G M W
3-Dimensional Image Processing for Gob Measurement & Weight Control

Glass Forming Technology Team

Mitsuo Ueda

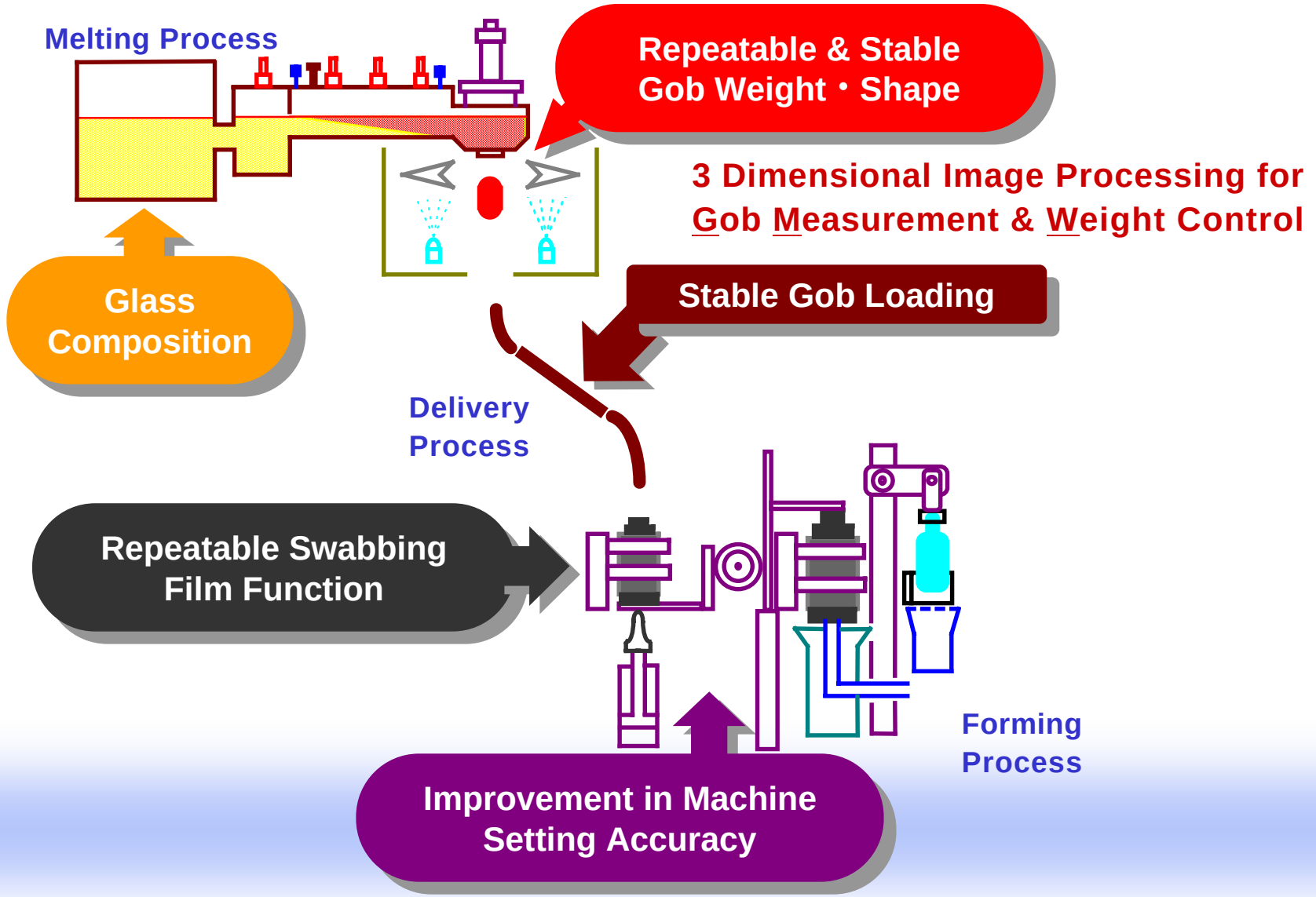
(presented by Melvin Si, Glass Forming Technology Team)

September 21, 2006

NIHON YAMAMURA GLASS CO.,LTD.

