Purpose: 4DCT images can suffer from poor image quality, motion artifacts, and missing data, which sometimes requires rescanning the patient. Most commercially available resorting software do yet not support adequate solutions for the manual correction of scans where a simple phase based resorting algorithm does not yield a satisfying result. Our purpose is to improve image quality through better resorting tools.

Methods: We have developed SPARK 4DCT, a Java based tool that allows the user to choose from six different automatic resorting algorithms, has an advanced manual resorting editor, and interpolates missing data caused by irregular breathing. Expert users can find a direct and convenient access to correcting phase and image selection errors, while advanced automated algorithms improve the baseline quality of the 4DCT with less effort.

Results: Using anonymized patient data as examples, we present how the most common problems of 4DCT quality are solved with SPARK 4DCT's alternative resorting algorithms, manual amplitude/phase assignment, missing data interpolation and manual resorting. To prove feasibility for the clinical routine, we also estimate the time required for improving the 4DCT quality.

Conclusions: By advancing the workflow of 4DCT resorting and extending the tools available to improve their quality, SPARK 4DCT can replace the commercial resorting software, and is potentially a useful tool to improve the clinical routine of 4DCT resorting in many hospitals. Its design as a Java applet makes its integration into any clinical environment easy, because it allows for access from almost any computer/operating system. As an asset to the 4DCT imaging community the tool will be freely available as an open source code, which, in combination with its simulation capabilities, makes this tool a candidate for facilitating further 4DCT research.