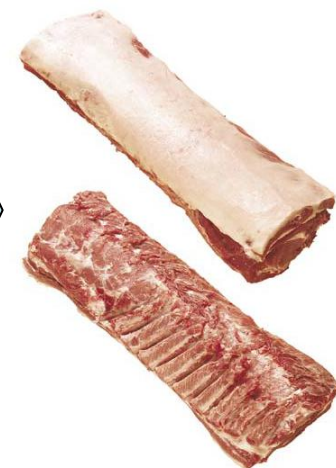
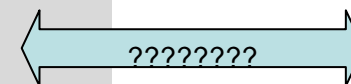
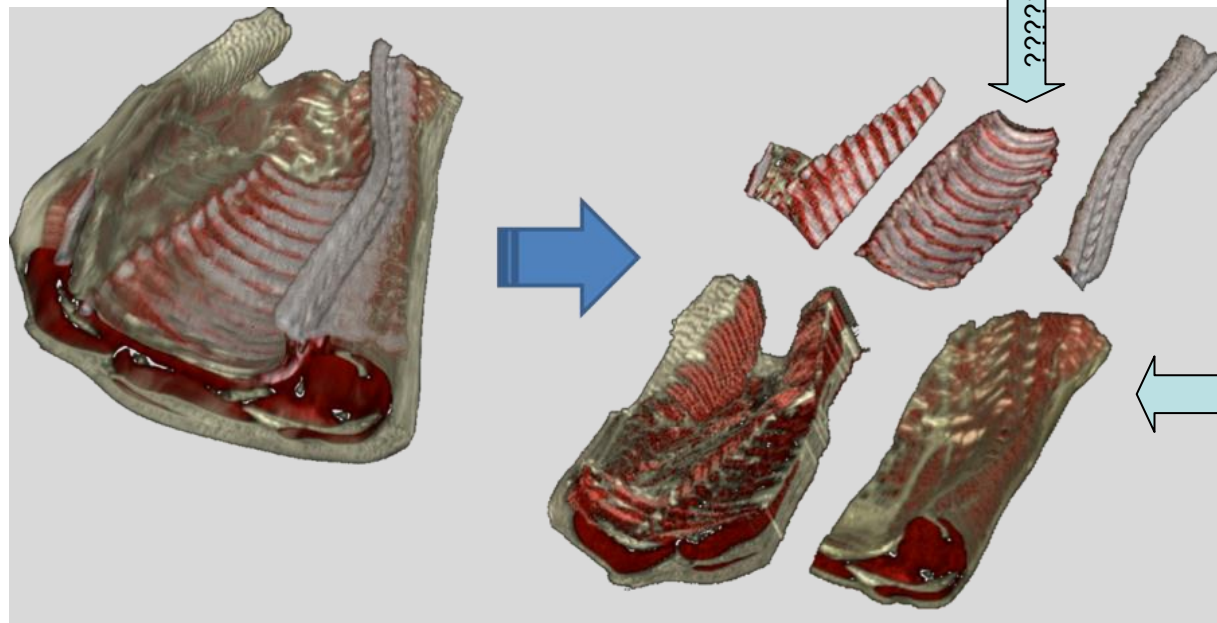
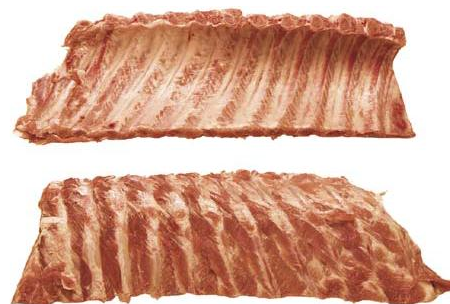
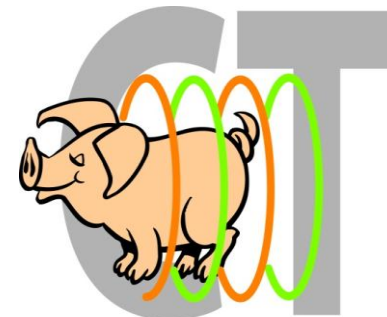


