



# ***In vivo* assessment and evaluation of lung cancer detection using an integrated spectral and imaging endoscopy system**

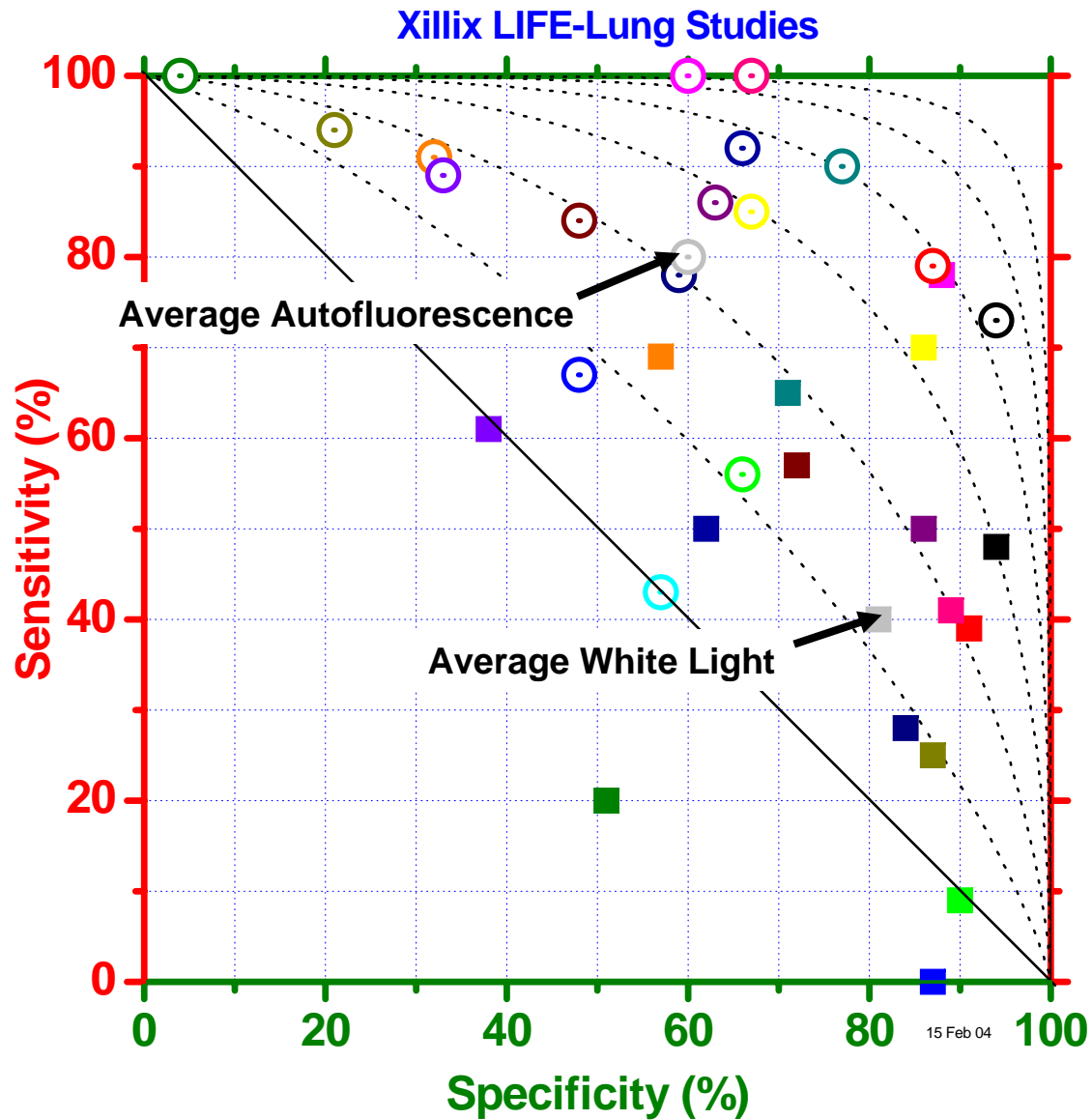
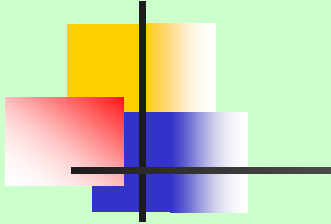
**Y.Fawzy, D. Reinders, M. Tercelj, M.Petek, and H.Zeng**

Presented by: **Yasser Fawzy, Ph.D**

**Perceptronix Medical Inc.**

# Lung Cancer Imaging Diagnostic Problem

*Subjective methodology no quantification*



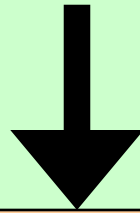
- Lam
- Lam
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- Weigal
- Kurie
- Venmans
- Venmans
- Vermlyen
- Khanavkhar
- Metwally
- Thiberville
- Van Rens
- Yokomise
- Ikeda
- Shibuya
- Sato
- Lee
- Average

