

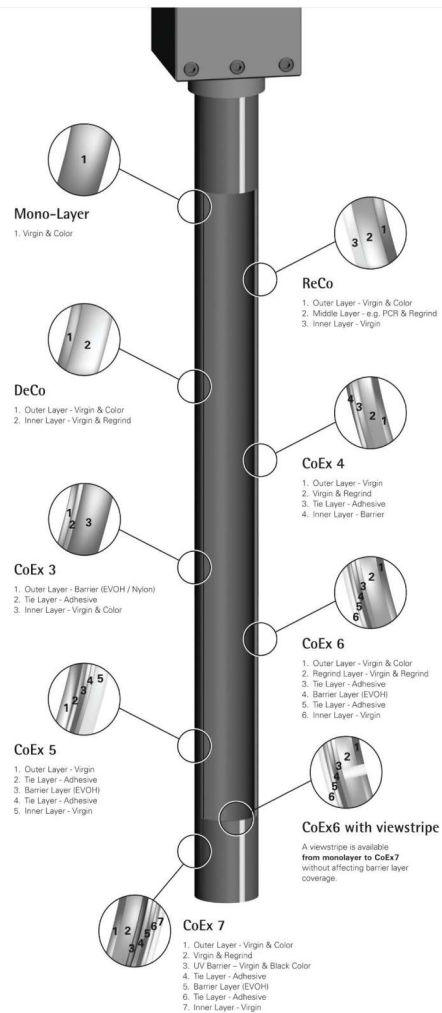
# 101 Multi-Layer Extrusion Blow Molding

Presented by Jens Schlueter





# Technical Basics



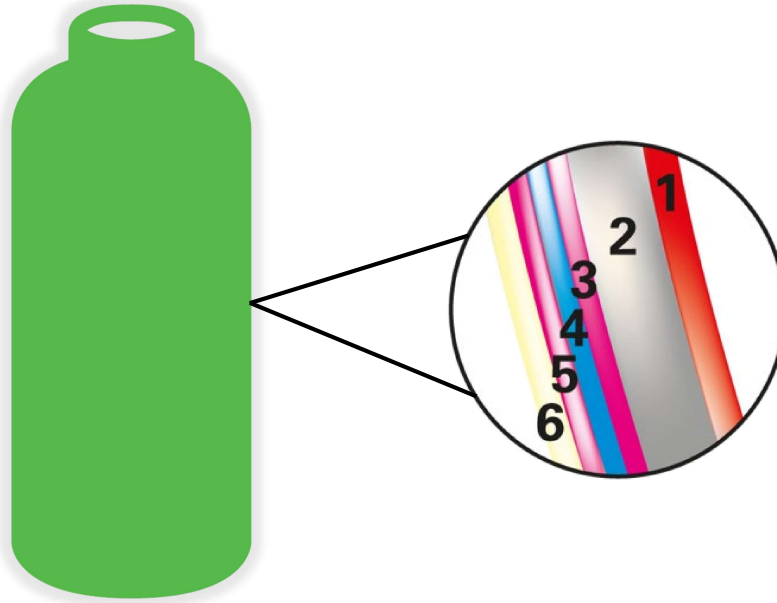
## Multi-Layer Blow Molding – Basics



- **Aesthetically Appropriate**
- **Durable**
- **Protective**
- **Sustainable**
- **Cost Effective**



# Multi-Layer Blow Molding – Basics

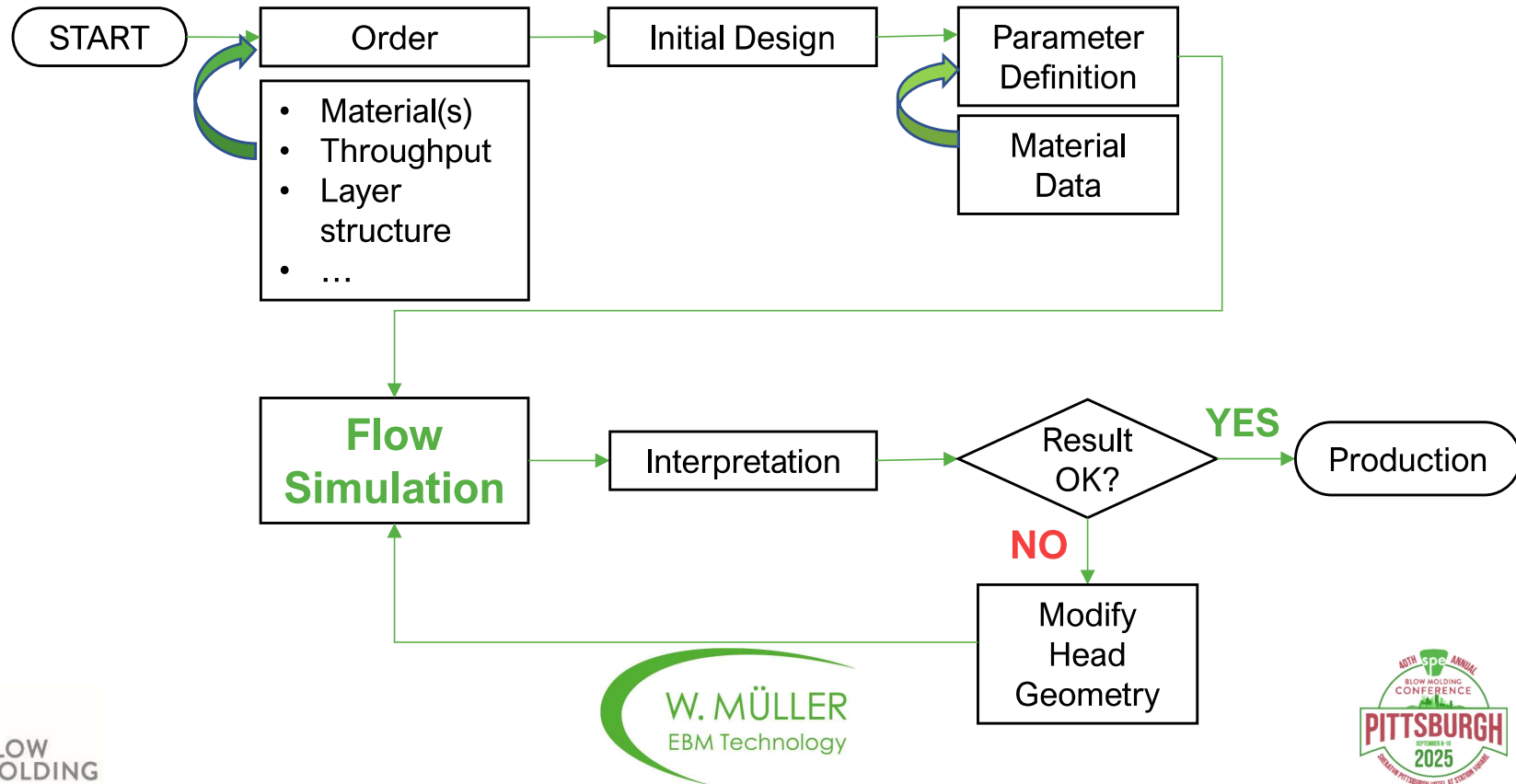


1. Virgin Outer Layer
2. Regrind/PCR Layer
3. Adhesive
4. Barrier Layer
5. Adhesive
6. Virgin Contact Layer

# Multi Layer Extrusion Head Design Process



# Multi-Layer Blow Molding – Design Process



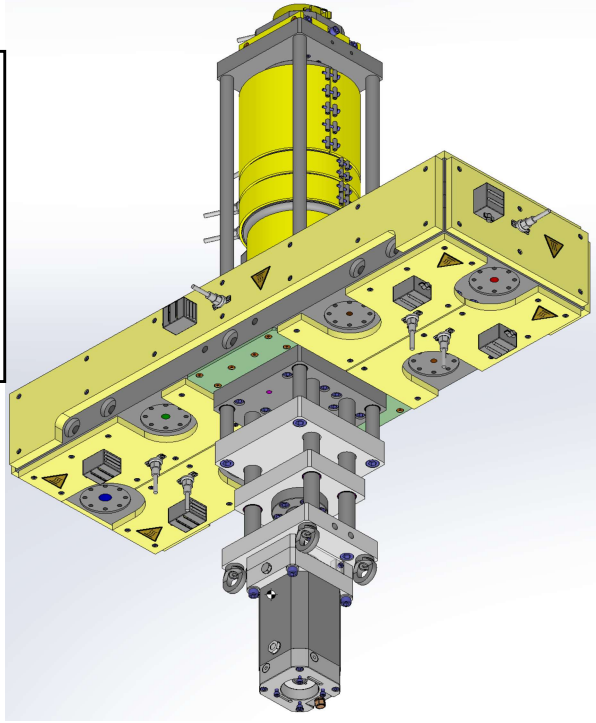
# Multi-Layer Blow Molding – Evaluation of the Simulation Results

- Melt Pressure
- Stagnation Zones
- Parison Quality (Wall Thickness Distribution)
- Layer Velocity
- Melt Temperature

