RETROSPECTIVE RECONSTRUCTION mode perform on the Siemens Somatom Scope in synchronized FreeBreathing (4D-CT) starting from virtual respiratory cycles.

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**Introduction :**

The treatment of extra- cranial lesions in stereotactic condition request a high precision on the movement of the target. Errors Positioning and deformation structures appear during unsynchronized CT acquisitions (freebreathing or blocked). The use of synchronized breathingfree 4D - CT allow to overcome Systematic errors. This study intended to evaluate reconstruction performance of the scanner Siemens Somatom Scope in 4D mode with virtual respiratory cycles.   
  
**Equipment and methods :**

The assembly developed for this study includes the motorized piloting of phantoms Quasar® and Catphan®. The mobile test object is a sphere 30 mm diameter in a pulmonary density insert. The image quality is explored using Catphan® moving. The maximum amplitude is 40 mm in the 3 reconstruction plans. Acquisition parameters are fixed: total collimation of 16x1.2 mm, voltage 130 kV, 320 mAs reference with modulated intensity (CARE Dose 4D ®), 0.1 pitch with rotation time of 0.6 s. Respiratory cycles (regular or very unstable) were modelled via the software Quasar Respiratory Motion. Retrospective mode 4D-CT of Siemens Scope divides the respiratory cycle into 8 phases. The phases are reconstructed with the RPF and the noise reduction option (SAFIRE®) method. Other sequences of Average reconstruction and max/MinIP are obtained with the levels of SAFIRE® 2 and 3. Varian Eclipse 11.0 TPS is used for the segmentation of mobile objects in each phase. Analyses focus on fidelity of area, diameter and expected positions reconstruction of the sphere for each phase. Stability of Hounsfield units and the modifications of contrasts are carried out on the various sections of the Catphan® phantom.

**Results :**

Sequences of regular sinusoidal respiratory cycles present accurary positionings without image deformation. The cycles simulating of coughs or the short apnea disturb the reconstruction of the phases with appearance of variations of positioning of several slice. These errors are corrected by excluding the irregular zones from the cycle before reconstruction. Levels 4 and 5 of SAFIRE® degrade the low-contrast resolution. The standard deviation of the Hounsfield units does not change significantly due to the automatic management of the signal intensity into 4D-CT. The Average and max/MinIP reconstructions present variations of diameter in the axis movement according to ct-slice thickness and types of errors in the respiratory cycle.

**Conclusion :**

The reconstruction of the images according to the respiratory cycle makes it possible to increase the precision on the positioning of mobile lesions. The major errors of respiratory instabilities can be corrected while excluding from the zones of the cycle. It is necessary to have a maximum of regular periods for accuracy retrospective reconstruction of the movement. The follow-up of the lesion on 8 phases will allow the delineation of a ITV. The sequences Average and max/MinIP will be exploited for the delineation and the dose calculations. The installation of an End to End quality control for each treatment plan will be carried out.