MORPHO 3D

A new device to register and analyze 3D shapes of animals

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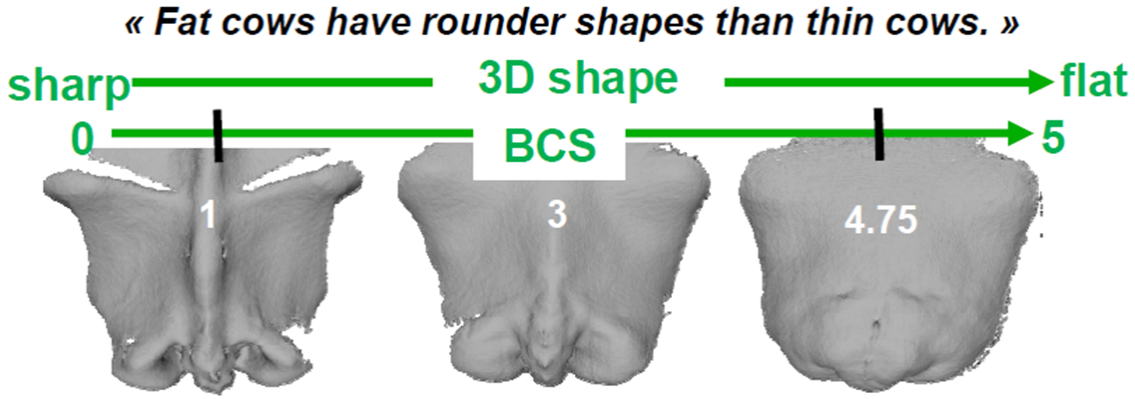
Presented by L. Journaux

Background

- *Fischer A. et al. 2015. Rear shape in 3 dimensions summarized by principal component analysis is a good predictor of body condition score in Holstein dairy cows. Journal of dairy science, 98(7), 4465-4476.*



- → New idea: is it possible to get a 3D image of the whole animal to assess new parameters like volume, surface and other morphological traits ?

Morpho 3D Project

- Objective: build a device able to scan the whole animal

- Hypothesis: 3D imaging allow
  - A fine, precise, non-subjective analysis of body condition and animal morphology, at high speed, while working safely
  - Identify and use new morphological traits: surface, volume

- Partners: 3D Ouest (SME), Idele, INRA, AgroCampus Ouest

The Morpho 3D scanner

5 recording systems

Laser (λ = 650 nm)

