

# Freedom Revision Knee Saw Bone Workshop

January, 2016

**maxx**  
medical

# Incision

- Use the classical anterior midline incision to access the knee joint via a medial parapatellar arthrotomy.
- The subvastus and midvastus approaches can also be used with the same instrumentation.

*Note:- When possible follow pre-existing scar from primary procedure.*

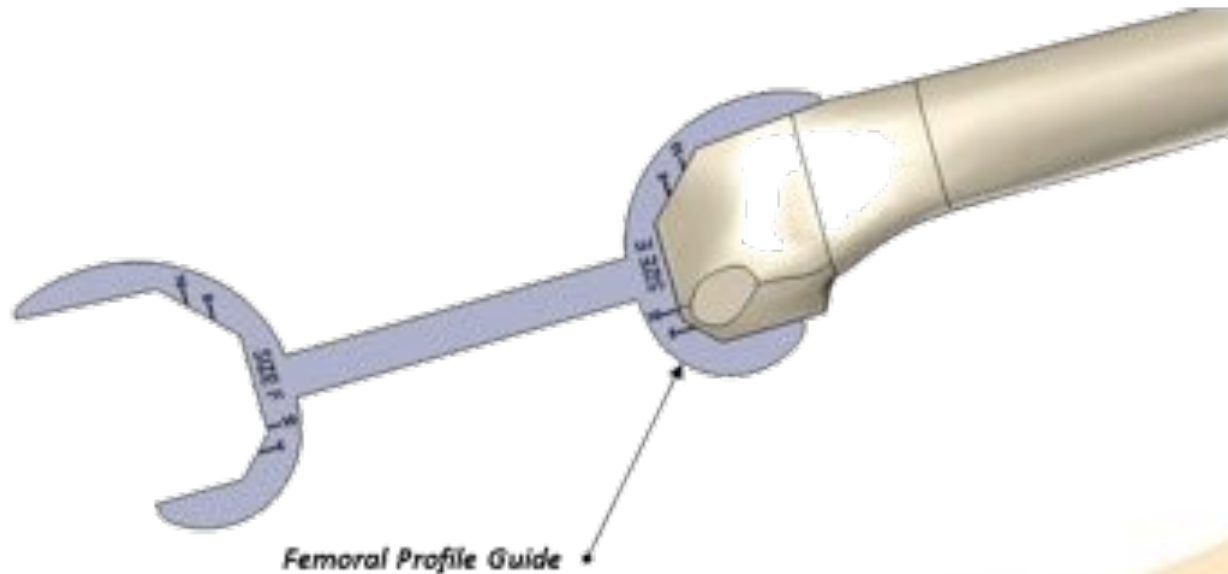
# Primary Implant Removal

- Preserve maximum bone stock.
- Tools like *Femoral Impactor/Extractor* & *Slap Hammer* can be used for primary implant removal.
- Use *Tibial Alignment Guide Blocks* to measure the flexion & extension gaps, as a predictor for implant sizing and tissue balancing requirements.

*Note:- Remove femoral implant first to improve access to the tibial component*

# Sizing the Femur

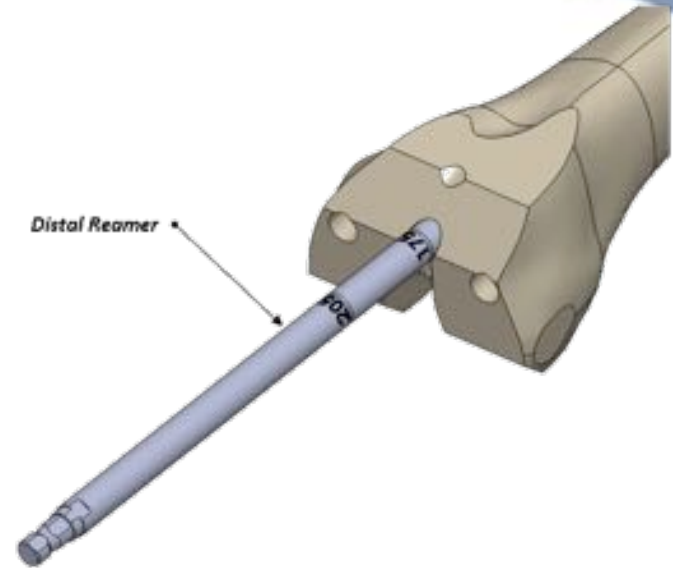
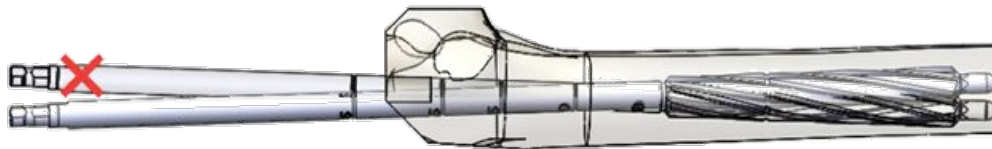
- Determine the size of revision femur using the *Femoral Profile Guide*.
- The removed primary implant is a useful reference.



# Reaming IM Canal

- Use table to determine Distal Reamer depth marking corresponding to stem extension.
- Ream the IM canal with reamer (Ø6.5 or Ø9 mm) to appropriate depth.

*Caution:- Ream angled anteriorly.*



Stem Length	Reamer Depth Marking
40mm	65
75mm	100
100mm	130
150mm	175

# Reaming IM Canal

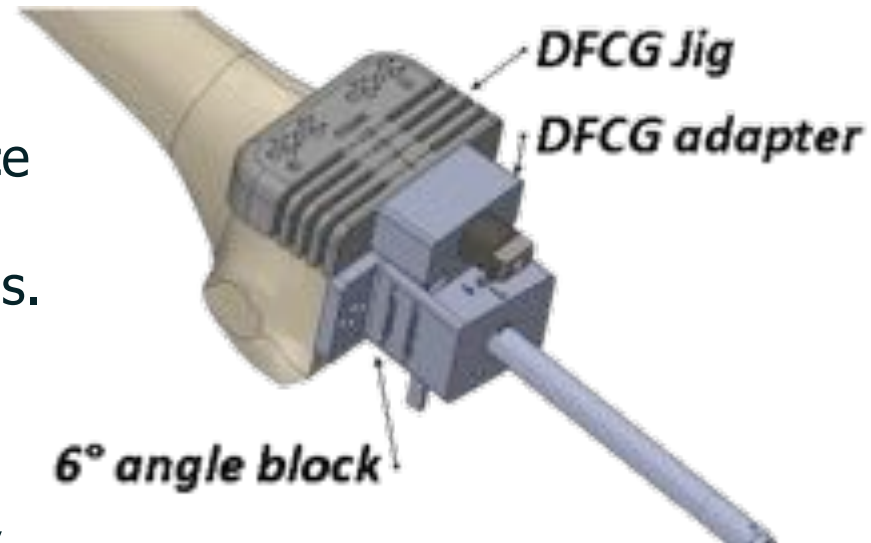
- Increase reamer diameter by 0.5mm until cortical bone contact is achieved.
- Do not exceed reamer diameter as per table.
- This diameter restriction is temporary. Additional reaming can be done after box cut preparation & removal of box cut guide.

Note:- If cementing the stem, the reamer diameter should be 0.5mm or 1mm larger than that of the stem.

Femoral Implant Size	Reamer $\emptyset$
B	$\emptyset$ 17.5mm
C	$\emptyset$ 18.0mm
E	$\emptyset$ 18.0mm
F	$\emptyset$ 22.0mm
G	$\emptyset$ 22.0mm
H	$\emptyset$ 22.0mm

# Distal Femoral Cut and Valgus Angle Preparation

- Assemble the DFCG jig and adapter, into the slot of the 6° angle block marked 'Revision.'
- Set the resection level by laying the 6° angle block against the distal face of the femur and then securing the DFCG jig to the bone using long pins.
- Assess the need for any medial or lateral distal augmentation using an angel wing.
- Resection depth can be adjusted by 2mm distally or proximally by using the  $\pm 2$ mm pin holes.

