

# Electronic Carcass Evaluation Devices



CWMA Annual Meeting  
May, 2006

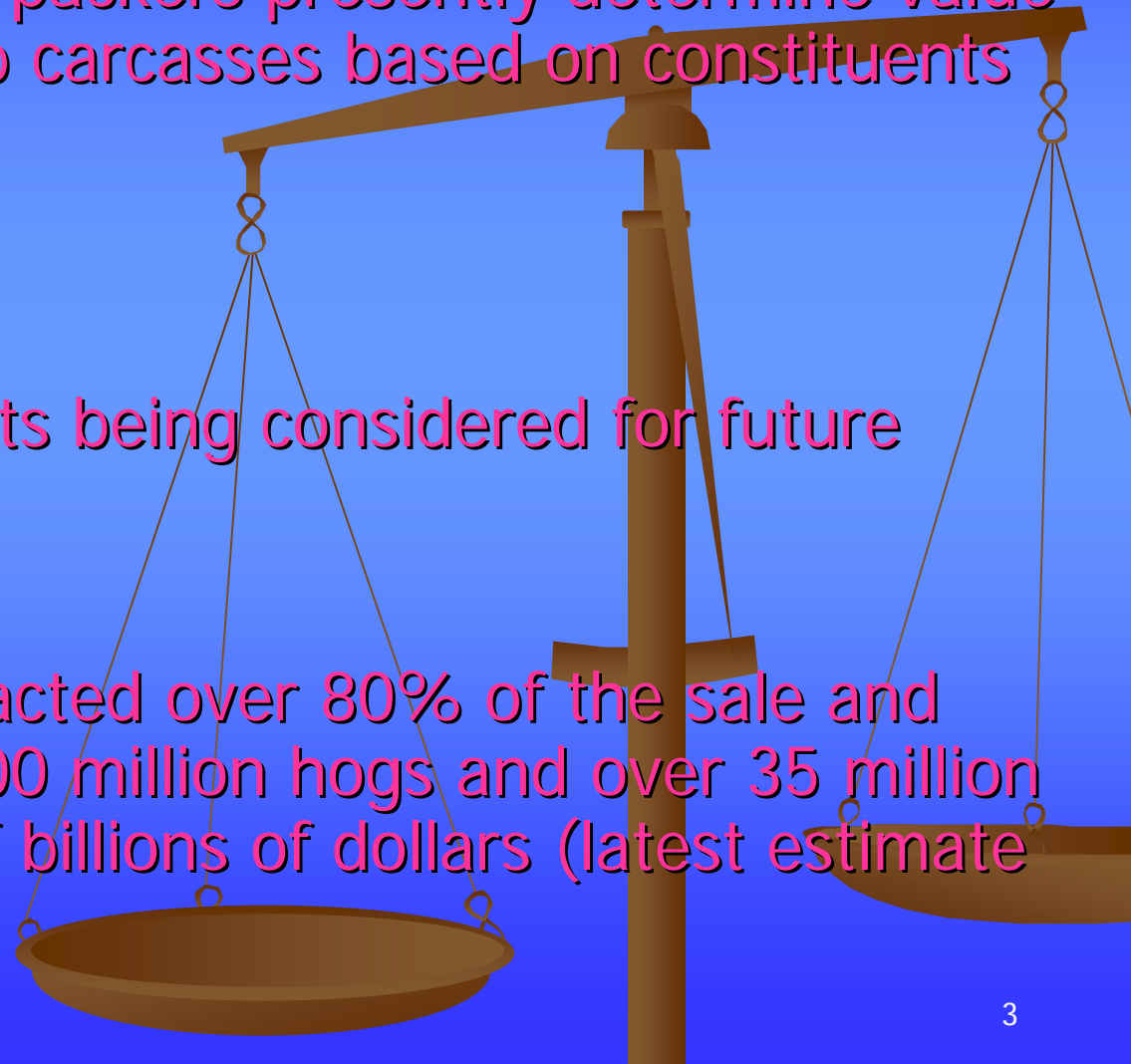
# Electronic Carcass Evaluation Devices

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# Livestock, Meat, & Poultry Evaluation Systems

- Meat processors and packers presently determine value of beef, pork, & lamb carcasses based on constituents
  - Marbling
  - Grade & yield
  - Fat/lean ratio
- Additional constituents being considered for future
  - Color
  - pH
- Industry value - impacted over 80% of the sale and harvesting of over 100 million hogs and over 35 million cattle with a value of billions of dollars (latest estimate \$38.8 billion).



# Electronic Carcass Evaluation Devices

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## Industry Trends for Livestock Procurement

- Live Weight Basis
  - Livestock Scales
- Carcass Weight Basis
  - Monorail scales
- Carcass grade and yield (Carcass Merit)
  - Monorail Scales & Grading Devices or Systems
- Primal cuts
  - Grading Device or Systems



# Electronic Carcass Evaluation Devices

## Problems Seen in the Industry with Current Standards

Standard Test Method for Livestock, Meat, and Poultry Evaluation Devices also known as F10.20

- Repeatability (6% difference (*packers name removed*) investigation 1.17 per head for 1% lean)
- Truncating Lean Percent

# Example Payment Grid

		Lean Percent Range						
		<a href="#">Next &gt;</a> <a href="#">Last &gt;&gt;</a>						
		<u>Hot Carcass 44.9 &amp; Down</u>	<u>45 - 46</u>	<u>46 - 47</u>	<u>47 - 48</u>	<u>48 - 49</u>	<u>49 - 50</u>	
		<u>Weight Range (lbs)</u>						
Live Weight Range (pounds)	<u>Under 209</u>	Under 155	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$2.00
	<u>210 - 220</u>	156 - 163	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$2.00
	<u>221 - 230</u>	164 - 171	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$2.00
	<u>231 - 240</u>	172 - 178	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$2.00
	<u>241 - 250</u>	179 - 186	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$2.00
	<u>251 - 260</u>	187 - 194	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
	<u>261 - 270</u>	195 - 202	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
	<u>271 - 280</u>	203 - 209	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
	<u>281 - 290</u>	210 - 218	-\$7.50	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
	<u>291 - 300</u>	219 - 225	-\$8.00	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
	<u>301 - 310</u>	226 - 233	-\$8.00	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
	<u>311 - 320</u>	234 - 240	-\$8.00	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
	<u>321 - 330</u>	241 - 248	-\$8.00	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
	<u>331 - 340</u>	249 - 255	-\$8.00	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00
<u>341 &amp; up</u>	256 & up	-\$8.00	-\$7.50	-\$6.00	-\$4.00	-\$3.00	-\$1.00	

# Electronic Carcass Evaluation Devices

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## Current Devices or Systems

Probes (Pork)

Fat-O-Meat'er  
Hennessy Probe

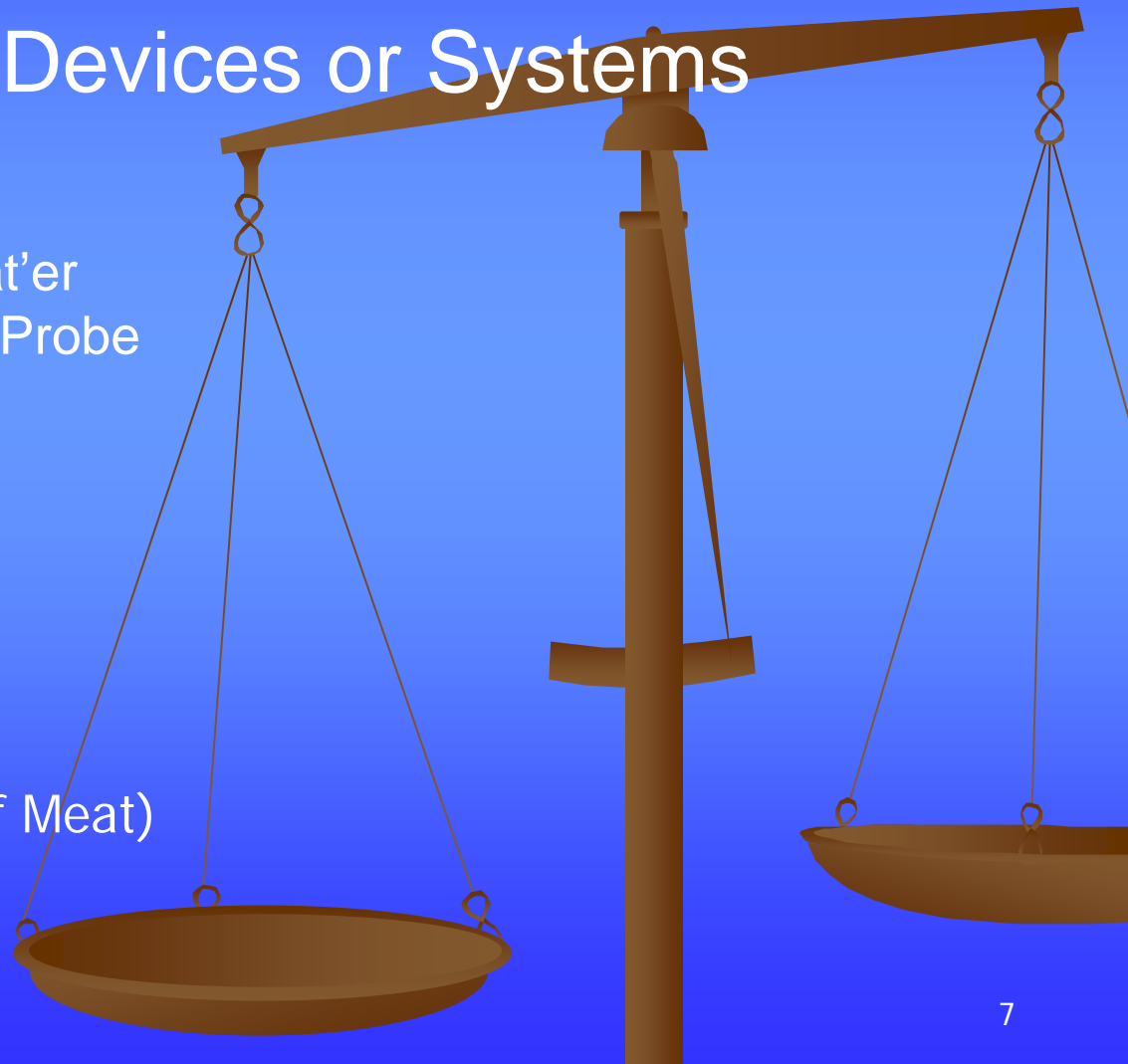
Ultrasound (Pork)