## Work Objectives

Developed

**I. Spectral Measurement Module**

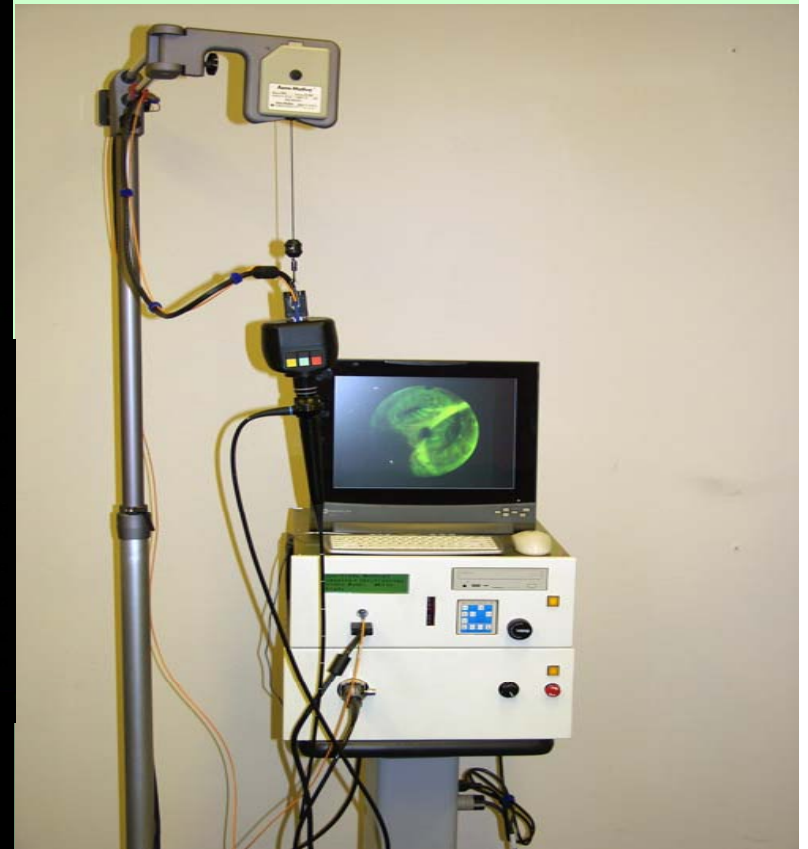
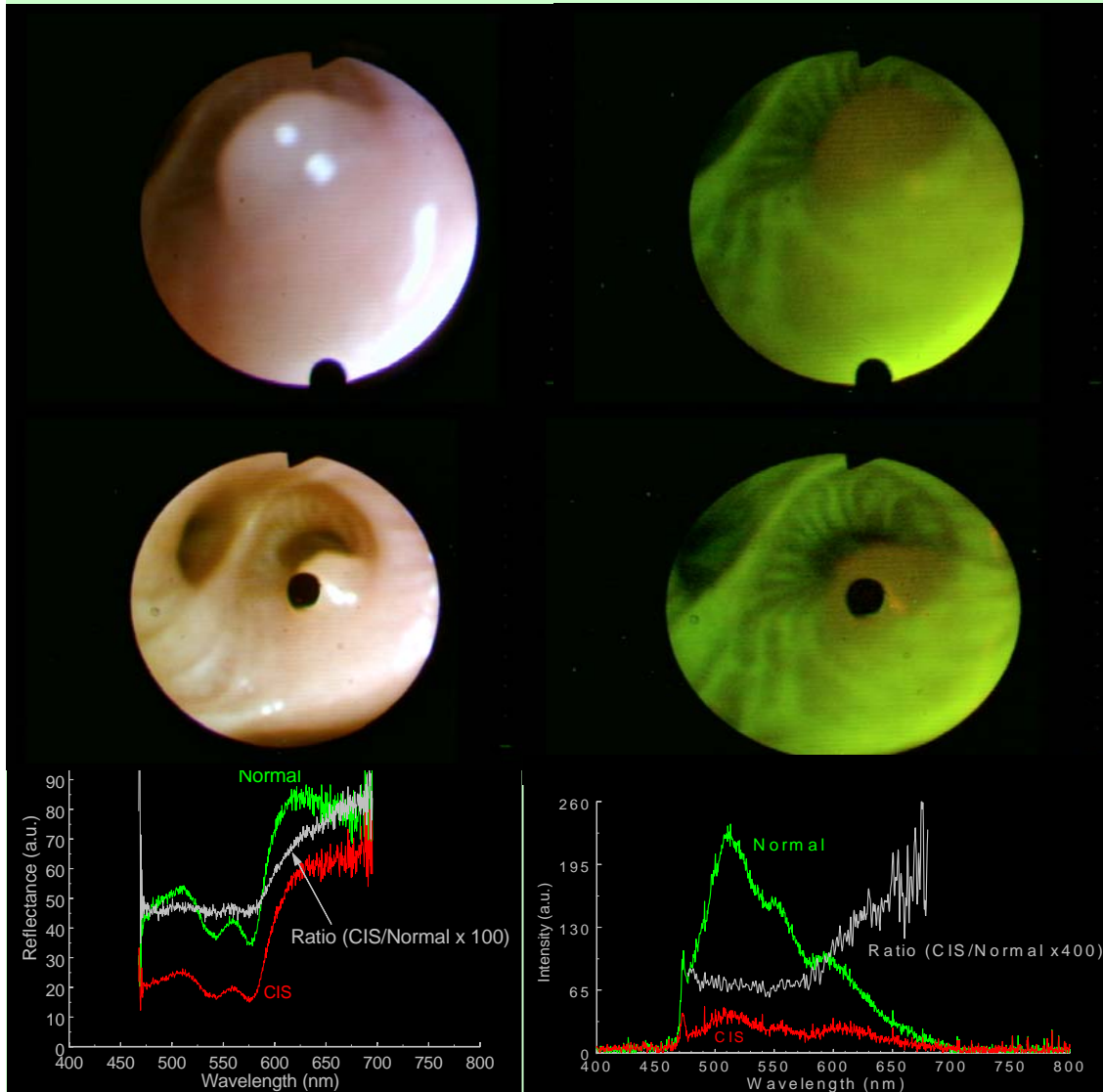
**II. Spectral Analysis and Classification**



