

# Industry 4.0, digital factory and new generation of smart robots

Dr. Nirut Naksuk

Director of Design and Engineering

National Metal and Materials Technology Center

# Industry 4.0, Digital Factory & Industrial Internet

1. Industry 4.0 – Technical Business Processes Globally Integrated  
Dassault Systems
2. IoT-controlled Swarm Manufacturing  
PSI Automotive & Industry
3. Use Cloud-technology for Automation  
PHOENIX CONTACT
4. Non-contact, non-destructive, in-line testing for Industry 4.0

# 1) Technical Business Processes Globally Integrated: Dassault Systems



CONSUMER PACKAGED GOODS & RETAIL /  
INDUSTRIAL EQUIPMENT CASE STUDY  
**WESTROCK**



**The Goal (of development cycle)**

**-> is to go from 18 months to 6 months**



3DEXPERIENCE

*Our customers, they're becoming increasingly interested in how our packaging*







3DEXPERIENCE

*The secondary package, what we make, is  
what the consumer sees on the shelf, and so*



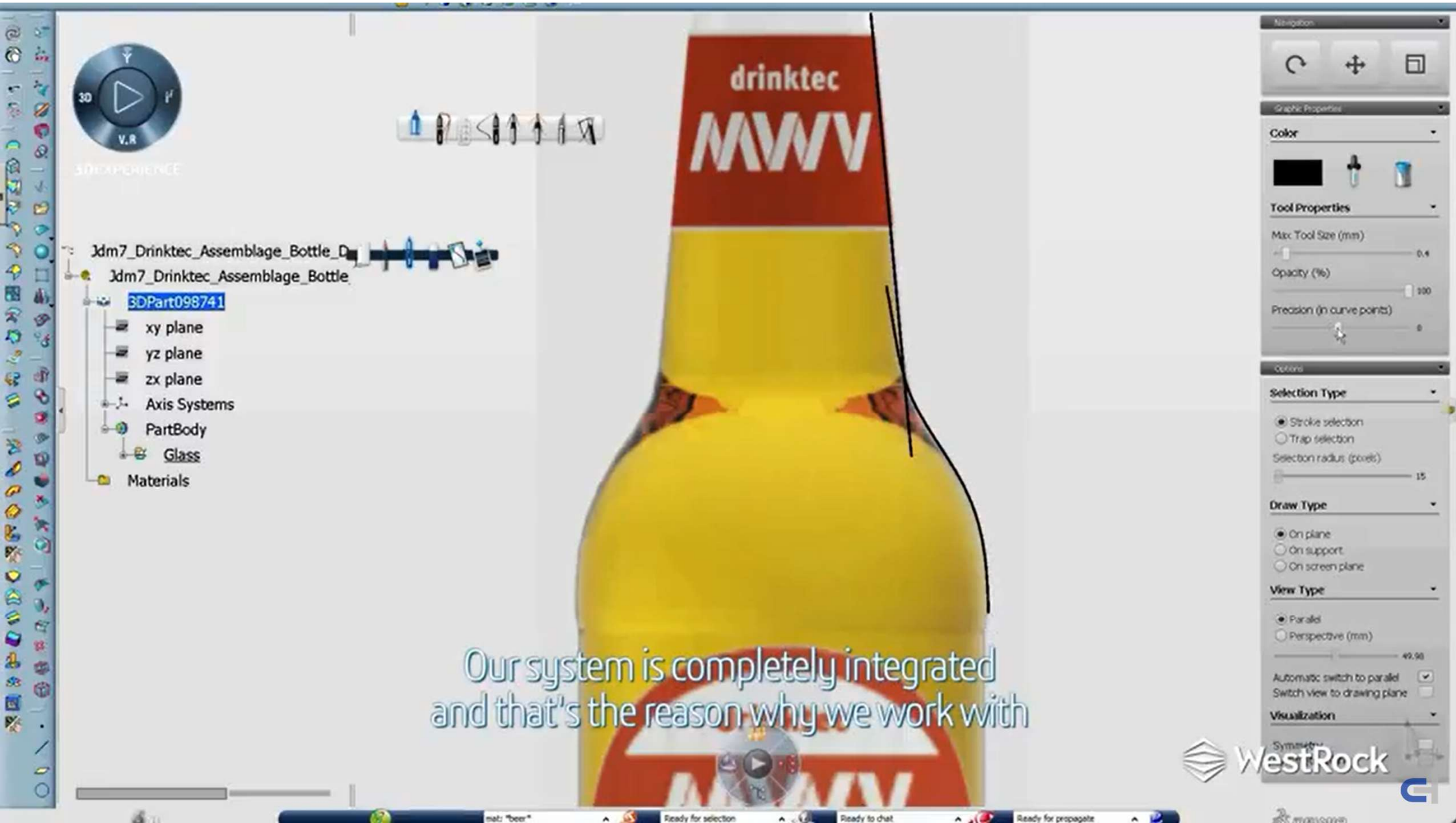


3DEXPERIENCE

*drives the consumer to that choice versus  
our competitor choice for our customers.*

 WestRock









Screenshot saved  
The screenshot was added to your  
OneDrive.  
OneDrive



3DEXPERIENCE™

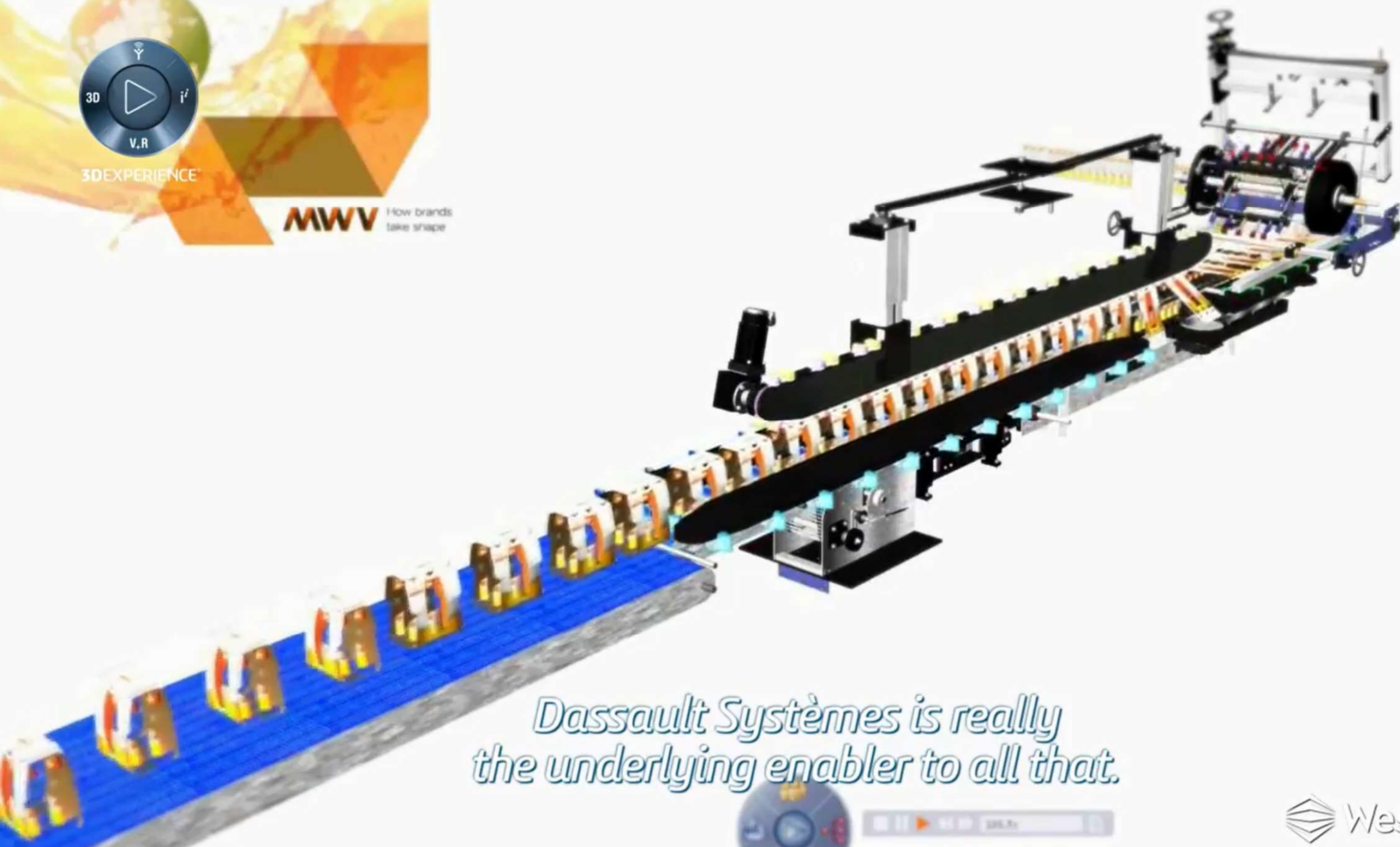


*We believe we can bring dynamically  
and incredibly faster speed to market.*

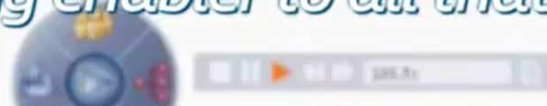
 WestRock







*Dassault Systèmes is really  
the underlying enabler to all that.*







3DEXPERIENCE®

*Dassault Systèmes is really  
the underlying enabler to all that.*



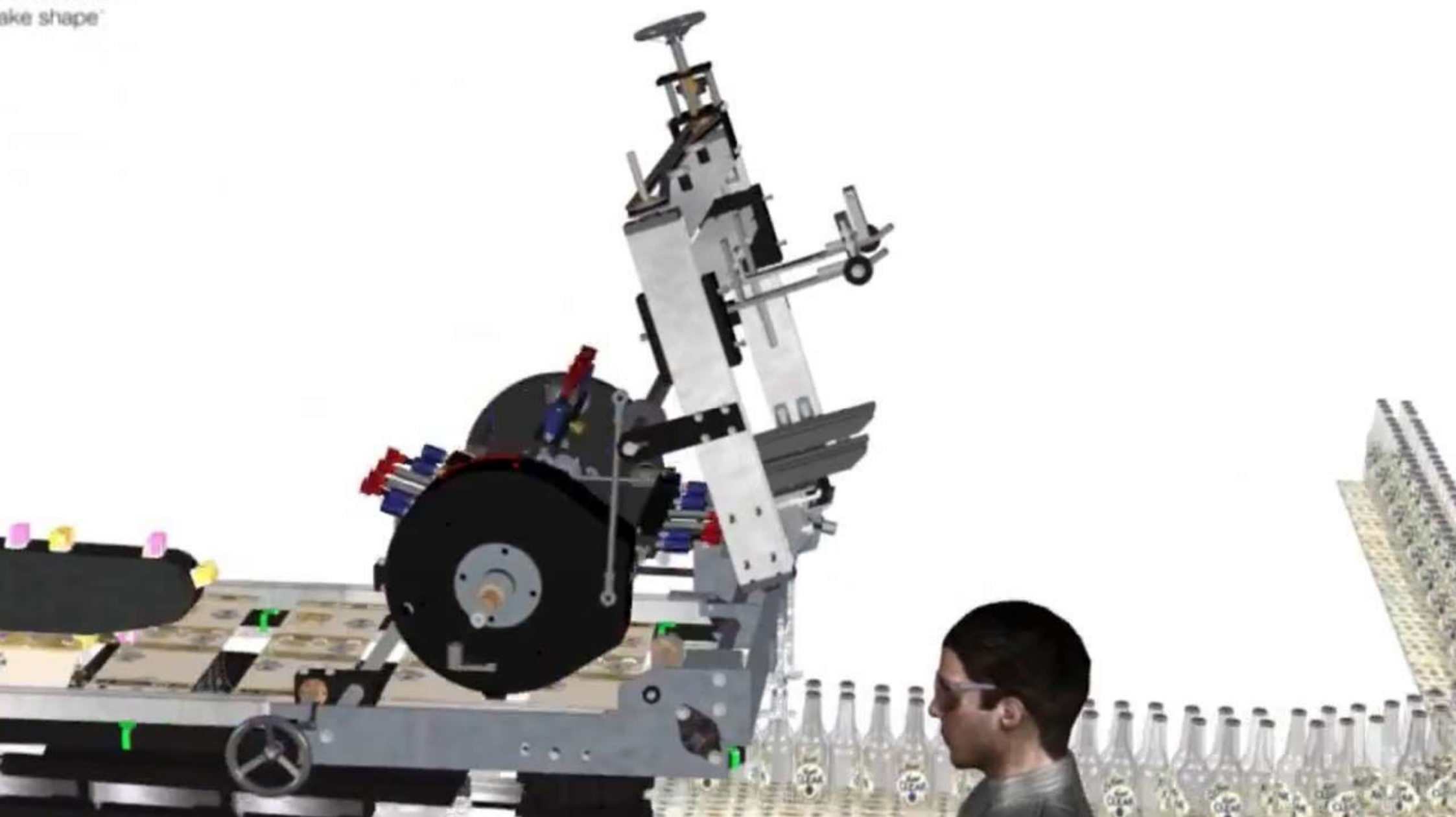
Screenshot saved

The screenshot was added to your  
OneDrive.

