Cattle & Carcass TRAINING

Fall 2020 Webinar – Part IV
December 15, 2020

USDA United States Department of Agriculture

Cattle & Carcass TRAINING

Use of Instrument Technology

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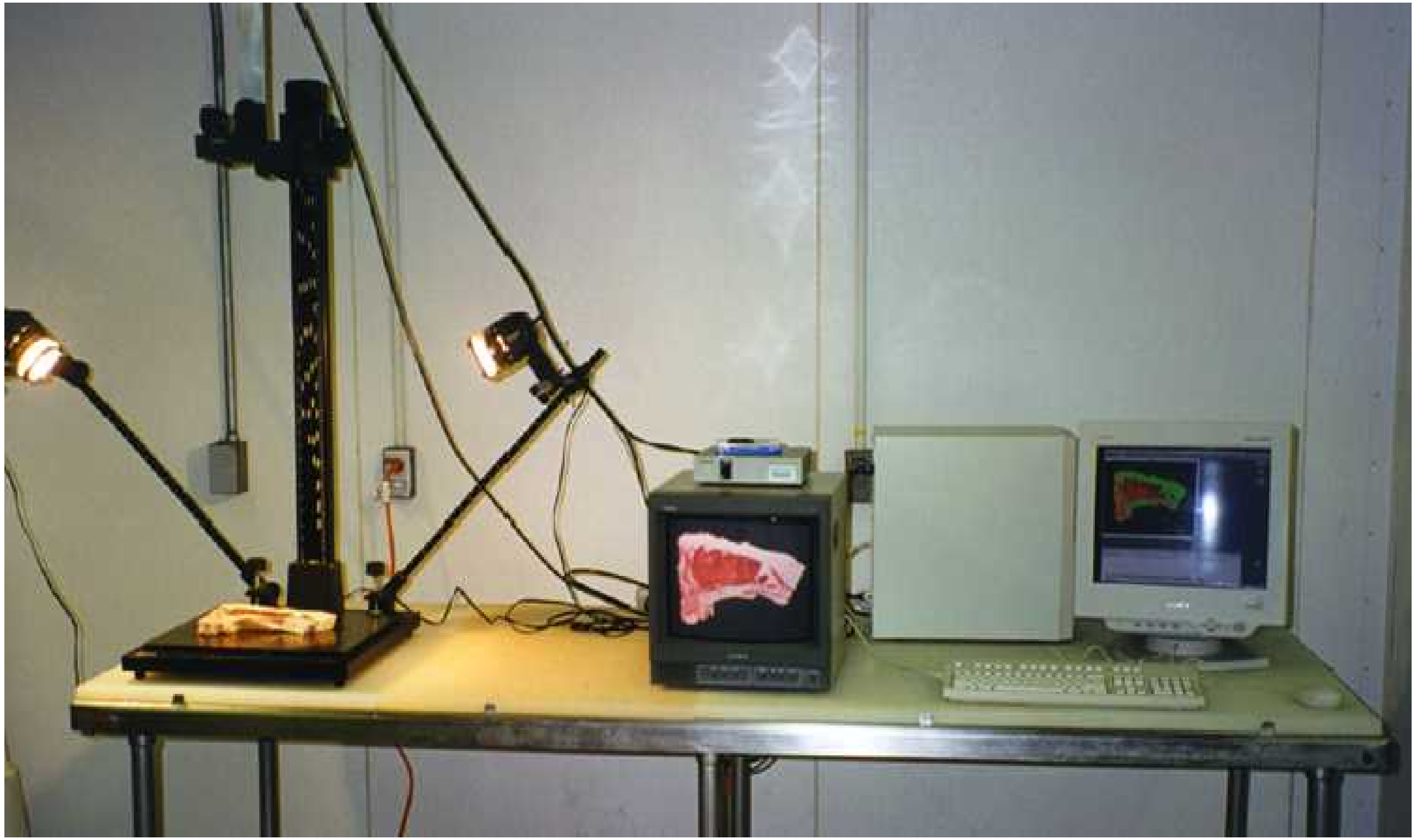
USDA United States Department of Agriculture

Cattle & Carcass TRAINING

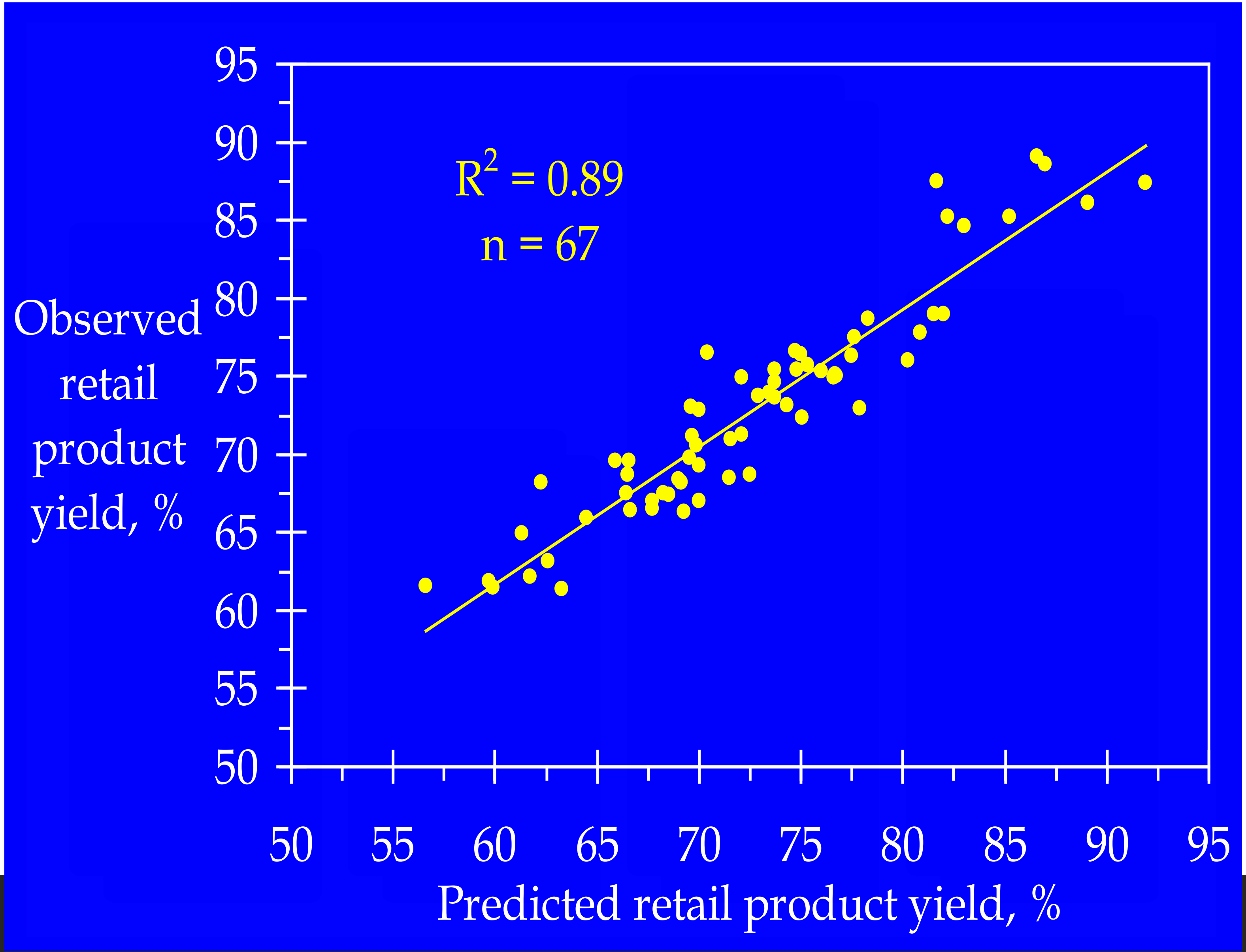
Development of the USMARC beef carcass grading camera

USDA United States Department of Agriculture

Steak Image Analysis



Prediction of cutability using image analysis variables and HCW



Background

- ARS and IBP entered into a Cooperative Research and Development Agreement (CRADA) to adopt this technology for on-line application directly to beef carcasses

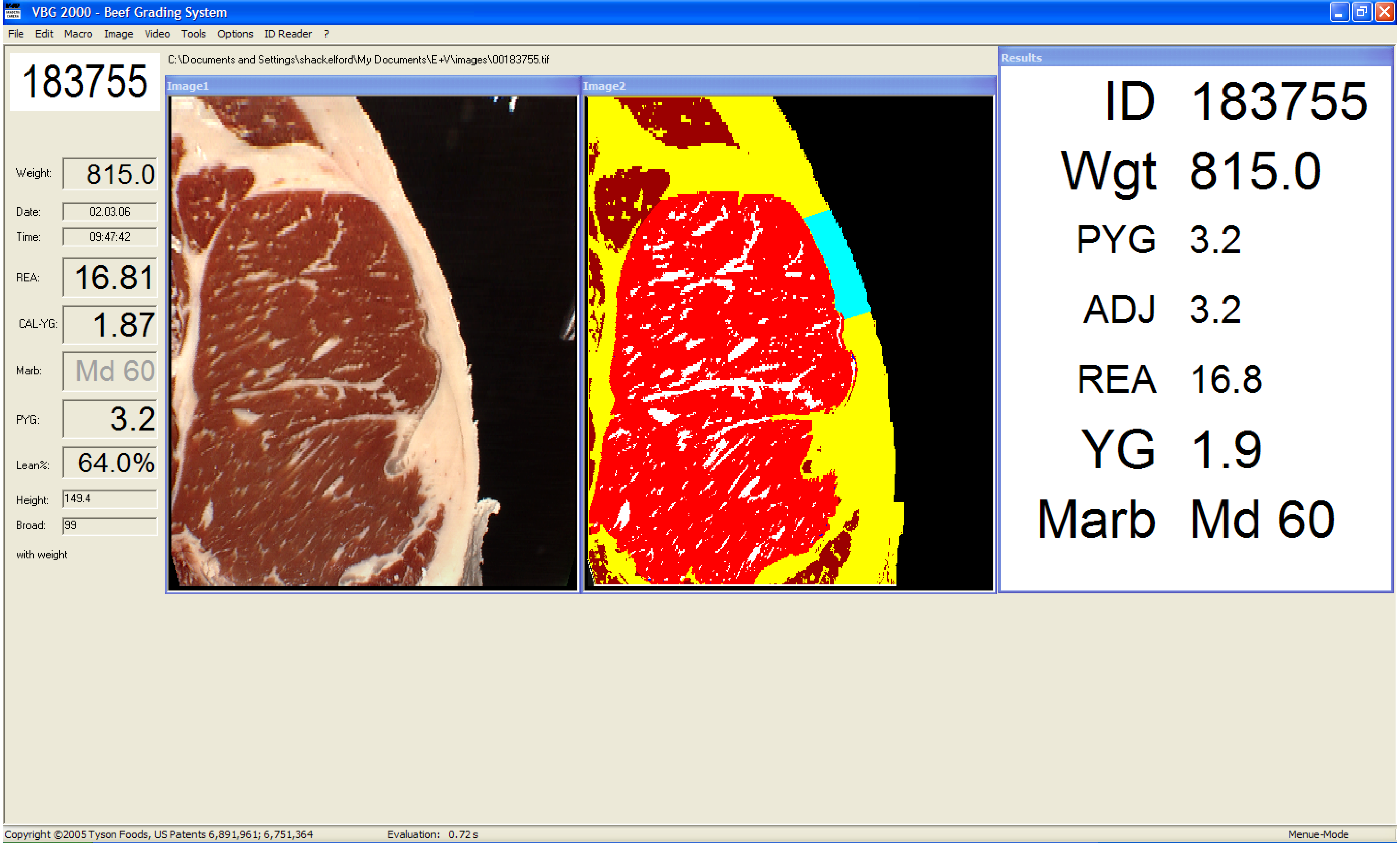
VBG2000

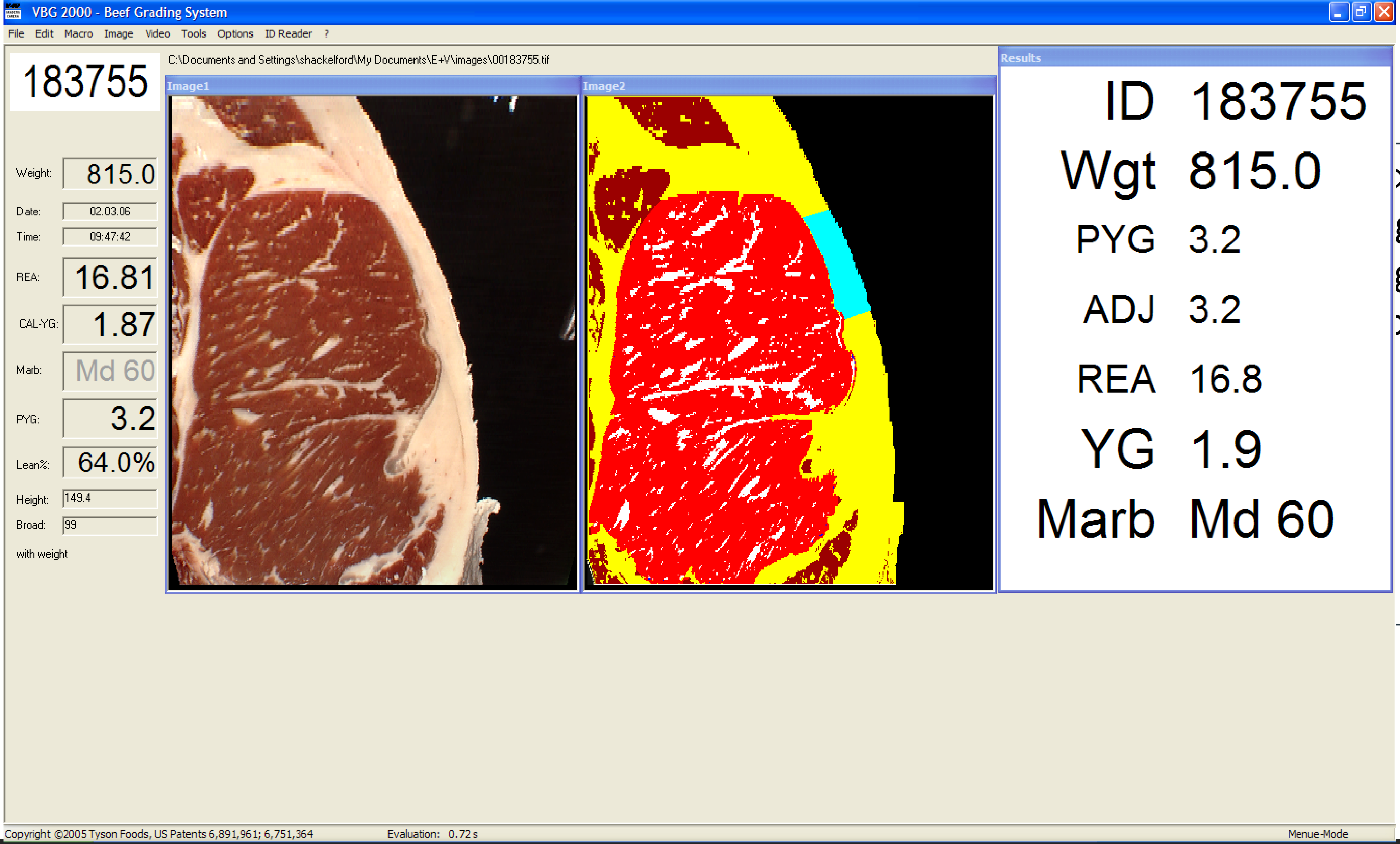
E+V, Germany

Camera Operation

Side-2. In this plant, Side-2 is the left side of the carcass.

Side-1. In this plant, Side-1 is the right side of the carcass.


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
183755
C:\Documents and Settings\shackelford\My Documents\E+V\images\00183755.tif
Image1
Image2
Results
Weight: 815.0
Date: 02.03.06
Time: 09:47:42
REA: 16.81
CAL-YG: 1.87
Marb: Md 60
PYG: 3.2
Lean%: 64.0%
Height: 149.4
Broad: 99
with weight
ID 183755
Wgt 815.0
PYG 3.2
ADJ 3.2
REA 16.8
YG 1.9
Marb Md 60
Copyright ©2005 Tyson Foods, US Patents 6,891,961; 6,751,364
Evaluation: 0.72 s
Menue-Mode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File Edit Macro Image Video Tools Options ID Reader ?
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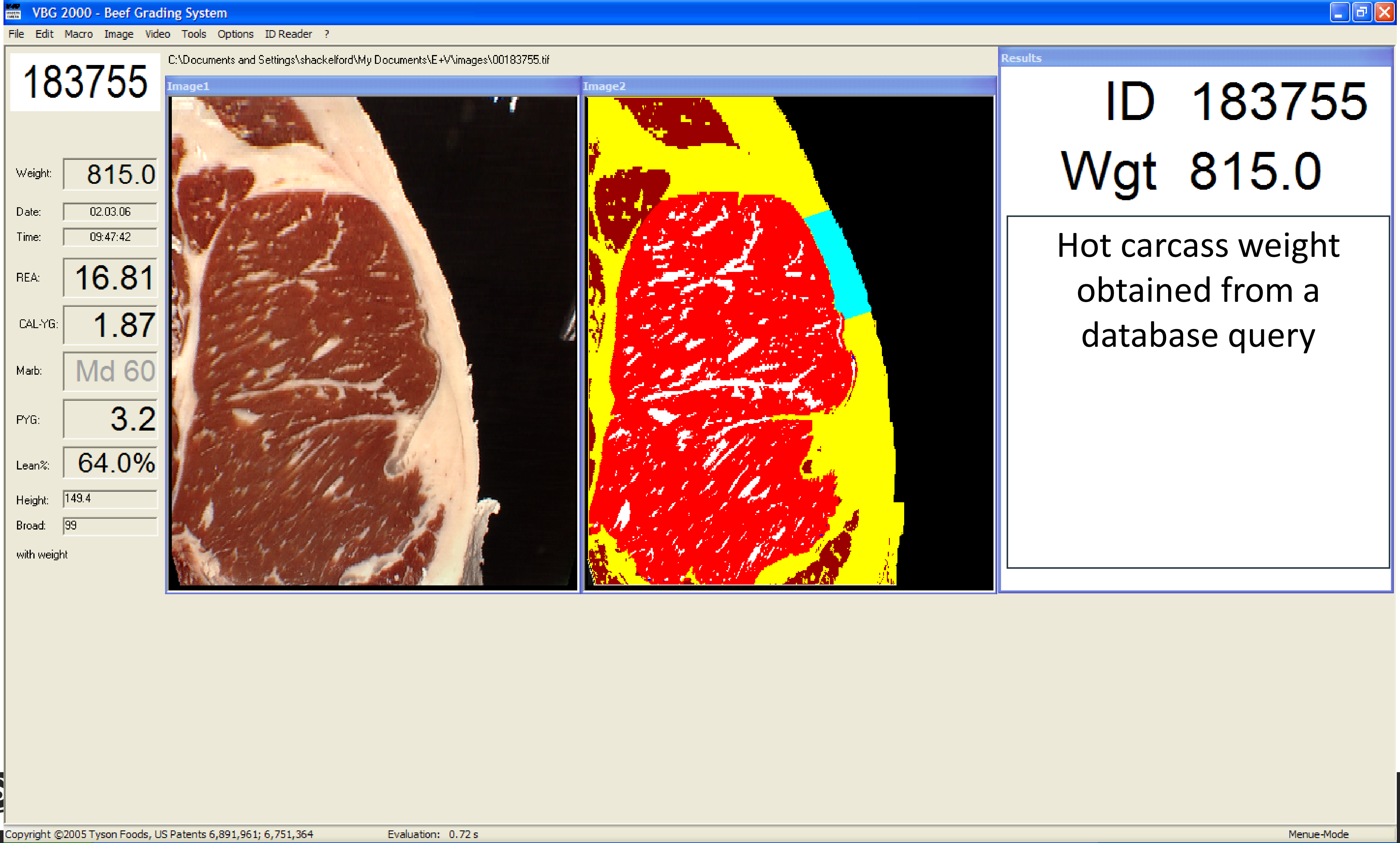
Image1
Image2
Results
Weight: 815.0
Date: 02.03.06
Time: 09:47:42
REA: 16.81
CAL-YG: 1.87
Marb: Md 60
PYG: 3.2
Lean%: 64.0%
Height: 149.4
Broad: 99
with weight
ID 183755
Wgt 815.0
PYG 3.2
ADJ 3.2
REA 16.8
YG 1.9
Marb Md 60
Copyright ©2005 Tyson Foods, US Patents 6,891,961; 6,751,364
Evaluation: 0.72 s
Menue-Mode



VBG 2000 - Beef Grading System
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Image1
Image2
Results
Weight: 815.0
Date: 02.03.06
Time: 09:47:42
REA: 16.81
CAL-YG: 1.87
Marb: Md 60
PYG: 3.2
Lean%: 64.0%
Height: 149.4
Broad: 99
with weight
ID 183755
Wgt 815.0
Hot carcass weight obtained from a database query
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Evaluation: 0.72 s
Menue-Mode

