

Glass: sustainability and competitiveness

Forming process stability



AFGM, Yogyakarta, September 2018

xparvision
heADING for perfection

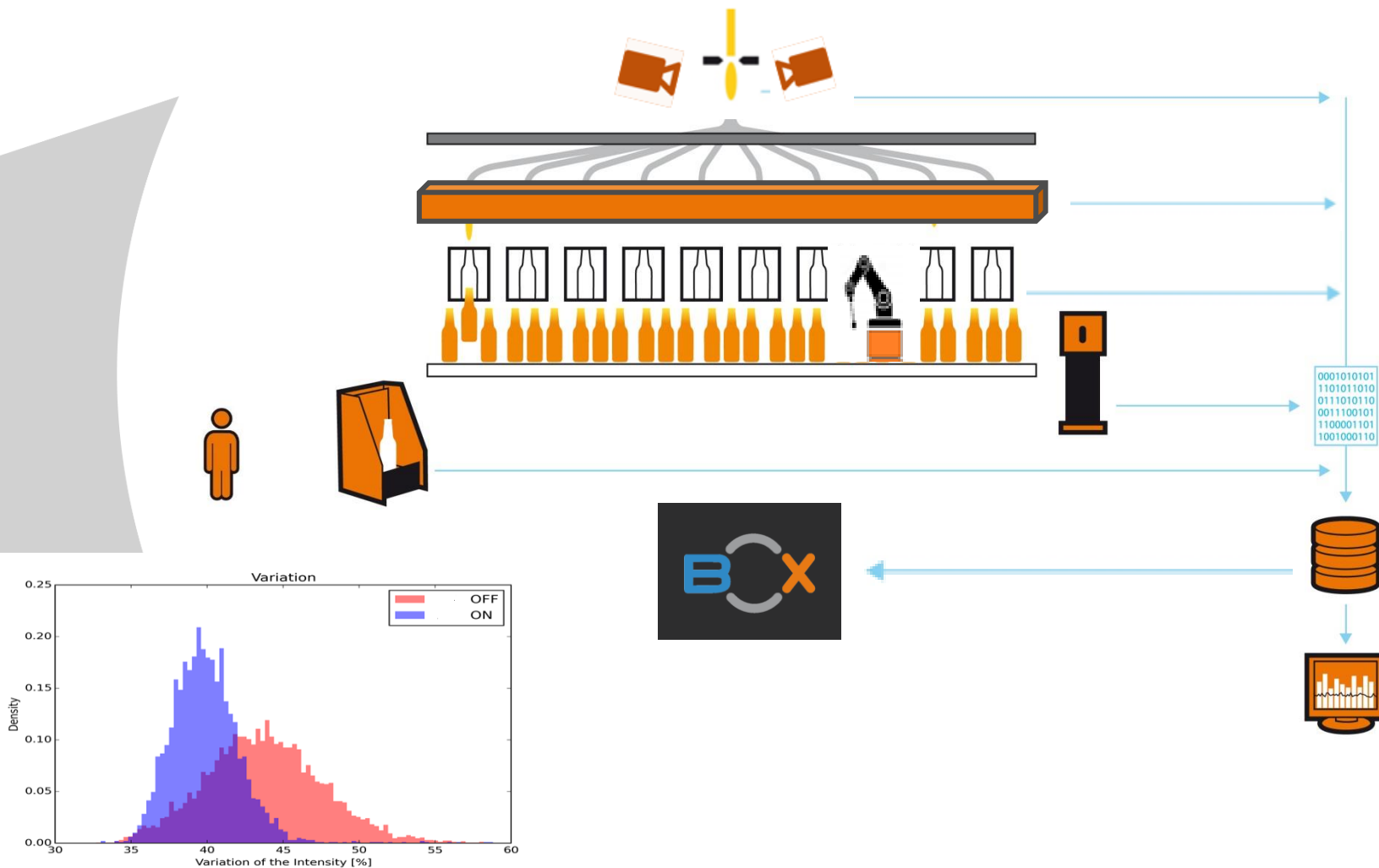
20 years track record of innovating the glass forming process

- 1999 Foundation XPAR Vision
- Focus
 - Container glass industry
 - Hot end production
 - One product → inspection and process monitoring
- Focus 2018
 - Container glass and table ware industry
 - Hot end production
 - Product portfolio of sensors & robotics → (inspection & process monitoring), process improvement, quality control & automation



