

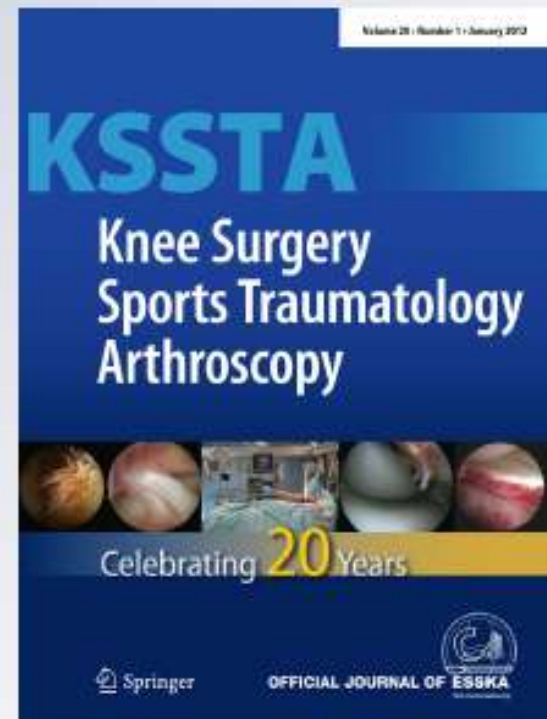
CT measurements prior to computer-assisted total knee arthroplasty do not improve rotational placement of the femoral component

A. de Ladoucette

**Knee Surgery, Sports Traumatology,
Arthroscopy**

ISSN 0942-2056

Knee Surg Sports Traumatol Arthrosc
DOI 10.1007/s00167-012-1909-6





CAS AND TDM ASSISTANCES FOR TKA

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Toulouse

ROTATION AND CAS

- ◆ WHAT DO WE KNOW?

ROTATION AND CAS

- ◆ WHAT RESULTS DO WE EXPECT?

ROTATION AND CAS

- ◆ WHAT RESULTS DO WE GET?

ROTATION AND CAS

- ◆ DISCUSSION



2 cl

1. WHAT DO WE KNOW?

FRONTAL ALIGNMENT
SAGITTAL ALIGNMENT

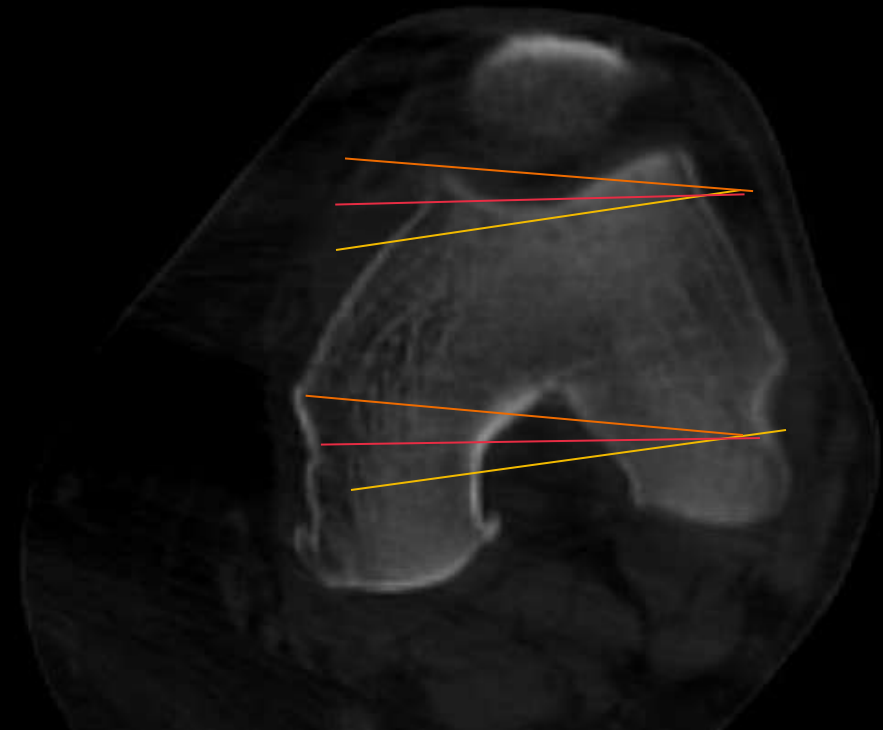
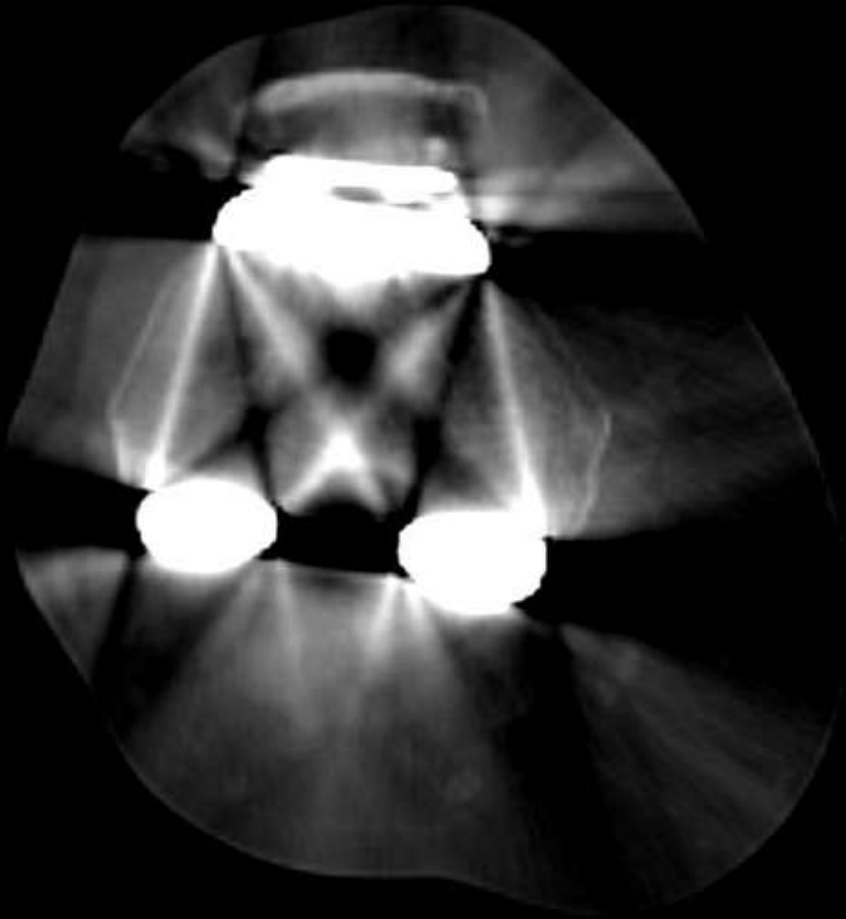


WHAT DO WE KNOW?

TRANSVERSAL PLAN



WHAT DO WE KNOW ? TRANSVERSAL PLANE



WHAT DO WE KNOW

- ◆ FEMORAL COMPONENT
 - ◆ patellar engagement
 - ◆ anterior pain
 - ◆ Laxity in flexion
 - ◆ Wear ?

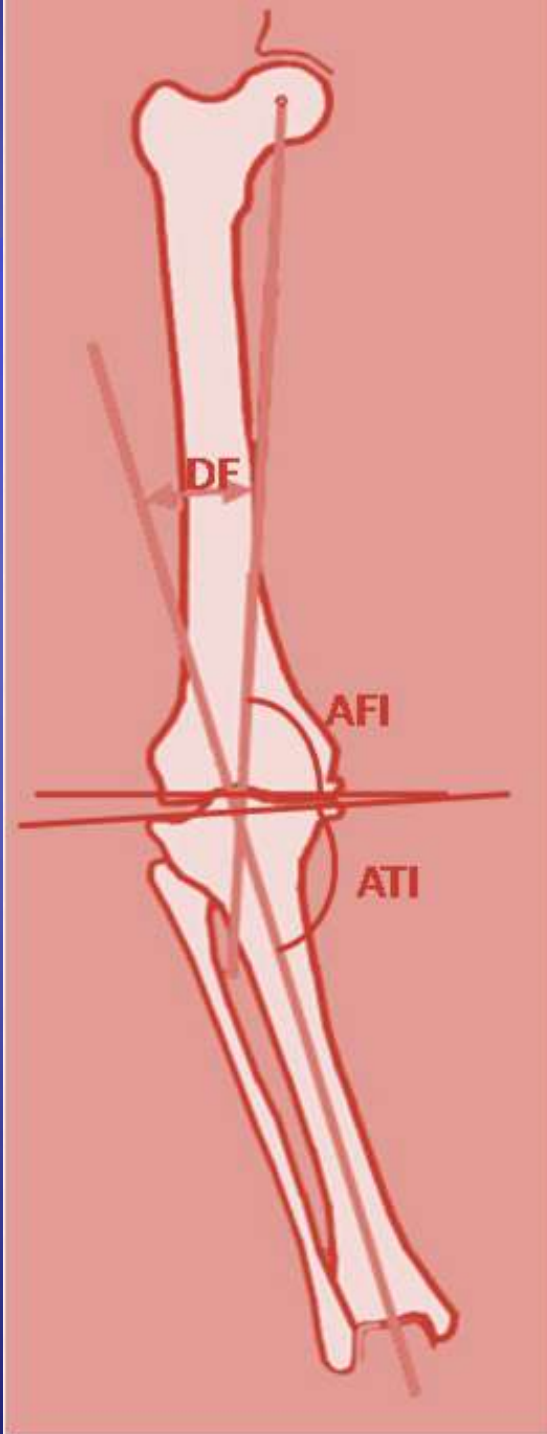
WHAT DO WE KNOW ?

- ◆ TIBIAL COMPONENT
- ◆ CAS CT BASED

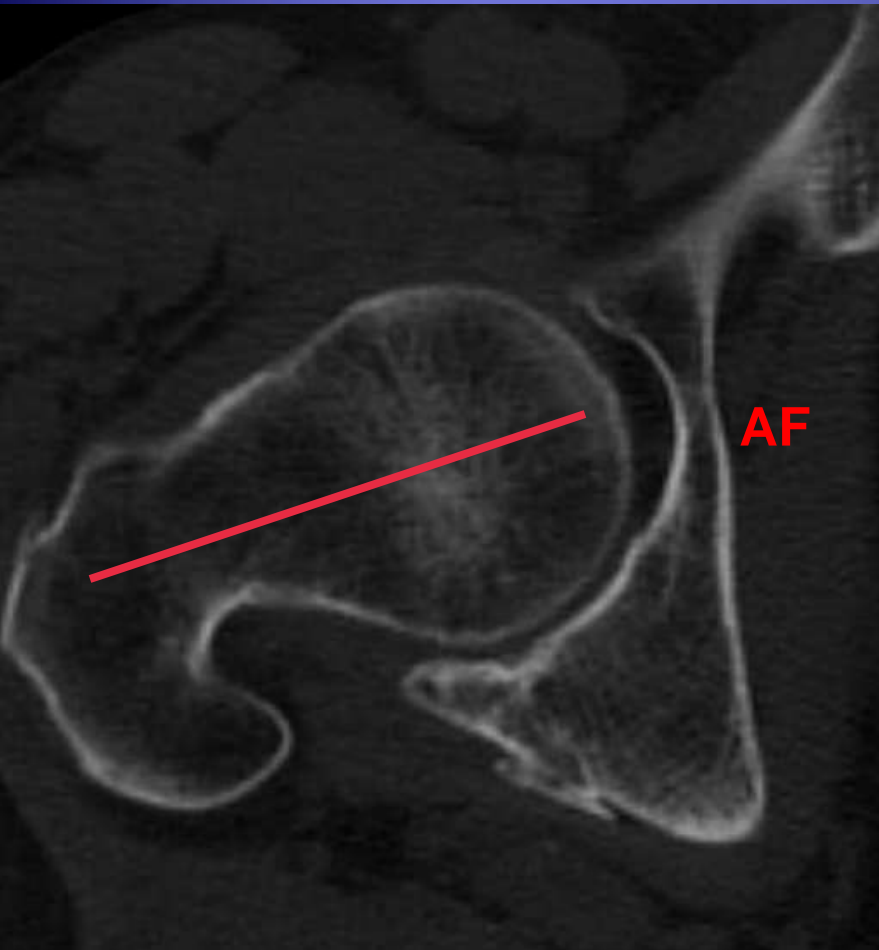
WHAT DO WE KNOW?