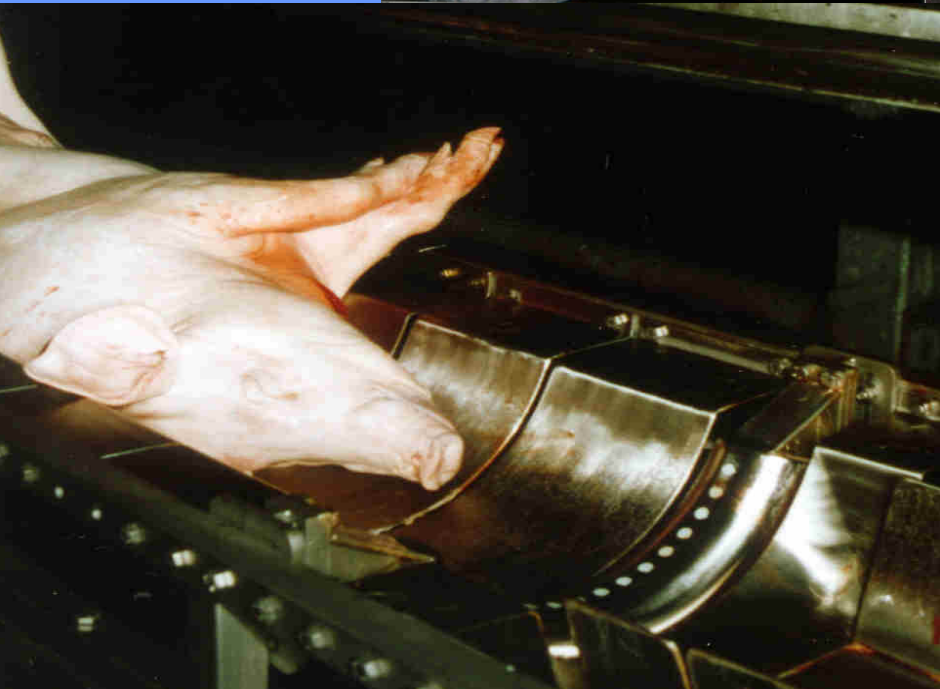
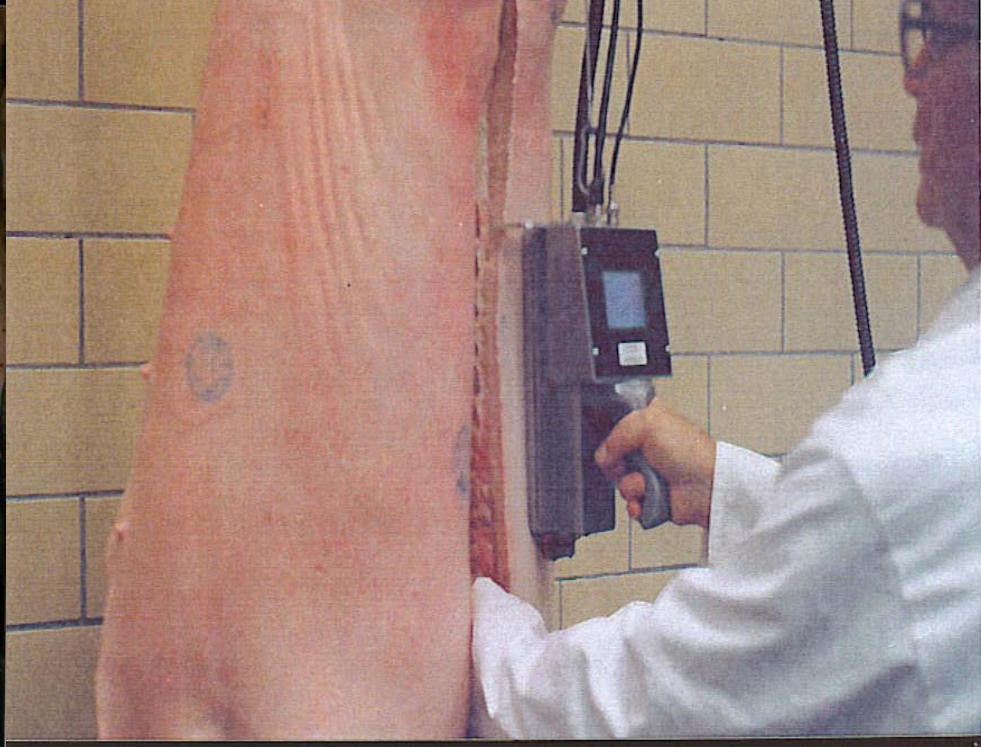
UltraFOM  
AutoFOM

TOBEC (Pork)

Vision (All Types of Meat)

Ruler





## CARCASS MANAGEMENT TECHNOLOGIES

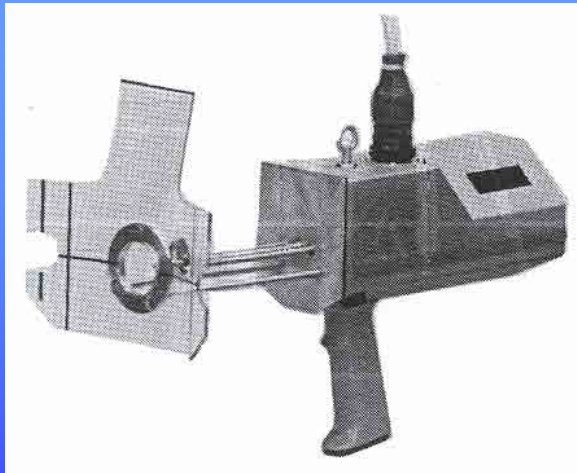


[www.rms.ca](http://www.rms.ca)



# Electronic Carcass Evaluation Devices

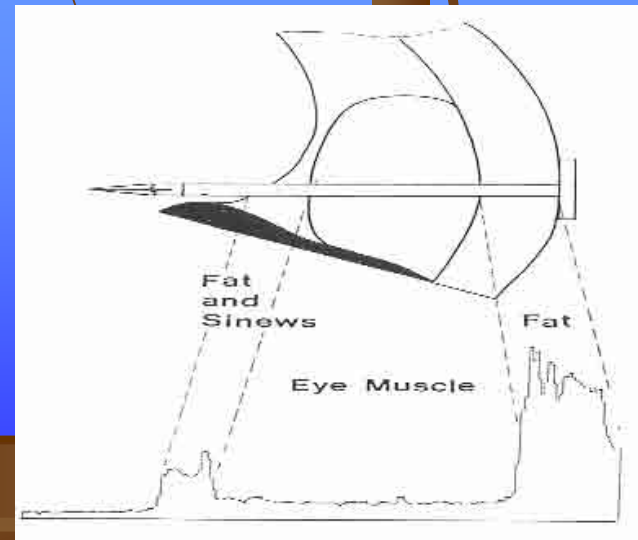
## Optical Probes (Hogs)



# Electronic Carcass Evaluation Devices

## Optical Probes

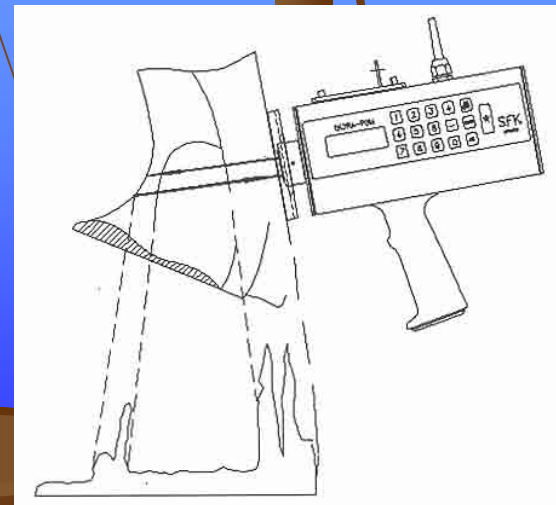
- Inserted between the 3rd and 4th last rib, 7 cm from the centerline
- Measures backfat and loin eye depth through the differences in reflectivity of fat and muscle



# Electronic Carcass Evaluation Devices

## Ultrasound

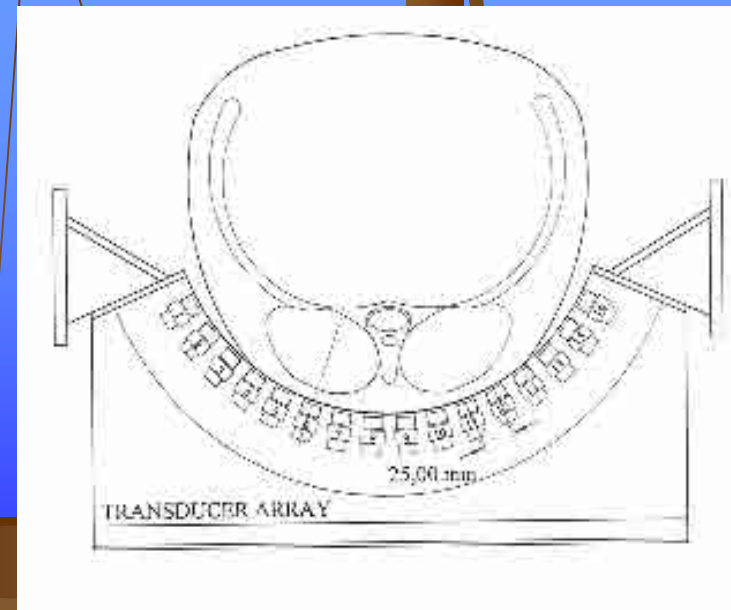
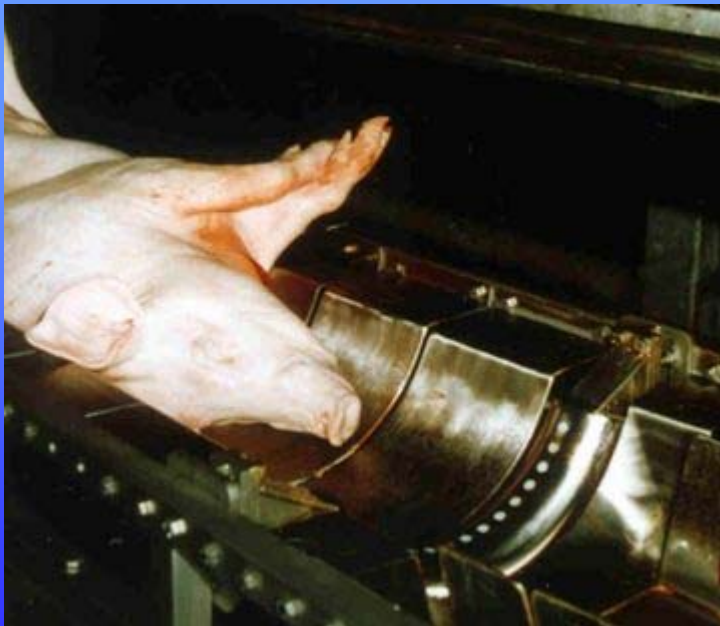
- Placed between the 3rd and 4th last rib, 7 cm from the centerline
- Uses ultrasonic technology to measure backfat and loineye depth



# Electronic Carcass Evaluation Devices

## Ultrasound

- Used on intact carcass after kill before evisceration



# Electronic Carcass Evaluation Devices

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## TOBEC

- Total Body Electrical Conductivity
- Uses electromagnetic scanning similar to MRI to measure fat and lean



