AbstractID: 9644 Title: Delving the Low-Dose Limits of Lung Nodule Detectability in 320-Slice CT

Purpose: Lower-dose imaging protocols in chest CT are becoming increasingly important in the screening of early-stage lung cancer. Such merits investigation of minimum-dose imaging techniques that maintain lung nodule detectability yet permit dose reduction, particularly for larger body habitus. The objective of this study was to investigate the extent to which radiation dose can be minimized, while maintaining diagnostic performance, through knowledgeable selection of reconstruction filter.

Methods: The Toshiba Aquilion ONE™ 320-slice CT system was used to scan an anthropomorphic phantom at dose ranging from ~0.2 mGy up through that typical of low-dose CT (LDCT, ~5 mGy) and diagnostic CT (~10 mGy). Patient dose was measured via MOSFET dosimetry. The phantom presented simulated nodules of varying size and contrast within a realistic anatomical background, and chest thickness was varied though addition of fat-equivalent bolus. Diagnostic performance was evaluated as a function of dose, patient thickness, and reconstruction filter by means of 9-alternative forced-choice (9AFC) human observer tests to quantify nodule detectability.

Results: Results were analyzed for a 3.2 mm simulated lung nodule – typically the smallest size of clinical significance in nodule screening. For a given reconstruction filter, nodule detectability decreased with reduced dose due to increased quantum noise. However, at even the lowest dose levels, nodule detectability could be restored through use of progressively smoother reconstruction filters. The resulting loss in spatial resolution did not appear to significantly reduce nodule detectability.

Conclusions: There is strong indication that radiation dose can be dramatically reduced below the current low-dose (5 mGy) and minimum-dose (1 mGy) levels with knowledgeable selection of reconstruction filters. Image noise, not spatial resolution, was found to be the limiting factor in detection of small, solid lung nodules. Therefore, the use of smoother reconstruction filters may permit lower-dose protocols without tradeoff in diagnostic performance.