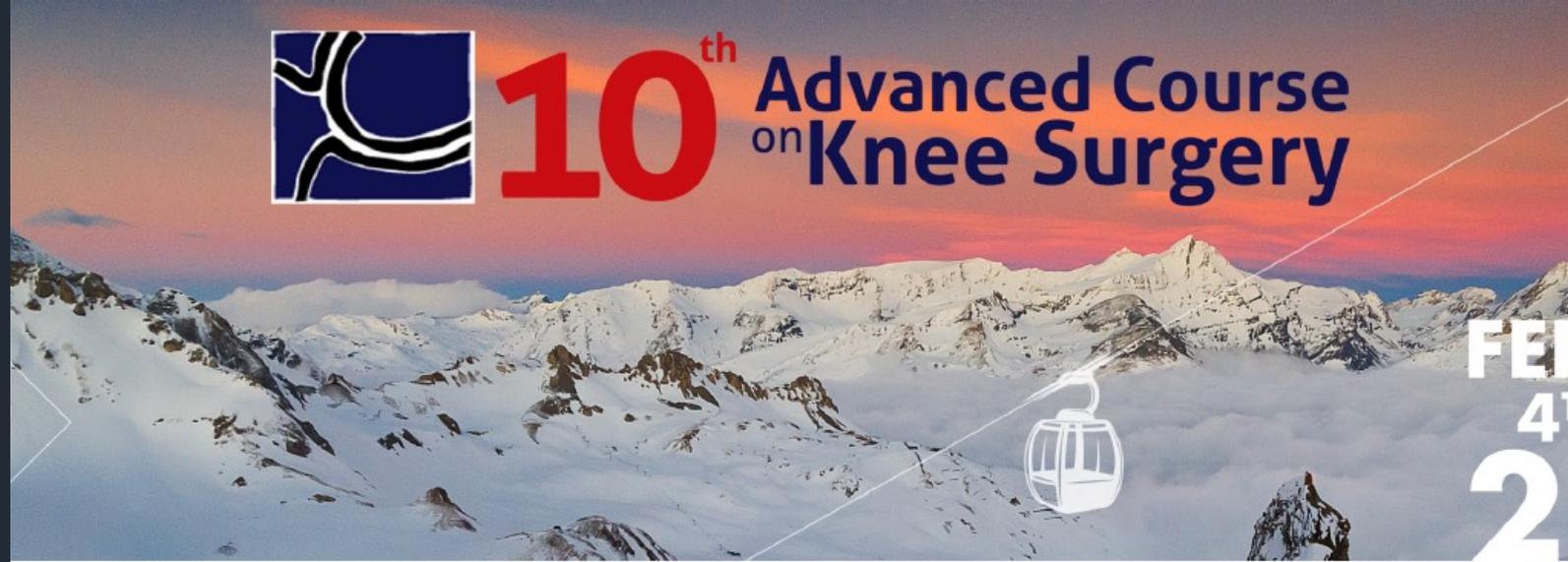


LATERAL UNI SURGICAL TECHNIC:

NAVIGATION



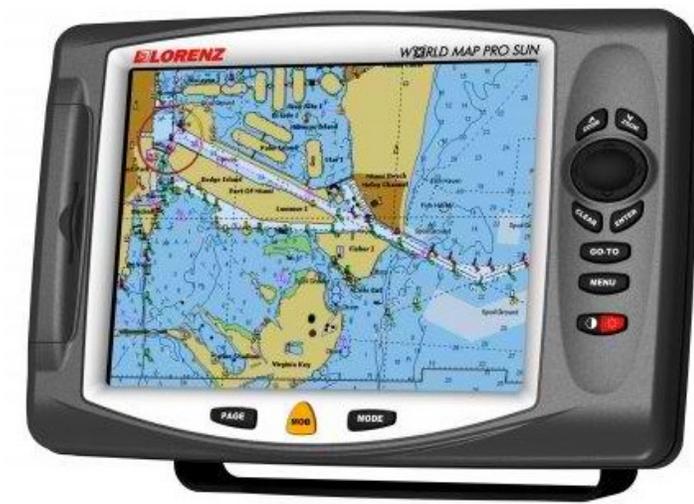
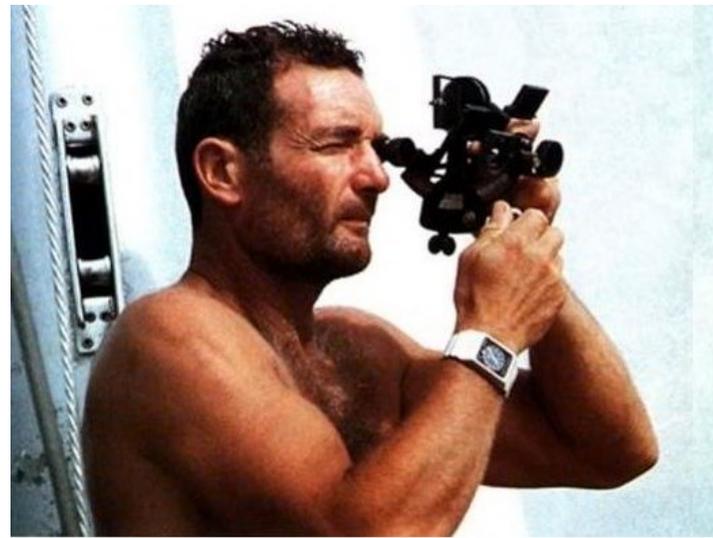
**10<sup>th</sup>** Advanced Course  
on **Knee Surgery**



