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Innovative instrumentation for assessing the mechanical properties of skin

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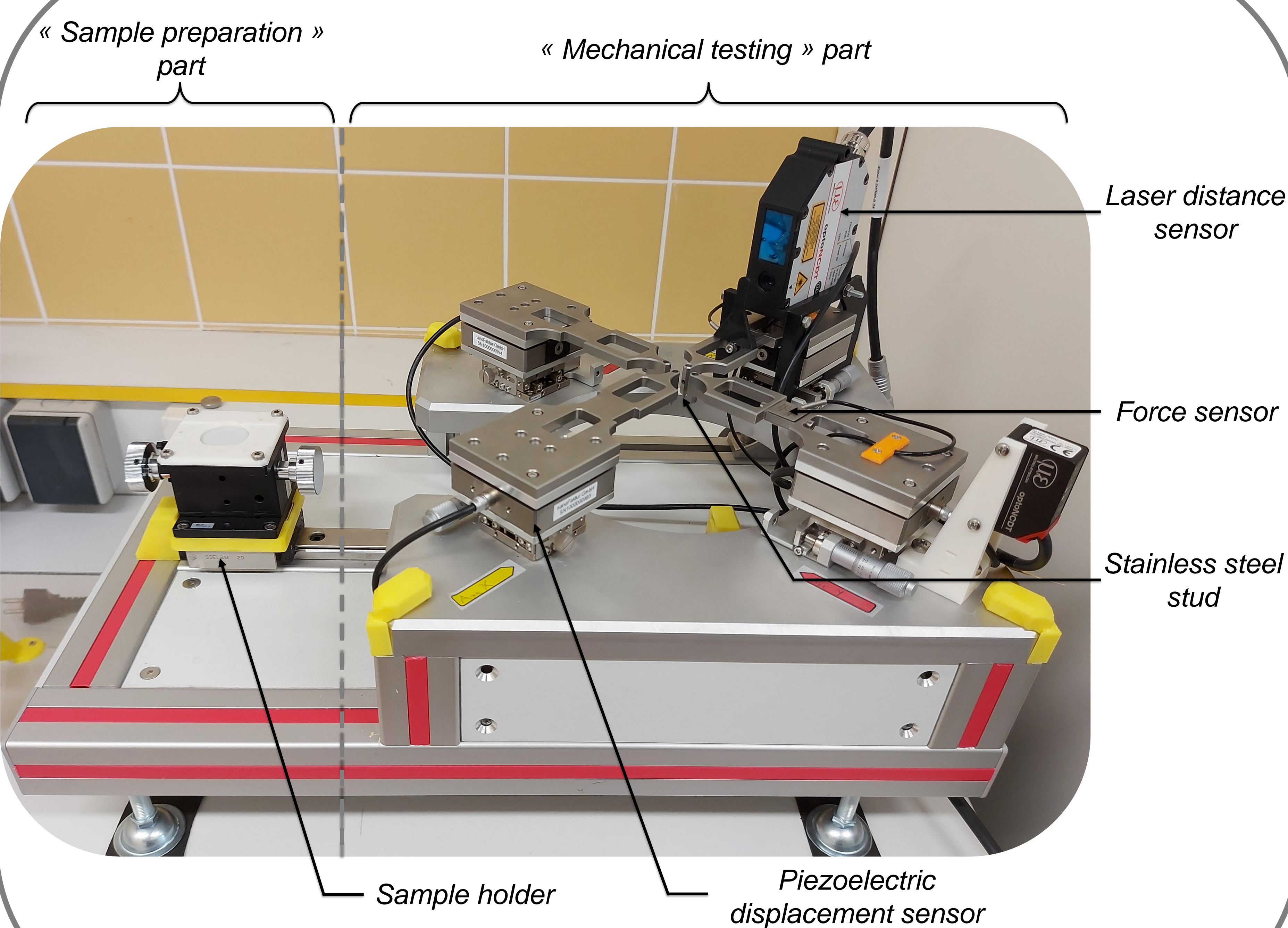
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I. Abstract

A specific instrument to evaluate the **viscoelastic properties** of human skin has been developed in this project. This **technology** combined with the use of **ex vivo human skin explants** under physiological conditions for several days, should enable to help for the development of products intended for treatments. Indeed, we propose to analyse and evaluate in an objective way:

- the effects of different **external stresses** (stretch marks, UV rays exposure, chemical exposure, air pollution, injuries, freezing, etc.)
- the effects of **medical or dermo-cosmetic products** (moisturising creams, anti-stretch mark creams, healing dressings, etc.) on the viscoelastic properties of human skin.