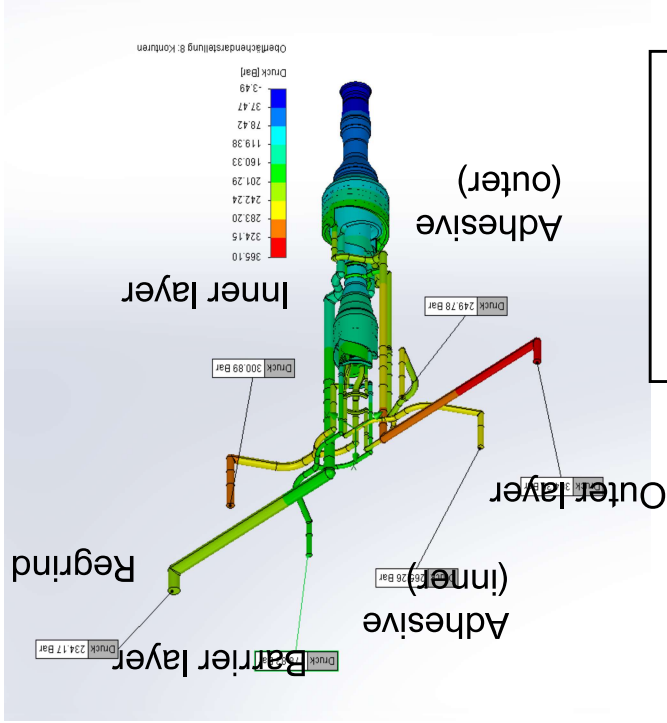


# Multi-Layer Blow Molding – Melt Pressure Evaluation

CoEx 6-Layer Head – One Parison

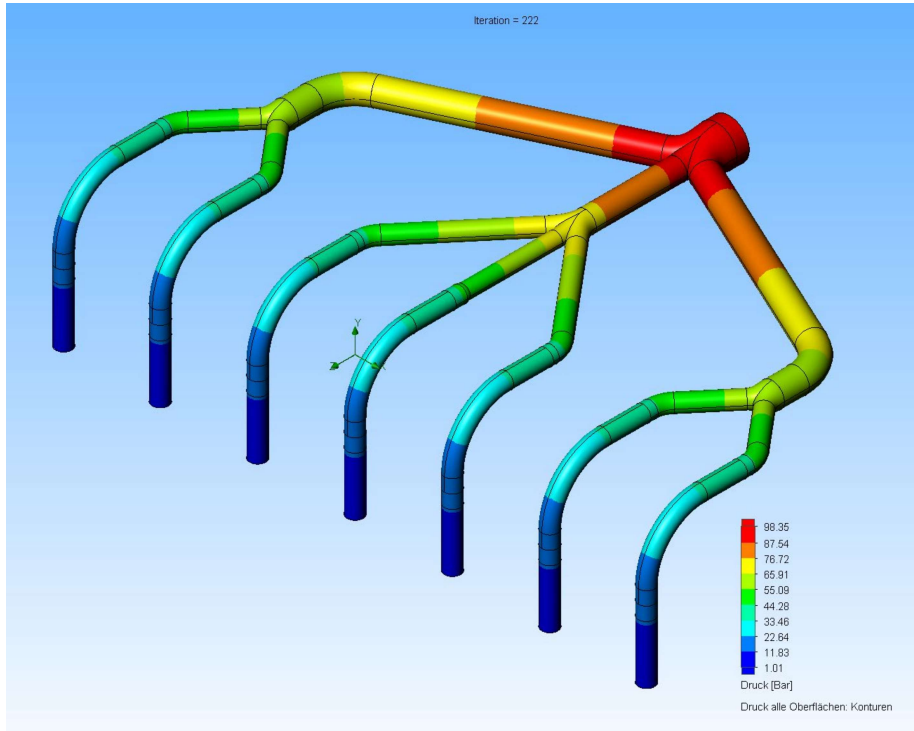


Flow channels are optimized so that the melt pressure is always under a critical level at highest given throughput.



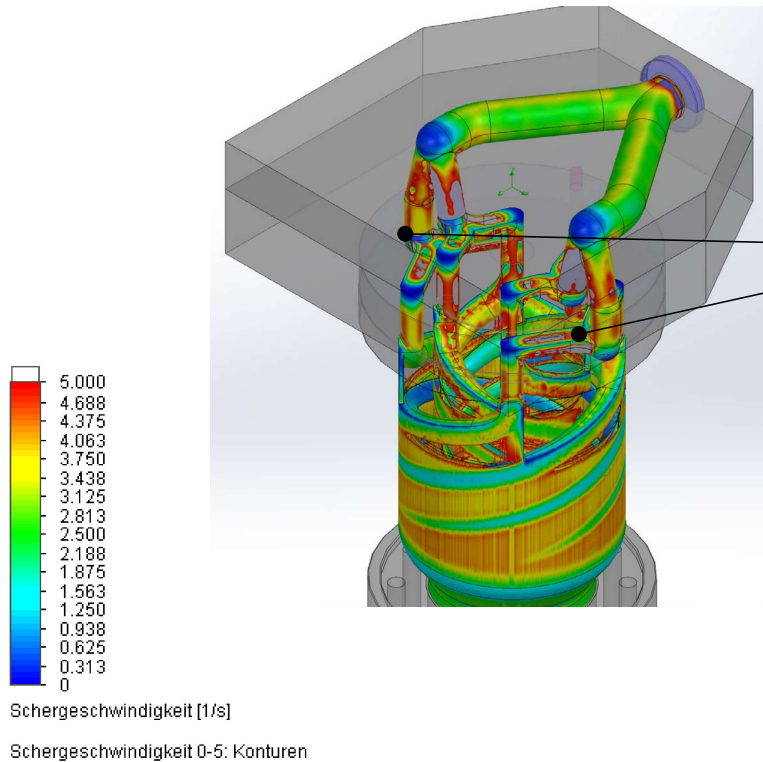


# Multi-Layer Blow Molding – Melt Pressure Evaluation



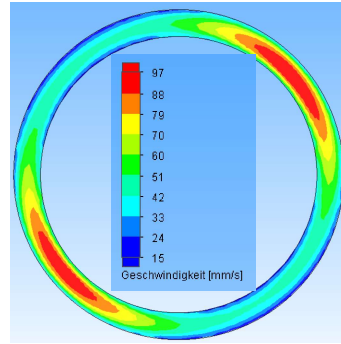
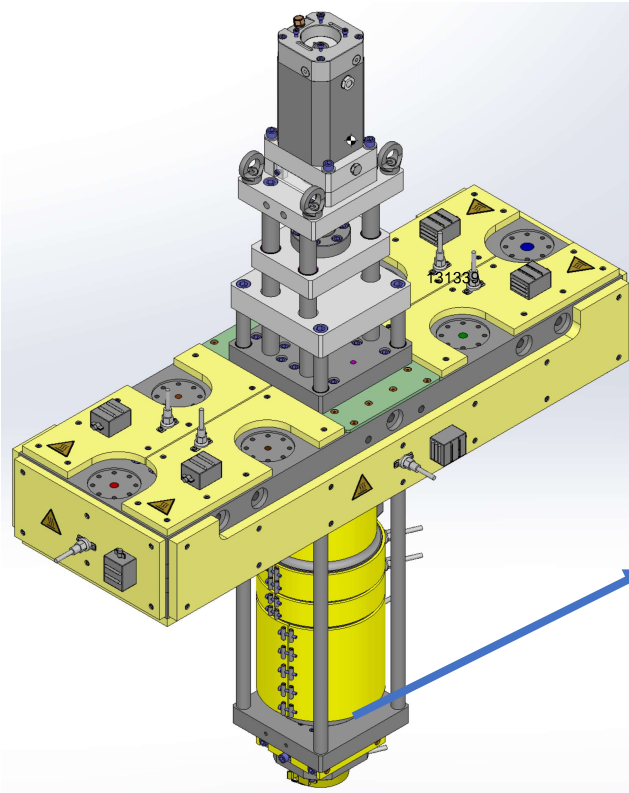
- Multi parison heads require equal melt pressures
- Any uneven number of parison required different flow channel designs to avoid using chokes to even parison length

# Multi-Layer Blow Molding – Stagnation Zones



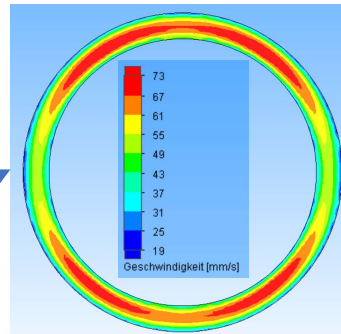
- Areas with low shear rates (blue) can be identified in Flow Simulation
- Material flow stagnates there
- By optimizing channel geometry, areas of stagnation can be reduced
- Thus, time for material and color change is reduced.
- Geometry optimization has to be done under consideration of manufacturing processes

