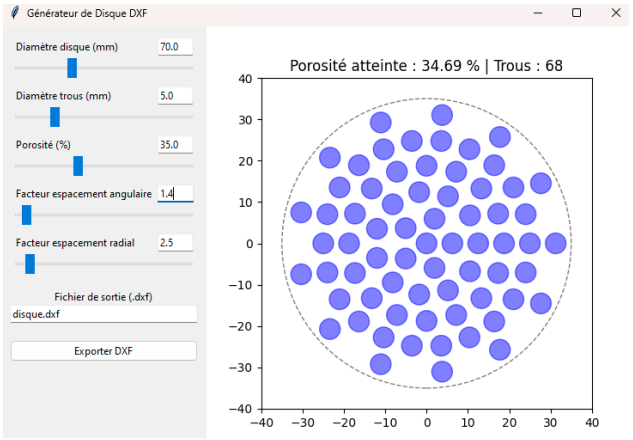
Arnaud Valente Jacot-Descombes

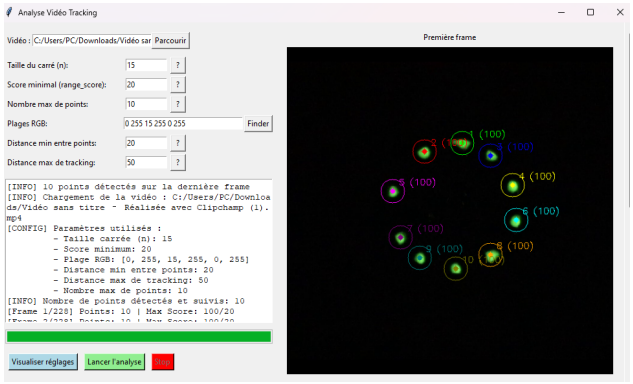
Rue du Tunnel 10, 1950 Sion arnaud_jacot@hotmail.com +41 79 120 08 45 LinkedIn Profile

BACHELOR THESIS: FALLING PERFORATED DISKS IN WATER

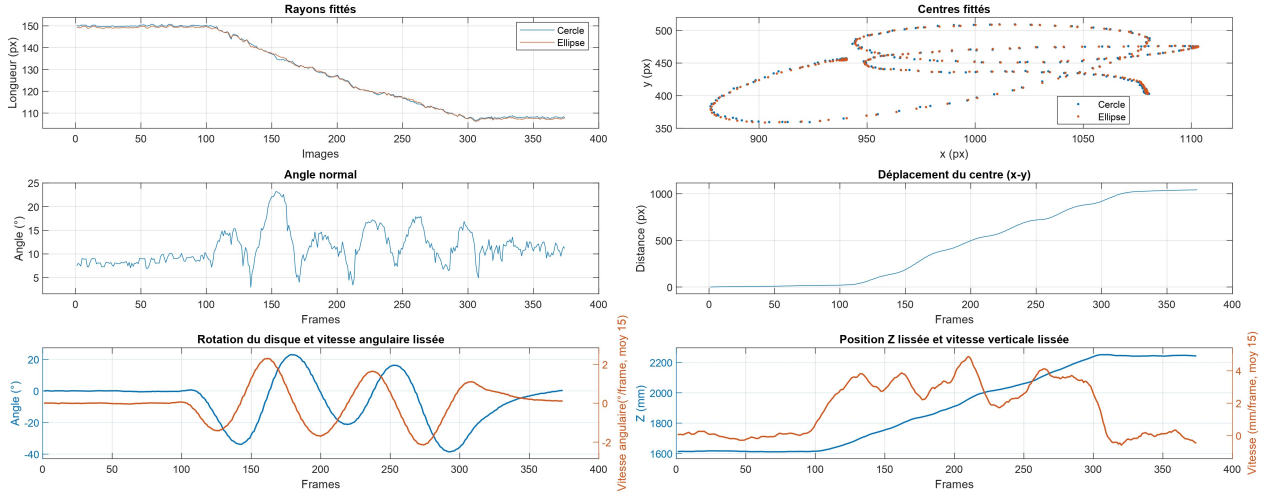
My role: As the technical lead, I developed the **parametric geometry generation algorithm** in Python to produce a large subset of the 140 disks tested. I also designed and implemented the **automated trajectory tracking** system with OpenCV, including detection of phosphorescent markers, camera calibration, and 3D tracking. I coordinated experimental data analysis and authored the methodological section of the final report. **Grade: 5.75/6**