Performing

***In vivo* Evaluation and Assessment**

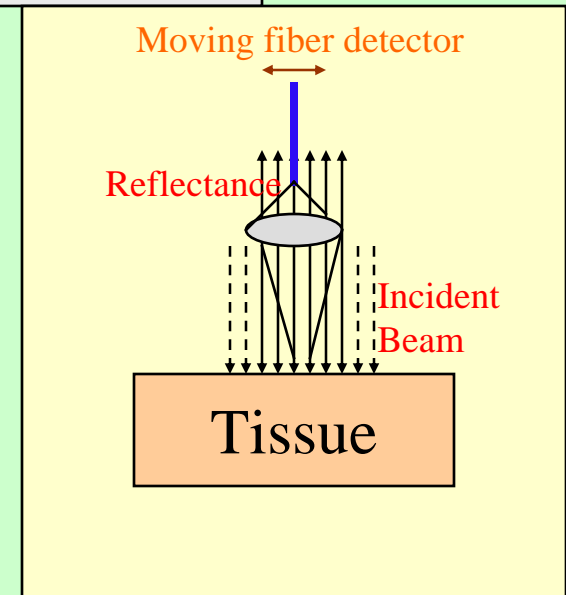
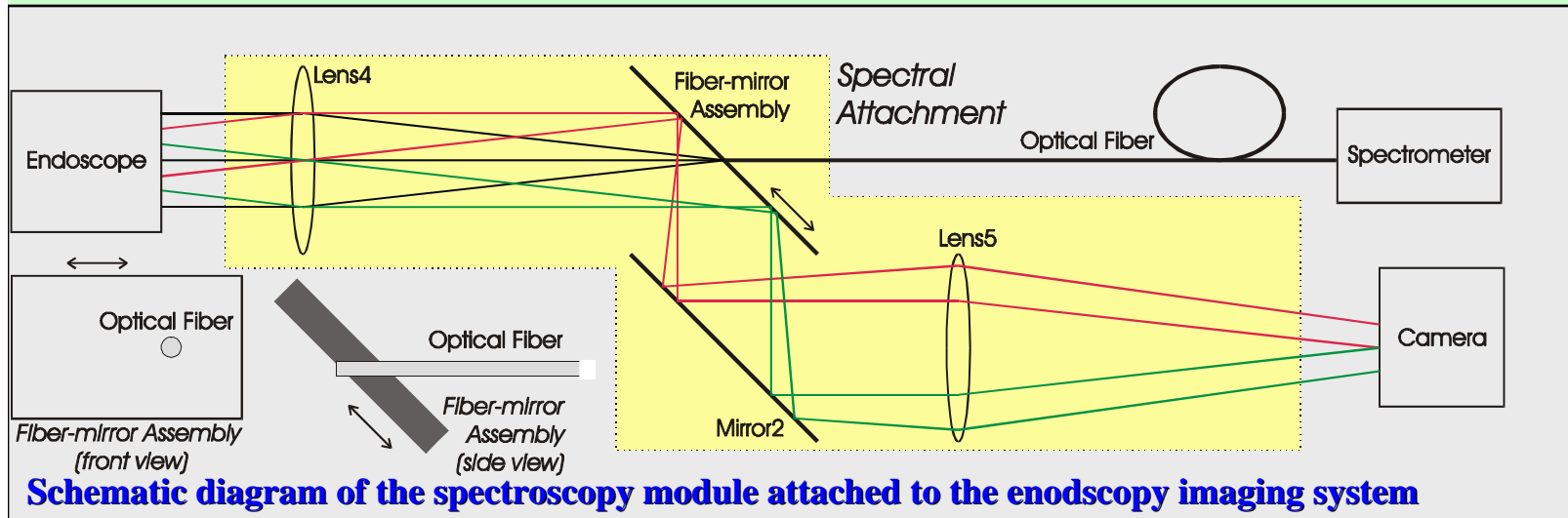
# Spectral Endoscopy System



