



Detection of off-flavours in maple syrup using spectroscopy

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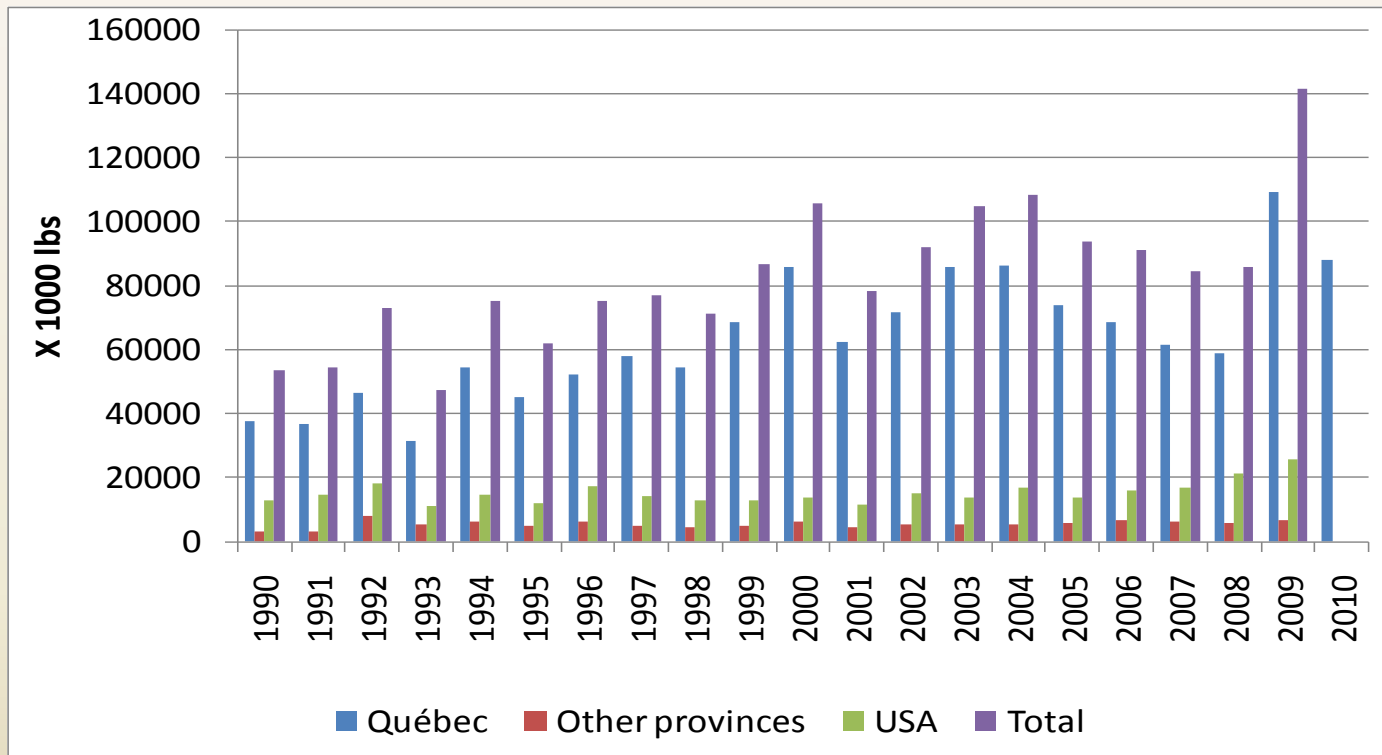
Summary

