VideometerLab for the Malting Industry

Videometer A/S

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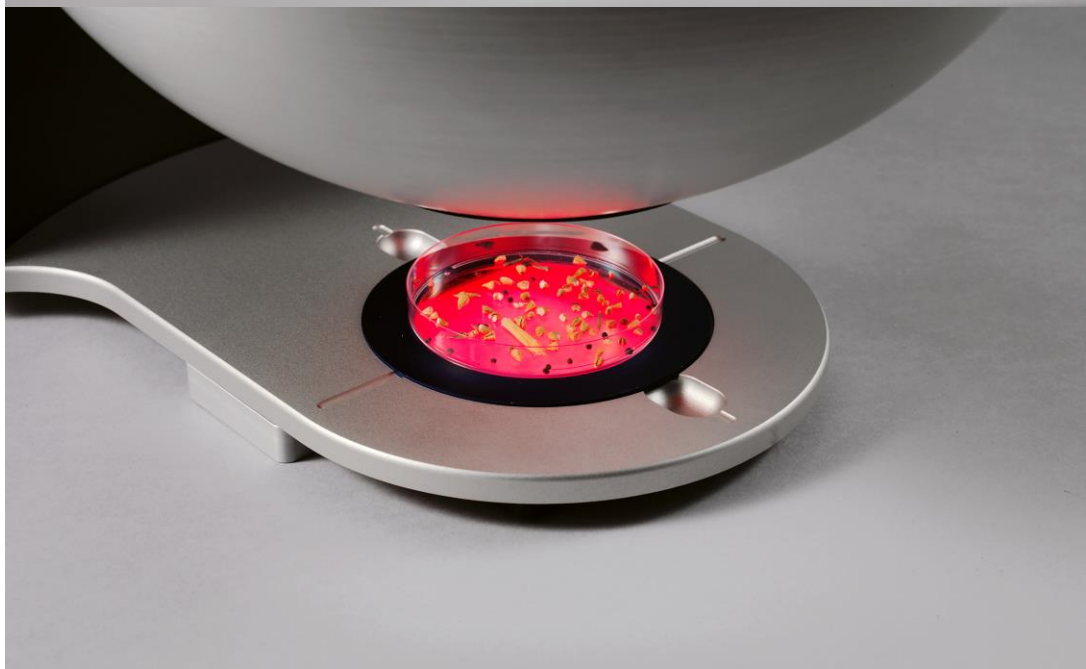
VideometerLab for the Malting industry

One Instrument – multiple tests

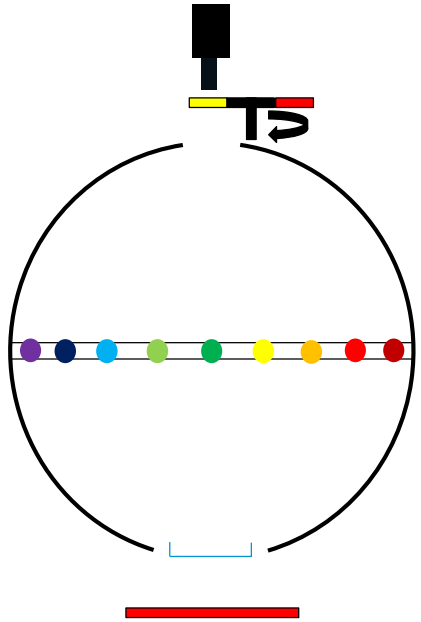
- Incoming barley
  - ✓ Red type Fusarium, mycotoxin potential
  - ✓ Gray molds, gushing potential
  - ✓ Skinning
  - ✓ Immaturity
  - ✓ Screen size
- Steeping process
  - ✓ Hydration
- Germination process
  - ✓ Chitting
  - ✓ Rootlets
  - ✓ Acrospire
- Malt final control
  - Fusarium / molds

Ease to use – no consumables – no sample prep

Result within 10 seconds!



LED band-sequential spectral imaging



Camera and lens

Emission filter changer

Integrating sphere

LEDs of multiple wavelengths

Sample is placed in target opening

Backlight or background

- LEDs: Stable, durable, large selection, rapidly developing technology
- Up to 20 different high-resolution bands acquired sequentially in 0.5-1.5 seconds
- May be combined with emission filters, backlight, and darkfield illuminant
- Combined **reflectance spectral imaging** and **fluorescence spectral imaging** possible!

VideometerLab 4

Flexible lab and at-line instrument for spectral imaging

- 19-20 spectral bands in the range 365 nm to 970 nm
- 2192 × 2192 pixels per band, 40 µm (2992 x 2992 high-res option, 30 µm)
- Very homogeneous and diffuse illumination
- Strobed LED light source
- 10 seconds per sample including handling
- Optional backlight strobe
- Optional fluorescence bands
- Software for calibration, acquisition, and analysis
- Patented technology

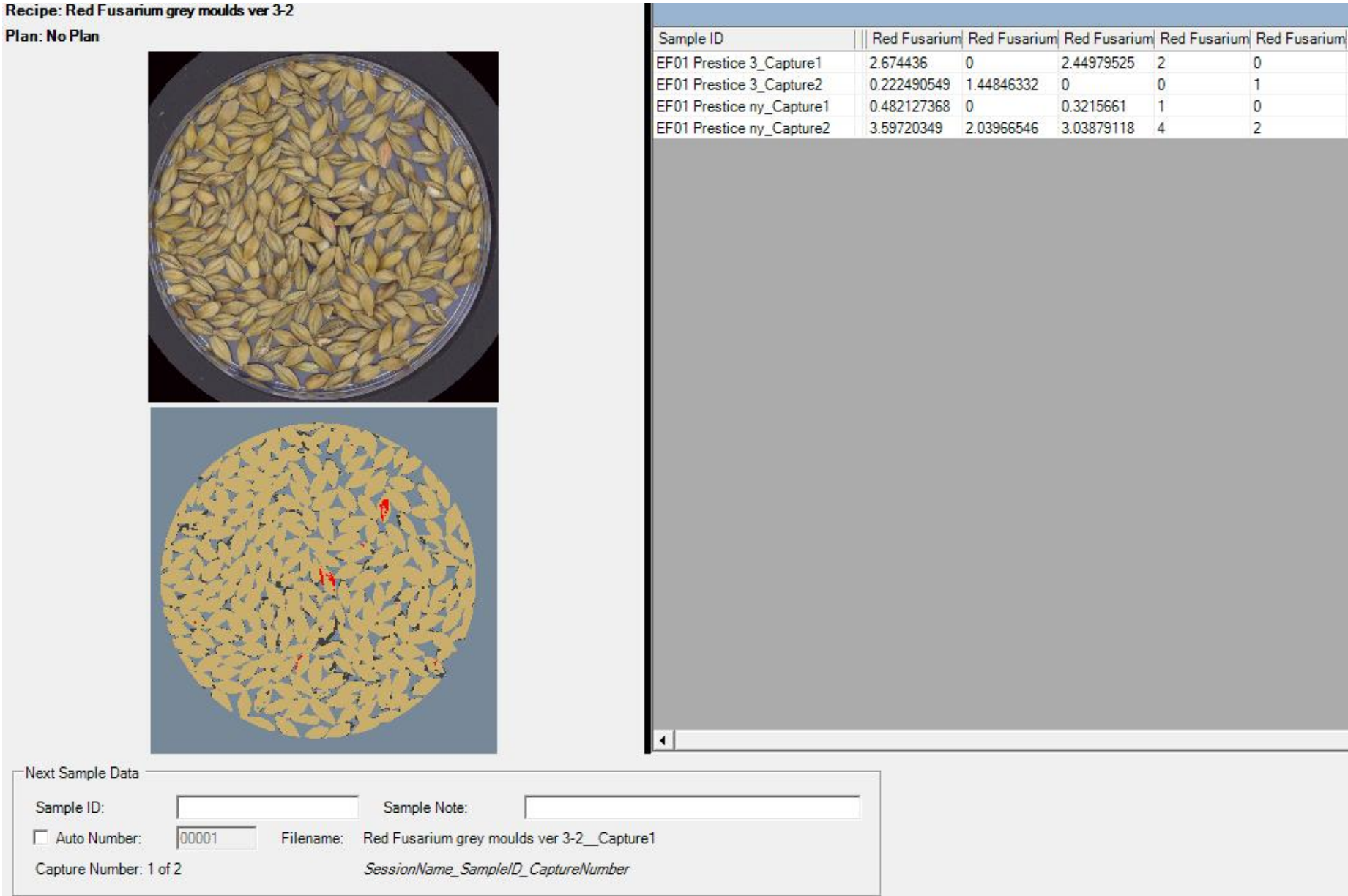
Incoming barley: Red Fusarium Gray mold test

