

# Slice shear force of various beef muscles

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Koochmaraie, and Tommy Wheeler

USDA, Agriculture Research Service  
U.S. Meat Animal Research Center  
Clay Center, Nebraska

# Thanks

The Beef Check-off

National Cattlemen's Beef Association

Packing industry

Staff of USMARC

[www.usmarc.usda.gov](http://www.usmarc.usda.gov)

then click on Meat Safety & Quality

The screenshot shows the website for the Roman L. Hruska U.S. Meat Animal Research Center (USMARC). At the top, the USDA logo and "United States Department Of Agriculture Agricultural Research Service" are visible. The page title is "U.S. Meat Animal Research Center : Home". A navigation bar includes "ARS Home", "About ARS", "Help", "Contact Us", and "En Español". A search bar is located on the left side, with a dropdown menu for "Browse By Subject" that is open, showing "Meat Safety & Quality" as an option. The main content area features a large green banner with the text "Home" and "Roman L. Hruska U.S. Meat Animal Research Center". Below this banner are three images: a pig in a pen, a sheep, and a cow. To the right of the main content is a sidebar titled "Surplus Livestock Sale Information" with links for "Sheep Sale" and "Cattle Sale".

U.S. Meat Animal Research Center : Home

USDA United States Department Of Agriculture Agricultural Research Service

Northern Plains U.S. Meat Animal Research Center

ARS Home About ARS Help Contact Us En Español

Printable Version E-mail this page

You are here: Home /

Home

Roman L. Hruska U.S. Meat Animal Research Center

Search

Enter Keywords

This site only Go

Advanced Search

Browse By Subject

- Home
- Animal Health
- Environmental Management
- Genetics & Breeding
- Meat Safety & Quality
- Nutrition
- Reproduction

Vacancies

Cattle Heat Stress

Cattle Research

Surplus Livestock Sale Information

- Sheep Sale
- Cattle Sale

Scientists at the Roman L. Hruska U.S. Meat Animal Research Center (USMARC) develop new technology in order to increase the efficiency of livestock production and benefit consumers. The USMARC was authorized by Congress on June 16, 1964, and development began in the spring of 1966 on 35,000 acres near Clay

# MSQRU

Meat Safety & Quality Research : Home

USDA United States Department Of Agriculture  
ARS Agricultural Research Service

Beltsville \ BARC U.S. Meat Animal Rsch. Ctr. Meat Safety & Quality Research

ARS Home About ARS Help Contact Us En Es

Printable Version E-mail th

You are here: Home / Meat Safety & Quality MSQRU Staff MSQRU Protocols

## Home

The primary objectives of the Meat Safety and Quality Research Unit are to reduce the risk of foodborne illness associated with the consumption of red meat, to respond to the research needs of the USDA action and regulatory agencies, to increase efficiency of lean meat production, and to improve eating quality of meat. Pre- and post-harvest food safety research addresses the microbial status of live animals and meat from farm to table using both molecular and standard microbiological techniques. Unique methods are developed and validated as necessary for sampling, isolating and identifying pathogenic and spoilage bacteria. Sources of pathogens and approaches for their control at various stages of livestock and meat production are determined in order to reduce the risk of pathogen contamination of meat, other food products, water, and the environment by meat animals. Approaches include determining mechanisms of pathogen infection, colonization, and shedding by meat animals, development and validation of specific sensitive detection methodologies, and interventions for control of pathogens in meat products, meat animals and the production environment. Meat quality research is directed toward identification of areas of the genome that regulate carcass composition and meat quality, the development of methodologies to classify carcasses based on meat quality traits and lean meat yield, the effect of breed on carcass composition and meat quality, and the development of strategies to optimize meat quality, especially tenderness.

### Current Projects:

- Meat Safety Publications
- Meat Quality Publications
- Meat Safety & Quality
  - MSQRU Staff
  - MSQRU Protocols
- Animal Health
- Genetics & Breeding
- Nutrition
- Reproduction
- About Us
- Research
- Products & Services
- People & Places

# MSQRU – scroll down to protocols

## Meat Quality

### Protocols

[Slice Shear Force Protocol For Large Volume](#)

[Slice Shear Force Protocol For Small Volume](#)

[Warner-Bratzler Shear Force Protocol](#)

[SSF Movie](#) requires [Apple Quicktime](#)

[Slice Shear Force Protocol For Adductor](#)

[Slice Shear Force Protocol For Biceps femoris](#)

[Slice Shear Force Protocol For Biceps femoris Ischiatic head](#)

[Slice Shear Force Protocol For Deep pectoral](#)

[Slice Shear Force Protocol For Gluteus medius](#)

[Slice Shear Force Protocol For Gracilis](#)

[Slice Shear Force Protocol For Infraspinatus](#)

[Slice Shear Force Protocol For Latissimus dorsi](#)

# MSQRU – keep scrolling

[Slice Shear Force Protocol For Latissimus dorsi](#)

[Slice Shear Force Protocol For Psoas major](#)

[Slice Shear Force Protocol For Rectus femoris](#)

[Slice Shear Force Protocol For Sartorius](#)

[Slice Shear Force Protocol For Semimembranosus](#)

[Slice Shear Force Protocol For Supraspinatus](#)

[Slice Shear Force Protocol For Semitendinosus](#)

[Slice Shear Force Protocol For Triceps brachii](#)

[Slice Shear Force Protocol For Tensor fasciae latae](#)

[Slice Shear Force Protocol For Teres major](#)

[Slice Shear Force Protocol For Trapezius](#)

[Slice Shear Force Protocol For Vastus intermedius](#)

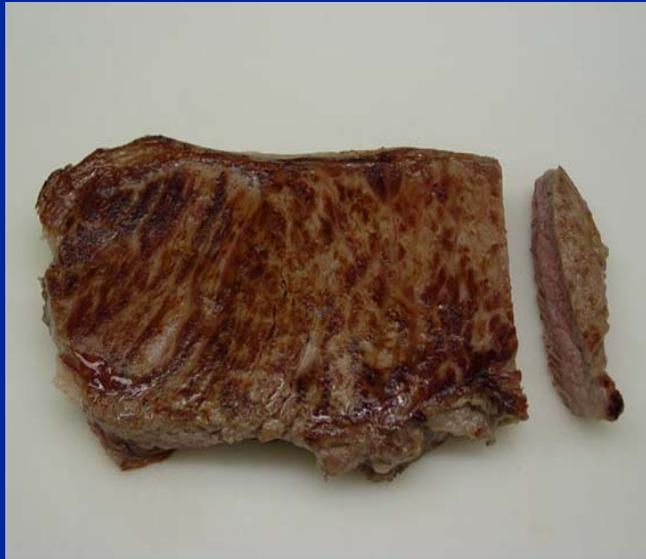
[Slice Shear Force Protocol For Vastus lateralis](#)

[Slice Shear Force Protocol For Vastus medialis](#)

[MFI](#)

# Obtaining 1 cm-thick, 5 cm-long slice

1



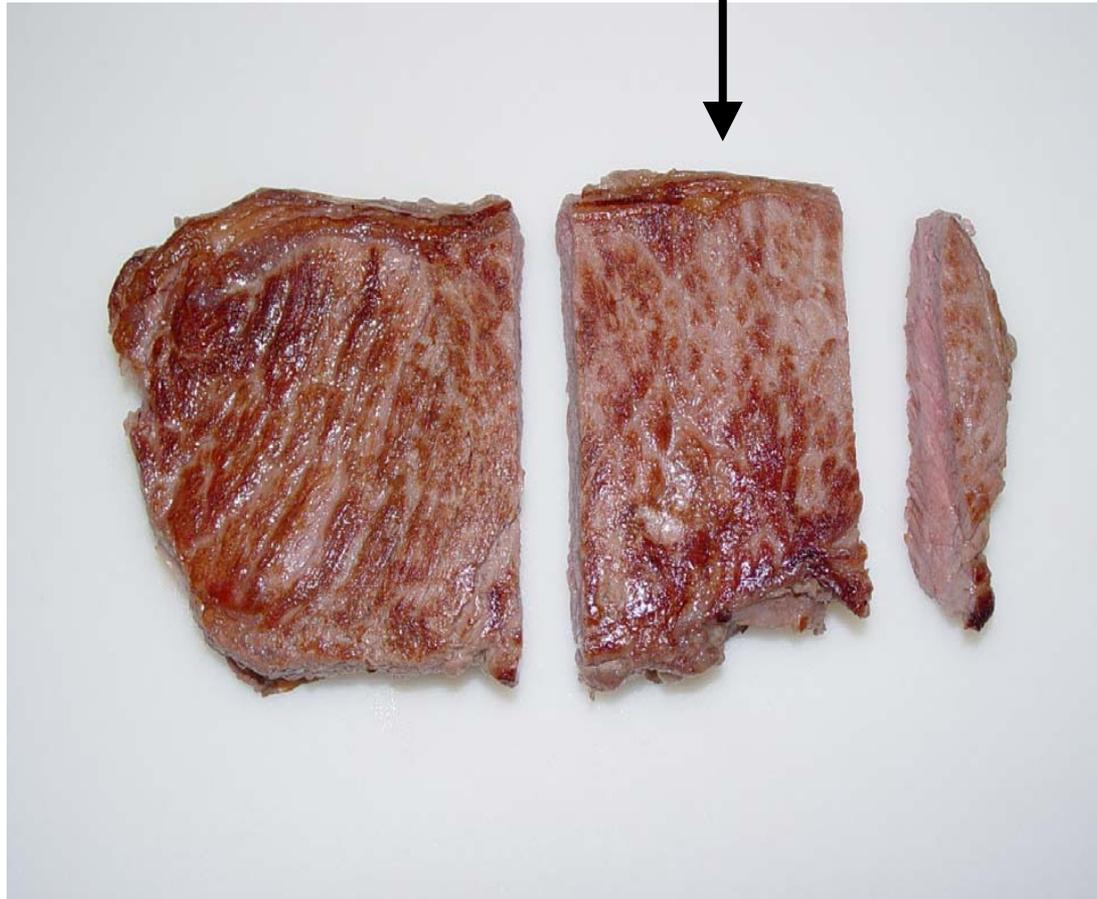
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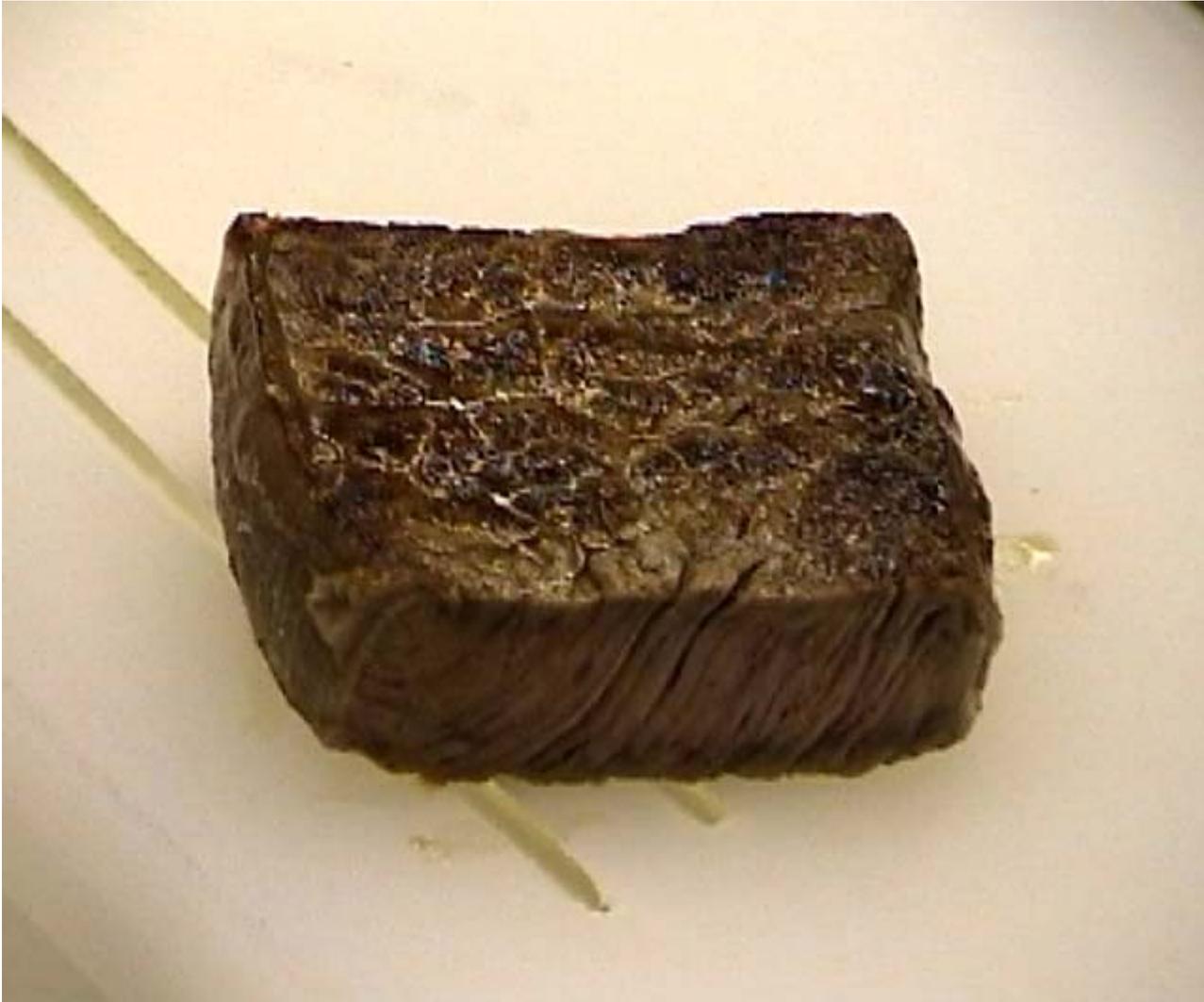
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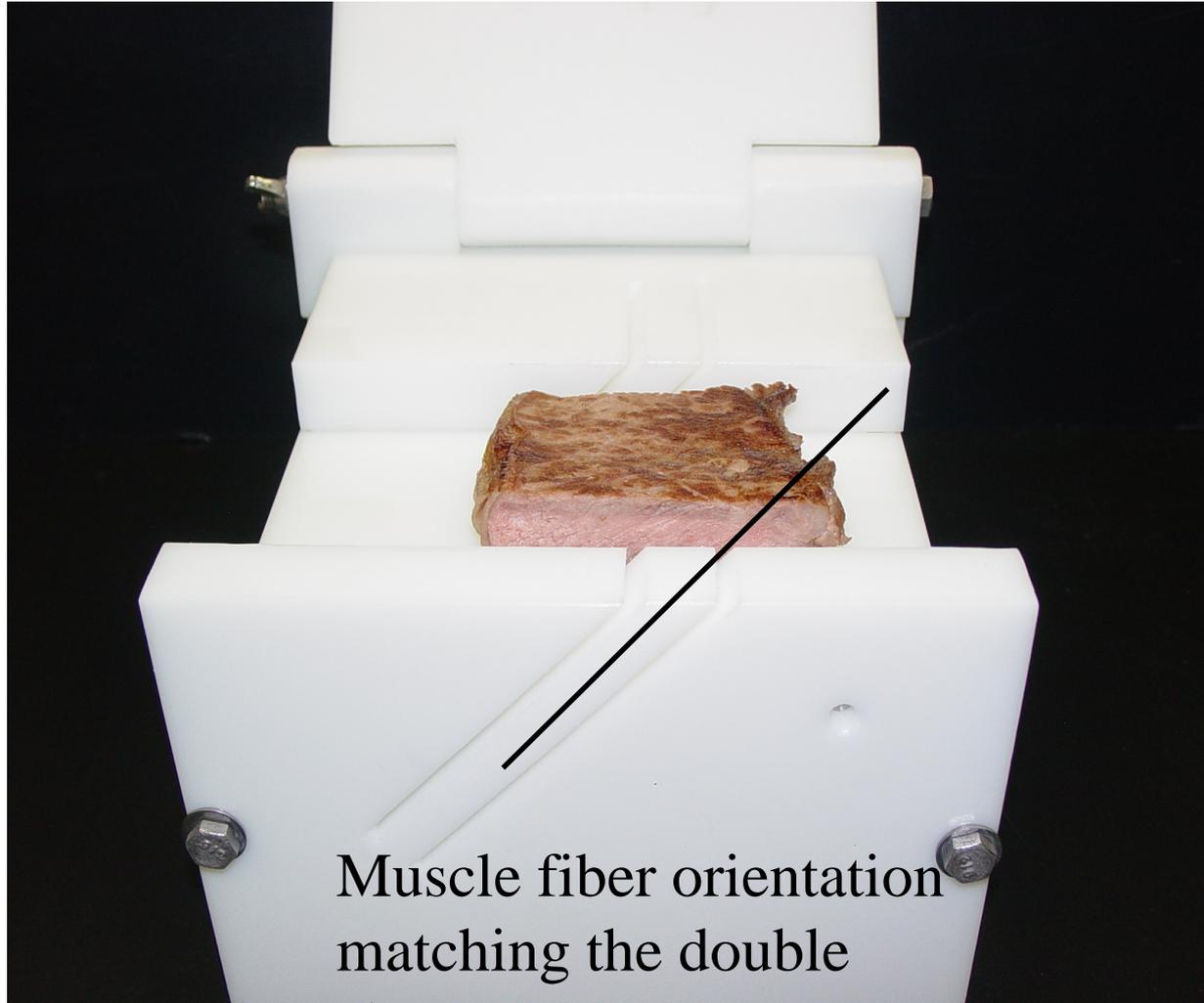
5-cm section



5-cm section with  $45^\circ$  fiber angle

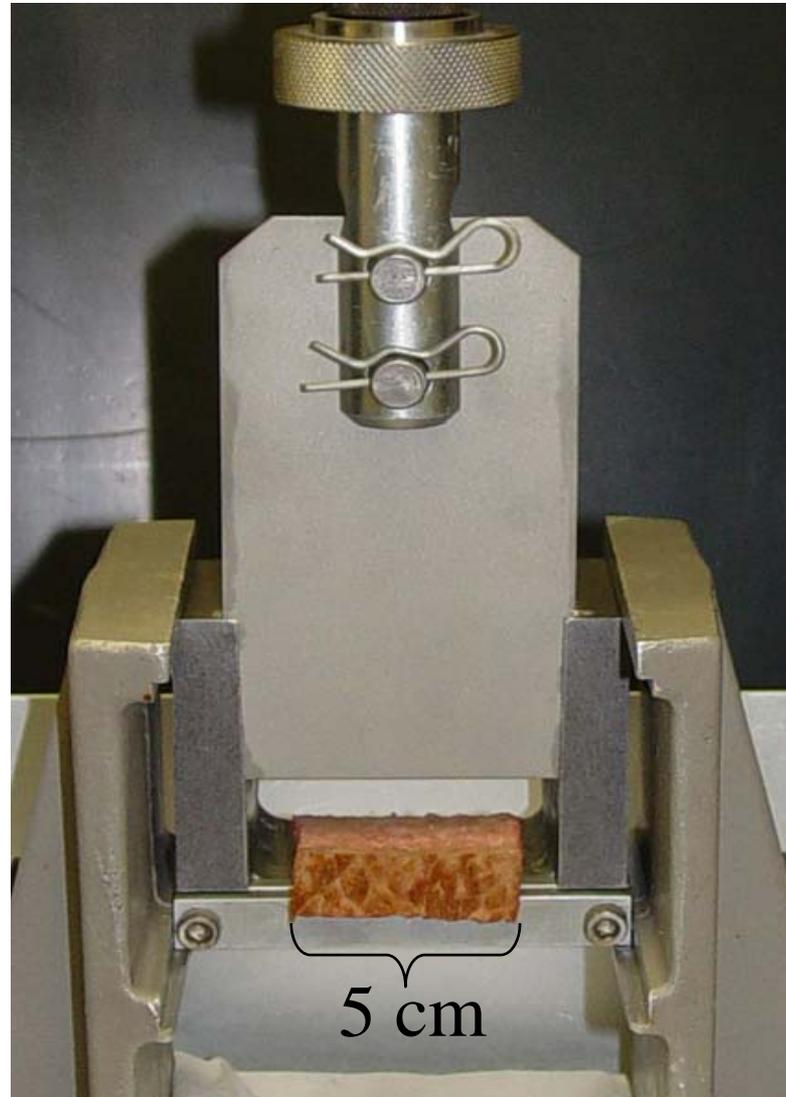
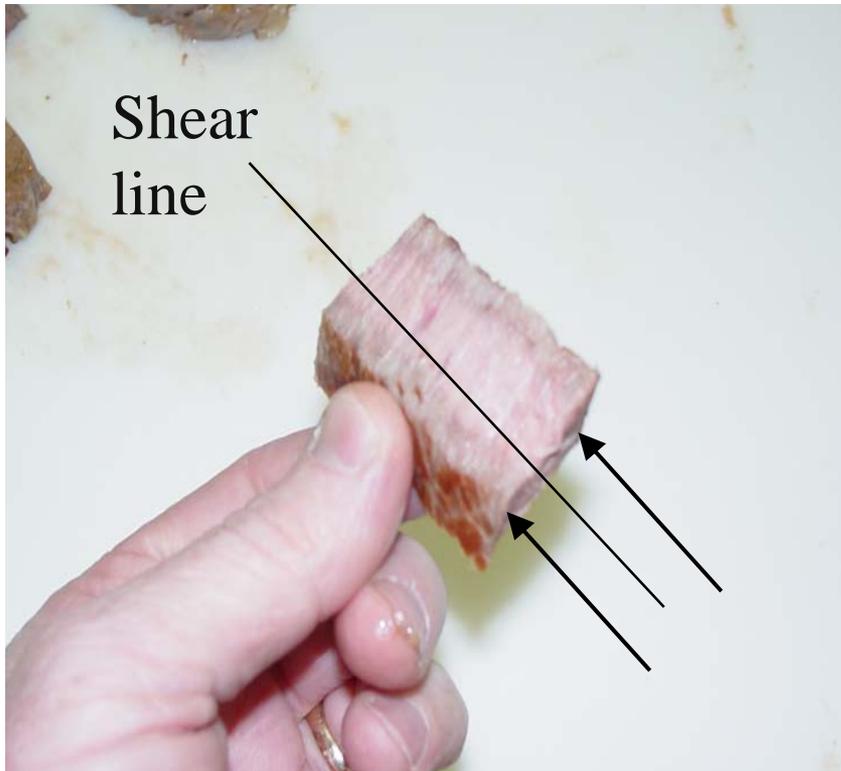


# Muscle fiber orientation in slice box



Muscle fiber orientation  
matching the double  
slots.

# Slice positioned in testing machine



# NCBA SSF fact sheet

## Slice shear force

S. D. Shackelford and T. L. Wheeler  
USDA-ARS U.S. Meat Animal Research Center, Clay Center, NE

### Introduction

Meat scientists rely on a variety of methods to assess eating quality. These include consumer studies, trained descriptive attribute panels, Warner-Brother shear force, and slice shear force.

