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# Danfysik – 40 years – and still going strong(er)

Forty years ago in 1964 a young engineer and entrepreneur, Ejnar Jespersen, had the idea and courage to start a company with the purpose of making and selling accelerators and accelerator equipment to the scientific community. He named the company Danfysik, which in Danish means something like “Danish Physics”. I am proud that over the past forty years hundreds of accelerators have either been made by Danfysik or have had essential parts manufactured by Danfysik. – Accelerators, such as isotope separators, ion implanters, van de Graafs, tandem accelerators, cyclotrons, linear accelerators, microtrons, synchrotrons, colliders, spallation neutron sources, FELs all over the world employ Danfysik technology.

Last year our success was recognized by the award, presented by HRH Prince Henrik of Denmark of the prestigious King Frederik IX's Award for Excellence in Export. – Furthermore, during the past year our synchrotron customers have shown their confidence in us by placing some of their most important supply contracts with us, including large magnet, beam line and insertion device orders for the French Soleil Project, the British Diamond Project, and the Swiss Light Source project. Finally, we are pleased that we have been awarded the contract to build the complete injection system for the Australian Synchrotron Project in Melbourne.

## Then and Now



*The Farm where it all began in 1964*

As many of our long standing customers will know, it all started in the farm buildings in Jyllinge, a working environment full of atmosphere providing the stimulus for new ideas and development. Here a small team of bright and hardworking physicists, engineers, and technicians developed and made the first power supplies, magnets, ion sources, and ion accelerators. This was our factory for more than 25 years until we in 1990 grew out of it and moved to a modern, spacious and purpose built factory.

Here we have developed our transducers, power supply, magnet, and insertion device technology, and in the later years two complete synchrotrons have been pre-assembled before final installation on sites in Europe and North America.

*Production and test area in Electronics division in 2004*



As indicated by this newsletter cover photo of the Sydney Opera building designed by the Danish architect Jørn Utzon, there is a good tradition for export of Danish design to Australia. We are honoured to be allowed to follow this tradition.

Bjarne Roger Nielsen  
Managing Director



Our last extension of building facilities took place at the beginning of this year when the Electronics Division moved into its own new premises in the same industrial estate. With this move we have facilitated an ideal environment for development, design, production and test of our magnet power supplies and transducers. The extension has provided more capacity for the Physics Division, too.

From the good old time in the Farm and until now it has always been our policy to be open to our customers and we have been pleased to welcome hundreds of customers to our premises over the years. We look forward to showing you our new facilities next time you pay us a visit.



# Top performance synchrotron technology

Customers all over the world are using Danfysik technology in their synchrotrons. Our products range from the source of electrons through the injector and the storage ring to the synchrotron light producing components, and via the optical beamline systems all the way to the experimental hutch. Many examples are shown on this page, but we have hundreds of more to tell you about. So please contact us if you want to know more about our top performance synchrotron technology.



Vacuum chamber and magnet details on the CLS 2.9GeV Booster Synchrotron



Storage ring quadrupole



An artistic view on the building of The Australian Synchrotron project

## Australian Synchrotron Project

The contract for the design, manufacture, delivery, installation and commissioning of the complete Synchrotron Injection System for the Australian Synchrotron Project was awarded to Danfysik on December 16 last year. The scope of supply includes a 100 MeV Linear Accelerator, a 15 m long LTB beam transport line, the 3.0 GeV 130 m circumference Booster Synchrotron,

and a 40 m long BTS beam transport line to the injection point of the Storage Ring. A complete "turn-key" system will be provided by Danfysik. The complete project will be completed in spring 2006. – For more information, please contact [sales@danfysik.dk](mailto:sales@danfysik.dk).



