

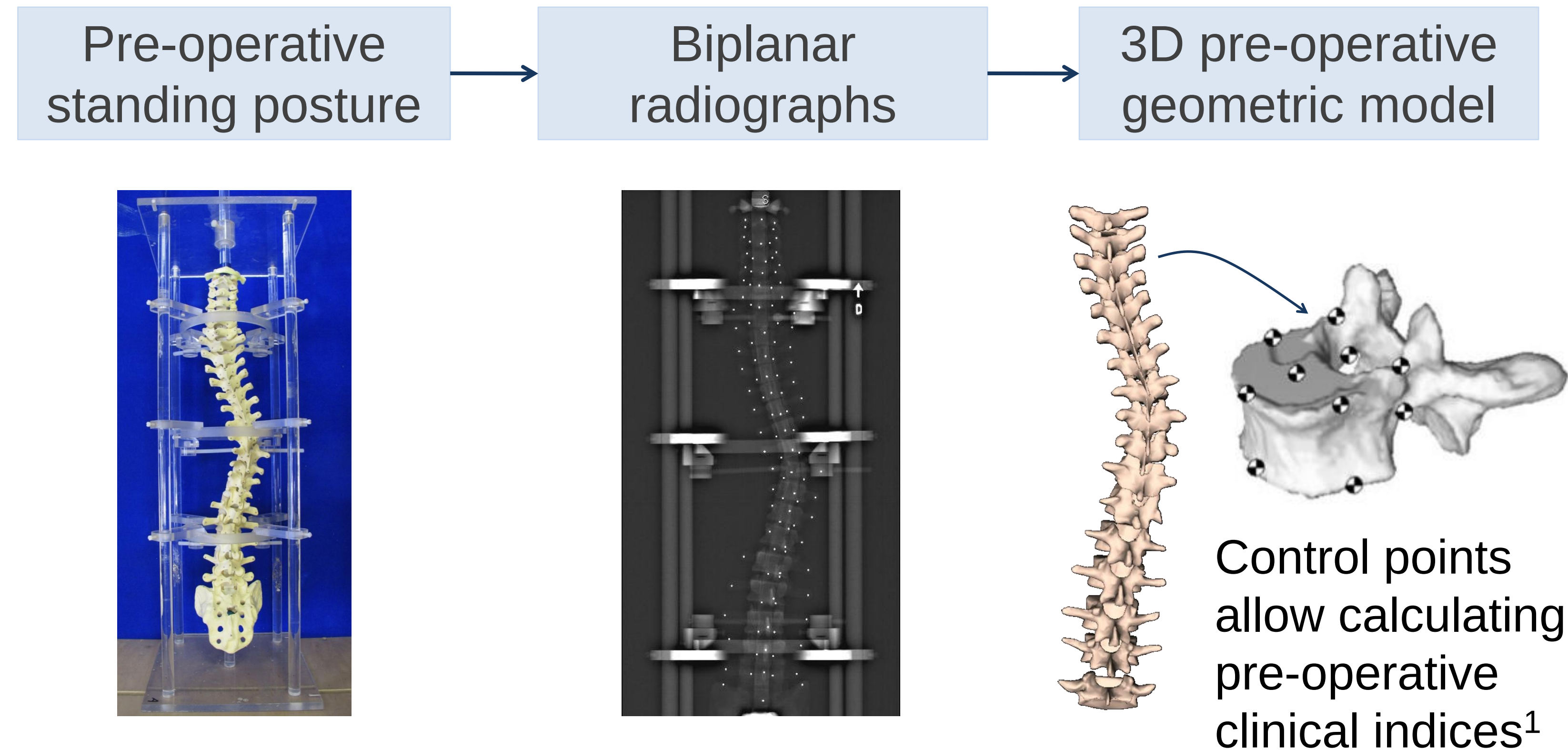
Intra-operative automatic measurement of 3D scoliotic deformities : *First results*

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INTRODUCTION

Scoliosis is a complex 3D deformation of the spine that can require complex surgical treatment.