# Coming soon!

# NCBA SSF fact sheet

Species	Muscle	Steak (chop) orientation <sup>a</sup>	Number of steaks (chops) per sample	Section length (cm) <sup>b</sup>	Maximum number of 5-cm-long sections per steak <sup>c</sup>	Slice box <sup>d</sup>	Maximum number of slices per section <sup>e</sup>	Maximum number of slices per sample
Beef	Longissimus	Muscle	1	5	1	45°	1	1
Pork	Longissimus	Muscle	2 <sup>f</sup>	5	1	45°	1	2
Lamb	Longissimus	Muscle	2 <sup>g</sup>	2.5 <sup>g</sup>	----	45°	1	1 (2 × 2.5) <sup>g</sup>
Beef	Gluteus medius	Muscle	1	5	3	45°	1	3
Beef	Triceps brachii	Muscle	1	5	2	45°	1	2
Beef	Biceps femoris	Muscle	1	5	1	45°	3	3
Beef	ischiatric head of BF	Fiber	1	5	2	90°	3	6
Beef	Semimembranosus	Muscle	1	5	2	90°	3	6
Lamb	Semimembranosus	Muscle	1	5	1	90°	3	3
Beef	Psoas major	Muscle	1	5	1	90°	2	2
Beef	Semitendinosus	Muscle	1	5	1	90°	3	6
Beef	Deep pectoral	Fiber	1	5	3	90°	1	3
Beef	Gracilis	Fiber	1	5	3	90°	1	3
Beef	Latisissimus dorsi	Fiber	1	5	2	90°	1	2
Beef	Tensor fasciae latae	Fiber	1	5	2	90°	1	2
Beef	Trapezius	Fiber	1	5	1	90°	1	1
Beef	Teres major	Muscle	2 <sup>g</sup>	2.5 <sup>g</sup>	----	90°	1	1 (2 × 2.5) <sup>g</sup>
Beef	Adductor	Muscle	1	5	1	90°	3	3
Beef	Rectus femoris	Muscle	1	5	1	45°	2	2
Beef	Vastus lateralis	Fiber	1	5	2	90°	3	6
Beef	Vastus medialis	Fiber	1	5	1	90°	1	1
Beef	Vastus intermedius	Muscle	1	5	1	90°	1	1
Beef	Spinalis dorsi	Longissimus	1	5	1	90°	1	1
Beef	Supraspinatus	Muscle	1	5	1	45°	2	2
Beef	Sartorius	Muscle	2 <sup>g</sup>	2.5 <sup>g</sup>	----	90°	1	1 (2 × 2.5) <sup>g</sup>
Beef	Infraspinatus <sup>h</sup>	Muscle	1	5	1	90°	2	2

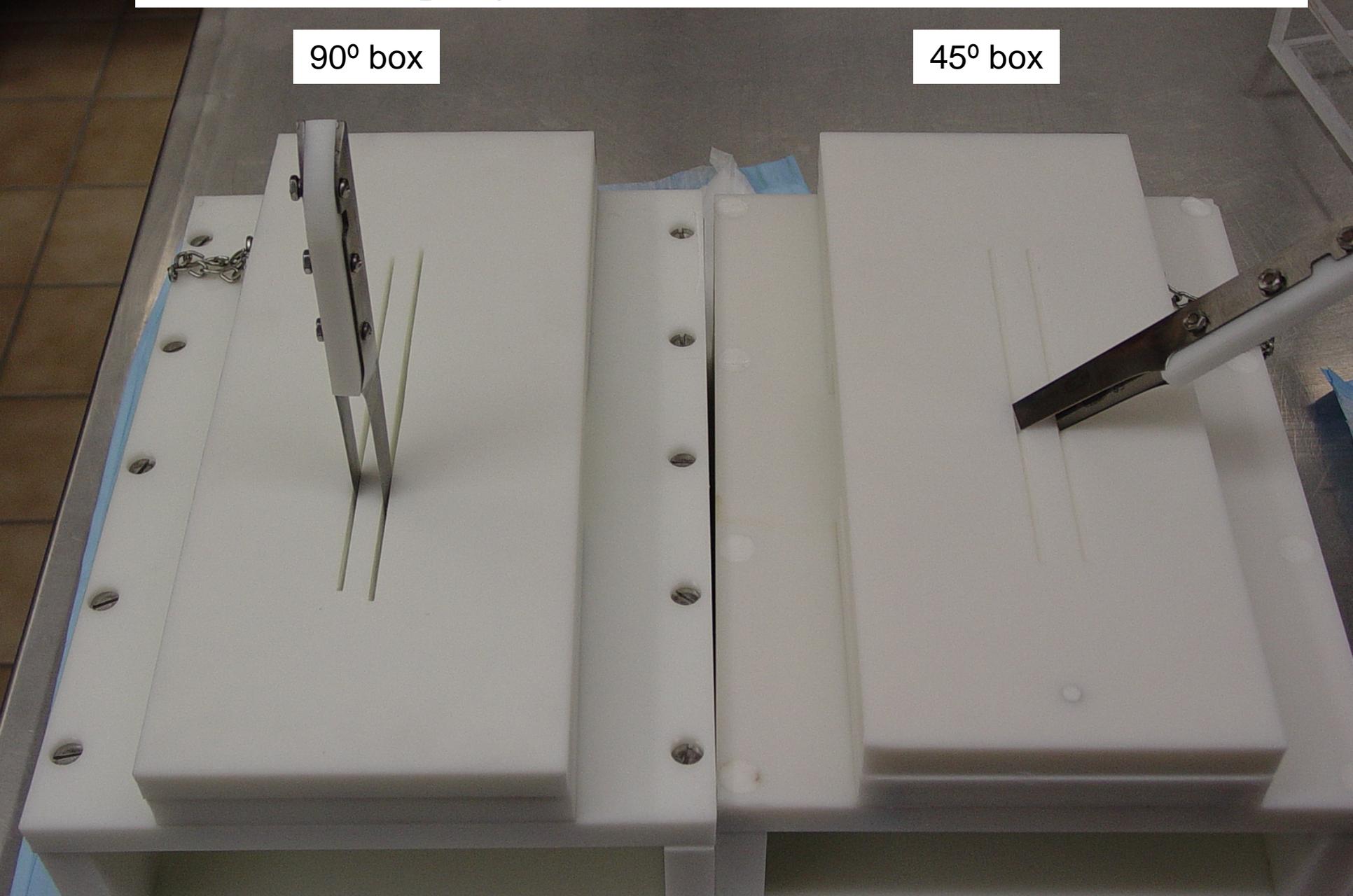
# USMARC Slice Shear Force Procedure for Beef Semimembranosus (SM)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of SM is conducted with the 90° box

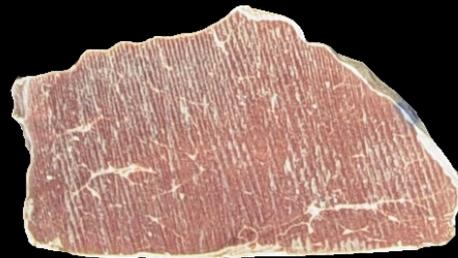
90° box

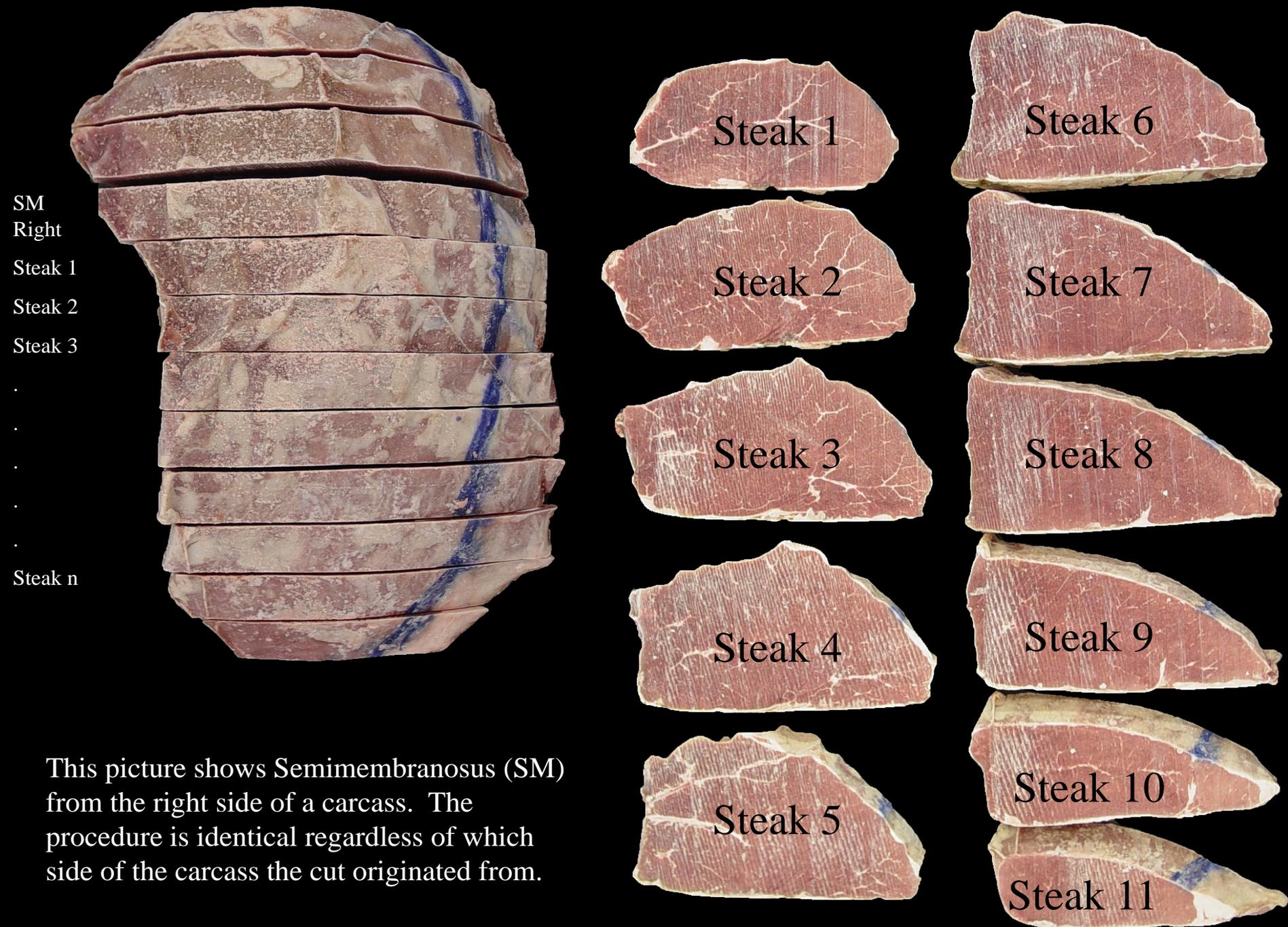
45° box

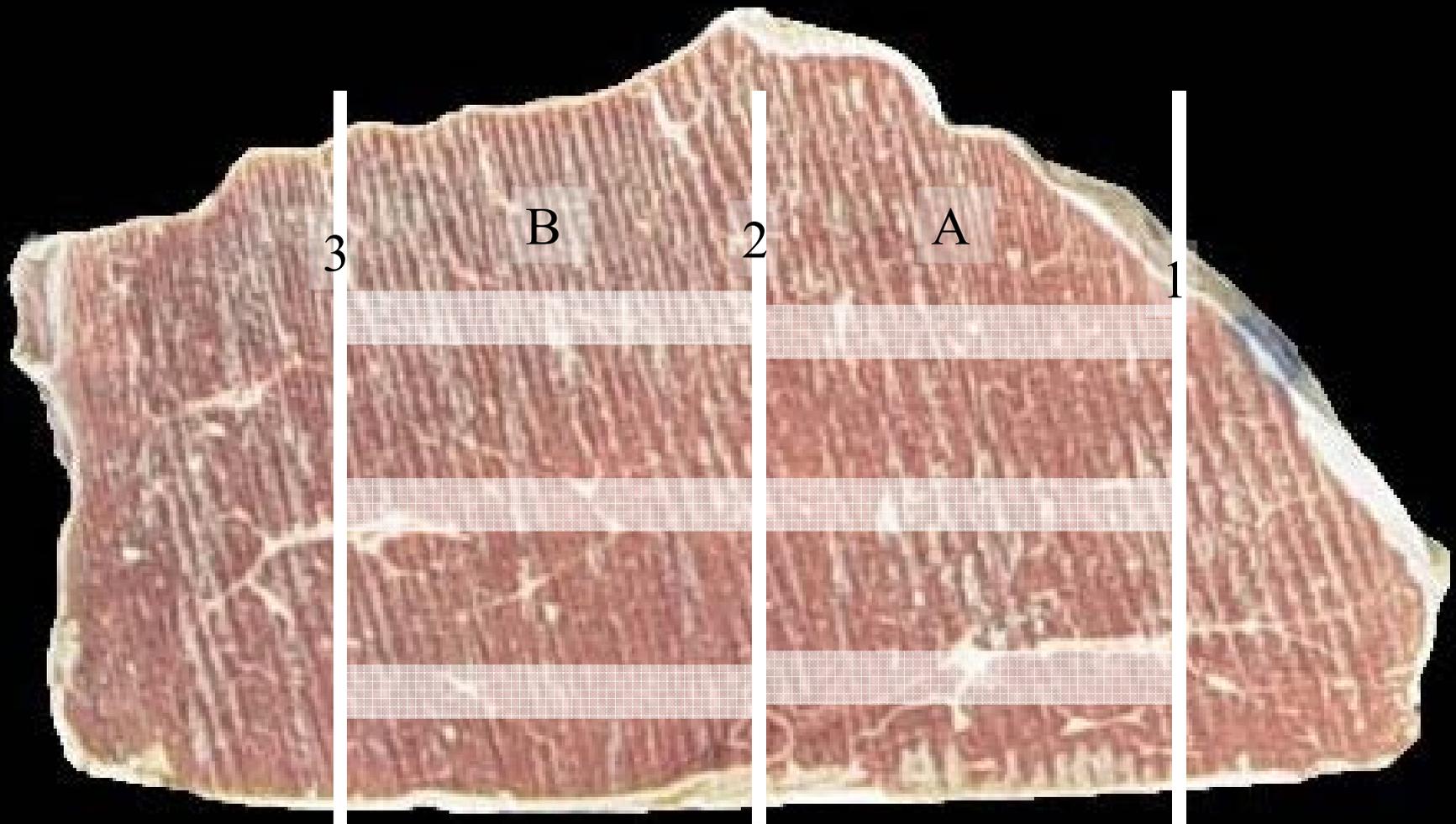


On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

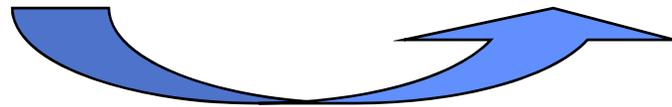
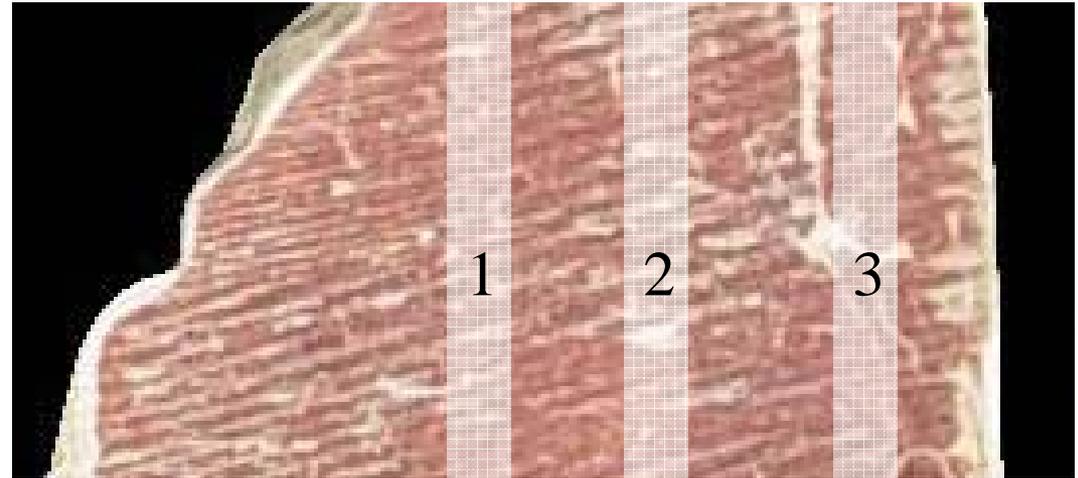
SM  
Right  
Steak 1  
Steak 2  
Steak 3  
.  
.  
.  
Steak n



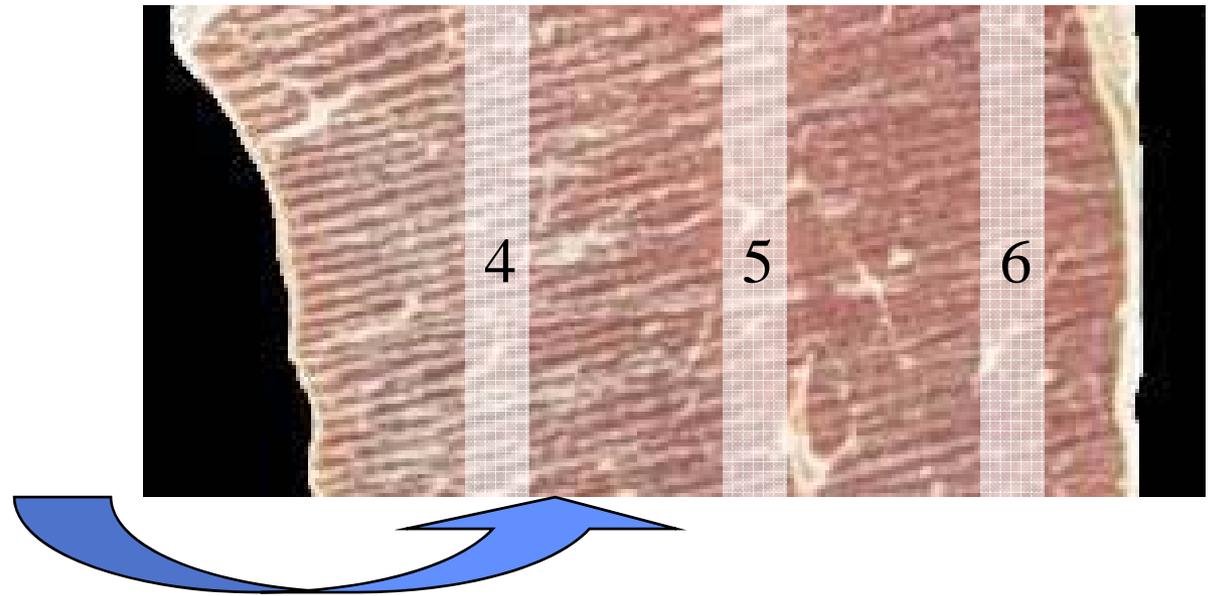




Orient the steak with the blue mark at the top right. Identify the best 10 cm for sampling columns A (5 cm) and B (5 cm) . If the steak is really small, then just take one column. If you cannot get three slices per section, then get two.



Make cuts 1 and 2 and rotate the piece **counter clockwise** and place in the 90 degree box. Obtain the 1<sup>st</sup> slice near the top (now on the left) of the section. Obtain the 2<sup>nd</sup> slice in the center and the 3<sup>rd</sup> slice near the bottom (now on the right). Space the slices approximately equally.



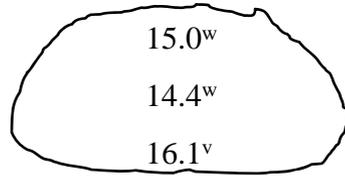
Make cuts 3 and 4 and rotate the piece **counter clockwise** and place in the 90 degree box. Obtain the 4<sup>th</sup> slice near the top (now on the left) of the section. Obtain the 5<sup>th</sup> slice in the center and the 6<sup>th</sup> slice near the bottom (now on the right). Space the slices approximately equally.