Accuracy in Biology

Application of
CT Scanning in (Meat) Industry

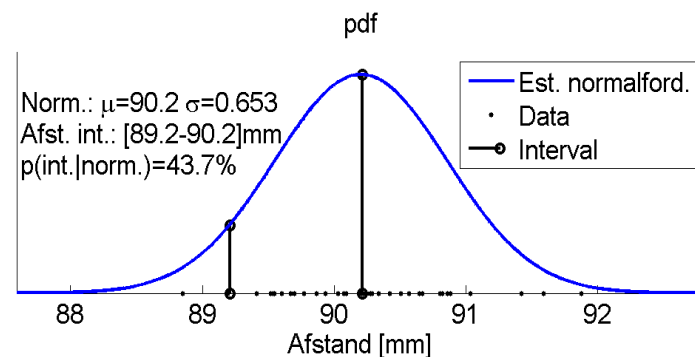
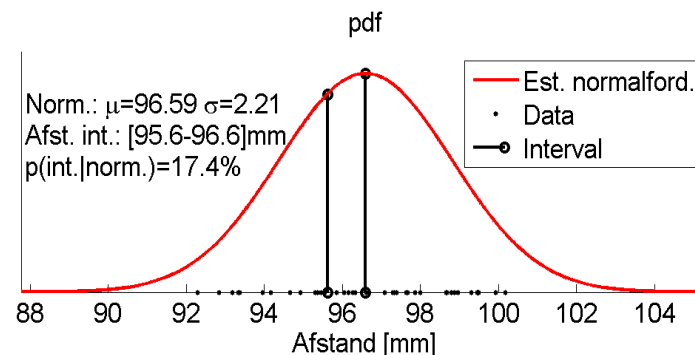
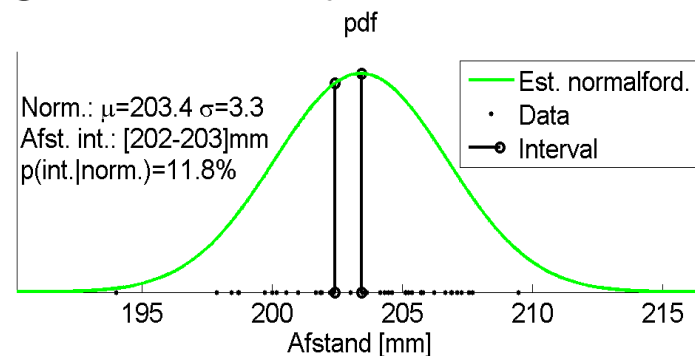
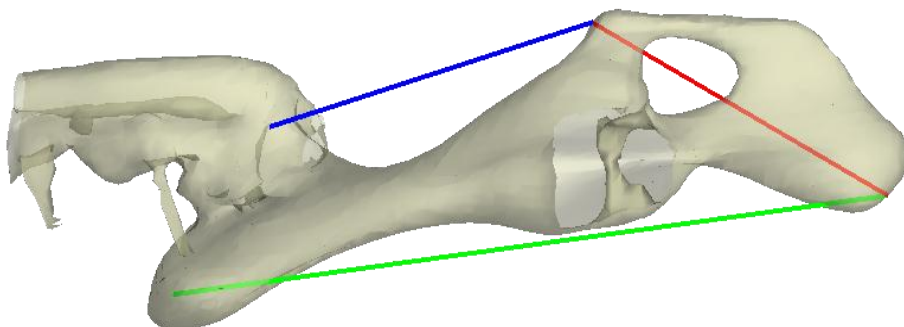


Motivation

- statistics of rigid anatomy

Quantify anatomic variation

- Geometric reference
- Rigid structure
- Design tool



Motivation

- statistics of yield



$$\text{Yield} = \frac{\text{Final product [kg]}}{\text{Raw material [kg]}}$$

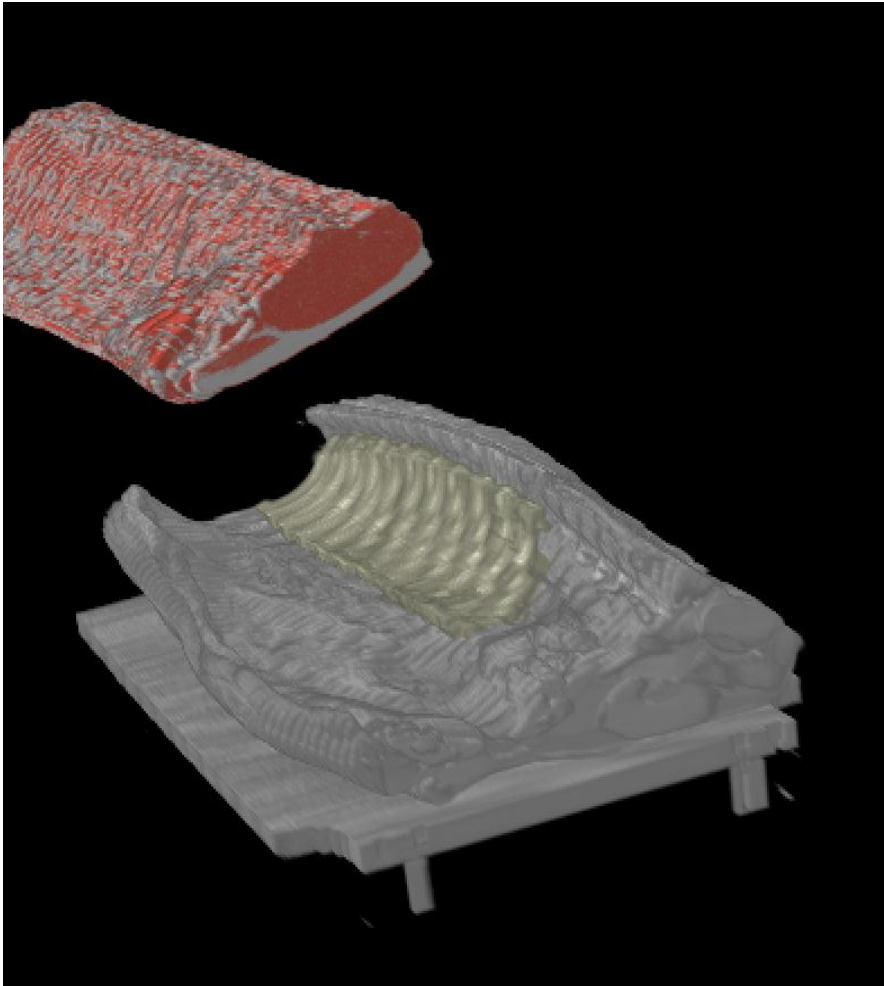
Use the right raw material
for a specific final product