2 step test:

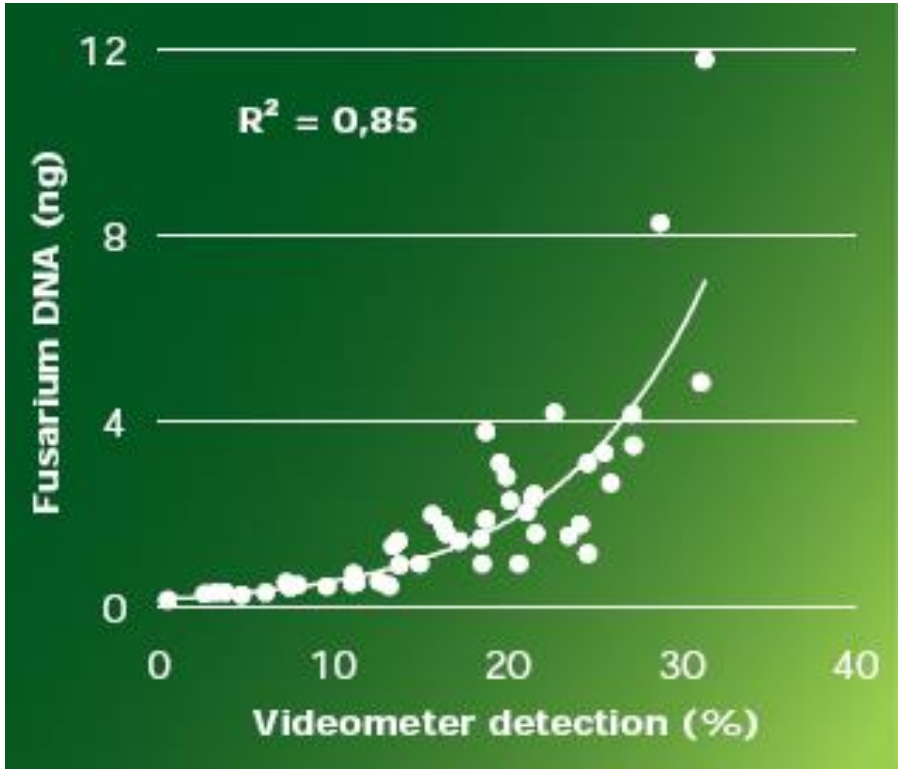
1. *Present the barley in a 90 mm petri dish (single layer)*
2. *Press F12*

Output will show the

1. *a **color image** of the sample*
2. *a **segmented image** with red type Fusarium marked with red color and gray type molds with black color*
3. *an **area fraction** of red type Fusarium and of gray type molds*



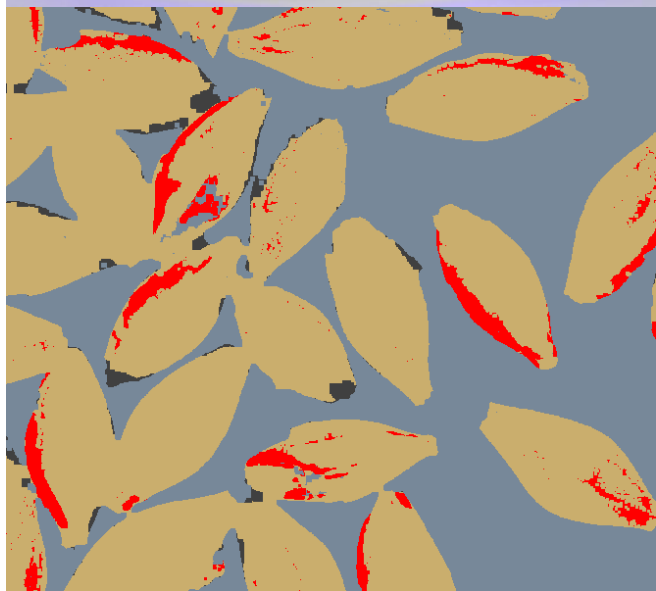
Red Fusarium and gray mold model validation