# Sample data sheet for SM SSF

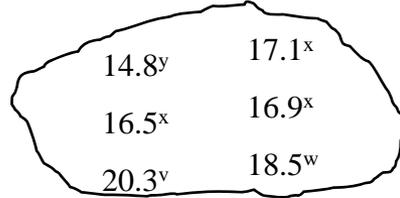
Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2001	01_SM	011_Right_Top	90°			15
07/01/2009	2001	01_SM	012_Right_Center	90°			15
07/01/2009	2001	01_SM	013_Right_Bottom	90°			15
07/01/2009	2001	01_SM	014_Left_Top	90°			15
07/01/2009	2001	01_SM	015_Left_Center	90°			15
07/01/2009	2001	01_SM	016_Left_Bottom	90°			15
07/01/2009	2002	01_SM	011_Right_Top	90°			15
07/01/2009	2002	01_SM	012_Right_Center	90°			15
07/01/2009	2002	01_SM	013_Right_Bottom	90°			15
07/01/2009	2002	01_SM	014_Left_Top	90°			15
07/01/2009	2002	01_SM	015_Left_Center	90°			15
07/01/2009	2002	01_SM	016_Left_Bottom	90°			15
07/01/2009	2003	01_SM	011_Right_Top	90°			15
07/01/2009	2003	01_SM	012_Right_Center	90°			15
07/01/2009	2003	01_SM	013_Right_Bottom	90°			15
07/01/2009	2003	01_SM	014_Left_Top	90°			15
07/01/2009	2003	01_SM	015_Left_Center	90°			15
07/01/2009	2003	01_SM	016_Left_Bottom	90°			15
07/01/2009	2004	01_SM	011_Right_Top	90°			15
07/01/2009	2004	01_SM	012_Right_Center	90°			15
07/01/2009	2004	01_SM	013_Right_Bottom	90°			15
07/01/2009	2004	01_SM	014_Left_Top	90°			15
07/01/2009	2004	01_SM	015_Left_Center	90°			15
07/01/2009	2004	01_SM	016_Left_Bottom	90°			15
07/01/2009	2005	01_SM	011_Right_Top	90°			15
07/01/2009	2005	01_SM	012_Right_Center	90°			15
07/01/2009	2005	01_SM	013_Right_Bottom	90°			15
07/01/2009	2005	01_SM	014_Left_Top	90°			15
07/01/2009	2005	01_SM	015_Left_Center	90°			15
07/01/2009	2005	01_SM	016_Left_Bottom	90°			15

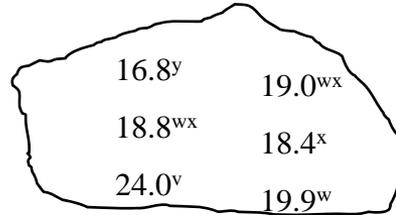
Steak 1=15.2<sup>g</sup>



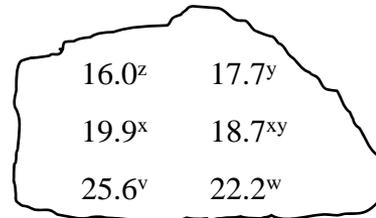
Steak 2=17.3<sup>f</sup>



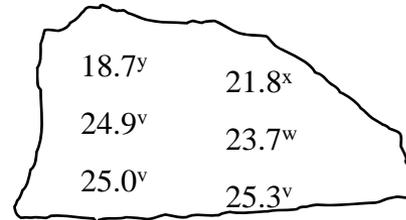
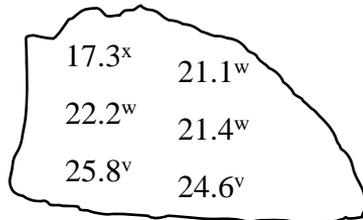
Steak 3=19.5<sup>e</sup>



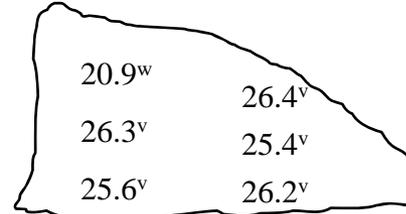
Steak 4=20.0<sup>e</sup>



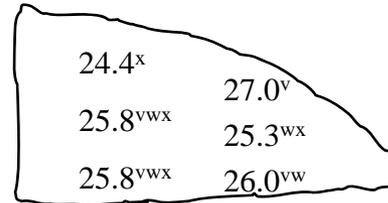
Steak 5=22.1<sup>d</sup>



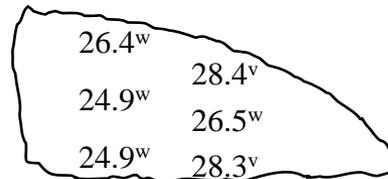
Steak 6=23.2<sup>c</sup>



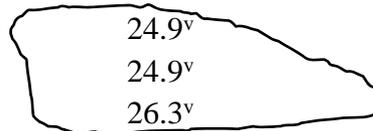
Steak 7=25.1<sup>b</sup>



Steak 8=25.7<sup>ab</sup>



Steak 9=26.5<sup>a</sup>



Steak 10=25.5<sup>b</sup>

# NCBA SSF fact sheet

Species	Muscle	Steak (chop) orientation <sup>a</sup>	Number of steaks (chops) per sample	Section length (cm) <sup>b</sup>	Maximum number of 5-cm-long sections per steak <sup>c</sup>	Slice box <sup>d</sup>	Maximum number of slices per section <sup>e</sup>	Maximum number of slices per sample
Beef	Longissimus	Muscle	1	5	1	45°	1	1
Pork	Longissimus	Muscle	2 <sup>f</sup>	5	1	45°	1	2
Lamb	Longissimus	Muscle	2 <sup>g</sup>	2.5 <sup>g</sup>	----	45°	1	1 (2 × 2.5) <sup>g</sup>
Beef	Gluteus medius	Muscle	1	5	3	45°	1	3
Beef	Triceps brachii	Muscle	1	5	2	45°	1	2
Beef	Biceps femoris	Muscle	1	5	1	45°	3	3
Beef	ischiatric head of BF	Fiber	1	5	2	90°	3	6
Beef	Semimembranosus	Muscle	1	5	2	90°	3	6
Beef	Semimembranosus	Muscle	1	5	1	90°	3	3
Beef	Deep pectoral	Fiber	1	5	3	90°	1	3
Beef	Gracilis	Fiber	1	5	3	90°	1	3
Beef	Latisissimus dorsi	Fiber	1	5	2	90°	1	2
Beef	Tensor fasciae latae	Fiber	1	5	2	90°	1	2
Beef	Trapezius	Fiber	1	5	1	90°	1	1
Beef	Teres major	Muscle	2 <sup>g</sup>	2.5 <sup>g</sup>	----	90°	1	1 (2 × 2.5) <sup>g</sup>
Beef	Adductor	Muscle	1	5	1	90°	3	3
Beef	Rectus femoris	Muscle	1	5	1	45°	2	2
Beef	Vastus lateralis	Fiber	1	5	2	90°	3	6
Beef	Vastus medialis	Fiber	1	5	1	90°	1	1
Beef	Vastus intermedius	Muscle	1	5	1	90°	1	1
Beef	Spinalis dorsi	Longissimus	1	5	1	90°	1	1
Beef	Supraspinatus	Muscle	1	5	1	45°	2	2
Beef	Sartorius	Muscle	2 <sup>g</sup>	2.5 <sup>g</sup>	----	90°	1	1 (2 × 2.5) <sup>g</sup>
Beef	Infraspinatus <sup>h</sup>	Muscle	1	5	1	90°	2	2

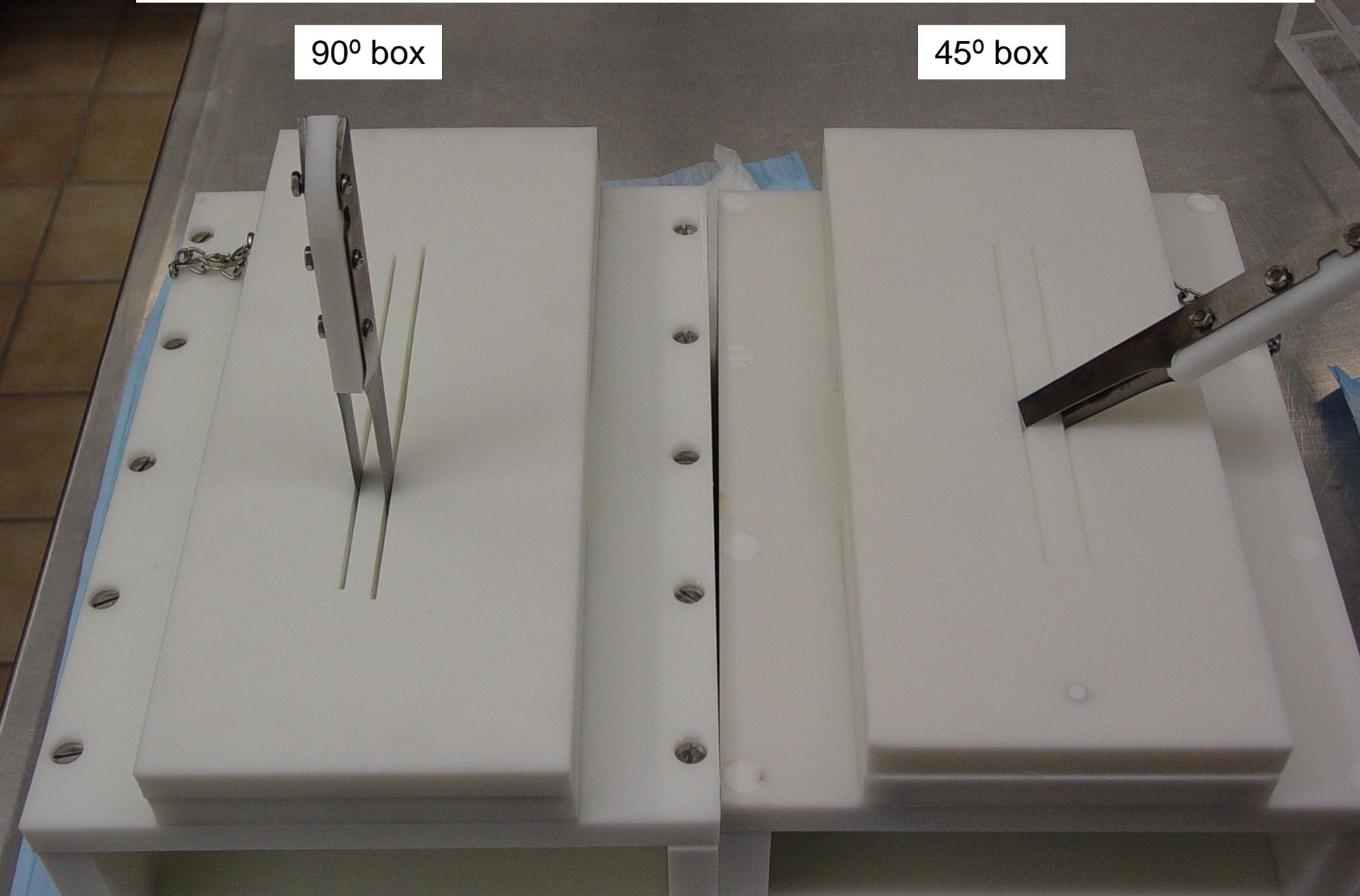
USMARC Slice Shear Force  
Procedure for Beef  
Biceps femoris long head (BF)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of BF is conducted with the 45° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# Biceps femoris – Left

Proximal

BF

Left

Steak 1

Steak 2

Steak 3

•

•

•

•

•

Steak n

Distal



*Silver skin side*

Steak 01

Steak 02

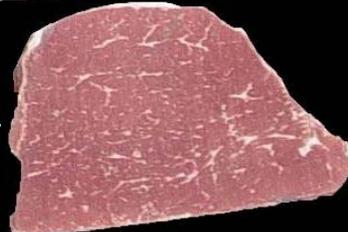
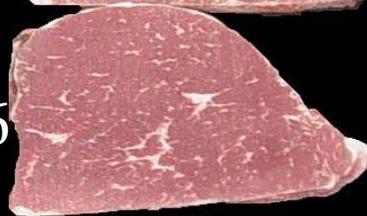
Steak 03

Steak 04

Steak 05

Steak 06

Steak 07



Steak 08

Steak 09

Steak 10

Steak 11

Steak 12

Steak 13

Steak 14



# Biceps femoris – Right

Proximal

BF

Right

Steak 1

Steak 2

Steak 3

•

•

•

•

•

•

•

Steak n

Silver skin side

Distal

Steak 01

Steak 02

Steak 03

Steak 04

Steak 05

Steak 06

Steak 07

Steak 08

Steak 09

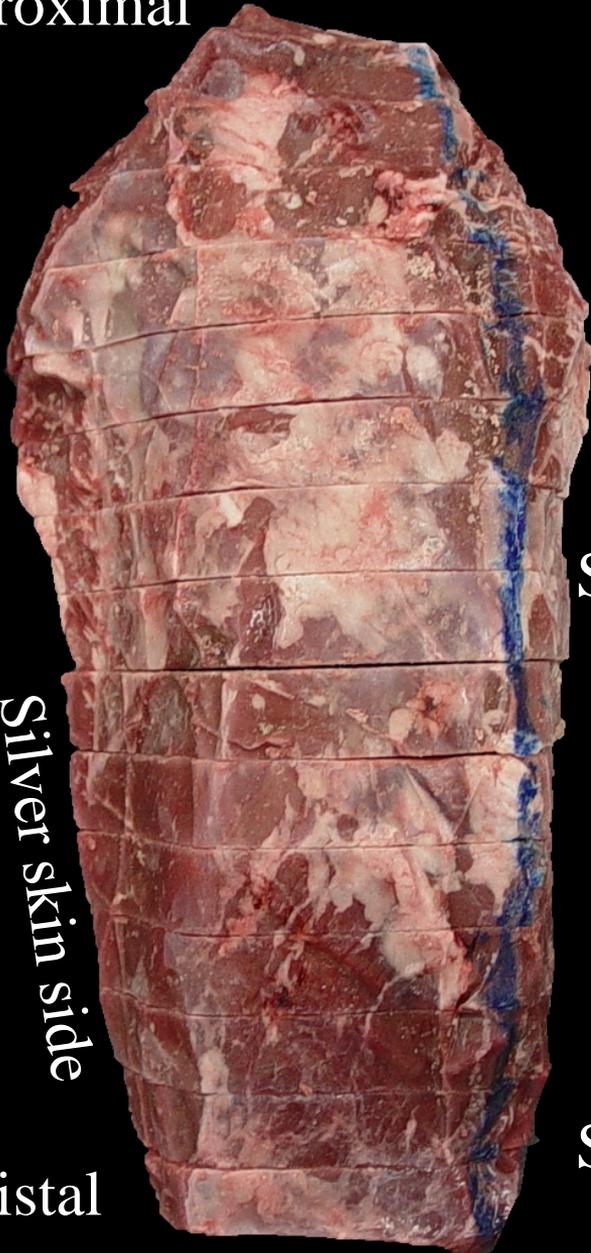
Steak 10

Steak 11

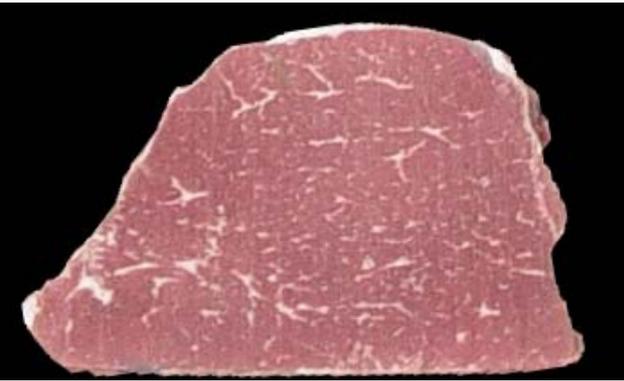
Steak 12

Steak 13

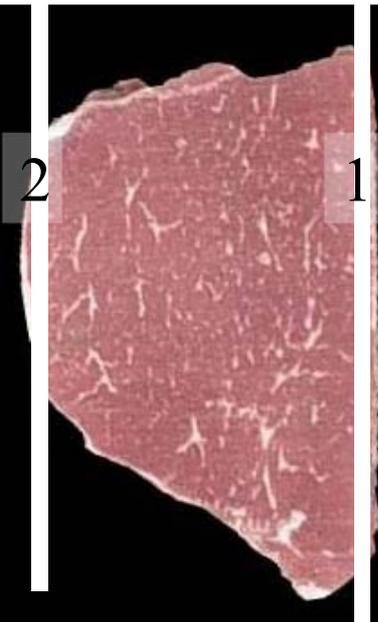
Steak 14



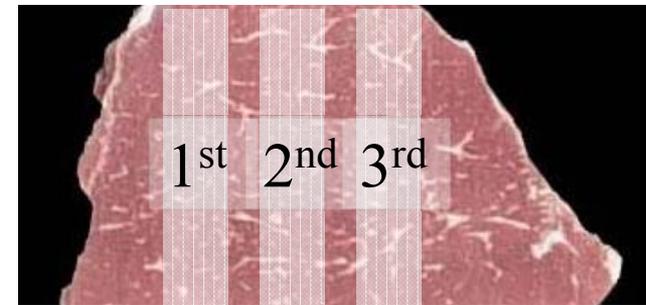
# Biceps femoris LEFT



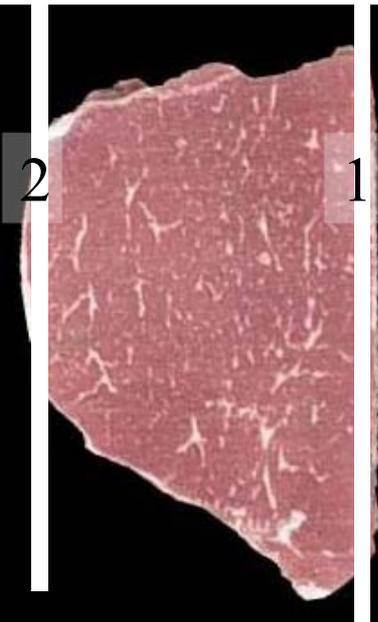
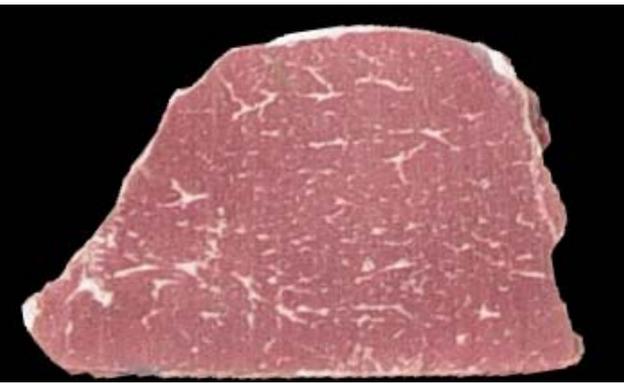
Orient the steak with the blue mark at the top right. Rotate the steak **counter clockwise** and make cut 1. Place in 5 cm box and make cut 2. Rotate the piece **counter clockwise** and then **flip it over** and place it in the 45 degree box. Obtain the 1<sup>st</sup> slice near the right side (now on the left) of the section. Obtain the 2<sup>nd</sup> slice near the center. Obtain the 3<sup>rd</sup> slice near the left (now on the right). Space the slices approximately equally.



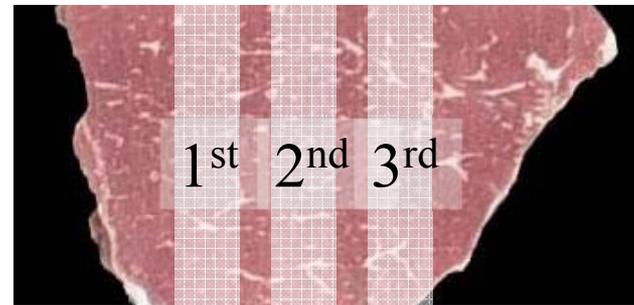
Flip  
it  
over



# Biceps femoris RIGHT



Orient the steak with the blue mark at the top right. Rotate the steak **counter clockwise** and make cut 1. Place in 5 cm box and make cut 2. Rotate the piece **counter clockwise** and place in the 45 degree box. Obtain the 1<sup>st</sup> slice near the right side (now on the left) of the section. Obtain the 2<sup>nd</sup> slice near the center. Obtain the 3<sup>rd</sup> slice near the left (now on the right). Space the slices approximately equally.



# Sample data sheet for BF SSF

Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2001	02_BF	021_Right	45°			15
07/01/2009	2001	02_BF	022_Center	45°			15
07/01/2009	2001	02_BF	023_Left	45°			15
07/01/2009	2002	02_BF	021_Right	45°			15
07/01/2009	2002	02_BF	022_Center	45°			15
07/01/2009	2002	02_BF	023_Left	45°			15
07/01/2009	2003	02_BF	021_Right	45°			15
07/01/2009	2003	02_BF	022_Center	45°			15
07/01/2009	2003	02_BF	023_Left	45°			15
07/01/2009	2004	02_BF	021_Right	45°			15
07/01/2009	2004	02_BF	022_Center	45°			15
07/01/2009	2004	02_BF	023_Left	45°			15
07/01/2009	2005	02_BF	021_Right	45°			15
07/01/2009	2005	02_BF	022_Center	45°			15
07/01/2009	2005	02_BF	023_Left	45°			15
07/01/2009	2006	02_BF	021_Right	45°			15
07/01/2009	2006	02_BF	022_Center	45°			15
07/01/2009	2006	02_BF	023_Left	45°			15
07/01/2009	2007	02_BF	021_Right	45°			15
07/01/2009	2007	02_BF	022_Center	45°			15
07/01/2009	2007	02_BF	023_Left	45°			15
07/01/2009	2008	02_BF	021_Right	45°			15
07/01/2009	2008	02_BF	022_Center	45°			15
07/01/2009	2008	02_BF	023_Left	45°			15
07/01/2009	2009	02_BF	021_Right	45°			15
07/01/2009	2009	02_BF	022_Center	45°			15
07/01/2009	2009	02_BF	023_Left	45°			15
07/01/2009	2010	02_BF	021_Right	45°			15
07/01/2009	2010	02_BF	022_Center	45°			15
07/01/2009	2010	02_BF	023_Left	45°			15

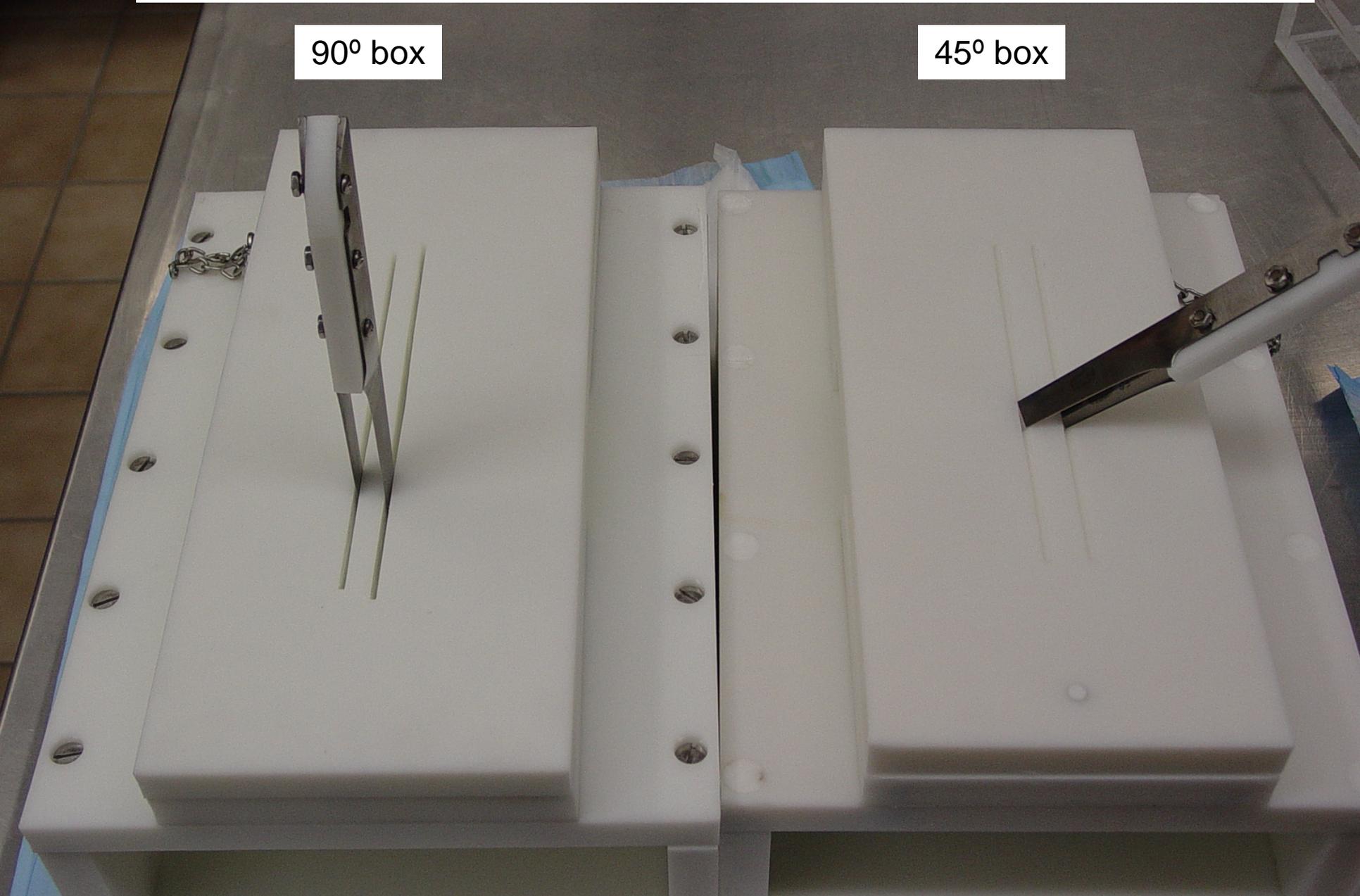
# USMARC Slice Shear Force Procedure for Beef Gluteus medius (GM)

- This project was funded, in part, by The Beef Checkoff.

