

# Slice Shear Force Protocol for Small Volume at Lower Cost

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The USDA neither guarantees nor warrants the standard of the products mentioned to the exclusion of other products that also may be suitable.

This protocol is for longissimus. We also have developed slice shear force protocols and their descriptions for 20 other muscles. If you are interested in these, contact us.

This option will give slice shear force results that are just as repeatable as the higher throughput option, but this lower throughput option that requires lower capital investment is more labor intensive. With two people you could process up to 50 samples per day, but if you are processing 50 samples per day every day or some frequent basis, you may want to consider the high throughput option.

We recommend you send someone to our lab to be trained in person. However, if that is not possible the following description of the protocol is fairly detailed. If you have any questions, do not hesitate to call us.

# SSF Standardized Equipment

## W-B Shear Machine for SSF

The Warner-Bratzler shear machine can be fitted with a blade designed for SSF.

Contact:

Dick Lundquist

G-R Manufacturing

6402 Martin Ave

Manhattan, KS 66503-8631

Ph. 785-293-5120, Fax 785-293-5124

[grmanufacturing@twinvalley.net](mailto:grmanufacturing@twinvalley.net)

# Cooking Equipment

George Foreman style cooking grill. Be sure the model you purchase has sufficient cooking surface to accommodate two steaks without crowding.

# SSF Standardized Equipment

## Slice Shear Force Kit

To help ensure consistency across institutions a Slice Shear Force Kit is available that includes three items: a sizing box, a slice box, and a double-bladed knife (it also could include the shearing blade if you wanted an extra). We strongly recommend using this kit.

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# Temperature Monitoring Equipment

Many sources and products are available. The following are products we use in our lab:

Digi-Sense thermometer, type J thermocouple. Cole Parmer Company. Catalog # EW-91100-00. Price-\$165. Phone: 800-323-4340. Fax: 847-247-2929. Email: [info@coleparmer.com](mailto:info@coleparmer.com) Website: [www.coleparmer.com](http://www.coleparmer.com)

Hypodermic temperature probe with 2.5” needle and mini connector. Omega Engineering Company. Catalog # EI1 107108/2.5”/HYP2-21-2.5-J-G-48-SMPW-M. Price-\$96. This is a special order product with an additional set up charge of \$50 per order. Place the order to the attention of John Bach, Extension 2310. Phone: 888-826-6342. Fax: 203-359-7700. Website: [www.omega.com](http://www.omega.com)

# Cooking Protocol

Internal temperature of the steaks should be 2 to 5°C prior to cooking. Frozen samples should be thawed at 2 to 5°C for approximately 24 to 36 hours to reach the correct internal temperature.

1. Plug in the grill and allow the grill to preheat for a least ten minutes.

2. Insert a long hypodermic needle thermocouple (approximately 2.5 inches long) into the geometric center of each steak and attach to a handheld thermometer. Be sure the needle is in the center both horizontally and vertically.

# Step 2: Thermocouple placement



3. Two steaks can be cooked at the same time, one on each side of the grill. Other arrangements do not work because of accommodating the thermocouples when the lid is closed for cooking.

# Step 3: Placement of steaks on grill



4. The steaks need to be placed as close to the edge as possible so that the needle probe will extend out past the edge of the grill when the lid is closed.

# Step 4: Monitoring temperature during cooking



Since internal steak temperatures will continue to rise approximately 6-7° after cooking, remove the steaks from the grill when they reach 65°C. Cooking times can vary by several minutes so close attention needs to be paid to the thermocouple temperatures.

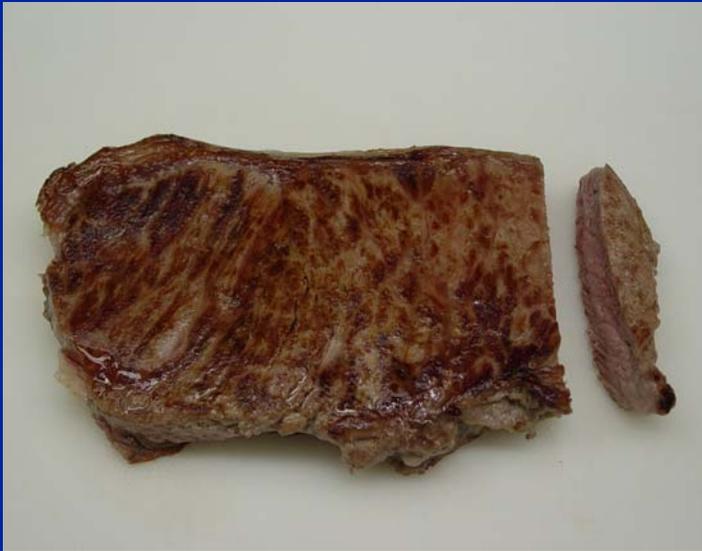
Continue to monitor temperature until it peaks and starts back down, and then record the maximum temperature the steak reaches during post-cooking rise as the final cooked temperature. Remove the thermocouple probe, record cooked weight (if you are monitoring cooking loss) and immediately proceed with the slice shear force procedure.

