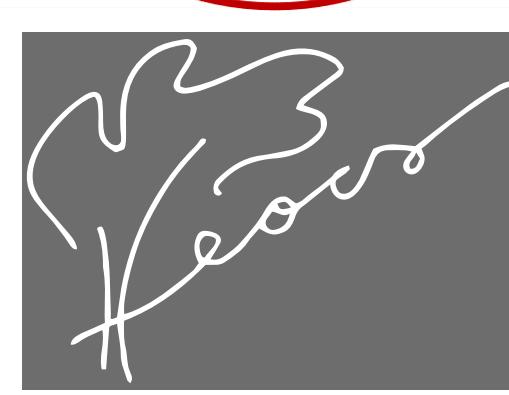
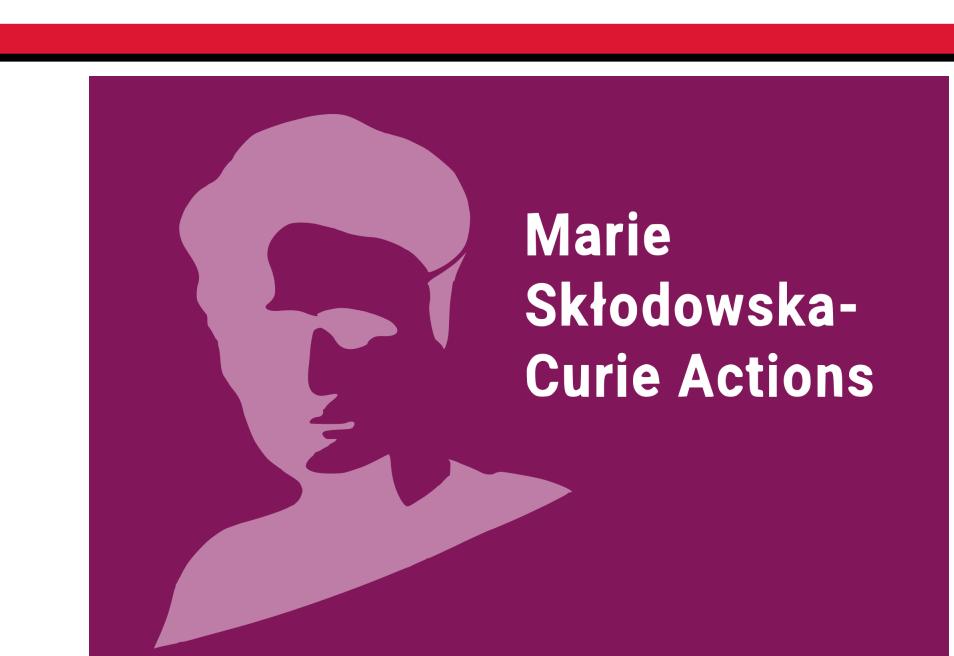
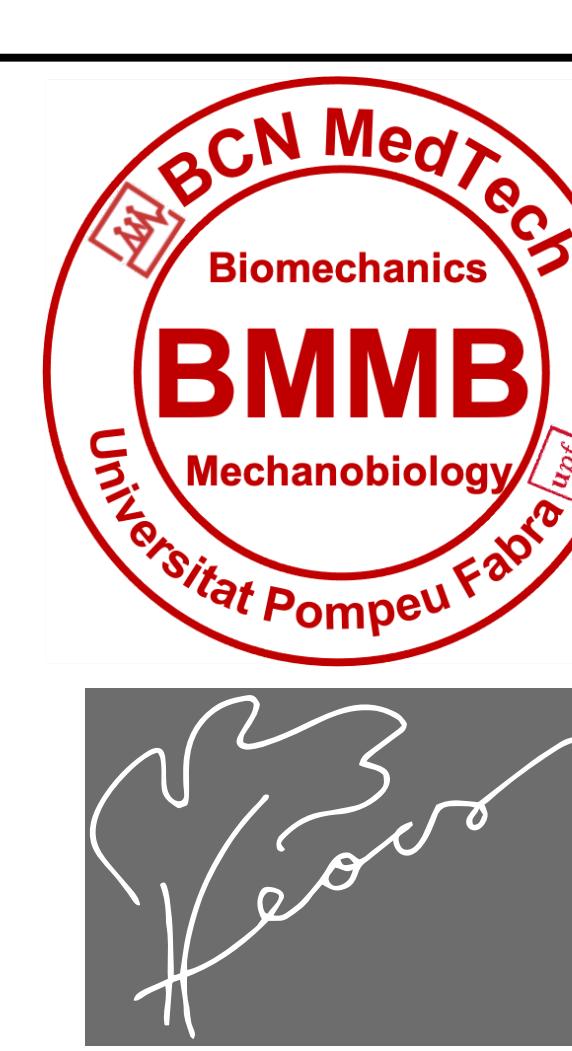


