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Modelling and design of the new engineering diffractometer eMAP at ISIS

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ISIS Neutron and Muon Source is now seeking its next phase of new instruments and significant upgrades to existing instruments: a portfolio of projects that has been called the Endeavour Programme. Endeavour will increase both capacity and capability of the facility to address 21st century challenges and enable research in areas such as advanced materials and manufacturing, clean energy technologies, and biosciences and health-care. Starting in the 2023/24 financial year, the Endeavour Programme will construct 4 new experimental instruments and 5 significant upgrades to existing instruments over a 10-year period.

Here we report on the modelling and design of the new engineering diffractometer, eMAP, at ISIS. eMAP is a new instrument providing greater depth penetration capability to enable measurements on real size engineering components, and represents a step change in our ability to study real world engineering components. The flux and resolution characteristics of eMAP will allow: 3D residual stress mapping; high spatial resolution; large, thick, heavy and complex shaped components; near-to-surface measurements; process measurement (e.g. in-situ welding); in-situ loading and special environments; long-term tests (e.g. creep).

eMAP is designed with a performance complementary to the diffraction capabilities offered by the existing ISIS engineering instruments. ENGIN-X, the current “workhorse” instrument is oversubscribed, especially for industrial partnership access. eMAP will bring extra capacity with new capabilities for stress measurement of full size engineering components, enabling engineering manufacturers and emerging technology SMEs to design the next generation of complex machines with improved performance, durability and capability.

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