Camera

0.5 m.s^{-1}

MORPHO 3D

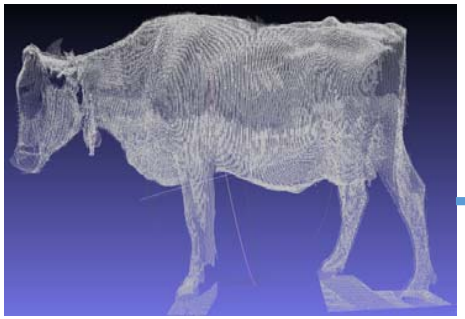
3D OUEST

INSTITUT DE L'ELEVAGE idele

INRA SCIENCE & IMPACT

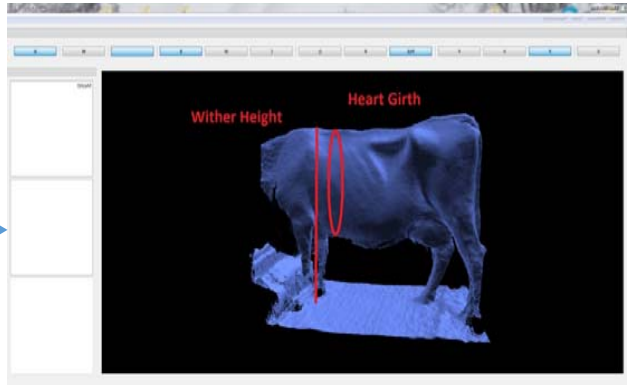
AGRO CAMPUS

Image processing



3D raw cloud

Smoothing and shape reconstruction on Meshlab®

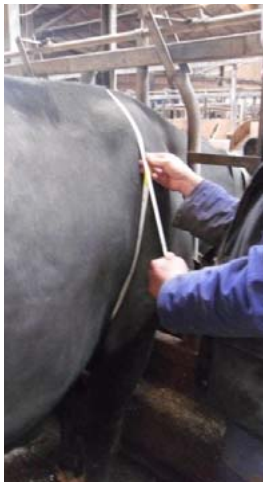


Measures on Metrux2α®

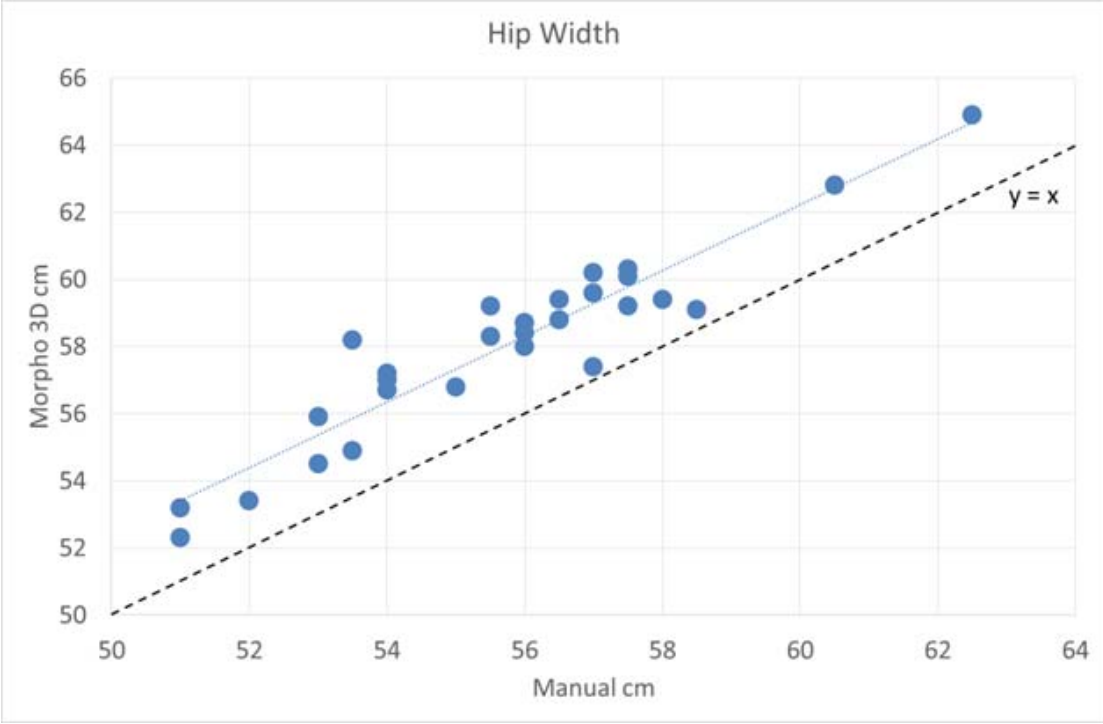
- Linear measures
- Circumferences
- Surfaces
- Volumes

Evaluation of the system performance

- Comparison of the scanner with manual measurements for withers height (WHG), hip width (HW), hearth girth (HG)
- Accuracy: 30 cows measured 1 time with each method
- Reproducibility: 6 different cows scanned and measured 4 times with each method
- Repeatability: 1 model plastic cow measured 6 times by 2 different operators with each method



Results



- High correlations between Manual and Morpho3D values (0.94 for hips width, 0,89 for chest depth, 0.78 for hearth girth, 0.62 for withers height)
- Slight and constant over estimation of Morpho3D measurements (around 3%)

Results:

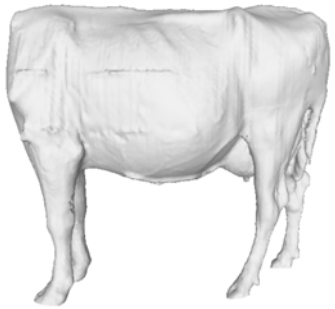
		Repeatability			Reproductibility		
		μ_r (cm)	σ_r	CV_r (%)	μ_R (cm)	σ_R	CV_R (%)
HG Hearth Girth	Manual	194.2	0.21	0.11	204.2	0.86	0.42
	Morpho3D	195.8	1.89	0.97	221.1	5.87	2.63
WHG Withers Height	Manual	129.1	1.04	0.80	148.9	1.07	0.72
	Morpho3D	131.1	0.34	0.26	148.6	2.12	1.42
HW Hips Width	Manual	39.8	0.35	0.88	55.5	1.01	1.82
	Morpho3D	39.9	0.67	1.68	58.1	0.55	0.94