Pre-operative measurement of 3D scoliotic deformities

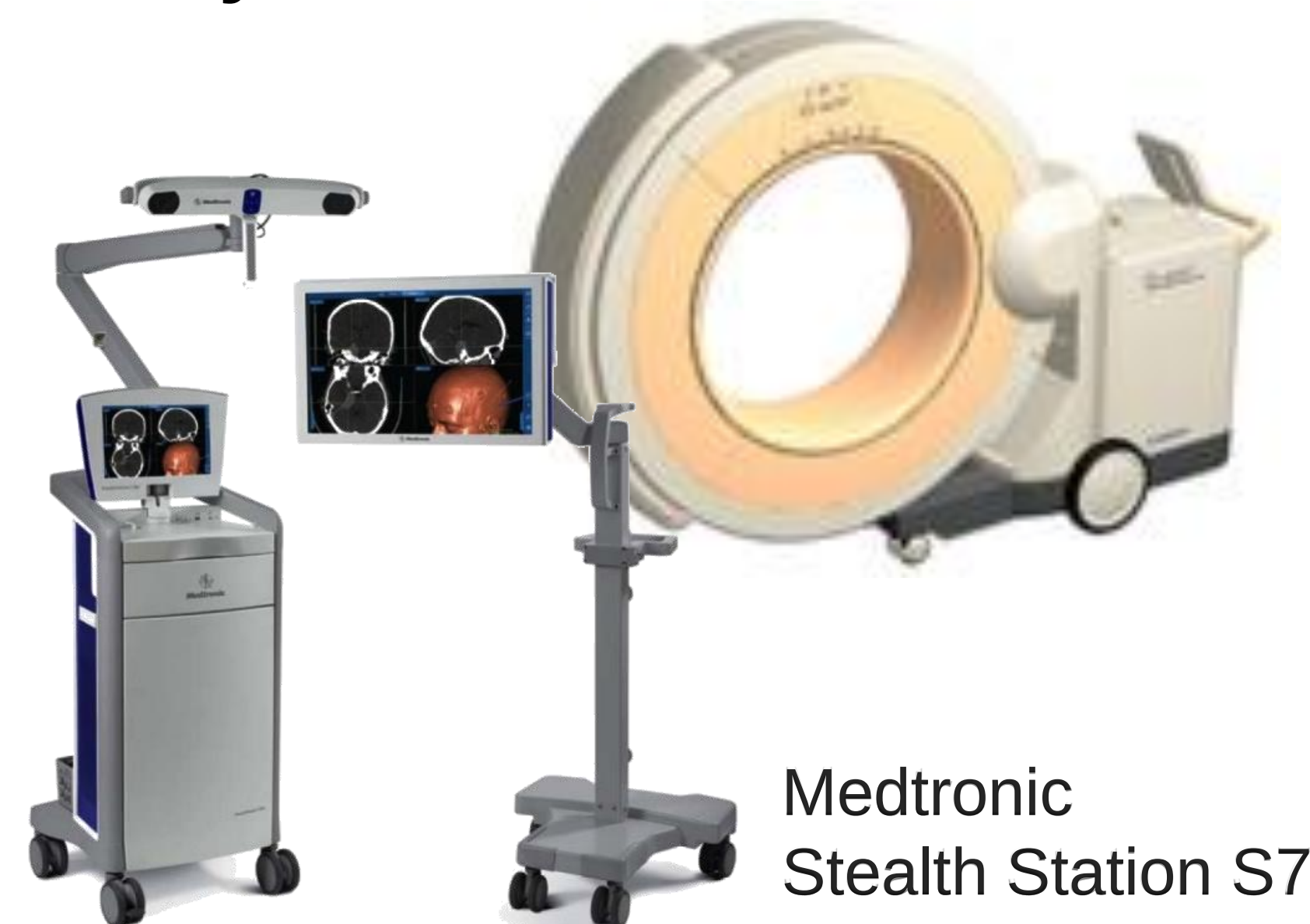


Intra-operative imaging/navigation systems²

✓ Visualization of 3D deformities of scoliotic spine

✓ Guide for pedicle screw insertion

✗ Scoliotic deformities and correction resulting from instrumentation maneuvers are not quantified