- ◆ RADIOLOGY
- ◆ TOMODENSITOMETRY (TDM, CT SCAN)
- ◆ COMPUTER ASSISTED SURGERY (CAS)

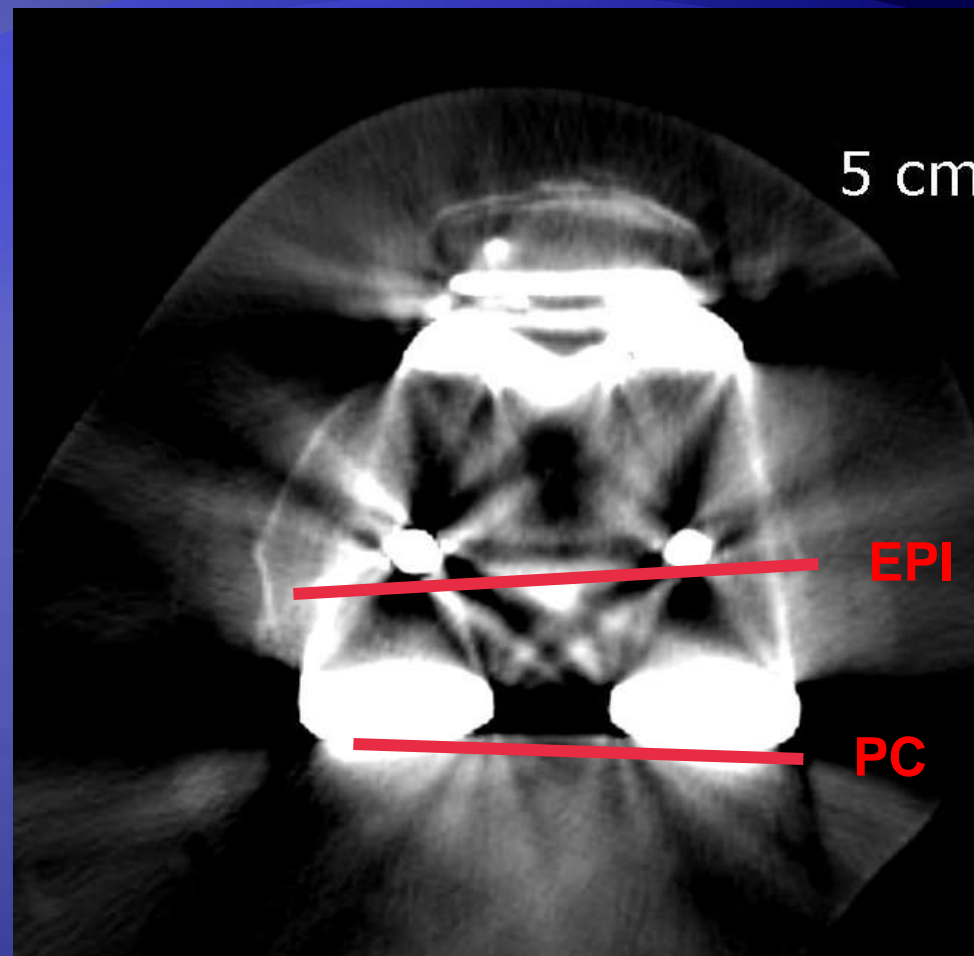
GONIOMETRY



CT SCAN

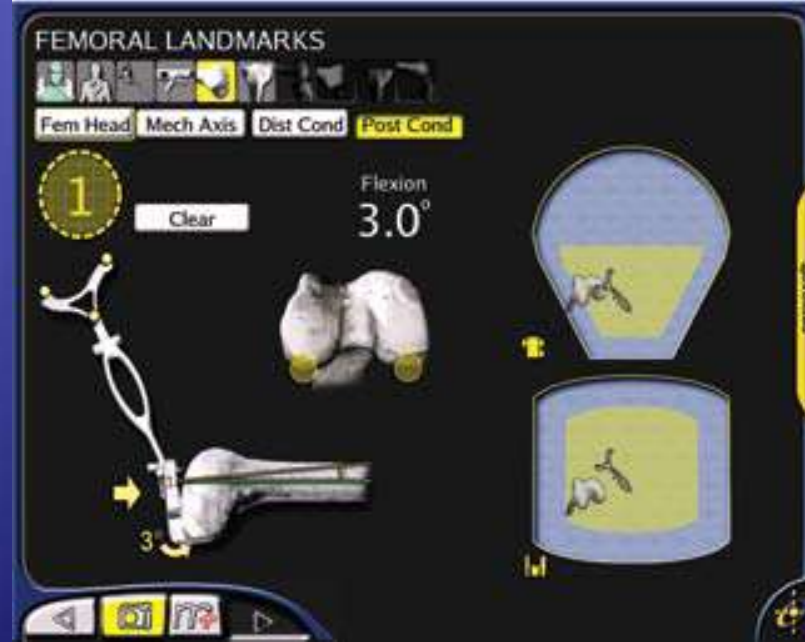
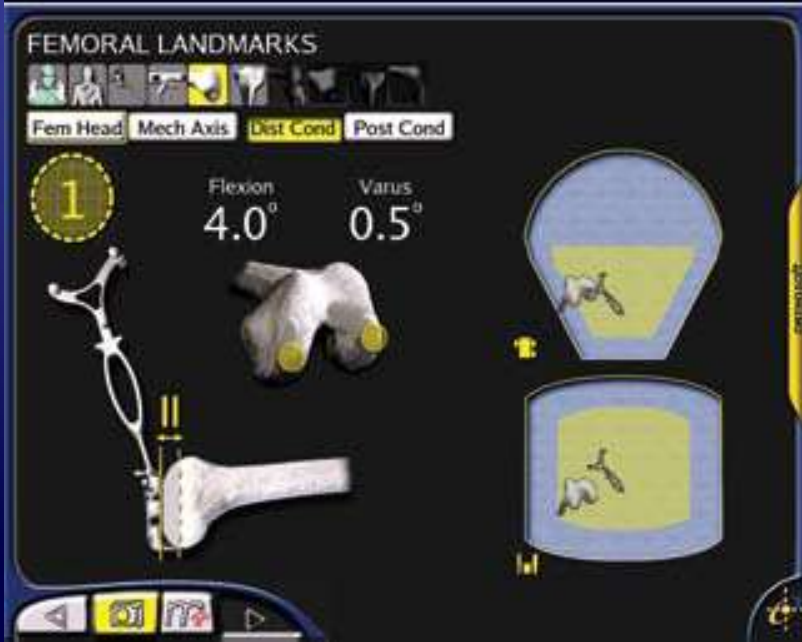
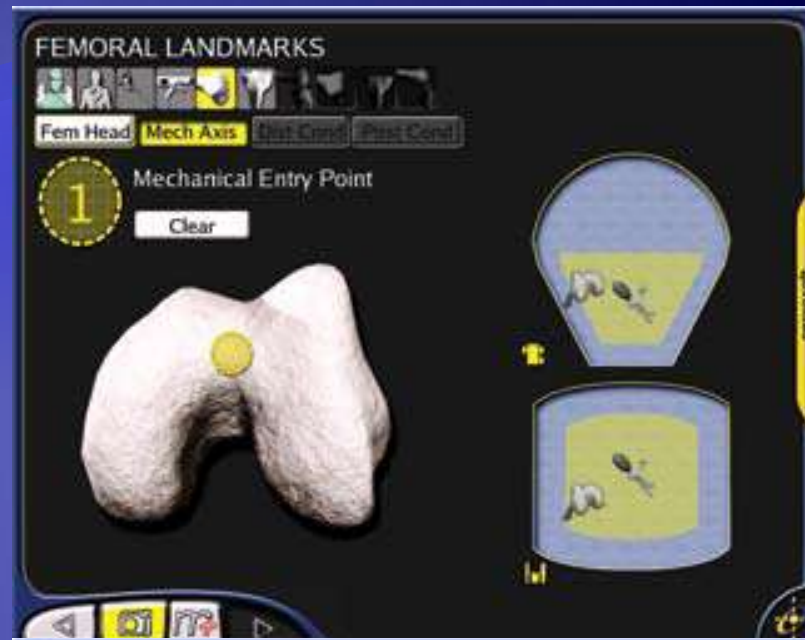
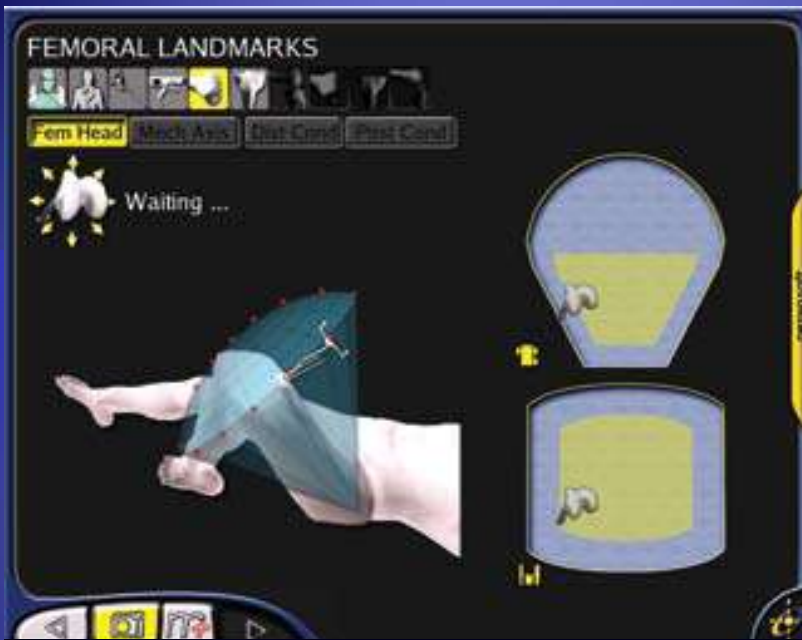


