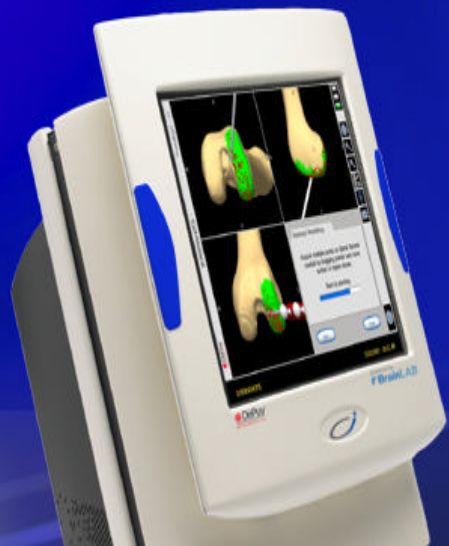


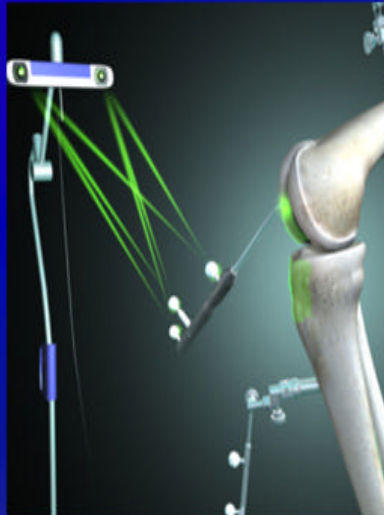
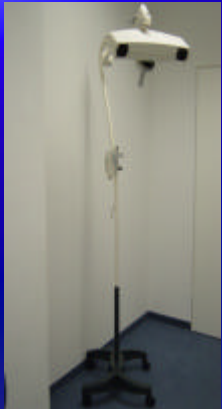
## How does it work?

- System can be compared with a GPS for automobile navigation.



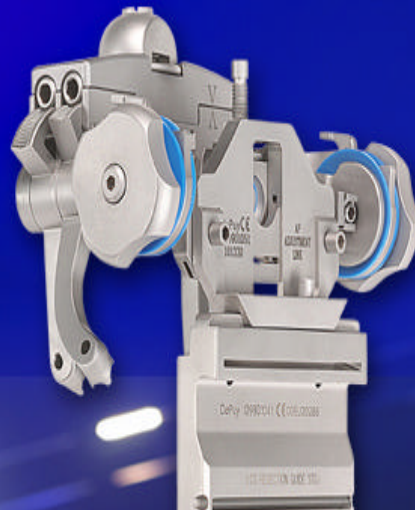
## How does it work?

- The camera replaces the satellite



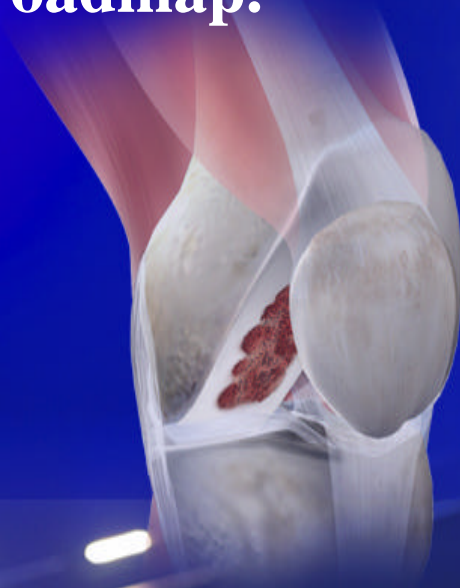
# How does it work?

- **The surgical instruments replace the car.**

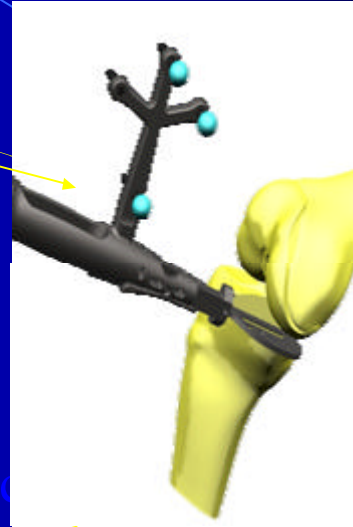


## How does it work?

- **Patient Anatomy compares with roadmap.**



# How does it work?

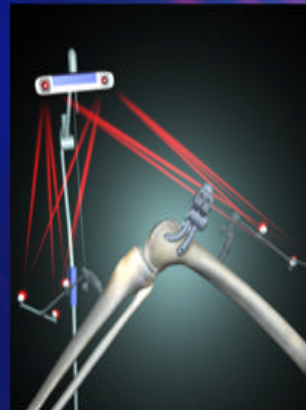
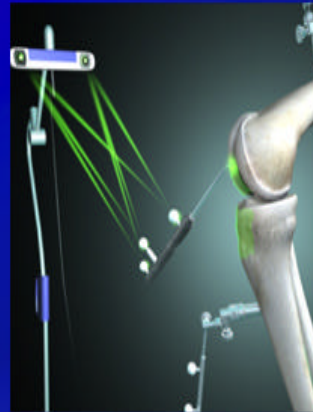


Tracking – Magnetic-Acc

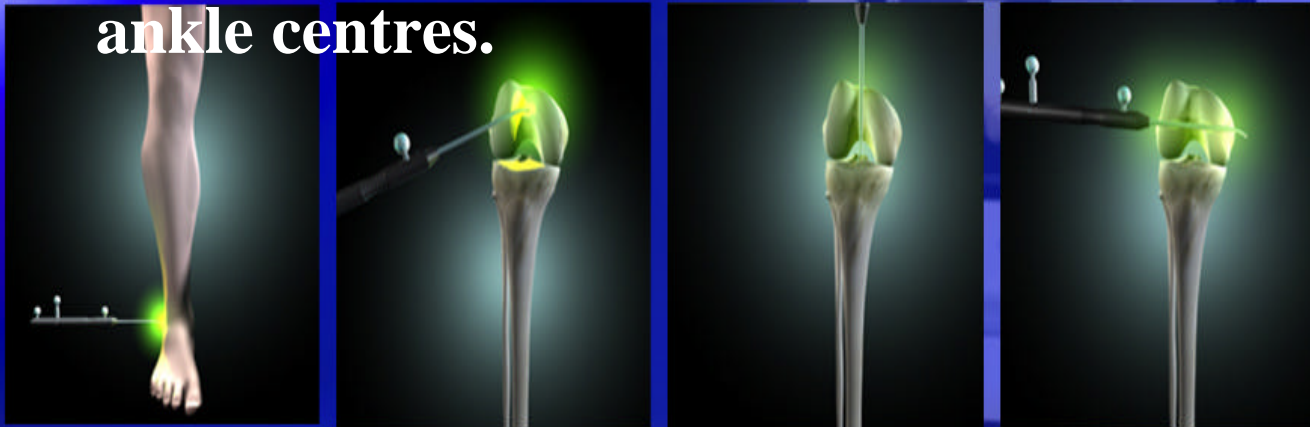
patient = reflectors = source

patient = source...cables...

