Container Glass Forming in 2020/25

The dark factory

XPARvision

heading for perfection

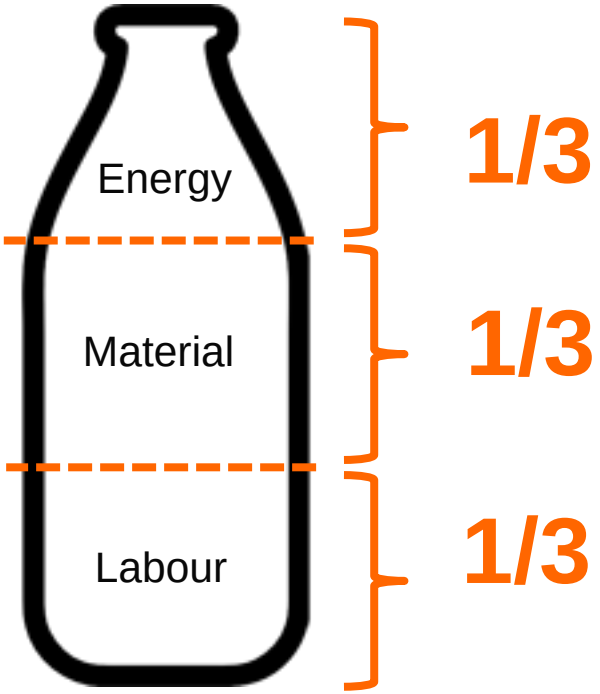
Dark Factory

- A Dark Factory is fully automated shop floor.
- It is dark, because there are no human beings

What are the drivers for a Dark Factory?

DRIVERS : REDUCE COST & INCREASE QUALITY

COST OF MAKING OF A BOTTLE

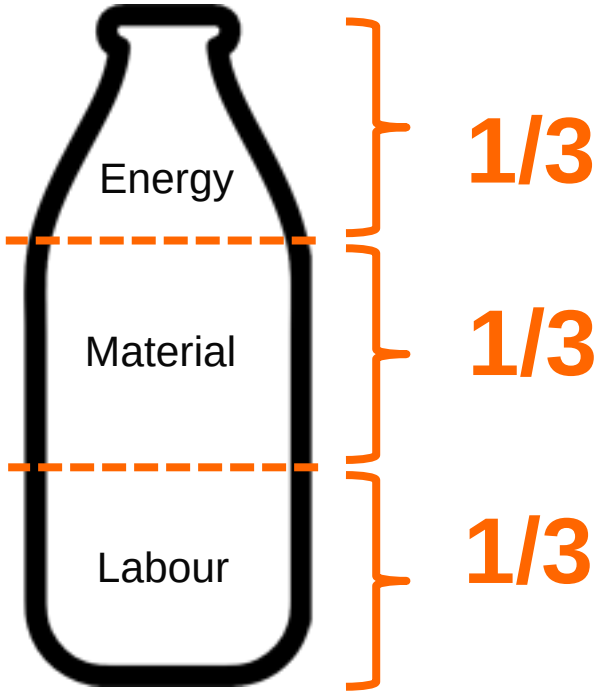


Alternatives

- Plastic, Aluminium, PET
- Cheap, flexible, light

Glass manufacturers need to improve quality, reduce costs, increase flexibility

COST OF MAKING OF A BOTTLE



Energy and Material costs are 50% related to the weight of bottle

COST: Energy & Material

Bottles are nowadays 50 .. 100% too heavy

- **Relative glass thickness fluctuations in the same section plane of different, randomly taken glass bottles**

green:	39 %
brown:	39 %
white:	32 %
brown-green:	48 %

20..30%

- Prof. Dr.-Ing. H. Hessenkemper, Glas- und Emailtechnik (TU Bergakademie Freiberg)

COST: Energy, Material

- Glass forming process efficiency is low:

  80 .. 90 %

- Glass forming is of low quality:

  Many defects, which are mostly **process** related

COST: Hot End Labor

- Glass forming process is not stable:

- Complex, very dependent on know-how people
- Many unknown variables (cullet, ambient temperature, redox, viscosity,……)
- Needs lot of attention (repeatability, instability)
- Wear and deterioration
- Material change
- Manual Swabbing

Dark Factory: huge cost reduction

- Example
- increasing efficiency 10%=>reducing energy cost 5%
- Lower cost HE labor by 60 %
- Reducing weight 30% -> reducing energy 15%
- And reducing material cost by 15%

Is a Dark Factory feasible?

