A new world of glass making

Lighter and stronger…

Paul Schreuders, Cebu Philippines, October 2019

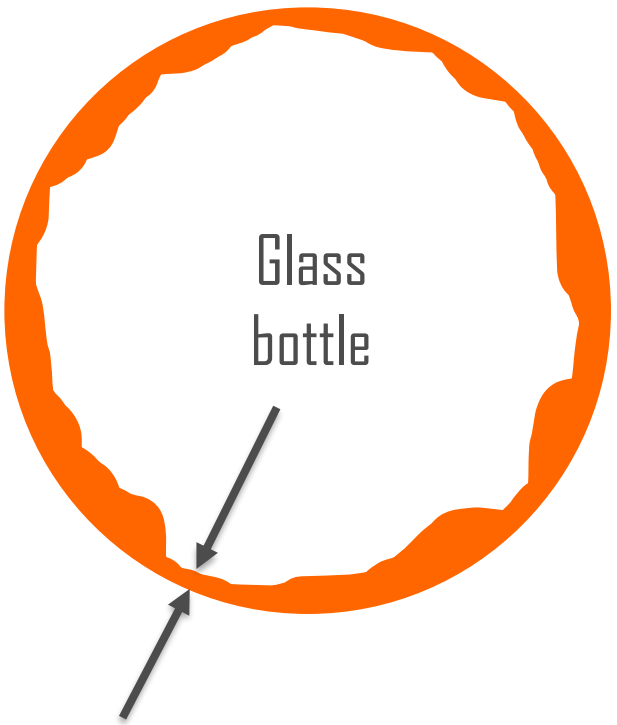
xparvision
heading for perfection

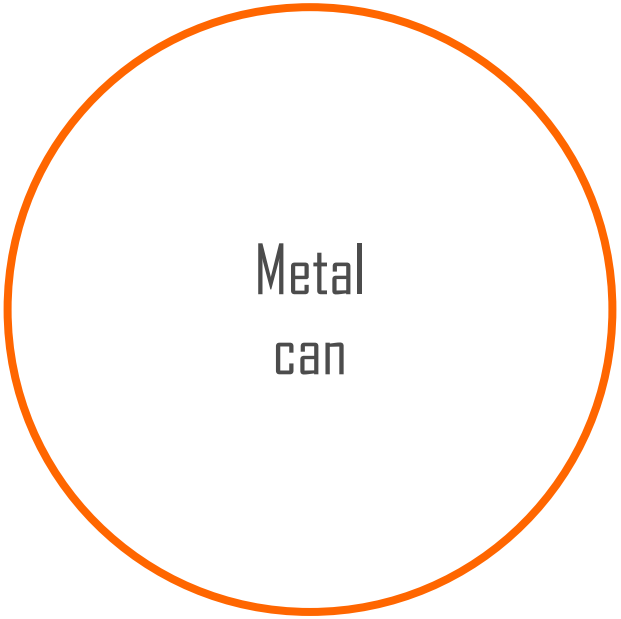
Question!

Glass is stronger then metal,

but why is a can much lighter than glass?

Answer





Two factors: material & (forming) process

Variation in glass wall thickness due to variation in glass forming process

Variation in glass forming process

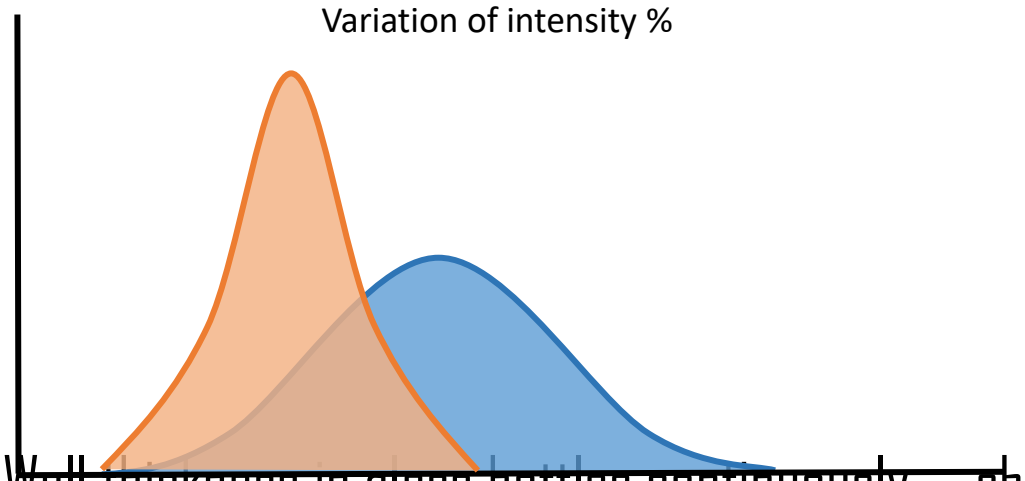
- Variation due to
  - Cullet quality
  - Glass homogeneity
  - Glass viscosity
  - Ambient temperature

  - (Manual) Swabbing
  - Wear – when to change materials (moulds; delivery; etc.)

