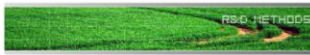




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COSM'O



TECHN'O

# Developments & validation of innovative techniques for the skin study *in vivo*...

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ORION Concept – COSM'O Lab., Tours, France



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COSM'O  
COSMETIC VALLEY  
FRANCE



TECHN'O



CONSULTING



R&D METHODS



TECHNIQUES

## Introduction

### **New techniques...why?**

- ✓ Interest of new technologies for the imaging of the skin
- ✓ New & mature Technologies – “Research and routine”
- ✓ Imaging “to perceive” & imaging “to understand”
- ✓ Steps of validation of techniques and related tools (contention systems and software)
- ✓ Tools for standardization and software for quantification



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## Interest of new technologies for the imaging of the skin

- **For the market :**
  - ✓ Needs of innovation in dermocosmetology to support innovation of products
  - ✓ Needs of « images » to support « science » and to « show »
- **For the science :**
  - ✓ More and more complex activity of the skin care product
  - ✓ Real biological activity



**Increase interest of new technologies**



## New and mature techniques Research vs Routine

- **New techniques for research :**
  - ✓ In a specific context
  - ✓ Involve in a specific environment
  - ✓ Need large competencies for development of techniques
- **Mature techniques for routine :**
  - ✓ Reliable, stable, accurate...
  - ✓ Validated
  - ✓ Related tools for quantification in stable conditions
  - ✓ For "intensive and reliable production of data"



**A gap between 2 fields of application  
To different use**





## Imaging « to perceive » Imaging « to understand »

### - To perceive:

- ✓ Quantitative digital photography
- ✓ Dermoscopy
- ✓ Realistic 3D acquisitions
- ✓ ...



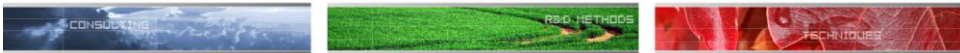
- Objective validation and measurement of the perception (in parallel of the clinical evaluation)
- Standardization & calibration

### - To understand

- ✓ Intra-cutaneous imaging
  - ✓ Ultrasound scanning
  - ✓ OCT
  - ✓ Confocal microscopy
  - ✓ Multiphotonic microscopy
  - ✓ RAMAN spectroscopy
  - ✓ ...



- To know the mechanism of the product action
- To prove the real activity
- To quantify the target of its activity (and not a consequence)



## Imaging « to perceive » Imaging « to understand »

### - To perceive:

- ✓ Quantitative digital photography
- ✓ Dermoscopy
- ✓ Realistic 3D acquisitions
- ✓ ...



- Objective validation and measurement of the perception (in parallel of the clinical evaluation)
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### - To understand

- ✓ Intra-cutaneous imaging
  - ✓ Ultrasound scanning
  - ✓ OCT
  - ✓ Confocal microscopy
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  - ✓ RAMAN spectroscopy
  - ✓ ...



- To know the mechanism of the product action
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## Steps for system validation

### - For the device :

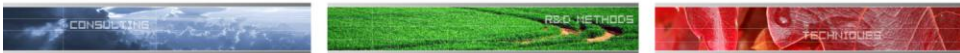
- ✓ Ergonomics of the system...
- ✓ Intrinsic variability of the device (repeatability)
- ✓ Extrinsic variability (reproducibility- environment –users...)
- ✓ Stable coupling between device and “object” or sample
- ✓ Sensitivity of technique
- ✓ Resolution (real resolution : capability to separate spatially 2 close structures or to distinguish a low evolution)
- ✓ Definition of the valid domain of use
- ✓ Definition of protocol for its using
- ✓ Pre-studies in real conditions

Scientific publications



Possible transfer in “routine” = critical step !!

- ✓ Monitoring, improvements...



## Steps for quantification validation

### - For the quantification :

- ✓ Non expert software !
- ✓ Ergonomic, easy to use = a guided process
- ✓ Dedicated quantification for one application
- ✓ Stability of the way to extract quantitative information contained into the image of signal
- ✓ Intrinsic Variability (stability of algorithm)
- ✓ Extrinsic variability (influence of users...)
- ✓ Compromise between modularity and stability
- ✓ Tests in real conditions (studies)

Scientific publications



Possible transfer in “routine”

- ✓ Monitoring, debug, improvements...





