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Thermal-Neutron Triple-axis Spectrometer Taipan and Its Future Upgrade at ANSTO

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Taipan is a high-flux thermal-neutron triple-axis spectrometer with a traditional single-detector design. Taipan has been the power horse for thermal neutron inelastic neutron scattering experiments in Australian Centre for Neutron Scattering (ACNS) at Australian Nuclear Science and Technology Organisation (ANSTO) for the last ten years,[1] generating numerous beautiful scientific highlights, ranging from phonon dispersion in thermoelectric materials[2], to spin-wave spectrum in multiferroics[3], and to magnetic diffractions in 100nm $BiFeO_3$ thin films[4,5]. Following the current trend for the neuron instrumentation worldwide,[6] it is interesting to consider a future upgrade of Taipan to increase its data-acquisition efficiency with a multi-analyser design. In this work, a flexible multi-analyser design is proposed for Taipan, and the advantages of such an upgrade are discussed via simulations. In contrast to the current Taipan with the single-detector design, the multi-analyser Taipan with 21 analyser channels will be able to simultaneously collect 21 different Q positions at the same energy transfer, providing at least one order of magnitude faster in data-acquisition rate. The splitting angle of the neighbouring channels is flexible and able to change from 1.5^o to 2.5^o. The energy and Q resolutions of all the channels are simulated at two different final energy configurations,[7] namely, E_f = 8.07 meV and 14.87 meV, to determine the optimized splitting angle for the most efficient data acquisition. The simulated results demonstrate that the data-acquisition efficiency on Taipan can be enhanced to one order of magnitude higher by implementing the new multi-analyser design. Different splitting angles are suitable for different types of scans depending on the purpose of the experiments. According to simulation, high performances are expected from the upgraded multi-analyser Taipan, as demonstrated on the cold-neutron triple-axis spectrometer Sika.[8,9]

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Topics

Neutron Instruments and Techniques

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