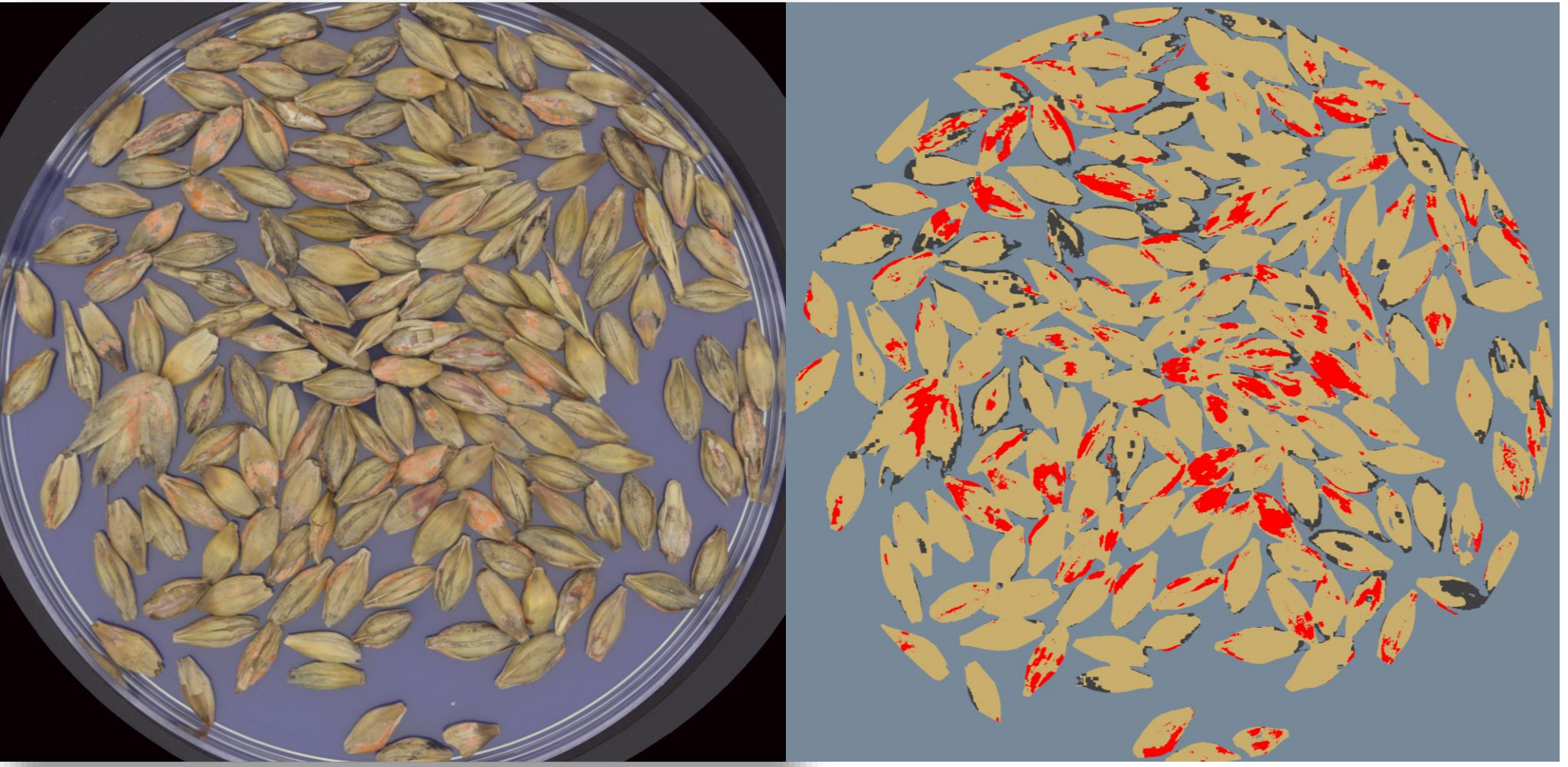
Excellent correlation with Fusarium DNA level

Comparison between VideometerLab® measurements and the level of Fusarium DNA quantified by qPCR

The Fusarium calibration for barley is developed together with ***Carlsberg Research Center*** *and* ***Viking Malt.***