Girder assembly for CLS booster



Injection Septum for the CLS project



The 500MeV Synchrotron

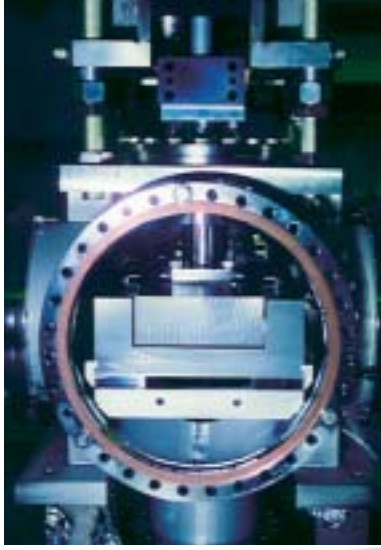


Power converters for dipole bending magnets





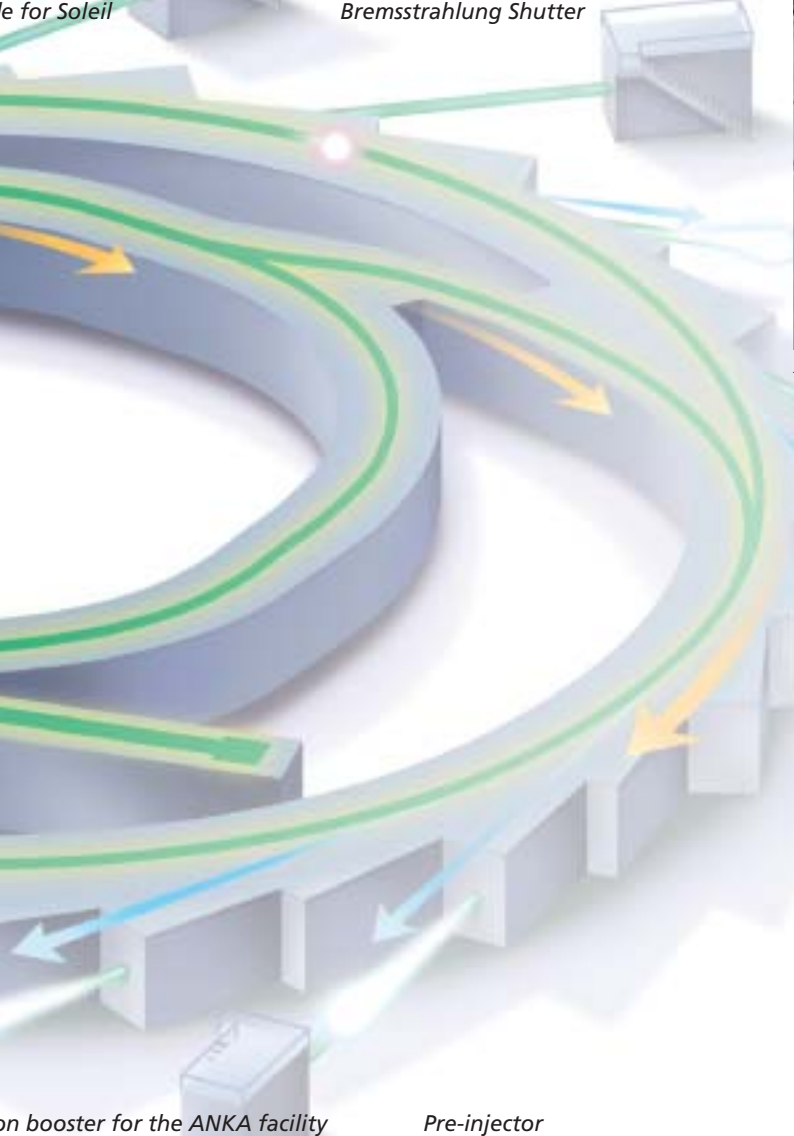
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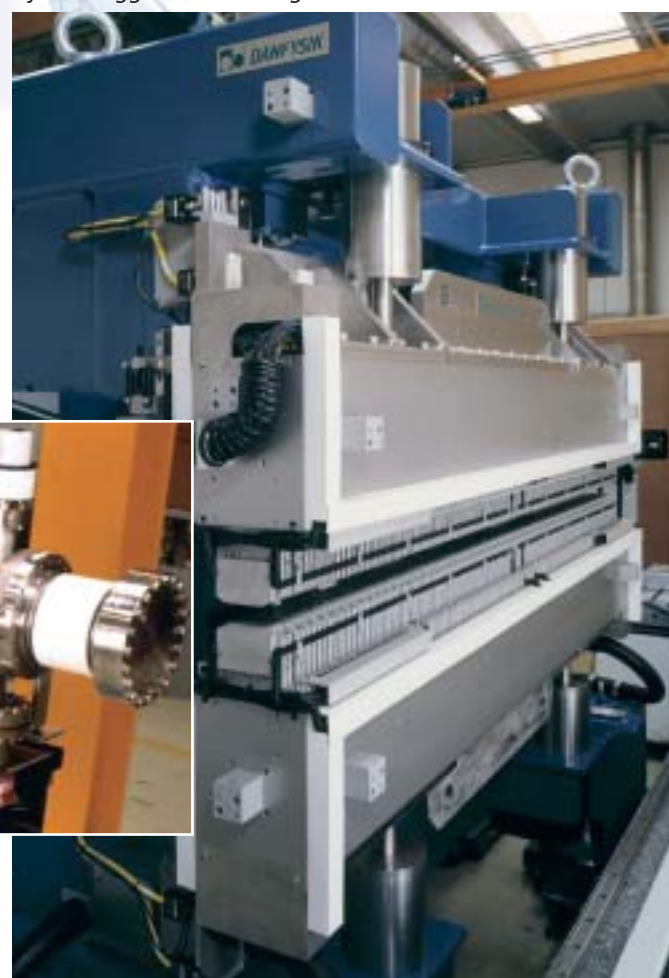
Bremstrahlung Shutter



X-ray beamline



Hybrid Wiggler for Swiss Light Source



on booster for the ANKA facility



Pre-injector



## New high performance power converter program

For more than 40 years precision current power converters have been a key product line at Danfysik – and it still is. We have created a line of power converters, which are designed to a modular concept and built to fulfill our customers needs in the physics research world.

In a time where physics research is developing more and more ideas with potential industrial application, we at Danfysik are shaping our new products to match these trends.

