CIA-CT

Project Newsletter
May 2010 - NR 2

Center for Industrial Application of CT scanning

EDITORS' NOTE

Dear reader,
Welcome to the second issue of our six-monthly newsletter about the CIA-CT project! The first issue, published in November 2009, was mainly addressed to provide a general overview of the project, with topics, objectives and involved partners. From this issue on, we will be more specific and detailed with contents and events regarding the world of CT scanning. In this issue you can read about the second Consortium meeting held at DMRI in March 2010 and all relevant events occurred that day (as the visit to DMRI "Scannerborg" and a seminar carried out by DMRI, concerning high capacity CT scanning in industry). At last we start being acquainted with the single project partners. This number is dedicated to present Deformalyze. We also invite you to attend our Conference on " Application of CT scanning in industry", which will be held at DTU the 8th of June. The detailed program is shown at the end of the newsletter.
The third number will be distributed in November 2010.

We hope that you can enjoy the contents.

Greetings

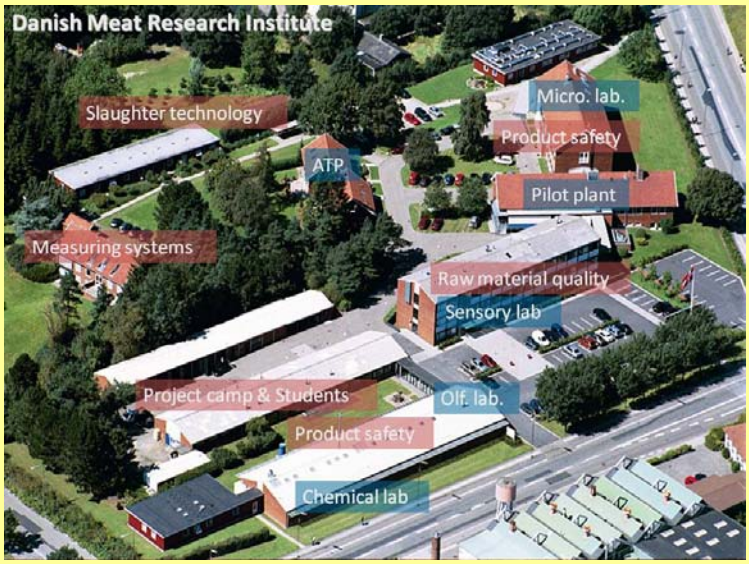
The Editors

RELEVANT EVENTS

The second Consortium meeting held at DMRI (http://www.teknologisk.dk/dmri) on March 18, 2010 and was focused on the detailed description of workpackages and progress reports registered in the first months of activity.

The meeting was attended by 23 people from the Consortium and by Jan Windmüller, from the Ministry of Science, Technology and Innovation.

An interesting part after the meeting was the visit to DMRI Mobile CT Scanning. The mobile unit, baptized “Scannerborg”, was originally donated by Norma & Frode S. Jacobsen Fund in 2004. An X-ray CT scanner (GE CTi/Performix tube) is used to scan pig carcasses and meat products. “Scannerborg” can be attached directly to the slaughterhouses. As an important data validation issue, the “virtual weight” is compared to the real weight of the scanned piece of meat just after the scanning.



The Danish Meat Research Institute is situated in a nice environment Roskilde. It became part of the Danish Technological Institute from October 1, 2009

DMRI Mobile CT Scanning “Scannerborg”

SEMINAR ON “HIGH CAPACITY CT”

Another event that took place at the second consortium meeting was the seminar held by DMRI with the title “High capacity CT”. Lars Bager Christensen, Marchen Hviid and Claus Borggaard introduced a project supported by Højteknologifonden and involving other Danish companies, expert in X-ray and CT scanning, towards the development of an online X-ray system for measuring meat-fat-distribution in pig carcasses or pieces. By measuring the distribution of meat, fat and bones in pork middles, it is possible to adapt the cutting according to current market prices. During the last years, the need for advanced measuring technology for flexible, automated production has increased in Denmark and other high cost countries. At the same time, the necessary technological development has become available and therefore the time is ideal for establishing a CT concept for future industrial production purposes. Preliminary studies have demonstrated potentials and realistic solutions, but have also clarified the extent and complexity of the challenge and risks. A CT scanner for online use in production is new and makes a decisive break with the normal understanding of CT technology, its use, speed and limitations.