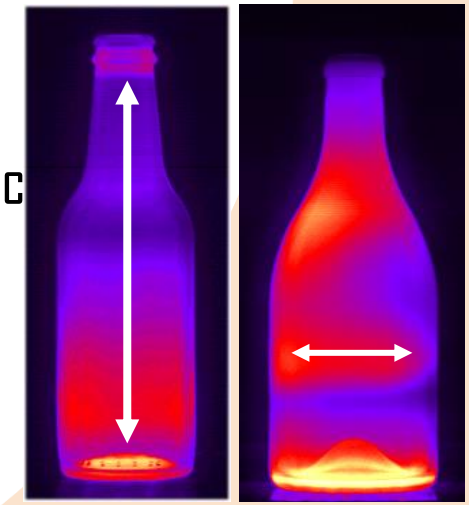
  - Know-how / experience: design blanks, setup process, control process (mainly manual)
  - Open loops (drifts)
  - Lack of factual information on critical process steps

Variation in glass forming process

- We deal with this variation by using more glass (NNPB: 1.8; BB: 2.3)

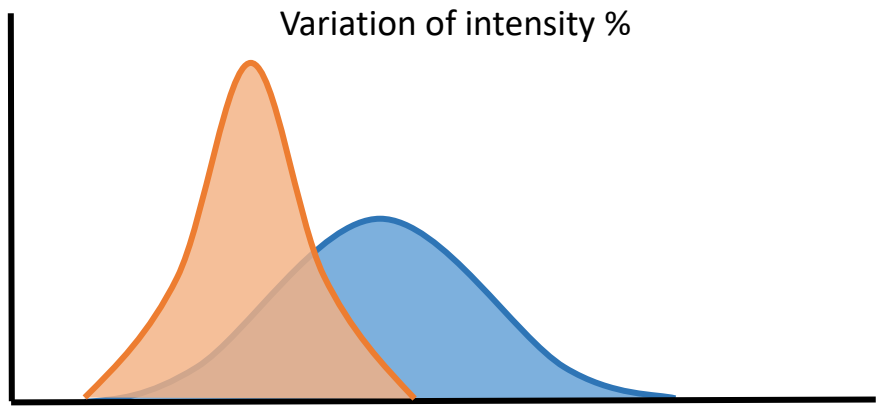


- Wall thickness in glass bottles continuously shifts both vertic and horizontally



Variation in glass forming process

- We should deal with this variation by
  - Reducing variation
  - Managing variation professionally and at Industry 4.0 level



- Wall thickness in glass bottles is less shifting = more constant glass distribution = less defects

Defects are process related

A glass forming process **in control** gives **no (critical) defects**!

A glass forming **out of control** gives **(critical) defects**!

"Defect-demons" do not exist

Defects are really preventable

Huge gains

Lighter and stronger containers...
produced with zero defects...
at higher speed...
with minimum human dependency