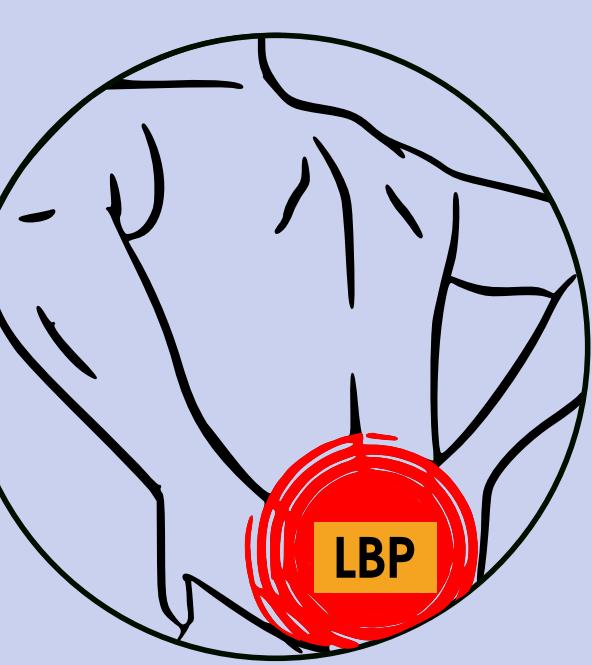
Mining of biomechanical and geometry data of IVD FE simulations

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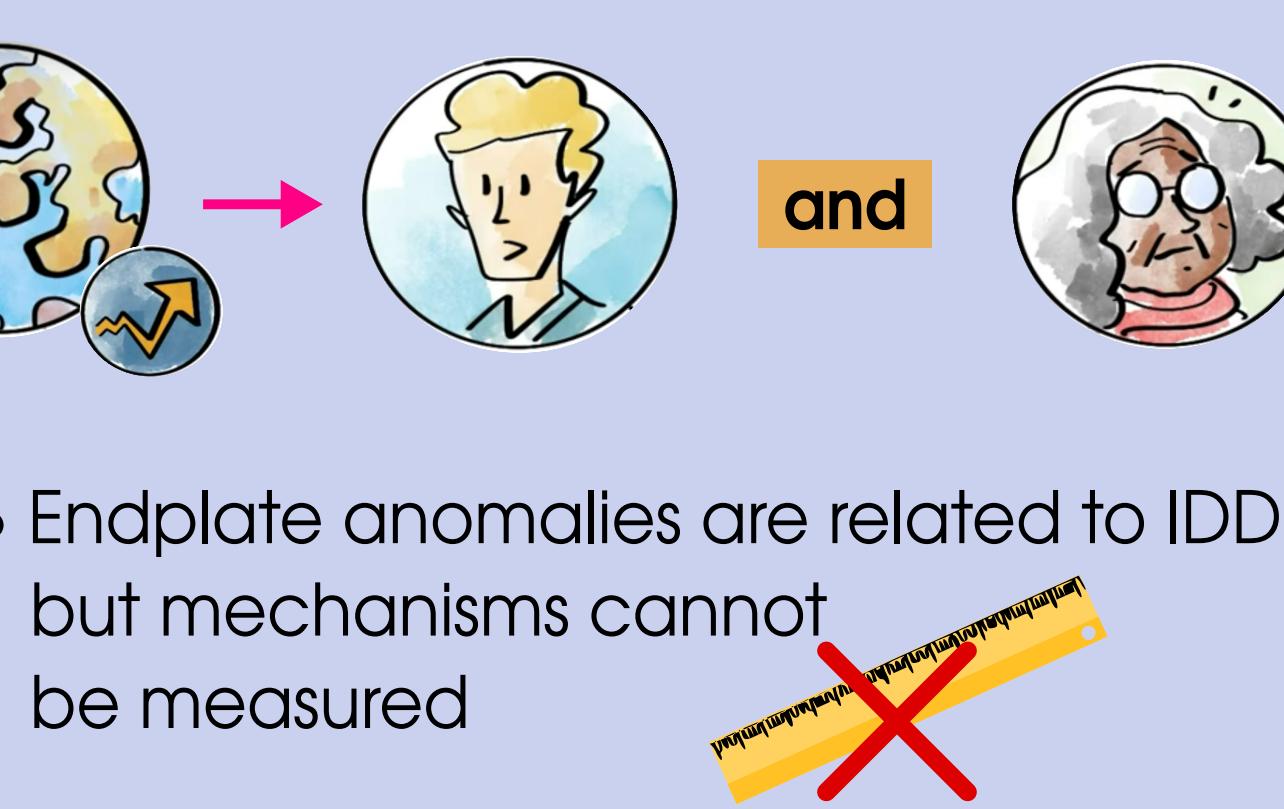
BACKGROUND



