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**Title:** A Simple technique to improve image quality of CBCT for brain

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**Purpose:** Improve the image quality of Cone-Beam CT from the Elekta Synergy Linear Accelerator for its use for radio surgery system or external radiation therapy for small brain tumors.

**Methods:** The image quality of the CBCT images using manufacturer-recommended preset value are not adequate to take full advantage of image fusion with planned CT and CBCT images for daily setup, especially for small targets or organs with low contrast in the brain. To resolve this issue various parameters, including the gantry rotational settings and the XVI image panel are experimentally optimized to improve image contrast in the CBCT images of the brain.

**Results:** Choosing a voltage of 120KVp instead of 100KVp reduced the bony artifacts, especially in the region of skull base. Increasing gantry rotation from 200° to 300° reduced streak artifacts. Increasing the x-ray tube current by a factor of 2 or 4 increased the signal-to-noise ratio (SNR) while minimizing the radiation dosage to a patient. Reducing the collimator setting for x-ray generator from a size of ~25cm by 25cm (at the Isocentre) to 25cm by 10cm minimized scattered radiation and radar artifacts, while covering whole brain independent of tumor position in the brain. Using 0.1 to 2mm thick aluminum filter effectively reduced scattered radiation from the head of the patient.

**Conclusion:** New protocol qualitatively improves low contrast of the brain. This setup is especially useful to correlate the targets in the middle of the brain when there are rotational discrepancies between CT and CBCT images. Further investigation of the this technique is required to qualitatively improve the CBCT image quality.