



**HAL**  
open science

## Interekt (INTERactive Exploration of Kinematics and Tropisms) : logiciel dédié au phénotypage semi-automatique de la croissance et/ou des mouvements tropiques d'organes de plantes

Félix Hartmann, Hugo Chauvet-Thiry, Bastien Pouget, Nicole Brunel-Michac, Jérôme Franchel, Bruno Moulia, Valérie Legué

### ► To cite this version:

Félix Hartmann, Hugo Chauvet-Thiry, Bastien Pouget, Nicole Brunel-Michac, Jérôme Franchel, et al.. Interekt (INTERactive Exploration of Kinematics and Tropisms) : logiciel dédié au phénotypage semi-automatique de la croissance et/ou des mouvements tropiques d'organes de plantes. 1eres rencontres du réseau Rhizophiles-INRAE, INRAE, Nov 2024, Dijon, France. hal-04906257

**HAL Id: hal-04906257**

**<https://uca.hal.science/hal-04906257v1>**

Submitted on 22 Jan 2025

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

# INTERactive Exploration of Kinematics and Tropisms

**F. Hartmann , H. Chauvet-Thiry,**  
B. Pouget,  
N. Brunel-Michac, J. Franchel, B. Moulia and V. Legué



**Téléchargeable :**

<https://forgemia.inra.fr/felix.hartmann/interekt>

Methods for a Quantitative Comparison of Gravitropism and Posture Control Over a Wide Range of Herbaceous and Woody Species. In *Plant Gravitropism*, Humana, New York.

Hartmann F.P., Chauvet-Thiry H. *et al.*, 2022.

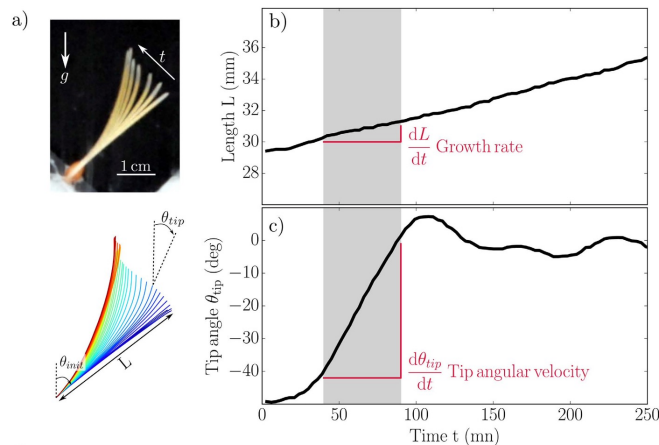
<https://hal.inrae.fr/hal-03400916>



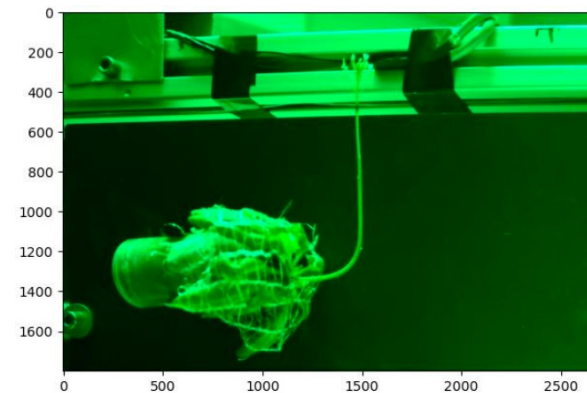
# Quelques mots sur la genèse du logiciel

\* **Compréhension des mécanismes de réponse gravitropique et de proprioception** : Difficulté de définir des mesures quantitatives en vue de la comparaison des réponses (espèces, phénotypes)

- Nécessité de définir une méthode d'analyse : orientation, la courbure et la croissance
- Analyse d'images
  - Intégration dans un modèle

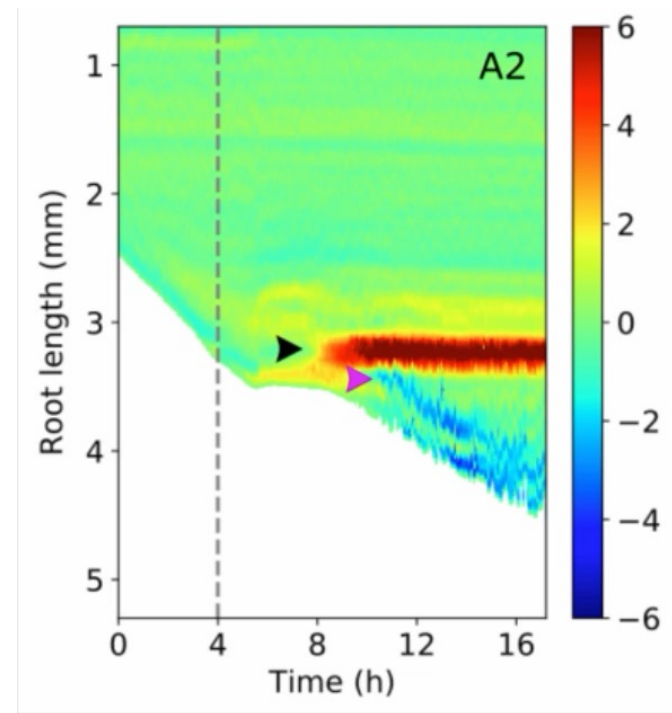
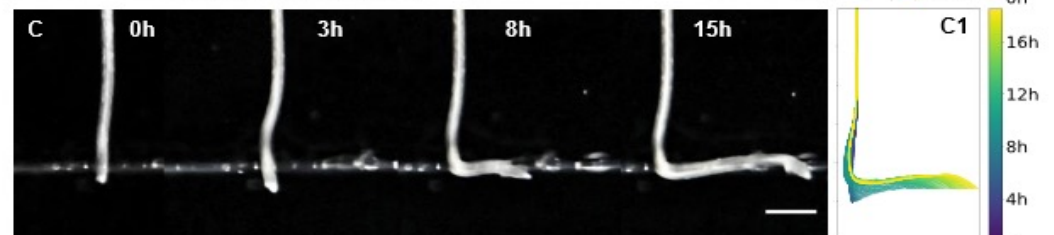


