

# NIFT-D™ and FoodQSM™

Non-invasive measurement to assist  
supply chain QA and management

Ross Clarke, 16 October 2007

<http://www.agresearch.co.nz>



Farming, Food and Health. **First**

*Te Ahuwhenua, Te Kai me te Whai Ora. Tuatahi*

# NIFT-D™ Gen-I



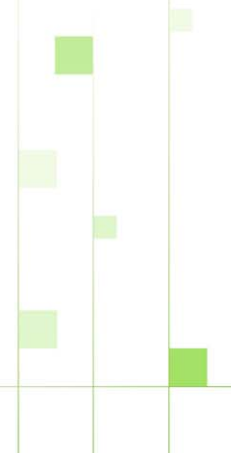
Developed for frozen box temperature measurement...



...NIFT-D™ is able to measure boxes automatically and non-invasively at 20 boxes/min.....



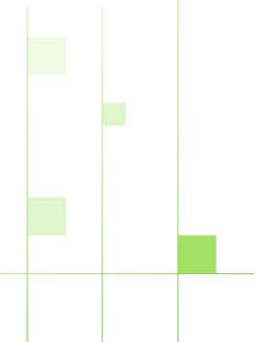
...and provide a temperature measurement in real time.



# NIFT-D™ Gen-II

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Temp range	-13 °F to 50 °F
Temp Accuracy	+/- 2°F (nominal)
Throughput:	20 boxes per minute*
Tunnel Dimensions	9.3in (h) x 24 (w) x 39(l) in
Materials	FDA approved materials
Bed Height:	30 inches (adjustable)
Power Supply:	50-60Hz, 400-480V AC 3 phase
Footprint:	53.2(w) x 94(l) in
Cleaning:	Wash down compatible
Network:	Ethernet enabled
Service:	Service agreements available



# The benefits

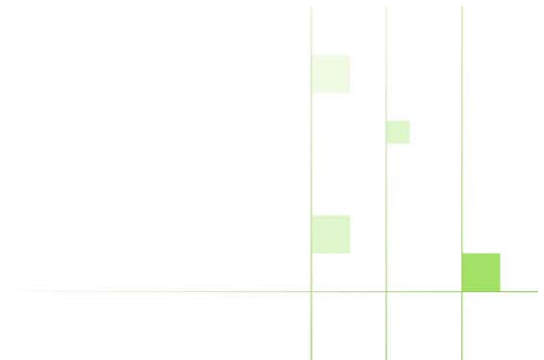


## Current best practice

- Random samples of boxes are drilled and probed
- Meat is over-chilled or over-frozen to ensure compliance with regulations

## NIFT-D™

- 100% QA
- Measures of bulk average, thermal centre and equilibrated temperature
- Can integrate to specific automated interventions
- Automated data metrics in real time



## Batch chilling 2400 cartons

Using Drill and Probe of 10 random cartons:

- Thermometer accuracy must be **15x** more accurate than NIFT-D to give the same accuracy in measuring the average temperature of the batch
- Assuming a standard deviation of 3°C, 25% chance of not detecting a box **6°C warmer** than the average

*Assuming that the 10 boxes are selected randomly and not from one specific location!*



# The hidden cost of “Drill and Probe”

Production rate (head of cattle/year)	270000
Average Cartons per head of cattle	10
Minimal no of tested cartons/day requiring re-processing	20
Annual no of tested cartons requiring re-processing	5400
Cost of empty carton, liner, labelling and strapping	\$2.00
<b>Total Cost of Annual damaged cartons</b>	<b>\$10,800.00</b>
Time taken to inspect and rework each carton and document QA	0.2 hr
Hourly cost of labour (full cost)	\$50.00
<b>Labour cost associated with Drill and Probe</b>	<b>\$54,000</b>
<b>Total Annual Cost to Test Cartons</b>	<b>\$64,800.00</b>