# Multi-Layer Blow Molding – Parison Quality



## Initial Geometry

- Uneven distribution of outlet velocity
- Result: uneven wall thickness

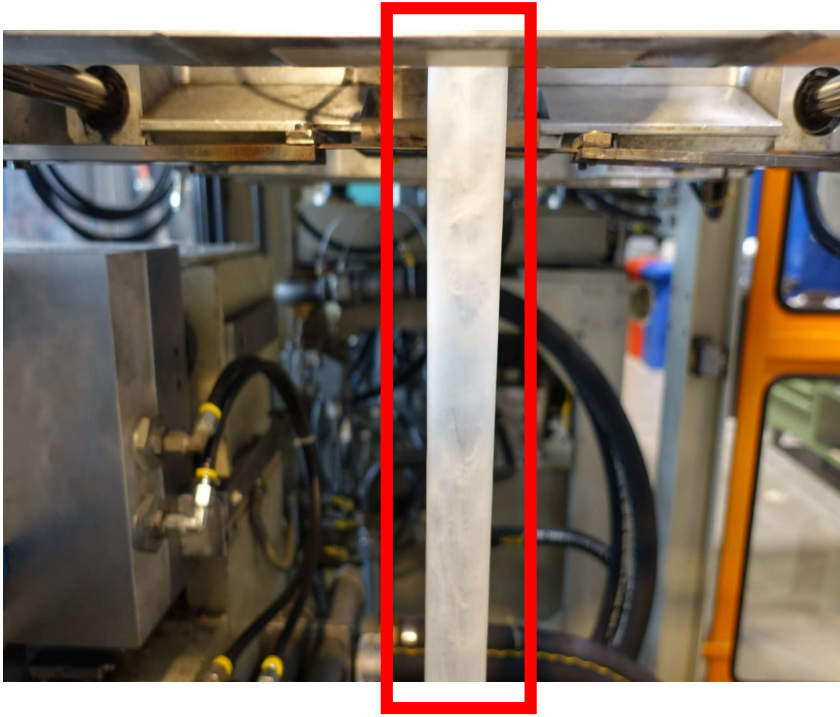


## Optimized Geometry

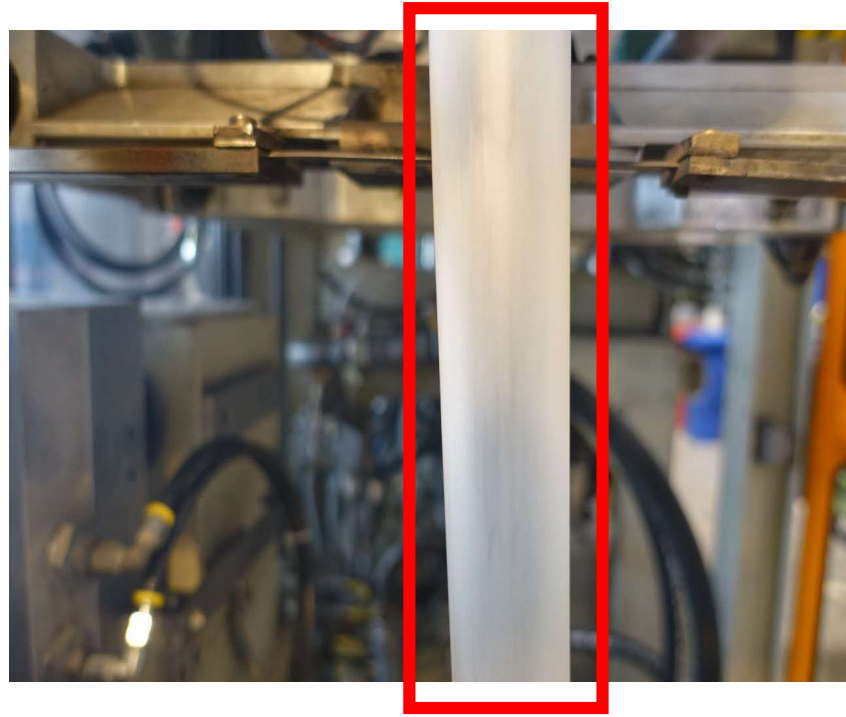
- Improved velocity distribution
- wall thickness more even