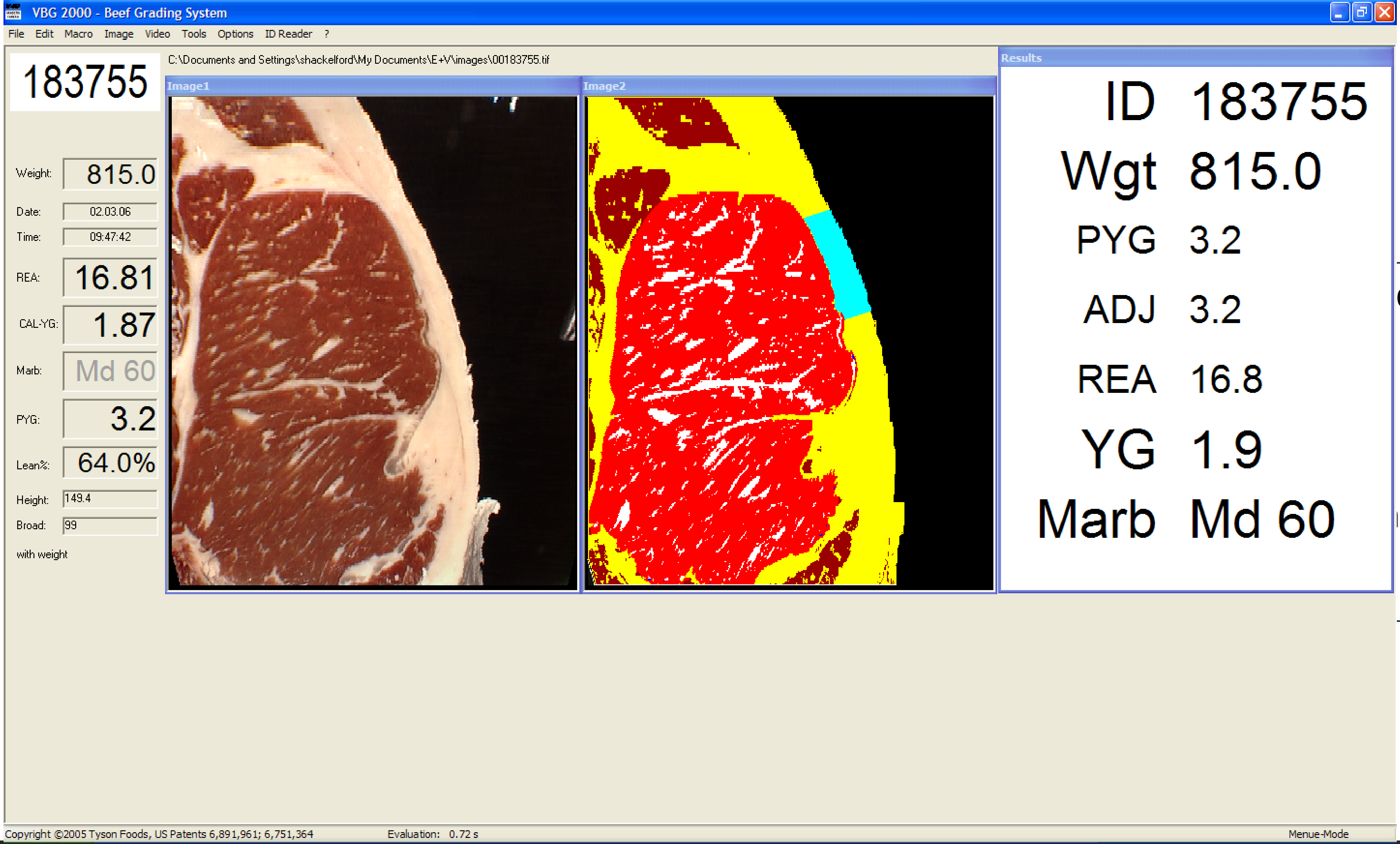
VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
183755
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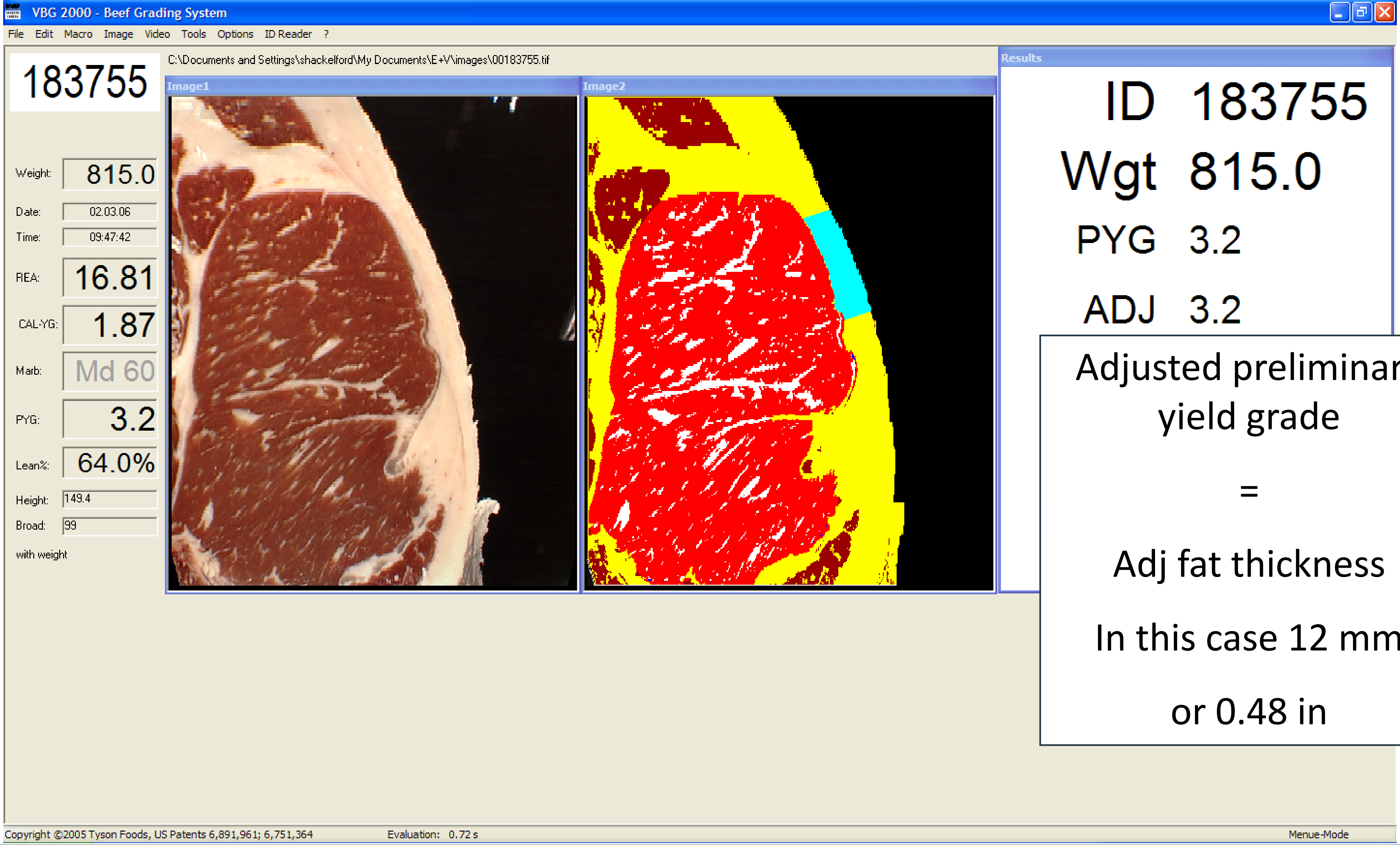
Image1
Image2
Results
Weight: 815.0
Date: 02.03.06
Time: 09:47:42
REA: 16.81
CAL-YG: 1.87
Marb: Md 60
PYG: 3.2
Lean%: 64.0%
Height: 149.4
Broad: 99
with weight
ID 183755
Wgt 815.0
PYG 3.2
ADJ 3.2
REA 16.8
YG 1.9
Marb Md 60
Copyright ©2005 Tyson Foods, US Patents 6,891,961; 6,751,364
Evaluation: 0.72 s
Menue-Mode

de



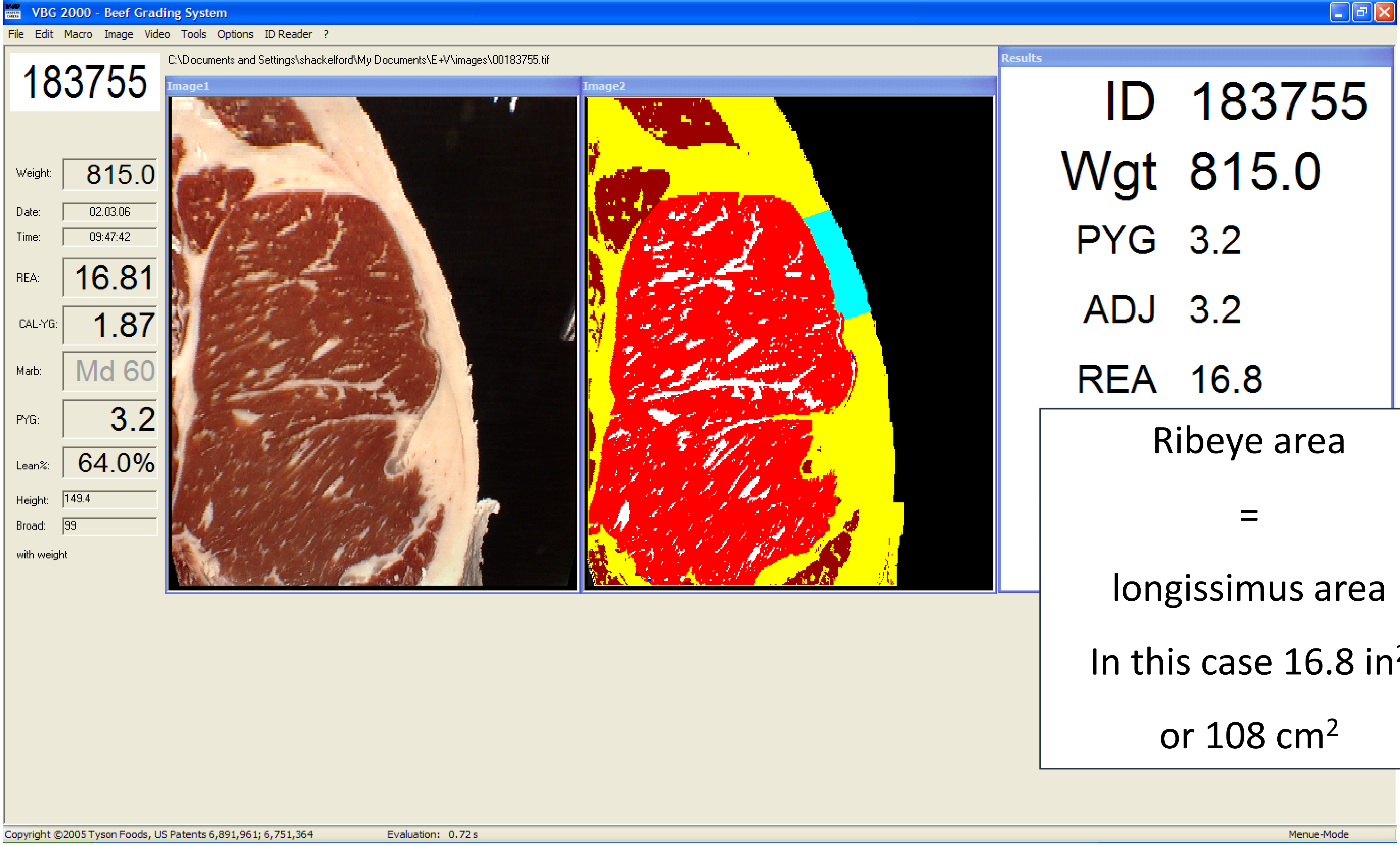
Adjusted preliminary yield grade

=

Adj fat thickness

In this case 12 mm

or 0.48 in



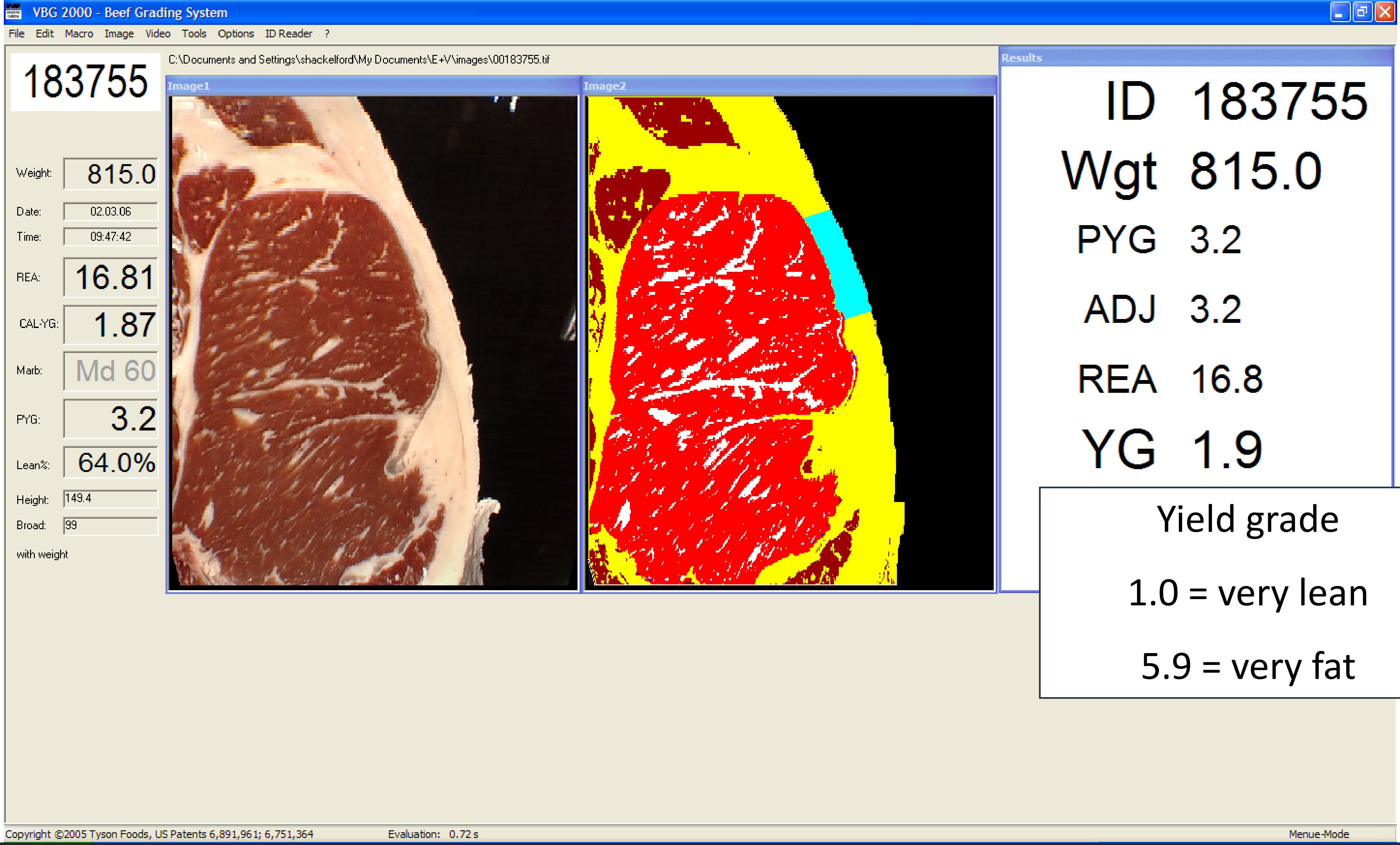
Ribeye area

=

longissimus area

In this case 16.8 in^2

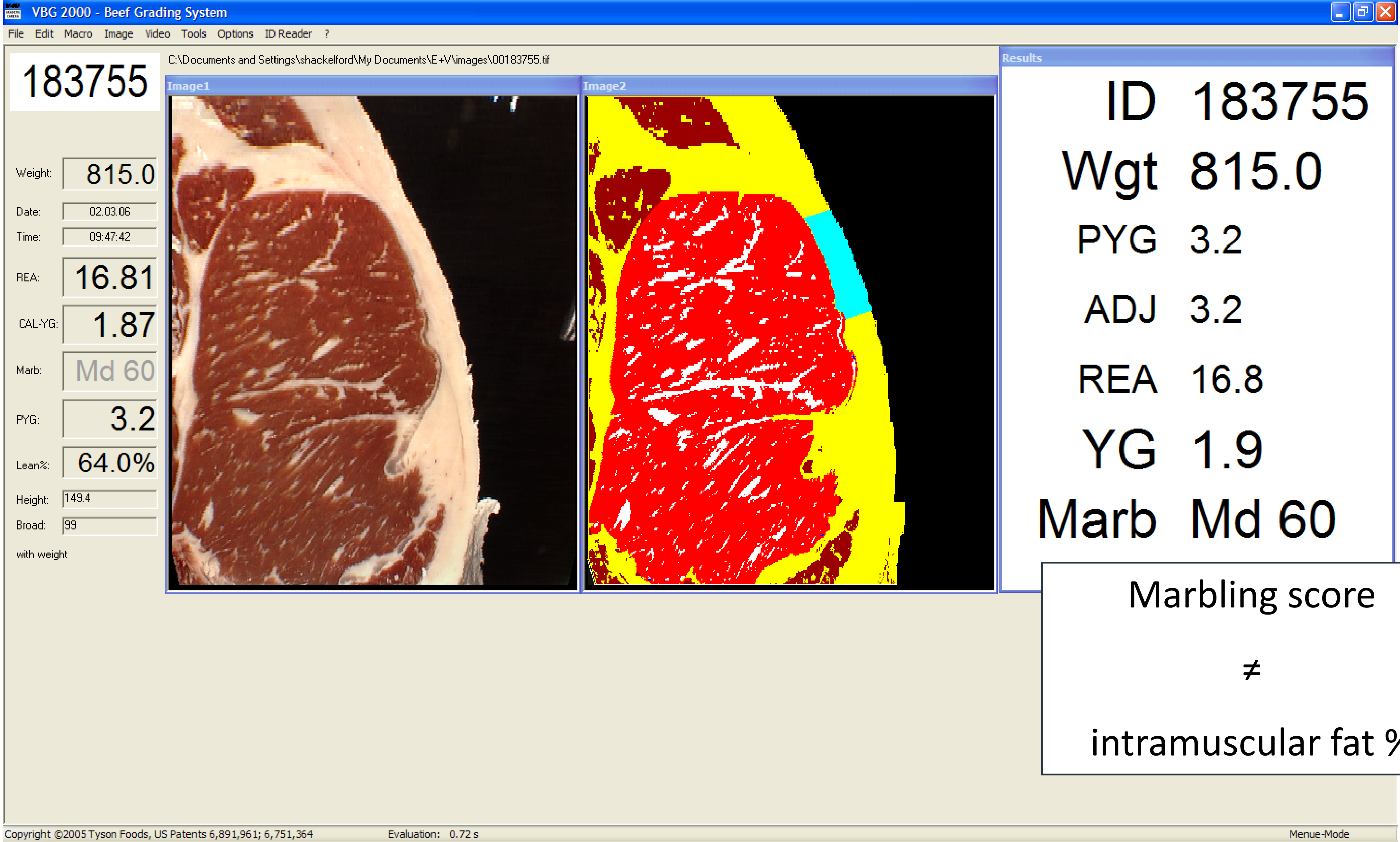
or 108 cm^2



Yield grade

1.0 = very lean

5.9 = very fat

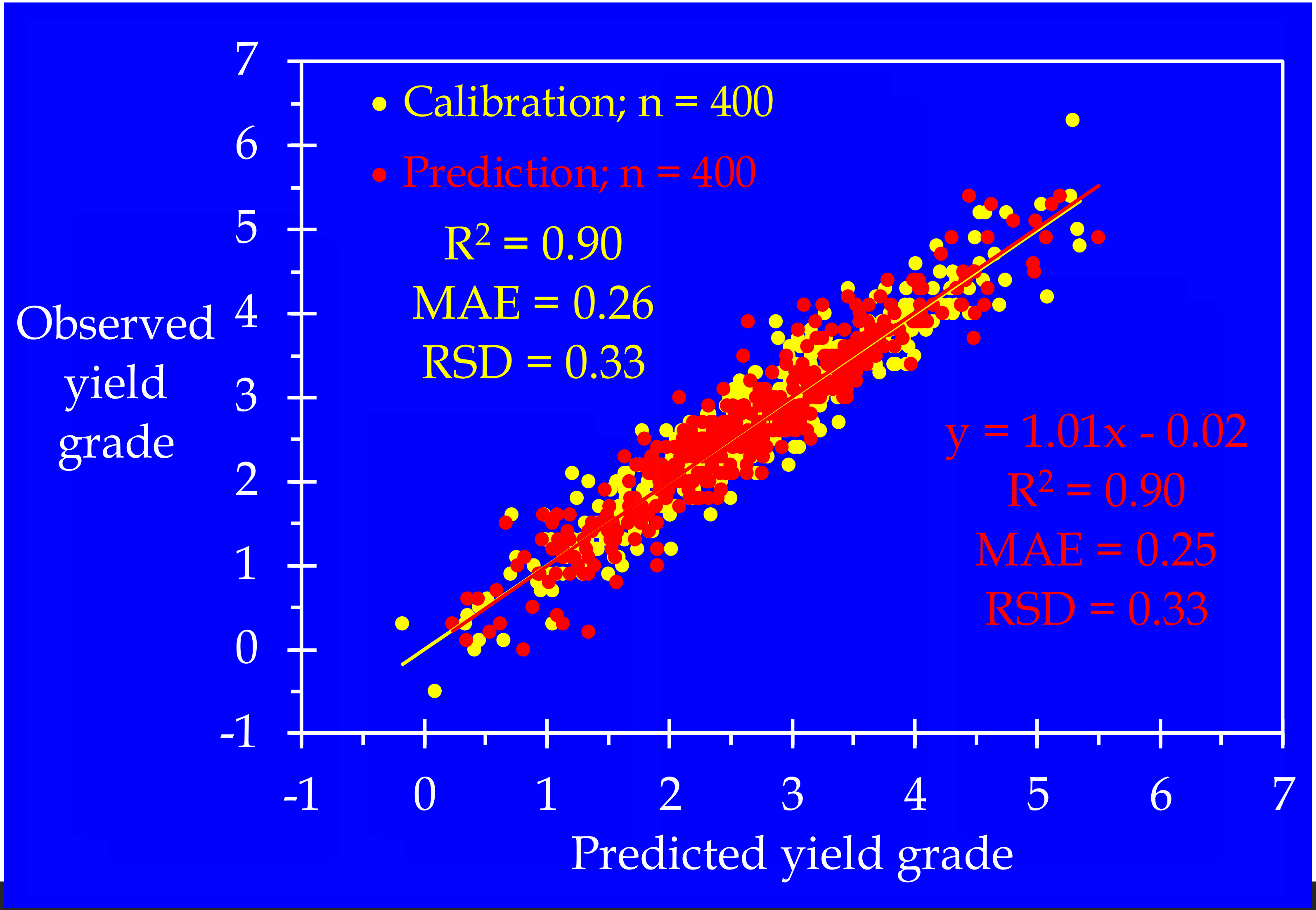


Marbling score

≠

intramuscular fat %

Prediction of yield grade using image analysis variables and HCW



Able to sort carcasses based on yield grade…

- The next 10 slides show variation in yield grade for images selected from 1,100 carcasses
- All 10 carcasses are from a narrow carcass weight range
  - 800 to 850 pounds
  - 363 to 386 kg

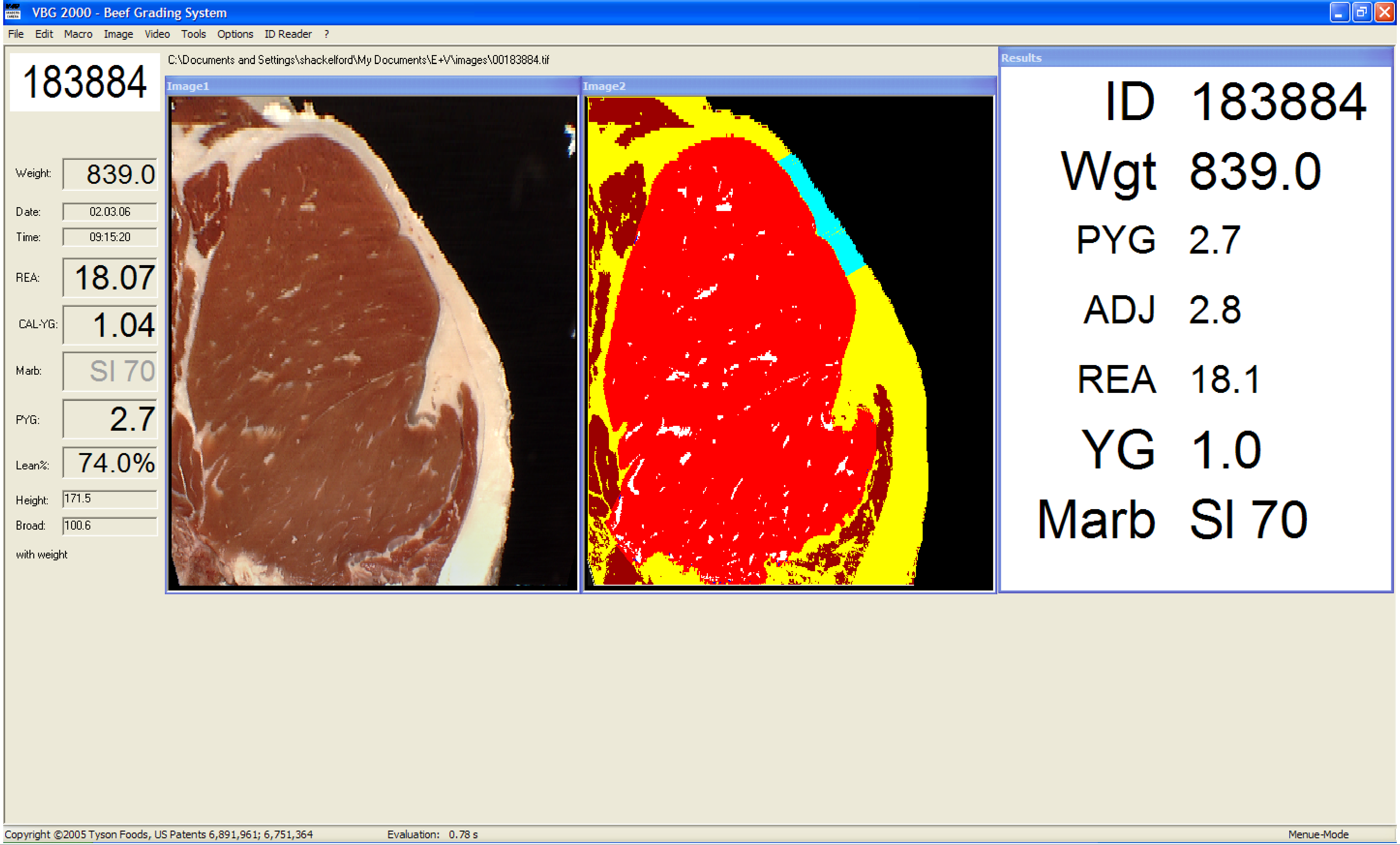

VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
183884
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Image1
Image2
Results
Weight: 839.0
Date: 02.03.06
Time: 09:15:20
REA: 18.07
CAL-YG: 1.04
Marb: Sl 70
PYG: 2.7
Lean%: 74.0%
Height: 171.5
Broad: 100.6
with weight
ID 183884
Wgt 839.0
PYG 2.7
ADJ 2.8
REA 18.1
YG 1.0
Marb Sl 70
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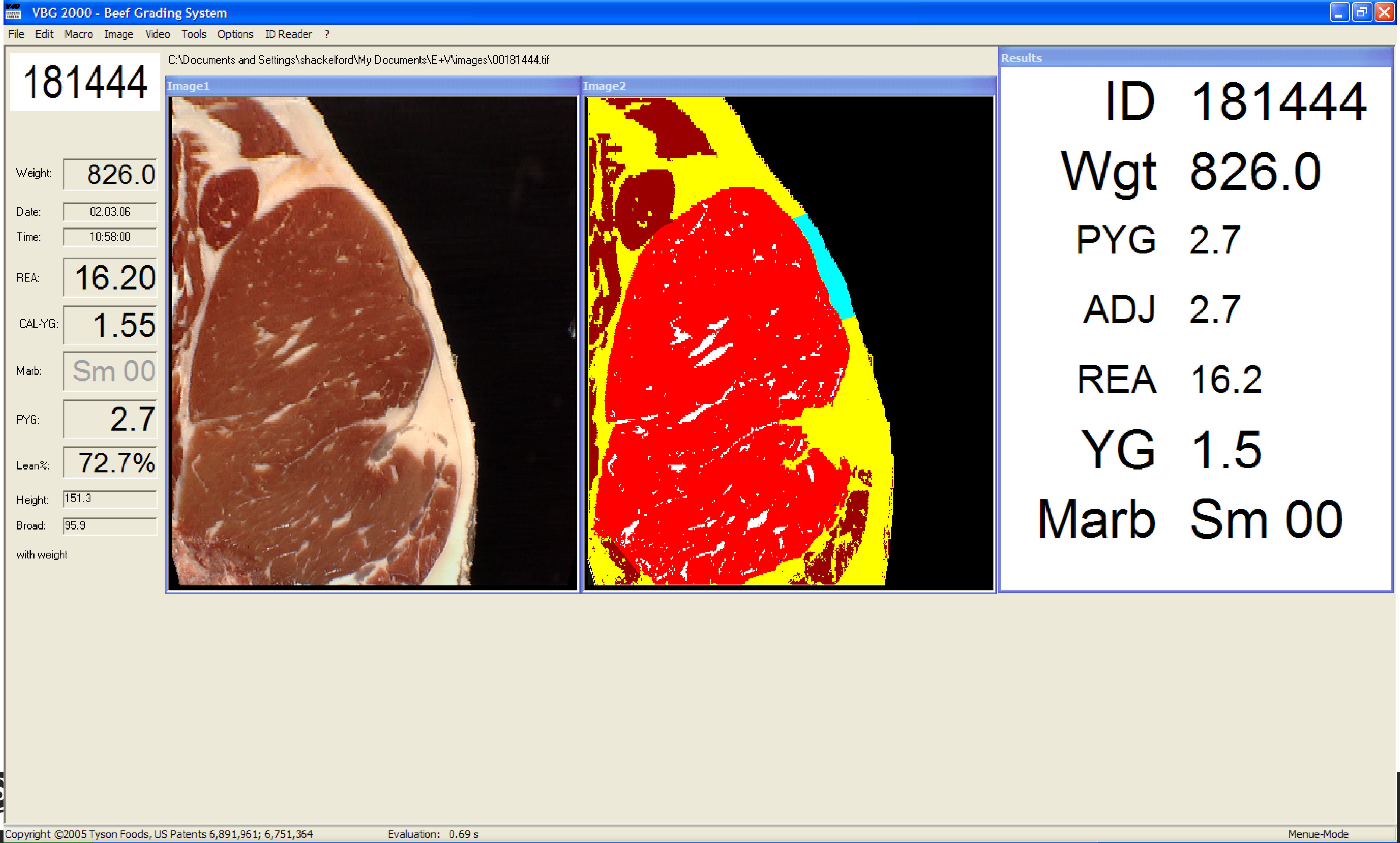
Evaluation: 0.78 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
181444
C:\Documents and Settings\shackelford\My Documents\E+V\images\00181444.tif
Image1
Image2
Results
Weight: 826.0
Date: 02.03.06
Time: 10:58:00
REA: 16.20
CAL-YG: 1.55
Marb: Sm 00
PYG: 2.7
Lean%: 72.7%
Height: 151.3
Broad: 95.9
with weight
ID 181444
Wgt 826.0
PYG 2.7
ADJ 2.7
REA 16.2
YG 1.5
Marb Sm 00
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Evaluation: 0.69 s
Menue-Mode

