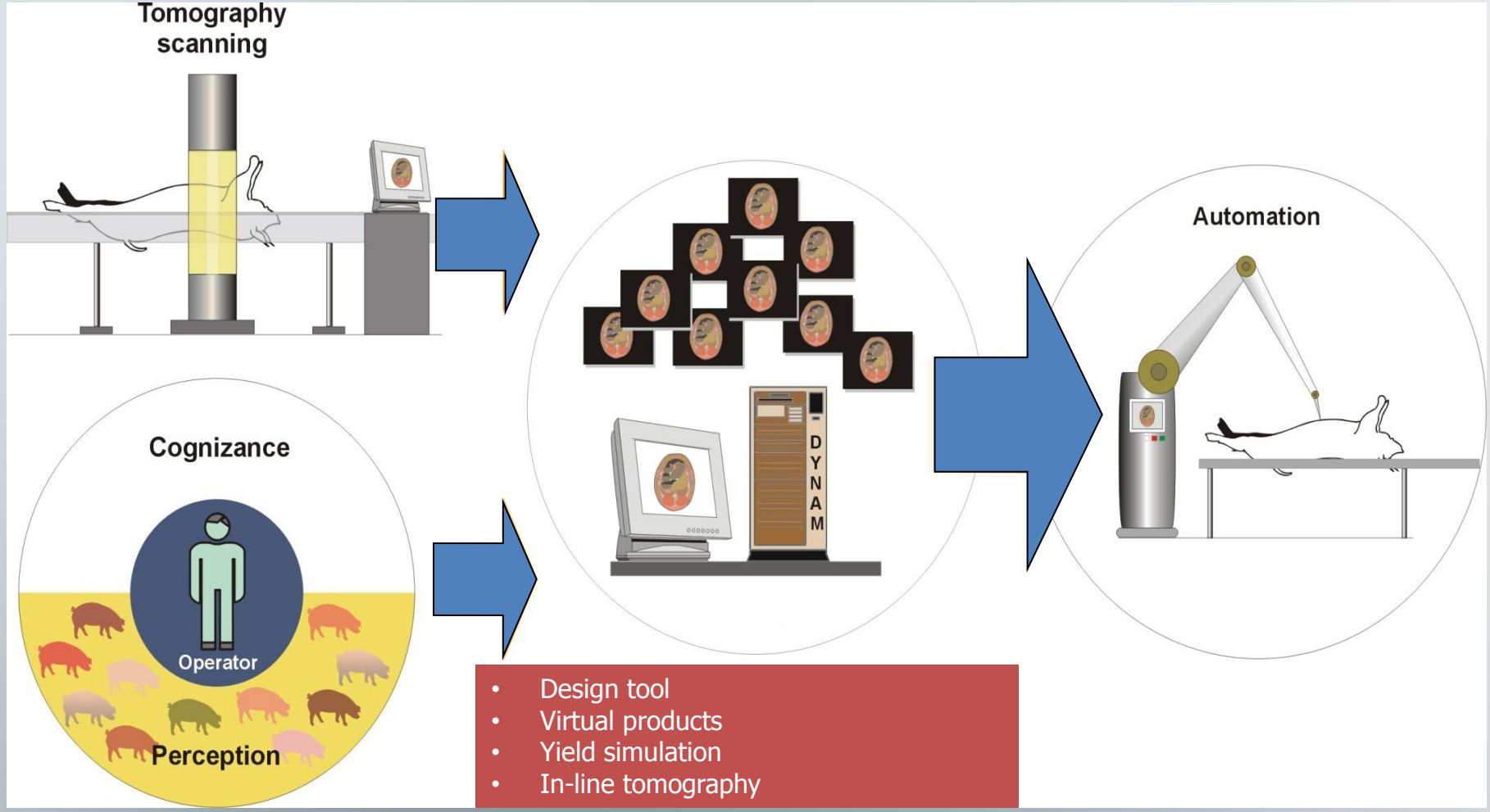
DANISH MEAT
RESEARCH INSTITUTE

In-line CT for applications in the food industry

Lars Bager Christensen
Senior Scientist, MSc, PhD

Computer Tomography
– from volume to value

DANISH MEAT
RESEARCH INSTITUTE

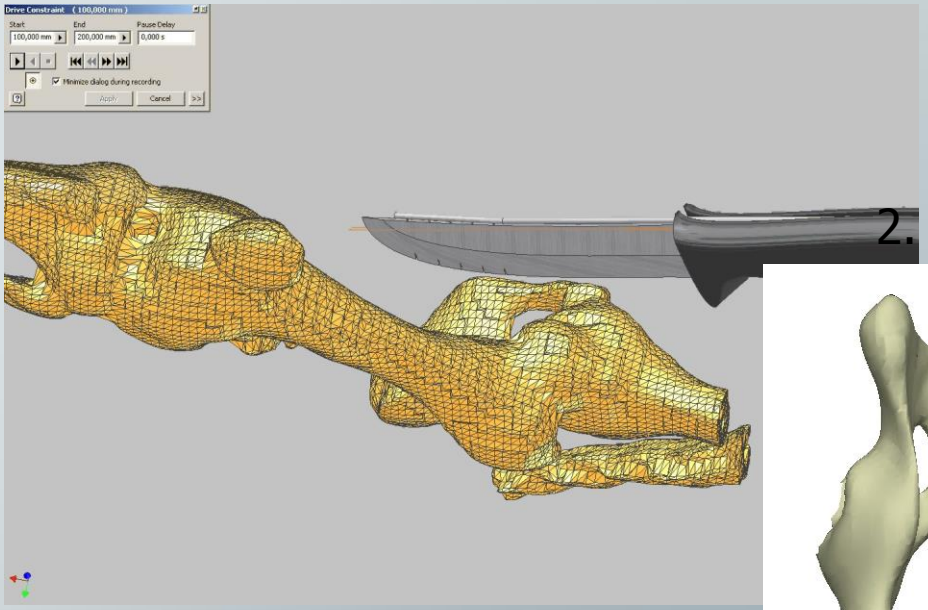


- Design tool
- Virtual products
- Yield simulation
- In-line tomography

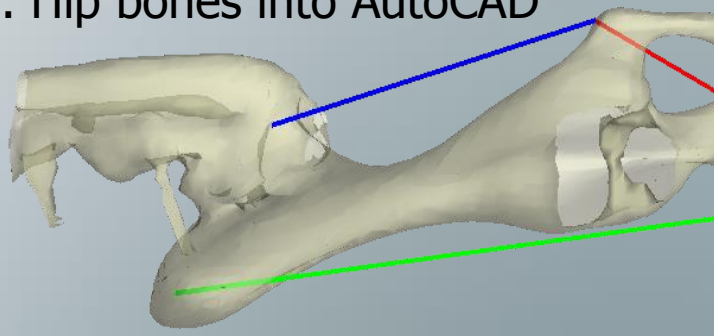
Design tool

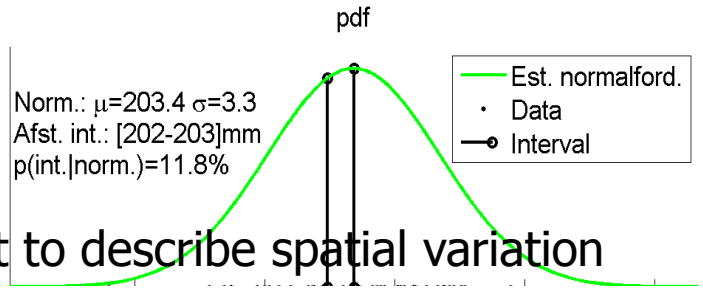