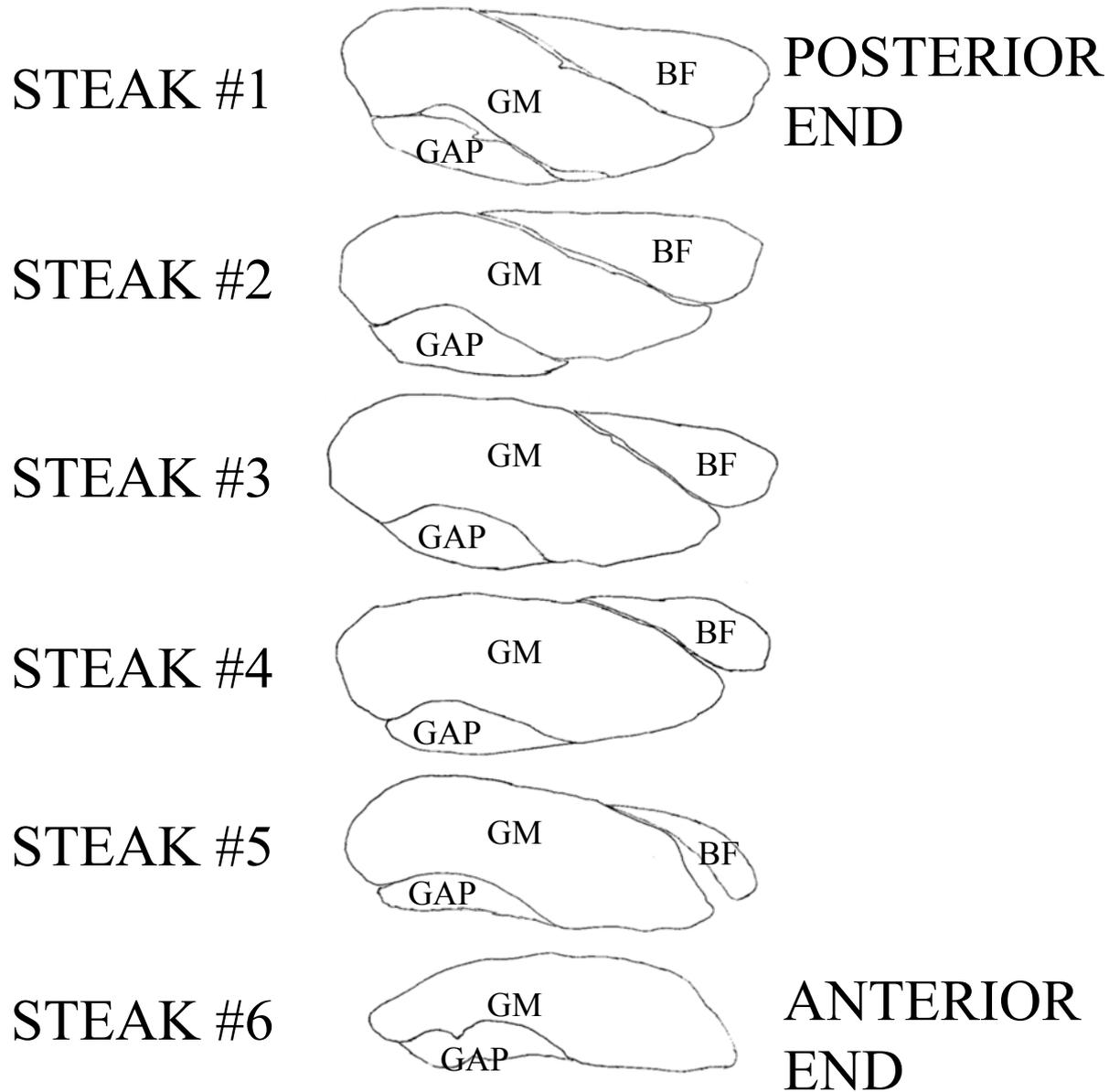
SSF sampling of GM is conducted with the 45° box

90° box

45° box

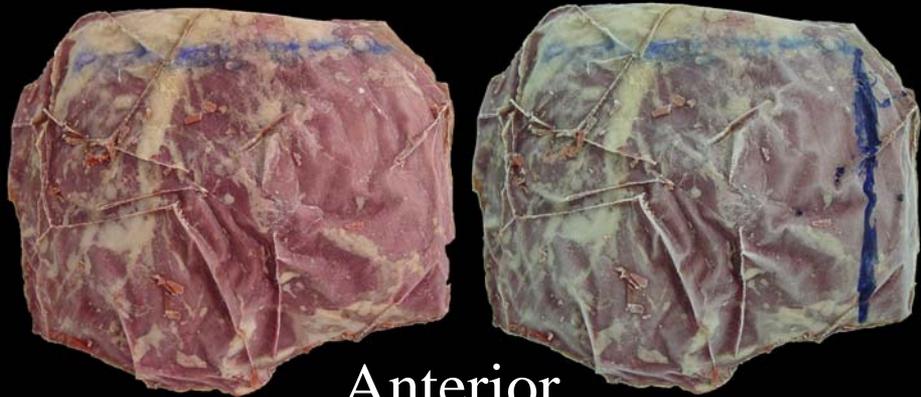


On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.



# Gluteus medius (GM) - Left

Posterior



Anterior

Posterior

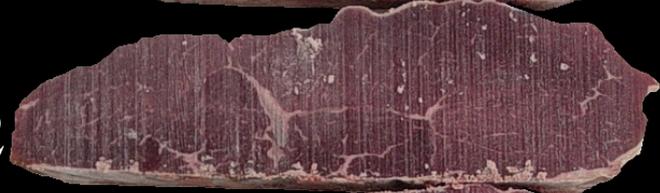


Anterior

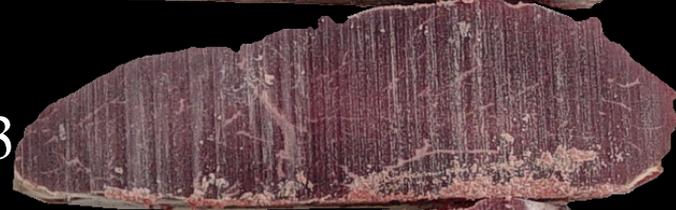
Steak 1



Steak 2



Steak 3



Steak 4



Steak 5



Steak 6



# Gluteus medius (GM) - Right

Posterior



Anterior

Posterior



Lateral

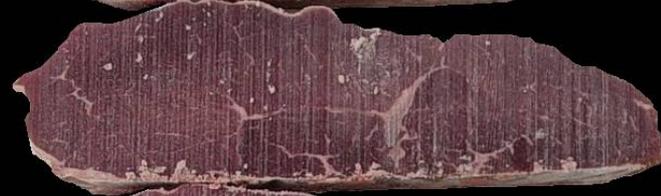
Medial

Anterior

Steak 1



Steak 2



Steak 3



Steak 4



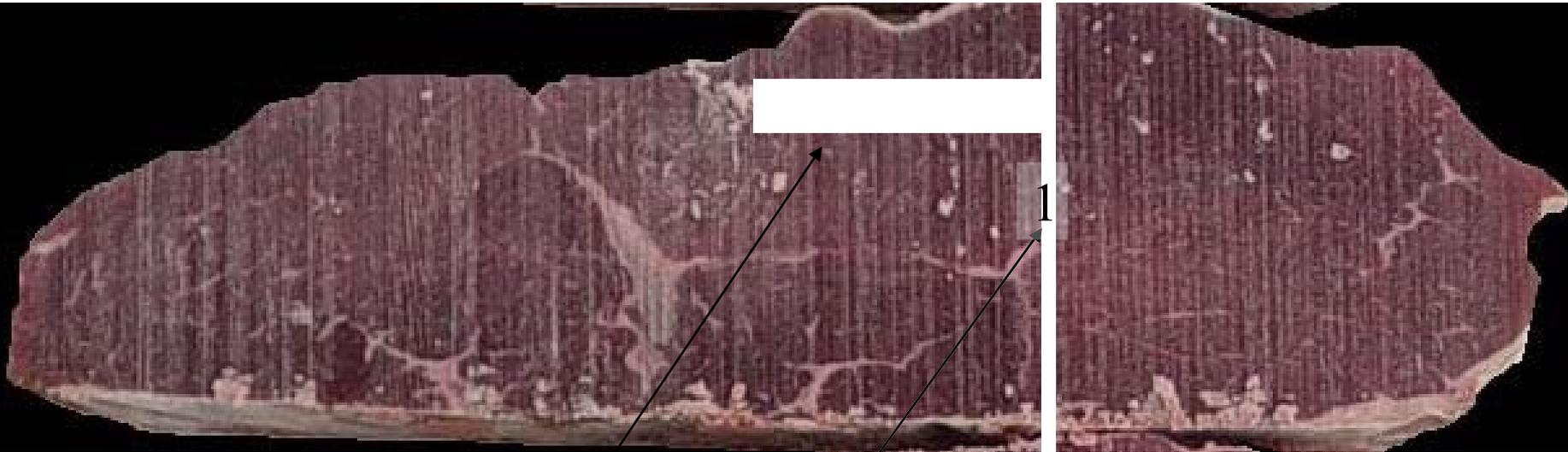
Steak 5



Steak 6



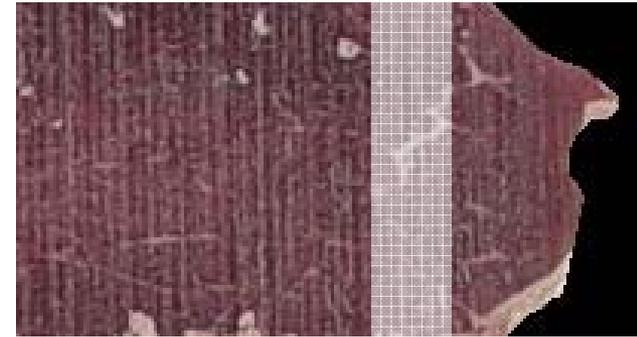
# GM Step 1



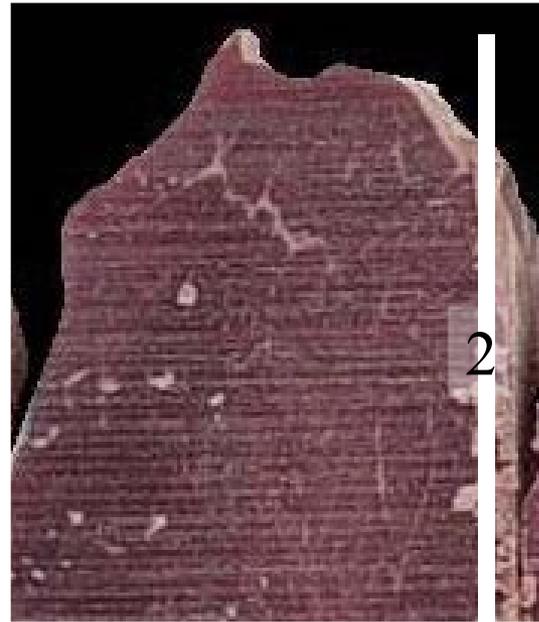
1<sup>st</sup> cut.

Orient the steak with the blue mark at the top right. The cut is made to leave a 5-cm-long section at the top center between the cut and the heavy connective tissue strip.

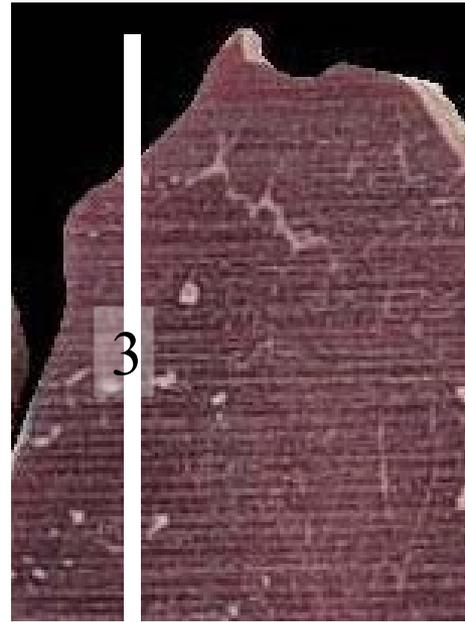
# GM Step 2 LEFT



Rotate the piece **clockwise** and place the piece in the 45° box. Take the slice as close as possible to the right end of the steak.

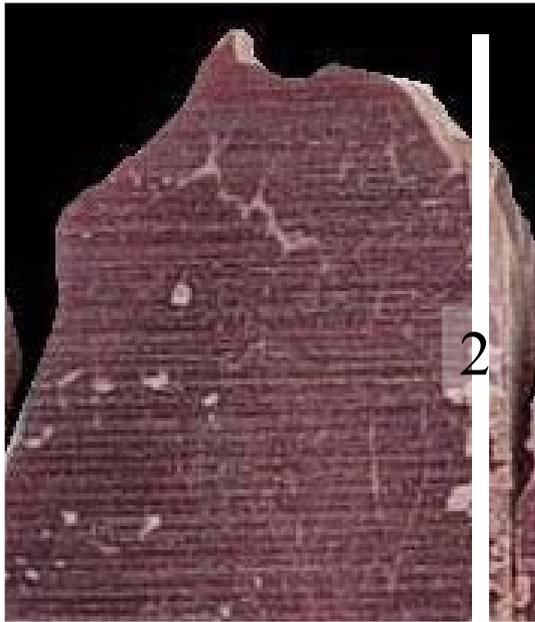


Rotate the right hand piece **counter clockwise**. Make the 2<sup>nd</sup> cut to square off the bottom of the steak (now on the right).

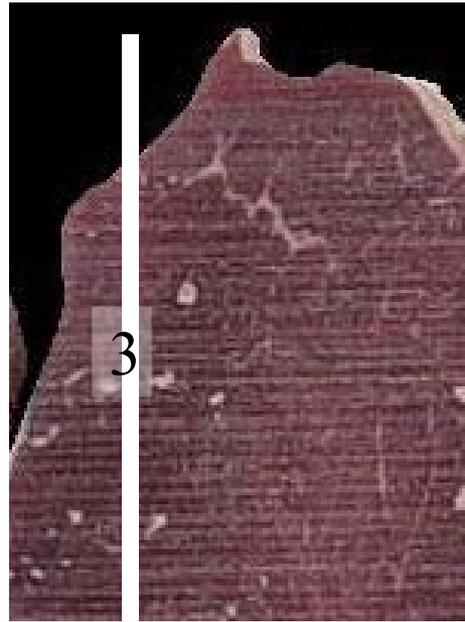


Place the piece in the sample sizer box and make the 3<sup>rd</sup> cut.

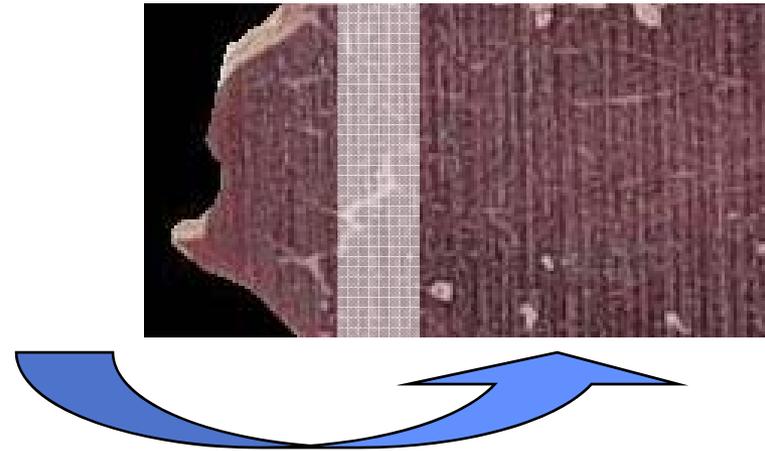
# GM Step 2 RIGHT



Rotate the right hand piece **counter clockwise**. Make the 2<sup>nd</sup> cut to square off the bottom of the steak (now on the right).

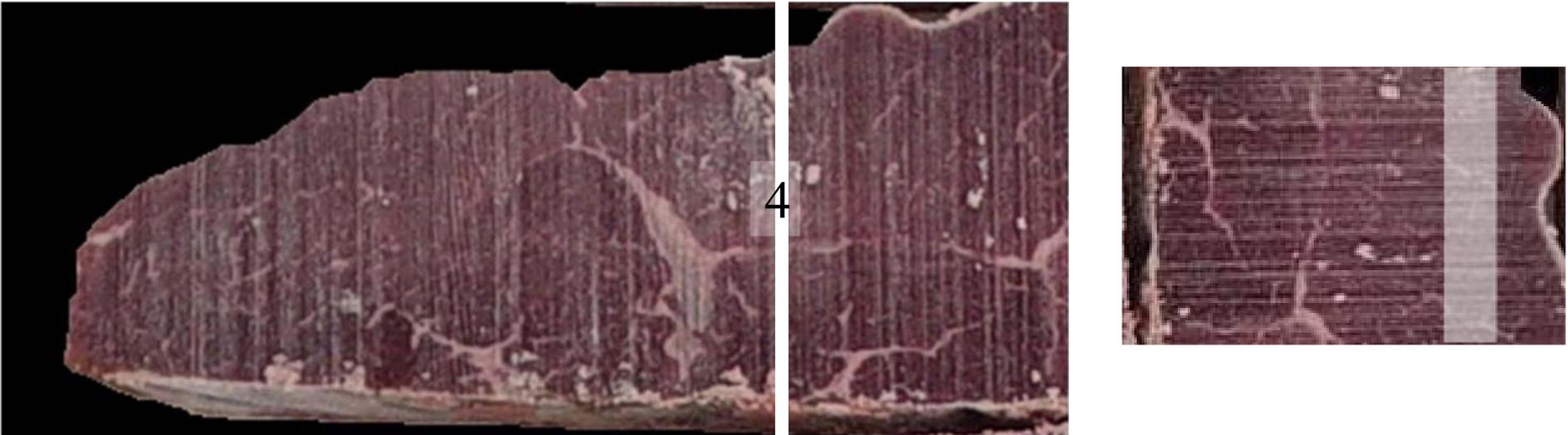


Place the piece in the sample sizer box and make the 3<sup>rd</sup> cut.



Rotate the piece **counter clockwise** and place the piece in the 45° box. Take the slice as close as possible to the right end of the steak (now on the left).

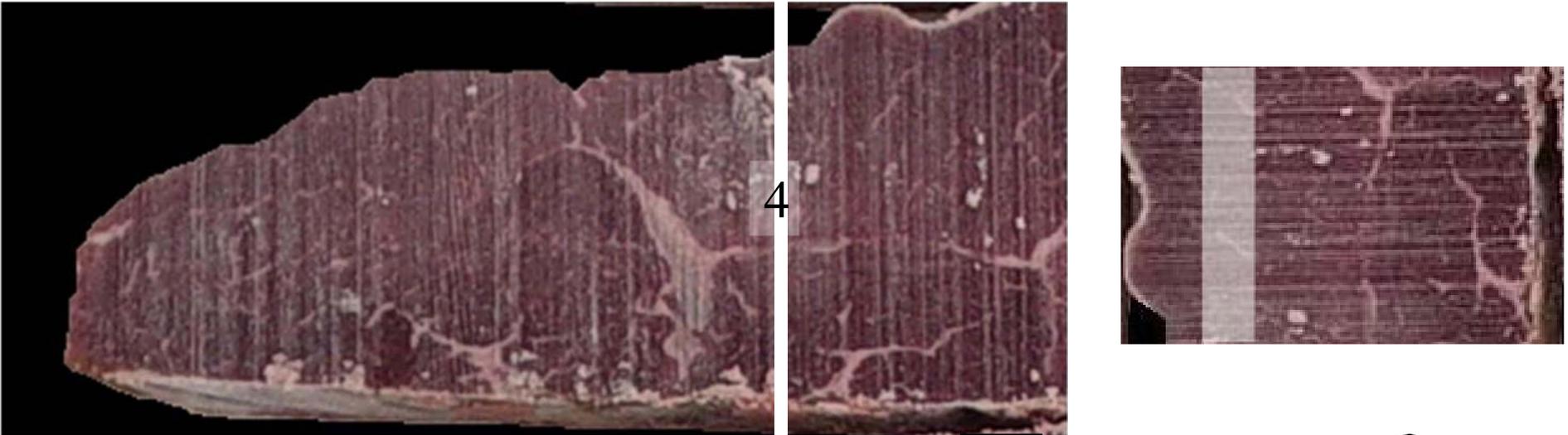
# GM Step 3 LEFT



Place the piece in the sample sizer box and make the 4<sup>th</sup> cut.

Rotate the piece **clockwise** and place the piece in the 45° box. Take the slice as close as possible to the top (now on the right) of the steak.

# GM Step 3 RIGHT



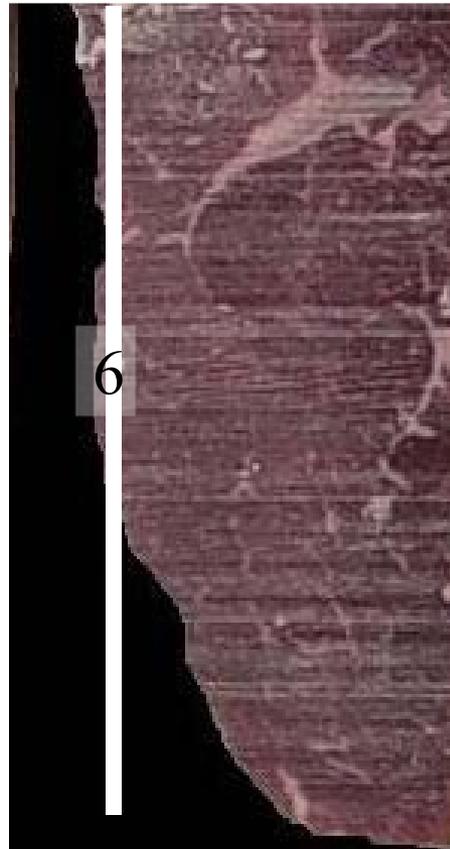
Place the piece in the sample sizer box and make the 4<sup>th</sup> cut.

Rotate the piece **counter clockwise** and place the piece in the 45° box. Take the slice as close as possible to the top (now on the left) of the steak.

