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# Application of Deep Learning in Polarized Target Nuclear Magnetic Resonance Measurements

Continuous wave Nuclear Magnetic Resonance (NMR) with constant current has been pivotal in solid-state polarized target experiments within Nuclear and High Energy Particle physics. Phase-sensitive detection using a Liverpool Q-meter is conventionally employed for monitoring polarization during scattering experiments. Yet, when operating outside of designed operational parameters, there are significant nonlinearities have not yet been well understood for high-fidelity running. Additionally under experimental conditions low signal to noise can lead to much larger experimental uncertainties reducing the overall figure of merit of the scattering experiments. This presentation discusses recent advancements aimed at enhancing data acquisitions in NMR-based polarization measurements and extending the operational capabilities of the Q-meter beyond its designated parameters using machine learning (ML) to analyze measurements with a low signal-to-noise ratio (SNR), corresponding to high noise levels. This innovative approach enables more effective real-time online polarization monitoring and offline data analysis, thereby enhancing the overall performance metrics in scattering experiments involving Spin-1 target material.

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