Dynamic Contour Detection

GEMA EMEA Distributor Seminar 2017

Presenter: Roman Mlakar / Albert Fässler

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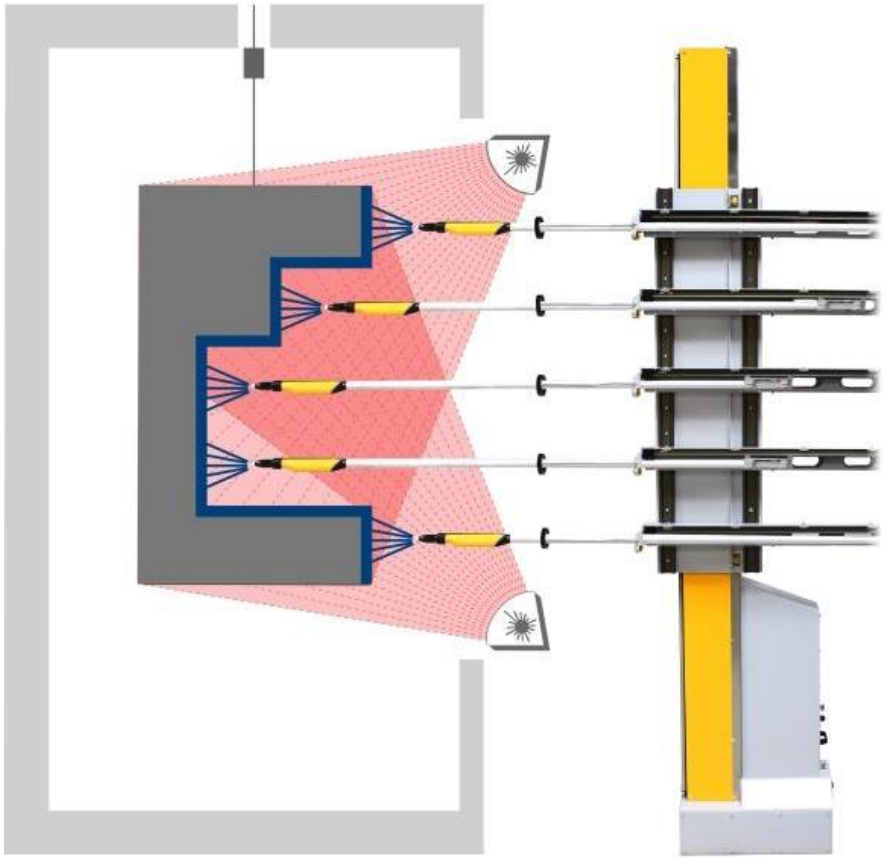
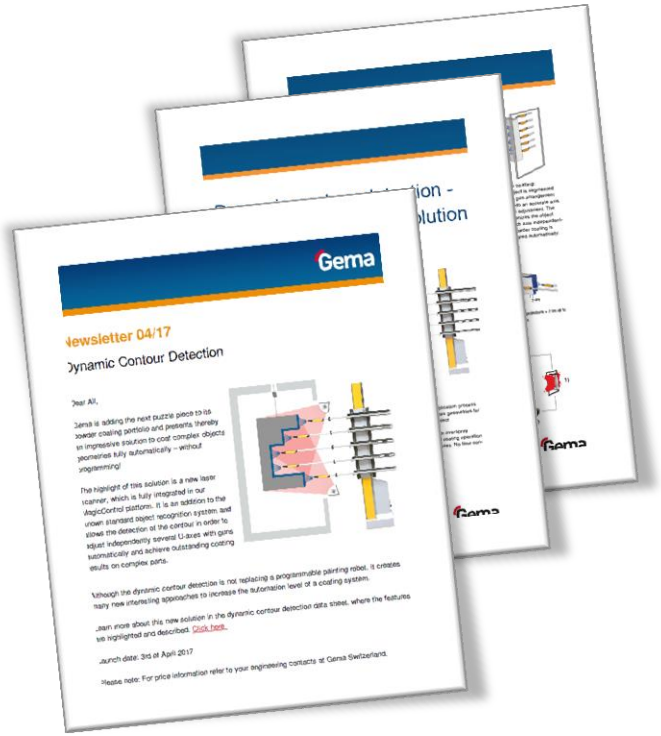
Your global partner for high quality powder coating

Dynamic Contour Detection



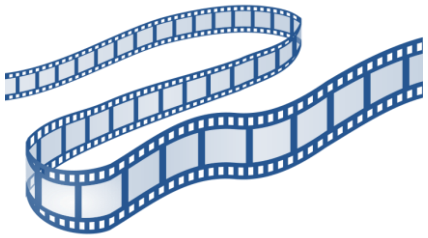
Brief description:

Contour detection is based on laser scanner technology followed by a dynamic and individual gun positioning.

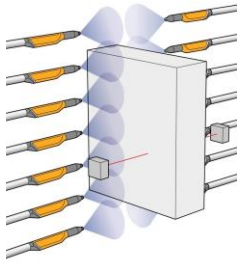
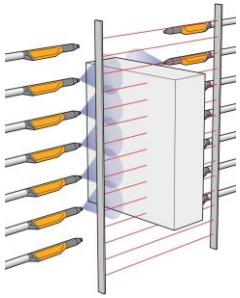
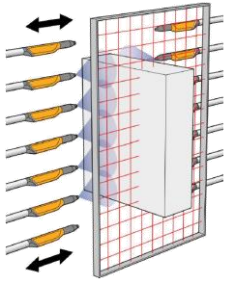
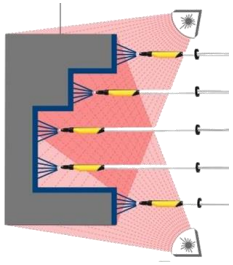


Launched Q1 2017

Dynamic Contour Detection



Levels of Automation

Manual coating	Gap control	H- Recognition	H/W-Recognition	Contour Detection	Object Identification
					
Operator	Photocell	Light barrier	Light barrier	Laser scanner	Code Platte / digital information

The dynamic contour detection is an addition to the known object recognition and increases the level of automation.

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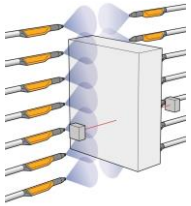
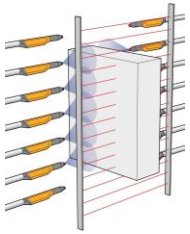
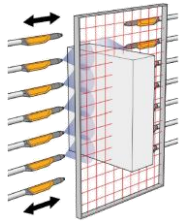
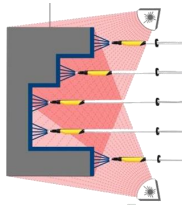
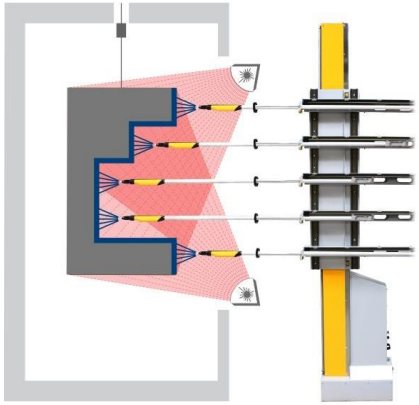
Level of Automation

	Manual coating	Gap control	H-Recognition	H/W-Recognition	Contour Detection	Object Identification	
							
	Operator	Photocell	Light barrier	Light barrier	Laser scanner	Code Platte / Object # [2]	Industrial robot
Triggering	M	A	A	A	A	A	A
Z-stroke [1]	M	M	A	A	A	A	A
X-position	M	M	M	A	A	A	A
Individual gun position	M	M	M	M	A	A	A
Gun parameter	M	M	M	M	M	A	A

M manually A automatically

[1] Horizontal gun arrangement [2] in combination with part detection

Dynamic Contour Detection vs. Robot



Object identification	no	yes
Sequence program	no	yes
Contour detection and situative gun positioning	yes	no
suitable for most complex parts	✓	✓✓

Dynamic contour detection

- doesn`t replace a robot
- decreases manual coating drastically
- provides new coating solutions