$$FT = AF/PC$$



$$PCA = EPI/PC$$

CAS



CAS

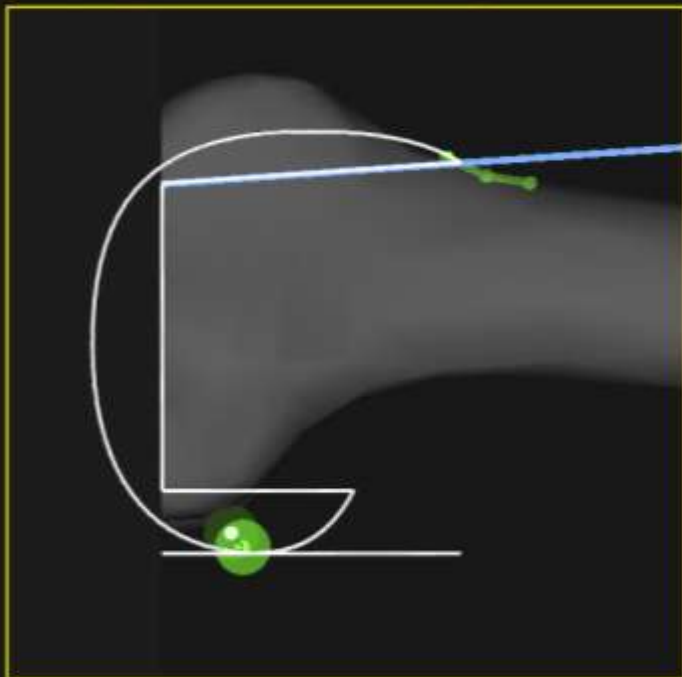
NAVIGATION DE LA ROTATION DU FÉMUR



NKII ◀

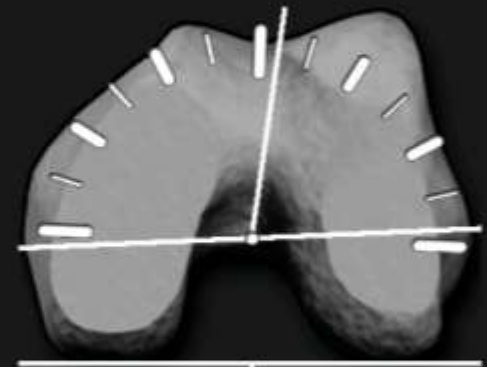
2

▶ AP: 2



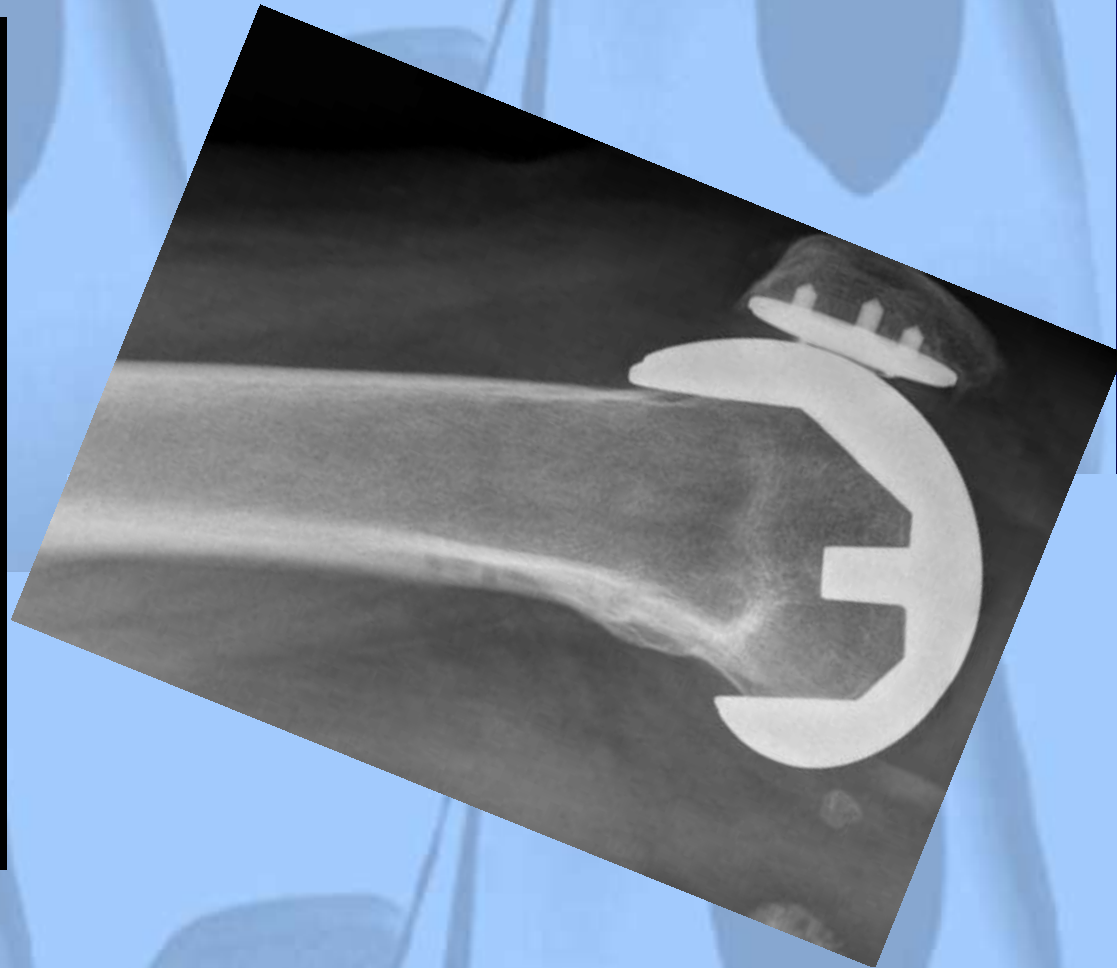
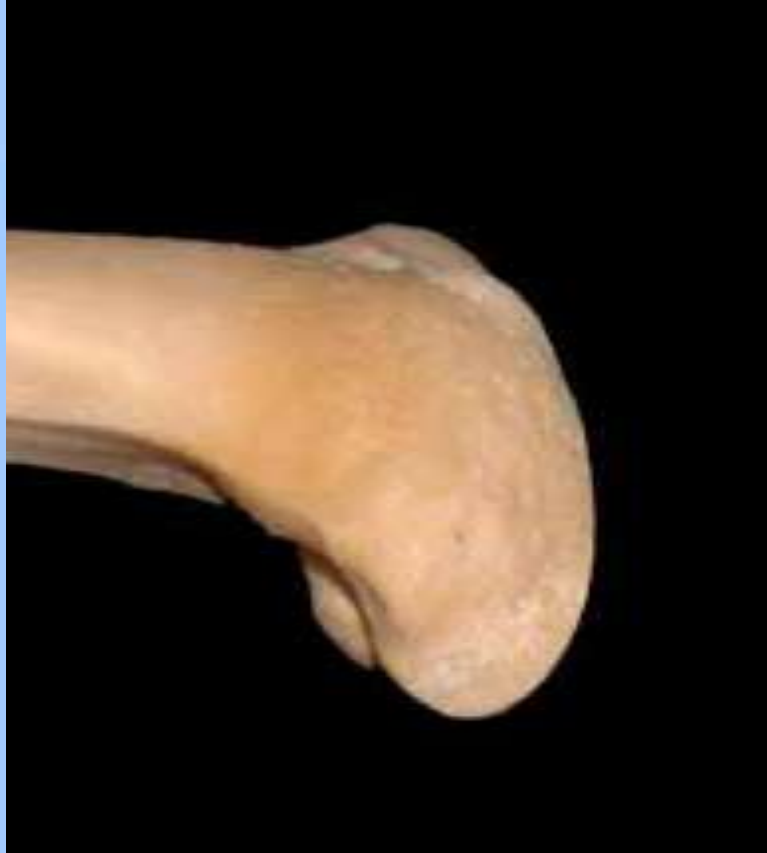
Épi.
externe
 5.0°

AP
interne
 6.0°



Axe post.
externe
 2.5°

TORSION FEMORALE EPIPHYSAIRE



2. WHICH RESULTS DO WE EXPECT?

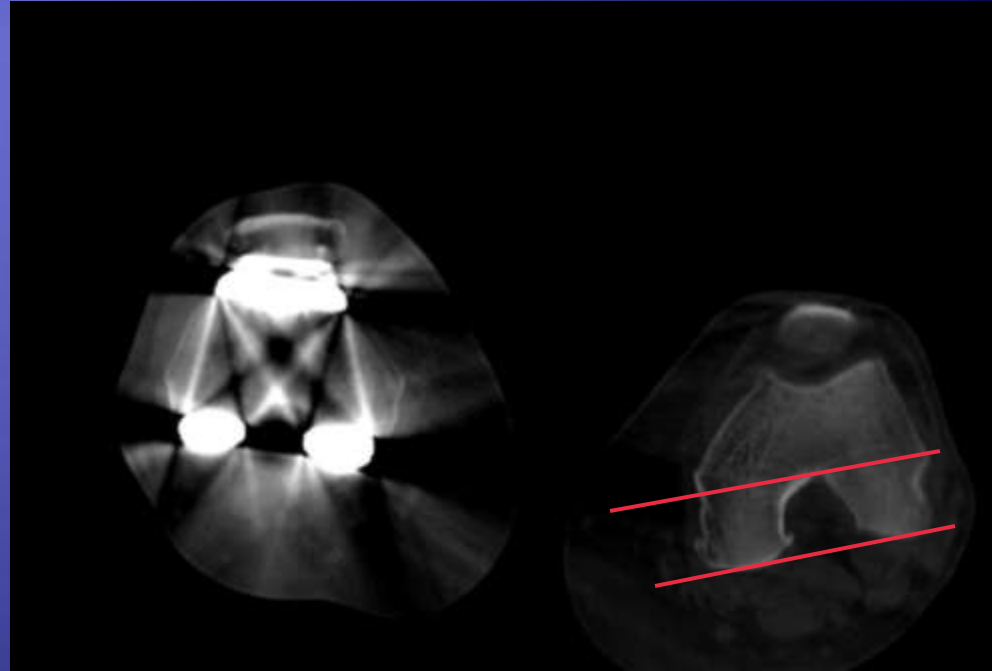
WHICH HELP CAS CAN GIVE FOR THE CONTROL OF FEMORAL ROTATION

- ◆ STÖCKL (2004): the use of a navigation system provides improved alignment accuracy, and can help to avoid femoral malrotation and errors in axial alignment
- ◆ CHAUHAN (2004): Post-operative CT showed a significant improvement in the alignment of the components using computer-assisted surgery in regard to femoral varus/valgus ($p = 0.032$), femoral rotation ($p = 0.001$),
- ◆ MICHAUT (2008) : La rotation adaptée sous navigation sur la base d'un scanner préopératoire constitue une avancée par rapport à la rotation ancillaire standardisée.
- ◆ LÜTZNER(2008): No notable differences were found between computer-assisted navigation and conventional implantation techniques as regards the rotational alignment of the femoral or tibial components. the deviation from the transepicondylar axis was relatively low.

WHICH HELP CAN CAS GIVE US IN THE CONTROL OF FEMORAL ROTATION ?

**MICHAUD
LUTZNER
CHAUHAN**

EPICONDYLAR REFERENCE



STOCKL POSTERIOR REFERENCE

WHICH HELP CAS CAN GIVE FOR THE CONTROL OF FEMORAL ROTATION?

MICHAUD
LUTZNER
STOCKL

CAS +

CHAUHAN

CAS -

WHAT DO I EXPECT ?

ROTATION SET WITH CAS = ROTATION MEASURED ON TDM ?

WHAT DO I EXPECT ?

POST OP FEMORAL ROTATION

=

PRE OP FEMORAL ROTATION $\pm 3^\circ$

SÉRIE

- ◆ 65 patients
- ◆ 22 hommes/ 39 femmes
- ◆ 86% varus
- ◆ 2008

SÉRIE

- ◆ INDICATION CAS
 - ◆ ANCILLARY
 - ◆ ÂGE
 - ◆ COMORBIDITY
 - ◆ REVISION
- ◆ 2 SOFTWARE VERSIONS

3. WHICH RESULTS DO WE GET?

	DF	AFI	ATI
PRE	- 5.84 ± 6.01	90.62 ± 2.58	85.32 ± 3.62
POST	- 0.87 ± 2.79	90.35 ± 1.84	88.59 ± 2.03
p	≠	<0.001	<0.001

WHICH RESULTS DO WE GET?

CAS

	FEMORAL TORSION	TEDF	ACP NAVIGUE
PRE			2.47 ± 1.69
POST			2.59 ± 1.79
p			<0.001

WHICH RESULTS DO WE GET?

CT SCAN

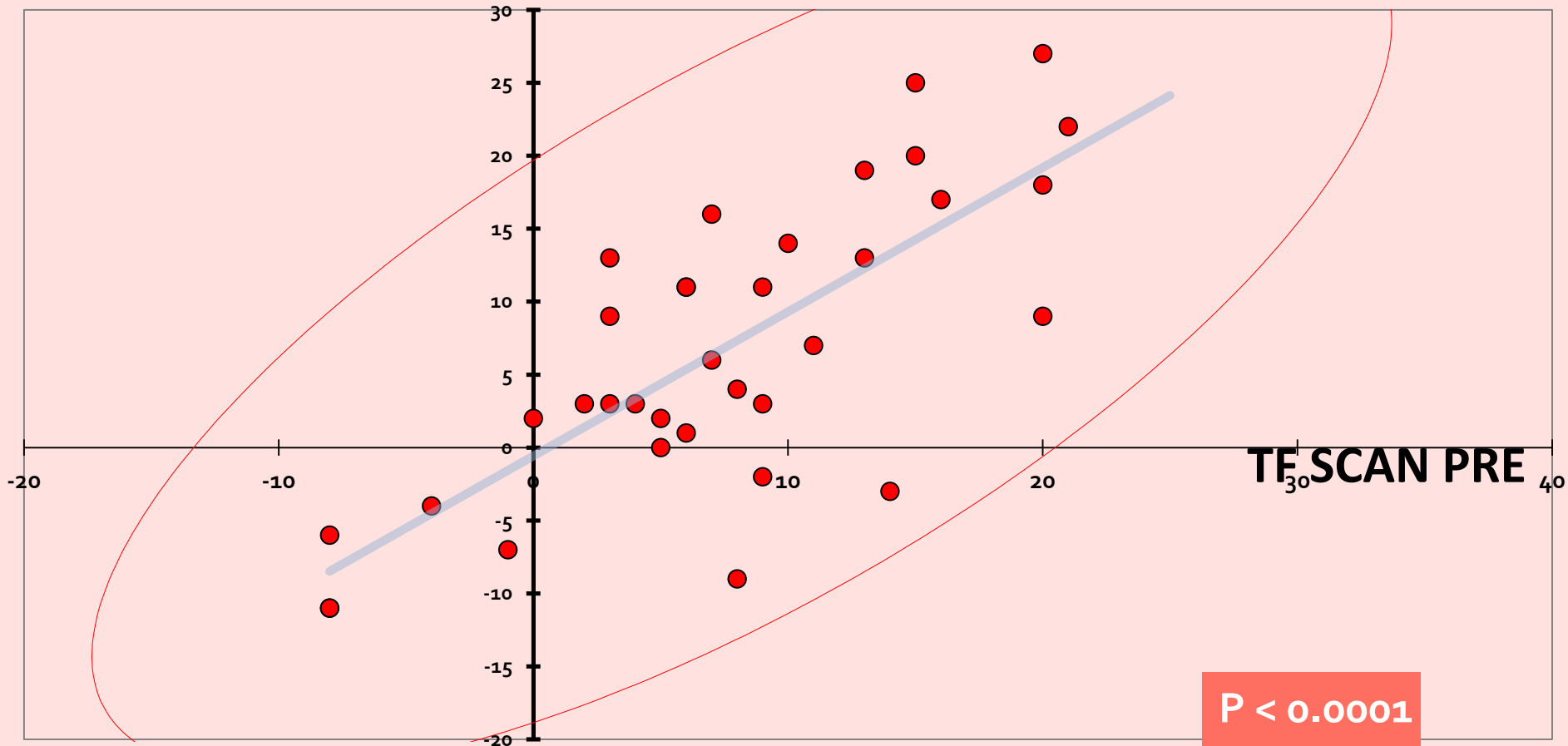
	FEMORAL TORSION	PCA	ACP CAS
PRE	7.38 ± 9.8	1.51 ± 6.7	
POST	8.18 ± 8.41	1.52 ± 4.48	
P	< 0.001	< 0.001	

