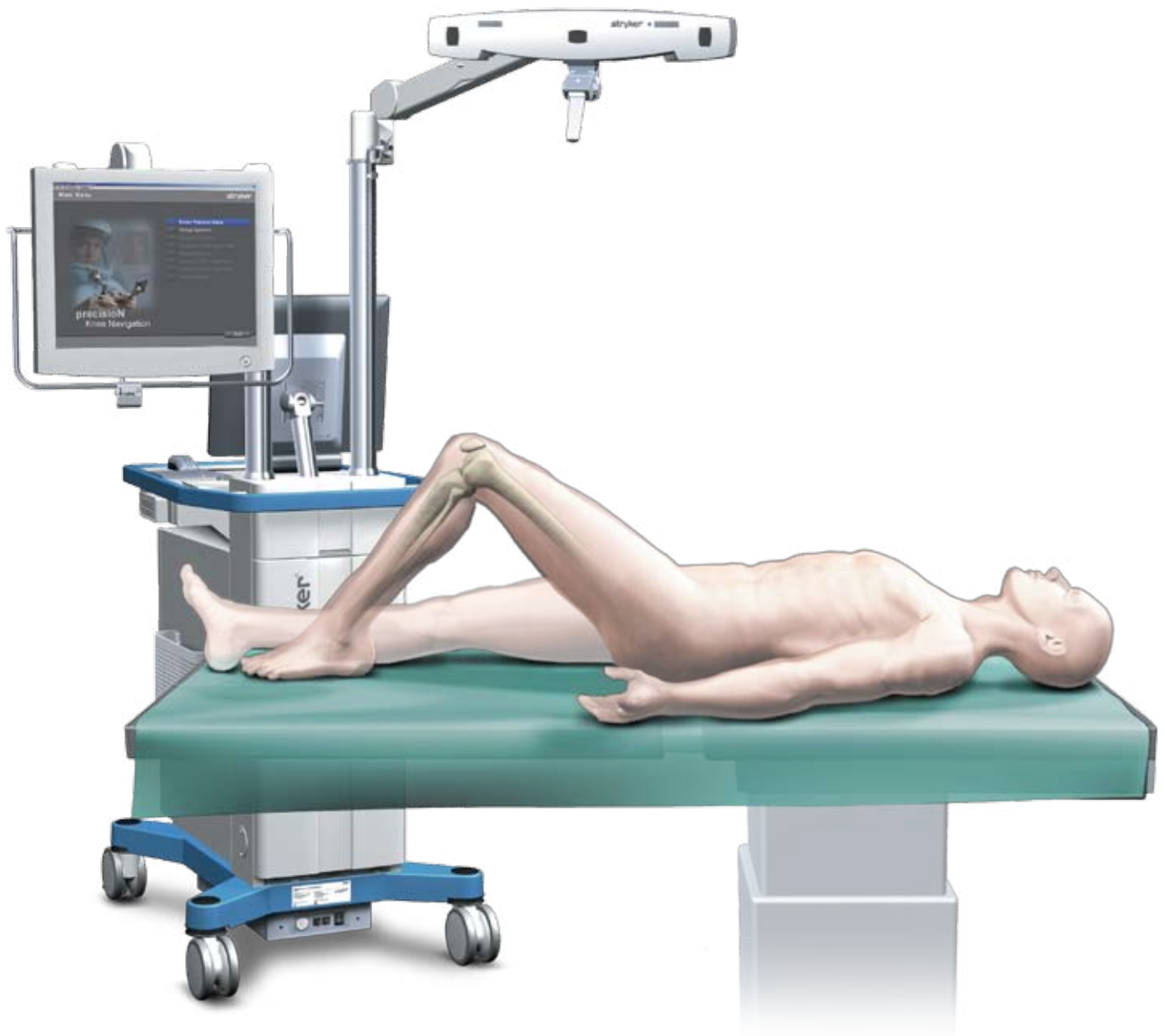


# precisionN Knee Navigation

## Operative Technique

precisionN Knee Software





## Introduction

The Stryker® Navigation System – precisionN Knee module is an interactive operative monitoring system designed to improve the surgical performance and clinical outcome of knee replacement surgery.

As a PC-based, imageless guidance system, the Stryker Knee Navigation System helps to facilitate improved decision making for alignment and orientation of instruments, trials and implants as well as for balancing soft tissue.

Furthermore, the Stryker Knee Navigation System provides surgeons with pre-operative, intra-operative and post-implantation assessments of the patient's joint kinematics and various documentation options.

Long term cost savings may result from possible shorter hospital stays, decreased morbidity and blood loss, improved joint stability and decreased rehabilitation time.<sup>1</sup>

The Stryker precisionN Knee software, as well as the dedicated instruments, are compatible and represent an open platform for different implant systems.

<sup>1</sup>) J.M. Sikorski, S. Chauhan: Aspects of Current Management, Computer Assisted Orthopedic Surgery: Do We Need CAOS?, JBJS(Br) Vol. 85-B, No. 3, April 2003

## Acknowledgement

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USA

Special appreciation is expressed to Dr. Knute Buehler for his direct assistance with the development of this Operative Technique, and many thanks to the other esteemed surgeons who assisted in the development and validation of the precisionN Knee product.

### Important Notice

Only trained medical personnel may use the Stryker Navigation System. As with any technical guide, the surgeon should consider the particular condition of the patient and perform the necessary adjustments, if required. Stryker® precisionN Knee module is not a replacement for the surgeon's qualification, expertise, or judgement.

Safety and caution notes should be carefully reviewed prior to proceeding. For the required safety information and contraindications, please refer to the Safety Information, supplied with the precisionN Knee software package, and to the

Instructions For Use, supplied with the system components.

For a detailed description of the software features and procedures, and for a comprehensive definition of the computed mechanical axes and resection levels, refer to the online User Manual for the precisionN Knee software.

For information related to the use of conventional instrumentation, please refer to the operative techniques and the user documentation supplied with each company's conventional instrumentation.

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## 1 System and Software Set Up



### System Start Up

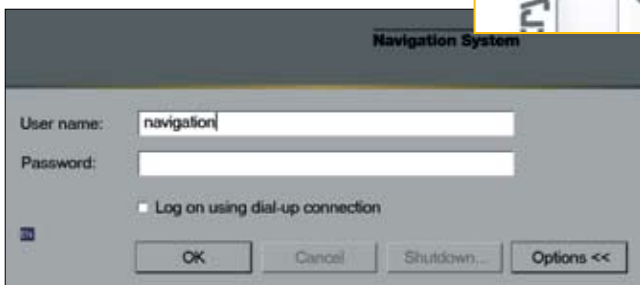
**Note:**

The system and software set up can be completed by the OR support staff prior to operation.

- ▶ To ensure instrument visibility, place the system opposite of the surgeon.
- ▶ Plug in the main power cable of the navigation system.



- ▶ Press the main power button on the front panel of the navigation system.
- ▶ Enter the user name (navigation) and press enter or use the left mouse button and click "OK".



- ▶ Upon Application Manager start up, use the mouse to select "precisionN Knee Navigation".

# 1 System and Software Set Up

## Software and Tool Preparation

### Enter Patient Data

- ▶ Select the “Enter Patient Data” screen.
- ▶ Record the patient’s first and last name.
- ▶ Indicate the leg side undergoing treatment.

Entering the patient’s name and indicating the leg side is mandatory.

Click “Next” to proceed.

### Prepare and Initialize Tools

The required tools are listed in the Setup System dialog.

- ▶ Load sterile batteries into the navigated tools.

One sterile battery will be needed for each tool used.

To initialize the navigated tools

- ▶ Face the LEDs towards the camera and press and hold the SELECT button on the tool for 2-3 seconds.

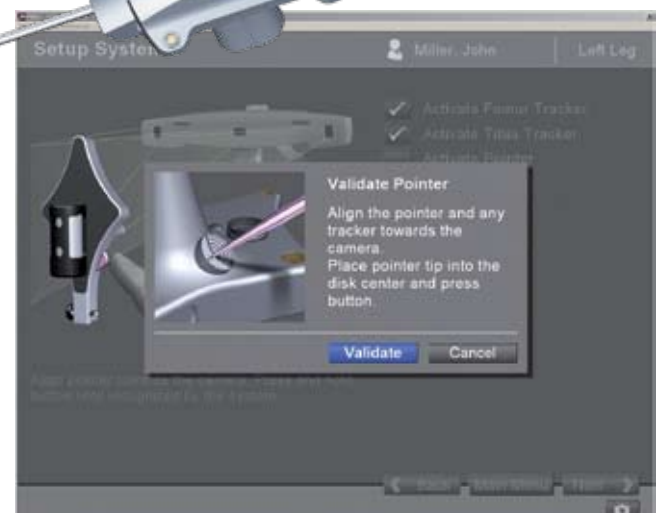
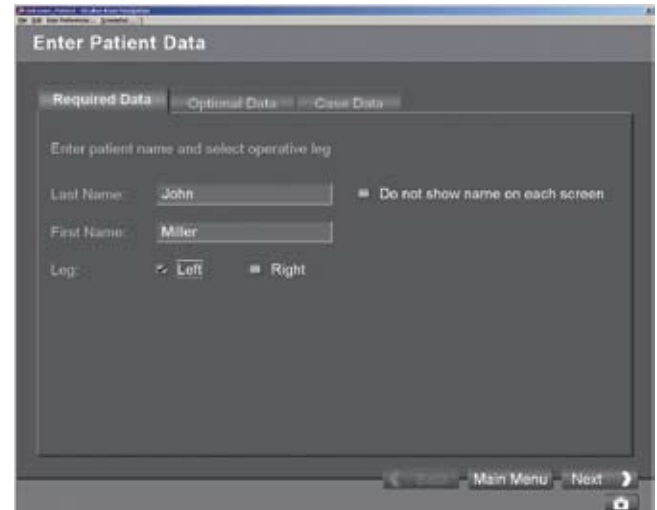
Tool initialization is confirmed by an audible alert and a checkmark in front of the software button.

Upon pointer initialization, the “Validate Pointer” pop-up window appears.

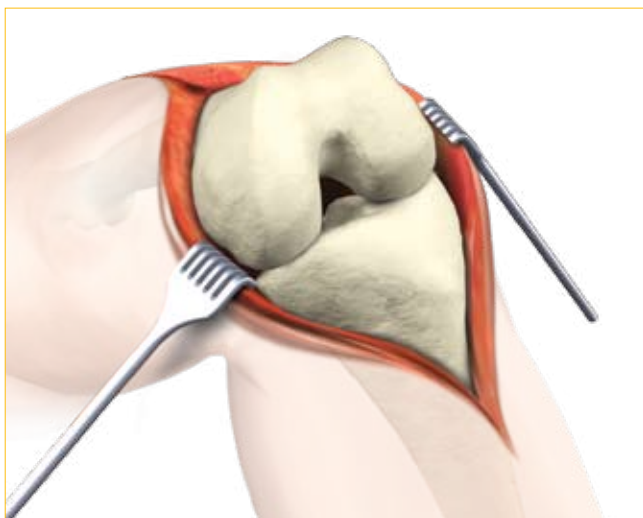
### Validate Pointer

With the pointer validation, the accuracy of the pointer tip is calibrated.

- ▶ Touch the center of any one of the tracker’s validation discs with the pointer tip and press the SELECT button on the pointer for 2-3 seconds to validate.



## 2 Patient Preparation



### **Incision**

Standard and minimally invasive techniques for exposing the knee joint can be applied and are supported by the Stryker Knee Navigation System.

### **Patient Anchoring**

The patient trackers must be rigidly fixated to femur and tibia of the leg undergoing treatment.

For tracker fixation two kinds of anchoring devices are available:

- OrthoLock™ anchoring device
- Bi-cortical Anchoring Pins

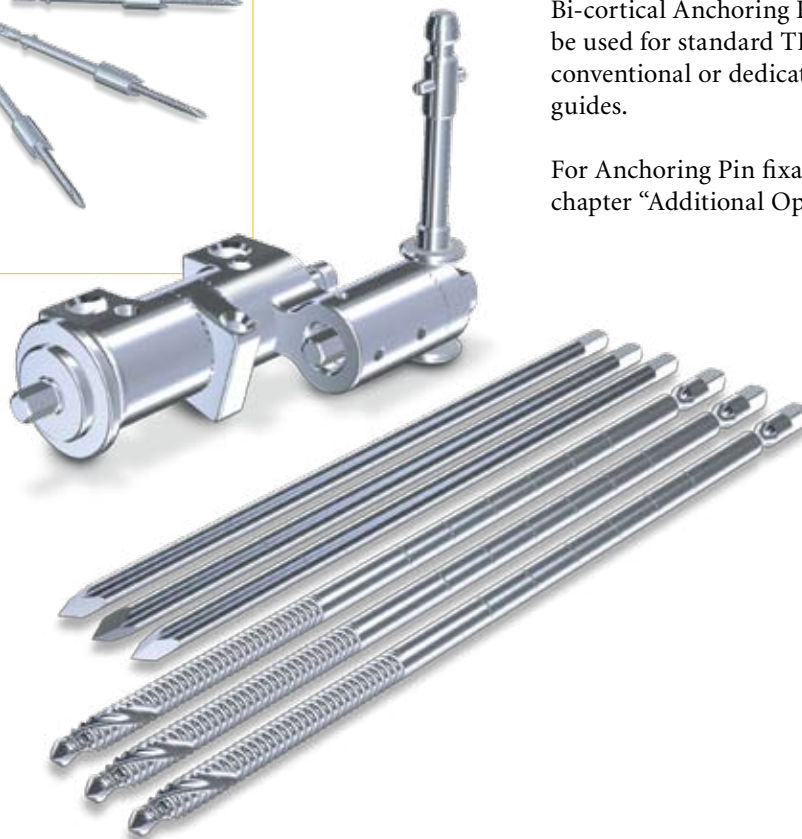
#### ► **OrthoLock™ anchoring device**

OrthoLock™ can be used for standard and minimally invasive TKA.

#### ► **Bi-cortical Anchoring Pins**

Bi-cortical Anchoring Pins can be used for standard TKA with conventional or dedicated cutting guides.

For Anchoring Pin fixation refer to the chapter “Additional Options”.





## 2 Patient Preparation

### OrthoLock™ Fixation

The OrthoLock™ can be used in conjunction with OrthoLock™ Ex- and Navigation Pins.

For fixation, a minimum of 2 pins are needed.

OrthoLock™ may be fixated prior to inflating tourniquet cuff.

To provide sufficient stability, the pins can be fixated bi-cortically.

On the femur, the pins are positioned close to the knee joint. To minimize muscle load, pins are placed with the knee in flexion.

On the tibia, the pins can be positioned distal of the tibial tubercle to avoid the patella tendon and collisions with the tibial implant.

#### **Note:**

For bi-cortical fixation, only engage the second cortex.

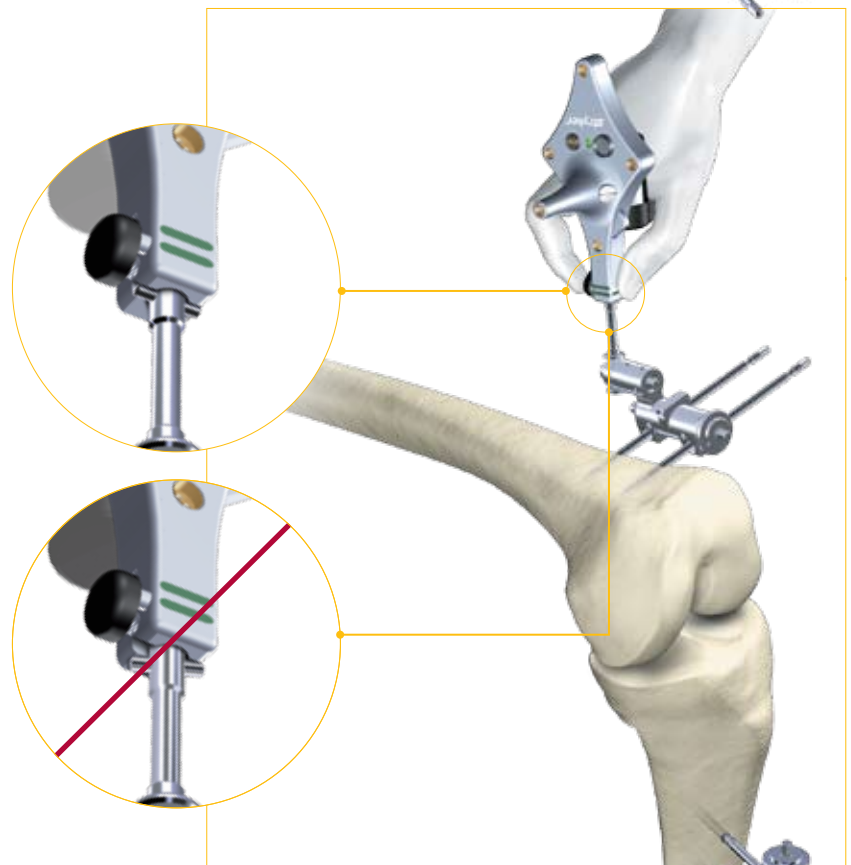
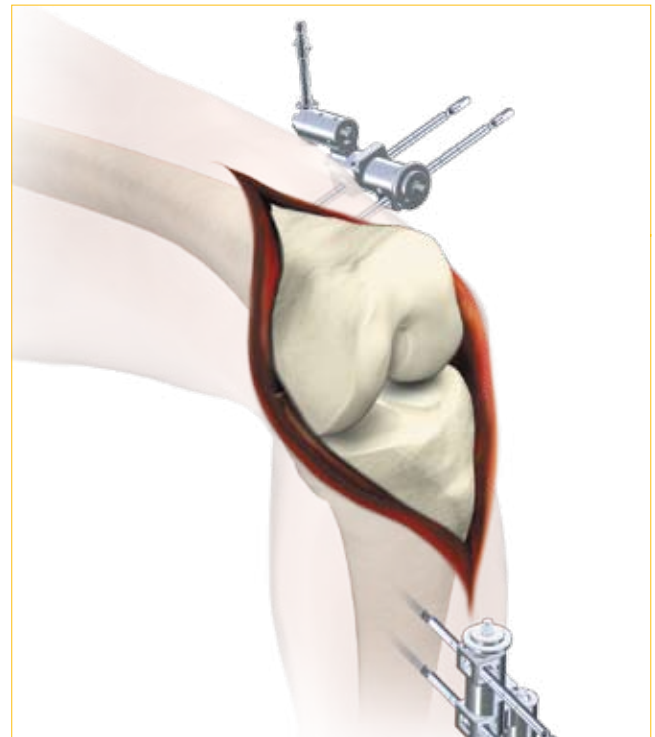
To help prevent drilling through the bone, stop pin insertion as soon as the pin penetrates the second cortex.