Chauvet et al., 2016



Hartmann et al., 2021

# \* Réponse des racines à un changement d'impédance du milieu

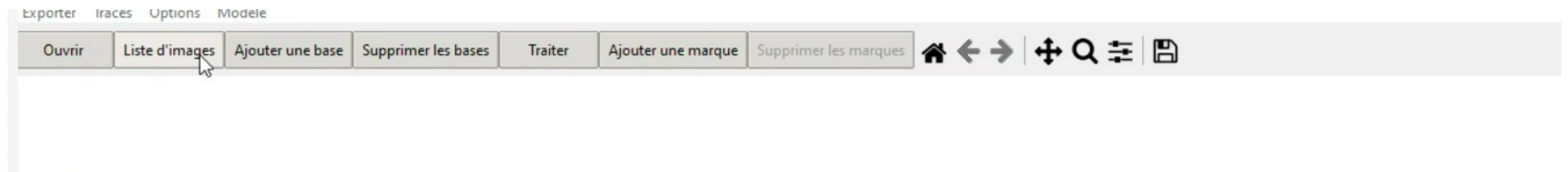


Current projects: poplar  
Bastien Pouget's PhD

Roué et al., 2019 (Arabidopsis)

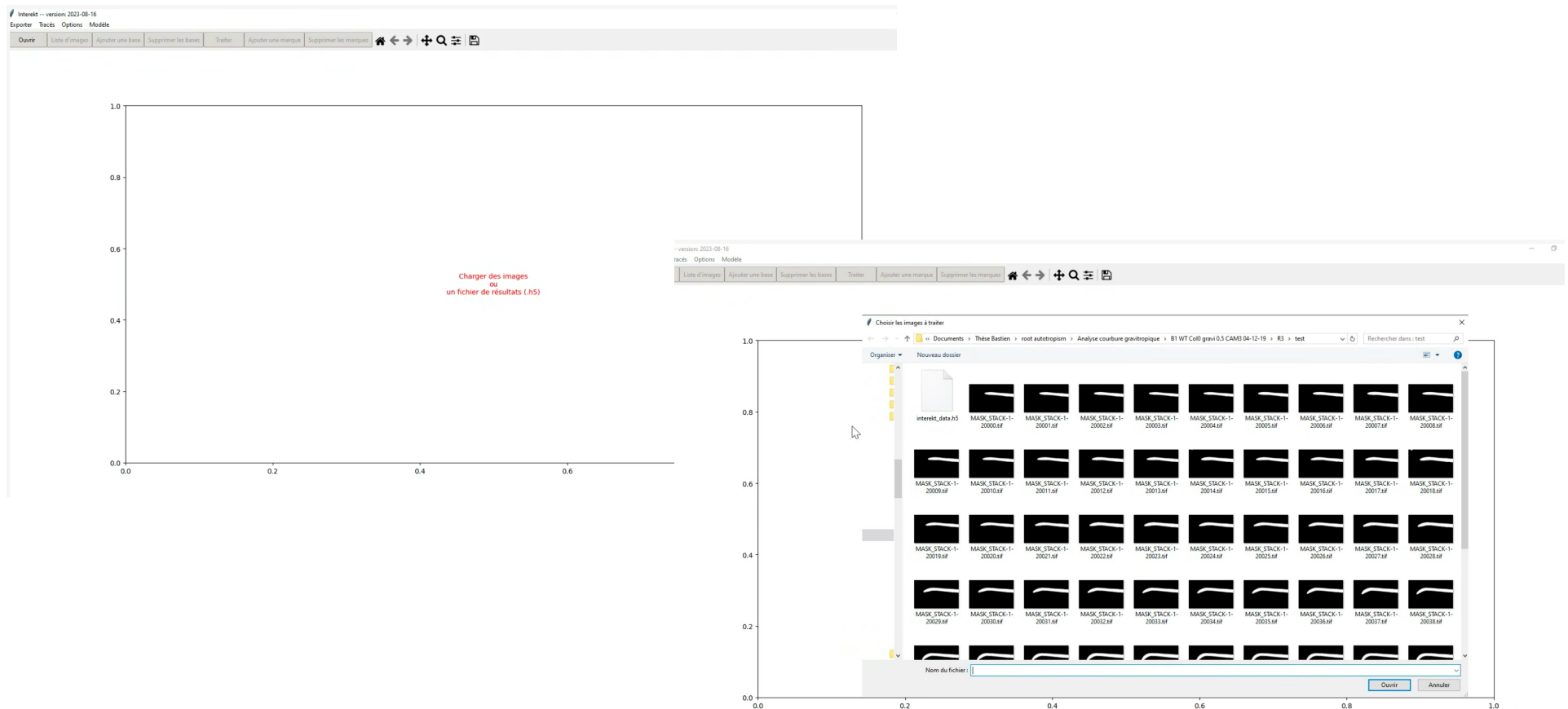


Ten steps...