- What is needed?
- Stable process with a predictable quality

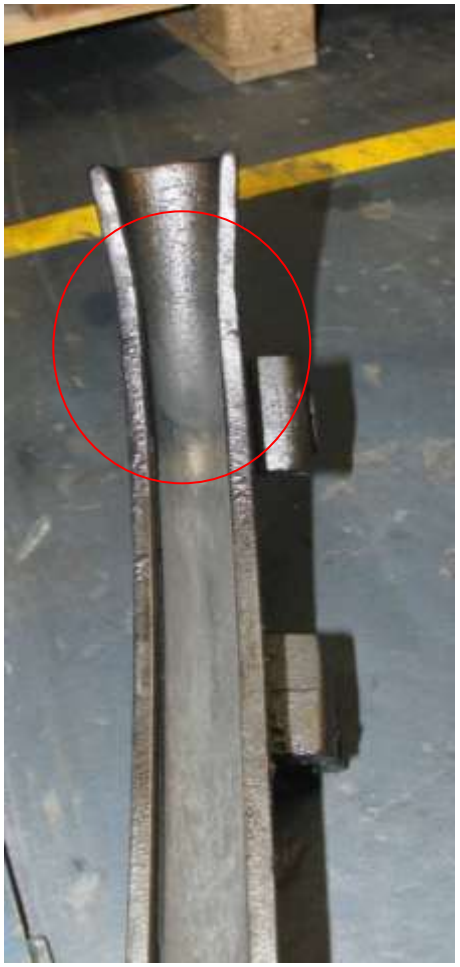
Instability glass process

- Main reasons for instability of glass forming process :
  wear and deterioration of the material:

- Examples:
  - Gob forming (tube, orifice, shears, ..)
  - Gob loading (alignment, through, deflector)
  - Blank/Blow Molds Coating
  - Conveyor belt

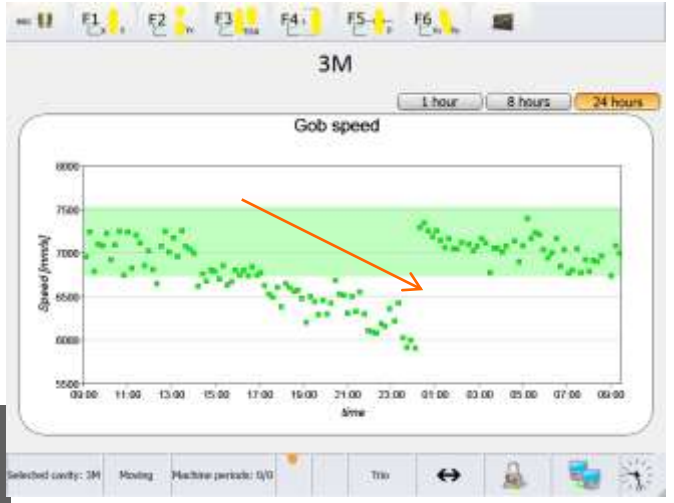
Wear and deterioration example:

Deflector



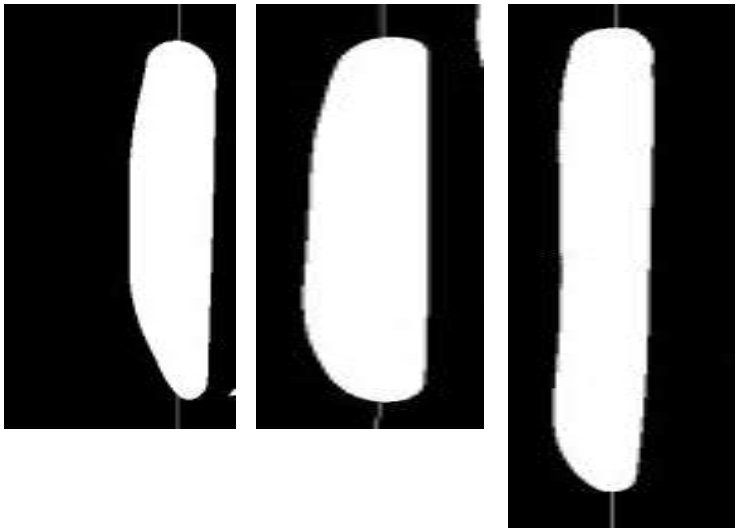
- Normally a coating is used in the deflector.
- This coating wears out after a while and more and more friction will appear in this area.
- When the gob meets more friction it will start to deform:
  - Length shorter
  - Increased diameter
  - Shape will deviate more from a cylindrical gob
  - Speed decreases
  - Cause of many defects

Gob Assist: Cavity 3M 15-07 00:15



Due to higher friction in delivery

Gobs gets shorter and the diameters increases

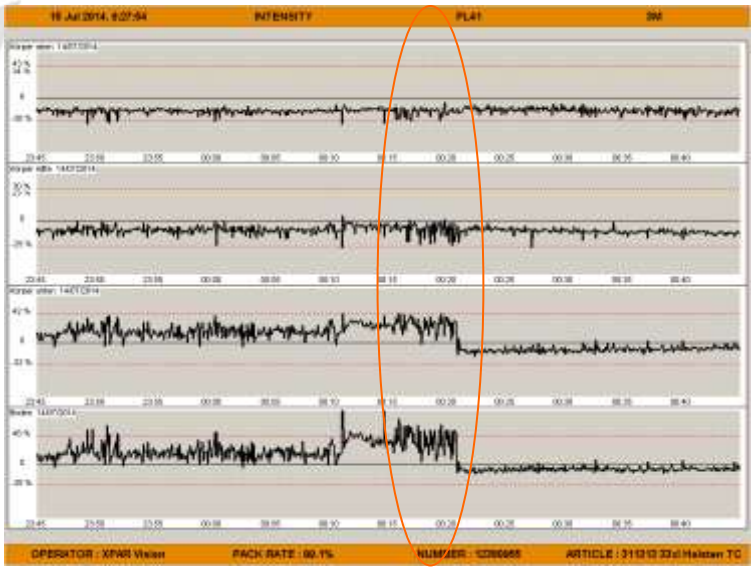


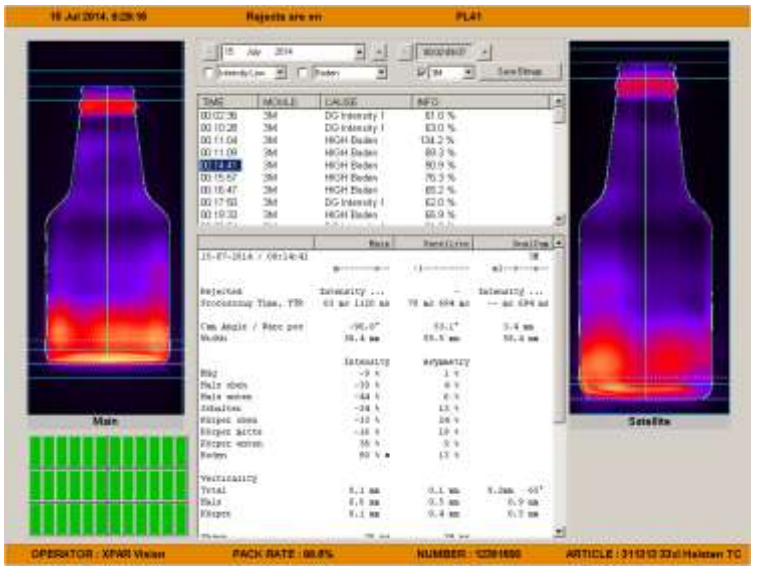
At gob cut shape of gobs might look equal…