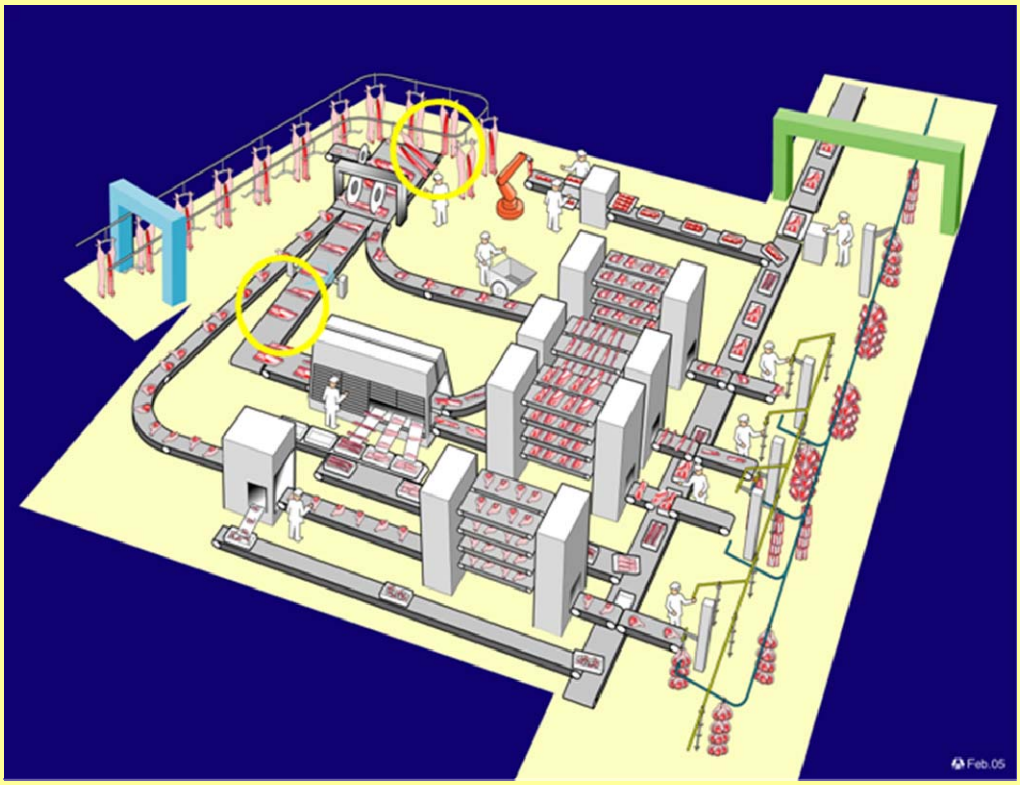
The lead in quality for Danish pork export is under tremendous pressure. Until now, automated production lines have been able to compensate high Danish wages, but increased market demands for product differentiation are an escalating challenge for the high-efficient Danish export industry. The CT scanner will improve the existing facilities to optimize and adjust the cutting of each individual carcass, according to current prices, quality demands and orders. After completion, the project partners will install the CT scanner at relevant Danish pig slaughterhouses. The CT scanner will also be tested on applications within the nearby areas, such as cheese production and cutting of beef and lamb.

The main criterion of success for the project is to implement a robust and cost-effective CT scanner, which can measure online under the environmental conditions and capacity requirements that can be found at the cutting line at a Danish pig slaughterhouse. Measurements should result in the spatial distribution of meat, fat

and bones and deliver an optimal recipe for automatic cutting of pork middles resulting in a return of investment for the slaughterhouse less than 12 month. The CT scanners self-diagnostic and reporting capability generate a detailed operational status including function control.
The main objective is to design an On-line CT-scanner characterized by

- High capacity i.e able to measure 700 pork middles/hour;
- Cost effective corresponding to 12 month return of investment for the slaughterhouse;
- A flexible platform for a broad range of applications.

