HBC.2024.0136

www.project-krak.be

AGENDA

14th November 2025

12:00 – 12:30 Lunch

12:30 – 12:40 Introduction & Agenda Review

12:40 – 14:15 KRAK Work Presentation & Discussion

14:15 – 14:30 Preparation for Plant tour

14:30 – 15:15 Plant tour

15:15 – 15:30 Break

15:30 – 15:45 Kellanova Presentation

15:45 – 16:00 Wrap-up

16:00 – 16:30 Closing & Networking

CONSORTIUM OVERVIEW

STEERING COMMITEE

- Agristo – we love potatoes
- Dossche Mills
- Kellanova
- Ecofrost – GOOD WITH POTATOES
- Lantmännen Unibake
- Zeelandia
- RESONIKS
- Aviko
- Vandemoortele – shaping a tasty future
- CAPTIC
- SOLINA
- Lotus – Since 1932
- IMCE
- PARTNER IN FOODSOLUTIONS – Family Dokter Company – DKB
- Fi&S – Food Ingredients & Specialties
- UGENT CACAOLAB

PARTNERS

- KU LEUVEN MeBioS
- hogeschool vives – RESEARCH GROUP FOOD PROCESSING MECHATRONICS
- FF FLANDERS' FOOD

FEDERATIONS & RESEARCH

- choprabisco.be – CHOCOLATE | PRALINE | BISCUIT | CONFECTIONERY
- FGBB
- UNIVERSITEIT GENT VEG-i-TEC

The KRAK Team

hogeschool vives
RESEARCH GROUP
FOOD PROCESSING
MECHATRONICS

KU LEUVEN
MeBioS

Food Processing

Michaël Verlinden

Kevin Vynckier

Thomas Sprangers

Lore Benthein

Mechatronics

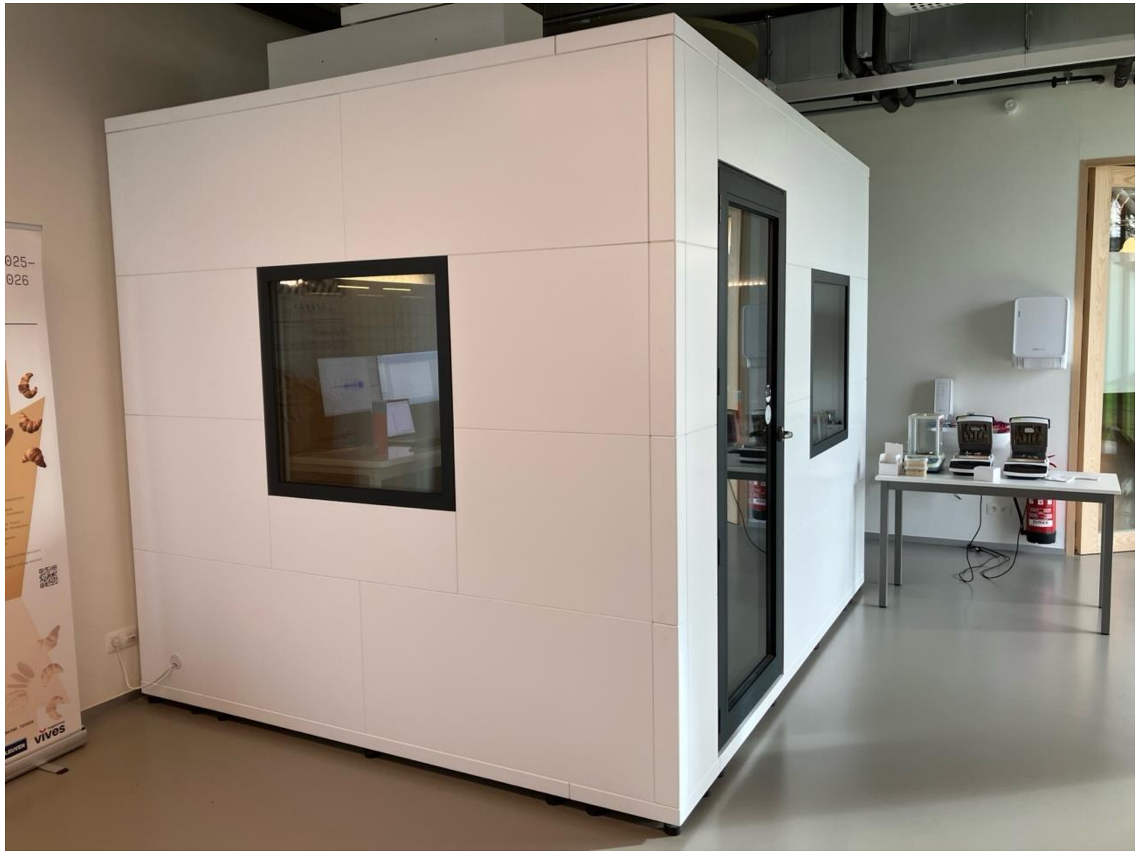
Catherine Middag

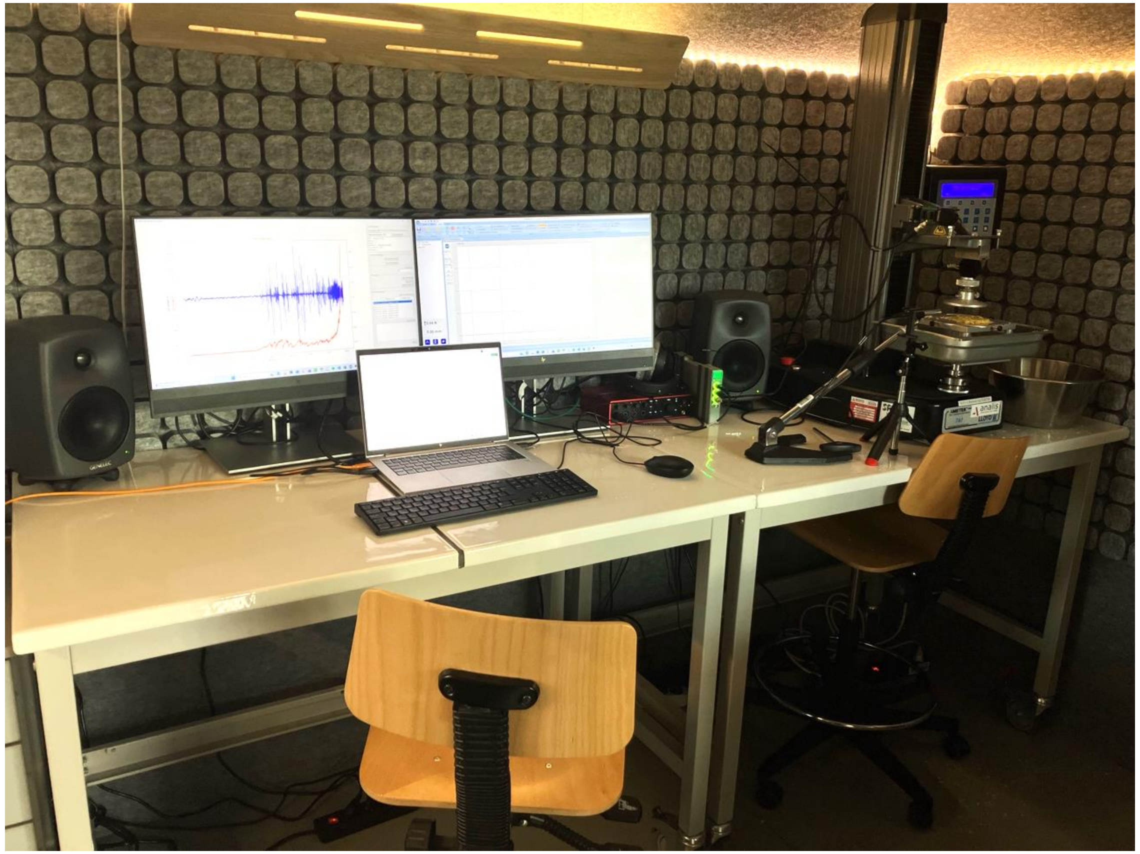
Tom Vangaever

MeBios

Mohammed Saif Ismael Hammeed

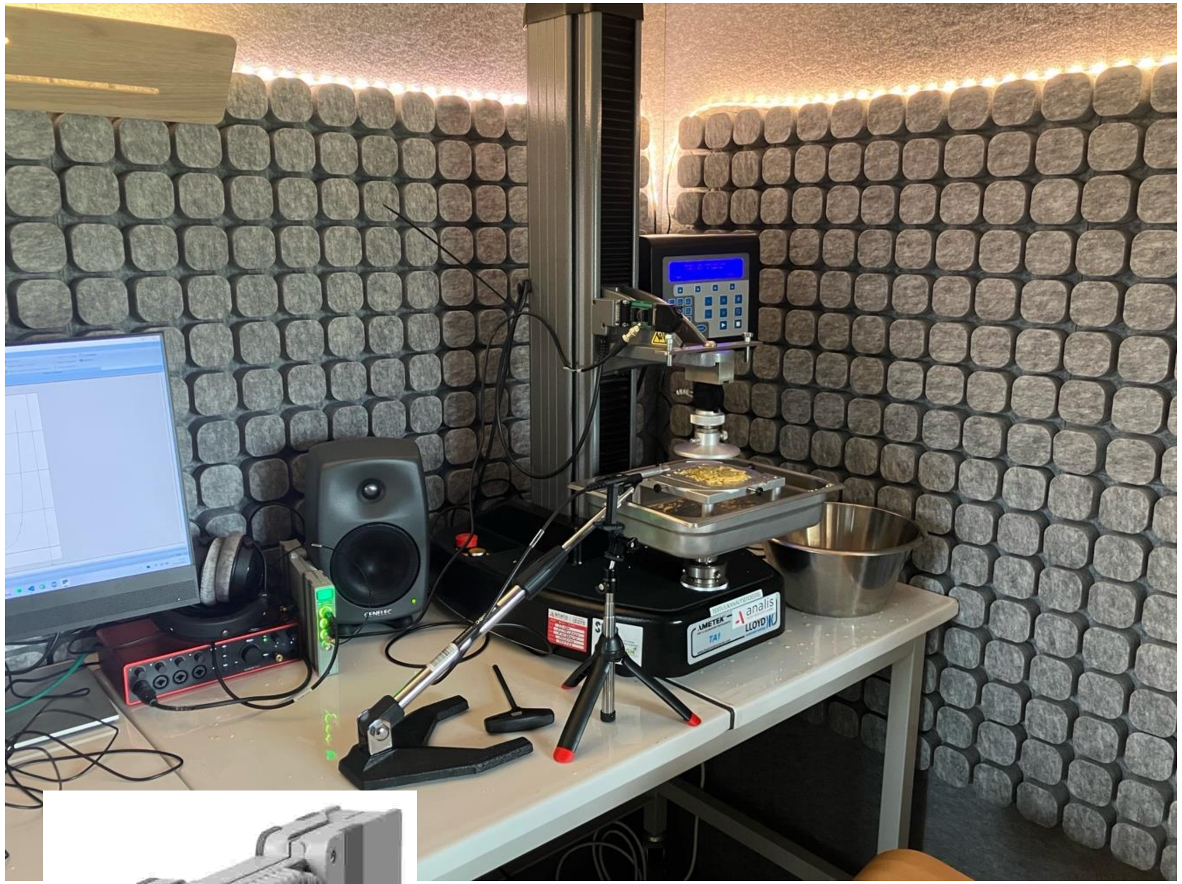
1. The audiolab



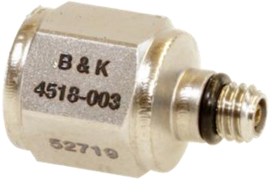


Audiobooth
Isolation index: 45dB – ISO 717-01
Double Wall

KRAK
OP ZOEK NAAR DE PERFECTE CRUNCH
JAN 2025-
DEC 2026



- 1/2' Free-field Microphone, Bruël & Kjær, 6.3 Hz to 20 kHz
- High Temperature Preamplifier 1706



Accelerometer, CCLD, 100m/g

4-Channel Input DAQ Module
LAN-XI, Type 3676

2. Methods

-1-
Chips

KRAK JAN 2025– DEC 2026

-2-
French Fries

KRAK JAN 2025– DEC 2026

-3-
Cookies

KRAK JAN 2025– DEC 2026

-4-
Bread (Baguette)

KRAK JAN 2025– DEC 2026

-5-
Chocolate

KRAK JAN 2025– DEC 2026

-6-
Breaded & Battered products

-1-
Chips

-2-
French Fries

-3-
Cookies

-4-
Bread (Baguette)

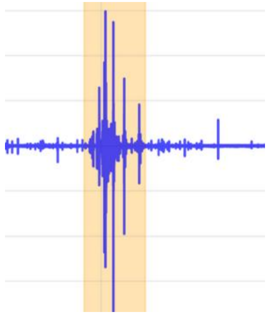
-5-
Chocolate

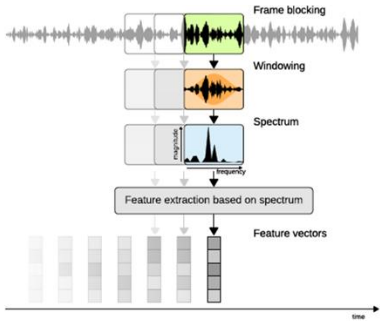
-6-
Breaded & Battered products

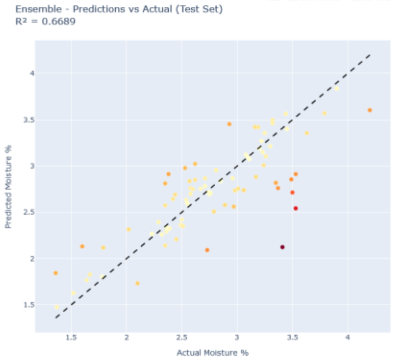
Method Optimization → Audio Selection - Region of Interest (ROI) → Audio Analysis & Feature selection ⟷ Model Selection, Training & Validation

correlation & validation

Sensory Data Collection







-3-
Cookies

Method Optimization

Probe
Speed
Distance
Orientation

Audio Selection - Region of Interest (ROI)

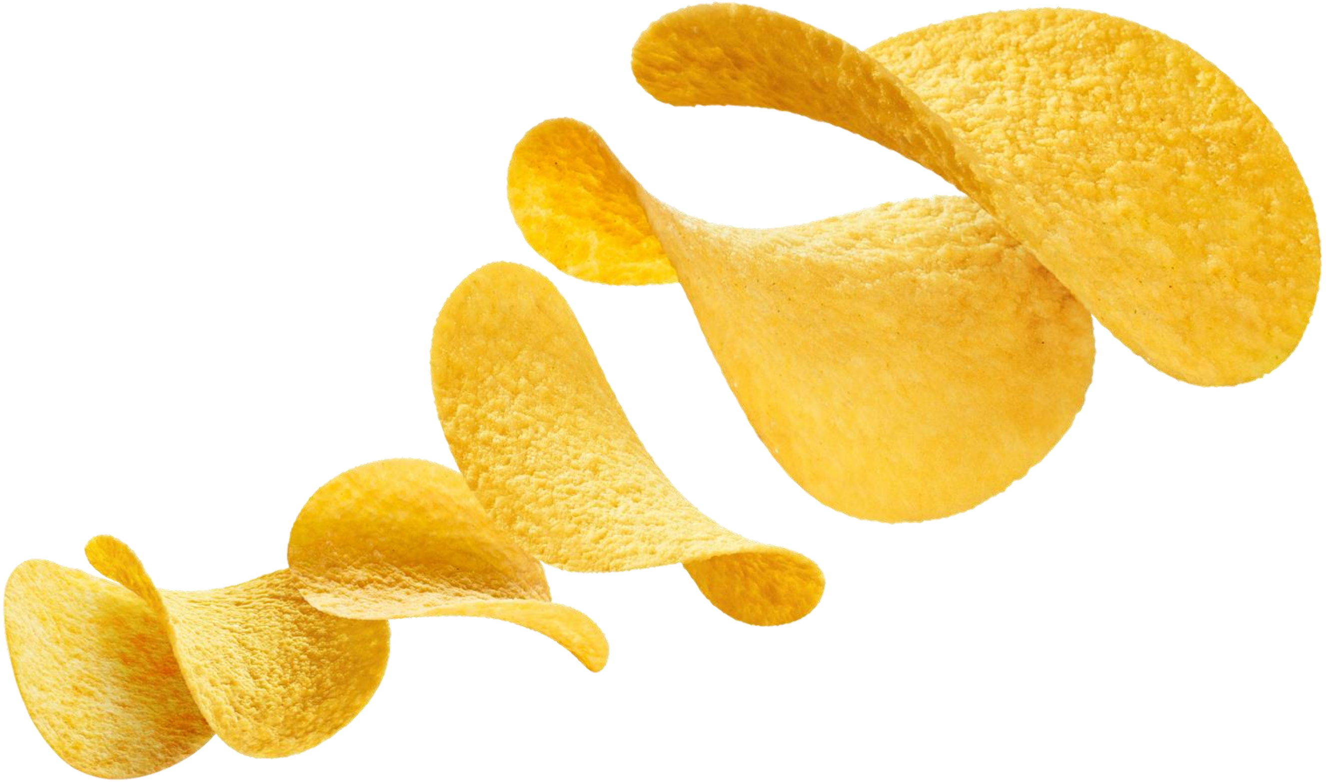
Audio Analysis & Feature selection

Model Selection, Training & Validation

correlation & validation

Sensory Data Collection

-1-
Chips



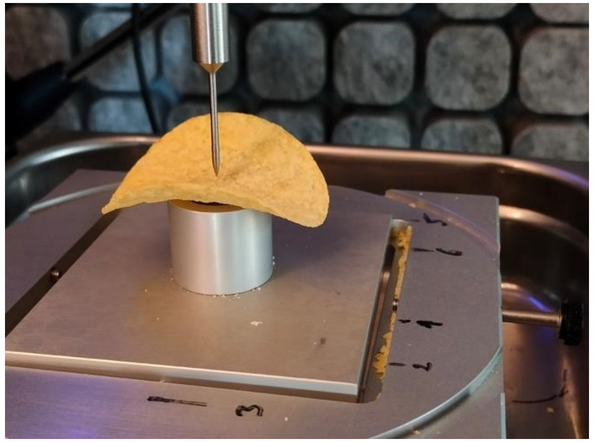
Model Case 5
Chips

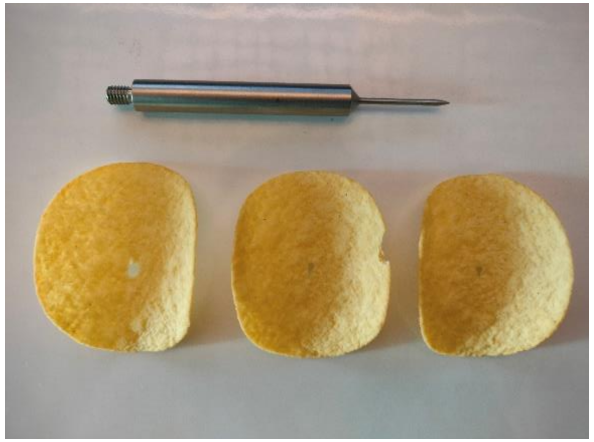
EXPERIMENTAL VARIABLES
Five types of chips will be evaluated:

Raw, Soft, Reference, Hard, Burnt

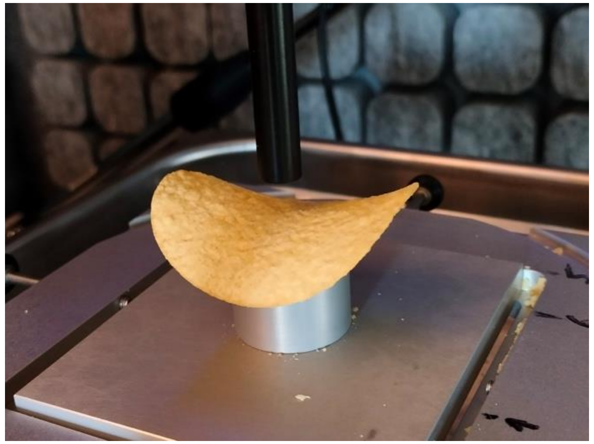
Variables	**Type**	**Values**
Sample		
Type	Categorical	5 types (Raw, Soft, Reference, Hard, Burnt)
Protocol		
Speed	Continuous	(0.2 mm.s−1, 1 mm.s−1 and 2 mm.s−1)
Type of breaking	categorical	1/ Hole* 2/Split** 3/Crush***

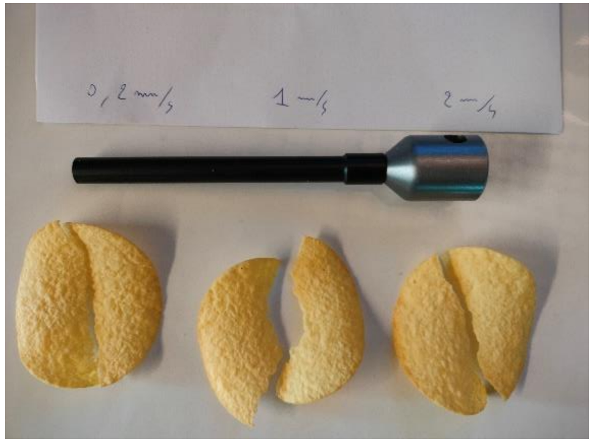
*Hole
Needle Probe (1,75mm) stop test at 3mm, chips convex on chip stand



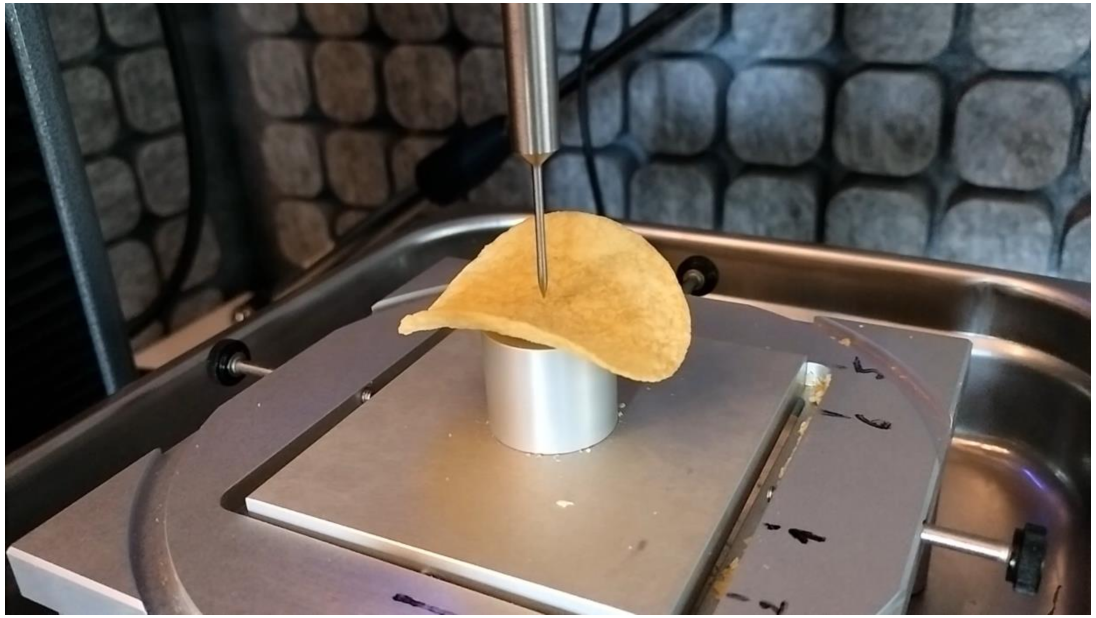
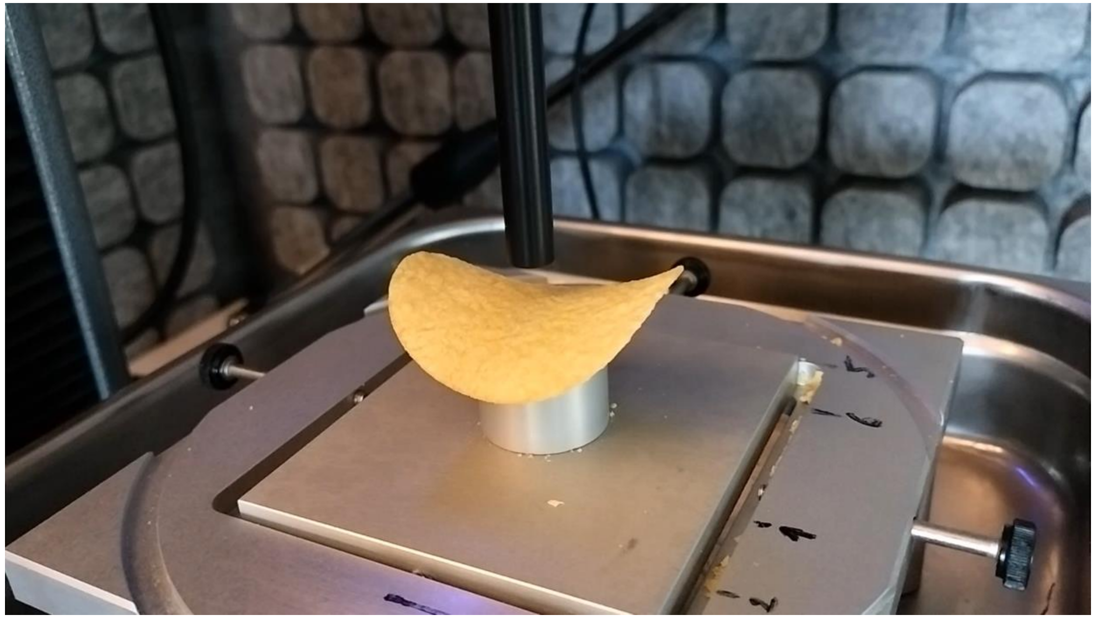
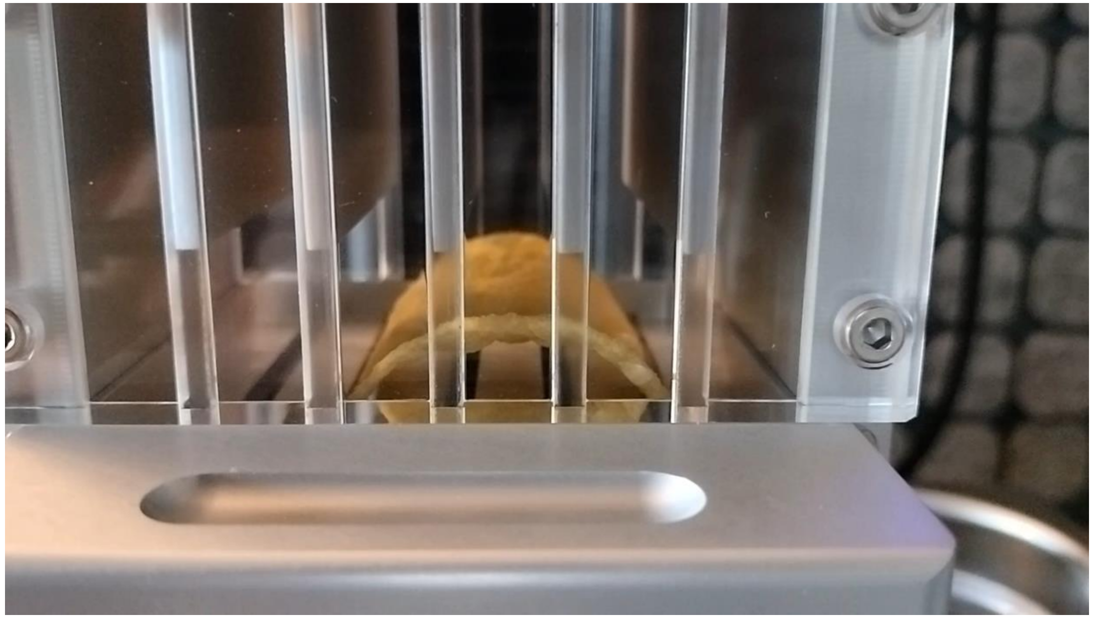