OneDrive

 **SYSTEMES**

ake shape







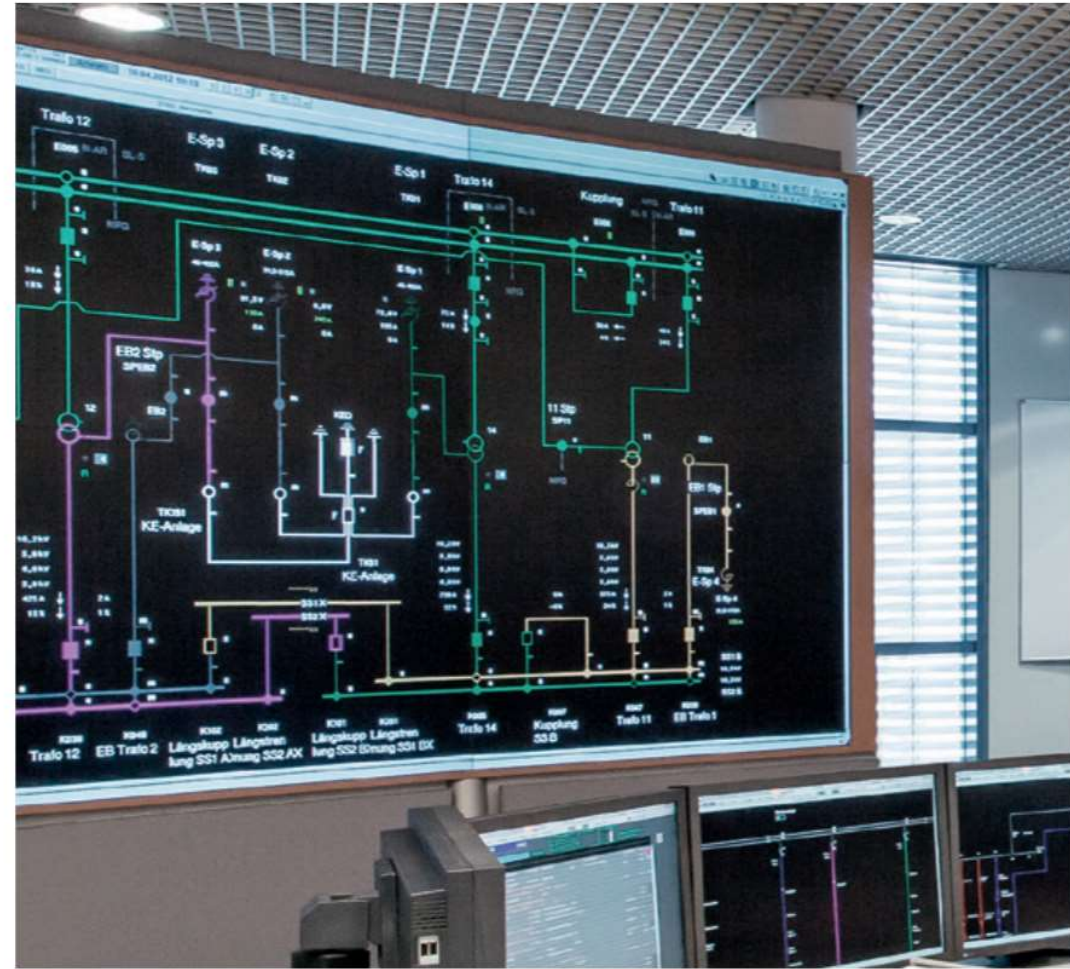






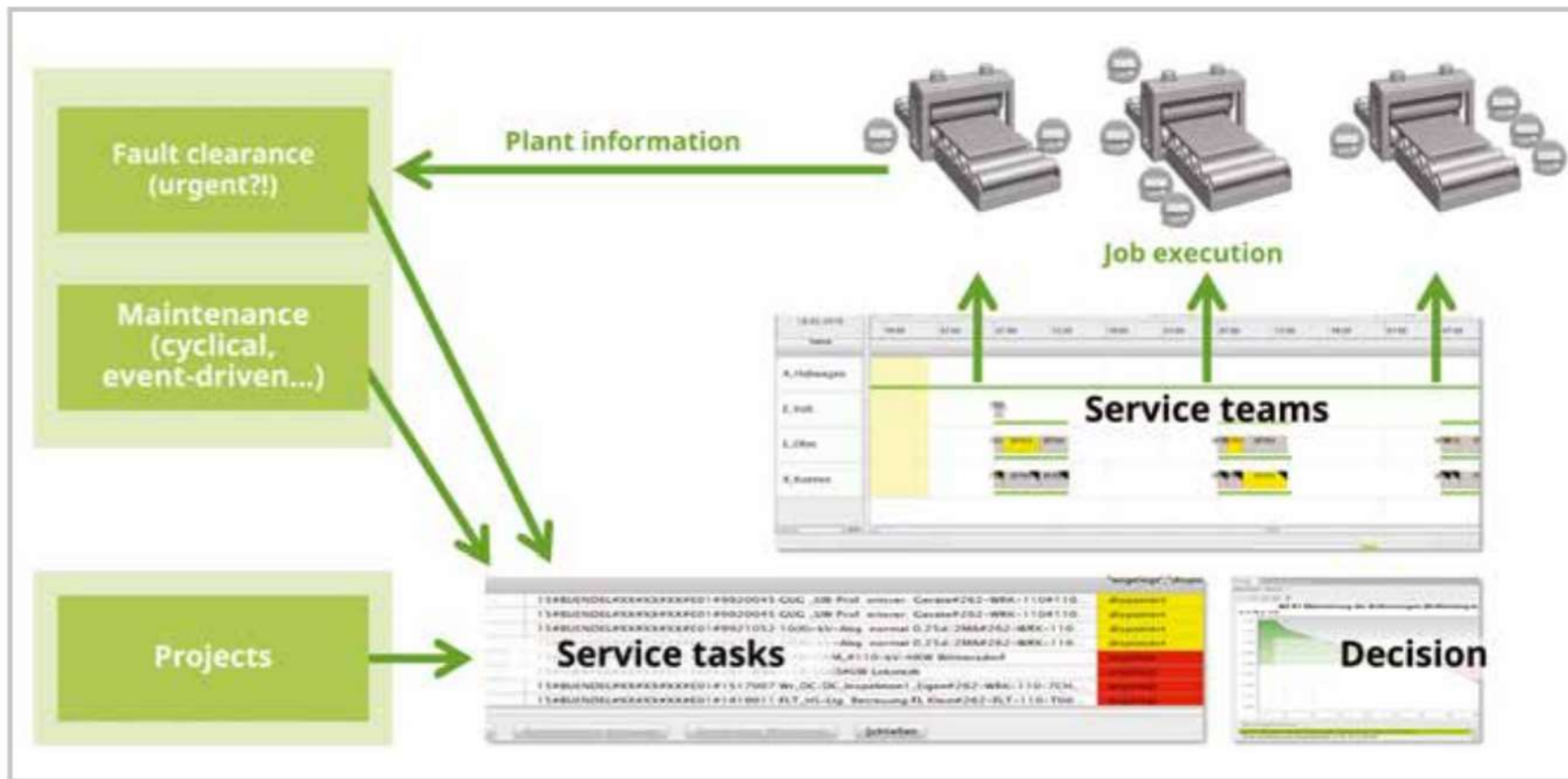
|             |             |             |             |
|-------------|-------------|-------------|-------------|
| Local ID:   | SPOPCRC-004 | Local ID:   | SPOPCRC-007 |
| Me-Id:      | CRC-NORM    | Me-Id:      | CRC-NORM    |
| Location:   | 41.05-4-3   | Location:   | 41.05-4-6   |
| Thickness:  | 0.3 mm      | Thickness:  | 0.3 mm      |
| Width:      | 1065 mm     | Width:      | 1065 mm     |
| Sum length: | 8182.7 m    | Sum length: | 7978.2 m    |
| Weight:     | 20000 kg    | Weight:     | 19500 kg    |

|             |             |
|-------------|-------------|
| Local ID:   | SPOPCRC-004 |
| Me-Id:      | CRC-NORM    |
| Location:   | 41.05-4-3   |
| Thickness:  | 0.3 mm      |
| Width:      | 1065 mm     |
| Sum length: | 8182.7 m    |
| Weight:     | 20000 kg    |

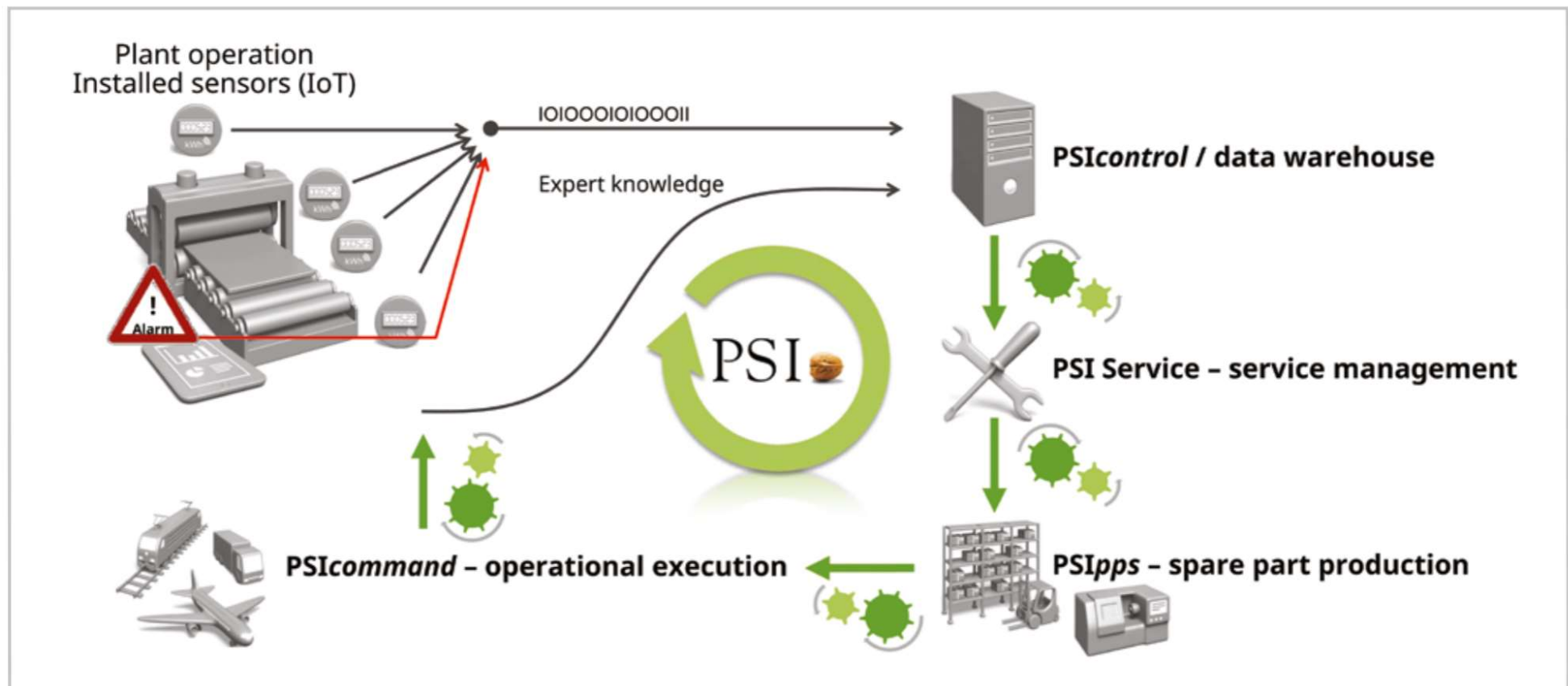




Optimised maintenance reduces the service teams costs.



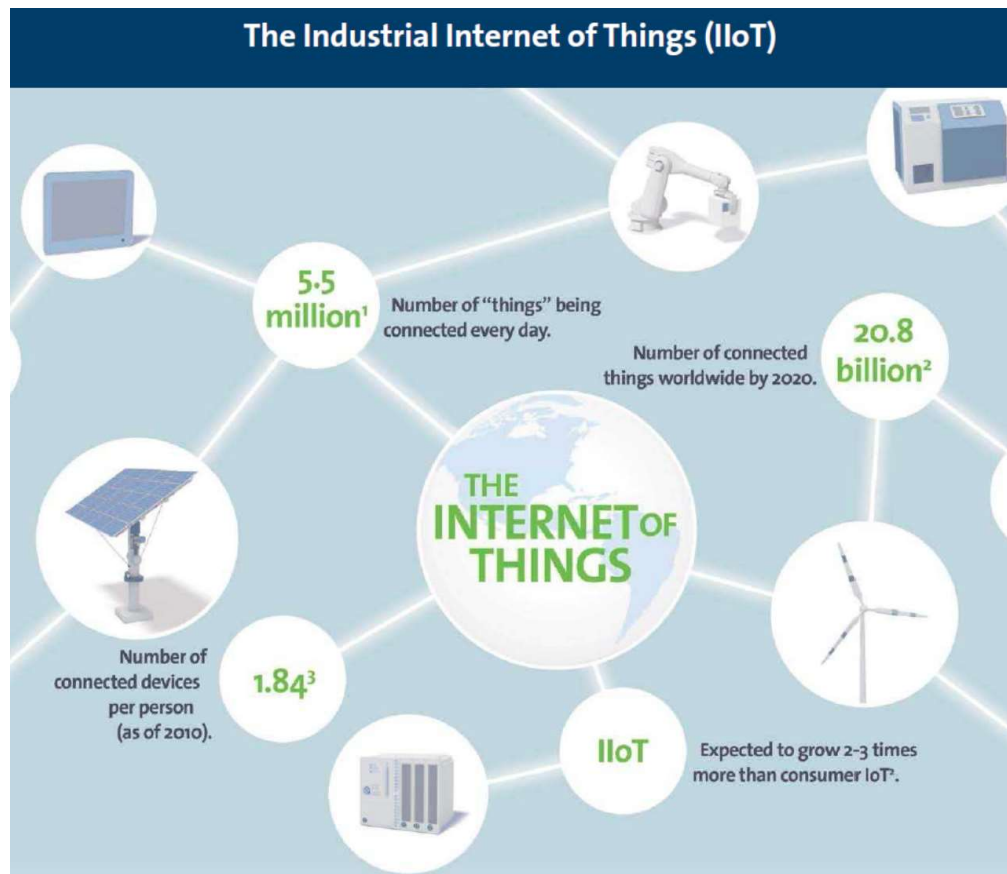
# Maintenance core processes using the potential of IoT