In a long term perspective the knowhow acquired from this project could be combined with micro-CT, opening up for a completely new field of industrial applications within quality control of high-value products in medical devices.

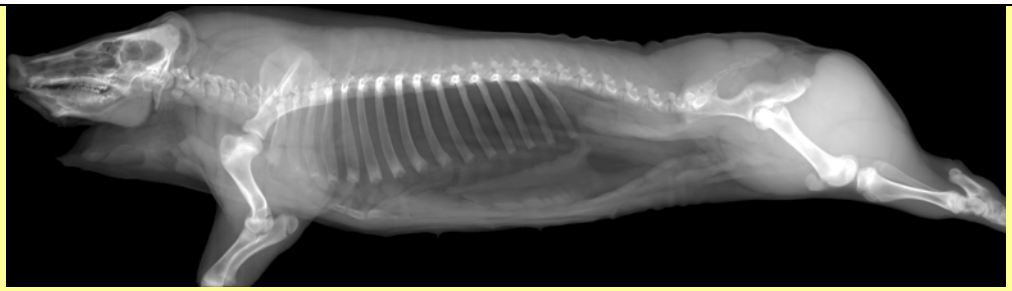


The figure shows the cutting line on a slaughterhouse. The yellow circles indicate possible places for on-line CT

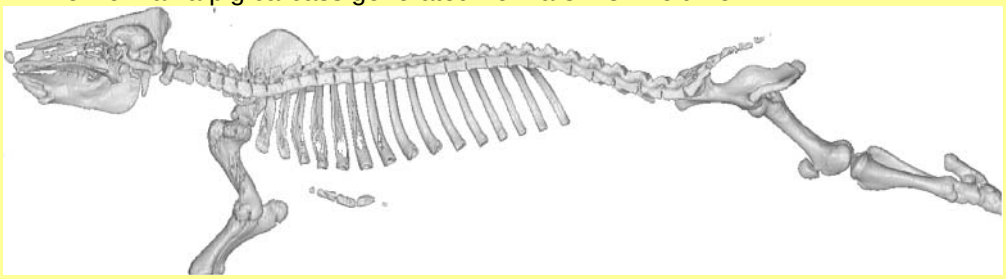
MEETING WITH DEFORMALYZE

Deformalyze provides consulting services and delivers solutions for automated data analysis focusing on industrial applications of CT. Typically a vast amount of data is acquired from CT and it is the analysis and interpretation of such data that Deformalyze is an expert in.

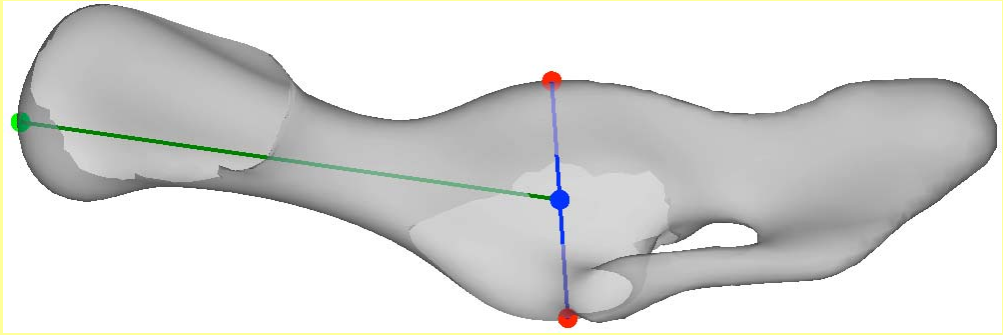
Population-based studies i.e. statistical analyses on composition, shape or specific measurements of a population of scanned objects are typical tasks that provide important insight otherwise unavailable. Building models of a whole population of objects via CT-scanning enables relating population-based insight to a new specific object of interest. This is a very strong tool e.g. for quality or process control.



