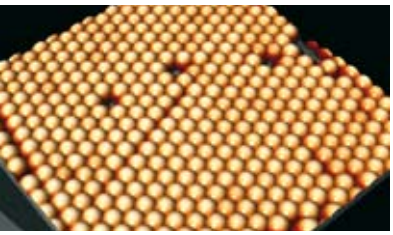
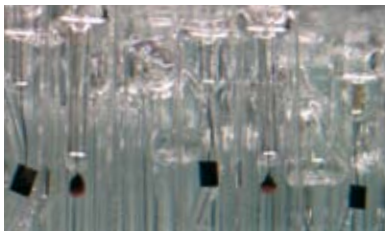
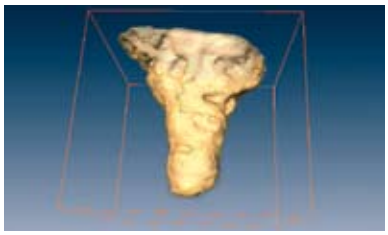
ANNUAL REPORT AND STATEMENT OF INCOME FOR 2007

DANISH FUNDAMENTAL METROLOGY LTD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Scientific research carried out at DFM provides Danish measurement techniques with an international reputation ensuring that Denmark is regarded as a knowledge based and quality conscious country. In addition, the research results in national primary standards are used as the basis for calibrating customers measuring equipment. The established knowledge is the basis for teaching and consultancy. DFM takes part in the educating of industrial researchers. Through research, DFM participates in the global production and sharing of knowledge and disseminate this knowledge to Danish consumers.

DFM focuses on research and primary standards that benefit small and intermediate companies, as they must meet the growing demands to specify their products in detail. DFM makes a strong effort in passing on information from foreign metrology institutes to Danish companies.

Edited by
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March 2008

TABLE OF CONTENTS

MANAGEMENT REPORT 2007

In several respects, 2007 marks a turning point for DFM and Danish metrology as a whole. Firstly, an increased political attention manifested itself as the two ministries involved, The Ministry of Science, Technology and Innovation and The Ministry of Economic and Business Affairs, formed a coordination group for metrology and further, a Metrology Committee was established as a consulting body for the two ministries. Both initiatives are results of several years of work to formulate a comprehensive national strategy for metrology.

Specifically, the new political focus resulted in a three-year grant from the Danish Council for Technology and Innovation in the amount of 7.5 million DKK to strengthen the Danish metrology and its internationalization; and later in the year followed a grant to support Danish participation in the European Metrology Research Programme.

In 2007, DFM started a new three-year strategy period with increased focus on its four primary areas of competence: Electricity, Optics, Nano, and Mathematics. During the three-year period, DFM will apply these competences to international research as well as to metrology services for Danish users, assisting them in using metrology for further innovation. DFM will continue its engagement in building metrology infrastructures within Europe and neighboring countries.

Seven highlights are summarized on pages 6-12. Five cases deal with novel metrology that DFM has developed in collaboration with other knowledge institutions, whereas two cases describes DFM's knowledge dissemination and organizational work.

The turnover and profit of the year was 16,8 and 0,2 million DKK, respectively. This is considered satisfactory; in particular in the view of the above-mentioned research funding will only be released in 2008. Commercial turnover, none-the-less from calibrations, showed significant increase.

In the coming year, DFM will continue working for the positioning of metrology in the Danish research and innovation landscape in accordance with the Danish national metrology strategy from 2005.

Wish you an enjoyable reading.

Steen Konradsen
Chairman of the Board

Kim Carneiro
Director

LEDELSENS BERETNING 2007

Året 2007 markerer på flere punkter et vendepunkt for DFM og dansk metrologi som helhed. Først og fremmest udmøntede en øget politisk opmærksomhed sig i, at de to berørte ministerier Økonomi- og Erhvervsministeriet samt Ministeriet for Videnskab, Teknologi og Udvikling nedsatte et koordineringsudvalg for metrologi; og et metrologiudvalg blev ligeledes nedsat med det formål at rådgive de to ministerier i metrologianliggender. Begge initiativer er et resultat af det flerårige arbejde med at formulere en samlet national strategi.

Som konkrete resultater af den fornyede fokus på metrologi bevilligede Rådet for Teknologi og Innovation i begyndelsen af året 7,5 millioner kr. til over tre år at styrke dansk metrologis internationalisering og organisation; og senere på året fulgte en årlig bevilling på 2,2 millioner kr. til støtte for den danske deltagelse i det nye europæiske program for metrologiforskning.

DFM tog i året hul på en ny treårig strategiperiode, med øget fokus på de fire primære kompetenceområder: Elektricitet, Optik, Nano og Matematik. DFM vil i perioden tydeliggøre sine kompetencer i international forskning og i metrologiske serviceydelser for danske brugere for at udnytte metrologiens innovative effekter. Desuden vil DFM forsætte sit engagement i opbygning af metrologisk infrastruktur i EU og tilgrænsende områder.

Syv af årets højdepunkter er sammenfattet på siderne side 6-12. Fem historier drejer sig om tekniske nyskabelser, der er udviklet ved DFM i samarbejde med andre videninstitutioner, mens to historier handler om DFM's videnspredning og organisatoriske arbejde.

Årets omsætning og resultat blev på henholdsvis 16,8 og 0,2 millioner kr., hvilket betragtes som tilfredsstillende, navnlig i betragtning af, at en del af de ovennævnte forskningsmidler først kommer til udbetaling i 2008. Kommercielle indtægter, ikke mindst kalibrering, steg væsentligt i forhold til foregående år.

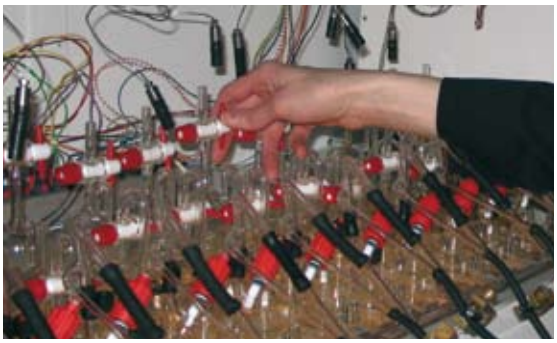
DFM vil i det kommende år fortsætte med at positionere metrologien i det danske forsknings- og innovationslandskab i overensstemmelse med den nationale strategi fra 2005.

God læselyst!

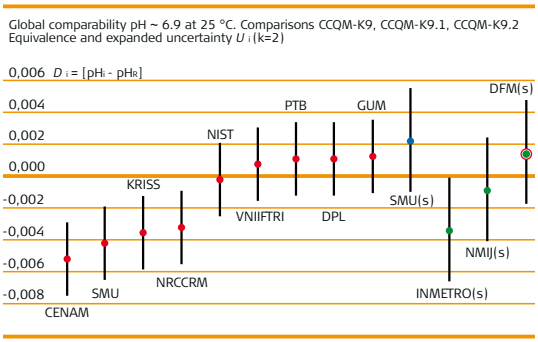
Steen Konradsen
Bestyrelsesformand

Kim Carneiro
Direktør

PRIMARY LABORATORY FOR pH MEASUREMENTS IMPLEMENTED AT DFM



DFM's primary setup for pH measurements



The results of the international comparisons of primary pH measurements at pH ~ 6.9. The main comparison (results in red) and two subsequent comparisons (blue and green) have been combined and show the difference with uncertainty to the international consensus value. DFMs result is at the far right.

DFM has during 2007 implemented a primary laboratory for pH measurements that was transferred from Radiometer Medical A/S in 2006. The performance of the facility has been demonstrated by participation in an international key comparison.

pH and pH measurements

Many chemical and biological processes depend critically on the pH-value at the local site. Every day millions of pH measurements are performed around the world. Take a look at all the bottles you have at home in your bathroom, cleaning cupboard and kitchen, most likely several of them will have the pH-value of the contents stated on the label.

All those millions of pH measurements could not be done, unless someone did primary pH measurements.

What is a pH-value and why is it so important? pH is a measure of the acidity or basicity of a liquid and is determined by the concentration of hydrogen ions, H+, that is available for chemical reactions.

Establishing pH measurements at the primary level is a very complicated process involving several days of preparations before the actual measurements can be made. This process results in a solution, which is called a primary buffer, with a very accurately determined pH value. The primary buffer is rather unstable and difficult to use for practical purposes. Therefore, it is used to determine the pH of other buffers that are more stable but less accurate. Such buffers are used to calibrate the systems that are used for all those millions of pH measurements.

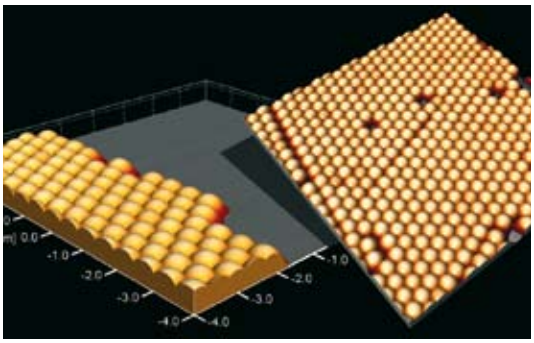
International comparisons

Capabilities at the primary levels are usually documented by participation in international comparisons. In the case of pH measurements, DFM has participated in a comparison of measurements of a solution of a phosphate buffer with 6 other institutes. The result of the comparison is shown in the figure. This clearly demonstrates that measurements performed at DFM compare well with those of other countries.

DFM'S PRIMARY PH SET-UP

The primary pH scale covers the range from 3.5 to 10. DFM can provide five of the seven primary buffers, namely those with pH between 4 and 10.

NANOPARTICLES



The nanoparticles are lying on an atomically flat substrate where they form a monolayer with the typical hexagonally ordered lattice structure. Notable details are typical lattice defects such as holes or misalignments of lines.

Danish industry has recently expressed considerable interest in a facility for the characterisation of nanoparticles. DFM has initiated measurements that determine the size of nanoparticles, one of the many parameters of interest. The diameters of reference particles are measured with nanometer accuracy using DFM's Atomic Force Microscope (AFM) facility.

