





2016 International Forum Korea
on Advances in Mechanical Engineering



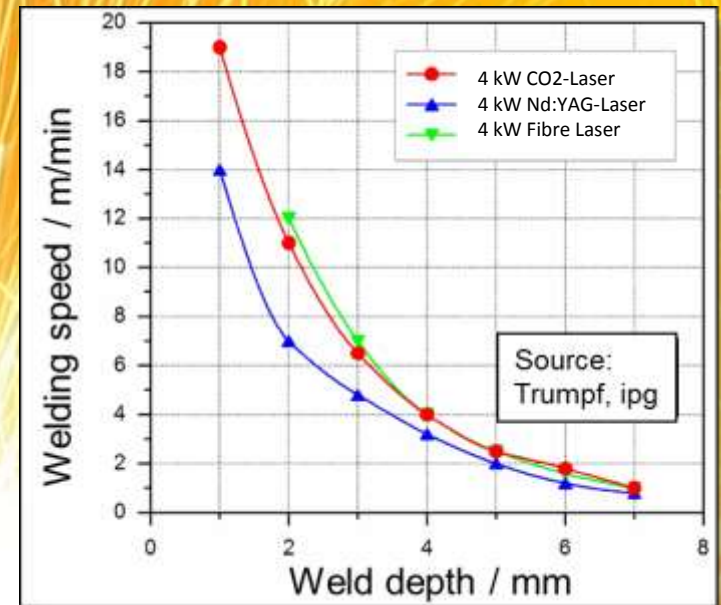
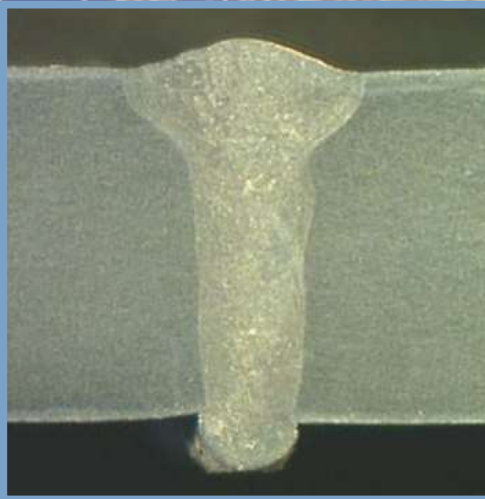
2016 IFAME

LASER WELDING IN HIGH VOLUME PRODUCTION

Hotel ICC, Daejeon, Korea

ADVANTAGES

- precise and fast
- only one-sided accessibility needed
- contact-free with minimum heat input
- new designs: combination of materials, butt and fillet welds

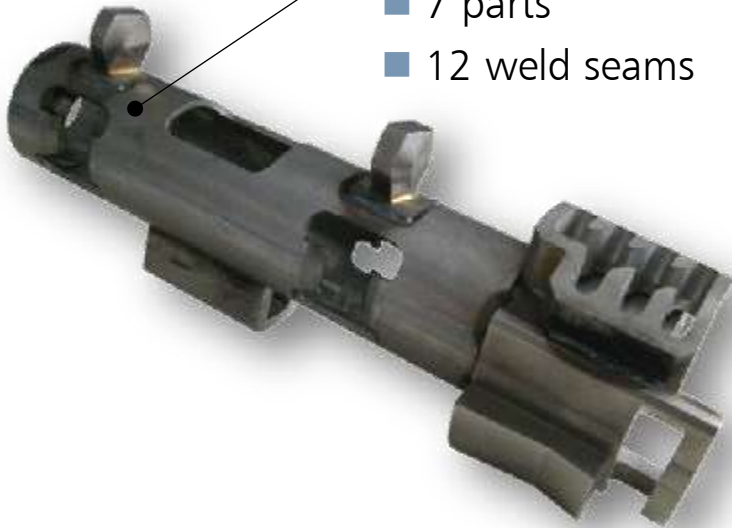


MOTIVATION FOR NEW DESIGNS

- economy and ecology → material saving, reduced machining
- light weight construction → sheet metal design
- material combination → adapted to machinability and functionality (e.g. sintered components, formed components and sheet metal parts)
- savings in production costs (no finishing)

