS

LECTOR (Matrix camera)



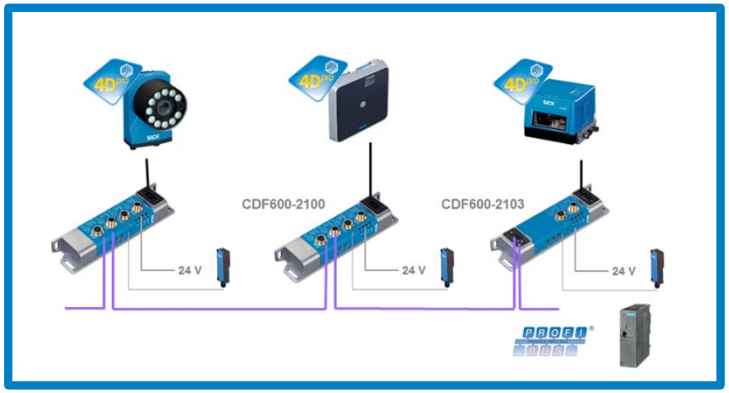
ICR8xx (Line camera)

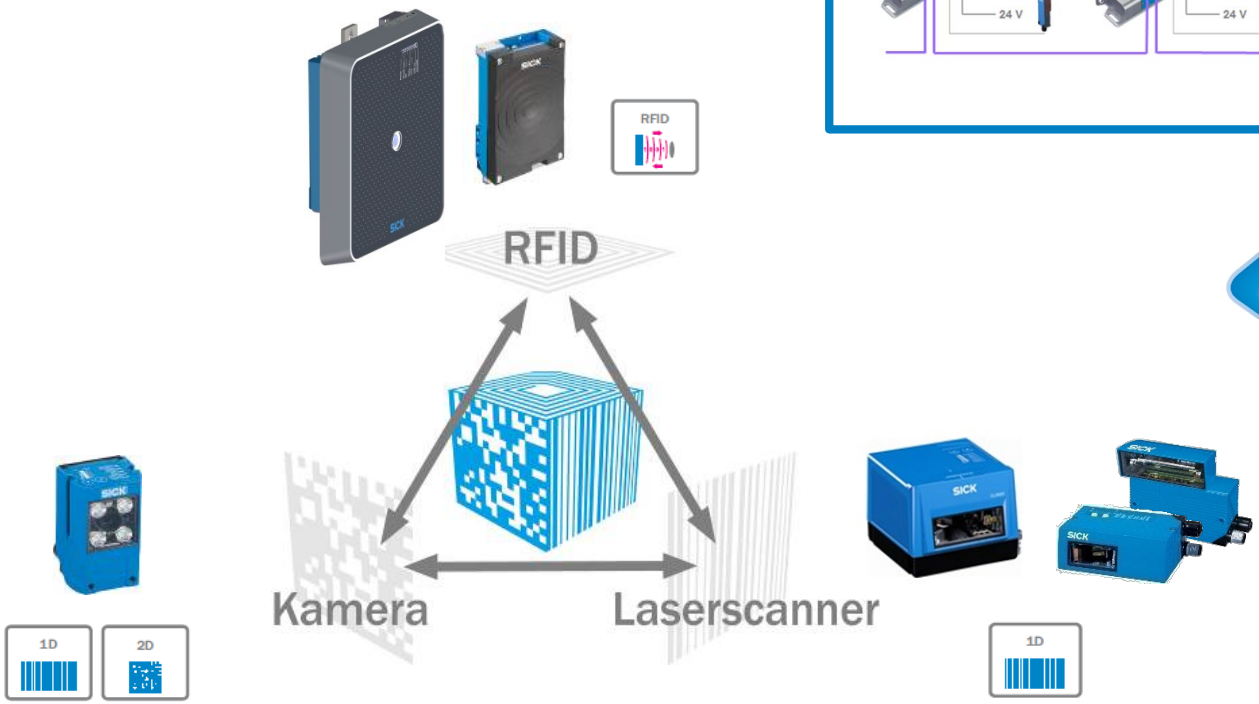
DWS (Dimensioning/Weighting/Scaning)

RFGS PRO (Gate – Solution)

RFMS PRO (Tunnel – Solution)

- **All 4D PRO devices are compatible and interchangable via our standardized 4D PRO plattform**
  - Same connection technology
  - Same user interface (SOPAS)
  - Same accessory concept





THANKS FOR YOUR ATTENTION!

Renè Klausrigler

Productmanagement „Identification & Measuring“

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