- three design strategies

DANISH MEAT
RESEARCH INSTITUTE

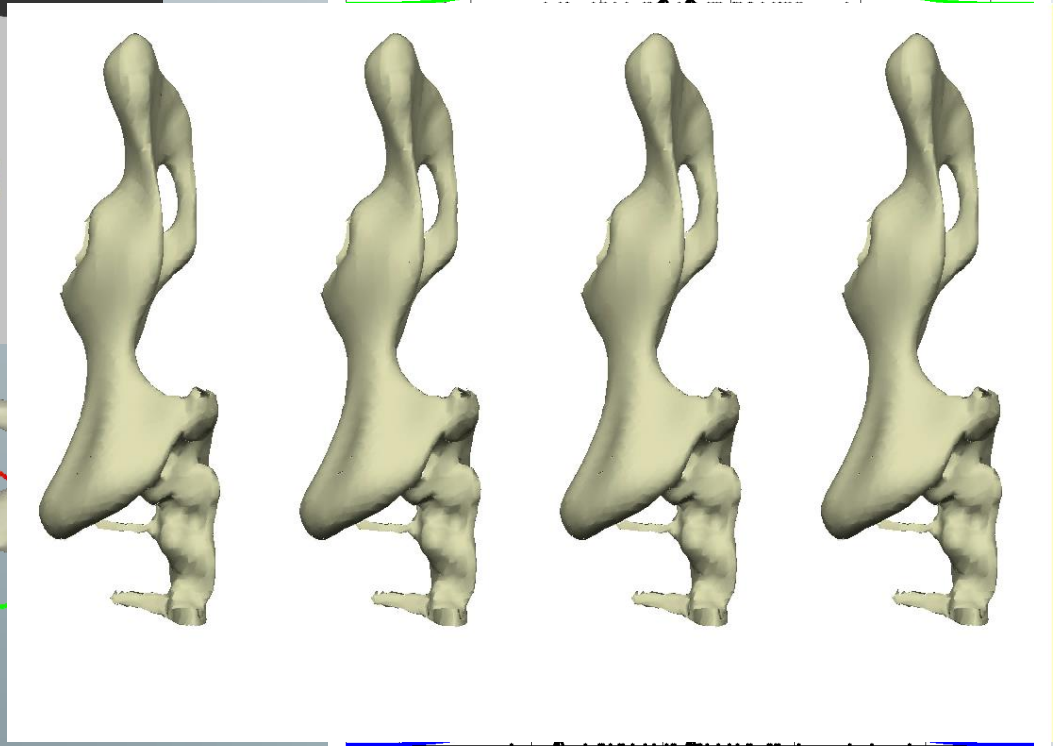


1. Hip bones into AutoCAD





2. Attempt to describe spatial variation



3. Statistical analysis of vital dimentions

4 major PC (37%) ± 2 StdDiv

Adaptive automated cutting

- designed on a CT modeling base

DANISH MEAT
RESEARCH INSTITUTE

- Up to 13 m/min
- Higher yield
- Less trimming
- Adaptive cutting
- 30 mm blades
- Rugged sensors