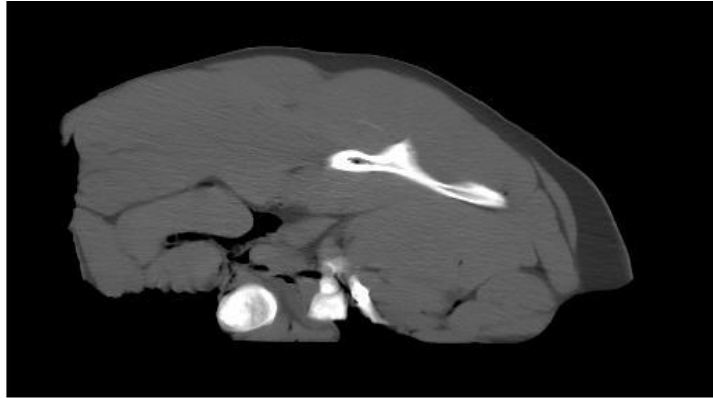
Challenge:

- Elastic structure

Benefits:

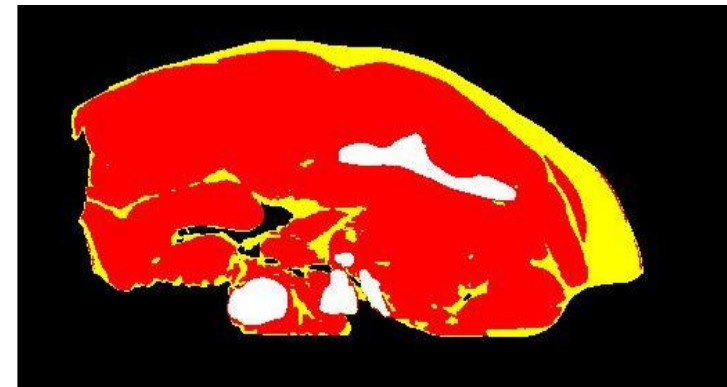
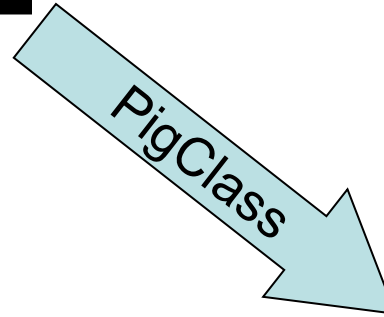
- Product planning
- Cost estimation
- Controlling machines





$$W_{\text{total}} = V_{\text{fat}} \cdot \beta_{\text{fat}} + V_{\text{meat}} \cdot \beta_{\text{meat}} + V_{\text{bone}} \cdot \beta_{\text{bone}}$$

- Based on weight measurement
- Objective & reproducible
- Warm or chilled carcass



Primal cutting

OPUS+ Cutting

Menu
Dataset Upload Cutting
Logged in as lbc
Log out

Cutting Yield
Current Dataset: Grp 1

Primal	Average	Std.
Leg	0.3181905	0.0093580
Middle	0.3858009	0.0150542
Fore-end	0.2960086	0.0150645