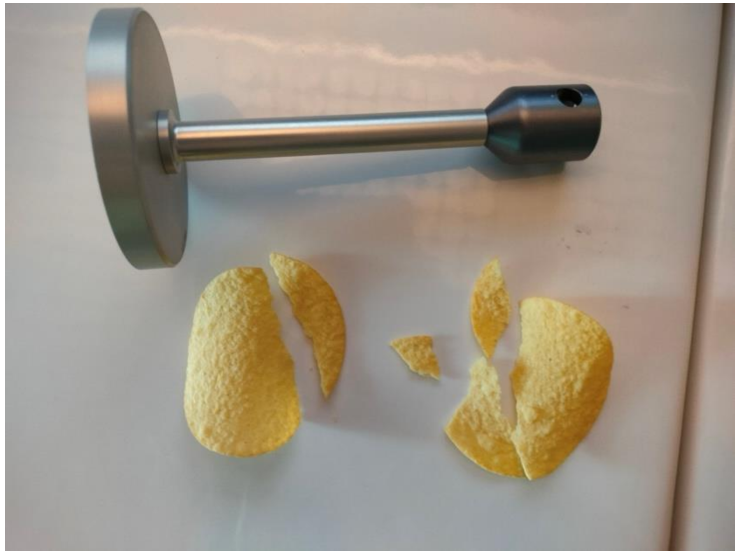
**Split
Puncture probe (9,4mm), plastic, stop test at 3mm, chip concave on chip stand

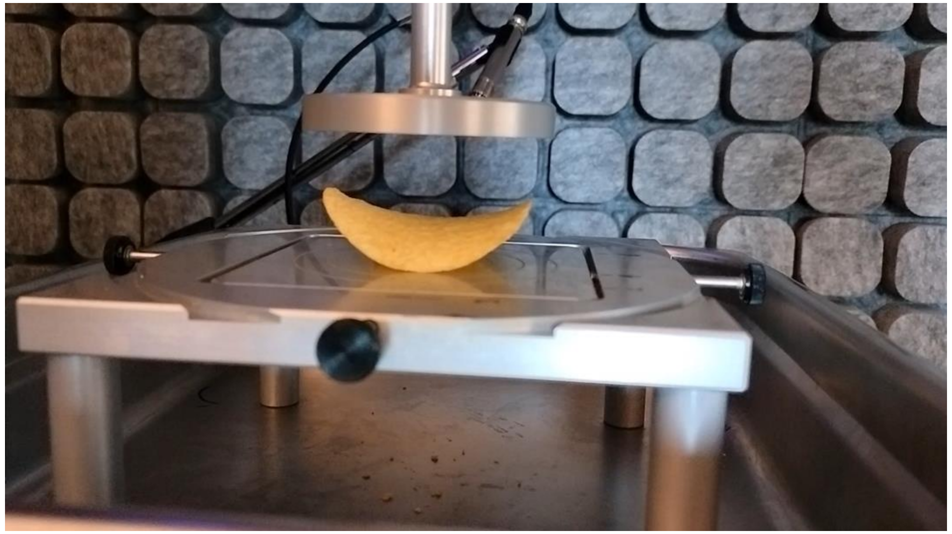




***Crush
Kramer cell,5 blades, stop test at 10mm

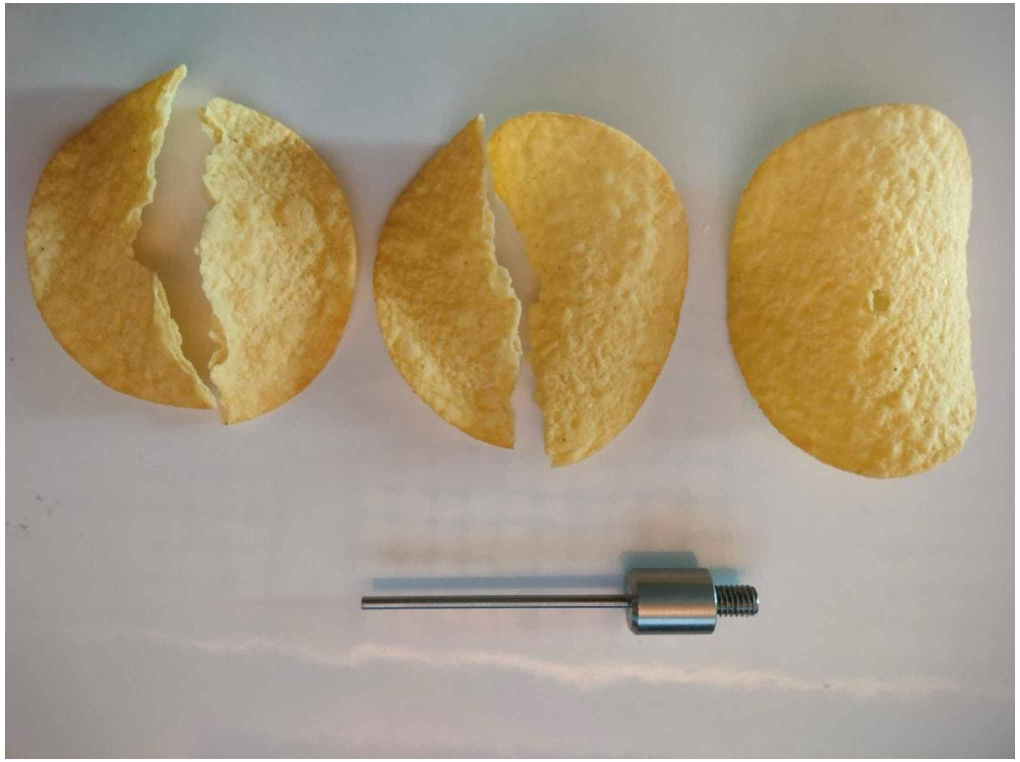


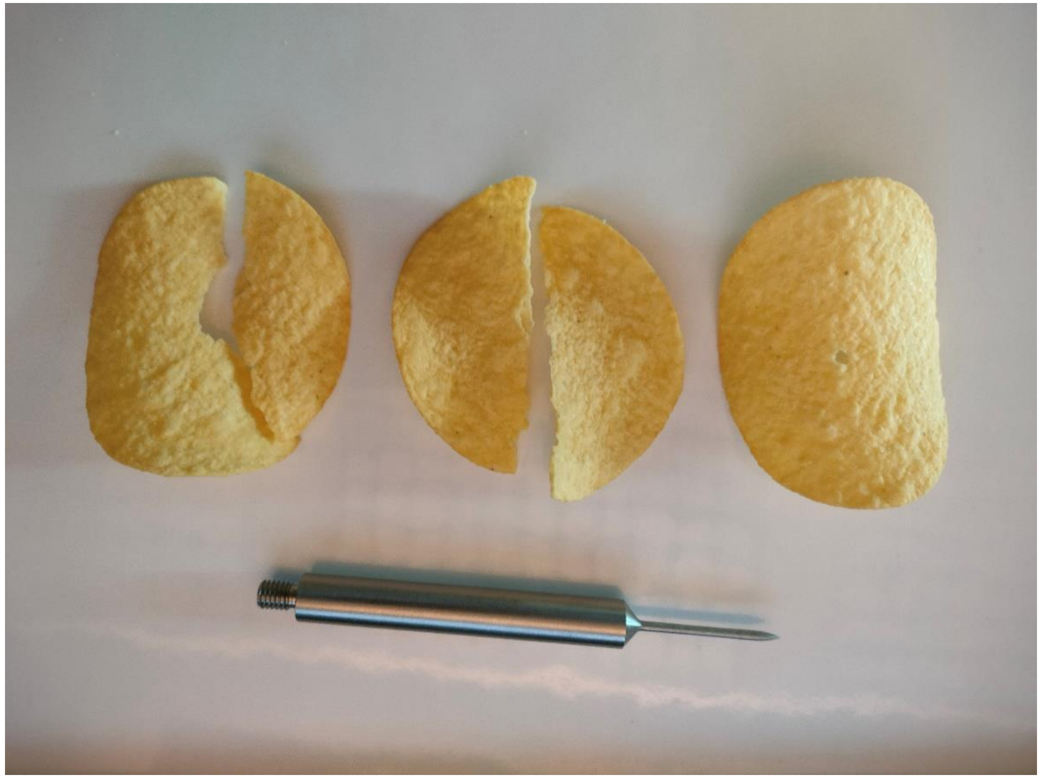


Other probes gave no even breaking

ORIENTATION

Concave

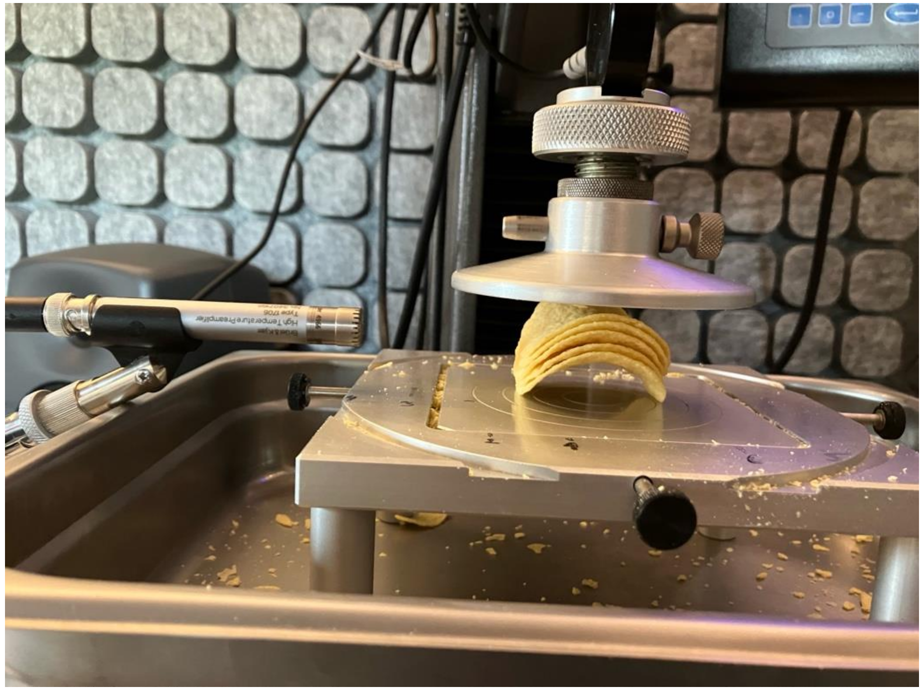


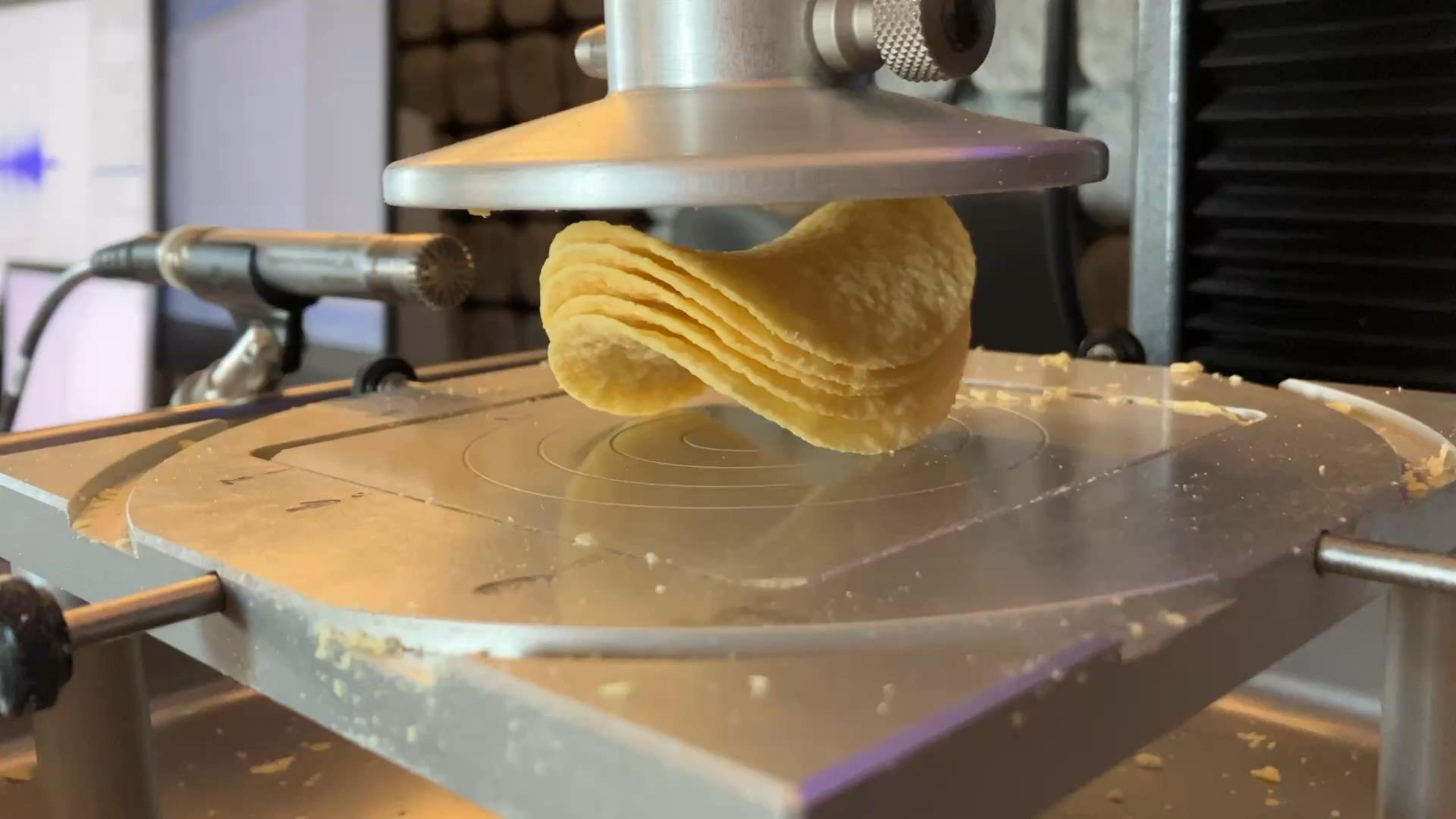


Type	Method	Speed	Repeats			3x total experiment
			6	3 cans		
		1				
	Needle	2				
		3				
		1				
1	Break	2				
		3				
		1				
	Crush	2				
		3				
		9 experiments per type				
		x5 types -->				
	>	**45 experiments**	**270**	**measurements**		

Experiment Number	Type	Method	Speed (mm/s)	Can number
1	Raw	Needle	0,2	1
2	Raw	Needle	0,2	2
3	Raw	Needle	0,2	3
4	Raw	Needle	0,2	1
5	Raw	Needle	0,2	2
6	Raw	Needle	0,2	3
7	Raw	Needle	1	1
8	Raw	Needle	1	2
9	Raw	Needle	1	3
10	Raw	Needle	1	1
11	Raw	Needle	1	2
12	Raw	Needle	1	3
13	Raw	Needle	2	1
14	Raw	Needle	2	2
15	Raw	Needle	2	3
16	Raw	Needle	2	1
17	Raw	Needle	2	2
18	Raw	Needle	2	3
19	Raw	Break	0,2	1
20	Raw	Break	0,2	2
21	Raw	Break	0,2	3
22	Raw	Break	0,2	1
23	Raw	Break	0,2	2

*Compression
Compression Plate (100mm) stop test at load of 350N, 5 chips stacked, concave





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Perimeter calculation of broken chips fragments

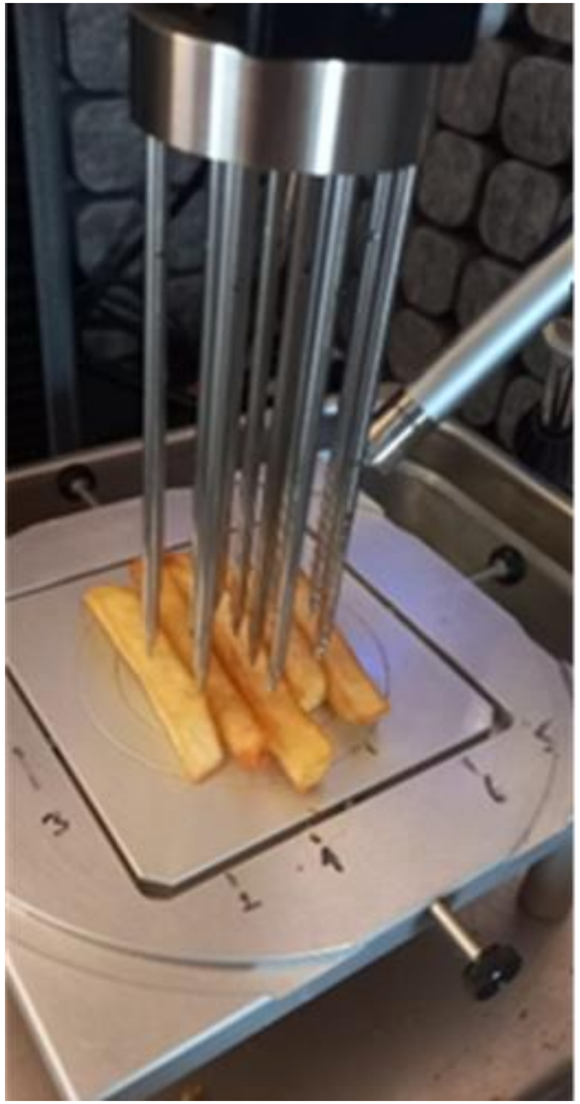
Filename	Num_Objects	Total_Perimeter_mm	Mean_Perimeter_mm
Chips_Sample_1.jpeg	11	165.20	15.01
Chips_Sample_2.jpeg	11	159.17	14.47

-2-
French Fries

Variables	Type	Values
SAMPLE		
DM Packed Product	Continuous	Q1: DM (high) Q3: DM (Low)
Frying time	Continuous	3.5min 4.5min 5.5min
PROTOCOL		
Speed	Continuous	Speed 1= 0.5 mm/s Speed 2 = 1 mm/s Speed 3 = 4mm/s
Probe	Categorical	1/ Knife 2/ Fork

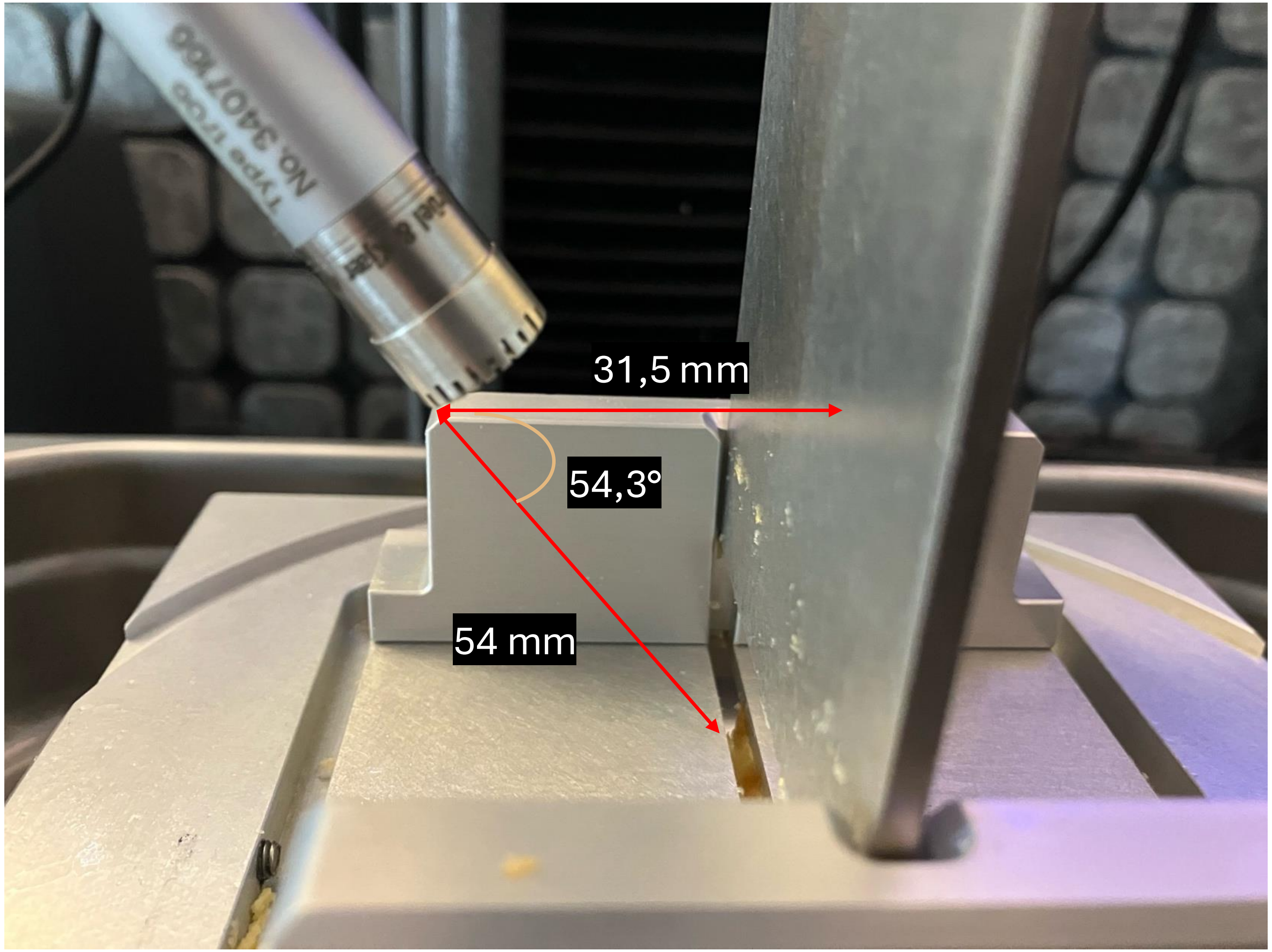
*Cut through
Knife probe (1.75mm) stop test at 15 mm, 6 fries in a row