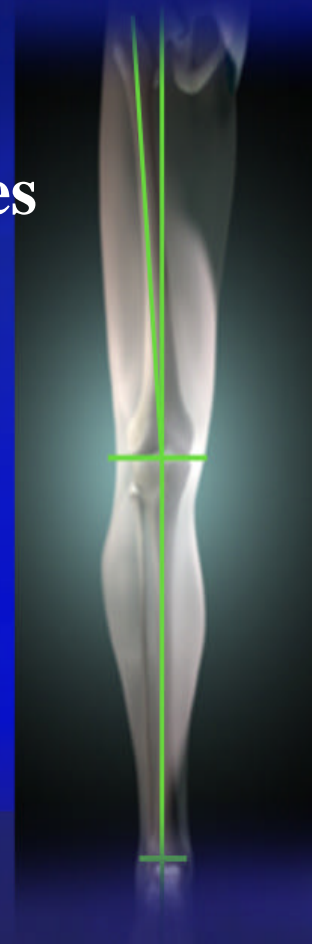
- The computer calculates the position data and displays the information to the screen



**Our Ci system calculates, based on the acquired points, hip, knee and ankle centres.**

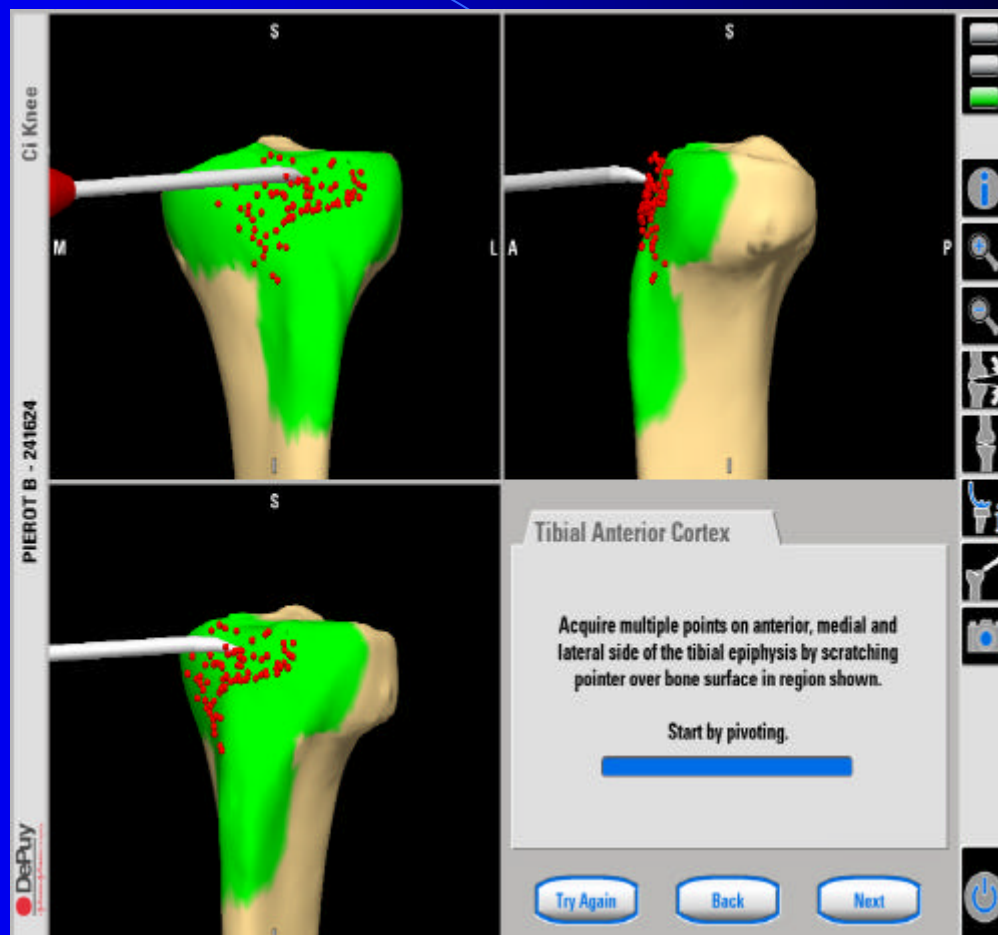


**The location of these centres  
defines the mechanical axis  
for femur and tibia.**

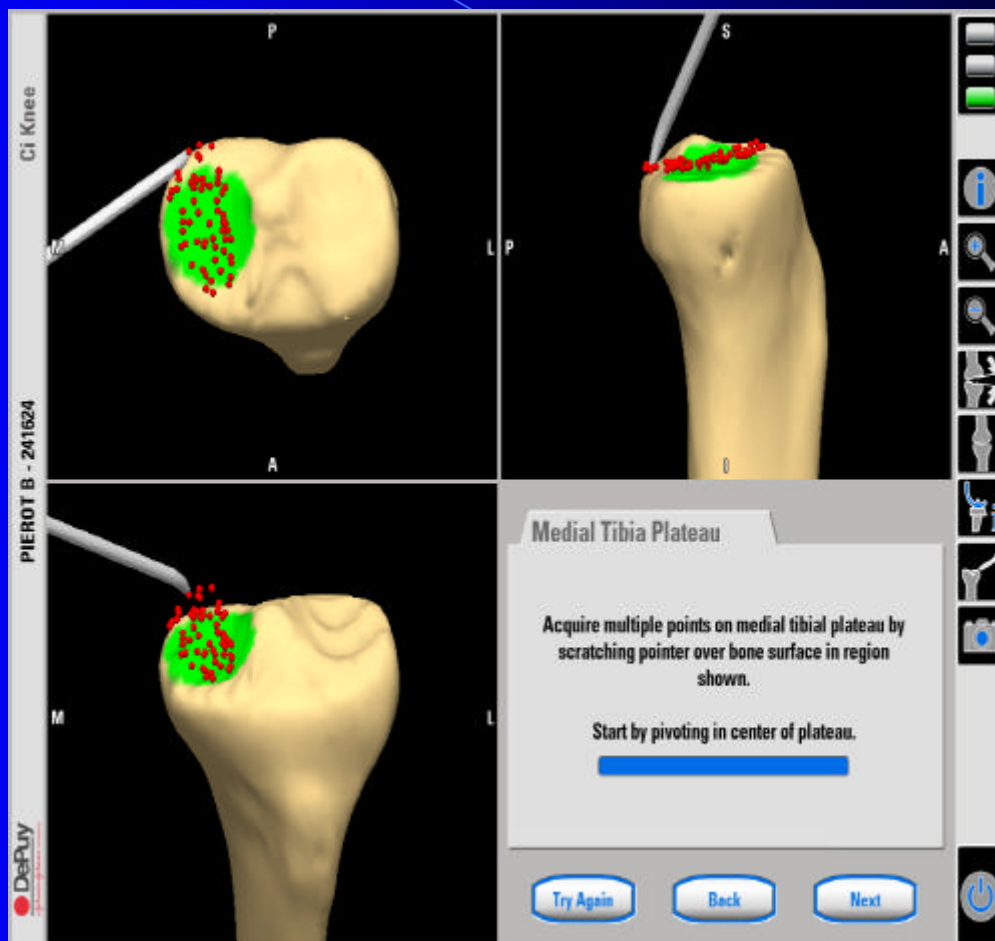




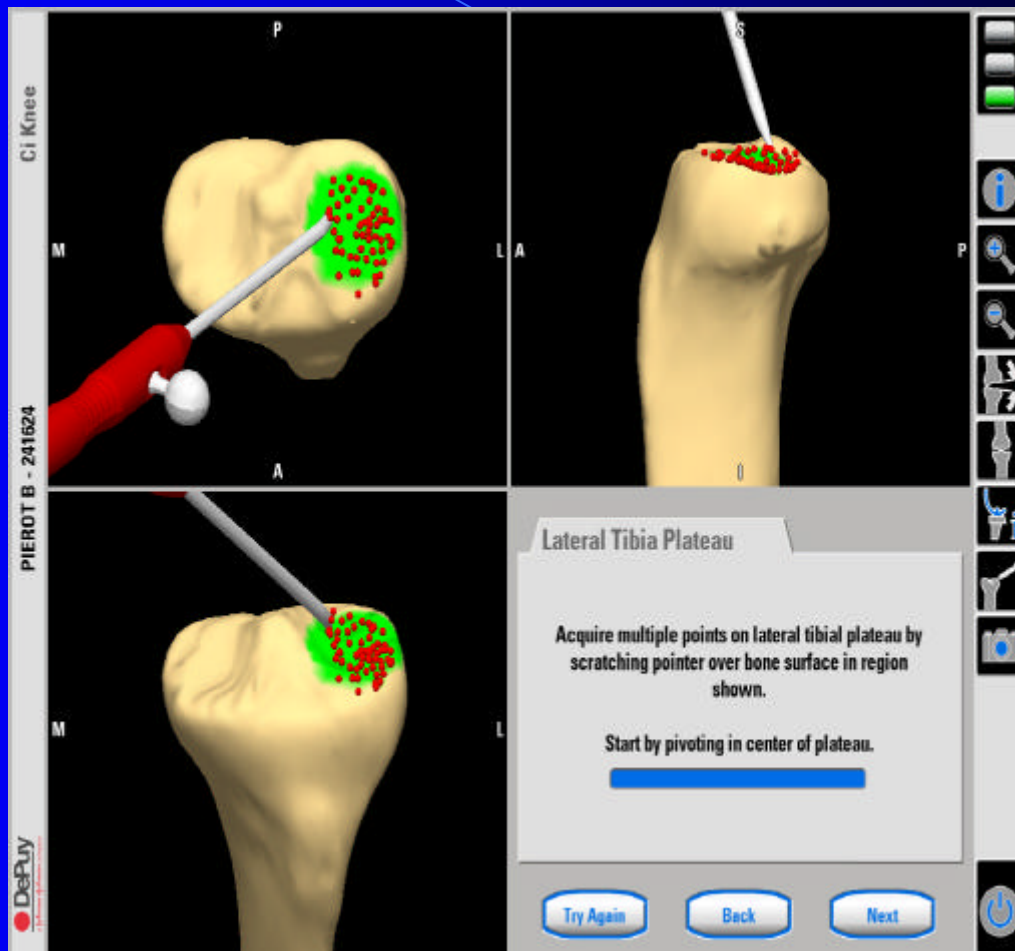
# Points picking



# Points picking



# Points picking



# Points picking

The screenshot displays a 3D medical software interface for point picking on a femoral condyle. The interface is divided into four quadrants showing different views of the bone: top-left (medial view), top-right (anterior view), and bottom-left (lateral view). The femoral condyle is highlighted in green, and a white pointer is shown picking red points on its surface. A vertical sidebar on the left contains the text "Ci Knee" and "PIEROT B - 241624". A vertical toolbar on the right contains various icons for navigation and tool management. A central text box titled "Medial Femoral Condyle" provides instructions: "Remove osteophytes. Acquire multiple points on medial femoral condyle, including points located posteriorly, by scratching pointer over bone surface in region shown. Start by pivoting." Below the text box is a blue progress bar and three buttons: "Try Again", "Back", and "Next". The DePuy logo is visible in the bottom-left corner.

Ci Knee

PIEROT B - 241624

DePuy

Medial Femoral Condyle

Remove osteophytes.  
Acquire multiple points on medial femoral condyle,  
including points located posteriorly, by scratching  
pointer over bone surface in region shown.

Start by pivoting.

Try Again Back Next

