Image quality comparison of post-processed true axial head CT reconstructions with direct reconstructions on scanner

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INTRODUCTION

- **CT scans are often reconstructed into a "True Axial" orientation (along the AC-PC line) to make reading the images easier for radiologists**
- **We investigated whether this reorientation added unwanted noise to head exams**

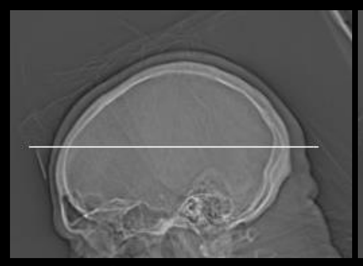

Figure 1a. Original Axial Acquisition

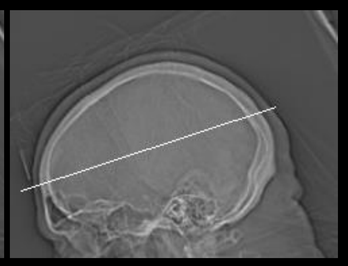

Figure 1b. "True Axial" Reconstruction

Figure 1. Comparison of Axial Acquisition and "True Axial" Reconstruction

METHODS

- **Forty head CT exams were gathered with IRB approval and underwent automated "True Axial" post-processing on a Siemens SOMATOM Force and SOMATOM Definition Flash. Fourteen of these exams were run on dual energy systems and thirteen used contrast**
- **The "True Axial" post-processing algorithm utilized the Siemens *syngo*.via imaging software. The algorithm transformed 0.5 mm axial slices into 3.0 mm "True Axial" slices**
- **We used global noise as our noise metric due to its reproducibility and ability to be automated [1] [2]**
- **The global noise algorithm parameters were set at a 13x13 pixel kernel, a soft tissue mask upper threshold of 100 HU, and a histogram bin size of 0.1 HU [3]. The median global noise of all the slices in the exam was taken to be the global noise**
- **The global noise of the original exams were compared to the automated "True Axial" exams using a paired t-test**
- **CT scans were also manually rotated by small, incremental amounts about the polar and azimuthal angles to investigate the general effects of rotation**

	All	Contrast Excluded (SE and DE)	Contrast Included (SE Only)	Dual Energy (No Contrast)	Single Energy (No Contrast)
Original	4.9 ± 2.2	3.8 ± 0.4	7.1 ± 2.5	4.0 ± 0.4	3.6 ± 0.3
Automated "True Axial"	5.1 ± 2.3	3.9 ± 0.4	7.6 ± 2.7	4.1 ± 0.4	3.7 ± 0.3

Table 1. Average global noises (HU) across all acquired CT exams. These averages are further categorized on their inclusion of contrast and whether a single energy (SE) or dual energy system (DE) was used

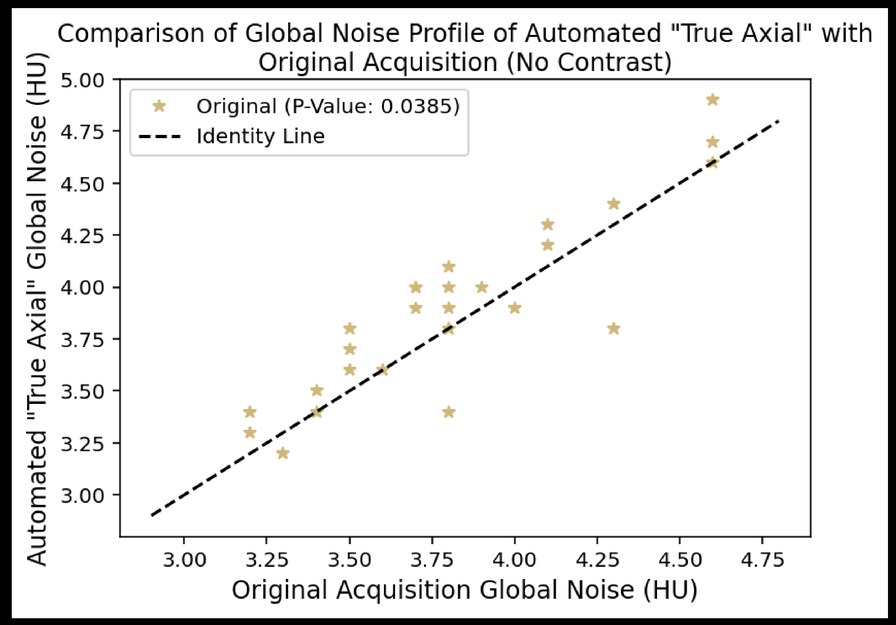

Figure 2. Comparing the global noise of the automatic "True Axial" reconstruction with the original acquisition

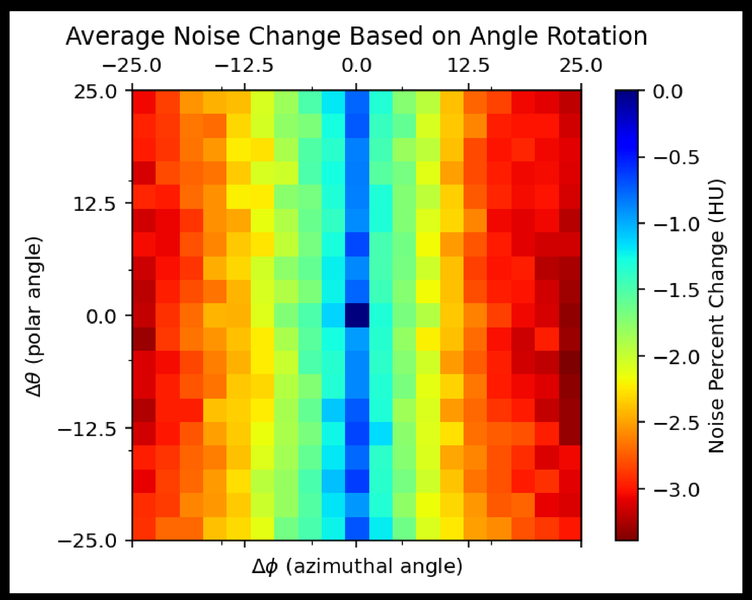

Figure 3. Percent change of global noise from the "True Axial" reconstruction when varying the azimuthal and polar angles

RESULTS

- **The global noise of the original exams (P<0.05, paired T-Test) is statistically lower than the global noise of the "True Axial" reconstructions as shown in Figure 2**
- **The average change in angle across all forty exams was 4.9° ± 4.8° .**
- **When averaged over forty exams, the average maximum change in noise is never more than 3.4 ± .9% in any arbitrary orientation as shown in Figure 3**

CONCLUSIONS

- **There is a statistically significant, but small difference in the global noise between axial and "True Axial" orientations. Ultimately, most individuals will not be able to distinguish such a small noise difference**
- **The average change in angle and noise percent change that the "True Axial" post-processing algorithm could shift the patient is ultimately very small**
- **Changes in noise likely come from the fact that some degree of interpolation is necessary when rotating the anisotropic voxels that make up the images.**

REFERENCES

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2. Ahmad, M., Jacobsen, M.C., Thomas, M.A., Chen, H.S., Layman, R.R. and Jones, A.K. (2021), A Benchmark for automatic noise measurement in clinical computed tomography. Med. Phys., 48: 640-647. https://doi.org/10.1002/mp.14635
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