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Brno, 22. 5. 2006


Naše ref.:SD/573/ZŠ

Vážený pane doktore,

V příloze Vám zasílám protokol z měření magnetického pole a vibrací podlah.

S pozdravem

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Survey of floor vibrations and magnetic fields at the Institute of Physics

Ordered by:

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Measurements were performed on 9th of May 2006. Their purpose was to estimate the propriety of a given room for possible installation of an electron beam lithography system.

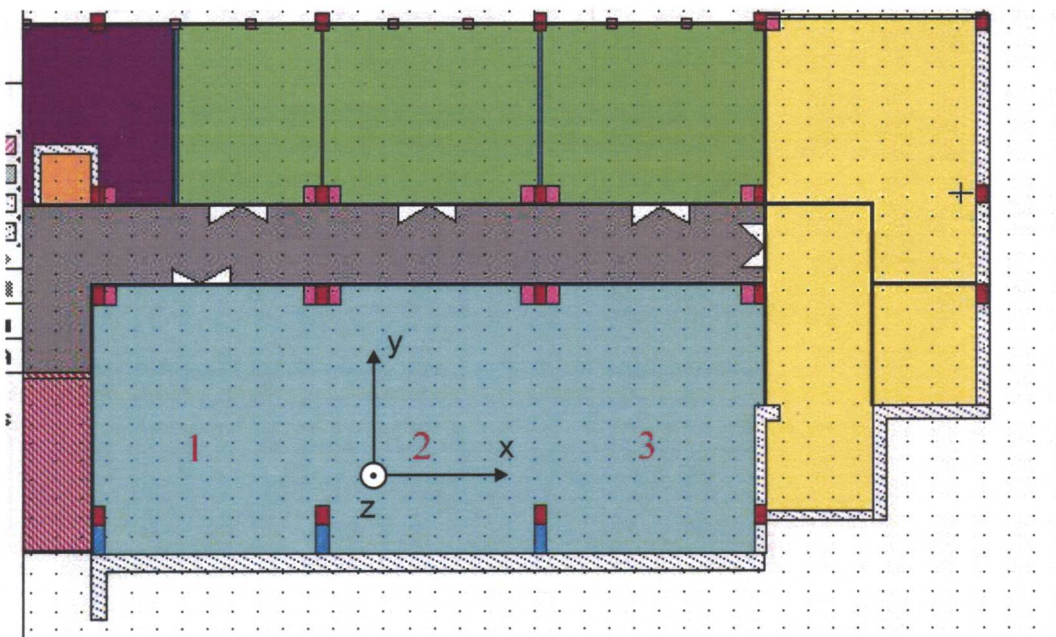


Fig. 1: A plan of the room.

In the first part, three different locations were considered and compared according to the magnetic field (see Fig. 1):

Location 1: Total RMS magnetic field B ranged between 2 and 4.5 mG depending on the cycle of the air conditioning system and other electric appliances. Behind the left wall there are stairs with about 5 kW cable responsible for the relatively large field.

Location 2, that is, in the middle of the room: $B = 1.0 \div 2.2$ mG.

Location 3: $B = 0.9 \div 2.2$ mG. This location represents a potential danger of increasing the field because of a planned new air conditioning system behind the right wall.

Thus, location 2 in the middle of the room was selected as the most appropriate for an installation of a lithography system.