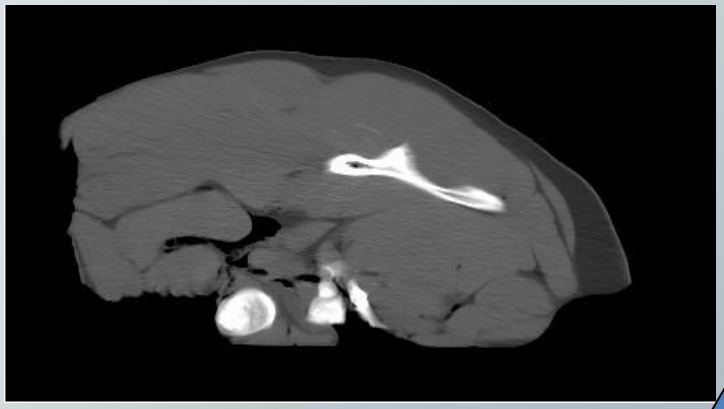
3D Trimmer - Prototype

DMRI Teknologisk Institut
&
Attec Danmark

Weight and quality

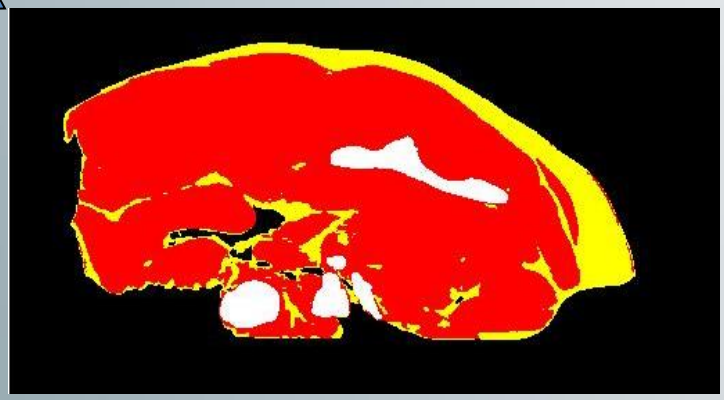
of virtual products

DANISH MEAT
RESEARCH INSTITUTE



PigClassWeb

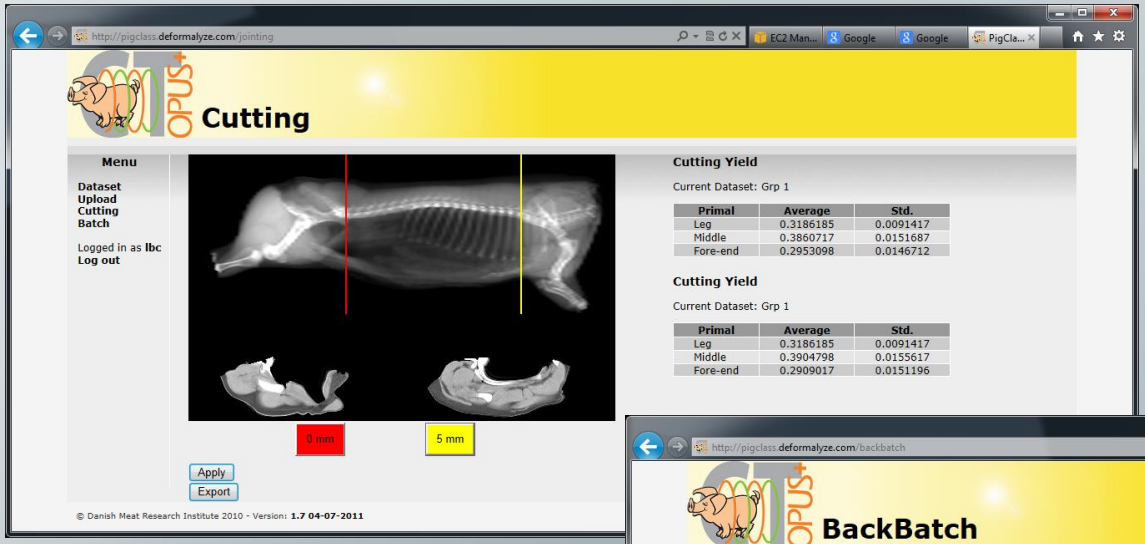
$$\text{Weight} = V_{fat} \cdot \beta_{fat} + V_{meat} \cdot \beta_{meat} + V_{bone} \cdot \beta_{bone}$$