Custom geometry generator to .dxf.



Automated video tracking of disk trajectories.



Example measurement report automatically generated by MATLAB.

Objectives & Outcomes

- **Experimental study** of the dynamic behavior of perforated disks
- Analysis of **140 different** PMMA disk geometries falling in water
- Identification of the effects of **porosity**, **asymmetry**, and **slot inclination**
- Characterization of trajectories and dynamic regimes
- Demonstration of systematic parameter influence on dynamics

Methods & Technologies

- Geometry generation via a **Python application** producing .dxf files
- Laser cutting of 70 mm PMMA disks
- Trajectory tracking using **phosphorescent markers** and a Canon EOS 77D camera
- Video-processing algorithm developed with **OpenCV** (680 lines)
- In-depth analysis and data extraction using **MATLAB** (900 lines)

Team: Project with S. Costa Pereira, M. Latrouite, D. Vacek, J. Zhang, C. Villa
Supervisor: Prof. François Gallaire, Laboratory of Fluid Mechanics and Instabilities (LFMI)

Arnaud Valente Jacot-Descombes

Rue du Tunnel 10, 1950 Sion arnaud_jacot@hotmail.com +41 79 120 08 45 LinkedIn Profile

LASER-BASED DEFLECTION MEASUREMENT

My role: In this two-person project, I led the **end-to-end design of the measurement system**. This included building the **electronic circuit**, programming the **Arduino code**, and developing a dedicated **Python interface** to control acquisition. I also designed the **MATLAB post-processing** algorithms to convert raw data into beam deflection with millimetric accuracy. **Grade: 5.75/6**

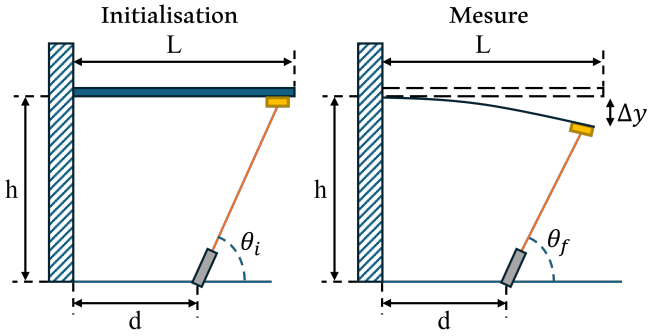
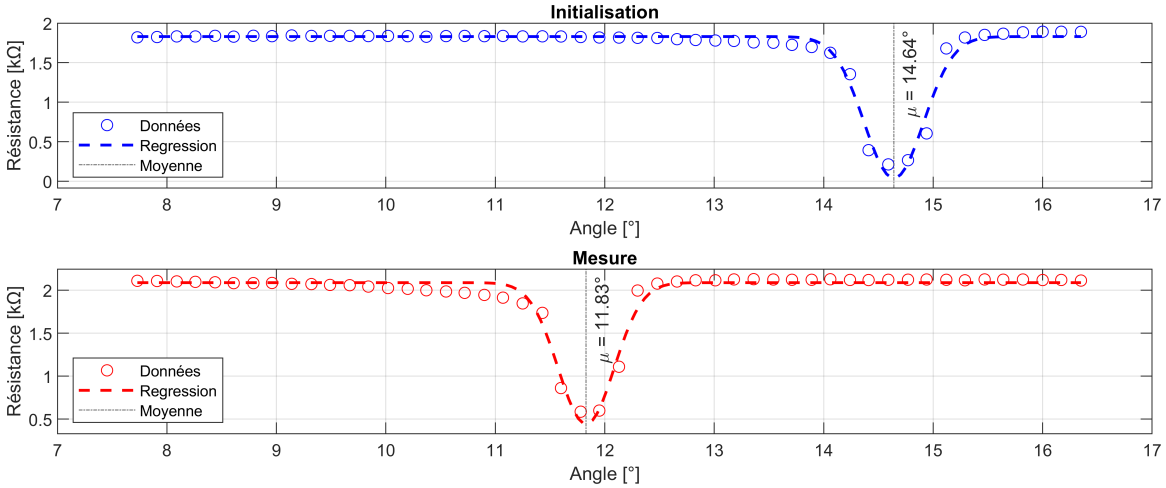