### 3) Use Cloud-technology for Automation

## PHOENIX CONTACT





10  
00  
  
11  
01



10  
00  
  
11  
01



10  
00  
  
11  
01



10  
00  
  
11  
01



10  
00  
  
11  
01



10  
00  
  
11  
01



10  
00  
  
11  
01

10  
00  
  
11  
01

10  
00  
  
11  
01

10  
00  
  
11  
01

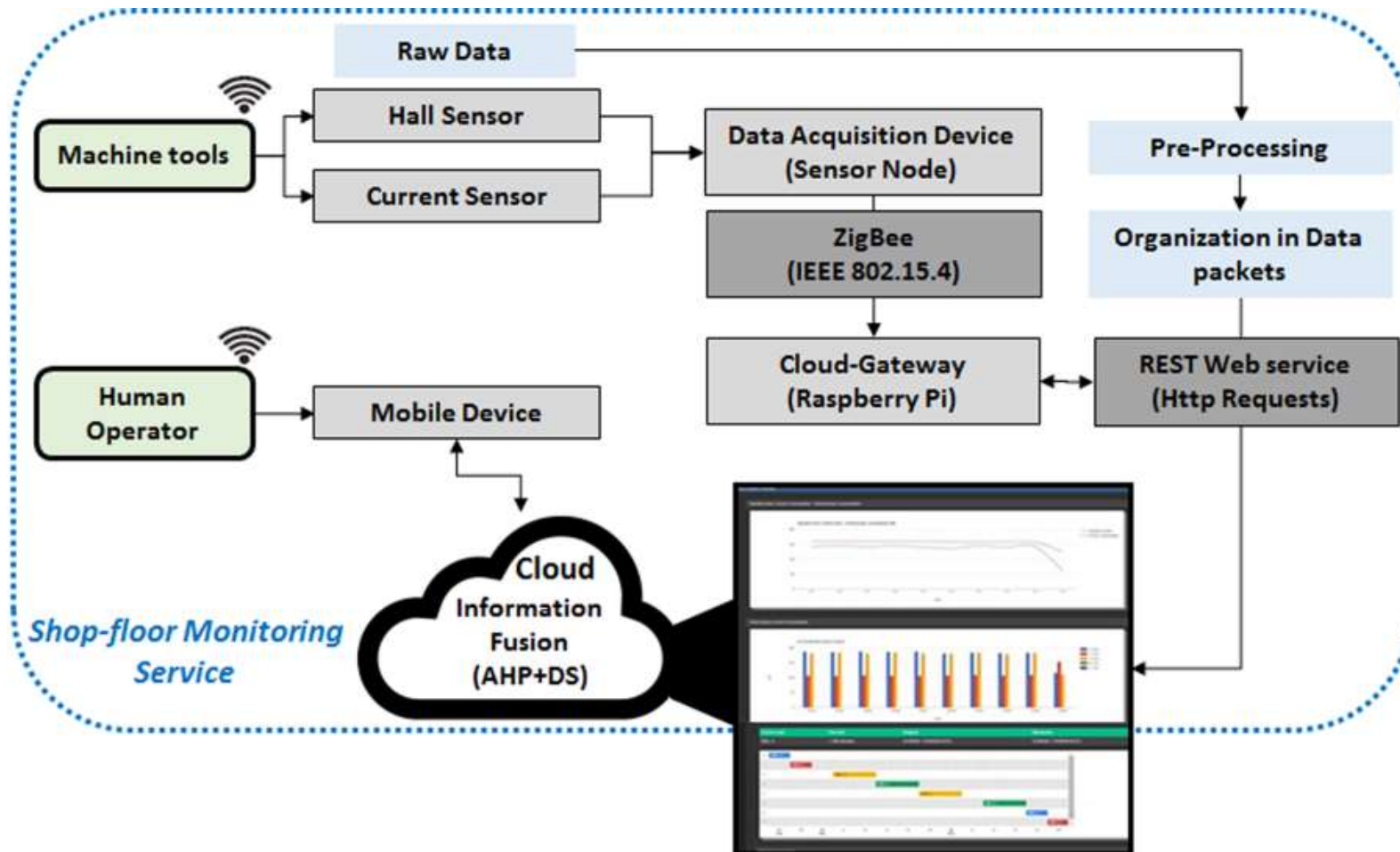
10  
00  
  
11  
01

10  
00  
  
11  
01





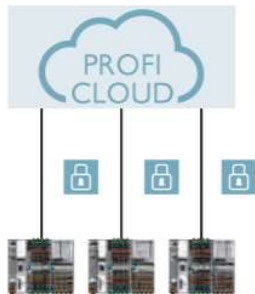
# Cloud-based remote maintenance





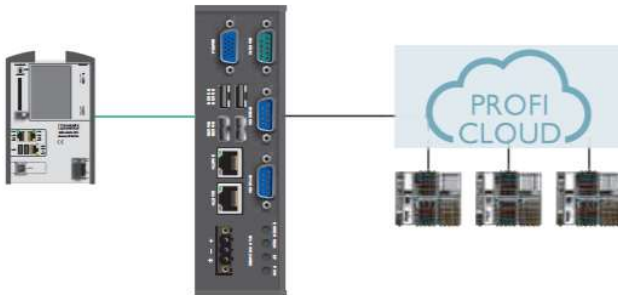


Secure TLS encryption



### Safe and easy communication

Via Internet access, all distributed PROFICLOUD-capable devices transmit your data to the cloud as if it were a PROFINET device – and of course, this data is TLS-encrypted.



### The PROFICLOUD coupler

Integrate the PROFICLOUD coupler into your local PROFINET network. The PROFICLOUD coupler displays all devices, which are located across the world and networked via the cloud, as local network devices.



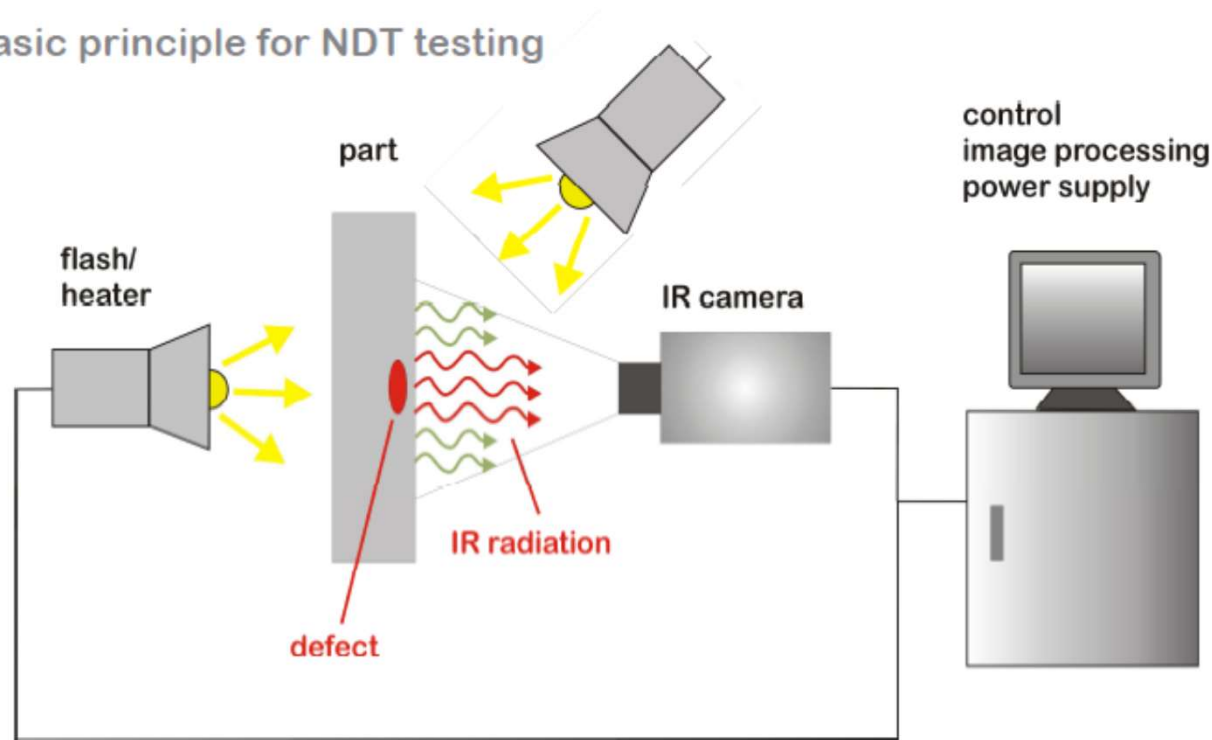
### Networks as easy as social media

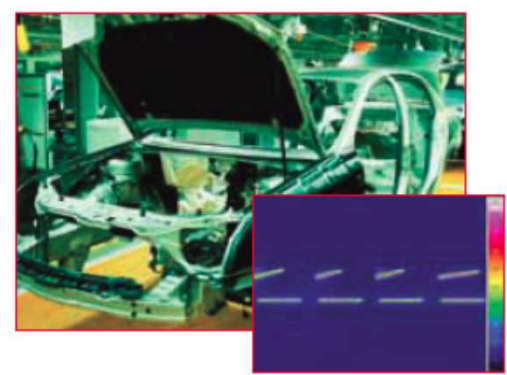
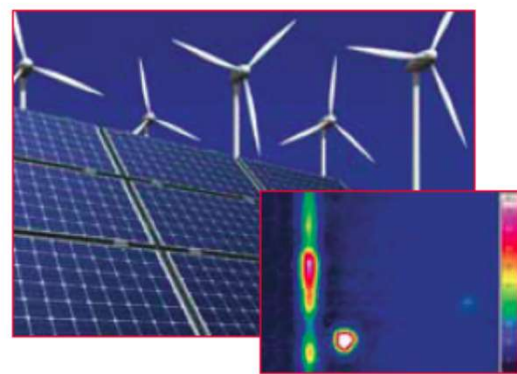
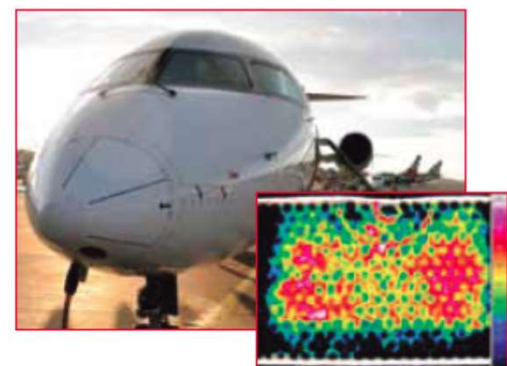
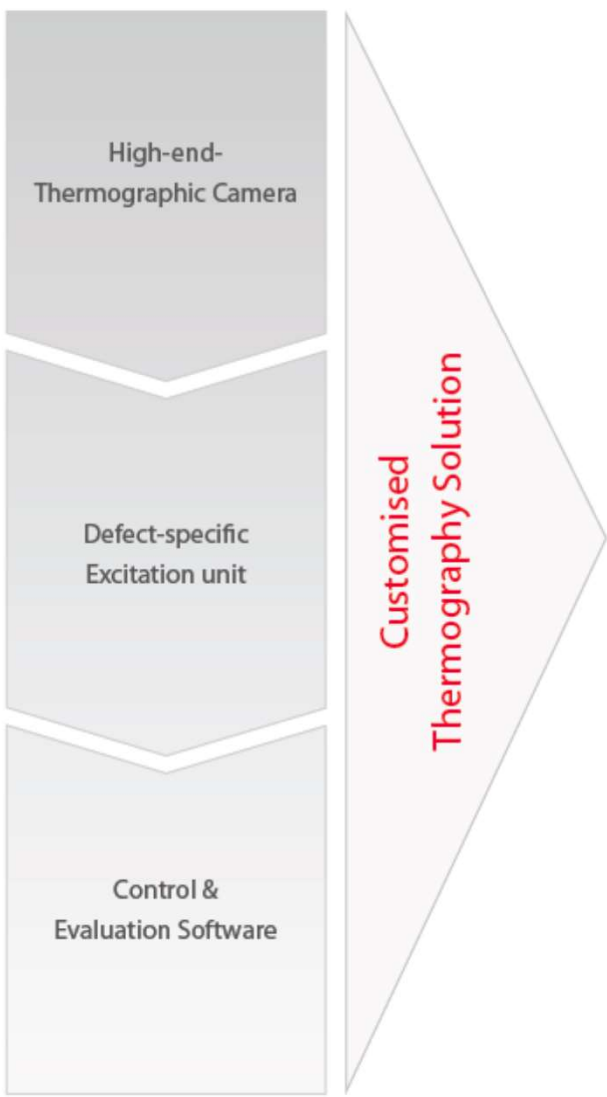
Network devices from the cloud as well as local devices are also available in the engineering environment. Costly programming work is thereby completely eliminated. Access to remote systems or machines, for example, can therefore be implemented in a much more straightforward manner. Your worldwide PROFINET network can be engineered just as easily as if it were a purely local network.

## 4. Non-contact, non-destructive, in-line testing for Industry 4.0

The Quality assessment of composite parts by Infrared Thermography

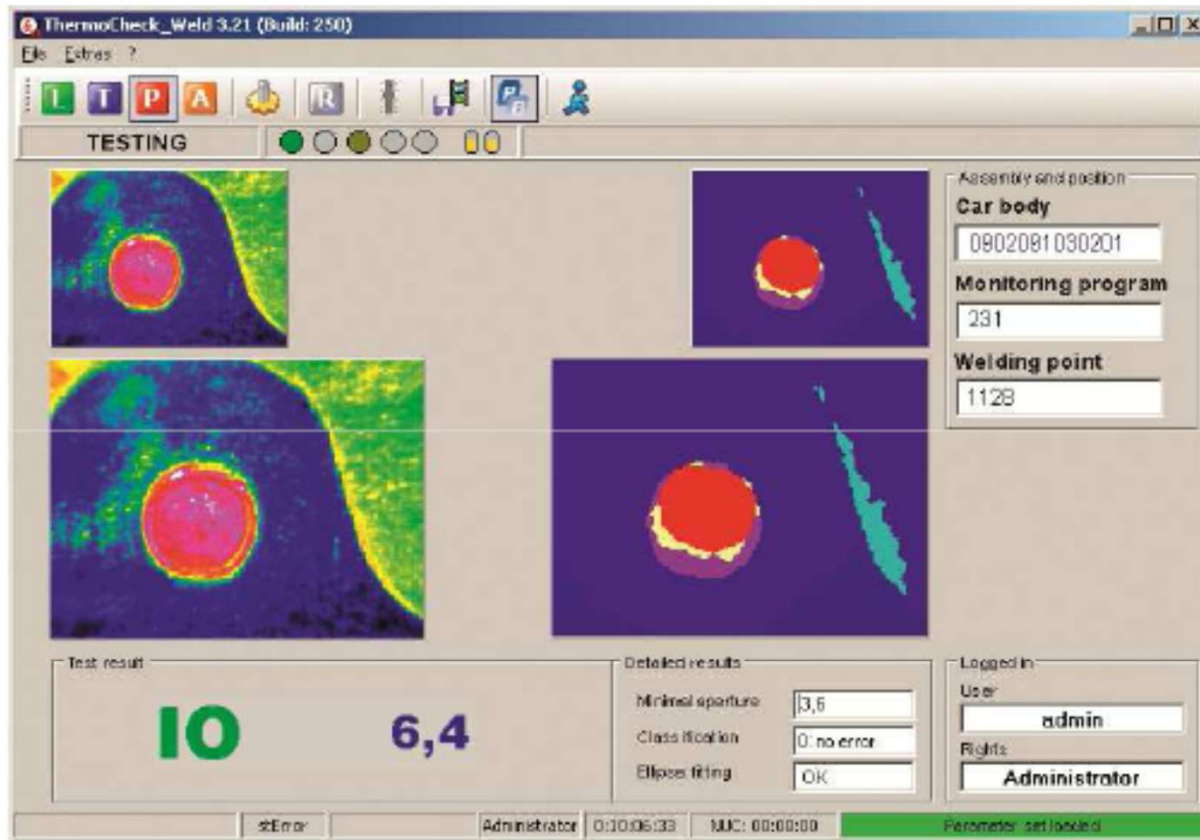
Basic principle for NDT testing



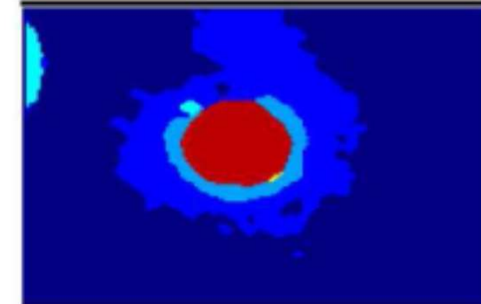
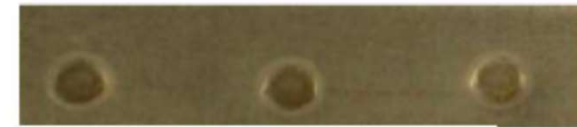


