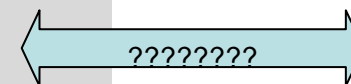
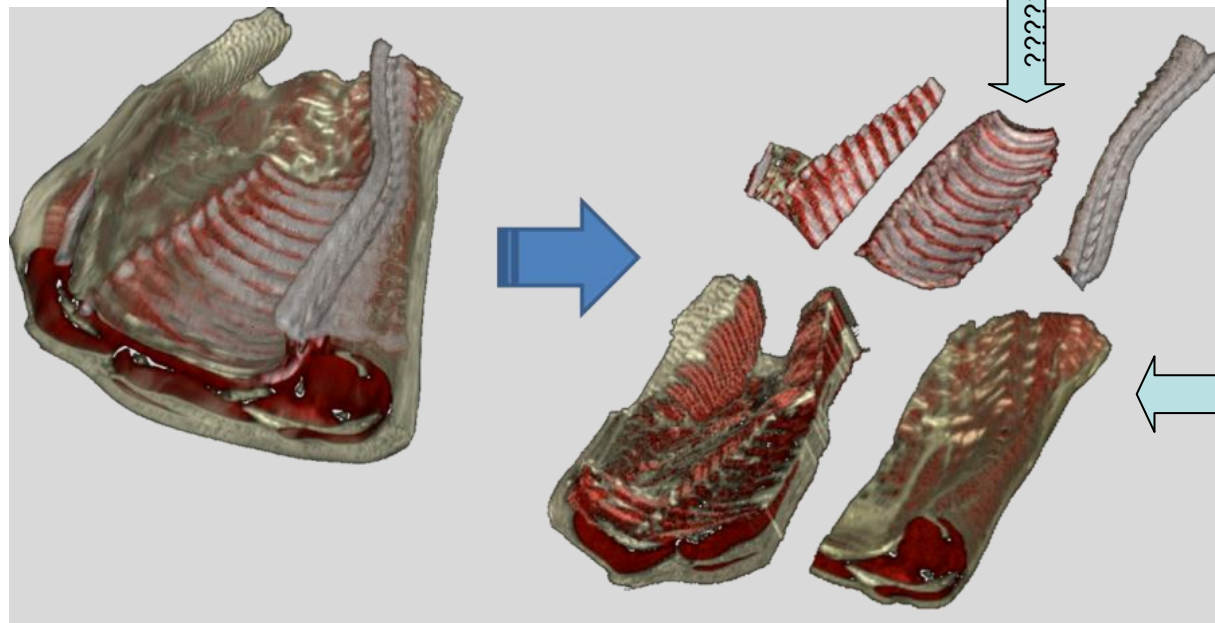
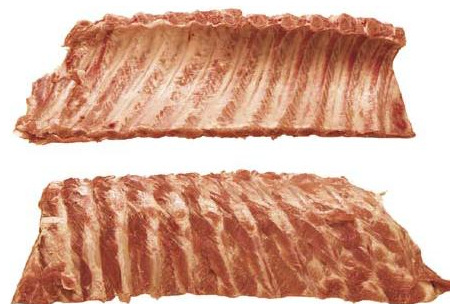
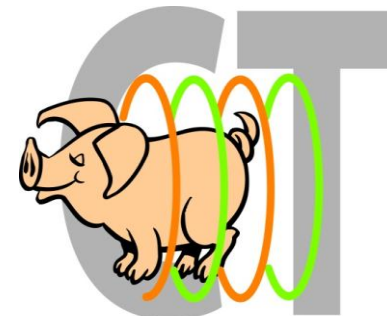


