Institur Pascal Axe M3G Team Plasma

Thesis supervisor: S. Menecier, *sebastien.menecier@uca.fr*
Co-supervisor : F. Perisse, *frederic.perisse@uca.fr,* J. Roche

Development of an Embedded Cold Plasma System for Sustainable Agriculture

CONTEXT & BACKGROUND

Modern agriculture faces a major challenge: reducing the use of chemical inputs (fertilisers, pesticides) while maintaining high yields in the context of climate change. Atmospheric-pressure cold plasma is emerging as a promising ecological solution: it stimulates seed germination, enhances plant growth and decontaminates seeds through the action of reactive oxygen and nitrogen species (RONS).

The transition from laboratory devices to field applications represents the key technological barrier this project aims to overcome: moving from large, fixed systems to compact, autonomous, and embedded ones.

PhD OBJECTIVES

The thesis aims to design, optimise, and validate a cold plasma generator prototype suitable for integration onto agricultural machinery (robots, seed drills), structured around three main axes:

- Design and miniaturisation of high-voltage power electronics supply (in collaboration with ISI Électronique)
- Physical characterisation of the plasma: electrical diagnostics (V(t), I(t)) and optical emission spectroscopy (OES)
- Agronomic validation: impact on germination, seedling emergence and plant physiology (in collaboration with GDEC)

PLANNED TIMELINE

- Year 1 – Literature review, specifications definition, design of miniaturised high-voltage power supply schematics
- Year 2 – Prototype fabrication, laboratory physical characterisation, energy optimisation
- Year 3 – Field-like testing campaigns on plant material with GDEC, results dissemination

CANDIDATE PROFILE

Required qualifications

- MSc or engineering degree in Electrical Engineering, Power Electronics, or a related field

Skills & qualities valued

- Strong background in power electronics and/or plasma physics
- Interest in life sciences and agronomy
- Enthusiasm for experimental and interdisciplinary research
- Ability to work with diverse industrial and academic partners

Contact person : Frédéric Perisse, frédéric.perisse@uca.fr