## New technologies transfer ...our job!



**Consultancy, Expertise, Training on New Techniques/Methods and Special Protocols**

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**Laboratory for the development, the validation and use of new methods and techniques for the study of the skin and the efficacy of skin care product (High technologies for imaging)**

- Collaborations and partnerships
- Validation of techniques & Methods
- Validation of products with increase value techniques
- Skin research



**Sales of « Packages » (Materials, softwares, Training&Support)**

- Materials for data acquisitions
- Validated softwares for quantifications
- Installations, Training and Support for users...



## Exemple 1 : Quantitative digital photography of the skin : easy?

### - Definition of needs:

- ✓ Color (Product or skin)
- ✓ Homogeneity (Skin complexion, make-up products, ageing....)
- ✓ Detection and quantification of different elements onto the skin (Pigmentary spots, telangiectasies, wrinkles and their density, acne lesions, hairs ...)
- ✓ Measurements of lashes (Real and apparent length, width, volume and curvature)
- ✓ Visibility of wrinkles (On pseudo photographs)
- ✓ Etc...

### On parametric reconstructed images (Spectroscopic images)

- ✓ Selective quantifications on only one component of the skin (Vascularisation or pigmentation)



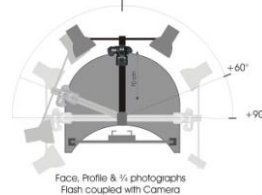




## System for the coupling

**Tool to control the ACQUISITION**

### HeadScan® V02



- ✓ Perfect repositionning of the subject
- ✓ Real 180° angles for acquisitions
- ✓ Coupling of : light/captor\*/subject
- ✓ Stability of the acquisition parameters
- ✓ Calibration
- ✓ Modular

\*Captor : Camera, video camera for dynamic acquisitions, Fringe projection captor...



## Software for the controlled quantifications

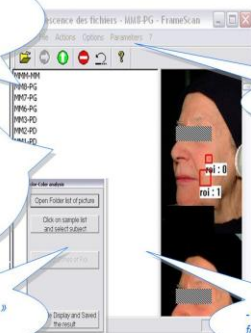
**Tool for ANALYSIS**

### FrameScan® V03.2

- Files Coding (Subject, Site, Time...)
- Tracability
- Protection of raw data
- Kinetics analysis

- Creation and storage of images for analysis (R, G, B channels, grey level, brightness...)
- Multi-formats : TIFF, BMP, JPEG
- Management of images modalities crossed and parallel polarized light acquisitions...

- Processing « Step by Step »
- User guide



- All Parameter setting adjustable & protected by password

- Color Calibration
- Calculation of color variations
- Correction of small shifts

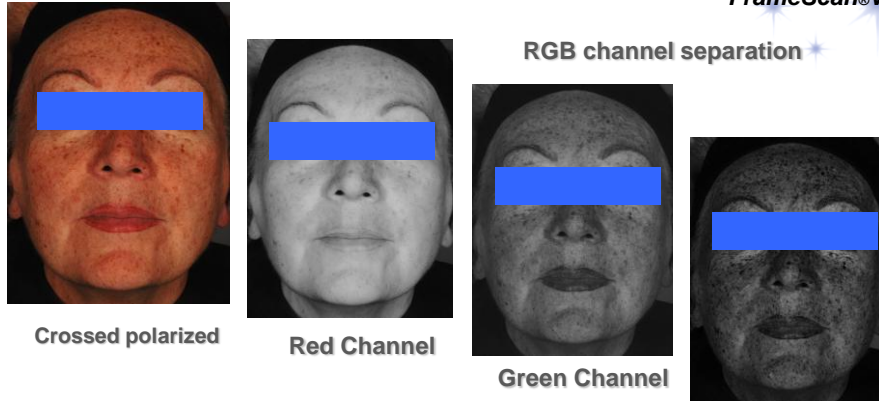
- Compilation and recording (file txt) to all individual results (Excel)





