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New Horizons with Entanglement and Quantum Tomography in Collider Physics

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A modern renaissance in how to understand and use quantum mechanics has arrived in nuclear and particle physics. Quantum tomography bypasses model-dependent assumptions and unnecessary theoretical superstructure that characterized the old use of quantum mechanics, which as designed for exclusive processes. A modern description of inclusive reactions is closely tied to the correlations of what can be observed experimentally.
Entanglement is a generic and experimentally useful feature of quantum probability, which probes features of experimental data that are not always described by probability distributions. Actively applying quantum tomography to entangled systems produces outcomes that go beyond the traditional data analysis procedure of making distributions and cuts. We illustrate applications with calculations using practical computing code that begins with collections of momentum 4-vectors. The procedure and code automate data analysis that traditionally would be ill-conditioned, and sometimes incapable of capturing the underlying physical processes.

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