Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Non-linear Multidimensional Optimization for use in Wire Scanner Fitting ALYSSA HENDERSON, University of Virginia, BALSA TERZIC, ALICIA HOFLER, Jefferson Lab, CENTER FOR THE ADVANCED STUDIES OF ACCELERATORS COLLABORATION — To ensure experiment efficiency and quality from the Continuous Electron Beam Accelerator at Jefferson Lab, beam energy, size, and position must be measured. Wire scanners are devices inserted into the beamline to produce measurements which are used to obtain beam properties. Extracting physical information from the wire scanner measurements begins by fitting Gaussian curves to the data. This study focuses on optimizing and automating this curve-fitting procedure. We use a hybrid approach combining the efficiency of Newton Conjugate Gradient (NCG) method with the global convergence of three nature-inspired (NI) optimization approaches: genetic algorithm, differential evolution, and particle-swarm. In this Python-implemented approach, augmenting the locally-convergent NCG with one of the globally-convergent methods ensures the quality, robustness, and automation of curve-fitting. After comparing the methods, we establish that given an initial data-derived guess, each finds a solution with the same chi-square- a measurement of the agreement of the fit to the data. NCG is the fastest method, so it is the first to attempt data-fitting. The curve-fitting procedure escalates to one of the globally-convergent NI methods only if NCG fails, thereby ensuring a successful fit. This method allows for the most optimal signal fit and can be easily applied to similar problems.

Alyssa Henderson
University of Virginia

Date submitted: 12 Nov 2013 Electronic form version 1.4