2D-view of half a pig carcass generated from a 3D CT volume



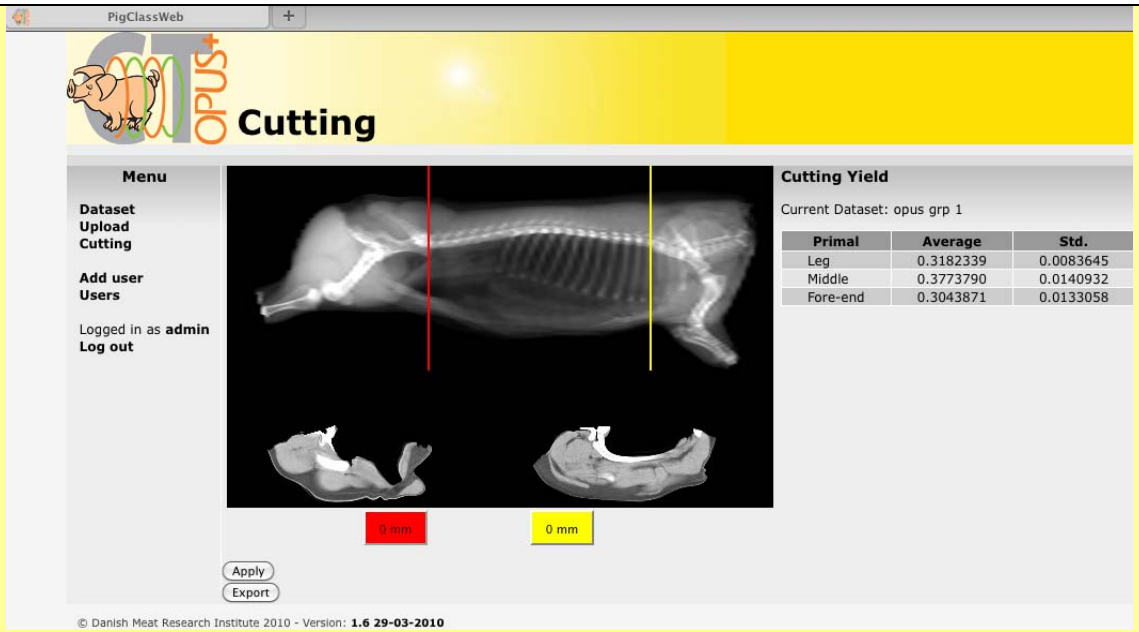
Extracted 3D-surface of skeleton



Statistical model of the pelvic bone made from a population of scans. Measurements can be done in the model, reflecting the variation in the population

Deformalyze is a young and dynamic company, based on 6 years of scientific work at phd-level at DTU Informatics, Technical University of Denmark, in collaboration with the Danish Meat Research Institute. Through this collaboration Deformalyze has gained invaluable knowledge in handling, analyzing and interpreting CT-data for the slaughterhouse industry in Denmark.

Deformalyze has developed and implemented a complete system coined "PigClassWeb", for handling the large amounts of CT-scans acquired by the DMRI in R&D projects. Through advanced image analysis PigClassWeb enables DMRI and the slaughterhouses to perform virtual cuts in a reference pig. These cuts are automatically propagated to the whole population of pigs that are scanned, in such a way that the virtual cuts are anatomically similar for each carcass, irrespective of size, weight and proportions. The ability to very accurately estimate the weight of arbitrary cuts enables Deformalyze to report the yields of the cuts on the population as a whole, as well as on each scanned carcass. The user can access the application through a simple web-browser, adjust the settings of a specific cut through a view of the scanned reference carcass. For the simpler type of cuts the results are ready within seconds, when applying the cut on the whole population. PigClassWeb is scalable in the sense that future scans automatically are processed and included in the "Population of Virtual Pigs". New types of cuts are currently in the pipeline to be included in PigClassWeb keeping it up-to-date and making it a very flexible tool for DMRI in R&D and for the slaughterhouses in the planning of the production.