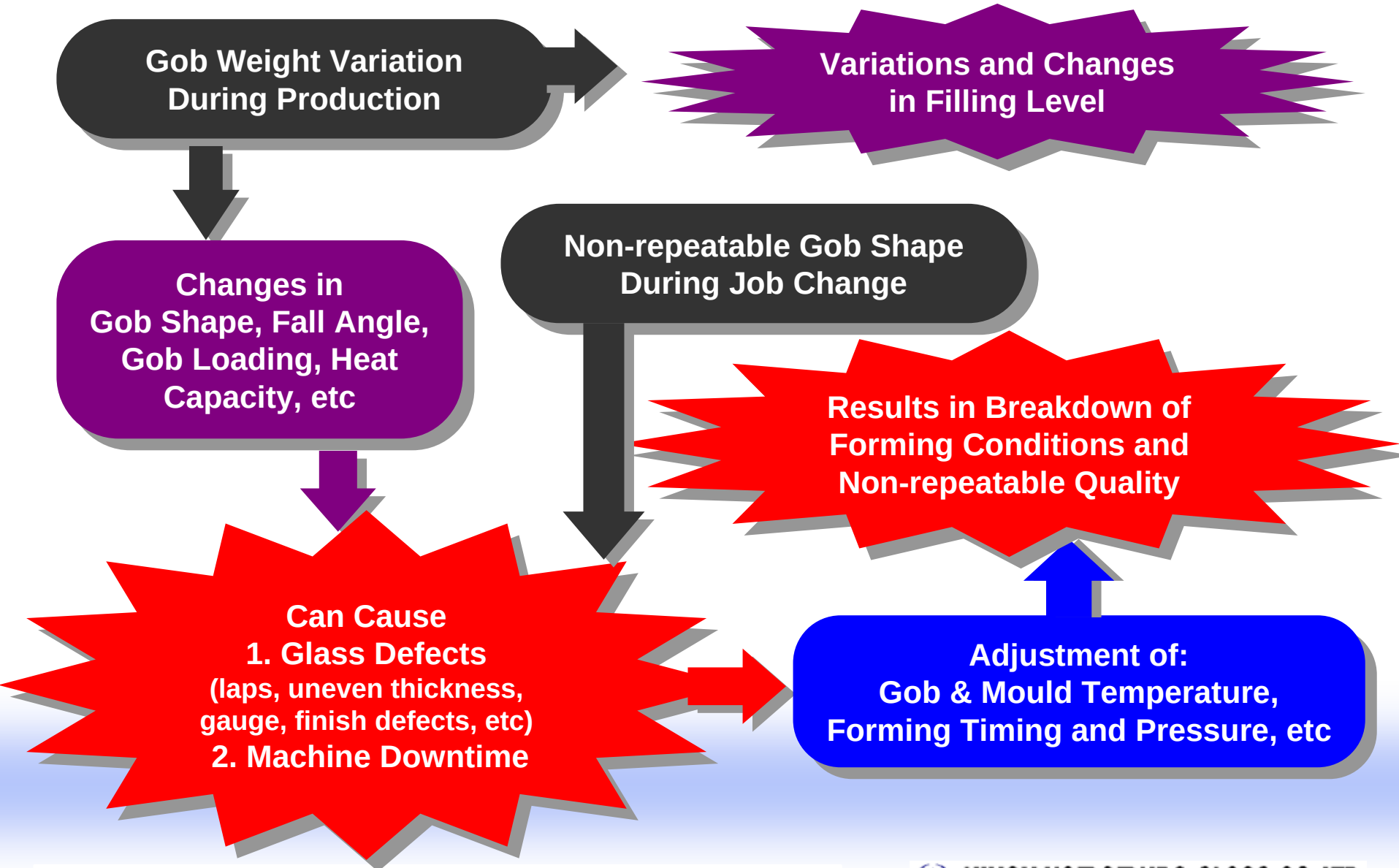
Development Concept

High Quality Bottle Production



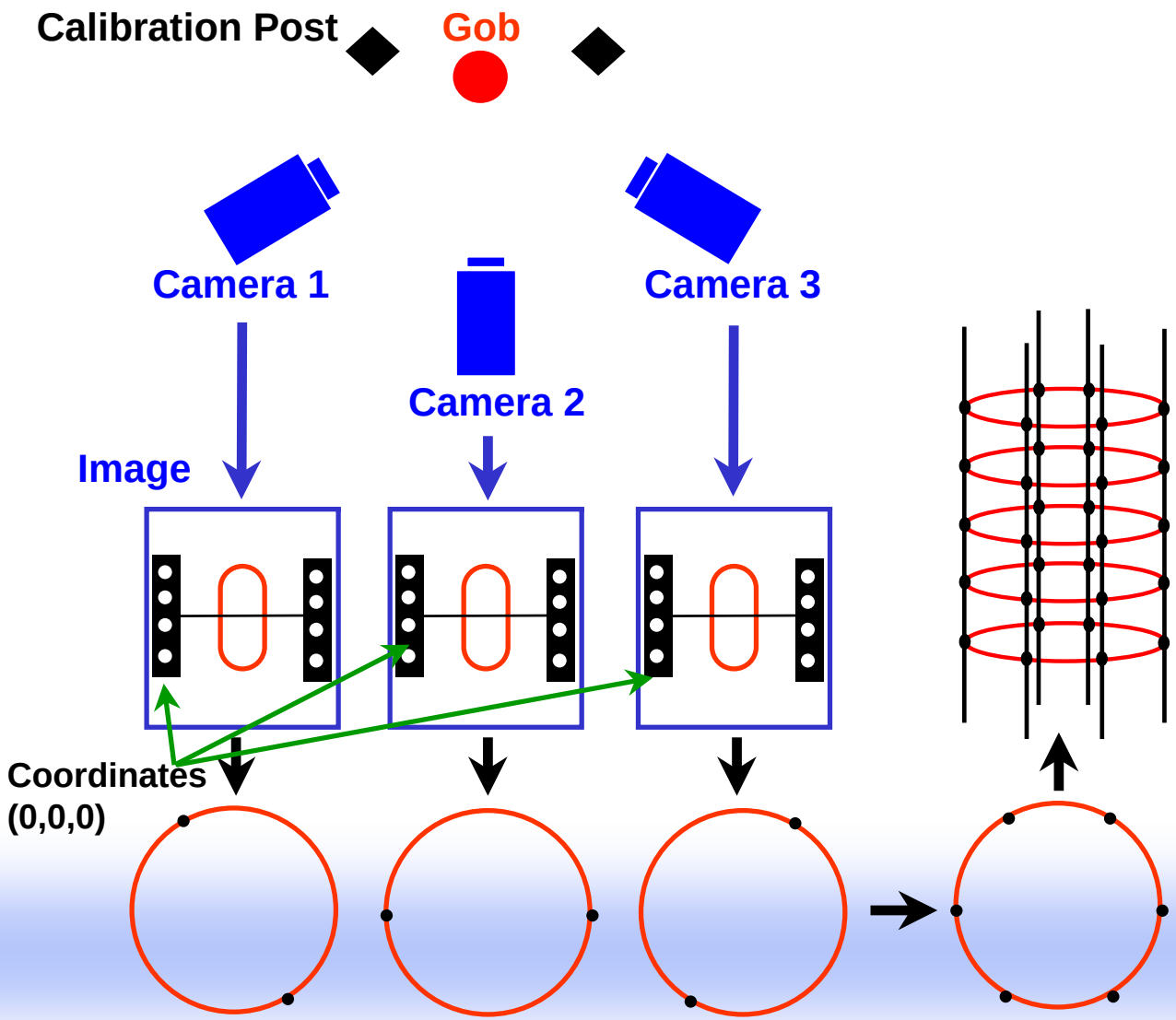
NIHON YAMAMURA GLASS CO.,LTD.

