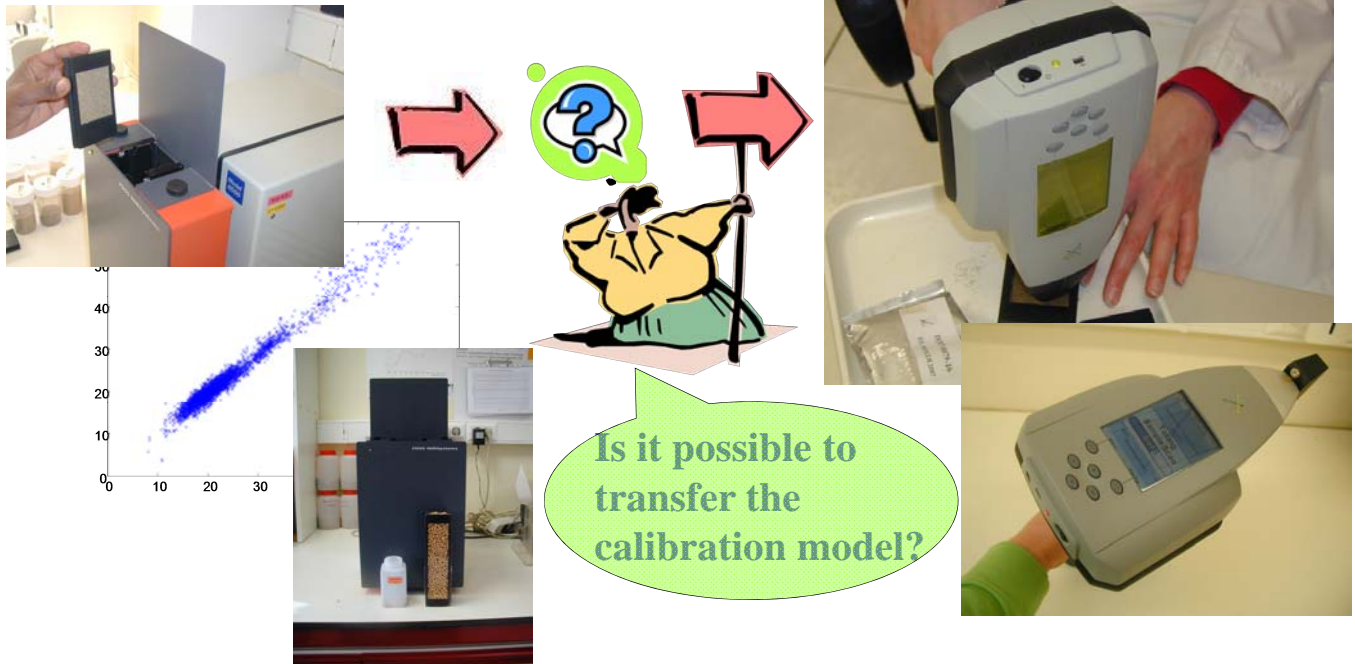


CALIBRATION TRANSFER FROM DISPERSIVE INSTRUMENTS TO HANDHELD SPECTROMETERS (MEMS)

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The new technological developments use the MEMs technology (Micro Electro Mechanical System). The handheld and miniature instruments are more and more required for on-site analysis.

The objective of this study is to assess the potentiality of a calibration transfer from dispersive instruments to a handheld spectrometer, the Phazir, based on MEMS.

The Phazir is an handheld near-infrared (NIR) spectrometer using MEMS technology. Its wavelength range is 1600 – 2400 nm. The Phazir combines a DTS (digital transform spectrometer) engine, a reflectance probe, rechargeable batteries, integrated computer and LCD display and software into one unit that can be used remotely, such as in field applications.

FEED DATA

A dataset of 9164 samples of feed has been analyzed using a Foss NIRSystem 6500. Different calibration models have been constructed using reference values for protein, fatty matter, fiber and starch content. In order to transfer these equations from this dispersive instrument (slave) to the handheld spectrometer Phazir (master), 27 feed samples were collected (10 repetitions) with both instruments and analyzed with reference methods for protein, fatty matter, fiber and starch content. These 27 samples were used for the standardization of the instruments. Two outliers have been removed and the data was split into a standardization set, std set (14 samples) and a test set (11 samples).

GLOBAL MODELS USING THE FOSS NIRSYSTEM 6500

Foss NIRSystem 6500 model 1100 - 2500 nm

Property (in % MS)	N	Min	Max	Factors	RMSECV	R2
Fat	3994	0.66	33.87	8	0.93	0.97
Fibre	2946	1.01	29.96	15	0.97	0.95
Protein	7665	8.04	63.64	15	1.18	0.98
Starch	1315	2.11	74.01	13	1.59	0.99

Foss NIRSystem 6500 Reduced model 1600 - 2400 nm

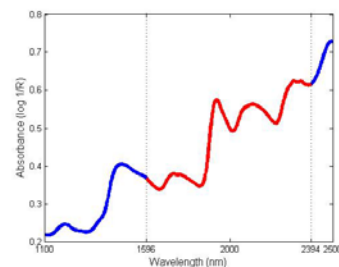
Property (in % MS)	N	Min	Max	Factors	RMSECV	R2
Fat	3994	0.66	33.87	8	0.94	0.97
Fibre	2946	1.01	29.96	15	1.06	0.94
Protein	7665	8.04	63.64	15	1.24	0.98
Starch	1315	2.11	74.01	13	1.76	0.99

GLOBAL MODEL USING THE PHAZIR

Phazir model 1600 - 2400 nm

Property (in % MS)	N (*)	Min	Max	Factors	RMSECV	R2
Fat	4008	0.66	33.87	8	0.94	0.97
Fibre	2960	1.01	29.96	15	1.08	0.94
Protein	7679	8.04	63.64	15	1.39	0.97
Starch	1329	2.11	74.01	13	1.77	0.99

* The 14 samples of the std set (from the Phazir instrument) have been added to the database



Spectrum of the 6500 (1100-2500 nm) in blue and at the range of the Phazir (1600-2400 nm) in red

MODEL COMPARISON

STD SET - Comparison Phazir- Foss 6500 (1100 - 2500 nm)

Property (in % MS)	N	Factors	RMSE	SEP	R2
Fat	14	8	0.44	0.38	0.99
Fibre	14	15	1.12	1.08	0.88
Protein	14	15	0.71	0.61	0.99
Starch	14	13	3.31	1.97	0.98

TEST SET - Comparison Phazir- Foss 6500 (1100 - 2500 nm)

Property (in % MS)	N	Factors	RMSE	SEP	R2
Fat	11	8	0.44	0.44	0.97
Fibre	11	15	1.43	1.47	0.87
Protein	11	15	1.06	1.11	0.87
Starch	11	13	3.56	1.41	0.99

CONCLUSION

As conclusion, several calibration models for different properties of feed developed on a FOSS NIRSystem 6500 have been successfully transferred to a Phazir handheld spectrometer.

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