# Better chiller management

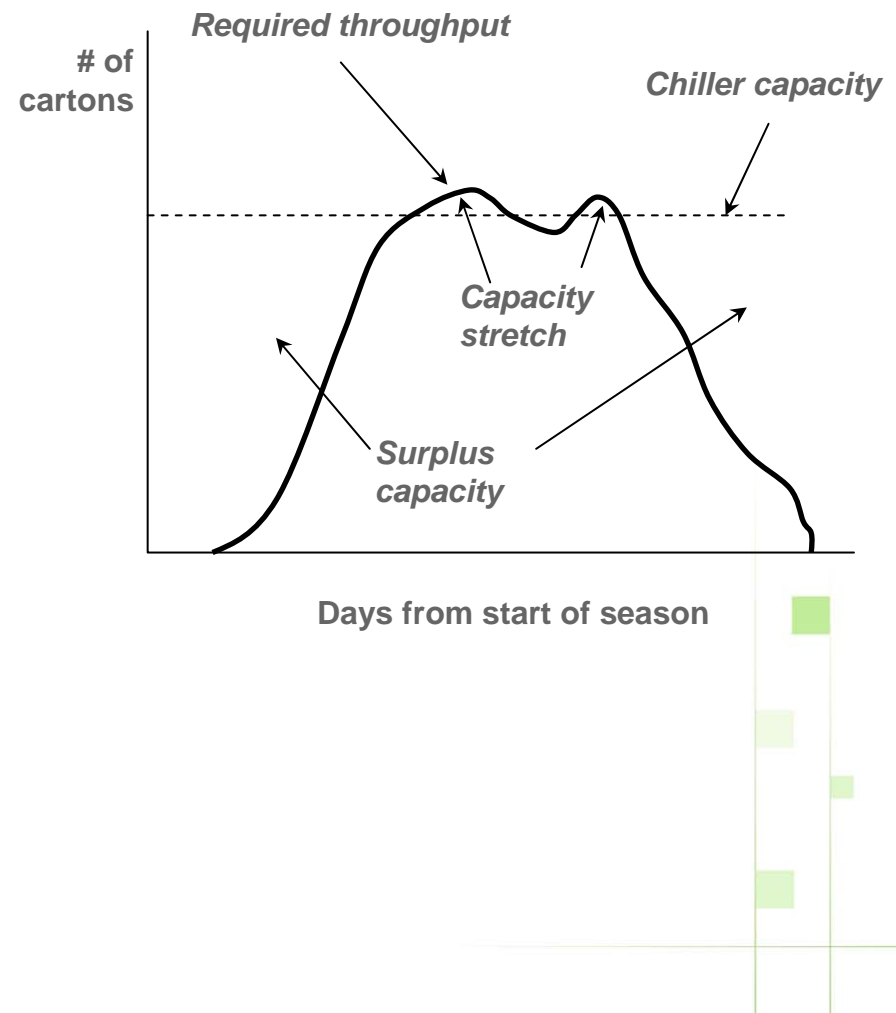


“Drill and Probe” requires chiller operators to guess when contents are chilled/frozen

- Safety versus throughput trade-off

During peak times, NIFT-D™ reduces freeze/chill time

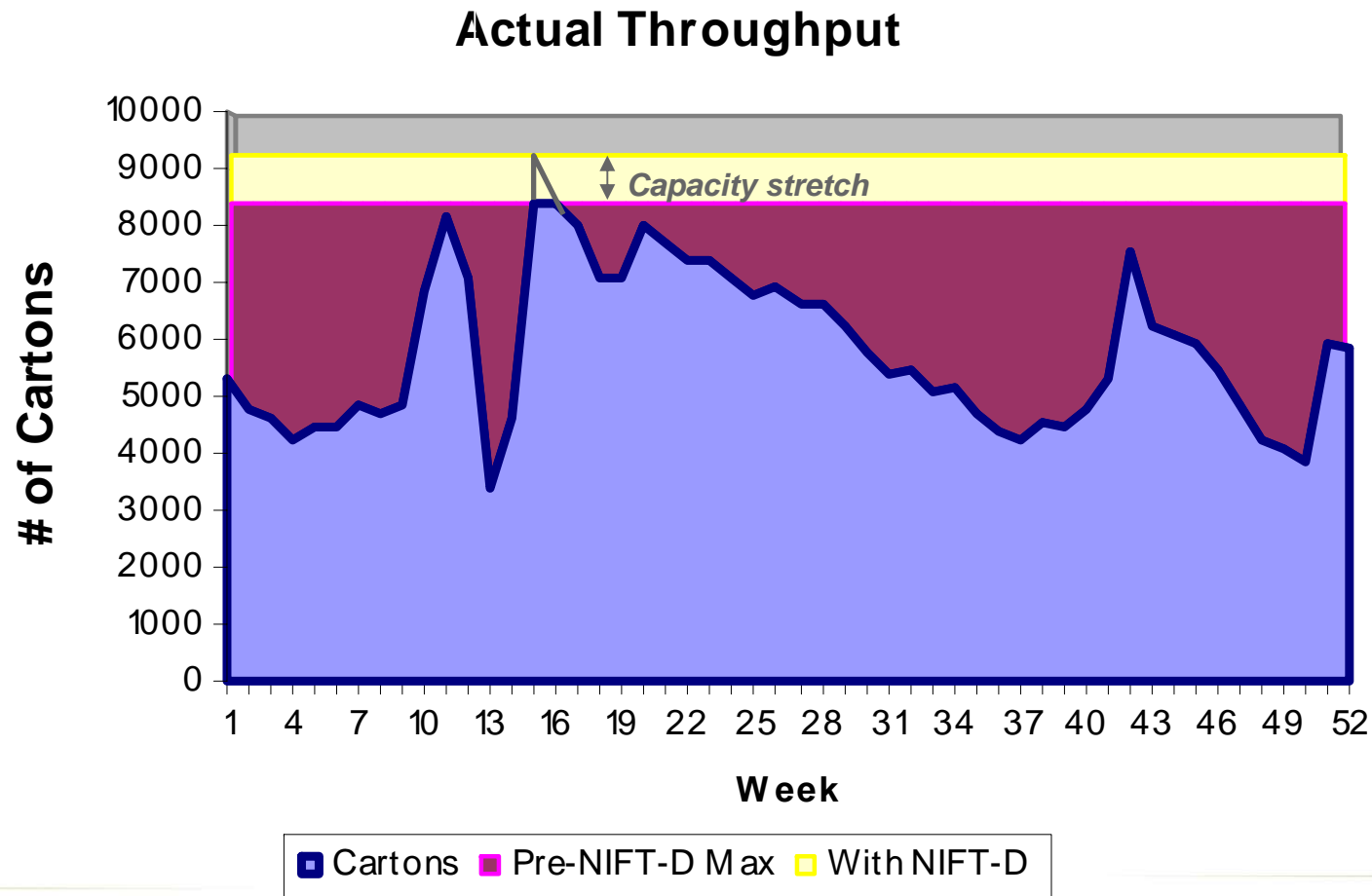
- Easy to implement equilibration
- Individual validation to eliminate “margin of error” in over-cooling



## Increased Throughput



NIFT-D™ enables increased throughput at times of peak production by shortening the freeze cycle while ensuring sufficient cooling for 100% of cartons.