…but length, shape and diameter can be different when loading into the blank…

…due to friction in the delivery system

IR-D: Cavity 3M 15-07 00:15



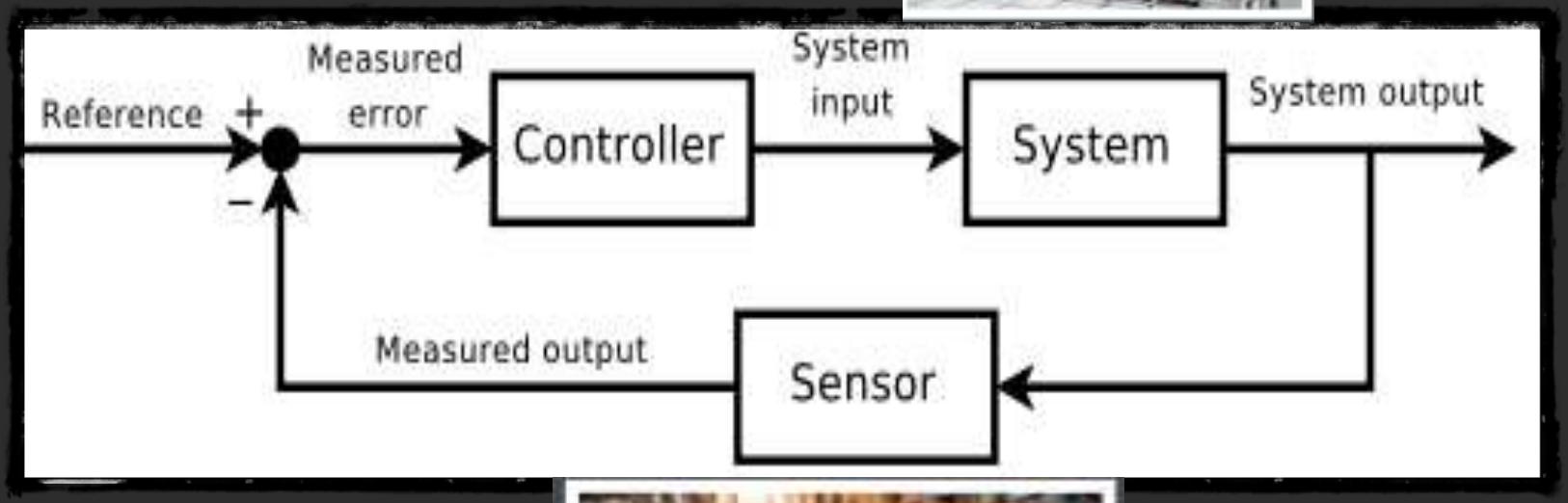


Due to the shorter length the glass distribution changes.

How to stabilize the glass forming process?