Avoid pin positions and pin orientations where any vulnerable neurovascular structures might be injured both at entry and exit points. Avoid pin collisions with the implants and any external checks, alignment or resection guides which may be utilized.

### Mount Patient Tracker

After anchoring device fixation is complete

- ▶ Mount the patient trackers to the femoral and tibial anchoring device.



## 3 Patient Registration

### Registration

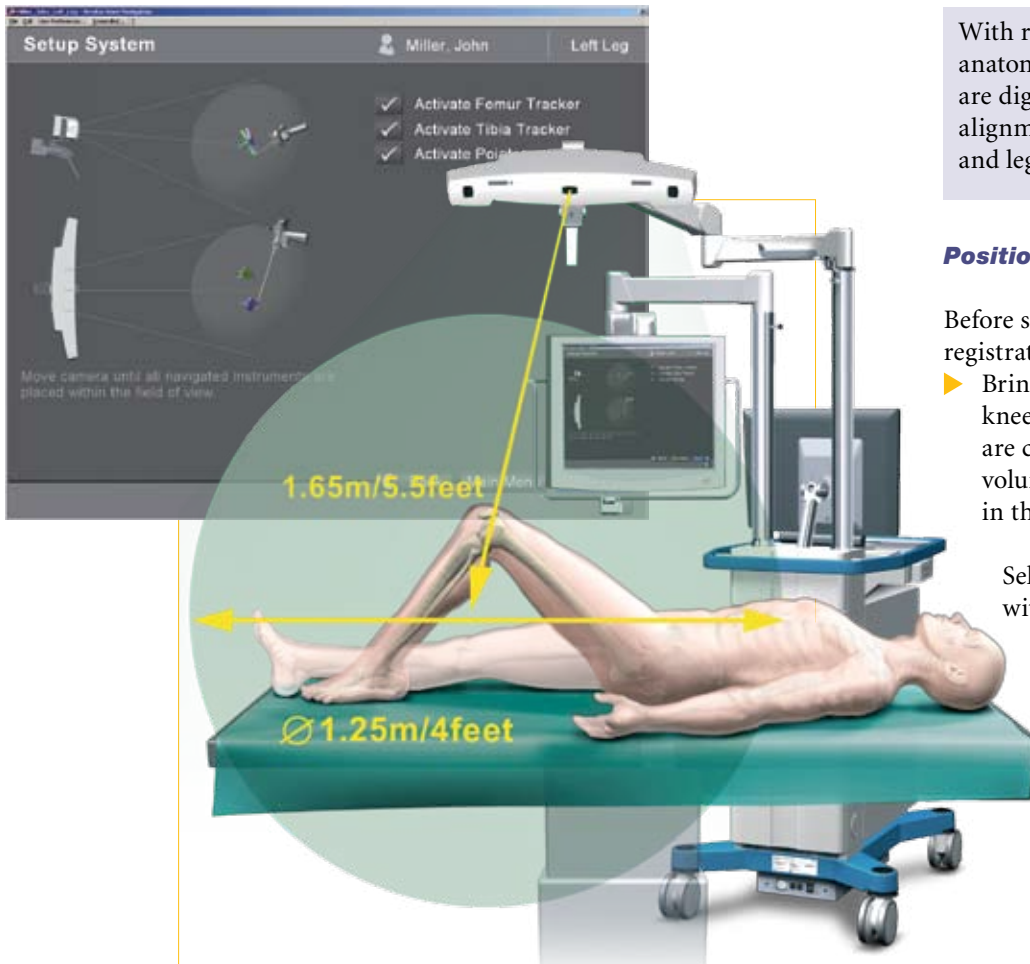
With registration, the positions of anatomical landmarks and axes are digitized as reference for the alignment of instruments, bone cuts and leg.

#### Position the Camera

Before starting with patient registration

- ▶ Bring the camera in line with the knee joint so that all instruments are centered in the working volume signified by the grey circles in the "Setup System" dialog.

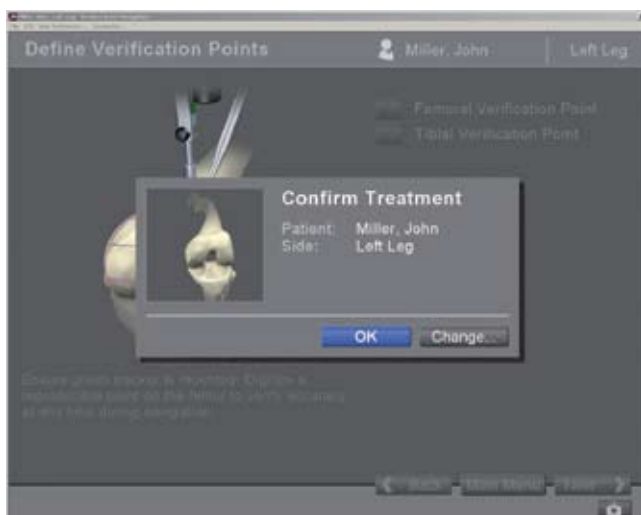
Select the Next button to proceed with the "Register Femur" dialog.



#### Confirm Treatment

Prior to femur registration

- ▶ Confirm the treatment and selected leg side by pressing the SELECT button of any navigated tool that is visible to the camera.





# 3 Patient Registration

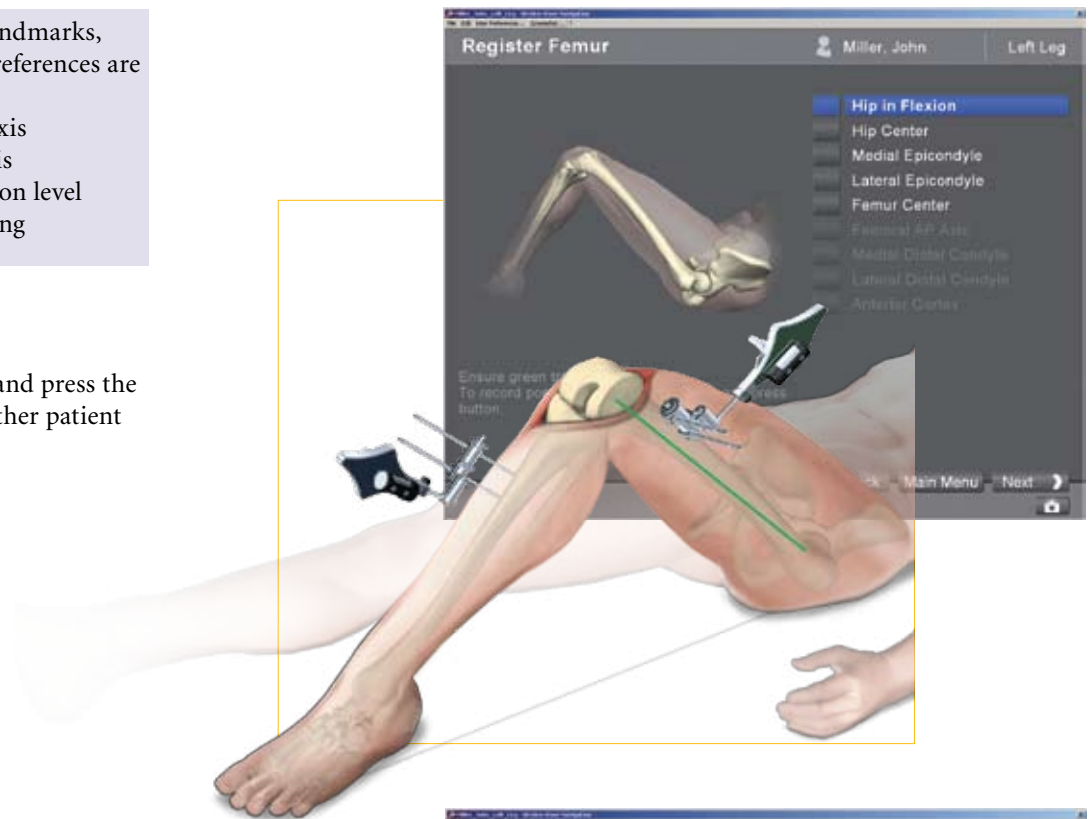
## Femur Registration

By digitizing femoral landmarks, the following axes and references are defined:

- Mechanical femur axis
- Femoral rotation axis
- Reference for resection level
- Reference for notching

### Hip in Flexion

- Flex hip at any angle and press the SELECT button on either patient tracker to record.



### Hip Center

- Slowly and smoothly circumduct the hip with changing radii.

During rotation, avoid pelvic movement.

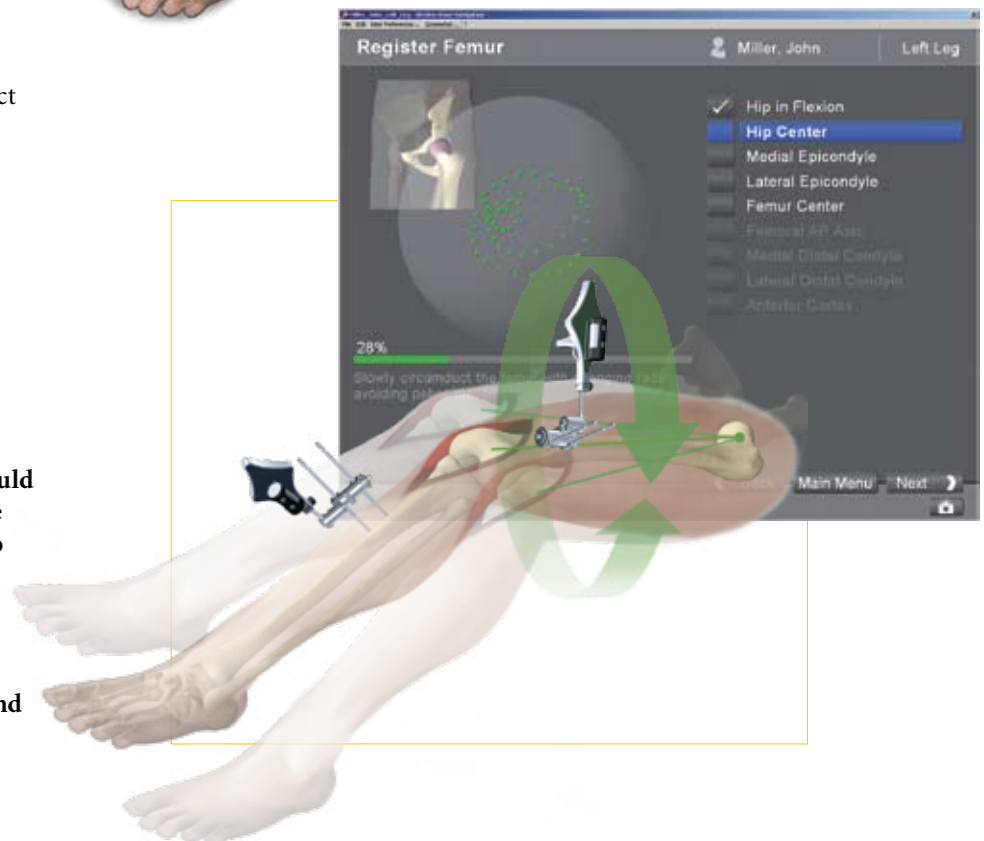
As soon as a sufficient number of points are recorded, the software automatically stops recording.

#### Note:

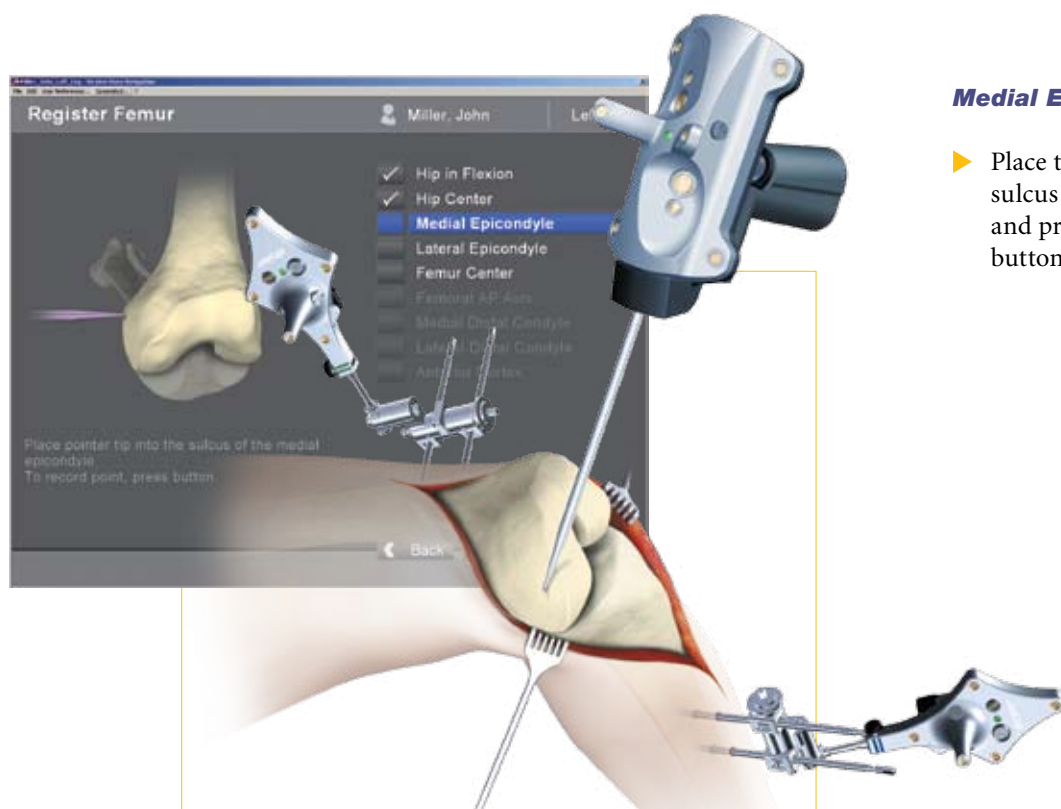
Avoid moving the camera or the OR table during motion analysis. Camera or OR table movement could compromise the calculation of the hip center or cause the software to reject the calculation.

#### Note:

In case of pelvic movement, have the assistant stabilize the pelvis and repeat range of motion.

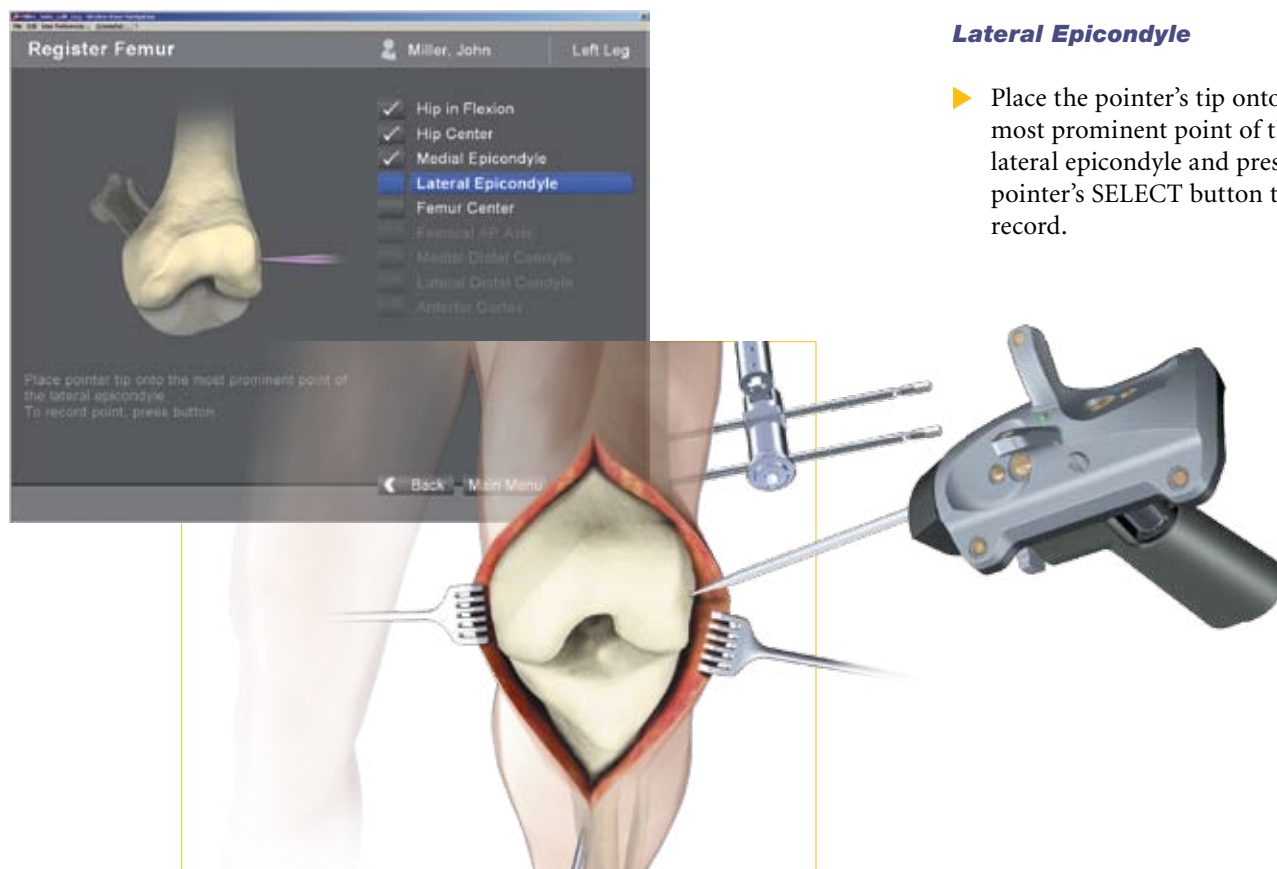


## 3 Patient Registration



### Medial Epicondyle

- ▶ Place the pointer's tip into the sulcus of the medial epicondyle and press the pointer's SELECT button to record.