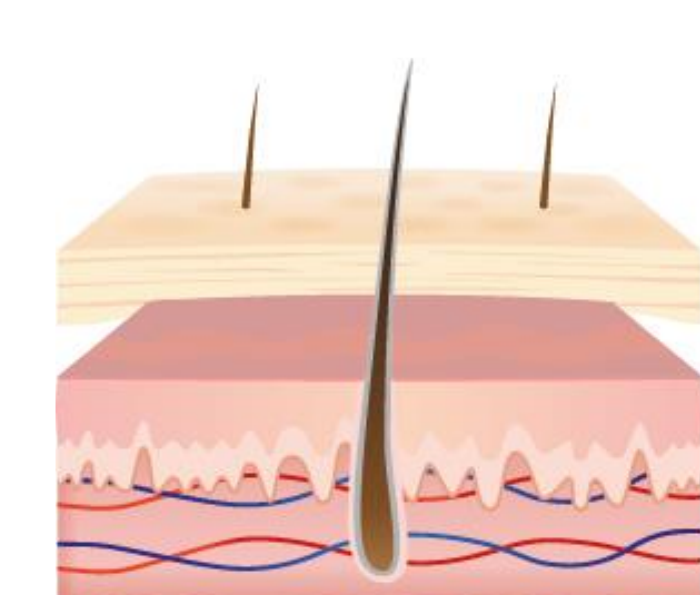
II. Instrumentation



III. Method



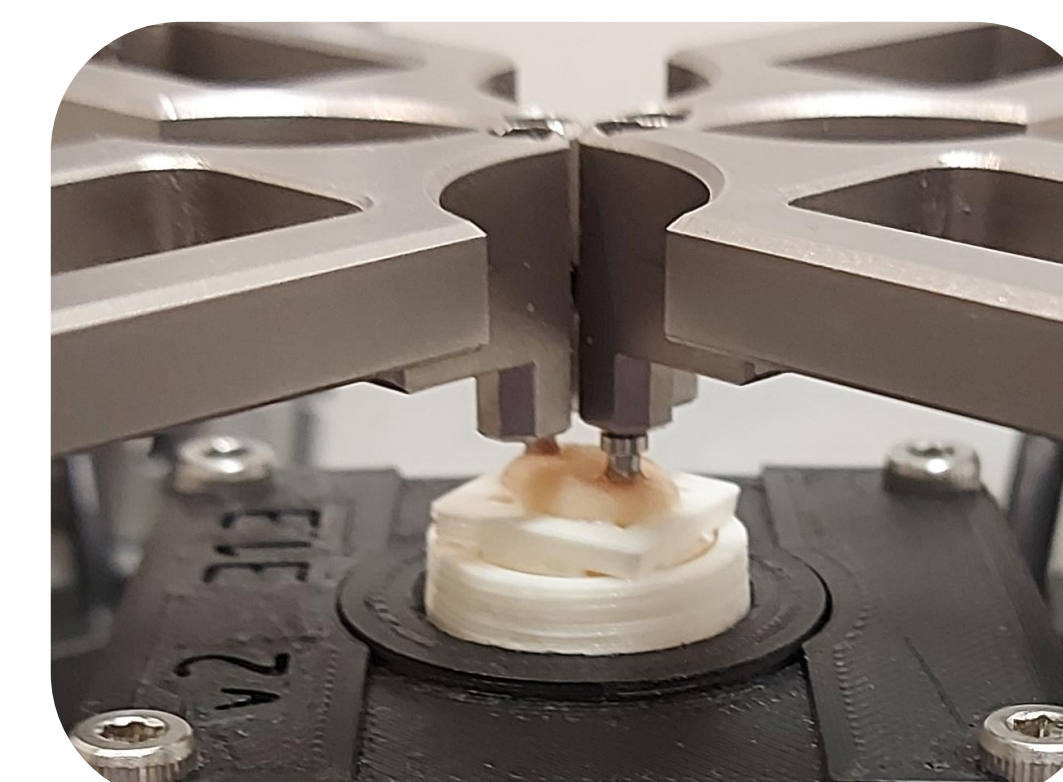
Ex vivo skin explant from BIO-EC company



Skin structure

- Skin from surgical operations.
- Skin explants kept alive for several days.