Product portfolio of sensors & robotics

Process improvement, quality control & automation



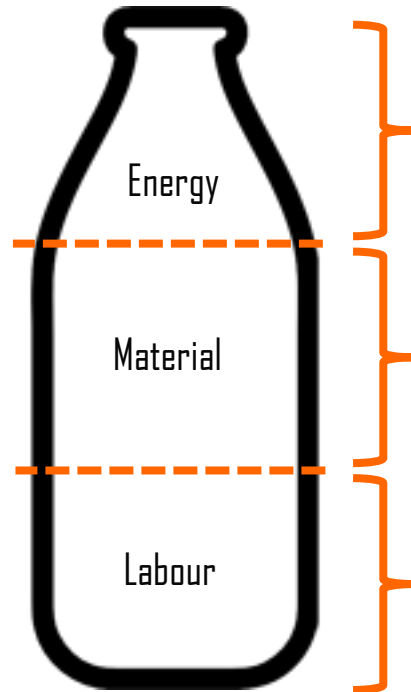
Glass forming today

Hot end pack most important

Sustainability

- Environmental (waste/energy/carbon)
- Social (labour conditions)

Cost



Characteristics

- **Efficiency low: 85-90%**
- Quality to customer < 100%
- Many unknown variables
- **No/slow (quality) feedback loop**
- **Forming highly human dependent**
- **Labour is aging, experience disappears**
- **Health/safety is a concern**
- Flexibility is low
- **Containers are too heavy (40%)**
- Speed of production too low

Alternatives

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



Huge potential for efficiency/quality & weight/speed

Glass forming today

Containers are (designed to be) 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 %

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

Example:

Beer bottle, customer spec. = min. thickness shoulder/body/heel 1 mm.

Beer bottle, design spec. = 1.8-1.9 mm thickness

...to compensate for forming process variations

Glass industry: level of forming process control is very low

Many process disturbances causing process variations...

- Cullet
- Batch/homogeneity
- Viscosity/temperature/homogeneity
- Feeder pull
- Ambient temperature
- Deterioration/wear
- Material change
- Operator change
- Stop/start
- **Swabbing**
- Gob condition (weight/shape/temperature) variation
- Loading variation
- Temperature variation
- Bottle variation/defects

...and...

Glass industry: level of forming process control is very low

...and...

- ...forming machines are getting bigger
- ...factual information in real time of gob condition, loading variation, temperature variation and bottle variation is hardly available
- ...customers continuously ask for better quality and lower carbon footprint
- ...workforce is aging, knowledge and experience are disappearing with every retiring employee

...it is time to change!...automation is required...

- Reduce disturbances
- Deal with disturbances: (re) actions manually, by automation or by robotics

Process stability is the key towards optimization, automation is required

Huge savings potential!

Lighter and stronger containers.....
produced with (almost) zero defects.....
at higher speed....
with minimal human dependency.

Sensors and automation

What is available today?

Sensors

Bottle/cavity variations

- Inspection
- Container geometry
- Glass distribution
- Position on belt/stuckware/downware