# SSF Protocol

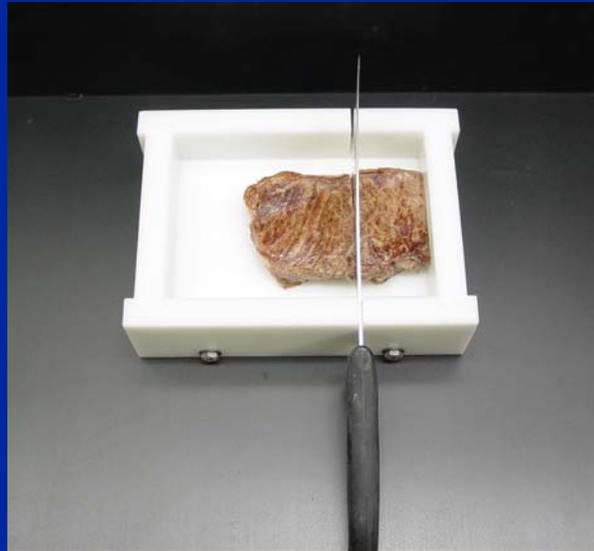
After recording final cooked temperature of the steak, remove from the lateral end of each steak a 1-cm-thick, 5-cm-long slice that is parallel to the muscle fibers.

