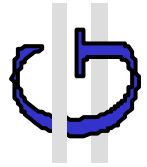


Novel Constructions for Ring-shaped Dies Broaden Processing Capabilities in Extrusion



Dr.-Ing. Heinz Gross, Gross Kunststoff Verfahrenstechnik, Rossdorf, Germany

My vision

Questions to experts

Conventional centering solution

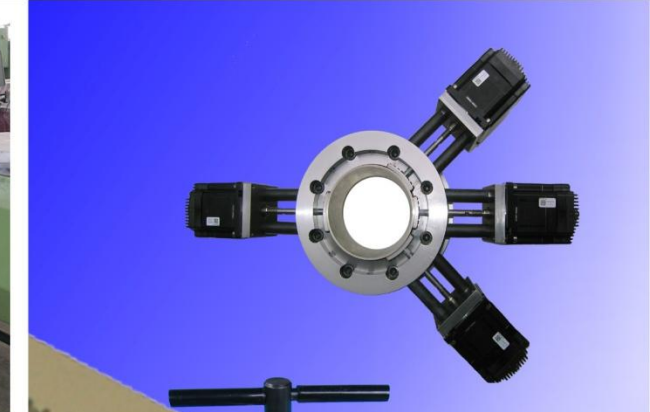
The tilting solution

Programming of the parison in extrusion blow molding

GWDS technology

Conclusion





We develop benefits



sensitively adjustable extrusion components

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How do you centre a die of a ring-shaped head?



Silly question! Naturally by shifting the die

My goodness ! The die has to be shifted!

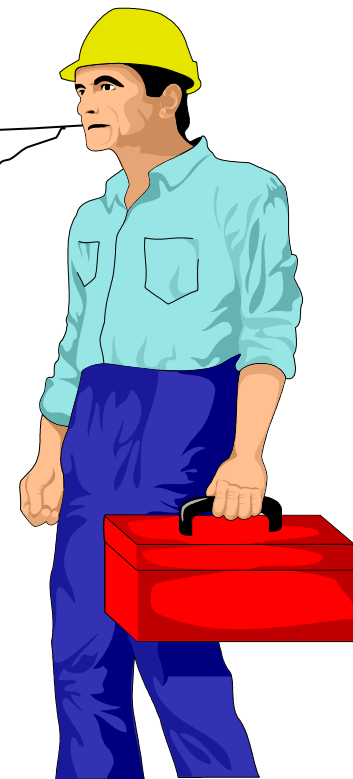
**But existing systems
are not **precise enough**
and not **reproducible!****