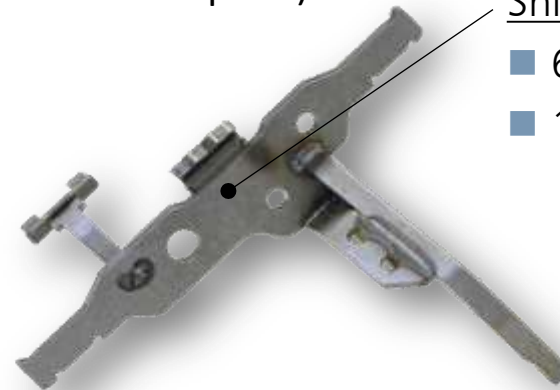
Gear shift controller

- 7 parts
- 12 weld seams



Shift fork

- 6 parts
- 12 weld seams

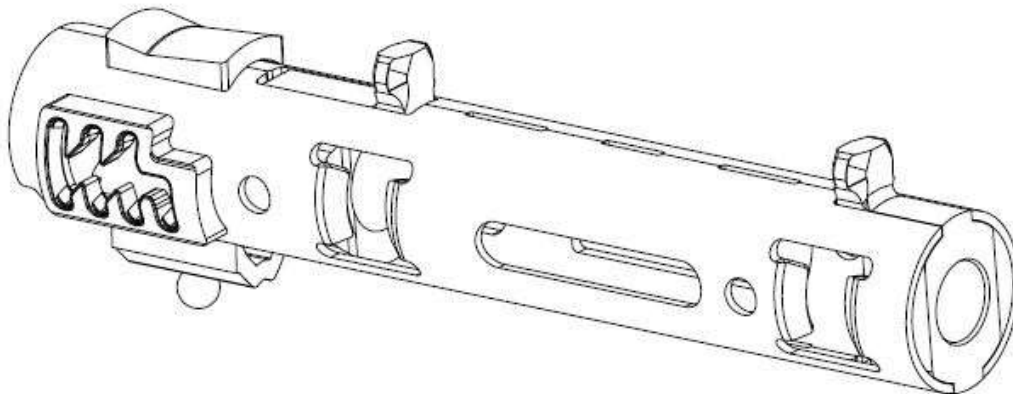
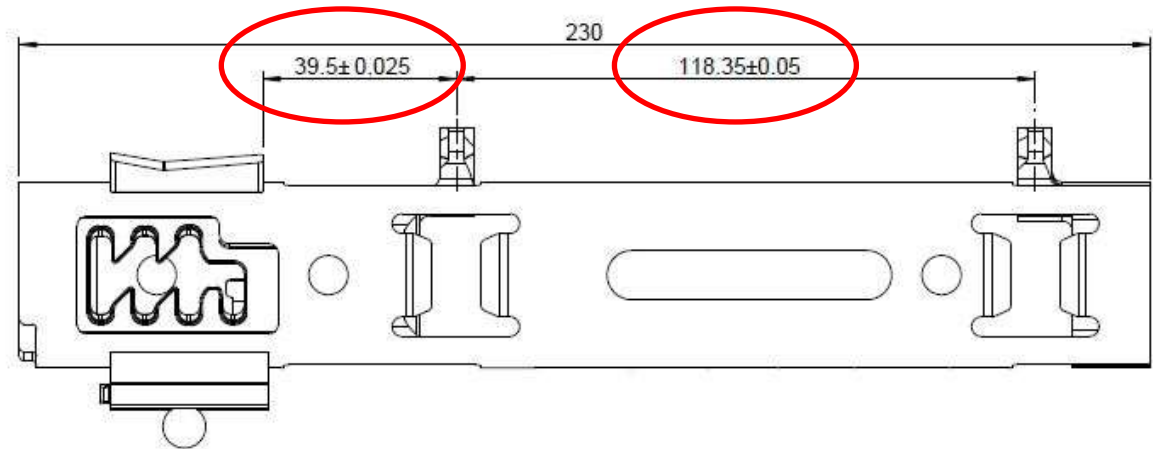


TRENDS

- small tolerances for assembly
- increasing number of component parts
- increasing number of weld seams
- weld seams distributed all-over the construction

39.5 ± 0.025 !

$118,35 \pm 0.05$!