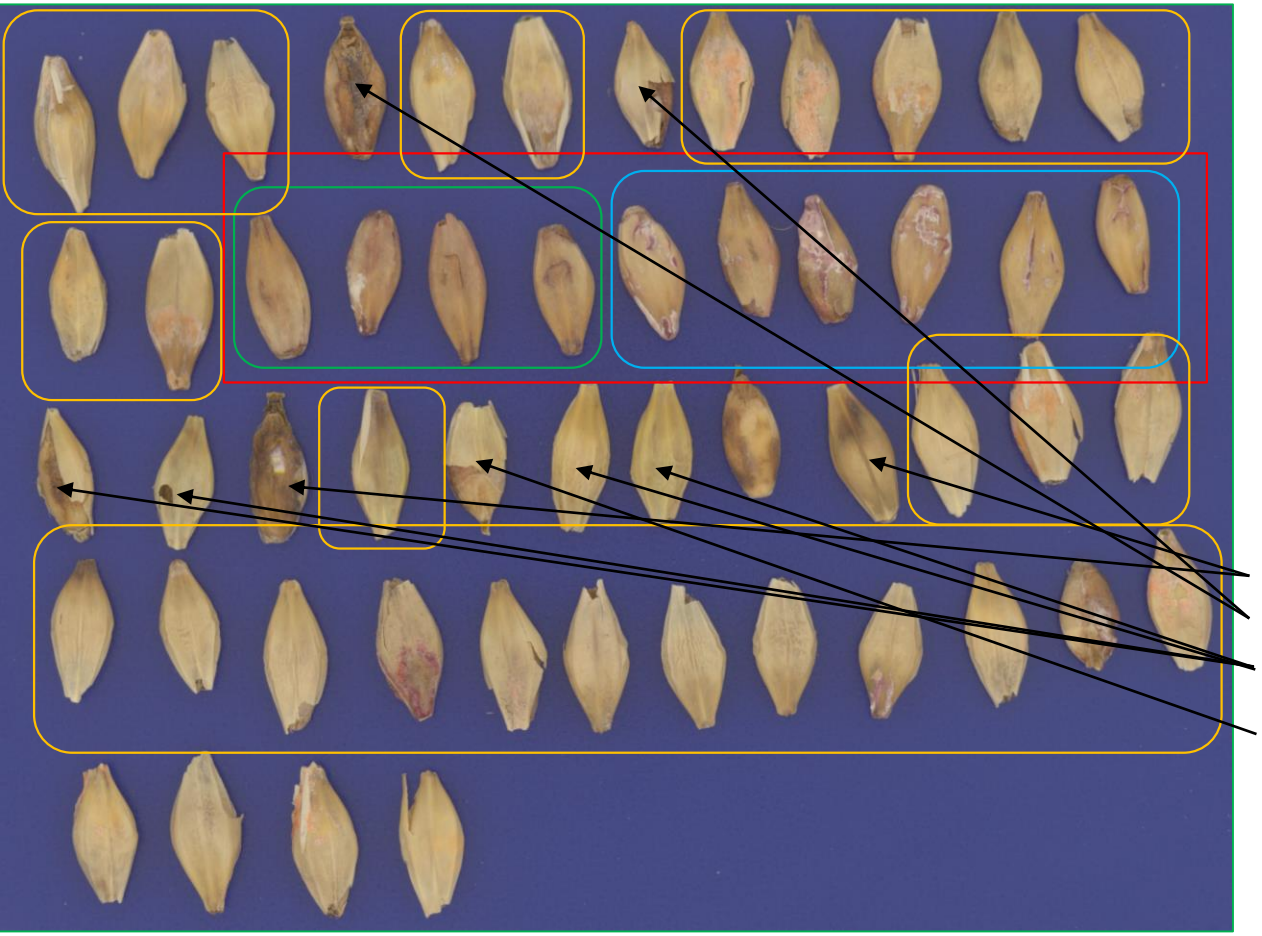
Heavily infected sample



Red color:
red, orange or purple areas on kernels

Black color:
Gray and black mold areas on kernels

Microdochium detection



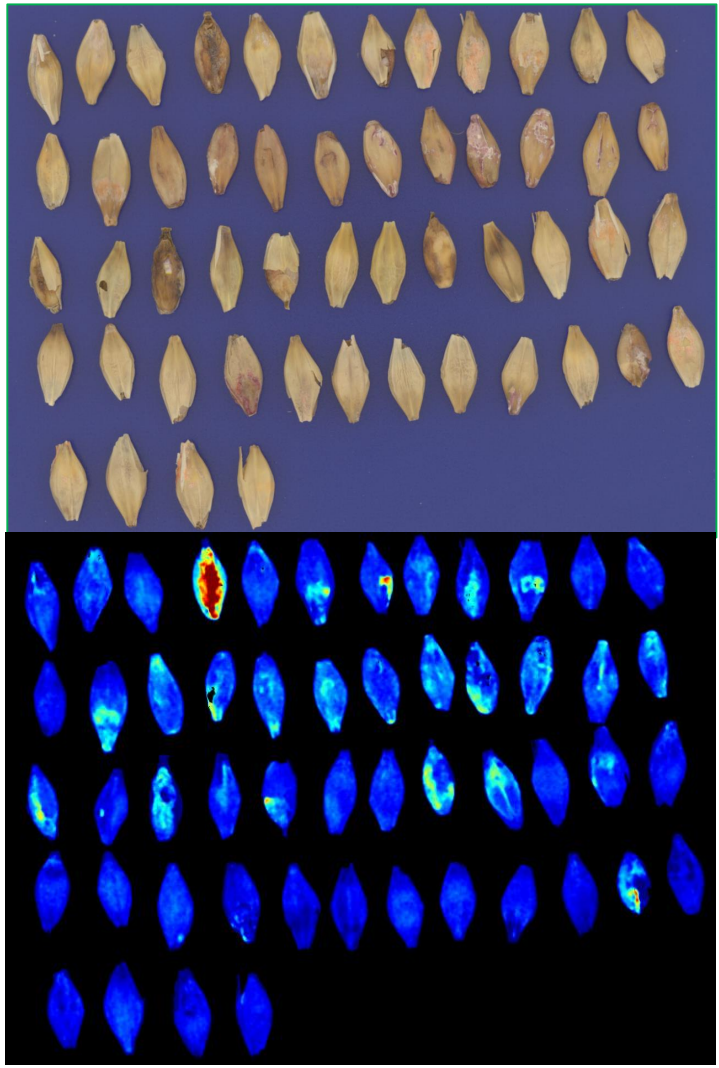
Artificially infected malt

Fusarium Culmorum

Fusarium Avenaceum

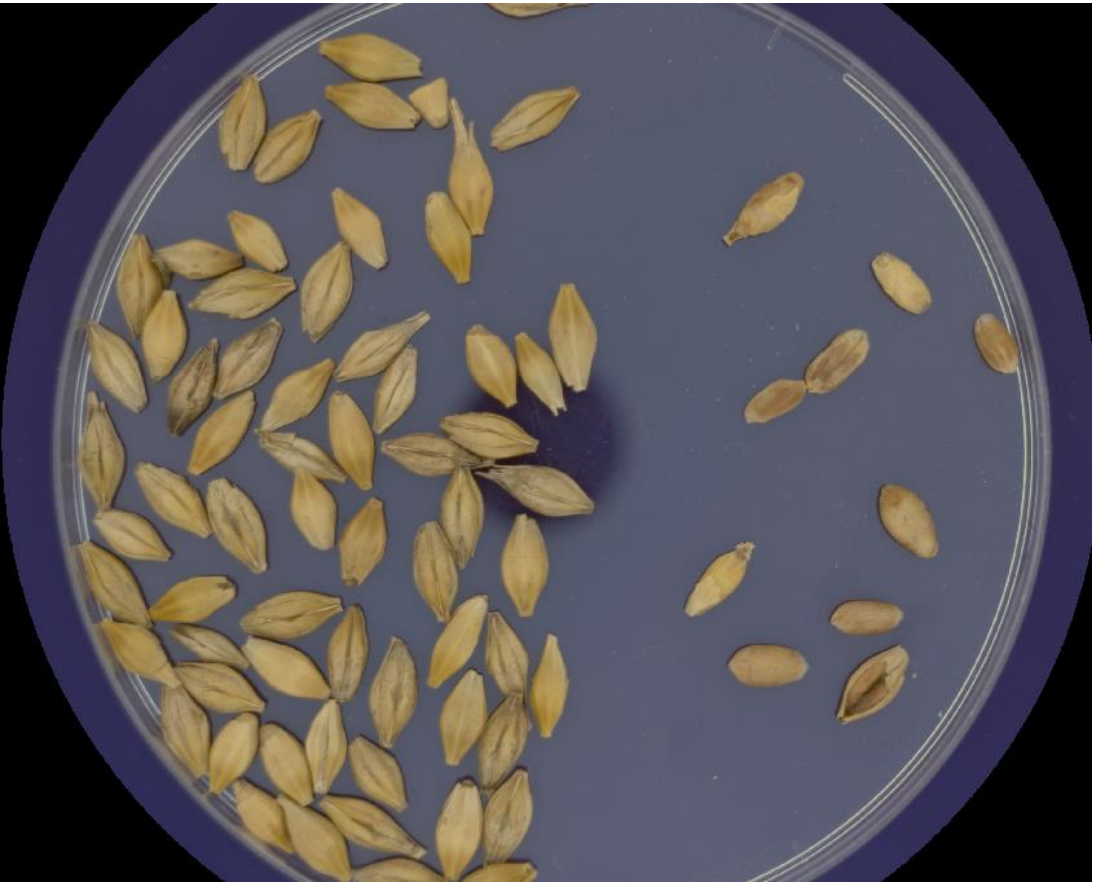
Fusarium avenaceum/tricinctum

Lewia infectoria
Microdochium bolleyi
Cladosporium
Fusarium poae

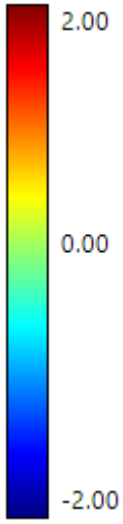