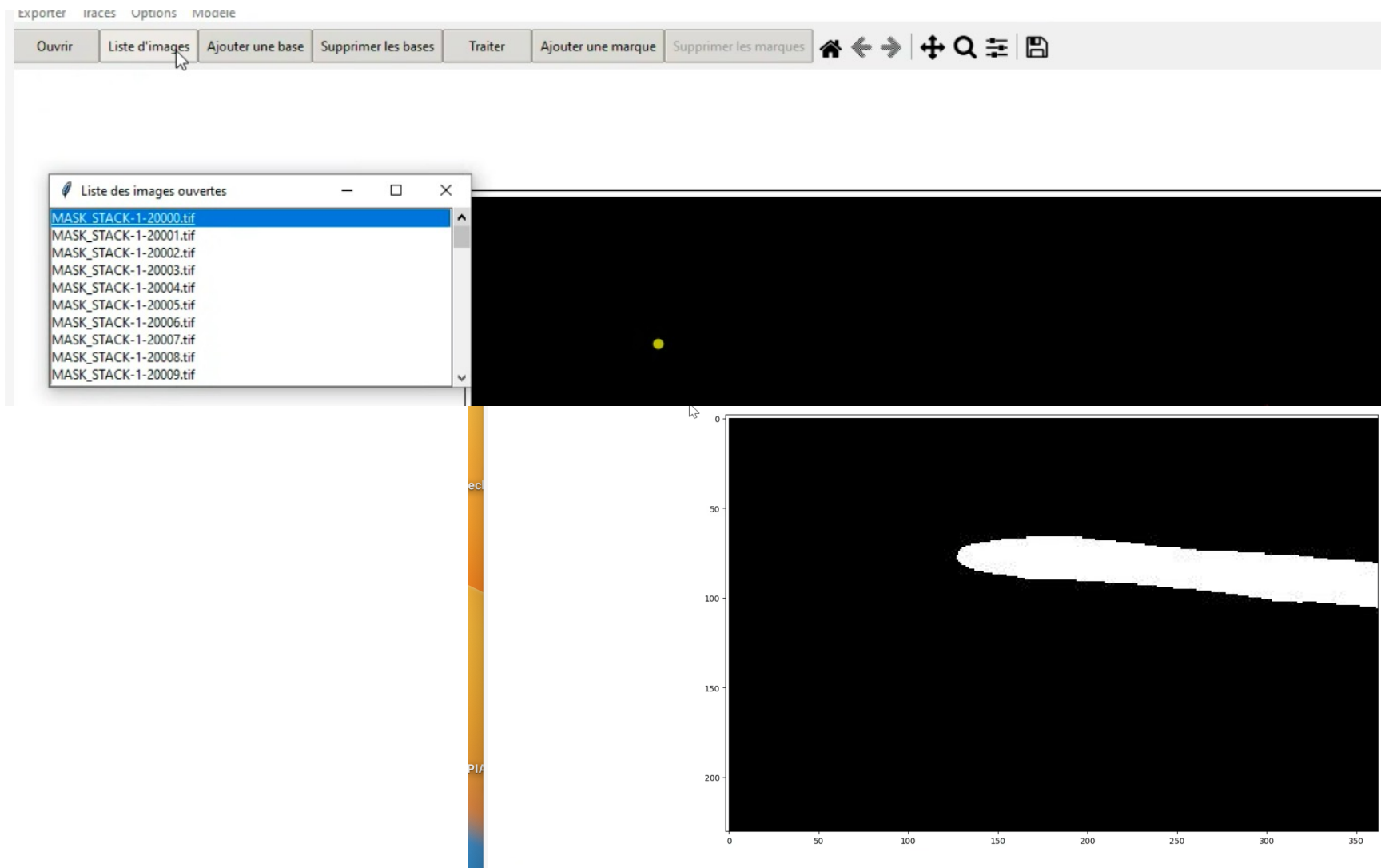


# Step 1: Import the sequence of images generated from the experiment

The software automatically stores the images into a single archive file



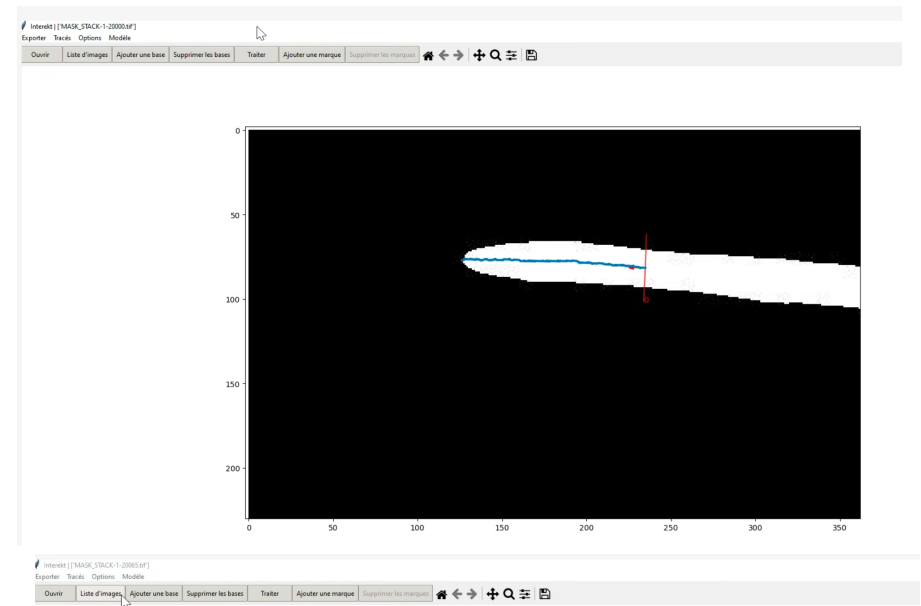
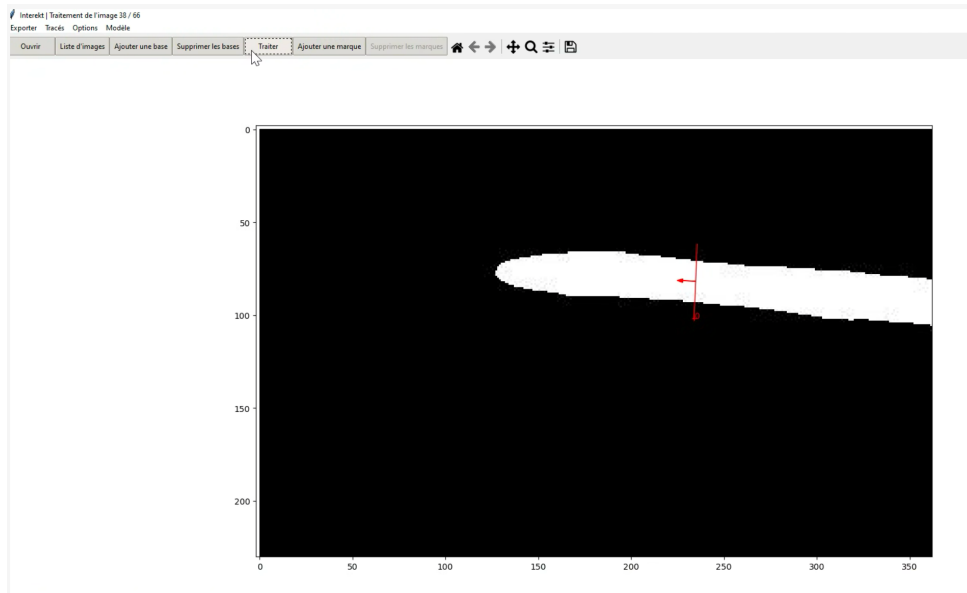
# Step2: Select the steady-state image