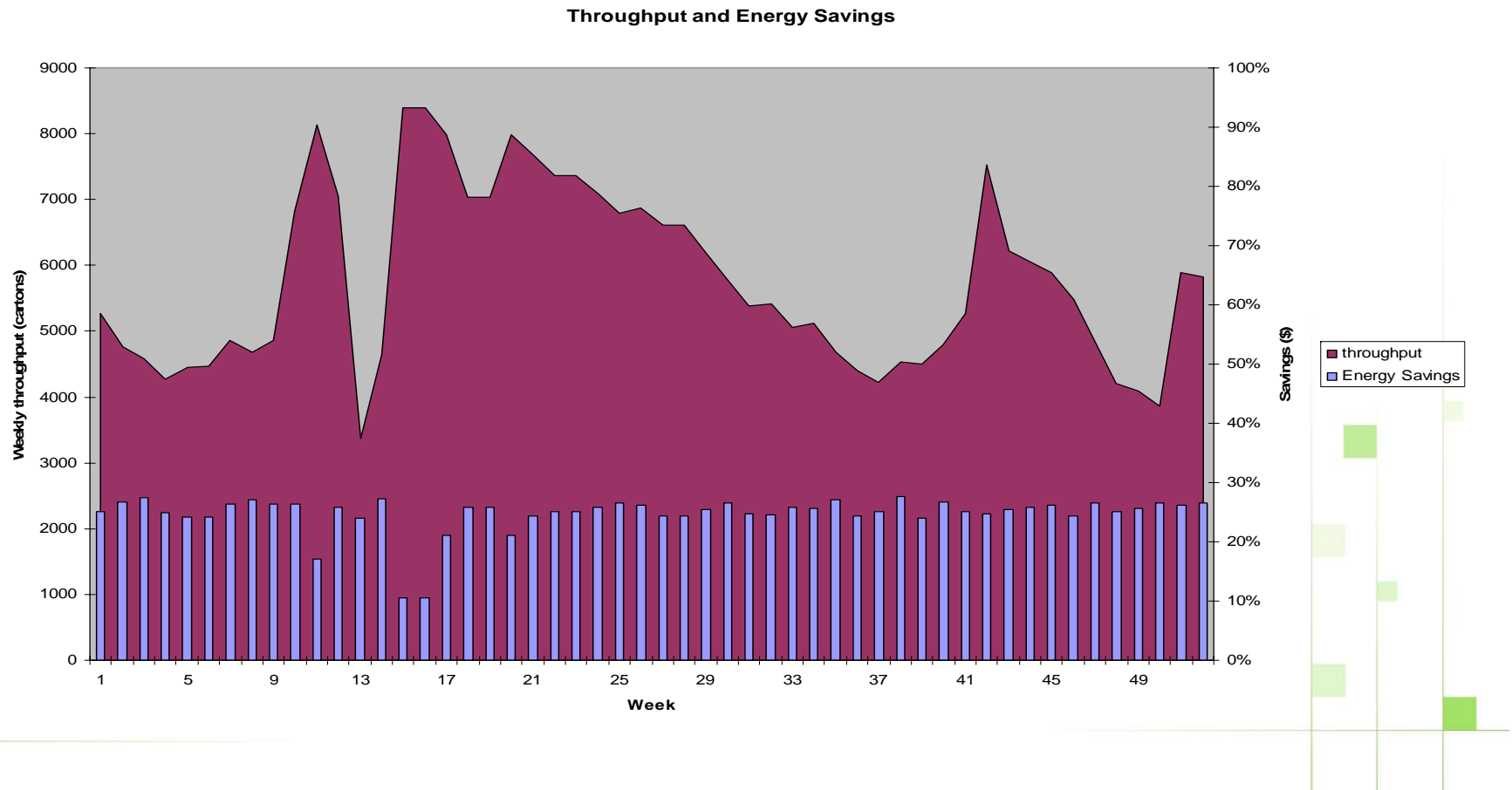




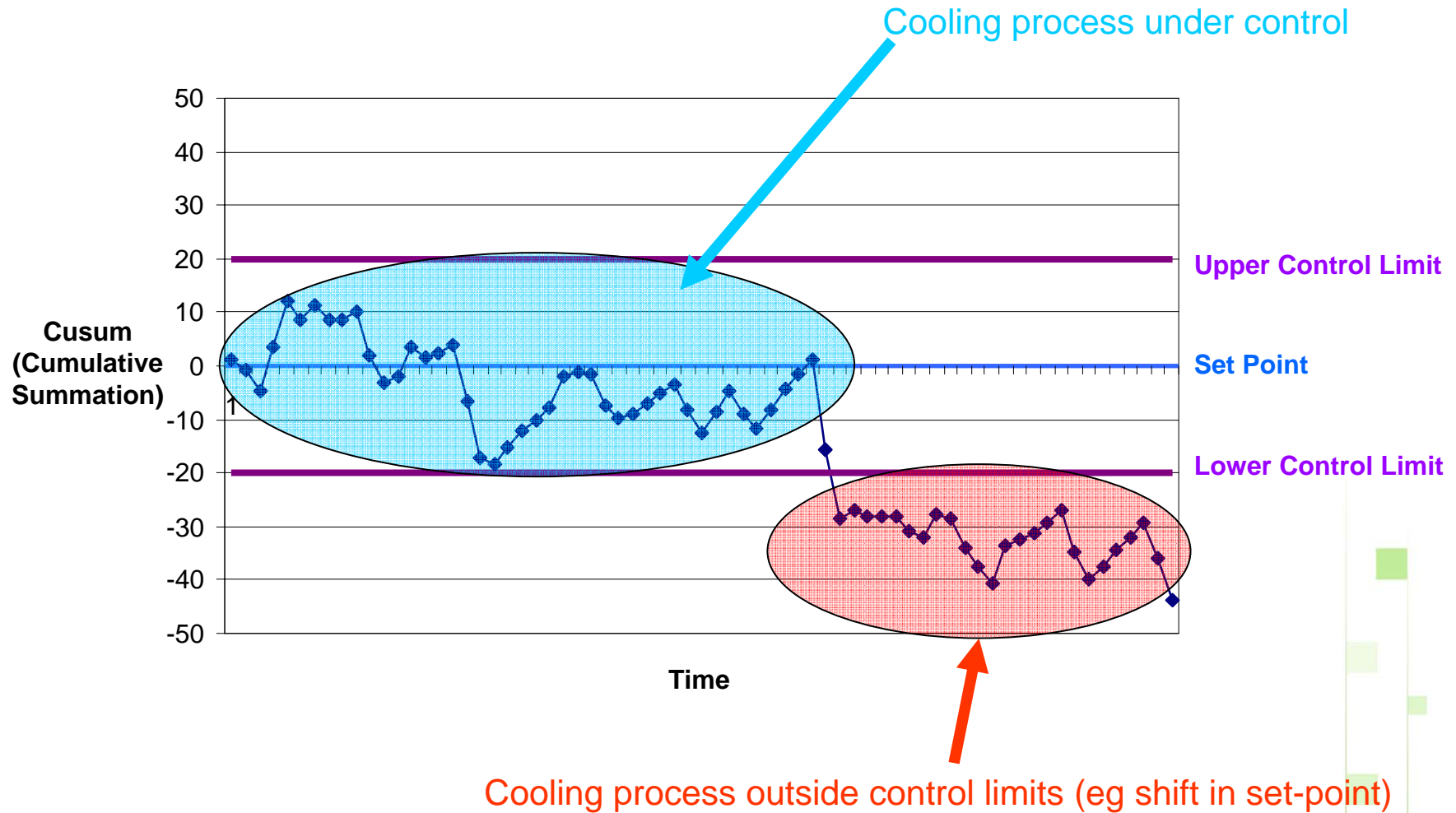
# Reduced Energy Costs



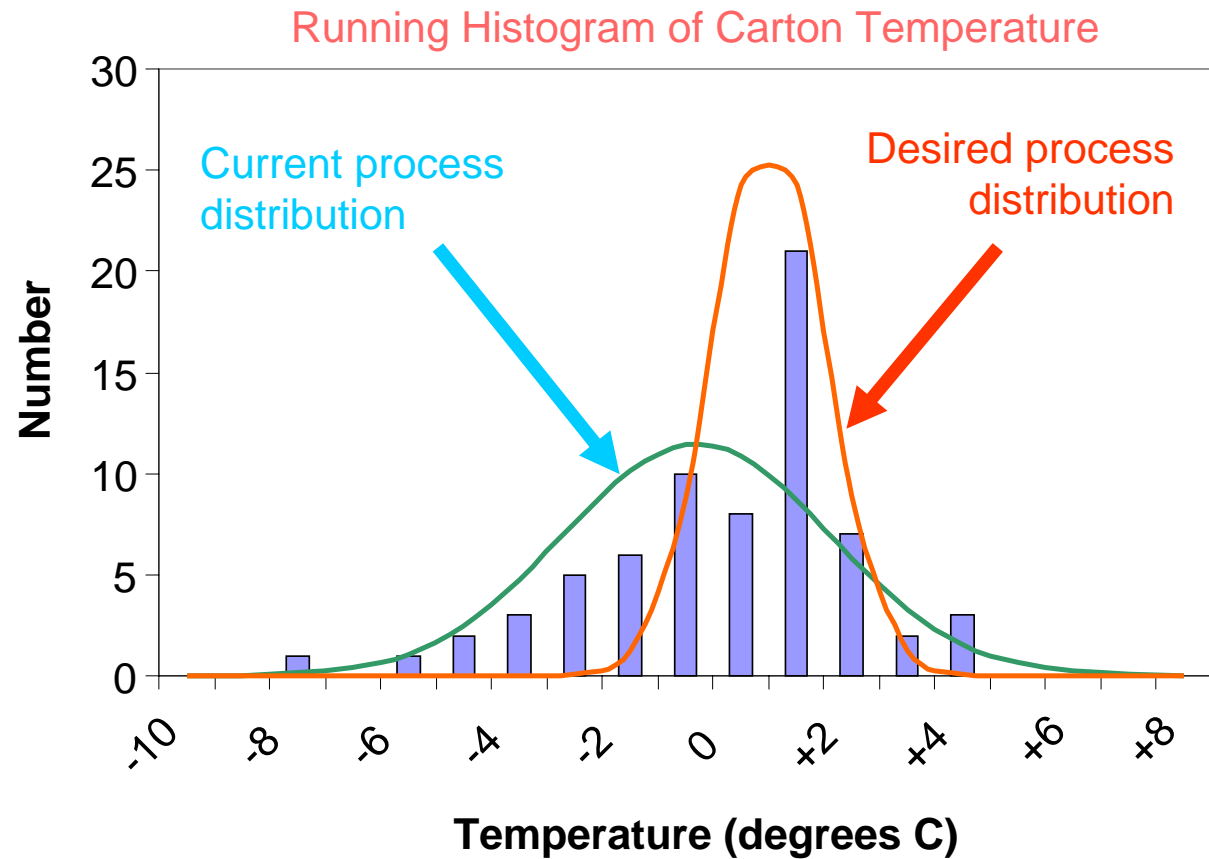
- Fan speeds can be reduced while ensuring adequate chilling when at below-peak capacity while enabling significant energy savings by running fans at half speed or less