# Electronic Carcass Evaluation Devices

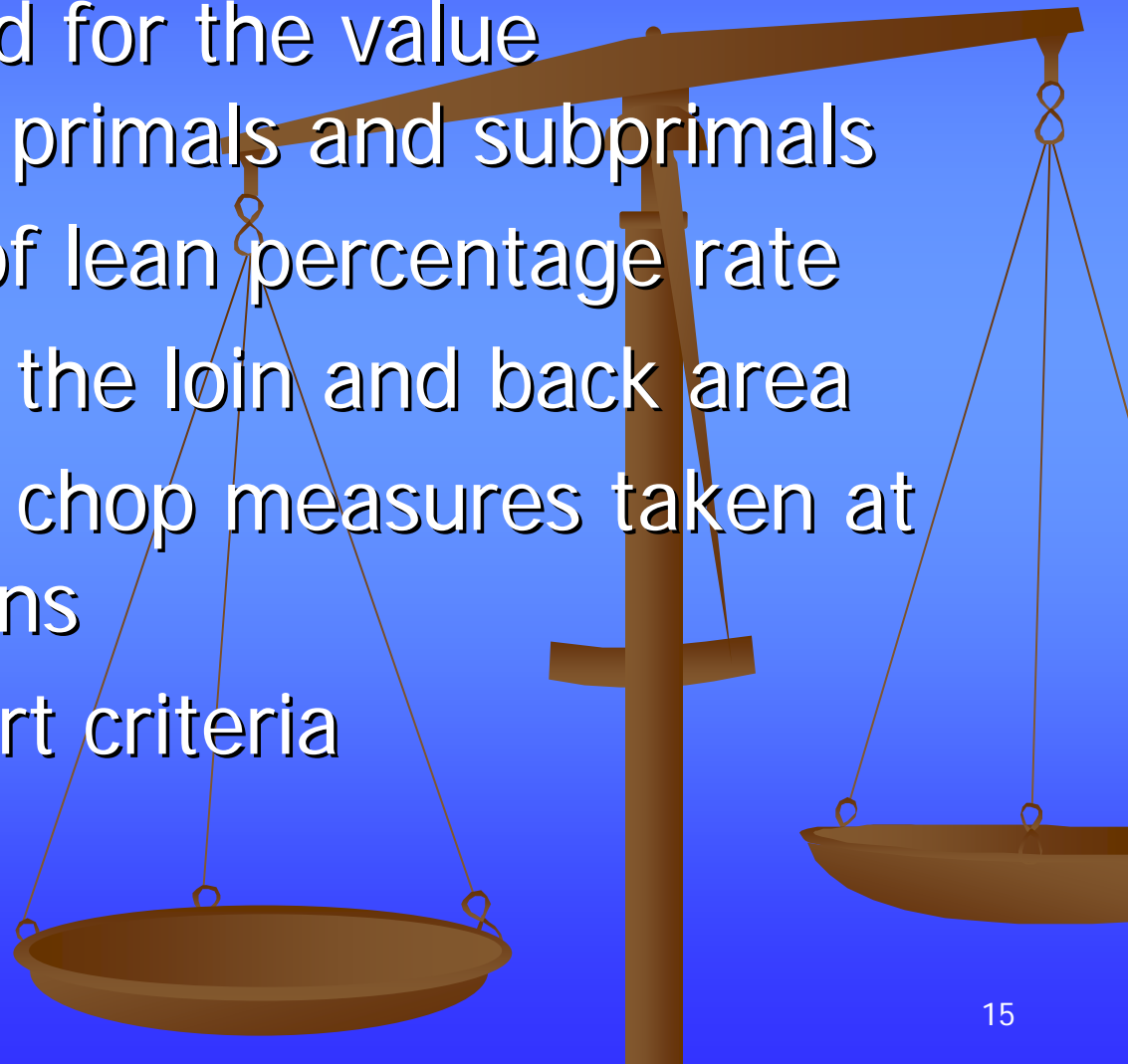
## TOBEC

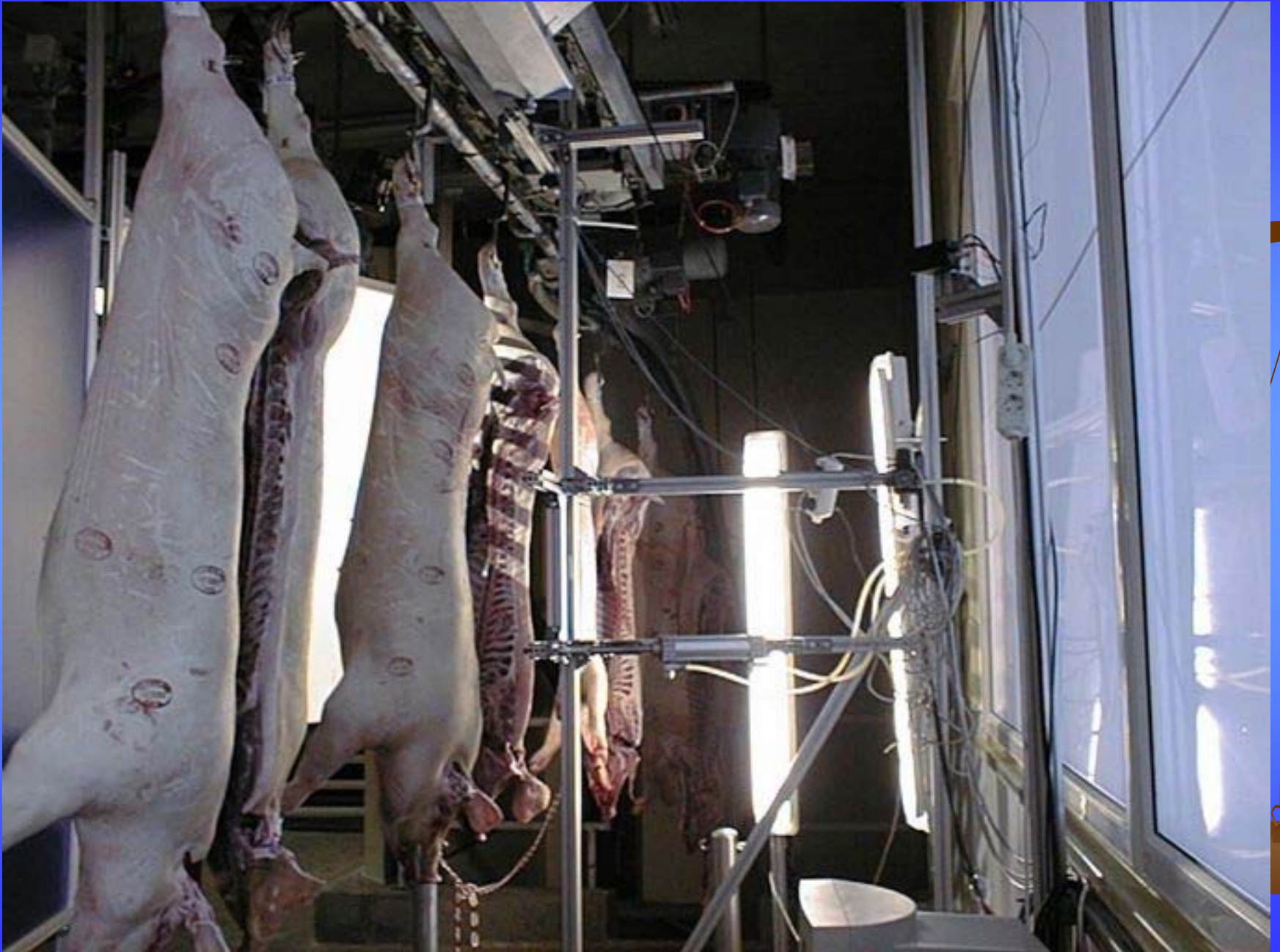
- Measures varying electrical properties to distinguish between bone, fat, and lean
- Whole carcass, fully automatic system



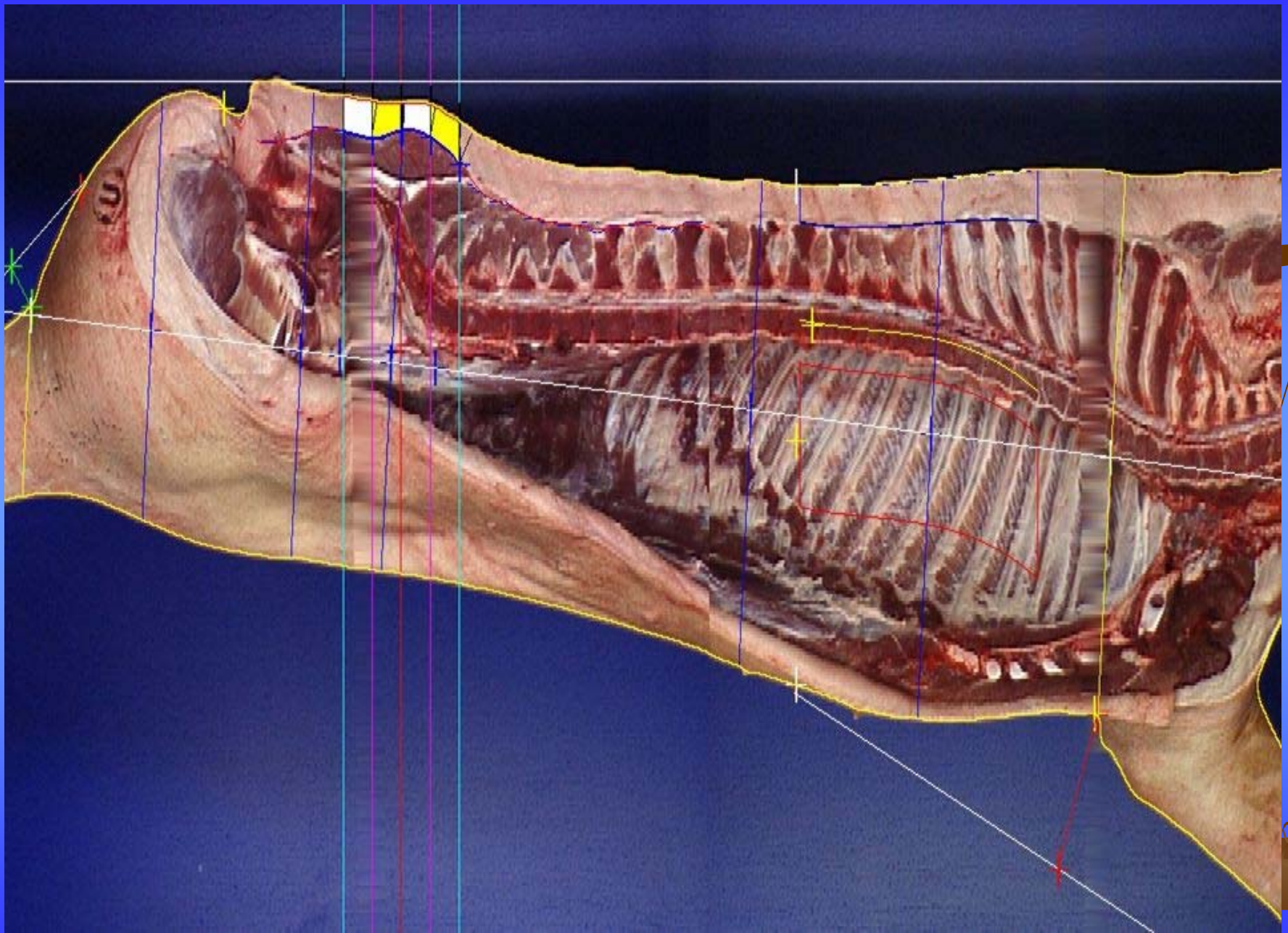
# Pork Information Determined

- Weight and yield for the value determination - primals and subprimals
- Determination of lean percentage rate
- Fat thickness in the loin and back area
- Belly, ham, and chop measures taken at different positions
- Derivation of sort criteria









**Bilder**

Lieferant

Schlachtnr.