Metal

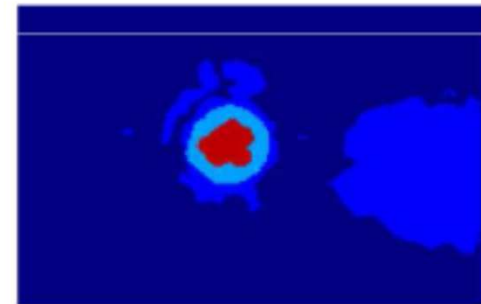
## NDT Testing for welding spots with ImageIR®



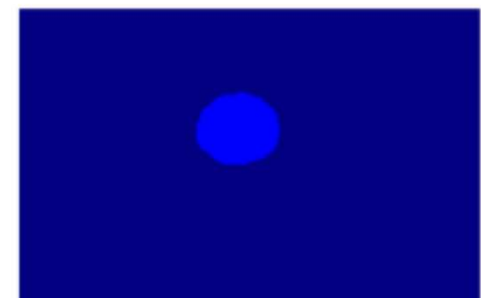
classification of spots for diameter (strength) and other quality parameters



ok



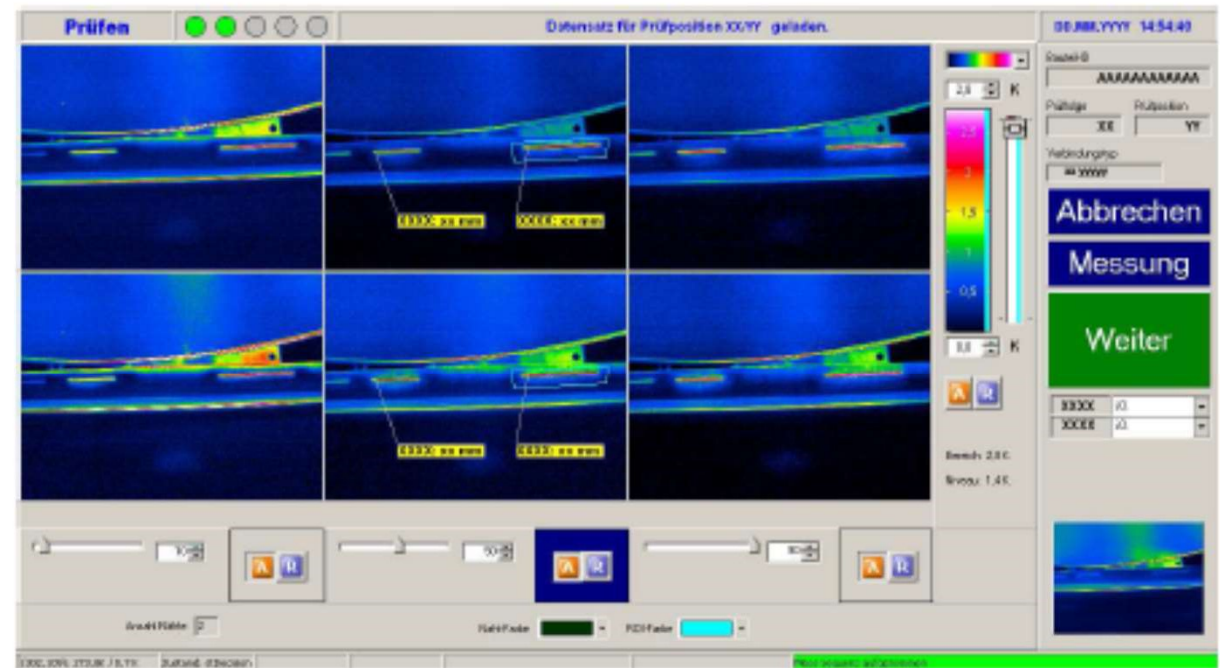
not  
ok



not  
ok



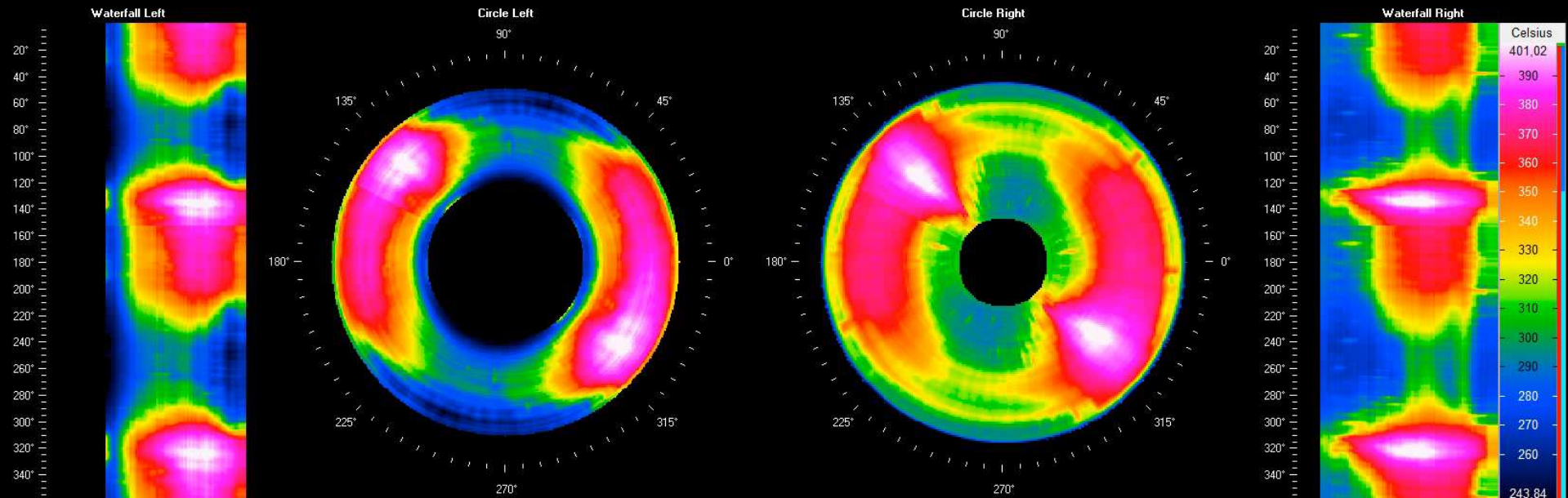
## Industrial thermography system for non-destructive testing of laser welding





