Pilot Vision+™

Vision-based quality management for PET bottles

Ensure consumer-safe food and beverages

Manage quality issues related to increased rPET %

Identify defects in the blowmolder at time of production

Detect mold and spindle related defects

PILVIS+0819

PILOT VISION+™

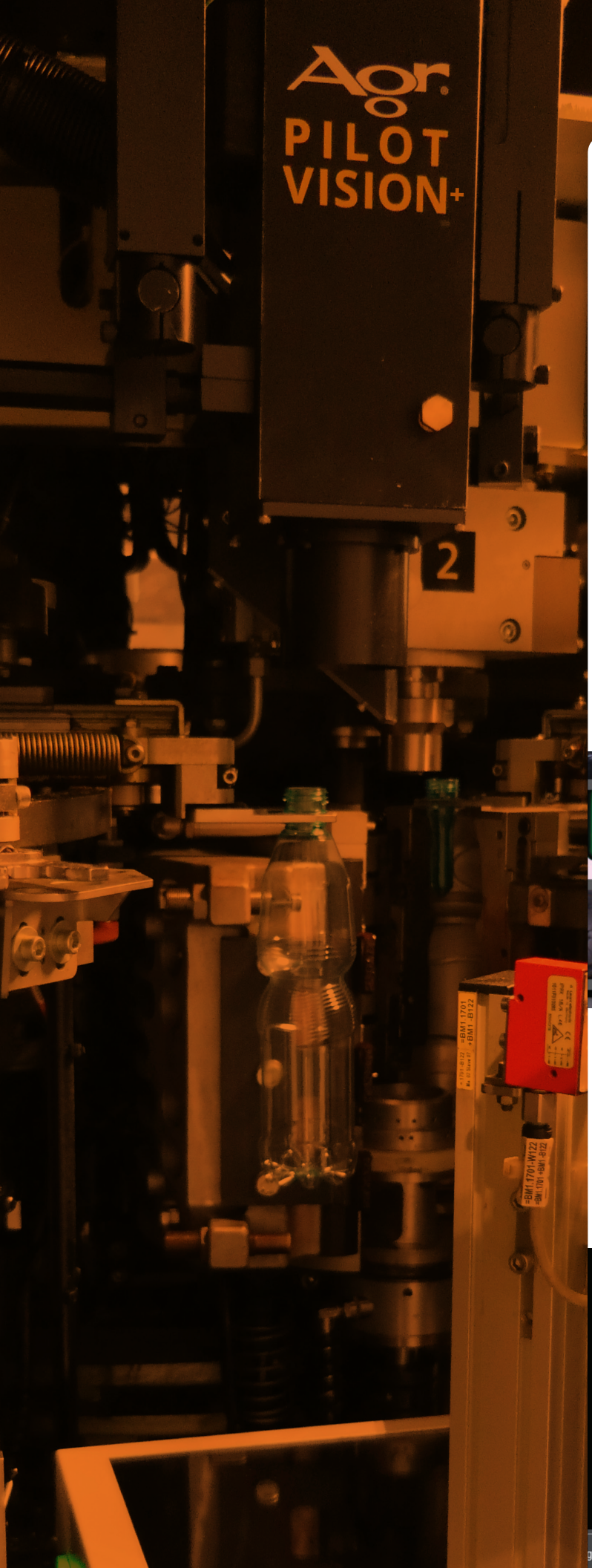
A VISION-BASED QUALITY MANAGEMENT SYSTEM

designed for the unique requirements of PET bottle converters and brand owners that manufacture their own containers. Specifically engineered for inspection applications inside the blowmolder, **Pilot Vision+**™ offers comprehensive bottle and preform inspection. The system is compatible with all major blowmolder brands and works in tandem with Agr's Pilot Profiler® material distribution measurement system and Process Pilot® automated control systems.

The multi-camera design facilitates complete container and preform evaluation for random defects—particularly those resulting from increased post-consumer resin (rPET) content. Most importantly, the **Pilot Vision+**™ system provides powerful capabilities to identify even the most complex defects in one intuitive and effective system.