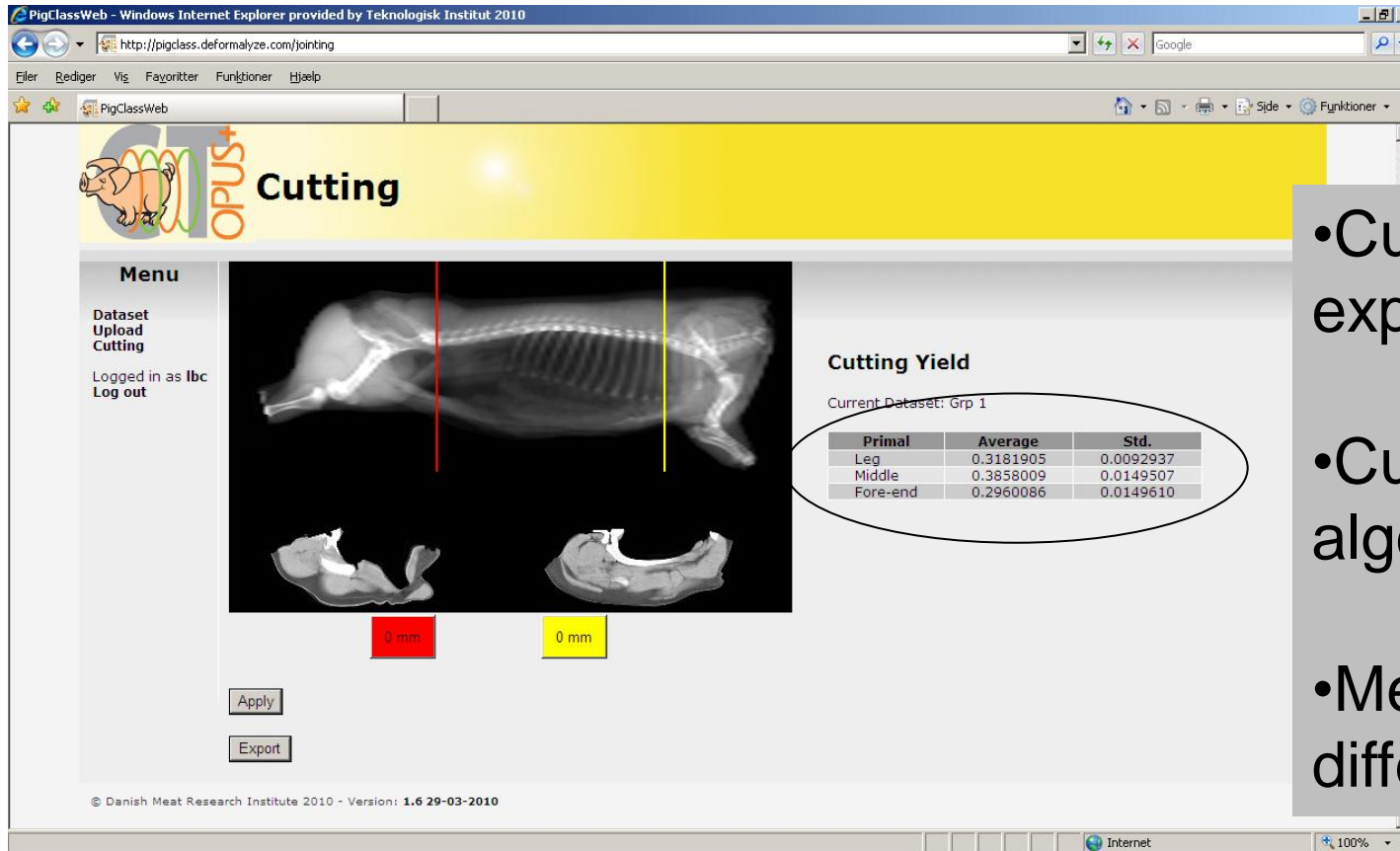
Cutting Yield
Current Dataset: Grp 1

Primal	Average	Std.
Leg	0.3286186	0.0094702
Middle	0.3751728	0.0149970
Fore-end	0.2960086	0.0150645