## Software for the controlled quantifications

FrameScan®V03



RGB channel separation

Crossed polarized

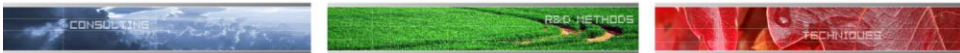
Red Channel

Green Channel

Blue Channel

Red : High homogeneity of the skin  
– Useful for lashes and hair evaluations

Bleu : High contrast for pigmentary and vascular elements onto the skin



## Software for the controlled quantifications

FrameScan®V03

Reconstructed parametric images



Acquired Image  
(Crossed polarized image)

Pigmentation

Vascularisation

Contrast

Separation of different components of the skin

QUANTIFICATIONS :

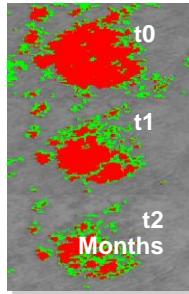
- Intensity, size, homogeneity, distribution, density (Acne, telangiectasies, complexion, pigmentation, spots ...)
- Multi-area measurements (Local & Global cartography)
- “Contrast of the face” – Perception of the relief and ptosis (Cutaneous slackening)





## Software for the controlled quantifications

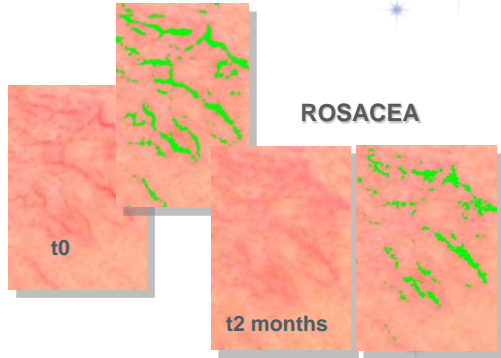
FrameScan®V03



PIGMENTARY SPOTS

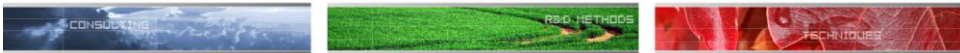
- Color (L\*a\*b\*) versus skin
- Morphology (surface, perimeter, edge regularity, contrast, visibility...)
- Homogeneity

Exemples



ROSACEA

- Number, surface, length
- Color

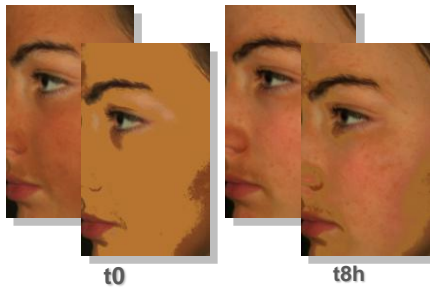


## Software for the controlled quantifications

FrameScan®V03



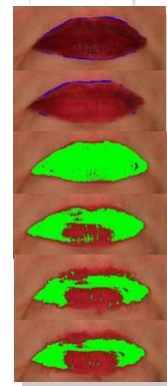
Exemples



t0

t8h

- Follow-up of the make-up behavior in time (selective sorting of pixels : « product pixels/skin pixels”)
- Foundation cream, eye liner, mascara, lipstick, ...







## Software for the controlled quantifications

FrameScan®V03



Acquired image (crossed polarized)



Red channel

### Exemples



Perceived Length Without product



Real length Without product

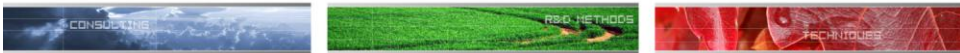


Real length WITH product

QUANTIFICATIONS : With "active contours"

- Real & Apparent Length, width (Validated correlation with the clinical evaluation)
- Number, crossings (parallelism of lashes), aggregates (resolution <math><8\mu\text{m}</math>)

And a lot of other functions...



