KA Imaging has developed a novel triple-layer X-ray detector capable of generating both a traditional X-ray image and material separated images in a single exposure. For example, a high-atomic-number image can be obtained to better visualize dense objects without the distraction and clutter of less dense objects. This is particularly useful in non-destructive testing applications, where such separation can be used for both improved visualization and to aid in material identification. Recently, we have been exploring tomosynthesis and cone-beam computed tomography (CBCT) to enable depth localization of features within the target. In a preliminary study, we scanned a spectral CT phantom using 360 projections in a full circular trajectory. The phantom was rotated between the detector and a portable X-ray source. A relatively low dose (0.5 mAs per projection) was used. The phantom materials mimicked water, calcium, and human soft tissue. For each projection, the three images from the triple layer detector were used to calculate a low and a high energy projection. Low and high energy projections were then separately reconstructed, and these low/high energy reconstructions were combined using logarithmic subtraction to create two images, one which emphasized calcium and one which reduced calcium. This proof-of-concept study demonstrates the material separation capabilities of this unique spectral CT data. Furthermore, higher atomic number materials (i.e. metals) that are more relevant to NDT should more easily be separated from low-Z materials than calcium. In this work, we will also demonstrate how combining the results from material separated data can yield a single color image (conforming to ASTM F792) for easier visualization. This work is promising to expedite the development of portable systems for field applications, supporting either rotating the object or moving the source and detector for fixed target scenarios and can pave the way to tomosynthesis/limited-angle CBCT in the field to support large targets where the source and detector physically cannot rotate completely around the object.