# Accuracy in Biology



Application of  
CT Scanning in (Meat) Industry

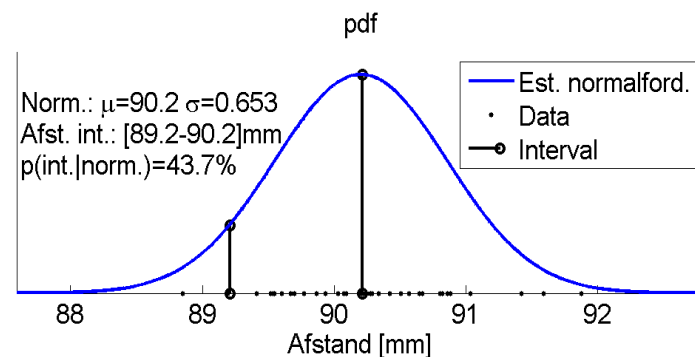
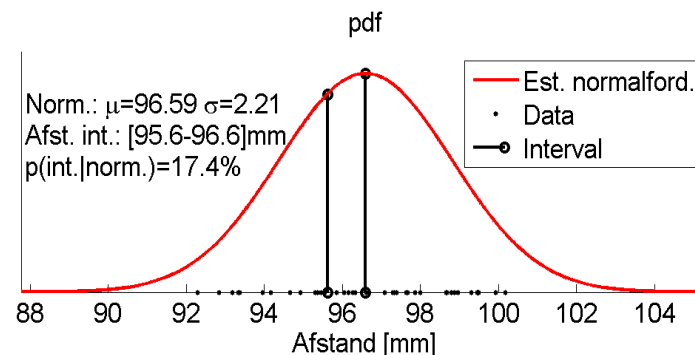
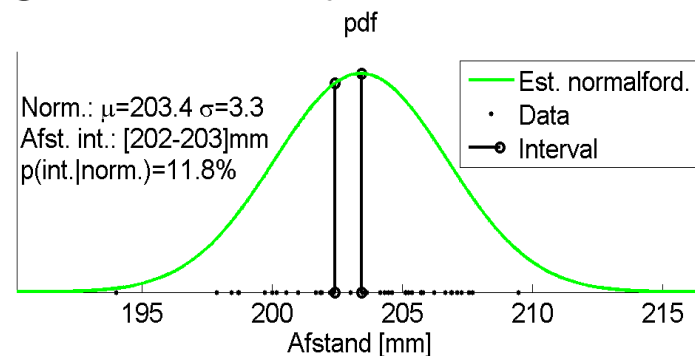
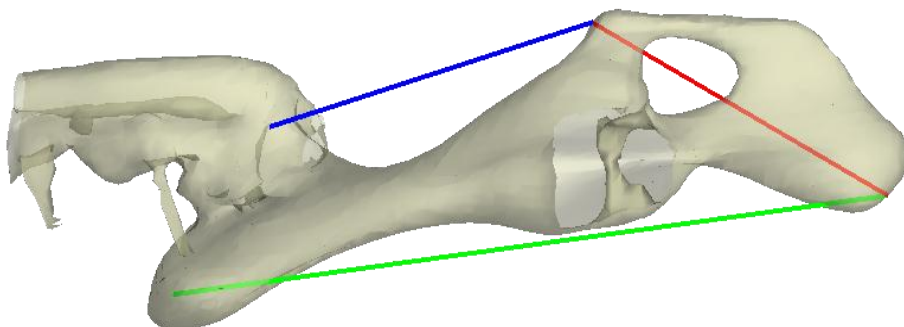


