Modeling-Independent Analysis with BPM Correlation Matrices*, K. BANE, Y. CAI, F. DECKER, J. IRWIN, M. LEE, M. MINTY, G. STUPAKOV, P. TENENBAUM, C. WANG, Y.T. YAN, F. ZIMMERMANN, SLAC - The BPM readings of a beamline are highly correlated. To exploit this correlation for beamline analysis, one can form the BPM readings into a correlation matrix of nPULSE rows by nBPM columns, where nPULSE is the number of beam pulses and nBPM is the number of BPMs. Each row of the matrix, which is a set of BPM readings from a single pulse, can be thought of as a vector in an nBPM-dimensional space. Without the need of referring to a beamline model (modeling independent), one can perform an SVD analysis of this matrix to obtain eigenvalues and eigenvectors (nBPM dimension). Most of the eigenvalues are small, which are due to noise. The number of eigenvalues that is above the noise floor is equal to the number of significant physical factors that are changing, and the linear space spanned by these eigenvectors is equal to the space spanned by the trajectory response vector to physical changes (physical vectors). A number of techniques for finding the physical vectors from the eigenvectors will be described and results from analyzing the SLAC Linear Accelerator will be presented.

* Work supported by the Department of Energy under Contract No. DE-AC03-76SF00515.