Nanoparticles, beneficial and problematic

Nanoparticles are increasingly being used in new products. Imagine windows that do not require cleaning, car windshields where rain droplets fall off immediately, floors that do not bind dirt and mud, roof tiles that permanently stay clean and furniture that is resistant to liquids and dirt. This is all realized by applying a thin cover of nanoparticles. The application of nanoparticles in the medical world is increasing, for example in connection with cancer diagnostics.

In clean room production facilities, on the other hand, nanoparticles are not wanted. They interfere with the production process and can even destroy manufactured goods. Particle counters are used for monitoring such facilities, securing the quality requirements. Nanoparticles can be toxic and should be monitored in certain environments.

The characterisation of nanoparticles is important for product specification and for ensuring that particle counters measure correctly.

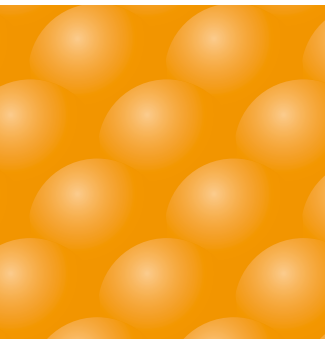
Typical nanoparticles used for coating are between 50 - 100 nanometer (1 nanometer = 1 nm = 0,000000001). For comparison, a human hair is approximately 50-micrometer thick, or 50000 nm. Nanoparticles exist in many forms and materials.

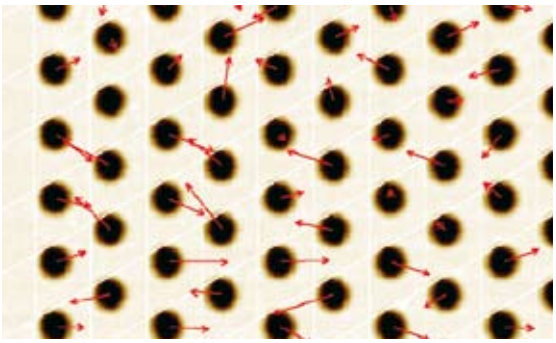
Dimensional measurement of nanoparticles with an Atomic Force Microscope

As a first step in the measurement of nanoparticles, DFM has embarked on the measurement of diameters of polymer nanoparticles. These reference particles are used to calibrate particle counters in industry to ensure traceable measurements in the industrial environment. DFM calibrates the reference particles using an Atomic Force Microscope. Since the reference particles are spherical and adhered to an atomically flat substrate, the diameter of the particles can easily be determined by measuring their maximum height relative to the surface of substrate.

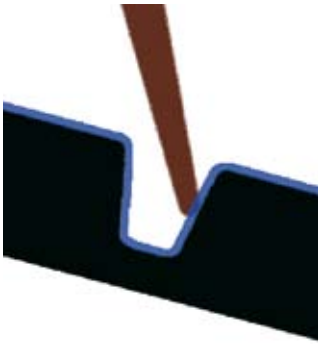
ATOMIC FORCE MICROSCOPE, AFM

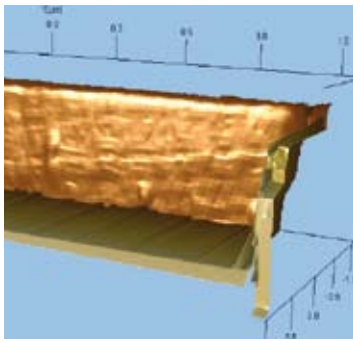
Images from AFM's are created line by line, as a very sharp tip is scanned over the specimen. A computer records the height of the tip while it is tracing the surface topography. DFM's metrological AFM is equipped with distance sensors that permit geometrical measurements in three dimensions with nanometer accuracy.





The arrows give the amplified position errors of the holes relative to a perfect position in the photonic structured material. The position error is on average of 2nm. (Image: Mikael Svalgaard, DTU Fotonik)





The sidewall roughness in photonic crystals structures can be measured accurately by tilting the sample relative to the probing tip (left figure). Right is an image of a sidewall with average roughness about 5 nm. (Image: Mikael Svalgaard, DTU Fotonik)

DFM and DTU Fotonik have in collaboration developed advanced and very accurate methods to measure imperfections on the nanometer scale. Imperfections of tiny "chips" designed to guide light can have adverse effect on their performance.

The need for fast and cheap data transmission continuously grows and creates a demand for a better way of transmitting information. As the information consist of light pulses, it is important to develop and characterize the chip structures in order to keep information losses at a minimum. Photonic crystals are periodic optical (nano)structures designed to guide the propagation of light. DTU Fotonik manufactures such twodimensional periodic structures. Future applications are expected within optical telecommunication.

Major challenges for photonic crystals

A major challenge is to fabricate periodic structures that are sufficiently regular to keep light scattering losses at a minimum. In particular, the deviation of the structures (holes) from their correct position and the roughness of the surface limit the performance severely.

A photonic crystal structure designed with a hole separation of 270 nm and a hole depth of 150 nm was fabricated in gallium arsenide using the state-of-the-art electronbeam facility at DTU Danchip. The structure was examined in detail and the maximum hole position error was found to be 4 nm (see figure). Another challenge is the determination of the sidewall roughness, which also affects the light propagation. Since the sidewalls of the narrow holes are difficult to measure, the roughness is at first estimated from a larger structure of the same material and same production method (see figure).

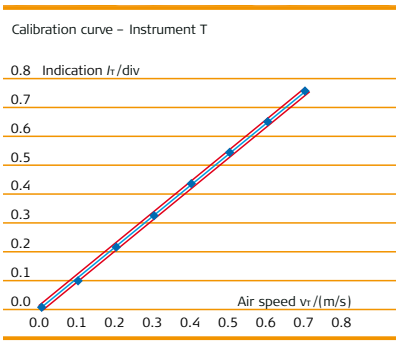
DFM is offering the developed service to customers

To understand and ultimately correct for imperfections and to optimise performance, DFM and DTU Fotonik use the metrological atomic force microscope (AFM) at DFM in connection with image analysis tailored to the application. The performed measurements of the hole positions and sidewall roughness on photonic crystals are the most accurate reported to date.

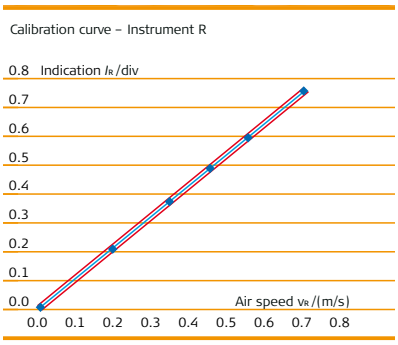
Following the initial measurement developments, DFM's facility has been used to investigate samples for customers.

The atomic force microscope (AFM) is a very high-resolution type of microscope, with demonstrated resolution down to fractions of a nanometer (1 nm = 0,000000001 m), which is more than 100 times better than an ordinary optical microscope. The metrology AFM microscope is situated in a clean room so that samples from other clean rooms can be examined without loss of quality. DFM uses the facility for calibration of standards and measurements on customers' samples.

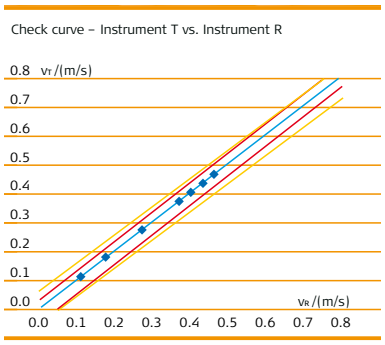
INTERMEDIATE CHECKS OF CALIBRATION STATUS



Calibration curve (blue line) with standard uncertainty (red curves) calculated from calibration results (points with error bars) and used to convert indications I_T of Instrument T into measured air speed values v_T



Calibration curve (blue linie) with standard uncertainty (red curves) calculated from calibration results (points with error bars) and used to convert indications I_R of Instrument R into measured air speed values v_R.



The check curve (blue line), including the expanded uncertainty (red curves), calculated from 7 pairs of measured air speed values (points with error bars) falls within the specified tolerance band (yellow lines) in the range 0.1 m/s to 0.6 m/s. The calibration status of Instrument T is therefore still valid in that range.

DFM and the pharmaceutical company Novo Nordisk A/S have developed a procedure for checking the calibration status of measuring instruments between regular calibrations. The procedure may lead to significantly extended calibration intervals. This is important where the calibration at an external laboratory is time consuming and costly compared to the check carried out in an internal laboratory.

A case study: Air velocity in clean rooms

When testing classified clean rooms the air velocity is measured at various points in the room. Usually the measuring instruments are calibrated at an accredited calibration laboratory before and after each clean room test. However, a more practical and less costly alternative has been formulated: perform check measurements and ensure that these are in compliance with the latest calibration. Then: how can this be done in a metrological sound way?

The developed procedure

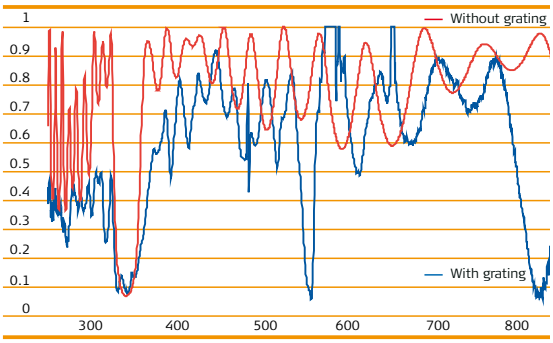
The procedure requires two measurement instruments of the same kind: a reference instrument (R) and a test instrument (T). Both have to be calibrated regularly at an accredited laboratory. From results reported in the most recent certificate, a linear calibration curve is calculated for each instrument using DFM-LSQ Analyzer©, a versatile Excel Add-In based on the method of least squares (see box).

The calibration curves are used to convert indications of the two instruments into measured quantity values and associated measurement uncertainties in a comparison, where a suitable generator (in the case study: a flow bench with adjustable flow) produces a number of quantity values (air speed values) measured by both instruments.

From these quantity values, a linear check curve describing the relationship between the quantities measured with the two instruments is calculated using DFM-LSQ Analyzer©. If the check curve, including the expanded uncertainty associated with that curve, falls within a specified tolerance band, the test instrument has passed the test.