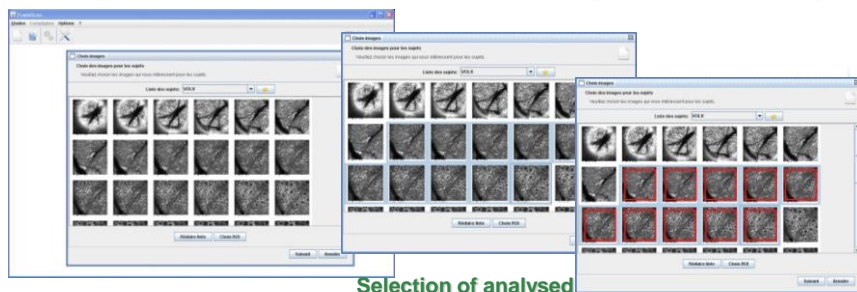
## Exemple 2 : Quantification of Confocal Laser Microscopy

ConfoScan® V01.1.0

*A mature technique and system for routine*

*A necessary extraction of quantitative information from the images*

*A large amount of data for analysis requiring a specific management*



Management of data and sample

Selection of analysed images (in stacks or blocks)

Multi-Selection ROIs for targeted analysis





## Exemple 2 : Quantification of Confocal Laser Microscopy

ConfoScan® V01.1.0

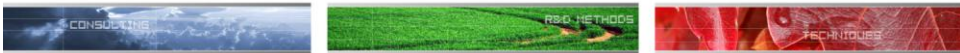


### Launch of a process for the analysis

- ✓ Pigmentation : Papillar dermis
- ✓ Ageing : Papillar and reticular dermis
- ✓ Z reconstruction for measurements of the different layer thickness
- ✓ Etc...

### Compilation of results

- ✓ Ficher Excel, Texte, PDF

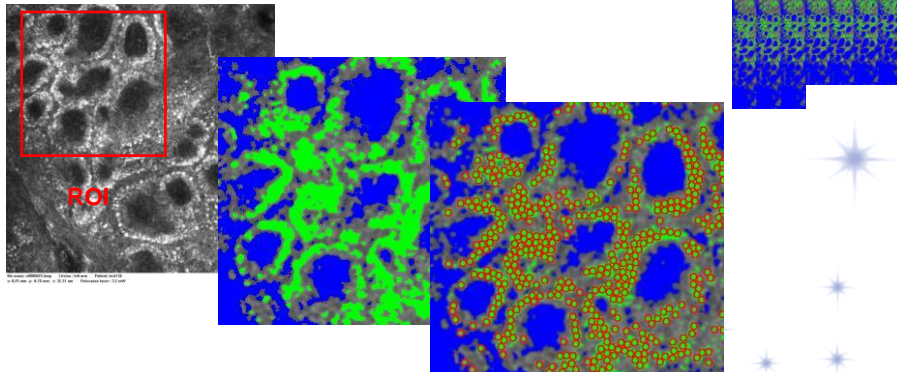


## Exemple 2 : Quantification of Confocal Laser Microscopy

ConfoScan® V01.1.0

### Pigmentation

- ✓ Number and melanin density on basal cells





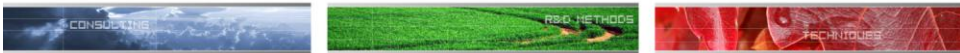
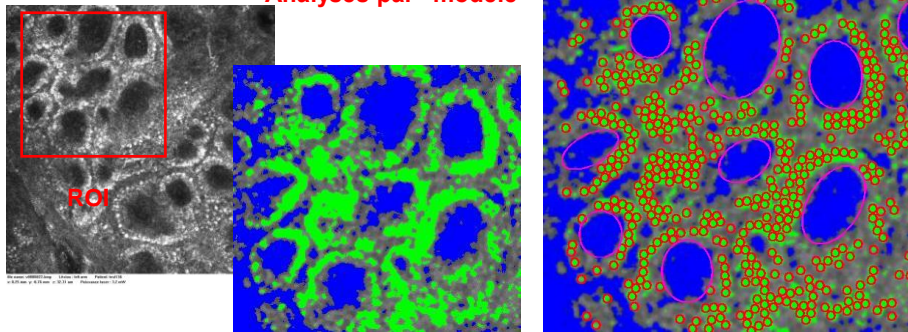
# Microscopie Confocale **IN VIVO**