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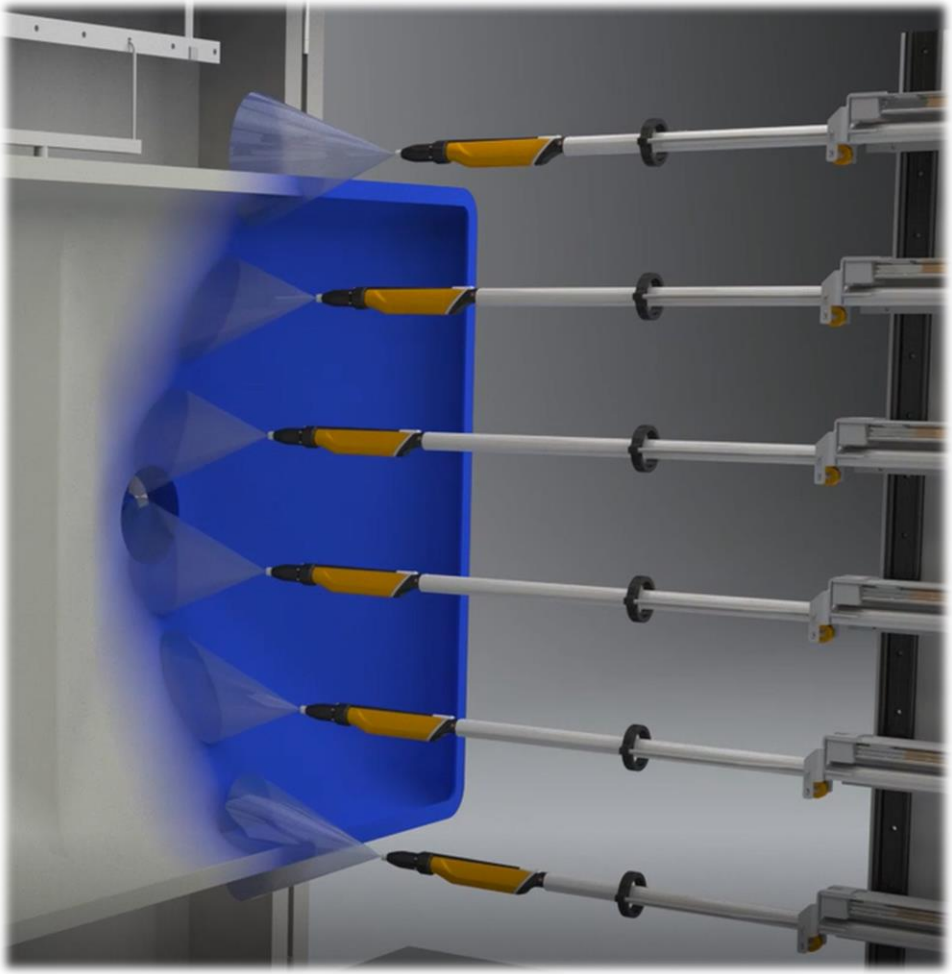
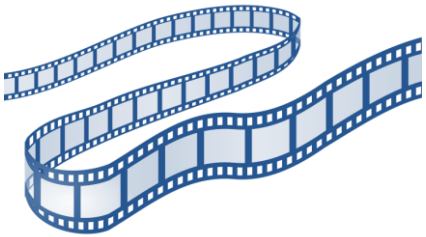
Dynamic Contour Detection





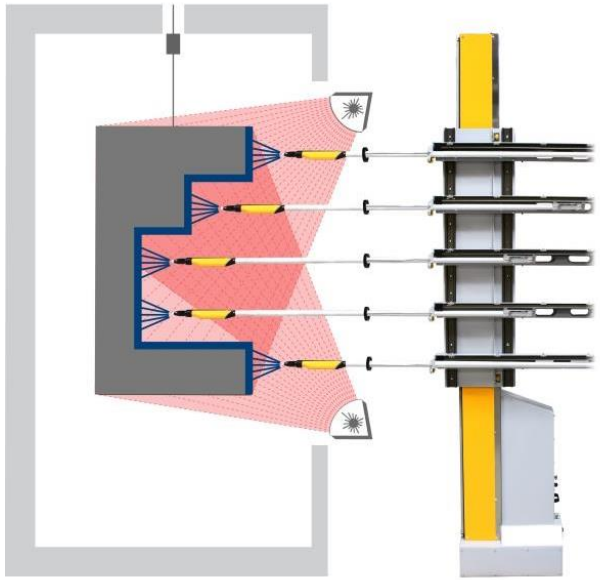
Features and Benefits

Versatile

- High level automation of the application process
- Automatic detection of the object contour, front- and rear of the object
- Automated programming of U-axes. No time-consuming axes adjustments
- Provides alternative coating solutions

Powder savings and constant coating quality

- Improved and consistent thickness distribution
- Reduced overspray
- Reduced manual coating operation



Agrostroj / Czech Republic

Agrostroj Pelhřimov
Agricultural machines

Economy

Efficiency

Automatisation

Agrostroj / Czech Republic

Agrostroj / Czech Republic

Installation Key Data

Parts:

Agricultural machines

Part size:

H	1’800 mm
W	800 mm
L	3’000 mm

Conveyer speed:

V max	1.9 m/min

Scope of delivery: **4 identical lines**, each with:

4 x Scanners

10 x OptiGun GA03P-1250 automatic guns

4 x OptiSelect GM03 manual guns

(2 lines with 2 x OptiGun GA03 on robots)

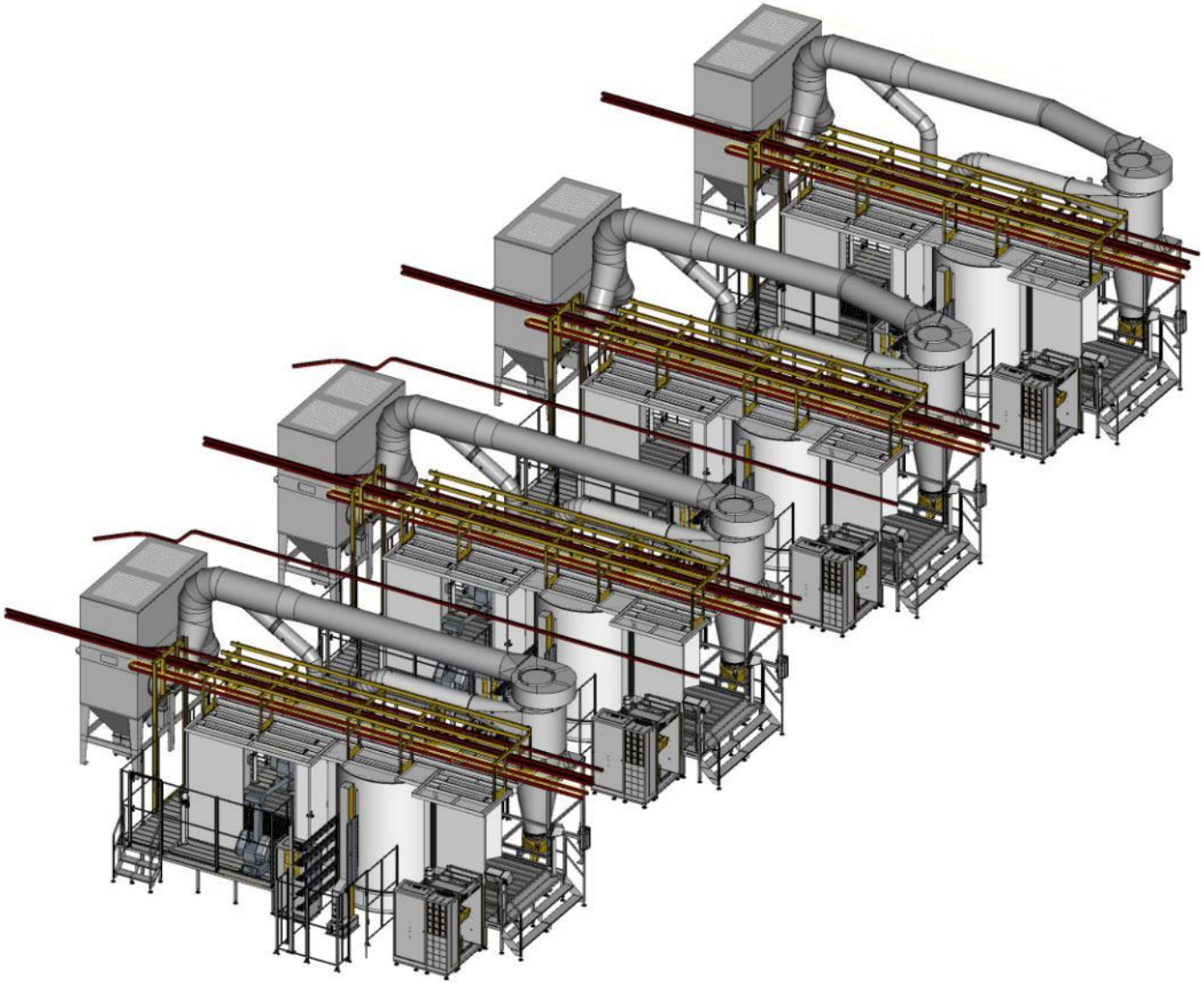
2 x ZA13 reciprocators with **10 U-axis UA04**

1 x Control system ICS04 / MagicControl CM30

1 x OptiCenter OC02

1 x MagicCylinder EquiFlow Quick Color Change system

Agrostroj / Czech Republic



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Agrostroj / Czech Republic

Agrostroj / Czech Republic

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Agrostroj Pelhřimov ist der grösste tschechische Produzent von Landmaschinen und bekannt als Zulieferer qualitativ hochstehender Produkte für viele namhafte Nutzfahrzeug- und Landmaschinen-hersteller. Die anspruchsvolle Produktepalette, strenge Anforderungen der Abnehmer und der **stark wachsende** Ausstoss erfordern eine stete Modernisierung der bestehenden Produktionslinien.