# Motivation

- statistics of rigid anatomy

Quantify anatomic variation

- Geometric reference
- Rigid structure
- Design tool



# Motivation

- statistics of yield



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

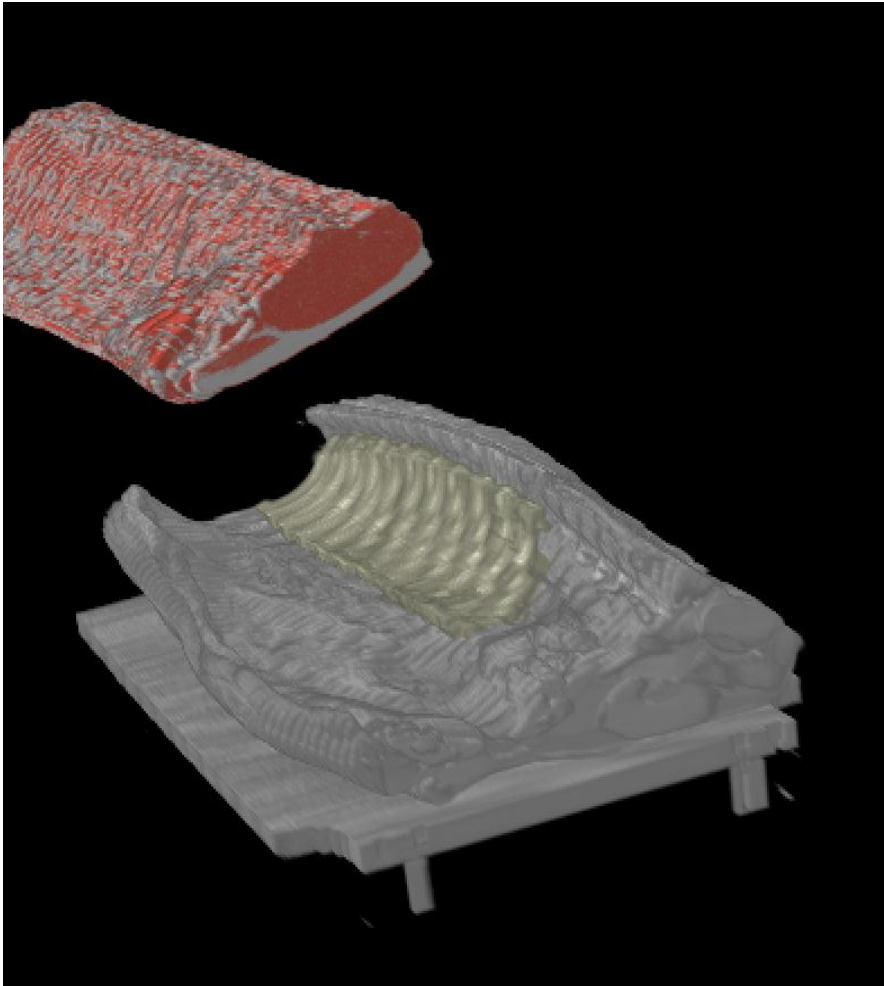
Use the right raw material  
for a specific final product

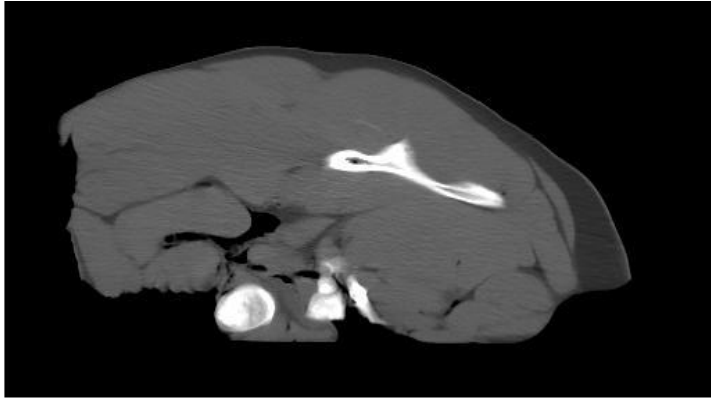
## Challenge:

- Elastic structure

## Benefits:

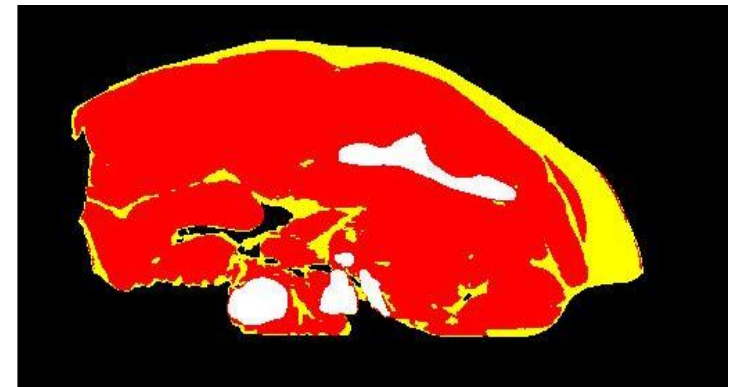
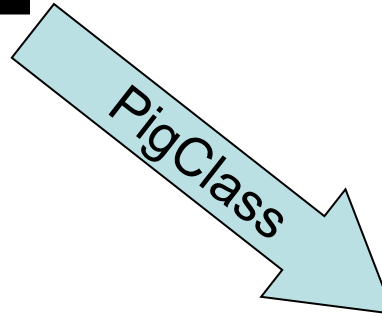
- Product planning
- Cost estimation
- Controlling machines