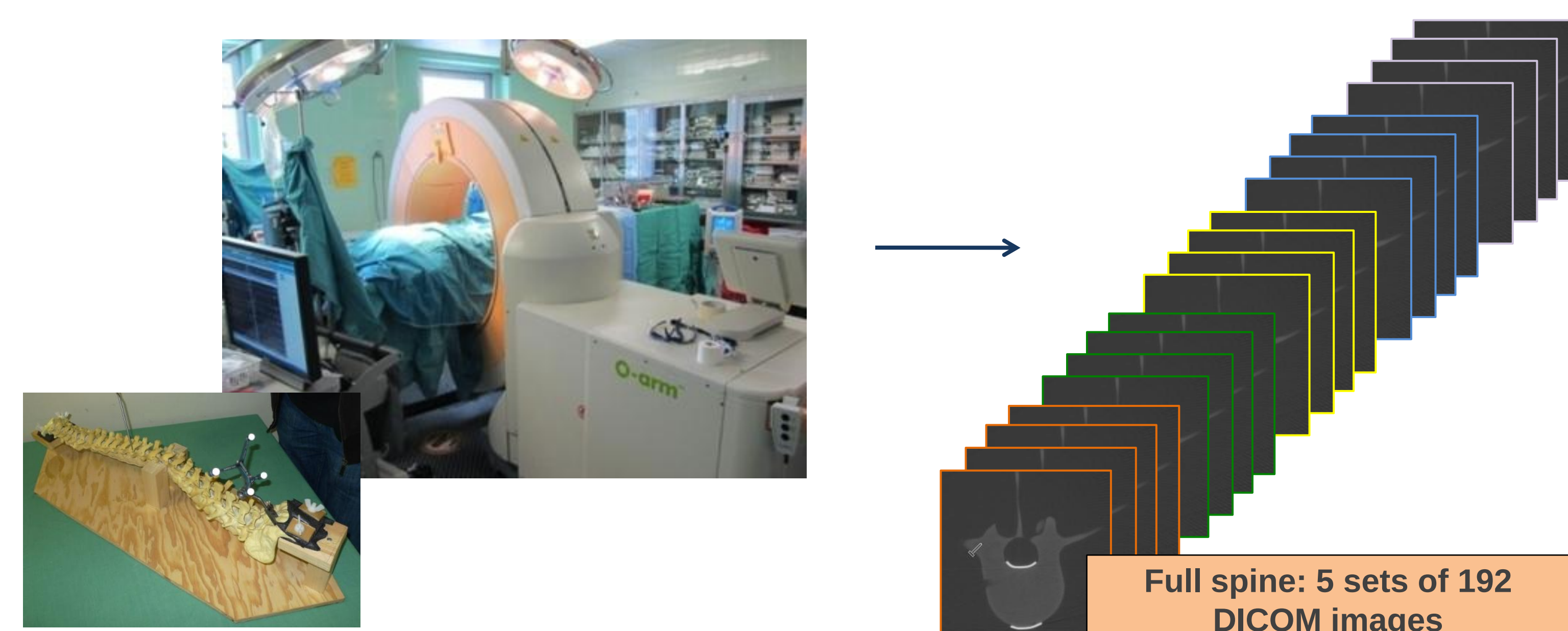


OBJECTIVE

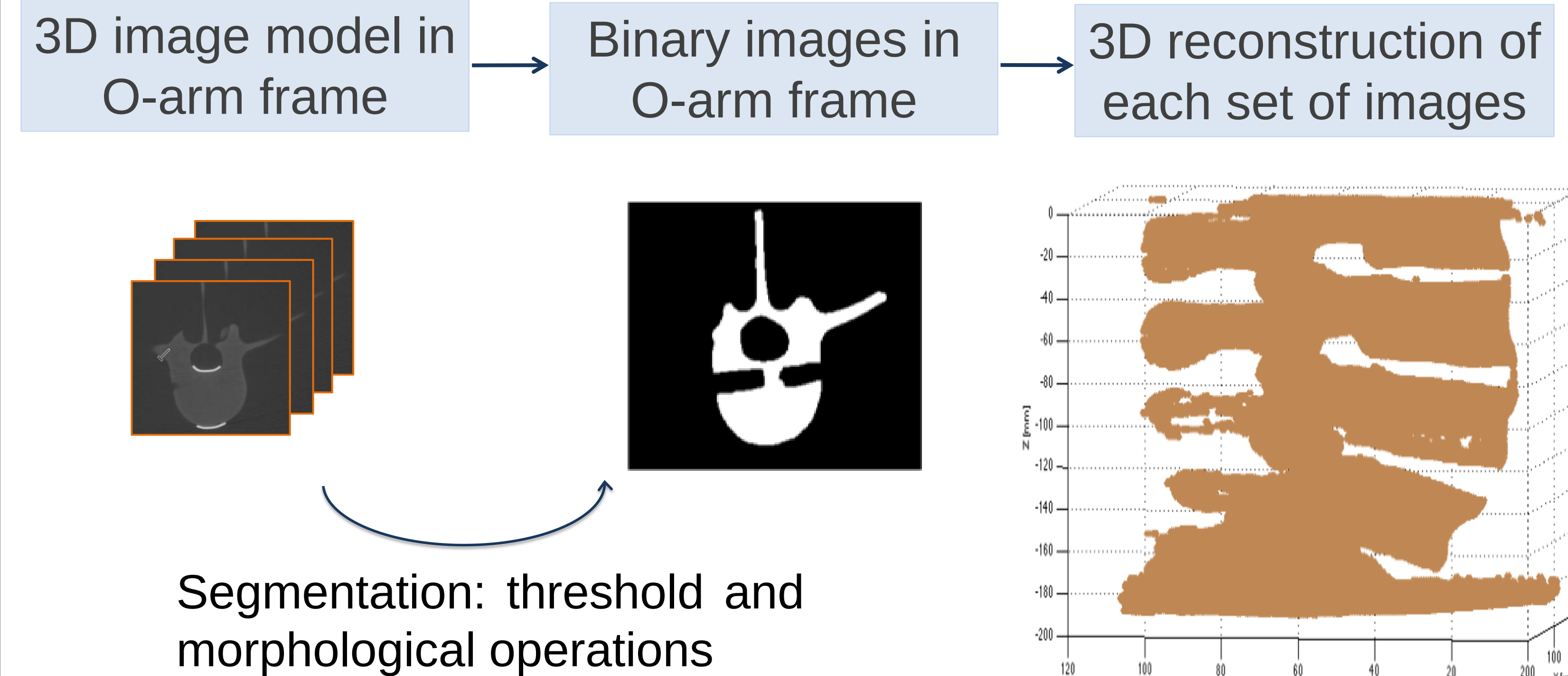
To calculate automatically the 3D deformities of the scoliotic spine.