DFM-LSQ Analyzer© is an Excel Add-in for the evaluation of measurements based on the methods of least squares. This analysis tool enables the user to adjust measured and unmeasured quantity values, so that they fulfil the specified physical constraints between these quantities. All calculations are consistent with the principles laid down in the Guide to the expression of uncertainty in measurement (GUM). No differentiations have to be performed by the user; this is all done numerically by the Add in.

A NEW OPTICAL TECHNIQUE FOR THE INVESTIGATION OF EMBEDDED STRUCTURES



Spectra of a specimen with and without a 40 nm deep embedded grating

The optical diffraction microscope

DFM has developed a technique that allows fast and nondestructive measurements of shapes of nano- and microstructures on top of surfaces or embedded in materials. A detailed knowledge of such structures is a prerequisite for improving functionalities of the samples having the structures.

The measurement of embedded nano- and microstructures in optical components

Today's measurements of embedded structures are usually performed using methods based on the application of electrons. These techniques are both timeconsuming and destructive, i.e. the samples cannot be used afterwards. If applicable, optical methods, based on photons, have the potential of being faster, cheaper and non-destructive.

At DFM, an optical diffraction microscope (ODM) is used for characterising nano- and microstructures. Results that demonstrate the sensitivity of the technique are shown in the figure. An ODM is a microscope that is used for measuring nanostructures from light diffraction of the specimen. Measurements have to be followed by mathematical modelling.

The results from and the potential of the new measurement technique are so promising that DFM in collaboration with Danish companies and universities have received funding from the Danish Council for Technology and Innovation for the establishment of an innovation consortium titled "Functional embedded nano- and microstructures".

DFM's first instrument

The development of the measurement technique was initially done in collaboration with a startup company, LuKa OptoScope. In this collaboration, DFM was responsible for the reference measurements while LuKa OptoScope was developing the ODM instrument. DFM took over LuKa OptoScope including their patents and other rights. Recently DFM was awarded the patent rights in the USA of the invention. A picture of the first instrument is shown in the figure.

Nano- and microstructures are terms used for small areas that are arranged in a pattern on a surface or embedded in a material. The areas have characteristics that are different from the rest of the surface or material.

DANISH METROLOGY REORGANISES TO MEET NEW CHALLENGES

For the ceremonial photograph of the founding of EURAMET e.V. in Berlin, 11 January 2007.

Left to right: Anneke van Spronssen (Holland), Julie Krener (Denmark), and Fabienne Gautier (EC) discuss progress af iMERA+ in Bratislava, September 2007.

New funding ensures stronger Danish participation in the new EURAMET and the coming European Metrology Research Programme, EMRP. At the same time a new Danish metrology organisation that combines legal and fundamental metrology is on its way.

New funding and political focus

Early 2007 the Danish Council for Technology and Innovation (RTI) provided a three-year funding for improvement of both internationalisation and structure of Danish metrology. This was a turn of the tide in funding for metrology infrastructure. It allows a strengthening of Danish participation in international forums as well as a necessary reorganisation of the decentralised Danish metrology organisation, preparing it for future developments in EURAMET and the EMRP.

Later in the year the Council reserved an annual funding of 0.29 million € for Danish participation in the EMRP. This funding will be used to provide national co-funding to the four successful project applications with Danish participation. DFM participates in three of these projects.

A new advisory Metrology Committee was formed in 2007 with the mission to coordinate both legal and fundamental metrology and give advice to both the Ministry of Economy and Enterprise and the Ministry for Science, Technology, and Innovation. The two ministries each have complementary responsibilities for metrology in Denmark. The council will provide a political focal point for Danish metrology.

The coming Danish organisation

In order to strengthen the cohesion of Danish metrology a new umbrella organisation DANIAmet will be formed. It will be founded by two existing organisations, CLM (Centre for Legal Metrology) and the current DANIAmet. In the future they will be called DANIAmet-CDFM and DANIAmet-NMI respectively. Reference laboratories for other Ministries than the above mentioned will be invited to join the new DANIAmet, since "their metrology world" and that of EURAMET and the Metre Convention" will increasingly overlap.

The new DANIAmet will be the hub for Danish metrology operators and provide a common voice towards the political system.

DANIAMET, EURAMET AND iMERA+

DANIAmet is an association of Danish metrology institutes.

EURAMET, the European Association of National Metrology Institutes is a Regional Metrology Organisation of Europe.

iMERA+ is a European Commission "ERANET" Coordinating Action. The consortium has 20 partners from 14 countries (plus JRC-IRMM), including 5 Ministries as formal partners. The project period is 1st April 2005 – 31 March 2008.

"METROLOGY – IN SHORT" NOW AVAILABLE IN 16 EDITIONS

In ten years, 16 editions of "Metrology –in Short has been published, covering three international editions, one regional edition and twelve national editions.

The MEDA countries include: Algeria, Cyprus, Egypt, Jordan, Israel, Lebanon, Malta, Morocco, Palestinian Authority, Syria, Tunisia and Turkey.

In 1998, DFM produced a booklet titled "Metrologi – kort og godt" ("Metrology in Short"). This booklet has become so popular that it now is available in 15 other editions and in 11 languages. This underlines a successful Danish way of disseminating metrological knowledge.

Metrology – in short

"Metrology – in short" is a handbook covering selected areas of national metrological issues: structure and function of metrology, SI units, organisation and a vocabulary. It is written as a short, easy to read text with links providing the interested reader with references.

DFM has experienced that in Denmark there is a genuine interest in metrology – if presented and disseminated in the right way. This has also proven to be the case in other countries.

METROLOGY

Metrology originates from the Greek word "metron" = measurement and is the science of measurement and its application. Metrology is divided into three categories:

1. Scientific metrology deals with the organisation and development of measurement standards and with their maintenance (highest level).
2. Industrial metrology has to ensure the adequate functioning of measurement instruments used in industry as well as in production and testing processes.
3. Legal metrology is concerned with measurements where these influence the transparency of economic transactions, health and safety.

For most people "Metrology – in short" provides easy understandable information about metrology at the international, regional and national level.

The original Danish version was published in 1998, financed by the Danish Authority of Business promotion. During the following eight years national editions of "Metrology – in short" followed from Finland in the North to the MEDA countries (see figure) in the South, from Portugal in the West to Japan in the East.

In 2007, a Lebanese ABC-guide on Metrology in English and Arab, and a regional MEDA version published in English and French appeared. In early 2008 the 3rd edition of "Metrology – in short" will be published.

Dissemination of metrology

Metrology creates an added value to goods via accurate product specifications. Therefore, dissemination of metrology as a value creator is an important aspect. There are two essential characteristics:

Metrology is often taken for granted although it covers a depth of knowledge familiar only to a few. Yet most of us make daily use of it – confident that we are sharing a common perception of what is meant by expressions such as metre, kilogram, litre, watt, etc.

Metrology is interdisciplinary – it is indispensable for fields like GPS, food safety, heat production and scientific research.

Ledelsespåtegning
Bestyrelse og direktion har dags dato behandlet og godkendt årsrapporten for 2007 for Dansk Fundamental Metrologi A/S.

Årsrapporten er aflagt i overensstemmelse med Årsregnskabsloven.

Vi anser den valgte regnskabspraksis for hensigtsmæssig, således at årsrapporten giver et retvisende billede af Dansk Fundamental Metrologi A/S' aktiver, passiver og finansielle stilling pr. 31. december 2007 samt af resultatet af selskabets aktiviteter og pengestrømme for regnskabsåret 1. januar – 31. december 2007.

Kgs. Lyngby, den 12. marts 2008

Direktion

Kim Carneiro
Direktør

Bestyrelse

Lars Barkler

Knut Conradsen
Næstformand

Kai Dirscherl
Medarbejderrepræsentant

Steen Konradsen
Formand

Jan Conrad Petersen
Medarbejderrepræsentant

Søren Stjernqvist

Ernst Tiedeman

REVISIONSPÅTEGNING

DEN UAFHÆNGIGE REVISORS PÅTEGNING

Til aktionæren i Dansk Fundamental Metrologi A/S
Vi har revideret årsrapporten for Dansk Fundamental Metrologi A/S for regnskabsåret 1. januar til 31. december 2007, omfattende ledelsesberetning, ledelsespåtegning, anvendt regnskabspraksis, resultatopgørelse, balance, pengestrømsopgørelse og noter, siderne 5 og 13-19. Vor revision har ikke omfattet siderne 6-12 samt 20-30. Årsrapporten aflægges efter Årsregnskabsloven.

Ledelsens ansvar for årsrapporten
Ledelsen har ansvaret for at udarbejde og aflægge en årsrapport, der giver et retvisende billede i overensstemmelse med Årsregnskabsloven. Dette ansvar omfatter udformning, implementering og opretholdelse af interne kontroller, der er relevante for at udarbejde og aflægge en årsrapport, der giver et retvisende billede uden væsentlig fejlinformation, uanset om fejlinformationen skyldes besvigelser eller fejl samt valg og anvendelse af en hensigtsmæssig regnskabspraksis og udøvelse af regnskabsmæssige skøn, som er rimelige efter omstændighederne.

Revisors ansvar og den udførte revision
Vores ansvar er at udtrykke en konklusion om årsrapporten på grundlag af vores revision. Vi har udført vores revision i overensstemmelse med danske revisionsstandarder og god offentlig revisionsskik jf. revisionsinstruks for revisor ved Godkendte Teknologiske Serviceinstitutter (GTS). Disse standarder kræver, at vi lever op til etiske krav samt planlægger og udfører revisionen med henblik på at opnå høj grad af sikkerhed, for at årsrapporten ikke indeholder væsentlig fejlinformation.

En revision omfatter handlinger for at opnå revisionsbevis for de beløb og oplysninger, der er anført i årsrapporten. De valgte handlinger afhænger af revisors vurdering, herunder vurderingen af risikoen for væsentlig fejlinformation i årsrapporten, uanset om fejlinformationen skyldes besvigelser eller fejl. Ved risikovurderingen overvejer revisor interne kontroller, der er relevante for selskabets udarbejdelse og aflæggelse af en årsrapport, der giver et retvisende billede, med henblik på at udforme revisionshandlinger, der er passende efter omstændighederne, men ikke med det formål at udtrykke en konklusion om effektiviteten af selskabets interne kontrol. En revision omfatter endvidere stillingtagen til, om den af ledelsen anvendte regnskabspraksis er passende, om de af ledelsen udøvede regnskabsmæssige skøn er rimelige samt en vurdering af den samlede præsentation af årsrapporten.