Screenshot of the PigClassWeb application for applying virtual cuts and computing yields on a population of scanned pig carcasses

The name Deformalyze is a contraction of “deformable body analysis” which is a core competence of the company. Deformable bodies include objects fully or partly comprised by soft tissue types, e.g. biological tissue. Through a close professional network including both academia and industry, Deformalyze keeps updated with advances in cutting-edge methodologies within its fields of research. This enables fast decision-making on how to solve each new challenge appropriately and efficiently. More information can be found on the company website: www.deformalyze.com


Martin Vester-Christensen and Søren Erbou, founders of Deformalyze

Temadag
"Industriel anvendelse af CT scanning"

Conference on" Application of CT scanning in industry"

8. juni 2010 kl. 9-17
DTU, bygning 101, mødelokale 1

Program

9.00-9.30	**Registrering**	
9.30-9.40	**Velkomst og introduktion** Computed Tomography, CT scanning åbner for revolutionerende muligheder og er derfor af meget stor interesse for producerende virksomheder indenfor forskellige brancher. Det 4-årige innovationskonsortium "Center for industriel anvendelse af CT-scanning – CIA-CT", er et større dansk tiltag indenfor området. I løbet af temadagen går vi i dybden med CT scanning som avanceret måleværktøj for verifikation og kvalitetssikring af produkter.	*Leonardo De Chiffre, DTU*
9.40-10.20	**Industrial application of CT scanning** *1* CT scanning is a new technology allowing for 3D measurements inside an object. Principle of operation, performance, and examples of applications to metrology and product development are briefly reviewed.	*Jean-Pierre Kruth, KU Leuven, Belgien*
10.20-10.50	**Pause**	
10.50-11.10	**Metrotomography®- metrology in a new dimension** *2* Computed Tomography has completely arrived in the industry. It is represented worldwide in big tradeshows and offers solutions for various applications in the consumer-, automotive or medical industry. For reduction of R&D times, for faster first part inspection reports or for shorter reaction times on failure analyses: Metrotomography® plays an important role in many serious decisions in the daily industrial life. Plastics manufacturers have changed their testing- and manufacturing processes due to the possibilities of this promising technology.	*Hubert Lettenbauer Carl Zeiss, Tyskland*
11.10-11.30	**CT scanning af industrielle komponenter** *3* I indlægget diskuteres udfordringen ved at verificere industrielle komponenter ved CT-scanning kontra verifikation med traditionelle målemetoder. CT scannings anvendelse til at kalibrere målestrategi på konventionelle målesystemer præsenteres.	*Kim Mortensen, 3D-CT A/S*
11.30-11.50	**CT scanning in medical device development** *4* Præsentationen omtaler Novos overvejelser med anskaffelse og erfaringer med brug af en CT scanner til anvendelse i forbindelse med produktudvikling og kvalitetssikring.	*Jan Andreasen, Novo Nordisk A/S*
11.50-12.10	**Toleranceverifikation ved anvendelse af CT scanning** *5* CT scanning skaber overblik over sammenspil imellem monterede og skjulte elementer, samt muliggør analyse på materiale, indeslutninger og støbefejl. I indlægget beskrives forskellige cases, hvor Zebicon har brugt CT scanning til kvalitetskontrol og produktanalyse, med speciel fokus på toleranceverifikation.	*Kasper Fedde Krogh, Zebicon A/S*
12.10-13.20	**Frokost**	

Program (fortsat)

13.20-13.40 **Traceability of measurements from CT scanning**

6 CT scanning allows for complex 3D measurements inside an object but is connected with traceability problems. State-of-the-art calibration artefacts and verification standards to ensure the traceability of CT scan measurements are presented.

Simone Carmignato, Padova Universitet, Italien

13.40-14.00 **Miniature replica step gauge for optical and CT scanners**

7 A 40 mm miniature step gauge was produced in a replica material. The artefact was calibrated using a tactile coordinate measuring machine and measured using optical and CT scanning. The stability over time of the step gauge was evaluated over a period of eight months.

Angela Cantatore, DTU Mekanik

14.00-14.20 **"CT Audit" inter-laboratory comparison on CT systems for dimensional metrology**

8 "CT Audit" is the first international comparison on Computed Tomography systems for dimensional metrology, organized by the University of Padova and involving important Institutions and companies in Europe, America and Asia. The presentation focuses on motivations, objectives and first results.