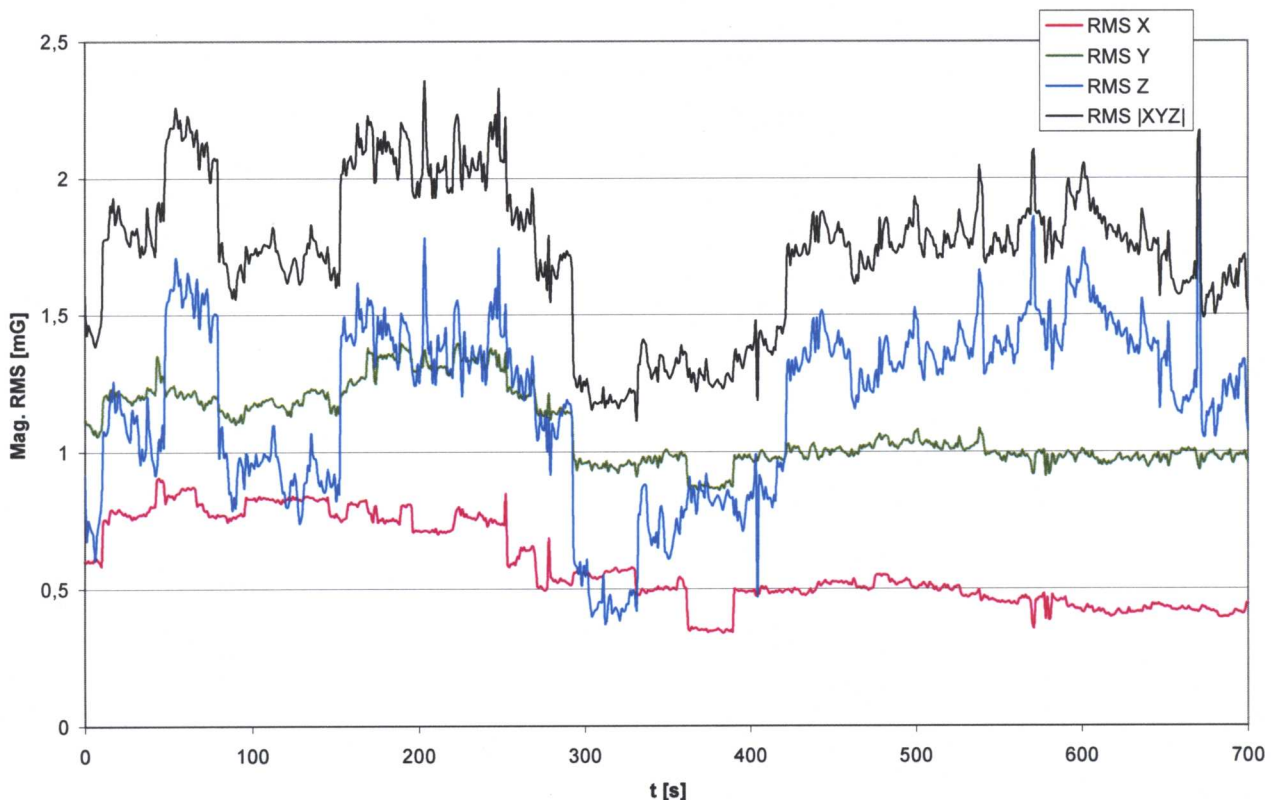
In the second part, detailed measurements of the best location no.2 were performed. They included (see the enclosed graphs):

1. time dependence of magnetic field RMS (wide bandwidth) in x , y , z axes,
2. magnetic narrow bandwidth plots in x , y , z axis of frequency [Hz] versus magnetic field [mG],
3. magnetic “DC” (bandwidth 0 to 2.5Hz) field fluctuations,
4. vibration plots in bandwidth and 1/3 octave in z axis (they were much lower in other directions) of frequency [Hz] versus velocity [$\mu\text{m/s}$] **at a high vibration level when all machinery was running** (from the workshop one floor above the measured room) and the same measurements **at a low vibration level when all machinery was stopped**.

The enclosed graphs are intended to be used for specification of the conditions for a producer of the lithography system. We did not perform acoustic measurements because new air conditioning needed for the clean room is expected to completely surpass the existing noise level.