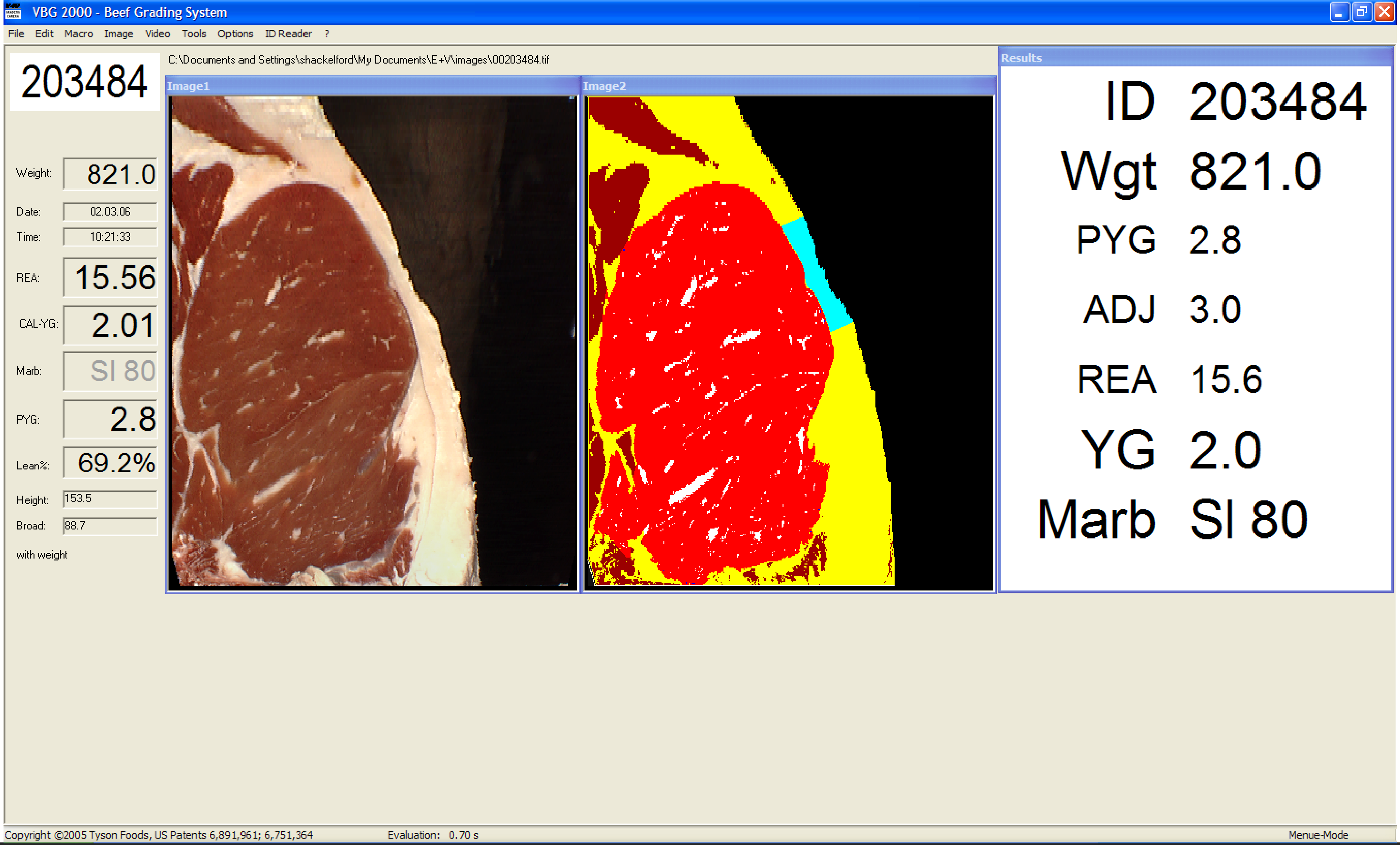
VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
203484
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Image1
Image2
Results
Weight: 821.0
Date: 02.03.06
Time: 10:21:33
REA: 15.56
CAL-YG: 2.01
Marb: Sl 80
PYG: 2.8
Lean%: 69.2%
Height: 153.5
Broad: 88.7
with weight
ID 203484
Wgt 821.0
PYG 2.8
ADJ 3.0
REA 15.6
YG 2.0
Marb Sl 80
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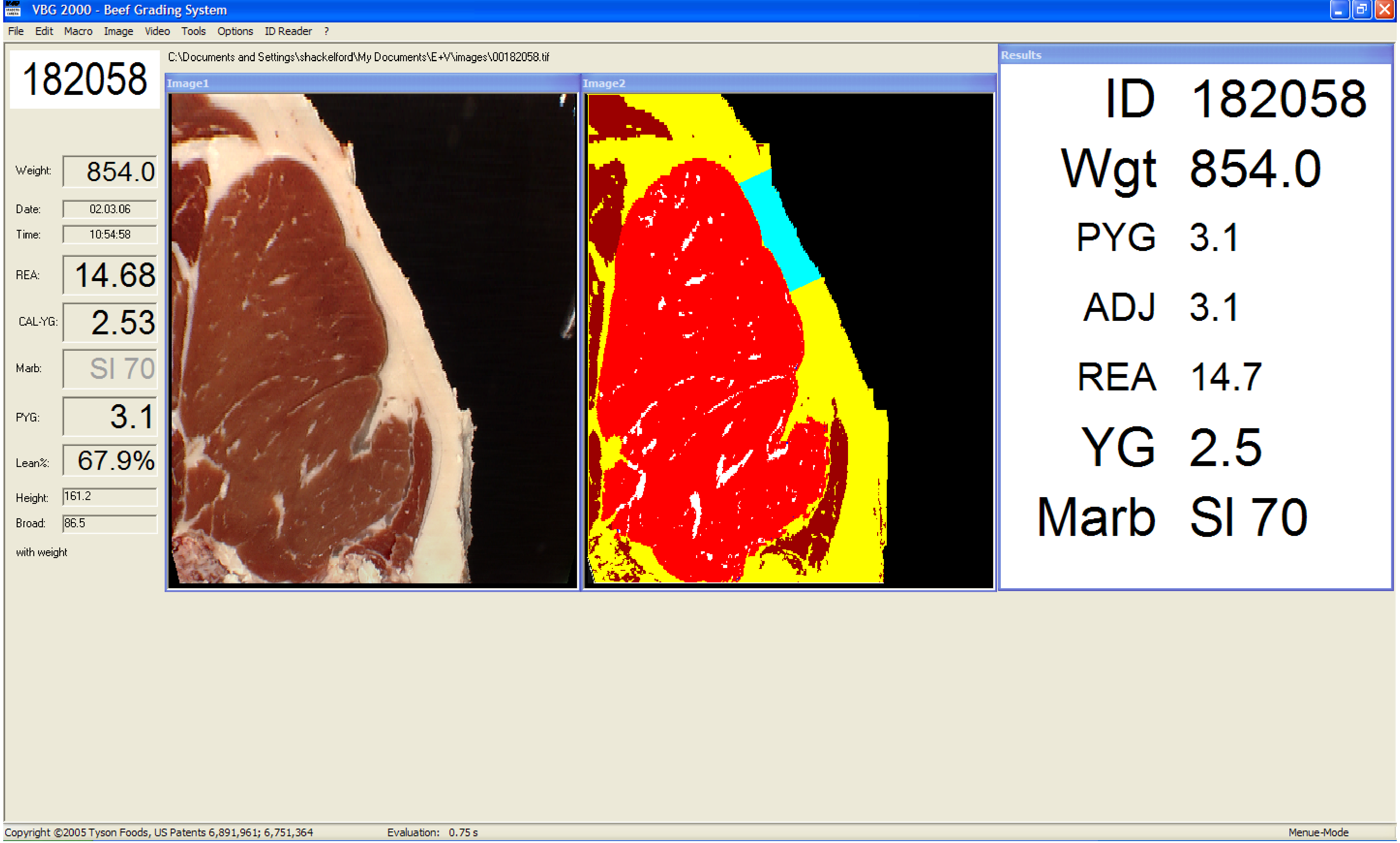
Evaluation: 0.70 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
182058
C:\Documents and Settings\shackelford\My Documents\E+V\images\00182058.tif
Image1
Image2
Results
Weight: 854.0
Date: 02.03.06
Time: 10:54:58
REA: 14.68
CAL-YG: 2.53
Marb: Sl 70
PYG: 3.1
Lean%: 67.9%
Height: 161.2
Broad: 86.5
with weight
ID 182058
Wgt 854.0
PYG 3.1
ADJ 3.1
REA 14.7
YG 2.5
Marb Sl 70
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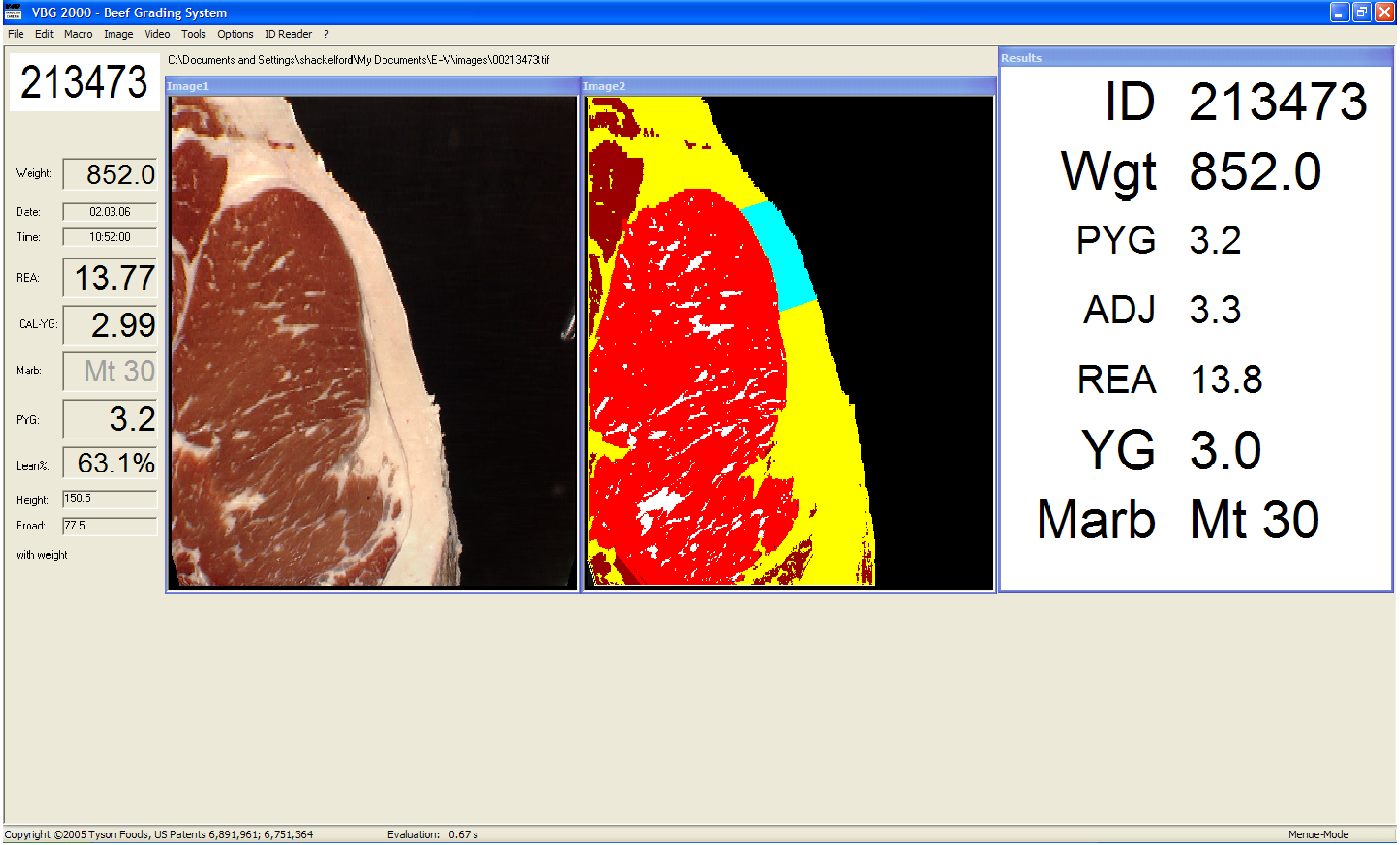
Evaluation: 0.75 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
213473
C:\Documents and Settings\shackelford\My Documents\E+V\images\00213473.tif
Image1
Image2
Results
Weight: 852.0
Date: 02.03.06
Time: 10:52:00
REA: 13.77
CAL-YG: 2.99
Marb: Mt 30
PYG: 3.2
Lean%: 63.1%
Height: 150.5
Broad: 77.5
with weight
ID 213473
Wgt 852.0
PYG 3.2
ADJ 3.3
REA 13.8
YG 3.0
Marb Mt 30
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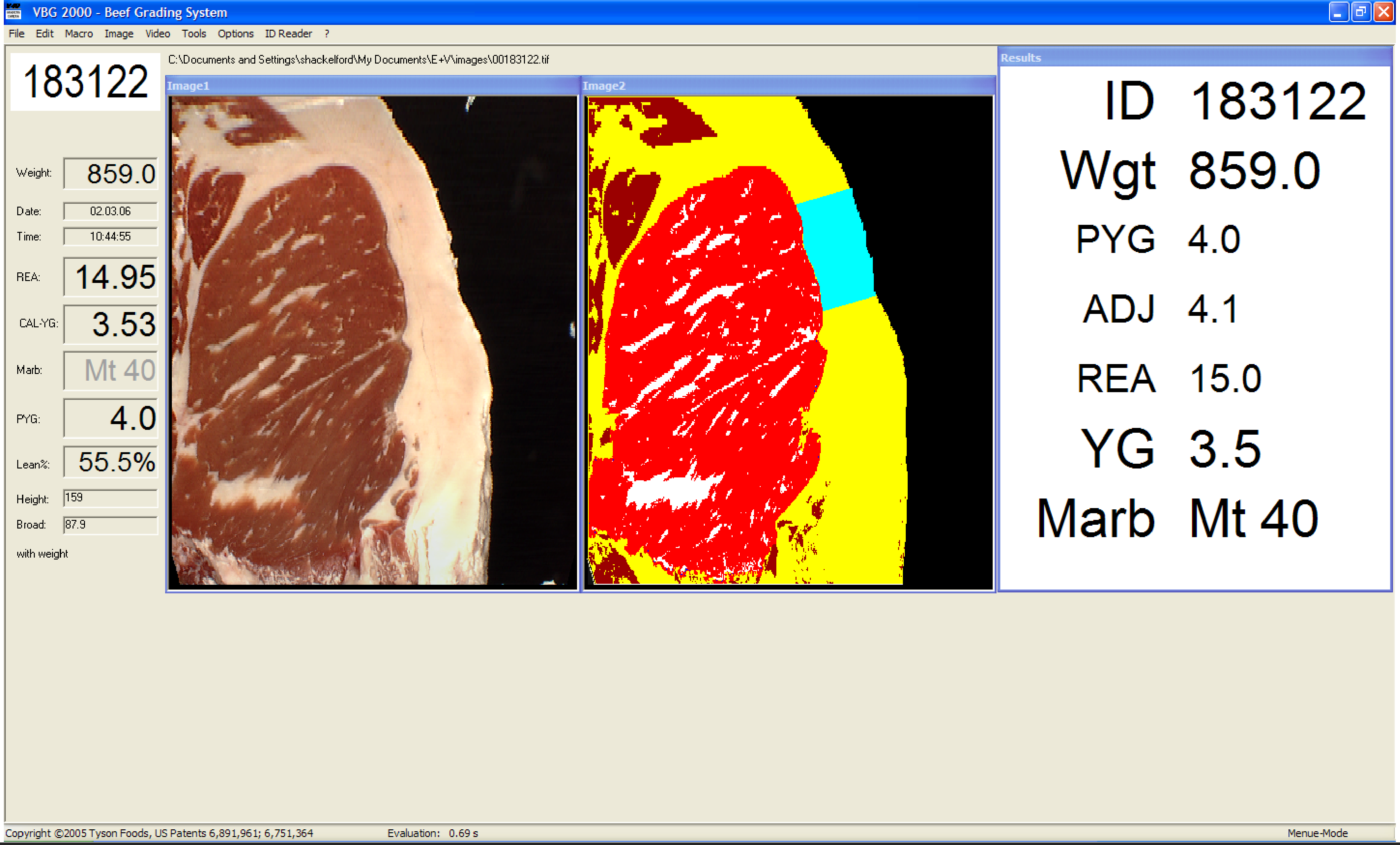
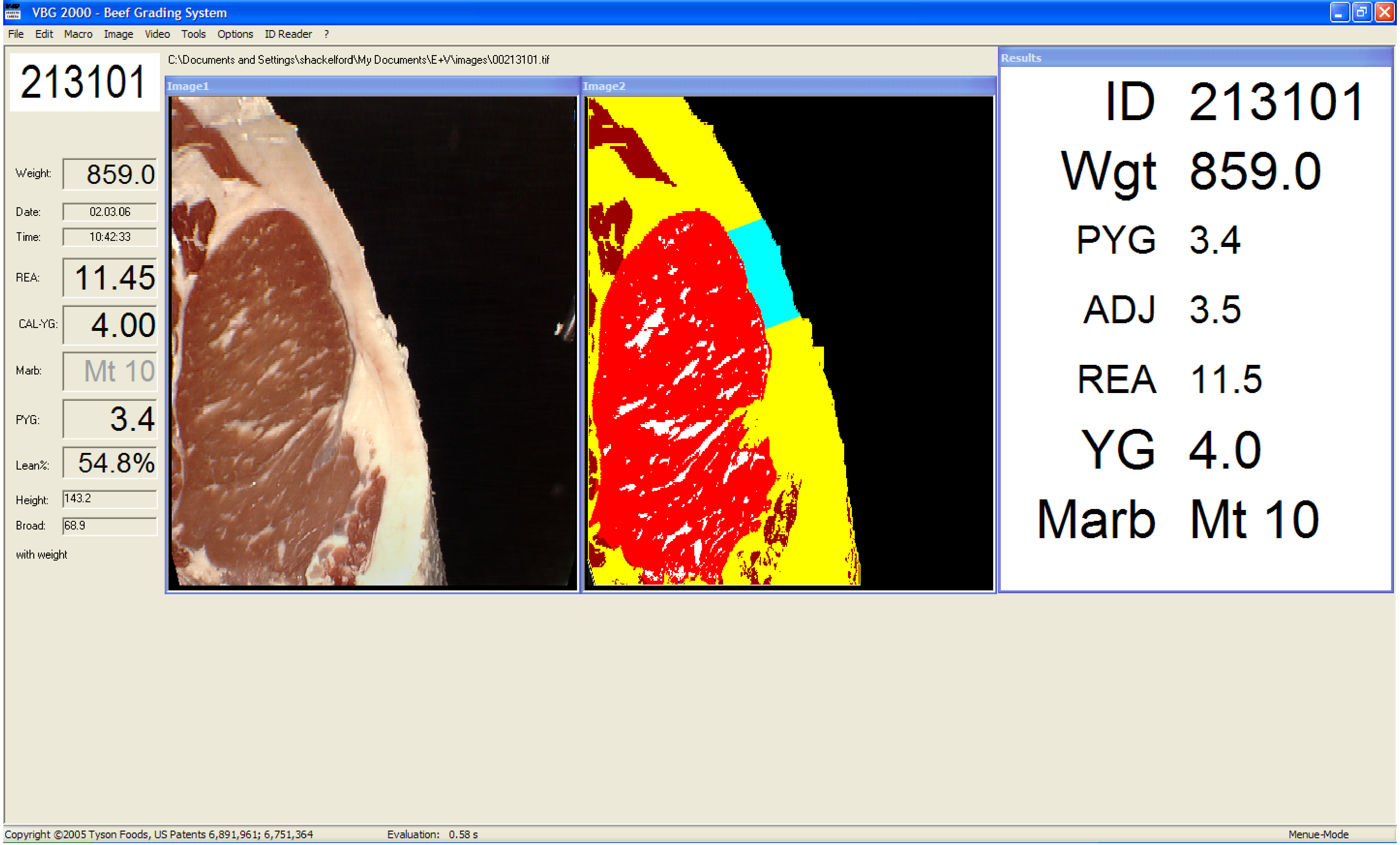
Evaluation: 0.67 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
183122
C:\Documents and Settings\shackelford\My Documents\E+V\images\00183122.tif
Image1
Image2
Results
Weight: 859.0
Date: 02.03.06
Time: 10:44:55
REA: 14.95
CAL-YG: 3.53
Marb: Mt 40
PYG: 4.0
Lean%: 55.5%
Height: 159
Broad: 87.9
with weight
ID 183122
Wgt 859.0
PYG 4.0
ADJ 4.1
REA 15.0
YG 3.5
Marb Mt 40
Copyright ©2005 Tyson Foods, US Patents 6,891,961; 6,751,364
Evaluation: 0.69 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
213101
C:\Documents and Settings\shackelford\My Documents\E+V\images\00213101.tif
Image1
Image2
Results
Weight: 859.0
Date: 02.03.06
Time: 10:42:33
REA: 11.45
CAL-YG: 4.00
Marb: Mt 10
PYG: 3.4
Lean%: 54.8%
Height: 143.2
Broad: 68.9
with weight
ID 213101
Wgt 859.0
PYG 3.4
ADJ 3.5
REA 11.5
YG 4.0
Marb Mt 10
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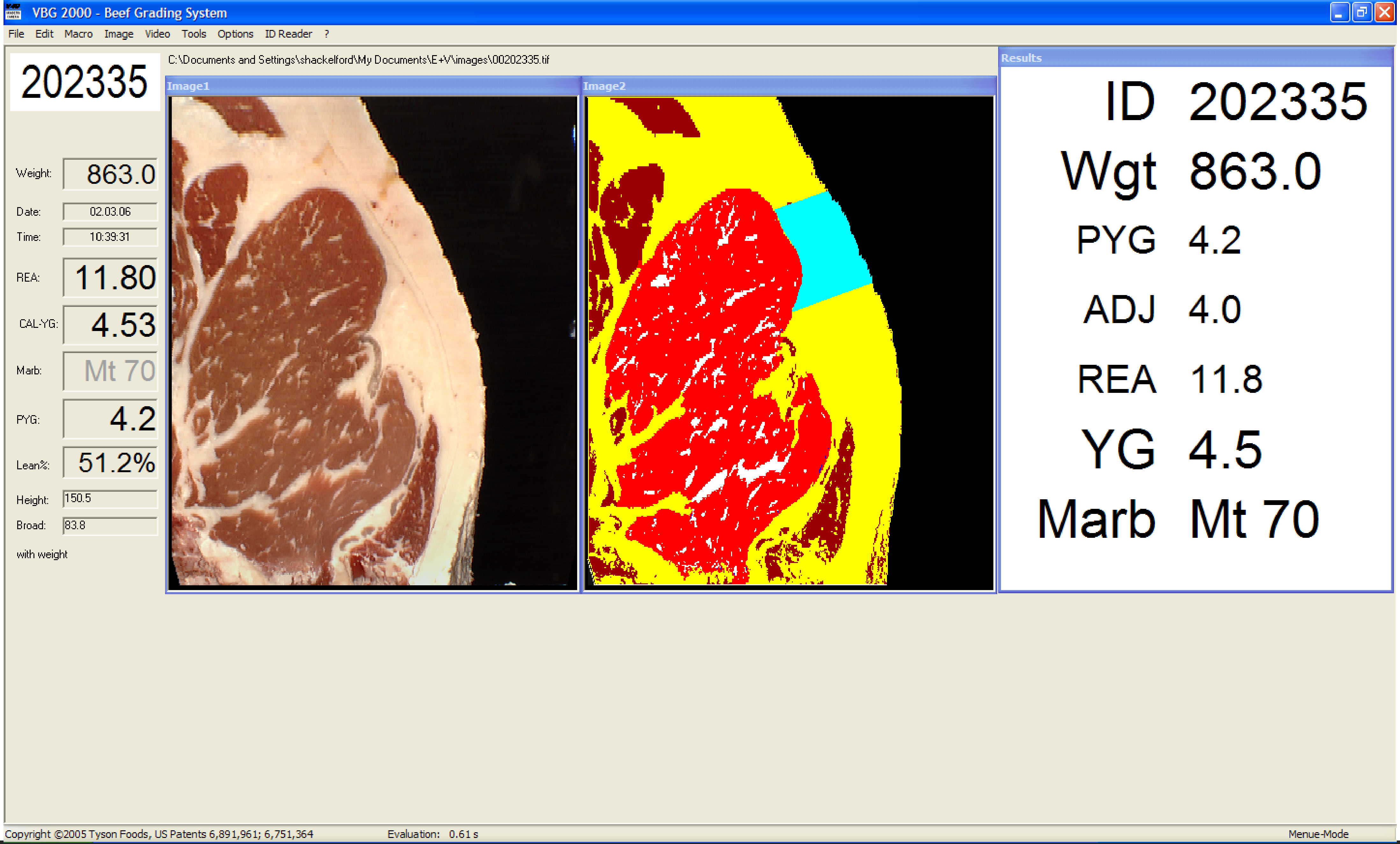
Evaluation: 0.58 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
202335
C:\Documents and Settings\shackelford\My Documents\E+V\images\00202335.tif
Image1
Image2
Results
Weight: 863.0
Date: 02.03.06
Time: 10:39:31
REA: 11.80
CAL-YG: 4.53
Marb: Mt 70
PYG: 4.2
Lean%: 51.2%
Height: 150.5
Broad: 83.8
with weight
ID 202335
Wgt 863.0
PYG 4.2
ADJ 4.0
REA 11.8
YG 4.5
Marb Mt 70
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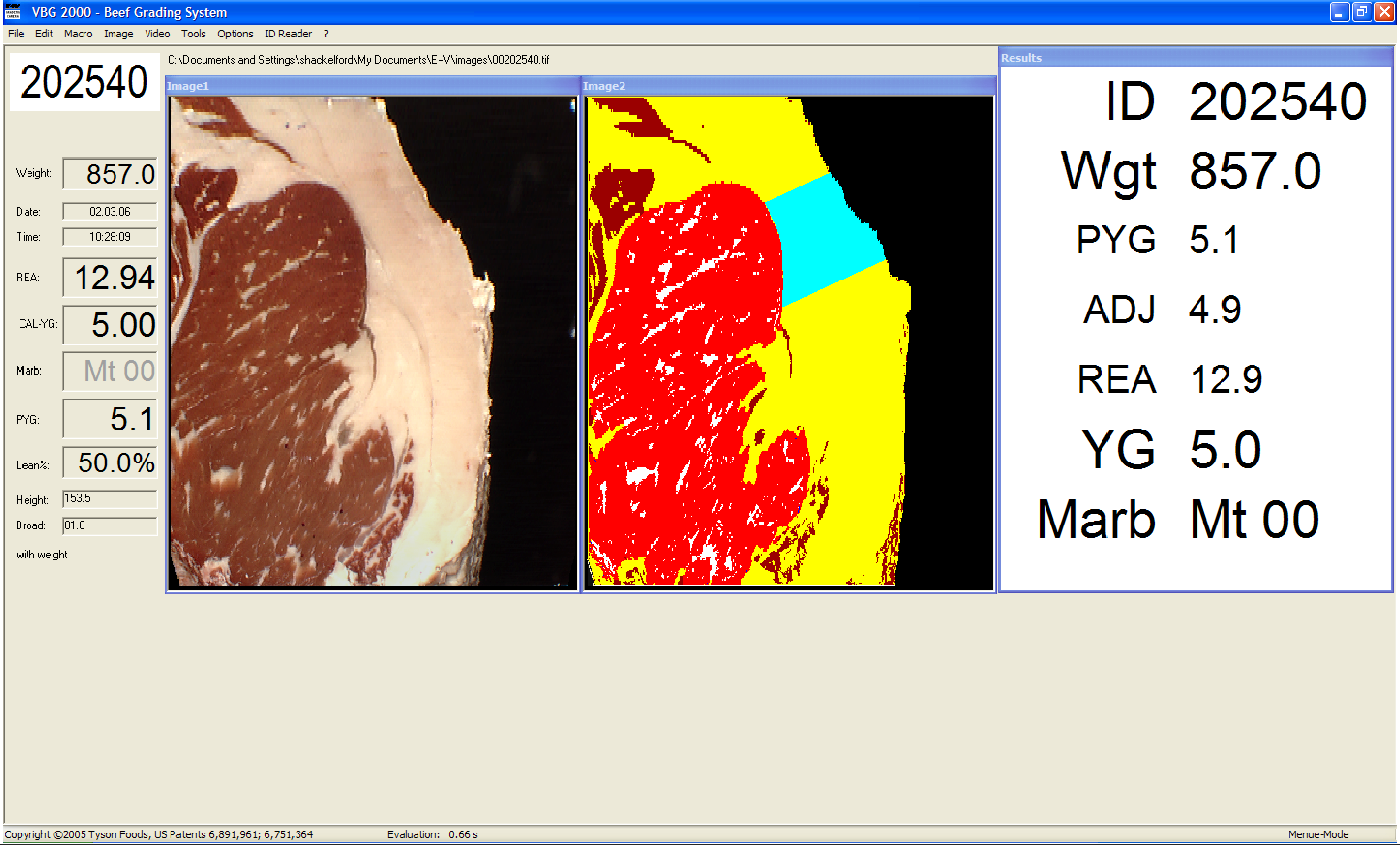
Evaluation: 0.61 s
Menue-Mode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File Edit Macro Image Video Tools Options ID Reader ?
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Image1
Image2
Results
Weight: 857.0
Date: 02.03.06
Time: 10:28:09
REA: 12.94
CAL-YG: 5.00
Marb: Mt 00
PYG: 5.1
Lean%: 50.0%
Height: 153.5
Broad: 81.8
with weight
ID 202540
Wgt 857.0
PYG 5.1
ADJ 4.9
REA 12.9
YG 5.0
Marb Mt 00
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Evaluation: 0.66 s
Menue-Mode