Diagram of the measurement tool operation.



Résumé de la régression

Fenêtre sélectionnée : 7.62° à 16.46°	RMSE (init / meas) : 0.071 / 0.070
Mu (init / meas) : 14.64° / 11.83°	R^2 (init / meas) : 0.968 / 0.962
Sigma (init / meas) : 0.27° / 0.26°	Variation angulaire : 2.81°
Amplitude : 1.79 / 1.64 kΩ	Deflexion : -23.18 mm

Measurement report generated by MATLAB. The actual deflection is -24 ± 1 mm.

Objectives & Outcomes

- Design of a **non-contact** beam deflection measurement system
- Development of an angular-tracking device using a **laser and LDR**
- Conversion of vertical displacement into precise angular measurement
- Validation against theoretical predictions

Methods & Technologies

- Laser mounted on a rotating holder driven by a **stepper motor** (28BYJ-48)
- **Interactive Python interface** to command measurement and upload Arduino code
- **MATLAB** post-processing with inverted Gaussian fitting to identify the precise angle
- High-resolution angular sampling (**2048 steps/rev**)

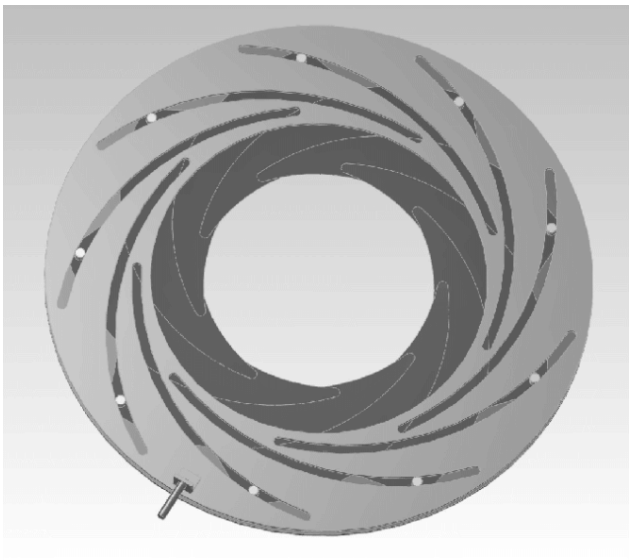
Course: Measurement Techniques, Prof. K. Mulleners
Team project: with E. Martin-Cocher

Arnaud Valente Jacot-Descombes

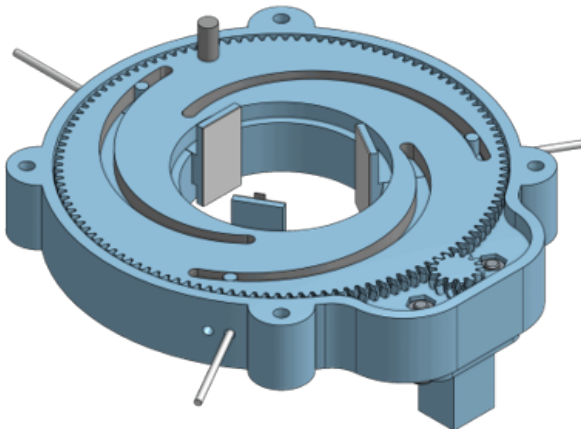
Rue du Tunnel 10, 1950 Sion arnaud_jacot@hotmail.com +41 79 120 08 45 LinkedIn Profile