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

1



2



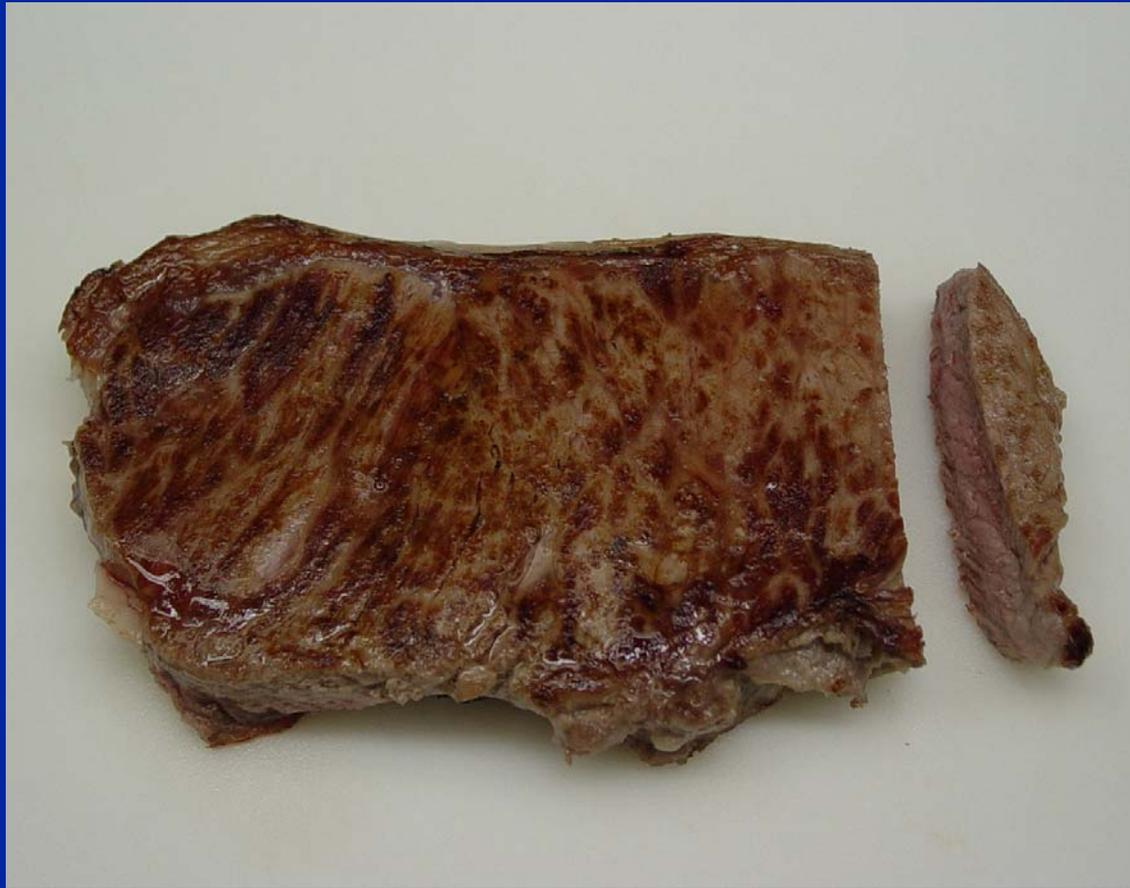
3



# SSF Protocol

1. A cut is made across the width of the longissimus at a point about 1 to 2 cm from the lateral end of the muscle.

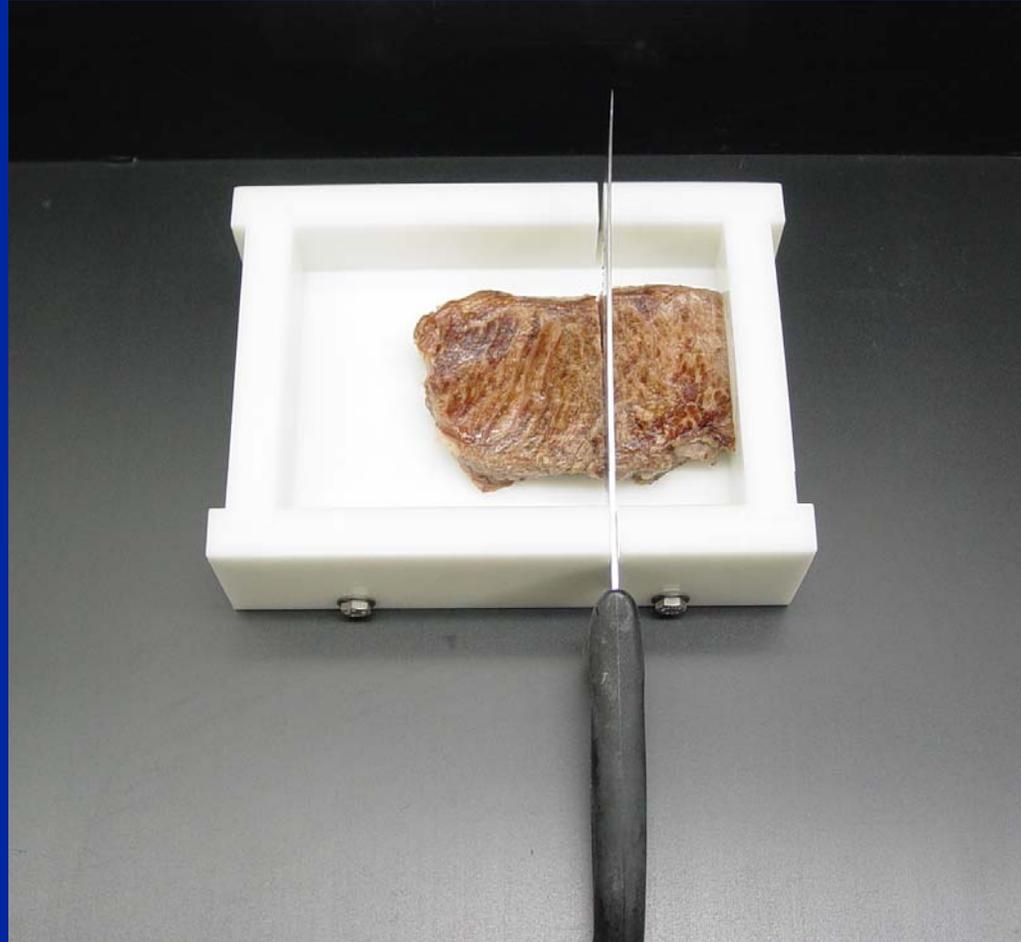
# Step 1. Square off the end of the muscle



# SSF Protocol

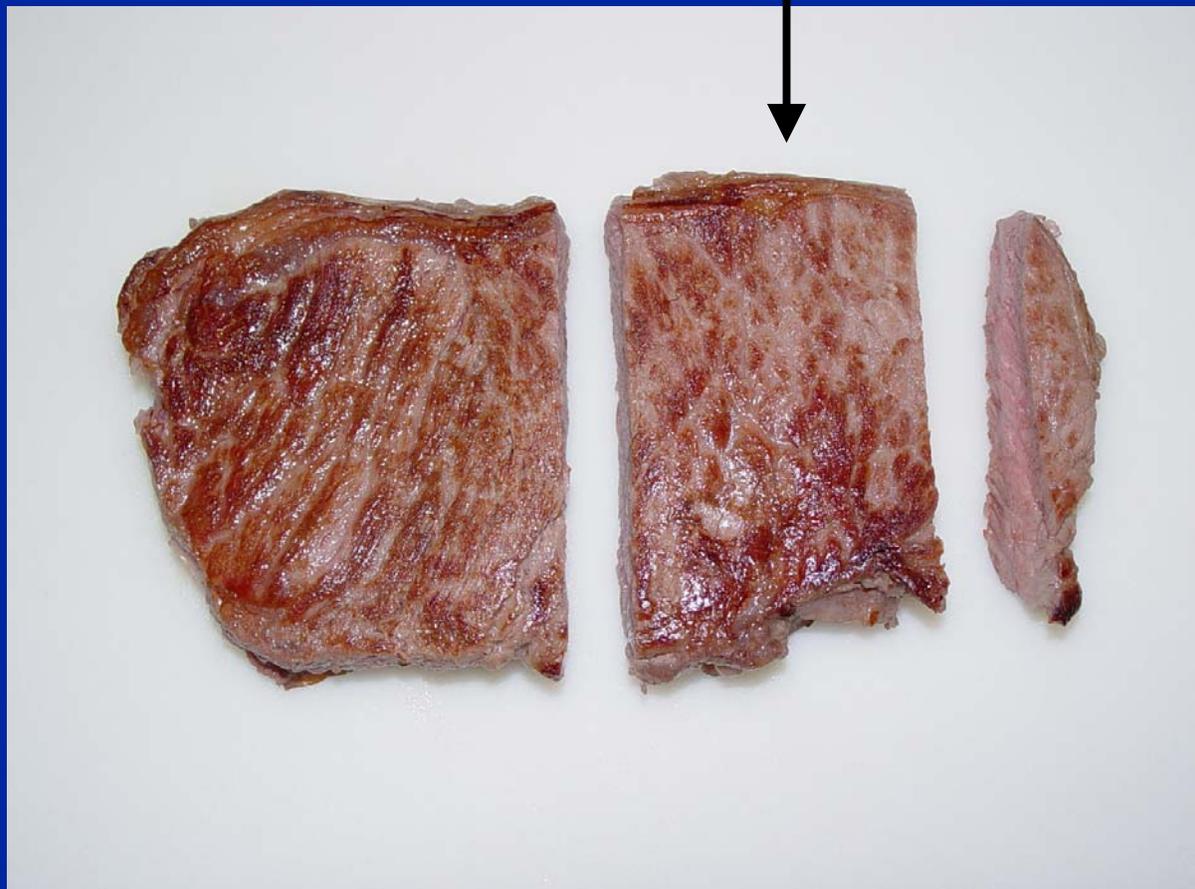
2. Using the sample sizing box, a second cut is made across the width of the longissimus, parallel to and at a distance of 5 cm from the first cut.

