(3) and testing (1). Qualitative and quantitative image quality assessment was performed by visual inspection and line profiles across anatomy of interest. **Results:** The independent testing case demonstrated that the network improved UHR PCD-CT image quality from unseen LR images. Line profiles demonstrated improved mastoid air cell delineation. **Conclusion:** The SR-CNN improved the visualization of fine bone structural detail in comparison to the original images with both smooth (low resolution) and sharp kernels (high noise), resulting in high resolution, low noise PCD-CT temporal bone images with potential of increased diagnostic performance.

TU300-GPD(B)-LOUNGE-196, Remote Ultrasound Detection Using Laser Interferometry: K. Kim[1], N. Katta[2], E. Lawrence[3], T. Milner[2] and L. Xiang[*4], (1)University of Califorrnia, Irvine, Irrvine, CA, (2)Beckman Laser Institute, University of California Irvine, Irvine, CA, (3)Polytec Inc, Irvine, CA, (4)University of California, Irvine, Irvine, CA

Purpose: Conventional modalities for ultrasound wave detection currently consists of piezoelectric transducers or medical ultrasound probes. However, these methods can cause variability in the quality of images depending on the skill of the user or may cause discomfort, as direct contact to the skin is required with the use of ultrasonic gel. We present the use of a laser interferometer for ultrasound detection. Through laser interferometry, remote detection of ultrasound and photoacoustics is demonstrated, eliminating the direct contact of the detection method to the skin. **Methods:** A pulsed picosecond Alexandrite laser was used to excite a water phantom containing a black twist tie with a pulsewidth of 900ps. The vibrometer was confocally aligned with the laser to capture the signal, which was sent to the data acquisition system (DAQ). Five runs were completed with varying energies, each with no averaging. Next, a scanning vibrometer was used, which could scan a certain number of points in each area based on the given parameters. A 5MHz focused ultrasound transducer was used to send ultrasonic waves using a pulser/receiver system. A water phantom was used as the medium, and 529 points were scanned across the phantom. **Results:** the interferometer system was able to capture signals with no averaging for varied energy levels from a therapeutic laser. Even with the laser power at the lowest, a distinct waveform can still be observed. We demonstrate the results from the scanned phantom using the vibrometer, which provides a grid map displaying where the greatest amplitude is seen over time on the surface of the phantom. **Conclusion:** The remote detection of ultrasound waves produced by a high energy therapeutic laser and a 5MHz ultrasound transducer was demonstrated in this work. Scanning results show that 2D imaging with an interferometer is possible with high accuracy.

TU300-GPD(B)-LOUNGE-197, Accurate Iodine Quantification Via Deep Silicon Photon-Counting CT: Size, Dose, Concentration, and Organ Dependencies: R. K. Panta[1], Z. Yin[2], F. Grönberg[2], M. Bhattarai[1], E. Abadi[*3], W. P. Segars[4] and E. Samei[5], (1)Center for Virtual Imaging Trials, Duke University, Durham, NC, (2)GE Healthcare, Waukesha, WI, (3)Duke University, Durham, NC, (4)Carl E. Ravin Advanced Imaging Laboratories and Center for Virtual Imaging Trials, Duke University Medical Center, Durham, NC, (5)Duke University Health System, Durham, North Carolina, UNITED STATES