8934

Schl.Gew./kg

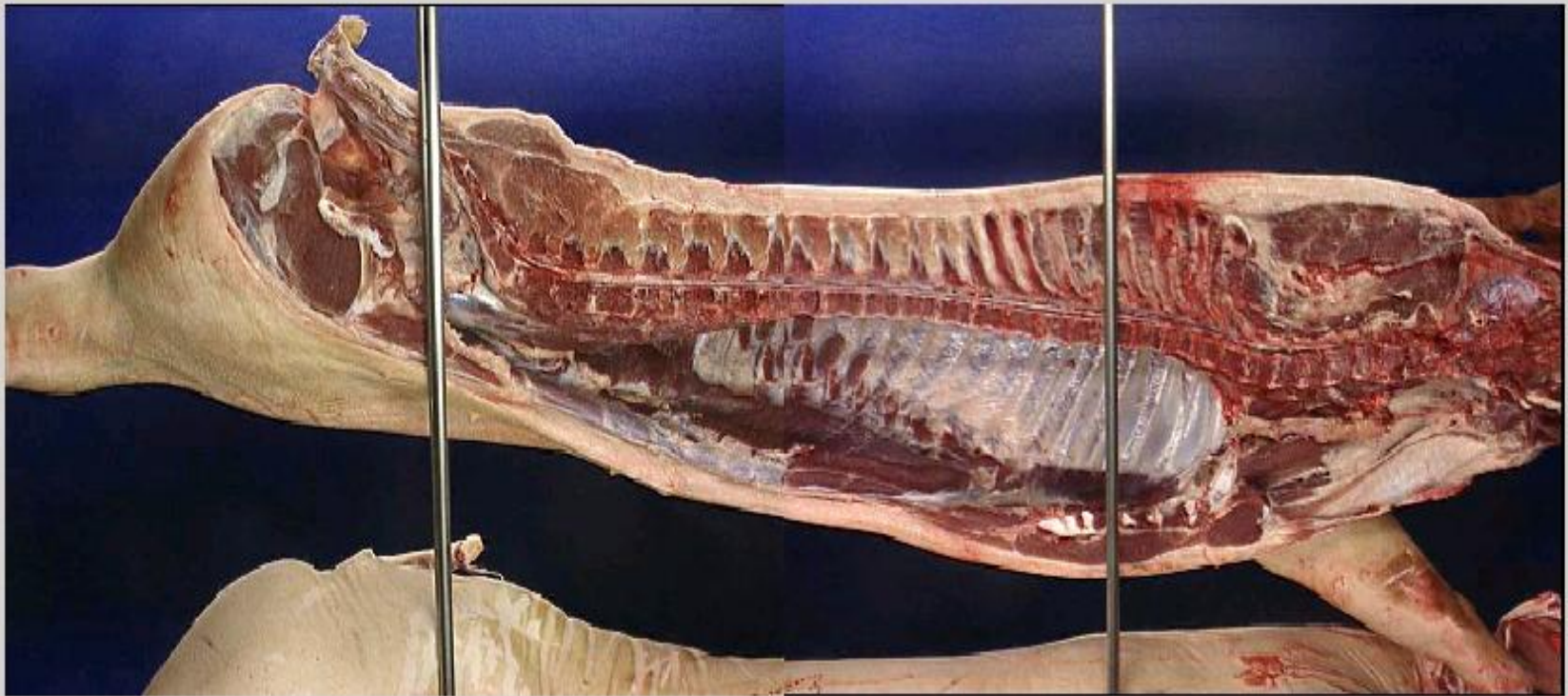
91.7

MFProz. Sonde

58.4

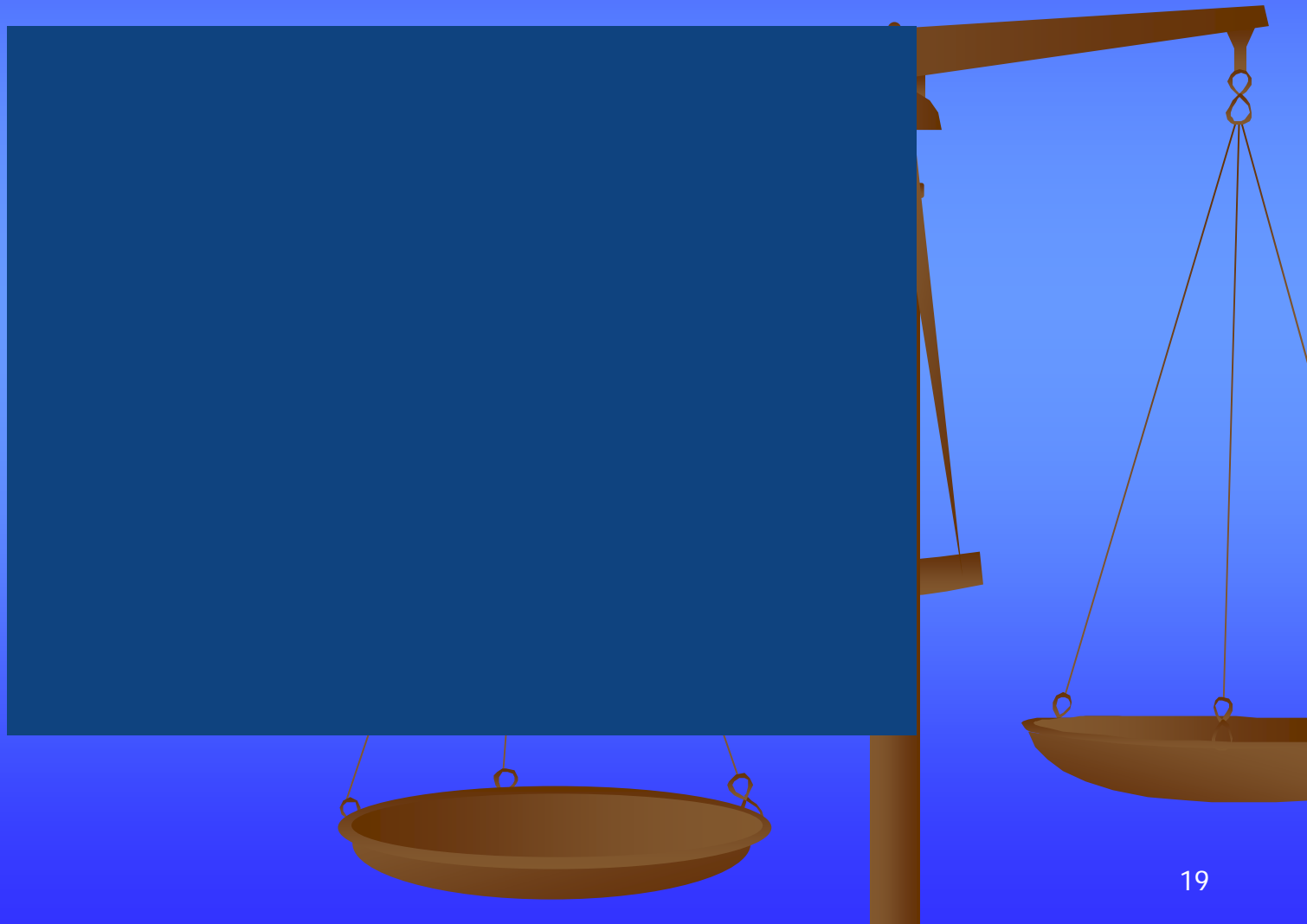
Schl.Datum

04.06.2002

Bildverzeichnis  
auswählen

Beenden

# Hog Grading – Vision (video)



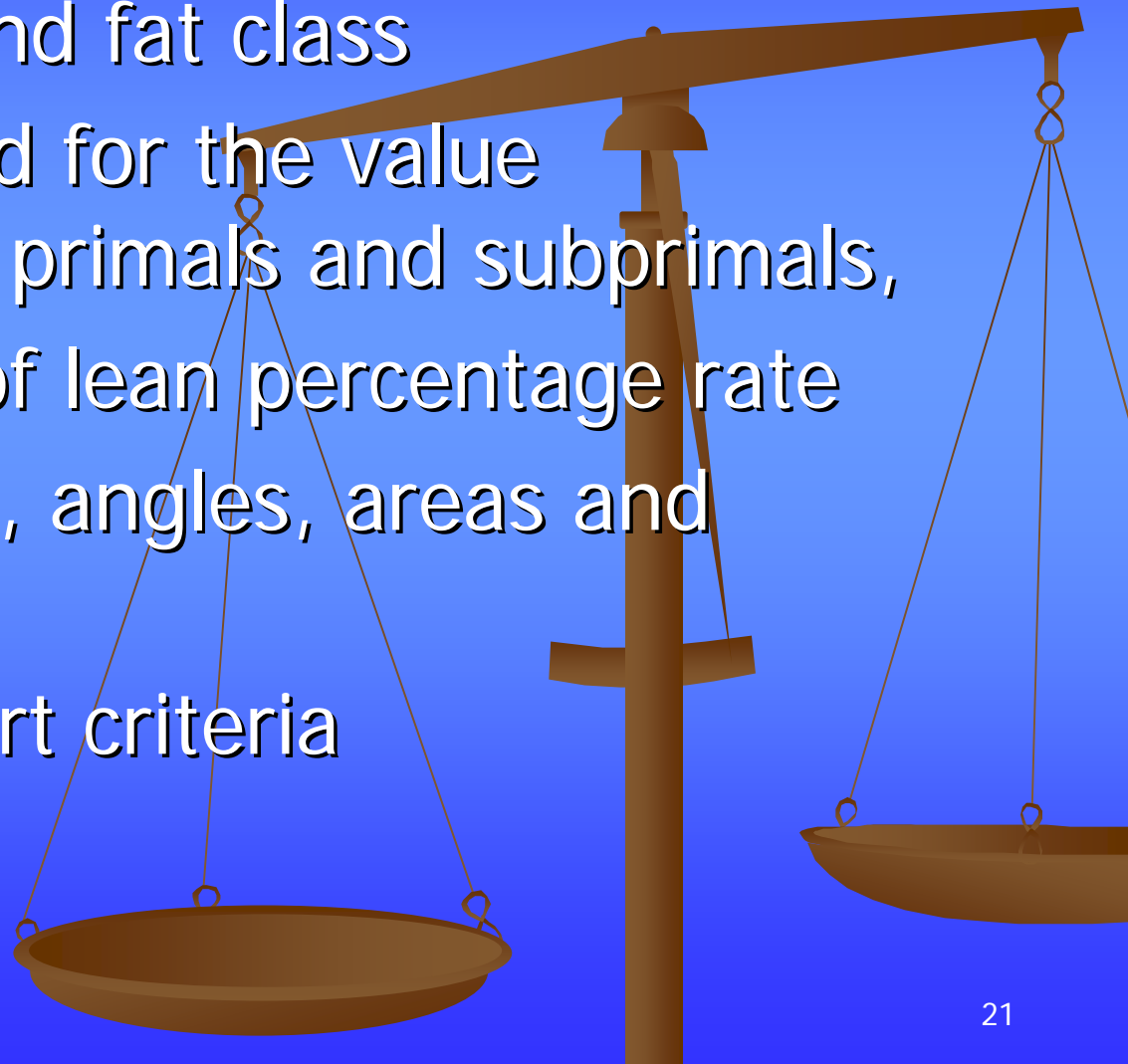
# Beef Ribeye Grading Information

- Yield Grade
- Fat/Meat Ratio
- Fat thickness
- Ribeye Area
- Ribeye Height and Width