Apply
Export



Real vs. virtual

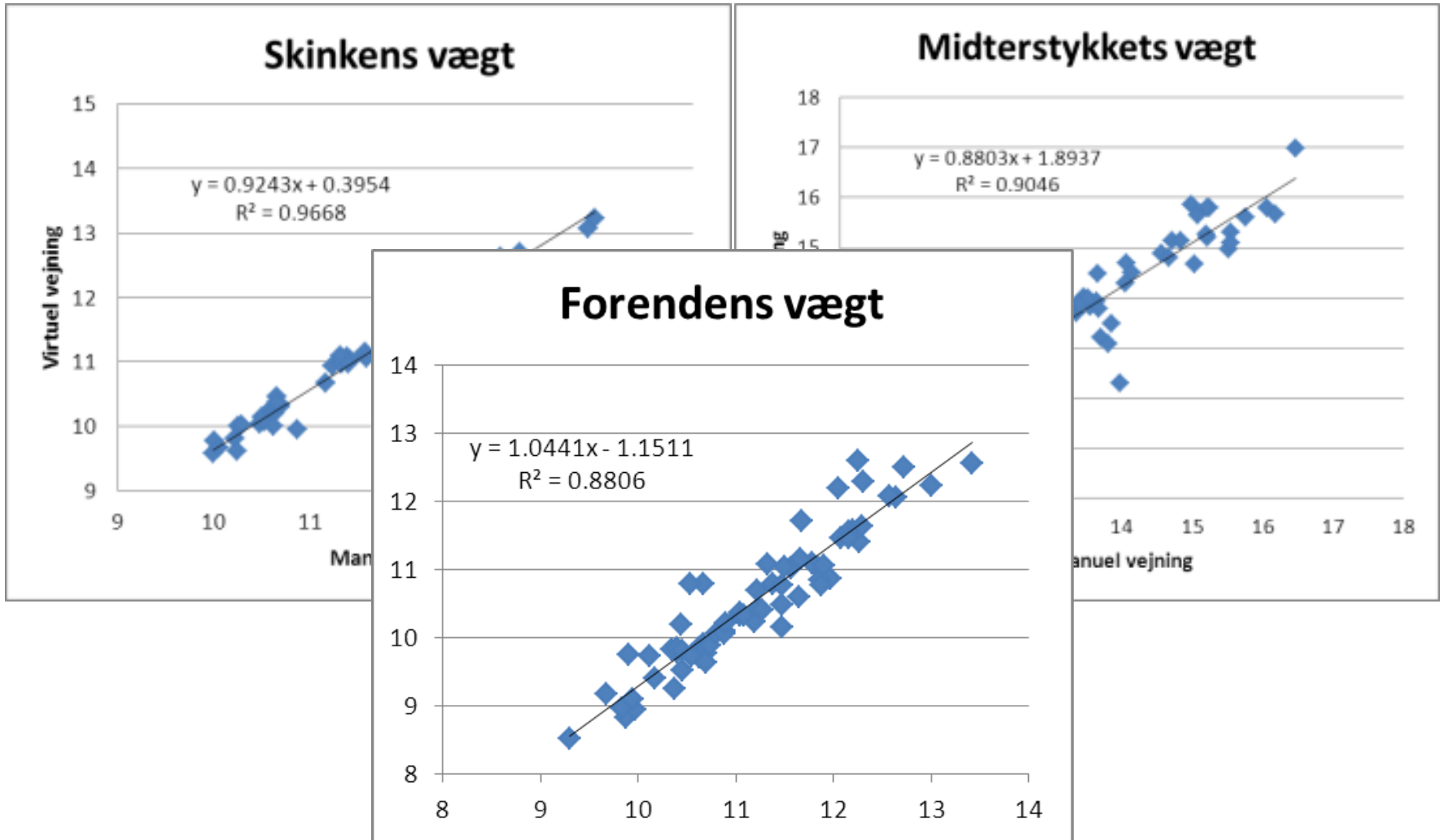


The screenshot shows the PigClassWeb application interface. On the left is a 'Menu' with options: Dataset, Upload, Cutting, Logged in as lbc, and Log out. The main area displays a 3D model of a pig carcass with a red vertical line and a yellow vertical line indicating cutting points. Below the model are two 3D views of the resulting cuts, labeled '0 mm' in red and yellow boxes. To the right, a 'Cutting Yield' table is shown, with the table itself circled in the image. The table has columns for 'Primal', 'Average', and 'Std.' and rows for 'Leg', 'Middle', and 'Fore-end'. Below the table are 'Apply' and 'Export' buttons. At the bottom left of the application window, it says '© Danish Meat Research Institute 2010 - Version: 1.6 29-03-2010'.

- Cutting yield by expert points
- Cutting yield by algorithm points
- Mean and SD of difference

Cutting into Primals	Ham	Middle	Shoulder
Mean difference	-0.0023	-0.0027	0.005
Rel. mean difference	-0.71%	-0.73%	1.6%
Standard deviation	0.0028	0.0083	0.0068