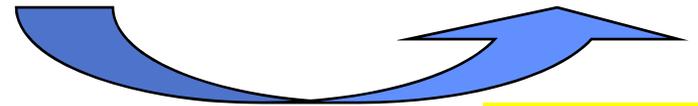
# GM Step 4 LEFT



Rotate the left hand piece **counter clockwise**. Make the 5<sup>th</sup> cut to square off the bottom of the steak (now on the right).



Place the piece in the sample sizer box and make the 6<sup>th</sup> cut.

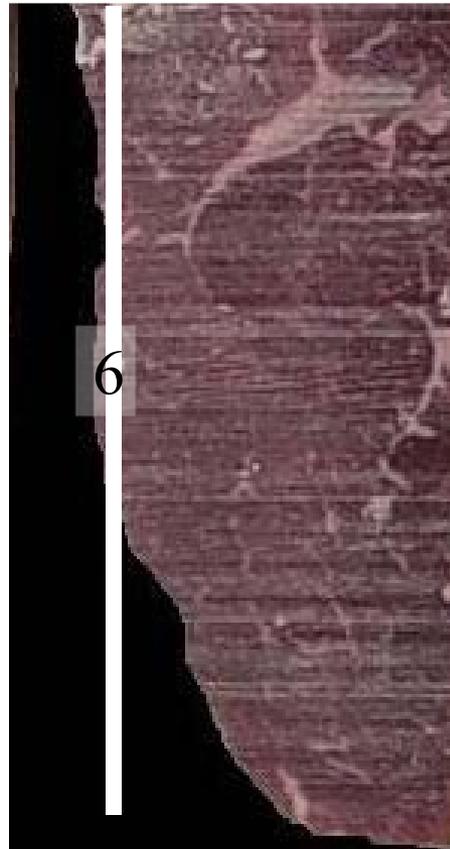


Rotate the piece **counter clockwise** and place the piece in the 45° box. Take the slice just to the right of the heavy connective tissue strip.

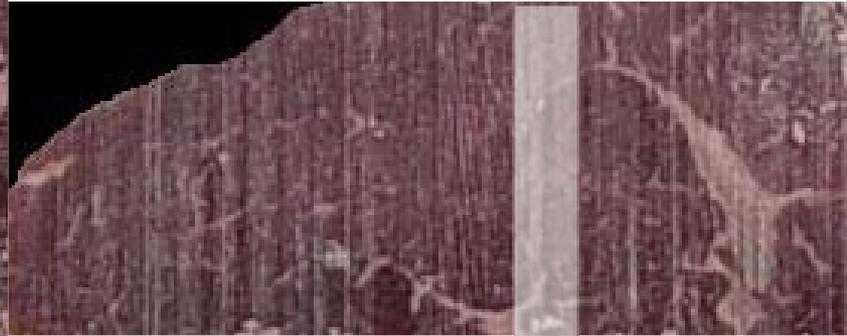
# GM Step 4 RIGHT



Rotate the left hand piece **counter clockwise**. Make the 5<sup>th</sup> cut to square off the bottom of the steak (now on the right).

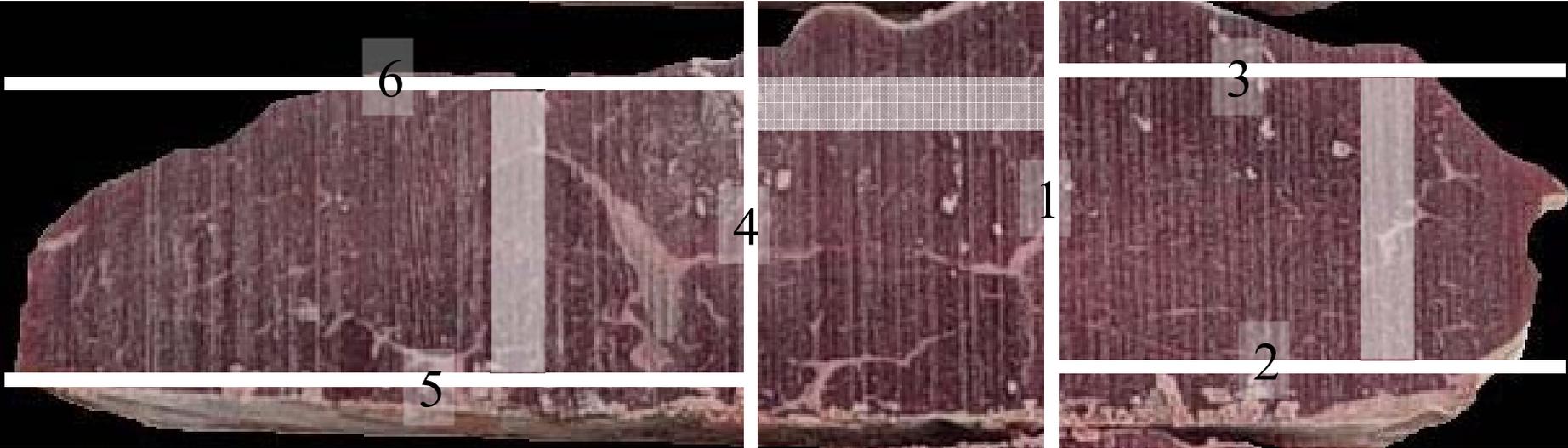


Place the piece in the sample sizer box and make the 6<sup>th</sup> cut.



Rotate the piece **clockwise** and place the piece in the 45° box. Take the slice just to the left of the heavy connective tissue strip.

# GM Overview



# Sample data sheet for GM SSF

Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2001	03 GM	031 Lateral end	45°			15
07/01/2009	2001	03 GM	032 Top center	45°			15
07/01/2009	2001	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2002	03 GM	031 Lateral end	45°			15
07/01/2009	2002	03 GM	032 Top center	45°			15
07/01/2009	2002	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2003	03 GM	031 Lateral end	45°			15
07/01/2009	2003	03 GM	032 Top center	45°			15
07/01/2009	2003	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2004	03 GM	031 Lateral end	45°			15
07/01/2009	2004	03 GM	032 Top center	45°			15
07/01/2009	2004	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2005	03 GM	031 Lateral end	45°			15
07/01/2009	2005	03 GM	032 Top center	45°			15
07/01/2009	2005	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2006	03 GM	031 Lateral end	45°			15
07/01/2009	2006	03 GM	032 Top center	45°			15
07/01/2009	2006	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2007	03 GM	031 Lateral end	45°			15
07/01/2009	2007	03 GM	032 Top center	45°			15
07/01/2009	2007	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2008	03 GM	031 Lateral end	45°			15
07/01/2009	2008	03 GM	032 Top center	45°			15
07/01/2009	2008	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2009	03 GM	031 Lateral end	45°			15
07/01/2009	2009	03 GM	032 Top center	45°			15
07/01/2009	2009	03 GM	033 Medial side of CT strip	45°			15
07/01/2009	2010	03 GM	031 Lateral end	45°			15
07/01/2009	2010	03 GM	032 Top center	45°			15
07/01/2009	2010	03 GM	033 Medial side of CT strip	45°			15

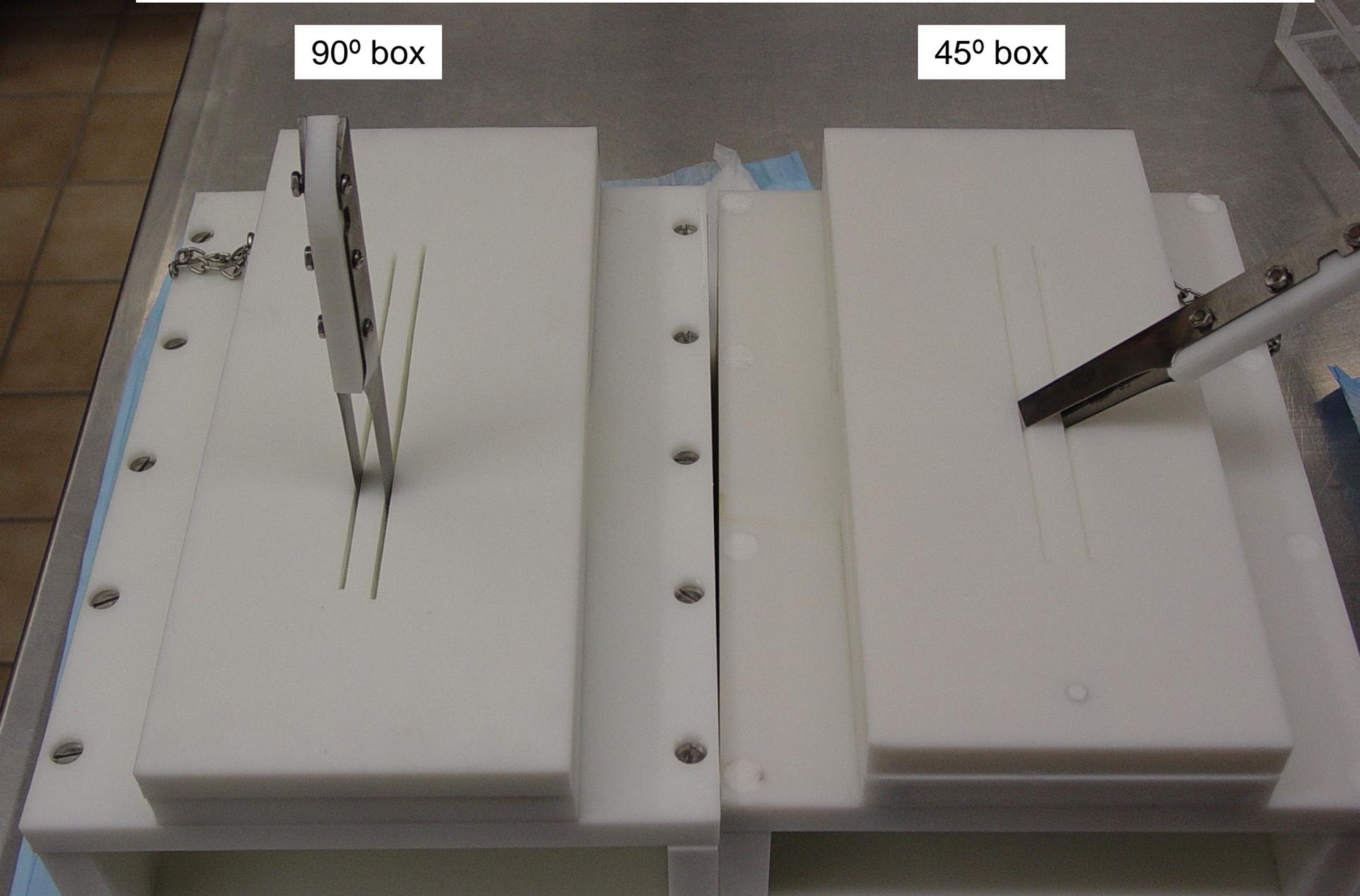
# USMARC Slice Shear Force Procedure for Beef Triceps brachii long head (TB)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of TB is conducted with the 45° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# Triceps brachii TB right



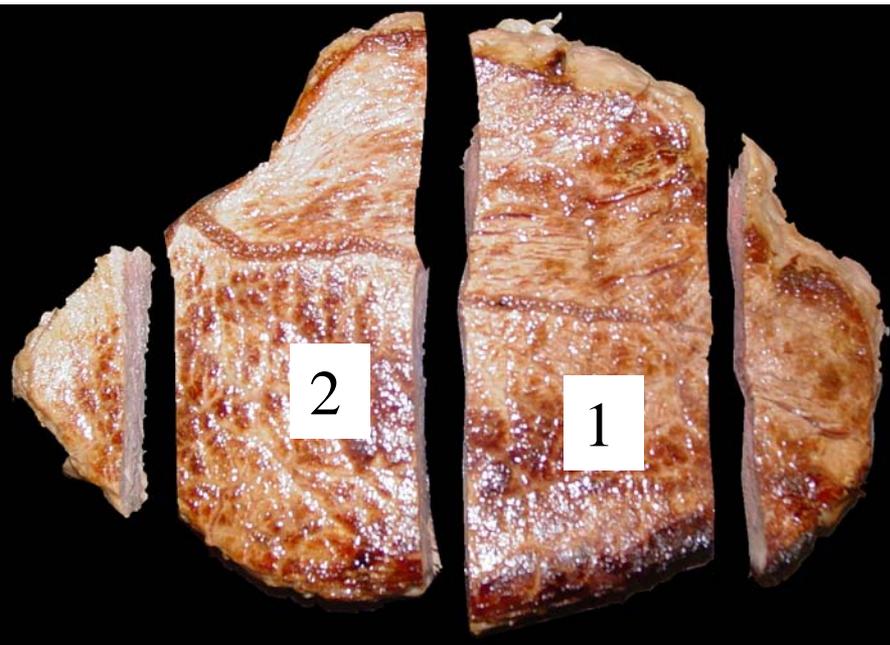
# Triceps brachii TB left



# Triceps brachii TB right



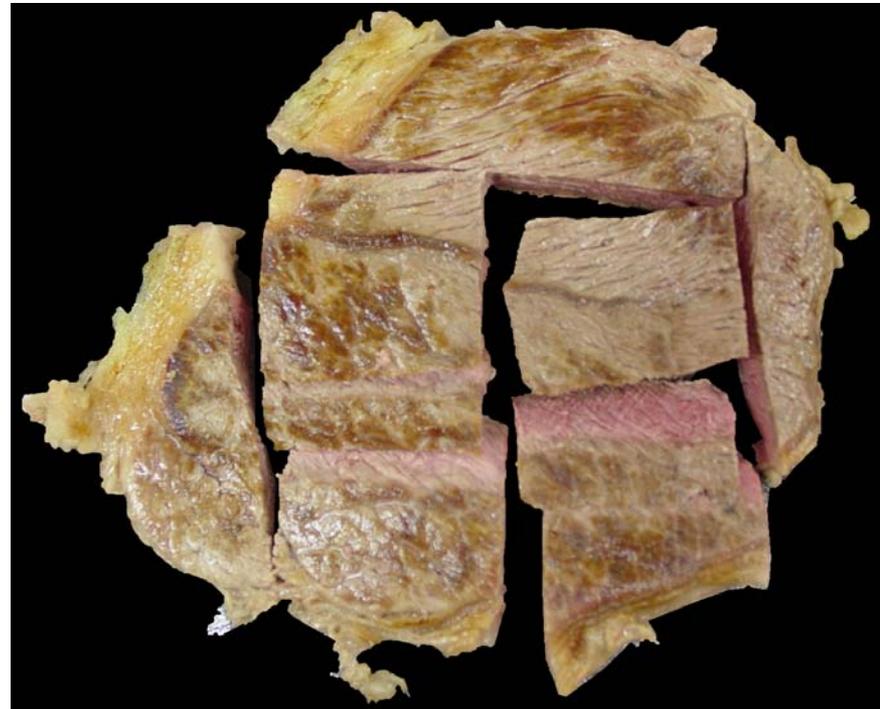
Orient the steak with the blue mark towards the **left** (the connective tissue strip is running side-to-side). Square the right end. Get one or two 5 cm portions. Rotate the 5 cm portion(s) **clockwise** 90 degrees. Use the **45 degree** box.



# Triceps brachii TB left

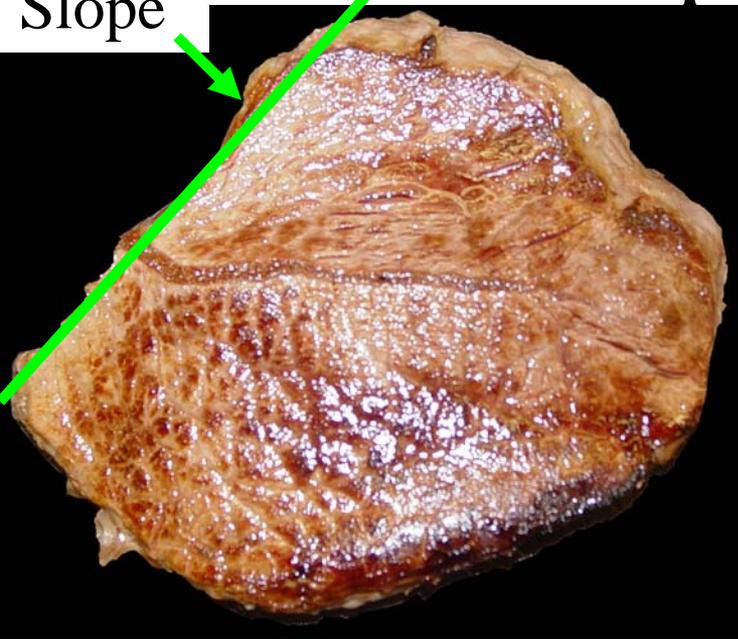


Orient the steak with the blue mark towards the **left** (the connective tissue strip is running side-to-side). Square the right end. Get one or two 5 cm portions. Rotate the 5 cm portion(s) **counter-clockwise** 90 degrees. Use the **45** degree box.

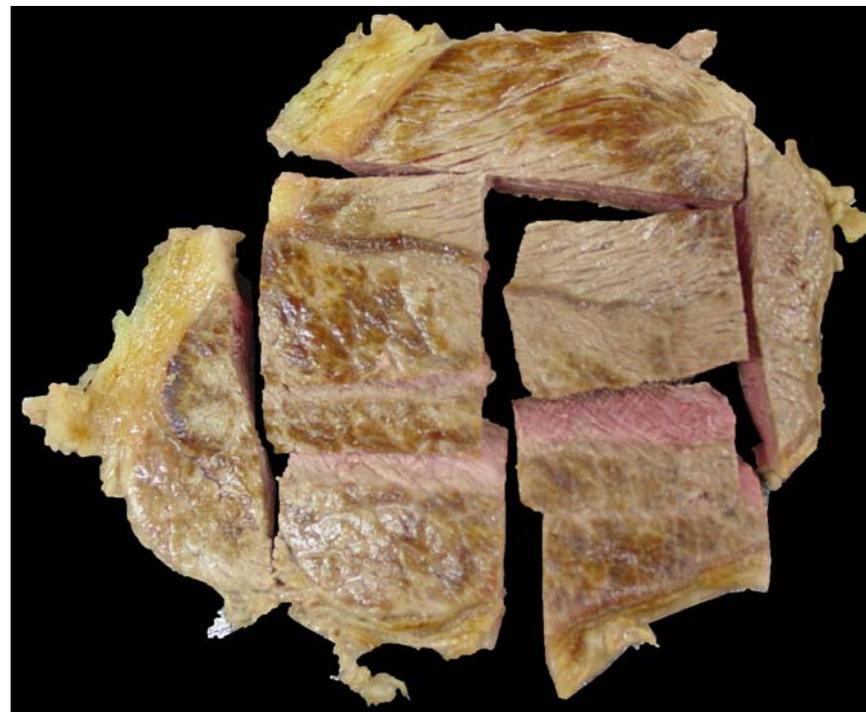


# Triceps brachii TB left

Slope



Orient the steak with the blue mark towards the **left** (the connective tissue strip is running side-to-side). Square the right end. Get one or two 5 cm portions. Rotate the 5 cm portion(s) **counter-clockwise** 90 degrees. Use the **45** degree box.



# Sample data sheet for TB SSF

Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2001	04_TB	041_Right	45°			15
07/01/2009	2001	04_TB	042_Left	45°			15
07/01/2009	2002	04_TB	041_Right	45°			15
07/01/2009	2002	04_TB	042_Left	45°			15
07/01/2009	2003	04_TB	041_Right	45°			15
07/01/2009	2003	04_TB	042_Left	45°			15
07/01/2009	2004	04_TB	041_Right	45°			15
07/01/2009	2004	04_TB	042_Left	45°			15
07/01/2009	2005	04_TB	041_Right	45°			15
07/01/2009	2005	04_TB	042_Left	45°			15
07/01/2009	2006	04_TB	041_Right	45°			15
07/01/2009	2006	04_TB	042_Left	45°			15
07/01/2009	2007	04_TB	041_Right	45°			15
07/01/2009	2007	04_TB	042_Left	45°			15
07/01/2009	2008	04_TB	041_Right	45°			15
07/01/2009	2008	04_TB	042_Left	45°			15
07/01/2009	2009	04_TB	041_Right	45°			15
07/01/2009	2009	04_TB	042_Left	45°			15
07/01/2009	2010	04_TB	041_Right	45°			15
07/01/2009	2010	04_TB	042_Left	45°			15

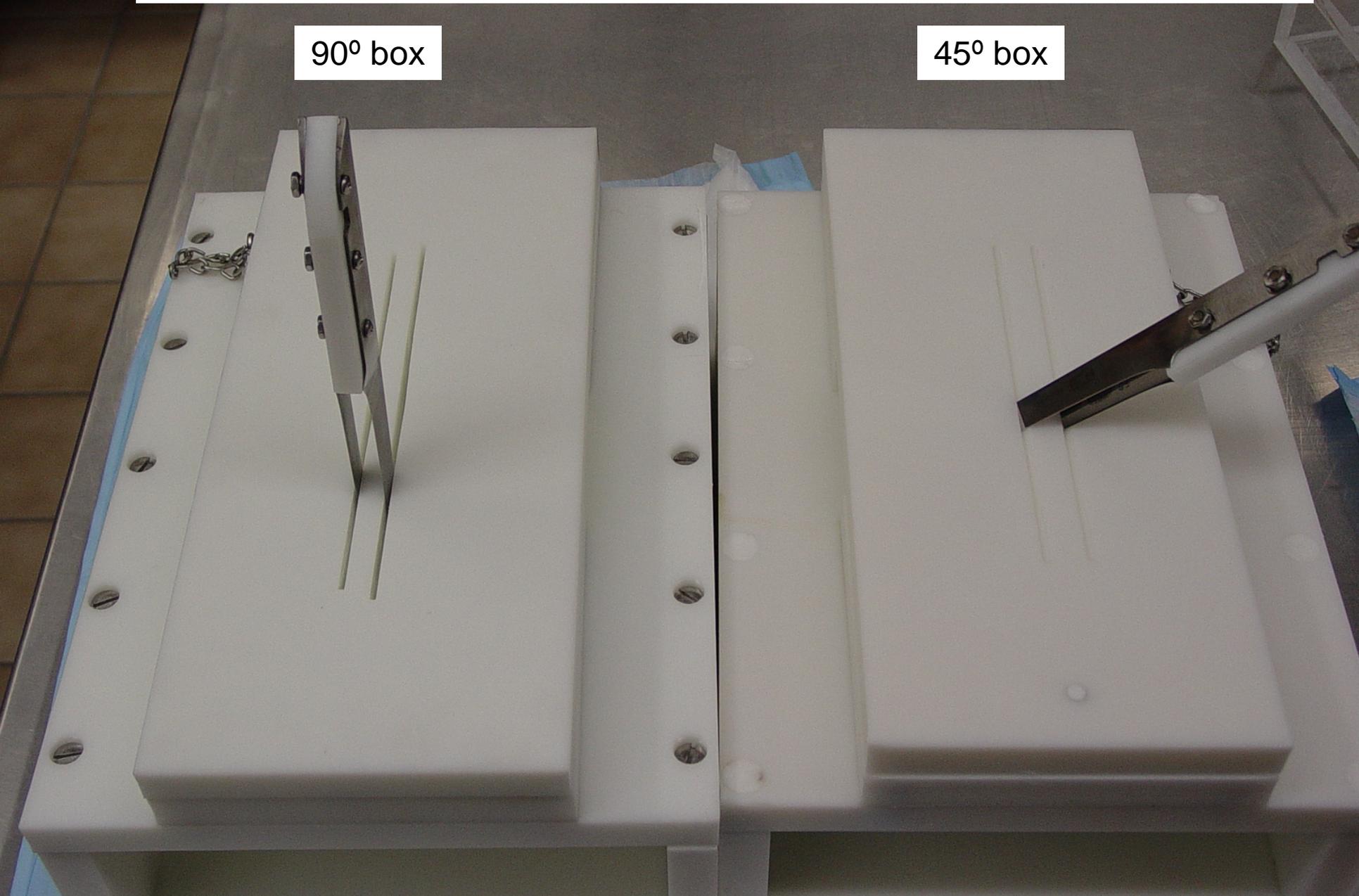
# USMARC Slice Shear Force Procedure for Beef Rectus femoris (RF)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of RF is conducted with the 45° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# Rectus femoris (RF) - Left

Proximal



Distal

Steak 1



Steak 2



Steak 3



Medial



Steak 4



Lateral



Steak 5



Steak 6



Steak 7



Steak 8



# Rectus femoris RF left

1. Orient the steak with the blue mark towards the top right.
2. Square-up the right side of steak.
3. Get one 5-cm long section from the steak.
4. Rotate the 5 cm portion **clockwise 90 degrees**. Get one slice from the big (Bottom, lateral, now on left) half of the steak.
5. Rotate the remainder of the 5 cm portion **180 degrees**. Get one slice from the small (Top, medial) half of the steak.