Sustainability

Competitiveness

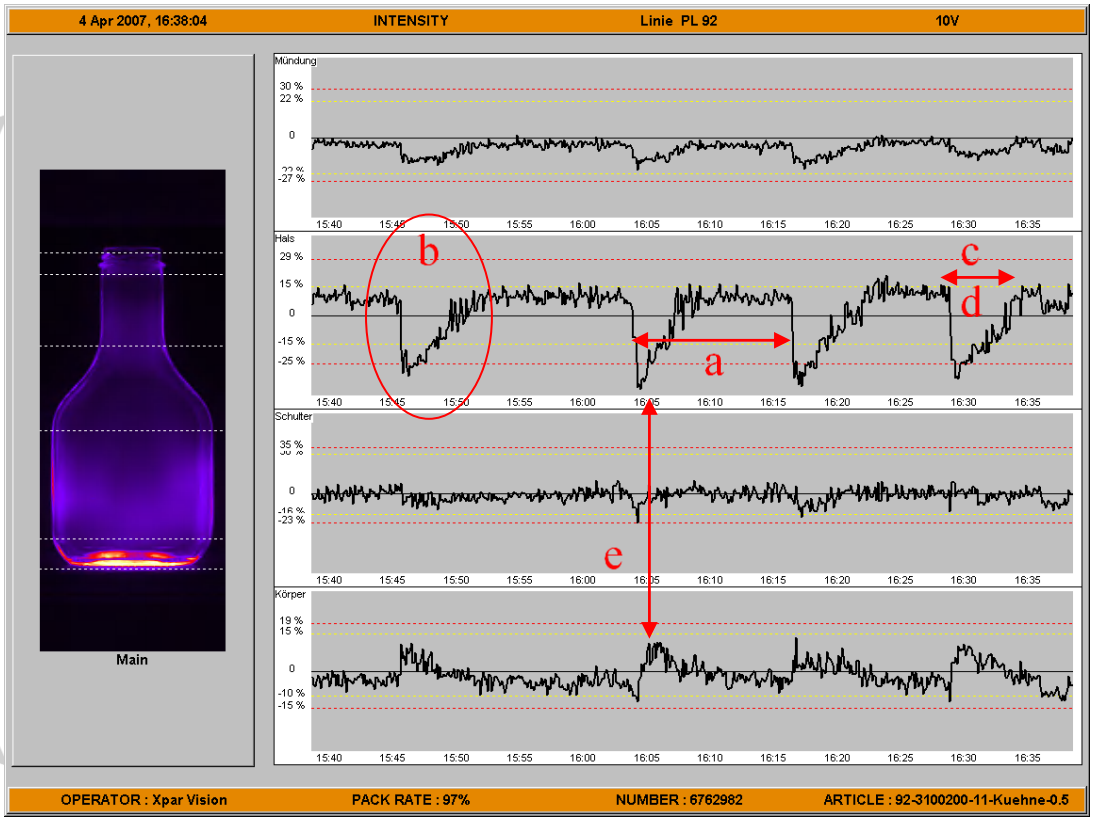
Bottom line

Reducing variation

Reducing variation due to (manual) swabbing

- Manual (blank & neck ring) swabbing
  - Generally can be highly disruptive and is certainly not consistent (frequency, impact)
  - Often is a cover up for other problems
  - Leads to specific swabbing related defects as choked neck, hollow neck, wall thickness/glass distribution, thin bottom (= shift in glass wall tickness variation)

Reducing variation due to (manual) swabbing



Frequency → every ca. 20 minutes

Impact → the effect on (vertical) glass distribution in the bottle

Impact time → how long it takes before the process stabilized again → ca. 5 minutes to recover

How many bottles are affected or should be rejected

Reducing variation due to (manual) swabbing

1. Manual swabbing with SOP's and in real time feedback
2. Autoswabbing
   - Robot on IS machine, moving to sections
   - Fixed system per section
   - ABL / Carboflam technology

Autoswabbing versus manual swabbing

- More consistent, improved product quality
- Less operator workload
- Safer (and more healthy)

Autoswabbing by robot: various options

Precise and accurate spraying (controllability, layer thickness)