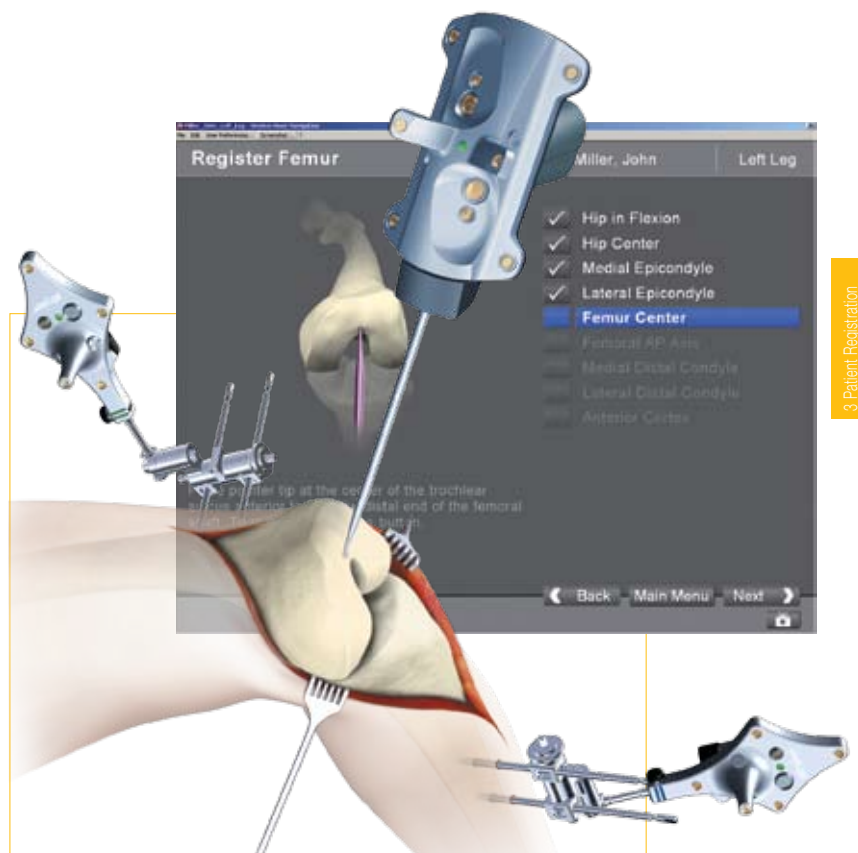
### Lateral Epicondyle

- ▶ Place the pointer's tip onto the most prominent point of the lateral epicondyle and press the pointer's SELECT button to record.

# 3 Patient Registration

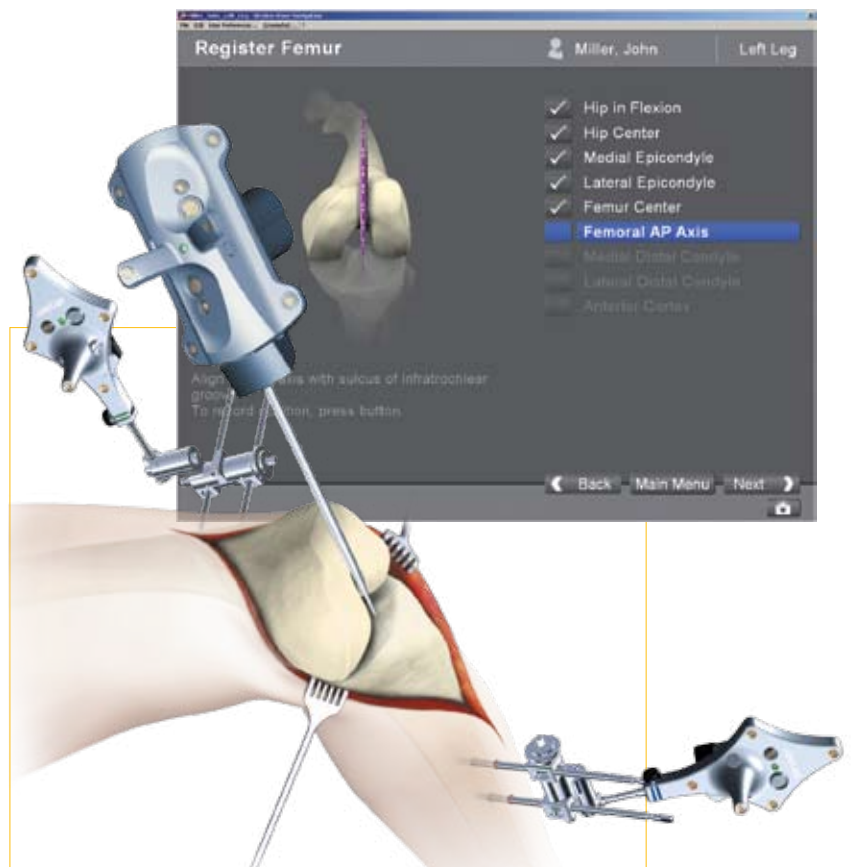
## Femur Center

- ▶ Place the pointer's tip at the center of the trochlear sulcus anterior toward the distal end of the femoral shaft and press the pointer's SELECT button to record. This is essentially where one would place the IM rod when using conventional instrumentation.

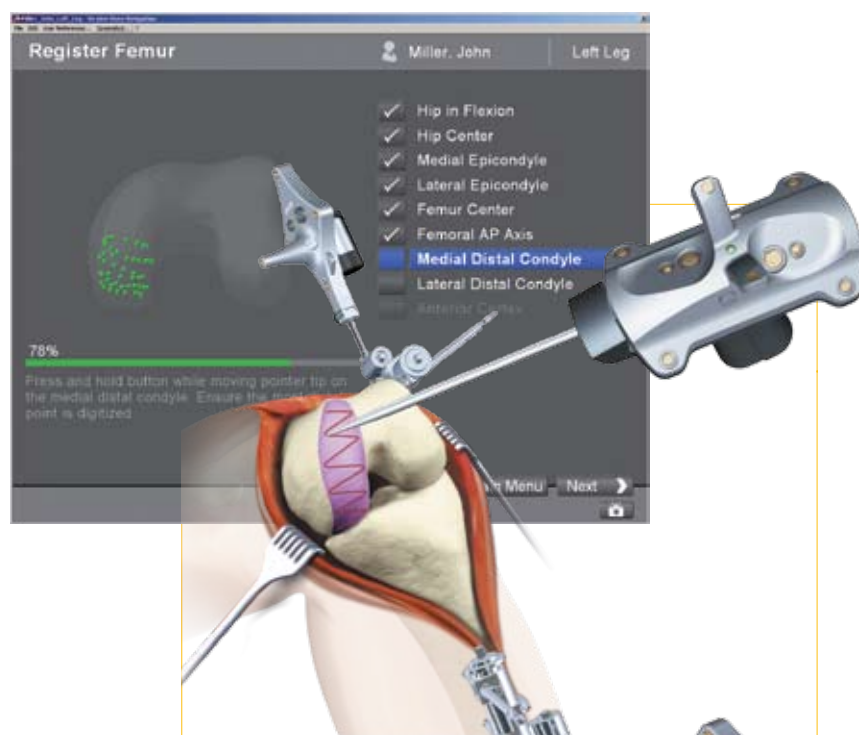


## Femoral AP Axis

- ▶ Align the pointer's axis with the most posterior point of the trochlea and the most anterior point of the intercondylar fossa, also referred to as Whiteside's line.
- ▶ Press the pointer's SELECT button to record.



## 3 Patient Registration



### Medial Distal Condyle

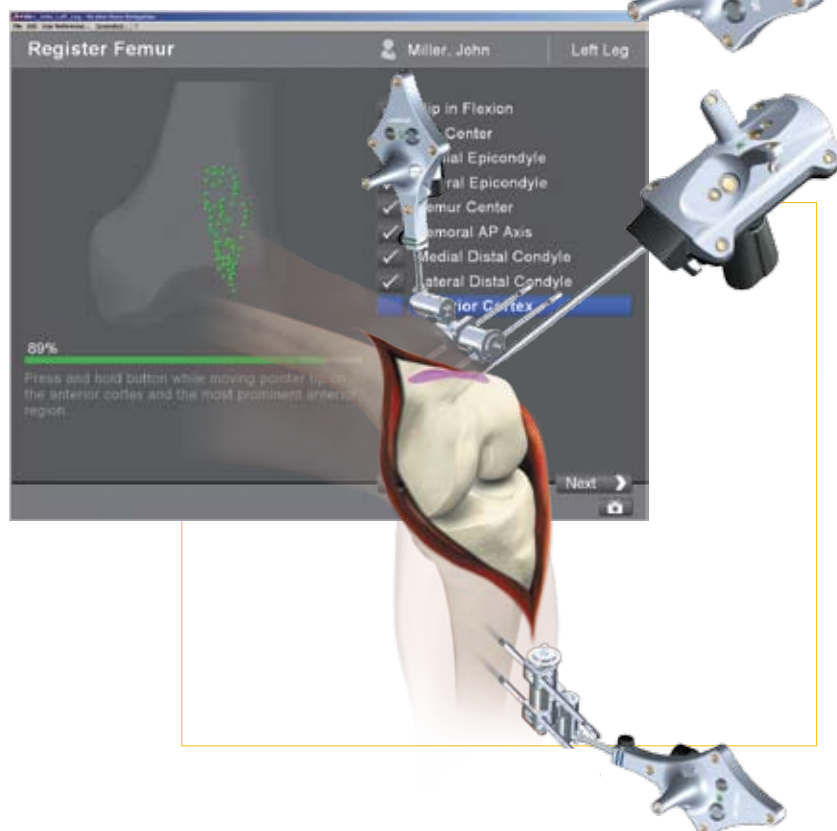
- ▶ Place the pointer's tip onto the medial condyle and begin digitizing by pressing the pointer's SELECT button and moving the tip over the surface of the medial condyle in a zig-zag painting fashion.

#### Note:

Ensure that the most distal aspect of the condyle has been included and that the pointer has not left the surface of the bone during digitization.

### Lateral Distal Condyle

For lateral distal condyle digitization, follow the instructions provided above for the medial side.



### Anterior Cortex

- ▶ Place the pointer's tip onto the anterior cortex and begin digitizing by pressing the pointer's SELECT button and moving the tip on the anterior cortex in a painting fashion.

During point acquisition

- ▶ Include the most prominent anterior region and the expected saw blade exit points.

Select "Next" to proceed to the "Register Tibia" dialog.



# 3 Patient Registration

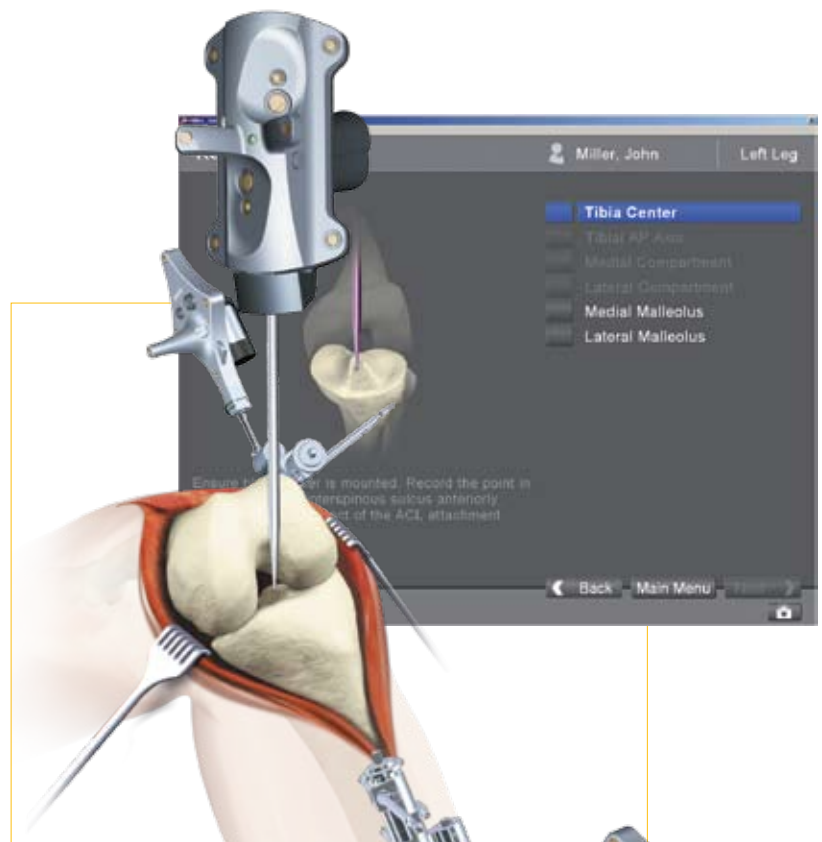
## Tibia Registration

By digitizing tibial landmarks, the following axes and references are defined:

- Mechanical tibia axis
- Tibial rotation axis
- Reference for resection level

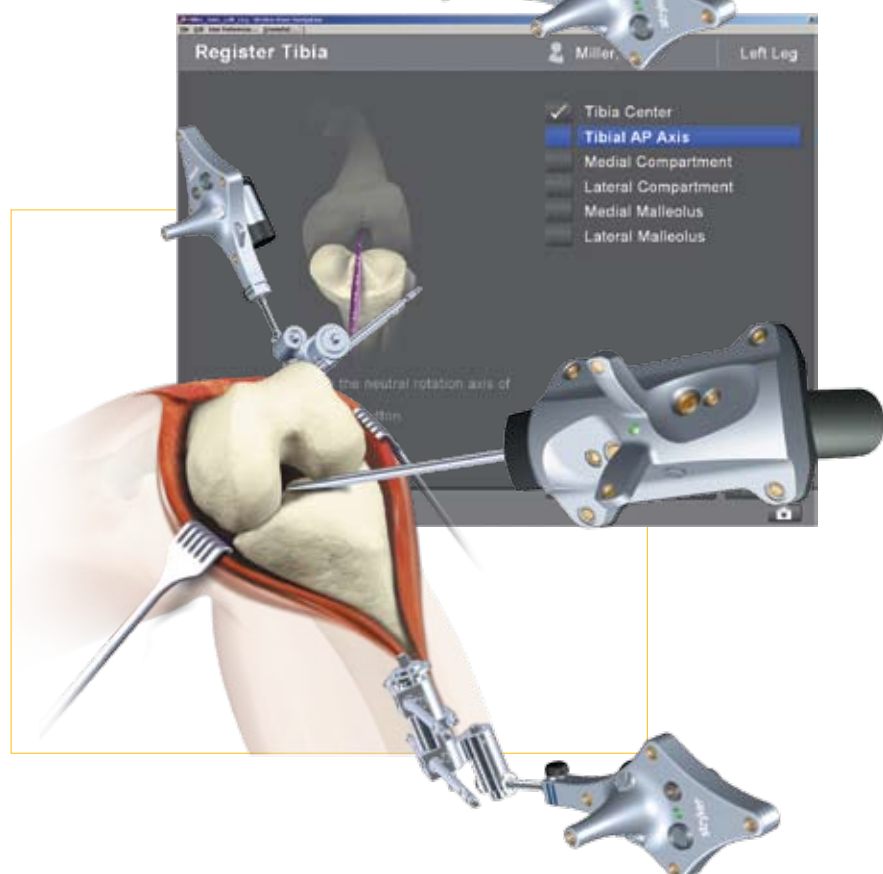
### Tibia Center

- ▶ Place the pointer's tip onto the middle of the interspinous sulcus anteriorly near the anterior mid footprint of the ACL attachment and press the pointer's SELECT button to record.



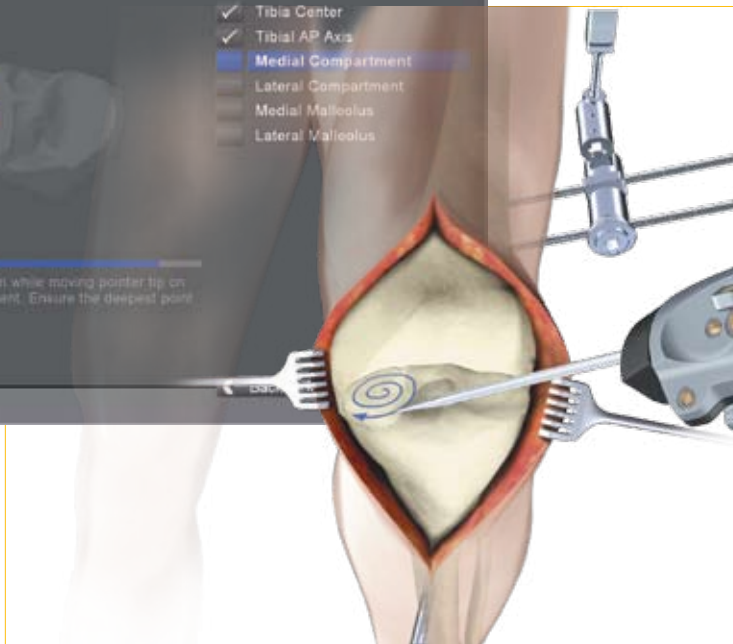
### Tibial AP Axis

- ▶ Align the pointer's axis with the midpoint of the posterior cruciate ligament and the medial third of the tibial tuberosity.
- ▶ Press the pointer's SELECT button to define and record a neutral tibial AP axis.