Gob loading variations

- Speed/Length
- Time of arrival
- Position
- Shape

Temperature variations

- Mould
- Plunger
- Neck Ring
- Parison

Gob Forming

- Temperature
- Shape
- Weight

Automation

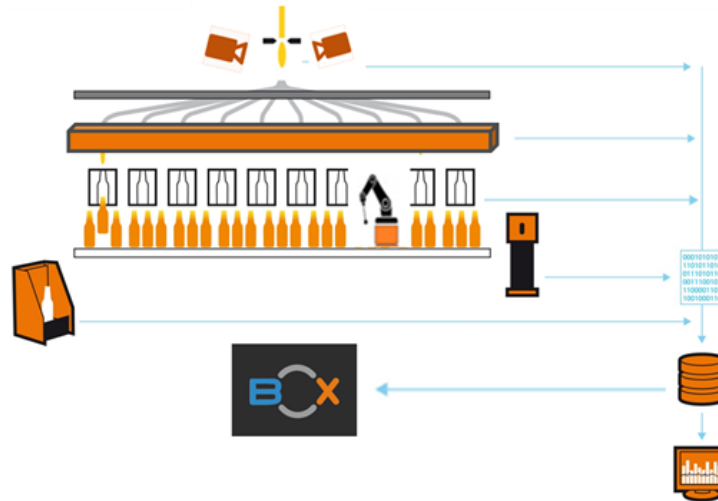
Gob weight control

Ware spacing control

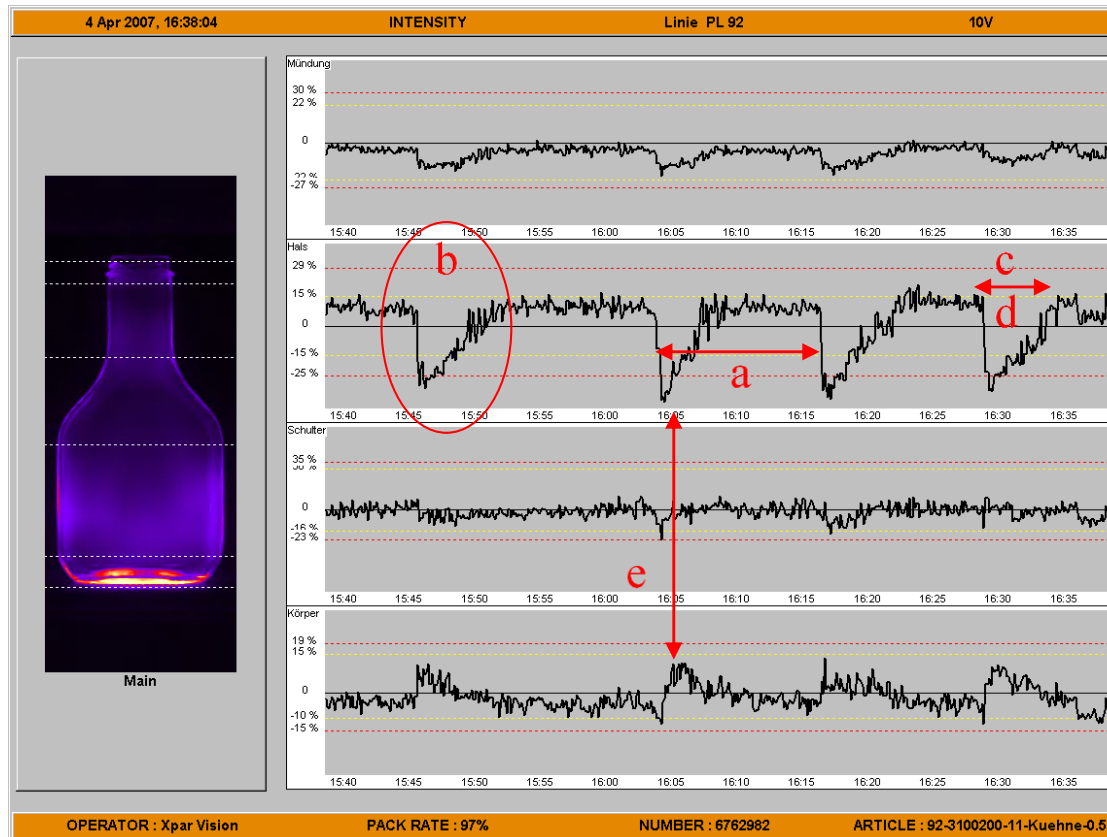
Mould temperature control

(Plunger) process control

Vertical glass distribution control



...limited by huge process disturbance due to swabbing



example shows:

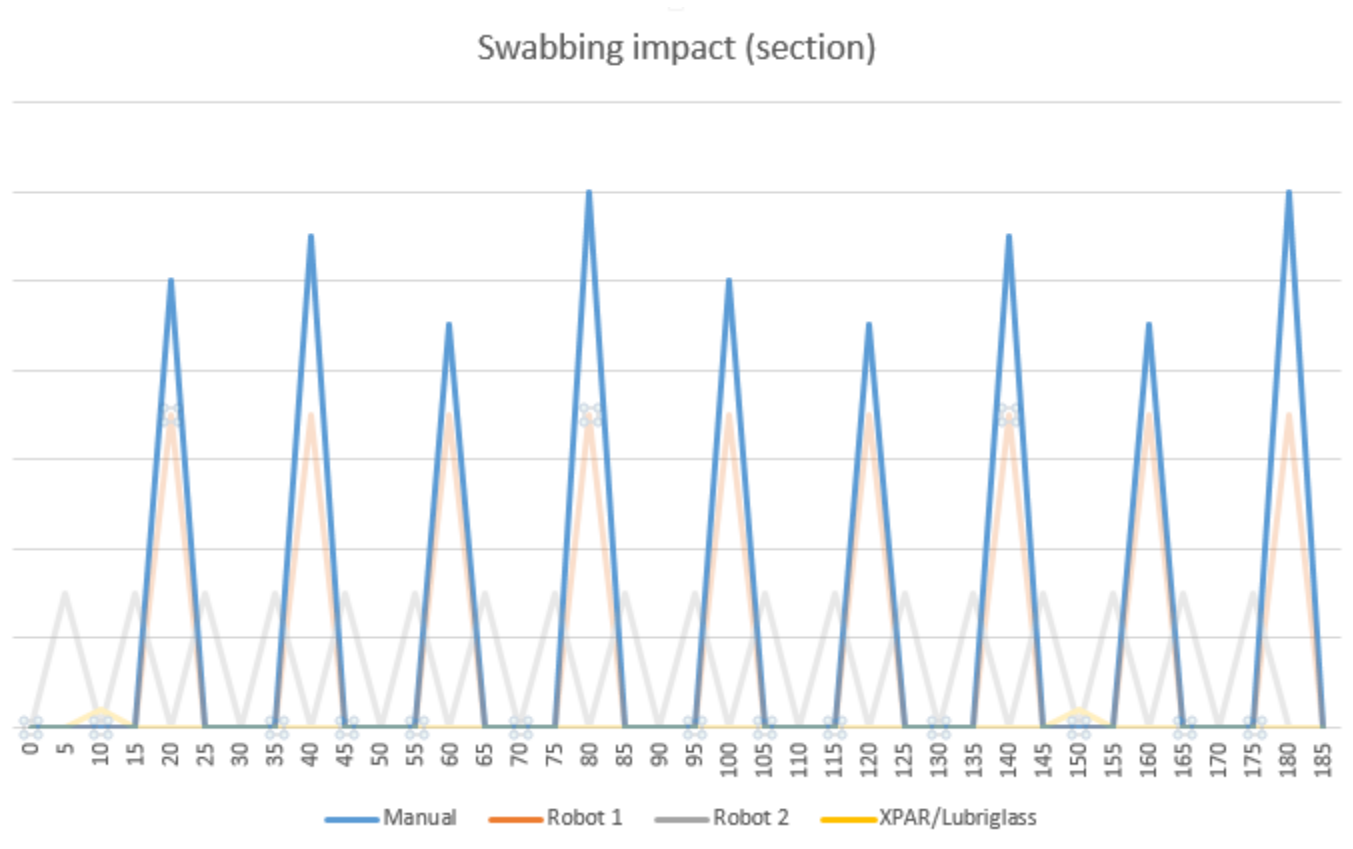
- (a) frequency,
- (b) the impact,
- (c) how long it takes before the process stabilized again,
- (d) how many bottles are affected or should be rejected,
- (e) what is the effect for the glass distribution in the bottle.