- Skin is positioned on the sample holder.
 - Holder is slid into the mechanical part of the technology.
 - Skin is glued to the arms of the technology.
- ➔ Mechanical tests can be performed

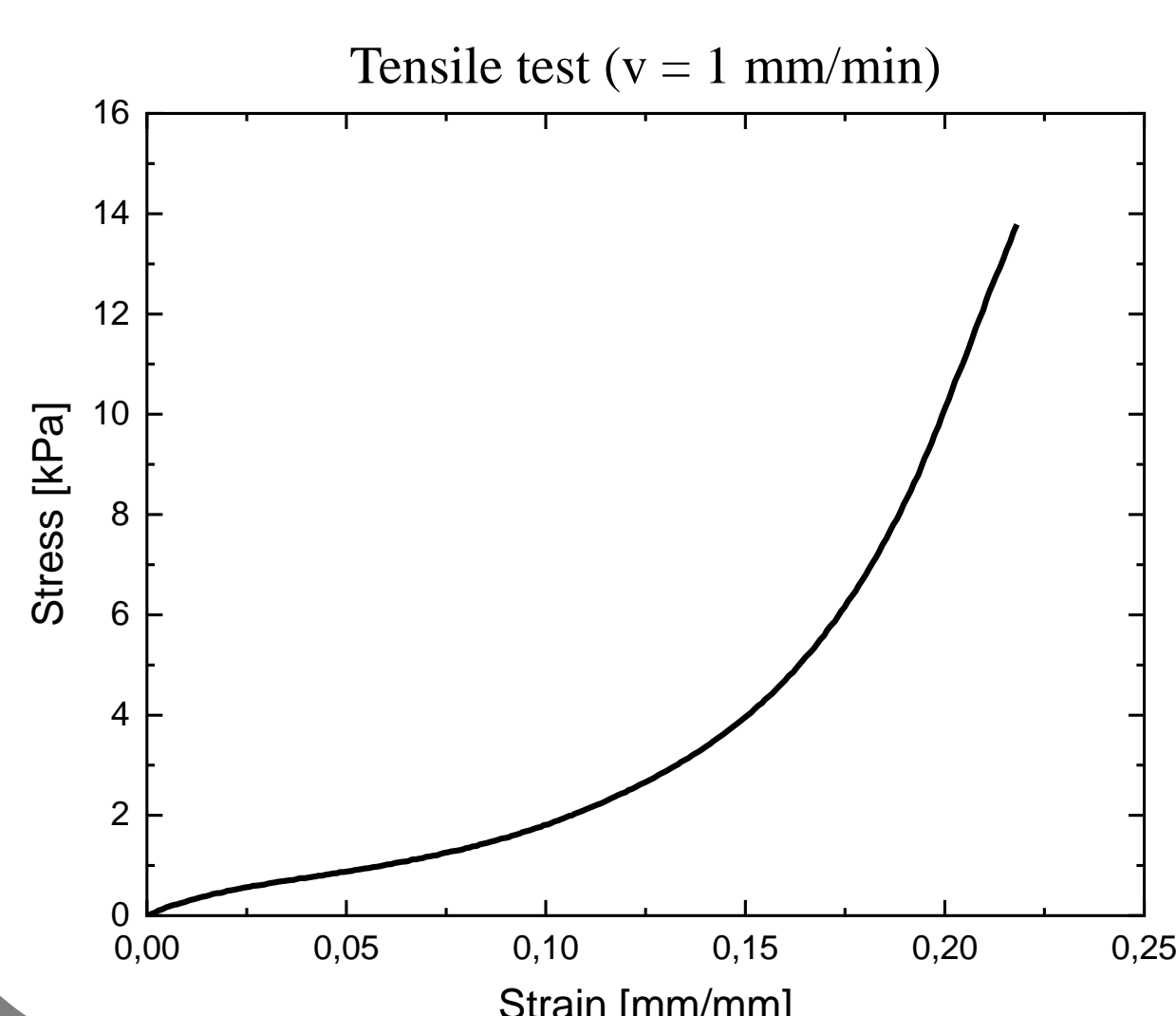


Skin explant glued to the technology

IV. Results

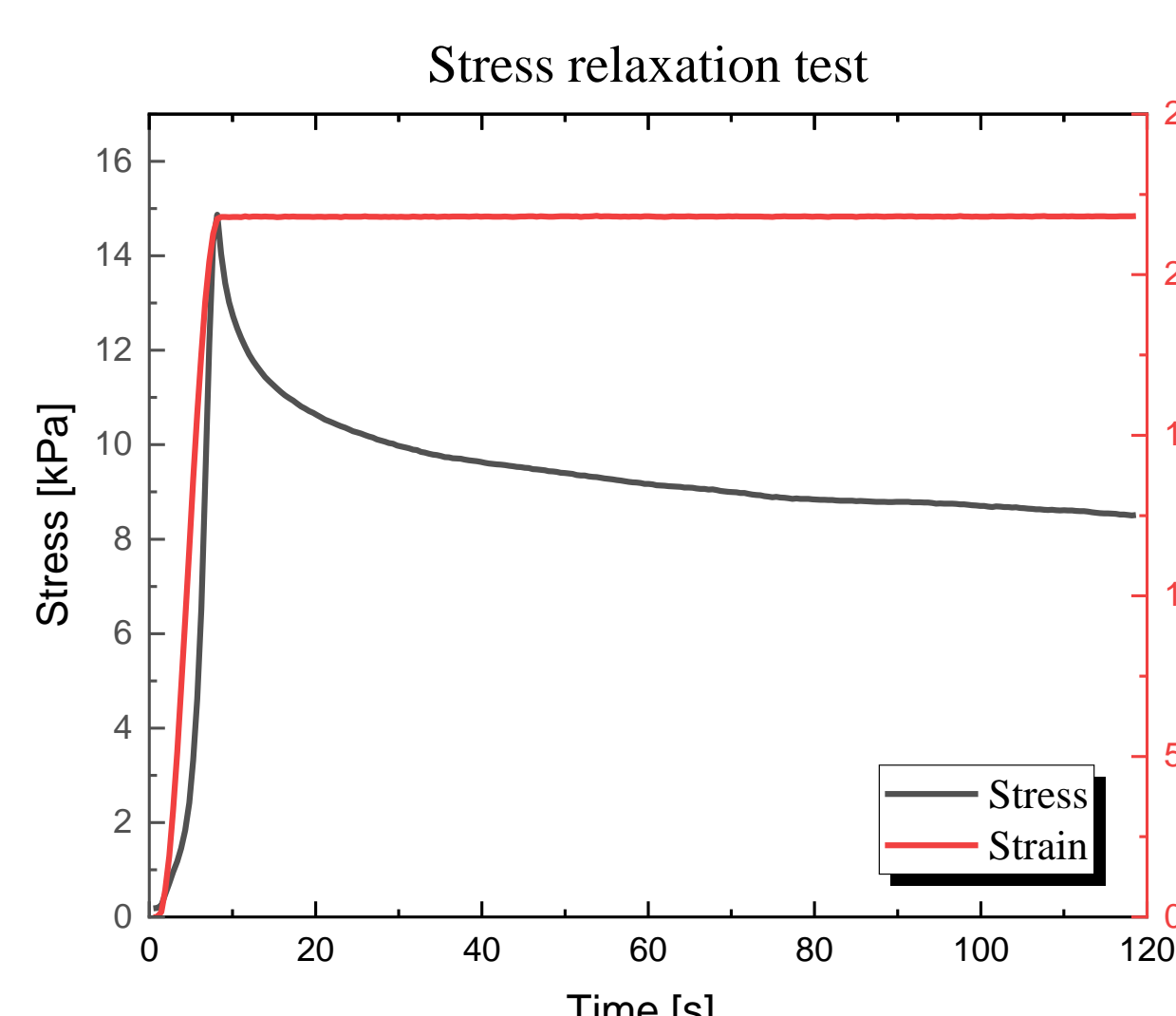
Tensile test

- ➔ Elastic behaviour of skin