THE RIGHT TECHNOLOGY TO MEET THE NEEDS OF TODAY AND TOMORROW

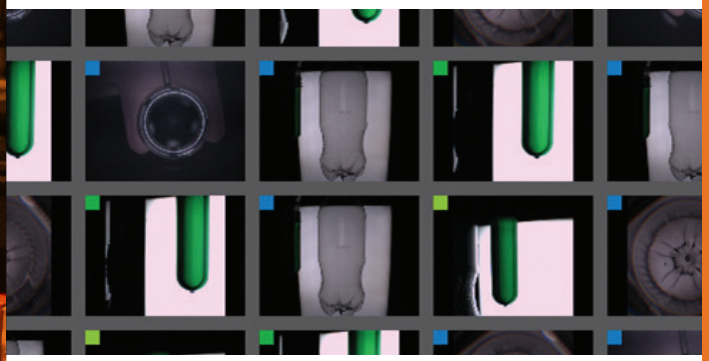
- High accuracy and reliable inspection inside the blowmolder
- Compatible with all major blowmolders—throughput up to 100,000 bph
- Up to 6 high-resolution cameras for comprehensive inspection
- Color preform cameras
- High-speed image processing
- Proven industry specific algorithms—designed specifically for containers
- Sealed cameras and light sources for aseptic environments
- Integrated cooling for use with heat-set blowmolding
- State-of-the art user authentication



POWERFUL, INTUITIVE INSPECTION TOOLS

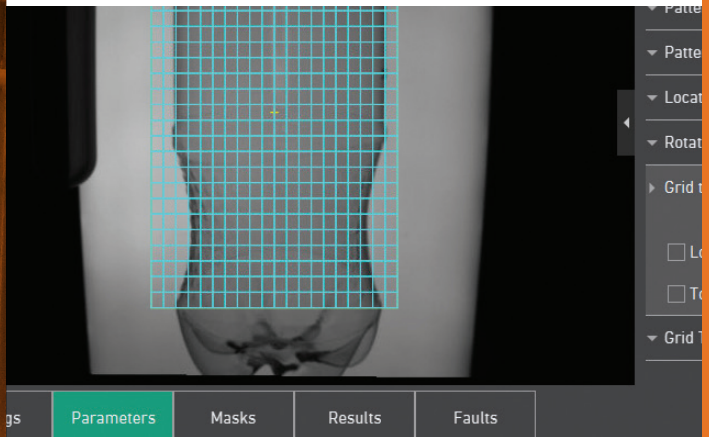
Robust inspection algorithms on the Pilot Vision+ system leverage sophisticated inspection techniques that have been developed as a result of Agr's many years of experience in bottle testing and inspection. For optimal inspection coverage and flexibility, Pilot Vision+ enables operators to set up multiple inspection regions for an entire part, a small region or a combination thereof. This provides flexibility for focusing on critical areas without compromising other regions of interest.

- Simple job creation and storage
- Flexibility to adjust parameters using live and history images during production
- Powerful part location and inspection tools with simplified controls
- Full-color preform images
- Pre-built tool sequences provided for each inspection type
- Multiple reference images for enhanced color inspection and sorting



ARRAY OF VISION TOOLS

- Multiple adjustable ROI tools for defining inspection regions
- Unlimited number of measurements or ROI's
- Pattern matching and learn capabilities
- Independent, multiple thresholds
- Image masking
- Digital image filtering
- Image orientation

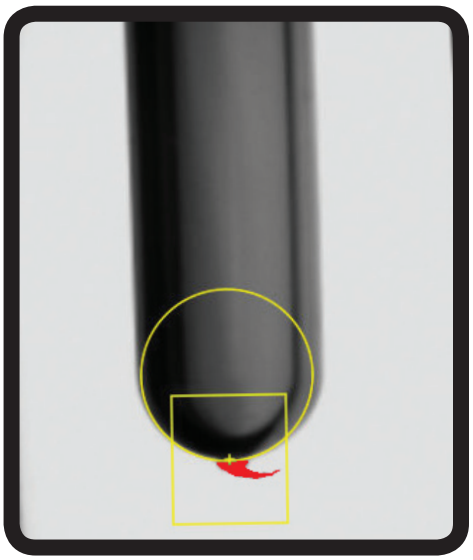


DEFECT DETECTION.