# Process Visibility



# Process Visibility

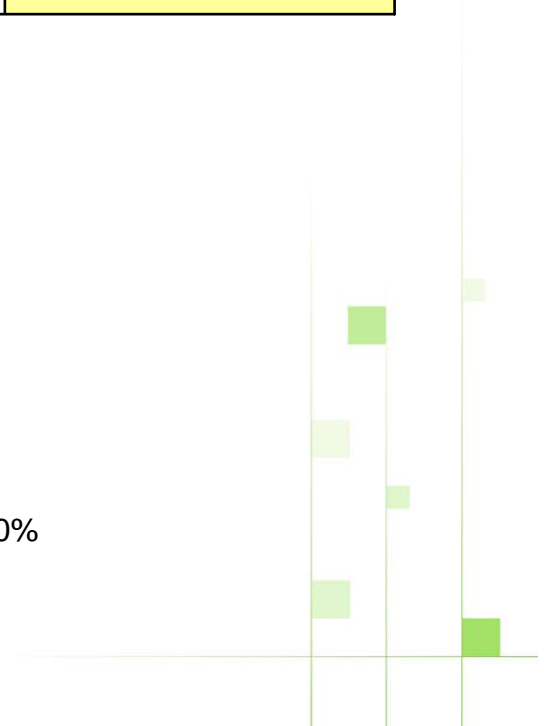
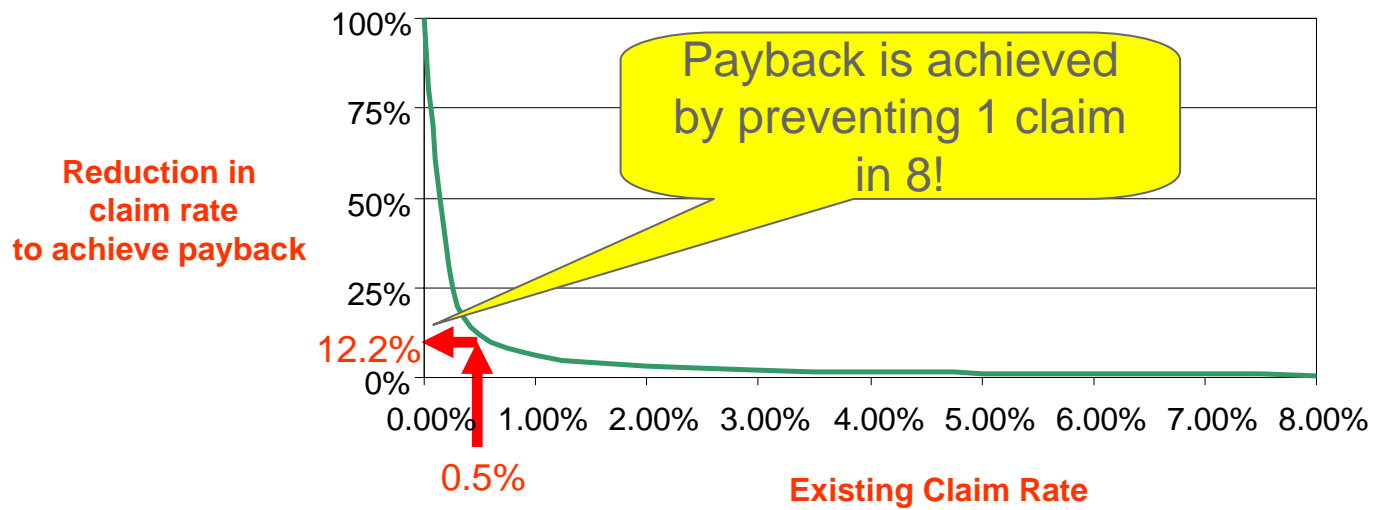


Graphing the current temperature distribution enables real-time corrective action and ensures temperature compliance.

# The risk and cost of claims

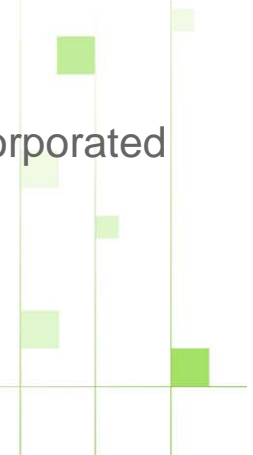


Approx Production rate (cartons p.a.)	700000
Cartons per Container	640
Annual no of containers pa	4218
Average Container Value	\$200,000
Percentage of container value claimed against insurance	80%



## Managing the Supply Chain

- NIFT-D™ provides 100% **product** inspection at key points along the supply chain
- Other measurements made at various stages include
  - Temperature of the cool chain environment (data loggers)
  - Microbiological status of the production facility
  - In-market assessment of shelf life and spoilage (acceptance testing)
  - Shelf life at the point of retail
- This information is often 'sparse'
  - Majority of microbe testing results can be below detectable limits
  - Only a few samples taken to be representative
- Currently, this range of data is often interpreted in isolation and rarely incorporated into a centralised repository



# FoodQSM™

A Single Database for all shipments

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The screenshot shows the FoodQSM web application interface for 'Test Meat Company'. The interface includes a navigation menu with options: Home, Code Maintenance, Application Settings, Model Administration, Change Plant, and Help. The main content area is divided into three sections:

- Shipment Details:** Fields for Species (Lamb), Shipment Date (25 Jan 2006), Shipment Number (Ship-fk1), and Batch Number (b001, b002, b003). Buttons for Save, Delete, and Cancel are present.
- Cut and Microbes:** A table listing different cuts and their associated microbes.
- Type and Filename:** A table listing different types and their associated filenames.