Det er vores opfattelse, at det opnåede revisionsbevis er tilstrækkeligt og egnet som grundlag for vores konklusion.

Revisionen har ikke givet anledning til forbehold.

Konklusion
Det er vores opfattelse, at årsrapporten giver et retvisende billede af selskabets aktiver, passiver og finansielle stilling pr. 31. december 2007 samt af resultatet af selskabets aktiviteter og pengestrømme for regnskabsperioden 1. januar til 31. december 2007 i overensstemmelse med Årsregnskabsloven.

København, den 12. marts 2008
KPMG C. Jespersen, Statsautoriseret Revisionsinteressentskab

Peter Gath, statsautoriseret revisor

ANVENDT REGNSKABSPRAKSIS

Generelt
Årsrapporten for Dansk Fundamental Metrologi A/S (DFM) for 2007 er aflagt i overensstemmelse med Årsregnskabslovens bestemmelser for klasse B-virksomheder. Herudover har selskabet frivilligt tilvalgt følgende regler for klasse C-virksomheder:

+ Aflæggelse af ledelsesberetning.
+ Udarbejdelse af pengestrømsopgørelse.

Årsregnskabet er aflagt efter samme regnskabspraksis som sidste år. Regnskabet er baseret på instituttets bogføring, men tallene er angivet i tusinde af kroner. Der kan derfor forekomme tilsyneladende afrundingsfejl ved sammentællingerne.

Omregning af fremmed valuta
Transaktioner i fremmed valuta omregnes til transaktionsdagens kurs. Valutadifferencer, der opstår mellem transaktionsdagens kurs og kursen på betalingsdagen, indregnes i resultatopgørelsen som en finansiel post. Tilgodehavender, gæld og andre monetære poster i fremmed valuta omregnes til balancedagens valutakurs. Forskellen mellem balancedagens kurs og kursen på tidspunktet for tilgodehavendets eller gældens opståen indregnes i resultatopgørelsen under finansielle indtægter og omkostninger.

RESULTATOPGØRELSEN

Indtægter
Indtægter fra forskningskontrakter indregnes i takt med at arbejdet udføres, hvorved nettoomsætningen svarer til salgsværdien af årets udførte arbejder (produktionsmetoden). Nettoomsætningen indregnes, når de samlede indtægter og omkostninger på forskningskontrakten og færdiggørelsesgraden på balancedagen kan opgøres pålideligt, og det er sandsynligt, at de økonomiske fordele, herunder betalinger, vil tilgå selskabet. I projekter, hvor DFM er tilskudsmodtager på vegne af et konsortium, indregnes tilskudsbeløbet som omsætning, i det omfang DFM på vegne af konsortiet er økonomisk ansvarlig over for tilskudsgiver; partneres omkostninger fradrages i udlæg. I projekter hvor DFM ikke er ansvarlig for partneres ydelser indregnes kun den forholdsmæssige andel af kontraktsummen, som direkte tilfalder DFM, i omsætningen. Indtægter fra resultatkontraktaktiviteter indtægtsføres i det år tilskuddene modtages, som er sammenfaldende med den tilladte anvendelsesperiode.

Skat af årets resultat
Årets skat, som består af årets aktuelle skat og forskydning i udskudt skat, indregnes i resultatopgørelsen med den del, der kan henføres til årets resultat, og direkte i egenkapitalen med den del, der kan henføres til bevægelser direkte i egenkapitalen.

BALANCEN

Materielle anlægsaktiver
Materielle anlægsaktiver måles til kostpris med fradrag af akkumulerede afskrivninger. Afskrivningsgrundlaget er kostpris med fradrag af forventet restværdi efter afsluttet brugstid. Kostprisen omfatter anskaffelsesprisen samt omkostninger direkte tilknyttet anskaffelsen indtil det tidspunkt, hvor aktivet er klar til brug.

Udstyr og inventar afskrives lineært over 3-7 år til en restværdi på 0-20% af anskaffelsesprisen. I anskaffelsesåret afskrives for et helt år uanset anskaffelsestidspunktet.

Indretning af lejede lokaler afskrives lineært baseret på aktivernes forventede brugstid, der regnes som 15 år fra 2002.

Udstyr og inventar overdraget 1. januar 2006 fra den selvejende institution Dansk Institut for Fundamental Metrologi afskrives med en særlig afskrivningsprofil over 6 år til en restværdi på 20%.

Anskaffelser med en anskaffelsessum på under 20 000 kr., udstyr anskaffet for offentlige tilskudsmidler samt mindre kontorinventar indregnes i resultatopgørelsen i anskaffelsesåret. Fortjeneste eller tab ved afhændelse af materielle anlægsaktiver opgøres som forskellen mellem salgspris med fradrag af salgsomkostninger og den regnskabsmæssige værdi på salgstidspunktet. Fortjeneste eller tab indregnes i resultatopgørelsen under afskrivninger.

Igangværende arbejder
Igangværende arbejder for fremmed regning måles til salgsværdien af det udførte arbejde omfattende medgået tid samt afholdte udlæg. Salgsværdien måles på baggrund af færdiggørelsesgraden på balancedagen og de samlede forventede indtægter på det enkelte igangværende arbejde.

Når salgsværdien på en forskningskontrakt ikke kan opgøres pålideligt, måles salgsværdien til de medgåede omkostninger eller nettorealisationsværdien, såfremt denne er lavere. Det enkelte igangværende arbejde indregnes i balancen under tilgodehavender eller gældsforpligtelser afhængig af nettoværdien af salgssummen med fradrag af àconto faktureringer og forudbetalinger. Omkostninger i forbindelse med salgsarbejde og opnåelse af kontrakter indregnes i resultatopgørelsen i takt med, at de afholdes.

Tilgodehavender
Tilgodehavender måles til amortiseret kostpris. Der nedskrives til imødegåelse af forventede tab efter en individuel vurdering af tilgodehavender.

Selskabsskat og udskudt skat
Aktuelle skatteforpligtelser og tilgodehavende aktuel skat indregnes i balancen som beregnet af årets skattepligtige indkomst, reguleret for skat af tidligere års skattepligtige indkomster samt for betalte àcontoskatter. Udskudt skat måles efter den balanceorienterede gældsmetode af alle midlertidige forskelle mellem regnskabsmæssige og skattemæssig værdi af aktiver og forpligtelser. Udskudte skatteaktiver, herunder skatteværdien af fremførselsberettigede skattemæssige underskud, måles til den værdi, hvortil de forventes at kunne realiseres, enten ved udligning i skat af fremtidig indtjening eller ved modregning i udskudte skatteforpligtelser inden for samme juridiske skatteenhed. Eventuelle udskudte nettoaktiver måles til nettorealisationsværdi.

Udskudt skat måles på grundlag af de skatteregler og skattesatser, der med balancedagens lovgivning vil være gældende, når den udskudte skat forventes udløst som aktuel skat. Ændring i udskudt skat som følge af ændringer i skattesatser indregnes i resultatopgørelsen.

Pengestrømsopgørelse
Pengestrømsopgørelsen viser selskabets pengestrømme fordelt på drifts-, investerings- og finansieringsaktivitet for året, årets forskydning i likvider samt selskabets likvider ved årets begyndelse og slutning.

RESULTATOPGØRELSE OG BALANCE

RESULTATOPGØRELSE (tkr.)

Noter		2007	2006
	Kundeomsætning	3 863	2 817
	Projektomsætning	2 521	4 573
	Resultatkontrakt	10 415	9 300
	Nettoomsætning i alt	**16 799**	**16 690**
	Projektpartnere	0	123
	Rejseomkostninger	556	446
	Andre udlæg	1 205	1 262
	Udlæg i alt	**1 761**	**1 831**
1	**Bruttoresultat**	**15 039**	**14 860**
2	Personaleomkostninger	10 808	10 416
	Andre eksterne omkostninger	2 968	2 916
	Omkostninger i alt	**13 776**	**13 332**
	Resultat før afskrivninger	**1 263**	**1 528**
3	Af- og nedskrivninger af materielle anlægsaktiver	1 299	1 286
	Af- og nedskrivninger i øvrigt	0	3 284
	Resultat før finansielle poster	**(36)**	**(3 042)**
	Finansielle indtægter	203	99
	Finansielle omkostninger	1	
	Resultat før skat	**166**	**(2 943)**
	Skat af årets resultat	0	0
	Årets resultat	**166**	**(2 943)**
	Årets resultat overføres til næste år.		

BALANCE PR. 31 DECEMBER (tkr.)

Noter	AKTIVER	2007	2006
	Deposita	373	373
	Finansielle anlægsaktiver i alt	**373**	**373**
	Udstyr og inventar	3 851	3 955
	Indretning af lejede lokaler	2 945	3 247
3	**Materielle anlægsaktiver i alt**	**6 796**	**7 202**
	Anlægsaktiver i alt	**7 169**	**7 576**
4	**Igangværende arbejder for fremmed regning**	**2 389**	**1 970**
	Tilgodehavender fra salg og tjenesteydelser	501	1 142
	Andre tilgodehavender	186	192
	Tilgodehavender i alt	**687**	**1 334**
	Likvide midler	**4 767**	**3 813**
	Omsætningsaktiver i alt	**7 843**	**7 117**
	Aktiver i alt	**15 012**	**14 693**
	PASSIVER	**2007**	**2006**
	Aktiekapital	1 000	1 000
	Overført resultat	11 704	11 538
5	**Egenkapital i alt**	**12 704**	**12 538**
	Forudbetalinger fra kunder og bevillingsgivere	291	161
	Kreditorer og skyldige omkostninger	755	965
	Anden gæld	1 261	1 029
	Kortfristet gæld i alt	**2 308**	**2 154**
	Passiver i alt	**15 012**	**14 693**
6	Eventualforpligtelser		

PENGESTRØMSOPGØRELSE (tkr.)