# Beef Information Determined

- Conformation and fat class
- Weight and yield for the value determination - primals and subprimals,
- Determination of lean percentage rate
- Lengths, widths, angles, areas and volumes
- Derivation of sort criteria

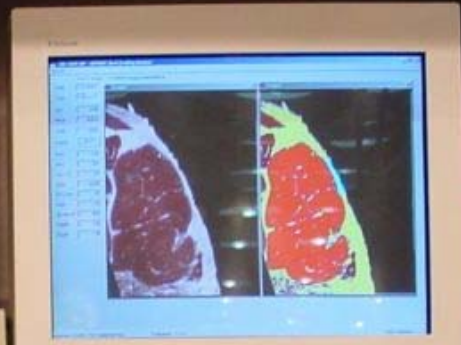




**WARNING**  
Enclosure is TOP-HEAVY



• Do Not Remove This Label Until Enclosure is Permanently Installed.  
• Label Must Be Reattached if Removed For Repairing.  
• To get more copies of Manual or of Heavy Label, call 1-800-368-5555.

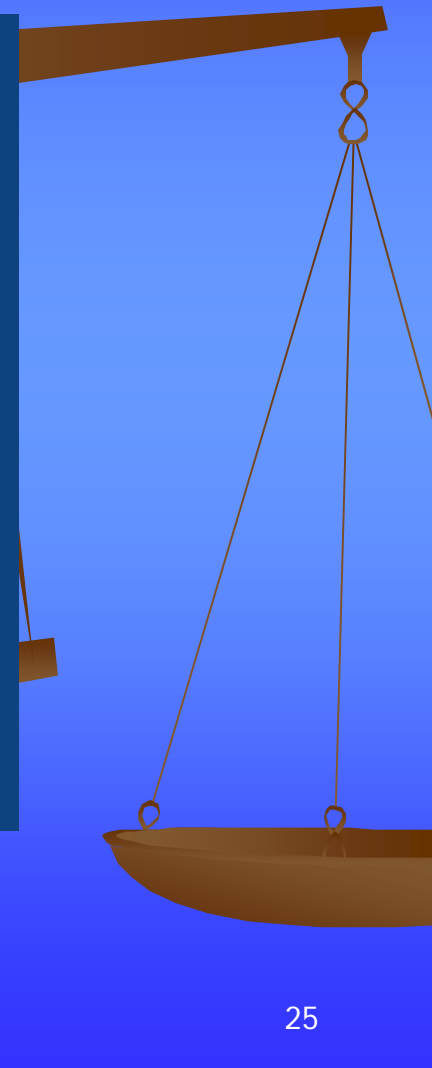


Date: 13.10.01  
Time: 14:41:34  
Fat: 7284  
Meat: 11673  
Total: 19569  
Lean%: 59.65  
PYG: 3.07  
REA: 16.26  
CAL-YG: 2.6  
Marb: S190  
RE-Color: 51.7  
Histo: 164  
RE-Meat%: 96.2  
Height: 151  
Broad: 96



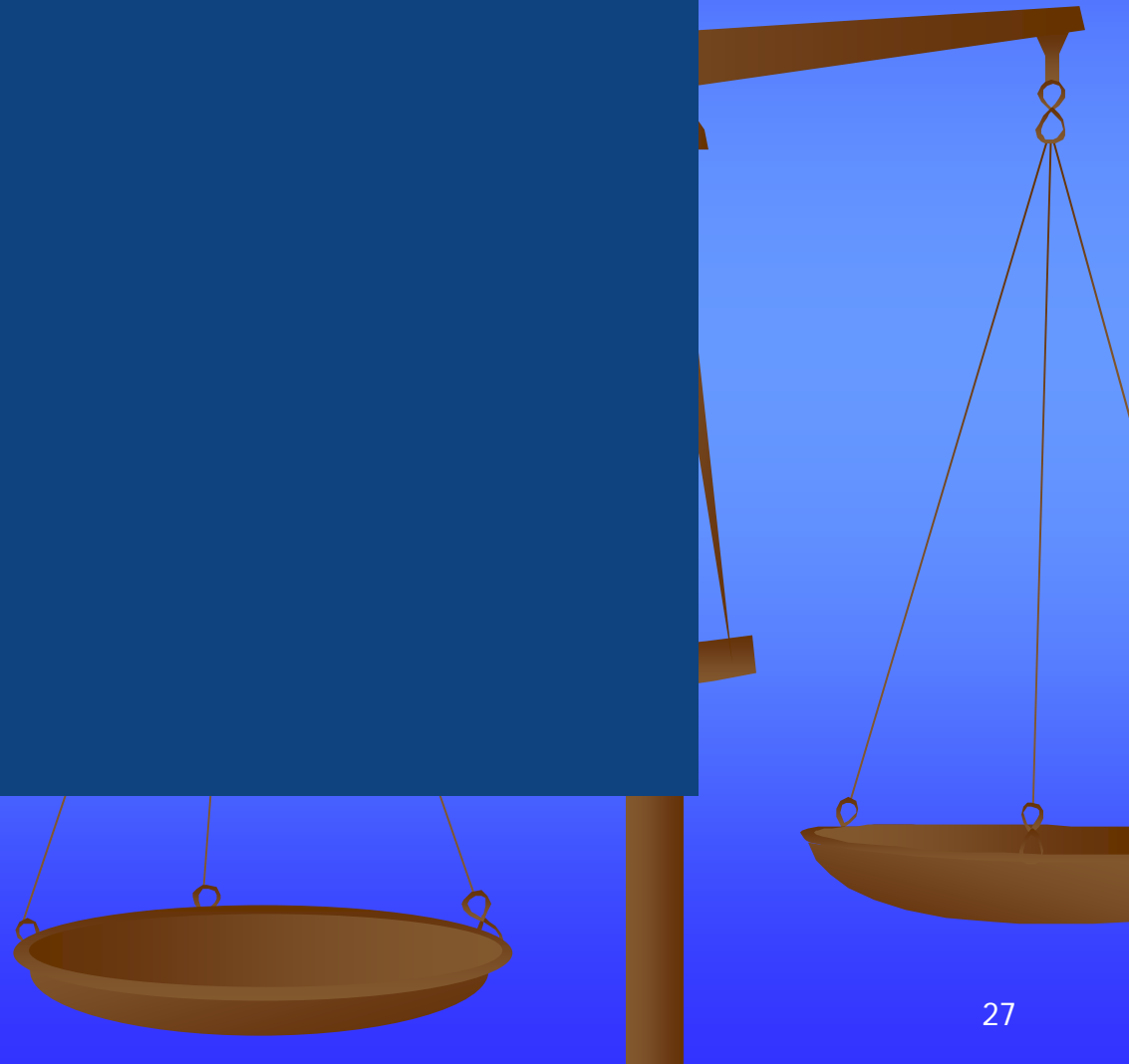


# Ribeye Vision (video)





# Beef Carcass – Vision (video)





Ergebnisse

Kamera 0

Aktion: Pute geladen  
 Dauer: 44 ms  
 Auswertung: Werte aus:  
 Dauer: 118 ms  
 Zähler: 286 im Puffer: 1

Differenz: 1 Basisindex: 0

Kamera 1

Aktion: Static  
 Dauer: Static  
 Auswertung: Werte aus:  
 Dauer: 119 ms  
 Zähler: 285 im Puffer: 0

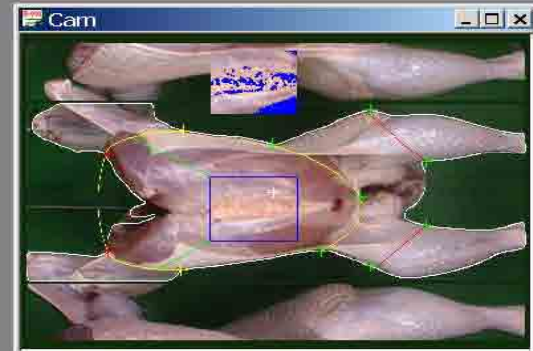
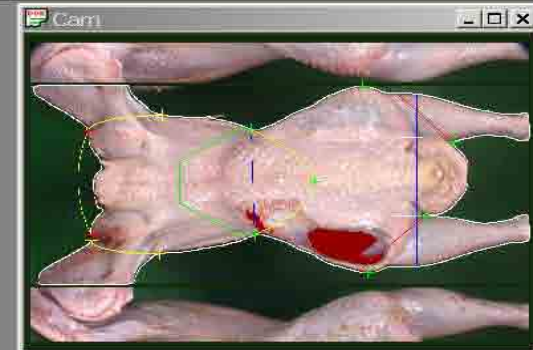
Partie

Brustblasen: 142 (63) Flügel fehlen: Putentyp:  
 Verletz: 0 / 0 links: 0  Hähne  
 Kratzspuren: 23 rechts: 0  Hennen