Pilot Vision+™ provides a modular approach—with the

PREFORM INSPECTION

Inspecting preforms prior to blowing allows for complete 360° sidewall inspection. Optics, LED illumination and image analysis routines are optimized to identify preform defects that impact bottle integrity, yet are difficult to detect on a blown bottle.



Detecting Color Variations

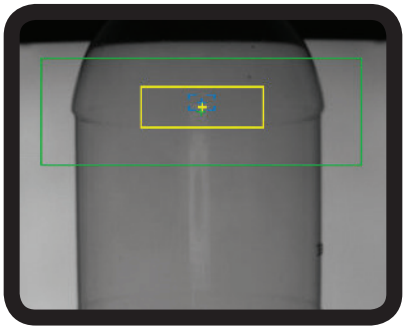
With the increased use of recycled PET (rPET), there can be additional challenges related to color consistency. Pilot Vision+ color cameras offer a means to ensure that colors are consistent.

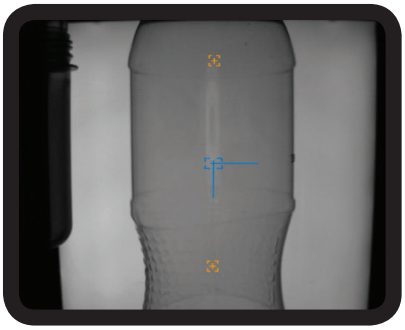
Multiple Reference Images

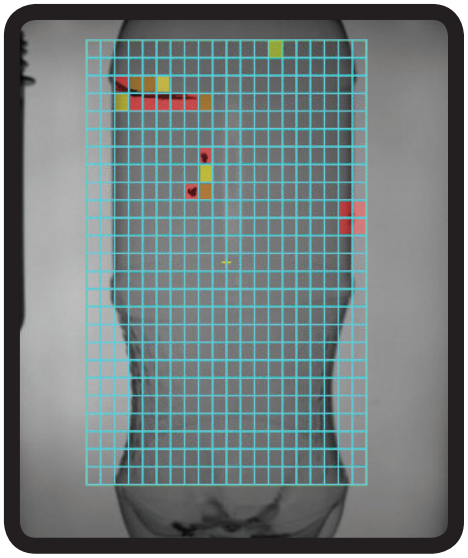
Pilot Vision+ has the capability to learn multiple reference images for defect detection, and multiple reference image sets for color inspection. This makes it possible to process a preform supply with slight color variations and manage the range of color by accepting those that match the reference images, while rejecting those that do not match.

COMMON PREFORM DEFECTS

Black spots | Impurities | Bubbles/blisters | Crystalinity | Unmelts | Color hues and color changes
Burn marks | Water spots | Streaks | Gate length







SIDEWALL INSPECTION

The Pilot Vision+ sidewall inspection module provides the capability to effectively monitor and manage sidewall defects that commonly occur in the bottle production process. The system offers complete sidewall coverage and can be configured with 1 or 2 cameras. Multiple Regions of Interest (ROI) can be defined to focus inspections on critical areas.

COMMON SIDEWALL DEFECTS

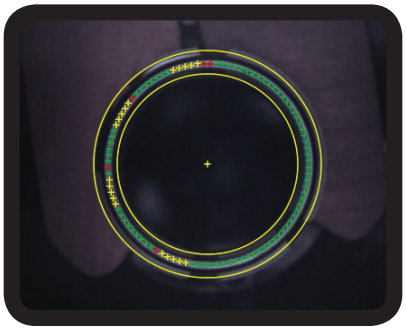
Neck folds | Clarity and consistency | Areas of crystalinity | Contamination – foreign materials
Dark spots | Holes | Underblown containers