Die **2006** installierte **KTL Anlage** galt damals **als Grösste in Europa** und kann pro Jahr bis zu 2 Mio. m^2 Stahl verarbeiten. Da die bestehende Pulveranlage jährlich nur 1.1 Mio. m^2 schaffte, wurde **2015** ein **Projekt** zur **Erweiterung und Modernisierung der Pulveranlage** gestartet. Die Ziele von Agrostroj waren die Steigerung der Beschichtungsleistung, beste Wirtschaftlichkeit im Betrieb sowie effiziente und schnelle Farbwechsel.

Die **Wahl fiel auf** das **MagicCylinder** Farbwechselsystem von Gema. Bei Referenzbesuchen konnte sich Agrostroj überzeugen, dass Farbwechsel sehr schnell, effizient und sauber durchgeführt werden.

Die **vielseitigen** und **exakten Einstellmöglichkeiten** der **Applikationstechnik** sichern eine stets hohe Qualität der Beschichtung der bis zu 52 Farbtöne mit **17'000** hinterlegten **Programmen**. Laser Scanner nehmen die Teileformen auf und steuern automatisch die neuen, einzeln verfahrbaren Horizontal-Zustellachsen (**U-Achsen**) für die Pistolen. Mit dieser Lösung beschichtet Agrostroj alle **komplexen Teile schneller und mit höchster Qualität.**

Dank modernster Technik, hohem Automatisationsgrad und ergonomischen Arbeitsplätzen verfügt Agrostroj aktuell über **eine der leistungsfähigsten Pulverbeschichtungsanlagen Europas.**

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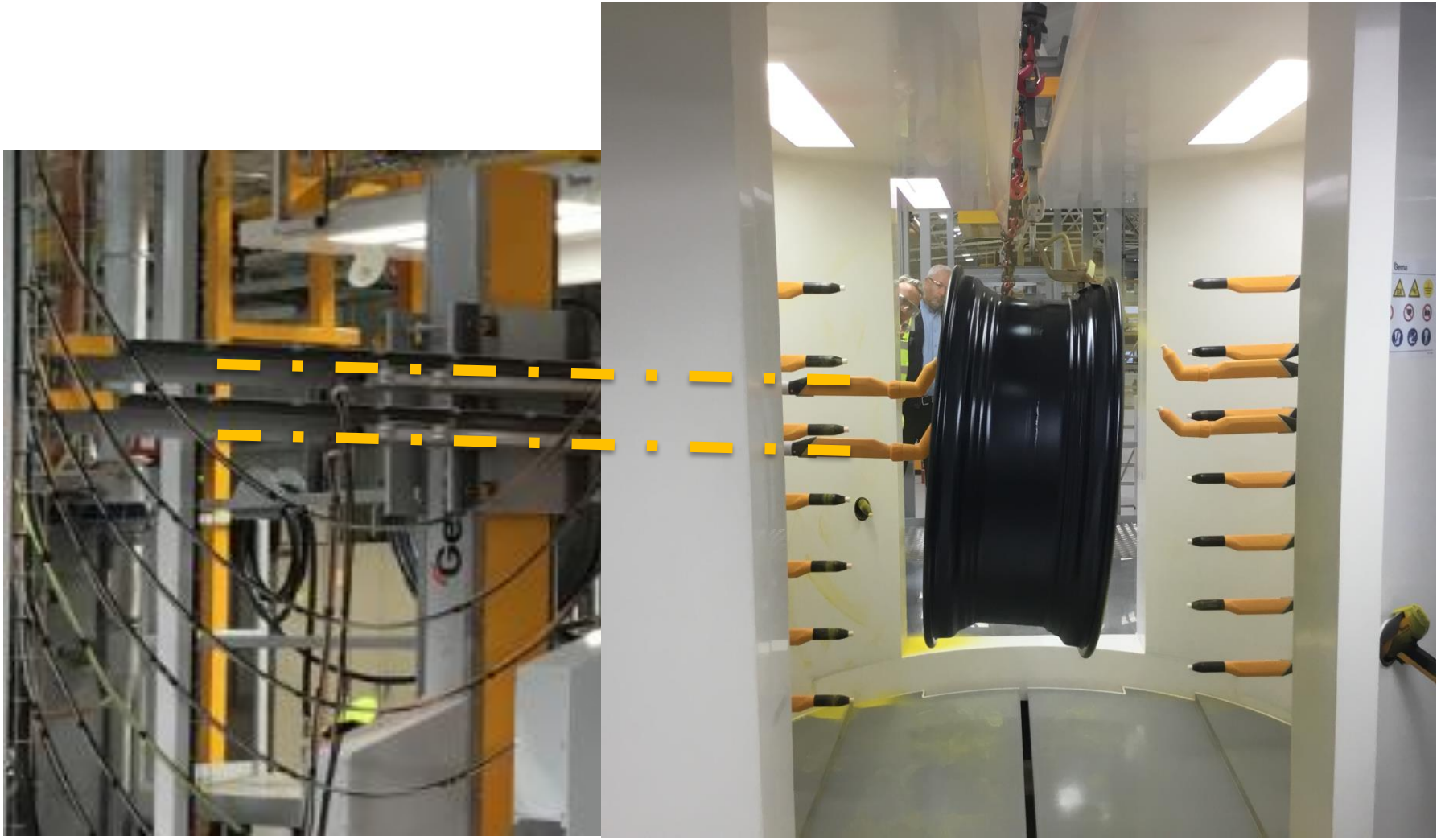
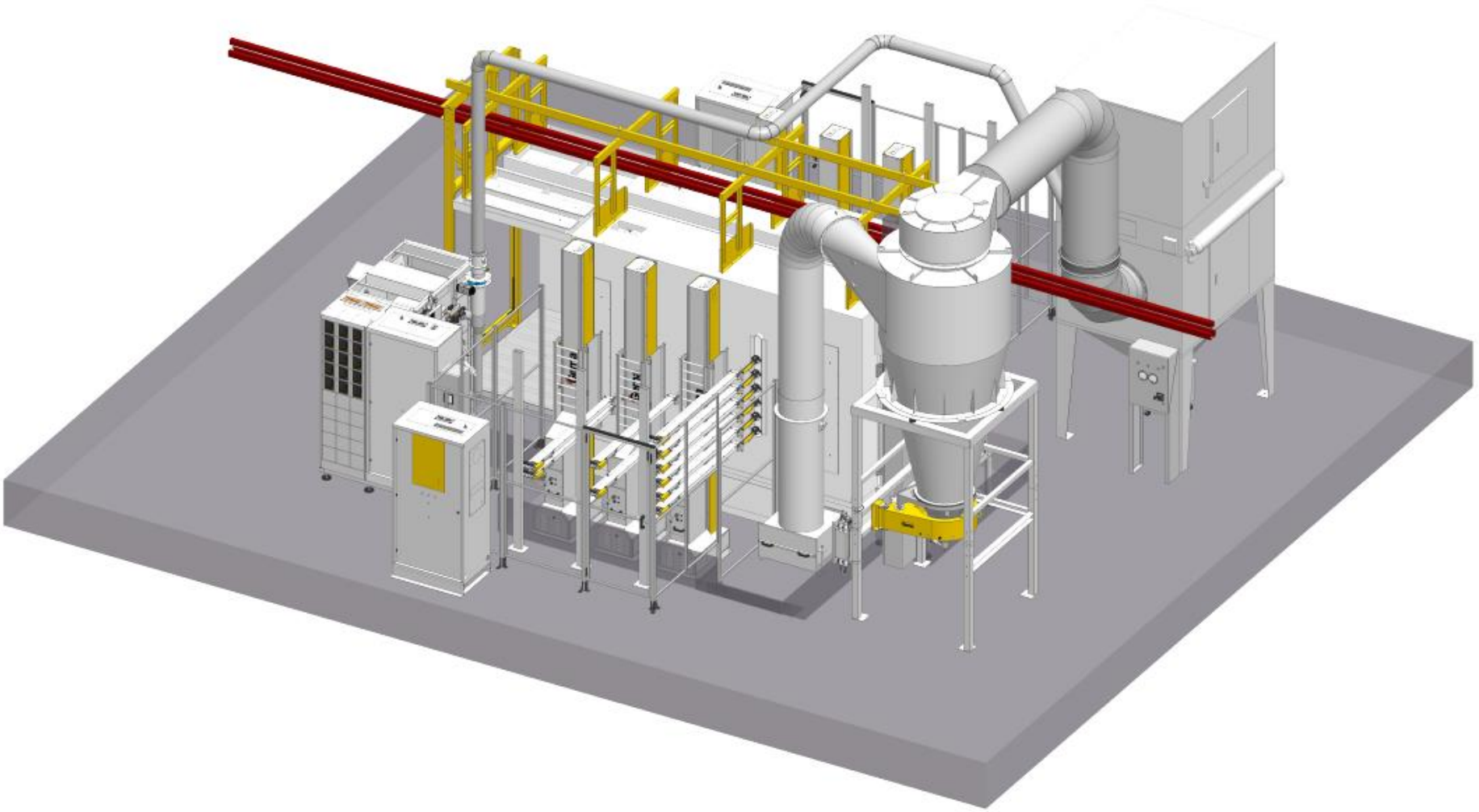
GKN / UK