INTRA-OPERATIVE MODEL

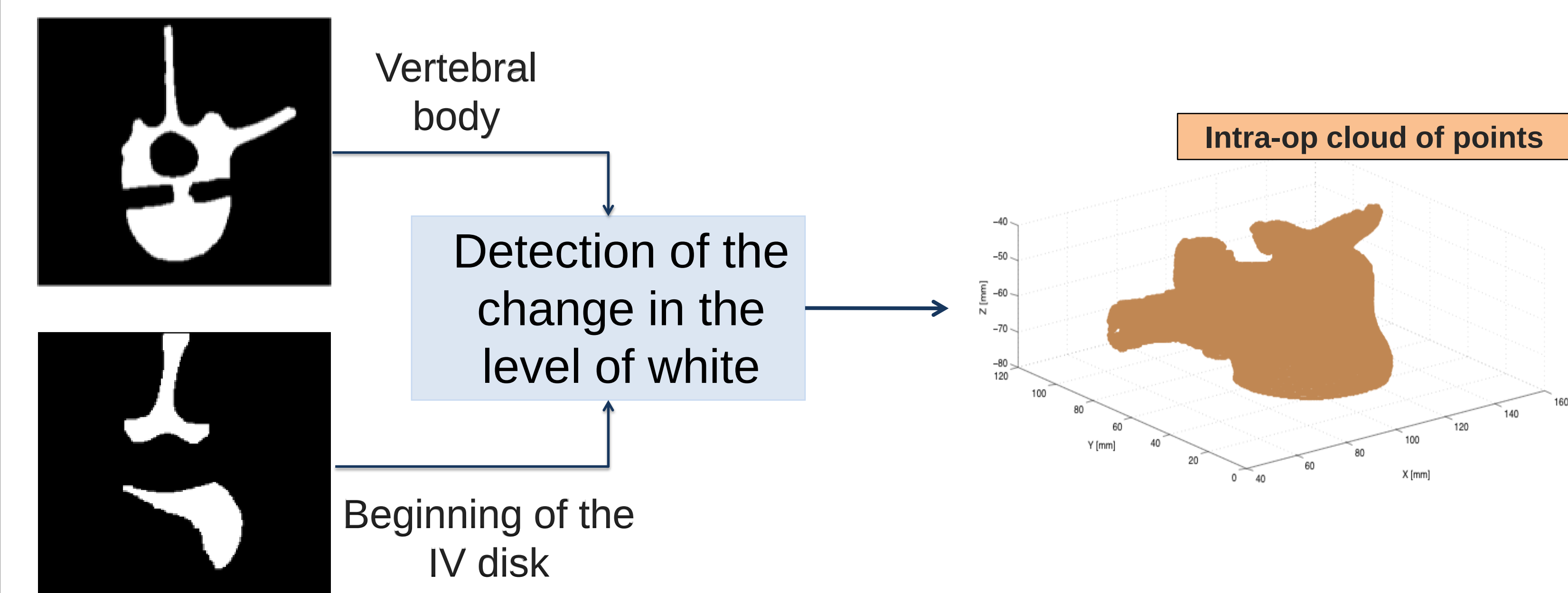
• Simulation of intra-operative prone positioning and acquisition of 2D/3D fluoroscopic images