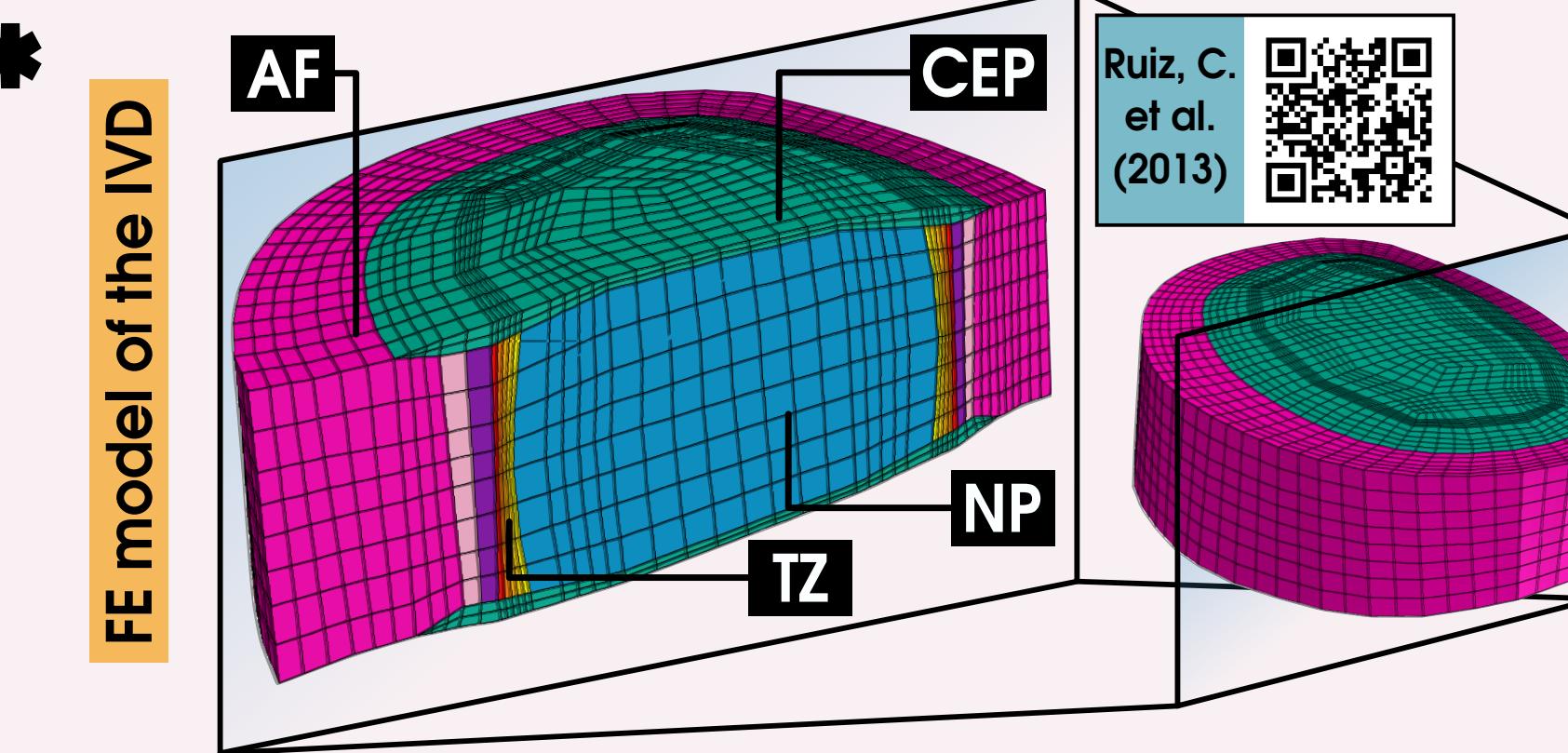
- 266 million individuals worldwide suffer degenerative disease of the spine [1]
- and
- Intervertebral disc (IVD) degeneration (IDD) is a major risk factor of low back pain (LBP)
- Endplate anomalies are related to IDD, but mechanisms cannot be measured