Swab frequency

Intuitiveness of UI

(Potential) other robot functions

Consistency

HE losses

Disruption

Lubricant consumption

Health and safety

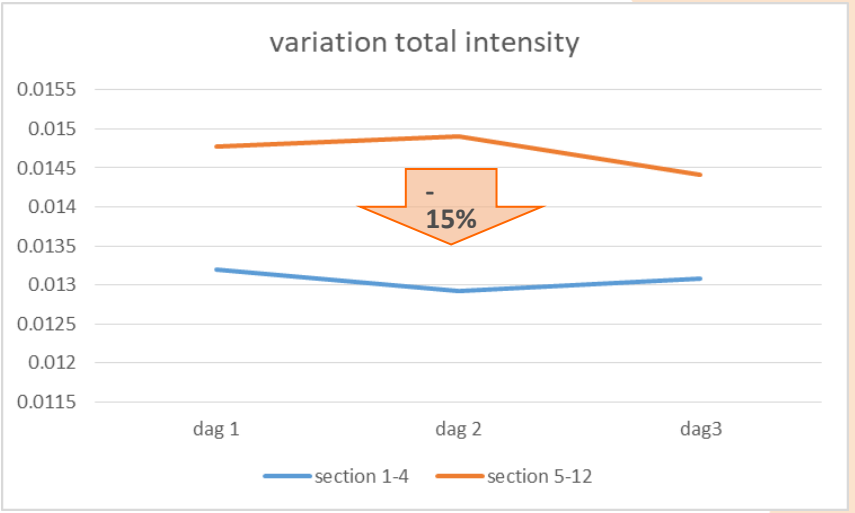
Easiness of use

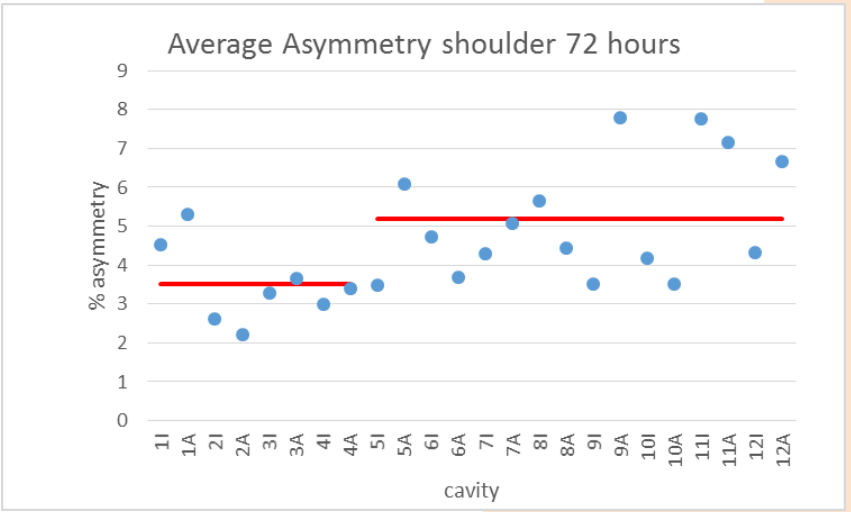
Autoswabbing by BlankRobot

- Precise and accurate spraying (controllability, layer thickness)
- Swab frequency
- Intuitiveness of UI
