How to make a Pulsed Magnet fail

P. van der Linden, O. Mathon, C. Detlefs

ESRF, 6 rue Jules Horowitz, F-38043 France

Magnetic fields available for synchrotron research have until now been limited to those attainable by superconducting magnets, between 10 and 15 Tesla depending on the configuration. One way to increase the magnetic field range is the use of pulsed magnets. In order to explore the possibilities of the use of pulsed magnetic fields several developments are under way [1,2]. At the ESRF pilot experiments have been performed do demonstrate the feasability of x-ray scattering and absorption experiments in a pulsed magnet.

In this contribution the basic workings and facts of life of a pulsed magnetic field coil will be explained: why does one want to use a pulsed magnetic field rather than a static field, how it is generated and where the mechanical and thermal limits are. This will then be applied to the synchrotron case, where conditions are different from a normal solid state physics research laboratory. The fact that the measured volume equals the focal spot size permits the miniaturisation of the coil which in turn changes the way it is designed and operated. It will be shown that the failure mode goes from stress limited to fatigue life limited.

[1] – J. Vanacken et al., "Feasibility of synchrotron X-ray measuement in pulsed magnetic fields", submitted
[2] : Nojiri, H. *et al.*, IEEE Trans. Appl. Supercond., **10**, 534 (2000).