Step 2. Obtain the 5-cm long section

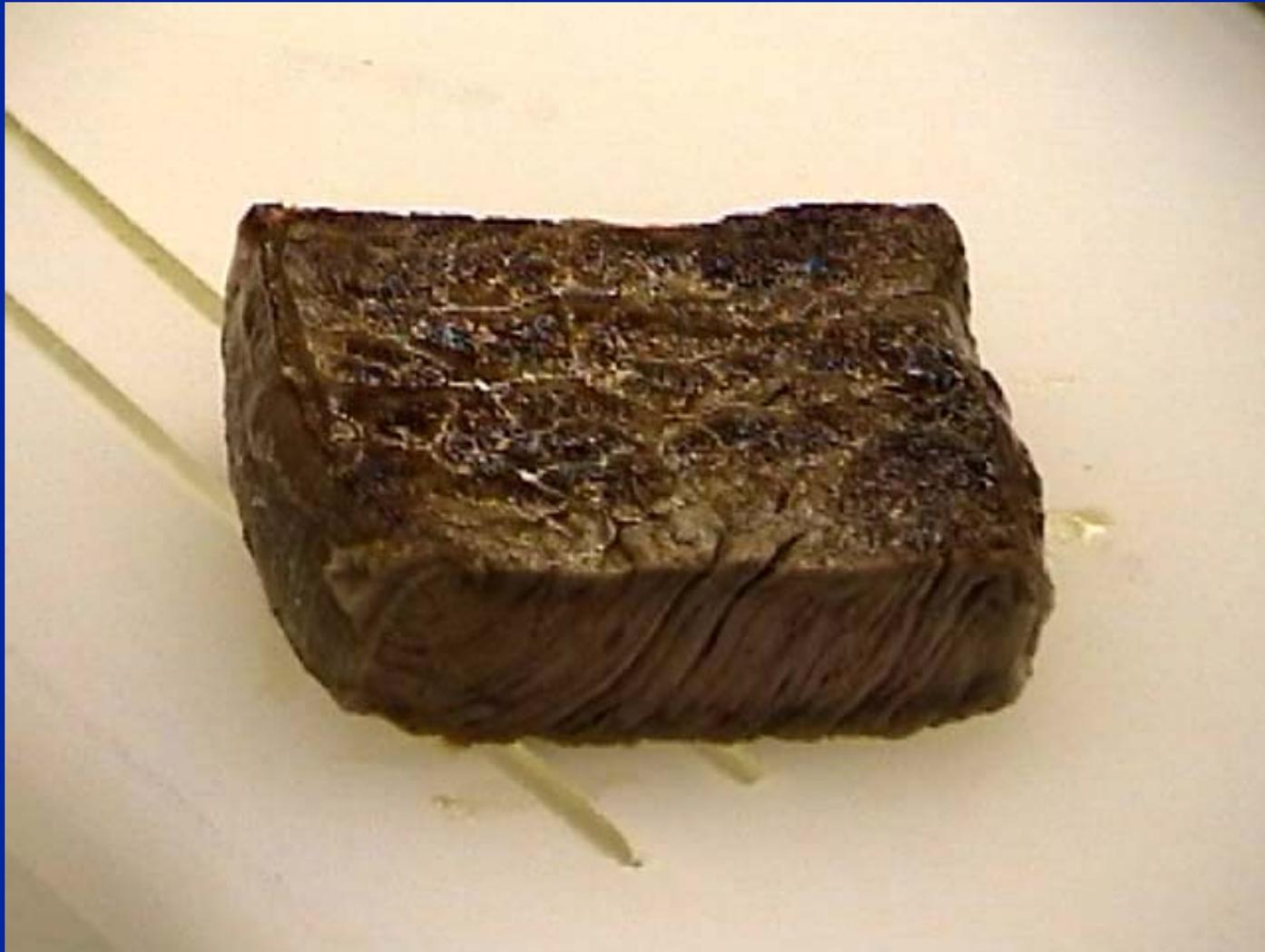


We now have a 5-cm long section from the lateral end of the longissimus with muscle fibers at a 45° angle.