# Points picking

The screenshot displays a software interface for knee surgery planning. It features four views of a 3D femur model: a lateral view (top-left), a medial view (top-right), an anterior view (bottom-left), and a posterior view (bottom-right). A white pointer is used to select points on the lateral femoral condyle, which are highlighted in green and red. The interface includes a vertical sidebar on the left with the text 'C.I. Knee' and 'PIEROT B - 241624', and the DePuy logo at the bottom. A central panel titled 'Lateral Femoral Condyle' contains instructions: 'Remove osteophytes. Acquire multiple points on lateral femoral condyle, including points located posteriorly, by scratching pointer over bone surface in region shown. Start by pivoting.' Below the text is a blue progress bar. At the bottom, there are three buttons: 'Try Again', 'Back', and 'Next'. A vertical toolbar on the right side contains various icons for navigation and tool manipulation.

C.I. Knee

PIEROT B - 241624

DePuy

### Lateral Femoral Condyle

Remove osteophytes.  
Acquire multiple points on lateral femoral condyle, including points located posteriorly, by scratching pointer over bone surface in region shown.

Start by pivoting.

Try Again Back Next

# Points picking

CI Knee

PIEROT B - 241624

DePuy

M

L A

P

S

S

S

Femoral Anterior Cortex

Acquire multiple points on anterior femoral cortex by scratching pointer over bone surface in region shown.

Start by pivoting.

Try Again Back Next

# Tibial Planning

*Genu valgum*

CI Knee

PIEROT B - 241624

DePuy

Frontal View

Lateral View

Axial View

M L A P

M L

P

Tibial Implant Planning

Posterior Slope	7.0°
Varus	0.0°
Resection High	8.0mm
Resection Low	8.0mm
Internal Rotation	0.0°
Lateral Shift	2.8mm
Posterior Shift	0.1mm

Implant Size

3

Free size

Reset Back Next

Navigation icons: Home, Info, Search, Rotate, Zoom, etc.