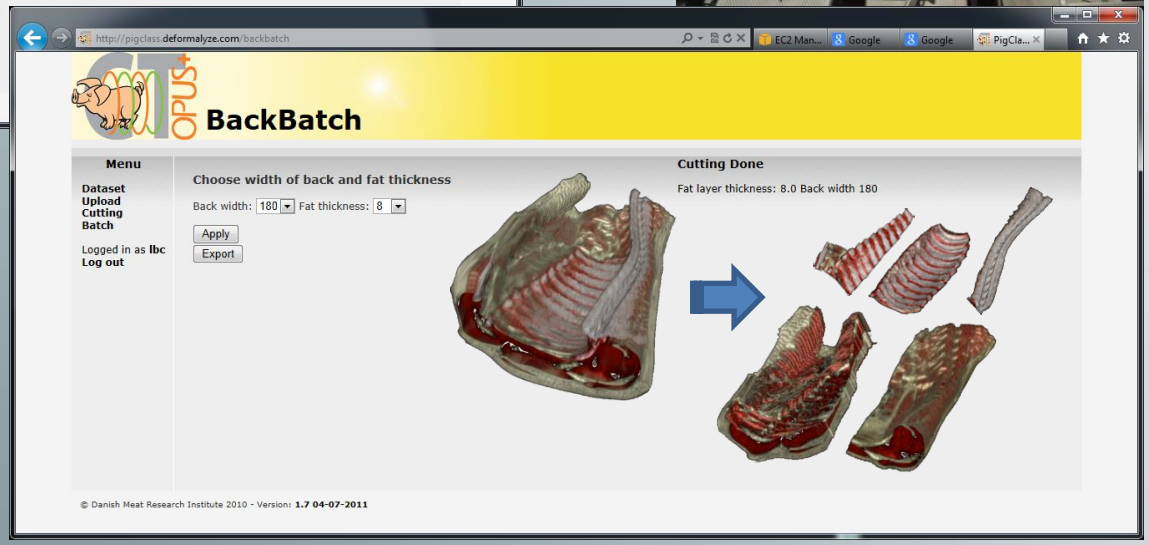


Virtual partitioning

- simulating yield

DANISH MEAT
RESEARCH INSTITUTE





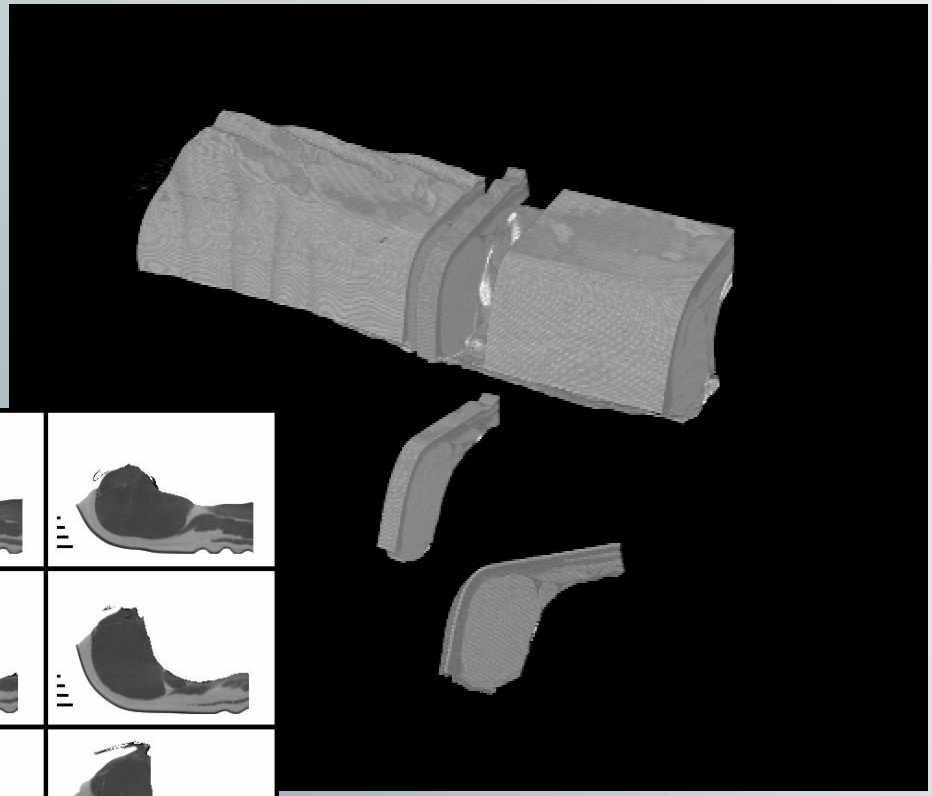
Based on catalogue representing the relevant population