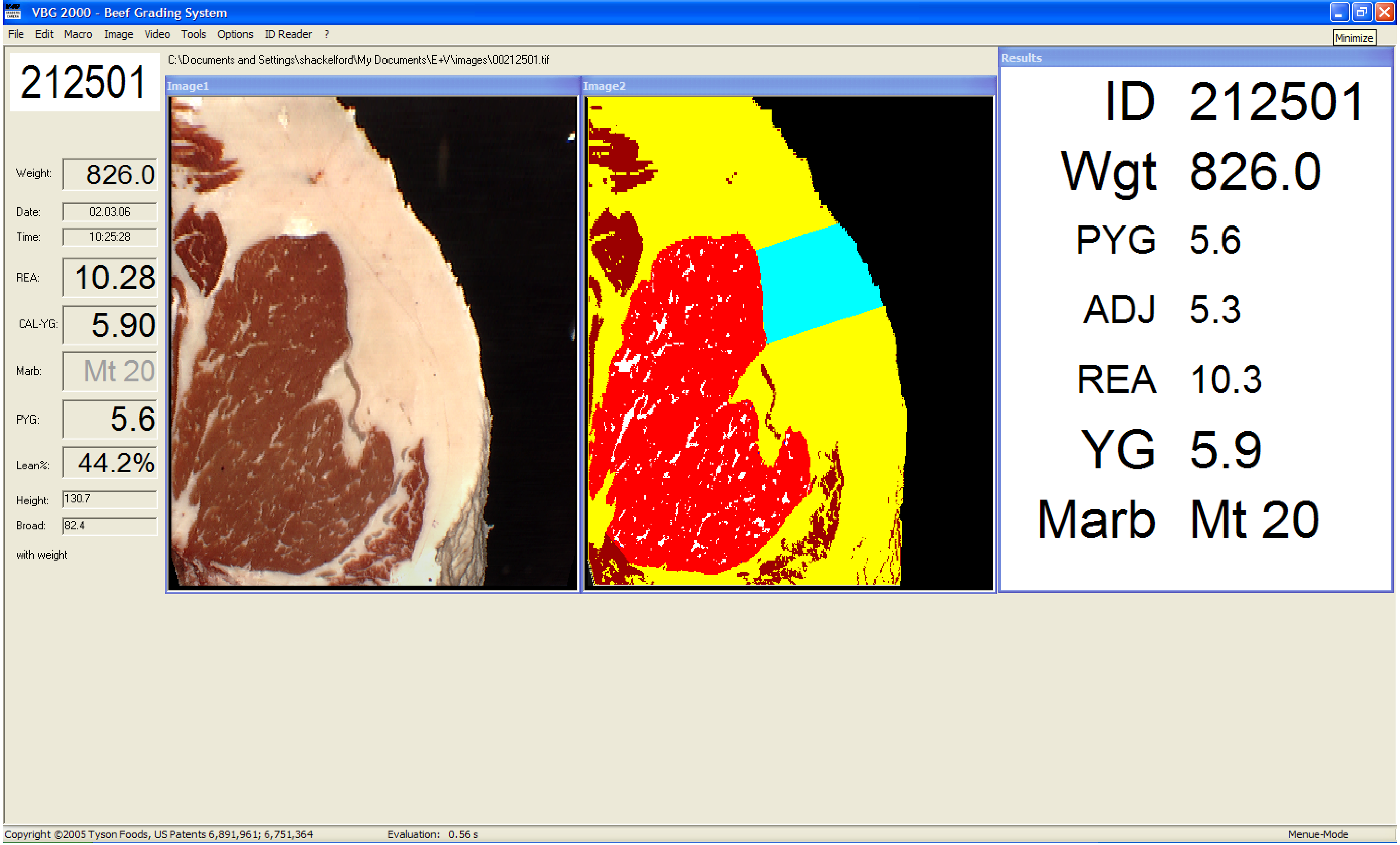
VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
Minimize
212501
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Image1
Image2
Results
Weight: 826.0
Date: 02.03.06
Time: 10:25:28
REA: 10.28
CAL-YG: 5.90
Marb: Mt 20
PYG: 5.6
Lean%: 44.2%
Height: 130.7
Broad: 82.4
with weight
ID 212501
Wgt 826.0
PYG 5.6
ADJ 5.3
REA 10.3
YG 5.9
Marb Mt 20
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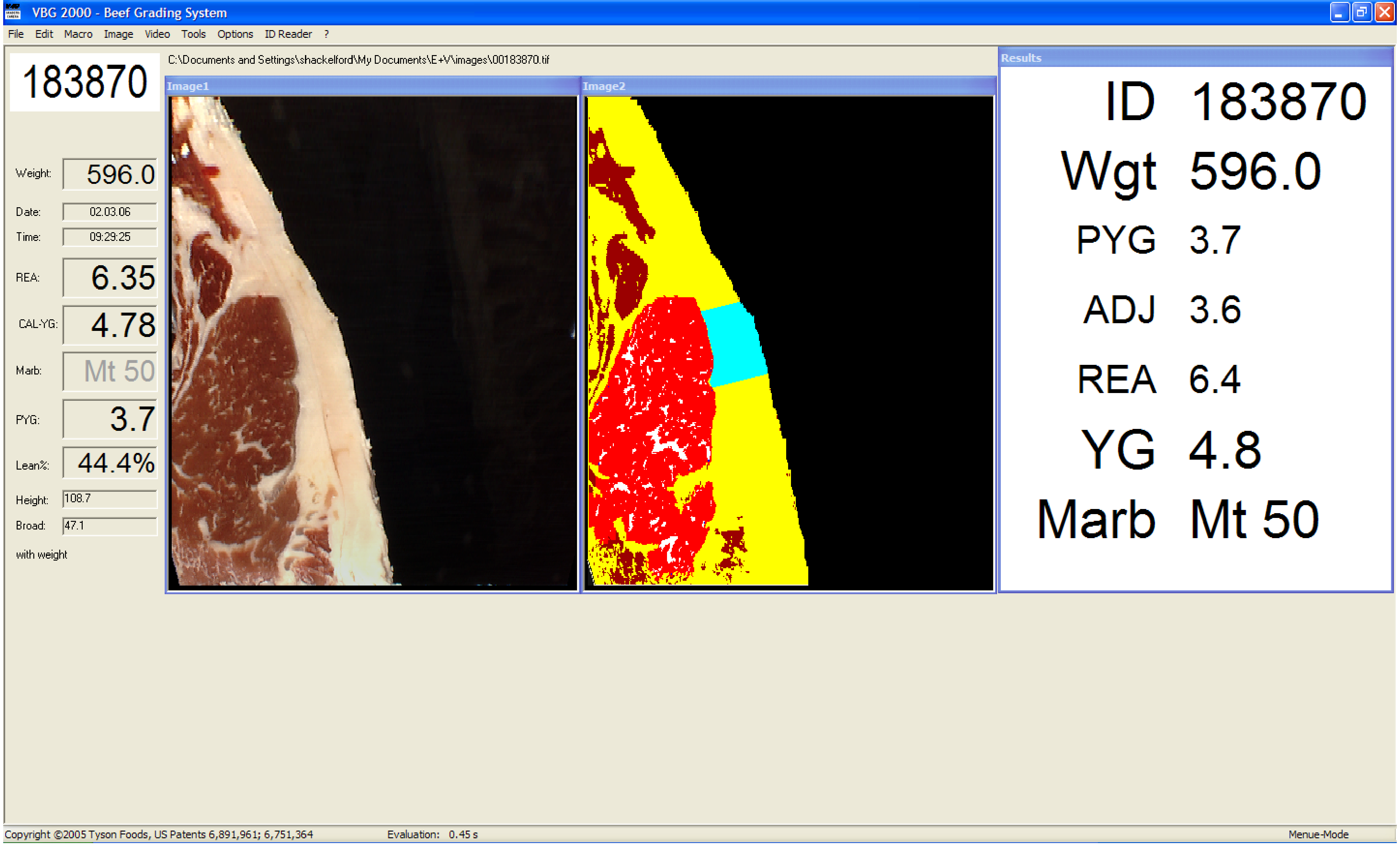
Evaluation: 0.56 s
Menue-Mode

- Able to sort carcasses based on ribeye area………..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183870
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Image1
Image2
Results
Weight: 596.0
Date: 02.03.06
Time: 09:29:25
REA: 6.35
CAL-YG: 4.78
Marb: Mt 50
PYG: 3.7
Lean%: 44.4%
Height: 108.7
Broad: 47.1
with weight
ID 183870
Wgt 596.0
PYG 3.7
ADJ 3.6
REA 6.4
YG 4.8
Marb Mt 50
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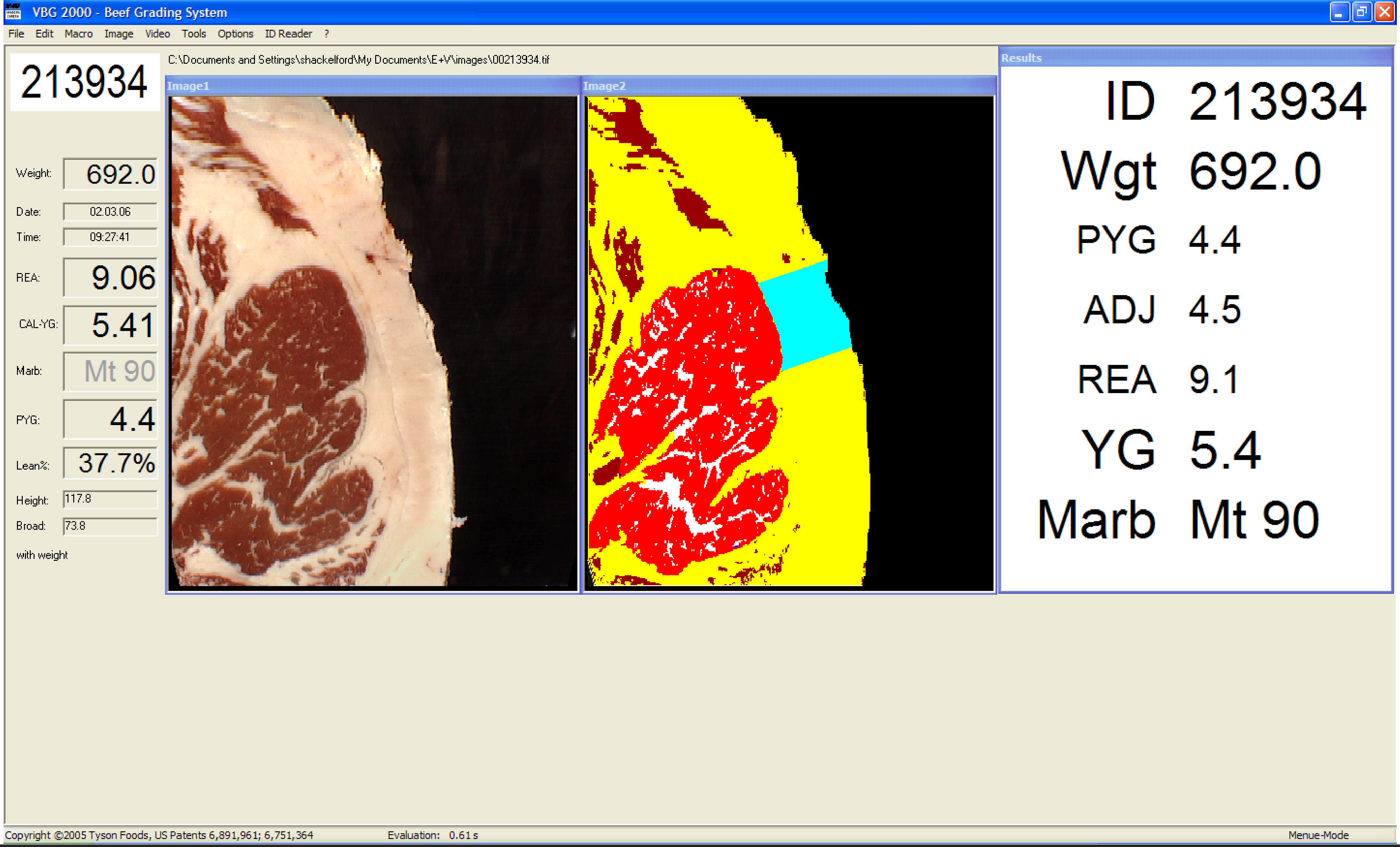
Evaluation: 0.45 s
Menue-Mode



VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
213934
C:\Documents and Settings\shackelford\My Documents\E+V\images\00213934.tif
Image1
Image2
Results
Weight: 692.0
Date: 02.03.06
Time: 09:27:41
REA: 9.06
CAL-YG: 5.41
Marb: Mt 90
PYG: 4.4
Lean%: 37.7%
Height: 117.8
Broad: 73.8
with weight
ID 213934
Wgt 692.0
PYG 4.4
ADJ 4.5
REA 9.1
YG 5.4
Marb Mt 90
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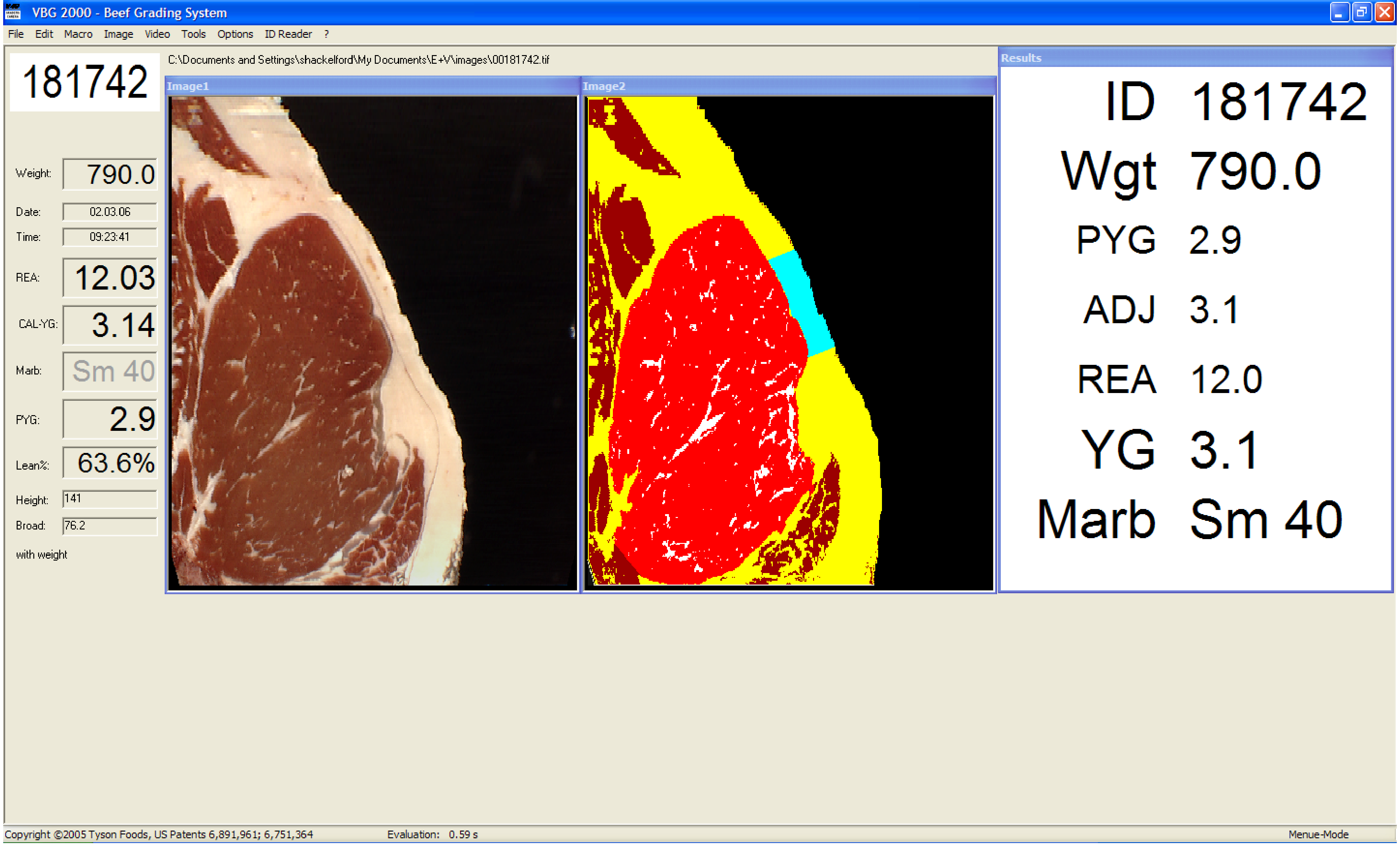
Evaluation: 0.61 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
181742
C:\Documents and Settings\shackelford\My Documents\E+V\images\00181742.tif
Image1
Image2
Results
Weight: 790.0
Date: 02.03.06
Time: 09:23:41
REA: 12.03
CAL-YG: 3.14
Marb: Sm 40
PYG: 2.9
Lean%: 63.6%
Height: 141
Broad: 76.2
with weight
ID 181742
Wgt 790.0
PYG 2.9
ADJ 3.1
REA 12.0
YG 3.1
Marb Sm 40
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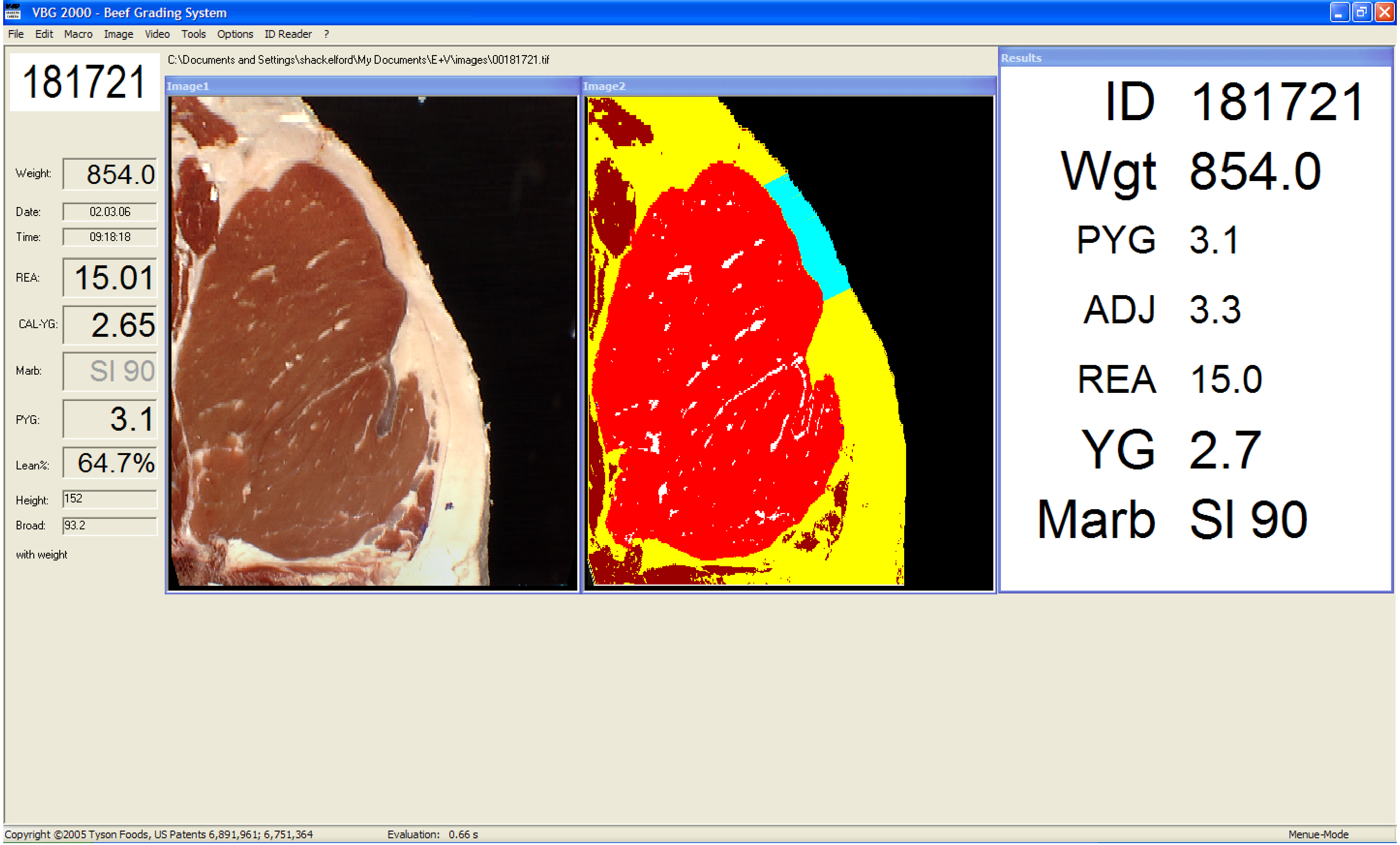
Evaluation: 0.59 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
181721
C:\Documents and Settings\shackelford\My Documents\E+V\images\00181721.tif
Image1
Image2
Results
Weight: 854.0
Date: 02.03.06
Time: 09:18:18
REA: 15.01
CAL-YG: 2.65
Marb: SI 90
PYG: 3.1
Lean%: 64.7%
Height: 152
Broad: 93.2
with weight
ID 181721
Wgt 854.0
PYG 3.1
ADJ 3.3
REA 15.0
YG 2.7
Marb SI 90
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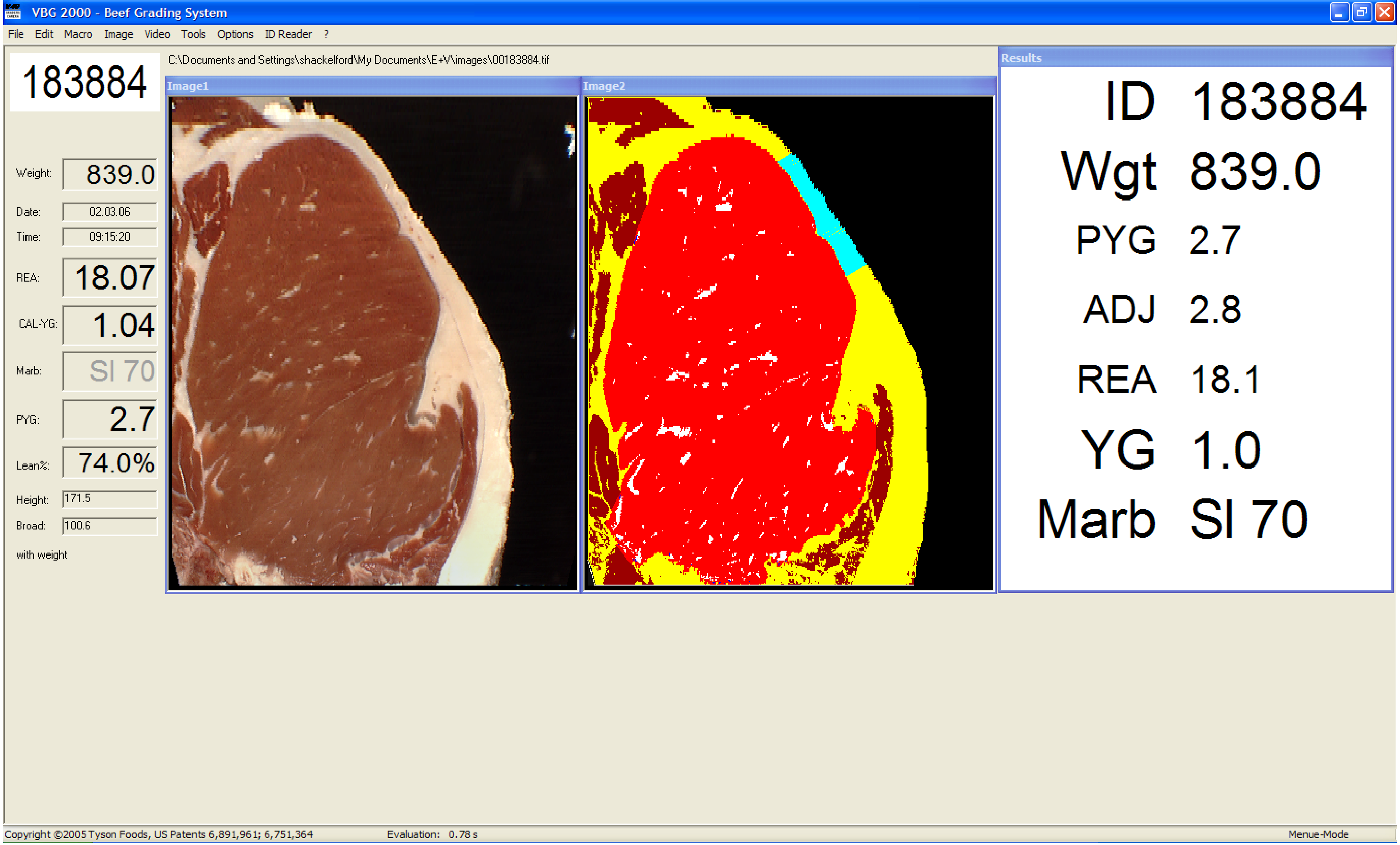
Evaluation: 0.66 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
183884
C:\Documents and Settings\shackelford\My Documents\E+V\images\00183884.tif
Image1
Image2
Results
Weight: 839.0
Date: 02.03.06
Time: 09:15:20
REA: 18.07
CAL-YG: 1.04
Marb: Sl 70
PYG: 2.7
Lean%: 74.0%
Height: 171.5
Broad: 100.6
with weight
ID 183884
Wgt 839.0
PYG 2.7
ADJ 2.8
REA 18.1
YG 1.0
Marb Sl 70
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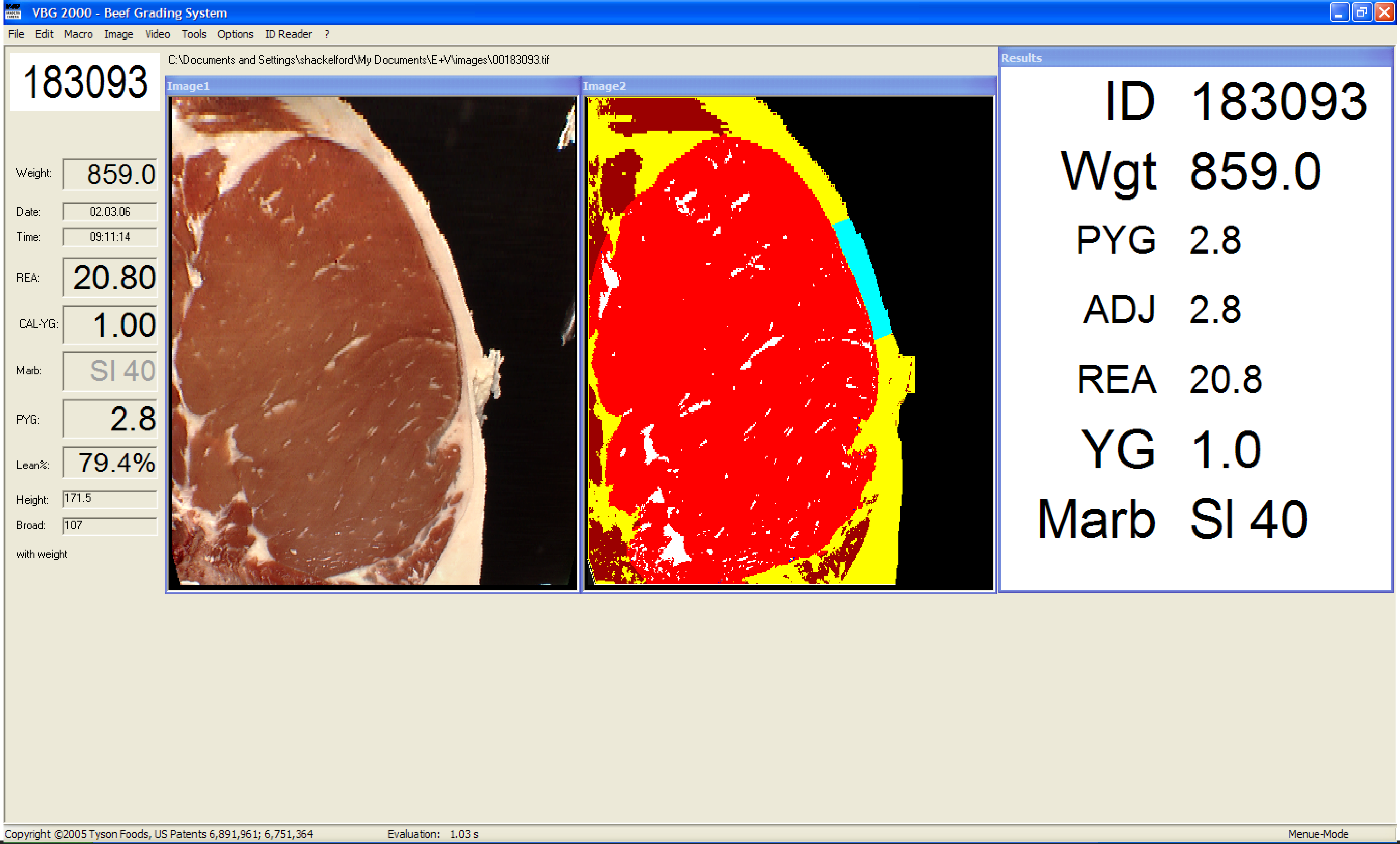
Evaluation: 0.78 s
Menue-Mode


VBG 2000 - Beef Grading System
File Edit Macro Image Video Tools Options ID Reader ?
183093
C:\Documents and Settings\shackelford\My Documents\E+V\images\00183093.tif
Image1
Image2
Results
Weight: 859.0
Date: 02.03.06
Time: 09:11:14
REA: 20.80
CAL-YG: 1.00
Marb: Sl 40
PYG: 2.8
Lean%: 79.4%
Height: 171.5
Broad: 107
with weight
ID 183093
Wgt 859.0
PYG 2.8
ADJ 2.8
REA 20.8
YG 1.0
Marb Sl 40
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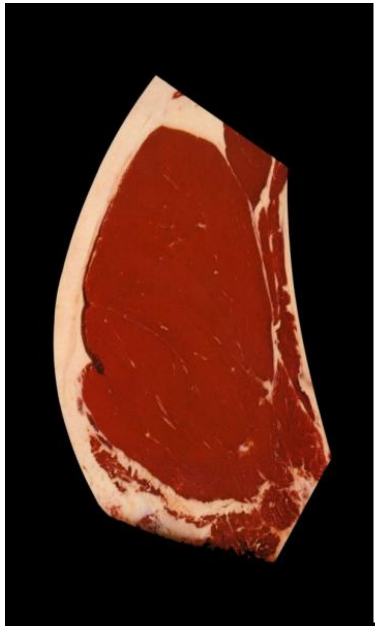
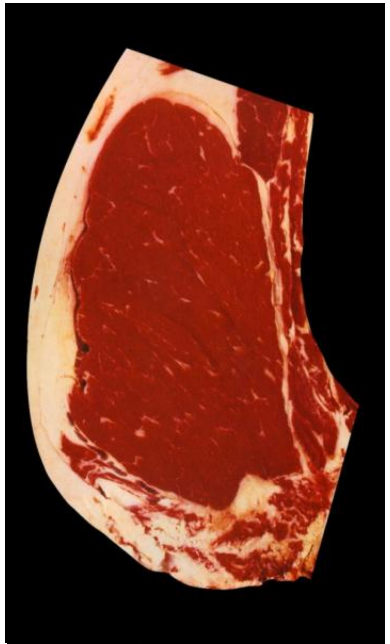
Evaluation: 1.03 s
Menue-Mode

Able to sort carcasses based on marbling score…

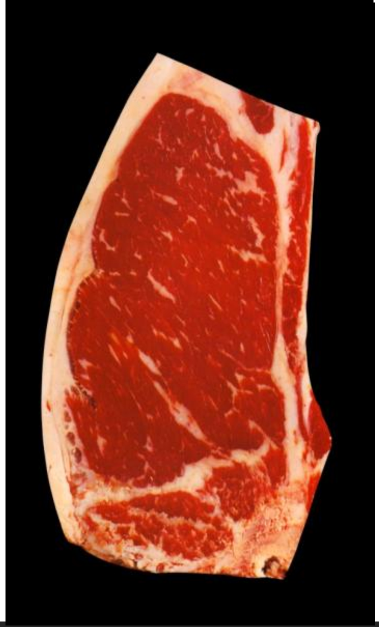


300 =
Slight^{00}
Select

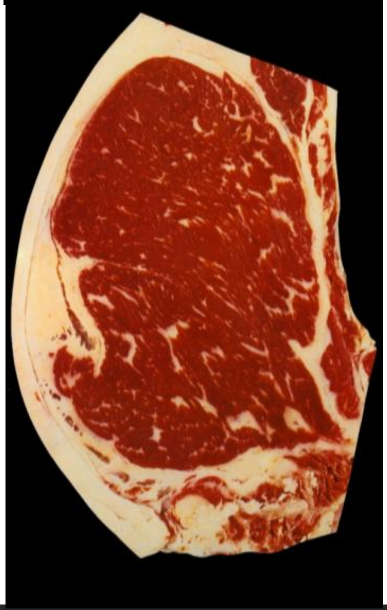


400 =
Small^{00}
Low Choice

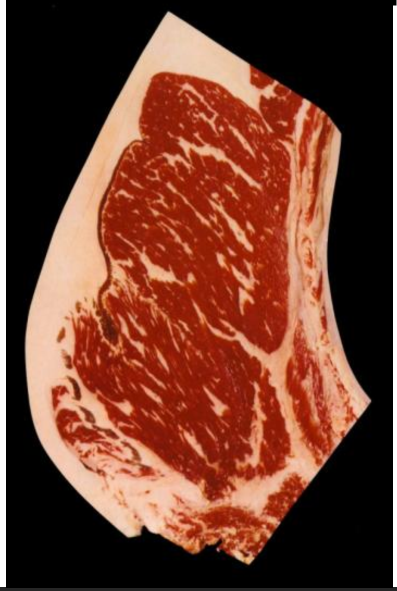
500 =
Modest^{00}
Average Choice



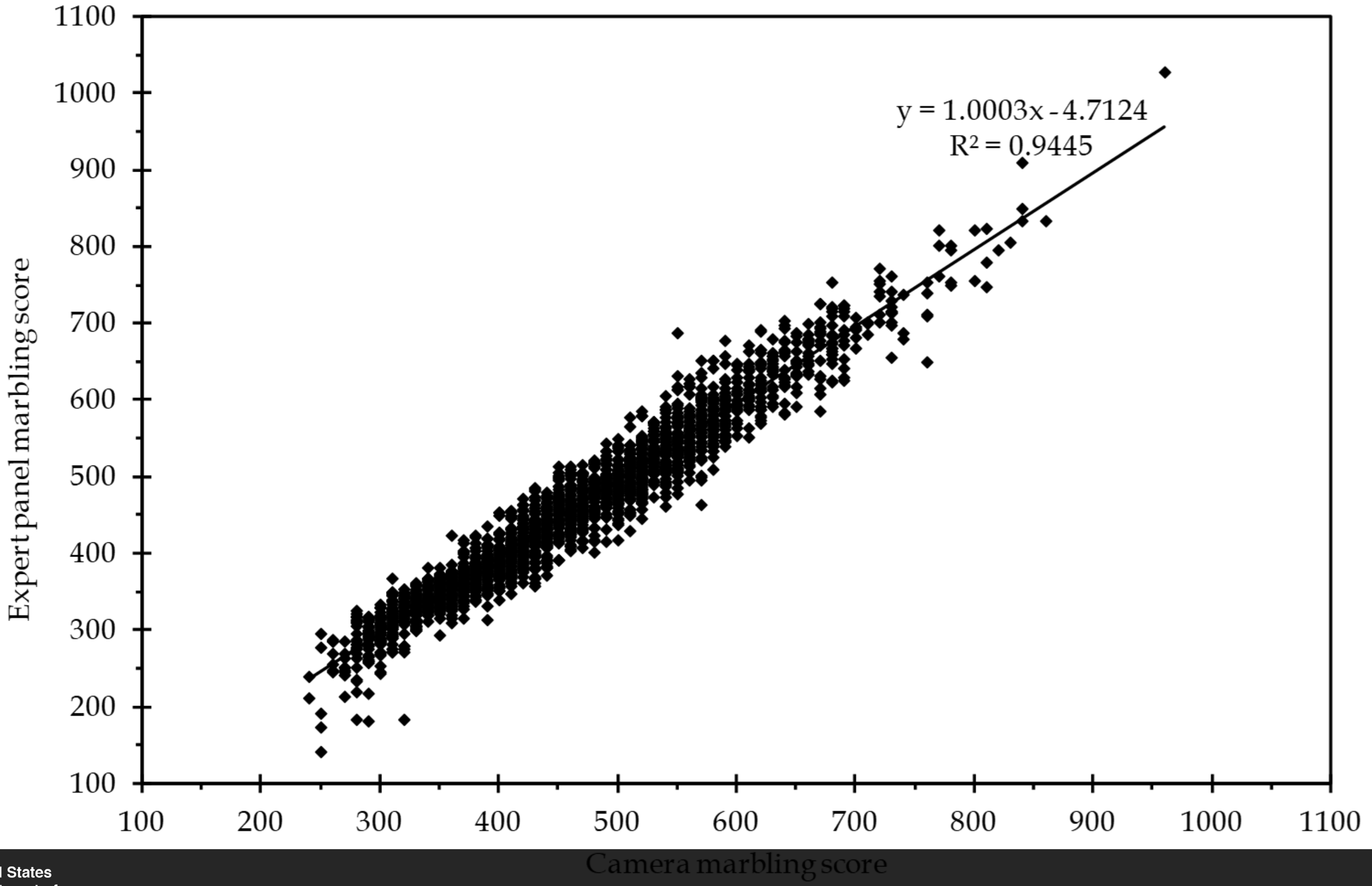
600 =
Moderate^{00}
High Choice

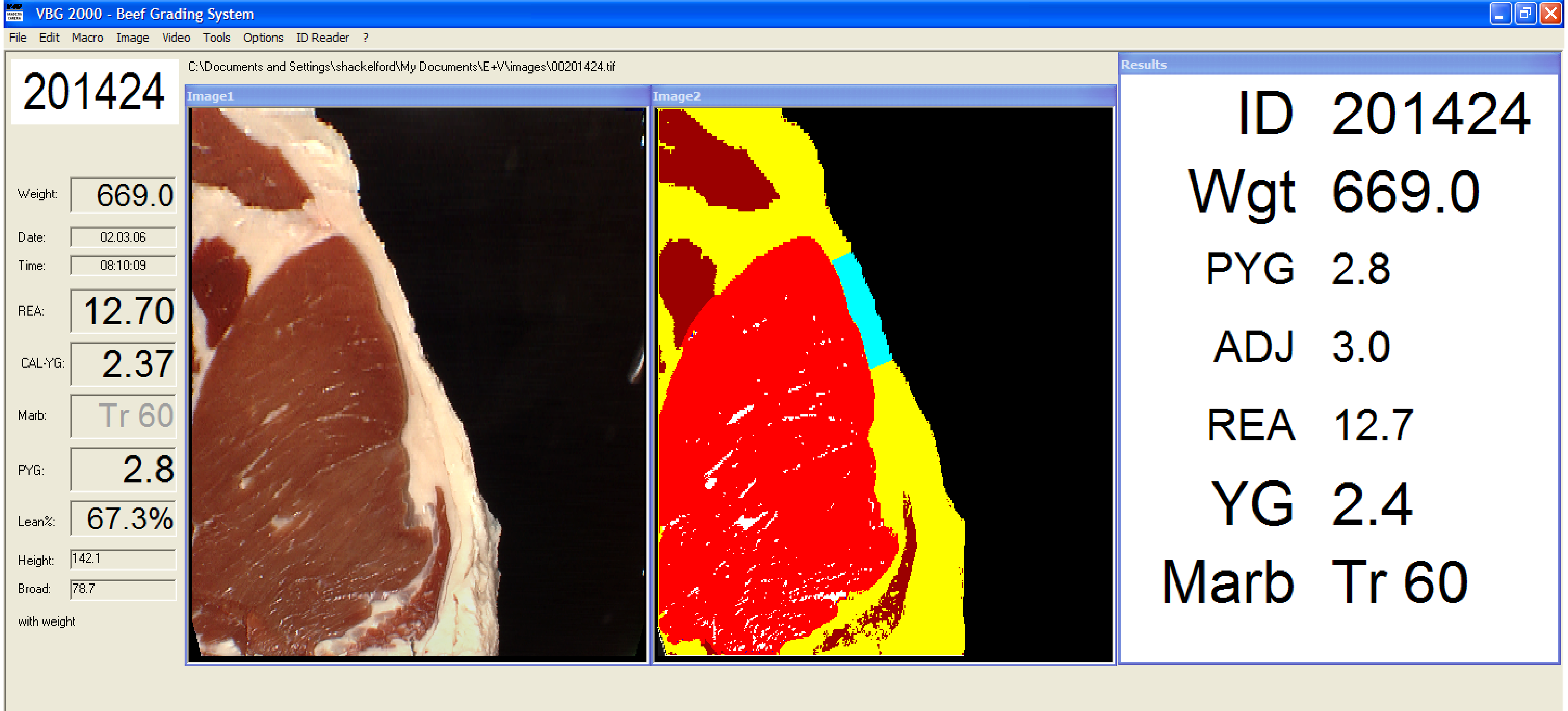


700 =
Slightly Abundant^{00}
Low Prime



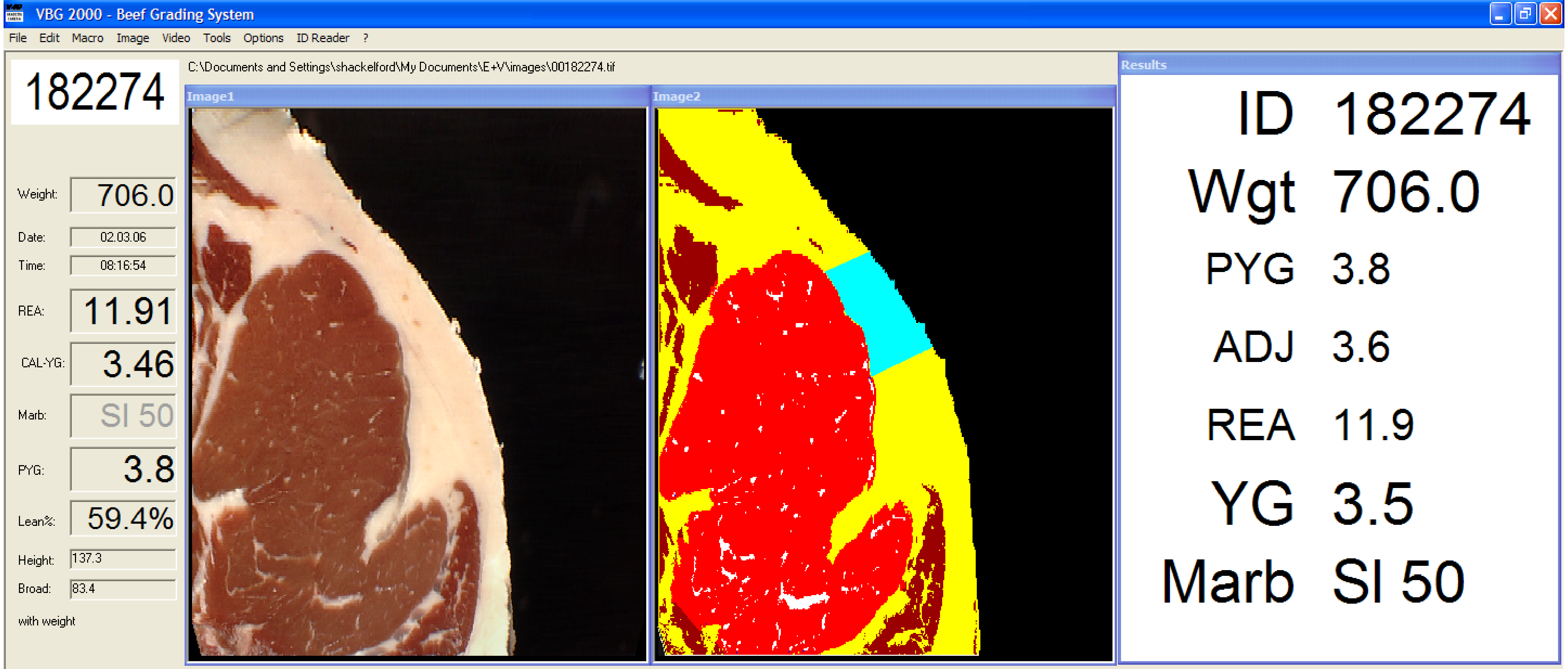
800 =
Moderately Abundant^{00}
Average Prime


y = 1.0003x - 4.7124
R² = 0.9445
Expert panel marbling score
Camera marbling score
100
200
300
400
500
600
700
800
900
1000
1100