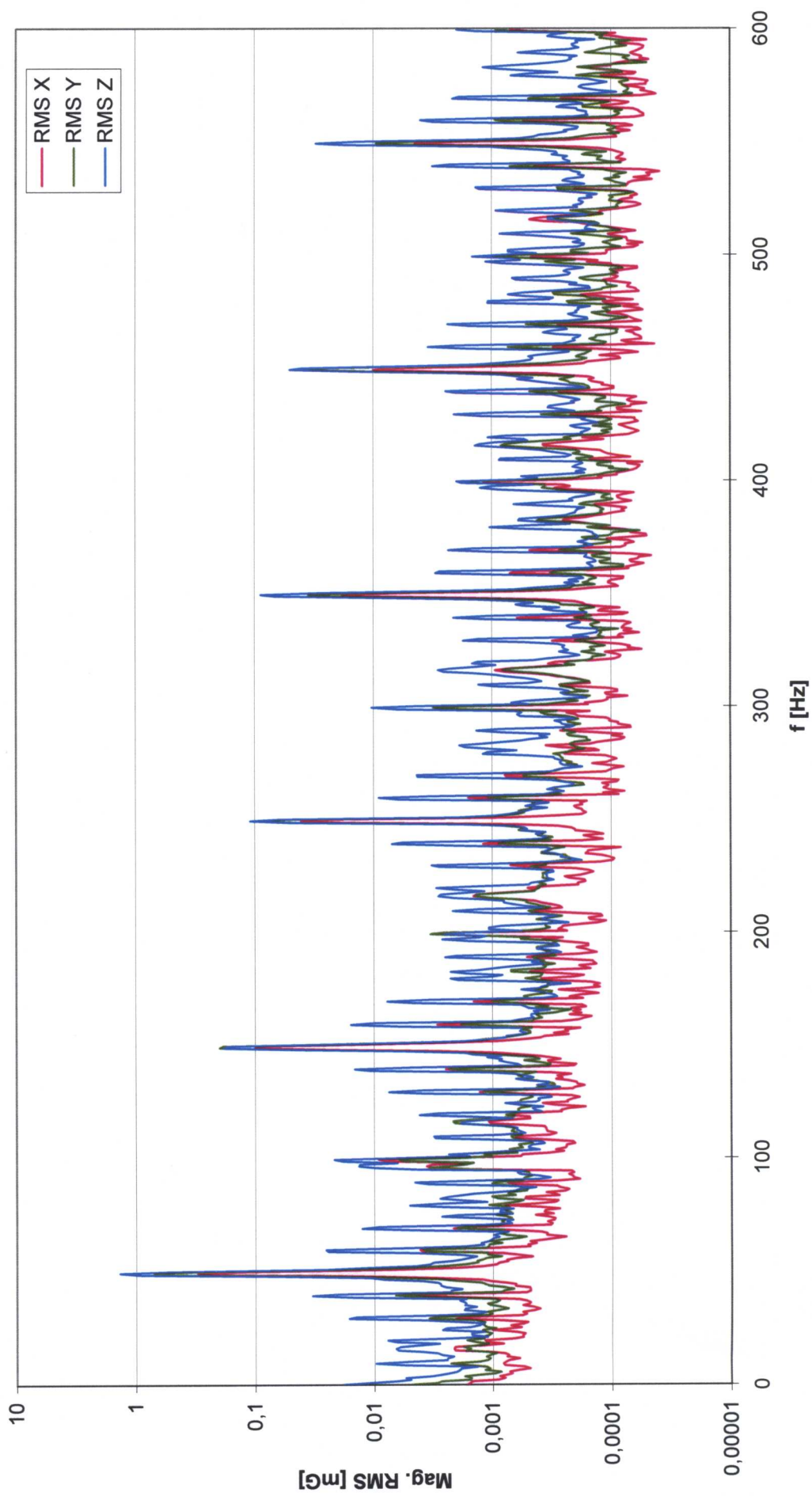
Measurements 1:

Magnetic field RMS as function of time (measurement bandwidth 10-250Hz)