**Puncture
Needles probe (10 needles of 1.75 mm), stop test at 5 mm, 5 fries in a row

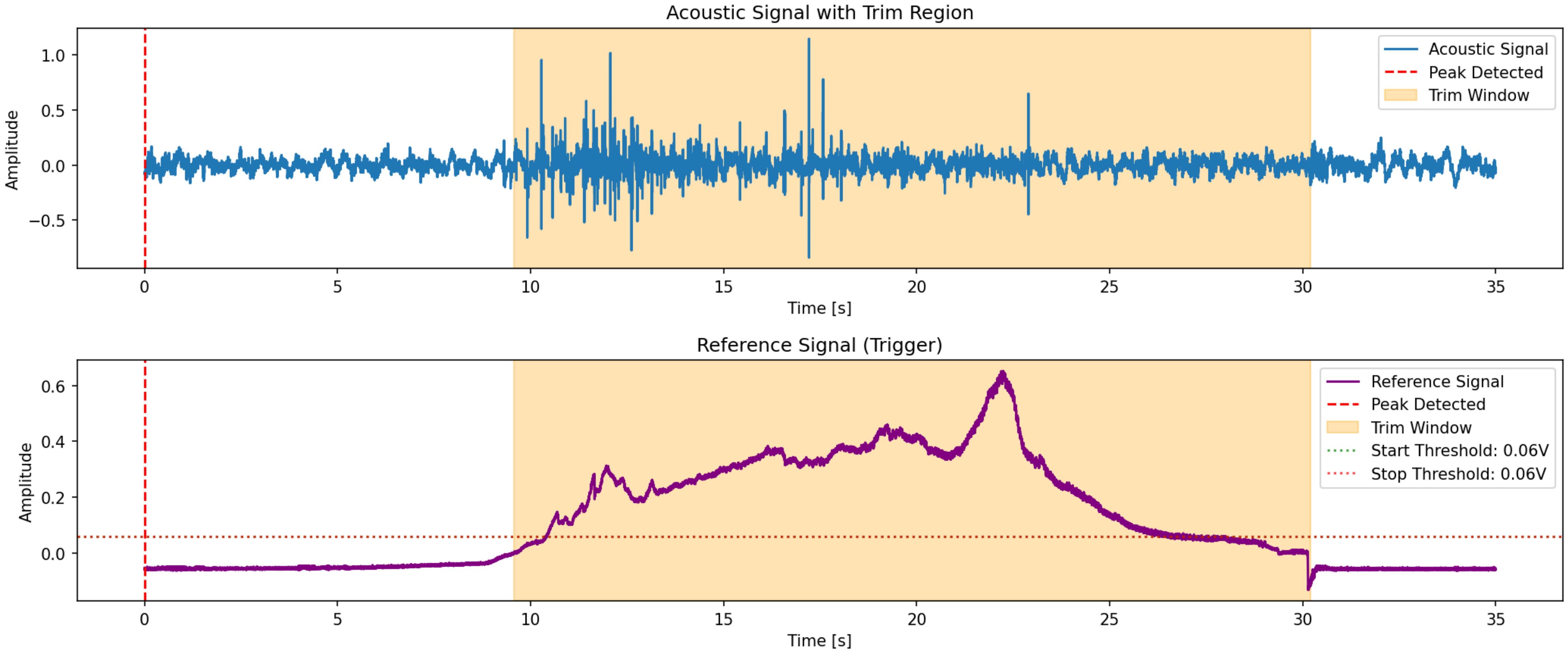


KRAK
OP ZOEK NAAR DE PERFECTE CRUNCH
JAN 2025–DEC 2026

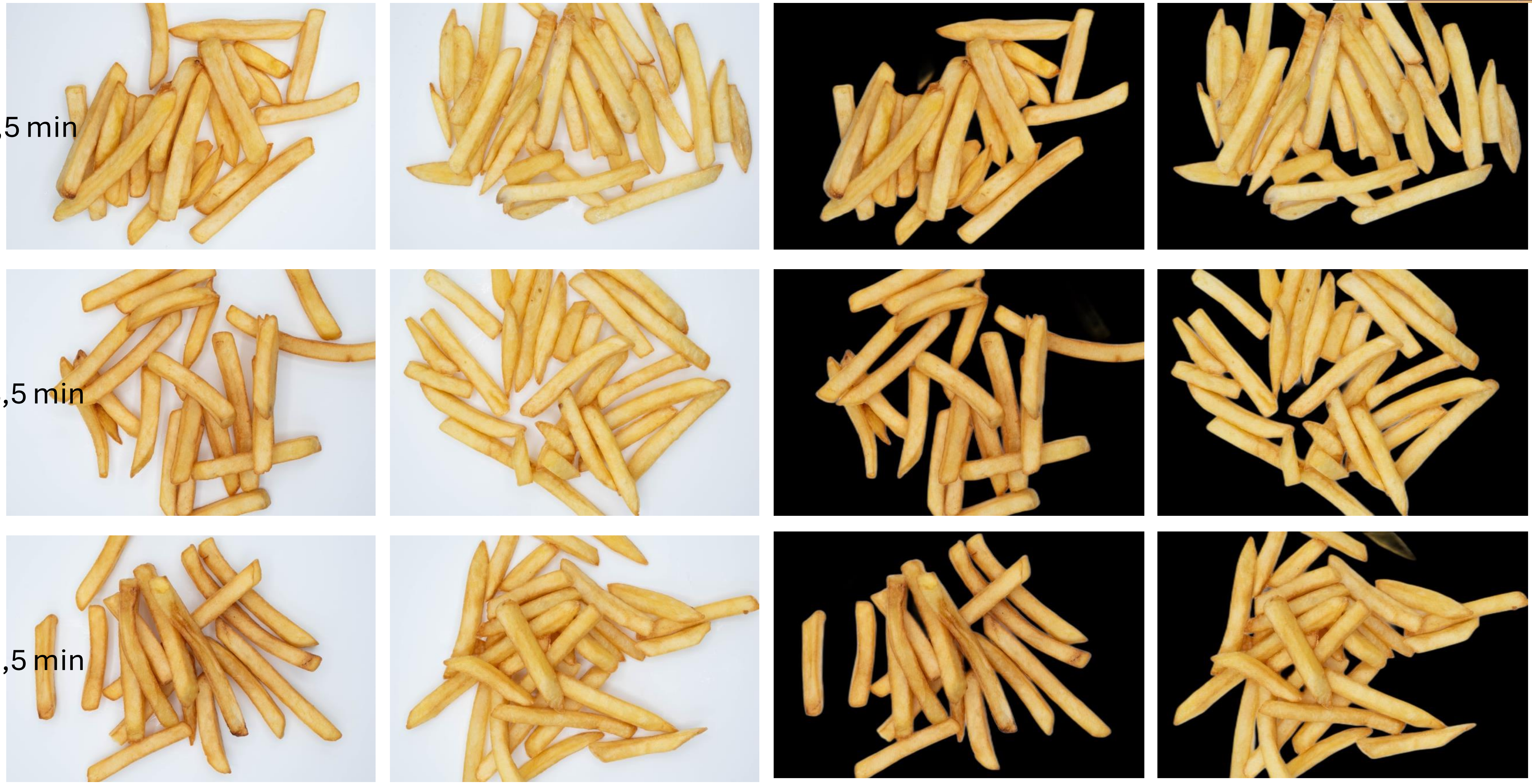
Microphone setup



Audio output



	Quality 1	Quality 3
3,5 min		
4,5 min		
5,5 min		



Quality 1

Quality 3

3,5 min

4,5 min

5,5 min

Bake Samples Overview (sorted by Composite Score: low → high)

frietjes-Q3-3,5.tif
Composite=39.73

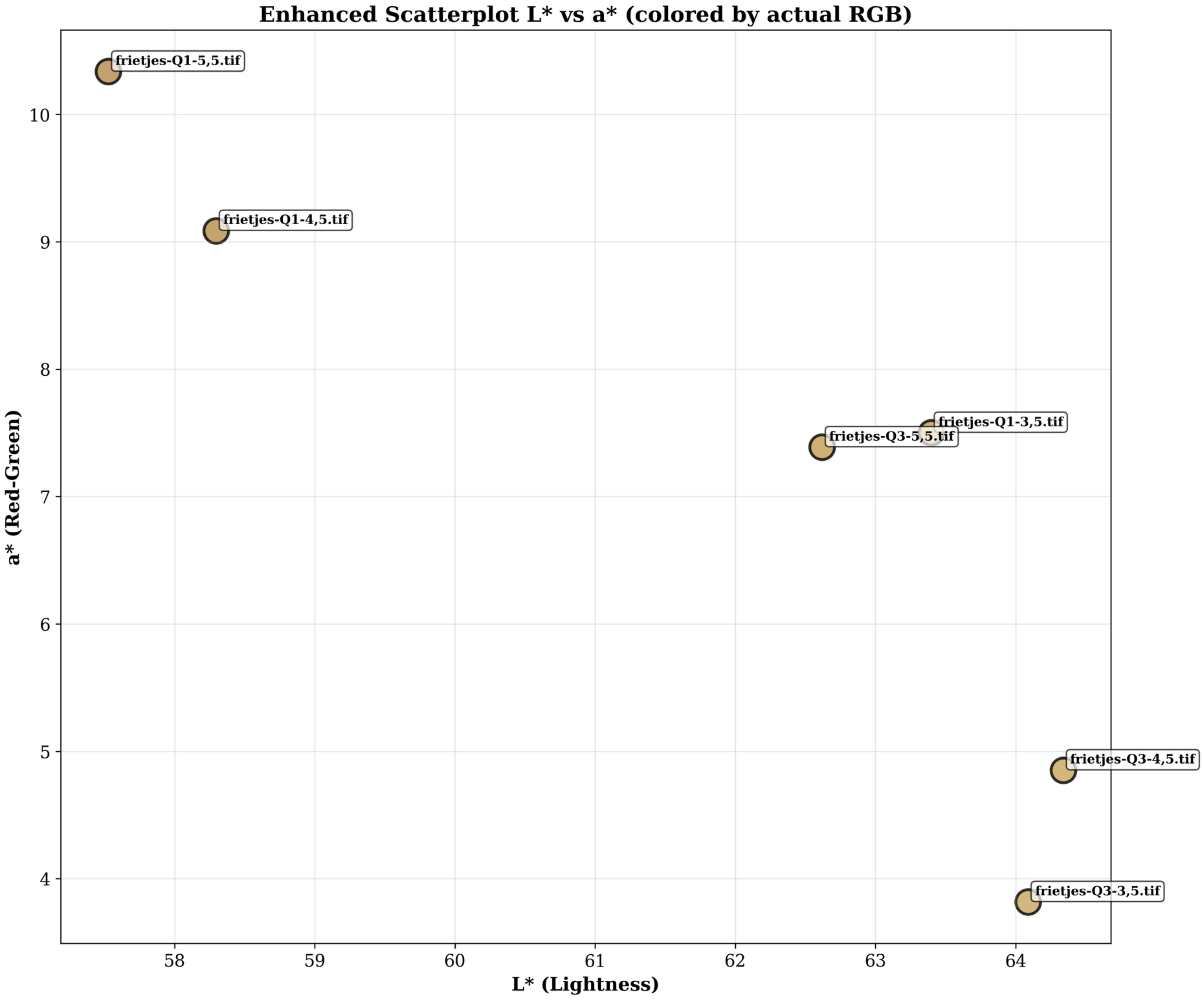
frietjes-Q3-4,5.tif
Composite=40.51

frietjes-Q1-3,5.tif
Composite=44.11

frietjes-Q3-5,5.tif
Composite=44.77

frietjes-Q1-4,5.tif
Composite=50.79

frietjes-Q1-5,5.tif
Composite=52.81



KRAK OP ZOEK NAAR DE PERFECTE CRUNCH JAN 2025–DEC 2026

-3-
Cookies

Variables	Type	Values
Moisture	Continuous	L1: 0-2% L2: 2-3% L3: 3-5%
Speed	Continuous	0,2 mm/s 1 mm/s 2 mm/s
Distance	Continuous	1,5 cm (only vertical) 2,5 cm 3,5 cm 4,5 cm
Orientation	Categorical	Horizontal Vertical

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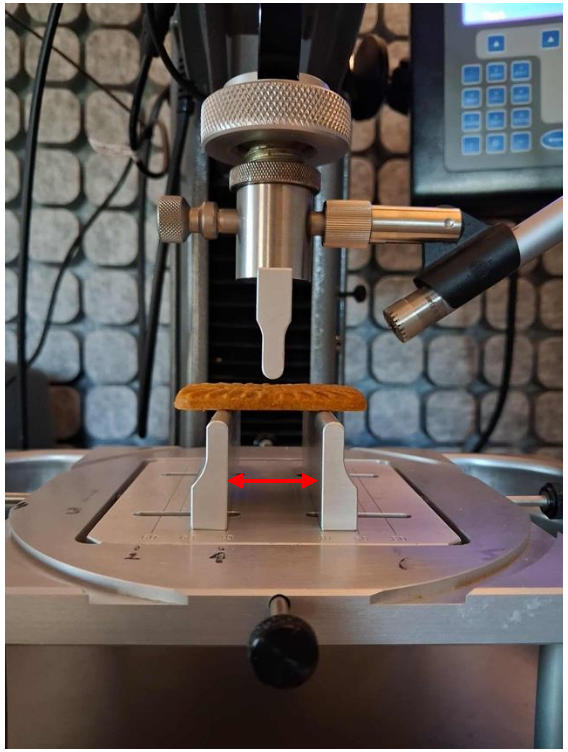
JAN 2025–
DEC 2026

Moisture

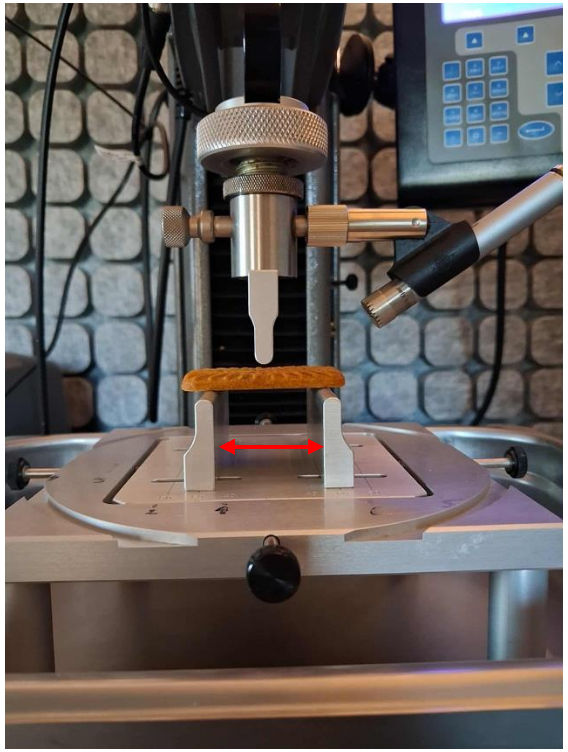
- Main parameter to determine the quality
- Hard to control
  - Climate chamber
    - Almost instant absorption of the moisture in the chamber → cookie to soft to break
  - Open air
    - Gradual moisture uptake → easy to follow up by weight
      - Fresh cookie = ±1,5% moisture → L1
      - After 2 hours open air +1% = ±2,5% → L2
      - After 4 hours open air +2% = ±3,5% → L3

Orientation

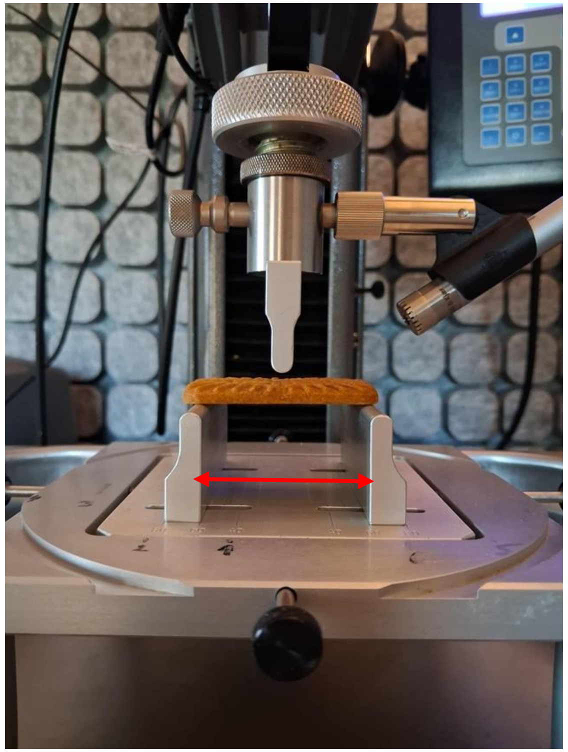
2,5 cm



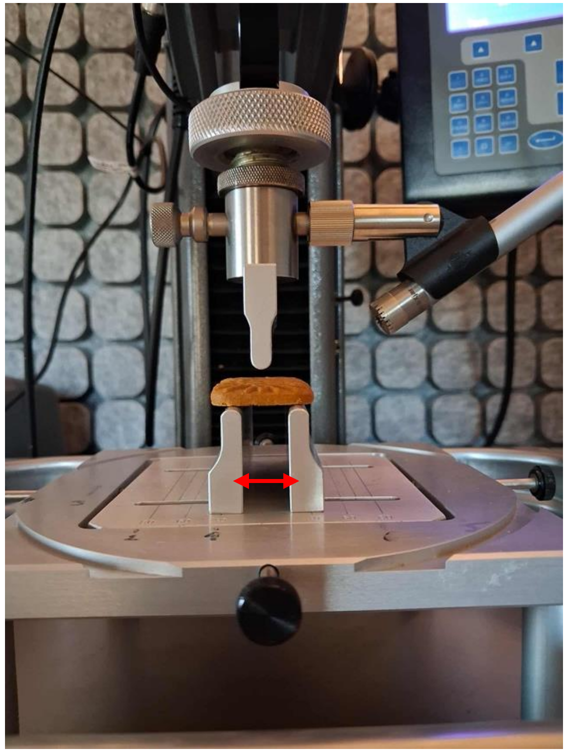
3,5 cm



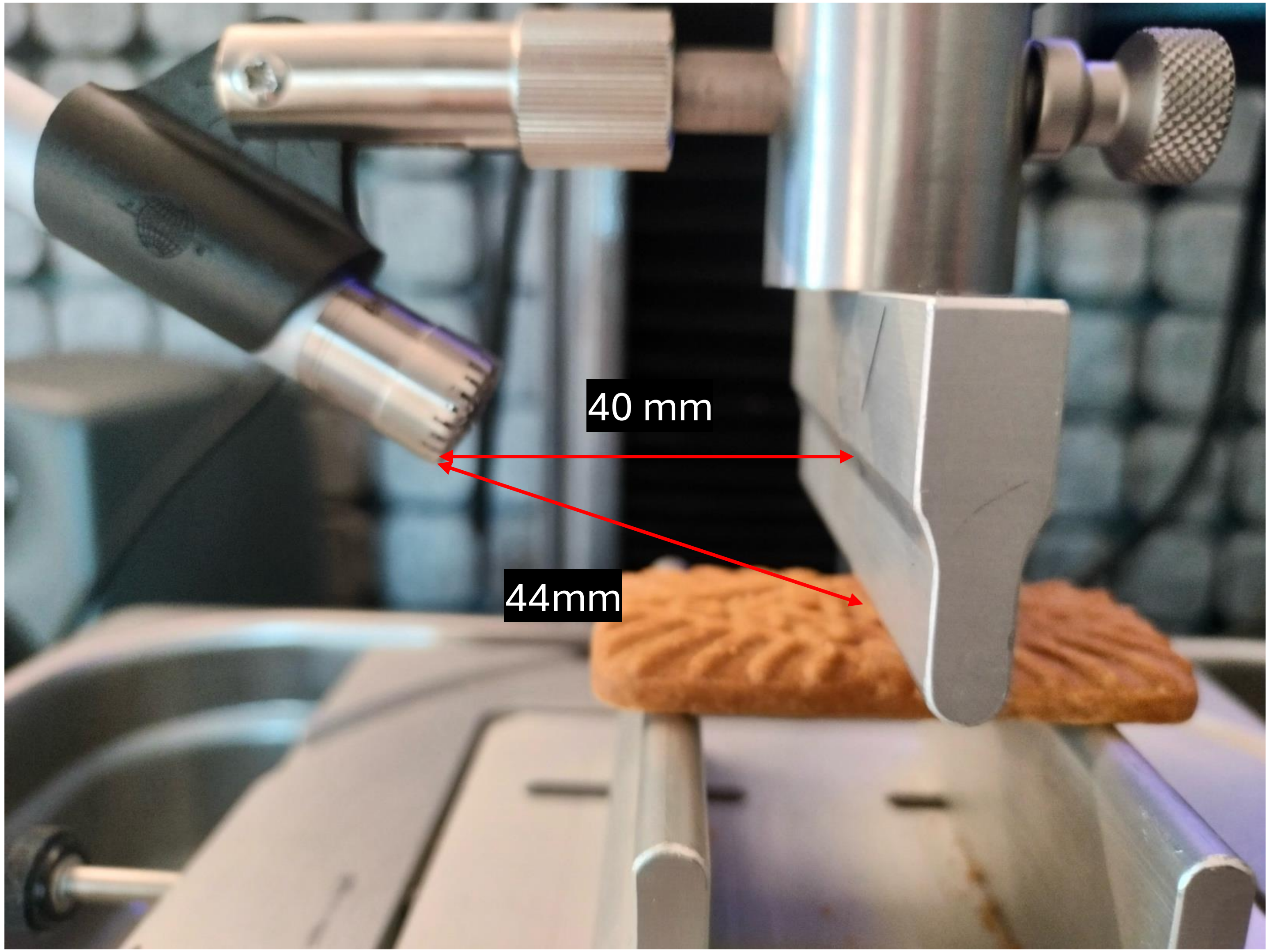
4,5 cm



1,5 cm



Microphone setup



Audio output

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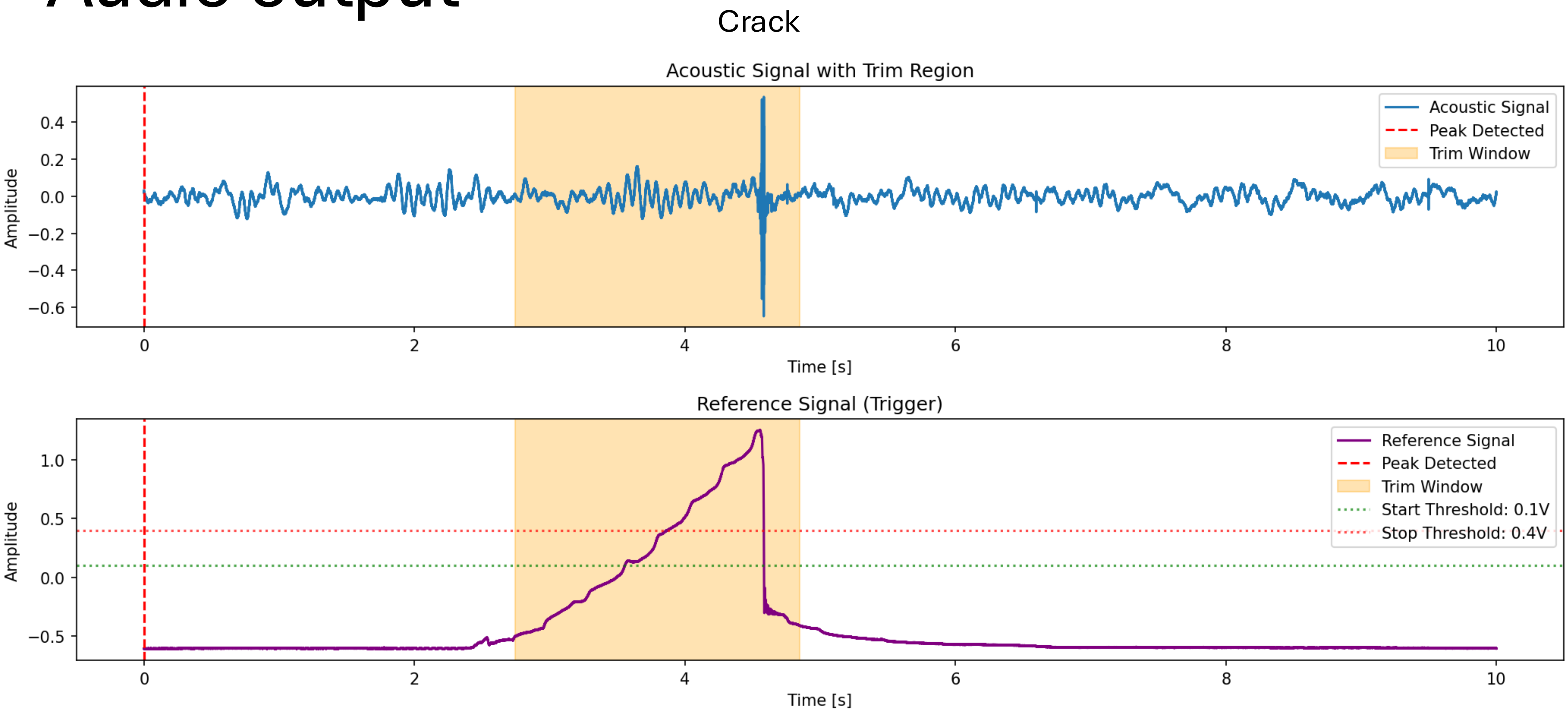


-4-
Bread
(Baguette)

Baguette Crust
Visual & Texture Profile

The crust is the bread's **sensory calling card**

VISUAL ATTRIBUTES
- **Darkness:** degree of browning from light to deep golden-brown
- **Thickness:** sidewall crust thickness, driven by oven temperature and bake time
- **Irregularity:** color variation, blisters, and cracks
- **Distribution:** top thicker; sides/bottom thinner

TEXTURE ATTRIBUTES
- **Crispiness:** cracks/snaps on touch or bite
- **Toughness:** resistance when biting through the crust
- **Cohesiveness:** structural integrity without excessive crumbling

Physicochemical markers:
- Water activity (Aw) of crust: 0.522–0.540
- Moisture: thick crust ≈ 11%; thin crust ≈ 9.67%
- Mechanical transition around Aw 0.68–0.69: brittle → tough (glass → rubbery)

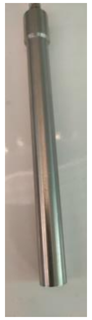
Puncture test most widely used (radius: 2mm – 40mm)

Measuring on **side** → least variation, even surface

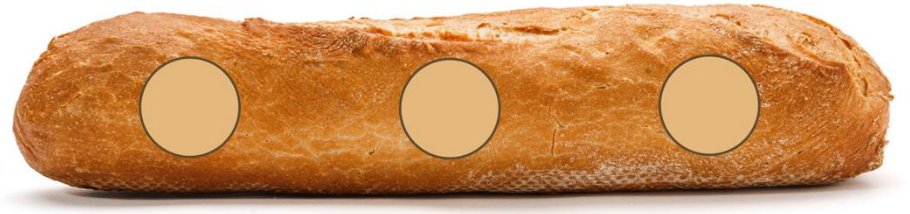
Measuring crust over **time:** 30 min - 4h after baking

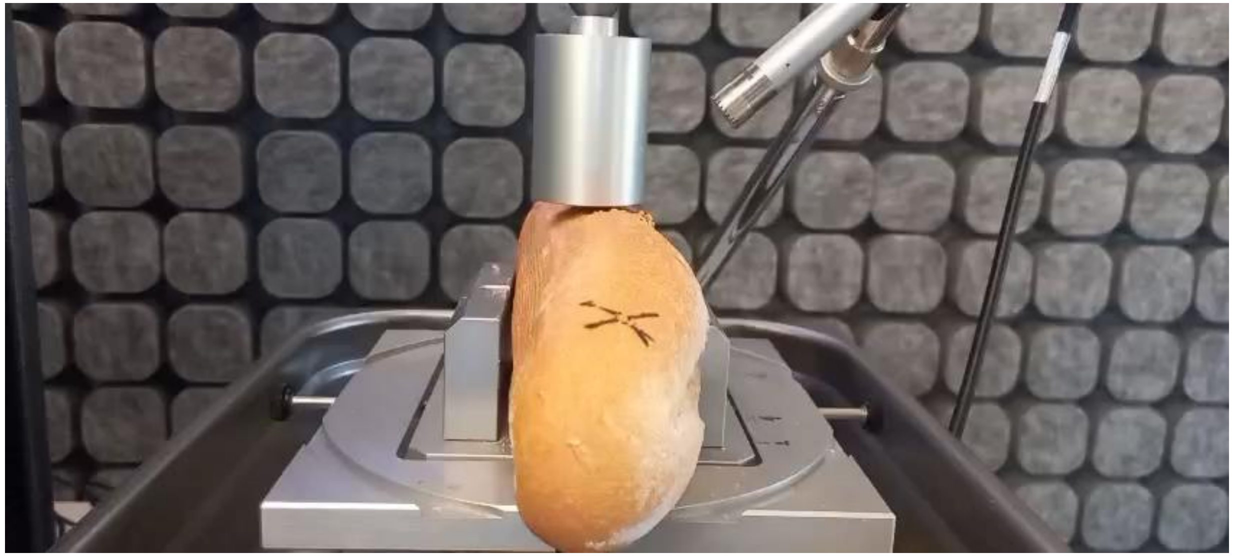
Different zones tip, side, center

Bread probe (Ø 35,5mm)



Puncture probe (Ø 10mm)





-5-
Chocolate

Chocolate

=SNAP
Method: protocol available for texture testing
Measure hardness value / max breaking force

Ingredients

More cocoa butter in dark chocolate → ‘better snap’
→ What is a better snap in terms of **audio features**?