- Introduction
 - Production statistics
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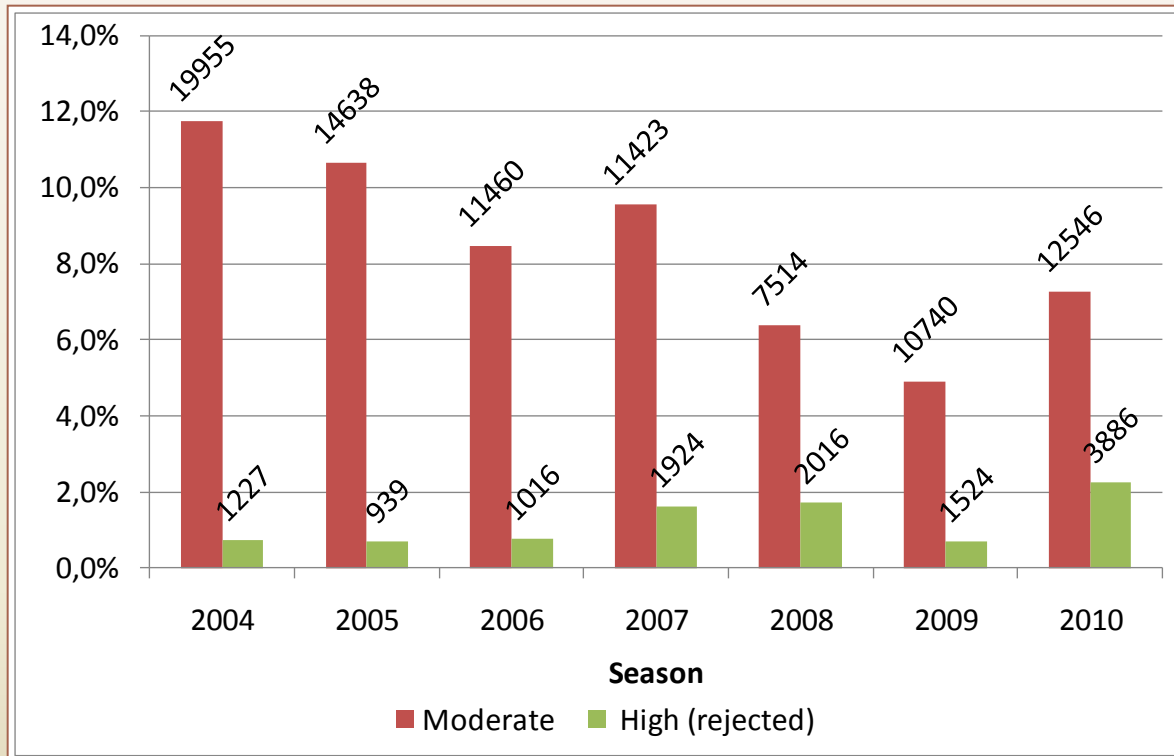
Introduction



Maple syrup production in North America

(source : FPAQ)

Introduction



Percentage of inspected syrups with taste defects in Quebec

(source : FPAQ)

Introduction



- Taste defects in maple syrup
 - Taste panel from ACER Inspection division
 - Each bulk container is analyzed for the presence of taste defects during inspection (quality control)

Categories of taste defects in Quebec	Description
1-Natural origin	Metabolism off-flavour
2-Microbial origin	Fermentation, mouldy
3-Chemical residue origin	Cleaner, sanitizer, defoamer
4-Undefined origin	List of defects not easily identifiable
5-Buddy	Bitter taste related to bud break (amino- acids)

- Two intensities of taste defects (moderate and high)
- Confirmation of high taste defects by a 2nd panel (MAPAQ)

Introduction

- The challenge of detecting off-flavours by inspectors
 - A large number of bulk maple syrups to inspect
 - Demands accurate aptitudes and a good training
 - Physically demanding, restricted to a maximum limit
 - Monopolizes personnel and resources and leaves practically no room for other tests