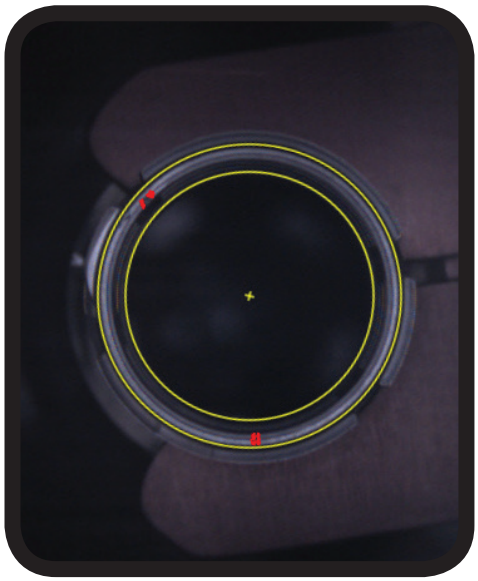
. .WHERE IT'S NEEDED

ability to expand inspection capabilities as needed.

SEAL SURFACE INSPECTION

The Pilot Vision+ seal surface inspection module offers the ability for bottle manufacturers and fillers to ensure product integrity and safety is not compromised by common seal surface defects. The seal surface module incorporates a dedicated camera, LED lighting system and robust image analysis algorithms, expressly designed for optimal imaging and accurate identification of defects.



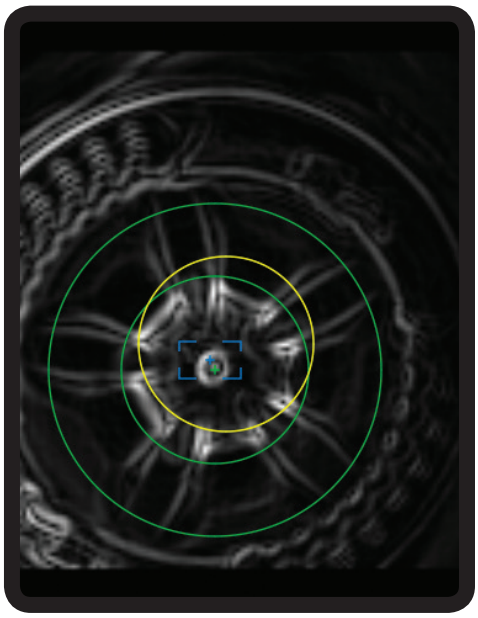


COMMON SEAL SURFACE DEFECTS
Nicks, dents (V notches) and scratches | Surface irregularities | Seal surface width (average)
Inner/outer diameter| Ovality| Blown finish | Choked neck| Seal surface integrity | Flash | Short shots

BASE INSPECTION

The base inspection on the Pilot Vision+ system utilizes a powerful set of inspection algorithms that identify the smallest defects and anomalies regardless of base size, shape or design. In addition, the system learns recurring marks such as recycle symbols, logos and mold numbers as well as unique mold attributes. This capability makes it possible for total base inspection without compromise. Variable LED lighting intensity and a library of imaging tools provide the means to fine-tune inspections to meet individual requirements and identify difficult defects with confidence.