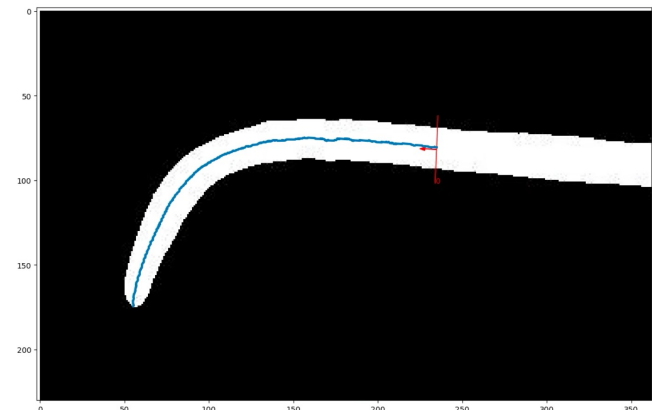


# Step 3: Start the extraction of organ shapes by adding a base

Une « base » : objet qui indique le début de l'organe et sa direction

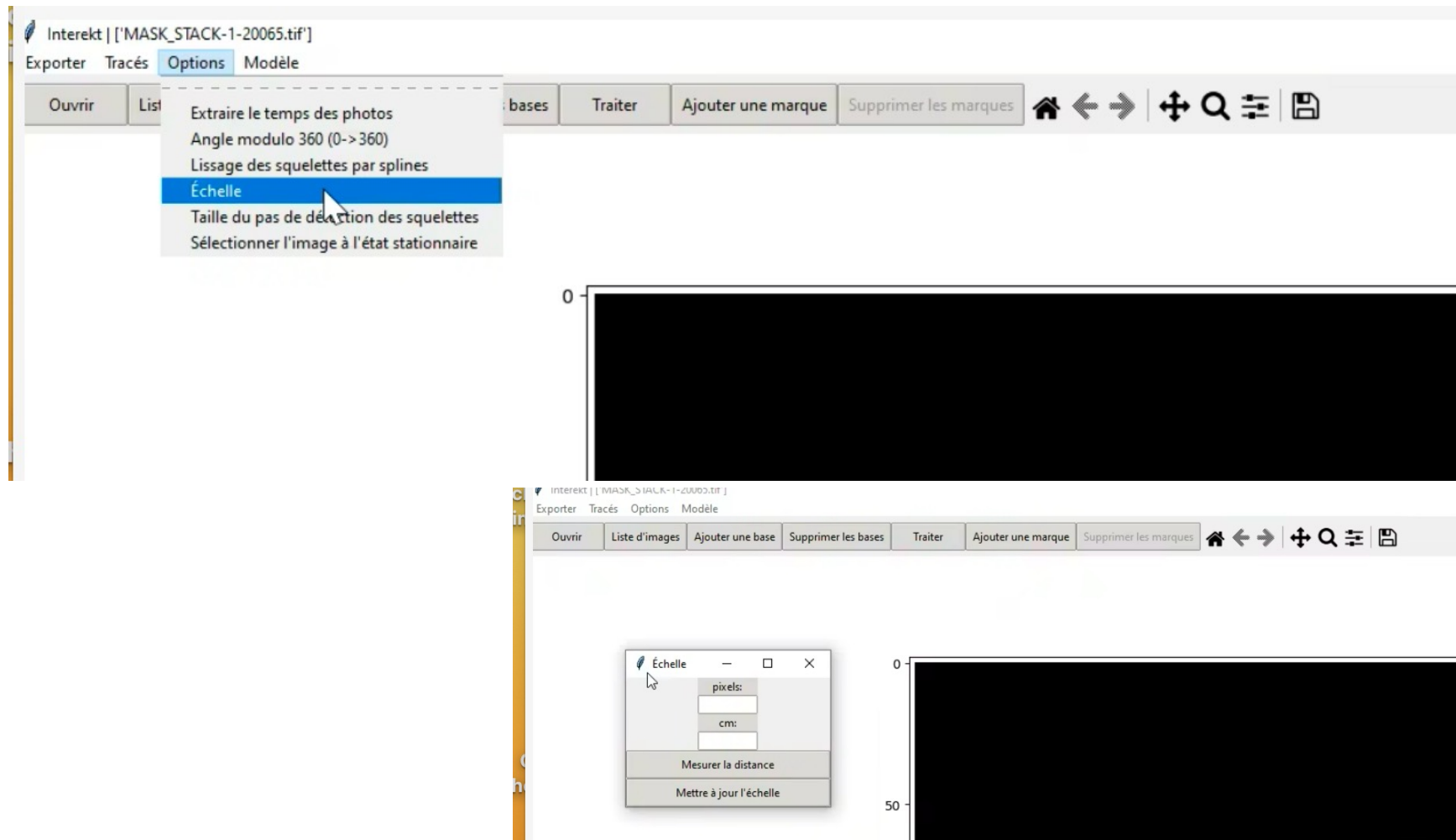


➤ Obtention d'une série de squelettes des racines

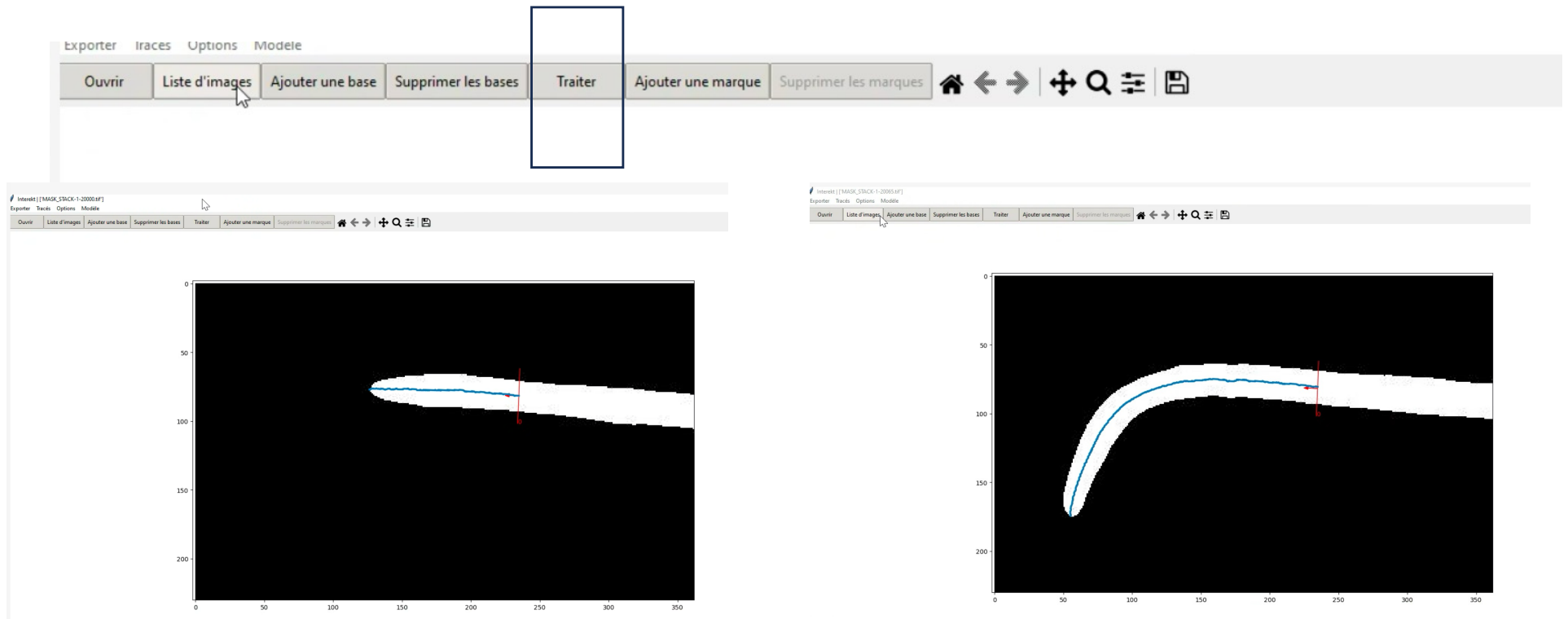