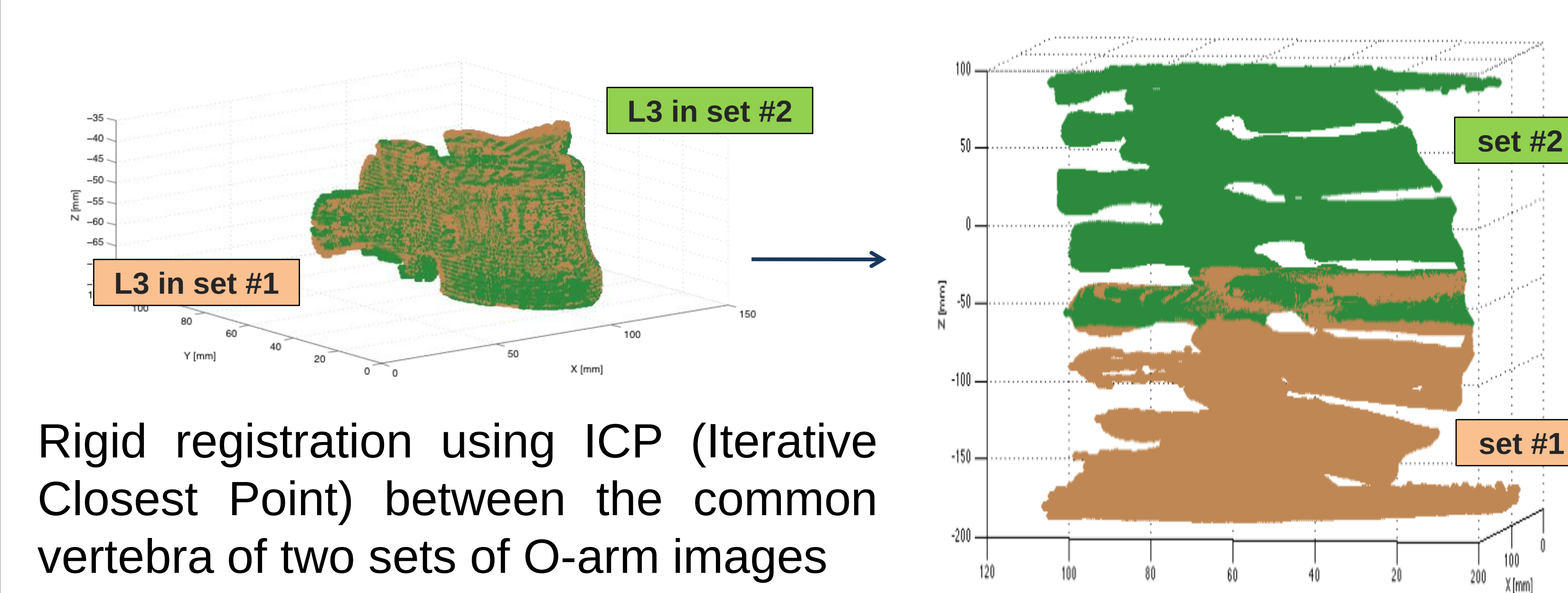
• Construction of the 3D geometric model



