

Thermoformed Molded Fiber Symposium



QUANTIFYING FIBER
FORMATION IN MOLDED
FIBER

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Fiber Formation

- Why Fiber Formation Matters
 - Strength / Stiffness
 - Weight
 - Barrier Properties
 - Cycle Time
 - Surface Smoothness
- What Impacts Fiber Formation
 - Consistency
 - Freeness / Drainage
 - Agitation in the forming tank
 - Additives
 - Tool Design



The Challenge of Quantifying Fiber Formation

- 3D Shape Solved with Technique
- Thickness/Caliper Solved with Technique
- Each Tool/Machine is Unique Solved with Automation and Sampling Strategy
 - Specific product features
 - Depth
 - Facility setup
- Each Cavity on a Machine is Unique Solved with Automation and Sampling Strategy
 - Location on the platen
 - Agitation uniformity

The Biggest Challenge - Scale

Light Transmittance to Measure Fiber Formation

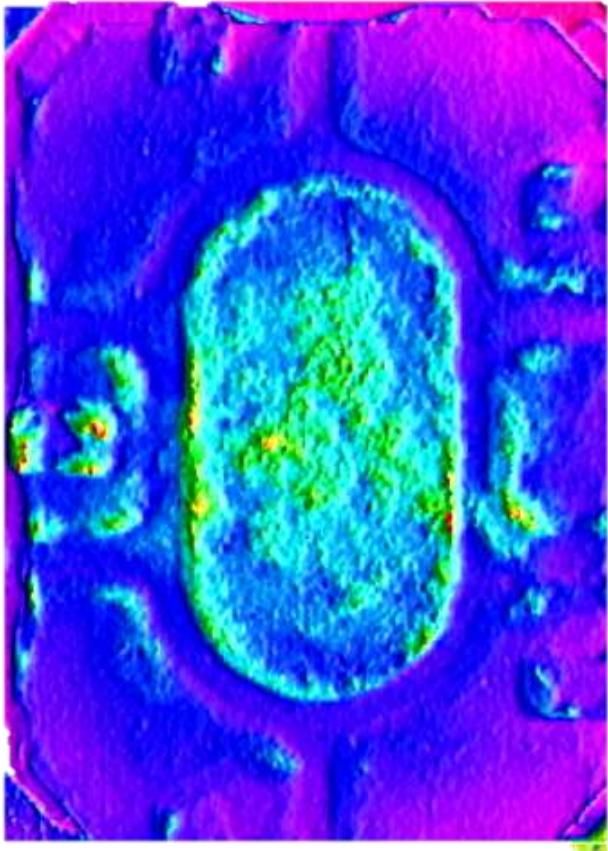
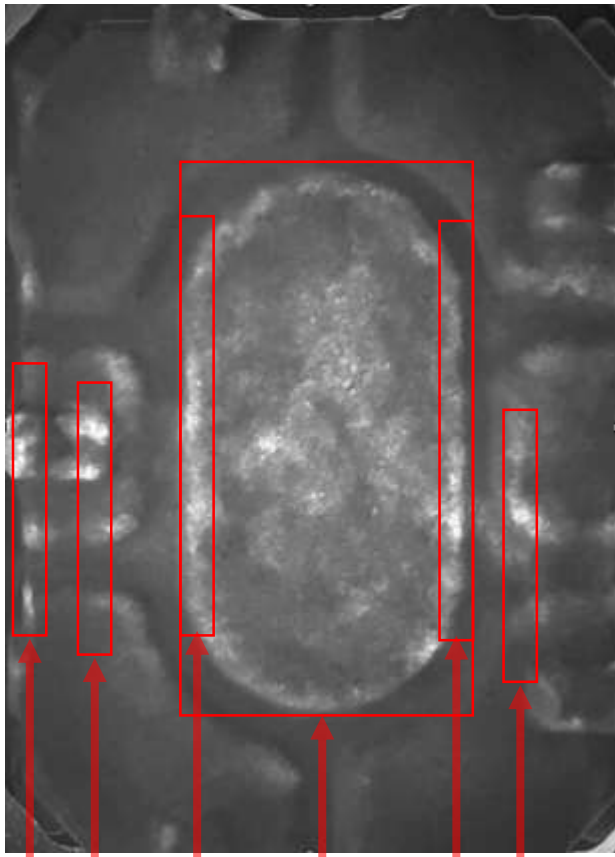
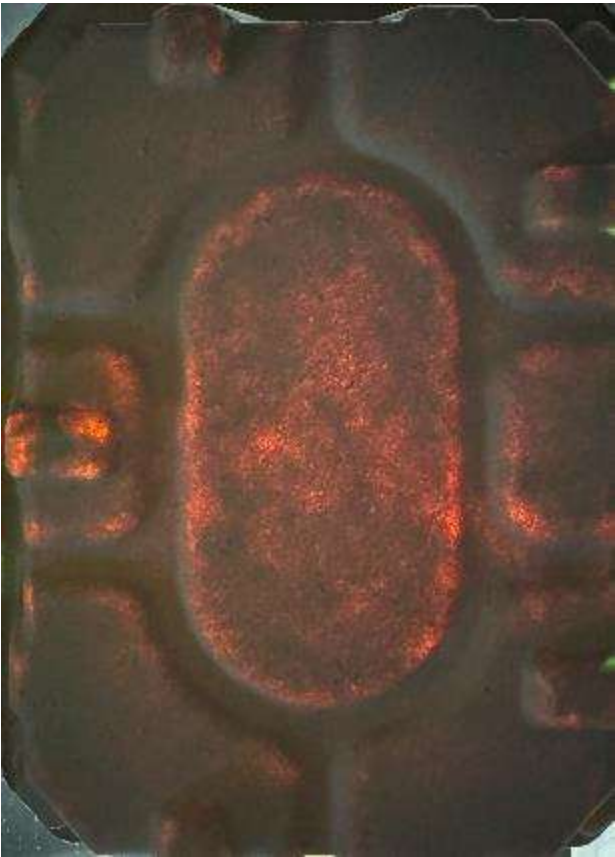
This method is used in several off-the-shelf analyzers for flat paper and has been studied by multiple groups over the years as an effective way to measure fiber formation