*ClearVu Elite™*

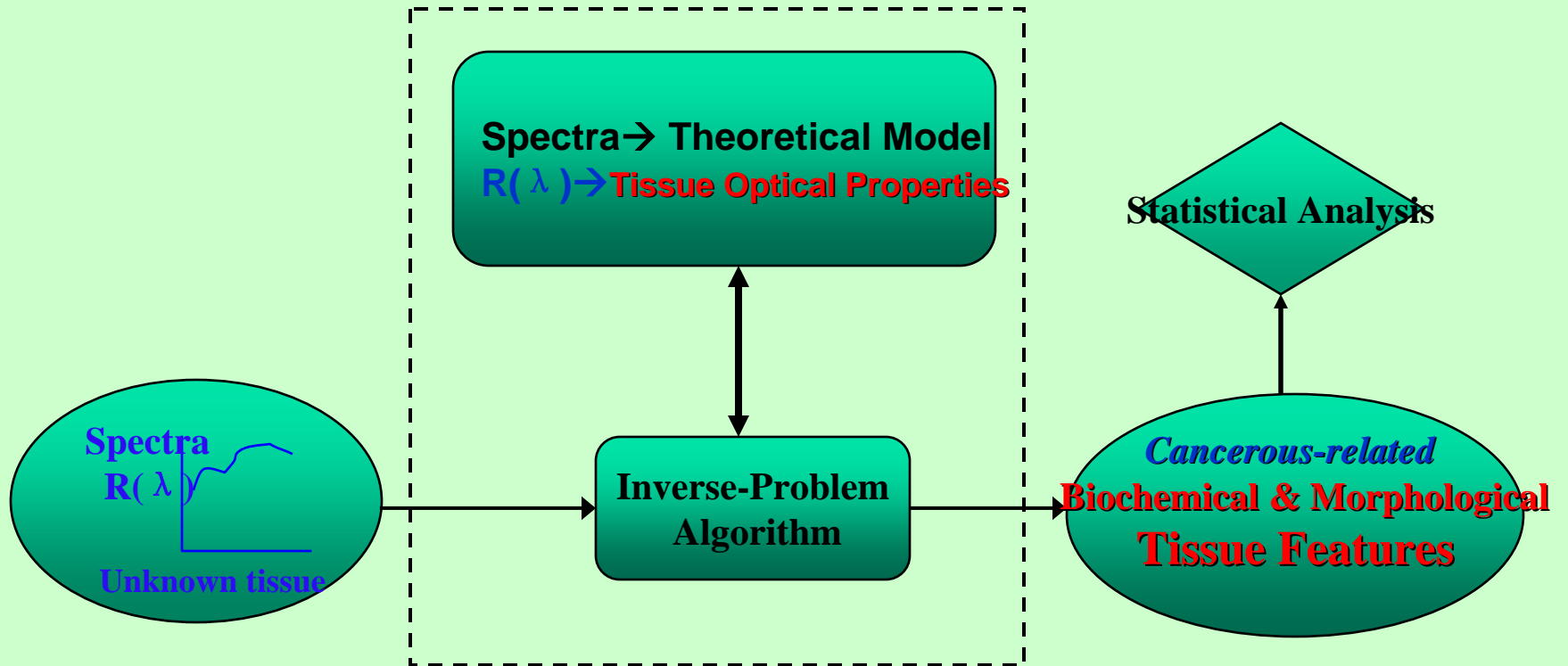
# I. Spectral Measurement Module

## Measurement Geometry



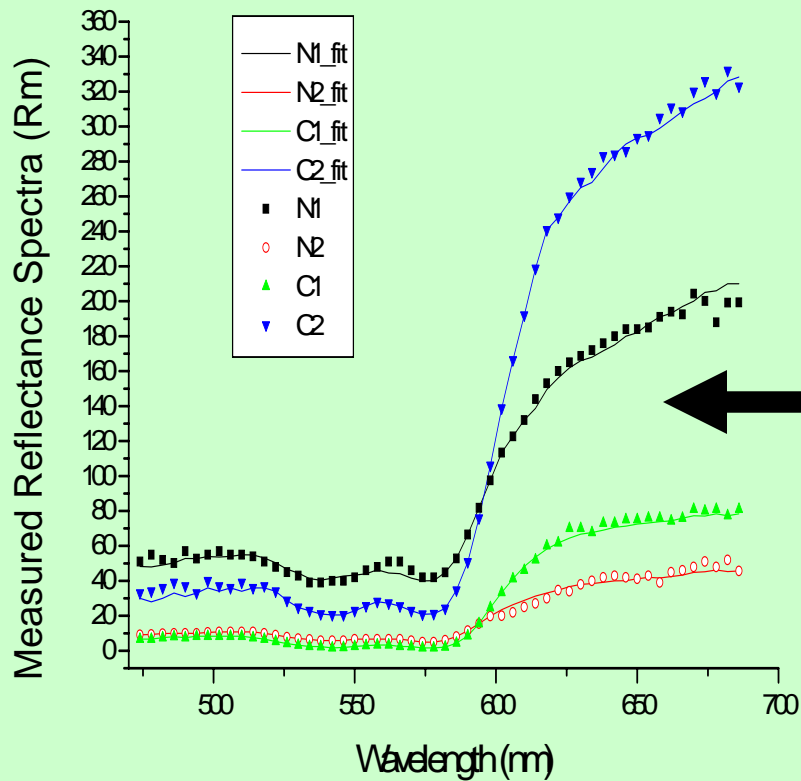
# II. Spectral Analysis

## Analytical Approach



# II. Spectral Analysis

## Model Fitting and Tissue Features

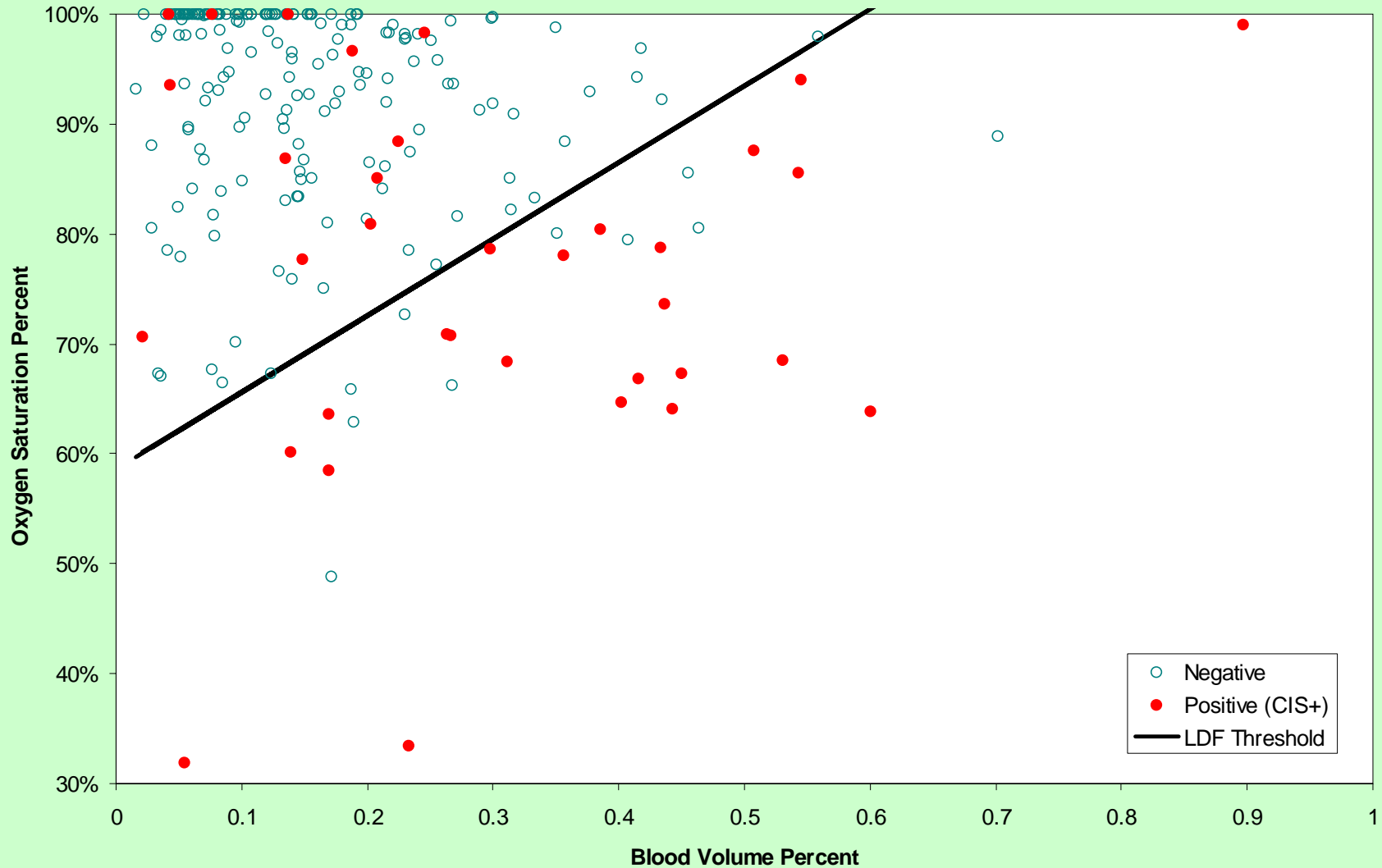


**Blood Volume Fraction**  
**Oxygen Saturation Parameter**  
Scattering Particles Volume Fractions  
Scattering Particles Average Size