• Segmentation of each vertebra for registration purposes

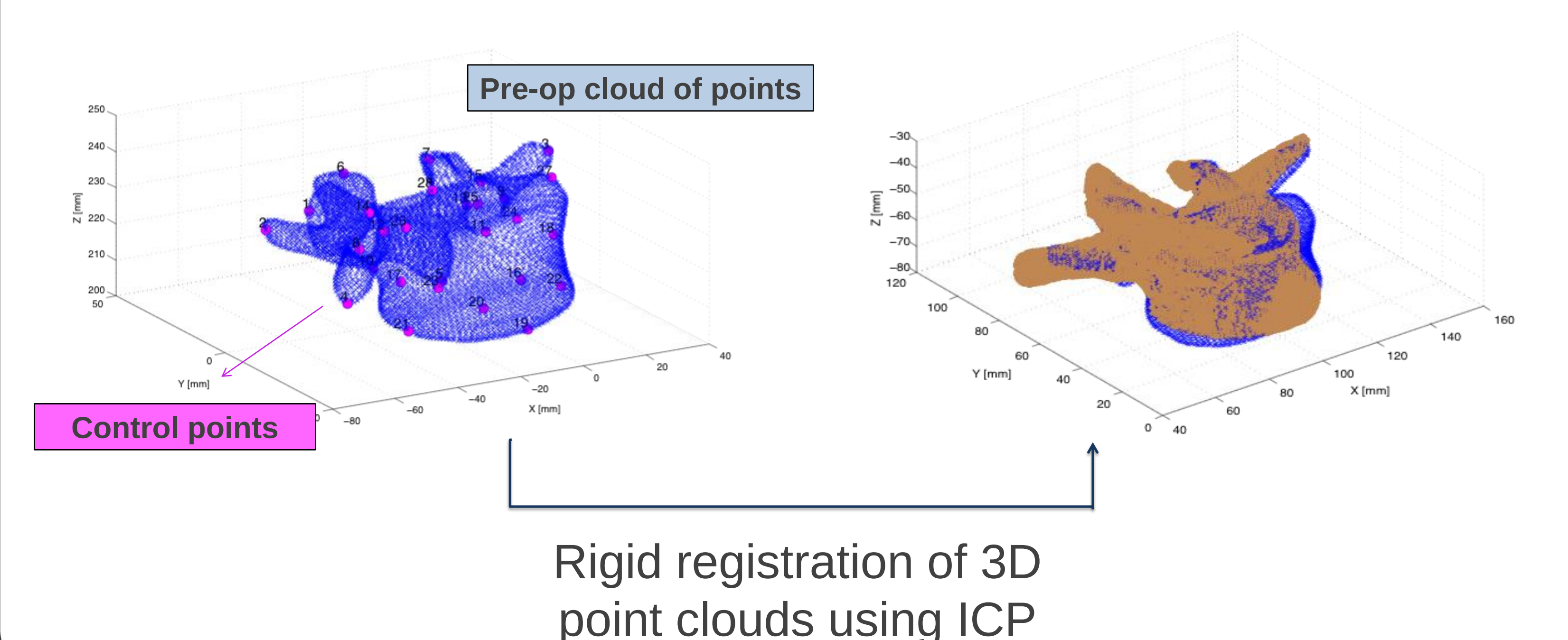


• Stitching of the sets of O-arm 3D images



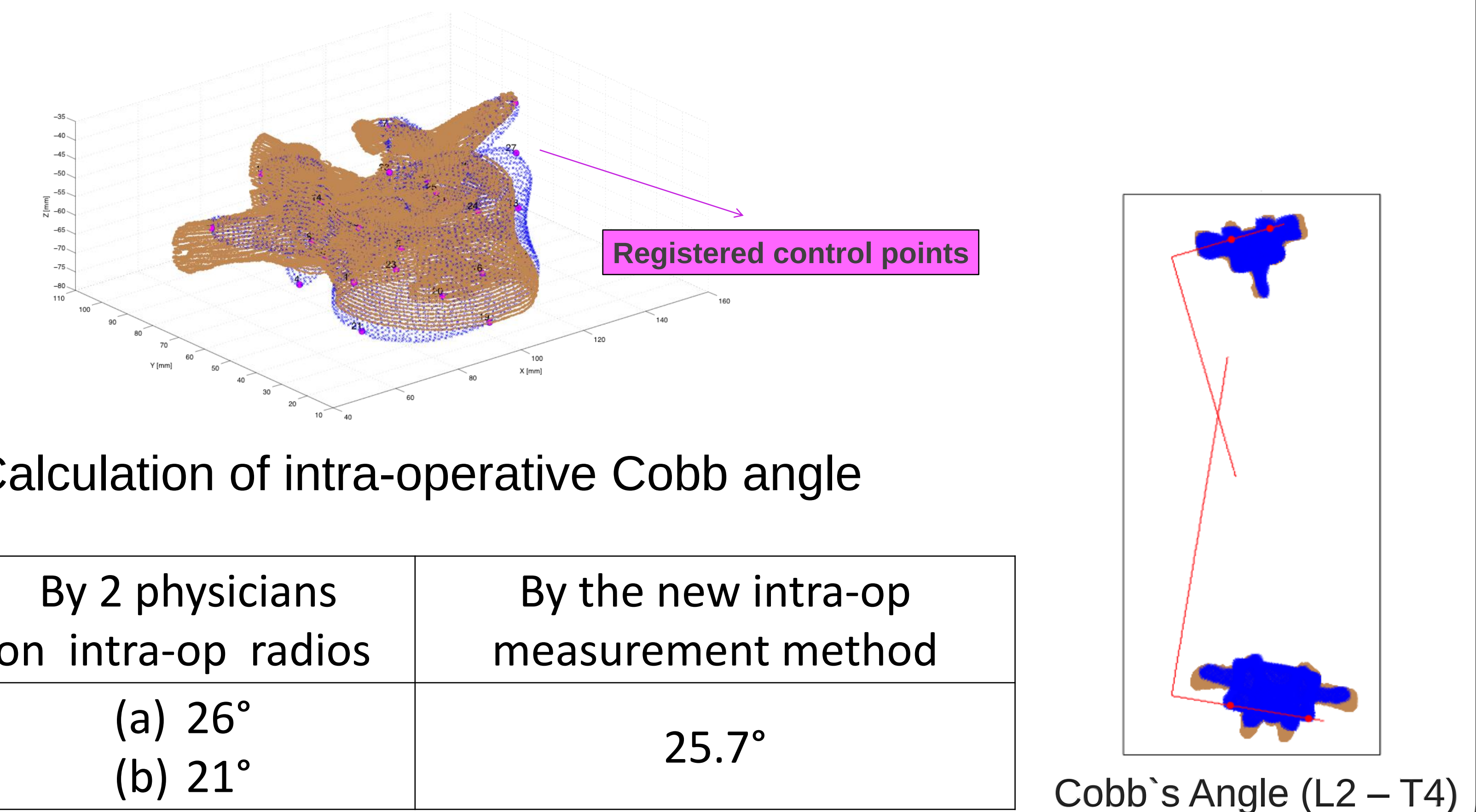
Rigid registration using ICP (Iterative Closest Point) between the common vertebra of two sets of O-arm images