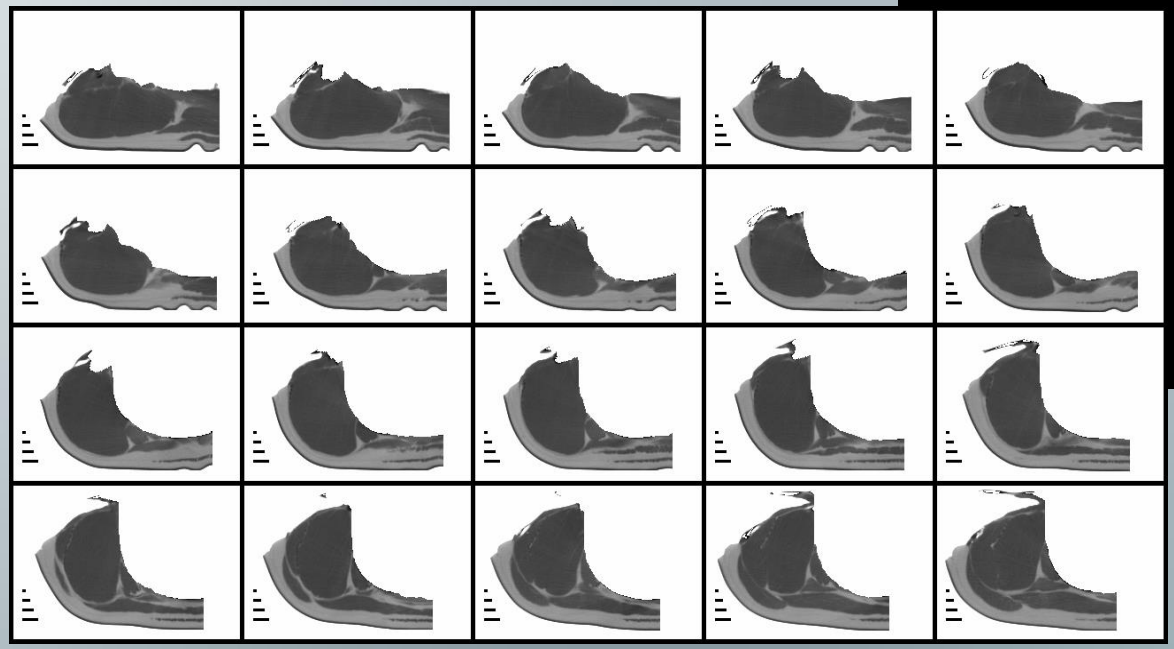
Simulation of

Yield and quality

DANISH MEAT
RESEARCH INSTITUTE

Case:
Bacon quality defined by meat content and distribution

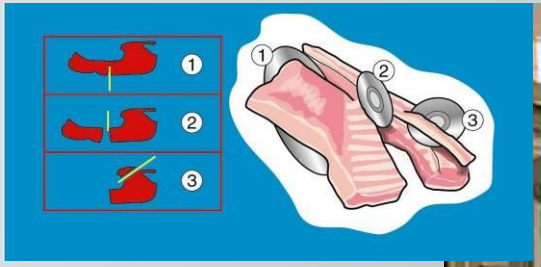


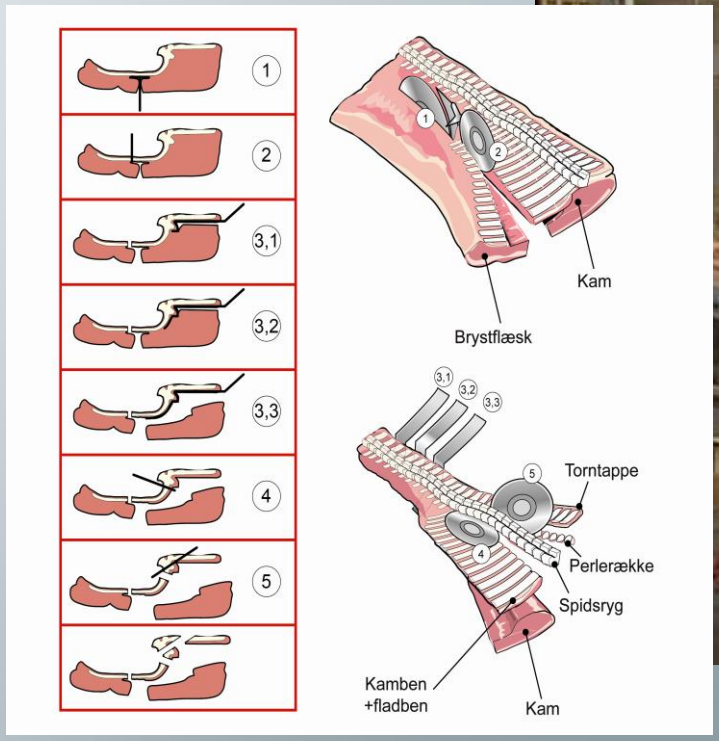


Optimizing yield

- cutting middles the right way

DANISH MEAT
RESEARCH INSTITUTE

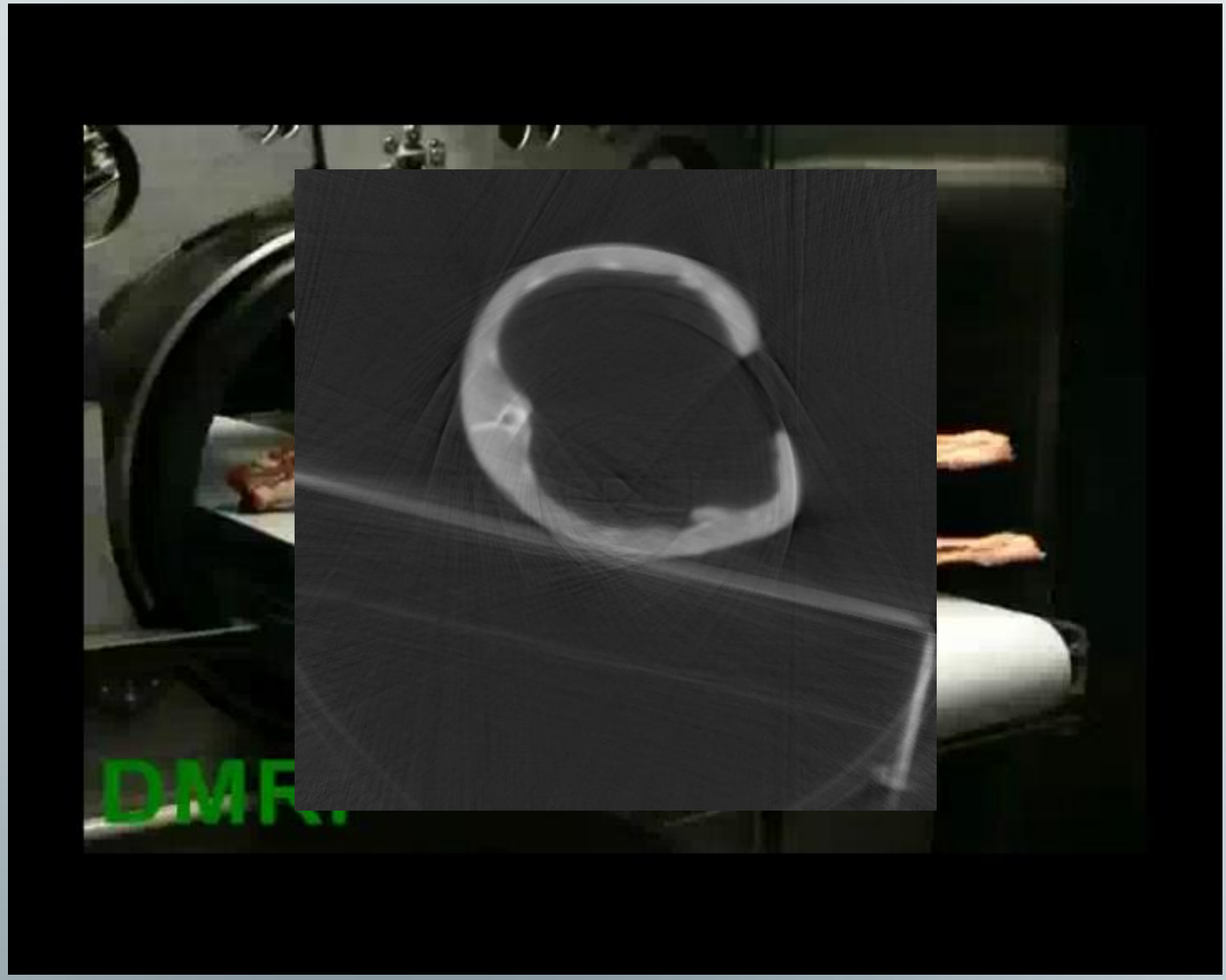




Scanning of lamb