FEB  
4  
2

F-X GUNEPIN





Had Eric Tabarly been better with computer assistance?

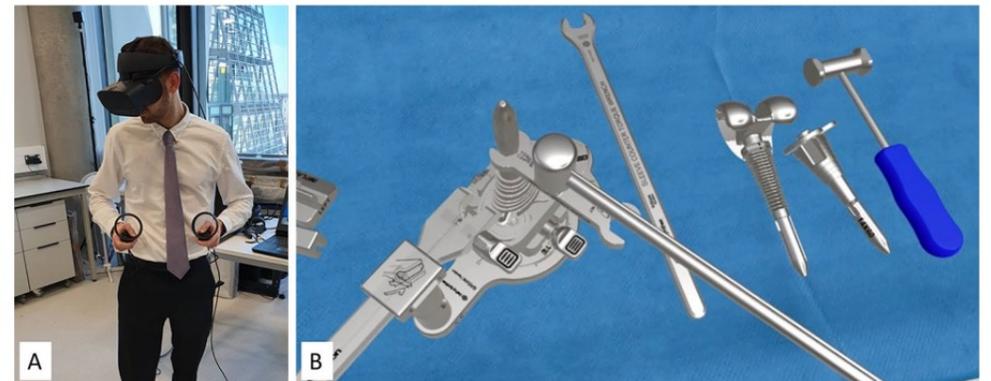
Am I a better surgeon with navigation?

# WHAT NAVIGATION?

- Passive, semi-active and active
- Depending on the level of information exchanged between the computer and the surgeon
- Anatomical, **functional** or mixed:
- Depending on the parameters used
- The future
  - Simulation:
  - Virtual surgery
  - Mobility sectors
  - Wear and tear

**Immersive virtual reality enables technical skill acquisition for scrub nurses in complex revision total knee arthroplasty**

Thomas C. Edwards<sup>1,2</sup> · Arjun Patel<sup>1,2</sup> · Bartosz Szyszka<sup>1</sup> · Alexander W. Coombs<sup>1</sup> · Alexander D. Liddle<sup>1</sup> · Rakesh Kucheria<sup>2</sup> · Justin P. Cobb<sup>1</sup> · Kartik Logishetty<sup>1,2</sup>



# THE PRECISION INCREASES WITH THE QUALITY OF THE BONE/COMPUTER REGISTRATION

- Basic:
  - Using visible rigid bodies
  - Quantify the position of one relative to the other
- Intermediate:
  - Statistical deformable model whose precision increases with the number of points palpated → Bone morphing
- High:
  - Integration of pre-operative images (CT or MRI) intra-operative registration by palpation of landmarks:
  - Specific (pre-operative marking)

# A CRUCIAL ELEMENT: THE SIGNAL

- Specifications:
  - Eliminate parasites and interference
    - Electric scalpel
    - Anesthetic monitoring
    - Avoid cable
- Today passive
  - Optical → visible single-use bodies
- Tomorrow active
  - Bluetooth
  - other
  - No random mobility
  - Bone anchor
- Others...