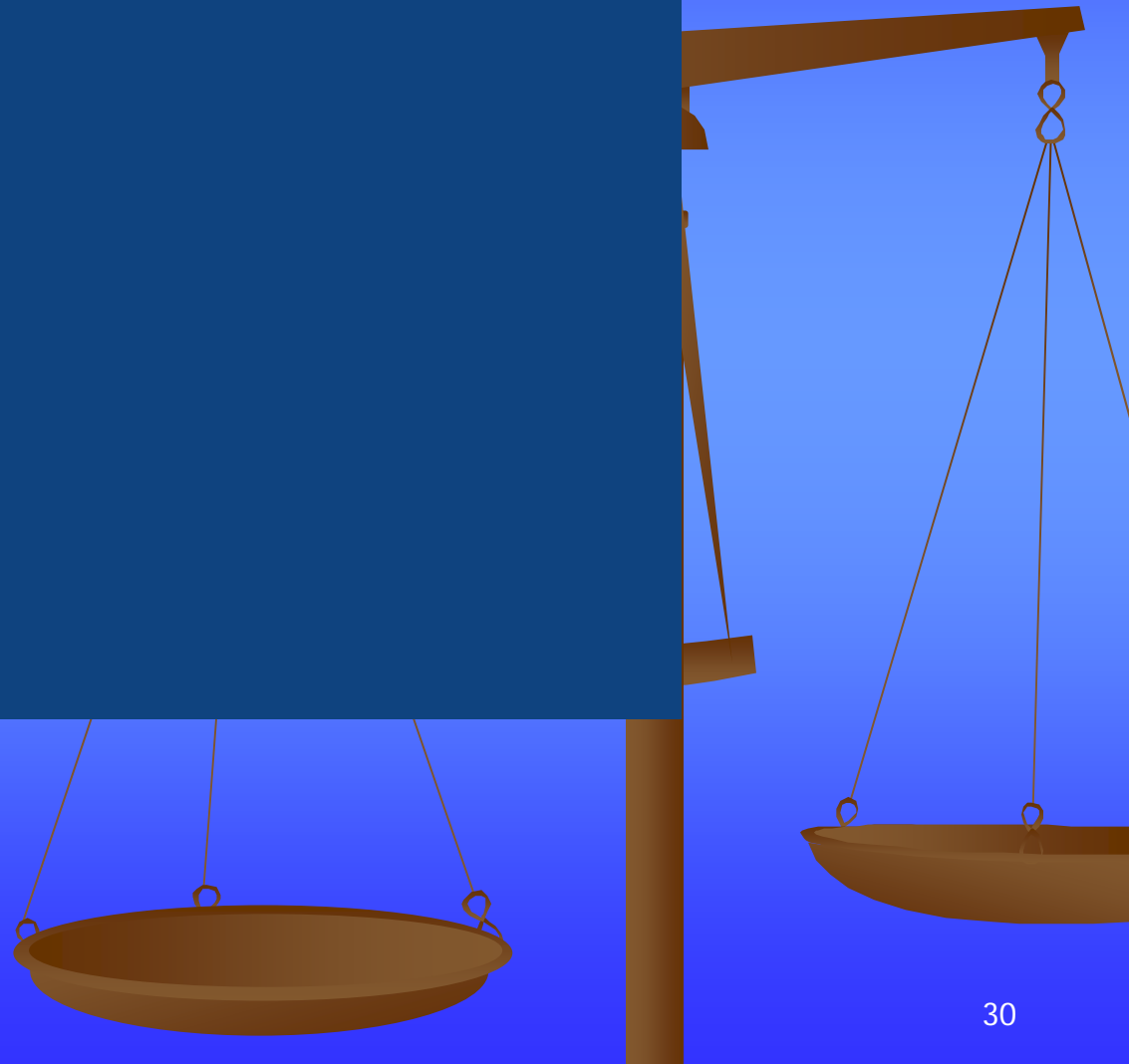
Schätzgrößen

Warmschlachtgewicht: 13.223138  
 Kaltschlachtgewicht: 12.989897  
 Brustgewicht: 5.536365  
 Rückengewicht: 2.468080  
 Schenkelgewicht: 4.205963  
 Oberschenkelgewicht: 2.701976  
 Unterschenkelgewicht: 1.668705  
 Gesamtfleischgewicht: 9.352726  
 Gesamtfettgewicht: 3.052626  
 Fleisch-Knochengewicht: 11.420178  
 Sub. Fett-Hautgewicht: 1.948485

20.04.2004 17:33:46: Rücken KS: J(2588)  
 20.04.2004 17:33:46: Brust BB: J VL: N(29) KVL: N(0)  
 20.04.2004 17:33:46: Kamera 0: Bild D:\Bilder\Letheta\DemoBilder\_Haehne\CO\31.03.2004.13-22-54 C0.tif geladen  
 20.04.2004 17:33:46: Kamera 1: Bild D:\Bilder\Letheta\DemoBilder\_Haehne\C1\31.03.2004.13-22-53 C1.tif geladen  
 20.04.2004 17:33:41: Rücken KS: N(0)  
 20.04.2004 17:33:41: Kamera 0: Bild D:\Bilder\Letheta\DemoBilder\_Haehne\CO\31.03.2004.13-22-53 C0.tif geladen  
 20.04.2004 17:33:41: Brust BB: J VL: N(0) KVL: N(0)  
 20.04.2004 17:33:41: Rücken KS: N(0)  
 20.04.2004 17:33:41: Kamera 1: Bild D:\Bilder\Letheta\DemoBilder\_Haehne\C1\31.03.2004.13-22-52 C1.tif geladen  
 20.04.2004 17:33:41: Kamera 0: Bild D:\Bilder\Letheta\DemoBilder\_Haehne\CO\31.03.2004.13-22-51 C0.tif geladen  
 20.04.2004 17:33:41: Brust BB: N VL: N(0) KVL: N(0)



# Turkey Grading (video)



# Electronic Carcass Evaluation Devices

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## Ruler (Hogs)

- Measure the backfat at the 10th rib
- Premiums / Discounts based on backfat only



# Livestock, Meat, & Poultry Evaluation Systems

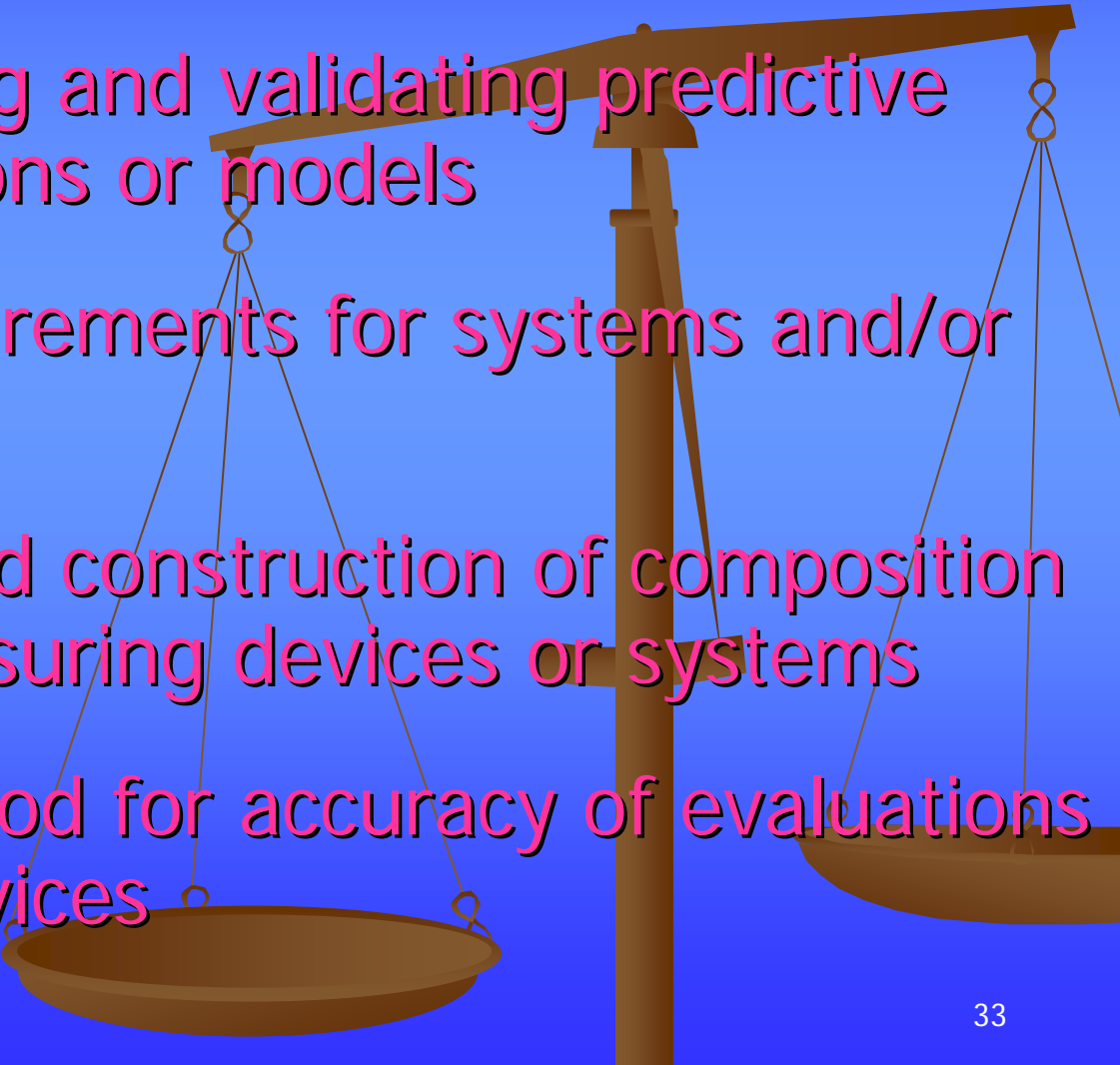
- Previously no standards for
  - Equipment design
  - Installation & use
  - Accuracy & testing
- 2001 ASTM Committee F 10 formed
  - Cooperative effort of ASTM, USDA, & NIST/WMD
  - Participation includes
    - Packing industry
    - Livestock growers & association
    - Device and system manufacturers
    - Academia
    - Several USDA divisions
    - NIST/WMD
    - National Conference on Weights & Measures





# ASTM Committee F10

## Livestock, Meat, & Poultry Evaluation Systems

- F 2340 - Developing and validating predictive accuracy of equations or models
  - F 2341 - User requirements for systems and/or devices
  - F 2342 - Design and construction of composition or constituent measuring devices or systems
  - F 2343 - Test method for accuracy of evaluations systems and/or devices
- 

# Inspection - Overview

- General Considerations
- Indicating/Recording Elements
- Measuring Elements
- Marking Requirements
- User Requirements



# Inspection



- Determine compliance with specs & other requirements (design, installation, operation)
- Not limited to visual examination.....may need to verify through test or other determination
- Extent & emphasis of inspection depends on:
  - familiarity with the device
  - age of device
  - whether or not device NTEP approved
  - whether or not complaint was received

# Application



- Electronic Livestock, Meat, and Poultry Evaluation Systems and/or Devices – Tentative Code
- Devices or systems measuring composition or quality constituents for determining value
- Scales integrated into systems making multiple composition measurements and used to determine a value for applications defined by G-A.1.
- H44 & ASTM References: A.1., A.2., A.3. and G-A.1. Commercial Equipment

# General Considerations – Selection

- Design and construction of device ensure accuracy and operation as intended
- Device must be suitable for application
  - Maximum capacity, minimum capacity, value of “d.”
- H44 & ASTM References: G-S.3., G-UR.1.1., G-UR.1.2., UR.1.,

# General – Use and Maintenance

- Equipment operated in manner indicated by construction or instructions on equipment
  - Some features may require instructions/markings
    - Measuring limitations
- Owner required to maintain equipment in proper operating condition

H44 & ASTM References: G-UR.3.1., G-UR.4.1., G-UR.4.2., UR.1., UR.2., UR.3.

# General – Accessibility & Assistance

## ■ Access

- Access to measuring elements, printers, consoles, associated equipment
- Access to apply security seals & check audit trail info
- Access to device with your test equipment
- Access to on site test objects

## ■ Assistance

- Operator for measuring system
  - Avoid liability for damage

H44 & ASTM References: G-UR.2.3., G-UR.4.4.