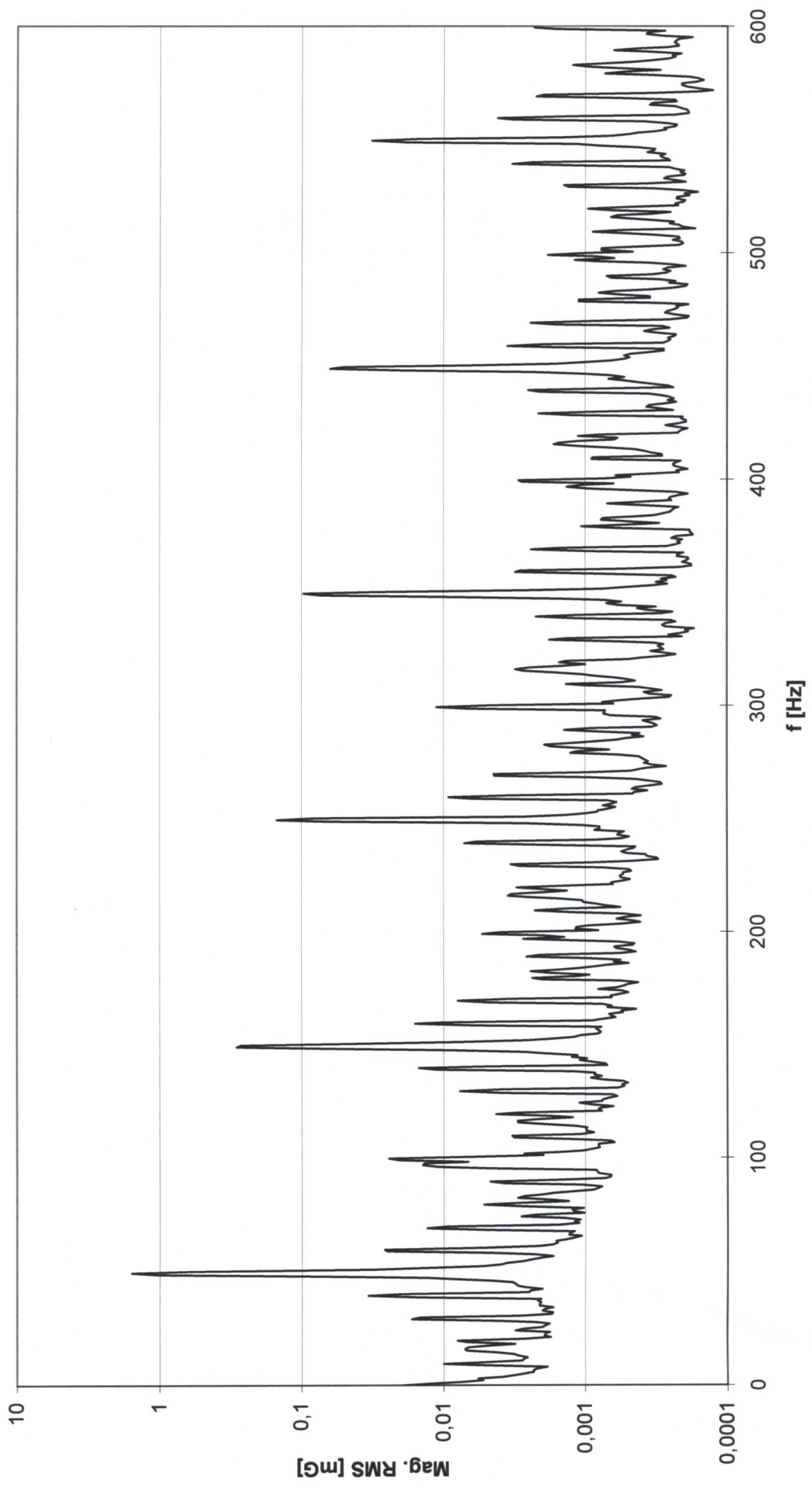


Measurements 2:

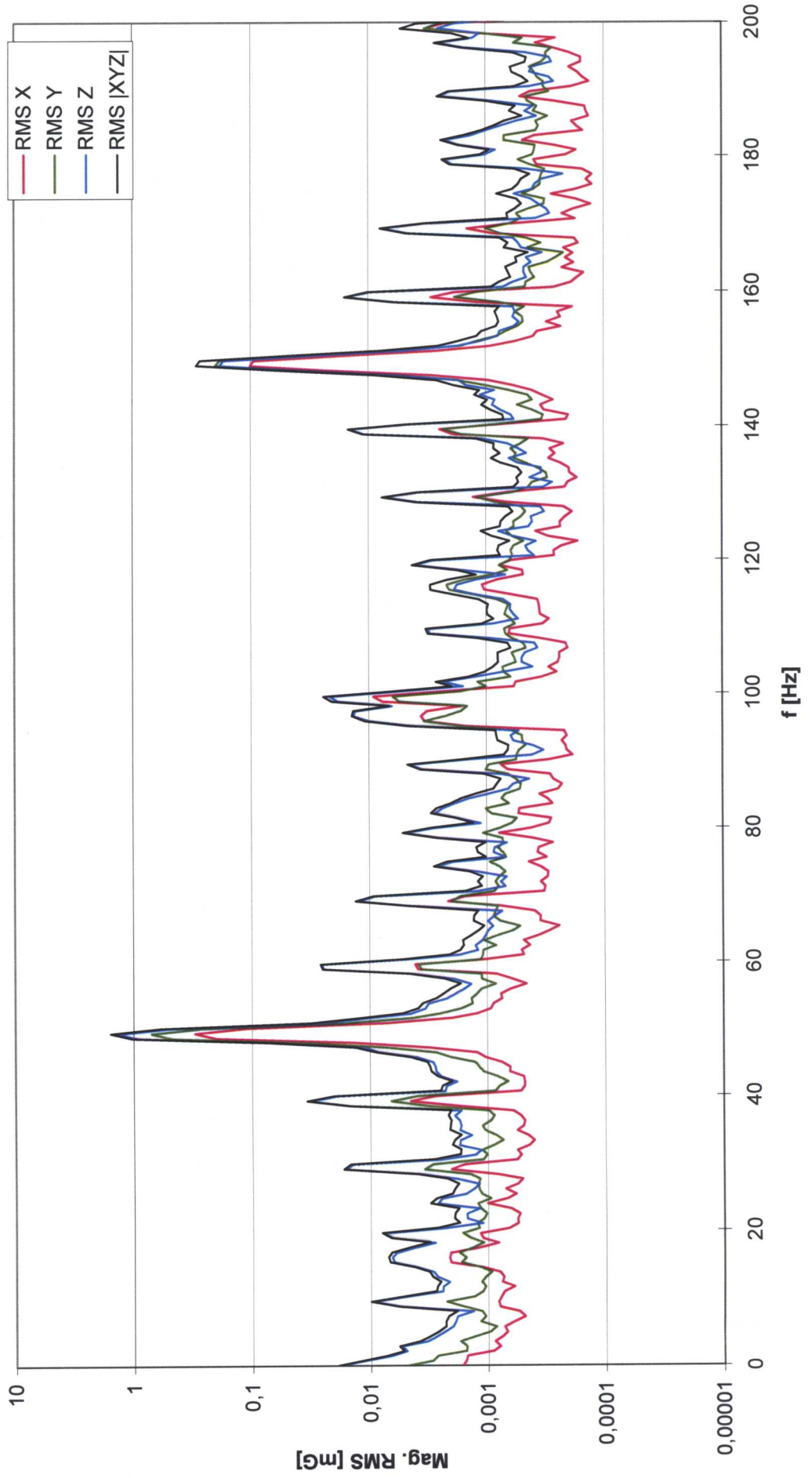
Magnetic field spectrum RMS for x, y, z axis (delta f = 0.7266)



Magnetic field spectrum RMS for total |xzy| (delta f = 0.7266)