• Finite element (FE) simulations determine the internal multiphysics mechanisms possibly involved in IDD

• An available **FE Mesh** model was pre-calibrated and previously validated for FE simulations *



but... Simulation results depends on IVD morphology [2]



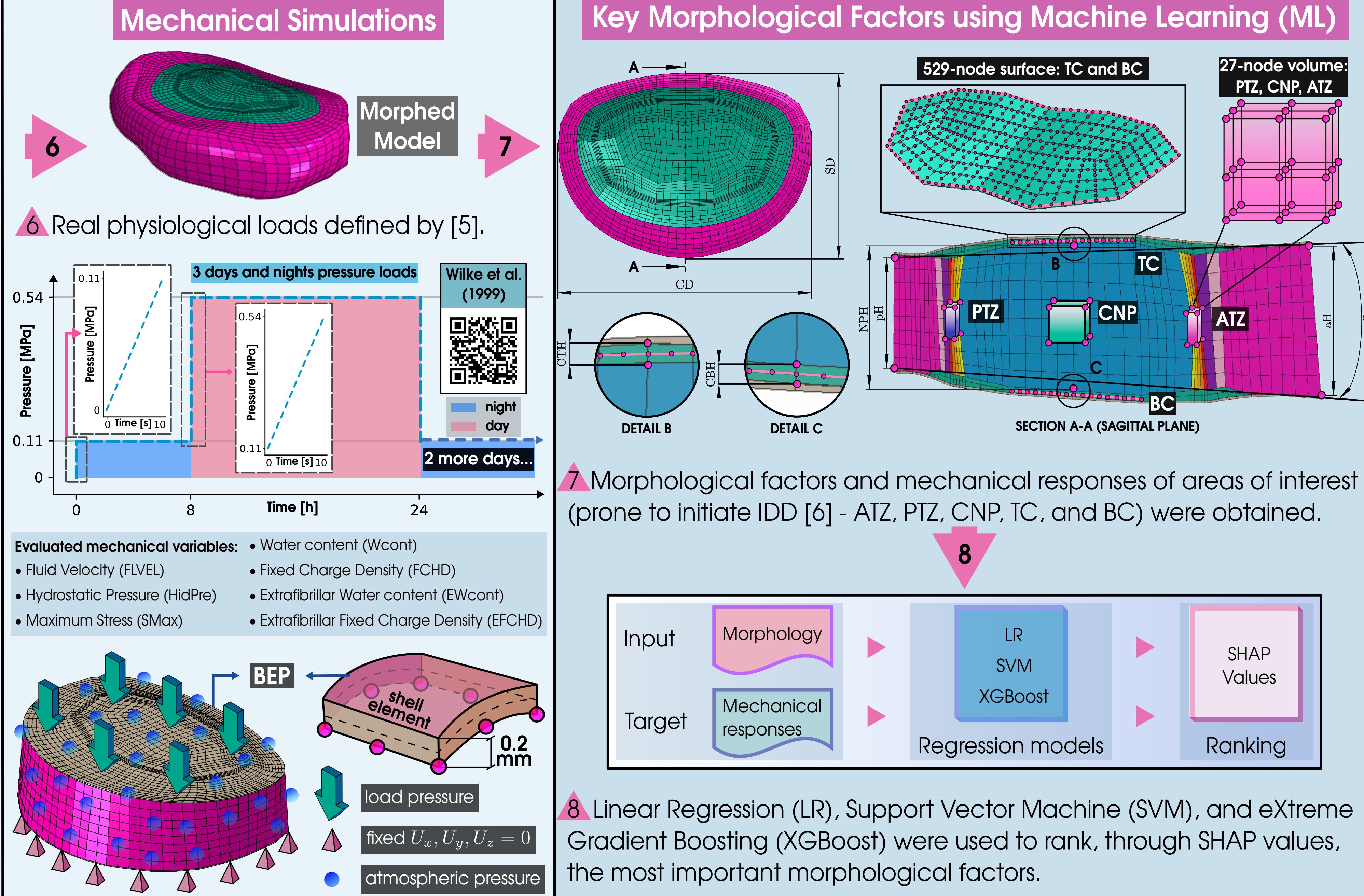
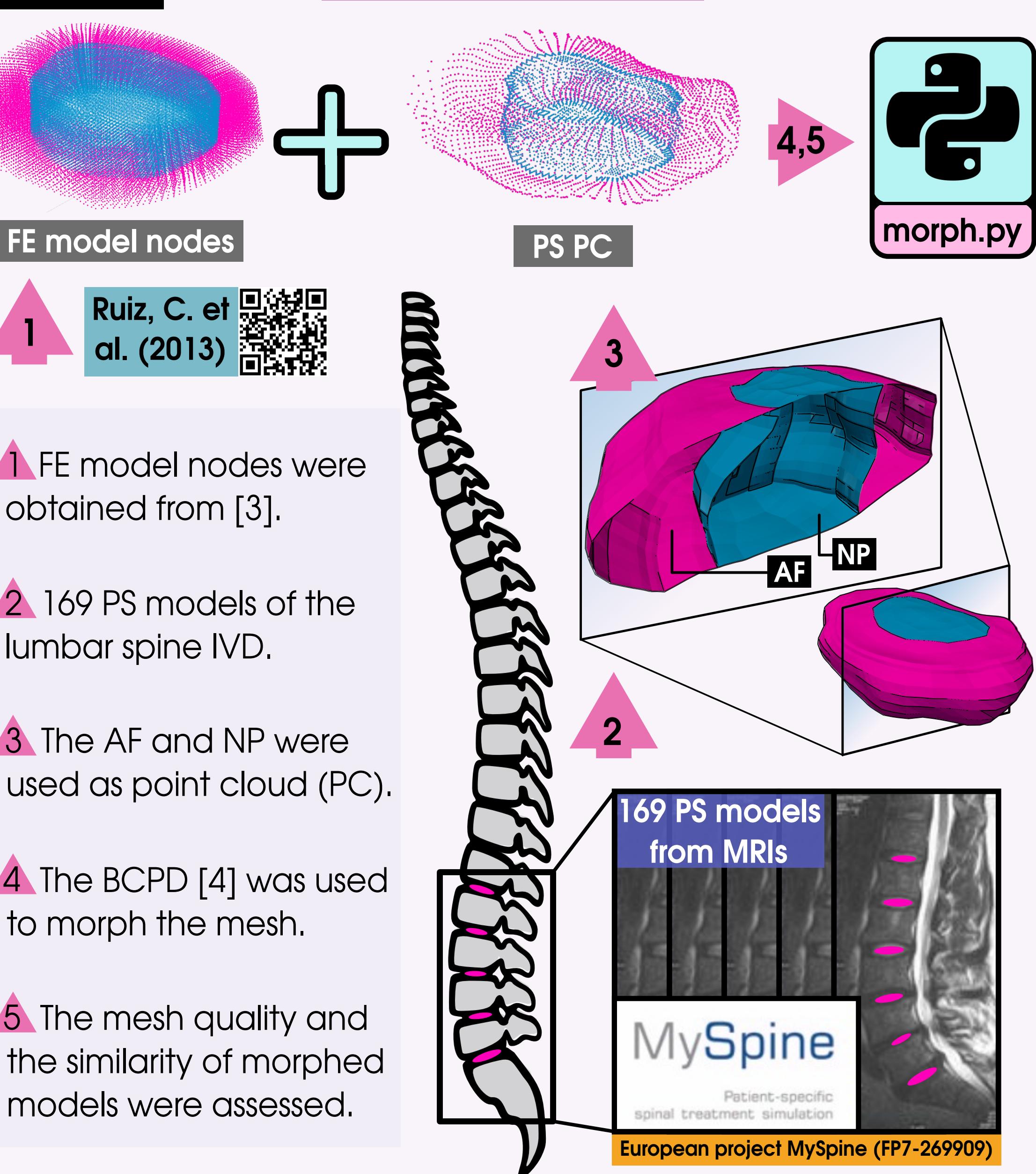
AF	anulus fibrosus
NP	nucleus pulposus
CEP	cartilage endplate
TZ	transition zone

