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Vibration Analysis of Dipole Magnets Using Piezoelectric Accelerometers in the ISIS Synchrotron

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Dipole magnets at ISIS are utilised in the Synchrotron particle accelerator to steer the 800MeV proton beam and maintain a circular trajectory within the 163m ring. Such is the importance of these magnets that failure of a single Dipole terminates the beam current, resulting in costly machine downtime. ISIS currently employs a simplistic form of condition monitoring to assess magnet health using a vibration meter to inspect pre-set locations across selected magnets before each cycle. This paper discusses a new condition monitoring scheme that utilises piezoelectric transducers and data acquisition technology, to perform real-time vibration monitoring and analysis, improving beam availability. In our feasibility study, two dipole magnets were instrumented and data acquired across two cycles. Proven analytical methods were applied and results showed initial characterisation to understand vibration modes. The challenges of operating the sensors in a high-radiation environment with large B fields, safety benefits of monitoring remotely, detail of the methodology, implementation, data acquisition, results and the aspirations to roll out this idea across the whole of ISIS are covered.

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