# Tibial cut navigation / Check



Frontal View

Planned Verified

M L

Ci Knee

Lateral View

Planned Verified

M L

Oblique View

Planned Verified

M L

PIEROT B - 241624

DePuy

### Tibia Resection Data

Press "Next" to proceed with updated values.  
Press "Back" to repeat verification.

	Actual	Planned	Deviation
Varus	0.0°	0.0°	0.0°
Posterior Slope	7.7°	7.0°	0.7°
Resection	7.7mm	8.0mm	0.3mm

Back Next



# *Ligament balancing*



*1° Extension*



*2° Flexion*



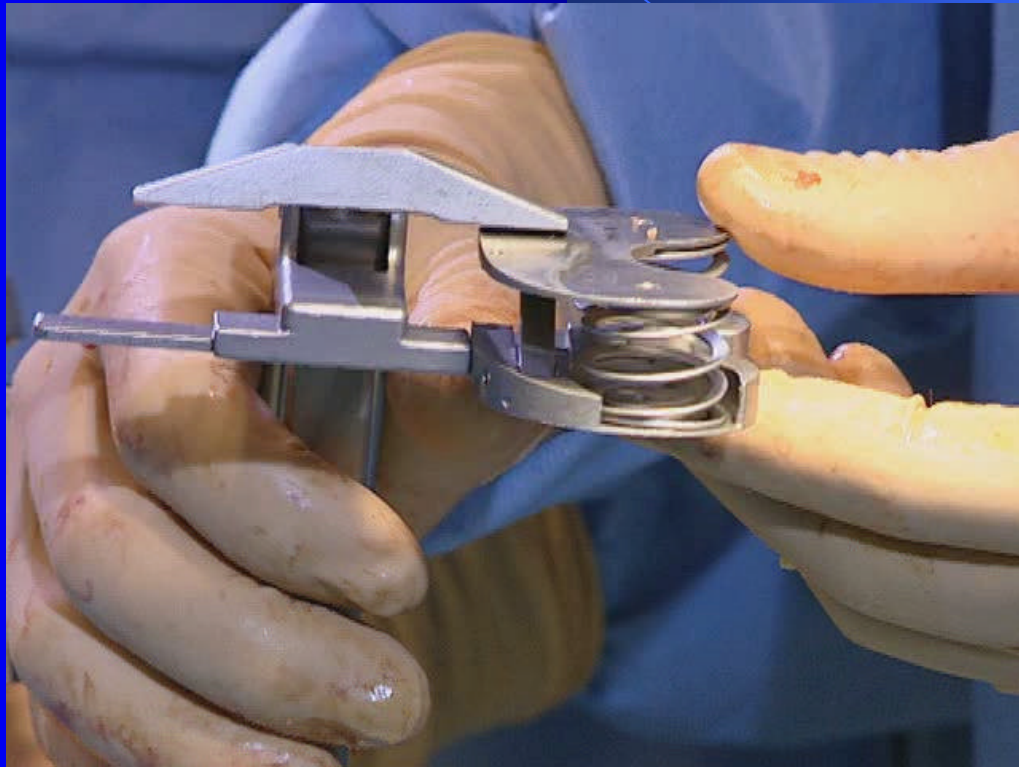
# LCS TKR Navigation & Soft tissues balancing

## DEVICES

-springs tensors “sensor tensor”



# CAS Ligament Tensor

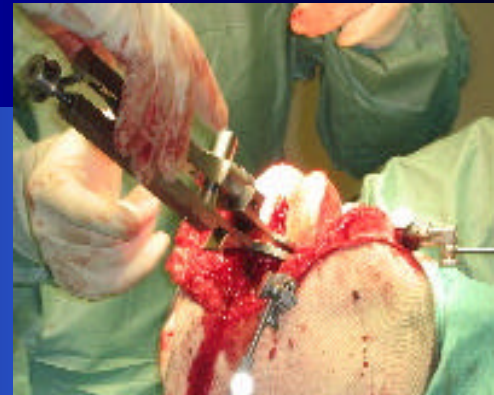
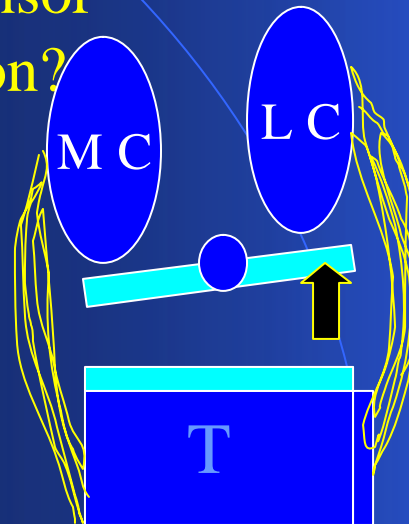


# LCS TKR Navigation & Soft tissues balancing

## DEVICES

- springs tensors “sensor tensor”
- fixed tensor
- dynamometric tensor

? Tension?



At same time:

- External Rotation
- Gap stored

# LCS TKR Navigation & Soft tissues balancing

## DEVICES

- springs tensors “sensor tensor”
- fixed tensor
- dynamometric tensor  
? Tension ?
- quarter blocks



Separately:

- External Rotation
- Gap stored

# LCS TKR Navigation & Soft tissues balancing

## DEVICES

- springs tensors “sensor tensor”
- fixed tensor
- dynamometric tensor
- ? Tension ?
- quarter blocks



# LCS TKR Navigation & Soft tissues balancing

## DEVICES

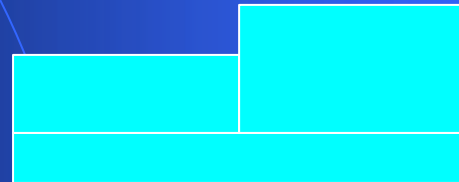
- springs tensors “sensor tensor”
- fixed tensor
- dynamometric tensor
  - ? Tension ?
- quarter blocks
- tunable blocks?



# LCS TKR Navigation & Soft tissues balancing

## DEVICES

- springs tensors “sensor tensor”
- fixed tensor
- dynamometric tensor
  - ? Tension ?
- quarter blocks
- tunable blocks?





# Femoral Planning

*PE Thickness*

*Gap optimisation*

The screenshot displays a software interface for femoral implant planning. It features three main views: two lateral views at the top and one frontal view at the bottom left. The femoral implant is shown in red, and the tibial component is in blue. A yellow horizontal line indicates the PE thickness. The control panel on the right lists the following parameters:

Femoral Implant Planning	
Flexion	45°
Resection Level	12.3mm
Anterior Shift	0.0mm
Insert Thickness	10MM
Joint line in Ext	0.0mm (Prox)
Joint line in Flex	0.5mm (Ant)
Extension Gap	19.1mm
Flexion Gap	19.1mm

The control panel also includes an 'Implant Size' section with a 'standard' button and a 'FreeSize' button with minus and plus signs. At the bottom of the control panel are 'Reset', 'Back', and 'Next' buttons. The software is identified as 'DePuy' and 'PIEROT B - 241624 Ci Knee'.

