Purpose:
A study was performed to determine the degree to which region-of-interest z-axis collimation can improve the image quality of a cone-beam CT system.

Methods:
The linearity and low and high-contrast resolution modules of a 20-cm diameter Catphan 600 phantom were imaged with a Siemens Zeego Angiography system using three "DynaCT" cone beam CT modes. These included (a) DR-H Head (20-sec), (b) DSA-H (8-sec), and (c) DR-Body(8-sec). All modes employ automatic exposure control (AEC), which can vary the kVp, mA and pulse width throughout the scan. Image quality was compared in 5-mm thick slices obtained with full-field (19-cm) collimation and minimal-width (2.3-cm) collimation. Body scans (c) were compared with and without saline bags added at the periphery of the Catphan to create a larger phantom.

Results:
The contrast-to-noise-ratios (CNRs) of the 15-mm diameter, nominal 1% (10HU) disk in the Catphan when imaged with full-field collimation were 1.28, 1.93, and 1.23 for DynaCT modes a, b, and c, respectively. With 2.3-cm collimation, the corresponding CNR's improved to 2.13, 2.46, and 1.45. The CNR's for images of the large phantom degraded to 0.51 for full-field and 0.55 for 2.3-cm collimation. Plots of measured CT numbers of plastics in the linearity section as a function of mass density were linear (R-squared >0.99) in all cases, with slopes that varied from 761 to 1006 HU/(g/cc) depending upon collimation, phantom size and the AEC selected kVp. Spatial resolution was 12 lp/cm for mode (a), and it was 8-9 lp/cm for all other modes including scans with the large phantom.

Conclusions:
Collimation significantly improves CNR for a small patient/phantom, but is less effective for large patients/phantoms. Collimation and phantom size have minimal effect on spatial resolution. They affect the slope and intercept but not the degree of linearity of CT number with density.