- There is no cohort of different IVD morphologies
- We do not know whether morphology can be a risk factor for IDD
- How could we automate the process for any patient?

OBJECTIVES

- Establish a procedure and algorithms to adapt a IVD structured FE mesh to patient-specific models
- Identify the morphological features best explaining the mechanical responses to decipher their influence on IDD

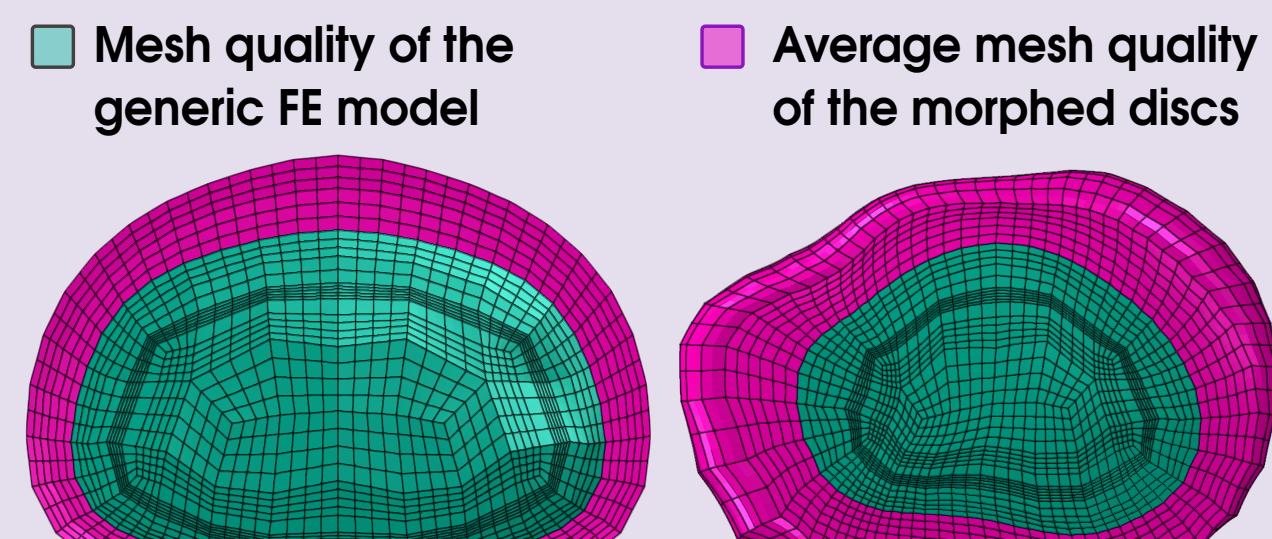
METHODS