5-cm section



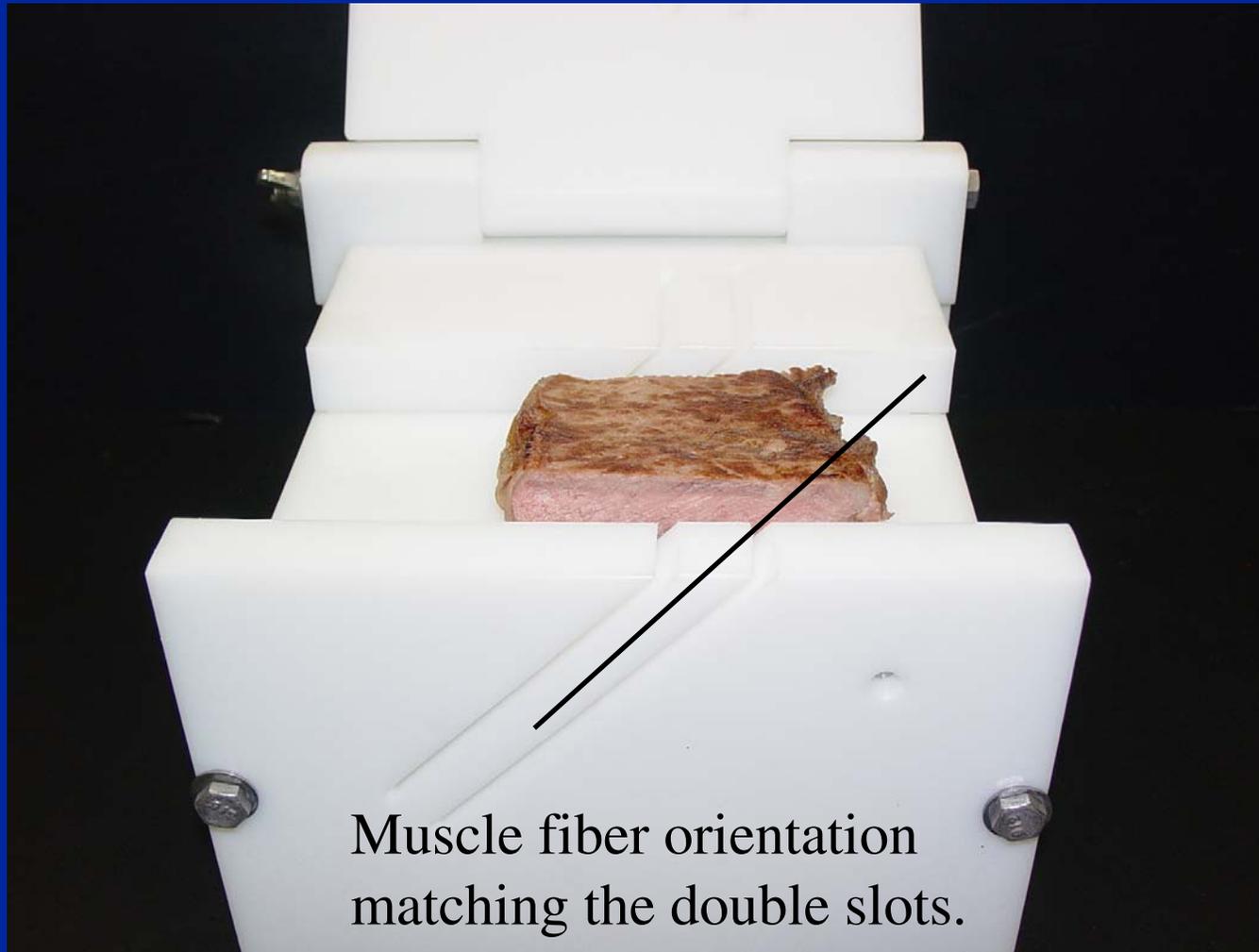
5-cm section with  $45^\circ$  fiber angle



# SSF Protocol

3. The 5-cm long section is placed in the slice box and centered on the two  $45^\circ$  slots with the angle of the slots lined up with the muscle fiber angle.