# General – Installation

- Installed according to manufacturer's instructions
- Performance not affected by installation
  - Not subject to environmental disturbances
- Installed such that markings are readily observable
- Installation rigid and secure
- Device and associated equipment and installation do not facilitate fraud

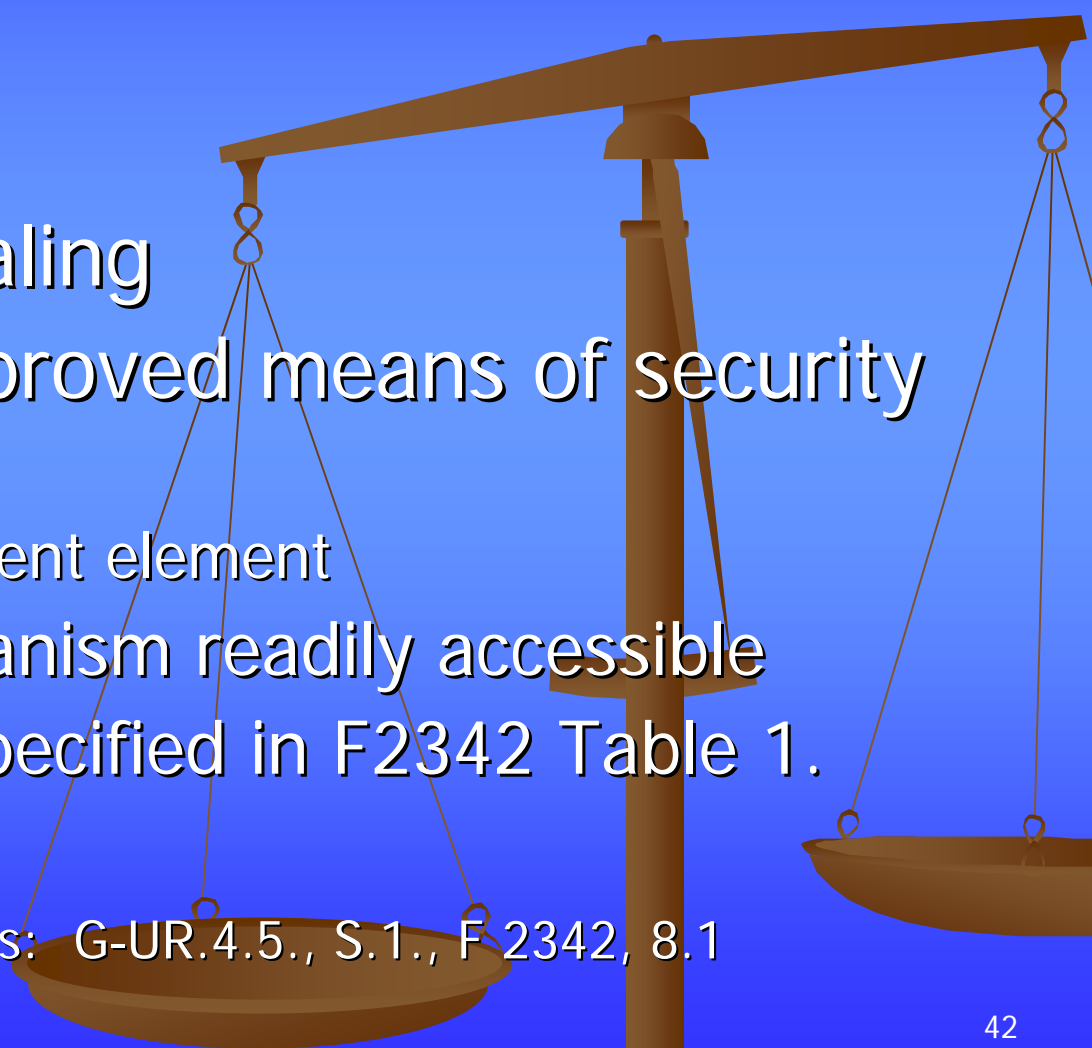
H44 & ASTM References: G-S.2., G-UR.2.1., G-UR.2.2., UR.1.1. S.1., F 2342, 7.2



# Indicating and Recording Elements – Provision for Sealing

- Security Seal (G-UR.4.5.)
  - Security seal must be affixed to adjustment mechanism designed to be sealed
- Provision for Sealing, Electronic (G-S.8., 1/1/90)
  - Requires device to be designed with provision to apply security seal
    - Physical seal or other approved means (e.g., audit trail)
  - Seal protects against metrological changes

# Measuring Elements – Security Seals

- 
- Provision for Sealing
  - Provision for approved means of security on:
    - Any measurement element
    - Adjusting mechanism readily accessible
    - Audit trails as specified in F2342 Table 1.
  - H44 & ASTM References: G-UR.4.5., S.1., F 2342, 8.1

# Indicating and Recording Elements

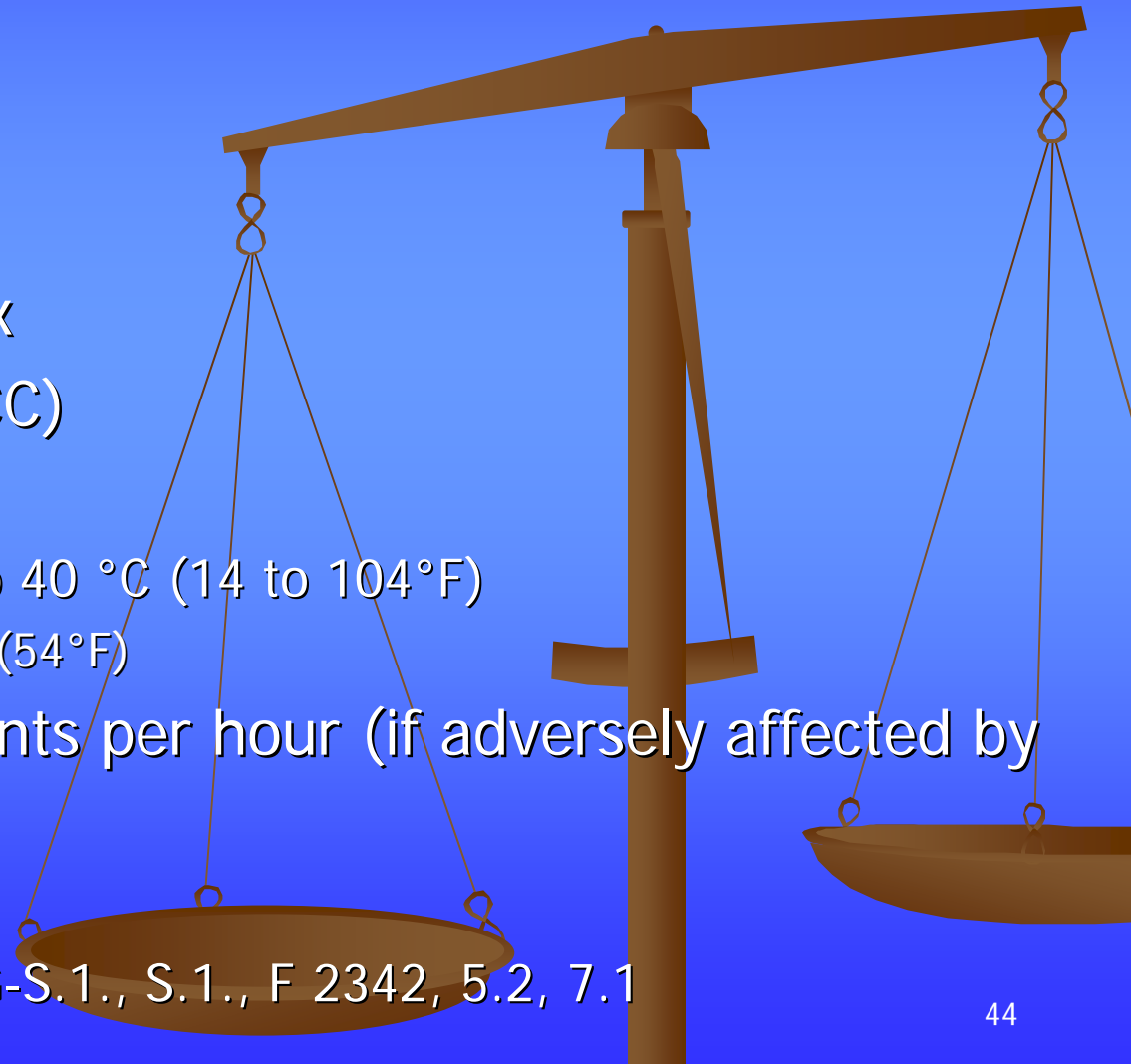
## ■ Design

- Must include indicating and recording elements
  - Minimum character size  $> 4$  mm
  - Recording may be electronic record
    - Must have communication interface for printing on site
- Automatically maintain ready to measure indication
  - Not ready must provide display and record fault condition or inhibit measurement All indications and recorded values – digital
- Value of dimension/volume “d” units –  $\leq 0.05$  inch or 1.0 mm for linear measurements,  $\leq 0.1$  % of capacity for units measuring mass

- H44 & ASTM References: S.1., F 2342, 4.1, 4.2, 4.3, 4.4

# Marking Requirements

- Manufacturer's ID
- Model Designation
- Serial Number & Prefix
- NTEP CC Number (if CC)
- Temperature Limits
  - If narrower than -10 to 40 °C (14 to 104°F)
    - Range at least 30 °C (54°F)
- Maximum measurements per hour (if adversely affected by speed)
- H44 & ASTM References: G-S.1., S.1., F 2342, 5.2, 7.1



# N. Test Procedures

- N.1. Method of test – ASTM F 2343
  - Technology specific
  - Manufacturers provide guidelines
- N. 2. Testing Standards – test with reference standards traceable to national standard – UR.4.
- N.3. Users required to verify and document accuracy each production day
  - N.3.1. Official Tests
    - Encouraged to witness in-house tests
    - May conduct own tests using on-site or other appropriate standards