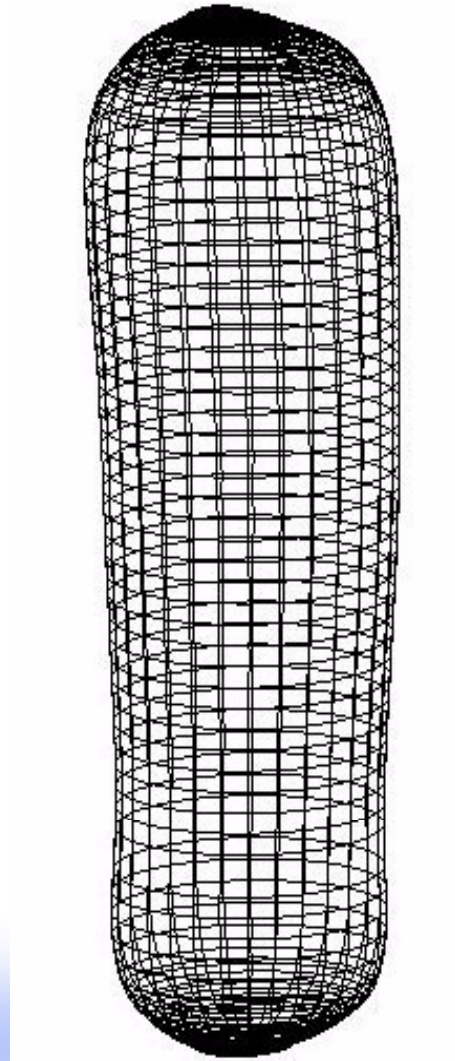
Importance of Gob Weight & Shape



Gob Measurement Principle

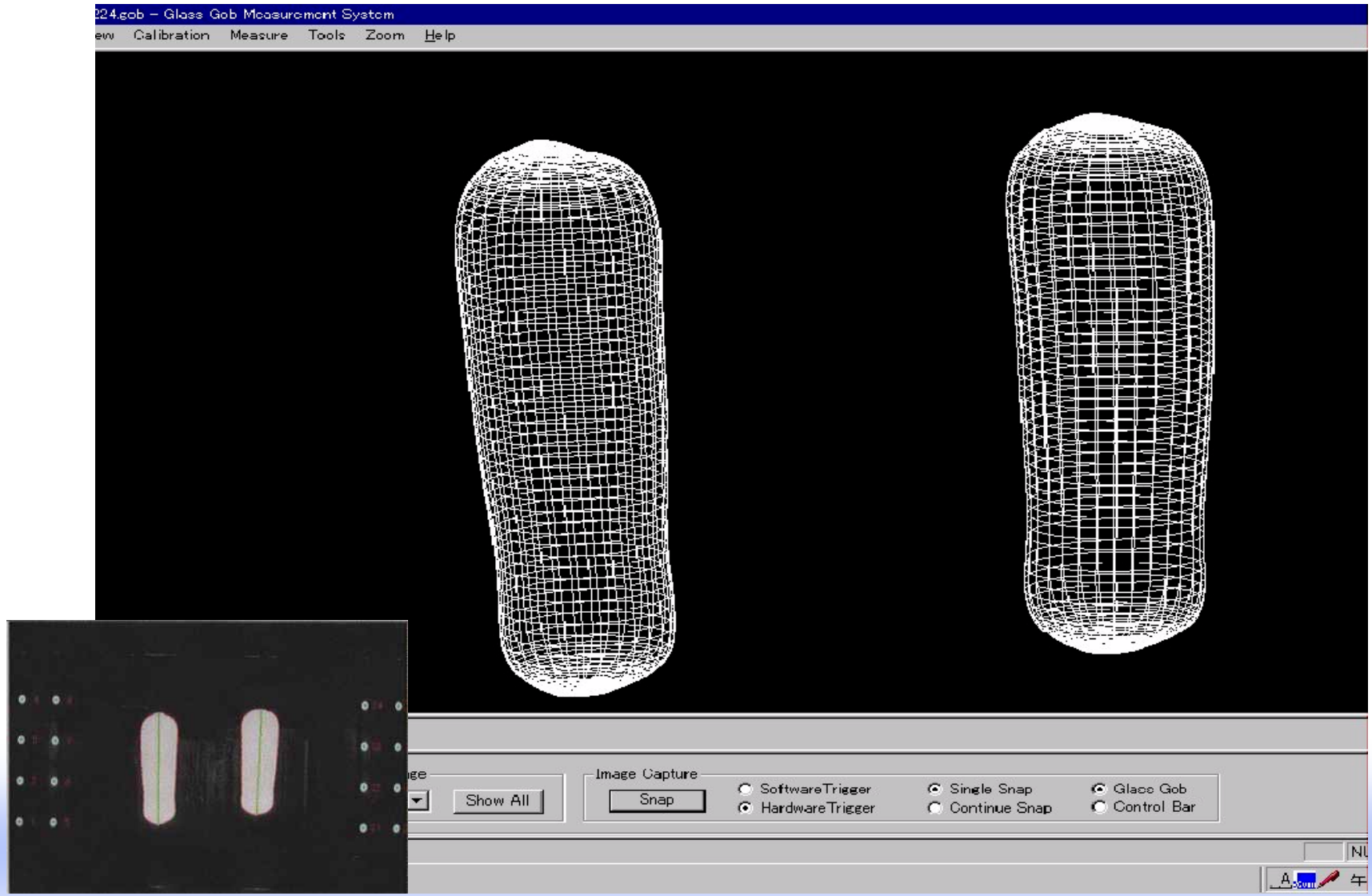
3 Dimensional Measurement Principle





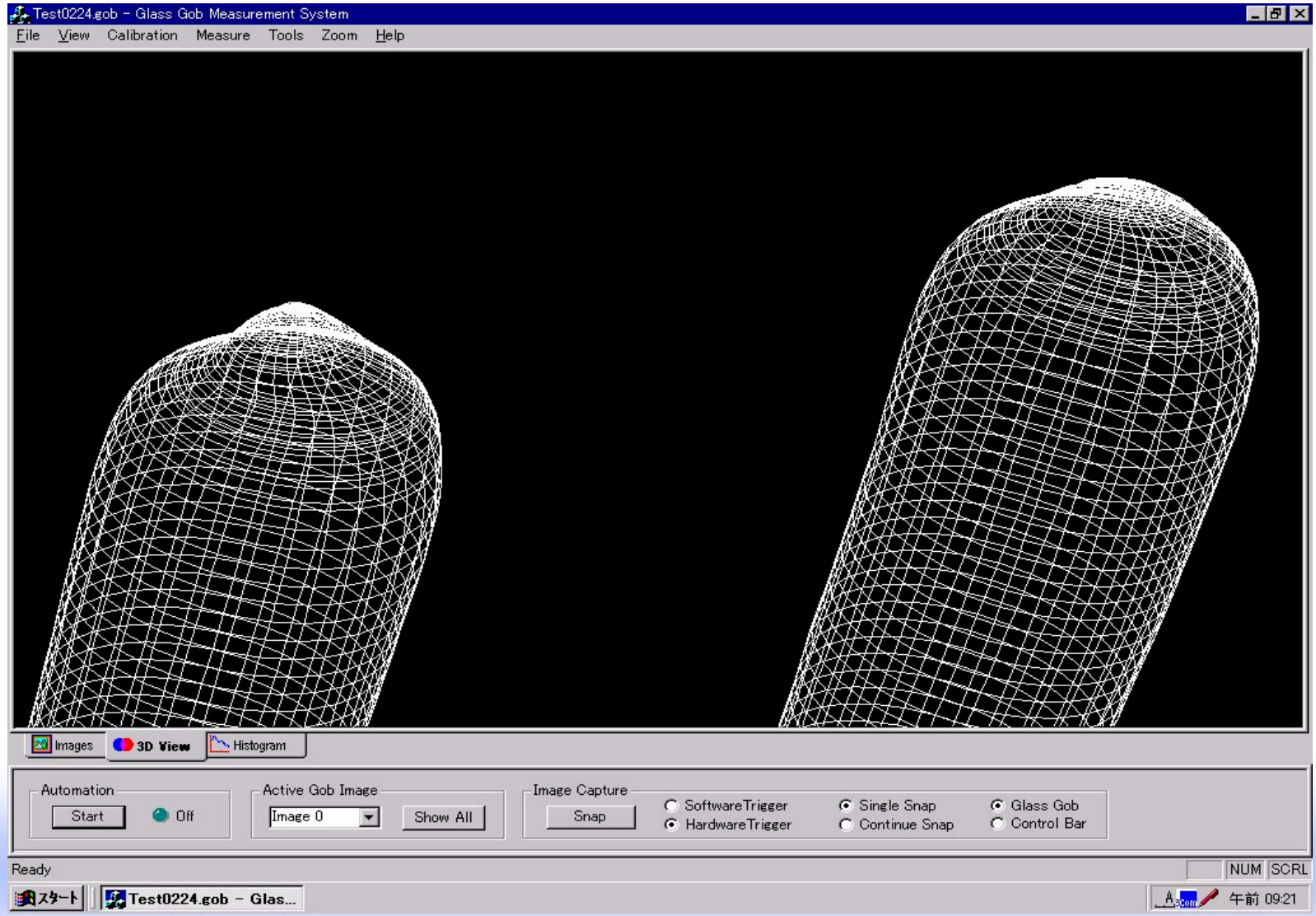
Wire Frame Image

3 Dimensional Gob Wire Frame Image



NIHON YAMAMURA GLASS CO.,LTD.

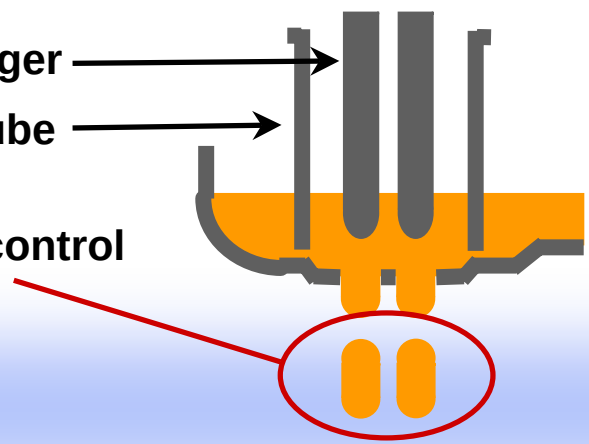
3 Dimensional Gob Wire Frame Image (Zoom)



NIHON YAMAMURA GLASS CO.,LTD.

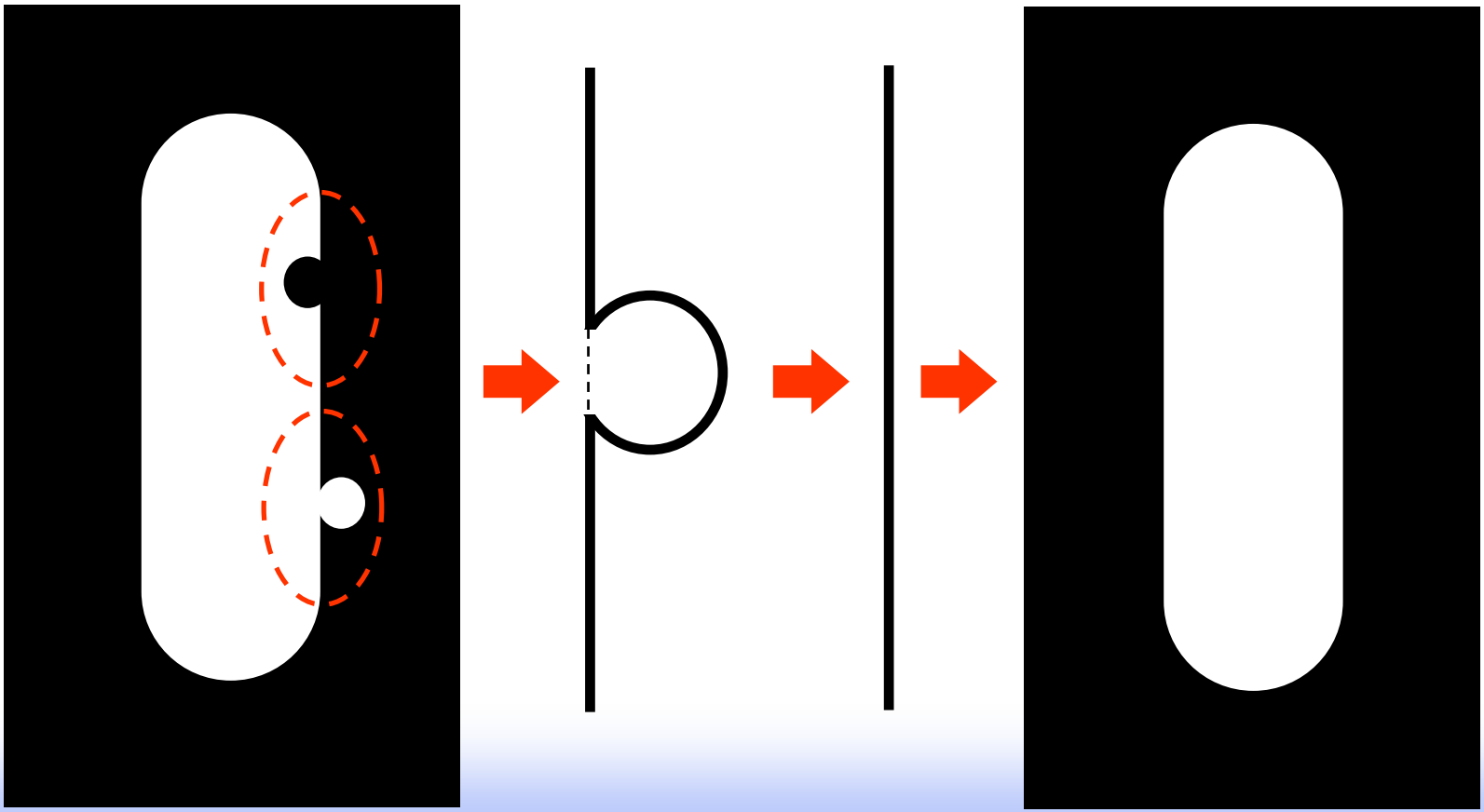
Numerical Representation of Gob

1. Continuous volume calculation from gob image
2. Automatic volume(calculated) control
   = Automatic Weight control
3. Measurement of each cavity. Average value use for control logic.
   Feeder tube height control.
4. From the 3 dimensional coordinates:
   Gob length, fall angle, drop consistency are numerically calculated.