Minimize swabbing disturbance

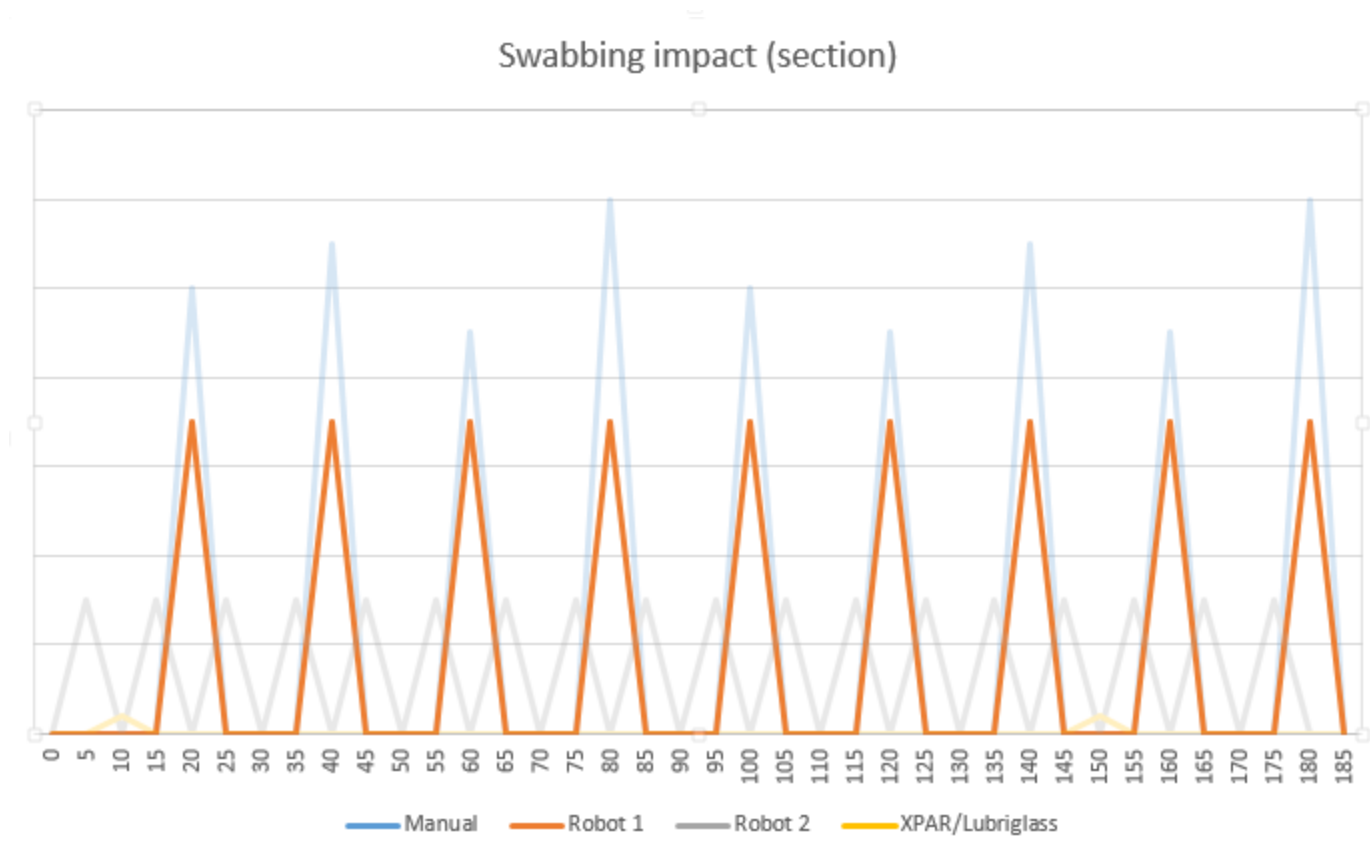
Blank side swabbing today

- Huge process disturbance due to manual swabbing limits the effect of sensors and automation
- Current automatic robot swabbing is simply converting manual into automatic
- Current automatic robot swabbing (once per 5 – 20 minutes) limits machine accessibility

