Computed tomography (CT) is an excellent tool for measuring bone density in natural tissues as it is based on X-ray absorption. When natural tissues are combined with biocompatible materials, such as titanium implants, the integration of such implants into the surrounding bone tissue is critical to the lifetime and durability of the implant.

A hybrid volume rendering technique has been developed that uses a three-dimensional color and opacity transfer function to render a color-coded density representation of the bone near the implant sites. In addition, a glyph-like, two-dimensional density profile for each implant is superimposed on the volumetric display. The glyph also shows the value of the line integral on two sides of the implant. The readings from these glyphs are correlated to mechanical stress tests that were conducted on the same specimen.

The visualization procedure described in this presentation consists of 2-D cross-sectional CT imaging, 3-D gradient-based hardware-accelerated volume rendering using 3-D texture mapping, implant site extraction using 3-D selection of a 2-D cross-sectional, tri-linearly interpolated 2-D image, computation of a bone density profile and line integral along the implant, glyph generation, and 3-D hybrid rendering of the implant site together with the glyph.

This method has been demonstrated to be successful in enabling the mapping of information derived from virtual bone density measurements onto data obtained from mechanical testing or mechanical simulations.