

**Purpose:** To develop the respiratory signal analysis program for a phase-based retrospective 4D CT using RPM, spirometer, stereo-camera and removed the irregular peaks of respiratory signals for accurate phase assignment in 4D CT.

**Methods:** In this study, an in-house respiratory signal analysis program was developed for the phase reassignment and the analysis of the irregular respiratory signals. Various irregular respiratory patterns were obtained from clinical experimental volunteers. After then, the in-house program analyzed the factors affecting to phase assignment which is directly related to irradiate sector. The algorithms for separating individual respiratory signals are presented, which made use of baseline signals of input signal to identify the nodes between baseline signals and input signal. Therefore, we could achieve irregular peak reduction and noise elimination in phase assignment. Subsequently, accuracy of phase assignment was improved with removal of irregular signals by self-developed algorithm. Furthermore, this program also has a function to detect period and amplitude automatically.

**Result:** The standard deviation (SD) of breathing period representing the baseline method was shown stable compare with gradient method, but the difference was not statistically significant. Gradient method shows inaccurate phase assignment when all irregular peaks were detected and assigned. On the other hand, baseline method which was self-developed algorithm confirmed accurate phase assignment with removal of error peak detection due to tussis. It was also verified superior peak detection with the suggested baseline method at respiratory signals which contained irregular period changes and drifts of amplitude.

**Conclusion:** This study is considered to be useful for not only image reconstruction and elevation of irradiating accuracy through phase assignment of RPM system but also analysis of respiratory signals. Moreover, this respiratory analysis program can be applied to the 4D CT reconstruction using various respiratory sensors for the reduction of motion artifact.