At the bottom of the interface, there is a row of five icons representing different data visualization options: CUSUM, Initial Dist., Microbe Time, Dec. Criteria, and Temp. Time.

Cut	Microbes
Saddle	Aerobic Plate Count, Entero
Shoulder	Aerobic Plate Count, Lactobacillus, Entero
Leg	Lactobacillus

Type	Filename
Temperature Logger	loggerdata1.dat
Temperature Logger	loggerdata2.dat
Temperature Logger	loggerdata3.dat
Initial Contamination	initial_var1.csv
Acceptance Sampling	accept_var1_lamb.csv

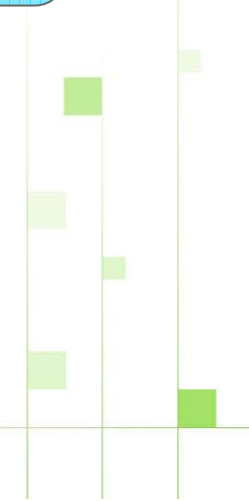
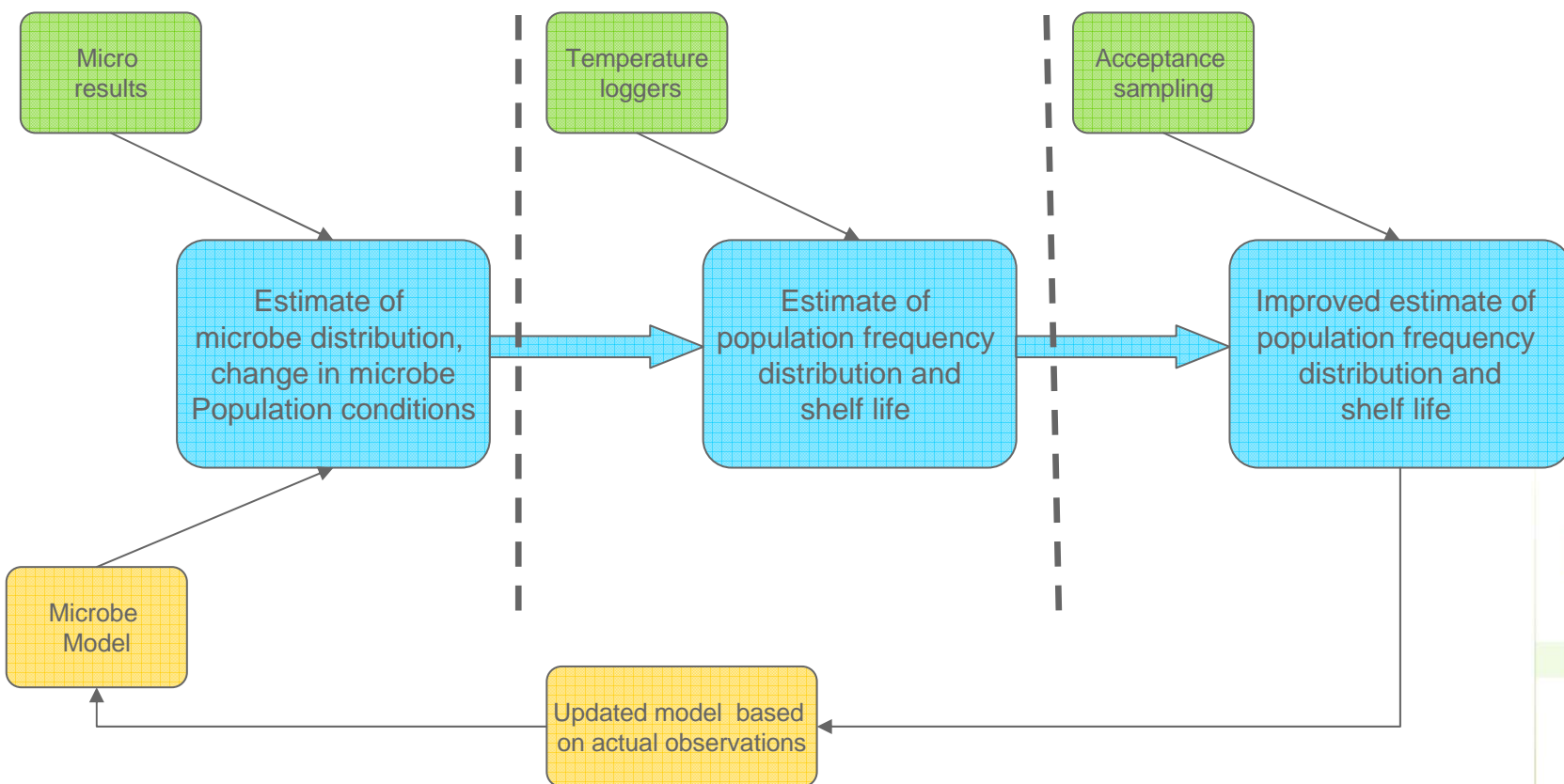
# FoodQSM™