## 3 Patient Registration



### Medial Compartment

- Place the pointer's tip onto the medial compartment and begin digitizing by pressing the pointer's SELECT button and moving the tip over the surface of the medial compartment in a painting fashion.

#### Note:

Ensure the lowest aspect of the compartment has been included. Avoid digitizing below the lowest anatomical point to avoid a false survey reading.



### Lateral Compartment

For lateral compartment digitization follow the instructions provided above for the medial compartment.

# 3 Patient Registration

## Medial Malleolus

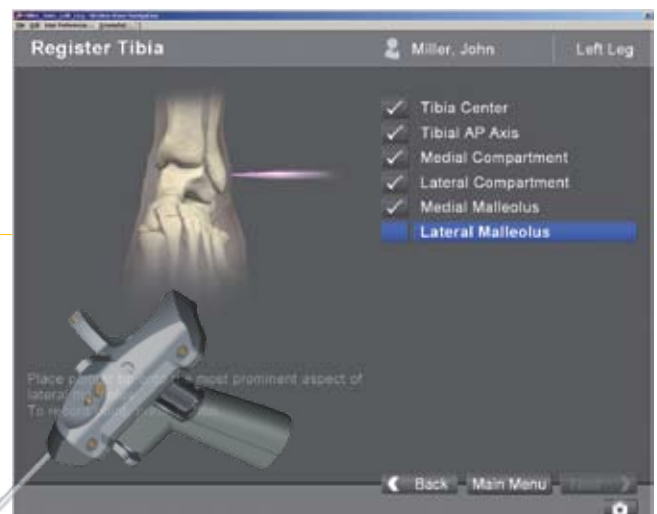
- Place the pointer's tip onto the most prominent aspect of the medial malleolus and press the pointer's SELECT button to record.



## Lateral Malleolus

- Place the pointer's tip onto the most prominent aspect of the lateral malleolus and press the pointer's SELECT button to record.

Select "Next" to proceed to the "Verify Registration" dialog.



## 4 Reference System

### Reference System

Upon completion of femur and tibia registration, the reference system is defined.

The digitized reference landmarks and axes are now used to assess the kinematics and for calculating the alignment of instruments and bone cuts.

#### **Reference for Varus/ Valgus, Flexion/ Extension or Slope**

With Stryker Navigation, the femur reference for varus/ valgus and flexion/ extension is the mechanical femur axis defined by the digitized

- Hip center, and
- Knee center

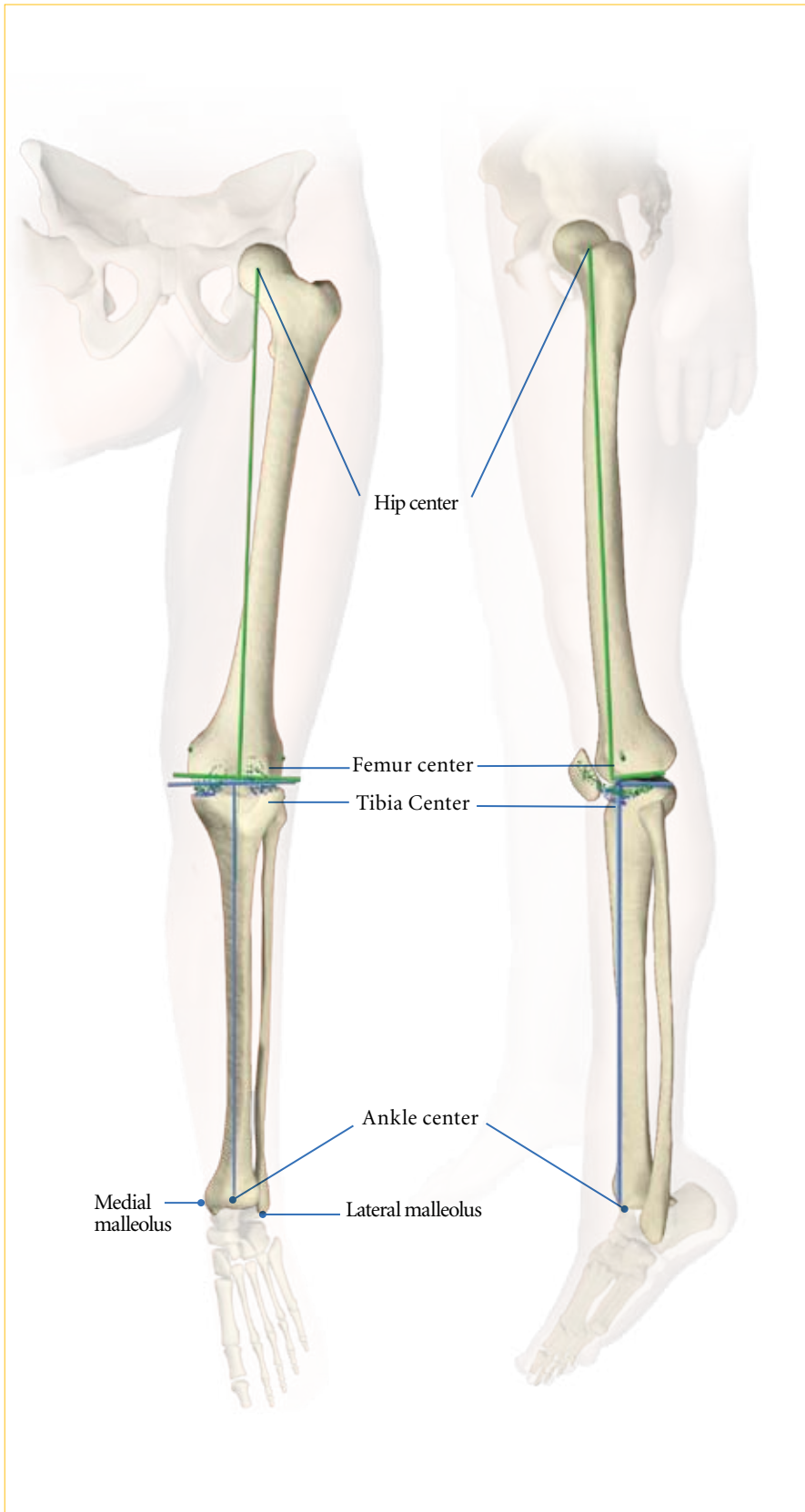
The tibia reference for varus/ valgus and slope is the mechanical tibia axis defined by the digitized

- Tibia center, and
- Calculated ankle center

The ankle center is calculated by dividing the digitized transmalleolar axis according to the ratio of 56% lateral to 44% medial.

#### **Note:**

With precision Knee software, the anatomical axis of femur and tibia is not taken into consideration.



## 4 Reference System

### Reference for Rotation

Reference for femoral rotation is the averaged rotation axis defined and calculated by the digitized

- Transepicondylar axis (medial and lateral epicondyle), and
- Femoral AP axis

Reference for tibial rotation is the digitized

- Tibial AP axis

#### **Note:**

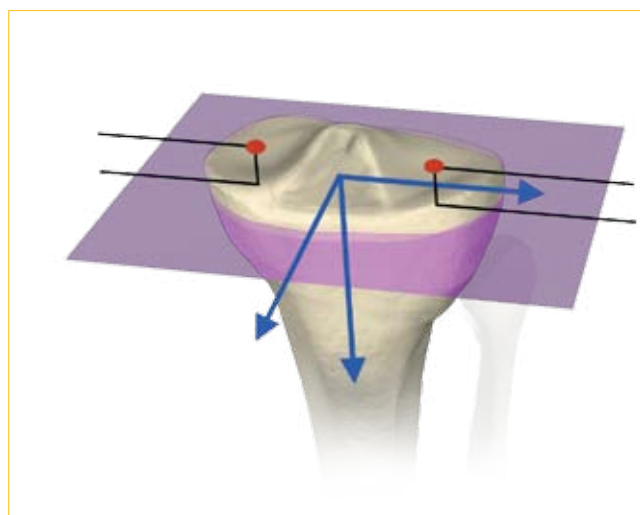
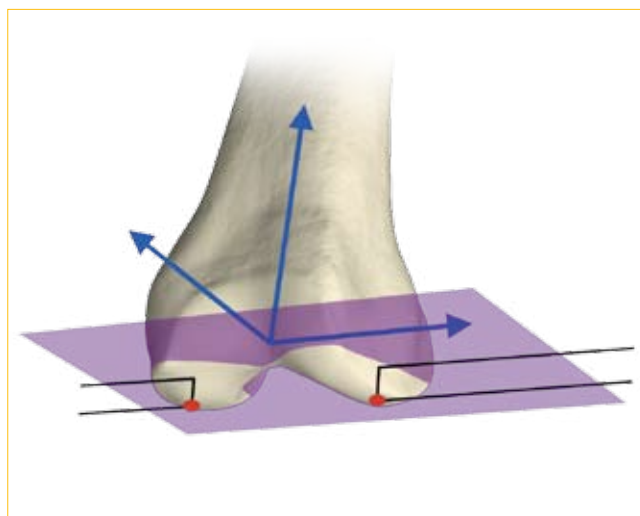
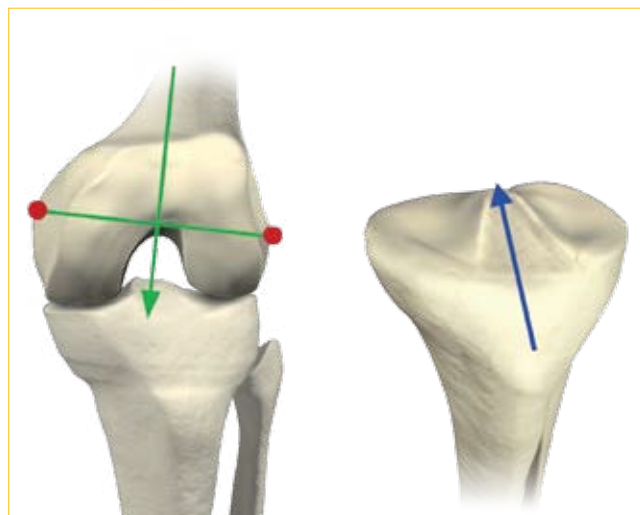
With the precisionN knee software, the posterior condylar line is not taken into consideration as reference for femoral rotation.

### Reference for Resection Level

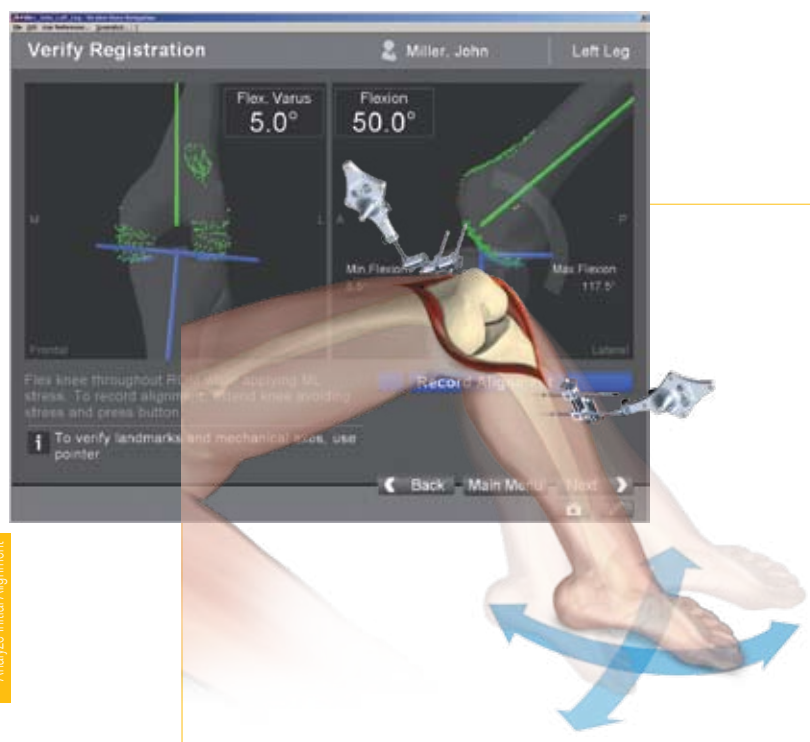
Reference for the distal femur resection level is the most prominent distal point of the digitized condyle.

Reference for the proximal tibia resection level is the most recessed point of the digitized compartment.

The system calculates the length of the perpendicular line from the reference point to the resection plane.



## 5 Verify Registration/ Analyze Initial Alignment



### Verify Registration/ Analyze Initial Alignment

The “Verify Registration” screen enables the surgeon to check the digitized mechanical axes for plausibility and to analyze initial leg alignment with respect to:

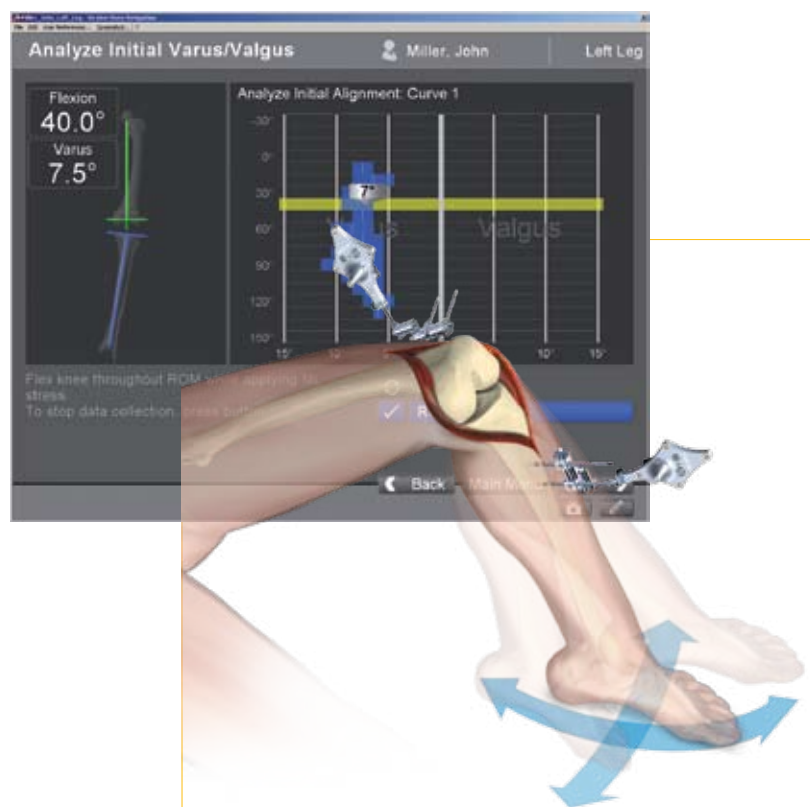
- ROM
- Varus/ valgus misalignment and laxity
- Flexion contracture or hyperextension

For analysis

- ▶ Bring the leg through a range of motion and apply varus and valgus stress.

For documentation, initial alignment can be recorded.

Highlight and select “Next” to proceed.



### Analyze Initial Varus-Valgus

With the “Analyze Varus-Valgus” screen the varus/ valgus deformity and laxity of the knee joint throughout a whole range of motion can be assessed.

The graph with the blue slider bars indicates the amount of varus/ valgus laxity and deformity with respect to the flexion angle.

To record the graph

- ▶ Activate the record button and perform a range of motion exercise at least twice while applying both varus and valgus load.
- ▶ Press the SELECT button on any tracker to stop recording.

Highlight and select “Next” to proceed with navigating the bone cuts.



# 6 Resect Bones

## Resect Bones - Options

### Workflow Options

Both posterior and anterior referencing techniques are supported by the Stryker precisionN Knee software.

Additionally, two software control options for navigating bone cuts are offered:

- **Manual Workflow**

With the manual workflow, the bone cut sequence can be configured and is displayed on sequential screens.

- **Reactive Workflow**

With the reactive workflow, the software selects the navigation screens automatically. Reactive screen selection is based upon trackers' position and alignment.

**Note:**

The posterior referencing workflow is described in the following chapters.

### Hardware Options

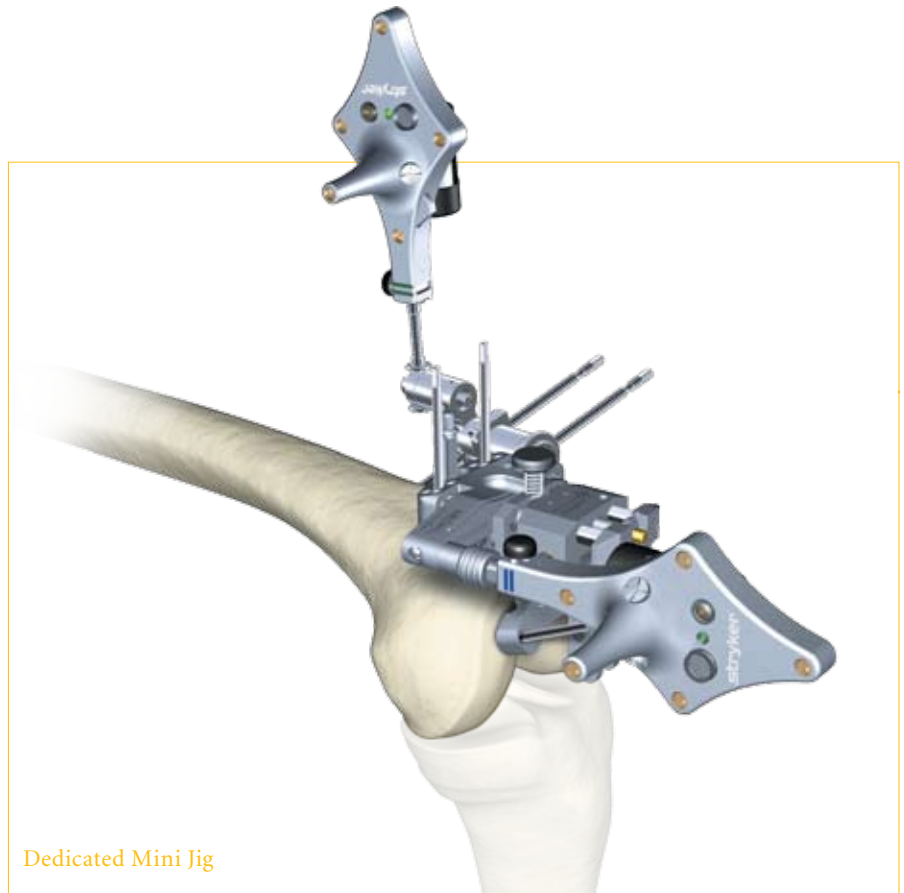
For distal femur and proximal tibia cuts, two different kinds of cutting blocks can be navigated:

- **Conventional cutting blocks**

Conventional cutting blocks with intramedullary fixation are navigated by inserting a Resection Plane Probe with a tracker into the cutting slot.

