

Title X-ray Computed Tomography Image Analysis to explain the Airflow Resistance Differences in Grain Bunks

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### **Abstract**

X-ray computed tomography (CT) is a technique that uses X-ray images to reconstruct the internal microstructure of objects. A high-resolution X-ray CT system with a resolution of 120  $\mu\text{m}$  was used to scan slices of grain bunks. Grain bunks of wheat, barley, flax seed, peas and mustard were scanned along horizontal and vertical directions. The X-ray CT images were analysed to explain the airflow resistance difference along the horizontal and vertical directions of grain bunks. Total airspace, airpath distribution and size of airpaths were determined from the images. Morphological information of the airpaths from the tomographic images showed that the size and number of airpaths vary between horizontal and vertical directions of many grain bunks. Airpath area and airpath lengths along the horizontal direction were 100% higher than in the vertical direction for wheat, barley and flax seed bunks, where as for pea and mustard bunks, they were only 30% higher in the horizontal direction than in the vertical direction. The numbers of airpaths along the horizontal direction for wheat, barley and flax seed, respectively, were 92%, 145% and 187% more than along the vertical direction. In pea and mustard bunks, however the increase in the number of airpaths was only 28% and 17%. The ratio of total airspace area to the total number of airpaths in the grain bulk is the best predictor for the difference in the airflow resistance in horizontal and vertical directions in the grain bulk.