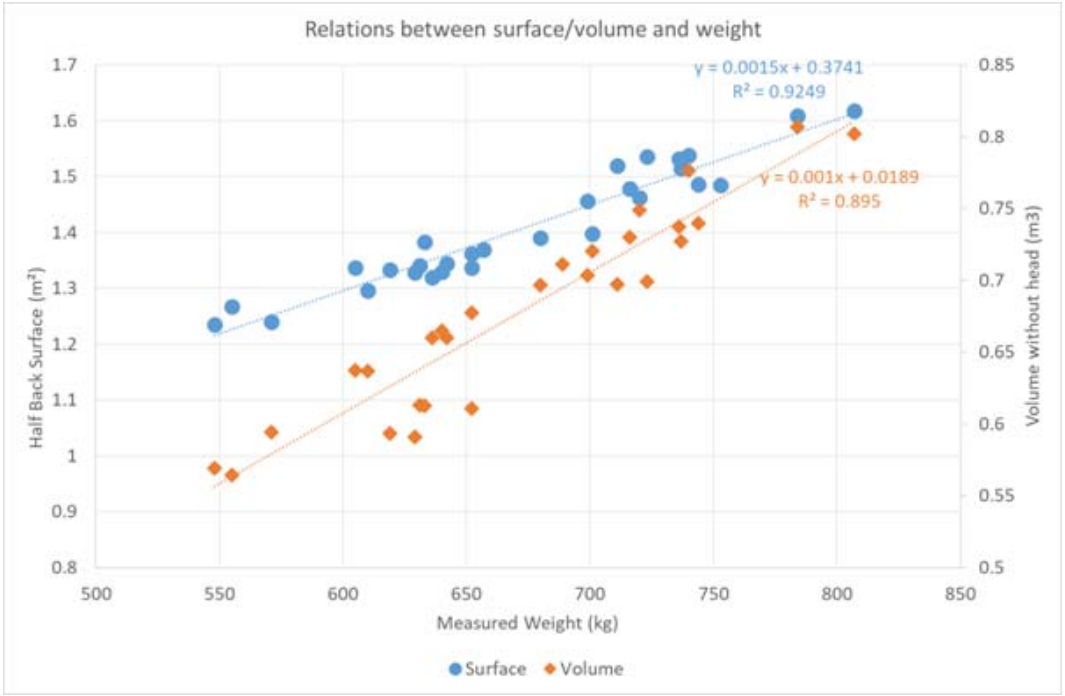
- **CVr & CVR values < 3 %: repeatability and reproductibility are (very) good**
- **Reliable technology for R&D uses**

First data on surface and volume

Half back surface

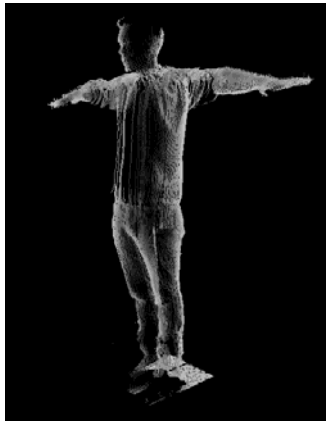
Body volume (without head)





What's next ?

- **Automated morphological scoring**
- **Volume: ingestion capacity, muscle volumes, pregnancy diagnosis,…**
- **Surface : weight estimation, energy expenditure,…**
- **Other species:**



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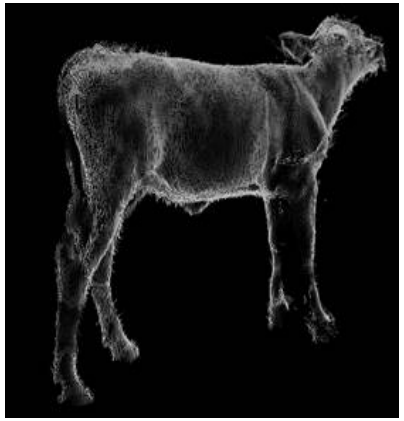
Goats



Calves

Thanks !