The latest products - the System 7000 and System 9000 - create a new superior price-performance range, bridging the gap between ultra high performance power converters and standard available products on the market. The two new systems incorporate – common with all other Danfysik power converters – the Ul-trastab current transducers for superior performance.



Power converters System 8500, 7000 and 9000

## Quantum leap in performance for new Cryocoolers

During November and December 2003 Oxford Danfysik delivered the first 6 of the new version of liquid nitrogen cryocoolers to customers at the APS, ALS and CLS. The new version signifies a quantum leap in performance. A PLC provides a swift PID-control loop for accurate pressure control and rugged, trouble-free restart after power loss. An industrial PC with a 15" flat screen provides a user friendly operator's panel as well as excellent data-logging opportunities and remote access via Ethernet. The cryogenic capacity of the system has been increased and thermal insulation has been improved leading to dramatic improvement to time between fills. Three further systems have just been sold to the Diamond Light Source.



## Implanters for high and low energy

Two new custom designed implanter installations were completed early this year. A 350 keV, 1mA ion implanter was delivered to the Angstrom Laboratory in Uppsala, Sweden. The implanter was designed and built over a well proven Danfysik basic concept and was laid out for 150mm dia. wafer implantation. A custom build versatile low energy implanter was delivered to FZ Rossendorf in Germany. The ion implanter is covering an energy from 50 keV down to 200eV of beam energy. A special deceleration system was developed in order to allow homogeneous scanning of the extremely low energy ion beam over 100 mm x 100 mm. – For more information, please contact [sales@danfysik.dk](mailto:sales@danfysik.dk).



The 50keV Ion Implanter for Rossendorf

# Danfysik a Key Supplier of Synchrotron Magnets

Danfysik is one of the major suppliers of magnets and magnet systems for the two large European Synchrotron Projects, Soleil in France and Diamond Light Source in UK.

For the Soleil Synchrotron Danfysik has been awarded the contract to build the 160 Storage Ring Quadrupole Magnets. The laminated magnet cores are made as fully glued quarter-yokes, and the mechanical tolerance on the magnet apertures is as narrow as  $\pm 20\mu\text{m}$ .

Danfysik is also an important supplier to the Diamond Light Source. 44 Booster Girder Assemblies for DLS are being made in our Jyllinge plant. The contract includes design, manufacture and test of all magnets, vacuum vessels and support structures needed for the complete DLS Booster Ring. The Booster Girder Assemblies are delivered as ready-to-install units with magnets mounted and pre-aligned and including leak tested and sealed vacuum vessel system.



Laminated quadrupole yoke production

## State-of-the-art Test Facilities for Insertion Devices

Danfysik is now (June 2004) completing the successful testing and shimming of the In-vacuum Undulator for the Swiss Light Source. For this purpose a new high class clean room facility has been established for assembly and testing of the ID.

The important features of the clean room facility are:

- Clean facility class 100,000
- Room temperature controlled to  $\pm 0.5^\circ\text{C}$
- Air lock access and overpressure in the room.

In June 2004 also the Soleil Synchrotron placed an order with Danfysik for delivery of an In-vacuum Undulator, recognising Danfysik's capabilities and facilities to make superior insertion devices.



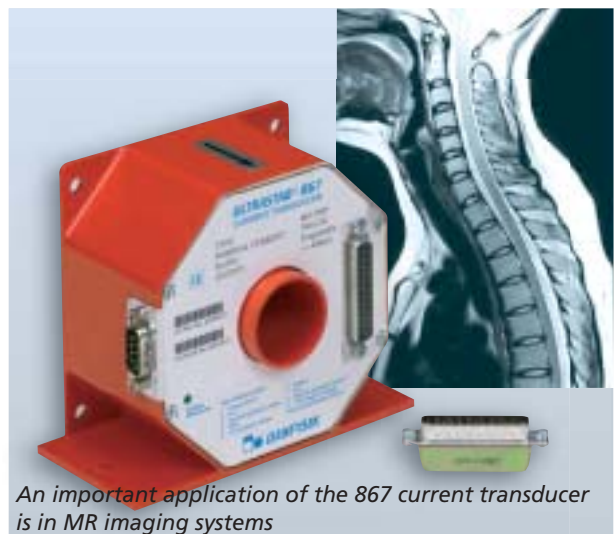
Final shimming of In-vacuum undulator in clean room

## New programmable precision Current Transducer

The Ultrastab 867-700PI Current Transducer is the first high performance transducer, with on board electronics, where the ratio of the transducer is fully programmable. This new high accuracy transducer features full programmability for 400mA output current of any desired maximum primary current from 80A to 700A.

The Ultrastab 867-700PI is designed as precision current feed back element in Danfysik power converters but is now also offered to our customers as the most adaptable precision current feed back module available on the market.

Today the Danfysik precision current transducers are not restricted to use in high performance power converters. Over the last 8 years they have been widely used by the major producers of Medical MR Scanners in precision Gradient Amplifiers. This application drives the technology to the extreme regarding demands for low noise, high bandwidth and fast response time in order to obtain ultimate imaging performance features.



An important application of the 867 current transducer is in MR imaging systems



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