131339

## Multi-Layer Blow Molding – Parison Quality



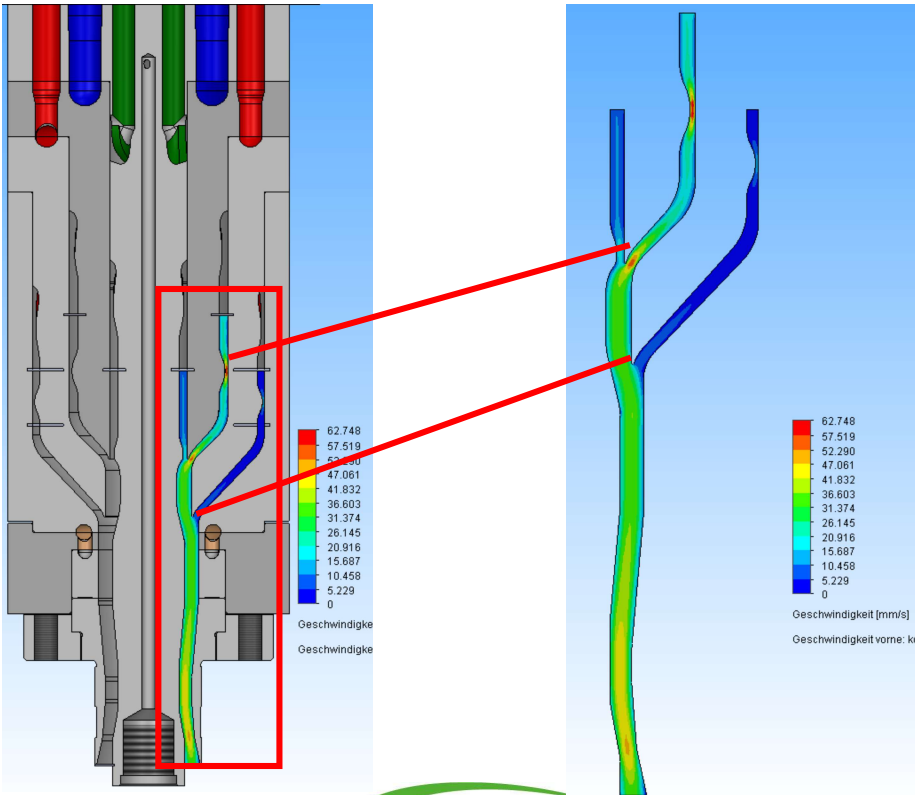
Not Matching Layer Velocities



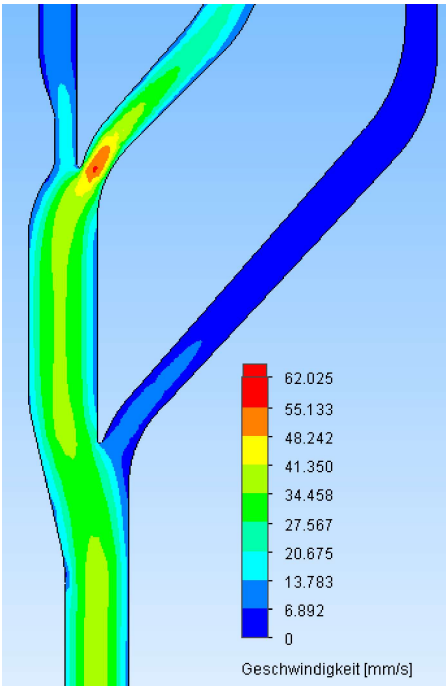
Matching Layer Velocities

# Multi-Layer Blow Molding – Layer Velocity

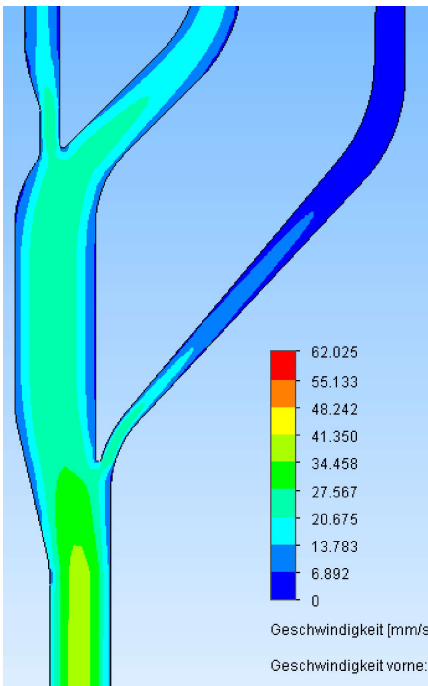
Cross-Section of 3-Layer Head



# Multi-Layer Blow Molding – Parison Quality

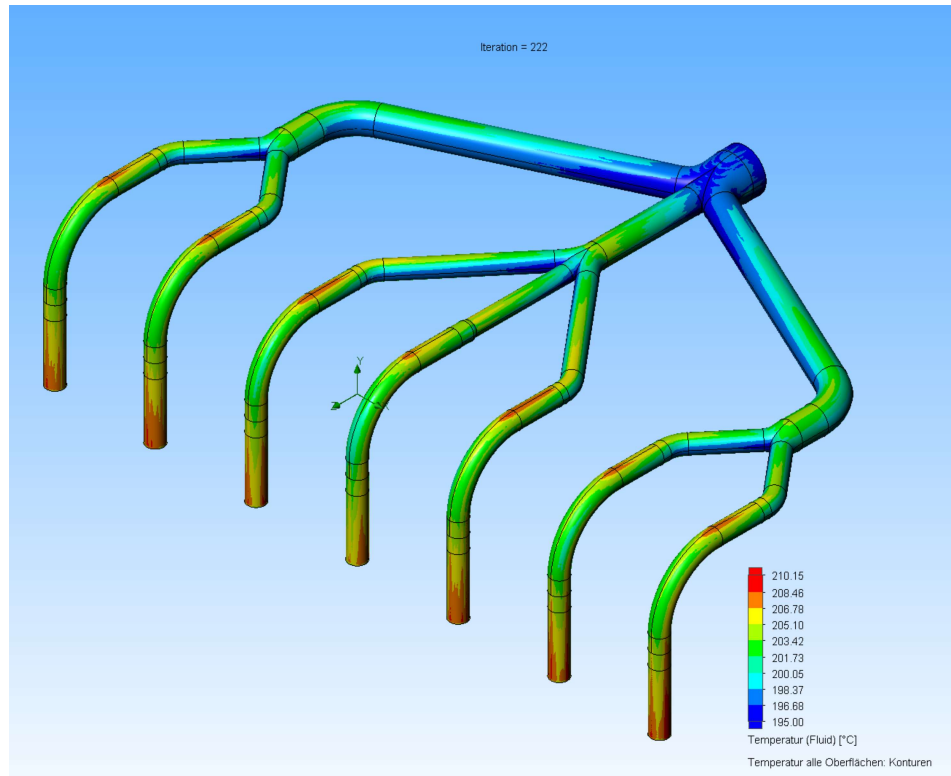


Initial Geometry



Optimized Geometry

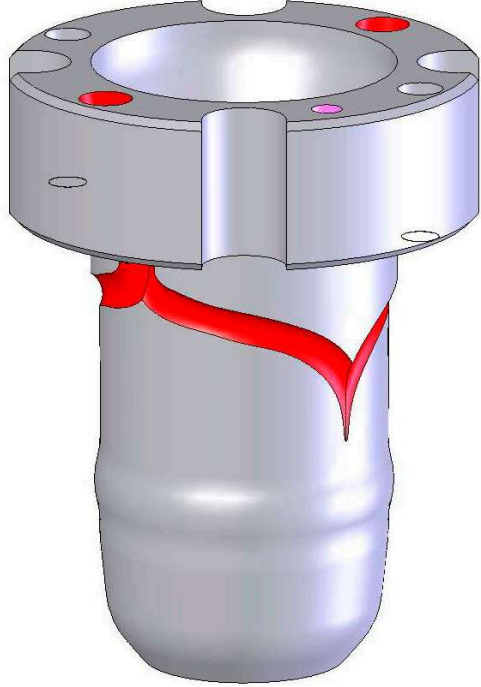
# Multi-Layer Blow Molding – Melt Temperature Evaluation



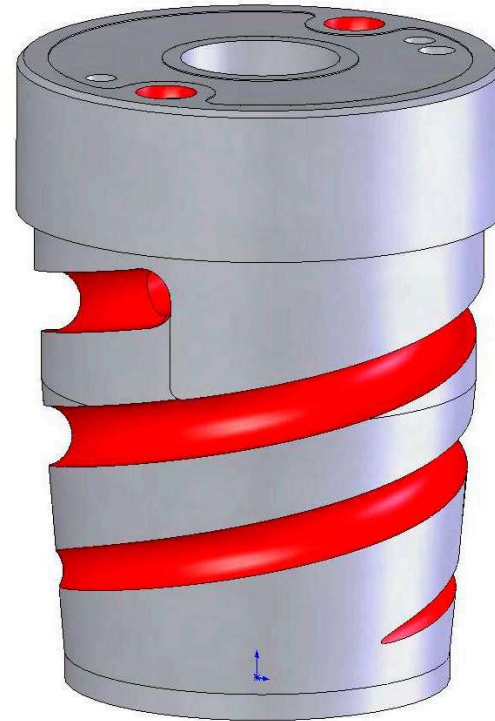
Multi parison heads require equal melt temperatures