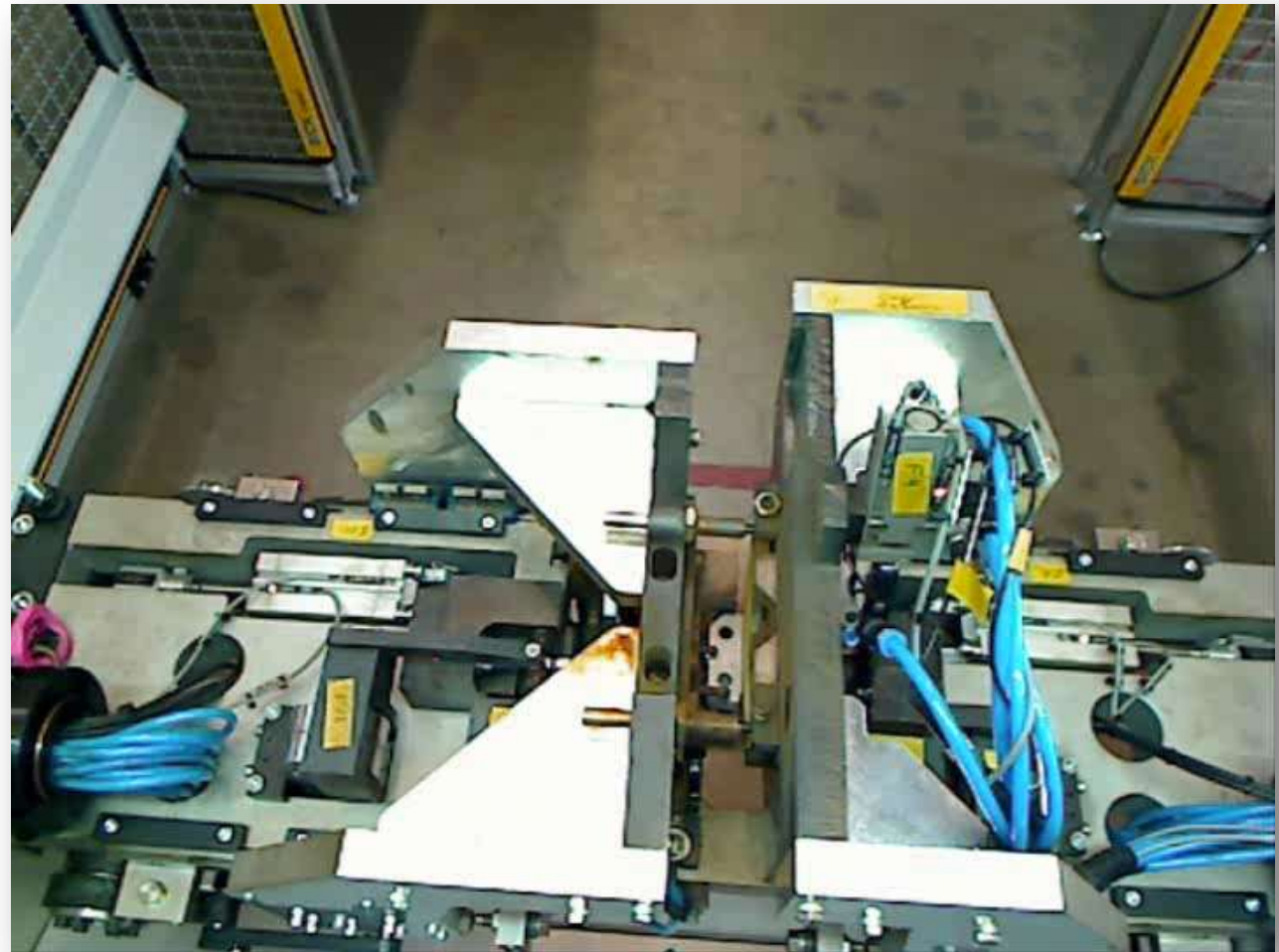


- Hybride kinematics: Laser robot + turn axis for workpiece (load capacity: 100 kg)
- Two welding stations on turn table (turn time < 2s)
- Manual loading of parts, in parallel to processing

“Robot-guided welding of shift forks” (Cycle time: 25s)