Noter		2007	2006
	Periodens resultat før renter og afskrivninger	1 263	1 528
	Ændring i igangværende arbejder for fremmed regning	(419)	(65)
	Ændring i tilgodehavender fra salg og tjenesteydelser	641	128
	Ændringer i andre tilgodehavender og periodeafgrænsningsposter	6	130
	Ændring i kortfristede gældsforpligtelser	153	(1 541)
	Pengestrømme fra driften	**1 645**	**179**
3	Køb og salg af materielle anlægsaktiver	(893)	(780)
	Pengestrøm fra investeringsaktivitet	**(893)**	**(780)**
	Renteindtægter og -omkostninger	202	99
	Pengestrøm fra finansieringsaktivitet	**202**	**99**
	Periodens likviditetsforskydning	**954**	**(502)**
	Likvide beholdninger primo	3 813	500
	Overtagne likvider i forbindelse med overtagelse af aktivitet	0	3 815
	Likvide beholdninger ultimo	**4 767**	**3 813**

NOTER

1 **Efterkalkulerede egenfinansierede forsknings- og udviklingsomkostninger er opgjort til 1 064 tkr.**

2 **Personaleomkostninger (tkr.)**

	2007	2006
Nettoomsætning i alt		
Løn og gager	10 634	10 265
Pensioner	0	0
Andre omkostninger til social sikring	121	102
Øvrige personaleomkostninger	52	48
Personaleomkostninger i alt	**10 808**	**10 416**

DFM har i 2007 i gennemsnit beskæftiget 18 medarbejdere opgjort efter antal årsværk. Løn og gager indeholder vederlag til direktionen og bestyrelseshonorar.

3 **Materielle anlægsaktiver (tkr.)**

Anskaffelsessum	**Udstyr og Inventar**	**Indretning af lokaler**	**Arkivalier**	**Software**	**Ialt**
Saldo 2007-01-01	4 891	3 549	760	384	9 584
Tilgang	893	0	0	0	893
Afgang	89	0	0	384	473
Saldo 2007-12-31	5 695	3 549	760	0	10 004
Afskrivninger					
Saldo 2007-01-01	936	302	760	384	2 382
Afskrivninger	997	302	0	0	1 299
Afskrivninger, afhændede aktiver	89	0	0	384	473
Saldo 2007-12-31	1 844	604	760	0	3 208
Bogført værdi	**3 851**	**2 945**	**0**	**0**	**6 796**
Vinding ved køb/salg	0	0	0	0	0
Årets afskrivning i alt	**997**	**302**	**0**	**0**	**1 299**

4 **Igangværende arbejder for fremmed regning (tkr.)**

Offentlige danske institutioner	345
Udenlandske institutioner	2 031
Danske virksomheder	12
Igangværende arbejder i alt	**2 389**

5 **Egenkapital (tkr.)**

	Aktiekapital	**Overført resultat**	**I alt**
Egenkapital 2007-01-01	1 000	11 538	12 538
Årets resultat		166	166
Egenkapital i alt	**1 000**	**11 704**	**12 704**

Der er udstedt 1 000 000 aktier med pålydende værdi på 1 kr.

Ejerforhold
Følgende aktionær ejer hele aktiekapitalen:

Danmarks Tekniske Universitet
Anker Engelundsvej 1
Bygning 101A
2800 Kgs. Lyngby

6 **Eventual forpligtelser**
Selskabet har en lejeforpligtelse vedrørende lejemål med en opsigelsesperiode på op til 12 måneder, svarende til 775 tkr.

Participation in committees and working groups under the Metre Convention and EURAMET

+ Comité International des Poids et Mesures (CIPM) 96th meeting
+ Consultative Committee for Electricity and Magnetism (CCEM)
+ Consultative Committee for Amount of Substance (CCQM)
+ Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV)
+ BIPM Director's Meeting
+ EURAMET Technical Committee for Mass (TC-M)
+ EURAMET Technical Committee for Electricity and Magnetism (TC-EM)
+ EURAMET Technical Committee for Length (TC-L)
+ EURAMET Technical Committee for Photometry and Radiometry (TC-PR)
+ EURAMET Technical Committee for Acoustics, Ultrasound and Vibration (TC-AUV)
+ EURAMET Technical Committee for Time and Frequency (TC-TF)
+ EURAMET Technical Committee for Quality (TC-Q)
+ BIPM Director's ad hoc Advisory Group on Uncertainty
+ Joint Committee on Guides in Metrology – Working Group 1 (GUM)
+ Working Group on Nanometrology under the Consultative Committee for Length (CCL)
+ Working Group on Electrochemistry under the Consultative Committee for Amount of Substance (CCQM)
+ 23rd General Conference on Weights and Measures

Participation in national and international projects

+ Implementation of Metrology in the European Research Area, iMERA, EU
+ State-of-the-art calibration with silicon detectors, Nordic Innovation Center NICE
+ Advanced optical fibre technology: novel concepts and applications, FiberTech, FTP
+ Diffusefield calibration of microphones, Diffusefield, FTP
+ Center for Industrial Nano Optics, CINO
+ Functional Materials with embedded Nano Structures, FINST
+ Training for Metrology, Accreditation and Standardization in Lebanon, EU
+ Market Surveillance in Metrology – Software Applications in Measuring Instruments, Lithuania Twinning Light

Calibration certificates and measurement reports

+ DC electricity	5
+ Electrochemistry	178
+ Mass	11
+ Length	19
+ Optical radiometry	11
+ Nano structures	3
+ Acoustics	1
+ Total	228

Dissertations

+ Lorenzo Carlini, "Shape and wear of Atomic Force Microscope tips", DFM-PhD-001

Refereed publications in international journals

+ Salvador Barrera-Figueroa, Knud Rasmussen, and Finn Jacobsen, "On experimental determination of the free-field correction of laboratory standard microphones at normal incidence", Metrologia 44 (2007) 57-63. DFM-2007-P01

+ Jan Hald, Jan C. Petersen, and Jes Henningsen, "Saturated Optical Absorption by Slow Molecules in Hollow-core Photonic Band-Gap Fibers", Phys. Rev. Let. 98 (2007) 213902. DFM-2007-P02

+ Gaetano Iuculano, Lars Nielsen, Andrea Zanobini, and Gabriella Pellegrini, "The Principle of Maximum Entropy Applied in the Evaluation of the Measurement Uncertainty", IEEE Transactions on Instrumentation and Measurement, 56 (2007) 717-722. DFM-2007-P03

+ Salvador Barrera-Figueroa, Knud Rasmussen, and Finn Jacobsen, "On experimental determination of the random incidence response of microphones", J. Acoust. Soc. Am. 121 (2007) 2628-2636. DFM-2007-P04

+ A. Kühle, J. Garnæs, and K. Dirscherl, "Why perform 3D calibration for a 1D AFM measurement?", Proceedings of the 7th euspen International Conference, Bremen, May 2007, 310-312, ed. E. Thornett, ISBN 10:0-9553082-2-4, ISBN 13: 978-0-9553082-2-2. DFM-2007-P05

+ Carl Georg Frase, Dominic Gnieser, Kai Dirscherl, Egbert Buhr, and Harald Bosse, "A new SEM CD operator verified against Monte Carlo simulations" In: Archie, Chas N. (editor): Metrology, Inspection and Process Control for Microlithography XXI. Bellingham, Wash.: SPIE, 2007 (Proceedings of SPIE: 6518), S. 65184P. – ISBN 978-0-8194-6641-9. DFM-2007-P06

+ Bernd Bodermann, Egbert Buhr, Alexander Diener, Kai Dirscherl, Gerd Ehret, Gerd, Carl Georg Frase, and Matthias Wurm, "Aspects and new developments on edge angle and edge profile metrology at PTB" In: Archie, Chas N. (publisher): Metrology, Inspection, and Process Control for Microlithography XXI. Bellingham, Wash.: SPIE, 2007 (Proceedings of SPIE: 6518) S. 65181X. – ISBN 978-0-8194-6641-9. DFM-2007-P07

+ P.-E. Hansen, N. Agersnap, A. Kühle, J. Garnaes, and J. C. Petersen, "Profile characterization using optical diffraction microscopy (ODM)" Proc. Northern Optics 2006, IEEE, 35-39 (2007), ISBN 14244-0435-5. DFM-2007-P08

Other publications and reports

+ Jan C. Petersen, Lars Nielsen and Anders Kühle, "DFM Årsberetning 2006", DFM-2007-R01

+ Pia Tønnes Jakobsen, Hans D. Jensen, and Peter Hyllested, "DFM measurements in CCQM-K9.2. Measurement of pH in a phosphate buffer solution, pH ~ 6.9", DFM-2007-R02

+ Hans D. Jensen, "DFM measurements in EUROMET 918. Comparison of measurement of conductivity and salinity", DFM-2007-R03

+ Jan Hald, Jes Henningsen and Jan C. Petersen, "Saturated Absorption by Slow Acetylene Molecules in Hollow-Core Photonic Bandgap Fibers", DFM-2007-R04

+ Jan Hald, "Report on repair and calibration of the green TESA laser", DFM-2007-R05

+ Jan Hald, "Sammenligning af DK1 & DK4 primære længdenormaler", DFM-2007-R06

+ Hans D. Jensen, "Final report NICe project 04162 – Primary calibration of electrolytic conductivity for measurement of purity of water", DFM-2007-R07

+ Kim Carneiro, Hans Dalsgaard Jensen, Preben Howarth, and Anders Kühle, "Faglig rapportering til Rådet for Teknologi og Innovation for 2006", DFM-2007-R08

+ Hans D. Jensen, "Primærlaboratorium for elektricitet – Årsrapport 2006", DFM-2007-R09

+ Jørgen Garnæs, "Primærlaboratorium for længde - Årsrapport 2006", DFM-2007-R10

+ Lars Nielsen, "Primærlaboratorium for masse – Årsrapport 2006", DFM-2007-R11

+ Jan C. Petersen, "Primærlaboratorium for radiometri - Årsrapport 2006", DFM-2007-R12