# External rotation



CI Knee

PIEROT B - 241624

DefPuy

Frontal View

Axial View

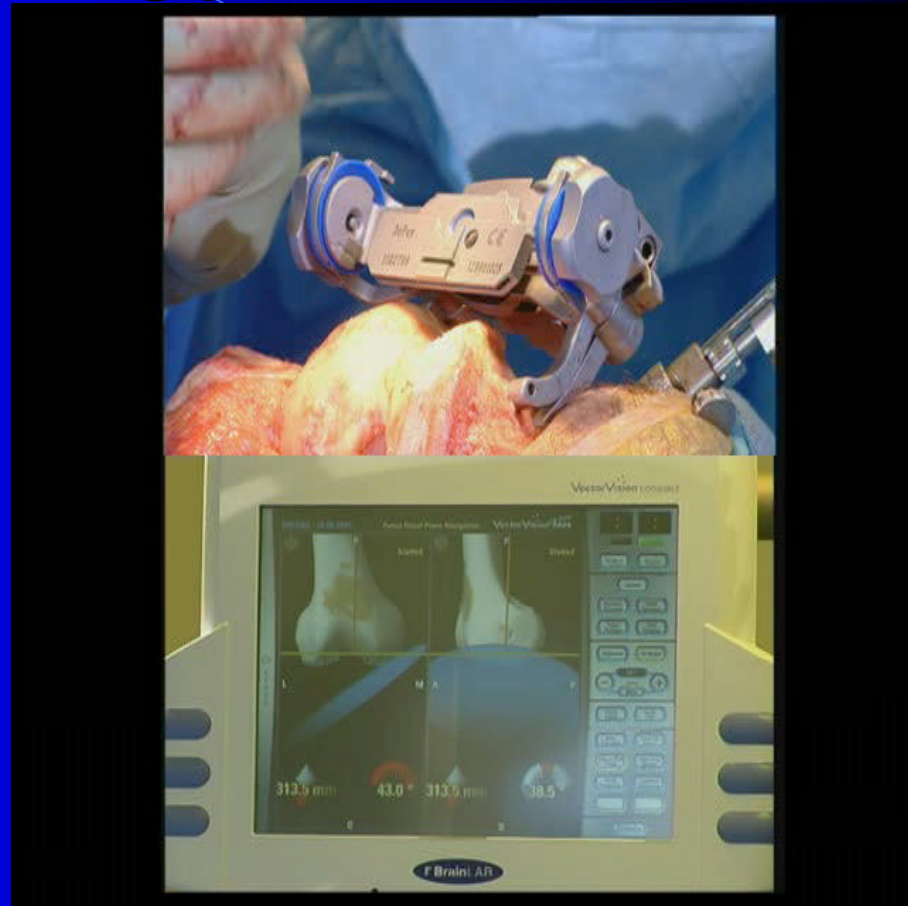
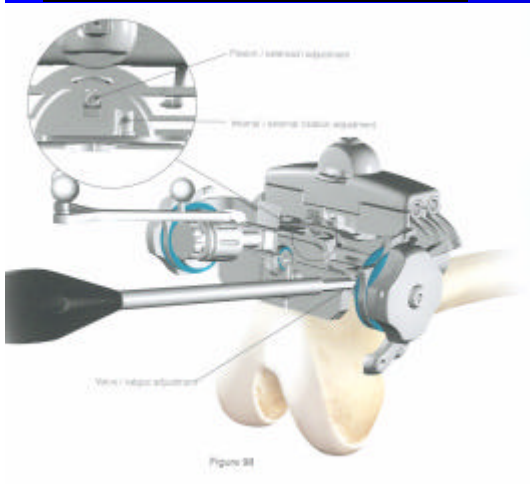
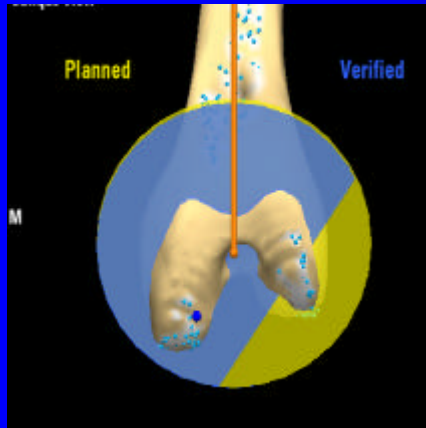
Epi: 0.4° WS: -2.7° Post: 9.0°

Femoral Implant Planning

Medial Shift	0.0mm
Varus	0.0°
Internal Rotation	0.0°
Implant Size	standard+

Reset Back Next

# Distal navigation / fine tuning / Cut



# Distal cut check

Frontal View

Planned Verified

M L

Lateral View

Planned Verified

M L

Oblique View

Planned Verified

M L

DePuy

CI Knee

PIEROT B - 241024

Distal Resection Data

Press "Next" to proceed with updated values.  
Press "Back" to repeat verification.

	Actual	Planned	Deviation
Valgus	0.6°	0.0°	0.6°
Flexion	4.9°	4.5°	0.4°
Resection	11.4mm	12.3mm	0.9mm