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

- 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, there 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 two vertical lines indicating cutting points: a red line on the left and a yellow line on the right. Below the carcass are two 3D models of meat cuts, one labeled '0 mm' in a red box and another labeled '0 mm' in a yellow box. To the right of the carcass is a 'Cutting Yield' section with the text 'Current Dataset: Grp 1' and a table:

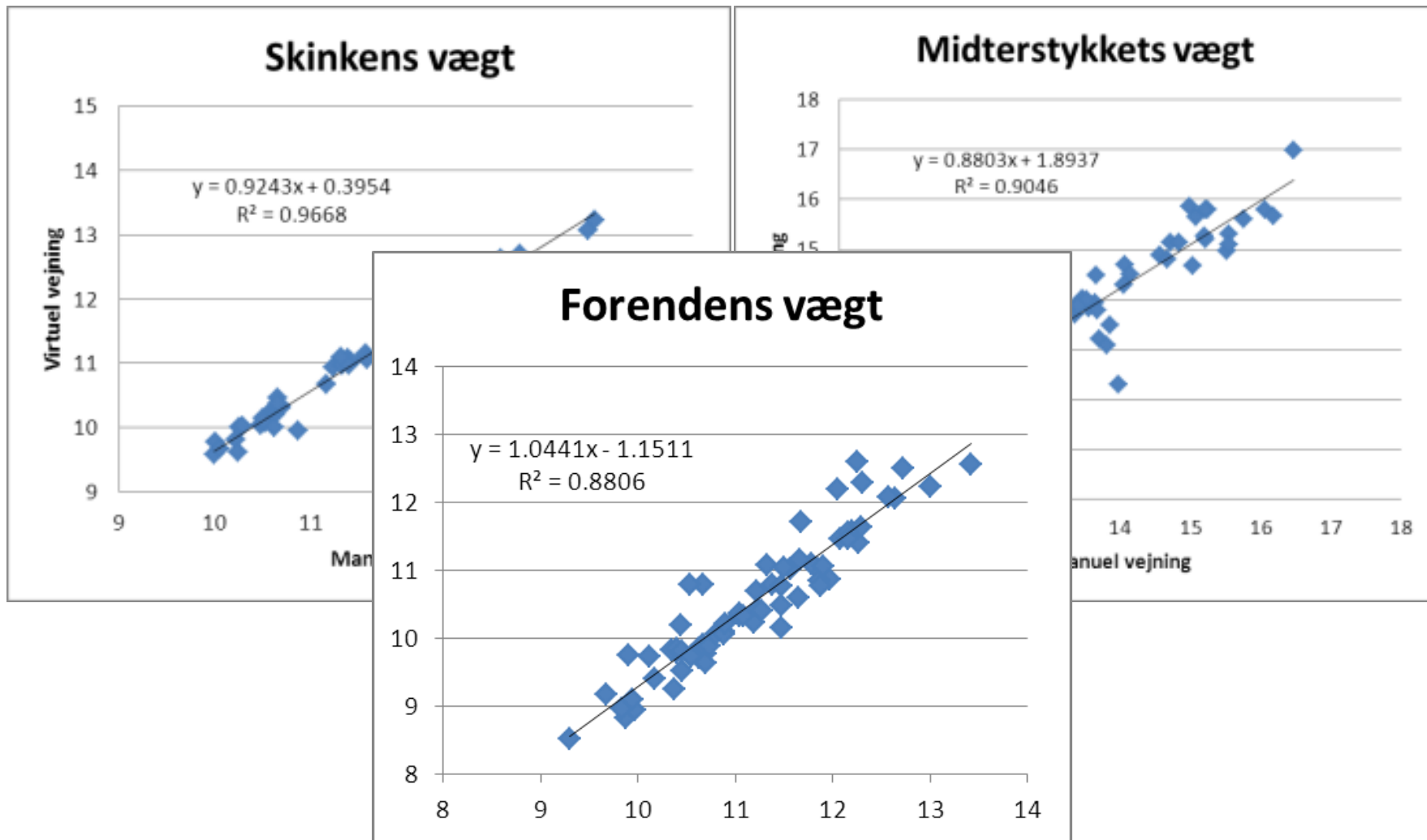
Primal	Average	Std.
Leg	0.3181905	0.0092937
Middle	0.3858009	0.0149507
Fore-end	0.2960086	0.0149610