BIRN / DK



QPC / Sweden

Gema

NEW trend-setting project

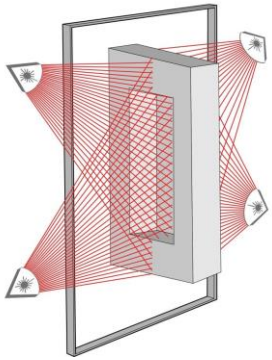
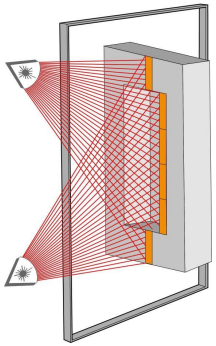
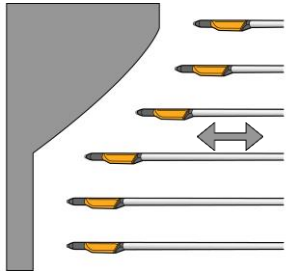
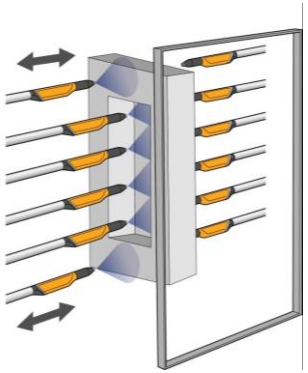
Installation Key Data

Company and Parts:
Renowned manufacturer for **trailer chassis**

Order size for GEMA:
approx. EUR 2’500’000.—

Scope of delivery: **2 identical lines**, each with:
1 x MagicCompact EquiFlow
6 x Scanners
33 x U-axis UA04
47 x automatic guns GA03
3 x manual guns GM03

Functional Sequences

Contour detection	Segment assignment	Gun positioning	Powder coating
			
Contour detection with laser scanner	Translation into segments. Each segment is assigned to a single gun	Alignment of each single gun.	Object synchronisation with help of an encoder and automatically starting/stopping of the coating.

System Components

Encoder

System control

Infeed- /z-axis

Laserscanner

System Components

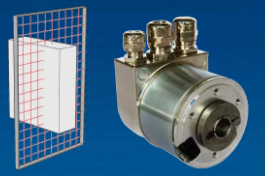
Encoder

System control

Infeed- /z-axis

Laserscanner

Conveyorspeed measuring



Encoder

An encoder is submitting conveyor speed to the control system in order to synchronize (shifting register) the detected object correctly with the gun position.

2-D Laser Scanner

Laserscanner

Laser Scanner

cover: contamination detection

rotoScan ROD4-08 plus	
Application	Contour measurement
Source	Laser, 905nm (infrared)
Laser classification	1 (IEC/EN 60825-1:2007) (U.S. 21 CFR 1040.10)
Dimensions[mm]	140x148x167
Weight[kg]	2.3
Protection	IP65
Source	24 V, DC
Interface	Ethernet
Temperature.	-20 – 50 °C

A Class 1 laser is safe under all conditions of normal use. This means the maximum permissible exposure (MPE) cannot be exceeded when viewing a laser with the naked eye or with the aid of typical magnifying optics (e.g. telescope or microscope).

CLASS 1
LASER PRODUCT

source: www.en.wikipedia.org

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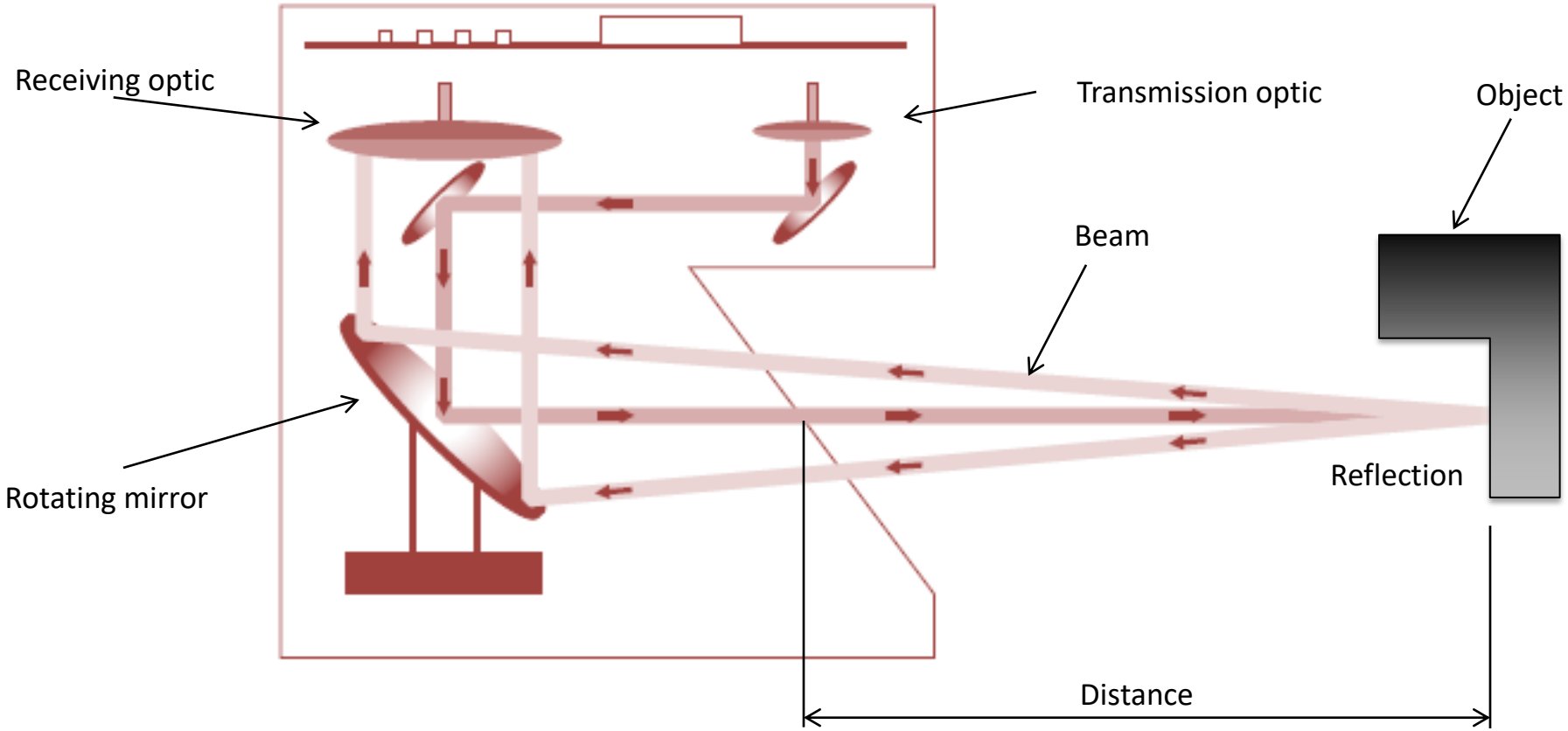
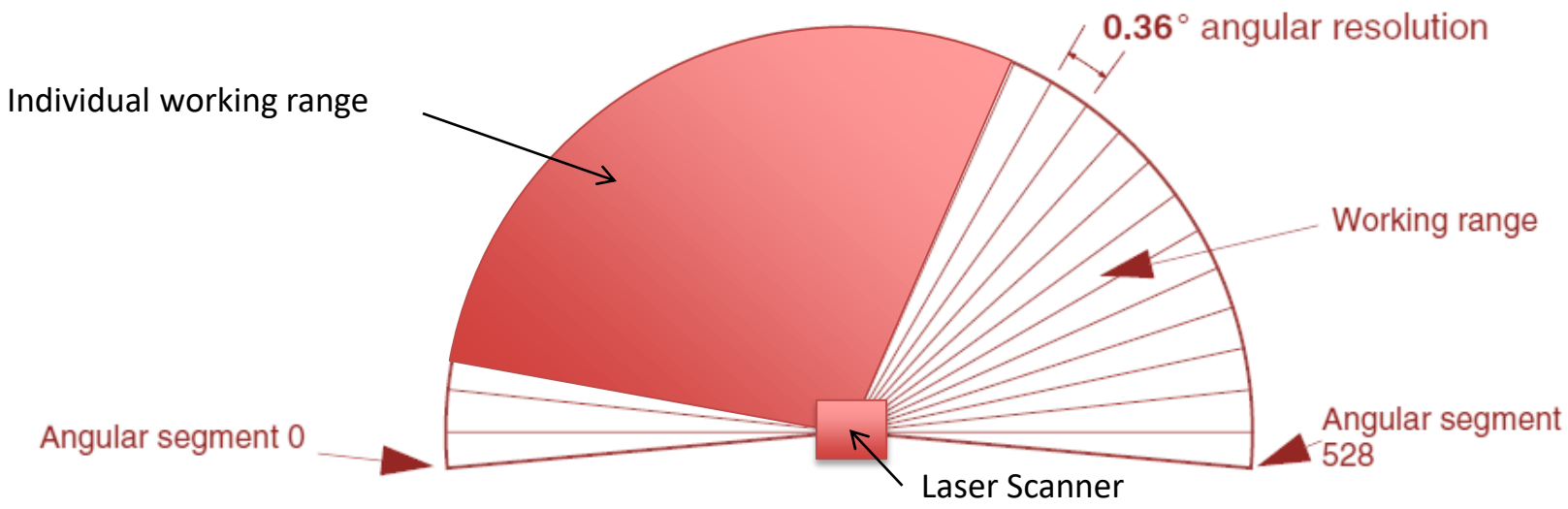
Laser Scanner – functional principle