• Registration between pre-op and intra-op geometric model



FIRST RESULTS

- Intra-operative 3D geometrical model accuracy ~ 1mm
- Update of the position of control points:



CONCLUSION AND PERSPECTIVES

- This work is a first step towards developing a new tool for the automatic measurement of 3D scoliotic deformities
- This intra-operative tool may be used to obtain real-time quantitative feedbacks during computer assisted surgeries.
- The imprecision of control points position can be corrected using a step of non rigid registration
- These results will have to be validated using medical images from real patients

REFERENCES

- (1) S Delorme, Y Petit, J A de Guise, H Labelle, C-É Aubin and J Dansereau (2003). Assessment of 3D Reconstruction and high resolution geometrical modeling of the human skeletal trunk from 2D radiographic images. IEEE Transactions on Biomedical Engineering. 50(8): 989-998.
- (2) Clinical Value of Image Guided Surgery for Spinal Procedures. Medtronic (Minneapolis, MN). www.medtronic.com.
- (3) C-É Aubin, H Labelle, C Chevretils, G Desroches, J Clin and A Boivin (2008). Preoperative planning simulator for spinal deformity surgeries. Spine; 33(20): 2143-2152.

ACKNOWLEDGMENTS



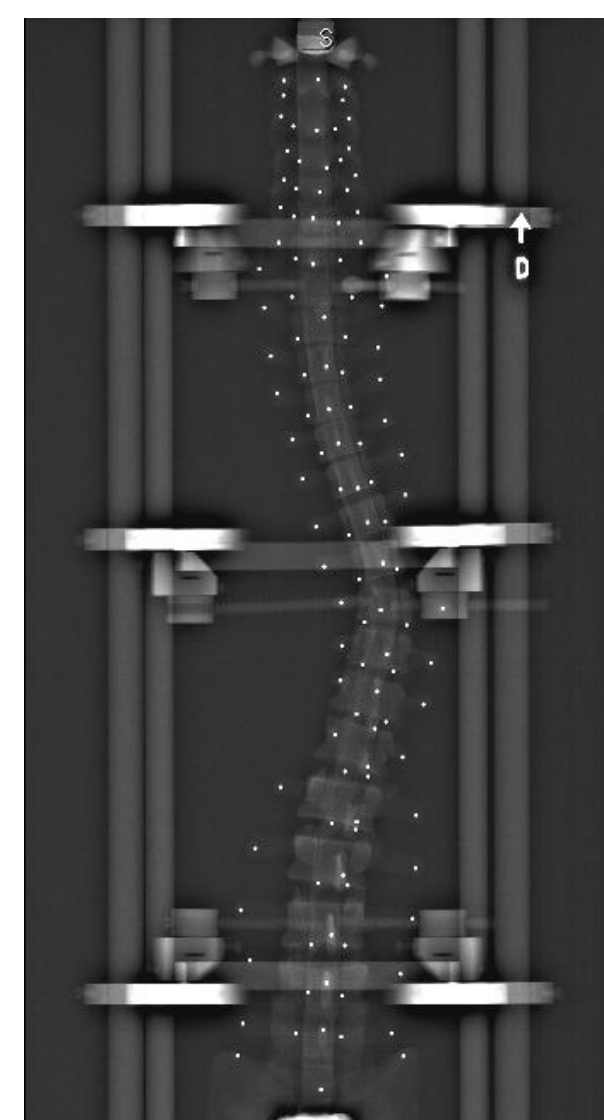
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PRE-OPERATIVE GEOMETRIC MODEL