# Break Testing

Test Number: 159483 Braking Number: 16  
Measurement Duration: 0.9 s

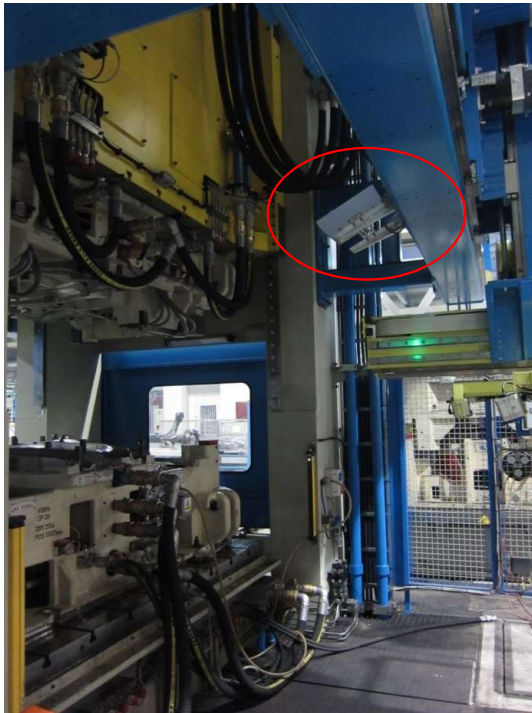


Rotational Direction

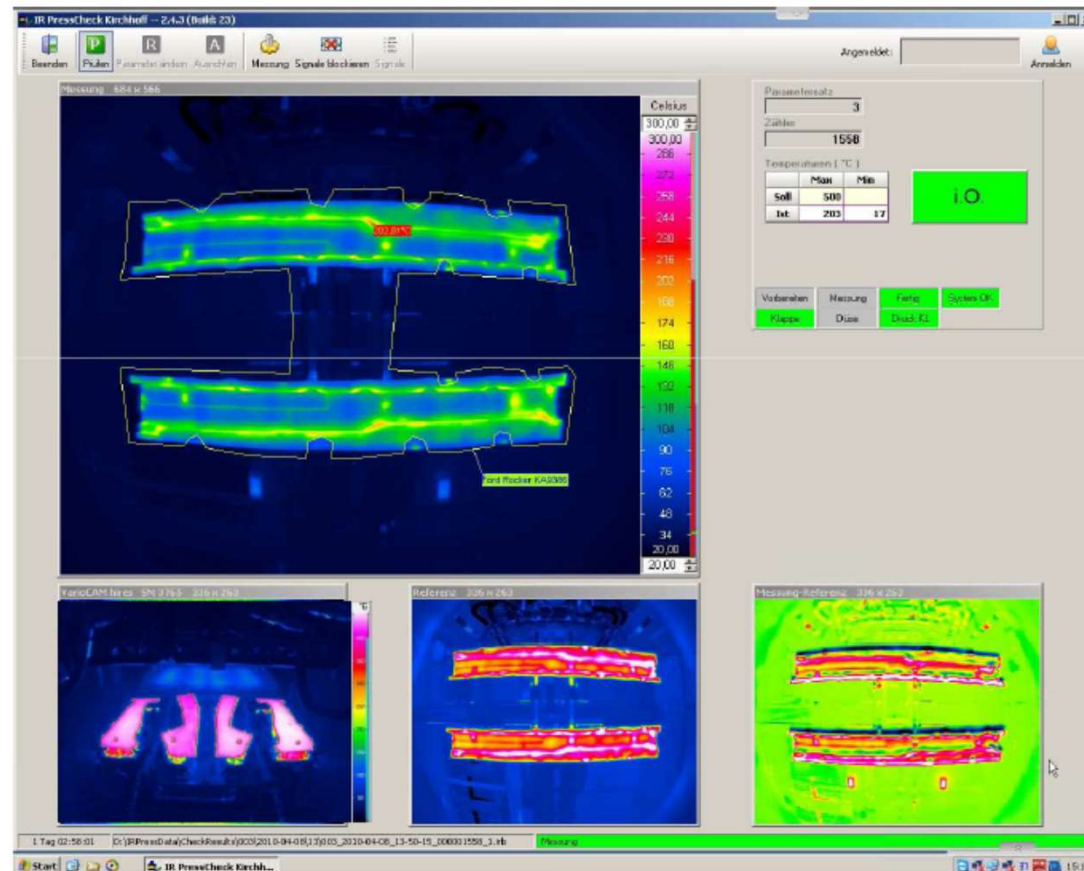
Left



# Thermographic Process Monitoring for Press Hardening



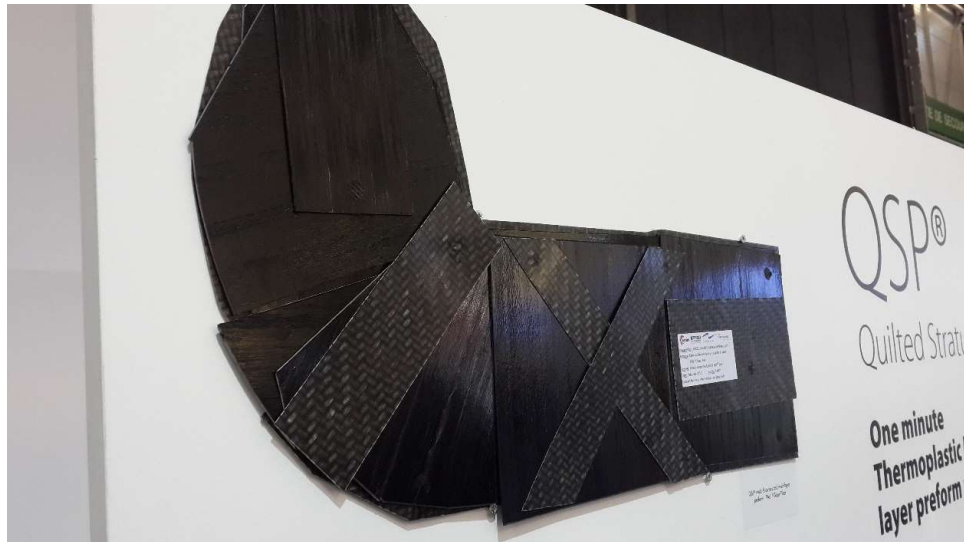
Before and after Pressing – Check mode



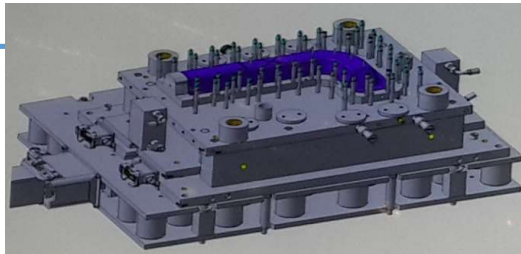
Composite

# Composite

## Thermoplastic Multi Thickness Layer Preform Assembly



**Press, Overmoulding + Thermoforming**

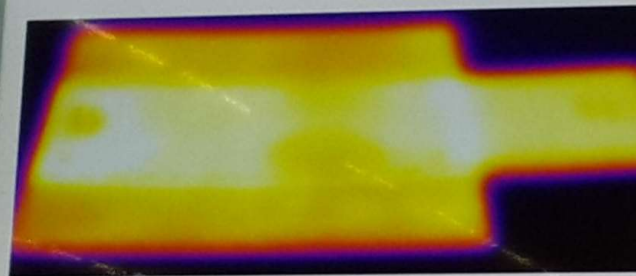




# Online monitoring

## Experimental set-up

Infrared camera



IR radiation emitted by the heated part

Detection by the infrared camera

Temperature calculation

Experimental  
set-up

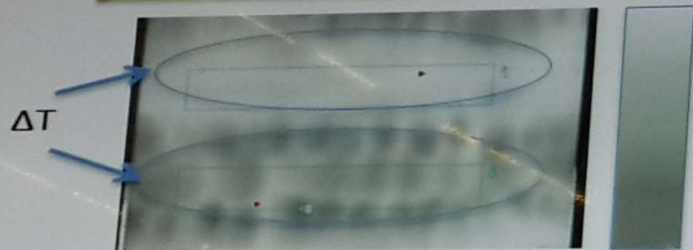


## Online monitoring:

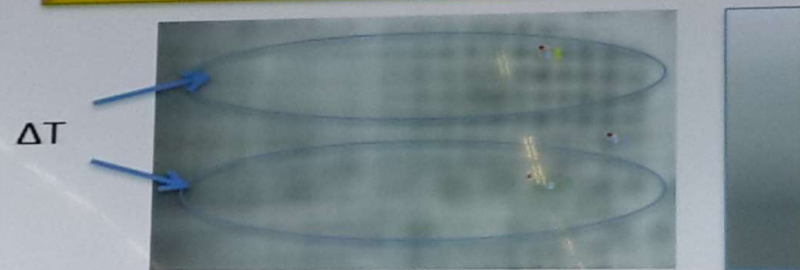
### Detection of heating heterogeneities

IR inspection of a composite plate after QSP heating ( $e=1,5\text{mm}$ )

Initial state: 10 to 20°C difference



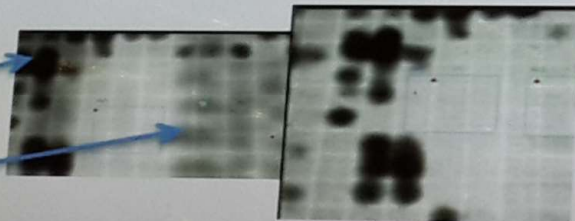
After oven optimisation: <5°C difference



### Detection of over heating defects

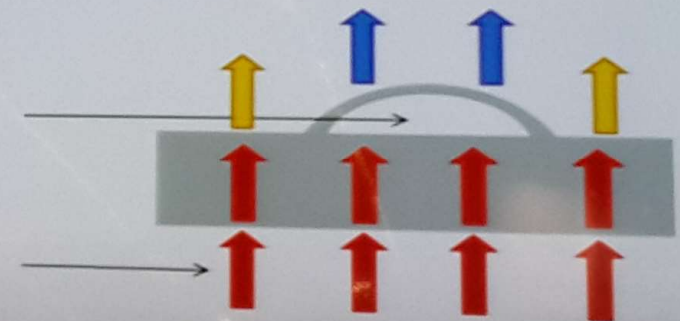
Over heating defects

Heating heterogeneities

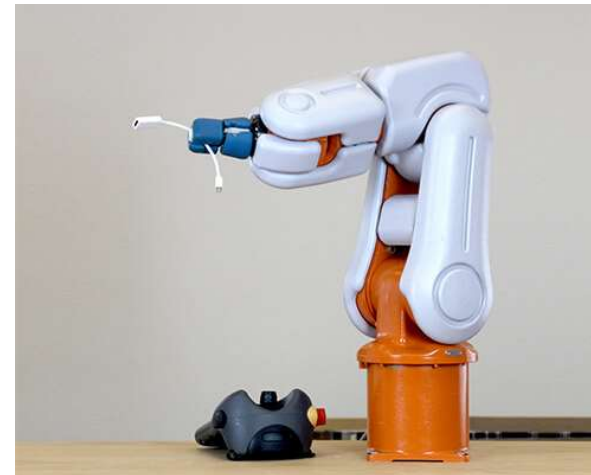
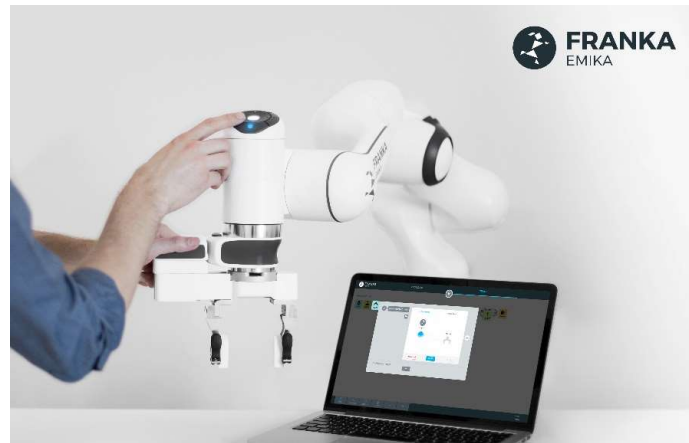
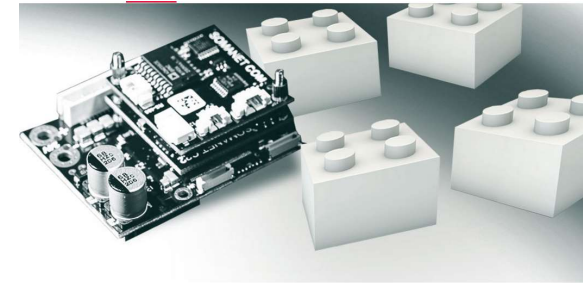


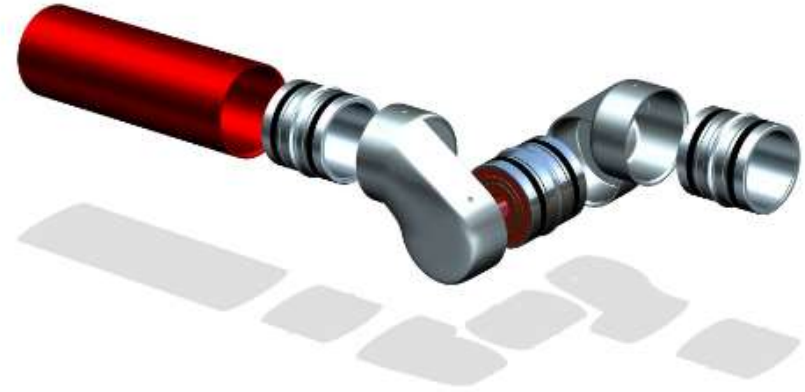
Thermal insulating due to air contain

Heat propagation from IR heating

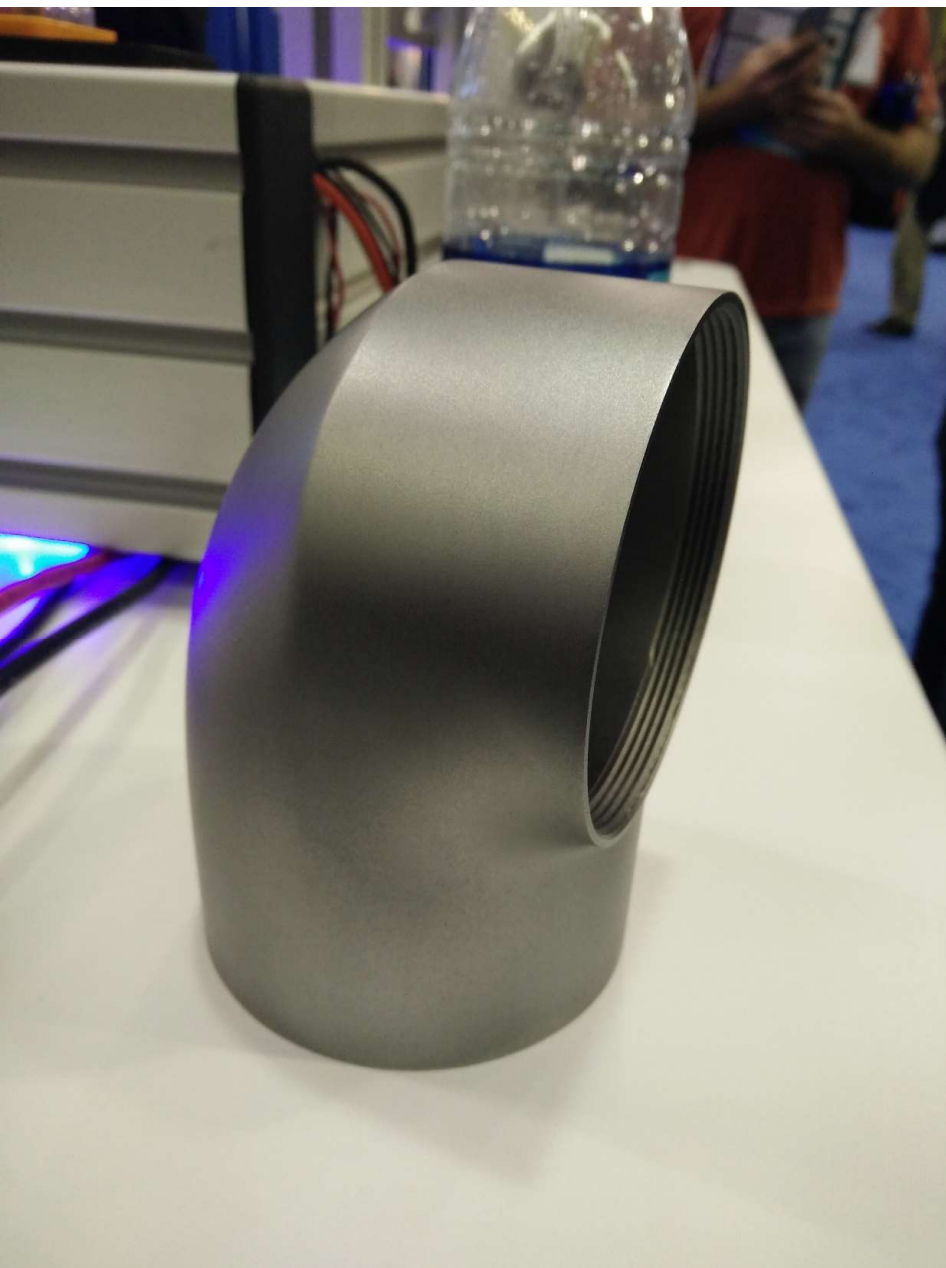


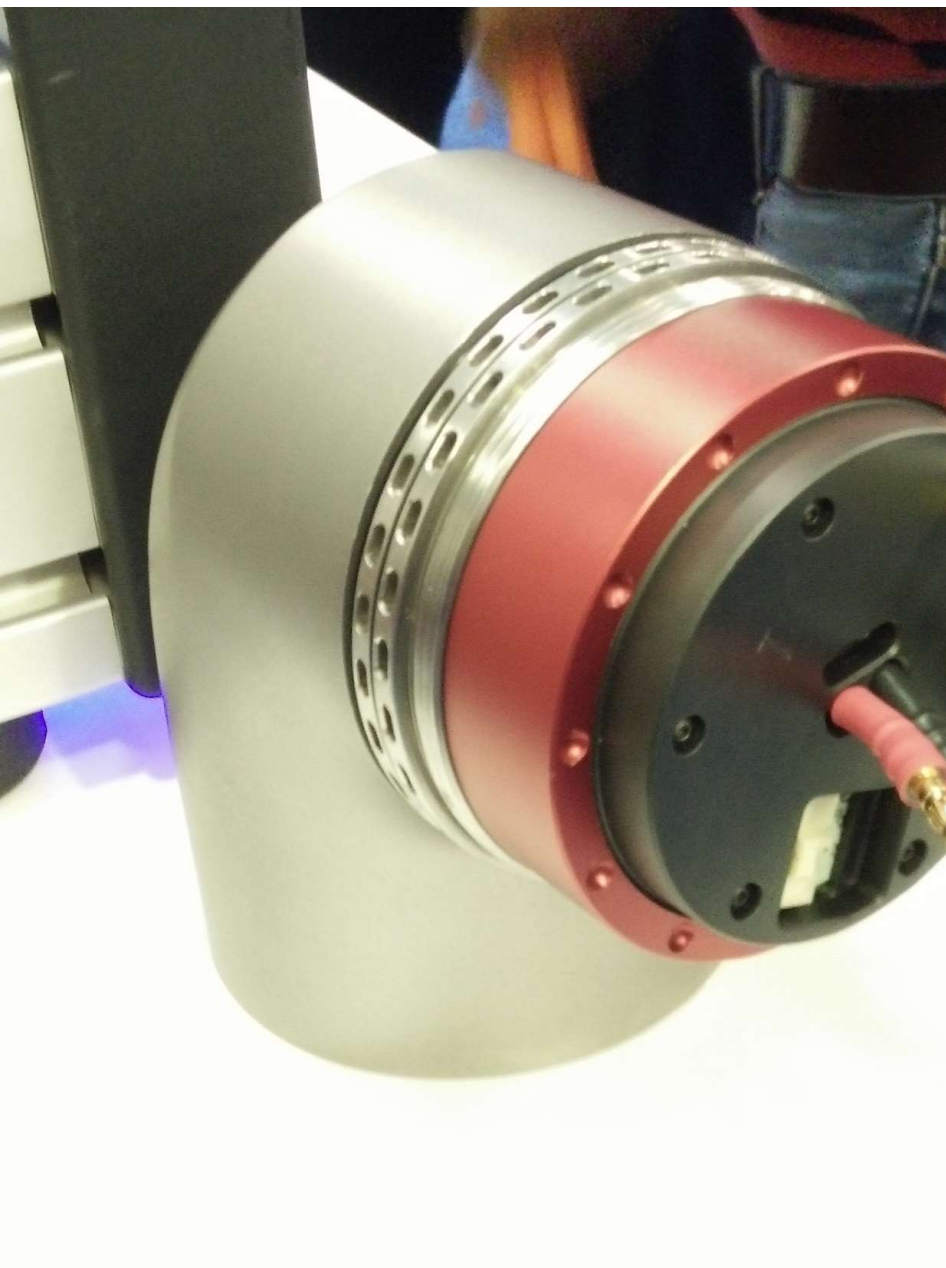
# New Generation of Smart Robots















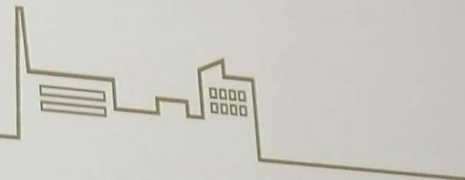
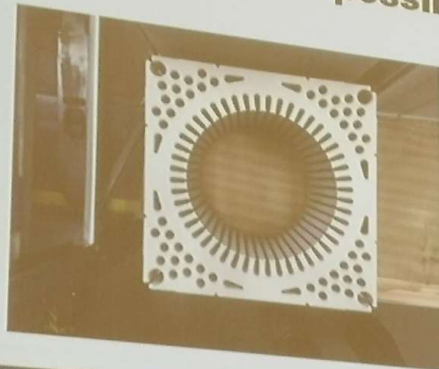
Daniel Pizzata, MODBOT CEO, FOUNDER



