Purpose:
To compare the dose reduction and image quality achieved using bismuth shielding or global decreasing of the tube current in head and thoracic CT

Methods:
An anthropomorphic head phantom and four sizes of thorax phantoms were used for dose measurement and image quality assessment. Three scans were performed on each phantom with a 128-slice clinical CT scanner: 1) reference (relevant clinical protocol); 2) reference plus bismuth shield; 3) reference with a global reduction in tube current chosen to match the dose reduction from bismuth shielding. Dose to the eye was measured with OSL dosimeters. Dose to the breast was measured with an ion chamber on the surface of the phantom. Image quality was evaluated by measuring the mean and standard deviation of CT numbers within the brain region for head CT and the lung and heart regions for thoracic CT.

Results:
Compared to reference scan, dose to the eye was reduced by 26.4% with bismuth shielding; dose to the breast region was decreased by 21% for the 15-cm phantom with a pediatric (2-ply) shield and by 37% for the 30, 35 and 40-cm phantoms with adult (4-ply) shields. The dose reduction achieved with bismuth shielding was limited to the anterior surface. Globally decreasing tube current reduced dose by similar amounts, but for all projection angles. Image noise was increased in the brain, lung and heart regions by similar amounts with both techniques. However, streak artifacts and an increase in CT numbers were observed for using bismuth shields, but not for global tube current reduction.

Conclusions:
Globally decreasing tube current can produce the same dose reduction, but for all projections, as bismuth shielding reduces dose to the anterior surface (eye and breast), with a similar noise increase, yet without the streak artifacts and CT number errors caused by bismuth shields.