Purpose: While photon-counting CT gains widespread recognition for its enhanced accuracy in effective photon energy measurement, its iodine quantification performance amidst diverse imaging conditions remains underexplored. This study evaluates the iodine quantification accuracy of deep silicon-based photon-counting CT (Si-PCCT) with dependencies on size, dose, concentration, and organs through a virtual imaging trial. **Methods:** We developed and validated a Si-PCCT simulator against a Si-PCCT prototype. We used Perspex phantoms of varying diameters (20, 30, and 40cm), each with six iodine concentrations (1, 2, 5, 9.9, 14.8, and 19.7 mg/ml), along with three iodine contrast-enhanced computational XCAT patient models with BMIs of 19, 28, and 38 kg/m^2. In a virtual imaging trial, we employed the Si-PCCT simulator to scan phantoms and patients replicating clinical imaging settings, under different radiation dose levels (200 and 400mA) while keeping other imaging parameters the same. We implemented a forward-model-based material-decomposition algorithm to generate iodine and water sinograms, which were reconstructed using a filtered-back projection technique. We evaluated iodine quantification accuracy of estimated iodine concentrations on phantoms and contrast-enhanced organs (liver, spleen, and kidneys) against the ground-truth iodine concentrations. **Results:** Linear (R^2>0.99) relationship was observed between the reconstructed material pixel values and the ground-truth iodine concentrations across all imaging conditions, with slopes from 0.59 to 0.50. Lower slopes were observed for larger object sizes and lower radiation dose levels. The mean absolute errors for estimated iodine concentrations were 0.10, 0.25, and 1.80 mg/ml for 20, 30, and 40cm phantoms, and 0.31, 0.37, and 0.70 mg/ml for the patients with BMIs 19, 28, and 38, respectively. **Conclusion:** The study demonstrates the potential of deep Si-PCCT to accurately quantify under diverse imaging conditions (variable size, dose, iodine concentration, and organs) in phantoms and a diverse virtual patient population, which is important for the diagnosis and monitoring of liver lesions.

TU300-GPD(B)-LOUNGE-198, Dose Rate By Distance for Au-198 Nanoparticles in Water: L. V. Angelocci, S. S. Sgrignoli, C. D. Souza, L. E. H. Teodoro, C. A. Zeituni and M. E. C. M. Rostelato[*], IPEN - Instituto de Pesquisas Energéticas e Nucleares, São Paulo, SP, Brazil

Purpose: To evaluate dose as a function of depth in water medium by a source of Au-198 nanoparticles, both as a point source and as homogeneously distributed over a volume representing a prostate tumor. Dose over an unidirectional axis was estimated and presented according to distance from the source, highlighting nearby organs at risk. The aim of the work is the first step in the dosimetric characterization of a new source for nanobrachytherapy under development, consisting of Au-198 nanoparticles injected directly in tumoral mass. **Methods:** Simulations were carried using MCNP6.2 code by Los Alamos National Laboratory. Four different simulations were realized, for two different source configurations (point source and 0.4 cm radius spherical source, modeling a prostate tumor) each considering two different components for the dose (beta emission and photon (gamma/x-ray) emission from the source). Medium considered was infinite water homogeneous. **Results:** Dose curve as a function of distance from the source was evaluated and allowed a first estimative of dose at points of interest for treatment with a new nanobrachytehrapy source. Point source results are valuable for future extrapolation for complex tumor/organs geometry. Prostate tumor model presents data that allows to estimate dose at center of tumor, borders of tumor, and at other organs nearby, such as rectum and bladder. **Conclusion:** Being a beta-emitter, Au-198 shows a high deposition of energy near the source, with doses falling significantly with distance from the source. However, due to gamma and x-ray emission from the source, as well as secondary radiation originating from the beta particles, not-negligible dose was scored at significant distance. This quantitative study will be relevant for posterior dosimetry of more complex cases as well to develop protocols for dosimetry and clinical use, as nanobrachytherapy (with nanoparticles as sources) is a relatively new field with few specific works published.

TU300-GPD(B)-LOUNGE-199, Fabrication of a Patient-Derived Anthropomorphic Thorax Phantom for End-to-End Quality Assurance for Online Adaptive Radiotherapy: D. N. Stanley*, J. Harms, J. A. Pogue, R. A. Cardan, N. N. Viscariello, R. A. Popple and C. E. Cardenas, The University of Alabama at Birmingham, Birmingham, AL