PCA: posterior condylar angle

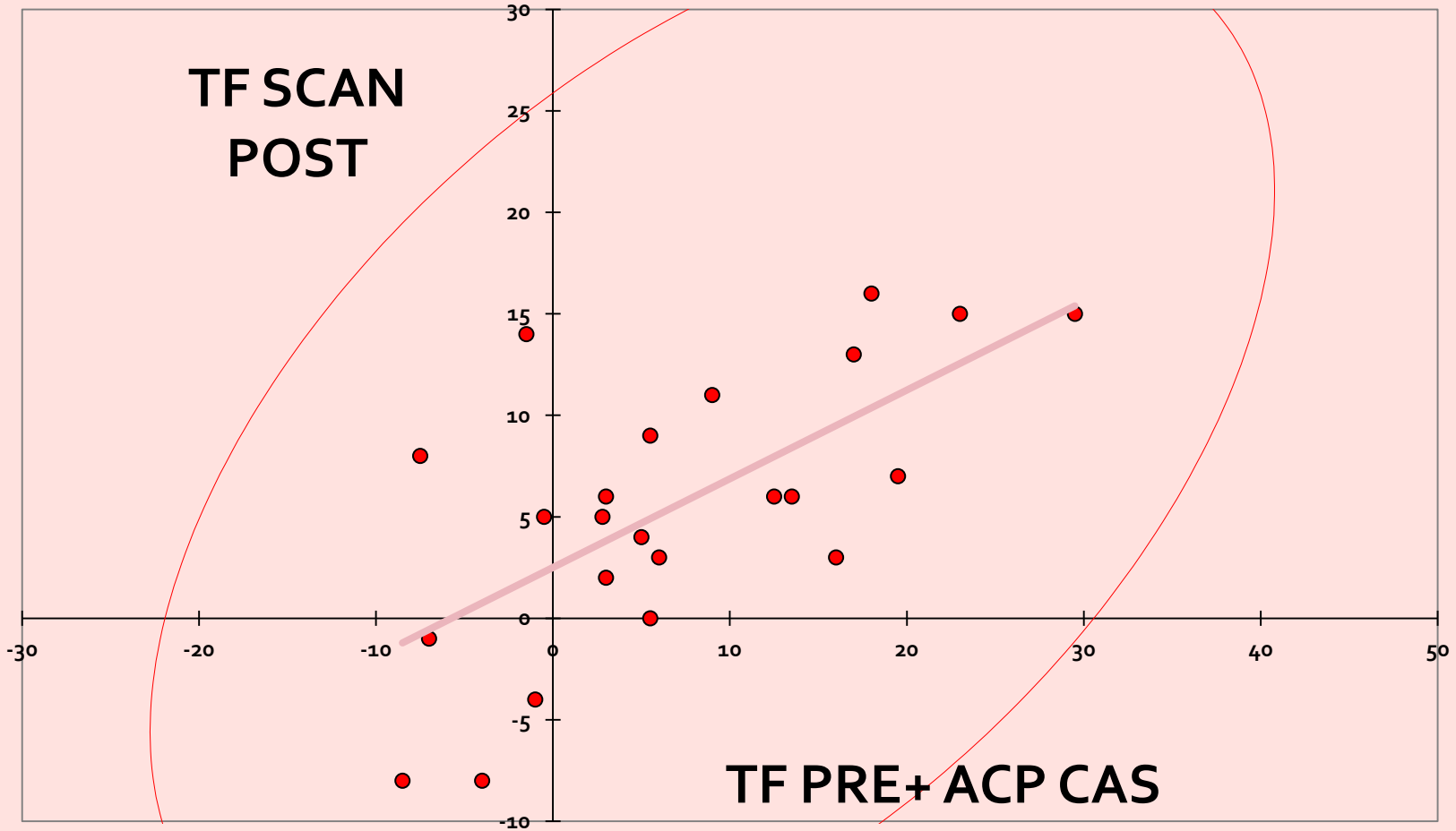
FEMORAL TORSION

CT SCAN

TF SCAN POST

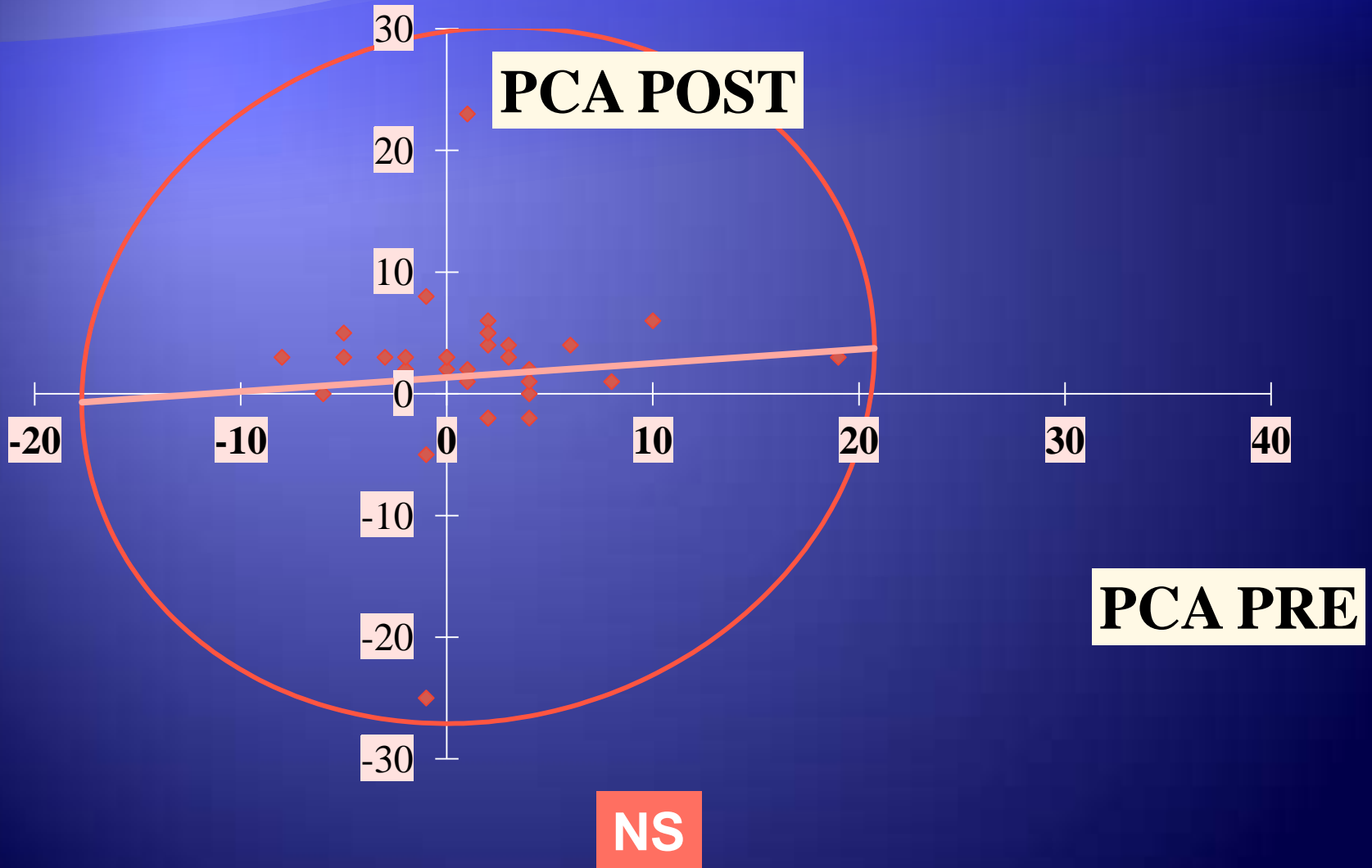


CT SCAN



PCA

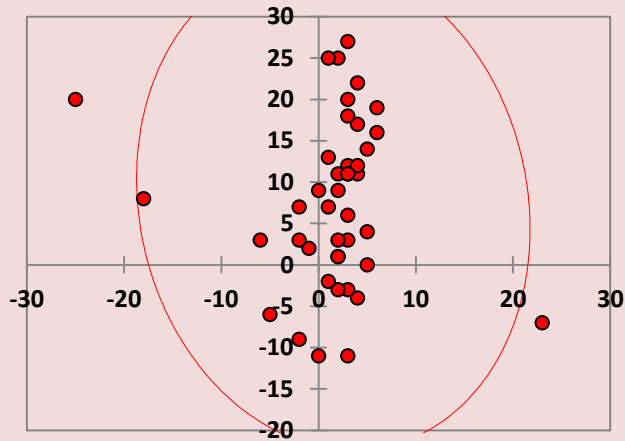
CT SCAN



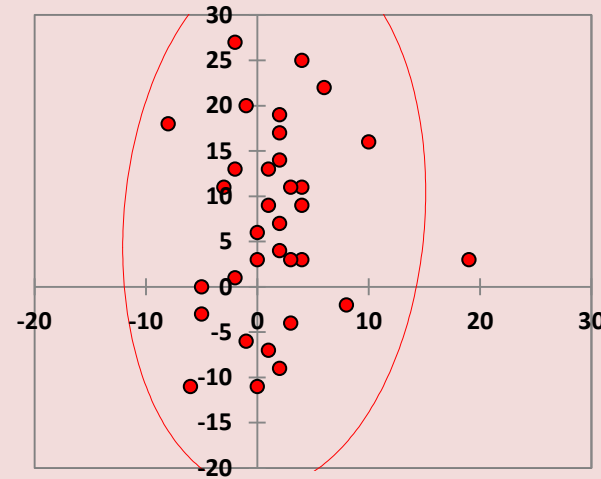
CORRELATION PCA/TF

CT SCAN

PCA pre



PCA post



TF
PRE

40

30

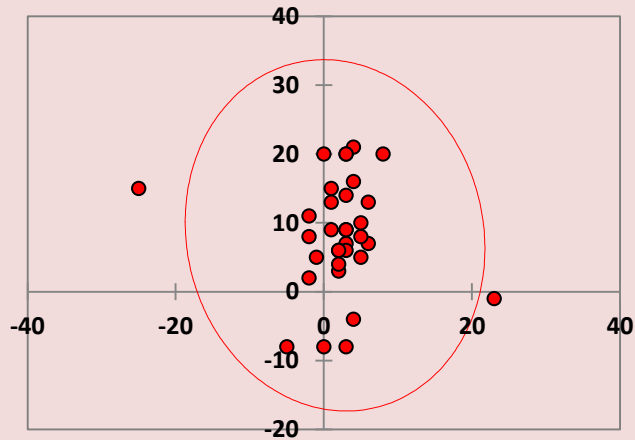
20

10

0

-10

-20



40

30

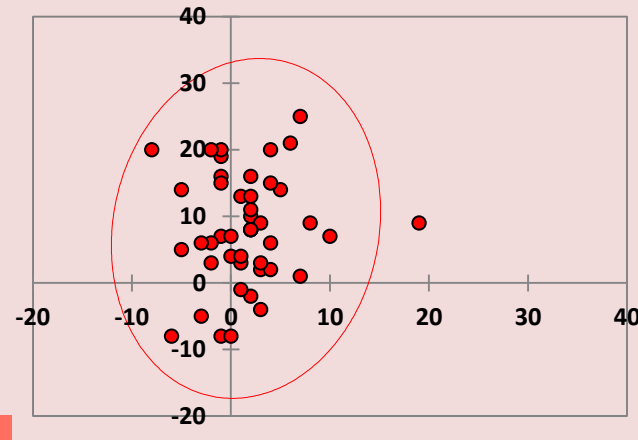
20

10

0

-10

-20



TF
POST

P NS

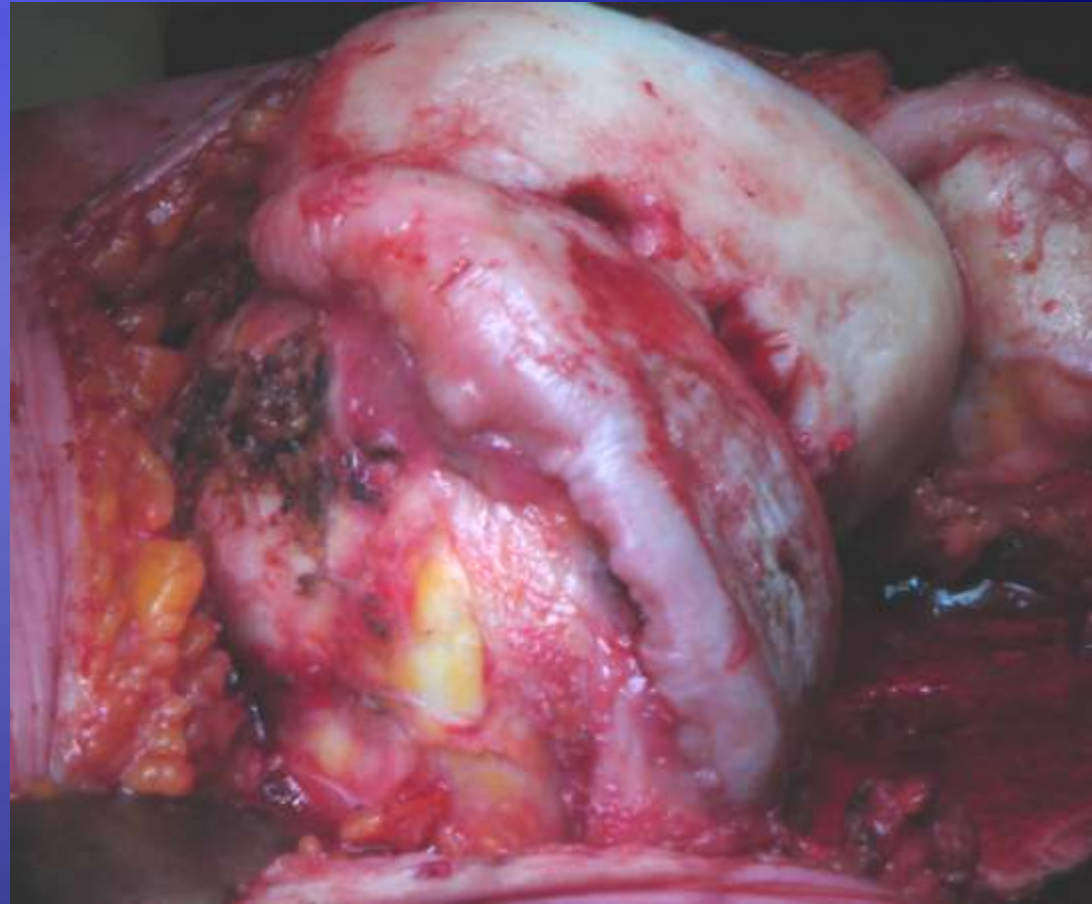
WHICH RESULTS DO WE GET?