- **Navigated resection guides**

The Dedicated Mini Jig and the Navigated MIS Jig shown here do not require intramedullary fixation and are equipped with a dedicated tracker interface.



Dedicated Mini Jig

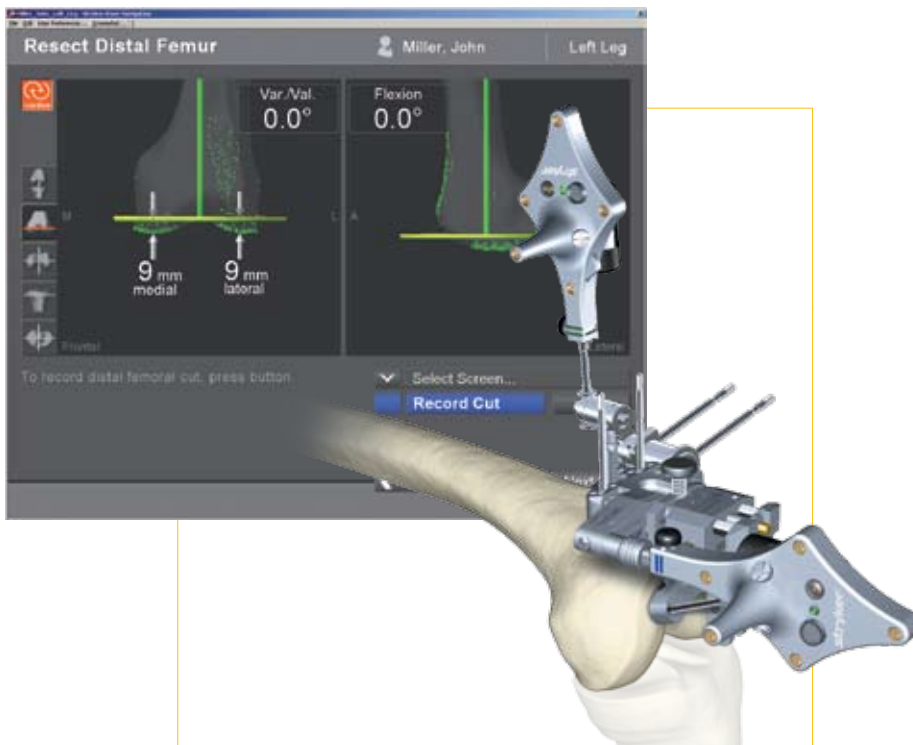


Navigated MIS Jig

# Operative Technique

## 6 Resect Bones

### Resect Distal Femur



When using the Dedicated Mini Jig

- ▶ Bring the cutting guide into position, fixate it to the distal femur and attach the blue tibial tracker, or tool tracker, to the tracker interface.

With the Reactive Workflow feature, the software automatically selects the “Resect Distal Femur” dialog.

On the screen, the yellow disc represents the actual cutting block’s saw capture position. Additionally, the varus/ valgus and flexion/ extension alignment as well as the medial and lateral resection depth is numerically displayed.

- ▶ Align and fix the cutting block to desired parameters on the bone with headless pins.

After proper cutting block fixation, the adjustment component and fixation plate can be removed and the distal femur can be resected.

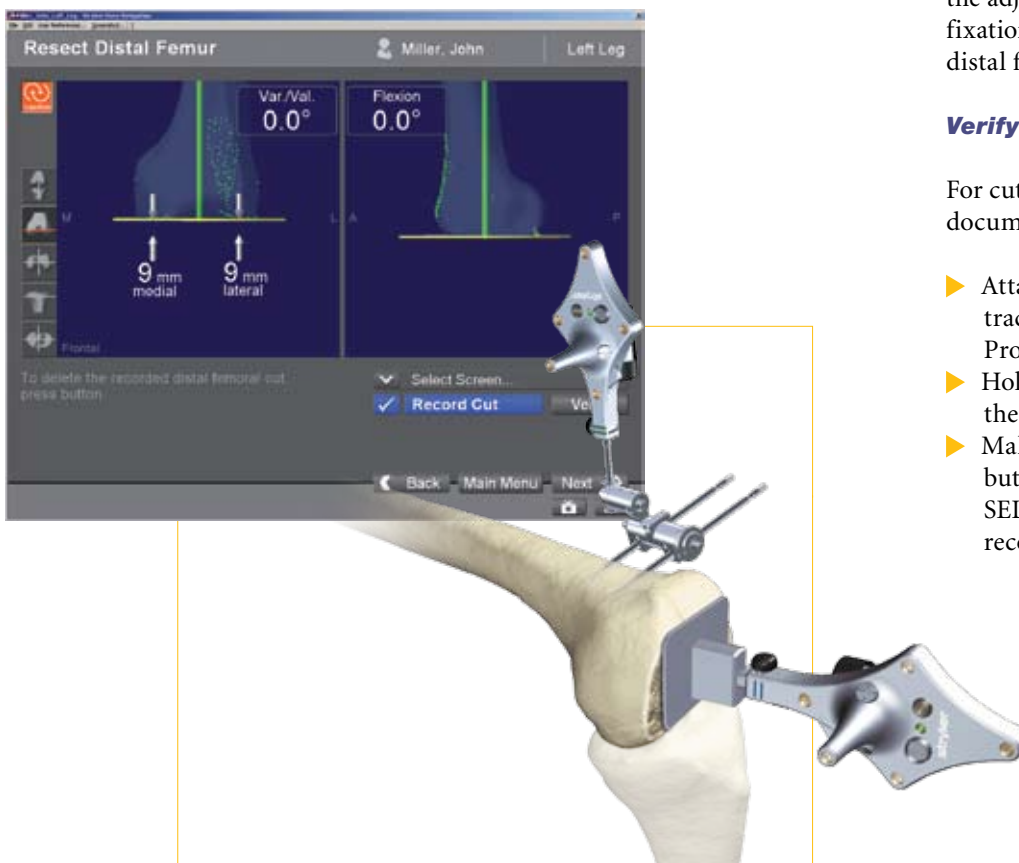
#### Verify Distal Femur Cut

For cut verification and documentation,

- ▶ Attach tibial tracker, or tool tracker, to the Resection Plane Probe.
- ▶ Hold the plane probe flush against the cut.
- ▶ Make sure the “Record Cut” button is highlighted and press the SELECT button on the tracker to record.

#### Note:

For detailed instructions on how to use dedicated cutting guides refer to the IFU supplied with the product and the Operative Technique for Navigated Resection Guides (Lit. no: 9100-091-000).



## 6 Resect Bones

### Align Femoral Rotation

- ▶ Position the AP Sizer flat against the distal femur cut.

When using AP Sizer with size specific slots

- ▶ Slide the Resection Plane Probe with the attached tibial tracker, or tool tracker, into the slot of the predicted size.

For AP Sizer without size specific slots

- ▶ Put the Resection Plane Probe onto any flat surface parallel to the anterior cutting plane.

With the Reactive Workflow feature, the software automatically selects the “Align Femoral Rotation” screen.

The yellow lines represent the AP Sizer rotation. The rotation is displayed as a numerical value with respect to the averaged rotation axis, digitized AP axis, and transepicondylar line.

- ▶ Align the rotation of the AP Sizer.

If the Resection Plane probe sits in the slot of the predicted size

- ▶ Check for potential notching.

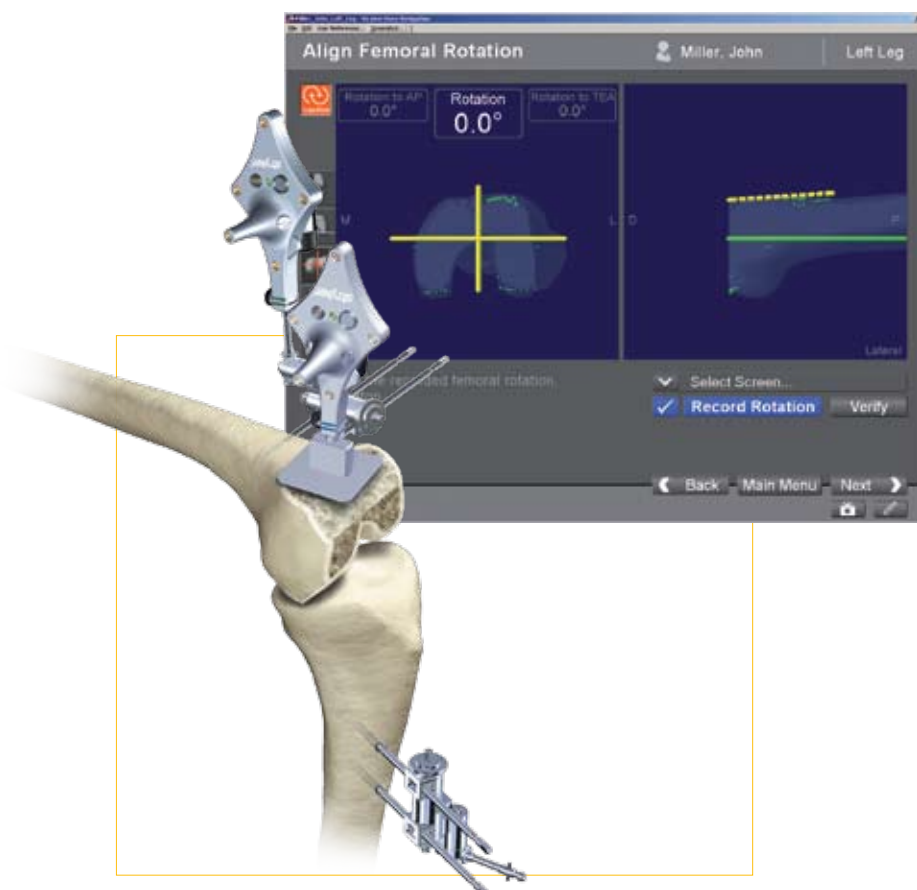
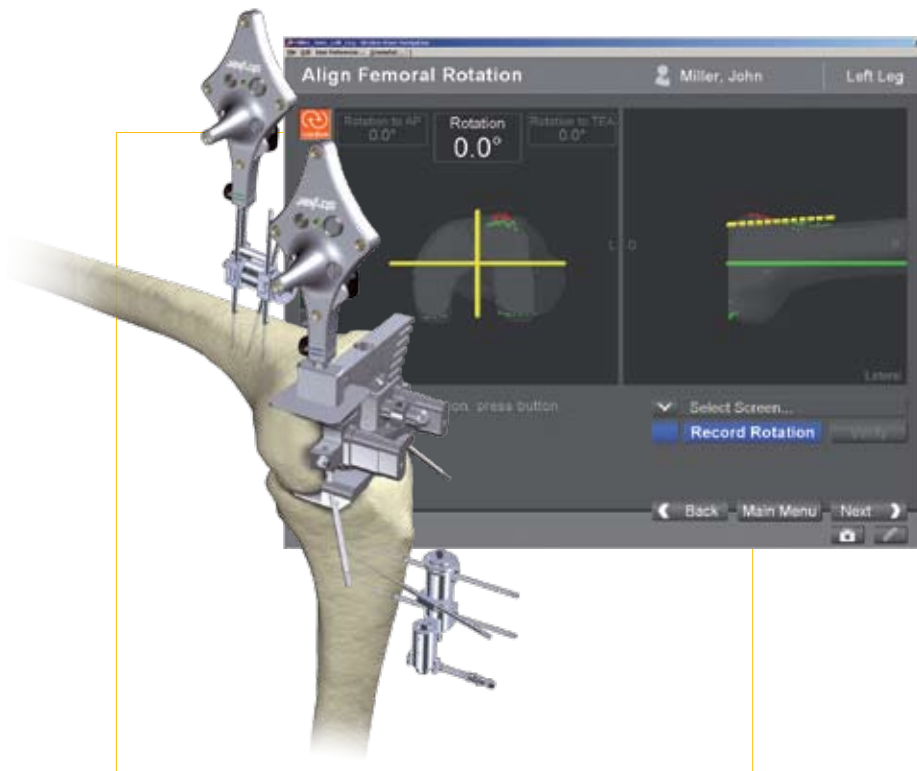
Upon proper alignment

- ▶ Fixate the AP Sizer and re-check the alignment.

With the AP Sizer fixed, the peg holes can be drilled. The 4-in-1 cutting block can be impacted into these holes and the remaining four femoral bone resections can be completed.

For anterior cut verification and documentation

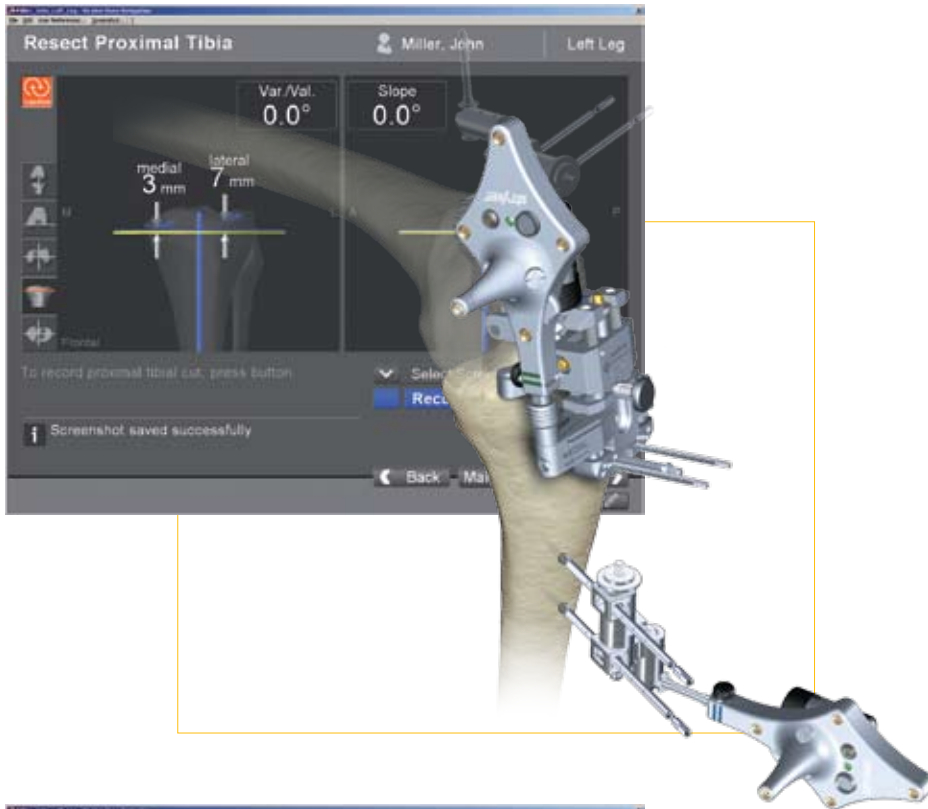
- ▶ Hold the Resection Plane Probe with tibial tracker, or tool tracker, flush against the anterior cut, make sure the “Record Rotation” button is highlighted, and press the SELECT button on the tracker to record.



# Operative Technique

## 6 Resect Bones

### Resect Proximal Tibia



When using the Dedicated Mini Jig

- ▶ Bring the cutting block into position, fixate it to the tibia, and attach the green femoral tracker, or tool tracker, to the tracker interface.

With the Reactive Workflow feature, the software automatically selects the “Resect Proximal Tibia” dialog.

On the screen, the yellow disc represents the actual cutting block’s saw capture position. Additionally, the varus/ valgus alignment, slope, and medial/ lateral resection depth are displayed as a numerical value.

- ▶ Align and fix the cutting guide to desired parameters on the bone with headless pins.

After proper cutting block fixation, the adjustment component and fixation plate can be removed and the proximal tibia can be resected.

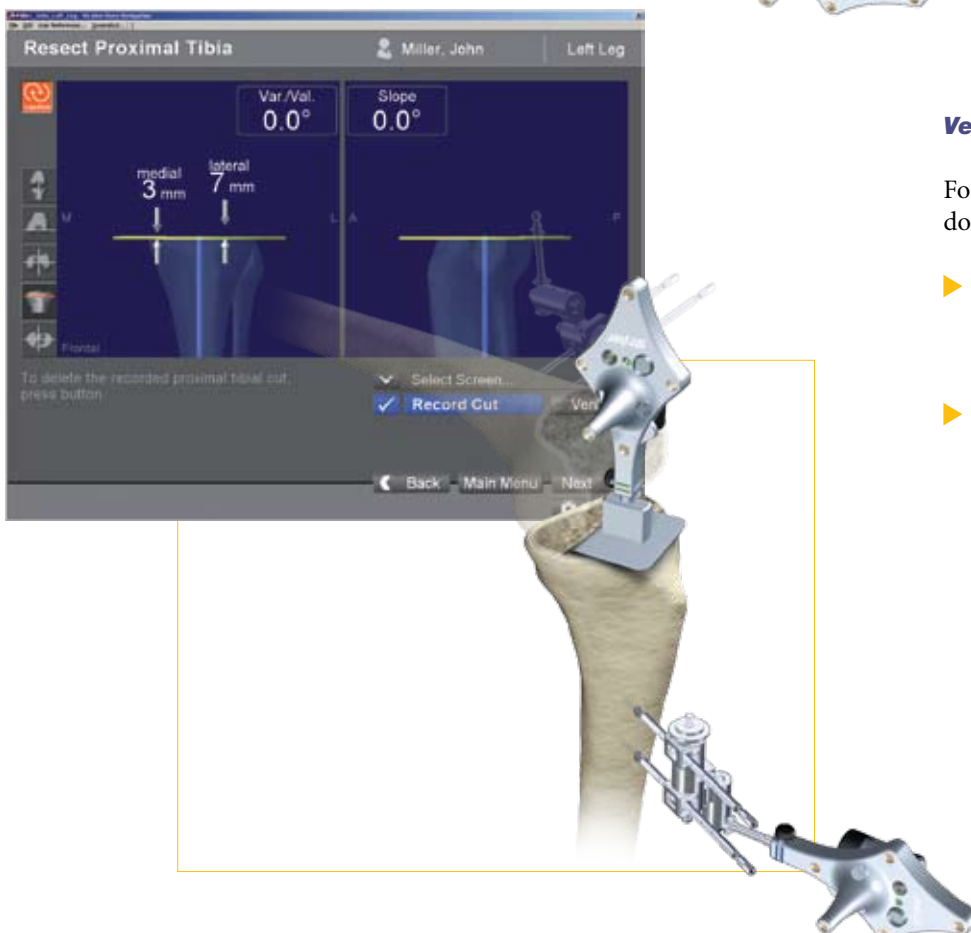
#### Verify Proximal Tibia Cut

For proximal tibia cut verification and documentation

- ▶ Attach the femoral tracker, or tool tracker, to the Resection Plane Probe and hold the plane probe flush against the cut.
- ▶ Make sure the “Record Cut” button is highlighted and press the SELECT button on the tracker to record the cut.