- Sensors
- Automated control loops

Example of a automated control loop



The BoX has two automated control loops

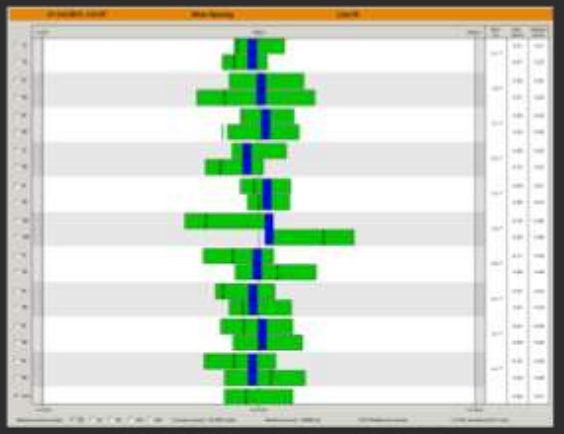
Automatic Ware Spacing control

Automatic Vertical Glass Distribution control

Ware Spacing Control Module

Goal: achieve optimal and stable spacing between all bottles

Without BoX



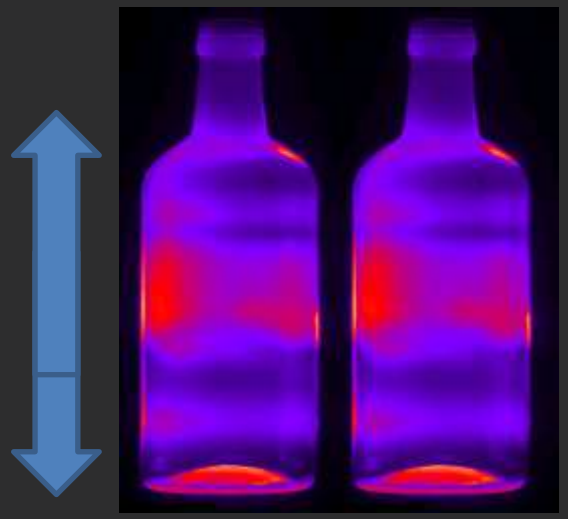
With BoX

Goals of VGD control

Vertical Distribution Control Module

The BoX controls and maintains the vertical glass distribution under continuously changing operational conditions such as environment and production process fluctuations:

- Feeder temperature & pull changes
- Glass conditions changes
- Ambient temperature changes
- Blank heat transfer changes (new Blank)
- Blank swabbing
- Section stop/start



Section 2


Esc
F1
F2
F3
F4
F5
F6
Glass Distribution
READY
giu-8
giu-9
yesterday
1 hour
8 hours
24 hours
Glass Distribution Section 2
GD Setpoint
GD Average
GD Inner Gob
GD Outer Gob
Set
1
3
4
5
6
7
8
9
10
Line 33

Is a Dark Factory feasible?

What is needed?

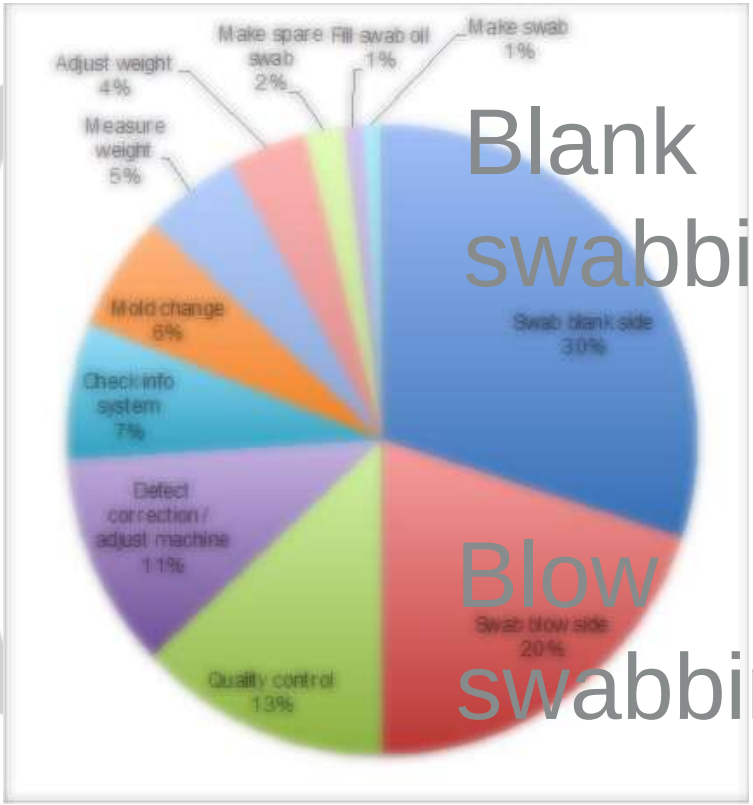
- Automated loops:
  - Ware spacing
  - Glass distribution
  - Gob Forming
  - Gob loading

Is a Dark Factory feasible?

What is needed?

