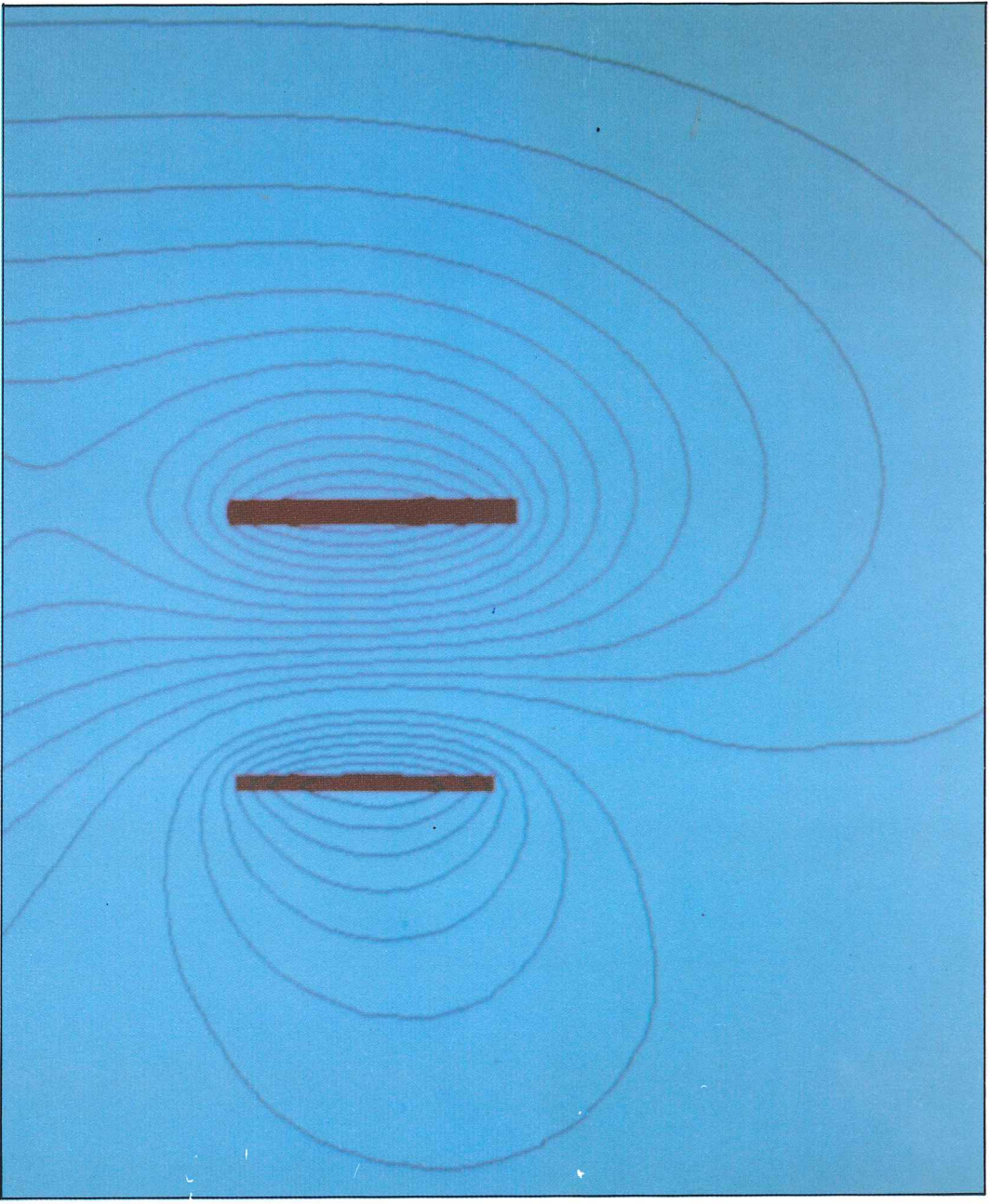


Active-Shield Magnet

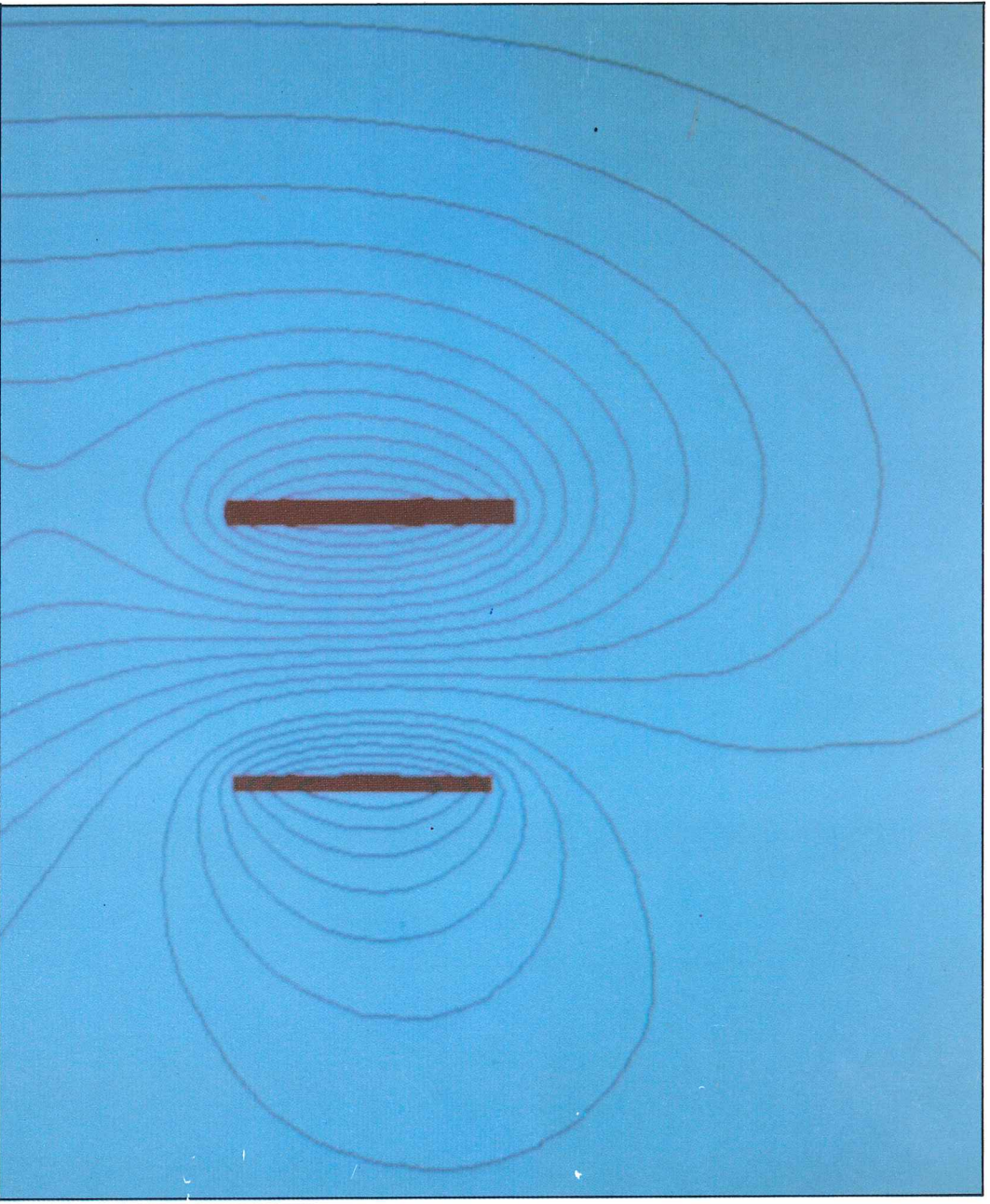
The Solution



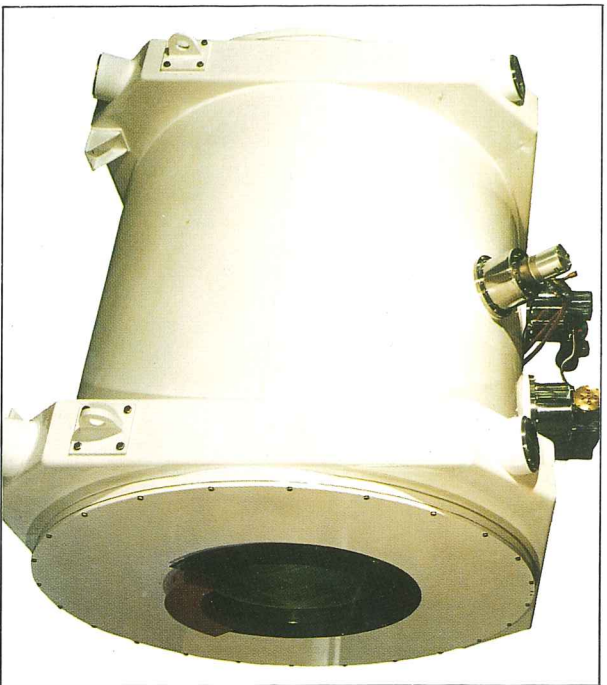
OXFORD

Active-Shield Magnet

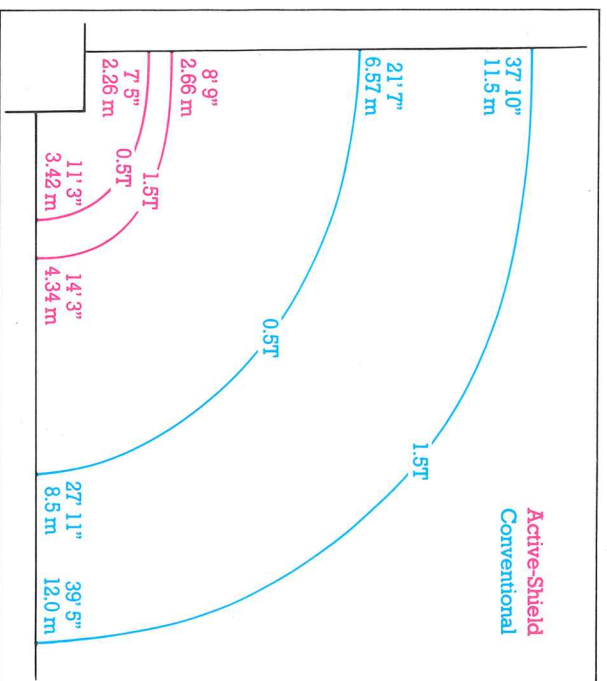
The Solution



OXFORD



Active-Shield Magnet with refrigerator option.



The 5 gauss line of the Active-Shield Magnet compared to a conventional magnet at two different fields, 0.5T and 1.5T.

Specifications

Field	Up to 1.5 Tesla
Homogeneity	15ppm over 50cm DSV
Shimming	Resistive and/or passive
Ramp Time	< 10 minutes to 0.5T < 15 minutes to 1.0T < 50 minutes to 1.5T
Cryostat Height	2550mm
Length	2460mm
Width	2150mm
Bore (inside shim coil)	920mm

Weight (with cryogenes)	9.6 Tonnes for 0.5T 11.2 Tonnes for 1.0T 13.5 Tonnes for 1.5T
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Cryogenes Helium Volume	> 1800 litres
Boil-off	< 400 mls per hour
Refill Interval	> 130 days
Boil-off with refrigeration	< 200 mls per hour
Refill Interval	> 260 days
Nitrogen Volume	250 litres
Boil-off	1.0 litre per hour
Boil-off with Refrigeration	0

