The use of Cobalt–60 in radiation therapy applications has a fifty-year long history. Unfortunately, over the last two decades, Cobalt-60 has steadily fallen out of favour in conventional clinical practice. The medical physics group at the Kingston Regional Cancer Centre has aimed to modernize Cobalt-60 radiation therapy by investigating the viability of intensity modulated radiation therapy (IMRT) with this source in a tomotherapy technique. An important feature of tomotherapy is the treatment geometry since it provides a convenient means to perform on-line computed tomographic (CT) imaging for patient set-up verification and dose reconstruction. Considerable research has been devoted to megavoltage computed tomography (MVCT) with radiation beams from medical linear accelerators. The research in this study explores the feasibility of using Cobalt-60 as an alternative radiation source for MVCT. An automated bench-top image acquisition system was designed and built to enable Cobalt-60 gamma ray fan-beam MVCT. The main components of the bench-top system include: an object rotation stage, a 2-dimensional scanning diode detector apparatus, and a conventional Cobalt-60 radiotherapy unit. MVCT images of simple test objects acquired with the experimental system demonstrate a 3 mm high-contrast spatial resolution, 2.8% low-contrast sensitivity, linearity between MVCT number and electron density, and an inherent absence of beam-hardening artifacts. In addition, MVCT images of human-equivalent test objects provide promising anatomical visualization, which may prove useful for accurate patient positioning prior to a radiation therapy treatment.