# MANY DIFFERENT VARIANTS

Automation is not possible or not cost efficient

next 47



September 2016

Carolin Funk, Moshe Schwimmer

CONFIDENTIAL © next47 GmbH - A Siemens Company

# WE MAKE OUR TOOLS AVAILABLE TO STARTUPS

next 47

## FRONTIER Partner Program

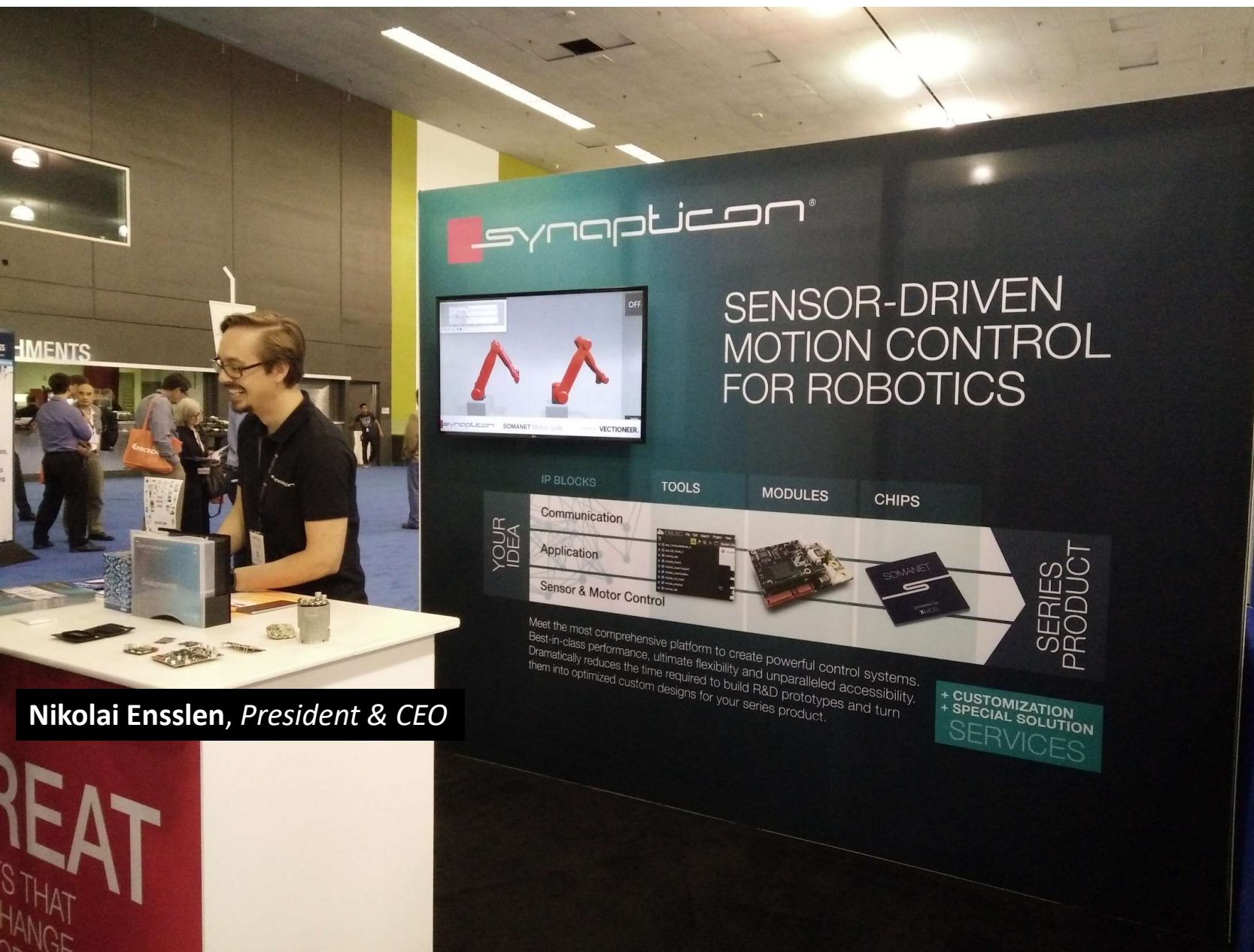
### Focused themes:

- Robotics
- 3D Printing
- Industrial Augmented and Virtual Reality

### Engagement platform:

- Access to technologies
- Developer support
- Marketing and sales support
- Funding opportunities

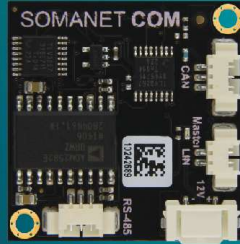
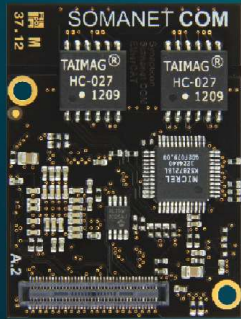
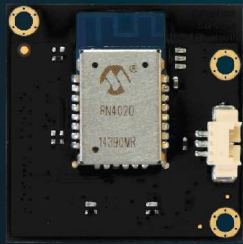
[www.next47.com/frontier](http://www.next47.com/frontier)



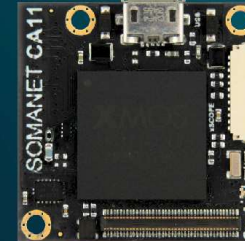
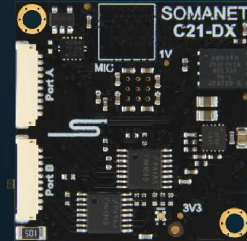
**Nikolai Ensslen, President & CEO**



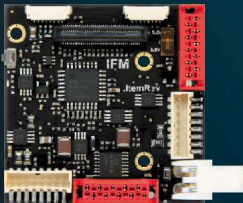
Browse the available selection of SOMANET COM Modules in our Online Shop [→](#) or directly in OBLAC [→](#)

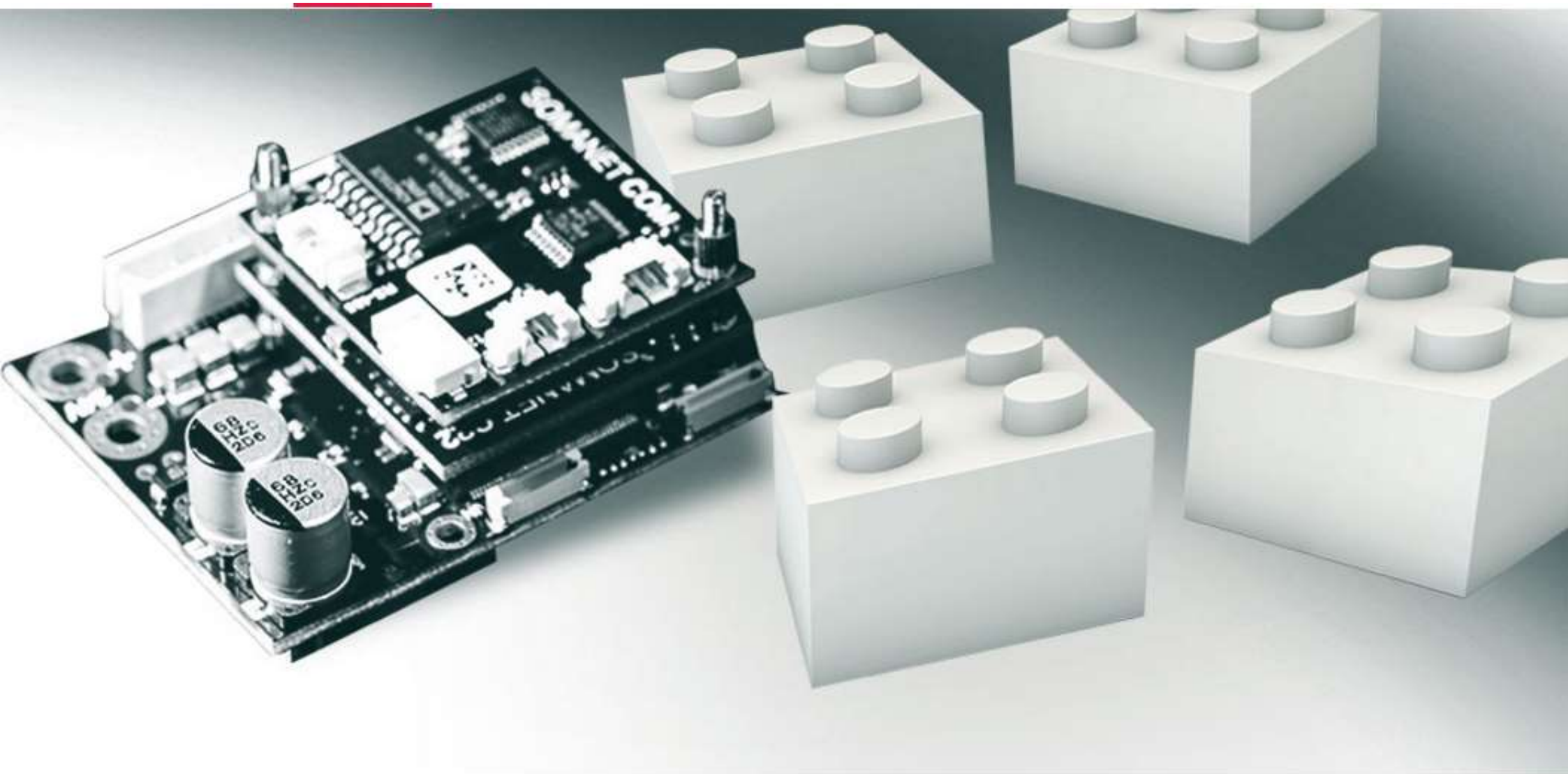


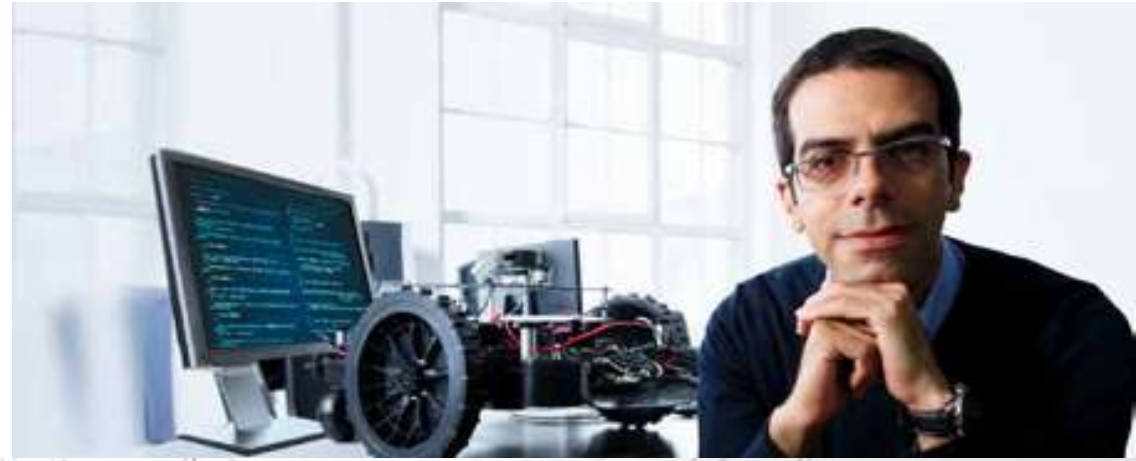
Browse the available selection of SOMANET CORE Modules in our Online Shop [→](#) or directly in OBLAC [→](#)