+ Anders Kühle, Kim Carneiro, Leonardo de Chiffre, Hans Nørgaard Hansen, and Kristian Eldam, "Handlingsplan for det metrologiske område, Længde", DFM-2007-R13

+ Preben Howarth, "Mission report Beirut 16 May - 2 June 2006", DFM-2007-R14

+ Lars Nielsen, "Handlingsplan for det metrologiske hovedområde Masse", DFM-2007-R16

+ Kai Dirscherl, "Feasibility study: Geometrical Measurement of Nanoparticles", DFM-2007-R17

+ Kai Dirscherl, "Feasibility study for Novo Nordisk: Geometrical Measurement of Nanoparticles", DFM-2007-R18

+ P.L. Hansen, K.T. Therkildsen, N. Malossi, B.B. Jensen, E.D. van Ooijen, A. Brusch, J.H. Müller, J. Hald and J.W. Thomsen, "Measurement of the $3s3p\,^3P_1$ Lifetime in Magnesium using a MOT", DFM-2007-R19

+ Jes Henningsen and Jan Hald, "Gas dynamics in hollow core photonic bandgap fibers", DFM-2007-R20

+ Pia Tønnes Jakobsen and Hans Dalsgaard Jensen, "Elektrokemiske referencemålinger – pH", Bragt i Dansk Kemi 88, nr. 4, 2007. DFM-2007-R21

+ Kai Dirscherl, "Euromet MEDA ILC Intermediate report", DFM-2007-R22

+ Preben Howarth, "Metrology – in short, MEDA edition", DFM-2007-R23

+ Preben Howarth, "Métrologie – en bref, édition Meda", DFM-2007-R24

+ J. Frederiksen, A. Drysdale, J. Nielsen, K. L. Bryder, B. Lind-Nielsen, J. Busk, L. Savstrup, G. Østergaard, and J. C. Petersen, "Plan of action for the metrological main field: Flow", (In Danish). DFM-2007-R25

+ Etienne Dupont, Bertil Sjöberg, Merih Malmqvist, and Kim Carneiro, "Support to the Quality Infrastructure of Turkey. Country report 2006-2007", DFM-2007-R26

Contributions at conferences and monographs

+ Kim Carneiro, "Turkish Quality Infrastructure 2006: METROLOGY", Project Board Meeting, Quality Infrastructure in Turkey, Ankara, Turkey, 14 January 2007

+ R. Pantoja, "How to use Moodle to create online learning communities", IMERA Workshop on Web supported training, Lyngby, Denmark, 27-28 February 2007.

+ M. Svalgaard, L.H. Frandsen, J. Garnæs, A. Kühle, "Local lattice imperfections of planar photonic crystals", PECS VII, Monterey, California, USA, 8-11 April 2007.

+ A. Kühle, J. Garnæs and K. Dirscherl, " Why perform 3D calibration for a 1D AFM measurement?", poster presented at euspen 8rd International Conference and 9th General Meeting of the European society for precision engineering and nanotechnology, Bremen, Germany, May 2007.

+ M. Svalgaard, L.H. Frandsen, J. Garnæs, A. Kühle, "Sidewall roughness measurement of photonic wires and photonic crystals", CLEO/IQEC 2007, Munich, Germany, 17-22 June 2007.

+ J. Hald, J. Henningsen, and J.C. Petersen, "Sub-transit-time saturated absorption spectroscopy in acetylene", SPIE Optics and Photonics, San Diego, USA, August 2007. Oral presentation 6673-21.

+ S. Barrera-Figueroa, K. Rasmussen and F. Jacobsen, "An investigation of microphone calibration in a diffuse sound field", Inter-Noise 2007. Istanbul, Turkey, 28-31 August 2007.

+ S. Barrera-Figueroa, K. Rasmussen and F. Jacobsen, "An initial investigation on simultaneous measurement of the free-field and diffusefield sensitivity of microphones", The 19th International Congress on Acoustics. Madrid, Spain, 2-7 September 2007.

+ J. Hald, J. Henningsen and J.C. Petersen, "Spectroscopy on Slow Molecules in Hollow-Core Photonic Bandgap Fibers", Frontiers in Optics 2007 (OSA's 91st Annual Meeting / Laser Science XXIII), San Jose, USA, 16-20 September 2007.

+ P-E. Hansen, L. Nielsen, "Fast hybrid scalar and Fourier modal method for scatterometry with least square measurements validation", E-MRS 2007 Fall Meeting, Warsaw, Poland, 17-21 September 2007. Invited Talk.

+ Kim Carneiro, "Reflections on Grand Challenges in Metrology", Programme owners' and programme managers' meeting, Bratislava, Slovakia, 10 October 2007

+ J.C. Petersen, J. Hald, M. H. Lang, and J. Henningsen, "Fibre Optical Frequency Standards based on Molecules in Hollow-Core Photonic Bandgap Fibers", Optical Fibre Measurement Conference, OFMC 2007, Teddington, United Kingdom, 15-17 October 2007. Oral presentation.

+ Lars Nielsen, "Evaluation of measurements by the method of least squares", GMA Expertenforum Entwicklungen der Messdatenauswertung und Messunsicherheits-bestimmung, Ilmenau, Germany, 8-9 November 2007.

+ J. Hald, J.C. Petersen J. Henningsen, "Optical frequency standards based on slow molecules in hollow-core fibers", DOPS Annual meeting, Risø, Denmark, 22-23 November 2007.

+ R. Pantoja and J.C. Petersen, "Danish measurement needs on security matters", IMERA Security Focus Group Workshop, Teddington, United Kingdom, 23 November 2007.

+ K. Carneiro, "Metrology to support the development of nanotechnology", Proceedings of the Int. School of Physics 'Enrico Fermi' Course CLXVI Metrology and Fundamental Constants. T.W. Hänsch, S. Leschiutta and A.J. Wallard (eds.) 533-548 (2007). ISBN 978-88-7438-037-4. DFM 2007-P09

Other talks

+ Jørgen Garnæs, "Nanometrologi – præcisionsopmåling af overflader" at the conference Innovation via Nanoteknologi arranged by GTS – Advanced Technology Group and Syddansk Universitet, Sønderborg, 24 Januar 2007

+ Jan C. Petersen, "LED sikkerhedskursus", Frederikshavn, 14 March 2007

+ Jørgen Garnæs, Teacher in "Training on Quality Assurance/ Quality Control (QA/QC) in Calibration labs" five days course funded by the EU commission under the Trade Enhancement Programme. Lectures covered for example requirements in ISO 17025 and software validation, Alexandria, Egypt, 25-29 March 2007

+ Jørgen Garnæs, "Gauge block calibration – Demonstration on primary optical techniques", lecture course 42215, "Geometrical metrology and machine testing", The Technical University of Denmark, 11 April 2007

+ Hans D. Jensen, "Usikkerhedsberegning", DFM-EUROLAB course, Lyngby, Denmark, 24 April 2007

+ Jan Hald, "Introduction to Metrology – the science of measurements", Lecture given as part of the course Experimental methods in building energy and indoor climate, at DTU-BYG, 6 June 2007

+ Jan Hald, "Metrologi", lecture and guided tour at DFM for two high school klasses from Nærum Gymnasium, 7 September 2007

+ Jan Hald, "Anvendelse af lasere ved Dansk Fundamental Metrologi",.Lecture given at Aarhus University, Institute for Physics and Astronomy as part of the course Anvendt laserfysik, 10 October 2007

+ Pia Tønnes Jakobsen, "Metrology in chemistry at DFM", seminar given at two workshops "pH, ledningsevne og turbiditet" at Hach-Lange 22–23 May and 20-21 November 2007

+ Hans D. Jensen, "Usikkerhedsberegning", DFM-EUROLAB course, Lyngby, Denmark, 22 November 2007

+ Hans D. Jensen, "EURAMET og IMERA", meeting of TKAEK, Nærum, Denmark, 28 November 2007

+ Kim Carneiro, " Meterens 100 års jubilæum", GEOFORUM at DFM, 4 December 2007

DANIAmet is the umbrella organisation of Danish primary laboratories and national reference laboratories. These laboratories have been appointed by DANAK on behalf of the Danish Safety Technology Authority. At present DANIAmet includes the following members, with primary status and reference status indicated by (P) and (R) respectively:

DFM
Matematiktorvet 307, 2800 Kgs. Lyngby
Subfield: Mass measurement (P)
Contact: Lars Nielsen, DFM
Telephone: +45 4525 5866
Fax: +45 4593 1137
ln@dfm.dtu.dk

DFM
Matematiktorvet 307, 2800 Kgs. Lyngby
Subfield: Optical radiometry (P)
Contact: Jan C. Petersen, DFM
Telephone: +45 4525 5864
Fax: +45 4593 1137
jcp@dfm.dtu.dk

DFM
Matematiktorvet 307, 2800 Kgs. Lyngby
Subfield: Elektrochemistry (P)
Contact: Hans D. Jensen, DFM
Telephone: +45 4525 5874
Fax: +45 4593 1137
hdj@dfm.dtu.dk

Danish Primary Laboratory for Acoustics (DPLA)
Skodsborgvej 307, 2850 Nærum.
Subfield: Acoustical measurements in gases and solids, vibrations (P)
Contact: Knud Rasmussen
Brüel&Kjær
Telephone: +45 4525 5888
Fax: +45 4593 1137
kra@dfm.dtu.dk

Danish Primary Laboratory for Length (DPLL)
Matematiktorvet 307, 2800 Kgs. Lyngby
Subfield: Length measurement (P), Dimensional metrology (P)
Contact: Jørgen Garnæs, DFM
Telephone: +45 4525 5884
Fax: +45 4593 1137
jg@dfm.dtu.dk

Danish Primary Laboratory for Electricity (DPLE)
Mads Clausens Vej 12, 8600 Silkeborg
Subfield: DC-electricity (P), AC electricity (P), HF-electricity (R)
Contact: Hans D. Jensen, DFM
Telephone: +45 8720 6969
Fax: +45 8681 2654
hdj@dfm.dtu.dk

Danish Technological Institute
Teknologiparken, 8000 Aarhus C
Subfield: Temperature measurement by contact (R)
Contact: Jan Nielsen
Telephone: +45 7220 1236
Fax: +45 7220 1212
jan.Nielsen@teknologisk.dk

