

A novel acoustic sensor approach to classify seeds based on sound absorption spectra

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The possibilities of acoustics

- › **Nondestructive**
 - › **In situ**
 - › **Rapid**
 - › Relatively **inexpensive**
- 

Ongoing investigations

Forage, Soil, Seeds...

- > variety
 - > particle size and shape
 - > density
 - > water content
- 

Experimental overview

› **Sound absorption** coefficient spectra

› **Multivariate statistical** tools

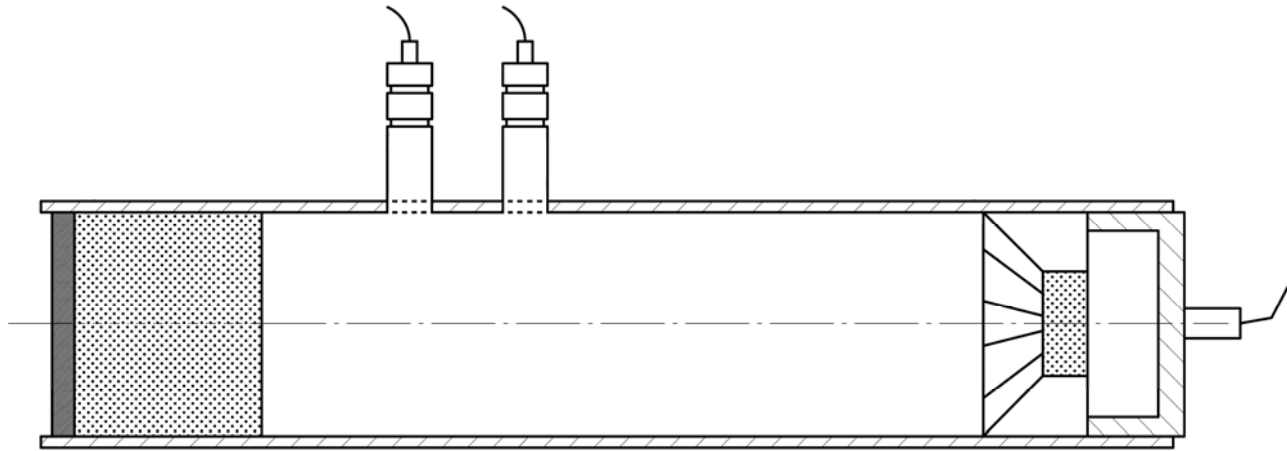
PCA
SIMCA

**Seed Type
classification
model**

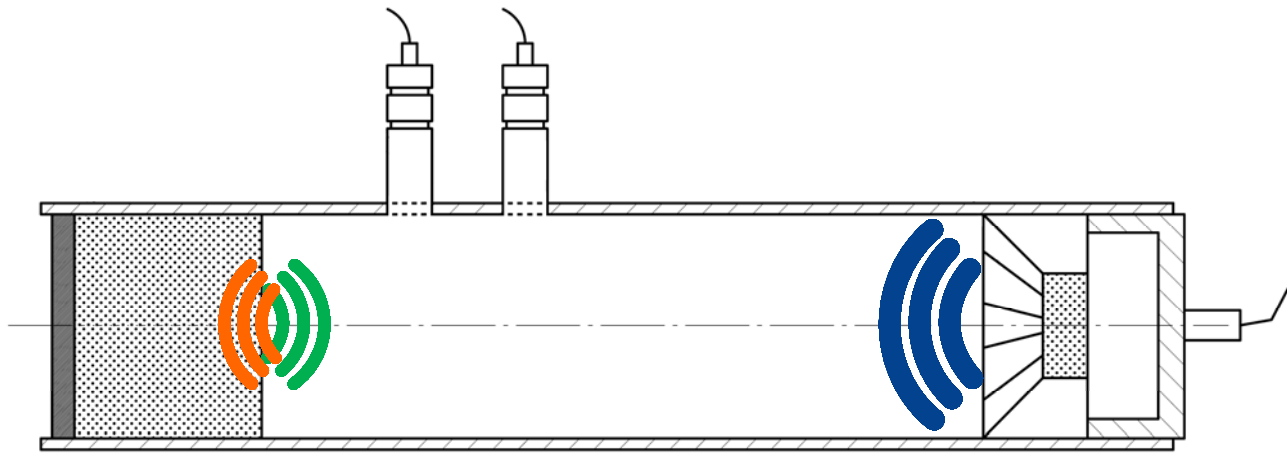
The impedance tube



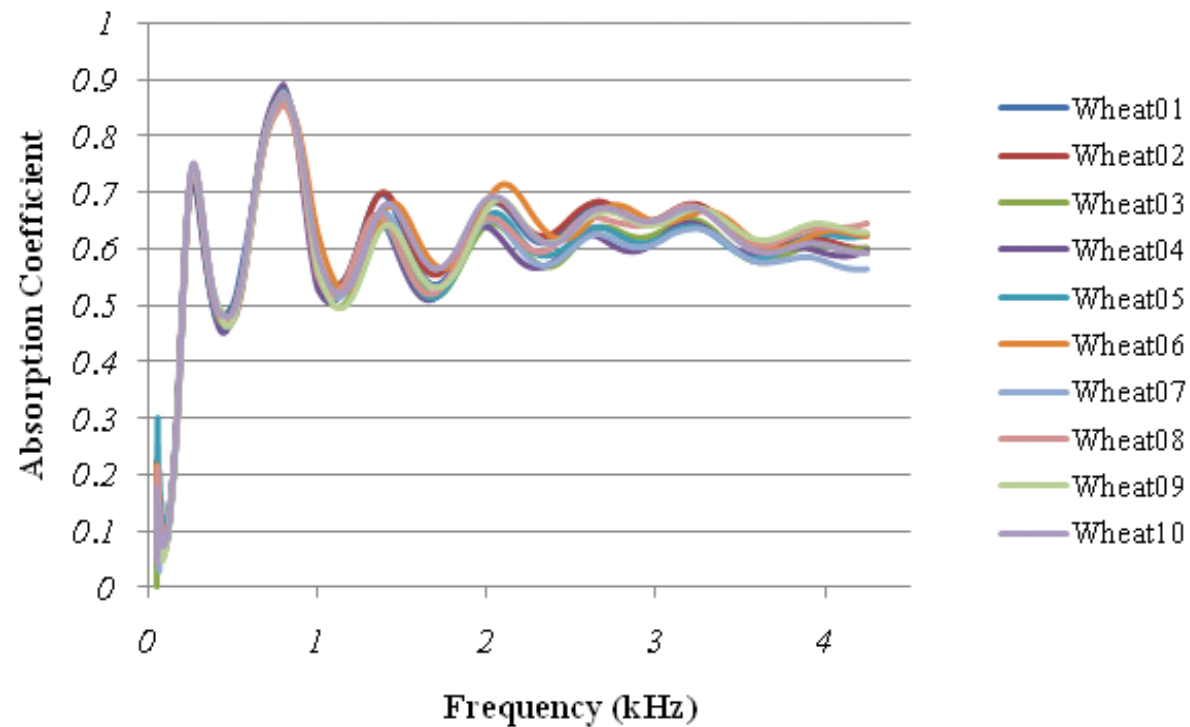
The impedance tube