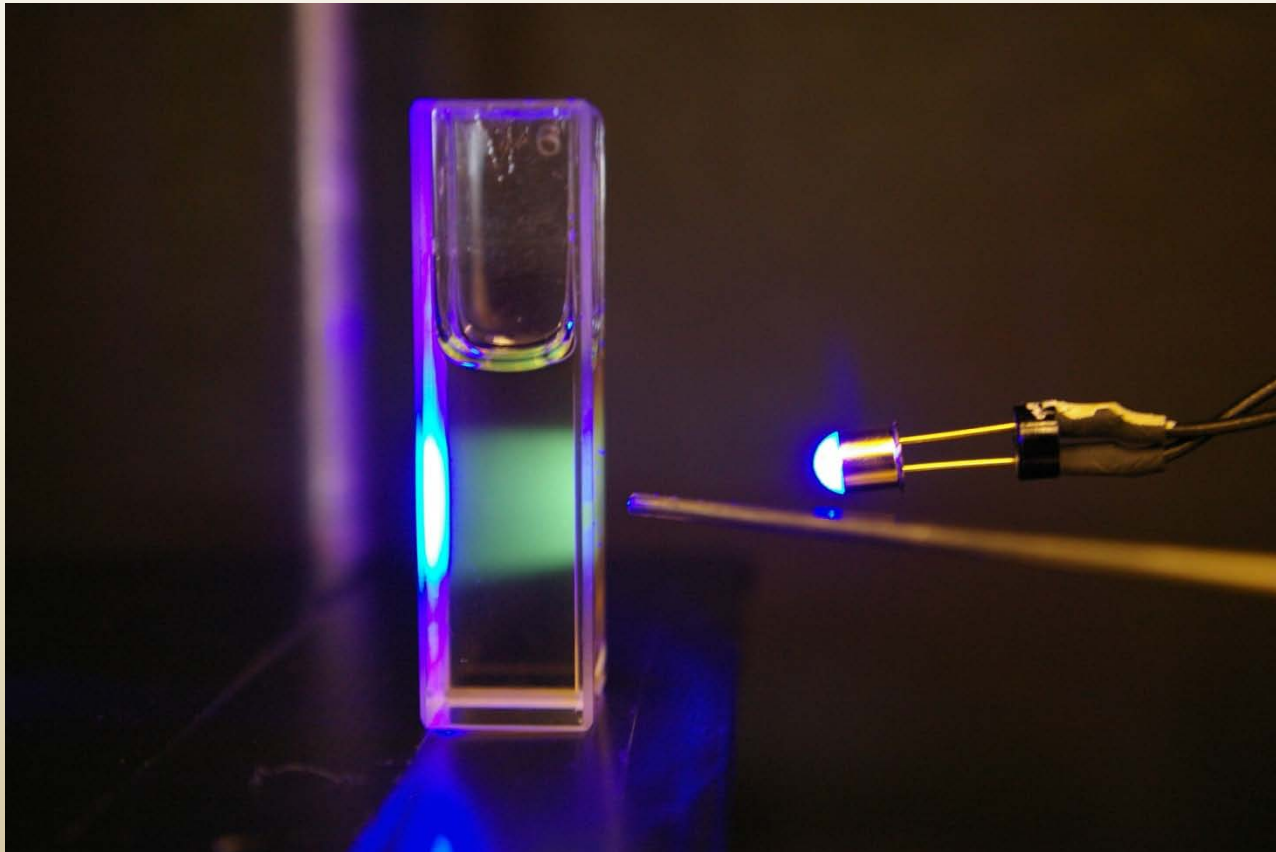
Prototype development

- The alternative: Automatic screening of taste defects
 - Help inspection personnel
 - Reduce the number of syrups that are submitted to taste testing by :
 - 1st level: Separating good syrups from those with taste defects
 - 2nd level: Indicating the intensity of defects (moderate or high)
 - 3rd level: Identifying the type of taste defects (ultimate goal)
 - Does not require specific aptitudes or qualifications to be used
 - Increase productivity (practically no maximum limit)
 - Makes resources available to test other parameters

