

## Fringe projection techniques

**Programme:**

- Ageing signs analysis
- Aeva-HE
- Visio-4D
- Futures developments
- Questions

**What's new?**

- Ageing signs analysis
- Aeva-HE
- Visio-4D
- Futures developments
- Questions

ORION Concept

IEC GROUP  
INSTITUTE OF EXPERTISE CLINIQUE

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## Ageing signs Evaluation

**Volunteers and study**

The idea was to develop an objective method using 3D technology to quote ageing sign on the face. For that we have measure more than 250 volunteers from 25 to 70 years old.

- 250 voluntaries has been measure
- 9 classes of age (every 5 years) with minimum 20 per class
- volunteers were Caucasian type, phototype I to V, all skin type
- Inclusion Criteria: BMI between 19 et 27
- Exclusion criteria: see IEC France protocol

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## Ageing signs Evaluation

**System setup and configuration**

We have used for this study the best configuration available:

- FaceSCAN-III-EO includes 2 fringe projection sensor mounted at 30° apart from the face with some tilt to get the bottom part of the face.
- Visio-3D positioning bench for having the model face always in the same space reference from the sensor position.
- FaceSCAN – V2 software for acquiring and processing 3D data

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## Ageing signs Evaluation

**Reference method**

We have compared our data to a visual scoring using the Atlas from Roland Bazin et Eric Doublet. The lateral resolution of the FaceSCAN system being limited we restricted the comparison to the following regions:

- Glabella or lion wrinkles,
- Nasogenian fold,
- Lips corner wrinkle
- Sagging.

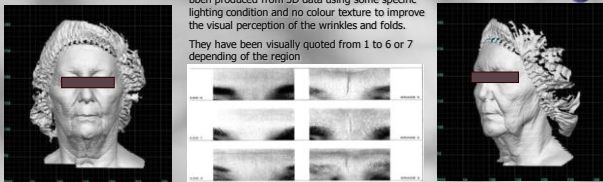
We also have used our oval analysis to compare with sagging effect!

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### Ageing signs Evaluation

Reference method

For each volunteers, we have provided 2 images from the front and half side. These images has been produced from 3D data using some specific lighting condition and no colour texture to improve the visual perception of the wrinkles and folds. They have been visually quoted from 1 to 6 or 7 depending of the region



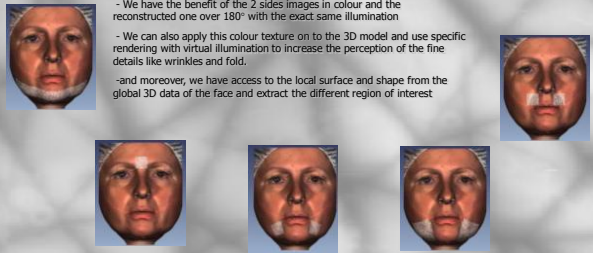
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### Ageing signs Evaluation

3D method

Using 3D data offers more potential than 2D images.

- We have the benefit of the 2 sides images in colour and the reconstructed one over 180° with the exact same illumination
- We can also apply this colour texture on to the 3D model and use specific rendering with virtual illumination to increase the perception of the fine details like wrinkles and fold.
- and moreover, we have access to the local surface and shape from the global 3D data of the face and extract the different region of interest



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### Ageing signs Evaluation

3D ageing sign analysis

To analyse ageing signs, local area in the region of interest has to be analysed. We have develop a method to extract automatically these areas as describe below:

- First we precisely center the model onto our 3D reference using 3 remarkable points ( eyes and lips corner).
- Automatic extraction for the user predefined areas using gold numbers:

- Glabella: 20 x 20 mm<sup>2</sup>
- Nasogenian fold: 15 x 20 mm<sup>2</sup>
- lips corner wrinkle: 20 x 20 mm<sup>2</sup>
- sagging: 40 x 40 mm<sup>2</sup>
- Ovale 120 x 20 mm<sup>2</sup>

Each area produce a single surface in SDF format to be analysed further in amplitude