Purpose: Traditional phantoms are not designed to evaluate AI-based autocontouring algorithms, central to the operation of Online Adaptive Radiotherapy(OART) systems, because these models are trained on anatomy-specific features not present in most phantoms. As OART sees wider implementation, ensuring the systems' accuracy and reliability is essential and a crucial component of this validation is verification of Hounsfield Unit(HU) accuracy.This study outlines a fabrication methodology for producing a radiographically accurate phantom anthropomorphic from real patient data, designed to closely mimic the radiographic properties and visual appearance of human anatomy. **Methods:** An anonymized patient dataset, with a structure set including lungs, heart, spinal cord, bones, and normal tissue contours, were converted into stereolithography files. The organs were then crafted using combinations of tissue-equivalent materials to mimic the physical and radiographic characteristics of the patient's anatomy . The final assembly was achieved with a 3D-printed body mold and a synthetic gelatin representing soft tissues, with access channels in each lung to simulate tumor growth/shrinkage. **Results:** The developed phantom displayed average(±STD) HU values of -733±170, 39±30, 158±16, 26±81, and -167±135 for the lungs, heart, bones, spinal cord and normal tissue, respectively. Lungs, heart, and normal tissue were within 5% compared to original CT data, and 12% for bones and spinal cord. Total printing time was approximately 75 hours, with an assembly duration of about 6 hours, and cost of raw materials below $500. Lastly, the phantom CT was evaluated by an autocontouring algorithm, verifying that the system could identify each structure, affirming that appearance and physical characteristics in the phantom match patient data closely enough that it could be used for quantitative evaluation. **Conclusion:** This study presents the design and creation of a cost-effective anthropomorphic thorax phantom that offers realistic radiographic qualities and anatomical accuracy for facilitating comprehensive end-to-end Quality Assurance(QA) of OART systems.

TU300-GPD(B)-LOUNGE-201, The Application of Artificial Intelligence Synthetic CT in Advanced Head and Neck Cancers: P. Tsai[1], N. Rowe[1], N. Lee[2], R. Kabarriti[3], R. Bakst[4], A. M. Chhabra[1], C. B. Simone II[1] and H. Lin*[1], (1)New York Proton Center, New York, NY, (2)Memorial Sloan Kettering Cancer Center, New York, NY, (3)Montefiore Medical Center, Bronx, NY, (4)icahn school of medicine at mount sinai, New York, NY

Purpose: The objective of this study was to evaluate the feasibility and accuracy of artificial intelligence (AI)-generated synthetic CTs (sCTs) derived from cone beam CTs for the evaluation of significant tissue composition and heterogeneity for loco-regionally advanced head and neck cancers. The impact of soft tissue and air heterogeneity and metal artifacts on sCT were investigated. **Methods:** We utilized the AccuLearning module (Manteia Medical Technologies, Milwaukee, WI) to generate AI synthetic CTs (sCTs) from cone beam CT (CBCT). This module employed U-Net architecture, with the data divided into training, validation, and testing sets at a ratio of 8:1:1. The sCTs were generated and assessed for ten additional patients, who were subsequently categorized into two groups: Group 1, with tumors in the soft tissue region (N=5), and Group 2, with tumors in areas of high heterogeneity (N=5). Image quality of sCT was assessed using Mean Absolute Error (MAE), Peak Signal to Noise Ratio (PSNR), and Structural Similarity Index (SSIM) compared to vCT. **Results**: AI-generated sCT effectively preserved complex anatomy in regions of high heterogeneity (bone/air/tissue) in head and neck cancer, yet the contrast between fat and soft tissue require improvement. Additionally, the degree of metal artifact was reduced in sCT compared to CBCT, but residual metal artifact remained. The MAE, PSNR, and SSIM for sCT compared to vCT were 116.3±40.9, 29.9±1.5, and 0.92±0.03, respectively. The sCTs in Group 1 (MAE: 97.23±14.19; SSIM: 0.93±0.01) had superior image quality over Group 2 (MAE: 123.37±35.60; SSIM: 0.91±0.02). **Conclusion:** AI-generated synthetic CT images were able to preserve the anatomy from CBCT for advanced head and neck cancers. Both soft tissue and heterogeneous regions of sCT showed excellent agreement with CBCTs and