on experimental system

DANISH MEAT
RESEARCH INSTITUTE



Challenges and progress

- detector hardware

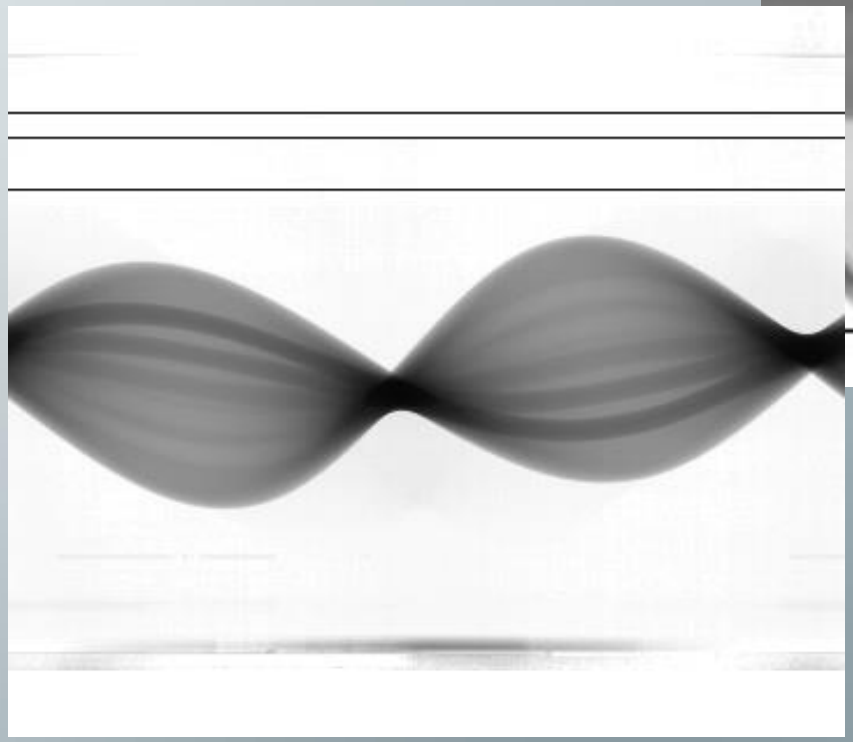
DANISH MEAT
RESEARCH INSTITUTE

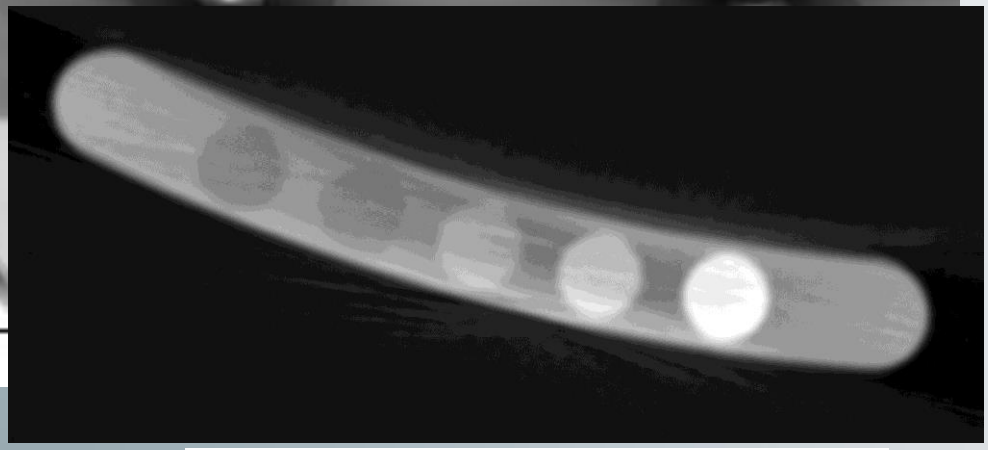
<u>Experimental model</u>

Dead pixels

Misalignment

Irregular pixel distribution





<u>Prototype model</u>

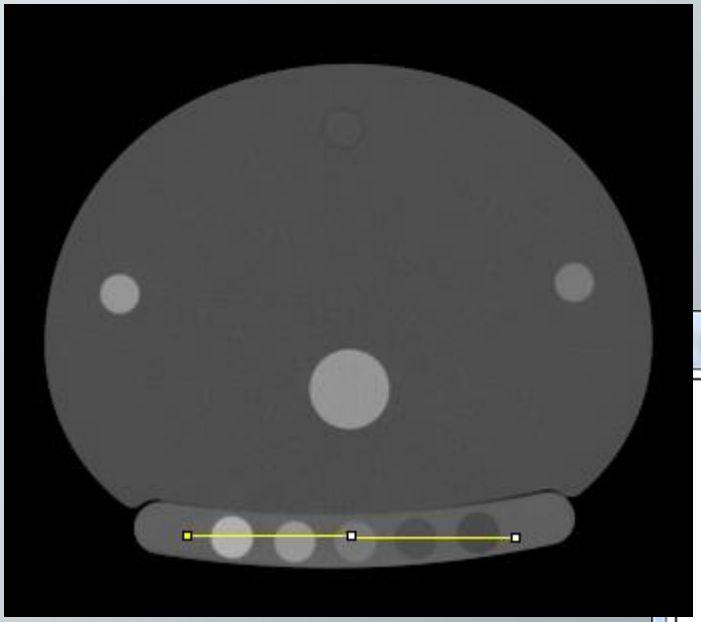
Dead pixels

Non-linearity