FORCE Technology
Park Allé 345, 2605 Brøndby
Subfield: Force and pressure (R)
Contact: Aykurt Altintas
Telephone: +45 4326 7000
Fax: +45 4326 7011
aya@force.dk

FORCE Technology
Navervej 1, 6600 Vejen
Subfield: Gaseous flow (volume) (R)
Contact: Jesper Busk
Telephone: +45 7696 1600
Fax: +45 7536 4155
jrb@force.dk

Danish Technological Institute
Teknologiparken, 8000 Aarhus C
Subfield: Water flow (P)
Contact: John Frederiksen
Telephone: +45 7220 1235
Fax: +45 7220 1212
john.frederiksen@teknologisk.dk

FORCE Technology
Park Allé 345, 2605 Brøndby
Subfield: Flow of liquids other than water (R)
Contact: Lene S. Kristensen
Telephone: +45 4326 7000
Fax: +45 4326 7011
lsk@force.dk

FORCE Technology
Park Allé 345, 2605 Brøndby
Subfield: Volume and density (R)
Contact: Lene S. Kristensen
Telephone: +45 4326 7000
Fax: +45 4326 7011
lsk@force.dk

DELTA Danish Electronics,
Light and Acoustics
Venlighedsvej 4, 2970 Hørsholm
Subfield: Humidity (R)
Contact: Anders B. Kentved
Telephone: +45 7219 4000
Fax: +45 7219 4001
abk@delta.dk

Risø National Laboratory
Frederiksborgvej 399, 4000 Roskilde
Subfield: Non-contact temperature
measurement (R)
Contact: Sønnik Clausen
Telephone: +45 4677 4523
Telefax: +45 4677 4565
sonnik.clausen@risoe.dk

REFERENCELABORATORIES OUTSIDE DANIAmet

A number of laboratories outside DANIAmet work for ministries and governmental agencies. The list below includes laboratories with a formal status as reference laboratory as well as laboratories doing similar work without a formal nomination.

DTU AQUA, Technical University of Denmark
National Institute of Aquatic Resources, Department of Seafood Research
Bld. 221, Søltofts Plads, 2800 Kgs. Lyngby
Ministry: Ministry of Food, Agriculture and Fisheries
Field: Food Chemistry
Contactperson: Maike Timm Heinrich
Telephone: +45 4525 4925
Fax: +45 4588 4774
www.dtu.dk

Faculty of Agricultural Sciences, Aarhus University, Department of Integrated Pest Management
Forsøgsvej 1, Flakkebjerg, 4200 Slagelse
Ministry: Ministry of Food, Agriculture and Fisheries
Field: Environmental Chemistry (soil and water)
Contactperson: Niels Henrik Spliid
Telephone: +45 8999 1900
Fax: +45 8999 3501
www.agrsci.dk

Danish Institute for Eksternal Quality Assurance for Laboratories in the Health Care, DEKS
Herlev Hospital, Herlev Ringvej 75, 2730 Herlev
Ministry: Ministry of Health and Prevention
Field: Laboratory Medicine
Contactperson: Inger Plum, 54M1
Telephone: +45 4488 3454
Fax: +45 4453 5369.
www.deks.dk

Eurofins Danmark A/S
Strandesplanaden 110, 2665 Vallensbæk Strand
Ministry: Danish Ministry of the Environment
Field: Environmental Chemistry (water, soil, sludge and waste)
Contactperson: Ulla Lund
Telephone: +45 7022 4230
Fax +45 7022 4255
www.eurofins.dk

FORCE Technology – Division for Energy and Environment
Park Allé 345, 2605 Brøndby
Ministry: Danish Ministry of the Environment
Field: Air emission monitoring
Contactperson: Lars Gram
Telephone: +45 4326 7000
Fax: +45 4326 7011
www.force.dk

National Environmental Research Institute, Aarhus University, Department of Atmospheric Environment
Frederiksborgvej 399, 4000 Roskilde
Ministry: Danish Ministry of the Environment
Field: Ambient air pollution measurements
Contactperson: Lone Grundahl
Telephone: +45 4630 1134
Fax: +45 4630 1214
www.dmu.dk

National Environmental Research Institute, Aarhus University, Department of Environmental Chemistry and Environmental Microbiology
Frederiksborgvej 399, 4000 Roskilde
Ministry: Danish Ministry of the Environment
Field: Environmental Chemistry and Microbiology
Contactperson: Pia Lassen
Telephone: +45 4630 1200
Fax: +45 4630 1114
www.dmu.dk

The National Food Institute
The National Veterinary Institute
Technical University of Denmark
Mørkhøj Bygade 19, 2860 Søborg
Ministry: Ministry for Foods, Agriculture and Fisheries
Field: Food chemistry/food microbiology
Contactperson: Inge Meyland
Telephone: +45 7234 6000
Fax: +45 7234 6001
www.dtu.dk

Danish Medicines Agency, Medicines Control Division
Axel Heides Gade 1, 2300 København S
Ministry: Ministry of Health and Prevention
Field: Microbiology, biology, chemistry, radioactivity
Contactperson: Margit Handlos
Telephone: +45 4488 9720
Fax: +45 4488 9195
www.dkma.dk

Eurofins Miljø A/S
Ladelundvej 85, 6600 Vejen
Ministry: Danish Ministry of the Environment
Field: Environmental microbiology
Contactperson: Anna K. Nørgaard
Telephone: +45 7022 4266
Fax: +45 7022 4255
www.eurofins.dk

Eurofins Steins Laboratorium A/S
Ladelundsvej 85, 6600 Vejen
Ministry: Danish Ministry of the Environment
Field: Microbiology
Contactperson: Inger Guldbæk
Telephone: +45 7022 4266
Fax: +45 7022 4255
www.eurofins.dk

Danish Plant Directorate
Skovbrynet 20, 2800 Kongens Lyngby
Ministry: Ministry for Food, Agriculture and Fisheries
Field: Food chemistry/Environmental chemistry
Contactperson: Ole P. Kristensen
Telephone: +45 4596 6603.
Fax: +45 4596 6610
www.plantedirektoratet.dk

Department of Forensic Medicine, University of Copenhagen
Frederik V's vej 11, 2100 København Ø
Ministry: The Danish Ministry of Justice
Field: Forensic genetics
Contactperson: Bo Thisted Simonsen
Telephone: +45 3532 6136
Fax: +45 3532 6270
www.sund.ku.dk

Department of Forensic Medicine, University of Copenhagen
Frederik V's vej 11, 2100 København Ø
Ministry: The Danish Ministry of Justice
Field: Forensic Chemistry
Contactperson: Kristian Linnet
Telephone: +45 3532 6100
Fax: +45 3532 6085
www.sund.ku.dk

Statens Seruminstitut
Artillerivej 5, 2300 København S
Ministry: Ministry of Health and Prevention
Field: Microbiology
Contactperson: Helle Bruhn-Rasmussen
Telephone: +45 3268 8103
Fax: +45 3268 8124
www.ssi.dk

DELTA Danish Electronics, Light & Acoustics
Venlighedsvej 4, 2970 Hørsholm
Ministry: Danish Ministry of the Environment
Field: Noise measurement
Contactperson: Torben Holm Pedersen
Telephone: +45 7219 4000
Fax: +45 7219 4001
www.delta.dk/reflab

THE 12 SUBJECT FIELDS OF METROLOGY

Fundamental metrology in Denmark follows the EURAMET division into 12 subject fields, while the subfields reflect metrological activities in Denmark. Plans of action drawn up for each subject field serve as guidelines in the nomination of primary and reference laboratories and give suggestions for other initiatives. The years in which plans of action have been published are shown in parenthesis. Primary and reference laboratories are designated (P) and (R) respectively

Subject field	Subfield	Laboratory
MASS AND RELATED QUANTITIES (1989, 1997)	Mass measurement Force and Pressure Volume and Density	Danish Fundamental Metrology Ltd (P) FORCE Technology (R) FORCE Technology (R)
ELECTRICITY AND MAGNETISM (1989, 1994, 2002)	DC electricity AC electricity HF electricity	Danish Primary Laboratory of Electricity (P) Danish Primary Laboratory of Electricity (P) Danish Primary Laboratory of Electricity (R)
LENGTH (1989, 1998, 2007)	Basic length measurements Dimensional metrology Micro/Nano	Danish Primary Laboratory for Length (P) Danish Primary Laboratory for Length (P)
TIME AND FREQUENCY (1992, 2000)	Time measurement Frequency	No laboratory
THERMOMETRY (1992, 1999, 2007)	Temperature measurement by contact Noncontact temperature measurement Humidity	Danish Technological Institute (R) Risø National Laboratory (R) DELTA Danish Electronics, Light & Acoustics (R)
IONISING RADIATIONS AND RADIOACTIVITY (1992, 2000)	Absorbed radiation dose – Industrial products. Absorbed radiation dose – Medical products Radiation protection Radioactivity	
PHOTOMETRY AND RADIOMETRY (1990, 1996, 2004)	Optical radiometry Photometry Colorimetry Optical fibres	Danish Fundamental Metrology Ltd (P)
FLOW (1990, 1999, 2007)	Gaseous flow (volume) Water flow (volume, mass and energy) Flow of liquids other than water Anemometry	FORCE Technology (R) Danish Technological Institute (P) FORCE Technology (R)
ACOUSTICS, ULTRASOUND AND VIBRATION (1992, 2000)	Acoustical measurements in gases Acoustical measurements in solids Acoustical measurements in liquids	Danish Primary Laboratory of Acoustics (P) Danish Primary Laboratory of Acoustics (P)
AMOUNT OF SUBSTANCE (1992, 1995, 2004)	Environmental chemistry Laboratory medicine Products and materials Food chemistry Pharmaceutical chemistry Microbiology Electrochemistry	 Danish Fundamental Metrology Ltd (P)
INTERDISCIPLINARY METROLOGY	No subdivisions	No laboratory
QUALITY	No subdivisions	No laboratory