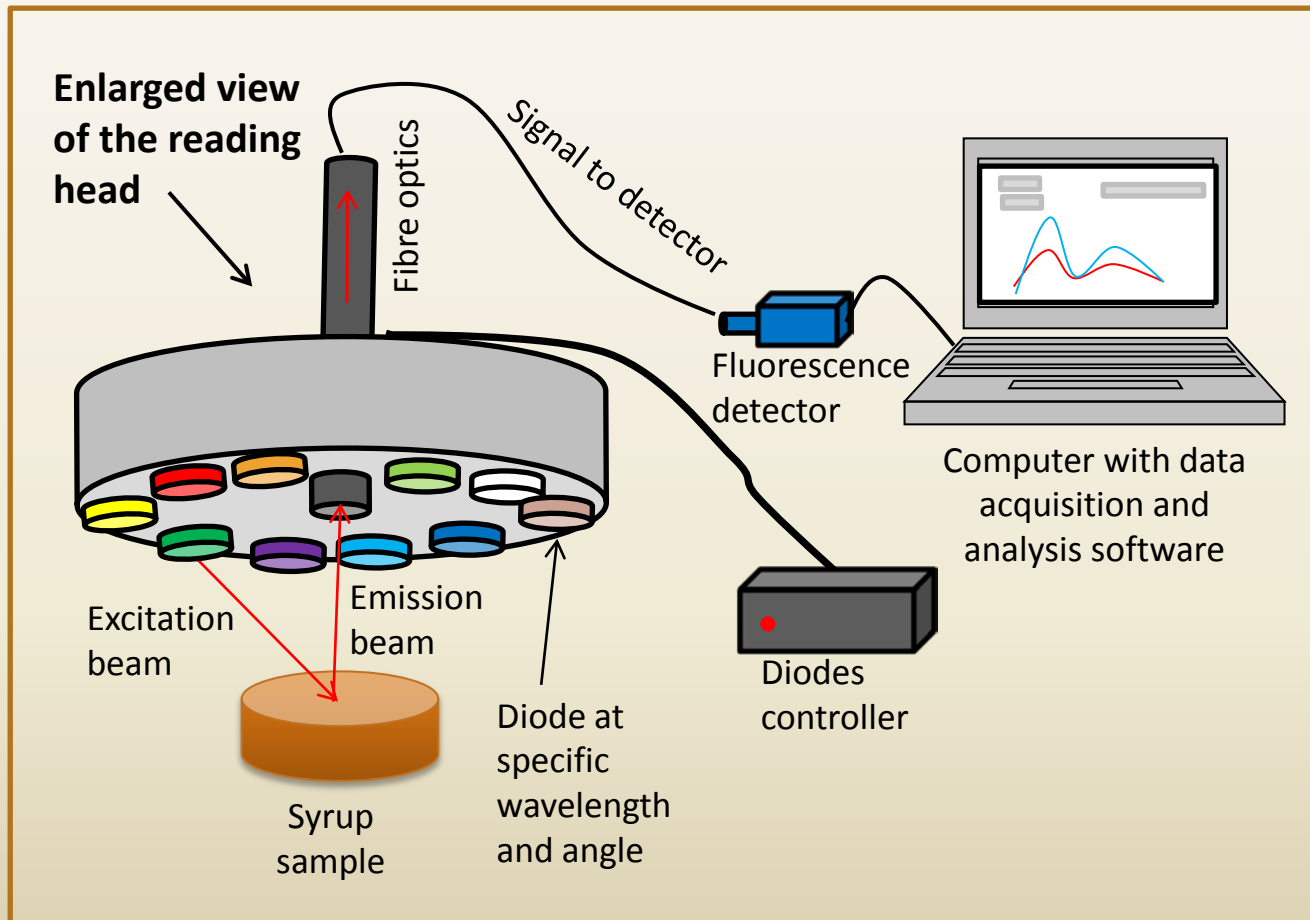


Prototype development

- Natural fluorescence of maple syrup



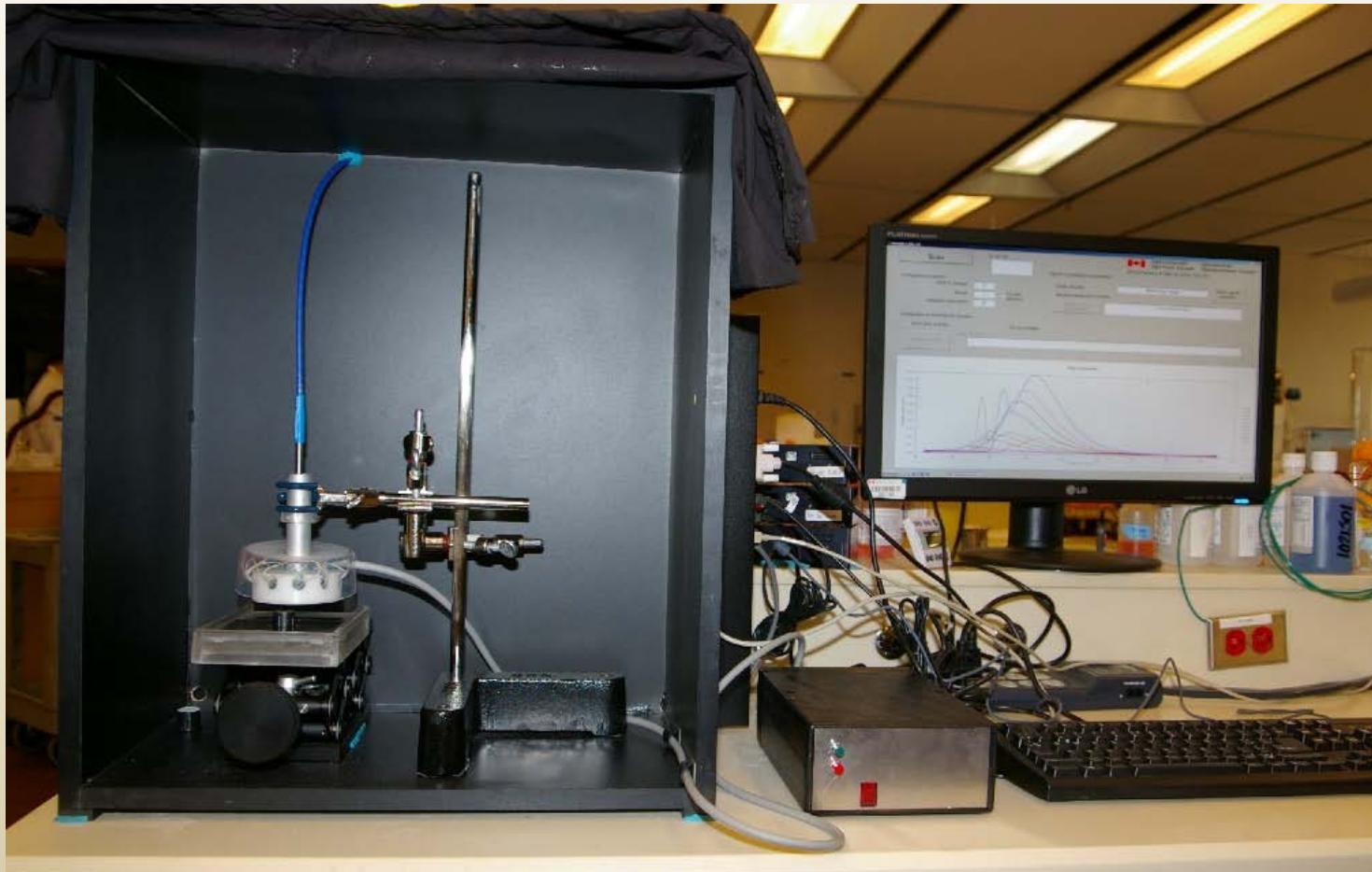
Prototype development



Prototype for taste defects detection in maple syrup



Prototype development



Results



Classification matrix

	Total samples	Identified without defects	Identified with defects
Samples without defects	219	209	10
	100%	95.4%	4.6%
Samples with defects	405	13	392
	100%	3.2%	96.8%
Percentage correct classification:			96.1%