# WHAT NAVIGATION FOR WHAT TO DO?

- **Passive**

- You choose everything, the system informs you of your position ( $\approx$  G.P.S)

- **Semi Active**

- The system help you go wherever you want ( $\approx$  G.P.S with route calculation)

- **Active**

- The system can perform gestures = robotic surgery



# TODAY

- Column with infrared sensors fixed in the bone
- Without imaging → bone morphing
- Simulation:
  - Axes, ligament tension, range of motion



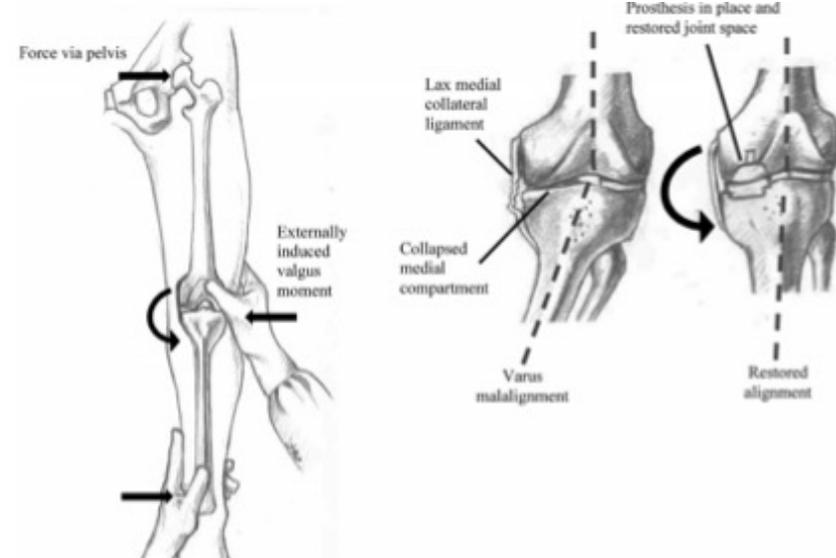
# PRE-OPERATIVE ASSESSMENT++

- Clinical assessment
  - Mobility, stability, reducibility
- Imaging:
  - Pangenometry
  - Knees facing and profile supported
  - Schuss
  - Stress clichés
  - ➔ Slope measurement++



# “FUNCTIONAL” TARGET

- Compensate for cartilage loss
- Retensioning of the lateral ligament plane



*A.L. Grant et al. / The Journal of Arthroplasty*

# INSTALLATION



[Eur J Orthop Surg Traumatol. 2018 Jul;28\(5\):793-797. doi: 10.1007/s00590-017-2107-5. Epub 2017 Dec 26.](#)

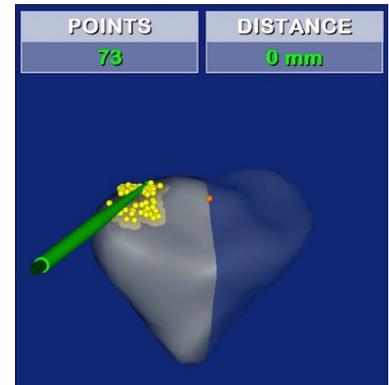
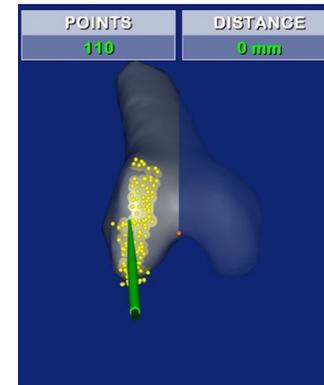
**Minimally invasive unicompartmental knee arthroplasty.**

Jenny JY<sup>1</sup>.

- PUC naviguée et voie d'abord réduite (6 cm)

# FIRST STEP

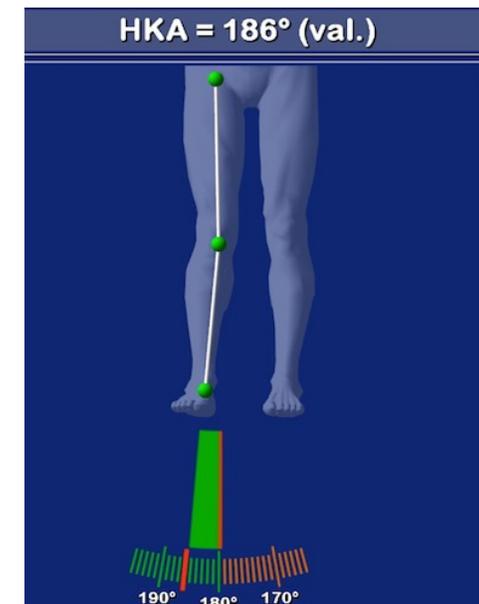
|                   |  |  |
|-------------------|--|--|
| CHIRURGIEN        | dr gunepin                             |  |
| PATIENT           | Nom                                    | Prénom <b>brigitte_</b>                |
| DATE DE NAISSANCE | 4                                      | Année (AAAA) 1952                      |
| COTE OPERE        | <input type="button" value="GAUCHE"/>  | <input type="button" value="DROIT"/>   |
| COMPARTIMENT      | <input type="button" value="INTERNE"/> | <input type="button" value="EXTERNE"/> |



