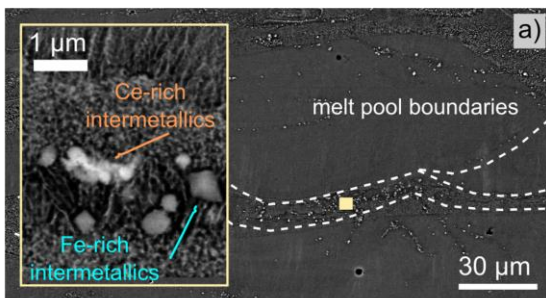


4D nano-tomography study of strain localization phenomena in iron-rich Al alloys produced by LPBF

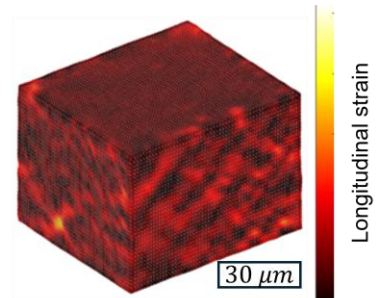
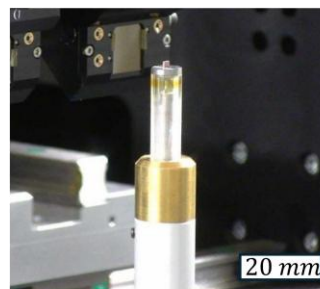
Key words. Laser-powder bed fusion, *in-situ* mechanical experiments, strain localization, Al alloys, synchrotron tomography, Digital Volume Correlation (DVC).

Context. Recent progress in additive manufacturing technologies, today mature even for metals and metallic alloys, have enabled the design and manufacturing of advanced metallic composites and alloys that combine lightweight with multifunctional properties. For example, it is possible to manufacture aircraft engine components with complex geometries (see Fig. 4 in Blakey-Milner et al., 2021) and to achieve significant (e.g., up to 40 %) weight reduction of structural components by replacing Ti with Al alloys. As a result, significant efforts have been recently devoted to improving the durability of additively manufactured metallic materials.

Objective. The goal of this internship project is to use advanced experimental techniques to study *in situ* the strain localization mechanisms of **iron-rich Al alloys produced by laser powder bed fusion -LPBF** (Arcieri et. al. 2025). The microstructure of these alloys contains a high-volume fraction of iron-rich intermetallic phases, within the Al matrix (Figure 1). To investigate the deformation mechanisms at the scale of the microstructure, the data collected during an ***in-situ* tensile test** carried out at MAX-IV (Lund, Sweden) **synchrotron facility** will be analyzed using **Digital Volume Correlation** (Hild et al., 2012). The measured 3D strain fields (Rocco et al., 2026) will be complemented with damage measurements based on microporosity evolution.



Microstructure of Fe-rich Al produced by LPBF



DVC-measured strain fields at submicrometric resolution

Figure 1. Scientific strategy to be pursued during the internship subject, relying on both synchrotron nano tomography and Digital Volume Correlation (DVC).

Resources provided:

- Iron-rich Al alloys samples produced by LPBF at Politecnico di Torino ([DISAT Dipartimento Scienza Applicata e Tecnologia](#));
- Image correlation codes and image processing software available within the Eikologie team at LMPS (<https://lmeps.ens-paris-saclay.fr/en/ro2-eikology>);
- Tomographic data collected during an *in-situ* experimental campaign carried out at MAX-IV (Lund, Sweden) ([MAX IV – Main - MAX IV](#));

Useful Information:

	Internship's duration: 6 months starting from Jan. 2027
	Laboratoire de Mécanique Paris Saclay (LMPS), Université Paris Saclay, CentraleSupélec, ENS Paris-Saclay, CNRS.
Supervisors:	Prof. Diego Manfredi (Associate Professor, Politecnico di Torino) and Prof. Gabriella Tarantino (Associate Professor, LMPS).
Scholarship	600 €/month + transport card

Application :

Interested candidates are asked to send their **CV + MSc academic track record** (relevé de notes M1+M2) at:

- Prof. Gabriella Tarantino (gabriella.tarantino@centralesupelec.fr) and
- Prof. Diego Manfredi (diego.manfredi@polito.it)

References :

B. Blakey-Milner et al. Metal additive manufacturing in aerospace: A review. *Materials & Design* 209 (2021): 110008. <https://doi.org/10.1016/j.matdes.2021.110008>

N. Arcieri et al. "Al-Fe-Ce alloy processed by laser powder bed fusion: microstructure and mechanical characterization." *Materials Science and Engineering: A* (2025): 149252. <https://doi.org/10.1016/j.msea.2025.149252>

F. Hild et al., 2012, Digital Image Correlation. In: Optical Methods for Solid Mechanics. A Full-Field Approach, P. Rastogi and E. Hack, eds. (Wiley-VCH, Weinheim, Germany), pp. 183-228.

A. Rocco et al. "Microporosity as key driver of the in-situ properties of a LPBF-AlSi10Mg mesoporous metamaterial." *Journal of the Mechanics and Physics of Solids* (2026): 106665. <https://doi.org/10.1016/j.jmps.2026.106665>