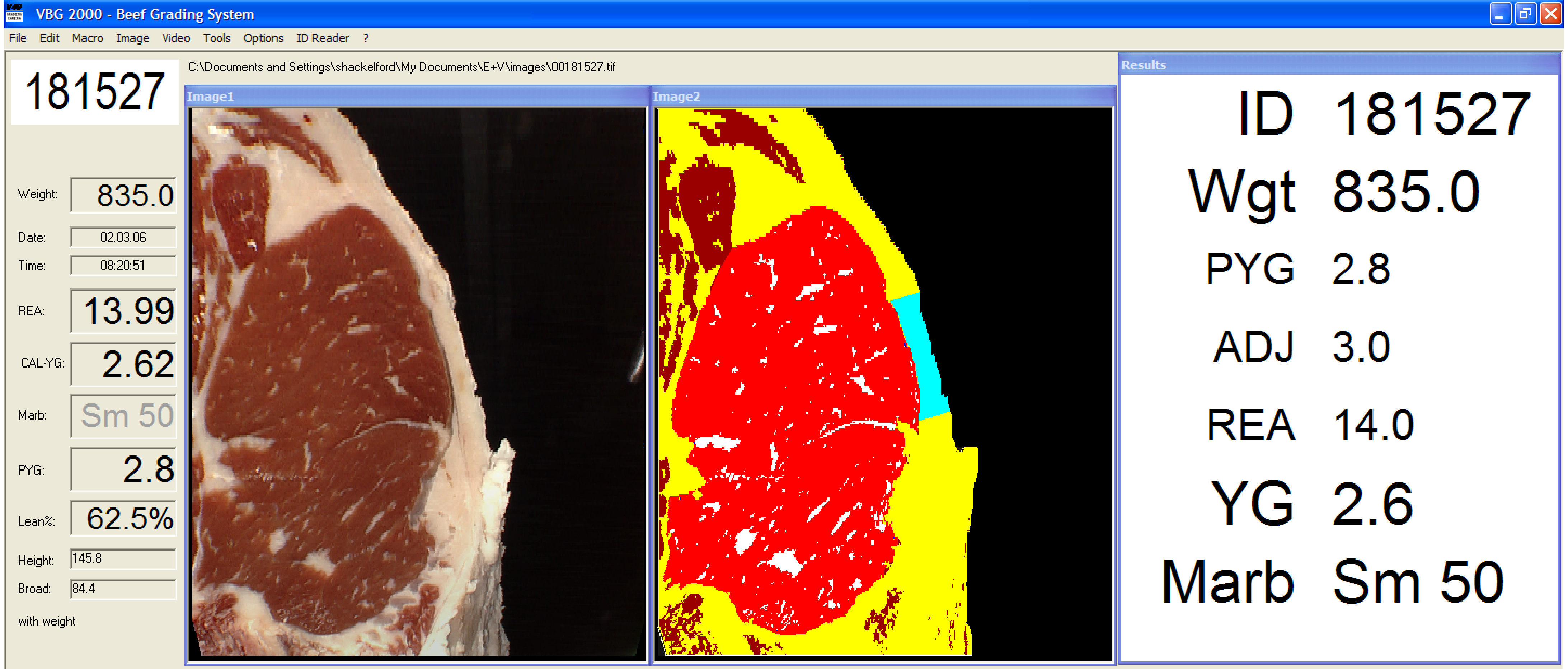
Tr = “Traces” degree of marbling

A maturity carcass with Tr60 would qualify for U.S. Standard and typically would be sold as “no roll” or ungraded beef



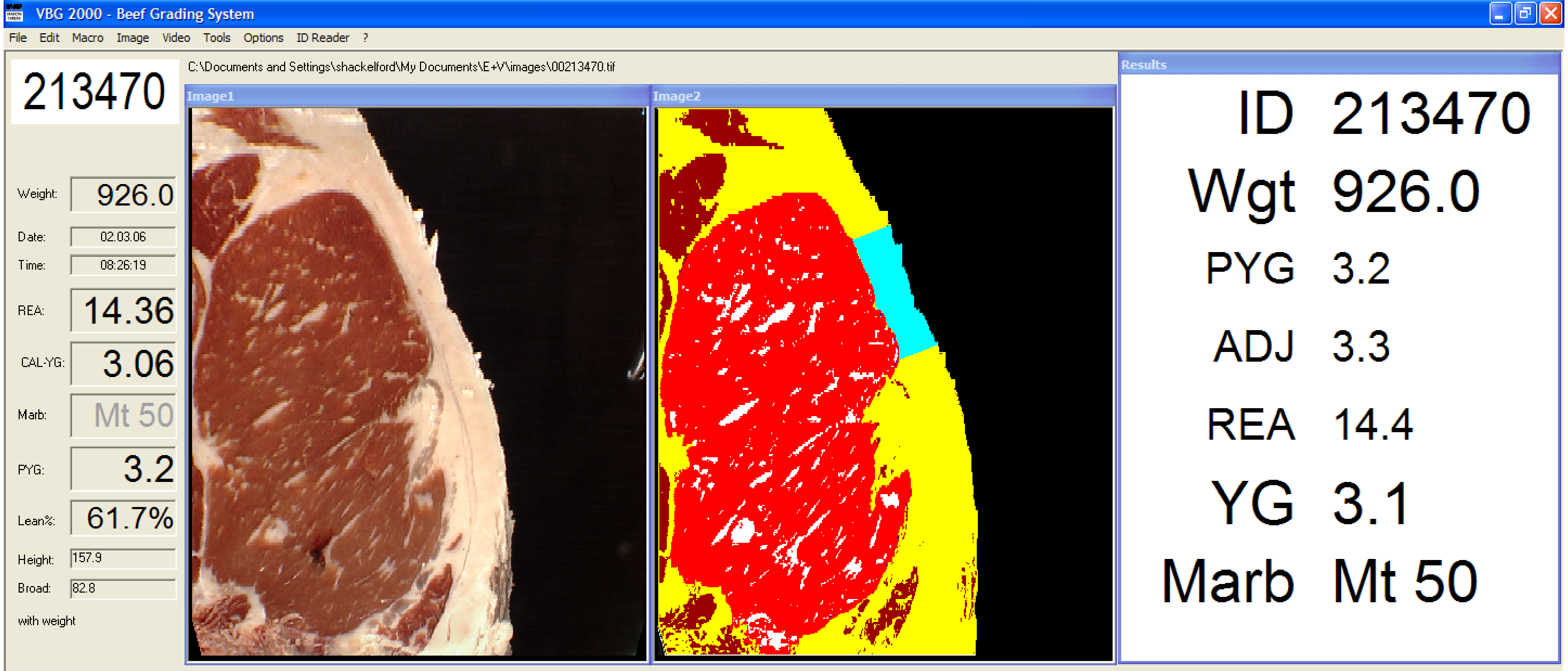
Sl = “Slight” degree of marbling

A maturity carcass with Sl50 would qualify for U.S. Select



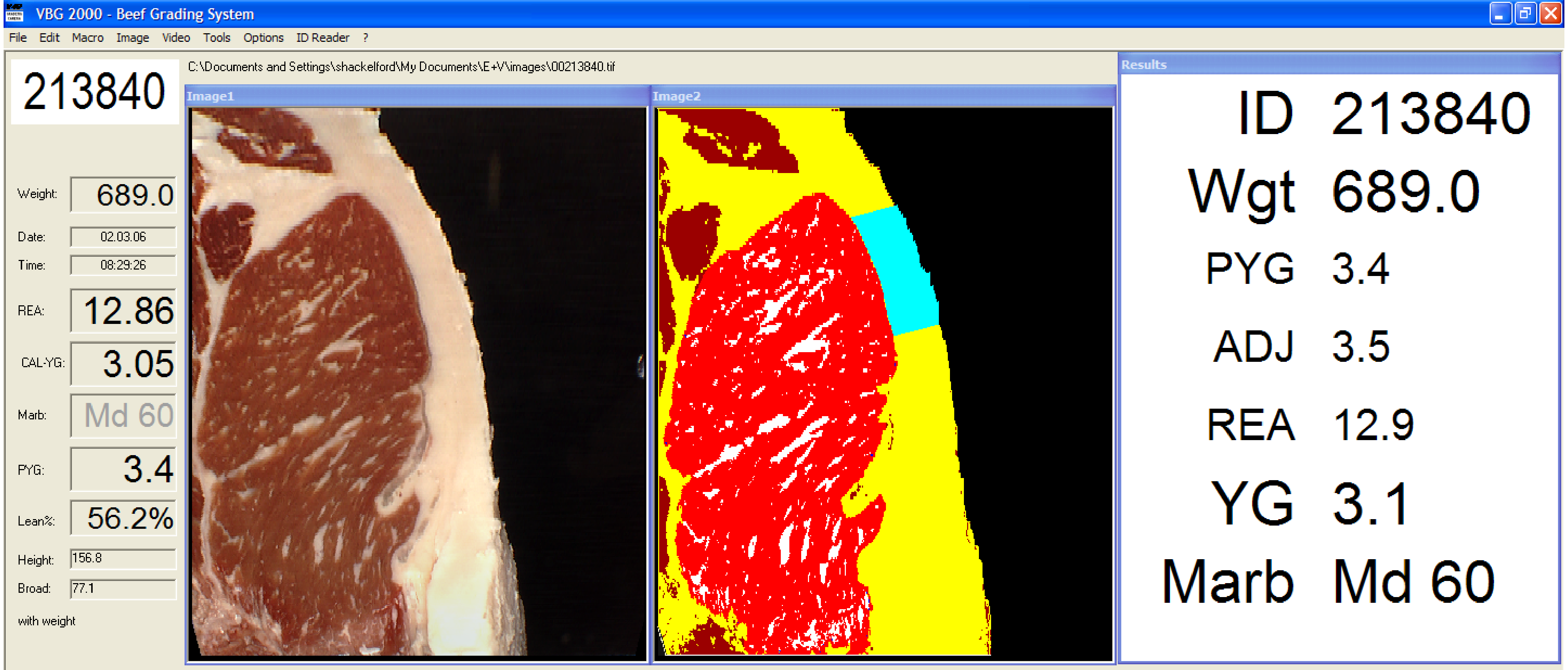
Sm = “Small” degree of marbling

A maturity carcass with Sm50 would qualify for U.S. Choice (Low Choice)



Mt = "Modest" degree of marbling

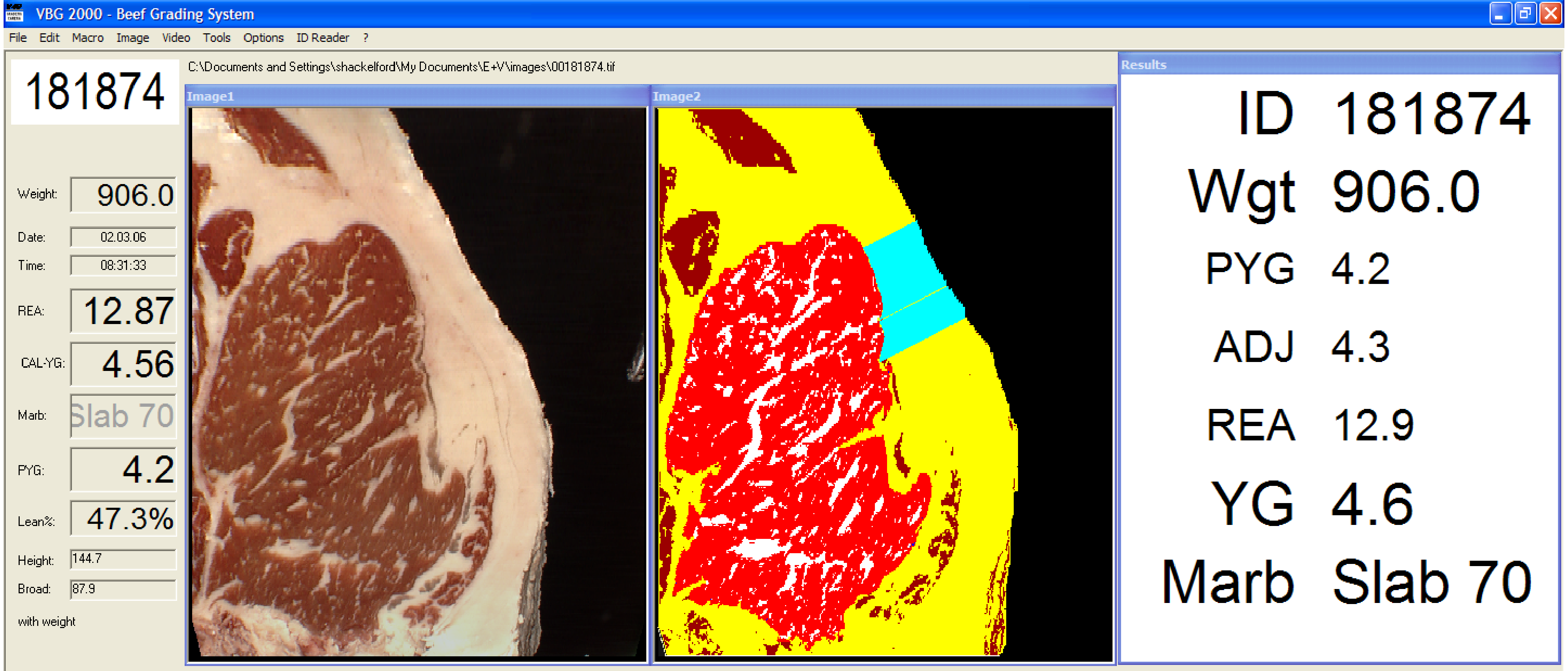
A maturity carcass with Mt50 would qualify for U.S. Choice (Average Choice)



Md = “Moderate” degree of marbling

A maturity carcass with Md60 would qualify for U.S. Choice (High Choice)

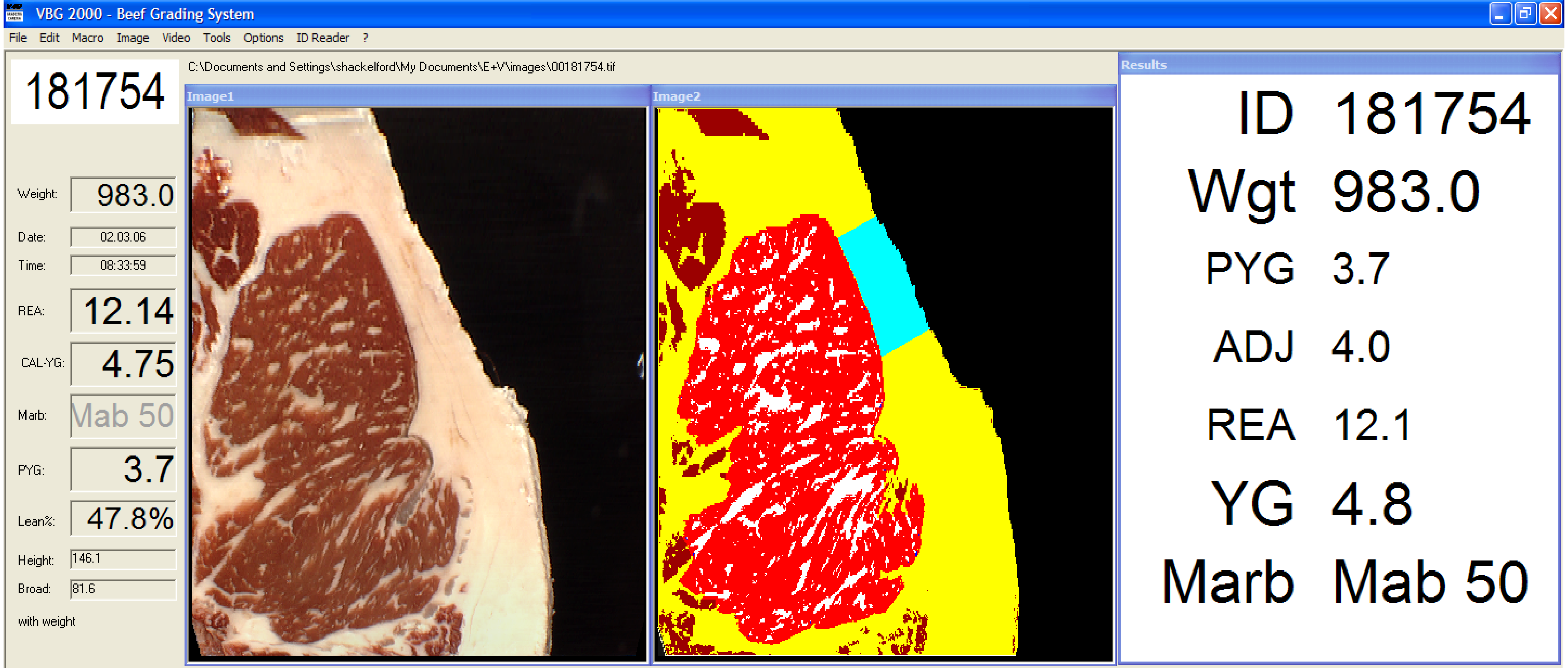
 Evaluation: 0.64 s Menue-Mode



Slab= “Slightly Abundant” degree of marbling

A maturity carcass with Slab70 would qualify for U.S. Prime (Low Prime)

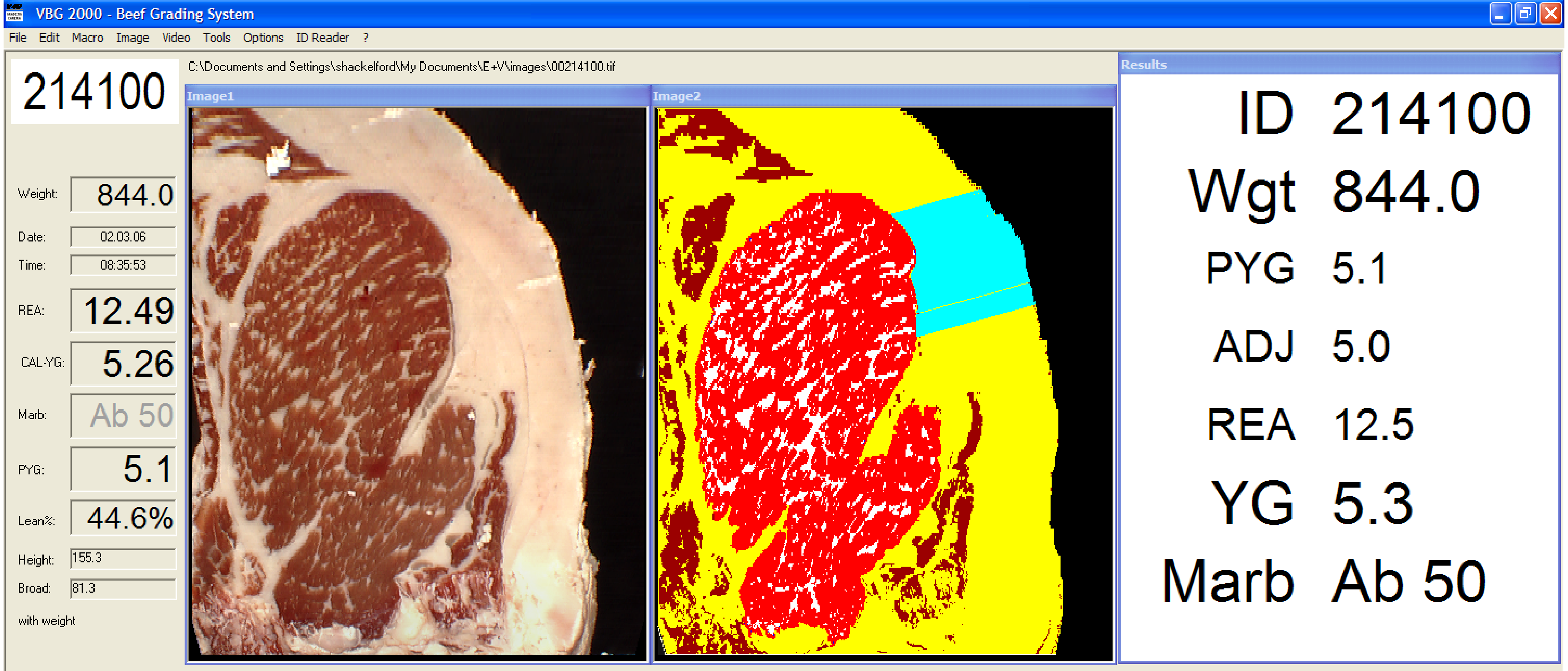
Copyright ©2005 Tyson Foods, US Patents 6,891,961; 6,751,364 Evaluation: 0.66 s Menue-Mode



Mab= “Moderately Abundant” degree of marbling

A maturity carcass with Mab50 would qualify for U.S. Prime (Average Prime)

 Evaluation: 0.63 s Menue-Mode



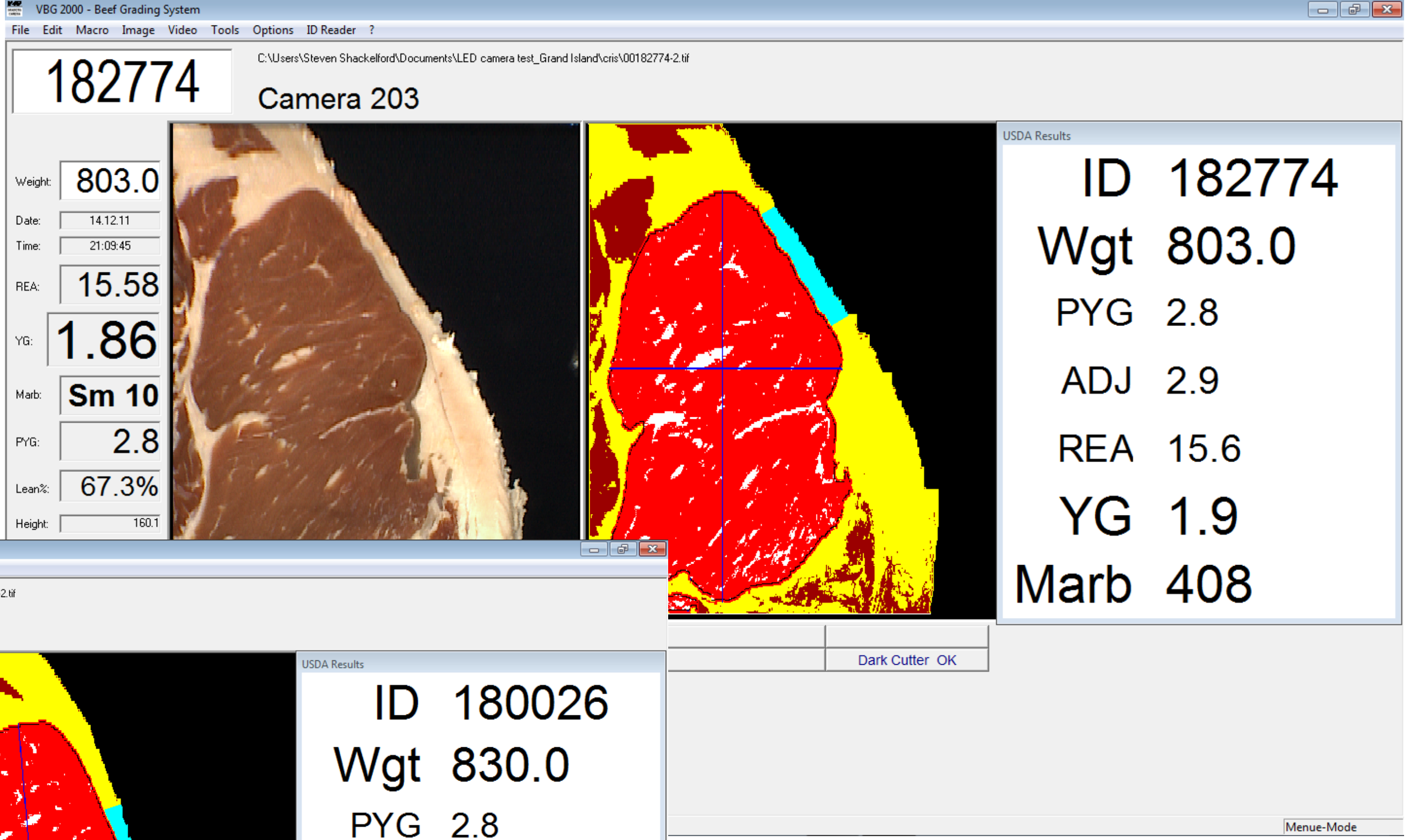
Ab= "Abundant" degree of marbling

A maturity carcass with Ab50 would qualify for U.S. Prime (High Prime)

 Evaluation: 0.64 s Menue-Mode

Able to identify dark cutter carcasses ……….