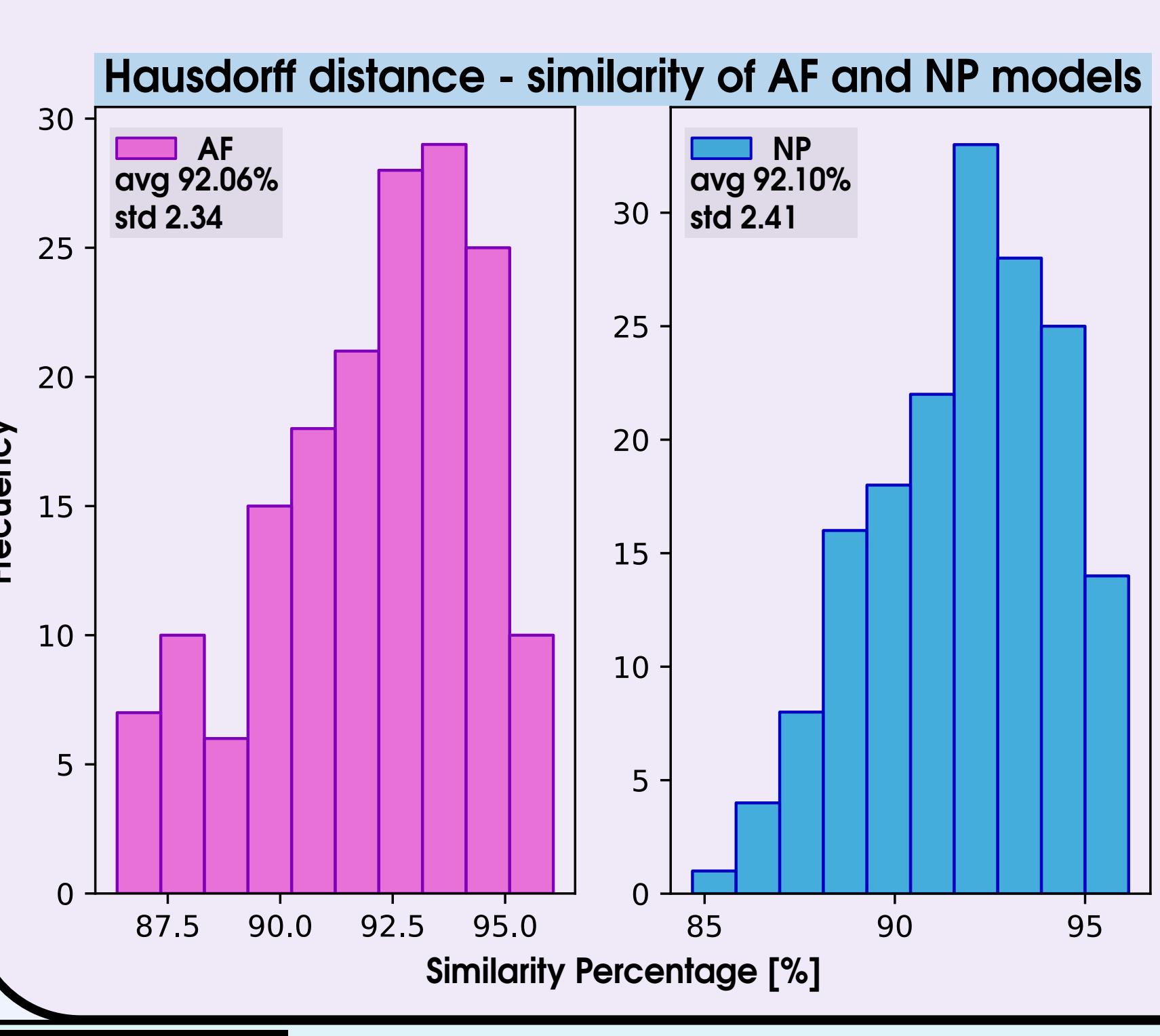
RESULTS

Morphing process

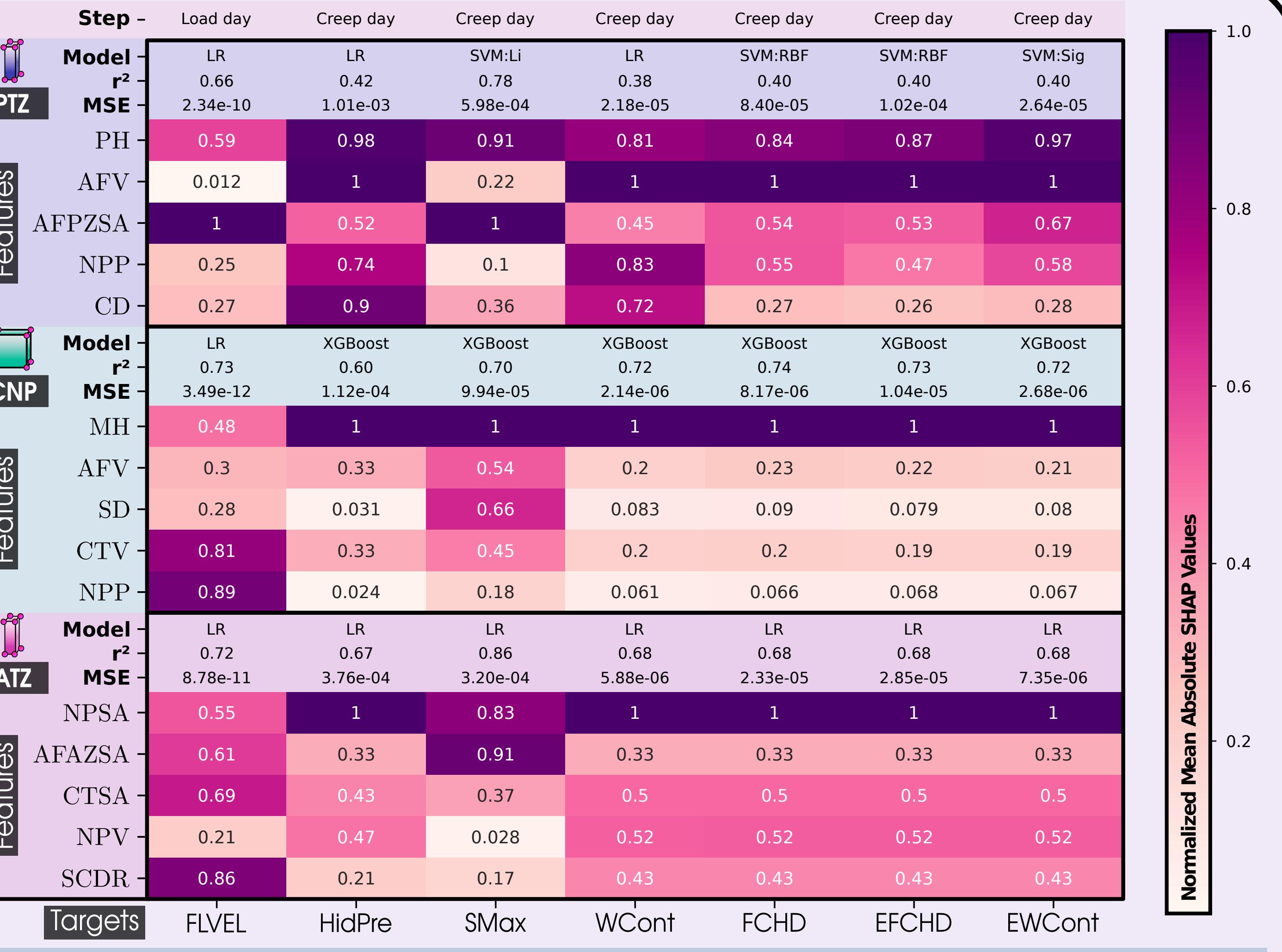
- No significant differences in mesh quality between the generic and the average of the morphed models
- The Hausdorff distance: the similarity between the PC and the FEM was about 92%



Ruiz, C. et al. (2013)
morph.py



Influence of morphology on mechanical response - PTZ CNP ATZ



- Mechanical variables affect the transport of metabolites, which regulate cell viability [7]
- The local heights strongly influence the local mechanical responses

Conclusions

An automatic morphing algorithm tool was successfully developed

PS FE simulations seem cornerstone to assess mechanoregulatory variables in critical regions

A repository of 169 IVD models has the same topology

Mechanical variables are strongly influenced by their local morphological factors and the CEP shape of the IVD

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