OVERVIEW OF THE MAGNET ACTIVITIES AT HIT

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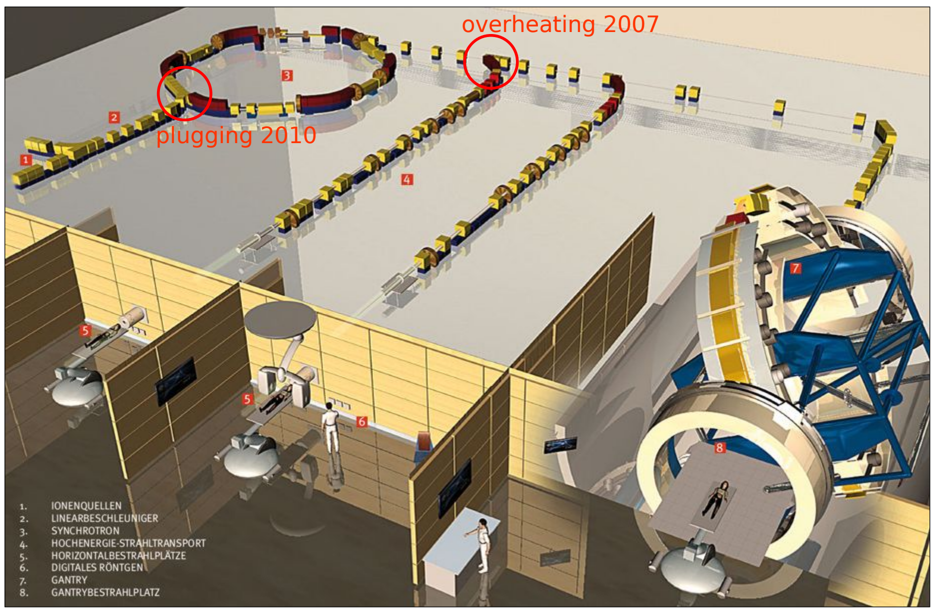
Abstract

The Heidelberg Ion Beam Therapy Centre (HIT) is the first facility in Europe with a dedicated heavy ion accelerator for cancer treatment with carbon ions and protons. Today, after three years of regular operation, up to 45 patient irradiations per day can be applied with two fixed beam treatment rooms in use. The accelerator comprises 146 normal conducting magnets ranging from 9 kg LEBT double steerers to the 74 tons 90° dipole on the gantry. Due to its medical application a high reliability is demanded from all subsystems. To avoid unscheduled shut downs due to magnet failures we set up a concept based on an exceptional spares inventory and preventive maintenance which will be presented in this paper. Moreover, we will discuss other activities concerning the magnets such as copper passivation and corrective maintenance.

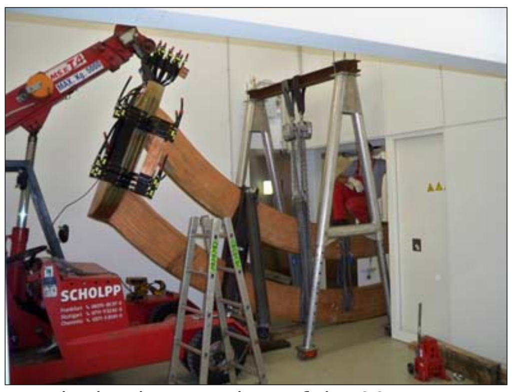
The HIT Facility



The Heidelberg Ion Beam Therapy Centre with 1. ion sources, 2. linear accelerator, 3. synchrotron, 4. high energy beam transport line, 5. horizontal treatment rooms, 6. digital x-ray imaging, 7. gantry, 8. gantry treatment room.

Spares Inventory

Delivery of the two 90° gantry dipole spare coils.



Bringing-in procedure of the 90° gantry dipole spare coils into the gantry hall.

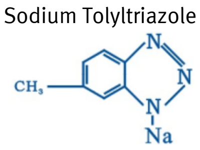
Copper Passivation

Passivation device from GSI Darmstadt connected to a spare coil.

Water hoses connected to the spare coil of the extraction septum.