Expert 1



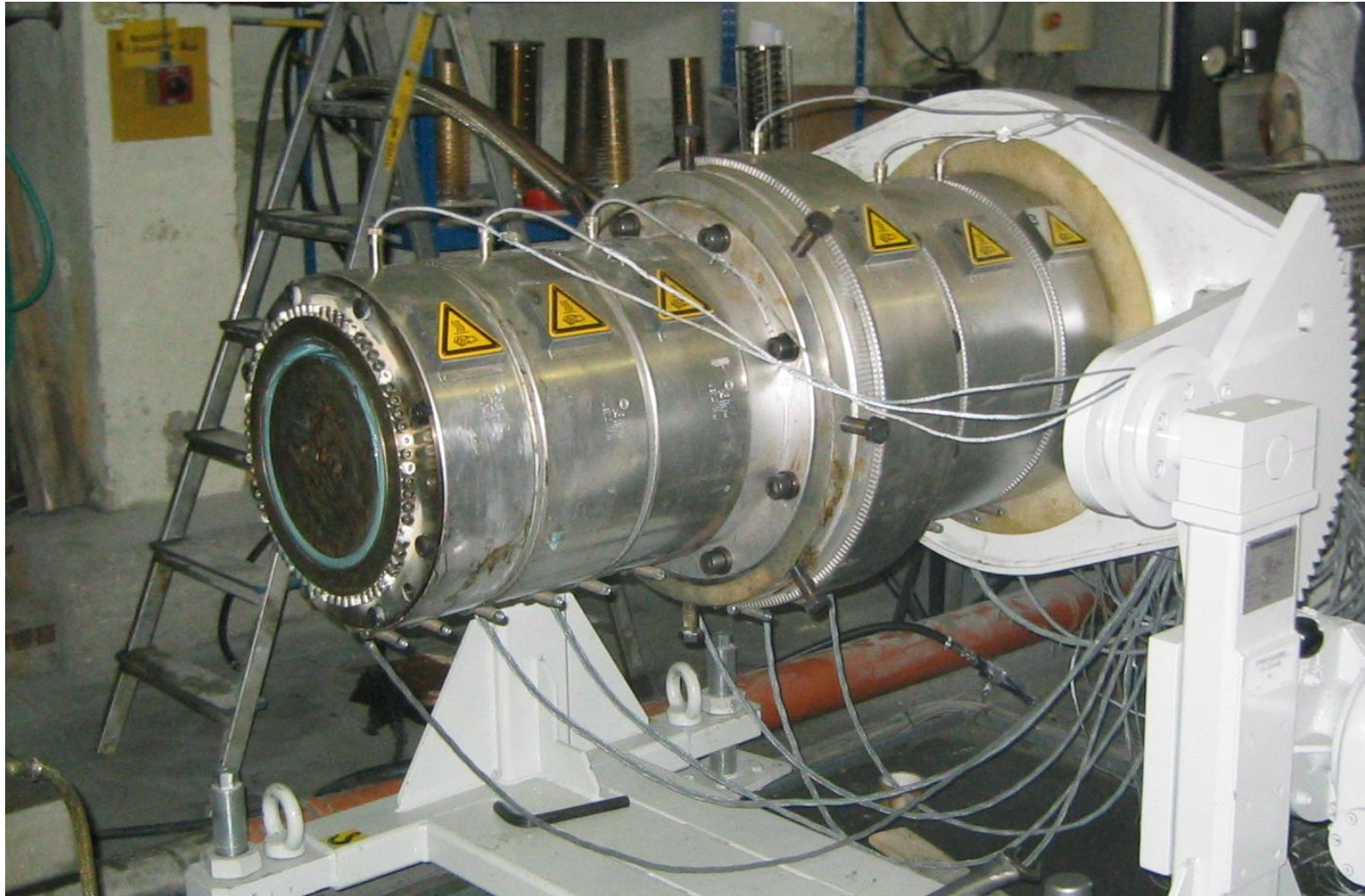
Expert 2



Clever operator



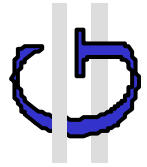
Actual centring solution



Video centring of a „conventional die“



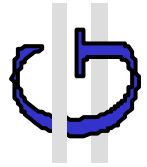
Conventional centering uses screws that are positioned radially to shift the die



- **It is impossible to center the dies precisely and sensitively**
- **A position that once has been existed can not be reproduced**
- **It can not avoided that wear will occur in the sealing planes**
- **The fabrication of the centering solution is costly**
- **Dies have to be precentered before starting the machine**
- **It is nearly impossible to automate existing solutions. In the case it is possible it is extremely costly**



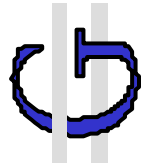
Important requirements for a good centering solution



- It must be possible to adjust the relative position between the die and the pin in a very **sensitive** and **precise** manner!
- It must be possible to **exactly reproduce** every position that once has been existed during the centering procedure!



New centering solution



Use of a very simple elastic tilting joint

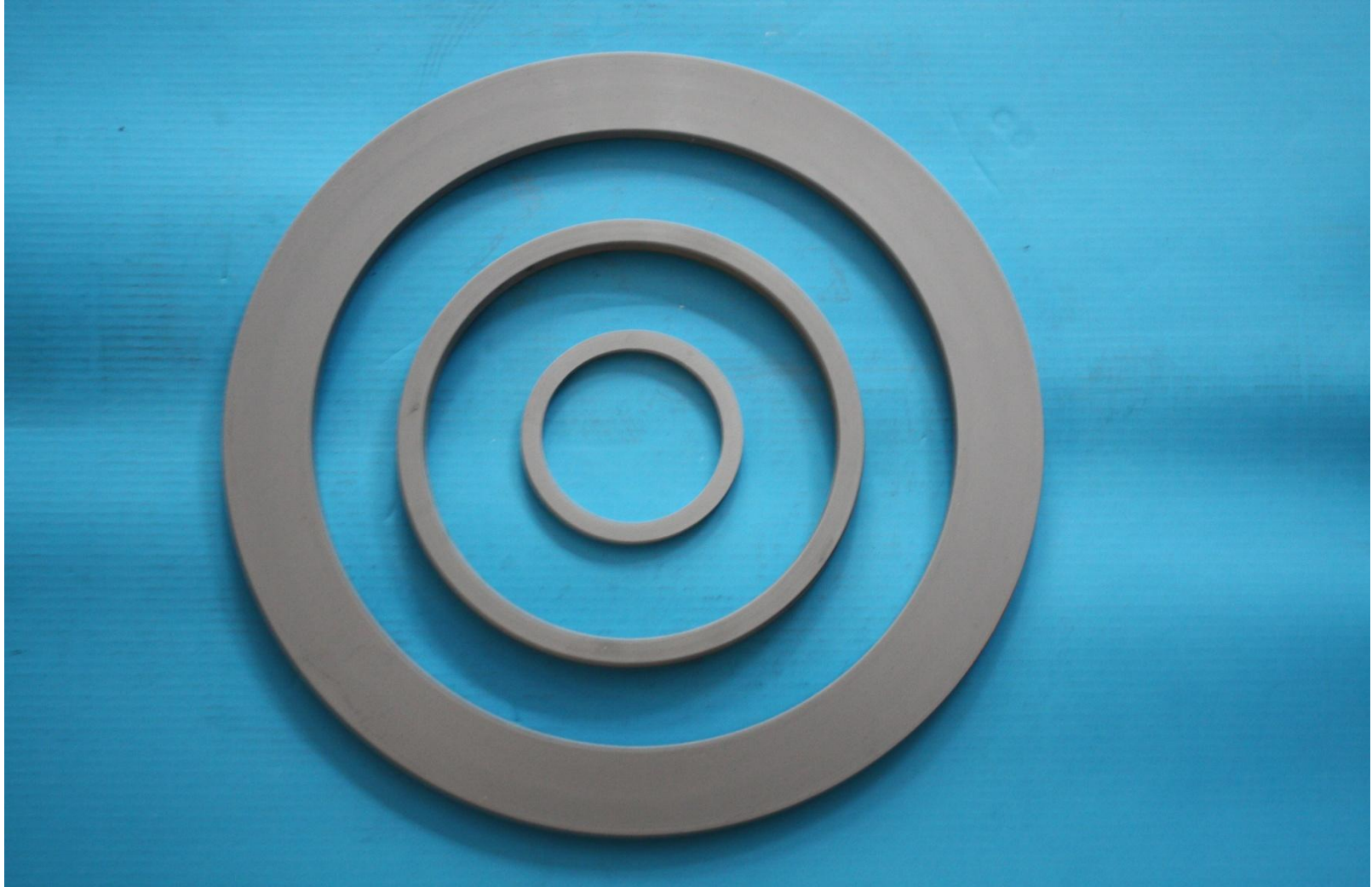
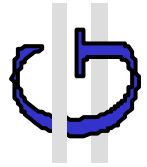
The tilting joint has two functions:

Sealing function

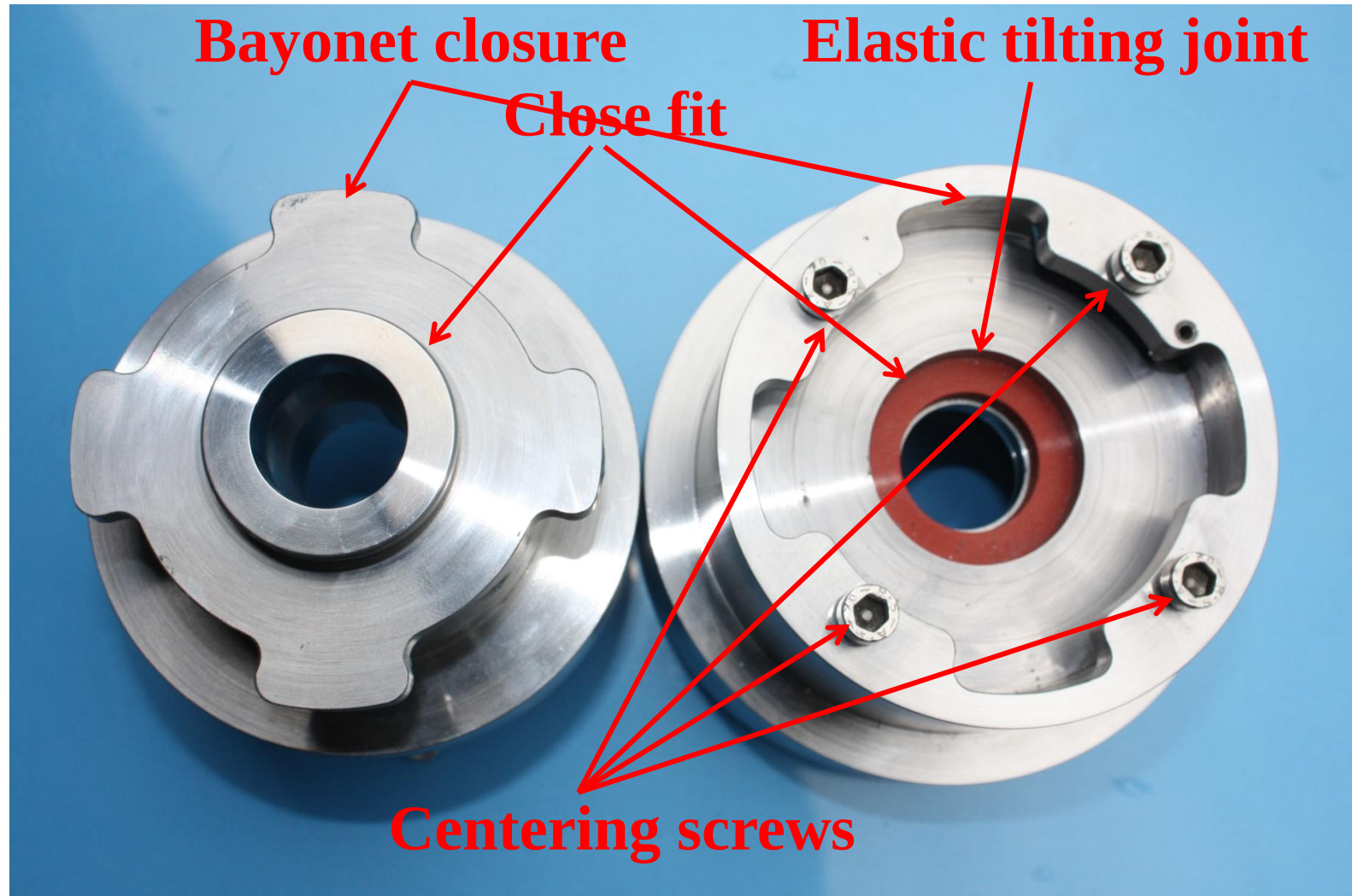
Tilting function



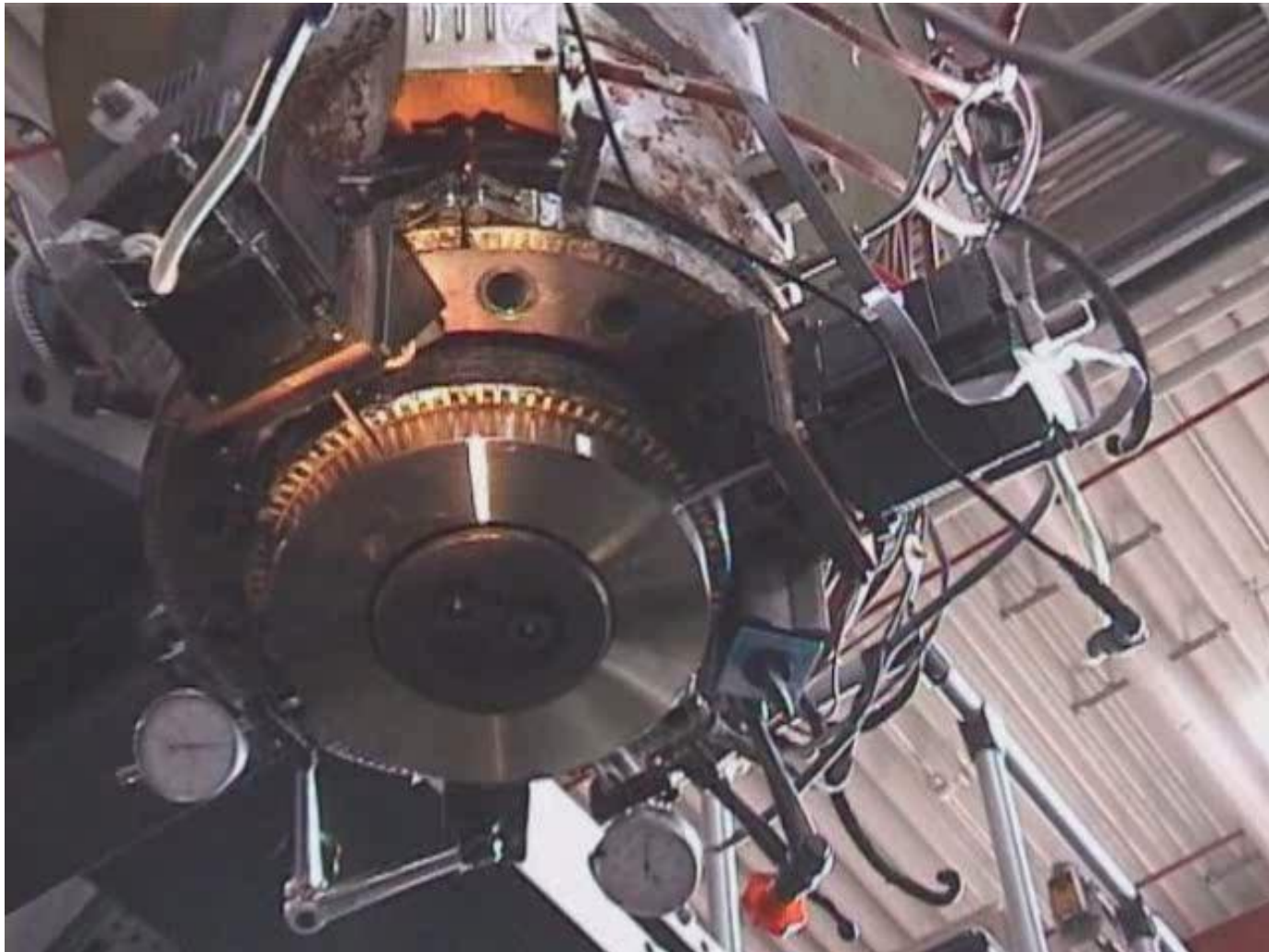
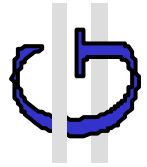
How looks an elastic tilting joint like?



