



**Master Internship position at the Center for Biomedical and Healthcare Engineering,
Mines Saint-Etienne – Laboratoire SAINBIOSE INSERM UMR 1059**

CHARACTERIZATION OF THE HEMODYNAMICS IN THE LEFT ATRIUM VIA 4D FLOW MRI

Keywords: 4D flow MRI, Hemodynamics, Left Atrium

Academic context: The research group at Mines Saint-Etienne leads major international research projects in the domain of soft tissue and fluid biomechanics in the cardiovascular system through a longstanding collaboration with the University Hospital in Saint-Etienne. This internship is part of a larger collaborative project between Mines Saint-Etienne, the University Hospital of Saint-Etienne and the University of Washington, Seattle (ANR JCJC – Bacardyn).

Scientific context: The biomechanics of the Left Atrium (LA) represents an important gap in the understanding of different cardiovascular pathologies. Recently, atrial cardiomyopathy was defined as any electrical, structural and/or mechanical dysfunctions of the left atrium. Structural and electrical changes in the LA are interconnected and will directly impact the hemodynamics in the cavity. The major risk is that the modification of the hemodynamics in the LA results in thrombogenic flow patterns. The goal of the project is to understand how the modification in the structure of the LA wall impacts the hemodynamics in the LA. For this, the biomechanics of the LA, both from a structure and fluid point of view, will be characterized.

The internship project will focus on one of these aspects: the hemodynamics in the left atrium. It aims at developing a methodology for the characterization of intra-atrial flow patterns from 4D flow MRI.

Project summary: Our group has previously developed methods to derive metrics from flow fields in cardiovascular applications. This project will start by developing an approach for the segmentation of the 4D flow MRI data, first starting with a static mask and then tracking the volume change across the cycle. Finally, the velocity fields will be analyzed and specific metrics will be derived to assess the left atrium function and potential thrombogenic risk. The work involves the combination of medical image processing and fluid mechanics. It will be performed in close collaboration with radiologists from the University Hospital of Saint-Etienne.

Student profile: Background in image processing, signal processing and/or fluid mechanics. Curiosity for biomedical applications.

Administrative aspects: This internship is funded for 6 months, starting in the spring of 2025 (possible start at the fall of 2025 as well).

If you are interested, send a curriculum vitae and a short cover letter describing potential previous research experience and interests. Please, submit via email with "LA 4D MRI internship" on the subject line to Fanette Chassagne, PhD (fanette.chassagne@emse.fr).