Purpose: To demonstrate a method to estimate organ doses from tube current modulated (TCM) CT examinations using angular organ dose weighting.

Method and Materials: An extensive set of Monte Carlo dose calcualtions has become available in recent years using realistic models of human anatomy. Dose to individual organs are documented for particular CT slice positions. For longitudinal TCM CT scans, the available slice-wise dose is weighted by the tube current for that position. This method has been applied to the RPI series of pregnant phantoms at different genstational ages. Organ doses for x-ray exposures in flat projections in the four primary directions are also available from tabulated data. To account for rotational TCM in organ dose calculations, a geometric combination of these flat projection organ doses is used to generate weighting factors for tube currents that vary with angle. Sample TCM CT scans have been constructed for standard CT scan ranges using the RPI-Adult Male and RPI-Adult Female phantoms.

Results: Applicaiton of longitudanal TCM to scans of pregnant patients are shown to reduce fetal dose by 25-35% relative to uniform current at maximum patient thickness. The effective dose applying rotational TCM is reduced by 29% for chest scans and 37% for abdominal scans relative to constant-current scans at those positions. These dose reductions are verified with direct Monte Carlo simulation of the applied TCM scheme.

Conclusion: TCM use is known to result in significant dose savings to the patient. Due to the uniqueness of each individual tube current modulated CT scan, direct Monte Carlo simulations of every possible scheme are impractical. This study demonstrates a method to estimate organ doses from an arbitrary TCM scheme using existing CT dose data. This algorithm is being adopted for use in a CT dose software tool, VirtualDose.