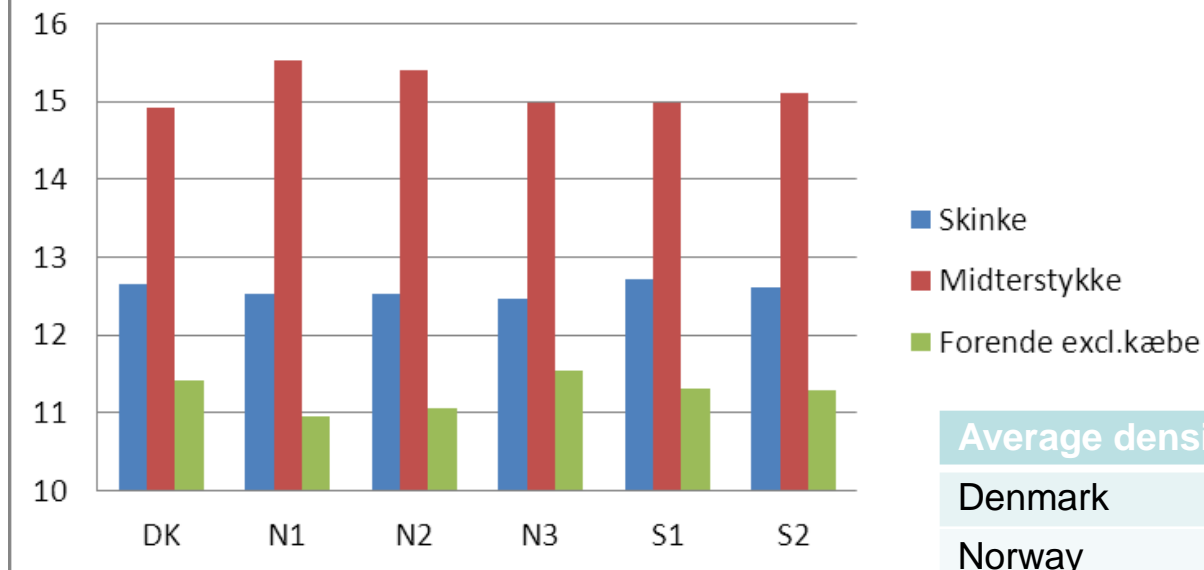
Cutting level I



Estimating primal yield

Cutting level I

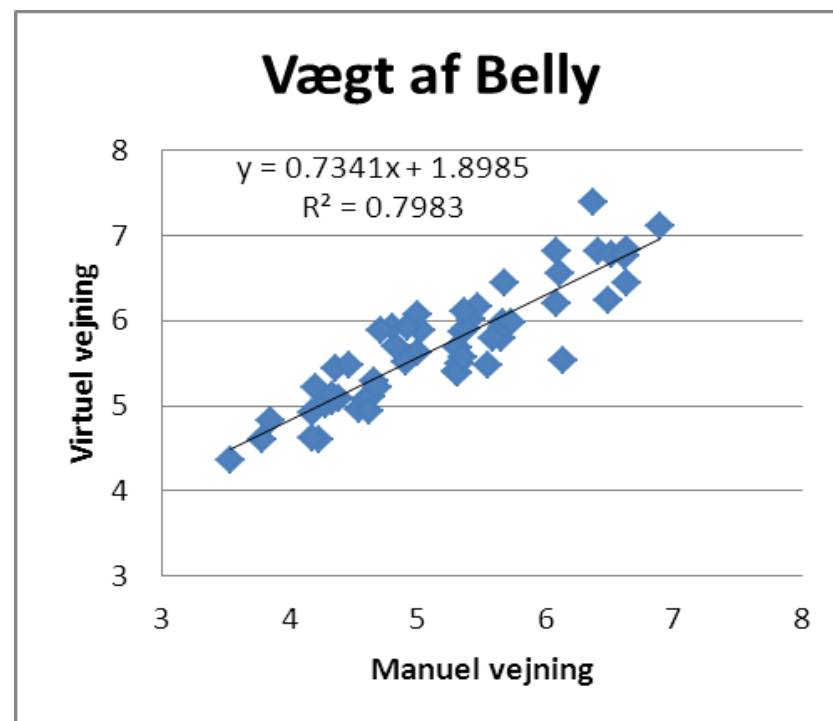
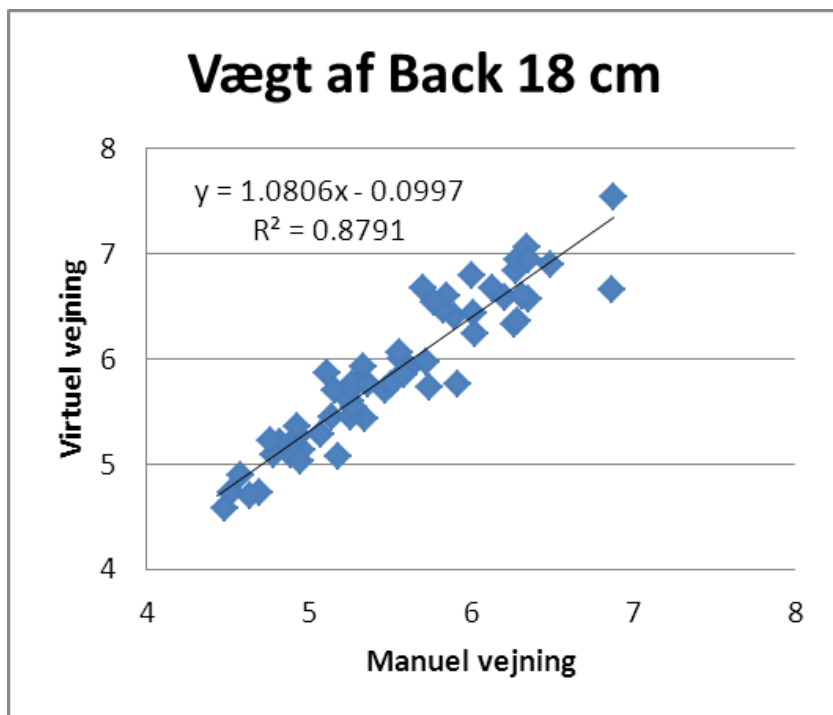
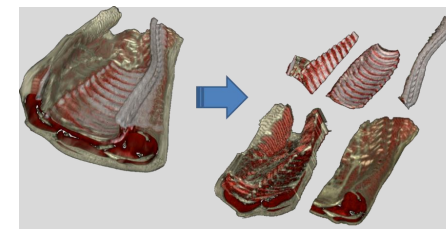
Gennemsnitlig vægt af skinke, midterstykke, forende (sum:39 kg)