What is Required

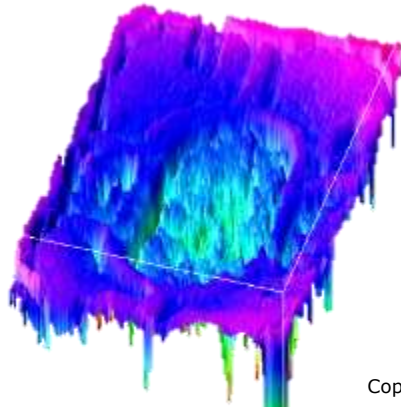
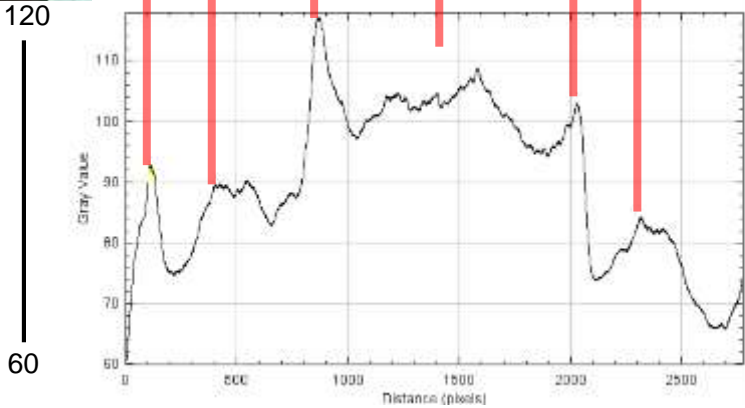
- Lights
 - Minimum 3000-5000 lumens for a 6x8 tray (more for a larger product)
- Custom Light Box / Backlit Conveyor
 - Must block excess source light and ambient light
- Camera
 - Sufficient resolution in low light
- Software
 - ImageJ or equivalent
 - Data analysis