- ➔ Young's modulus (E) ↔ Stiffness



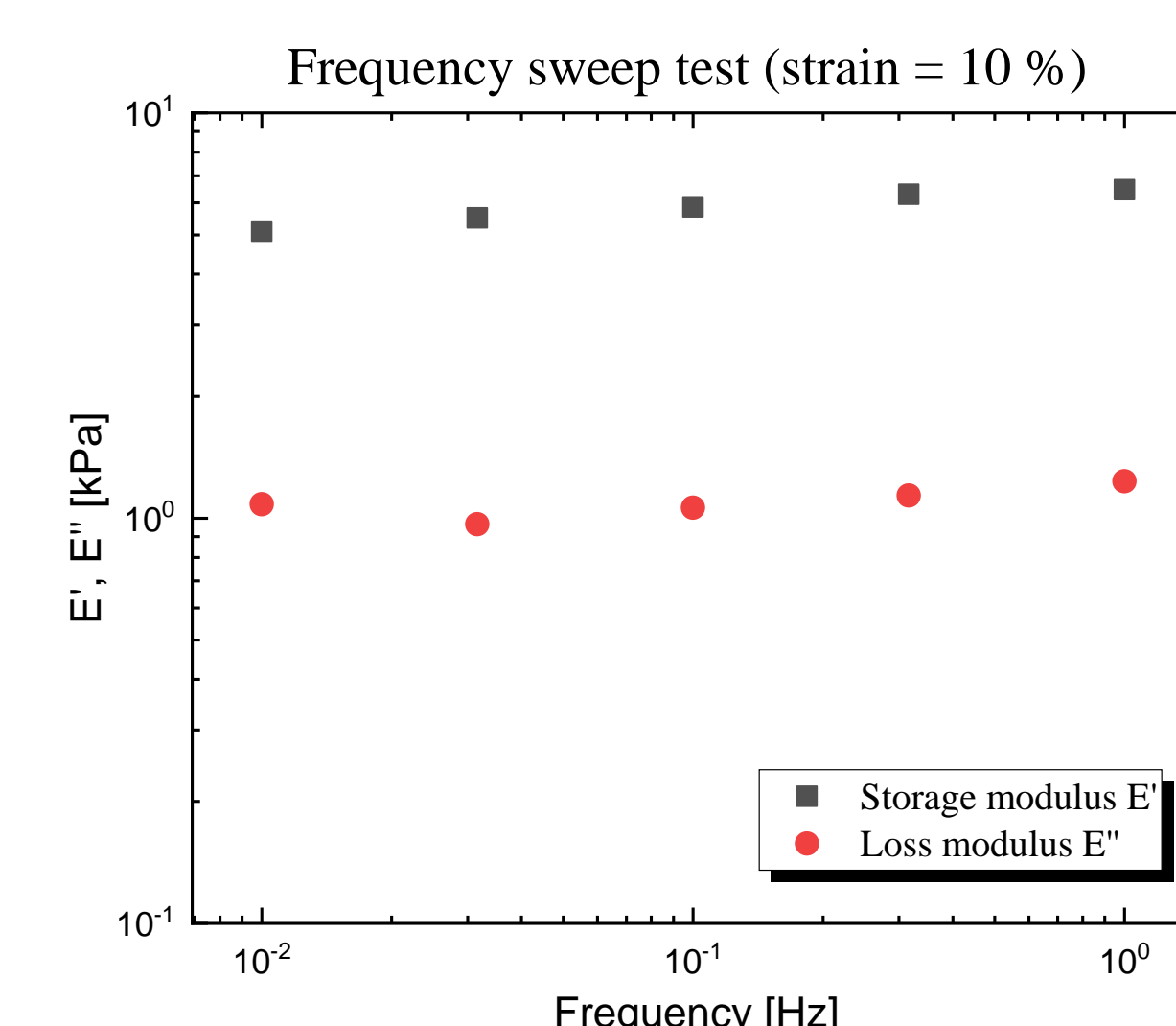
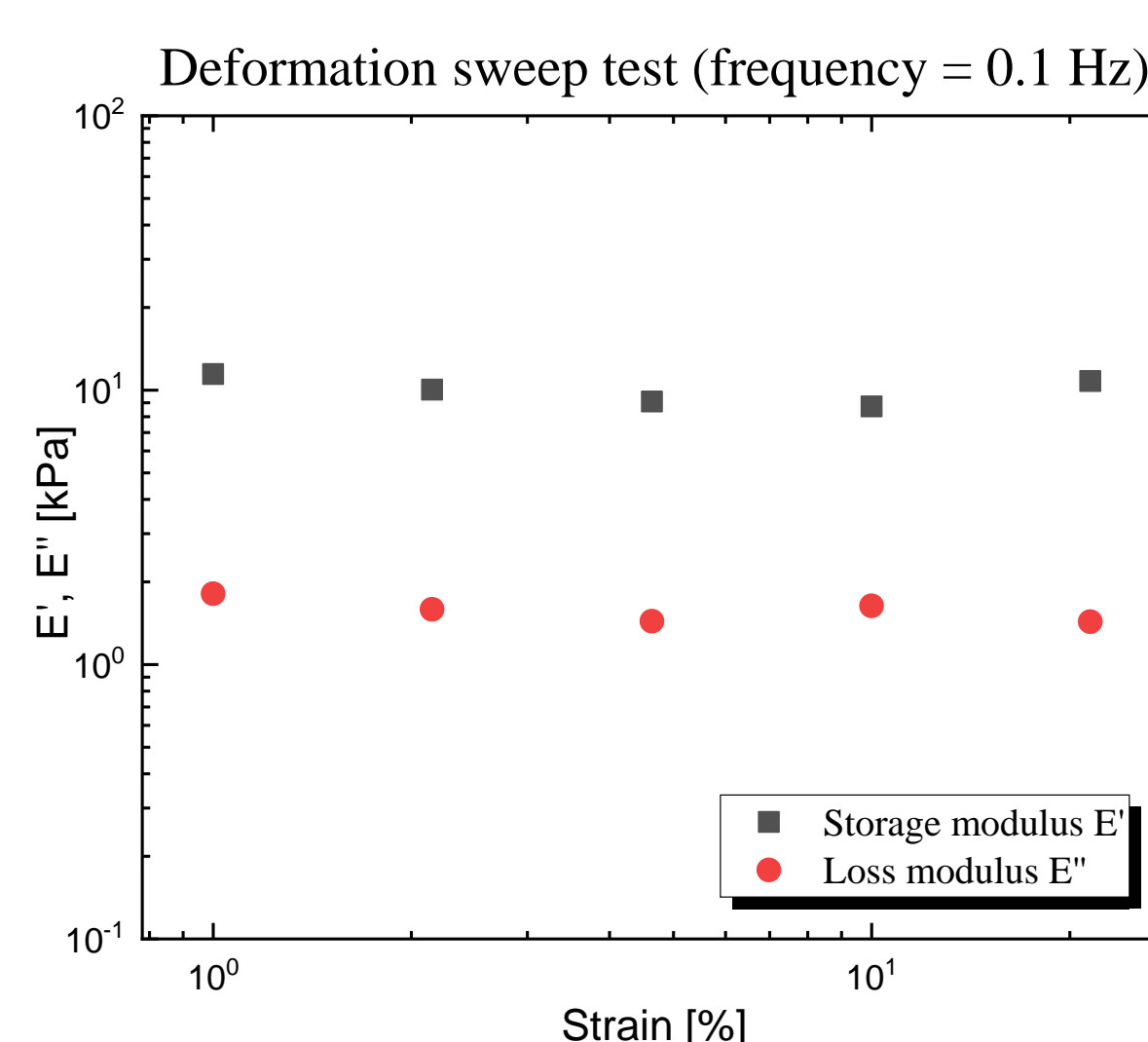
Stress relaxation test

- ➔ Viscoelastic behaviour of skin
- ➔ Relaxation modulus E(t)



Dynamic tests: Deformation sweep + Frequency sweep

- ➔ Viscoelastic behaviour of skin
- ↳ Elastic component E'
- ↳ Dissipative component E''



V. Conclusion

Progress of the project

- ✓ A **new instrumentation** to evaluate the mechanical properties of human skin has been developed.
- ✓ A **characterisation** of the mechanical properties of ex vivo human skin explants has been carried out.
- ✓ The 1st results obtained demonstrate the **device's ability** to accurately explore the mechanical properties of ex vivo human skin explants.

Perspectives & Applications

- In view of the 1st results, **continue the development** of the technology:
 - Addition of force sensors to control skin bonding pressure.
 - Possibility of adapting the technology to *in vivo* measurements.
- Evaluate the **effects of different stresses** and wound healing on the mechanical properties of human skin.

Reference

[1] Patent N°PCT/FR2021/052389



Medical & Cosmetics