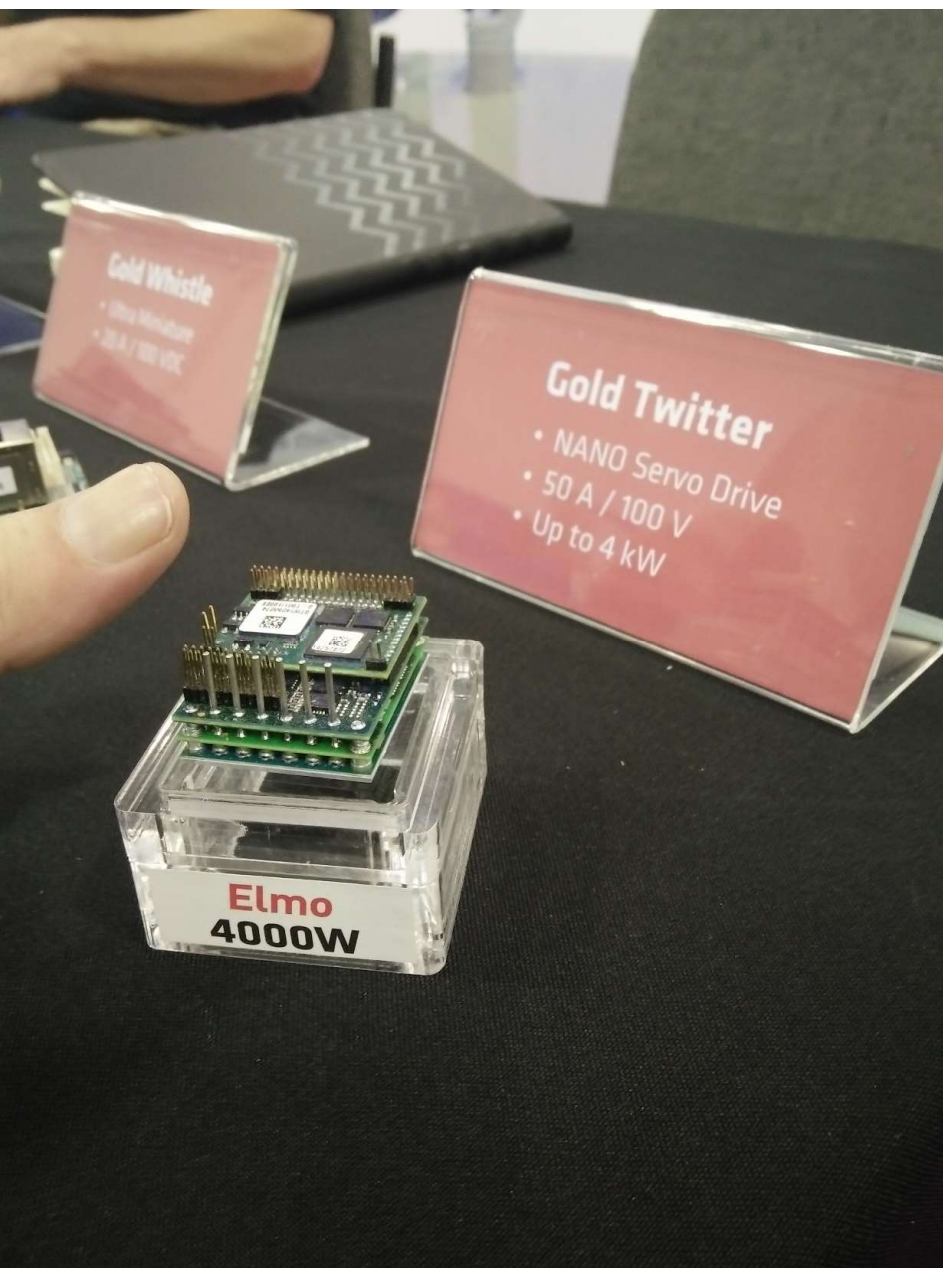
Browse the available selection of SOMANET IFM Modules in our Online Shop [→](#) or directly in OBLAC [→](#)











### Gold Whistle

- Ultra Miniature
- 20 A / 100 VDC

### Gold Twitter

- NANO Servo Drive
- 50 A / 100 V
- Up to 4 kW

**Elmo**  
**4000W**

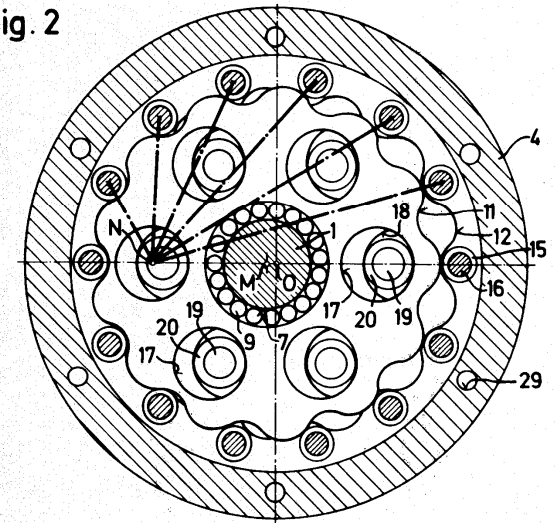
## An exploded view of a blue industrial robotic arm. The main body of the arm is shown in the upper left, with its base and mounting flange. Below it, the mounting flange and base plate are shown in an exploded state. To the right, the arm's wrist and end effector are shown in an exploded state, with various joints and components visible. The entire assembly is rendered in a clean, technical style with a light blue background.

Sept. 27, 1977

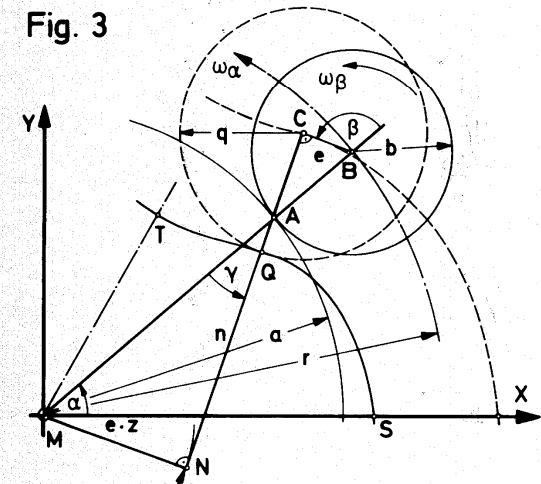
Sheet 2 of 6

**4,050,331**

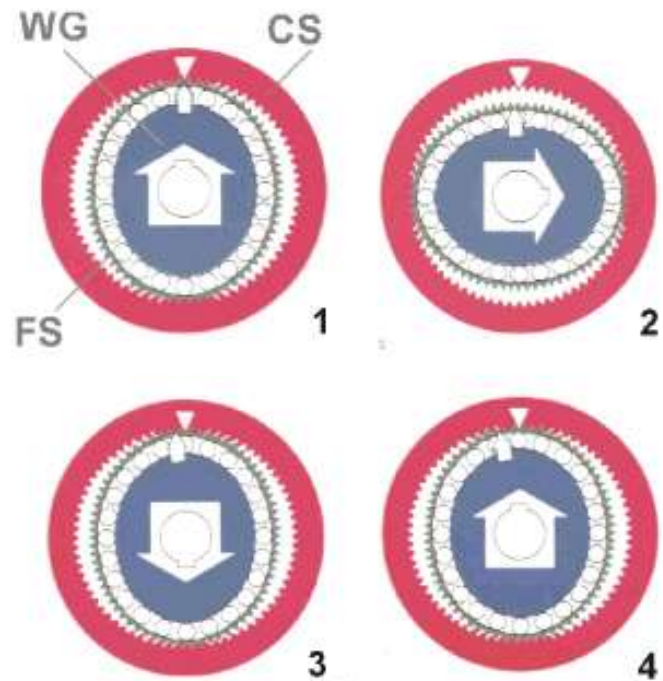
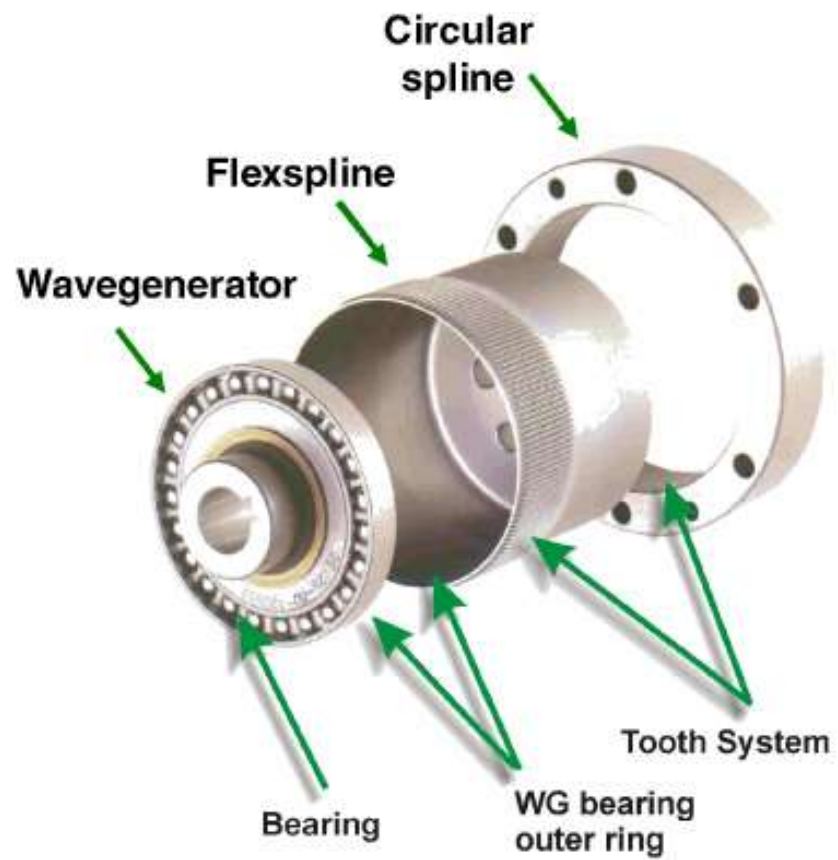
**Fig. 2**



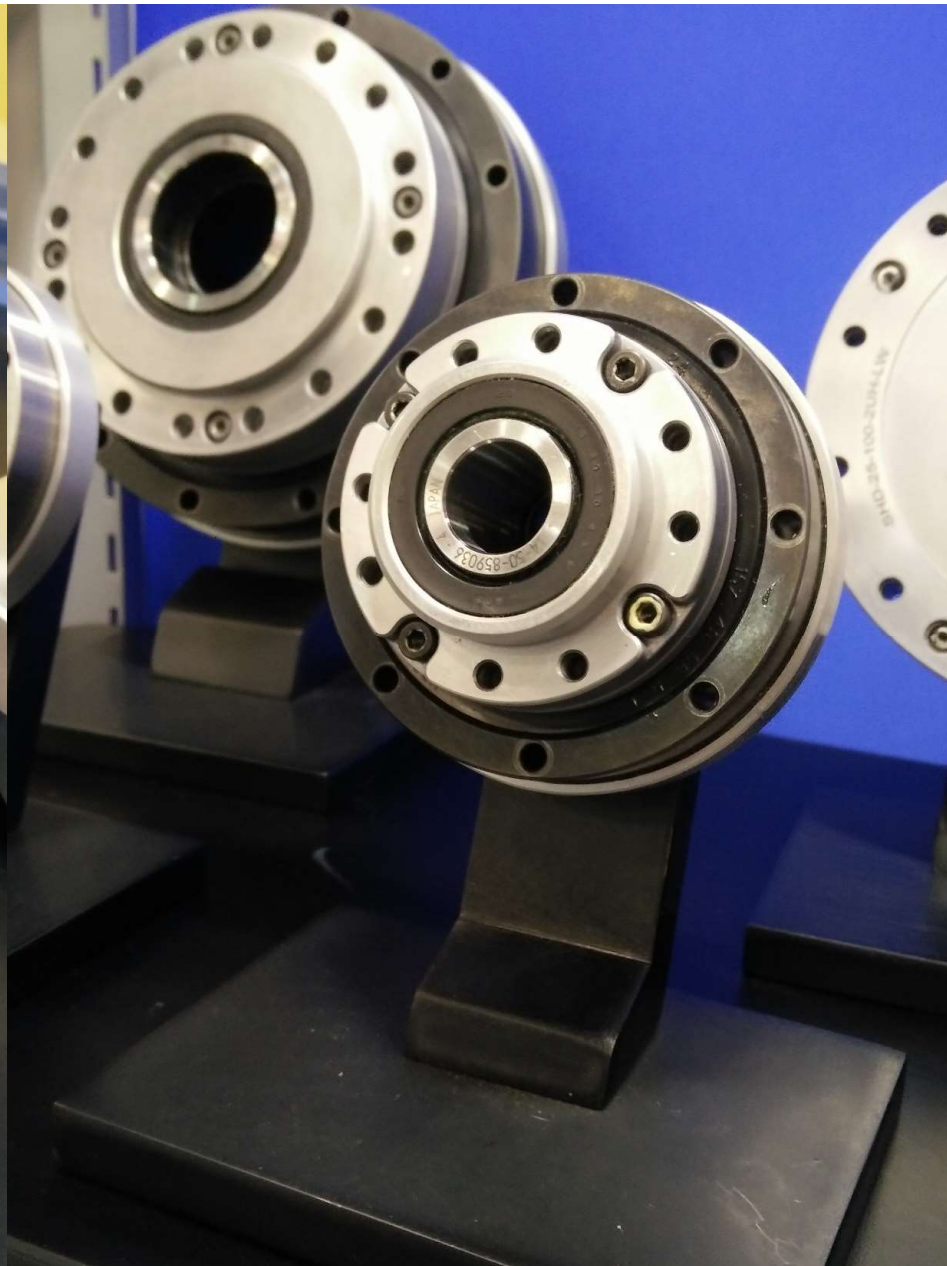
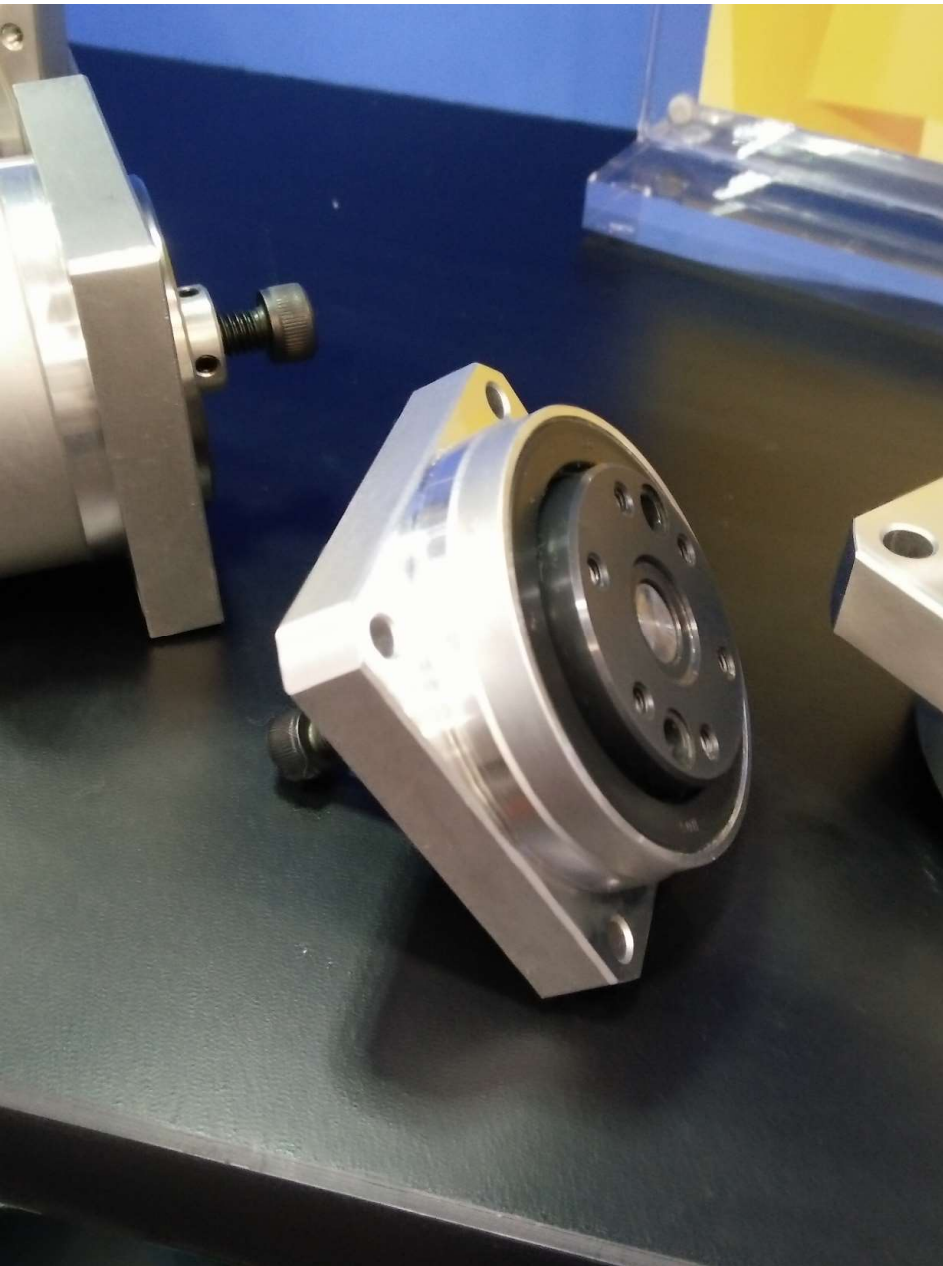
**Fig. 3**