# Step 4: Set the image scale

All distances in pixels will be converted into cm using this ratio

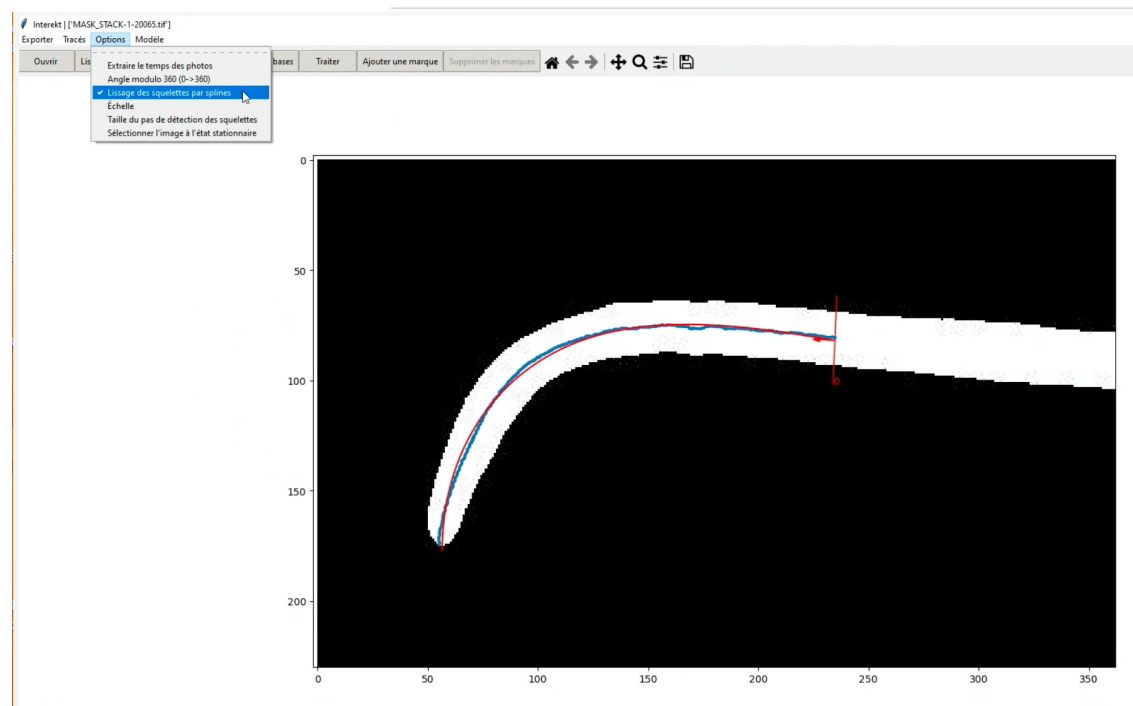


# Step 5: Organ shape extraction...may take some time



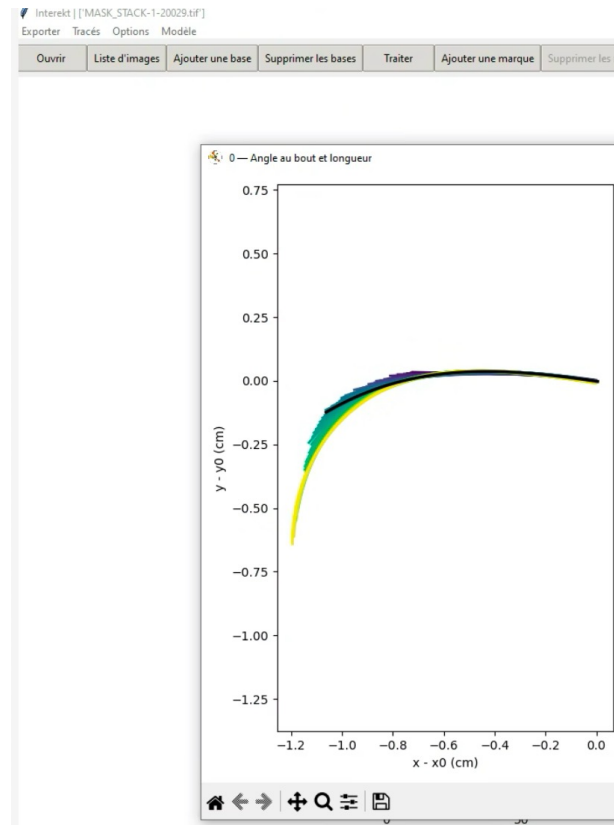
➤ Obtention d'une série de squelettes des racines