Knowledge from fracture tests available
Different shapes possible → thick tablet gives best measurement results

Research questions

Ingredient influence on snap?
Effect of chocolate **thickness**?

-6-
Breaded & Battered products

Breadcrumbs – Crispiness Evaluation

Crispiness under realistic conditions

Assess crispiness evolution after preparation
→ *warm holding*, *delivery*, *serving* conditions

Characterization of breadcrumbs

Compare different breadcrumb types (panko, big crumbs, extra baked, dense crumbs)

Open question: measure baked on standard substrate *or* unbaked (as such)?

Investigate which audio features are linked to
→ breadcrumb type / structure
→ crispiness loss during warm holding

Sensory attributes: crispiness, brittleness, hardness

2. Measurement System Optimization Methodology

Methodology

Step 1: Optimize the method (Setup protocol)

In our experiments, we test different configurations of our method and use the audio data to find the optimal configuration for which we expect the audio signals for the crunchy and non-crunchy food to be as different as possible.

Taking the cookies as an example, we want to find the optimal method (Distance, Orientation, Speed) that produces the largest difference in the audio signals between the soft and hard cookies.

The optimal configuration for cookies:

For the cookie dataset, when modeling the **number of peaks**, we discovered an interaction effect between **Speed** and **Moisture %**.

Distance (cm)	Orientation (Short/Long)	Speed (mm/s)	Difference in number of peaks predicted for low and high moisture %
-	Short	0.2	3.50
-	Short	2.0	2.37

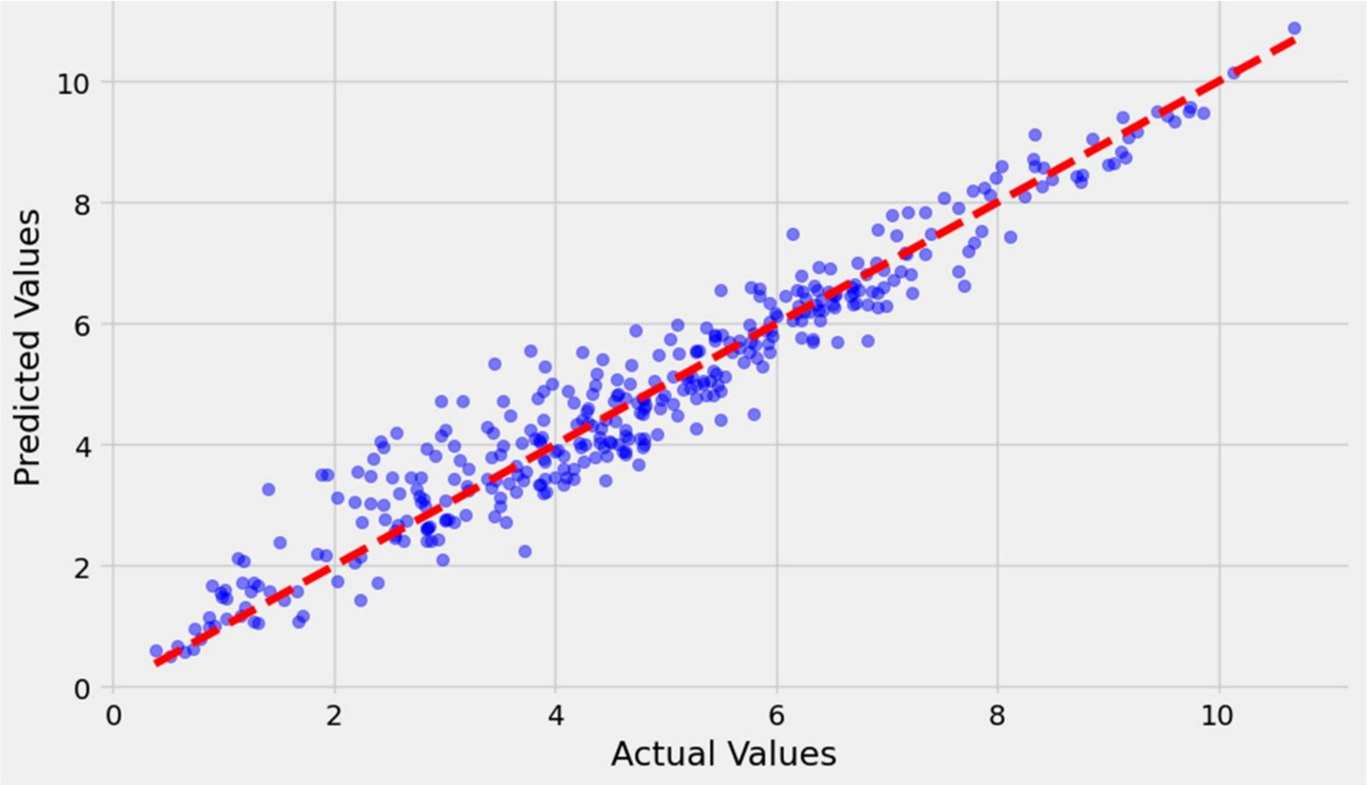
Methodology

Step 2: Optimize the model (Prediction protocol)

Using the "optimal method" discovered in step 1, collect more data by only varying levels of the crunchy/crispy parameter, and find a mathematical model that best correlates the variance in the audio due to the change in the crunchy/crispy parameter.

Methodology

Our goal:



2. Audio Acquisition & Analysis

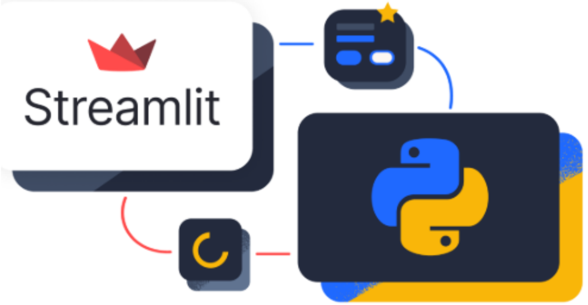
3 approaches

- With audio signal processing expertise
- Use of deep learning pre-trained audio neural networks
- Making own deep learning model

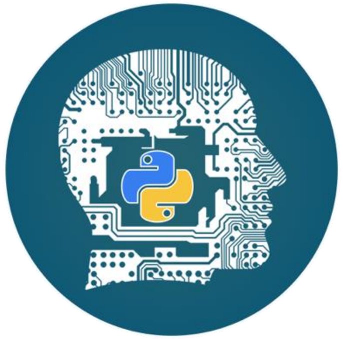
Data flow: Audio signal processing

Audio aquisition

Server Storage
MinIO S3 Bucket
Bruges



Signal processing for feature engineering
Streamlit Web interface
(GUI)



Machine Learning
Models

Signal processing (Streamlit web interface)

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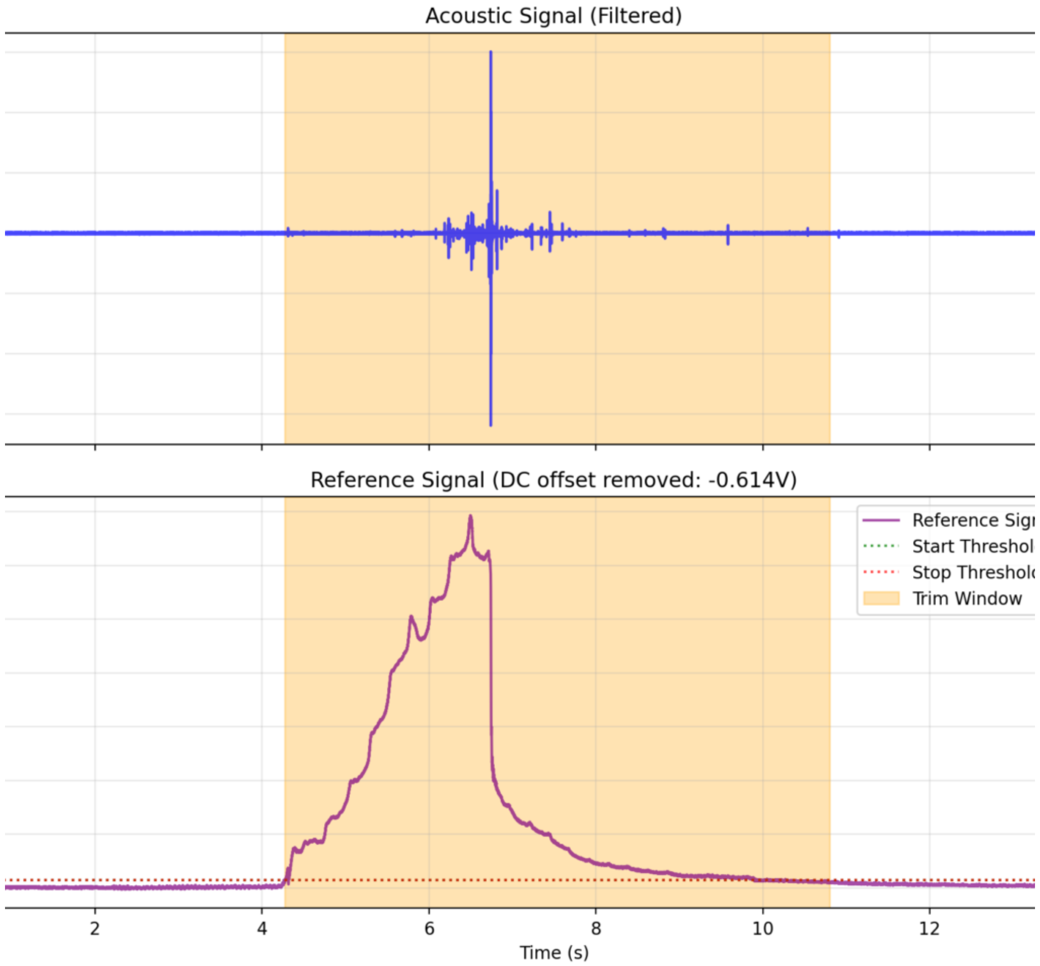
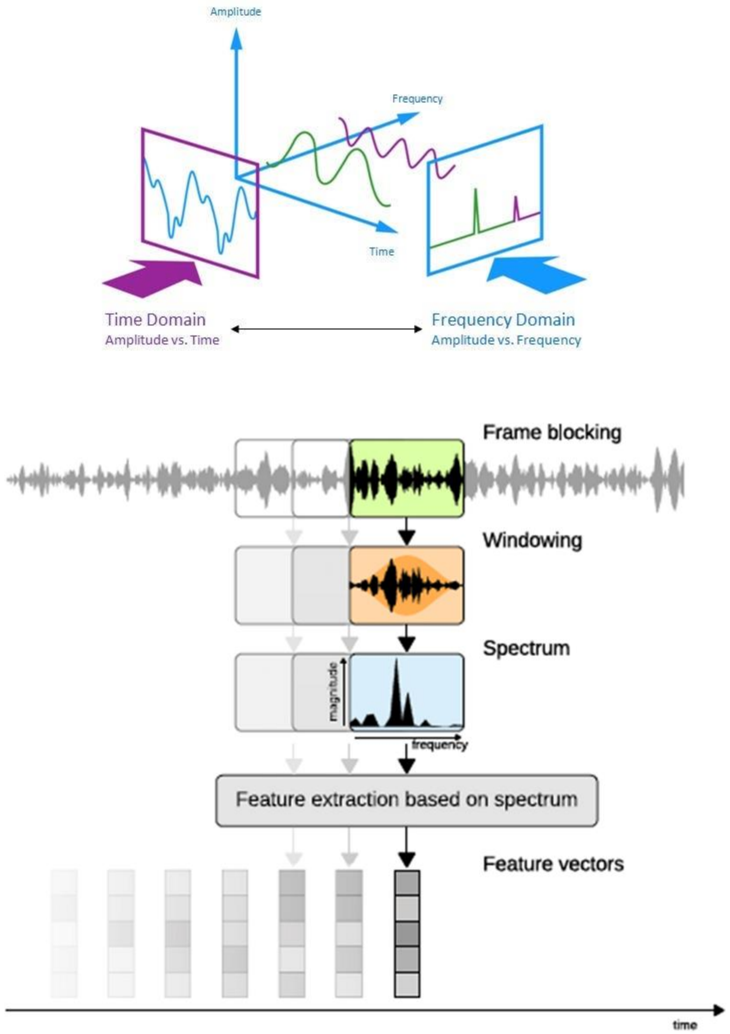
1. Analysis window



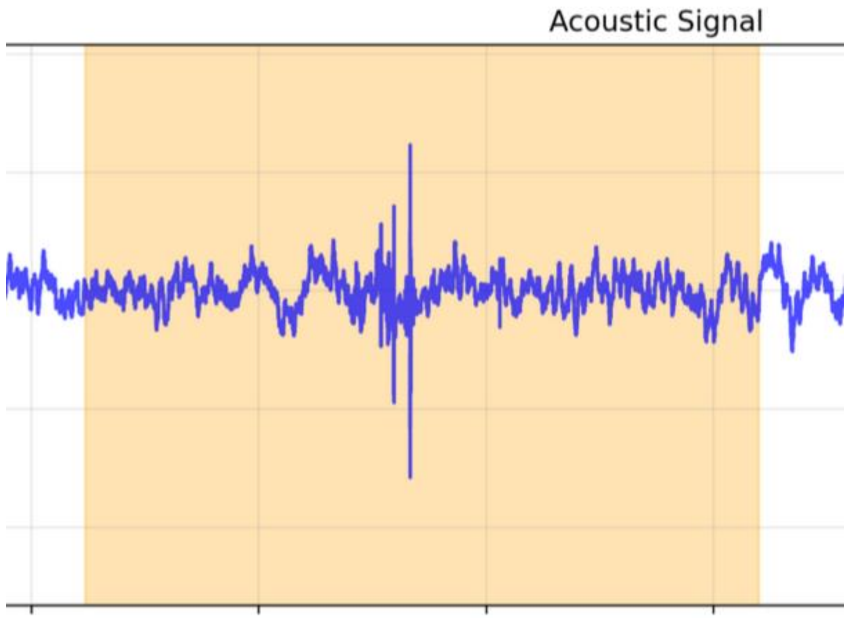
2. Feature extraction

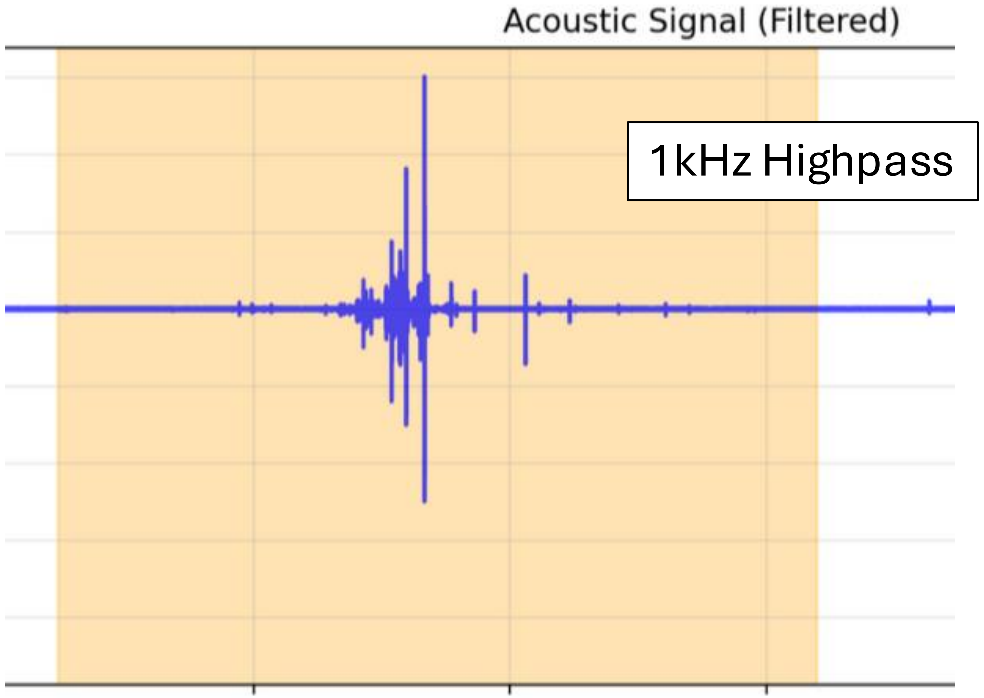


Signal processing

1. Analysis window

- Automated method
  - Visual inspection
  - Audio inspection
- Filtered/unfiltered





Signal processing

1. Analysis window

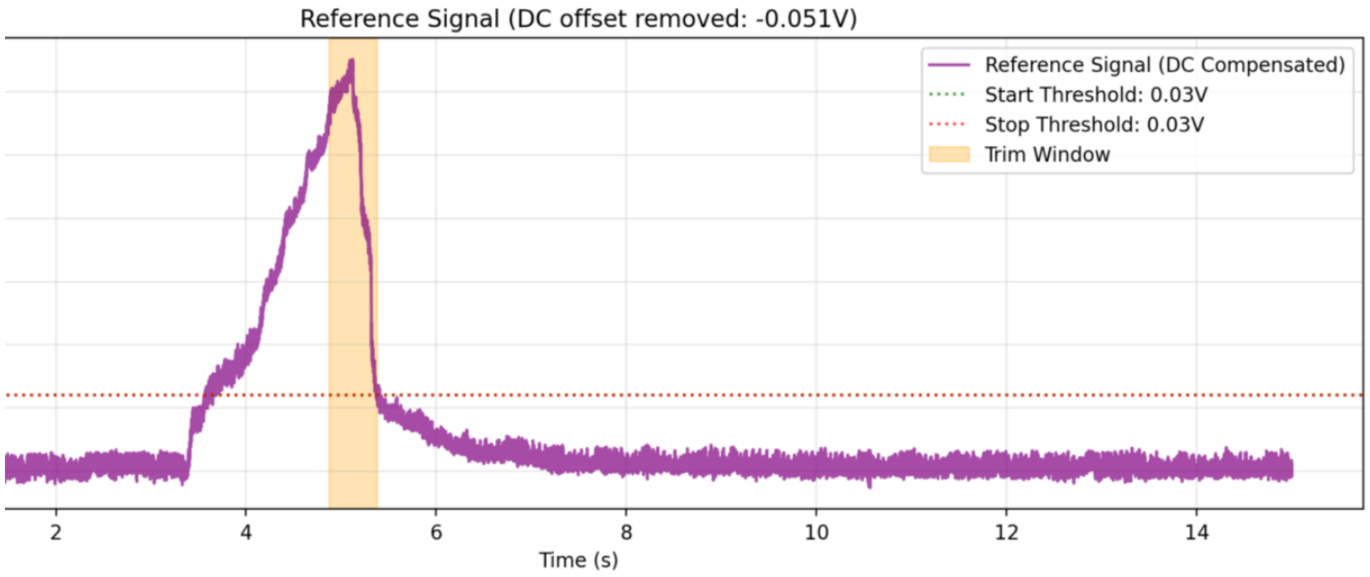
- Automated method:
  - Loadcell Data:

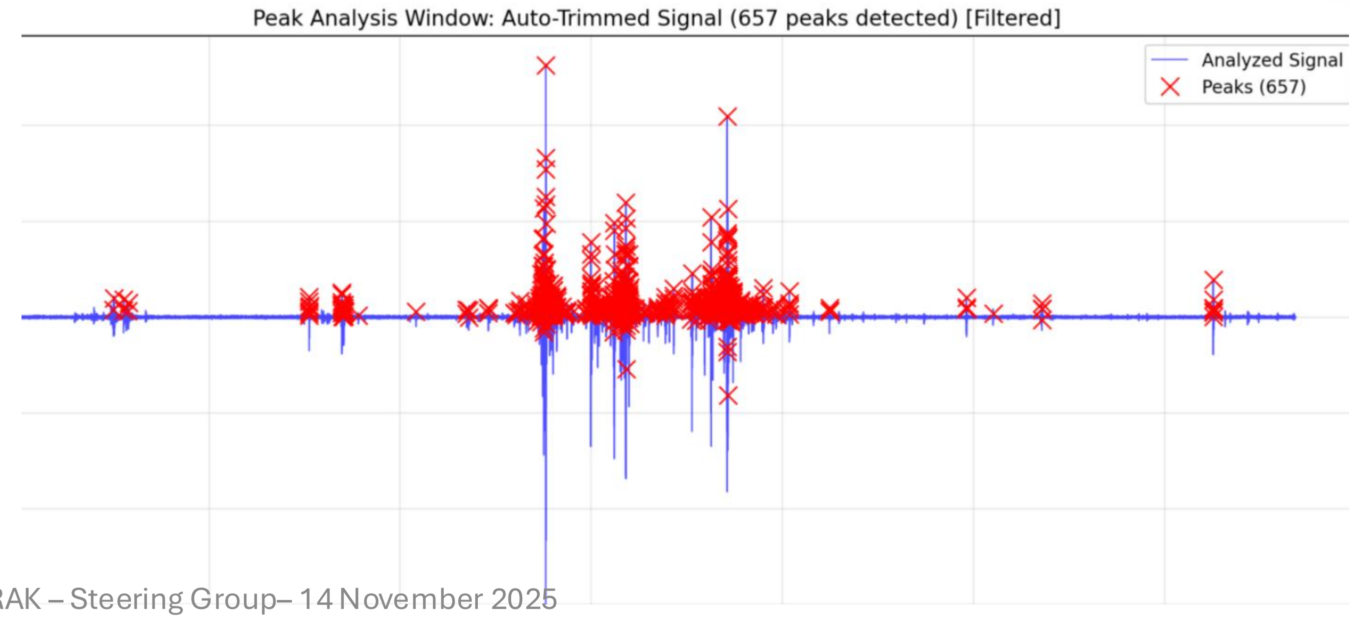
    Thresholds

    Sharp decline

  - Audio Data:

    Peaks

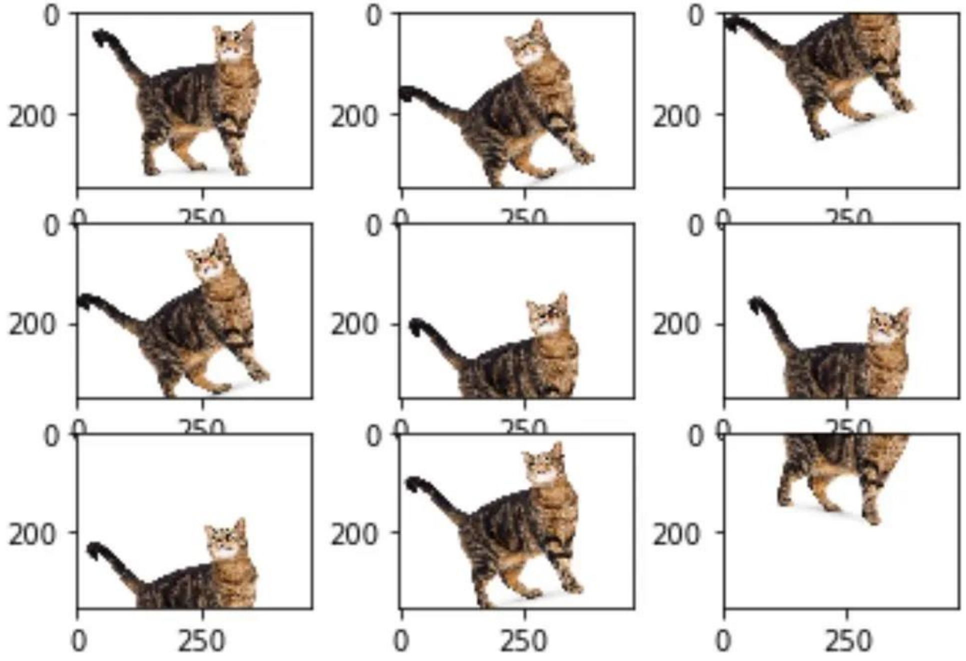




Signal processing

1. Analysis window

- **Different ways of looking at the data**
- **Augment the number of usefull features**



Signal processing

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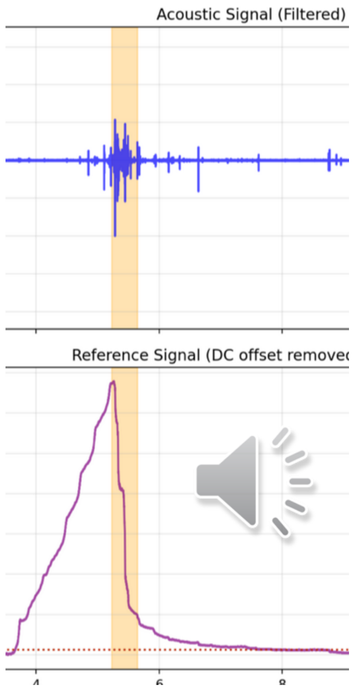
1. Analysis window