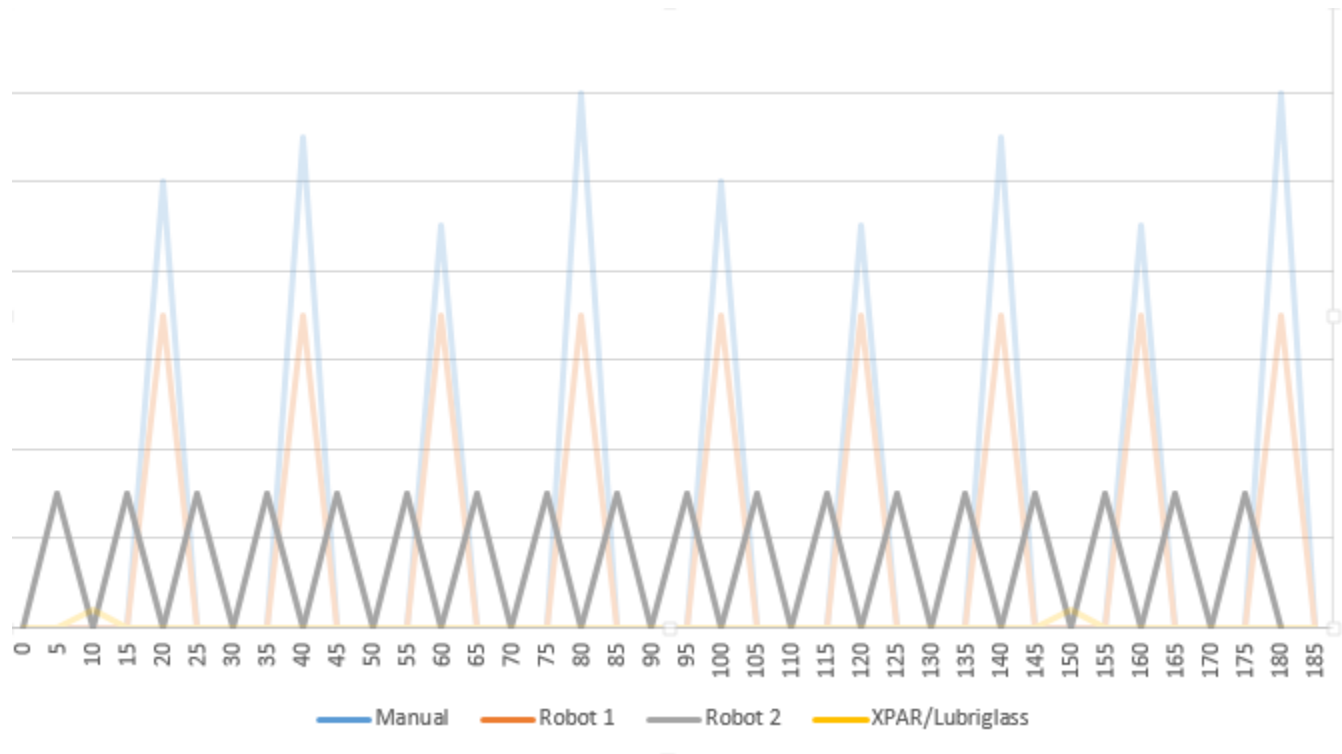
Swabbing method: impact vs. interval



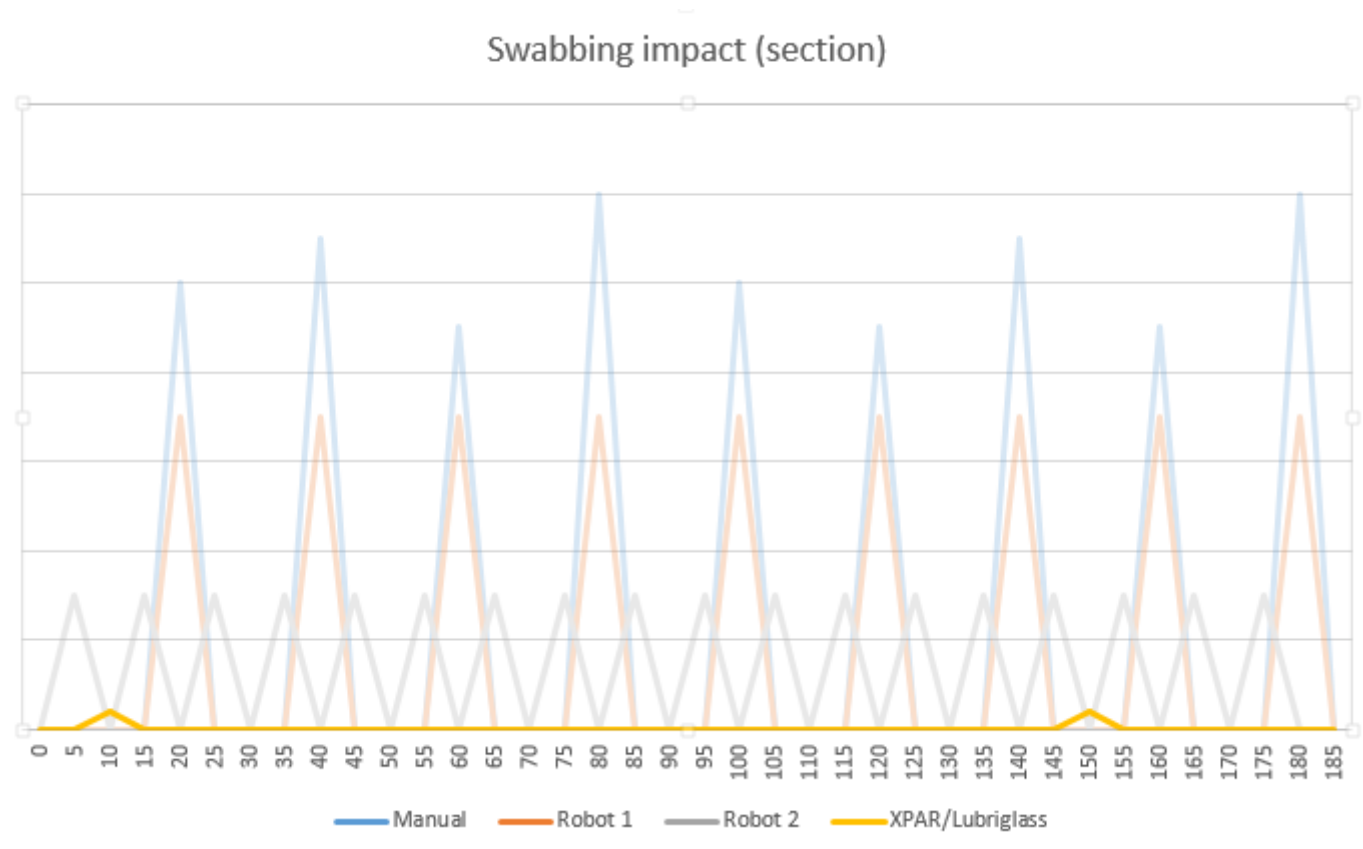
Swabbing method: impact vs. interval



Swabbing method: impact vs. interval



Swabbing method: impact vs. interval



...ultra low frequency & impact blank side swabbing

Minimize swabbing disturbance

Ultra low frequency & impact swabbing

- Exclusive cooperation LubriGlass
- Patented lubricant
- Very accurate & controlled robotized swabbing
- Very small amounts of lubricant
- > 3 hours swabbing period
- Hardly any impact



Concept partners



- New lubricant (LG/LGL)
- Unique composition
- Less is more
- Minimal impact to forming process



- Blank Robot for swabbing
- Sensors for feedback
- Integration of data
- Process optimization

Exclusive partners!