- Automated loops
- Robots:
  - Swabbing
  - Materials change
  - Job Change

Time distribution operator



Time distribution tasks hot end operator

- Robots and smart sensors will replace (most) functions of the hot end operator
- Leading to better output
- Reducing the operational costs (TCO)

Critical step towards the Dark Factory

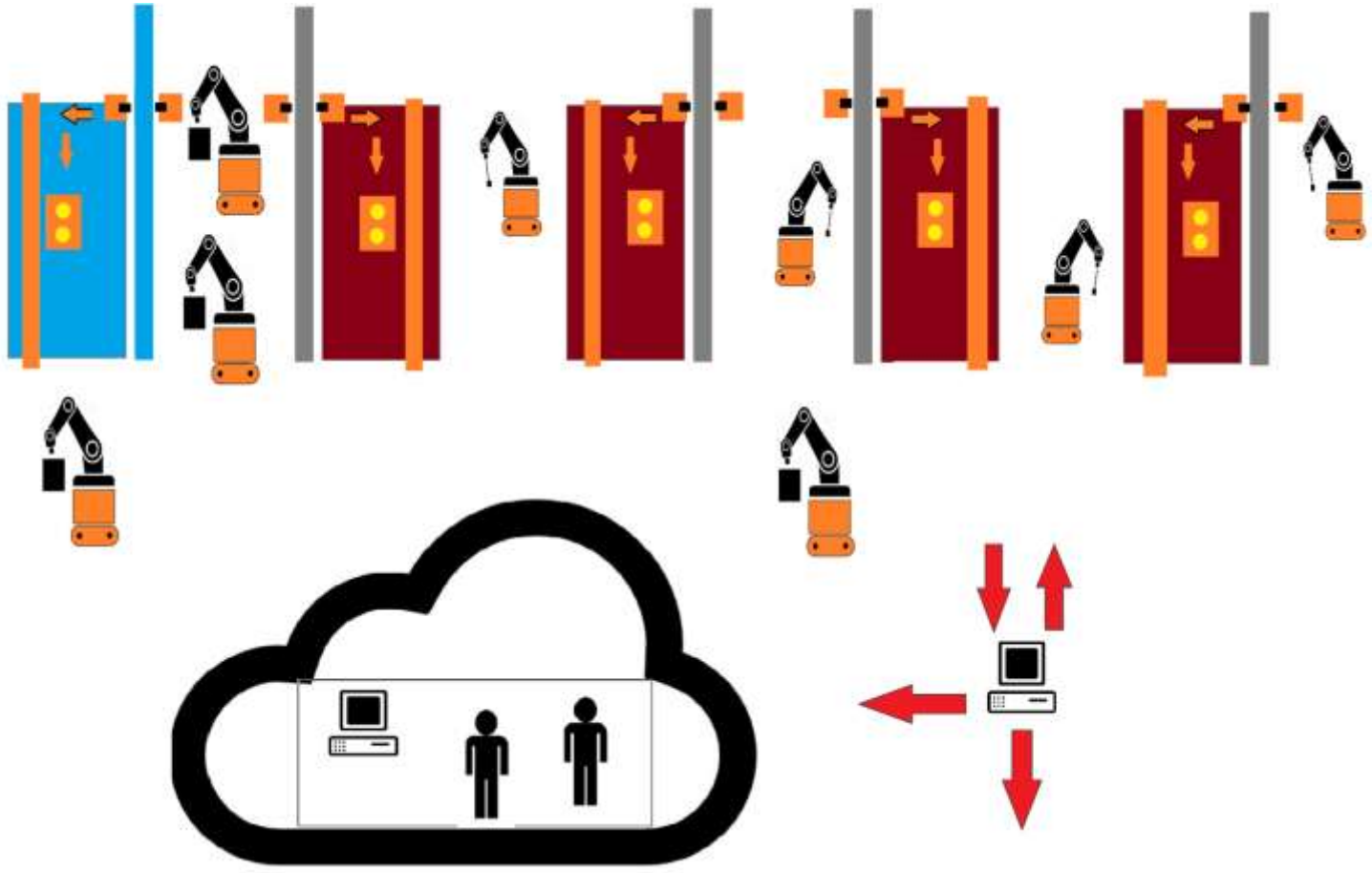
Hot end robotized (blank) swabbing

- Constant swabbing
- Uniformity of swabbing into moulds
- Reduced graphite oil consumption
- Decrease defects due to swabbing
- Decrease operator exposure to smoke, noise and danger
- Reduce workload