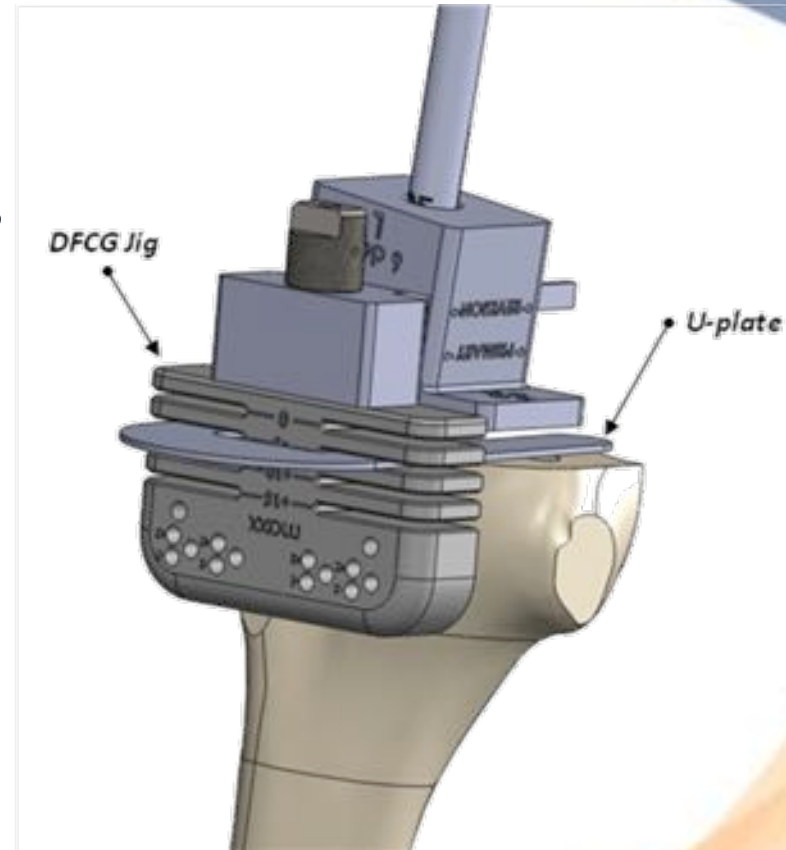


*Note: The Freedom Knee® PCK femoral has a fixed 6° valgus angle.*



# Distal Femoral Cut and Valgus Angle Preparation

- If augmenting both sides, use U-Plate to maintain the correct joint line.
- Insert U-plate in augment slots (+5, +10 or +15) and lay the U-plate against the distal face
- Secure the DFCG jig to the bone with long pins.





# Distal Femoral Cut and Valgus Angle Preparation

- Remove everything except reamer and DFCEG Jig.
- Use an oscillating saw to make distal femoral cut.
- If necessary, prepare augment cuts on the medial & lateral sides.
- Saw through the 0mm,+5mm, +10mm or +15mm augment slots for 0,1,2,3 distal augments.

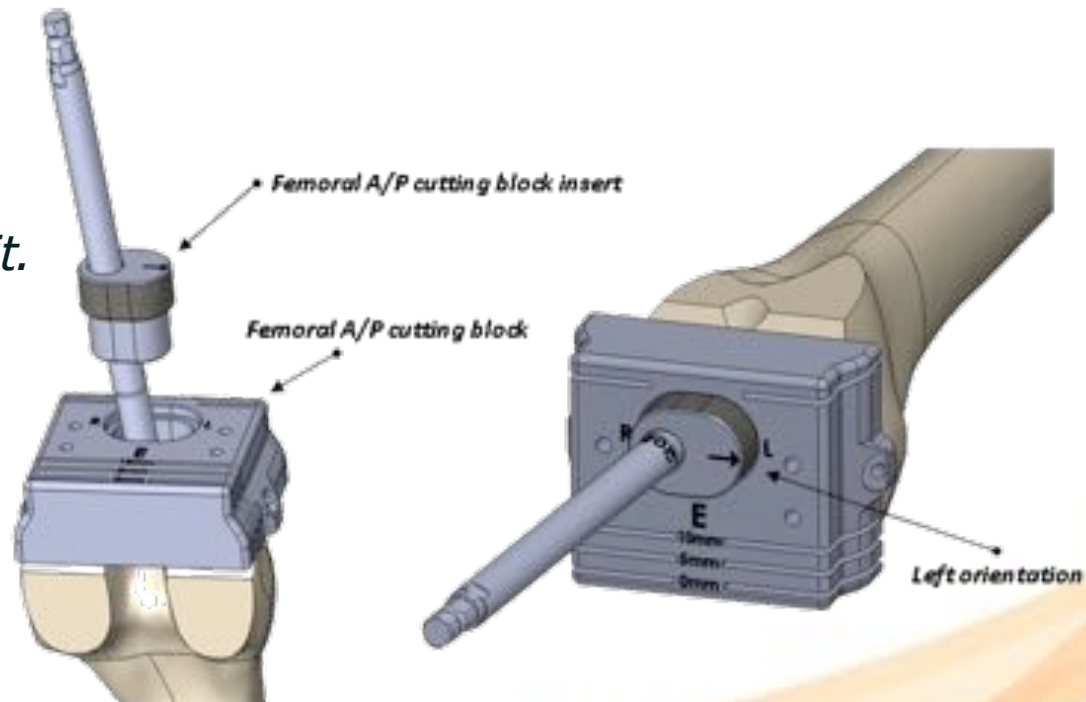
## NOTE:

- *Femoral distal & posterior augments are symmetric and are each 5mm thick.*
- *Distal Femoral augments, may be stacked up to three high to correct defects from 5mm to 15mm.*
- *Posterior Femoral augments, may be stacked up to two high to correct defects of 5mm and 10mm.*
- *However, the maximum number of distal and posterior augments combined per side is four; i.e. if three distal augments are used on the medial side, then at most one posterior augment may be used on that same side.*

# Anterior and Posterior Cuts

- Select appropriate size *Femoral A/P Cutting Block* and drop it over the distal reamer, resting it on the previously resected distal face of the femur.
- Then slide the *Femoral A/P Cutting Block Insert* over the distal reamer and fit it in correct orientation.

*Note:- If the distal reamer was removed previously, reintroduce it.*

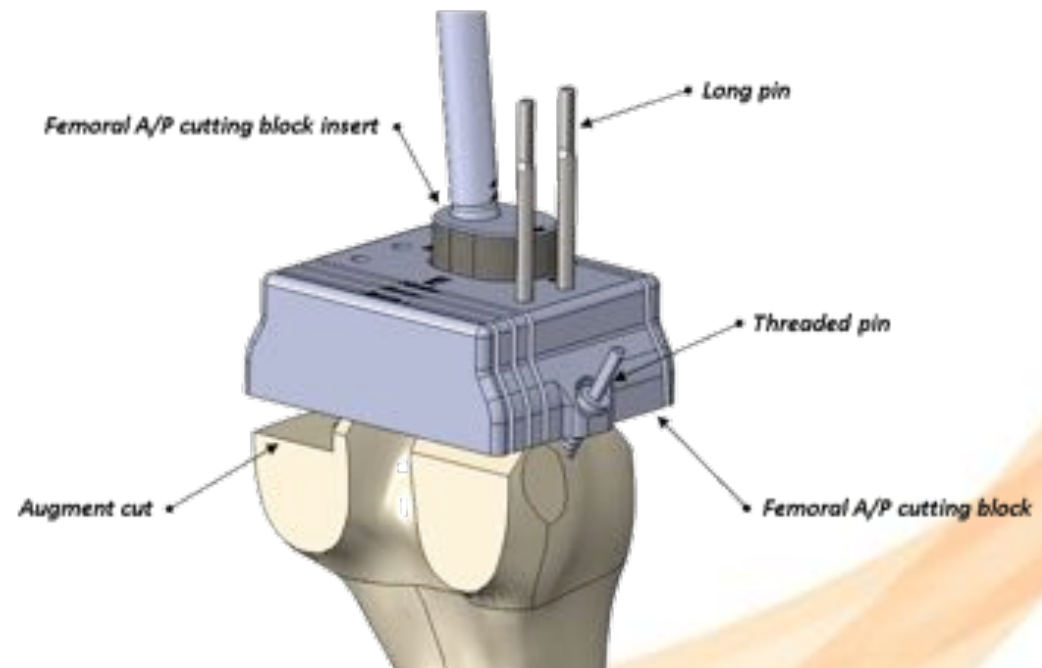


# Anterior and Posterior Cuts

- Use *Angel Wing* to align anterior & posterior cutting slots with the resected surfaces from the explanted femoral.
- Slightly rotate the *Femoral A/P Cutting Block*, as needed, to balance this optimal alignment.
- Secure with smooth or threaded headed pins.