Distance measurement

The light pulse propagation time is a direct measurement of the distance to the object.

Laser Scanner - functional principle



Distance measuring

The scanner is an optical, two-dimensional measuring distance sensor.	
Working range	max. 190°, divided in 0.36° angular segments
Scanrate*	25 scans/s respectively 40ms/scan

* 1 Scan = periodically transmitted light pulses via a rotating deflector unit within the working range in 40ms.
-> 1 scan = 529 measurements in 40ms

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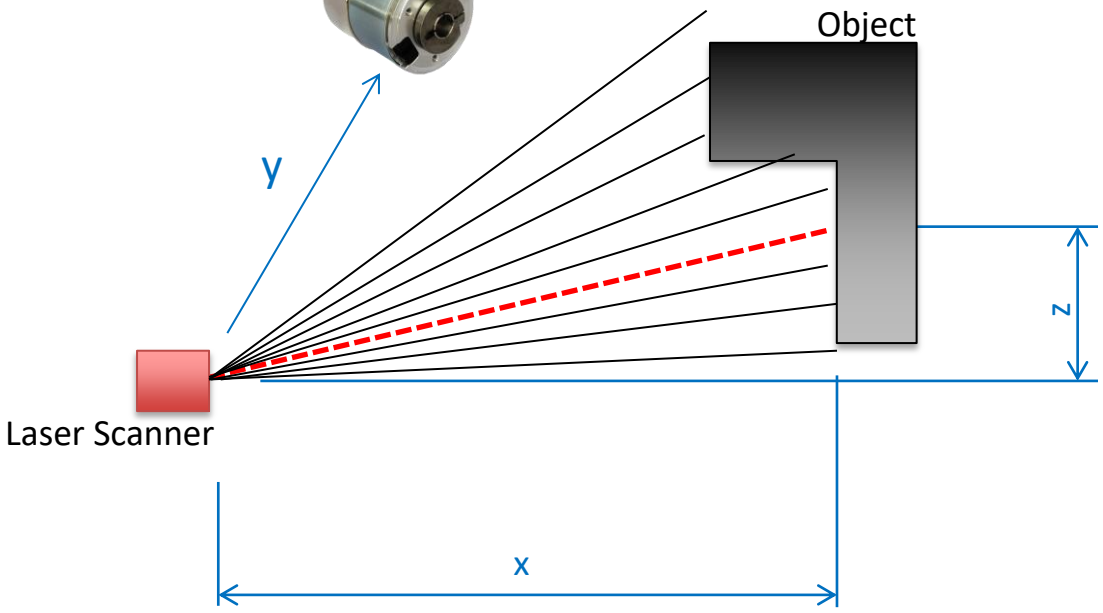
Laser Scanner – functional principle



2½ D

The scanner is an optical, two-dimensional measuring distance sensor. Each point is defined by 2 coordinates (x/z) and the third dimension is calculated (CM30) by an additional attribute (conveyor movement).

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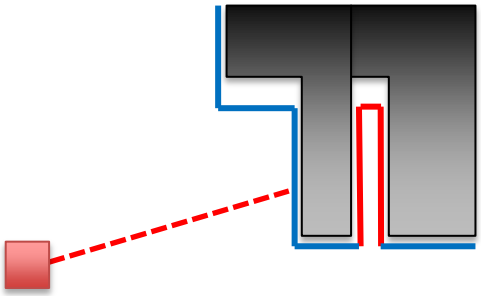
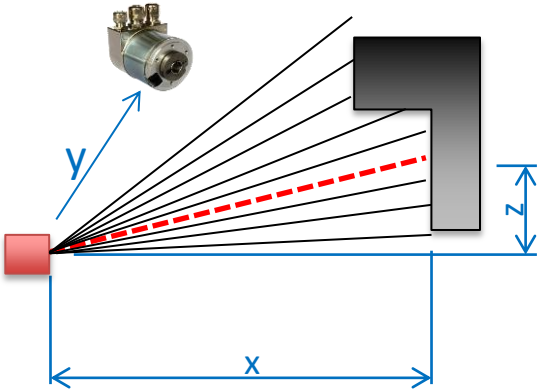
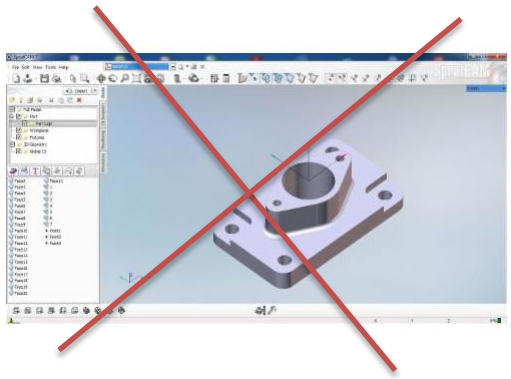
Laser Scanner

Contour detection	2 ½ D	3D model / 2D drawing
Detection of visible, outlying surfaces of an object with help of laser object **measurement**	Each point is defined by 2 coordinates (x/z) and the third dimension is calculated by an additional attribute (conveyor movement)	No computer aided compilation to a 2-/3D graphic possible