## Multi-Layer Blow Molding – Insert Design



Dual Heart Pinola



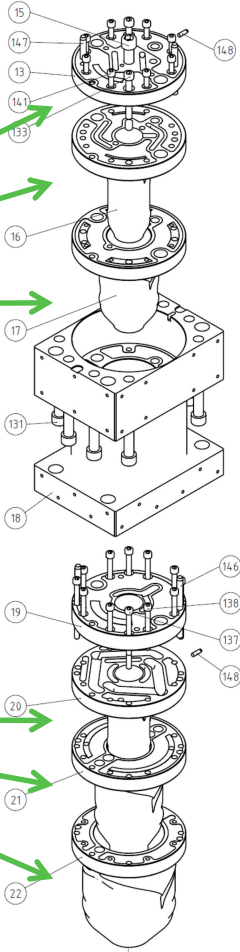
Spiral Pinola

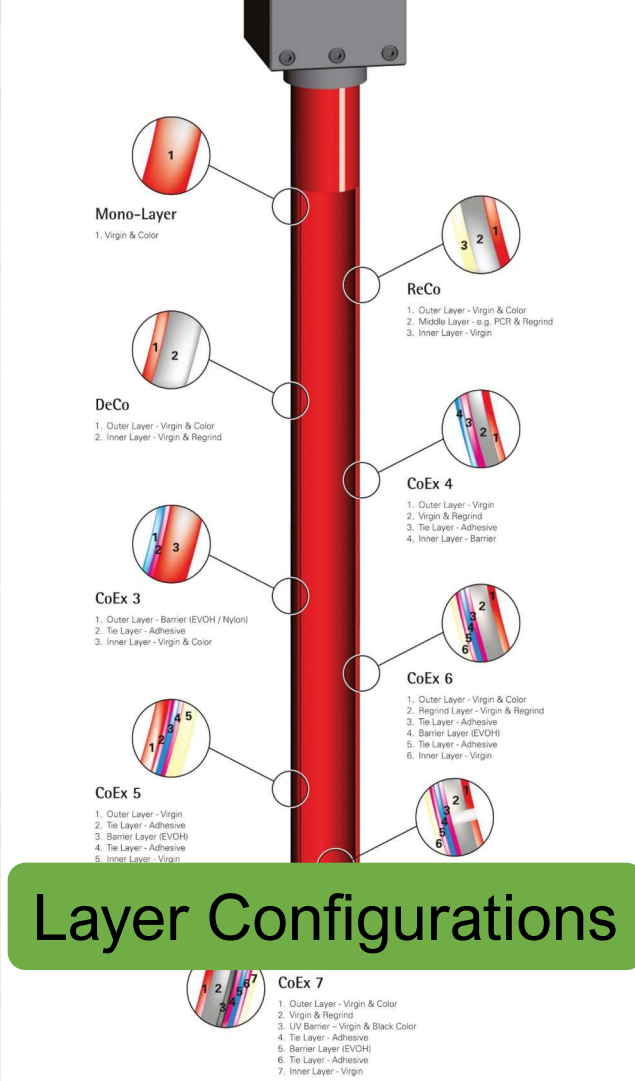


# Multi-Layer Blow Molding – Insert Design

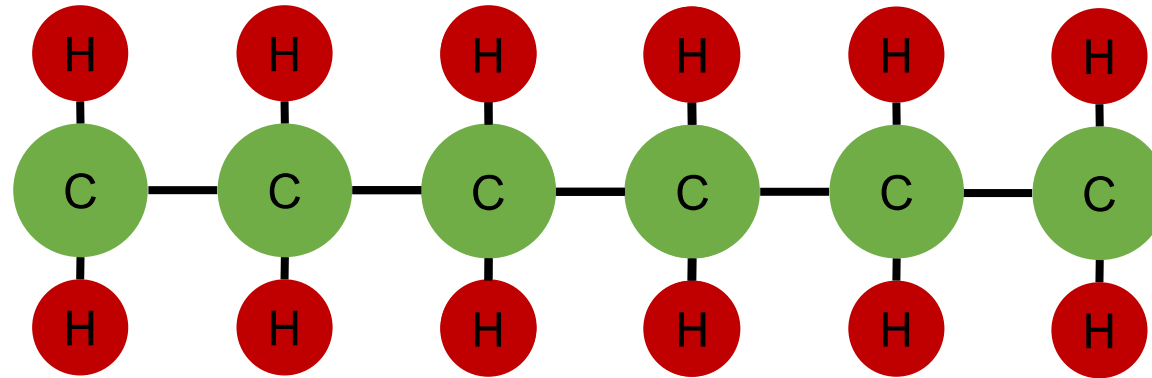
Inside Layers

Outside Layers





# Multi-Layer Blow Molding Layer Configurations – Material Considerations

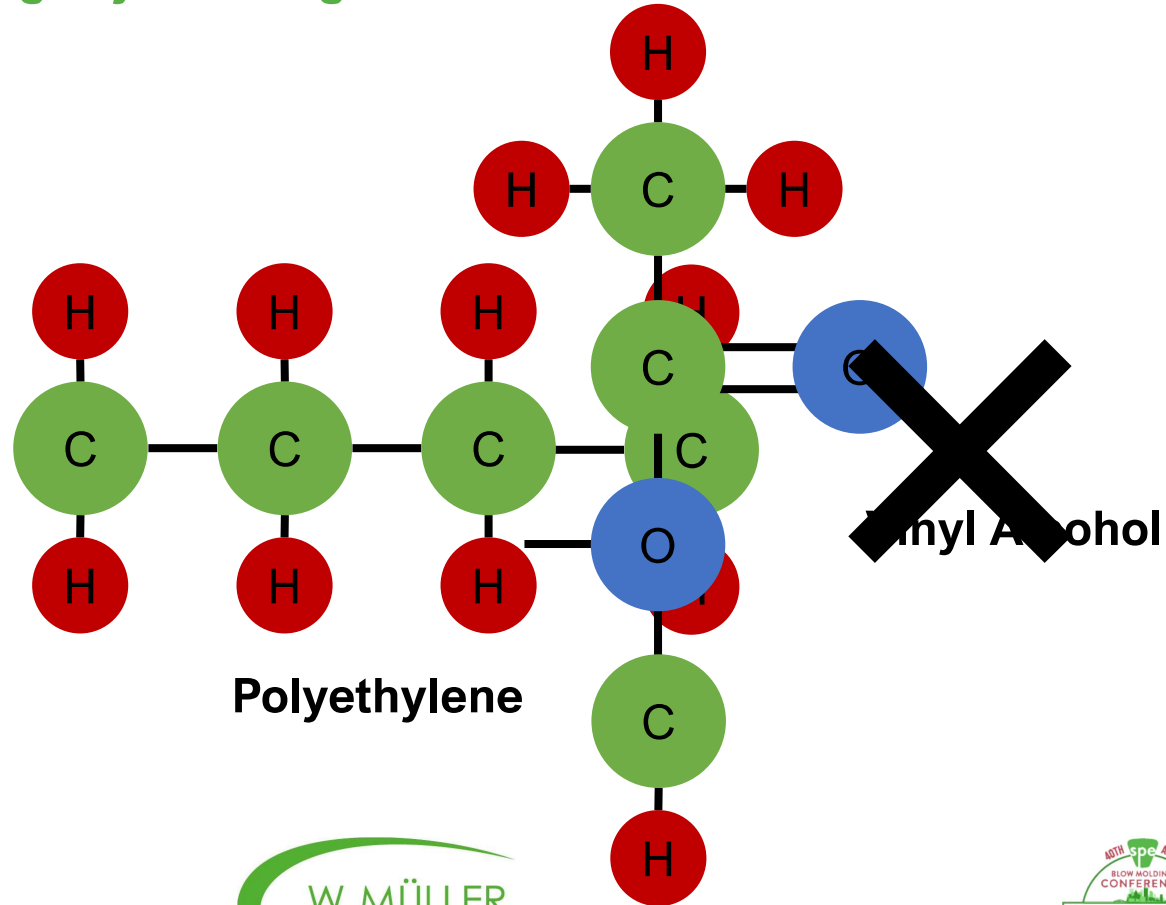


**Polyethylene**

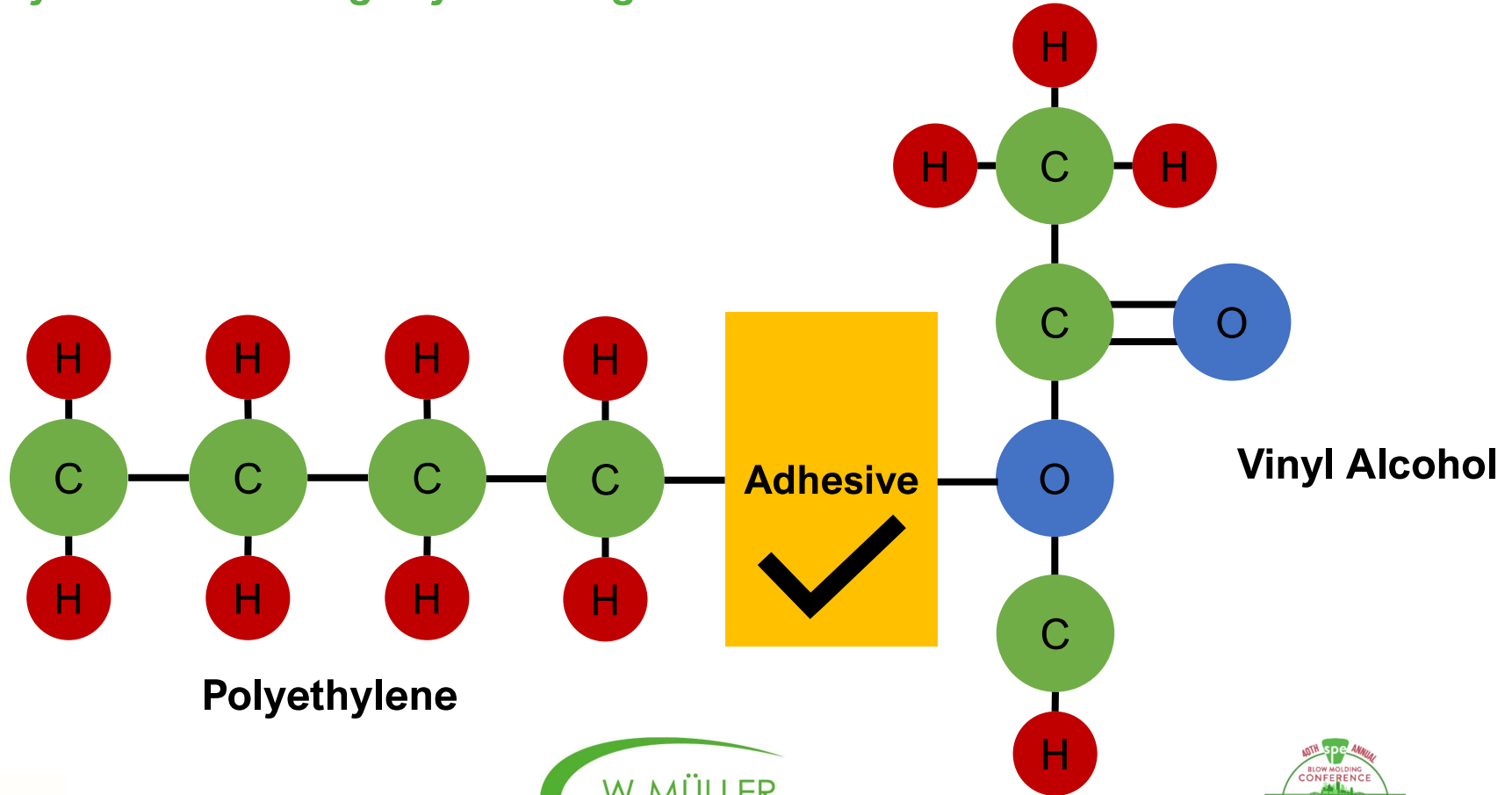
**Polyethylene**



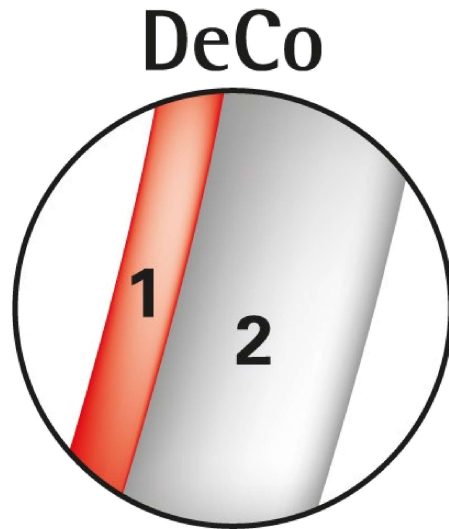
# Multi-Layer Blow Molding Layer Configurations – Material Considerations