Average densities	Fat	Meat	Bone
Denmark	0.997	1.117	1.433
Norway	0.976	1.105	1.434
Germany	0.984	1.108	1.463
Sweden	0.990	1.120	1.419

✓ Objectivity in benchmarking

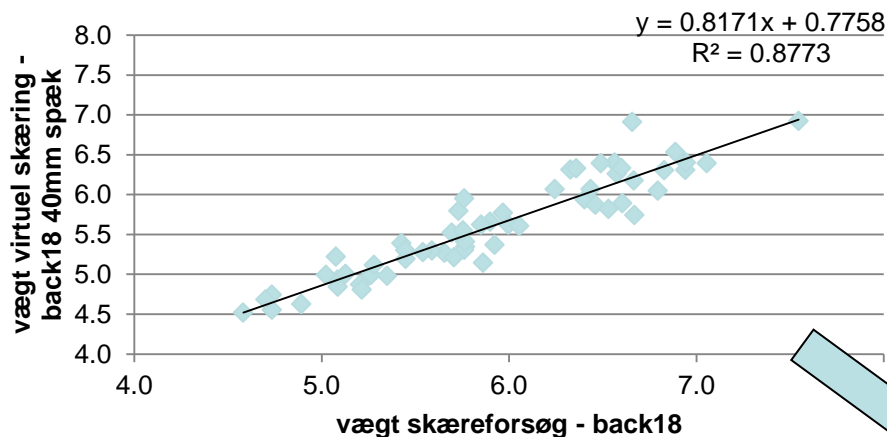
Cutting level II



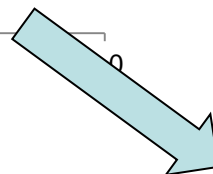
Estimating final
product yield

Cutting level III

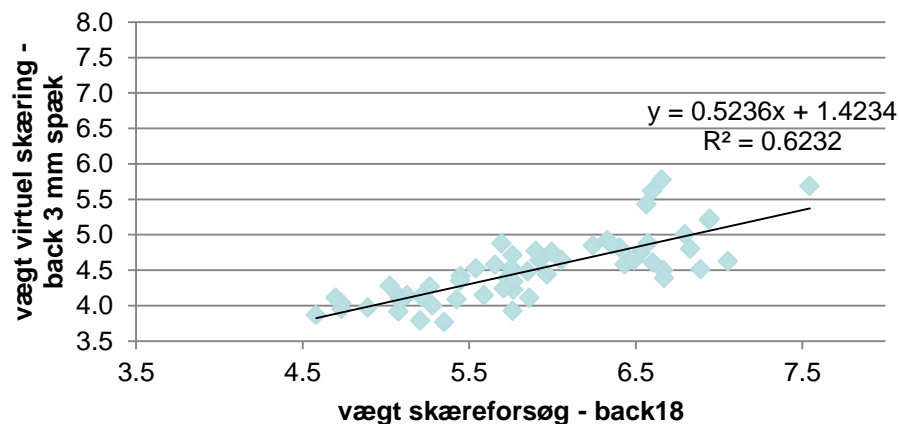
**Virtuel skæring vs. skæreforsøg
back18 40 mm**