Applied copper inhibitor:

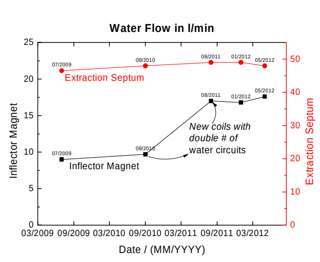
Sodium Tolyltriazole $C_7H_6N_3Na$



Preventive Maintenance

Magnet maintenance matrix. Fields with × are done for all magnets; fields with ½ are done for half of the magnets.

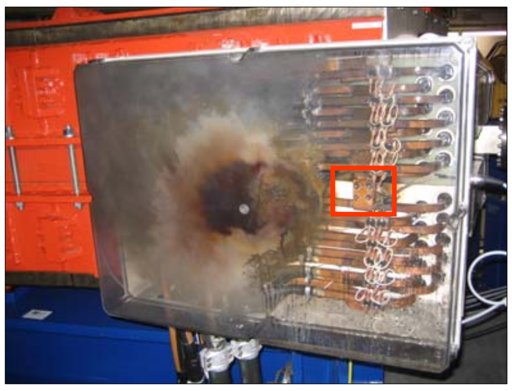
maintenance task	maintenance period			
	1	3	4	6
interlock tests of flow meters and thermo switches	×		×	
logging of water flows	×		×	
visual inspection of magnets	½	½		×
retightening of screw joints of half of magnets		½		



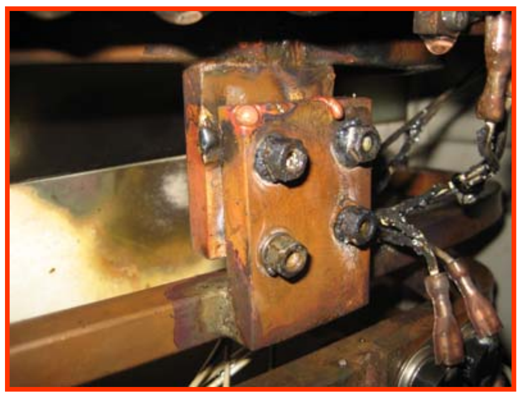
Water flows of magnets with 35 ℃ temperature rise (in/out) since 2009.

Corrective Maintenance

Overheating:



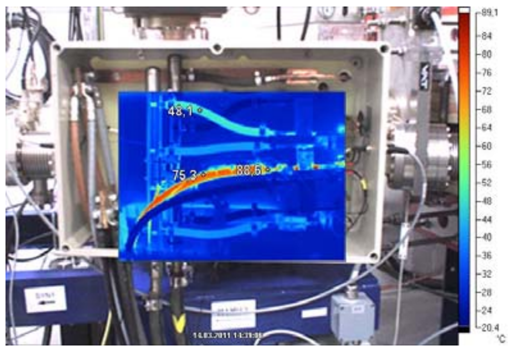
Connection box of first 45° dipole into the first horizontal treatment room after overheating.



Electrical bridge in the magnet connection box after contact problem.

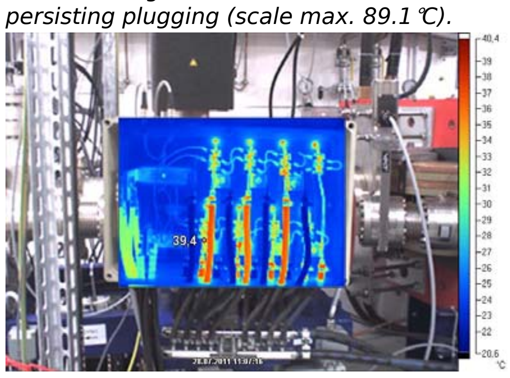
Connection box after repair.

Plugging:



Thermal image of water circuits with persisting plugging (scale max. 89.1 ℃).

Copper oxide (CuO) layer inside the cooling channel of the inflector magnet.



Thermal image of the water circuits after repair (scale max. 40.4 ℃).

*Copper oxide under an optical microscope (**find the moon** ☺).*

References

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