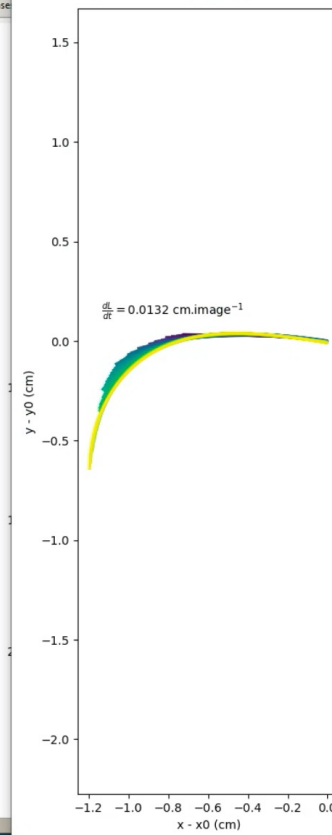
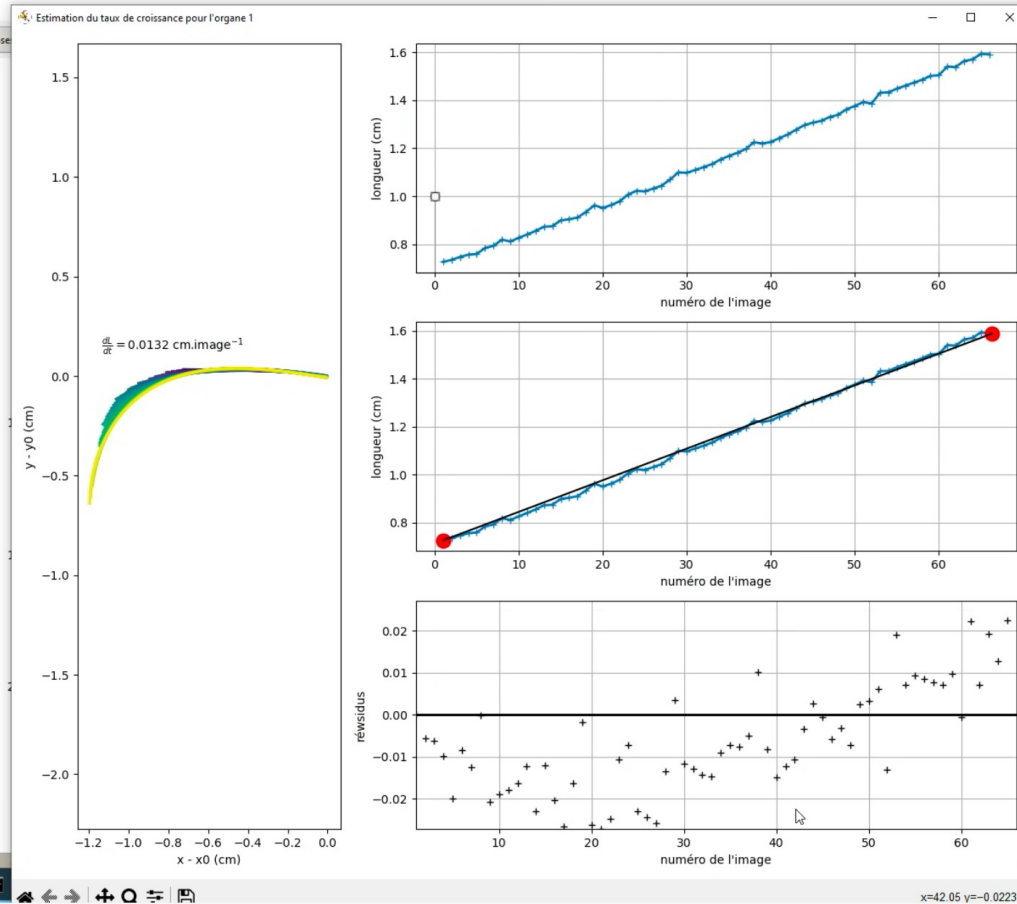
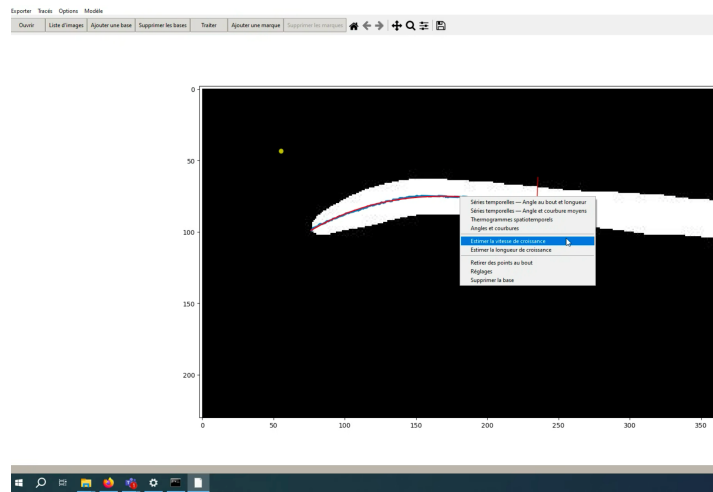