Tilting pipe die having a bayonet closure and small adjusting screws



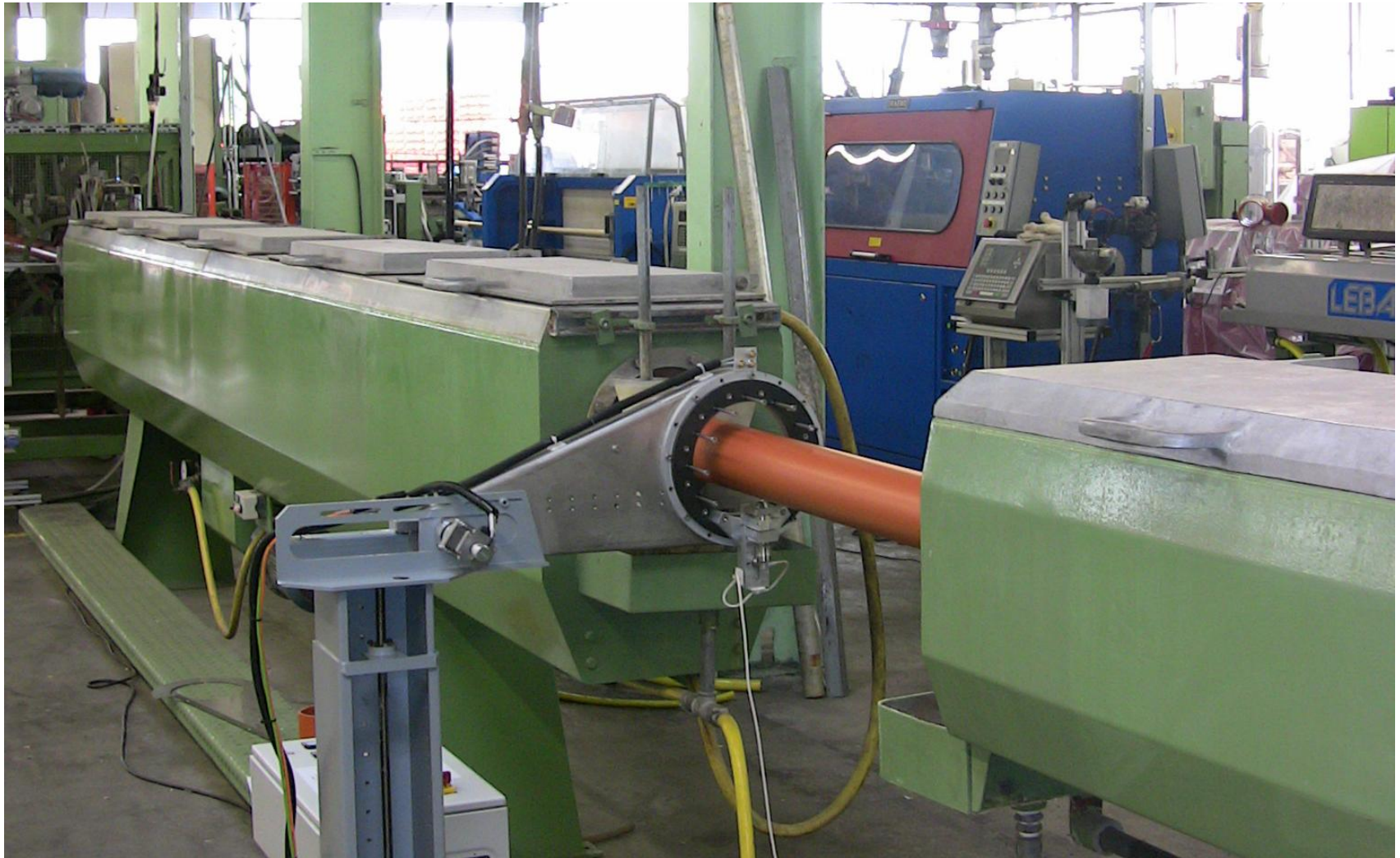
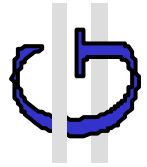
Blow molding die equipped with an elastic tilting joint and two stepper motors