Features/Configuration

Side Cryogen Fill	
Stainless Steel Bore Tube	
Integral Shim Bore Tube	
2141 Magnet Power Supply	400A, 15V Air-cooled Power Supply for 0.5T and 1.0T system
2160 Magnet Power Supply	650A, 9V Air-cooled Power Supply for 1.5T system
Digital Level Meters	Liquid Helium and liquid Nitrogen
7620	Communications and Diagnostics Interface
Shim Power Supply	Resistive, Air-cooled Power Supply - Computer Controlled (with 32 programmable memories)
ERDU	Emergency Rndown Unit

Options

Auto Retractable Current Lead Refrigeration

The Oxford Active-Shield Magnet

MRI Stray Fields, the Practical Problem

The many diagnostic benefits of Magnetic Resonance Imaging are becoming well understood and accepted by clinicians all around the world. However, despite the obvious clinical advantages of the technique, a severe limitation is often placed on the purchase of suitable equipment by the inconvenience and cost of installation.

These problems, invariably related to the unwanted effects of high stray magnetic fields impacting upon the immediate hospital environment have been treated, but not cured, by a variety of methods. Firstly, and most favoured as there is no risk of compromising magnet performance, is the construction or modification of a building at a location remote from the hospital complex. Apart from the obvious expense, it is often inconvenient to site an important diagnostic facility far from the main areas. Secondly, Yoke Shielding: where the magnet is enclosed in a closely fitted thick iron shield. Effective Yoke Shielding carries a high weight penalty (as much as 30 Tonnes for a 1.5T system), which may require extensive floor strengthening in many sites. Lastly, Room Shielding: where the magnet room is virtually converted into an iron box. Though effective for fields outside the room, this method actually produces an *Increase* of field within the "box". Room Shielding is also expensive, requires extensive modification to the site and causes high installation inconvenience.

Environmental Fit

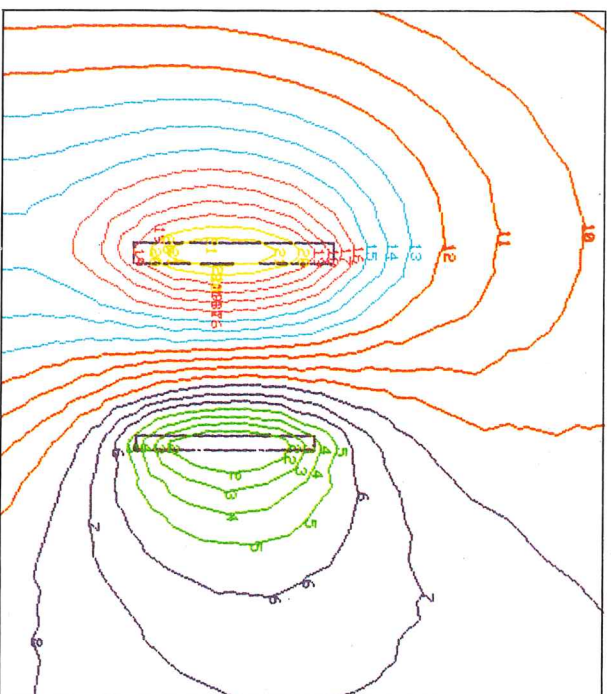
MRI, unlike other diagnostic modalities, does not fit easily or cheaply into the hospital environment. Not only the immediate area, but costly space around and above the magnet is affected by stray magnetic fields which impose severe use limitations on these areas. To make MRI more acceptable to the hospital environment, the problem of magnet installation and operation must be solved in a way that restricts the effects of stray fields without incurring substantial site modification or performance penalties.

The Practical Solution

As leaders in magnets for whole body imaging, Oxford have researched and developed a new approach to the problems of field containment - the Oxford Active-Shield Magnet. This new approach features a special array of superconducting coils which reduce the 5 gauss field volume by 95% and bring the 1 gauss threshold as near as 3.5 metres (for a 1.0T field).