1st level: Separating good syrups from those with taste defects by spectroscopy (submitting to taste testing by inspectors only syrups detected with taste defects by spectroscopy would typically increase by a factor of 5 the number of syrups inspected in a day)

Results

2nd level: Indicating the intensity of defects (moderate or high)
Above 95% correct classification

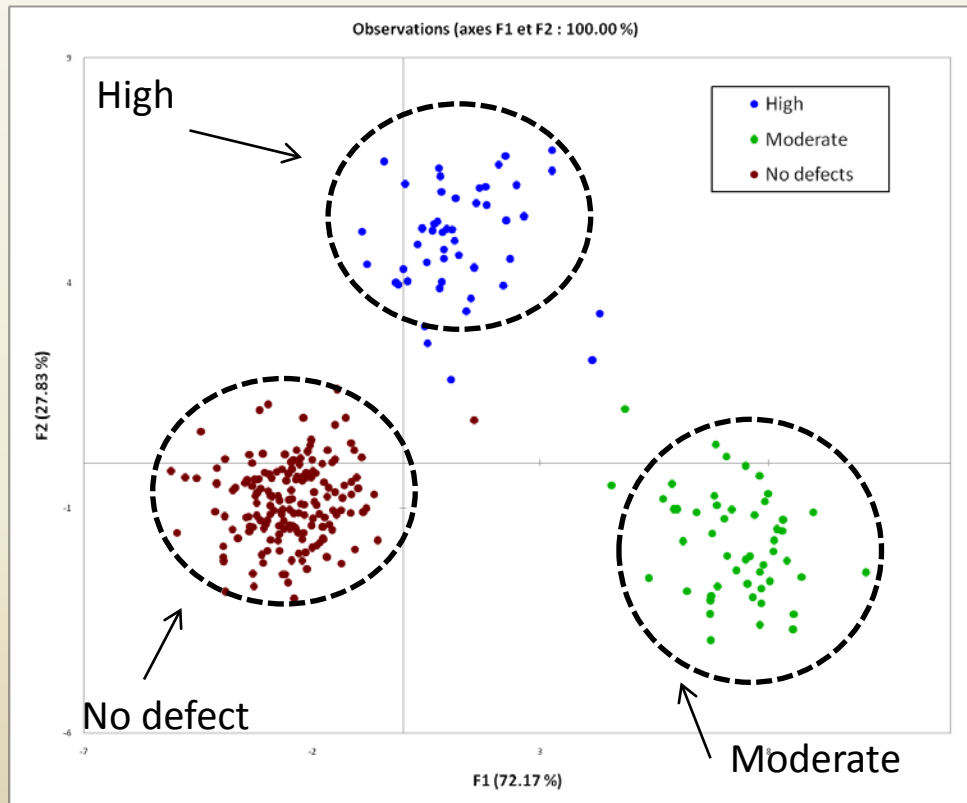


Figure 1. - Classification capacity based on discriminant factorial analysis of spectra obtained from a subset of 270 maple syrups samples – presence and **intensity** of taste defects