# II. Spectral Analysis

## LDF analysis

Scatterplot of Model Output Values by Pathology



# Publications



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## Journals

- Zeng, H. et al. 2004 Optics Letters, 29(6) (2004) 587-589.
- Terceji, M. et al. 2005. Lung Cancer, 50 (1) (2005) 35-42.
- Fawzy et. al. 2006 J. Appl. Opt., Vol.16 No. 45
- Fawzy et. al. 2006 Journal of Biomedical Optics Vol. 11, No. 4

## Patent/Pending Patent

US Patent No. 6898458 (2005)

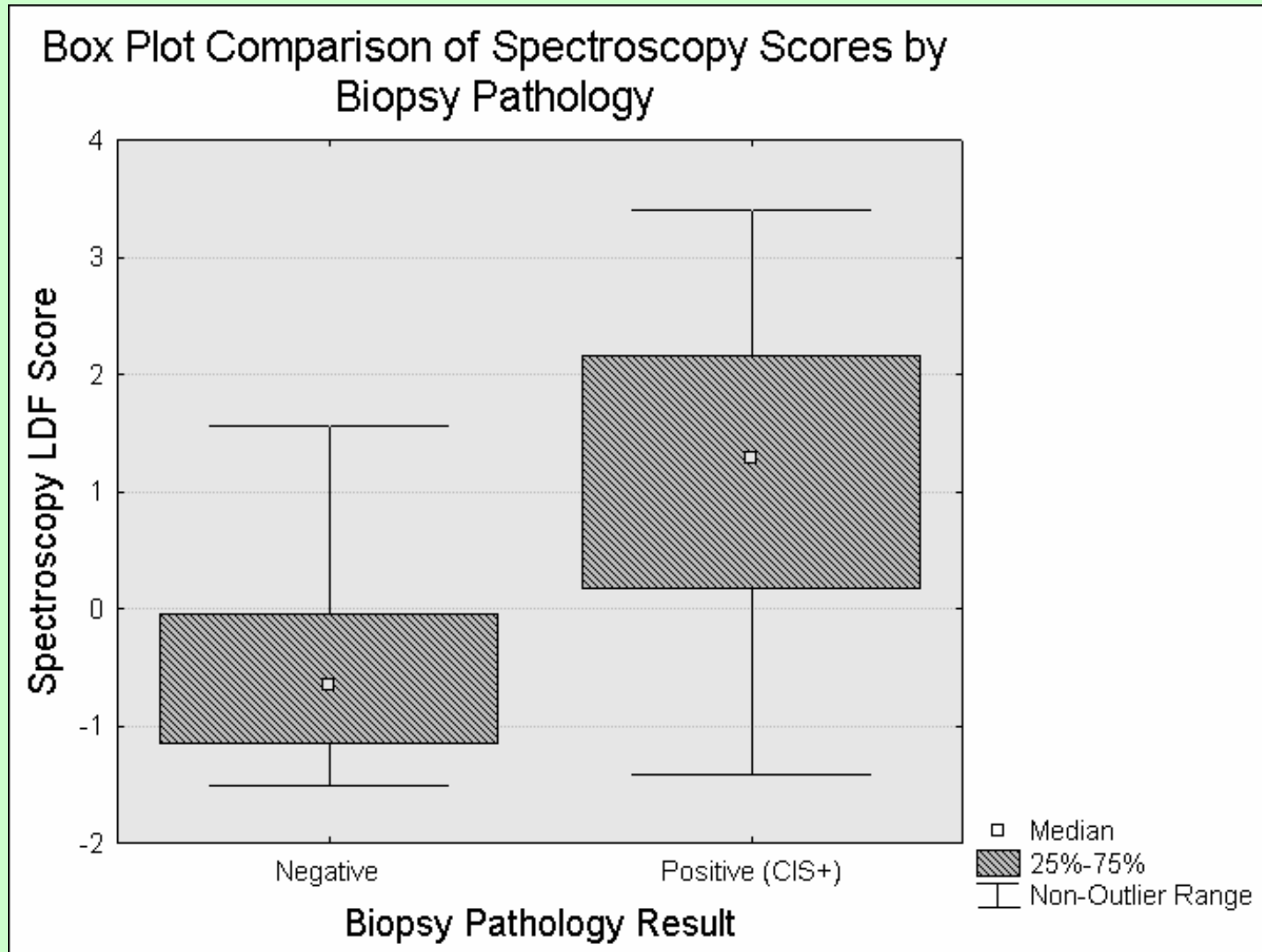
PCT/CA2006/000080 (2006)