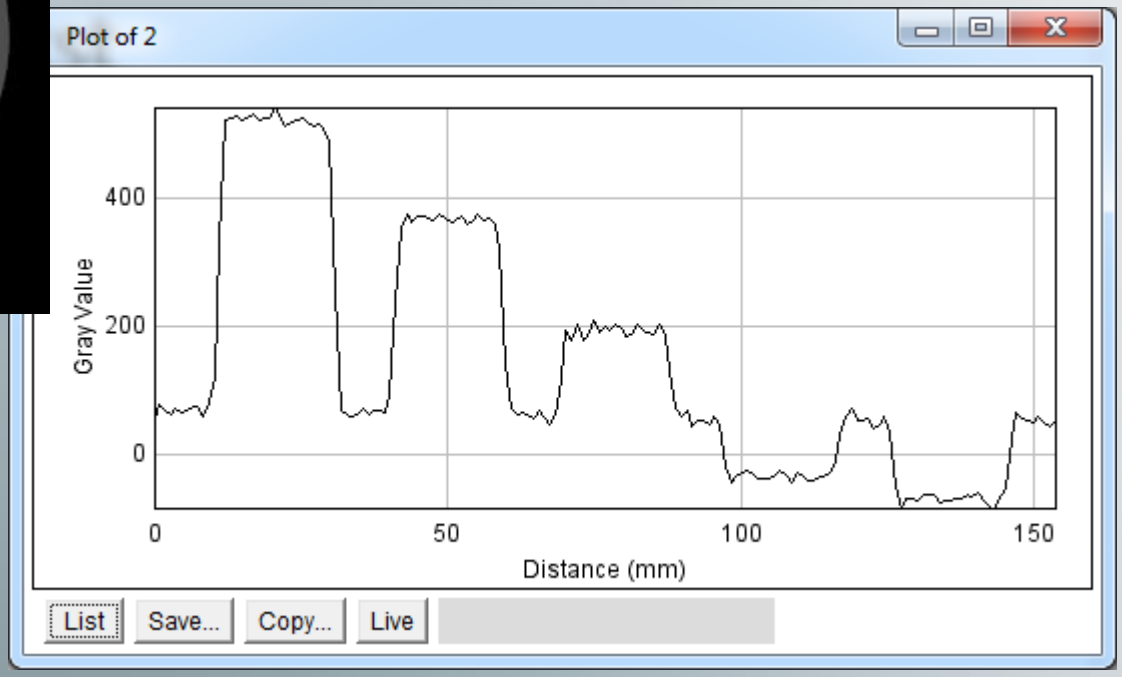
Phantom measurement

- on reference scanner

DANISH MEAT
RESEARCH INSTITUTE

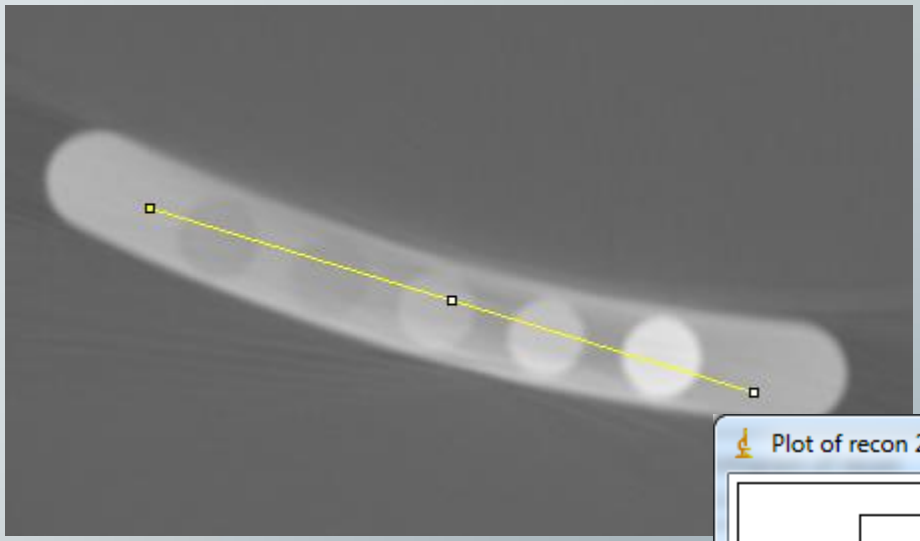


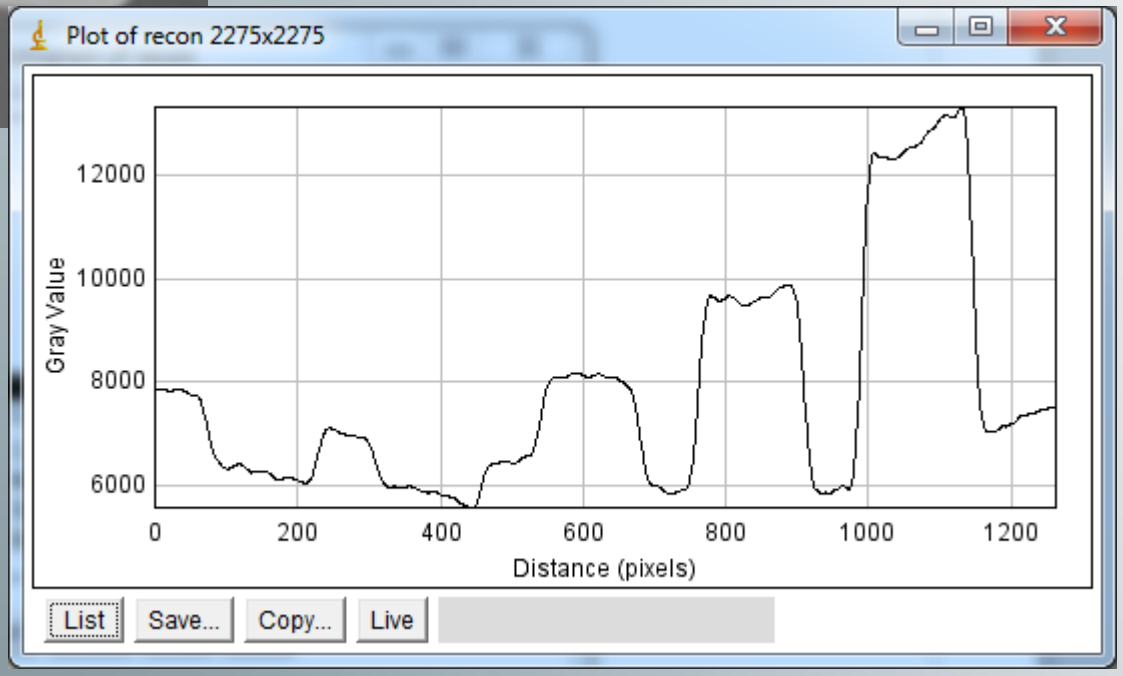
- Medical phantom
- QCT



In-line prototype

DANISH MEAT
RESEARCH INSTITUTE





Beam hardening
- Cupping
- Streaks & dark bands

Photon starvation

Prototype design

testing onlineCT ultimo 2013

DANISH MEAT