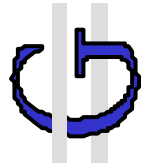


Closed-loop control of excentric and asymmetric thickness differences



Online wall thickness measuring system for core-foamed pipes





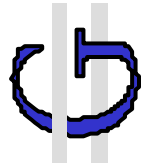
Advantages of the tilting solution

The two central requirements are fulfilled without **any restrictions**:

- The die can be centered in the range of one micrometer if this is necessary
- A position that has been achieved can be exactly reproduced at any time

This technical functionality is reached on a surprising easy manner





Advantages of the tilting solution

- **No precentering is necessary due to a close fit between the die and the pin**
- **It is possible to fine-tune the position of the die to the optimum**
- **Centering is possible with two fingers; no elongation**
- **Changing of the die by a turn, no screws are necessary**
- **Easy to be automate, dynamic tilting is possible**
- **No interruption of the process in extrusion blow molding**
- **Low manufacturing cost due to fewer parts**
- **Safe during operation and easy to maintain**



What is the shape the flow channel geometry of an extrusion blow molding die should have at its exit?



It has to be conical! There is no question about that!

Of course conical and nothing else!

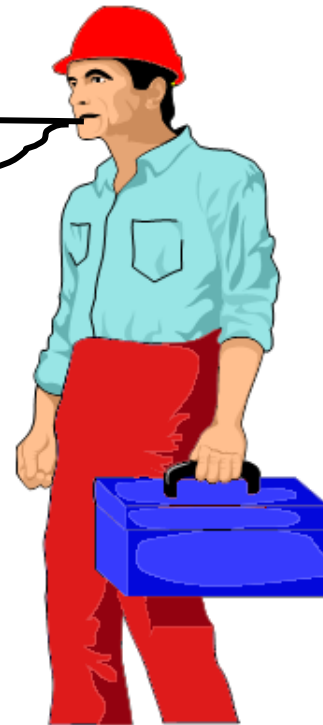
But I would like to have it cylindrical rather than conical to be in a better position to optimize the thickness distribution of my products !!!!