IRIS-DIAPHRAGM–INSPIRED ROBOTIC GRIPPER

My role: The gripper design is based on a **biomimetic spiral cam concept** developed with a teammate (D. Vacek).
I then performed the **complete mechanical modeling** in **Onshape PTC**, creating a fully parametric system, and handled fabrication via **3D printing** and **laser cutting**.
I also produced the **detailed assembly drawing** of the full system. Finally, I contributed to the **control code** and **experimental tests** on raspberries, achieving a **100% pick rate** with no fruit damage. **Grade: 5.5/6**



Our inspiration.



Our innovative gripper design.

Objectives & Outcomes

- Design of a **biomimetic robotic gripper**
- Development of a gripper capable of picking **raspberries** precisely and gently
- Integration of a **conductivity sensor** to assess ripeness
- Design of a **parametric spiral-cam mechanism**
- **100%** of raspberries harvested were **ripe and undamaged**

Methods & Technologies

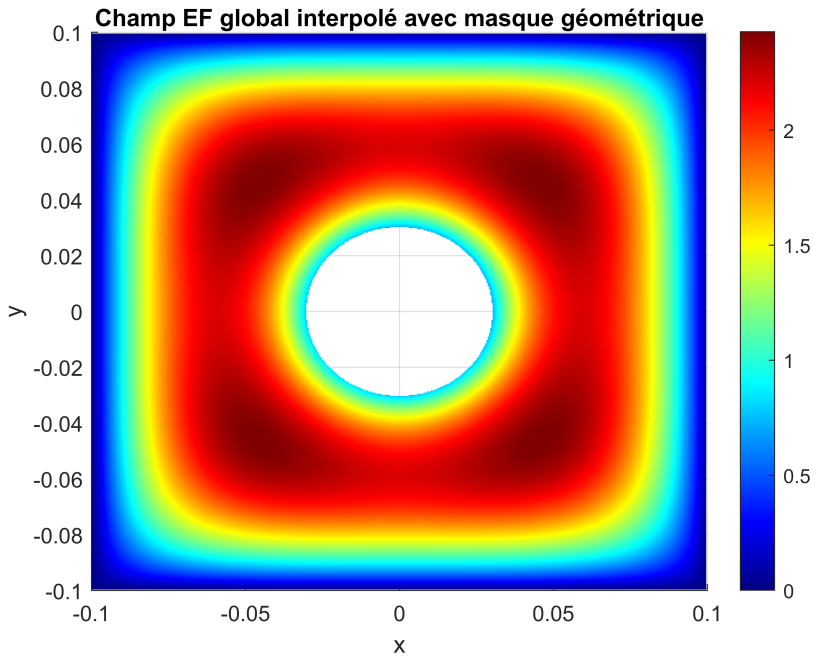
- **3D-printed** gripper in PETG
- Storage compartment **laser-cut** in MDF
- Integration of a **pressure sensor** to control gripping force and prevent damage
- Electronics driven by **Arduino** (2 DC motors, sensors)
- Development of a complete **automated picking cycle**

Course: ME-320 Product Development and Engineering Design, EPFL
Team: S. Costa Pereira, M. Latrouite, D. Vacek, S. Vlazakis

Arnaud Valente Jacot-Descombes

Rue du Tunnel 10, 1950 Sion arnaud_jacot@hotmail.com +41 79 120 08 45 LinkedIn Profile

PARALLELIZED THERMAL SOLVER WITH BIQUADRATIC FINITE ELEMENTS



Analysis result with 4,096 biquadratic finite elements.