1. CAS: EXPECTED ROTATION = ROTATION DONE
2. AXES EVALUATED WITH CAS \neq AXES WITH TDM
3. POST = PRE $\pm 3^\circ$

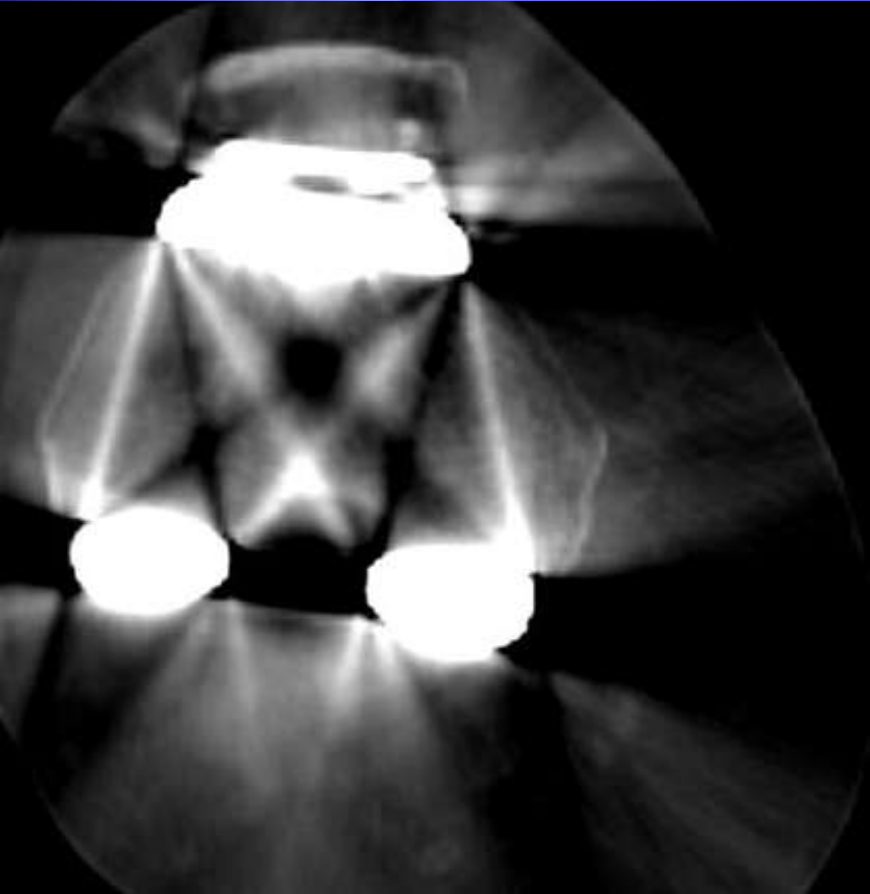
WHY ?

- ◆ **EXTERNAL FEMORAL ROTATION**
 - ◆ **WHICH MARK ?**
 - ◆ CAS
 - ◆ CT SCAN
 - ◆ **HOW MUCH ?**

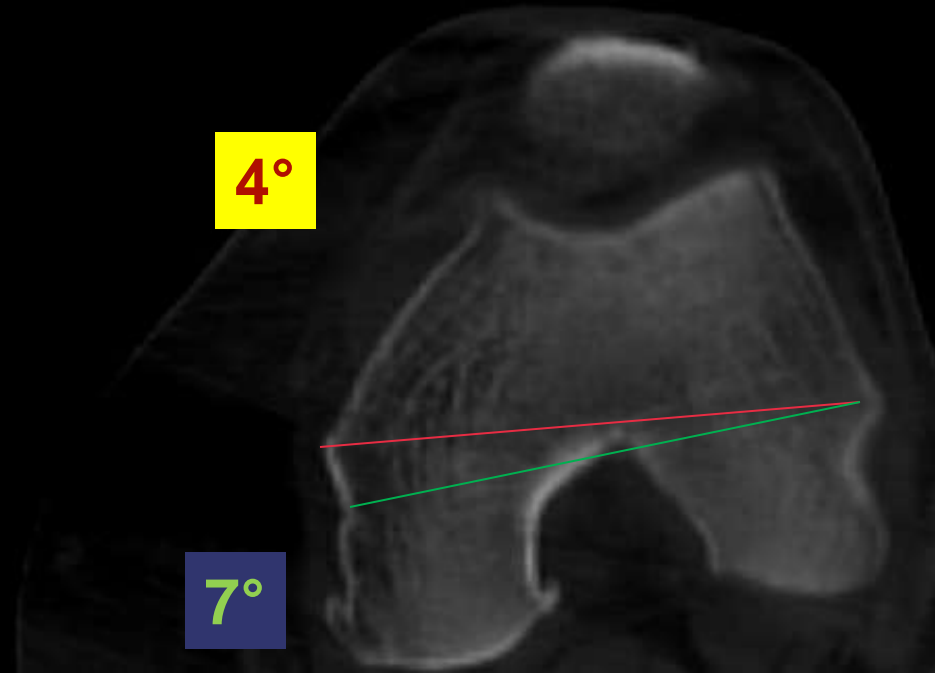
CAS AND MEDIAL EPICONDYLE



WHICH MARKS ? CT SCAN

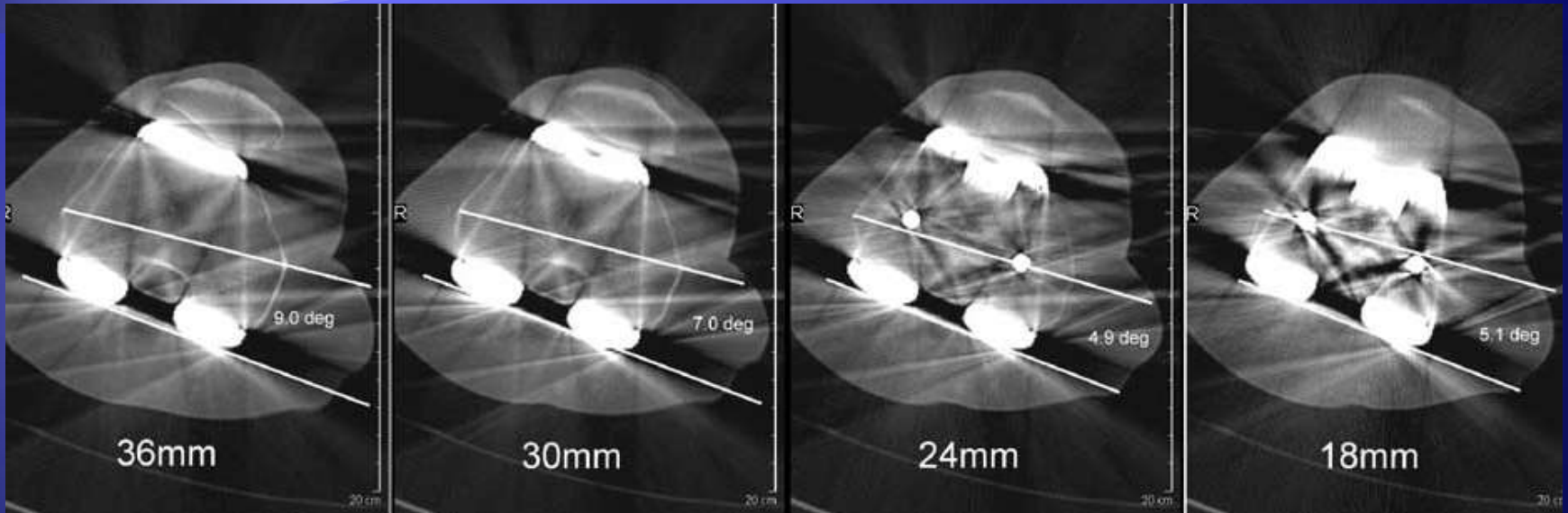


4°



7°

EPICONDYLAR MARKS ?



EPICONDYLAR AXIS: IMPRECISE

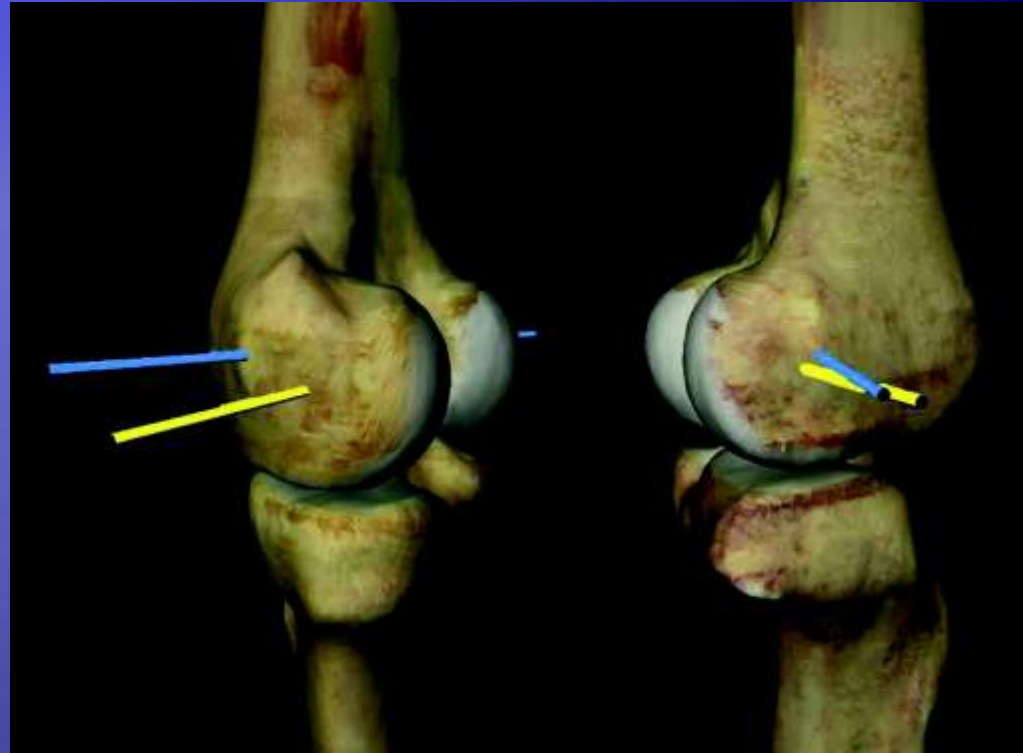
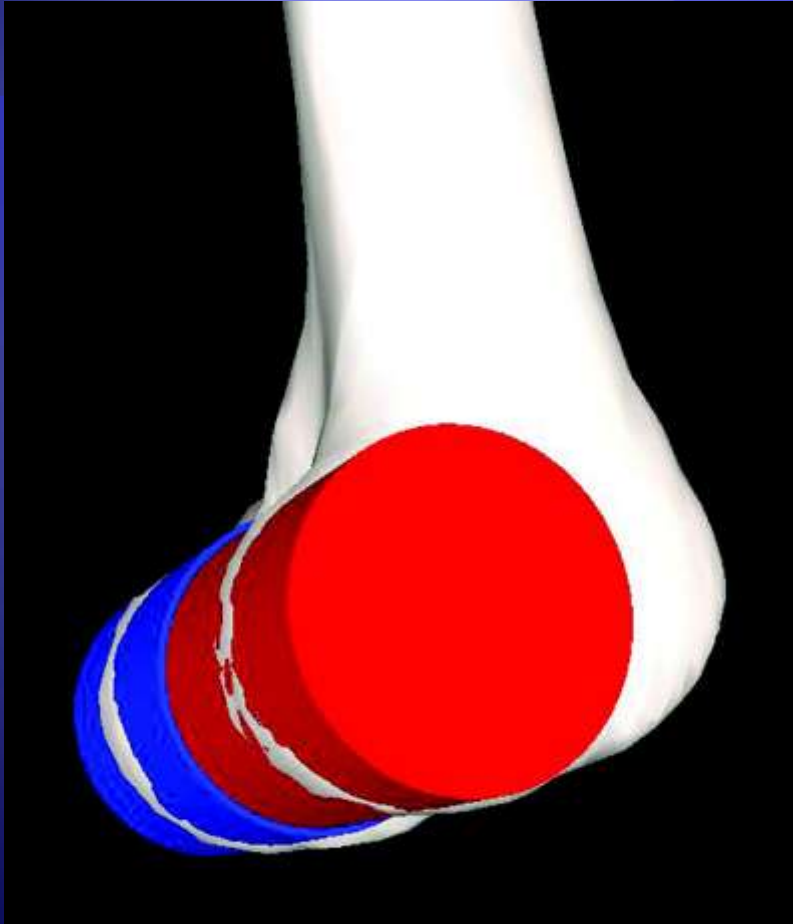
STIEHL J ARTHROPL 1995

