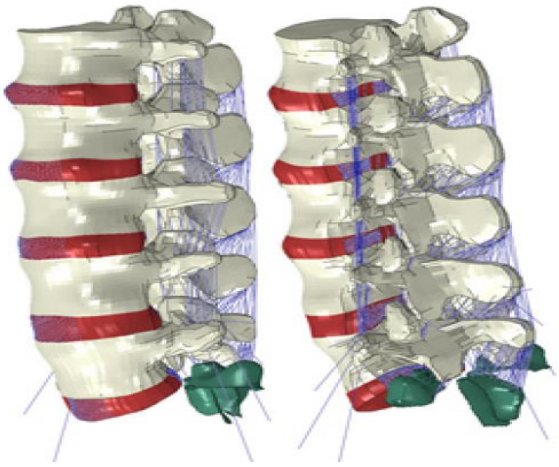
# Case Study: University of Sheffield and SIMULIA

# A New Predictive Tool for Lumbar Spine Surgery



## Testimonial

"The challenge within MySpine was always going to be the construction of a clinically usable workflow from many complex constituent components that were computationally viable. Without the use of N8HPC resources the goals of this ambitious in silico medicine project simply could not have been fulfilled."

**- Professor Damien Lacroix, Insigneo Institute for In Silico Medicine, University of Sheffield.**

## Project

N8 HPC is being used to improve the diagnosis and treatment of lower back pain, a condition that affects 80% of the active population at some point in their lives. The problem for clinicians is categorising each patient based on the severity of their spinal degeneration and then choosing which of the three categories of available therapy is most appropriate, i.e. conservative treatment, discectomy or spinal fusion. The EC funded MySpine and has developed predictive software that provides the clinician with three future scenarios, one for each treatment alternative, personalised to the anatomy and physiology of a 3D reconstruction of the patient's lower back derived from a sophisticated combination of MRI and CT scan data. Thereafter, using Abaqus software (product of Dassault Systemes Simulia Corp A Dassault Systemes Company), the three treatment possibilities are investigated using complex ageing algorithms for the vertebrae and intervertebral discs, simulations which require many hours of processing. The MySpine project centres on a comparison between the real results from a cohort of 200 patients and the results of their simulated equivalent outcomes, and must be completed to a strict schedule. Only by using N8 HPC has it been possible to meet the project's deadlines by speeding up the workflow six-fold.

## Partners

**Professor Damien Lacroix & Professor Alejandro Frangi** – University of Sheffield.
**Dr Jerome Noally** – Institute of Bioengineering of Catalonia, Spain
**Professor Kelta Iito** – Technical University of Einhoven, Netherlands
**Professor Christian Hellmich** – Technical University of Vienna, Austria
**Professor Marie-Christine Ho Ba Tho** – CNRS – University of Technology of Compiegne, France
**Dr Luis Del Rio** – CETIR, Centre Medic, Spain

## Impact

MySpine will enable clinicians to provide patients with individualised in silico-based care, offering personalised advice not only based on the patient's lower back condition, but also on age, gender, activity and morphological characteristics. The clinical predictive tool created in MySpine will provide the clinician with a quantitative understanding of the patient's condition within 24 hours and greater predictive power in selecting the optimum lumbar spine treatments based on advanced ageing algorithms implemented in a reliable decision making support system. The results from the project will also have significant industrial impact by providing a sizeable library of anatomical information against which implants manufacturers can test and improve the design of spinal implants.

## Success

The successful use of N8 HPC has been bought about by the combination of resources from two projects: MySpine itself has created the simulation system necessary to benefit from the support within Abaqus for parallelisation. Sister infrastructure project VPH-Share has provided the seamless execution facility that automates the entire clinical workflow from patient scan data all the way through to clinically relevant analytical outputs. The result is an automated computational workflow that puts optimised clinical decision support within the reach of all spinal clinicians.

MySpine
Patient-specific spinal treatment simulation

DASSAULT SYSTEMES

N8 HIGH PERFORMANCE COMPUTING

European Commission