Blow molding Expert 1



Expert 2



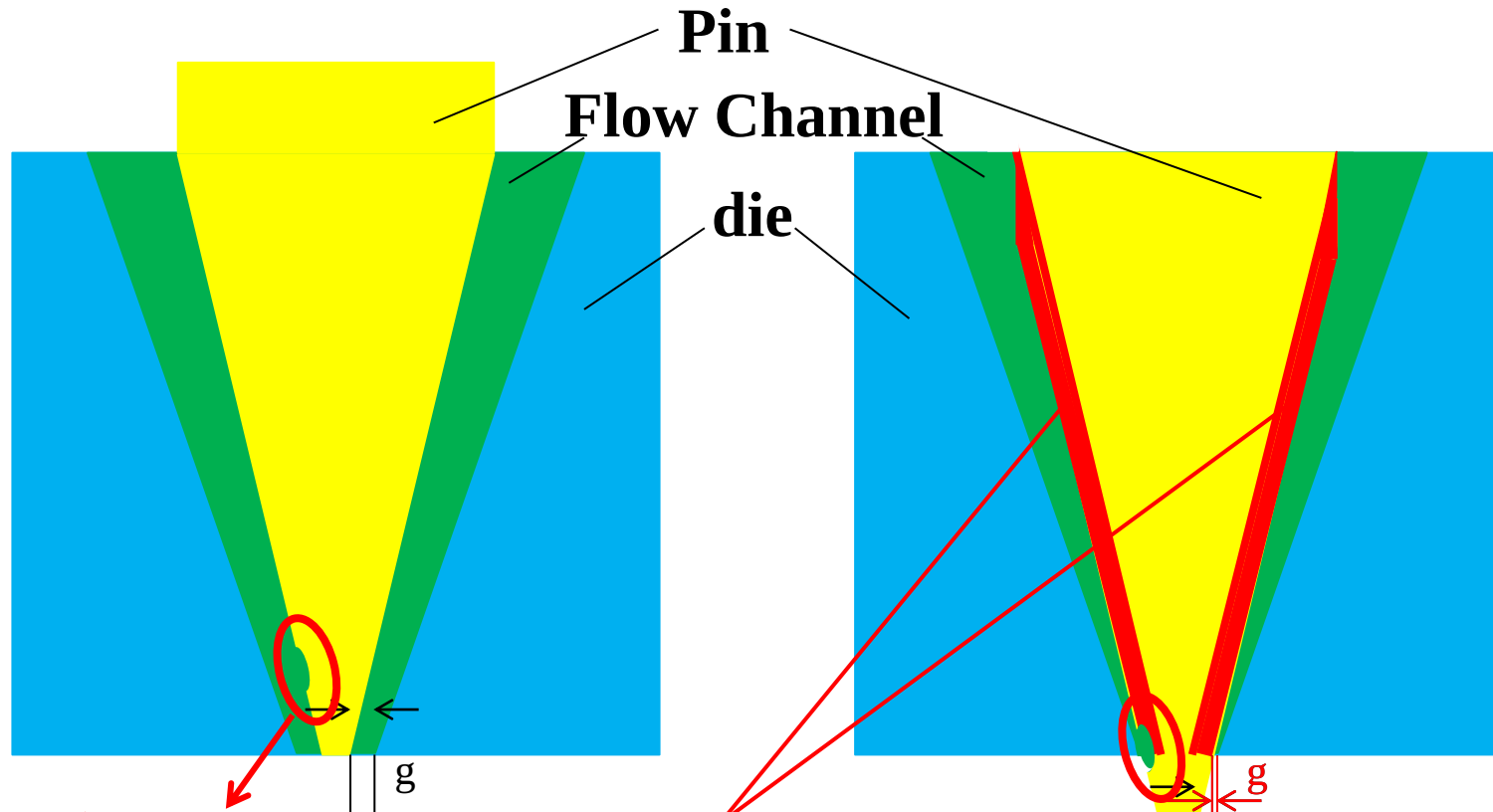
Clever operator who has visited the PPS28 and who listened to this presentation



Oval bottle with a round thread on top



Conventional „conical die“



Additional mass is discharged.
 The local mean velocity is significantly increased by the pin
 Extraction velocity is increased dramatically!
 Compulsorily also the overall flow channel gap changes
 The parison shape is negatively effected
 when chanprofiling is moved in the more effective position
 Not a desired peak in the thick regions with bottom of the main part



„Cylindrical“ or rather GWDS-Die



Flow channel Pin Pin guiding

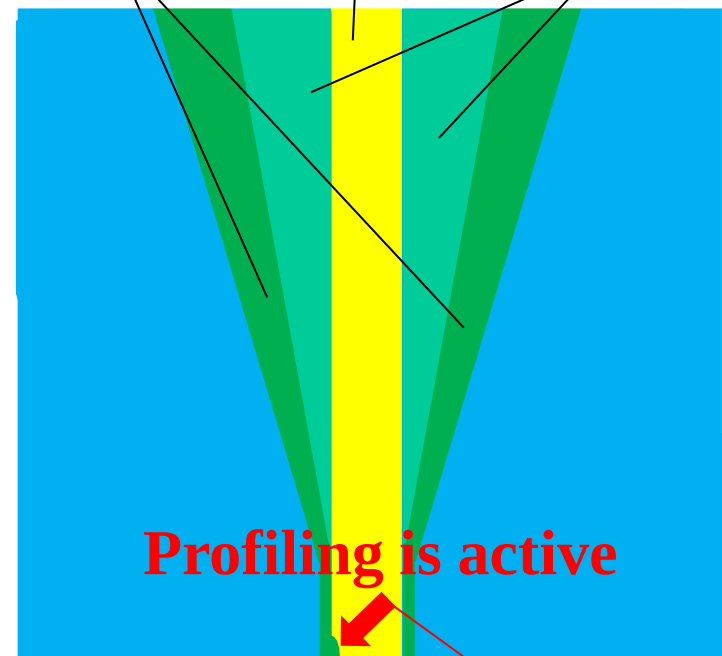


Profiling is not active

g $\leftarrow$ $\rightarrow$ g **Local profiling**

- No negative effect on the velocity
- No negative effect on the parison
- No negative effect on the thickness