# Step 3: Muscle fiber orientation in slice box



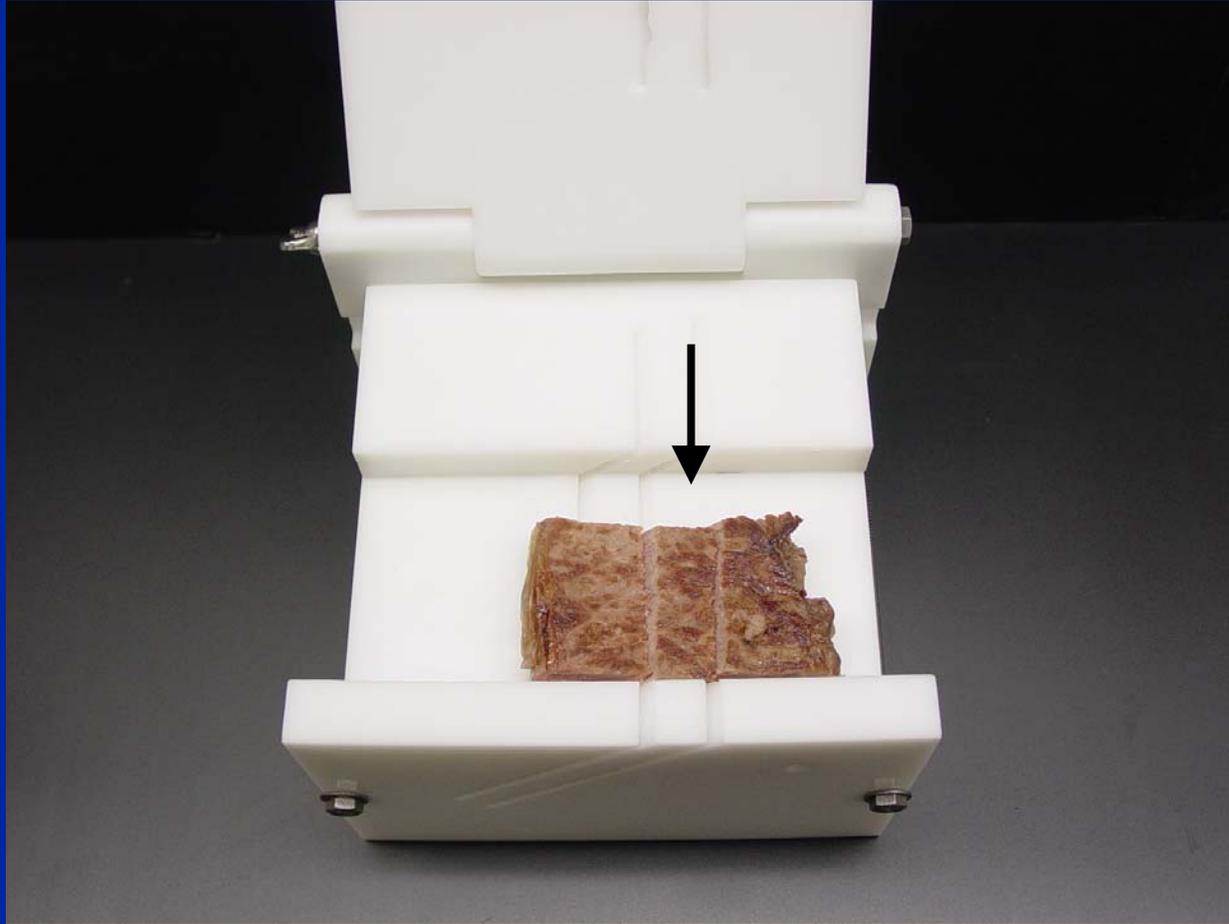
# SSF Protocol

4. Close the lid of the box. Insert the double-bladed knife that consists of two parallel blades spaced 1 cm apart into the slots at the back and make two parallel cuts simultaneously through the length of the 5-cm long section. This cut is made with 4 to 5 up-and-down sawing motion strokes while pulling the knife forward (the knife blades must be kept sharp to get a good “clean” cut – failure to do so will result in slices less than the full thickness and underestimate SSF). This cut provides a 1-cm thick, 5-cm long slice that is parallel to the muscle fibers.

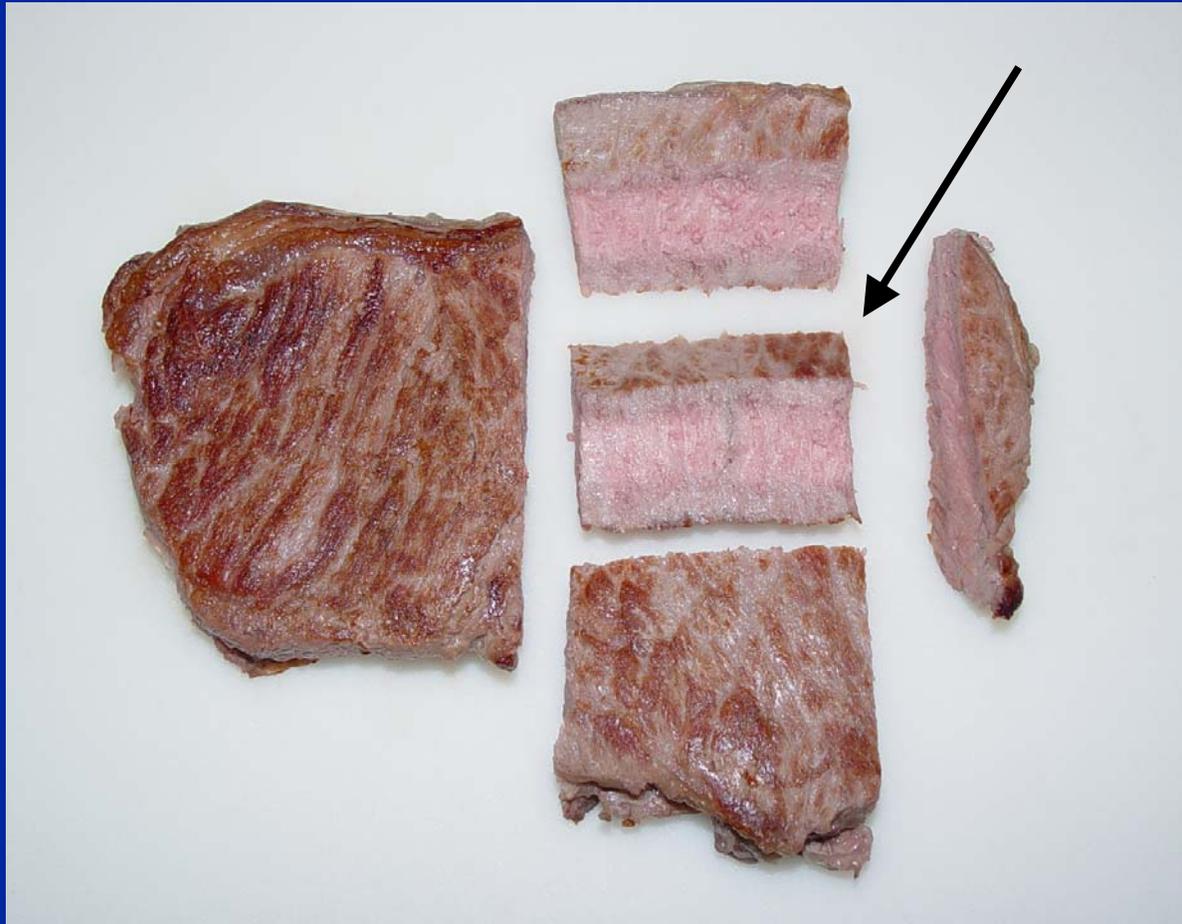
Step 4. Obtaining 1 cm-thick, 5 cm-long slice