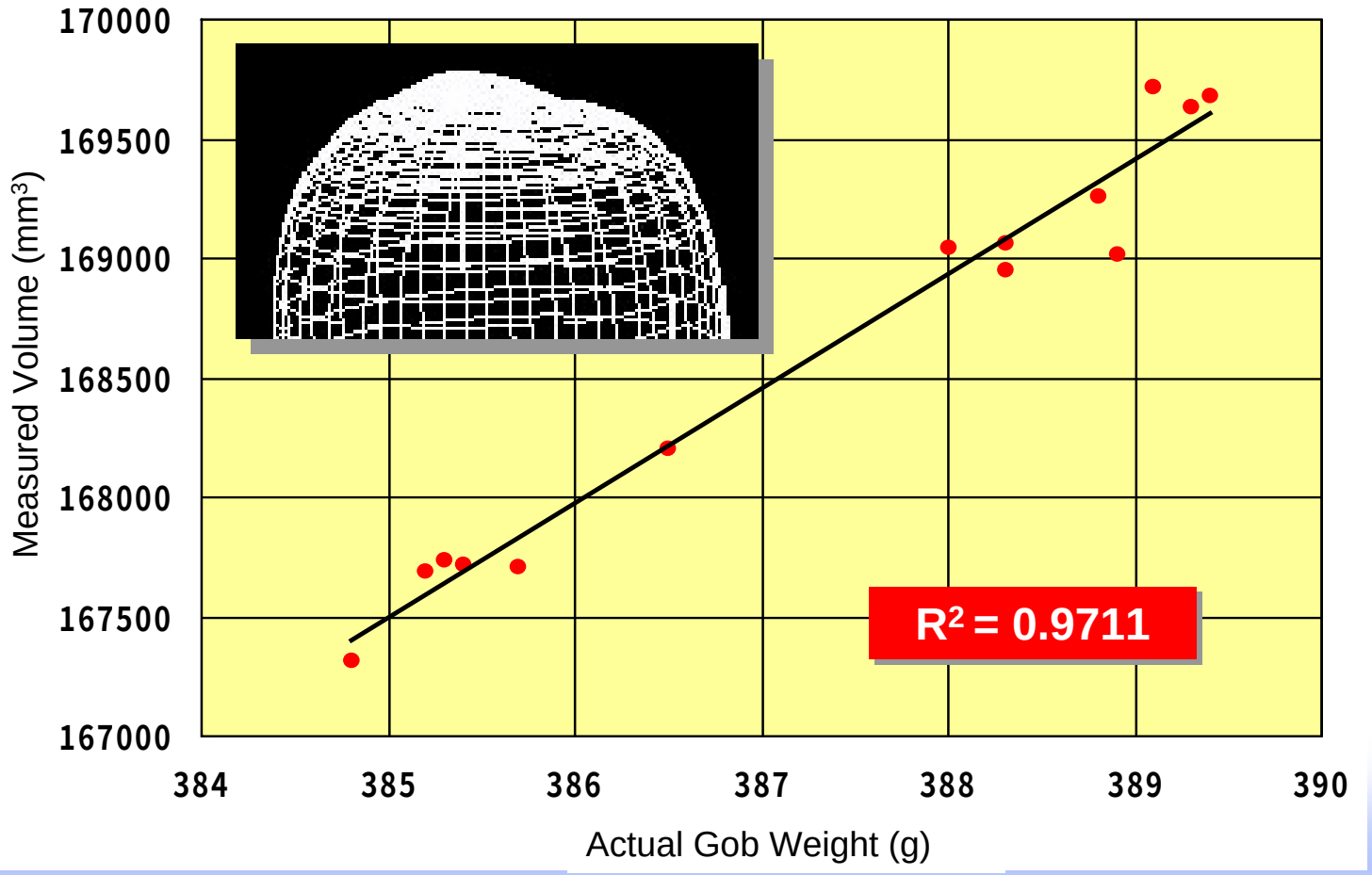
Volume Measurement Accuracy

Image Processing of Water, Oil, Shear Spray Particles on Gob Edge



Volume Measurement Accuracy

Relationship between Measured Volume and Actual Gob Weight



System Structure

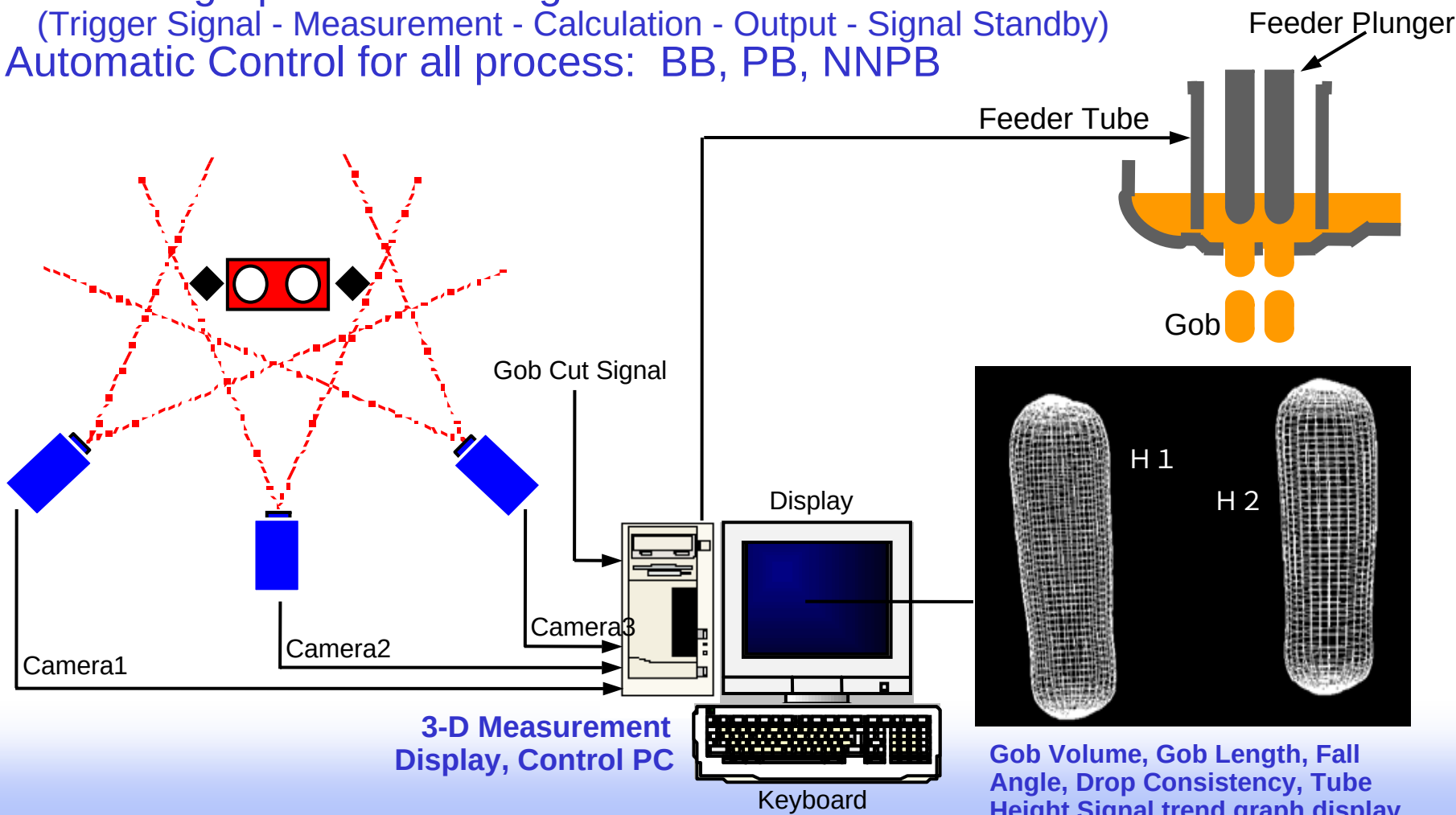
GMW System

Patent Pending

Processing Speed: 1.5 sec/gob

(Trigger Signal - Measurement - Calculation - Output - Signal Standby)

Automatic Control for all process: BB, PB, NNPB



3-D Measurement Display, Control PC

Gob Volume, Gob Length, Fall Angle, Drop Consistency, Tube Height Signal trend graph display

Camera: Water Jacket, Lens: Air Purge System

System Features & Performance

GMW Features & Performance

Automatic Gob Weight Control

- Fully Automatic System (no need for periodic weight sampling for calibration)
- Weight Variation R of below 1% of control weight