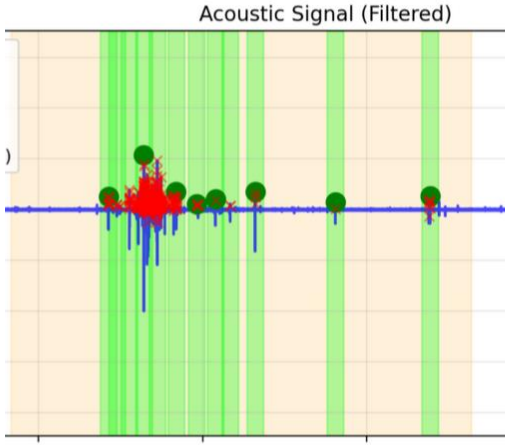
- **Different analysis windows: focus on different aspects of the audio signal**

broad: first to last peak
(within loadcell tresholds)

focused: main cracking
(loadcell decline + audio peak)



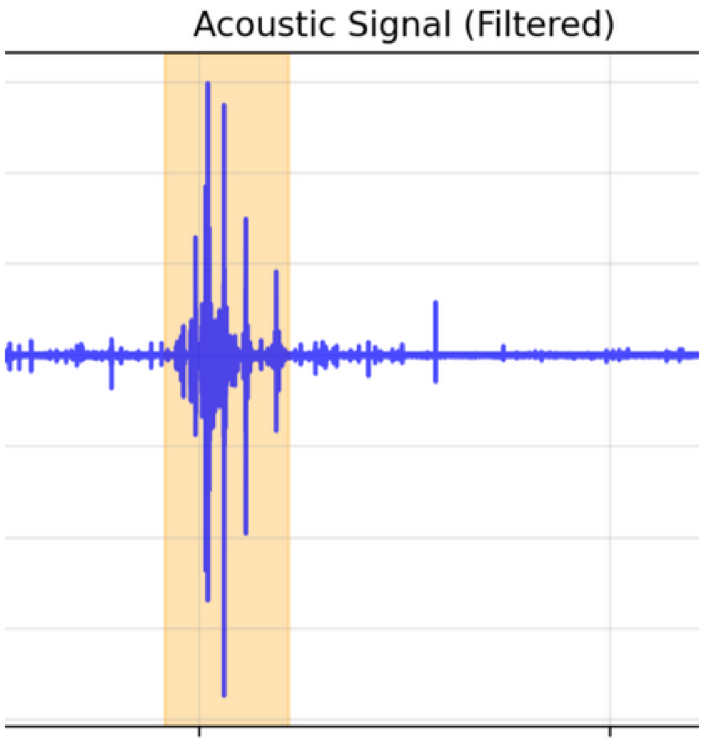
focused: audio peaks
(statistical features)



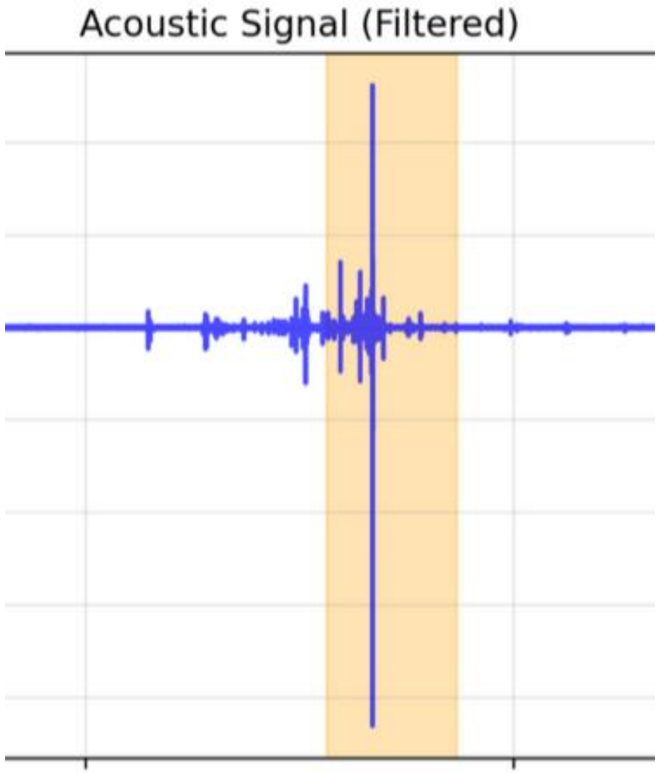
Signal processing

Audio examples: cookie

‘Crunchy’



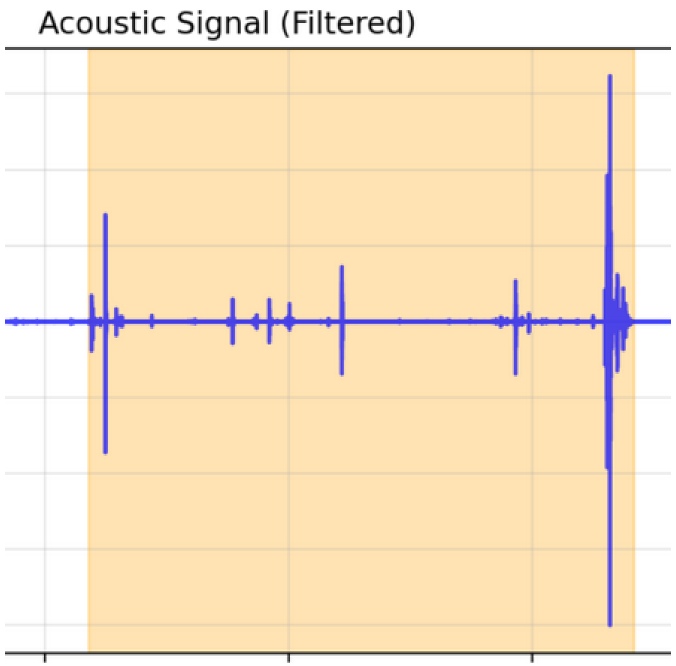
‘Moist’



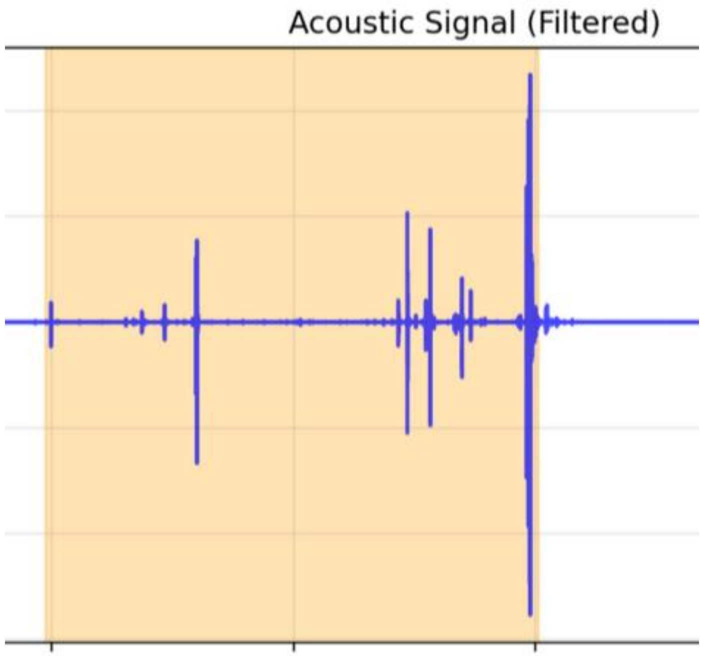
Signal processing

Audio examples: chips (single)

Crunch: low



Crunch: high

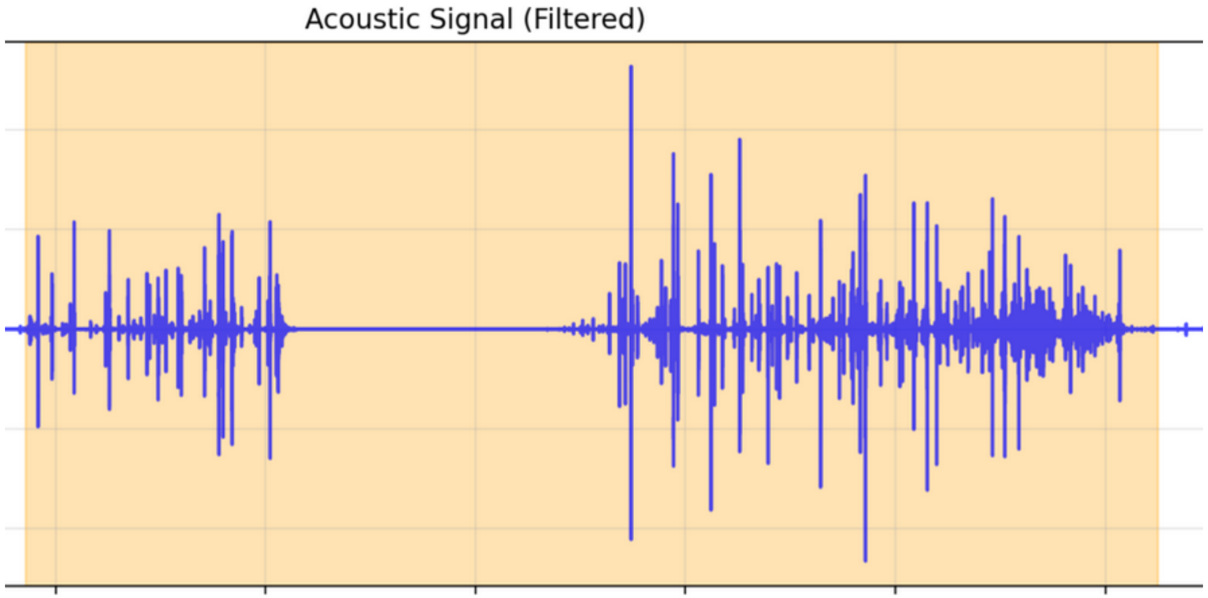


t

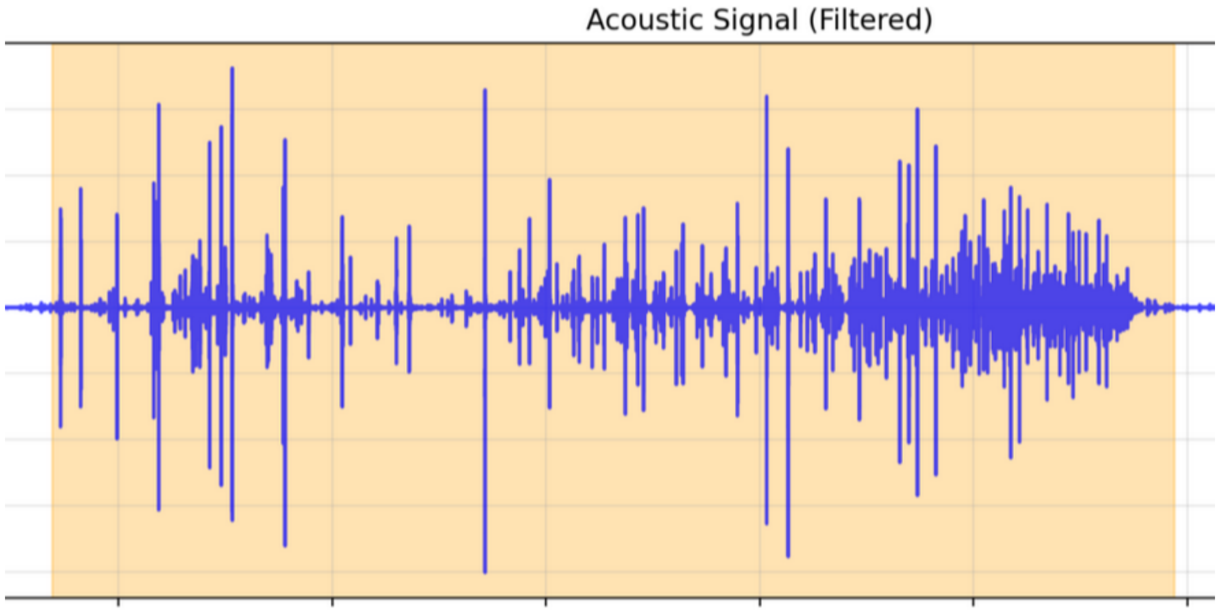
Signal processing

Audio examples: chips (stacked)

Crunch: low

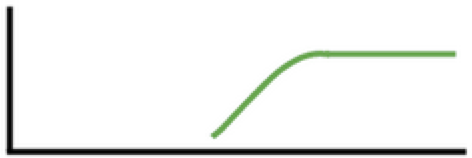


Crunch: high

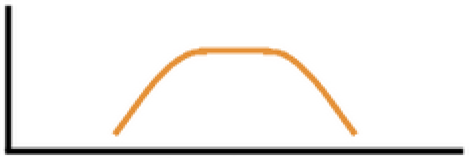


t

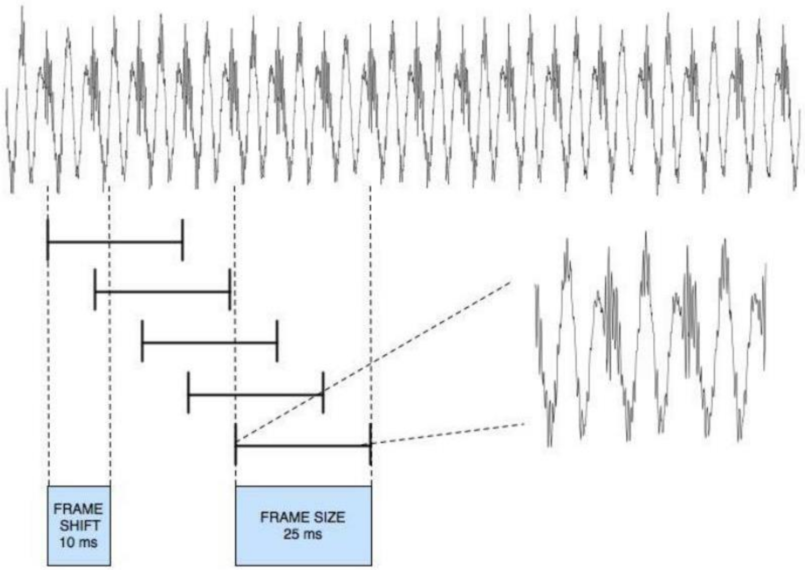
Signal processing



2. Feature extraction



- Trimmed analysis window: always unfiltered data
- Feature extraction:
  - Multiple audio filters:
    - High pass
    - Band pass
  - Multiple settings:
    - Frame size
    - Frame shift



Signal processing

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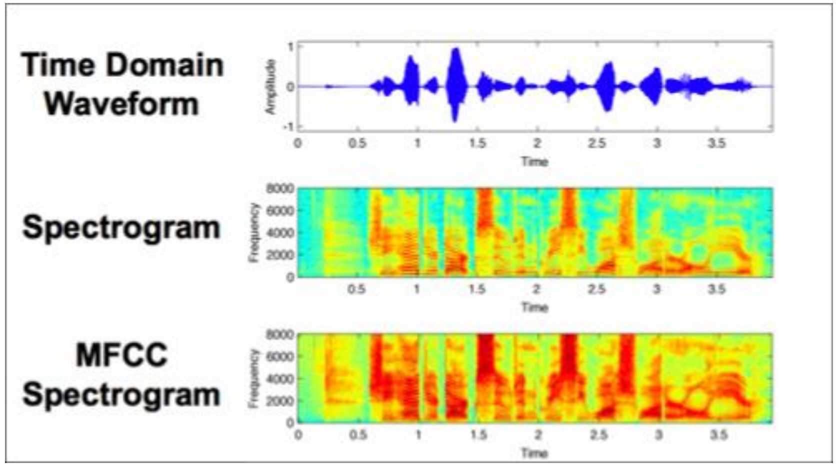
2. Feature Types: general features

- Time domain:
  - Energy of the signal, distribution of energy over the signal
  - Peaks: number of peaks per time, sharpness of peaks, peak heights, …
- Frequency domain:
  - Distribution of energy over the spectrum
  - Peakedness, randomness, symmetry, peaks vs valleys, …
- Mel frequency domain:
  - MFCCs (short-term spectral shape info in several logaritmic frequency bands)
  - + derivatives: velocity and acceleration of changes in spectral shape



Signal processing

2. Feature Types: more sophisticated features

- Chroma features:
  - Energy per tone (music: 12 tones)
- Impulse response/transient features:
  - Onset, transient, … analysis: number of “attacks” in the signal, how long their effect lasts, ..
- Impact and crack related features:
  - Impact sharpness (abruptness of spike, time between cracks, …)
- Knock related features
- Speech features:
  - intensity, duration of the explosive part of a /p/, /b/, /t/ etc
  - Pitch, voicing ratio, tempo, …
  - Formant analysis (which frequencies are observed together per sound? ➔ dominant resonances + bandwith (energy damping per resonance frequency))

Data science time!

- Many feature sets x many frequency bands x many trimming methods = **many features!** (around 20.000)

- We have limited data (max. around 400 samples, first around 70)
  - 20000 features is too much!
  - Not all models are suitable

- How to know which features to use? ➔ feature selection!
- Which modelling technique to choose? ➔ model selection!

Feature selection funnel

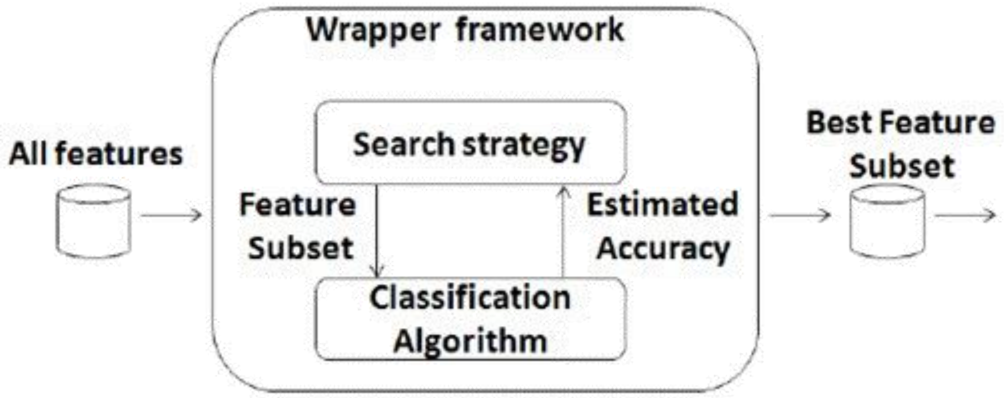
1. Remove low-variance features/ remove correlated features

2. Remove features with no correlation with moisture

Filter methods (purely statistical)
Pearson correlation >0,85
Spearman correlation >0,90

3. Keep features which increase the predictive power of the ML model

Wrapper/embedded methods (Machine Learning)



CLASSIFICATION

Model selection: start from simple models

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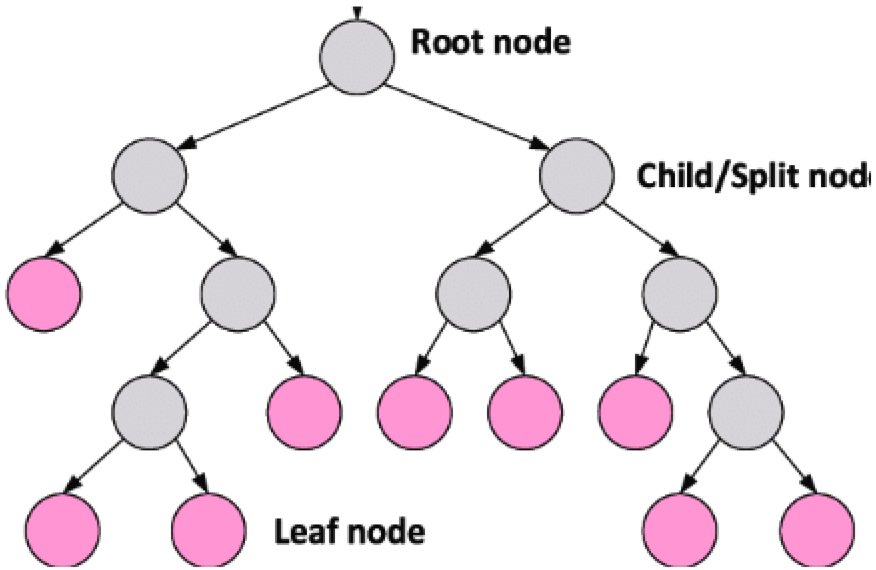
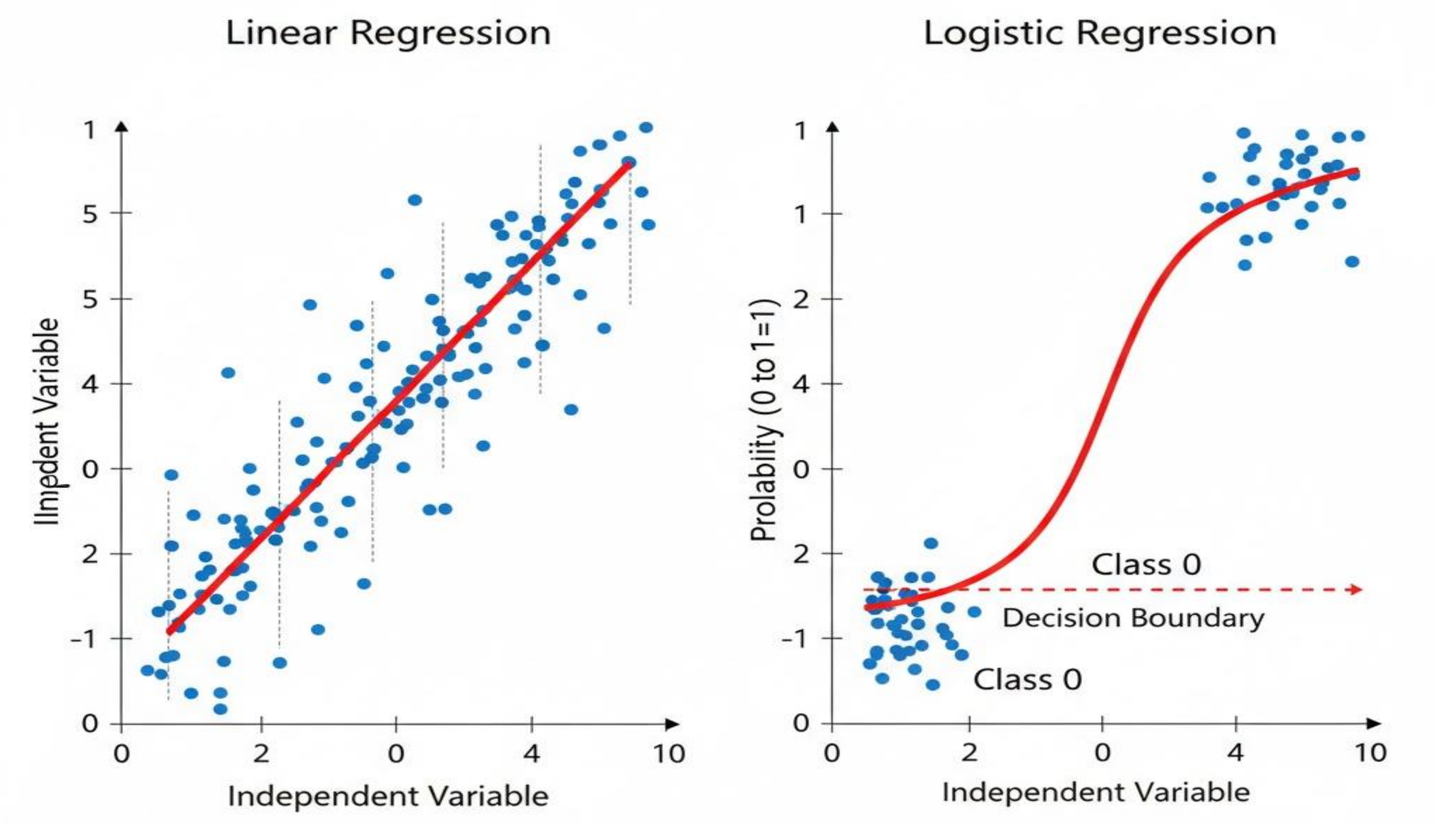
Decision tree / regression tree

logistic / linear regression





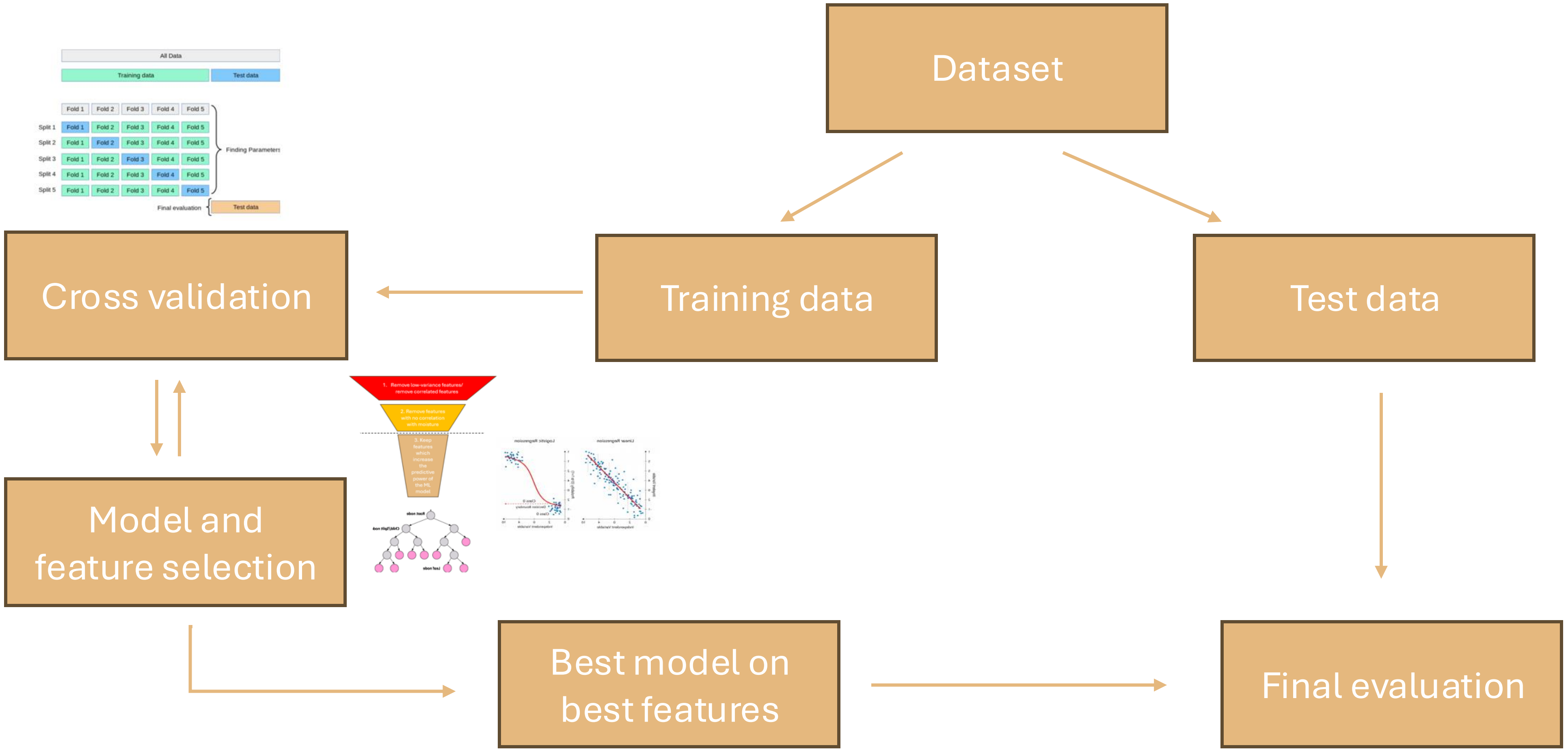
Model selection: start from simple models

... and combine many into an ensemble model!