- (Potential) other robot functions

Autoswabbing by BlankRobot: some results

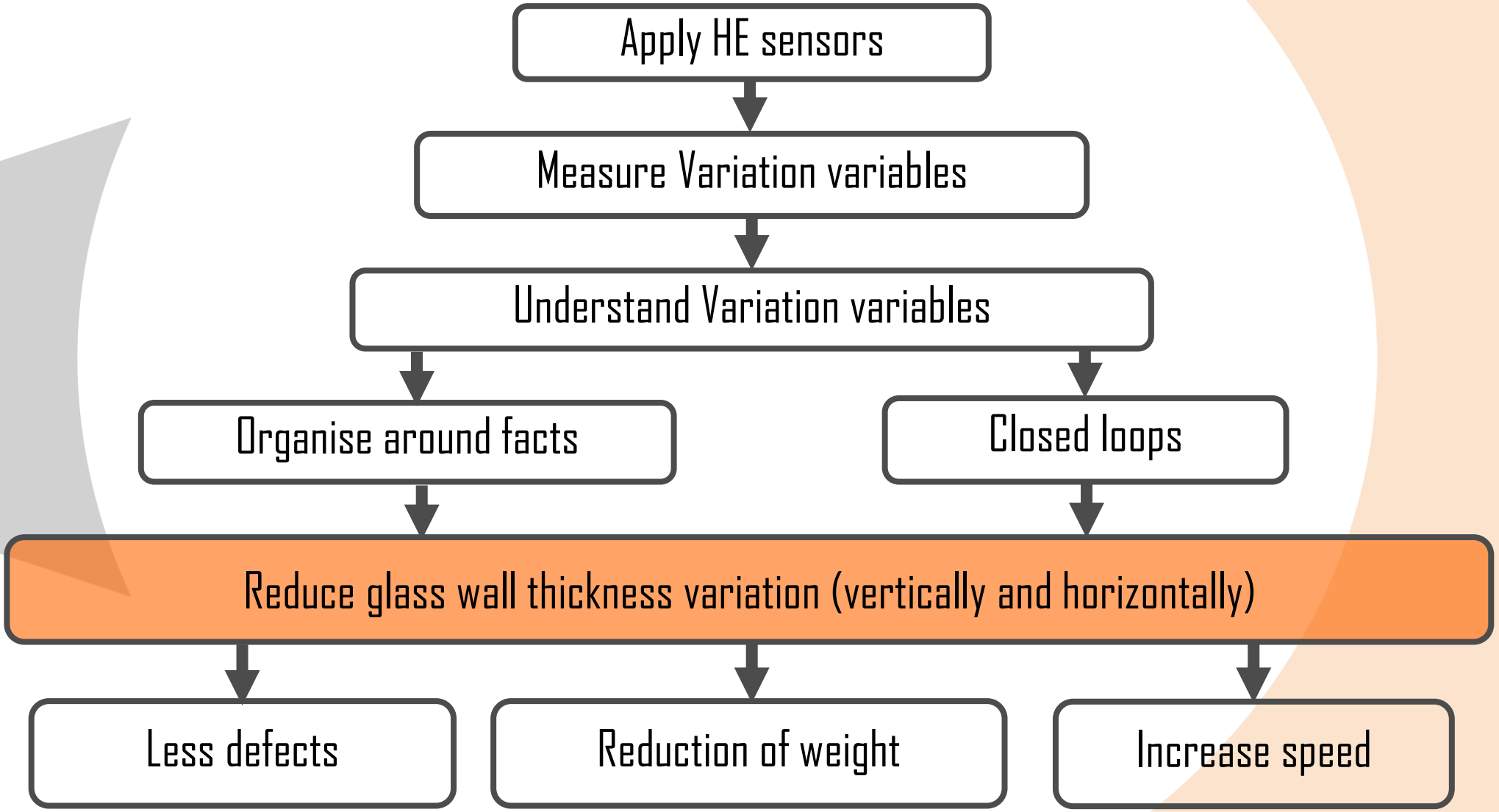
- ✓ Increased stability of forming process
  - Automated swabbing every 2-3 hours
  - No process disturbance of swabbing
- ✓ No swabbing related defects
- ✓ No spillage of lubricant
  - Less lubricant consumption
  - Clean machine
- ✓ Inproved Health & Safety
- ✓ Reduced operator workload





