

POST-DOCTORAL POSITION OFFER – 18 MONTHS (2025-2026)

DETERMINATION OF THE STRAIN FIELDS OF A HEAD PROTECTION HELMET DURING AN IMPACT BASED ON MEASUREMENTS FROM AN INTEGRATED “SMART” TEXTILE

Organizations	Laboratory of Applied Biomechanics / Aix-Marseille University / Amidex
Localization	Bd. P. Dramard, Faculté de Médecine secteur-Nord, 13916 Marseille cedex 20, France
Duration/ Salary	18 months / 2800 to 3200 € (gross) per month (upon experience)
Starting period	2 nd semester 2025
Keywords	Mechanics, “Smart” textiles, Protective helmet, Characterization and modeling
Collaborators	Frederic Turquier, Nicolas Bailly
Contact	frederic.turquier@univ-amu.fr

Host institution

The **Laboratory of Applied Biomechanics (LBA)** is a joint research unit of the Université Gustave Eiffel and Aix-Marseille Université, located within the Faculty of Medicine on the North Hospital-University Campus in Marseille. Its research program is based on the biomechanical modeling and simulation of the human body (Virtual Human) for health, sports, and safety applications. The laboratory's objectives include understanding trauma mechanisms to improve prevention and treatment of resulting injuries, and enhancing medical devices and associated surgical techniques. The LBA has gained international recognition and influence over the past decades (<https://lba.univ-gustave-eiffel.fr/>).

Scientific context

This postdoc research is part of the 3 year Excellence Chair program “**Innovative Materials for Human Body Applications**” funded by the A*Midex foundation and initiated in 2025 (<https://www.univ-amu.fr/fr/public/actualites/decouvrez-les-nouveaux-laureats-des-appels-projets-amidex-decembre-2024>). 5 full time equivalent researchers are planned to be recruited. More specifically, this postdoc concerns the work package dealing with the integration of instrumented textiles in head protection helmets to predict cranio-cerebral injuries in real time. Depending on the achievements, a post-doc extension could be considered.

Objective

The post-doc aims to establish, during an impact, the transfer function between the measurement of the physical quantity (electrical or optical signal) obtained by a “smart” textile integrated into a head protection helmet (figure 1) and the deformations undergone by the helmet or its parts. The available technologies best suited to the needs in terms of feasibility, spatial and temporal resolution, measurement range, and finally reliability will have to be evaluated before being deployed. A dialogue between experiments and numerical simulations will be initiated with loading conditions of increasing complexity.



Figure 1 : « Smart » textile



Figure 2 : Two wheeled helmet exemple

Main phases and deliverables

The researcher will benefit from LBA's expertise in modelling and characterizing technical textiles (multi-scale) and protective helmet. The work will include the following tasks (provisional timescale):

- Literature review (2 months)
- Experiments on systems with integrated "smart" textiles: from bare textiles subjected to quasi-static traction to 2-wheeled helmets submitted to an impact (6 months)
- Multi-scale modelling and simulation aligned with the tests (6 months)
- Establishment of the transfer function (2 months)
- Communication objective: 1 submitted article, 1 podium presentation (2 months)

Candidate profile : PhD in mechanics/biomechanics

- Solid theoretical foundation in continuum mechanics
- Skilled in modelling and simulation using the Finite Element Method (LS Dyna, Radioss, etc.)
- Aptitude for experimental work (experience in signal processing would be a plus)
- Fluent in English (minimum B2), autonomous, rigorous, and team-oriented