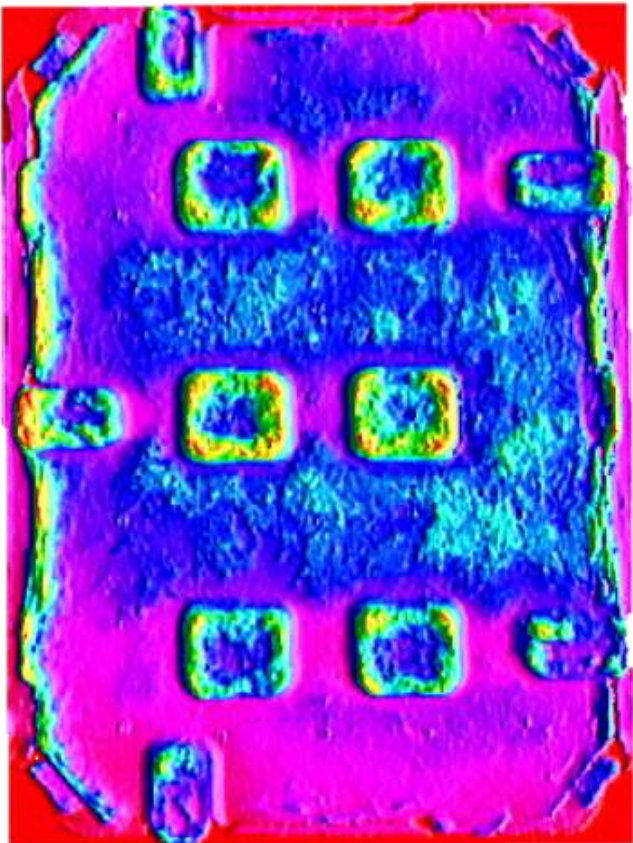
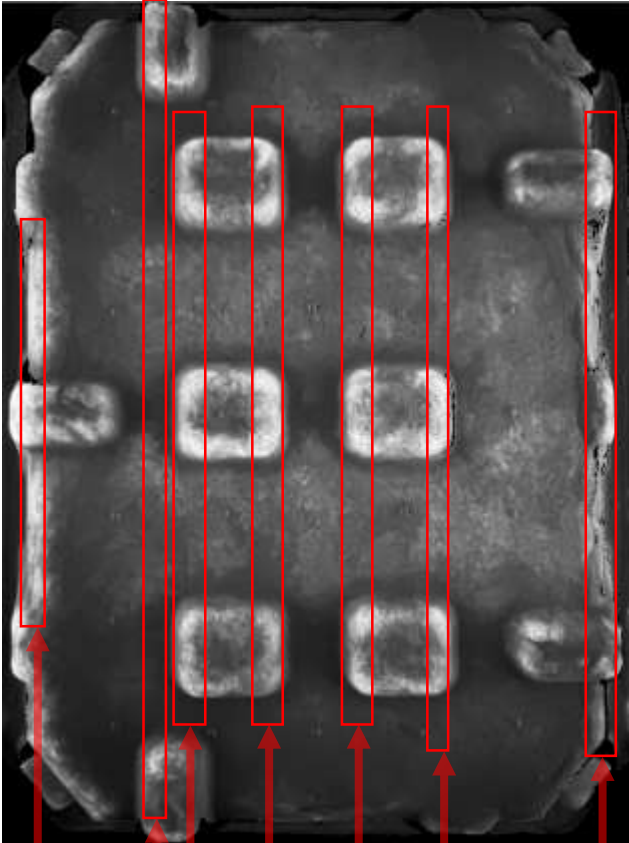
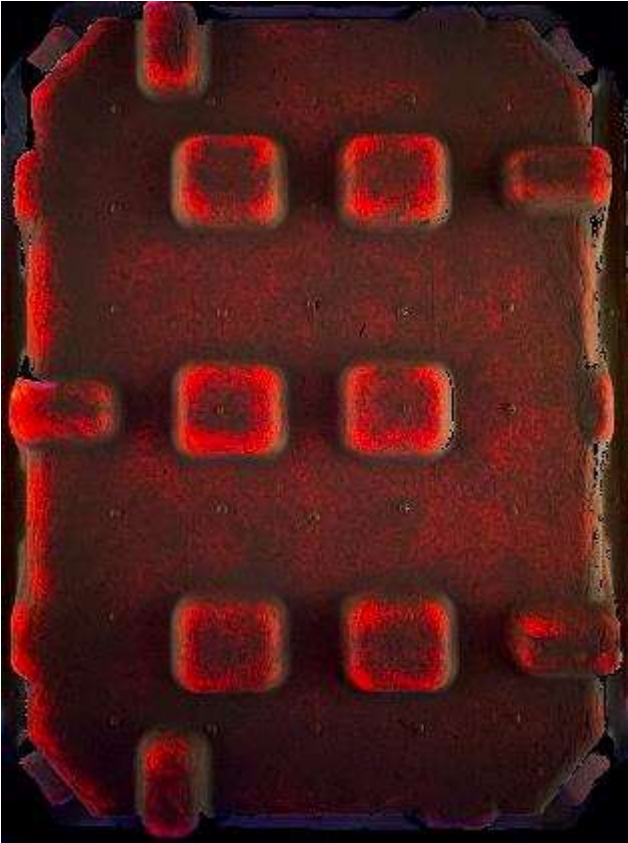
Demonstration of the Process – Detecting Bad Formation