*Note:- In case of distal augment cuts, optimal fixation may be achieved by pins exclusively in medial or lateral side.*

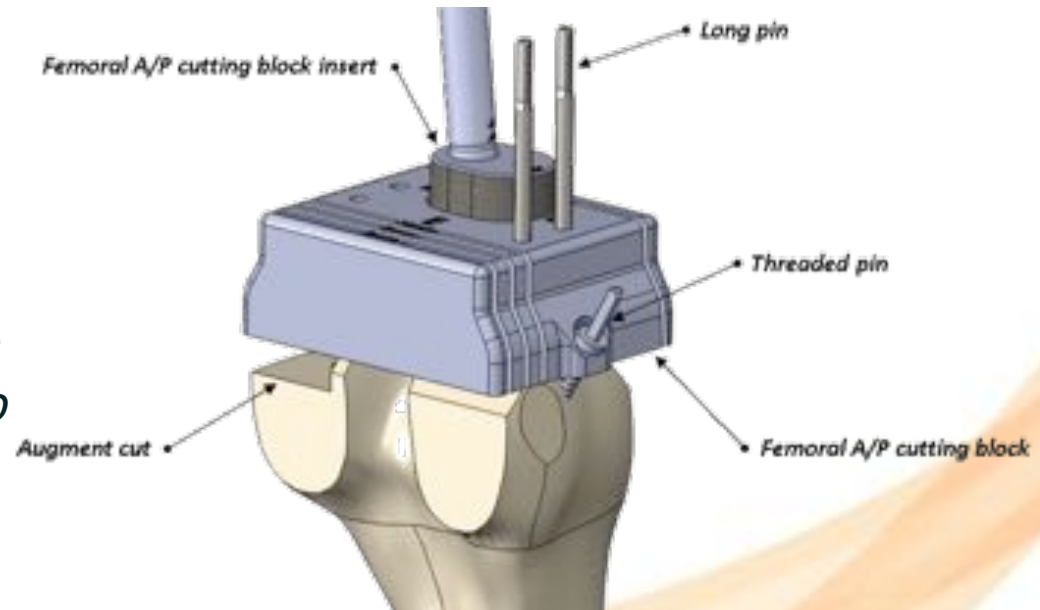
*Caution:- Avoid anterior notching by visualizing the cuts using Angel Wing. Reposition the block if required.*



# Anterior and Posterior Cuts

- Assess the need for posterior medial or lateral augmentation, and make cuts with oscillating saw.
- For posterior cuts, use the '0mm' slots if no augmentation is needed or use the '5mm' or '10mm' augment slots to remove bone for 1 or 2 augments, respectively.
- Remove all instrumentation other than the distal reamer.

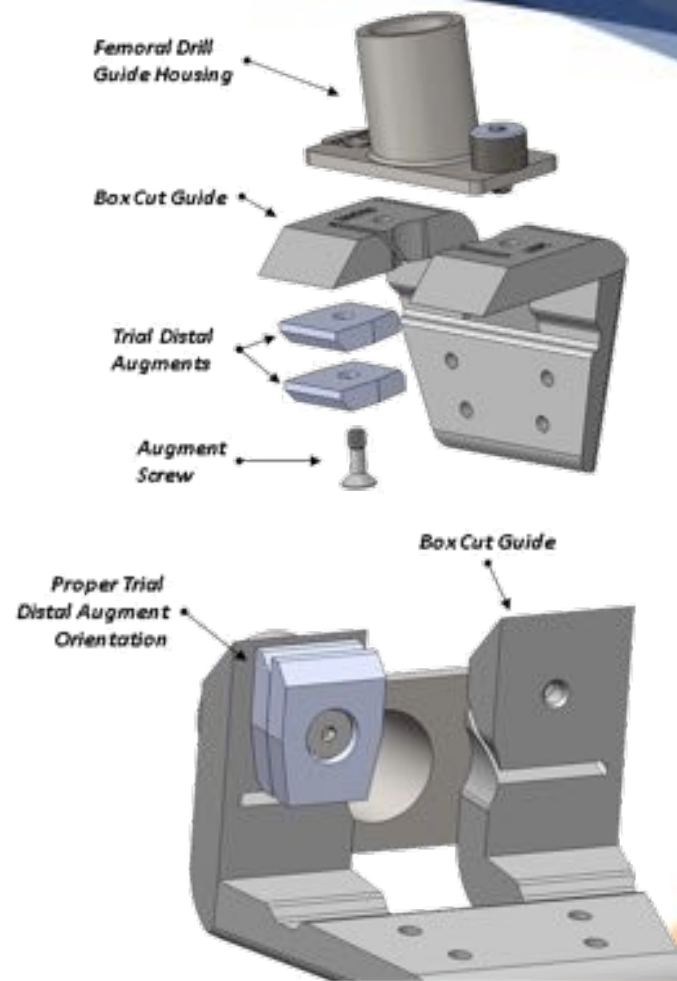
*Note:- Maximum number of distal and posterior augments combined per side is four. Therefore, two posterior augments may be used on a particular side only if two or fewer distal augments are used on that same side; again adding up to a combined maximum number of four augments per side.*



# Box Cut Preparation

- Select PCK *Box Cut Guide* (BCG) to match the implant size, and attach *Trial Distal Femoral Augments*.
- Use *Augment Screws* as needed.
- Attach *Femoral Drill Guide Housing* [Small (B-E) / Large (F-H)] to the BCG.

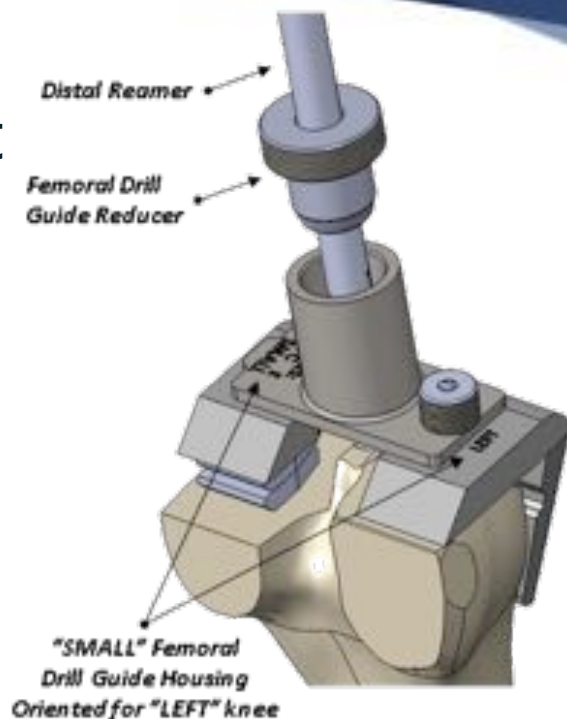
*-Note: Proper orientation of the trial distal femoral augments will ensure no interference with the subsequent box and chamfer cuts.*





# Box Cut Preparation

- Drop the PCK BCG assembly over the reamer & position flush against the resected femur.
- Slide the *Femoral Drill Guide Reducer* over the distal reamer. It accepts the  $\text{\O}9.0\text{mm}$  of the distal reamer and is needed to correctly position the BCG.
- Secure using long pins through the set of most distal holes.
- Remove all other instrumentation including the distal reamer.



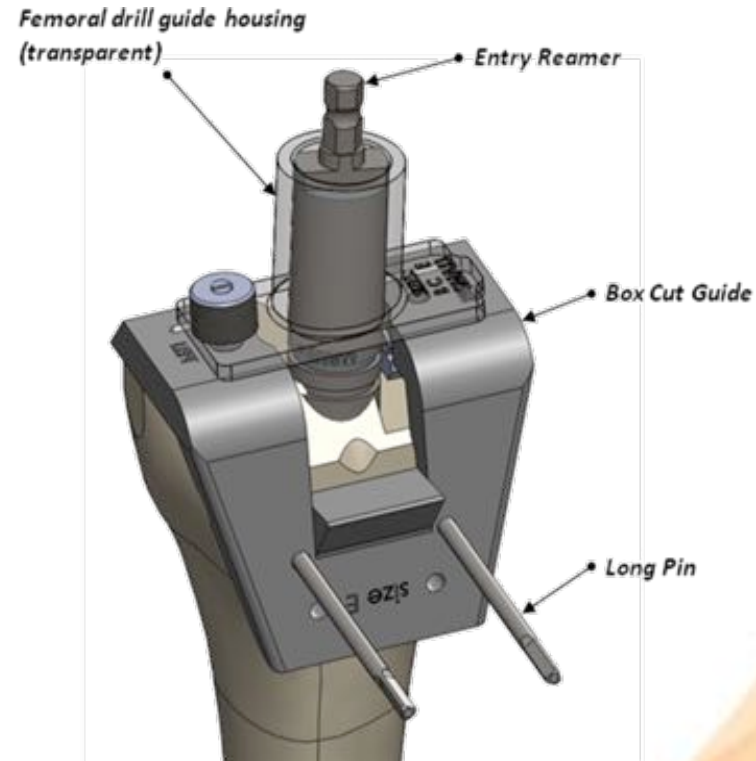


# Central Boss Reaming

Only required if the distal reamer used is less than  $\phi 17\text{mm}$

- Reattach the femoral drill guide housing to the BCG in correct orientation.
- Advance the *entry reamer* until the proximal end of the reamer reaches the top of the femoral drill guide housing.
- Remove everything except BCG.