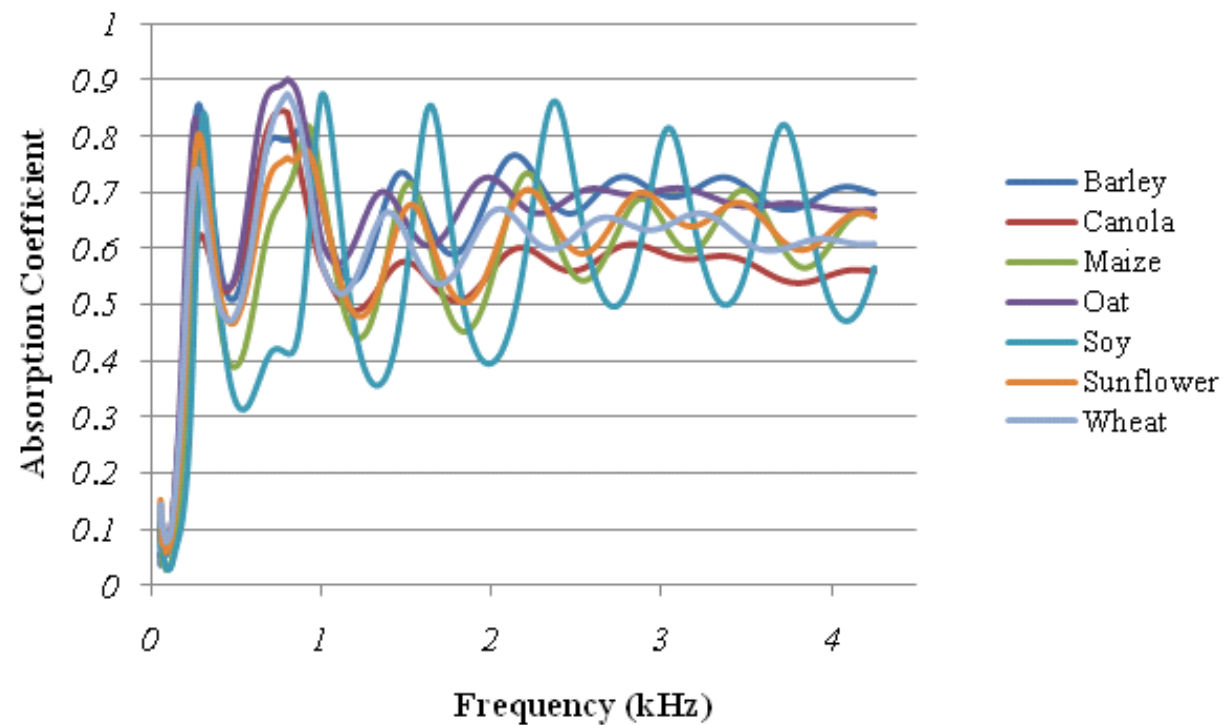
The impedance tube



Results - Absorption spectra



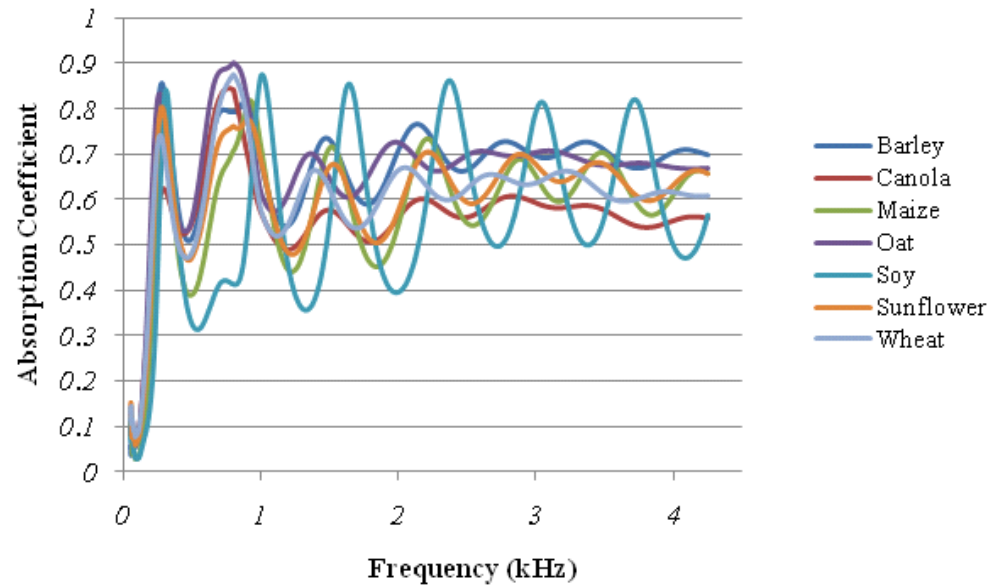
Results - Absorption spectra



Results

- › Grain size
- › Shape (*sphericity*)

- › Absorption magnitude
- › Resonance oscillations amplitude
- › Resonance peak frequencies



Model development

Absorption Spectra
(training samples)