Simone Carmignato, Padova Universitet, Italien

14.20-14.50 **Pause**

14.50-15.10 **X-ray imaging at high speed: opportunities and limitations using low-energy X-ray imaging**

9 This presentation focuses on the basic idea of using low energy X-rays. Specific examples on the usage of on-line X-ray imaging systems for food and natural materials inspection address the challenges of image acquisition, processing and quantification, for ensuring 24/7 performance.

Jørgen Rheinlænder, InnospeXion ApS

15.10-15.30 **CT scanning for on-line quality control in meat production**

10 An optimized workflow for CT scanning of pig carcasses is presented, including real time validation of images, automated tissue assessment and virtual cutting into primals.

Lars Bager Christensen DMRI

15.30-15.50 **Image analysis and modeling in industrial CT**

11 CT-scanning calls for advanced mathematical and statistical tools for automatically extracting and comparing the information of interest. Examples from the meat industry are given, ranging from weight models and virtual cutting of pig carcasses to statistical modeling of bone shape.

Søren Erbou, Deformalyze ApS

15.50-16.10 **Pause**

16.10-16.30 **CT scanning with new contrast mechanisms**

12 The talk will show the perspectives of using phase contrast and dark field imaging for new ways of performing CT-scanning. These techniques enable higher contrast in tissue and give also new opportunities for microstructural imaging.

Robert Krarup Feidenhans'l, NBI

16.30-16.50 **CT scanning using synchrotron sources**

13 Synchrotrons provide an alternative to laboratory CT systems, allowing for fast measurements with high signal to noise ratios. Examples ranging from industrial R&D applications to more fundamental materials science applications will be presented.

Erik M. Lauridsen, Risø DTU M4D

16.50-17.00 **Afrunding af temadagen og afslutning**

TILMELDING

den 14. temadag:

"Industriel anvendelse af CT scanning"

Conference on" Application of CT scanning in industry"

Tirsdag den 8. juni 2010

Bygning 101, mødelokale 1
Danmarks Tekniske Universitet (DTU)
2800 Kgs. Lyngby

Tilmelding til temadagen senest tirsdag d. 1. juni 2010 på følgende link:

https://conferences.dtu.dk/conferenceDisplay.py?confId=58

Gebyr for deltagelse: DKK 1850 - EUR 250

Gebyret omfatter konferencemateriale samt fortæring. Gebyret er momsfrit.

Yderligere oplysninger:

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Invitation

Den Danske Brugergruppe indenfor Koordinatmåling i samarbejde med innovationskonsortiet ”Center for industriel anvendelse af CT-scanning – CIA-CT”, indbyder til

den 14. temadag:

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Du og dine kolleger indbydes hermed til en ualmindelig spændende temadag. Temadagen er den 14. i en serie af konferencer vedrørende koordinatmåling og geometrisk metrologi, og til dette arrangement har vi sammensat et særligt hold med meget inspirerende foredragsholdere fra Danmark og udlandet.

Temaet er denne gang CT scanning, der er ved at revolutionere den måde, hvorpå man kan foretage industrielle målinger og kvalitetssikring. Med CT scanning får industrivirksomheder mulighed for at se inde i produkterne i forbindelse med udvikling og produktion. Den 1. september 2009 startede det 4-årige innovationskonsortium ”Center for industriel anvendelse af CT-scanning – CIA-CT” som et større, samlet dansk tiltag indenfor området. Oplysninger om konsortiet, der støttes af Rådet for Teknologi og Innovation, kan fås på hjemmesiden: www.cia-ct.mek.dtu.dk.

Temadagen vil give dig en indføring i anvendelse af CT scanning til måling, kvalitetssikring og produktudvikling i fremstillingsindustrien. Programmet omfatter det sidste nye fra udlandet samt konkrete erfaringer fra brugere af CT scanning hos danske industrivirksomheder.

Vi har opbygget denne helt specielle temadag med hele 13 indlæg, hvoraf de fleste holdes på engelsk. Indlæggene er korte og overskuelige, og temadagen fremstår som et intensivt og indholdsrigt kursus om den industrielle anvendelse af CT scanning.

Vi glæder os til at se dig!

www.dtu.dk **www.cgm.dk**
www.ipu.dk

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NR2 – MAY 2010

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Deformalyze

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