KATZ J ARTHROPL 2001

ECKHOFF JBJS 2003

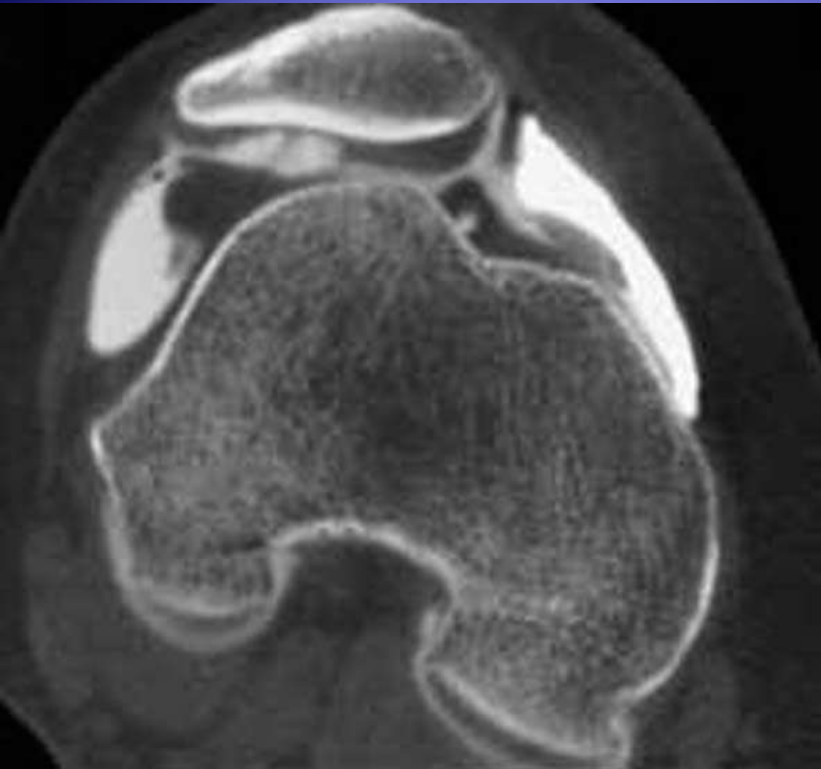
WAI HUNG J ARTHROPL 2009

EPICONDYLAR AXIS



Three-dimensional knee model constructed from the Visible Human database
with epicondylar (blue) and cylindrical (yellow) axes ECKHOFF JBJS VOLUME 85-A · SUPPLEMENT 4 · 2003

WHICH MARKS ?

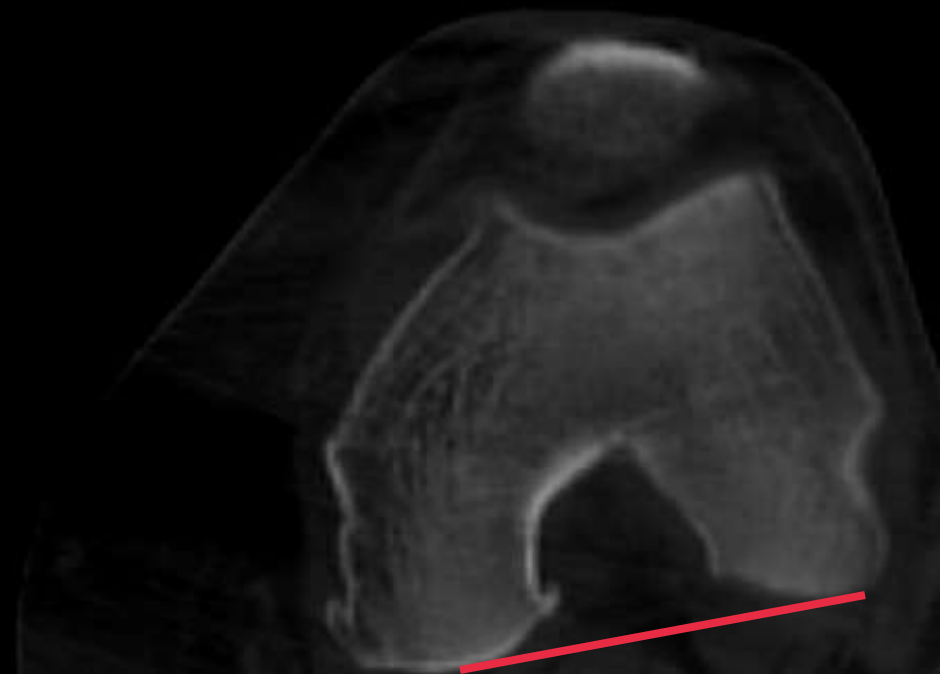
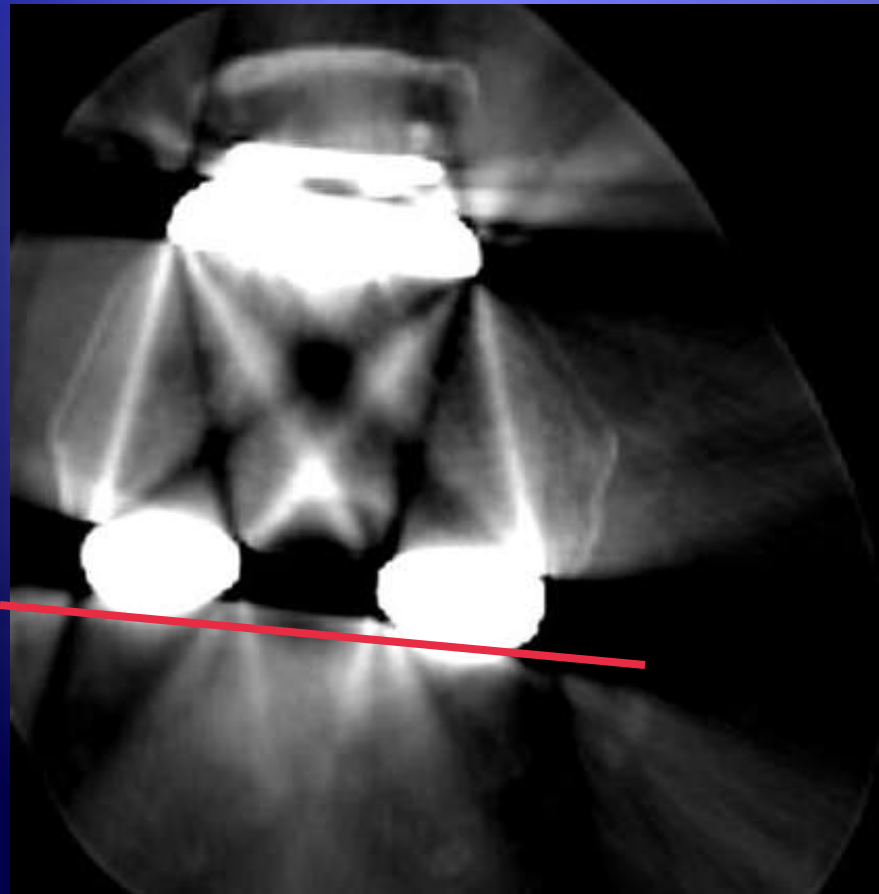


- ◆ **OTHER MARKS:**

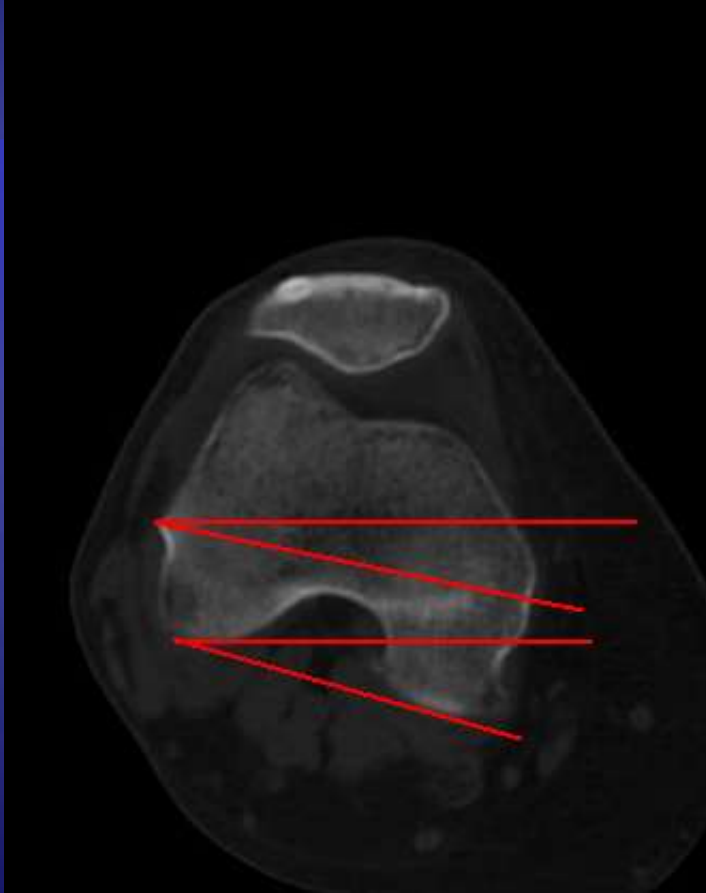
- ◆ **ANTERO POSTERIOR AXIS: DIFFICULT**

WHICH OTHER MARKS ?

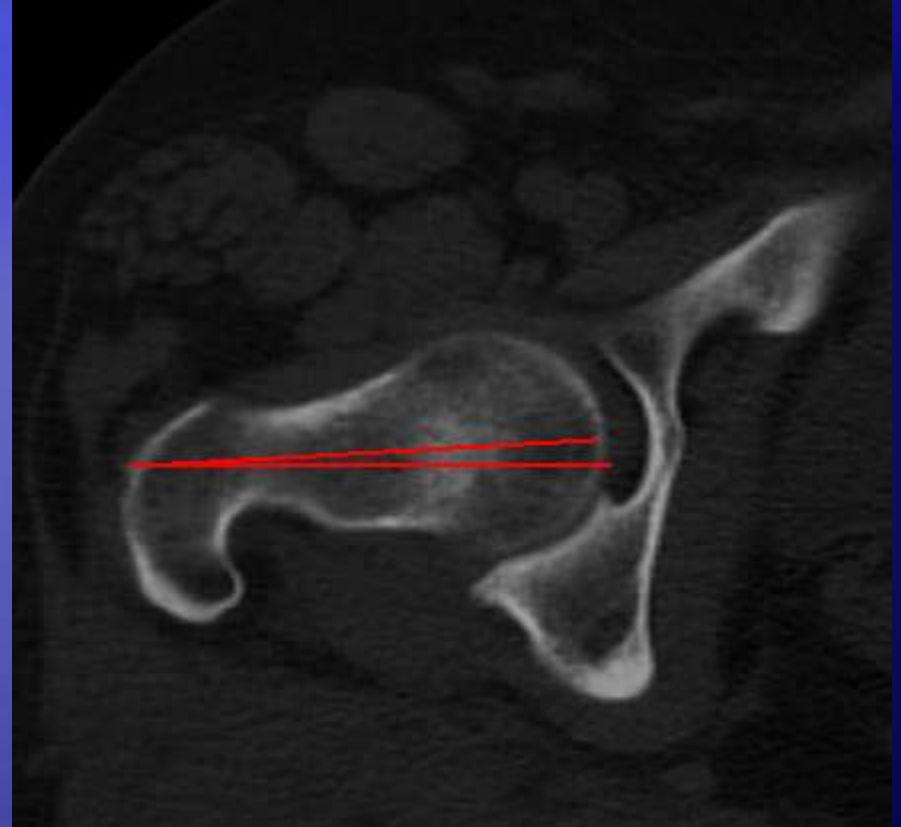
- ◆ POSTERIOR CONDYLAR AXIS



WHICH ROTATION?