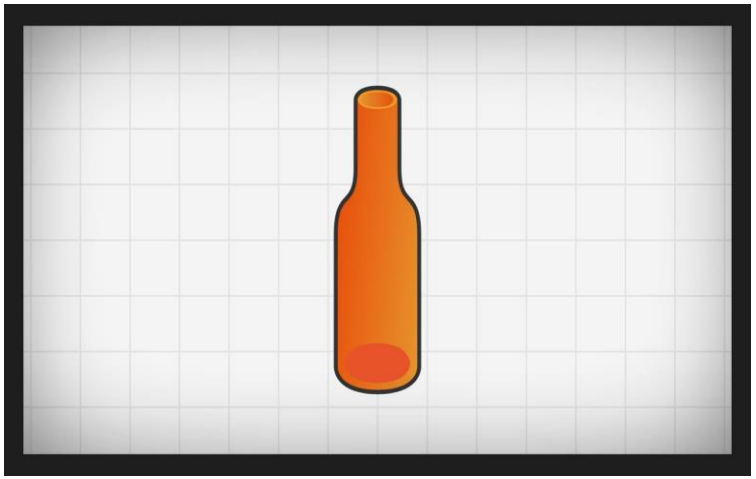
Managing variation

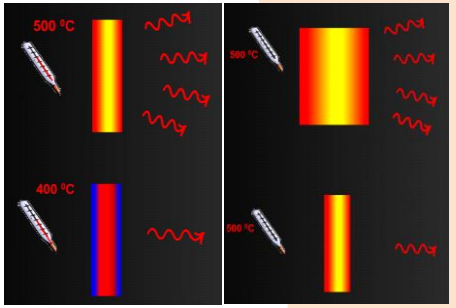
Manage variation at Industry 4.0 level

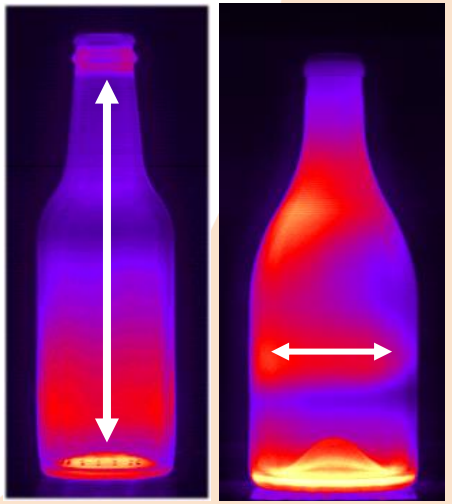


Apply sensors

- Measure factual glass wall thickness variations (and defects) on every single bottle