- Every model trained on a slightly different dataset: different samples, different feature subsets, different model type, ...

- Two well-known ensemble models:
  - XGBoost (combination of decision trees)
  - Ensemble linear regression with Elastic Net (combination of linear regression models + extra feature selection)

Model validation: experimental setup

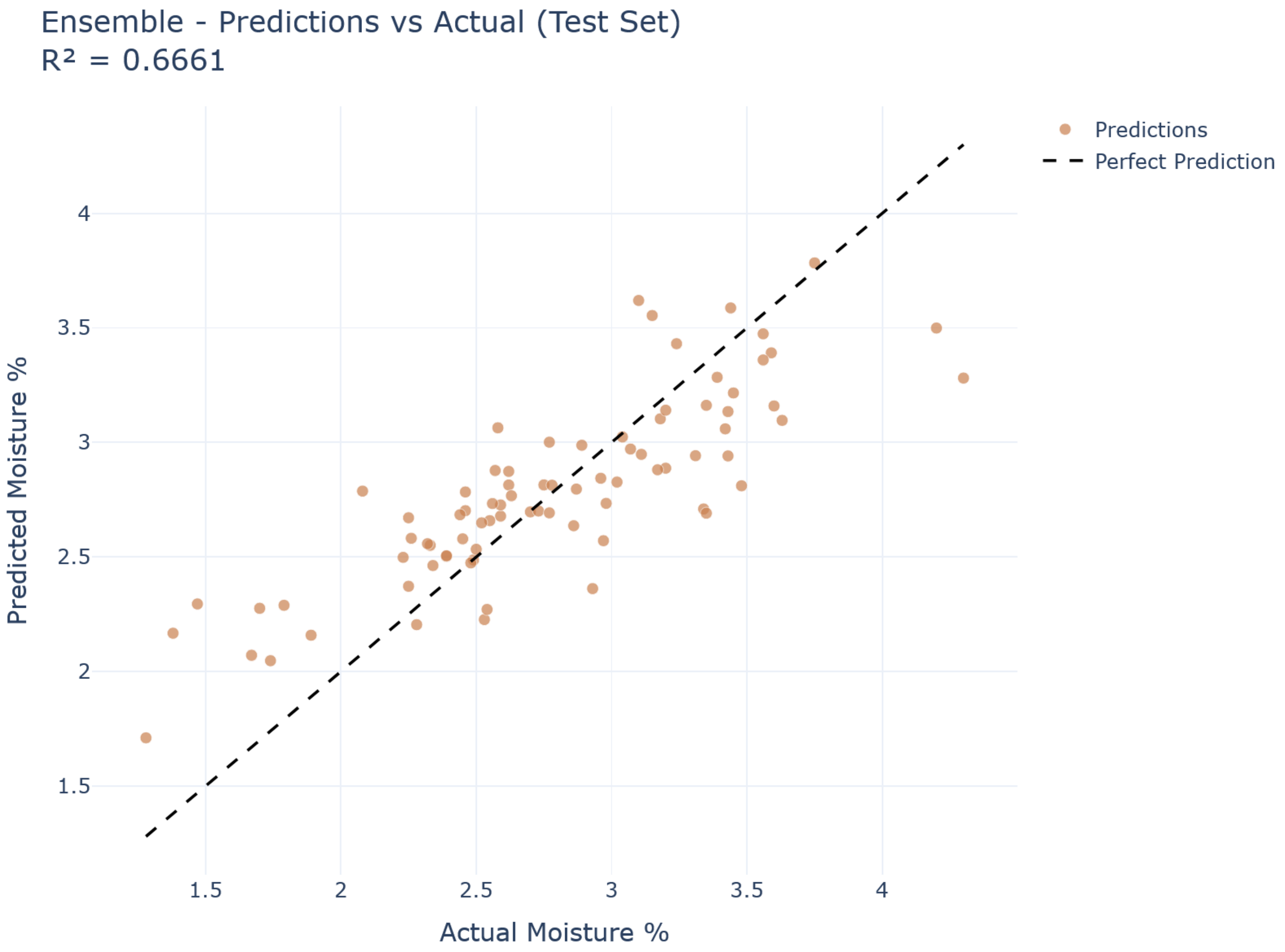


Machine learning

3. Results

- Model test on new data
- Model combined from models created with different analysis windows
- Further finetuning:
  - Better feature selection methods
  - Examine outliers ?
  - Feature combinations for nonlinear relationships

- **Dataset:**
  - Orientation: horizontal
  - Speed: 0.2mm/s



Machine learning

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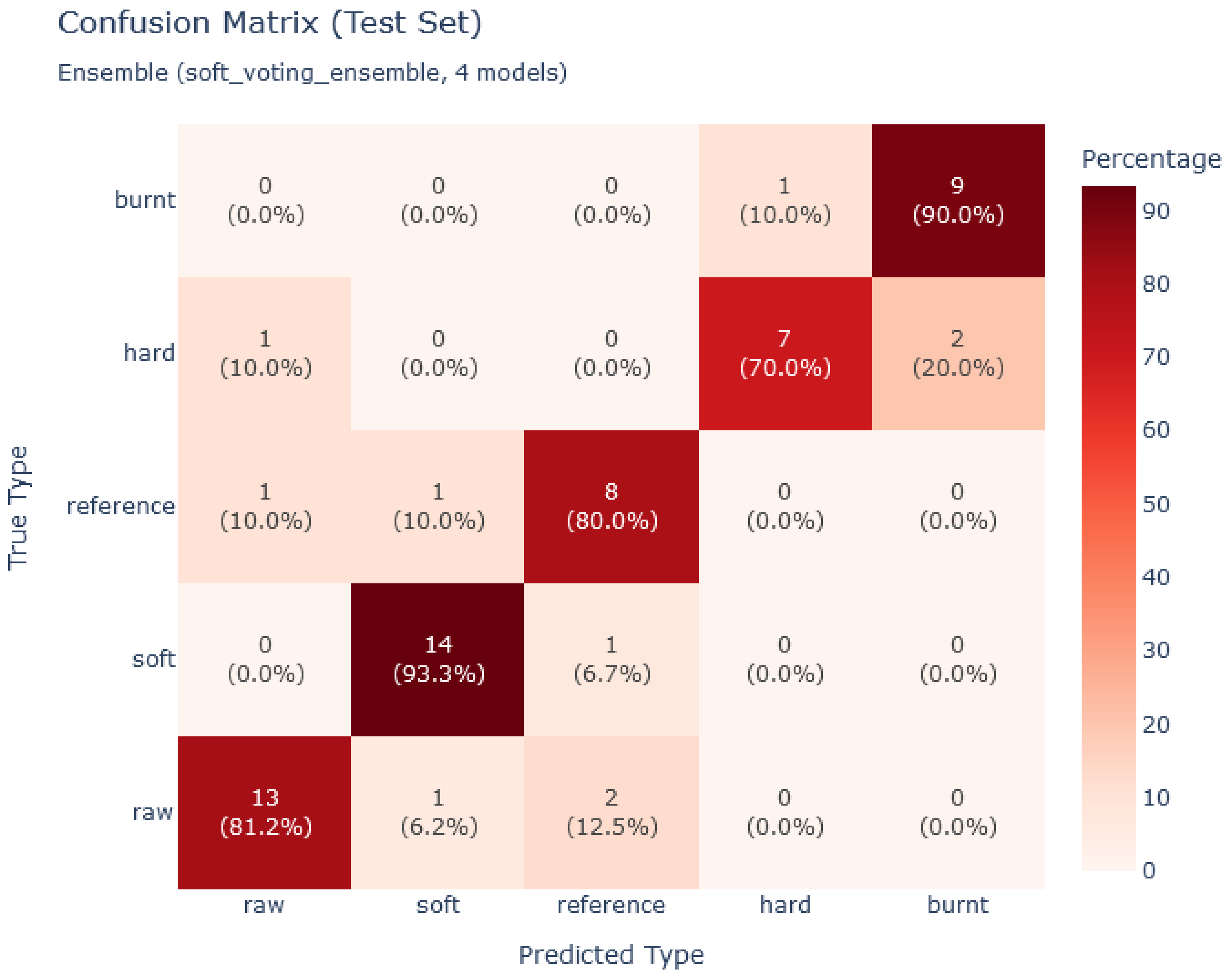
3. Results

- Chips predicted quality vs real quality (classification)
- Model test on new data (not previously seen by model)
- Ensemble model from different analysis windows
- Overall accuracy: 83%

- **Dataset:**
  - Method: Break
  - Speed: 0.2mm/s



Machine learning

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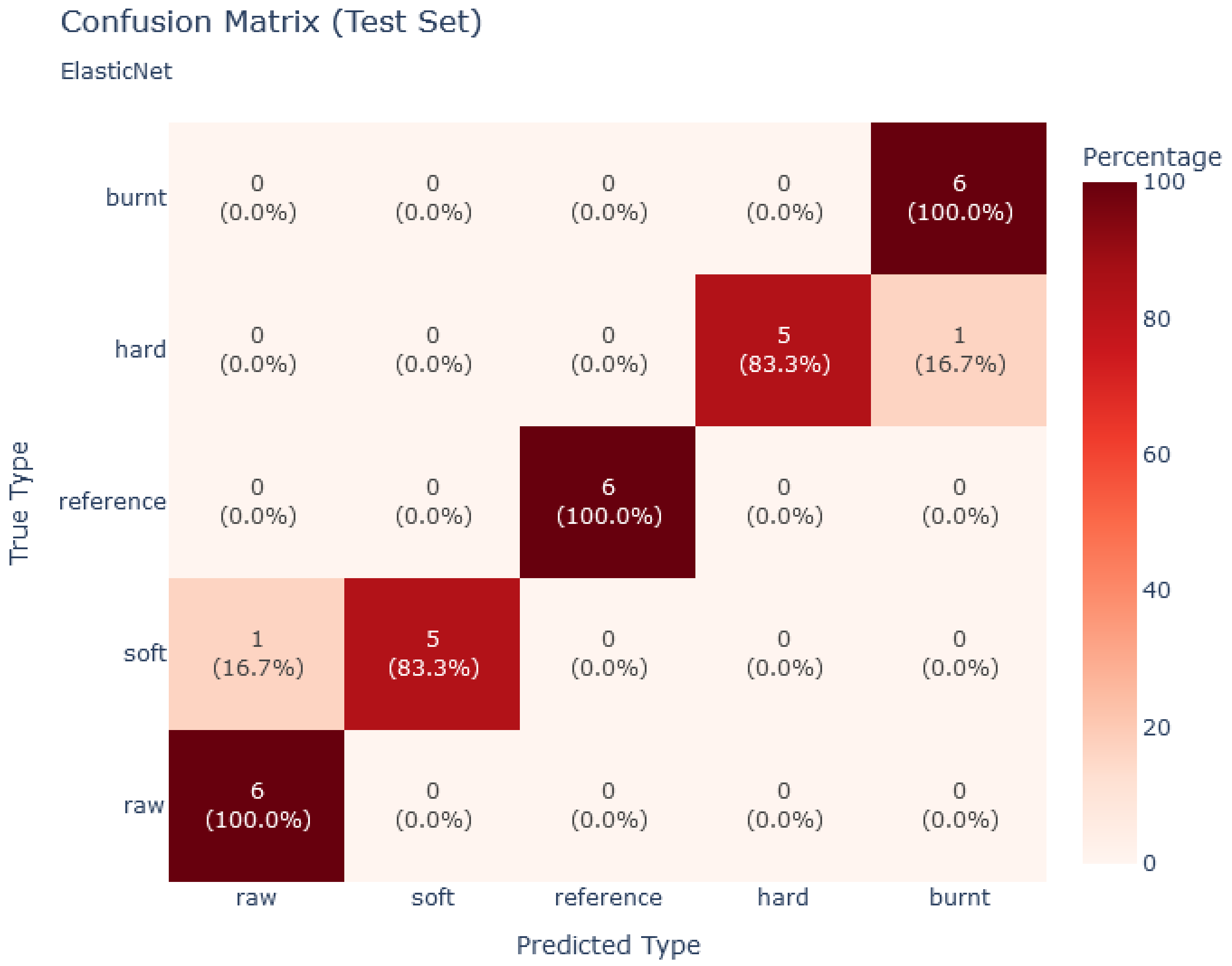
3. Results

- Chips predicted quality vs real quality (classification)
- Model test on new data (not previously seen by model)
- First model: Finetuning possible
  - Feature selection
  - Combining different models from different analysis windows
- Overall accuracy: 93%

- **Dataset:**
  - Method: **STACKED**
  - Speed: 2mm/s



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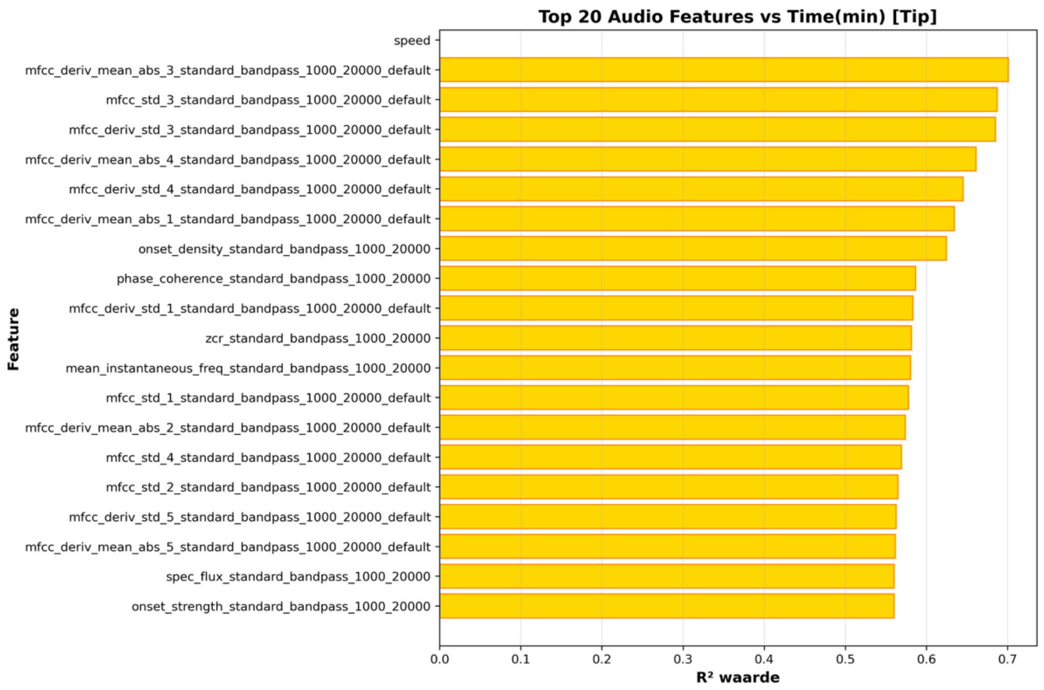
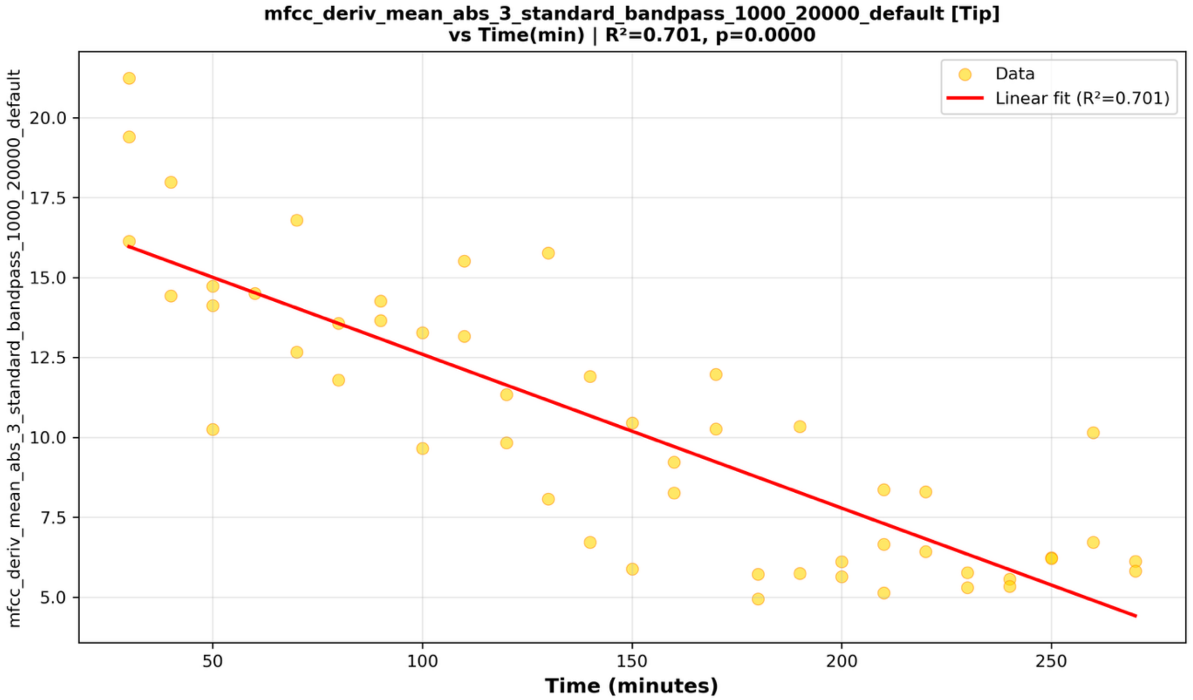
Crispiness over time : Tip, Puncture probe

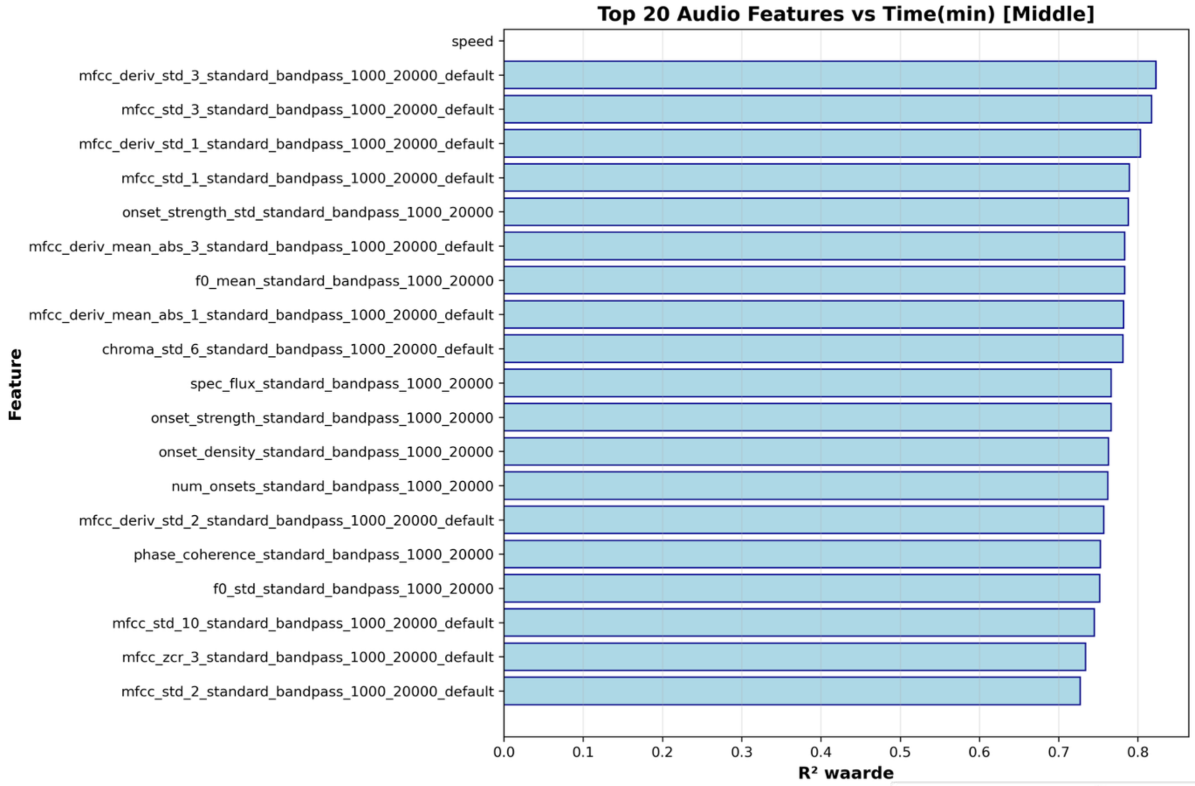


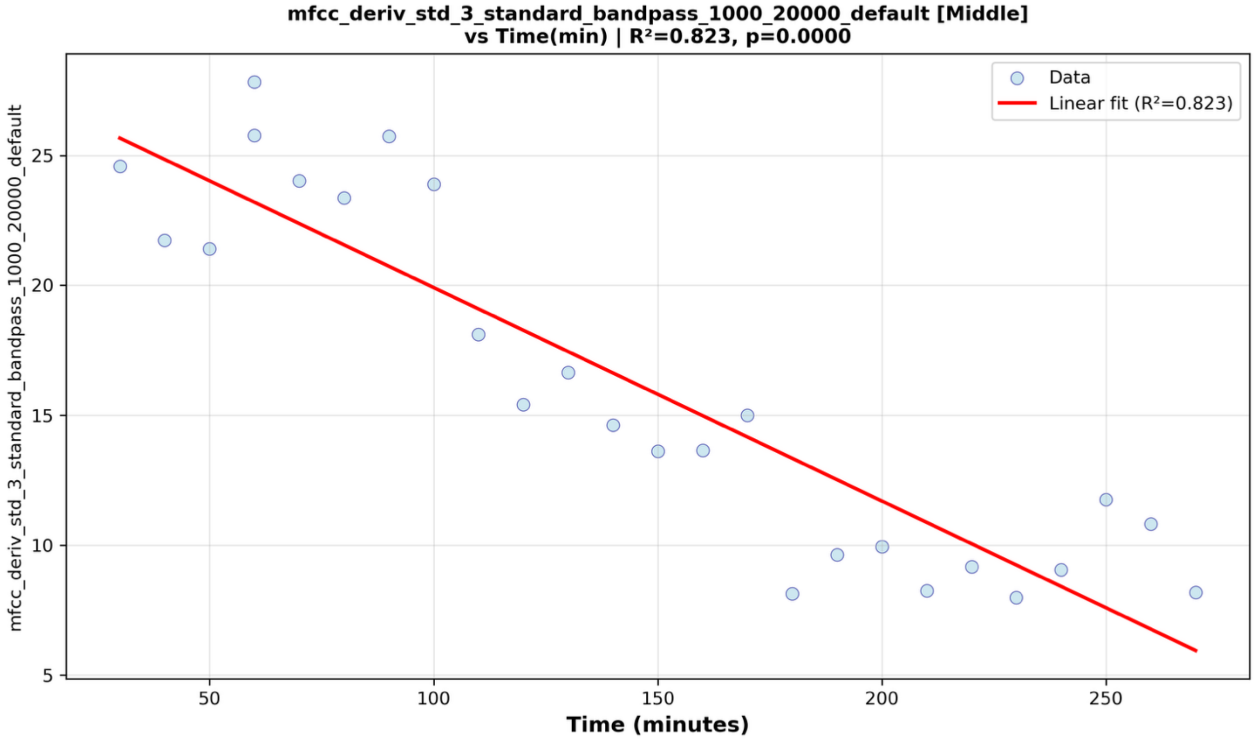


-4-
Bread
(Baguette)

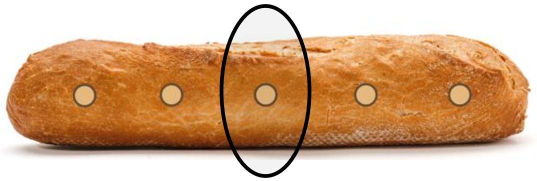
Puncture probe (Ø 10mm)

Crispiness over time : Middle, Puncture probe





Puncture probe (Ø 10mm)



-4-
Bread
(Baguette)

Which features were selected the most for the cookies?

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Feature Type	Acoustic Meaning	Moisture Connection
Spectral entropy	Spread of energy	Cracking = broadband noise
Peak density / num peaks	Transient density	Cracking = many small impacts
MFCC regularity/range	Spectral envelope variation	Cracking = irregular fine structure
F_0 std / range	Unstable resonances	Cracking = multiple microfractures
Chroma std	Frequency irregularity	Cracking = scattered spectral content
Impact sharpness	Steep attack	Cracking = sharp onsets
High-band energy (10–20 kHz)	Brightness	Cracking = high-frequency content

Which features were selected the most for the chips?