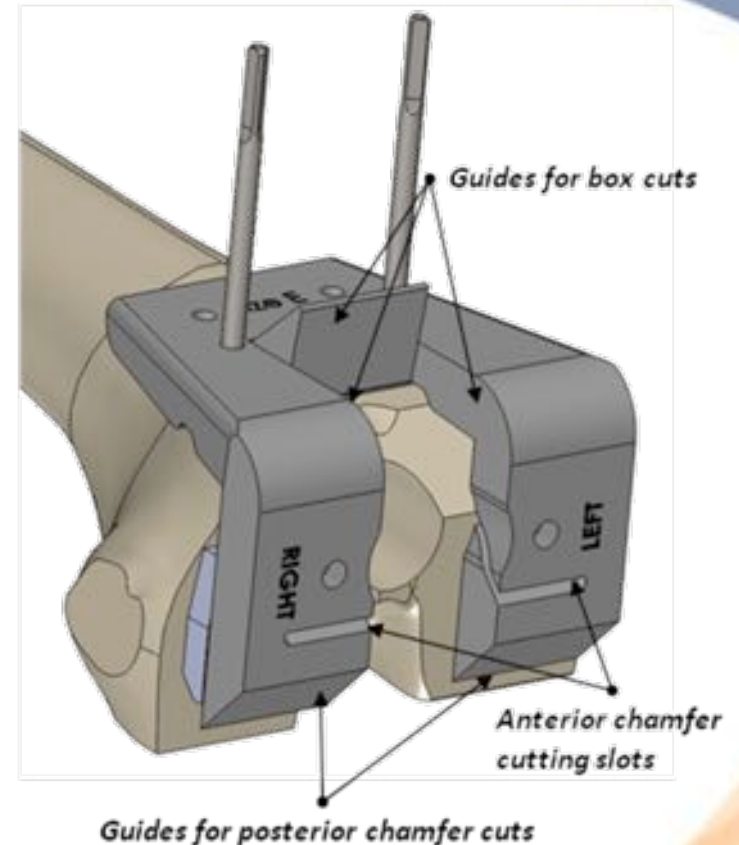
*-Note: Pins can be introduced through the proximal set of holes for additional fixation, but only after removing the entry reamer.*



# Intracondylar Box Cuts

- Use a reciprocating saw, to make the box cuts on the distal femur.
- Use an oscillating saw for the anterior, posterior and chamfer cuts.
- Remove all instrumentation in preparation for trialing.

*-Caution: Be careful not to risk fracture by undermining the medial or lateral condyles.*

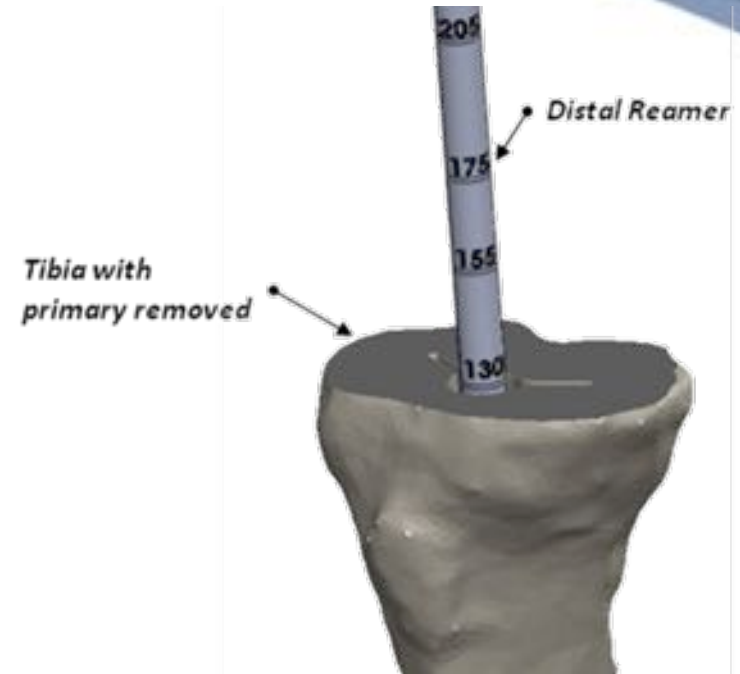


# Additional Reaming\*

- This is required only if reaming beyond  $\text{Ø}17.5\text{mm}$  with a size B femur or beyond  $\text{Ø}18\text{mm}$  with a size C or E femur to accommodate a larger diameter stem extension.
- Additional reaming is to be done freehand, using the previously reamed IM canal as a guide for orientation and depth.

# Tibial Preparation- Reaming IM Canal

- Use Table to determine the reamer depth marking corresponding to the stem extension & offset junction combination to be implanted.
- Start with the sharp tipped 6.5mm or 9mm *distal reamer*, and progressively increase diameter in 0.5mm until cortical bone contact is achieved.



Stem Length	Reamer Depth Marking	
	No Offset	With Offset
40mm	65	100
75mm	100	130
100mm	130	155
150mm	175	205

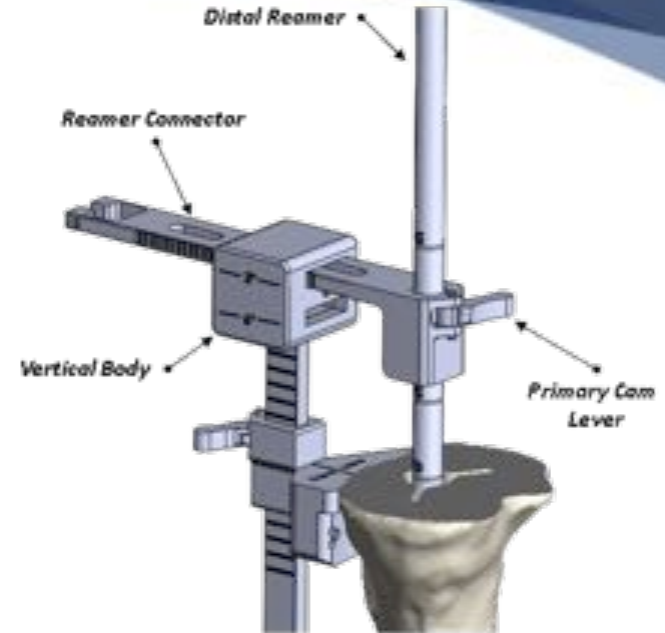
Note:- If cementing the stem, the reamer diameter should be 0.5mm or 1mm larger than that of the stem.

# Refining the Proximal Tibial face

- Assemble the *IM Tibial Cutting Guide* (TCG), and slide it over the distal reamer.
- Set desired resection level and pin TCG Jig to the bone using long pins.
- Remove all other instruments and resect tibia using oscillating saw.

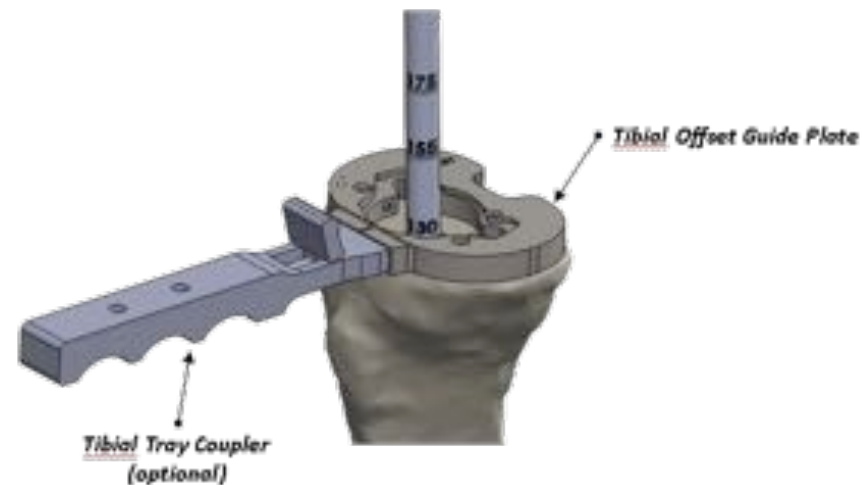
## Notes:

- Depth of resection should be minimized to preserve bone stock.
- Using the 3° slot in the vertical body results in a 3° posterior slope of the resected tibia.
- After pinning TCG Jig, resection depth can be adjusted by using the  $\pm 2$ mm pin holes in the TCG jig.