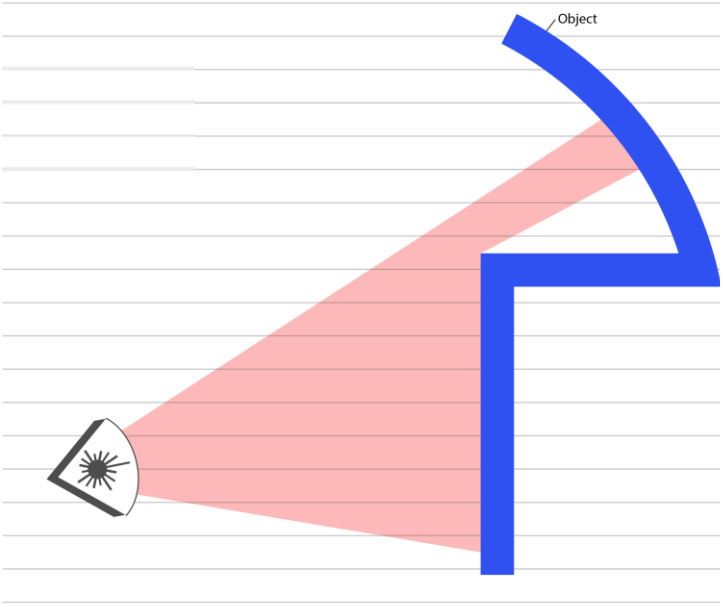




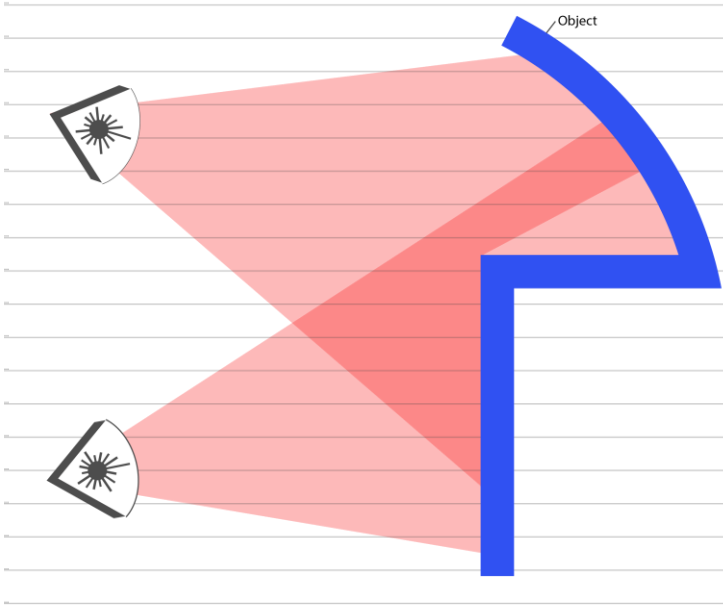


Shadow Effect

Certain geometries cause non visible areas for the scanner. Therefore a second scanner is needed.



1 Laser Scanner



2 Laser Scanner

Magic Control CM30

Encoder

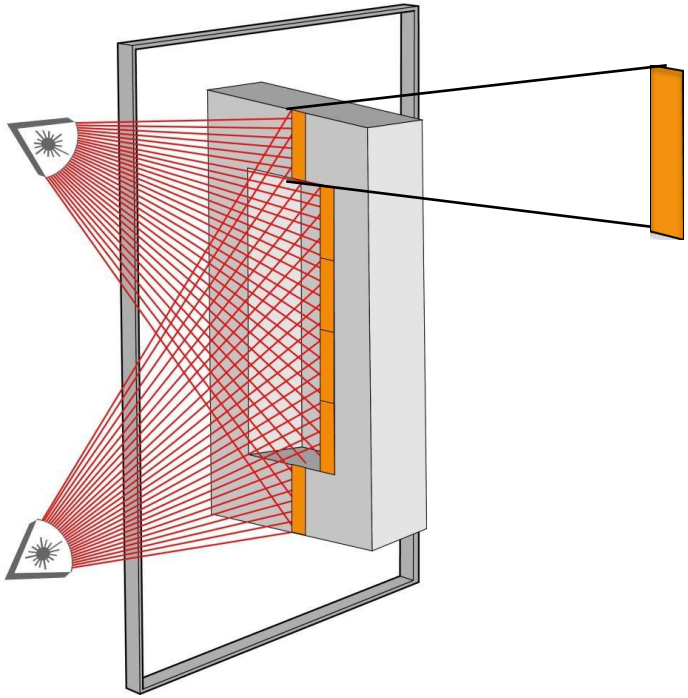
System Control

Infeed- /z-axis

Laserscanner

Segments

The multiple measurements are assigned to predefined segments.

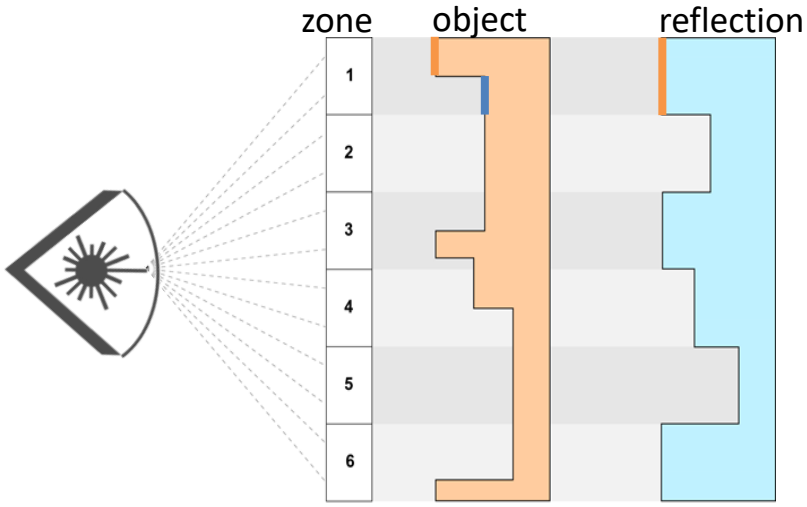


1 segment

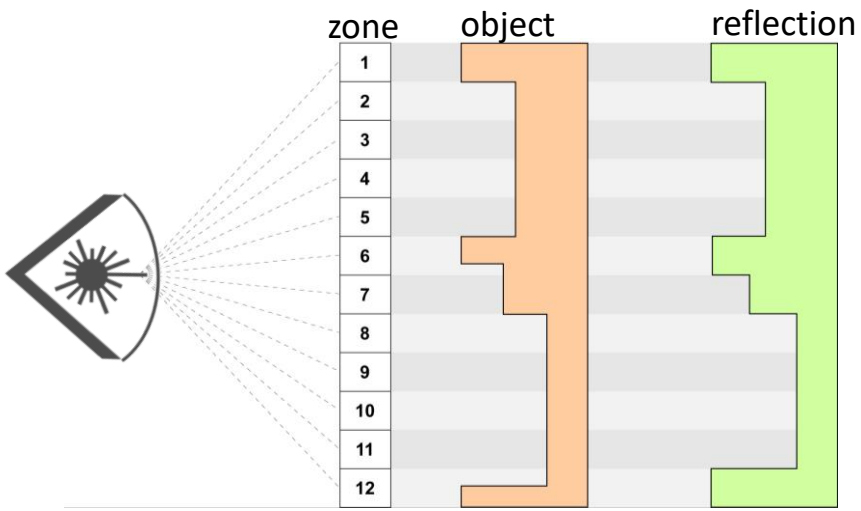
e.g. 6 segments

Segments

Within a segment the closest contour to the scanner is decisive for the reflected geometry.