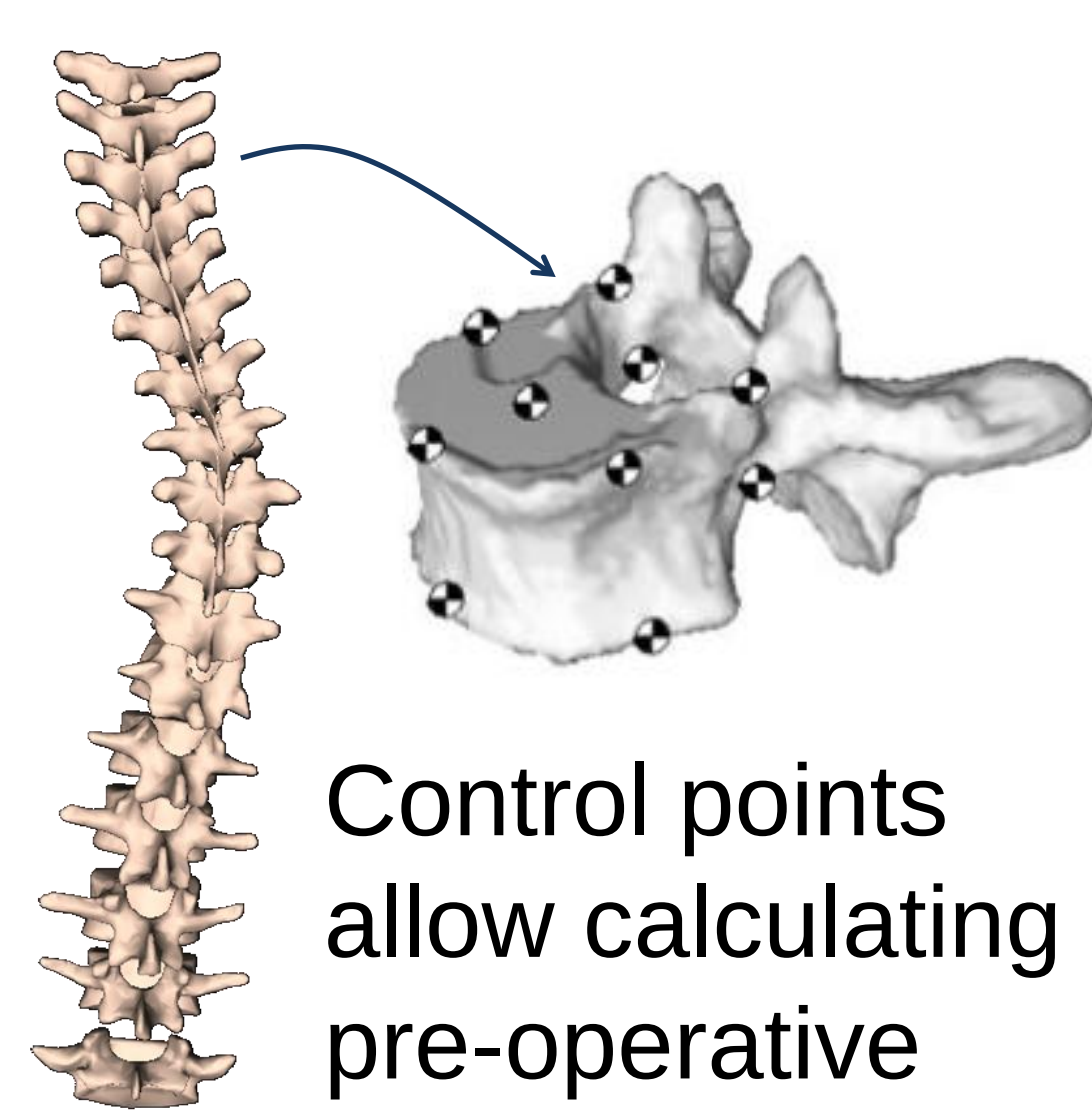
Pre-operative
standing posture



Biplanar
radiographs



3D pre-operative
geometric model



Control points
allow calculating
pre-operative
clinical indices²