AbstractID: 9174 Title: Computerized gating of breathing pattern for synchronized delivery of radiation

Purpose: To evaluate the stability of a device that accepts inputs from a spirometer in gating the breathing cycle to synchronize the breath hold state with the generation of radiation for treatment delivery or imaging. **Method and Materials:** We have constructed a Gated Breath Synchronizer (GBS) consisting of a data acquisition module with USB interface to a computer. The module has A/D input channels to acquire flow and other signals from a spirometer. It has a 16 bit digital I/O for controlling a breathing valve solenoid, connection to a panic button, and interfacing with the radiation generating device. We have developed software to monitor the lung volume and accept a target breath hold lung volume. It adjusts the timing and duration of the breath hold to coach the patient to reach the target breath hold lung volume gradually in a regular breathing pattern. We are also developing a simulated patient in software with relevant characteristics in pulmonary physiology for testing the system. The simulated patient has a 0.5 liter tidal volume, increases the depth of breathing after breath hold, has an inspiration reserve volume (IRV) of 3.5 liters and sets the panic switch after prolonged breath hold. We have evaluated the transition of the system from a restful breathing state to a steady state of regular breathing with breath hold for target breath hold lung volumes at 0.05 liters and 0.5 to 4.5 liters in 0.5 liter steps above functional residual capacity. **Results:** Stable breathing patterns with acceptable breath hold lengths were achieved in all cases except for when the coached breathing state approached the IRV, in which case the simulator properly activated the panic switch. **Conclusion:** The GBS system showed stable response in adjusting the patient from restful breathing to regular breathing with breath hold. Supported by NIHPO1CA59827.