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### Ageing signs Evaluation

3D ageing sign analysis

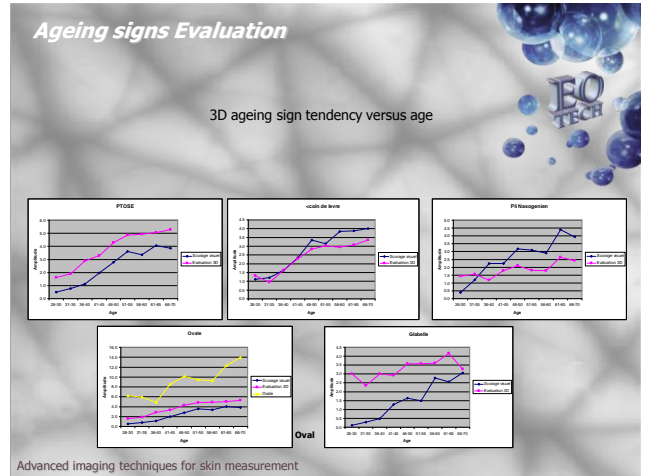
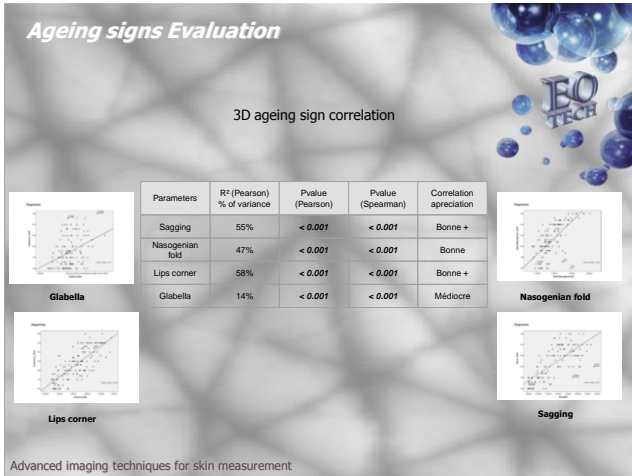
Local areas have some shape which are unique for each individual. Before measuring the amplitude these shapes has to be removed.

We use a specific filter ( call morphing filter) to remove the local shape and produce an area which can be analysed

You can see for each region the non corrected shape surface and the corrected one



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### Ageing signs Evaluation

3D ageing sign evaluation by 3D method

**Advantages:**

- Good correlation between visual score and 3D analysis
- Provide objective and quantitative evaluation
- Fast and non invasive
- Can be coupled with 2D imaging and provide more sensitive images for visual evaluation

**Limitations:**

- the set-up cannot be transported easily
- Lateral resolution too poor to analyse to crowfeet, forehead, and peri-oral regions

**Future possibilities:**

- Extension to all wrinkles areas
- Global analysis of the face as complementary to local regions

***This help me to switch to the next subject...***

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### Ageing Evaluation

Today State of the art

**What do we have today?**

- DermaTOP** for local measurement with measuring field form 25 to 100 diagonal, and from 0.017 to 0.057 mm lateral resolution, 2 to 5 µm vertical resolution
- FaceSCAN-III-EO**, for global measurement with a field of view of 400 mm diagonal, 0.3 lateral resolution, 0.1 vertical

-Both are using fringes projection and optical triangulation, with 1.4 Mpixel cameras black and white or colour

*And what do you need for the future...*

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### Ageing Evaluation

**Actual limitations**

**DermaTOP:** Even if the dermaTOP fulfil the needs for high resolution demands, there is impossible to switch between FOV's for the same volunteer.

**FaceSCAN:** It offers global evaluation with 2 synchronized sensors but its lateral resolution is limited ( 0.3) and cannot resolve cross feet wrinkles and fine lines

There is a gap in between these 2 sensors which can be filled, this is why we have launch the **AEVA project!**

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### Ageing Evaluation

**Why a new sensor?**

**5.0 MPix CCD**

**64 bit OPTICAL 2008**

Last development in Breuckmann company bring some new state of the art for higher demands!