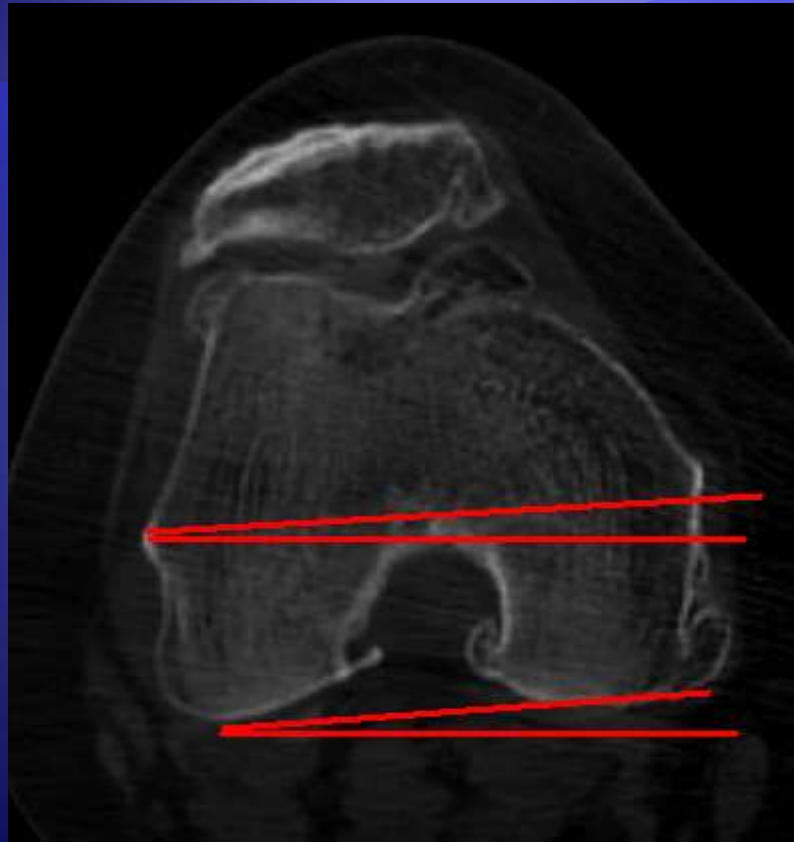


EPI -13°
ACP -12°
PCA 1°

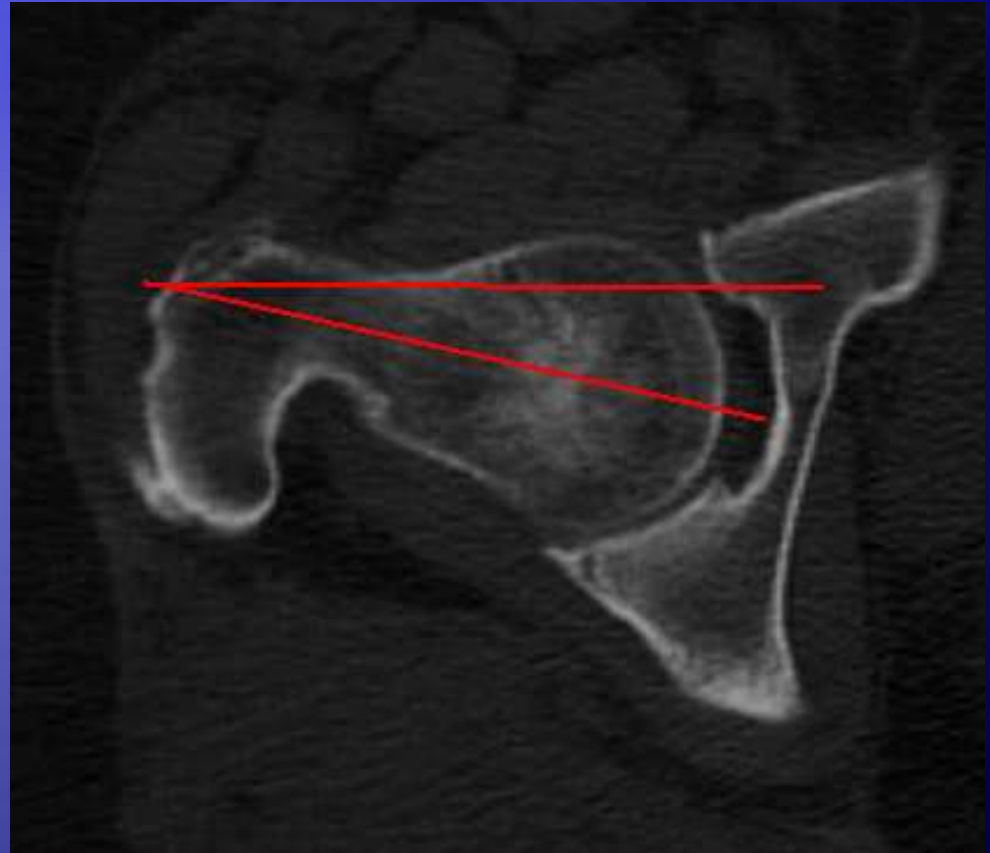


AF 7°
DF -4°
TF -29°

WHICH ROTATION ?

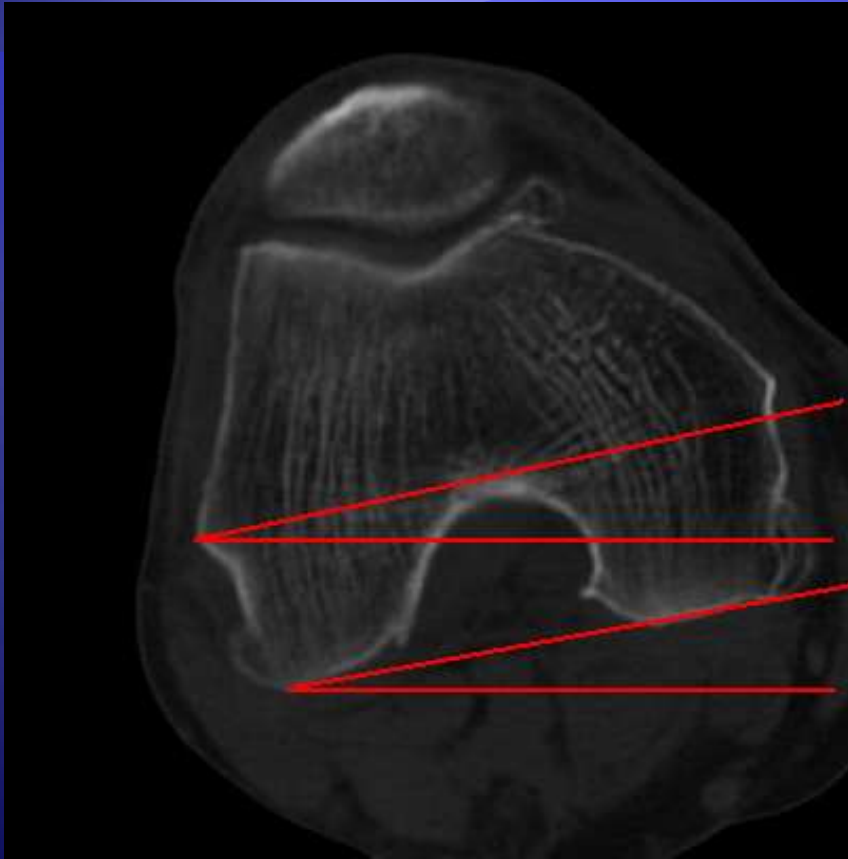


EPI 3°
ACP 5°
PCA -2°



AF -12°
DF -5°
TF 19°

WHICH ROTATION?