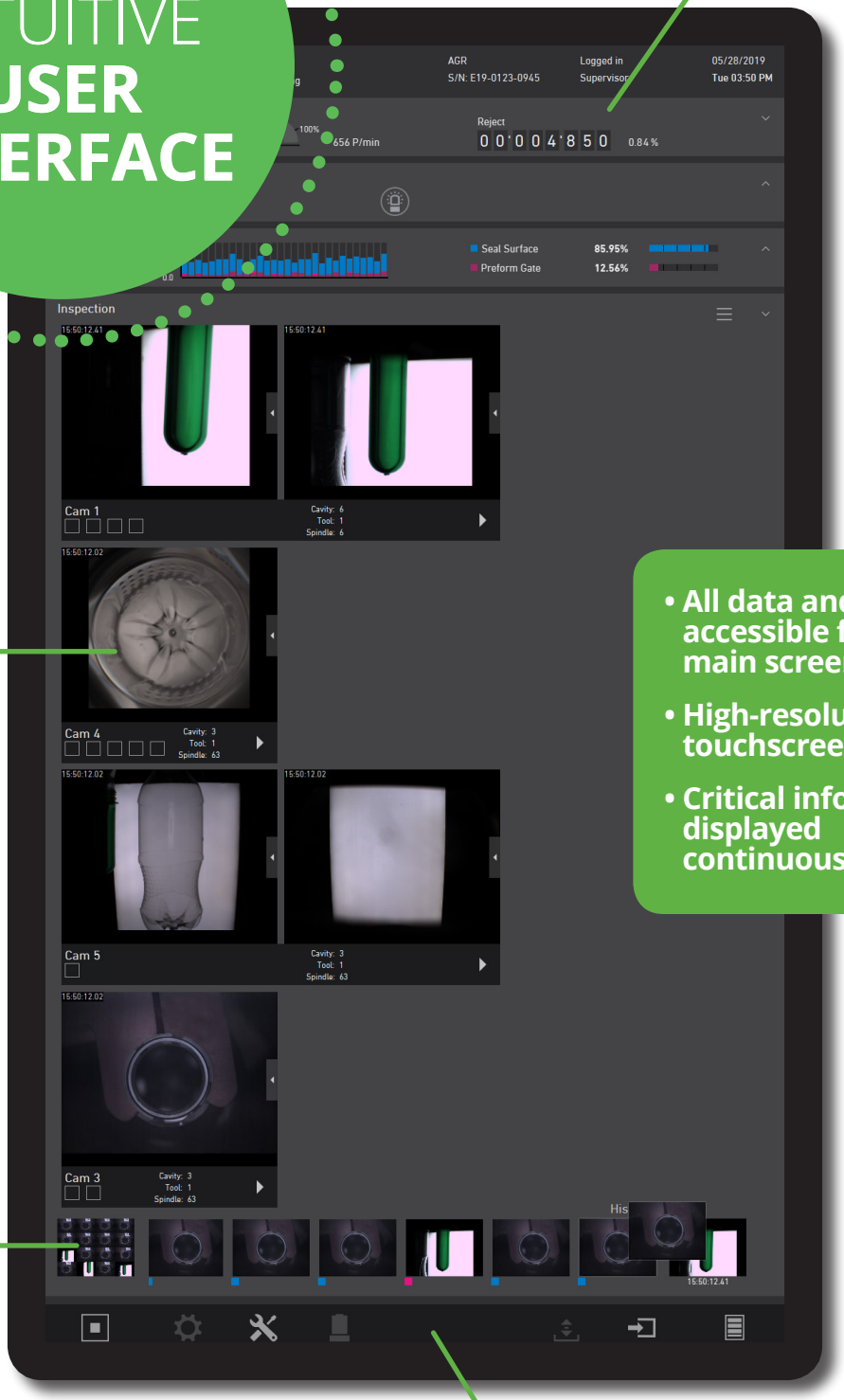
The base inspection incorporates a unique liquid lens design that provides continuous image clarity and automatically accounts for minor deviations in working distance, without mechanical components. This feature also eliminates the need for mechanical lens adjustment when changing between containers of different heights. Height settings are saved with each job and focus is automatically adjusted to accommodate new container heights. This saves changeover time and ensures a clear, high-resolution image of the base at the start of production.



COMMON BASE DEFECTS
Holes: base • foot region • gate| Opaque spots | Foreign particles | Unmelted material
Under-blown and improperly formed feet and base characteristics | Folds in base region | Off-center gate
Gate size | Gate ovality/tears

LARGE, INTUITIVE **USER INTERFACE**

EXPANDABLE STATISTICS AND PRODUCTION STATUS



LIVE INSPECTIONS AND DEFECT DETECTION

- **All data and info accessible from main screen**
- **High-resolution touchscreen**
- **Critical information displayed continuously**

HISTORY BROWSER

CONTROL BAR

ADVANCED ANALYSIS TOOLS

1 DEFECT CATEGORIZATION AND REJECT STATISTICS

- Categorized defect types help identify the problem quickly
- Color-coded fault group indicators display on rejected bottle images
- Adjustable reject alarm thresholds by fault group
- Per-minute reject rate graph for last 24 hours
- Scrollable 30-minute segments with minute-by-minute break down by fault group