**New technology!** Combination of Fringe projection and stereometry provide more accuracy, better resolution, self calibration and insensitive to small movements

**Ultra high resolution** with 2 x 5 Mega pixels cameras using firewire2 connections fully synchronized

**High performances** with temperature regulated projector, high stability main frame and colour camera for texture, 64 bit OS supported

**New design** as high technology signature

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### Ageing Evaluation

**Performances**

The AEVA-HE has been designed to be the must in Skin Aging Evaluation

- 3 FOV's, 2 standard, 1 optional
- 2.5 MP cameras, 1 B&W, 1 colour
- New 64 bit software with latest development

System	FOV WxHxD mm3	XY resolution	Z resolution	Acquisition time	target
Aeva- HE250	200x150x60	80 µm	2 µm	< 1 second	Face
Aeva- HE450	360x270x225	35 µm	4 µm	< 1 second	Part of Body
Aeva- HE150 (Optional)	120x90x75	60 µm	8 µm	< 1 second	Local

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### Ageing Evaluation

**Aeva-HE measurement**

The high resolution measurement made by the Aeva-HE 250 system provides high resolution texture and 3D data which are comparable to dermaTOP measurement.

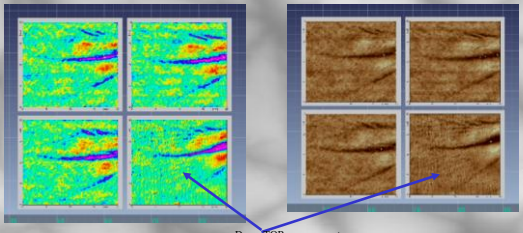
Our aging zones extraction can prove this!

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### Ageing Evaluation

**Comparison with dermaTOP systems**

How Aeva compare to the dermaTOP



DermaTOP measurement


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### Ageing Evaluation

**Comparison with FaceSCAN system**

AEVA-HE 450 provides twice lateral resolution than the faceSCAN system.

- Enough to resolve main wrinkles and folds
- More accurate data due to stereometric set up




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### Ageing Evaluation

**Conclusions**

**The Aeva\_HE system is the best alternative to evaluate ageing signs on the face**

- Can evaluate all areas of interest in **one acquisition** including wrinkles on crossfeet, forehead, under eye, and peri-oral areas, eye bags, glabella, nasogenian and lips corner fold, sagging and oval
- Can evaluate ageing signs using our latest software development
- Provide more accurate data and less sensitive to movement
- Incorporate high res colour texture for further 2D image analysis



Résolution

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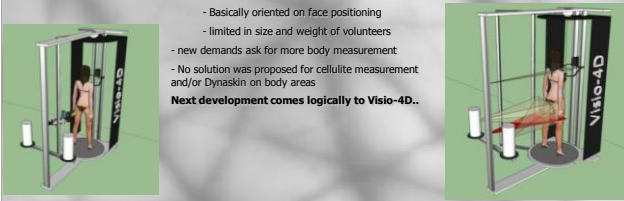
### Ageing Evaluation

**Visio-4D**

**New sensor...new bench... why not!**

- Visio-3D have some limitations:
  - Basically oriented on face positioning
  - limited in size and weight of volunteers
- new demands ask for more body measurement
- No solution was proposed for cellulite measurement and/or Dynaskin on body areas

**Next development comes logically to Visio-4D..**



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## Ageing Evaluation

### Visio-4D performances

#### What is new?

- Free open access to the platform
- Platform move up and down to adapt to volunteers size
- fix seat for face measurement
- Fix foot print for standing body measurement
- Rotation of the model over 360° by stepper motor control
- DermaTOP or Aeva sensor mounted on rotation arm over 270°
- faceSCAN and alignment laser on fix arm
- Self alignment mirror for panelist
- Universal set-up for face and body measurement



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## Ageing Evaluation

### Visio-4D benefits

#### Advantages

- All in one
- easy to operate
- More automatism available
- same price than the visio3D with electrical driven chair
- Can receive volunteers up to 2 m and 120 Kg



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## Ageing Evaluation

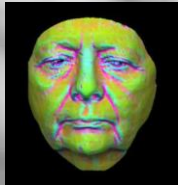
### Future developments

#### Applications:

- Global face ageing evaluation using curvature or amplitudes of wrinkles and fold
- Cellulite using combination of Dynaskin and FaceSCAN with Visio-4D

#### Systems:

Aeva tableTOP system for ageing evaluation of face...



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## Ageing Evaluation

# Thank you!

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