Objectives & Outcomes

- Design of a **finite element solver** for steady-state heat conduction in **MATLAB**
- Modeling of an aluminum plate with a central circular hole, subject to boundary conditions on outer edges, a global surface heat flux, and an inner-boundary heat flux
- High-resolution temperature field **computed efficiently**
- Handling several thousand finite elements on a **standard laptop**

Methods & Technologies

- Generation of an **adaptive Q9 mesh** in polar and Cartesian coordinates
- Element matrices derived **symbolically** then optimized into explicit functions
- Full **parallelization** of element matrix computation with **parfor**
- Optimized storage (**CSR**) and solution via multi-threaded sparse solver
- Advanced post-processing with local biharmonic interpolation

Personal project extending Prof. F. Gallaire's *Finite Elements* course

Arnaud Valente Jacot-Descombes

Rue du Tunnel 10, 1950 Sion arnaud_jacot@hotmail.com +41 79 120 08 45 LinkedIn Profile

AUTOMATED WINE LIST GENERATION

Catégorie	Cépage	Cave	Origine	Volume	Tarif	ERREUR
Rouge	Gamay V.Vignes	Domaine Cornulus	Savièse	75cl	42,00 CHF	OK
Rose	Cépage de test	Cave de test	Inconnue	75cl	99,00 CHF	Erreur Catégorie
Rouge	Gamay V.Vignes	Domaine Des Chevaliers	Salquenen	85cl	52,00 CHF	Erreur Volume
Rouge				75cl	58,00 CHF	Erreur cellule vide
						Vide
Rouge	Dôle Maitre de Chai	Provins	Sion	75cl	42,00 CHF	OK
Rouge	Pinot Noir Réserve	Domaine des Muses	Sierre	75cl	72,00 CHF	OK

Example inventory table with error handling.

CARTE DES VINS

Nos Vins Blancs

Bouteilles 3/8

Cépage	Cave	Origine	Tarif
Fendant	Cave Finbec	Sion	15.0
Fendant	François et Mathieu Constantin	Ayent	15.0
Fendant Calixte	PAP Vins	Salins	15.0
Fendant La Madeleine	André Fontannaz et filles	Vétroz	15.0
Fendant Le Banneret	Carlo et Jean-Charles Maye	Chamoson	16.0
Johannisberg	Simon Maye et Fils	St-Pierre-De-Clages	24.0
Les Gamines	La Madeleine	Vétroz	19.0
Petite Arvine	La Madeleine	Vétroz	24.0
Riesling	Les Bernunes	Sierre	26.0

Bouteilles 50cl

Cépage	Cave	Origine	Tarif
Lafnetscha	Gregor Kuonen	Salquenen	36.0
Malvoisie Flétrie	Cave des Remparts	Saillon	48.0
Paien Octoglaive	Domaine Cornulus	Savièse	38.0

Bouteilles 75cl

Cépage	Cave	Origine	Tarif
Amigne de Vétroz 1 Abeille	La Madeleine	Vétroz	53.0
Amigne de Vétroz 1 Abeille	T. Constantin	Pont-de-la-Morge	58.0

Wine list generated in two clicks from an Excel inventory via a Python script.

Objectives & Outcomes

- Development of a complete tool for automatic wine list generation
- Creation of a styled PDF from a simple Excel inventory file
- Intelligent classification by volume, grape variety, and winery
- Professional layout with ornaments and refined typography

Methods & Technologies

- Python script using pandas to read and process the inventory
- Dynamic generation of a styled LaTeX file with decorative frames
- Use of TikZ and pgfornament for graphic elements
- Automated compilation with pdflatex and error handling
- End-to-end solution packaged for non-technical users

Personal project for the wine bar ***Le Ticino*** in Sion