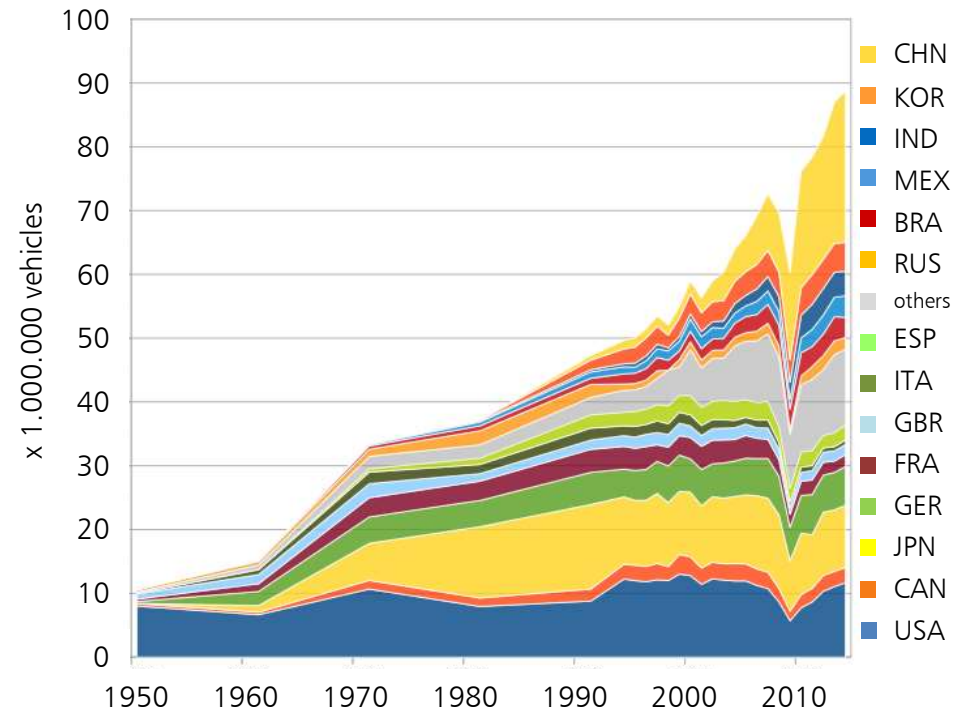


- 6 single parts
- 12 weld seams
- 1.6 Million pcs./year
- 4 variants





Source: webfound.com



Source: OCIA Statistics

Currently: 90 million vehicles are built per year!

“Any customer can have a car painted any color that he wants so long as it is black!” (H.Ford)



Production of Model T in 1924



Henry Ford (1919)

Standardized products manufactured in high volumes cause a decrease of unit costs.
-> In 1923 were 2.201.188 identical cars produced.

What do all this cars have in common?



Source: wikipedia.de

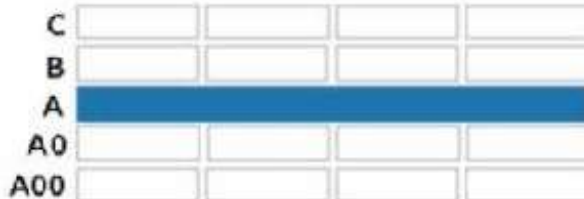
They are based on the same platform!

PLATFORM STRATEGY



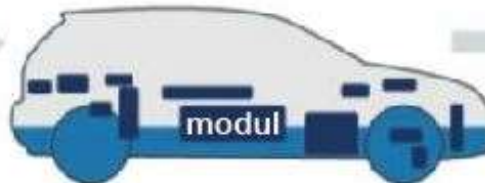
synergies just in
one vehicle class

vehicle classes

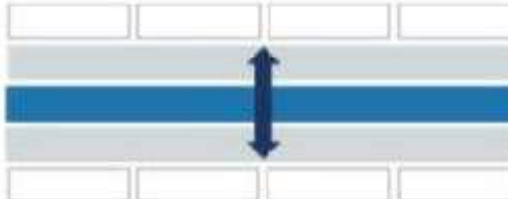


body shape

MODUL STRATEGY



synergies partially
across vehicle classes



body shape

MATRIX STRATEGY



synergies across
all vehicle classes



body shape

Source:



More than 40 models are based on MQB!

MQB characteristics:

- comprehensive worldwide standardized components and production technologies (e.g. gear box, steering system, ...)
- less all-over complexity, more flexibility, reduced weight
- technology of upper class models for volume models realizable
- long-term and worldwide volume and niche models are producible at competitive prices



Source: VW Autogramm,
Zeitschrift für VW-Mitarbeiter

Inside, all models are “black”!