At the bottom of the interface, there are 'Apply' and 'Export' buttons, and a copyright notice: '© 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

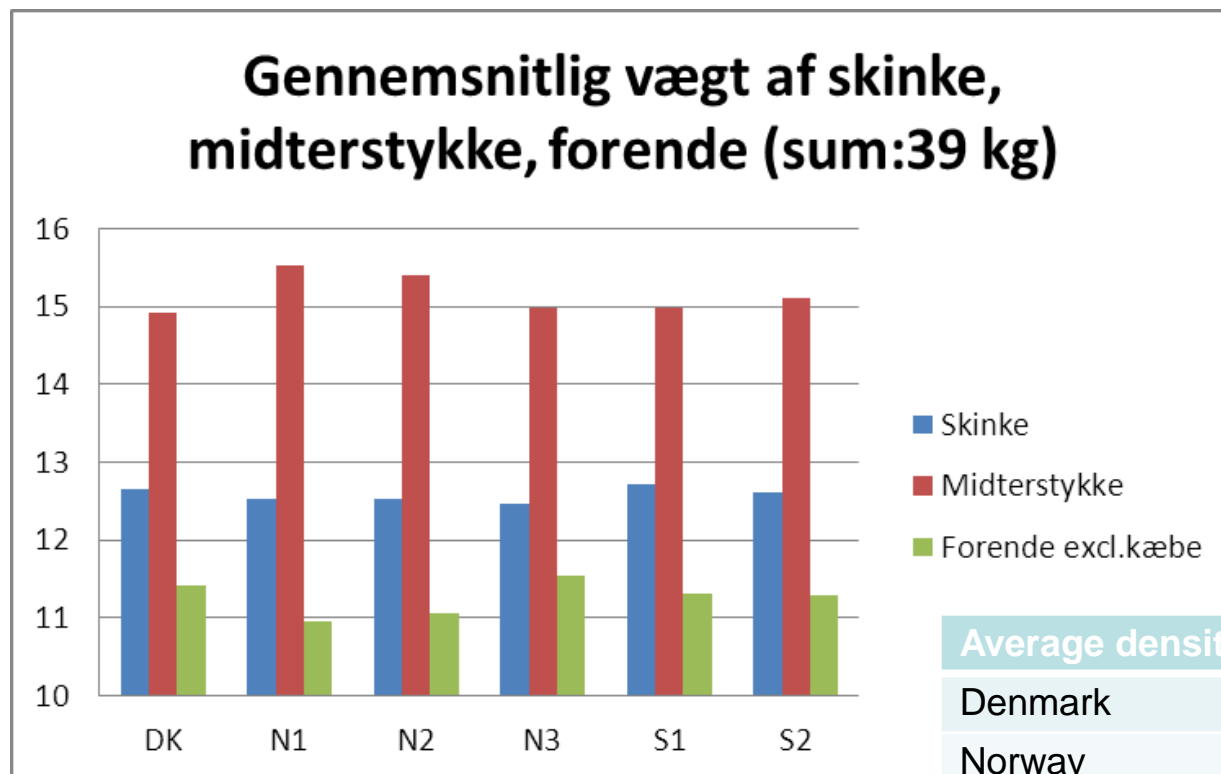
<b>Cutting into Primals</b>	<b>Ham</b>	<b>Middle</b>	<b>Shoulder</b>
<b>Mean difference</b>	<b>-0.0023</b>	<b>-0.0027</b>	<b>0.005</b>
<b>Rel. mean difference</b>	<b>-0.71%</b>	<b>-0.73%</b>	<b>1.6%</b>
<b>Standard deviation</b>	<b>0.0028</b>	<b>0.0083</b>	<b>0.0068</b>