2 MOLD AND SPINDLE CORRELATION OF DEFECT DATA

- To quickly identify defects related to a specific mold or spindle
- Tracking of bottle rate and production events
- Alarm counts for last 7 days, sorted by frequency

3 BOTTLE HISTORY BROWSER

- Adjustable inspection parameters, using history images, without interference with running inspections
- Easy review of recently rejected bottle images
- Reject monitoring and quick access to history browser

The Process Pilot®

Blowmolder Management System

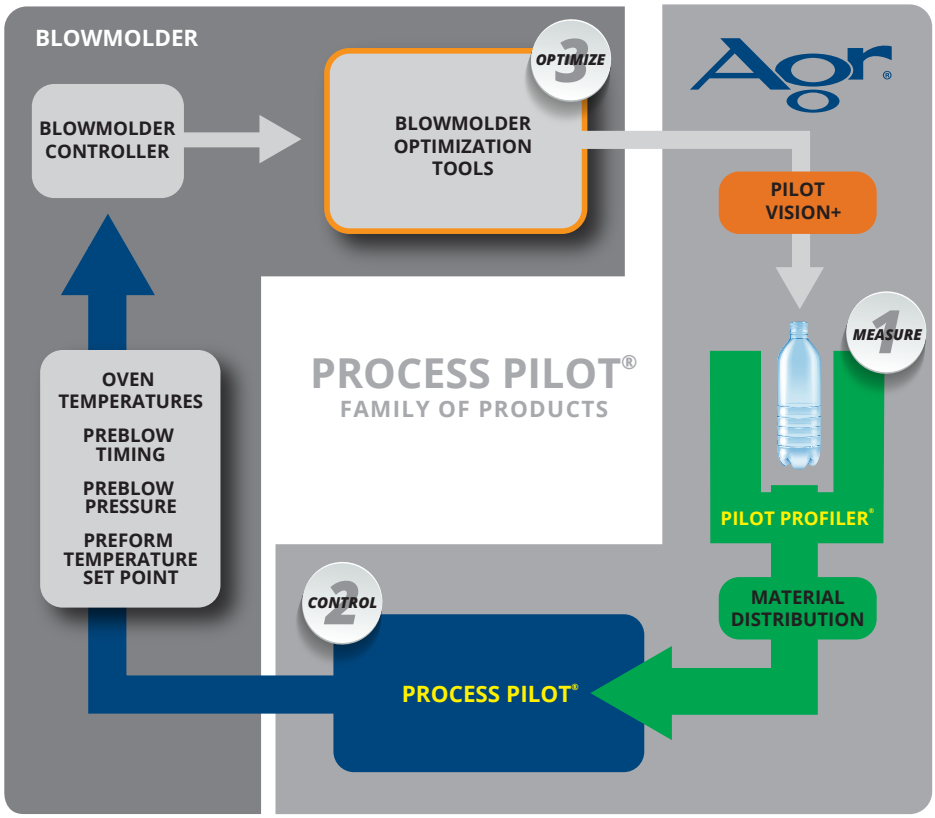
Quality and process management capabilities can be further expanded by combining the Pilot Vision+ system with Agr's Process Pilot® blowmolder management system. This powerful combination offers a total Process and Quality control program for PET containers that includes thickness management, random defect detection and stable, consistent production 24/7 that can only be achieved through automated blowmolder control.

The Process Pilot approach is based upon three fundamental concepts:

1. **Measure**: Agr's Pilot Profiler® measurement system monitors every bottle to identify on-going changes in material distribution.

2. **Control**: Process Pilot closed-loop control software proactively manages the blowmolder thickness measurements to maintain desired material distribution and produce consistent, high quality bottles.

3. **Optimize**: Process Pilot enhancement tools give you the means to optimize bottle production to a target that is most suitable for the product, application or operational goals—making it possible to efficiently produce the best performing bottles with maximum profitability.



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