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On the performance of engineering diffraction at the ESS long pulse source

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Abstract

Neutron engineering diffractometers are key to non-destructive investigations of the mechanical and microstructural behavior of bulk engineering materials with 3-dimensional resolution. Due to the relatively high real and reciprocal space resolutions required, measurements can be time consuming and are generally flux limited. While existing short pulse sources are readily capable of achieving the desired wavelength resolution through the appropriate choice of moderator and instrument length, a long pulse source like the ESS will on one hand require additional pulse shaping, but can on the other hand offer tailoring the resolution to the requirements of specific measurements or experiments. In order to explore the potential of such an instrument at the future ESS source we investigate the basic performance aspects by taking into account the base line parameters of 5MW, 14Hz repetition rate and 2.86ms burst time. By means of simulations and/or modelling, we compare performance factors of different concepts against existing benchmark instruments such as Engin-X (ISIS). Using a pulse shaping chopper system starting at 6m from the moderator, and with a length‘ of about 155m it will be possible to achieve (i) a favorable line shape, (ii) variable wavelength resolutions that are (iii) constant over the desired wavelength band of 1.8Å and (iv) to compare to various instruments at other sources that provide comparable resolutions for either stress/strain or texture investigations in order to identify potential gains in performance.