# Cutting level I



Estimating primal yield

# Cutting level I

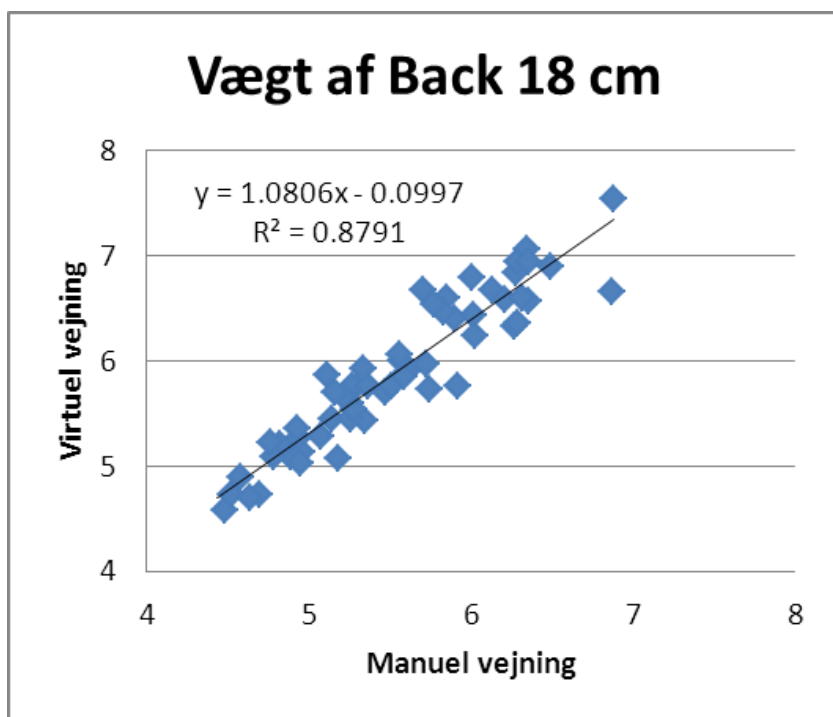
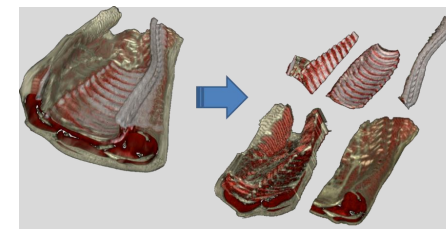


Average densities	Fat	Meat	Bone
Denmark	0.997	1.117	1.433
Norway	0.976	1.105	1.434
Germany	0.984	1.108	1.463
Sweden	0.990	1.120	1.419