# Multi-Layer Blow Molding Layer Configurations – Material Considerations

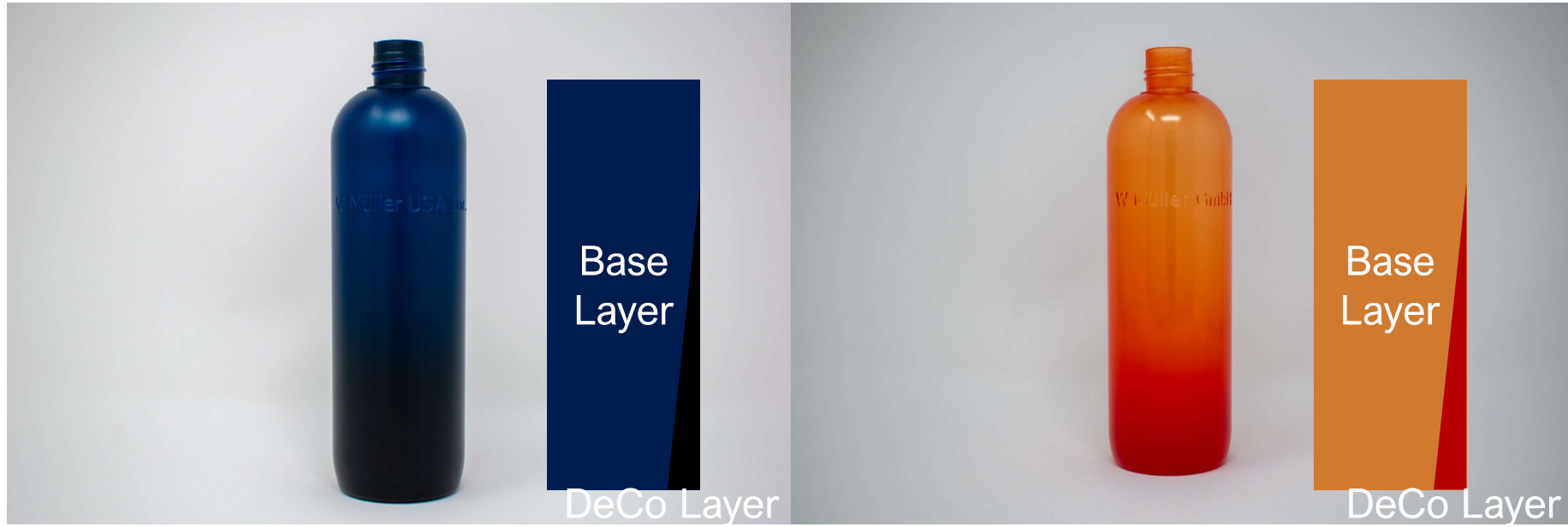


# Multi-Layer Blow Molding Layer Configurations

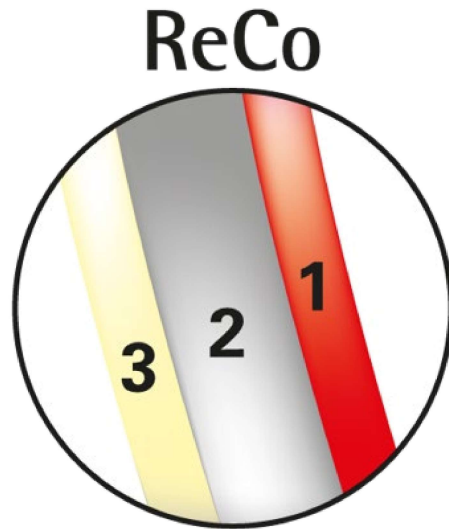


1. Virgin Decoration Layer
2. Regrind/PCR

## Multi-Layer Blow Molding Layer Configurations – Gradation Effect



# Multi-Layer Blow Molding Layer Configurations



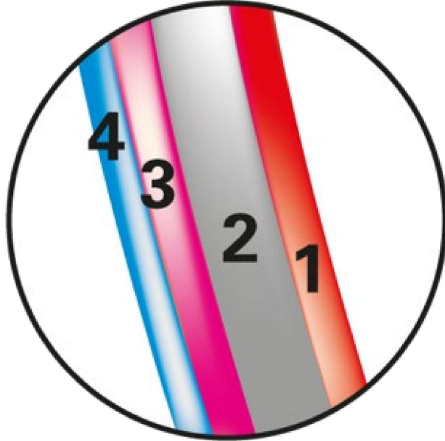
1. Virgin Decoration Layer
2. Regrind/PCR
3. Virgin Inner Layer





# Multi-Layer Blow Molding Layer Configurations

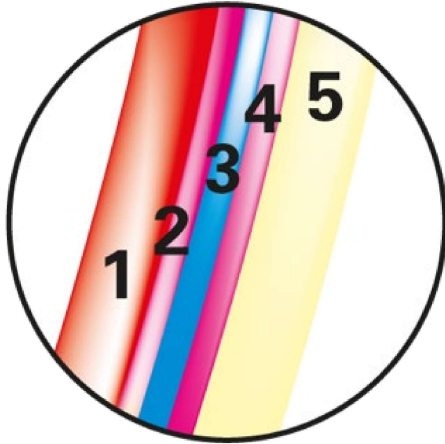
## CoEx 4



1. Virgin Decoration Layer
2. Regrind/PCR
3. Adhesive
4. Barrier Layer

# Multi-Layer Blow Molding Layer Configurations

## CoEx 5



1. Virgin Decoration Layer
2. Adhesive
3. Barrier Layer
4. Adhesive
5. Virgin Inside Layer

# Multi-Layer Blow Molding Layer Configurations

## CoEx 6



1. Virgin Decoration Layer
2. Regrind/PCR\*
3. Adhesive
4. Barrier Layer
5. Adhesive
6. Virgin Inside Layer

\*PCR/Regrind layer can be on either side of the barrier & adhesive layers

# Multi-Layer Blow Molding Layer Configurations

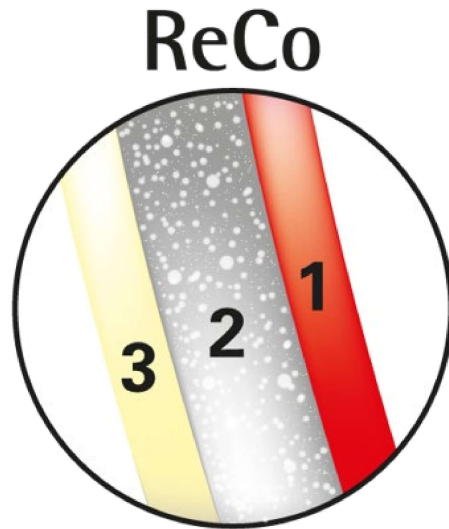
## CoEx 7



1. Virgin Decoration Layer
2. Adhesive
3. Oxygen/Moisture Barrier
4. Adhesive
5. UV Barrier (High-Carbon Black Color)\*
6. Regrind/PCR\*
7. Virgin Inside Layer

\*PCR/Regrind and barrier layers can be on either side of the barrier & adhesive layers

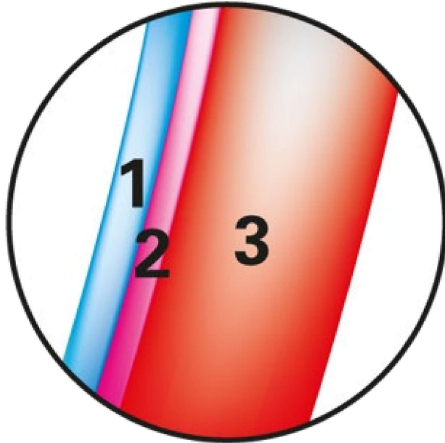
## Multi-Layer Blow Molding Layer Configurations – Foamed Layer