Gob Shape Recording・Retrieval・Comparison

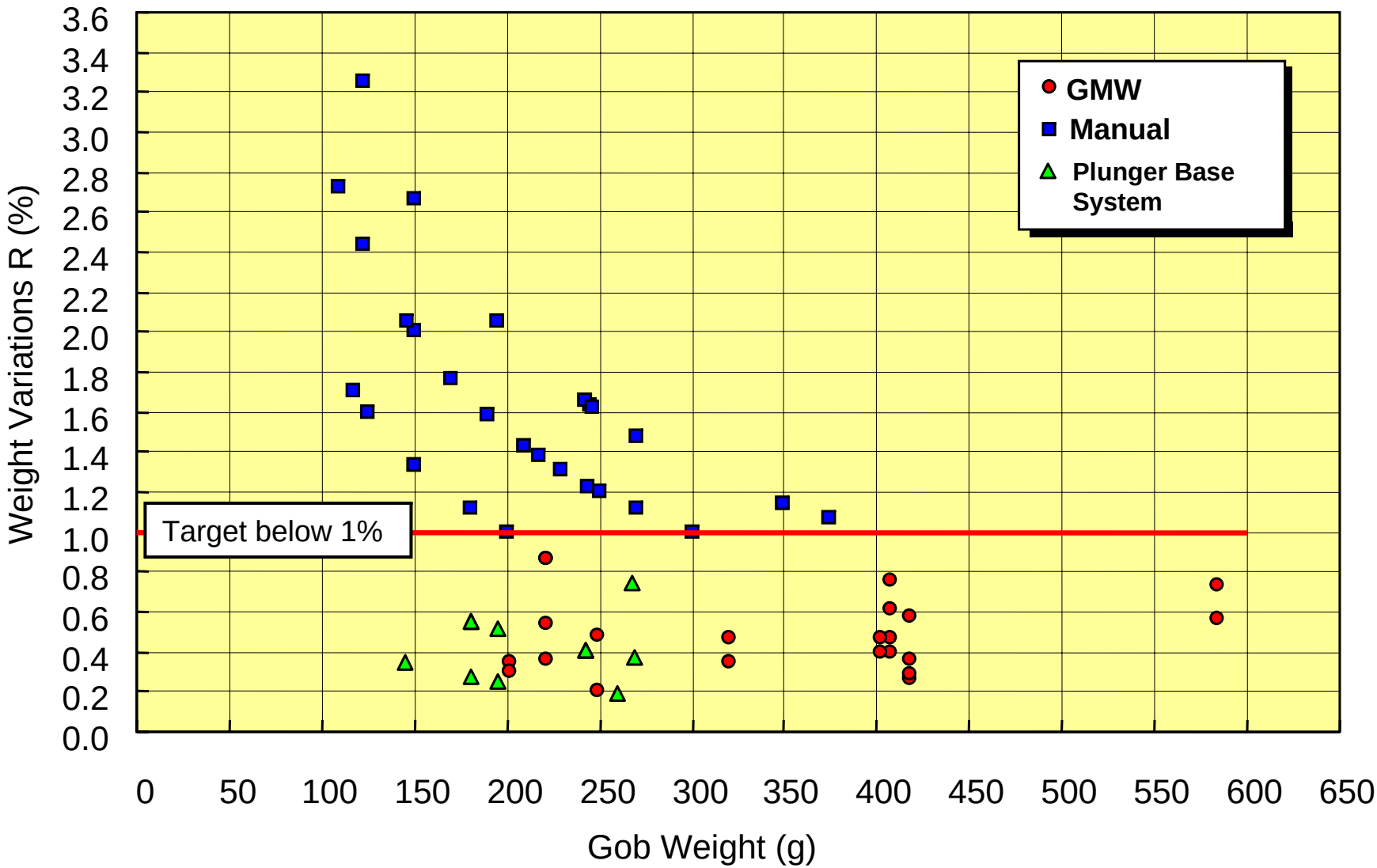
Gob Measurement Trend Data ・Recording ・Retrieval

- Gob Volume
- Gob Length
- Gob Fall Angle
- Feeder Tube Height Adjustment
- Drop Consistency

Alarm Functions

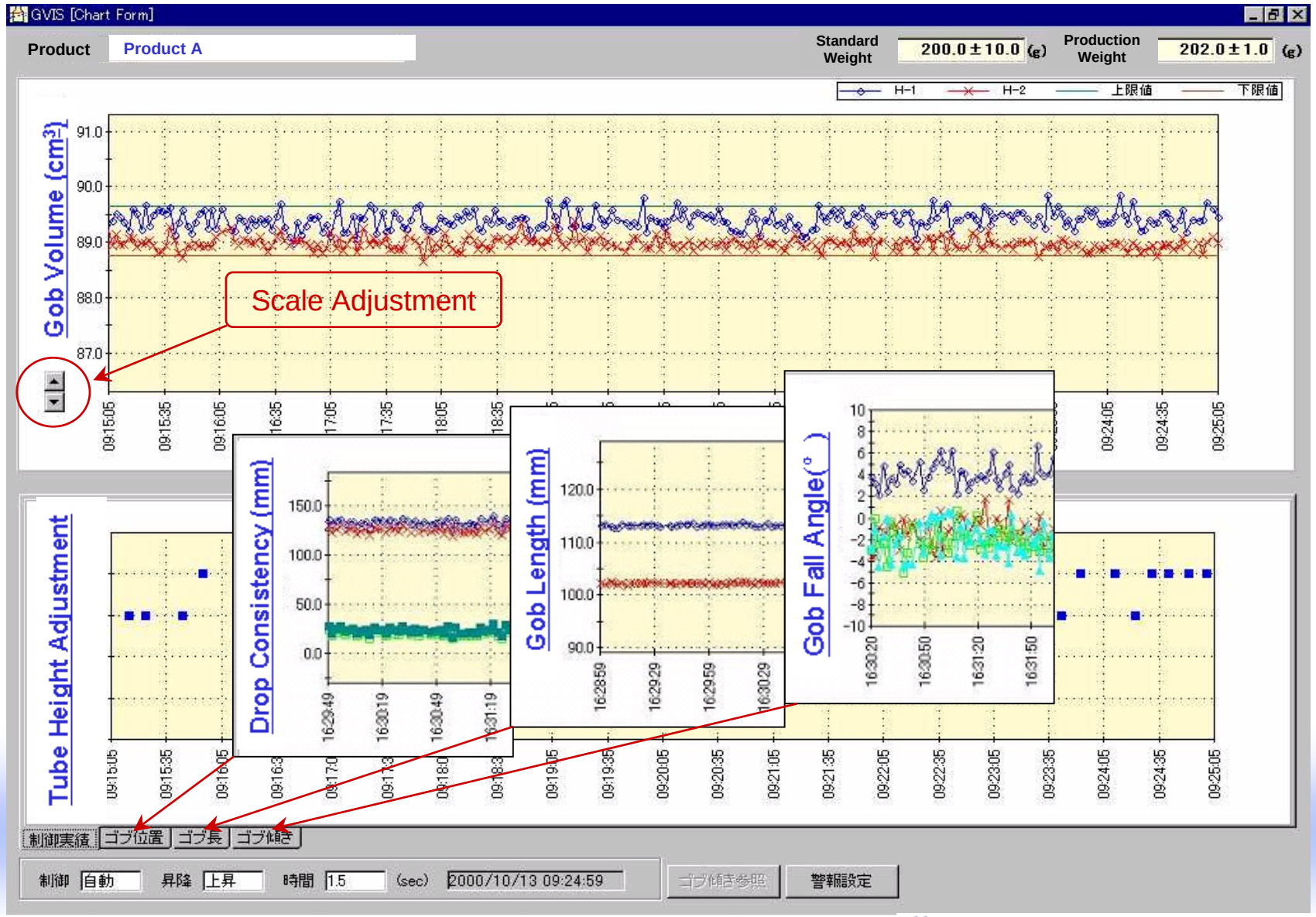
- Trend Graph Data
- Camera Water Jacket Temperature
- Camera Lens Air Purge Pressure

Automatic Control Performance



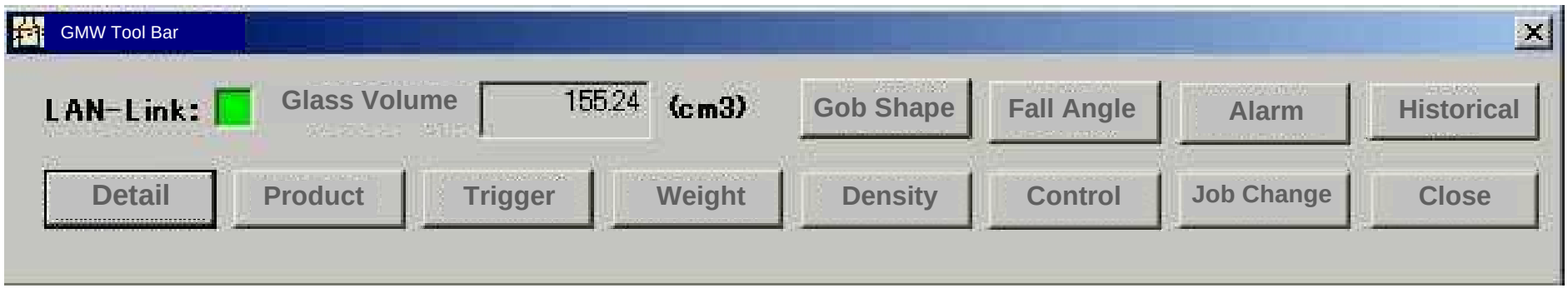
NIHON YAMAMURA GLASS CO.,LTD.