#### Note:

For detailed instructions on how to use dedicated cutting guides refer to the IFU supplied with the product and the Operative Technique for Navigated Resection Guides (Lit. no: 9100-091-000).





## 6 Resect Bones

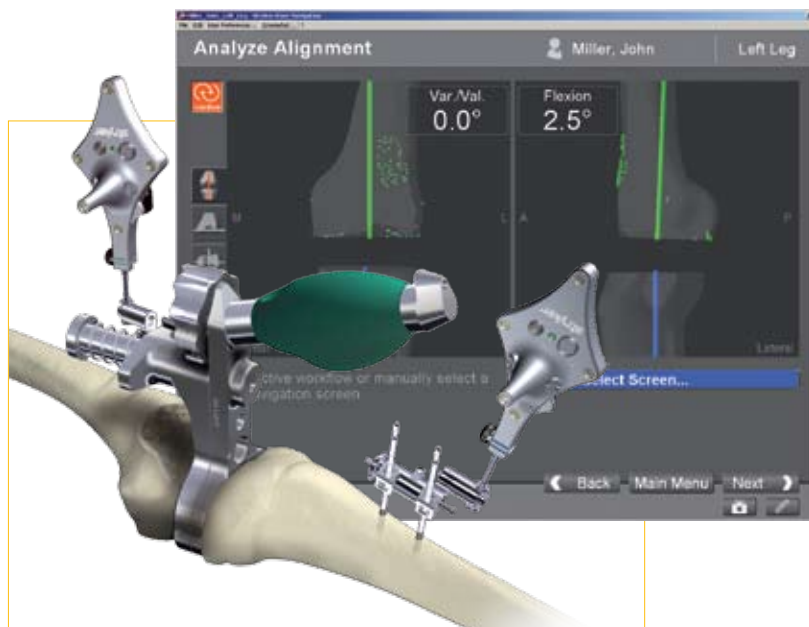
### Soft Tissue Balancing

Within the Reactive Workflow feature, an “Analyze Alignment” screen is integrated to help control soft tissue balancing.

- ▶ Attach femoral and tibial tracker to the anchoring devices.

With the Reactive Workflow feature, the software automatically selects the “Analyze Alignment” screen.

- ▶ Distract the knee joint and perform sequential soft tissue releases until the desired varus/ valgus balance is achieved.



### Align Tibial Rotation

For Stryker implants

- ▶ Attach the femoral tracker, or tool tracker, to dedicated Tibial Alignment Handle and use the alignment handle to position the tibial template onto the resected tibial plateau.

With the Reactive Workflow feature, the software automatically selects the “Align Tibial Rotation” screen.

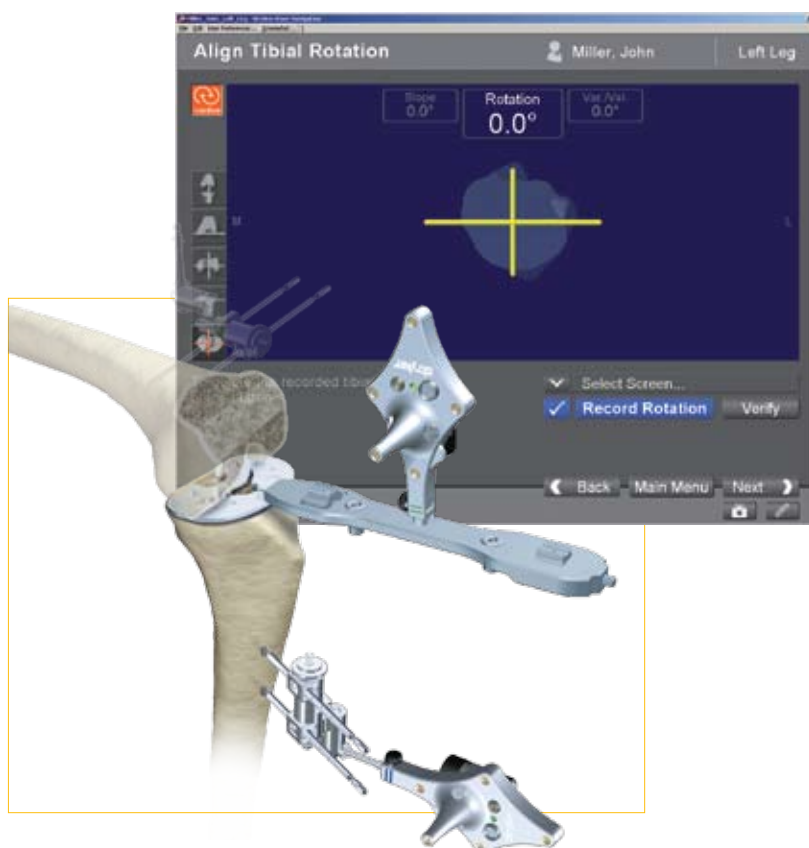
On the software screen, the yellow cross represents the actual template rotation. Additionally, the rotational alignment is displayed as a numerical value.

- ▶ Align the tibial template properly and pin the template into position.

To record the template position

- ▶ Make sure the “Record Rotation” button is highlighted and press the SELECT button on the tracker.

To proceed with analyzing the intra-operative leg alignment, highlight “Next” and press the SELECT button on any tool.



#### Note:

When using a non-Stryker Alignment Handle, the femoral tracker, or tool tracker, can be attached to the square Resection Plane Probe and held

against the handle. Make sure the tracker is in line with the handle's axis and the Resection Plane Probe parallel to the tibial template.



## 7 Analyze Trial and Final Alignment



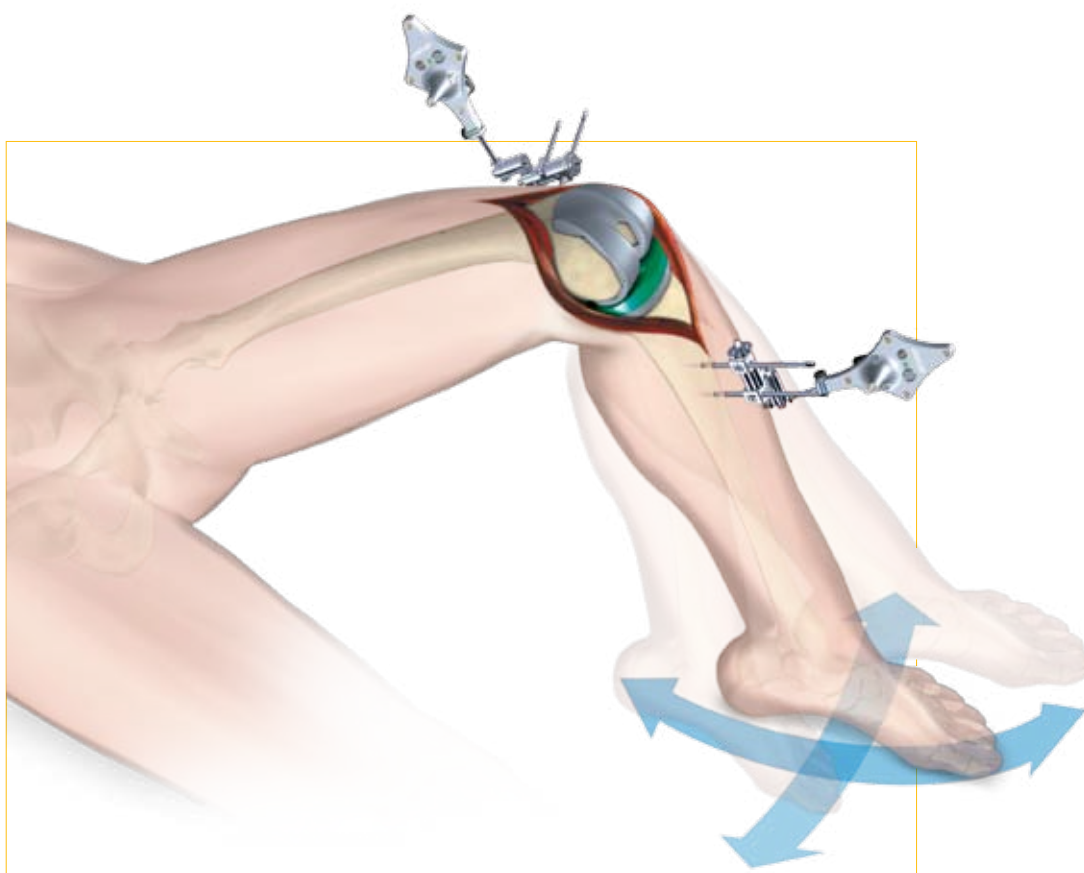
### Analyze Trial Alignment

The “Analyze Trial Alignment” screen is similar to “Verify Registration”.

It enables the surgeon to assess the intra-operative leg alignment and ROM with the trial implants in place.

The result of soft tissue balancing and comparisons between tibial inlays, range of motion and leg alignment can be controlled and adjusted.

For documentation, intra-operative alignment can be recorded.

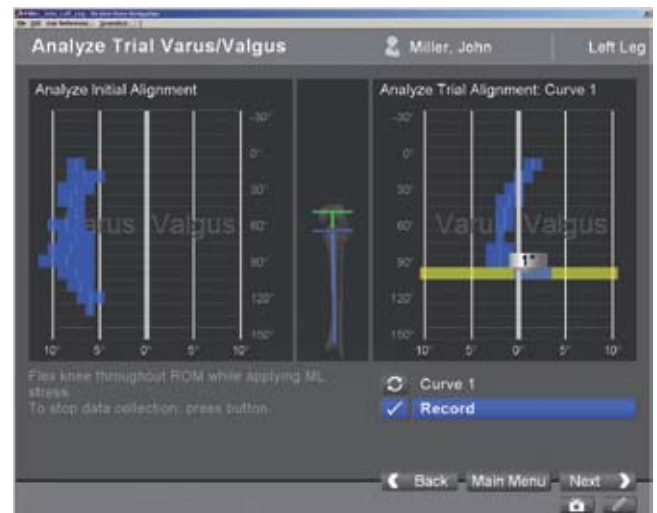


## 7 Analyze Trial and Final Alignment

### Analyze Trial Varus Valgus

The “Analyze Trial Varus/ Valgus” screen is similar to “Analyze Initial Varus/ Valgus”.

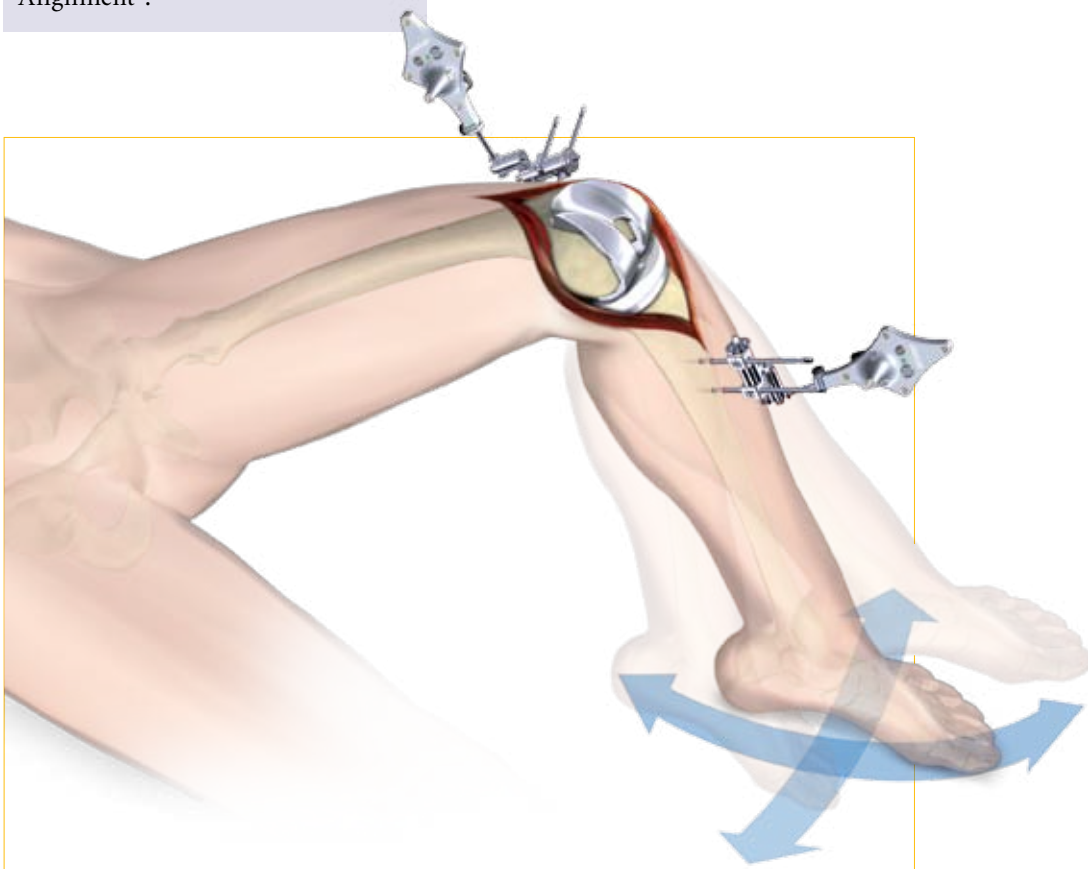
It enables the surgeon to assess the varus/ valgus alignment and the stability of the knee joint with the trial implants in place.



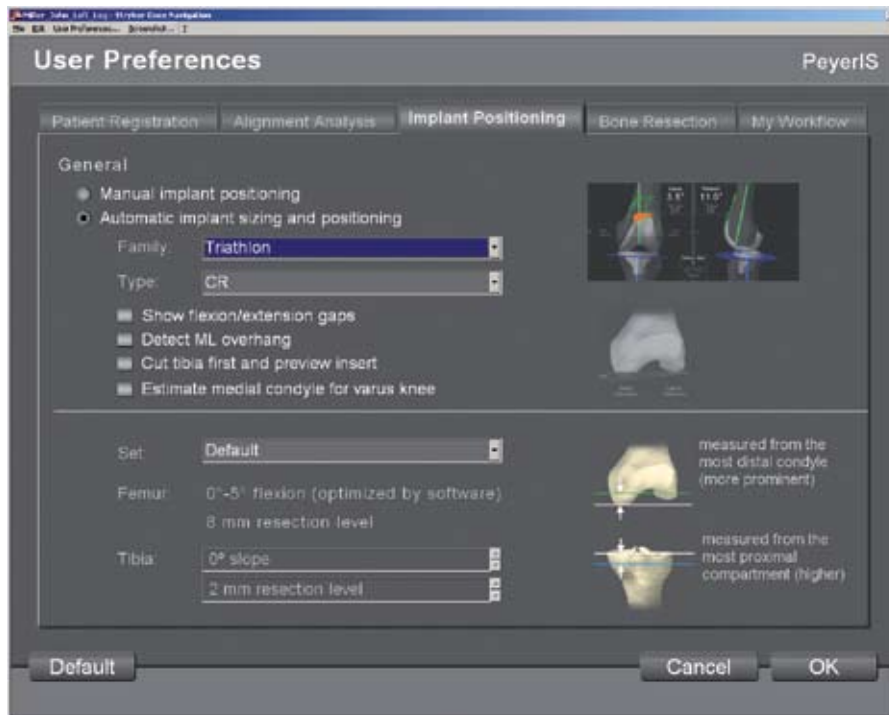
### Analyze Final Alignment

After final prosthesis implantation, an outcome assessment can be performed.

For the outcome assessment, the same screen types are used as in “Analyze Initial and Trial Alignment”.



## 8 Automatic Sizing and Implant Positioning



### Automatic Sizing and Implant Positioning

Automatic femoral implant sizing and positioning can be enabled in the user settings for the following Stryker® implant families and types:

- Triathlon™ (CR and PS)
- Scorpio® (CR and PS)
- Scorpio® NRG (CR and PS)

Based on the selected implant family and the digitized axes and bone morphology, the software calculates the optimal size and position of the femoral implant.

The goal of the calculations is to achieve the best anterior match while keeping the implant size as small as possible.

Unlike the standard patient registration workflow, automatic implant sizing and positioning requires a specific anterior cortex digitization and additional surface mapping of the posterior condyles.

#### Note:

The calculations are based on the digitized axes and digitized bone morphology only. The soft tissue conditions are not considered.



### Medial/ Lateral Posterior Condyle

- ▶ Place the pointer's tip onto the medial posterior condyle and begin digitizing by pressing the pointer's SELECT button and moving the tip over the surface of the medial posterior condyle.
- ▶ Repeat this procedure for the lateral posterior condyle.