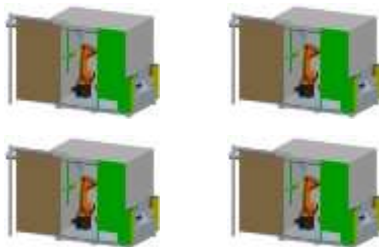
1.600.000 pieces/year



12 weld seams



4 machines sufficient!



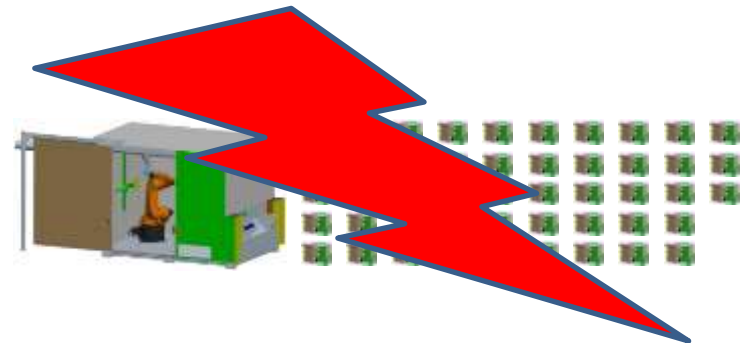
9.000.000 pieces/year!



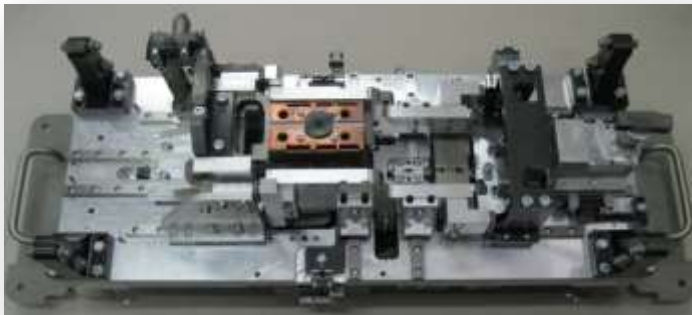
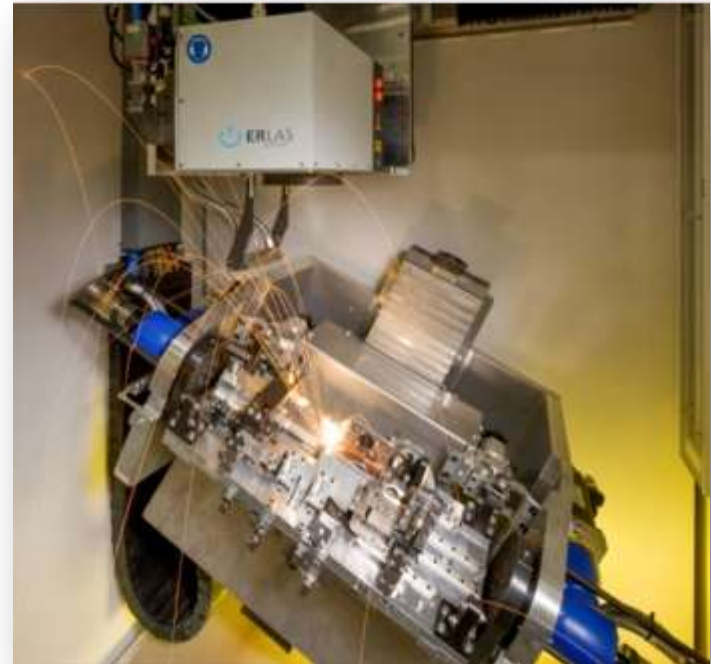
26 weld seams



