The Newton polytope of a polynomial $f$ is a combinatorial approximation to $f$ that also encodes much information about the hypersurface $H$ defined by $f$. In this talk, I will address the problem of how to recover the Newton polytope (or even $f$) when $H$ is represented numerically via a witness set, which is a data structure capturing the notion of a generic point of $H$. This talk will describe witness sets and how such a representation may arise without knowledge of $f$, explain an algorithm for solving this problem, and perhaps how it was used to find a face of the Lüroth invariant. (Received September 04, 2014)