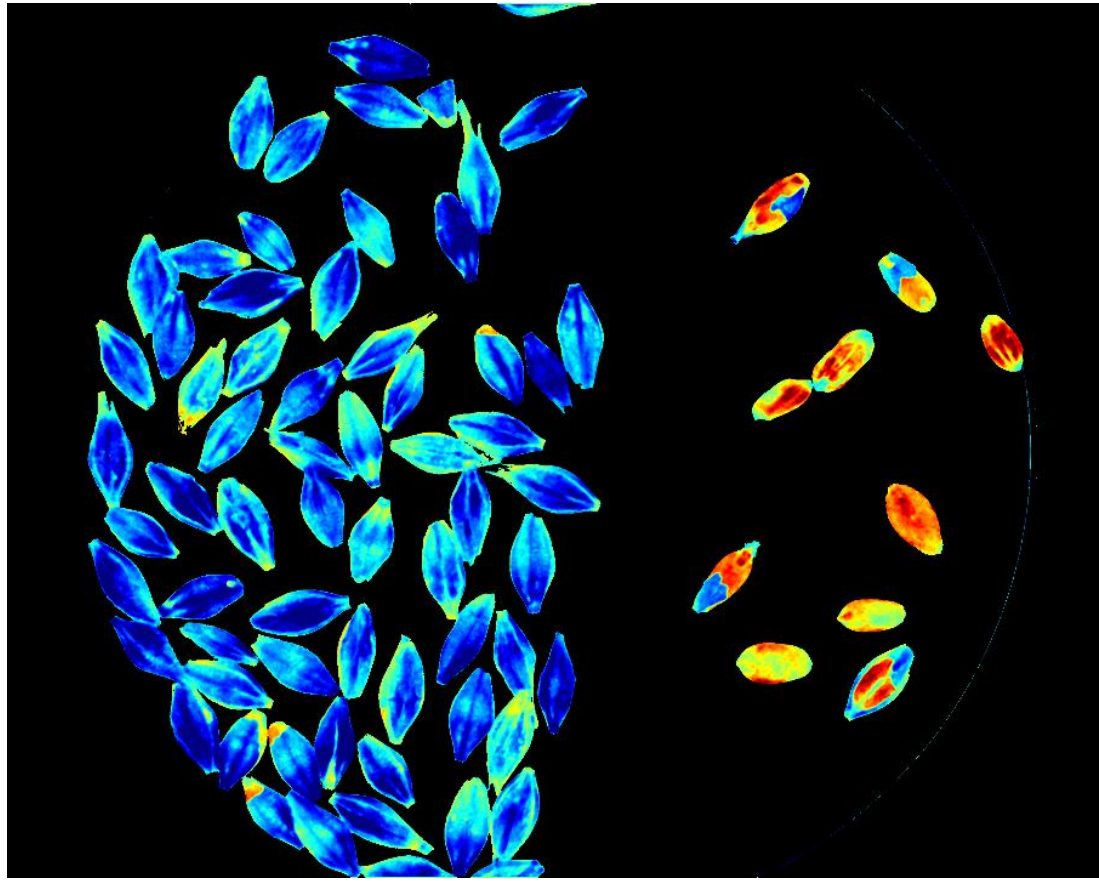
52 ”red” kernels analyzed with NGS after spectral imaging

Incoming barley: skinning test



No skinning (left) – skinned kernels (right)





Heatmap for skinning

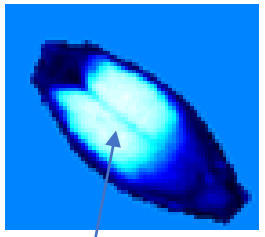
Steeping process: Hydration

2 step test:

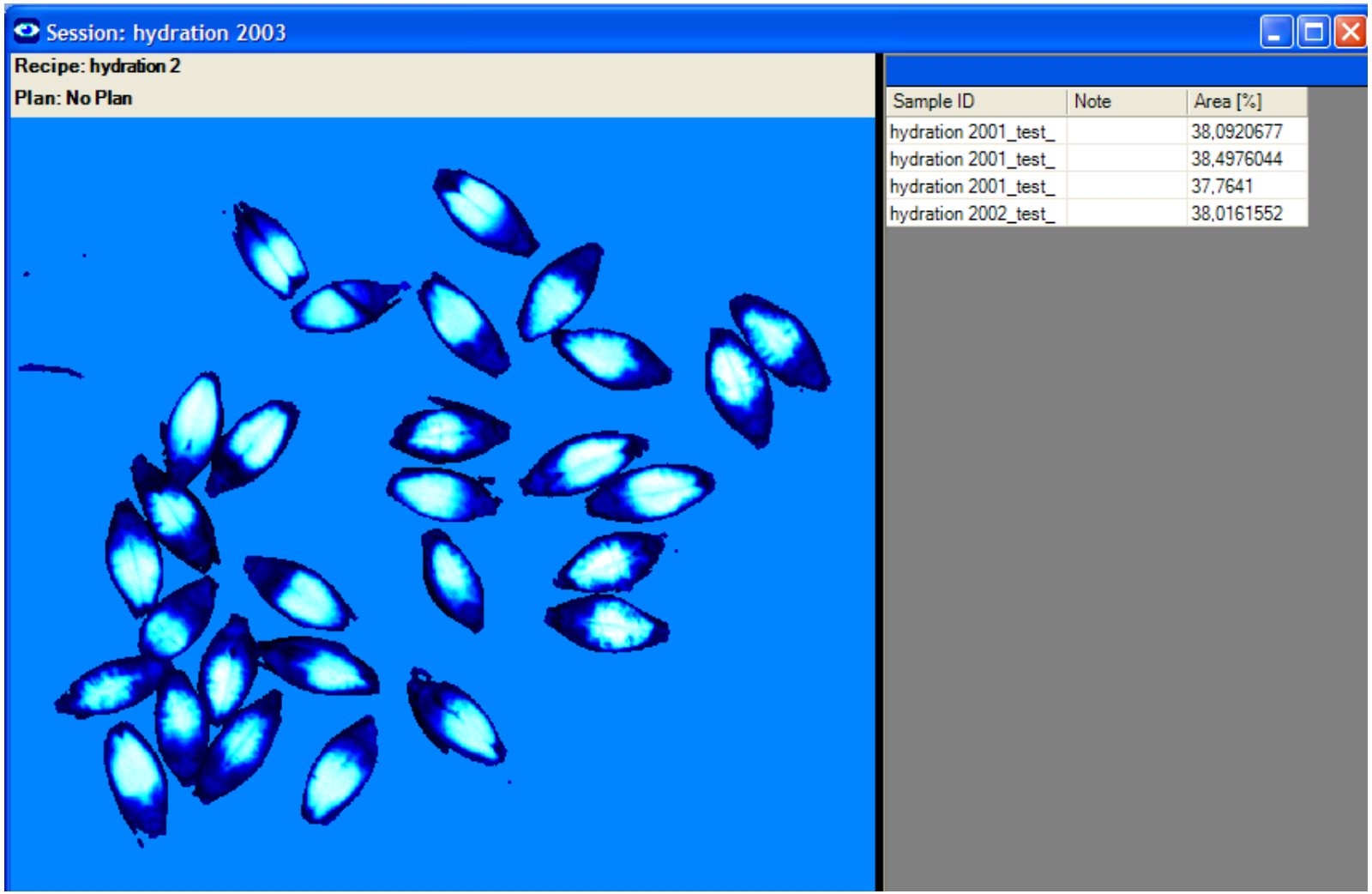
1. *Part the kernels lengthwise and place them in a 90 mm petri dish with cross-section facing upwards. Use a black background*
2. *Insert the petri dish and press F12*

