AbstractID: 3104 Title: Squared Contrast-Noise Ratio Per Dose and Rh-filter Thickness for Digital Mammography

Purpose: Increase detection sensitivity of breast carcinoma is greatly needed for digital mammography. We show that the tissue-lesion contrast-noise ratio (CNR) at a given dose level can be improved by increasing the Rh-filter thickness used for the Rh-target in digital mammography.

Method and materials: Currently a 25μm-Rh filtration is the standard in digital mammography for all the modes with a Rh-target. To test if this standard filter-thickness is optimal, we studied how the contrast-noise ratio between breast and infiltrating ductal carcinoma (IDC) of 5mm-size embedded a 6cm-thick breast changes with Rh-filter thickness for Rh-target. We performed imaging experiments by modifying the filter wheel of a GE Senographe 2000D unit with Rh-filters of 25μm, 37μm, 50μm, 62μm and 75μm. Before imaging a phantom the x-ray HVL values at 29 kVp and radiation outputs were measured for each Rh-filter thickness ranging from 25μm to 75μm. A 50%-glandular and 50%-adipose breast phantom of 6cm with an infiltrating ductal carcinoma (IDC)-simulating insert of 5mm in size was used as the phantom for all the cases. The CNR's between the breast phantom and the IDC-insert were measured, and average glandular doses were calculated by using a filtration-dependent x-ray spectra model and a breast-dosimetry model based on a validated Monte Carlo simulation. The exposure times were recorded as well.

Results: In contrast to conventional wisdom, the tissue-lesion CNR at a given dose level increases with increasing Rh-filter thickness from 25μm to 75μm. The measured squared CNR per dose were increased by 7%, 13%, 18% and 21% for 37μm, 50μm, 62μm and 75μm Rh-filters compared to that for the standard 25μm Rh-filter, respectively.

Conclusions: Increasing Rh-filter thickness for Rh-target from 25μm to 50μm can increase tissue-lesion squared CNR per dose by 13% with a tolerable increase of exposure duration.