**At point of production:**

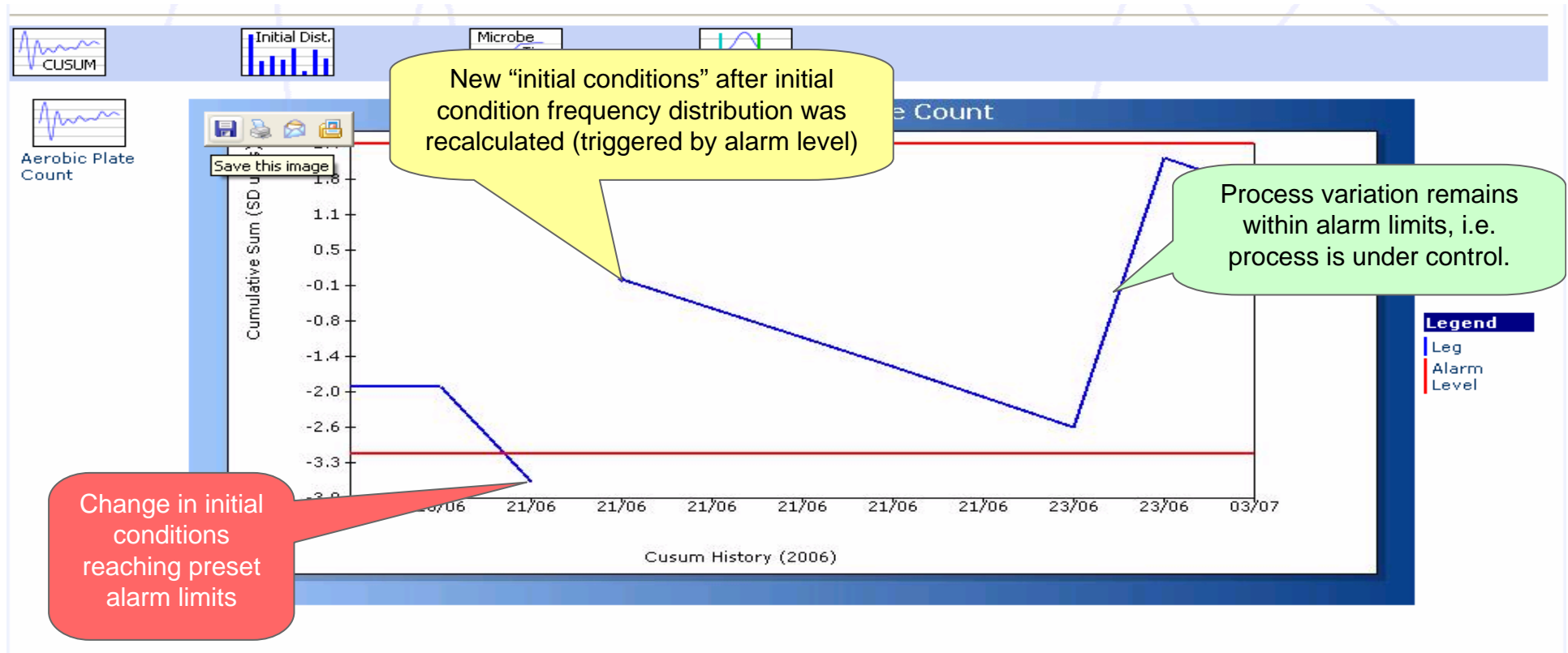
**During transit:**

**In market:**



# Example Cusum Chart (using actual data)

The Cusum chart represents a powerful tool for monitoring and managing changes in the production facility that could impact shelf life.