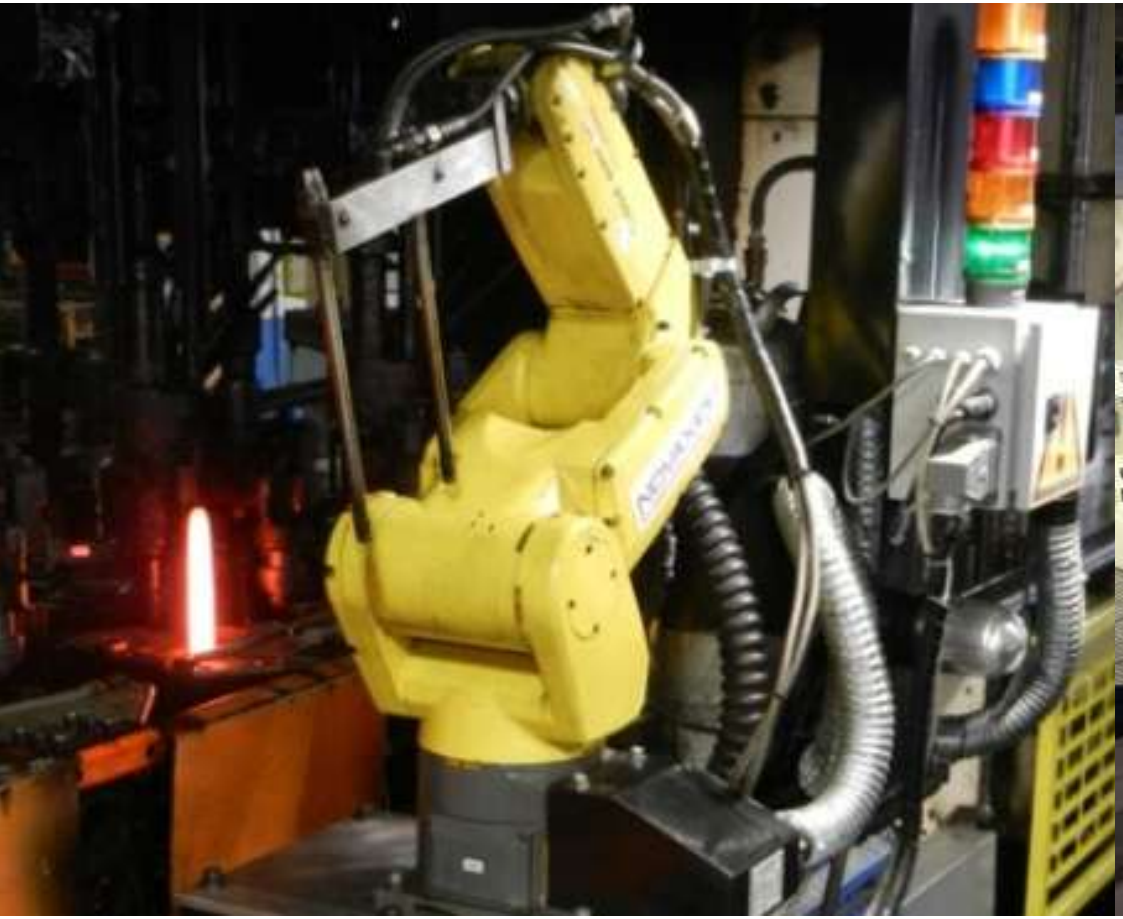
Next steps

- More (good) sensors, automated control loops, robot functions
- Integration of systems
- Smart use of data: more know how forming process
- Smart swabbing: use avaible sensor data
- Universal database platform for all (furnace, feeder, machine, hot end sensors/loops, cold end sensors)
- Robot friendly IS-machine!

Ultimate goal: dark factory



Thank you for your attention



www.xpanvision.com

Bright ideas. Better glass.

xpanvision

moulding for perfection