#### Note:

Ensure that the most posterior aspect of the condyle has been included and that the pointer's tip does not digitize false points in the air at the back of the knee.

## 8 Automatic Sizing and Implant Positioning

### Anterior Cortex

For automatic sizing and implant positioning, adequate digitization of the anterior cortex has to be ensured.

To provide guidance, a digitization grid and the proximal implant contours of every second implant size are superimposed on the bone model. The proximal implant contours are derived from the implant database. Their positions are determined by the digitized landmarks.

The proximal implant contours define the area of the anterior cortex most important for an optimized and enhanced anterior implant match. In addition, the contours determine size specific digitization regions.

When digitizing, the software will “check off” and change the color of the size specific digitization regions once the minimum amount of points have been obtained for that region and implant size.

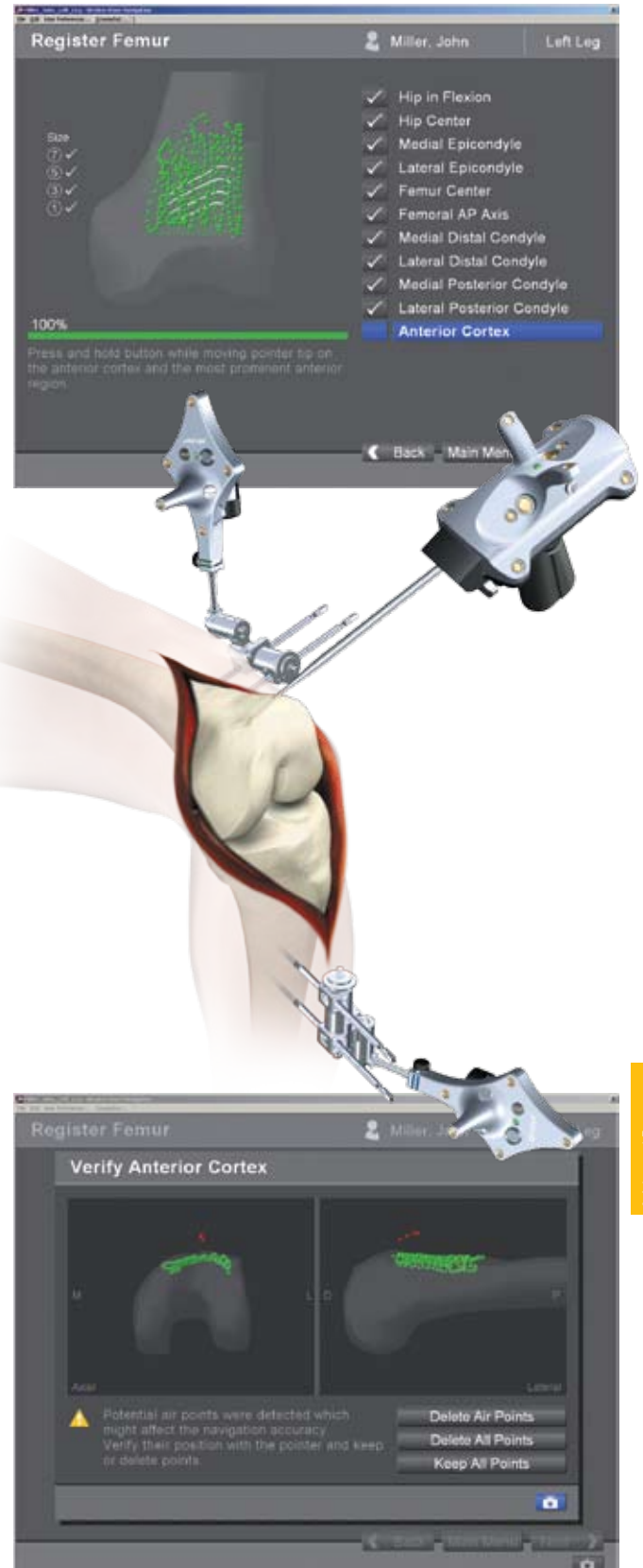
- ▶ Place the pointer's tip onto the anterior cortex and begin digitizing by pressing the pointer's SELECT button and moving the tip over the surface of the anterior cortex.

#### Note:

For the software to be able to properly calculate the optimal size and best anterior match, the following must be ensured: The relevant portions of the anterior cortex must be covered and the digitization must represent the bone morphology properly. Uneven point distribution and uneven mapping density should be avoided. The digitized points should cover an area reaching at least 12 mm proximal to the final implant.

After digitization, potential air points are displayed by the software and can be deleted.

Select “Next” to proceed.





## 8 Automatic Sizing and Implant Positioning



### Position Implant

After completion of patient registration, the software will calculate the size and position for the best fitting implant and place it on the virtual femur.

For verification, the following calculated parameters are displayed graphically and in numerical value in the “Position Implant” dialog:

- Femoral implant size
- Flexion angle
- Medial & lateral distal resection level
- Medial & lateral posterior resection level
- AP shift (if applicable)
- Uncovered anterior bone resection (area marked in orange)
- Maximum gap between implant and the anterior cortex and its position (orange dot) (if applicable)

Varus/ valgus and rotational alignment, as well as the reconstruction of the posterior and distal condyles are achieved in accordance with the principles of conventional surgical technique.

The calculated parameters are either displayed within the bone model or in the numerical value boxes in grey (see the highlighted area in the screenshot).

In addition to the calculations, the dialog provides online information on the actual leg alignment and, if selected in the user settings, a preview on the size of the flexion and extension gap.

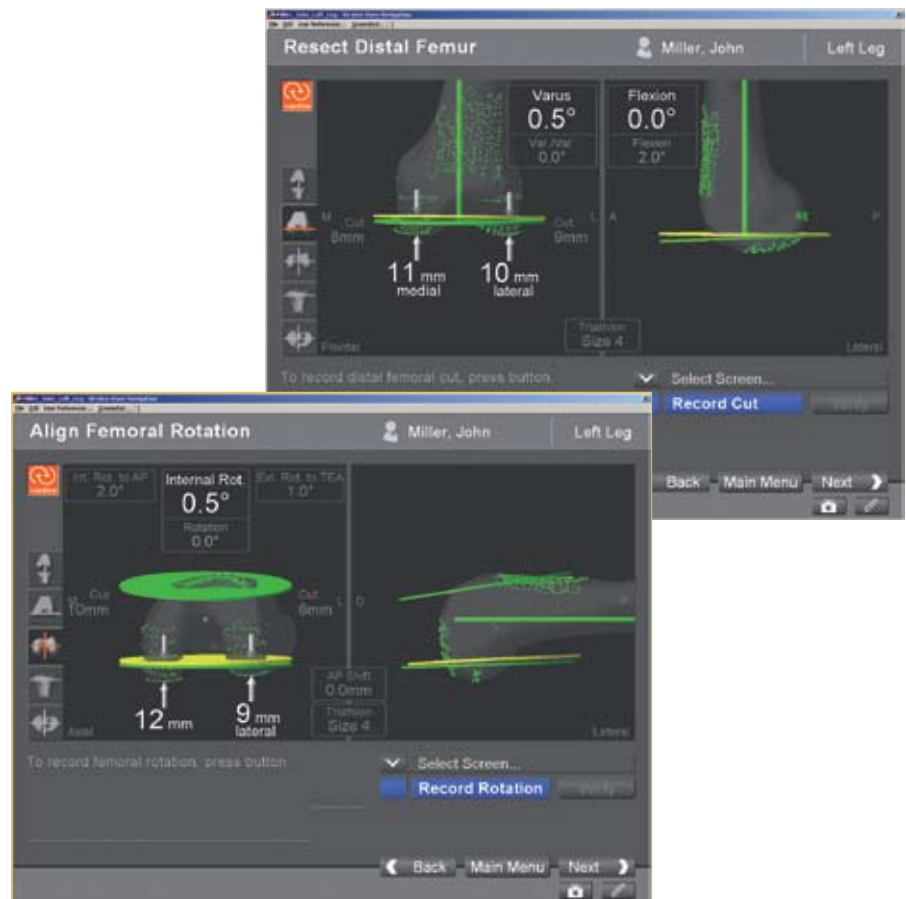


- ▶ Verify the calculated femoral implant size and position.
- ▶ Select “Next” to open the “Planned Femoral Implant” dialog summarizing size, alignment and position of the calculated femoral implant.
- ▶ Select “OK” to proceed.



## 8 Automatic Sizing and Implant Positioning

The calculated parameters are displayed in the “Resect Distal Femur” and “Align Femoral Rotation” dialog in grey numerical values, suggesting the target for instrument alignment. In addition, the suggested resection levels are displayed as green planes.

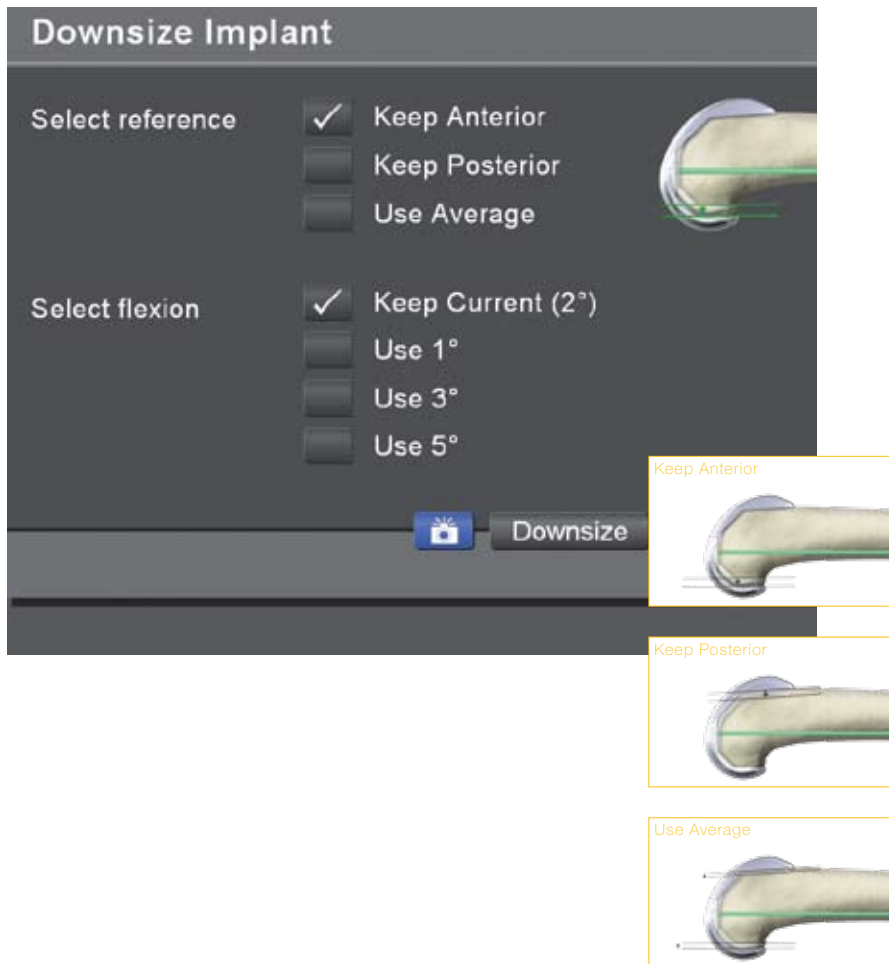


If soft tissue constraints require, the calculated implant can be quickly virtually downsized to visualize the result of using a smaller femoral component instead of the suggested one, or, if desired, a more in depth implant modification dialog may be entered.

- Select “Downsize to ...” or “Modify Implant Position ...”.



## 8 Automatic Sizing and Implant Positioning



### Implant Modification - Option 1: Downsize to ...

The “Downsize Implant” dialog facilitates downsizing the calculated implant to the next smaller one.

- To downsize the calculated implant
- ▶ Select which (resection) plane shall be kept in position when downsizing the calculated implant:
    - Anterior resection plane
    - Posterior resection plane
    - Implant center line
  - ▶ Select the desired flexion angle of the downsized femoral implant.
  - ▶ Select “Downsize”.

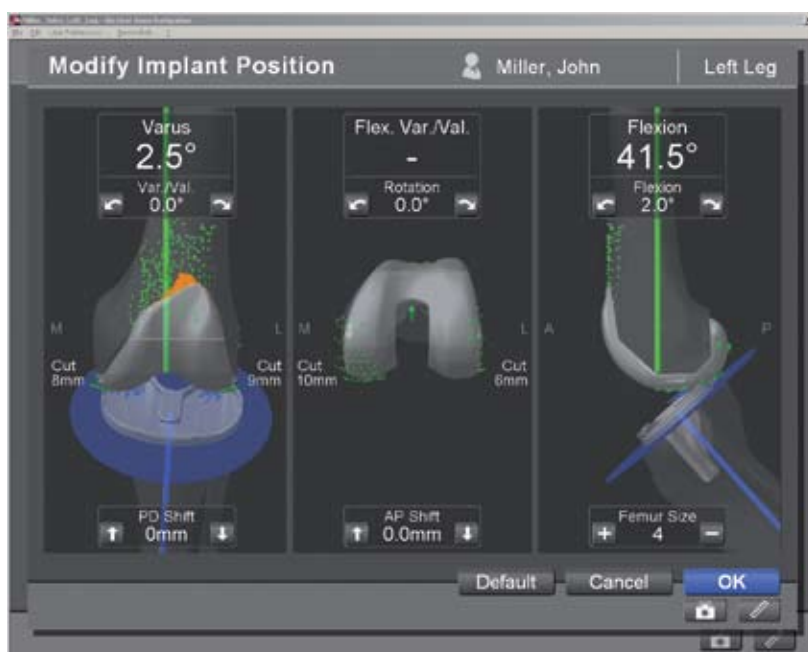
### Implant Modification - Option 2: Modify Implant Position ...

The “Modify Implant Position” dialog allows to manually adjust the suggested femoral implant position with respect to

- Varus/ valgus
- Proximal- distal shift (Resection level)
- External/ internal rotation
- Anterior/ posterior shift
- Flexion/ extension
- Size

When modifying the implant size and position, orange marked areas indicate uncovered anterior bone resection. If applicable, an orange dot displays the position of the maximum gap between implant and anterior cortex.

In case of notching, a warning message is displayed.



- To modify the implant position or size
- ▶ Select the arrow control buttons.

To close the “Modify Implant Position” screen

- ▶ Select “OK”.

# 8 Automatic Sizing and Implant Positioning

## Automatic Sizing and Implant Positioning - Calculations

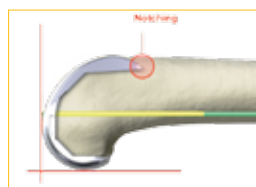
Optimal femoral implant size and position is calculated in the following manner:

First, the software virtually positions the smallest implant size on the digitized femur.

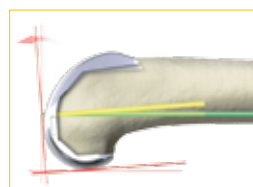
For positioning, varus/ valgus and rotational alignment are set to 0°. The distal and posterior condyles are reconstructed in accordance to the principles of conventional surgical technique.

After positioning the smallest implant size, the software iterates this process for all available implant sizes. In addition, different flexion angles as well as AP shift are applied.

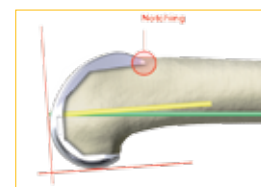
### Implant Sizing and Positioning - Iterations



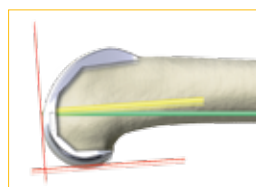
1. Position smallest implant and assess fit



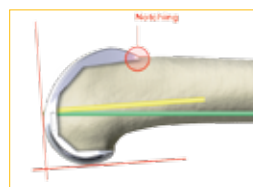
2. Apply flexion (1° to 5°)



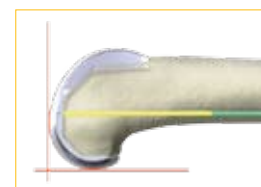
3. Assess fit (for each flexion)



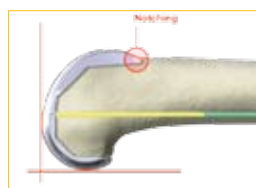
4. Apply AP shift (for each flexion)



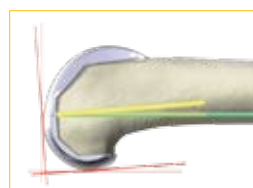
5. Assess fit



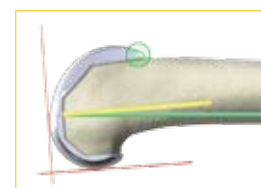
1a. Select next bigger size ...



... and assess fit



2a. Apply flexion (1° to 5°)



3a. Assess fit ...

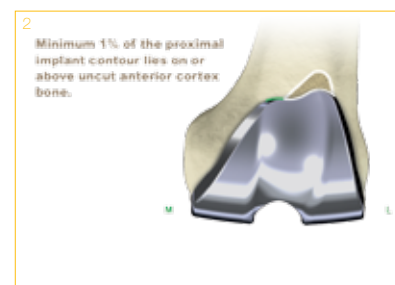
Within these iterations, the software selects the femoral implant size and position which fits the following (prioritized) criteria best:

1. Maximum run out of uncovered anterior cortex resection is smaller than 12 mm.
2. Minimum 1% of the proximal implant contour is lying on or above uncut anterior cortex.
3. Minimum 60% of the proximal implant contour has contact with cut anterior cortex.
4. Maximum gap between the proximal implant contour and uncut anterior cortex bone is smaller than 1.5 mm.