Arrangement in 6 segments



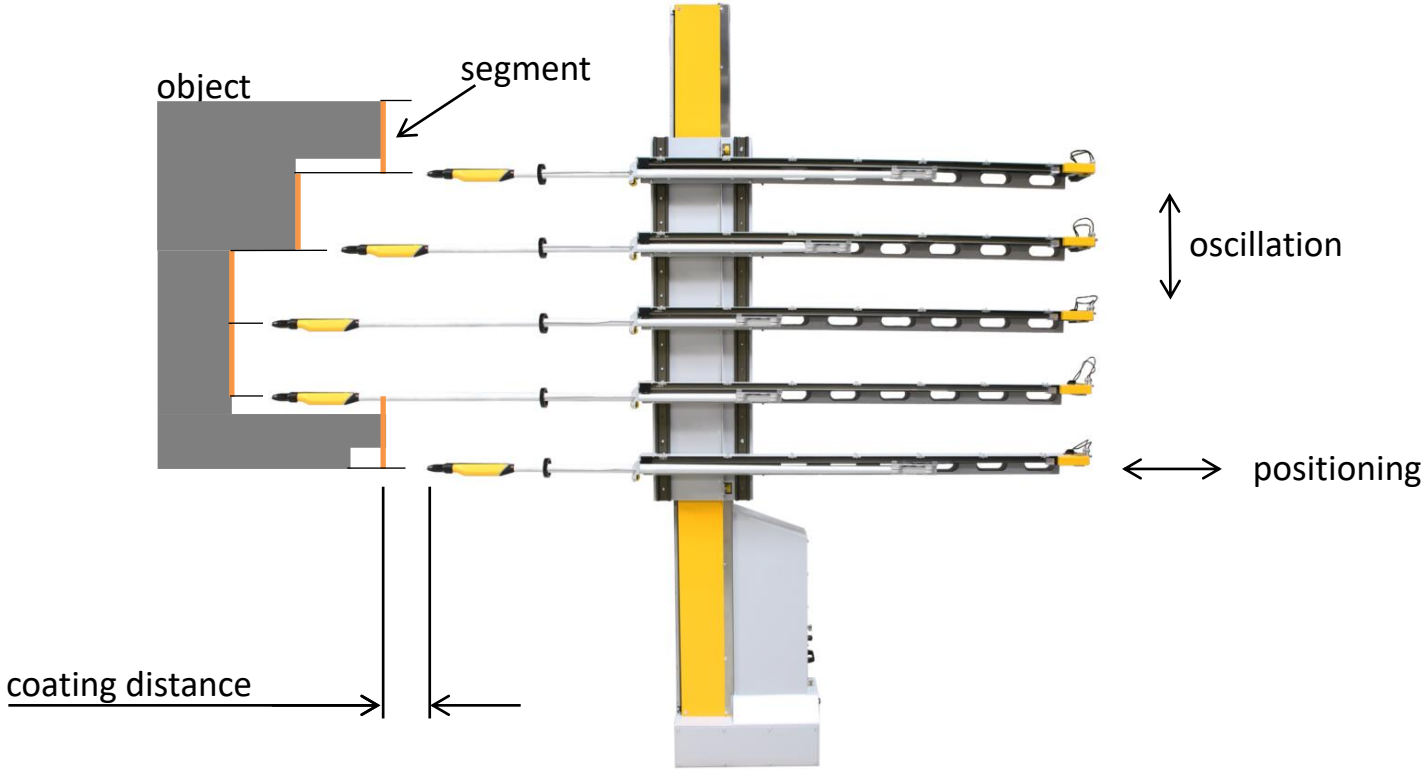
Arrangement in 12 segments

The more segments, the closer the reflected object to the original.

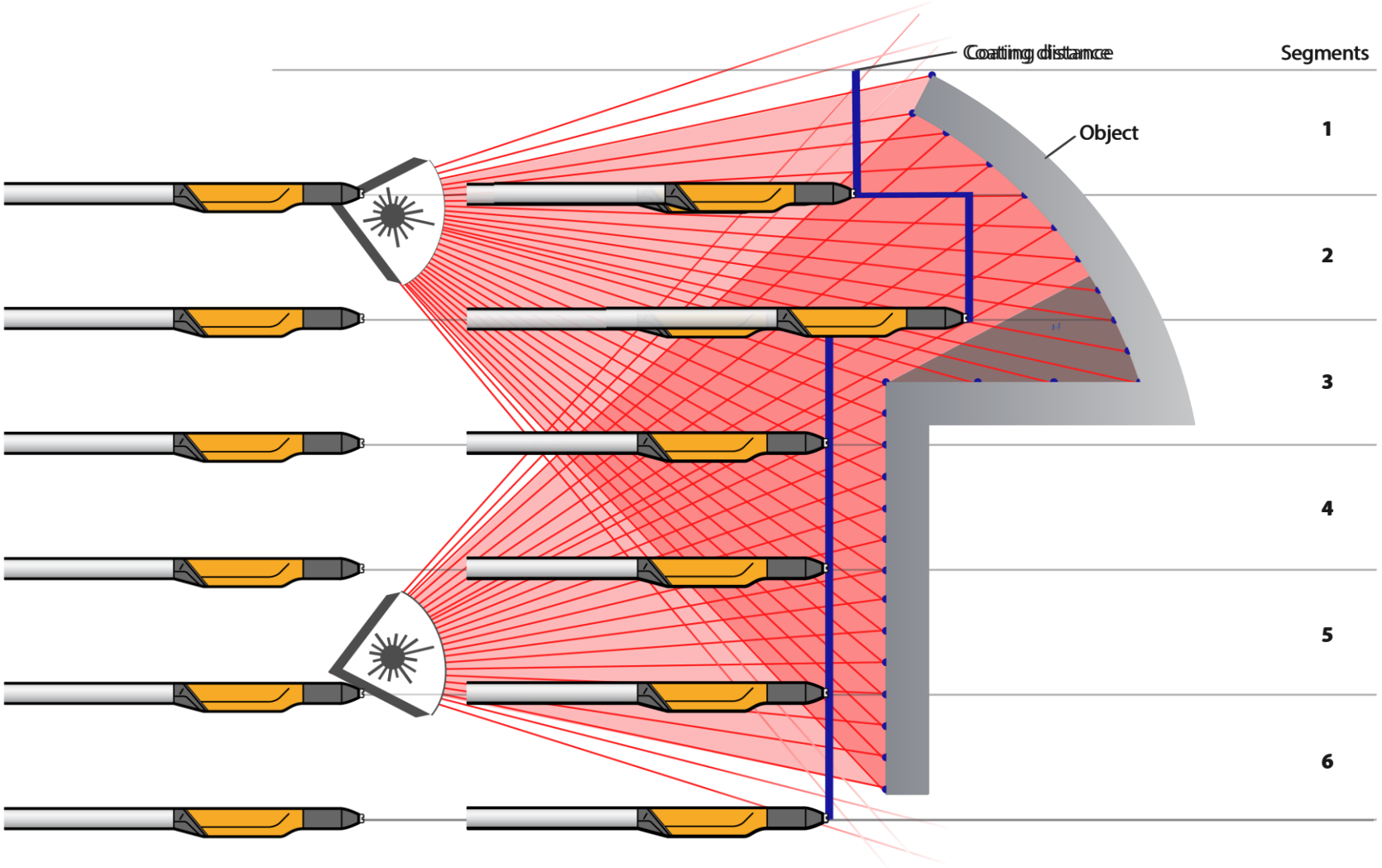
Gunpositioning, Oscillation

Usually each segment has an assigned gun.

Individual positioning of the guns in x-direction.
Oscillation of all guns within the segment in z-direction. Stroke calculation incl. overtravel.
A simultaneous movement in x- and z direction is not possible.