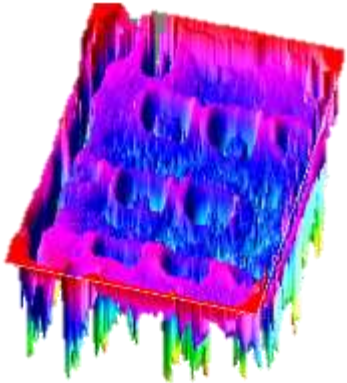
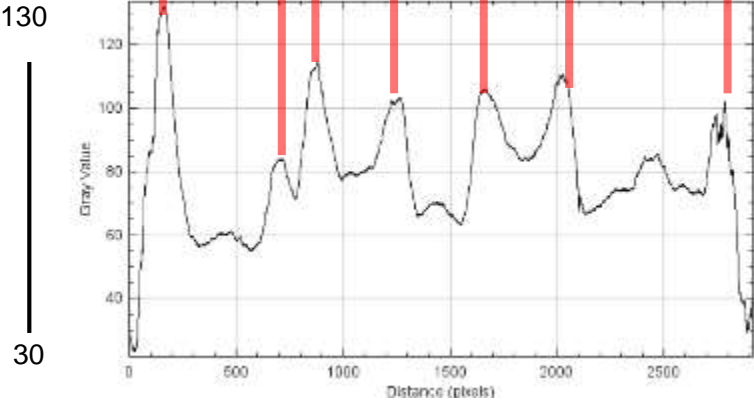
Peaks: 5
Range: 60-120
Average: 90
Std. Dev.: 20



