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Comparing Experimental Apples and Oranges with Quantile-Quantile Plots[1] ALLEN ANDERSEN, JR DENNISON, Utah State University, MATERIALS PHYSICS GROUP TEAM — An important question often encountered in experimental physics is, are two observables related or not? Quantile-quantile (q-q) analysis compares the cumulative distributions of two observations (or one set of observations and a theoretical curve) in a way that is both visually apparent and statistically quantifiable. If the two observables follow the same distribution, the q-q plot will be linear; if they are identical the plot will have unity slope. Deviations from a linear q-q plot indicate that the two observables do not follow the same distribution. We show that the q-q analysis method is applicable to a wide range of scenarios in experimental physics. As an example, we present a case study of a series of voltage step-up to dielectric breakdown tests with two observables—non-shorting pre-arcs and critical electrostatic discharge (ESD) breakdowns. In each test many pre-arcs are observed, but only one ESD. Initially it was unclear whether or not the field distributions of these two observations were related. Q-q analysis found an extremely significant correlation between pre-arcs and ESD events. Establishing the more copious pre-arcs as an indication of ESD behavior has the potential to greatly accelerate material characterization test times and facilitate selection from numerous candidate materials for applications.

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Allen Andersen
Utah State University

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