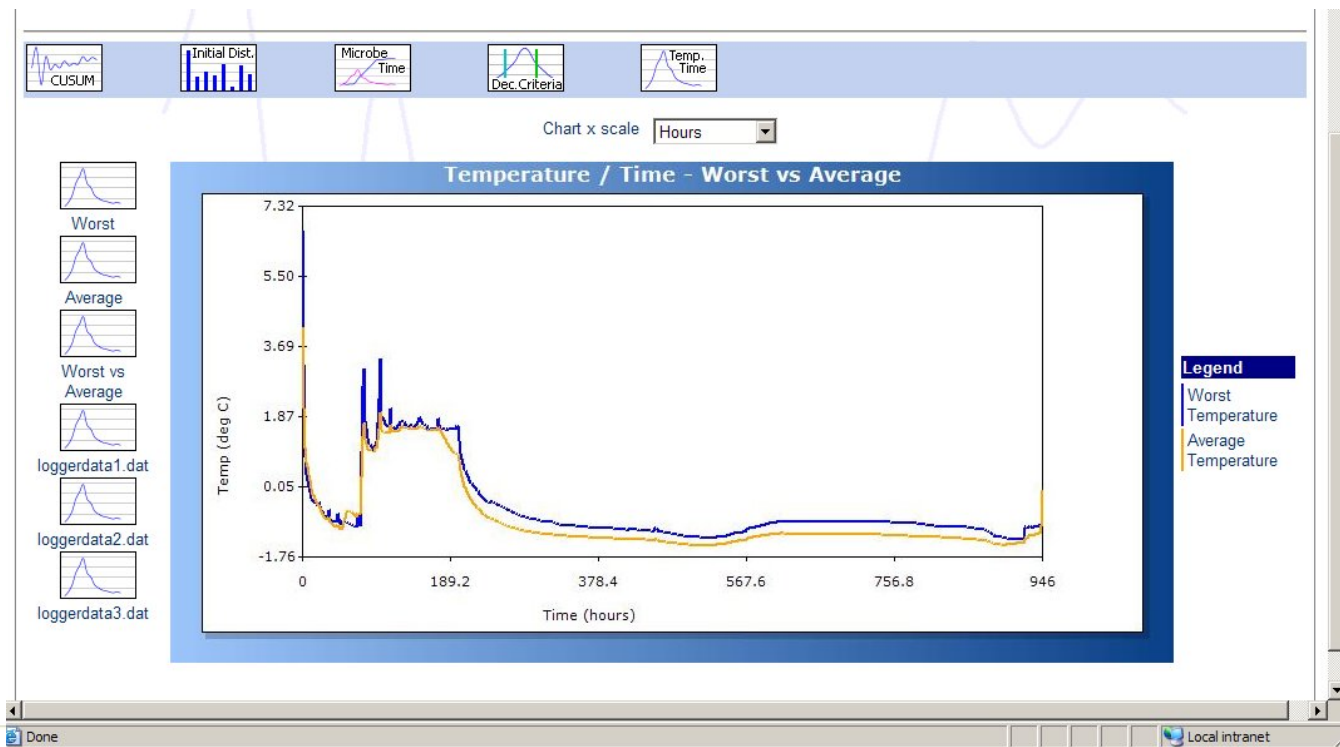




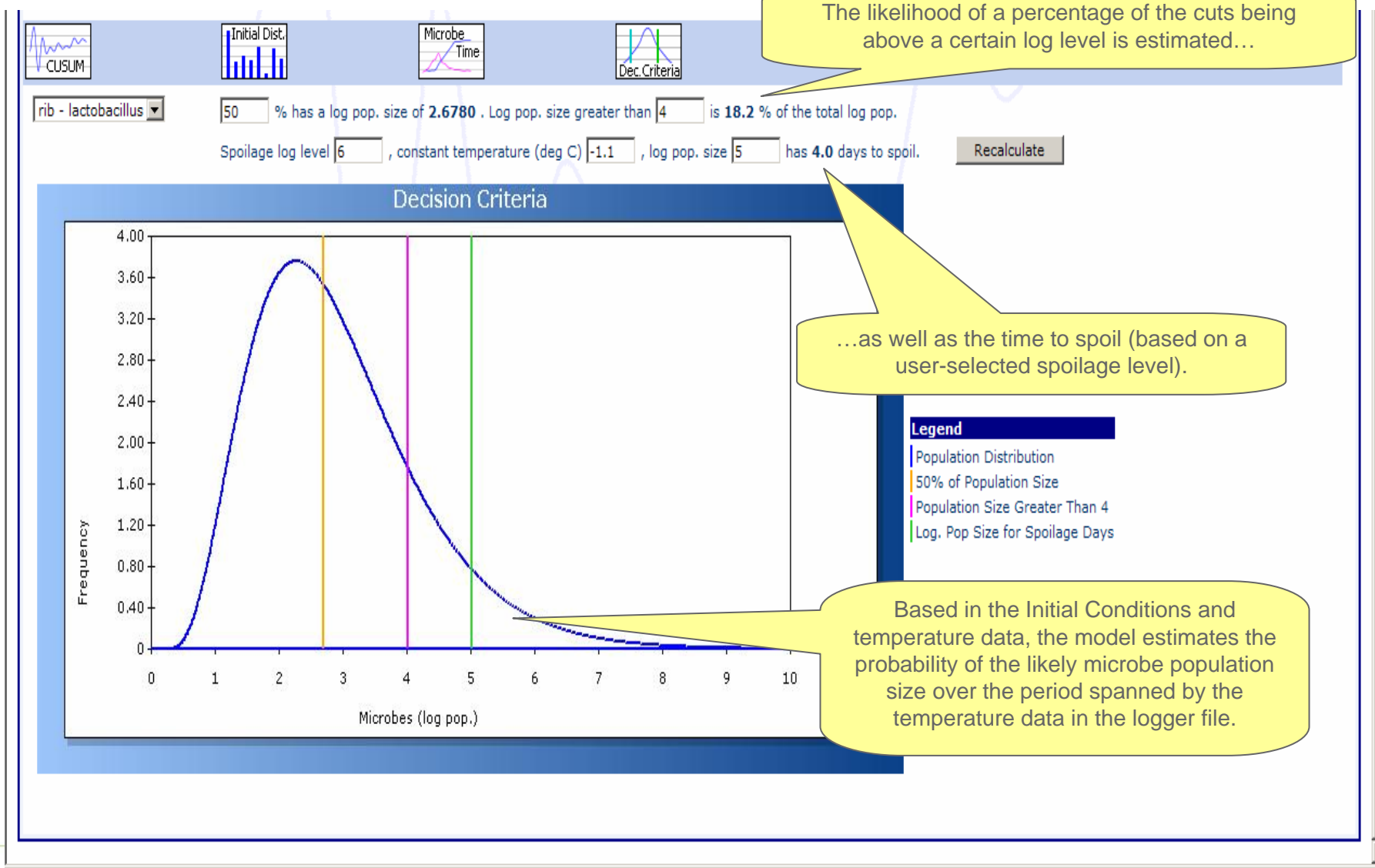
# Temperature/Time Profiles in FoodQSM™

Typical Temperature/Time profiles 'guide' the microbial growth models

Where available, actual Temperature/Time profiles for specific shipments can be included to generate better predictions



# FoodQSM™ Output



# *NIFT-D<sup>TM</sup> + FoodQSM<sup>TM</sup>*



Supply chain management through:

- full QA of product at critical points of the supply chain
- Ongoing management of the levels of, and changes in, microbial populations at the point of production
- Estimates of shelf life based on expected and actual cool chain environment
- Ongoing updating using actual results from acceptance sampling
- Full traceability back to point of production