Output will show the

1. *a **heatmap image** of the sample showing degree of hydration*
2. *an **area fraction** of non-hydrated areas on the cross-sectional area*



Not hydrated



Germination process: Chitting

2 step test:

1. *Put the kernels in a 90 mm petri dish*
2. *Insert the petri dish and press F12*

Output will show the

1. *a **color image** of the sample showing kernels with sprout with a green rectangle and kernels without sprout as a red rectangle*
2. *the percentage og sprouted kernels is shown*

Makes it easy to follow the germination process and decide to add more water or change the temperature.

Germination process: Rootlets

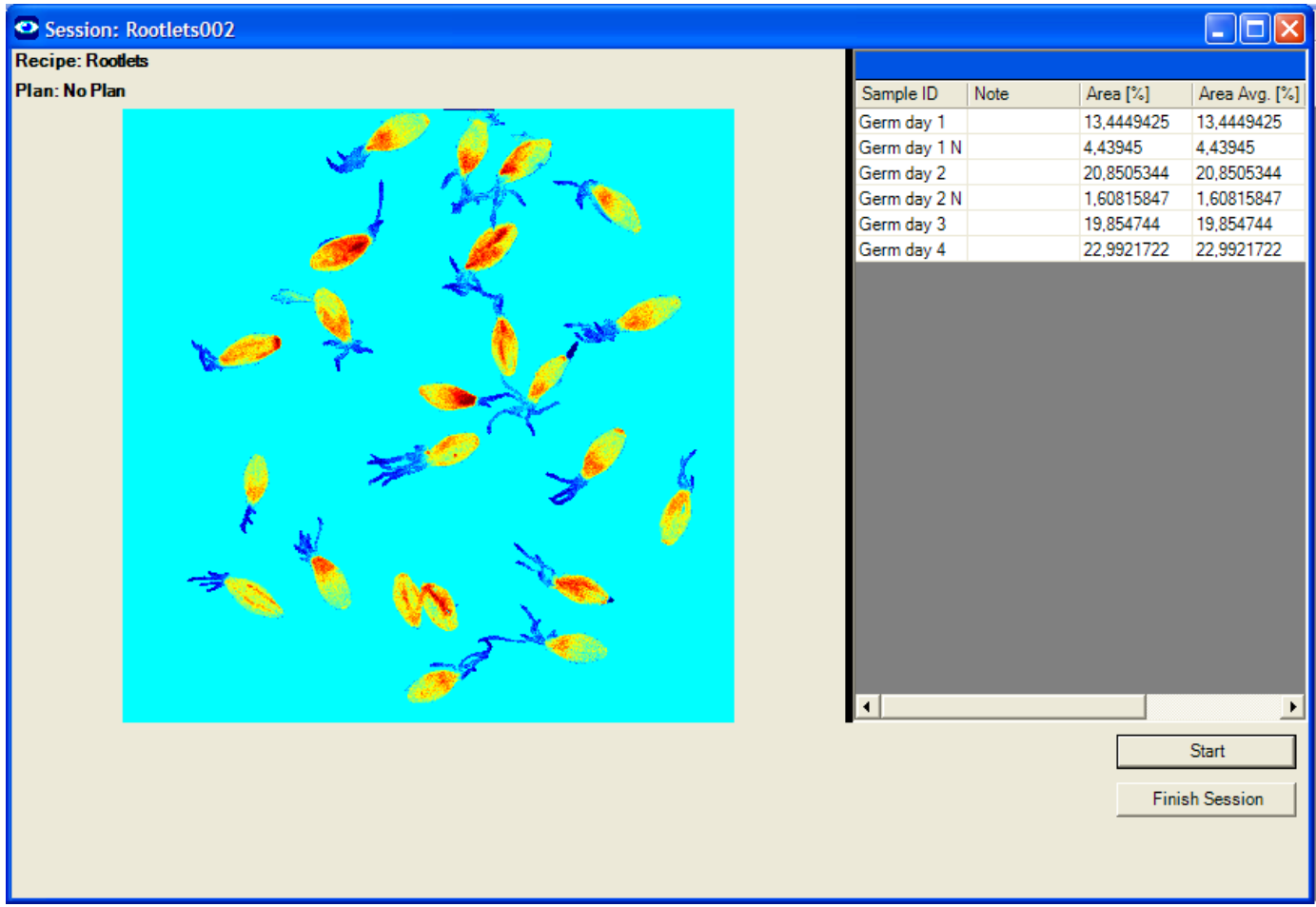
2 step test:

1. *Put the kernels in a 90 mm petri dish*
2. *Insert the petri dish and press F12*

Output will show the

1. *a **heatmap image** of the sample showing rootlet*
2. *the area fraction of rootlet in relation to full area of kermnels including rootlets*

Makes it easy to follow the germination process and decide to add more water or change the temperature.