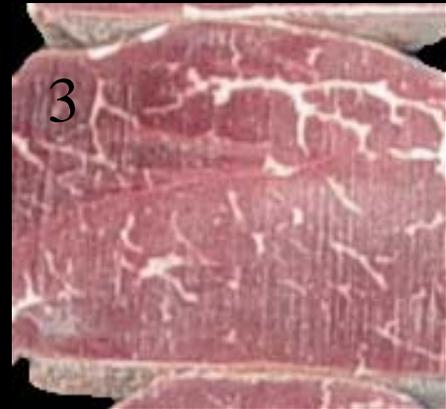
1



2



3



4



5



# Sample data sheet for RF SSF

Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2001	06_RF	061_Bottom	45°			15
07/01/2009	2001	06_RF	062_Top	45°			15
07/01/2009	2002	06_RF	061_Bottom	45°			15
07/01/2009	2002	06_RF	062_Top	45°			15
07/01/2009	2003	06_RF	061_Bottom	45°			15
07/01/2009	2003	06_RF	062_Top	45°			15
07/01/2009	2004	06_RF	061_Bottom	45°			15
07/01/2009	2004	06_RF	062_Top	45°			15
07/01/2009	2005	06_RF	061_Bottom	45°			15
07/01/2009	2005	06_RF	062_Top	45°			15
07/01/2009	2006	06_RF	061_Bottom	45°			15
07/01/2009	2006	06_RF	062_Top	45°			15
07/01/2009	2007	06_RF	061_Bottom	45°			15
07/01/2009	2007	06_RF	062_Top	45°			15
07/01/2009	2008	06_RF	061_Bottom	45°			15
07/01/2009	2008	06_RF	062_Top	45°			15
07/01/2009	2009	06_RF	061_Bottom	45°			15
07/01/2009	2009	06_RF	062_Top	45°			15
07/01/2009	2010	06_RF	061_Bottom	45°			15
07/01/2009	2010	06_RF	062_Top	45°			15

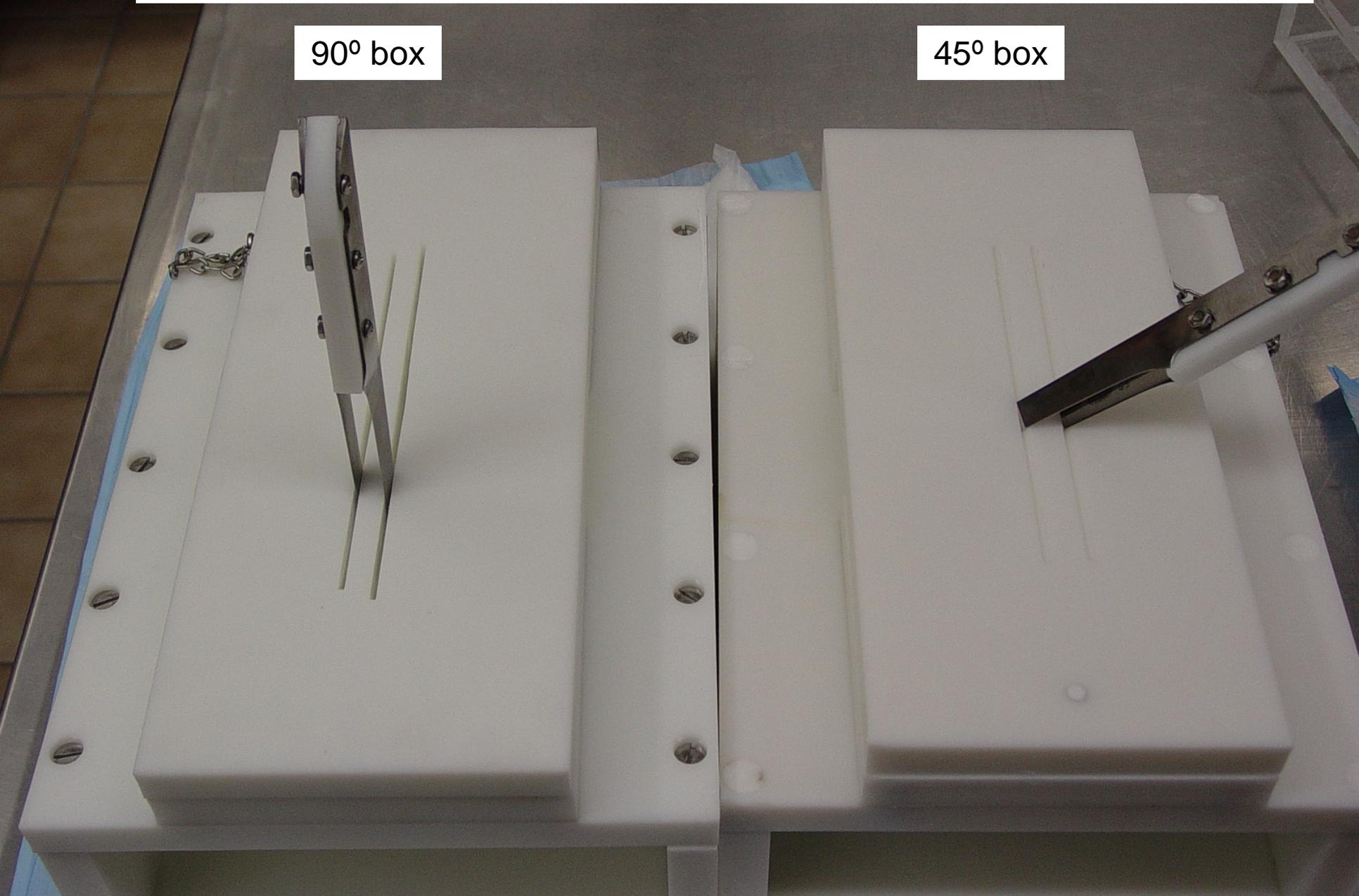
# USMARC Slice Shear Force Procedure for Beef Vastus lateralis (VL)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of VL is conducted with the 90° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

Two approaches are presented for VL.

The first approach allows for the best evaluation of SSF, but might not be suitable in many situations. Steaks are cut perpendicular to the fiber orientation.

The second approach is more easily implemented but does not allow for sampling parallel to the muscle fiber orientation. Steaks are cut conventionally.

# Vastus lateralis (VL) - Right



Obtain one or two  
5-cm sections of VL.  
Obtain up to  
three slices from each section.

Obtain one or two  
5-cm sections of VL.  
Obtain up to  
three slices from each section.

# Vastus lateralis (VL) - Left



Orient the steak with the blue mark to the top right. Obtain one or two 5-cm-long sections per steak. Using the 90 degree box, obtain up to three slices from each section.

# Vastus lateralis (VL)



Vastus lateralis steaks were marked in the top right corner (based on fiber angle slanting down left at the top left corner, right side being the wider end, and looked for silver skin on top) before cooking. The first cut was on that right side. Two sets of 3 slices were taken when possible from the best 10 cm. The 5 cm piece was turned so that the top of the steak was now to the left. A slice was taken from the left, center and right of each 5 cm piece when possible. We used the 90 degree box. All slices were kept, then culled to 6 pieces. (If we had six samples, one piece of each slice was culled. Otherwise, additional pieces from some samples were also kept randomly.) .

# Sample data sheet for VL SSF

Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2001	07_VL	071_Right_Top	90°			15
07/01/2009	2001	07_VL	072_Right_Center	90°			15
07/01/2009	2001	07_VL	073_Right_Bottom	90°			15
07/01/2009	2001	07_VL	074_Left_Top	90°			15
07/01/2009	2001	07_VL	075_Left_Center	90°			15
07/01/2009	2001	07_VL	076_Left_Bottom	90°			15
07/01/2009	2002	07_VL	071_Right_Top	90°			15
07/01/2009	2002	07_VL	072_Right_Center	90°			15
07/01/2009	2002	07_VL	073_Right_Bottom	90°			15
07/01/2009	2002	07_VL	074_Left_Top	90°			15
07/01/2009	2002	07_VL	075_Left_Center	90°			15
07/01/2009	2002	07_VL	076_Left_Bottom	90°			15
07/01/2009	2003	07_VL	071_Right_Top	90°			15
07/01/2009	2003	07_VL	072_Right_Center	90°			15
07/01/2009	2003	07_VL	073_Right_Bottom	90°			15
07/01/2009	2003	07_VL	074_Left_Top	90°			15
07/01/2009	2003	07_VL	075_Left_Center	90°			15
07/01/2009	2003	07_VL	076_Left_Bottom	90°			15
07/01/2009	2004	07_VL	071_Right_Top	90°			15
07/01/2009	2004	07_VL	072_Right_Center	90°			15
07/01/2009	2004	07_VL	073_Right_Bottom	90°			15
07/01/2009	2004	07_VL	074_Left_Top	90°			15
07/01/2009	2004	07_VL	075_Left_Center	90°			15
07/01/2009	2004	07_VL	076_Left_Bottom	90°			15
07/01/2009	2005	07_VL	071_Right_Top	90°			15
07/01/2009	2005	07_VL	072_Right_Center	90°			15
07/01/2009	2005	07_VL	073_Right_Bottom	90°			15
07/01/2009	2005	07_VL	074_Left_Top	90°			15
07/01/2009	2005	07_VL	075_Left_Center	90°			15
07/01/2009	2005	07_VL	076_Left_Bottom	90°			15

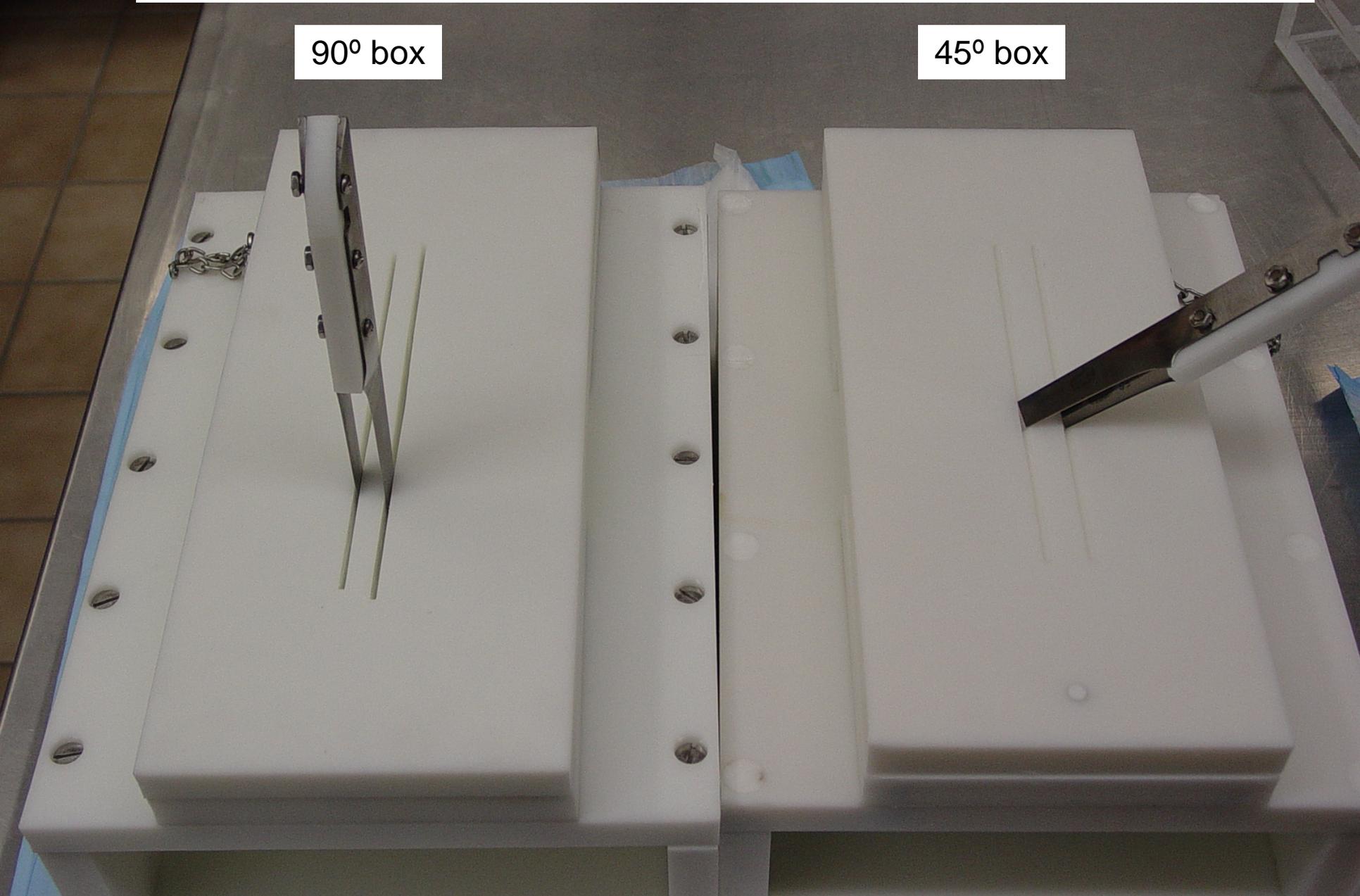
# USMARC Slice Shear Force Procedure for Beef Semitendinosus (ST)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of ST is conducted with the 90° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# Semitendinosus (ST) - Right

Proximal

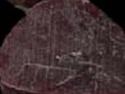


Distal

Steak 1



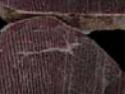
Steak 2



Steak 3



Steak 4



Steak 5



Steak 6



Steak 7



Steak 8



Steak 9



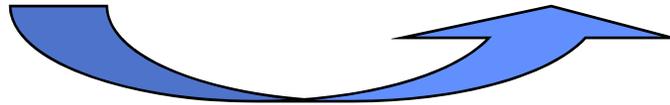
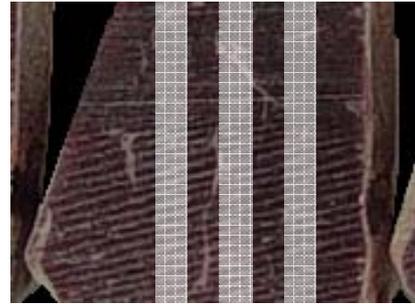
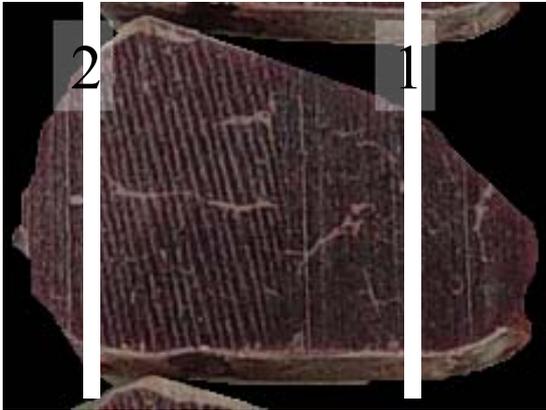
Steak 10



Steak 11



ST



Make cuts 1 and 2 and rotate the piece counter clockwise and place in the 90 degree box. Obtain the 1<sup>st</sup> slice near the top (now on the left) of the section. Obtain the 2<sup>nd</sup> slice in the center. Obtain the 3<sup>rd</sup> slice near the bottom (now on the right). Space the slices approximately equally.

# Sample data sheet for ST SSF

Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2001	08_ST	081_Top	90°			15
07/01/2009	2001	08_ST	082_Center	90°			15
07/01/2009	2001	08_ST	083_Bottom	90°			15
07/01/2009	2002	08_ST	081_Top	90°			15
07/01/2009	2002	08_ST	082_Center	90°			15
07/01/2009	2002	08_ST	083_Bottom	90°			15
07/01/2009	2003	08_ST	081_Top	90°			15
07/01/2009	2003	08_ST	082_Center	90°			15
07/01/2009	2003	08_ST	083_Bottom	90°			15
07/01/2009	2004	08_ST	081_Top	90°			15
07/01/2009	2004	08_ST	082_Center	90°			15
07/01/2009	2004	08_ST	083_Bottom	90°			15
07/01/2009	2005	08_ST	081_Top	90°			15
07/01/2009	2005	08_ST	082_Center	90°			15
07/01/2009	2005	08_ST	083_Bottom	90°			15
07/01/2009	2006	08_ST	081_Top	90°			15
07/01/2009	2006	08_ST	082_Center	90°			15
07/01/2009	2006	08_ST	083_Bottom	90°			15
07/01/2009	2007	08_ST	081_Top	90°			15
07/01/2009	2007	08_ST	082_Center	90°			15
07/01/2009	2007	08_ST	083_Bottom	90°			15
07/01/2009	2008	08_ST	081_Top	90°			15
07/01/2009	2008	08_ST	082_Center	90°			15
07/01/2009	2008	08_ST	083_Bottom	90°			15
07/01/2009	2009	08_ST	081_Top	90°			15
07/01/2009	2009	08_ST	082_Center	90°			15
07/01/2009	2009	08_ST	083_Bottom	90°			15
07/01/2009	2010	08_ST	081_Top	90°			15
07/01/2009	2010	08_ST	082_Center	90°			15
07/01/2009	2010	08_ST	083_Bottom	90°			15

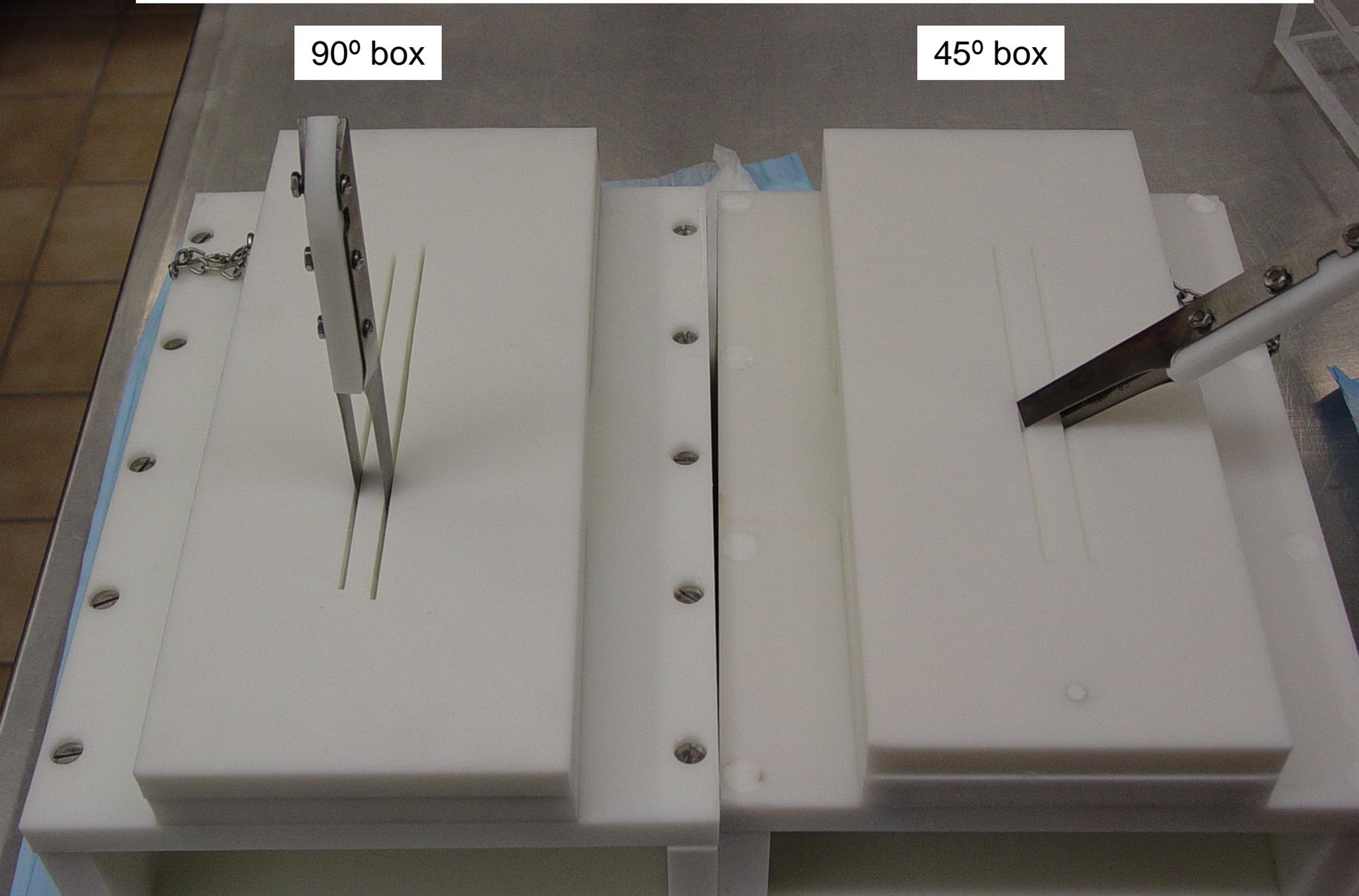
# USMARC Slice Shear Force Procedure for Beef Adductor (AD)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of AD is conducted with the 90° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# Adductor (AD) - Left