EPI 13°
ACP 10°
PCA 3°



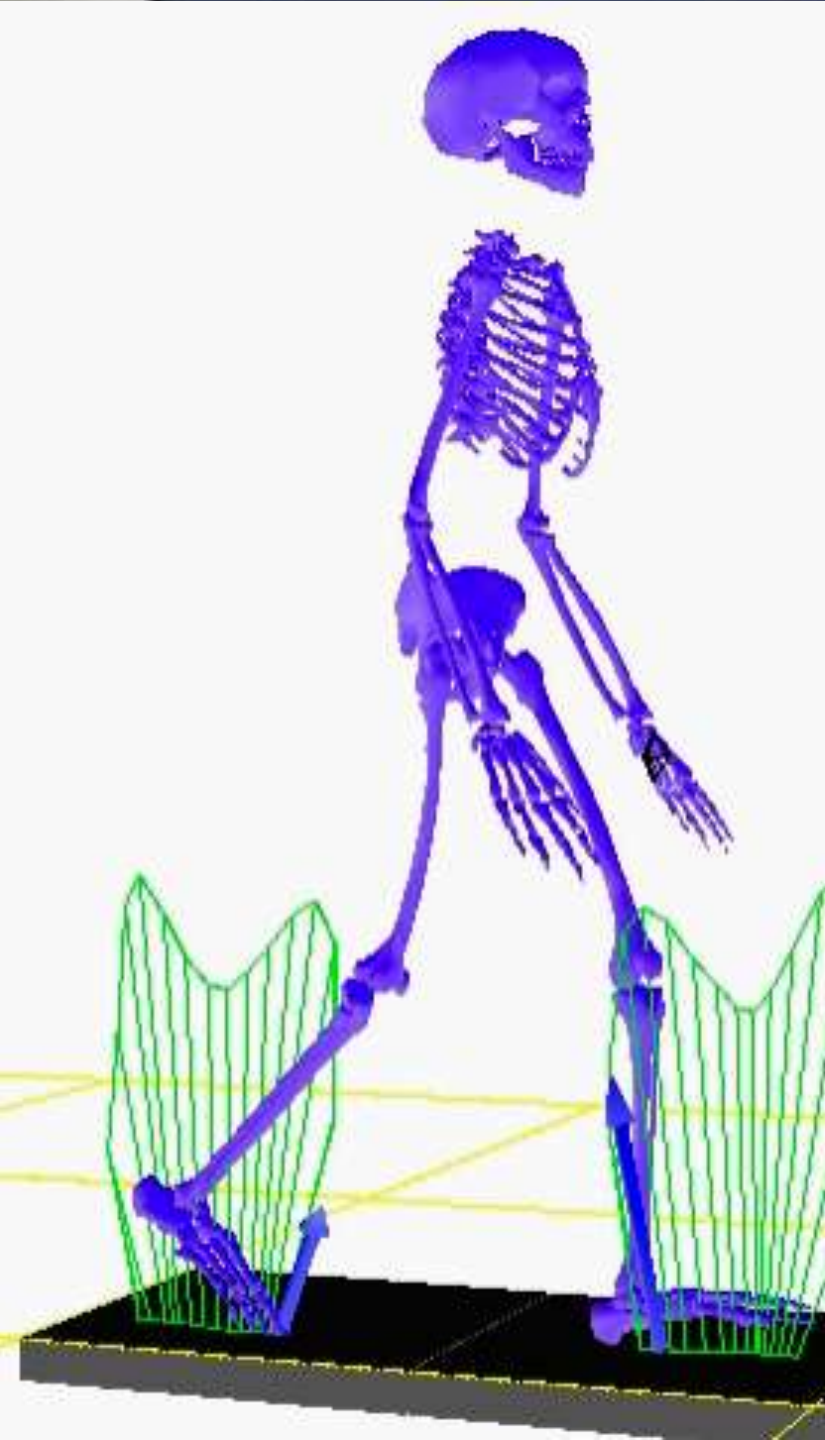
AF 24°
DF -7°
TF 14°

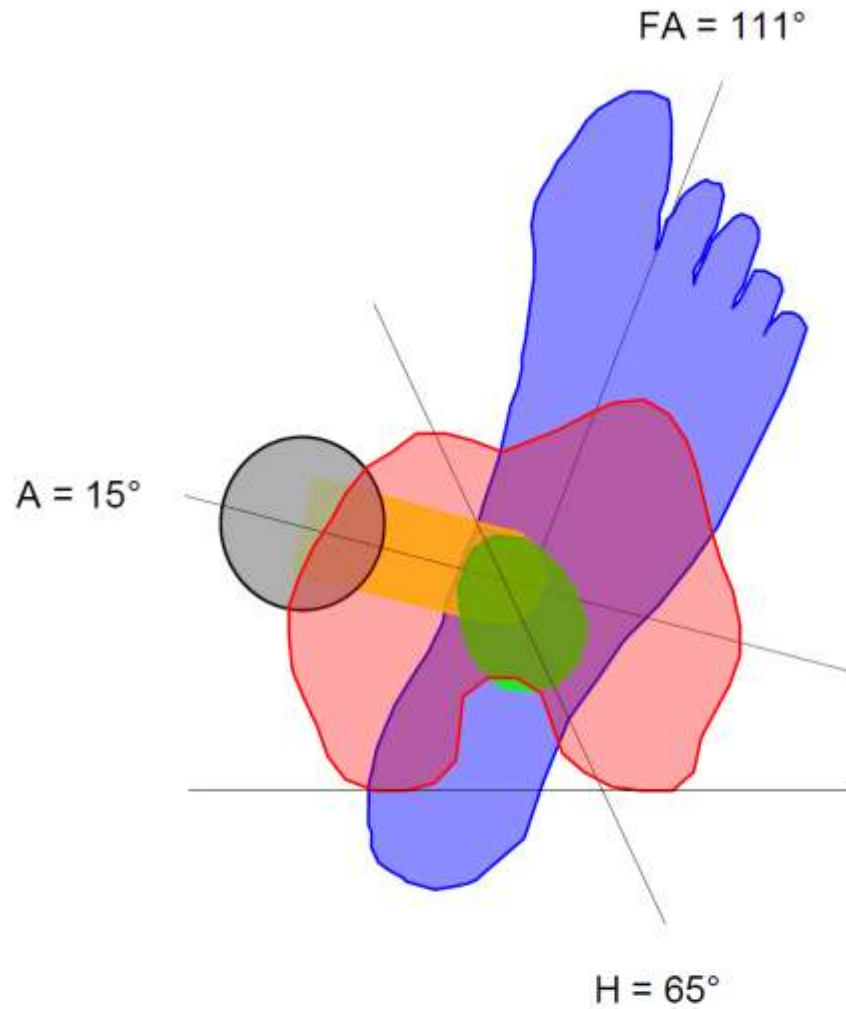
WHICH ROTATION?

	1st CASE	2nd CASE	3rd CASE
FEMORAL TORSION	-30	-15	-11
CONDYLAR AXIS	-13	+3	+13

CONCLUSION

1. POSTERIOR FEMORAL CUT- CAS
2. MEASURES \neq CAS- CT SCAN
3. AXIS OF REFERENCE
4. SINGLE CORRELATION





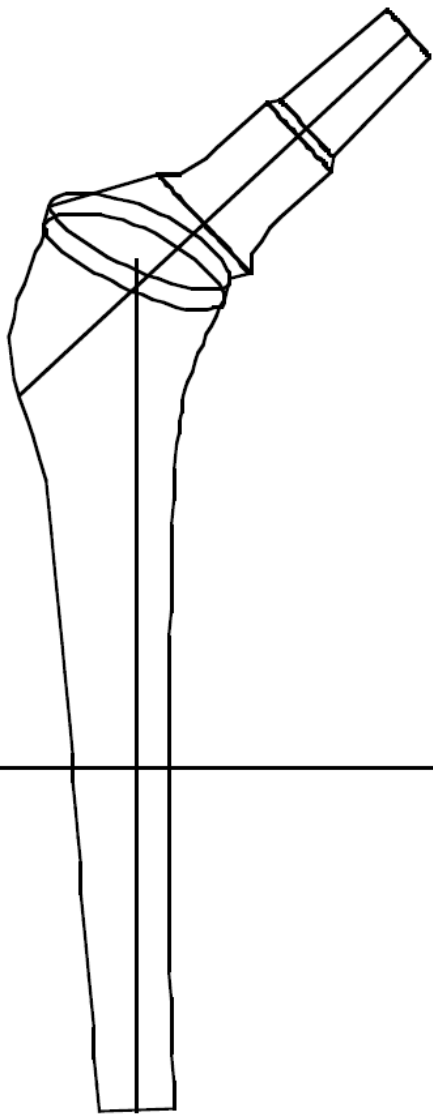
BOTTOM VIEW

A : Anteversion = 15°

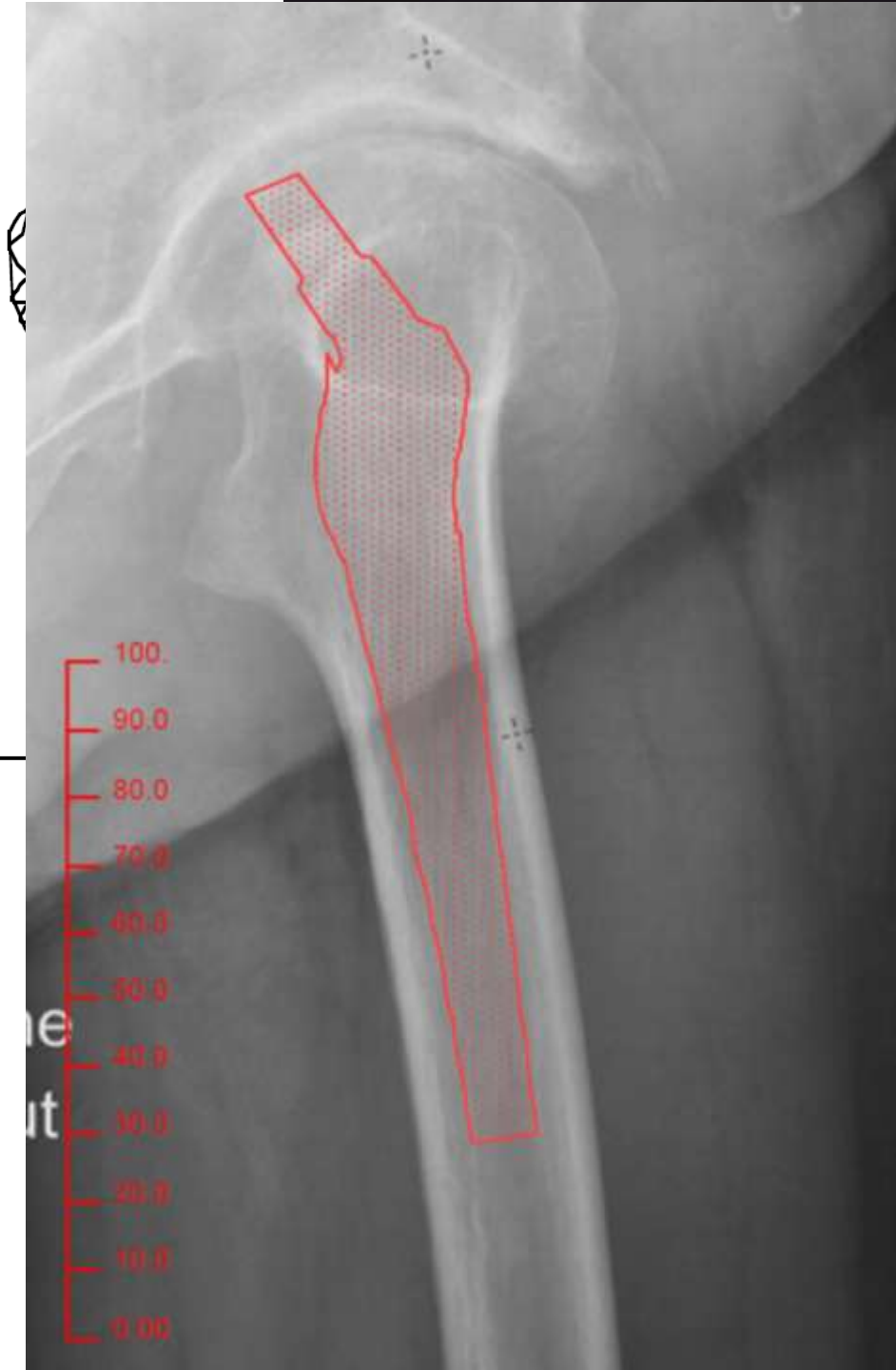
Δ : Anteversion - helitorsion = -50°

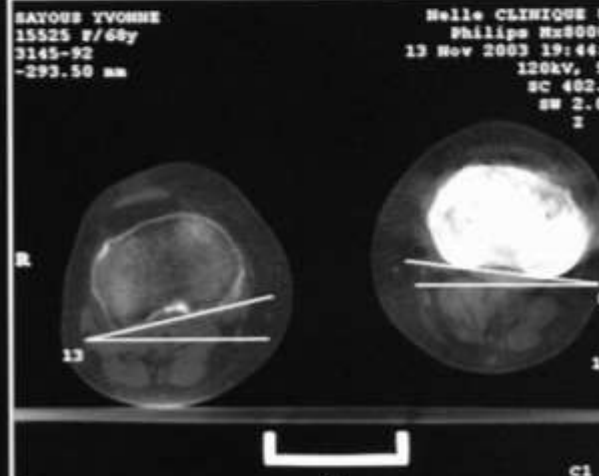
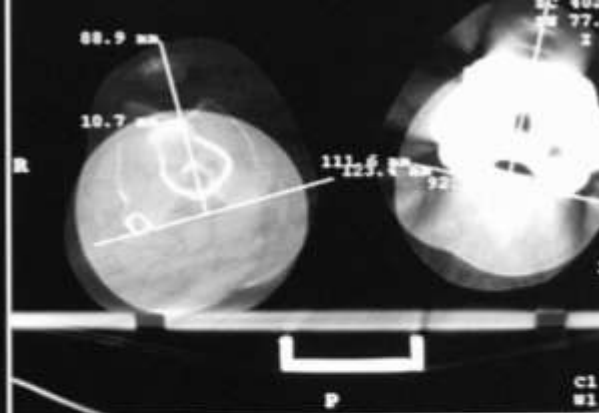
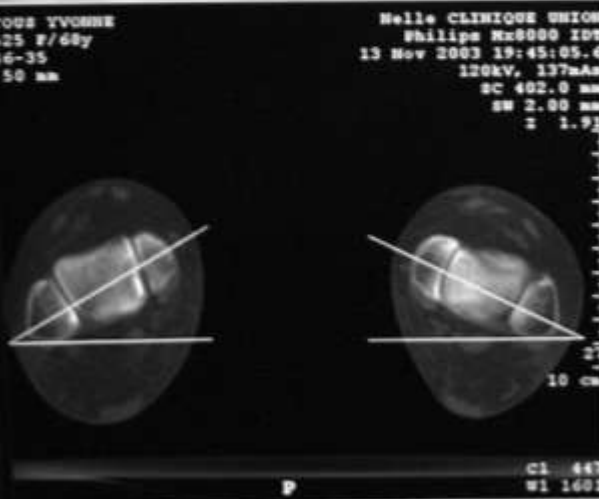
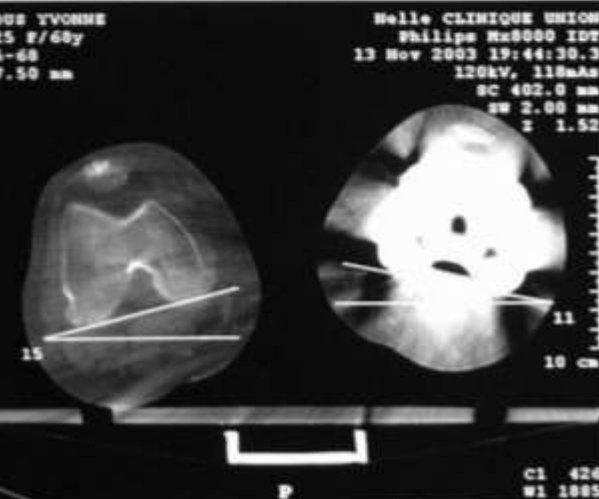
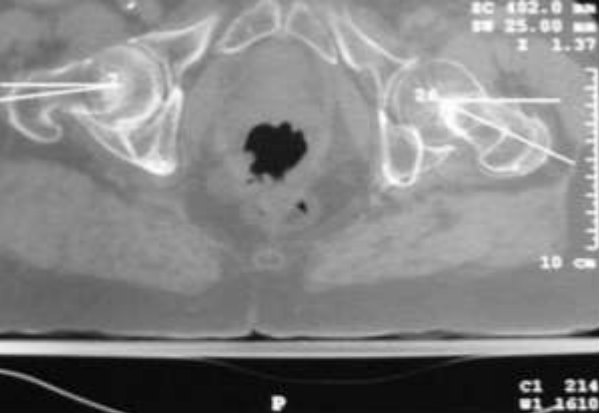
H : Helitorsion = 65°

FA : Foot Axis = 111°



Anteversion: 15.000
Neck Angle: 130.000
Lever Arm: 54.000
Neck Length: 70.000
Neck Radius: 7.500
Head Length: Long III





BAD RESULTS

	RIGHT	LEFT
FEMORAL TORSION	8	-15
TIBIAL TORSION	17	15
FT ROTATION	-2	-3

FINAL CONCLUSION

- ◆ PRE OP TDM - IRM
- ◆ CAS > FD
- ◆ NO LINK CAS – CT SCAN
- ◆ CAS = FINGER