# Harmonic Drive







# SRI Abacus



This all might seem like it would be worrying for Harmonic Drive, the principle manufacturer of Harmonic Drive gears, but it's not, because Harmonic Drive is a partner in the project. It has licensed the Abacus design from SRI and is collaborating with them to commercialize it. "We're in the process of doing lifetime testing right now, and we expect to have beta version drives within the year," Kernbaum says. "After that, we'll be rolling out our first product line."

There are no parts that rub or slide against each other (like gear teeth), only parts rolling against other parts. Rubbing and sliding result in wasted energy, and in fact, conventional transmissions are typically only 50 percent efficient.





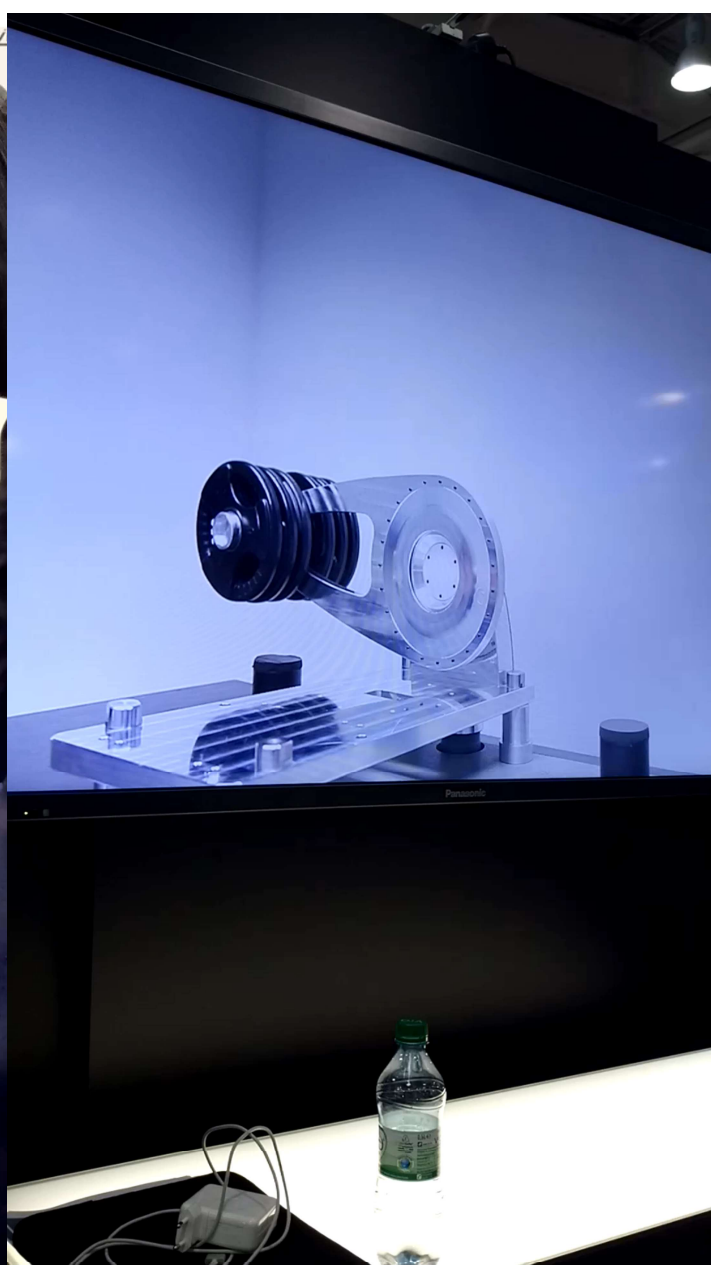
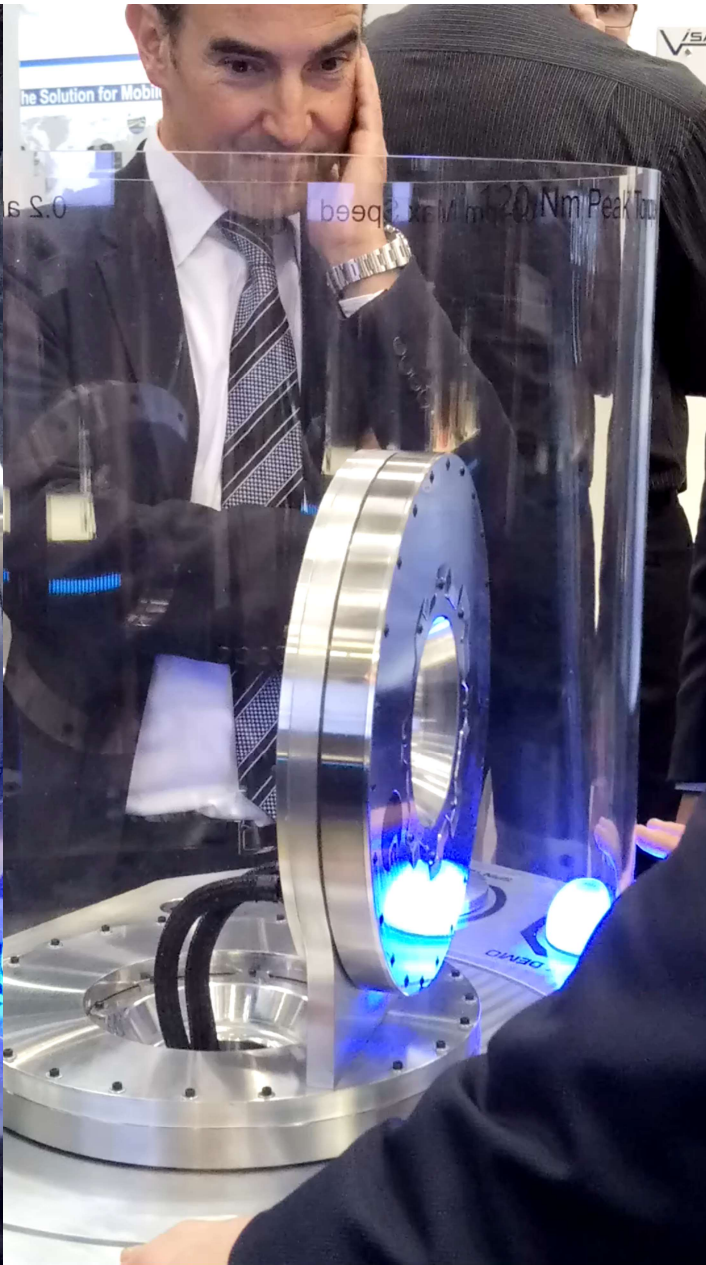
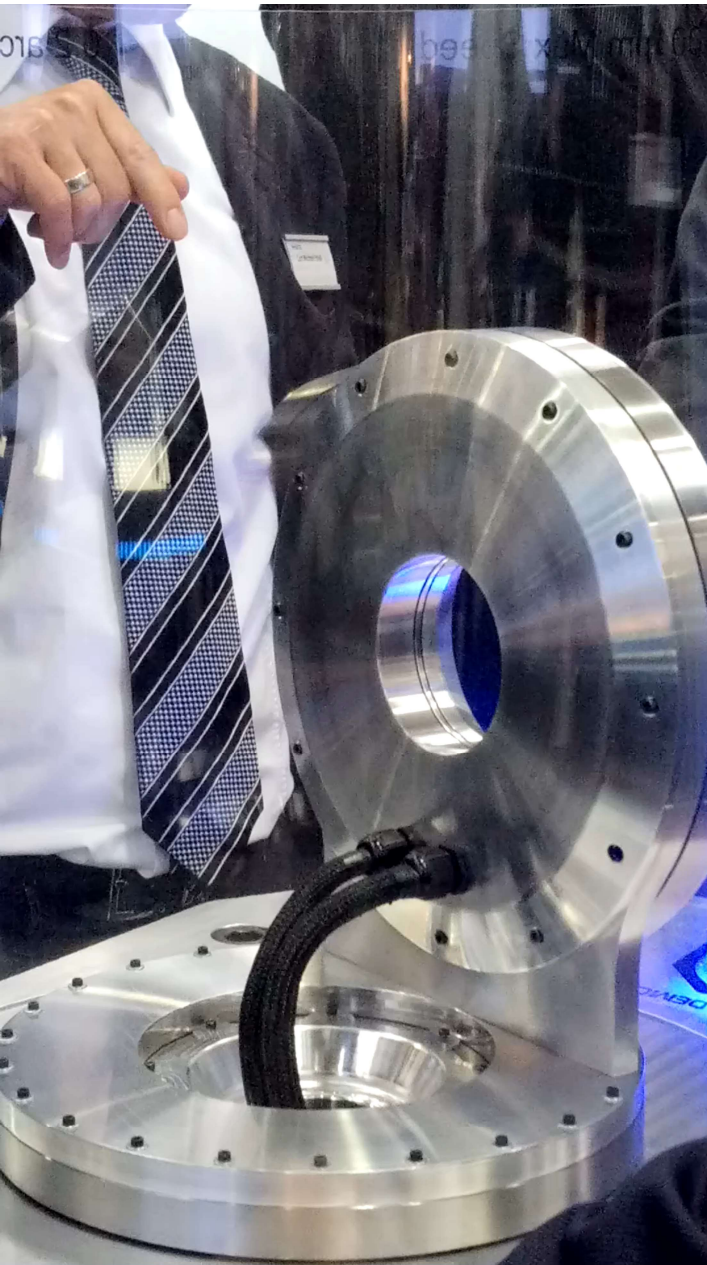
Alexander Kernbaum,  
SRI International, CA

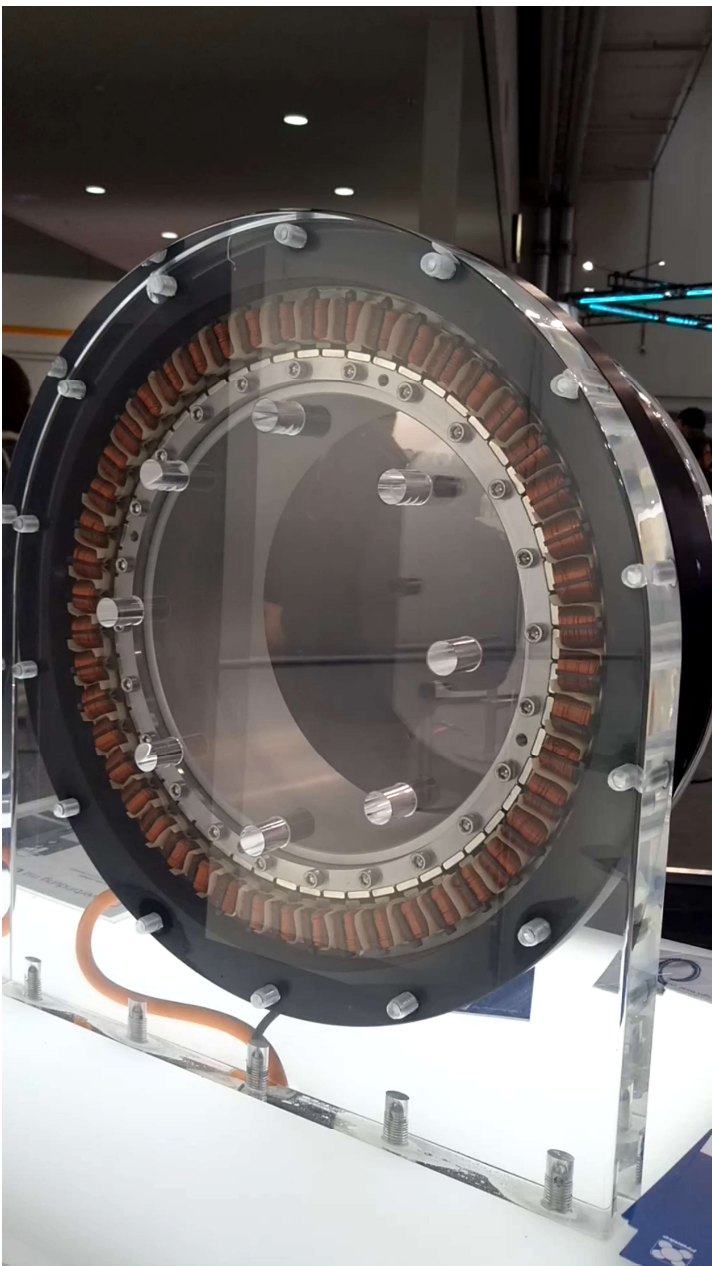












Thank you for your kind  
attention