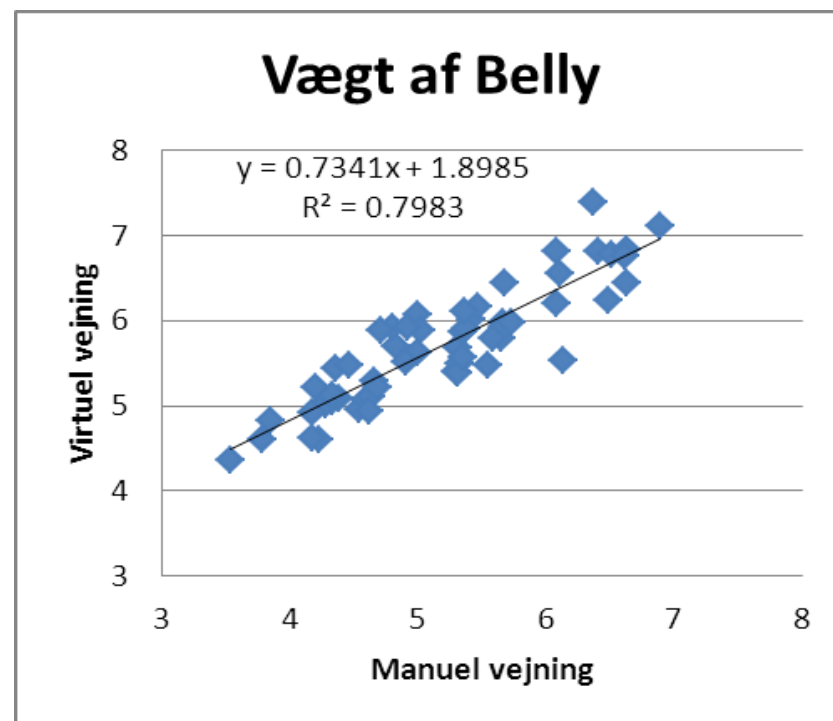
✓ Objectivity in benchmarking



# Cutting level II

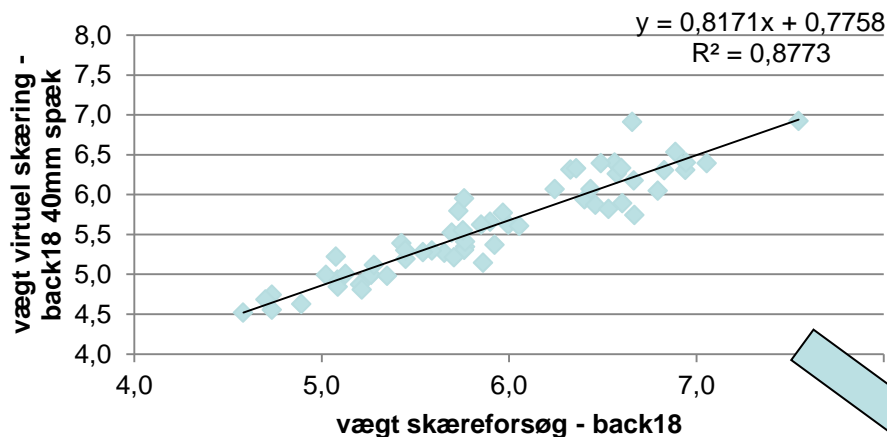


Estimating final  
product yield

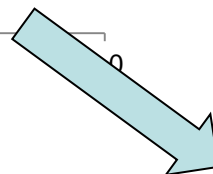


# Cutting level III

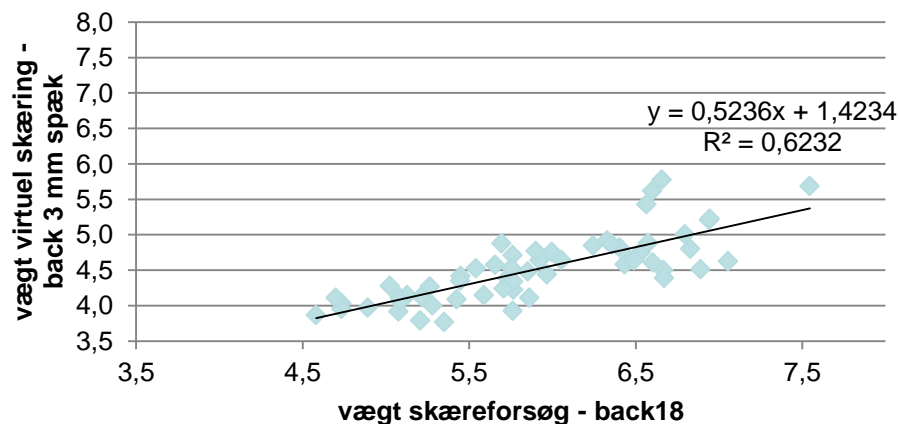
**Virtuel skæring vs. skæreforsøg  
back18 40 mm**