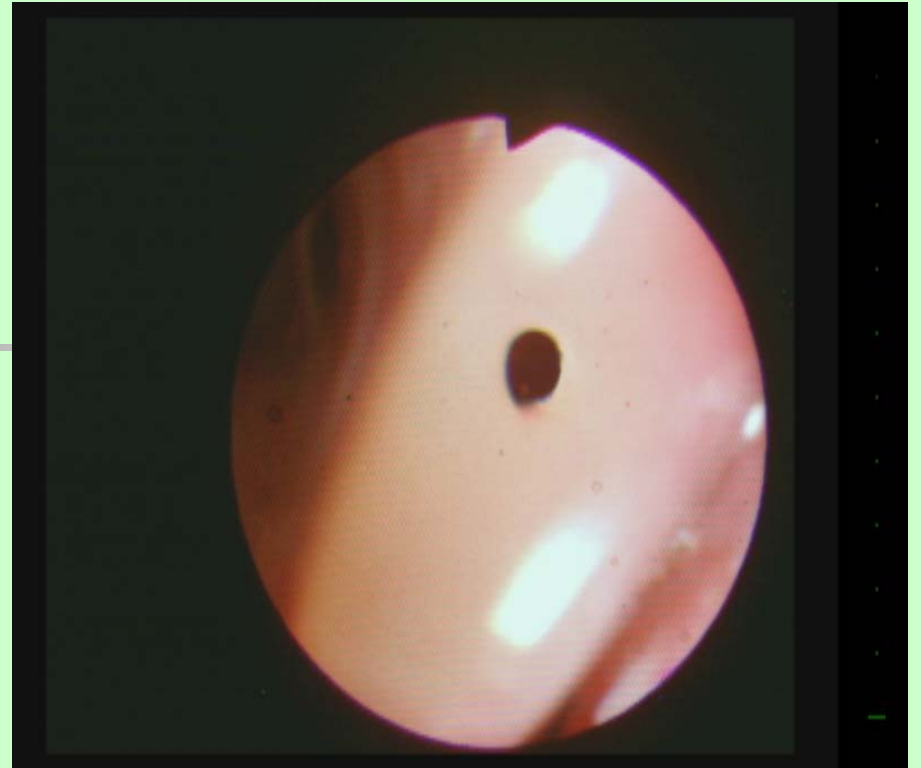
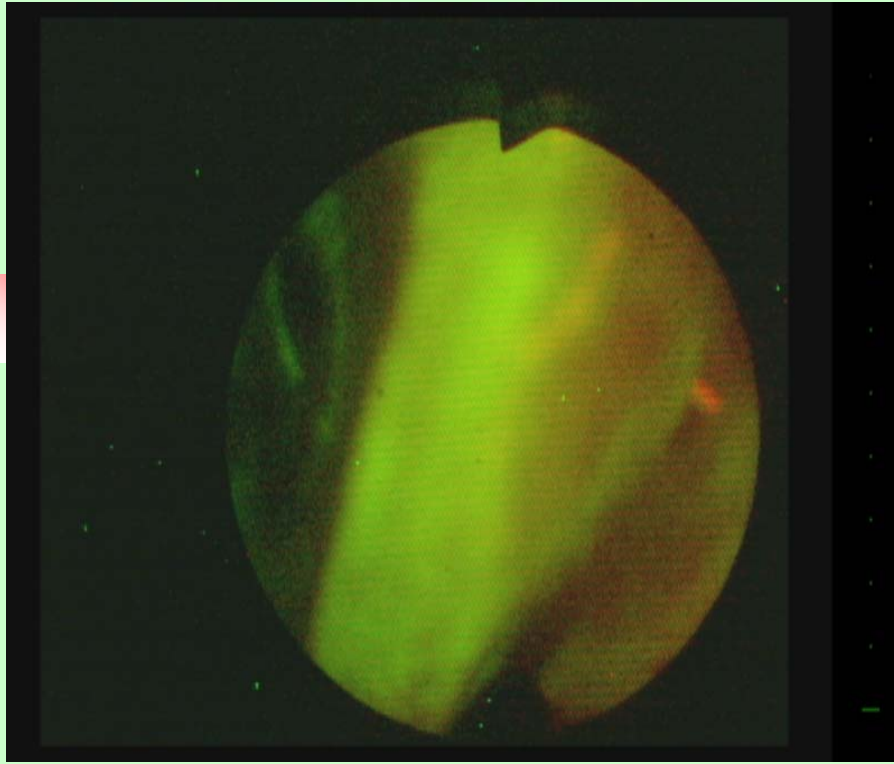
# *In vivo* Evaluation and Assessment *Clinical Study*

- 219 lesions from 135 subjects (437 spectra)
- Biopsy Data → Ljubljana Medical Hospital Clinical Centre, Slovenia  
BCCA, Vancouver, BC