Feature Type	Acoustic Meaning	Crunchiness Connection
Spectral Entropy	Spread of energy	Cracking = broadband noise
Chroma Std	Frequency irregularity	Cracking = scattered spectral content
Peak Density / Num Peaks	Transient density	Cracking = many small impacts
F_0 Range / Std / Mean	Unstable resonances	Cracking = multiple microfractures
MFCC Regularity / Std / Range	Spectral envelope variation	Cracking = irregular fine structure
High-Frequency Energy (10–25 kHz)	Brightness.	Cracking = high-frequency content
Impact Sharpness	Steepness of attack	Cracking = sharp onsets
Formant Variability (F_4_std)	Variability in resonance peaks	Cracking = high variability in resonance
ZCR (Zero-Crossing Rate)	Frequency of waveform sign changes	Cracking = high ZCR (many small impacts)
Energy Percentiles (p95)	Energy at high percentile of amplitude distribution.	Cracking = high energy bursts

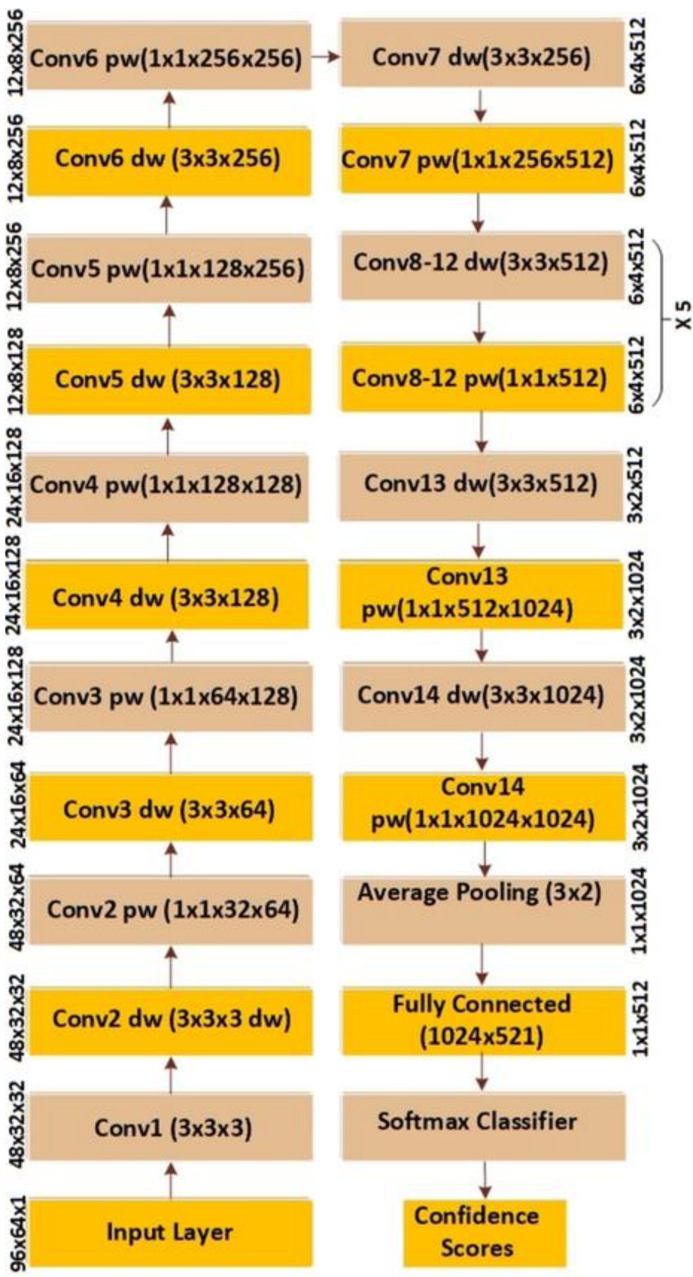
An alternative approach: Deep Learning

- Can we start from alternative features without using our audio-knowledge?

  - Use of deep learning pre-trained audio neural networks
  - Training own deep-learning network

Use of deep learning pre-trained audio neural network: YAMNet (Google)

- No signal processing: input = raw audio (resampled to 16kHz, mono)
- Very deep neural network, trained on huge audio human-labeled database (AudioSet corpus)
- Used here to derive 1024 frame-level embeddings (features)
- Simple statistics (std, mean, ...) → file-level features
- Same approach as before: feature & model selection



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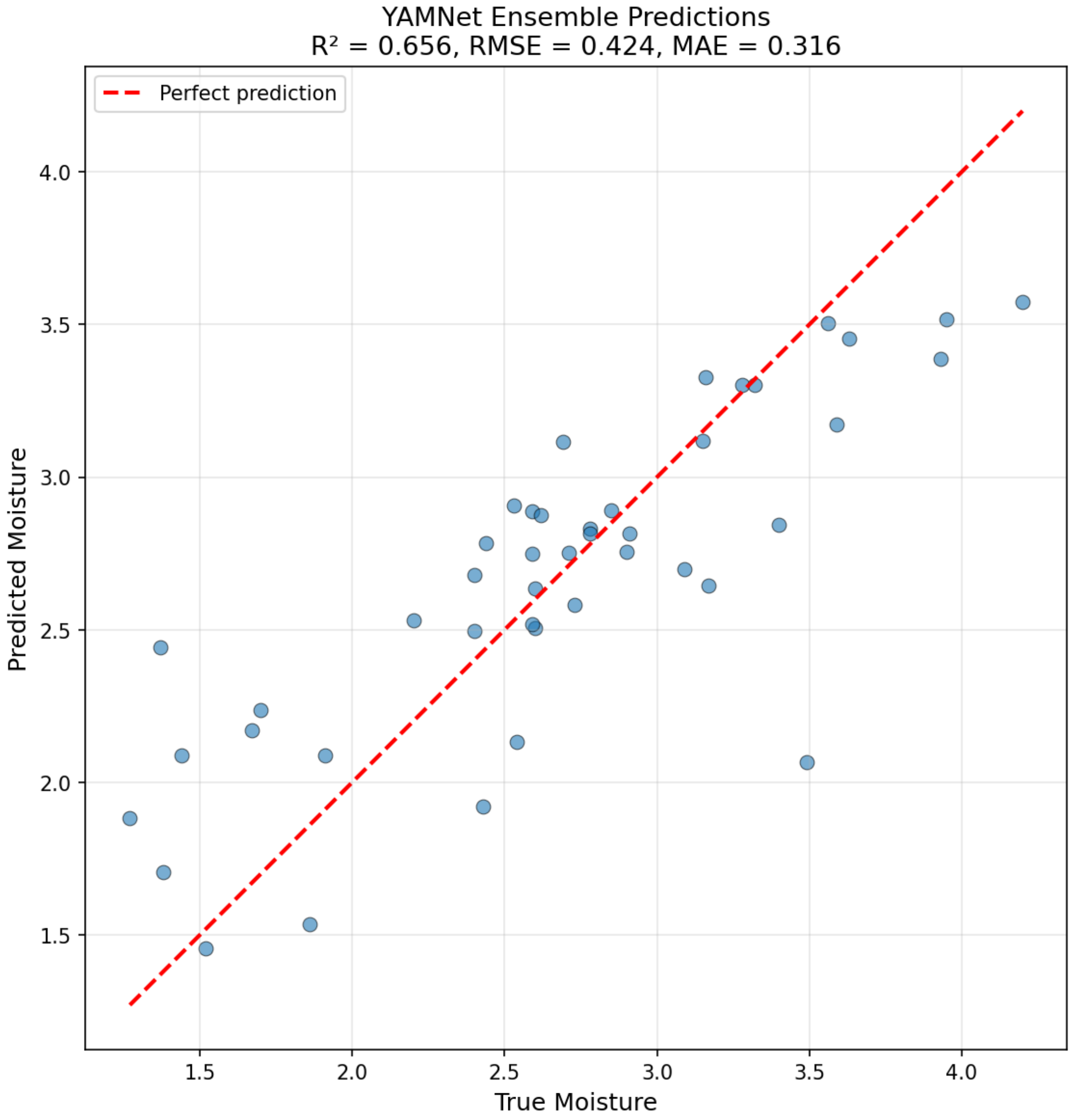
!Preliminary results on cookies!
Appels vs pears: other test set, other dataset (only 220 data points)

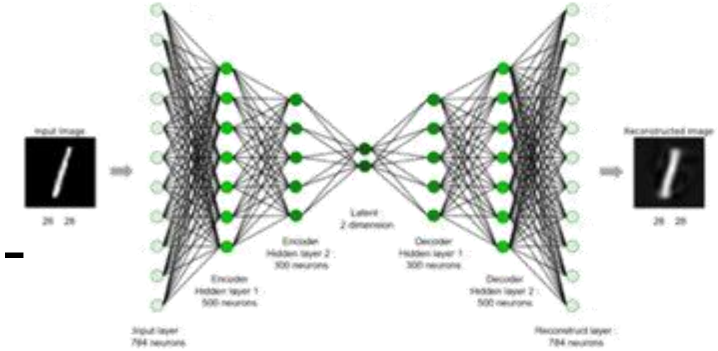


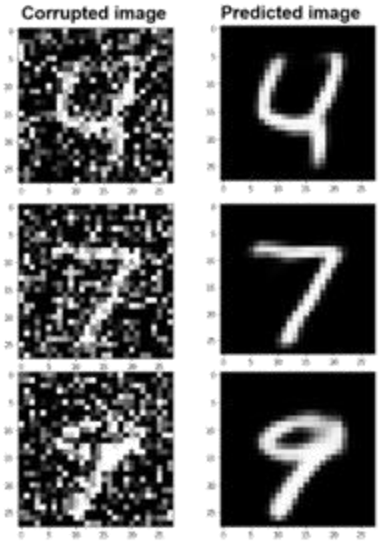
-3-
Cookies

Denoising autoencoder

- Step 1: download 10 hours of ASMR (mukbang) crunchy audio
- Step 2: add noise to the audio
- Step 3: train an autoencoder to predict the original audio from the audio with noise
- Step 4: latent space (256 dim) should capture good crunchy features
- Simple statistics (std, mean, ...) → file-level features
- Same approach as before: feature & model selection

+ noise





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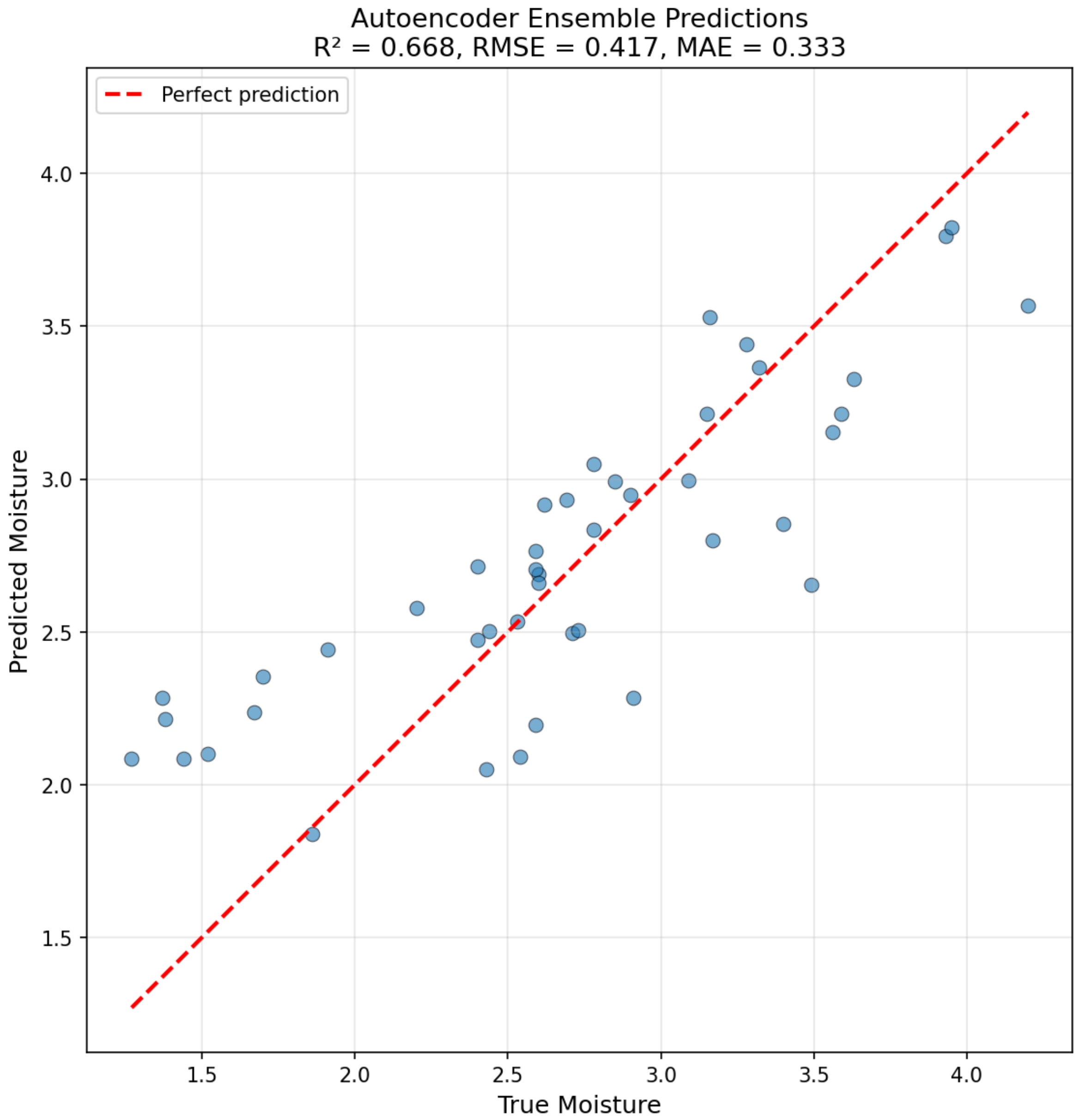
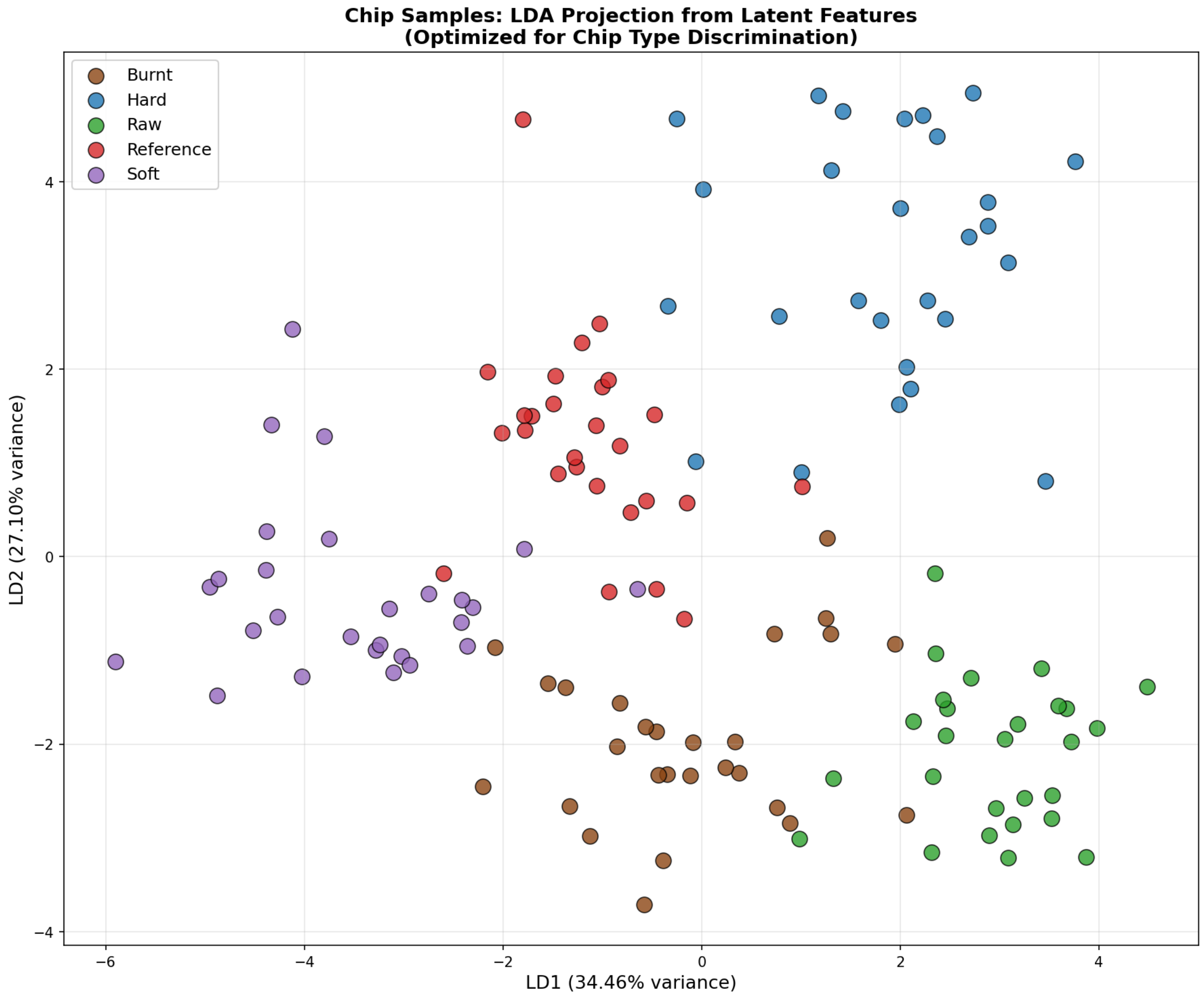
Appels vs pears: other test set, other dataset (only 220 data points)



-3-
Cookies

Next to do: classify the chips using DNN



-1-
Chips

Conclusions

- We **seem** to have 3 methods to tackle the audio analysis
- No table with comparison on speed, performance, simplicity, cost etc yet → first more experiments + same test setup

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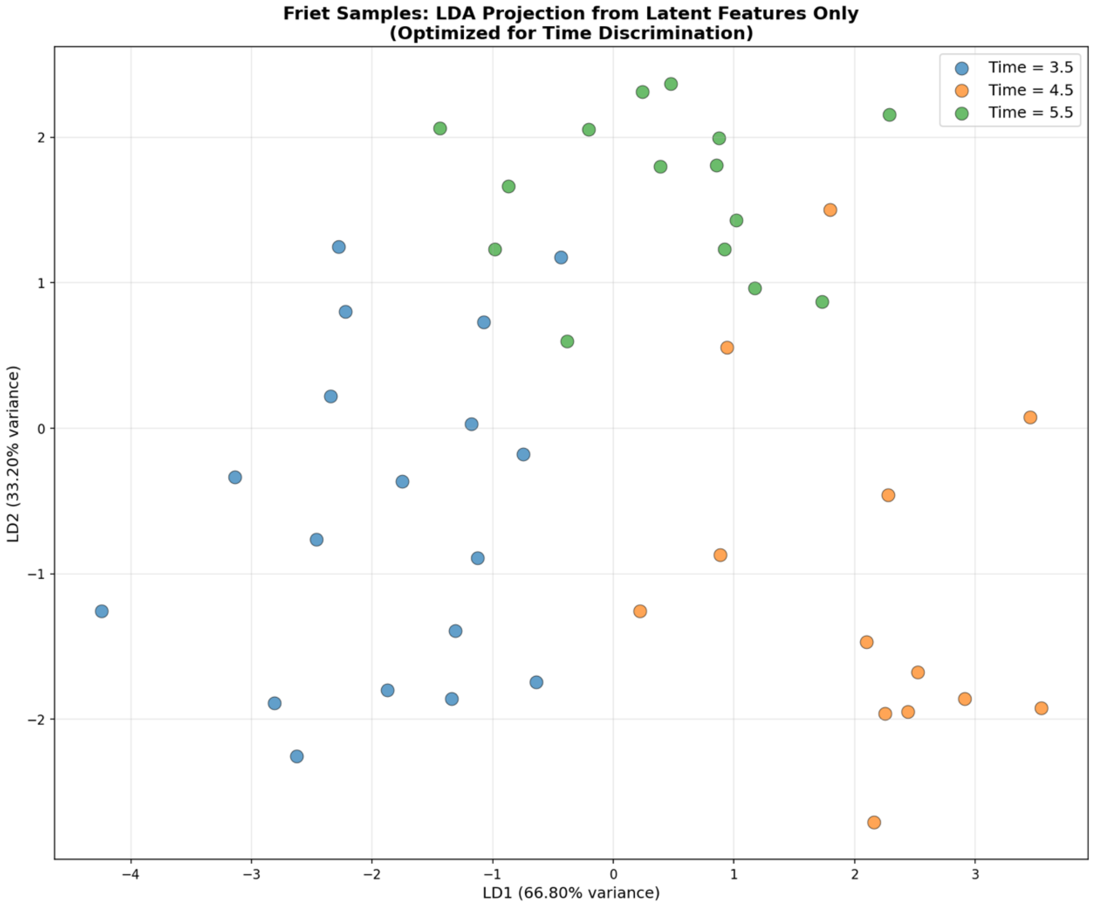
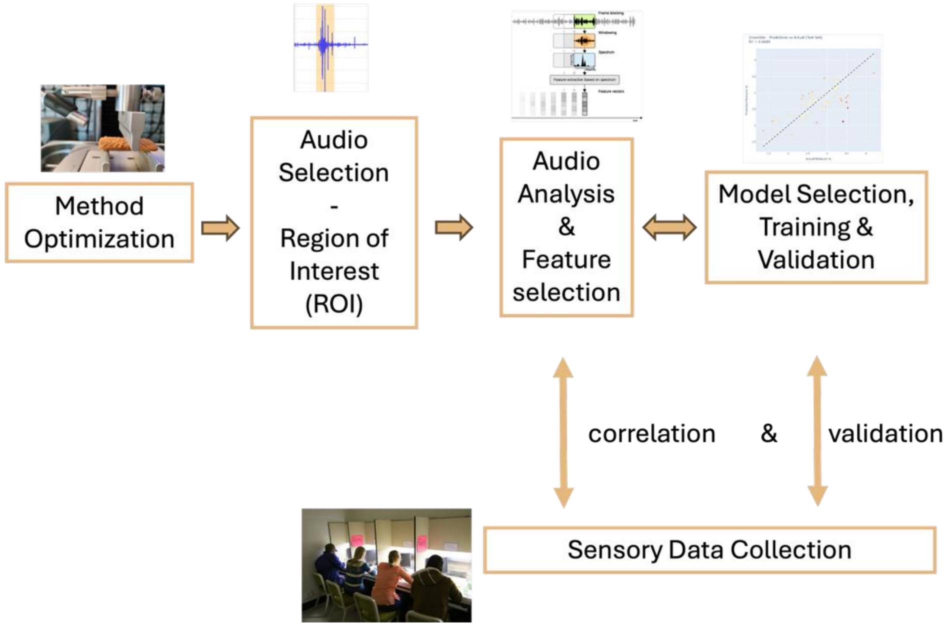
Next on our list…



-2-
French
Fries

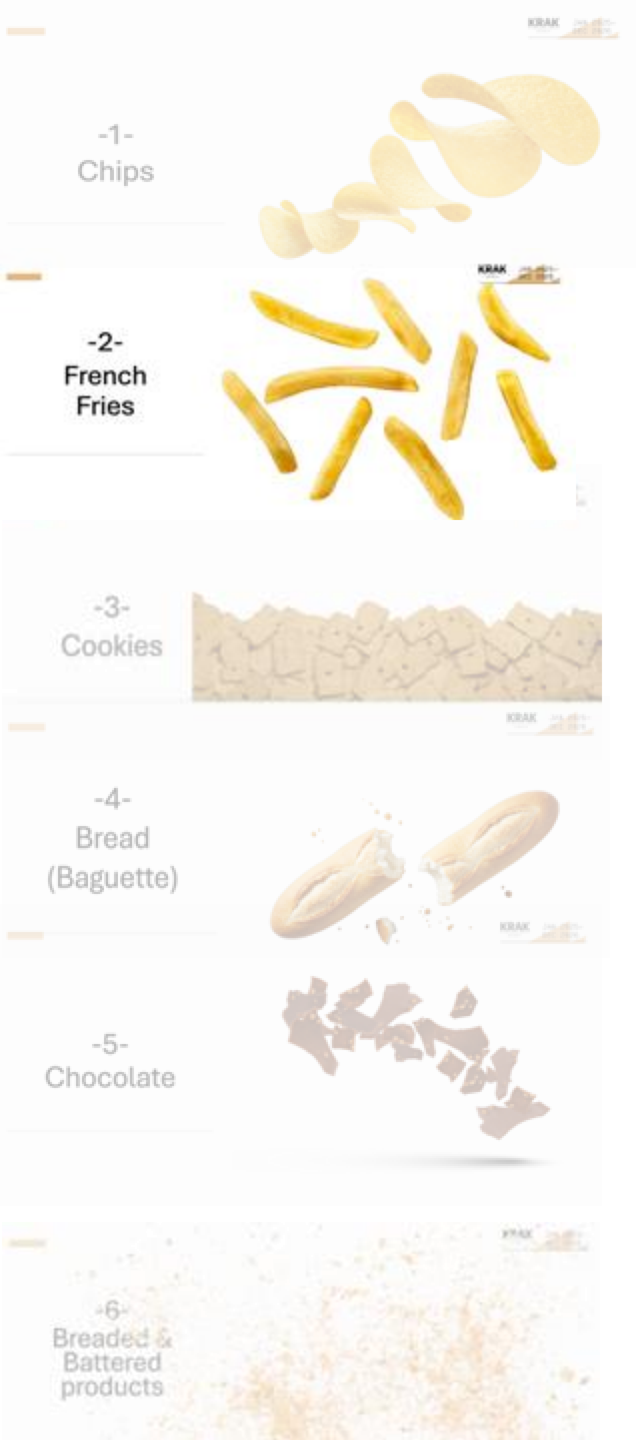
4. Wrap up.