Germination process: Acrospire length inside kernel

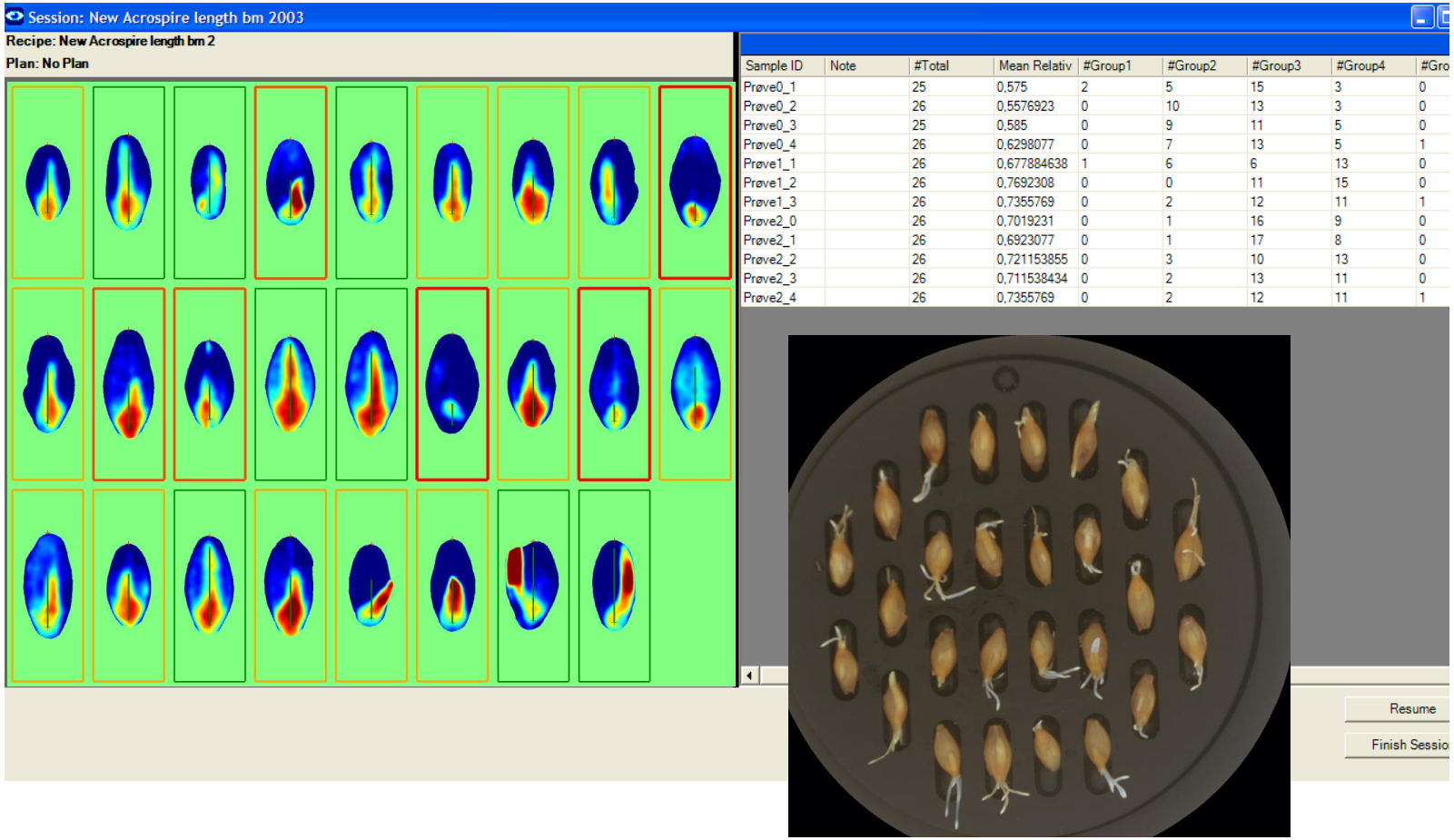
3 step test:

1. *Boil the germinated malt 10 minutes and leave the kernels in the water for a ½ hour*
2. *Place kernels in the presentation plate – with the front side up.*
3. *Insert the plate and press F12*

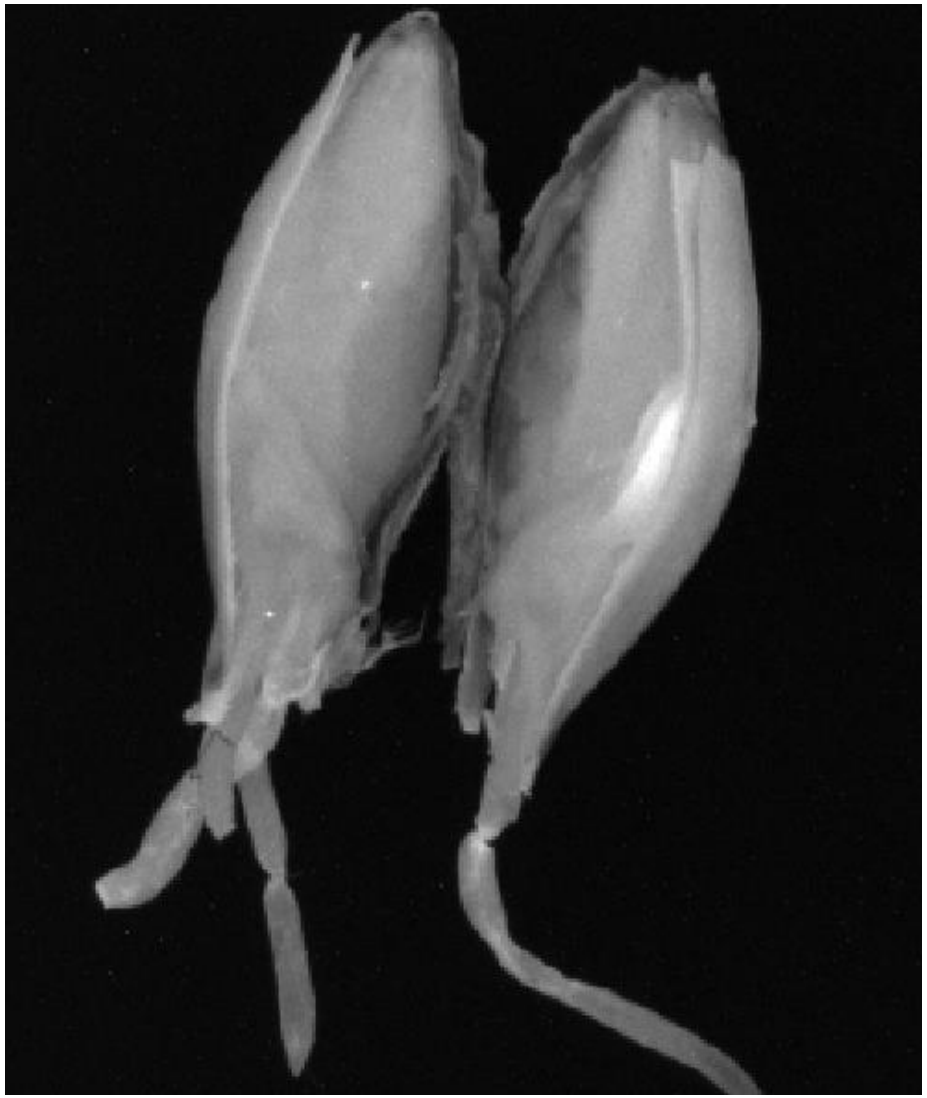
Output will show the

1. *a **heatmap image** of aligned kernels showing acrospire*
2. *the **relative length distribution** of acrospires across all kernels*

A fast and accurate way to calculate the mean acrospire length - in order to know when to stop the process.