DETAILS OF PERSONNEL

Board of Governors
Lars Barkler, Director, Lithium Balance A/S
Knut Conradsen, Vice President, Technical University of Denmark (Vice Chairman)
Kai Dirscherl, Staff Scientist, MSc, PhD, DFM (from 19 December)
Steen Konradsen, AREPA Test & Calibration A/S (chairman)
Anders Kühle, Staff Scientist, PhD, DFM (until 19 December)
Jan C. Petersen, PhD, Staff Scientist, DFM
Ernst Tiedemann, Managing Director, FORCE Technology
Søren Stjernqvist, Managing Director, Danish Technological Institute

Management
Kim Carneiro, Director, MSc (EE), PhD

Accountant
KPMG, Certified Accountant

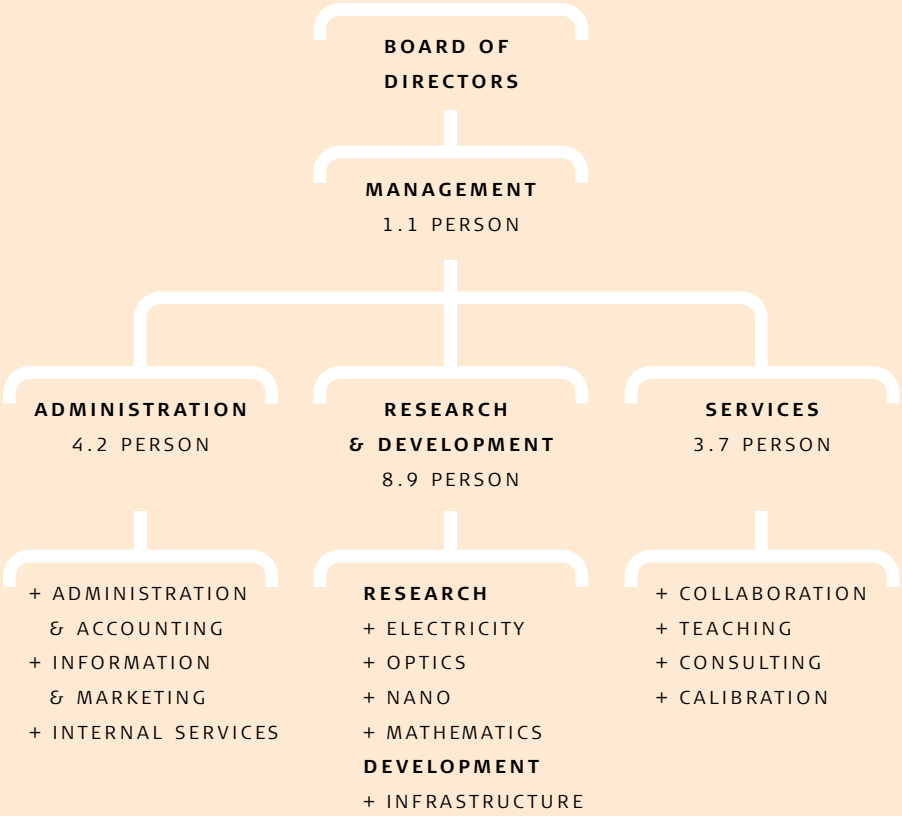
Staff
Kim Carneiro, MSc (EE), PhD
Lars Nielsen, MSc (EE), PhD
Steen Rahbek, Techician
Hans Dalsgaard Jensen, MSc (EE), PhD
Jan Conrad Petersen, PhD
Jørgen Garnæs, PhD
Preben Howarth, MSc, BSc (Economy)
Peter Høgh Hyllested, Technician
Anders Kühle, MSc (EE), PhD (until July 31)
Jan Hald, PhD
Isabella Stendal, Secretary
Bo Bengtsen, Technician
Salvador Barrera Figueroa, MSc (ME), PhD
Anne Lumholdt, Secretary
Lis Lilleballe, Technician (until January 31)
Rita Pantoja Lesso, MSc
Pia Tønnes Jakobsen, MSc, PhD
Poul Erik Hansen, MSc, PhD
Kai Dirscherl, MSc, PhD
Jan-Ulrik Holtoug (from February 9)
Line Groth Andersen, Technician (January 1 – September 30)
Pia Krog-Pedersen, Secretary (from December 1)
Anders Tegtmeier Pedersen, MSc (from December 1)

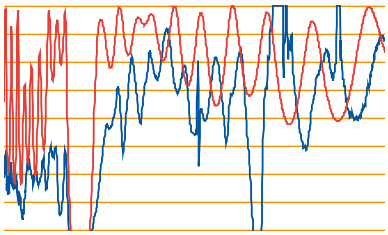
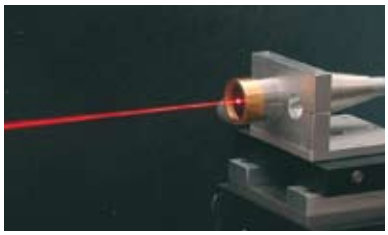
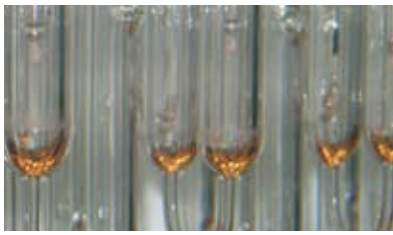
Short term visitors and students
Ana Maria Cubillas de Cos (October 3 – December 20)
Lorenzo Carlini (until January 31)
Ana Carrasco Sanz (April 16 – 21)
Konstantinos Athanassiadis (June 18 – 22)
Ioannis Kouroupas (June 18 – 22)
Wladyslaw Kozlowski (December 3 – 7)

KEY FIGURES

Nøgletal i millioner kr.	2003	2004	2005	2006	2007
Bruttoomsætning	21,7	20,2	18,3	16,7	16,8
Nettoomsætning	14,5	13,6	15,0	14,9	15,0
Årets resultat [1]	0,3	0,4	0,6	0,3	0,2
Egenkapital [2]	8,4	8,8	9,4	12,5	12,7
Kommerciel omsætning	7,0	4,7	5,2	2,8	3,9
– heraf små virksomheder (under 50 ansatte)	0,8	0,7	0,4	0,4	0,4
– heraf mellemstore virksomheder (50-250)	0,3	0,5	0,5	0,4	0,5
– heraf store virksomheder (over 250 ansatte)	0,6	0,3	0,2	0,2	0,4
– heraf offentlige danske institutioner	2,0	0,5	0,3	0,2	0,1
– heraf udenlandske virksomheder og institutioner	3,3	2,7	3,8	1,6	2,5
Udenlandsk bruttoomsætning	7,4	7,6	4,5	2,7	3,6
Forskning og Udvikling					
Antal forskning og udvikling samarbejdsprojekter	13	13	15	13	6
– heraf centerkontrakter og innovationskonsortier	1	1	1	1	2
– heraf internationale projekter	11	11	8	6	4
Forskning og udvikling omsætning (millioner kr.) [3]	15,8	16,6	13,6	15,4	13,9
– heraf egenfinansieret [4]	0,8	1,1	0,5	1,5	1,0
Forskning og udvikling indsats (årsværk)	8,1	8,2	8,7	10,8	9,3
Antal kunder					
Danske private virksomheder	32	28	27	22	39
– heraf små virksomheder (under 50 ansatte)	14	8	10	10	9
– heraf mellemstore virksomheder (50-250)	7	8	8	7	13
– heraf store virksomheder (over 250 ansatte)	11	12	9	5	17
Offentlige danske institutioner	3	2	3	3	4
Udenlandske virksomheder og institutioner	28	17	19	21	20
Samlet kundemasse	63	47	49	46	63
Antal medarbejdere efter uddannelse (årsværk)					
Dr. & ph.d.	9	10	10	10	10
M.sc.	5	3	3	3	3
Øvrigt teknisk personale	3	3	3	3	3
Administrativt personale	2	2	2	2	2
Gennemsnitligt antal medarbejdere	19	18	18	18	18
Antal publikationer					
Publikationer med bedømmelse	7	8	12	8	8
Afsluttede ph.d. – og eksamensprojekter	2	1	4	2	1
Andre rapporter	78	67	60	26	31
Indlæg ved konferencer	22	20	23	20	16
Bedømmelser for internationale tidsskrifter	10	6	31	14	
Kalibreringscertifikater og målerapporter	130	151	181	220	228
Presseklip	17	12	36	22	23
Undervisning					
Undervisning (antal dage)	60	11	33	38	51
Undervisning (antal deltagere)	141	63	161	201	215
Vejledere/undervisere på universiteter	2	3	3	4	2
Eksternt fagligt arbejde (antal udvalg)	20	20	31	25	22
– heraf internationalt fagligt arbejde	14	14	24	20	18
Effektivitet					
Omsætning pr. medarbejder (1.000 kr.)	1174	1122	1021	924	940
Overskud pr. medarbejder (1.000 kr.)	15	23	32	19	10
Kommerciel omsætning pr. resultatkontraktkrone [5]	0,8	0,5	0,6	0,3	0,4
FoU-omsætning pr. resultatkontraktkrone [5]	1,7	1,8	1,5	1,7	1,5

1) Resultatet er eksklusive ekstraordinære poster
2) Til og med 2005 er tallene for den selvejende institution DFM, herefter for DFM A/S
3) Fra 2004 medtages også nationalt og internationalt samarbejde om metrologi
4) Fra 2005 er egenfinansieringen den efterkalkulerede egenfinansiering
5) I 2007 er kun det ordinære resultatkontraktbeløb medregnet


BOARD OF DIRECTORS
MANAGEMENT
1.1 PERSON
ADMINISTRATION
4.2 PERSON
RESEARCH & DEVELOPMENT
8.9 PERSON
SERVICES
3.7 PERSON
+ ADMINISTRATION & ACCOUNTING
+ INFORMATION & MARKETING
+ INTERNAL SERVICES
RESEARCH
+ ELECTRICITY
+ OPTICS
+ NANO
+ MATHEMATICS
DEVELOPMENT
+ INFRASTRUCTURE
+ COLLABORATION
+ TEACHING
+ CONSULTING
+ CALIBRATION

MISSION

To develop and disseminate measurement knowledge at an international scientific level with focus on Danish interests