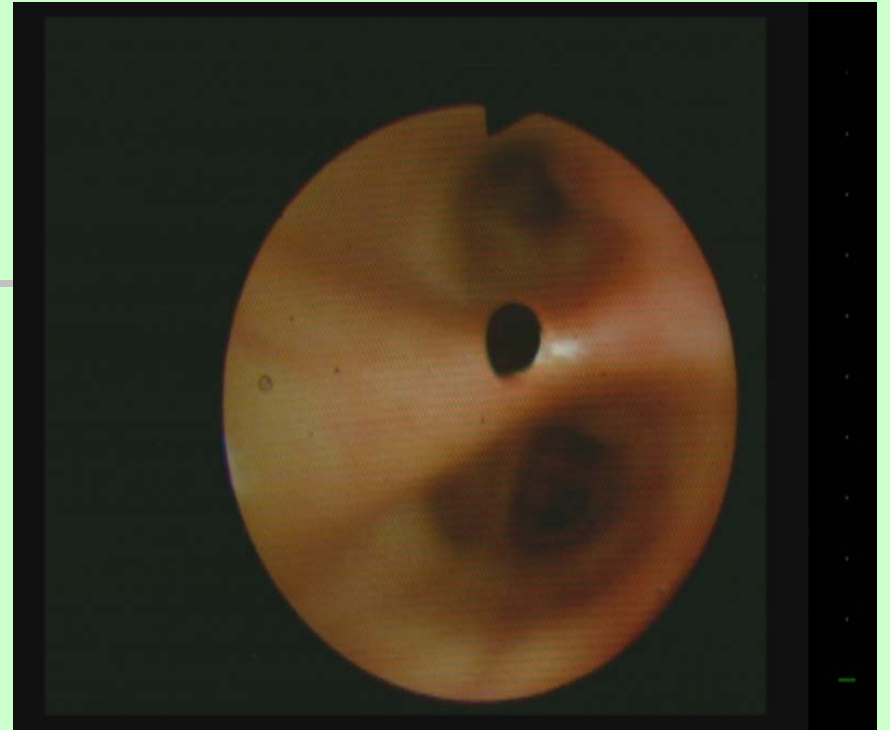
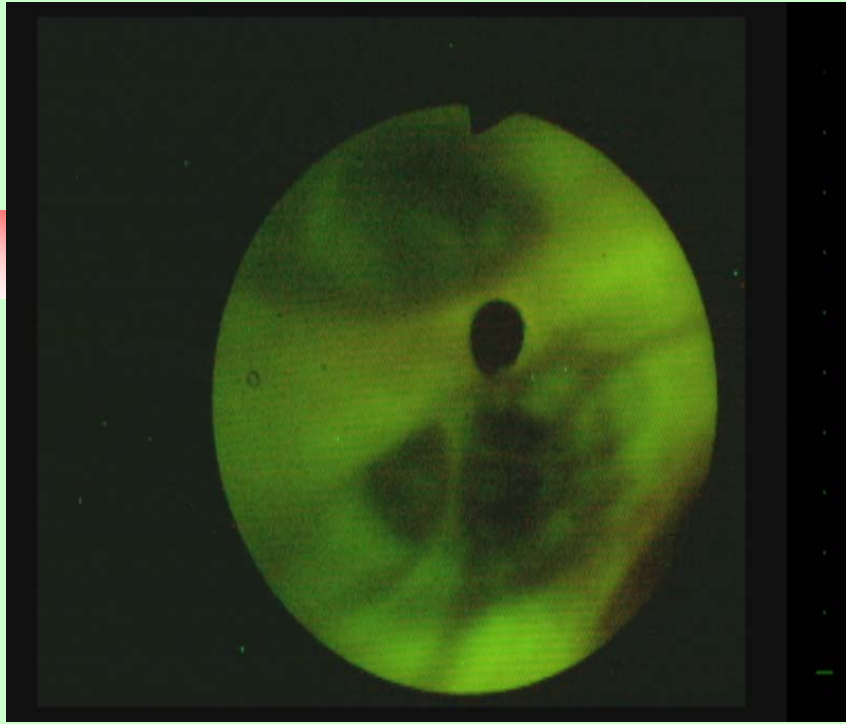
	Diagnosis	Lesions with Processed Diffuse Reflectance Spectra	Number of Processed Spectra
<b>Benign Lesions</b>	Metaplasia, Hyperplasia, and Normal	<b>155</b>	<b>310</b>
	Dysplasia MILD/MODERATE	<b>29</b>	<b>47</b>
<b>Malignant Lesions</b>	<b>CIS/ Cancer</b>	<b>35</b>	<b>80</b>
	<b>TOTAL</b>	<b>219</b>	<b>437</b>

# Score Distribution by Pathology





- **Visual: Suspicious**
- **Score: 0.37515 (positive)** (Blood : 0.1486284 O2Sat: 0.776806)
- **Pathology: small cell**