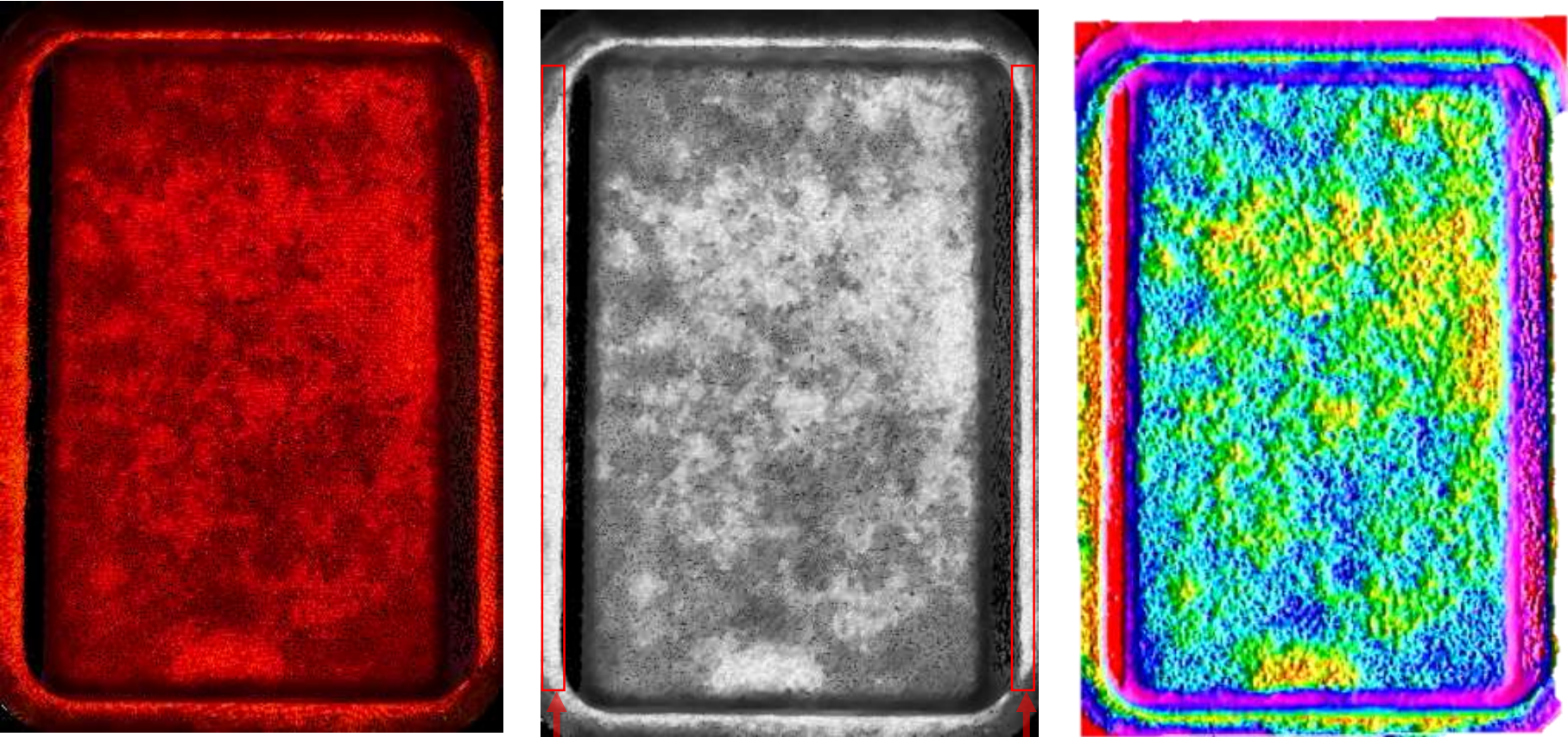
Demonstration of the Process – Detecting Bad Formation



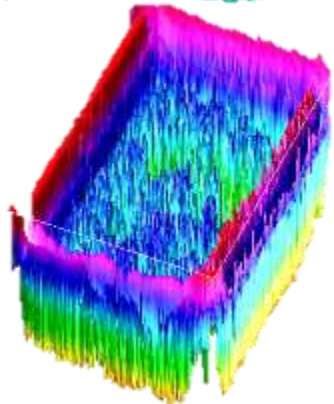
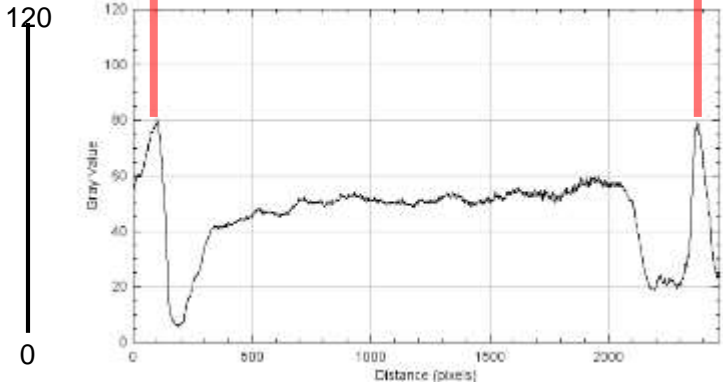
Peaks: 7
Range: 30-130
Average: 85
Std. Dev.: 30