RESEARCH INSTITUTE

The Danish National
Advanced Technology Foundation

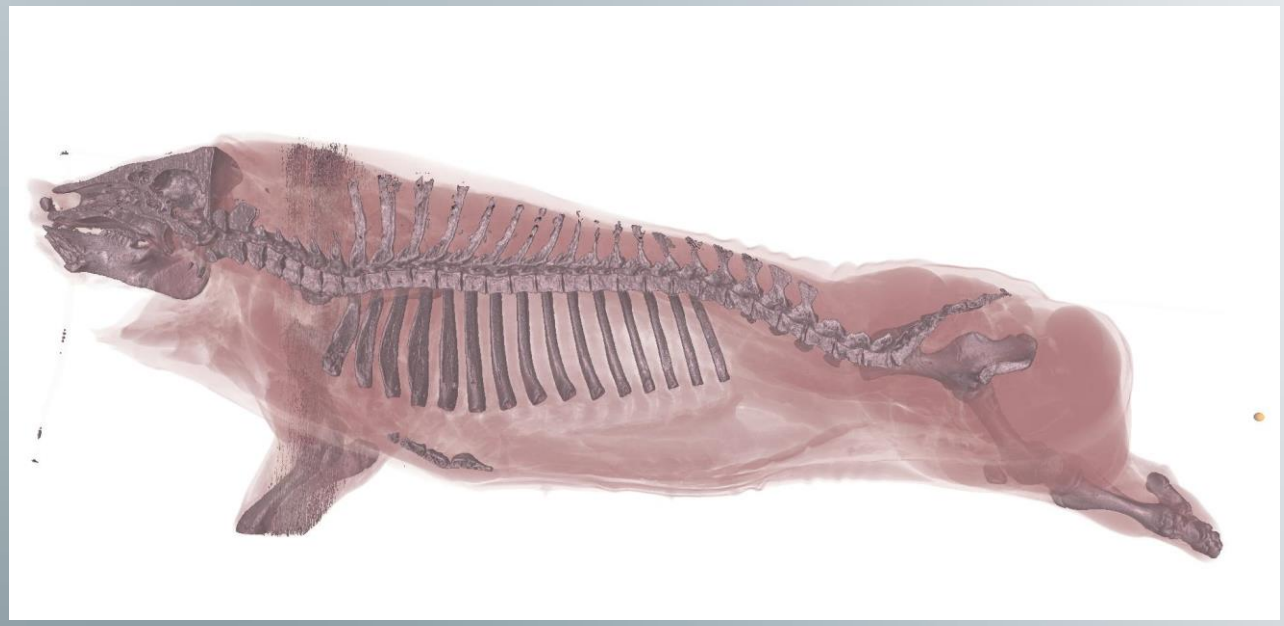
- Volume reconstruction: 4 sec
- Image analysis: 2.5 sec
- 750 products/hour
- 17 slice helix
- GPU image generator

Status autumn 2013

- last week

DANISH MEAT
RESEARCH INSTITUTE

Questions?

DANISH MEAT
RESEARCH INSTITUTE

- Design tool
- Virtual products
- Yield simulation
- In-line tomography