Acquisition of sensor positions

Bone Morphing

Acquisition of axes



# SECOND STEP: SELECT THE TARGET



# THIRD STEP → DO WHAT WE PLANE

Removal of osteophytes

Release of soft tissues

Complete the roadmap

The screenshot displays a 3D model of a knee joint with a blue roadmap overlay. The interface includes several data fields and control elements:

- HKA: 182° (val.)** (highlighted in green)
- 5 mm** and **7 mm** (highlighted in green)
- LAXITE** box: Extension: 1 mm, Flexion: 3 mm
- FEMUR** table:

|               |          |
|---------------|----------|
| TAILLE        | 4        |
| CARROSSAGE    | 0°       |
| FLEX./RECURV. | 0°       |
| MED. / LAT.   | 0 mm     |
| DISTALE       | 6 + 0 mm |
- TIBIA** table:

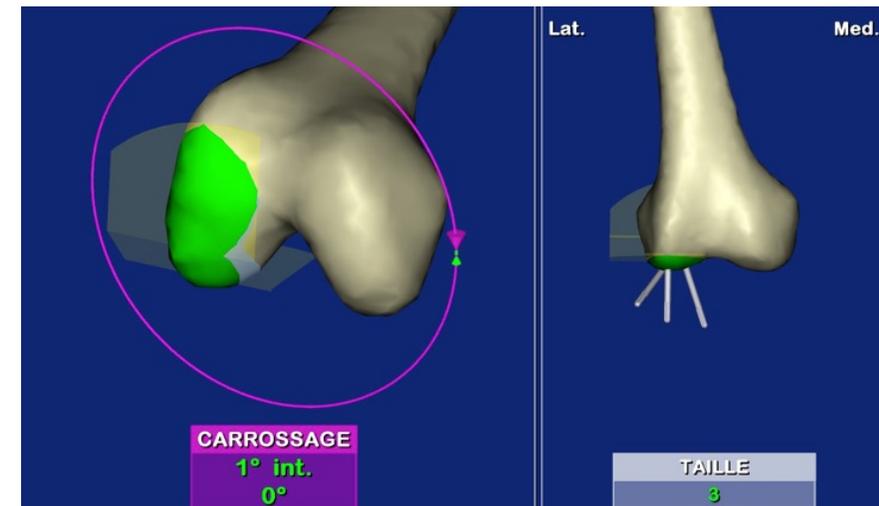
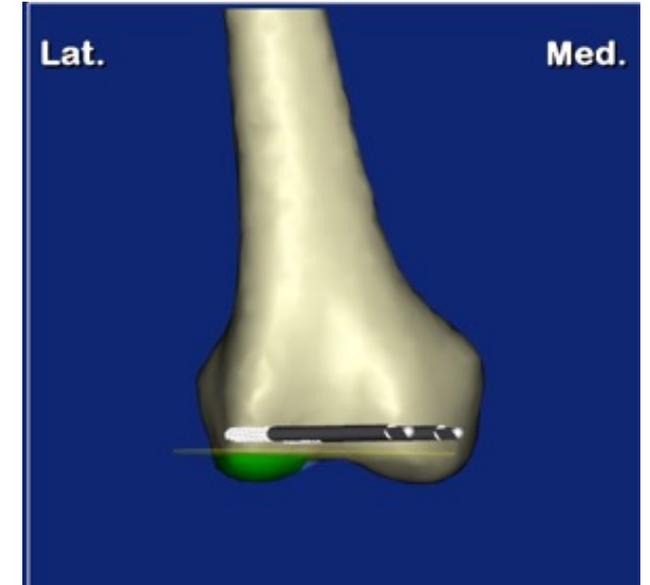
|             |      |
|-------------|------|
| TAILLE      | 1    |
| ROTATION    | 7°   |
| PENTE Post. | 6°   |
| ANT./POST.  | 0 mm |
| MED. / LAT. | 0 mm |
- HAUTEUR 8 - 1 mm** (highlighted in green)
- INSERT 9 mm** (highlighted in green)
- Control buttons: -, Refresh, +