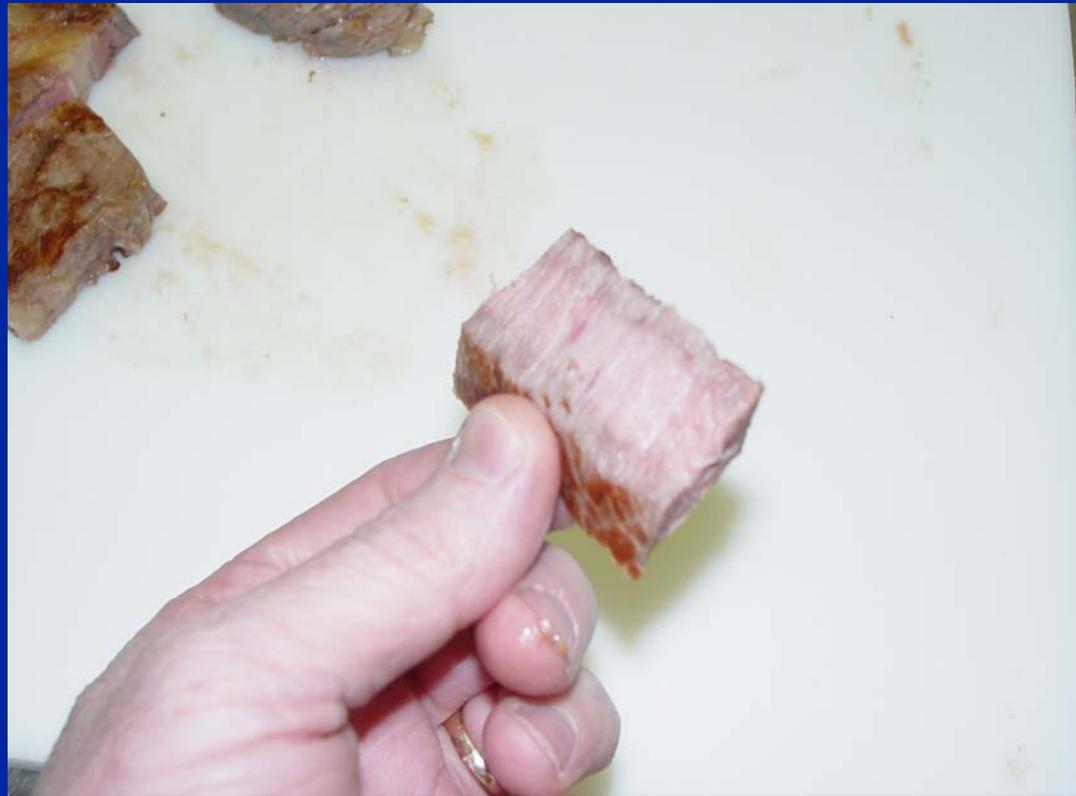
# The slice



1 cm-thick, 5 cm-long slice parallel to fibers



1 cm-thick, 5 cm-long slice parallel to fibers



# Warner-Bratzler machine with SSF blade

The slice will be sheared with a Warner-Bratzler shear machine using a slice shear force blade from G-R Manufacturing .



# Setting up the W-B Shear Machine

Install the blade, using the manufacturer's spacers (the thickness of the gap is critical, 0.082 inches). Be sure the wing nuts are tightened firmly.

Using the black knob, manually lower and raise the testing unit to be sure the blade is free.

Turn on the force gauge by pressing the red I key.

After the self test at start-up, the display will read zero. Select KG as the unit of measurement by pressing the UNITS key until KG appears.