# Tibial Baseplate Positioning

- Reintroduce the distal reamer into the IM canal.
- Select the *Tibial Guide Plate* size that offers bony support all around with no overhang.
- Optionally, the *Tibial Tray Coupler* can be used to hold and help position the tibial guide plate.





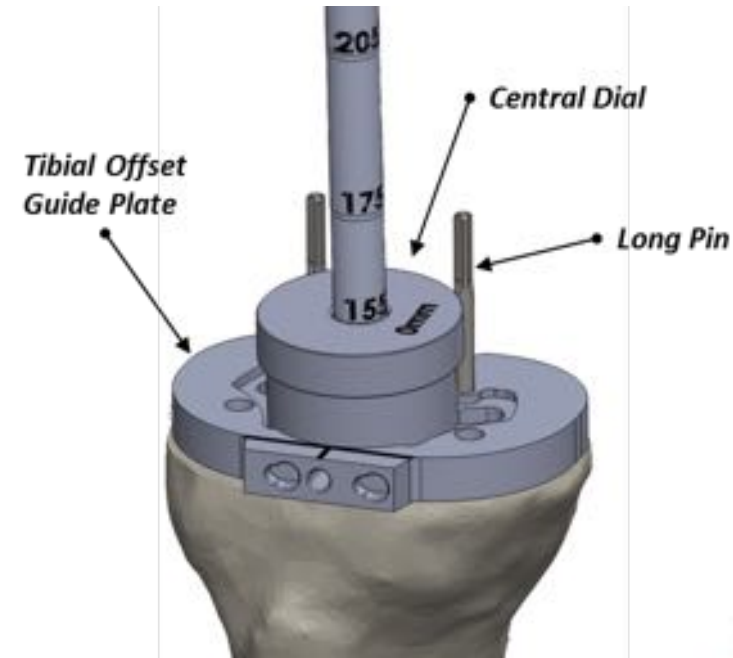
# Tibial Baseplate Positioning

*If NO tibial offset is needed:*

- Slide the *Central Dial* over the reamer and into the recess in the guide plate.
- Rotate the guide plate slightly about the distal reamer for a position of optimal coverage.
- Pin guide plate using long pins and remove all other instrumentation.

*Note:*

*-With the central dial, the tibial baseplate is centered about the IM canal and no tibial offset will be performed.*



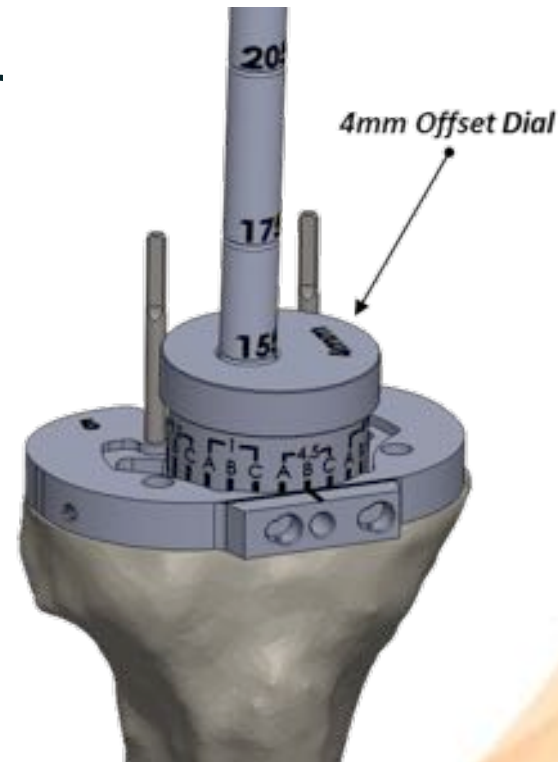
# Tibial Baseplate Positioning

*If tibial offset is needed:*

- Remove the central dial.
- Slide the *4mm offset dial* over the reamer and secure in recess of tibial guide plate.
- Turn the offset dial about the reamer to reposition the guide plate for optimal coverage.
- If coverage is not adequate, repeat with the *6mm offset dial*.
- Pin guide plate using long pins and remove all other instrumentation.

*Note:*

*-The offset dials offer 360° of relative offset positioning of the tibial baseplate with respect to the IM canal.*



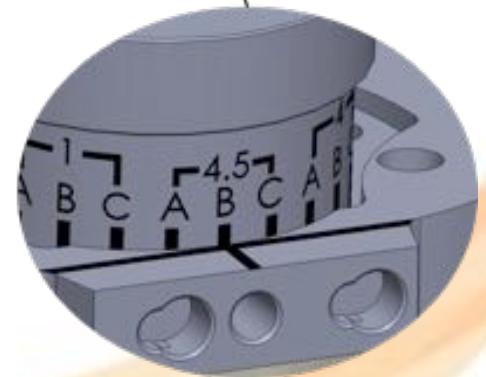
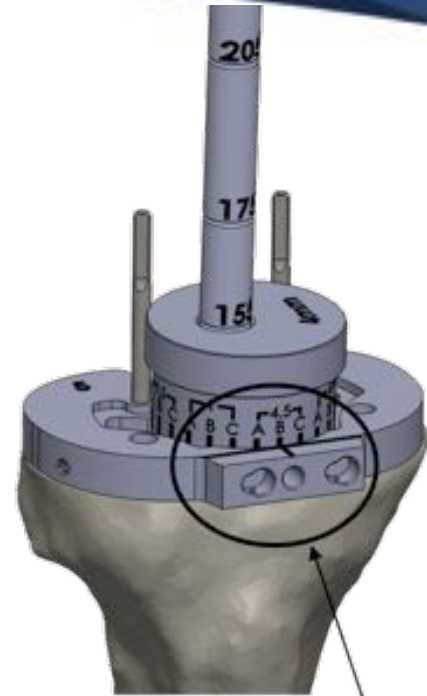
# Tibial Baseplate Positioning

*If tibial offset is used:*

- Make note of which marking on the offset dial is aligned with the midline marking on the tibial offset guide plate.
- This marking aids in later assembling the trial and implant components correctly.

*Notes:*

- Determine the best-fit combination of baseplate size, offset vs. no offset, offset amount, and offset positioning to give optimal coverage of the resected tibia.
- With only the pinned guide plate in place, proceed to keel preparation.

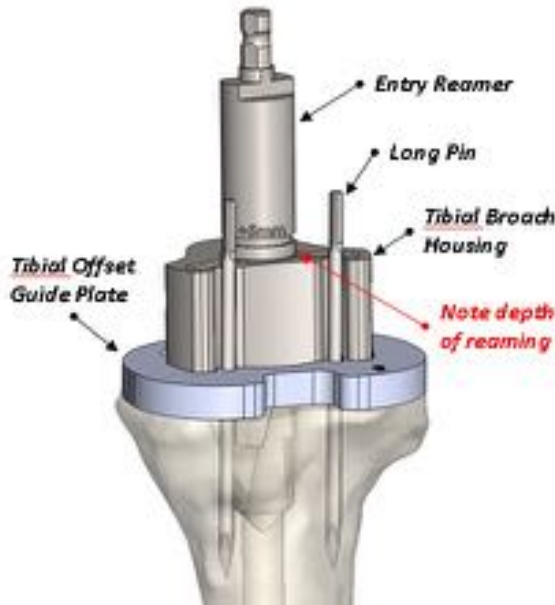


# Keel Preparation

- Place the *tibial broach housing* in the recess of the pinned tibial offset guide plate.

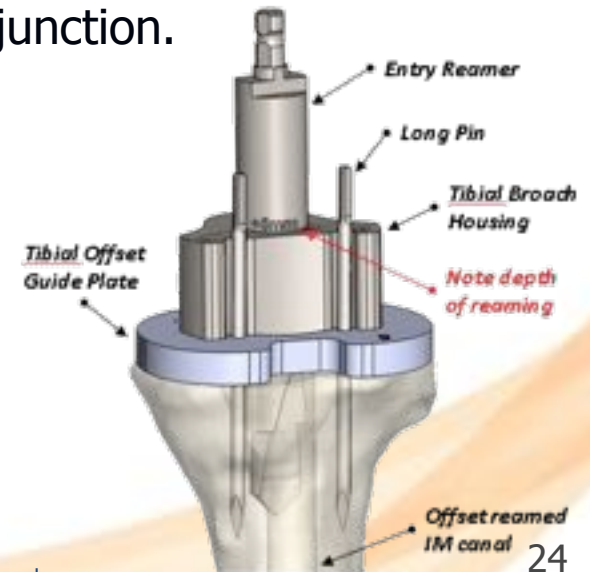
## In cases without a tibial offset:

Using the *entry reamer*, gently ream the proximal tibia until the distal most groove on the reamer reaches the top of the *tibial broach housing*.