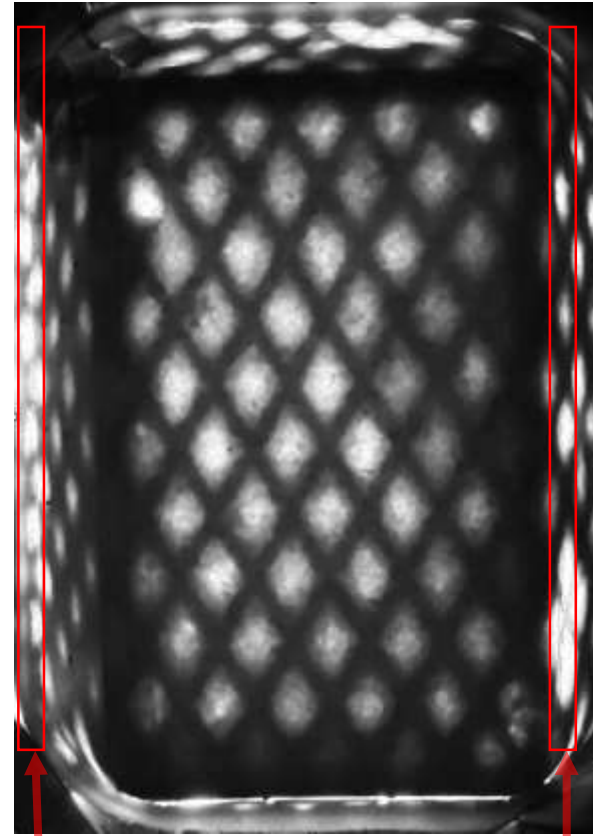
Demonstration of the Process – Detecting Good Formation



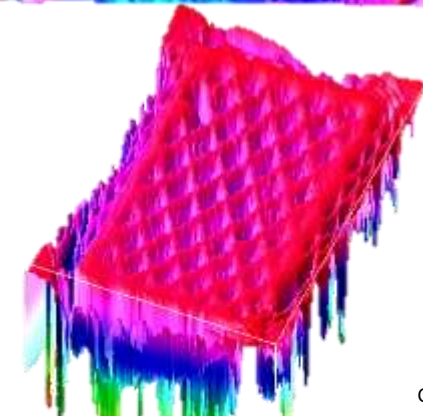
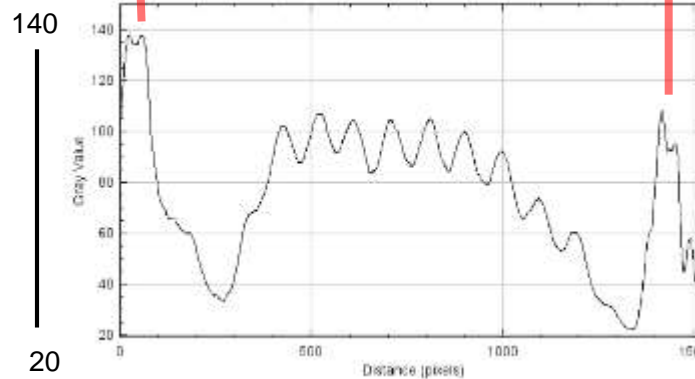
Peaks: 2
Range: 10-80
Average: 45
Std. Dev.: 10



Can We Force a "Good" Formation?