# Geometric quantities obtained from the skeleton of an organ ?

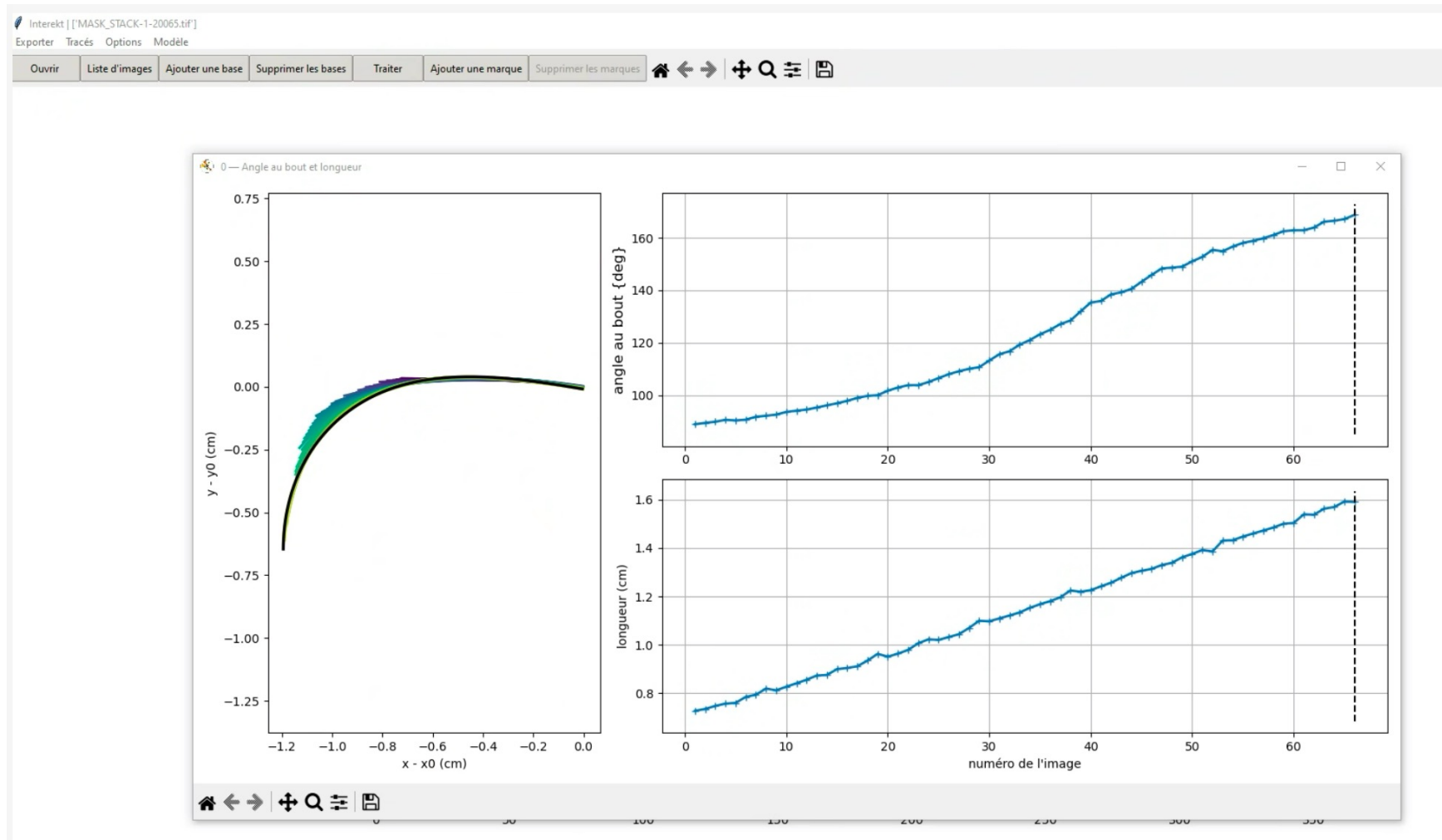
- Time-lapse description of the tropic movement



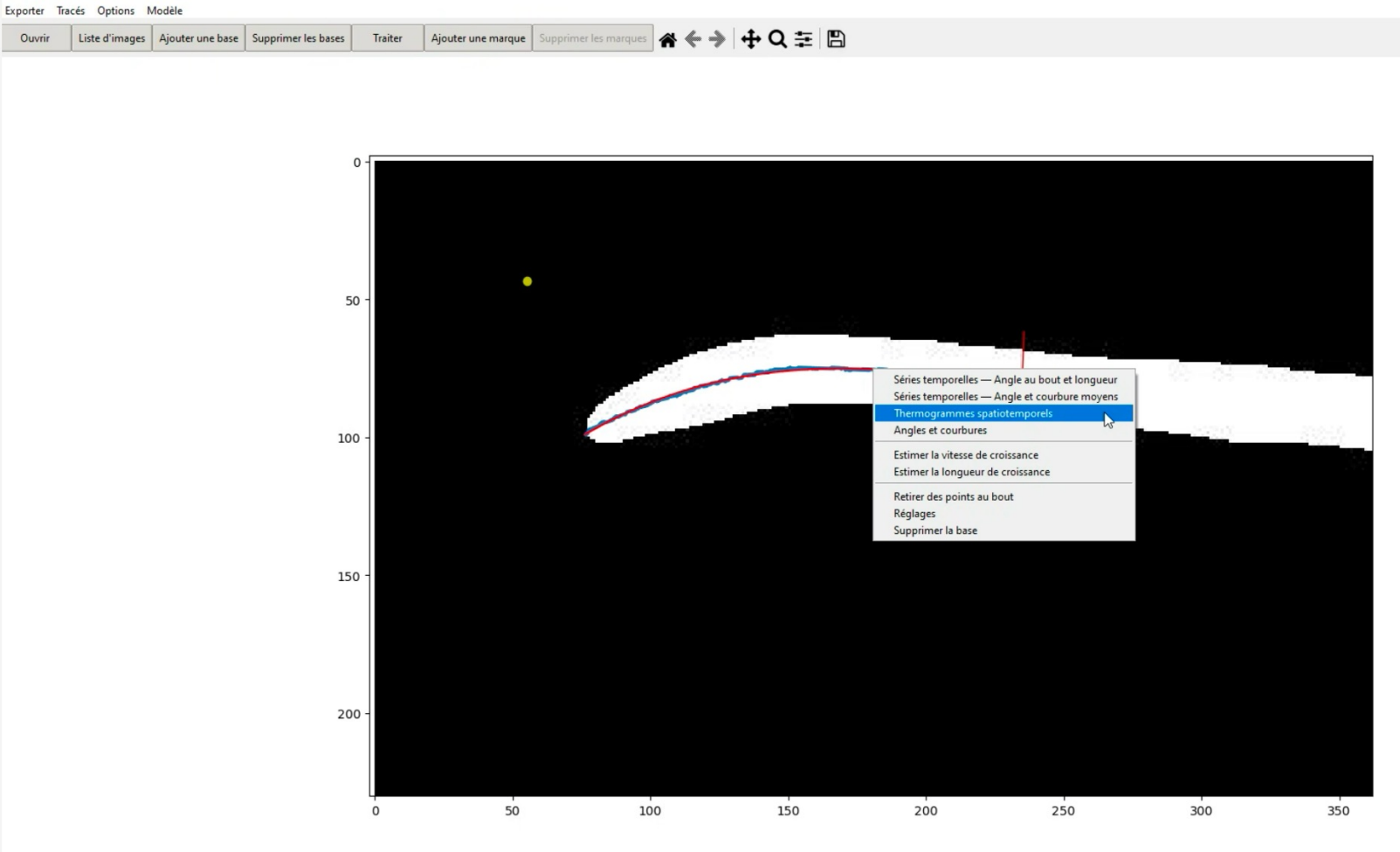
# Step 6: Estimating the growth rate of an organ (dL/dt)