Back Next

# Ant cut check



CI Knee  
PIEROT B - 241024  
DePuy

**Axial View** A

Planned Verified

**Lateral View** A

Planned Verified

**Oblique View** S

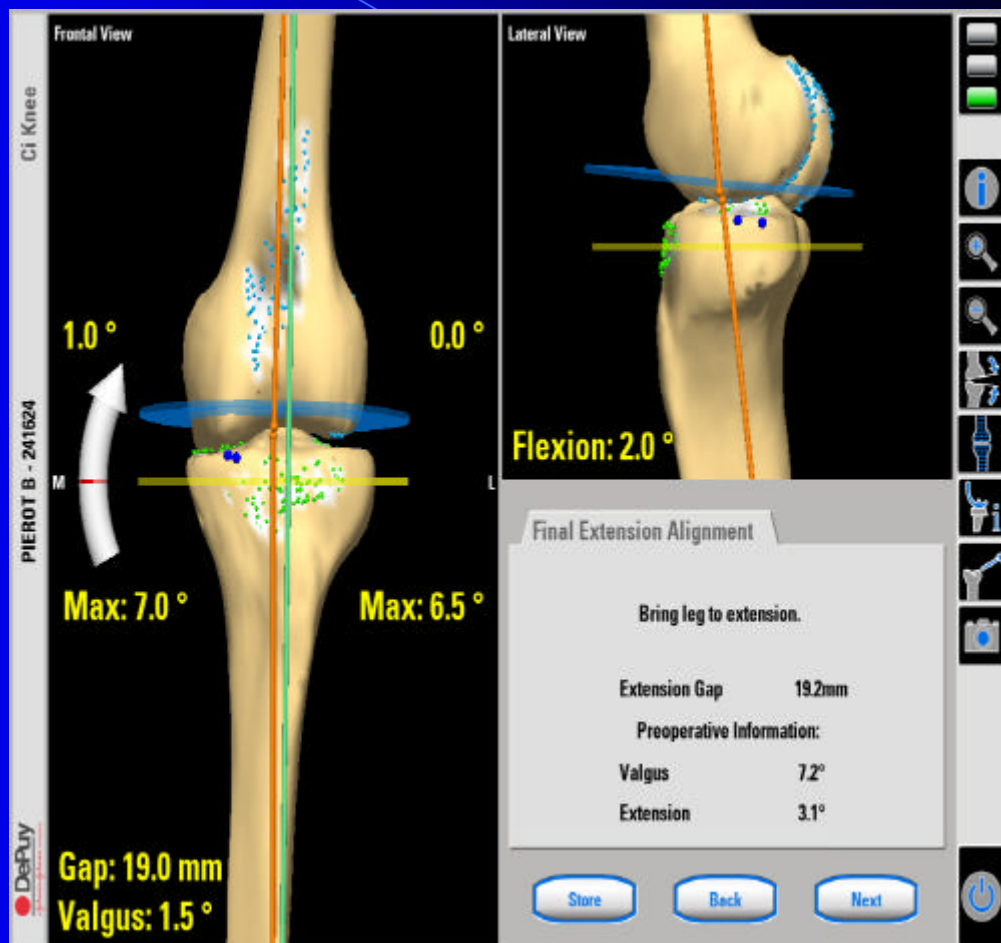
Planned Verified

**A/P Resection Data**

Press "Next" to proceed with updated values.  
Press "Back" to repeat verification.

	Actual	Planned	Deviation
Internal Rotation	0.0°	0.0°	0.0°
Anterior Shift	1.0mm	0.0mm	1.0mm

# Final Alignment



## **The potential advantages of computer assisted surgery (CAS) are:**

- 1.increase in accuracy**
- 2.More information...flexible surgical decisions**
- 3.less invasive operations (no intra-medullary instruments)**
- 4.step by step verification of surgical procedures**
- 5.reproducible and comparable results**
- 6.Surgical tool teaching**
- 7.reduction of “tourniquet time”...after learning curve!**
- 8.reduces Xray CT Free!!**
- 9.surgeon decision NO ROBOTIC!**

# Benefits for LCS Users

- Better and more sophisticated soft tissue ligament balancing due to the sensor-tensor
- More accurate bone cuts due to elimination of stack up of errors
- Less invasive due to elimination of IM rods
- Increased accuracy due to execution of a well established plan based on acquired landmarks





C'est le chirurgien  
qui décide et non la  
machine....

# Rôles de l'infirmier(e) en salle (au CHBAH)

- Préparation et vérification du matériel la veille.



## Avant l'arrivée du patient

- l'infirmière circulante branche la navigation et lance la procédure.

# préparation de la navigation

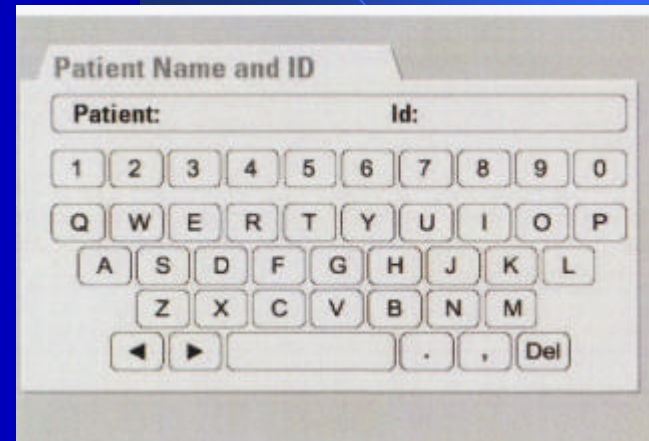
## Connexion du système

- Câble d'alimentation.
- Vérifier que le voltage soit sur 220 volts avant de brancher le système.
- Prise de terre qui est jaune.
- Câble de l'unité de caméra qui est orange.
- **!!! La caméra doit être branchée 20 min avant de lancer toute procédure !!!**



# lancement de la procédure

- Allume la navigation.
- Attend deux bips sonore.
- Encode les données.
- La suite de la procédure est faite avec le chirurgien et le délégué .



# installation du patient



- DD.
- Bras en croix.
- Garrot pneumatique.
- Cale genou électrique jambe opérée.
- Dépend du chirurgien.