Cutting complexity increases  
- for algorithm and operator



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

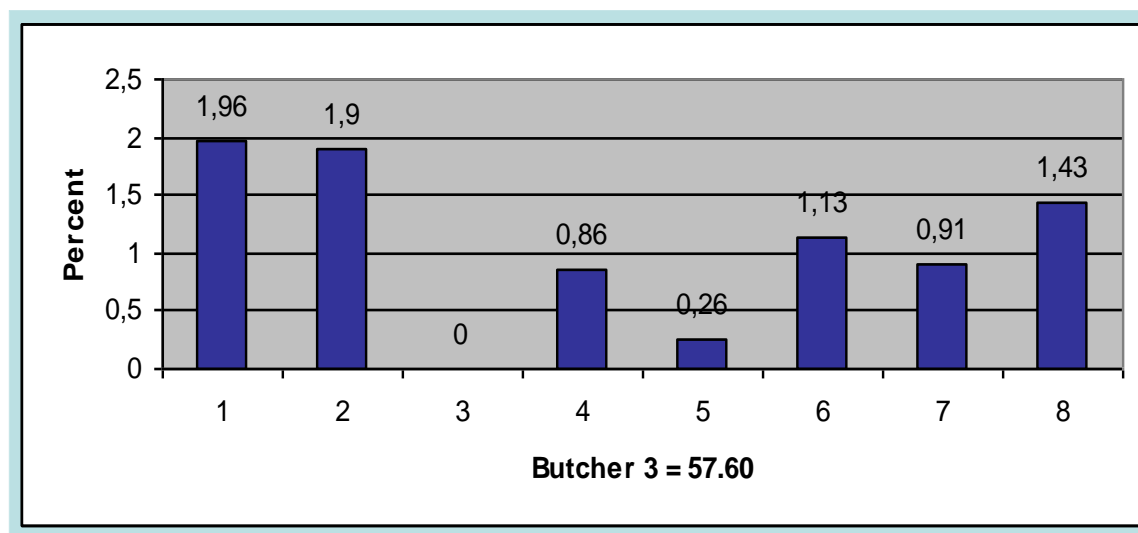


# Accuracy chain

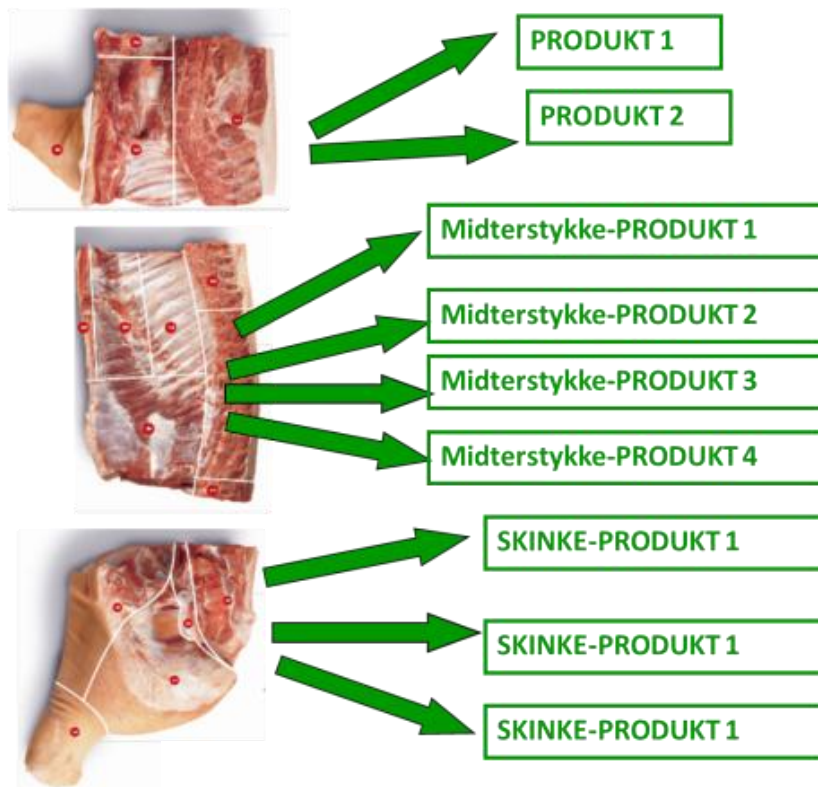
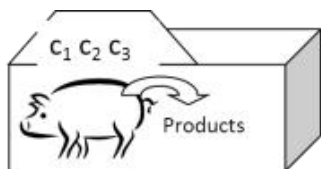
- Virtual cutting

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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