Flow channel Pin Pin guiding



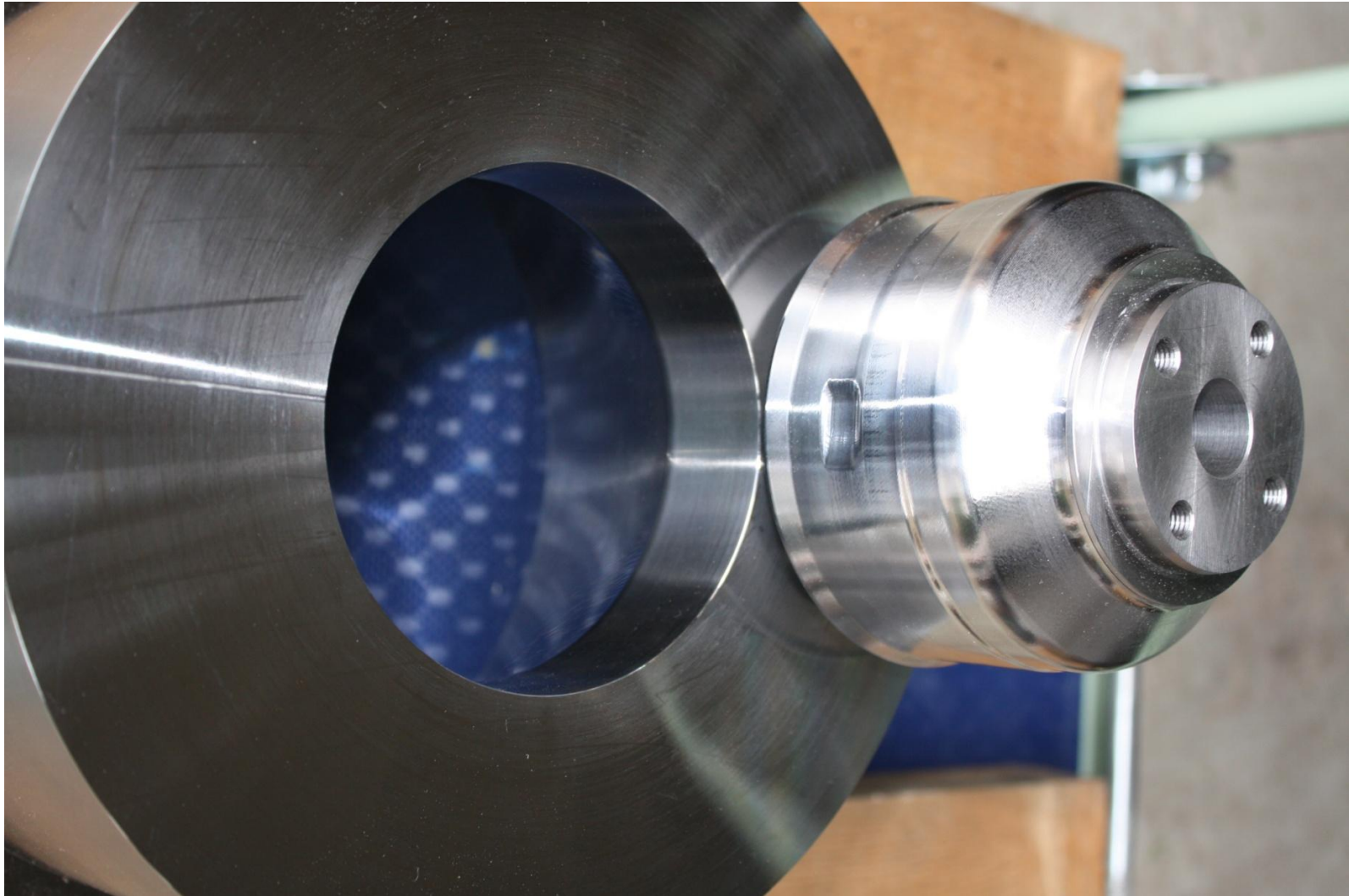
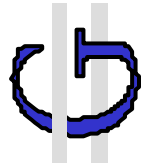
Profiling is active

g $\leftarrow$ $\rightarrow$ g **Local profiling**

- Flow channel gap keeps the same
- Local difference in thickness
- No additional material is forced out