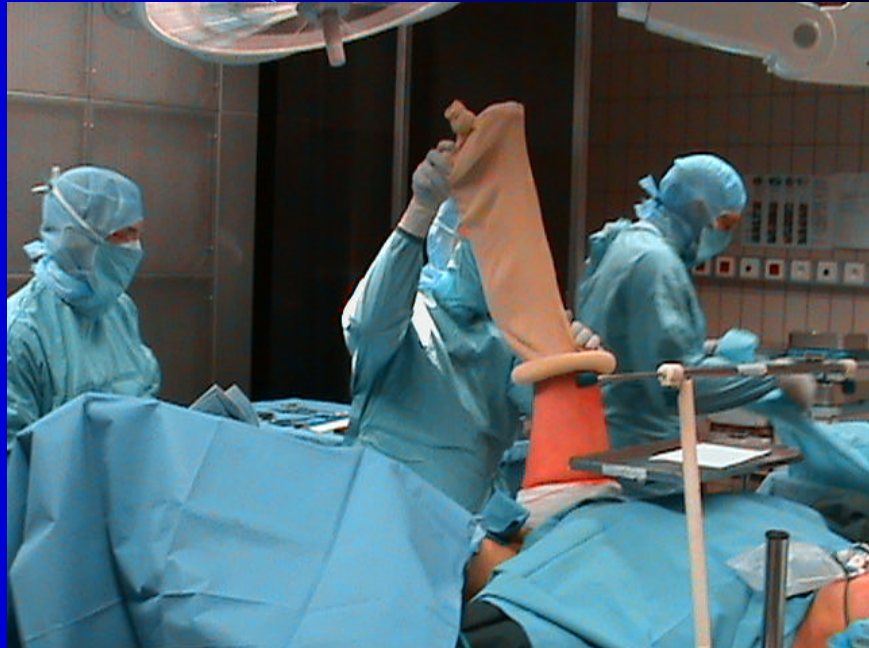


# Préparation site opératoire.



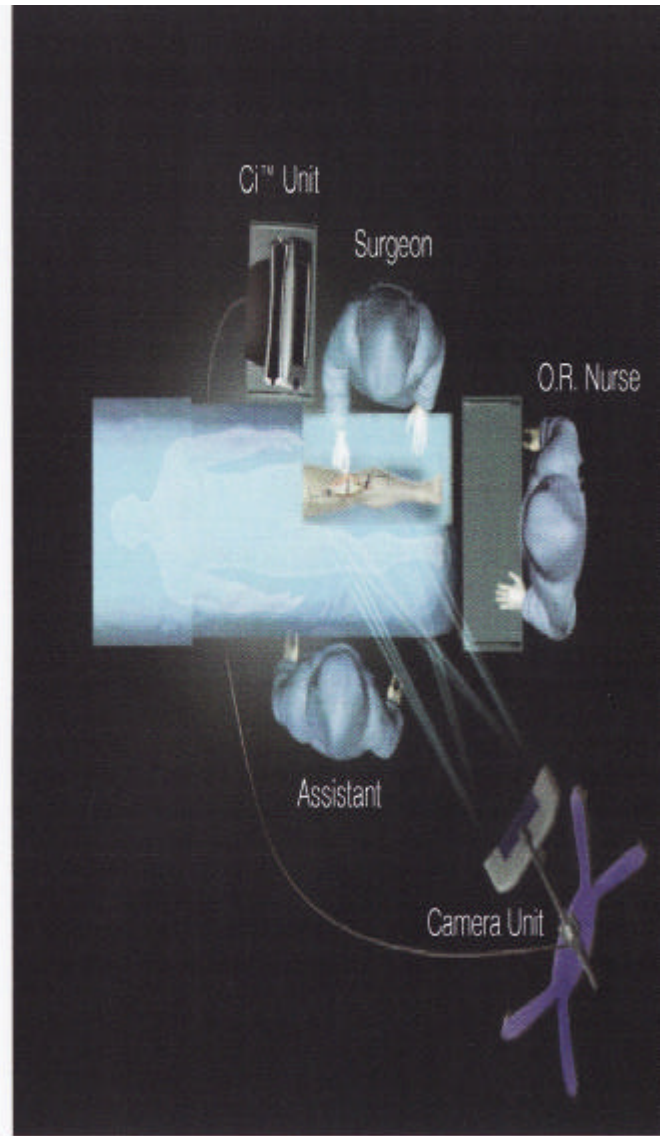
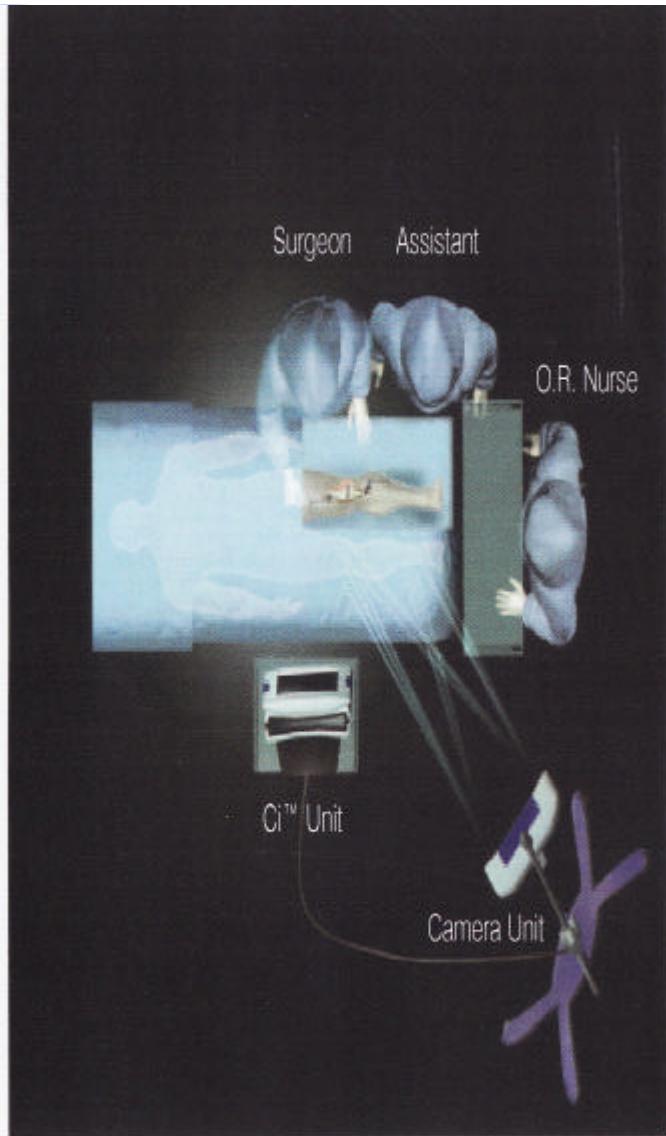


- drapage.



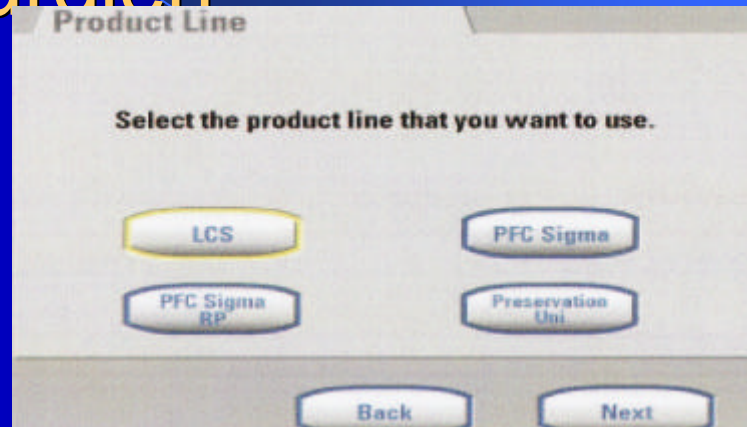
# disposition du matériel

- Chirurgien → une bonne vue sur l'écran.
- Caméra infrarouge a une vue ininterrompue des *marqueurs* tibiaux ou fémoraux.
- caméra → 1.5 – 2 mètres du site opératoire.
- Autres matériels coté non opéré.

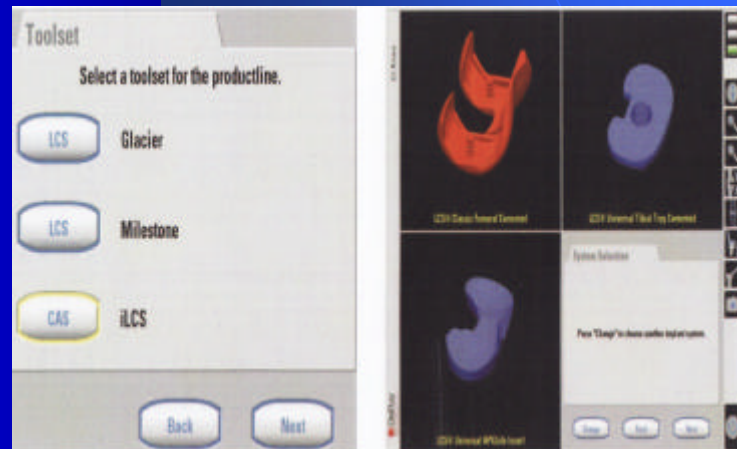


# Suite de la procédure pour le chirurgical

- Ligne de produit (LCS, PFC sigma, .....).