Ultra low frequency & impact swabbing

- ✓ Limited lubricant consumption
- ✓ No pollution → safety & health
- ✓ No disturbance glass forming process
- ✓ Reduced badly affected bottles due to swabbing
- ✓ Increased lifetime of (mould) material
- ✓ More time for operator
- ✓ Robot has time to do more ...!!





Additional robot functions:

- ✓ Automatic alignment of delivery
- ✓ In-section diagnoses (visual and thermal)
- ✓

“Blank Robot is a revolutionary step towards full forming process control”

Very small amounts of lubricant

Blank Robot – Oil consumption

100%



Manual

25%



Current Swabbing Robot

1%

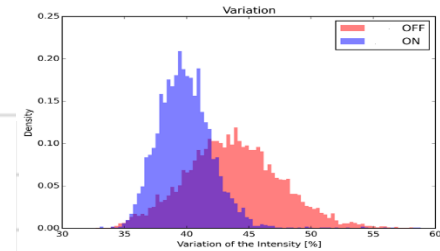
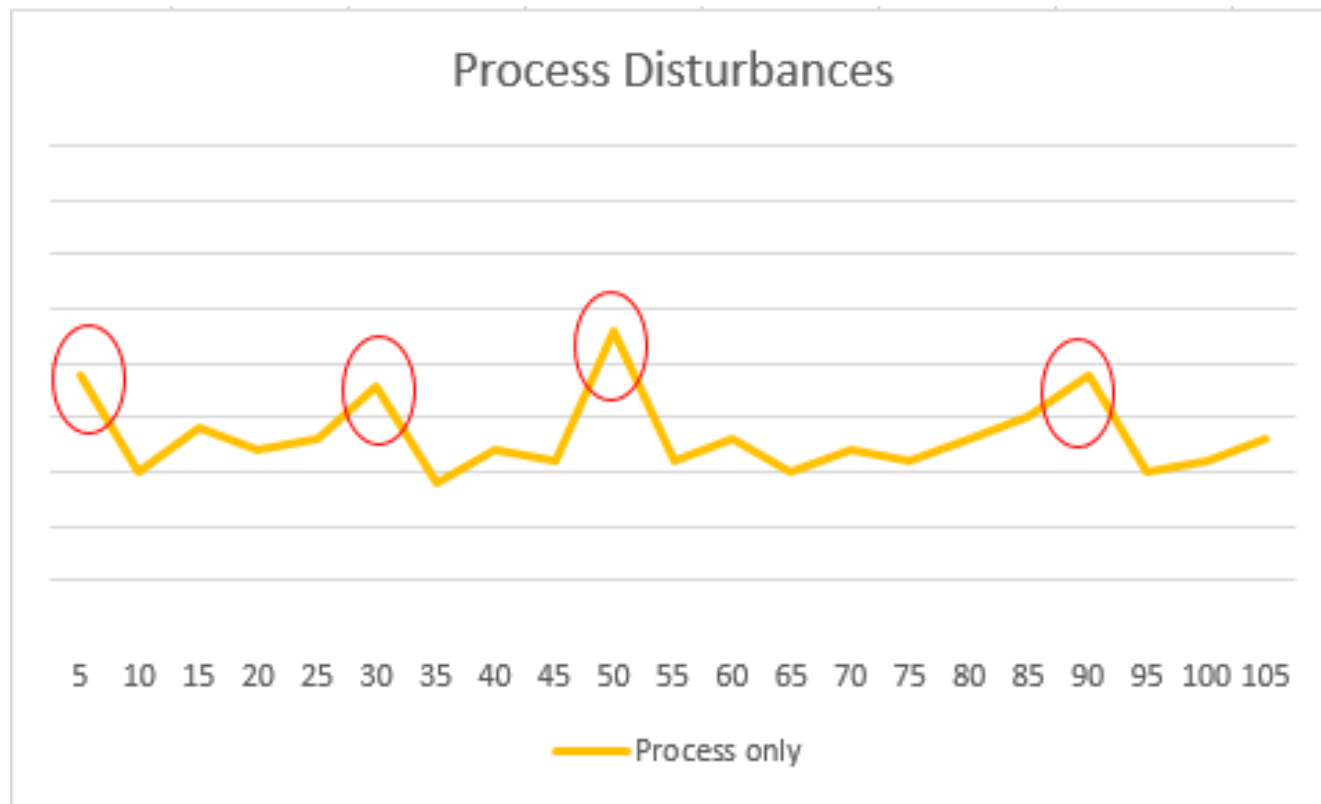