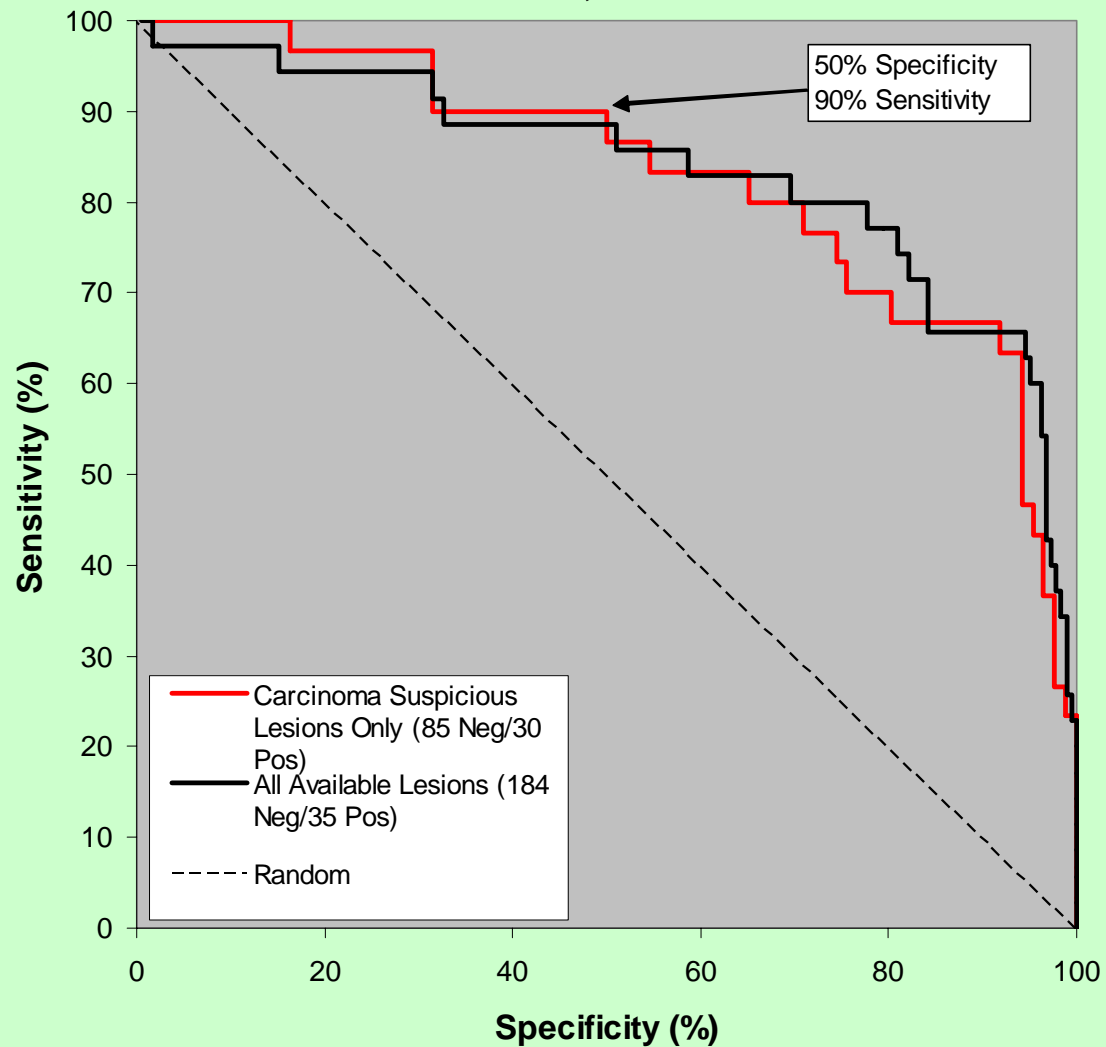
**Visual : Suspicious**

**Score: -1.328172292 (negative)** (Blood: 0.0643615 O2Sat: 0.98)

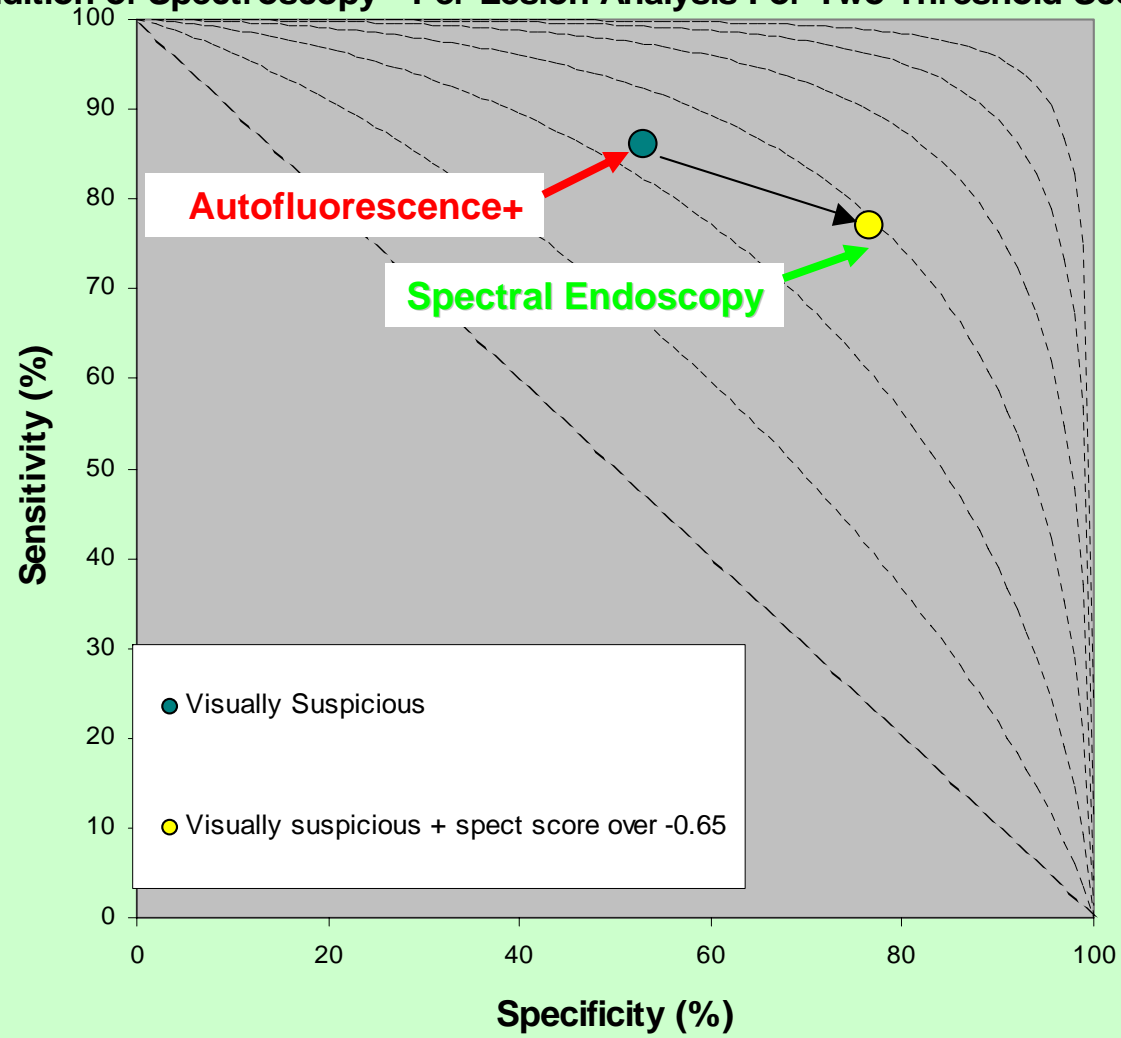
**Pathology: Dysplasia - Mild**

# Effect of Visual Diagnosis

## ROC Curve for Spectroscopy Score Performance, Per Lesion



### Effective Performance of White Light/Fluorescent Visual Classification With Addition of Spectroscopy - Per Lesion Analysis For Two Threshold Scores



# Diagnostic Table

	Negative Pathology (Excess Biopsies)	Positive Pathology (CIS/Cancer)
Total Lesions	<b>184</b>	<b>35</b>
Visually Suspicious	<b>86</b>	<b>30</b>
Visually Suspicious Plus Spectroscopy Positive (Threshold -0.62)	<b>43</b>	<b>27</b>



# CONCLUSIONS

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- We Developed Device and Method for Spectral Measurement and Analysis Integrated to Endoscopic Imaging
- The System is Undergoing International *In vivo* Clinical Investigational Study
- Initial Results Show that the System can Improve the Specificity to Lung Cancer Detection Without Significant Loss in the Detection Sensitivity.

**Perceptronix**  
*Early diagnosis, better outcomes™*



**THANK YOU**