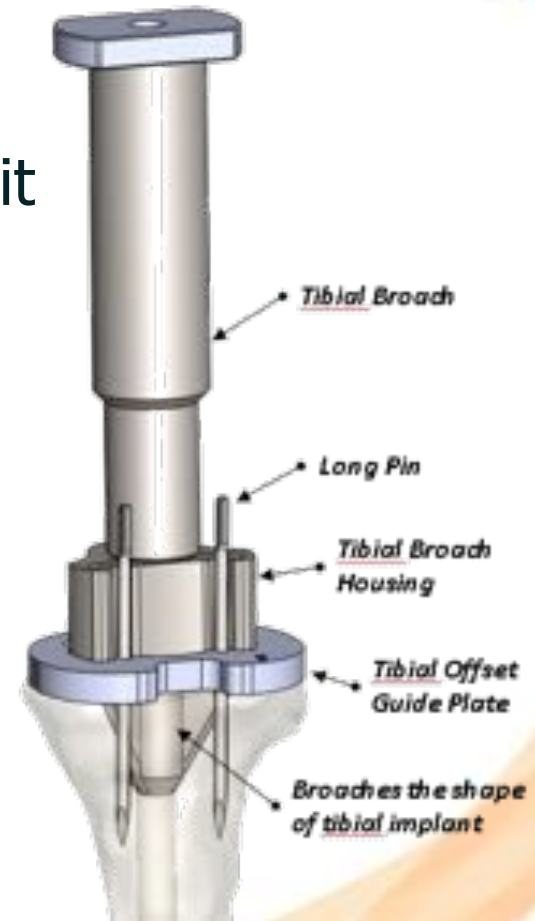
## In cases with a tibial offset:

Using the *entry reamer*, gently ream the proximal tibia until the proximal '+5mm' groove on the reamer reaches the top of the *tibial broach housing*. The increased drill depth is needed to accommodate the proximal portion of the offset junction.



# Keel Preparation

- Broach for the tibial keel by inserting and gently tapping the *tibial broach* through the tibial broach housing until it reaches its endpoint.
- Extract using slap hammer.
- Remove all instrumentation.





# Additional Step\*

*\*Note: Only required when offset junction is used and stem extension diameter is less than  $\varnothing 15\text{mm}$*

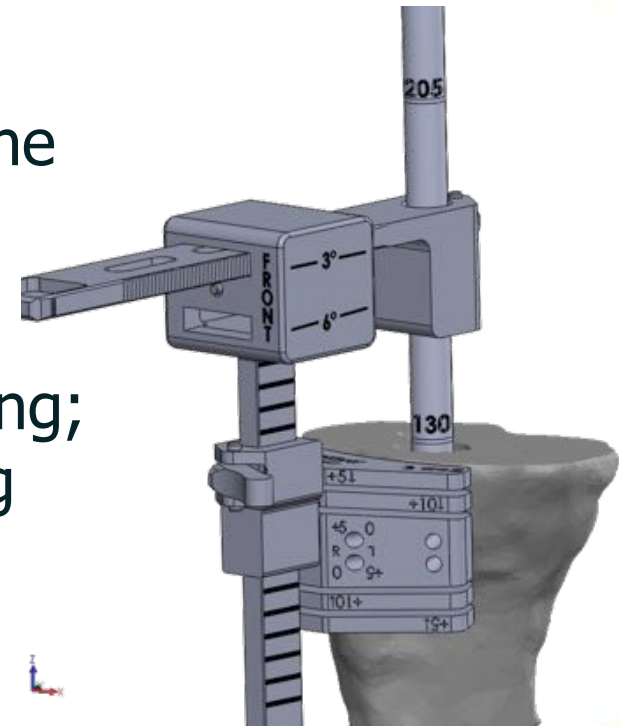
- Reintroduce the *distal reamer* into the IM canal. Use the *central dial* to reposition the *tibial offset guide plate* centered about the IM canal.
- Secure using *long pins*, and replace central dial with *tibial broach housing*.
- Using the *entry reamer*, gently ream until the proximal most end of the reamer reaches the top of the tibial broach housing.





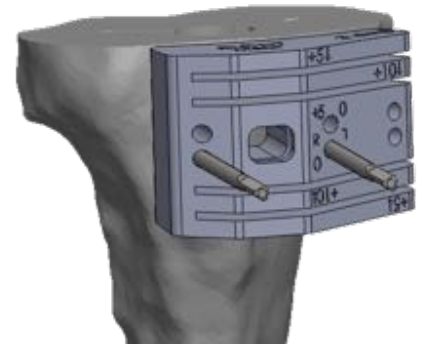
# Tibial Augment Preparation

- Reintroduce the distal reamer into the IM canal.
- Attach Tibial Augment Cutting Jig to the IM TCG, and slide over the reamer.
- Set the height position of the tibial augment cutting jig using an angle wing; aligning the proximal surface of the jig with the proximal most point on the resected surface of the tibia.
- Secure the jig to the tibia with long pins through the neutral pin holes marked '0'.



# Tibial Augment Preparation

- Resect the bone for tibial augments.
- For one augment use '+5' mm slot & for two augment use the '+10' mm slot.
- For three augments, move the tibial augment cutting jig to the '+5' mm pin holes and saw through the '+10' mm slot.

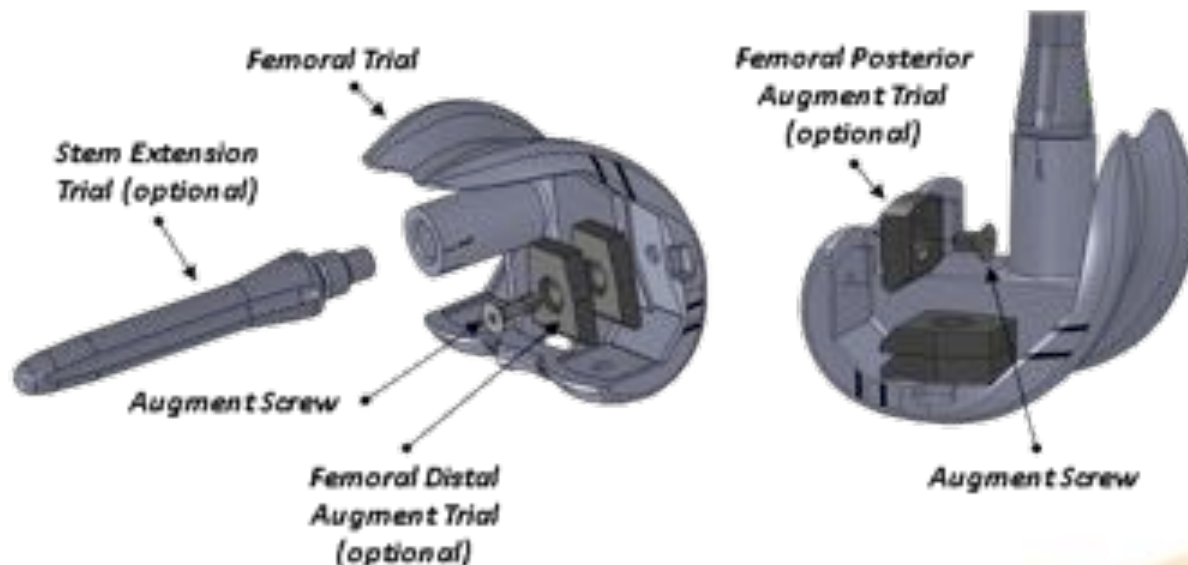


*-Note:*

- *Tibial augments address **medial and lateral tibial defects** and are optional for use with the stemmed tibial baseplate.*
- *Tibial augments are 5mm thick and may be stacked up to three high to correct **defects from 5mm to 15mm.***
- *Tibial augments are reversible for medial and lateral defects and decreasing sizes can be used together to create a **conical profile.***