Summary



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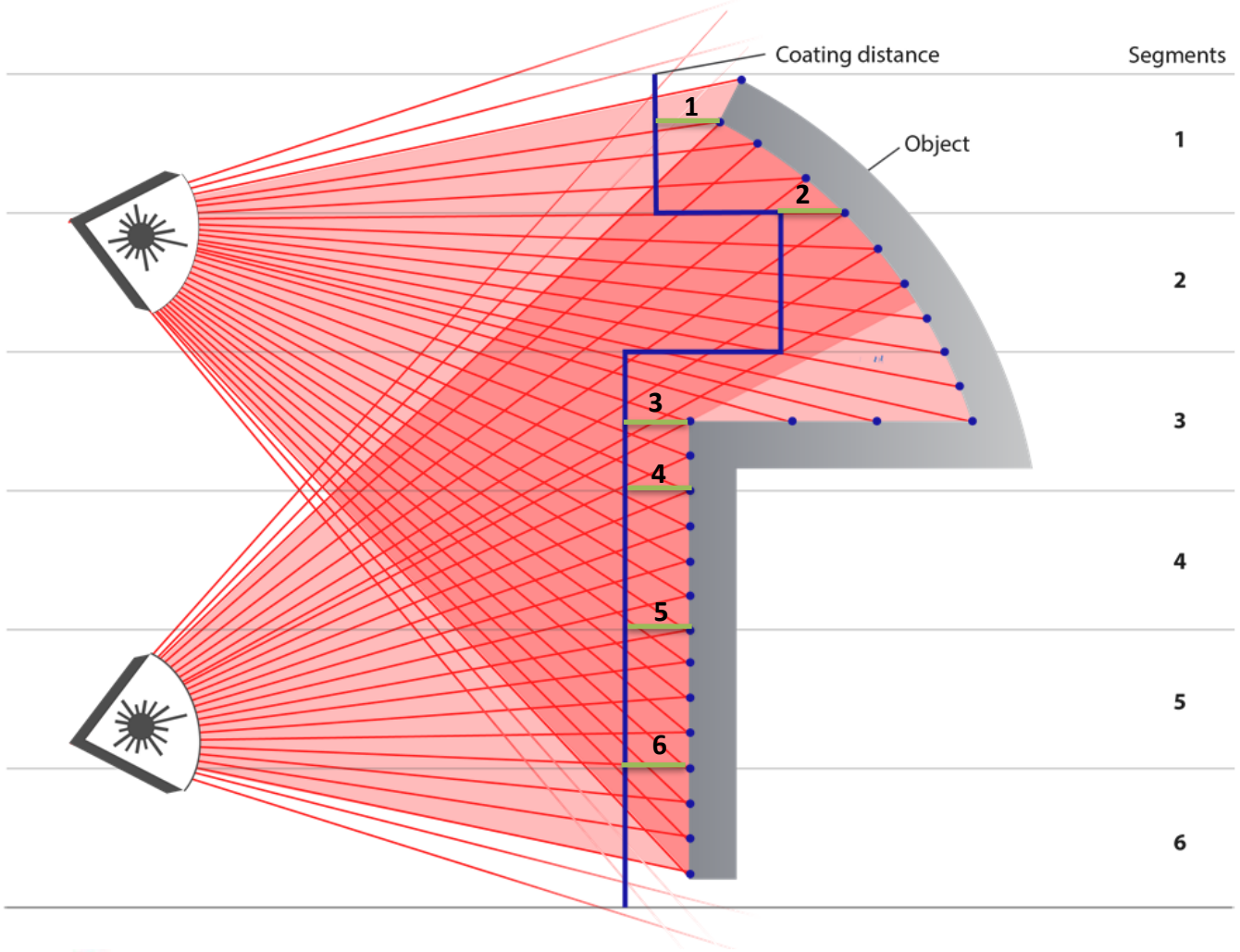
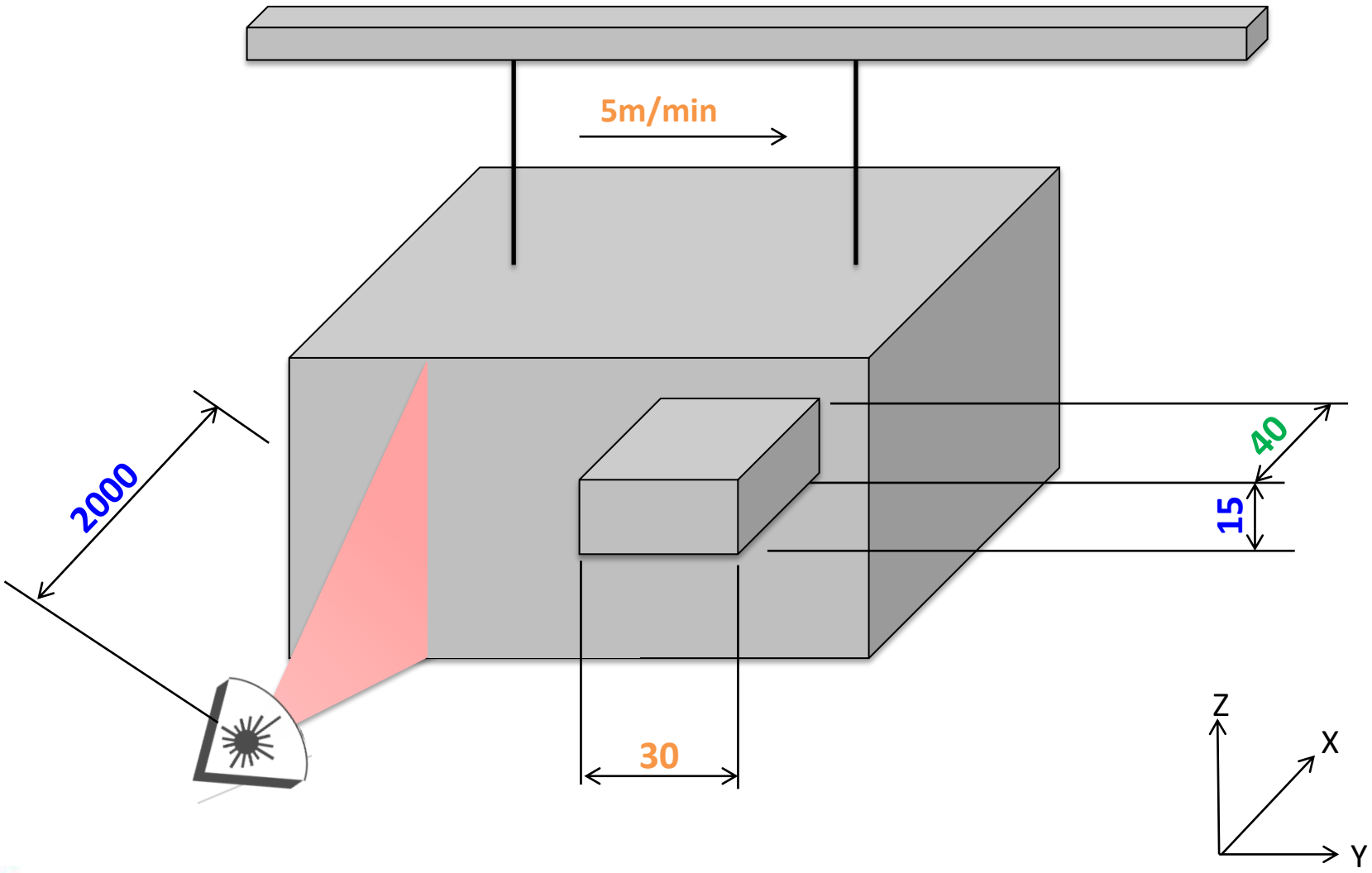
Summary



Relevant distance for the coating distance

Accuracy



Infeed and z-Axis

Encoder

System Control

Laserscanner

Infeed- /z-axis

Infeed- and z-axes

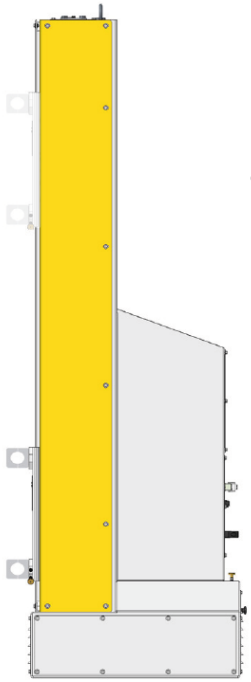
New gun positioning system

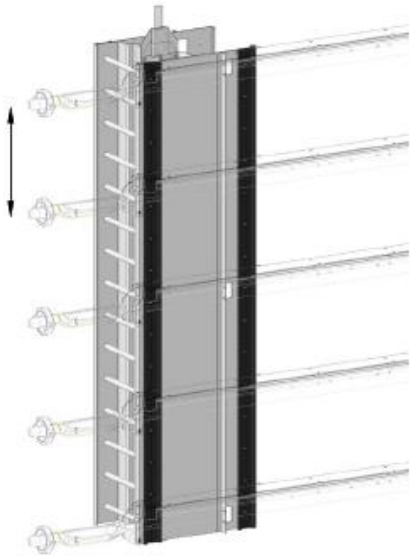
- Vertical reciprocator ZA13
- U-axis UA04

Gema

Z-axis

Strong but Smooth running ZA13





Expansion kit for
UA04 axes assembly

type	13	18	23	28
Stroke [mm]	1300	1800	2300	2800

- Short or long stroke operation
- Stoke speed 0.08 – 0.4m/s
- 100kg loading capacity
- Expansion kit for up to 6 infeed axes UA04
- Control CM22/30; CAN Bus
- 3-phase asynchronous motor
- 0,75kW power
- Incremental encoder for positioning, regulated by CDB3000 unit
- ATEX Zone 22

U-axis

Compact and fast infeed axis UA04

- Stroke up to 2200mm
- Stoke speed 0.08 – 0.6m/s
- Suitable for OptiGun GA03-X
- Integrated cleaning of OptiGun
- Control CM22/30; CAN Bus
- Servo motor drive technology
- 0,4 kW power
- Rotary pulse generator for positioning regulated by ServoC plus unit
- ATEX Zone 22

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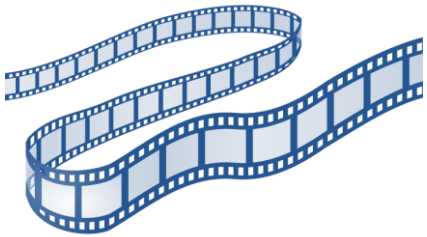
Gun axis UA04

Integrated cleaning function (blow-off)

- Blow off is digitally controlled via solenoid valves
- Two intensities (low during coating, high during color change)

Dynamic Contour Detection

Agrostroj Pelhřimov



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