# Step 7: Estimating the angle

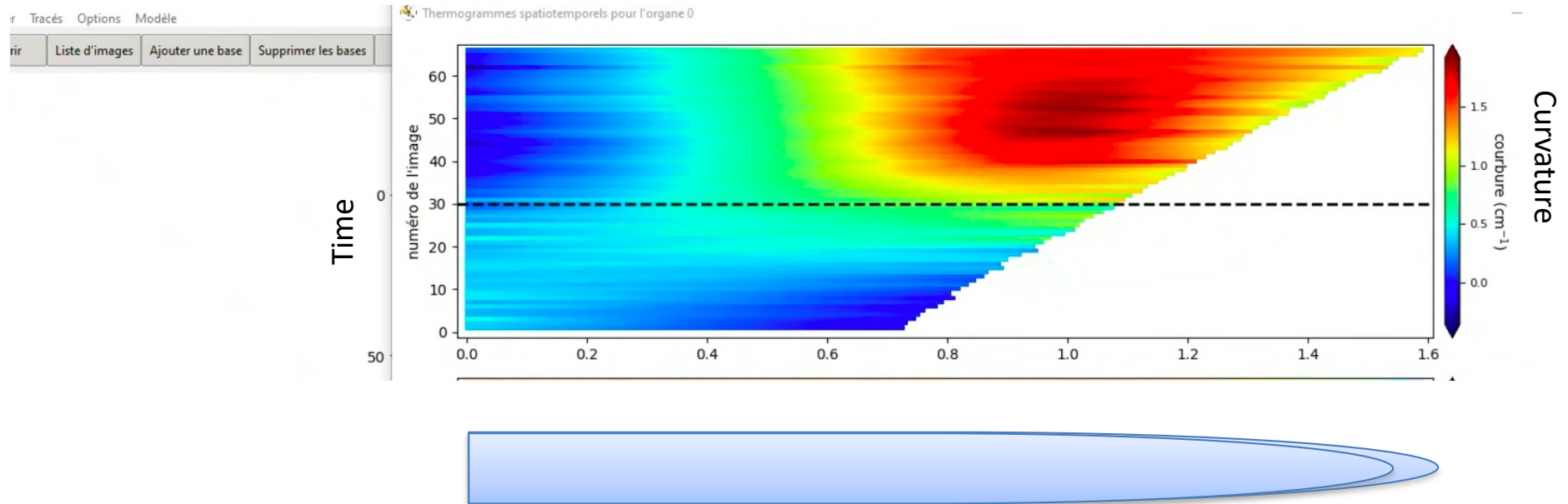


# Step 8: Estimating the intensity and location of curvature through a heatmap

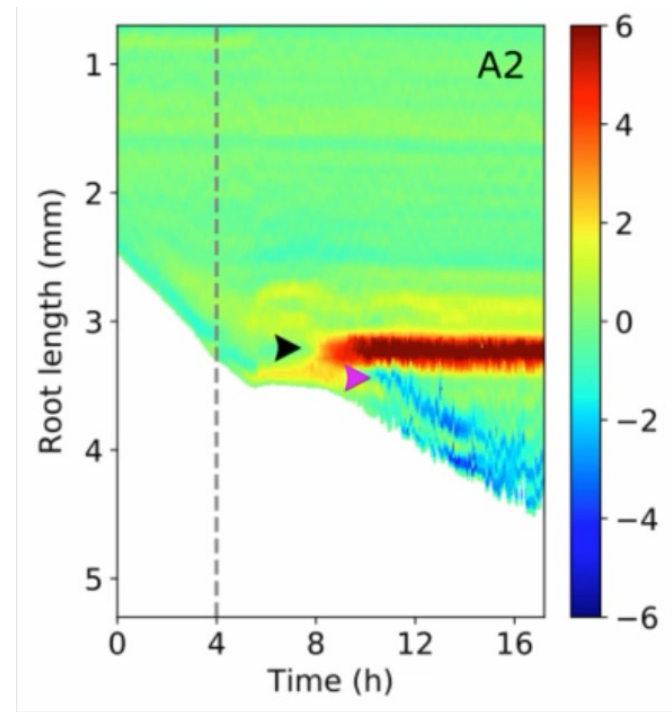
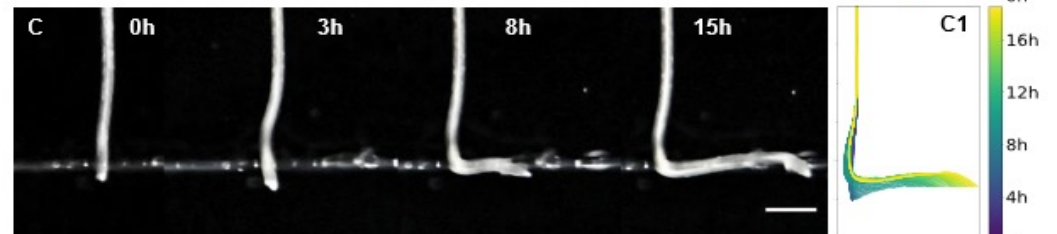
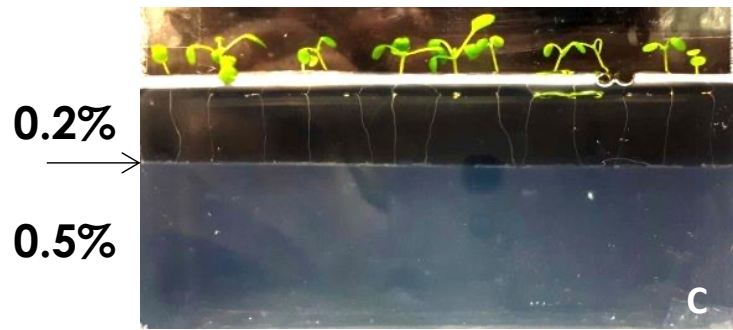




# An example of heatmap: gravitropic response



# Réponse des racines à un changement d'impédance du milieu



Roué et al., 2019 (Arabidopsis)

## Step 9: Export the results into an output CSV file.



**Step 10: be happy to do it!**





**F. Hartmann , H. Chauvet-Thiry,**  
B. Pouget (PhD), J. Roué (PhD), M. Lebourg (M2 internship)  
V. Audimar, N. Brunel-Michac, J. Franchel,  
B. Moulia and V. Legué



Y. Forterre and O. Pouliquen