Gob Volume & Trend Graph



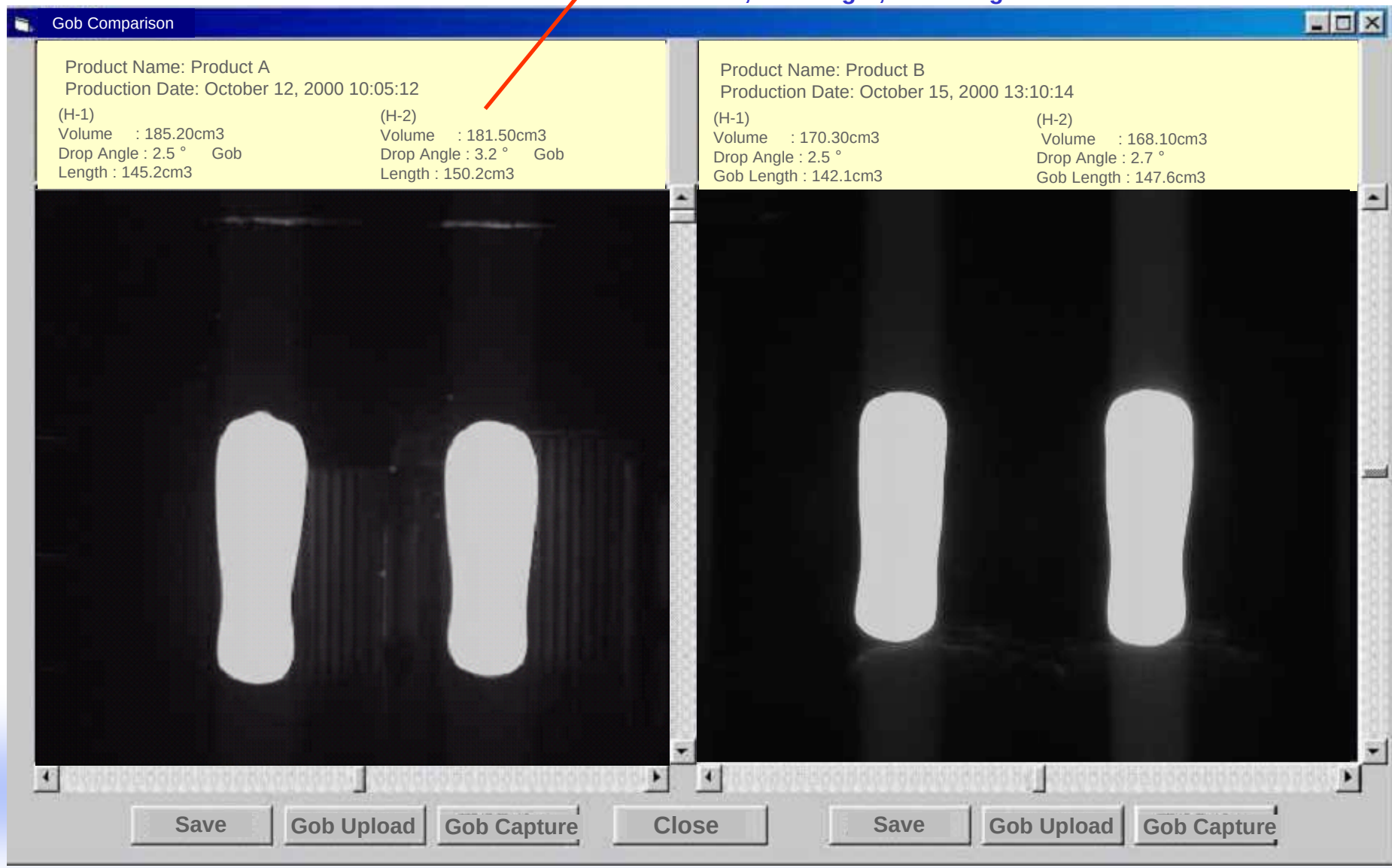
NIHON YAMAMURA GLASS CO.,LTD.