Blank Robot

- ✓ No spillage
- ✓ No pollution
- ✓ Health and Safety
- ✓ Clean IS Machine

Sensors and automation: impact

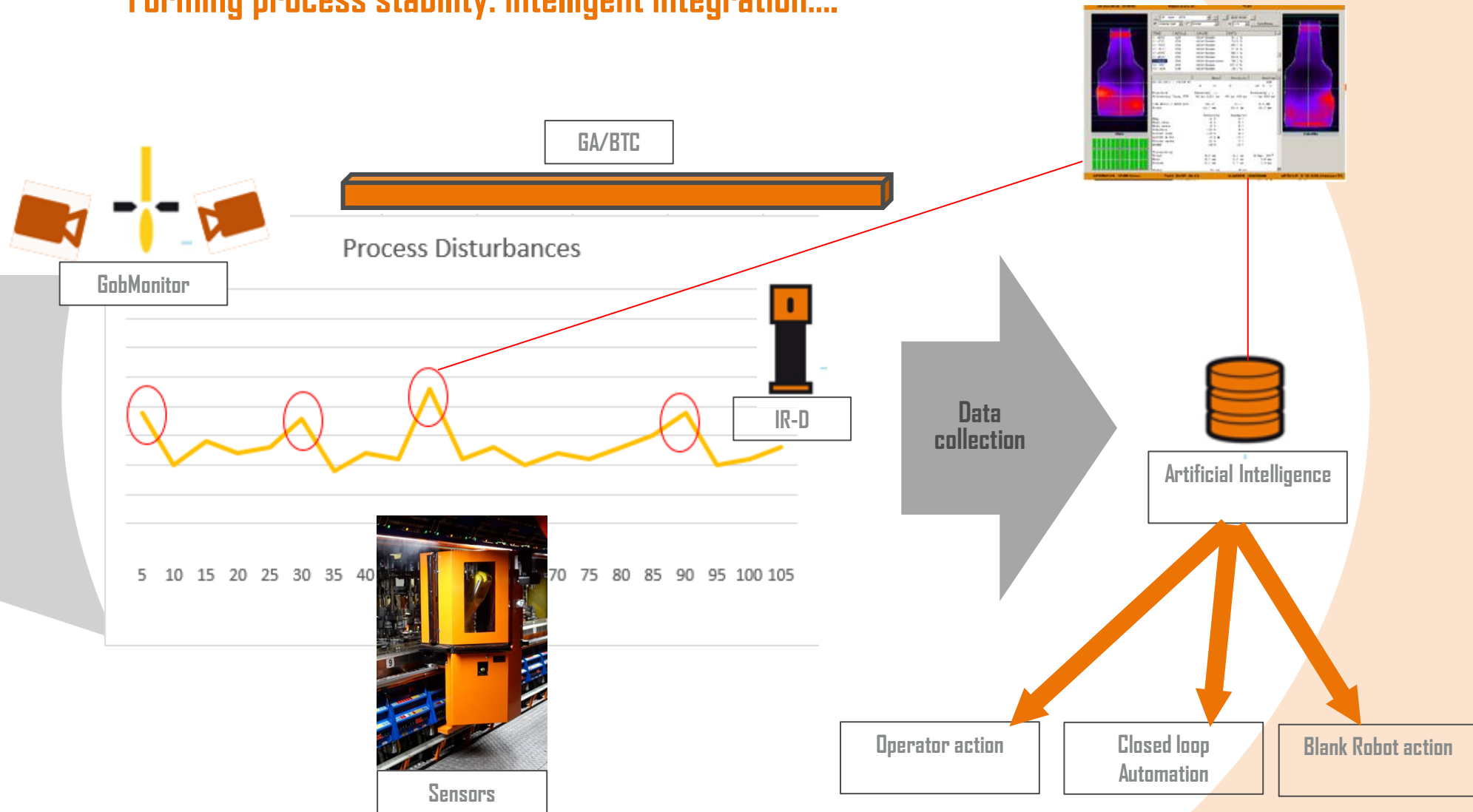
Forming process stability: efficiency/quality, weight/speed...



...when eliminating the (huge) process disturbance due to swabbing

Sensors and intelligence

Forming process stability: intelligent integration....



Full forming process control

Potential for improvement is huge

Lighter and stronger containers, produced with zero defects at higher speed, with minimal human dependency



Spot the difference...



Bright ideas. Better glass.