1. Virgin Decoration Layer
2. *Foamed* Regrind/PCR
3. Virgin Inner Layer

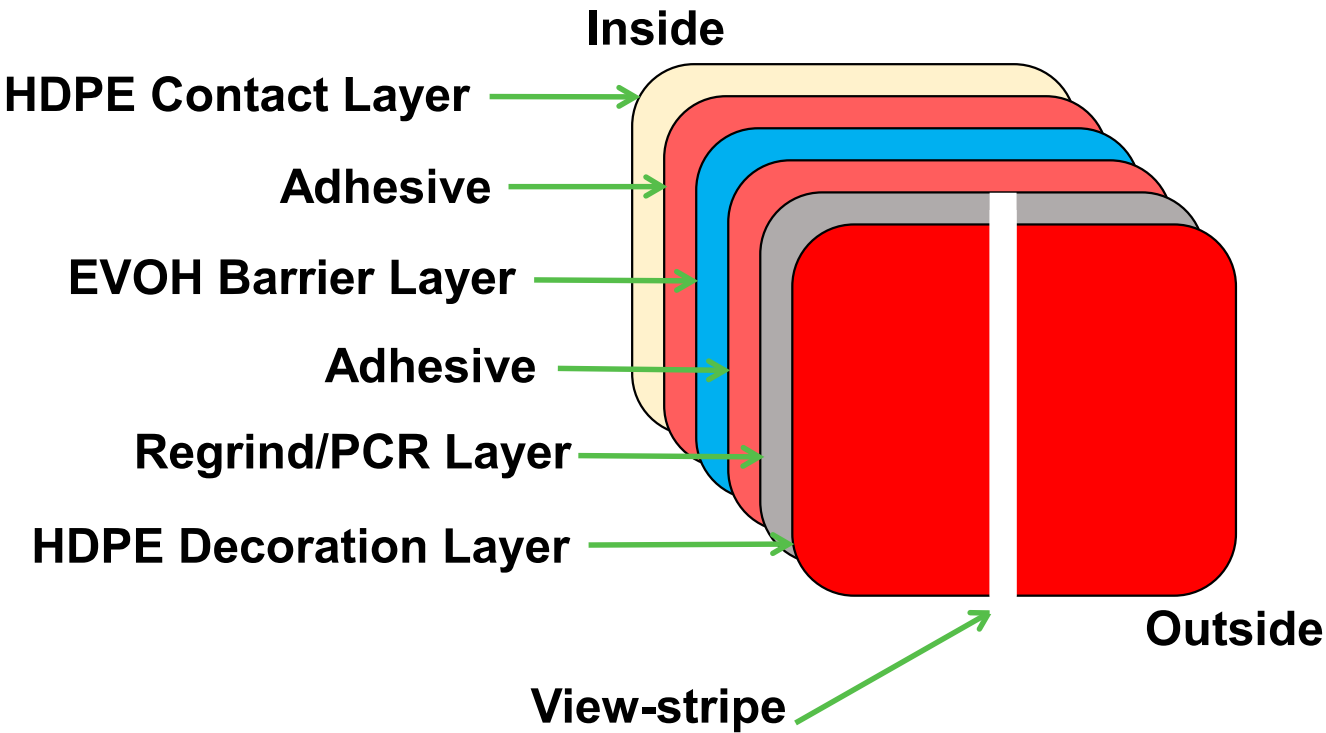
# Multi-Layer Blow Molding Layer Configurations

## CoEx 3



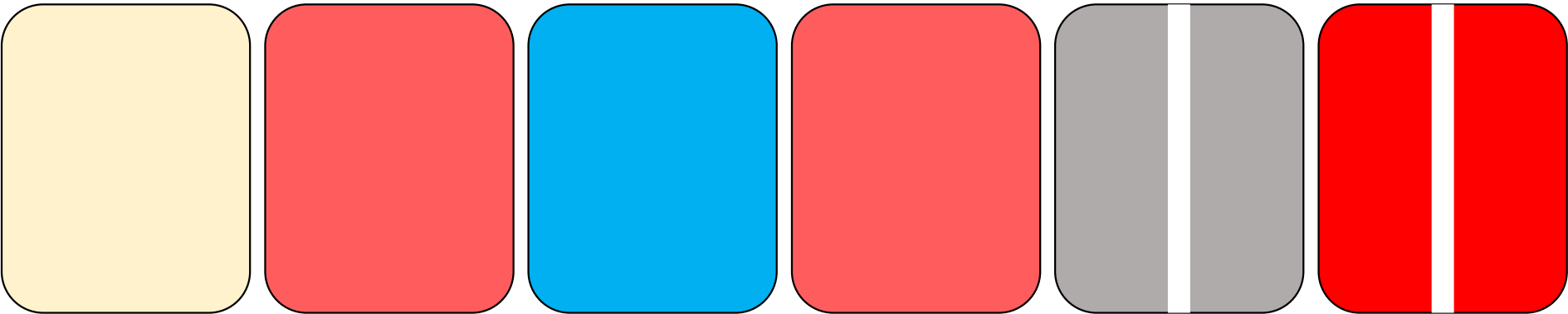
1. **Barrier *Outer* Layer**
2. **Adhesive Layer**
3. **Virgin Inner Layer**

# Multi-Layer Blow Molding Layer Configurations – View Stripe



# Multi-Layer Blow Molding Layer Configurations – View Stripe

Inside



Outside



**Add shelf value**  
**Keep Protective Qualities Intact**

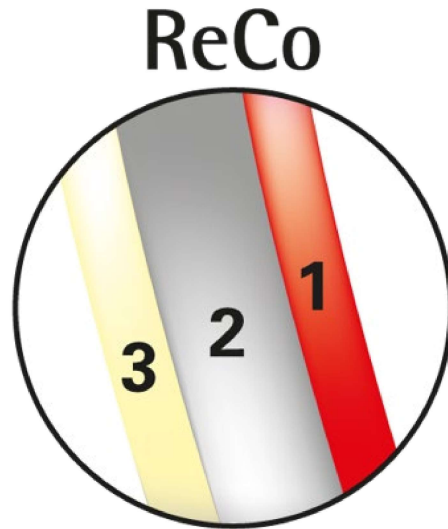




Multi-Layer Blow Molding – Sustainability



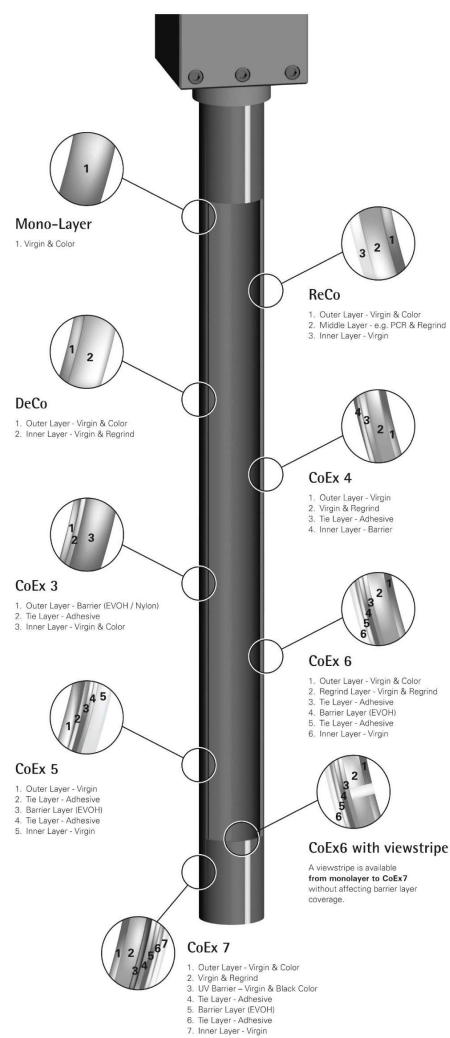
## Multi-Layer Blow Molding – Sustainability



**Replace 60% of the mass  
of the container with PCR**

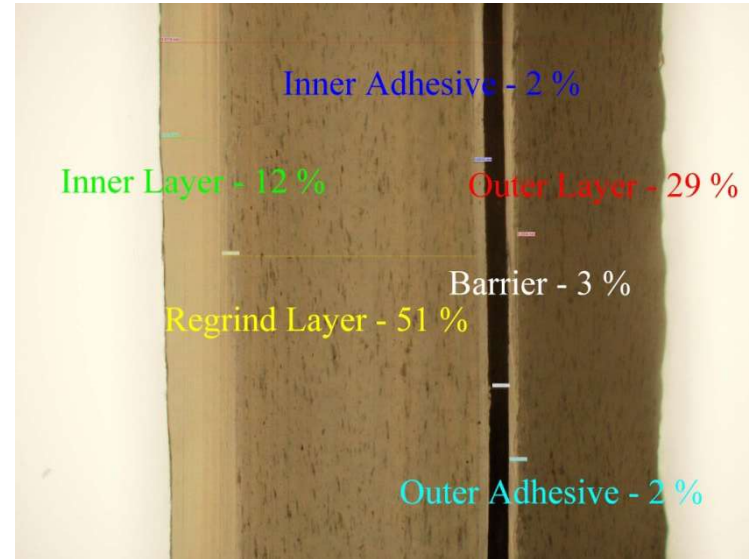
**1.7 Million kgs less virgin  
material usage every year**