Proximal



Distal

Steak 1



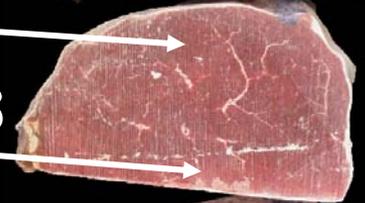
Steak 2



Superficial

Deep

Steak 3



Steak 4



Steak 5



Steak 6



# Adductor (AD) - Right

Proximal



Distal

Steak 1



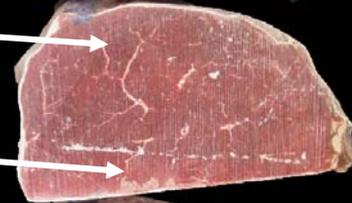
Steak 2



Superficial

Deep

Steak 3



Steak 4



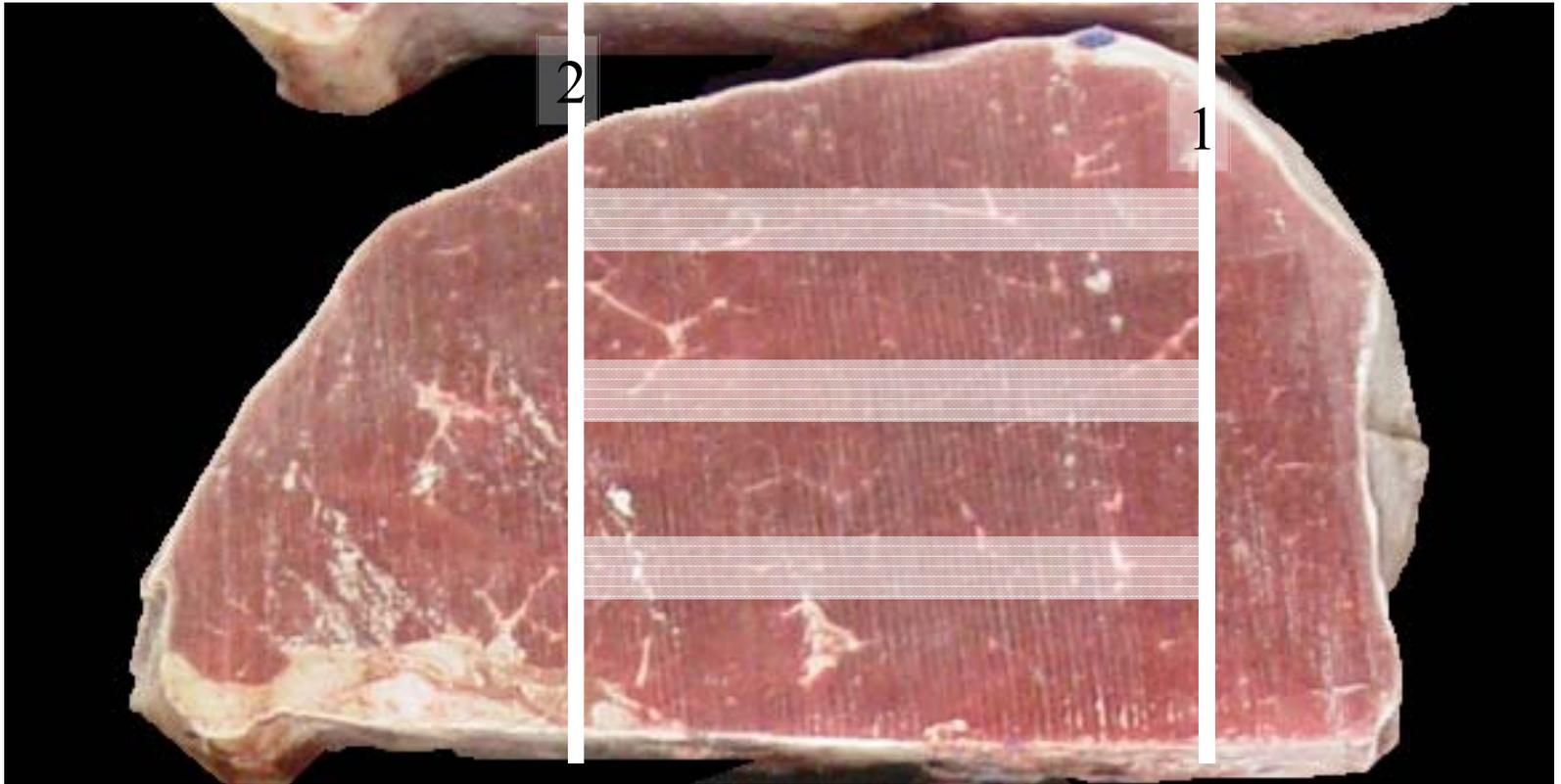
Steak 5



Steak 6

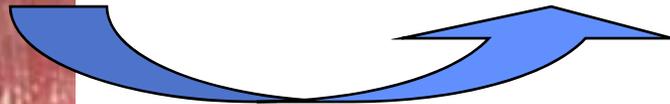
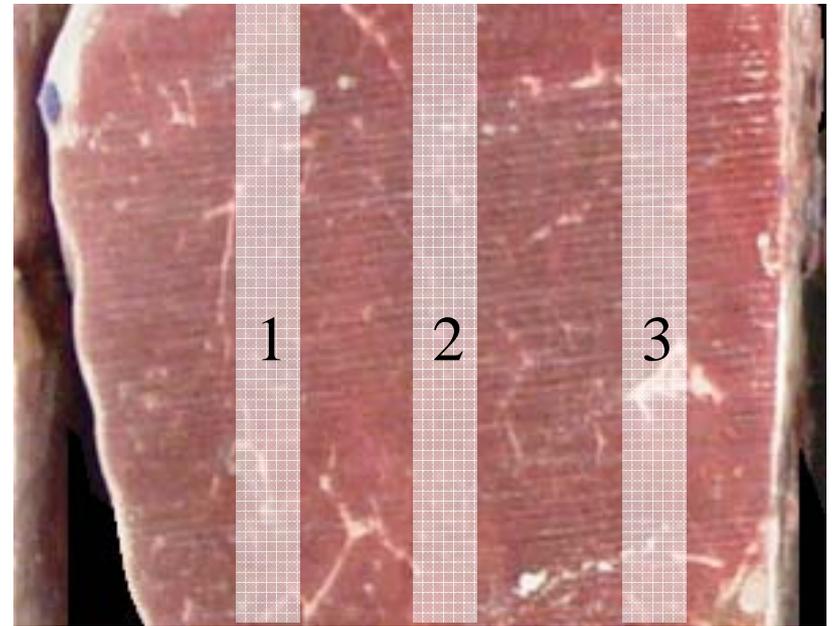


# Adductor (AD)



Orient the steak with the blue mark at the top right. Obtain one 5-cm long section and remove up to three slices from the section.

# Adductor (AD)



Make cuts 1 and 2 and rotate the piece **counter clockwise** and place in the **90 degree** box. Obtain the 1<sup>st</sup> slice near the top (now on the left) of the section. Obtain the 2<sup>nd</sup> slice in the center and the 3<sup>rd</sup> slice near the bottom (now on the right). Space the slices approximately equally.

# Sample data sheet for AD SSF

Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2011	09_AD	091_Top	90°			15
07/01/2009	2011	09_AD	092_Center	90°			15
07/01/2009	2011	09_AD	093_Bottom	90°			15
07/01/2009	2012	09_AD	091_Top	90°			15
07/01/2009	2012	09_AD	092_Center	90°			15
07/01/2009	2012	09_AD	093_Bottom	90°			15
07/01/2009	2013	09_AD	091_Top	90°			15
07/01/2009	2013	09_AD	092_Center	90°			15
07/01/2009	2013	09_AD	093_Bottom	90°			15
07/01/2009	2014	09_AD	091_Top	90°			15
07/01/2009	2014	09_AD	092_Center	90°			15
07/01/2009	2014	09_AD	093_Bottom	90°			15
07/01/2009	2015	09_AD	091_Top	90°			15
07/01/2009	2015	09_AD	092_Center	90°			15
07/01/2009	2015	09_AD	093_Bottom	90°			15
07/01/2009	2016	09_AD	091_Top	90°			15
07/01/2009	2016	09_AD	092_Center	90°			15
07/01/2009	2016	09_AD	093_Bottom	90°			15
07/01/2009	2017	09_AD	091_Top	90°			15
07/01/2009	2017	09_AD	092_Center	90°			15
07/01/2009	2017	09_AD	093_Bottom	90°			15
07/01/2009	2018	09_AD	091_Top	90°			15
07/01/2009	2018	09_AD	092_Center	90°			15
07/01/2009	2018	09_AD	093_Bottom	90°			15
07/01/2009	2019	09_AD	091_Top	90°			15
07/01/2009	2019	09_AD	092_Center	90°			15
07/01/2009	2019	09_AD	093_Bottom	90°			15
07/01/2009	2020	09_AD	091_Top	90°			15
07/01/2009	2020	09_AD	092_Center	90°			15
07/01/2009	2020	09_AD	093_Bottom	90°			15

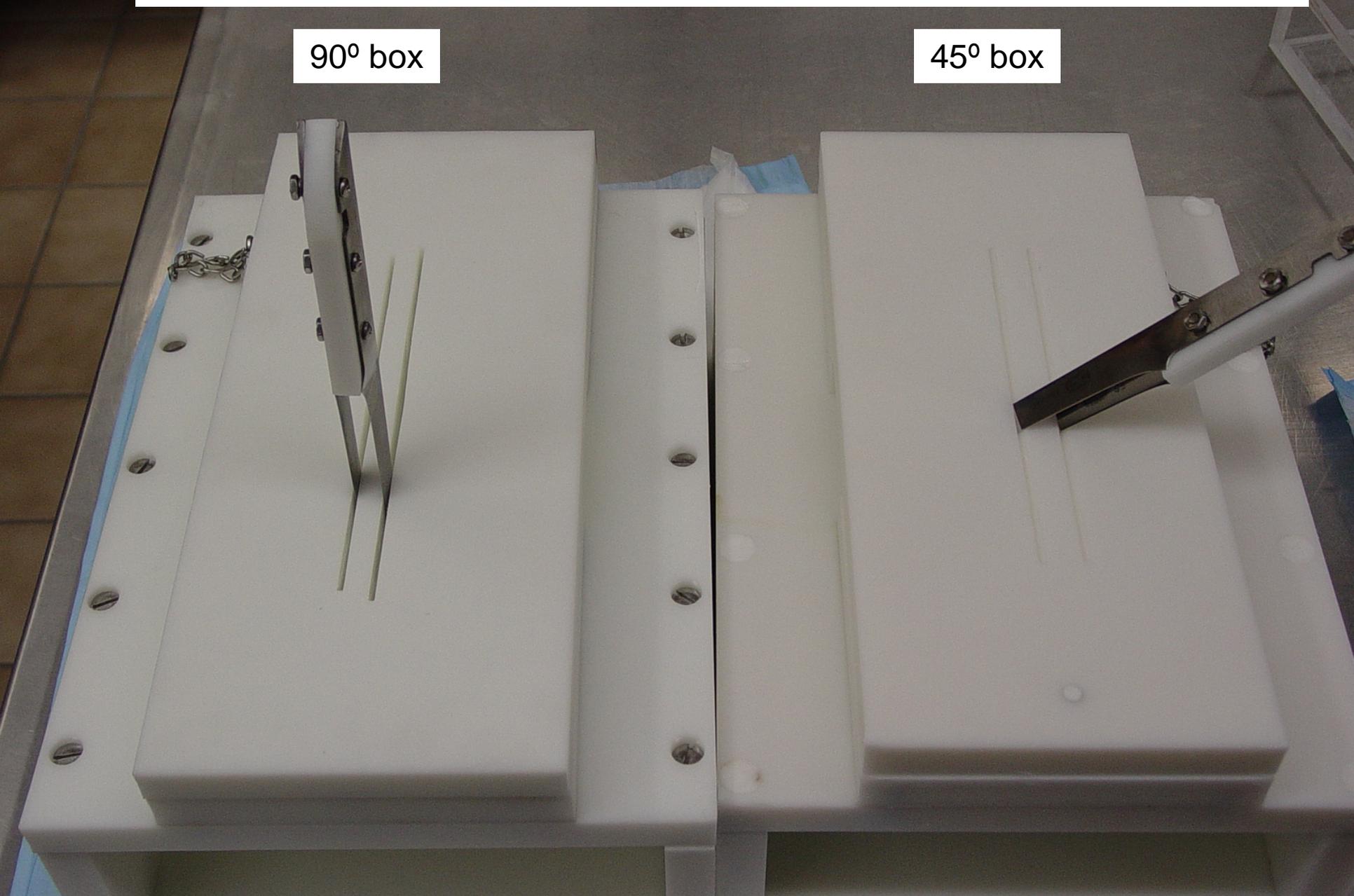
# USMARC Slice Shear Force Procedure for Beef Deep pectoral (DP)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of DP is conducted with the 90° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# Deep pectoral (DP) - Left

Steaks cut perpendicular to fiber



Steak 1

Steak 2

Steak 3

Steak 4

Steak 5

Steak 6

Steak 7

Steak 8

Steak 9

Steak 10

Steak 11

Steak 12



# Deep pectoral (DP) - Right

Steaks cut perpendicular to fiber



Steak 1



Steak 2



Steak 3



Steak 4



Steak 5



Steak 6



Steak 7



Steak 8



Steak 9



Steak 10



Steak 11

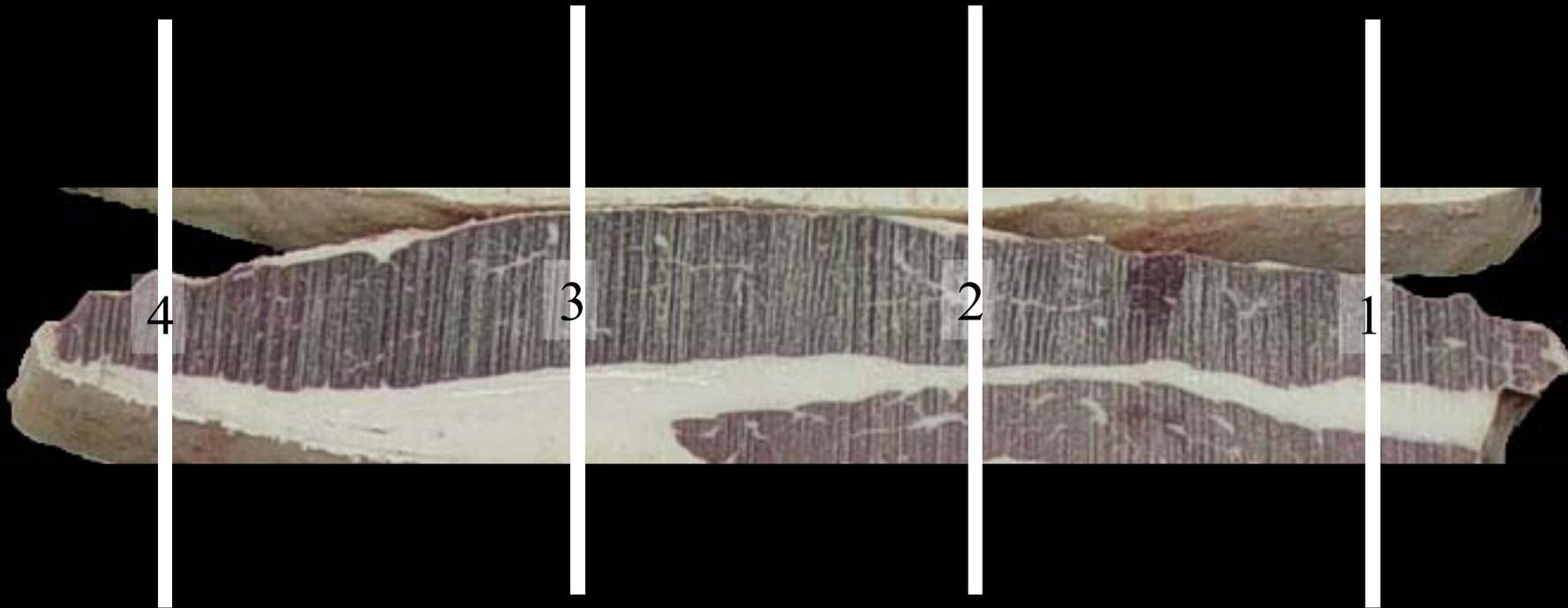


Steak 12



# Deep pectoral

Orient the steak with the blue mark towards the top right. Depending on the length of the steak, obtain up to three 5-cm-long sections per steak. Obtain the first section towards the blue mark (right). Because of warping, you may have to re-square the steak between each section. Using the 90 degree box, obtain 1 slice from each section.



# Sample data sheet for DP SSF

DP\_SSF data for SSF vs WBS

Date	Animal	Steak	Location	Slice box	SSF	Notes
	51	DP_03	1_Right	90°		
	51	DP_03	2_Center	90°		
	51	DP_03	3_Left	90°		
	51	DP_04	1_Right	90°		
	51	DP_04	2_Center	90°		
	51	DP_04	3_Left	90°		
	52	DP_03	1_Right	90°		
	52	DP_03	2_Center	90°		
	52	DP_03	3_Left	90°		
	52	DP_04	1_Right	90°		
	52	DP_04	2_Center	90°		
	52	DP_04	3_Left	90°		
	53	DP_01	1_Right	90°		
	53	DP_01	2_Center	90°		
	53	DP_01	3_Left	90°		
	53	DP_02	1_Right	90°		
	53	DP_02	2_Center	90°		
	53	DP_02	3_Left	90°		
	54	DP_01	1_Right	90°		
	54	DP_01	2_Center	90°		
	54	DP_01	3_Left	90°		
	54	DP_02	1_Right	90°		
	54	DP_02	2_Center	90°		
	54	DP_02	3_Left	90°		
	55	DP_03	1_Right	90°		
	55	DP_03	2_Center	90°		
	55	DP_03	3_Left	90°		
	55	DP_04	1_Right	90°		
	55	DP_04	2_Center	90°		
	55	DP_04	3_Left	90°		
	56	DP_03	1_Right	90°		
	56	DP_03	2_Center	90°		
	56	DP_03	3_Left	90°		
	56	DP_04	1_Right	90°		
	56	DP_04	2_Center	90°		
	56	DP_04	3_Left	90°		

# Commonality

GR, LT, TRAP, TFL  
are just like DP

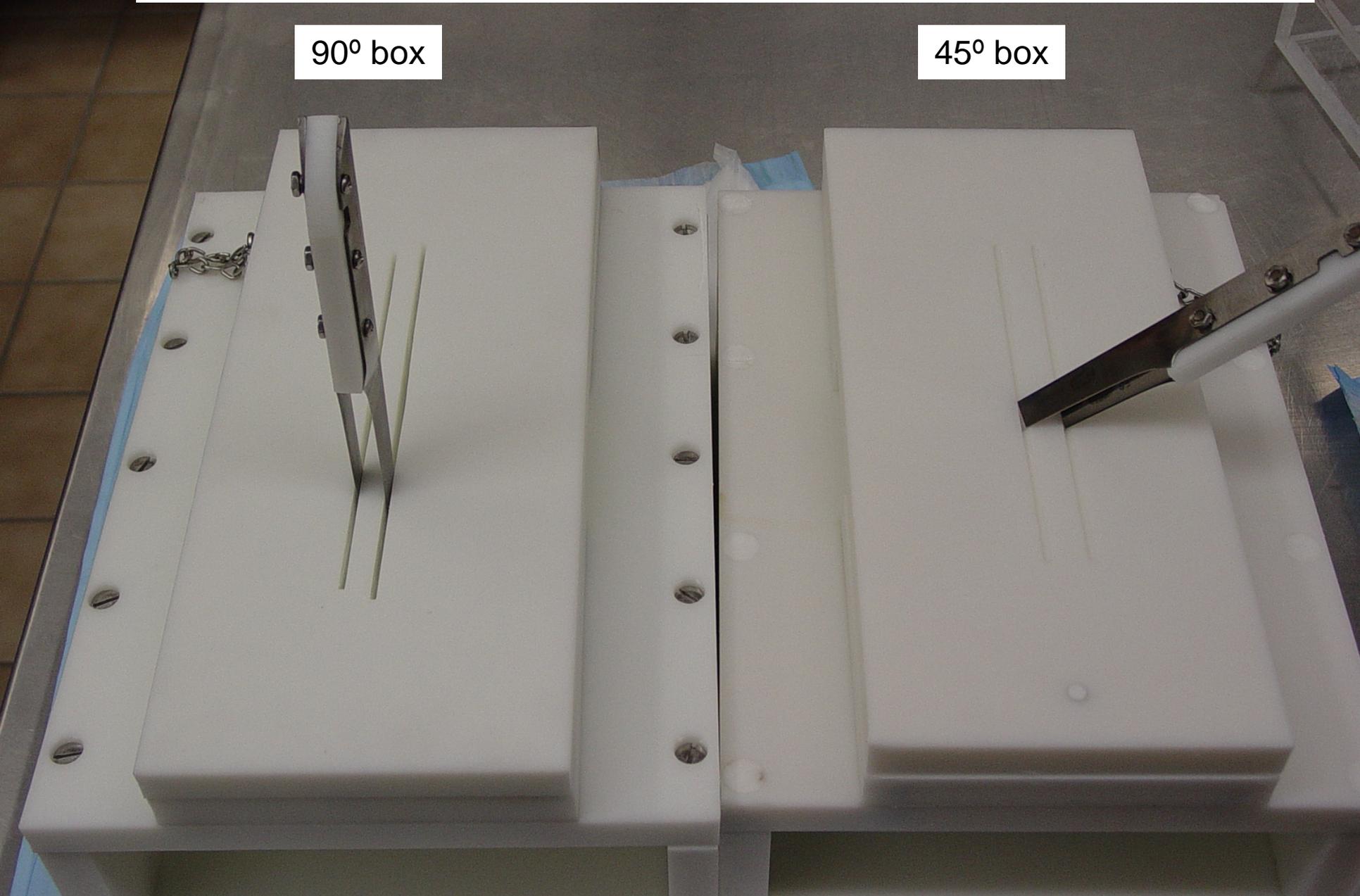
# USMARC Slice Shear Force Procedure for Beef Biceps femoris ischiatic head (BFIH)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of BFIH is conducted with the 90° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# BFIH - Left