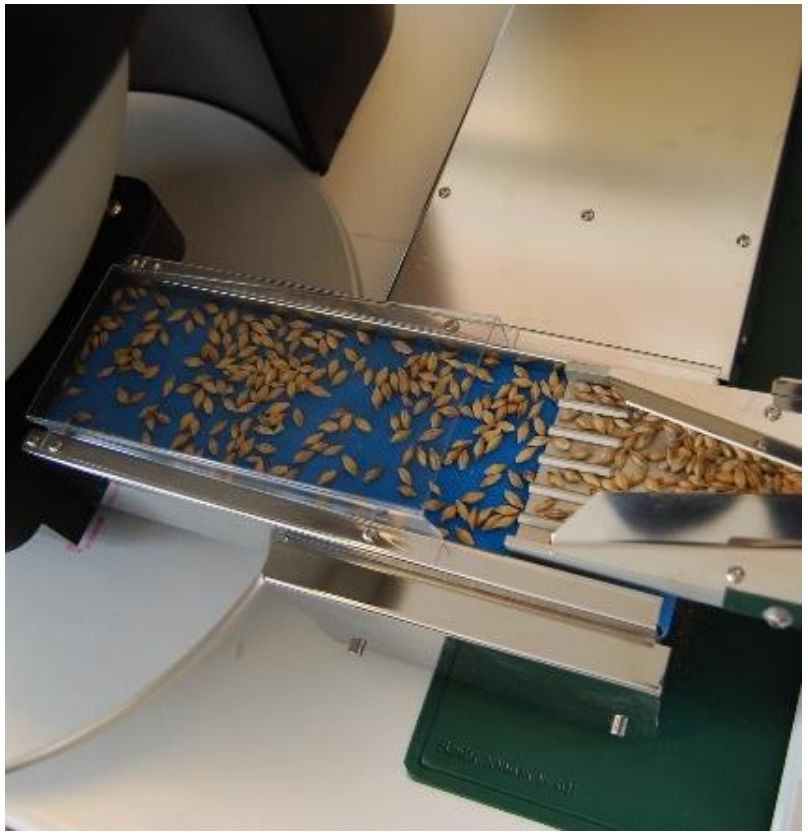
Acrospire seen using chlorophyll fluorescence



Acrospire in barley malt.
Excitation at 435 nm, emission filter 600 nm LP

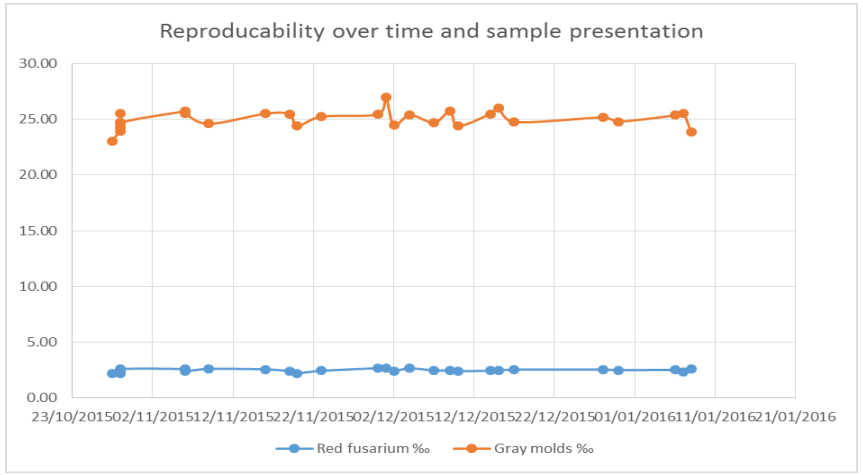
Autofeeder option:

Measuring larger sample sizes

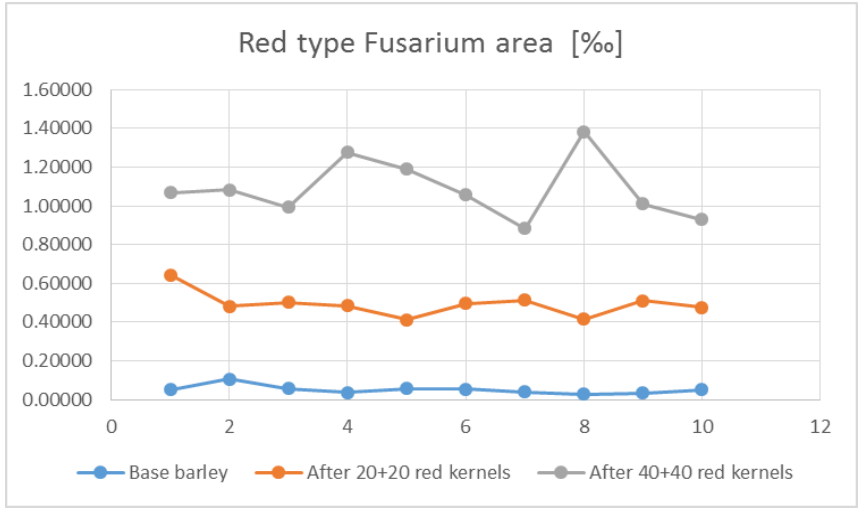


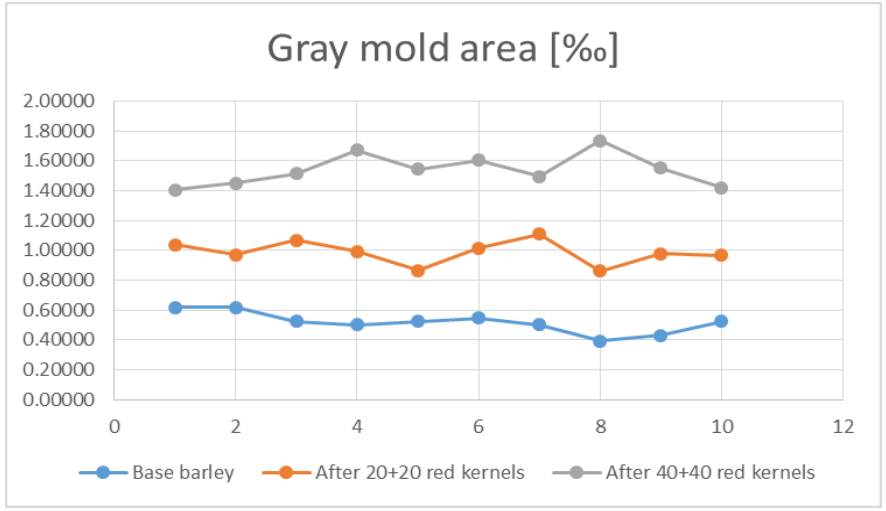
Feeding most granular products

High reproducibility and sensitivity



Same 560 g sample measured repeatedly over several months using the autofeeder option





Adding few infected and partially infected seeds to the 560 g sample gives a signifikant rise in detected infection level