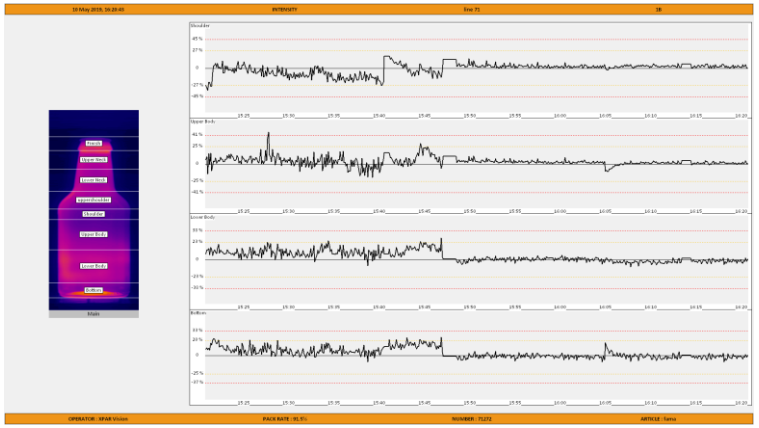


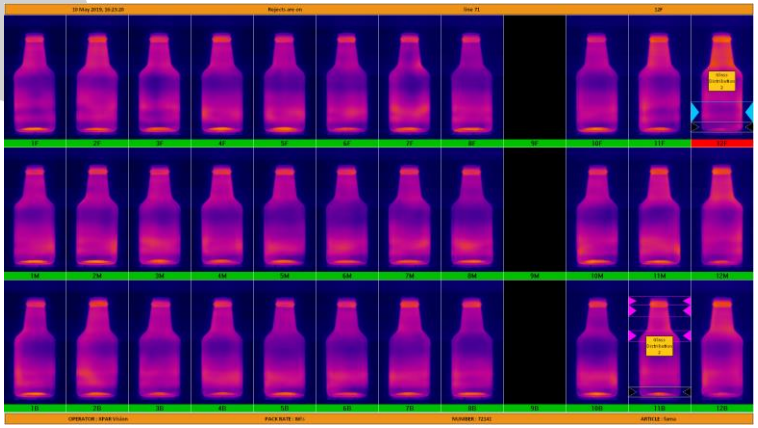


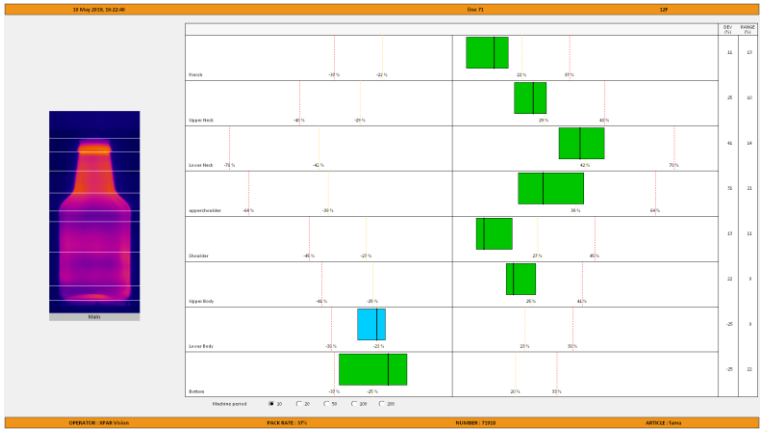


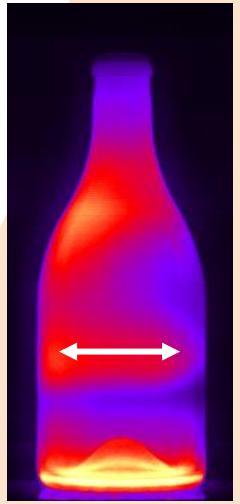
Apply sensors

- Relate this info to
  - Cavity
  - Section
  - Gob (F-M-B)
  - IS machine



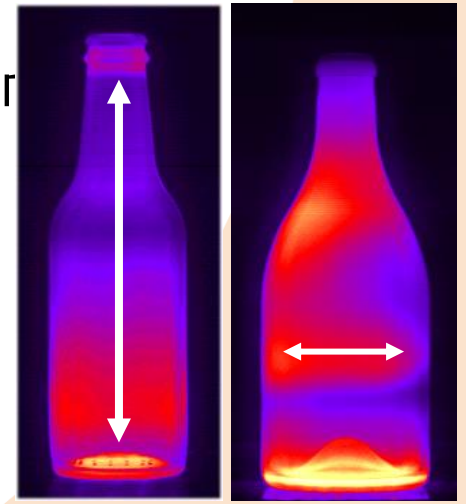




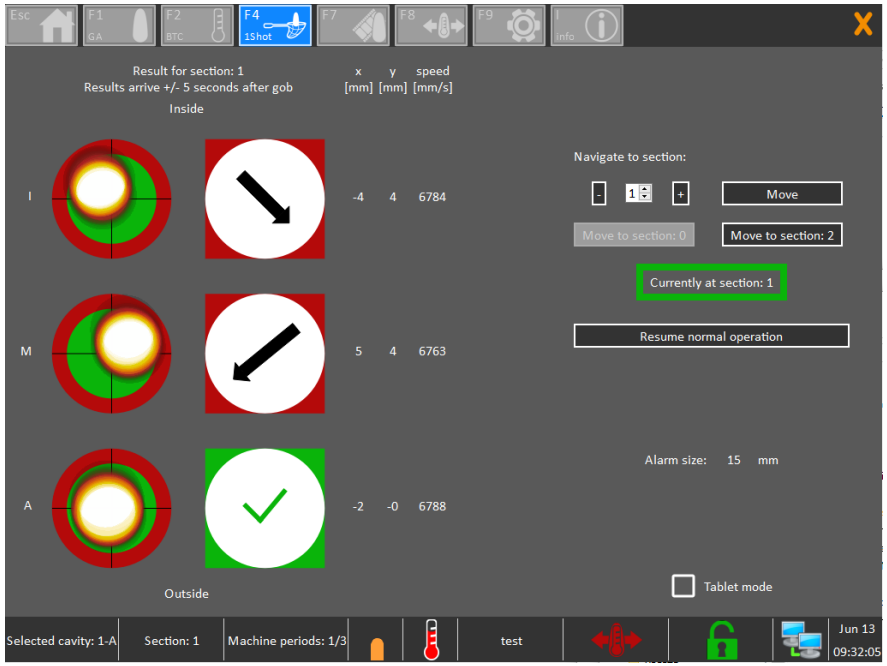


Apply sensors

- Understand shift in glass wall thickness variations
  - Timing (cooling, contact)
  - Swabbing
  - Gob weight/shape/temperature
  - Gob loading
  - Temperatures blanks/parison/plunger
  - Wear and malfunction
- Measure sub processes by facts → gob weight/shape/temper gob loading, temperatures blanks/parison/plunger, wear
- Organize around facts → SOP's