Steaks cut perpendicular to fiber

Distal

BFIH

Left

Steak 1

Steak 2

Steak 3



Steak n

Proximal

Steak 01



Steak 02



Steak 03



Steak 04



Steak 05



Steak 06



# BFIH - Right

Steaks cut perpendicular to fiber

Distal

BFIH

Right

Steak 1

Steak 2

Steak 3



Steak n

Proximal

Steak 01



Steak 02



Steak 03



Steak 04

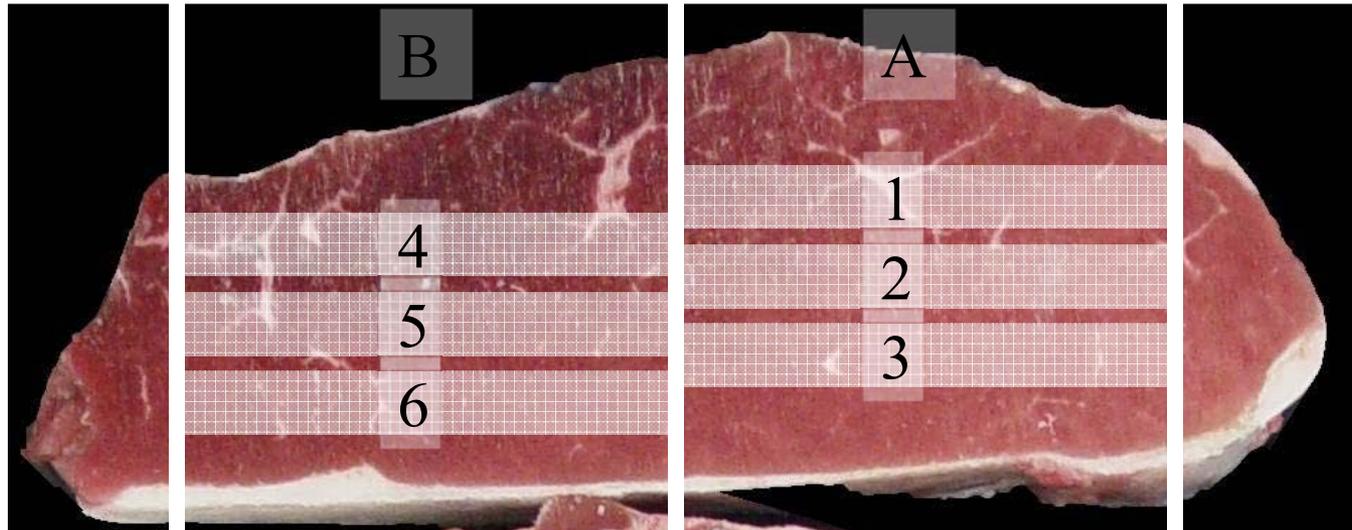


Steak 05

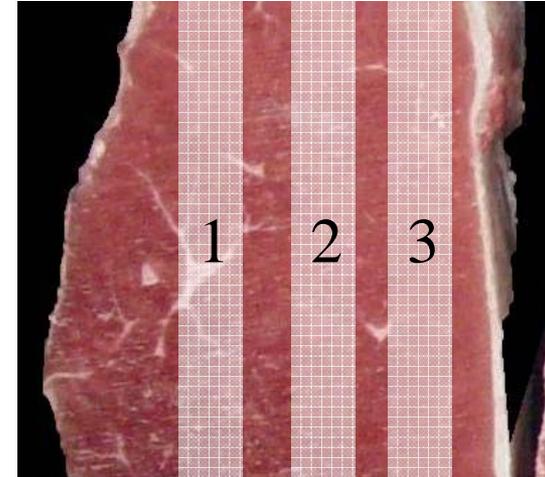
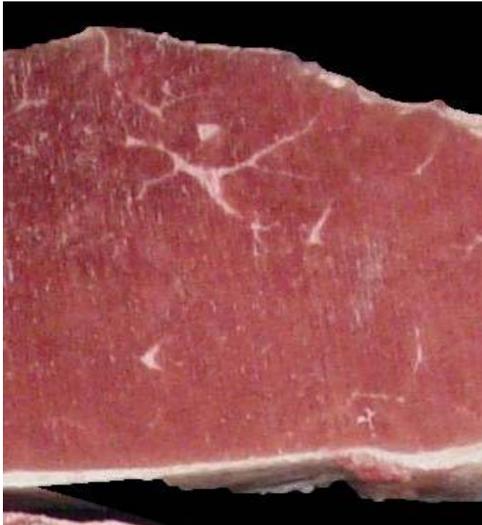


Steak 06

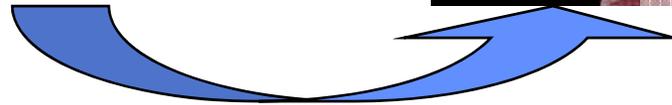
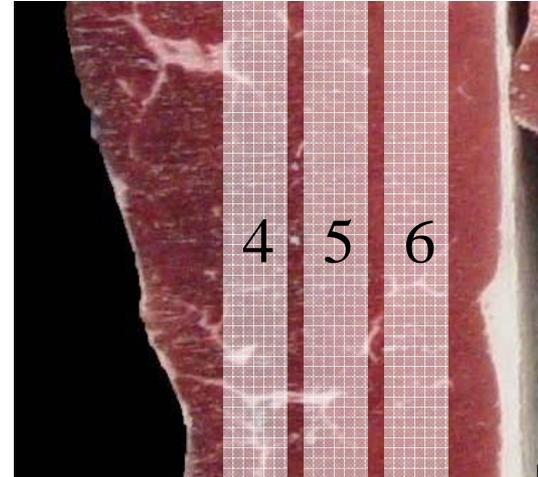
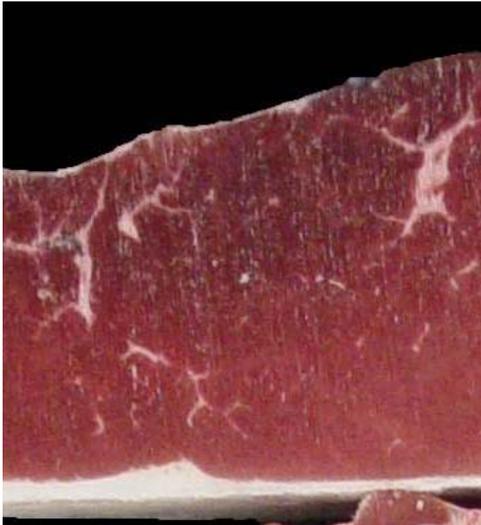




Orient the steak with the blue mark at the top right. If the steak is small, then just take one column. If you cannot get three slices per section, then get two... or one.



Make cuts 1 and 2 and rotate the piece **counter clockwise** and place in the 90 degree box. Obtain the 1<sup>st</sup> slice near the top (now on the left) of the section. Obtain the 2<sup>nd</sup> slice in the center and the 3<sup>rd</sup> slice near the bottom (now on the right). Space the slices approximately equally.



Make cuts 3 and 4 and rotate the piece **counter clockwise** and place in the 90 degree box. Obtain the 4<sup>th</sup> slice near the top (now on the left) of the section. Obtain the 5<sup>th</sup> slice in the center and the 6<sup>th</sup> slice near the bottom (now on the right). Space the slices approximately equally.

# Sample data sheet for BFIH SSF

Fresh\_SSF\_Data

Date	Yellow tag ID	Muscle	Location	Slice box	SSF	Notes	DPM
07/01/2009	2011	12_BFIH	121_Right_Top	90°			15
07/01/2009	2011	12_BFIH	122_Right_Center	90°			15
07/01/2009	2011	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2012	12_BFIH	121_Right_Top	90°			15
07/01/2009	2012	12_BFIH	122_Right_Center	90°			15
07/01/2009	2012	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2013	12_BFIH	121_Right_Top	90°			15
07/01/2009	2013	12_BFIH	122_Right_Center	90°			15
07/01/2009	2013	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2014	12_BFIH	121_Right_Top	90°			15
07/01/2009	2014	12_BFIH	122_Right_Center	90°			15
07/01/2009	2014	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2015	12_BFIH	121_Right_Top	90°			15
07/01/2009	2015	12_BFIH	122_Right_Center	90°			15
07/01/2009	2015	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2016	12_BFIH	121_Right_Top	90°			15
07/01/2009	2016	12_BFIH	122_Right_Center	90°			15
07/01/2009	2016	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2017	12_BFIH	121_Right_Top	90°			15
07/01/2009	2017	12_BFIH	122_Right_Center	90°			15
07/01/2009	2017	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2018	12_BFIH	121_Right_Top	90°			15
07/01/2009	2018	12_BFIH	122_Right_Center	90°			15
07/01/2009	2018	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2019	12_BFIH	121_Right_Top	90°			15
07/01/2009	2019	12_BFIH	122_Right_Center	90°			15
07/01/2009	2019	12_BFIH	123_Right_Bottom	90°			15
07/01/2009	2020	12_BFIH	121_Right_Top	90°			15
07/01/2009	2020	12_BFIH	122_Right_Center	90°			15
07/01/2009	2020	12_BFIH	123_Right_Bottom	90°			15

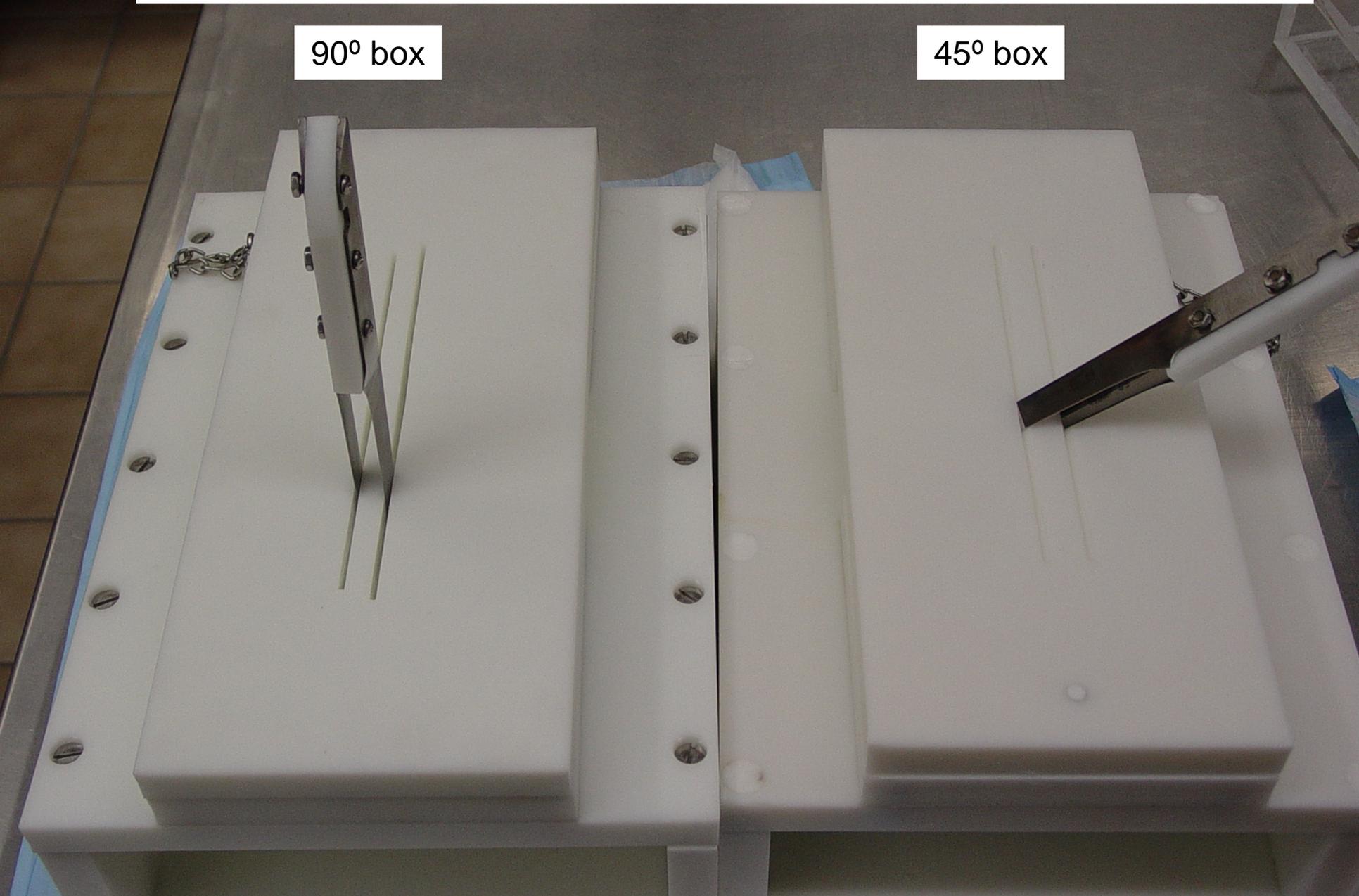
# USMARC Slice Shear Force Procedure for Beef Psoas major (PM)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of PM is conducted with the 90° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# Psoas major (PM) - Left

Posterior



Anterior

Steak 1



Steak 2



Steak 3



Steak 4



Steak 5



Steak 6



Steak 7



Steak 8



Steak 9



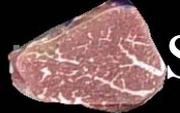
Steak 10



Steak 11



Steak 12



Steak 13



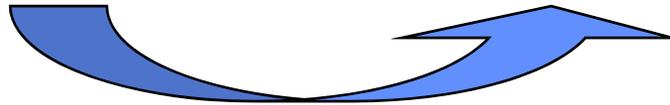
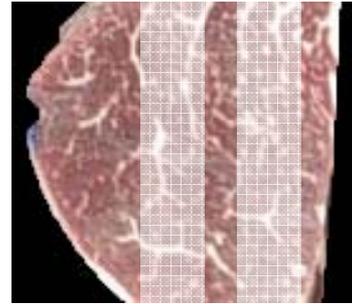
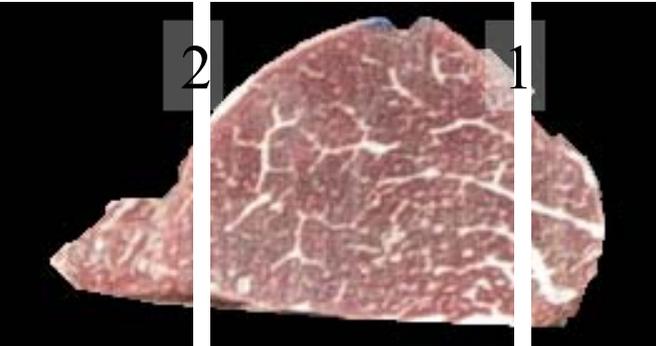
Steak 14



Steak 15



# PM



Make cuts 1 and 2 and rotate the piece **counter clockwise** and place in the 90 degree box. Obtain the 1<sup>st</sup> slice near the top (now on the left) of the section. Obtain the 2<sup>nd</sup> slice near the bottom (now on the right). Space the slices approximately equally.

# Sample data sheet for PM SSF

PM\_SSF data for SSF vs WBS

Date	Animal	Steak	Location	Slice box	SSF	Notes
	51	3	1_Top	90°		
	51	3	2_Bottom	90°		
	51	4	1_Top	90°		
	51	4	2_Bottom	90°		
	52	3	1_Top	90°		
	52	3	2_Bottom	90°		
	52	4	1_Top	90°		
	52	4	2_Bottom	90°		
	53	3	1_Top	90°		
	53	3	2_Bottom	90°		
	53	4	1_Top	90°		
	53	4	2_Bottom	90°		
	54	3	1_Top	90°		
	54	3	2_Bottom	90°		
	54	4	1_Top	90°		
	54	4	2_Bottom	90°		
	55	3	1_Top	90°		
	55	3	2_Bottom	90°		
	55	4	1_Top	90°		
	55	4	2_Bottom	90°		
	56	3	1_Top	90°		
	56	3	2_Bottom	90°		
	56	4	1_Top	90°		
	56	4	2_Bottom	90°		
	57	3	1_Top	90°		
	57	3	2_Bottom	90°		
	57	4	1_Top	90°		
	57	4	2_Bottom	90°		
	58	3	1_Top	90°		
	58	3	2_Bottom	90°		
	58	4	1_Top	90°		
	58	4	2_Bottom	90°		
	59	3	1_Top	90°		
	59	3	2_Bottom	90°		
	59	4	1_Top	90°		
	59	4	2_Bottom	90°		
	60	3	1_Top	90°		
	60	3	2_Bottom	90°		
	60	4	1_Top	90°		
	60	4	2_Bottom	90°		
	61	3	1_Top	90°		
	61	3	2_Bottom	90°		
	61	4	1_Top	90°		
	61	4	2_Bottom	90°		

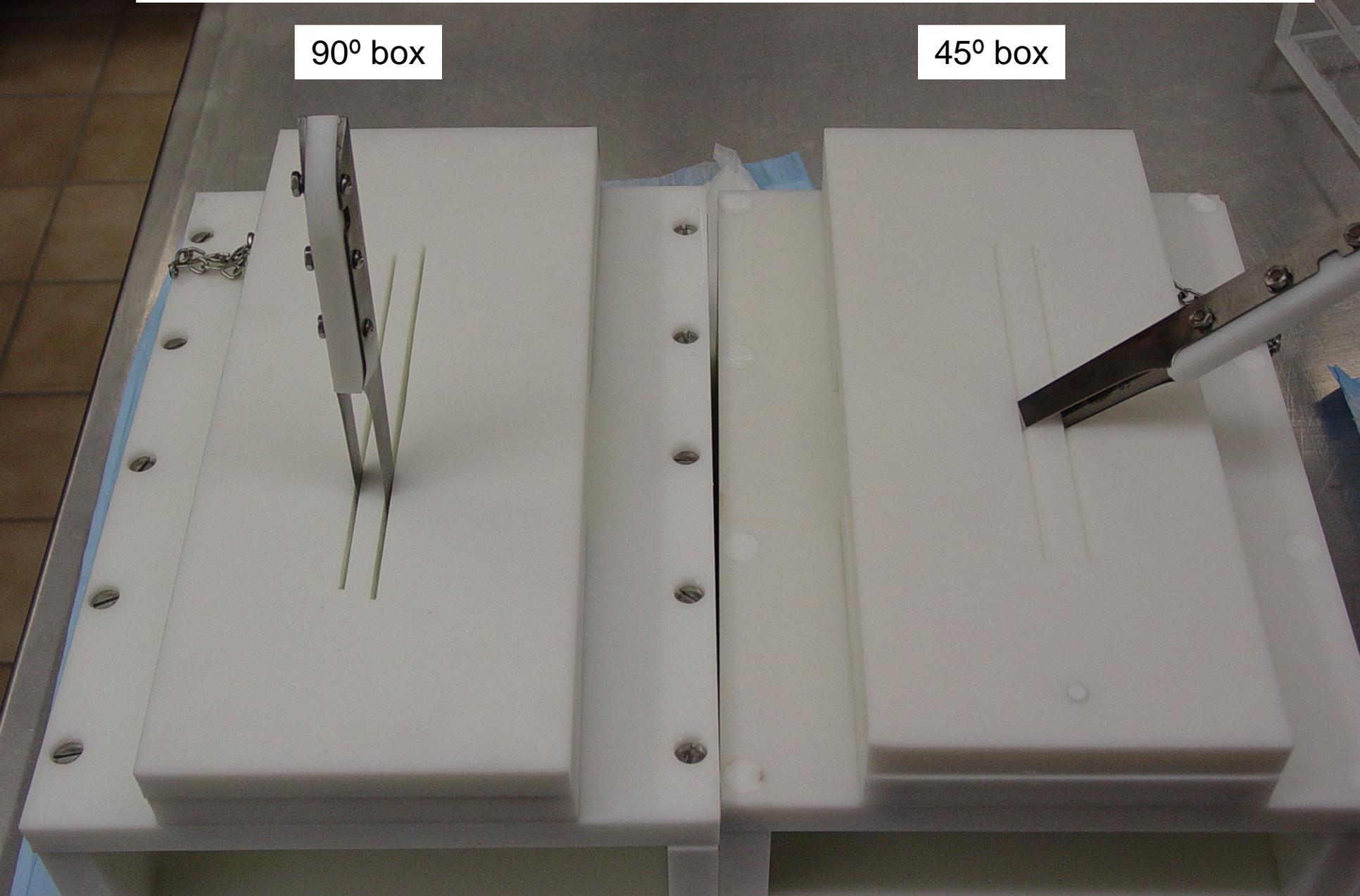
# USMARC Slice Shear Force Procedure for Beef Supraspinatus (SS)

- This project was funded, in part, by The Beef Checkoff.

SSF sampling of SS is conducted with the 45° box

90° box

45° box



On the following slides, a picture of a frozen steak is shown rather than a cooked steak. This was done in order to more clearly show steak orientation. But, slice shear force measurement is conducted on cooked steaks. Steaks are sampled and slice shear force is measured immediately after completion of cooking.

# Supraspinatus (SS) - Left

Anterior



Steak 1

Steak 2

Steak 3

Steak 4

Steak 5

Steak 6

Steak 7

Steak 8

Steak 9



Posterior

# Supraspinatus SS left

Orient the steak with the blue mark towards the right. Square-up the steak removing the blue mark. Get one 5-cm long section from the steak. Rotate the 5 cm portion **clockwise** 90 degrees. Use the 45 degree box. Get one or two slices from each 5-cm long section.



# Sample data sheet for SS SSF

SS\_Data Page 1 of 3

Date	Animal	Steak	Location	Slice box	SSF	Notes
07/07/2005	1	4	1	45°		
07/07/2005	1	4	2	45°		
07/07/2005	2	4	1	45°		
07/07/2005	2	4	2	45°		
07/07/2005	3	4	1	45°		
07/07/2005	3	4	2	45°		
07/07/2005	4	4	1	45°		
07/07/2005	4	4	2	45°		
07/07/2005	5	4	1	45°		
07/07/2005	5	4	2	45°		
07/07/2005	6	4	1	45°		
07/07/2005	6	4	2	45°		
07/07/2005	7	4	1	45°		
07/07/2005	7	4	2	45°		
07/07/2005	8	4	1	45°		
07/07/2005	8	4	2	45°		
07/07/2005	9	4	1	45°		
07/07/2005	9	4	2	45°		
07/07/2005	10	4	1	45°		
07/07/2005	10	4	2	45°		
07/07/2005	11	4	1	45°		
07/07/2005	11	4	2	45°		
07/07/2005	12	4	1	45°		
07/07/2005	12	4	2	45°		
07/07/2005	13	4	1	45°		
07/07/2005	13	4	2	45°		
07/07/2005	14	4	1	45°		
07/07/2005	14	4	2	45°		
07/07/2005	15	4	1	45°		
07/07/2005	15	4	2	45°		
07/07/2005	16	4	1	45°		
07/07/2005	16	4	2	45°		
07/07/2005	17	4	1	45°		
07/07/2005	17	4	2	45°		
07/07/2005	18	4	1	45°		
07/07/2005	18	4	2	45°		
07/07/2005	19	4	1	45°		
07/07/2005	19	4	2	45°		
07/07/2005	20	4	1	45°		
07/07/2005	20	4	2	45°		
07/07/2005	21	4	1	45°		
07/07/2005	21	4	2	45°		
07/07/2005	22	4	1	45°		
07/07/2005	22	4	2	45°		