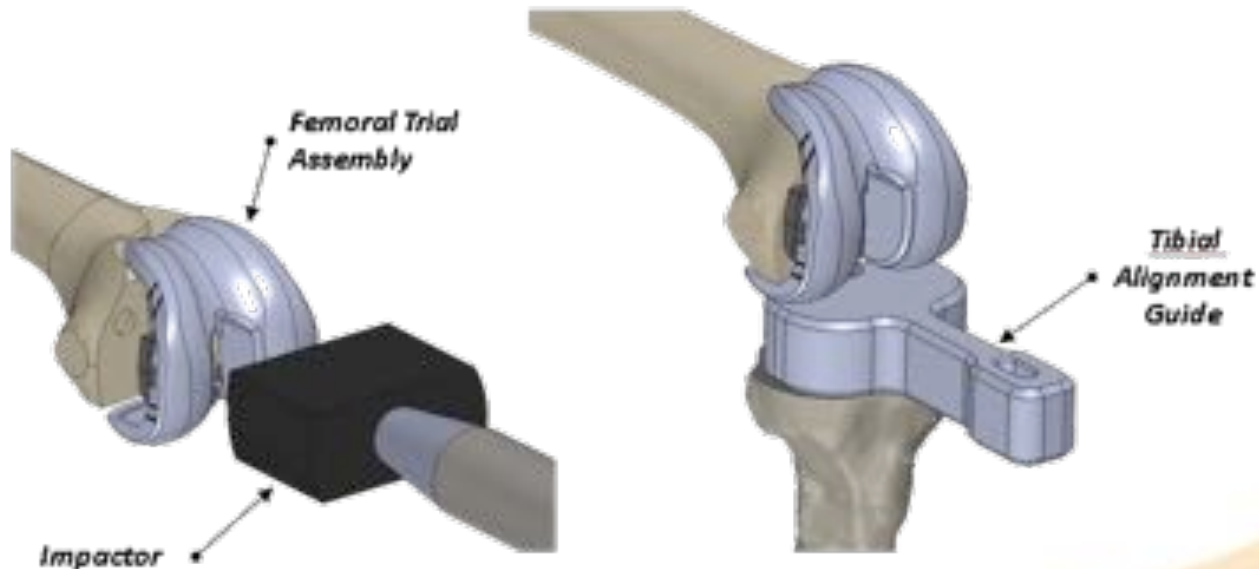
# Trialing the femoral components

- Assemble the femoral trial with optional components like a stem extension trial, posterior femoral augment trials and distal femoral augment trials.
- The number and type of augments is dictated by the augment cuts previously made.



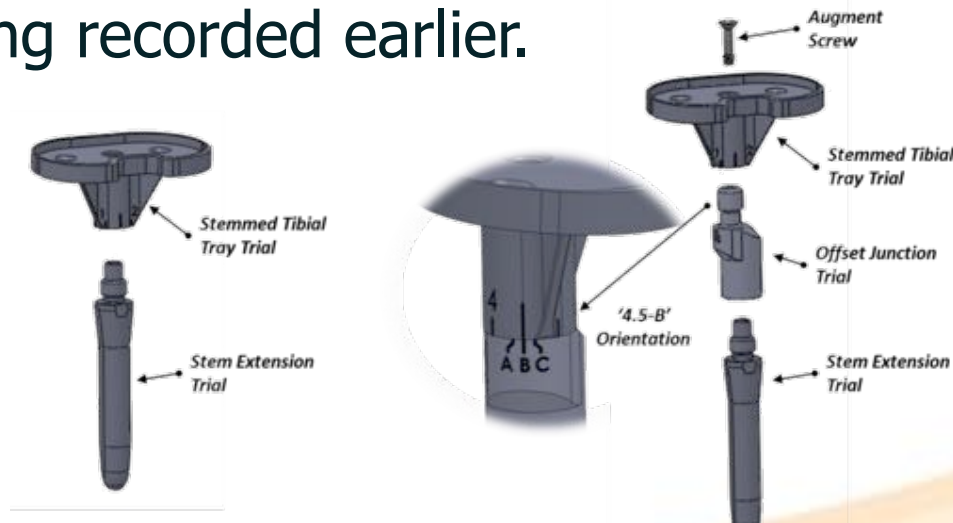
# Trialing Femoral Components

- Place and impact the femoral trial assembly into the prepared femur using a *femoral impactor*.
- Using a *tibial alignment guide*, reduce the knee to estimate the tibial liner thickness.
- Once satisfied with their performance, remove the trial assemblies. Take note of all component sizes.



# Trialing Tibial Components

- Select the *stemmed tibial tray trial* and *stem extension trial* and optional components including an *offset junction trial* and *tibial augment trials*.
- Thread and hand tight stem into keel or if an offset is used then into the distal end of offset junction.
- If offset is used, thread proximal end of offset junction into keel until it can spin freely.
- Use *15mm augment screw* to secure the connection as per marking recorded earlier.





# Trialing Tibial Components

- Secure *tibial augment trials* to the distal surface of the stemmed tibial tray trial with the appropriate length *augment screws*.
- The number and size of augment trials per side is determined by the previously made tibial augment cuts.
- Thread and hand tight the screw with a 2mm hex driver.

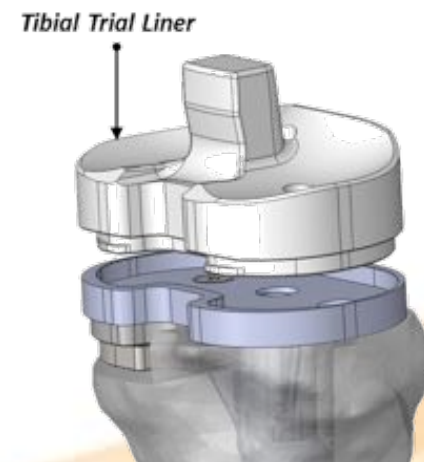
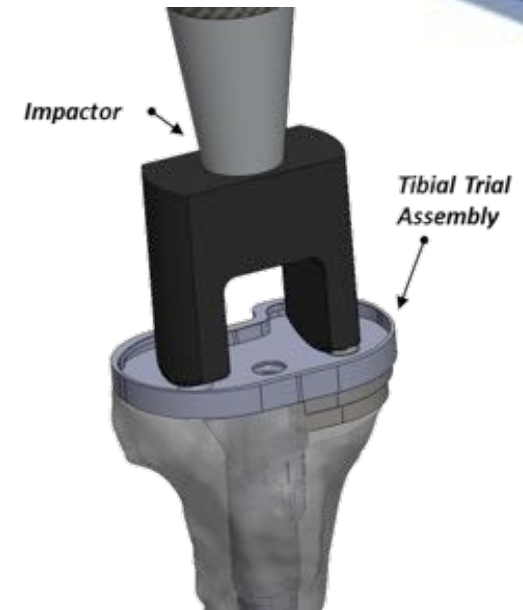
Note:- Stacked multiple tibial augment trials can be of the same size or in descending sizes to form cone.





# Trialing Tibial Components

- Impact the tibial trial assembly into the resected and prepared tibia.
- Insert the appropriate size and thickness *tibial trial liner* into the recess in the stemmed tibial tray trial.
- If no offset junction is used, secure the tibial trial liner to the stemmed tibial tray trial by threading the captured liner screw into the stemmed tibial tray trial using a 2mm hex driver



# Trialing the Patella

- Refer to the standard Freedom Total Knee® System Surgical Technique (MXO-MP00005) for information on the preparation and trialing of the patella

# Preparing Tibial Components

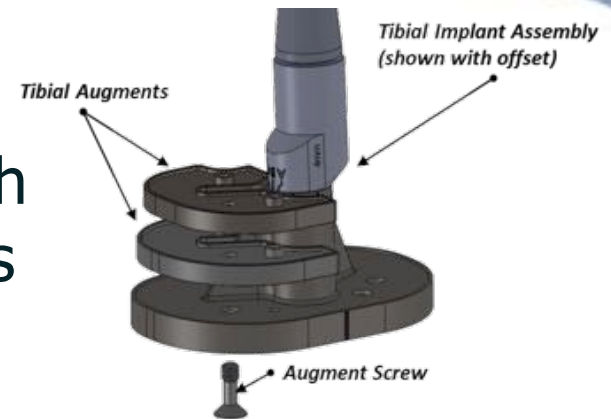
- Assembly of the implants should replicate the trials.
- Remove all necessary plugs from the baseplate.
- If no offset is used, place the baseplate face down and seat the stem extension firmly within the keel taper.
- If offset is used, seat stem extension firmly in distal offset taper, and then align marking on proximal offset and keel taper.
- Place baseplate face down and strike it solidly once using a two pound mallet.

*Caution: Striking the stem more than once to engage the taper may loosen the taper connection.*



# Preparing Tibial Components

- Attach tibial augments to the distal surface of the stemmed tibial baseplate with the appropriate length augment screw as required. The lugs are used to aid alignment and placement.