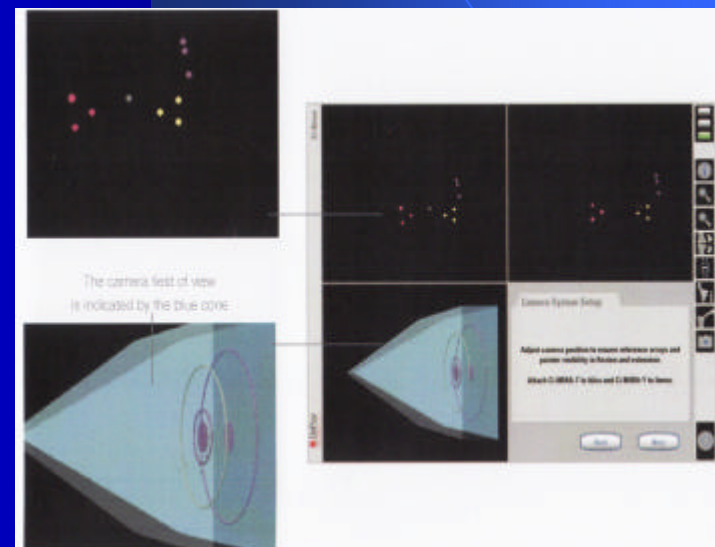
- Choix des instruments et la ligne de produit.



- Choix du genou droit ou gauche.



- Alignement de la caméra.
- A cette étape, la procédure est lancée et la navigation peut commencer.



**Durant l'intervention: IC  
reste a proximité de l'écran .**



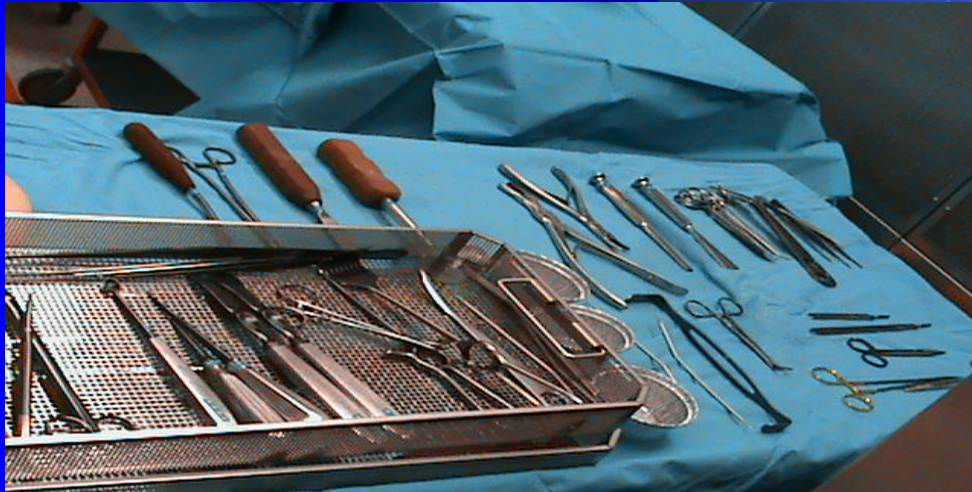
il existe des housses stériles que l'on peut mettre sur l'écran pour que l'équipe chirurgicale puisse le faire elle-même. Tout dépend de l'habitude du service.

# l'instrumentation

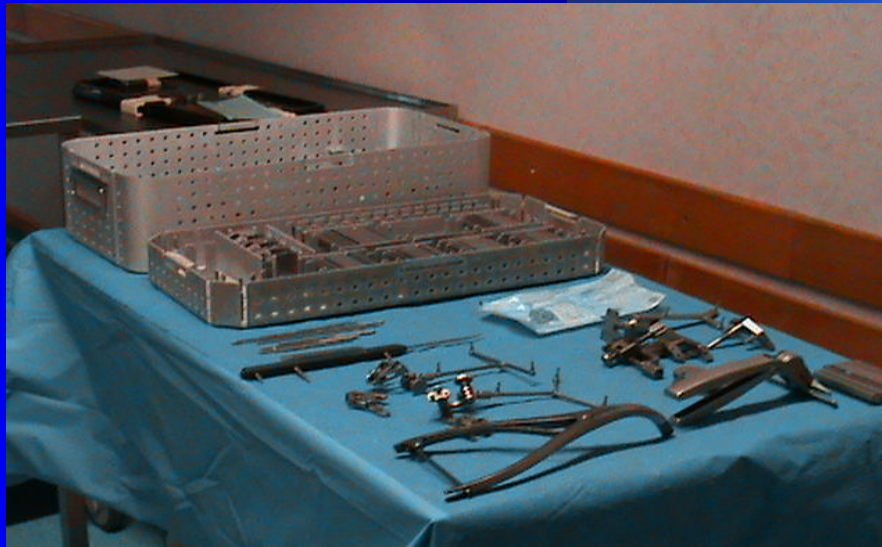




- Durant l'intervention, la gestion du matériel standart est réalisé par l'instrumentiste.



- Le matériel spécifique à la navigation est géré par le délégué et l'instrumentiste.

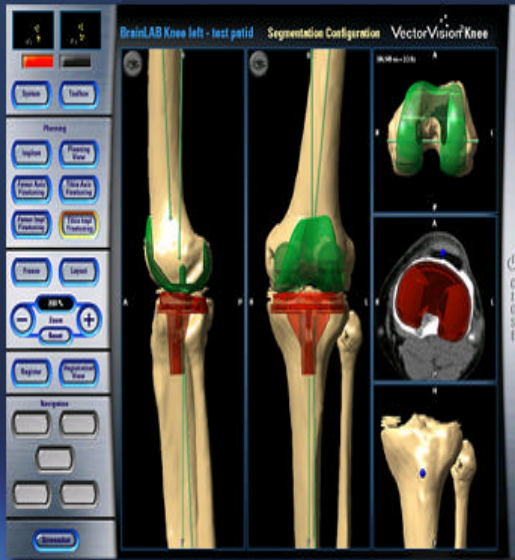


# conclusion

- La navigation est une technique opératoire qui permet de réaliser des actes avec une grande précision en guidant et en donnant une visualisation 3D au le chirurgien.
- C'est néanmoins une technique peut fréquemment utilisée et pour des indications chirurgicales bien précise.

# Remerciement à:

- Au DDI du CHBAH qui m'a autorisé à faire mon tfe dans son établissement.
- K. VERMEALEN; chef infirmière au bloc d'orthopédie du CHBAH, qui m'a aidé dans la réalisation de mon travail.
- P. LONCHAY; délégué de la firme DEPUY qui ma apporté des explications.
- Dr JP DELCOUR et H. CHARLIER, chirurgien orthopédiste au CHBAH, pour l'aide apporté pour la réalisation du travail.
- Toute l'équipe du bloc d'orthopédie du CHBAH.



**QUESTIONS?**



MERCI DE VOTRE  
ATTENTION