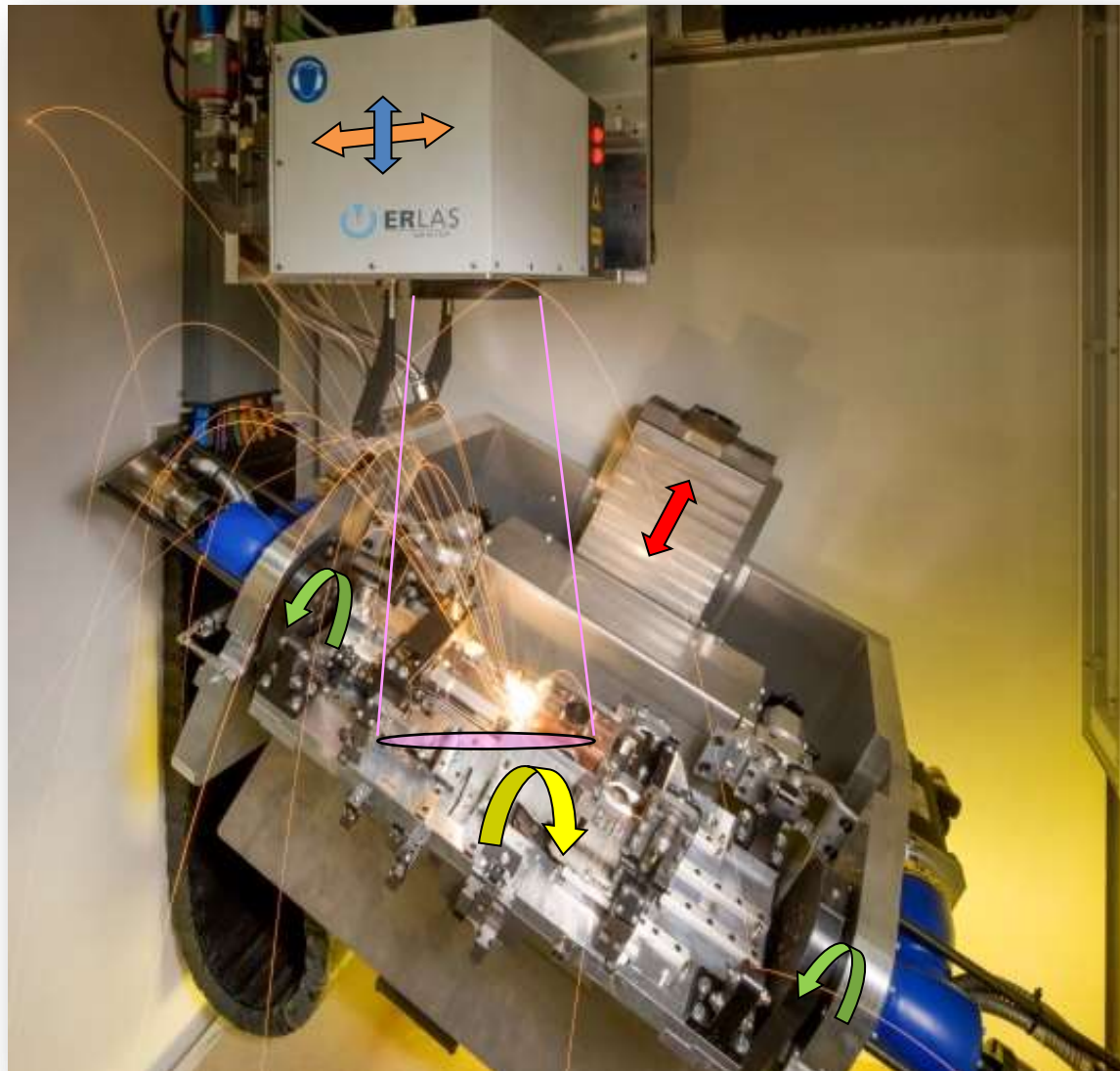
$$4 \text{ machines} \cdot \frac{9 \cdot 26}{1,6 \cdot 12} \approx 49 \text{ machines}$$