# FOURTH STEP: BONE CUTTING

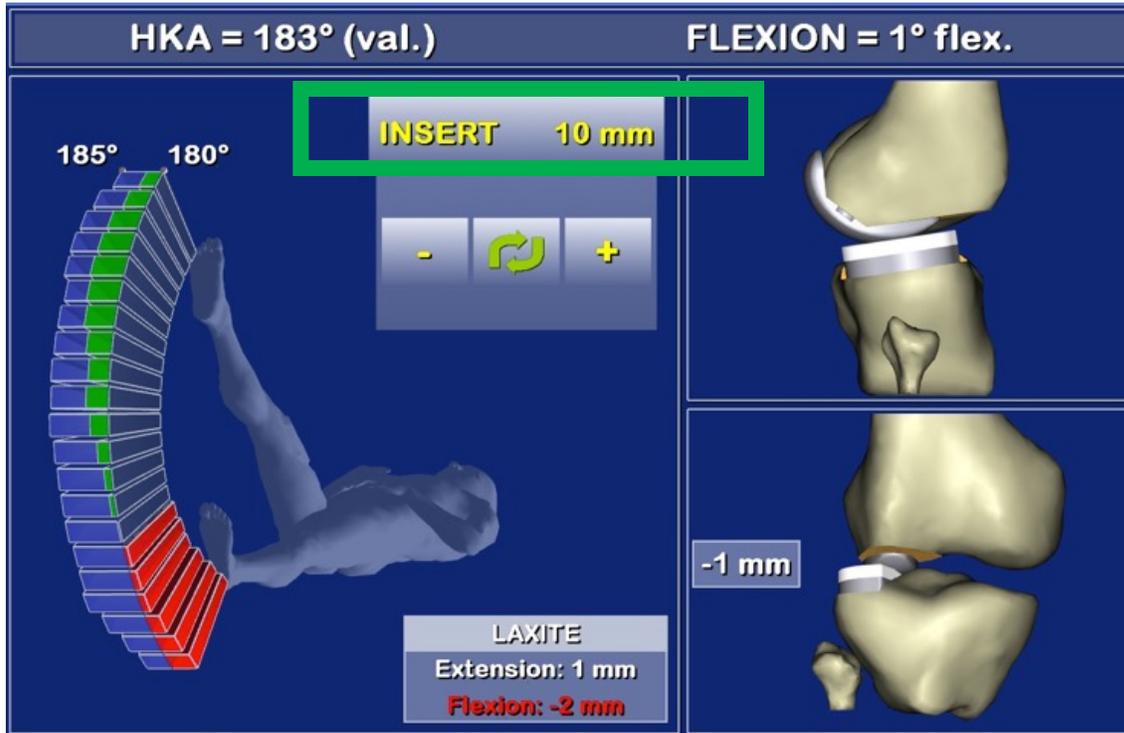
- For the Tibia
  - According to planning
  - Height measurement and flexion-extension tests with the 9 mm thick trial implant
  - Space control
    - By navigation
    - And dynamic observation
- Skate stable in flexion to validate the slope

# FEMUR

- Distal cut in extension
  - Tibial reference
  - And navigation control
- Flexural camber
  - ➔ This is the delicate moment...
  - ➔ Navigation control+++



# TRIES



➔ then choice of definitive implants

Surgeon is guided at each step and validates what he has done



J Arthroplasty. 2017 May;32(5):1443-1452. doi: 10.1016/j.arth.2016.11.036. Epub 2016 Nov 29.

## **Determination of the Accuracy of Navigated Kinematic Unicompartmental Knee Arthroplasty: A 2-Year Follow-Up.**

Grant AL<sup>1</sup>, Doma KD<sup>2</sup>, Hazratwala K<sup>2</sup>.

Greater precision in installation  
No significant difference otherwise

J Knee Surg. 2019 Nov 4. doi: 10.1055/s-0039-1700494. [Epub ahead of print]

## **Computer-Navigated versus Conventional Total Knee Arthroplasty: A Meta-Analysis of Functional Outcomes from Level I and II Randomized Controlled Trials.**

Chin BZ<sup>1</sup>, Seck VMH<sup>1</sup>, Syn NL<sup>1</sup>, Wee IJY<sup>1</sup>, Tan SSH<sup>1</sup>, O'Neill GK<sup>1</sup>.

The present meta-analysis suggests **limited superiority of navigated TKA** over its conventional counterpart, in terms improvement in functional outcomes at long-term follow-up

# CONCLUSION

- Navigation does not replace a complete clinical and paraclinical assessment
- Allows you to clarify surgical sensations

- Better surgeon ?

But improves the precision of implant placement

→ Do not add the use of complex ancillaries to a delicate surgery  
so if you choose navigation  
use it in your daily practice

