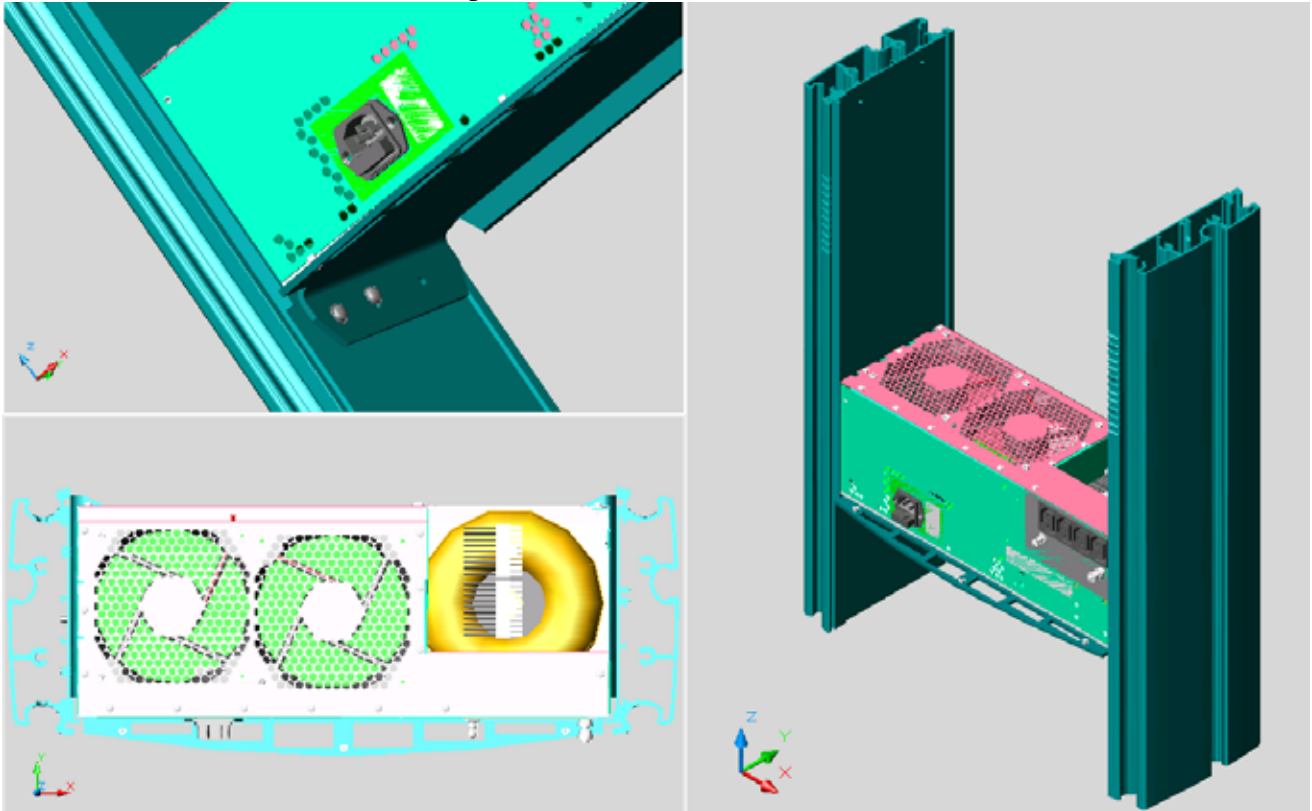


Thermal design of an ultrasound scanner

This document describes the ideas and thoughts regarding the thermal design of an ultrasound scanner in 2007. The theoretical basis of this design is based on a yearlong experience together with a dedicated thermal course at [Delta](#) in Denmark.

1. Direct dissipation of heat

One of the most effective ways of getting rid of heat is to transport the heat to vertical aluminium surfaces. As can be seen below this ultrasound scanner has a mechanical design with two vertical aluminium profiles.



The power components inside the power supply are mounted on the 5mm aluminium bottom plate. This plate is thermally connected to the shelf below. This shelf is designed with a bending at the ends of $r=5\text{mm}$ due to the heat transfer capability. The vertical sides act as heat sinks for the design. (These pictures are borrowed from B-K Medical)

2. Fan selection

The design is based on two rather large fans that rotate slowly. The two fans are synchronized in order to avoid difference frequency noise components.

3. Flow area

The mechanical design of the flow through the instrument is based on keeping the same area for the air flow from the intake to the exhaust of the cooling air. This will prevent noisy air ducts. Heat spreaders are placed on critical components in order to avoid hot spots.

4. Temperature control

The temperature is monitored several places in the instrument and the fan speed is regulated accordingly. This creates the most silent ultrasound scanner in the world of $<28\text{dB}$. The measurement had to be performed during a holiday in order to switch off the air conditioning of the room.