# Inspection Procedures Example

## Fat-O-Meat'er

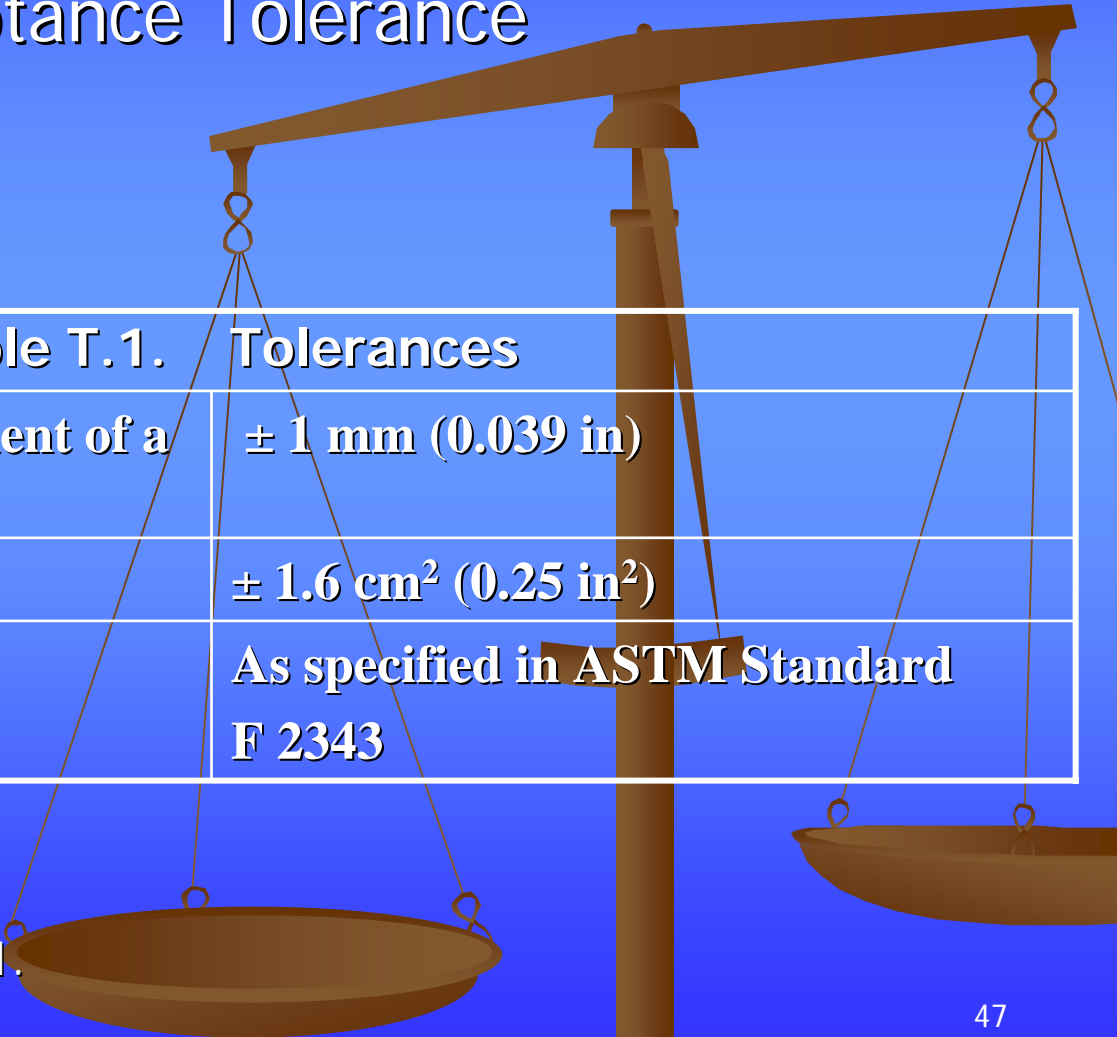
(a complete procedure is in ASTM Standard FF2343-06 <sup>1</sup>).

- Typically the probe of the device is passed through each slot on the test block 10 times.
- The readings on the device are recorded.
- The recorded readings are compared to the calibrated value for the light and dark areas in each slot of the test block.
- Any differences between readings and calibrated values are check for compliance with tolerances.

<sup>1</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org)

# Tolerances

- Maintenance & Acceptance Tolerance
  - Table T.1.



<b>Individual linear measurement of a single constituent</b>	<b><math>\pm 1</math> mm (0.039 in)</b>
<b>Measurement of area</b>	<b><math>\pm 1.6</math> cm<sup>2</sup> (0.25 in<sup>2</sup>)</b>
<b>For measurements of other constituents</b>	<b>As specified in ASTM Standard F 2343</b>

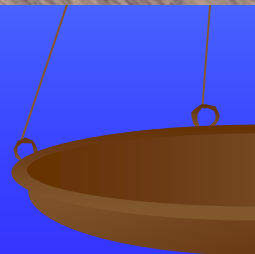
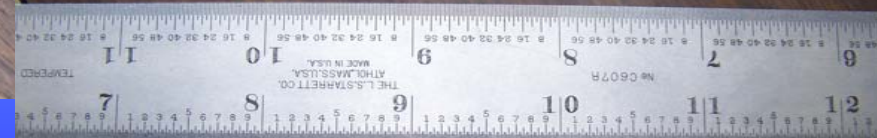
- H44 & ASTM References: T.1.

# Tolerances

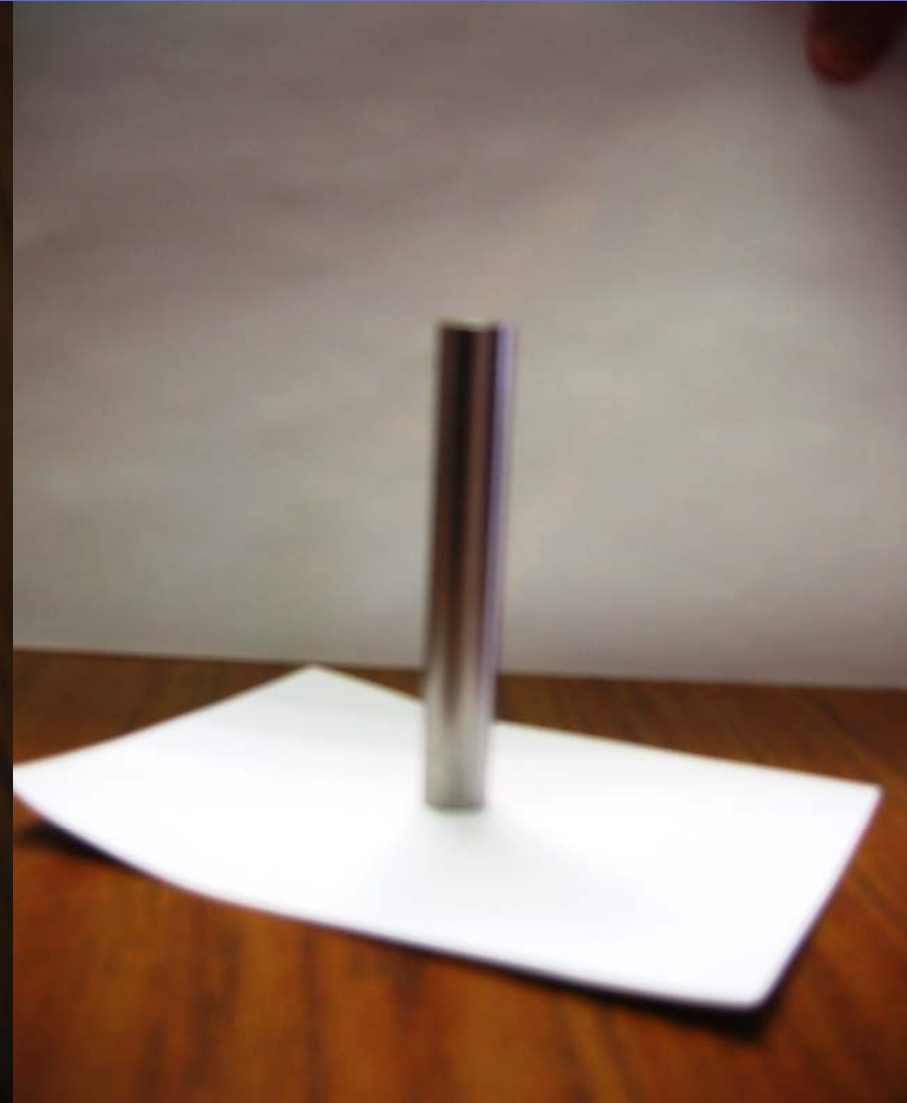
- Disturbances, field evaluation –
  - Difference with & without  $< 1$  division
  - Blank indication
  - Provide error message
  - So unstable that it can't be used as correct reading
- H44 & ASTM References: T.3., T.6.



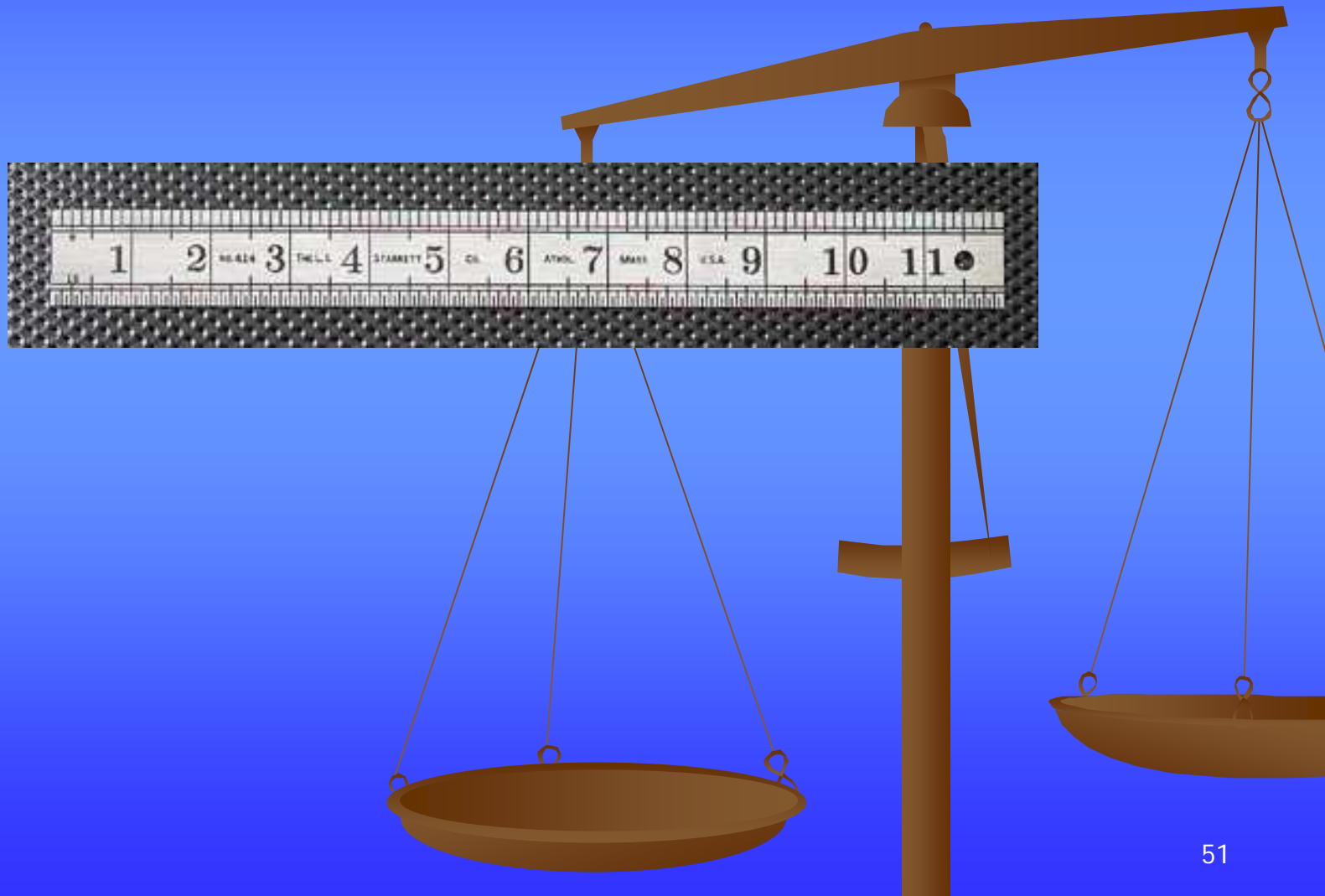
# Testing Standards (Fat-O-Meat'er)



# Testing Standard (Autofom)



# Reference Standards



# Future Test Standard (Vision System)

