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A System for Electrostatic Reconstructions

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The standard reconstruction model with the IVAS® software suite has historically relied on a spherical apex model [1]. The assumption of simple projection properties causes well-known issues when trying to reconstruct data from some specimens with structures of different evaporation fields [2] We are introducing a set of tools to facilitate reconstruction of atom probe tomography data to non-spherical apex forms, incorporating the resulting electrostatics.

The primary electrostatic model we have implemented is a technique similar to the boundary element model called the distributed point source method (DPSM) [3], (Fig. 1). Using this technique we build mesoscopic electrostatic models that can be used to compute trajectory maps from non-spherical apex models, including the effects of important ion optical elements such as apertures and the rest of the specimen shank. The initial implementation determines the projection properties of an equilibrium (equi-field) apex shape assuming a homogeneous material. We expect reconstructions to build up as in the spherical Bas model, but with the depth and projection properties determined directly from the electrostatic model.

We hope to improve reconstructions by incorporating apex geometry evolution as determined either by direct imaging or calculated through evaporation modelling tools. Many groups in the atom probe community have or are developing field evaporation models [4-8]. They employ various computational techniques and embody different pieces of the relevant physics to predict the specimen endform evolution. In addition, recent development in complementary techniques such as atomic force microscopy promise to provide direct 3D measurements of specimen shapes, possibly at multiple times during an atom probe analysis [9, 10]. Incorporating the inhomogeneous magnification imposed by a non-spherical apex will allow us to improve reconstruction accuracy in a more physically correct way than the various techniques currently used.

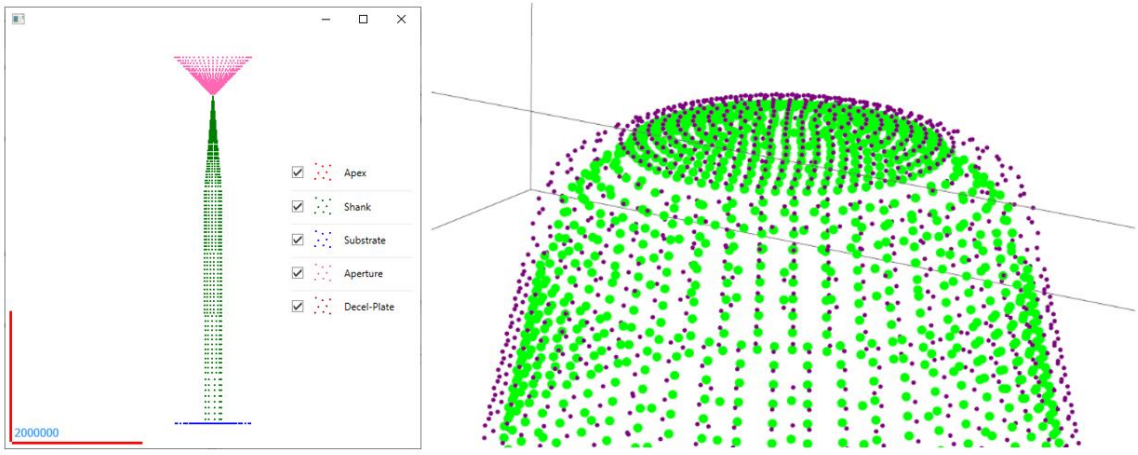

Figure 1. a) A DPSM model including aperture, and a wire specimen. b) A close-up view of the DPSM apex model, blue points represent surface definition positions, green points are the positions of solved charges.

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