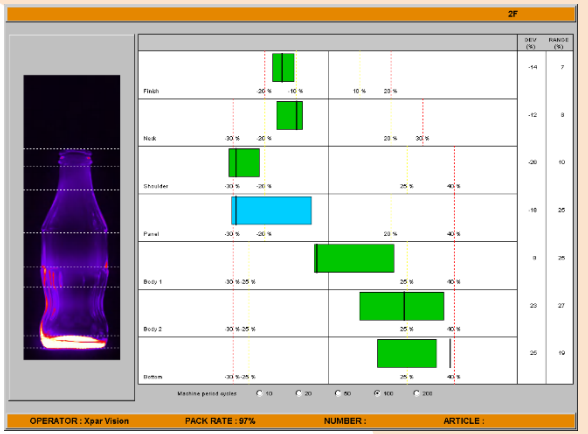
Apply sensors for gob loading

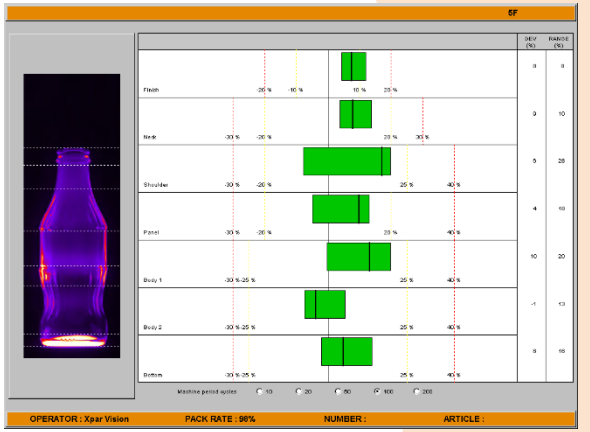


Apply (automated) closed loops

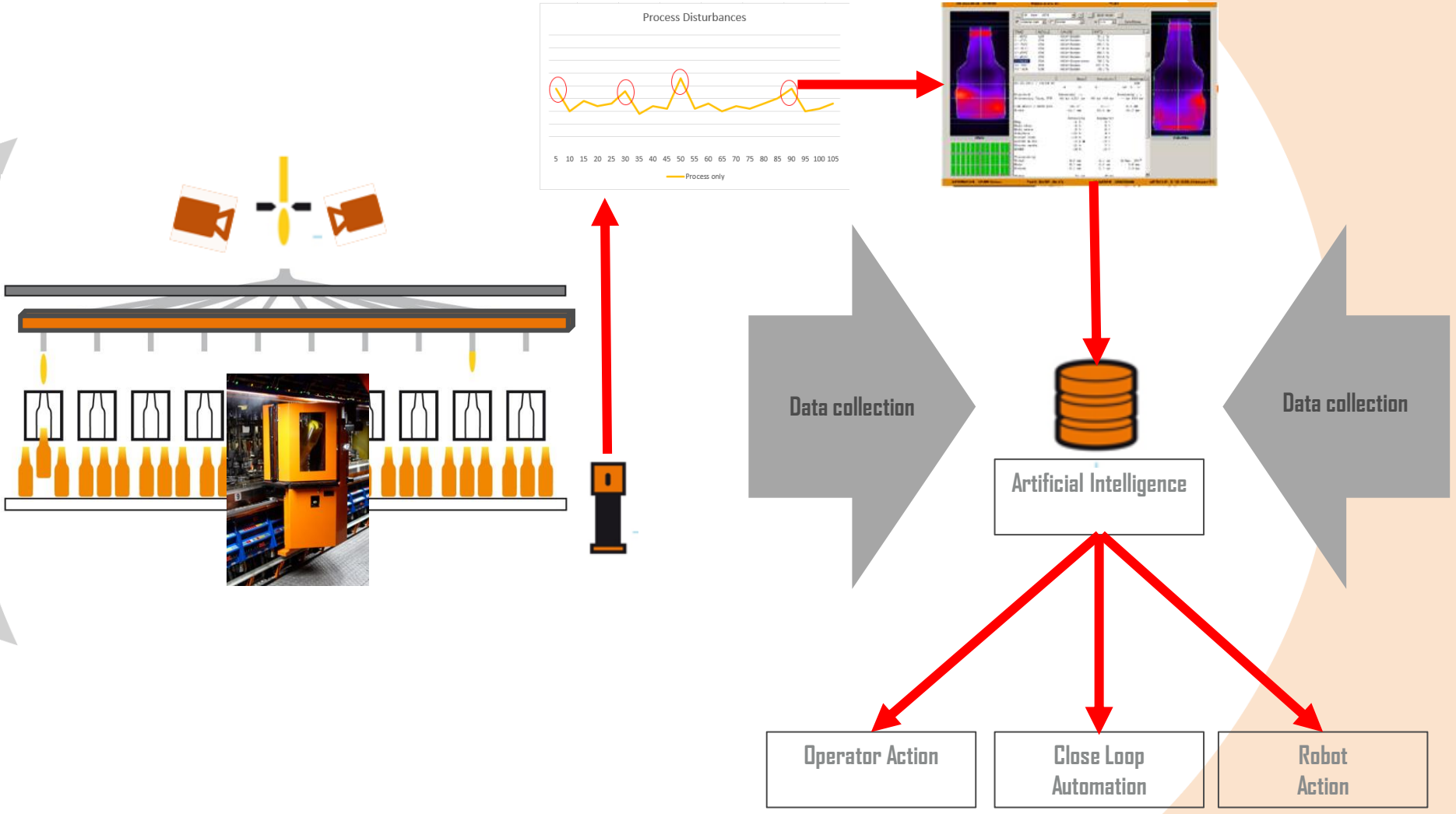
- Available today:
  - Gob weight control
  - Ware spacing control
  - Mould temperature control
  - Plunger process control
  - **Vertical glass distribution control**
  - Plunger temperature control

  - Delivery alignment control
  - Feeder temperature control
  - …
  - …





A new world of glass making



Questions

- Can we make glass bottles lighter and stronger?
- Can we make glass bottles with much less glass wall thickness variations = almost constant glass distribution = almost no defects?
- Can we make glass bottles based on mainly factual measurements instead of only human experience?

Answer

Yes we can!

Bright ideas. Better glass.

Better world.