Active-Shield has two other important advantages: it gives full protection against stray fields during rapid ramping or in the event of a total run down for safety reasons (quench) and it preserves full homogeneity during normal operation.

This shielding performance is achieved with low weight gain to allow the Active-Shield Magnet to



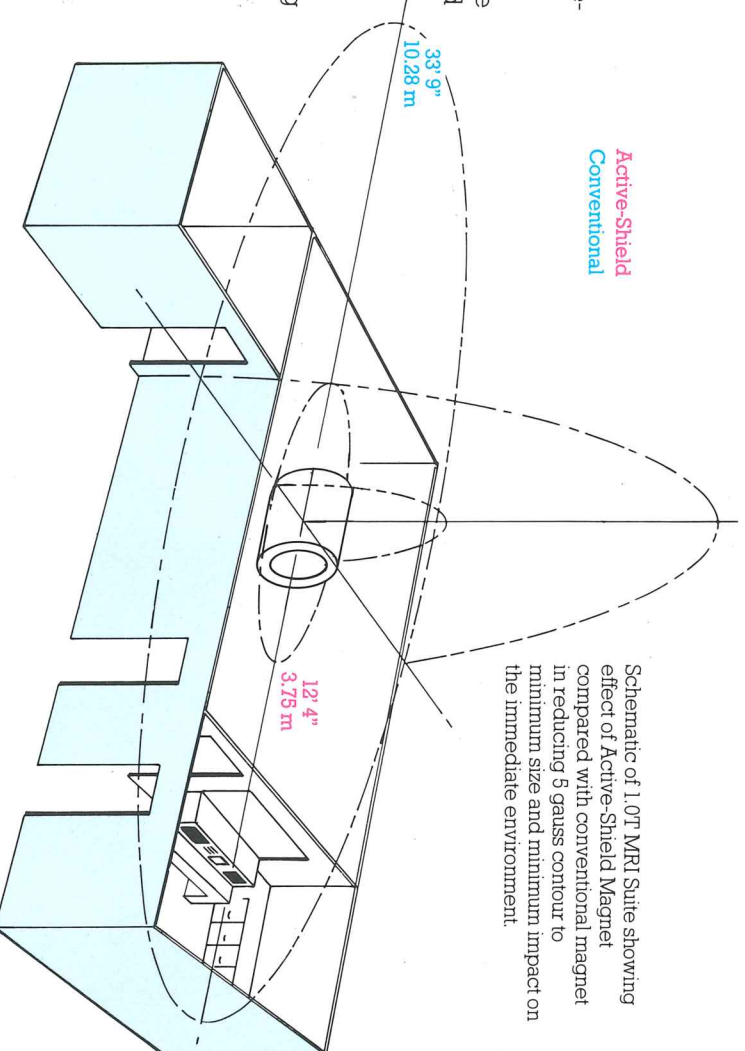
CAD printout showing magnetic flux lines around special array of superconducting coils.

be installed in many diagnostic suites with minimum modification to existing buildings and minimum disruption to hospital routine.

Containing magnetic fields at the magnet has other distinct operational and cost benefits. Due to the relatively small space actually affected by stray magnetic fields in an Active-Shield installation, the MRI suite can be much smaller and areas around the MRI suite can be more effectively utilised for a wider range of purposes.

- The Oxford Active-Shield Magnet provides the most practical and cost effective solution to the problem of environmental acceptability by:
- Minimising pre-installation cost and inconvenience.
 - Reducing 5 gauss volume by 95% and 1 gauss line to maximum of 6.2 metres (1.5T field along Z axis) allowing installations in smaller suites.
 - Ensuring full performance specification at any chosen field.
 - In many cases permitting installation of an MRI system in locations previously thought unsuitable.

Active-Shield
Conventional



Schematic of 1.0T MRI Suite showing effect of Active-Shield Magnet compared with conventional magnet in reducing 5 gauss contour to minimum size and minimum impact on the immediate environment.

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