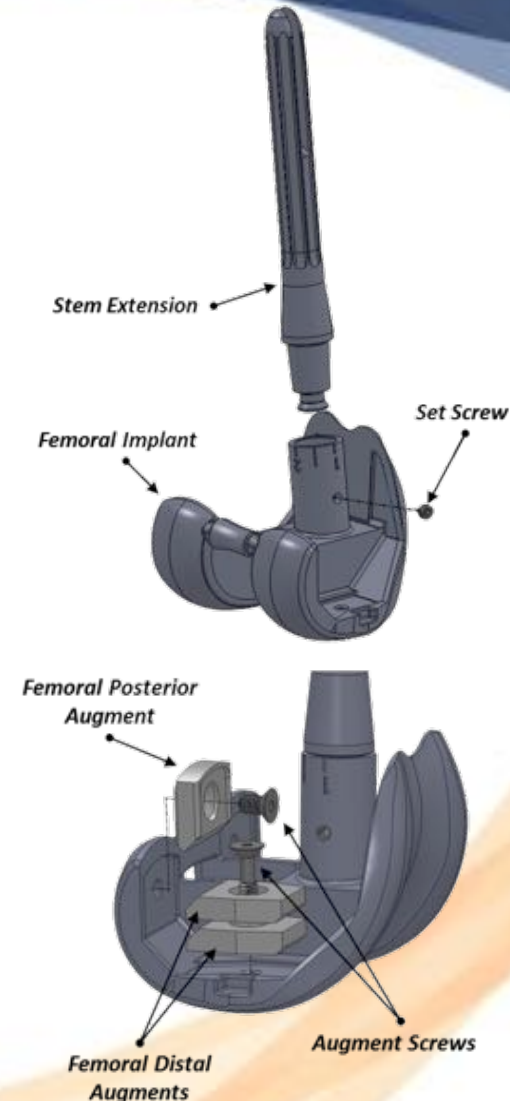


*Note: Use the 2mm hex key to thread and hand tighten the set screws in both the offset junction and the baseplate prior to attaching any augments.*

*Note: Thread the augment screw fully through each augment trial before stacking and threading in the next augment trial.*

# Preparing Femoral Components

- Assembly of the implants should replicate the trials.
- Firmly seat the stem extension into the female taper of femoral implant central boss.
- Strike the assembly solidly once using a two pound mallet. Protect the articular surface and the stem extension.
- Use the 2mm hex key to thread and hand tighten the set screw through the hole in the side of the central boss.
- Attach posterior and distal augments with the appropriate length augment screw.



# Implantation

Recommended order of implantation is :

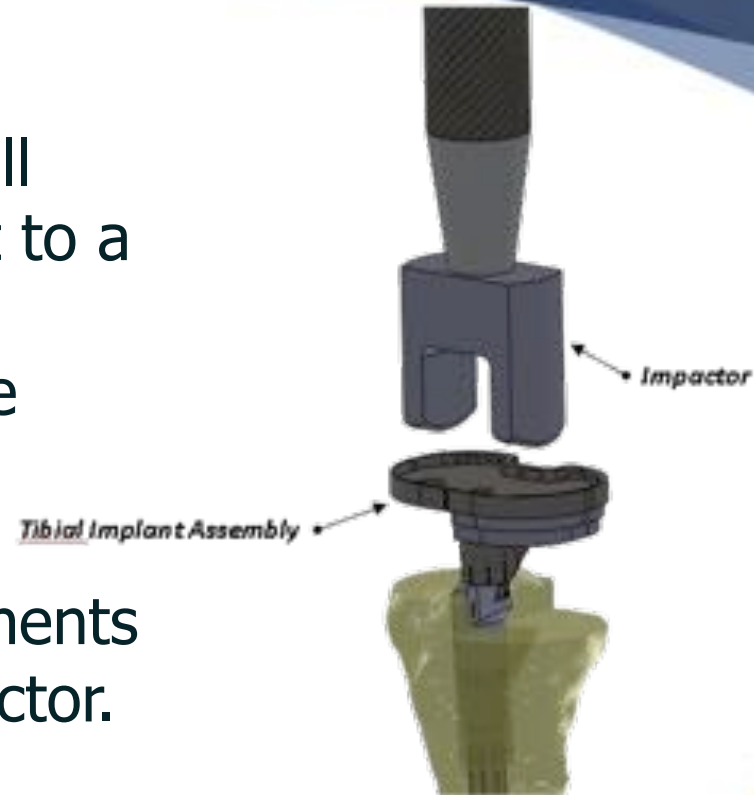
- Stemmed tibial components
- PCK femoral components
- Tibial articulating surface (tibial liner)
- Patellar component



# Implantation

## Stemmed tibial components

- Irrigate the bone surfaces and drill sclerotic areas with a 1/8" drill bit to a depth of approximately 1/8".
- Firmly press cement into the bone surfaces, all areas underside the baseplate.
- Firmly impact the femoral components into place using the femoral impactor. Remove excess cement.

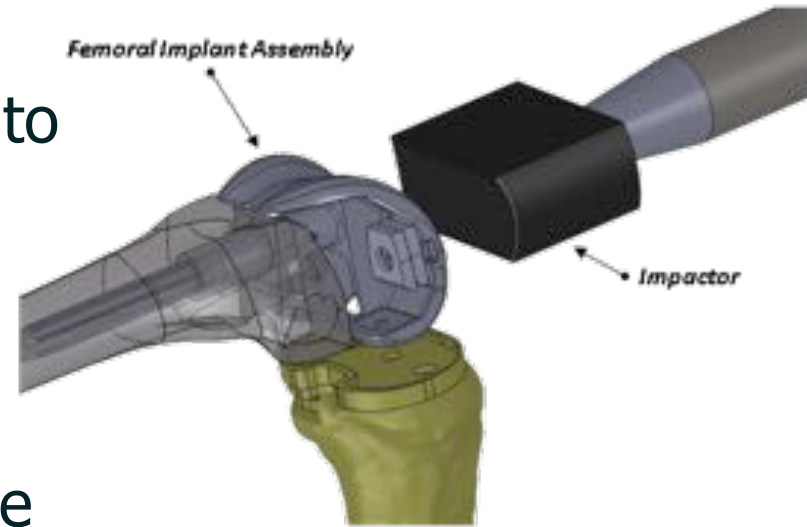


Note:- If cementing the stem, the IM canal must have been reamed 0.5mm to 1mm larger in diameter than the stem diameter to be implanted.

# Implantation

## Stemmed femoral components

- Hyperflex the knee and dry the distal femoral bone cuts.
- Finger pressurize bone cement to the posterior condyles and undersurface of the femoral component.
- Firmly impact the femoral components into place using the femoral impactor.
- Remove excess cement.

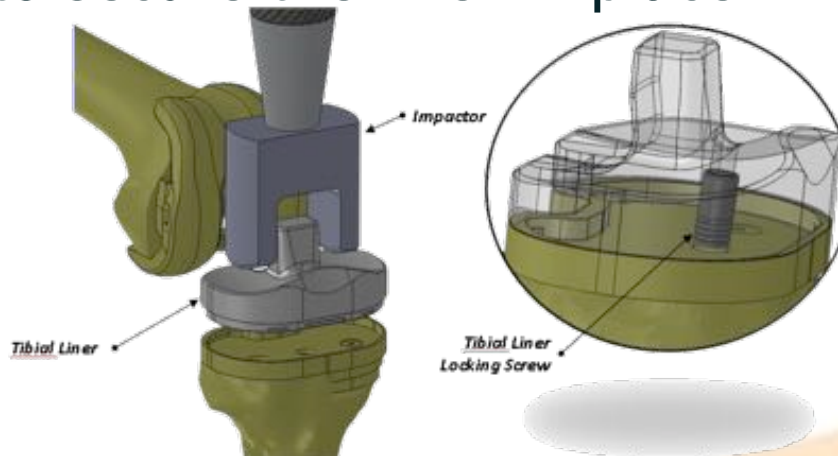


Note:- If cementing the stem, the IM canal must have been reamed 0.5mm to 1mm larger in diameter than the stem diameter to be implanted.

# Implantation

## Tibial articulating surface

- Irrigate the surface of the stemmed tibial baseplate and remove excess debris to clear the locking mechanism.
- Firmly impact the selected tibial liner into place with the tibial impactor and check to see that the locking mechanism is engaged .
- Using a 2mm hex driver advance the captured locking screw (currently inside the liner) into the stemmed tibial baseplate to secure the liner in place.



# Implantation

## Patellar component

- Refer to Freedom Total Knee® System Surgical Technique (MXO-MP00005) for information on preparation and implantation of the patella.
  
- Closure is performed in the usual manner