Normal lean color

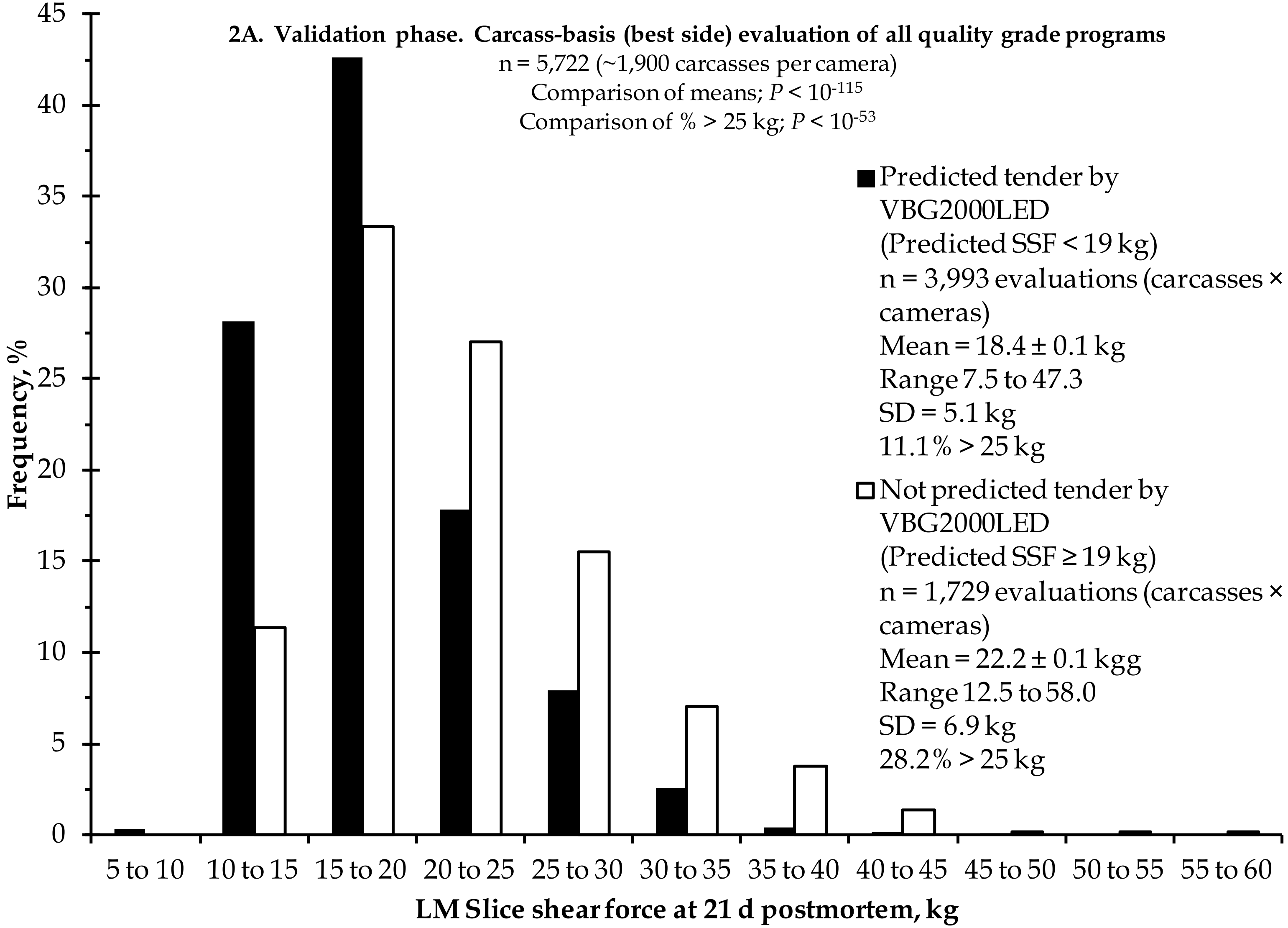


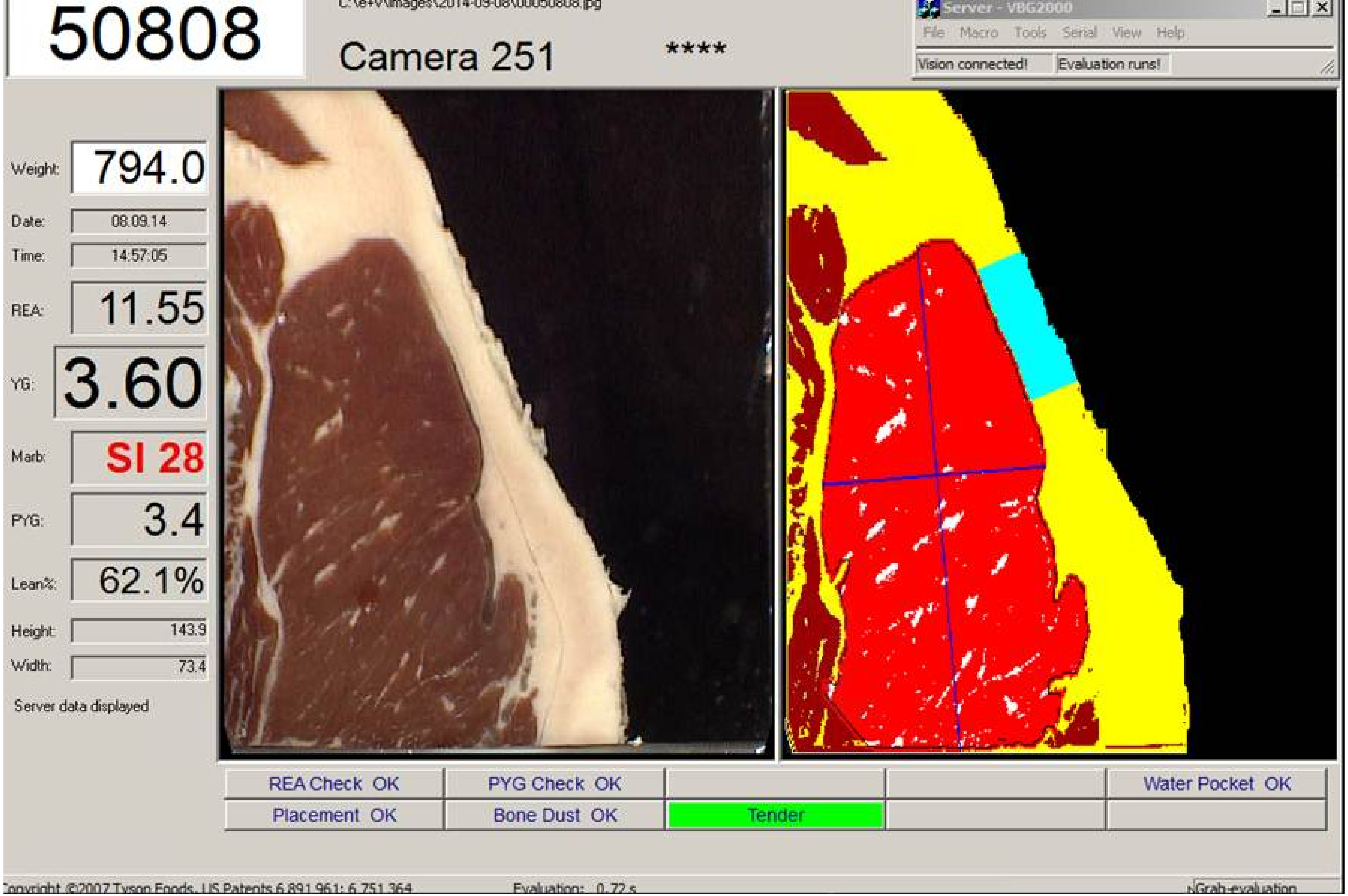
Dark cutter

Able to identify more consistently tender carcasses…

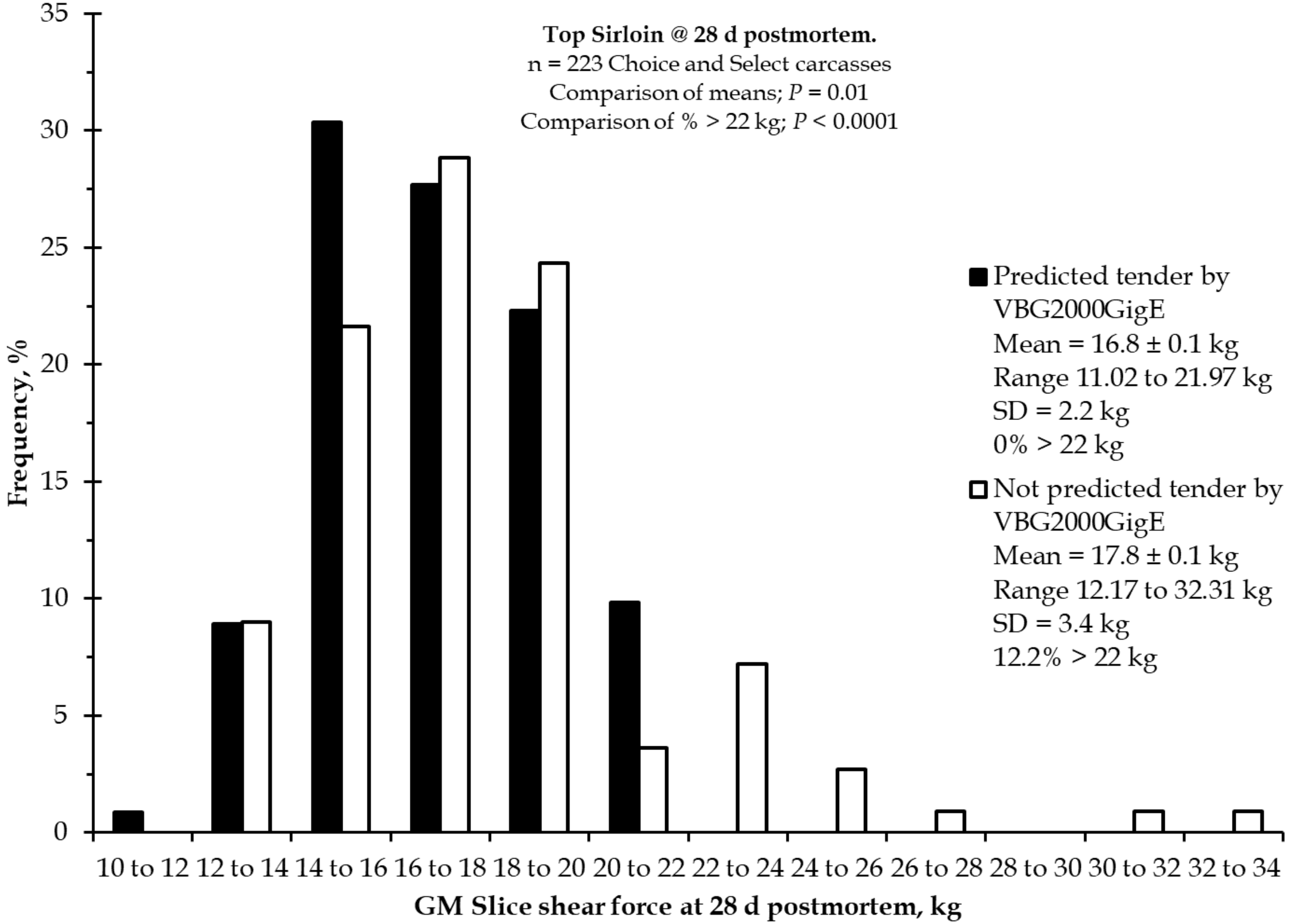
Longissimus (strip loin and ribeye)

Validation phase

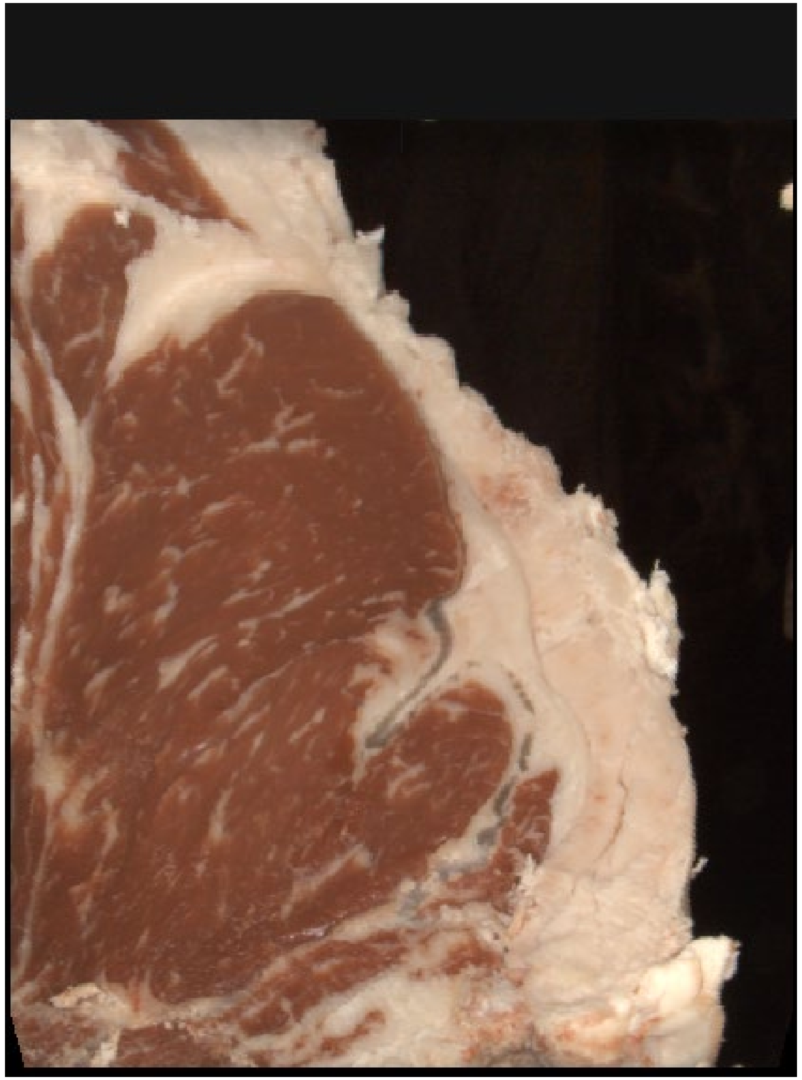



50808
Camera 251
****
Server - VBG2000
File Macro Tools Serial View Help
Vision connected!
Evaluation runs!
Weight: 794.0
Date: 08.09.14
Time: 14:57:05
REA: 11.55
YG: 3.60
Marb: SI 28
PYG: 3.4
Lean%: 62.1%
Height: 143.9
Width: 73.4
Server data displayed
REA Check OK
PYG Check OK
Water Pocket OK
Placement OK
Bone Dust OK
Tender
Evaluation: 0.72 s
Grab-evaluation

Center-Cut Top Sirloin (Gluteus medius)



Fat color



Who, what, when…

- The packing plants, NOT USDA, own and operate the cameras.
- Grading is voluntary
- Use of camera data for grading is voluntary
  - Most plants do not use USDA yield grades. Instead, these plants use the camera to determine vision yield grades.
  - Some plants use the camera for marbling assessment for quality grade determination but rely on certifying graders to conduct all aspects of program certification
  - Other plants use the camera for marbling assessment for quality grade determination and program certification
  - grader override

Every day in the plant

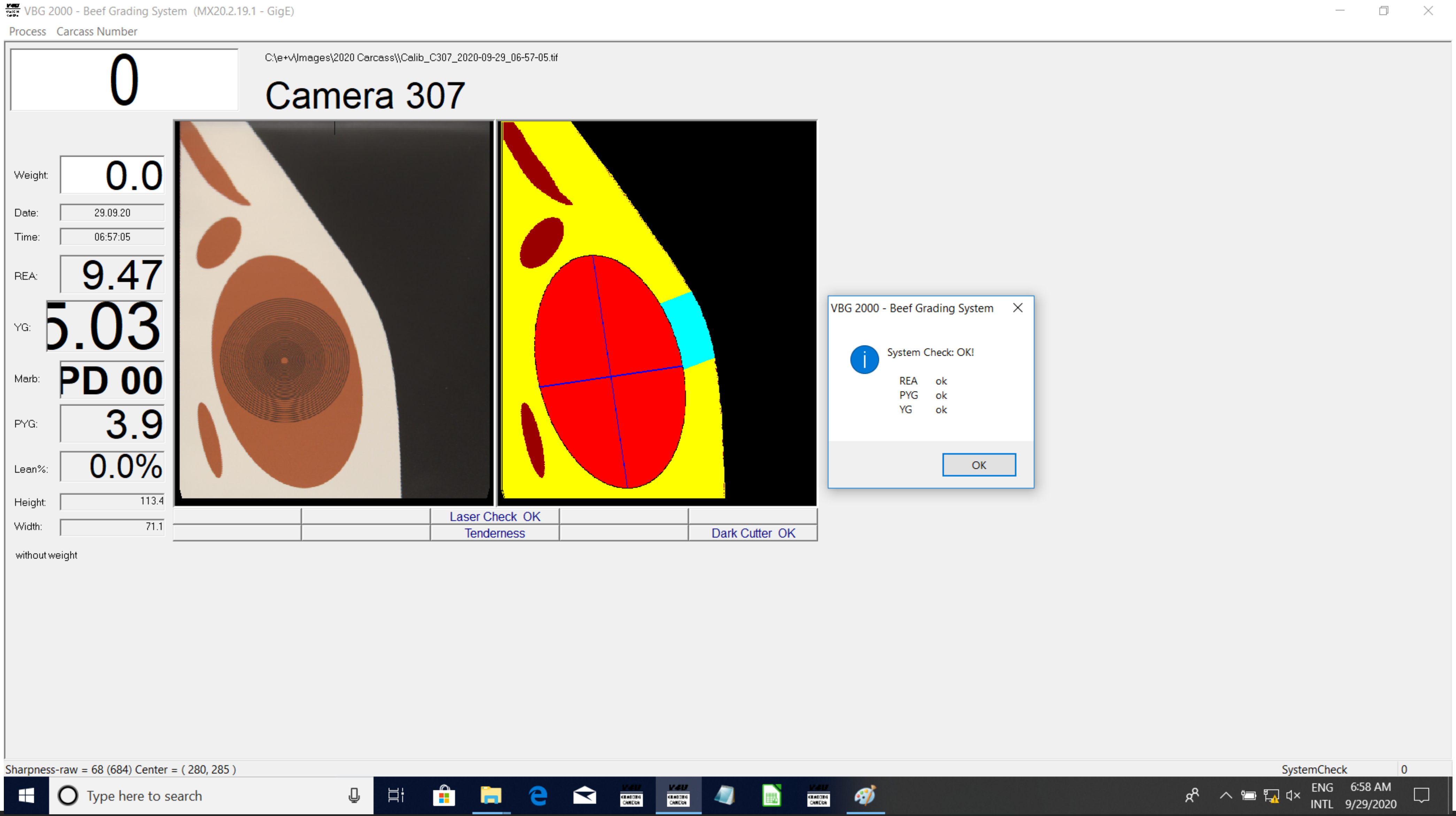
- System check
- USDA Marbling check – before each shift

System check

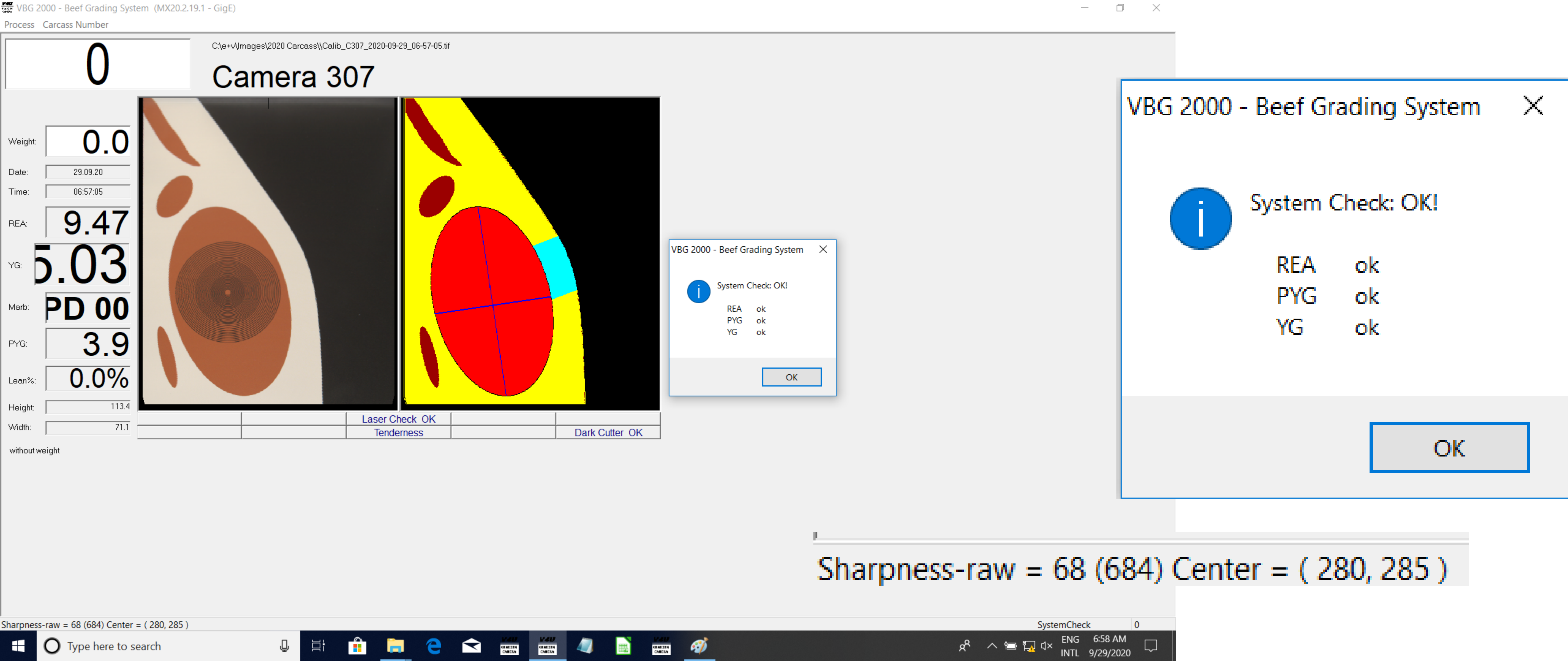
Faux ribeye card

- Fits on the camera so that the camera can image the faux ribeye just like it would image a real ribeye
- Checks ribeye area, fat thickness (PYG), and YG against reference values.
- Checks camera sharpness