**ConfoScan® V01**

**Analyse du vieillissement - Papilles**

✓ *Nombre, densité, orientation et critère forme des papilles*

Analyses par "modèle"



# Exemple 2 : Quantification de Confocal Laser Microscopy

**ConfoScan® V01.1.0**

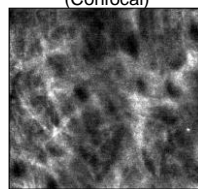
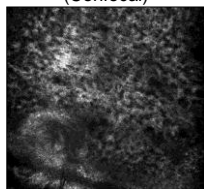
**Ageing- Superficial reticular dermis**

✓ *Texture and density: fragmentation*

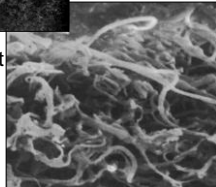
Photodamaged Elastin (Confocal)

Normal Skin (Confocal)

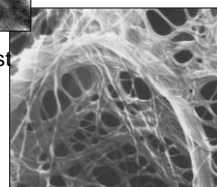
**Elastosis**  
**Photo-ageing**



75 year old panelist  
In-vivo confocal



41 year old panelist  
In-vivo confocal

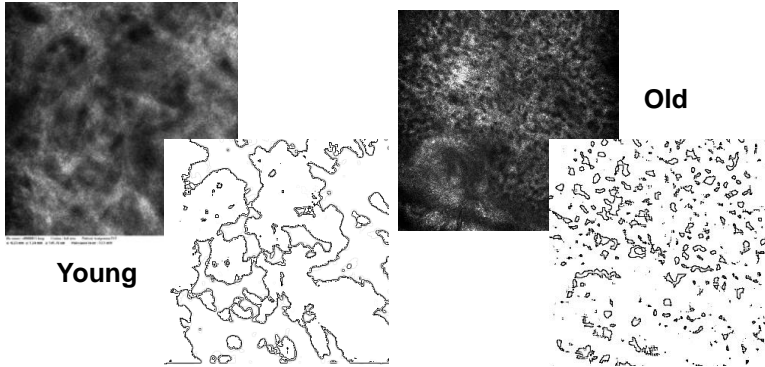




## Exemple 2 : Quantification of Confocal Laser Microscopy

ConfoScan® V01.1.0

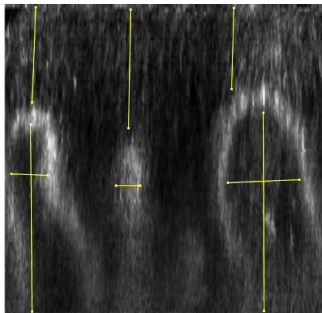
**Ageing- Superficial reticular dermis**  
 ✓ *Texture and density: fragmentation*



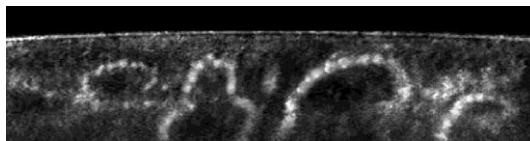
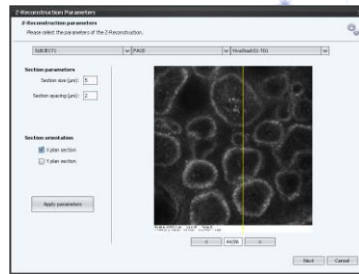
## Exemple 2 : Quantification of Confocal Laser Microscopy

ConfoScan® V01.1.0

**Z reconstructions – Height of papilla, thickness of Stratum Corneum...**



Z Magnified image



Z real size image : papilla







***New technologies are more complex?... Yes!  
 More accurate? ... Yes, if you know what you search!  
 Reliable?... Yes, in their domain of validity!  
 Innovation and validation ; a contradiction?... No!***

***If it's new...it's not well known...but it will be!***



**Together**

***Thank you for your attention***



***To think differently ...***