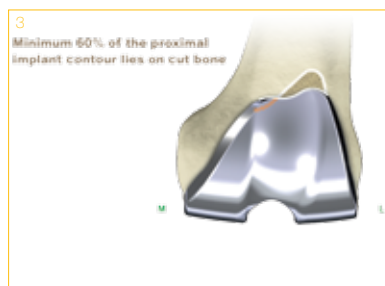
### Implant Sizing and Positioning - Criteria for Best Fit



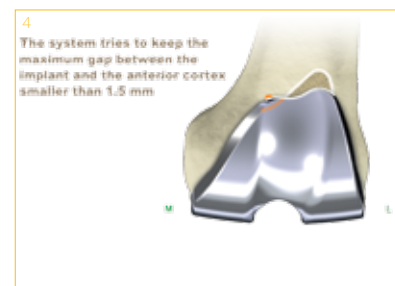
1



2

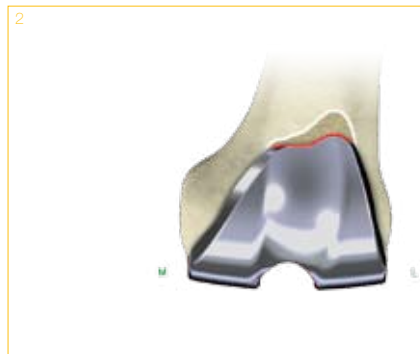


3



4

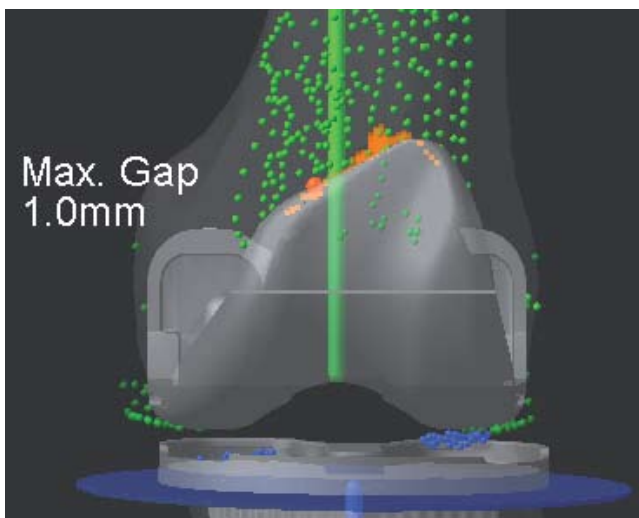
## 8 Automatic Sizing and Implant Positioning



### Notching

The software indicates notching if one of the following criteria applies:

1. Maximum run out of uncovered anterior cortex resection is larger than 12 mm.
2. Entire proximal implant contour has contact with cut anterior cortex.



### Maximum Gap between Proximal Implant Contour and Anterior Cortex Bone

A gap between the proximal implant contour and anterior cortex is calculated by the software. The gap is measured at its maximum in the sagittal plane perpendicular to the digitized mechanical femur axis.



### Estimate Medial Condyle for Varus Knees

With the “Estimate medial condyle for varus knees” feature activated, the software alerts the user if the digitized lateral condyle is more prominent than the medial side.

With the alert, the software offers an estimation of the original medial condyle or to continue with the more prominent lateral condyle as reference for distal femur resection level and for calculating the best fitting implant.

## 8 Automatic Sizing and Implant Positioning

### Automatic Sizing and Implant Positioning - Options

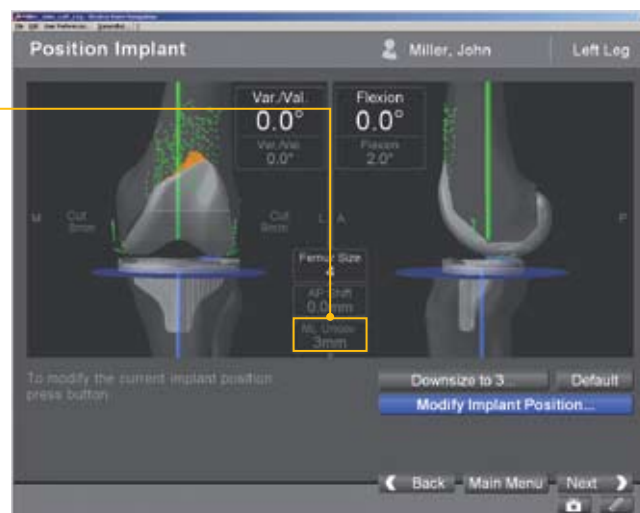
#### Detect ML Overhang

The “Detect ML Overhang” functionality can be enabled in the user settings. It requires the digitization of the medial and lateral overhang region. In the “Position Implant” dialog the average medial/ lateral overhang or uncovered bone cut will be displayed in numerical value. The amount of overhang or uncovered bone is measured at the AP position of the digitized overhang region.

#### Note:

Potential medial/ lateral overhang or uncovered bone cut is displayed only. It is not considered in the automatic sizing and positioning calculations.

ML Uncov.  
3mm



#### Navigated Drill Template for AP Alignment

Navigated Drill Templates for AP alignment are available for Stryker Triathlon™, Scorpio® and Scorpio® NRG implant systems. Navigated drill templates can be selected in the user settings, if automatic sizing is enabled. They can be used to prepare the rotational alignment and AP position of the 4-in-1 cutting block. The navigated drill templates can replace the conventional AP sizer.

With the navigated drill template, an additional frontal view of the anterior cortex is displayed. The anterior cortex view gives a preview of the position and size of the uncovered bone resection against the given flexion/ extension of the distal femur cut and the AP implant position.





## 9 Additional Options - Gap Monitoring

### Gap Monitoring



Gap monitoring enables the surgeon to analyze the size of the flexion/extension gap based upon the recorded bone resections.

Gap monitoring can be enabled in the User Preferences menu.

For Gap Monitoring, it is mandatory to

- ▶ Record the distal femur cut,
- ▶ Record the proximal tibia cut, and
- ▶ Record the posterior femur cut.

#### **Note:**

**The posterior femur cut must be recorded by using the Posterior Plane Probe.**

For gap assessment

- ▶ Attach both trackers to the anchoring device.

With the Reactive Workflow feature, the software automatically selects the “Analyze Alignment” screen.

- ▶ Distract the knee in extension to assess the size of the extension gap.
- ▶ Distract the knee in flexion to assess the size of the flexion gap.

Depending on the result, additional measures such as ligament or capsule release may be applied to achieve an equal gap in flexion and extension.



## 9 Additional Options - Documentation Tools

### Documentation Tools

#### Screenshot

The screenshot feature allows for intraoperative navigation screenshots. The screenshots can be used to illustrate lectures, research papers, articles or promotion materials.

The screenshots are stored in the PNG format on hard drive D:\KneeData\patients\...

To create a screenshot

- ▶ Highlight and select the screenshot button.

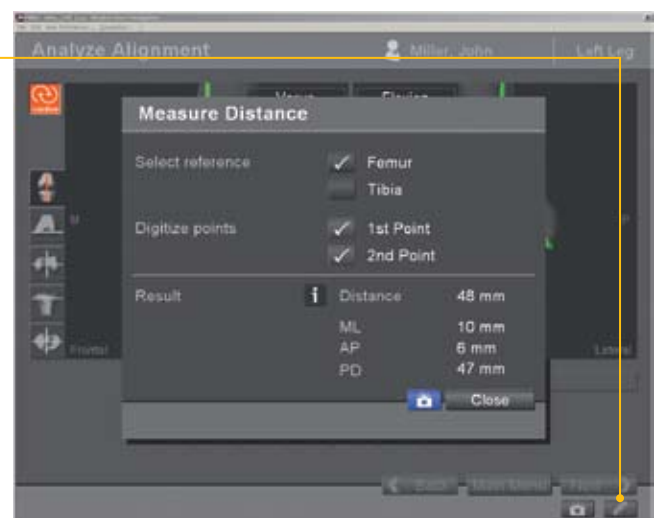


#### Ruler

Located on all navigation screens, is a universal measurement tool enabling the surgeon to perform and document the required measurements.

To activate the dialog

- ▶ Select the ruler button,
- ▶ Select whether the distance is measured on the femur or tibia,
- ▶ Digitize two points.

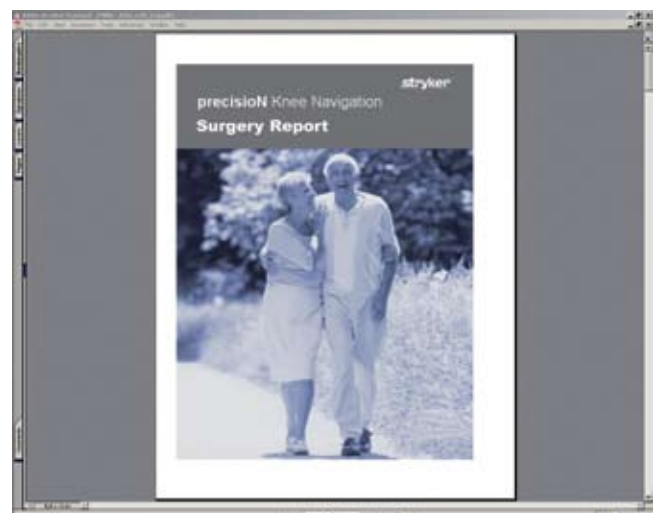


Upon digitization of the two points, the overall distance as well as the medial-lateral, anterior-posterior, and proximal-distal distance is calculated.

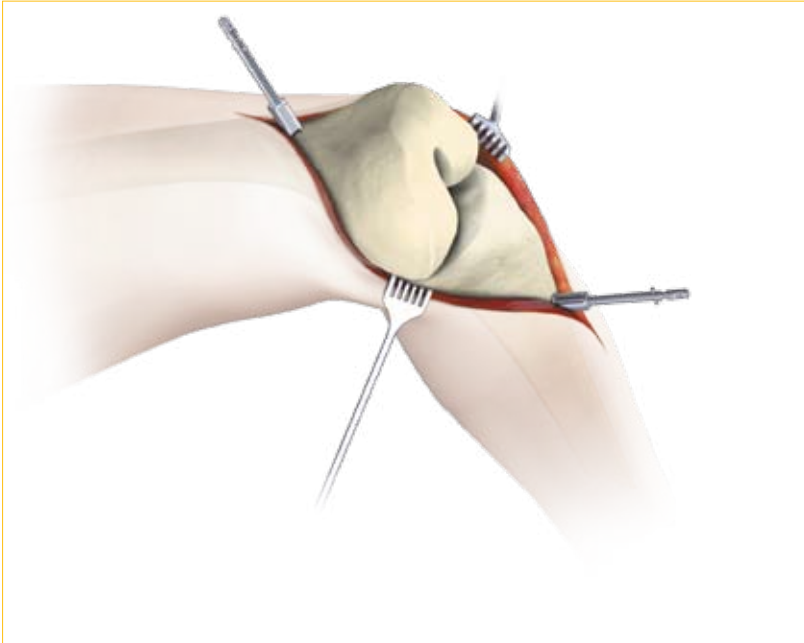
#### Report

The report is automatically created after saving the patient file. It compiles all relevant surgery data including the recorded positions of the cutting planes and all kinematics data.

The report is saved as a pdf file on the hard drive D:\KneeData\patients\... and can be accessed via the main menu.



## 9 Additional Options - Miscellaneous



### **Bi-cortical Anchoring Pin Fixation, Position and Orientation**

Bi-cortical Anchoring Pins are two step pins available in different thread diameters and lengths.

Rotational stability of bi-cortical Anchoring Pins is provided by the pins' bone anchor splines.

On the femur, the Anchoring Pin can be positioned within the incision in a region of the metaphysis.

On the tibia, the Anchoring Pin can be inserted in the midportion of the bone and distal to the tibial tubercle to avoid collision with the tibial cutting guide and the keel of the implant.

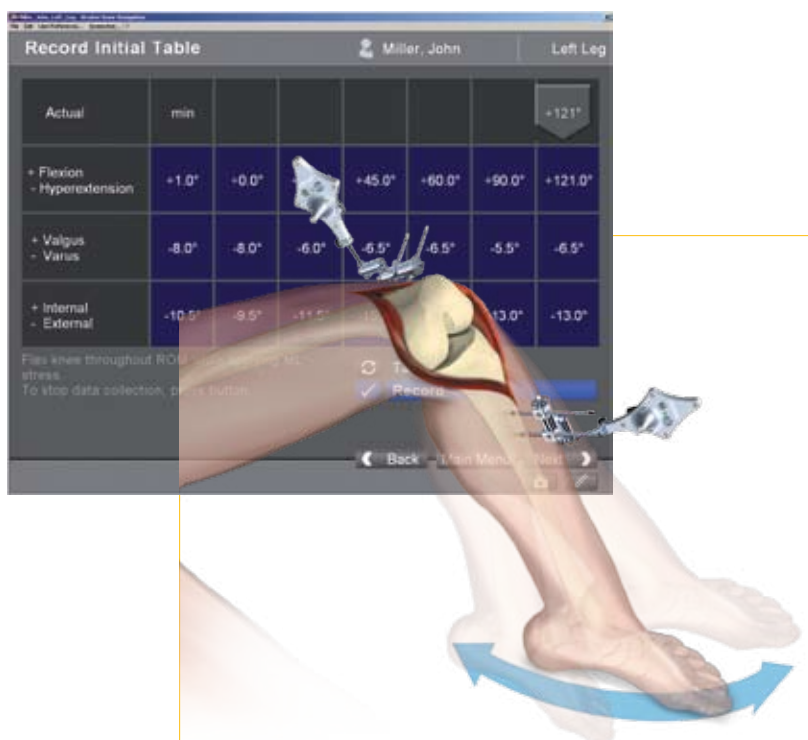
For fixation, pre-drill a pilot hole with a 3.2mm drill.

The pin can be inserted bi-cortically, using the Insertion Tool.

#### **Note:**

Avoid pin positions and pin orientations where any vulnerable neurovascular structures might be injured on either side of the entrance

or exit points.  
Choose an Anchoring Pin with the appropriate thread length according to the insertion depth.



### **Record Initial Table/ Record Trial Table/ Record Final Table**

The "Record Table" screen automatically documents the kinematic data (flexion/ extension, varus/ valgus, rotation) at specific flexion angles throughout the whole range of motion.

If selected in the User Preferences, the Record Table feature is part of the Analyze Initial and Trial and Final Alignment sequences.

## 9 Additional Options - Miscellaneous

### Anterior Referencing

Stryker® precisioN Knee software supports the posterior as well as the anterior referencing bone cut sequence.

If anterior referencing is selected in the user settings, the “Align Femoral Rotation” dialog is expanded and displays the rotational and the flexion/ extension alignment of the anterior cutting plane.



### HTO Workflow

With Stryker® precisioN Knee software, a HTO workflow supporting the assessment of the overall leg alignment can be enabled. For HTO navigation the following landmarks have to be digitized:

- Hip in flexion
- Hip center
- Femur center
- Femoral AP axis
- Tibia center
- Tibial AP axis
- Medial/ lateral malleolus



### Hotspot Landmark Redigitization

During navigation and alignment analysis, the following landmarks can be redefined by hotspot redigitization:

- Medial/ lateral epicondyle
- Femoral AP axis
- Tibial AP axis

To open the hotspot redigitization dialog

- Move the pointer tip close to the landmark.

The deviation of the newly defined landmark or axis to the previous registration will be displayed.

- Select “Redigitize” to redigitize the landmark or axis.



# Appendix

## 10 Part List

	Part Number	Description
		<b>Anchoring Devices</b>
	6007-4xx-000	Anchoring Pins 4 mm x 20/ 25/ .../ 60 mm
	6007-5xx-000	Anchoring Pins 5 mm x 30/ 40/ 50 mm
	6007-015-000	Insertion Tool (for Anchoring Pins)
	6007-003-000	OrthoLock™
	6007-10x-xxx	OrthoLock™ EX-Pins 3x110/ 4x150 mm
	6007-00x-xxx	Navigation Pins 3x100/ 3x150/ 4x100 mm
		<b>Navigation Hardware</b>
	6003-175-000	Pivotal® Alignment Handle
	6003-027-000	Resection Plane Probe – Slots 1.3 mm <sup>1</sup>
	6003-028-000	Resection Plane Probe – Round
	6003-070-000	Posterior Plane Probe
	6003-100-110	Universal Joint Screwdriver <sup>2</sup>
	6003-100-100	Screwdriver <sup>2</sup>
	6003-250-000	Pivotal® Tracker AP Sizer Interface
	6541-002-808	Navigated Tibial Alignment Handle
	6541-005-610	MIS Femoral Navigated Stylus
	6541-004-401	Navigated Tracker Adapter Triathlon
	8001-0315	Navigated Drill Template - Scorpio
	6541-1-688	Navigated Drill Template - Triathlon
		<b>Accessories</b>
	6000-006-000	Instrument Battery

<sup>1)</sup> **Note:** Resection Plane Probes are available for slots from 0.9 mm to 1.5 mm.

<sup>2)</sup> **Note:** Screwdriver required for OrthoLock™, Navigated MIS Jig and Dedicated Mini Jig.



# 10 Part List

Description	Part Number	
<b>Software</b>		
precisionN Knee Navigation	6003-640-000	
<b>Navigation Platform</b>		
Navigation System II - Cart	7700-100-000	
eNlite	7700-300-000	
<b>Navigated Tools</b>		
Ortho Grip Knee Pointer	6003-012-000	
Tibia/ Pelvis Tracker	6003-005-000	
Femur Tracker	6003-010-000	
Universal Tracker (optional)	6000-005-000	
<b>Dedicated Mini Jig</b>		
Adjustment Component	6003-100-020	
Mini Fixation Plate	6003-300-020	
Mini Cutting Guide	6003-300-010	
Tracker Adapter	6003-100-090	
<b>Navigated MIS Jig</b>		
Navigated MIS Jig A	6003-200-010	
Navigated MIS Jig B	6003-200-020	
Tracker Adapter	6003-200-030	



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**Joint Replacements**

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**Trauma, Extremities & Deformities**

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**Craniomaxillofacial**

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**Spine**

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**Biologics**

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**Surgical Products**

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**Neuro & ENT**

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**Interventional Pain**

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**Navigation**

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**Endoscopy**

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**Communications**

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**Imaging**

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**Patient Handling Equipment**

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**EMS Equipment**

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