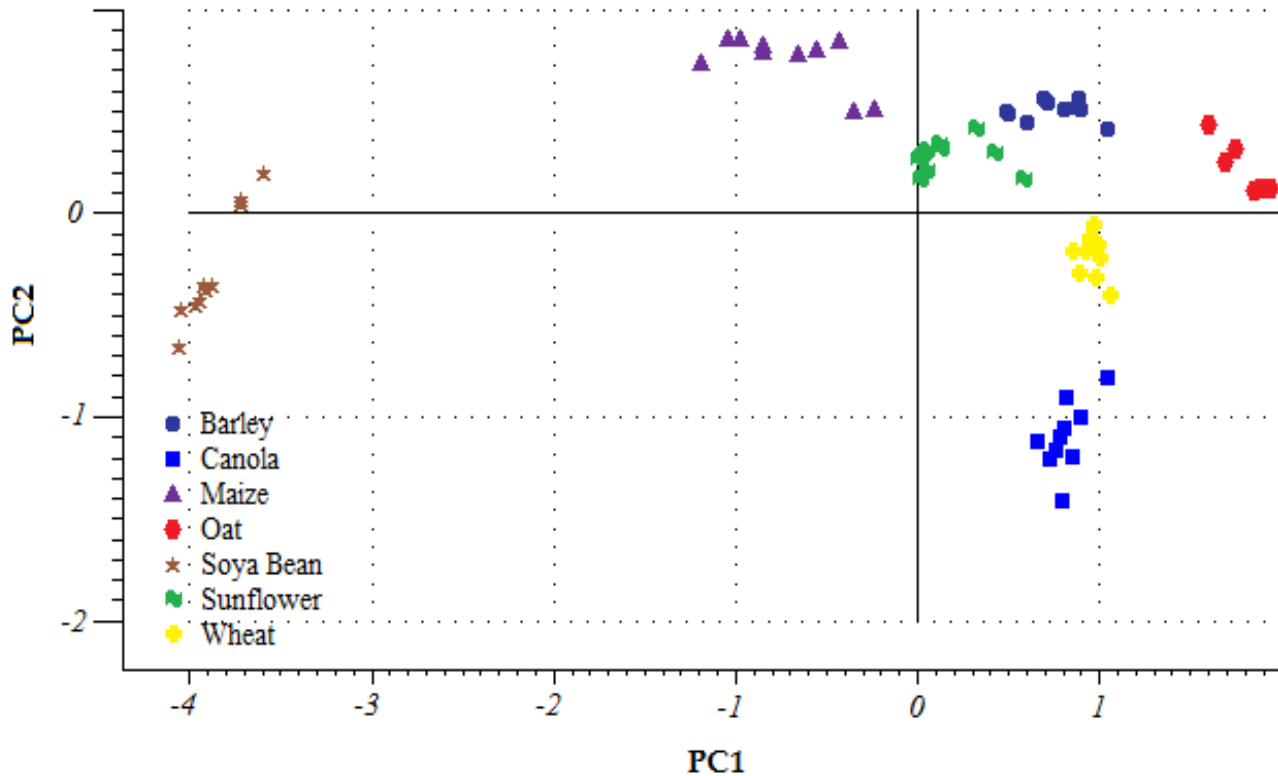


PCA



SIMCA

Results - PCA scoreplot



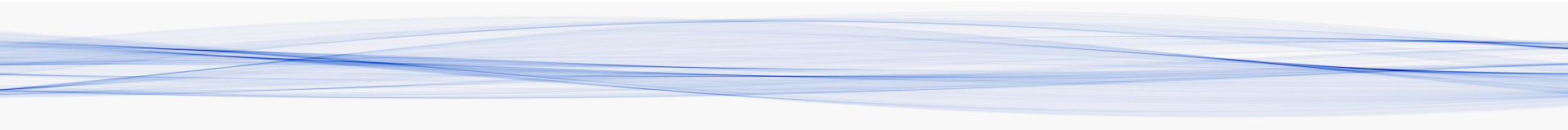
Results - SIMCA classification models

	<i>Barley model</i>	<i>Canola model</i>	<i>Maize model</i>	<i>Oat model</i>	<i>Soya Bean model</i>	<i>Sunflower model</i>	<i>Wheat model</i>
<i>Barley01</i>	*						
<i>Barley02</i>	*						
<i>Canola01</i>		*					
<i>Canola02</i>		*					
<i>Maize01</i>			*				
<i>Maize02</i>			*				
<i>Oat01</i>				*			
<i>Oat02</i>				*			
<i>SoyaBean01</i>					*		
<i>SoyaBean02</i>					*		
<i>Sunflower01</i>						*	
<i>Sunflower02</i>						*	
<i>Wheat01</i>							*
<i>Wheat02</i>							*

Further work

- › **Classification of:**
 - › Grain size
 - › Weight/density
 - › Water content
- › **In situ system development**

Conclusion



We are seeking commercial partners for further development

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Further Reading (Open access article):

<http://www.mdpi.com/1424-8220/10/11/10027/>



Thank you

Any questions?