System Check - Completion



System Check - OK

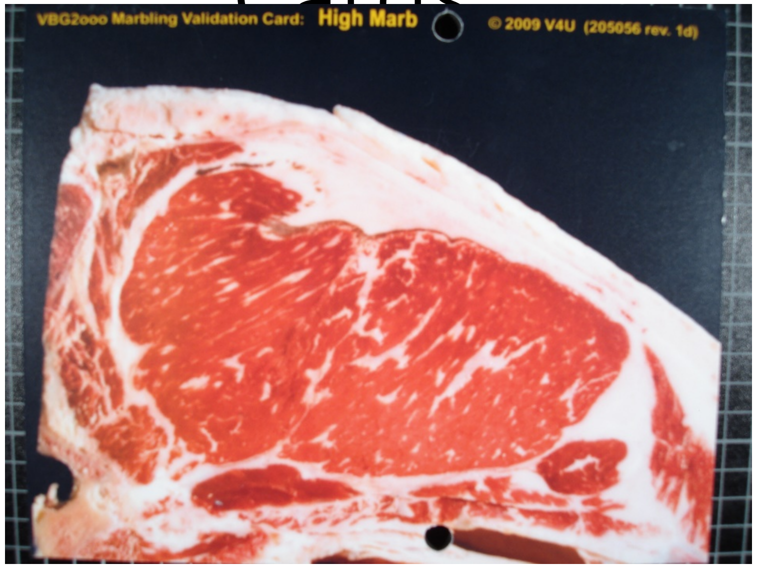


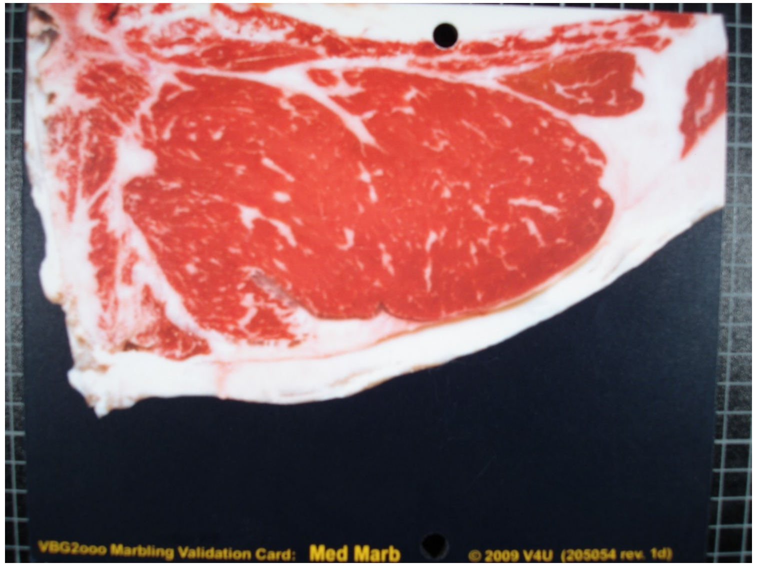
USDA Marbling check

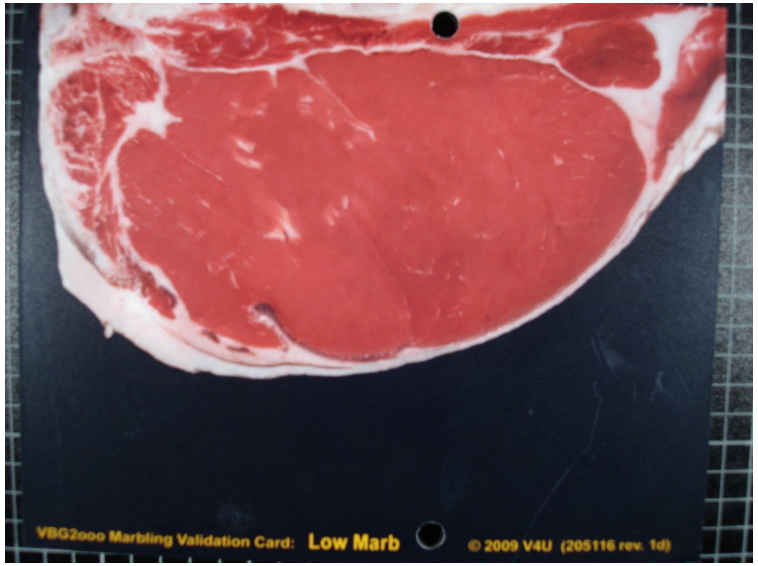
Ribeye images spanning range of marbling scores

- Test to make sure that the camera has not changed over time.
- Compares the values obtained to reference values assessed when the most recent (quarterly) servicing of the camera was performed.
- Each card is imaged 5 times and truncated statistics (mean and SD) are calculated by discarding the highest and lowest values.

USDA Marbling Check – Four Cards

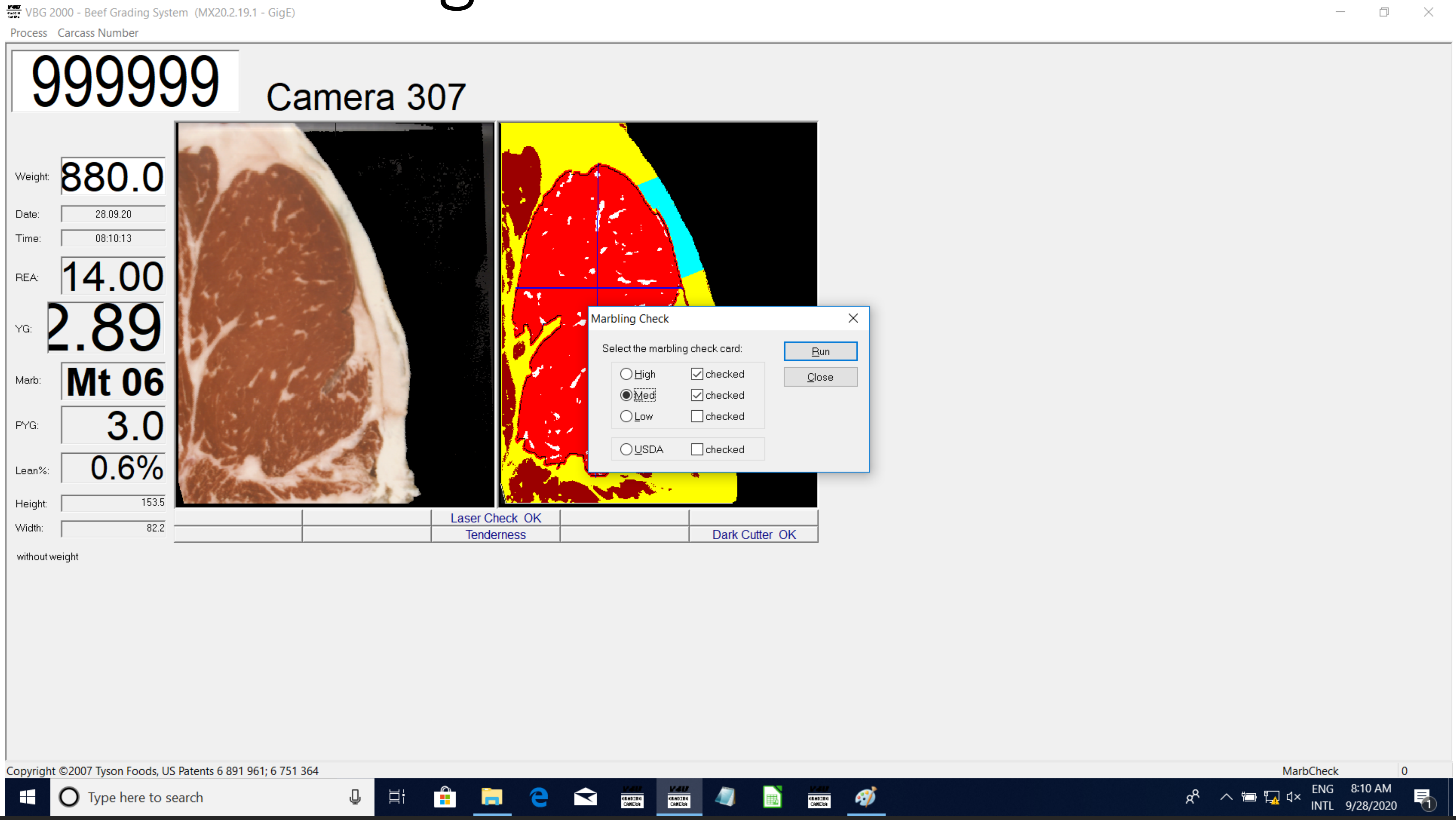




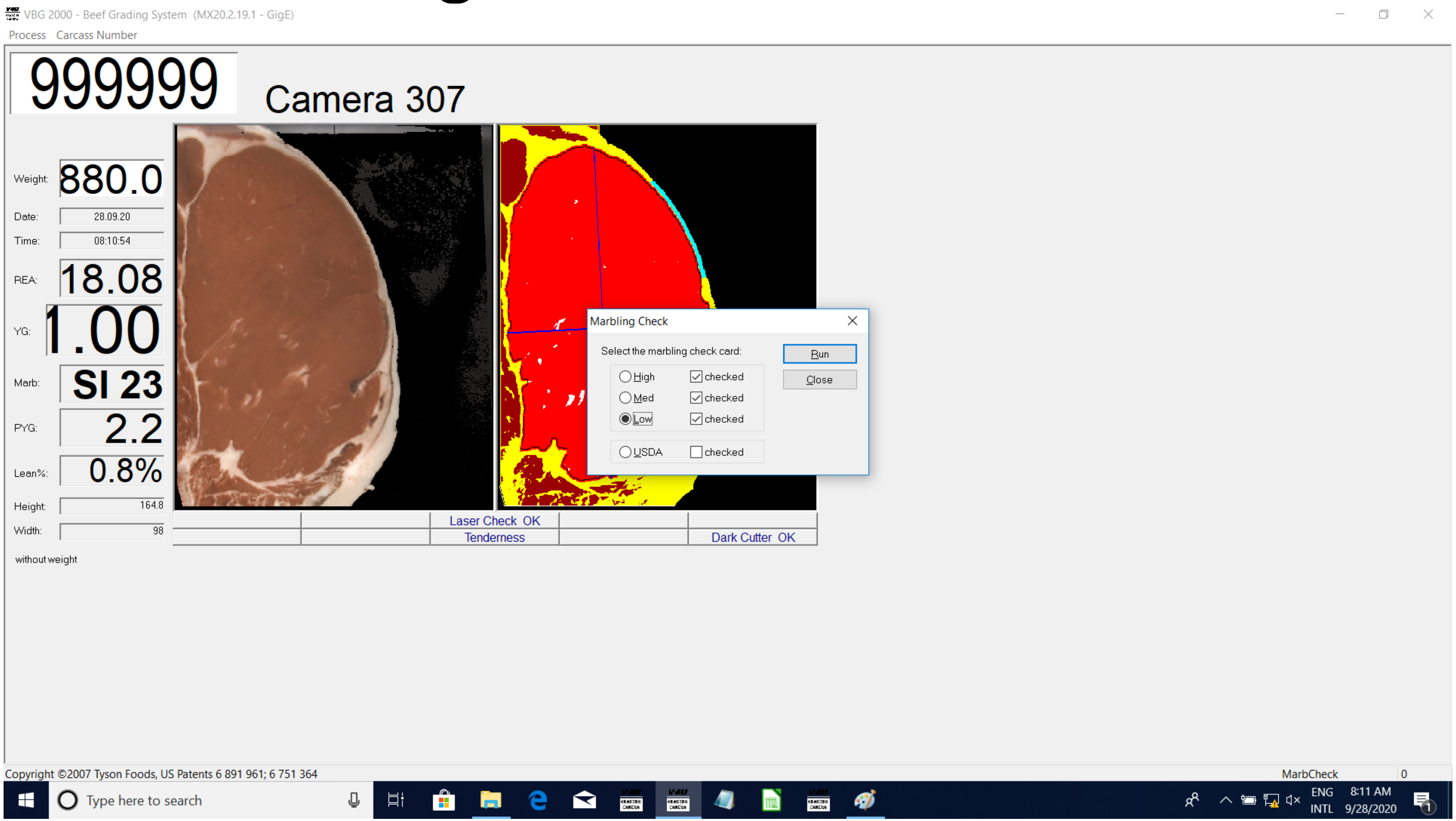


USDA Marbling Check – High Card

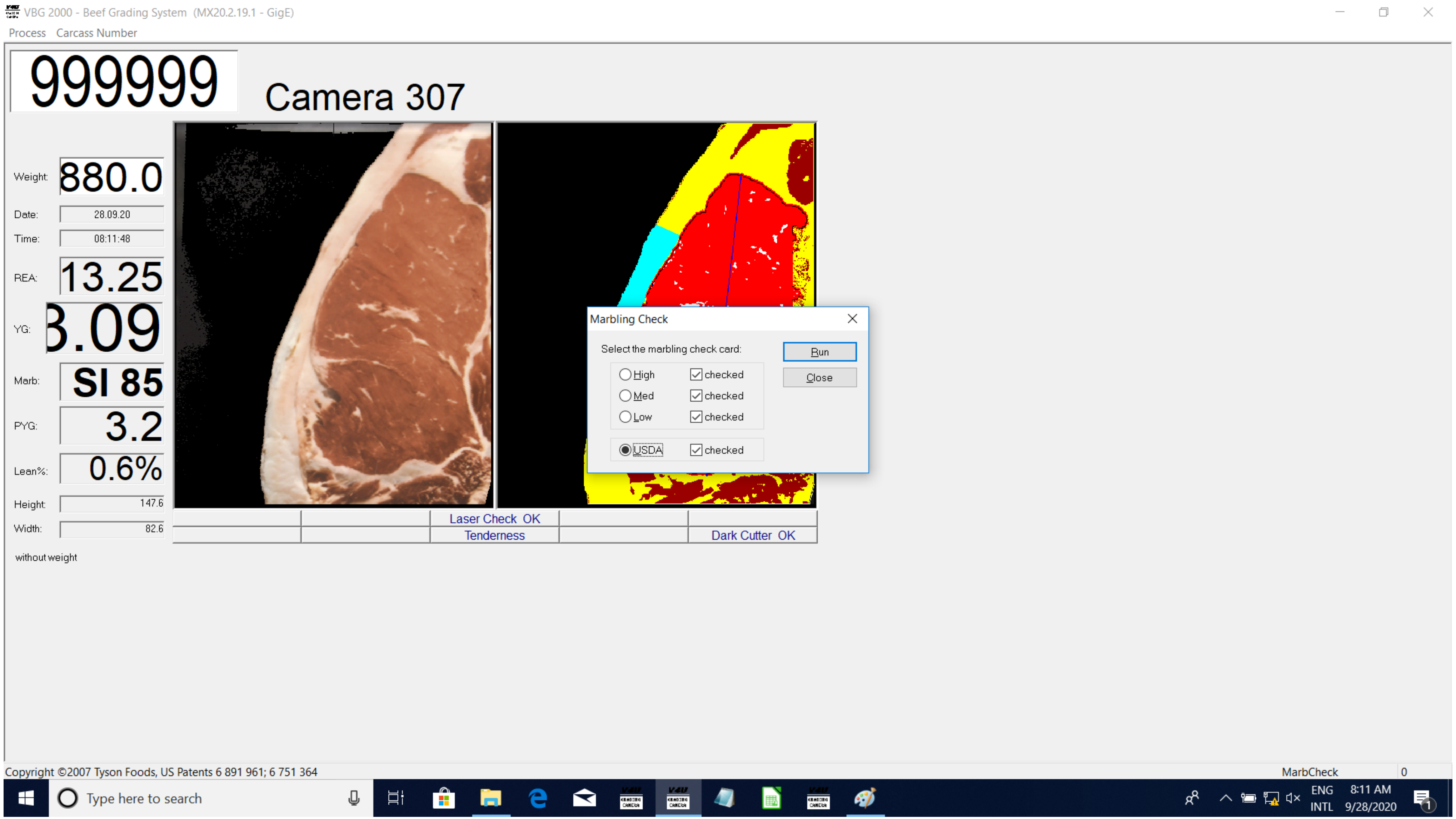
USDA Marbling Check – Medium card



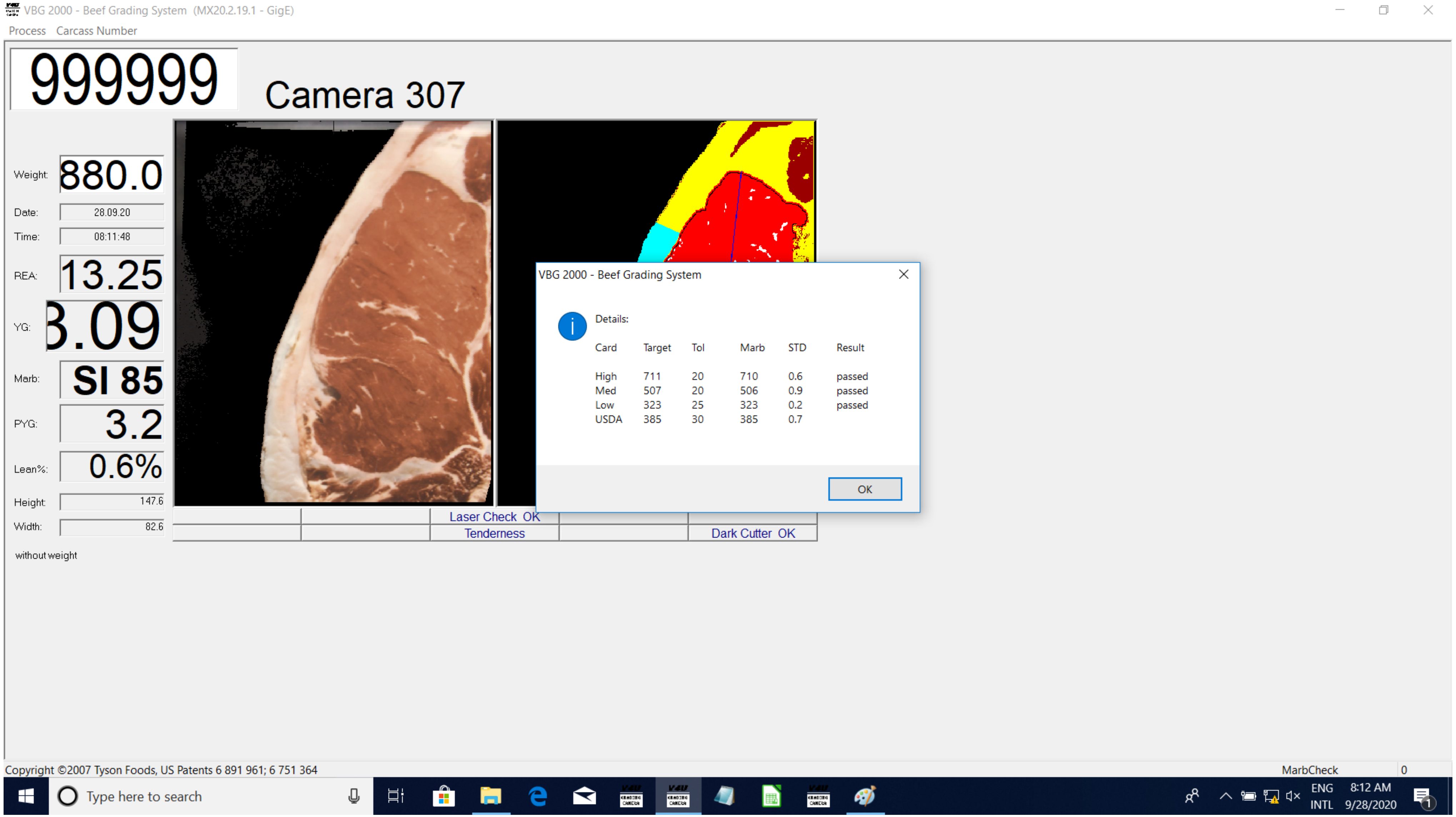
USDA Marbling Check – Low Card



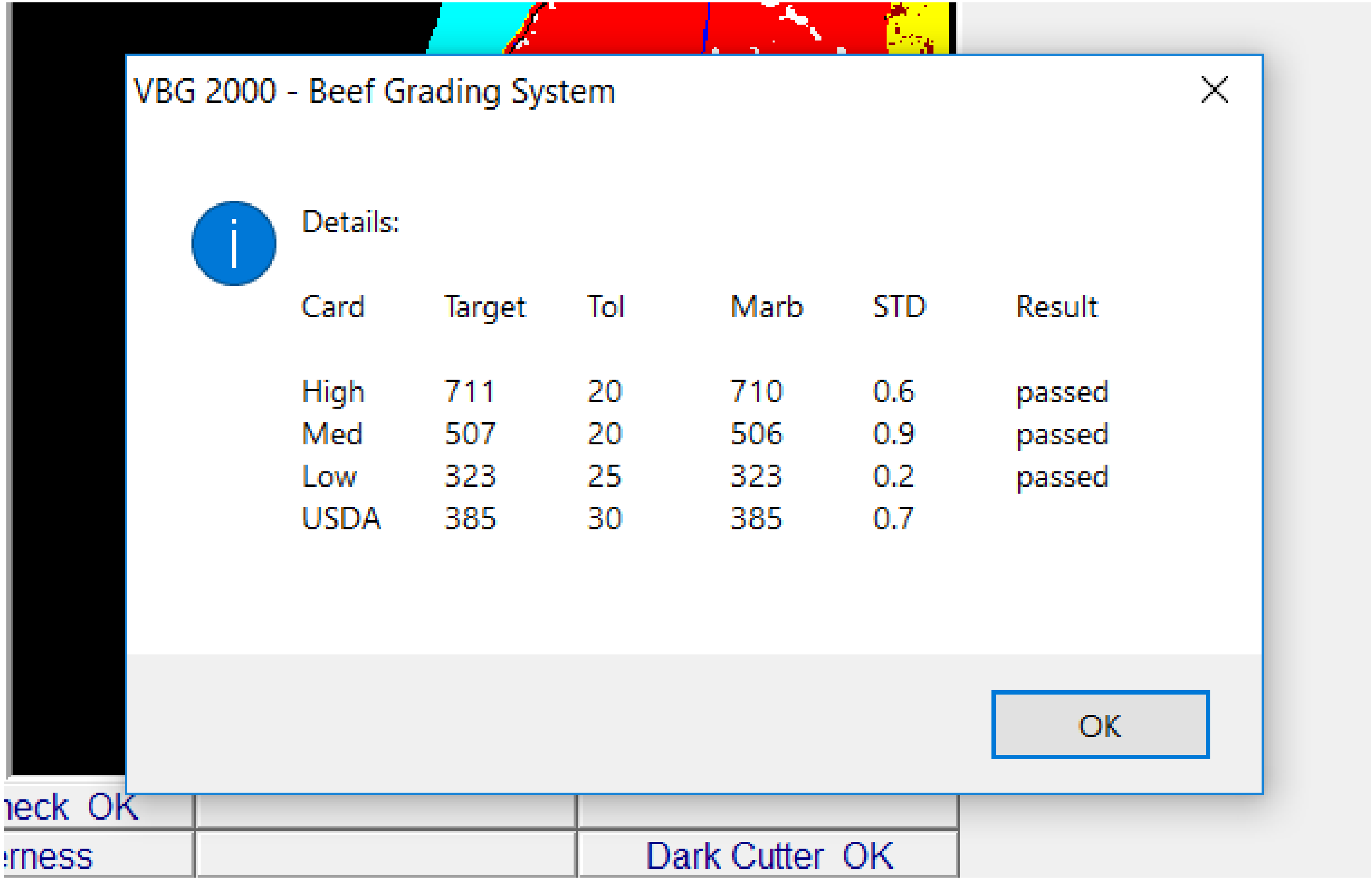
USDA Marbling Check – All Checked



USDA Marbling Check - Statistics



USDA Marbling Check - Results



Card	Target	Tol	Marb	STD	Result
High	711	20	710	0.6	passed
Med	507	20	506	0.9	passed
Low	323	25	323	0.2	passed
USDA	385	30	385	0.7	

Greater Omaha Packing

Washington Grown: Inside a Beef Slaughter Facility

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