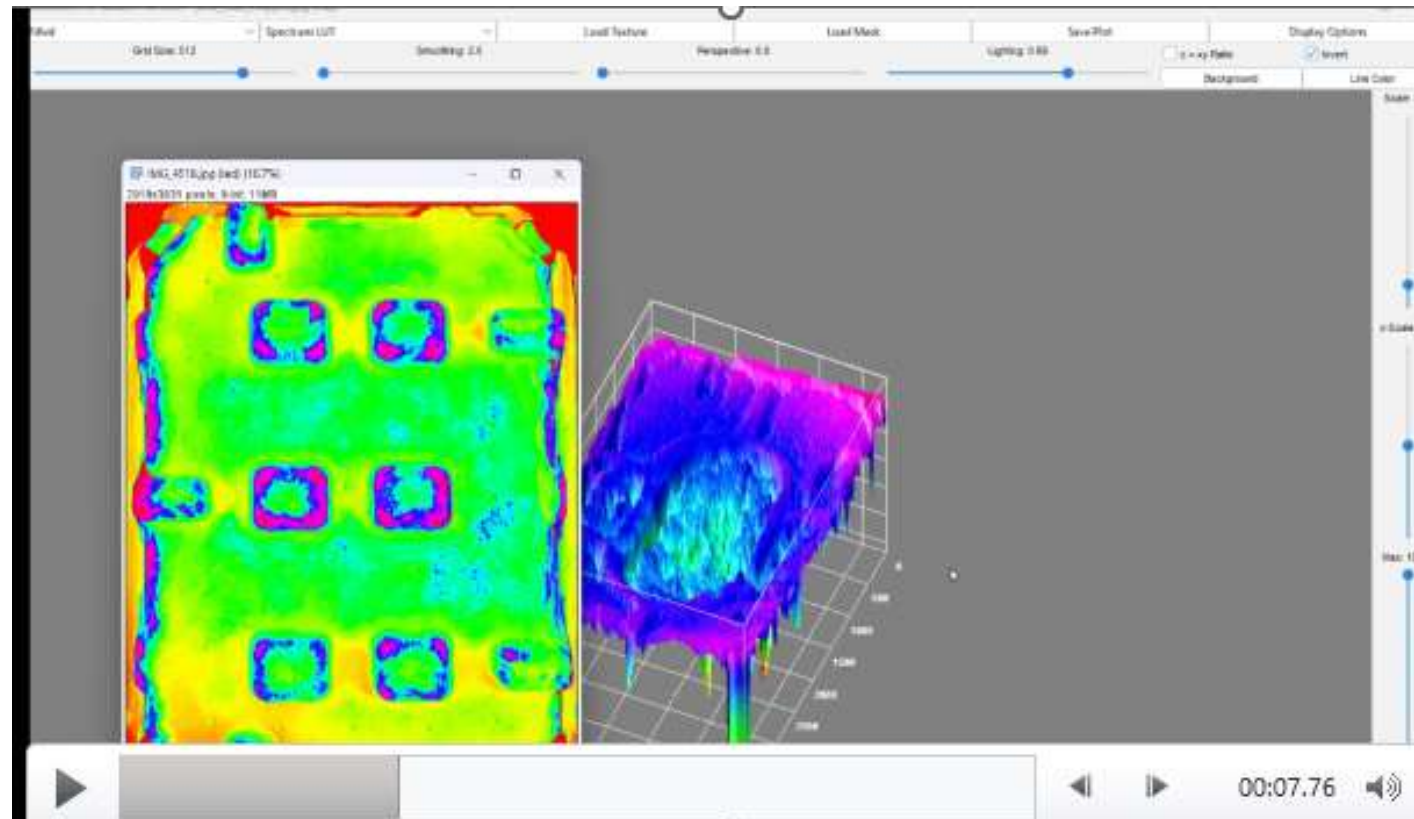


Peaks: 2
Range: 20-140
Average: 85
Std. Dev.: 20



Automating the Analysis

On a standard computer with no visual updates, each image can be processed in about 1.0 second



Automating the Process

- Need a fast, reliable, and consistent method to take images of molded fiber parts
- Suitable backlit conveyors, cameras, and software exist today
- Integrating these into a complete system for the industry should be doable
- Some thermoformed fiber machines may have the ability to do this analysis in the machine
- Proposed operational range we should be targeting
 - Sample one part from each cavity on each machine once per hour (~0.80% sampling rate)
 - 10 machines * 15 cavities per machine = 150 samples per hour / 3,600 per day
 - 50 machines * 15 cavities per machine = 750 samples per hour / 18,000 per day



Quantifying Formation

- To compete with plastic and folded paper, thermoformed fiber producers need to squeeze every ounce of efficiency from their machines
 - Improve Strength / Stiffness
 - Reduce Weight
 - Improve Barrier Properties
 - Reduce Cycle Time
 - Increase Surface Smoothness
- Quantifying fiber formation can help thermoformed fiber production

Go From Good to Great

Thank you!

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