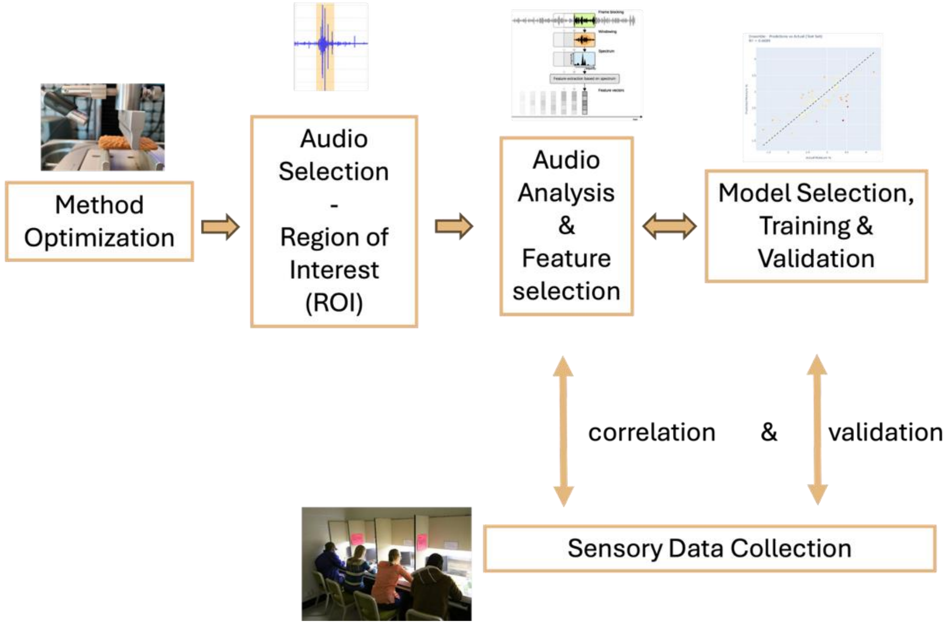


- Different methods tested and evaluated
- Breaking method --> model to predict crispiness

  Raw, Soft, Reference, Hard, Burnt (accuracy 83%)
- Main audio features determined (Spectral entropy, MFCC regularity/range etc.)

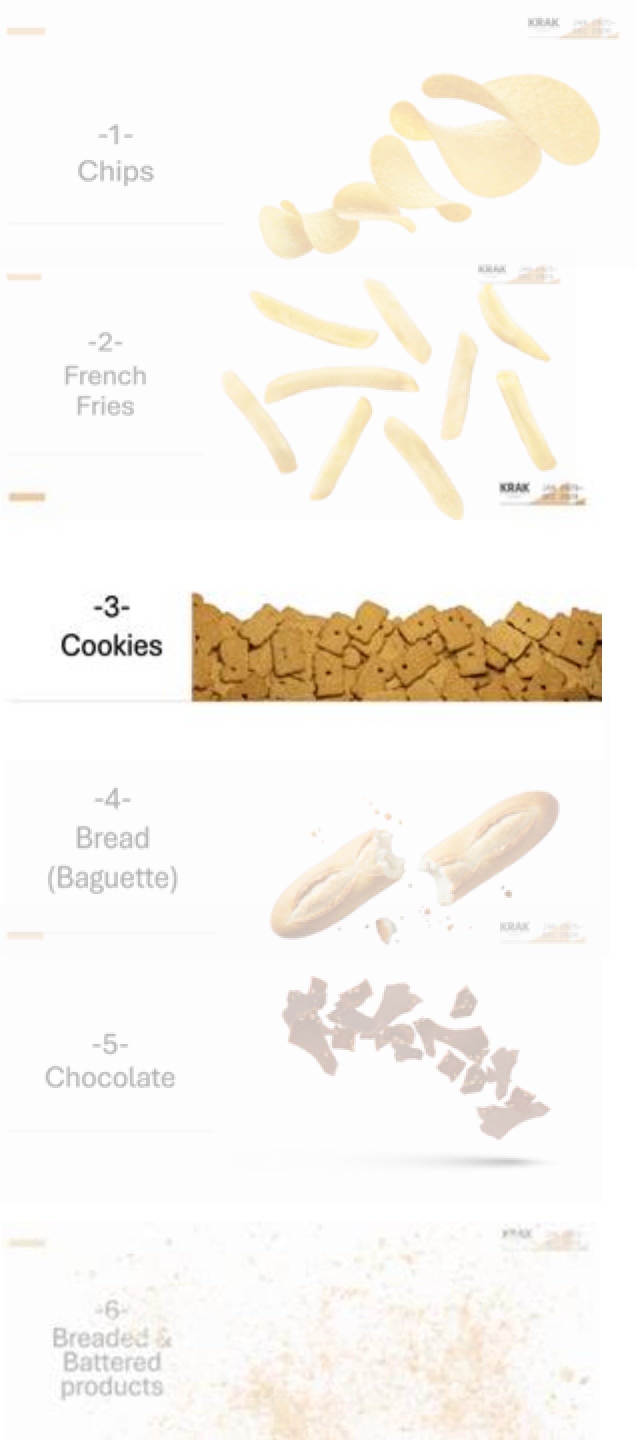
→ Next steps: more crisps at one time, sensory correlation

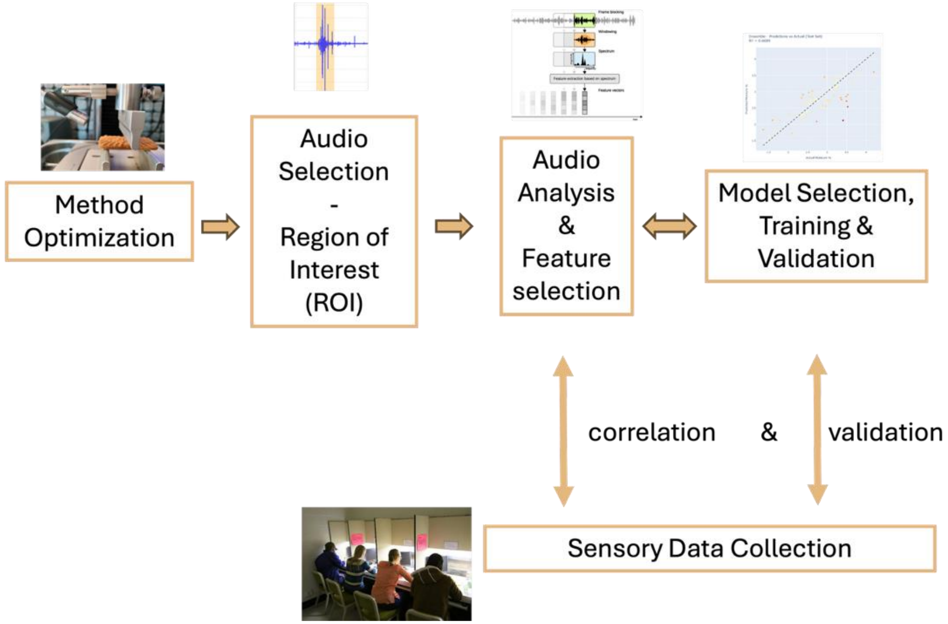




- Different methods tested
- Differentiate baking times

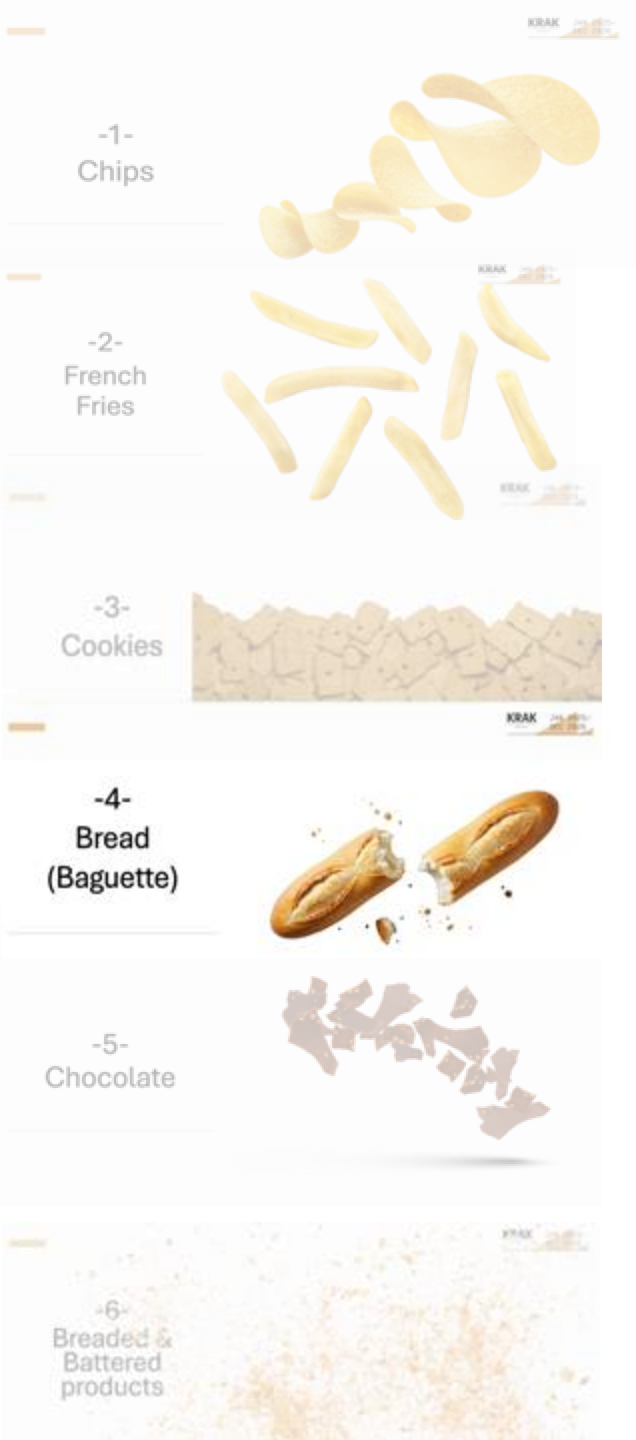
→ Next steps: method evaluation, differentiate “qualities”, sensory correlation





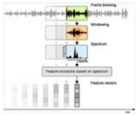
- Different methods tested and evaluated (DOE) → low speed
- Main audio features determined (Spectral entropy, MFCC regularity/range etc.)
- Moisture level correlation with audio driven predicted value (Model)

→ Next steps: validation & sensory correlation

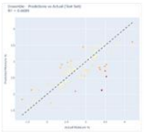


Method Optimization ⇨

Audio Selection - Region of Interest (ROI) ⇨



Audio Analysis & Feature selection ⇔



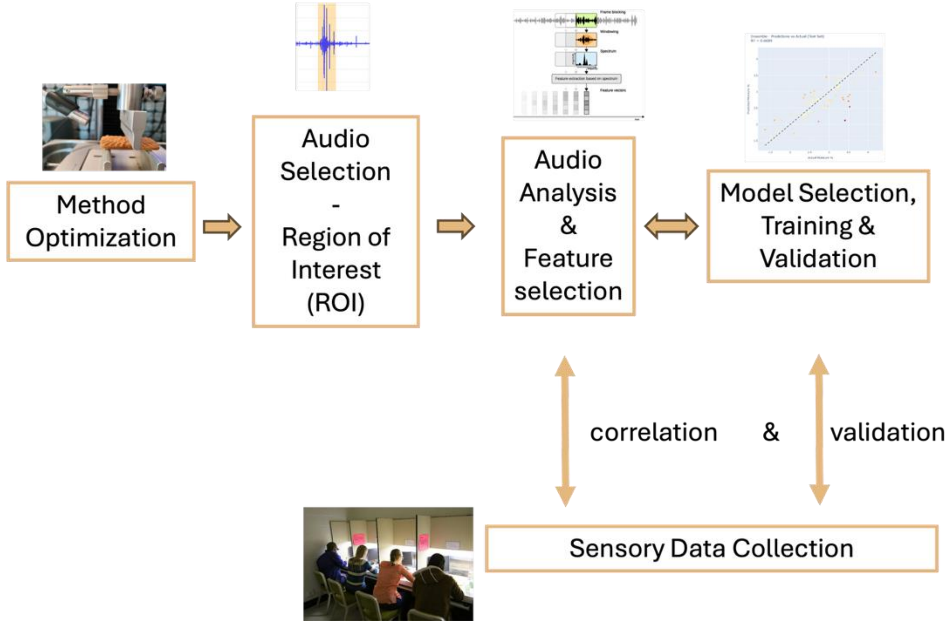
Model Selection, Training & Validation

correlation & validation

Sensory Data Collection

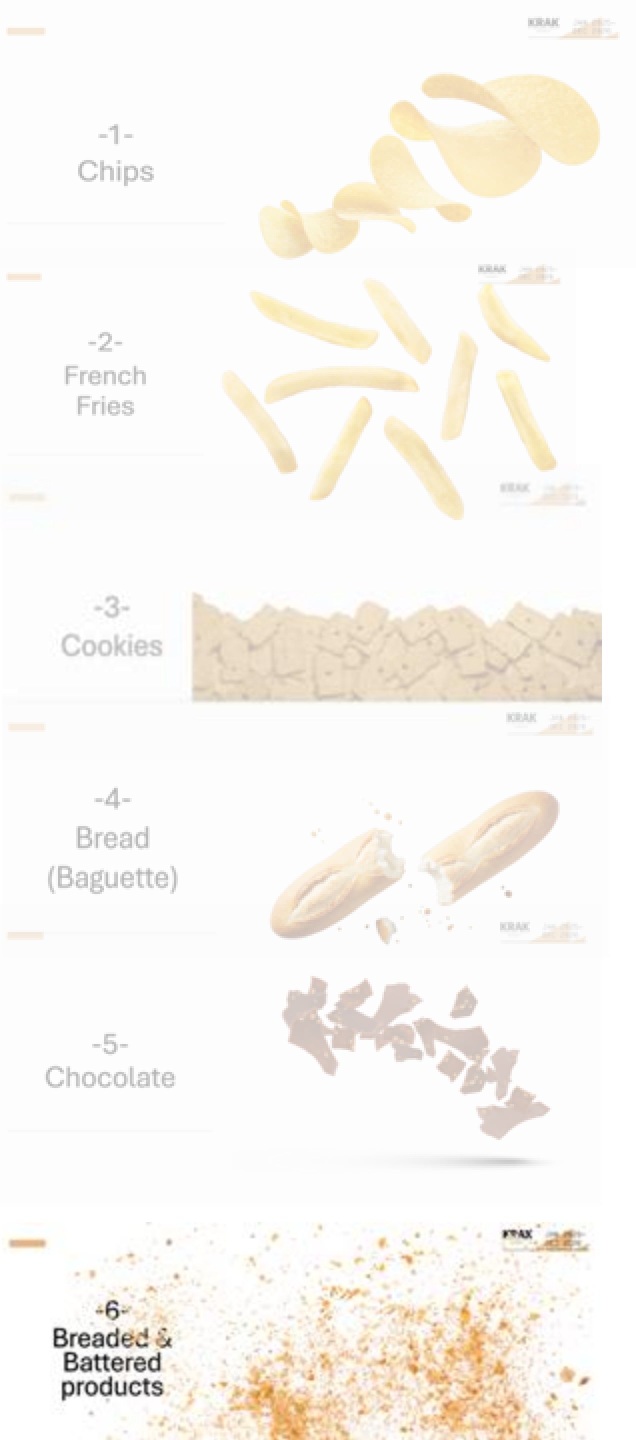
- Different methods tested
- Different zones (side, center) evaluated
- First audio feature correlations with crispiness over time

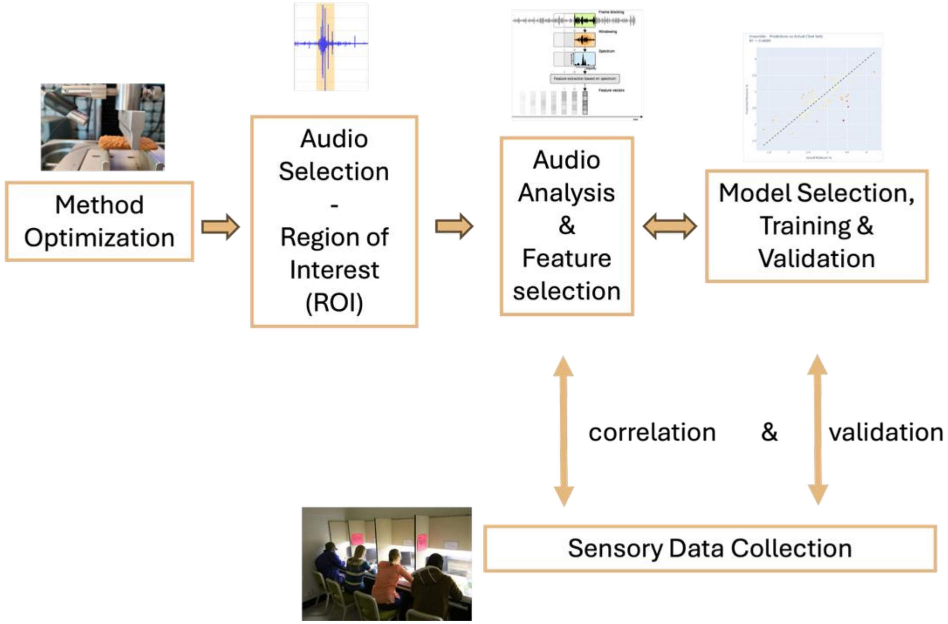
→ Next steps: method evaluation, model training, sensory correlation



- **1 method:** protocol available for texture testing

→ **Next steps:** feature extraction (different cocoa butter levels), model training, sensory correlation





→ **Next steps:** determining measurement protocols

5. Did you hear about KRAK?

PROGRAMMA PRAKTISCH HERBELE

← Programma

HOE KLINKT JOUW FAVORIETE SNACK?

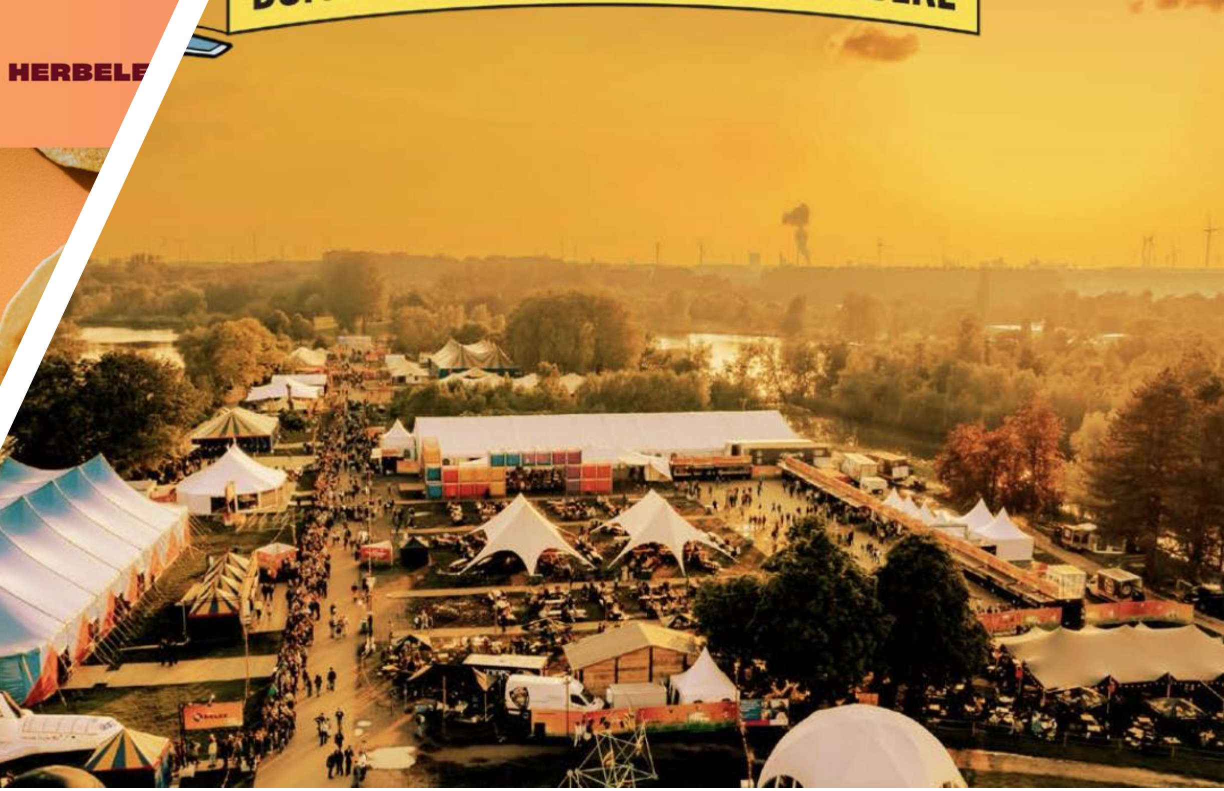
ZATERDAG —— DOORLOPEND Jungle
ZONDAG —— DOORLOPEND Jungle
MAANDAG —— DOORLOPEND Jungle

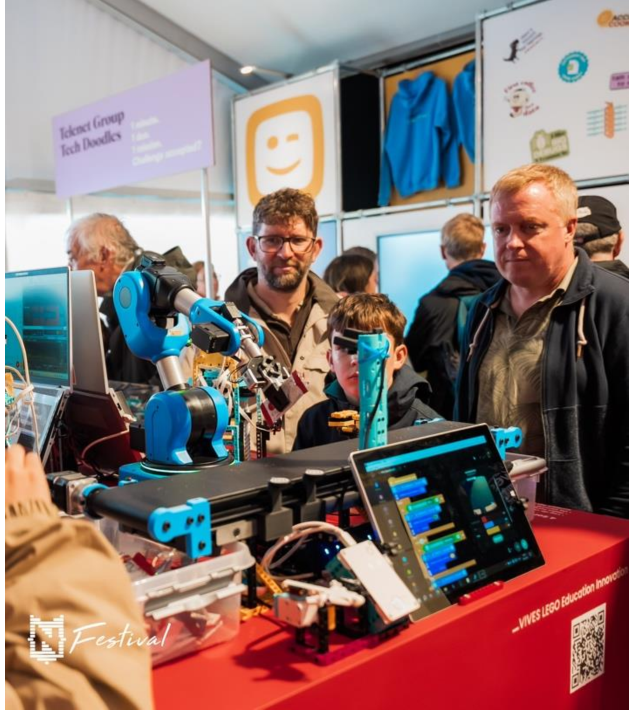
EXPERIENCE KINDVRIENDELIJK

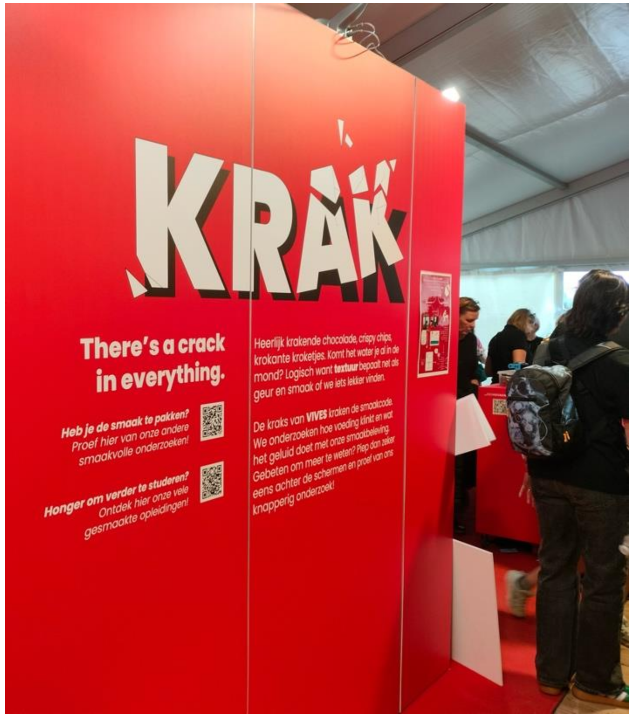
CRUNCH Wist je dat het geluid van een knapperige croissant
smaakbeleving compleet kan veranderen? Bij Hogeschool V
crunch serieus en onderzoeken ze hoe geluid onze manie
En jij mag meedoen! Met AI analyseren ze geluidsgolven
ultieme smaakervaring. Klinkt cool, euh, lekker toch? I
stap je in de smaakhokjes, proef je met je oren én je
hoe technologie en smaak samensmelten in een lan
Snacken voor de wetenschap!

Experience in samenwerking met Hogeschool

I 2025 – DOMEIN PUYENBROECK, WACHTEBEKE



KRAK @ Nerdland Festival

7, 8, 9 juni 2025

KRAK @ Academische opening Hogeschool VIVES

23 september 2025

KRAK @ Dag van het Onderzoek

3 oktober 2025

CARDBOARDS EN DEMOSESSIES

Tijdens de poster- en demosessies kwam het onderzoek pas echt tot leven. Door een speling van het logistieke lot, ditmaal geen klassieke roll-up banners, maar strakke cardboards. Met veel enthousiasme en gedrevenheid gaven diverse onderzoekers het beste van zichzelf. Gewapend met grafieken, tabellen en infographics stonden ze collega-onderzoekers te woord. En ook aan de demotafels was er heel wat animo:

- KRAK serveerde een krokant onderzoek rond smaakbeleving
- Preisnijden met AI zorgde voor pretoogjes
- De VR-app Bandenmonteur leerde ons digitaal sleutelen aan wagens
- Dankzij e-learning klonk kindzorg bijna kinderlijk eenvoudig
- Bij FONEMI weerklonk de kracht van klank voor taalontwikkeling

KRAK
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JAN 2025-
DEC 2026

KRAK @ ‘Voedingsquiz’
Technopolis voor studenten
3de graad secundair

oktober 2025

6. What’s next?

- Optimization of the modeling protocols
- Sensory correlation (start with cookies)
- Bread, Chocolate & Breadcrumbs → method optimization
- Software development

VLAAMSE STEM OLYMPIADE
TECHNOLOGY APPROVED

Join the Flemish STEM Olympiad

Inspire the next generation of innovators

- ✓ A VIVES initiative supported by universities, the Flemish Government & industry partners
- ✓ Fun, hands-on & smart challenges for pupils (ages 10–14)
- ✓ Over **60.000 young minds** take part each year!
- ✓ Goal: **inspire young students** to choose STEM studies
- ✓ We're looking for **food industry partners** to collaborate and co-create this and next editions

Learn more: www.stemolympiade.be

Contact: koen.malfait@vives.be

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2 12 2025

Inspiratiesessie 'Efficiënt en kwalitatief bakken met nieuwe technologieën'

Food Innovation Park

https://www.menti.com/alnueeon5bmw

Feedback?

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FOOD PROCESSING

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