Tool Bar Function

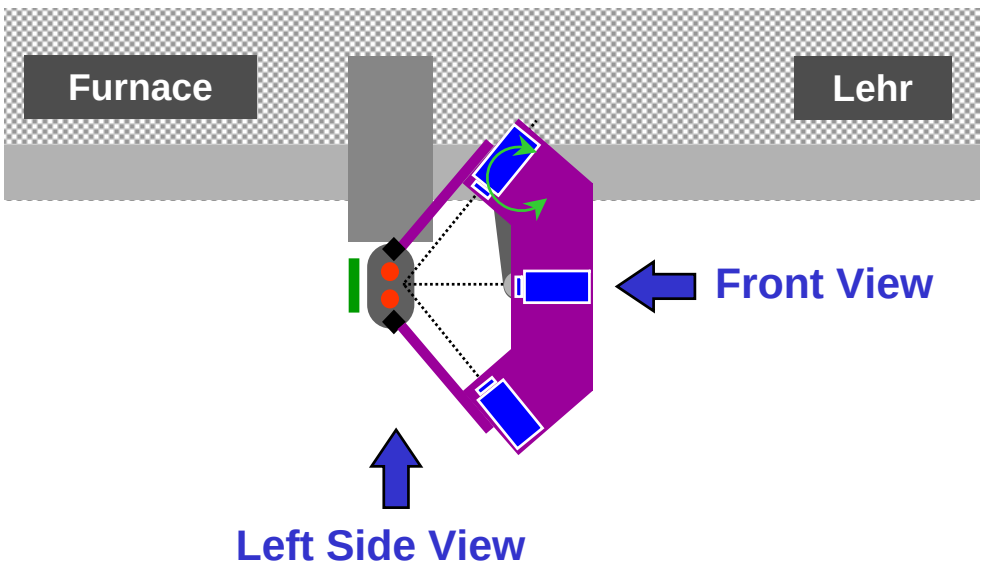


Gob Shape Window

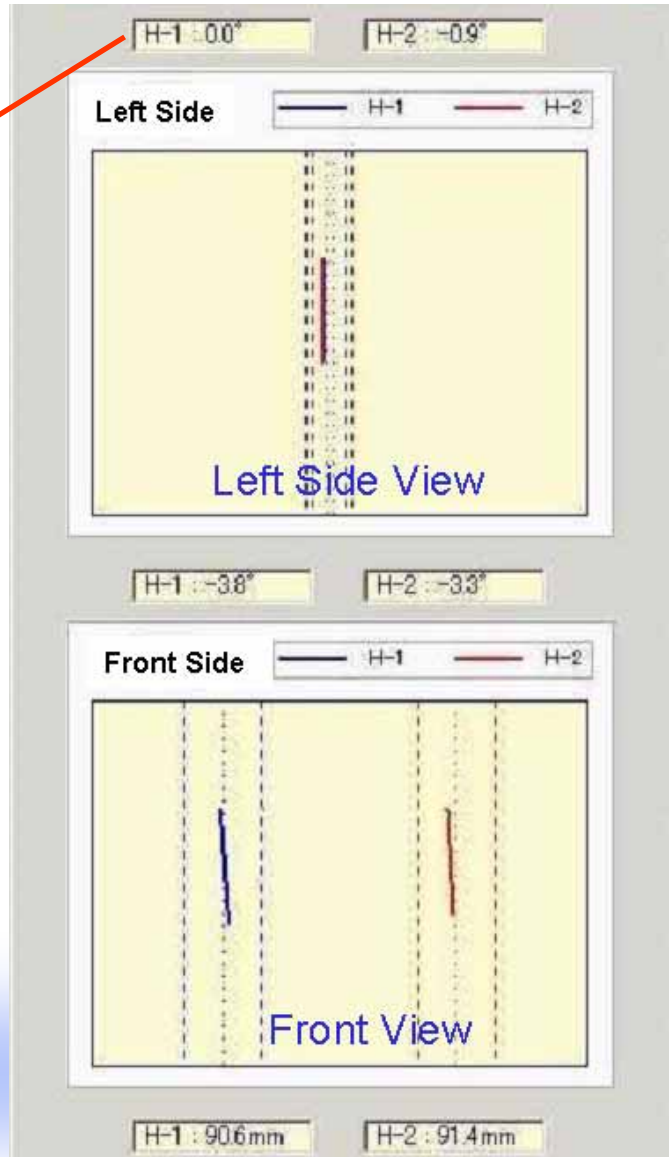
Gob volume, Fall angle, Gob length



Gob Fall Angle

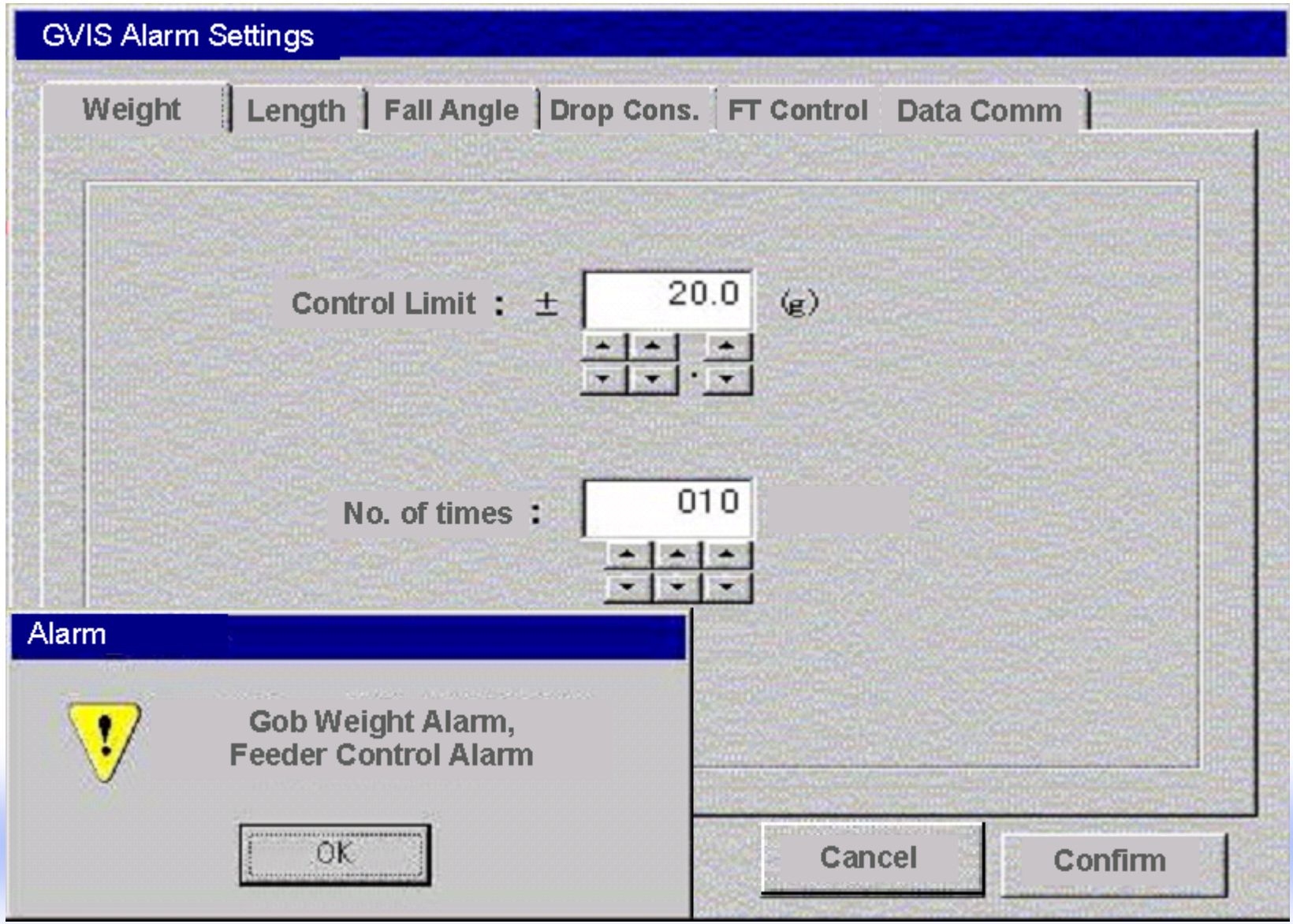


Fall Angle

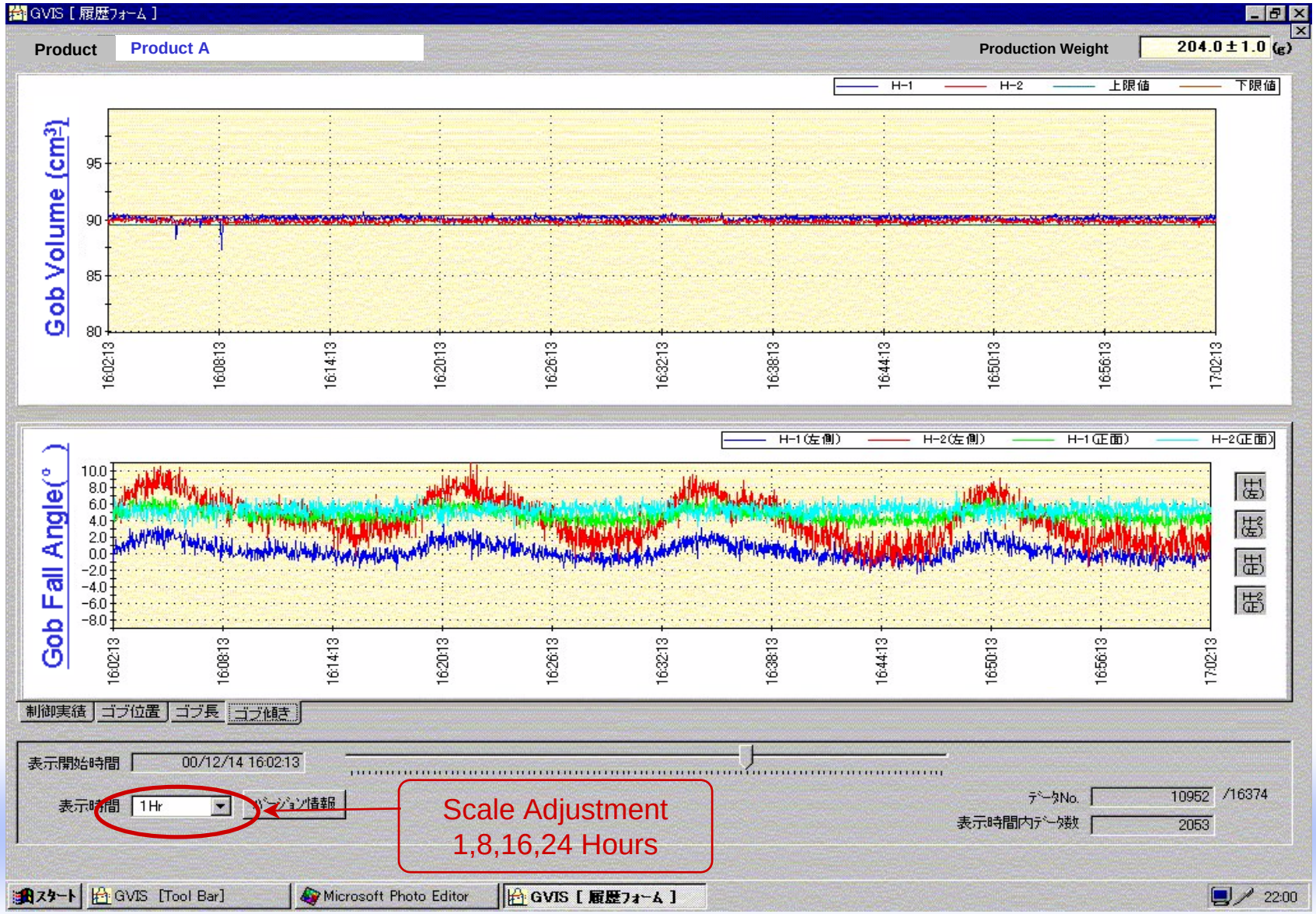


NIHON YAMAMURA GLASS CO.,LTD.

