von Neumann projections are the main operations by which information can be extracted from the quantum to the classical realm. They are, however, static processes that do not adapt to the states they measure. Advances in the field of adaptive measurement have shown that this limitation can be overcome by "wrapping" the von Neumann projectors in a higher-dimensional circuit which exploits the interplay between measurement outcomes and measurement settings. Unfortunately, the design of adaptive measurement has often been ad hoc and setup specific. We shall here develop a unified framework for designing optimized measurements. Our approach is twofold: The first is algebraic and formulates the problem of measurement as a simple matrix diagonalization problem. The second is algorithmic and models the optimal interaction between measurement outcomes and measurement settings as a cascaded network of conditional probabilities. Finally, we demonstrate that several figures of merit, such as Bell factors, can be improved by optimized measurements. This leads us to the promising observation that measurement detectors which - taken individually - have a low quantum efficiency can be arranged into circuits where, collectively, the limitations of inefficiency are compensated for.