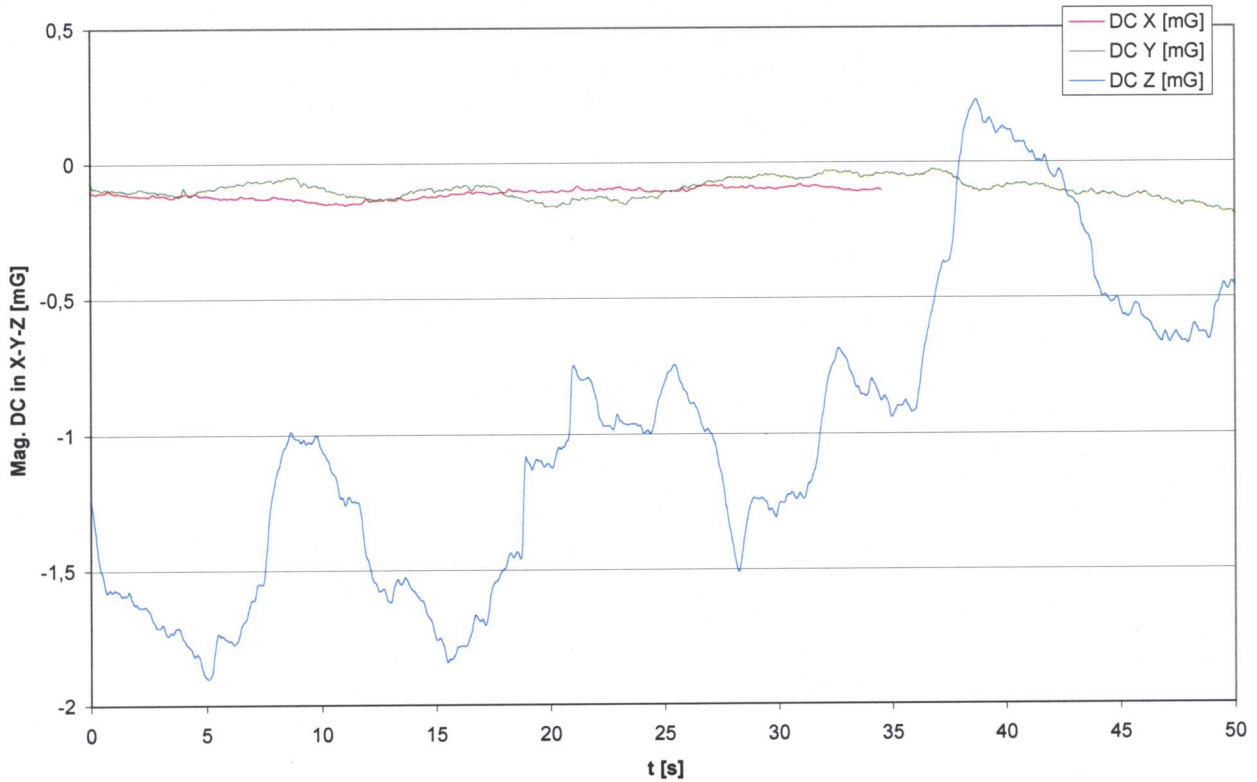


Detail of magnetic spectrum for x, y, z axis and total |xzy|



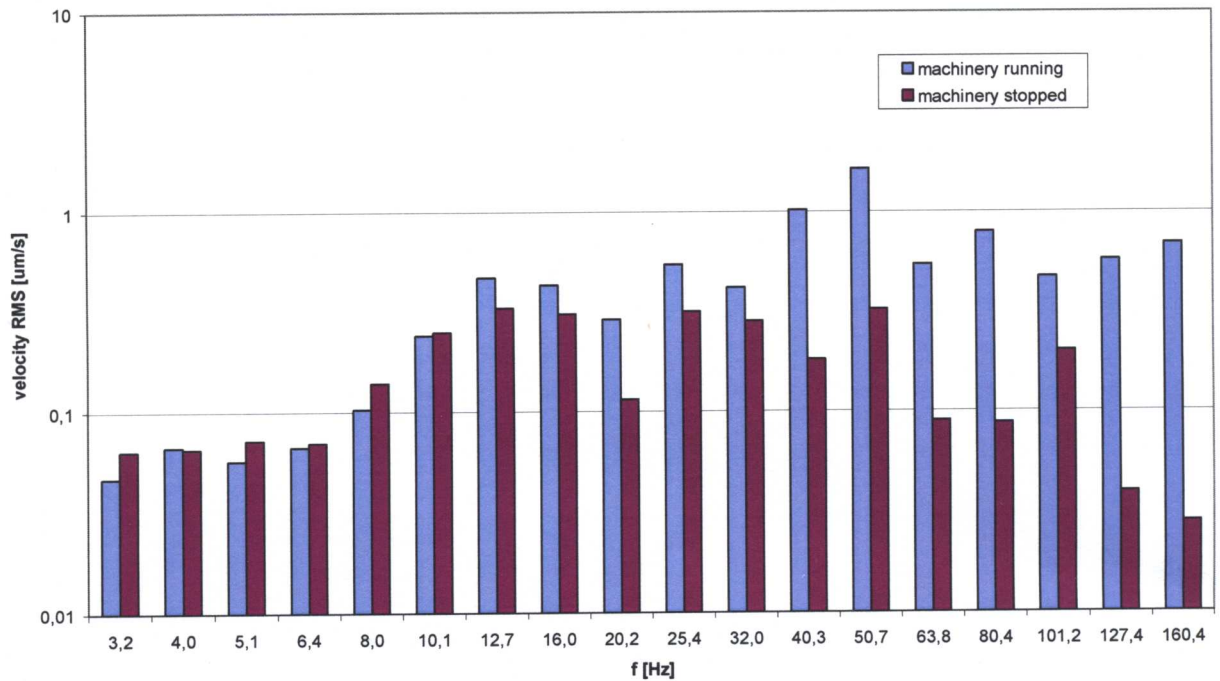
Measurements 3:

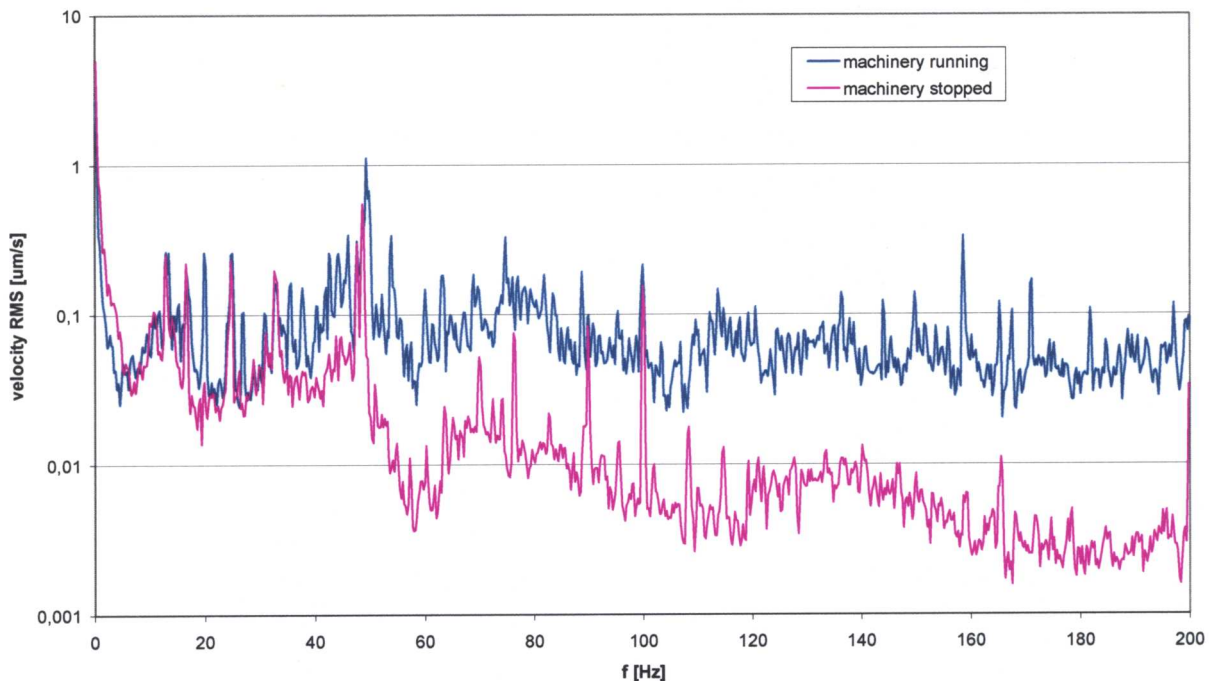
Magnetic DC field fluctuations (sampling rate 25Hz, bandwidth 0-2.5Hz)



Measurements 4:

Vibration 1/3 octave RMS



Vibration narrowband RMS (delta f=0.254313Hz)**Conclusions**

Although the location no. 2 have seemed the most suitable for an electron beam lithography system the results show significantly high magnetic and vibration background. Such level is considered to be on the edge or over the specifications of environmental requirements for this kind of instrument. It is suggested to contact a producer of e-beam lithographic system and send him these measurements results and require his judgement.

If the magnetic field level is unacceptably high it is suggested to use an active magnetic field cancelling system. References to some systems has been given to the user; however, it is pointed out that the lithography producer should recommend a system according to his experience.

It is assumed that no additional sources of noise, like electric cables, will be installed in the neighbourhood of the given room. Even if a magnetic field cancelling system is to be installed it is recommended to take a special care when installing any additional electric cables in order not to increase the field. Such precautions might be placing the cables far from the room or using special "twisted" power cables that are available on the market.

The customer intends to install a large isolated concrete block in the ground. This construction measure, if properly designed and built, should decrease the level of vibration significantly.

Special care must be taken when designing the air conditioning system and the system provider should guarantee the acoustic noise levels to be lower than the requirements specified for the instrument.



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Brno, 15th of May 2006