Alarm Setting Window

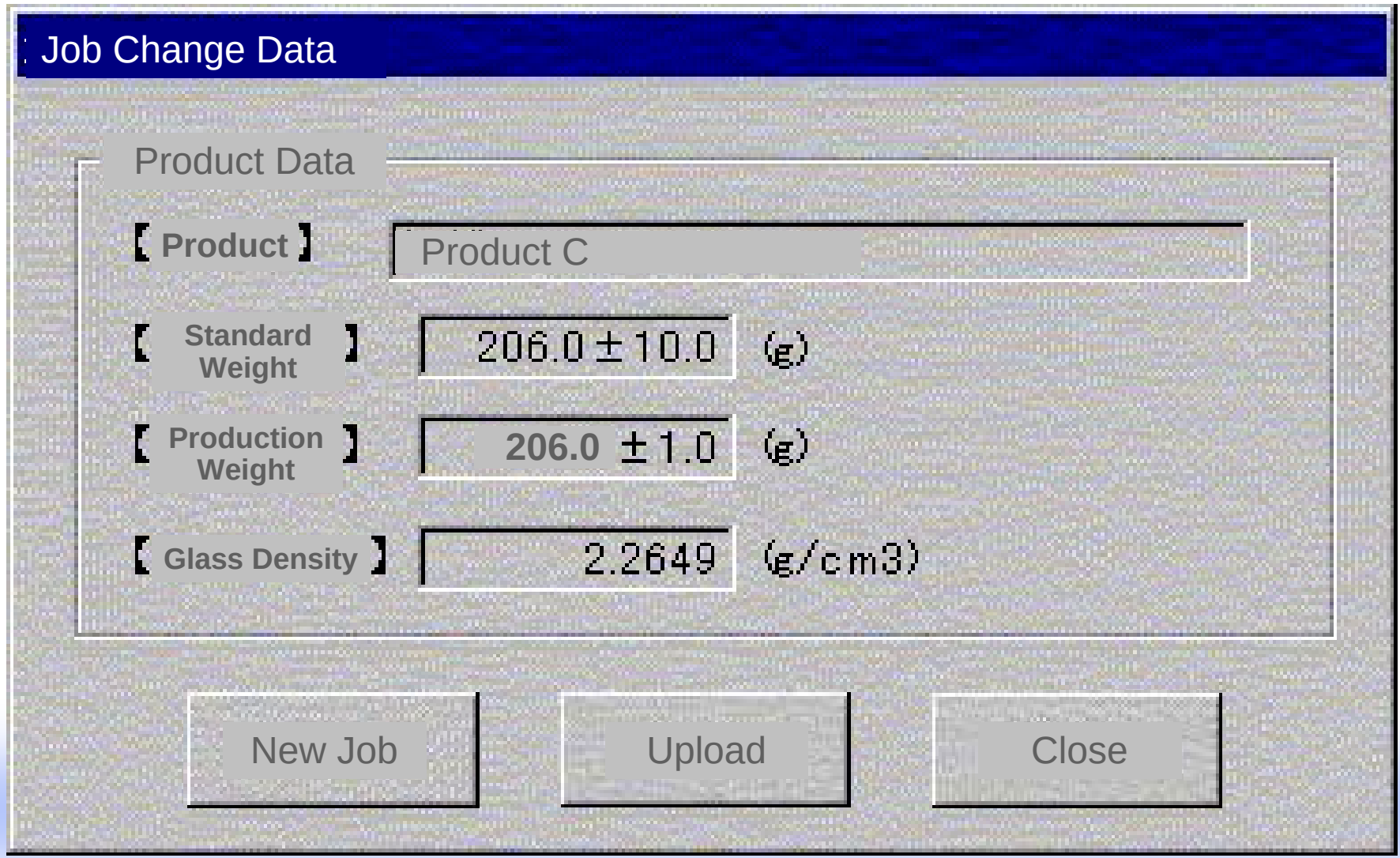


Historical Trend Data

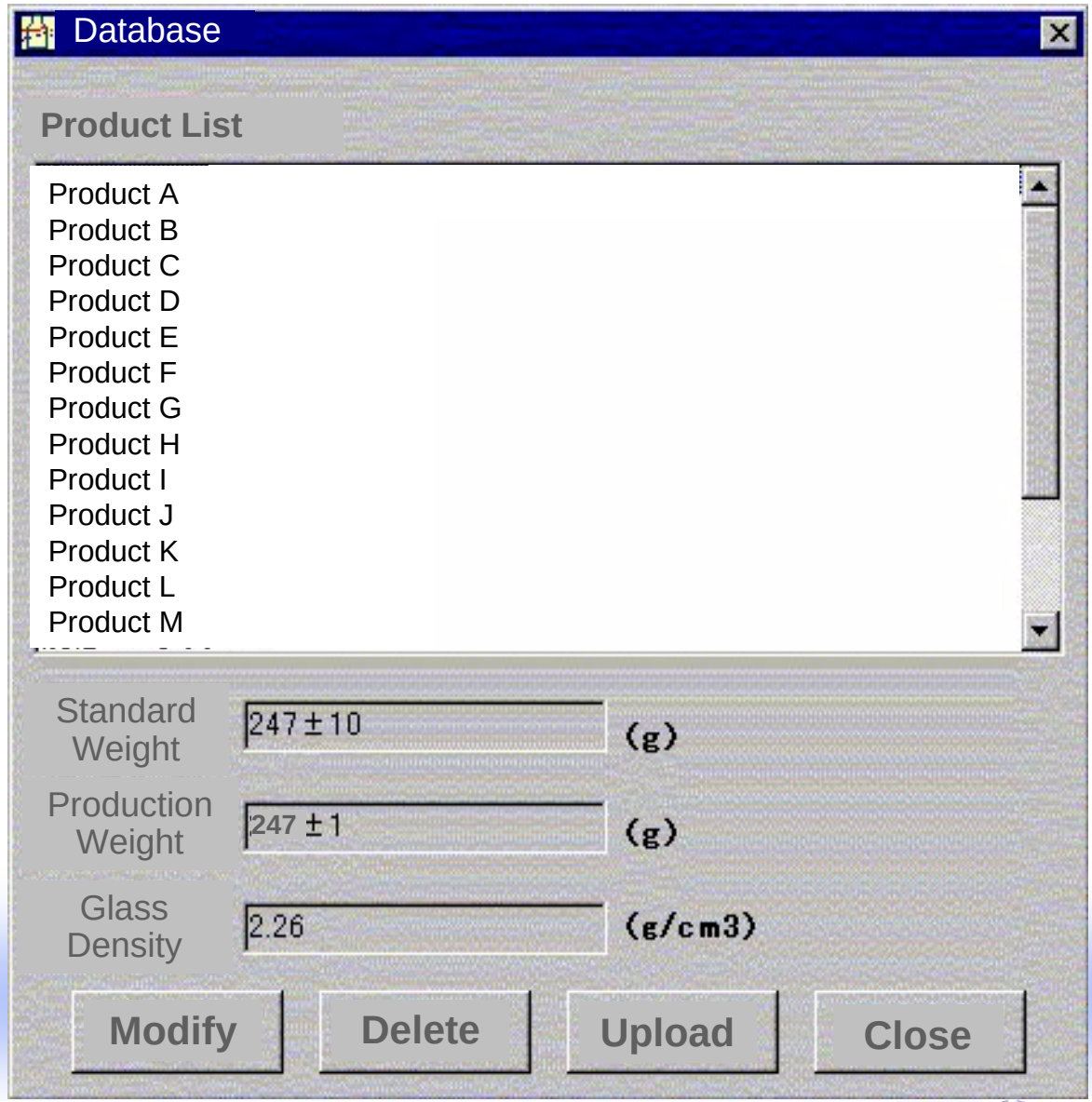


NIHON YAMAMURA GLASS CO.,LTD.

Job Change Data



Job Change Database



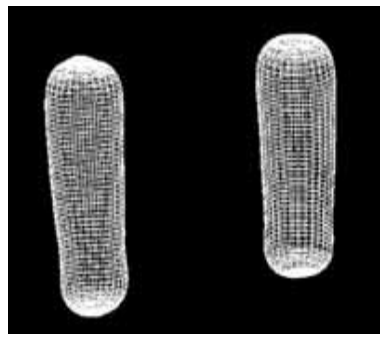
NIHON YAMAMURA GLASS CO.,LTD.

Summary

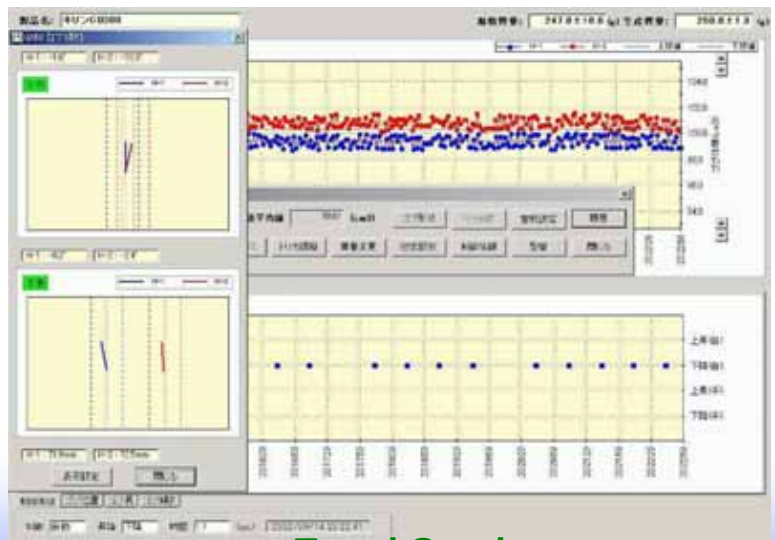
GMW System

Compact Housing Unit

Control Panel



3D Wire
Frame Image



Trend Graph

Summary

1. The GMW system helps contribute to stable production and improve quality.

- **Fully Automatic System**

  No need for periodic weight sampling for calibration.
  This means more time for defects correction

- **Stable gob weight control**

  Applicable for BB, PB, NNPB process

  Weight variation R of below 1% of control weight

- **Job change repeatability**

  Gob images and other numerical parameters helps facilitates job change setup

- **Better gob loading & delivery**

  Continuous monitoring of gob length, fall angle & drop consistency for early identification of loading & delivery problems

Summary

2. Repeatable gob shape & weight, stable gob weight are important factors in achieving light weighting and non-swabbing technology.
3. By linking the gob image data with servo-driven mechanism, automatic gob forming is possible.