Applications

# Multi-Layer Blow Molding Applications – Food & Beverage

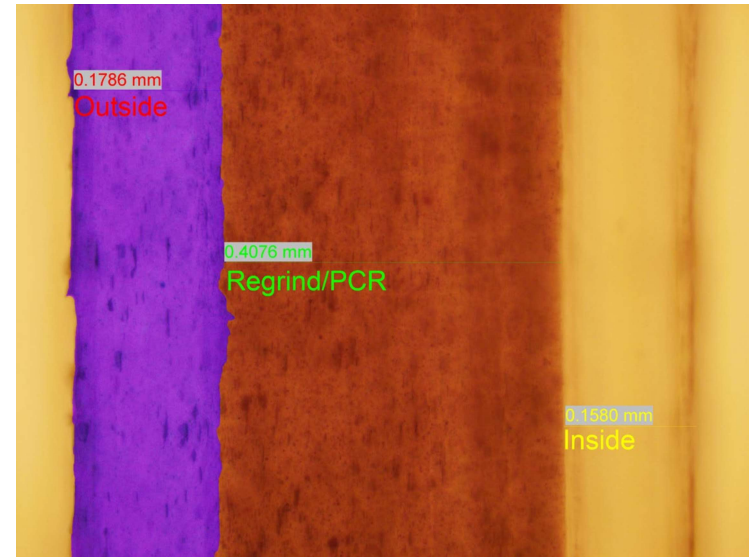


\*Barrier stained black using iodine for better visual representation

## CoEx 6 to preserve flavor



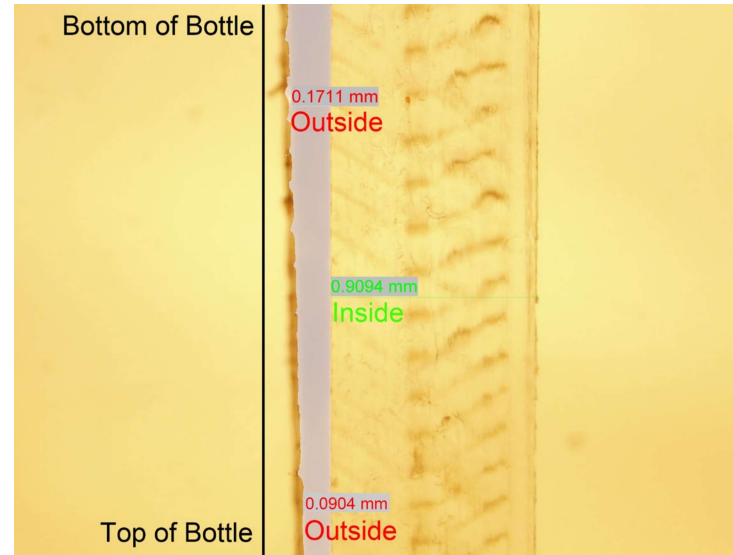
# Multi-Layer Blow Molding Applications – Personal Care



**DeCo 2/ReCo 3 to save color costs**



# Multi-Layer Blow Molding Applications – Personal Care

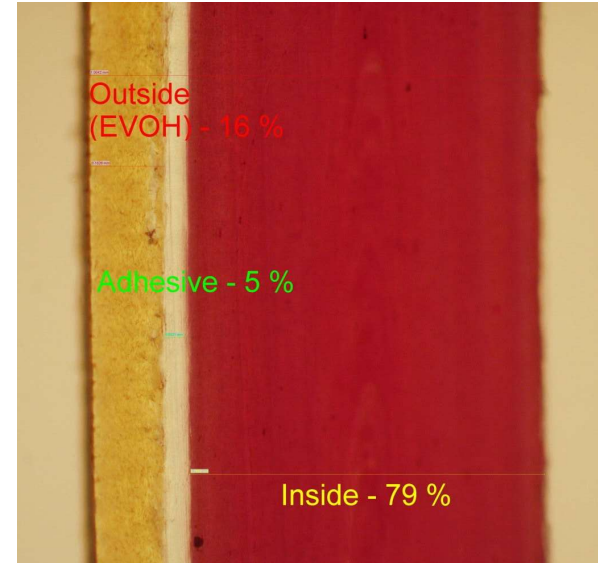


**DeCo 2 for a gradated design**





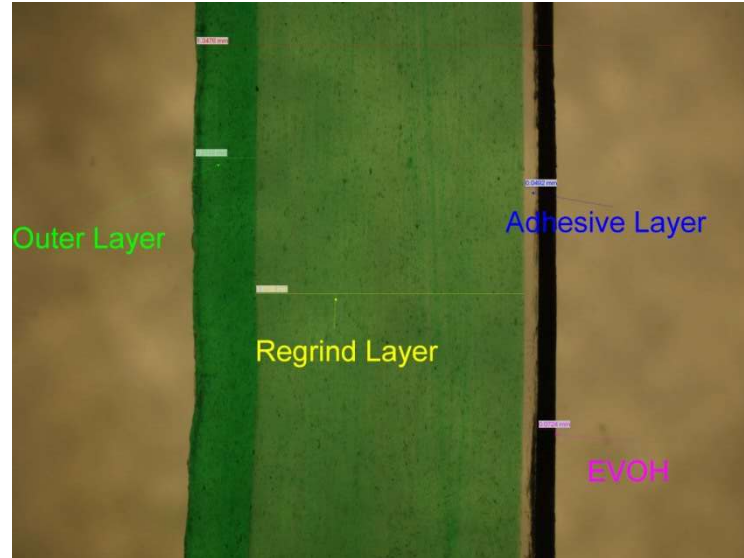
# Multi-Layer Blow Molding Applications – Cosmetics



**CoEx 3 to highlight color**



# Multi-Layer Blow Molding Applications – Agro-Chemical



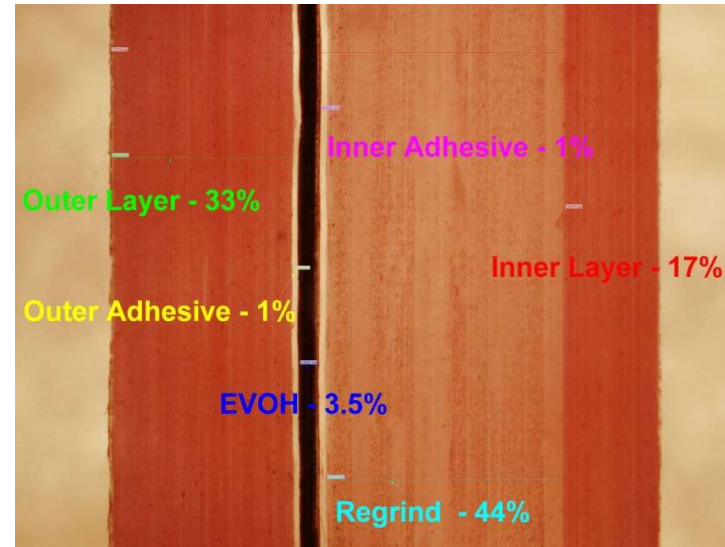
\*Barrier stained black using iodine for better visual representation

## CoEx 4 to isolate contents





# Multi-Layer Blow Molding Applications – Petroleum

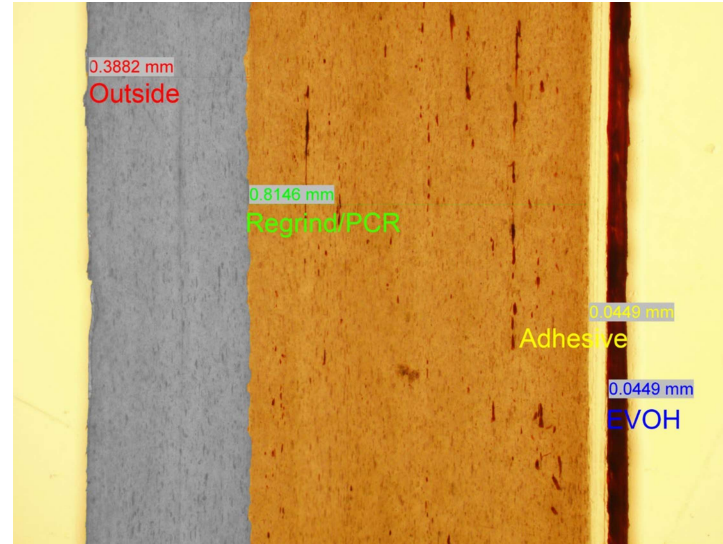


\*Barrier stained black using iodine for better visual representation

## CoEx 6 to protect consumers



# Multi-Layer Blow Molding Applications – Lubricants & Additives

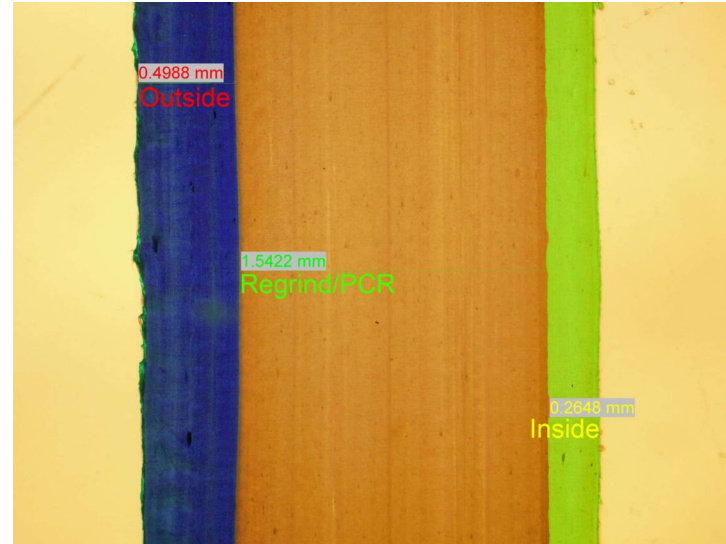


\*Barrier stained black using iodine for better visual representation

## CoEx4 to use more recyclables



# Multi-Layer Blow Molding Applications – Industrial Packaging



**ReCo3 to save virgen material**



**Expertise Courtesy of:**



- **Family Owned & Operated**
- **Legendary Quality & Reliability**
- **24/7 Global Support, Service, & Spare Parts**
- **Hand-Made in Troisdorf, Germany for Over 45 years**