Welding with laser
scanner in a single setup



Preparation of complete
assembly in mobile
workpiece carrier



Scanner positioning

y-axis
500 mm

z-axis
400 mm

3D-Scanner

xy: 190 x 320 mm²
 Δz : +/- 70 mm
 $v_{\max} = 70$ m/min

Work-piece motion

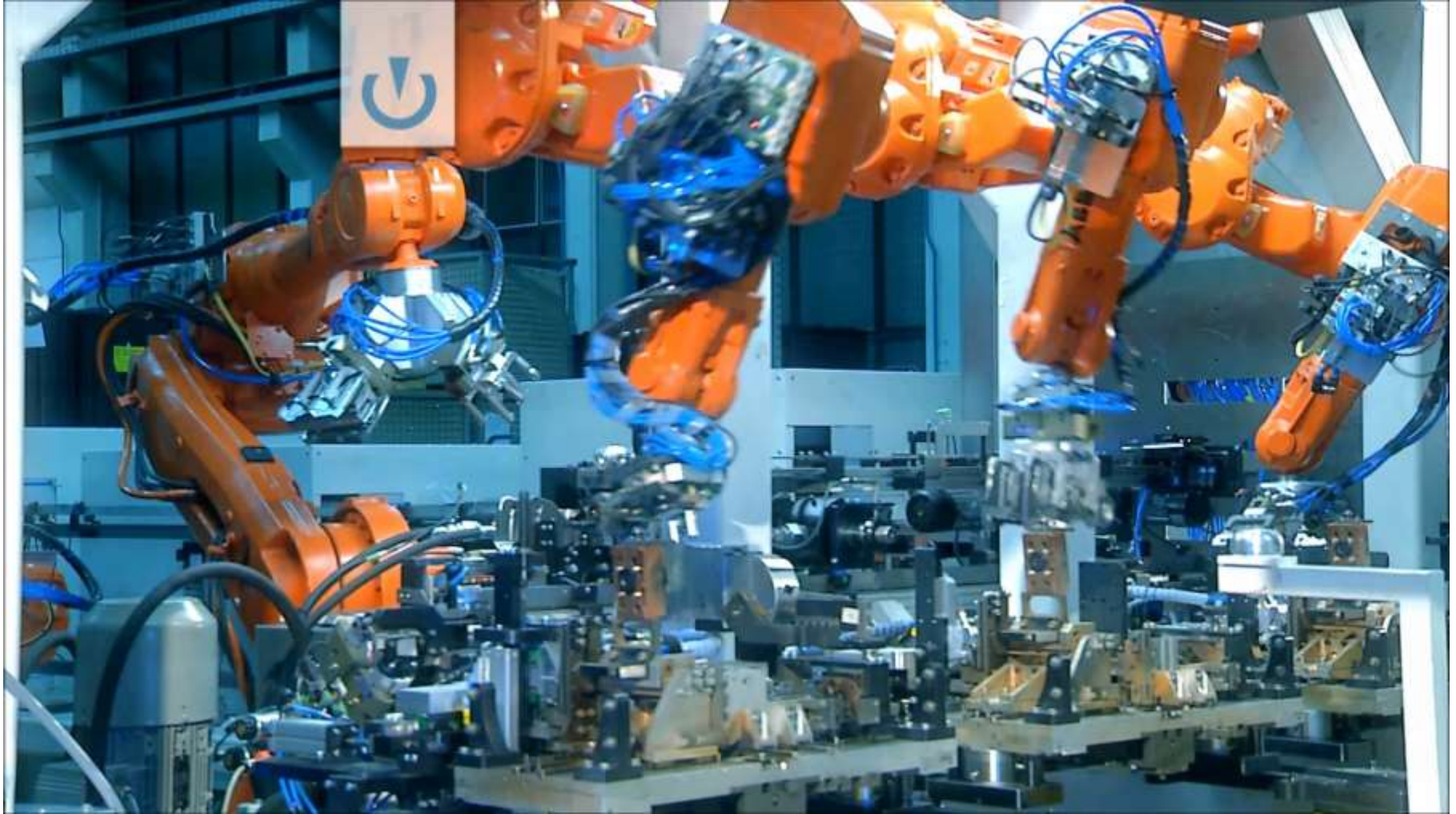
z-axis
280 mm

b-axis
+/- 360°

a-axis
+/- 75°

“Scanner-assisted welding of steering column brackets” (Cycle time: 9.5s)







- Novel machine concept for high speed remote welding with 3D scanner
- Two welding cells with additional axes for work-piece orientation
- Ten mobile workpiece carriers for the preparation of assemblies in parallel to laser welding
- Seven articulated robots for handling and feeding of child parts
- 54 numerical controlled axes, synchronized via leading axis technology
- Almost 2 Million pieces per year/machine



Differences in comparison to automatic loading

- Significantly lower purchase price
- Cycle time > 14 s
- Output controllable by number of operators





“Almost any one can think up an idea.
The thing that counts is
developing it into a practical product!”

Henry Ford

THANKS FOR YOUR ATTENTION!