Results

3rd level: Indicating the type of defects
80 % correct classification

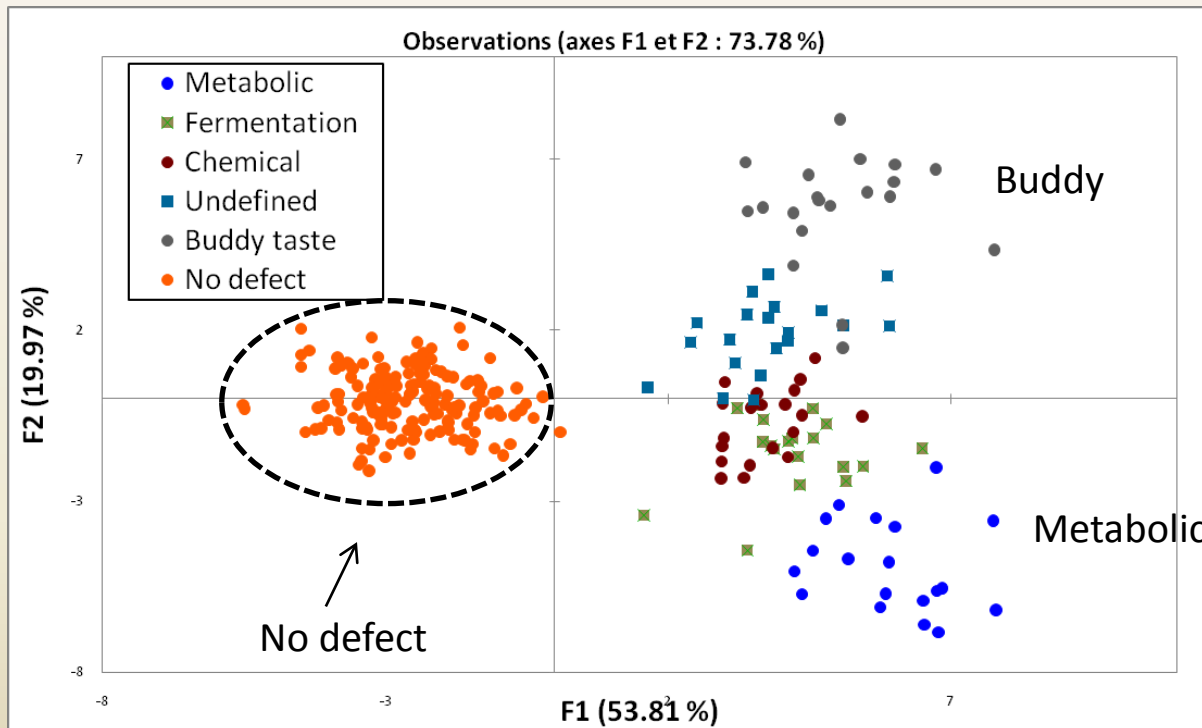


Figure 2. - Classification capacity based on discriminant factorial analysis of spectra obtained from a subset of 270 maple syrups samples – presence and **type** of taste defects



Conclusion and perspectives

- Results from laboratory experiments indicate that spectroscopy can detect :
 - the presence of taste defects
 - Their intensity
 - The type of defect
- Simple and easy to use equipment adapted for inspection
- Calibration and validation of prototype necessary at inspection sites
 - In 2011 : data collection on many thousands of syrups to cover as much variability as possible (calibration)
 - In 2012: Validation and robustness (season effect)
- Partnership for equipment manufacturing
 - Available for the 2013 season
- Spectroscopy as a platform for maple syrup inspection
 - Taste defects
 - Adulteration
 - Value added characteristics
 - Flavours
 - Nutritive and functional attributes (antioxidants, vitamins, etc.)



Merci

Thank you

“Special thanks to the personnel of ACER Inspection division for providing samples and expertise”

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