Cutting complexity increases
- for algorithm and operator



**Virtuel skæring vs. skæreforsøg
back18 3 mm**

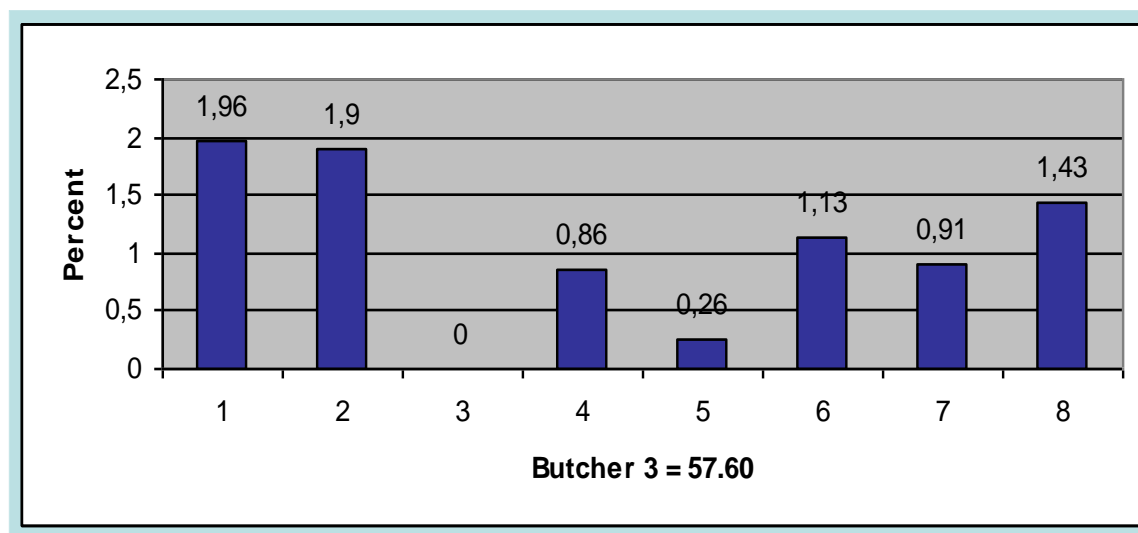


Accuracy chain

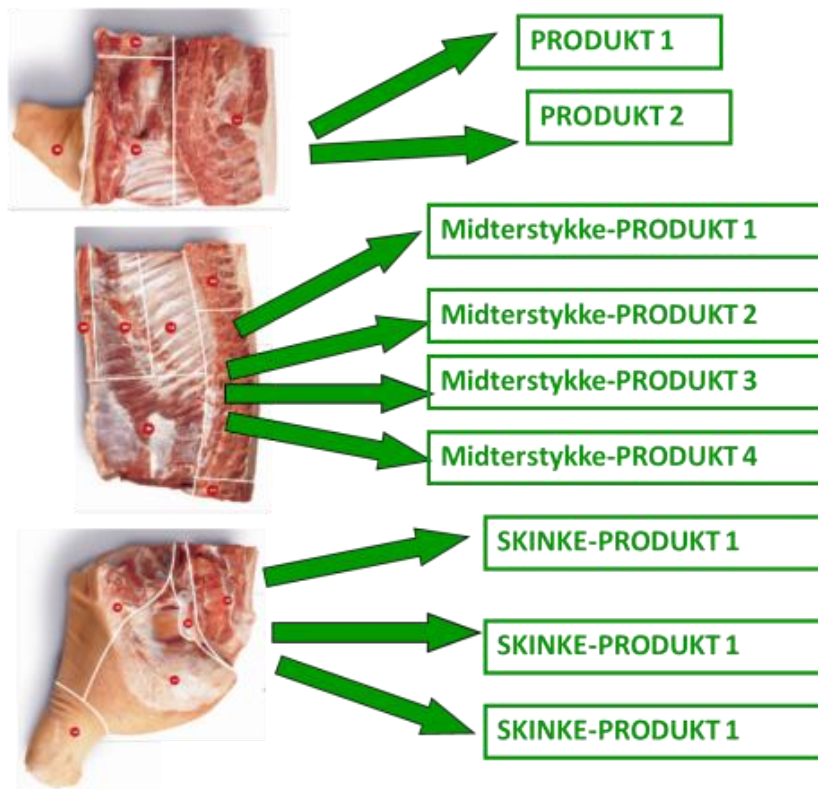
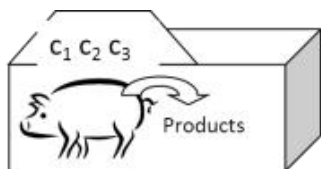
- Virtual cutting

Process	Scanning protocol	Assessment	Tissue density	Cutting level
Primary contributions	Manufacturer	Algorithm	Age	Recipe
	Reconstruction		Breed	Alignment
	Slice thickness		Feeding	
	Energy			
Range	0.1% - 1.0%	0.1% - 1.3%	Approx. 1 %	In progress

- Expert cutting



Questions??



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