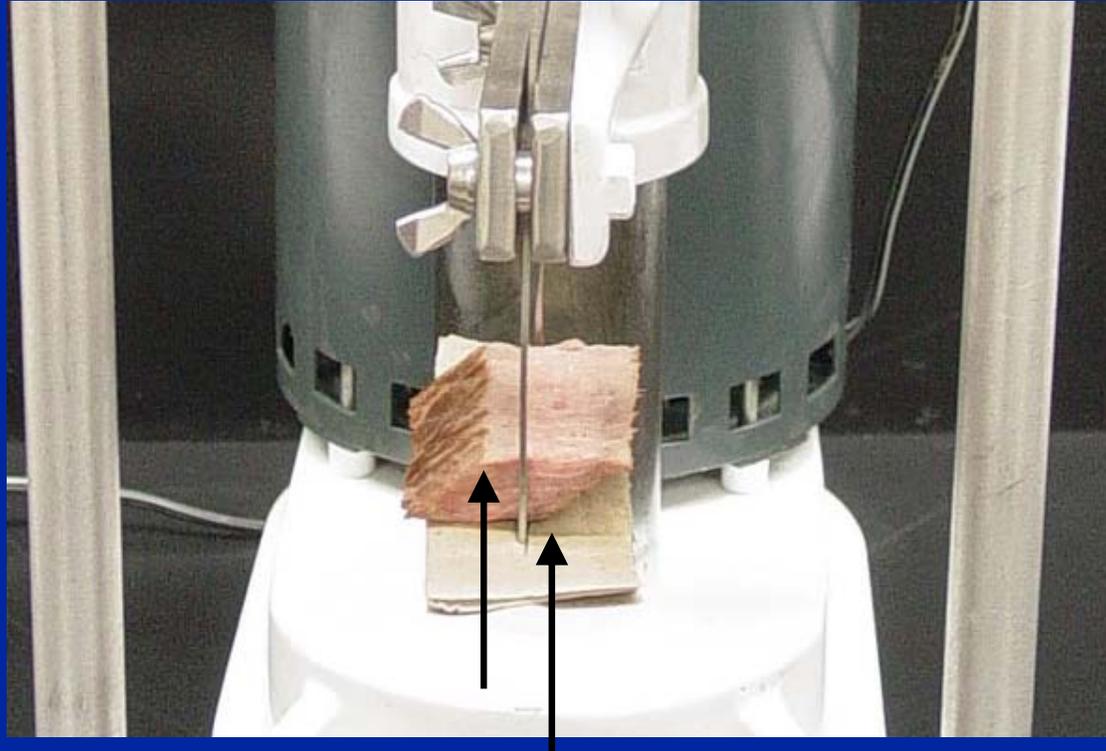
Press the MAX key until the symbol at the left lower corner has two arrows pointing away from each other to indicate tension testing.

Turn on the motor for the testing unit.

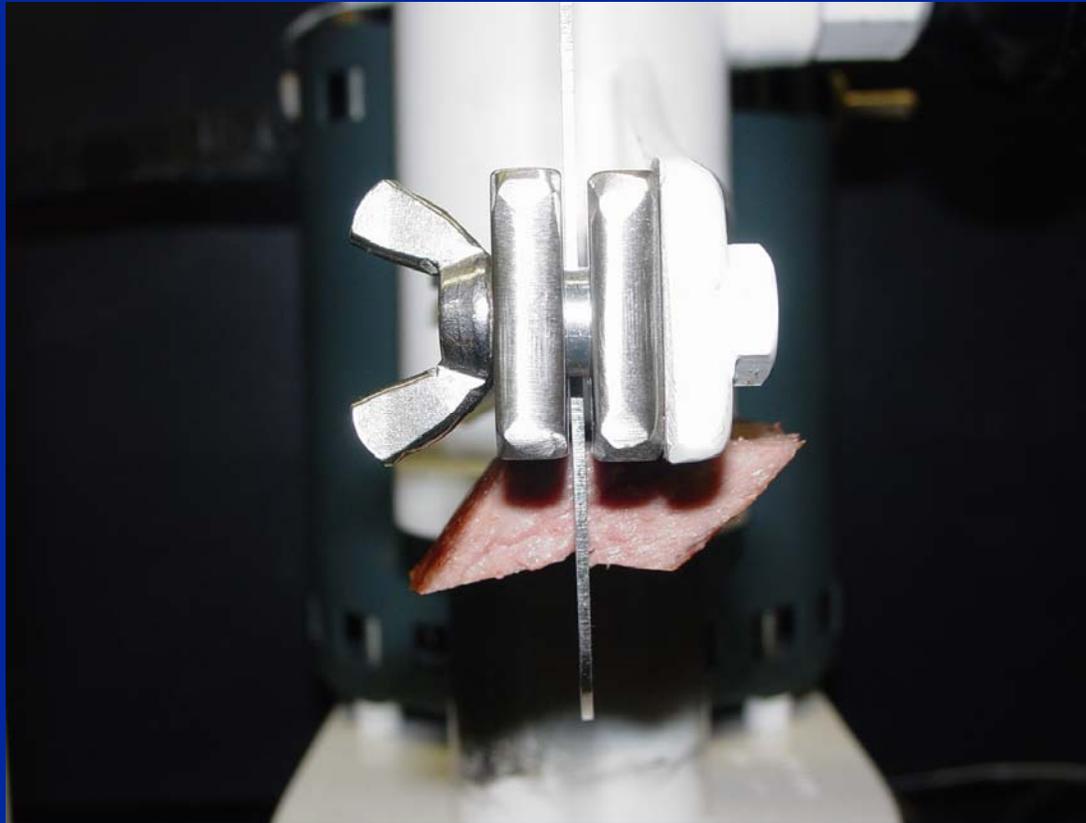
Place the slice into the slot in the blade. Be sure the slice is positioned so that the slice will be sheared in the center, perpendicular to the muscle fibers along the 5-cm dimension of the slice.

# Step 5: Shearing the slice





When positioning the slice, it must be exactly centered so the blade shears in the center and avoids the cooked crust on both the top and bottom sides of the slice. (G-R Manufacturing is trying to design an accessory that will hold the slice for you to make this process easier.)



Until this accessory is available, use the black knob to slide the testing unit down to contact the slice and hold it in place. Double check that the slice is properly positioned.

Push in the two projecting buttons on the top of the tester to start shearing.

Record the digital reading of the shear value.

Push reset, then zero. You must do this step or the next sample reading will not be saved.

Using the black knob, manually raise the testing unit back to the top position.

Wipe meat residue off of the blade. Proceed with the next sample.