Purpose: To investigate potential radiation dose reduction to peripheral organs (such as glandular breast tissue) of the patient during helical CT exams by adjusting the tube start angle and table height.

Methods: A Radcal 0.6cc ionization chamber was placed on the anterior surface of an anthropomorphic thorax phantom. Helical CT scans were performed on a Siemens Sensation 64 CT scanner using 24x1.2mm collimation, 120kVp, 100mAs with a pitch of 1.5. CareDose4D was turned off. The table was set to a variety of heights (table height of 100mm, 130mm, 160mm, 200mm, and 255mm) to investigate the effect of table height on peripheral organ doses. Since the tube start angle is random and is not under the user's control for helical scans, 24 helical scans were performed under each table height to yield a variety of tube start angles. The exposure of the ionization chamber for each scan was recorded. After scanning, the raw projection data were extracted and read in by a Siemens proprietary MATLAB code to obtain the tube start angle for each scan.

Results: At a fixed table height, the exposure varies by more than a factor of two depending on the tube start angle. As the table moves higher (the ionization chamber closer to the top of the gantry), the exposure decreases. While keeping all the scanning parameters (kVp, mAs, pitch) the same, by just adjusting the table height and the tube start angle, the lowest measured exposure is 732mR, while the highest measured exposure is 2810mR.

Conclusions: The uncontrolled tube start angle in current commercial CT scanners results in great uncertainties in dose to peripheral organs. Moving the table up decreases anterior organ doses. By adjusting both the tube start angle the table height, dose to a point in glandular breast tissue could be reduced by 74%.