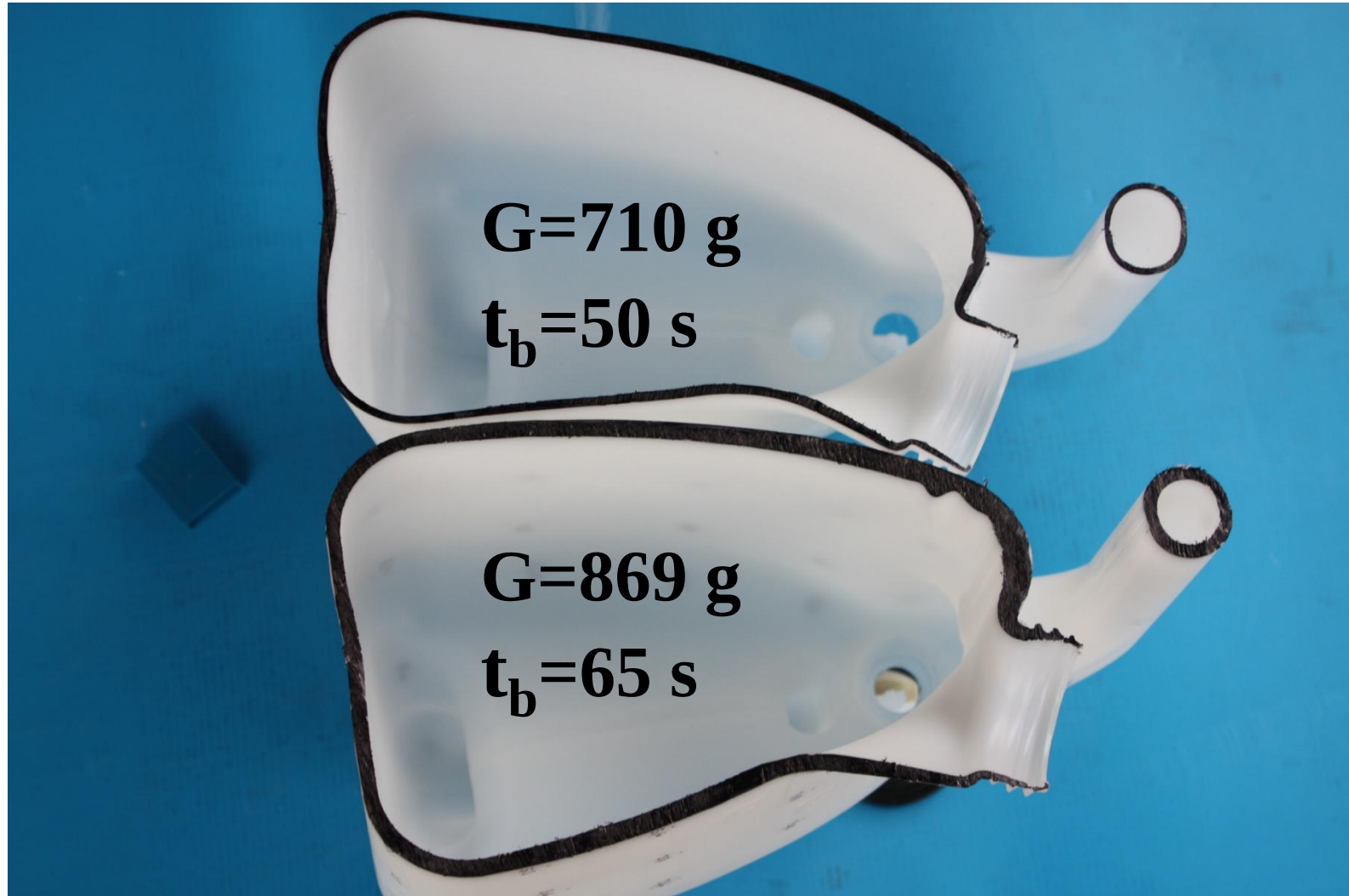
GWDS die and pin



GWDS pin consisting of several individual profiled disks



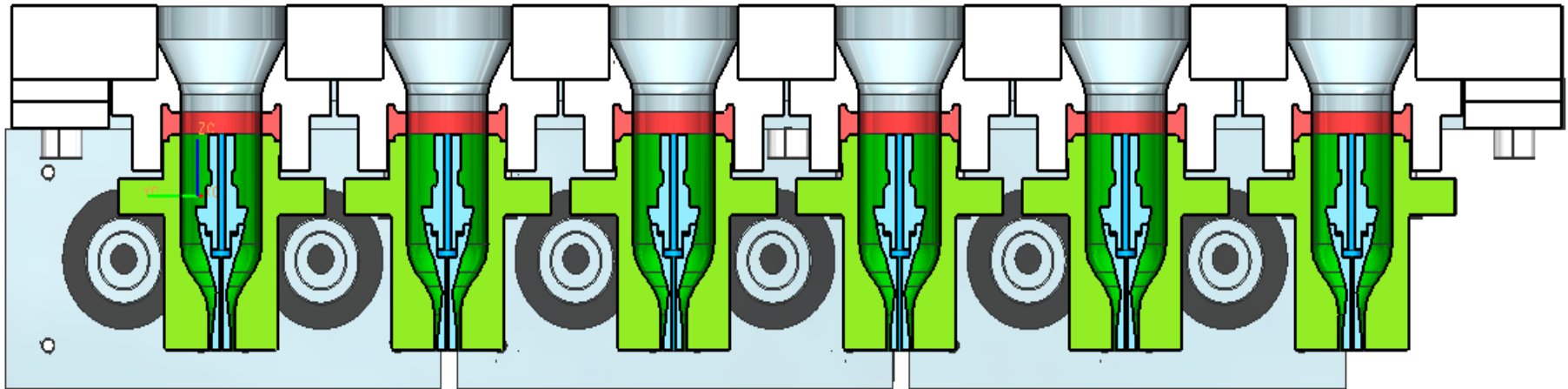
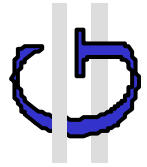
Comparison conventional production and GWDS production



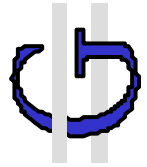
Tube with a very complex geometry



Retrofitting unit to use the tilting and the GWDS technology for the production of 10 mm tubes



Use of an elastic tilting joint in combination with the GWDS

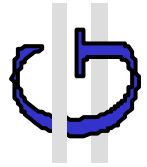


New processing possibilities are opened up

- Every die position can be exactly reproduced at any time
- Change of the parison thickness in radial direction possible for every die diameter
- Centering with the help of motors
- Change of the die position during the extraction of the parison possible



Summary



- The tilting technology is the first solution that enables a sensitive and reproducible centering of dies from the control cabinet of the machine
- A bayonet closure accelerates the die changing and reduces the ease of failures and breakdowns during operation
- A dynamic as well axial as also radial wall thickness programming is possible for small die diameters when using the GWDS technology
- A combination of the tilting solution and the GWDS technology opens up new processing possibilities which could not be realized up to now
- The quality of the products can be further improved while saving raw material and while in the same time increasing the capacity of the machine
- **All presented technologies can be easily retrofitted to any existing head without too high costs**
- **The return of investment times are extremely short as well for the tilting solution as also for the GWDS technology**

